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syngo.via
VB10A

SY

HL7 Conformance Statement

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1 Introduction

1.1 Purpose

This document gives a compact view of the HL7 interface provided by *syngo.via*.

1.2 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working knowledge of HL7.

1.3 Definitions, Terms and Abbreviations

1.3.1 Abbreviations

CDA	Common Document Architecture
HL7	Health Level Seven
ISR	Imaging Service Request
IS	Information System
LOINC	Logical Observation Identifiers Names and Codes
OEM	Original Equipment Manufacturer
RIS	Radiology Information System
RP	Requested Procedure
SPS	Scheduled Procedure Step

1.3.2 Definition and Terms

CDA	The CDA is a document markup standard that specifies the structure and semantics of a clinical document for the purpose of exchange. A CDA document is a defined and complete information object that can include text, images, sounds and other multimedia content. It can be transferred within a message, and can exist independently, outside the transferring message.
HL7	HL7 is a standard for information exchange between medical applications. It is an abbreviation of "Health Level Seven", 7th OSI layer protocol for the health environment. (OSI = Open Systems Interconnect, a model to describe defined layers in a network operating system). The HL7 protocol defines the format and the content of the messages that applications have to pass to one another under various conditions (e.g. to pass the message between applications / systems that a patient has been admitted in a hospital). For further information please refer to [1].
ISR	An Imaging Service Request includes pertinent specific and general information. Each instance of an Imaging Service Request carries the information common to one or

more Requested Procedures requested at the same moment. For further information please refer to [2].

RP	A Requested Procedure is an instance of a Procedure of a given Procedure Type. An instance of a Requested Procedure includes all of the items of information that are specified by an instance of a Procedure Plan that is selected for the Requested Procedure by the imaging service provider. For further information please refer to [2].
SPS	A Modality Scheduled Procedure Step is an arbitrarily defined scheduled unit of service, that is specified by the Procedure Plan for a Requested Procedure. A Modality Scheduled Procedure Step prescribes the Protocol which may be identified by one or more protocol codes. A Modality Scheduled Procedure Step involves equipment (e.g. imaging Modality equipment, anesthesia equipment, surgical equipment, transportation equipment), human resources, consumable supplies, location, and time (e.g. start time, stop time, duration). For further information please refer to [2].

1.4 References

[1] HL7 Standard, chapter 2 “Control”, http://www.hl7.org/

[2] DICOM Standard, 2014a, http://medical.nema.org/

[3] CDA Standard, http://www.hl7.org/implement/standards/

1.5 General information

Syngo.via, on which this Conformance Statement focuses, provides a set of interfaces for tight integration with Imaging IT systems.

- An OEM interface is used to realize frontend integration (remote image callup).

- A bi-directional interface is available for backend communication. The HL7 interface ensures the RIS to *syngo.via* communication. Furthermore syngo.via is informed about new procedures via DICOM Modality Worklist service.

2 Overview

Syngo.via supports the following features regarding HL7 communication:

- Patient Update / Merge (ADT^A08, ADT^A40 or ADT^A34)
- Report Export (ORU^R01)
- Report Import (ORU^R01) for the option *syngo.via* WebReport

2.1 Supported Messages

The table below provides an overview about all HL7 messages that are supported by *syngo.via* as receiving application.

Message	Description	Segment Decomposition
Supported inbound messages		
ADT^A08	Patient Update	**MSH, EVN, PID, PV1, [{OBX}], [{AL1}]**
ADT^A34	Patient Merge – Patient ID only	**MSH, EVN, PID, [PD1], MRG**
ADT^A40	Patient Merge	**MSH, EVN, PID, MRG, [PV1]**
ORU^R01	Unsolicited Transmission of an observation to be transferred to *syngo.via* WebReport	**MSH, PID, OBR, {OBX}, [PV1]**
Supported outbound messages		
ORU^R01	Unsolicited Transmission of an observation	**MSH, PID, OBR, {OBX}**

Table 1: Overview of supported messages

2.2 ACK / NACK behavior

If a message is sent to *syngo.via* which is not supported (e.g. ORU) or a mandatory attribute is missing (e.g. Patient Name), *syngo.via* nevertheless replies with an HL7 ACK in order to avoid blocking the connection. The message is stored within the backlog of the HL7 gateway. (see *Table 12* for a list of required attributes which are expected by *syngo.via*)

3 Implementation Details

3.1 HL7 Version

Generally *syngo.via* will expect HL7 version 2.3.1, but messages based on version 2.4 and 2.5 will also be processed.

3.2 Configuration

3.2.1 Minimal Layer Protocol (MLP)

The *syngo.via* HL7/XML interface uses HL7's Minimal Layer Protocol (MLP) protocol over TCP/IP to receive and send messages. Briefly, the message body is encoded using transaction framing with 0xB start and 0x1C+0xD end.

TXS	TX Body												TXE	
0xB	A	B	C	D	E	…							0x1C	0xD

Figure 1: Encoding message using MLP

Such encoded transactions are then sent to (or received from) a TCP/IP port at the *syngo.via* HL7/XML interface.

3.2.2 Sending HL7 Messages to *syngo.via*

MLP encoded HL7 messages have to be sent to the port 9973 at the *syngo.via* HL7/XML interface. No additional configuration needs to be done on the *syngo.via* HL7/XML interface if port 9973 is used. Note that the TCP/IP connection is permanent and the interface port is blocked as long as the Information System (IS) is connected to it (dedicated connection).

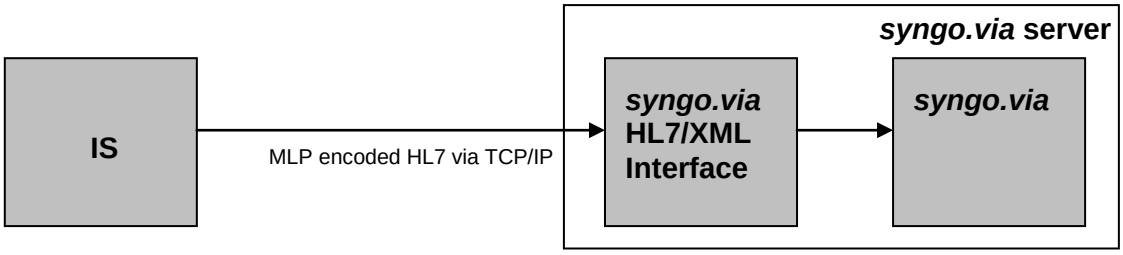

Figure 2: Sending HL7 to *syngo.via* HL7/XML interface

3.2.3 Sending HL7 Messages out of syngo.via

MLP encoded HL7 messages are sent to the receiving port of the Information System. This port needs to be configured within the *syngo.via* HL7/XML interface. Additionally to the Port configuration the IP address of the receiving system needs to be set on the *syngo.via* HL7/XML interface. Note that the TCP/IP connection is permanent and the interface port is blocked as long as the IS is connected to it (dedicated connection).

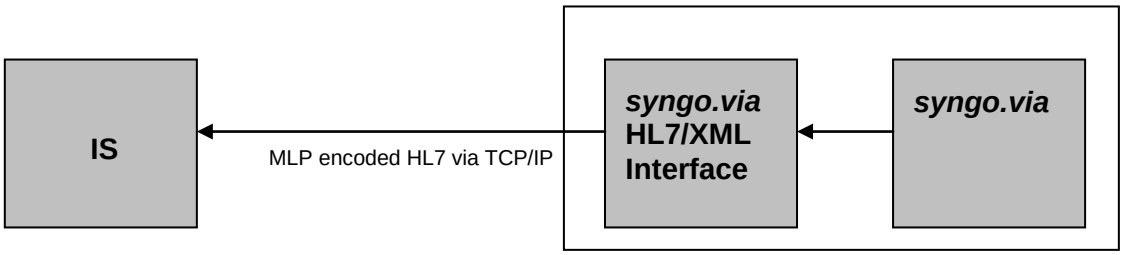

Figure 3: Sending HL7 out of *syngo.via*

3.3 Restrictions

Exactly one IS instance can connect to the HL7 interface provided by *syngo.via*.

3.4 Finding matches

If objects are either created or updated at the RIS, *syngo.via* tries to find a matching existing patient and Requested Procedure (RP). If it finds either of that, it performs an update rather than creating a new record.

To match a patient, a configurable combination of the following fields is used.

- Patient ID (PID-3.1) *(mandatory)*
- Assigning Authority (PID-3.4)
- Patient Name (PID-5)
- Patient Date of Birth (PID-7)

The patient is by default identified through Patient ID and Assigning Authority/Issuer of Patient ID. If the latter is not set and no default value is set for Assigning Authority/Issuer of Patient ID the above mentioned configuration is applied for patient identification.

4 Inbound Messages

4.1 Patient Update / Merge

The Patient information Update and Patient Merge messages trigger changes to patient information, including demographics, patient identification, patient location/class changes, and patient merges. These changes may occur at any time for a patient record. These messages are used for both inpatients (i.e., those who are assigned a bed at the facility) and outpatients (i.e., those who are not assigned a bed at the facility) if the patient has been previously registered.

4.1.1 Patient Information Update – ADT^A08

Incoming ADT^A08 message triggers changes to patient demographics and account information (e.g. change in patient name, patient address, etc.).

The table below indicates the message semantics of the ADT^A08 message:

ADT^A08	Patient Administration Message	Chapter in HL7 v2.3.1
MSH	Message Header	2
EVN	Event Type	3
PID	Patient Identification	3
PV1	Patient Visit	3
[{OBX}]	Observation/results	7
[{AL1}]	Allergy	3

Table 2: Message semantics of ADT^A08

syngo.via tries to find the patient and

- erases values of attributes where the message contains a null value (two adjacent quotation marks “”)
- ignores empty attributes
- updates the below specified attributes (with a non-null value)

Attribute	DICOM Tag Number	Part of DICOM Module	DICOM Value Representation	HL7
Patients Name*	(0010,0010)	Patient Identification / Patient	PN	ADT PID:5
Patients Sex	(0010,0040)		CS	ADT PID:8
Patients BirthDate	(0010,0030)		DA	ADT PID:7
Patients BirthTime	(0010,0032)		TM	ADT PID:7
Other Patient Names	(0010,1001)		PN (VM 1-n)	ADT PID:9
Ethnic Group	(0010,2160)		SH	ADT PID:10
Allergies	(0010,2110)	Patient Medical	LO	ADT AL1:3

Table 3: attributes to be updated by a received ADT^A08 message

** Patient Name is expected in DICOM format.*

If the patient is not found, *syngo.via* stores the update information. Imaging data which enters the system afterwards and matches the patient demographics within the update message, gets updated while receiving/importing.

Note: this patient update message can be used to update only non-key attributes. To change a key attribute, a "Patient Merge – ADT^A40" or a "Patient Merge (Patient ID Only) – ADT^A34" message has to be issued by the sending application.

4.1.2 Patient Merge – ADT^A40

A Patient Merge triggered by an ADT^A40 message indicates that a merge has been done at the internal identifier level. That is, PID-3-patient ID identifier has been merged with MRG-1 Patient ID.

Note: Be aware that the RIS has to send all the attributes which are configured in syngo.via to identify a patient in order to merge the patient.

The table below indicates the message semantics of the ADT^A40 message:

ADT^A40	Patient Administration Message	Chapter in HL7 v2.3.1
MSH	Message Header	2
EVN	Event Type	3
PID	Patient Identification	3
MRG	Merge Information	3

[PV1]	Patient Visit	3

Table 4: Message semantics of ADT^A40

There are two use cases for the patient merge message:

1. ***Merging of two patient object branches into a single one***
   In this case the PID and MRG segments represent two existing patients in the database. After finding the target patient and merge patient (MRG segment), all RPs from the merge patient are moved to the target patient. See *Table 6* for an explanation which attributes are changed in this case.
2. ***Update patient's key attributes***
   the target patient (PID segment) is not found. Only the merge patient (MRG segment) exists. A new patient is created with the key attributes from PID segment and all other fields are populated from the existing merge patient in database. All RPs from the merge patient are moved to the new patient. See *Table* 5 for an explanation which Patient's key attributes are changed in this case.

Patients get identified by a configurable combination of fields. The MRG segment only provides the patient name and patient id. Therefore, the *syngo.via* can only process the message in case the merge patient gets identified unambiguously using these fields.

If the patient with the correct patient identification does not exist, *syngo.via* modifies only the patient identification attributes:

Attribute	Tag Number	Part of DICOM Module	Value Representation	HL7
Patients Name	(0010,0010)	Patient Identification / Patient	PN	ADT PID:5
Patient ID	(0010,0020)		LO	ADT PID:3
Issuer Of Patient ID	(0010,0021)		LO	ADT PID:3

Table 5: attributes which get updated based on Patient Merge

If the patient with the correct patient identification already exists, *syngo.via* copies the following attributes from that patient:

Attribute	DICOM Tag Number	Part of DICOM Module	DICOM Value Representation	HL7
Patients Name	(0010,0010)	Patient Identification / Patient	PN	ADT PID:5
Patient ID	(0010,0020)		LO	ADT PID:3
Issuer Of Patient ID	(0010,0021)		LO	ADT PID:3
Other Patient IDs	(0010,1000)		LO (VM 1-n)	ADT PID:3
Other Patient	(0010,1001)		PN (VM 1-n)	ADT

Attribute	DICOM Tag Number	Part of DICOM Module	DICOM Value Representation	HL7
Names				PID:9
Patients Birth Date	(0010,0030)		DA	ADT PID:7
Patients Birth Time	(0010,0032)		TM	ADT PID:7
Patients Sex	(0010,0040)		CS	ADT PID:8
Ethnic Group	(0010,2160)		SH	ADT PID:10

Table 6: attributes which get updated during Patient Merge

4.1.3 Patient Merge (Patient ID Only) – ADT^A34

ADT^A40 message shall be used for Patient Merge messages, several older systems still use the ADT^A34 ("Merge patient information - patient ID only") message for this purpose.

The difference between the ADT^A40 and the older ADT^A34 is, that the A40 deals with the Patient Identifier List, whereas the ADT^A34 only supports the Patient ID.

syngo.via also supports the ADT^A34 message in order to enhance the interoperability to older RIS as those systems more often support the retired ADT^A34 and do not support the ADT^A40.

The table below indicates the message semantics of the ADT^A34 message:

ADT^A34	ADT Message	Chapter
MSH	Message Header	2
EVN	Event Type	3
PID	Patient Identification	3
[PD1]	Patient Additional Demographic	3
MRG	Merge Information	3

Table 7: Message semantics of ADT^A34

Hint: syngo.via treats and analyzes the ADT^A34 in the same way as the ADT1^A40.

4.2 Report Import

The ORU message is used for receiving results from other systems and forwarding these results to *syngo.via* WebReport. With the OBX and the OBR segments, one can construct almost any clinical report as a three-level hierarchy, with the Patient Context within the PID segment at the upper level, an order record within the OBR segment at the next level and one or more observation records within the OBX at the bottom.

4.2.1 Unsolicited Report – ORU^R01

ORU^R01	Unsolicited Observation Message	Segment used within syngo.via ORU msg	Chapter
MSH	Message Header	Yes	2
{ [PID	Patient Identification	Yes	3
[PD1]	Additional Demographics	No	3
[{NK1}]	Next of Kin/Associated Parties	No	3
[{NTE}]	Notes and Comments	No	2
[PV1	Patient Visit	No	3
[PV2]]]	Patient Visit - Additional Info	No	3
{[ORC]	Order common	No	4
OBR	Observations Report ID	Yes	7
{[NTE]}	Notes and comments	No	2
{[OBX]	Observation/Result	Yes	7
{[NTE]}}	Notes and comments	No	2
{[CTI]}}}	Clinical Trial Identification	No	7
[DSC]	Continuation Pointer	No	2

Table 8: General message semantics of ORU^R01

4.2.1.1 Identifying Information

The table below indicates the message semantics of the ORU^R01 message:

Attribute	DICOM Tag Number	Part of DICOM Module	DICOM Value Representation	HL7
Patients Name*	(0010,0010)		PN	ORU PID:5
Patient ID	(0010,0020)		LO	ORU PID:3
Patients	(0010,0030)		DA	ORU PID:7

BirthDate		Patient Identification / Patient		
Patients Sex	(0010,0040)		CS	ORU PID:8
Accession Number	(0008,0050)	Imaging Service Request	SH	ORU OBR:3
Procedure Description	(0032,1060)	Requested Procedure Module	LO	ORU OBR:4

Table 9: attributes used to identify the patient the report belongs to by a received ORU^R01 message

4.2.1.1.1 Result Status

The result status (OBR-25) attribute is aggregated across all available OBX-11 segments. In case multiple OBX-11 segments are available, all of those need to be filled with

- F (meaning: “Final: The report has been finalized in the IS)

in order for the report to be treated as finalized by *syngo.via* WebReport.

4.2.1.1.2 Report Content

The report in plain text format is conveyed within the OBX2-5 Observation Value.

Information about the observation date will be read from OBR-7 Observation Date/Time. It is assumed that this value correlates with the DICOM Study Date (0008,0020). The report date will be read from OBR-22 Results rpt/status chng - date/time. The reason for study will be read from OBR-31.2 and the reading radiologist will be taken from OBR-32 Prinicipal Result Interpreter.

4.2.1.1.3 Example Report

MSH|^~\&|RAD|BMH|||301203140327||ORU^R01|RMS|P|2.3.1|<x0D>

PID|1||000999888777|001010126512|LASTNAME1 MIDDLENAM^FIRST^^^|<x0D>

OBR||00003^001|36494140|ULT4476814 ^OB LIMITED FOR VIABL SNGL OR MUL|||2

01003150319|||||||^^^ |067900^DOCTORLN1^FIRSTNM^^^^MD||||||3012031403

27|||F||1^^^^^S^^STAT||||^OB US TO RULE IN PREGNANCY|000000&UNASSIGNED&

DOCTOR&&&&|<x0D>

OBX|5|TX|36494140&BODY||***** FINAL *****~~~REASON FOR EXAM: OB US TO RULE IN PREGNANCY~DIAGNOSIS: . .~COMMENTS: OB US TO RULE IN PREGNANCY ~ACC#: 12341234~PROCEDURE: ULT 9876- OB LIMITED FOR VIABL SNGL OR MUL - Jul 11 2009 ~*** Anywhere Memorial Hospital ~1234 South Sealevel Blvd., Whitest

Beach, TX 12345 Phone: (123) 456-7890 ~Ext 9999 ~----------~-----~Pat. Name: LASTNAME1 MIDDLENAM, FIRST Study Date: 07/11/2009 3:21am~Pat. No: 999888777 Referring MD: DOCTORLN1, FIRS

TNM~LMP: Unknown Sonographer: SMITHY~NA by US: 08.9 weeks DOB, Age: 05/05/1990, 19~ GA Selected: 08.9 weeks ~(Sonographic)~ EDD: 10/18/2010~----------~----- ~MEASUREMENTS \T\ FETAL AGE FETAL GROWTH

EVALUATION~Measurement GA Range Source % for 08.9 Ratios~---------- ------- ---------- ------- ---------- ~----------~Sac 3.6 cm 08.7 wk (07.8-09.6) Hellman Sac 38%~CRL 2.5 cm 09.2 wk (08.5-09.9) Hadlock CRL 65%~GA for sonogram 08.9 wk (08

.1-09.8)~based on (Sac,CRL) Avg ~----------~-----~CLINICAL SUMMARY~Fetus Number:single~Fetal Heart Rate: 170 bpm~Yolk Sac seen:yes~Ovaries: wnl~Fibroid seen:NONE~IMPRESSION:~ RADIOLOGIST DICTATED REPORT: \E\ ~DOCTOR UNASSIGNED~~~Report Dictated by DOCTOR UNASSIGNED on: Jul 11 2009 3:23A~Transcribed by: on Jul 11 2009 3:23A~|||||F|<x0D>

Report in plain text

5 Outbound Messages

5.1 Report Export

The ORU message is used for transmitting results to other systems. With the OBX and the OBR segments, one can construct almost any clinical report as a three-level hierarchy, with the Patient Context within the PID segment at the upper level, an order record within the OBR segment at the next level and one or more observation records within the OBX at the bottom. The message is encoded using the UTF8 encoding.

5.1.1 Unsolicited Report – ORU^R01

ORU^R01	Unsolicited Observation Message	Segment used within syngo.via ORU msg	Chapter
MSH	Message Header	Yes	2
{ [PID	Patient Identification	Yes	3
[PD1]	Additional Demographics	No	3
[{NK1}]	Next of Kin/Associated Parties	No	3
[{NTE}]	Notes and Comments	No	2
[PV1	Patient Visit	No	3
[PV2]]]	Patient Visit – Additional Info	No	3
{[ORC]	Order common	No	4
OBR	Observations Report ID	Yes	7
{[NTE]}	Notes and comments	No	2
{[OBX]	Observation/Result	Yes	7
{[NTE]}}	Notes and comments	No	2
{[CTI]}}}	Clinical Trial Identification	No	7
[DSC]	Continuation Pointer	No	2

Table 10: General message semantics of ORU^R01

5.1.1.1 Observation value encoding into HL7:

The *syngo.via* Report is generated in an XML format prior to being sent to the internal HL7 engine.
For the report in plain text (OBX2-5) the tabs are converted to spaces (0x20) and the linefeed character (0x0A) is replaced with a value of \.br\ by the internal HL7 engine to indicate new lines within the formatted report for the HL7 output.

For the CDA report the study related DICOM attributes are available in the Body section of the CDA within the “DICOM Object Catalog”.

5.1.1.1.1 Result Status

The result status (OBR-25) attribute is filled with

- P (meaning: “Preliminary: A verified early result is available, final results not yet obtained)

For compatibility reasons the information is also transferred in OBX1-11.

5.1.1.1.2 Report Content

The message contains the:

- report in plain text format is conveyed within the OBX2-5 Observation Value
- the report in PDF format is encoded as Base64 string within the OBX3-5 Observation Value
- the structured finding and study information with the structured report (including coded data fields, picklists and picklist groups) in CDA format is sent within the OBX4-5 Observation Value

  For implementation details, see CDA Implementation chapter.

5.1.1.1.3 Example Report

MSH|^~\&|syngo.via|syngo|ANY_RIS|RIS|201310100812||ORU^R01|2|P|2.3.1|||||UNICODE UTF-8
PID|1||99001||RCTest_001||19611212|F
OBR|1||1234|^RCTest Study01|||20100910132420||||||||||1234|000001||123223|20131007101515||
MR;SR|P|||||reason|&&Dr1
OBX|1|CE|&IMP|1|||||P
OBX|2|FT|&BODY|2|Diagnostic Imaging Report\.br\\.br\\.br\+------------+----------
----------+\.br\\F\Name: \F\RCTest_001, \F\\.br\+-
-----------+----------+--+-------+----------+\.br\\F\Patient ID: \F\99001
\F\ \F\Sex: \F\female \F\\.br\+------------+----------+--+-------+----------
--+\.br\\F\Birth Date: \F\12/12/1961 \F\ \F\Age: \F\48 years \F\\.br\+------------+-
----------+--+-------+----------+\.br\\.br\Request And Procedure\.br\+----------
----------+----------+\.br\\F\Requested Procedure: \F\req proc
\F\\.br\+----------+----------+\.br\\F\Accession Number:
\F\1234 \F\\.br\+----------+----------
----------+\.br\+----------+----------+\.br\\F\

Report in plain text

\F\9/10/2010 \F\\.br\\F\Study Date and Time: \F\ at
\F\\.br\\F\ \F\13:24:20 \F\\.br\+----------+----------
----------+\.br\\F\Study Description: \F\RCTest Study 01
\F\\.br\+----------+----------
+\.br\\.br\Technique\.br\\.br\Clinical Information\.br\\.br\Findings Summary\.br\\.br\+----------
----------+----------+\.br\\F\Name \F\Value
\F\\.br\+----------+----------+\.br\\F\[1] Distance Line
\F\7.75 cm \F\\.br\+----------+----------
-+\.br\\.br\Impression\.br\\.br\+----------+-+----------
+\.br\\F\Reading Physician: \F\ \F\, Dr1 \F\\.br\+----------+-+--
----------+\.br\\.br\Findings Details\.br\\.br\+----------
----------+\.br\\F\Finding [1] Distance Line:
\F\\.br\+------+----------+\.br\\F\Value \F\7.75 cm
\F\\.br\+------+----------+\.br\\F\
\F\\.br\+----------+\.br\\F\
[Img] \F\\.br\+----------
+\.br\\F\ \F\\.br\+----------
----------+\.br\\F\ \F\\.br\+----------
----------+\.br\|||||P

OBX|3|FT|&BODY|3|JVBERi0xLjUNCjUgMCBvYmoNCjw8L1R5cGUgL1BhZ2UvUGFyZW50ID
MgMCBSL0NvbnRlbnRzIDYgMCBSL01lZGlhQm94IFswIDAgNjEyIDc5Ml0|||||P

Report in PDF
(Base64 encoding, truncated sample)

OBX|4|FT|&BODY|1|<?xml version="1.0" encoding="UTF-8"?><ClinicalDocument xmlns="urn:hl7-org:v3" xmlns:voc="urn:hl7-org:v3/voc" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"><!--**********--><!-- CDA Header --><!--**********--><typeId root="2.16.840.1.113883.1.3" extension="POCD_HD000040" /><templateId root="2.16.840.1.113883.10.20.6" /><id root="2.16.840.1.113883.19" extension="20131007081515" /><code code="18748-4" codeSystem="2.16.840.1.113883.6.1" codeSystemName="LOINC" displayName="Diagnostic Imaging Report" /><title>CDA report</title><effectiveTime value="20100910132420" /><confidentialityCode code="N" codeSystem="2.16.840.1.113883.5.25" /><languageCode code="en-US" /><recordTarget><patientRole><id root="1.2.840.113619.2.62.994044785528.10" extension="99001" /><addr nullFlavor="NI" /><telecom nullFlavor="NI" /><patient><name><family>RCTest_001</family></name><administrativeGenderCode codeSystem="DCM" code="F" /><birthTime value="19611212132420" /></patient></patientRole></recordTarget><author><time value="20131007081515" /><assignedAuthor><id root="a43db488-9e87-416b-9b38-bcbf5ea4f2ad" /><addr nullFlavor="NI" /><telecom nullFlavor="NI" /><assignedAuthoringDevice><softwareName>syngo Reporting</softwareName></assignedAuthoringDevice></assignedAuthor></author><custodian><assignedCustodian><representedCustodianOrganization><id root="2.16.840.1.113883.19.5" /><name>ReportingTestTask</name><telecom nullFlavor="NI" /><addr nullFlavor="NI" /></representedCustodianOrganization></assignedCustodian></custodian><participant typeCode="REF"><associatedEntity classCode="PROV"><id nullFlavor="NI" /><addr nullFlavor="NI" /><telecom nullFlavor="NI" /><associatedPerson><name><given>DR ref</given></name></associatedPerson></associatedEntity></participant><inFulfillmentOf><order><id root="2.16.840.1.113883.19.4.27" extension="1234" /></order></inFulfillmentOf><documentationOf><serviceEvent classCode="ACT"><id root="1.3.12.2.1107.5.8.1.12345.30000009999991621020000000001" /><id root="1.2.840.113619.2.62.994044785528.26" extension="ERROR-BAD-REQUESTEDPROCEDUREID" /><effectiveTime value="20131007081515" /></serviceEvent></documentationOf><relatedDocument ypeCode="XFRM"><parentDocument><id

Report in CDA (truncated sample)

root="1.3.12.2.1107.5.8.15.999999.30000013100710105764400000006"
/></parentDocument></relatedDocument><!--**********--><!--

Coded content from Report :

<!--**********--><!-- Coded content from report --><!--
**********--><entry><observation classCode="OBS"
moodCode="EVN"><code code="408729009" codeSystemName="SNOMED-CT" /><value
xsi:type="CD" code="AgeGroup" codeSystemName="LocalCodeSystem" /><entryRelationship
typeCode="REFR" inversionInd="true"><observation classCode="OBS" moodCode="EVN"><code
code="PR-308" codeSystemName="99SMS_CTMR" displayName="Age-related PSA"><translation
code="100" codeSystemName="Demo" displayName="Age" /></code><value xsi:type="PQ"
value="19" unit="years"
/></observation></entryRelationship></observation></entry><entry><observation classCode="OBS"
moodCode="EVN"><code code="408729009" codeSystemName="SNOMED-CT" /><value
xsi:type="CD" code="BodyPart" codeSystemName="LocalCodeSystem" /><entryRelationship
typeCode="REFR" inversionInd="true"><observation classCode="OBS" moodCode="EVN"><code
code="RID35746" codeSystemName="RADLEX" displayName="junction of body parts"
/><entryRelationship typeCode="REFR" inversionInd="true"><observation classCode="OBS"
moodCode="EVN"><code code="SHOULDER" codeSystemName="DCM" displayName="shoulder"
></observation></entryRelationship></observation></entryRelationship></observation></entry>

5.1.1.2 Observation request segment

OBR segment includes the following fields :

HL7	Meaning
OBR-3	Accession number
OBR-4	StudyInstanceUID – DICOM study identifier “^” Study description – from DICOM “^” “StudyInstanceUID” constant “^” ReportUID –unique identifier for the report “^” “ReportUID” constant
OBR-18	Accession number
OBR-19	Study ID
OBR-21	Requested Procedure ID (if available) or Preformed Procedure ID
OBR-24	Modality
OBR-31	reason of requested procedure

Table 11: Fields of OBR segment

5.1.2 CDA Implementation

This chapter describes the constraints of the CDA Header and Body elements used in the Diagnostic Imaging Report document, and provides examples of conforming fragments from the document. For more information, see the CDA standard [3].

The CDA document is divided into two important parts: Header and Body.

```
<ClinicalDocument xmlns="urn:hl7-org:v3" xmlns:voc="urn:hl7-
org:v3/voc" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xsi:schemaLocation="urn:hl7-org:v3 CDA.xsd">
  <!--
**********************************************************
  CDA Header
**********************************************************
-->
  …
  <!--
**********************************************************
  CDA Body
**********************************************************
-->
  <component>
    <structuredBody>
      ...
    </structuredBody>
  </component>
</ClinicalDocument>
```

5.1.2.1 CDA Header

The header describes the document itself (e.g., unique ID, document type classification, version), the participants (ex.: authors, patients) and the document's relationships to orders and other documents.

Syngo.via populates the minimum required elements, such as:

5.1.2.1.1 Report title

The report title is stored in the code field of the CDA header:

```
 <code displayName="Diagnostic Imaging Report" codeSystemName="LOINC" codeSystem="2.16.840.
1.113883.6.1" code="18748-4"/>
```

5.1.2.1.2 Effective time

The document creation time, when the document first came into being is encoded using effectiveTime.

```
<effectiveTime value="20081017123846"/>
```

5.1.2.1.3 Confidentiality code

Confidentiality code (*confidentialityCode*) is a required contextual component of CDA, where the value expressed in the header holds true for the entire document unless overridden by a nested value. The coding strength for this element is CWE. It's set as "N" which stands for normal confidentiality. Normal confidentiality rules (according to good health care practice) apply, that means, only authorized individuals with a legitimate medical or business need may access this item.

```
<confidentialityCode codeSystem="2.16.840.1.113883.5.25" code="N"/>
```

5.1.2.1.4 Record Target

The *recordTarget* element is always present. It records the patient or patients whose health information is described by the clinical document. A CDA document typically has exactly one *recordTarget* participant. The patients ID, name, birth time, gender code all set based on the available attributes from DICOM.

recordTarget\patientRole\id[extension]	PatientId DICOM attribute (0010,0020)
recordTarget\patientRole\patient\name	PatientsName DICOM attribute (0010,0010)
recordTarget\patientRole\patient\administrativeGenderCode	PatientsSex DICOM attribute (0010,0040)
recordTarget\patientRole\patient\birthTime	PatientsBirthTime and PatientsBirthDate DICOM attributes (0010,0030) and (0010,0032)

5.1.2.1.5 Author

The *author* element represents the creator of the clinical. There can be one or more authors identified in the header. However syngo.via filles allways the assignedAutorhingDevice only.

author\time[value]	Document creation date and time
author\assignedAuthor\assignedAuthoringDevice\softwareName	syngo Reporting

5.1.2.1.6 Custodian, Participant, InFulfillmentOf, DocumentationOf

Based on the CDA R2 constraints (Section 4.2.2.3 of the CDA specification), these elements are required. Since some of these items are optional in DICOM SR documents, the default values are used.

custodian\assignedCustodian\representedCustodianOrganization\name	Insitution name DICOM attribute (0008,0080)
custodian\assignedCustodian\representedCustodianOrganization\telecom	null

participant\associatedEntry	null
documentationOf\serviceEvent\id	StudyInstanceUID DICOM attribute (0020,000D)
documentationOf\serviceEvent\effectiveTime	Study Date DICOM attribute (0008,0020)

5.1.2.2 CDA Body

The CDA body consists of one or more sections that can nest and which are related through a component relationship. Within the section, the title and text elements constitute the narrative block that must be rendered. Also, section may contain entries which convey the machine-computable semantics of the section and links to related information. Each section can contain a code, typically a LOINC code, that identifies the section and a title that is the display heading of the section.

The CDA documents created by the syngo.via contain two sections:

5.1.2.2.1 DICOM object catalog

DICOM Object Catalog lists the study related DICOM attributes. The DICOM Object Catalog section is not intended for viewing, so this section does not contain text, only enumerated observations describing the patient demographics and the DICOM study attributes.

The DICOM Object Catalog section is identified by the code:

```
  <component>
    <section>
      <code displayName="DICOM Object Catalog" codeSystemName="DCM" codeSystem="1.2.840.100
08.2.16.4" code="121181"/>
      ...
    </section>
  </component>
```

The section contains several observation entries, each of them representing exactly on DICOM attribute of the reported study.

```
      <entry>
        <observation classCode="OBS" moodCode="EVN">
          <code displayName="StudyInstanceUid" codeSystemName="DCM" code="0020000d"/>
          <value xsi:type="ED">1.3.12.2.1107.5.8.15.999999.3000081339448460000122l</value>
        </observation>
      </entry>
```

The list of possible attributes:

Code	Attribute name
(0020,000D)	StudyInstanceUid
(0008,1060)	NameOfPhysiciansReadingStudy
(0008,1030)	StudyDescription
(0010,1050)	PerformingPhysiciansName
(0008,0020)	StudyDate
(0008,0030)	StudyTime

(0010,1020)	PatientsSize
(0010,1030)	PatientsWeight
(0008,0050)	AccessionNumber
(0008,0050)	Modality
(0018,0022)	ScanOptions
(0018,0152)	Exposure
(0018,1120)	GantryDetectorTilt
(0018,0050)	SliceThickness
(0018,1210)	ConvolutionKernel
(0008,0080)	InstitutionName
(0008,0081)	InstitutionAddress
(0008,1010)	StationName
(0008,1040)	InstitutionalDepartmentName
(0008,1090)	ManufacturersModelName
(0020,0010)	StudyId
(0008,0130)	StudyDescription
(0032,1064)	RequestedProcedureCodeSequence
(0040,0440)	ProtocolContextSequence
(0008,0090)	ReferringPhysiciansName
(0008,0092)	ReferringPhysiciansTelephoneNumbers
(0008,1080)	AdmittingDiagnosisDescription
(0040,1001)	RequestedProcedureId
(0032,1060)	RequestedProcedureDescription
(0040,1002)	ReasonForTheRequestedProcedure
(0032,1032)	RequestingPhysician
(0032,1033)	RequestingService
(0040,0009)	ScheduledProcedureStepId
(0040,0007)	ScheduledProcedureStepDescription
(0040,0254)	PerformedProcedureStepDescription
(0040,0253)	PerformedProcedureStepId
(0040,0243)	PerformedLocation
(0018,1040)	ContrastBolusRoute
(0018,1041)	ContrastBolusVolume
(0018,1042)	ContrastBolusStartTime
(0018,1043)	ContrastBolusStopTime
(0018,1044)	ContrastBolusTotalDose
(0018,1045)	SyringeCounts
(0018,1046)	ContrastFlowRate
(0018,1047)	ContrastDuration
(0018,1048)	ContrastBolusIngredient
(0018,1049)	ContrastBolusIngredientConcentration
(0018,0060)	Kvp

5.1.2.2.2 Report contents

Narative text part

The syngo.via report and all the coded information available in syngo.via are described in this section. The <text> element of this section contains the whole syngo.via report represented in the format specified in the CDA standard.

Nested inside the <text> element can be a range of formatting elements that the CDA standard defines. These formatting elements are very reminiscent of HTML tags – but the syntax is not that of HTML and neither HTML, XHTML, nor any other standard can be used, only what CDA defines.

```
<text>
  <paragraph>Header</paragraph>
  <table>
```

```
    <tbody>
      <tr>
        <td valign="middle">Name:</td>
        <td valign="middle" colspan="4">CT_8TP_SingleSeries</td>
      </tr>
    </tbody>
  </table>
</text>
```

Structured information

After the narrativepart follows the list of coded observation entries. This list is a flat list of <entry> tags, which is divided in five main groups. Each group starts with a predefined <entry> which is uniquely identified with a code. After such a header entry the preceeding observation entries will contain the structured information.

Images

All the images which are present in the report are storead inside the CDA as special observation media entries. They are identified with an ID, and the image stream is stored in the value tag serialized using the base64 encoding. Looks like the following:

```
<entry>
  <observationMedia classCode="OBS" moodCode="EVN" ID="ID8178FDF398B1ADCD6284EE95FF59A49B">
      <value mediaType="image/png" representation="B64">0AAAAAX...NSR0IArs4K5CYII=</value>
  </observationMedia>
</entry>
```

The list of images starts with the observation entry identified with the code:

```
<code displayName="Report images" codeSystemName="99SMS_SY" code="ReportImages"/>
```

Finding attributes

The finding related observation entries are always starting with the observation entry identified with the code:

```
<code displayName="FindingType" codeSystemName="99SMS_SY" code="FindingType"/>
```

Each finding attribute is represented by an observation entry, which contains the code of the finding attribute and the value of the attribute.

```
<entry>
  <observation classCode="OBS" moodCode="EVN">
    <code displayName="Modality" codeSystemName="DCM" code="121139"/>
    <value displayName="Computer Tomography" codeSystemName="DCM" code="CT" xsi:type="CD"/>
  </observation>
</entry>
```

The list of possible finding attributes and the matching codes is available at the Technical Documentation part of the Global SY SCM Enable Portal.

In case when a finding references DICOM images, a complex observation describes the DICOM UIDs of the referenced secondary capture image. This will contain the StudyInstanceUID, SeriesInstanceUID and SopInstanceUID of the referenced image.

```
<entry>
  <act classCode="ACT" moodCode="EVN">
    <id root="1.3.12.2.1107.5.8.15.999999.30000013020813394484600001019"/>
    <code displayName="StudyInstanceUID" codeSystemName="DCM" code="0020000D"/>
    <entryRelationship typeCode="COMP">
      <act classCode="ACT" moodCode="EVN">
        <id root="1.3.12.2.1107.5.8.15.999999.300000150114131103484000000155"/>
        <code displayName="SeriesInstanceUID" codeSystemName="DCM" code="0020000E"/>
        <entryRelationship typeCode="COMP">
          <observation classCode="DGIMG" moodCode="EVN">
            <id root="1.3.12.2.1107.5.8.15.999999.300000150114131103484000000159"/>
            <code displayName="SopInstanceUID" codeSystemName="DCM" code="00080018"/>
          </observation>
        </entryRelationship>
      </act>
    </entryRelationship>
  </act>
</entry>
```

Coded content from the report

Picklists and user defined numeric fields can be also used in the report, and in case if they are coded, these codes will also appear in the list of coded entries.

```
<code displayName="Coded content from report" codeSystemName="99SMS_SY" code="CodedContent"
/>
```

Non finding information

Dedicated information, like Tumor Burden calculations, baseline information, timepoint informations, can be also included in the CDA. These observation entries will be listed after the NonFindingData entry.

```
<code displayName="Non-finding information" codeSystemName="99SMS_SY"
code="NonFindingData"/>
```

6 Required Attributes

Following fields are required by *syngo.via*.

The attributes marked as required are checked when ADT or ORU messages enter the system and if not present or exceeding the acceptable length, they are stored within the backlog of the HL7/XML interface of syngo.via.

6.1 ADT

HL7	Meaning	Required
MSH-07	Date/Time Of Message	
MSH-09	Message Type	Yes
MSH-10	Message Control ID	
MSH-12	Version ID	Yes
PID-03.01	Patient Identifier List / ID	Yes (max. 64 char)
PID-04	Alternate Patient ID	
PID-05	Patient Name	Yes (max. 64 char)
PID-07	Date Of Birth	
PID-08	Administrative Sex	
PID-09	Patient Alias	
PID-18.01	Patient Account Number / ID	
PID-18.04	Patient Account Number / Assigning Authority	
MRG-01.01	Prior Patient Identifier List	Yes (max. 64 char)
MRG-04.01	Prior Patient ID	
MRG-07	Prior Patient Name	
PV1-02	Patient Class	
PV1-03	Assigned Patient Location	
PV1-06	Prior Patient Location	
PV1-08	Referring Doctor	
PV1-15	Ambulatory Status	
PV1-19	Visit Number	
PV1-21	Charge Price Indicator	

PV1-44	Admit Date and Time	
PV1-45	Discharge Date and Time	

Table 12: required fields of ADT messages

6.2 ORU

HL7	Meaning	Required
MSH-07	Date/Time Of Message	
MSH-09	Message Type	Yes
MSH-10	Message Control ID	
MSH-12	Version ID	Yes
PID-03.01	Patient Identifier List / ID	Yes (max. 64 char)
PID-04	Alternate Patient ID	
PID-05	Patient Name	Yes (max. 64 char)
PID-07	Date Of Birth	
PID-08	Administrative Sex	
OBR-03.01	Filler Order Number	Yes (max. 16 char)
OBR-04	Universal Service ID	
OBR-07	Observation Date/Time	Strongly Recommended
OBR-22	Results rpt/status chng - date/time	Strongly Recommended
OBR-25	Result Status	Yes
OBR-31.2	Reason For Study	Strongly Recommended
OBR-32	Principal Result Interpreter	Strongly Recommended
OBX-02	Value Type	Yes
OBX-05	Observation Value	Yes (max. 655236*[1])

[1] The length of the observation value field is variable, depending upon value type. See *OBX-2-value type*.

OBX-11	Observation Result Status	Yes

Table 13: required fields of ORU (Report Import) messages