NINA

Nuclear Medicine Information and Nuclear Medicine Archive System

This is a short module description of NINA.
There are two basic building blocks, the information system (NI) and the archive (NA). These are further divided into modules, some are alternatives others are optional, please ask for configuration assistance.

1 Nuclear Medicine Archive System

1.1 Base Archive

This is the basic building block for all the other components and is needed in all possible configurations.

- Basic Archiving (common structure for the specific Archive modules)
- Archive Administration (WEB based interface)
- Status display (WEB based interface)
- Basic Backup (System, Configuration, Database)

1.2 Specific Archives

At least one of these modules is needed for an installation doing permanent storage.

1.2.1 DICOM Archive

- DICOM Archive
- DICOM Server (C-STORE SCP/SCU, C-FIND SCP, C-MOVE SCP)
- Adenda function (import and export of files in DICOM format)
- Administration Interface (WEB based interface)
- Query and Send functions (WEB based interface)

1.2.2 USTU Archive (Elscint)

- USTU Archive
- USTU Server (STORE SCU/SCP, FIND SCP, MOVE SCP)
- Adenda function (import and export of files in USTU format)
- Administration Interface (WEB based interface)
- Query and Send functions (WEB based interface)

1.2.3 Interfile Archive

- Interfile Archive
- Adenda function (import and export of files in interfile format)
- Administration Interface (WEB based interface)
- Query functions (WEB based interface)

1.2.4 CTI-PET Archive

- CTI-PET Original Data Archive
- Interface to the CTI provides archiving functions (this module must be supplied and installed by CTI/Siemens on the CTI system)

- Administration Interface (WEB based interface)
- Archive, Query and Send functions (WEB based interface)

1.2.5 GE-PET Archive

Functionality not yet specified

1.2.6 ADAC/Philips PET Archive

Functionality not yet specified

1.2.7 Foreign Data Archive

This Archive is the Platform for integrating various kinds of data sources, e.g. Ultrasound devices or paper and filmscanners, see modules for this integration later in this text.

- Foreign Data Archive
- Adenda function (import and export of files in various formats)
- Administration Interface (WEB based interface)
- Query functions (WEB based interface)

1.3 Archive Extensions

These modules are designed as extensions to the archive modules described above. It is also possible to configure a conversion only system, which does not local permanent storage, ask for configuration help.

1.3.1 Multi Area functionality

For all archive Modules mentioned above, there is the possibility to have the additional functionality of more then one data area. This is needed for configurations where data sets should be kept separated, for example the quality assurance data, separate Areas for handover of data to other departmens which should not be given full access to the archives etc.

1.3.2 Conversion Modules

All these conversion modules assume the existence of an archive or a receiving module for the source format and an archive or a sending module for the target data format.

1.3.2.1 USTU to DICOM (Elscin)

The “groups” are converted into DICOM NM and the “reports” are converted into DICOM HC format.

1.3.2.2 Interfile to DICOM

Conversion to NM DICOM data format.

1.3.2.3 CTI-PET to DICOM

Conversion to NM or PET DICOM format configurable.

1.3.2.4 GE-PET to DICOM

Conversion to NM or PET DICOM format configurable.

1.3.2.5 ADAC/Philips PET to DICOM

Conversion to NM or PET DICOM format configurable.

1.3.2.6 Foreign data Formats to DICOM

This module is needed to i.e. integrate a Ultrasound device into a DICOM Archive by also using the Foreign Data Archive, the DICOM Archive and the Ultrasound integration module later in this text.

1.3.2.7 DICOM to DICOM

Since there are sometimes different interpretations of the DICOM standard there is the need to convert from DICOM to DICOM.

1.3.2.8 DICOM to USTU

All data elements that are convertible to USTU are converted. Other Data elements are silently ignored.

1.3.3 Archive integrating Query

This module gives the possibility to search in all configured archives of all types (e.g. DICOM, USTU) for patients and studies.

1.3.4 Statistic Reports

Produce various statistic reports on the data stored in the archive (Number of patients, studies, average and maximum number of studies per patient; development of these figures over time, etc.).

1.3.5 Access control and user administration

This module gives the possibility to restrict access to the WEB based interfaces of all modules based on user name and password. There are levels of access which can be given to the users, the user administration itself is part of the top access level.
Furthermore the access to the Archives which use a network protocol (e.g. DICOM, USTU) can be set up to restrict access to based on the protocol specific communication partner identification scheme.

1.3.6 Receiver Modules

Instead of having a full Archive in a specific format, these modules provide “receiving only” service. They simply collect the data sent in the format they are designed for to a conversion module described above or a Sender Module described bleow. There is no long term storage or query functionality.

1.3.6.1 DICOM Receiver

Provides a single DICOM Application Entity that can be sent to (C-STORE SCP). Multiple installations of this module on one system are possible.
The data can be further processed by a conversion module (1.3.2.7 – 1.3.2.8) or a sender module (1.3.7.1).

1.3.6.2 USTU Receiver (Elscint)

Provides one receiving SP station emulation. Only one installation of this module per computer is possible.
The data can be further processed by a conversion module (1.3.2.1) or a sender module (1.3.7.2).

1.3.7 Sender Modules

these modules provide an “automatic sending” service for received or converted data to a network target in the specific format and network protocol. There is no long term storage or query functionality.

1.3.7.1 DICOM Sender

Provides automatic sending of Data in DICOM Format to an application entity (C-STORE SCU). Multiple installations of this module are possible.
The data source can be a DICOM Archive (1.2.1), a conversion module (1.3.2,1 – 1.3.2.7) or a DICOM Receiver module (1.3.6.1).

1.3.7.2 USTU Sender (Elscint)

Provides automatic sending of Data in USTU Format to a SP station on an OSI network. Multiple installations of this module are possible.
The data source can be a USTU Archive (1.2.2), a conversion module (1.3.2,8) or a USTU Receiver module (1.3.6.2).

1.4 Long term data store

The basic Archive module gives only a basic storage facility. The amount of data is limited by the size of the disc of the server system, which also contains the operating system, the application programs and al temporal data.
For long term storage there must be a facility large and save enough to keep the data as long as the customer wants to store it.

1.4.1 Automatic CD –Jukebox (NSM modular systems)

- fully automatic jukebox
- size can be flexible adjusted to the customer needs
- writing and reading the CDs is done automatically (no need of handling the media by the user)
- there can be up to 16 jukeboxes connected to one server (if the server system hardware is able to drive that many SCSI devices)
- we normally configure each jukebox with 1 writer and 2 reader and filled with empty CDs on delivery

1.4.2 Manual CD – Jukebox (CD-Changers, e.g. Nakamitchi)

- half automatic jukebox (consists of 7 CD changers per system)
- a separate CD-writer must be connected to the server
- burning the CDs and inserting them into the jukebox needs user intervention which makes errors in this process possible.
- Integrating into the database and reading the CDs is done automatically

1.4.3 Manual CD Storage

- writing of CDs and providing access to them (by inserting the requested CD into a device on the server) is done manually by the user.
- there must be at least one Writer and one Reader connected to the server.
- there can be, of course, long delays on data requests, when the system is waiting for a CD and the server needs to provide it manually.

1.4.4 Harddisk Storage

- the long term storage is done on large harddiscs which should be configured so some kind of soft- or hardware RAID, but this depends on the customer needs on reliability and cost efficience.
- in contrast to one time writeable media based long term storage this solution offers the possibility to purge data from the long term storage.

1.4.5 Tape Libraries

- the long term storage is put onto a external tape library which normally is integrated via the nfs network protocol.
- Ii the library supports purging of data then the same possibilities as for the harddisc storage are offered.
- the access speed heavily depends on the speed of the tape library and the network connection.
- the library could either be supplied by Elimpex or from the customer as many costumers already run such systems for their in house data management.

1.5 Backup

The long term data storage must not be mistaken as a backup media, it is the online media used to access the data via the archive server.
Additionally you need a possibility to save your Data offline from the Server for disaster recovery.
If the long term storage facility solves that problem transparent to the archive – as a tape library could do this, then this mechanism should be used otherwise one of the following modules is needed.

1.5.1 Tape Backup for long term storage

As data is stored on the long term storage, it is also saved on a tape device or a tape roboter. Depending on the tape device there is more or less user intervention needed to operate this module.

1.5.2 CD Backup for long term storage

If CDs are used as long term storage, there is also the possibility that each CD is burned twice and one of them is stored at a different secure place.
If a NSM Jukebox is used this must be equipped with a loading bay for manipulating CDs by the user.

1.6 HIS Connectivity

To enhance the patient data quality it is possible to integrate the access to an existing Hospital Information System (HIS).
The amount of patient data taken from the HIS can be configured to the customer needs.
As there are many different HIS systems this is always an individual programming project.

1.6.1 HIS – Modality Integration

To transfer the patient data to the data modality there must be an interface provided by the modality. Depending on this interface the following modules are needed.

1.6.1.1 DICOM Worklist interface

A DICOM Worklist is provided for the modality

1.6.1.2 DICOM Study interface

This interface can be used for some DICOM modalities which do not support DICOM worklist but C-STORE SCP

1.6.1.3 USTU HIS interface (Elscint)

This interface supplies GE/Elscint SP Modalities with patient data.

1.6.1.4 HIS interface for Video data source

This interface supplies HIS data to the Video data, see later in this document.

1.6.1.5 HIS interface for Paper scanner data source

This interface supplies HIS data to the Paper module, see later in this document.

1.6.1.6 HIS integration for other modalities

Specify the interface for your modality and we will develop an interface for it.

1.6.2 HIS – Received Study enhancement

As some modalities refuse to take patient data, the only possibility to integrate consistent patient information is to integrate the information, when the studies are sent to the archive.

1.7 Integration of other data sources

1.7.1 Video data source (e.g. Ultrasound devices)

Images provided via video signal (FBAS, BAS, SVHS, Y/C) can be stored in a foreign data Archive (and converted into a DICOM archive by use of a conversion module, see above).

1.7.2 Paper scanner

Examination results, and other patient documents can be scanned with normal paper scanner and are stored in a foreign data Archive (and converted into a DICOM archive by use of a conversion module, see above).

1.7.3 Other sources

All other data sources where there is a possibility to access the data in an electronically way can be stored as described for the data sources above, tell us the format and we will develop the interface and data conversion for you.

2 Nuclear Medicine Information System

This system helps organizing your nuclear medicine department:

- organize the patient flow
- plan examinations in advance
- support for reporting the examinations
- planning nuclear material orders
- productivity monitoring

etc.

2.1 NIS Base system

This is the basic building block for all the other components and is needed in all possible system configurations.

- Basic Administration (common structure for the specific Information system modules)
- Information System Administration (WEB based interface)
- Status display (WEB based interface)
- Basic Backup (System, Configuration, Database)

2.2 Patient flow management

Every patient has to pass several stations on an examination. This is supported by the patient flow management.
By registering the stations needed, the patient record is automatically passed to the next station.
You never lose sight of where your patients are and which modality is currently in use.

2.3 Examination schedule planning

This module gives you the possibility to plan examinations in advance and give fixed appointments to patients. This is the base for planning nuclear material use.

2.4 Personnel planning

Interconnected with the examination schedule there must be the personnel available to do the examinations.

2.5 Nuclear material management

Based on the examination schedule, planning the orders for nuclear material can be organised and optimised.

2.6 HIS connectivity

To enhance the patient data quality it is possible to integrate the access to an existing Hospital Information System (HIS).
The amount of patient data taken from the HIS can be configured to the customer needs.
As there are many different HIS systems this is always an individual programming project.

3 Hardware

The needs for server and Integration system hardware heavily depends on your configuration and performance needs. Please ask us for advise.