

PACS Administrator Certification: CIIP or PARCA?

By Herman Oosterwijk¹

As PACS applications became more sophisticated and complex, the need for one or more full-time individuals to support these systems became obvious. Someone had to and take responsibility for data integrity and availability of the images and related information. The profession of a PACS System Administrator (SA) evolved by having both clinical (Radiologic Technologists) as well as IT folks taking up the slack to support the PACS.

These early SA's were basically learning on-the-job, because there was initially no dedicated training available. Over the past 5-10 years, professional organizations and annual meetings, notably SIIM, as well as the PACS 2005, 2006, 2007 etc. meetings in San Antonio, Texas, began to include dedicated tracks to educate these folks. In addition, several academic and commercial training institutes started to offer training courses, seminars, and hands-on workshops².

There are now computer-based training courses as well as text books on the subject of PACS, and the essential standards that make these systems work, i.e. DICOM and HL7. Vendors also provide SA training, but it is generally recognized that these vendor-specific training sessions do not address system fundamentals and mostly concentrate on the specific user interfaces of their equipment.

As these training classes developed, it became obvious that there was a need for certification: To provide some indication of acquired skills, and to also set a baseline for training.

Certification

When professional organizations began defining certification requirements, it seemed that almost no-one could agree upon the SA job requirements. This is because an SA's job varies depending on their background, strength of other departments, facility culture, and history.

For example, a SA with a strong IT background might be able to troubleshoot connectivity issues between a modality and the PACS by themselves (such as by using a network sniffer that shows the DICOM protocol data units and TCP/IP packets) while another SA would have to leave this up to their IT counterparts.

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² The PARCA website has a list of training schools and organizations as well as resources: see <http://www.pacsadmin.org/links.php>

After many meetings and discussions on the topic of SA qualifications, there seemed to evolve three different tracks with three different career paths, even though in many cases, all these skills could be present in one SA. But before we elaborate on this more, it also became clear that there is a requirement for a common ground and vocabulary, i.e. all SA's need to be able to communicate on the same level.

They need to have a basic set of clinical AND technical vocabulary and understanding. That means that people with an IT background need to know the difference between a PA and LAT chest so they can configure the proper hanging protocol on a radiology workstation. Similarly, it would mean that the clinical folks need to know the difference between a switch and a router in case they need to find out why the network performance degrades and it suddenly takes twice as long for images to be exchanged.

After establishing this clinical and IT foundation for all SA's, there are those professionals that specialize in standards so that they could assist in something such as mapping HL7 to DICOM Attributes at an interface broker, to make sure all appropriate exams show up on a modality worklist following a technical career track, i.e. Technical Analyst.

The second group of professionals would concentrate on the PACS clinical workflow issues, so they can re-design a system to become more effective and efficient following a workflow analyst career track.

A third group might also be involved with the coordination and project management of new modalities, implementation of speech recognition, 3-D, or other projects following the organizational career track.

Certification Options

There are currently two options available for SA certification, PARCA and CIIP. The first and second career tracks mentioned above are addressed by the PARCA certifications, while the CIIP designation covers the third track.

Before going into the differences between these organizations, let's first concentrate on the different certification requirements. These requirements are posted on-line, for PARCA at www.pacsadmin.org and for the CIIP at www.abii.org.

Even although the PARCA certification guidelines are more extensive than the CIIP requirements, which only has a test-content outline, there is enough detail to be able to compare both certifications.

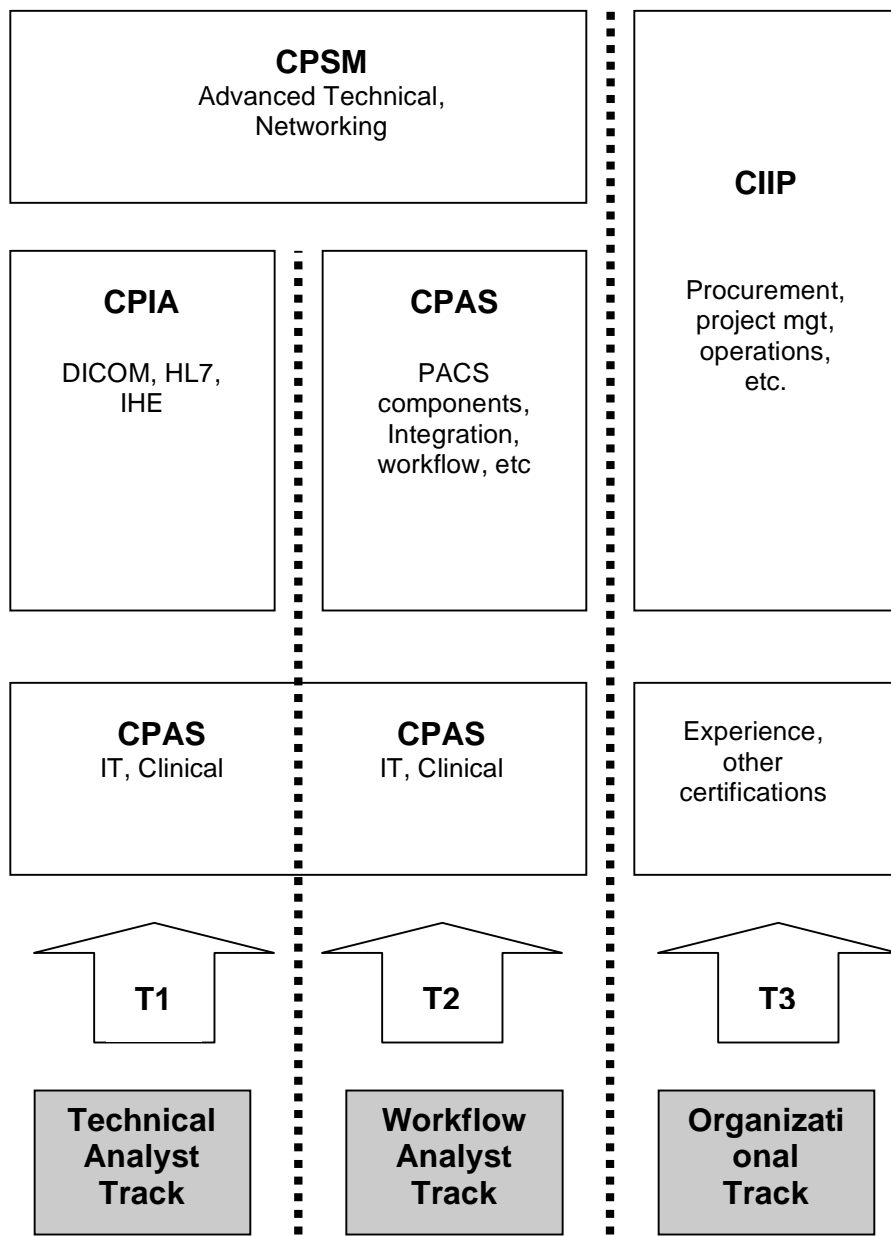


Figure 1: Different Certification Tracks

Both certifications require clinical and IT credentials. In the case of CIIP, this is achieved by having specific education/certification requirements, combined with a certain amount of experience. In the case of PARCA, this is achieved by taking the CPAS exam, which extensively tests the clinical and IT skills of a candidate. Both of these methods have their advantages: The CIIP approach favors experience over current knowledge while the PARCA approach does not require experience but rather, for a candidate to prove current skills and knowledge.

For professionals that would like to get into this field, but lack the required experience making them ineligible to take the CIIP exam, a good option for SA certification is to take the PARCA route. However, even if you have the required experience, it might be a good choice to take the PARCA CPAS exam regardless, to assess your current skill level. Several candidates that took both the CIIP and CPAS exams expressed that the CPAS indeed has been a good preparation for the CIIP.

PARCA has two different certification routes, the Interface Analyst (CPIA) and the System Administrator (CPSA) track (T1 and T2 in the figure) . These can then be topped off by the System Manager (CPSM) capstone certification. The CPIA deals with interface standards such as DICOM, HL7 and IHE, the CPSA requires knowledge about PACS components, workflow, integration and security. The CPSM requires hands-on networking exercises such as setting up a VPN.

The CIIP certification deals with many of these topics, but also covers subjects such as project management, procurement, operations, training, education and systems management (T3 in the figure). Details about either of these tracks are included in the tables at the end of this article.

Differences between PARCA and CIIP

In addition to the different areas and skills that these certifications address, there are also differences in their approach to certification. Some of the differences will almost certainly disappear as the certifying agencies get a few more years experience under their belts; some of them are fundamentally different.

One of the differences that will disappear over time is the level of maturity: PARCA has been available since early 2005, while CIIP had only its first pilot exam in June this year. Consequently, there are books and study guides available for PARCA, while CIIP has only a mini-study guide available on-line.

Also, most training institutions have adjusted their programs to ensure all PARCA requirements are covered, while there is still work in progress to define the learning objectives for CIIP. The latter is an effort undertaken by SIIM in the form of an EAN, or Educator Advisory Network.

The structure of the tests is also dissimilar. The CIIP exam consists of a fixed set of questions (for now), the PARCA exams vary each time they are conducted because the individual items on the test are randomly drawn from a question pool, so that no two exams are identical.

The way the exams are delivered is also quite different. PARCA has an anytime-anywhere philosophy, providing the exam on-line. This means that it is available for professionals from remote locations who might not have travel funds readily available, particularly those outside the U.S. Consequently, PARCA certificates are issued to SA's throughout the world.

CIIP exams are planning to be conducted about three or four times a year at predetermined testing centers and will be proctored. In addition, the exam costs also differ. The CIIP exam cost is \$400, with a \$200 retake fee in case you don't pass. The cost for the CPAS exam is \$100 exam and \$200 for the CPIA or CPAS with a "free" retake capability of two times within a year of taking the test. PARCA also requires a \$30/year membership.

The organizational structure is also different: the CIIP is managed under the auspices of ABII, which was founded by SIIM and ARRT while PARCA is an independent organization.

It's not about the piece of paper

Certification is a major effort, and, as many people have said before: the race is not about the finish but all about the journey. I have first-hand experience running races having finished two NYC marathons: it truly is not about the competition but about the many months of training and preparation.

The same holds true for SA certification, it takes many months of studying, reading text books, taking classes face-to-face or using computer-based training, and attending professional conferences. The effort should not be underestimated, but it is an excellent opportunity to learn about subjects an SA needs to know now and in the future. It is particularly helpful to strengthen the weak areas in an SA's background: IT knowledge for those coming from the clinical arena, and clinical knowledge for those coming from the IT sector.

Certification is also about empowerment: What better way to gain the knowledge and skills in order to better manage these complicated and sophisticated systems and ultimately provide better patient care? SA management includes taking care of image quality issues; improving workflow; reconciling studies, exams and patients; and supporting the expedient processing and reporting of a patient's critical images and related information.

Conclusion

PARCA, and recently CIIP, have achieved a high-level of acceptance as witnessed by the fact that the combined number of PARCA and CIIP certified professionals is already in the hundreds. The titles are showing up on business cards and in job requisitions.

There is still a long way to go for the thousands of professionals that are still preparing themselves for certification. Surveys have found that more than 90% of SA's believe certification is important, while more than 80% are seriously considering taking the exams.

Each certification has its strengths and weaknesses as to what are covered as part of its requirements. Each one supports distinctly different career tracks, although many professionals might opt to go for both, making sure they master not only the technical but also the organizational skills.

As time passes, we will better understand whether our best-guesses of the required skills actually take hold. There will also be the need for continuing education requirements as many new specialties are just now becoming clinical reality, such as optical coherence tomography for ophthalmology or tomosynthesis for digital mammography -- and just wait until pathology comes on-line with its digitized images.

New challenges, require additional knowledge and skills --that is what being involved in this high-tech industry is all about, change is the only true predictor. SA certification will help to master those skills in a consistent manner. In turn, this will provide those who certify with excellent career opportunities. In addition, it will also provide those hiring SA professionals with a benchmark upon which to base their employment decisions.

Certification differential between PARCA and CIIP:

| | PARCA | CIIP |
|--------------------------|---|---|
| Certification levels | Three: Associate, System Administrator, Interface Analyst and Manager | One level |
| Skills tested | detailed clinical, IT, workflow, standards | focus on organizational, project management and operations |
| Exam entry requirements | None; baseline established by CPAS exam | Certain pre- qualifications and experience required |
| Maturity | Exams available since Jan. 2005 | first pilot in June 2007 |
| Study guides | available as books | mini-guide available on-line |
| Exam dates and locations | anytime, anywhere: on-line | Proctored and delivered in testing centers 3-4 times a year |
| Geographic scope | Worldwide | U.S. based for now |
| Cost | \$100-200/exam; free retakes | \$400, retake fee \$200 |
| Organizational structure | independent organization | ABII, founded by SIIM and ARRT |

CIIP Test Content Outline and PARCA requirements.

For a complete list of certification requirements, see the PARCA and ABII-CIIP website (www.pacsadmin.org and www.abii.org).

| CIIP Test Content Outline (see www.abii.org for complete description) | |
|---|--|
| I. | HI & IT Procurement |
| | A. Determine organization readiness (plan, readiness) |
| | B. Establish and implement a process for vendor selection (RFP) |
| | C. Negotiate contracts with vendors (contracts, skills) |
| II. | Project Management |
| | A. Identify goals, scope, risks, and key team members |
| | B. Evaluate the feasibility of a project. |
| | C. Utilize common project management tools |
| III. | Operations |
| | A. Design and implement quality improvement (QI) procedures |
| | B. Develop and implement policies and procedures |
| | C. Ensure compliance with federal regulations (HIPAA, MQSA) |
| IV. | Communications |
| | A. Recognize roles and relationships in healthcare settings (org chart, specialties) |
| | B. Communicate with healthcare professionals (anatomy, positioning, imaging planes). |
| | C. Alert clinical staff about issues regarding system availability or changes (downtime) |
| | D. Provide decision-makers (business units, CIO, etc.) with information about system changes |
| | E. Develop user feedback mechanisms (reports, surveys). |
| V. | Training and Education |
| | A. Perform needs assessment to determine training needs (learning styles, objectives) |
| | B. Evaluate and select training programs according to user needs (methods, tools) |
| | C. Implement training or educational programs |
| | D. Evaluate effectiveness of training. |
| VI | Image Management |
| | A. Manage the design of the environment for viewing and interpreting images (ergonomics) |
| | B. Evaluate the human computer interface (usability, input devices) |
| | C. Determine optimal image flow and implement process that ensures data integrity. |
| | D. Import and export outside studies into a PACS |
| VII | Information Technology |
| | A. Assess storage and archiving needs and determine architecture (media, methods) |
| | B. Design and specify network architecture (protocols, configuration) |
| | C. Implement and maintain appropriate hardware and software. |
| | D. Retrieve information from databases for operations, QA, and planning (SQL, databases). |

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| | E. Identify and implement IT standards (LDAP, XML) |
| | F. Develop appropriate replacement schedule |
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| VIII | Systems Management |
| | A. Determine requirements for optimal, cost effective system capacity and throughput |
| | B. Plan disaster recovery and business continuity strategies. |
| | C. Use problem management and system availability tools and strategies |
| | D. Plan and evaluate data migration procedures |
| | E. Maintain data security and individual privacy |
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| IX | Clinical Engineering |
| | A. Assess imaging modality capabilities (DR, MG, CT, MR, etc.) |
| | B. Supervise modality integration (DICOM). |
| | C. Establish a program for image display, quality control |
| | D. Recognize hazards specific to the healthcare environment. |
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| X. | Medical Informatics |
| | A. Identify and implement medical imaging standards (DICOM,HL7). |
| | B. Apply appropriate IHE guidelines (profiles, connectathon) |
| | C. Integrate image architecture into organization's long-range plan (MPI, RHIO) |

| PARCA CPAS requirements (see www.pacsadmin.org for a full description) | |
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| Technical requirements | |
| I Computer Basics | |
| 1.1 Hardware | |
| 1.2 Software | |
| 1.3 CPU | |
| 1.4 Memory | |
| 1.4 Disk technology | |
| 1.5 IP/MAC addresses | |
| 1.6 Exchange media | |
| II Operating System Basics | |
| 2.1 Unix | |
| 2.2 Windows | |
| 2.3 DOS prompts | |
| III Database Basics | |
| 3.1 Hierarchical, relational, object databases | |
| 3.2 SQL knowledge | |
| IV Data Representations | |
| 4.1 Binary data format | |
| 4.2 Bits, Bytes | |
| 4.3 Hexadecimal representation | |
| 4.4 Signed/unsigned data | |
| 4.5 Floating point | |
| 4.6 Monochrome/RGB | |
| V Networking technology | |
| 5.1 WAN/LAN, T1, ISDN, DSL | |
| 5.2 Internet (http, url, domains) | |
| 5.3 ISO model | |
| 5.4 Ethernet, TCP/IP | |
| 5.5 WAN packet, circuit switching | |
| 5.6 Throughput, bandwidth, level of service | |

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| VI Security Concepts | |
| 6.1 System security | |
| 6.2 Authentication | |
| 6.3 Authorization | |
| 6.4 Confidentiality | |
| 6.5 Integrity | |
| Clinical Requirements | |
| I Medical Terminology | |
| II Human anatomy | |
| III Radiology Imaging Basics | |
| 3.1 Principles of digital modalities | |
| 3.2 operational procedures of CR | |
| 3.3 Modality imaging characteristics | |
| 3.4 Positioning and viewing techniques and terms | |
| 3.5 QA/QC | |
| 3.6 Collimation and shuttering | |
| IV Exam process flow | |
| 4.1 Physician order | |
| 4.2 Exam performance | |
| 4.3 Results reporting | |
| 4.4 Remote system access | |
| V Priors and outside exams | |
| 5.1 Digitization | |
| 5.2 CD import | |

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| PARCA CPSA requirements (see www.pacsadmin.org for a full description) |
| I. PACS Overview |
| 1.1 PACS architecture and components |
| 1.2 Architecture |
| 1.3 Acquisition rate, typical data generation |
| 1.4 Communication |
| II. PACS Components, acquisition and viewing |
| 2.1 Image Acquisition |
| 2.2 CR/DR |
| 2.3 Image viewing general |
| 2.4 Workstation requirements |
| 2.5 Viewing functionality |
| III. PACS components, Image Archiving |
| 3.1 Archiving components |
| 3.2 Storage technology |
| 3.3 Exchange media |
| 3.4 ASP services |
| 3.5 DB integrity and maintenance |
| IV. Integration |
| 4.1 Different levels of integration. |
| 4.2 Modality Integration |
| 4.3 HIS/RIS/PACS integration |
| 4.4 Report Integration and Speech Recognition |
| 4.5 Electronic Health Record |
| 4.6 IHE |

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| V. Workflow |
| 5.1 Workflow analysis |
| 5.2 Workflow tools |
| 5.3 Workflow issues |
| 5.4 CR/DR workflow |
| 5.5 Workflow exercise |
| VI. PACS System Administration |
| 6.1 Project management |
| 6.2 System Maintenance |
| 6.3 Image and Information Management |
| 6.4 Continuity of care |
| VII. Outside radiology: |
| 7.1 Cardiology |
| 7.2 Radiation therapy |
| 7.3 Nuclear Medicine |
| 7.4 Other clinical specialties |
| VIII. HIPAA |
| 8.1 HIPAA requirements for PACS |
| 8.2 Implementation zones |
| 8.3 Administrative safeguards |
| 8.4 Physical Safeguards |
| 8.5 Technical safeguards |
| IX. PACS implementation: |
| 9.1 The implementation process |
| 9.2 RFP components |
| 9.3 Economic justification |
| X. Miscellaneous: |
| 10.1 FDA approvals |

| PARCA CIA requirements (see www.pacsadmin.org for a full description) | |
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| A. DICOM standard | |
| I. DICOM introduction and negotiation | |
| 1.1 | DICOM architecture and background |
| 1.2 | Common issues |
| 1.3 | Importance of Information model |
| 1.4 | AE, SCU/SCP, FSR/FSC/FSU |
| 1.5 | Negotiation |
| 1.6 | Association |
| II. DICOM Messages and objects: | |
| 2.1 | SOP Class concept |
| 2.2 | Composite (Image) Message Structure |
| 2.3 | Data Elements |
| 2.4 | Value Representations, including padding |
| 2.5 | Specialization and privatization |
| III. DICOM Storage and image mgt Services: | |
| 3.1 | Storage Service Class |
| 3.2 | Important Storage Service Classes |
| 3.3 | Storage Commitment |
| 3.4 | Modality Performed Procedure Step |
| 3.5 | Modality Worklist |
| IV. DICOM Print, Query/Retrieve and SR: | |
| 4.1 | Print |
| 4.2 | Print extensions |
| 4.3 | Query/Retrieve-FIND |
| 4.4 | Query/Retrieve-MOVE-GET |
| 4.5 | Structured Reports |
| V. DICOM Image Quality: | |
| 5.1 | Pixel representation |
| 5.2 | Image pixel pipeline |
| 5.3 | GSDF |
| 5.4 | Presentation State |

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| VII. DICOM conformance statements | |
| 7.1 | Comparing conformance statements |
| 7.2 | Gap Analysis |
| VIII. DICOM Networking | |
| 8.1 | Message structure in detail |
| 8.2 | Configure DICOM devices |
| 8.3 | Sniffers and active test software |
| 8.4 | Interpret logs and DICOM dumps |
| IX. DICOM Troubleshooting | |
| 9.1 | Send/receive TCP/IP Ping |
| 9.2 | DICOM Verification (Echo) |
| 9.3 | Send/receive test messages |
| 9.4 | Send/receive SOP Classes and Xfer syntaxes |
| 9.5 | Modify image headers and anonymization |
| B. HL7 V 2 standard. | |
| I. HL7 messaging, theory: | |
| 1.1 | Message Structure |
| 1.2 | Patient registration (ADT) |
| 1.3 | Data Types |
| 1.4 | Segments |
| 1.5 | Acknowledgements |
| 1.6 | Error messages |
| 1.7 | General Order messages |
| 1.8 | Interpret HL7 message profiles |
| II. HL7 V2 Troubleshooting: | |
| 2.1 | Messaging dialogue |
| 2.2 | Capture and parse messages |
| 2.3 | Change/expand messages |
| 2.4 | Reverse engineering of HL7 |
| 2.5 | Create order and ack message |

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| 5.5 | Overlays |
| 5.6 | Compression |
| VI. DICOM Media | |
| 6.1 | Media specifications |
| 6.2 | DICOM Part 10 files |
| 6.3 | Application Profiles |
| 6.4 | CD interchange issues |

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| C. Other important standardization efforts: | |
| I. IHE | |
| 1.1 | IHE Introduction |
| 1.2 | IHE actors |
| 1.3 | Profiles |
| 1.4 | IT infrastructure |
| 1.5 | NM and PDI profiles |

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| PARCA CPSM requirements (see www.pacsadmin.org for a full description) | |
| I. Image Quality, grayscale pipeline: | |
| 1.1 | Pixel representation |
| 1.2 | Pixel pipeline in detail |
| 1.3 | Modality LUT |
| 1.4 | MASK |
| 1.5 | VOI LUT |
| 1.6 | Presentation LUT |
| 1.7 | GSDP |
| II. Image quality, presentation pipeline: | |
| 2.1 | Shutters |
| 2.2 | Image annotations |
| 2.3 | Spatial transformation |
| 2.4 | Display Area Annotation |
| 2.5 | Hanging protocols |
| III. Image quality, trouble shooting: | |
| 3.1 | IHE cons. presentation state test images |
| 3.2 | AAPM TC 18 monitor tests |
| 3.3 | AAPM TC 18 anatomical test images |
| IV. Advanced topics, DICOM Standard | |
| 4.1 | New DICOM objects (CT/MR) |
| 4.2 | GWL: General Purpose Worklist |
| 4.3 | Hanging Protocols |
| 4.4 | PDF encapsulation |
| 4.5 | Configuration Management |

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| VI. Advanced standards, general | |
| 6.1 | Information model |
| 6.2 | CDA |
| 6.3 | CCOW |
| 6.4 | Audit trails |
| 6.5 | HL7 3.0 |
| VII. Security | |
| 7.1 | HIPAA requirements for PACS |
| 7.2 | Administrative safeguards |
| 7.3 | Physical Safeguards |
| 7.4 | Technical safeguards |
| 7.5 | Standard implementation security |
| 7.6 | Secure remote servicing |
| 7.7 | Implementation zones |
| VIII. Networking fundamentals | |
| 8.1 | LAN design |
| 8.2 | Ethernet, TCP/IP |
| 8.3 | WAN network design |
| 8.4 | Packet switching, circuit switching |
| 8.5 | The Internet |
| 8.6 | High availability |
| 8.7 | Throughput, b.width, lvl svc params |
| IX. Security mechanisms | |
| 9.1 | Network monitoring tools |

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| 4.6 WADO |
| V. Structured Reporting (SR): |
| 5.1 Different SR SOP Classes |
| 5.2 SR building blocks |
| 5.3 Templates |
| 5.4 Special applications |
| 5.5 SR used for CAD |
| 5.6 Use of SR in IHE Radiology |

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| 9.2 Firewalls |
| 9.3 DMZ |
| 9.4 Encryption |
| 9.5 IDS |
| 9.6 Patch management |
| X. Security implementation |
| 10.1 Network monitoring tools |
| 10.2 Firewalls and DMZ: |
| 10.3 Proxy servers |
| 10.4 Secure VPN connections |
| 10.5 IPsec |