A Basis for Joint Interoperability

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Presentation Overview

- Introduction
- Joint Technical Architecture (JTA) Overview
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  - Technical Architecture View
  - Systems Architecture View
- Extending the JTA Systems Architecture View
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  - Hardware and Software Requirements
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Introduction: Acknowledgements

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Introduction: Why Interoperability?

• “Joint operation” does NOT equal
  • a collection of forces
  • conducting independent operations
  • in the same geographical area

• Actual “Joint Operations” => Work Together
  • MUST be able to communicate =>
  • MUST have interoperable systems

• How to get interoperable systems?
  • The Joint Technical Architecture (JTA)
Joint Technical Architecture Overview

- JTA has three components
  Each called an “architecture view”

- Definition: “Architecture” within the JTA
  - Operational Component
  - Technical Component
  - Systems Architecture Component **

- Relationships between JTA Components
JTA Overview: Definition of “Architecture”

- NOT merely the typical computer systems engineer’s usage: computer hardware lay-out

- Much broader:

  “An architecture is composed of the structures or components (of a system), their relationships, and the principles and guidelines governing their design and evolution over time.”

  Source: IEEE
JTA Overview: Operational Architecture View

- Doctrinal template:
  - which UNITS communicate
  - which DATA to
  - which OTHER UNITS
  - via which SYSTEMS
JTA Overview: Technical Architecture View

- Set of implementation guidance and standards
  - WIN32 API
  - TCP/IP
  - X-windows (X11R5)

- Note contrast with CSE’s definition/usage!
JTA Overview: Systems Architecture View

• Answers the “HOW?” question
  in response to the “WHY?”
  from the Operational Architecture View

• Note:
  Closest to CSE’s usage of “architecture”

• Primary focus of paper:
  Extend description of this JTA component!
JTA Overview: Relationships between JTA Components

- Operational
  - Identifies Warfighter Information Needs
  - Processing and Information Exchange Requirements

- Technical
  - Identifies Rules, Standards and Conventions
  - Time-phased Technical Guidance

- Systems
  - Overlays Capabilities on Requirements
  - Technology Insertion Feedback

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Extending the JTA Systems Architecture View

- Address these categories of requirements
  
  a) Data Requirements **
  
  b) Hardware and Software Requirements
     (to a CSE, the “computer systems architecture”)
  
  c) Communications Requirements
Why focus on data requirements?

What data (information) is present and how can it be depicted?

Information Exchange

Why not exchange ALL information?
The MUST Share Subset
The CAN Share Subset
Why focus on data requirements?

- Interoperability is accomplished ...
  - by first **IDENTIFYING DATA** needed by other users or systems,
  - and then **SHARE THAT DATA QUICKLY ENOUGH** that it is still useful upon receipt by those other users or systems.
Extending the JTA SA View: Data

What data is present?

- JV2010 Functional Areas within a Tactical Battlespace
  a) Dominant Maneuver
  b) Precision Engagement
  c) Focused Logistics
  d) Full Dimensional Protection

- Categories within each functional area
  a) Survival Information
  b) Planning Information
“Survival information requires immediate action such as to attack the enemy, avoid being attacked, and/or to prevent fratricide. It is, therefore, extremely time-sensitive.”

“Planning information is used as a basis for determining future action and is generally not as time-sensitive as survival information.”

Source: JV2010 C4I Capstone Requirements Document
Currently being staffed in US ACOM
Joint Vision 2010 Data Interoperability Model

Dominant Maneuver

Full Dimensional Protection

Focused Logistics

Precision Engagement

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Extending the JTA SA View: Data
JV2010 Data Interoperability Model Key

- **Dash/Dot Line**: Theoretical Boundary for information which might be shared.

- **Thin Striped Section**: Planning information within each functional area

- **Thick Striped Section**: Survival information within each functional area

- **Solid Thick Line**: Joint Information Exchange Requirements (JIERs) necessary for interoperability. “MUST Share” Subset.

- **Large Dashed Line**: Subset of information which can feasibly be shared between the new system and legacy system(s). “CAN Share” Subset.
Extending the JTA SA View: Data
Why not exchange ALL information?

1) Do not NEED all data

2) "Communications pipe" not large enough to share all data
   (and greater capacity => greater demand, anyway!)

3) Must avoid information overload

Therefore, “theroretical boundary” not right answer!
Extending the JTA SA View: Data Interoperability & Information Exchange

- Warfighters’ information exchange requirements
  Function of mission needs
  Joint Information Exchange Requirements (JIERs)

- Information exchange capabilities
  Function of systems being used

- “MUST Share” Data Subset
  Defined by JIERs
  Required for NEW systems; GOAL for legacy

- “CAN Share” Data Subset
  Identifies limitations of legacy systems
Extending the JTA SA View: Data

Data Requirements Summary

• Interoperability depends heavily on data exchange

• JV2010 Data Interoperability Model depicts data (information) in tactical battlespace

• Information Exchange Requirements must be identified clearly and early for new systems!

The MUST Share Subset
The CAN Share Subset
Extending the JTA SA View: Hardware & Software Requirements

• “Computer Architecture” to a CSE

• Information Systems (on commercial hardware)
  • Defense Information Infrastructure - Common Operating Environment (DII-COE) compliance
  • Goal: Convergence on a single hardware/software standard
  • Realistically possible in the foreseeable future?

• Embedded Hardware and Software
  • Usually “custom made” for their particular applications
  • Typically even more complex than information systems
  • Exceptionally difficult to create “architectural” requirements to apply broadly to this type of system ...
Extending the JTA SA View: Communications Requirements

• Key Operational Questions:
  ♦ With whom must this system communicate?
  ♦ What is the requisite bandwidth (or required capacity) for each destination?

• Engineering Requirements & Design Issues:
  ♦ What transmission medium is most appropriate?
  ♦ Can we separate the radio from the application?

• It is also critical to use standardized transmission protocols (e.g., 1553 MUX buses in an embedded system, or TCP/IP for an information system network) whenever possible.
Conclusion

- Extending the JTA System Architecture View to specifically address ... 
  - Data Requirements
  - Hardware and Software Requirements
  - Communications Requirements

... should make it easier to develop system requirements which will support joint interoperability
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  Systems Architecture View **

• Extending the JTA Systems Architecture View
  Data Requirements  **
  Hardware and Software Requirements
  Communication Requirements

• Conclusion