The Value of a Reference Architecture
GSAN 99 Workshop

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So…Why a Reference Architecture?

- **MOTIVATION**: Need an overarching architecture strategy to accommodate cross-organization incremental system level solutions for a shared environment: frame incremental solution choices to ensure consistent concepts and rules of structure are incorporated into all intermediate solutions.

- **PURPOSE**: Provide the basis for making incremental specific design decisions and product choices later on in the system building process.

- **DEFINITION**: A high-level parameterized system framework for a ‘system’ that defines its overall target structure (components and relationships among them) in a systematic consistent manner.
Objectives

● System-wide Properties (example)
  - Quality of Service
  - Policies (permissions, prohibitions, obligations)
  - Autonomy
  - Cooperation - Execute tasks jointly,
  - Shared environment - Interoperate, Information Sharing
  - Scalability - Addition of resources (users, system)
  - Interoperability - Mutual understanding of exchanged messages
  - Connectivity - Ability of systems to exchange messages
Current Challenges

- Cross-Enterprise Endeavor with:
  - Incomplete Requirements
  - Heterogeneous Legacy Systems
  - Lack of Interaction Specification
  - Severe Constraints:
    - Politics, Resource Constraints, Independent Organization Mandates
- COTS Middleware Complexity
- Architecture ‘tools’ Complexity, Inconsistency, Incompleteness

- Inadequate and Complex Software Architecture
  - ADLs, without commercial maturity and support
  - Styles and connectors: how do they relate to: each other, APIs, interaction, QoS parameters, networks, actions, etc. ?
  - Few (Integrated) Tools aimed at the architect’s problem
  - UML incomplete: semantics of interaction lacking + graphic tools do not capture all of UML (e.g., ROSE ©)
  - Multiple languages, models, and frameworks for “required use”, with insufficient consistency
  - Conformance testing anyone?

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Incremental Developed Shared System of Systems Guided By A Reference Architecture

- Different Increments
- Different Organizations
- Different Phases

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Use of Reference Architecture

The Aggregation of the Generic RM-ODP Framework and Specific Customer Requirements

- **Viewpoints**
  - provide abstraction
  - separation of concerns
  - can be incremental

- **Viewpoint Consistency**
  - architecture evaluation
  - common understanding
  - increased completeness and consistency
  - geographically distant multi-organization can specify and implement separately

Example:
- **C2**--Actions
- **Commander**--Role
- **Joint Chiefs**--Role
- **Supply**--Resources
- **Map**--Resources
- **Authority**--Permission
- **Responsibility**--Obligation
- **Tasking Order**--Contract
- **Response Delay**--QoS

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Relationships Across Viewpoints (Sample RM-ODP)

- Enterprise
- Information
- Computational
- Engineering
- Technology

- Relationship
- Role
- Enterprise object
- Actions
- Interactions
- Contract
- QoS
- Policy: Obligation Permission Prohibition

- Static Schema
- Invariant Schema
- Dynamic Schema

- Components
- Interaction
- Interface client/server
- Interface signal
- Interface stream
- Binding
- Signature
- Binding Object
- Contract
- QoS

- Node
- Cluster
- Capsule
- Functions
- Managers
- Transparency

- Engineering Interface
- Local Binding
- Distributed Binding
- Channel
- Control
- Signature

- Interworking RP
- Programmatic RP

Conformance reference points

Summary

● Reference Architecture is an integrated framework that only addresses "common" objectives and issues to:
  - Evolve towards target Corporate 'system'
  - Integrate legacy and evolving new solutions
  - Incorporate new IT as it matures
  - Achieve Corporate strategic goals
  - Integrate business processes and information technology
  - Enable shared environment
References