Notes to Instructors

This Instructor Manual is a resource for instructors using this component. Each component is broken down into units, which include the following elements:

1. Learning objectives
2. Suggested student readings, texts, reference links to supplement the narrated PowerPoint slides
3. Lectures (voiceover PowerPoint in Flash format); PowerPoint slides (Microsoft PowerPoint format), lecture transcripts (Microsoft Word format); and audio files (MP3 format) for each lecture

Self-assessment questions reflecting Unit Objectives with answer keys and/or expected outcomes

1. Application Activities (e.g., discussion questions, assignments, projects) with instructor guidelines, answer keys and/or expected outcomes
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Component Overview

This unit will address the OSI, including the purpose and content of each of its seven layers: physical, data link, network, transport, session, presentation, and application. Products, processes, protocols and tools at each level will be explained. This unit will also focus on the flow of data through the models as data is transmitted and receive by end devices.

Component Objectives

At the completion of this component, the student will be able to:

- Explain the functions of all layers of the ISO OSI models, including how they are interconnected and supported.
- Recommend components of networking hardware that meet standards and support information exchange.
- Analyze standards associated with the EHR functional model, the PHR functional model, and the family of profiles associated with specific domain functional requirements.
- Explain the process and value of EHR certification.
- Describe data standards required for the interoperable exchange of health care data, including terminology, data elements, document standards, imaging standards, and medical device standards.
- Describe components of health IT standards (including HL7 and TC215) for health information exchange used by various stakeholders.
- Examine additional standards related to shared and effective use of data, including clinical decision support.
- Describe enterprise architecture models; including centralization vs federation and grids, service oriented architectures, and local implementations with respect to systems from single units to organizations, regions (RHIOS and HIEs), states, and nationwide healthcare information systems (NHIN).
- Incorporate professional and regulatory standards related to privacy, confidentiality, and security when implementing and maintaining networks and health information exchange systems, including NHIN.
Component Authors

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Disclaimer

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Likewise, the above also applies to the Curriculum Development Centers (including Columbia University, Duke University, Johns Hopkins University, Oregon Health & Science University, University of Alabama at Birmingham, and their affiliated entities).
Component 9/Unit 1

Unit Title
ISO Open Systems Interconnection (OSI)

Unit Description
This unit will address the OSI, including the purpose and content of each of its seven layers: physical, data link, network, transport, session, presentation, and application. Products, processes, protocols and tools at each level will be explained. This unit will also focus on the flow of data through the models as data is transmitted and receive by end devices.

Unit Objectives
By the end of This unit the student will be able to:
1. Explain the OSI representation of the various layers involved in networking, including the general functions of each layer and their interconnections
2. Explain the concept of the Application layer
3. Explain the concept of the Presentation layer
4. Explain the concept of the Session Layer
5. Explain the concept of the Transport layer
6. Explain the concept of the Network layer
7. Explain the concept of the Data Link layer
8. Explain the concept of the Physical layer
9. Explain connection-oriented versus connectionless communication
10. Explain the use of network addressing including security considerations and vulnerabilities

Unit Topics / Lecture Titles
1a Application, Presentation, Session and Transport Layers of the OSI model
1b Network, Data Link and Physical Layers of the OSI model

Unit References
(All links accessible as of 1/5/2012)
Lecture 1a

Lecture 1a Charts, Tables and Figures
1.1 Table: Parrish, Michele. 2011.
1.2 Table: Parrish, Michele. 2011.
1.3 Table: Parrish, Michele. 2011.

Lecture 1a Images
Slide 5: Source, Medium and Receiver. Courtesy Michele Parrish. Used with permission.
Slide 9: OSI Model showing layers and their functions. Courtesy Michele Parrish. Used with permission.
Slide 10: Model Comparison. Courtesy Michele Parrish. Used with permission.
Slide 11: PDU. Courtesy Michele Parrish. Used with permission.
Slide 21: Sequence. Courtesy Michele Parrish. Used with permission.
Slide 22: Acknowledgements. Courtesy Michele Parrish. Used with permission.

Lecture 1b
None were used for this lecture.

Lecture 1b Charts, Tables and Figures
None were used for this lecture.

Lecture 1b Images
Slide 6: IPv4 Addresses. Courtesy Michele Parrish. Used with permission.

*Indicates this link is no longer functional.
Slide 7: Special IP Addresses. Courtesy Michele Parrish. Used with permission.
Slide 9: IP Address Parts. Courtesy Michele Parrish. Used with permission.
Slide 11: Subnetting. Courtesy Michele Parrish. Used with permission.
Slide 12: Router. Courtesy Michele Parrish. Used with permission.
Slide 15: Ping. Courtesy Michele Parrish. Used with permission.
Slide 16: Tracert. Courtesy Michele Parrish. Used with permission.
Slide 17: Data Link. Courtesy Michele Parrish. Used with permission.
Slide 18: MAC Addresses. Courtesy Michele Parrish. Used with permission.

Unit Required Readings
None

Student Application Activities
1. Internetworking Basics. This article includes terminology used in networking, networking basics and an in-depth look at each layer of the OSI model. [http://docwiki.cisco.com/wiki/Internetworking_Technology_Handbook](http://docwiki.cisco.com/wiki/Internetworking_Technology_Handbook)
2. Port Numbers. This is the official IANA document that lists all port numbers and their associated protocols/applications. [http://www.iana.org/assignments/port-numbers](http://www.iana.org/assignments/port-numbers)

Student Application Activities
Comp9_unit1_activity.doc
Comp9_unit1_activity_key.doc
Comp9_unit1_self_assess.doc
Comp9_unit1_self_assess_key.doc

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Component 9/Unit 2

Unit Title
Network Media and Hardware Communication Devices

Unit Description
This unit is designed to help the student understand network media, hardware devices, and how to select appropriate items to meet the guidelines for usage.

Unit Objectives
By the end of this unit the student will be able to:
1. Select appropriate network media types (such as Ethernet and Wireless) to facilitate networking and data exchange, taking into account access and regulatory requirements
2. Select appropriate hardware devices (such as routers, switches, and access points) to facilitate networking and data exchange, taking into account access and regulatory requirements

Unit Topics / Lecture Titles
2a Network media
2b Network media
2c Hardware devices

Unit References
(All links accessible as of 2/1/2012)

Lecture 2a
References were not used for this lecture.

Lecture 2a Charts, Tables and Figures
None

Lecture 2a Images
Slide 3: Signals. Courtesy Michele Parrish. Used with permission.
Slide 5: Data Modulation. Courtesy Michele Parrish. Used with permission.
Slide 11: NICs. Courtesy Michele Parrish. Used with permission.
Slide 12: Wireless NICs. Courtesy Michele Parrish. Used with permission.

*Indicates this link is no longer functional.
Lecture 2b
References were not used for this lecture.

Lecture 2b Charts, Tables and Figures
2.1 Table: Parrish, Michele. 2011.

Lecture 2b Images
Slide 4: Coaxial cable. Courtesy Michele Parrish. Used with permission.
Slide 5: Bayonet Neill-Concelman (BNC) connector. Courtesy Michele Parrish. Used with permission.
Slide 6: Twisted Pair (TP) Cable. Courtesy Michele Parrish. Used with permission.
Slide 7: RJ-45. Courtesy Michele Parrish. Used with permission.
Slide 8: T568A or T568B standards. Courtesy Michele Parrish. Used with permission.
Slide 10: Fiber Optic Cable. Courtesy Michele Parrish. Used with permission.
Slide 11: Copyright(c) Mrzeon and made available under Creative Commons Attribution-Share Alike 3.0 Unported, 2.5 Generic, 2.0 Generic, and 1.0 Generic (http://en.wikipedia.org/wiki/File:Optical_fiber_types.svg)
Slide 14: Horizontal Wiring. Courtesy Michele Parrish. Used with permission.
Slide 15: Work Area Outlet. Courtesy Michele Parrish. Used with permission.

Lecture 2c
References were not used for this lecture.

Lecture 2c Charts, Tables and Figures
None

Lecture 2c Images
Slide 5: Switch. Courtesy Michele Parrish. Used with permission.
Slide 7: Back of Router. Courtesy Michele Parrish. Used with permission.
Slide 9: WAP. Courtesy Michele Parrish. Used with permission.
Slide 10: DSL Modem. Courtesy Michele Parrish. Used with permission.
Slide 11: Cable Modem. Courtesy Michele Parrish. Used with permission.

Unit Required Readings
None

*Indicates this link is no longer functional.
Student Application Activities

1. *How Digital Television Works.* On June 12, 2009 the United States transitioned from analog tv signals to all digital tv signals. Read about the difference between analog and digital tv and why the change was made. http://electronics.howstuffworks.com/dtv.htm

2. *List of device bit rates.* This article contains listings of the bandwidth for LANs, WANs, wireless networks and other devices. Bandwidth is important in determining the “pipe” that your data will be able to travel down. The bigger the bandwidth, the bigger the “pipe”. http://en.wikipedia.org/wiki/List_of_device_bandwidths

3. *Cabling.* This article includes information about the different types of network media including the categories of twisted pair and media connectors. http://fcit.usf.edu/network/chap4/chap4.htm

4. *GetConnected - Tech Talk - Ethernet Cables and Router Speed.* This video presents information about Ethernet cables and router speed. It discusses the type of cabling that you would use in a home or small network. 5 minutes and 50 seconds long. http://www.youtube.com/watch?v=QlIbd2Fu3bo

5. *Introduction to Structured Cabling.* This paper describes why the structured cabling standard should be followed and what the standard entails. Note: Since this is a 2000 document some of the bandwidth information may be out of date. http://www.dit.gov.bt/sites/default/files/cablingstandard.pdf


7. *How to Make an Ethernet Cat5e/Cat6 Cable.* This page shows how to make a twisted pair cable. It shows the tools that are needed to make the cable. It also includes a video showing the process. Video is 7 minutes and 18 seconds long. http://discountlowvoltage.blogspot.com/2009/10/how-to-make-ethernet-cat5e-cable.html

Student Application Activities
Comp9_unit2_activity.doc
Comp9_unit2_activity_key.doc
Comp9_unit2_self_assess.doc
Comp9_unit2_self_assess_key.doc

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Component 9/Unit 3

Unit Title
National and International Standards Developing Organizations

Unit Description
This unit introduces students to the national and international organizations that create standards used in networking and health information exchange

Unit Objectives
By the end of this unit the student will be able to:
1. Explain why standards related to networking and health information exchange are important in the current environment.
2. Standards development
3. How standards are developed
4. Who develops them
5. How standards are accredited
6. How standards are selected
7. Understand different kinds of standards being developed and for what purpose
8. Learn about Standards Developing Organizations and the standards they create
9. Demonstrate how to find, obtain, and use standards that are needed to facilitate networking and health information exchange

Unit Topics / Lecture Titles
3a Importance of standards and their development
3b Kinds of standards
3c Standard organizations

Unit References
(All links accessible as of 2/1/2012)
Lecture 3a
Additional resources for information contained in this lecture


*Indicates this link is no longer functional.

Lecture 3a Charts, Tables and Figures
None

Lecture 3a Images
Slide 5 – Photos courtesy of Dr. Ed Hammond
Slide 6 – Photos courtesy of Dr. Ed Hammond
Slide 7 – Photos courtesy of Dr. Ed Hammond
Slide 11 – Image courtesy of Dr. Ed Hammond
Slide 23 – Image courtesy of Dr. Ed Hammond

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Lecture 3b

Additional resources for information contained in this lecture


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Lecture 3b Charts, Tables and Figures
None

Lecture 3b Images
None

Lecture 3c


*Indicates this link is no longer functional.

Lecture 3c Charts, Tables and Figures
3.1 Table: created by Dr. Ed Hammond
3.2 Table: created by Dr. Ed Hammond

Lecture 3c Images
Slide 22: courtesy of Dr. Ed Hammond

Unit Required Readings
None

Student Application Activities
2. Health Level 7 http://www.hl7.org
3. CDISC http://www.cdisc.org
4. CEN http://www.cen.eu/cen/Sectors/Sectors/ISSS/Committees
5. GS1 http://www.gs1.org
6. NCPDP http://www.ncpdp.org
7. ASC X12N http://www.x12n.org
8. ASTM E31 http://www.astm.org/COMMIT/COMMITTEE/E31
9. IHE http://www.himss.org/ASP/topics_ihe*
10. DICOM http://medical.nema.org/
11. IHTSDO http://www.ihtsdo.org

Student Application Activities
Comp9_unit3_activity.doc
Comp9_unit3_activity_key.doc
Comp9_unit3_self_assess.doc
Comp9_unit3_self_assess_key.doc

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Component 9/Unit 4

Unit Title
Basic Health Data Standards

Unit Description
This unit provides an orientation to the important data-related standards that enable interoperable health data interchange.

Unit Objectives
By the end of this unit the student will be able to:

1. Understand why it is necessary to use a common set of data elements with common names to be able to exchange and understand data from other places.
2. Understand what is meant by semantic interoperability.
3. Understand many of the sets of controlled vocabularies in use today – how they are used and who requires their use.
4. Understand the use, purpose and interrelation among sets of controlled vocabularies in use today.
5. Identify the more common controlled vocabularies in use today: ICD, CPT, DRG, NDC, RxNorm, and LOINC.
6. Identify the more common controlled vocabularies in use today: SNOMED, MEDCIN, MedDRA, Nursing terminologies, MeSH and UMLS.
7. Understand data elements; attributes of data elements.
8. Understand contribution of master meta-dictionary of data elements to semantic interoperability.
9. Explain how data structures can be built from basic data components.
10. Explain how templates and archetypes facilitate networking and information interchange.
11. Discuss Clinical Data Architecture (CDA), Continuity of Care Document (CCD), and Continuity of Care Record (CCR) Standards.

Unit Topics / Lecture Titles
4a Semantic interoperability
4b Controlled vocabularies
4c Common controlled vocabularies in use today
4d Data elements

*Indicates this link is no longer functional.
Unit References
(All links accessible as of 2/1/2012)

Lecture 4a
References were not used for this lecture.

Lecture 4a Charts, Tables and Figures
None

Lecture 4a Images
Slide 8: Photo courtesy of Dr. Betsy Humphreys of the NLM.

Lecture 4b

Lecture 4b Charts, Tables and Figures
None

*Indicates this link is no longer functional.
Lecture 4b Images
Slide 7: Courtesy of Dr. James J. Cimino, NIH Clinical Center
Slide 8: Courtesy of Dr. James J. Cimino, NIH Clinical Center
Slide 17: Courtesy of Dr. James J. Cimino, NIH Clinical Center

Lecture 4c

Lecture 4c Charts, Tables and Figures
4.2 Table. Courtesy of Dr. James J. Cimino, NIH Clinical Center.
4.3 Table. Courtesy of Dr. James J. Cimino, NIH Clinical Center.

Lecture 4c Images
Slide 10: Source: Courtesy of Dr. James J. Cimino, NIH Clinical Center.

Lecture 4d

Lecture 4d Charts, Tables and Figures

**Lecture 4d Images**
Slide 27: Source: W. Ed Hammond, PhD

**Lecture 4e**

Acknowledgement: Material used in this lecture comes from the following sources

**Lecture 4e Charts, Tables and Figures**
None

**Lecture 4e Images**
None

**Lecture 4f**
Acknowledgement: Material used in this lecture comes from HL7 CDA standards and ASTM CCR Standard.

*Indicates this link is no longer functional.


**Lecture 4f Charts, Tables and Figures**

None

**Lecture 4f Images**


**Unit Required Readings**

None

**Student Application Activities**

3. CDISC  [http://www.cdisc.org](http://www.cdisc.org)
5. GS1  [http://www.gs1.org](http://www.gs1.org)
6. NCPDP  [http://www.ncpdp.org](http://www.ncpdp.org)
7. ASC X12N  [http://www.x12n.org](http://www.x12n.org)

*Indicates this link is no longer functional.
9. IHE [http://www.himss.org/ASP/topics_ihe](http://www.himss.org/ASP/topics_ihe)*
11. IHTSDO [http://www.ihtsdo.org](http://www.ihtsdo.org)

**Student Application Activities**
- Comp9_unit4_activity.doc
- Comp9_unit4_activity_key.doc
- Comp9_unit4_self_assess.doc
- Comp9_unit4_self_assess_key.doc
Component 9/Unit 5

Unit Title
EHR Functional Model Standards

Unit Description
This unit explores the functional requirements and standards for electronic health records (EHRs).

Unit Objectives
By the end of this unit the student will be able to:
1. Understand linking and aggregating data at all levels,
2. Understand how data may be interchanged among heterogeneous settings without loss of information,
3. Understand HL7 v2.x messaging communication standards,
4. Understand HL7 v3.0 messaging standards, and
5. Understand other data interchange standards including DICOM for imaging standards, NCPDP for prescriptions and medication reimbursement, IEEE for device interface standards, ASC X12N for claims and reimbursement standards, ASTM for document exchange, and IHE for profiles and registry standards.
6. Explain how model-based standards are created,
7. Define the methodology development framework,
8. Describe HL7 v3.0 messaging standards,
9. Imaging standards,
10. Standards for pharmacy services,
11. Interface standards for medical devices,
12. Claims and reimbursement standards,
13. Concept of profiling, and
14. Use and value of implementation guides.

Unit Topics / Lecture Titles
5a Health Data Interchange Standards
5b Health Data Interchange Standards
5c Health Data Interchange Standards

Unit References
(All links accessible as of 2/15/2012)
**Lecture 5a**

Acknowledgement: Material used in this lecture comes from the web pages of the various Standards Developing Organizations.

**Lecture 5a Charts, Tables and Figures**

None in this lecture.

**Lecture 5a Images**

Slide 12: Source: W. Ed Hammond, PhD  
Slide 14: Source: W. Ed Hammond, PhD  
Slide 15: Source: W. Ed Hammond, PhD  
Slide 16: Source: W. Ed Hammond, PhD  
Slide 17: Source: W. Ed Hammond, PhD  
Slide 18: Source: W. Ed Hammond, PhD  
Slide 19: Source: W. Ed Hammond, PhD  
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Slide 21: Source: W. Ed Hammond, PhD  
Slide 22: Source: W. Ed Hammond, PhD  
Slide 25: Source: W. Ed Hammond, PhD

**Lecture 5b**


Acknowledgement: Material used in this lecture comes from the following source


**Lecture 5b Charts, Tables and Figures**

None in this lecture.

**Lecture 5b Images**

Slide 10: W Ed Hammond, PhD.  

*Indicates this link is no longer functional.*

**Lecture 5c**

Acknowledgement: Material used in this lecture comes from the web pages of the various Standards Developing Organizations.

**Lecture 5c Charts, Tables and Figures**

None in this lecture.

**Lecture 5c Images**


**Unit Required Readings**

None in this lecture.

**Student Application Activities**

1. *Health Level Seven International.* Read more about HL7 including standards and how to implement. http://www.hl7.org/index.cfm
3. *HL7 ADT Message Overview.* This article provides a simple overview of HL& ADT messages. http://knol.google.com/k/hl7-adt-message-overview#*
6. *Standardization of Terminology.* This article talks about the importance of creating a standard for terminology so that different healthcare organizations can share information. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2526413/?tool=pubmed*

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Student Application Activities
Comp9_unit5_activity.doc
Comp9_unit5_activity_key.doc
Comp9_unit5_self_assess.doc
Comp9_unit5_self_assess_key.doc
Component 9/Unit 6

Unit Title
Health Data Interchange Standards

Unit Description
This unit emphasizes the importance of adhering to health data interchange these standards in order to ensure compatibility between systems.

Unit Objectives
By the end of this unit the student will be able to:
1. Understand the definition(s) of an Electronic Health Record
2. Understand architecture for an EHR
3. Identify and understand key standards for the EHR
4. Understand the HL7 EHR Functional Model Standards
5. Understand functional profiles
6. Understand the standards for Functional Models for the PHR
7. Understand the certification requirements for the EHR, PHR and functional profile

Unit Topics / Lecture Titles
6a EHR Functional Model Standards
6b EHR Functional Model Standards
6c EHR Functional Model Standards

Unit References
(All links accessible as of 2/21/2012)

Lecture 6a

Acknowledgement:
1. The material presented in this lecture was taken from the web sites of the various standards. Details of the standards listed here can

*Indicates this link is no longer functional.
be obtained from the various SDOs. There may be a membership cost or other cost associated with the standards.

Lecture 6a Charts, Tables and Figures
None used in this lecture

Lecture 6a Images
Slide 6: Photo of book by W. Ed Hammond, PhD.

Lecture 6b

Lecture 6b Charts, Tables and Figures
None used in this lecture

Lecture 6b Images

Lecture 6c
None used in this lecture

Acknowledgements
1. Much of the material in this lecture is derived from the following websites:

Lecture 6c Charts, Tables and Figures
None used in this lecture

*Indicates this link is no longer functional.
Lecture 6c Images

Unit Required Readings
None

Student Application Activities
1. Read more about HL7 including standards and how to implement. http://www.hl7.org/index.cfm
2. Info and news concerning EHR. http://www.himss.org/ASP/topics_ehr.asp
3. An article about choosing an EHR. http://www.ahraonline.org/Downloads/onlineinstitute/quickcredit/oigc_elechealthrecord.pdf*
6. Information about openEHR http://www.openehr.org/home.html*

Student Application Activities
Comp9_unit6_activity.doc
Comp9_unit6_activity_key.doc
Comp9_unit6_self_assess.doc
Comp9_unit6_self_assess_key.doc

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Component 9/Unit 7

Unit Title
Supporting Standards for EHR Applications

Unit Description
This unit presents a set of standards that support the application layer of the OSI and extend EHR functionality

Unit Objectives
By the end of this unit the student will be able to:
1. Understand the clinical decision support standard Arden Syntax,
2. Understand standards for clinical guidelines,
3. Understand object-oriented expression language for clinical decision support – GELLO,
4. Understand the clinical decision support standard Infobutton,
5. Understand disease management, and
6. Understand other clinical decision support applications.
7. Understand other standards that help to support networking and reporting requirements as well as functionality to optimize the connectivity among heterogeneous systems deployed within a single enterprise,
8. Understand single sign-on standards and the HL7 Clinical Context Object Workgroup (CCOW) standard,
9. Understand regulatory standards, and
10. Understand issues relating to person identifiers, master patient indices, and record locator services.

Unit Topics / Lecture Titles
7a Supporting Standards for EHR Application
7b Supporting Standards for EHR Application
7c Supporting Standards for EHR Application
7d Supporting Standards for EHR Application

Unit References
(All links accessible as of 2/24/2012)

Lecture 7a
Acknowledgement:
1. Material for this lecture was synthesized from HL7 International Arden Syntax Standard. [http://www.hl7.org](http://www.hl7.org)

*Indicates this link is no longer functional.
Lecture 7a Charts, Tables and Figures
None in this lecture.

Lecture 7a Images
Slide 7: Source: W. Ed Hammond

Lecture 7b
Acknowledgement:
These slides were derived from documentation in HL7 standards and ASTM standards.

Lecture 7b Charts, Tables and Figures
None in this lecture.

Lecture 7b Images
Slide 24: HL7 International documentation and other material.

Lecture 7c
1. Slide 17: Source: Courtesy of Dr. Clem McDonald
Acknowledgement:
Some of the material in this unit was taken from HL7 at http://www.hl7.org

Lecture 7c Charts, Tables and Figures
None in this lecture.

Lecture 7c Images
Slide 8: What are Infobuttons? (n.d.). Retrieved February 24, 2012, from NIH Laboratory for Informatics Development, National Library of Medicine, University of Utah Department of Biomedical Informatics, and Columbia University Department of Biomedical Informatics website: http://www.infobuttons.org/
Slide 9: Source: Slide set from W. Ed Hammond (original source unavailable)
Slide 10: Source: Courtesy of Dr. James Cimino
Slide 12: Source: Dr. W. Ed Hammond
Slide 15: Source: Courtesy of Dr. William W. Stead of Vanderbilt CPOE System

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Slide 16: Source: Courtesy of Dr. William W. Stead of Vanderbilt CPOE System
Slide 18: Source: Slide set from W. Ed Hammond (original source unavailable)
Slide 21: Source: W. Ed Hammond
Slide 22: Source: Slide set from W. Ed Hammond (original source unavailable)
Slide 24: Source: Slide courtesy of Dr. Suzzane Bakken (original source unavailable)

Lecture 7d
Acknowledgement: Material in this section was derived from HL7 and IHE standards.

Lecture 7d Charts, Tables and Figures
None in this lecture.

Lecture 7d Images
Slide 9: Source: Dr. Mike Russell, Duke University and HL7
Slide 11: Source: Dr. Mike Russell, Duke University and HL7
Slide 19: Source: Courtesy of Ammon Shabo, co-chair Genomic WG, HL7

Unit Required Readings
None

*Indicates this link is no longer functional.
Student Application Activities


3. GELLO: An Object-Oriented Query and Expression Language for Clinical Decision Support. This is a paper that discusses the format of GELLO and its use. http://www.openclinical.org/docs/int/docs/gello.pdf


5. Infobuttons at Intermountain Healthcare: Utilization and Infrastructure. This article “describes the infobuttons infrastructure at Intermountain Healthcare and assesses their use after 4 years of their initial release.” http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1839474/


7. HL7 CCOW standard. This page is HL7’s CCOW standard page providing information about CCOW. http://www.hl7.org.au/CCOW.htm

8. CCOW Information for the Healthcare Industry. This site provides information about CCOW including what it is, how it works and its benefits. http://www.cryptlib.orion.co.nz/*


*Indicates this link is no longer functional.
### Student Application Activities
- Comp9_unit7_activity.doc
- Comp9_unit7_activity_key.doc
- Comp9_unit7_self_assess.doc
- Comp9_unit7_self_assess_key.doc

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Component 9/Unit 8

Unit Title
Enterprise Architecture Models

Unit Description
This unit addresses different enterprise architecture models that provide an infrastructure for healthcare networks.

Unit Objectives
By the end of this unit the student will be able to:

1. Explain regional healthcare networks – policy and implementation strategies
2. Explain the concept of a Nationwide Healthcare Information network
3. Explain the significance of Service Oriented Architecture in networking and health information exchange networks
4. Explain the value of an Enterprise Architecture in networking and health information exchange networks
5. Describe key elements of various service-oriented architecture platforms and infrastructure options

Unit Topics / Lecture Titles
8 Regional health care networks
8 National health care networks

Unit References
(All links accessible as of 2/22/2012)

Lecture 8
No referenced used in this lecture.

Lecture 8 Charts, Tables and Figures
None in this lecture.

Lecture 8 Images
None in this lecture.

Unit Required Readings
None in this lecture.
Student Application Activities


3. **NIHN Enterprise Architecture Overview.** This document from ONC provides an overview of EA. [http://healthit.hhs.gov/portal/server.pt/gateway/PTARGS_0_11673_910398_0_0_18/NHINEnterpriseArchitectureOverview.doc*](http://healthit.hhs.gov/portal/server.pt/gateway/PTARGS_0_11673_910398_0_0_18/NHINEnterpriseArchitectureOverview.doc*)


5. **Network for Regional Healthcare Improvement.** This site is home to The Network for Regional Healthcare Improvement (NRHI), a National coalition of Regional Health Improvement Collaboratives. [http://www.nrhi.org/](http://www.nrhi.org/)


7. **A Service Oriented Architecture based Medical Grid Application.** This article presents a case of using SOA for different medical entities to share mammogram images. [http://arxiv4.library.cornell.edu/ftp/cs/papers/0405/0405074.pdf](http://arxiv4.library.cornell.edu/ftp/cs/papers/0405/0405074.pdf)

**Student Application Activities**

- Comp9_unit8_activity.doc
- Comp9_unit8_activity_key.doc
- Comp9_unit8_self_assess.doc
- Comp9_unit8_self_assess_key.doc

*Indicates this link is no longer functional.

Health IT Workforce Curriculum  Networking and Health Information Exchange  Version 3.0/Spring 2012

This material was developed by Duke University funded by the Department of Health and Human Services, Office of the National Coordinator for Health Information Technology under Award Number 1U24CO000024
Unit Title
Privacy, Confidentiality, and Security Issues and Standards

Unit Description
This unit explores issues related to creating an environment in which to transport data in a secure manner that ensures privacy and confidentiality.

Unit Objectives
By the end of this unit the student will be able to:
1. Explain the concepts of privacy and confidentiality requirements and policies and learn how to implement the requirements
2. Describe how to secure data storage and transmission using data encryption, signatures, validation, non-repudiation, and integrity (PKI, certificates, and security protocols)
3. Define access control methods
4. Analyze access restrictions to data storage and retrieval (physical and software)

Unit Topics / Lecture Titles
9a Privacy, Confidentiality, and Security Issues and Standards
9b Privacy, Confidentiality, and Security Issues and Standards

Unit References
(All links accessible as of 2/16/2012)

Lecture 9a
References were not used for this lecture.

Lecture 9a Charts, Tables and Figures
None in this lecture.

Lecture 9a Images
Slide 18: Certificate. Courtesy Michele Parrish. Used with permission.

Lecture 9b
References were not used for this lecture.
Lecture 9b Charts, Tables and Figures
None in this lecture.

Lecture 9b Images
Slide 7: ACLs. Courtesy Michele Parrish. Used with permission.
Slide 8: Time Restrictions. Courtesy Michele Parrish. Used with permission.

Unit Required Readings
None in this lecture.

Student Application Activities
2. Orange Book Certification. This site contains the criteria for obtaining Orange Book certification. They also explain the different levels of Orange Book certification. ftp://ftp.all.kernel.org/pub/linux/libs/security/Orange-Linux/refs/Orange/Orange-I-II.html#toc5
3. Encryption. This article contains information about encryption, symmetric and asymmetric. http://www.encryptionanddecryption.com/encryption/
4. Tutorial: An introduction to Public Key Infrastructure (PKI).
5. This video is a tutorial about PKI. It explains the different pieces of the infrastructure including certificates and keys. 9 minutes and 34 seconds long. http://www.youtube.com/watch?v=EizeExsarH8
6. How to Choose a Good Password (And Why You Should). This article contains information about what you should do and what you shouldn’t do with passwords. It also includes information about why you should do these things.

*Indicates this link is no longer functional.

10. **HIPPA.** Information about HIPPA including who must follow the law, what information is protected, what rights does the law provide to consumers and who can look at your health information. [http://www.hhs.gov/ocr/privacy/]

11. **Assuring the Privacy and Security of Transmitting Sensitive Electronic Health Information.** This article discusses concerns about the security of transferring health information. Includes case studies. [http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2815468/?tool=pubmed]*

12. **Social Networking and the Medical Practice: Guidelines for Physicians, Office Staff and Patients.** These guidelines were produced by the Ohio State Medical Association. [http://www.osma.org/files/documents/tools-and-resources/running-a-practice/social-media-policy.pdf]*


14. **Proposed HIPPA Rule Change.** On July 8, 2010 HISS announced a proposed change to HIPPA that would affect the privacy, security and enforcement rules. This pdf is the proposed change. [http://www.himss.org/handouts/20100714_ProposedRegsHHS.pdf]*

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**Student Application Activities**

- Comp9_unit9_activity.doc
- Comp9_unit9_activity_key.doc
- Comp9_unit9_self_assess.doc
- Comp9_unit9_self_assess_key.doc

*Indicates this link is no longer functional.
Component 9/Unit 10

Unit Title
Health Information Exchange

Unit Description
This unit explores the networking standards and the standards required for interoperability to enable the creation of Health Information Exchanges.

Unit Objectives
By the end of This unit the student will be able to:
1. Understand the purpose and importance of a Health Information Exchange strategy,
2. Understand what an HIE is,
3. Understand the components of an HIE, and
4. Explore some examples of HIEs.

Unit Topics / Lecture Titles
10 Health Information Exchange

Unit References
(All links accessible as of 3/12/2012)

Lecture 10
References were not used for this lecture.

Lecture 10 Charts, Tables and Figures
None in this lecture.

Lecture 10 Images

Unit Required Readings
None in this lecture.

Student Application Activities
None in this lecture.
Student Application Activities
Comp9_unit9_activity.doc
Comp9_unit9_activity_key.doc
Comp9_unit9_self_assess.doc
Comp9_unit9_self_assess_key.doc
### Component Acronym Glossary

**DCHI Acronym Guide (January 2011)**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Name</th>
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<tbody>
<tr>
<td>AAFP</td>
<td>American Academy of Family Physicians</td>
</tr>
<tr>
<td>ABIM</td>
<td>American Board of Internal Medicine</td>
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<tr>
<td>ACK</td>
<td>Acknowledgment (Data networks)</td>
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<td>Access Control Lists</td>
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<tr>
<td>ACM</td>
<td>Association for Computing Machinery</td>
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<tr>
<td>ACMI</td>
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<tr>
<td>ACR</td>
<td>American College of Radiology</td>
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<td>Analysis Data Model (ADaM)</td>
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<td>ADEs</td>
<td>Adverse Drug Events</td>
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<td>ADR</td>
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<td>ADT</td>
<td>Admissions, Discharge, Transfer</td>
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<td>AHIC</td>
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<tr>
<td>AHIMA</td>
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</tr>
<tr>
<td>AHIP</td>
<td>America's Health Insurance Plans</td>
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<td>AHRQ</td>
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<td>AM</td>
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<td>American National Standards Institute</td>
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<td>API</td>
<td>Application Programming Interfaces</td>
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<td>ARRA</td>
<td>American Recovery and Reinvestment Act</td>
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<td>ASC X12</td>
<td>Accredited Standards Committee</td>
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<td>American Society for Testing And Materials</td>
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<td>ASQ</td>
<td>American Society for Quality</td>
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<td>ATA</td>
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<td>ATCB</td>
<td>Authorized Testing and Certification Bodies</td>
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<td>AUP</td>
<td>Acceptable Use Policy</td>
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<td>BCMA</td>
<td>Bar Code Medication Administration</td>
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<td>Business Continuity Planning</td>
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<td>Bispectral Index</td>
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<td>BMI</td>
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<tr>
<td>bps</td>
<td>Bits Per Second</td>
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<td>BRIDG</td>
<td>Biomedical Research Integrated Domain Group</td>
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<tr>
<td>BSA</td>
<td>Body Surface Area</td>
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<tr>
<td>BSLM</td>
<td>Bioinformatic Sequence Markup Language</td>
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<td>CaDSR</td>
<td>Cancer Data Standard Repository</td>
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<td>CAP</td>
<td>College of American Pathologists</td>
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<td>CBA</td>
<td>Cabarrus Health Alliance</td>
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<td>CCD</td>
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<td>CCHIT</td>
<td>Certification Commission for Healthcare Information Technology</td>
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<td>Clinical Context Object Workgroup (HL7)</td>
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<td>CDASH</td>
<td>Clinical Data Acquisition Standards Harmonization</td>
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<td>Centers for Disease Control and Prevention</td>
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<td>Common Data Elements</td>
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<td>CDISC</td>
<td>Clinical Data Interchange Standards Consortium</td>
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<td>Chronic Disease Management</td>
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<tr>
<td>CDS</td>
<td>Clinical Decision Support</td>
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<tr>
<td>CDSR</td>
<td>Cochrane Database of Systematic Reviews</td>
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<tr>
<td>CDSS</td>
<td>Clinical Decision Support System</td>
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<td>CEN</td>
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<td>CG</td>
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<td>Context Inspired Component Architecture</td>
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<td>Clinical Information System</td>
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<td>Common Message Element Type</td>
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<td>CPM</td>
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<td>CPOE</td>
<td>Computerized Provider Order Entry</td>
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<td>CPT</td>
<td>Current Procedural Terminology</td>
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<td>CQI</td>
<td>Consumer Quality Initiatives</td>
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<td>CRL</td>
<td>Certificate Revocation List</td>
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<td>Cathode Ray Tube</td>
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<td>CSI</td>
<td>Computable Semantic Interoperability</td>
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<td>CSMA/CA</td>
<td>Carrier Sense Multiple Access/Collision Avoidance</td>
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<td>Carrier Sense Multiple Access / Collision Detection</td>
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<td>CTA</td>
<td>Center for Technology and Aging</td>
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<td>CTSA</td>
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<td>Common Warehouse Model</td>
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<td>DICOM</td>
<td>Digital Imaging and Communications in Medicine</td>
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<td>DMAIC</td>
<td>Define, Measure, Analyze, Improve, Control</td>
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<td>DMIM</td>
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<td>DNS</td>
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<td>Department of Defense</td>
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<td>DoS</td>
<td>Denial of Service</td>
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<tr>
<td>DRG</td>
<td>Diagnosis-related Group</td>
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<td>DSL</td>
<td>Digital Subscriber Line</td>
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<td>Definition</td>
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<td>DSS</td>
<td>Decision Support System</td>
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<td>Draft Standard for Trial Use</td>
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<td>Emergency Department</td>
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<td>Electroencephalogram</td>
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<td>EMEA</td>
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<td>Fiber Data Distributed Interface</td>
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<td>Family Educational Rights and Privacy Act</td>
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<td>FM</td>
<td>Frequency Modulation</td>
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<td>Description</td>
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<td>FMEA</td>
<td>Failure Mode and Effects Analysis</td>
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<td>FQHC</td>
<td>Federally Qualified Health Center</td>
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<td>GDSN</td>
<td>Global Data Synchronisation Network</td>
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<td>GELLO</td>
<td>an object-oriented expression language for clinical decision support</td>
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<td>GEM</td>
<td>Guideline Elements Model</td>
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<td>Generic Incident Notification</td>
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<td>HCD</td>
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<td>Health Disparities Collaborative</td>
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<td>HDF</td>
<td>Hierarchical Data Format</td>
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<td>U.S. Department of Health and Human Services</td>
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<td>HIS</td>
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<td>Hierarchical Message Descriptions</td>
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<td>Healthcare Services Specification Project</td>
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<tr>
<td>HTTP</td>
<td>Hypertext Transfer Protocol</td>
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HW  Hardware
Hz    Hertz
IANA  Internet Assigned Numbers Authority
ICD   International Classification of Diseases
ICD-10-CM  International Classification of Diseases, 10th Revision, Clinical Modification
ICH   International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use
ICMP  Internet Control Message Protocol
ICPC  International Classification of Primary Care
ICSR  Individual Case Safety Report
ICT   Information and Communication Technologies
ICU   Intensive Care Unit
IDS   Intrusion Detection System
IE    Internet Explorer
IEC   International Electrotechnical Commission
IEEE  Institute of Electrical and Electronics Engineers
IETF  Internet Engineering Task Force
IG    Implementation Guide (HL7)
IHE   Integrating the Healthcare Enterprise
IHS   Indian Health Services
IHTSDO International Health Terminology Standards Development Organisation
IIS   Internet Information Services
INR   International Normalized Ratio
IOM   Institute of Medicine
IP    Internet Protocol
IP/OP Inpatient/Outpatient
IS    Information System
ISDN  Integrated Services Digital Network
ISO   International Organization for Standardization
<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>MSH</td>
<td>Message Header Segment</td>
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<td>Meaningful Use</td>
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<td>NAHIT</td>
<td>National Alliance for Health Information Technology</td>
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<td>NAT</td>
<td>Network Address Translation</td>
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<td>NCPDP</td>
<td>National Council for Prescription Drug Programs</td>
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<td>National Cancer Institute</td>
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<td>National Committee on Vital Health Statistics</td>
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<td>National Drug File</td>
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<td>National Drug File-Reference Terminology</td>
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<td>National Electrical Manufacturers Association</td>
</tr>
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<td>NEDSS</td>
<td>National Electronic Disease Surveillance System</td>
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<tr>
<td>NETSS</td>
<td>National Electronic Telecommunications System for Surveillance</td>
</tr>
<tr>
<td>NetBUI</td>
<td>NetBios Extended User Interface</td>
</tr>
<tr>
<td>NGC</td>
<td>National Guideline Clearinghouse</td>
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<tr>
<td>NHIMG</td>
<td>National Health Information Management Group</td>
</tr>
<tr>
<td>NIC</td>
<td>Network Interface Cards</td>
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<tr>
<td>NIH</td>
<td>National Institutes of Health</td>
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<tr>
<td>NIST</td>
<td>National Institute for Standards and Technology</td>
</tr>
<tr>
<td>NIST-ATL</td>
<td>National Institute for Standards and Technology-Advanced Technology Laboratories</td>
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<tr>
<td>NHIN</td>
<td>Nationwide Health Information Network</td>
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<tr>
<td>NLB</td>
<td>Network Load Balancing</td>
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<td>NLM</td>
<td>National Library of Medicine</td>
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<tr>
<td>NPI</td>
<td>National Provider Identifier</td>
</tr>
<tr>
<td>NRZ</td>
<td>Non Return to Zero</td>
</tr>
<tr>
<td>NTFS</td>
<td>New Technology File System</td>
</tr>
<tr>
<td>NQF</td>
<td>National Quality Forum</td>
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<tr>
<td>OASIS</td>
<td>Organization for the Advancement of Structured Information Standards</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
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</tr>
<tr>
<td>OCC</td>
<td>Office of Care Coordination</td>
</tr>
<tr>
<td>OCL</td>
<td>Object Constraint Language</td>
</tr>
<tr>
<td>OCR</td>
<td>Office of Civil Rights</td>
</tr>
<tr>
<td>ODM</td>
<td>Operational Data Model or Optical Character Recognition</td>
</tr>
<tr>
<td>OID</td>
<td>Object Identifier</td>
</tr>
<tr>
<td>OLAP</td>
<td>Online Analytical Processing</td>
</tr>
<tr>
<td>OMG</td>
<td>Object Management Group</td>
</tr>
<tr>
<td>ONC</td>
<td>Office of the National Coordinator for Health Information Technology</td>
</tr>
<tr>
<td>ONC-ATCB</td>
<td>Office of the National Coordinator Authorized Testing and Certification Body</td>
</tr>
<tr>
<td>OOD</td>
<td>Operating Room</td>
</tr>
<tr>
<td>OR</td>
<td>Object Oriented Design</td>
</tr>
<tr>
<td>OS</td>
<td>Operating System</td>
</tr>
<tr>
<td>OSI</td>
<td>Open Systems Interconnection</td>
</tr>
<tr>
<td>OTP</td>
<td>One-Time Passwords</td>
</tr>
<tr>
<td>OUI</td>
<td>Organizational Unique Identifier</td>
</tr>
<tr>
<td>OWL</td>
<td>Web Ontology Language</td>
</tr>
<tr>
<td>PACS</td>
<td>Picture Archiving and Communication Systems</td>
</tr>
<tr>
<td>PBMS</td>
<td>Pharmacy Benefit Managers</td>
</tr>
<tr>
<td>PCI</td>
<td>Peripheral Component Interconnect</td>
</tr>
<tr>
<td>PCT</td>
<td>Primary Care Trust</td>
</tr>
<tr>
<td>PDAs</td>
<td>Portable Digital Assistants or Personal Digital Assistants</td>
</tr>
<tr>
<td>PDCA</td>
<td>Plan–Do–Check–Act</td>
</tr>
<tr>
<td>PDSA</td>
<td>Plan-Do-Study-Act</td>
</tr>
<tr>
<td>PDUs</td>
<td>Protocol Data Units</td>
</tr>
<tr>
<td>PHDSC</td>
<td>Public Health Data Standards Consortium</td>
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<td>PHER</td>
<td>Public Health Emergency Response</td>
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<td>PHI</td>
<td>Protected Health Information</td>
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<tr>
<td>PHII</td>
<td>Personal Health Record</td>
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<tr>
<td>PHR</td>
<td>Public Health Informatics Institute</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>PHR-FM</td>
<td>Personal Health Record-Functional Model</td>
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<tr>
<td>PIC</td>
<td>Process Improvement Committee (HL7)</td>
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<td>PIX</td>
<td>Patient Identifier Cross-Referencing</td>
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<tr>
<td>PKI</td>
<td>Public Key Infrastructure</td>
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<tr>
<td>PM</td>
<td>Project Management</td>
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<td>PMH</td>
<td>Past Medical History</td>
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<tr>
<td>PMI</td>
<td>Patient Master Index</td>
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<tr>
<td>PMS</td>
<td>Practice Management System</td>
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<td>POP</td>
<td>Post Office Protocol</td>
</tr>
<tr>
<td>PPP</td>
<td>Point-to-Point Protocol</td>
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<td>QAP</td>
<td>Quality Assurance Project</td>
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<td>QFD</td>
<td>Quality Function Deployment</td>
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<tr>
<td>QI</td>
<td>Quality Improvement</td>
</tr>
<tr>
<td>RA</td>
<td>Registration Authority</td>
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<tr>
<td>R-ADT</td>
<td>Reservation/Registration-Admission, Discharge, Transfer</td>
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<tr>
<td>RAID</td>
<td>Redundant Array of Independent Disks</td>
</tr>
<tr>
<td>RAM</td>
<td>Random Access Memory</td>
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<tr>
<td>RBAC</td>
<td>Role Based Access Control</td>
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<tr>
<td>RCRIM</td>
<td>Regulated Clinical Research Information Management</td>
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<tr>
<td>RELMA</td>
<td>Regenstrief LOINC Mapping Assistant</td>
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<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>RFI</td>
<td>Radio Frequency Interference</td>
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<td>RFID</td>
<td>Radio Frequency Identifiers</td>
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<td>RFP</td>
<td>Request For Proposal</td>
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<td>RHIOs</td>
<td>Regional Health Information Organizations</td>
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<td>RIM</td>
<td>Reference Information Model</td>
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<td>RIS</td>
<td>Radiology Information Systems</td>
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<td>RMIM</td>
<td>Refined Message Information Model</td>
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<td>RMPI</td>
<td>Registry Master Patient Index</td>
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<td>ROI</td>
<td>Return On Investment</td>
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<td>RPM</td>
<td>Remote Patient Monitoring</td>
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<td>Definition</td>
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<td>RPS</td>
<td>Regulated Product Submission</td>
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<td>RSNA</td>
<td>Radiological Society of North America</td>
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<tr>
<td>RX</td>
<td>Prescription</td>
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<td>SAEAF</td>
<td>Services-Aware Enterprise Architecture Framework</td>
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<td>SAIF</td>
<td>Services Aware Interoperability Framework</td>
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<td>Storage Area Network</td>
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<td>Serial Advanced Technology Attachment</td>
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<td>SCO</td>
<td>SDO Charter Organization</td>
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<td>SCSI</td>
<td>Small Computer System Interface</td>
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<td>SDLC</td>
<td>Software Development Life Cycle</td>
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<td>SDM</td>
<td>Systems Development Method</td>
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<td>SDO</td>
<td>Standard Development Organization</td>
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<td>SDTM</td>
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<td>SEI</td>
<td>Subject Matter Expert</td>
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<td>Software Engineering Institute</td>
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<td>Simple Mail Transport Protocol</td>
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<td>SNOMED CT</td>
<td>Systematized Nomenclature of Medicine--Clinical Terms</td>
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<td>SNOMED RT</td>
<td>Systematized Nomenclature of Medicine--Reference Terminology</td>
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<td>SOA</td>
<td>Service Oriented Architecture</td>
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<td>Simple Object Application Protocol</td>
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<td>SOP</td>
<td>Structured Product Labeling</td>
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<td>SPC</td>
<td>Statistical Process Control</td>
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<td>Standard Operating Procedure</td>
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<td>SSA</td>
<td>Social Security Administration</td>
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<td>SSID</td>
<td>Service Set Identifier</td>
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<td>SSL</td>
<td>Secure Socket Layer</td>
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<td>SSN</td>
<td>Social Security Number</td>
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<tr>
<td>SSO</td>
<td>Single Sign-On</td>
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<tr>
<td>STP</td>
<td>Shielded Twisted-Pair</td>
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<tr>
<td>TCP/IP</td>
<td>Transmission Control Protocol / Internet Protocol</td>
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<td>TEPR</td>
<td>Toward an Electronic Patient Record Conference</td>
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<tr>
<td>TLS</td>
<td>Transport Layer Security</td>
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<td>TP</td>
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<td>Time to Live</td>
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<td>UMLS</td>
<td>Unified Medical Language System</td>
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<td>Universal Resources Locators</td>
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<td>Unique Patient Identifier</td>
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<td>UPS</td>
<td>Un-interrupted power supply</td>
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<td>Ultrasound</td>
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<td>Veterans Administration</td>
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<td>Virtual Private Network</td>
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<td>Volume Shadow Copy Service</td>
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<td>Voluntary Universal Healthcare Identification System</td>
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<td>World Wide Web Consortium</td>
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<td>Wide Area Network</td>
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<td>World Organization of National Colleges, Academies and Academic Associations of General Practitioners/Family Physicians. (World Organization of Family Doctors)</td>
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<td>Web Services Description Language</td>
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<td>World Wide Web</td>
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<td>XDR</td>
<td>External Data Representation</td>
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<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
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