DICOS DEPLOYMENT

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Presented by Carl Crawford

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Transportation Security Administration

Global Systems Technologies Inc.

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So What? Who Cares?

- DICOS will work "out of the box"
  - Could be a reason why DICOS is not deployed
  - Emphasis placed to take on format
  - Communication protocol not emphasized
    - Exceptions (myriad) may cause problems
- What will it take to have DICOS function properly in the field?
  - Retire much risk before deployment
    - Connectathons, simulators, emulators, exception injectors
    - Use common software development kits (SDK)
  - Have processes in place to fix problems
    - Fast response – allow temporary changes to spec

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Why Should you Listen to Me?

- Steve and Carl integrated Analogic's CT scanner to L3's workstation for the L3 3DX Examiner
  - Solved with Analogic's emulator of L3's workstation
- Carl supported the development of the technical requirement specs for DICOS v1 for NEMA.

Commonly Asked Questions

What are the problems that have to be overcome before it works perfectly in the field?

- Problems:
  - Implementers have different understanding of the tag attributes within the standard.
  - Missing tag attributes, required for decoding, placed in private tags.
  - One OEM (A) may encode/decode image slices in stand alone slices, while another OEM (B) encodes/decodes the complete image. Result in OEM (A) not supporting decoding of OEM (B) images.
  - Variations in the interpretation of the DICOS standard. How addressed? Utilization of the DICOS Toolkit provides a "golden standard" and tools for DICOS file implementation compliance.
  - Additional usage needed. Vendor feedback is pivotal in addressing unknowns.

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Commonly Asked Questions

What are the problems that have to be overcome before it works perfectly in the field?

- Problems:
  - Vendors need a place to get clarification and to ask their questions on both the standard and the Software Development Kit (SDK).
  - DICOS v2A. Toolkit updates pending and needed to address vendor feedback being addressed in DICOS v2A. Will DICOS version 2A be perfect? Not likely but a lot closer.
  - Complete DICOS standard is not implemented by all vendors.
  - Past examples cited in Backup slides.
  - Emphasis placed on standard not communications.

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Commonly Asked Questions

Are these problems expected?

- Yes, past experience is a good indicator of this. This occurred with DICOM at RSNA.

- IEEE 802.3 (Ethernet Standard) was evolutionary. Mobile standards (GSM, CDMA, W-CDMA, TD-CDM…, etc.) have all been through iterations.

- Yes, standards are evolutionary in nature and based on lessons learned through usage.

Commonly Asked Questions

How can these problems be eliminated/reduced before DICOS is deployed?

- Phased approach in small steps (see backup slides).
- Provide a clearinghouse for questions and answers.
- Provide a maintained DICOS golden standard SDK that vendors can use to implement the DICOS common file format.
- Provide documentation and example code for vendors to use in their implementation.

Commonly Asked Questions

How can these problems be eliminated or reduced before DICOS is deployed?

- Provide an update to DICOS to address the changes in DICOS v2A and upcoming DICOS updates (new modalities, limitations, etc.).

- Additional usage of the standard and the available DICOS Toolkit.

- A demonstrated commitment to the standard and open standards in general.

- Connectathons, emulators, exception emulators.

Commonly Asked Questions

How long will it take to resolve problems after they are discovered in the field?

- Finger pointing could lead to delays.
- Function of the level of the problem.
  - The decode/encoding of images will be resolved in the phases approach, leaving problems which arise from fielding.
- Simple problems, quickly (1 or 2 days); larger problems within 7 days.
- Inputs from parties will be used to resolve the issues.
- For the SDK, a standard deficiency, a standard interpretation issue or a bug in the DICOS SDK. Assuming a high priority toolkit bug in the toolkit – normally less than 24 hours.

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Commonly Asked Questions

What are the roles of the various stakeholders (TSA, vendors, NEMA) when resolving these problems?

- Vendors to identify the problems and recommend solutions to TSA and NEMA. There solutions to the problem will taken as the final guideline.
- TSA will assist in the solution of the problems and keep a running log of the problems and solutions.
- The stakeholders will vary depending on the nature of the issue or request.
  - If an update to the standard is needed, NEMA will be involved.
  - If it is an interpretation, then the TSA, the vendors and the SDK provider.
- All changes to the SDK will be approved by the TSA for bugs that do not involve an update to the Standard.
- Vendors will propose changes in addition to the identification of needed bug fixes.

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Commonly Asked Questions

How to reduce finger pointing when systems from different vendors are connected in the field?

- A common issue with paper standards. Having the "Golden Standard" provided by the DICOS Toolkit will address this issue to a large degree, however, the need for a stakeholder DICOS committee made up of the TSA and vendor representatives and a issue clearinghouse is key.

- Good leadership (See Bernie Gordon at ADSA16).

Commonly Asked Questions

What does the experience with other networking standards say about what will happen with DICOS?

- History in the networking, cellular and medical industry show that standards are written with flexibility in interpretation.

- Unfortunately this leads to incompatibilities in interfaces. Past standards did not provide SDKs as DICOS has done through the sponsorship of the TSA.

- The TSA's approach in providing a DICOS Toolkit showed significant foresight and should reduce past historical issues with standards.

- Using a software industry best practice of having implementations platforms / SDKs available has been proven to be a significant advantage in reducing issues. Successful examples include Apple's iOS SDK, Microsoft Windows provided SDKs, Android, Java Dev Kit, .NET Framework SDK, etc.

Questions

Backup Slides

Issues with the use of DICOS

Technical example problems that have come up in the use of DICOS.

- **Question**: How can I generate a 2-D SP(Scan Projection) image format compliant with those specified in the DICOS standard, version 2?

- **Response**: Added Table 93 into Table 30 (as suggested in Option 2); however, with the additional detail of usage = "U". This change (API updates, examples, test, etc.) made and included in the current version of the DICOS Toolkit.

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Issues with the use of DICOS

Technical example problems that have come up in the use of DICOS.

- **Question:** Our CT scanners produce separate volumes for various energy levels. Is there a way to mark the particular energy level of a volume? Typically the energy level is indicated in the X-ray kV and mA setting.

- **Response:** The CT's peak kilo voltage can be set per section with SDICOS::Section::SetKVP(float). DICOS does not offer a way to save the mA setting for CT.

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Issues with the use of DICOS

Technical example problems that have come up in the use of DICOS.

- **Question**: I need to generate a 3D image format compliant with those specified in the DICOS standard, version 2.
- **Response**: Directed vendor to proper example in SDK.

Current Status of DICOS Development

- DICOS v2A has been approved; DICOS v3 is in the works.

- The TSA is evaluating the strategy for Stratovan SDK (DICOS v2A) development to be awarded early FY18.

- The TSA is evaluating options for future DICOS development/administration in light of sharp dues increases.

- Intend planned deployment of DICOS in small increments: Stratovan SDK, TSS, OTAP and Common GUI, presently. Anticipate and will continue to address issues as DICOS is implemented in the field.

Phases Involved in Deployment of any DICOS Version

- Phase 0:
  - Stratovan SDK – Toolkit development and TSS encoding of OEM images.
- Phase 1:
  - OEMs have been implementing DICOS during their development of a prototype GUI for checkpoint.
    - Encoding and decoding of their own images.
    - Implementation issues came to light.
    - Identified issues and resolved them.
      - Private tags will be allowed under certain conditions.
  - OTAP, Stratovan ATR development and TRAP
    - Going forward all data collection will result in all images being placed in DICOS format.
- Phase 2:
  - OEMs encoding of own images; the TSA will test at the TSIF on a third party CGUI for compliance and compatibility.
  - DICOS images will be restricted to the TSIF testing.
- Phase 3: OEMs will be implementing DICOS within their own network of TSEs.
  - Conducted at OEM's plant
  - Demonstration at TSIF

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Phases Involved in Deployment of any DICOS Version

- Phase 4: (Year)
  - OEMs will be implementing DICOS within their own network of TSEs.
    - Conducted at OEM's plant
    - Demonstration at TSIF
- Phase 5: (Year)
  - At the TSIF networking different OEM's TSE, have the ability to display all the different images, in DICOS format, on a third party CGUI.
- Phase 6: (Year)
  - Inclusion in future procurements for DICOS compliance in the purchase of future TSEs.
- Phase 7: (Year)
  - All OEM TSEs will be networked and have the ability to be DICOS compliant.

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Implementation Issues

- Understanding of the DICOS Standard
  - When vendors write the encoder/decoder, DICOS will also work. Issues surface when one vendor tries to decode what another vendor encoded.
- Misinterpretation of the Tag Attribute
  - The tag attribute was written with one meaning, but it was not clear and could be interpreted differently by different vendors.
- Tag Attribute
  - The tag attribute may not meet the encoders requirements and the vendor performs an internal self-modification to the standard to customize it. This internal modification is not known to the decoder. (For example, pixel representation is defined as 16-bits, but the vendor actually has a 24-bit pixel.)
- Fail to support the full standard
  - The encoder vendor encodes a 3-D image using the continues tag attribute while the decoder only supports the single slice decoding.
- Handshaking
  - The file/stream header may be incomplete due to limited testing.

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DICOS Stakeholders Activities
(demonstrated commitment to the standard)

- Checked Baggage Common GUI
  - OEMs generating encoding/decoding of their images into DICOS images using the SDK.
  - Determining first level bugs and recommending corrections.
- OTAP
  - Encoding of all bag image database into the DICOS format.
- APSS CT-EDS Window 1 Awards
  - Focuses on DT&E for enhanced detection, ASL integration, and CGUI modular design for Checkpoint CT.
- OEM Initiative
  - Many OEMs are moving to DICOS using the TSA SDK, as a path to future procurements.

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DICOS v3.0

- Topics and Issues for DICOS v3.0 include:
  - Additional Modalities
    - Differential Phase Contrast (DPC)   - Bottle Liquid Screener (BLS)
    - Coded Aperture Imaging (CAI)   - X-ray Diffraction (XRD)
    - Phase Contrast Imaging (PCI)   - Electronic Trace Detection
    - Air Cargo
    - CAT, BAT, BPSS
  - TDR Enhancements
    - Prohibited- item reporting
    - Deep Learning
    - Third party ATR support for reporting results
    - Aggregated TDRs from all TSEs
      - Passenger
      - Baggage screening results
  - Cyber Security

Location of Stratovan DICOS SDK and Toolkit

Go to: www.Stratovan.com

Click on: Products, Select: Security, DICOS

Complete Form.

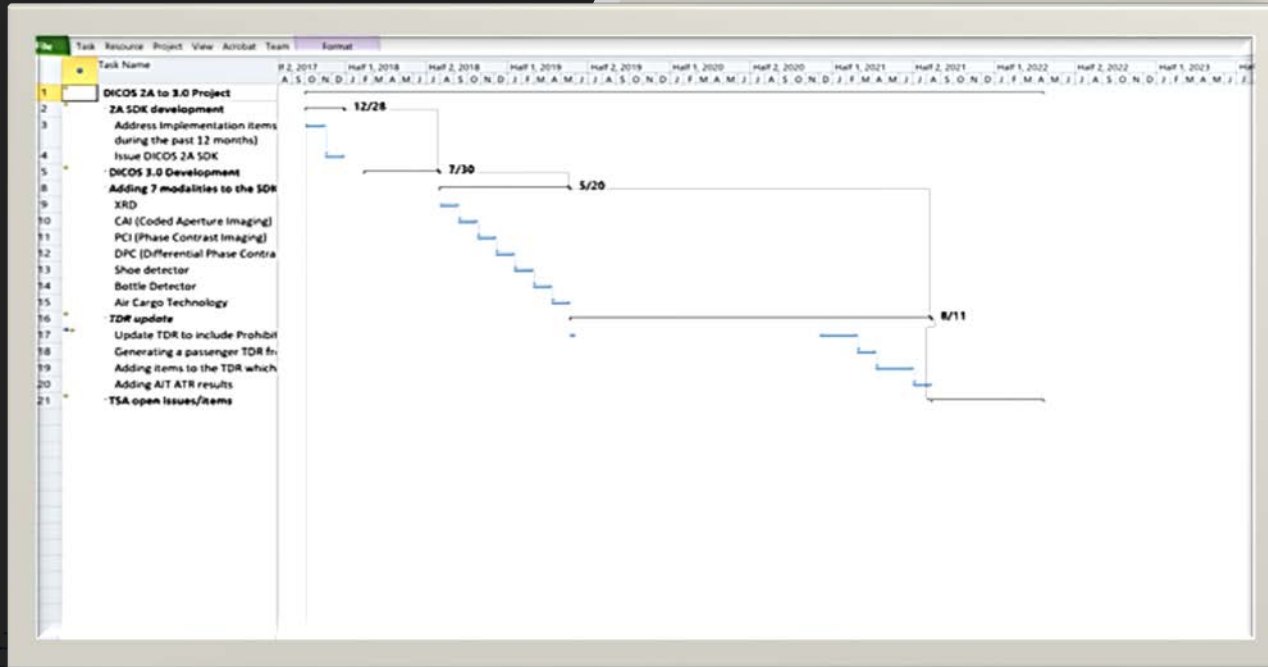# Project Schedule