Sante DICOM Viewer Lite

Network configuration guide

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Definitions

DICOM Services
The DICOM protocol consists of many different services, most of which involve transmission of data over a network. The program supports the store, query/retrieve and echo services (C-STORE/C-FIND/C-MOVE/C-ECHO SCU).

Store Service (C-STORE)
The DICOM Store service is used to send images or other persistent objects to a PACS or workstation.

Query/Retrieve Service (C-FIND/C-MOVE)
This service enables a workstation to find lists of images or other objects and then retrieve them from a PACS system.

Echo Service (C-ECHO)
This service enables a workstation to verify the connection and the communication with another workstation or a PACS system.

DICOM communication protocol
The communication protocol is an application protocol that uses TCP/IP to communicate between systems. DICOM files can be exchanged between two entities that are capable of receiving image and patient data in DICOM format.

Communication between DICOM nodes
Two DICOM nodes (workstations, PACS systems) can communicate if they know each other. That means, each system must know the AE Title, the IP address or hostname and the IP port of the other system.

AE Title
AE Title or AET is an abbreviation for Application Entity Title. An AE Title is used by an Application Entity (AE) to identify itself. AE Titles need to be locally unique and are typically managed by a system administrator. They are case-sensitive and 16 bytes long. They are to be configured prior to initializing a DICOM connection.

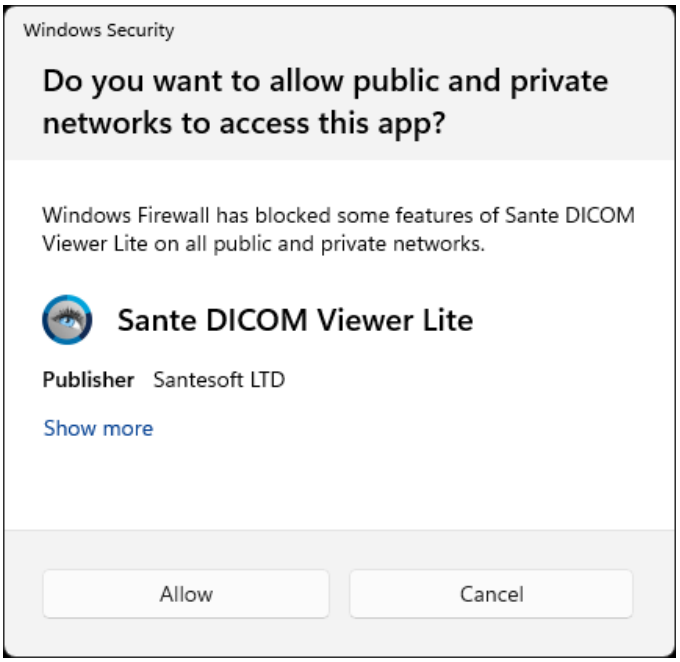
IP Address
An Internet Protocol (IP) address is a numerical identification (logical address) that is assigned to devices participating in a computer network utilizing the Internet Protocol for communication between its nodes. Although IP addresses are stored as binary numbers, they are often displayed in more human-readable notations, such as 192.168.100.1. Usually, they can be translated into a hostname via the local hosts file, or the Domain Name System (DNS) resolver, and can be used instead of the hostname.

Hostname
A hostname is a domain name assigned to a host computer and is translated into an IP Address via the local hosts file, or the Domain Name System (DNS) resolver. It can be used instead of an IP Address.

Port
TCP/IP protocol uses the notion of port numbers to identify sending and receiving application endpoints on a host. Each side of a TCP connection has an associated 16-bit unsigned port number (1-65535) reserved by the sending or receiving application. Arriving TCP data packets are identified as belonging to a specific TCP connection by its sockets, that is, the combination of source host address, source port, destination host address, and destination port. Ports need to be locally unique and are typically managed by a system administrator. The numbers 104 and 11112 are usually used as IP Ports in DICOM networking, but any number between 1 and 65535 can be used, but it must be unique for the host (node/PC), and it must not be used from any other application.

Firewall

A firewall is a dedicated software, which inspects network traffic passing through it, and denies or permits passage based on a set of rules. If there is a firewall in your computer, you have to unblock the application.



Configuration

Configure the Sante DICOM Viewer Lite

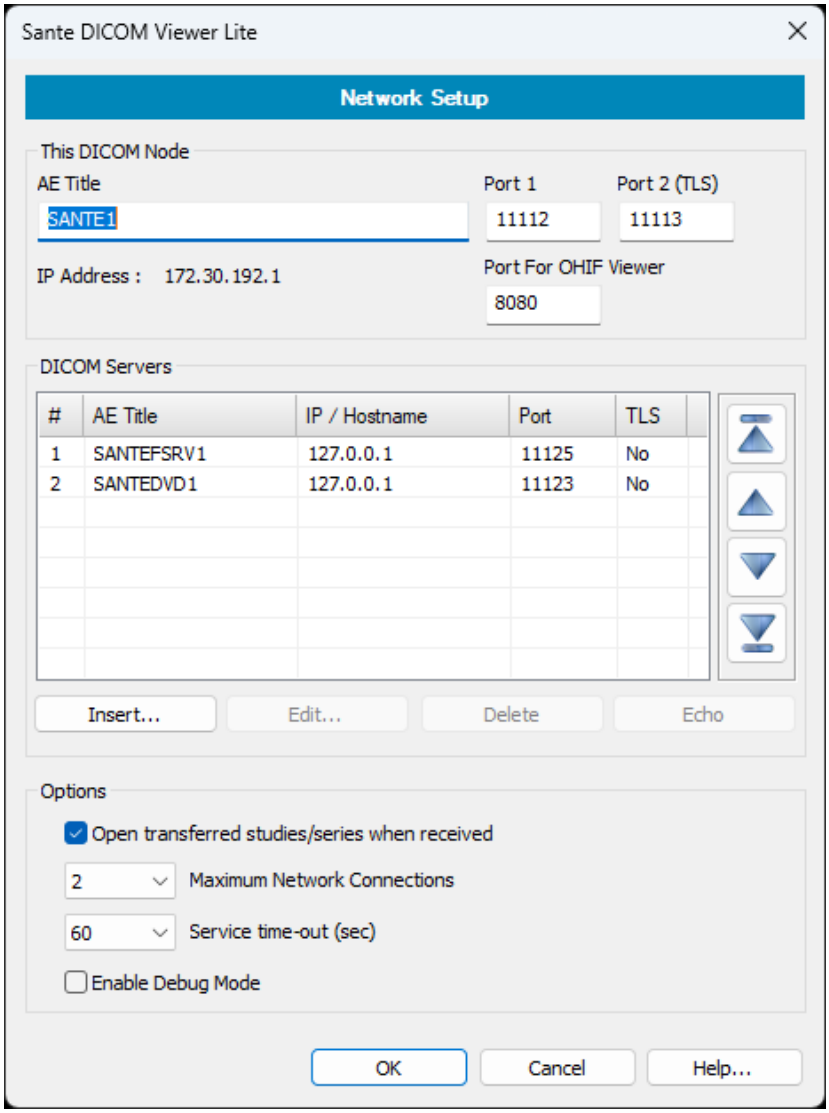
Select the menu command **"Options➧ Network Setup"**. A dialog box appears and allows you to insert the AE Title and the IP Port of Sante DICOM Editor. Furthermore, it allows you to insert the AE Title, IP address and port of other nodes in your network like a PACS system or medical scanners.

The IP Address of the program

Usually, a system has only one IP address and that address is displayed in this dialog box. If there are more than one network adapters and IP addresses, the program opens its ports in all the IP addresses, though it displays only the first one.

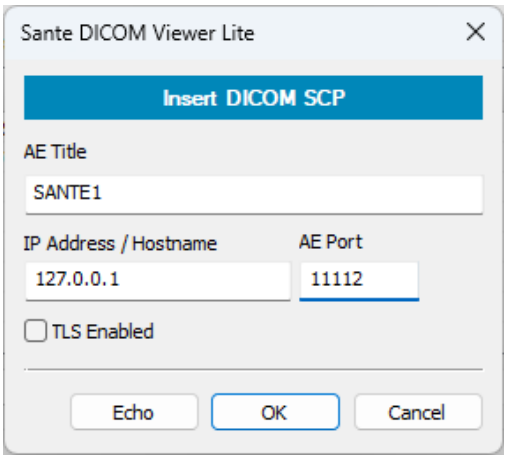
The ports of the program

The program opens three ports, two for DICOM connections and one for use from the built-in OHIF viewer. The first port must only be used by remote DICOM nodes that are not TLS enabled and the second port must be used only for remote DICOM nodes that support TLS. A mixed-up situation is not possible. The port of the OHIF viewer is also TLS enabled.



Insert/Edit a PACS system

Press the "Insert" or "Edit" buttons of the above dialog box. A new dialog box appears and allows you to insert the information of your PACS system.



Other Options

Open transferred studies/series when received

When the program receives studies and/or series it inserts them in the database. If you wish to open them immediately after they have been received, check the checkbox "Open transferred studies/series when received".

Maximum Network Connections option

When the program acts as a client and the user searches and retrieves studies/series from other servers, this option determines the maximum number of outgoing connections. The program starts transferring as many studies/series as the maximum connections number indicates and the rest of them are put in a queue. The program waits for a transfer to finish and then opens another until the queue is empty. When the program acts as a server the number of incoming connections is unlimited. That means, any number of remote clients can connect with the program and transfer files, without any limitation.

Service time-out option

This option determines how long the program waits for a response from the peer. If this time passes the program interrupts the connection.

Program's security

For maximum security, the user must replace the cert.pem and key.pem files provided by the program with others that have been created by the user.

How to create the cert.pem and key.pem files

(all paths are the default paths of the programs)

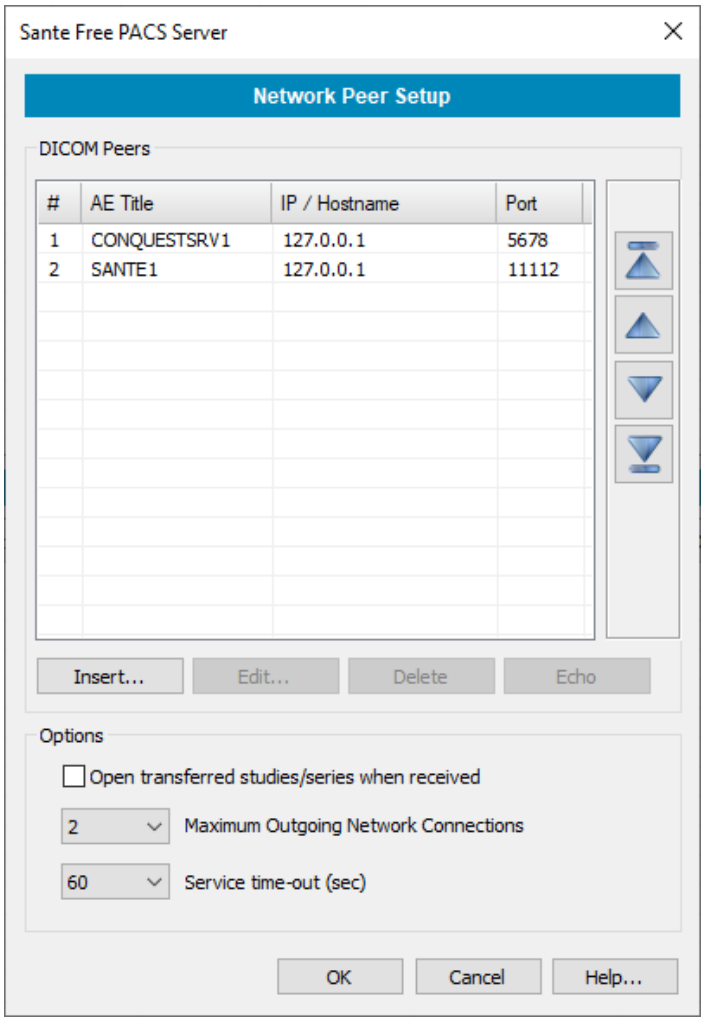
- Download and install the OpenSSL utility
  https://slproweb.com/products/Win32OpenSSL.html
- Download the default configuration file
  https://github.com/openssl/openssl/blob/master/apps/openssl.cnf
  and put it in the bin folder of the OpenSSL library ("C:\Program Files\OpenSSL-Win64\bin")
- Add the path of the binaries of the OpenSSL utility to PATH system variable.
- In the command prompt run the command:
  SET PATH=%PATH%;C:\Program Files\OpenSSL-Win64\bin
- In the command prompt run the command:
  openssl req -x509 -newkey rsa:4096 -keyout key.pem -out cert.pem -sha256 -days 36500 -nodes
- Replace the files in the "C:\Sante DBase\.Configuration Files\TLS" folder with the newly generated ones.

Configure your PACS server

The Sante DICOM Viewer Lite is compatible with most DICOM PACS providers. Please advise your PACS software help file about AE configuration of your PACS server. Below are examples of the configuration of Sante PACS Server PG, Sante PACS Server, Sante Free PACS Server and one of the most popular free PACS servers, the Conquest server. All PACS servers have similar configuration with these ones.

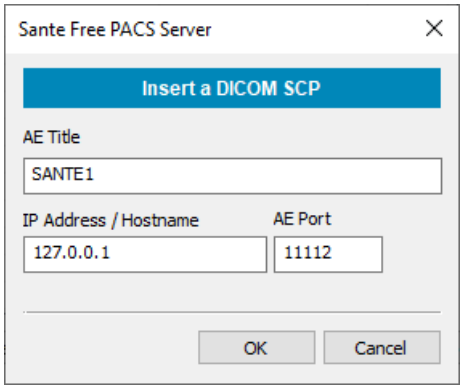
The Sante PACS Server PG, Sante PACS Server and Sante Free PACS Server configuration

Select the menu command **"Network➧ Network Peer Setup"** of Sante PACS Server PG, Sante PACS Server or Sante Free PACS Server, and the network peer setup dialog box appears.



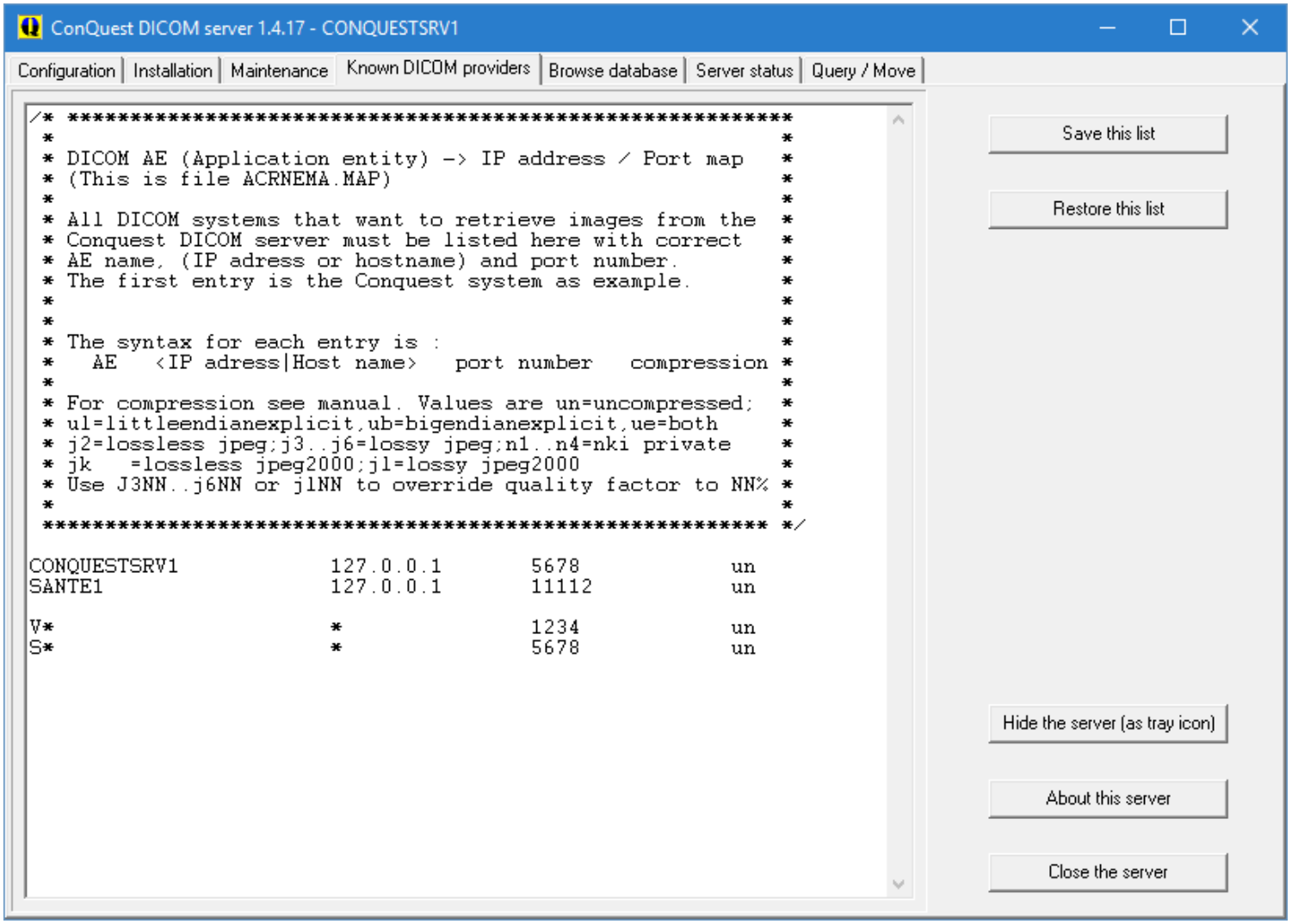
Insert Sante DICOM Viewer Lite as a network peer

Press the "Insert" button of the above dialog box. A new dialog box appears and lets you insert the AE Title and the IP Address and port of Sante DICOM Viewer Lite.



The Conquest configuration

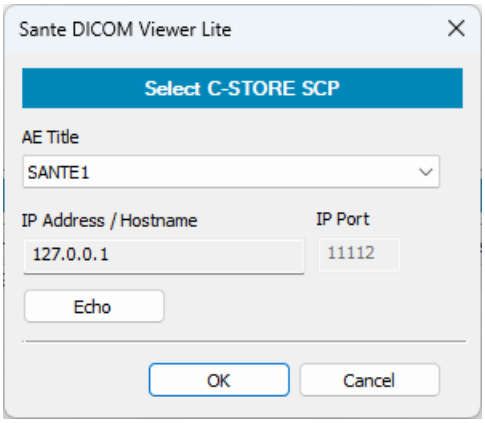
Select the "Known DICOM providers" tab and insert the AE Title, IP Address and IP Port of Sante DICOM Viewer Lite. Press the "Save this list" button.



Send files/series to a PACS server (C-STORE service)

Send files opened in the program

Use the menu command **"File➔Send➔Send To C-STORE SCP"** to send the active DICOM file or DICOM series to a C-STORE SCP server. This command is enabled when you have opened one or more DICOM files and/or series, and you have configured the DICOM networking.



AE Title combo box
Selects a C-STORE SCP server.

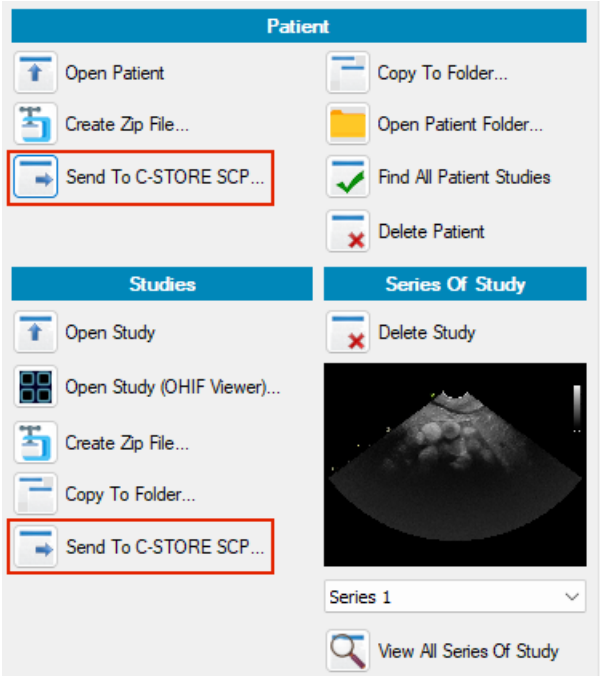
Echo button
Tests the connection with the selected C-STORE SCP server.

OK button
Sends the selected entries to the selected C-STORE SCP server and closes the dialog box.

Cancel button
Interrupts the procedure and closes the dialog box.

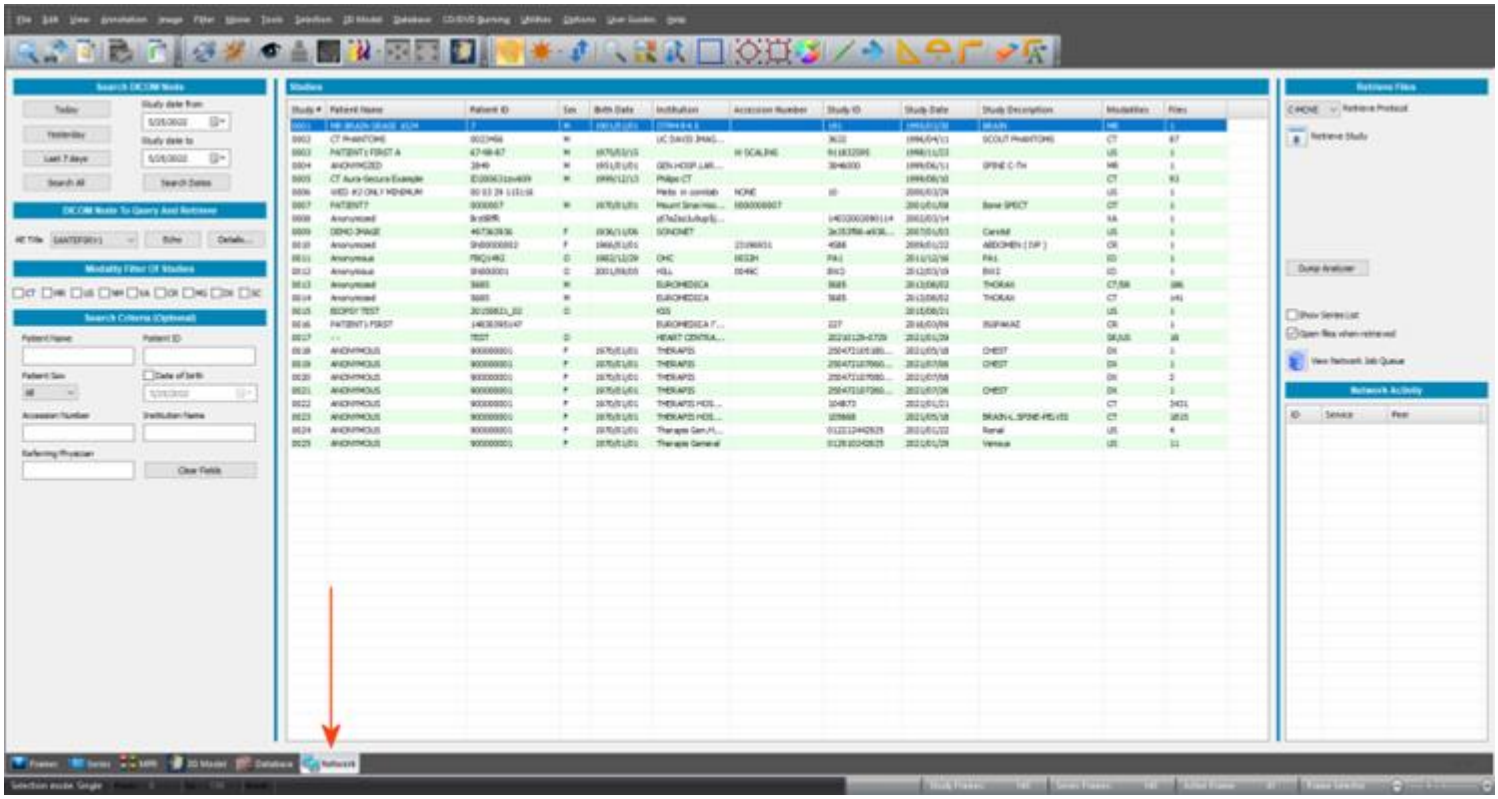
Send files stored in the database

From the interface of the database select the button **“Send to C-STORE”**. This button is enabled when the user has selected at least one patient/study from the query results.

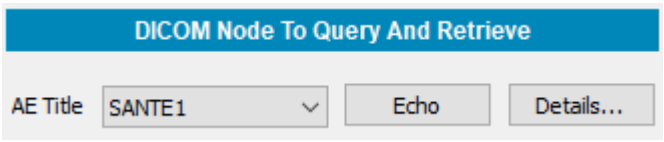


Query and retrieve (C-FIND/C-MOVE services)

Select the "Network" tab from the mode selection control, in the lower left corner of the main window.

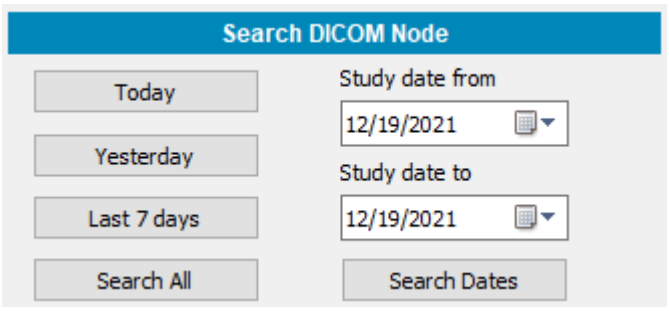


The "C-STORE SCP" tool in the upper left corner of the Network window allows the user to select the server from which the series/studies will be retrieved. The user must have already configured the known DICOM servers as described in the section Configuration.



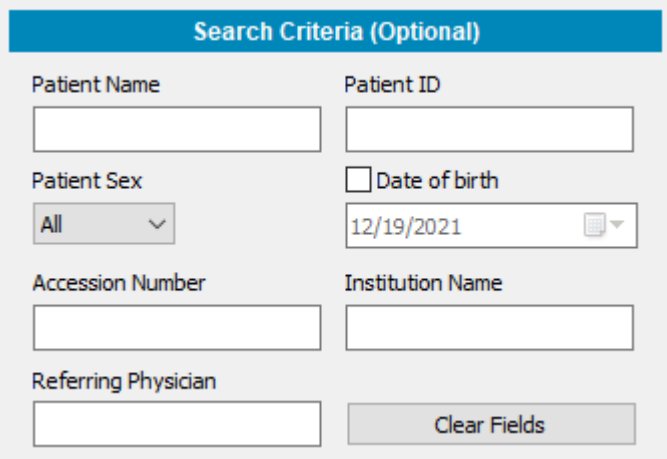
The combo box "AE Title" contains all the known DICOM servers, and the user can select from this combo box the desired series/study source. The button "Refresh AE Titles" allows the user to refresh the contents of the combo box "AE Title" if he has just added new servers with the Configuration procedure. The button "Echo" allows the user to determine if a server is alive and it can answer find/retrieve queries. The button "Settings" allows the user to configure the network.

The program has four buttons that allow the user to query the selected server.

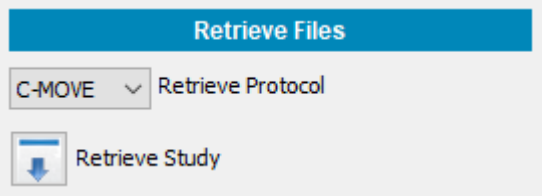


The **"Today"** button asks the server for the series/studies of the current date.
The **"Yesterday"** button asks the server for the series/studies of the previous of the current date.
The **"Last 7 Days"** button asks the server for the series/studies of the last seven days.

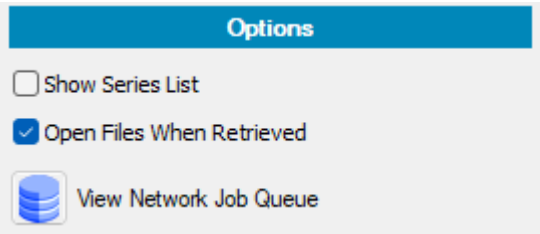
The **"Search All"** button asks the server for all the series/studies.
The **"Search Dates"** button asks the server for all the series/studies of a specific range of date.
The user can fine tune the query by adding more information about the desired results, like the patient's name, the patient ID etc.



The results of the queries are displayed in the Study and Series lists. The user can retrieve the desired series/studies by selecting them in the list and pressing the corresponding **"Retrieve"** button.

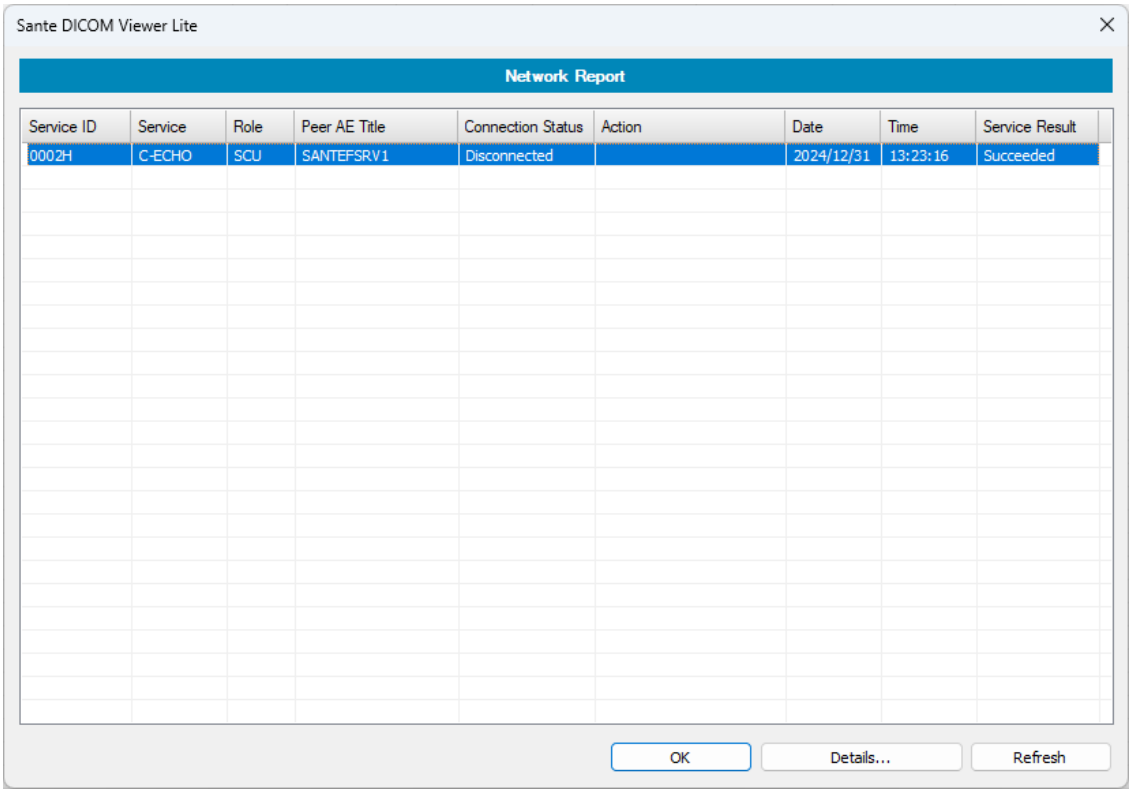


If the user wishes the program to load automatically in the main window the just arrived series/studies, he must have the option **"Open study/series when retrieved"** enabled.

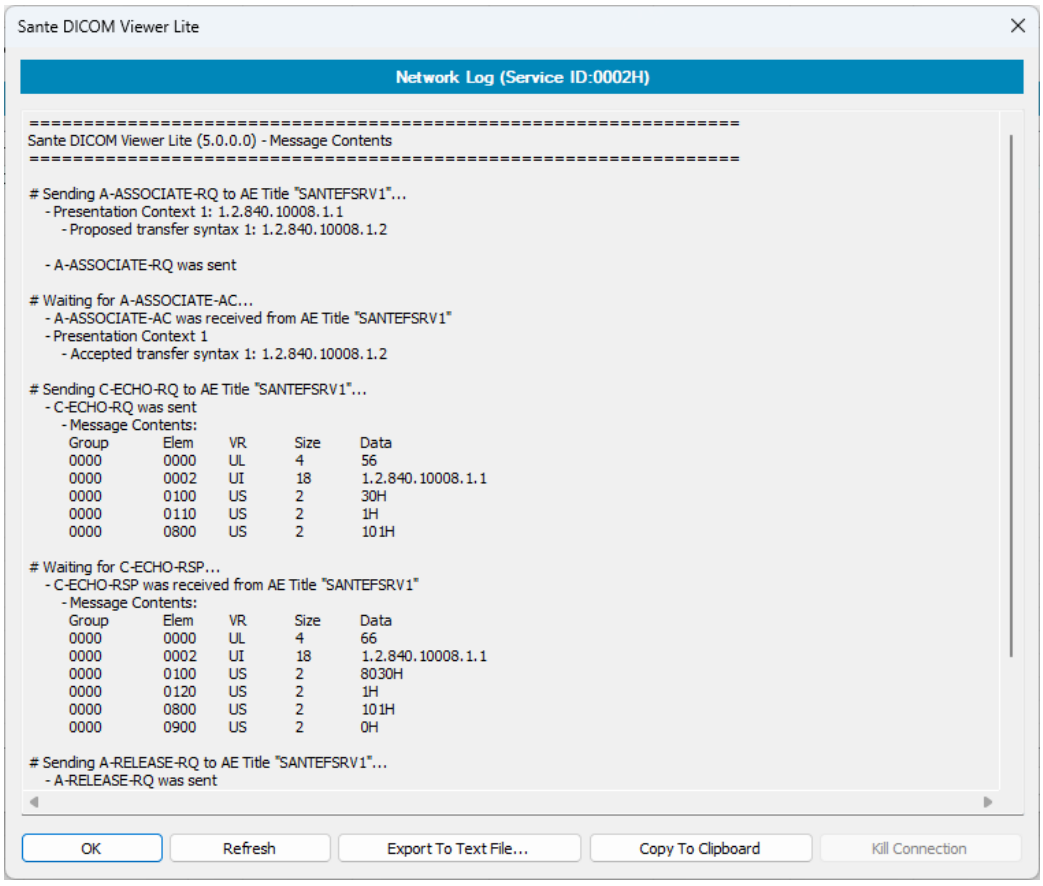


Network Report

Use the menu command **"View➔View Network Report"** to view all the network logs. The program keeps a log for every network activity and displays them in the Network Report dialog box.



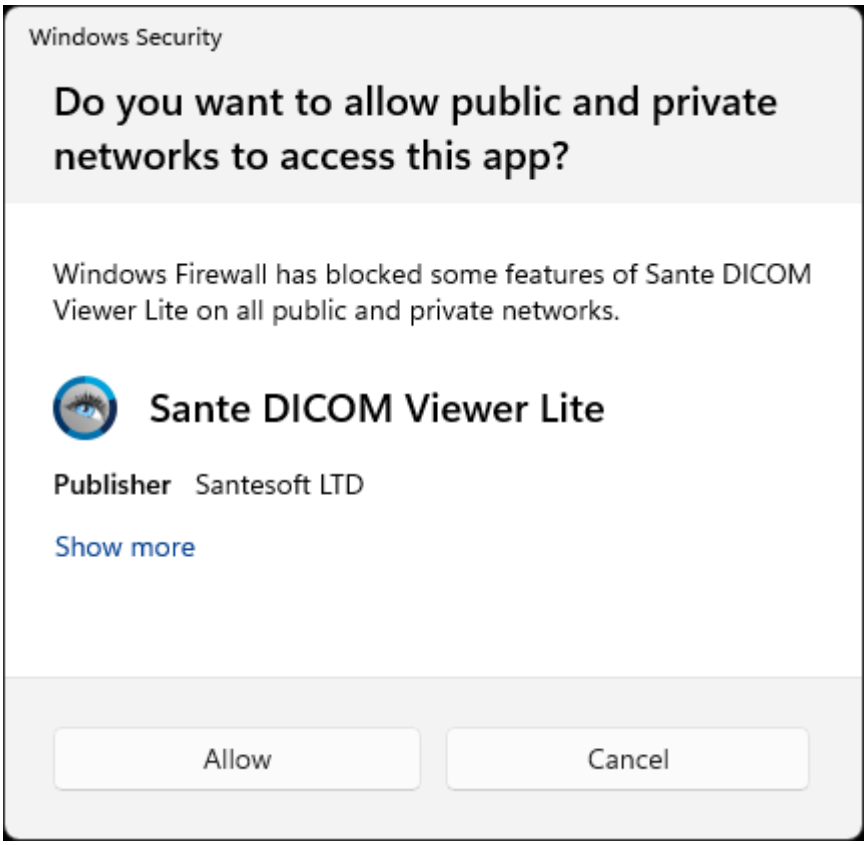
To view the details of the log of an activity, select its row and press the **"Details..."** button or double click the row of this activity.



Troubleshooting

If the program cannot communicate with other DICOM nodes or transfer files between them, please review the following checklist:

1. **Port Usage**
    a. Ensure that the program's port is not being used by another application.
    b. Verify that the program's port is not blocked by a firewall or antivirus software.
2. **Firewall Configuration**
    a. When the program starts, it prompts you to add it to the firewall exception list. If you selected "Cancel", you must add it manually to allow communication.



3. **Subnetwork Configuration**
    a. If the server and client nodes are on different subnetworks, ensure that the program's port is correctly forwarded by the router.
4. **DICOM Node Information**
    a. If the program can "ECHO" the other node but cannot transfer files:
        i. Both the server and client must recognize each other. You need to add the AE Title, IP address, and port of the application to the "Known DICOM Nodes" list on both sides. Without this information, the nodes cannot send or receive files.
5. **Multiple Network Cards**
    a. If the PC has multiple network interfaces (physical, logical, or virtual) and thus multiple IP addresses, ensure the client and server communicate on the same subnetwork:
        i. For example, if the server has two IP addresses (e.g., 192.168.1.1 and 172.91.1.1) and the client has an IP address in the 192.168.1.* range, the client must use 192.168.1.1 as the server's IP. Similarly, if the client is in the 172.91.1.* range, it must use 172.91.1.1 as the server's IP.
        ii. The server and client must be on the same subnetwork to establish proper communication.
6. **IP Address Validation**
    a. If the PC has multiple IP addresses, the program displays only the first one by default, but it opens ports on all available network interfaces. Use the ipconfig command in the Command Prompt to list all IP addresses of the PC.

By following these steps, you can resolve most communication and file transfer issues with DICOM nodes.

How to Check a Program's Port

You can use the netstat utility in Command Prompt or PowerShell to verify if the program's port is open and determine the associated IP address.

Step 1: Check if the Port is Open

1. Open Command Prompt or PowerShell.
2. Run the following command to check if port **11112** is open and to identify the IP address it is bound to:

   netstat -ano -p tcp | find "11112"
   a. The output will show the port's status and the IP address it is bound to.
   b. The last number in the output is the **PID (Process ID)** of the application that has opened the port.

Step 2: Identify the Application

1. Use the PID from the previous step to identify the application using the port.
2. Run the following command:

   tasklist | find "49904"
   a. Replace 49904 with the PID obtained from the netstat command.
   b. The output will display the name of the application associated with the PID.