PUBLIC

iQ-ROUTER/PRO/ PREMIUM

PD-730-156 ADMINISTRATION GUIDE

Version 3.1 PUB INT EN - 001R

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1 Introduction

1.1 Scope of the document

This document represents the iQ-ROUTER/PRO/PREMIUM Administration Guide for software version 3.1 provided by IMAGE Information Systems Europe GmbH.

This Administration Guide provides all necessary information regarding the installation and licensing of the application as well as how the software is properly maintained in order to fulfill its intended use.

It contains instructions concerning the configuration and set-up of the application as well as hints regarding troubleshooting problems.

All patient names used in this administration guide are completely fictitious.

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Throughout this guide trademark names are used. Rather than putting in a trademark symbol at every occurrence of the trademark name, we state that we are using the names only in an editorial fashion and to the benefit of the trademark owner with no intention of infringing upon the trademark.

We assume no responsibility for inaccurate information or descriptions of third-party products.

Disclosure level of this document is PUBLIC (PUB), which means that this document is freely available to anyone interested, such as resellers, current end users as well as potential customers. Primary color is orange.

1.2 Purpose of the software

iQ-ROUTER/PRO/PREMIUM is a software-based router utilizing DICOM protocols for its functionalities. The software is intended to facilitate typical tele-radiological scenarios. As such, it aims to accelerate the imaging workflow in one or between several imaging center(s) or hospital(s) by distributing diagnostic data, such as radiological images and reports, at relevant times to the appropriate stations for archiving or further processing. It can further be used to ensure data consistency, to pseudonymize patient information and to secure communication between multiple imaging institutions.

iQ-ROUTER is intended for small imaging centers with a small number of imaging devices, whereas iQ-ROUTER PRO facilitates the image distribution in mid-size imaging centers and small hospitals. The purpose of iQ-ROUTER PREMIUM, however, is to serve as central image distribution node for imaging center groups, for VNA and for large hospitals.

These software devices are intended to be used either within traditional medical networks, in which the imaging institutions manage the entire network in their own facilities, or as part of a cloud solution, where the imaging archive (PACS) is hosted by a third-party.

The device consists of stand-alone software and documentation. It requires appropriate computer hardware and a Windows operating system to operate as intended. IT and PACS administrators are responsible for installation, configuration and maintenance of the application. They need advanced computer literacy, at least basic DICOM expertise and must be familiar with the institution's medical imaging procedures and workflow and with the user documentation of iQ-ROUTER/PRO/PREMIUM.

NOTICE:

When the iQ-ROUTER/PRO/PREMIUM software is used not for human medicine but for **veterinary medicine**, the product does **not** fall under the European Council Directive 93/42/EEC and, therefore, does not qualify as a medical device in the EEA. The regulations of the 93/42/EEC do not apply.

Refer to the iQ-ROUTER/PRO/PREMIUM Instructions for Use for more comprehensive details regarding the purpose of iQ-ROUTER/PRO/PREMIUM, for an analysis of the intended patient population and the user groups and for information about the use conditions and contra-indications.

1.3 Warnings and precautions

The purpose of this section is to define and explain the warnings and precautions used in this document.

Misuse of the software

△ WARNING:

Danger of misdiagnosis.

Copies of this software marked as "Alpha", "Beta" or "Preliminary" versions must – under no circumstances – be used for diagnostic purposes.

H.-No.: 1.1.1 - 1.3.3

△ WARNING:

The manufacturer does not assume liability for any misuse of the software or for any clinical outcome resulting from the use of the software. The software is made available to the user with the understanding that the software is only used as a means to aid processes or decisions that can be made without the use of the software.

H.-No.: 1.1.1 - 1.3.3

Behavior in case of software errors/failures

△ WARNING:

Although the iQ-ROUTER/PRO/PREMIUM software is subjected to extensive validation and verification procedures by the manufacturer, it is nevertheless possible that unforeseen errors, deviations or failing processing may arise during use of the software. Users should at all times be aware and warned of such eventualities. In case faulty software behavior is observed that may put a patient or the user at risk, the user is asked to immediately contact the manufacturer or local reseller. The manufacturer's contact data is stated in the user documentation and inside the application itself.

H.-No.: 1.1.1 - 1.3.3

User competence and training

△ WARNING:

Danger of use errors.

The iQ-ROUTER/PRO/PREMIUM software is certified as a medical device according to the European Council Directive 93/42/EEC. Before using this application, make sure that you have thoroughly read and fully understood the content of the Instructions for Use and Administration Guide, including all of the warnings and notices.

H.-No.: 1.1.5, 1.1.7, 1.1.8, 1.1.10, 1.2.4

△ WARNING:

Danger of misdiagnosis.

This medical software does not replace the competence and judgment of qualified medical or radiological personnel in any way. It should only be used by qualified and trained persons, because any actions of the user may directly affect the accuracy of the functions and the results acquired with the help of the software.

H.-No.: 1.1.5, 1.1.7, 1.1.8, 1.1.10, 1.2.4

NOTICE:

Acrobat Reader or another PDF reader must be installed on the system to open and view the iQ-ROUTER/PRO/PREMIUM instructions for use and administration guide.

Conditions of installation and use and software environment

△ WARNING:

Danger of application failures or missing data due to misconfiguration. No special training is necessary to be able to install iQ-ROUTER/PRO/PREMIUM, although general computer literacy is required. The configuration settings, however, should be made by a system administrator with technical know-how and experience concerning in-house procedures and processes for the organization. If the installation and/or configuration is performed by personnel not sufficiently qualified, this may lead to non-functioning or limited functionality of the software as well as failure of communication with other devices within the network.

H.-No.: 1.1.1, 1.1.4, 1.2.3, 1.2.4

△ WARNING

Danger of application failures or unavailability.

All modifications to the medical software have to be made by IT service personnel. This includes the installation, verification as well as changes in the software. The risk of malfunction is relatively high when modifying software. Abnormal termination of the software as well as temporary or permanent data losses are possible when improperly administered. Therefore all modifications to the software are performed solely by service personnel.

Modifying application folders and or files to different locations, deleting or renaming them without considering other parts may cause problems in the functioning of the software. Keep the file and folder structure intact and only follow the user documentations' instruction for configuring the application.

H.-No.: 1.1.1, 1.1.4, 1.2.3, 1.2.4

\triangle WARNING:

Danger of application failures or unavailability.

Modifying application folders and or files to different locations, deleting or renaming them without considering other parts may cause problems in the functioning of the software. Keep the file and folder structure intact and only follow the user documentations' instruction for configuring the application.

H.-No.: 1.1.1, 1.1.4, 1.2.3, 1.2.4

△ WARNING:

Danger of unauthorized access to application.

An unauthorized access to the system may lead to non-functioning. To minimize this risk, the system should be protected by a password so that only authorized persons will have electronic access to the system. Authorized persons access the system using a password-protected Windows account. The passwords should only be known to the respective system administrators.

H.-No.: 1.1.1, 1.1.8

△ WARNING:

Danger of application failures due to the use on non-specified system hardware and software. The use of system hardware and/or software that is not approved by the manufacturer may make the application unavailable or cause application failures and/or misbehavior. Refer to the system requirements information given in the user documentation.

H.-No.: 1.1.1, 1.1.2, 1.1.7, 1.2.1 - 1.2.4

△ WARNING:

Danger of application failures or unavailability.

The capabilities and the performance of the software can be affected by limitations caused by the hardware. Therefore an appropriate setup and maintenance of the hardware is necessary (e.g. professional connection to power and network, sufficient ventilation, regular cleaning of the fan, etc.).

The available hard disk space should be checked regularly – once per quarter is recommended – to ensure that enough storage capacity is available to temporarily store patient studies for potential forwarding processes. Old log files or media projects created on the hard disk but no longer needed should be deleted.

H.-No.: 1.1.1, 1.1.4, 1.1.7, 1.2.1, 1.2.3

△ WARNING:

Danger of data loss or inconsistencies.

Potentially occurring fluctuations in the power supply can lead to data losses and data inconsistencies. The use of an uninterruptible power supply (UPS) is recommended in case the power supply voltage is not fused.

H.-No.: 1.1.4, 1.1.5, 1.2.3

△ WARNING:

Danger of data loss/inconsistencies or application failures.

Computer viruses hold a considerable risk. A virus infection may potentially lead to data losses and to data inconsistencies as well as application failures. To avoid the risk of a virus infection of the computer, on which the application is running, as well as other systems within the medical network, all systems should be furnished with anti-virus software that needs to be updated regularly.

H.-No.: 1.1.1, 1.1.4, 1.1.8, 1.2.3

NOTICE:

Anti-virus software or firewalls may affect the workstation software as they may accidentally block necessary application files or communication (e.g. ports). It is recommended to configure such applications accordingly to ensure the faultless running of iQ-ROUTER/PRO/PREMIUM on the system. A system test should be performed before using it productively.

Manipulated, incomplete, missing and/or compressed data

△ WARNING:

Danger of misdiagnosis due to manipulated data.

The user should make sure that the whole chain of data flow from the acquisition device via DICOM routers, PACS and workstations does not affect the diagnostic accuracy of received data, e.g. regarding pixel aspect ratios, compression artifacts, slice thickness, etc.

H.-No.: 1.1.5, 1.1.9

△ WARNING:

Danger of misdiagnosis due to non-DICOM 3.0 compliant image data. Use of DICOM dialects might lead to incompatibility and delay or even wrong diagnosis. System administrators should run a system integration test with each newly connected acquisition device before clinical use.

H.-No.: 1.1.4, 1.1.5, 1.2.1

△ WARNING:

Danger of incorrect patient demographics or study meta data. The modality operator is responsible for the quality of the image data as well as the correctness of the patient and study information. Insufficient quality can lead to misdiagnosis while incorrect patient information can lead to wrong diagnosis for a respective patient (patient mix).

H.-No.: 1.1.4, 1.1.5, 1.1.6

△ WARNING:

Danger of data loss or corruption.

Modifying or deleting DICOM information in study data might lead to image corruption! It should only be done if absolutely necessary and only by knowledgeable personnel.

H.-No.: 1.1.4, 1.1.6, 1.1.7, 1.2.4

△ WARNING:

Danger of deletion or modification of crucial data due to dataset manipulations. Dataset manipulations using the "Attributes" module and its actions may delete or modify crucial data within a dataset. In addition, actions may lead to datasets that are no longer compliant with the DICOM standard.

iQ-ROUTER/PRO/PREMIUM does not verify the changes resulting from such a defined action and does not verify if an action violates the DICOM standard in any way. The user is responsible for the configuration of the attribute manipulation and the changes made to a dataset.

H.-No.: 1.1.4, 1.1.5, 1.1.6, 1.2.3, 1.2.4

△ WARNING:

Danger of misdiagnosis due to the use of lossy image compression.

Excessive compression levels may cause compression artifacts that might reduce the image quality to non-diagnostic level. These images may therefore no longer be usable for diagnostic purposes!

The user's organization should make sure to use lossy compression only according to local regulatory requirements.

H.-No.: 1.1.5, 1.1.9

△ WARNING

For users under the jurisdiction of the U.S. Food and Drug Administration (FDA)

Danger of misdiagnosis due to lossy image compression in mammography.

Currently the FDA does not permit images regenerated from lossy compressed data to be used in the same manner as the original mammogram. As a consequence, mammography images should not be lossy compressed by iQ-ROUTER/PRO/PREMIUM if the images are intended to be reviewed for primary diagnosis or final image interpretation or be stored for retention purposes.

For mammography reading only original (uncompressed) or lossless compressed images must be used to ensure that the images are displayed and processed in FDA approved diagnostic quality.

H.-No.: 1.1.9

Security and protection of patient data

△ WARNING:

Danger of unauthorized access to patient information.

iQ-ROUTER/PRO/PREMIUM works with image data containing information that identifies individual patients (while displaying and exporting data). It is the user's responsibility to prevent unauthorized access to the information and potential patient data theft to ensure the patient's rights to data protection.

Windows users and Windows log in mechanisms should be used to regulate access to the system on which iQ-ROUTER/PRO/PREMIUM is installed. The server itself should be situated in a server room that can only be accessed by authorized personnel.

H.-No.: 1.1.8

△ WARNING:

Danger of unauthorized access.

iQ-ROUTER/PRO/PREMIUM offers the possibility of encryption for routing. However, data is cached locally on the hard disk during forwarding and then remains there unencrypted. In order to guarantee the security of the person data it must be ensured that no unauthorized party gets access to the system at any time.

H.-No.: 1.1.8

△ WARNING:

Danger of unauthorized access to patient information.

Potential misconfiguration of the rule-based data routing could lead to unauthorized access to patient-related data when data is routed to a wrong destination.

The correctness of the routing rules should always be verified using anonymized test data before the system modifications are put into effect productively.

H.-No.: 1.1.8

△ WARNING:

Danger of unavailability of data due to application failure.

If the software fails and the medical image data cannot be transmitted, the data must be made available by other means in order to ensure the availability of data with minimum delay for viewing and clinical diagnosis. The operator is required to plan for contingencies in case of a failure of iQ-ROUTER/PRO/PREMIUM to ensure that diagnostics and resulting treatment can start with as little delay as possible.

H.-No.: 1.2.1, 1.2.2

Any further warnings or precautions regarding individual functions of the software are documented in the respective sections of the iQ-ROUTER/PRO/PREMIUM Instructions for Use and this Administration Guide.

2 System requirements

NOTICE:

The system requirements stated below are the requirements and recommendations valid at the release of this software version and/or the release date of this document. This information is subject to change over the course of the product's life-cycle. The manufacturer will inform about updates regarding the system requirements when iQ-ROUTER/PRO/PREMIUM becomes available for systems other than those defined below (e.g. newer operating systems). Contact your reseller or the manufacturer for the latest information. Keep in mind that iQ-ROUTER/PRO/PREMIUM as a medical device will not automatically support any new technology that becomes available on the market. The software will have to be tested according to legal regulations before being released for such systems.

2.1 General hardware and software requirements

For iQ-ROUTER/PRO/PREMIUM the system requirements concerning both hardware and software are:

- Intel Multi-Core CPU with ≥ 2 GHz
- ≥ 4 GB main memory
- ≥ 10 GB free hard disk space for the installation as well as files generated over time (e.g. log files)
- Network connection of at least 1 Gbit/s
- Any consumer display for configuring the application
- Dell or HP hardware
- Operating system:
 - One of the following server operating systems (Standard edition):
 - Windows Server 2019 64-bit
 - \circ Windows Server 2016 64-bit
 - Windows Server 2012 R2 64-bit
 - Or either one of the following client operating systems (at least a Pro edition):
 - Windows 10 64-bit
 - Windows 8.1 64-bit
- Dell or HP hardware
- Any PDF reader (e.g. Adobe Acrobat Reader or Foxit) or Windows default PDF app (for opening user documentation; current versions recommended)

2.2 Additional system requirements

2.2.1 TCP/IP port

A free TCP port is required to connect iQ-ROUTER/PRO/PREMIUM with the DICOM network in order to exchange information with other modalities or DICOM stations, such as CT, CR, MR, US and PACS.

By default, port 14000 is used. Refer to section 9.1.2.1 for instructions on how to configure a different port.

NOTICE:

Also check the firewall settings to ensure that the port can be used for communication.

2.2.2 Verifying hardware and software compatibility

If using third-party applications, higher system requirements may apply. We recommend consulting the system requirement documents of all modules and select the highest level. It is also possible that certain third-party applications do not support specific operating systems. In such a case, use an operating system that is referenced for all applications you wish to install.

2.2.3 Ensuring system security

It is recommended that the application is used only within a secured environment. A secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to iQ-ROUTER/PRO/PREMIUM.
- Firewall or router protections to ensure that iQ-ROUTER/PRO/PREMIUM only has network access to approved external hosts and services.
- These protections should include measures that prevent DoS (Denial of Service) attempts that try to flood the network with requests that tie up its resources and may, therefore, lead to a non-functioning of iQ-ROUTER/PRO/PREMIUM.
- Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN)). Alternatively, a connection secured with SSL could be used between two iQ-ROUTER/PRO/ PREMIUM applications in order to transmit data between different networks.
- Use of an up-to-date firewall.
- A regularly updated anti-virus/malware software.

We recommend the use of up-to-date anti-virus software on the computer on which iQ-ROUTER/PRO/PREMIUM is run. The virus definitions must be updated regularly (updates should be run as soon as they become available, but at least once a day).

Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

NOTICE:

Anti-virus software or firewalls may affect the iQ-ROUTER/PRO/PREMIUM software as they may accidentally block necessary application files or communication (e.g. ports). It is recommended to configure such applications accordingly to ensure the faultless running of iQ-ROUTER/PRO/PREMIUM on the system. A system test should be performed before using it productively. To keep constant power supply voltage we strongly recommend the use of an uninterruptible power supply (UPS). The interposition of such a device prevents data losses and data inconsistencies that can be produced at the occurrence of fluctuations in the power supply voltage.

2.2.4 Ensuring system availability when using energy-saving modes

Computers offer options to manage how the system uses power and tries to save energy by reducing the computers performance and by putting to sleep defined hardware components. Usually computers come with pre-configured and pre-selected power plans.

It is important to keep in mind that in energy-saving modes not all hardware components of the system may be functional. As consequence, also the performance of iQ-ROUTER/PRO/PREMIUM may be limited as well. For instance, if you switch off the network cards, the application will no longer be able to receive image data from other stations and transmit them to their destination. It might also be that the hard disk is turned off in sleep mode, which makes it impossible for the application to cache received data onto the hard disk.

It is recommended to check the system's power plan and power options and to configure the various elements in a way that does not interfere with the functioning of the application or ensure that components like the hard disk and the network cards or the computer as a whole are never put to sleep.

2.2.5 System requirements for concurrent license server

In case that several iQ-ROUTER/PRO/PREMIUM stations in the network shall run with a concurrent license instead of hardware-bound single licenses, a dedicated concurrent server machine must be set up. The Concurrent Server software requires specific hardware and software on the server where it is run.

For details concerning the system requirements for the concurrent server refer to the Concurrent Server documentation.

3 Installing the software

iQ-ROUTER/PRO/PREMIUM runs on Microsoft Windows operating systems according to the requirements stated in chapter 2. For more information about Windows Server and consumer OS and their hardware system, see the respective Windows user's guide and online help.

The software is usually downloaded from a website and installed afterwards. It can also be installed from optical media.

The software is available with different forms of licensing – single seat licenses (bound to one computer) and concurrent licenses (also called floating licenses, which are not bound to a specific computer). For all details, see chapter 5.

The application provides functionality for both types of licensing. However, for the use of concurrent licensing an additional Concurrent Server is needed. Refer to chapter 5 for the necessary procedures.

△ WARNING:

Danger of application failures or missing data due to misconfiguration. No special training is necessary to be able to install iQ-ROUTER/PRO/PREMIUM, although general computer literacy is required. The configuration settings, however, should be made by a system administrator with technical know-how and experience concerning in-house procedures and processes for the organization. If the installation and/or configuration is performed by personnel not sufficiently qualified, this may lead to non-functioning or limited functionality of the software as well as failure of communication with other devices within the network.

H.-No.: 1.1.1, 1.1.4, 1.2.3, 1.2.4

3.1 Installation after download

The software download includes all installation files.

To install the software on your hard disk, follow the instructions given here:

- After you downloaded the software into a directory of your choice on the local hard disk locate the directory using the Windows Explorer and execute the installation file. Administrator permissions are required to perform the installation.
- Follow the instructions of the installation wizard to install the software on your hard disk.
- You may change the installation directory from the default to one of your choice. However, it is recommended to install the software in the default directory.
- In the installation wizard, it is possible to select the license mode (single or concurrent), before beginning the installation. For more information about the license system and the available license modes, refer to chapter 5.

3.2 Launching the application

iQ-ROUTER/PRO/PREMIUM consists of three separate applications:

1. iQ-ROUTER service

This is a Windows service that is automatically started together with the Windows operating system. The service can be stopped, started and restarted under "Services" in the system's "Control Panel".

2. Router Configurator

This is a user interface for the configuration of the iQ-ROUTER service. To launch the Router Configurator use one of these methods:

- Click the Windows "Start" button, select "iQ-ROUTER" from the list of programs and then "Router Configurator".
- Launch Windows Explorer, find the software's installation folder (by default: C:\Program Files\iQ-ROUTER) and double-click RouterConfigurator.exe.

3. Router Monitor

This is a user interface for monitoring the activity of the iQ-ROUTER service. To launch the Router Monitor use one of these methods:

- Click the Windows "Start" button, select "iQ-ROUTER" from the list of programs and then "Router Monitor".
- Launch Windows Explorer, find the software's installation folder (by default: C:\Program Files\iQ-ROUTER) and double-click RouterMonitor.exe.

3.3 Upgrading the application

NOTICE:

Upgrade fees may apply for the software upgrade and also specific license procedures will have to be observed before the new license can be delivered. Therefore, contact your local reseller for instructions BEFORE upgrading your software.

3.3.1 General

From a technical point of view, an upgrade from an existing iQ-ROUTER/PRO/PREMIUM installation to a newer software version is very easy.

NOTICE

However, a direct upgrade to iQ-ROUTER/PRO/PREMIUM 3.1 is only possible starting from iQ-ROUTER/PRO/PREMIUM 2.1. Earlier versions need to be upgraded first to version 2.1 before installing the new version. This is necessary in order to keep the previous configuration. Simply run the new installation file and install the new software version on top of the existing installation. All configuration and log files will be maintained during the upgrade.

3.3.2 Upgrading single licenses

Keep in mind that a license valid for one software version will not be valid for a newer software version. That means, after the upgrade you will be able to use the new version for the default 30 day trial period. Afterwards you will need a new full license to run the new version.

3.3.3 Upgrading concurrent licenses

For concurrent license networks special requirements apply. Refer to the Concurrent Server documentation for the necessary procedure.

4 Uninstalling the software

The software can, at any time, be removed easily and safely from the system.

Follow the steps below to remove the application from the computer:

- Open the "Control Panel" and select "Add or Remove Programs".
- Scroll down to the "iQ-ROUTER" entry software and click it.
- Select "Uninstall" to uninstall the software.
- Afterwards you may have to delete the program data folder (C:\ProgramData\iQ-ROUTER) manually in the Windows Explorer because, even after uninstalling the software, it will exist and contain the application's configuration and log files.

5 Licensing

5.1 Licensing system

A license is defined by several key characteristics:

- The license type: It distinguishes between the different use cases, i.e. the use for product evaluation, the full productive use or the use for demonstration purposes
- The license edition: It identifies the feature set that will be available in the licensed product
- The license period: It defines whether a license is valid for a specific time period or provides life-time access to the licensed product
- The license mode: It defines whether a license can be used for a single workstation only or for a specified number of concurrent users

Additionally, the following characteristics are provided to further customize the functionality of iQ-ROUTER/PRO/PREMIUM:

- Number of AETs and attribute rules
- Cloud mode

The following sections will give a thorough description of the individual characteristics of a license. On the basis of this information you will be able to decide which software licenses are the most effective for your institution.

5.1.1 The license type – trial, commercial and demo licenses

The license type determines the intended use case of the product. That means whether the software is used for product evaluation, for a commercial use in a productive environment or for demonstration purposes.

| License type | Description | |
|--------------|--|--|
| Trial | These licenses are not for sale and only intended for the purpose of evaluating the software prior to purchasing a full commercial license. Trial licenses are always limited in time. They typically allow the evaluation of the different license editions. This includes the default trial license that is provided automatically | |
| Commencial | These liseness must be surplused and allow the full and usting use of | |
| Commercial | the software. | |
| | They are available as time-limited or time-unlimited licenses for the different license editions. | |

Below you can see all available license types and their purpose:

| License type | Description |
|--------------|--|
| Demo | These licenses are not for sale and only handed out to distributors and resellers for the purpose of providing product demonstrations and technical assistance to end users. |
| | They are typically limited in time and cover the software's entire feature set. |

Read the following sections for more information about available license editions and license periods.

5.1.2 The license edition – BASIC, PRO and PREMIUM

The license edition determines the feature set available in the product. Some features may only be accessible in higher editions of the software.

| Edition | Description |
|---------|---|
| BASIC | The BASIC license is intended for the encrypted and/or compressed DICOM data transmission for small imaging centers with up to 2 devices. |
| | The license limits the maximum number of DICOM modalities to 3 and the maximum number of attribute rules to 5. |
| PRO | The PRO license is intended for the encrypted and/or compressed DICOM data transmission for mid-sized imaging centers and small hospitals with up to 10 devices. |
| | The license limits the maximum number of DICOM modalities to 11 and the maximum number of attribute rules to 25. |
| PREMIUM | The PREMIUM license is intended for the encrypted and/or compressed DICOM data transmission for imaging center groups as central cloud node, for VNA and/or large hospitals supporting up to 100 DICOM nodes. |
| | The license limits the maximum number of DICOM modalities to 100 and the maximum number of attribute rules to 250. |

All three editions also support the plugin system that allows the connection of optional plugin software to the router application in order to provide additional workflow options. Refer to section 5.1.6 for details on the licensing of plugins and to section 9.1.2.9 for further information about the configuration of plugins.

5.1.3 The license period – time-unlimited vs. time-limited licenses

All licenses can either be limited in time or run for the entire life-time of the product.

Time-unlimited (life-time) licenses will never expire, while time-limited licenses have a fixed date after which the license expires and the product becomes inaccessible.

30 days before a time-limited license is going to expire, you will receive a reminder dialog once a day when you start the application. Once expired, the license needs to be renewed to further use the application.

NOTICE

All time-limited licenses are date-sensitive. Intended or involuntary modification of the Windows system date is handled as an attempt to tamper with the license and will invalidate a time-limited license. As a result, the application can no longer be accessed. In case of date corruption, first try to set the system clock to the correct date and time. This should reactivate the license. If, after date correction the application still does not start, contact your local reseller. Keep in mind that the issuing of a replacement key might only be possible for a fee.

5.1.4 The license mode – single vs. concurrent license

A **single license** is a software license that is bound to the computer on which the licensed application is installed. The license, which is created on the basis of the hardware fingerprint (the system's hardware configuration), is only valid for the station for which the license was requested. Another station cannot use this license, but needs its own activation data.

A **concurrent license** (i.e. floating license or network license) is an alternative licensing model contrary to the usual single licensing. It allows you to use a specified number of product instances in a network at the same time without having to license each application individually.

In a concurrent licensing network, the Concurrent Server is responsible for managing the licenses. The individual client workstations connect to the Concurrent Server and ask for permission to start. The server will provide a license slot as long as one is still available.

Thus, the major benefit of concurrent licensing is the fact that you only have to activate one license key for the concurrent license server. But not always is using a concurrent license the best choice.

5.1.4.1 When to use a single or a concurrent license

From our experience, the following guidelines can be used to decide between single and concurrent licenses:

• If you have more users than workstations that shall be equipped with the product: **Single licensing is recommended**

- If you have a smaller number of users than workstations available: **Concurrent licensing** is recommended
- If you have so many users that managing all of the single, computer-bound licenses becomes cumbersome: **Concurrent licensing is recommended**

5.1.4.2 How to mix licenses with different key characteristics in one network

It is also possible to mix product licenses that have different key characteristics, i.e. different license editions (i.e. BASIC vs. PRO), different license periods (i.e. time-unlimited vs. time-limited) or even for different license types (i.e. commercial vs. trial).

The use of single and concurrent licensing is not mutually exclusive. Your choice of single or concurrent or a mix of both will depend on the criteria stated in section 5.1.4.1.

The following example shows how it can work to mix different product licenses in one network:

You want to set up twenty iQ-ROUTER/PRO/PREMIUM 3.1 clients. However, two out of these twenty clients need PRO features of the application while the other clients are fine with the BASIC feature set. Now you have two options.

1. Mix single and concurrent licensing

The two clients that require the PRO feature set use single licenses, while the other clients obtain their BASIC license from the Concurrent Server.

This means, you have two dedicated PRO stations in your network, for which a license is always available. The number of concurrent BASIC users depends on the number of concurrent licenses you have purchased.

2. Host two Concurrent License Servers

One Concurrent Server instance can hold only one license of iQ-ROUTER/PRO/PREMIUM 3.1 (either the BASIC, PRO or PREMIUM license). Anyway, you are free to install a second instance of the Concurrent Server on another computer and activate the BASIC license on one and the PRO license on the other instance.

This means that all clients where the BASIC feature set shall be available must connect to the Concurrent Server hosting the BASIC license and all clients that require PRO features must connect to the Concurrent Server providing the PRO licenses. For both editions, the number of concurrent users depends on the number of concurrent licenses you have purchased for each Concurrent Server.

In the same way you could also handle licenses with different license periods or even manage a productive network while evaluating a different license edition by using a trial license on a dedicated test station.

5.1.4.3 How to switch between single and concurrent license mode

The license mode is initially decided when installing the software (see chapter 3). In order to change the license mode after the software has already been installed, follow these steps:

- Go to "Control Panel" \rightarrow "Programs and Features" \rightarrow "Uninstall a program".
- Select the "iQ-ROUTER" entry from the table.
- Click the option "Change". The "Program Maintenance" wizard opens.
- Select "Modify" and click "Next". The dialog from the original installation is shown again and allows you to switch between single and concurrent license mode.
- Select the appropriate license mode and click "Install".

5.1.5 Cloud mode

Where iQ-ROUTER/PRO/PREMIUM shall be used in a cloud scenario (with iQ-4CLOUD), an additional cloud mode is provided. This mode requires to configure a fixed "Server AET" in the license that identifies the central PACS provided with iQ-4CLOUD. All communication needs to include this AE as either the receiver or the sender. The advantage that this mode provides is that it is no longer necessary to configure every single modality that needs to communicate with the central PACS. Only an entry for the PACS itself is required in the "DICOM Modalities" list. Sending and querying the PACS is then allowed from any modality in the network.

NOTICE:

For query/retrieve operations, it is still necessary to explicitly configure both parts of the communication. Otherwise, the central PACS would not know how to route back the query results.

5.1.6 Licensing of plugins

iQ-ROUTER/PRO/PREMIUM provides an interface that allows the connection of software plugins, such as the Reconciliation Plugin.

The iQ-ROUTER/PRO/PREMIUM setup only provides the interface but does not deploy any of the available plugins. The individual plugins are provided separately on request with instructions on how to connect them to iQ-ROUTER/PRO/PREMIUM.

Each plugin needs to be licensed separately in order to use its functionality.

For more information refer to the documentation of the respective plugin.

5.2 Activating the software

5.2.1 The default trial license

When iQ-ROUTER/PRO/PREMIUM is started for the first time, a single license is automatically provided. This default trial license allows you to evaluate the software for 30 days.

For the first 15 days, this license grants access to all features of the PRO edition. For the last 15 days, the feature set is restricted to the BASIC edition. A trial period for the PREMIUM edition is not automatically included and would have to be requested from your local reseller.

Refer to section 5.1.2 for an overview of the features in the different license editions.

After the default trial license expires, the application stops working. You will have to obtain and activate a new license if you wish to continue using iQ-ROUTER/PRO/PREMIUM. Before you purchase a license for productive use, you need to decide:

- Which license edition you need, i.e. which product features you want to have access to.
- If you want to purchase a life-time license or a license for a specific time period only.
- If you want to use single or concurrent licensing.

Refer to section 5.1 and its sub-sections for details that will help you to make the best licensing decision for your institution.

NOTICE

The default trial license does not allow you to test concurrent licensing. If you wish to evaluate concurrent licensing, you should request a concurrent trial license from your local reseller. The default trial also does not cover any plugins. In order to evaluate a specific plugin, you need to request a trial license specifically for that plugin.

5.2.2 Activating single licenses

The activation process for a single license to be used on one computer is quite simple:

 Look up the hardware fingerprint, which is created when the iQ-ROUTER/PRO/PREMIUM software is first installed on a computer. You find it in the initial license dialog that is displayed at every start of the application:

| Keep in mind that the expire in 30 day(s). | e license of [Prod | uct] [Version] is time-limited and will |
|--|--|--|
| Use "Activate" in cas to obtain a new licen without downtime. To desired registration (| e you already hav ise in time, if you o do so, contact y name and the follo | ve a new license. Otherwise, remembe wish to continue using [Product] our local reseller and include the owing information: |
| | | |
| Product: [Product] Version: [Version] Current hardware fin | gerprint: ACPW8- | YB46S-TN6B7-B7FCS |
| Product: [Product] Version: [Version] Current hardware fin Copy to clipt | gerprint: ACPW8- board | YB46S-TN6B7-B7FCS |
| Product: [Product] Version: [Version] Current hardware fin Copy to clipt | gerprint: ACPW8- board | YB46S-TN6B7-B7FCS |

Reminder dialog

- Use the "Copy to clipboard" button to copy the license information, including the hardware fingerprint, and paste it into an email. Also include the following information:
 - The license edition you wish to purchase (BASIC, PRO or PREMIUM). See section 5.1.2.
 - The intended license period (time-unlimited, 1 year, 2 years etc.). See section 5.1.3.
 - If there are any plugins that you want to purchase. See respective plugin documentation.
 - Your name and contact details.
 - The name for which the software shall be registered.
- Then send the email to your reseller for activation.
- You will receive an email in return with the registration name and license key.
- Enter the information in the respective fields of the "Activate license" dialog:

| ake sure to enter the regi ere given to you: | stration name and key below, exactly as they |
|---|--|
| Hardware fingerprint: | ACPW8-YB46S-TN6B7-B7FCS |
| Registration name: | [Your name] |
| License key: | AEABTA-HXSVPS-CMGQPQ-6E8CGQ-SAK6V3 |
| License key: | AEABTA-HXSVPS-CMGQPQ-6E8CGQ-SAK6V3 |
| | |
| | |
| | |
| | |

"Activate license" dialog with example entries

 Afterwards, click "Activate" to apply the license. The system informs you whether the activation was successful:



Example of an "Activation successful" dialog if the key is valid

- The key will be stored on the computer and does not have to be entered each time the application is started. Minor hardware modifications are possible, the hardware fingerprint may change, but the license will remain valid.
- In case of "invalid key" information, check first if the hardware fingerprint is still the same that you provided when requesting the activation.
- The current license and hardware fingerprint can be looked up in the license info dialog (Router Configurator → Manual configuration → License page → License Details button) of the iQ-ROUTER/PRO/PREMIUM application:



Example of a "License information" dialog

5.2.3 Using concurrent licenses

The heart of a concurrent network is the Concurrent Server. It manages all concurrent license activities in a network. Therefore, all license activations need to be done at the server and not at the individual clients. For detailed information about the administration of the Concurrent Server, including instructions about how to activate licenses, refer to the Administration Guide of the Concurrent Server.

The Concurrent Server software is not included in the iQ-ROUTER/PRO/PREMIUM installation package. It must be obtained and installed separately. You can download the Concurrent Server from the Download Center at <u>www.image-systems.biz</u>.

The following preparations must be made for the application to be used with a concurrent license:

- The Concurrent Server must be installed on a server that is in the same network as your clients.
- A valid license for iQ-ROUTER/PRO/PREMIUM 3.1 must be activated at the Concurrent Server.
- The license mode of your application has to be set to "concurrent licensing" (refer to section 5.1.4).

If you wish to test iQ-ROUTER/PRO/PREMIUM in a concurrent license network you will need an activation key to provide a trial period. For concurrent license networks it is **required** to first run a trial period to test the faultless functioning of the concurrent network before purchasing a full license.

5.2.3.1 Discovering the Concurrent Server

When an iQ-ROUTER/PRO/PREMIUM application within the network (i.e. a client) is started, it tries to find the Concurrent Server within the network. This is done using a UDP multicast on the group defined in the Concurrent Server (default: 239.255.177.177:25000). If the discovery succeeds, the connection parameters of the Concurrent Server are automatically stored in the application's configuration and are used upon the next application start. If the discovery fails, the following dialog is displayed allowing to manually configure IP/hostname and port of the Concurrent Server.

| Dear User Product] [Version] in order to connect and port of your Co | cannot find the Concurrent Server automatically. successfully, provide the correct IP address/hostname ncurrent Server below: |
|---|---|
| IP/hostname: | 192.168.100.100 |
| Port: | 2314 |
| | |
| | |
| | |

Discovery failed dialog

5.2.3.2 Manually reconfiguring the discovery or Concurrent Server address

It is also possible to manually change the discovery group and port as well as the Concurrent Server IP and port on the client stations. To do this, open the client's registry editor (e.g. by using [Win] + [R], typing "regedit" (without "") and clicking OK) and navigate to the key:

HKEY_LOCAL_MACHINE\SOFTWARE\iQ-ROUTER\License

The following table describes the possible values of this key and their meaning:

| Value | Туре | Description |
|----------------|-----------|---|
| Concurrent | REG_DWORD | Defines, whether single or concurrent licensing is active. "0" enables single licensing. Any value bigger than "0" enables concurrent licensing. However, the license mode can also be configured through the installer. See section 5.1.4.3 for more information. |
| DiscoveryGroup | REG_SZ | Defines the group address to be used for discovery requests. This defaults to "239.255.177.177" and needs to match the configuration of the Concurrent Server. |
| DiscoveryPort | REG_DWORD | Defines the port to be used for discovery requests. This defaults to "25000" and needs to match the config- uration of the Concurrent Server. |
| ServerAddress | REG_SZ | Defines the IP or hostname of the Concurrent Server that the application is going to connect to. By default, |

| Value | Туре | Description |
|------------|-----------|---|
| | | this is not configured. Leaving this value empty or completely removing it will result in a new discovery. |
| ServerPort | REG_DWORD | Defines the port of the Concurrent Server that the application is going to connect to. By default, this is not configured. Completely removing this value will result in a new discovery. |

5.2.3.3 Requesting a license

Once connected with the Concurrent Server, the application asks the server for permission to start. The server, on the other hand, checks the number of iQ-ROUTER/PRO/PREMIUM instances that are already running within the network. If that number has not yet reached the maximum number of allowed active license slots, then the requesting application is granted the permission to start.

When a client is shut down, the server automatically recognizes that and frees the previously used license slot. Thus, the number of free slots increases and an application on another computer may be used instead.

5.2.3.4 License-related messages on client-side

5.2.3.4.1 "Connection failed" message

If the application cannot connect to the Concurrent Server, the following dialog appears.

| Productj [version] | was unable to connect to the configured Concurrent |
|----------------------|--|
| Server at 192.168.1 | 120.132:2314. |
| You have two option | ns: |
| 1. Press "Find autor | matically" to try and find the Concurrent Server |
| automatically in the | network. |
| 2. Press "Retry conr | nection" to test the current or a new configuration. |
| | |
| IP/hostname: | 192.168.120.132 |
| IP/hostname: | 192.168.120.132 |
| Port: | 2314 |
| IP/hostname: | 192.168.120.132 |
| Port: | 2314 |
| IP/hostname: | 192.168.120.132 |
| Port: | 2314 |

Connection failed dialog

This dialog allows you to discover the server in the network ("Find automatically"). Usually this should fix the issue. If this does not correct the behavior, you may have a network issue or a faulty Concurrent Server configuration. Refer to the Administration Guide of the Concurrent Server for further troubleshooting.

5.2.3.4.2 "Connection lost" message

If the Concurrent Server is not reachable for 20 minutes, the following dialog will notify the users at the application clients:

| [Product] [V connection i restart. | ersion] has lost the connection to the Concurrent Server. If the s not restored, the application may no longer be available after a |
|--|--|
| Please re-es possible or | stablish the connection to the Concurrent Server as soon as contact your system administrator for assistance. |
| After confirm [Version] un | ning this dialog you may continue your work with [Product] itil it is shut down. |
| | |
| | |
| | |
| | |

Connection lost dialog

This dialog is just a notification. Once the user clicks the "Continue" button, the application continues to work as before. In the background, the application will try to reconnect with the Concurrent Server. In case the server will not be available for another 20 minutes, the message will pop up again.

You should check the availability of the system, on which the Concurrent Server is running, the availability of the Concurrent Server service itself and the network connection between the Concurrent Server system and the clients.

5.2.3.4.3 "Maximum concurrent users reached" message

The number of concurrent users of iQ-ROUTER/PRO/PREMIUM in a network is always limited. If this limit is reached, the following dialog opens:



Maximum concurrent users reached dialog

To prevent this issue, you should regularly check the usage statistics of your license at the Concurrent Server. If it happens frequently that users are unable to access the application clients when needed, you may need a license with more concurrent users to handle the demand. In this case, contact your local reseller to discuss an increase of concurrent users.

5.2.3.4.4 "Client authentication failed" message

The Concurrent Server can be set up to only accept license slot requests from authorized clients. In this case, a whitelist containing all approved clients or a blacklist containing all rejected clients is managed at the server.

If your Concurrent Server requires client authentication, the users may experience the following messages on their workstations when trying to start iQ-ROUTER/PRO/PREMIUM:



Whitelisted/blacklisted message at client

This means that the client is not allowed to receive a license slot from the Concurrent Server due to missing authentication. The computer, where iQ-ROUTER/PRO/PREMIUM is installed may be either on the Concurrent Server's blacklist or not on its whitelist. In any case, you should check the settings of the Concurrent Server if you want to authenticate the affected client.

5.3 Logging of license activities

Sometimes it can be useful to provide your reseller or distributor with more comprehensive license information (e.g. for trouble-shooting). For this purpose, a function to save the current license log is provided. It can be found in Router Configurator \rightarrow Manual configuration \rightarrow License page.

This function is not needed in everyday working life, but your reseller or distributor may ask for the license log in case of technical support requests and in case of issues experienced with the license system.

5.4 Ensuring the validity of the iQ-ROUTER/PRO/PREMIUM license

After the iQ-ROUTER/PRO/PREMIUM software has been licensed, certain system parameters must remain consistent in order to keep the license valid and iQ-ROUTER/PRO/PREMIUM functional.

The following table contains different system settings and their influence on the license status:

| Risk for license status | Changes to the system |
|-----------------------------|---|
| Invalidates the license | Changing the system's main board |
| | Changing the system's processor |
| | Reinstallation of the operating system |
| May invalidate the license | Changing, removing, replacing or disabling any real or virtual network adapters (MAC addresses) |
| Does not affect the license | Adding, removing or replacing memory (RAM) |
| | Adding or replacing additional storage devices |
| | Adding, removing or replacing the graphics card |
| | Adding, removing or replacing optical drives |
| | Renaming the computer (hostname) |
| | Upgrading the operating system |
| | Reinstalling the application |

6 License migration and renewal

6.1 Single licenses

6.1.1 Changing an existing license

In some cases it may become necessary to change an existing license, i.e. to enter new activation data even though a license is currently active. This may happen if:

- You wish to upgrade an iQ-ROUTER BASIC license to iQ-ROUTER PRO or PREMIUM.
- You wish to downgrade an iQ-ROUTER PRO or PREMIUM license to iQ-ROUTER BASIC.
- You wish to renew a time-limited license that is about to expire.
- You wish to activate or deactivate the use of a specific plugin.

NOTICE:

Contact your local reseller for the procedures of changing an existing license.

After you have received the new license activation data from your local reseller (registration name and license key), open Router Configurator, click on the "Manual configuration" button, switch to the *License* page and then click "Activate license". Then enter the new registration name and activation key. Click "Activate" to confirm the activation.

6.1.2 Deactivating an existing license

When a license is removed from your current system, it will no longer be valid. The hardware fingerprint will change and the previously used activation key becomes invalid. This procedure might be necessary if you want to migrate an existing license to a different computer or if you do not wish to use the software any longer. In those cases, you have to send the deactivation information file (created while the license is removed) to your local reseller.

If you wish to remove your purchased license, you need to follow the instructions given here:

Open the Router Configurator, click the "Manual configuration" button, switch to the *License* page and click the "Deactivate license" button in order to deactivate the license key. A security dialog will ask you to confirm your decision to deactivate the license:

| Do you reall Afterwards | ly wish to de it will no long | activate the ger be possit | license o ble to us | f [Product] e the applica | Version]? tion. | |
|----------------------------|----------------------------------|-------------------------------|------------------------|--------------------------------|--------------------|--|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

"Deactivation confirmation" dialog

During the deactivation a text file (.log) will be created called "deactivation_iQ-ROUTER_3.1_{CURRENT_DATE}.log". This file contains a deactivation key verifying the license deactivation. Keep the file; you may need it later to prove the successful deactivation. The file can be found in %ProgramData%\iQ-ROUTER\license.

NOTICE:

Do not press "Yes, deactivate" unless you really wish to deactivate your license. During this process, the hardware fingerprint will change and your previous activation data will become invalid. You will have to request a replacement key that might require a fee.

6.1.3 Migrating an existing license

If you want to move your purchased license from one computer to another, you need to follow the instructions given here:

- Install the software on the new computer.
- Deactivate the license on the old computer. To do that open the Router Configurator, click the "Manual configuration" button and switch to the *License* page. Click the "Deactivate license" button in order to deactivate the license key. When the license is deactivated it will no longer be valid on that machine. The hardware fingerprint will change and the previously used activation key becomes invalid.
- During the deactivation a confirmation file (.log) is created in %ProgramData%\iQ-ROUTER\license directory, called "deactivation_iQ-ROUTER_3.1_{CURRENT_DATE}.log". This file contains a deactivation key verifying the license deactivation. Send this file together with the license information of the new iQ-ROUTER/PRO/PREMIUM installation by email to your reseller. For details regarding the licensing process and the necessary information you need to provide, see section 5.2.2.
- You will receive an email in return with the registered name and activation key.

NOTICE:

Keep in mind that for replacement keys a fee might be charged. Therefore, contact your reseller BEFORE you transfer your iQ-ROUTER/PRO/PREMIUM license to a new computer!

6.2 Concurrent licenses

For detailed information about the administration of the Concurrent Server, including instructions about how to change, renew, migrate or deactivate licenses, refer to the Administration Guide of the Concurrent Server.
7 Maintenance

The software itself requires no specific maintenance tasks apart from regular restarts. However, the capabilities and the performance of the software can be affected by limitations and failures caused by the hardware, the network or other software installed on the system. Therefore, the proper operation and the maintenance of the hardware and network are necessary (e.g. professional connection to power and network, sufficient ventilation, regular cleaning of the fan, etc.). Instructions regarding hardware and software specifications as well as software maintenance given by the manufacturers must be adhered to.

The user should always use the latest software version and update existing installations when updates become available.

△ WARNING

Danger of application failures or unavailability.

All modifications to the medical software have to be made by IT service personnel. This includes the installation, verification as well as changes in the software. The risk of malfunction is relatively high when modifying software. Abnormal termination of the software as well as temporary or permanent data losses are possible when improperly administered. Therefore all modifications to the software are performed solely by service personnel. Modifying application folders and or files to different locations, deleting or renaming them

without considering other parts may cause problems in the functioning of the software. Keep the file and folder structure intact and only follow the user documentations' instruction for configuring the application.

H.-No.: 1.1.1, 1.1.4, 1.2.3, 1.2.4

7.1 Maintenance schedule

In order to ensure the faultless operation of iQ-ROUTER/PRO/PREMIUM, it is necessary to properly keep up the system by performing specific recommended maintenance tasks.

The following table provides you with an overview of all recommended maintenance activities and states when and how often you should schedule them. You will find all details for every task in the section stated under "Reference".

| Time interval | Task | Reference |
|---------------|---|-----------|
| Daily | Update anti-virus definitions | 7.4 |
| | Run anti-virus/anti-malware check (after definition updates) | 7.4 |
| | Check availability and performance of all network/internet connections | 7.5 |
| Weekly | Reboot iQ-ROUTER/PRO/PREMIUM system (when installed on client computer) | 7.2 |
| | Install Windows security updates/patches | 7.6 |
| Monthly | Reboot iQ-ROUTER/PRO/PREMIUM system (when installed on server system) | 7.2 |

| Time interval | Task | Reference |
|---------------|--|-----------|
| Quarterly | Check available hard disk space | 7.3 |
| | Check iQ-ROUTER/PRO/PREMIUM system for hard disk fail- ures and S.M.A.R.T. errors | 7.3 |
| | Check for new Windows system drivers (update only after verification by local reseller!) | 7.6 |
| | Check for iQ-ROUTER/PRO/PREMIUM patches for installed software version. Update, if available. | 7.67.7 |
| | Check for new iQ-ROUTER/PRO/PREMIUM software versions. Verify possibilities for software update (together with local reseller!). | 7.67.7 |
| Annually | State-of-the-art check for system hardware | 7.7 |
| On demand | Record and report software malfunctions of iQ-ROUTER/ PRO/PREMIUM (at least severe software errors) | 7.8 |

7.2 Regular software and system restarts

As a software application, iQ-ROUTER/PRO/PREMIUM is intended for frequent, but not for continuous use.

Usually, the software will be installed on a Windows server system. The system must be shut down and restarted at least once a month. This automatically also restarts the router software and ensures the freeing of potentially blocked system resources.

In cases where the software is installed on a client computer (e.g. with Windows 10 OS), the software and the system must be shut down and restarted at least once a week.

7.3 Securing sufficient hard disk space

It should be checked regularly – once per quarter is recommended – if enough storage capacity is still available on the hard disk to temporarily save image data that is transmitted but also to store log files.

Old log files created on the hard disk but no longer needed should be deleted. These log files are stored under C:\ProgramData\iQ-ROUTER\log.

Also check quarterly that the system does not show any hard disks failures or S.M.A.R.T. error messages in the system logs.

7.4 Protection from virus/malware infection

Computer viruses and malware hold a considerable risk. This risk is very high because iQ-ROUTER/PRO/PREMIUM is part of a larger network or even connects different networks through

data transfer. A virus/malware infection may potentially lead to data losses and to data inconsistencies. To avoid the risk of a virus infection of the server, on which the software is running, all systems should be furnished with anti-virus software that needs to be updated regularly. Updates should be run as soon as they become available, but at least once a day.

Anti-virus/anti-malware checks should also be run regularly on the server where iQ-ROUTER /PRO/PREMIUM is installed. It is recommended to run a check after virus definition updates.

NOTICE:

Anti-virus software or firewalls may affect the server software as they may accidentally block necessary application files or communication (e.g. ports). It is recommended to configure such applications accordingly to ensure the faultless running of iQ-ROUTER/PRO/PREMIUM on the system. A system test should be performed before using it productively. See section 12.1 for the acceptance test checklist.

7.5 Ensuring a proper network/internet connection

A failure or partial loss of the network/internet connection or a low bandwidth within the medical network managed through iQ-ROUTER/PRO/PREMIUM can pose risks when imaging data cannot be made available at the receiving devices, is received only incompletely or is not transmitted fast enough, especially in emergency cases.

Therefore, check daily all network/internet connections going through iQ-ROUTER/PRO/ PREMIUM for their availability and performance. This check should be done before the first procedure is scheduled at the respective receiving device. Example: If the night shift starts at 8 p.m. and the imaging data is sent to a radiologist's home for emergency reading, verify the connection at the beginning of the night shift.

In case, emergency cases are transmitted across the tested connection(s), the transmission time should be no longer than 15 minutes. For details on how to handle such a performance test, refer to the respective acceptance tests described in annex 12.1.

7.6 Keeping the system up-to-date

You should check regularly if your system is still up-to-date and perform necessary updates. Check the following items:

- Install Windows security updates and patches within one week after their release.
- Check quarterly for new Windows system drivers but update them only after checking back with your local reseller to ensure the compatibility with the currently installed iQ-ROUTER/PRO/PREMIUM version.
- Check quarterly if software patches for the currently installed iQ-ROUTER/PRO/PREMIUM software are available. If yes, update the system accordingly.
- Check quarterly if a new software version of iQ-ROUTER/PRO/PREMIUM is available. Verify
 that the software requirements of the new version match the system. Contact your local
 reseller to discuss updating your system to the new version.

NOTICE:

Remember to perform a system acceptance test before putting the system back into productive operation. See section 12.1for the acceptance test checklist.

7.7 Ensuring the system's state of the art

It is recommended to check annually whether the system hardware is still state-of-the-art.

- Check if the used Windows operating system is still supported by Microsoft. Check how long support will still be granted in order to schedule a necessary OS update on time. (Keep in mind that this may also affect the used iQ-ROUTER/PRO/PREMIUM software.)
- Check the Windows logs for potential hardware errors that may suggest an impending system failure.
- Reboot the computer and measure the startup time. It should be reasonable and not exceed 3 minutes.

7.8 Recording and reporting software malfunctions

Although the iQ-ROUTER/PRO/PREMIUM software is subjected to extensive validation and verification procedures by the manufacturer, it is nevertheless possible that unforeseen malfunctions occur during the use of the software.

We recommend to record and count the number at least of severe software errors, such as crashes, throughout the entire software life-cycle and to report such incidents to your local reseller or directly to the manufacturer.

Generally, the following assumptions can be made as reference:

- An up-to-date server system (e.g. Windows Server 2019) with all necessary security patches and current anti-virus/malware software should run 30 days without crashing.
- An up-to-date client system (e.g. Windows 10) with all necessary security patches and current anti-virus/malware software should run 1 week without crashing.

△ WARNING:

In case faulty software behavior is observed that may put a patient or the user at risk, the user is asked to immediately contact the manufacturer or local reseller. The manufacturer's contact data is stated in the user documentation (last page of this document) and inside the application itself.

H.-No.: 1.1.1 - 1.3.3

NOTICE:

Also the reporting of minor errors and inconveniences in handling the application can be helpful in order to improve the software in future versions.

8 Folders and paths

The following table lists all folders of the iQ-ROUTER/PRO/PREMIUM installation directory and their description.

The default installation directory of the application is: C:\Program Files\iQ-ROUTER

△ WARNING:

Danger of application failures or unavailability. Modifying application folders and or files to different locations, deleting or renaming them without considering other parts may cause problems in the functioning of the software. Keep the file and folder structure intact and only follow the user documentations' instruction for configuring the application.

H.-No.: 1.1.1, 1.1.4, 1.2.3, 1.2.4

| Folder | Description |
|--------------------------|---|
| \iQ-ROUTER | Root folder of the iQ-ROUTER/PRO/PREMIUM install- ation. Contains the main executable files. |
| \iQ-ROUTER\doc | Contains documentation files (Administration Guide, Instructions for Use and New Features and Bug Fixes). |
| \iQ-ROUTER\license | Contains files related to the license system used by iQ-ROUTER/PRO/PREMIUM. |
| \iQ-ROUTER\license\lang | Contains language files used by the license system. |
| \iQ-ROUTER\platforms | Windows-specific libraries required by the application. |
| \iQ-ROUTER\plugins | Prepared folder for the integration of optional plugins. |
| \iQ-ROUTER\tools | Contains additional tools provided together with iQ-ROUTER/PRO/PREMIUM. |
| \iQ-ROUTER\tools\openssl | Contains OpenSSL related files. |

The following table lists all folders where program or user specific files of iQ-ROUTER/PRO/PREMIUM are located, including their description:

| Folder | Description |
|--------------------------------|---|
| \ProgramData\iQ-ROUTER\conf | Contains configuration files used by iQ-ROUTER/PRO/ PREMIUM. |
| \ProgramData\iQ-ROUTER\license | Contains license related data created at run-time. |
| \ProgramData\iQ-ROUTER\log | Contains log files written by iQ-ROUTER/PRO/PREMIUM. |
| \ProgramData\iQ-ROUTER\temp | The default storage folder for instance that shall be forwarded. Instances will be stored until the forwarding has either succeeded or until all retries have failed. |

9 Software administration

9.1 Router Configurator

iQ-ROUTER/PRO/PREMIUM provides a graphical configuration tool called "Router Configurator", which can be used to configure the iQ-ROUTER service.

The start dialog of the configuration tool provides two different modes:

- 1. Configuration wizard (left button)
- 2. Manual configuration (right button)



Router Configurator – Start dialog

The following sections describe both modes in depth.

9.1.1 Using the configuration wizard to set up router scenarios

The configuration wizard, accessed by clicking the button on the left, allows you to configure iQ-ROUTER/PRO/PREMIUM in five simple steps. This configuration covers the main functionalities provided by iQ-ROUTER/PRO/PREMIUM. Additionally, the wizard gives you the possibility to pre-configure a second iQ-ROUTER/PRO/PREMIUM as it would be used in tele-radiological installations.

9.1.1.1 Step 1 – Choosing the router environment



Configuration wizard "Step 1 – General"

In this step, you first need to decide which type of environment applies to your intended installation.

"Environment 1" will cover a tele-radiological scenario that connects two networks via two iQ-ROUTER/PRO/PREMIUM instances. Each instance will handle the incoming and outgoing transmissions and will provide on-the-fly compression and decompression. All supported DICOM services will be handled as well. The kind of compression between the instances will be chosen using the "Transfer syntax (compression type)" drop-down menu which offers the following options:

- Little Endian Implicit
- Little Endian Explicit
- Big Endian Explicit

- JPEG Lossless, Non-hierarchical, 1st Order Prediction
- JPEG Baseline
- JPEG Extended, Process 2+4
- RLE Lossless
- JPEG-LS Lossless
- JPEG-LS Lossy (Near-lossless)
- JPEG 2000 (Lossless only)
- JPEG 2000 (Lossless or Lossy)
- Deflated Explicit VR Little Endian

The external IP addresses or hostnames of both iQ-ROUTER/PRO/PREMIUM machines have to be entered in the respective fields.

"Environment 2" will cover non-tele-radiological scenarios with a single iQ-ROUTER/PRO/ PREMIUM installation. Only the IP address or hostname of the machine where iQ-ROUTER/PRO/ PREMIUM is running must be entered.

NOTICE:

The selected environment will influence the following steps of the configuration wizard.

9.1.1.2 Step 2 – Setting up iQ-ROUTER/PRO/PREMIUM

| 🔁 iQ-ROUTER - Configuration Wizard | × |
|---|-----|
| Step 2 - iQ-ROUTER Settings Configure the settings for iQ-ROUTER | |
| DICOM | |
| Define the network listen port(s). The application will listen on this port for incoming connection requests. The port shall not be in use by any other application on the system(s). | |
| Listen port | |
| | |
| Set the compression quality or the compression ratio. The quality is used for JPEG Lossy. A lower quality value will increase the compression ratio. The ratio is used for JPEG 2000 only. | |
| JPEG Lossy Quality 80% | |
| JPEG-LS Near-lossless deviation 2 | |
| JPEG 2000 ratio 1:6 | |
| Note: A ratio value of 1 will force the JPEG 2000 codec to use a lossless compression. Choose a ratio higher than 1 and select JPEG 2000 as lossy and JPEG 2000 LosslessOnly as lossless transfer syntaxes in case you need both. | |
| | |
| Back Next Can | cel |

Configuration wizard "Step 2 – iQ-ROUTER Settings"

In the following the necessary settings are shortly described with their meaning and functionality:

• Listen port: The TCP port that the iQ-ROUTER service will listen on for incoming connections. By default, the service uses port 14000, but you can change the port, if necessary.

| NOTICE: |
|--|
| Make sure that the port you choose is not in use by any other application or blocked e.g. by a |
| firewall. |
| |

• **Compression**: Allows you to decide how strongly data shall be compressed using the different compression codecs. This influences the quality of the image data.

△ WARNING:

Danger of misdiagnosis due to the use of lossy image compression.

Excessive compression levels may cause compression artifacts that might reduce the image quality to non-diagnostic level. These images may therefore no longer be usable for diagnostic purposes!

The user's organization should make sure to use lossy compression only according to local regulatory requirements.

H.-No.: 1.1.5, 1.1.9

- JPEG Lossy Quality: Defines the quality of the lossy JPEG compression. A higher value will provide a better image quality but will result in bigger file sizes. A lower value will result in smaller file sizes but a lower image quality.
- JPEG-LS Near-lossless deviation: Defines the quality of the JPEG-LS Lossy compression ratio. A higher value will result in a smaller file size but in a lower image quality.
- JPEG 2000 ratio: Defines the quality of the JPEG 2000 (Lossless or Lossy) compression. If set to 1, compressed images will be lossless. Setting it to a value different than 1 will result in lossy compressed images where the ratio parameter is the estimated compression ratio (e.g. a ratio of 10 will result in an image data compression of nearly 1:10).

9.1.1.3 Step 3 – Configuring the DICOM modalities

| 🙀 iQ | -ROU | TER - Configuration | Wizard | | | | × |
|------|-----------------------|---|--|---|------------------------|----------------------------|---|
| Ste | p 3 - Add y | DICOM Modalities our network modalities | and their individua | al compression mode | | | |
| | DICON [s s | A Modalities Define your modalities i setting you select on pa setting you may use "B Network A | in either one netwo age 1 of this wizard ack". | rk or both networks (ba: I). If you want to change | sed on the your env | e environment ⁄ironment | |
| | # | Name | AE Title | Hostname | Port | Preferred TS | |
| | 1 | CT Radiology | CTRAD001 | 192.168.110.100 | 104 | Little Endian Exp | |
| | 2 | Workstation Ra | WSRAD001 | 192.168.110.101 | 1234 | JPEG-LS Lossle | |
| | - | | | | | | |
| | < | | | | | > | |
| | 1 | Network B | [| Add Ed | it | Delete | |
| | # | Name | AE Title | Hostname | Port | Preferred TS | |
| | 1 | PACS Hospital | PACS | 192.168.110.102 | 5678 | JPEG 2000 (Los | |
| | 2 | Workstation Re | WSREAD001 | 192.168.110.103 | 104 | JPEG-LS Lossle | |
| | | | | | | | |
| | < | | | | | > | |
| | | | | Add Ed | it | Delete | |
| | | | | Back | Ne | ext Cancel | |

Configuration wizard "Step 3 – DICOM Modalities"

Step 3 allows to add all DICOM modalities that shall be able to communicate through iQ-ROUTER/PRO/PREMIUM. Depending on the chosen environment from step 1, you will have to add at least one modality to "Network A" and "Network B" (for environment 1) or at least one modality to "Network A" only (for environment 2).

Use the *Add*, *Edit* or *Delete* buttons to administrate the modalities. See 9.1.2.3 for further information about the configuration of modalities.

9.1.1.4 Step 4 – Preparing the creation of the configuration files

| 😫 iQ-ROU | JTER - Configuration Wizard | | × |
|--------------------------|--|-----------|---|
| Step 4 - Selec | Configuration Files ct the folder(s) to store the configuration file(s) | | |
| | | | |
| | | | |
| | | | |
| | File for Router A: | | |
| | C:\ProgramData\iQ-ROUTER\conf\router.xml | | |
| | File for Router B: | | |
| | C:\tmp\router.xml | `` | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | Back Next | Cancel | |

Configuration wizard "Step 4 – Configuration Files"

If "Environment 1" was selected in the first step, this allows to select the directory in which the configuration file for the second iQ-ROUTER/PRO/PREMIUM instance will be stored. You can then take this file and copy it into the program data folder of the second iQ-ROUTER installation.

The configuration for the local iQ-ROUTER/PRO/PREMIUM instance will always be stored in the default location (%ProgramData%\iQ-ROUTER\conf\router.xml) overwriting any existing configuration.

9.1.1.5 Step 5 – Creating the necessary configuration file(s)

| 🚱 iQ-ROUTER - Configuration Wizard | × |
|--|--------|
| Step 5 - Create Configuration File(s) Create configuration files based on the settings you made | |
| | |
| Click 'Next' to create the configuration files. | |
| | |
| | |
| | |
| | |
| | |
| | |
| Back | Cancel |
| Back Next | Cancel |

Configuration wizard "Step 5 – Create Configuration File(s)"

With Step 5 you will start the creation of the configuration file(s). The file creation status is shown in the progress bar in the middle. At the end of the process, you will find the configuration file or files (depending on the chosen environment) in the chosen directories.

This step completes the iQ-ROUTER/PRO/PREMIUM configuration with the help of the configuration wizard.

9.1.2 Using the manual configuration for rule-based operations and for adjusting specific router settings

The manual configuration gives access to all configuration options available for the local iQ-ROUTER/PRO/PREMIUM installation.

The configuration dialog provides tabs for various categories of settings. Each individual category is explained in detail in the following sections. Additionally, the following buttons are provided at the bottom of the configuration dialog:

- *About* Opens the "About" dialog with further information about the product and the manufacturer.
- *Help* Opens the Administration Guide of the software with the default PDF viewer.

NOTICE: Acrobat Reader or another PDF reader must be installed on the system to open and view the iQ-ROUTER/PRO/PREMIUM Administration Guide or the Instructions for Use.

Save and Exit Saves all configuration changes and opens the "iQ-ROUTER Service Controller" dialog that allows to – optionally – restart the service to apply the saved changes and to close the Router Configurator.

| iQ-ROUTER Service Controller | × |
|---|-----------------------------------|
| Information The changes in the configuration were saved succes | sfully. |
| The iQ-ROUTER Service Application has to be restart | ed in order to apply the changes. |
| Service | |
| Service is stopped | |
| F | Restart Service Close |

NOTICE:

Keep in mind that configuration changes will only take effect if the iQ-ROUTER service is restarted after saving the made changes. Without service restart, the application will continue functioning on the basis of the previous settings.

Exit

Exits the configurator without saving any changes made in the configurator.

9.1.2.1 Configuring general application settings

The "General" page contains basic settings for the iQ-ROUTER/PRO/PREMIUM application, including the default settings for the logging of application activities and the default settings that the application will use for DICOM communication. You may change these default settings when necessary. For instance, you may change the AE title in case several router instances are integrated into the network, in order to apply a unique AE title to every instance. Or you may change the port in case this port is already used by another application on the system.

| Forward rules | AE title mapping | 9 | Attributes | Plugins | License |
|-------------------|---------------------|--------|----------------|---------|----------------|
| General | Compression setting | gs | DICOM Moda | alities | Access control |
| ogging | | | | | |
| Log mode | | Rollin | g | | \sim |
| Log level | | INFO | | | \sim |
| Max. file size | | 1048 | 5760 | | |
| Max. file count | | 10 | | | |
| | | 0 | pen log folder | | |
| ICOM | | | | | |
| AE Title | | DCM | ROUTER | | |
| Max. association | ns | 25 | | | |
| Max. association | ns per entity (AE) | 15 | | | |
| Max. PDU Size | | 1638 | 4 | | |
| Pseudonymizati | on | | | | |
| "Search for all" | (allow wildcards) | | | | |
| Allow insecure of | connections | ✓ 1 | 4000 | Port | |
| Allow secure co | nnections (TLS/SSL) | 2 | 2762 | TLS/SSL | Port |
| LS/SSL Settings | | | | | |
| Advanc | ced | | | | |

Manual configuration – General page

In the following, you will find every setting found on the *General* tab page with a short description of its functions.

Logging settings

- **Log mode**: Sets the mode used when writing log files. The following modes are available:
 - Rolling: The current log file is backed up once it reaches a certain size (see "Max. file size"). Backup files will be removed once they exceed a certain number (see "Max. file count").
 - Daily: The current log file is backed up on a daily basis. Backup files will be removed once they exceed a certain number (see "Max. file count").
- **Log level**: Sets the level used when writing log files. The level controls the amount of information that is written. The following levels are available:
 - OFF disables logging
 - FATAL logs only fatal information
 - ERROR includes information of the log level FATAL as well as all errors
 - WARN (default log level) includes information of the log level ERROR as well as all warnings
 - INFO includes warnings as well as high level process information
 - DEBUG includes information of the log level INFO as well as more detailed process information
 - TRACE includes information of the log level DEBUG as well as very detailed process information mostly required for a developer to understand the source of an error; Note that the log files of this log level may become very large
- **Max. file size**: Specifies the maximum size of the current log file in bytes. This setting is only available when the log mode is set to "Rolling".
- Max. file count: Specifies how many backup log files are kept at any given time.
- **Open log folder**: Opens a Windows Explorer instance pointing to the directory that contains the log files of the application.

DICOM settings

• **AE Title**: Sets the Application Entity Title used by iQ-ROUTER/PRO/PREMIUM during DICOM communication.

The AET is only used if:

- Only the forward module for image distribution is used (no direct routing to a fixed destination AE).
- A C-ECHO request is sent directly to iQ-ROUTER/PRO/PREMIUM for testing purposes.

In all other scenarios the AET of the destination is used throughout the DICOM communication.

NOTICE:

If the AET of iQ-ROUTER/PRO/PREMIUM itself is used, make sure that the configured AET is unique in the whole network environment.

 Max. associations: Limits how many parallel connections will be accepted and processed by iQ-ROUTER/PRO/PREMIUM. If the configured number of connections is reached, any additional connection will be refused.

NOTICE:

The total number of associations that can be handled simultaneously by iQ-ROUTER/PRO/PREMIUM is limited by the hardware that the application is running on. An appropriate configuration of this value depends on the amount of AEs in the network environment and the peak traffic or e.g. the amount of associations opened by individual AEs.

- Max. associations per entity (AE): Limits how many parallel connections will be accepted for each individual AE. If the configured number of connections is reached, any additional connection from the same AE will be refused.
- Max. PDU Size: Limits the maximum size (in bytes) of each data package sent over the network. The configured value will control which maximum size iQ-ROUTER/PRO/PREMIUM will accept when negotiating an incoming association. It will also be offered to remote AEs when requesting a connection.
- Pseudonymization: If enabled, all store and query requests will be pseudonymized.
 For a store request, pseudonymization means that the Patient Name will be overridden with either Patient ID (if it exists) or Accession Number. If neither exists, the Patient Name is cleared. Additionally, the Other Patient Name and Patient Comment tags will be removed completely (if they exist).

For a query request, pseudonymization means that the Patient Name contents will be cleared.
 "Search for all" (allow wildcards): If enabled, all query requests will be forwarded by iQ-ROUTER/PRO/PREMIUM. If disabled, query requests where one of the following tags contains

an empty value or a single wildcard ("*" or "?") will be rejected by iQ-ROUTER/PRO/PREMIUM. Query parameters are:

- Accession Number
- Patient ID
- Referring Physician Name
- Series Instance UID
- Study Date
- Study Instance UID
- Study Time

This feature is meant to prevent query requests that potentially return a large amount of results which could negatively impact the performance of the query destination.

- Allow insecure connections: If enabled, insecure (unencrypted) connections are allowed on the configured "Port". If disabled, no insecure connections are allowed.
- **Port**: Sets the TCP port that the iQ-ROUTER service listens on for insecure connections.

NOTICE:

Make sure that the configured port is not in use by any other application or blocked e.g. by a *firewall.*

- Allow secure connections (TLS/SSL): If enabled, secure (encrypted) connections are allowed on the configured "TLS/SSL Port". If disabled, no secure connections are allowed.
- TLS/SSL Port: Sets the TLS/SSL port that the iQ-ROUTER service listens on for secure connections.

NOTICE:

Make sure that the sender supports secure communication as defined by DICOM "Transfer Layer Security" when connecting to this port.

TLS/SSL Settings

 Advanced: Opens the "Advanced TLS/SSL Settings" dialog. See section 9.1.2.1.1 below for further information.

9.1.2.1.1 Advanced TLS/SSL settings

NOTICE:

For a step-by-step guide about the configuration of SSL communication, refer to 9.4.

NOTICE:

If a secure data transmission is to be set up between iQ-ROUTER/PRO/PREMIUM 3.1 and an iQ-ROUTER/PRO/PREMIUM 2.1 version, it is strongly recommended to use up-to-date TLS certificates to ensure that all routers can successfully use these certificates. When employing old TLS certificates, there is a chance that you will be experiencing compatibility issues. Do not assign an old TLS certificate created with iQ-ROUTER/PRO/PREMIUM 2.1 to both routers. Instead, make sure to at least create a new TLS certificate for iQ-ROUTER/PRO/PREMIUM 3.1 and use it for communication. Certificates created with version 3.0 are fully compatible with version 3.1.

The communication using SSL encryption (TLS) is based on the exchange of signed certificates. The certificates will be created using one shared key. Within the communication between two peers each peer will authenticate itself to the other using its certificate. The shared key provided to both sides is used to verify the certificate of the communication peer. A key may or may not be encrypted (depending on the cipher used). If the key is encrypted, the passphrase/password has to be known as well.

Certificates can be created and signed by the user himself (self-signed certificates) or can be created by the user and signed by a trusted "Certificate Authority" (CA certificate). iQ-ROUTER/PRO/PREMIUM provides some tools to create and self-sign certificates. Refer to section 9.3 for further information about the creation of certificates.

iQ-ROUTER/PRO/PREMIUM supports the secure communication as defined by DICOM "Transport Layer Security". The encryption is SSL-based. The server-side within iQ-ROUTER/PRO/PREMIUM (SCP side) requires several parameters to be set, e.g. the own certificate and key combination.

| ieneral | | |
|---|--|-----------|
| Private Key File | C:\ProgramData\iQ-ROUTER\ca_selfsigned\key.pem | |
| Certificate File | C:\ProgramData\iQ-ROUTER\ca_selfsigned\cert1.pem | |
| Password | •••• | |
| Certificate Verification: | Require ~ | · |
| Read seed file: | | - |
| Write seed file: | | |
| rusted certificates | | |
| Trusted certificate directory: | | |
| | Imp | ort |
| Trusted certificate files: | | |
| C:\ProgramData\iQ-ROUTE | R\ca_selfsigned\cert2.pem Ac | ld |
| | Del | ete |
| | | |
| | | |
| | | |
| | | |
| | | |
| Cipher suites | | |
| Cipher suites TLS_RSA_WITH_3DES_ED TLS_RSA_WITH_AFS_128 | DE_CBC_SHA | ld |
| Cipher suites TLS_RSA_WITH_3DES_EI TLS_RSA_WITH_AES_128 | DE_CBC_SHA 3_CBC_SHA | ld ete |
| Cipher suites TLS_RSA_WITH_3DES_EU TLS_RSA_WITH_AES_128 | DE_CBC_SHA 3_CBC_SHA Dek | ld ete |
| Cipher suites TLS_RSA_WITH_3DES_EI TLS_RSA_WITH_AES_128 | DE_CBC_SHA 3_CBC_SHA Dek | ld ete |
| Cipher suites TLS_RSA_WITH_3DES_EU TLS_RSA_WITH_AES_128 | DE_CBC_SHA 3_CBC_SHA Del | ld ete |

Router Configurator – Advanced TLS/SSL settings

Below you find a description of all the advanced TLS/SSL settings provided by iQ-ROUTER/PRO/PREMIUM:

General settings

- Private Key File: Enter here the path to the file containing the shared key. Or use the button
 to the right to browse the Windows file system for the file. Depending on the cipher used to
 create the key, the key may or may not be encrypted. If a cipher with encryption is used
 (default) you need to provide the passphrase/password in field "Password". The key file has
 to be stored in PEM format.
- Certificate File: Enter here the path to the file containing the signed certificate to be used to authenticate the SCP side of iQ-ROUTER/PRO/PREMIUM. Or use the button to the right to browse the Windows file system for the file. If the certificate is signed by CA the trusted

certificate of the CA has to be given either within "Trusted certificate files" or installed in the "Trusted certificate directories". The certificate file has to be stored in PEM format.

- **Password**: Enter here the passphrase required to decrypt the shared key. This is only needed if a cipher with key encryption is used.
- **Certificate Verification**: Here, you need to select the mode of verification of the certificate as it is provided by the communication peer. The available modes are:
 - Require: The peer's certificate is required and verified against the shared key. Anonymous requests are refused. The peer's certificate must be installed as trusted certificate.
 - Check (if present): The peer's certificate is not required, i.e. anonymous requests are allowed. If a certificate is provided by the peer it is verified using the shared key. Requests using certificates created using a key other than configured in "Private Key File" or not installed as trusted certificate will be refused.
 - Ignore: Certificates provided by the communication peer are accepted but not validated against the shared key given by "Private Key File". Anonymous requests are allowed.
- Read seed file: The TLS protocol relies on a pseudorandom number generator (PRNG) for the creation of session keys. You can influence the initialization values for the PRNG by providing a read seed file that holds self-generated random data. Alternatively, use the button to the right to browse the Windows file system for the requested file.

In a medical environment, it is a good approach to create the read seed file from a DICOM file (this file should never be made available to a third party). The "openssl.exe" delivered together with iQ-ROUTER/PRO/PREMIUM (default path: C:\Program Files\iQ-ROUTER\openssl) provides a command-line call that allows you to create such a read seed file:

openssl.exe rand -rand image.dcm -out randseed.bin 2048

The command will read a DICOM file named "image.dcm" and create a 2048 byte file named "randseed.bin" that can be used as read seed file.

• Write seed file: If the PRNG was initialized with the help of a read seed file, it is also possible to write the (modified) state of the PRNG back to a write seed file, so that the application will be initialized with different random data. Enter the path to the file into this field or use the button to the right in order to browse to the directory containing this file.

Trusted certificates

 Trusted certificate directory: Enter here the directory containing trusted certificates accepted by iQ-ROUTER/PRO/PREMIUM or use the button to the right to browse to the directory using the Windows file system. Certificates stored in this directory must use the hash value calculated from the certificate as filename.

Use the *Import* button to store certificates correctly within the configured directory.

- Trusted certificate files: Shows the list of currently trusted certificates accepted by iQ-ROUTER/PRO/PREMIUM. Use the *Add* button to add a trusted certificate to the list or select a certificate in the list and use the *Delete* button to remove it.
- Cipher suites: Shows the list of so-called "cipher suites" currently accepted by iQ-ROUTER/PRO/PREMIUM. You can use the *Add* and *Delete* buttons to add or remove cipher suites to/from the list.

A cipher defines the algorithm used for encryption and decryption. Each "cipher suite" defines:

- The algorithm to be used for key exchange of session keys
- The algorithm to be used for bulk data encryption

- The algorithm to be used for secure hash (message digest)

DICOM applications supporting the "Basic TLS Secure Transport Connection Profile" defined in Part 15 of the DICOM standard must alwavs the support TLS_RSA_WITH_3DES_EDE_CBC_SHA "cipher suite" for secure DICOM communication. DICOM applications supporting the "AES TLS Secure Transport Connection Profile" defined in Part 15 of the DICOM standard must always support both of the following "cipher suites" for secure DICOM communication and must preferably select the AES "cipher suite":

- TLS_RSA_WITH_AES_128_CBC_SHA
- TLS_RSA_WITH_3DES_EDE_CBC_SHA

9.1.2.2 Defining compression settings for available transfer syntaxes

In order to speed up the data transfer between different stations or even between different networks (e.g. in tele-radiology scenarios) or in order to provide image data to the destination station in a way that it can handle, iQ-ROUTER/PRO/PREMIUM can compress and decompress image data on-the-fly during a data transmission.

Data compression can be done in a lossless way, maintaining the current quality of the image data while reducing the size of the data, or in a lossy way that may reduce the size of the image data even further but may also affect the quality of the image data.

\triangle WARNING:

Danger of misdiagnosis due to the use of lossy image compression.

Excessive compression levels may cause compression artifacts that might reduce the image quality to non-diagnostic level. These images may therefore no longer be usable for diagnostic purposes!

The user's organization should make sure to use lossy compression only according to local regulatory requirements.

H.-No.: 1.1.5, 1.1.9

△ WARNING

For users under the jurisdiction of the U.S. Food and Drug Administration (FDA)

Danger of misdiagnosis due to lossy image compression in mammography. Currently the FDA does not permit images regenerated from lossy compressed data to be used in the same manner as the original mammogram. As a consequence, mammography images should not be lossy compressed by iQ-ROUTER/PRO/PREMIUM if the images are intended to be reviewed for primary diagnosis or final image interpretation or be stored for retention purposes.

For mammography reading only original (uncompressed) or lossless compressed images must be used to ensure that the images are displayed and processed in FDA approved diagnostic quality.

H.-No.: 1.1.9

The settings on the *Compression settings* page can be used to set the strength of data compression for the different available compression codecs. They will affect the use of the corresponding transfer syntaxes as they are defined for every DICOM modality with which iQ-ROUTER/PRO/PREMIUM communicates.

| Forward rules | AE title mapping | At | tributes | Plugins | License |
|--------------------|----------------------|-----|-------------|---------------|----------------|
| General | Compression settings | | DICOM Modal | ities | Access control |
| PEG | J | 90 | Lossy qua | lity | |
| Advan | ced | 1 | | | |
| PEG 2000 | | 1:1 | Lossy ratio |) | |
| Advand | ced | | | | |
| PEG-LS | | 2 | Near-lossle | ess deviation | |
| Advan | ced | | | | |
| Runtime Length End | oding (RLE) | | | | |
| Advan | ced | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Manual configuration – Compression settings page

iQ-ROUTER/PRO/PREMIUM already comes with default settings for each of the compression codecs. The lossy settings provided in this section will only affect the corresponding lossy transfer syntaxes.

You can alter these settings, if necessary and in accordance with any national guidelines or inhouse procedures, by moving the sliders.

JPEG settings

- Lossy quality: Defines the quality of lossy JPEG compression. A higher value will provide a better image quality, but will result in a bigger file size. A lower value will result in a smaller file size, but a lower image quality.
- **Lossy smoothing**: Defines the smoothing level of lossy JPEG compression. A higher value will apply a higher smoothing ratio.
- **Advanced**: Opens the "Advanced JPEG Settings" dialog allowing to configure advanced behavior for JPEG compression. See section 9.1.2.2.1 for further information.

JPEG 2000 settings

- Lossy ratio: Controls the JPEG 2000 compression. If set to 1, a lossless image compression is used for the "JPEG 2000 (Lossless or Lossy)" transfer syntax. Setting it to a value different than 1, a lossy compression is used for the "JPEG 2000 (Lossless or Lossy)" transfer syntax where the ratio parameter is the estimated compression ratio, e.g. setting the value to 10 will result in an image data compression ratio of 1:10.
- **Advanced**: Opens the "Advanced JPEG 2000 Settings" dialog allowing to configure advanced behavior for JPEG 2000 compression. See section 9.1.2.2.2 for further information.

JPEG-LS settings

- **Near-lossless deviation**: Controls the JPEG-LS compression ratio. A higher value will result in a smaller file size, but in a lower image quality.
- **Advanced**: Opens the "Advanced JPEG-LS Settings" dialog allowing to configure advanced behavior for JPEG-LS compression. See section 9.1.2.2.3 for further information.

Runtime Length Encoding (RLE) settings

• **Advanced**: Opens the "Advanced RLE Settings" dialog allowing to configure advanced behavior for RLE compression. See section 9.1.2.2.4 for further information.

9.1.2.2.1 Advanced JPEG settings

The following advanced settings are available for JPEG compression. Changes in this section should only be made by personnel with advanced knowledge concerning this type of data compression.

Use the *OK* button to save the changes or the *CANCEL* button to ignore the changes made in these advanced settings.

| UID Instance Creation: | Automatic | ~ |
|--|------------------|---|
| | Automatic | |
| Encoding | | |
| JPEG Huffman optimization: | | |
| Predictor-6 Workaround: | | |
| Create Offset Table: | | |
| Secondary Capture: | | |
| Accept Wrong Palette Tags: | | |
| ACR-NEMA Compatibility: | | |
| True Lossless Encoder (lossless only): | | |
| Color conversion: | Lossy YCbCr | ~ |
| Compressed Bits: | Automatic | ~ |
| Subsampling: | 4:4:4 (YBR_FULL) | ~ |
| Fragment Size: | 0 | |
| Selection Value (lossless only): | 6 | |
| Point-Transform | 0 | |
| Decoding | | |
| Color conversion: | Photometric | ~ |
| Planar configuration: | Automatic | ~ |

Advanced JPEG Settings

Common settings

- **UID Instance Creation**: Configures the condition under which a compressed or decompressed image receives a new SOP Instance UID. Possible values are:
 - Automatic: Upon compression, assign a new SOP Instance UID if compression is lossy. Upon decompression never assign a new SOP Instance UID.
 - Always: Always assign a new SOP Instance UID on compression and decompression.
 - Never: Never assign a new SOP Instance UID.

Encoding settings

- JPEG Huffman optimization: If enabled, the Huffman coding optimization will be used for JPEG compression. The Huffman coding scheme reduces the file size by replacing fixed 12bit code by variable 1-16-bit code. The Huffman optimization is a lossless process.
- Predictor-6 Workaround: Enable/Disable workaround for JPEG lossless images with overflow in predictor 6.

- **Create Offset Table**: Choose whether or not to create an offset table for the PixelData (7EE0,0010) items or not.
- Secondary Capture: If enabled, compressed images are automatically converted to Secondary Capture. In addition to the SOP Class UID, all attributes required for a valid Secondary Capture image are added. A new SOP Instance UID is always assigned.
- Accept Wrong Palette Tags: Accept incorrect palette attribute tags (0028,111x) and (0028,121x).
- ACR-NEMA Compatibility: Accept ACR-NEMA images without photometric interpretation.
- True Lossless Encoder (lossless only): Choose whether or not to use a true lossless Encoder.
- **Color conversion**: Choose which color space should be used. Possible values:
 - Lossy YCbCr
 - Lossy RGB
 - Monochrome
- **Compressed Bits**: Sets the rate of compressed bits per sample. Possible values:
 - Automatic
 - Force 8-bits/sample
 - 12-bits/sample (not baseline)
 - 16-bits/sample (lossless only)
- Subsampling: Possible subsampling options are:
 - 4:4:4 (YBR_FULL):

Standard YCbCr component subsampling. This option will disable color component subsampling for compression in the YCbCr color space. The DICOM photometric interpretation is encoded as YBR_FULL.

- 4:2:2 (YBR_422): 4:2:2 subsampling with YBR_FULL_422. This option enables a 4:2:2 color component subsampling for compression in the YCbCr color space. The DICOM photometric interpretation is encoded as YBR_FULL.
- 4:2:2 Non-Standard (YBR_FULL): Non-standard YCbCr component subsampling. This option enables a 4:2:2 color component subsampling for compression in the YCbCr color space. The DICOM photometric interpretation is encoded as YBR_FULL which violates DICOM rules.
- 4:1:1 Non-Standard (YBR_FULL): Non-standard YCbCr component subsampling. This option enables a 4:1:1 color component subsampling for compression in the YCbCr color space. The DICOM photometric interpretation is encoded as YBR_FULL which violates DICOM rules.
- 4:1:1 Non-Standard (YBR_FULL_422): Non-standard YCbCr component subsampling. The option enables 4:1:1 color component subsampling for compression in the YCbCr color space. The DICOM photometric interpretation is encoded as YBR_FULL which violates DICOM rules.
- **Fragment Size**: Limits the fragment size (in KB) which may cause the creation of multiple fragments per frame.
- Selection Value (lossless only) : Sets the selection value for lossless JPEG.
- **Point-Transform**: Selects the point-transform for lossless JPEG.

NOTICE:

Using this option with a value other than 0 causes a loss of precision i.e. makes the compression lossy.

Decoding settings

- **Color conversion**: Compression color space conversion. Possible values are:
 - Photometric: If the compressed image uses YBR_FULL or YBR_442 photometric interpretation, it is converted to RGB during decompression.
 - Lossy only: If the compressed image is encoded in JPEG lossy, this value assumes the YCbCr color model and converts it to RGB.
 - Always: If the compressed image is a color image, this value assumes thr YCbCr color model and converts it to RGB.
 - Never: This value never converts the color space during decompression.
 - Guess (lossy only): If the compressed image is encoded in JPEG lossy and the underlying JPEG library "guesses" the color space to be YCbCr, this value converts it to RGB.
 - Guess: If the underlying JPEG library "guesses" the color space of the compressed image to be YCbCr, this value converts it to RGB.
- Planar configuration: Describes how the decoder should handle planar configuration of decompressed color images. Possible values are:
 - Automatic: Automatically determines whether color-by-plane is required from the SOP Class UID and decompressed photometric interpretation.
 - Color by pixel: Always creates color-by-pixel planar configuration.
 - Color by plane: Always creates color-by-plane configuration.

9.1.2.2.2 Advanced JPEG 2000 settings

The following advanced settings are available for JPEG 2000 compression. Changes in this section should only be made by personnel with advanced knowledge concerning this type of data compression.

Use the *OK* button to save the changes or the *CANCEL* button to ignore the changes made in these advanced settings.

| Advanced JPEG 2000 Settings | × |
|-----------------------------|------------------------|
| Common | |
| UID Instance Creation: | Automatic \checkmark |
| Encoding | |
| Secondary Capture: | |
| Create Offset Table: | |
| Fragment Size: | 0 |
| Decoding | |
| Ignore Offset Table: | |
| ОК | CANCEL |

Advanced JPEG 2000 Settings

Common settings

- **UID Instance Creation**: Can be used to configure the condition under which a compressed or decompressed image receives a new SOP Instance UID. Possible values are:
 - Automatic: Upon compression, this value assigns a new SOP Instance UID if compression is lossy. Upon decompression never assign a new SOP Instance UID.
 - Always: This value always assigns a new SOP Instance UID on compression and decompression.
 - Never: This value never assigns a new SOP Instance UID.

Encoding settings

- Secondary Capture: If enabled, compressed images are automatically converted to Secondary Capture. In addition to the SOP Class UID, all attributes required for a valid Secondary Capture image are added. A new SOP Instance UID is always assigned.
- Create Offset Table: Defines whether or not to create an offset table for the PixelData (7EE0,0010) items.
- **Fragment Size**: Limits the fragment size (in KB) which may cause the creation of multiple fragments per frame.

Decoding settings

• **Ignore Offset Table**: Defines whether or not the offset table should be ignored when decompressing multi-frame images.

9.1.2.2.3 Advanced JPEG-LS settings

The following advanced settings are available for JPEG-LS compression. Changes in this section should only be made by personnel with advanced knowledge concerning this type of data compression.

Use the *OK* button to save the changes or the *CANCEL* button to ignore the changes made in these advanced settings.

| Advanced JPEG-LS Settings | × |
|------------------------------|-----------------------------|
| Common | |
| UID Instance Creation: | Automatic \checkmark |
| Encoding | |
| Options enabled: | |
| Option T1: | 3 |
| Option T2: | 7 |
| Option T3: | 21 |
| Option RESET: | 64 |
| Option LIMIT: | 0 |
| Prefer cooked encoding mode: | |
| Secondary Capture: | |
| Create Offset Table: | |
| Fragment Size: | 0 |
| Interleave Mode: | Line (color-by-line) \sim |
| Decoding | |
| Ignore Offset Table: | |
| Planar configuration: | Restore \checkmark |
| ОК | CANCEL |

Advanced JPEG-LS settings

Common settings

- **UID Instance Creation**: Configures the condition under which a compressed or decompressed image receives a new SOP Instance UID. Possible values are:
 - Automatic: Upon compression, this value assigns a new SOP Instance UID if the compression is lossy. Upon decompression it never assigns a new SOP Instance UID.
 - Always: This value always assigns a new SOP Instance UID on compression and decompression.
 - Never: This value never assigns a new SOP Instance UID.

Encoding settings

- **Options enabled**: Enables/Disables the five JPEG-LS compression options described below.
 - Option T1: Sets the JPEG-LS encoding parameter threshold 1.
 - Option T2: Sets the JPEG-LS encoding parameter threshold 2.
 - Option T3: Sets the JPEG-LS encoding parameter threshold 3.
 - Option RESET: Sets the JPEG-LS encoding parameter reset.
 - Option LIMIT: Sets the JPEG-LS encoding parameter limit.

- Prefer cooked encoding mode: If enabled, the "cooked" lossless encoder should be preferred over the "raw" one.
- Secondary Capture: If enabled, compressed images are automatically converted to Secondary Capture. In addition to the SOP Class UID, all attributes required for a valid Secondary Capture image are added. A new SOP Instance UID is always assigned.
- **Create Offset Table**: Defines whether or not to create an offset table for the PixelData (7EE0,0010) items or not.
- **Fragment Size**: Limits the fragment size (in KB) which may cause the creation of multiple fragments per frame.
- **Interleave Mode**: Describes which interleave mode the JPEG-LS data stream should use. Possible values are:
 - Automatic: This value uses the same interleave mode as the DICOM attribute says in Planar Configuration. Note: The cooked encoder will force "Line".
 - Sample (color by pixel): Sample-interleaved.
 - Line (color by line): Line-interleaved (best performance).
 - None (color by plane): Un-interleaved.

Decoding settings

- **Ignore Offset Table**: Defines whether or not to ignore the offset table when decompressing multi-frame images.
- Planar configuration: Describes how the decoder should handle planar configuration of decompressed color images. Possible values are:
 - Automatic: Automatically determines whether or not color-by-plane is required from the SOP Class UID and decompressed photometric interpretation.
 - Color by pixel: Always creates color-by-pixel planar configuration.
 - Color by plane: Always creates color-by-plane configuration.

9.1.2.2.4 Advanced RLE settings

The following advanced settings are available for RLE compression. Changes in this section should only be made by personnel with advanced knowledge concerning this type of data compression.

Use the *OK* button to save the changes or the *CANCEL* button to ignore the changes made in these advanced settings.

| Advanced RLE Settings | × |
|-----------------------------------|--------|
| Common | |
| Creation Instance UID: | |
| Encoding | |
| Secondary Capture: | |
| Create Offset Table: | |
| Fragment Size: | 0 |
| Decoding | |
| Reverse Decompression Byte Order: | |
| ОК | CANCEL |

Advanced RLE settings

Common settings

• **Creation Instance UID**: Choose whether or not a new SOP Instance UID should be assigned upon compression and decompression.

Encoding settings

- Secondary Capture: If enabled, compressed images are automatically converted to Secondary Capture. In addition to the SOP Class UID, all attributes required for a valid Secondary Capture image are added. A new SOP Instance UID is always assigned.
- **Create Offset Table**: Defines whether or not to create an offset table for the PixelData (7EE0,0010) items.
- **Fragment Size**: Limits the fragment size (in KB) which may cause the creation of multiple fragments per frame.

Decoding settings

 Reverse Decompression Byte Order: Choose whether or not the byte order should be reversed upon decompression. This is needed to correctly decode some incorrectly encoded images with more than one byte per sample.

9.1.2.3 Managing DICOM modalities as communication partners

The *DICOM Modalities* page allows to configure all modalities that are supposed to use a data transmission through iQ-ROUTER/PRO/PREMIUM in order to provide image data at a specified destination. Unless you are using the cloud mode, all modalities (receiver and sender) and their network configuration must be known to iQ-ROUTER/PRO/PREMIUM in order to facilitate a communication between them.

| Forward rules | AEt | AE title mapping Compression settings | | Attributes | | | ins | License |
|-----------------------|--------|--|-------|------------------|------|------------|-----------|---------------|
| General | Compre | | | DICOM Modalities | | Access con | | ccess control |
| Name | AET | îtle | Hostr | name | Port | Prefe | erred TS | |
| CT Radiology | CTR | AD001 | 192. | 168.110.100 | 104 | Little | Endian B | Explicit |
| PACS Hospital | PAC | S | 192. | 168.110.102 | 5678 | JPEC | G 2000 (L | ossless only) |
| Workstation Radiology | y WSF | RAD001 | 192. | 168.110.101 | 1234 | JPEC | G-LS Los | sless |
| Workstation Reading | WSF | READ001 | 192. | 168.110.103 | 104 | JPEC | G-LS Los | sless |
| | | | | | | | | |
| | | | | | | | | |
| | | | | A | dd | E | Edit | Delete |

Manual configuration – DICOM Modalities page

You can *Add*, *Edit* and *Delete* modalities with the help of the respective buttons underneath the table or with the shortcut menu available on right-click into the table. Furthermore, the shortcut menu allows to send a network ping or a DICOM echo to the chosen modality to test the communication.

Click into a column header in order to sort the table according to the selected item, e.g. "Name" or "AE Title".

Adding or editing a modality opens the "Add/Edit a modality" dialog where you are supposed to enter the details necessary for a successful communication on network and DICOM level.

| 10014 | | | 1 |
|---------------------------------------|------------------------|---------------------------------------|---|
| Name | CT Radiology | | |
| AE title | CTRAD001 | |] |
| Peer | ○ Hostname | | |
| | • IP Address | 192 . 168 . 110 . 100 |] |
| Port | 104 | | |
| Enable transfer syntax conversion | \checkmark | | |
| Preferred transfer syntax | Little Endian Explicit | · · · · · · · · · · · · · · · · · · · |] |
| Deflated syntax for non-image objects | | | |
| LS/SSL | | | |
| Secure connection | | | |
| Anonymous | | | |
| Private Key File | | | |
| Certificate File | | | |
| Password | | | |
| Certificate Verification: | Require | V | |

Add/Edit a modality dialog

DICOM settings

- Name: Enter here a logical (human-readable) name that easily identifies the modality that you are about to configure. This name will only be used for display purposes inside of iQ-ROUTER/PRO/PREMIUM.
- **AE title**: This field requires you to enter the actual Application Entity Title of the modality as it is provided during DICOM communication.
- Peer: Configure here either the hostname or the IP address of the modality. If no fixed IP address is given to the station, the hostname should be used to avoid reconfiguration. The use of a hostname, however, requires that it can successfully be resolved to the current IP address.
- **Port**: Enter here the TCP port on which the modality listens and receives or sends data.
- Enable transfer syntax conversion: Check this box to enable the transfer syntax conversion. You can then define the transfer syntax into which iQ-ROUTER/PRO/PREMIUM shall convert the data before sending them to the target station. If disabled, DICOM data will be routed or forwarded with the same compression in which the data is received.
- Preferred transfer syntax: Choose the preferred transfer syntax in which the modality shall receive DICOM image objects. iQ-ROUTER/PRO/PREMIUM will convert all objects before transferring them to the modality. The supported transfer syntaxes are:
 - Little Endian Explicit
 - Little Endian Implicit

- Big Endian Explicit
- JPEG Lossless, Non-hierarchical, 1st Order Prediction
- JPEG Baseline
- JPEG Extended, Process 2+4
- RLE Lossless
- JPEG-LS Lossless
- JPEG-LS Lossy (Near-lossless)
- Deflated Explicit VR Little Endian
- JPEG 2000 (Lossless only)
- JPEG 2000 (Lossless or Lossy)

Non-image objects (e.g. structured reports or embedded PDF) will not be affected. Refer to "Deflated syntax for non-image objects" for more information.

NOTICE:

When it is not possible to convert DICOM objects to the configured transfer syntax, they will be transferred using their original transfer syntax instead.

 Deflated syntax for non-image objects: If enabled, a zip-based compression is offered to the modality for all non-image objects. If the modality does not support the deflated syntax, the objects will be sent in an uncompressed way.

TLS/SSL settings

NOTICE:

For a step-by-step guide about the configuration of SSL communication, refer to 9.4.

- **Secure connection**: Choose whether or not the connection between iQ-ROUTER/PRO/ PREMIUM and the modality should be a secure (encrypted) connection.
- **Anonymous**: If a secure connection shall be used, choose here whether or not such a connection should use an anonymous authentication or a certificate-based authentication.

NOTICE:

When the modality requires a certificate-based authentication the communication using an anonymous authentication will fail.

The following fields must only be considered when the option for a secure connection is enabled:

 Private Key File: Provide here the path to the file containing the shared key. You may use the button to the right of the edit field in order to browse the Windows file system for the required file.

Depending on the cipher used to create the key, the key may or may not be encrypted. If a cipher with encryption is used (default) the passphrase/password has to be given in the "Password" field. The key file has to be stored in PEM format.

 Certificate File: Provide here the path to the file containing the signed certificate to be used to authenticate the SCP side of iQ-ROUTER/PRO/PREMIUM. Alternatively, use the button to the right to browse to the respective file. If the certificate is signed by CA, the trusted certificate of the CA has to be given either within the "Trusted certificate files" or installed in the "Trusted certificate directories". The certificate file has to be stored in PEM format.

- **Password**: Enter here the passphrase that is required to decrypt the shared key (only needed if a cipher with key encryption is used).
- **Certificate Verification**: Finally, select the mode of verification of the certificate provided by the modality. Possible values are:
 - Require: The peer's certificate is required and verified against the shared key. Anonymous requests are refused. The peer's certificate has to be installed as trusted certificate.
 - Check (if present): The peer's certificate is not required, e.g. anonymous requests are allowed. If a certificate is provided by the peer it is verified using the shared key. Requests using certificates created using a different key than configured in "Private Key File" or not installed as trusted certificate will be refused.
 - Ignore: Certificates provided by the modality are accepted but not validated against the shared key given by "Private Key File". Anonymous requests are allowed.

Use the *OK* button to save the configuration and add the new modality to the list of communication partners. Click *Cancel* to discard the configuration.

Use the *Ping* button to test the connection between the iQ-ROUTER/PRO/PREMIUM station and the currently configured modality.

9.1.2.4 Limiting the access to specific DICOM modalities

The *Access control* page allows fine-grained control about which of the configured modalities are allowed to communicate with each other.

By default, all connections between all modalities are allowed. But in some cases it may be necessary to limit the number of communication partners, for instance in networks that connect different institutions with each other and where the modalities of one institution are not supposed to send data to the stations of another institution.

The *Access control* page lets you reduce the number of modalities from which a specific station can receive data. It does not define where a station can send data to.

| Forward rules | AE title mapping | Attributes | Plugins | License |
|--------------------------------------|----------------------|--------------------|--------------|----------------|
| General | Compression settings | DICOM Modalit | ies | Access control |
| Modalities | | | | |
| CT Radiology Workstation Radiolog | v | Alias: | CT Radiolog | JY |
| PACS Hospital | , | AE Title: | CTRAD001 | |
| Workstation heading | | Hostname/IP: | 192.168.11 | 0.100 |
| | | Allow all: | \checkmark | |
| | | | | |
| | | | | |
| | | | | |
| Access Control | | | | |
| Modalities available | | Modalities allowed | 1 | |
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Manual configuration – Access control page

In order to limit the number of allowed communication partners for a specific modality, follow the instructions below:

- In the section "Modalities" you find a list of all currently configured modalities. Select the one, for which you want to define the allowed communication partners.
- To the right, you find the main communication details of the selected modality. First of all, uncheck the "Allow all" checkbox. At this point, the modality would not be allowed to receive data from any of the other stations.
- At the same time, the "Modalities available" list in the "Access control" section will show all modalities currently known to iQ-ROUTER/PRO/PREMIUM. The "Modalities allowed" list is empty.
- Now select all those modalities from the "Modalities available" list that the chosen modality shall be allowed to communicate with and use the ">>" button to move them to the "Modalities allowed" list.
- Use the "<<" button if you want to remove a modality from the "Modality allowed" list.

NOTICE:

The modality selected in the "Modalities" list represents the receiver of data (SCP) and the modalities in the "Modalities allowed" represent the senders of data to that modality (SCUs).

9.1.2.5 Configuring forward rules for image transmissions to particular DICOM modalities

The *Forward rules* page allows to set up a flexible forwarding/image distribution system. Image forwarding based on defined rules makes it possible to provide data to specific stations at specific times under specific conditions. Thus, you are able to manage scenarios such as the following:

- Images of one type (e.g. CT or MR) can be sent to one station for diagnosis while different image type (e.g. MG) is sent to another dedicated station.
- Image data is sent to a different destination during night shift or on the weekends.
- Images coming from a particular institution is sent to a specific reading radiologist, while images from another institution are provided to another.

| Gener | al | Compression settings AE title mapping | | DICOM | A | Access control | | |
|---------|-------------|--|-----------|-----------------|-------------|----------------|--------|--|
| Forward | d rules | | | Attributes | P | Plugins | | |
| ✓ Ena | ble Forward | ding (Image Distril | bution) | | | | | |
| Status | Descriptio | n | Туре | | Destination | n | | |
| - | Workstat | ion (night shift) | With cond | With conditions | | WSRAD001 | | |
| | | | | | | | | |
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| | Settings | | | Add | 6 | Edit | Delete | |
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Manual configuration – Forward rules page
To globally enable or disable the forwarding functionality, use the "Enable Forwarding (Image Distribution)" checkbox at the top of the *Forward rules* page.

The forwarding system itself consists of a configurable set of rules. Each rule defines which incoming data shall be forwarded to which destination. A list of all configured rules is shown in the table underneath the checkbox.

Use the checkbox in front of each individual rule (in the "Status" column) to enable or disable its use.

Rules can be added, edited or deleted either by using the respective button underneath the table or by using the shortcut menu (right-click into the table).

The *Settings* button underneath the table allows you to set particular global options for the forwarding feature. Refer to section 9.1.2.5.1 for further information.

9.1.2.5.1 Defining global forward settings

Clicking the *Settings* button in the *Forward Rules* dialog will give access to some global forwarding options that will be applied to all active forward rules. For each of the option a default parameter is already given.

| Forward Settings | × |
|--|---------------------|
| Asynchronous (parallel) forwards: Number of forward tries: Waittime before retry (seconds): Forward cache folder: | 3 180 forward |
| | Ok Cancel |



You have the possibility to provide the following settings.

- **Asynchronous (parallel) forwards**: If enabled, multiple forward jobs are processed in parallel. If disabled, the forward jobs are processed sequentially.
- Number of forward tries: Defines the total number of times that iQ-ROUTER/PRO/ PREMIUM will try to deliver the object(s). If the number of tries is reached without a successful transfer to the destination modality, the data will be deleted from the local cache.
- Waittime before retry (seconds): Specifies the time (in seconds) that iQ-ROUTER/PRO/ PREMIUM will wait between retries to deliver the DICOM object(s).
- Forward cache folder: Specifies the path to the directory where iQ-ROUTER/PRO/PREMIUM will (temporarily) store DICOM objects for image distribution.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

9.1.2.5.2 Adding or editing forward rules

A forward rule consists of a few general settings and – optionally – a number of conditions. The conditions provide different filters that define whether or not a forward rule shall be used for incoming DICOM data.

| Enabled: | | | ✓ | | |
|--------------|----------------------------|---------------------------|-----------|------|--------|
| Description: | | Workstation (night shift) | | | |
| Туре: | | With conditions | | | |
| Destin | Destination: Workstation R | | Radiology | ~ | |
| onditio | n(s) | | | | |
| # | Туре | Pattern | | | |
| 1 | Source AE | SourceAE | = CTRAD* | | |
| 2 Time span | | 22:00:00 | - 6:59:59 | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | Add | Edit | Delete |

Add/Edit Forward Rules

Provide the following parameters in order to configure a functional forward rule:

- **Enabled**: Decide here whether this particular forward rule shall actually be used or not by checking or unchecking the checkbox.
- Description: Enter a logical (human readable) description that lets you easily identify the meaning of the rule. It will later be shown in the table of the *Forward rules* tab page and lets you distinguish one rule from another.
- **Type**: Here, you decide when this particular rule is supposed to be used. Currently, two types of forward rules are supported:
 - *Always*: The forward rule is always executed independent of the incoming DICOM data.
 - *With conditions*: A set of conditions decides whether or not incoming DICOM data shall be forwarded.
- **Destination**: Provide here to which destination AE title the data shall be forwarded.

If the "Type" of the forward rule is "With conditions", it is possible to add one or multiple conditions below the general settings.

The "Condition(s)" table displays all conditions that have already been configured for the respective forward rule.

Use the respective button underneath the table if you want to add a new condition, to edit or to delete an already existing condition. Alternatively, you can use the shortcut menu (right-click into the table) to access these options.

If more than one condition is defined for the forward rule, you need to choose if only one of them must apply in order to use the rule or if all of them must apply. To do so, use the "Condition logic" drop-down menu underneath the table. Two options are possible:

- AND: All conditions must be met in order to forward the incoming DICOM data according to the rule.
- OR: At least one condition must be met in order to forward the incoming DICOM data according to the rule.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

9.1.2.5.3 Adding or editing forward rule conditions

This section explains how you can define specific conditions under which a forward rule shall take effect.

| Add/Edit Forward Rule Condit | tion | × |
|------------------------------|-----------|--------|
| Туре | Time span | \sim |
| Condition is true | | |
| From (0-23) | 22 | |
| To (0-23) | 6 | |
| O | k Cancel | |

Add/Edit Forward Rule Condition

Conditions of the following types can be created:

- Source AE
- Destination AE
- Time span
- Day of the week
- DICOM tag exists
- DICOM tag value matches

Additionally, it is possible to configure for each condition whether or not it is expected to be true or false using the "Condition is true" checkbox.

Depending on the selected type, the other configuration options differ. In the following you will find descriptions of all available settings for each of the condition types.

Source AE

Use the type "Source AE" if you want to apply a specific forward rule only if the data is received from a particular modality.

| Add/Edit Forward Rule Condition | × |
|--------------------------------------|---------------|
| Туре | Source AE 🗸 🗸 |
| Condition is true | |
| Source AE Title (supports wildcards) | CTRAD* |
| Field not used | |
| Ok | Cancel |

Source AE condition

By using the "Source AE Title (supports wildcards)" edit field, you may configure an AE title (AET) that either fully matches the one from a sending modality or you can use wildcards ("*") to match multiple AETs at once (e.g. if the AET of all CTs starts with "CTRAD" and is suffixed with a unique number, you may set up the condition using "CTRAD*" to match all CTs).

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

Destination AE

Use the type "Destination AE" if you want to apply a specific forward rule only if the data is supposed to be sent to a particular destination.

| Add/Edit Forward Rule Condition | × |
|---|------------------------|
| Type Condition is true Destination AE Title (supports Field not used | Destination AE V PACS |
| Ok | Cancel |

Destination AE condition

By using the "Destination AE Title (supports wildcards)" edit field, you may configure an AE title (AET) that either fully matches the one from a sending modality or you can use wildcards ("*") to match multiple AETs at once.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

<u>Time span</u>

Use the type "Destination AE" if you want to apply a specific forward rule only if the data is received during a specific time span. Whether or not the selected time span matches is based on the system date of the server on which iQ-ROUTER/PRO/PREMIUM is run.

| Add/Edit Forward Rule Condition | n X |
|---------------------------------|-------------|
| Туре | Time span V |
| Condition is true | |
| From (0-23) | 22 |
| To (0-23) | 6 |
| Ok | Cancel |

Time span condition

Use the "From (0-23)" and "To (0-23)" edit fields to specify the time span during which the forward rule shall be executed. A 24 hour-schedule is used. Times from 0 to 11, therefore, apply to a.m. times, while times from 12 to 23 refer to p.m. times. The condition will match if DICOM data is received during this time span.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

Day of the week

Use the type "Day of the week" if you want to apply a specific forward rule only if the data is received on specific days of the week, e.g. over the weekend. Whether or not the selected time span matches is based on the system date of the server on which iQ-ROUTER/PRO/PREMIUM is run.

| Туре | Day of the week | ~ |
|-------------------------|-----------------|---|
| Condition is true | \checkmark | |
| Day of the week - Start | Saturday | ~ |
| Day of the week - End | Sunday | ~ |

Day of the week condition

Use the "Day of the week – Start" and "Day of the week – End" drop-down menus to select the weekday(s) on which the forward rule shall apply. You can either select only one day by choosing the same weekday for start and end or a range of successive weekdays. The condition will match if DICOM data is received during this range.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

DICOM tag exists

Use the type "DICOM tag exists" if you want to apply a specific forward rule only if a specific DICOM tag exists in the data that is received.

| Add/Edit Forward Rule Condition | × |
|--|-------------------------------|
| Type Condition is true DICOM Tag (Format: gggg,eeee) Field not used | DICOM tag exists V 0010,0010 |
| Ok | Cancel |

DICOM tag exists condition

Use the "DICOM Tag (Format: gggg,eeee)" edit field to specify the DICOM tag that iQ-ROUTER/PRO/PREMIUM must look for. The condition will match if the DICOM data received contains this particular tag.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

DICOM tag value matches

Use the type "DICOM tag value matches" if you want to apply a specific forward rule only if a specific DICOM tag exists and contains the defined value.

| ad/Ealt Forward Rule Condition | · |
|------------------------------------|--------------------------------|
| Туре | DICOM tag value matches \sim |
| Condition is true | |
| DICOM Tag (Format: gggg,eeee) | 0008,0080 |
| Compare value (supports wildcards) | IMAGE* |
| Ok | Crewl |

DICOM tag value matches condition

Use the "DICOM Tag (Format: gggg,eeee)" edit field to first specify the DICOM tag that iQ-ROUTER/PRO/PREMIUM shall look for. Afterwards, define in the "Compare value (supports wildcards)" edit field which value the router shall expect in this particular DICOM tag. You can either define the exact value or use wildcards ("*") to define strings that must be part of the actual value. The condition will match if DICOM data is received that contains the tag with the given value.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

9.1.2.6 Using AE title mapping

The *AE title mapping* page provides a mapping mechanism for the AE title of sending modalities.

AE title mapping means that the actual AE title of the sending modality is replaced by a different AE title when iQ-ROUTER/PRO/PREMIUM communicates a requested DICOM transfer from this modality to a destination. The destination station will only know the mapped AE title.

AE title mapping may be helpful, for instance, when the AE title of a DICOM station, which is not only configured in iQ-ROUTER/PRO/PREMIUM but also in all connected modalities, changes. Instead of having to modify the configuration of every single modality, you can simply map the old AE title to the new one within iQ-ROUTER/PRO/PREMIUM. Let's say, the archive is migrated to a new system, which receives a new AE title in order to facilitate the simultaneous use of both the old and the new PACS server while the migration is still in progress. After the migration is completed, the old PACS server is removed and the new server will keep its new AE title and all modalities will have to know this new AE title for a successful image transfer.

| General | Compression | n settings | DICOM Moda | alities | Access control |
|-------------------|-------------|-------------|--------------|---------|----------------|
| Forward rules | AE title r | mapping | g Attributes | | License |
| Enable AE title m | apping | | | | |
| ncoming AE Title | | Outgoing AE | Title | | |
| CTRAD001 | | HOSP_CTR | AD001 | | |
| PACS | | NEW_PACS | | | |
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Manual configuration – AE title mapping page

In order to globally enable or disable the AE title mapping, use the "Enable AE title mapping" checkbox at the top of the *Forward rules* page.

The table underneath the checkbox lists all mapping entries that are currently configured in the system.

Mapping entries can be added, edited or deleted either by using the respective button underneath the table or by using the shortcut menu (right-click into the table).

Click into a column header in order to sort the table according to the incoming or outgoing AE title.

Adding or editing a mapping entry only consists of two steps:

1. Select the "Incoming 'calling' AE title" from the drop-down menu. It contains all configured DICOM modalities for which no AE title mapping exists yet.

2. Enter the AE title that shall be used instead of the original one in the "Mapped to (Outgoing 'calling' AE)" edit field.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

| Add/Edit AE mapping entry | | × |
|--|---------------------------|---|
| Incoming 'calling' AE title Mapped to (Outgoing 'calling' AE) | CTRAD001 HOSP_CTRAD001 | ~ |
| Ok | Cancel | |

Add/Edit AE mapping entry

9.1.2.7 Applying attribute manipulation to transferred datasets

The *Attributes* page allows to configure a set of rules to automatically adjust incoming DICOM date e.g. to match external to internal identifiers or to mark external data as such in order to distinguish it from image data that was acquired in-house.

△ WARNING:

Danger of deletion or modification of crucial data due to dataset manipulations. Dataset manipulations using the "Attributes" module and its actions may delete or modify crucial data within a dataset. In addition, actions may lead to datasets that are no longer compliant with the DICOM standard. iQ-ROUTER/PRO/PREMIUM does not verify the changes resulting from such a defined action

and does not verify if an action violates the DICOM standard in any way. The user is responsible for the configuration of the attribute manipulation and the changes made to a dataset.

H.-No.: 1.1.4, 1.1.5, 1.1.6, 1.2.3, 1.2.4

| Ger | neral | Con | npression settings | DICOM Mod | alities | Access contro |
|--------------------------------|-----------------|------------|-----------------------|----------------------|------------|---------------|
| Forward rules AE title mapping | | Attributes | Plugins | License | | |
| ✔ E | nable Attribute | Rules | | | | |
| # | Name | | Description | | Conditions | Actions |
| 1 | Patient ID F | Prefix | Set Patient ID prefix | for external studies | 1 | 1 |
| 2 | Convert to | UTF-8 | Convert dataset to | Unicode | 1 | 1 |
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| Te | est rules | | | Add | Edit | Delete |
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Manual configuration – Attributes page

In order to globally enable or disable the option to modify transmitted DICOM datasets, use the "Enable Attribute Rules" checkbox at the top of the *Attributes* page.

The table underneath the checkbox lists all attribute rules that are currently configured in the system.

Attribute rules can be added, edited or deleted either by using the respective button underneath the table or by using the shortcut menu (right-click into the table).

Use the *Test rules* button to verify if the configured attribute rules will work according to your expectations. This test can be done from within the Router Configuration. Refer to section 9.1.2.7.2 for details on how to run such tests.

9.1.2.7.1 Adding or editing an attribute rule

An attribute rule consists of a few general settings and – optionally – one or more conditions with one or multiple actions for each. The conditions provide different filters that define whether or not an attribute rule shall be applied to incoming DICOM data. The actions, however, specify how the condition-matching DICOM data is modified before it is transmitted to the destination.

| Name: | Patient ID Prefix | | |
|--------------|--|--------|--|
| Description: | Set Patient ID prefix for external studies | | |
| Condition(s) | | | |
| # | Description | Add | |
| 1 | Sender is external PACS | Edit | |
| | | Delete | |
| | | Logic: | |
| | | AND | |
| Action(s) | | | |
| # | Description | Add | |
| 1 | Set prefix to Patient ID | Edit | |
| | | Delete | |
| | | Up | |
| | | Down | |

Add/Edit an attribute rule

The configuration of every attribute rule starts with identifying information.

- **Name**: Enter a logical (human readable) name for the rule.
- Description: Enter a logical (human readable) description that lets you easily identify the meaning of the rule. It will later be shown in the table of the *Forward rules* tab page and lets you distinguish one rule from another.

These details will later be shown in the table of the *Attributes* tab page and let you distinguish one rule from another.

Afterwards, you can define the condition(s) and actions associated with every rule. Conditions define whether or not the data manipulation actions shall be applied to incoming DICOM data

while the actions define how the DICOM data shall actually be adjusted. If no condition is defined, all actions are applied to all incoming DICOM data.

The "Condition(s)" and "Action(s)" tables show the currently configured conditions or actions respectively.

Conditions

Use the respective button next to the "Condition(s)" table if you want to add a new condition, to edit or to delete an already existing condition. Alternatively, you can use the shortcut menu (right-click into the table) to access these options.

If more than one condition is defined for the attribute rule, you need to choose if only one of them must apply in order to use the rule or if all of them must apply. To do so, use the "Logic" drop-down menu next to the table. Two options are possible:

- **AND**: All conditions must be met in order to apply the actions to incoming DICOM data.
- **OR**: At least one condition must be met in order to apply the actions to incoming DICOM data.

<u>Actions</u>

Use the respective button next to the "Action(s)" table if you want to add a new action, to edit or to delete an already existing action. Alternatively, you can use the shortcut menu (right-click into the table) to access these options.

If more than one action is defined for the attribute rule, you need to choose in which order the actions are performed. Use the *Up* and *Down* buttons next to the table to change the action order. Actions are always processed from top to bottom. Defining the order is necessary if multiple actions depend on each other or if an action would overwrite changes made by a previous action.

9.1.2.7.1.1 Adding or editing an attribute condition

| tribute Condition | | |
|--|--------------|------|
| Туре | Sending AE | ~ |
| Description | | |
| Condition is true | \checkmark | |
| Use regular expression (not wildcard matching) | | |
| Pattern (for comparison) | EXT_PACS | Test |
| Attribute tag (gggg,eeee) | | |
| In sequence | | |

This section explains how you can define specific conditions under which an attribute rule shall take effect.

Attribute Condition dialog

Cancel

1

Ok

Conditions of the following types can be created:

Sequence item (1 to 999)

- Tag exists
- Tag matches
- Sending AE
- Receiving AE

After selecting the condition type, continue with the following parameters in order to configure an attribute condition:

- Description: Enter a logical (human readable) description that lets you easily identify the meaning of the condition. It will later be shown in the "Condition(s)" table of the *Attributes* tab page and lets you distinguish one condition from another.
- **Condition is true**: Decide here whether the condition is expected to be true or false.

Depending on the selected type, the other configuration options differ. In the following you will find descriptions of all available settings for each of the condition types.

Tag exists

Use the type "Tag exists" if you want to apply the attribute rule only if a specific DICOM tag exists in the data that is received.

| Attribute Condition | × |
|--|-------------------------|
| Туре | Tag exists \checkmark |
| Description | Patient ID exists |
| Condition is true | |
| Use regular expression (not wildcard matching) | |
| Pattern (for comparison) | Test |
| Attribute tag (gggg,eeee) | 0010 0020 PatientID |
| In sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| Ok | Cancel |

Tag exists condition

Use the "Attribute tag (gggg,eeee)" edit field to specify the DICOM tag that iQ-ROUTER/PRO/PREMIUM must look for. The condition will match if the DICOM data received contains this particular tag.

The "In sequence" checkbox must be used in case the DICOM tag in question is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

Tag matches

Use the type "Tag matches" if you want to apply the attribute rule only if a specific DICOM tag exists and contains the defined value.

| Attribute Condition | × |
|--|--|
| - | |
| Type | Tag matches V |
| Description | Institution Name matches external hospital |
| Condition is true | \checkmark |
| Use regular expression (not wildcard matching) | |
| Pattern (for comparison) | External Hospital Test |
| Attribute tag (gggg,eeee) | 0008 0080 InstitutionName |
| In sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| | |
| Ok | Cancel |

Tag matches condition

For this type of condition, you not only need to specify the DICOM tag that iQ-ROUTER/PRO/ PREMIUM must look for but also the value (= pattern) that shall be expected in this tag.

- Use regular expression (not wildcard matching): If enabled, the option allows you to use a regular expression for the "Pattern (for comparison)". If disabled, you can use wildcard matching instead. For further information about regular expressions and wildcard matching, refer to section 9.1.2.8.
- Pattern (for comparison): The value that is used to compare against the value of incoming DICOM data. This can either be a regular expression, if the checkbox "Use regular expression (not wildcard matching)" is checked, or a string that can contain wildcards.

Use the *Test* button to verify the functioning of your pattern configuration.

Use the "Attribute tag (gggg,eeee)" edit field to specify the DICOM tag that iQ-ROUTER/PRO/PREMIUM must look for. The condition will match if the DICOM data received contains this particular tag.

The "In sequence" checkbox must be used in case the DICOM tag in question is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

Sending AE

Use the type "Sending AE" if you want to apply the attribute rule only if the data is received from a particular modality.

| Attribute Condition | × |
|--|--|
| | |
| Туре | Sending AE V |
| Description | Sender is any CT in Radiology department |
| Condition is true | |
| Use regular expression (not wildcard matching) | |
| Pattern (for comparison) | CTRAD* Test |
| Attribute tag (gggg,eeee) | |
| In sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| | |
| Ok | Cancel |

Sending AE condition

For this type of condition, you need to specify the sending station's AE title that iQ-ROUTER/PRO/ PREMIUM must look for.

- Use regular expression (not wildcard matching): If enabled, the option allows you to use a regular expression for the "Pattern (for comparison)". If disabled, you can use wildcard matching instead. For further information about regular expressions and wildcard matching, refer to section 9.1.2.8.
- Pattern (for comparison): The value that is used to compare against the AE title of the sending modality. This can either be a regular expression, if the checkbox "Use regular expression (not wildcard matching)" is checked, or a string that can contain wildcards.

Use the *Test* button to verify the functioning of your pattern configuration.

Receiving AE

Use the type "Receiving AE'' if you want to apply the attribute rule only if the data is sent to a particular modality.

| Attribute Condition | | × |
|--|---|--------|
| | | |
| Туре | Receiving AE | \sim |
| Description | Receiver is any Workstation in Radiology department | |
| Condition is true | | |
| Use regular expression (not wildcard matching) | | |
| Pattern (for comparison) | WSRAD* | Test |
| Attribute tag (gggg,eeee) | | |
| In sequence | | |
| Sequence tag (gggg,eeee) | | |
| Sequence item (1 to 999) | 1 | |
| | | |
| Ok | Cancel | |

Receiving AE condition

For this type of condition, you need to specify the receiving station's AE title that iQ-ROUTER/ PRO/PREMIUM must look for.

- Use regular expression (not wildcard matching): If enabled, the option allows you to use a regular expression for the "Pattern (for comparison)". If disabled, you can use wildcard matching instead. For further information about regular expressions and wildcard matching, refer to section 9.1.2.8.
- Pattern (for comparison): The value that is used to compare against the AE title of the sending modality. This can either be a regular expression, if the checkbox "Use regular expression (not wildcard matching)" is checked, or a string that can contain wildcards.

Use the *Test* button to verify the functioning of your pattern configuration.

9.1.2.7.1.2 Adding or editing an attribute action

This section explains how you can define specific actions that shall be performed on incoming DICOM data under this specific attribute rule.

| Attribute Action | × |
|--------------------------|-----------------------------------|
| General | |
| Туре | Prefix ~ |
| Description | Add prefix to external Patient ID |
| Target attribute | |
| Tag (gggg,eeee) | 0010 0020 PatientID |
| Tag in sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| Prefix | |
| Value | EXT- |
| Ok | Cancel |

Attribute Action

Actions of the following types can be created:

- Add tag
- Prefix
- Suffix
- Replace from string
- Replace from tag
- Delete tag
- Clear tag
- New UID
- Leading zeros
- Convert to UTF8 (whole dataset)

Use the "Description" option to enter a logical (human readable) description that lets you easily identify the meaning of the action. It will later be shown in the "Action(s)" table of the *Attributes* tab page and lets you distinguish one action from another.

Depending on the selected type, the other configuration options differ. In the following you will find descriptions of all available settings for each of the action types.

<u>Add tag</u>

Use the type "Add tag" if you want to add any DICOM tag with a configurable value to the data that is received. If the incoming DICOM data already contains the specified tag, the action will not be performed.

| Attribute Action | × |
|--------------------------|---------------------------|
| General | |
| Туре | Add tag \checkmark |
| Description | Add our institution name |
| Target attribute | |
| Tag (gggg,eeee) | 0008 0080 InstitutionName |
| Tag in sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| New attribute value | |
| Value | IMAGE |
| | |
| | |
| Ok | Cancel |

Add tag action

Use the "Tag (gggg,eeee)" edit field to specify the DICOM tag that iQ-ROUTER/PRO/PREMIUM shall add.

The "In sequence" checkbox must be used in case the DICOM tag in question is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

Use the "Value" edit field to enter the value that iQ-ROUTER/PRO/PREMIUM shall write into the specified DICOM tag, in case it does not yet exist.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

<u>Prefix</u>

Use the type "Prefix" if you want to add a prefix to a particular DICOM tag in the data that is received. If the incoming DICOM data does not contain the specified tag, the action will not be performed.

| Attribute Action | × |
|--------------------------|------------------------------------|
| General | |
| Туре | Prefix ~ |
| Description | Add prefix to external Patient IDs |
| Target attribute | |
| Tag (gggg,eeee) | 0010 0020 PatientID |
| Tag in sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| Prefix | |
| Value | EXT- |
| Ok | Cancel |
| | Prefix action |

Use the "Tag (gggg,eeee)" edit field to specify the DICOM tag to whose value iQ-ROUTER/PRO/ PREMIUM shall add a prefix.

The "In sequence" checkbox must be used in case the DICOM tag in question is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

Use the "Value" edit field to enter the prefix value that iQ-ROUTER/PRO/PREMIUM shall add in front of the already existing value within the specified DICOM tag, in case it does exist.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

<u>Suffix</u>

Use the type "Suffix" to add a suffix to a particular DICOM tag in the data that is received. If the incoming DICOM data does not contain the specified tag, the action will not be performed.

| Attribute Action | × |
|--------------------------|------------------------------------|
| General | |
| Туре | Suffix ~ |
| Description | Add suffix to external Patient IDs |
| Target attribute | |
| Tag (gggg,eeee) | 0010 0020 PatientID |
| Tag in sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| Suffix | |
| Value | -EXT |
| Ok | Cancel |
| | Suffix action |

Use the "Tag (gggg,eeee)" edit field to specify the DICOM tag to whose value iQ-ROUTER/PRO/ PREMIUM shall add a suffix.

The "In sequence" checkbox must be used in case the DICOM tag in question is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

Use the "Value" edit field to enter the suffix value that iQ-ROUTER/PRO/PREMIUM shall add behind the already existing value within the specified DICOM tag, in case it does exist.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

Replace from string

Use the type "Replace from string" if you want to replace the value existing in a particular DICOM tag with a different string in the data that is received. If the incoming DICOM data does not contain the specified tag, the action will not be performed.

| lype | Deplace from othing |
|----------------------------|-----------------------------------|
| уре | Replace from string |
| Description | Replace with our Institution Name |
| arget attribute | |
| Tag (gggg,eeee) | 0008 0080 InstitutionName |
| ag in sequence | |
| Sequence tag (gggg,eeee) | |
| Gequence item (1 to 999) | 1 |
| eplacement options | |
| alue (or format for regex) | IMAGE |
| lse regular expression | |
| equilar expression | Test |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Replace from string action

Use the "Tag (gggg,eeee)" edit field to specify the DICOM tag whose value iQ-ROUTER/PRO/ PREMIUM shall replace with a different value string.

The "In sequence" checkbox must be used in case the DICOM tag in question is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

Use the "Value" edit field to enter the replacement value that iQ-ROUTER/PRO/PREMIUM shall use instead of the existing value within the specified DICOM tag, in case it does exist.

The replacement value can also be defined by using regular expressions. This way, it is possible to add back references (e.g. "1,2" or "\$1,\$2") to access sub-matches from sub-expressions built in the "Regular expression" field.

• **Use regular expression**: If enabled, the option allows you to use a regular expression for the "Value". For further information about regular expressions, refer to section 9.1.2.8.2.

 Regular expression: If you enabled the use of regular expression, you must enter here the regular expression that shall be used to match against the configured "Value". Refer to section 9.1.2.8.2 for details.

Use the *Test* button to verify the functioning of your regular expression.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

Replace from tag

Use the type "Replace from tag" if you want to replace the value existing in a particular DICOM tag with the value contained in a different DICOM tag in the data that is received. If the incoming DICOM data does not contain either or both of the specified source and target tags, the action will not be performed.

| Attribute Action | × |
|---|---|
| General | |
| Туре | Replace from tag \sim |
| Description | Pseudonymize Patient Name with Patient ID |
| Target attribute | |
| Tag (gggg,eeee) | 0010 0010 PatientName |
| Tag in sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| Replacement options | |
| Use regular expression | |
| Regular expression | Test |
| Source attribute | |
| Tag (gggg,eeee) | 0010 0020 PatientID |
| In sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| Source attribute options | |
| Use regular expression for source attribute | |
| Regular expression (for source) | Test |
| Format string (for source) | |
| Ok | Cancel |

Replace from string action

Use the "Tag (gggg,eeee)" edit field in the section "Target attribute" to specify the DICOM tag whose value iQ-ROUTER/PRO/ PREMIUM shall be replaced.

Use the "Tag (gggg,eeee)" edit field in the section "Source attribute" to specify the DICOM tag whose value shall be used as replacement.

The "In sequence" checkbox must be used in case one or both of these DICOM tags (source and/or target) is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

You can also use regular expressions to further specify how the replacement of the values shall be done. This possibility exists for the replacement itself but also for the source attribute:

Replacement options with regular expression:

- Use regular expression: If enabled, the option allows you to use a regular expression for the value of the configured "Tag".
- Regular expression: If you enabled the use of regular expression in this section, you must enter here the regular expression that shall be used to match against the configured "Tag".

Source attribute options with regular expression:

- **Use regular expression for source attribute**: If enabled, the option allows you to use a regular expression for the value of the configured source tag.
- Regular expression (for source): If you enabled the use of regular expression in this section, you must enter here the regular expression that shall be used to match against the configured source tag.
- Format string (for source): Use this field to define a format string that is then used to manipulate the result of the "Regular expression".

For details on how to use regular expressions, refer to section 9.1.2.8.2.

You can use the *Test* buttons to verify the functioning of your configured regular expression(s).

<u>Delete tag</u>

Use the type "Delete tag" if you want to completely delete a particular DICOM tag (not only its value) from the data that is received.

| General | |
|--------------------------|----------------------------------|
| Туре | Delete tag 🔨 |
| Description | Remove external Institution Name |
| arget attribute | |
| Tag (gggg,eeee) | 0008 0080 InstitutionName |
| Tag in sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| | |
| | |

Delete tag action

Use the "Tag (gggg,eeee)" edit field to specify the DICOM tag that iQ-ROUTER/PRO/PREMIUM shall delete from the incoming data, in case this particular DICOM tag exists in the data.

The "In sequence" checkbox must be used in case the DICOM tag is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

<u>Clear tag</u>

Use the type "Clear tag" if you only want to remove content from a particular DICOM tag but keep the actual DICOM attribute in the data that is received. It is possible to either remove the entire content or just a part of it. If the incoming DICOM data does not contain the specified DICOM tag, the action will not be performed.

| Attribute Action | × |
|------------------------------|---|
| General | |
| Туре | Clear tag V |
| Description | Remove prefix (first three characters) of Patient IDs |
| Target attribute | |
| Tag (gggg,eeee) | 0010 0020 PatientID |
| Tag in sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| Clear options | |
| Clear all | |
| Start (character position) | 0 |
| Count (number of characters) | 3 |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| Ok | Cancel |

Clear tag action

Use the "Tag (gggg,eeee)" edit field to specify the DICOM tag from which iQ-ROUTER/PRO/ PREMIUM shall remove content in the incoming data, in case this particular DICOM tag exists in the data.

The "In sequence" checkbox must be used in case the DICOM tag is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

Additional "Clear options" allow you to further specify which content shall be removed from the attribute:

- **Clear all**: If enabled, the complete content of the configured "Tag" is cleared. If disabled, only the part defined by "Start" and "Count" will be cleared.
- Start (character position): If "Clear all" is disabled, define here the position of the first character that shall be cleared. Note that this is 0-indexed. This means that you would have to enter "2" in case you want to clear starting from the 3rd character.
- Count (number of characters): Define here the total number of characters (starting from "Start") that shall be removed.

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

<u>New UID</u>

Use the type "New UID" if you want to generate a new UID for any DICOM tag with a value representation of "UI" in the data that is received. It is possible to either remove the entire content or just a part of it. If the incoming DICOM data does not contain the specified DICOM tag, the action will not be performed.

This option may be helpful, for instance, when objects that are stored in one series shall be distributed in a series for each object, e.g. in ultrasound studies with multiple multi-frame objects in one series or in mammography studies, where all views are stored in one series.

NOTICE:

Make sure to only configure tags that really contain such a UIDs (unique identifier), such as a study, series or SOP instance UID.

| General | | |
|--------------------------|-------------------------------------|---|
| Туре | New UID | ~ |
| Description | Put each image into separate series | |
| arget attribute | | |
| Tag (gggg,eeee) | 0020 000E SeriesInstanceUID | |
| Tag in sequence | | |
| Sequence tag (gggg,eeee) | | |
| Sequence item (1 to 999) | 1 | |
| | | |
| | | |
| | | |

New UID action

Use the "Tag (gggg,eeee)" edit field to specify the DICOM tag containing a UID in which iQ-ROUTER/PRO/PREMIUM shall create a new UID for the incoming data.

The "In sequence" checkbox must be used in case the DICOM tag is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

Use the *Ok* button to save the made changes or the *Cancel* button to discard all changes.

Leading zeros

Use the type "Leading zeros" if you want to prepend zeros ("0") to each numeric value within the target attribute until a given maximum length is reached in the data that is received. Non-numeric characters within an attribute value will not be changed. Example: Setting the max. length to 5 will convert the value "INT123" to "INT00123".

| ttribute Action | , |
|-------------------------------|----------------------------|
| General | |
| Туре | Leading zeros V |
| Description | Pad Patient ID to 10 signs |
| Target attribute | |
| Tag (gggg,eeee) | 0010 0020 PatientID |
| Tag in sequence | |
| Sequence tag (gggg,eeee) | |
| Sequence item (1 to 999) | 1 |
| Leading-Zero options | |
| Length (filled up with zeros) | 10 |
| | |
| | |

Leading zeros action

Use the "Tag (gggg,eeee)" edit field to specify the DICOM tag in which iQ-ROUTER/PRO/ PREMIUM shall check the current value for numeric strings and prepend them with zeros ("0") in case the maximum number of characters is not yet reached.

The "In sequence" checkbox must be used in case the DICOM tag is part of a DICOM sequence. If that is the case, use the two edit fields beneath the checkbox to define the "Sequence tag" and "Sequence item".

Under "Leading-Zero options", use the "Length (filled up with zeros)" edit field to define the total length to which each individual numeric component inside the specified "Tag" shall be filled up with zeros.

Convert to UTF8 (whole dataset)

Use the type "Convert to UTF8 (whole dataset)" if you want to convert every DICOM dataset that is received to the UTF-8 (ISO_IR 192) character set.

| eneral | | |
|--------------------------|---------------------------------|---|
| Туре | Convert to UTF8 (whole dataset) | ` |
| Description | Convert to Unicode | |
| arget attribute | | |
| Tag (gggg,eeee) | | |
| Tag in sequence | | |
| Sequence tag (gggg,eeee) | | |
| Sequence item (1 to 999) | 1 | |
| | | |
| | | |

Convert to UTF8 (whole dataset) action

No further settings are required for this type of attribute action.

Use the *Ok* button to add this action or the *Cancel* button to discard this action.

9.1.2.7.2 Testing rules

Attribute rules with their conditions and specified actions should always be verified for their correct functioning before they are used productively. iQ-ROUTER/PRO/PREMIUM allows you to easily test how your configuration will work.

Use the *Test rules* button on the *Attributes* page to access the *Test attributes dialog* where you can check if the configured attribute rules will work according to your expectations.

| ataset file | | C:\test\Newman, Sandra\1\1.3.12.2.1107.5.2.6.14044.300000 | 05122107122404600000022.dcm | |
|-------------------------------|-----|---|-----------------------------|---|
| ending AE name CT Radiology ~ | | | | |
| eceiving AE na | ame | Workstation Radiology \checkmark | | |
| taset | | | | |
| Tag | VR | Value | Name | |
| (0008,0005) | CS | ISO_IR 100 | SpecificCharacterSet | |
| (0008,0008) | CS | DERIVED\SECONDARY\M\ND | ImageType | |
| (0008,0016) | UI | 1.2.840.10008.5.1.4.1.1.4 | SOPClassUID | |
| (0008,0018) | UI | 1.3.12.2.1107.5.2.6.14044.30000005122107122404600000022 | SOPInstanceUID | |
| (0008,0020) | DA | 20051220 | StudyDate | |
| (0008,0021) | DA | 20051221 | SeriesDate | |
| (0008,0022) | DA | 20051221 | AcquisitionDate | |
| (0008,0023) | DA | 20051221 | ContentDate | |
| (0008,0030) | TM | 080525.265000 | StudyTime | |
| (0008,0031) | TM | 081922.750000 | SeriesTime | |
| (0008,0032) | TM | 081506.989984 | AcquisitionTime | |
| (0008,0033) | TM | 081922.765000 | ContentTime | |
| (0008,0040) | US | 0 | RETIRED_DataSetType | |
| (0008,0041) | LO | IMA NONE | RETIRED_DataSetSubtype | |
| (0000 0050) | сu | 100 | AccossionMumber | > |

Test attribute rules

The testing will be performed against a sample DICOM dataset:

- **Dataset file**: Enter the path to the file with which you want to run the test. Alternatively, use the button to the right to browse the Windows file system for the file location.
- Sending AE name: Select the station that is supposed to send this dataset from the dropdown box. Since attribute rules may only be performed if the data is received from a specific modality, this selection can be important.
- Receiving AE name: Select the station that is supposed to receive this dataset from the drop-down box. Since attribute rules may only be performed if the data is sent to a specific modality, this selection can be important.

As soon as the dataset is selected, the "Dataset" table will be filled with all DICOM information that iQ-ROUTER/PRO/PREMIUM finds while parsing this object.

Click the Run button to start the test.

The results of the test will also be shown in the "Dataset" table. DICOM tags that were modified during this process will be highlighted in red:

| Dataset file | | C:\test\Wewman, Sandra\1\1.3.12.2.1107.5.2.6.14044.300000 | 05122107122404600000022.dcm | |
|--------------------------------|-----|---|-----------------------------|-------------|
| Sending AE name CT Radiology ~ | | | | |
| Receiving AE na | ame | Workstation Radiology | | |
| ataset | | | | |
| The | VD | Value | Name | |
| Tag | VIC | Value | Name | i i i |
| (0008,0005) | CS | ISO_IR 192 | SpecificCharacterSet | |
| (0008,0008) | CS | DERIVED\SECONDARY\M\ND | ImageType | |
| (0008,0016) | UI | 1.2.840.10008.5.1.4.1.1.4 | SOPClassUID | |
| (0008,0018) | UI | 1.3.12.2.1107.5.2.6.14044.3000005122107122404600000022 | SOPInstanceUID | |
| (0008,0020) | DA | 20051220 | StudyDate | |
| (0008,0021) | DA | 20051221 | SeriesDate | |
| (0008,0022) | DA | 20051221 | AcquisitionDate | |
| (0008,0023) | DA | 20051221 | ContentDate | |
| (0008,0030) | TM | 080525.265000 | StudyTime | |
| (0008,0031) | TM | 081922.750000 | SeriesTime | |
| (0008,0032) | TM | 081506.989984 | AcquisitionTime | |
| (0008,0033) | TM | 081922.765000 | ContentTime | |
| (0008,0040) | US | 0 | RETIRED DataSetType | |
| (0008,0041) | LO | IMA NONE | RETIRED DataSetSubtype | |
| (0000 0050) | сш | 100 | AccossionNumber | · · · · · · |
| < | | | | > |

Test attribute rules – Result

Carefully check the results to verify that everything worked as expected. You may have to run several tests with different test datasets in order to cover all attribute rules that you have defined. This may tests that verify that specific actions are not performed, because the conditions do not fully match.

9.1.2.8 Using wildcards and regular expressions to specify comparison and replacement actions

When using forwarding and/or attribute manipulation, there exist possibilities to further specify how rules, conditions or actions should actually be handled. In those cases, iQ-ROUTER/PRO/ PREMIUM offers the following methods:

- Wildcard matching
- Regular expressions

Wildcard matching is only available for comparison while *regular expressions* can also be used to provide replacement options.

9.1.2.8.1 Wildcard matching

A wildcard character can be used as substitute for any other character or characters in a string. iQ-ROUTER/PRO/PREMIUM supports two different wildcard characters:

- ? (question mark): Substitutes for any zero or one character (0-1)
- * (asterisk): Substitutes for any zero or more characters (0-n)

| Wildcard string | Matching string | Non-matching strings |
|-----------------|-----------------|----------------------|
| 123??? | 1231 | 1239919991 |
| | 12313 | 1233211 |
| | 123133 | 8443 |
| ABC* | ABC | ADC |
| | ABC12dfessds | ACB12133 |
| ?INT* | 1INT12345 | 12INT |
| | INTABC | 1IN12345678 |
| | INT | |

Examples:

9.1.2.8.2 Regular expressions

Regular expressions provide a much more complex way of describing character sets using syntactic rules. A regular expression provides a concise and flexible means to "match" (specify and recognize) strings of text, such as particular characters, words, or patterns of characters.

The following sections will give a high-level overview about the regular expression syntax supported by iQ-ROUTER/PRO/PREMIUM.

In case more technical detail is needed: iQ-ROUTER/PRO/PREMIUM uses the standard C++ regular expression library as implemented in Visual Studio 2017. There are plenty of resources on the web that provide deeper explanations of the capabilities of the library.

9.1.2.8.2.1 Perl regular expression syntax

In Perl regular expressions, all characters match themselves except for the following special characters:

.[{}()*+?|^\$

9.1.2.8.2.1.1 Wildcard

The single character ".", when used outside of a character set, will match any single character.

9.1.2.8.2.1.2 Anchors

A " $^{"}$ character shall match the start of a line. A " $^{"}$ character shall match the end of a line.

9.1.2.8.2.1.3 Marked sub-expressions

A section beginning with "(" and ending with ")" acts as a marked sub-expression. Whatever matched the sub-expression is split out in a separate field by the matching algorithms. Marked sub-expressions can also be repeated, or referred to by a back-reference.

9.1.2.8.2.1.4 Non-marking grouping

A marked sub-expression is useful to lexically group a part of a regular expression, but has the side-effect of generating an extra field in the result. As an alternative you can lexically group a part of a regular expression without generating a marked sub-expression by using "(?:" and ")". For example "(?:ab)+" will repeat "ab" without generating any separate sub-expressions.

9.1.2.8.2.1.5 Repeats

Any atom (a single character, a marked sub-expression, or a character class) can be repeated with the "*", "+", "?" and "{}" operators.

The "*'' operator will match the preceding atom zero or more times, for example the expression "a*b'' will match any of the following:

b ab aaaaaaab

The "+" operator will match the preceding atom one or more times, for example the expression "a+b" will match any of the following:

```
ab
aaaaaaaab
```

but will not match:

b

The "?" operator will match the preceding atom zero or one times, for example the expression "ca?b" will match any of the following:

cb cab

but will not match:

caab

An atom can also be repeated with a bounded repeat:

"a{n}" Matches "a" repeatedly exactly *n* times.
"a{n,}" Matches "a" repeatedly *n* or more times.
"a{n, m}" Matches "a" repeatedly between *n* and *m* times (inclusive).

For example:

^a{2,3}\$

Will match either of:

aa aaa

But neither of:

а

aaaa

It is an error to use a repeat operator if the preceding construct cannot be repeated, for example:

a(*)

Will raise an error, as there is nothing for the "*'' operator to be applied to.

9.1.2.8.2.1.6 Non-greedy repeats

The normal repeat operators are "greedy", that is to say they will consume as much input as possible. There are non-greedy versions available that will consume as little input as possible while still producing a match.

- "*?": Matches the previous atom zero or more times, while consuming as little input as possible.
- "+?": Matches the previous atom one or more times, while consuming as little input as possible.
- "??": Matches the previous atom zero or one time, while consuming as little input as possible.
- "{n,}?": Matches the previous atom n or more times, while consuming as little input as possible.
• "{n,m}?": Matches the previous atom between *n* and *m* times, while consuming as little input as possible.

9.1.2.8.2.1.7 Possessive repeats

By default, when a repeated pattern does not match then the engine will backtrack until a match is found. However, this behavior can sometime be undesirable so there are also "possessive" repeats: these match as much as possible and do not then allow backtracking if the rest of the expression fails to match.

- **+": Matches the previous atom zero or more times, while giving nothing back.
- "++": Matches the previous atom one or more times, while giving nothing back.
- "?+": Matches the previous atom zero or one time, while giving nothing back.
- "{n,}+": Matches the previous atom *n* or more times, while giving nothing back.
- "{n,m}+": Matches the previous atom between *n* or *m* times, while giving nothing back.

9.1.2.8.2.1.8 Back references

An escape character "\" followed by a digit n, where n is in the range 1-9, matches the same string that was matched by sub-expression n. For example the expression:

^(a*).*\1\$

Will match the string:

Aaabbaaa

But not the string:

aaabba

The \g escape can also be used for the same function, for example:

- \g1: Matches whatever matched sub-expression 1.
- \g{1}: Matches whatever matched sub-expression 1: This form allows for safer parsing of the expression in cases like \g{1}2 or for indexes higher than 9 as in \g{1234}.
- \g-1: Matches whatever matched the last opened sub-expression.
- \g{-2}: Matches whatever matched the last but one opened sub-expression.
- \g{one}: Matches whatever matched the sub-expression named "one".

Finally the "\k" escape can be used to refer to named sub-expressions, for example "\k<two>" will match whatever matched the sub-expression named "two".

9.1.2.8.2.1.9 Alternation

The "|" operator will match either of its arguments, so for example: "abc|def" will match either "abc" or "def".

Parenthesis can be used to group alternations, for example: "ab(d|ef)" will match either of "abd" or "abef".

Empty alternatives are not allowed (these are almost always a mistake), but if you really want an empty alternative use "(?:)" as a placeholder, for example "|abc" is not a valid expression, but "(?:)|abc" is and is equivalent. Also, the expression "(?:abc)??" has exactly the same effect.

9.1.2.8.2.1.10 Character sets

A character set is a bracket expression starting with "[" and ending with "]" defines a set of characters, and matches any single character that is a member of that set. A bracket expression may contain any combination of the following:

Single characters

For example "[abc]" will match any of the characters "a", "b", or "c".

Character ranges

For example "[a-c]" will match any single character in the range "a" to "c". By default, for Perl regular expressions, a character x is within the range y to z if the code point of the character lies within the code points of the endpoint of the range.

Negation

If the bracket-expression begins with the " $^{"}$ character, then it matches the complement of the characters it contains, for example "[^a-c]" matches any character that is not in the range "a-c".

Character classes

An expression of the form "[[:name:]]" matches the names character class "name", for example "[[:lower:]]" matches any lower case character.

Collating elements

An expression of the form "[[.col.]]" matches the collating element *col*. A collating element is any single character, or any sequence of characters that collates as a single unit. Collating elements may also be used as the end point of a range, for example: "[[.ae.]-c]" matches the character sequence "ae", plus any single character in the range "ae"-c, assuming that "ae" is treated as a single collating element in the current locale.

As an extension, a collating element may also be specified via its symbolic name, for example:

[[.NUL.]]

matches a "\0" character.

Equivalence classes

An expression of the form "[[=colo=]]", matches any character or collating element whose primary sort key is the same as that for collating element *col*, as with collating elements the name *col* may be a symbolic name. A primary sort key is one that ignores case, accentuation, or locale-specific tailoring; so for example "[[=a=]]" matches any of the character: a, À, Á, Â, Â, Ä, Å, A, à, á, â, ã, ä and å.

Escaped Characters

All the escape sequences that match a single character or a single character class are permitted within a character class definition. For example: "[\[\]]" would match either of "[" or "]" while "[\W\d]" would match any character that is either a "digit", or is not a "word" character.

Combinations

All of the above can be combined in one character set declaration, for example: "[[:digit:]a-c[.NUL.]]".

Escapes

Any special character preceded by an escape shall match itself. The following escape sequences are all synonyms for single characters:

| Escape | Character |
|--------|---|
| \a | \a |
| \e | 0x1B |
| \f | ∖f |
| \n | \n |
| \r | \r |
| \t | \t |
| \v | \v |
| /b | \b (but only inside a character class declaration) |
| \cX | An ASCII escape sequence - the character whose code point is X % 32 |
| \xdd | A hexadecimal escape sequence - matches the single character whose code point is 0xdd |

| Escape | Character | | |
|----------|--|--|--|
| \x{dddd} | A hexadecimal escape sequence - matches the single character whose code point is 0xdddd | | |
| \0ddd | An octal escape sequence - matches the single character whose code point is Oddd | | |
| \N{name} | Matches the single character which has the symbolic name "name". For example "\N{newline}" matches the single character "\n" | | |

"Single character" character classes

Any escaped character x, if x is the name of a character class, shall match any character that is a member of that class, and any escaped character X, if x is the name of a character class, shall match any character not in that class.

The following are supported:

| Escape sequence | Equivalent to |
|-----------------|---------------------------|
| \d | [[:digit:]] |
| \1 | [[:lower:]] |
| \s | [[:space:]] |
| \u | [[:upper:]] |
| \w | [[:word:]] |
| \h | Horizontal whitespace |
| \v | Vertical whitespace |
| \D | [^[:digit:]] |
| \L | [^[:lower:]] |
| \s | [^[:space:]] |
| /U | [^[:upper:]] |
| \W | [^[:word:]] |
| ∖н | Not horizontal whitespace |
| \v | Not vertical whitespace |

Character properties

The character property names in the following table are all equivalent to the names used in character classes.

| Form | Description | Equivalent character set form |
|------|--|-------------------------------|
| /pX | Matches any character that has the property X. | [[:X:]] |

| Form | Description | Equivalent character set form |
|-----------|---|-------------------------------|
| \p{Name} | Matches any character that has the property "Name". | [[:Name:]] |
| \PX | Matches any character that does not have the property X. | [^[:X:]] |
| $P{Name}$ | Matches any character that does not have the property "Name". | [^[:Name:]] |

For example "\pd" matches any "digit" character, as does "\p{digit}".

Word boundaries

The following escape sequences match the boundaries of words:

- "\<": Matches the start of a word.
- "\>": Matches the end of a word.
- "\b": Matches a word boundary (the start or end of a word).
- "\B": Matches only when not at a word boundary.

Buffer boundaries

The following matches only at buffer boundaries: a "buffer" in this context is the whole of the input text that is being matched against (note that " $^{"}$ and " $^{"}$ may match embedded newlines within the text).

- "\`": Matches at the start of a buffer only.
- "\": Matches at the end of a buffer only.
- "\A": Matches at the start of a buffer only (the same as "\`").
- "\z": Matches at the end of a buffer only (the same as "\").
- "\Z": Matches a zero-width assertion consisting of an optional sequence of newlines at the end of a buffer: equivalent to the regular expression "(?=\v*\z)". Note that his is subtly different from Perl which behaves as if matching "(?=\n?\z)".

Continuation escape

The sequence "\G" matches only at the end of the last match found, or at the start of the text being matched if no previous match was found. This escape is useful if you are iterating over the matches contained within a text, and you want each subsequence match to start where the last one ended.

Quoting escape

The escape sequence "\Q" begins a "quoted sequence": All the subsequent characters are treated as literals, until either the end of the regular expression or "\E" is found. For example the expression "\Q*+\Ea+" would match either of:

*+a

}*+aaa

Unicode escapes

"\C" matches a single code point: This has exactly the same effect as a "." operator. "\X" matches a combining character sequence: That is any non-combining character followed by a sequence of zero or more combining characters.

Matching line endings

The escape sequence "\R" matches any line ending character sequence, specifically it is identical to the expression "(?>\x0D\x0A?|[\x0A-\x0C\x85\x{2028}\x{2029}])".

Keeping back some text

"\K" resets the start location of "\$0" to the current text position: In other words everything to the left of "\K" is "kept back" and does not form part of the regular expression match. "\$" is updated accordingly.

For example if "foo\Kbar" matched against the text, "foobar" would return the match "bar" for "0" and "foo" for "1".

This can be used to simulate variable width look-behind assertions.

Any other escape

Any other escape sequence matches the character that is escaped, for example "\@" matches a literal "@".

What gets matched?

If you view the regular expression as a directed (possibly cyclic) graph, then the best match found is the first match found by a depth-first-search performed on that graph, while matching the input text.

Alternatively: The best match found is the left-most match, with individual elements matched as follows:

| Construct | What gets matched | | |
|---------------------------|--|--|--|
| AtomA AtomB | Locates the best match for <i>AtomA</i> that has a following match for <i>AtomB</i> . | | |
| Expression1 Expression2 | If <i>Expression1</i> can be matched, then that match will be returned, otherwise the application attempts to match <i>Expression2</i> . | | |
| S{N} | Matches S repeated exactly N times. | | |
| S{N,M} | Matches S repeated between N and M times, and as many times as possible. | | |

| Construct | What gets matched | | |
|---|--|--|--|
| S{N,M}? | Matches S repeated between N and M times, and as few times as possible. | | |
| (?>S) | Matches the best match for S, and only that. | | |
| (?=S), (?<=S) | Matches only the best match for S (this is only visible if there are capturing parenthesis with S). | | |
| (?!S), (? S)</td <td>Considers only whether a match for S exists or not.</td> | Considers only whether a match for S exists or not. | | |
| (?(condition)yes-pattern no-pattern) | If <i>condition</i> is true, then only <i>yes-pattern</i> is considered, otherwise only <i>no-pattern</i> is considered. | | |

9.1.2.8.2.2 Overview and examples for regular expressions

The following table provides a compact overview over parts of the Perl regular expression syntax that will be used frequently. Examples can be found at the end to help understanding the usage of regular expressions.

| Marked sub-expressions: | | | | |
|---|--|--|--|--|
| A section beginning with "(" and ending with ")" is marked as a sub-expression. | | | | |
| Whatever matched the sub-expression is split up into a separate field. | | | | |

| Placeholder: | | |
|--------------|---|--|
| Syntax | Meaning | |
| \$n | Outputs what matched the <i>nth</i> sub-expression. | |
| \n | Same as ``\$n". | |

| Anchors: | | | | |
|----------|--|---------|--|--|
| Syntax | Meaning | Example | Comment | |
| \d | Digit (0-9 and digits from non-roman scripts) | \d\d | Two consecutive digits. | |
| \D | Not digit | \D\D | Two consecutive non digits. | |
| \₩ | Word (alpha-numeric characters, "_" and characters from non- roman scripts | \w\d\w | Sequence of a character, followed by a digit, followed by a character. | |
| /W | Not word | /W/W | Two consecutive non word characters. | |

| Anchors: | | | | |
|----------|--|--------|---|--|
| \s | Whitespace (whitespace characters like t , r , n , f) | \d\s\d | Sequence of a digit, followed by a whitespace, followed by a digit. | |
| \S | Not whitespace | \S\S | Two consecutive non whitespace characters. | |

| Ranges and character sets: | | | | |
|----------------------------|----------------------------------|---------------|---|--|
| Syntax | Meaning | Example | Comment | |
| | Any character except "\n". | ^\d. | Anything that starts with a digit followed by any character except "\n". | |
| a b | "a" or "b" | \s\$ \d\$ | Anything that ends with either a whitespace or a digit. | |
| [abc] | Range ("a" or "b" or "c") | Li[cs]en[cs]e | The word "License", even if misspelled. | |
| [^abc] | Range (NOT "a" or "b" or "c") | [^\W\d] | Matches anything that does not include non- word characters or digits. | |
| [a-q] | Letter between "a" and "q". | [a-z] | Matches all letters of the alphabet in lower- case. | |
| [A-Q] | Letter between "A" and "Q" | [A-Z] | Matches all letters of the alphabet in upper- case. | |
| [0-7] | Digit between 0 and 7. | - | - | |

| Quantifiers: | | | | |
|--------------|------------------------|-----------|---|--|
| Syntax | Meaning | Example | Comment | |
| * | 0 or more | \d* | Anything that includes 0 or more digits. | |
| + | 1 or more | [a-zA-Z]+ | Anything that includes at least one lower- or upper-case letter from the alphabet. | |
| ? | 0 or 1 | y(es)? | Matches "y" or "yes". | |
| {n} | Exactly <i>n</i> times | \d{4} | Exactly four consecutive digits. | |

| Quantifiers: | | | | |
|--------------|---|-------------|---|--|
| {n,} | <i>n</i> or more times | \d{4}\w{2,} | Four consecutive digits, followed by at least two word characters. | |
| {n,m} | At least <i>n</i> times but not more than <i>m</i> times | \w{1,5} | At least one but not more than five word characters. | |

| Look-ahead/look-behind: | | | | |
|-------------------------|------------|--------------------|---|--|
| Syntax | Meaning | Example | Comment | |
| ?= | Lookahead | \d(?=\s) | A digit that is followed by whitespace (whitespace is not stored in the matching string). | |
| ?<= | Lookbehind | (?<=\s)\w{4}(?=\s) | Four word characters that are preceded and followed by a whitespace (whitespace is not stored in the matching string). | |

| Sample patterns: | | | | |
|---|---|---|---|--|
| Regular expression | Match | No match | Comment | |
| ^CT | CT CT HEAD | MR HEAD CT | Matches the "CT" in all strings starting with "CT". | |
| СТ(.*?)2 | CT0000012 CT Head no. 2 Exam CT in 2 layer | CR0000012 CT HEAD no. 3 Exam 2 CT | Matches the "CT" and following "2" including all characters in between. | |
| [A-Za-z0-9-]+ | 1234-abcd IIS001 | Q | Matches all letters, numbers and hyphens. | |
| ^[1-9]{1}\$ ^[1- 4]{1}[0-9]{1}\$ ^50\$ | 1 45 | 51 0 | Matches any number from 1 to 50 (inclusive). | |
| #?[A-Fa-f0-9]{3}[A- Fa-f0-9]{3} | #000000 ffffff | #000000g fffff | Matches any valid hexadecimal color (with or without ``#"). | |
| (?=.*\d)(?=.*[a- z])(?=.*[A- Z]).{8,15} | MyPassword1 abcdefgA1 | abcdeA1 MyPassword | Matches any character string with at least one upper-case letter, one lower-case letter and one digit with a length of 8-15 (useful for passwords). | |

| Sample patterns: | | | | |
|---|--|----------|--|--|
| ^[\w\.]+@[a-zA- | a@b.com a:b@c.biz Matches email | | Matches email | |
| $Z_] + \ [a-zA-Z] \{2, 6\}$ | 123.abc@def.info | a@b.u | addresses. | |
| ^(2004 2005)(0[1- | 20040101 | 20120101 | Matches all dates | |
| 9] 1[0123])(0[1- 9] [12][0-9] 3[01])\$ | L[0123])(0[1- [12][0-9] 3[01])\$ 20050222 10043030 (DICOM format year 2004 and | | (DICOM format) of the year 2004 and 2005. | |
| | | | Note that the expression also matches "20040230" and "20040431" which are not valid dates. | |

9.1.2.9 Configuring of plugins

iQ-ROUTER/PRO/PREMIUM provides a plugin system allowing to extend the basic functionality of the product to adjust it to the needs of specific environments. The following plugins are currently supported and provided on request:

- Reconciliation Plugin
- AAA Plugin

| General | Compression | n settings | DICOM Mod | alities | Access control |
|-----------------------|-------------|------------|---------------------|----------------------|----------------|
| Forward rules | AE title r | mapping | Attributes | Plugins | License |
| Name | Version | File | | | |
| AAA Plugin | 2.0.0 | C:\Program | Files\iQ-ROUTER\plu | gins\AAA.dll | |
| Reconciliation Plugin | 2.0.0 | C:\Program | iles\iQ-ROUTER\plu | _ gins\Reconcile. | dll |
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Router Configurator - Plugins

NOTICE:

Since iQ-ROUTER PREMIUM 3.1 does not support the use of any other than the plugins stated above, customers who are actively using other plugins with iQ-ROUTER 2.x should not upgrade to version 3.1 without contacting the reseller or manufacturer beforehand.

For more details on the plugins, refer to the respective user documentation.

9.2 Router Monitor

The Router Monitor allows to monitor the general status of the iQ-ROUTER/PRO/PREMIUM service. When the application is started, you will find the following icon in the system tray:



The tray icon provides the following shortcut menu (right-click):

| Show/Hide |
|-----------|
| Options |
| About |
| Exit |

Show/Hide Shows/Hides the main window of the Router Monitor.

| T Router Monitor | | | × |
|------------------|------------|-----------|--------|
| Status | \diamond | Transfers | Errors |
| Store | 0 | 0 | 0 |
| Find | 0 | 0 | 0 |
| Move | 0 | 0 | 0 |
| Forward | 0 | 0 | 0 |

This window shows the current status of iQ-ROUTER/PRO/PREMIUM and its modules as well as counters indicating the number of successful and erroneous transfer.

Options Opens the *Options* dialog of the Router Monitor.

| Options | x |
|--|---|
| General General Start application visible Daily counter (reset values on midnight) | |
| Refresh Cycle 500 ms | |
| OK Cancel | |

The following options are provided:

- Start application visible: Choose here if the Router Monitor main window shall become visible when starting the application or if it should be hidden.
- Daily counter (reset values on midnight): If enabled, the counters shown in the main window are reset every day at midnight. If disabled, the counters are only reset when restarting the service.
- Refresh Cycle: Set the interval to refresh the counters in the main window (in ms).
- *About* Opens the "About" dialog of iQ-ROUTER/PRO/PREMIUM, which provides further information about the product and the manufacturer.

Exit Closes the Router Monitor application.

9.3 Creating self-signed certificates for TLS/SSL encrypted communication

iQ-ROUTER/PRO/PREMIUM provides a script that helps you create self-signed SSL certificates, which can be used to secure and encrypt the transmission of image data between the different connected modalities and DICOM stations. The script and the OpenSSL binary are already installed during the setup.

Use the shortcut 'Create self-signed certificates' from the Windows start menu \rightarrow iQ-ROUTER in order to start the script. It will guide you through the process.

9.3.1 Step A – PEM passphrase



The passphrase will be used to encrypt the key and is required in the iQ-ROUTER/PRO/PREMIUM TLS/SSL configuration.

NOTICE:

If the passphrase is lost, the key and the certificates based on it cannot be used any longer.

9.3.2 Step B – Number of certificates

| C:\Windows\system32\cmd.exe | _ | × |
|--|---|--------------|
| ###################################### | | ^ |
| Certificates will be stored in: C:\ProgramData\iQ-ROUTER\ca_selfsigned | | |
| A. Enter PEM pass phrase (4-45 characters) | | |
| Enter PEM pass phrase to encrypt the key and press Enter: secret_passwor | d | |
| B. Enter the number of certificates to create (1-9) | | |
| Enter a number and press Enter: 2 | | |
| | | \checkmark |

Enter the number of certificates that you wish to create. Usually at least two are required (one for each peer in the connections).

9.3.3 Step C – Cipher (encryption mode)

| C:\Windows\system32\cmd.exe | _ | × |
|--|---|---|
| A. Enter PEM pass phrase (4-45 characters) | | Â |
| Enter PEM pass phrase to encrypt the key and press Enter: secret_password | 1 | |
| B. Enter the number of certificates to create (1-9) | | |
| Enter a number and press Enter: 2 | | |
| C. Choose a cipher (encryption mode) | | |
| Choose a cipher (encryption mode): 1) TLS_RSA_WITH_3DES_EDE_CBC_SHA 2) TLS_RSA_WITH_AES_128_CBC_SHA 3) quit | | |
| Type the number of the cipher and press ENTER: 1 | | ~ |

Choose one of the two DICOM defined cipher suites.

NOTICE:

iQ-ROUTER/PRO/PREMIUM and its underlying SSL implementation support a lot more than those two cipher suites. However, this script only provides these two options. Refer to the OpenSSL documentation for instructions in case you need to create certificates using another cipher.

9.3.4 Step D – Create PEM key



This step will be processed automatically. It will show progress information for the creation of the PEM key file.

9.3.5 Step E – Create x self-signed certificates



The last step will ask for a number of information to be integrated into the certificate(s). Most of them are not required to be filled out. The most important information is the "Common name (e.g. server FQDN or YOUR name)" that identifies the machine.

9.4 Step-by-step guide for TLS/SSL configuration

The following provides a step-by-step guide for the TLS/SLL configuration of iQ-ROUTER. The following scenario is used to describe the configuration:

- One computer with iQ-VIEW and iQ-ROUTER1.
- One computer with iQ-WEB and iQ-ROUTER2.
- Only the communication between the two iQ-ROUTER instances is encrypted.
- Self-signed certificates are used for the encryption.

These are the steps required to configure the encryption:

Step 1 – Create self-signed certificates (see section 9.3 for a detailed description)

Step 2 – Configure iQ-ROUTER1

- Open the Router Configurator.
- Configure the incoming communication on the General tab:
 - Check the "Allow secure connections (TLS/SSL) checkbox and choose the port that shall be used.
 - Click the *Advanced* button in the "TLS/SSL Settings" group.
 - Set "Private Key File" to the path to the "key.pem" file created in step 1.
 - Set "Certificate File" to the path to the "cert1.pem" file created in step 1.
 - Set "Password" to the one used during step 1 (if a password was used during the certificate creation).
 - Add all "cert.pem" files from the other modalities that are involved to the "Trusted certificate files". In this scenario only "cert2.pem" has to be added (which is used as certificate file by iQ-ROUTER2).
- Navigate to the *DICOM Modalities* page and configure the outgoing communication:
 - Add iQ-WEB with the following configuration:
 - \circ $\;$ AET: AET of the iQ-WEB $\;$
 - IP: IP of iQ-ROUTER2
 - Port: secure port of iQ-ROUTER2
 - Check the "Secure connection" checkbox.
 - Uncheck the "Anonymous" checkbox.
 - Private Key File: "key.pem" file created in step1.
 - Certificate File: Choose the same as for incoming communication ("cert1.pem").
 - Password: the password used in step 1 (if any was configured there).
 - Add the local iQ-VIEW as usual.

Step 3 – Configure iQ-ROUTER2

- Open Router Configurator.
- Configure the incoming communication on the *General* tab:
 - Check the "Allow secure connections (TLS/SSL) checkbox and choose the port that shall be used.
 - Click the *Advanced* button in the "TLS/SSL Settings" group.
 - Set "Private Key File" to the path to the "key.pem" file created in step 1.
 - Set "Certificate File" to the path to the "cert2.pem" file created in step 1.
 - Set "Password" to the one used during step 1 (if a password was used during the certificate creation).
 - Add all "cert.pem" files from the other modalities that are involved to the "Trusted certificate files". In this scenario only "cert1.pem" has to be added (which is used as certificate file by iQ-ROUTER1).
- Navigate to the *DICOM Modalities* page and configure the outgoing communication:
 - Add iQ-VIEW with the following configuration:
 - \circ $\;$ AET: AET of iQ-VIEW $\;$
 - IP: IP of iQ-ROUTER1
 - Port: secure port of iQ-ROUTER1
 - Check the "Secure connection" check box.
 - Uncheck the "Anonymous" check box.
 - Private Key File: "key.pem" file created in step 1.

- Certificate File: Choose the same as for incoming communication ("cert2.pem").
- Password: the password used in step 1 (if any was configured there)
- Add the local iQ-WEB as usual.

Step 4 – Configure iQ-VIEW

- Add iQ-WEB:
 - AET: AET of iQ-WEB
 - IP: IP of iQ-ROUTER1
 - Port: unsecure port of iQ-ROUTER1

Step 5 – Configure iQ-WEB

- Add iQ-VIEW:
 - AET: AET of iQ-VIEW
 - IP: IP of iQ-ROUTER2
 - Port: unsecure port of iQ-ROUTER2

10 Abbreviations and acronyms

| Abbreviation | Meaning |
|---------------------|--|
| ACR NEMA | The American College of Radiology and the National Electrical Manufacturers Association |
| AE / AET / AE Title | Application Entity Title |
| СА | Certificate Authority |
| CPU | Central Processing Unit |
| CR | Computed Radiography |
| СТ | Computed Tomography |
| DICOM | Digital Imaging and Communications in Medicine |
| DoS | Denial of Service |
| EEA | European Economic Area |
| EEC | European Economic Community |
| EN | English |
| FDA | Food and Drug Administration |
| GB | Gigabyte |
| GHz | Gigahertz |
| INT | International |
| IP | Internet Protocol |
| IT | Information Technology |
| JPEG | Joint Photographic Experts Group |
| КВ | Kilobyte |
| MAC | Media Access Control |
| Mbit/s | Megabits per second |
| MG | Mammography |
| MR | Magnetic Resonance Tomography |
| ms | Millisecond |
| PACS | Picture Archiving and Communication System |
| PDF | Portable Document Format |
| PDU | Protocol Data Unit |
| PEM | Privacy-Enhanced Mail |
| PRNG | Pseudorandom Number Generator |
| PUB | Public |
| RAM | Random Access Memory |
| RGB | Red Green Blue |
| RLE | Runtime-Length Encoding |

| Abbreviation | Meaning |
|--------------|-------------------------------------|
| SCP | Service Class Provider |
| SCU | Service Class User |
| SOP | Service Object Pair |
| SP | Service Pack |
| SSL | Secure Sockets Layer |
| ТСР | Transmission Control Protocol |
| TLS | Transport Layer Security |
| UDP | User Datagram Protocol |
| UID | Unique Identifier |
| UPS | Uninterruptible Power Supply |
| US | Ultrasound |
| UTF-8 | 8-bit Unicode Transformation Format |
| VNA | Vendor Neutral Archive |
| VR | Value Representation |

11 List of shortcuts

Currently, iQ-ROUTER/PRO/PREMIUM does not provide any shortcuts for application functions.

12 Annex

12.1 Acceptance test – Checklist

In order to ensure that iQ-ROUTER/PRO/PREMIUM faultlessly transmits the imaging data between the connected DICOM devices according to potentially set schedules, uses appropriate data compression allowing for diagnostic reading of the transmitted data and executes any data-modification procedures as intended, it is necessary to perform system acceptance tests before using the system productively.

Such acceptance tests should be performed:

- 1. Before placing the system into operation for the first time, i.e. after installing and configuring iQ-ROUTER/PRO/PREMIUM.
- 2. After every substantial configuration change, e.g. hardware or software changes, when a new DICOM node is added (sending and/or receiving), the license is changed or renewed, schedules are adapted or modification rules are added or changed etc.
- 3. Every quarter, unless the national regulations in your country require more frequent intervals.
- 4. After power supply failures.

In the following you find a checklist with the recommended iQ-ROUTER/PRO/PREMIUM acceptance tests. It consists of two parts – some general license tests and device-related data transmission tests. You may use this checklist to document your performed acceptance tests. Print out the checklist and fill in your results. You should use a new checklist for every device connected to iQ-ROUTER/PRO/PREMIUM.

Checklist – General license check

| # | <pre># Test (description)</pre> | | Test result | | |
|----|---|------------------|-------------|--------|---------|
| | | respon- sible | Passed | Failed | Skipped |
| 1. | The software license has not expired. The license will expire on: | Admin | | | |
| 2. | The license covers the correct software edition, i.e. BASIC, PRO or PREMIUM. Used edition is: | Admin | | | |

Checklist – Data transmission checks

These tests should be performed for every configured DICOM connection that passes through iQ-ROUTER/PRO/PREMIUM. The tests differ depending on whether a station actively sends data to another device or whether it is used to query and retrieve data from another device.

Type of transmission (Perform the acceptance tests for the selected type of transmission)

| □ Data is sent (C-STORE) | Sending device: Receiving device: | |
|--|--------------------------------------|--|
| \Box Data is queried/retrieved (Q/R) | Querying device: Queried device: | |
| | | |

| # | Test (description) | Person respon- sible | Test result | | |
|--|--|---|--------------------------|------------------------|----------------------|
| | | | Passed | Failed | Skipped |
| Acce | ptance tests for C-STORE transmissions | | | | |
| Perfor | mance checks | | | | |
| Trans times conne Note: recons | mit a typical study from sender to recipient. Perform the t of the day (in order to determine bottlenecks). Test the re ection is intended for (emergency, urgent and/or normal cas A typical study includes not only the original images but ar structions, secondary capture images, presentation states e | ransmission te espective use ses). ny additional c etc. | est at cases onter | diffe that t suc | rent this h as |
| 3. | For emergency cases: | Admin | | | |
| | (Data must be completely transmitted and readable within 15 minutes.) | | | | |
| | Time: Duration: | | | | |

| # | Test (description) | Person | Test result | | |
|--------------|---|------------------|-------------|--------|---------|
| | | respon- sible | Passed | Failed | Skipped |
| 4. | For urgent cases: | Admin | | | |
| | (Data must be completely transmitted and readable within 1 hour.) Time: Duration: | | | | |
| 5. | For normal cases: | Admin | | | |
| | (Data must be completely transmitted and readable within 24 hours.) Time: Duration: | | | | |
| Time | schedule checks | | | | |
| If the on we | connection is supposed to be used at a specific time sched eekends), perform the following tests. | ule (e.g. durir | ng nig | iht ho | ours, |
| 6. | Transmit a study from sender to recipient at the start of the intended time schedule. The study arrives at the recipient. Scheduled start time: Time of transmission: Duration: | Admin | | | |
| 7. | Transmit a study from sender to recipient at the end of the intended time schedule. The study arrives at the recipient. Scheduled end time: Time of transmission: Duration: | Admin | | | |
| Acce | ptance tests for Query/Retrieve connections | 1 | T | r | |
| 8. | Search for a typical study using the search parameters defined in the procedures of your institution (e.g. patient name, patient ID, accession number, institution name). The searched for study/studies is/are found within max. 20 seconds. | Admin | | | |
| 9. | Select a typical study and retrieve it from the queried station. The entire study should be retrieved within max. 15 minutes. Note: Perform this test at different times of the day. Time: Duration: | Admin | | | |

| # | Test (description) | Person | Test result | | ult |
|--------------------------|--|------------------|-------------|--------|---------|
| | | respon- sible | Passed | Failed | Skipped |
| Acce | ptance tests for both types of data transmission (C-S | FORE, Q/R) | | | |
| Image Check origin | e data quality checks the received image data at the received station and, if ne al data (e.g. concerning number of objects, image quality). | cessary, comp | are it | : with | the |
| 10. | The received/retrieved data was transmitted completely (e.g. no series or images or additional objects missing) and in the correct order (i.e. images within a series). | Physician | | | |
| 11. | The image quality is sufficient to allow for diagnostic reading (e.g. images not cut off, no artifacts, without limitations in number of gray-scale shades). It corresponds with the quality of the source images. | Physician | | | |
| 12. | All relevant patient, study, series and image information is available, correct and complete (e.g. patient name and ID, DOB, study date, modality, body part, contrast agent and dose information etc.) | Physician | | | |

Remarks:

Date of acceptance test:

Reason for acceptance test:

After evaluating the results of the acceptance tests, the iQ-ROUTER/PRO/PREMIUM 3.1 system is:

 \Box Approved for productive use

 \Box Not approved for productive use

Signed by:

Name: Physician Name: PACS/IT Administrator

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