



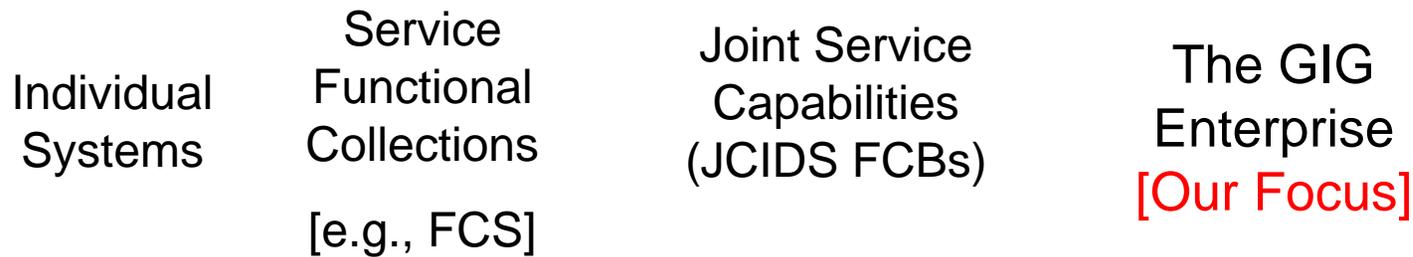
Concept for an Enterprise Wide (EW)
System Engineering (SE)
Collaborative Engineering Environment (CEE)

Dr. David Signori
Dr. Jimmie McEver
Dr. Kenneth Jordan
Dr. Stuart Starr

October 25, 2006

- Selected Definitions
- Key Questions
- Strategy
- Summary

- SoS (source: B. E. White)
 - “A collection of systems that functions to achieve a purpose not generally achievable by the individual systems acting independently”
- SoSE (source: J. E. Kaplan)
 - “The cross-system and cross-community process
 - That ensures the development and evolution of mission-oriented capabilities
 - To meet multiple stakeholders’ evolving needs
 - Across periods of time that exceed the lifetimes of individual systems”



Faster individual system evolution and better individual system optimization,...but may lead to problems in overall interoperability and integration



Better overall Interoperability and Integration,... but, may lead to individual system sub-optimization; not well matched to existing processes

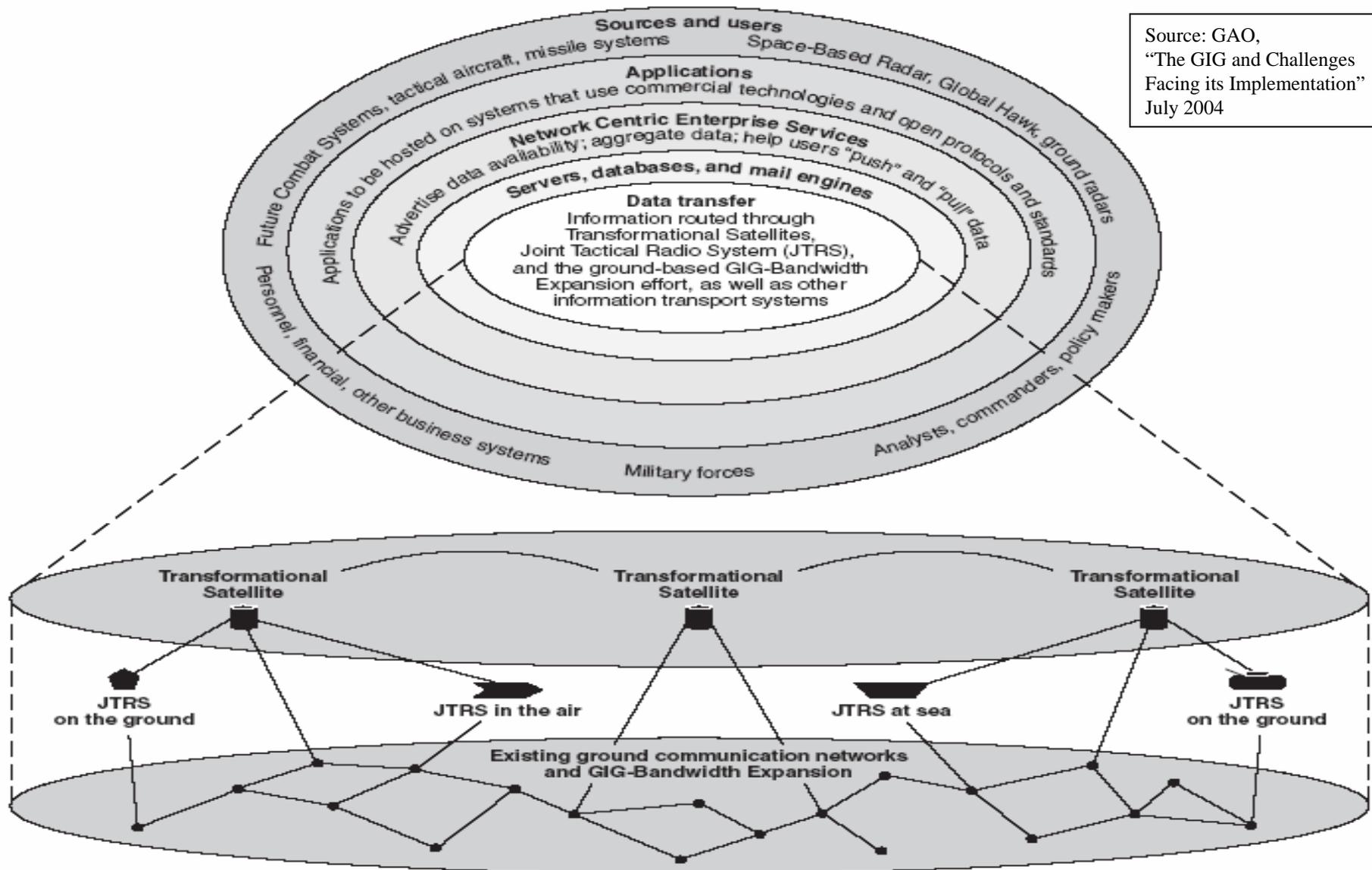
- An integrated, scalable, fully distributed processing and transport environment, commercial-technology based, that:
 - Moves information from any source to any destination
 - Provides tailored information through intelligent pull
 - Is dynamic, adaptive, self reconfiguring, robust, and secure
 - Integrates legacy C4ISR systems
 - Permits full exploitation of sensor, weapon, and platform capabilities
 - Joint cooperative component
 - Sensor-to-sensor for cueing

Source: Mike Frankel, former DASD(C3I Systems)



A Characterization of the GIG Vision

Source: GAO,
“The GIG and Challenges
Facing its Implementation”
July 2004





Agenda

- Key Definitions

Key Questions

- Strategy
- Summary



The DoD's 3 major decision-making processes are not structured to support cross-cutting, department-wide development efforts such as the GIG

– JCIDS

- The new process is not yet identifying shortfalls and gaps in joint military capabilities on a department-wide basis
- Requirements setting continues to be driven by Service perspectives

– PPBES

- Is structured in terms of individual Service programs and outdated mission areas instead of cross-cutting capabilities such as net-centricity
- It is not flexible enough to quickly accommodate requirements resulting from lessons learned or from rapidly emerging technologies

- Acquisition
 - **Is unsuited to developing a system of interdependent systems such as the GIG**
 - DoD has struggled to achieve Service buy-in on joint Service development programs to address interoperability problems
- Overall
 - The lack of integration among these three processes makes it difficult to ensure that development efforts are affordable and technically feasible



Tenets of Net-Centricity

10

- A robustly networked force improves
 - Information sharing
- Information sharing and collaboration enhances
 - Quality of information
 - Shared situational awareness
- Shared situational awareness enables
 - Collaboration
 - Self-synchronization

Bottom Line: Dramatic increase in mission effectiveness

- Can we adapt the tenets of net-centricity to guide SoSE for the GIG?
- If so, what Enterprise Wide (EW), System Engineering (SE) Collaborative Engineering Environment (CEE) would be needed to implement that concept?



Agenda

- Selected Definitions
- Key Questions
- Strategy
- Summary



The Collaborative Engineering Environment (CEE)

- CEE -- features and purpose
 - An SE force networked together and with stakeholders
 - Supported by shared tools, services and information
 - That empower various communities of interest to solve a range of problems collaboratively
- Key attributes
 - Empower culture change, guidance and management
 - Provide repositories and websites for posting and sharing information
 - Support continual assessment and decision making through
 - Analytical tools and services
 - Integrated M&S environments
 - Distributed test beds

- Accessed through an easy-to-use web portal
- Navigational aids to help users find the information they need
- Incentives to provide up-to-date information
- Designated Points of Contact (POCs) to feed the CEE
- FAQs and help desk



Empowering Culture Change, Guidance and Management

- The CEE should serve to empower culture change, guidance and management by providing
 - Access to education resources
 - Top level guidance for end-to-end (E2E) capabilities
 - POCs for all levels of management and systems – responsibility matrix
 - Access to latest products (e.g., NCIDs, JCIDS products)



Repositories and Websites for Posting and Sharing Information

- The CEE should provide access to the following
 - Enterprise and individual program schedules
 - Enterprise-wide standards
 - Current performance and interface issues
 - System emulations to support interface development and testing (supplied and updated by programs)
 - Clearing house for suggestions for E2E system improvement



Elements of a CEE Tool Box: “Soft” Tools

- These tools should be useful in rapidly
 - Performing exploratory analyses
 - Identifying the “interesting” parts of solution space
- Representative “soft” tools include
 - Expert elicitation techniques; e.g.,
 - RAND’s Subjective Transfer Function approach
 - Polling techniques
 - Multi-attribute Utility Theory (e.g., Analytical Hierarchy Procedure)
 - System dynamics models (e.g., CAPE)
 - Simple, agent based models (e.g., MANA)



Elements of a CEE Tool Box: Constructive M&S

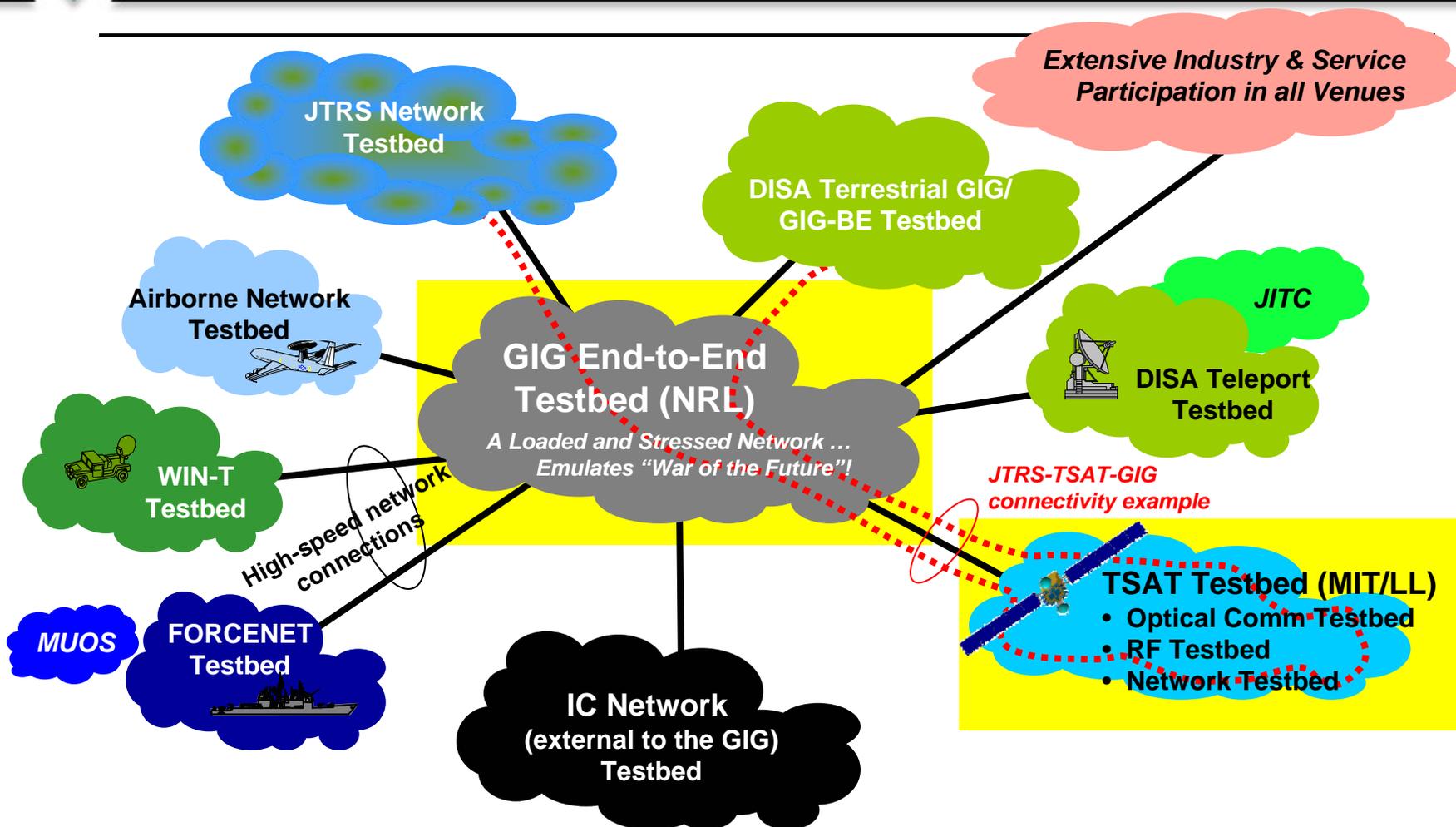
- These constructive M&S tools should be used to
 - Build on the results of “soft” tools to support more detailed, quantitative analyses
 - Provide baseline results to
 - Guide the conduct of testbed assessments
 - Extend testbed results
- Representative constructive M&S include
 - OPNET/NETWARS (transport layer analyses)
 - NESTOR (service layer analyses)
 - JWARS (military mission analyses)



Elements of a CEE Tool Box: Testbeds

- It is anticipated that these testbeds will
 - Support the more credible assessment of key Measures of Merit (drawing on the insights developed from constructive M&S)
 - Facilitate the harmonization of the GIG with Service visions (e.g., LandWarNet, FORCEnet, Constellation Net)
 - Provide insights to enhance the quality of existing constructive M&S
- A variety of testbeds are envisioned
 - System-of-systems testbeds (e.g., NRL-orchestrated testbeds)
 - Mission-oriented testbeds; e.g.,
 - FCS SoSIL (USA)
 - Distributed Mission Operations Center (DMOC) (USAF)

Key Testbeds to Exploit



Provides inter-network demonstration and validation

- Become knowledgeable about NATO Code of Best Practice (COBP) for C2 Assessment
- Apply Net-Centric Data Strategy to guide the collection, conversion, storage of data generated through application of the CEE tool box
- Develop experimental design skills that enable you to apply the designated models efficiently and effectively

- Selected Definitions
- Key Questions
- Strategy

→ Summary

- A CEE may enable a net-centric approach to SoSE for the GIG
- The CEE should serve to
 - Empower culture change, guidance and management
 - Provide repositories and websites for posting and sharing information
 - Support continual assessment and decision making
- If the CEE is to be viable, it must be
 - Evolvable and scalable to be consistent with the nature of the GIG
 - Consistent with the Services' plans to create and apply CEEs to address their own SoSE issues (e.g., FORCEnet, LandWarNet, ConstellationNet)