Understanding Data Transfer Between Disparate Systems

Welcome!

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IATRIC systems

Objective:

Provide basic HL7 understanding with progressively more complex topic discussion of HL7 standards and interoperability topics.

- What is HL7?

- HL7 Field Formats

- HL7 Segments

- HL7 Messages Types

- Review of Common HL7 Messages

- Custom Z Segments

- Using NPR to create HL7 Interfaces (real-time versus batch)

- Data Exchange and Communication Standards

- HL7 Version 2.x and 3

- A Closer Look at Version 3

- Interoperability Topics

What is HL7?

HL7 Organization definition: Health Level Seven is one of several American National Standards Institute (ANSI) accredited Standards Developing Organizations operating in the healthcare arena. Most SDOs produce standards (sometimes called specifications or protocols) for a particular healthcare domain such as pharmacy, medical devices, imaging or insurance (claims processing) transactions. Health Level Seven's domain is clinical and administrative data.   www.hl7.org

HL7 develops standards to improve information sharing and provides interoperability to allow information exchange between disparate systems.

What is HL7?

- HL7 was established in 1987 and was accredited in 1994 by the American National Standards Institute (ANSI).
- The first version 2 standard was created in 1989 and has been revised and updated consistently since then.
- The current version of HL7 2 is 2.6, approved in October 2007.
- All version 2 standards are backwards compatible.

- Version 3 development began in 1995. Release 1 was published in 2000, and updated again with Release 2 in 2005.
- HL7 releases a Normative Edition of the Version 3 specification on a yearly basis.
- Clinical Document Architecture is based on V3 Normative Edition 2005

Need for a Standard:

- Disparate systems at a Hospital need to be able to interact with each other as efficiently as possible

- A common specification helps in this area:
  -"Normalizes" the data for everyone's benefit
  -Easier to implement
  -Easier to support
  -Getting everyone on the same playing field helps save $$

- HL7 Version 2.x is very common

- HL7 Version 2.5.1 used for Meaningful Use Stage 2 items

- HL7 Version 3 is gaining acceptance with Clinical Document exchanges

HL7.org:

- Made up of voting members

- These members are encouraged to participate and contribute to the standard

- Workgroups meet several times through the year to discuss specific areas and edit the standards as needed

- Iatric has 7 voting members in HL7.org as well as Co-Chair for Structured Documents Workgroup

Each HL7 v2 message is made up of:

- Fields – The individual pieces of data within the message *(ex: patient name, dob, ssn).* Individual fields are separated from one another by the bar or "pipe" symbol (|)

- Segments – Groupings of fields with similar intent *(ex: Patient information contained within one common segment, charge information contained within one common segment)*

- [ ] indicates optional segment, { } indicates repeating segment

- Message Type – Defines the HL7 classification for the message (what "kind" of message is being sent)

- Control Characters – These are used to control the message parsing process with specific control characters defining the start of message, end of segment and end of message.

Let's take a look at a sample HL7 Message:

MSH|^~\&|ADT||ENGINE||20040301192350||ADT^A04|ADT757452230|P|2.1|||
EVN|A04|20040301192350|
PID|||H000000076||TESTCHRISTIANSEN^JOHN^||19931212|M|||1400 CHARLES ST^^LOVES PARK^IL^61111||||
PV1||O|HH.ADULT^^|ELE||^^|DEM^DEMING,RICHARD E|^|^|||||AROU|||^|RCR||MED|||||||||||||||||HHC||REG RCR|||
200402251124||
PD1||||DEM^DEMING,RICHARD E||
GT1|||TESTCHRISTIANSEN,JOHN||1400 CHARLES ST^^LOVES PARK^IL^61111|885-2277|||||SP|745-69-5847|||
DG1||||TEST
IN1|1|MCR-A||MEDICARE|PO BOX 1602^^OMAHA^NE^68101||Y||||UNK||||||SP|||||1|||||||||||||7896547
ZSR||||||||||||||||||||||||^^^^|||||N||UNKNOWN

HL7 Message Type in MSH Segment

HL7 Fields separated by BAR - |field|

HL7 Segments

```
MSH|^~\&|SEMM||PYXIS||20040301192350||ADT^A04|ADT757452230|P|2.1|||◄
EVN|A04|20040301192350|◄
PID|||H000000076||TESTCHRISTIANSEN^JOHN^||19931212|M|||1400 CHARLES ST^^LOVES PARK^IL^61111||||◄
PV1||O|HH.ADULT^^|ELE||^^|DEM^DEMING,RICHARD E|^|^|||||AROU|||^|RCR||MED||||||||||||||||||HHC||REG◄
RCR|||200402251124||◄
PD1||||DEM^DEMING,RICHARD E||◄
GT1|||TESTCHRISTIANSEN,JOHN||1400 CHARLES ST^^LOVES PARK^IL^61111|885-2277||||||SP|745-69-5847|||◄
DG1||||TEST◄
IN1|||MCR-A||MEDICARE|PO BOX 1602^^OMAHA^NE^68101||Y||||UNK||||||SP|||||1||||||||||||||7896547◄
ZSR||||||||||||||||||||||||||^^^^|||||||||UNKNOWN◄
```

- Every HL7 message is made up on two or more HL7 segments.

- Every HL7 message has an MSH segment.

- Every HL7 segment ends with a carriage return ◄ .Since the carriage return is a <u>ASCII code 13</u> (non-printable character) you will not see it when viewing the message.

Fields:

- Defined as a string of characters

- Transmitted as character string and the sending and receiving systems are responsible for assigning "meaning" to each string.

- (Ex: patient name of "John Smith" is transmitted in the field designated for the patient name (PID-5), the receiving system is responsible for retrieving this data within the message and assigning this to the patient name field in their system.

- Each field has a specified length, data which exceeds this length is ignored.

- Each segment is made up of Required and Optional fields. Required fields must be present in message for proper function, Optional fields may be used if desired but are not mandatory.

- Some fields may repeat if defined as repeatable type fields.

- Data Types are used to specify what kind of data is stored in each field. This is then used by the receiving system for proper processing of the data.

Data Type	Mnemonic	Description
HL7	AD	Address
	CE	Coded element
	DT	Date
	DTM	Date/time
	FC	Financial class
	FT	Formatted text
	ID	Coded values for HL7 tables
	MO	Money
	NM	Numeric
	ST	String
	TM	Time
	TN	Telephone number
	TS	Time stamp

Some data type examples

(and many others!)

Field characteristics

SEQ	LEN	DT	OPT	ELEMENT NAME
1	1	ST	R	Field Separator
2	4	ST	R	Encoding Characters
3	180	HD	O	Sending Application
4	180	HD	O	Sending Facility
5	180	HD	O	Receiving Application
6	180	HD	O	Receiving Facility
7	26	TS	O	Date/Time Of Message
8	40	ST	O	Security
9	7	CM	R	Message Type
10	20	ST	R	Message Control ID
11	3	PT	R	Processing ID
12	8	ID	R	Version ID
13	15	NM	O	Sequence Number
14	180	ST	O	Continuation Pointer
15	2	ID	O	Accept Acknowledgment Type
16	2	ID	O	Application Acknowledgment Type
17	2	ID	O	Country Code
18	6	ID	O	Character Set
19	60	CE	O	Principal Language Of Message

Let's take a look at some common message Segments:

- MSH

- PID

- PV1

- *(and many others)*

A closer look at the MSH Segment:

- Every HL7 message has a Message Segment Header (MSH) segment.

- The MSH segment defines the intent, source, destination and some specifics of the syntax of a message.

- The MSH also contains the Message Control ID (MCI). The MCI is used to acknowledge a receipt of an HL7 message. This will be discussed in more detail.

MSH|^~\&|SEM||PYX||20040301192350||ADT^A04|ADT757452230|P|2.3|||

MSH Segment elements

SEQ	LEN	DT	OPT	ELEMENT NAME
1	1	ST	R	Field Separator
2	4	ST	R	Encoding Characters
3	180	HD	O	Sending Application
4	180	HD	O	Sending Facility
5	180	HD	O	Receiving Application
6	180	HD	O	Receiving Facility
7	26	TS	O	Date/Time Of Message
8	40	ST	O	Security
9	7	CM	R	Message Type
10	20	ST	R	Message Control ID
11	3	PT	R	Processing ID
12	8	ID	R	Version ID
13	15	NM	O	Sequence Number
14	180	ST	O	Continuation Pointer
15	2	ID	O	Accept Acknowledgment Type
16	2	ID	O	Application Acknowledgment Type
17	2	ID	O	Country Code
18	6	ID	O	Character Set
19	60	CE	O	Principal Language Of Message

A closer look at the PID Segment:

- Patient Identification Segment (PID)

- The PID segment contains the patient specific information specifying the patient associated to the transaction.

- This is not always a required segment but is present whenever patient specific information is being exchanged.

- Key fields include patient name, identifying numbers such as MRN and Account number and demographic info.

PID|||H000000076||TESTCHRISTIANSEN^JOHN^||19931212|M|||1400 CHARLES ST ^^LOVES PARK^IL^61111||885-2277|||S||D000000844|745-69-5847|||^

HL7 v2 Messaging

PID Elements

PID segment elements

SEQ	LEN	DT	OPT	ELEMENT NAME
1	4	SI	O	Set ID – PID
2	20	CX	B	Patient ID
3	20	CX	R	Patient Identifier List
4	20	CX	B	Alternate Patient ID – PID
5	48	XPN	R	Patient Name
6	48	XPN	O	Mother's Maiden Name
7	26	TS	O	Date/Time of Birth
8	1	IS	O	Sex
9	48	XPN	O	Patient Alias
10	80	CE	O	Race
11	106	XAD	O	Patient Address
12	4	IS	B	County Code
13	40	XTN	O	Phone Number – Home
14	40	XTN	O	Phone Number – Business
15	60	CE	O	Primary Language
16	80	CE	O	Marital Status
17	80	CE	O	Religion
18	20	CX	O	Patient Account Number
19	16	ST	B	SSN Number – Patient
20	25	DLN	O	Driver's License Number – Patient
21	20	CX	O	Mother's Identifier
22	80	CE	O	Ethnic Group
23	60	ST	O	Birth Place
24	1	ID	O	Multiple Birth Indicator
25	2	NM	O	Birth Order
26	80	CE	O	Citizenship
27	60	CE	O	Veterans Military Status
28	80	CE	O	Nationality
29	26	TS	O	Patient Death Date and Time
30	1	ID	O	Patient Death Indicator

PID|||H000000076||TESTCHRISTIANSEN^JOHN^||19931212|M|||1400 CHARLES ST ^^LOVES PARK^IL^61111||885-2277|||S||D000000844|745-69-5847|||^

A closer look at the PV1 Segment:

- Patient Visit Segment (PV1).

- Used to communicate patient visit-specific information.

- Messages can contain multiple PV1 segments to communicate information about multiple patient visits.

- Key fields include Provider information, Admission information and basic Financial information.

PV1||I|CCU^CCU31^31|ELE||PED^300^B|DEM^DEMING,RICHARD E|^|^|CCU||||AROU||Y|DEM^DEMING,RICHARD E|IN||SP||||||||||||||||||SWA||ADM IN|||200402181007||^

PV1 segment elements

SEQ	LEN	DT	OPT	ELEMENT NAME	SEQ	LEN	DT	OPT	ELEMENT NAME
1	4	SI	O	Set ID - PV1	26	12	NM	O	Contract Amount
2	1	IS	R	Patient Class	27	3	NM	O	Contract Period
3	80	PL	O	Assigned Patient Location	28	2	IS	O	Interest Code
4	2	IS	O	Admission Type	29	1	IS	O	Transfer to Bad Debt Code
5	20	CX	O	Preadmit Number	30	8	DT	O	Transfer to Bad Debt Date
6	80	PL	O	Prior Patient Location	31	10	IS	O	Bad Debt Agency Code
7	60	XCN	O	Attending Doctor	32	12	NM	O	Bad Debt Transfer Amount
8	60	XCN	O	Referring Doctor	33	12	NM	O	Bad Debt Recovery Amount
9	60	XCN	O	Consulting Doctor	34	1	IS	O	Delete Account Indicator
10	3	IS	O	Hospital Service	35	8	DT	O	Delete Account Date
11	80	PL	O	Temporary Location	36	3	IS	O	Discharge Disposition
12	2	IS	O	Preadmit Test Indicator	37	25	CM	O	Discharged to Location
13	2	IS	O	Re-admission Indicator	38	80	CE	O	Diet Type
14	3	IS	O	Admit Source	39	2	IS	O	Servicing Facility
15	2	IS	O	Ambulatory Status	40	1	IS	B	Bed Status
16	2	IS	O	VIP Indicator	41	2	IS	O	Account Status
17	60	XCN	O	Admitting Doctor	42	80	PL	O	Pending Location
18	2	IS	O	Patient Type	43	80	PL	O	Prior Temporary Location
19	20	CX	O	Visit Number	44	26	TS	O	Admit Date/Time
20	50	FC	O	Financial Class	45	26	TS	O	Discharge Date/Time
21	2	IS	O	Charge Price Indicator	46	12	NM	O	Current Patient Balance
22	2	IS	O	Courtesy Code	47	12	NM	O	Total Charges
23	2	IS	O	Credit Rating	48	12	NM	O	Total Adjustments
24	2	IS	O	Contract Code	49	12	NM	O	Total Payments
25	8	DT	O	Contract Effective Date					

PV1||I|CCU^CCU31^31|ELE||PED^300^B|DEM^DEMING,RICHARD E|^^|CCU||||AR
OU||Y|DEM^DEMING,RICHARD E|IN||SP||||||||||||||||||||SWA||ADM IN|||200402181007||^

HL7 v2 Messaging

HL7 has many Message Types, which can make the entire process of determining what you need seem daunting.

- Admission, Discharge, Transfer (ADT)
- Order Message (ORM, ORR, RDE, etc.)
- Financial Management (DFT, BAR)
- Ancillary Data Reporting (ORU, CRM, etc.)
- Master File Notification (MEN, MEQ, etc.)
- Medical Records Information Management (MDM)
- Scheduling (SRM, SIU, SQM)
- Patient Referral (RQI, REF, RQA, etc.)
- Patient Care (PGL, PPR, PPG, etc.)

- Fortunately when evaluating a vendor's product, you usually receive an interface specification document or a list of HL7 interfaces needed.

- Based on that list, you will select the interfaces needed for your specific integration needs.

- The most common Message Types are:
  - Admission, Discharge, and Transfer (ADT)
  - Order Entry (ORM)
  - Ancillary Data Reporting (ORU)

Common HL7 Messages

Now that we've taken a look at some message construction items let's focus on the most common HL7 interfaces:

- **Admission, Discharge and Transfer (ADT)**

- Order Entry (ORM)

- Ancillary Data Reporting (ORU)

Admission, Discharge and Transfer (ADT)

- ADT is the most common HL7 interface since many systems on the network require an active patient list.

- Typically used to sync up any outside system with a patient list from an Admissions application.

- Sends patient demographic, visit, insurance and diagnosis information.

- Every HL7 message is generated based on an event trigger in the source application. *(ex: new patient is registered, patient merges, patient room changes)*

ADT Sample:

MSH|^~\&|Iatric||||20050110045504||ADT^A01|599102|P|2.3||| **PID**|1||10006579^^^1^MRN^1||SMITH^JOHN^D||
19241010|M||1|111 MAIN ST^^ANYTOWN^CA^999990000^^M|
1|8885551212|8885551212|1|2||40007716^^^^VN^1|123121234|||||||||||NO NK1|1|SMITH^HUEY|SO|3583 MUSE
RD^^ANYTOWN^CA^999990000|8885552222||Y||||||||||||| **PV1**|1|I|PREOP^101^1^1^^^S|3|||
37^DISNEY^WALT^^^^^^Iatric^^^^CI|||01||||1|||37^DISNEY^WALT^^^^^^Iatric^^^^CI|2|
40007716^^^Iatric^VN|4|||||||||||||||||1||G|||20050110045253|||||| GT1|1|8291|SMITH^DONALD^D||111^MAIN ST^
^ANYTOWN^CA^999990000|8885551212||19241010|M||1|123121234||||ACME INC|111^MAIN ST^^ANYTOWN^
CA^999990000|8885551212||PT|

DG1|2|I9|71596^OSTEOARTHROS NOS-L/LEG ^I9|OSTEOARTHROS NOS-L/LEG ||A|
IN1|1|MEDICARE|3|MEDICARE|||||||ACME INC|19891001|||4|SMITH^DONALD^D|1|19241010|111^MAIN ST^^
ANYTOWN^CA^999990000|||||||||||||||123121234A|||||||PT|M|111 MAIN ST^^ANYTOWN^CA^999990000|||||8291
IN2|1||123121234|ACME INC|||123121234A|||||||||||||||||||||||||||||||||||||||||||8885551212
IN1|2|NON-PRIMARY|9|MEDICAL MUTUAL CALIF.|PO BOX 44776^^HOLLYWOOD^CA^441414776
||8003621279|PUBSUMB|||ACME INC ||||7|SMITH^DONALD^D|1|19241010|111 MAIN ST^^ANYTOWN^CA
^999990000|||||||||||||||||056269770|||||||PT|M|111^MAIN ST^^ANYTOWN^CA^999990000|||||8291 **IN2**|2||
123121234|ACME INC||||||||||||||||||||||||||||||||||||||||||||||||||||8885551212 IN1|3|SELF PAY|1|SELF PAY|||||||||||5||1

Common HL7 Messages

Let's focus on the most common HL7 interfaces:

- Admission, Discharge and Transfer (ADT)

- **Order Entry (ORM)**

- Ancillary Data Reporting (ORU)

Order Entry (ORM)

- ORM are used to send general order messages:
    - Radiology Orders
    - Order Entry (OE) Orders
    - Laboratory Orders (MIC, BBK, PTH, LAB)

    - Pharmacy orders are not usually ORM type

- ORM events are triggered by NEW, CANCEL, EDIT, HOLD, REACTIVATE order activity within the source application

- Each order typically includes some identifying number which uniquely identifies the order in the source application *(ex: Order number, specimen number)*

ORM Sample:

MSH|^~\&|Iatric||||20050110045504||ORM^O01|599102|P|2.3|||

PID|1||10006579^^^1^MRN^1||SMITH^JOHN^D||19241010|M||1|111 MAIN

ST^^ANYTOWN^CA^999990000^^M|1|8885551212|8885551212|1|2||

40007716^^^^VN^1|123121234||||||||||||NO NK1|1|SMITH^HUEY|SO|3583 MUSE

RD^^ANYTOWN^CA^999990000|8885552222||Y||||||||||||||

PV1||O|OP^PAREG^||||2342^Jones^Bob|||OP|||||||||2|||||||||||||||||||||||||

20060307110111|

ORC|NW|20060307110114

OBR|1|20060307110114||003038^Urinalysis^L|||20060307110114

Let's focus on the most common HL7 interfaces:

• Admission, Discharge and Transfer (ADT)

• Order Entry (ORM)

• **Ancillary Data Reporting (ORU)**

Order Entry (ORU)

- ORU are used to send:
    - Radiology Reports
    - Departmental Reports
    - Nursing Results
    - Laboratory Results (MIC, BBK, PTH, LAB)

- ORU events are triggered in NEW, CANCEL, or UPDATE

- May contain orders if orders have been attached to each result in the source application but not required

ORU Sample

MSH|^~\&|Iatric|||20050110045504||ORU^R01|599102|P|2.3|||

PID|1||10006579^^^1^MRN^1||SMITH^JOHN^D||19241010|M||1|111 MAIN ST^^ANYTOWN^CA^999990000^^M|1|8885551212|8885551212|1|2||40007716^^^^VN^1|123121234|||||||||||NO NK1|1|SMITH^HUEY|SO|3583 MUSE RD^^ANYTOWN^CA^999990000|8885552222||Y||||||||||||| **NK1**|1|Jones^Jane^Lee^^RN|VAB^Vaccine administered by (Name)^HL70063|

NK1|2|Jones^Jane^Lee^^RN|FVP^Form completed by (Name)-Vaccine provider^HL70063|101 Main Street^^Atlanta^GA^38765^^O^^GA121||(404) 554-9097^^WPN|

ORC|CN|||||||||||1234567^Welby^Marcus^J^Jr^Dr.^MD^ L|||||||||Peachtree Clinic|101 Main Street^^Atlanta^GA^38765^^O^^GA121|(404) 554-9097^^WPN|101 Main Street^^Atlanta^GA^38765^^O^^GA121|

OBR|1|||^CDC VAERS-1 (FDA) Report|||20010316|

OBX|1|NM|21612-7^Reported Patient Age^LN||05|mo^month^ANSI|

OBX|1|TS|30947-6^Date form completed^LN||20010316|

OBX|2|FT|30948-4^Vaccination adverse events and treatment, if any^LN|1|fever of 106F, with vomiting, seizures, persistent crying lasting over 3 hours, loss of appetite|

OBX|3|CE|30949-2^Vaccination adverse event outcome^LN|1|E^required emergency room/doctor visit^NIP005|

OBX|4|CE|30949-2^Vaccination adverse event outcome^LN|1|H^required hospitalization^NIP005|

OBX|5|NM|30950-0^Number of days hospitalized due to vaccination adverse event^LN|1|02|d^day^ANSI|

OBX|6|CE|30951-8^Patient recovered^LN||Y^Yes^ HL70239|

OBX|7|TS|30952-6^Date of vaccination^LN||20010216|

OBX|8|TS|30953-4^Adverse event onset date and time^LN||200102180900|

OBX|9|FT|30954-2^Relevant diagnostic tests/lab data^LN||Electrolytes, CBC, Blood culture|

OBR|2|||30955-9^All vaccines given on date listed in #10^LN|

OBX|1|CE30955-9&30956-7^Vaccine type^LN|1|08^HepB-Adolescent/pediatric^CVX|

OBX|2|CE|30955-9&30957-5^Manufacturer^LN|1|MSD^Merck^MVX|

OBX|3|ST|30955-9&30959-1^Lot number^LN|1|MRK12345|

OBX|4|CE|30955-9&30958-3^ Route^LN|1|IM^Intramuscular ^HL70162|

OBX|5|CE|30955-9&31034-2^Site^LN|1|LA^Left arm^ HL70163|

OBX|6|NM|30955-9&30960-9^Number of previous doses^LN|1|01I

OBX|7|CE|CE|30955-9&30956-7^Vaccine type^LN|2|50^DTaP-Hib^CVX|

OBX|8|CE|30955-9&30957-5^ Manufacturer^LN|2|WAL^Wyeth_Ayerst^MVX|

OBX|9|ST|30955-9&30959-1^Lot number^LN|2|W46932777|

OBX|10|CE|30955-9&30958-3^ Route^LN|2|IM^Intramuscular^HL70162|

HL7 v2 Messaging
Common Segments

We just looked at HL7 ADT, ORM and ORU. They have several common segments which contain Patient Info *([ ] =optional, { } = repeating)*:

ADT

MSH	Message Header
EVN	Event Type
PID	Patient Identification
[PD1]	Additional Demo
[{ NK1 }]	Next of Kin
PV1	Patient Visit
[PV2]	Patient Visit - Add Info.
[{ DB1 }]	Disability Information
[{ OBX }]	Observation/Result
[{ AL1 }]	Allergy Information
[{ DG1 }]	Diagnosis Information
[DRG]	Diagnosis Related Group
[{ PR1	Procedures
[{ROL}]	Role
}]	
[{ GT1 }]	Guarantor
[	
{ IN1	Insurance
[IN2]	Insurance Additional Info.
[{IN3}]	Insurance Add'l Info - Cert.
}	
]	
[ACC]	Accident Information
[UB1]	Universal Bill Information
[UB2]	Universal Bill 92 Information

ORU

MSH	Message Header
[PID	Patient Identification
[PD1]	Additional Demographics
[{NK1}]	Next of Kin
[{NTE}]	Notes and Comments
[PV1	Patient Visit
[PV2]]	Patient Visit - Add Info
]	
{	
[ORC]	Order common
OBR	Observations Report ID
{[NTE]}	Notes and comments
{	
[OBX]	Observation/Result
{[NTE]}	Notes and comments
}	
{[CTI]}	Clinical Trial Identification
}	
[DSC]	Continuation Pointer

ORM

MSH	Message Header
[{ NTE }]	Notes and Comments
[	
PID	Patient Identification
[PD1]	Additional Demographics
[{ NTE }]	Notes and Comments
[PV1	Patient Visit
[PV2]	Patient Visit- Additional Info
[{ IN1	Insurance
[IN2]	Insurance Additional Info
[IN3]	Insurance Add'l Info - Cert.
}]	
[GT1]	Guarantor
[{ AL1 }]	Allergy Information
]	
{	
ORC	Common Order
[	
Order Detail Segment OBR, etc.	
[{ NTE }]	Notes and Comments (for Detail)
[{ DG1 }]	Diagnosis
[	
{	
OBX	Observation/Result
[{ NTE }]	Notes and Comments (for Results)
}	
]	
]	
{ [CTI] }	Clinical Trial Identification
[BLG]	Billing Segment

Custom Segments

- "Z" segments can be used to send any custom defined information
- As long as HL7 rules are followed "anything goes" with custom segments.
- Sending and receiving applications need to be in agreement with content of each custom segment
- Unexpected segments could cause issues with a receiving system, each needs to be defined.

ZDR||1234567890|Murphy^Richard^MD|9876543210|Smith^John^MD|7777777777|
Jagger^Mick^|5555555555|Richards^Keith^|3333333333|Watts^Charlie^|…etc

- Creating an NPR report in the format of an HL7 message is definitely a significant task but is doable.

- The report can be scheduled to deliver the file to an FTP server.

- NPR report interfaces are more batch mode than real-time.

- Hospitals have created HL7 NPR Report Interfaces for almost all message types.

- The specific requirements need to be reviewed when determining whether or not an NPR Report will get the job done but it is a viable option.

Data Exchange Standards

Data Exchange Standards

We have looked at HL7 v2 message, segments and fields. Now let's look at how you transmit them to another vendor.

- Lower Level Protocol (LLP) is a term used when discussing the transmission of the HL7 Messages.

- Lower Levels (layers 1 through 4) support the actual transmission or movement of the data.

- The term Lower Level Protocol is referring to the portion of the ISO OSI (Open System Interconnect). The OSI is divided into seven layers or levels.

Data Exchange Standards

HL7 Messages are typically moved via a network connection between two systems that reside on the same network.

Each system has a role in the communication. One acts as the CLIENT and the other acts as the Server. Typically the one sending the data is the CLIENT, but that does not have to be.
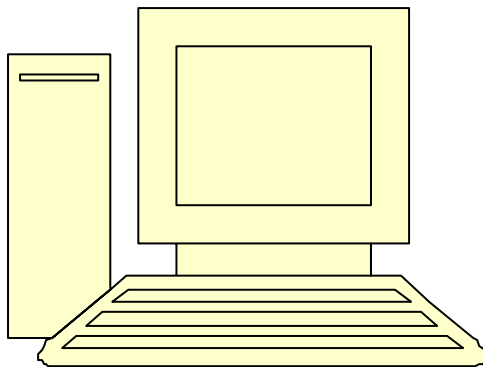
Client
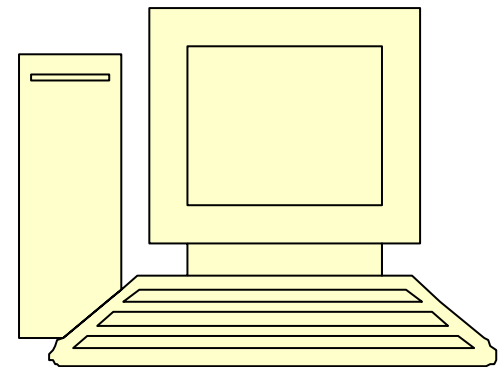
Server

Data Exchange Standards

The CLIENT will open a TCP/IP Socket with the SERVER.

- This connection will be exclusively used for these two systems to communicate.

Client

Server
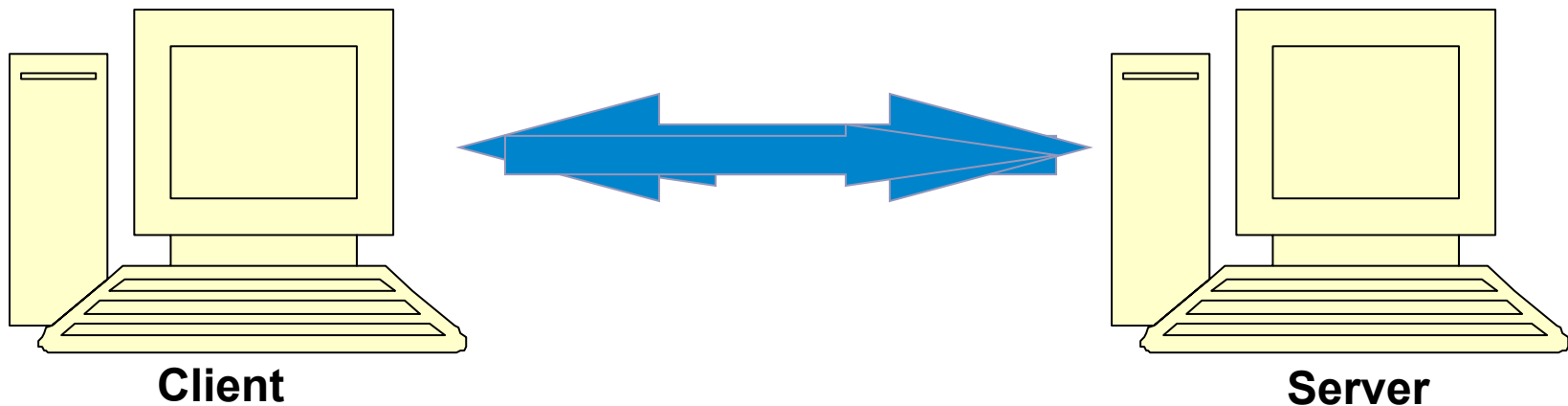
Once the TCP/IP Connection is established the sending system can deliver an HL7 message:

```
MSH|^~\&||SEM|||200605221309||ADT^A04|ADT1.1.9198|P|2.1
EVN|A04|200605221309
PID|1||M000001327||TEST^RECURRING^^^^||19680215|F|^^^^^||^^^^|||||||L000029512|74
DG1|1|TX||PROTIMES
PV1|1|O|RCA^^||||HARR^HARNER^ROBERT|HARR^HARNER^ROBERT|||||||||RCR||U||||
```

The receiving system will acknowledge the message using an ACK Message:

```
MSH|^~\&|||||SWA|200605221309||ACK|ADT1.1.9200|P|2.1||||
MSA|AA|ADT1.1.9198
```
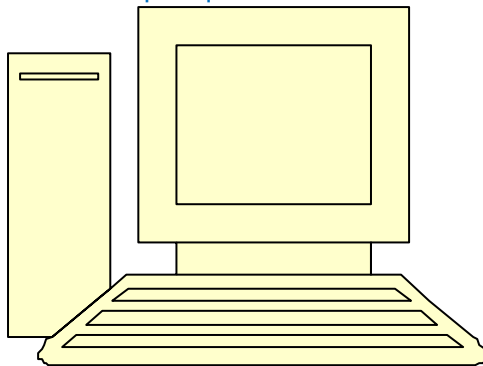
Client
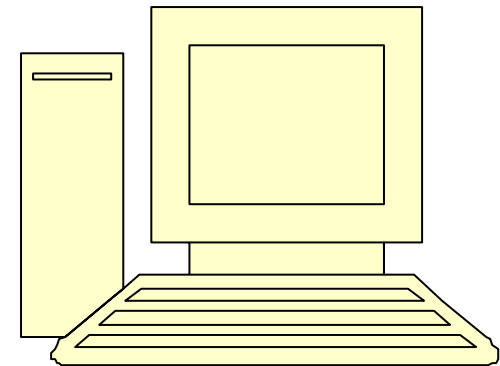
Server

Data Exchange Standards

- The acknowledgment of delivery of a message is a significant feature that HL7 LLP provides.

- Message Control ID (MCI) is contained within the MSH Segment of the sending application.

```
MSH|^~\&||SEM|||200605221309||ADT^A04|ADT1.1.9198|P|2.1
EVN|A04|200605221309
PID|1||M000001327||TEST^RECURRING^^^^||19680215|F|^^^^^||^^^^|||||||L000029512|74
DG1|1|TX||PROTIMES
PV1|1|O|RCA^^||||HARR^HARNER^ROBERT|HARR^HARNER^ROBERT|||||||||RCR||U||||

MSH|^~\&||||SWA|200605221309||ACK|ADT1.1.9200|P|2.1||||
MSA|AA|ADT1.1.9198
```

- The acknowledgment contains the MCI of the message from the sending application and this confirms the message was received.

Data Exchange Standards

Client Hello

Server Hello

Key Exchange

Cipher Suite Negotiation

HTTP GET

Data Transfer
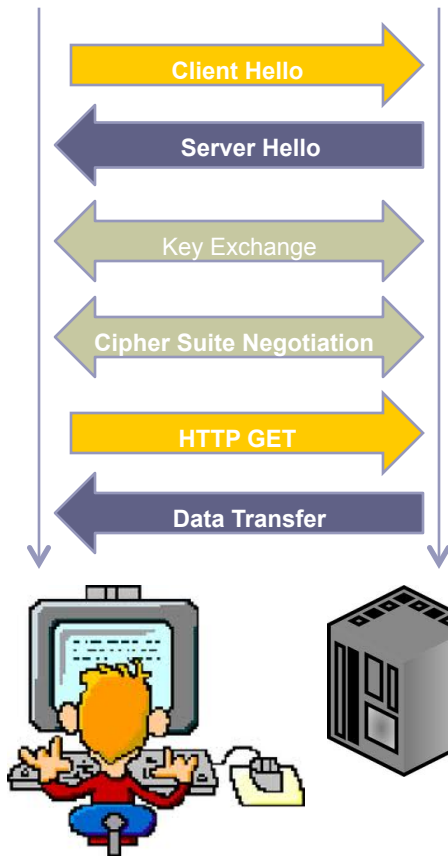
- Other methods can be used to deliver HL7 messages to the receiving system.
  - Send message via FTP.
  - FTPS – FTP using SSL (Secure Socket Layer) – Meditech Supports
  - SFTP – FTP using SSH (Secure Shell)
  - Download and copy to shared Folder
  - WebService interaction

- Secure transmission of Protected Healthcare Information (PHI) must be maintained: VPN, SFTP/FTPS, HTTPS, etc…

Data Exchange Standards

- HL7 also has a Batch Mode for transmitting messages. This method is used to transmit several HL7 messages at one time. Message structure:

[FHS]   (file header segment)
  { [BHS]   (batch header segment)
{ [MSH   (zero or more HL7 messages)
      ....] }
  [BTS] }   (batch trailer segment)
[FTS] (file trailer segment) Notes:

Communication Standards

- Unsolicited: Defines an interface that will send HL7 results without being asked, only requiring that a TCP/IP socket be established with the receiving system.

- Unsolicited interface is the source, providing the HL7 results to the destination system.

Admissions System   Ancillary System

Sends ADT Msg

Sends ACK Msg

Client - Source   Server - Destination

Communication Standards

- Solicited: Defines an interface that will send an HL7 QRY (Query) requesting data, only requiring that a TCP/IP socket be established with the receiving system.

- Solicited interface is the destination, asking the source system for HL7 information.

Admissions System

Ancillary System

Sends ADT Msg

Sends QRY Msg

Client - Source

Server - Destination

Communication Standards

Examples of Solicited Interfaces:

- HL7 ADT Query: Ancillary system asking for an MPI search based on patient information collected.

- HL7 ORM Order Query: Ancillary system asking for order information for a specific patient.

- HL7 ORU Report Query: Ancillary system asking for documents/reports for a specific patient.

- Clinical Document query requesting a clinical document for a patient.

Source / Destination   **Destination / Source**

HL7 Content: Query()

Commit Acknowledgement()

HL7 Content: Query()

Commit Acknowledgement()

Example QRY (from requesting application):
MSH|^~\&|HHIS|HHIS|||200705261231||QRY|859465864|P|2.2|
QRD|200705261231|R|I||||24RD||DEM|HCS||
QRF|EPI||||TESTPATIENT^ROBERT^S^M^19610716&1&30^|

QRD and QRF segments are repeated in Response
Patient information is returned in the QRY response that met the
QRY criteria.
QRYP returns an MSA segment QRY that
acknowledges the QRY and contains the MCI.

Example QRY Response:
MSH|^~\&||SAHHCS|||200705261231||DSR||P|2.2
MSA|AA|859465864
QRD|200705261231|R|I||||24RD||DEM|HCS
QRF|EPI||||TESTPATIENT^ROBERT^S^M^19610716&1&30^|
PID|1|||M0000623961|TESTPATIENT^ROBERT|MARY|19410716|M|TESTPATIENT,........
IN1|1|MCR-B||MEDICARE|P O BOX 1602^^HOMETOWN^TN^38506||||||||||||||||||||||............
NK1|1|TESTPATIENT^NANCY^|WIF|343 RIDGE DR^^BELVIDERE^IL^61008|.......
GT1|1||SMUSZKIEWICZ^ROBERT J^||343 RIDGE DR^^BELVIDERE^IL^61008|815 ......

Communication Standards

- Unidirectional Interface: Defines an HL7 interface that is one way, source   destination.

- Even though an ACK is returned from a destination when acknowledging an HL7 message, still considered unidirectional.

- Bidirectional Interface: Defines an HL7 interface that is interfaced in both directions, source   destination and destination   source.

Uni vs. Bidirectional Test:

- HL7 ADT to Other Vendor (OV) with acknowledgement MSA?

  Unidirectional

- HL7 QRY for patient information?

  Unidirectional

- PACS Interface, which consists of:
    - MT HL7 ADT to recipient
    - MT HL7 ORM/ORU to recipient
    - OV HL7 ORM Status Update to RAD System

  Bidirectional

Communication Standards

- When discussing interfaces with vendors the terms unidirectional or bidirectional may come up depending upon the data exchange needed.

- "outbound" term also used to describe a system sending data out to another system

- "inbound" term also used to describe a system receiving data from another system.

- Important to clarify direction of data exchange when discussing multiple interfaces

HL7 Version 3
and FHIR

- Version 2.x has been approved by an ANSI since the early 90's and is used extensively throughout the healthcare industry.

- Version 3 conceived approx. 15 years ago (XML was new at that time)

- Version 3 is a departure from the 2.x:

  - "Top down" message development with emphasis on reuse

  - Representation of complex relationships

  - Large scale integration support

  - Uniform set of models supporting reuse

  - More robust and fully specified standard

  - Expanded scope to include community medicine

Some advantages with HL7 v3:

- Uses industry standard XML language

- Uses formal object oriented methodology with reusable structures (Reference Information Model, RIM)

- Designed to be a global standard for universal use

- Supports transfer of data larger than just messages which facilitates exchange of complex items such as clinical documents

- Designed with interoperability in mind

- Designed primarily to be machine readable, not human readable

- More of a true standard with data relationships defined

Some disadvantages with HL7 v3:

- More complicated than v2.x, fully model driven

- Is not backward compatible with v2.x

- Less optionality than v2.x

- Slow adoption, majority of systems still use v2.x

- Cost. Because v3 is not backwards compatible and the majority of systems still use v2.x, converting an existing v2.x interface to v3 is time consuming and can be difficult

Sample XML code

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
- <ClinicalDocument xmlns="urn:hl7-org:v3">
<realmCode code="US" />
<typeId extension="POCD_HD000040" root="2.16.840.1.113883.1.3" />
<templateId root="2.16.840.1.113883.10.20.1" />
<templateId root="2.16.840.1.113883.3.88.11.32.1" />
<templateId root="1.3.6.1.4.1.19376.1.5.3.1.1.6" />
<templateId root="1.3.6.1.4.1.19376.1.5.3.1.1.2" />
<templateId root="1.3.6.1.4.1.19376.1.5.3.1.1.1" />
<templateId root="2.16.840.1.113883.10.20.3" />
<templateId root="2.16.840.1.113883.3.88.11.83.1" />
<id root="1.2.840.113619.21.1.3214775675415888320.1636630734011800" />
<code displayName="Summarization of episode note" codeSystemName="LOINC" codeSystem="2.16.840.1.113883.6.1" code="34133-9" />
<title>Southside Clinic Clinical Summary</title>
<effectiveTime value="20111111113854-0500" />
<confidentialityCode codeSystem="2.16.840.1.113883.5.25" code="N" />
<languageCode code="en-US" />
- <recordTarget>
- <patientRole>
<id extension="234-TEST011" root="1.2.840.113619.21.1.3214775675415888320.2.1.1.1" />
- <addr use="HP">
<streetAddressLine>4839 NW Montgomery St.</streetAddressLine>
<city>Portland</city>
<state>OR</state>
<postalCode>97434</postalCode>
<country>US</country>
```

(Continued)

```xml
</addr>
<telecom value="mailto:caldwells@uswest.com" />
<telecom use="WP" value="tel:+1-503-434-0090" />
<telecom use="HP" value="tel:+1-503-555-6054" />
- <patient>
- <name xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:type="PN">
<given>Walter</given>
<given>S.</given>
<family>Caldwell</family>
</name>
<administrativeGenderCode displayName="Male"
codeSystem="2.16.840.1.113883.5.1" code="M" />
<birthTime value="19440302" />
<maritalStatusCode codeSystem="2.16.840.1.113883.5.2" code="M" />
<raceCode codeSystem="2.16.840.1.113883.6.238" code="2106-3" />
<ethnicGroupCode codeSystem="2.16.840.1.113883.6.238" code="2186-5" />
- <languageCommunication>
<templateId root="2.16.840.1.113883.3.88.11.32.2" />
<templateId root="2.16.840.1.113883.3.88.11.83.2" />
<templateId root="1.3.6.1.4.1.19376.1.5.3.1.2.1" />
<languageCode code="en-US" />
<preferenceInd value="true" />
</languageCommunication>
</patient>
</patientRole>
```

Sample Message in v2.x and v3:

Version 2.3.1 (87 characters of data)
MSH|^~\&|LAB^North^Side|767543|ADT|767543|19900314130405||ACK^|XX3657|P|2.3.1
MSA|AA|ZZ9380

HL7 Version 3 (477 characters of data)

```
<ACK>
  <MSH>
   <MSH.1>|</MSH.1>
   <MSH.2>^~\&amp;</MSH.2>
   <MSH.3>
    <HD.1>LAB</HD.1>
    <HD.2>North</HD.2>
    <HD.3>Side</HD.3>
   </MSH.3>
   <MSH.4>
    <HD.1>767543</HD.1>
   </MSH.4>
   <MSH.5>
    <HD.1>ADT</HD.1>
   </MSH.5>
   <MSH.6>
    <HD.1>767543</HD.1>
   </MSH.6>
```

Message Continued:

```
   <MSH.7>19900314130405</MSH.7>
   <MSH.9>
    <CM_MSG_TYPE.1>ACK</CM_MSG_TYPE.1>
   </MSH.9>
   <MSH.10>XX3657</MSH.10>
   <MSH.11><PT.1>P</PT.1></MSH.11>
   <MSH.12>
    <VID.1>2.3.1</VID.1>
   </MSH.12>
  </MSH>
  <MSA>
   <MSA.1>AA</MSA.1>
   <MSA.2>ZZ9380</MSA.2>
  </MSA>
</ACK>
```

HL7 v3 XML

HL7 Version 2.3.1 – 87 characters
MSH|^~\&|LAB^North^Side|767543|ADT|767543|19900314130405||ACK^|XX3657|P|2.3.1
MSA|AA|ZZ9380

HL7 Version 3 – 477 characters
```
<ACK>          Parent
  <MSH>          Child
    <MSH.1>|</MSH.1>
    <MSH.2>^~\&amp;</MSH.2>
    <MSH.3>
      <HD.1>LAB</HD.1>
      <HD.2>North</HD.2>
      <HD.3>Side</HD.3>
    </MSH.3>
…..... Removed some data to fit on slide
    <MSH.12>
      <VID.1>2.3.1</VID.1>
    </MSH.12>
  </MSH>
  <MSA>
    <MSA.1>AA</MSA.1>
    <MSA.2>ZZ9380</MSA.2>
  </MSA>
</ACK>
```

HL7 3 is larger than 2.x, 5-11 times larger

HL7 3 is made up of data tags, beginning and ending each data definition and value.

HL7 3 is hierarchical, parent to child relationship

HL7 3 data is contained within data tags

HL7 3 data tags are constructed with <data tag> and ended with </data tag>

HL7 3 Parent tags encompass child tags

HL7 3 data tag definitions can be minimal or verbose (self-documenting)

Example Minimal Data Tag:

```
<MSH>
    <MSH.1>|</MSH.1>
    <MSH.2>^~\&amp;</MSH.2>
    <MSH.3>
      <HD.1>HOSPITAL</HD.1>
</MSH.3>
```

….some data not included

Example Verbose Data Tag:
```
<MSH>
    <MSH_1_FieldSeparator>|</MSH_1_FieldSeparator>
    <MSH_2_EncodingCharacters>^~\&amp;
      </MSH_2_EncodingCharacters>
    <MSH_3_SendingApplication>
      <EI>
        <EI_1_EntityIdentifier>HOSPITAL
        </EI_1_EntityIdentifier>
      </EI>
    </MSH_3_SendingApplication>
```

….some data not included

Reference Information Model (RIM):

- The object oriented information model used as the foundation in HL7 v3

- Pictorial representation of the clinical data

- Identifies the life cycle of events that a message or groups of related messages will carry

- Shared model which all parties use to share healthcare information amongst themselves

- Supports codified data transfer (ex: LOINC, SNOMED….etc)

- ANSI approved standard

Reference Information Model (RIM):

- Made up of six core classes which define how the data is related:

  - Act – actions

  - Entity – People, places and things

  - Role – Patient, location or care, specimen

  - Act Relationship – Used to connect acts

  - Participation- Used to connect roles to acts

  - Role Link – Used to connect roles

Reference Information Model (RIM) – *time for more caffeine!*

RIM 2.34
Normative RIM R3
November 16, 2010
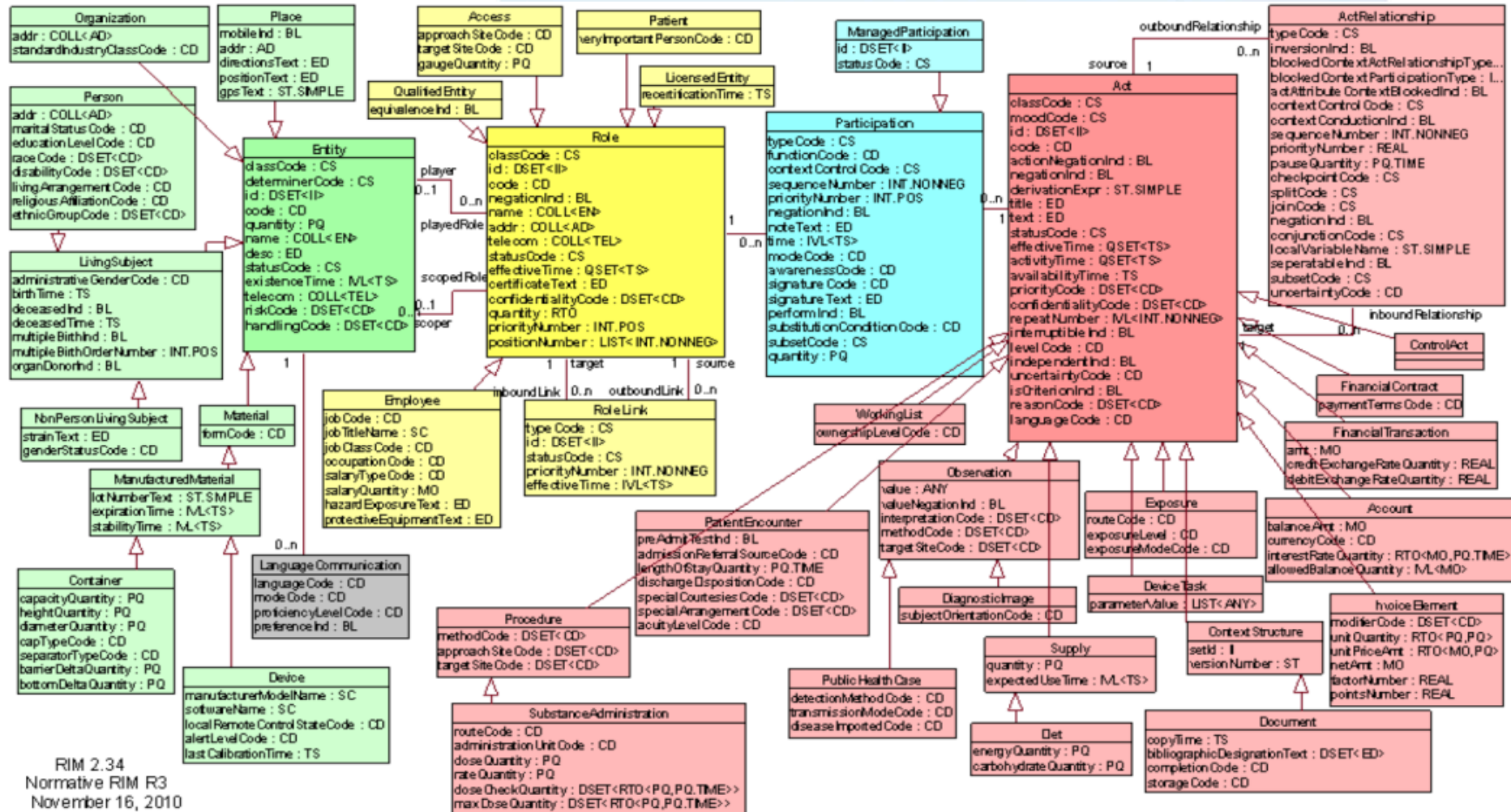
Reference Information Model (RIM):
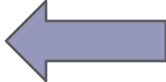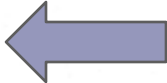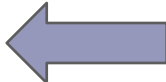
- Object Oriented - Classes use attributes to allow these six core classes to be used for everything needed for healthcare interoperability data representation

- Example Acts attributes:

  - ID

  - Class

  - Codes

  - State

  - Mood

  - *(and many others)*

Example of ACT attributes:


```
                    Act
classCode : CS
moodCode : CS
id : DSET<II>
code : CD
actionNegationInd : BL
negationInd : BL
derivationExpr : ST.SIMPLE
title : ED
text : ED
statusCode : CS
recordStatusCode : CS
effectiveTime : QSET<TS>
activityTime : QSET<TS>
availabilityTime : TS
priorityCode : DSET<CD>
confidentialityCode : DSET<CD>
repeatNumber : IVL<INT.NONNEG>
interruptibleInd : BL
levelCode : CD
independentInd : BL
uncertaintyCode : CD
reasonCode : DSET<CD>
languageCode : CD
contextConductionStyleCode : CS
```

Example of Act *Mood* attribute:

Moods of a Lab Observation

- The Doctor's Order that an Observation be performed (mood=RQO)
  - V2 Placer Order
- The Laboratory Promise to Carry Out the Doctor's Request. Observation (mood=PRMS)
  - V2 Filler Order
- The Actual Observation Process culminating in a Finalized Result (mood=EVN)
  - V2 Observation

Another example of Act *Mood* attribute:

Moods of a Patient Encounter

- Inpatient Encounter Appointment (mood=APT)

  Scheduling information for a future inpatient encounter.

- Inpatient Encounter (mood=EVN)
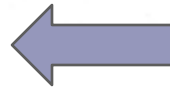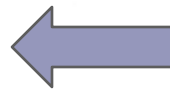
  Information about the actual inpatient encounter event

Refined Reference Information Model (RMIM):

- RIM alone is too general to specify the requirements for a specific v3 object

- RMIM created to solve this problem.

- RMIM is a refinement of the RIM for a specific case.

- Model which shows all of the data for a particular message/set of messages

- All RMIMs are derived from the RIM

- There is only one RIM but many, many RMIMS

Refined Reference Information Model (RMIM):

- Color coded similar to RIM

- Acts, Entities and Roles shown as boxes
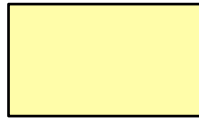
- Participations and Act Relationships show as directional boxes
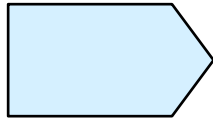
- Choices are shows as dashed boxes

- *(and more)*

RMIM example:

- Patient arrives at Good Health Hospital Emergency Room via ambulance

- Patient is in respiratory distress and has an accelerated heartbeat.

- Physician on duty feels that he should be treated at this time.

- Pulmonologist will be needed for consultation

- Patient is admitted

- *(lets see how this could look on a RMIM)*

Active Emergency Encounter RMIM
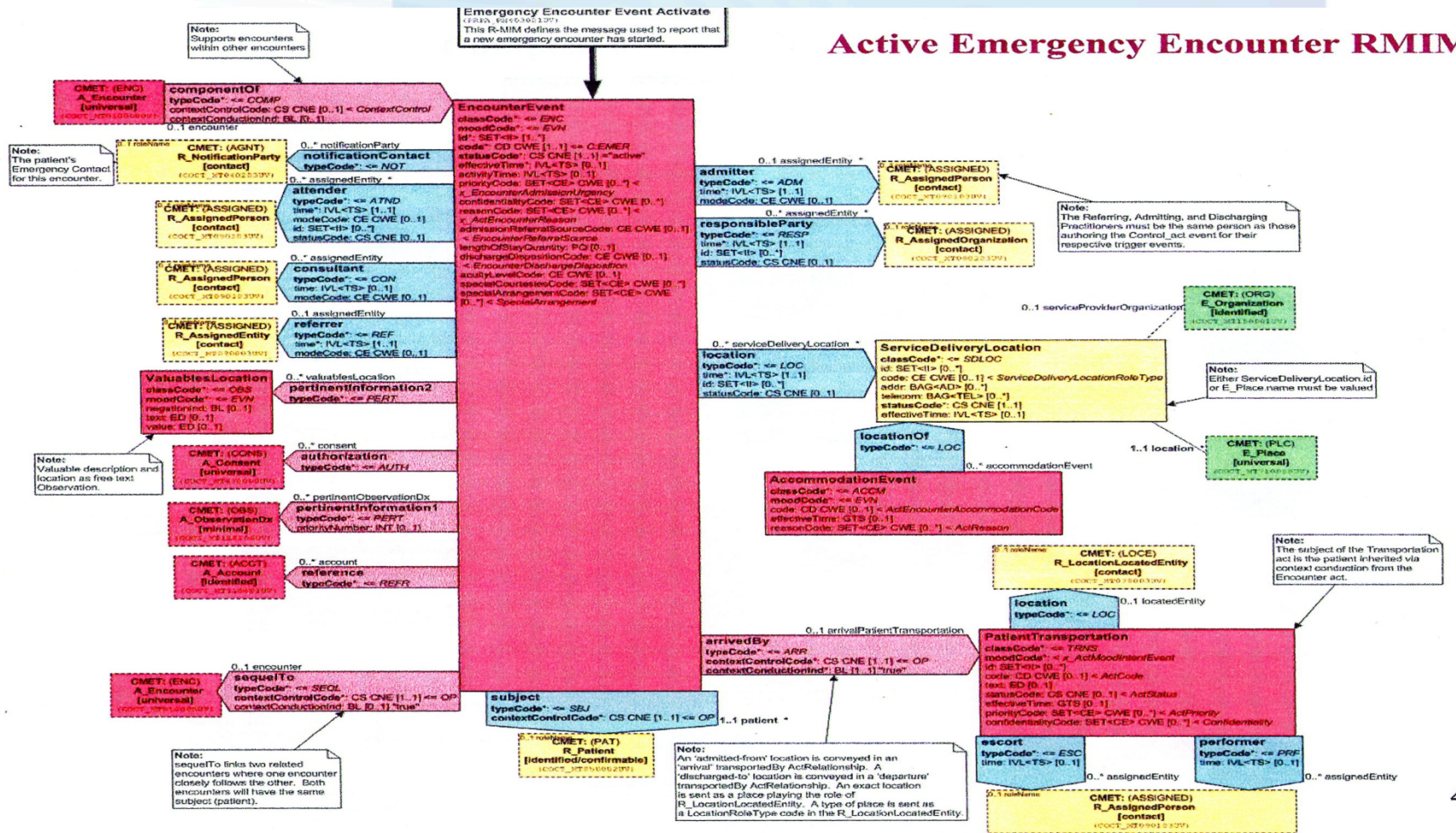
FHIR – Fast Health Interoperable Resources

From HL7.org:

- *"Next generation standards framework created by HL7.org*

- *Combines the best features of HL7 v2, v3 and CDA while leveraging the latest web standards and applying a tight focus on implementability"*

Created because:

- HL7 v3 is very complicated (as we just saw). It has a steep learning curve and one needs to understand the RIM model before v3 can be implemented

- Development process for v3 is slow (years)

- Poor adoption of v3 so far

- Transition path from v2.x is part of FHIR's roadmap (v2 will still be around for a long time)

- New markets and changes (ex: cloud based apps, regional EHRs, API, mobile apps…etc)

History

- "what would we do if we were to revisit the healthcare interoperability space from scratch?" approach (2011)

- Requirements began to take shape in Fall 2011

- FHIR name selected in 2012

- Focus is driven by the needs of the Implementer not the needs of the Modeler

- Built around "Resources"

- Resources are the smallest unit of transaction

- Small, discrete items which can be maintained and used independently

- Can be assembled to solve real-world clinical problems

- *"FHIR is suitable for use in a wide variety of contexts – mobile phone apps, cloud communications, EHR-based data sharing, server communication in large institutional healthcare providers, and much more"*
  -(from hl7.org)

FHIR Resource Index

Alphabetical

A-D:
- AdverseReaction
- Alert
- AllergyIntolerance
- (Binary)
- CarePlan
- Composition
- ConceptMap (informative)
- Condition
- Conformance
- Device
- DeviceObservation Report (for committee)
- DiagnosticOrder

D-M:
- DiagnosticReport
- DocumentReference
- DocumentManifest
- Encounter
- FamilyHistory
- Group
- ImagingStudy
- Immunization
- ImmunizationRecommendation
- List
- Location
- Media

M-P:
- Medication
- MedicationAdministration
- MedicationDispense
- MedicationPrescription
- MedicationStatement
- MessageHeader
- Observation
- OperationOutcome
- Order
- OrderResponse
- Organization
- Other
- Patient

P-Z:
- Practitioner
- Procedure
- Profile
- Provenance
- Query
- Questionnaire
- RelatedPerson
- SecurityEvent
- Specimen
- Substance
- Supply
- ValueSet

- Strong focus on creating a standard which is fast and easy to implement

- Specification is free for use with no restrictions, concise and is easy to understand

- Strong foundation in Web standards– XML, JSON, HTTP, Atom, OAuth, etc.

- Support for RESTful architecture (but not required)

- Works well with electronic document exchange

From HL7.org:

- A Human-readable wire format for ease of use by developers"

- Support data exchange with: RESTful API (HTTP), Search/Query, documents, messaging and services

- Is a framework standard, can be applied to solve many different common healthcare data exchange problems."

- Currently published as a Draft Standard still in the Trial Use phase in the industry (DSTU)

- Full normative specification likely later in 2015

- Some implementers are already using FHIR and are providing feedback

- Hope to see increased use over time

Some common usage scenarios where FHIR could be implemented:

- Personal Health Record vendor provides a RESTful API to allow a patient to access their data from a portal. This could use the FHIR search and read operations.

- Document sharing with XDS and various FHIR Resources

- Clinical Decision Support using search operation

FHIR®©

- For additional information please visit www.hl7.org/fhir

0 Welcome to FHIR® 🌍

First time here? Read the high level summary and then the FHIR overview / roadmap. See also the open license.

DSTU update: New security note about risks associated with displaying HTML (see DSTU update history).

Major Sections:

General Documentation

Implementation & Exchange

Clinical Resources

Administrative Resources

Infrastructural Resources

Interoperability Topics

What is Interoperability?
(one of many definitions)

"Interoperability is the ability of two or more systems or components to exchange information and to use the information that has been exchanged.

- Functional interoperability is the capability to reliably exchange information without error.
- Semantic interoperability is the ability to interpret, and, therefore, to make effective use of the information so exchanged."

HL7 and Interoperability
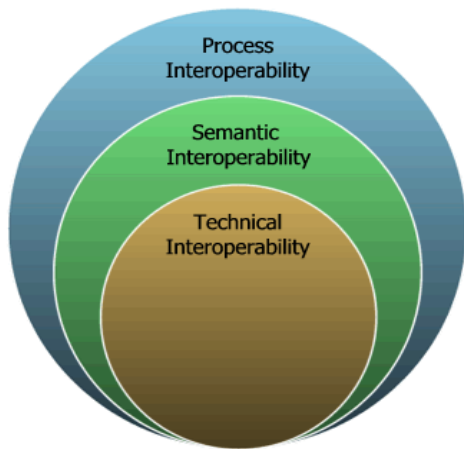
- **Syntactic**: Utilizing international standard data formats and communication protocols

- **Process Interoperability**: The degree to which the integrity of workflow processes can be maintained between systems

- **Semantic Interoperability**: Ensures information sent and received between systems is unaltered in its meaning. It is understood the same way by both receiver and sender.

- **Technical Interoperability**: Systems send and receive data successfully

Meaningful Use:

- Stage 1 – Data Capture and sharing *(2011-2013)*

- Stage 2 – Advance clinical processes *(2014-2016)*

- Stage 3 – Improved outcomes *(2017)*

These are all involved with this effort:

- Functional and Semantic Interoperability

- Syntactic, Process and Technical Interoperability

Interoperability goals:

- Connecting with Communities

  - HIEs becoming more common (Health Information Exchange)

  - EMR agnostic, crosses EMRs

  - Long term repository storage of patient data

  - Real-time access of patient data community wide!
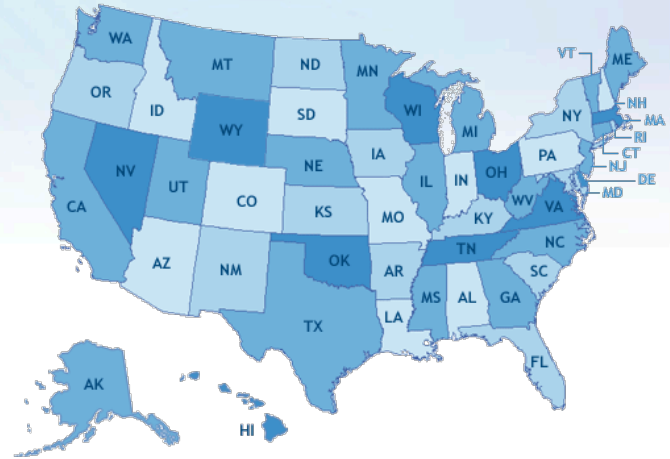
HL7 and Interoperability, pulling it all together:

- HL7 used to transmit patient data in messages

- HL7 v2.x works very well for this but does not support transmitting larger document type items very well.

- HL7 v3 supports transmission of document type items and intricate patient care workflows.

- Because of these features HL7 v3 is a better fit for interoperability needs than v2.x

- Let's take a look at the documents that we would get into with interoperability.

Many Interoperability Standards
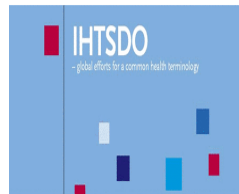
Semantic

PIX / PDQ

XML

Syntactic

REST

SOAP

HiTSP
enabling healthcare interoperability

CDA
Clinical Document Architecture

HTTP

OID

ASTM INTERNATIONAL

IHTSDO
– global efforts for a common health terminology

ANSI
Standards Activities

LOINC®

HL7 INTERNATIONAL

Clinical Document Architecture (CDA)

- A specification (standard) for document exchange developed by HL7.org. All other documents types based on CDA.

- Provides common architecture, coding, framework and markup language for the creation of electronic clinical documents

- Uses

  - XML

  - RIM

  - Codification (SNOMED, ICD…etc)

  - Can be simple or complex depending upon the implementation
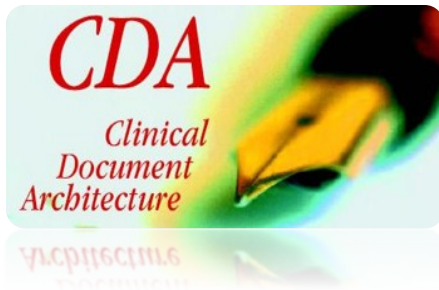
Clinical Document Architecture (CDA):

A clinical document must have the following characteristics:

- **Persistence** – document exists over time and can be used in many contexts.
- **Stewardship** – the document is maintained by an organization that is entrusted with its care
- **Potential for authentication** – intended to be used as a legally authenticated document.
- **Context** – "who, what, when,where and why" need to be answered in the document.
- **Wholeness** – authentication spans the whole document, not just portions.
- **Human readability** – allows the document to be used

Clinical Document Architecture (CDA):

- Header - data required for document discovery and management. This outlines the patient, providers and document type.

- Body - Relevant clinical data meeting the criteria, made up of defined **Sections**.

- Sections – Contains one **narrative block** and potentially **coded entries** (ex: Problems/Home Meds/Allergies/Vitals)

- Narrative block – Human readable content intended for user viewing

- Coded entries – Intended for machine readability

- Can include many different items such as images, text, graphics, sounds….etc

- Simple CDAs can be created and expanded over time

CDA Guiding principles:

- Focus on patient care

- Minimize technical barriers to implement

- Promote longevity of clinical records and information

- Promote exchange of information independent from the underlying transfer mechanism

- Enable policy makers to control the information requirements

- Currently used in many implementations in the US and world wide

CDA Benefits:

- Industry accepted, internationally accepted and implemented

- Strong vendor support with interest growing

- Codified vocabularies (SNOWMED, LOINC, RXNORM)

- Object oriented for flexibility and reuse

- Allows for the creation of a large number of Clinical Documents to meet specific needs at hand

Consolidated CDA (C-CDA):

- Attempt to pull together disparate standards being developed for Clinical Documents into a single source

- Existing document templates used within the industry were examined to identify and correct areas of overlap, errors and ambiguity

- Consolidation of existing templates for Clinical Document Exchange

- Is not an additional CDA document type

- Is not multiple CDA documents merged together into one new document

Consolidated CDA (C-CDA):

Consolidated CDA document types which can be deployed:

- CCD version 1.1
- Consultation Note CDA
- Discharge Summary CDA
- History & Physical CDA
- Operative Note CDA
- Procedure Note CDA
- Progress Note CDA
- DICOM CDA
- Unstructured Document CDA

Types of documents involved with interoperability:

CCD (Continuum of Care Document)

- Standards are governed by HL7.org

- Contains 16 sections to choose from with at least 2 required

- Contain an entire visit summary and can span multiple patient visits

- Codification rules in place (ex: LOINC, SNOWMED, RXNORM)

Sample CCD (stylesheet):

Iatric Memorial Hospital Continuity Of Care Document

Patient	Catherine C Demo		
Date of birth	October 17, 1970	Sex	Female
Contact info	123 Elk Street St Marys, Pa 15857, US Primary Home: (814)788-1234	Patient IDs	M795
Performer (primary care physician)	James E Devlin of Iatric Memorial Hospital		
Author	James E Devlin, Iatric Memorial Hospital		
Guardian	Catherine C Demo		
Contact info	123 Elk Street St Marys, Pa 15857 Primary Home: (814)788-1234		
Next of kin	Charles Clay Demo		
Contact info	123 Elk Street St Marys, Pa 15857 Primary Home: (814)788-1234		
Informant	Iatric Memorial Hospital		
Document maintained by	Iatric Memorial Hospital		

Table of Contents

- Summary Purpose
- Advance Directives
- Results
- Vital Signs

HL7 and Interoperability

Another sample CCD:

Iatric Memorial Hospital Continuity Of Care Document

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Next of kin	Charles Clay Demo		
Contact info	123 Elk Street St Marys, Pa 15857 Primary Home: (814)788-1234		
Informant	Iatric Memorial Hospital		
Document maintained by	Iatric Memorial Hospital		

Table of Contents

- Summary Purpose
- Advance Directives
- Results
- Vital Signs
- Medications

Summary Purpose

Patient Summary

Advance Directives

Directive	Response	Verification
Does the PT have a Living Will:	Yes	James E Devlin
List holder of Living Will:	Catherine C Demo	James E Devlin
Is a copy of the Living Will on file at ERHC:	Yes	James E Devlin
Does the PT have a Durable Power of Attorney:	Yes	James E Devlin
List holder of Durable Power of Attorney:	Catherine C Demo	James E Devlin
Is a copy of the Durable Power of Attorney on file at EHRC:	Yes	James E Devlin

Results

	March 18, 2010	March 23, 2010
Chemistry		
SODIUM, BLOOD (133-145 MMOL/L)	132*	
POTASSIUM, BLOOD (3.5-5.1 MMOL/L)	4.8	
CHLORIDE, BLOOD (98-111 MMOL/L)	92*	
TCO2, SERUM (21-31 MMOL/L)	38*	
Hematology		
WBC (4.8-10.8 X10^3/uL)	16.6*	12.2*
RBC (4.20-5.40 X10^6/uL)	3.50*	3.90*

Types of documents involved with interoperability:

C32

- Similar to CCD but standards are governed by HITSP **(HealthCare Information Technology Standards Panel)**

- Contains 16 sections to choose from with at least 5 being required

- Stricter than CCD

- Use of this document type was common several years ago but with Meaningful Use Stage 2 this document type is no longer as common

Types of documents involved with interoperability:

CCR (Continuity of Care Record)

- Similar to CCD/C32 but standards are governed by ASTM (American Society for Testing and Materials)

- Has 16 sections as well but these are different than CCD/C32

- Not terribly common but to date has been primarily used with Personal health record data with vendors such as Microsoft Health Vault® and No More Clipboard®

Which one to use?

- CCD and C32 document formats are primarily used to exchange information between EHR, HIE, governmental agencies, etc. because of the standards imposed.

- CCD 1.1 needed for Meaningful Use Stage 2

- CCR document formats are primarily used to exchange information with Personal Health Record Vendors such as Microsoft® HealthVault® and No More Clipboard®.

- Many other formats exist for specific needs, but are not as common in normal use.

Some Clinical Document Use Cases:

Outbound:

- Create and send document automatically when predefined business rules are met
- Create and send document on demand (user initiated)
- Create and send document as a result of a query (solicited)

Inbound:

- Query and consume document automatically when predefined business rules are met
- Query and consume document on demand (solicited, user initiated)
- Receive and consume document automatically (unsolicited)

Some Clinical Document Use Cases:

Outbound workflow examples:

- Within HIE, create and send patient consent document when patient has indicated consent level or when HIE requests consent information
- Create and send document upon patient discharge or departure (immediate or delayed sending)
- Provide clinical document when requested by patient
- Patient has an encounter at a practice, Physician wants a CCD regarding the last encounter patient had at the hospital. The physician EHR system generates a query which is then received and the clinical document is generated and returned to the practice.

Some Clinical Document Use Cases:

Inbound workflow examples:

- Query an outside EHR for Clinical Document when patient arrives at the Hospital
- Physician practice transmits encounter summary to Hospital after patient visit
- Clinical at Hospital requests Clinical Documents from outside sources for all patient encounters within the past 180 days
- Within HIE, member transmits a document to be consumed into the HIS system

What is DIRECT? (http://directproject.org)

•The Direct Project specifies a *simple, secure, scalable, standards-based* way for participants to send authenticated, encrypted health information *directly* to *known, trusted recipients over the Internet*

•Seeks to benefit patients and providers by making the transport of health information faster, more secure, and less expensive.

•Required for Meaningful Use Stage 2, not a requirement for Stage 1

What is DIRECT? (http://directproject.org)

•The Direct Project specifies a *simple, secure, scalable, standards-based* way for participants to send authenticated, encrypted health information *directly* to *known, trusted recipients over the Internet*

- **Simple:** Connects healthcare stakeholders through universal addressing using simple push of information.

- **Secure:** Users can easily verify messages are **complete** and **not tampered** with in travel.

- **Scalable:** Enables Internet scale **with no need for central network** authority.

- **Standards-based:** Built on common Internet standards for **secure e-mail communication**.

In Direct Secure Messaging…..

- Each organization is assigned a secure certificate key **pair** - used to encrypt the information sent to them.

- The **public key** is used by senders to encrypt the message, and the **private key** is used for decrypting the message.

- The **private key** of the sender is also used to sign the encrypted message - allowing the recipient to accurately validate the sender of the message.

- Users can be assigned an individual level certificate, but industry standard calls for users within an organization to share a common certificate.

- **HISP (Health Information Service Provider):** Entity that responsible for delivering health information as messages between senders and receivers over the Internet.
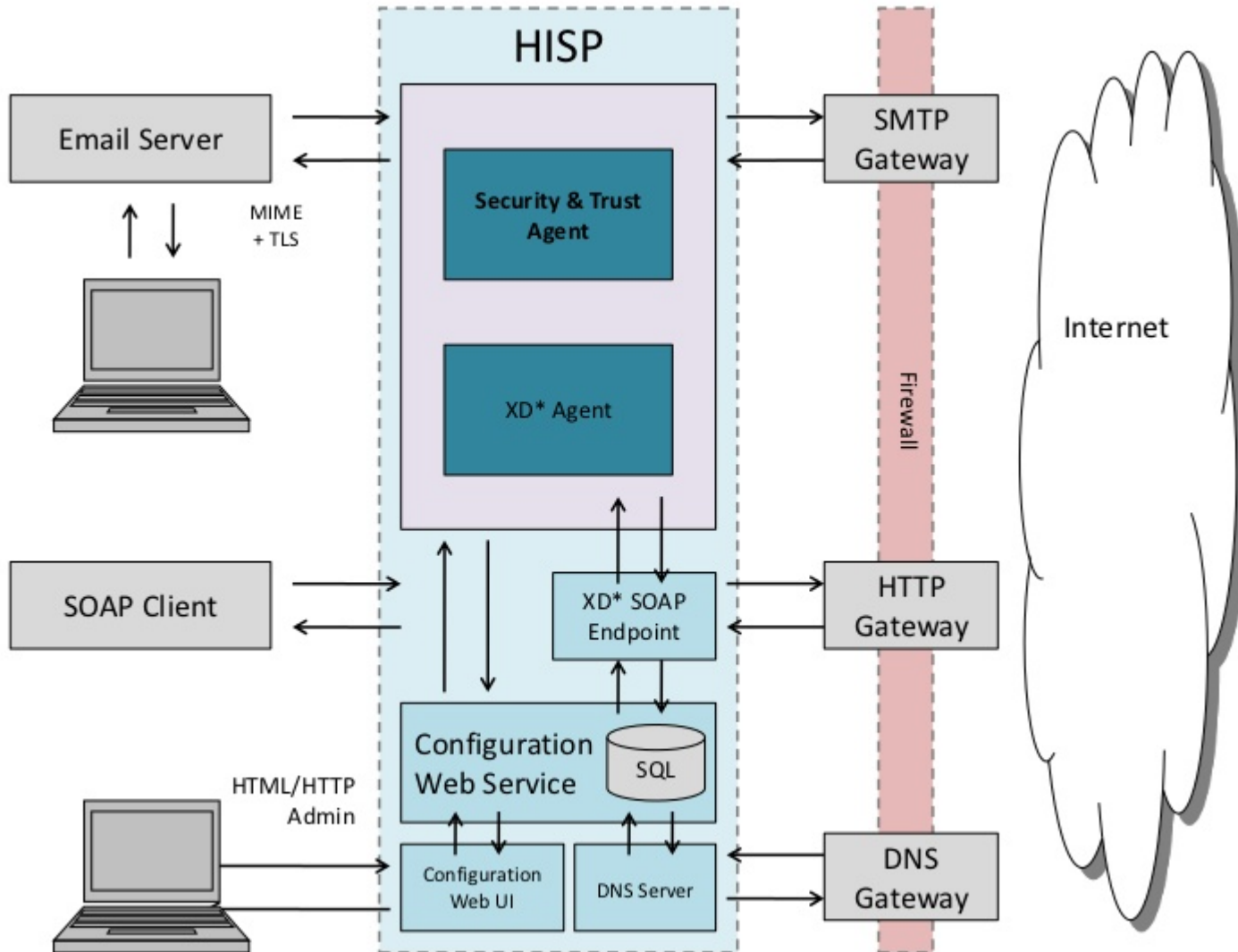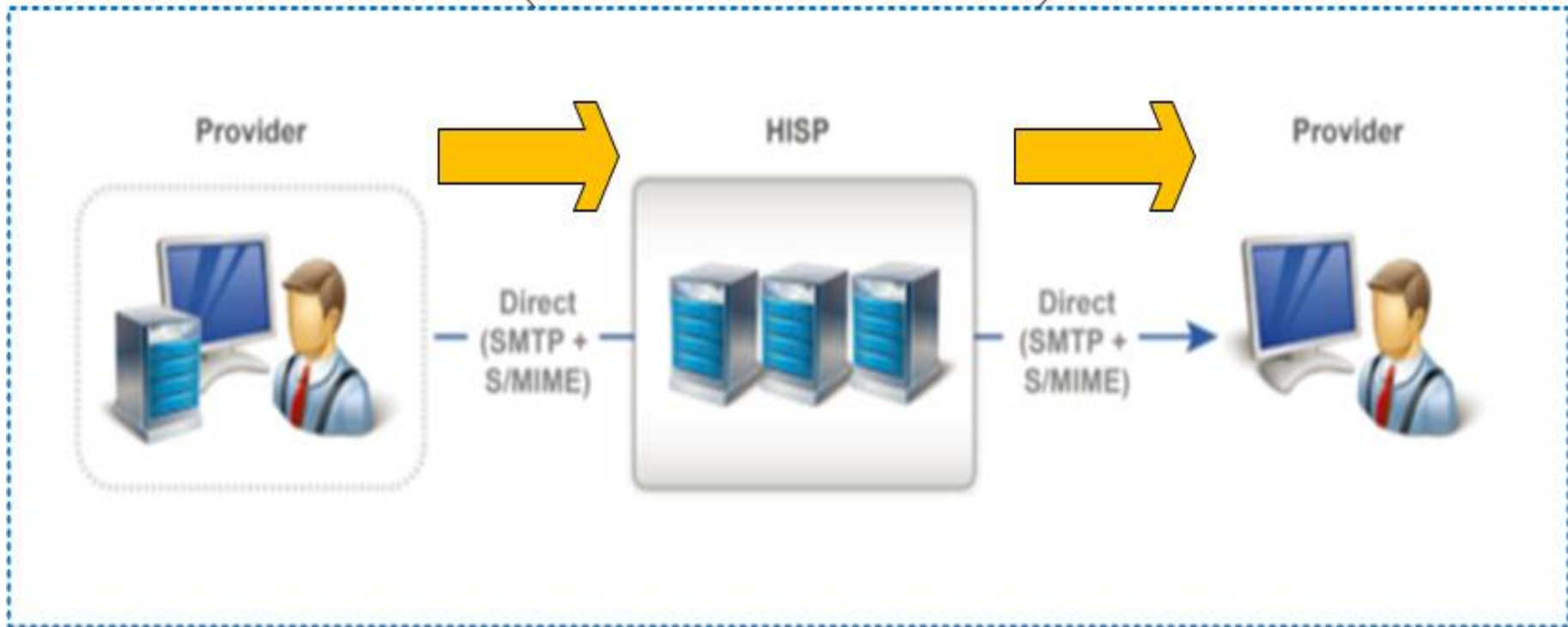
When a user sends a message, the sending system signs the content with the sender's private key, and encrypts the message with the recipient's public key.

Once the message is received by the recipient system, it is decrypted with the recipient's private key. The secure signature of the message is also checked to ensure and confirm sender identity and authenticity.

Provider

HISP

Provider

Direct (SMTP + S/MIME)

Direct (SMTP + S/MIME)

Codification Standards:

SNOMED CT - **S**ystemized **N**omenclature of **Med**icine - Clinical Terms
Implemented internationally as a standard

LOINC - **L**ogical **O**bservation **I**dentifiers **N**ames & **C**odes
Developed by the Regenstrief Institute, Inc and the LOINC Committee

RxNorm - Standardized nomenclature for clinical drugs and drug delivery
devices Produced by the National Library of Medicine (NLM) in 2001

UNII - FDA Unique Ingredient Identifier, is part of RxNorm database

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Cross Enterprise Document Sharing (XDS)

- Profile created by IHE (Integrating the Healthcare Enterprise)

- Provides Clinical Document query/retrieval functionality within a network to enable sharing of **documents** between healthcare entities

- Federated system of document repositories with a registry to allow access to these documents

- Facilitates access to patient electronic health records across health enterprises

XDS (Cross Enterprise Document Sharing)

Cross Enterprise Document Sharing (XDS)

- Most widely adopted framework for this purpose at this time

- FHIR provides "Resources" to support XDS

XDS (Cross Enterprise Document Sharing)

Cross Enterprise Document Sharing (XDS)

- Document Repository – Location where the documents are stored (can be more than one)

- Document Registry – Index of available documents

- Document Sources – Create documents and submits **to** the repository

- Document Consumers – Requests and retrieves documents **from** the repository

XDS (Cross Enterprise Document Sharing)
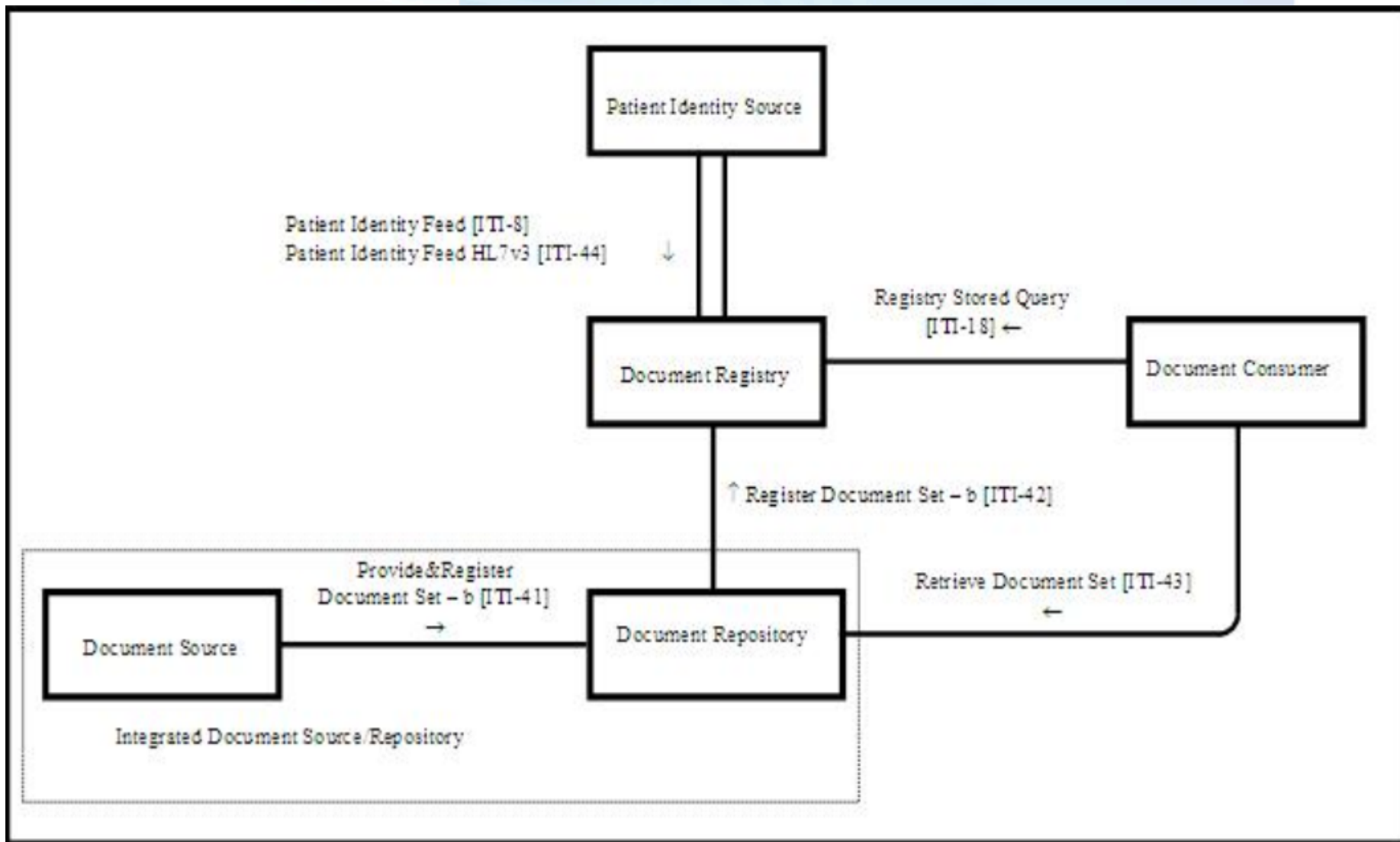
Record Locator Service:

- An index containing patient demographic information and the **location** of a patient's medical records

- Contains no clinical information. Obtaining the clinical record is a separate transaction *not* involving the RLS

- Participating entities decide whether or not to put record locations into the RLS

- Designed to take the query in the form of demographic details and return only the **location** of matching records

Record Locator Service

Patient Index (RLS)

Clinical Data Source

Healthcare Practitioner
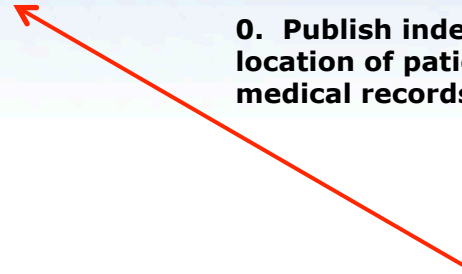
Patient Index (RLS)

0. Publish index to location of patient medical records

Clinical Data Source

Healthcare Practitioner

Patient Index (RLS)

0. Publish index to location of patient medical records

1. Request Record Locations for Patient

2. Record Locations for Patient Returned

Healthcare Practitioner

Clinical Data Source

Record Locator Service
RLS

Patient Index (RLS)

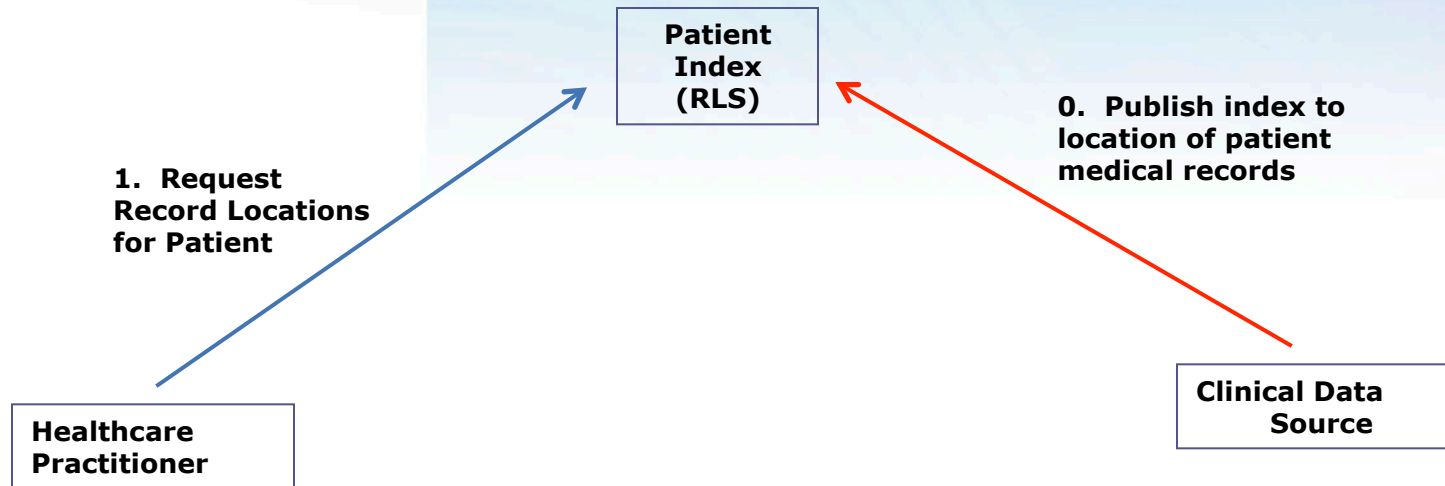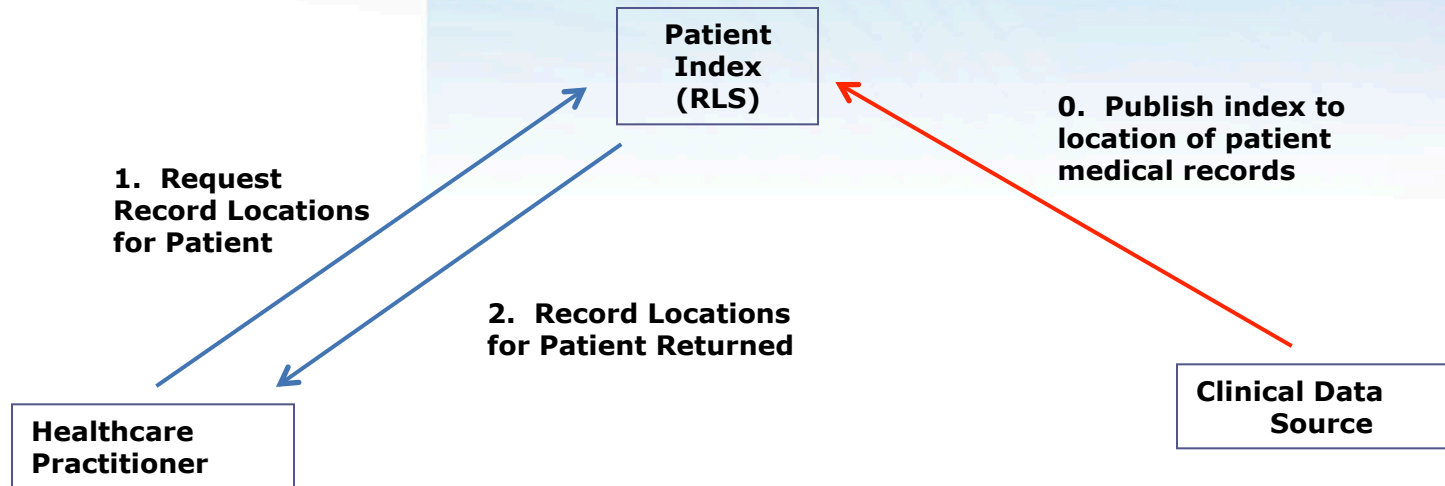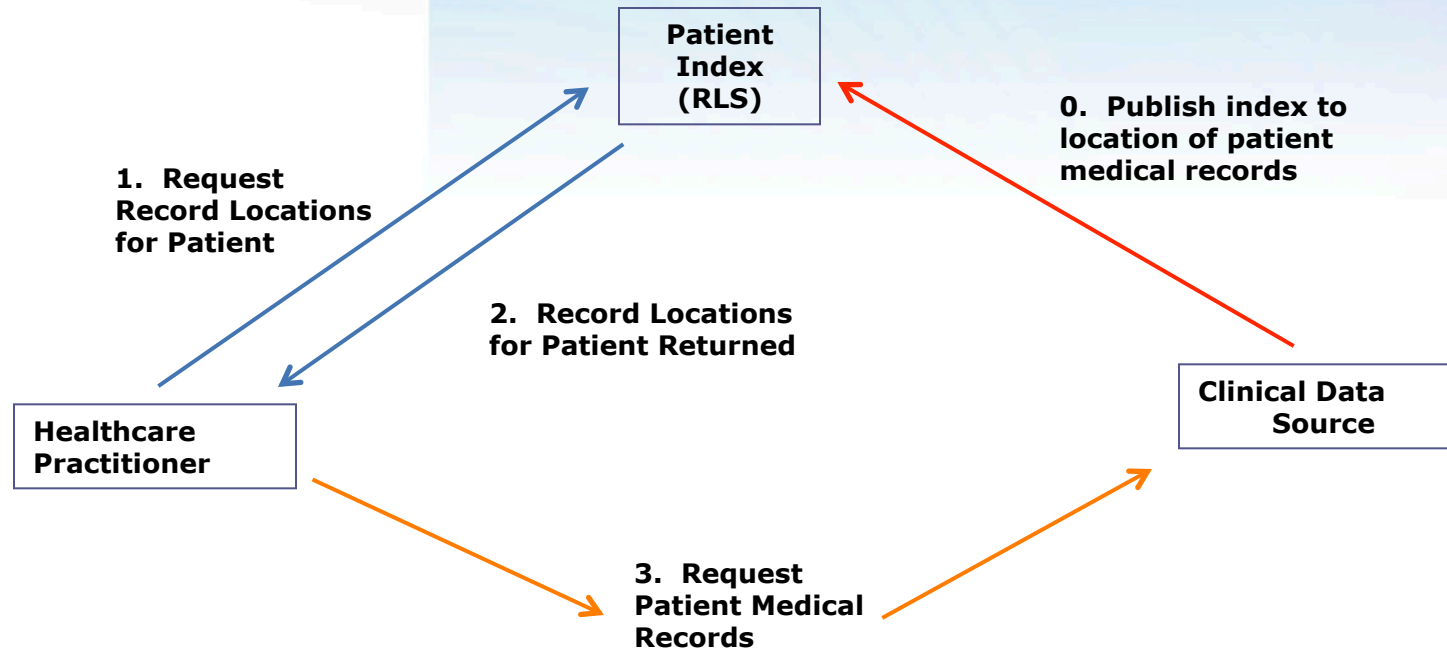**0. Publish index to location of patient medical records**

1. Request Record Locations for Patient

2. Record Locations for Patient Returned

Healthcare Practitioner

Clinical Data Source

3. Request Patient Medical Records

4. Provide Patient Medical Records
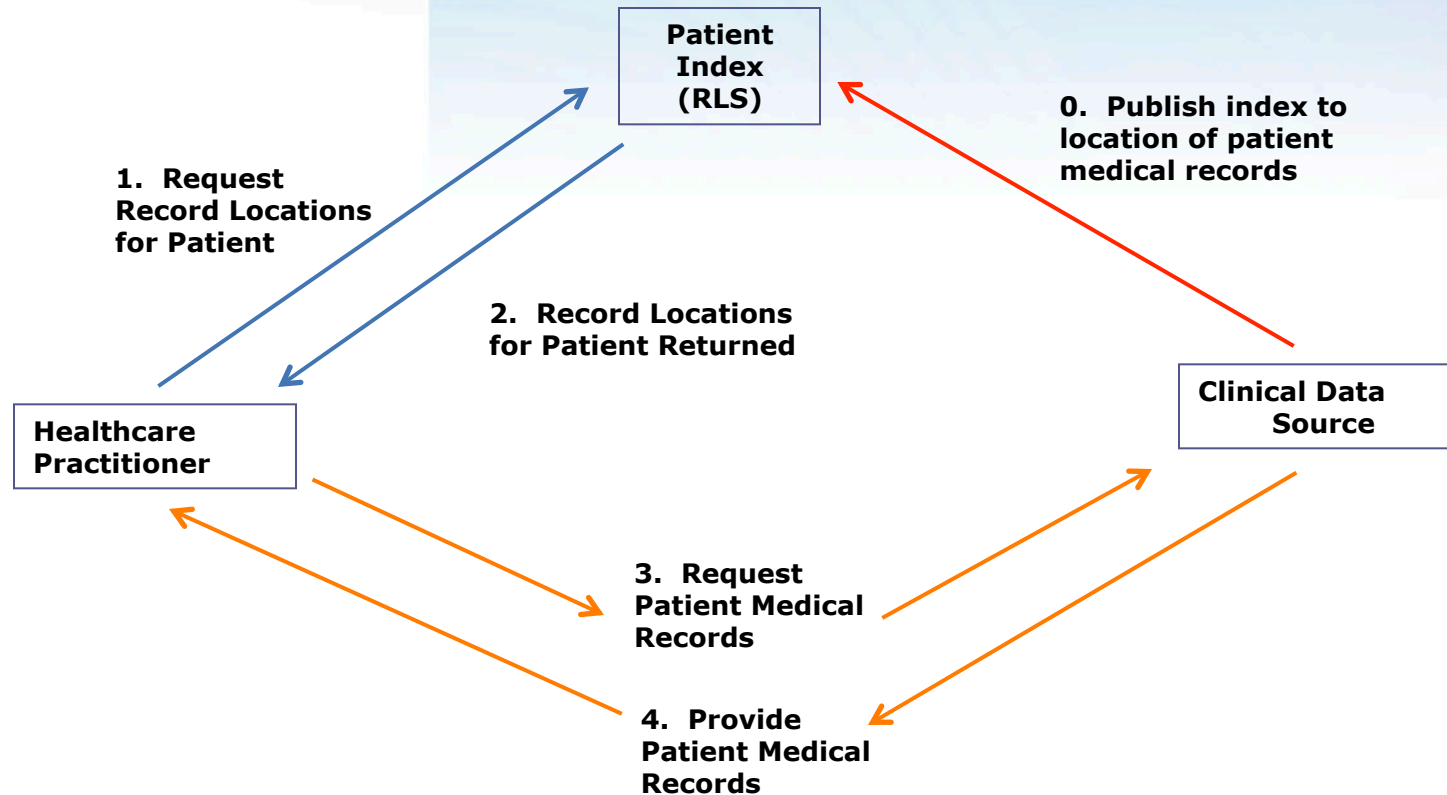
Patient Identification Verification:

- Needs – To link Patient Identifiers from multiple sources. Query for demographics to ensure and verify Patient Identity ("How is patient matching done?"

- Common example would be patient identification across a community HIE or across a network of hospitals

- Solutions

  – <u>Patient ID Cross-Referencing Transaction Package</u> IHE Patient Cross-Referencing Transaction (PIX)

  – <u>Patient Demographics Query Transaction</u>   IHE Patient Demographics Query Transaction (PDQ)

Patient Identification Verification:

- Profile which supports the cross-referencing of patient identifiers from multiple Patient Identifier Domains

- Receives patient demographic information from multiple senders/ domains and stores this on a common Patient Identifier Cross-Reference Manager (Table).

- Provides the ability to access the list(s) of cross-referenced patient identifiers either via a query/response or via an update notification

- The PIX profile does not specific how patient matching will occur, it simply receives data requests and returns patient identifiers related to the patient identifier present in the query

- Provides necessary interoperability while maintaining the flexibility to be used with any cross-referencing policy and algorithm as deemed adequate by the enterprise

Example:

- *Name= John Smith.*
  Site=PCP
  MRN=12345

- *Name= John Smith.*
  Site=Specialty
  MRN=98765

- *Name= John Smith.*
  Site=Hospital
  MRN=55555

- If the PCP's system wants to communicate with the Specialty's system about patient John Smith, this would then let them know that MRN=12345 (from PCP) is equivalent to MRN=98765(from Specialty)

Patient Identification Verification:

- Profile where patient demographic information is used to identify the patient

- Lets applications query a central patient information server in order to retrieve patient demographics and visit/encounter information.

- Some systems will have a more comprehensive demographic picture of a patient than others, this profile helps bridge the gaps to allow these to work together

(Example):
-System A captures Richard W Murphy, **DOB=1/11/2014**, Male
-System B captures Richard Murphy, **DOB= 5/27/40**, Male

PDQ profile would help an outside system differentiate between these two different patients when quarried.

Patient Identification Verification:

Benefits - Simple inquiry for patient demographic information. Provides a very simple means for inquiring to receive demographic information based on:

- Partial or complete patient name (printed on the patient record or told by the patient)

- Patient ID (obtained from printed barcode, a bed-side chart, etc.)

- Partial ID entry or scan

- Date of birth/age range

- Bed ID

Codification Standards:

Purpose	Meaningful Use Stage 1	Meaningful Use Stage 2
Problem List	Applicable HIPAA code set required by law (i.e.,ICD-9-CM); or SNOMED CT®	Applicable HIPAA code set required by law (e.g.,ICD-10-CM) or SNOMED CT®
Medication List / Electronic Prescribing	Any code set by an RxNorm drug data source provider that is identified by the United States National Library of Medicine as being a complete data set integrated within RxNorm+	RxNorm
Medication Allergy List	No standard adopted at this time.	UNII (Unique Ingredient Identifier)
Procedures	Applicable HIPAA code sets required by law (i.e., ICD-9-CM or CPT-4®)	Applicable HIPAA code sets required by law (i.e., ICD-10-PCS or CPT-4®)
Vital Signs	No standard adopted at this time.	CDA template
Units of Measure	No standard adopted at this time.	UCUM (Unified Code for Units of Measures)
Lab Orders and Results	LOINC® when LOINC® codes have been received from a laboratory	LOINC®

Object Identifiers (OID)

- A globally unique string representing an ITU-T/ISO Object Identifier (OID) in a form that consists only of numbers and dots

  "2.16.840.1.113883.6.1" (LOINC OID)

- Used to identify patients, locations, organizations, code systems, value sets, etc., within a CDA document.

- HL7 also assigns OIDs to public identifier-assigning authorities both U.S. nationally (e.g., the U.S. State driver license bureaus, U.S. Social Security Administration, HIPAA Provider ID registry, etc.) and internationally (e.g., other countries Social Security Administrations, Citizen ID registries, etc.)

Summary

- Health Level Seven is one of several American National Standards Institute (ANSI) accredited Standards Developing Organizations (SDOs) operating in the healthcare arena.

- Version 2.x messages made up Segments and Fields. Data is sent with Acknowledgement returned.

- Many different types of standard messages and segments to meet many different needs within healthcare

- Custom segments and fields can be created if needed

- Version 2.x is very robust but does not lend itself to transferring documents

Summary

- Version 3 allows lends itself much better to the transfer of documents. This uses XML at coding language and was designed with interoperability in mind.

- Version 3 uses the Reference Information Model (RIM) to address complex healthcare data relationships and scenarios

- Interoperability is the ability of two or more systems or components to exchange information and to use the information that has been exchanged.

- Interoperability is concerned with connecting patients, providers and communities to improve healthcare.

Summary

- Clinical Document Architecture (CDA) is a specification for document exchange to help facilitate interoperability

- CCD/CCR/C32 are all different types of documents, which one is used depends upon the goals trying to be accomplished, preference, cost, regulations and many other factors.

- Record Locator Service (RLS) used to determine location of stored clinical documents and retrieve these documents (persistence)

- PIX and PDQ used for positive patient matching

Questions?

Thank you.

Enjoy MUSE 2014
Please stop by booth 505 with any questions!

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