

DFdiscover System Administration Guide

DFdiscover System Administration Guide

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Preface

This guide describes all aspects of DFdiscover system administration and is written for DFdiscover system administrators. Most tasks can be performed through the DFdiscover system application, **DFadmin**, but some require typing UNIX commands as either `datafax` or `root`. Some familiarity with UNIX and computer system administration is assumed.

1. Getting Help

For software support, please contact the DFdiscover team:

- via email, <help@dfnetresearch.com>;
- visit our website, www.dfnetresearch.com.

2. Conventions

A number of conventions have been used throughout this document.

Any freestanding sections of code are generally shown like this:

```
# this is example code
code = code + overhead;
```

If a line starts with # or %, this character denotes the system prompt and is not typed by the user.

Text may also have several styles:

- Emphasized words are shown as follows: *emphasized words*.
- Filenames appear in the text like so: `dummy.c`.
- Code, constants, and literals in the text appear like so: `main`.
- Variable names appear in the text like so: `nBytes`.
- Text on user interface labels or menus is shown as: **Printer name**, while buttons in user interfaces are shown as **Cancel**.
- Menus and menu items are shown as: **File** > **Exit**.

Chapter 1. Introduction

1.1. About This Guide

This guide describes all aspects of DFdiscover system administration and is written for DFdiscover system administrators. Most tasks can be performed through the DFdiscover system application, **DFadmin**, but some require typing UNIX commands as either `datafax` or `root`. Some familiarity with UNIX and computer system administration is assumed.

DFdiscover Installation and Configuration

This guide does not describe DFdiscover installation or configuration procedures. Those topics are covered in [Software Installation Guide](#).

In this guide, it is assumed that the installation and initial configuration of DFdiscover has been completed.

This chapter begins with a system level overview, meant to give an appreciation of how DFdiscover works. [Chapter 2, Security](#) presents an overview of security topics related to DFdiscover.

[Chapter 3, Getting Started with DFadmin](#) through [Chapter 10, DFadmin - Traffic](#) describe how to use the DFdiscover system administration application, **DFadmin**. This application is used to configure new studies, roles and users, manage your DFdiscover license, start and stop DFdiscover daemons, and several other useful things.

Several administration functions are available when DFdiscover is not running. [Chapter 11, DFserveradmin](#) describes **DFserveradmin** which provides these functions.

[Chapter 12, Periodic Maintenance](#) describes recommended periodic maintenance procedures, which are very important to the health of your DFdiscover system.

[Chapter 13, Troubleshooting](#) provides troubleshooting and system crash recovery assistance.

[Chapter 14, DFdiscover System Files](#) describes the DFdiscover file system and its important directories and files.

1.2. DFdiscover System Overview

The goal in this chapter is to give you a general idea of how DFdiscover works at the server level, a level not typically seen by the end user. We describe the main system components and how they interact. Although we sometimes refer to file and command names, the purpose of this chapter is not to describe how to perform system administration tasks. That will come in the chapters to follow. This introduction will help you to see how the various system administration tasks fit into the bigger DFdiscover system picture.

1.3. Software Versions

In DFdiscover, a version number comprises 3 components: a major version number (X), a minor version number (Y) and a patch number (Z). Every client and server application is identified with a version number of the form X.Y.Z.

A major release of the software increments the major version number (X+1) and resets the minor version and patch numbers back to 0. Major releases can include new functionality, protocols and data structures that impact compatibility with previous releases.

Minor releases can include bug fixes and functionality updates/improvements that work on top of the existing protocols and data structures. New functionality may also be introduced so long as it does not require changes to the software infrastructure

on the server. Patches may be released for individual applications to fix urgent bugs. Patches do not introduce any new functionality.

Every DFdiscover application has a X.Y.Z version number. Generally speaking, all of the applications have the same number. When a client application connects to a server application they compare version numbers. The major version numbers must always match. If they do not, the connection immediately fails and the client reports an error. If the minor version numbers do not match, the success of the connection is controlled by the **Version Strict** settings defined for DFdiscover and possibly also at the study level. Those settings are described in [Version Strict \(Master\)](#) and [Version Strict \(Studies\)](#).

1.4. Client/Server Terminology

DFdiscover is a client/server application which means that the results supplied by the software are not generated by one monolithic application, but rather by multiple, co-operating processes. Some of these co-operating processes are the client applications that users interact with, while other processes are non-interactive, and computationally oriented. The former is called a client and the latter is called a server. In general, a client is any application that a user can invoke from a command-line or from a window system menu. In DFdiscover, typical clients include **DFexplore**, **DFsetup**, and **DFadmin**, as well as command-line clients such as **DFexport**.

Server applications are more difficult to describe and categorize because there are many different types of servers. In general, a server is an application that a client application can ask to perform an action on its behalf. Your UNIX workstation, as configured by the operating system, may already be a login server (managing login requests from users), a boot server (providing system files to other diskless computers so that they can boot), and a file server (providing disk file access to other computers).

In DFdiscover, there are study database servers (handling all requests to a study database), an EDC server (which handles secure, encrypted requests from **DFexplore** and **DFadmin** clients), an incoming document server (routing all incoming documents to their correct location), and an outgoing document server (handling all requests to send out documents).

1.5. Daemons and Other Background Processes

While most users will only be aware of the individual applications they use, these tools are really just clients which request services from one or more of the main DFdiscover processes. These processes run in the background and do most of the actual work. These processes are: master, slaves, study servers, EDC servers, inbound, and outbound. Four of these processes (master, slave, EDC server and outbound) are referred to as daemons because they run continuously in the background, without human intervention, as long as the DFdiscover system is operational. This distinguishes them from the study database and inbound servers that are automatically started when needed and exit when their task is done.

An operational DFdiscover system will have all of these background processes running concurrently on the same or different computers on your network. There will only be one copy of the master and at most one copy of each database server. In order to send documents there must be an outbound daemon. And finally, if a DFdiscover system has recently received several documents, the inbound server may be running, dealing with one of the newly arrived documents.

1.5.1. Master Daemon

The master daemon is started automatically when the host server computer starts. It can also be started by executing the command ¹

```
# /opt/dfdiscover/bin/DFbootstrap
```

It runs on the licensed DFdiscover server and has 4 primary functions:

¹ Typically, the daemons are defined at the system level so that the operating system starts them when the computer boots and halts them before the computer is shut-off. Hence, it is rare that a user will have to manually execute this command.

- It controls the total number of users (or clients) that are allowed to run concurrently on the system. This is constrained by the DFdiscover software license.
- It serves as a *connection router* for DFdiscover client applications, servicing requests for a connection to a particular server. It determines where the requested server is running and returns this information to the client. If the requested server is not running, the master solicits a slave daemon to start it.
- It receives notification of each incoming document and responds by soliciting a helper application to process the incoming document.
- It manages outgoing documents (typically Query Reports being that are emailed/sent back to the clinical sites) by assigning the document to the outbound daemon.

1.5.2. Study Server

When a DFdiscover application needs information about how a study is configured (e.g. where is the default study printer located?), or needs to read from or write to a study database, it requests a connection to the study database server. The master honors this request, if it can, and if not, it solicits a slave to start the study server, making sure that there is one server process executing for each DFdiscover study.

It is the job of the study database server to serialize all database transactions, and to lock data records as needed, ensuring that only one user is able to modify a record at a time.

1.5.3. EDC server

The EDC server handles the secure, encrypted communication between an **DFexplore** client and the study server. The EDC server starts another EDC server child process automatically when a new **DFexplore** connection is established and stops the child process when the **DFexplore** client exits.

1.5.4. Inbound Server

The job of the inbound server is to process the G3 or TIFF fax files received by fax software, as well as PDF and TIFF documents received by email and from **DFsend**. This includes:

- breaking down the incoming files into individual pages,
- de-skewing and flipping pages as necessary,
- reading the CRF barcodes to identify the study they belong to,
- running the ICR software to generate an initial (workflow level 0) data record for each CRF page,
- sending the pages and data records to the appropriate study database server, or if none is identified, to the image router,
- and finally, archiving the original document.

The inbound server is started, and assigned a document to process, by the master daemon that receives email whenever a new document has arrived. When the inbound server has finished the current document, the master will assign it another document, if there is one. Otherwise, the server exits, and will be subsequently re-started by the master when needed.

1.5.5. Outbound Server

The outbound server runs continuously and handles all outgoing document transmissions from DFdiscover. The outbound server receives requests from the master to send a document, queue the document for faxing or emailing, and track the

document to its completion or ultimate failure. These documents are typically quality control reports being sent to the clinical sites participating in DFdiscover studies.

1.6. DFdiscover System Limits

The following is a complete listing of DFdiscover database limits and formats used in DFdiscover system administration. The same parameters may appear in other tables with different limits because the limit is different in that context.

Table 1.1. DFdiscover System Limits

| Description | Limit | Comments |
|--|------------------|--|
| Number of outbound documents that can be queued concurrently | 1-65535 | |
| Username | 16 chars maximum | From the alphabet A-Z, a-z, 0-9, _ (underscore) |
| Study number | 1-255, 1-999 | The suggested range for study numbers that require barcodes is 1-249. Study numbers of 250-255 may be used by DF/Net Research, Inc. in distributing example or test studies such as study 254, Acceptance Test Kit. On an appropriately licensed system, it is further possible to use study numbers in the range 256-999 for EDC studies. |
| Plate number | 0-511 | Plate 0 references the new record queue. |
| Workflow level | 0-7 | Level 0 represents new, not yet validated, or pending records. Once a record has a level greater than 0, it cannot be assigned level 0 again. |

Chapter 2. Security

2.1. Introduction

DFdiscover implements product and database security at a variety of levels. To fully utilize DFdiscover it is important to understand the security choices available.

The implementation of a proper security model for DFdiscover requires understanding secure communication, authentication, what permissions are available to users, and then appropriately allowing or restricting those permissions.

This chapter presents the information necessary to implement security within DFdiscover. Rather than repeat the details already available in other chapters or manuals, some sections include cross-references.

2.2. Secure Communication

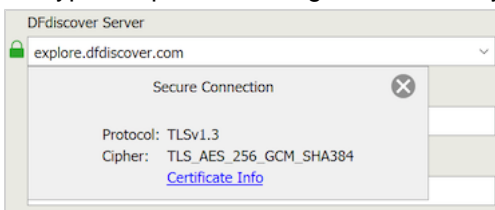
Within DFdiscover communication between client applications and server is via encrypted communication on port 443. This port must be open on any firewalls between the local computer and the study server.

The security of the communication is based upon 3 industry standard technologies:

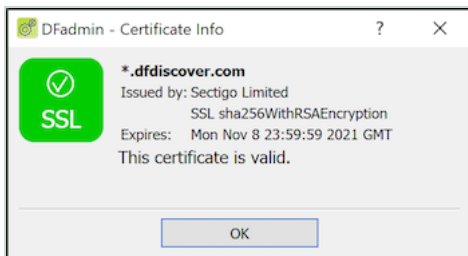
1. Communication protocols, namely TLS 1.2 or 1.3,
2. Strong encryption ciphers, and
3. Independent certification and confirmation of the server.

This is industry-standard technology that encrypts the bi-directional communication using a 'certificate of trust' provided by the server. It is the same technology used by banks and the majority of secure, global web services.

You can visually confirm that the communication is secure by examining the details of the communication protocol and encryption cipher. In the login screen of any desktop client, click the green lock icon next to the **DFdiscover Server** input field.



You can also examine the certificate of trust. After login, select **Help > Certificate Info** and look for the green checkmark.



2.3. User Authentication

The first level of security in DFdiscover is user authentication - before a user can access DFdiscover they must provide a valid username and password combination. The mechanism for implementing that username and password combination depends upon the type of user and type of application:

- **DFexplore, DFsend, DFsetup and DFadmin user (client-side, interactive user).** **DFexplore, DFsetup and DFadmin** users are authenticated at the DFdiscover application level - the username and password combination are created, maintained, and verified directly by DFdiscover. This has the advantage that these users do not need a UNIX login account.

Creation and administration of these accounts is performed entirely by a DFdiscover administrator - there is no need to involve a UNIX administrator as these users will not need access to the underlying UNIX system.

- **DFexport, DFbatch, DFattach and DFpdfpkg user (client-side, command-line user).** Like the interactive user applications, these applications are also authenticated at the DFdiscover application level. As a preliminary step however, the user must use their operating system credentials to gain access to a command-line.

Since there is no login dialog for these applications, the user is required to supply their authentication information through command-line options or environment variables. Users can also choose to manage their password information locally on their desktop computer with **DFpass** (see [Programmer Guide, DFpass](#) and [Programmer Guide, User Credentials](#)). Proper implementation of **DFpass** allows users to access command-line applications in scripts and the cron facility without exposing their password as clear text.

- **Central data management office DFdiscover user (server-side user).** This is the "traditional" DFdiscover user that is authenticated by a username and password combination created, maintained, and verified at the UNIX operating system level.

Each such user is identified by a unique username. That DFdiscover username is also the UNIX login name. Each UNIX login name also has a password, and that combination of login name and password uniquely identifies an individual within the operating system, and also within DFdiscover.

Before this type of user can access DFdiscover, they require a login account which is defined by the UNIX administrator. In the process of creating this login account, a unique login name and password are assigned. The password is the responsibility of the user and should be changed regularly, in accordance with the company's computer security requirements. A user's login name is publicly available so it is critical that each user maintain the privacy of their password.

Once a user has a UNIX login name and password, they can login to the UNIX system. Once they are logged in, they also have general access to DFdiscover and are identified in DFdiscover with their UNIX login name, also known as their DFdiscover username. However, each user is required to have a DFdiscover login account so permissions can be granted to each user for accessing various DFdiscover applications and studies. The DFdiscover login account is administered by the DFdiscover administrator (or) study administrator using **DFadmin**.

2.4. Two-Factor Authentication

The DFdiscover administrator may have enabled two-factor authentication for some or all login accounts. If two-factor authentication is enabled, after successful authentication the login screen updates to request a security code (see [DFexplore User Guide, Two-Factor Authentication](#)). Independently an email is sent to the email address for the account. The email contains a unique 6-digit security code. This security code must be entered in the login dialog to complete login verification. Each security code is unique to a login username on a specific device and expires if not used within 10 minutes.

Each verification in two-factor authentication, with the same credentials, and device is valid for 30 days. After 30 days the process will repeat and a new security code will again be needed. Logging in with different credentials and/or a different device will also initiate two-factor authentication. Deleting or deactivating a user account will reset the validity of all of the user's previously used devices. Upon reactivating any user account a new security code must be entered in the login dialog to complete login verification on each device.

2.5. Filesystem Permissions

The UNIX operating system restricts access to each file and directory by ownership:

- **owner.** Is the user the owner of the file? The person that creates any new file or directory becomes the owner of it. Ownership cannot be changed except by a UNIX administrator.
- **group.** Is the user in the same group as the file's group? Each user belongs to one or more groups, their primary group and zero or more secondary groups. Groups exist to simplify sharing of files among collaborating users and are created and assigned by the UNIX administrator. The default group for DFdiscover is `studies`. Unless a finer segregation of groups is required for DFdiscover, all DFdiscover users should have `studies` as their primary group.

When a file or directory is created by a user it is assigned that user's primary group for group ownership.

- **other.** If the user is not the owner of the file, and they are not in the same group as the file's group, they are considered to be part of the general population of users, with no special ownership privilege for this file or directory.

and action:

- **read.** Is permission granted to read the file?
- **write.** Is permission granted to write (overwrite, update, or append) to the file?
- **execute or search.** Is permission granted to execute the file (meaningful only if the file is an executable application), or to search inside the directory?

To ensure that files which need to be shared among DFdiscover users can be easily shared it is important to understand and properly implement filesystem permissions. To assist in the consistent application of filesystem permissions, the UNIX-provided **umask** setting should be used. The **umask** setting can be set or altered at any time but it is most advantageous when it is specified in the user's login file, their `.profile` or `.login`, and then applies consistently while they are logged in. The default **umask** setting is `022`, which prevents a file created by a user from being updated by any other. This setting can hinder collaboration within DFdiscover and it is recommended that the default setting for DFdiscover users be `002`.

There is additional information about filesystem permissions at the study database level in [Section 2.9, "Filesystem Permissions"](#), at the end of this chapter.

A full description of UNIX filesystem permissions is beyond the scope of this document but is easily found in any UNIX administration guide.

2.6. PDF Encryption Password

At the user-level, it is possible to encrypt, using standard PDF encryption, any or all PDFs created by the user. This is not a permissions related issue per se, but is relevant to user login settings and hence to this section.

PDFs can be optionally encrypted, encryption providing an additional security layer if the PDFs are transmitted electronically. Encryption occurs at PDF creation time using a one-time encryption password provided by the user, or using the user-specific encryption password found in the file `.dfpdfpasswd` in the PDF creator's home directory.¹ This file must contain exactly one plain-text line, and this line is read and used as the user's encryption password during PDF creation.

2.7. DFdiscover System-Level Permissions

Any user that can successfully authenticate on a UNIX host which is running DFdiscover, and has access to a command-line, can:

- access individual study databases to which they have been granted permission,
- access the **DFexplore** client application running on the server,

¹ File permissions on this file should be set to `0600`, preventing other users from viewing or modifying the file contents.

- access the **DFsetup** client application running on the server,
- view DFdiscover license activity
- view the DFdiscover documentation.

Access to individual studies is controlled by the DFdiscover and/or study administrator and is further detailed in [DFadmin - Users](#) and [DFadmin - Roles](#). It is not possible for any user to access any study database unless they have been explicitly granted permission by an administrator. Permissions to access **DFexplore** and **DFsetup** can be altered for each user as indicated in [Section 8.8, “Permissions”](#).

2.8. DFdiscover Study-Level Permissions

Study roles, as defined and assigned to users in **DFadmin**, determine a user's permission to use the DFdiscover client applications and determine what they are able to do within each of these applications. The permission specifications provided by DFdiscover can be very detailed and are described in [DFadmin - Roles](#).

2.8.1. Impact of Database Access Restrictions on Standard Reports

Database access restrictions can influence the output of each report. If database access restrictions have been implemented by the DFdiscover administrator for the study, execution of the same report by different users may lead to different results, and some users may not be able to run certain reports at all. The table summarizes the effect that access restrictions have on each report.

Table 2.1. Conformance with Access Restrictions for Standard Reports

| Conformance | Report Name(s) |
|---|--|
| (none): All database access restrictions are ignored. The output from this report is not affected by access restrictions and is the same for all users. | DF_ATcrfs, DF_ATfaxes, DF_ICcenters, DF_ICschema, DF_ICvisitdates, DF_ICvisitmap, DF_QCfaxlog, DF_QCstatus, DF_SScenters, DF_SSschema, DF_SSvars, DF_SSvisitmap, DF_WFcrfs, DF_WFcrfsperwk, DF_WFdiskusage, DF_WFfaxes, DF_WFqcs |
| (record): All database access restrictions are applied. The output is restricted to those records for which the user has access permissions. The output from this report will vary across users and will reflect their individual record access restrictions. | DF_ATmods, DF_ICkeys, DF_ICqcs, DF_ICrecords, DF_PTcrfs, DF_PTlist, DF_PTmissing, DF_PTqcs, DF_PTunexpected, DF_qcsbyfield, DF_stats |
| (subject): All database access restrictions are applied. The output is restricted to those subjects for whom the user has full visit and plate access permissions. The output from this report will vary across users and will reflect their individual subject access restrictions. | DF_PTvisits |
| (site): All database access restrictions are applied. The output is restricted to those sites for which the user has full subject, visit and plate access permissions. The output from this report will vary across users and will reflect their individual site access restrictions. | DF_CTcrfs, DF_CTqcs, DF_CTvisits, DF_PTschedule, DF_QCfax, DF_QCprint, DF_QCreports, DF_QCsent, DF_QCview |

| Conformance | Report Name(s) |
|---|--|
| (full): All database access restrictions are applied. Only users with unrestricted access to all records in the study database can run this report. The output from this report will be the same for all such unrestricted users. | DF_ICimages, DF_QCupdate, DF_XXkeys, DF_XXtime |

2.8.2. Impact of Database Access Restrictions on Edit checks

In **DFexplore** the data fields available to edit checks are restricted by the user's site, subject, visit, plate and read level access permissions. This helps to ensure that users will not be shown database values in edit checks to which they would normally not have access, but it also means that data records unavailable to the **DFexplore** user cannot be used in edit checks. This restriction does not apply to hidden fields. Thus data values that are needed in an edit check, but should not normally be seen by users with a certain role, can be made available by defining them as hidden fields on plates to which the user has read access permissions.

In **DFbatch** edit checks have *unrestricted access to all study data* and ignore all access restrictions on the current user. To mitigate any negative consequences of allowing edit checks unrestricted access to all study data in **DFbatch**:

- edit check programmers must be aware of database access restrictions for the study and design their edit checks to respect the intentions of the study management team. Although an edit check may require access to restricted data to perform some logic check, the programmer should be careful not to display the restricted information to users not allowed to see it.
- permissions on the study edit checks file should be maintained as restrictive as possible so that only authorized edit check programmers can access the file and add or update the edit checks.

2.9. Filesystem Permissions

Many tasks in DFdiscover rely upon successful access to one or more files in the underlying filesystem. Given that the study is administered in the manner described in this chapter, no special attention needs to be paid to the permissions on those underlying files. However, it is still recommended that the DFdiscover administrator periodically review and update the permissions on the filesystems accessed by each DFdiscover study using [Programmer Guide, DFstudyPerms](#). This practice is further detailed in [Section 12.5.2, "Monitoring study directory permissions"](#).

Chapter 3. Getting Started with DFadmin

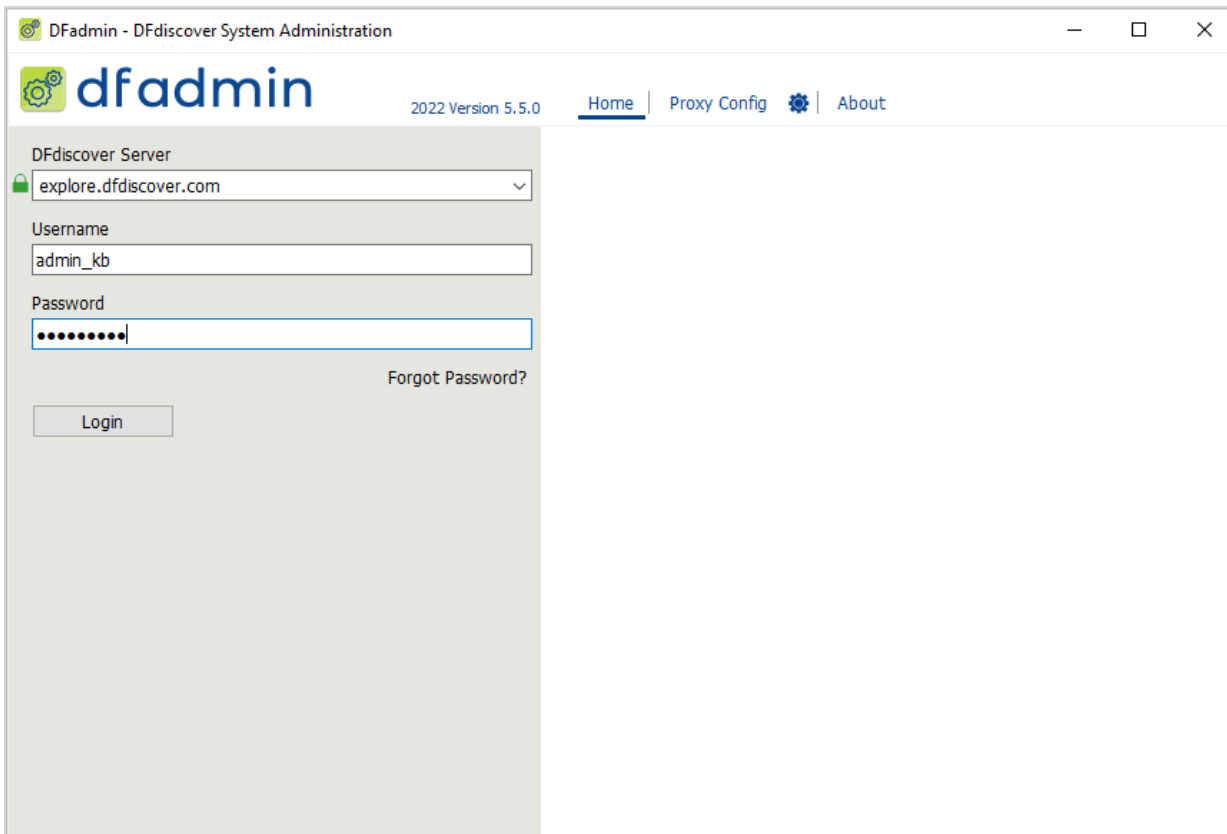
3.1. Starting DFadmin

To start **DFadmin**:

- On Windows and macOS, click (or double-click) the **DFadmin** icon.
- On Linux, type the following at a shell prompt:

```
# /opt/dfdiscover/bin/DFadmin
```

Once the application is launched, the login screen is presented.



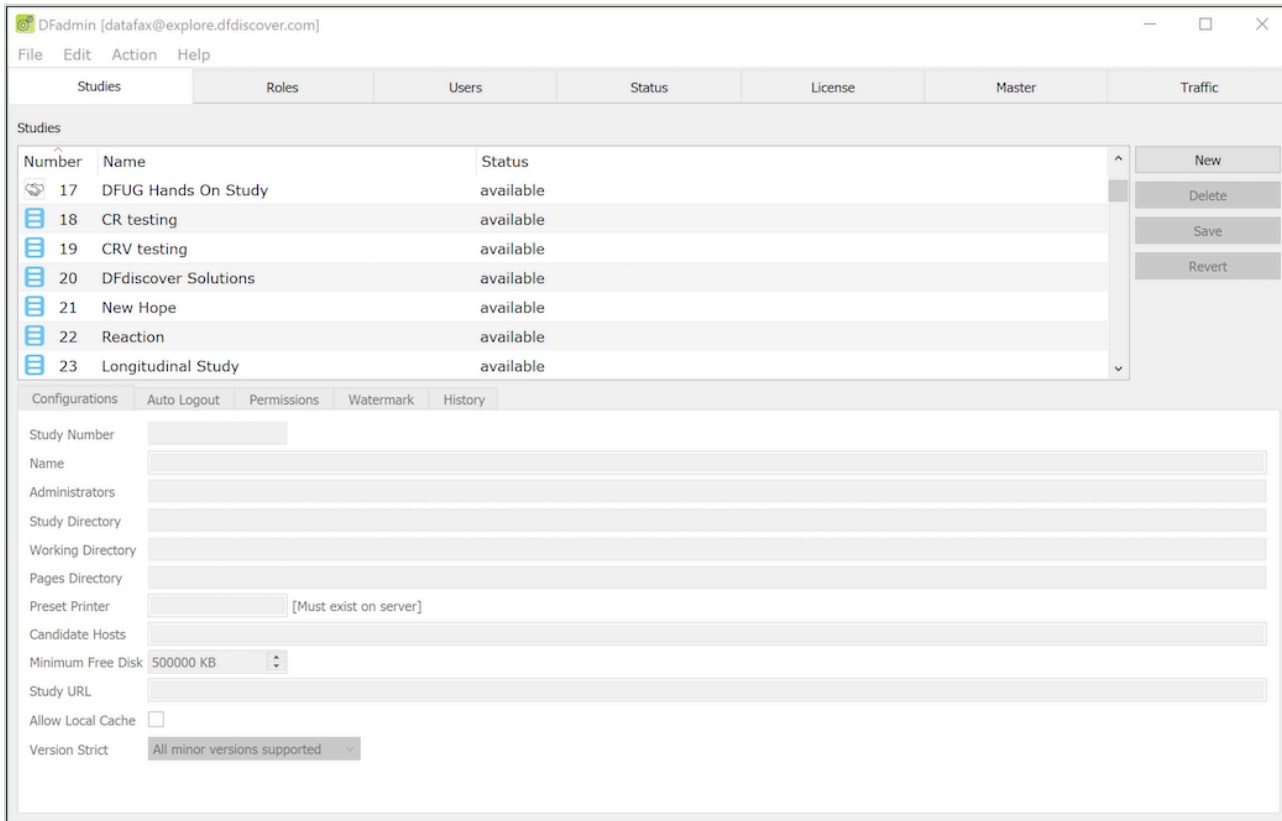
The **DFdiscover Server** field requires the hostname of the DFdiscover server. You must enter your valid login credentials in the **Username** and **Password** fields. In addition, you must have been previously granted DFdiscover or study administration permissions.¹

Click **Login**. After successful authentication, the **DFadmin** application appears.

¹ Some organizations install a proxy server to filter requests sent to the internet. If your computer is behind a proxy server click **Proxy Server** to configure the proxy server. Contact your IT department for the necessary information.

3.2. DFdiscover System Administration Tasks

DFAdmin provides tools for DFdiscover and study administrators to perform common system administration tasks using a tabbed visual interface.



The views available in **DFAdmin** are:

- **Studies.**

- register new studies, update existing studies
- identify location of the study directory and files relevant to the study configuration
- review permissions of study users

- **Roles.**

- define permissions and structure into meaningful roles
- set maximum workflow level and application permissions for each study

- **Users.**

- create user accounts for staff that are allowed to use DFdiscover
- administer all activities relevant to user account management including contact information, password and account status
- assign study roles to users

- **Status.**
 - check DFdiscover services status
 - enable/disable studies
 - review study connection details
- **License.**
 - manage DFdiscover password needed to activate software license
 - review license usage statistics
- **Master.**
 - register email address to receive automated warning/error messages
 - specify login password complexity, reuse and notification rules
 - identify the default printer
 - specify a text banner to appear on login dialogs
- **Traffic.**
 - define server available to process incoming documents
 - define server available to process outgoing documents
 - configure DFdiscover to send back a receipt when documents arrive from selected clinical sites

Chapter 4. DFadmin - License

4.1. Introduction

DFdiscover is licensed by a unique host identifier for a single server machine. This licensed machine is the only machine permitted to execute the DFdiscover master daemon. This machine is often referred to as the "DFdiscover master".

DFdiscover uses a concurrent user license model, which permits up to a purchased maximum number of concurrent users to be using the software, and does not limit which users are running the client applications, or where those applications can be run. Only the DFdiscover master daemon needs to be licensed; the individual client machines do not.

If you are licensing DFdiscover for the first time, you must choose your DFdiscover master carefully. In particular, this machine should have demonstrated network and hardware reliability. If the DFdiscover master is 'down' (unavailable), DFdiscover will not function on that machine or any client machines.

DFadmin will only connect to a server that already has a valid license. To enter license information for new installations or to update license information on servers where the license has expired, use **DFserveradmin** (see [Software Installation Guide, LicensingRequest and Install DFdiscover License](#)).

Each DFdiscover license is controlled by a password which encodes 4 attributes:

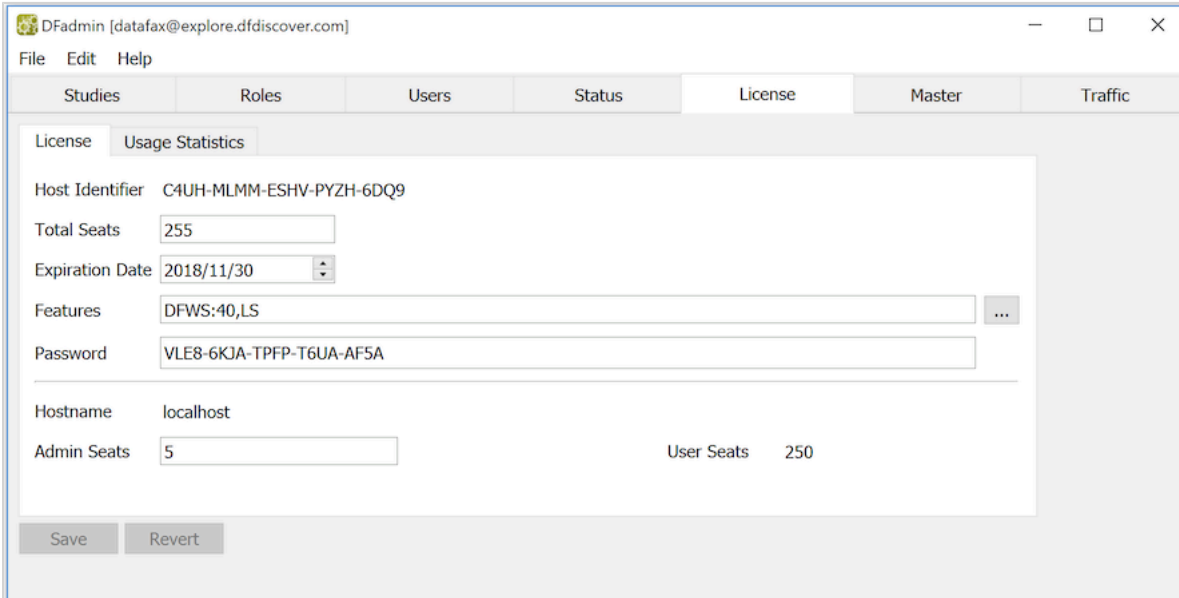
- the unique host identifier of the master,
- the license expiration date,
- the number of license seats, and
- optional features.

These 4 attributes are provided to DF/Net Research, Inc.. Using these attributes as input, a password is computed and provided back to you. Since the provided password encodes the 4 attributes, changing the value of any attribute without also requesting and updating the password invalidates the software licensing, potentially making DFdiscover unusable.

4.2. DFadmin's License Tab

DFadmin provides a view for updating license information, as well as a view for reviewing current license usage.

The **License** tab has two views: **License** for entering DFdiscover software license details, and **Usage Statistics** for reviewing seat usage.



4.3. Entering and Reviewing License Information

The **License** view is where all changes to license information are made.

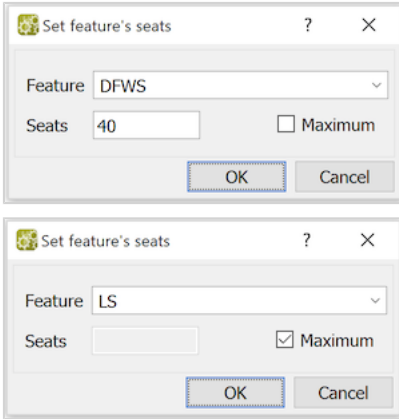
Click the **License** tab. The **License** view is separated into two sections, separated by a horizontal rule: an upper section for values that are password restricted, and a lower section for values that can be modified independent of the password.

4.3.1. Password Restricted Values

The following values appear in the upper section:

- **Host Identifier.** The host identifier is a 20 character alphanumeric value expressed in 5 dash-separated blocks of 4 characters/digits. It is unique to one computer. For DFdiscover, this is the host identifier of the server machine that has been chosen to run the master daemon. This value does not change and should not be modified.
- **Total Seats.** This number defines the maximum number of concurrent user logins that are permitted. The number, in the range 1 to 500 inclusive, is equal to the number of seats purchased. Normal use of the software will occupy seats up to the maximum number of concurrent logins permitted.
- **Expiration Date.** DFdiscover is licensed for a defined period of time. The software license expires at midnight on the license expiration date.
- **Features.** DFdiscover optionally includes features that may be valuable to a certain type of client. These features can be licensed separately. Features are defined by an acronym and an optional seats limiter. Features available for licensing are **DFWS**, web services via API, and **LS**, large study numbers.

Individual features can be directly entered in the field, or they can be selected from the **...** dialog. Multiple features are separated by a comma (,). The maximum number of seats available to **DFWS** connections can be limited, whereas large study numbers, **LS**, is simply available or not.



- **Password.** The value for this field is provided by DF/Net Research, Inc. on payment of the software license fee. The value is 20 characters in length, presented as 5 dash-separated blocks of 4 characters or digits. To prevent confusion, the digits 0 ('zero') and 1 ('one'), and the letters O ('oh') and I ('eye') never appear in a password.

4.3.2. Password Independent Values

The following values appear in the lower section, below the horizontal rule. They can be updated independent of the password value.

- **Hostname.** The hostname is the name by which the DFdiscover server is known on your network, and is the output of the command:

```
% hostname
```

This field is not used when defining/evaluating the password, however it is verified in other areas of the software. Be careful before changing it.

- **Admin Seats.** Seats can be reserved for use by DFdiscover and study administrators, to ensure that they are never locked out because all licensed seats are taken by users. We recommend that at least 1 seat be reserved for administrators. The split between administrative seats and user seats can be changed at any time. Each login by a DFdiscover or study administrator takes an administrative seat if one is available; if an admin seat is not available, administrator login will try to take a general user seat. All other users cannot take one of the admin seats even if one is available and all user seats are in use.

It is also possible to change the allocation of seats assigned to a feature (as a subset of the purchased **Total Seats**). Specifically, it is possible to assign an upper limit to seats that can be used by **DFWS**. The notation is **FEATURENAME:MAXSEATS**. For example, **DFWS:40** indicates that feature **DFWS** has been licensed and that a maximum of 40 seats can be occupied by users/clients using that feature.

This change can also be made independent of a password change.

DFadmin [datafax@explore.dfdiscover.com]

File Edit Help

Studies Roles Users Status License Master Traffic

License Usage Statistics

Host Identifier C4UH-MLMM-ESHV-PYZH-6DQ9

Total Seats 255

Expiration Date 2018/11/30

Features DFWS:40,LS

Password VLE8-6KJA-TPFP-T6UA-AF5A

Hostname localhost

Admin Seats 5 User Seats 250

Save Revert

4.3.3. Applying Changes

Verify that each field has been entered correctly. To save and apply the license information, click **Save** or select **File > Save**. If any license fields are incomplete or incorrect, the save will fail and the existing license will be left unchanged.

If complete and accurate, the license information is saved and passed to the DFdiscover master daemon. It is not necessary to restart DFdiscover - the expiration date, seat count and features on a currently licensed system will be automatically updated.

Subsequently, each time the DFdiscover master starts, it verifies the license. The master (and hence DFdiscover) will fail to start if the license file cannot be found or any of the information in the file is incorrect.

Click **Revert** to undo changes you have made to any fields in the license view.

4.4. License Expiry

DFdiscover warns of approaching license expiry 60, 30, 14, 7, 6, 5, 4, 3, 2, and 1 days prior to the expiry date. The person recorded as the **Problem Mail Recipient** (in the Master tab) will receive email messages similar to the following:

```
date machine DFmaster.rpcd[pid]: your software license expires in # days
```

If the license is not renewed, it will expire at midnight on the expiry date. In this case the essential DFdiscover services will halt and not restart, and the **Problem Mail Recipient** will receive an email message similar to the following:

```
date machine DFmaster.rpcd[pid]: your software license has expired
```

If the DFdiscover license expires, HylaFAX will continue to receive faxes. When the DFdiscover license is subsequently renewed, the received faxes will be processed by DFdiscover. Nothing will be lost. Be careful however that the incoming fax directory has sufficient disk capacity to store any faxes that arrive while the DFdiscover software is off-line.

4.5. Updating License Information without DFAdmin or DFserveradmin

It is possible to apply new license information to an active DFdiscover installation without the use of **DFAdmin** or **DFserveradmin**. Logged-in to the licensed DFdiscover server, the system super-user can update/install a new license file and send a UNIX SIGHUP signal to **DFmaster.rpcd**. The SIGHUP signal is interpreted as a request to re-read the license file. Before sending the SIGHUP signal, the new license information must be entered into the DFdiscover license file, namely `/opt/dfdiscover/work/license`.

From the command-line, the following steps cause **DFmaster.rpcd** to re-read its license:

1. Before editing `/opt/dfdiscover/work/license`, make a backup copy of the file.
2. Edit `/opt/dfdiscover/work/license` with a text editor and save the changes.
3. Determine the process id, `pid`, of **DFmaster.rpcd**:

```
# ps ax | grep DFmaster
```

4. Send the SIGHUP signal to **DFmaster.rpcd**:

```
kill -HUP pid
```

If the new license can be loaded and validated successfully, the new settings are applied. Otherwise, they are ignored. The interval to license expiry is re-calculated if necessary which may also reset the timing for the license expiry warning emails.

Invalid license settings

If the new license file cannot be loaded and validated successfully, it is imperative that the old license settings be re-entered and saved to the license file. Although invalid settings are ignored in this scenario, valid settings are required if there is a need to restart DFdiscover.

A recommended practice is to keep a backup copy of a valid license file before attempting to update the active license file from the command-line.

4.6. Reviewing License Usage Statistics

DFdiscover provides current and cumulative license usage information in the **Usage Statistics** view.

| | Limit | In Use | Max Used | Rejected |
|--------------------|-------|--------|----------|----------|
| Total Seats | 255 | 41 | 41 | 0 |
| User Seats | 250 | 36 | 36 | |
| Admin Seats | 5 | 5 | 5 | |
| Features | | | | |
| DFWS | 40 | 40 | 40 | 160 |
| LS | | | | |

Statistics are available for seat usage and feature usage. Seat usage is reported by **User Seats** and **Admin Seats**, mirroring the specification in the license itself. Feature usage is reported individually for each licensed feature.

For seats and features, DFdiscover is able to report the licensed value (**Limit**), the current value (**In Use**), the maximum value since start (**Max Used**) and the number of license requests that could not be fulfilled (**Rejected**).

The statistics reported include:

- **Statistics since *date/time*.** The date and time of the beginning of the reporting period. Reported usage is available since DFdiscover last started, or the license was last updated.
- **Limit.** The number of seats included in your current DFdiscover license is shown in the first row of the table. This is a static value matching the value of **Total Seats** in the **License** view.
- **In Use.** This is the number of concurrent seats currently in use by clients connected to the DFdiscover server. The number of seats available is the difference between **Limit** and **In Use**.
- **Max Used.** The maximum number of seats that have ever been used concurrently is reported in this column. If the maximum has been reached (matches the limit) and you see many rejections in the next field it may be time to purchase additional seats.
- **Rejected.** The number of times that a license request could not be granted because all available licenses were in use is reported in this column. DFdiscover does not track if rejected requests came from administrators or users.

The statistics can be updated at any time by clicking **Refresh**.

Chapter 5. DFadmin - Master

5.1. Introduction

The master daemon ¹ is the most important application in the DFdiscover system. It connects every client application to the appropriate study database server, and without it no useful work can be done. The master is started when **DFbootstrap** is executed (which typically occurs when the licensed computer is started) and runs continuously.

The master has 4 functions:

- It controls the total number of users (or clients) that are allowed to run concurrently on the system. This is constrained by the DFdiscover software license.
- It serves as a *connection router* for DFdiscover client applications, servicing requests for a connection to a particular server. It determines where the requested server is running and returns this information to the client. If the requested server is not running, the master solicits a slave daemon to start it.
- It receives notification of each incoming document and responds by soliciting a helper application to process the incoming document.
- It manages outgoing documents (typically Query Reports being that are emailed/sent back to the clinical sites) by assigning the document to the outbound daemon.

5.2. Starting DFdiscover

In most installations, DFdiscover and the master are configured to start automatically whenever the computer (re-)starts and stop automatically whenever the computer halts. It is also possible to start and stop DFdiscover manually or with the **DFserveradmin** application (see [DFserveradmin](#)).

DFdiscover can be started manually, by `root`, with the **DFbootstrap** command as in:

```
# /opt/dfdiscover/bin/DFbootstrap
DFmaster.rpcd: your software license expires in 19 days
1. Checking state of incoming daemons...

2. Checking /opt/dfdiscover/work/.dfincoming_work...

3. Checking /opt/dfdiscover/incoming...
   0 faxes awaiting processing.
DFmaster.rpcd: started.
Done.
```

There is no further direct user interaction with the master process. It operates as a background process, receiving and directing requests from other DFdiscover processes.

5.3. Stopping DFdiscover

DFdiscover runs continuously on the server. It is started when the host computer is started and is halted when the computer is halted.

¹The term daemon indicates that the program runs continuously in the background. It is not under direct user control.

Occasionally it may be necessary to halt DFdiscover, to perform a system administration task, like installing a system upgrade, updating the DFdiscover software, or to install additional disk storage. Stopping DFdiscover can be performed with the **DFserveradmin** application (see [DFserveradmin](#)), or manually from the command-line.

DFdiscover can be halted, by `root`, with the **DFshutdown** command as in:

```
# /opt/dfdiscover/bin/DFshutdown
```

Any attempt to halt DFdiscover will fail if there are open client connections. In such a case, messages similar to these will be displayed.

```
Locating DFdiscover slave daemons...
Trying to shutdown slave daemons...
  Slave daemon on explore.dfdiscover.com shutdown.
Done.

Trying to shutdown study servers...
  Server 007 on explore.dfdiscover.com will not exit - Study server is in use.
Failed.

DFdiscover shutdown failed. Some processes still running.
```

If this occurs, it will be necessary to have all users exit their DFdiscover applications before shutdown can proceed.

5.3.1. Forcing DFdiscover to shutdown

Shutdown can be forced to proceed, regardless of any warnings, by executing **DFshutdown** and including the `-f` option. This is not recommended as a general solution but instead should be used in those cases where shutdown must proceed, for example, because the computer is also halting. The invocation is:

```
# /opt/dfdiscover/bin/DFshutdown -f
```

5.4. Configuring the DFdiscover master

The master is configured with defaults during the initial installation of DFdiscover. In most environments, these defaults require no further modification or specification. If necessary, re-configuration of the master is simple and in most situations has to be done only once. Configuration is done through the master tab in **DFadmin**.

To (re-)configure the master, click the **Master** tab in **DFadmin**. The **Master** view has the following appearance.

The following configuration parameters can be specified in the dialog:

- **Bootstrap Slave Host.** The value for this field is typically the same as the hostname of the master, but it can also be a comma-delimited list of hostnames on the local network. When the master daemon is started, it starts one slave process on each listed host. Since DFdiscover server processes will only execute on machines running a slave process, each machine that will be a database server must also be listed as a slave. Good choices for database servers are machines that have local disk space (so they can swap efficiently), sufficient CPU power, and typically have a light processing load.

DFdiscover attempts to distribute work evenly to all slave machines². Also, if one machine is down, DFdiscover will continue and try to start the server on another machine.

The default value for this field is the hostname of the computer running the master daemon. In most environments, this is sufficient.

- **Problem Mail Recipient.** Messages related to license expiry or usage will be emailed to the specified address(es). Specifically,
 - when the number of days to license expiry is: 60, 30, 21, 14, 7, 6, 5, 4, 3, 2 and 1, a warning message will be emailed
 - when license expiry occurs, an error message will be emailed
 - when no licenses are available, and a user requests a license, a warning message will be emailed
- **Preset Printer.**

² When attempting to distribute the load, DFdiscover only considers the number of DFdiscover servers that are running on each candidate computer. It does not consider other software that might be running.

Several applications permit printing. Applications that are connected to a study server use the study specific value for a printer. Other applications, such as **DFadmin** or Image Router do not have a study connection. They use this value as their default print location, unless otherwise overridden.

- **CDN URL.**

DFdiscover reports are built from JavaScript (JS) and Cascading Style Sheet (CSS) resources that reside on a separate server. By default, DFdiscover provides and shares a common server to make these resources available. This server is known as the CDN and the resources are rooted at the CDN URL. One advantage of this structure is that DFdiscover reports which are shared externally can also access these same resources via the CDN URL.

- **Version Strict.**

It is possible to enforce software version numbers between client and server applications at the master level. This enforcement determines the behavior at client connection time.

The choice **Version strict applied per study basis** allows the study-level configuration of the same setting to control the setting. This is the less restrictive choice.

The choice **Only current version supported** specifies that the client and server application versions must match exactly, and it is not possible to override this at the study level. This is the more restrictive choice.

For further details, also see [Software Versions](#) and [Version Strict \(Studies\)](#).

- **Multi-tenant.**

Check this box if the server hosts studies for more than one client (tenant). A multi-tenant server places additional restrictions on:

- permission to use the Image Router
 - visibility of users that have accounts with other tenants on the server
- Enabling this setting is suitable for CROs and organizations that offer DFdiscover as a service.

The following **Login Password Security Settings** may be specified:

- **Minimum password length.** Users may change their password to a string no shorter than the value specified here, and no longer than the fixed maximum of 64 characters.
- **Passwords require.** To increase the strength of user passwords you may require that they must contain any combination of the following attributes:
 - at least one character and one digit
 - at least one lowercase and one uppercase character
 - at least one special character (@!#\$)
- **Password expires every.** Passwords may be set to expire every 1-9999 days, after which the user will be prompted to enter a new password on the next login.
- **Disallow reuse of last.** When resetting their password users can be prevented from reusing their previous 1-10 passwords. A value of 0 in this widget allows users to re-enter their current password. This applies to each user's initial password and to any reset passwords, so to prevent users from reusing these passwords after first login set this parameter to at least 1.
- **Lockout users for.** If an incorrect password is entered several times you may suspect that someone is trying to break into your system using another user's login account. To minimize this risk, you can lock the login account for 1-999999 minutes after 1-9999 failed login attempts. A compromise, for forgetful users, might be to lock the account for a short period of time, during which they can look up the password and try again. When a lockout occurs, this message appears

at the bottom of the login dialog: Account locked because of repeated password errors - You may try again in XX minute(s).

- **Notification Mail Recipient.** When a login account is locked out a message is written to the system log. In addition, an email can be sent to the addresses specified in this widget.
- **Password reset option.** Selecting this option will allow users to reset their passwords to a temporary single-use password from the login dialog. By default, this option is not selected. The user's email address used for this purpose must be registered under the **Users** tab in the Email field of the contact info section.

A banner may be specified to customize the login dialogs for **DFexplore**, **DFsetup**, **DFadmin** and **DFsend**. The banner appears at the bottom of the login dialog when the user selects the DFdiscover server. The banner may consist of one or more lines, include UNICODE characters, and use HTML to add formatting and links to URLs.

Links to media, such as image files are not supported. However, images may be included using base64 encoding (which represents binary data in an ASCII string format). Base64 image encoders are readily available online.

By default, the login banner consists of the organization name, country, state, locality and email contact information.

Chapter 6. DFAdmin - Studies

6.1. Introduction

A DFdiscover study can be thought of as a database of related CRFs. An actual clinical trial might be logically divided into more than one database and thus may be defined as more than one study to DFdiscover. For example, while subject CRFs might all go into the main study database, a separate investigator database might be kept for investigator registration forms, an investigator fact sheet, and correspondence with investigators. The key structural difference between these 2 databases is that while a subject ID would serve as the ID key field in the subject database, an investigator number would serve as the ID key field in the investigator database.

In very large studies with many sites it might also be desirable to divide the sites into regional databases, to keep the individual study databases smaller and thereby improve system performance.

In most cases, clinical trial databases are paired as a development database and a production database. Work is done in the development database, tested and then pushed to the linked production database. The trial is conducted with, and data is collected in, the production database.

6.2. Study Numbers

A maximum of 999¹ active studies (or databases) can be defined per DFdiscover installation.

Each DFdiscover study is assigned a unique number in the range 1 to 999. DFdiscover is able to automatically identify and route CRFs that have a DFdiscover barcode. For such studies, the maximum study number is 255 (this is the maximum that can be barcoded). If the study will contain paper forms that are either scanned or faxed, and should be automatically routed, then the study numbers must be in this range of 1-255. If the study is purely EDC with no scanned or faxed paper forms, or if automatic routing is not needed, then the full range of 1-999 can be used.

A study number is the first key necessary to uniquely identify a CRF and route it to the correct database. Because of this study numbers must be chosen carefully, and their uniqueness maintained for the duration of the study. Consideration should also be given to how the numbers are planned. For example, are numbers assigned sequentially starting with study number 1? Or is some other stratification desired, with study ranges allocated for product lines, phase, region, or other natural ways to categorize studies?

6.3. Study Directories

A study database is implemented as a collection of files that reside on one or more storage devices. Typically, the collection of files that are a study database are all stored under one unique parent directory. Placing all the files for a particular study under a parent directory that is unique to that study is a good way to organize those files. This eliminates the possibility of mistakenly sharing one file between two or more studies, and makes it easier to encapsulate a study for migration or backup purposes.

When each study has its own parent directory, DFdiscover names all sub-directories and study files consistently across studies. Hence the name and location of a file (relative to the parent study directory) will be the same regardless of which study it belongs to.

The default DFdiscover file structure for a study includes the following:

¹DF/Net Research, Inc. occasionally makes test and demonstration studies available for use by clients. Since these studies use study numbers in the range 250 through 255, it is recommended that the maximum study number used actually be 249. On an appropriately licensed system, it is further possible to use study numbers 256 through 999 for EDC studies.

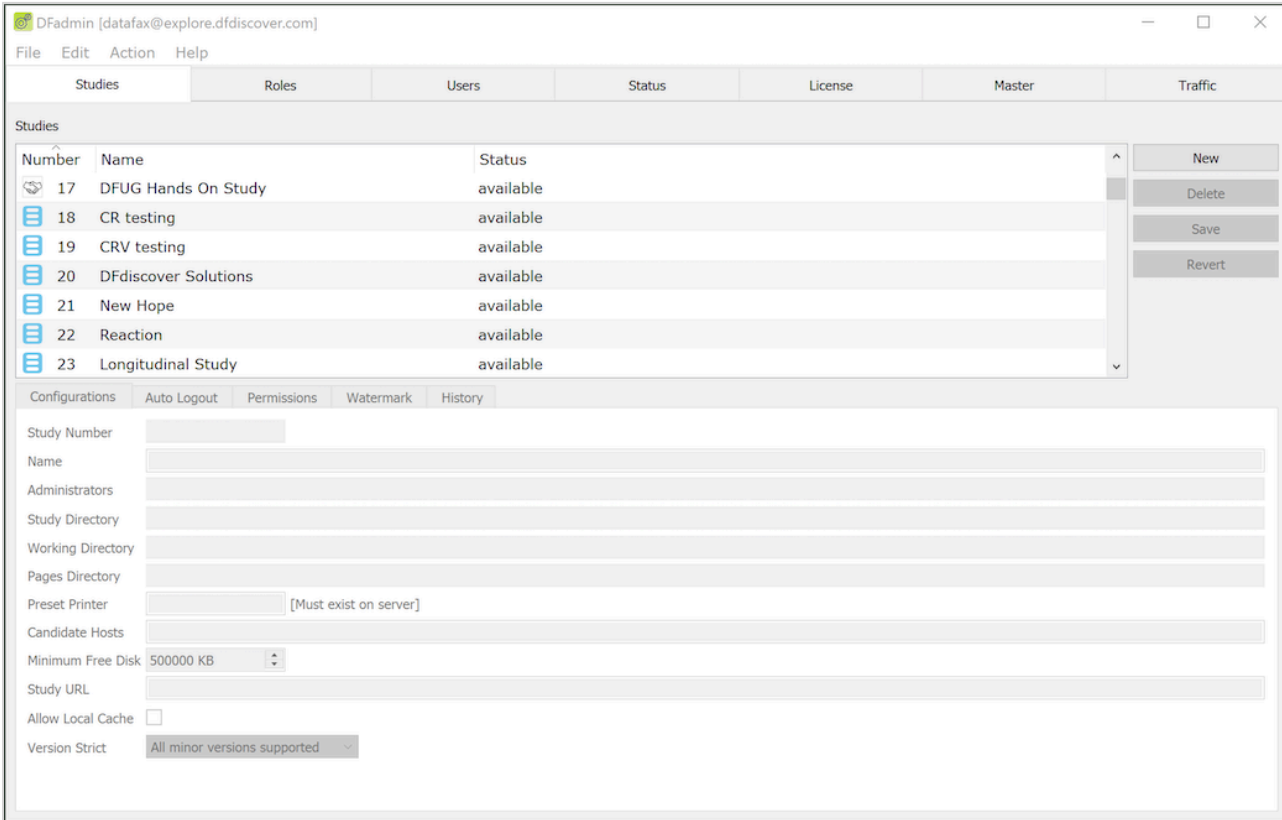
| | |
|-----------------|--|
| batch | Control files and output logs for study-level batch edit checks. |
| bkgd | Background image files used by DFExplore , DFsetup , and DFprintdb applications. |
| data | All DFdiscover database files, including one data file and one index file for each unique plate. It is strongly recommended that this data directory be local to the machine that executes the study database server. |
| dde | Double data entry sets that are waiting to be processed. |
| dfsas | Any stored SAS® jobs that were created from DFExplore . |
| drf | Any DRFs (Data Retrieval File) created by server-side applications, including reports, and DFExplore . |
| ecbin | Any study specific scripts or applications that are called from within edit checks using the <code>dfexecute</code> function, or on arrival of a specified plate defined under Plate Arrival Triggers in the DFsetup plates view. |
| ecsrc | All edit check source files that are specific to this study. |
| lib | Specific library files, including study server configuration file, sites database, visit map, data dictionary, ICR template. |
| lut | Any study specific lookup tables. |
| pages | Base directory for standard resolution (100dpi) CRF pages. Each data record has a corresponding CRF image file below this directory. |
| pages_hd | Base directory for high resolution (300dpi) CRF pages. Each data record has a corresponding CRF image file below this directory. |
| reports | Study specific scripts and applications that generate output for review by study staff. This directory also contains all previously created Query Reports. |
| work | Storage location for study temporary files. |

All of these directories are created automatically by DFdiscover when a new study is defined. In general, the files and directories should not be accessed directly but instead be accessed through one or more DFdiscover applications.

A detailed description of the format of study configuration and data files can be found in [Programmer Guide](#), [Study Files](#), [DFdiscover Study Files](#).

6.4. Studies view

Most study administration tasks are performed using the **Studies** tab in **DFAdmin**.



All studies currently registered with DFdiscover are displayed, one row per study, in the studies list. Each row shows the unique DFdiscover study number, the descriptive study name, and the study status. If the study is not available (either disabled or restricted) the status message will include the administrator's username as well as the message from the administrator. The study list is filtered based on the current user's permissions: the DFdiscover administrator can see all known studies in the list (no filtering is applied), while a study administrator can only see the studies they have permission to administer.

Using the Studies view, DFdiscover administrators can:

- Register and configure a new DFdiscover study.
- Delete a study from the DFdiscover study registry. This action does not delete anything from the study directory. It makes the study unavailable to DFdiscover users, until/unless it is recovered using one of the 'Add' options.
- Delete all study data. This action is typically used to remove all test data before going live. It removes directories: data, pages, pages_hd, drf, work, and reports/QC, and all dfsas/*. * files (i.e. DFsas job output files) from disk.
- Delete all study data and setup info. This action removes everything from the study directory except the study configuration file DFserver.cf.
- Define a watermark that is applied to all printed output generated by users assigned to any of the roles listed in the watermark definition.

The first study server 'start' message in the DFdiscover server_log corresponds to the date the study was created. A log message identifying the study, user, date and time is also appended to server_log for each of the 3 delete operations.

The following study settings may be specified in the **Configurations** tab:

- **Tenant** is an optional, descriptive label for the client/tenant that "owns" this study. This setting is visible only in installations that enable multi-tenant hosting (see [Multi-tenant, Master](#)).
- **Study Number** is the unique number for the study.
- **Name** is the name of the study.
- **Administrators** are the administrators for the study.
- **Study Directory** is the top-level disk folder where the study is stored on the server.
- **Working Directory** is where the temporary data is saved as it is processed.
- **Pages Directory** is where images are stored. HD pages are stored in a sibling folder with the same prefix plus a `_hd` suffix.
- **Preset Printer** is the printer where print operations are directed, unless another printer is specified elsewhere as an override.
- **Candidate Hosts** identifies the servers where slave daemons are running. The value must equal, or be a subset of, the value for **Bootstrap Slave Hosts** in the Master view.
- **Minimum Free Disk** is the minimum amount of free disk space for the study. The recommended minimum value for this field is 500MB. The maximum value is 20GB.
- **Study URL** is ignored in the current release.
- Checking **Allow Local Cache** enables the **DFexplore** application to cache study setup information (never study data) on the user's local computer. This will shorten start times for repeated uses of the same study.
- **Version Strict** specifies how DFdiscover handles connections from client applications that do not exactly match the DFdiscover server software version.

The following study settings are specified in the **Auto Logout** tab:

- **Default** is the auto logout interval automatically assigned to users for this study.
- **Maximum** is the maximum auto logout interval that a user can set.

6.5. Adding a New Study

Each new study must be registered before it is used in **DFsetup** to create the study database or in **DFadmin** to define study roles and assign them to users. Studies should be registered early in the study-planning phase so that a study number can be allocated, ensuring that the same number cannot be assigned to another study.

Procedure 6.1. Adding a new study

1. Click **New** or select **Action** > **New...**

The **New Study** dialog is displayed.

DFadmin - New Study

These configuration parameters are required to define the new study:

Study Number: 225

Study Name: NearSIS Protocol

Study Space: opt_studies

Study Folder: nearsis

New Study
 Restore previous Study at this location
 Restore previous Study with new Study Number

OK Cancel

2. Study Number

Each study database must be assigned a unique number in the range 1 to 999 inclusive.

3. Study Name

The study name appears in a variety of places including the study selection dialogs, the title bar at the top of **DFexplore** and **DFsetup**, and in the header of most DFdiscover reports.

4. Study Space

Before any studies can be registered a UNIX administrator must specify permitted study spaces, i.e. the UNIX pathname(s) where study directories can be created, and provide a label for each space. Study space directories must be created with `datafax` as the owner, `studies` as the group, and have read-write-execute permission for both `datafax` and `studies`. Each space must be unique (case-insensitive) and cannot itself be a study directory, nor can any sub-component of a study space be a study directory.

If multi-tenant is enabled on the server, it is recommended that each tenant be assigned a unique study space. This further helps with the separation of storage and simplifies backup and restore operations.

Once the UNIX directories are created from a command-line, they can be registered as study spaces by running **DFserveradmin** as root on the DFdiscover server, and selecting the study spaces tab.

Note

No part of a study space can itself be a DFdiscover study directory. For example, `/opt/studies` and `/opt/studies/NIH_Studies` could both be study spaces for the following study directories: `/opt/studies/A`, `/opt/studies/B`, `/opt/studies/NIH_Studies/A`, `/opt/studies/NIH_Studies/B`, etc., but `/opt`, `/opt/studies` and `/opt/studies/NIH_Studies` cannot be DFdiscover study directories. Study directories cannot include the follow characters: `\`' $; & * < > |` and SPACE

5. Study Folder

Specification of the UNIX path to a new study directory is performed in 2 steps. First select a 'Study Space' from the drop-down list of predefined spaces, and then specify a study folder name, which will be appended to the study space to create the UNIX pathname for the study directory. For example, if the user selects study space name 'NIH_Studies' which has been mapped to UNIX directory '/opt/studies1', and then enters study folder name 'ECIC' the study directory becomes '/opt/studies1/ECIC'. The study folder name must be unique (case-insensitive) within the study space.

6. Mode

Select one of 3 modes:

- **New Study** . Use this mode to create a new DFdiscover study.
- **Restore previous Study at this location** . A study which has been deleted using 'Delete-Remove Study from DFdiscover' remains on the DFdiscover server and can be restored using this option, if you remember the study number, space and folder names.
- **Restore previous Study with new Study Number** . This option is similar to the second option, but allows you to restore the study using a different study number. It does not update any existing data records or barcodes with the new study number, so this is of limited value, but may be useful in some cases. For example, you might have a StudySpace/Test pathname which you clean out using 'Delete-All Study Data and Setup Info' when no longer needed, and restore when you want to use it to setup and test a new study.

Each of these modes has specific requirements and will produce an error message if they are not met. A 'New' study must have a new study number and a space/folder path that does not already exist on the DFdiscover server. A study can only be restored using the second mode if the space/folder path exists on the server and the configuration file at that location has the specified study number. And for the third mode the space/folder path must exist, but the study number must be different.

7. Click **OK**.

This does 3 things on the DFdiscover server:

- The study directory is created (if needed) and the configuration is saved to file `lib/DFserver.cf` in the study path.
- The study is added to the DFdiscover study registry.
- The study database server starts for the first time, verifies that DFdiscover is able to create and write to the study directory, and then creates and initializes the study directories and files. If the file system creation completes successfully, the study list is updated and the focus shifts to the new study entry.

6.6. Deleting a Study

Three types of delete can be performed in the **DFAdmin** Studies tab, as described below. These options are available, to DFdiscover administrators only, by clicking **Delete** or selecting **Action > Delete**.

• Remove Study From DFdiscover...

This option can be launched from **Delete** as well as from the **Action** menu. It removes the study from the DFdiscover study registry, file , and removes study roles and user role assignments from the DFdiscover user database, file `DFuserdb.log`, but does not remove anything in the study directory from disk. As a result: the study server can no longer start, the study will no longer appear in study selection dialogs, the study will not be available to command-line applications, and if any barcoded pages arrive for the study they will be sent to the router.

As long as the study directory is not removed from disk by a UNIX administrator the study can be brought back online at any time using **Action > New** and re-entering the study number and directory. If the study roles and user role assignments have been saved they can then be imported, effectively restoring the study to its previous state.

• Delete All Study Data...

This option is typically used to clean out test data, images and work files before going live with a new study database. It deletes study directories: `data`, `pages`, `pages_hd`, `drf`, `work`, `reports/QC` and also deletes **DFsas** output files from directory `dfsas`, but keeps any **DFsas** job files.

• Delete All Study Data and Setup Info...

This option keeps a study registered in the DFdiscover study registry but deletes everything about it, including all data and setup information. The study directory remains on disk but the only thing it contains is the study `lib` directory and file `lib/DFserver.cf`. This option is used to restart a study setup from scratch, or to re-use the study number and directory for a new study.

Use with caution

These options make permanent changes and must be used with great care. They are only available to users who have been granted 'DFdiscover Administrator' status under the 'Permissions' section of the 'User' tab. When one of these options is selected, **DFadmin** presents the user with a confirmation dialog and also requires the user to enter their password before the action is performed. If a mistake is made and data is unintentionally deleted, the only solution is to recover it from a backup.

6.7. Modifying an Existing Study

Once a study is added its study number and directory cannot be changed, but other configuration parameters can be modified at any time by either a study or DFdiscover administrator.

Study re-configuration

A disabled study cannot be re-configured using **DFadmin** until it is re-enabled, with the exception of the value for **Candidate Hosts**.

The values for the following parameters can be safely changed at any time:

- **Tenant.** This descriptive label is displayed in the Studies tab only and is used solely for internal documentation purposes.
- **Study Name.** A change to the descriptive study name is reflected in any application that starts after the change is saved.
- **Preset Printer.** A change to the default printer takes effect immediately. The printer queue must exist on the server and be listed in `/opt/dfdiscover/lib/DFprinters` if one exists, or the entry will not be used.
- **Candidate Hosts.** If the value for **Candidate Hosts** is changed and the study server is already running, the study server will continue to run on the current host. The new hostname(s) will only be considered as possible candidates for the next start of the study server, after the current instance terminates.
- **Minimum Free Disk (KB).** A change to the value of **Minimum Free Disk (KB)** does take effect immediately.
- **Study URL.** This parameter is ignored for the current release. Although a value can be specified and changes will be saved, the value is not used within DFdiscover and will be removed in a future release.
- **Version Strict.** When a client application connects to a DFdiscover study server the client version number is compared with the server version number. The result of that comparison, combined with the value of this setting, determines whether or not the connection proceeds. For additional details regarding version numbers, see [Software Versions](#).

It is possible for this value to be set and enforced at the master level, in which case the choice is disabled in this dialog.

The choice **All minor versions supported** requires that only the major version number of the client match with the server. Clients with any version or patch number, within the matching major version number, are accepted. This is the less restrictive choice.

The choice **Only current version supported** requires that the major and minor version numbers of the client match with the server. All patch numbers, within the matching major and minor version number, are accepted. This is the more restrictive choice.

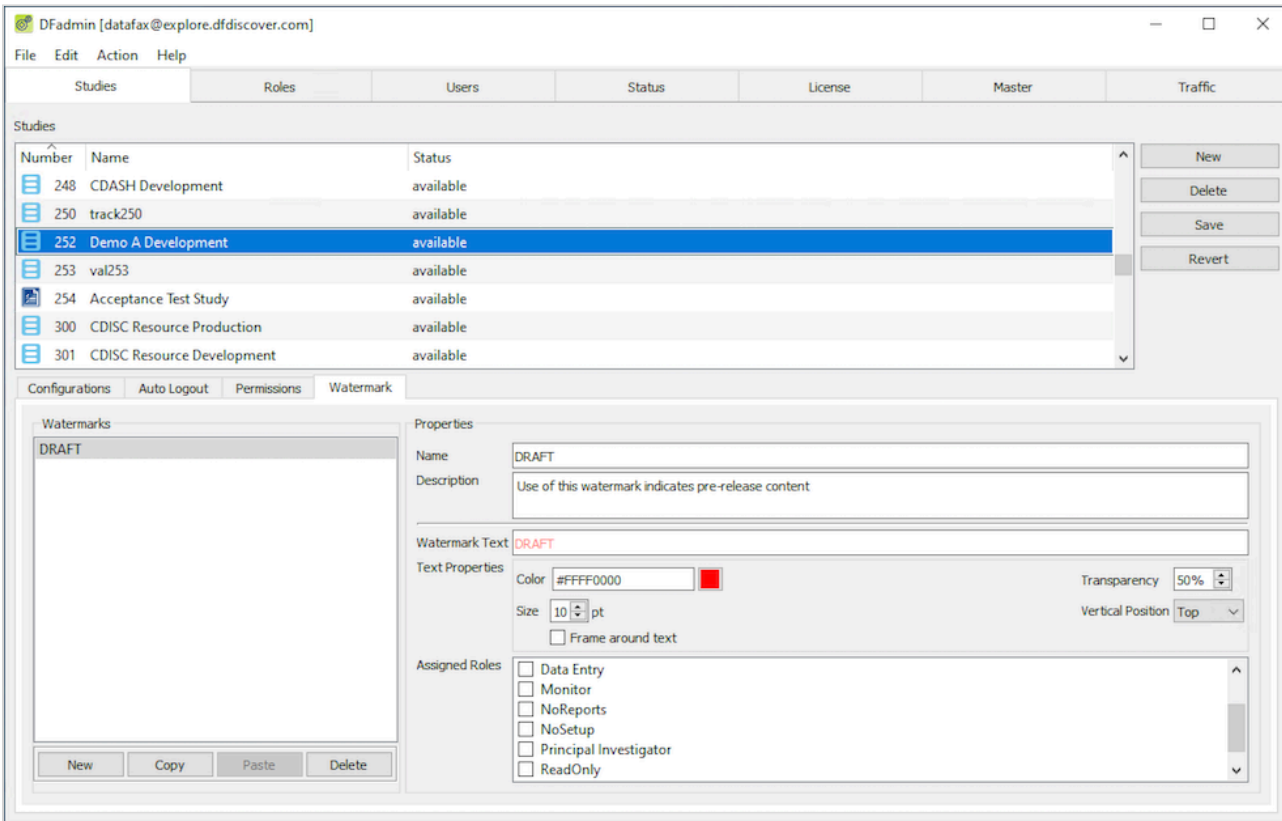
The appropriate choice may depend upon the software changes in minor versions and also study requirements.

- **Auto Logout - Default and Maximum (Minutes).** **DFexplore** and **DFsetup** sessions automatically logout after a specified period of inactivity. In **DFexplore** users can set their auto logout preference to any value between 1 minute and the specified maximum. The default specification is the initial value for new users. The maximum may not exceed 1440 minutes (24 hrs). Default and maximum auto logout values can also be specified for each study role, where they either inherit the study level values entered here, or override them with values for users with that particular role. Changes to auto logout specifications take effect on a user's next connection to the study server.

6.8. Watermarks

Watermarks are used in **DFexplore**, when users assigned to specified roles print PDFs using **DFexplore**. Any pages output by these users are overlaid by the watermark, except for the printing of blank CRF pages.

Watermarks are defined in the **Watermark** view.



To define a new watermark:

1. Click **New**. Give the watermark a unique name (maximum 32 characters) or accept the default name provided.
2. **Description**

Provide a description for your watermark (optional - maximum 200 characters).

3. Watermark Text

Provide the text of the watermark (maximum 100 characters). UNICODE characters are allowed. Use \n to separate multiple lines of watermark text. Watermark text may contain meta-words %DFUSER (replace with login user name), %DFDATE (replace with current date in format yyyy/mm/dd) and %DFTIME (replace with current time in format hh:mm:ss).

4. Text Properties

Several properties of the text can be specified:

- **Color** . Click the color square to display the color chooser dialog, or enter a hexadecimal value directly.
- **Transparency** . Transparency ranges from 0% to 100%. A watermark with transparency set to 100% is not visible!
- **Size** . Point size, for the text font, ranges from 6 to 36 points.
- **Vertical Position** . Select **Top**, **Center** or **Bottom**.
- **Frame around text** . Check this box to draw a frame around the watermark text.

5. Assigned Roles

Check the role names that use this watermark.

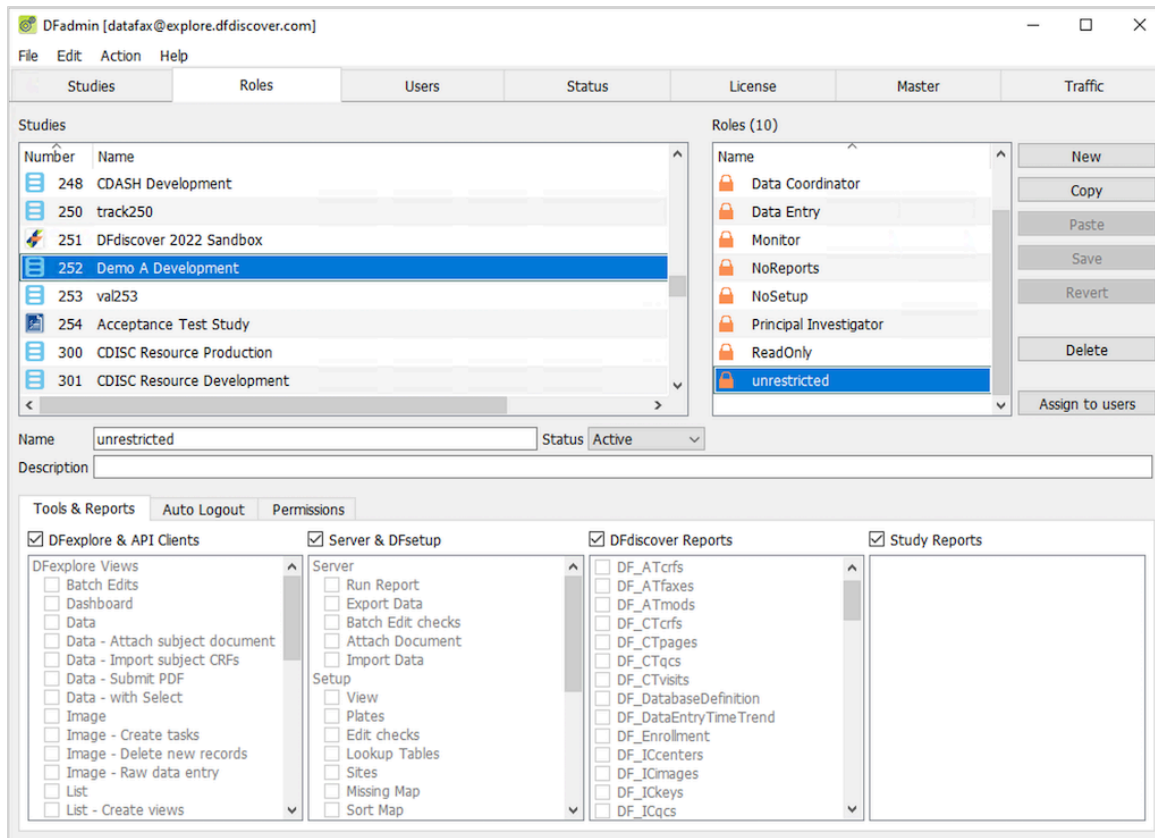
Chapter 7. DFadmin - Roles

7.1. Introduction

User permissions to access studies, perform data entry, run reports, etc. are specified by defining study roles. Only DFdiscover and study administrators can create study roles and assign them to users (see [DFadmin - Users](#)). This chapter describes how study roles are created and the full array of specific permissions they encompass.

7.2. The Roles tab

Select the Roles tab.



Roles belong to studies. Selecting a study from the **Studies** list reveals the current roles for that study in the **Roles** list. In this example 8 roles for study number 252 are listed. Role names are case-sensitive and must be unique within a study.

While roles must be defined separately for each study they can be easily copied and pasted from one study to another. Any changes made to role specifications apply only to the study within which the changes are made. Thus, it is possible for 2 roles to have the same name but different permissions in different studies.

The **Status** drop-down is used to switch any role between active and inactive states at any time, without losing the role definition. Users who are granted many roles within a study have permissions associated with their active roles, and if all roles have been made inactive, they are not able to use the study at all.

Role Buttons

New Add a new role to the selected study.

| | |
|------------------------|---|
| Copy | Copy the selected role into memory. |
| Paste | Paste the most recently copied role to the current study. |
| Save | Save a new or modified role in the current study. |
| Revert | Undo all modifications to the current role. |
| Delete | Delete the selected role from the current study. Deleting a role also removes the role from each user's role assignment list. If a role is deleted and then redefined it will be necessary to reassign it to all users who need it. |
| Assign to users | Grant users access to a role. |

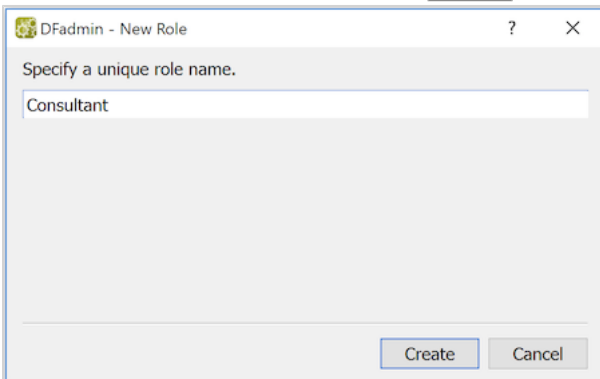
When do role changes take effect?

Roles can be added, modified and switched between active and inactive at any time, including while users are logged in and working in the study. A user's permission for all studies is evaluated on login to **DFexplore** and thus the user's **DFexplore** instance must be restarted for any changes to take effect.

7.3. Adding a New Role

To add a new role to a study, select the study and click **New**. Study status must be **available** before roles can be added, edited or deleted.

Enter a unique role name and click **Create**. Each role name in a study must be unique (case sensitive).



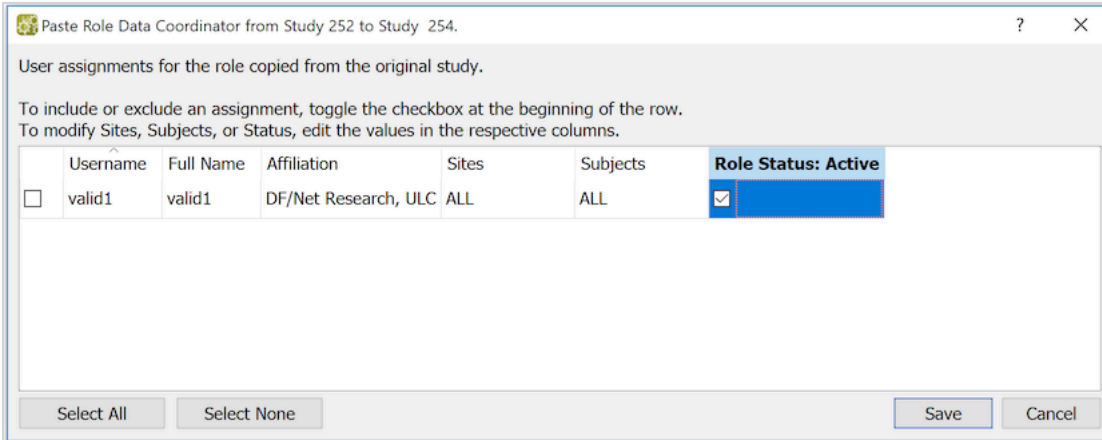
The new role name is added to the study roles list, but the role has no permissions and has not been assigned to any users.

7.4. Copying and Pasting a Role

Another way to add a new role is to copy and paste one from the same or another study.

Select a role and click **Copy** to copy it to the clipboard. Paste it any number of times into the same or different studies by selecting the study and clicking **Paste**. Each time a role is pasted, you are prompted to specify a unique role name. If a role with the same name already exists you are required to enter a new, unique name for the role being pasted.

If any users have been assigned the copied role the following dialog will appear when it is pasted.



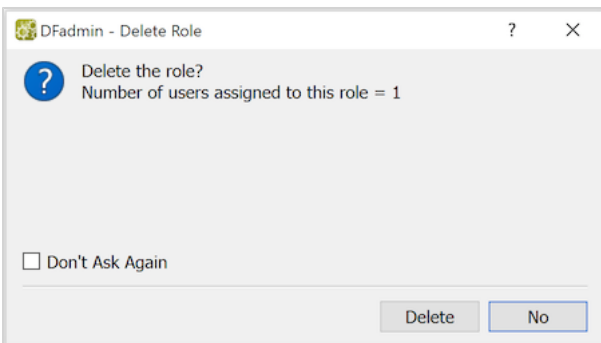
The dialog lists all users who have the copied role, and is used to apply these same role assignments, or modifications of them, when saving the new role. The checkbox in the first column beside each user must be checked to assign the pasted role to the user. By default, this checkbox is off for all users. **Select All** and **Select None** can be used to check and uncheck this box for all users. It is also possible to edit the **Sites**, **Subjects** and **Role Status** specifications for each user before saving the role and user role assignments.

Click **Save** to add the role to the study along with all of the selected user role assignments. Click **Cancel** to cancel both the user role assignments and the addition of the role to the study.

If any of the users could not be assigned the role, due to overlapping role permissions or because the user was locked by another administrator, the role and user role assignments will be saved with the exception of rejected user role assignments (if any).

7.5. Deleting a role

A role can be deleted at any time by selecting **Delete**. When a role is deleted, the confirmation dialog displays the number of users currently assigned the role.



A role can be deleted while users with that role are working in **DFexplore**. They will not be affected until the next time they login.

Deleting a role deletes both the role definition and user assignments. If a role is deleted and then re-defined it will be necessary to reassign it to all users who need it.

If you need to temporarily disable a role change the role status to inactive rather than deleting it.

7.6. Tools & Reports

This section of the Roles tab is used to specify permissions for **DFexplore** & API Clients, **DFsetup**, some study server operations, standard DFdiscover reports and custom study reports. If the box at the top of each of these 4 sections is checked permission is granted to all items in that section. When the same box is unchecked permission is granted by checking each item individually.

Note

Using a right mouse click or the keyboard accelerators Ctrl+A or Ctrl+Shift+A, all items in the current section can be checked or unchecked simultaneously.

The meaning of the individual items is described below.

7.6.1. DFexplore Views

The **DFexplore** View menu is the gateway to the main functional modules that make up this application. Some users may only need access to a few of these modules. The following permissions grant access to each **DFexplore** view and to specific features within each view.

| | |
|---------------------------------------|---|
| Batch Edits | Create or retrieve, run and review output from batch edit checks |
| Dashboard | Enable the DFexplore dashboard |
| Data | Perform data management operations using tasks and subject binders |
| Data - Attach subject document | Add a document to associate with a particular subject data record |
| Data - Import subject CRFs | Allow user to import a PDF file of scanned CRF images |
| Data - Submit PDF | Allow user to make a secure transmission of scanned CRFs and source documents to the DFdiscover server, as an alternative to faxing or emailing |
| Data - with Select | Allow access to the following options under Select in Data View: <ul style="list-style-type: none"> • By Data Fields: allow user to build a task set using data field criteria • By Data Retrieval File: allow user to build a task set using an existing data retrieval file • Define Tasks: allow user to define new tasks for themselves and others • Export Tasks to Local File: allow user to export tasks to a local file. • Import Tasks from Local File: allow user to import tasks from a local file. • Change Mode & Level: allow user to change working mode and the workflow level to which records are moved when saved • Batch Validate: allow user to move records in the current task set to a specified level • Batch Sign: allow user to sign records in the current task set to a specified level |
| Image | Enter data from CRFs received by fax, email or DFsend |
| Image - Create tasks | Allow user to create new data entry tasks within Image View for specified users and study roles |

| | |
|-----------------------------------|---|
| Image - Delete new records | Allow user to delete records in Image View that have not yet been saved to the study database |
| Image - Raw data entry | Allow user to enter a specified number of new records for specified visits or plates using Image View, but without images |
| List | Spreadsheet viewer, data exports, DFsas job exports |
| List - Create views | Create and save record and field selection criteria in named views |
| List - Import Data | Import data from external files |
| Queries | Review data queries |
| Reasons | Review reasons added to explain data values |
| Reports | Run DFdiscover and custom study reports. Only those reports enabled in the DFdiscover Reports and Study Reports section will be available. Note: DFdiscover report DF_SBhistory must be enabled in order to view history of changes (audit trail) for plates and fields. |
| Reports - Create lists | Save a list of reports and report options for subsequent execution |
| Schedule | Review the current site/subject visit schedule and scheduling requirements |
| Status | Review current status and workflow level of all records in the study database |

Data - with Select Permission

In an EDC study this permission should be granted to data management staff only. Clinical sites should *not* have this permission. In addition to restricting access to the Select menu permissions described above, users without this permission also have the following restrictions:

- they can save new data records to level 0 with status pending or to level 1 with status final or incomplete.
- they can revise and save pending level 0 records which remain at level 0 if resaved with status pending, and advance to level 1 if saved with status final or incomplete.
- once records have reached level 1 or higher these users can no longer save with status pending; they must use final or incomplete.
- the Select menu for such users displays just 2 items: 'All Records' which allows users to select and modify any record for which they have permission, and 'By Task' which allows users to review and modify records which meet pre-specified selection criteria.
- when 'All Records' is selected these users can only save records they have modified, and all such records move to level 1.
- when performing a task, the task definition determines which records are retrieved, whether they can be saved without modification and the workflow level to which saved records are moved, but tasks must be carefully defined as users can only see, modify and save records for which they have the necessary get, modify and write level permissions.

7.6.2. DFExplore Print/Save

Permissions to print and save CRFs, data and report output are under the following permission controls:

| | |
|-----------------------|---|
| Blank CRFs | Print and save blank CRFs in Data view |
| Completed CRFs | Print and save CRFs containing data values in Data view |
| Data | Print and save data and metadata records in List, Queries and Reasons views. Print and save database statistics in Status View. |
| DFsas jobs | Create, modify and export DFsas jobs in List View |
| Images | Print and save images in Data view, Image View and List View |
| Reports | Print and save reports in Reports View |

7.6.3. DFexplore Miscellaneous

| | |
|---------------------------------|--|
| Developer | Reload edit checks and lookup tables, and trace edit check execution |
| May disable edit checks | Permission to turn off edit check execution while reviewing records and performing data entry |
| Show query status detail | Display internal notes and complete status labels in: Queries View, the Query window within Data view, and in the Queries & Reasons review and approval dialogs. |

7.6.4. API Clients

Permission to access specific API client applications are controlled by the items in this section. Supported DFdiscover applications include:

| | |
|------------------|--|
| DFcollect | Mobile app for online and offline data collection |
| DFengage | Mobile app for collection of electronic patient-reported outcomes |
| DFsources | Mobile app for source document submission, including redaction and certification |
| DFweb | Browser-based web app for data collection |

7.6.5. Server

| | |
|--------------------------|--|
| Run Report | permission to run DFreport |
| Export Data | Permission to run DFexport.rpc and/or DFexport |
| Batch Edit checks | Permission to run DFbatch |
| Attach Document | Permission to run DFattach |
| Import Data | Permission to run |

7.6.6. Setup

Permission to use **DFsetup** to view study setup specifications or be able to create and modify them is granted as follows:

| | |
|--------------------|--|
| View | Read-only permission for all study setup files |
| Plates | Modify Plates, Fields, Styles and CRFs |
| Edit checks | Modify Edit checks |

| | |
|---------------------------------|---|
| Lookup Tables | Modify Lookup tables |
| Sites | Modify clinical sites database |
| Missing Map | Modify Missing value codes and labels |
| Sort Map | Modify Query sort order for Query Reports |
| Visit Map | Modify subject follow-up schedule |
| Conditional Terminations | Modify Conditional termination of subject follow-up |
| Conditional Cycles | Modify Conditional visit cycles |
| Conditional Visits | Modify Conditional visits |
| Conditional Plates | Modify Conditional plates |
| Query Titles | Modify Query Report titles |
| Query Covers | Modify Query Report covers |
| Query Messages | Modify Query Report messages |
| CRF Type Map | Modify mapping of CRF to categorical type |
| CRF Background Map | Modify sharing of CRF background across visit definitions |
| Query Category Map | Modify Query category value codes and labels |
| Study Logo | Not currently used |

7.7. Auto Logout

After a specified period of inactivity, **DFexplore** and **DFsetup** automatically exit, logging out the current user.

Different specifications can be entered for each role, or they can be inherited from the study level specification, entered in the **DFadmin** Studies dialog. **Initial** is the initial setting users have on first login, after which the user may use **File > Preferences** to change it to any value between 1 minute and the specified 'Maximum'. **Maximum** can be any value from 1 to 1440 minutes (24 hrs).

When users change their auto logout setting it is retained for the next login session unless it is reset using edit check function `dfpref`, which is typically used in `DFopen_study` or `DFopen_patient_binder`. If **Maximum** is reduced at some point during the study, any retained values that are greater than the new maximum will be reduced to the new maximum when the user logs in.

7.8. Database Permissions

For each role, permission to view, create, modify and delete data and metadata (queries and reasons) must be specified by entering one or more rows in the permissions table. Multiple rows will be needed if permissions differ by visits and/or

plates. It is illegal to include a visit/plate combination in more than one row; i.e. conflicting permissions for the same record cannot be defined.

When working in the permissions table, the tab and arrow keys may be used to select a cell for editing, and the space bar is used to toggle through the options associated with each check box. Keyboard accelerators (Ctrl+A or Ctrl+Shift+A) are used to toggle all check boxes in the row (on or off).

Example 7.1. Database Permissions

The following example shows typical permissions for clinical sites.

| Get | | Show | | Modify | | Write | | Data | | | | | Queries | | | | | Reasons | | | | | |
|-------------------------------------|--------|--------|---------------|--|--|--------|-----|-------------------------------------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|-------------------------------------|--------------------------|--------------------------|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Visits | Plates | Levels | Hidden Fields | Int. Queries | Levels | Levels | | C | M | D | L | P | C | M | D | A | B | C | M | D | A | | |
| <input checked="" type="checkbox"/> | ALL | ALL | 0-7 | <input checked="" type="checkbox"/> Show | <input checked="" type="checkbox"/> Show | 0-2 | 0-2 | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | | | | <input type="checkbox"/> Show | <input type="checkbox"/> Show | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Status Use the check box at the beginning of each row to activate or deactivate the database permissions defined in the row. When the box is checked the permissions are active, i.e. included in the role definition and applied to users with that role.

Get Visits The entry in this cell determines the visits/assessments to which the permissions apply. One or more visits in the range 0 to 65535 may be specified, like this: **0,2,5-10,101**. **ALL** or *****(asterisk) may be entered to represent all visit/assessment numbers.

Get Plates The entry in this cell determines the plates to which the permissions apply. One or more plates in the range 1 to 501 may be specified, like this: **1-10,21-29,55,68**. **ALL** or *****(asterisk) may be entered to represent all possible plate numbers.

Get Levels The 'Get Levels determine which data records a user can see in **DFExplore**. Data records at other levels will be hidden to users with this role. One or more levels in the range 0 to 7 may be specified, like this: **0-3,5,6**. **ALL** or *****(asterisk) may be entered to represent all possible levels, and **-**(dash) represents no levels. If a user has permission to see a data record they automatically have permission to see all of the queries and reasons attached to that record regardless of the levels of the queries and reasons.

In **DFExplore** new blank pages and new pending records have workflow level 0. Thus, without level 0, a **DFExplore** user would not be able to see blank pages or new pending records, which means they would not be able to enter new data records or complete new pending data records. Typically, only those individuals responsible for original data entry should have access to level 0 records.

Show Hidden Fields Fields defined as hidden in **DFsetup** can be made available in specified roles. The options include **all** or **none**. Hidden fields can be made available on some plates but not on others by defining multiple rows, with the desired visit/plate combinations.

Show Internal Queries Internal queries are typically not made available to the clinical sites. However, it may be desirable to reveal internal queries after they have been resolved, thus the following options are available: **all**, **resolved** and **none**. If no permission to view internal queries exists, but the role includes full permissions to create and modify queries, internal queries will always be visible to the user working with that role. If no permission to view internal queries exists, and the role includes partial (e.g. edit check only) permissions to create and modify queries, internal queries can be created by an edit check but do not become visible to a user working

with that role. To make internal queries available on some plates but not on others, multiple rows can be defined with the desired visit/plate combinations.

Modify Levels

The 'Modify' levels determine which data records can be modified in **DFexplore**. Data records at other levels can be viewed but not changed (provided they are included in the user's 'Get' levels). One or more levels in the range 0 to 7 may be specified, like this: **0-3,5,6**. **ALL** or *****(asterisk) may be entered to represent all possible levels, and **-**(dash) represents no levels.

In **DFexplore** level 0 is used for both new blank pages and new pending records. Thus, a user with Get permission for level 0 records, who does not have Modify permission for level 0, will be able to see blank and new pending records, but will not be able to change them.

Permissions specified for queries and reasons only apply to data records the user is allowed to modify. The level of the query or reason itself is irrelevant. If a data record can be changed, query and reason permissions take effect for all queries and reasons on that data record, regardless of the metadata record levels. And if a data record cannot be changed neither can the metadata on that record, even for queries and reasons that are at modify levels. This dependence on the level of the data record also applies to the auto-resolution of missing value and illegal value queries, as described under Query permissions below.

Write Levels

The 'Write' levels determine the workflow levels at which data, queries and reasons may be saved in the study database. One or more levels in the range 0 to 7 may be specified, like this: **0-3,5,6**. **ALL** or *****(asterisk) may be entered to represent all possible levels, and **-**(dash) represents no levels.

Write levels are applied separately within each row of the role definition; and can thus be different for different visit/plate combinations.

When a data record is saved in *Validate* or *DDE* mode the data and all metadata records (both old and new) are written at the user's current working level, whether the records have been modified or not. When working in *Modify* mode only modified records are saved at the user's working level; unmodified records remain at their current level. As a result, the data and its associated queries and reasons can move to different levels. When working in *Edit* mode the level remains unchanged for data records, whether they are modified or not, and also remains unchanged for metadata records that are not modified, but new and modified queries and reasons are saved with the level of the data record.

Users at the clinical sites should typically have Write levels 0-1. This allows them to enter new records with status pending (level 0) and ensures that all saves with status final or incomplete are moved to level 1. Alternatively, clinical sites can be restricted to Write level 1 only to prevent them from creating new pending records; forcing all records to be saved at level 1 with status Final or Incomplete.

A user restricted to write level 0 would be able to create and modify new pending records, but cannot raise them to status incomplete or final. This might be used if an investigator needs to review and approve data entry performed by others before it is elevated to Incomplete or Final status.

Data

Permission to (C)reate, (M)odify, and (D)elete data records, and to mark records (M)issed are specified separately by checking the box corresponding to each of these functions. If none of these boxes is checked the role will allow **DFexplore** users to retrieve the data records specified under the Get specifications, but will not allow them to make any changes to these records.

The Modify check box has a middle state, denoted by a dash or shading (depending on platform). This signifies that the user is allowed to change a record's status and level but not

modify any of the data fields. This feature is useful for site monitors who need to perform source verification, and perhaps add queries, but not change data values. Typically, such users will use predefined tasks which will retrieve the records that need to be reviewed, and move them to a designated level when they click a save button to indicate that the review was completed. This mode allows data fields to be modified by edit checks that might be used within the task to update hidden fields on each plate that is reviewed with the user, date and time of the review, or other information obtained from the reviewer using edit check functions `dfask` or `dfcapture`.

Checking the (P)assword required box indicates that the user must enter their password to save records and attach documents (using the **Plate > Attach Subject Document** action) with the visit and plate numbers defined on that row. This applies to all record transactions, whether performed in Data View or Fax View, and whether creating a new record, saving a modified record, marking a record or assessment missed, changing image status in the Review Images dialog, or deleting an image or data record. If a password is required, on performing one of the above actions, the user is presented with a dialog in which to enter their password, and the operation is completed only if the correct password is entered.

For plates with an eSignature module where the record is eligible for signing, saving the record will prompt the user for both username and password on the first signing, then just password on subsequent signings in a given **DFexplore** session. Once the credentials are accepted, the eSignature fields are automatically populated. Refer to [Study Setup User Guide, eSignature Module and 21 CFR Part 11 Compliance](#) for further details.

For the following operations users are always required to enter their password, regardless of role specifications:

- Batch validate a set of records in Data View
- Import Subject Documents in Data View
- Import Subject Data in List View

If the credentials are not accepted, the user is prompted to re-enter their credentials. If they fail to do so in the configured number of attempts, they are automatically logged out and a notification email is sent to the DFdiscover administrator.

It is also possible to require entry of the user's password in an edit check using function `dfpassword`, for example before: unmasking certain data fields, revealing certain data entry screens, or running a randomization script.

Queries

Query permissions are granted by checking the box associated with (C)reate, (M)odify, (D)elete, (A)pprove and (R)eply. Each of these permissions has three levels: not allowed (unchecked), allowed (checked), and allowed only when performed by an edit check (shaded or dashed).

DFexplore includes a number of rules for automatically changing query status. These rules and the permissions required to enable them are described below.

1. Query status changes from unresolved to pending if a new reply is entered. This rule applies to all queries. Of course the user must have permission to reply to queries on the current record, and the data record must be at a workflow level for which the user has modify permission.
2. Query status changes from unresolved to pending if a new reason is entered, subject to the following conditions:

- the query usage type is external (not internal)
 - the data record level is included in the user's modify levels
 - the user has permission to modify queries; either full permission (checked) or edit check permission (shaded or dashed).
3. In **DFexplore** queries, with category missing value or illegal value, can be auto-resolved when the user corrects the field, and auto-unresolved if the user changes the field back to a missing or illegal value. This only occurs when all of the following conditions are met:
- the user has just changed the value of the data field
 - the field has an external query (not internal)
 - the category code is missing or illegal
 - the query reply type is refax/correction
 - the query status is unresolved or resolved (not pending)
 - the data record level is included in the user's modify levels
 - the user has permission to modify queries; either full permission (checked) or edit check permission (shaded or dashed).

When these conditions are met the following rules are applied in order until a rule is met. For Illegal value queries:

- if the category code was illegal at plate entry, and the field has been returned to the value it had at plate entry, then the query status is returned to the status it had at plate entry
- else, if the new value is illegal, then query status is set to new unresolved (code 1)
- else, if the new value is a missing value code, then query status is set to resolved NA (code 3)
- else, the new value must be legal, and thus query status is set to corrected (code 5). Note: if a field does not have legal value specifications all values are considered legal, and if a field is optional, a blank value is considered legal.

For missing value queries:

- if the category code was missing at plate entry, and if the field has been returned to the value it had at plate entry, then the query status is returned to the status it had at plate entry
- else, if the new value is blank or illegal, then query status is set to new unresolved (code 1)
- else, if the new value is a missing value code, then query status is set to resolved NA (code 3)
- else, the new value must be non-blank and legal, and thus query status is set to corrected (code 5). Note: if a field does not have legal value specifications all values are considered legal.

Typically roles assigned to **DFexplore** users at the clinical sites should allow them to: (R)eply to queries (checked), (C)reate, (M)odify and (D)elete queries only when this is performed by an edit check (shaded or dashed), and not allow them to (A)pprove replies to queries (unchecked); while roles assigned to central data management staff should allow them to: (C)reate, (M)odify, (D)elete and (A)pprove queries (checked), but not (R)eply to queries (unchecked).

Reasons

Reason permissions are granted by checking the box associated with (C)reate, (M)odify, (D)elete, and (A)pprove. Each of these permissions has three levels: not allowed (unchecked), allowed (checked), and allowed only when performed by an edit check (shaded or dashed).

As for queries, reason permissions only take effect on data records the user can modify, and the level of the reason record itself is ignored.

Typically roles assigned to **DFexplore** users at the clinical site should allow them to: (C)reate and (M)odify reasons (checked), but not allow them to (A)pprove reasons (unchecked) unless there are also edit checks that create reasons for them (shaded or dashed); while roles assigned to central data management staff should allow them to: (A)pprove reasons (checked), but perhaps not (C)reate or (M)odify them, except when this is done by an edit check (shaded or dashed).

If a user has permission to approve reasons, any reasons they create or modify will be automatically approved, whether created manually or by function `dfaddreason`.

If users do not have permission to approve reasons any reasons they create or modify will be saved with the pending status, whether created manually or by function `dfaddreason`.

Users with shaded or dashed permission cannot approve reasons themselves, but approved reasons can be created by edit checks. For these users reasons created/modified by `dfaddreason` will be automatically approved if the edit check adds the reason without user intervention, but if the edit check displays the reason dialog so the user can approve or modify it then the reason will be saved with status pending.

Automatic "Set by Edit check" reasons, which are created when an edit check changes a data field, are automatically approved for all user regardless of reason approval permission, but these reasons can be over-ridden within the edit check using the `dfaddreason` function to create a custom reason with a specified status.

Effect of Get Restrictions on Edit checks

Restrictions on records the user can Get (i.e. see), specified by Visit, Plate and Level, have implications for edit checks in **DFexplore**. A user must be able to at least view a data record before edit checks can see it. Any reference to a field the user does not have permission to view returns missing in an edit check. This restriction does not apply to **DFbatch**.


Invalid database permissions

A row that is highlighted in red indicates:


- an invalid entry in at least one of the columns, or
- overlapping visit/plate combinations; to avoid permission conflicts each visit/plate combination can appear in only one row in the permissions table.

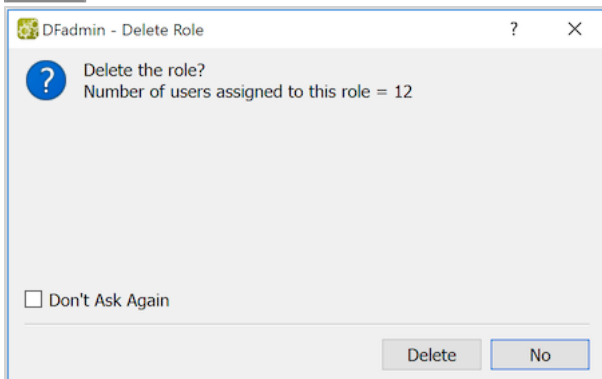
7.8.1. Adding Database Permission

To add a new database permission:

1. Select the first empty row in the permissions table.
2. Enter the visit/plate combination to which the permissions apply.
3. Enter the remaining permission specifications. Press Enter or Tab to check the validity of the specifications.
4. If none of the values appear in red, the row will be accepted as valid, the delete icon () will appear in the last column, and a new empty row will be added to the permissions table.
5. When all of the rows needed to define the database permissions for the role have been completed, select **File > Save** to save the permissions. Any changes made to the permissions are not saved until they are saved explicitly in this way.

7.8.2. Deleting Database Permission

To delete a specific database permission specification (table row), click the corresponding delete icon (). A confirmation dialog is displayed, warning you of the number of users who are affected by this modification to the role definition. Click **Delete** to confirm and proceed with the deletion; otherwise, click **No** to cancel the deletion.



7.8.3. Modifying Existing Study Roles

Permissions can be changed by clicking and overwriting the value or changing the check box state (checked, shaded/dashed or unchecked), followed by pressing Enter or Tab to verify that the value is valid.

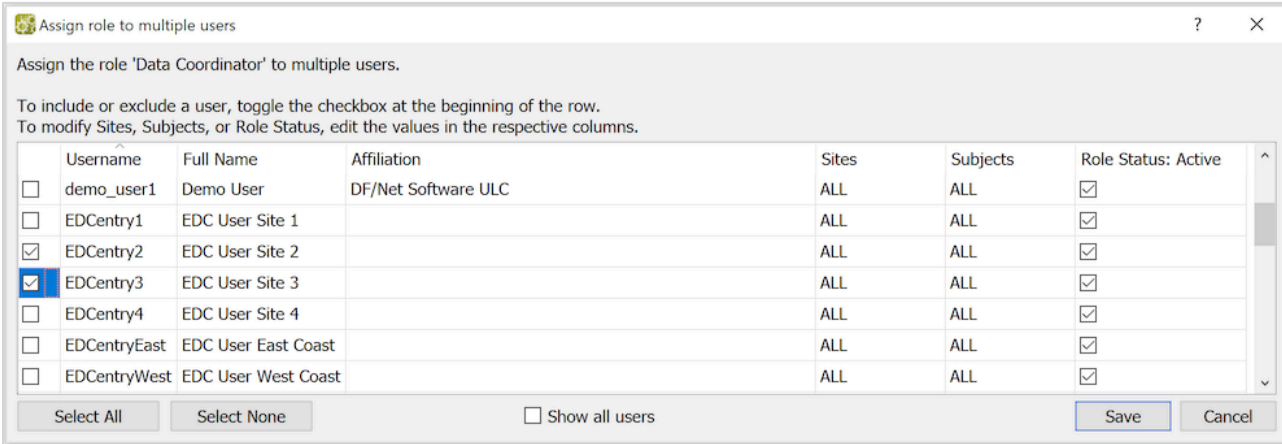
Rows highlighted in red, indicate errors in role definition. Role errors can occur because an individual value specification is invalid, or because a visit/plate combination overlaps with the combination specified in another row. Invalid specifications cannot be saved. Permissions containing both errors and some new or modified entries that are valid can be saved, but rows containing errors are dropped if they were newly defined, and are returned to their previous valid values if the error was introduced by a modification.

7.9. Assign Roles to Users

A role can be assigned to any or all users by selecting the role and clicking **Assign to users**. A confirmation dialog is displayed listing all users currently using this study, their full name, affiliation and user settings. You may modify sites, subjects or role status from this dialog.

If you want to see a list of all users, mark **Show all users**.

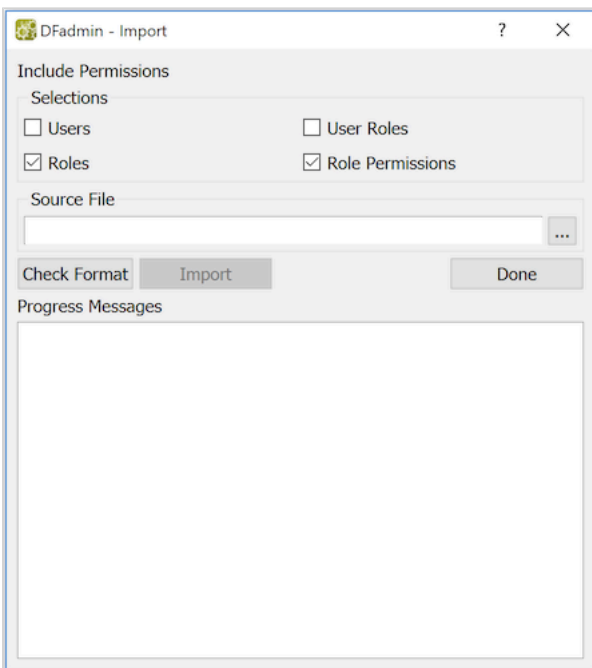
Select the users to receive this role assignment (or select all using **Select All**) and click **Save**.



7.10. Import

Study roles, permissions, role assignments to users, and user contact information can be imported from a text file. Import will overwrite any matching specifications that already exist. The import dialog includes options for selecting the type of records to be imported (i.e. Users, User Roles, Roles and Role Permissions) from the import file as illustrated in [Example 7.2, "Import Roles"](#). The import file must be formatted as described in [Table 14.20, "DFuserdb.log"](#), excluding the Record Time Stamp and Modifier fields.

Example 7.2. Import Roles



Procedure 7.1. Importing Users, Roles and Permissions

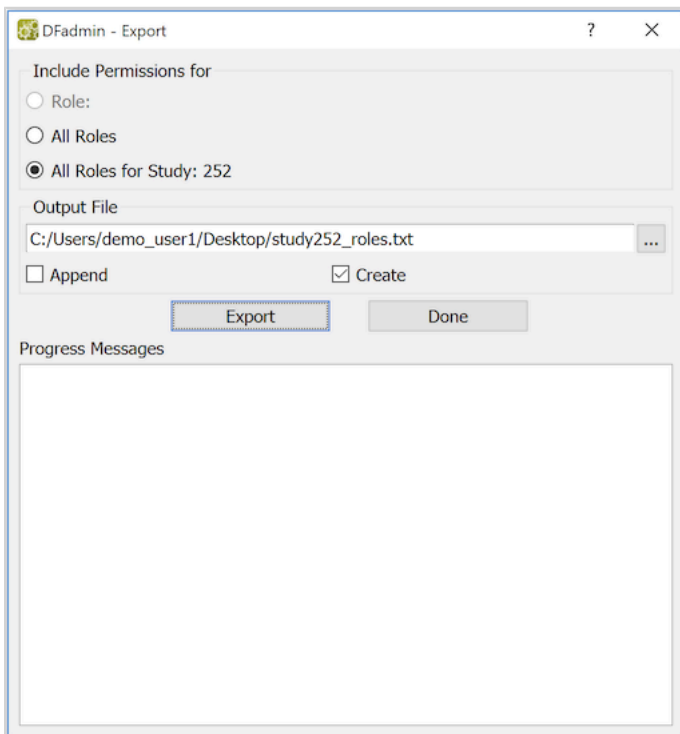
1. Select **File > Import**
2. Specify the types of data to import. This is specified by checking or unchecking the items in the **Selections** section of the dialog.

3. Specify the **Source File** name or pick a file by clicking .
4. Click . Any invalid entries are displayed. is enabled only if there are no invalid records.
5. Click . Progress and errors messages (such as overlapping permissions) are displayed while importing.
6. Click to dismiss the dialog.

7.11. Export

Study roles, permissions, role assignments to users, and user contact information can be exported to a text file. Export can overwrite or append its output to the specified file. The output file format is described in [Table 14.20](#), “DFuserdb.log”.

Example 7.3. Export Roles



Procedure 7.2. Exporting Users, Roles and Permissions

1. Select the study, user or role to be exported (if export is to be limited to a single user, study or role).
2. Select **File > Export**.
3. Select the users, studies or roles to be exported (all or currently selected study, user or role).
4. Specify an **Output File** name or pick the file using the file selection button.
5. Select **Append** to write the exported data to the end of file, or **Create** to overwrite the file with the exported data.
6. Click . Progress and errors messages are displayed while exporting.
7. Click to close the Export dialog.

7.12. DFengage Considerations for Roles

DFengage is an electronic patient reported outcome (ePRO) application fully integrated with DFdiscover, built on the WeGuide platform. DFengage relies on the role permissions and user accounts defined in DFAdmin. Refer to [Study Setup User Guide, DFengage Considerations](#) for setup of plates and visits to be completed in DFengage. Refer to [Section 8.12, "DFengage Considerations for Users"](#) for details on the user permissions.

A specific role called 'ePROdata' is required for DFengage users. The role definition must include:

- **Tools & Reports**

Under DFexplore, check Views – Data. Under API Clients, check DFengage. Under Server & DFsetup, check Setup – View and Setup – Visit Map.

- **Permissions**

View only access is required to the visit and plate where the baseline visit date is captured. This record will not be displayed in DFengage. No modify, write, data, query, or reason permissions.

Write access is required for ePRO visits and plates. List these individually. Do not show hidden fields or internal queries. Write level must be 1. Data – C (create) and M (modify) and Reasons – M (modify) permissions are required.

Chapter 8. DFadmin - Users

8.1. Introduction

Users must be granted permission to access DFdiscover studies. A DFdiscover user account is created using the **Users** tab in **DFadmin**, and involves entering user contact information, preferences and study permissions. This account is required for both DFdiscover and **DFexplore**. In addition, a UNIX user account is required for DFdiscover, but not for **DFexplore**.

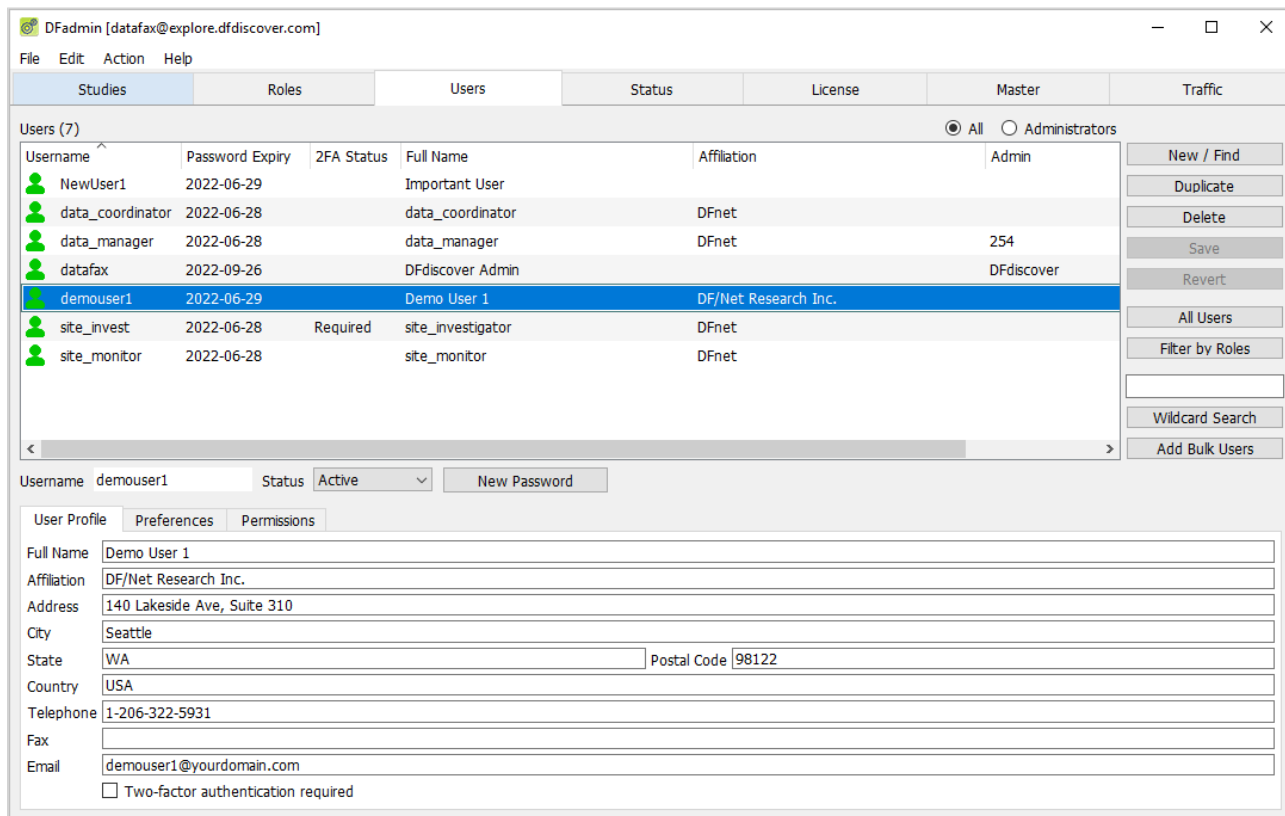
DFdiscover user accounts can be modified by any DFdiscover administrator or study administrator, but there are limitations.

- Only a DFdiscover administrator can grant and revoke DFdiscover system and study administrative privileges for other users.
- A study administrator can create and update study roles and DFdiscover user accounts, and can grant and revoke study roles to any user in the DFdiscover user database. Study administrators are restricted to performing these functions in their own studies.

To administer user permissions, two applications are available: the **Users** dialog described here and the command-line application *Programmer Guide, DFuserdb*.

8.2. The Users tab

Click the **Users** tab to display the **Users** view.



The screenshot shows the DFadmin application window with the 'Users' tab selected. The main area displays a table of users with columns for Username, Password Expiry, 2FA Status, Full Name, Affiliation, and Admin. The user 'demouser1' is highlighted. Below the table, there is a form for editing the user profile, including fields for Full Name, Affiliation, Address, City, State, Postal Code, Country, Telephone, Fax, and Email. A checkbox for 'Two-factor authentication required' is also present.

| Username | Password Expiry | 2FA Status | Full Name | Affiliation | Admin |
|------------------|-----------------|------------|-------------------|----------------------|------------|
| NewUser1 | 2022-06-29 | | Important User | | |
| data_coordinator | 2022-06-28 | | data_coordinator | DFnet | |
| data_manager | 2022-06-28 | | data_manager | DFnet | 254 |
| datafax | 2022-09-26 | | DFdiscover Admin | | DFdiscover |
| demouser1 | 2022-06-29 | | Demo User 1 | DF/Net Research Inc. | |
| site_invest | 2022-06-28 | Required | site_investigator | DFnet | |
| site_monitor | 2022-06-28 | | site_monitor | DFnet | |

User Profile for demouser1:

- Full Name: Demo User 1
- Affiliation: DF/Net Research Inc.
- Address: 140 Lakeside Ave, Suite 310
- City: Seattle
- State: WA
- Postal Code: 98122
- Country: USA
- Telephone: 1-206-322-5931
- Fax:
- Email: demouser1@yourdomain.com
- Two-factor authentication required

The Users list displays each user's: username, password expiry date, two-factor authentication (2FA) status, full name, affiliation and administrative privileges. DFdiscover administrators are shown as **DFdiscover**, study administrators are

shown as **All Studies** or the list of study numbers they are allowed to administer. A blank password expiration date indicates that the user has not yet been assigned a password.

The following actions are available.

| | |
|------------------------|--|
| All | Show all users currently defined in the DFdiscover users database. |
| Administrators | Show DFdiscover system and study administrators only. The Admin column shows 'DFdiscover' if the user is a DFdiscover administrator, 'All Studies' if the user has permission to administer all studies, and a list of DFdiscover studies if the user has permission to administer selected studies. |
| New / Find | Add a new DFdiscover user account or find an existing user account by email address. |
| Duplicate | Add a new DFdiscover user with the same account details and permissions as an existing user. |
| Delete | Inactivate a DFdiscover user account and remove it from the list of displayed users. Once defined a user account is never actually deleted; thus users listed in study audit trails can always be identified. |
| Save | Save any changes made to current user account or user permissions. |
| All Users | Show users without applying any study role filtering. If 'All' choice is selected (from the All or Administrators choices), all DFdiscover users will appear in the list. Otherwise, only DFdiscover system and study administrators will be displayed. |
| Filter by Roles | Select this option to filter the users list by study roles. |
| Wildcard Search | Select this option to display users that contain a specified text string in either the Login, Full Name or Affiliation fields. Wildcard matches are not case sensitive and include the following options: <ul style="list-style-type: none"> • * - matches zero or more characters • ? - matches a single character • [...] - matches the set of characters in square brackets Thus for example: <ul style="list-style-type: none"> • *er - matches usernames, full names and affiliations ending in 'er'. • ????? - matches usernames, full names and affiliations that have exactly 5 characters • [ab]*er - matches usernames, full names and affiliations that begin with 'a' or 'b' and end in 'er'. |
| Status | Status must be set to Active to enable a user login, and may be set to Inactive at any time to disable it. The head icon appears as an empty outline if login is disabled. Inactivating a user login retains all user information, compared to 'Delete' which removes it. |
| New Password | Select this button to generate a temporary password for the user to use on their initial (or next) login, at which time the user will be prompted to change the temporary password. The system-generated password conforms to the requirements specified under the |

Master tab. It can be modified by editing the password field, but the value must conform to the password rules.

An invalid password.

A valid password.

When a new password is saved, the list of users is updated and the new password expiry date is displayed.

User Profile

Enter user contact information. Only the **Email** address is required for proper DFdiscover operation. Without a valid email address, users will not be able to register for two-factor authentication or reset their own password using the the **Password Reset** option in the **DFexplore**, **DFsetup** and **DFsend** login dialogs.¹

If the user is an administrator, their email address is also used as the sender identification when they perform certain actions, for example when they restrict a study.

It is recommended that an email address is required for each registered user.

As an added level of account security, two-factor authentication can be enabled. When enabled, the user will be required to enter a unique 6-digit security code (that they receive by email) once every 30 days for each device that they use to access DFdiscover. Certain conditions, such as password resets, can reduce this interval.

Preferences

Record the user's preferred language and contact method (fax or email). This information is not currently used by DFdiscover.

Permissions

Define the roles a user is granted in different studies. A user must have at least one role in one study.

8.3. Adding a New User

Users are not able to access any DFdiscover applications until they have been registered as a DFdiscover user.

Username

A DFdiscover username is a unique and permanent user identifier. Once created, a new user account is retained in the DFdiscover users database even if the user is deleted. While it is possible to reactivate a deleted user account and modify it for use by a different user, this is not recommended if the user account has been used to process data for any study, as it could result in confusion in the interpretation of audit trail reports.

When adding a new user, chose the username carefully and make sure that it has been entered correctly before saving a new user account.

Multi-tenant Servers

The appearance of the **New User** dialog, and the procedure for adding users, is affected by the setting of **Multi-tenant** in the **Master** panel (see **Multi-tenant, Master**).

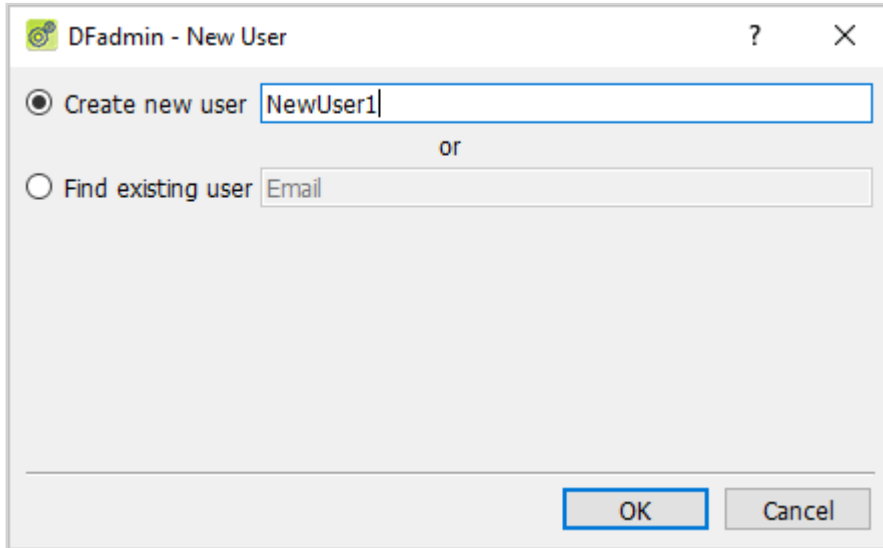
In multi-tenant installations, a study admin is permitted to create new user accounts or assign new study permissions to existing user accounts. To locate existing user accounts, the study admin must know the email address of the existing user account.

¹ In addition, an administrator must enable the system-wide capability for users to reset their own passwords.

1. Click **New / Find**.

With **Create new user** selected, enter the new user's unique username. Alternatively, with **Find existing user** selected, enter the email address of the user you wish to add. It is not possible to create a new user account starting from an email address.

Users are uniquely identified by their username, which must consist of 16 characters maximum from the list: A-Z, a-z, 0-9, underscore. The first character of the username must be from the list: A-Z, a-z.



DFadmin - New User

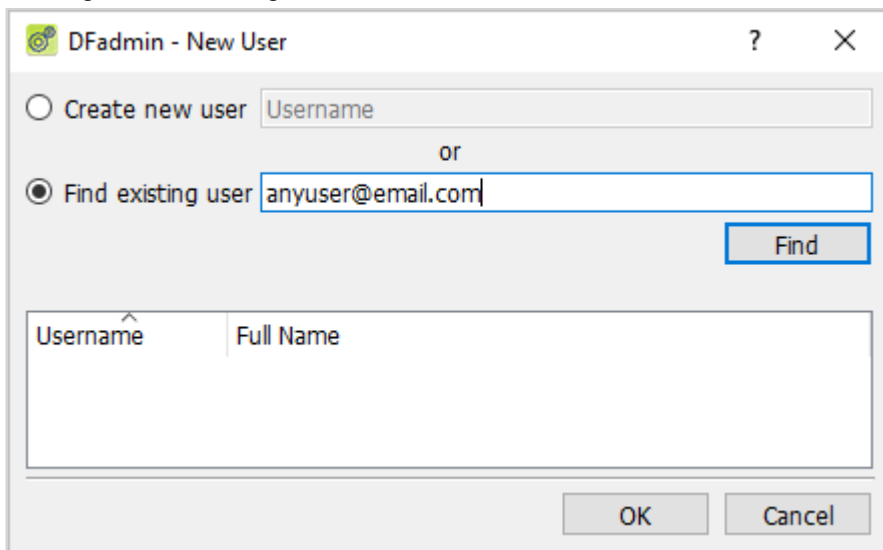
Create new user

or

Find existing user

OK Cancel

Unlike usernames, email addresses are not required to be unique. When entering an email address, click **Find** to locate existing accounts using that email address.



DFadmin - New User

Create new user

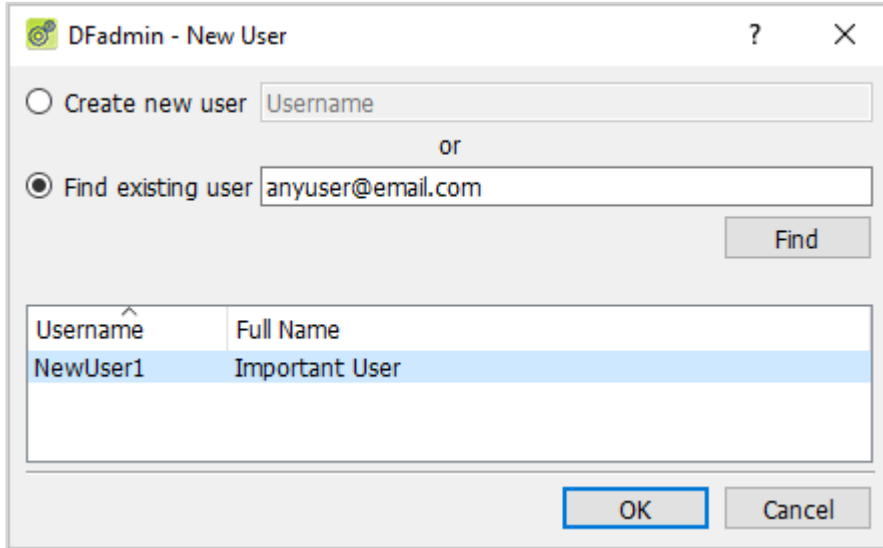
or

Find existing user

| Username | Full Name |
|----------|-----------|
|----------|-----------|

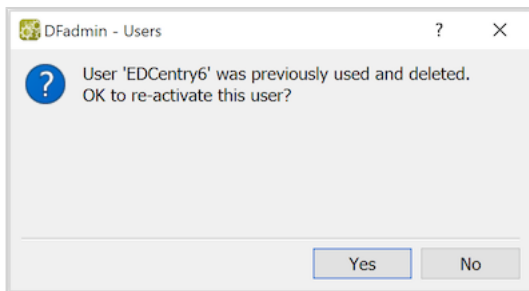
OK Cancel

If the email address is defined, select the desired user account from the list.



2. Click **OK** to add the user and exit the dialog.

If the username is associated with a deleted user account, a confirmation dialog opens asking if you wish to re-activate the deleted user account. Click **Yes** to retrieve the deleted user account information including user contact info, preferences and permissions, all of which can then be modified as needed.



8.4. Duplicating an Existing User

When creating a new user account that will have study roles and permissions identical or similar to an existing user, it may be easier to duplicate an existing user.

1. **Select the user whose permissions will be duplicated.**

Highlight the user in the **Users** list.

2. Click **Duplicate**.

The **Duplicate** dialog appears. The dialog appearance is almost identical to the **Add** dialog,

3. **Enter the new user's username.**

Users are uniquely identified by their username, which must consist of 16 characters maximum from the list: A-Z, a-z, 0-9, underscore. The first character of the username must be from the list: A-Z, a-z.

4. Click **Create** to create the duplicate user.

The new user account is created, with data copied from the duplicated user, and the new username is displayed in the **Users** list. The new user account can then be modified as needed to correct contact information, preferences and permissions.

8.5. Deleting an Existing User

Deleting a DFdiscover user account changes the account status to deleted, but does not actually remove it from the DFdiscover users database. A user is locked when it is selected in DFdiscover and thus cannot be deleted if it is currently locked by another DFdiscover or study administrator.

1. **Select the user to be deleted.**

Highlight the user in the **Users** list.

2. Click **Delete**

A confirmation dialog appears. Click **OK** to confirm the deletion, thereby deleting the user from the **Users** list and revoking all of their DFdiscover permissions, or click **Cancel** to cancel the delete action.

Deleting an active user

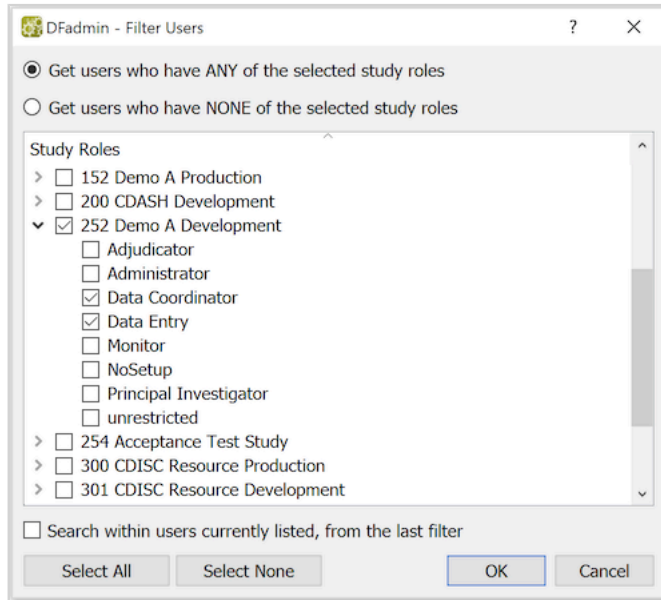
It is safe to delete a user who is currently logged in and working in a DFdiscover study. Users issuing commands from a terminal window will be affected on the very next command, but deleting a user will not have an immediate effect on users of DFdiscover applications, including **DFexplore**. User permissions are checked when an application is started. Thereafter, the permissions are not checked again until the application is re-started. An active user will be able to continue working until they exit the application.

8.6. Filtering Users

Filtering the user list is an easy way to find users who have specified roles for specified studies. It can also be used to find users who do not have specified roles.

1. Click **Filter by Roles**.

The dialog lists all DFdiscover studies and the roles for each study. Individual study roles can be selected, or all roles for a study can be selected, using the check boxes beside study and role names. After selecting studies and study roles, use the toggle options at the top of the dialog to indicate whether you want to list users who have any of the selected roles, or conversely list users who have none of the selected roles. After performing an initial search, you can refine it by marking **Search within users currently listed, from the last filter**. If this box is not checked filtering is applied to all registered DFdiscover users.



2. Click **OK** to apply the filter.

Users who meet the filter specifications are listed in the Users list in the main window. After filtering users, click **All Users** to restore the complete list of registered DFdiscover users.

8.7. Adding New Users in Bulk

For users submitting data via electronic patient reported outcomes (ePRO) applications such as DFengage, their permissions must be set up with a specific study role and access to one subject only. It may be expedient to create accounts for these users all at once at the start of the study. This may be accomplished using the Add Bulk Users function.

1. With the Users tab selected, click **Add Bulk Users**.
2. The Add Bulk Users dialog appears. Select the study and role and specify the username prefix and the range of subject IDs for the users to be created. The subject IDs specified must be defined in the Sites configuration in **DFsetup**. Provide the initial, temporary password to be used for all accounts.

DFadmin - Add Bulk Users

Specify the study, role, username prefix and range of subject IDs to create multiple user accounts each with access to a single subject ID. Each subject user account will be assigned a unique username based on their subject ID and the same temporary password for all accounts.

Study: 117 DFengage eDiary

Role: ePROdata

Username Prefix: s117p

Subjects Range: 10-15,20-25,30-35 Preview usernames

Preview usernames: s117p10-s117p15, s117p20-s117p25, s117p30-s117p35

Initial Password: ●●●●●●

Add 18 user accounts

Results:

Close

- Once all information is provided, click **Add X user accounts** to continue, where X is the number of user accounts to be added.
- Review the details of the new users to be added, including the study number, role name, and usernames. Click **Yes** to proceed with adding the accounts. Click **No** to cancel and return to the previous step.

DFadmin - Users

Add 18 user accounts with the following usernames and grant study '117', role 'ePROdata' permission for the respective subject records.

s117p10-s117p15, s117p20-s117p25, s117p30-s117p35

Click 'Yes' to add the accounts

Yes No

- The Results panel in the Add Bulk Users dialog will update with the username and status of all the users defined above.

DFadmin - Add Bulk Users

Specify the study, role, username prefix and range of subject IDs to create multiple user accounts each with access to a single subject ID. Each subject user account will be assigned a unique username based on their subject ID and the same temporary password for all accounts.

Study: 117 DFengage eDiary

Role: ePROdata

Username Prefix: s117p

Subjects Range: 10-15,20-25,30-35 Preview usernames

Preview: s117p10-s117p15, s117p20-s117p25, s117p30-s117p35

Initial Password: ●●●●●●

Add 18 user accounts

Results:

| | Username | Log message |
|---|----------|-------------|
| 1 | s117p10 | Success |
| 2 | s117p11 | Success |
| 3 | s117p12 | Success |
| 4 | s117p13 | Success |
| 5 | s117p14 | Success |
| 6 | s117p15 | Success |
| 7 | s117p20 | Success |
| 8 | s117p21 | Success |

Close

8.8. Permissions

User permissions come from the roles they are assigned within each study. The creation of study roles is described in [Chapter 7, DFadmin - Roles](#). This section describes how study roles are assigned to users.

Users can perform different roles at different clinical sites within the same study, and can perform different roles for different subjects within the same site, but a user cannot perform different roles for the same subject within the same study.²

A user who performs different roles at different sites within a study, will be limited to the database permissions associated with the role they perform at each site. For example, a user might be able to enter medical history data for all subjects at one site but only view it for all subjects at a different site. This role differentiation only affects database permissions (i.e. permission to view, create, modify and delete data and metadata). Users with multiple roles have access to the superset of **DFexplore** views, DFdiscover applications, DFdiscover reports and Study reports, derived from all of the roles they are assigned in one study. Thus these permissions can vary among studies but not within a study.

Permissions for DFdiscover studies are specified in the [Permissions](#) view.

² This rule has been implemented because performing different roles for the same subject could lead to permission conflicts and confusion in interpreting the audit trail.

The screenshot shows the DFAdmin user management interface. At the top, there is a list of users with columns for user name, creation date, status, role, and organization. The user 'demo_user1' is selected. Below the list, there are tabs for 'User Profile', 'Preferences', and 'Permissions'. The 'Permissions' tab is active, showing a dropdown for 'Study or DFdiscover Administrator' set to 'None'. There is a checkbox for 'Allow access to Image Router'. Below this is a table of 'Study Roles' with columns for 'Study', 'Sites', 'Subjects', and 'Role Name'. The table contains five rows of study roles, each with a checkbox in the first column.

| Study | Sites | Subjects | Role Name |
|---|--------------------|----------|---------------------|
| <input checked="" type="checkbox"/> 101 Acme Pharma Development | ALL | ALL | unrestricted |
| <input checked="" type="checkbox"/> 152 Demo A Production | 250, 350 | ALL | unrestricted |
| <input checked="" type="checkbox"/> 200 CDASH Development | ALL | ALL | unrestricted |
| <input checked="" type="checkbox"/> 252 Demo A Development | 250, 350, 450, 999 | ALL | Administrator |
| <input checked="" type="checkbox"/> 254 Acceptance Test Study | ALL | ALL | datafax permissions |

User permission specifications include the following elements:

Study or DFdiscover Administrator

Only a select subset of users should be given this global privilege. Any user can be assigned DFdiscover or study administrative privileges. Click the button located at the right end of this widget.

The dialog box titled 'Study or DFdiscover Administrator' has a close button and a help icon. It contains four radio button options: 'None', 'DFdiscover Admin', 'Study Admin for All Studies', and 'Study Admin for Selected Studies:'. The 'Study Admin for Selected Studies' option is selected. Below it is a list of studies with checkboxes: '152 Demo A Production' (checked), '200 CDASH Development', '252 Demo A Development' (checked), '254 Acceptance Test Study', '300 CDISC Resource Production', '301 CDISC Resource Development', '500 EOS', and '501 EOS Development'. At the bottom are 'OK' and 'Cancel' buttons.

Choose the correct option (**None** removes any previous admin permissions) and mark studies to include as needed.

Allow access to Image Router

The Image Router displays document pages that could not be identified, and is used to route any CRF pages among them to the appropriate study database. Selecting this option gives the user permission to use this application.

It is important that only coordinating site staff with an understanding of all studies have this permission.

Status

Mark the checkbox at the left end of each row in the permission table to activate the permissions specified by the row when checked, and deactivate them when the box is not checked. This can be used to temporarily revoke permissions without deleting them from the table.

Study

Enter the study number or select the study from the study list. If a valid study number is entered, the field automatically displays the study name. The study must be specified before the other cells of the table are entered.

| | |
|------------------|---|
| Sites | The sites, at which the user performs the role, are specified by entering ALL or * (indicating all sites), or a range of valid study sites. e.g. 1,5-8,98,99 |
| Subjects | The subjects, for which the user performs the role, are specified by entering ALL or * (indicating all subjects at the specified sites), or a range of valid subject IDs . e.g. 1001-1099,1301-1399 |
| Role Name | Type the study role name or pick it from the list of study roles. Since roles are defined separately for each study, the study must be specified before a valid role can be entered. |

A row highlighted in red indicates one of the following errors:


- An invalid entry in at least one of the cells in the row.
- Conflicting study roles, indicating that different roles have been specified for some set of study subjects within one or more sites.

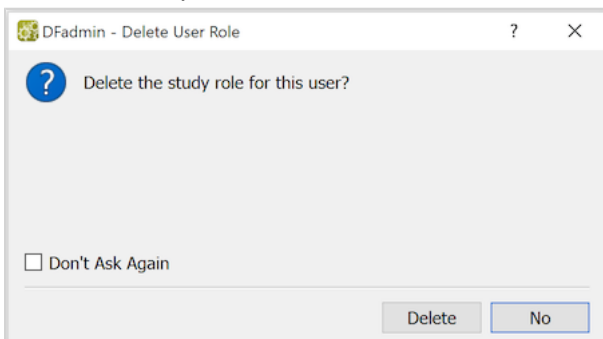
8.8.1. Adding Study Permissions

New study permissions are added as follows:

1. Select the first empty row in the permissions table.
2. Specify the **Study**.
3. Specify the **Sites**.
4. Specify the **Subjects**.
5. Specify the **Role**.
6. If none of the values appear in red the row will be accepted as valid, the delete (trash can) icon will appear at the right end of the row, and a new empty row will be added to the permissions table.
7. When all of the rows needed to specify the user's study permissions have been completed, select the **DFadmin** menu item **File** > **Save** to save the current permissions. Changes made to user permissions are not saved until they are saved explicitly using **File** > **Save**.

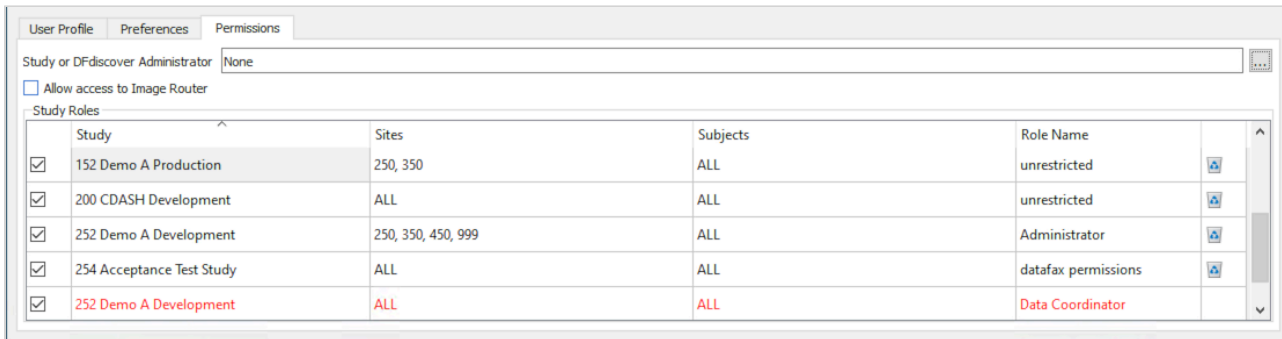
8.8.2. Deleting Study Permissions

To delete a specific database permission specification (table row), click the corresponding delete icon (). A confirmation dialog is displayed, warning you that the user permissions are affected by this modification to the role definition. Click **Delete** to confirm and proceed with the deletion; otherwise, click **No** to cancel the deletion.



8.8.3. Modifying Study Permissions

Study permissions can be changed by clicking and overwriting a cell and then pressing Enter or Tab to verify that the value is valid. Rows highlighted in red indicate errors.



| Study | Sites | Subjects | Role Name |
|---------------------------|--------------------|----------|---------------------|
| 152 Demo A Production | 250, 350 | ALL | unrestricted |
| 200 CDASH Development | ALL | ALL | unrestricted |
| 252 Demo A Development | 250, 350, 450, 999 | ALL | Administrator |
| 254 Acceptance Test Study | ALL | ALL | datafax permissions |
| 252 Demo A Development | ALL | ALL | Data Coordinator |

If a set of permissions containing errors is saved the rows containing errors are dropped if they were newly defined, or revert to their previous valid values if the error was introduced by a modification.

8.9. User and Session Settings

The DFdiscover client applications preserve settings for each user so that they can be retrieved and applied during subsequent login sessions. These settings include previous DFdiscover servers, proxy settings, main window sizes and positions, and the settings in application preference dialogs. User passwords are never included.

The settings are stored on the local computer in a unique location defined by the user login account. The settings are also separated by application and, where appropriate, by study.

Specifically, the settings are stored locally in these locations:

- macOS and Linux: `$HOME/.config/$TOOLNAME_db/$TOOLNAME.db`, where `$HOME` is the login directory for the user.
- Windows: `%APPDATA%\$TOOLNAME_db\$TOOLNAME.db`, where `%APPDATA%` is generally the `AppData\Roaming` sub-folder of the user's login directory.

`$TOOLNAME` is one of `DFexplore`, `DFsend`, `DFATK`, `DFadmin` or `DFsetup`.

Generally speaking, users do not know, or need to know, that these settings files exist.

8.9.1. Sharing Settings File(s)

It is possible to streamline or standardize the settings for multiple users by creating one or more session setting files and then sharing those files with (new) users. This will give them the advantage of having certain settings pre-configured and standardized.

It is possible to share the settings file between the three supported operating systems. So it is possible to define the settings with an application on macOS and share that same file with users on macOS, Windows and Linux.

The file to be shared must match the `$TOOLNAME`. It is not possible to create a settings file for one application and share it for another application - this will certainly cause problems and/or unexpected behavior.

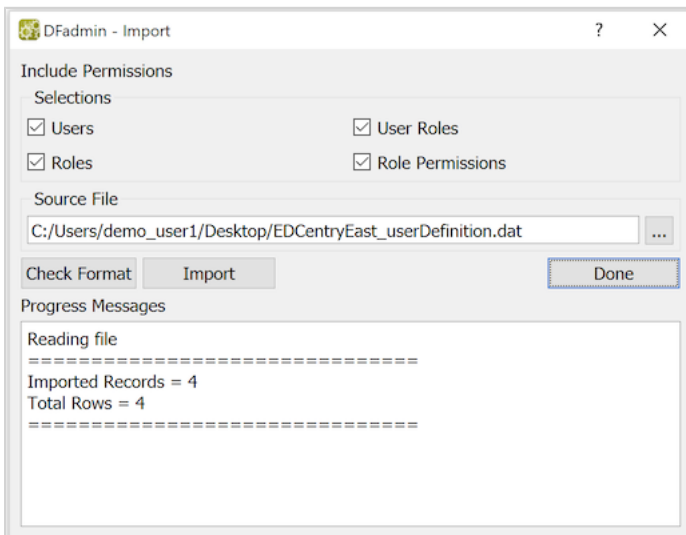
8.9.2. Local Cache

If the DFdiscover or study administrator has enabled local caching for one or more studies, frequently requested properties such as study logos and configuration files will be automatically cached in each user's local environment.³ Any user can clear their cache by selecting **File > Clear Cache** within **DFExplore** or by removing the following file from their local filesystem. These two actions are equivalent. Under normal circumstances there is no need for the user to clear or remove the local cache - **DFExplore** quietly manages the cache without user intervention.

- macOS and Linux: `$HOME/.config/DFlocal_db/$DFlocal.db`, where `$HOME` is the login directory for the user.
- Windows: `%APPDATA%\DFlocal_db\DFlocal.db`, where `%APPDATA%` is generally the `AppData\Roaming` sub-folder of the user's login directory.

8.10. Import

Study roles, permissions, role assignments to users, and user contact information can be imported from an ASCII file. Import will overwrite any matching specifications that already exist. The import dialog includes options for selecting the type of records to be imported (i.e. Users, User Roles, Roles and Role Permissions) from the import file. The import file must be formatted as described in [Table 14.20, "DFuserdb.log"](#), excluding the Record Time Stamp and Modifier fields.



Procedure 8.1. Importing Users, Roles and Permissions

1. Select **File > Import**
2. In the **Selections** section of the dialog select the types of data you wish to import.
3. Specify the **Source File** name or pick a file using the file selection button.
4. Click **Check Format**
Any invalid entries will be displayed. **Import** will be enabled only if there are no invalid records.
5. Click **Import**. Progress and errors messages are displayed while importing.
6. Click **Done** to close the Import dialog.

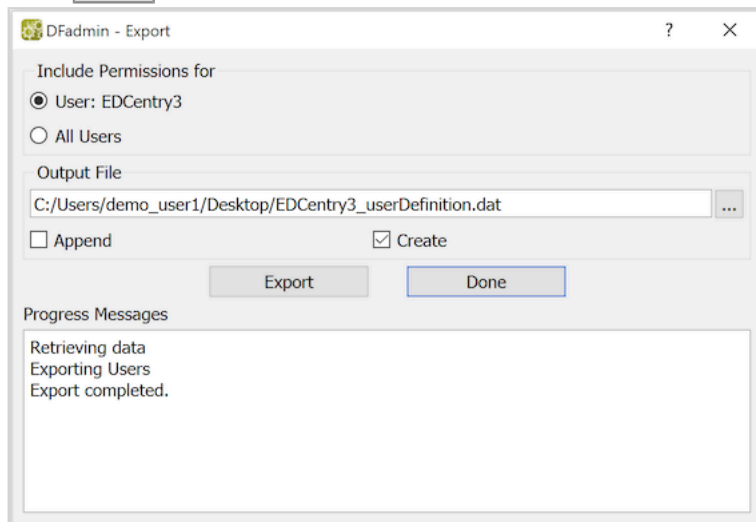
8.11. Export

³Study data is *never* cached.

All user account information, including study permissions, can be exported to an ASCII file, with the output format described in [Table 14.20](#), “DFuserdb.log”.

Procedure 8.2. Exporting Users

1. Optionally, highlight the user to be exported (if export is to be limited to a single user).
2. Select **File > Export**.
3. In the dialog, select the current user or all users.
4. Enter an **Output File** name or pick the file using the file selection button.
5. Choose **Append** to write the exported data to the end of file, or **Create** to overwrite the file with the exported data.
6. Click **Export**. Progress and errors messages are displayed while exporting.



7. Click **Done** to close the Export dialog.




8.12. DFengage Considerations for Users

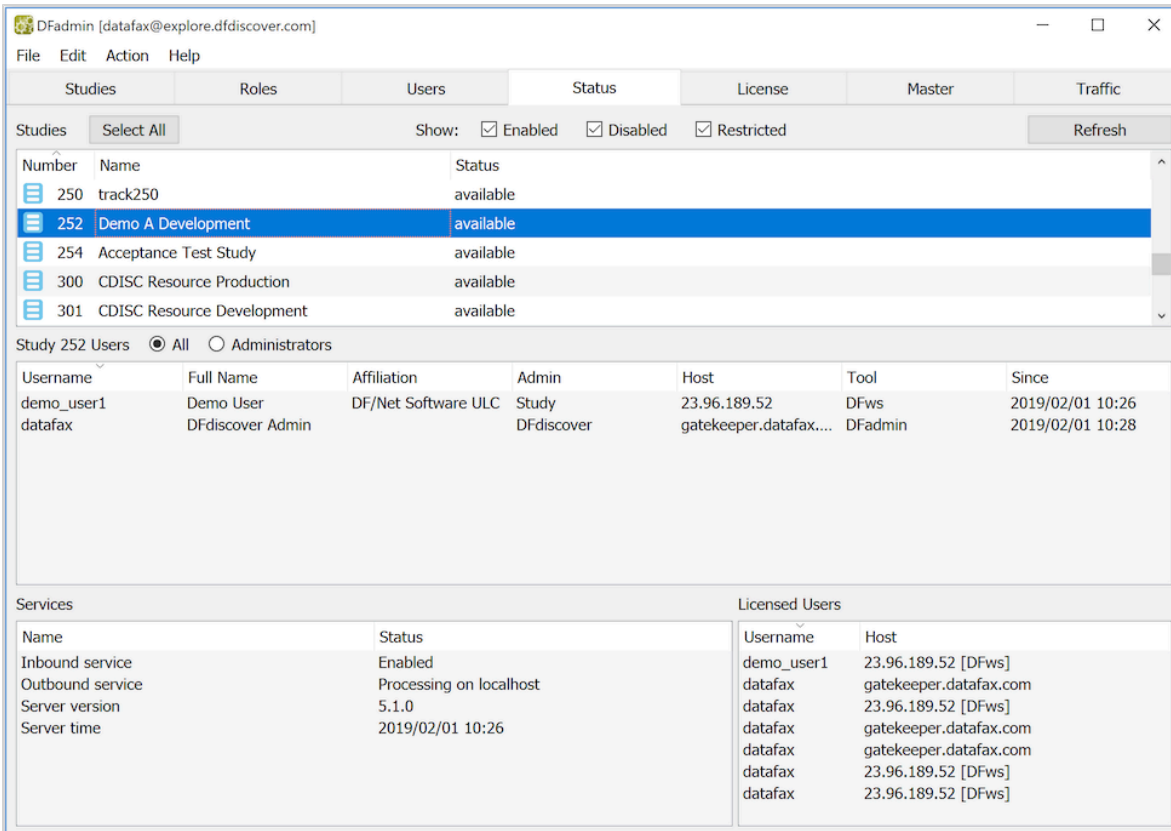
Each DFengage user requires a DFdiscover user account with access to one study, one site, one subject ID, and the ‘ePROdata’ role assignment. Refer to [Section 7.12](#), “DFengage Considerations for Roles” for details on the role definition. DFengage users may be added in bulk using the Add Bulk Users feature.

Chapter 9. DFAdmin - Status

9.1. Introduction

The **Status** tab shows the studies, users, and services currently running on the DFdiscover server. This includes:

- the number, name and status of all studies registered on the DFdiscover server which the user has permission to administer
- this list may be restricted to any combination of: enabled, disabled and restricted studies using the check boxes above the list
- the current status of each study is indicated with an icon: enabled studies (), disabled studies (), and restricted studies ().
- for disabled and restricted studies the user who set the status and the reason message they entered equal to or less than 150 characters is also displayed
- if a study is in read-only mode 'Study is in Read-Only mode' is displayed in red when the study is selected
- when a study is selected 'All' current users or just 'Administrators' are shown in the middle panel
- the current status of the Inbound and Outbound services appears in the bottom left panel
- all users currently using a DFdiscover license (seat) across all studies and services appear in the bottom right panel



The screenshot shows the DFAdmin interface with the 'Status' tab selected. The 'Studies' table lists several studies, with 'Demo A Development' (ID 252) selected. Below this, the 'Study 252 Users' table shows two users: 'demo_user1' and 'datafax'. At the bottom, the 'Services' section shows 'Inbound service' as 'Enabled' and 'Outbound service' as 'Processing on localhost'. The 'Licensed Users' table lists multiple instances of 'demo_user1' and 'datafax' on the host '23.96.189.52'.

| Number | Name | Status |
|--------|----------------------------|-----------|
| 250 | track250 | available |
| 252 | Demo A Development | available |
| 254 | Acceptance Test Study | available |
| 300 | CDISC Resource Production | available |
| 301 | CDISC Resource Development | available |

| Username | Full Name | Affiliation | Admin | Host | Tool | Since |
|------------|------------------|---------------------|------------|-----------------------|---------|------------------|
| demo_user1 | Demo User | DF/Net Software ULC | Study | 23.96.189.52 | DFws | 2019/02/01 10:26 |
| datafax | DFdiscover Admin | | DFdiscover | gatekeeper.datafax... | DFAdmin | 2019/02/01 10:28 |

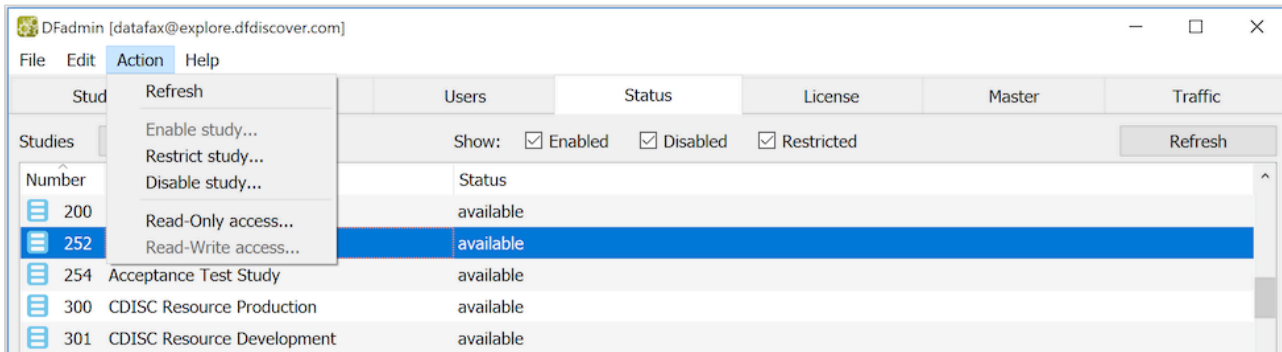
| Name | Status |
|------------------|-------------------------|
| Inbound service | Enabled |
| Outbound service | Processing on localhost |
| Server version | 5.1.0 |
| Server time | 2019/02/01 10:26 |

| Username | Host |
|------------|------------------------|
| demo_user1 | 23.96.189.52 [DFws] |
| datafax | gatekeeper.datafax.com |
| datafax | 23.96.189.52 [DFws] |
| datafax | gatekeeper.datafax.com |
| datafax | gatekeeper.datafax.com |
| datafax | 23.96.189.52 [DFws] |
| datafax | 23.96.189.52 [DFws] |

9.2. Changing Study Status

Access to each study can be limited using the Action menu to:

- Disable a study, which stops the study database server making it unavailable to all users, essentially locking the study database so that neither the data nor the study setup can be modified.
- Restrict a study, which makes it available to DFdiscover and study administrators but unavailable to all other users.
- Make a study Read-Only, which allows study data and setup information to be viewed but not changed.



A study may be simultaneously 'Restricted and Read-Only' which limits study access to DFdiscover and study administrators while preventing them from making any changes. This is accomplished by first 'Restricting' the study and then making it 'Read-Only' or vice versa, the order in which these 2 operations are performed is irrelevant.

Putting a study into 'Restricted' access mode does not take effect immediately. Existing users can continue working until they log off. It does however prevent new users from connecting to the study. When all existing connections have terminated, the administrator who put the study into restricted mode receives an email message indicating that the study is now restricted to DFdiscover and study administrators.

It is not possible to 'Disable' a study while it is being used. In such cases the study should first be restricted and then disabled when all users have logged out.

It may take several seconds for the 'Disable' action to complete, as the study server may need to perform extensive shutdown processing before reporting that the action has been successful.

Selecting 'Enable' returns studies which have been disabled or restricted to full access, and selecting 'Read-Write' returns studies which have been made 'Read-Only' to full access.

It is possible to change the status of more than one study at a time by selecting multiple studies and then selecting the desired status from the **Action** menu. Use Shift-click to select a range of studies, and Control-click(Win) or Command-click(Mac) to select studies one at a time.

When a change in status is selected a confirmation dialog will appear with **OK** to proceed and **Cancel** to abort the operation.

When a study is 'Disabled' or 'Restricted' the confirmation dialog allows entry of an optional message which if provided will be displayed in the study selection dialog in **DFexplore** and **DFsetup**. This message is also displayed in the 'Enable study' confirmation dialog to remind users why the study is in it's current state before they reverse it. The reason for disabling or enabling a service have been standardized to accept a maximum 150 character message.

Study status cannot be changed if anyone is currently using the study in either **DFexplore** or **DFsetup**. This applies not only to status changes that limit access, but also to those that reverse previously applied limitations.

What gets disabled?

When a study is disabled the study database and setup remain unchanged, but client applications, and fax processing daemons will not be able to communicate with the study server.

Faxes that arrive while a study server is disabled will be received and processed by DFdiscover but any pages barcoded for a disabled study will be held until the study is re-enabled, and will not show up in the study's new fax queue until processing is triggered by the arrival of the next fax received by the DFdiscover server. It is not necessary for the next fax to contain pages barcoded coded for the study in question or for any study.

When a Query Report is successfully faxed to it's destination clinical site, the study database server is notified. This allows it to update the status field in all queries included in that report, to indicate that they have been transmitted. Since updating the Query database requires the study server, queries will not be updated if the study server is disabled while Query Reports are being transmitted.

What gets restricted?

While a study is in restricted access mode, DFdiscover and study administrators will be able to use client and shell-level applications to the full extent allowed by their study role permissions, while other users will not be allowed to use any of the DFdiscover applications, including: **DFexplore**, **DFsetup**, **DFexport.rpc**, **DFimport.rpc**, **DFprintdb**, **DFcompiler** and **DFstatus**.

Also, since shell-level applications like often appear in study specific reports and custom applications, this restriction will extend to applications that may normally be able to run from a UNIX login account.

Restricting a study has no effect on the processing of incoming or outgoing faxes, except that only a DFdiscover or study administrator will be able to save records in fax view and route unidentified pages to the study in the router.

Unlike 'read-only' and 'disabled', 'restricted' access is a volatile state. If the DFdiscover master is shutdown and restarted, disabled studies remain disabled, and read-only studies remain read-only, but restricted studies become unrestricted.

What happens in Read-Only mode?

While a study is in Read-Only mode client applications and shell-level applications are available to view and export study data and setup information, but the study setup and database cannot be changed.

Studies are typically put into Read-Only mode when data collection is complete, all queries have been resolved, and the data has been verified against source documents. Statistical analysis may be ongoing or an FDA audit may be in progress thus the study cannot be disabled, but no further changes are expected or allowed.

In this state we do not expect to receive any additional CRFs by fax, email or PDF submission. If any pages barcoded with the DFdiscover study number are received they are sent to the unidentified fax router where they can be reviewed, but they cannot be routed to the study database as long as it remains in read-only mode.

Chapter 10. DFadmin - Traffic

10.1. Introduction

Traffic is the general description for three related features:

- incoming document processing, known as Inbound
- outgoing document processing, known as Outbound
- received document receipt processing, known as Auto Reply

These features are all administered in the Traffic tab of **DFadmin**.

DFdiscover can be configured to send a receipt back to selected clinical sites each time that a document is received from them. Also, incoming document processing can be blocked from any sender that is not registered with DFdiscover. Both features are administered in DFdiscover through an option known as **Auto Reply**.

Auto Reply is intended as a debugging aid within DFdiscover, assisting in the diagnosis of clinical sites from whom document reception is unreliable. Once the problem is diagnosed it is no longer necessary for this feature to remain enabled for that site.

10.2. How incoming documents are processed

There is a great deal of work that DFdiscover does to automatically process and route incoming documents. In this section, the process is described in detail.

Incoming and outgoing faxing from DFdiscover is accomplished by third-party software, HylaFAX; or by using a third-party fax outsourcing service, Protus/MyFax. For purposes of this description, both are generically referred to as the "Fax software". The DFdiscover Inbound and Outbound services act as overseers and provide additional end-user functionality and rely on the Fax software to interact with the modem devices.

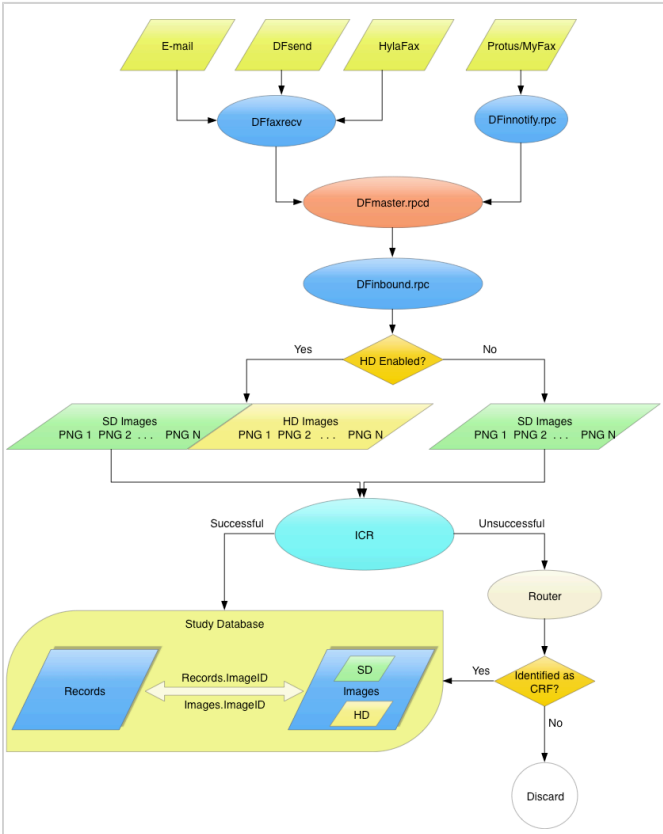
Faxes and email

In addition to receiving faxes via the traditional physical fax machine, DFdiscover is also capable of receiving incoming documents via email and **DFsend**.

Once a fax or document has been received to disk, the handling of both input streams is identical. This alternate input stream is described in [Processing of an incoming email](#).

DFdiscover relies on an email message from the HylaFAX software to initiate its incoming fax processing. In the case of installations using the Protus solution, a Protus fax daemon runs in the background and periodically polls for new faxes arriving at the Protus servers. Incoming fax processing by DFdiscover is event driven; the processing software executes only when a fax has arrived. If there are no recently arrived faxes requiring processing, no Inbound service will be running. Each time a new fax arrives, the Inbound service is dispatched by the master daemon to process that fax. If multiple new faxes arrive at or near the same time, the master daemon will dispatch the first fax to the Inbound service, queue the additional faxes, and then de-queue each fax as the Inbound service completes the previous fax. Incoming faxes will never be discarded because there is no Inbound service available. The fax will be queued by DFdiscover (freeing HylaFAX or the Protus service to receive the next fax) until the service is available.

DFdiscover routes an incoming document from the Fax software, email, or **DFsend** to its ultimate destination within DFdiscover. The remainder of this section describes each step in detail.



Procedure 10.1. Processing of an incoming document

1. Document arrives and is received by the Fax software

- HylaFAX configurations: When a completed CRF containing N pages is sent from a fax machine at an investigator site to a fax modem running the Fax software, the fax modem answers the call and creates a file for receipt of the fax document in the DFdiscover incoming fax directory. As receipt of the fax progresses, the size of the incoming file increases. Transmitted in standard resolution, a typical fax page requires approximately 25 Kilobytes of disk space.

When transmission is complete, a mail notification message is sent to user `datafax`. Receipt and processing of the fax transmission by the Fax software is complete.

If the transmission enters the system via an email message, alternate processing takes place during this step and the next. That processing is described in [Processing of an incoming email](#).

The email message sent by the Fax software (or received directly via email) is parsed by the **DFfaxrecv** application that checks the message content for validity. The message content is valid if the following conditions are true:

- the sender of the message is the Fax software
- the subject of the message indicates a newly arrived fax

If the message content is valid, the filename is then passed to the master to signal it that this file needs processing.

- Protus configurations: A completed CRF containing N pages is sent from a fax machine at an investigator site to the Protus fax server. The fax is received and is stored in their server for later retrieval by DFdiscover. The Protus fax daemon process running on the DFdiscover server periodically checks to see if any new faxes have arrived in the Protus fax server. If a new fax is present, it is downloaded and placed into the DFdiscover incoming document

directory. Once each document has been downloaded and transferred to DFdiscover, the Protus fax daemon deletes the fax from the Protus fax server and notifies the master daemon that a new document has arrived.

2. DFdiscover master assigns the Inbound service to process the fax

In dealing with incoming fax documents, the responsibility of the master daemon is to assign the fax to the Inbound service.

If the Inbound service is busy processing another fax, the master records the incoming fax's name in a FIFO queue for future processing. Subsequently, when the Inbound service completes processing of the previous fax, the master dispatches the first fax from the queue.

As soon as the Inbound service starts, it sends the master a message to indicate that it has started to process the assigned fax. The master updates its inbound database to indicate that the service is processing.

3. DFdiscover identifier is assigned to the fax

Immediately after the Inbound service has notified the master that it has started processing the assigned fax, it requests a unique DFdiscover identifier for that fax from the master. The master consults sequence files in `/opt/dfdiscover/work` to determine the identifier.

From the fax name, the master determines the year and week in which the fax arrived. It uses this to construct a 4-digit number, `YYWW` where `YY` is the last two digits of the year (minus the century) and `WW` is the week within that year (01 to 53).

The master searches for a file named `.seqYYWW` in `/opt/dfdiscover/work`. If no such file exists, the master returns the identifier of 1 to the incoming daemon and creates the sequence file `.seqYYWW` recording 2 as the file contents. If the file does exist, its contents are returned as the DFdiscover identifier, and then incremented by one before being written back to the file.

The DFdiscover identifier supplied by the master to the Inbound service represents the sequencing of when a fax arrived within a particular year and week. For example, the third fax to arrive during the week of September 16, 2017 would have a `YYWW` value of 1738 (the 38th week of 2017) and a sequence number of 0003. The unique DFdiscover identifier for that fax then becomes 1738/0003. Because of the algorithm used to generate the identifier, DFdiscover can guarantee that the identifier is unique within the DFdiscover installation.

For the remainder of this description, `YYWW/FFFF` will be used as the example DFdiscover identifier.

Another point to note here is that these unique fax identifiers are being assigned before the fax is processed, and thus before there is any possibility of determining which study the fax belongs to. As a result all fax identifiers are unique, not just within each DFdiscover study, but across all DFdiscover studies being managed on the same DFdiscover installation.

Important

It is extremely important that the sequence files, used to assign these unique fax identifiers, not be manually edited or deleted. Deleting a sequence file will cause the sequencing for that `YYWW` combination to be reset to 1, which will result in non-unique fax names. Fortunately, DFdiscover will detect this condition and prevent old faxes from being overwritten by new faxes with the same name. Even after a particular `YYWW` has passed in time, it is important to leave the sequence files in case it is ever necessary to retrieve and re-process a fax file from the archives.

4. Inbound service archives the fax

If the value of `INBOUND_ARCHIVE_DURATION` in the daemon's configuration is any number greater than 0, a copy of the received fax is made (without alteration to the fax) in the archive directory. The location of the archive directory is

determined by evaluating the `INBOUND_ARCHIVE_DIR` parameter in the daemon's configuration. The name assigned to the archive copy is the `YYWW/FFFF` identifier.

5. Inbound service decompresses the fax

The Inbound service breaks the original N -page fax into its individual N pages. This occurs in the incoming daemon's work directory.

The conversion creates 100 dpi PNG files, as well as 300 dpi PNG files if High Definition (HD) images are enabled in **DFadmin**. There is exactly one PNG file created for each page in the fax. Hence an N -page fax document creates N 1-page PNG files. The page names for the PNG files are determined from the DFdiscover identifier. In the Inbound service's working directory, the sub-directory `YYWW` is created (if necessary) containing files named

```
0.FFFF1 0.FFFF2 0.FFFF3 ... 0.FFFFN
```

The files are then renamed so that the page number within the fax is leading zero-padded to three digits.

Important

An important point to be aware of here is that the original fax files cannot be archived in a separate directory for each study. The main reason for this is that there is no guarantee that DFdiscover will be able to uniquely link a single fax with a single study. A site involved in multiple studies may send CRFs for more than 1 study in the same fax transmission. You might even use more than one DFdiscover study number to keep separate databases (e.g. lab data, clinic data, endpoint adjudication reviews, etc.) for the same study. Also a fax might not contain any barcoded CRFs. Consequently all received fax files across all studies are archived to the same fax archive directory.

Conversion of the original fax to PNG files is complete. The Inbound service indicates this to the master by sending it a message containing the name of the archived fax, the number of pages it contains, the fax's receipt date and time stamp (or the email transmission's receipt date and time stamp), the sender identifier of the fax (for faxes, this is transmitted by the sending fax machine; for emails, this is the sender's email address) and whether or not the fax was archived. The master records this information by appending it to the file `/opt/dfdiscover/work/fax_log`. This log file is in plain text format and can easily be consulted to determine a particular document's context. In fact, this is the file that is consulted by client applications like **DFexplore** to determine context.

6. Each fax page is put in standard DFdiscover orientation

At this point in the incoming processing there are one or more PNG files named `0.FFFFPPP`. Processing now proceeds sequentially and repeats separately for each page. If page processing fails at any step, the PNG file is moved to the unidentified fax routing directory, `/opt/dfdiscover/identify`, where the page can be subsequently viewed and dealt with manually using the **DFexplore** Image Router function.

The width of the page is tested to ascertain that it is within a reasonable tolerance of being a US-letter or A4 page in portrait orientation. Then the height of the page is tested to be within the same tolerance.

The service then begins searching for the DFdiscover barcode signature line near the top of the page (within the top 2.5" of the page). If the line cannot be found, it is assumed that the page is wrong-side up, it is flipped right-side-up and the line search is repeated.

After the signature line is found, the vertical offset between the right end and left ends of the line is used as the measure of skew inherent in the entire page. An angle of rotation is calculated using the arctangent of the vertical offset divided by the length of the line. The entire page image is then rotated by this angle around the left corner of the signature line. The assumption here is that the same degree of correction is required across both the length and width of the page.

Occasionally, this assumption fails, and skew correction is not as good as it might be, but in general the correction is adequate and better than if no correction had been applied at all.

When rotation completes, the resulting page image is then shifted so that the top of the signature line is coincident with the top of the page and the left end of the signature line is 0.5" from the left edge of the image. This is the standard DFdiscover orientation for a CRF image. All images must be in this orientation before they can be scanned for their DFdiscover barcode.

7. Inbound service scans page for barcode

In standard DFdiscover orientation, the barcode for a CRF can be found starting an inch from the left edge of the image and down 0.125" from the top of the image. A readable barcode contains either 17 or 26 vertical bars, evenly spaced at 0.25" intervals, each of thickness 0.04" or 0.12". The 0.04" bars are counted as having value 1 while the 0.12" bars have value 0. The concatenation of 0s and 1s for the first 8 bars is evaluated as a binary number and assigned to the study number, the next 9 bars constitute the plate number, and, if present, the last 9 bars constitute the sequence number. For more information on DFdiscover CRF barcoding, consult [Barcode User Guide](#).

The newly rotated and shifted page image is then written to a file named *FFFFPPP* and the original version of the page in *0.FFFFFPP* is deleted. At the same time, a placeholder record for the data that will be ICRed from the image is written to the file *DFrecin.###* where *###* is the study number that was scanned from the initial part of the barcode. If *DFrecin.###* already exists, the new record is appended to the file; otherwise, the file is created. Although unlikely, it is possible for one fax to contain CRFs from multiple studies and hence multiple *DFrecin.###* files may be created. The purpose of each *DFrecin.###* file is to temporarily record the:

- fax page name
- study number
- and plate number

in preparation for the next phase, ICR, of the Inbound service.

As previously noted, pages which fail any of the preceding steps are moved to the unidentified images routing directory, */opt/dfdiscover/identify*. Pages that have passed all of the steps will be ICRed and then added to the new pages input queue for a study, where they can be retrieved and reviewed in **DFexplore**, and finally entered into the study database.

8. ICR processing occurs for each identified page

When all pages have completed the barcode reading step, the ICR software is launched by the incoming daemon. ICR processing begins by scanning for file names that begin with the *DFrecin* prefix. For each such file that is found, the study number is determined by stripping the last three digits from the file name. The Inbound service then attempts to make a connection with the database server for that study number. If the connection is successful, the service requests the location of the ICR template file and the CRF pages directory from the study database server.

For each record in the *DFrecin* file, the plate number is extracted from the 5th field and the image identifier is extracted from the 3rd field. These two pieces of information together with the already read ICR template permit the software to scan the CRF image for data fields.

ICR can read hand-written numbers, check boxes, dates (containing digits and characters), and visual analog scales, but not hand-written text. ICR will fail to read a value and leave the field's value as blank, if any one or more of the following conditions is true:

- the field type is string, meaning that the contents are hand-written text
- the field cannot be located on the CRF
- the read value is illegal when tested against the field's legal range

- more than one choice has been marked for a choice field

ICR is not data entry

The ICR step should be viewed only as an assist to data entry, not as a complete replacement for it. It is important that all records be reviewed to complete blank fields, correct any ICR errors, pick up corrections and comments written by investigators in the margins of the CRF, and flag missing data with queries. All of these tasks can be performed by study personnel through **DFexplore**.

9. Pages and data are sent to the study database

When ICR processing completes on a CRF page, the resulting data record is assigned a workflow level of 0 and is sent via a network message to the study database server, which appends it to the study input queue for new faxes file. The corresponding image file is moved from the Inbound service's working directory to the study's CRF pages directory. The corresponding record from `DFrecin` is then deleted. If a connection to the study server cannot be established (i.e., the study server may be in read-only mode), the CRF images are sent to the `DFdiscover identify` directory, instead of to the study's `pages` directory.

When all of the records in a `DFrecin` file have been processed, the file will be empty and it is deleted. Since the fax image files have also been moved to the study's CRF pages directory, the Inbound service working directory is empty and is deleted. The service will report an error if this condition is not true.

Incoming fax processing by `DFinbound.rpc` is now complete. Before termination, the Inbound service sends a fax completion notification message to the master and then exits.

Procedure 10.2. Processing of an incoming email

1. Document arrives by email

DFdiscover is also capable of accepting CRFs that are received by email. The following requirements for emailed CRFs must be met:

- The recipient of the message must be user `datafax` on the DFdiscover server. If emails are arriving from external locations, email routing must allow email to reach the DFdiscover server.
- The sender of the message is not user `datafax` or any email address that contains the phrase `MAILER-DAEMON`.
- The body of the message must contain one or more PDF or TIFF files encoded as MIME attachments. Other attachment types will be silently ignored. If no attachments can be processed, the email will be bounced with a Data Format error.
- Each TIFF attachment may contain one or more CRF pages. The TIFF images may be color, grayscale and black-and-white, at least 100 dpi resolution, and no more than 300 dpi resolution.
- The mail application (typically `sendmail` on the UNIX platform) must have permissions to write to the `/opt/dfdiscover/incoming` directory. Typically this means that the directory must have access and write permissions for everyone, unless the user id (`root`, `uucp`, or `daemon`) that executes the mail application belongs to the `studies` group.

2. Message body is decoded

The decoding is performed by the DFdiscover `DFfaxrecv` application which breaks out the individual attachments. TIFF attachments are saved to `/opt/dfdiscover/incoming` with names in the form `email#####-###.tmp`. PDF attachments are saved to `/opt/dfdiscover/incoming` with names in the form `email#####-###.pdf`. These PDF files are then passed to `DFgs` to convert them to TIFF files with names in the form `email#####-###.tmp`.

3. DFdiscover master is notified

The **DFfaxrecv** application notifies the master of the arrival of the new images. If DFdiscover is not operational at the time, the transmission remains queued in this directory. It will subsequently be de-queued and processed automatically by DFdiscover when it restarts.

4. Regular processing resumes

The remainder of the processing of the email transmission follows the same procedure already described in [Processing of an incoming document](#).

10.3. Outgoing Documents

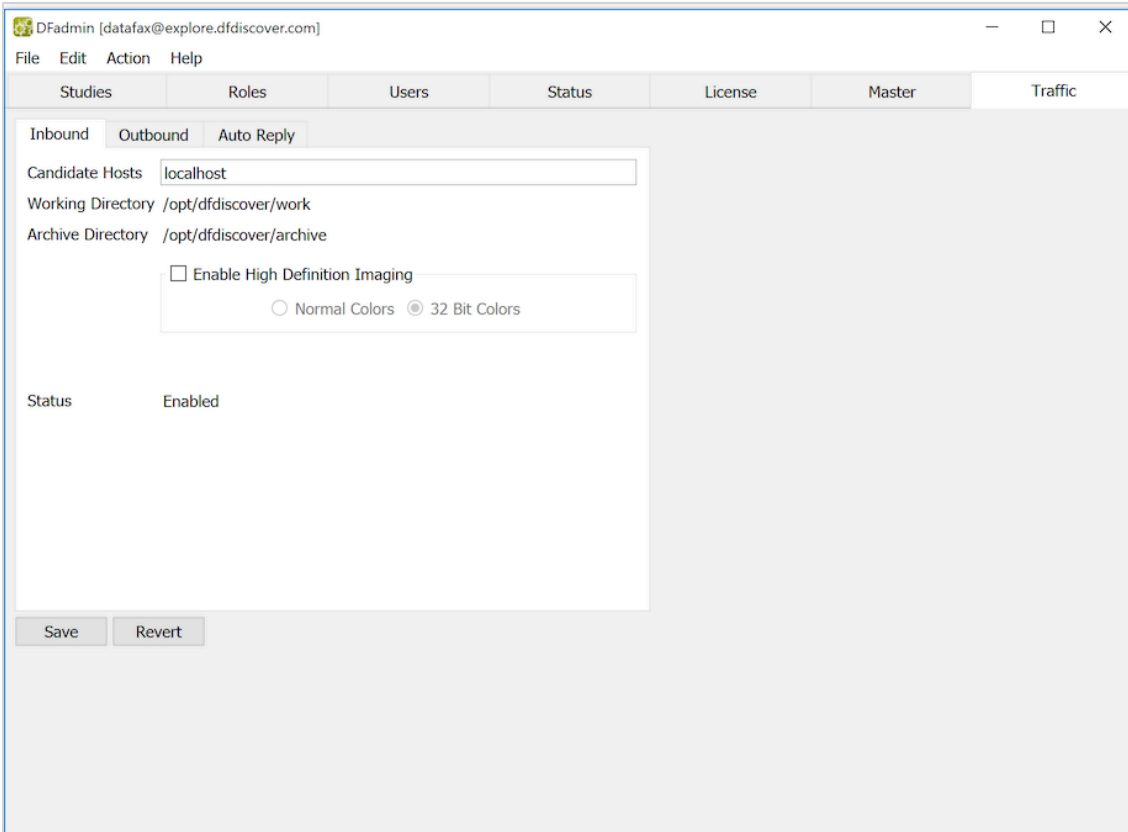
Through DFdiscover, it is possible to send documents to one or more recipients directly from your computer. Users will exercise this feature most via **DF_QCfax**, one of the standard DFdiscover reports, which sends Query Reports to the participating sites of a study.

DFdiscover manages outgoing traffic with the Outbound service that behaves like the UNIX **lpd** daemon. It is always running in the background (unlike the Inbound service which only executes when there is an incoming document to process), and it works from a spool directory. Programmers can interface with the outgoing daemons via the shell-level commands **DFsendfax** (to queue a document for sending), **DFfaxq** (to monitor the status of the outbound queue), and **DFfaxrm** (to remove a document from the queue). These DFdiscover utilities are described in [Programmer Guide, Shell Level Programs](#).

10.4. Inbound

Faxes that arrive at one of the fax modems on a DFdiscover server are received by HylaFAX, which subsequently informs the DFdiscover master daemon that there is a fax that needs to be processed. The master then assigns the fax to the incoming fax daemon for processing. These are the basic actions of the Inbound service.

The Inbound feature must be defined before DFdiscover will be able to process incoming documents. The definition and configuration of the Inbound feature is done in the [Inbound](#) view.



10.4.1. Modifying Inbound Configuration

When DFdiscover is started for the first time, DFdiscover will identify that there is no Inbound service defined and it will define and configure it with default values. In most environments, these default values will not need to be changed. However, if re-configuration is needed, only the candidate host can be changed using **DFadmin**:

- **Candidate Hosts.** Enter the host names (comma-delimited) of all computers that the master can consider as candidate CPUs where the Inbound service might be permitted to run. In 99% of all cases, only one hostname is needed and that is the hostname of the master.

Candidate Hosts also require slave daemons

The Inbound service can only run on machines that are also running slaves. If a candidate host is specified that is not also running a slave, that candidate will never be chosen.

- **Working Directory.** The working directory must be writable by user `datafax`, and is typically defined with the same value as the DFdiscover work directory, `/opt/dfdiscover/work`. To change its value, the inbound configuration file `/opt/dfdiscover/lib/DFinbound.cf` must be directly edited by the DFdiscover administrator.

The working directory is temporary space only - once an incoming document is processed, the working directory becomes empty again.

- **Archive Directory.** This is a directory where the Inbound service stores the original documents (TIFF or PDF). It must be writable by user `datafax`. Since the files may be large, this should be a directory with lots of available space. Also this directory should be monitored regularly to make sure that space is available for archiving of incoming transmissions (see [Archive File Maintenance](#) for more information). To change its value, the inbound configuration file `/opt/dfdiscover/lib/DFinbound.cf` must be directly edited by the DFdiscover administrator.

After making any changes, select **File > Save** to save the changes and re-configure the Inbound service. Modifications can be made regardless if the Inbound service is currently enabled. If the Inbound service is processing while its configuration is modified, the modifications will not take effect until the next incoming document is processed.

10.4.2. Enable/Disable Inbound

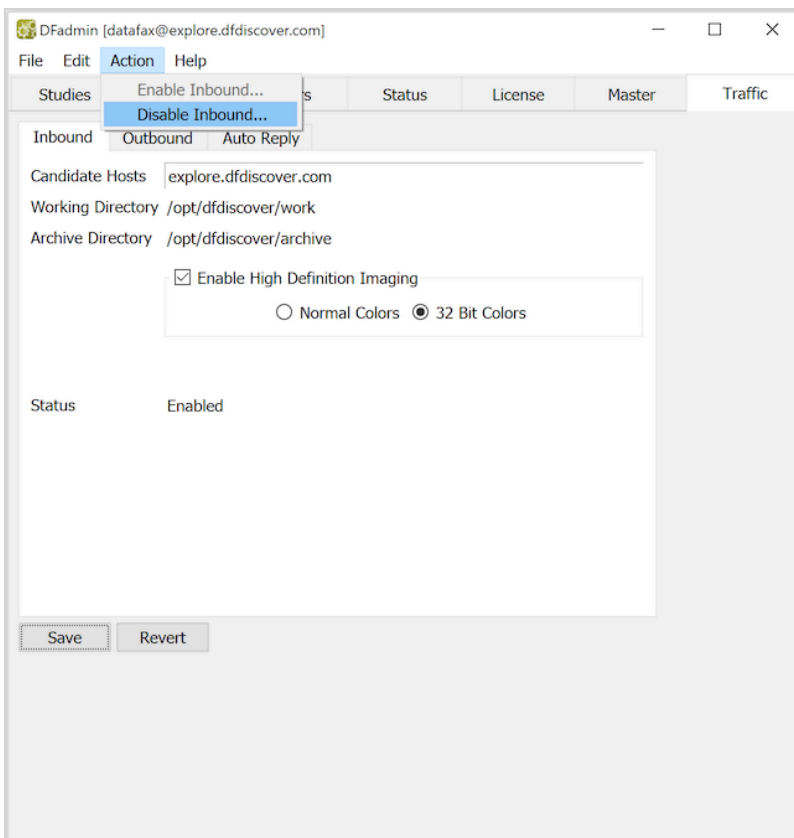
In the Inbound view, **Status** is a read-only field that shows the current status of the Inbound service. Typically, the service is always enabled, which means that it can process incoming documents as they arrive. However, the service can also be disabled by the administrator - when disabled, documents continue to arrive, but they wait in a queue and are not processed by DFdiscover until the Inbound service becomes enabled.

The possible statuses are:

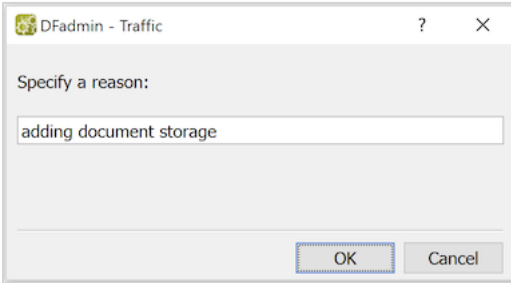
- Enabled, on-line, and available for processing each incoming document
- Disabled, off-line, incoming documents are queued and not processed

To change the status of the Inbound service, select one of:

- **Action > Enable Inbound** Enable the currently disabled Inbound service.
- **Action > Disable Inbound** Disable the currently enabled Inbound service.

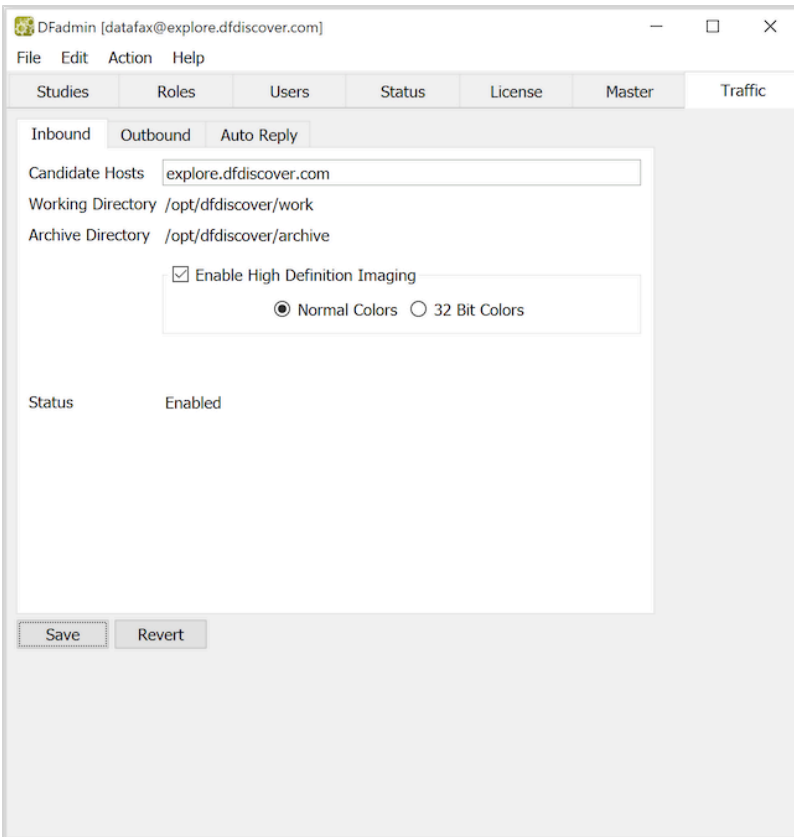


A reason can be provided to describe why the Inbound service is being disabled. A reason is not required but is recommended particularly if the server is administered by more than one person. When the Inbound service is disabled the reason appears in the **Status** field of the Inbound view.



10.4.3. Enable/Disable High Definition (HD) Imaging

DFdiscover accepts incoming documents via fax, email and **DFsend**. Documents that are transmitted via fax can have only one resolution, 100 dpi (SD, or standard definition) - this is part of the G3 fax standard. Documents that arrive via email or **DFsend** may have higher resolution if they were scanned at higher resolution at the sending site. For such documents it is possible to instruct DFdiscover to also image and store them on the server at a higher resolution, namely 300 dpi (HD, or high definition).



While it may seem preferable to image documents at the highest available setting, there are several considerations:

- High definition images require more disk storage space on the DFdiscover server.
- High definition images require more bandwidth, and hence time, to transmit to an **DFexplore** client. On the client side, each user may also choose whether to request HD or SD.
- DFdiscover will always keep an SD version of each page of each document. If high definition is also enabled, the HD version is also kept, thereby further increasing storage requirements.

- If the source documents are in color or contain shaded areas that need to be maintained, then high definition should be enabled. With HD enabled, one can also select the color fidelity in the imaged document. In general, the **Normal Colors** setting is acceptable for clinical study documents. Use **32 Bit Colors** only if the source document has photographic detail that needs to be preserved. If **32 Bit Colors** is enabled, the stored images are significantly larger (up to 10 times) than a SD image (and hence will also take longer to transmit) - be mindful of this before enabling. For most documents, there is no discernible improvement in quality with **32 Bit Colors** over **Normal Colors**.

In general, if the existing SD quality is sufficient, there is no need to enable HD.

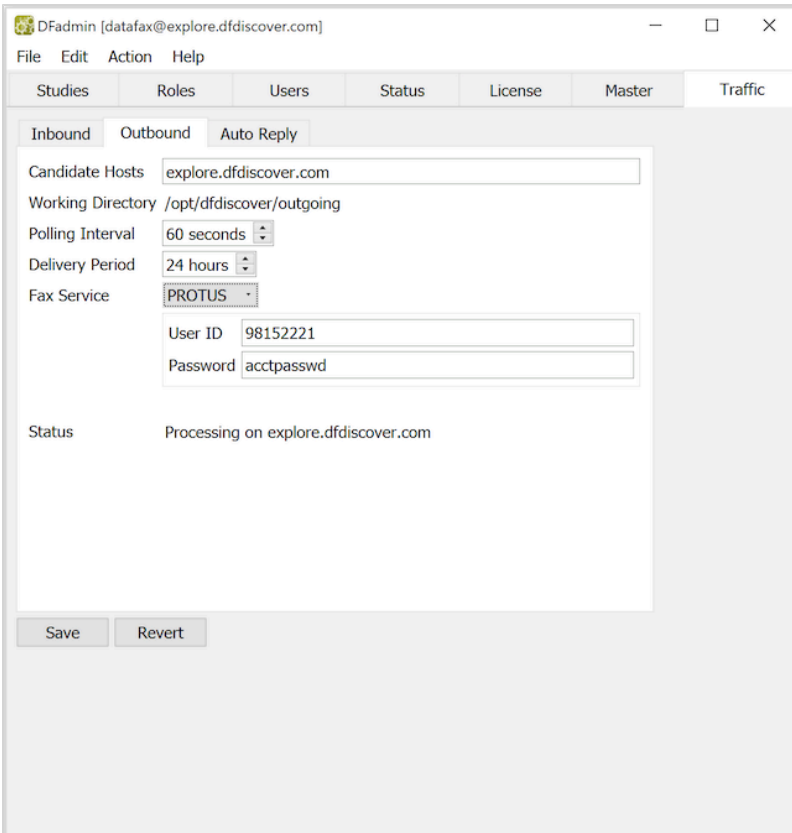
When high definition is enabled or disabled, the new setting is applied only to documents that are received after the changed setting is saved. DFdiscover does not retrospectively re-image previously received documents.

There is a similar setting at the client end, in **DFexplore**. Those details are not described here but, in summary, the end user is able control whether they wish to request HD or SD images. Over low-speed or low-bandwidth connections, SD is more efficient and hence preferred. Selecting HD in such an environment can result in slower image loads and decreased **DFexplore** performance.

10.5. Outbound Service

Documents which require transmission from DFdiscover to external sites, typically participating investigative sites, are handled by the Outbound service.

The Outbound service must be defined and configured before DFdiscover is able to send outgoing documents. The definition and configuration of the Outbound feature is done in the **Outbound** view.



10.5.1. Modifying Outbound Configuration

When DFdiscover is started for the first time, DFdiscover identifies that there is no Outbound service defined and it will define and configure one with default values. In most environments, these default values do not need to be changed. However, if re-configuration is needed, the following parameters can be changed:

- **Candidate Hosts.** Enter the host names (comma-delimited) of all computers that can be considered as candidate computers where the Outbound service might be permitted to run. In 99% of the cases, only one hostname is needed and that is the hostname of the master.

Candidate Hosts also require slave daemons

The Outbound service can only run on machines that are also running slaves. If a candidate host is specified that is not also running a slave, that candidate will never be chosen.

- **Working Directory.** The working directory must be writable by user `datafax` and is defined by default with the same value as the DFdiscover work directory, `/opt/dfdiscover/work`. To change its value, the outbound configuration file `/opt/dfdiscover/lib/DFoutbound.cf` must be directly edited by the DFdiscover administrator. It cannot be changed using **DFadmin**.

The working directory is temporary space only - once an outgoing document is sent, the working directory becomes empty again.

The permissions on the files queued for outgoing transmission are such that only user `datafax` can read or write them. This prevents any other user from being able to tamper with an outgoing document before it is delivered.

- **Polling Interval.** This value is the number of seconds that the Outbound service will wait between checks for new requests in the outgoing document queue. The Outbound service runs in a loop where it checks the queue for work, does whatever work may need to be done, then sleeps for the specified number of seconds before beginning the loop again. A recommended value is anywhere in the 20 to 60 second range.
- **Delivery Period.** This value is the maximum number of hours that the Outbound service will wait for a reply from HylaFAX as to the disposition of a document that has been queued for faxing. If a reply is not received in this time period, DFdiscover considers the transmission of that document to have been a failure; resources are freed, any failure commands for the document are executed, and the queue entry is removed. A reasonable value is in the 8 to 16-hour range.

If a large number of documents is typically being queued, be careful not to make this value so small that even under normal circumstances, HylaFAX would not be able to reply in time as it would still be processing the large volume of documents.

- **Fax Service.** You can select the Fax Service your DFdiscover server is setup for. **EMAIL**, **HYLAFAX** or **PROTUS** service can be used for fax handling services.
 - **EMAIL.** Email services will be used for fax handling. Ensure that external email is configured on your DFdiscover server - `postfix` is a common email service. Configuration of `postfix` or other email services is beyond the scope of this document.
 - **HYLAFAX.** HylaFAX software will be used for fax handling. Ensure that HylaFAX is installed on the DFdiscover server.
 - **PROTUS.** Protus service requires **UserID** and **Password** values for accessing the Protus server. The UserID and Password is provided to you by Protus or your Protus service provider.¹ These credentials are required to setup DFdiscover for using Protus service. Protus IP Solutions is an application service provider that offers an Internet fax service targeting Personal, Small Business and Corporate users sold under the brand name MyFax. Protus solutions are

¹ **DFadmin** does not accept the `&`, `|` or `=` characters. If the password provided by Protus contains any of those characters, request another password.

sold both directly and through a network of worldwide partners, including major service providers. Additional information is available at www.protus.com or www.myfax.com. If you use Protus services, you do not need fax lines or modems. You receive a toll-free number with the equivalent of 24 modems behind it that your sites use as your fax number. Faxes are received and stored by a Protus server until requested by the **DFprotusfax** daemon DFdiscover uses for this purpose. Faxes are retrieved and processed through the normal DFdiscover channels while faxes to be sent are uploaded to the Protus server for sending. All communication is encrypted using SSL encryption. Some of the advantages in using Protus for a DFdiscover installation are as follows.

- The cost of installing and maintaining individual phone lines and fax modems, as well as long distance charges for outgoing faxes are eliminated.
- No special serial port multiplexer cards or drivers are required on your DFdiscover server.
- You pay per use vs. carrying excess capacity. Instant capacity is available on demand.
- The cost of the service is minimal. There is a monthly account charge which includes the first 100 outbound and 200 inbound faxes.
- Data transfers are initiated at the DFdiscover server end. If your DFdiscover server is down for backup, upgrading, or other reasons (power failure?), Protus stores your incoming faxes until your DFdiscover server is back running and incoming faxes are requested. Fax service is always available to your sites.
- Protus provides full tracking, reporting and audit for compliance to HIPAA, GLB and SOX.

Since the Protus server is location-neutral, study sites databases must be configured differently. All numbers must be fully qualified. Fax numbers in North America require a leading "1", followed by the area code and number. All other fax numbers require a leading "011", followed by the country code and number. Dash and bracket delimiters may be used to aid readability. For example, a fax number in North America of 905-555-1234 could be entered as 1-905-555-1234, 1(905)555-1234, 19055551234, etc.. To use the Protus Internet Fax service with DFdiscover you will need to set up an account and have the Protus XML integration services (or "Web services") enabled. Email notifications need to be disabled and the fax file format must be set to TIFF. If you are having problems using Protus, verify that the service is set up correctly. To setup an account suitable for use with DFdiscover directly with Protus IP Solutions, please contact:

Richard Solomon
Sr. Sales Representative, Major Accounts
j2 Global
2 Gurdwara Rd, Suite 300
Ottawa, Ontario
Canada K2E 1A2
<rsolomon@protus.com>
tel: (888) 733-0000 extension 7642
tel: (613) 733-0000 extension 7642

After making any changes, select **File** > **Save** to save the changes and re-configure the Outbound service. Modifications can be made regardless of whether or not the Outbound service is currently enabled. If the Outbound service is processing while its configuration is modified, the modifications will not take effect until the next outgoing document is processed.

10.5.2. Start/Stop Outbound

In the Outbound view, **Status** is a read-only field that shows the current status of the Outbound service. Typically, the service is always processing, which means that it can process outgoing requests as they are issued. However, the service can also be stopped by the administrator - when stopped, outgoing fax requests are not processed until the Outbound service is re-started.

The possible statuses are:

- Processing on *hostname* , on-line, running on *hostname*, and available for processing each outgoing fax request
- Disabled, off-line, outgoing fax requests cannot be processed

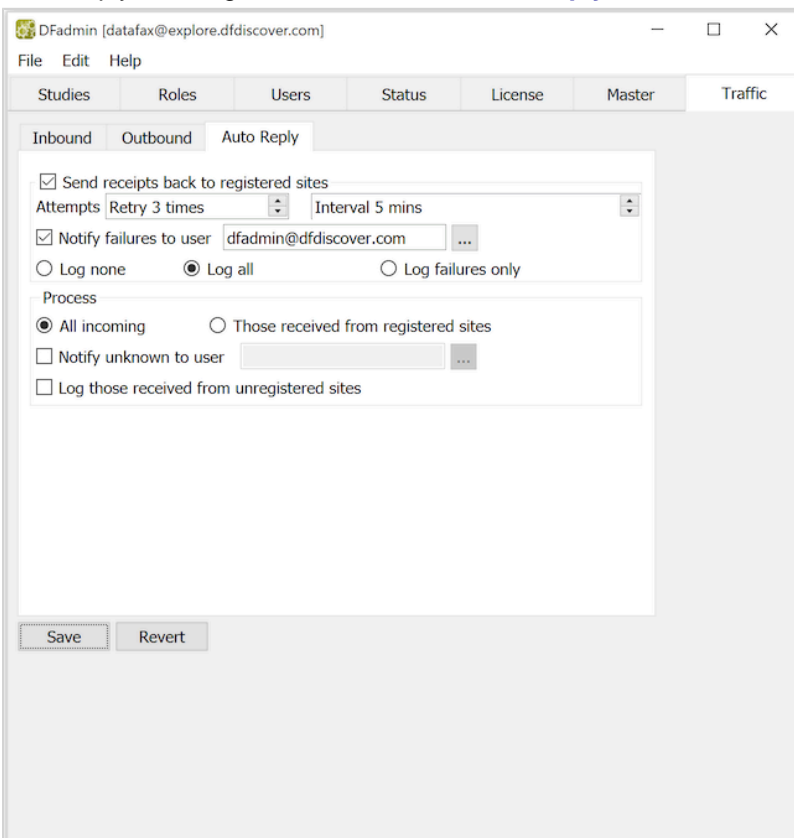
To change the status of the Outbound service, select one of:

- **Action** > **Start Outbound** Start the currently stopped Outbound service.
- **Action** > **Stop Outbound** Stop the currently processing Outbound service. Documents that are currently being transmitted will complete transmission but documents waiting in the queue will not be processed until the Outbound service is started again.

10.6. Auto Reply

Auto reply is a debugging feature useful for diagnosing problems with sites that have ongoing difficulty submitting CRFs to DFdiscover. The feature works by sending a receipt to selected sites when documents from them arrive into DFdiscover. The receipt contains information about when the document was received, how many pages it contained, etc. A site that is having difficulty sending can then wait for their Auto Reply receipt before sending more CRFs - this will tell them immediately if there is a problem.

Auto Reply is configured in DFadmin's **Auto Reply** view.



The configuration parameters that can be altered are:

- **Send receipts back to registered sites.** Enabling this checkbox enables basic Auto Reply processing. When enabled, DFdiscover faxes or emails a confirmation of receipt for each document received from a registered site. Registered sites require a unique sender id for identification by DFdiscover. Hence, receipts are not sent to all sites that submit documents, but only to those that are registered. The remaining options are relevant only with this setting of the option.

With this option is not checked, Auto Reply is turned off and receipts are never sent to any site, whether a registered site or not.

- **Attempts.** When sending receipts, how many attempts should be made and at what interval?
- **Notify failures to user.** If an Auto Reply receipt cannot be sent, should a notification be sent to an internal administrator, and if so, to whom?
- **Log.** This is a choice field. When set to **Log none**, no log will be kept of receipts that are sent back. This log is not necessary and nothing in DFdiscover requires or references it; its purpose is purely informational. Setting this option to **Log all** configures DFdiscover to log every attempt to send a receipt. To log only those receipts that could not be sent, set this option to **Log failures only**.
- **Process.** This is a choice field that optionally allows DFdiscover to filter documents that originate from an unknown sender. When set to **All incoming** DFdiscover uses normal Inbound processing, where all received documents are processed. If the option is set to **Those received from registered sites**, only documents that arrive from registered sites are processed, all other documents from unregistered sites are discarded. This latter setting must be used with great care, as documents from unregistered sites will be deleted without further warning.
- **Notify unknown to user.** This setting applies only when **All incoming** is also set. If a document is received from an unregistered site, should a notification be sent to an internal administrator, and if so, to whom?
- **Log those received from unregistered sites.** This setting applies only when **All incoming** is also set. If a document is received from an unregistered site, should a log record be written? Log records are written to `sitefax_log`, which is described in [Table 14.38](#), “`sitefax_log`”.

After making any changes, select **File > Save** to save the changes and re-configure the Auto Reply service. The changes will be applied starting with the next incoming document that is received.

10.7. Registered Sites Database

Prior to enabling reply fax processing by setting, a database of registered sites must be initiated. It does not need to be complete at this time. Since reply fax processing is based on the sender identification, the registered sites database is implemented at the generic DFdiscover level, not at the study specific level. At the study specific level, some of the same sites will appear in the studies database. This is expected, noting that the information required for the study sites database (which identifies where Query Reports will be sent) is different information than that required for the registered sites database (which identifies from where faxes are sent).

A registered sites database must be created directly on the server. No special editor is included in DFdiscover for the creation or modification of this file, however, it is easily updated with a simple text editor. New sites can be added, existing sites modified, and sites deleted while the reply fax feature is enabled.

It is a plain text file, named `/opt/dfdiscover/lib/DFsites.db`, that identifies the clinical sites that will receive fax or email receipts. The format of this file is documented in [Table 14.15](#), “`DFsites.db`”.

Example 10.1. Typical records from `DFsites.db`

```
1|General Hospital|905-999-9876|1-905-999-9876|/opt/studies/xyz/replyfax/reply.001
1|St. Elsewhere|elsewhere@hospital.com|mailto:person@hospital.com|/opt/studies/abc/
replyfax/reply.001
```

For the successful operation of reply fax and the registered sites database, each site must transmit a unique sender identification string. This can be a fax number or email address. The replyfax field (field 4) of each `DFsites.db` record

may also consist of a fax number or email address. Comparison between the sender identification and the replyfax field is always performed case-insensitive.

Sites which do not need fax or email receipts are not required to be included in this file.

10.8. Fax receipt for registered sites

The 5th field of each site registration record identifies the name of a text file to be used as a template for that site's fax receipt. The same receipt file may be shared across sites simply by referencing the same file in the 5th field of each site record that shares the file. Conversely, each site might use or require a separate receipt, for example, to allow for different languages.

The requirements for a fax receipt are documented in [Table 14.12](#), "DFreceipt.sample". An example, shown in [Example 10.2](#), "Example ReplyFax receipt file", illustrates a fax receipt.

Example 10.2. Example ReplyFax receipt file

```
DFDISCOVER RECEIPT FOR STUDY XYZ
To: %s
From: XYZ STUDY coordinating site
Re: recently received fax from fax machine %g

A %p page fax was received at %t on %d.

If this does not agree with your fax log, please contact:
Jane Wright at 905-999-8888, extension 7777

THANK YOU FOR YOUR CONTINUING SUPPORT
```

The symbols %s, %g, etc are placeholders for information that is filled in by DFdiscover during the composition of the receipt for an individual fax.

Chapter 11. DFserveradmin

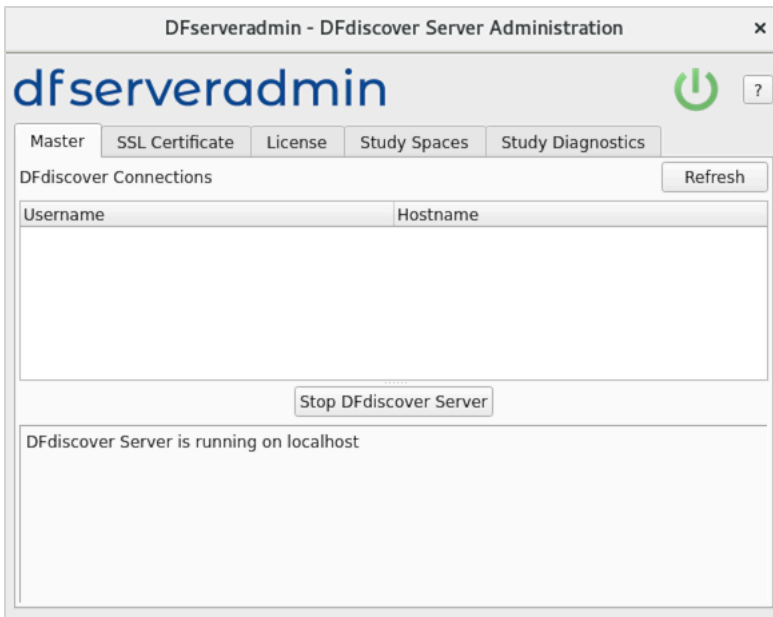
11.1. Introduction

DFserveradmin is a server-based application that is used to:

- start and stop the DFdiscover services.
- request SSL certificate signing from DF/Net Research, Inc. (DFnet).
- manage your DFdiscover license and see usage statistics.
- run study diagnostics.
- check and fix study file permissions.

DFserveradmin must be started from the command-line by the system `root`. There are no options required or recognized by this application.

Invoking **DFserveradmin** at the command-line displays the main user interface for the application. If DFdiscover is currently running the green start icon is displayed in the header. The stop icon is displayed if DFdiscover is not running.



The functionality of **DFserveradmin** is grouped into several tabbed windows. Related functions appear in the same tabbed window. The purpose of each window appears in the name of the tab. Click the corresponding tab name to access its tabbed view and functionality.

11.2. Master

DFserveradmin opens with the **Master** view visible.

On an operational system, any connections to the DFdiscover server are listed. It is not recommended that you stop DFdiscover with live connections, as this will disconnect these sessions without warning the user that made the connection. The list of users is not updated in real time. Click **Refresh** to refresh the user list with current connections.

Click **Start DFdiscover Server** to start DFdiscover. Click **Stop DFdiscover Server** to stop DFdiscover. Progress messages are logged to the messages panel. Additional startup information may also be logged to `/tmp/dfstartlog`.

11.3. Request an SSL certificate signing

Client applications cannot connect to your DFdiscover server unless a signed, and current, SSL certificate is in place on the server. Signed SSL certificates are typically valid for a period of 1 or 2 years.

When installed, a signed SSL certificate tells any client applications attempting a connection that the server is known, can be trusted and that communication is encrypted.

There are several commercial certificate signing authorities. Some clients prefer to have a signed certificate from one of these authorities. For these clients, a commercial certificate can be acquired independently and installed, as described in [Installing a Signed Certificate](#).

Alternatively, DFnet can act as the signing authority for your server certificate. There is no additional charge for this service.

To use DFnet as your certificate signing authority, click the **SSL Certificate** tab.

A new system does not have a signed certificate, so this dialog must be completed and submitted for signing to DFnet. Responses are required for all fields. The responses are visible to any user that selects **Help > Certificate Info** in their client application. Further, the **DFdiscover Server Domain Name** value must exactly match the fully qualified domain name (FQDN) of your server. Otherwise, users will be presented with a certificate warning dialog each time that they login to your server.

Click **Send Request** to email the unsigned SSL certificate request to DFnet for processing.

You can expect an email response containing a signed certificate within 24 hours on business days. In the interim, it is still possible to proceed as **DFserveradmin** also generates a self-signed certificate that is valid for 10 days. The signed certificate will be emailed back to the email address that was specified as the `Email Address` in the certificate request procedure. Typically it will appear as a small (~2KB) attachment named `edccert.pem`.

Outgoing email

The certificate signing request is emailed to DF/Net Research, Inc. from the machine where the **DFserveradmin** application was executed. This machine must be able to send email to an external recipient (DFnet). If that is not

possible, the files `/tmp/cert.csr.txt` and `/tmp/cert.csr` can be transferred (use binary mode if doing this via ftp) to another machine and sent as attachments in an email to `<certreq@dfnetresearch.com>`.

11.3.1. Installing a Signed Certificate

The signed certificate, whether received from DFnet or from a commercial signing authority, must be installed in the location referenced by the `certificate` keyword in the `/opt/dfdiscover/lib/DFedcservice.cf` file. For example, this `DFedcservice.cf` file:

```
master localhost
key /opt/dfdiscover/lib/edckey.pem
certificate /opt/dfdiscover/lib/edccert.pem
documentroot /opt/dfdiscover/edcdocs
```

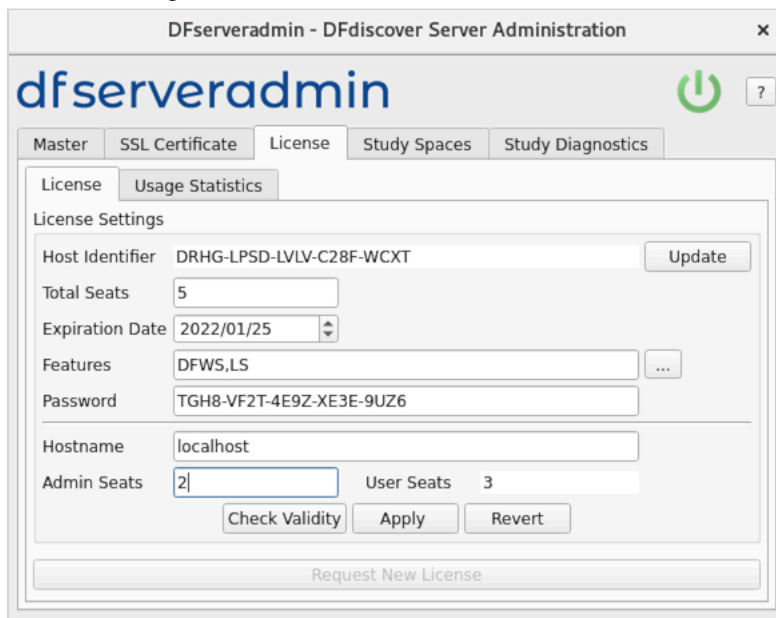
identifies `/opt/dfdiscover/lib/edccert.pem` as the location of the server certificate.

To install a new, or update an existing, certificate, save the signed certificate to this location.

A signed certificate is typically valid for one or two years and must be renewed on an annual basis.

11.4. License

Before starting the DFdiscover server, a valid license must be installed. Click the [License](#) tab to display the License view.



The screenshot shows the DFserveradmin web interface. The title bar reads "DFserveradmin - DFdiscover Server Administration". The main header features the "dfserveradmin" logo and a power icon. Below the header are navigation tabs: "Master", "SSL Certificate", "License", "Study Spaces", and "Study Diagnostics". The "License" tab is selected, and within it, the "Usage Statistics" sub-tab is active. The "License Settings" section contains the following fields and controls:

- Host Identifier: DRHG-LPSD-LVLV-C28F-WCXT (with an "Update" button)
- Total Seats: 5
- Expiration Date: 2022/01/25 (with a dropdown arrow)
- Features: DFWS,LS (with a "..." button)
- Password: TGH8-VF2T-4E9Z-XE3E-9UZ6
- Hostname: localhost
- Admin Seats: 2 (with a "User Seats" field set to 3)

At the bottom of the settings area are three buttons: "Check Validity", "Apply", and "Revert". A "Request New License" button is located at the very bottom of the interface.

On new installations, click [Request New License](#) to display the license request form.

Request New License x

License Information

Name

Company

Email Password to

Email Invoice to same as Email Password

Purchase Order #

Total Seats (All Servers) 5 Current 5

Total Number of Servers Current 1

Details for this Server

OS Version Linux 4.18.0-294.el8.x86_64 x86_64

DFdiscover Version 5.4.0

Number of Seats 5

Number of Admin Seats

License Period 2022/01/25 to 2023/01/25

Hostname localhost

Host Identifier DRHG-LPSD-LVLV-C28F-WCXT

Features DFWS,LS ...

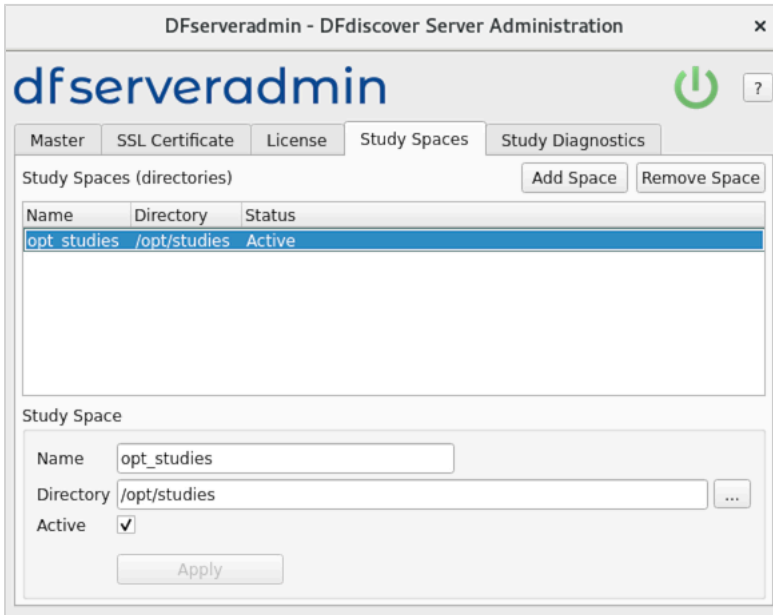
Message

Complete the form, editing any pre-filled fields as required. Click **Send Request** to submit the license request to DFnet for processing. A server password will be emailed back to the address provided.

Note that issuing a license is not an "automatic" email response, and is subject to review and verification by DFnet staff. Normally you can expect a response with 24 hours if your request is made during technical support hours.

11.5. Study Spaces

Before new studies can be registered in **DFadmin**, the UNIX directories that serve as the root for DFdiscover study directories must be created from the UNIX command-line and then registered as DFdiscover **Study Spaces**.



When adding a new study in the **DFadmin** Studies dialog, the administrator then selects one of the predefined study spaces and enters only a study folder name. This ensures that administrators can only create study directories in locations that have been approved by the UNIX administrator.

Note

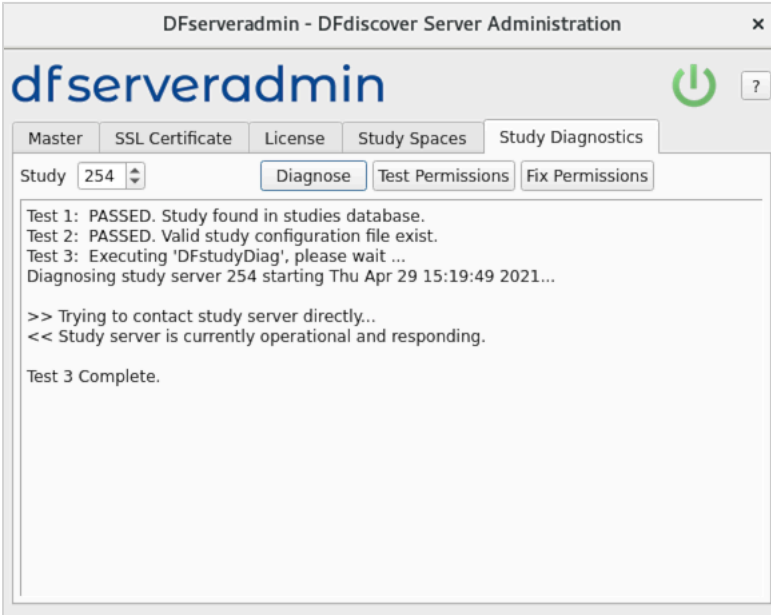
No part of a study space can itself be a DFdiscover study directory. For example, `/opt/studies` and `/opt/studies/ABC_Studies` could both be study spaces for the following study directories: `/opt/studies/A`, `/opt/studies/B`, `/opt/studies/NIH_Studies/A`, `/opt/studies/NIH_Studies/B`, etc., but `/opt`, `/opt/studies` and `/opt/studies/NIH_Studies` cannot be DFdiscover study directories.

Study spaces and directories must be unique, case-insensitive and cannot include the follow characters: `\ ' $; & * < > |` and SPACE

11.6. Study Diagnostics

If you are having problems connecting to a study, this utility may help in troubleshooting the problem. This function is equivalent to running `/opt/dfdiscover/utils/DFstudyDiag` on your study at the command-line in a terminal session.

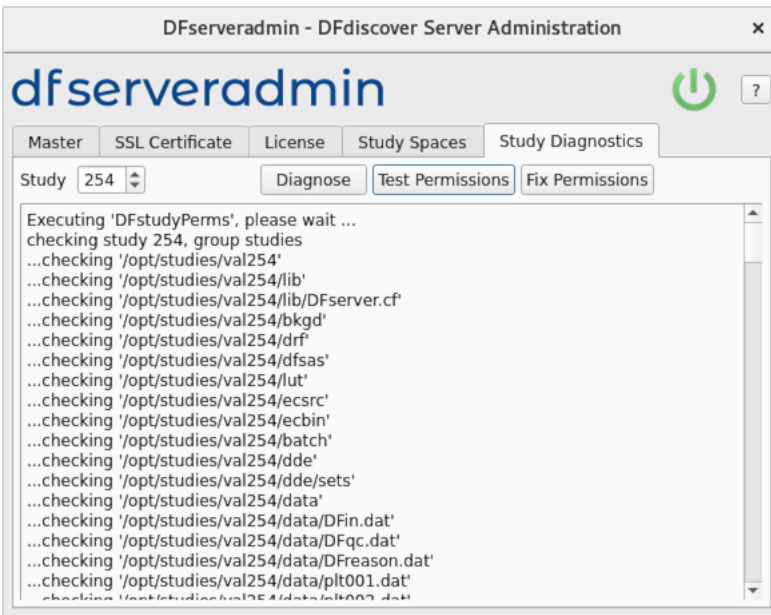
Select a study number and click **Diagnose**. The output is displayed in the output window. For more information, see [Programmer Guide, DFstudyDiag](#),



11.7. Study Permissions

If you suspect you are having problems with file-level permissions, this utility may help in troubleshooting and fixing the problem. This function is equivalent to running `/opt/dfdiscover/utills/DFstudyPerms` on your study at the command-line in a terminal session.

Select a study number and click either **Test Permissions** to troubleshoot, or **Fix Permissions** to fix any problems. Any problems or corrections are listed in the output window. For more information, see [Programmer Guide, DFstudyPerms](#),



Chapter 12. Periodic Maintenance

12.1. Introduction

This chapter discusses various topics relevant to ongoing, periodic maintenance of a DFdiscover system. Familiarity with these topics is recommended, and as many of the concepts as possible should be implemented in each DFdiscover environment. Some topics could even be paraphrased into standard operating procedures.

The most critical area of maintenance for any DFdiscover installation is disk usage monitoring. DFdiscover can be brought to a grinding halt by failing to notice that you are about to run out of disk space. Periodic monitoring of current disk usage and planning to make sure that disk space will be available for incoming faxes is essential to the health of the system.

12.2. Disk Maintenance

Disk usage by a DFdiscover study is highest for CRF image files. Generally, 90% of the disk space required for a study is consumed by CRF image files. This section covers managing disk space for the individual CRF image files that are kept in the `PAGE_DIR` directory defined for each study. [Archive File Maintenance](#) discusses management of the original TIFF/PDF files that the image files are extracted from.

12.2.1. Monitoring and planning future disk needs

So far we have concentrated on the notion that disk usage for a study can be planned for in advance. For many larger trials it may not be possible to determine the exact number of CRF pages that will be received. For example, the accrual rate may be different than expected, or the percentage of re-faxed pages that occurs is higher than normal. For such trials, it is important to continually monitor information about current disk usage patterns and base future disk demand planning decisions on that information.

The best way to plan future disk needs is to monitor your current disk usage patterns and extrapolate. This can be accomplished using `DF_WFdiskusage`, which lists and graphs, in chronological order, the total and average disk usage by week for study fax pages. [Example 12.1, "Sample output from DF_WFdiskusage"](#) is an example of the information that the report provides. `DF_WFdiskusage` accepts several options to customize its behavior. For additional details see [Standard Reports Guide, DF_WFdiskusage](#).

Example 12.1. Sample output from DF_WFdiskusage

```
DF_WFdiskusage: Disk Space Used Per Week.           DFstudy 251. Feb 26,2015 10:30
Disk usage from week 201449 to 201505 inclusive
Yr   Wk      Kb      Each * represents 9 Kb
      +-----+-----+-----+-----+-----+-----+
2014 49:      521 | *****max
2014 50:      346 | *****
2014 51:      354 | *****
2014 52:       82 | *****min
2015 03:      182 | *****
2015 04:      155 | *****
2015 05:      154 | *****
      +-----+-----+-----+-----+-----+
Total: 1794 Kbytes in 7 weeks
Mean: 256 Kbytes per week
```

```
Min: 82 Kbytes (week 201452)
Max: 521 Kbytes (week 201449)
```

A periodic procedure should be established whereby **DF_WFdiskusage** is executed for each active DFdiscover study. If available disk space is low, it should be run at least once per week. If available disk space is not a current concern, that interval can be extended to at least once per month. In either case, execution of this application at regular intervals is a task well suited to the UNIX cron facility.

With the output from **DF_WFdiskusage**, consider the following points when planning future disk needs:

- **What is the current average weekly disk usage?** At the current rate of disk consumption, for how many weeks into the future will there be disk space available? Is any study exceeding or falling below expectation for weekly disk usage? If a study is exceeding expectation, will this affect other studies that share the same disk partition?
- **Are any current studies terminating or new studies starting?** If studies are drawing to an end one can expect that there will be greater than average disk usage in the closing weeks, as investigators fax all outstanding CRFs, and thereafter disk usage should drop to near zero. On the other hand, new studies typically start slowly as investigators recruit subjects, but then they quickly reach operating levels. Do not be fooled by disk usage that falls below expectation over the first few weeks or even months.
- **Remember that a formatted disk has about 5-10% less capacity than its unformatted (published) size.** Formatting a disk can require 5-10% of its published capacity, and this space is then unavailable for fax page storage.
- **The time required to acquire new disks can vary from a day or two to several weeks depending on the vendor.** Become familiar with the lead times required by your hardware vendors. One can expect that it will take one week on average to receive a disk after it is ordered. If the disk is a newly announced product from a vendor, the delivery time will be even longer.

12.3. Disaster Planning and backup/recovery procedures

There are many options available to system managers that minimize or even eliminate downtime in the event that your primary server becomes inoperative due to anything from a hardware failure to an actual disaster such as a fire, flood, extreme weather conditions or an earthquake. Some common backup/recovery procedures are outlined below. You should have a "Disaster Planning" document as part of your SOPs that outlines the necessity for the method you have chosen, and what your staff needs to do to implement your chosen method. Your backup/recovery system should be tested on a regular basis to document that it is working and that you are able to recover should an actual disaster occur.

12.3.1. Replicating your server to another location

The quickest method of recovery from the loss of your primary server is to have a duplicate server that can be deployed as soon as the failure of your primary server is detected. Ideally, your backup server should be identical to your primary server, including at least availability of other external services (modem lines, Internet access, power supply backup). Ideally, your backup server should be at a different physical location. If your primary server is located in an area that is more susceptible to hurricanes or earthquakes, pick a location that historically has lower risk for such events.

There are many software solutions available for synchronizing two systems. At DF/Net Research, Inc., we use rsync. With rsync and cron, two identical systems can be synchronized at a scheduled interval (e.g., once nightly, once per hour). Only data that has changed is transmitted between servers, making this a very efficient method of keeping two systems up to date with each other. Once two systems have been synchronized, you may want to limit what directories get copied to make the most of whatever network bandwidth you have available. This should include the same directories you would normally backup using tape. Usage of rsync is described in the man page for the application. See man rsync for details.

Because recovery involves the use of a second server, a license key for that server must be obtained before it can be tested or used in an actual disaster recovery. Test license keys are available from DF/Net Research, Inc. for this purpose. Should your primary server be involved in an actual disaster, you must request a temporary license transfer to your backup system.

12.3.2. Disk backup and recovery procedures

True backups require a quiet filesystem. If this is done during off-hours, it is unlikely that any user will be modifying a study database. However faxes may still be arriving, especially from international sites. This problem can be solved at two levels:

- disable HylaFAX from answering any new incoming fax calls, or
- shutdown DFdiscover.

The former solution has the problem that it may frustrate sites that are trying to fax while the backup is being done. The latter solution should be careful to not backup the incoming fax directory as its contents will not be quiet as long as one or more incoming faxes are being received.

DFdiscover can be halted from a shell script (like the **cron** process that performs the backups) by executing the command

```
# /opt/dfdiscover/bin/DFshutdown -f
```

and then subsequently restarted using

```
# /opt/dfdiscover/bin/DFbootstrap
```

If only an individual study directory (or group of study directories) needs to be backed up, then **DFdisable.rpc** is used to temporarily disable the study servers that must not be running while the backup is executing. This allows users of other studies to continue with their DFdiscover activities while the backup proceeds. When the backup is complete, **DFenable.rpc** must be used to re-enable the halted study servers.

There are many freely and commercially available applications for performing system backup. Discuss the options with your corporate IT team.

12.3.2.1. What should a regular DFdiscover backup include?

It is essential to back up the DFdiscover setup and configuration as well as the individual DFdiscover study definitions and data.

12.3.2.1.1. DFdiscover Setup and Configuration Files

There are two files in your `/opt/dfdiscover/lib` directory which contain information that will be essential to rebuilding your DFdiscover server.

- This file contains the study number and `$STUDY_DIR` location for each study. While you may need to put your study information in a different location on a new server, this information is essential to knowing where to look for it in available backups.
- This file contains a list of the filesystem locations on a server where DFdiscover study information and data can be stored. As with , knowing how the old system was configured is important even if the new system needs to be different for some reason.

There are also non-study-specific files that DFdiscover updates regularly, and hence they also need to be part of a regular backup. These include the directories:

```
/opt/dfdiscover/work  
/opt/dfdiscover/lut  
/opt/dfdiscover/ecsrc
```

/opt/dfdiscover/ecbin
 /opt/dfdiscover/lib
 /opt/dfdiscover/archive, or whatever the local setting is for the TIFF/PDF archive directory

12.3.2.1.2. Study Files

This includes the DFdiscover setup and configuration files, the data records themselves, and the images, if any, associated with them. At a minimum, the directories to backup include:

```
$STUDY_DIR/bkgd
$STUDY_DIR/data
$STUDY_DIR/dfsas
$STUDY_DIR/dfschema
$STUDY_DIR/drf
$STUDY_DIR/ecbin
$STUDY_DIR/ecsrc
$STUDY_DIR/lib
$STUDY_DIR/lut
$STUDY_DIR/pages
$STUDY_DIR/pages_hd1
$STUDY_DIR/reports/QC
$STUDY_DIR/work
```

There may also be other directories used by a study team that are not specific to, or required by, DFdiscover - consult with the DFdiscover users to identify what those directories or files might be. It may be safest, and most inclusive, to specify the study root directory for backup. In this way every sub-directory will by default be included.

Example 12.2. Use of tar to backup a study

```
# cd /opt/studies/val254
# tar cf /dev/rmt/0 bkgd data dfsas dfschema drf ecbin ecsrc lib lut pages pages_hd
  reports/QC work
```

In this case, the study is rooted at /opt/studies/val254.

If there are other directories or files to be included, it may be safest to capture the entire study hierarchy with this command:

```
# cd /opt/studies/val254
# tar cf /dev/rmt/0 .
```

or this command:

```
# cd /opt/studies/
# tar cf /dev/rmt/0 val254
```

The former excludes the study parent directory name from the backup, while the latter includes it.

12.3.2.2. Testing

As with any backup or disaster recovery solution, it must be tested to confirm that it is operating in the expected manner, that all of the needed contents are in fact being backed up and that is occurring on the planned, regular schedule.

DF/Net Research, Inc. encourages all clients to test their backups at least once per month. Additional, manual backups should be performed for "milestone" events - for example, launch of a new study, close of a completed study, or before upgrading to a new software version. Individual needs and resources will vary. Clients are also encouraged to have a

¹This directory may not be present in studies where HD resolution has not been enabled.

secondary, standby server available at all times and to regularly update the secondary server with the contents of the primary server.

12.4. Archive File Maintenance

This section covers the management of the original archive (TIFF or PDF) files that the PNG files are extracted from. In DFdiscover, these files contain the original fax transmission as received from the sender via the fax modem (or scan transmission via **DFsend**). Each file contains the total number of pages sent in the transmission.

Archiving of TIFF and PDF files is controlled by the value of the `INBOUND_ARCHIVE_DURATION` variable defined in the configuration of incoming daemon(s). Unless archiving has been explicitly disabled by setting the value of this parameter to 0, each incoming file is archived by the DFdiscover incoming daemon. The value of the archived fax is in the ability of an administrator to subsequently manually recover pages that are mistakenly deleted. This process is described in [Retrieving lost CRF images](#). The DFdiscover software itself does not require archived faxes, nor does it confirm their existence.

Generally speaking, archive files should be routinely saved to secondary media (tape) and then deleted from primary storage (disk). How many archive files are kept on disk before being moved to secondary storage is a matter of individual preference and comfort level, but an average of 4 weeks of archived faxes is appropriate. This leads to a monthly procedure in which any archive files that are more than 4 weeks old are moved to secondary storage and deleted from disk.

By way of example, consider an environment where the archive files have never been moved to secondary storage and it is now desired to begin implementing a routine monthly procedure for doing this. The archive files have been kept in `/opt/dfdiscover/archive` and all but the four most recent weeks worth of files must be moved to tape storage on device `/dev/rmt/0`. The archive directory has the following contents:

```
# ls /opt/dfdiscover/archive
1716/      1720/      1724/      1728/
1717/      1721/      1725/      1729/
1718/      1722/      1726/      1730/
1719/      1723/      1727/      1731/
```

The following command would have the desired result of archiving the oldest weeks to tape:

```
# cd /opt/dfdiscover/archive
# tar cvf /dev/rmt/0 171{6,7,8,9} 132{0,1,2,3,4,5,6,7} | lp
```

The `tar` command is used to backup the files to tape in this case, but other backup commands are equally valid. This particular `tar` command also creates a table of contents listing as the backup is created, and that listing is directed to the default printer. This provides a convenient, printed table of contents that can be kept with the tape.

The next step is to delete from primary storage the archive files that have been copied to secondary storage. Before deleting the archive files, verify that the backup created on secondary media is complete. This confirmation can be done with a visual review of the printed table of contents or by immediately performing a test restore of the media to another location.

After confirming that the backup copy of the TIFF files is complete, delete the original copies of the files from disk. Continuing with the example, the command to execute is:

```
# cd /opt/dfdiscover/archive
# /bin/rm -rf 171{6,7,8,9} 132{0,1,2,3,4,5,6,7}
```

Having completed the steps, the directory would have the following contents:

```
# ls /opt/dfdiscover/archive
1728/      1729/      1730/      1731/
```

The only remaining step is to formalize this process into a periodic routine.

12.5. Study Maintenance

This section describes those activities that should be executed on a regular database as part of a pro-active study maintenance process.

Before going 'live' with a new study setup, it is advisable to restore the study directory to a base (empty) state that does not contain any test data or test images.

Periodically the study directories should be examined and old, stale files removed. These files are typically temporary files that were created by users in the study work directory and quality control reports that were created but never sent.

It may also be required to perform regular archiving of a study database for interim analyses.

12.5.1. Going live with a DFdiscover study

It is highly recommended that a study setup be thoroughly tested before real data is accepted from investigative sites. This testing should include completing blank case report forms with actual data, faxing the case report forms into the system, validating the ICRed data records, and creating Query Reports to test the visit map, page map, and/or conditional plate and termination maps. The *DFdiscover Study Setup Worksheets* are an excellent aid in ensuring that all of the required steps are completed and documented.

The result of this testing will be a study database that contains data, CRF images, and Query Reports that are not relevant to the real study data. It is important before going live with a study to remove all of this test data. It is straightforward to remove this test data before the real data arrives; it is much more tedious to remove it once it becomes combined with real subject data.

Procedure 12.1. Deleting test data

To delete the existing test data from a study the following steps should be followed.

1. **Disable the study server**

It is a requirement that the study server be disabled when the test data is deleted. This can be done either via the **Status** dialog of **DFadmin** or from the command-line, using **DFdisable.rpc**, as illustrated in [Example 12.3, "Disabling study 254"](#).

Example 12.3. Disabling study 254

```
# /opt/dfdiscover/bin/DFdisable.rpc -s 254 "going live"
```

2. **Remove, or rename, the existing data pages pages_hd and reports/QC directories**

Note that removal of these directories assumes that they contained only information that was created by DFdiscover. If these directories contain other information that is outside the control of DFdiscover (and this is not recommended), then they cannot simply be deleted.

Example 12.4. Removing the directories containing test data for study 254

```
# cd /opt/studies/val254
# rm -r data pages pages_hd reports/QC
```

3. **Enable the study server**

Once the study server starts again, the removed directories will be re-created as empty directories.

Example 12.5. Enabling study 254

```
# /opt/dfdiscover/bin/DFenable.rpc -s 254 "going live"
```

For documentation purposes, the setup should be printed from the **Study** > **Print** menu in **DFsetup** and the current user permissions should be printed from the **Permissions** dialog in **DFadmin**.

12.5.2. Monitoring study directory permissions

A DFdiscover study is stored on disk as an inverted tree structure in the filesystem. The information required at any moment during the use of a study is available as one or more files in that filesystem structure. Using the UNIX filesystem directly has the advantage that this same information is also readily available to applications outside of DFdiscover, for example, for the purposes of scripting or working with third-party applications. However, this flexibility also has the drawback that UNIX filesystem permissions and the permissions required by DFdiscover are not always in perfect agreement. This can lead to users that are unable to open files that should otherwise be permitted to. The purpose of this section is to describe the permissions that DFdiscover requires and suggest ongoing maintenance to ensure that those permissions are maintained.

12.5.2.1. Owner and group

By default, DFdiscover will create all of the needed directories and files for a study with owner `datafax` and group `studies`. The ownership should always remain as `datafax`. The group `studies` is intended for general sharing of study files across all DFdiscover users. This typically matches the primary group assigned during login to DFdiscover user accounts. If a different group is being used for the study, then that group name should be applied to all of the directories and files. At the same time, that group name should be listed as the primary group for login to those DFdiscover accounts that are specific to the study.

No permissions are required for `other`, and so they are not granted by DFdiscover. It should be possible to accomplish all needed tasks with owner or group permissions.

Owner and group settings are not applied by DFdiscover to directories or files which it does not create. For example, a `sas` or `batch` sub-directory, which is created by a user will not have the same ownership and group. It is recommended that owner `datafax` and group `studies` be applied to these directories and files, but this must be done manually.

12.5.2.2. Maintaining study filesystem permissions

DFdiscover includes a utility application, **DFstudyPerms**, (see [Programmer Guide, DFstudyPerms](#)) which examines, reports, and optionally repairs permissions for a study filesystem. This application should be run from the command-line whenever a permissions problem is suspected and also as part of a regular maintenance procedure to identify and correct problems with permissions.

To report on study permission problems, any user can execute the command:

```
% /opt/dfdiscover/utils/DFstudyPerms #
```

where `#` is the study number. Run in this fashion, **DFstudyPerms** remains silent unless a problem is discovered. Any permissions which do not match the expected permissions are reported, one line per file or directory. It also uses the group `studies` unless another group is specified with the `-g groupname` option.

To fix study permission problems, the `root` account is required. In this case the command is:

```
# /opt/dfdiscover/utils/DFstudyPerms -f #
```

where `#` is the study number and `-f` instructs the application to correct any permission errors that it encounters. Again, the `-g groupname` option is needed if the study group is not `studies`.

It is recommended that the latter invocation be added to `root`'s `crontab` and executed at least once per month.

12.5.2.3. Default study filesystem permissions

Table 12.1, “Study filesystem permissions” lists the study filesystem permissions. The permissions are reported as 3 triples of 3 characters. The first triple is owner permissions, the second group, and the third other. The 3 character positions, `rwX`, represent read permission, write permission, and search permission respectively. If a particular permission is not granted, it appears as a dash, `-`, in the listing. If a file or directory is checked by **DFstudyPerms** it is also checked for either exact permissions or minimum permissions. If it is checked for exact permissions, it must have exactly the listed permissions - any other permission will generate a message. If it is checked for minimum permissions, then additional permissions (for example, additional write permissions for group) are acceptable and will not generate a message.

Note

Most of the permissions are checked by **DFstudyPerms** but not all of them. It is expected that a future version of **DFstudyPerms** will include checking of these additional files.

Table 12.1. Study filesystem permissions

| Name | File or Directory | Permissions | Type of check | Notes |
|--------------------|-------------------|------------------------|---------------|---|
| . | Directory | <code>rxXr-x---</code> | Minimum | This is the study parent directory. If users are permitted to create their own sub-directories, the permissions will need to be <code>rxXrwx---</code> |
| batch | Directory | <code>rxXr-x---</code> | Minimum | |
| bkgd | Directory | <code>rxXrwx---</code> | Minimum | |
| bkgd/DFbkgd???.tif | File | <code>rw-rw----</code> | Minimum | |
| bkgd/plt??? | File | <code>rw-rw----</code> | Minimum | |
| bkgd/DFbkgd??? | File | <code>rw-rw----</code> | Minimum | |
| data | Directory | <code>rxXr-x---</code> | Minimum | Write permissions on this directory should never be granted to any account other than <code>datafax</code> . |
| data/*.dat | File | <code>rw-----</code> | Exact | |
| data/*.idx | File | <code>rw-----</code> | Exact | |
| data/*.jnl | File | <code>rw-r-----</code> | Exact | These audit trail files must not be writable by any account other than <code>datafax</code> . They are readable for the purposes of audit trail reports like DF_ATmods . |
| drf | Directory | <code>rxXrwx---</code> | Minimum | |
| dde | Directory | <code>rxXrwx---</code> | Minimum | |
| dde/sets | Directory | <code>rxXrwx---</code> | Minimum | |
| dfsas | Directory | <code>rxXrwx---</code> | Minimum | |
| ecbin | Directory | <code>rxXr-x---</code> | Minimum | |
| ecsrc | Directory | <code>rxXr-x---</code> | Minimum | |
| lib | Directory | <code>rxXrwx---</code> | Minimum | |
| lib/DFcenters | File | <code>rw-rw----</code> | Minimum | |
| lib/DFfile_map | File | <code>rw-rw----</code> | Minimum | |
| lib/DFschema | File | <code>rw-rw----</code> | Minimum | |

| Name | File or Directory | Permissions | Type of check | Notes |
|--|-------------------|-------------|---------------|---|
| lib/DFschema.stl | File | rw-rw---- | Minimum | |
| lib/DFserver.cf | File | rw-r----- | Exact | |
| lib/DFsetup | File | rw-rw---- | Minimum | |
| lib/DFsetup.backup | File | rw-rw---- | Minimum | This file contains the previous version of the study setup and is overwritten as part of the initialization process of DFsetup . |
| lib/DFtips | File | rw-rw---- | Minimum | |
| lib/DFvisit_map | File | rw-rw---- | Minimum | |
| lib/DFccycle_map | File | rw-rw---- | Minimum | These remaining files in the study lib directory are optional. |
| lib/DFcplate_map | File | rw-rw---- | Minimum | |
| lib/DFcterm_map | File | rw-rw---- | Minimum | |
| lib/DFcvisit_map | File | rw-rw---- | Minimum | |
| lib/DFedits | File | rw-rw---- | Minimum | |
| lib/DFlut_map | File | rw-rw---- | Minimum | |
| lib/DFmissing_map | File | rw-rw---- | Minimum | |
| lib/DFpage_map | File | rw-rw---- | Minimum | |
| lib/DFqcproblem_map | File | rw-r----- | Minimum | |
| lib/DFqcps.prolog | File | r--r----- | Minimum | |
| lib/DFqcsort | File | rw-rw---- | Minimum | |
| lib/DFraw_map | File | rw-rw---- | Minimum | |
| lib/QCcovers | File | rw--rw----- | Minimum | |
| lib/QCmessages | File | rw--rw----- | Minimum | |
| lib/QCtitles | File | rw--rw----- | Minimum | |
| lut | Directory | rwxr-x--- | Minimum | |
| pages,pages_hd | Directory | rwxr-x--- | Minimum | |
| pages/????, pages_hd/???? | Directory | rwxr-x--- | Minimum | These are the directories, organized by year and week of year, in which the CRF images are stored. |
| pages/????/???????, pages_hd/????/??????? | File | rw-r----- | Exact | |
| reports | Directory | rwxr-x--- | Minimum | If users are permitted to install their own study-specific reports, these permissions will need to be rwxrwx--- |
| reports/QC | Directory | rwxrws--- | Minimum | |
| reports/QC/*-??????? | File | rw-rw---- | Minimum | |
| reports/QC/QC_LOG | File | rw-rw---- | Minimum | |
| reports/QC/QC_NEW | File | rw-rw---- | Minimum | |
| reports/QC/SENDFAX.log | File | rw-rw---- | Minimum | |

| Name | File or Directory | Permissions | Type of check | Notes |
|---------------------------|-------------------|-------------|---------------|-------|
| reports/QC/SENDFAx.qup | File | rw-rw---- | Minimum | |
| reports/QC/internal | Directory | rxwxrwx--- | Minimum | |
| reports/QC/sent | Directory | rxwxrwx--- | Minimum | |
| reports/QC/sent/*-??????? | File | rw-rw---- | Minimum | |
| work | Directory | rxwxrwx--- | Minimum | |
| work/DFvisit.dates | File | rw-rw---- | Minimum | |
| work/DFX_* | File | rw-rw---- | Minimum | |
| work/DF*.drf | File | rw-rw---- | Minimum | |
| work/DF_QCupdate.log | File | rw-rw---- | Minimum | |

12.5.3. Cleaning the study work directory

The `work` directory for a DFdiscover study includes a mixture of temporary files created by DFdiscover and temporary files created by users.

Files that have names beginning with `DFX` are created by the DFdiscover **DF_XXkeys** report. They are overwritten each time that **DF_XXkeys** or **DF_QCupdate** is executed. In most circumstances, they should be left alone. However, if disk space is at a premium they can be deleted, as they will be re-created the next time the reports are run.

The other temporary files that might be found in the work directory will be specific to each DFdiscover installation. You will have to use your own discretion in deciding which files to delete. As a general guideline, files with the following attributes are good candidates for deletion:

- at least one month old,
- created by a user other than user `datafax`, and
- have typical temporary file names like `temp`, `tmp`, `test`, and `NoName`

12.5.4. Cleaning the study Query Reports directory

The reports directory for a DFdiscover study includes study specific reports as well as Query Reports. The Query Reports are stored in a further `QC` sub-directory of the `reports` directory. Reports that are created by **DF_QCreports** are stored in this `QC` sub-directory and then are moved to a further `QC/sent` sub-directory when they are successfully faxed to investigators. If reports are created by **DF_QCreports** but are never subsequently faxed out, they will be left in the `QC` sub-directory. Periodically check the files in the `QC` sub-directory of the study `reports` directories for such reports and delete them if they are out of date. If there is any doubt, this step should be coordinated with the staff member responsible for creating Query Reports for the study.

12.5.5. Procedures for archiving a DFdiscover study

When preparing to close-out a study or archive a copy for interim analysis, the following issues need to be considered:

- **The current state of the study setup needs to be archived.** All of this setup information is, under normal circumstances, in the study `lib` directory. However, lookup tables, for example, may reside elsewhere.
- **Is the new record queue empty?** Ideally, there should be no new records awaiting validation.

- **What data needs to be archived?** Does all of the data need to be archived? Primary records only? Are the journal files also required?
- **Do the CRF images need to be archived?** Almost always, the answer to this question is yes. The CRF images must be archived but is unlikely that there will be sufficient primary (disk) storage available to maintain an archive copy. Hence the CRF images should be archived to tape, DVD or cloud storage. The requirements for keeping the CRF images can be quite onerous and hence it is important to choose a secondary storage medium that will be readable many years in the future.
- **If the study is being closed out, DFdiscover permissions should be revoked for all users that have access to the study.** Minimally, each previously permitted user should be assigned a role that permits view-only, and eventually permissions should be completely removed.
- **Disable or de-register the study.** The study may also be disabled, so that no users can access it, or deleted from the DFdiscover studies database. The latter solution is ultimately preferred as this guarantees that DFdiscover will not process incoming faxes for the study to the study new queue.

A minimal set of steps for making an archive copy of the primary database records might follow the scenario in [Example 12.6](#), "Making an archive copy of the primary database records for study 254".

Example 12.6. Making an archive copy of the primary database records for study 254

```
# mkdir -p /opt/archive254/data
# cd /opt/studies/val254
# tar cf - lib | ( cd /opt/archive254; tar xpf - )
# foreach p ( `DFlistplates.rpc -s 254` 0 511 )
? DFexport.rpc -s primary 254 $p /opt/archive254/data/exp$p
? end
# tar cf /dev/rmt/0 pages
```

This example makes an archive of the study setup and primary data for study 254 in a separate archive directory, `/opt/archive254`. Additionally, all of the current CRF images are archived to tape.

12.5.6. Retrieving lost CRF images

Rarely, a user may encounter the message 'image not available' in the **DFexplore Review Images** dialog. Before retrieving a lost image file, attempt to determine the cause of the problem and log it. Periodically review the log to look for any systematic problems that might be correctable.

Procedure 12.2. Retrieving lost CRF images

The steps to retrieving a lost CRF image are as follows.

1. Determine the name of the lost CRF image

The name of the CRF image in question will be the name that followed the **Can't load** warning in the message window. The name will begin with the study pages directory and end with digits in the form `YYWW/FFFFPPP`, where `YYWW` is the year and week that the fax was received, `FFFF` is the parent fax's sequential number within `YYWW`, and `PPP` is the page number within the fax.

2. Determine if the lost CRF image is still in the filesystem

DFdiscover does not ever delete image files - instead the image is renamed by prepending the name with an `x` and the file permissions are set so that the file is not accessible by a typical user. Therefore, even a deleted file is still present in the filesystem. DFdiscover always attempts to retrieve and restore lost CRF images on its own. If DFdiscover is not able to do so, the following procedures should be performed by the DFdiscover administrator. Generally this includes

undoing the file renaming and setting the permissions so that the file is again accessible. This may be needed for only the `pages` directory, or it may also be required for the `pages_hd` directory if HD imaging is enabling.

Example 12.7. Restoring a CRF image by renaming

Suppose that **DFexplore** reports that image '1601/0023002' is not available. Looking in the filesystem under the directory where the image should be stored, the administrator sees:

```
# cd /opt/studies/mystudy/pages/1601
# ls -l *0023002
-r----- 1 datafax studies 38951 Jan 5 10:06 X0023002
```

which confirms that the CRF image file is still present in the filesystem. To restore the CRF image then requires the steps:

```
# mv X0023002 0023002
# chmod 640 0023002
```

whereby the file name is restored by removing the leading `x` and restoring the permissions so that the file can be seen by members of the study group. This should then be repeated with the `pages_hd` directory. In this directory, it may be that:

- the same renaming is required, or
- the image is not present at all.

The latter case is not unusual - it would indicate that HD imaging was not enabled at the time that the fax was first received. In such a case there would be no need to restore the HD image in the `pages_hd` directory.

12.6. DFdiscover Study Consistency

The DFdiscover system includes several reports that target potential problem areas in a study setup and study database. These reports are **DF_ICrecords**, **DF_ICimages**, **DF_ICqcs**, **DF_ICkeys**, **DF_ICvisitmap**, and **DF_ICvisitdates**. This section concentrates on the **DF_ICrecords**, **DF_ICimages**, and **DF_ICqcs** reports. Any failure output from these reports represents a consistency error requiring DFdiscover administration privileges to resolve. The remaining reports [Standard Reports Guide, DF_ICkeys](#), [Standard Reports Guide, DF_ICvisitmap](#) and [Standard Reports Guide, DF_ICvisitdates](#) detect consistency errors that a user can resolve.

12.6.1. DF_ICrecords

The **DF_ICrecords** report verifies the integrity of data records for all or specified plates in the database. It does this by confirming that each record has the correct number of fields defined by the plate definition in the study setup. Additionally, **DF_ICrecords** performs the following checks on each record in the specified data files:

- the record has the correct study and plate number,
- the record has properly formatted creation and modification timestamps
- there is exactly one primary record for the record's key fields

The latter check detects more than one primary record for a set of keys and also detects secondary records that have no primary.

Executing this report with the `-d` option creates a DRF named `ICrecords.drf` that contains a record for each data record that fails one or more of the above checks. Using [Select-By Data Retrieval File DFexplore](#) is used to correct each problem record detected by **DF_ICrecords**. After resolving the problems, re-execution of **DF_ICrecords** will generate no error output.

In addition to the **DF_ICrecords** report, the shell-level utility, **DFcmpSchema**, are used to more stringently examine each record. **DF_ICrecords** ensures that the database structure is consistent with DFdiscover requirements. **DFcmpSchema** ensures that the database content is consistent with the study schema.

12.6.2. DF_ICimages

The **DF_ICimages** report verifies that each data record in a study database references a CRF image in the study pages directory, and conversely that each CRF image in the study pages directory is referenced by exactly one data record.

In most cases, the **DF_ICimages** report should be run with the `-x` option which forces the report to execute with the database in a read-only state. Without this option, the database is in a read-write state that allows the database state to change while the report is being run. The end result may be that **DF_ICimages** indicates problems with are present because they are timing related.

If the **DF_ICimages** report detects a record that references a missing CRF image, follow the steps in [Retrieving lost CRF images](#).

If the **DF_ICimages** report detects a CRF image that is not referenced by a data record, two resolution methods are possible:

- Move the CRF image from the study pages directory to the `/opt/dfdiscover/identify` directory so that it can be re-entered into the study new queue.

For example, if **DF_ICimages** indicates that the CRF image `9901/0045001` does not have a corresponding data record, the following command will move the CRF image back to the identify directory for subsequent identification and re-processing:

```
# cd /studies/mystudy/pages
# mv 9901/0045001 /opt/dfdiscover/identify/9901.0045001
```

- Locate the original journal entry for the record in the study journal files and re-submit that (edited) journal record with **DFimport.rpc**.

Using the same example image name, the steps are to locate the original journal entry for the record (the original entry is denoted with leading text of `d|0|0`), edit the journal record, and pass the result to **DFimport.rpc**. **DFimport.rpc** requires the study number.

Example 12.8. Restoring a record from the journal for study 254

```
# cd /studies/mystudy/data
# grep "d|0|0|9901/0045001" *.jnl | \
/opt/dfdiscover/bin/DFget 5-NF | /opt/dfdiscover/bin/DFimport.rpc -an 254 -
```

The needed steps can be accomplished with one command that locates the needed journal record (using **grep**), removes the leading 4 fields of the journal record (using **DFget**), and finally imports the record by adding it to the new record queue using **DFimport.rpc**.

Finally, if **DF_ICimages** detects a CRF image that is referenced by two or more data records, **DFexplore** is used to review all of the involved records and delete all but the correct primary (or secondary) record.

12.6.3. DF_ICqcs

The **DF_ICqcs** report:

- detects final database records that have one or more unresolved queries
- detects queries that are not referenced by the key fields in any data record (free floating queries)

- detects multiple queries that reference the same data field (duplicate queries)

The **DF_ICqcs** report includes the `-r` option that causes the report to attempt to repair problems resulting from un-referenced queries and final records having unresolved queries. Inconsistencies are resolved by deleting all un-referenced queries. On final records, the unresolved queries are marked as resolved.

Multiple queries that reference the same data field can be resolved by using **DFexplore** to delete all but one of the duplicate queries.

12.7. System Maintenance

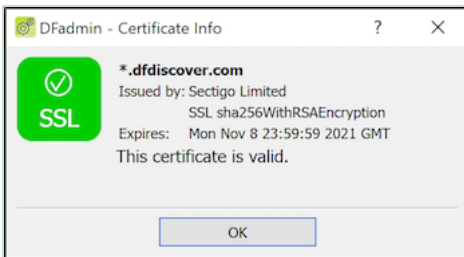
A DFdiscover system as a whole also needs routine maintenance. This maintenance includes regular, generally daily, backups of important filesystems as already described, as well as routine pruning of the filesystem that involves truncating log files.

12.7.1. Certificate Info

Each of the client applications communicates with the DFdiscover server using HTTPS on port 443. This port must be open on any firewalls between the local computer and the study server.

This is industry-standard technology that encrypts the bi-directional communication using a 'certificate of trust' provided by the server. It is the same technology used by banks and the majority of secure, global web services.

You can visually confirm that the communication is secure. After logging-in to **DFadmin** select **Help** > **Certificate Info** and look for the green checkmark.



12.7.1.1. Renewing the Certificate

In the **Certificate Info** dialog, take note of the expiry date. The certificate for your server is valid for a defined period of time.

If the certificate expires, clients will not be able to connect using encrypted communication. It is your responsibility to ensure that certificate expiry does not happen. This is easy to handle.

The certificate issuer for your DFdiscover server is identified in the value of the **Issued by** field. If

- DF/Net Research, Inc. is your certificate issuer, use the command-line **DFcertReq** utility or **DFserveradmin** to request a new certificate
- DF/Net Research, Inc. is not your certificate issuer, contact the certificate issuer directly to arrange a new certificate

12.7.2. Truncating DFdiscover log files

There are various log files that are maintained by DFdiscover that can be periodically truncated. In truncating these files it is important to maintain the file permission and ownerships that were in place before the file was truncated. Also, you should choose between completely clearing all of the log messages or maintaining a context of the most recently written log messages. In the examples below, both methods are indicated.

12.7.2.1. /opt/dfdiscover/work/server_log

The **DFmaster.rpcd** application appends an entry to this log file each time a study database server starts or stops. These entries are useful in debugging but are not required for the proper functioning of a DFdiscover system.

Entries are expected to appear in pairs and have the following appearance:

```
DFserver.rpc.251[27239]: start on teamserver at Mon Jan 22 17:23:37 2018
DFserver.rpc.251[27239]: exit at Tue Jan 23 09:29:53 2018
```

Messages may be appended to this file between the start and exit messages, but each start should eventually be terminated by an exit.

Messages are also appended to this file if a DFdiscover administrator deletes a study, study data, or study data and setup info using the **DFadmin** 'Delete' option. The example below illustrates the message from each of these operations performed on study 101.

```
DFedcservice.101[21877]: jack@localhost deleted all study data Fri Dec 1 12:00:09 2017
DFedcservice.101[21877]: jack@localhost deleted all study data and setup info Fri Dec 1
12:01:19 2017
DFedcservice.101[21877]: jack@localhost deleted study from datafax registry Fri Dec 1
12:02:58 2017
```

This file can be pruned at any time; the **DFmaster.rpcd** process will re-create or re-synchronize with the file after any changes. Pruning can be accomplished from the command-line as described below.

- To clear all messages:

```
# cat /dev/null > /opt/dfdiscover/work/server_log
```

- To maintain the 50 most recent messages:

```
# cd /opt/dfdiscover/work
# tail -50 server_log > new_server_log
# mv new_server_log server_log
# chown datafax:studies server_log
```

12.7.2.2. /opt/dfdiscover/work/sendfax_log

Each transmitted fax, independent of originating study, adds a record to this file. The record includes information about the user name of the sender, the name of the transmitted file, the date and time of transmission, and the disposition status (sent/failed) of the fax. This information is not used by any DFdiscover application or report and is intended to be a debugging aid in the case of failed transmissions.

This file can be pruned in the same manner as the `work/server_log` file and can be pruned at any time. Since the file does not grow very large or very quickly, it is safe to prune this file on a quarterly, semi-annual, or even annual basis.

12.7.3. Files to not prune

Certain log files contain information that is relevant to a DFdiscover installation over its entire history. These log files should *not be pruned*.

12.7.3.1. /opt/dfdiscover/work/fax_log

This file contains a record for each incoming fax that has been received by the DFdiscover system, independent of destination study. Each record includes information on the name of the received fax (the `YYWW/SSSS` part is particularly important), the

number of pages, the sender identification, and the date and time of receipt. This information is subsequently used by the **Page > Context** option in **DFexplore**, as well as reports: **DF_ATfaxes**, **DF_WFcrfsperwk**, and **DF_XXtime**.

The contents of this file are also mirrored by an index file, `work/fax_log.idx`. The contents of these two files *must absolutely* remain in sync.

12.7.3.2. /opt/dfdiscover/work/.seqYYWW

The unique sequence number that belongs to a fax is determined at the time of fax arrival by the **DFmaster.rpcd** process. The process determines the sequence number by consulting the appropriate `.seqYYWW` file. Under normal circumstances, only the `.seqYYWW` file for the current week is required. However, should a document need to be re-processed from the TIFF/PDF archive, the `.seqYYWW` file for the original year and week of receipt will be consulted, not the `.seqYYWW` for the current year and week. As a result, it is important that these files not be removed; this is partially the reason why they are named with a leading dot (.).

12.7.4. Truncating HylaFAX log files

HylaFAX provides a detailed log of all transactions that is very useful in debugging faxing problems. The information contained in these log files includes the remote fax machine number, the speed and encoding method used to transfer the fax and information about the duration and success or failure of each transmission. These log files need to be cleaned up periodically, and HylaFAX provides two scripts to accomplish this.

The first of these, **faxcron**, truncates the log files, and the second, **faxqclean**, is responsible for purging job description and old document files that are left over after a fax request has completed. Both of these scripts are normally run automatically by the UNIX **cron** facility.

To ensure that scripts have been correctly configured on your machine you will need to log in as root (or have a super-user perform these steps) and execute the following commands:

```
# crontab -l > mycronjobs
# more mycronjobs
```

If you see lines containing **faxqclean** and **faxcron**, the scripts are already correctly installed and no further action is necessary. If they do not appear, edit the `mycronjobs` file and add the following lines to the end of the file:

```
25 23 * * * /opt/hylafax/sbin/faxqclean
0 3 * * 0 /opt/hylafax/sbin/faxcron
```

which executes the **faxqclean** script every day at 11:25PM and the **faxcron** script every Sunday at 03:00AM. Save the file and then inform **cron** of the changes with the command:

```
# crontab mycronjobs
```

It may be necessary to increase the frequency of the script execution for a very high-volume site. In such a case, it can occur that the partition containing the HylaFAX logs (typically `/var`) will fill with log files leaving no space for normal system operation.

12.7.5. Conclusion

Periodic maintenance of a DFdiscover system as described in this chapter is a preventive measure that can save many hours or days of corrective or restorative work. It also gives DFdiscover users a feeling of confidence that the system is always available and running smoothly. Done regularly, this maintenance should require no more than 30 to 45 minutes per week.

Chapter 13. Troubleshooting

13.1. Introduction

This chapter provides troubleshooting assistance for the DFdiscover administrator.

DFdiscover is a complex system. There are many applications that communicate with each other, and each application relies on not only its own health but also on the health of those applications that it communicates with. To alleviate some of this complexity when errors occur, DFdiscover employs the `syslog` facility for errors and informational messages generated by the daemon and server applications. In addition, the client applications present most of their error messages in dialog boxes as soon as the errors occur.

13.2. System Error Log

Errors, warnings and other messages, generated by DFdiscover daemon and server applications, are sent to `syslog`, which in turn writes the messages to the system log files, as configured in `/etc/syslog.conf`. By default, all messages from DFdiscover servers and daemons with a severity level of `err` and higher are logged to `/var/log/messages`.

In many cases the messages will not appear elsewhere, and client applications may not even be aware that an error has occurred on the server end.

As DFdiscover administrator, one should regularly review the system error log, particularly the end of the file, as that is where the most recent messages are.

13.2.1. Message Format

Most DFdiscover messages are written to the `syslog` "user" facility, with a severity level of "err" or "crit" for more serious errors. DFdiscover daemon messages are written to the `syslog` "daemon" facility. The default severity level is "notice". **DFedcservice** also issues login and study access messages at the "warning" level and extensive logging messages at the "info" level that are ignored by `syslog` using the default configuration.

The logged message includes a syslog message header and a message body. The message header consists of a facility indicator, a severity level indicator, a timestamp, a tag string, and optionally the process ID. The message body contains information specific to DFdiscover. This includes the hostname of the machine that it occurred on, and the application name that generated the error message.

The format of this header information is as follows:

```
1 SYSLOG_HEADER 2 machine 3 program[4username:5studynumber:6PID]: 7 message
```

- 1 The syslog message header, which may vary from system to system.
- 2 The hostname of the machine that the error occurred on
- 3 The name of the application that generated the message
- 4 The owner of the application instance
- 5 The study number associated with the application instance if known
- 6 The unique process identifier of the application instance
- 7 The actual text of the message

When unexpected events or errors occur in a DFdiscover system, the first place to start looking is in the system error log.

13.3. Login Error Messages

This section describes some common messages that users may encounter during login while using DFdiscover applications such as **DFexplore**, **DFsetup**, **DFadmin** and **DFATK**.

Table 13.1. Login Dialog

| | |
|-----------------|---|
| Message: | The DFdiscover Server is not reachable. Confirm the server name and network connection. |
| Possible Cause: | There is no internet connection available or server address/name entered is invalid. |
| Solution: | Confirm that your internet service is functioning properly. Confirm that you have correctly typed DFdiscover Server in the login dialog. Otherwise, contact your DFdiscover Study Coordinator or System Administrator. |
| Message: | The connection to the server was closed! Please re-login. |
| Possible Cause: | While using the Password Reset dialog, the internet connection was lost. |
| Solution: | Confirm that your internet connection is functioning properly, then exit and try again. Otherwise, contact your DFdiscover Study Coordinator or System Administrator. |
| Message: | Unable to connect to DFdiscover server! - Check if DFdiscover EDC Service is running! |
| Possible Cause: | DFdiscover is not running on the specified server or DFdiscover EDC Service is not running. |
| Solution: | Contact your DFdiscover Study Coordinator or System Administrator and confirm that the DFdiscover Server and DFdiscover EDC Service is running properly. |
| Message: | Error: No DFdiscover connection available - contact administrator |
| Possible Cause: | DFdiscover is not running on the specified server or DFdiscover EDC Service is not running. |
| Solution: | Contact your DFdiscover Study Coordinator or System Administrator and confirm that the DFdiscover Server and DFdiscover EDC Service is running properly. |
| Message: | Authorization Failed - incorrect username or password |
| Possible Cause: | Username or Password were either mistyped or could not be validated by the server. |
| Solution: | Re-enter your Login and Password, and attempt to login again. Contact your DFdiscover Study Coordinator or System Administrator and confirm that your login account is active. |
| Message: | Account locked because of repeated password errors... |
| Possible Cause: | Multiple attempts to login with incorrect password have blocked the account. |
| Solution: | Contact your DFdiscover Study Coordinator or System Administrator and request re-activation of your account. |
| Message: | Error: Not Administrator |
| Possible Cause: | Attempting to login to DFadmin application using a non-admin account. |
| Solution: | Only Study and System Administrators can use the DFadmin application. Contact your DFdiscover System Administrator. |
| Message: | ... - Check if DFdiscover server is running! |
| Possible Cause: | Connected to DFdiscover EDC service however DFdiscover Server is not available. |

| | |
|-----------------|---|
| Solution: | Contact your DFdiscover System Administrator. Confirm that the DFdiscover Server and DFdiscover EDC Service is running properly. |
| Message: | Error: This client software is not compatible with this server |
| Possible Cause: | Connecting to DFdiscover server with incompatible version of DFdiscover client application. |
| Solution: | Contact your DFdiscover System Administrator to download a version of the DFdiscover application that is compatible with the DFdiscover server. |
| Message: | Error: No DFdiscover license available |
| Possible Cause: | All licensed seats are in use by other DFdiscover users. |
| Solution: | Wait for a seat to become available and try again. If the problem persists or recurs frequently contact your Study or System Administrator to suggest they consider adding additional seats to the DFdiscover server. |

13.4. Locks

DFdiscover creates a lock directory for those operations or activities that require exclusive access to a resource. DFdiscover creates the lock directory at the appropriate time and then deletes the lock directory when exclusive access is no longer required. In unusual circumstances, it may occur that the process that is controlling the lock directory exits prematurely, leaving the lock directory behind. In these cases, it will be necessary to remove the lock directory.

13.4.1. /opt/dfdiscover/work/DFmaster.rpcd.lock

It is essential to the correct operation of DFdiscover that only one copy of the process be running at any one time. When a **DFmaster.rpcd** process is already running, the DFdiscover system and the UNIX system (through the **portmapper**) are able to enforce this requirement. However, when **DFmaster.rpcd** is starting and before it has a chance to register itself with the portmapper, it may occur that two independent processes or users attempt to start more than one . To prevent this from occurring, the **DFmaster.rpcd** process tests for and then creates the lock directory, /opt/dfdiscover/work/DFmaster.rpcd.lock, at the beginning of its initialization. If the lock directory already exists, the following message appears:

```
DFmaster.rpcd[25859]: another process is starting a master daemon or the
daemon has been disabled - waiting 20 seconds before retry...
DFmaster.rpcd[25859]: another process is starting a master daemon or the daemon
has been disabled - waiting 40 seconds before retry...
DFmaster.rpcd[25859]: another process is starting a master daemon or the daemon
has been disabled - waiting 60 seconds before retry...
DFmaster.rpcd[25859]: another process is starting a master daemon or the daemon
has been disabled - waiting 80 seconds before retry...
DFmaster.rpcd: failed to start service
```

and the process exits without starting (as another **DFmaster.rpcd** is presumably starting at the same time). If the lock directory does not exist, it is created and subsequently removed by **DFmaster.rpcd** after it has successfully registered the UNIX portmapper.

13.4.2. /tmp/DFslave.rpcd.hostname.lock

When a slave process starts, it follows the same sequence of initialization steps that the master does, and it too needs to ensure that only one slave process is executing. In the case of the slave process it is however true that there can be multiple slaves across a DFdiscover network, but never more than one on any given computer. Hence, a starting slave creates a

lock directory in a directory that is local to the machine rather than in shared directory space. In particular, the lock is created as `/tmp/DFslave.rpcd.hostname.lock`.

On (mis-configured) systems where `/tmp` is not writable by everyone, a DFdiscover slave cannot be started (there will likely be other non-DFdiscover problems as well). This is an administrative issue to keep in mind if the `/tmp` directory is modified.

13.5. Diagnosing a study server

Occasionally, as a result of unusual circumstances, a study server may exit and subsequently fail to restart. In such a case, the **DFstudyDiag** utility is used to determine why the study server will not start. The utility begins a series of checks for consistency of server status. The results of the checks are reported and may require `root` privileges to complete the diagnosis.

It is safe to execute this utility at any time, however, in a larger networked environment with many slave machines, the diagnosis may require a long period of time to complete.

Procedure 13.1. Diagnosing a study server

1. Execute DFstudyDiag

DFstudyDiag requires the study number of the study to diagnose. To start the utility, type:

```
# /opt/dfdiscover/utils/DFstudyDiag -s ###
```

where `###` is the study number.

2. Monitor the output from the diagnosis checks

It is possible that the diagnosis will find that the study server is fully operational, as in:

```
# /opt/dfdiscover/utils/DFstudyDiag -s 253
Diagnosing study server 253 starting Mon Aug 14 09:36:09 2017...

>> Trying to contact study server directly...
<< Study server is currently operational and responding.
```

3. Apply the suggested corrective action

If the diagnosis detects a problem, it suggests a solution, as in this example:

```
# /opt/dfdiscover/utils/DFstudyDiag -s 253
Diagnosing study server 253 starting Mon Aug 07 09:41:27 2017...

>> Trying to contact study server directly...
<< Failed.

>> Trying to load studies database from master...
<< OK.

>> Contacting slaves on candidate hosts...

>> Checking portmapper entries on candidate hosts...
<< OK.

>> Looking for existing serverstatus file...
```

```
<< The file '/opt/dfdiscover/work/.serverstatus253' exists although no study server
<< appears to be running. The file should be removed.
```

```
Please show this output to your DFdiscover administrator.
```

Implement the suggested solution, and then attempt diagnosis again. Some solutions may require multiple steps that will not be detected by only a single diagnosis.

13.6. Troubleshooting Techniques

13.6.1. Check for DFdiscover or system error messages

The DFdiscover processes log all unexpected events to the system message log. It is recommended that this file always be checked after an unexpected event. Messages in this file may not always make sense to a user or DFdiscover administrator but they can be very valuable to a DFdiscover support person.

13.6.2. Permissions: does the problem occur as user datafax?

UNIX permissions are a common source of problems within DFdiscover. If a problem occurs with a DFdiscover executable, one can easily determine whether or not permissions are a cause of (or contributor to) the problem. As user `datafax`, re-run the problematic executable, repeating the steps that led to the problem. If the problem is not repeatable, then permissions are likely a cause of the problem.

To verify the DFdiscover permissions for a study, use the **DFstudyPerms** utility. This application has the following usage:

```
% /opt/dfdiscover/utils/DFstudyPerms [-f] [-g group] #
```

where `-f` instructs the utility to fix any problems that it finds, and `-g group` indicates the group name for the study, which is required when the group name is not the default `studies`.

13.6.3. Permissions: are the DFdiscover application permissions correct?

To restore the DFdiscover permissions that were applied to the software at the time that it was installed, re-run the **SETPERMS** script that is part of the DFdiscover software and can be located in the `/opt/dfdiscover` directory.

13.6.4. Which step of a shell-script is failing?

All of the DFdiscover shell scripts are relatively quiet during their execution. They echo the occasional message. To make the shell script very verbose, add the statement:

```
set -x
```

as the second line of any existing shell script. Re-run the shell script and watch all of the output go by!

13.7. Other troubleshooting areas

The remaining material is a compilation of troubleshooting information that has been collected over the years from telephone and web-based support.

Although this section is comprehensive, it is possible that your site may experience a failure or symptom that is not enumerated here. If you are unable to resolve the problem using this resource, contact DF/Net Research, Inc. using any of the methods listed in [Getting Help](#).

13.7.1. Database server process cannot be started

Attempts to start client applications for a particular study database cause a `Study server not running` on local network message to appear on the user's screen.

The utility application **DFstudyDiag** must be run with `-s #`, where `#` is the DFdiscover study number, to determine the reason that the study server cannot be started. [Example 13.1, "Using DFstudyDiag to evaluate the status of a study server"](#) illustrates use of **DFstudyDiag** on study 248.

Example 13.1. Using DFstudyDiag to evaluate the status of a study server

```
# /opt/dfdiscover/utils/DFstudyDiag -s 248

Diagnosing study server 248 starting Tue May  8 12:12:25 2018...
>> Trying to contact study server directly...
<< Failed.
>> Trying to load studies database from master...
<< OK.
>> Contacting portmapper on candidate hosts...
<< OK.
>> Contactingslaves on candidate hosts...
<< OK.
>> Checking portmapper entries on candidate hosts...
<< OK.
>> Looking for existing serverstatus file...
<< The file '/opt/dfdiscover/work/.serverstatus248' exists although no study
server
<< appears to be running. The file should be removed.
Please show this output to your DFdiscover administrator.
```

The output will include instructions for resolving the problem.

13.7.2. Faxed CRF pages are missing, or partially processed faxes are found in an incoming daemon work directory

The incoming fax daemons process incoming faxes in their own separate work directories (configured using **DFadmin - Incoming**). When a fax has been completely processed the fax page images are moved to either the study CRF pages directory or to the unidentified router. Thus if you find any pages remaining in an incoming daemon work directory after it has exited, something has gone wrong.

This situation may be brought to your attention by a user who indicates that 1 or more pages of a received fax appear to be missing or misplaced. They might report that in validating the data records for a new fax, they can get the first few pages to come up in **DFexplore**, but the last pages cannot be located. There are messages in the errors file similar to the following:

```
/opt/dfdiscover/work/001/1732: File exists
```

This message is a symptom that a previous **DFinbound.rpc** process terminated before completing the processing of a fax.

The application starts after the arrival of a new fax and exits when processing of the fax is complete. During this processing, **DFinbound.rpc** creates and manages several intermediate versions of fax image files, routing each of them before completion so that the work directory is always empty when it exits (it should also be empty before it starts). If **DFinbound.rpc** is terminated in-progress then it is possible for one or more intermediate files to be left behind. The next time that the **DFinbound.rpc** application processes a document in that working directory it notices that it is not empty and attempts to

clean up the remaining files. In general, no action is required (other than to wait until the next fax is processed) to recover from this situation.

13.8. Recovering from a Power Failure

Your DFdiscover server should be paired with an uninterruptible power supply (UPS) that is configured to shut your server down should an interruption in power exceed the capacity of the UPS. If your server is not protected by a UPS or other source of emergency power and power is interrupted, there may be problems restarting your server or gaining access to DFdiscover.

The steps needed to recover from a power failure are as follows.

1. Verify that all DFdiscover processes are running

After the system has restarted, check to verify that all expected DFdiscover processes are running. This is easily accomplished from the command-line.

```
ps -ef | grep DF
```

The following output is typical of a running DFdiscover server (*long output lines have been truncated*).

```
datafax 10369 5190 0 06:30:09 ? 0:00 /opt/dfdiscover/bin/./x86_linux/
bin/DFoutbound.rpc -c ...
datafax 10346 5190 0 06:30:06 ? 0:00 /opt/dfdiscover/bin/./x86_linux/
bin/DFmaster.rpcd -c ...
datafax 10370 10369 0 06:30:09 ? 0:00 /opt/dfdiscover/bin/./x86_linux/
bin/DFoutbound_B ...
datafax 10356 5190 0 06:30:06 ? 0:00 /opt/dfdiscover/bin/./x86_linux/
bin/DFslave.rpcd -q
root 24273 24269 0 13:50:39 pts/5 0:00 grep DF
datafax 10363 5190 0 06:30:09 ? 0:00 /opt/dfdiscover/bin/./x86_linux/
bin/DFedcservice
```

If your system is using HylaFAX, the DFprotusfax process will not appear.

2. Set DFuserdb locking to a known state

Use the following command to set the DFuserdb locking to a known state. Shut down the DFdiscover server and start it up again as follows:

```
DFshutdown
DFuserdb -unlock
DFbootstrap
```

Repeat step 1 to verify that the expected processes are running.

3. Remove any stale study server status files

Before your system lost power, any studies that were open at the time had a study server status file associated with them. These files may need to be removed when power is restored as they are stale and do not reflect the current status of your system. See [Other troubleshooting areas](#) for information diagnosing and fixing study server problems.

4. Remove any stale lock files

Before your system lost power, it may have been in the process of starting up. This can happen in cases where power interruption is intermittent. Review [Locks](#) and remove any stale locks, then restart the DFdiscover server using **DFbootstrap**. Repeat step 1 to verify that all expected processes are running.

5. Perform consistency checks on active studies

After your system has started, run all the DF_IC*** reports and fix any problems reported.

13.9. Recovering from a full Filesystem

As you have no doubt already learned (or been reminded) in this chapter, disk maintenance in your DFdiscover environment is an important and ongoing requirement. To help protect your DFdiscover environment from unexpected problems that result from full filesystems, DFdiscover shuts down the incoming fax process when one or more full filesystems is detected. This does not mean that incoming fax transmissions are blocked. Faxes can still be received by the fax modems and HylaFAX during this time; it only means that any faxes received will not be processed through DFdiscover until space is made available in the affected filesystems. However, if this condition is left uncorrected for a period of time it can occur that the filesystem containing the incoming directory also fills, and then HylaFAX will shut down and incoming fax transmissions will no longer be received. This particular situation is discussed in greater detail at the end of this section.

Full filesystem problems are typically detected by the DFdiscover incoming daemon when attempting to move CRF images from the incoming work directory to a study `pages` or `pages_hd` directory. If the partition containing the study `pages` or `pages_hd` directory is at 100% capacity or reaches 100% capacity during the processing of an incoming document, DFdiscover will fail to complete the processing of the incoming document, it will generate error messages, and finally it will create the directory `/opt/dfdiscover/work/DFfsfull`. Subsequent to this, each incoming daemon that is started by the arrival of a new document will first check to see if the directory `/opt/dfdiscover/work/DFfsfull` exists, and if so processing will be aborted. Each new document will remain in the incoming work directory until the situation is corrected.

The steps needed to correct a full filesystem problem are as follows.

1. Determine which filesystem is full

The easiest way to determine which filesystem has reached 100% capacity is to inspect the system error message log file. Scan the messages near the end of the file that have the following appearance:

```
fax /opt/dfdiscover/incoming/fax00123.tif could not be moved to /opt/dfdiscover/
archive/1810/0250;
free some disk space and then manually move the file
```

or

```
fax /opt/dfdiscover/work/001/1730/0020002 could not be renamed to /opt/studies/
study123/pages/1730/0020002 -
contact your DFdiscover administrator
```

2. Acquire additional disk space in the affected filesystem(s)

If the archive filesystem is full (as was indicated in the first message), some or all of the existing archive files can be removed to secondary media and then deleted from primary storage. This topic was previously covered in [Archive File Maintenance](#).

If one of the study pages directories is full (as was indicated in the second message), more disk space will need to be acquired.

3. Move any files that the DFdiscover software was unable to move

Once additional free disk space is available, resolve all of the problems that DFdiscover noted as errors in the system error message log file. The text of each problem message indicates the step that needs to be performed to resolve the problem. For example, to resolve the problem indicated by the first message, one would:

```
# mv /opt/dfdiscover/incoming/fax00123.tif /opt/dfdiscover/archive/1810/0250
```

and similarly, to resolve the problem indicated by the second message, one would:

```
# mv /opt/dfdiscover/work/001/1730/0020002 /opt/studies/study123/pages/1730/0020002
```

If the filesystem full situation occurred early in the processing of a multi-page fax, several of these problems may need to be resolved, typically one per fax that could not be moved. Be sure to resolve each of these problems.

4. Remove `/opt/dfdiscover/work/DFfsfull`

At this point, the problems that may have occurred around the time that a full filesystem condition was detected have been resolved. Removal of the `DFfsfull` directory will enable DFdiscover to resume processing new incoming faxes as they arrive. Any faxes that were received during the time that the `DFfsfull` directory existed are processed automatically on receipt of the next fax. To remove the `DFfsfull` directory:

```
# rmdir /opt/dfdiscover/work/DFfsfull
```

13.9.1. Interaction with HylaFAX

The above scenario describes what occurs when a DFdiscover incoming daemon discovers that there is insufficient disk space available to process a fax. In that case, all incoming transmissions are left in the incoming directory defined by your HylaFAX configuration. If the problem is left uncorrected for a period of time such that the filesystem containing the incoming directory also fills, then the problem will escalate to the HylaFAX level. At the HylaFAX level, the HylaFAX software will no longer answer any incoming calls. This is now a serious situation as investigators will no longer be able to transmit case report forms to your site.

To correct this problem, you must first resolve the DFdiscover filesystem problems that were detected. Follow the steps described above to accomplish this. When these steps are completed the filesystem containing the incoming directory should no longer be at 100% capacity. The next incoming call will be answered by a fax modem and your operation will return to a normal state.

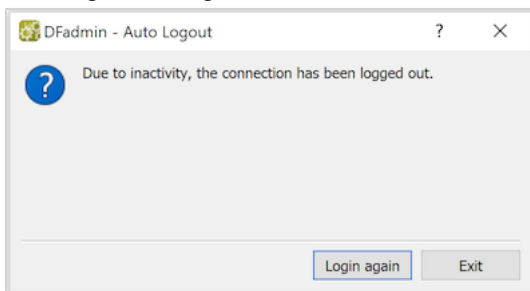
13.10. DFdiscover System Administration Tool

DFadmin connects to the DFdiscover master via network communication (even if the **DFadmin** is started on the same host as the master) and hence its operation will be affected by network interruptions and/or network failures. The behavior of **DFadmin** in response to such problems is outlined in the following sections:

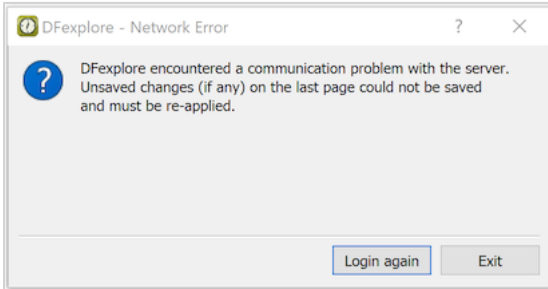
13.10.1. Auto Logout

There are two situations where auto logout can occur, one expected and one unexpected:

1. Expected - timeout: **DFadmin** will auto logout if there has been no interaction for the amount of time set in the **DFadmin** auto logout dialog, which allows a maximum value of 60 minutes. The following dialog will appear.



2. Unexpected - critical error. Any client application, will auto logout the connected user if a critical error, such as a loss of network connection, is detected. The dialog, **DFexplore** shown here, has the following appearance:



In both instances, the user will be logged out *without* saving any changes. For this reason, users are encouraged to save changes regularly and never leave a client application unattended.

Following an auto logout, the user will be notified on next login that their application auto logged out during its last use and when that occurred.

13.10.2. DFdiscover server not responding

If a DFdiscover server (master or study database) does not respond to a **DFadmin** request within sixty seconds, a dialog will appear indicating that there has been no response from the DFdiscover server. If the user suspects that the lengthy delay is a result of network congestion, the user can choose to wait until sixty seconds has elapsed. Otherwise, the user can exit the application (any unsaved changes will be lost).

Chapter 14. DFdiscover System Files

14.1. Introduction

This chapter is a reference for the files and directories that comprise a DFdiscover installation. It starts with a brief overview of the top level directories of the DFdiscover installation directory. It then describes in detail the DFdiscover configuration and status files maintained under the `lib` and `work` directories. A similar chapter, [Programmer Guide, Study Files DFdiscover Study Files](#), describes the file system maintained for each individual DFdiscover study.

14.2. DFdiscover system directories

The following directories are part of a standard DFdiscover installation.

| | |
|--------------------------|--|
| <code>bin</code> | This directory contains all of the executables included in a DFdiscover installation. All DFdiscover applications are executed from this directory. In most cases, the executable is only a symbolic link to a script that determines and executes the true executable for the current operating system and hardware. In some cases, the executable is a shell script itself. |
| <code>doc</code> | This directory contains all of the DFdiscover documentation. |
| <code>ecbin</code> | This directory contains any scripts called by edit checks that are system-wide or common to all studies. |
| <code>ghostscript</code> | This directory contains configuration information and documentation for the DFgs interpreter included with DFdiscover. |
| <code>identify</code> | Fax pages received by DFdiscover which cannot be identified as belonging to any of the registered studies, are stored in this directory (1 file per page). They can be viewed, printed, deleted, and if appropriate, routed to a study using the DFexplore Image Router function. |
| <code>lib</code> | <p>The directory holds all system configuration files (managed using DFadmin), and 3 databases used to keep track of the current status of each study server, the inbound fax daemon, and the outbound fax daemon. The following files are described in detail later in this chapter in DFdiscover system configuration files:</p> <ul style="list-style-type: none">• DFedcservice.cf. EDC service configuration file• DFinbound.cf. inbound daemon configuration file• DFinbound.db. current status of the inbound daemon• DFlogin.html. configuration file for login banner• DFmaster.cf. master daemon configuration file• DFoutbound.cf. outbound daemon configuration file |

- **DFoutbound.db.** current status of the outbound daemon
- **DFreceipt.sample.** example replyfax receipt
- **DFreplyfax.cf.** configuration file for replyfax feature
- **DFsites.db.** database of registered sites for replyfax feature
- **DFstudies.db.** current status of all study database servers
- **DFuserdb.log.** user, role, and permissions database
- **iso3166-1.** ISO 3166-1 table of 3-character country codes

reports

This directory contains the standard DFdiscover reports which are executable through Reports View in **DFexplore**.

utils

This directory contains various utility applications. They are less frequently used than the executables in the `bin` directory. The executable is a symbolic link to a script that determines and executes the true executable for the current operating system and hardware.

work

This directory contains various DFdiscover log and status files. The following files are described in detail later in this chapter in [DFdiscover system work files](#):

- **001.** the work directory used by the incoming fax daemon. The directory is used for temporary storage of the incoming fax pages being processed by the incoming fax daemon. When fax processing is complete this directory will be empty.

This directory is not described further below.

- **router_log.** log of all faxes in router
- **fax_log.** log of all faxes received
- **fax_log.idx.** index on log of all faxes received
- **license.** DFdiscover software license
- **replyfax_log.** Log of all receipt faxes sent by replyfax feature
- **sendfax_log.** log of all transmitted faxes
- **server_log.** log of server start and stop activity
- **sitefax_log.** log of faxes received from unregistered sites
- **.serverstatus###.** Lock for executing server
- **.seqYYWW.** incoming fax sequence numbering
- **.seqOUT.** outgoing fax sequence numbering

x86_linux Operating system and hardware specific executables for Redhat or SUSE Linux on Intel hardware. If DFdiscover is not installed on Linux Intel hardware, this directory will not be present.

The remainder of this chapter describes the files kept under the DFdiscover `lib` and `work` directories. Each file is described using a common format.

Do not edit system files

You should *never* try to manually edit any of the DFdiscover system files! These files are created and maintained by one or more DFdiscover applications and are integral to the proper functioning of the various applications which together make up the DFdiscover system. Manual edits could produce unexpected and disastrous effects. It is however perfectly safe to read these files for system diagnosis, or use them as input for system administration scripts. It is for this reason that this information is provided here.

14.3. Format used to describe files

Each file documented in this section is described with the following attributes:

Table 14.1. File attributes

| Heading | Description |
|-------------------|--|
| Usual Name | the file name that is usually given to files having this format. Some files are kept at the DFdiscover directory level while others are kept separately with each study directory. |
| Type | one of: "clear text" or "binary". Clear text files can be reviewed with any text editor. |
| Created By | the name of the DFdiscover program(s) that create and modify this file. If you need to edit the contents of the file, use the program listed here. |
| Used By | the name of the DFdiscover program(s) that reference or read this file. |
| Field Delimiter | how fields within a record are delimited. Typically, the delimiter is a single character. |
| Record Delimiter | how records within the file are delimited. Typically, the delimiter is a single character. |
| Comment Delimiter | how comments within the file are delimited. If comments are not permitted within the file, "NA" is indicated. |
| Fields/Record | the expected number of fields per record. If the number of fields varies across records, the minimum number is given, followed by a +. |
| Description | a detailed description of the meaning of each field. |
| Example | one or more example records from the file. |

14.4. DFdiscover system configuration files

Table 14.2. DFedcservice.cf

| | |
|-----------------|---------------------|
| Usual Name | DFedcservice.cf |
| Type | clear text |
| Created By | INSTALL |
| Used By | DFedcservice |
| Field Delimiter | space character |

| | |
|-------------------|---|
| Record Delimiter | \n |
| Comment Delimiter | # |
| Fields/Record | 2 |
| Description | The file configures the DFedcservice processes, telling it where to find its SSL key and certificate as well as which DFmaster.rpcd to talk to. The format of the configuration file is one keyword, value pair per record with one occurrence of each of the following keywords required: <code>master</code> , <code>key</code> , <code>certificate</code> . The file can also instruct the DFedcservice process to bind to a particular network interface using the optional <code>bindaddr</code> keyword. This is useful if the server running DFedcservice has more than one network adapter (either real or virtual), and it also services non-DFdiscover requests on port 443. Finally, the list of ciphers available for secure communication can be specified using the optional <code>ciphers</code> keyword. The value is a comma-delimited list of ciphers used for secure communication. DFdiscover ships with the current recommended list of ciphers based upon widely-accepted best security practices. The list can be edited as needed to add newer ciphers (should they become available after the DFdiscover release). A good, albeit technical, reference for this can be found here as well as an up-to-date list of recommended ciphers . |
| Example | <pre>master apache.dfnetresearch.com key /opt/dfdiscover/lib/edckey.pem certificate /opt/dfdiscover/lib/edccert.pem bindaddr 192.168.3.30 ciphers ECDHE-RSA-AES128-SHA,ECDHE-RSA-AES128- SHA256,TLS_AES_128_GCM_SHA256,TLS_CHACHA20_POLY1305_SHA256</pre> |

Table 14.3. DFinbound.cf

| | |
|-------------------|---|
| Usual Name | DFinbound.cf |
| Type | clear text |
| Created By | DFadmin |
| Used By | DFinbound.rpc |
| Field Delimiter | = |
| Record Delimiter | \n |
| Comment Delimiter | # |
| Fields/Record | 2 |
| Description | The file configures the DFinbound.rpc daemon. The format of the configuration file is one keyword, value pair per record with one occurrence of each of the following keywords required: <code>WORKING_DIR</code> , <code>INBOUND_ARCHIVE_DIR</code> . |
| Example | <pre>WORKING_DIR=/opt/dfdiscover/work INBOUND_ARCHIVE_DIR=/opt/dfdiscover/archive</pre> |

Table 14.4. DFinbound.db

| | |
|------------|----------------------|
| Usual Name | DFinbound.db |
| Type | clear text |
| Created By | DFadmin |
| Used By | DFmaster.rpcd |

| | |
|-------------------|---|
| Field Delimiter | |
| Record Delimiter | NA, only one record permitted |
| Comment Delimiter | # |
| Fields/Record | 7 |
| Description | The incoming daemon database maintains the status of the incoming daemon. The fields within the single record are defined in Table 14.5, “Field descriptions for DFinbound.db” . |
| Example | <code>001 /opt/dfdiscover/bin/DFinbound.rpc -c /opt/dfdiscover/lib/DFinbound.cf purgatory Inbound daemon 001</code> |

Table 14.5. Field descriptions for DFinbound.db

| Field # | Contains | Description |
|---------|-------------------------|--|
| 1 | daemon number | the unique identifier of the daemon. The daemon number must be in the range 1 to 255. |
| 2 | host name | the host name of the machine that the daemon is executing on. If the daemon is currently processing a fax, this field contains the host name of the machine that DFinbound.rpc is executing on. If the daemon is not running, the field is empty. |
| 3 | RPC program number | the RPC program number that the daemon is servicing. If the daemon is not running, the field is empty. |
| 4 | RPC version number | the RPC version number that the daemon is servicing. If the daemon is not running, the field is empty. |
| 5 | command to start daemon | the command that the slave daemon executes to start the incoming daemon. The leading applications name will always be the same while the argument configuration file may change across daemons. |
| 6 | candidate host names | a comma delimited list of machines that the incoming daemon can execute on (no spaces). |
| 7 | label | a descriptive label for the daemon. It is generally ignored, and is only provided so that this database format is compatible with the format of the studies database. |

Table 14.6. DFlogin.html

| | |
|-------------------|---------------------|
| Usual Name | DFlogin.html |
| Type | HTML |
| Created By | DFadmin |
| Used By | DFedcservice |
| Field Delimiter | NA |
| Record Delimiter | NA |
| Comment Delimiter | NA |
| Fields/Record | NA |

| | |
|-------------|--|
| Description | The login banner HTML file defines the information that is displayed at the bottom of the login screen for DFexplore , DFsetup , DFadmin and DFsend . This file may contain only HTML text as configured in DFadmin . For more information, refer to Configuring the DFdiscover master . |
| Example | <pre> <html> <center> <h1>DF/Net Research, Inc.</h1> <p><h3>Seattle, Washington, USA</h3></p> <p>For assistance, contact help@dfnetresearch.com</p> </center> </html> </pre> |

Table 14.7. DFmaster.cf

| | |
|-------------------|---|
| Usual Name | DFmaster.cf |
| Type | clear text |
| Created By | DFadmin |
| Used By | DFmaster.rpcd |
| Field Delimiter | = |
| Record Delimiter | \n |
| Comment Delimiter | # |
| Fields/Record | 2 |
| Description | <p>This file configures the behavior of the DFmaster.rpcd process. The format of the configuration file is one keyword, value pair per record with one occurrence of each of the following keywords required: <code>AUTO_SLAVES</code>, <code>CDN_URL</code>, <code>MAILEE</code>, <code>PASSWORD_RULES</code>, <code>PRINTER</code>, <code>VERSION_STRICT</code>.</p> <p>The value for <code>PASSWORD_RULES</code> is an 8-tuple where fields have the following meaning:</p> <p><code>length, complexity, expiry, reuse, lockout, failures, email, reset</code></p> <ul style="list-style-type: none"> • length. the minimum number of characters required in a valid password • complexity. the sum of the following complexity rule values: <ul style="list-style-type: none"> • 1 at least one character and one digit must be included • 2 at least one lowercase and one uppercase character must be included • 4 at least one special character must be included • expiry. a single password is valid for this number of days and must be changed before this period ends, otherwise the password expires • reuse. reuse of this many most recent passwords is not permitted • lockout. after multiple failed login attempts, lockout the user for this many minutes • failures. the user is locked out if there are this many consecutive failed login attempts |

| | |
|---------|---|
| | <ul style="list-style-type: none"> • email. if the user is locked out, send a notification email to this address • reset. allow the user to reset their own password (1) from the login dialog or disallow (0) this functionality <p>Additional requirements for the values matching each keyword are given in Configuring the DFdiscover master.</p> |
| Example | <pre>AUTO_SLAVES=purgatory MAILEE=root PRINTER=hp51j CDN_URL=https://cdn.dfdiscover.com/v5 PASSWORD_RULES=8,1,90,3,5,5,user@domain.com,1 VERSION_STRICT=0</pre> |

Table 14.8. DFoutbound.cf

| | |
|-------------------|--|
| Usual Name | DFoutbound.cf |
| Type | clear text |
| Created By | DFadmin |
| Used By | DFoutbound.rpc |
| Field Delimiter | = |
| Record Delimiter | \n |
| Comment Delimiter | # |
| Fields/Record | 4 |
| Description | The file configures the DFoutbound.rpc process. The format of the configuration file is one keyword, value pair per record with one occurrence of each of the following keywords required: WORKING_DIR, POLLING_INTERVAL, ROUND_TRIP_TIMEOUT. |
| Example | <pre>WORKING_DIR=/opt/dfdiscover/work POLLING_INTERVAL=20 ROUND_TRIP_TIMEOUT=24</pre> |

Table 14.9. DFoutbound.db

| | |
|-------------------|---|
| Usual Name | DFoutbound.db |
| Type | clear text |
| Created By | DFadmin |
| Used By | DFmaster.rpcd |
| Field Delimiter | |
| Record Delimiter | NA, only one record permitted |
| Comment Delimiter | # |
| Fields/Record | 7 |
| Description | The outgoing daemon database maintains the status of the outgoing daemon. |

| | |
|---------|---|
| | The fields within the record are defined in Table 14.10, "Field descriptions for DFoutbound.db" . |
| Example | <code>001 /opt/dfdiscover/bin/DFoutbound.rpc -c /opt/dfdiscover/lib/DFoutbound.cf purgatory Outbound daemon 001</code> |

Table 14.10. Field descriptions for DFoutbound.db

| Field # | Contains | Description |
|---------|-------------------------|--|
| 1 | daemon number | the unique identifier of the daemon. The daemon number must be in the range 1 to 255. |
| 2 | host name | the host name of the machine that the daemon is executing on. If the daemon is currently running, this field contains the host name of the machine that DFoutbound.rpc is executing on. If the daemon is not running, the field is empty. |
| 3 | RPC program number | the RPC program number that the daemon is servicing. If the daemon is not running, the field is empty. |
| 4 | RPC version number | the RPC version number that the daemon is servicing. If the daemon is not running, the field is empty. |
| 5 | command to start daemon | the command that the slave daemon executes to start the outgoing daemon. The leading applications name will always be the same while the argument configuration file may change across daemons. |
| 6 | candidate host names | a comma delimited list of machines that the outgoing daemon can execute on (no spaces). |
| 7 | label | a descriptive label for the daemon. It is generally ignored, and is only provided so that this database format is compatible with the format of the studies database. |

Table 14.11. DFprinters

| | |
|-------------------|--|
| Usual Name | DFprinters |
| Type | clear text |
| Created By | text editor |
| Used By | DFexplore |
| Field Delimiter | NA |
| Record Delimiter | \n |
| Comment Delimiter | NA |
| Fields/Record | 1 |
| Description | <p>This optional file defines the list of printer names that are accessible from DFdiscover client or server machines and are PostScript capable. The file contains one printer name per record (line). In each application that has a print dialog, the list of available printers is created from the contents of this file.</p> <p>If the file does not exist, or is empty, the default behavior is used which involves querying the list of printers known to the host via the lpstat -t command.</p> |
| Example | <code>hp4000_med hp1j5_safety hp4050</code> |

Table 14.12. DFreceipt.sample

| | |
|-------------------|---|
| Usual Name | DFreceipt.sample |
| Type | clear text |
| Created By | text editor |
| Used By | DFinbound.rpc |
| Field Delimiter | NA |
| Record Delimiter | NA |
| Comment Delimiter | NA |
| Fields/Record | NA |
| Description | <p>A receipt file contains a text message that will be faxed back to those clinical sites that are defined to use DFdiscover's replyfax feature.</p> <p>A receipt file may contain only ASCII text. Certain substitutions can be performed by the reply fax feature in the body of the message before the receipt is faxed. These substitutions are:</p> <ul style="list-style-type: none"> • %s. site name as taken from field 2 of DFsites.db • %p. total number of pages received in the fax • %t. local time of day that the fax was received • %d. local date that the fax was received • %g. the G3 fax identifier, typically the subscriber id of the sending fax |
| Example | <pre>DFDISCOVER RECEIPT for STUDY XYZ To: %s From: XYZ STUDY coordinating site Re: recently received fax from number %g A %p page fax was received at %t on %d (local time). If this does not agree with your fax receipt, contact: John Doe at 1-888-123-4567, extension 7777 THANK YOU FOR YOUR ONGOING STUDY PARTICIPATION.</pre> |

Table 14.13. DFreplyfax.cf

| | |
|-------------------|----------------------|
| Usual Name | DFreplyfax.cf |
| Type | clear text |
| Created By | DFadmin |
| Used By | DFinbound.rpc |
| Field Delimiter | space character |
| Record Delimiter | \n |
| Comment Delimiter | NA |
| Fields/Record | 2+ |

| | |
|-------------|---|
| Description | This file records the settings from the replyfax dialog in DFadmin . The structure of the file is one setting per record where each setting has a keyword to identify it followed by 1 or more arguments. The keywords and their possible arguments are listed in Table 14.14, "Field descriptions for DFreplyfax.cf" . |
| Example | <p>The following reply fax configuration file has receipts enabled, 3 retries at 5 minute intervals, logging of fax back failures only, notification to root@servername.com of fax back failures, processing of all faxes, and logging of faxes from unregistered sites only.</p> <pre> receipts 1 attempts 3 5 log 2 notify 1 root@servername.com processing 0 unknownfax 1 0 </pre> |

Table 14.14. Field descriptions for DFreplyfax.cf

| Keyword | Argument 1 | Argument 2 | Argument 3 |
|------------|---|---|---|
| receipts | 0 (disable reply fax feature) or 1 (enable reply fax feature) | | |
| attempts | # (number of retries - default is 2) | # (minutes between retries - default is 10) | |
| log | 0 (do not log fax backs) or 1 (log all fax backs) or 2 (log only fax back failures) | | |
| notify | 0 (do not notify) or 1 (notify) | email address to send notification to if first argument is 1 | |
| processing | 0 (process all incoming faxes/emails) or 1 (process faxes/emails from registered sites only) | | |
| unknownfax | 0 (do not log faxes/emails from unregistered sites) or 1 (log faxes/emails from unregistered sites) | 0 (do not send a notification email) or 1 (send a notification email) | email address to send notification of unregistered faxes to if second argument is 1 |

Table 14.15. DFsites.db

| | |
|-------------------|--|
| Usual Name | DFsites.db |
| Type | clear text |
| Created By | text editor |
| Used By | DFinbound.rpc |
| Field Delimiter | |
| Record Delimiter | \n |
| Comment Delimiter | NA |
| Fields/Record | 5 |
| Description | This file identifies the clinical sites that are to receive fax or email receipts when the replyfax feature of DFdiscover is enabled. Sites that do not require fax/email receipts do not need to be defined in this file. The file contains 1 record per clinical site as described in Table 14.16, "Field descriptions for DFsites.db" . |

| | |
|---------|--|
| Example | <p>The following example database illustrates two sites where each site receives a unique receipt. The first site (General Hospital) has a fax number as its sender ID and receives a receipt via fax. The second site (St. Elsewhere) has an email address as its sender ID and receives a receipt via email.</p> <pre>1 General Hospital 888-123-4567 1-888-123-4567 /opt/studies/xyz/lib/reply.001 1 St. Elsewhere elsewhere@hospital.com mailto:person@hospital.com /opt/studies/abc/lib/reply.001</pre> |
|---------|--|

Table 14.16. Field descriptions for DFsites.db

| Field # | Contains | Description |
|---------|-------------------|--|
| 1 | status | the status field is set to 1 to enable fax receipts to this site. To disable fax receipts (but keep the site in the database), set the status field to 0. |
| 2 | site name | the name of the site. |
| 3 | sender ID | the sender ID (usually the site's fax number or email address) must be included in each received fax/email from the site. It is required to uniquely identify where each transmission came from. Any faxes or emails from the site which do not include this identifier will not be recognized as arriving from this site. This field can accommodate up to a maximum of 100 characters. Comparison of the sender identification with this value is always performed case-insensitive. |
| 4 | reply fax number | the fax number or email address to which all reply fax receipts are to be transmitted for this site. It is valid for this fax number or email address to be different from the sender id. Exactly one reply address is permitted in this field, up to a maximum of 100 characters in length. The number of reply addresses is not enforced, therefore the user must exercise care when entering a value for this field. |
| 5 | receipt file name | the full pathname of the file that contains the reply fax receipt for this site. |

Table 14.17. DFstudies.db

| | |
|-------------------|---|
| Usual Name | DFstudies.db |
| Type | clear text |
| Created By | DFadmin |
| Used By | DFmaster.rpcd |
| Field Delimiter | |
| Record Delimiter | \n |
| Comment Delimiter | # |
| Fields/Record | 7 |
| Description | <p>The study servers database maintains the status of all of the study servers defined for your DFdiscover site.</p> <p>The fields within each record are defined as described in Table 14.18, "Field descriptions for DFstudies.db".</p> |
| Example | <pre>102 goofy 536871270 1 /opt/dfdiscover/bin/DFserver.rpc -c /local/study102/lib/DFserver.cf goofy,ariel Example study 102</pre> |

Table 14.18. Field descriptions for DFstudies.db

| Field # | Contains | Description |
|---------|-------------------------|---|
| 1 | daemon number | the study number of the server. The study number must be in the range 1 to 999. Study numbers beyond 255 are available for EDC studies and only if the software is licensed to allow it. |
| 2 | host name | the host name of the machine that the server is executing on. If the server is currently running, this field contains the host name of the machine that DFserver.rpc is executing on. If the server is not running, the field is empty. |
| 3 | RPC program number | the RPC program number that the server is servicing. If the server is not running, the field is empty. |
| 4 | RPC version number | the RPC version number that the server is servicing. If the server is not running, the field is empty. |
| 5 | command to start server | the command that the slave daemon executes to start the study server. The leading applications name will always be the same while the argument configuration file will change across study servers. |
| 6 | candidate host names | a comma delimited list of machines that the study server can execute on (no spaces). |
| 7 | label | the study name. |

Table 14.19. DFstudyspaces.db

| | |
|-------------------|--|
| Usual Name | DFstudyspaces.db |
| Type | clear text |
| Created By | DFserveradmin |
| Used By | DFadmin, DFmigrate |
| Field Delimiter | |
| Record Delimiter | \n |
| Comment Delimiter | # |
| Fields/Record | 3 |
| Description | <p>This file holds the UNIX pathnames where users are allowed to install DFdiscover study directories.</p> <p>Each record is comprised of 3 fields. The first field contains a label displayed in DFadmin when users select the 'Study Space' for a new study, the second field contains the full UNIX pathname corresponding to that label, and the third is either a 0 to indicate this study space is not available for new studies, or a 1 if it is. The UNIX pathname is the root directory for all DFdiscover studies created under that space.</p> |
| Example | <pre>NIH Studies /opt/studies1 1 Other Studies /opt/studies2 1</pre> <p>To create a new study a user selects a study space and then enters a study folder name. For example, selecting 'NIH Studies' and then entering ECIC as the folder name would create study directory /opt/studies1/ECIC.</p> |

Table 14.20. DFuserdb.log

| | |
|------------|--------------|
| Usual Name | DFuserdb.log |
|------------|--------------|

| | |
|-------------------|--|
| Type | clear text |
| Created By | DFadmin |
| Used By | DFmaster.rpcd, DFuserdb |
| Field Delimiter | |
| Record Delimiter | \n |
| Comment Delimiter | # |
| Fields/Record | Variable |
| Description | <p>The user database log provides an audit trail of all additions and changes made to users, roles and permissions. It includes 5 record types for: Users, User Roles, Roles, Role Permissions, and Passwords.</p> <p>The fields within each record are defined in Table 14.21, “Field descriptions for DFuserdb.log - User Record” (User Record), Table 14.22, “Field descriptions for DFuserdb.log - User Role Record” (User Role Record), Table 14.23, “Field descriptions for DFuserdb.log - Role Record” (Role Record), Table 14.24, “Field descriptions for DFuserdb.log - Role Perm Record” (Role Permissions Record), Table 14.25, “Field descriptions for DFuserdb.log - Password Record” (Password Record)</p> |
| Example | <p>User Record:</p> <pre>20060315165834 USER datafax datafax 2 DFdiscover Admin 0 0 0 -1</pre> <p>User Role Record:</p> <pre>20060315165834 USRL datafax datafax 1 1 1 * *</pre> <p>Role Record:</p> <pre>20060316131756 ROLE datafax 1 253 2 FullPerms * * * </pre> <p>Role Perm Record:</p> <pre>20060316131756 RLPM datafax 1 1 2 * * 1,2,3,4 1,2,3,4,5 1,2,3,4 * * * 1 2</pre> <p>Password Record:</p> <pre>20060316131756 PASS datafax datafax md50f3a987b1eb76652e11c903930dc4d15 1288026696</pre> |

Table 14.21. Field descriptions for DFuserdb.log - User Record

| Field # | Contains | Description |
|---------|------------------------|---|
| 1 | Record Time Stamp | the date and time this record was created |
| 2 | Record Type | the static 4 letter record identifier: USER |
| 3 | Record Modifier | the username of the user who created this record |
| 4 | User Login (key field) | the username uniquely identifying a DFdiscover user even if that user has been deleted or made inactive |

| Field # | Contains | Description |
|---------|---------------|--|
| 5 | Status | the status of this username (0=Deleted, 1=Inactive or 2=Active) |
| 6 | Full Name | full name (Maximum 256 characters) |
| 7 | Affiliation | affiliation name (Maximum 256 characters) |
| 8 | Address | street address (Maximum 256 characters) |
| 9 | City | city name (Maximum 256 characters) |
| 10 | State | state or province (Maximum 256 characters) |
| 11 | Postal Code | ZIP or postal code (Maximum 256 characters) |
| 12 | Country | country (Maximum 256 characters) |
| 13 | Telephone | phone number (Maximum 256 characters) |
| 14 | Fax | fax number (Maximum 256 characters) |
| 15 | Email | email address (Maximum 256 characters) |
| 16 | Language | language preference (0=English or 1=French) <i>[ignored in the current release]</i> |
| 17 | Receipt | how user prefers to receive messages (0=Mail, 1=Fax or 2=Email) <i>[ignored in the current release]</i> |
| 18 | Router Access | permission to use DFrouter (0=No or 1=Yes) |
| 19 | Administrator | permission to perform administrative tasks at the system or study levels (blank=No Admin privileges, -1=DFdiscover Admin, *=Admin for All Studies, or list of study numbers=Admin for specified studies) |

Table 14.22. Field descriptions for DFuserdb.log - User Role Record

| Field # | Contains | Description |
|---------|------------------------|--|
| 1 | Record Time Stamp | the date and time this record was created |
| 2 | Record Type | the static 4 letter record identifier: USRL |
| 3 | Record Modifier | the username of the user who created this record |
| 4 | User Login (key field) | the username uniquely identifying a DFdiscover user even if that user has been deleted or made inactive |
| 5 | Role ID (key field) | a sequential identification number, unique across all roles for all studies, assigned to each role when it is created, regardless of whether or not the role is saved |
| 6 | Instance (key field) | a sequential number which identifies the potentially multiple specifications of the current study role for the current user (i.e. for different sites and/or subjects) on different rows in the user permissions table |
| 7 | Status | the status of this instance of this role for this user (0=Deleted, 1=Inactive or 2=Active) |
| 8 | Sites | sites at which this user has this role as specified by this instance |
| 9 | Subjects | subjects for which this user has this role as specified by this instance |

Table 14.23. Field descriptions for DFuserdb.log - Role Record

| Field # | Contains | Description |
|---------|-------------------|---|
| 1 | Record Time Stamp | the date and time this record was created |
| 2 | Record Type | the static letter record identifier: ROLE |

| Field # | Contains | Description |
|---------|---------------------|---|
| 3 | Record Modifier | the username of the user who created this record |
| 4 | Role ID (key field) | a sequential identification number, unique across all roles for all studies, assigned to each role when it is created, regardless of whether or not the role is saved |
| 5 | Study | a DFdiscover study number |
| 6 | Status | the status of this role (0=Deleted, 1=Inactive or 2=Active) |
| 7 | Role Name | the role name, which must be unique within a study, but not across studies (Maximum 256 characters) |
| 8 | Description | the role description (Maximum 256 characters) |
| 9 | DFexplore Views | the list of Explore Views accessible by users with this role (0=None, 1=Views-Info, 2=Views-Schedule, 3=Views-Data, 4=Views-Queries, 5=Views-History, 6=Views-Reasons, 7=Views-Image, 8=Views-Data - with Select, 9=Views-Reports, 10=Views-Status, 11=Views-List, 12=SavePrint-Blank CRFs, 13=SavePrint-Completed CRFs, 14=SavePrint-Images, 15=SavePrint-Data, 16=SavePrint-Reports, 17=SavePrint-DFsas jobs, 18=Misc-Developer, 19=Reports-Create lists, 20=List-Create views, 21=Fax-Delete new records, 22=Fax-Raw data entry, 23=May disable edit checks, 24=List-Import Data, 25=Fax-Create tasks, 26=Show query status detail, 27=Data-Import subject CRFs, 28=Data-Submit PDF, 29=Dashboard, 30=Data-Attach subject document or * represents ALL views) |
| 10 | Reports | the list of reports accessible by users with this role (DFdiscover report names in comma delimited format or * represents ALL reports) |
| 11 | Study Reports | the list of study reports accessible by users with this role (study report names in comma delimited format or * represents ALL study reports) |
| 12 | Tasks | the list of Tasks accessible by users with this role (study task names in comma delimited format or * represents ALL tasks) <i>[not implemented in this release]</i> |
| 13 | Tools | the comma-delimited list of DFdiscover applications (or application components) accessible by users with this role (0=None, 2=Setup-View, 8=Server-Export Data, 9=Server-Batch Edit checks, 11=Server-Import Data, 12=Setup-Plates, 13=Setup-Edit checks, 14=Setup-Lookup Tables, 15=Setup-Centers, 16=Setup-Missing Map, 17=Setup-Sort Map, 18=Setup-Visit Map, 19=Setup-Conditional Terminations, 20=Setup-Conditional Cycles, 21=Setup-Conditional Visits, 22=Setup-Conditional Plates, 23=Setup-Query Titles, 24=Setup-Query Covers, 25=Setup-Query Messages, 26=Setup-CRF Type Map, 27=Setup-CRF Background Map, 28=Setup-Query Category Map or * represents ALL DFdiscover applications) |
| 14 | Auto Logout Default | the initial default auto logout period (in minutes) for DFexplore and DFsetup users with this role (The 'Maximum' can be any value from 1 to 1440 minutes). (0 represents inheriting this value from Study settings). |
| 15 | Auto Logout Maximum | the maximum value that can be set as auto logout period (in minutes) in DFexplore and DFsetup by users with this role (The 'Maximum' can be any value from 1 to 1440 minutes). (0 represents inheriting this value from Study settings). |

Table 14.24. Field descriptions for DFuserdb.log - Role Perm Record

| Field # | Contains | Description |
|---------|----------------------|---|
| 1 | Record Time Stamp | the date and time this record was created |
| 2 | Record Type | the static 4 letter record identifier: RLPM |
| 3 | Record Modifier | the username of the user who created this record |
| 4 | Role ID (key field) | a sequential identification number, unique across all roles for all studies, assigned to each role when it is created, regardless of whether or not the role is saved |
| 5 | Instance (key field) | a sequential number which identifies the different specifications making up the definition of the current role, i.e. the different rows in the role permissions table for the same Role ID |
| 6 | Status | the status of this role instance specification (0=Deleted, 1=Inactive or 2=Active) |
| 7 | Visits | the visits to which these permissions apply |
| 8 | Plates | the plates to which these permissions apply |
| 9 | Data Permissions | a list of permissions for data records (1=Create, 2=Modify, 3=Delete, 4=Register as Lost) which are applied in DFexplore . |
| 10 | Query Permissions | a list of permissions for queries which are applied in DFexplore . Operations allowed both manually and by edit checks: (1=Create, 2=Modify, 3=Delete, 4=Approve replies, 5=Create/Modify replies), operations allowed only when performed by edit checks: (6=Create, 7=Modify, 8=Delete, 9=Approve replies, 10=Create/Modify replies) |
| 11 | Reason Permissions | a list of permissions for reason records which are applied in DFexplore . Operations allowed both manually and by edit checks: (1=Create, 2=Modify, 3=Delete, 4=Approve), operations allowed only when performed by edit checks: (6=Create, 7=Modify, 8=Delete, 9=Approve) |
| 12 | Get Levels | only records at these levels can be retrieved in DFexplore (* represents ALL levels, equivalent to 0-7) |
| 13 | Modify Levels | only records at these levels can be modified in DFexplore (* represents ALL levels, equivalent to 0-7) |
| 14 | Write Levels | records can be written to only these levels in DFexplore (* represents ALL levels, equivalent to 0-7) |
| 15 | Hidden Fields | permission to see Hidden Fields - applied in DFexplore . (0=None or 1=All) |
| 16 | Internal Queries | permission to see Internal queries - applied in DFexplore . (0=None, 1=Resolved queries only or 2=All) |

Table 14.25. Field descriptions for DFuserdb.log - Password Record

| Field # | Contains | Description |
|---------|------------------------|--|
| 1 | Record Time Stamp | the date and time this record was created |
| 2 | Record Type | the static letter record identifier: PASS |
| 3 | Record Modifier | the username of the user who created this record |
| 4 | User Login (key field) | the username uniquely identifying a DFdiscover user even if that user has been deleted or made inactive. |
| 5 | Password Hash | the MD5 hash of the user login and password |

| | | |
|----------|--|--|
| | deleted | This page has been permanently deleted. |
| | printed | This page was either printed or exported as PDF. |
| | from incoming | This page was sent to the router because DFinbound.rpc daemon could not identify it (Barcode read failure). |
| | Moved from study ### | From DFexplore the page has been sent to the router. It did not belong to the original study. |
| | The last four fields of the log record are not relevant for some operations. | |
| Examples | <pre>2017-12-05 10:56:54 sandra 1749.000D001 to study 253 2603 1 3 2017-12-07 11:00:39 sandra 1749.000A001 printed 2017-12-07 16:33:01 sandra 1749.000A001 deleted </pre> | |

Table 14.28. Field descriptions for `router_log`

| Field # | Description |
|---------|--|
| 1 | date the operation was performed |
| 2 | time the operation was performed |
| 3 | user who performed the operation |
| 4 | fax page id on which the operation was performed |
| 5 | description of the operation |
| 6 | study number |
| 7 | subject ID |
| 8 | visit number |
| 9 | plate number |

Table 14.29. `fax_log`

| | |
|-------------------|---|
| Usual Name | <code>fax_log</code> |
| Type | clear text |
| Created By | DFmaster.rpcd |
| Used By | DF_XXtime, DF_ATfaxes, DF_WFcrfsperwk, DFexplore |
| Field Delimiter | |
| Record Delimiter | \n |
| Comment Delimiter | NA |
| Fields/Record | 5 |
| Description | <p>DFmaster.rpcd appends a record to <code>fax_log</code> for every fax or PDF received by DFdiscover, thus the most recent transmissions appear at the end of this file.</p> <p>Each record contains 5 pieces of information described in Table 14.30, "Field descriptions for <code>fax_log</code>".</p> <p>The third field recorded in <code>fax_log</code> is the date and time the transmission was received. For a typical fax transmission the date and time comes from the TIFF file "Date & Time" tag created by HylaFAX when the fax is received to disk. If DFdiscover receives a TIFF or PDF file as an email attachment, the date and</p> |

| | |
|---------|---|
| | <p>time written to <code>fax_log</code> comes from the computer clock on the machine that processed the incoming mail. This is true, even if a TIFF file attachment already contains a date and time tag representing when it was created at the site. In such cases the original date and time tag is replaced in the TIFF file before it is saved in the DFdiscover archive directory. In the case of a PDF file attachment, Ghostscript is used to convert the file to TIFF format, with the date and time tag set from the machine that processed the incoming PDF, before the attachment is saved in the DFdiscover archive directory.</p> <p>The fourth field contains a quoted string which identifies the sender. It will contain one of the following:</p> <ul style="list-style-type: none"> • the sender id programmed into the sending fax machine if the pages were sent by fax • a blank string if the sender id is unknown because the sender id was not programmed into the sending fax machine • the senders email address if the file was sent as an email attachment, unless the file contains a non-blank image description field (e.g. TIFF files sent by email may contain such information), in which case the image description is used • DFexplore Submit PDF:username if the pages were transmitted using the DFexplore 'Submit PDF' feature. |
| Example | <pre>/opt/dfdiscover/archive/1742/0024 16 Tue Oct 17 04:46:23 2017 555-1212 28</pre> |

Table 14.30. Field descriptions for `fax_log`

| Field # | Description |
|---------|---|
| 1 | full pathname of fax file, typically in the archive directory |
| 2 | total number of pages in fax |
| 3 | date and time fax was transmitted |
| 4 | sender identification or a combination of <code>app name method:username:pathname</code> (compacted if the pathname exceeds approximately 75 characters or bytes) |
| 5 | archive duration. This field is currently ignored unless its value is 0 |

Table 14.31. `fax_log.idx`

| | |
|-------------------|---|
| Usual Name | <code>fax_log.idx</code> |
| Type | binary |
| Created By | DFmaster.rpcd |
| Used By | DFmaster.rpcd |
| Field Delimiter | NA |
| Record Delimiter | NA |
| Comment Delimiter | NA |
| Fields/Record | NA |
| Description | <p>The <code>fax_log.idx</code> file is an index on the <code>fax_log</code> file and enables DFmaster.rpcd to quickly retrieve individual entries from <code>fax_log</code> for operations such as Get Context in DFexplore.</p> <p>This file is not user editable or readable.</p> |

Table 14.32. license

| | |
|-------------------|---|
| Usual Name | license |
| Type | clear text |
| Created By | DFadmin |
| Used By | DFmaster.rpcd |
| Field Delimiter | \t (tab) |
| Record Delimiter | \n |
| Comment Delimiter | # |
| Fields/Record | 2 |
| Description | <p>DFdiscover is a licensed software product. It is licensed for a particular machine (by unique host identifier). Each DFdiscover license is typically valid for a one year period. The license is provided yearly by DF/Net Research, Inc. in the form of a codeword. The codeword encodes, among other things, the host identifier, the expiration date, and the maximum number of concurrent users.</p> <p>The license file contains values for each of the following keywords: <code>hostid</code>, <code>hostname</code>, <code>clients</code>, <code>expiration</code>, <code>password</code>.</p> <p>The value for <code>hostname</code> can be changed without affecting the other values, and in particular, without requiring a new license. However, it is critical that the values for the other keywords not be changed without a new password because they are interrelated.</p> |
| Example | <pre>hostid SH2X-F77S-JURH-DJMQ-JCHW hostname venus nclients 1 expiration 20061231 password KZTD-CQA3-MY5W-HX5E-24N3</pre> |

Table 14.33. replyfax_log

| | |
|-------------------|---|
| Usual Name | replyfax_log |
| Type | clear text |
| Created By | DFadmin |
| Used By | DFoutbound.rpc |
| Field Delimiter | |
| Record Delimiter | \n |
| Comment Delimiter | # |
| Fields/Record | 7 |
| Description | <p>The DFdiscover reply fax configuration includes an option to log all receipts sent to registered sites. This log information is stored in this file, one record per receipt, and is described in Table 14.34, "Field descriptions for replyfax_log".</p> |
| Example | <pre>/opt/studies/xyz/lib/DFreceipt.sample SentOk Fri May 18 11:16:23 2018 datafax purgatory 18881234567 1</pre> |

Table 14.34. Field descriptions for `replyfax_log`

| Field # | Description |
|---------|---|
| 1 | the full pathname of the faxed receipt |
| 2 | the final fax transmission disposition. Will contain one of two possible values: <code>SentOk</code> or <code>Failed</code> |
| 3 | the date and time that the fax was transmitted |
| 4 | the username of the person who requested that the fax be transmitted |
| 5 | the hostname of the machine from which the request was made |
| 6 | the phone number that the fax was sent to |
| 7 | the number of attempts needed to successfully send the fax if the status in field 2 is <code>SentOk</code> , or the total number of failed attempts if the status in field 2 is <code>Failed</code> |

Table 14.35. `sendfax_log`

| | |
|-------------------|---|
| Usual Name | <code>sendfax_log</code> |
| Type | clear text |
| Created By | DFoutbound.rpc |
| Used By | |
| Field Delimiter | |
| Record Delimiter | \n |
| Comment Delimiter | NA |
| Fields/Record | 7 |
| Description | <p>Every fax that is faxed from DFdiscover is recorded by DFoutbound.rpc to this file. The file is always appended to so that the most recently transmitted fax is listed at the end of the file.</p> <p>Each fax sent to one recipient represents one record in the file. Each entry records the information described in Table 14.36, "Field descriptions for <code>sendfax_log</code>".</p> |
| Example | <code>/studyA/reports/QC/001-171203 SentOk Sun Dec 3 11:16:23 2017 root venus 5551212 1</code> |

Table 14.36. Field descriptions for `sendfax_log`

| Field # | Description |
|---------|---|
| 1 | the full pathname of the faxed file |
| 2 | the final fax transmission disposition. Will contain one of two possible values: <code>SentOk</code> or <code>Failed</code> |
| 3 | the date and time that the fax was transmitted |
| 4 | the username of the person who requested that the fax be transmitted |
| 5 | the hostname of the machine from which the request was made |
| 6 | the phone number that the fax was sent to |
| 7 | the number of attempts needed to successfully send the fax if the status in field 2 is <code>SentOk</code> , or the total number of failed attempts if the status in field 2 is <code>Failed</code> |

Table 14.37. server_log

| | |
|-------------------|---|
| Usual Name | server_log |
| Type | clear text |
| Created By | DFmaster.rpcd |
| Used By | |
| Field Delimiter | NA |
| Record Delimiter | \n |
| Comment Delimiter | NA |
| Fields/Record | 5 |
| Description | <p>Each time that a DFdiscover study server starts or exits, it appends a message to this file in the following format:</p> <pre>DFserver.rpc.###[PPPPP]: start exit on Host at Date Time</pre> <p>where the study number is indicated by ### and the process id by PPPPP. If the server is starting the log message will contain the word <i>start</i> and if the server is exiting, the log message will contain the word <i>exit</i>. The hostname of the CPU that the server started on is reflected in the <i>Host</i> value and the time it started (or exited) in the <i>Date</i> and <i>Time</i> fields.</p> <p>If the server exited normally there should be exactly one pair of <i>start</i> and <i>stop</i> log messages for each unique combination of process id and host.</p> <p>Messages are also appended to this file if a DFdiscover administrator deletes a study, study data, or study data and setup info using the DFadmin 'Delete' option. The example below illustrates the message from each of these operations performed on study 101.</p> <p>This log file is not consulted by any DFdiscover process and is purely for informational purposes. It can be truncated if it grows too large.</p> |
| Example | <pre>DFserver.rpc.153[20401]: start on idemo41 at Wed Nov 29 22:22:11 2017 DFserver.rpc.153[20401]: exit at Thu Nov 30 00:54:03 2017 DFedcservice.101[21877]: jack@localhost deleted all study data Fri Dec 1 12:00:09 2017 DFedcservice.101[21877]: jack@localhost deleted all study data and setup info Fri Dec 1 12:01:19 2017 DFedcservice.101[21877]: jack@localhost deleted study from datafax registry Fri Dec 1 12:02:58 2017</pre> |

Table 14.38. sitefax_log

| | |
|------------------|-----------------------|
| Usual Name | sitefax_log |
| Type | clear text |
| Created By | DFoutbound.rpc |
| Used By | |
| Field Delimiter | |
| Record Delimiter | \n |

| | |
|-------------------|--|
| Comment Delimiter | NA |
| Fields/Record | 5 |
| Description | <p>Configuration of the DFdiscover replyfax feature allows for logging of each fax that is received from an "unregistered" site. An unregistered site is a sending fax site that not appear in the <code>DFsites.db</code> database.</p> <p>One log entry is created for each fax transmission received from an unregistered site. The format of each entry is described in Table 14.39, "Field descriptions for sitefax_log".</p> |
| Example | <code>/opt/dfdiscover/archive/1820/0025 1 Fri May 18 10:20:12 2018 "905 522 7284" unregistered</code> |

Table 14.39. Field descriptions for sitefax_log

| Field | Description |
|-------|--|
| 1 | full pathname to the location of the received fax |
| 2 | total number of pages in the received fax |
| 3 | date and time that the fax was received in <i>Day Mon DD HH:MM:SS</i> format |
| 4 | Sender identification (typically fax number) of the sending fax machine |
| 5 | always contains the string "unregistered" |

Table 14.40. .serverstatus###

| | |
|-------------------|--|
| Usual Name | <code>.serverstatus###</code> |
| Type | clear text |
| Created By | DFmaster.rpcd |
| Used By | DFmaster.rpcd, DFserver.rpc |
| Field Delimiter | NA |
| Record Delimiter | NA |
| Comment Delimiter | NA |
| Fields/Record | 1 |
| Description | <p>This file keeps track of the process ID number of the study server if it is currently executing. It is created and used by DFmaster.rpcd to keep track of which study servers are running.</p> <p>It is a serious error to delete a server status file unless instructed to do so by the output of the DFstudyDiag utility.</p> |

Table 14.41. .seqYYWW

| | |
|-----------------|-----------------------|
| Usual Name | <code>.seqYYWW</code> |
| Type | clear text |
| Created By | DFmaster.rpcd |
| Used By | DFmaster.rpcd |
| Field Delimiter | NA |

| | |
|-------------------|---|
| Record Delimiter | NA |
| Comment Delimiter | NA |
| Fields/Record | 1 |
| Description | <p>This file keeps track of the next sequence number to be assigned to an incoming fax within the current week of the current year. These sequence files are created and maintained exclusively by DFmaster.rpcd. Each sequence file has a name of the form <code>.seqYYWW</code> where YYWW represents a particular week within a particular year.</p> <p>Each sequence file contains exactly one positive number, which is the next number to be assigned to the next fax which arrives in that particular week of that particular year. When a fax arrives, it is assigned the number from the sequence file. The number is then incremented and written back to the file.</p> <p>If the required sequence file does not exist, it is created by the master and should thereafter remain in existence. It is a serious error to delete any sequence file, however if one is accidentally deleted, it can be recreated with the DFcmpSeq utility.</p> |

Table 14.42. .seqOUT

| | |
|-------------------|--|
| Usual Name | <code>.seqOUT</code> |
| Type | clear text |
| Created By | DFmaster.rpcd |
| Used By | DFmaster.rpcd |
| Field Delimiter | NA |
| Record Delimiter | NA |
| Comment Delimiter | NA |
| Fields/Record | 1 |
| Description | <p>This file keeps track of the next sequence number to be assigned to the next outgoing fax. This sequence file is created and maintained exclusively by DFmaster.rpcd.</p> <p>The sequence file contains exactly one positive number, which is the next number to be assigned to the next fax to be sent out. When a fax is sent, it is assigned the number from the sequence file. The number is then incremented and written back to the file.</p> <p>If the required sequence file does not exist, it is created by the master and should thereafter remain in existence. It is a serious error to delete any sequence file.</p> |

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A.1.15. c3.js

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A.1.16. d3.js

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