Relationship of "Interoperability" and Group Objectives

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Agenda

- The Relationship Between "Interoperability" & Achieving Group Objectives
- The Spectrum of Interoperability
- Methods Used By Groups to Achieve Interoperability
- Group Benefits
- Summary

The Relationship Between "Interoperability" & Achieving Group Objectives

- **Inter**operability, by definition, requires two or more entities trying to achieve some common objective(s)

- From a relationship perspective, two or more entities brought together to achieve some common objective(s) can take many forms, as examples:
  - *Enterprise*
    - Two or more entities brought together by a parent to achieve some common goal(s) usually defined by the parent
  - *Federation/Partnership*
    - Two or more entities trying to achieve some common goal(s) usually by participant consensus

- Group objectives and the level of interoperability across entities are inseparably intertwined
  - *The achievable level of interoperability across entities can be driven by budget, past performance, individual entity constraints and/or trust*
    - Group objectives may need to be adjusted due to level of interoperability that is realizable
  - *Objective definition should be done during the relationship formative phase to minimize possible rework*

Group objectives need to be defined early as it drives the level of interoperability and visa versa. For simplicity's sake this presentation will use the term "group" to cover all relationships defined above.

The Spectrum of Interoperability

Many levels of "interoperability"

- Simple Data Sharing
  - *Weather data, science missions, situational awareness*
- Resource Sharing
  - *Antennas*
  - *Crew*
  - *Software/services*
- Full operational integration
  - *Shared, trained crews, software & equipment able to fully operate spacecraft bus and payload(s) with full connectivity to all mission partners*

Data Sharing   Full Operational Integration
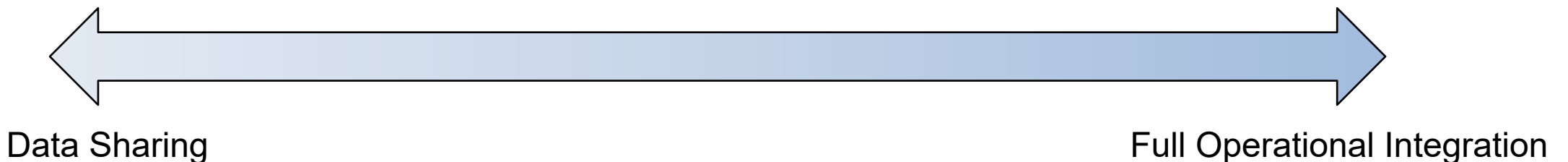
Level of interoperability must be viewed in terms of group objectives

Methods Used By Groups to Achieve Interoperability

- Common data and messaging standards and supporting infrastructure
  - *Required for any level of interoperability*
  - *Could include common data repositories*

- Common IT infrastructure (centralized or distributed)
  - *Common virtualization/containerization , processing, storage and transport*

- Common software services, models and/or codebase

- Common user experience ("look & feel") employed across entities

- Common CONOPS across entities

- Standardized spacecraft systems, components and/or interfaces across entities

Increasing levels of interoperability

Decreasing levels of mission optimization

Balance needs to be struck between group objectives & mission optimization all of which fold into interoperability needs

Group Benefits (1/2)

- Common data and messaging standards & supporting infrastructure may enable:
  - *Data sharing across entities*
    - Tipping & Cueing
    - Situational awareness
    - Payload data sharing
  - *Machine to machine interfaces for constrained timelines*
  - *Cross entity analysis regarding enterprise performance*
  - *Resource sharing*

- Common IT infrastructure (centralized or distributed) may enable:
  - *Potential enterprise cost savings by achieving economies of scale across entities*
  - *Reduced cost as contractors do not need to develop a host environment*
  - *Lower facility footprint (data center)*
  - *Simplified data & resource sharing*
  - *Strengthened cyber protections and options available to entities*
  - *Simplified configuration control and deployment*
  - *Dev/Sec/Ops*
  - *More rapid fielding of new capabilities due to Dev/Sec/Ops & facility availability*
  - *Single point of entry/interface for external entities*

Group Benefits (2/2)

- Common software services, models and/or codebase may enable:
  - *Potential for reduced development & sustainment costs by reducing the amount of Mission Unique Software (MUS)*
  - *More rapid fielding of new capability by reducing size/scope of software development effort*
  - *Simplified cross-entity management of virtual hardware and hardware resources (FEPs, Crypto, antennas, etc.)*

- Common User Experience ("look & feel") may enable operators to focus on learning spacecraft/mission nuances vs. how to interact with the system across entities
  - *Reduced training time for new missions (reduced implementation timeline)*

- Common CONOPS may enable similar control room behavior (i.e. approach to anomaly resolution, approach to scheduling, control room position roles & responsibilities, etc.)
  - *Reduced crew training for new missions or consolidated operations center (reduced implementation timeline)*

- Standardized spacecraft systems, components and/or interfaces across entities may enable:
  - *Further reduced unique ground software (MUS) (reduced development and sustainment costs)*
  - *Operations commonality (reduced implementation timeline)*

Summary

- Level of interoperability is inseparably intertwined with group objectives
  - *Both need to be clearly defined early in enterprise formation to minimize rework*

- Balance of group objectives and mission optimization needs to be struck which impacts level of interoperability

- Cost savings and reduced time to implement new capabilities are potentially key benefits to increasing levels of interoperability