

A Basis for Joint Interoperability

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Presentation Overview

- Introduction
- Joint Technical Architecture (JTA) Overview
 - Operational Architecture View
 - Technical Architecture View
 - Systems Architecture View ****
- Extending the JTA Systems Architecture View
 - Data Requirements ****
 - Hardware and Software Requirements
 - Communication Requirements
- Conclusion



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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)



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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



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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



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JTA Overview: Operational Architecture View

- **Doctrinal template:**

which UNITS communicate

which DATA to

which OTHER UNITS

via which SYSTEMS



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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!



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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!



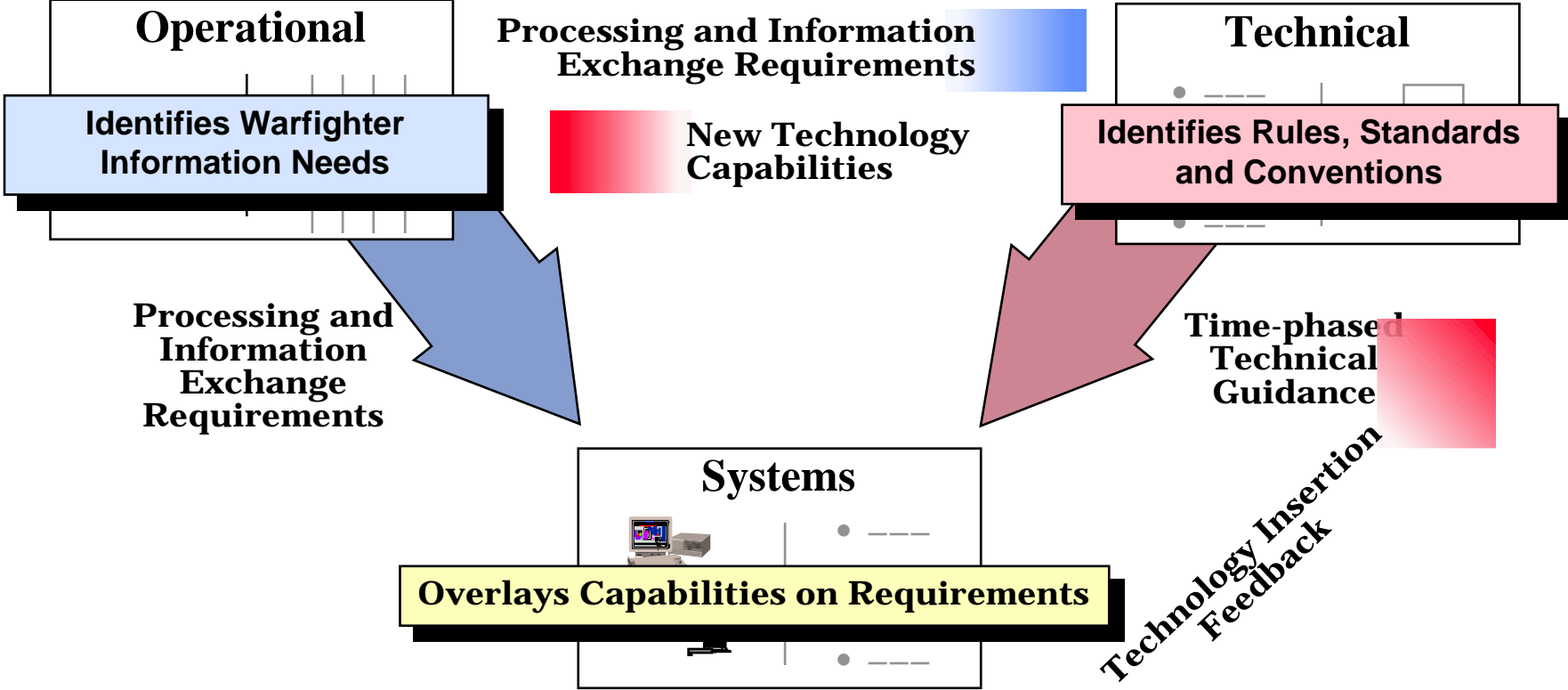
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JTA Overview: Relationships between JTA Components



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



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Extending the JTA SA View: Data Requirements Overview

- 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



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Extending the JTA Systems Architecture View: Data Why focus on data requirements?

- Interoperability is accomplished ...
 - by first **IDENTIFYING DATA** needed by other users or systems,

and then
 - by arranging to **SHARE THAT DATA QUICKLY ENOUGH** that it is still useful upon receipt by those other users or systems



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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**



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Extending the JTA SA View: Data Survival Information vs 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



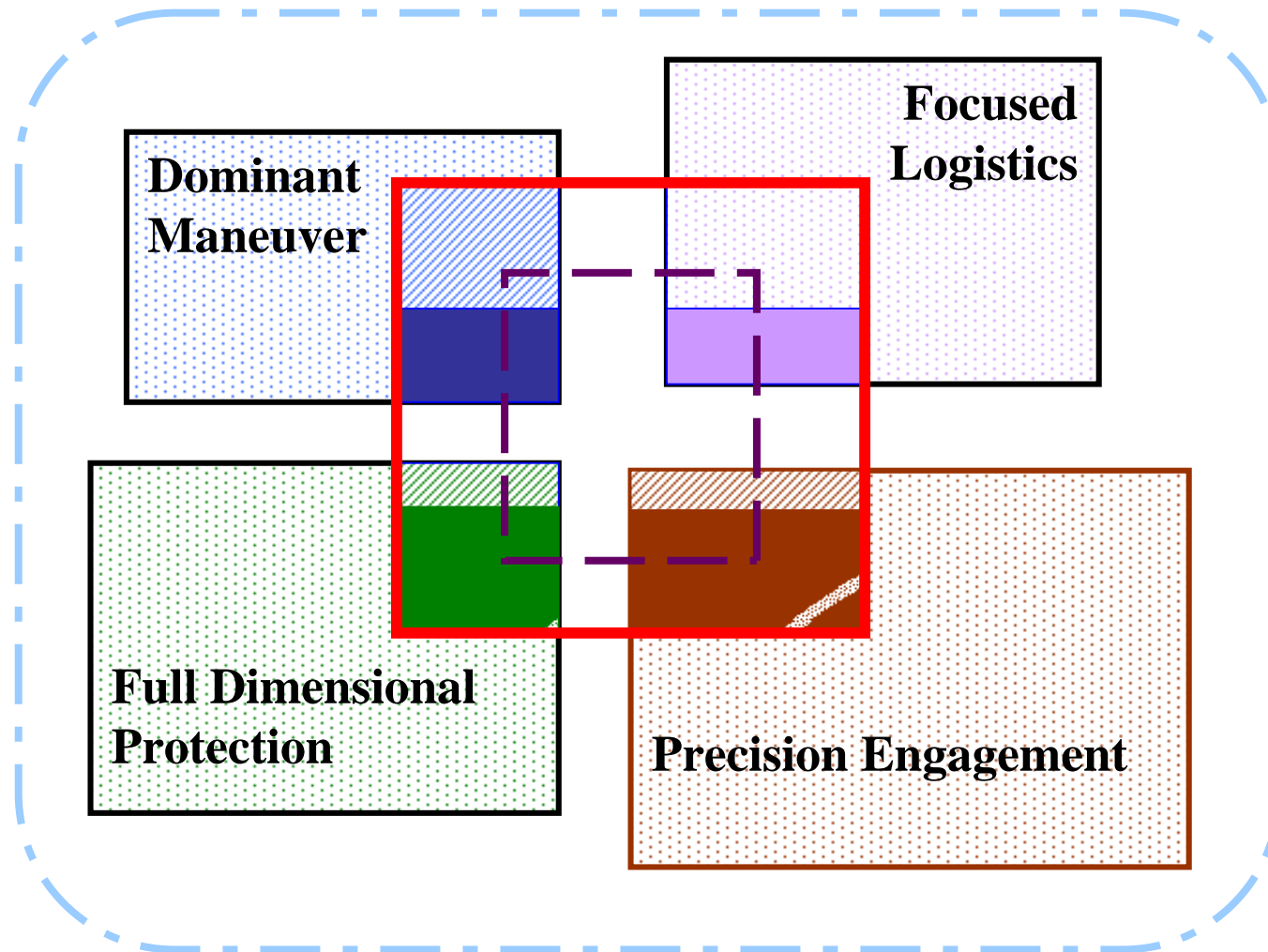
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Joint Vision 2010 Data Interoperability Model



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.



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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!



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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



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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



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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 ...



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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**.



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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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