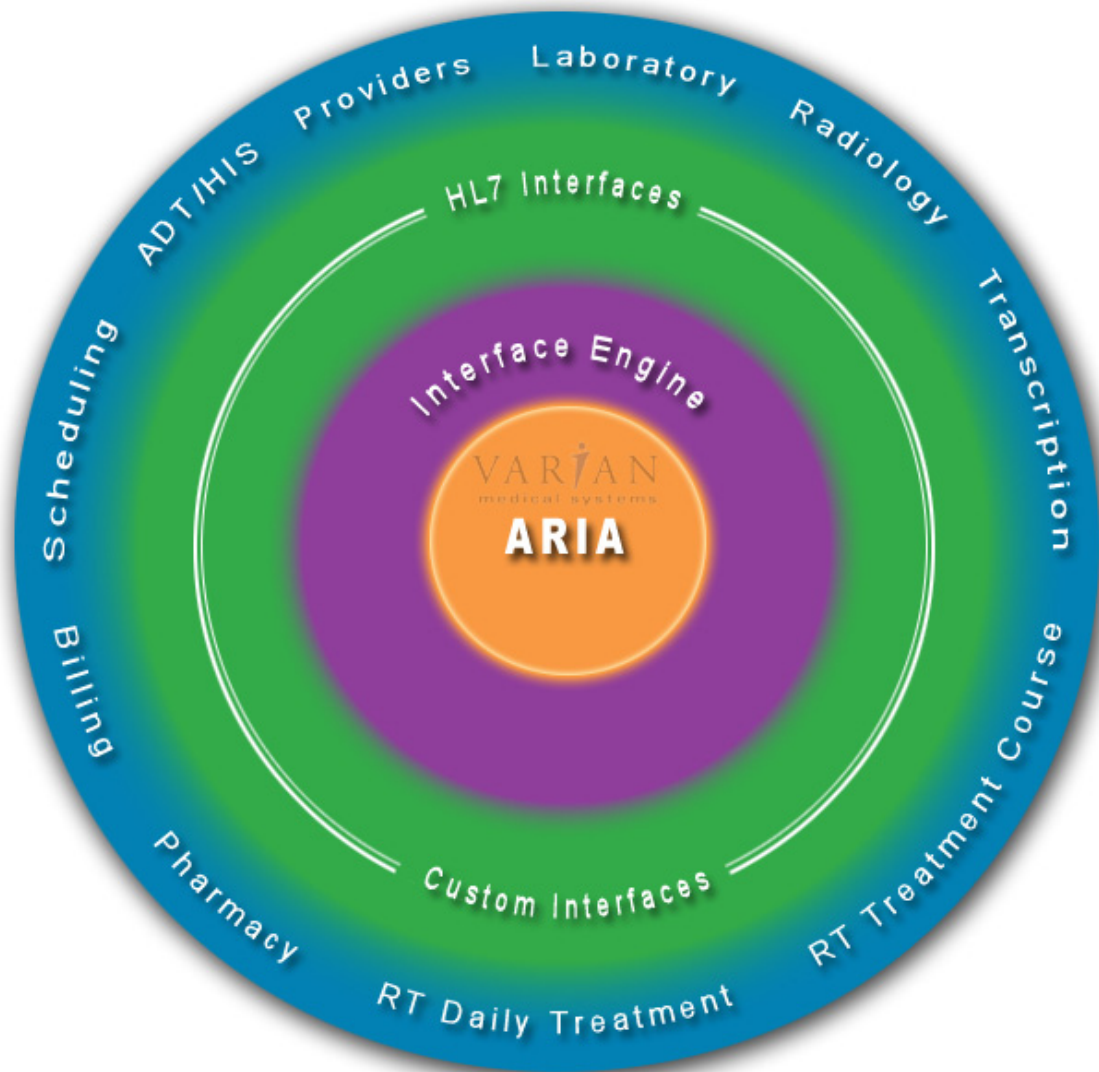


Information Exchange Manager

Overview



Contents

Introduction	3
HL7	3
Interfaces	3
Information Exchange Manager (IEM).....	4
Benefits of Interfacing	6
Interface Message Formats.....	6
Currently Supported Interface Types.....	7
Integration Connectivity	12
Interface Connectivity.....	13
Appendix 1: Matrix of ARIA products and Interfaces	14
Appendix 2: Terminology	15
Appendix 3: Implementing Interfaces	16

Introduction

Varian Medical Systems is committed to the IHE (Integrating the Healthcare Enterprise) goals of open-standards exchange of electronic data amongst Health Information Systems (HIS). Varian's Information Exchange Manager (IEM) is an integration engine which combines sophisticated logic, flexible configuration settings and Health Level 7 (HL7) messages to communicate with external departments and systems.

This document gives customers general information on using IEM to exchange data between HIS and Varian's Oncology Information Systems (OIS). In this document, OIS is used to refer to ARIA for Radiation Oncology, ARIA for Medical Oncology or the combination of the two. More detailed information, in the form of interface guides, is available from Varian sales representative.

HL7

HL7 is one of several American National Standards Institute (ANSI)-accredited Standards Developing Organizations operating in the healthcare arena. Their mission is: *"To provide standards for the exchange, management and integration of data that support clinical patient care and the management, delivery and evaluation of healthcare services. Specifically, to create flexible, cost effective approaches, standards, guidelines, methodologies and related services for interoperability between healthcare information systems."*

The HL7 standard is supported by most health system vendors and is used in the majority of large North American hospitals today. The current standard defines transactions to transmit data for:

- patient registration
- admission, discharge and transfers
- insurance
- charges and payors
- orders and results for laboratory tests and image studies
- nursing and physician observations
- dietary, pharmacy, and supply orders
- master files

Interfaces

An interface consists of a connection and processing that enables two systems to exchange electronic messages containing data in a meaningful format. IEM enables Varian products to communicate with other hospital systems such as patient registration, lab, billing, transcription services and pharmacy.

For example, an installation of IEM and ARIA for Medical Oncology or ARIA for Radiation Oncology could receive messages containing patient registration data from the hospital registration system, generate and send messages containing billing events data to the billing system(s) and receive messages containing lab results data from the lab system(s).

Information Exchange Manager (IEM)

IEM is designed to comply with and support the HL7 Standards, versions 2.3. This is in keeping with Varian's philosophy of open systems that communicate effectively with other vendors' products. Using IEM, both outbound and inbound interfaces can be implemented. Data, such as demographic, financial, schedule, provider, and lab results, can be shared.

IEM is event-driven in accordance with HL7 philosophy. Events in the HIS will trigger messages that IEM properly receives, interprets and utilizes to perform operations and insert data in ARIA.

When necessary, IEM can perform translations on data content to match differing coding systems, modify location of data within the HL7 segments and perform conditional processing on the data received. IEM can also convert non-HL7 formats into the HL7 accepted format, which constitutes a custom interface.

IEM runs on Microsoft Windows 2003 Server Standard Edition (English version only), Service Pack 1 operating system unattended on the client's interface server. As messages are received from hospital systems, IEM validates the messages, acknowledges them to the sending system and updates the appropriate fields in ARIA. IEM also watches for changes made to the ARIA database that should be sent out to other systems.

IEM's architecture allows for easy addition of new interfaces with little impact to existing interfaces. Each interface runs independently of the others and therefore can have different settings for filters, data handling, processing and other events.

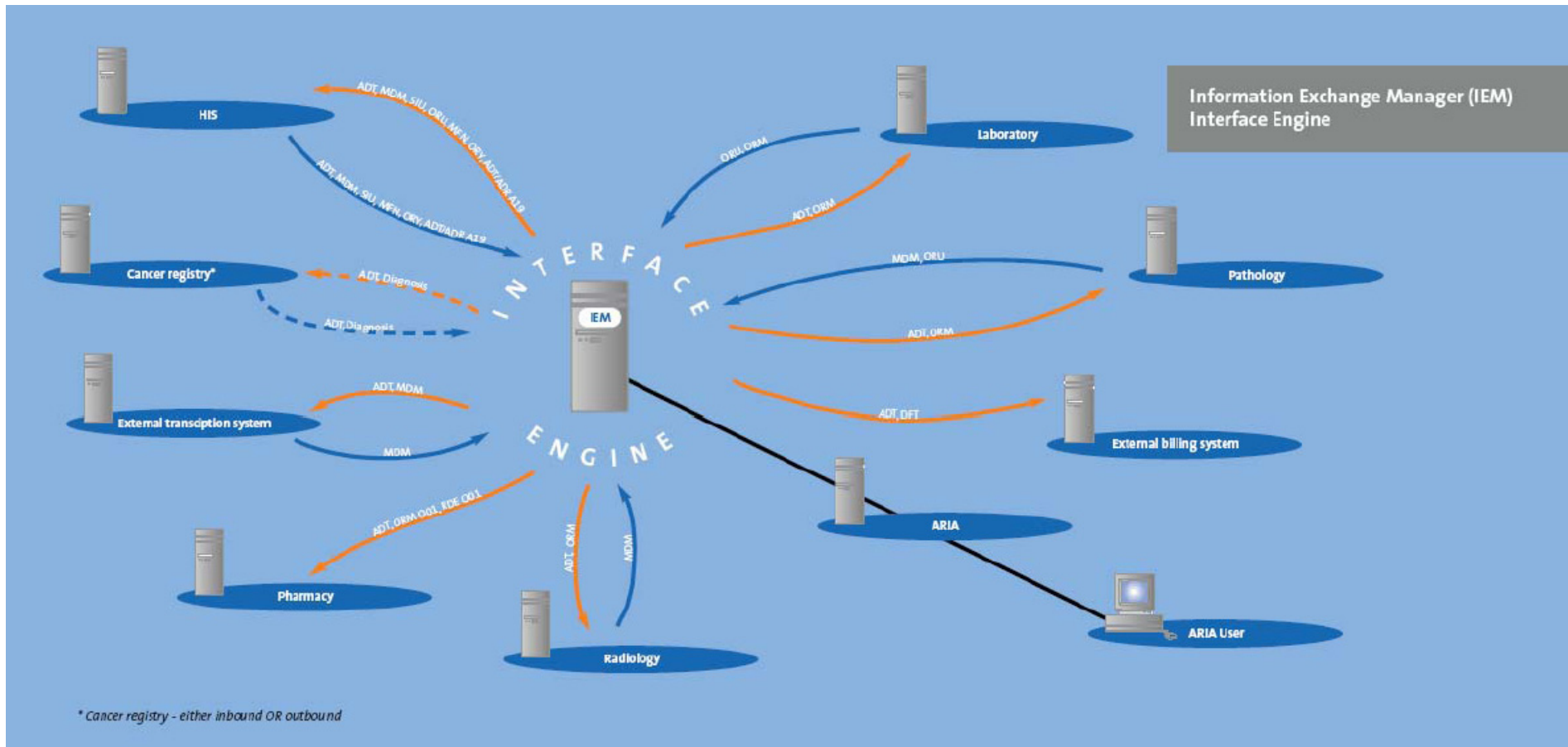


Figure 1. IEM exchanges key data between systems

Benefits of Interfacing

Data Integrity

Electronic transfer of data ensures the information remains consistent across all systems - without having to staff additional resources to enter the same data multiple times. Re-entering data introduces the risk of errors. Furthermore, by sharing data, health providers can capture and validate patient information using the most appropriate system. This allows health providers to optimize their processes and provide a single point of entry for data, further improving data integrity.

Health enterprises that share instead of re-enter data can give wider access to a central electronic health record, again ensuring the best information is available where it is needed.

Timely Data

When data is shared electronically, it will be as current as possible. The exchange of information between systems can occur as the data is recorded (real time) or it may be collected and sent periodically as appropriate.

Interface Message Formats

As previously stated, IEM utilizes and supports HL7 2.3 standard messages.

In cases where a hospital system does not or cannot support the HL7 format, or the data being transferred is not supported by HL7, a custom program may be written by Varian Medical Systems. These custom programs (Custom Interfaces) either convert the client's data into HL7 format for data coming into ARIA, or from HL7 format to a file format acceptable to the hospital system for data going out of ARIA. In either case, Varian Medical Systems and the client's information systems staff or product vendor work together to agree on a format to exchange data.

In general, a custom interface is an extension to an IEM Interface. A custom built module is created for the specific vendor and plugged into IEM.

Currently Supported Interface Types

Clinics and departments need to share many types of data with external systems and other departments. IEM supports both ARIA for Radiation Oncology and ARIA for Medical Oncology information systems with an assortment of interface types. As Varian further develops IEM, more interfaces will be offered for ARIA. Please see the table in Appendix 1 for Varian's interface offerings by product.

Varian currently provides many interface types as standard, meaning that they are already developed and validated. These interfaces are implemented according to the process outlines in Appendix 2. This section discusses those "standard" interfaces and describes how they function at a high level. Detailed interface specifications will be provided at the beginning of the implementation project.

ADT

ADT, for Admissions Discharges and Transfers, is sometimes called a Demographics interface. This interface exchanges essential patient demographic data between systems. A broader set of data, including patient's next of kin, can also be exchanged.

IEM supports **inbound** and **outbound** processing of Patient Demographics using HL7's ADT message formats. Using an ADT interface eliminates the need for the clinic staff to enter duplicate patient registrations in ARIA applications and the Hospital's Registration/ADT system.

The IEM inbound ADT interface is designed to provide a means for keeping the ARIA database current with patient information provided by an outside system. In response to HL7 messages received through the interface, the IEM interface will add and or update patient information.

Key to this process is identifying the patient. The incoming HL7 messages must contain an identifier or identifiers that will uniquely identify the patient record. This allows updates to patient demographic information such as Name, Address, Birth Date etc. to be applied to the correct patient record. It is extremely important that these "matching" identifiers be correct and created only by the sending system through the interface. If a matching identifier is incorrect it can lead to a patient chart changing identity as would be the case if a Name change were applied to the wrong chart.

Billing

Also called Financial or Charges interface, the Billing interface sends data about activities performed in the clinic to a billing system where they are processed for payment.

In ARIA, Procedure Codes, their attribute details and modifiers are attached to an activity. As the clinic performs activities and marks them complete in Time Planner, Patient Manager or Activity Capture, the procedure codes accumulate. Clinic staff members use Activity Capture to review and approve procedures for billing.

At the scheduled time or interval, the IEM billing interface sends the approved transactions out to the billing system. Billing jobs can also be manually initiated.

The service or resource being billed is described using one of several available coding

schemes. ARIA uses standard CPT (Current Procedural Terminology) codes to specify billed services and resources. Other procedure code sets may be implemented.

IEM allows multiple billing scenarios to be defined. Each billing scenario is a configured set of Hospitals, Departments and Activity Types, batching rules and the associated interface through which the billing data will be sent. This allows for certain charges (such as professional charges) to be sent to one Billing System while other charges (such as technical charges) are sent to a different Billing System.

Global activity types can be associated with multiple billing scenarios, allowing specific transactions to be sent out to more than one billing system. IEM controls all scenarios according to strict rules so that all charges are sent appropriately, and not submitted to the same billing system twice.

Lab Orders

IEM supports **outbound** orders interfaces using the HL7 ORM (Order Message) message format. Users can create lab orders for patient blood work and other tests in ARIA for Medical Oncology. When these orders are approved by an authorized user, an outbound order is sent using HL7's ORU message formats.

IEM also supports order modifications and cancellations. If an existing order is adjusted to have tests added or removed, a new message is sent out containing the entire order. The identifying Placer Order number remains the same.

This interface currently supports ARIA for Medical Oncology only.

Lab Results

A Lab Results Interface brings the resultant data from lab tests performed for a patient into the ARIA. An ORU (Observation Result Unsolicited) message is generated when lab tests are completed and released from the lab system. This HL7 message will contain a patient identifier and the lab results. IEM reads the message, locates the patient in the ARIA and inserts or updates the results in the patient chart. At this point, the results are available for viewing online in ARIA. If results are received for a patient not in the database, the interface can be configured to either ignore the results or report them as errors.

If IEM encounters a problem while processing the HL7 message, the message and the problem description will display on the message log. "Errors" will cause the entire message to be rejected. "Warnings" will reject only the offending data item, but will process the remaining information. Log files are always available for administrators to review.

Query/Response

A Query/Response Interface allows one system to request patient updates from another. This allows the front desk in a department to “ask” the HIS for patient registration information based on the patient’s name and medical record number.

IEM can send or receive queries, depending on the products implemented: **outbound** (send query and receive response) for ARIA for Radiation Oncology and **inbound** (receive query and send response) for ARIA for Medical Oncology.

IEM can process ADT A19 or ADR A19 messages as responses.

Pharmacy

ARIA for Medical Oncology supports outbound pharmacy orders using two forms of HL7 messages to Pharmacy systems. These are ORM-O01 and the RDE/RXE.
This interface currently supports ARIA for Medical Oncology only.

If an existing order is cancelled (a message is sent canceling the order) and then subsequently reordered in Manager from ARIA for Medical Oncology, a new order message with a new Placer Order number is set out.

Varian Medical Systems also supports integration to lab devices such as chemistry or blood analyzers. This type of integration is possible through the use of Dawning Technologies SNI device.

This interface supports ARIA for Medical Oncology only at this time.

Providers

Sometimes called Master File Upload, this interface imports information about referring physicians into ARIA.

IEM supports **inbound** (to ARIA for Radiation Oncology or ARIA Medical Oncology) and **outbound** (from ARIA for Medical Oncology only) processing of Patient Demographics using HL7’s ADT (Admission, Discharge and Transfers) message formats. Using an ADT interface eliminates the need for the clinic staff to enter duplicate patient registrations in ARIA applications and the Hospital’s Registration/ADT system.

Transcription

IEM supports **inbound** and **outbound** processing of transcriptions (document exchange) using HL7’s MDM (Medical Documentation Management) message formats. The inbound transcription interface component is used to insert or update documentation (such as progress notes) into ARIA.

Users can then view the transcription information in ARIA using the “Progress Note” Document Manager or Dynamic Documents component. The outbound transcription interface component is used to send transcribed health care professional documentation (progress notes or Documents) from ARIA to external systems.

During the update process, an unapproved document will be replaced with the new one. Any approved documents will be erred out and the new transcription information will be inserted.

Scheduling

IEM supports **inbound** and **outbound** scheduling interfaces to share scheduling information. Using the Scheduling interface eliminates duplicative data entry of patient appointments information.

IEM allows creation, rescheduling (Inbound component only), modification, cancellation, deletion (Inbound component only) of appointments as well as the “Patient No Show” event.

The delete event should only be used when an appointment has been erroneously scheduled and then removed from the schedule. This is to avoid affecting any statistical processing.

Radiotherapy History (Radiation Treatment Summary)

IEM supports **outbound** radiotherapy history interfaces (session or treatment course summary) to export treatment parameters at the completion of session or treatment course, into another application.

The interface relies on the HL7 ORU (Observational Results Unsolicited) messages to send data such as patient diagnosis, reference point, plan, and field information.

This interface supports ARIA for Radiation Oncology only.

Imaging

Outbound image orders are entered and approved within ARIA for Medical Oncology, an HL7 message is produced for the order. The IEM Interface Engine accepts the order message and sends it to the receiving system.

Inbound reports are released, and an HL7 message will be generated containing a patient identifier and the reports. The IEM Interface Engine accepts the message, locates the patient and updates the database with the report. At this point, the report is available for viewing in ARIA for Medical Oncology.

This interface supports ARIA for Medical Oncology only.

Pathology

Outbound pathology orders are entered and approved within ARIA for Medical Oncology, an HL7 message is produced for the order. The IEM Interface Engine accepts the order message and sends it to the receiving system.

Inbound pathology reports are released, and an HL7 message will be generated containing a patient identifier and the reports. The IEM Interface Engine accepts the message, locates the patient and updates the database with the report. At this point, the report is available for viewing in ARIA for Medical Oncology.

This interface supports ARIA for Medical Oncology only.

Custom Interfaces

A custom interface is a program or set of programs created when IEM and the hospital system cannot communicate using HL7 - either because the hospital system does not support HL7 and cannot be enhanced to do so, or the information being exchanged is not supported in HL7. In some cases it is possible to extend the HL7 formats to accommodate unsupported data thereby allowing a modified version of a standard interface to be used.

The process starts with defining an exchange message format. The exchange message format is based upon the data elements required to update the target system. Corresponding data elements in the hospital system are identified and a message format is agreed upon. As this type of custom interface will communicate using the file exchange method, a file-naming scheme is also required.

Hospital System as the Source

If the data originates in the hospital system, the HIS vendor builds a module to format the data according to the exchange message format, and transfers it as a file to the shared directory on the IEM server. Varian Medical Systems builds a custom interface module that becomes part of the IEM Interface. The new custom interface module must read and verify the file based on the exchange message format and pass the extracted data on to the main part of the IEM Interface which updates the ARIA.

Varian Information System as the Source

If the data is originating in ARIA, a custom interface module is added to IEM to create data, format it according to the exchange message format, and send it to the recipient hospital system through the shared directory. The hospital system vendor builds a module to receive and verify the data. The information is then used to update their database.

In general, custom interfaces are extensions to IEM Interfaces. A custom built module is created for the specific vendor and plugged into IEM. Custom interfaces are more expensive and time consuming to create than a standard interface that uses HL7. Custom interfaces that do not use HL7 are restricted to the file exchange transport method.

Integration Connectivity

IEM can communicate with the enterprise systems through TCP/IP sockets based interface engine or by exchanging files across a network. In some circumstances a manual file transfer method using CDs can also be accommodated, although this method by its own nature is the least reliable.

- **Using TCP/IP sockets.** This means connecting directly (point to point) or through a centralized interface engine, such as Datagate© or CloverLeaf©. TCP/IP sockets is an industry standard for communicating between networked servers. Many systems already support TCP/IP sockets, or can be altered to do so. IEM supports data transfers through TCP/IP sockets using the HL7 Minimum Lower Level Protocol. Systems communicating via TCP/IP sockets may do so directly (point to point) or through a Centralized Interface Engine.
- **Using files to pass data between systems.** This involves setting up shared network directories which both systems can access. The systems exchange files by writing and reading from pre-determined directories.

Minimal Lower Layer Protocol (MLLP)

IEM uses the Minimal Lower Layer Protocol (MLLP) to send messages.

1. A single vertical tab character indicates the start of block (Hex), 0x0B, at the beginning of the message;
2. The characters (Hex) 0x1C (FS) indicates end of block, and termination character (hex) - 0x0D (carriage return) comes at the end of the message.

Message Acknowledgments

When a message is sent using TCP/IP from one system to another, HL7 describes a process for indicating that the message has been successfully received. Essentially, the receiving system sends an indication that the message was received and properly formatted. This is called an *acknowledgment*. This acknowledgment also indicates to the sending system that the next message can be sent. IEM fully supports the HL7 requirements for acknowledgements, both original and enhanced modes.

In situations where a message is sent and an acknowledgment is not received, IEM will go into a re-send mode until the message is acknowledged.

Sequence Number Protocol

IEM supports the optional HL7 sequence number protocol. The sequence number stored in MSH 13 is checked against the last received message to make sure that the messages are received in order. For more information, see the IEM HL7 Message Segments Guide.

Interface Connectivity

TCP/IP Sockets

TCP/IP sockets is an industry standard for communicating between networked servers. This method of connectivity is either direct (point to point) or through the client's Interface Engine, such as Datagate© or CloverLeaf©. Many systems already support TCP/IP sockets, or can be altered to do so. IEM supports data transfers through TCP/IP sockets using the HL7 Minimum Lower Level Protocol.

File Exchange

As an alternative to TCP/IP sockets and/or interface engines, IEM can also communicate with a hospital system using files. IEM and the hospital system must be connected to the same network through which they would use a shared directory to exchange information. The sending system will create the file and place it in the shared directory. The receiving system reads the file, processes the information and deletes the file to indicate it has finished with it. This method of exchanging data must be used when custom interfaces that do not use HL7 are involved and would also be used to transfer data formatted in HL7 when systems do not support TCP/IP sockets. Files can be exchanged with AS/400 and UNIX servers using protocols such as Network File System (NFS) or File Transfer Protocol (FTP). The OIS can mount or export drives as required.

Appendix 1: Matrix of ARIA products and Interfaces

At Varian Medical Systems, we are constantly adding new interface types and enhancing interface functionality to IEM. The following table shows what is available for each product in the ARIA OIS line, as of December 2007.

Interface	ARIA for Radiation Oncology	ARIA for Medical Oncology
ADT Inbound	X	X
ADT Outbound	X	X
Billing Outbound	X	X
Lab Results Inbound	X	X
Lab Orders Outbound		X
Pharmacy Outbound		X
Provider Inbound	X	X
Provider Outbound		X
Imaging Orders Outbound		X
Imaging Results Inbound		X
Pathology Orders Outbound		X
Pathology Results Inbound		X
Query Inbound		X
Query Outbound	X	X
Transcription Inbound	X	X
Transcription Outbound	X	X
Scheduling Inbound	X	X
Scheduling Outbound	X	X
Radiotherapy History Outbound (Radiation Treatment Summary)		
• Treatment session	X	
• Treatment course	X	

Appendix 2: Terminology

	HL7 Messages	Interface
ADT	Admission Discharge Transfer	ADT Inbound/Outbound
DFT	Detail Financial Transaction	Billing Outbound
ORU	Observe Result/Unsolicited	Lab Results Inbound, Pathology results Inbound, Radiotherapy History <ul style="list-style-type: none"> • Treatment Session • Treatment Course
ORM	Order Message	Lab Orders Outbound, Pathology Orders Outbound, Imaging Orders Outbound
ORM 001, RDE 001	Pharmacy Encoded Order Message	Pharmacy
MFN	Master File Notification	Provider Inbound/Outbound
QRY, ADT A19	Patient Query/Response	Query/Response Inbound/Outbound
MDM	Medical Document Management	Transcription Inbound, Imaging Results Inbound, Pathology Results Inbound, Transcription Outbound
SIU	Scheduled Information Unsolicited	Scheduling Inbound/Outbound

Appendix 3: Implementing Interfaces

Varian Medical Systems has a dedicated team of professionals that specialize in electronic data transfer. The team has implemented over 600 interfaces in Medical Oncology and Radiation Oncology settings.

Typically the interface implementation process begins during the sales cycle. Varian and the customer work together, to develop preliminary interface requirements and a corresponding quotation. To supplement this process, the customer completes an interface questionnaire that often includes the exchange of interface specifications.

Once an initial scope analysis and an agreement to develop an interface is in place, the following steps are typically required:

- Analyze the requirements and produce a design document & detailed project plan.
- Review and sign off the design document and detailed project plan.
- Install, setup and test of third-party system HL7 component or custom segment (if required). Customer responsibility.
- Map system codes (if applicable).
- Develop a custom interface (if required).
- Configure / set up the test & production environments at the client site.
- Test the communications at the client site.
- Test the interface at the client site.
- Provide interface specific training to the client.
- Perform Acceptance Test and verify results in the test environment at the client site.
- Sign off the test results.
- Migrate the interface into the production environment.

To ensure that all interface projects are successful, client and hospital system vendor participation is required at various stages.