




# HL7 Session 3

June 2013

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# Agenda

- **Message Processing Rules**
  - Special HL7 Protocols
  - Message Control Segments
  - Conformance using Message Profiles
- 

# Message Processing Rules (1/3)

## Response using original processing rules

- Accept and validate the message in responding system
  - Validate MSH - 9, MSH - 11 and MSH – 12
  - If any of the above validations fail, send back AR in MSA - 1
- Accept and validate/process the message in the receiving application
  - Send AA in MSA-1 if processing is successful
  - Send AE in MSA-1 if error on processing (e.g. sequence number error).
  - Send AR in MSA-1 in case there is failure in processing (e.g. system down, queue full).
- Transmit the response message

Both MSH-15-accept acknowledgment type and MSH-16 application acknowledgement type are null or not present.

# Message Processing Rules (2/3)

## Response using enhanced acknowledgement

- Accept and validate the message in responding system
  - Status of interface, availability of safe storage
  - Syntactical correctness
  - Validate MSH - 9, MSH - 11 and MSH – 12
- Transmit general acknowledgement message
  - Send CA in MSA -1 if message can be accepted
  - Send CR in MSA-1 if any of MSH 9, 12 or 11 is not acceptable.
  - Send CE in MSA -1 in case it cant be accepted due to other reasons (sequence number error).
- Transmit application acknowledgement
  - If the message header segment indicates that the initiating system also requires an application acknowledgment, this will be returned as the initial message of a later exchange.


At least one of MSH-15-accept acknowledgment type or MSH-16 application acknowledgment type is not null.

# Message Processing Rules (3/3)

## Important:

The original acknowledgment protocol is equivalent to the enhanced acknowledgment protocol with MSH-15-accept acknowledgment type = NE and MSH-16 application acknowledgment type = AL

# Agenda

- Message Processing Rules
  - **Special HL7 Protocols**
  - Message Control Segments
  - Conformance using Message Profiles
- 

# Special HL7 Protocols (1/5)

## Sequence number protocol

- Initial Conditions
  - Receiving system will store the sequence number of the most recently accepted transaction before acknowledging
  - Initiating system keeps a queue of outgoing transactions indexed by the sequence number
  - Sequence number is a positive(non-zero) integer. It is incremented by one (by the initiating system) for each successive transaction
- Reserved sequence number values
  - 0 is reserved for use only while initiating system (re-)starts the link
  - -1 is reserved for use only when the initiating system is resynchronizing the link.
- When the initiating system sends a message with a sequence number of 0 or -1, the segments beyond the MSH need not be present in the message, or, if present, all fields can be null.
- if the receiving system gets a transaction
  - with a 0 (zero) in the sequence number field, it should send back a sequence number one greater than the sequence number of the last transaction it accepted
  - if this value does not exist, it should send back a sequence number of -1

# Special HL7 Protocols (2/5)

## Continuation messages and segments

- Segment fragmentation/continuation using the **ADD** segment
  - Used within a message to break a long segment into shorter segments within a single HL7 message

Example : Segment "C" can be fragmented within HL7 message as:

```
A|1  
B|2  
C|34  
ADD|5|678  
ADD||90  
D|1
```

is same as

```
A|1  
B|2  
C|345|678|90  
D|1
```

Note: The "|" at the end of the first ADD segment is part of the value, while the first "|" of each ADD is not.



# Special HL7 Protocols (3/5)

## Continuation messages and segments

- Message fragmentation/continuation using the **DSC** segment
  - When a message itself must be fragmented and sent as several HL7 messages, the DSC segment is used

For example, a single logical message may be fragmented into two HL7 messages:

---Sender HL7 message (fragment 1)---

MSH|||||||1001||2.4|123||..

A|...

B|...

DSC|W4xy

---- Sender HL7 message (fragment 2)---

MSH|||||||2106||2.4|124|W4xy|

C|...

D|...

Such a sequence is logically the same as the single message:

MSH|...|2.4|123||..

A|...

B|...

C|...

D|...

# Special HL7 Protocols (4/5)

## Continuation messages and segments

- Segment fragmentation across messages
  - When the last segment of a message itself must be fragmented and sent as several HL7 messages, the ADD and DSC segments are used

For example :

```
MSH|...|2.4|  
ANY|12  
ADD  
DSC|JR97  
----- (fragment 2)  
MSH|...|2.4|JR97  
ADD|345
```

is logically the same as

```
MSH|...|2.4  
ANY|12345
```

# Special HL7 Protocols (5/5)

## HL7 batch protocol

- There are instances when it is convenient to transfer a batch of HL7 messages. Common examples would be a batch of financial posting detail transactions (DFT's) sent from an ancillary to a financial system.
- HL7 batch file structure:

The structure of an HL7 batch file is given by the following (using the HL7 abstract message syntax)

[FHS]	(file header segment)
{	--- BATCH begin
[BHS]	(batch header segment)
{ [	--- MESSAGE begin
MSH	(zero or more HL7 messages)
....	
....	
] }	--- MESSAGE end
[BTS]	(batch trailer segment)
}	--- Batch end
[FTS]	(file trailer segment)

- The following segments relate to the HL7 Batch Protocol:  
BHS Batch Header, BTS Batch Trailer, FHS File Header and FTS File Trailer

# Agenda

- Message Processing Rules
- Special HL7 Protocols
- **Message Control Segments**
- Conformance using Message Profiles

# Message Control Segments (1/2)

Segment Category	Segment Name	Description	Purpose
Control	ADD	Addendum segment	Used to define the continuation of the prior segment
	BHS	Batch header segment	Defines the start of a batch
	BTS	Batch trailer segment	Defines the end of a batch
	DSC	Continuation pointer segment	Used in the continuation protocol
	ERR	Error segment	Used to add error comments to acknowledge messages
	FHS	File header segment	Used to head a file (group of batches)
	FTS	File trailer segment	Defines the end of file
	MSA	Message acknowledgment segment	Contains information sent while acknowledging another message
	MSH	Message header segment	Defines the intent, source, destination, and some specifics of the syntax of a message
General Purpose	NTE	Notes and comments segment	Used for sending notes and comments
	OVR	Override segment	This segment allow a sender to override specific receiving application's business rules to allow for processing of a message that would normally be rejected or ignored
	SFT	Software segment	This segment provides additional information about the software product(s) used as a Sending Application. The primary purpose of this segment is for diagnostic use.

# Message Control Segments (2/2)

## Few of the segments and some of their fields:

- **BHS** – Batch Header Segment
  - Batch Field Separator
  - Batch Encoding Characters
  - Batch Creation Date/Time
  - Batch Control ID
- **FHS** – File Header Segment
  - File Field Separator
  - File Encoding Characters
  - File Creation Date/Time
  - File Control ID
- **NTE** - Notes and Comments
  - Set ID - NTE
  - Source of Comment
  - Comment
  - Comment Type
- **BTS** – Batch Trailer Segment
  - Batch Message Count (ST)
  - Batch Comment
  - Batch Totals (NM)
- **FTS** – File Trailer Segment
  - File Batch Count
  - File Trailer Comment
- **SFT** – Software Segment
  - Software Vendor Organization
  - Release Number
  - Software Product Name
  - Software Install Date

# Agenda

- Message Processing Rules
- Special HL7 Protocols
- Message Control Segments
- **Conformance using Message Profiles**

# Conformance using Message Profiles (1/13)

## Need for Conformance

- HL7 standard defines the specifications only at a broader level
- Need to define boundary conditions such as optionality and cardinality.

## HL7 message profile

- is an unambiguous specification of one or more standard HL7 messages that have been analyzed for a particular use case.
- prescribes a set of precise constraints upon one or more standard HL7 messages
- may have a unique identifier(MSH-21) as well as publish/subscribe topics.
- specifies what data will be passed in a message.
- defines the format in which the data will be passed.
- specifies the acknowledgement responsibilities of the sender and receiver.

**A message profile fully describes a conversation between two or more systems through the combination of the following:**

- one use case analysis
- one or more dynamic definitions
- one or more static definitions



# Conformance using Message Profiles (2/13)

## Use Case Analysis

- The use case analysis may be documented as a use case diagram (supported with text) or just a textual description.
- A use case model documents the scope and requirements for an HL7 message profile or set of message profiles.
- The use case model must:
  - Provide a name that clearly and concisely defines the exchange
  - Document the purpose for each message exchange
  - Define the actors, including the sending and receiving applications
  - Define the flow of events between these actors including, where appropriate, derived events
  - Document the situations in which the exchange of a particular HL7 message profile is required

# Conformance using Message Profiles (3/13)

## Dynamic Definition

- The dynamic definition is an interaction specification for a conversation between 2 or more systems.
- It may reference one to many static definitions.
- The dynamic definition may include an interaction model in addition to the acknowledgement responsibilities.
- The dynamic definition shall identify whether an accept and/or application level acknowledgment is allowed or required.
- The dynamic definition shall define the conditions under which an accept and/or application level acknowledgment is expected.
- For any one static definition there may be one or more dynamic definitions.

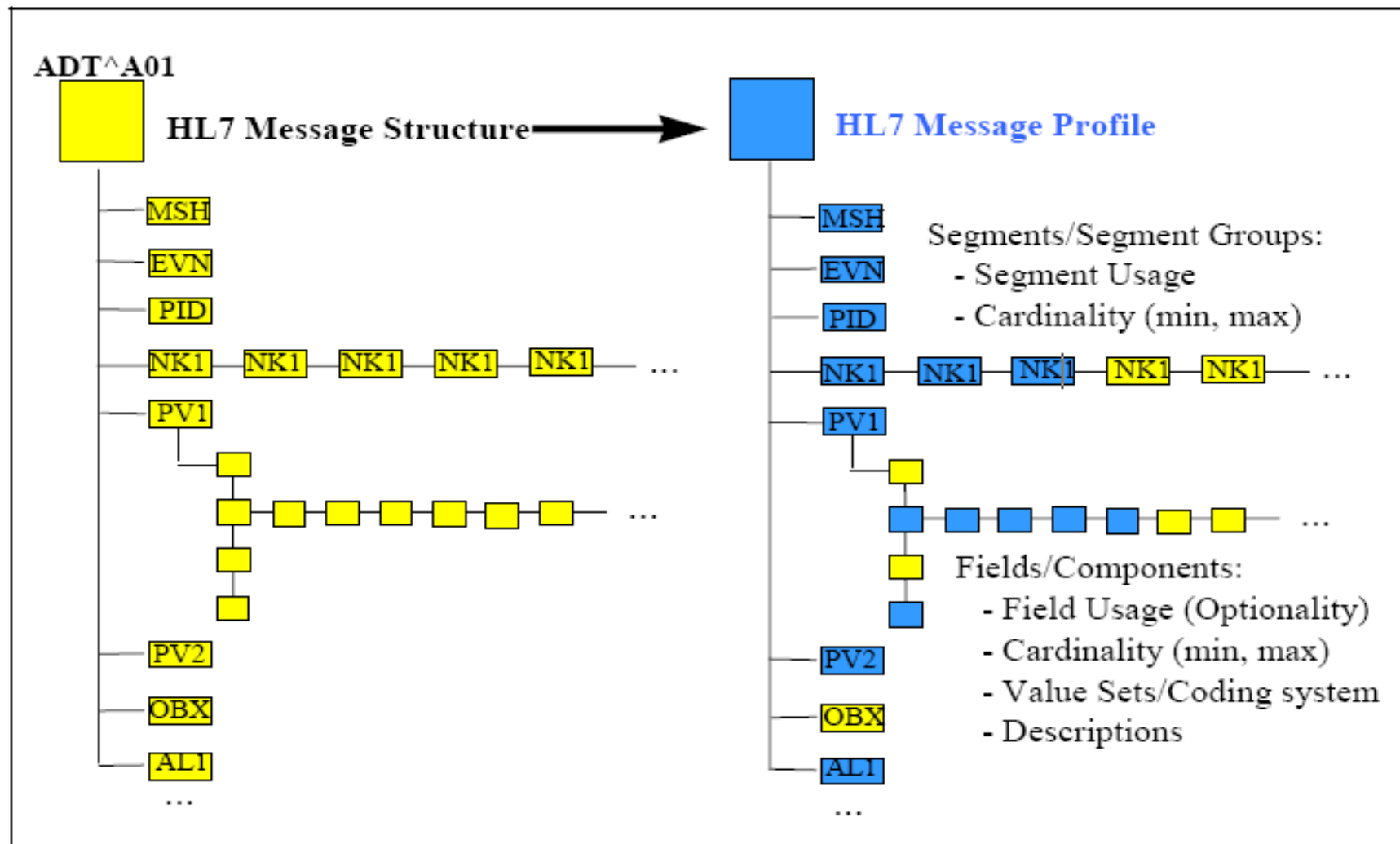
# Conformance using Message Profiles (4/13)

## Static Definition

- The static definition is an exhaustive specification for a single message, and is normatively expressed in XML
- The static definition is based on a message structure defined in the HL7 Standard.
- A complete static definition shall be defined at the message, segment, and field levels.
- A static definition explicitly defines:
  - Segments, segment groups, fields and components usage rules
  - Cardinalities
  - Value sets and coding systems.

# Conformance using Message Profiles (5/13)

Static Definition Illustration



# Conformance using Message Profiles (6/13)

## Static Definition concepts

- Length
  - Length is defined to be a constraint on the number of characters that may be present in one occurrence of a message field or element.
  - This definition satisfies both requirements; it applies (strictly) to an element's data value—i.e., the set of characters present in the message representing a value of the element's predefined data type—and it is measured in characters.
  - Length shall be specified using the following syntax: "m..n", where m and n are non-negative integers designating the minimum and maximum number of characters the element may have

# Conformance using Message Profiles (7/13)

## Minimum and Maximum Length Examples

Value	Description
	For constrainable profile: no length defined, i.e. no requirements on the length are given. Leaving this information empty is not allowed for implementable profiles.
0..0	For withdrawn elements: minimum and maximum set to 0.
1..1	Element must have exactly one character
1..n	Element may have up to n characters
n..n	Element must have exactly “n” characters
1..*	Element may have any length.
n..*	Element may have any length which is greater than or equal to “n”, where “n” is greater than or equal to 1.
m..n	Element must have a minimum length of “m” and a maximum length of “n” where “m” is less than or equal to “n” and “m” is greater than or equal to 1.

# Conformance using Message Profiles (8/13)

## Static Definition concepts

- Whether or not an element is populated is controlled by cardinality.
- But if the element is populated with a non null value, the minimum and maximum length definition must hold.
- The null information representation (two double quotes) is not considered to be a value with applicable length information.
- Length should not be specified for composite elements. In these cases, the actual min and max lengths can be very difficult to determine.
- **Conformance Length**
  - Constraining specifications may also specify a conformance length.
  - This is the number of characters that any conformant application must be able to correctly handle.
  - For example, a constrainable profile may declare that the min and max lengths of a specific field are 3 and 2500.
  - An implementation profile may further constrain this length to specify what is actually supported by an application.
  - Conformance length is a redundant concept in implementation profiles that will not be further constrained, and should not be specified.

# Conformance using Message Profiles (9/13)

## Static Definition concepts

- **Truncation Flag**
  - The truncation flag is a simple boolean.
  - In a constrainable profile, the value may be true or false.
  - False signifies that the element may not be truncated, while true means that the value may be truncated.
  - If a profile fixes truncation to false, no other further constraining profile may mark this value as true.
  - If the value is fixed to true, other further constraining profiles may mark it as true or false.
  - In an implementation profile, a value of true for the truncation flag signifies that the application supports the defined truncation behaviour for the appropriate type.
  - A value of false indicates that the application does not support data truncation for this element.



# Conformance using Message Profiles (10/13)

## Static Definition concepts

- **Cardinality**

- It used to control message content, and usage is used to define application requirements.
- Cardinality controls the number of occurrences of an element appearing in a message.
- Some elements shall always be present (e.g., cardinality [1..1], [1..n]).
- Others shall never be present (i.e., cardinality [0..0]).
- Others may be optional with zero or more occurrences (e.g., cardinality [0..n]).
- Cardinality identifies the minimum and maximum number of occurrences that a message element must have in a conformant message.
- Cardinalities are expressed as a minimum-maximum pair of non-negative integers.
- A conformant message must always contain at least the minimum number of occurrences, and shall not contain more than the maximum number of occurrences.
- An explicit cardinality range is required for segment group, segment, and field elements.

# Conformance using Message Profiles (11/13)

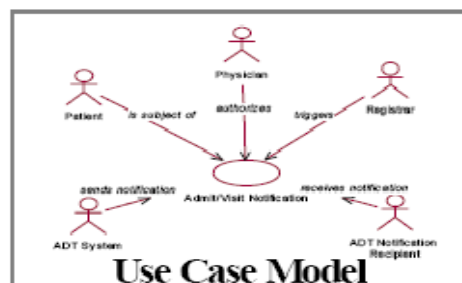
## Cardinality

Value	Description	Valid Usage Codes
[0..0]	Element never present	X
[0..1]	Element may be omitted and it can have at most one occurrence	RE, O, C <sup>2</sup> , CE
[1..1]	Element must have exactly one occurrence	R
[0..n]	Element may be omitted or may have up to n occurrences	RE, O, C <sup>2</sup> , CE
[1..n]	Element must appear at least once, and may have up to n occurrences	R
[0..*]	Element may be omitted or may have an unlimited number of occurrences	RE, O, C <sup>2</sup> , CE
[1..*]	Element must appear at least once, and may have an unlimited number of occurrences	R
[m..n] <sup>3</sup>	Element must have at least "m" occurrences and may have at most "n" occurrences. Except that in the case where the usage code is RE, the element may also be omitted or have zero occurrences	R and RE
[m..*] <sup>3</sup>	Element must have at least "m" occurrences and may have an unlimited number of occurrences. Except that in the case where the usage code is RE, the element may also be omitted or have zero occurrences.	R and RE

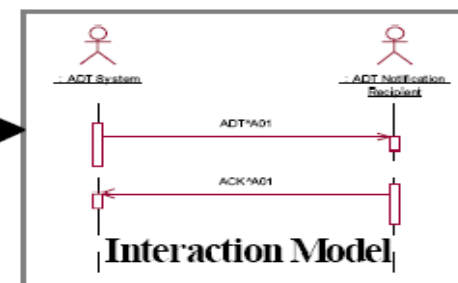
- <sup>2</sup> If the usage code is C, then the element must be present if the associated condition predicate evaluates to true.
- <sup>3</sup> *m* must be greater than 1 and *n* must be greater than or equal to *m*; the case where *m* equals 1 is addressed separately.

# Conformance using Message Profiles (12/13)

## Message Profile Example



- 1 Use Case Model
  - 1.1 Use Case: Admit/Visit Notification
2. Dynamic Interaction Model
- 3 Dynamic Definition: ADT/ACK (Event A01)
  - 3.1 ADT^A01
  - 3.2 ACK^A01



- 4 Static Definition: - Message Level - ADT/ACK (event A01)

- 4.1 ADT^A01
- 4.2 ACK^A01

- 5 Static Definition - Segment Level

- 5.1 MSH - Message Header Segment Definition
- 5.2 EVN - Event Type Segment Definition
- 5.3 PID (Y) - Patient Demographics Segment Definition
- 5.4 PD1 - Patient Additional Demographic Segment Definition
- 5.5 NK1 - Next of kin Segment Definition
- 5.6 PV1 (2) - Admit Visit Info Segment Definition
- 5.7 AL1 - Allergy Segment Definition
- 5.8 MSA - Message Acknowledgment Segment Definition
- 5.9 ERR - Error Segment Definition

- 6 Static Definition - Field Level

- 6.1 Table 0001 - Sex
- 6.2 Table 0002 - Marital Status

Segment	ADT Message	Usage	Cardinality	Chapter
MSH	Message Header	R	[1..1]	2
EVN	Event Type	R	[1..1]	3
PID	Patient Identification	R	[1..1]	3
[ PD1 ]	Additional Demographics	X	[0..1]	3
[ PCL ]	Role	X	[0..1]	12
[ NK1 ]	Next of Kin / Associated Parties	NE	[0..1]	3
PV1	Patient Visit	R	[1..1]	3
[ PV2 ]	Patient Visit - Additional Info	NE	[0..1]	3
[ PCL ]	Role	X	[0..1]	12
[ DSI ]	Disability Information	X	[0..1]	3
[ OBS ]	Observation/Result	X	[0..1]	7
[ AL1 ]	Allergy Information	NE	[0..1]	3
[ DSI ]	Diagnosis Information	X	[0..1]	6
[ DSG ]	Diagnosis Related Group	X	[0..1]	6
[ PCL ]	Procedure	X	[0..1]	6
[ PCL ]	Role	X	[0..1]	12
[ GFI ]	Guarantor	X	[0..1]	6
[ INS ]	Insurance	X	[0..1]	6
[ INS ]	Insurance Additional Info	X	[0..1]	6
[ INS ]	Insurance Additional Info - Cert.	X	[0..1]	6
[ PCL ]	Role	X	[0..1]	12
[ ]				
[ AC ]	Accident Information	X	[0..1]	6
[ UH1 ]	Universal HL1 Information	X	[0..1]	6
[ UH2 ]	Universal HL1 92 Information	X	[0..1]	6
[ PIA ]	Patient Death and Autopsy	X	[0..1]	3

## Static Definition - Message Level

Type	Table Name	Value	Description	Source	Dest
ADT	0007	Admission Type		HL7 2.3, ANS, UH2	PV1-4
	0007	A	Admission	HL7	
	0007	E	Emergency	HL7	
	0007	L	Labor and Delivery	HL7	
	0007	R	Routine	HL7	
	0007	ACC	Accident		
	0007	EMR	Emergency		
	0007	LAD	Labor and Delivery		
	0007	MR	Medication		
	0007	PD1	Procedure		
	0007	OS	Observation		
	0007	UFI	Urgent		
	0007	UR	Urgency		
	0007	PIA	Patient Death and Autopsy		

**4.1 ADT^A01**  
The dynamic profile of the ADT^A01 event notification requires that an HL7 Accept Acknowledgement be sent but that no HL7 Application Acknowledgement is sent in response to this ADT^A01 message.

Dynamic Profile Identifier:  
[msg(1M^01 v3.35) dynamic-profile(2) c=HL-app^005]

**4.2 ACK^A01**  
The dynamic profile of the ACK^A01 acknowledgment requires that neither an HL7 Accept Acknowledgement or an HL7 Application Acknowledgement is sent in response to this ACK^A01 message.

Dynamic Profile Identifier:  
[msg(1M^01 v3.35) dynamic-profile(2) c=HL-app^004]

## Dynamic Definition

SEQ	LEN	DT	Usage	Cardinality	TBLX	ITEM#	ELEMENT NAME
1	4	SI	X			00104	Set ID - PID
2	20	CK	NE	[1..1]		00105	Patient ID
3	20	CK	X	[1..1]		00106	Patient Identifier List
4	20	CK	X	[1..1]		00107	Admissible Patient ID - PID
5	40	XPN	R	[1..1]		00108	Patient Name
6	40	XPN	NE	[1..1]		00109	Mother's Maiden Name
7	20	TS	NE			00110	Date/Time of Birth
8	1	IS	NE		0001	00111	Sex
9	40	XPN	X			00112	Patient Alias
10	80	CE	X		0006	00113	Race
11	100	XAD	X	[1..1]		00114	Patient Address
12	4	IS	X		0200	00115	County Code
13	40	XPN	NE	[1..1]		00116	Phone Number - Home
14	40	XPN	NE	[1..1]		00117	Phone Number - Business
15	80	CE	X		0200	00118	Primary Language
16	80	CE	X		0000	00119	Marital Status
17	80	CE	X		0006	00120	Religion
18	20	CK	X			00121	Patient Account Number
19	16	ST	NE			00122	SSN Number - Patient
20	25	DAN	X			00123	Driver's License Number - Patient
21	20	CK	X			00124	Mother's Identifier
22	80	CE	X		0100	00125	Ethnic Group

# Conformance using Message Profiles (13/13)

## Profile Types

- HL7 standard profile : represents a specific HL7 published standard, creation and publication limited to HL7 use.
- Constraining Profile : with optional elements which must be further constrained.
- Implementation Profile : No optional part, fully implementable.

This allows vendors/provider to publish generic profiles from which fully constrained implementation profiles can be created.

# Mood Code

- Used to specify how the data in a segment should be processed
- Added to OBX, RXO, PRB, GOL, PTH and PRD segments
- Only allowed in new messages
- E.g.: In an OBX segment, this field can be used to specify whether it contains a result or whether the sender expects the receiver to perform the observation

Code	Description
INT	Intent (an intention to plan or perform an act)
APT	Appointment
ARQ	Appointment Request
PRMS	Promise
PRP	Proposal
RQO	Request – Order
EVN	Event
EVN CRT	Event Criteria
EXP	Expectation

# Syllabus

Sr. No	Topic	Sections in book (Chapter 2)
1	Conceptual approach of HL7	2.2-2.4
2	Elements of HL7 messages	2.5
3	Construction and processing of HL7 messages	2.6-2.9, 2.11, 2.13
4	Special HL7 protocols	2.10
5	Conformance using message profiles	2.12
6	Acknowledgment messages	2.14
7	Message control segments	2.15
8	HL7 data types and their uses	2.16, Chapter 2A

# Special Notes

- DO NOT FORGET TO REFER TO ALL PRESENTATION SLIDES AND REFERENCE BOOKS BEFORE EXAMINATION
- YOU MUST PUT IN ATLEAST 40+ HOURS OF EFFORT
- SLIDES IN PRESENTATION DO NOT COVER ALL THE TOPICS. REFER ALL THE BOOKS THAT ARE PROVIDED
- PLEASE MAKE SURE YOU ATTEMPT ALL TESTS WITH FULL DEDICATION
- AFTER ALL THE ONLINE TESTS ARE DONE, REVIEW YOUR ANSWERS ONLINE

# Thank You