HL7 Interoperability

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 Messages Types

- HL7 Segments

- HL7 Field Formats

- 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

HL7 Organization definition: Health Level Seven is one of several [American National Standards Institute](#) (ANSI) accredited Standards Developing Organizations (SDOs) 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.

Each HL7 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.

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)

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|||

HL7 Messaging

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 Messaging

PID 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||^

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||||AROU||Y|DEM^DEMING,RICHARD E|IN||SP|||||||||||||||||||SWA||ADM IN|||200402181007||^

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

(and many others!)

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

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)*

Common HL7 Messages

ADT

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

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

Common HL7 Messages
ORU

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 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

We have looked at HL7 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.
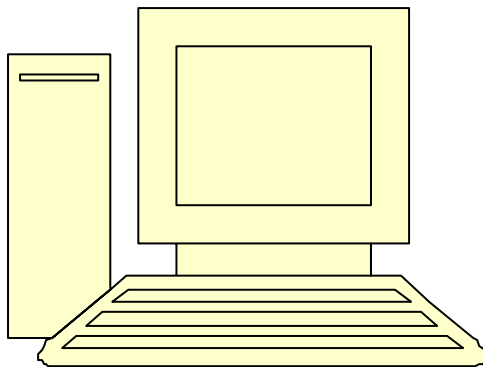
Client
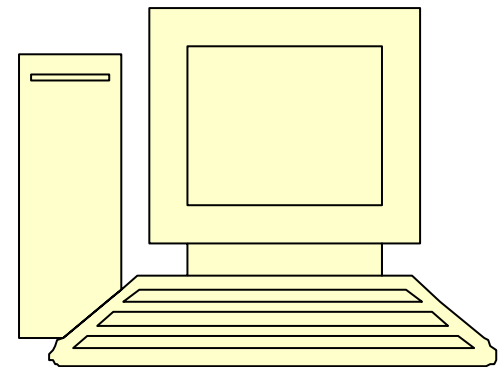
Server

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
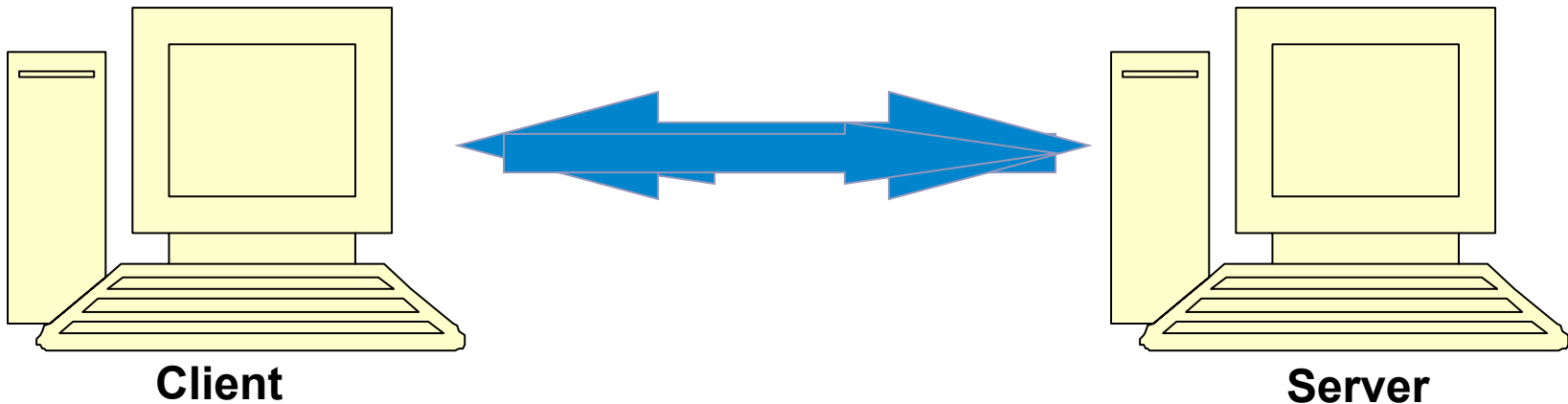
Data Exchange Standards

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

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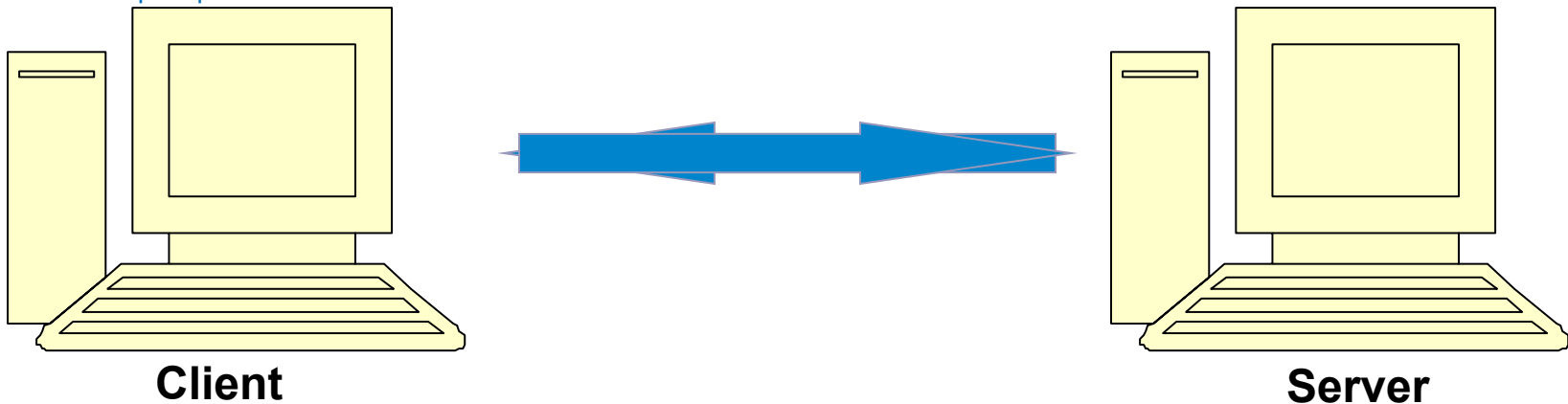
- The acknowledgment of delivery of a message is a significant feature that HL7 LLP provides.

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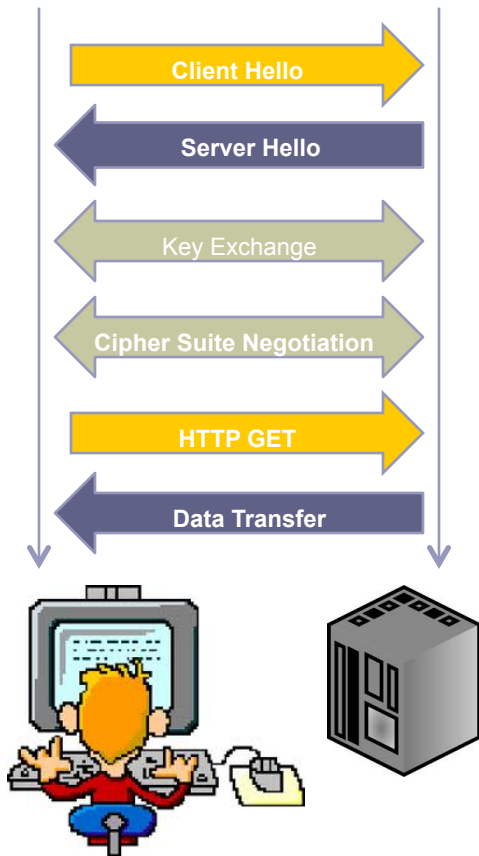
- Other methods can be used to deliver HL7 messages to the receiving system.
  - Send message via FTP.
  - FTPS – FTP using SSL (Secure Socket Layer) – Meditech Supports
  - SFTP – FTP using SSH (Secure Shell)
  - Download and copy to shared folder.

- 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.

Source / Destination	Destination / Source

HL7 Content: Query()

Commit Acknowledgement()

HL7 Content: Query()

Commit Acknowledgement()

Communication Standards

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^|

QRYP1ientp information is MSAedim the QRYl response that met the
QRYacknowledge the QRY and contains the MCI.

QRD and QRF segments are repeated in Response
acknowledge the QRY

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

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

- Version 3 is a departure from the 2.x version in how the messages are formatted but does offer some advantages for Web publishing and self documenting.

- Version 3 is based on XML, a Web-based language.

- Some movement in the market to transition to 3.

- Version 3 is more complex than v2.x

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>
```

```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>
```

Some advantages with HL7 v3:

- Uses industry standard XML language

- Uses formal object oriented methodology (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 items such as documents

- Designed with interoperability in mind

- Designed to be machine readable, not human readable

Sample Message in v2.x and v3:

Version 2.3.1 (87 characters of data)
MSH|^~\&|LAB^foo^bar|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>foo</HD.2>
      <HD.3>bar</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 Version 2.3.1 – 87 characters
MSH|^~\&|LAB^foo^bar|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>foo</HD.2>
     <HD.3>bar</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.

- 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
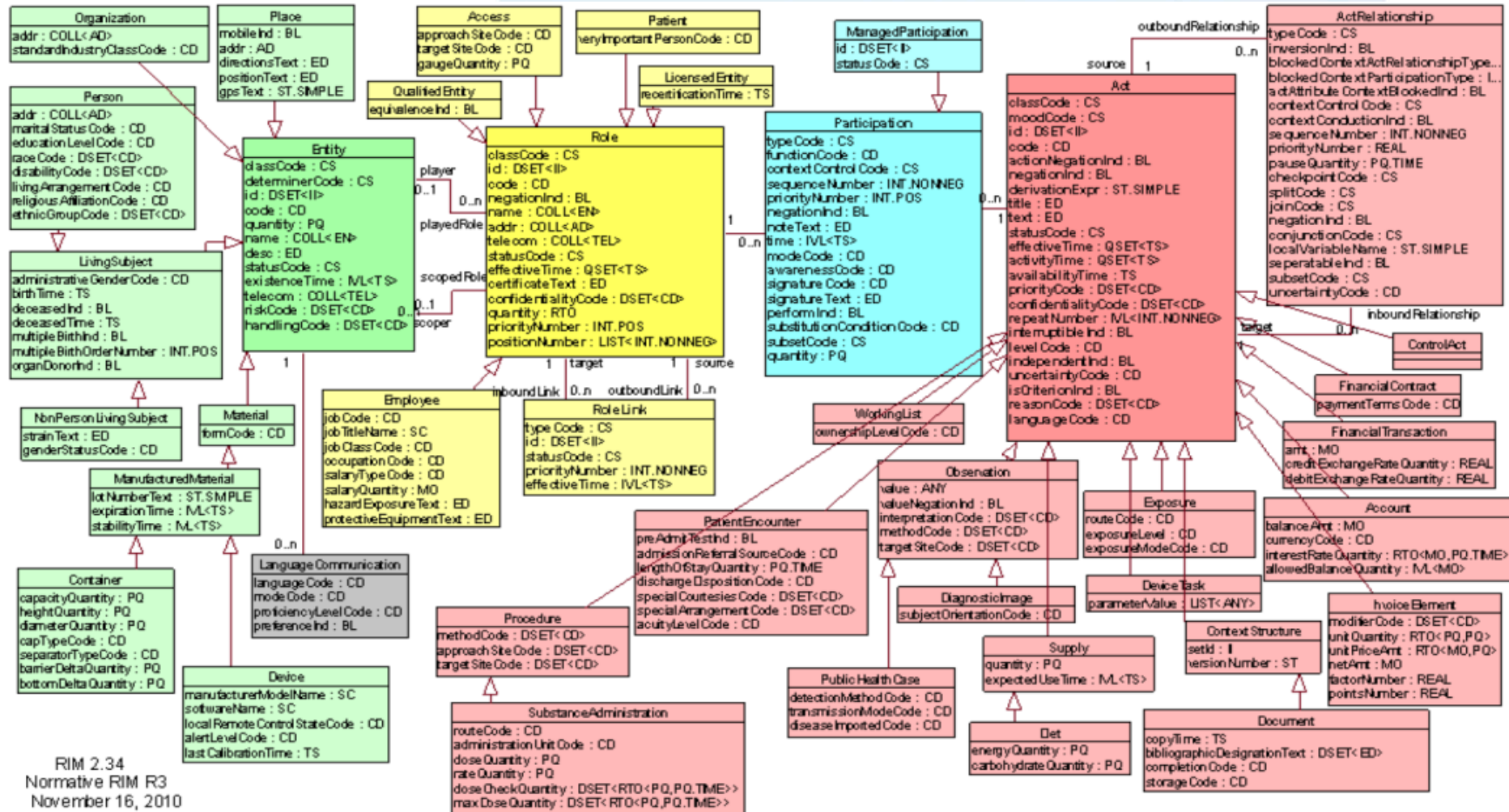
Reference Information Model (RIM):

- Classes use **attributes** to allow these six core classes to be used for everything needed for healthcare interoperability

- Example Acts attributes:

  - ID

  - Class
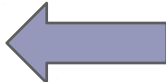
  - Codes

  - State

  - Mood

  - *(and many others)*
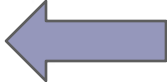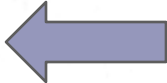
Example of ACT attributes:

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)
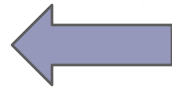 - V2 Observation

Another example of Act *Mood* attribute:

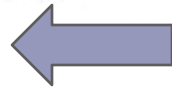# Moods of a Patient Encounter

- 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
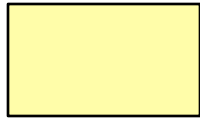
- Participations and Act Relationships show as directional boxes

- 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
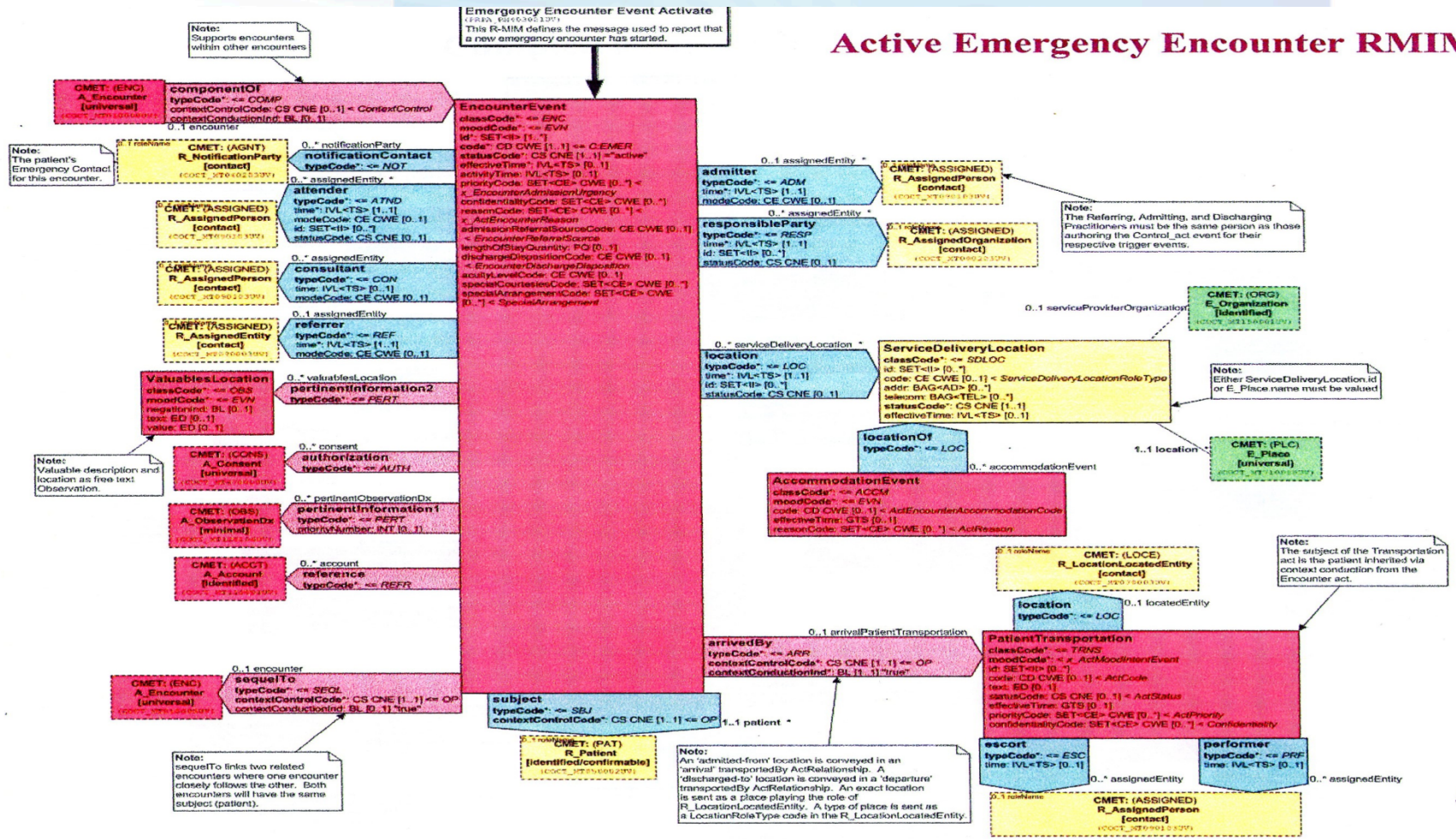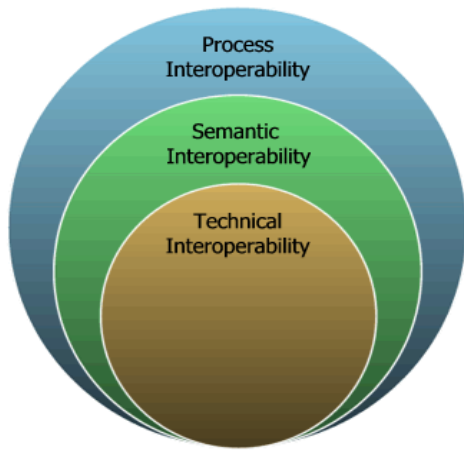
What is Interoperability?
(one of many definitions)

"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

Interoperability goals:

- <u>Meaningful Use Stage 1</u>

  - Core Objective 11 – Electronic copy of health information
  - Core Objective 13 – Exchange key clinical information
  - Menu Set Objective 7 – Provide summary care record

- <u>Connecting to patients</u>

  - Patient access to data from comfort of home
  - Patient access to their health records on demand
  - Integration with vendor products such as Microsoft Health Vault and others

Interoperability goals:

- <u>Connecting providers</u>

  - Real-time access to patient records

  - Ability to place patient orders in provider's office

  - Provider access to patient's complete records

  - Meaningful Use incentives

  - Better information=better patient care

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!
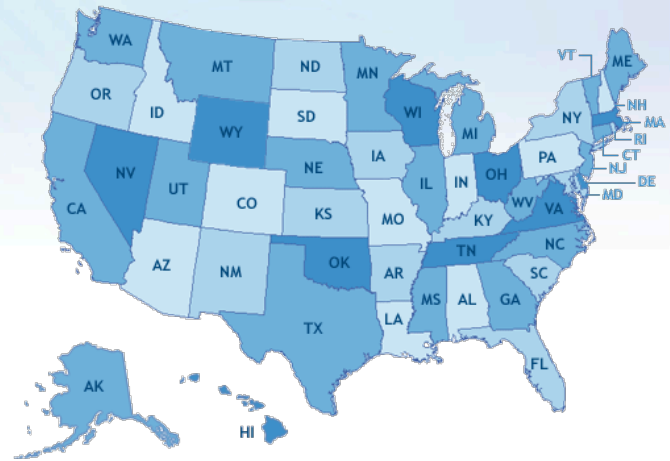
HL7 and Interoperability, pulling it all together:

- 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

XML

PIX / PDQ
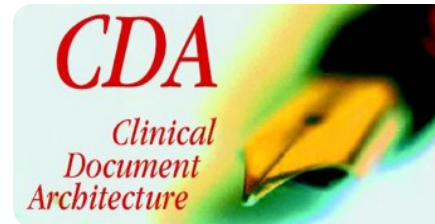
Syntactic

REST

SOAP

HL7 INTERNATIONAL

HiTSP
enabling healthcare interoperability

CDA
Clinical Document Architecture

HTTP

OID

ASTM INTERNATIONAL

IHTSDO
– global efforts for a common health terminology

ANSI
Standards Activities

LOINC®

Clinical Document Architecture (CDA):

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

- Defines the "rules" for clinical document exchange

- Uses

  - XML

  - RIM

  - Codification (SNOMED, ICD…etc)

  - Can have many different looks and feels, can be simple or complex depending upon the implementation
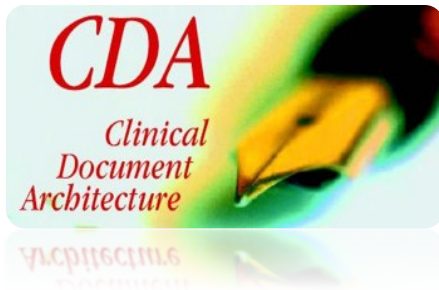
Clinical Document Architecture (CDA):

A clinical document must have the following characteristics:

- **Persistence** – document exists over time and can be used in many contexts.
- **Stewardship** – documents must be managed by a steward.
- **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** – for authentication.

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.

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

- Simple CDAs can be created and expanded over time

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

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

CDA Benefits:

- Industry accepted, internationally accepted and implemented

- Strong vendor support with interest growing

- Includes many coding vocabularies (SNOWMED, LOINC, RXNORM)

- 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

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:

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

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		
Author	James E Devlin		
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
- 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*

Iatric Memorial Hospital Continuity Of Care Document

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

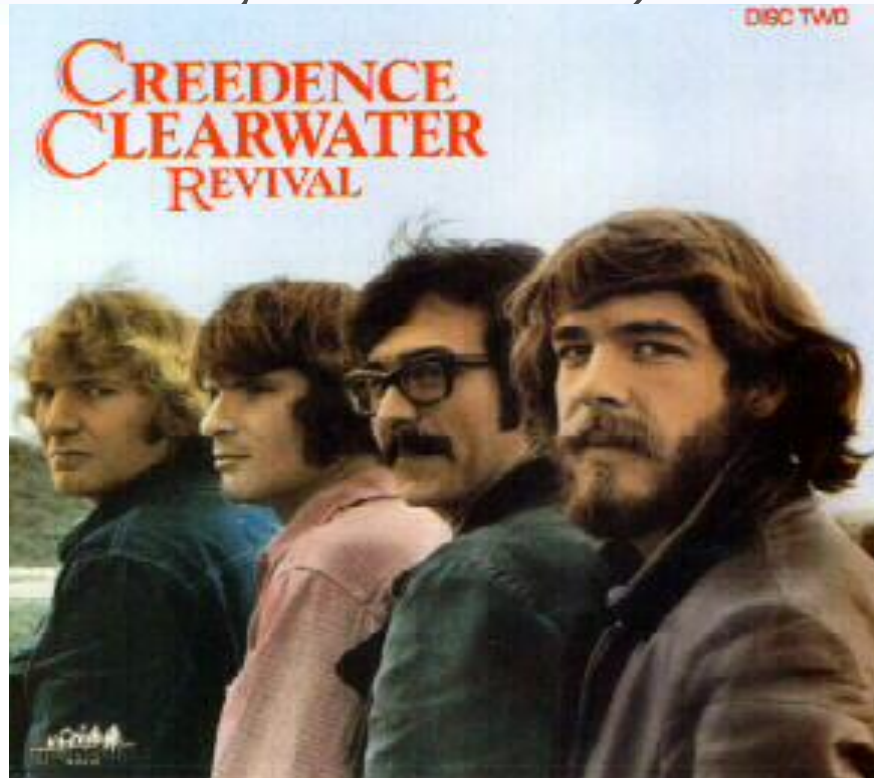- Probably the most common document being exchanged at this time

Types of documents involved with interoperability:

CCR (Continuity of Care Record)

- re governed ting and

- different

- record data th vault and

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.

- CCR document formats are primarily used to exchange information with Personal Health Record Vendors such as Microsoft® HealthVault®.

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

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.

Questions?

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Thank you.

ASCII Table

Char	Dec	Char	Dec	Char	Dec	Char	Dec	Char	Dec	Char	Dec
(nul)	0	(syn)	22	,	44	B	66	X	88	n	110
(soh)	1	(etb)	23	-	45	C	67	Y	89	o	111
(stx)	2	(can)	24	.	46	D	68	Z	90	p	112
(etx)	3	(em)	25	/	47	E	69	[	91	q	113
(eot)	4	(sub)	26	0	48	F	70	\	92	r	114
(enq)	5	(esc)	27						93	s	115
(ack)	6	(fs)	28						94	t	116
(bel)	7	(gs)	29					_	95	u	117
(bs)	8	(rs)	30	4	52	J	74	`	96	v	118
(ht)	9	(us)	31	5	53	K	75	a	97	w	119
(nl)	10						76	b	98	x	120
(vt)	11						77	c	99	y	121
(np)	12						78	d	100	z	122
(cr)	13	#	35	9	57	O	79	e	101	{	123
(so)	14	$	36	C	58	P	80	f	102			124
		;	59	Q	81	g	103	}	125
		<	60	R	82	h	104	~	126
(dc1)	17			=	61	S	83	i	105	(del)	127
(dc2)	18	(	40	>	62	T	84	j	106		
(dc3)	19	)	41	?	63	U	85	k	107		
(dc4)	20	*	42	@	64	V	86	l	108		
(nak)	21	+	43	A	65	W	87	m	109		

ASCII 28 is an HL7 Ending Message Character

ASCII 11 is an HL7 Beginning Message Character

ASCII 13 is an HL7 End Segment Character