Information Sharing in the GIG Environment and the C2 Perspective

24 April 07

Precision Strike Conference

People throughout the trusted, dependable and ubiquitous network are empowered by their ability to access information and recognized for the inputs they provide.

Build, Populate, Protect

C3-NII

Topics

- GIG Basis
  - Vision and Objectives
  - Overall architecture and GIG structure
- Key GIG Tiers
  - Transport
  - Enterprise Services
  - Applications
    - Illustrate how SOA operates in the GIG architecture
- C2 Structures – New (SOA) vs Old (Tightly coupled)
  - Technical approach
  - Implementation aspects
  - Future direction
- GIG delivery considerations
  - Commercial and military
  - Differences in IT approaches

Background

C2 Considerations

Future

Topics

- The GIG Architectural Construct
  - Feature attributes of the GIG and netcentricity
  - Differences from past implementation approaches to the future GIG
- C2 Architectural Perspective
  - New C2 governance and implemention approaches
  - The relationship of C2 within the GIG
  - The importance of SOA and SLA to C2
  - Critical consideration of data to C2
- Understanding the Transport Layer
  - A key enabling element for C2
  - The separation of transport and C2 applications
- Identifying How C2 is Enabled by the Network
  - Tactical edge approaches to networks
- The future C2 application set is NECC
  - Characteristics and implementations

The GIG is All About

Information

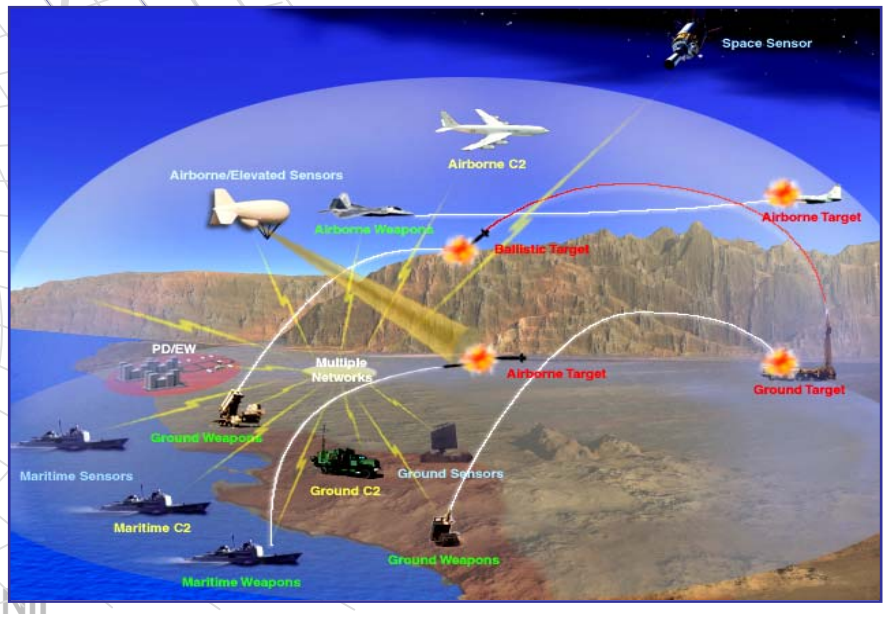
- Assured
- Timely
- Highly Available
- Right - Needed

The NII emphasis is shifting from the establishing transport programs to the network, services and applications perspective

Net-Centric Vision *(Define the End Point)*

- ***Vision – Power to the Edge***
  - People throughout the trusted, dependable and ubiquitous network are empowered by their ability to access information and recognized for the input they provide.
  - To enable and empower people at the edge of the network
- **Goals**
  - **Goal #1 – Make information available on a network that people can depend upon and trust**
  - **Goal #2 - Populate the network with new, dynamic sources of information to defeat the enemy (post before you process)**
  - **Goal #3 - Deny the enemy comparable advantages and exploit weaknesses**

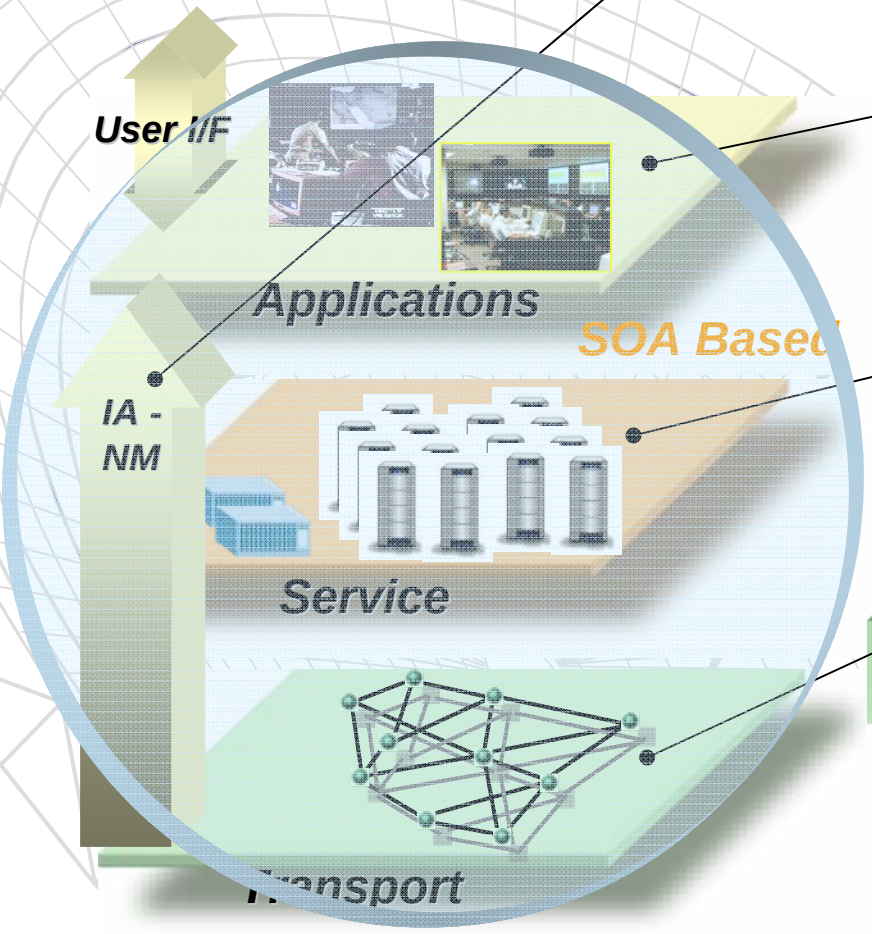
- **A robust networked force leads to information sharing**
  - **Enhancing the shared situational awareness in support of the commander's intent**
- **Achieved by leveraging the commercial information transformation**
  - **Information is more than a technology**
  - **Evolution of capability – being measured daily**



C3-NII

GIG Perspective

Information & the GIG - Layered Perspective



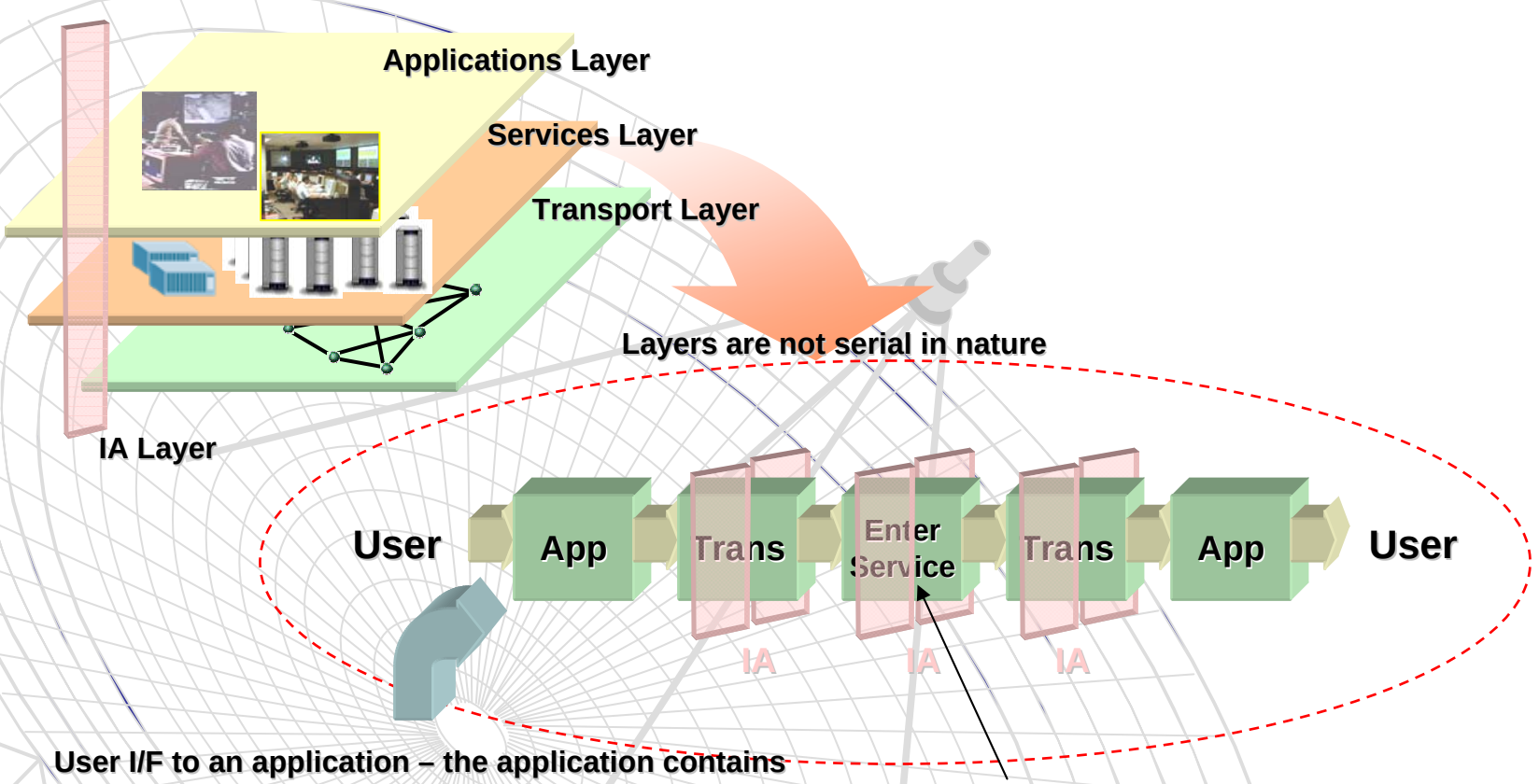
- ✓ Loosely coupled applications based upon SOA/SLA
- ✓ Enabled applications are highly adaptive and flexible

- ✓ Defined data strategy – attributes set by applications
- ✓ XML driven by DoD directives
- ✓ SOA enterprise environment with managed services

- ✓ IP based with QoS established by applications
- ✓ Multi-media for highly available communications

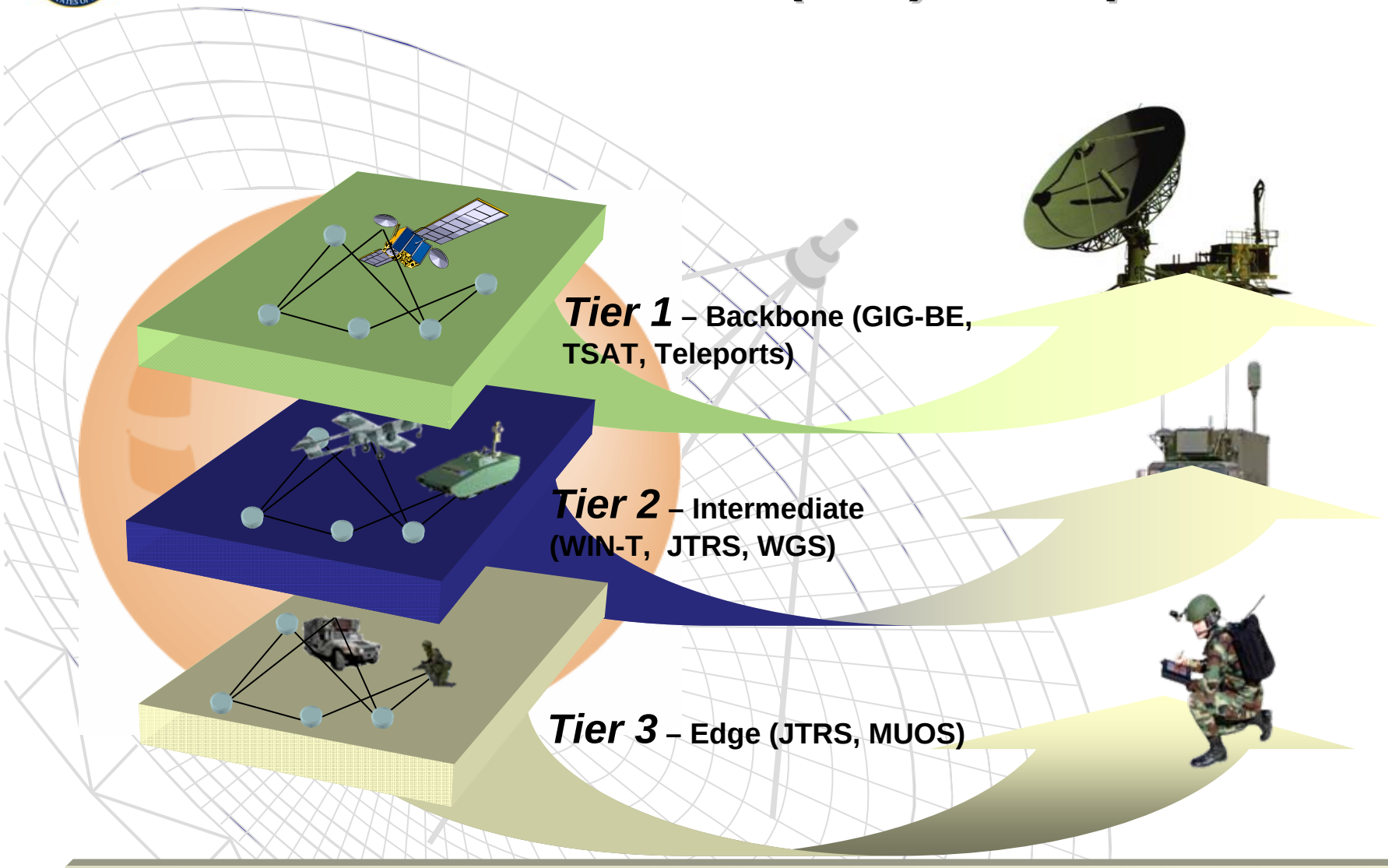
Assured information (data) access is the critical concept – the user sets the information access requirements

A GIG Functional Dissection



- The Layers are not sequential as layered perspective
- Services and application layer rarely are interfaced (I/F) directly
- Transport has minimally knowledge or intelligence while application is knowledge element

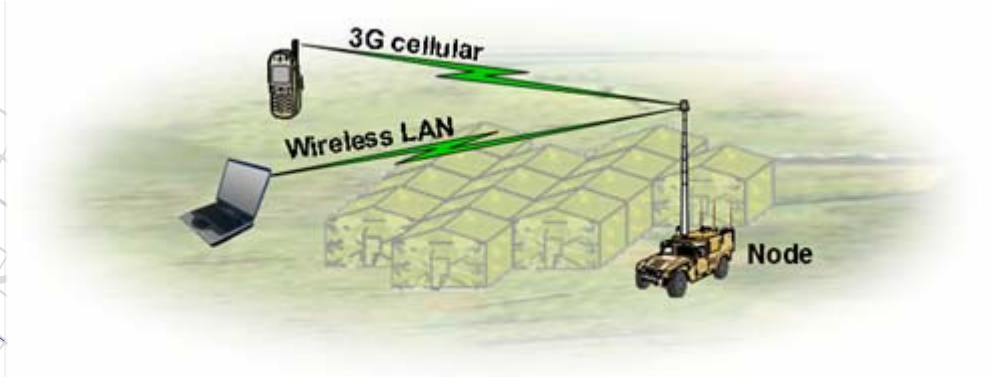
Global Information Grid (GIG) Transport Tiers

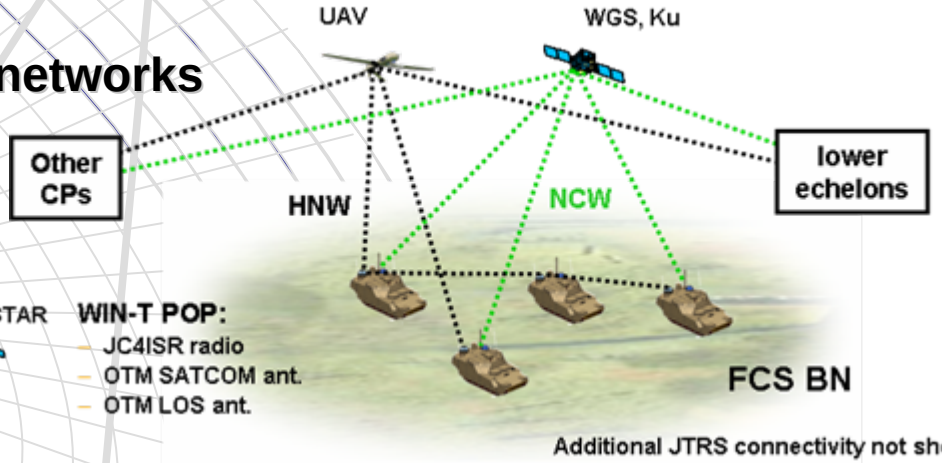


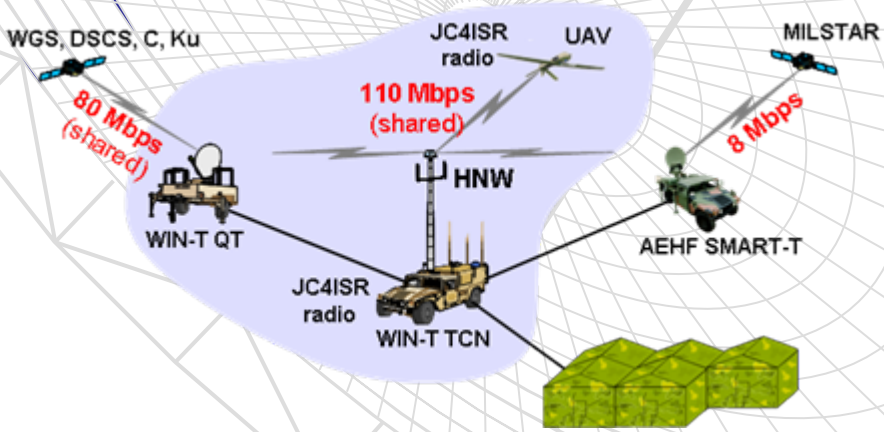
- GIG is an IP unified network having a BLACK routing and switching basis – tier in many respects as commercial networks

Key GIG Communications Network Component Programs

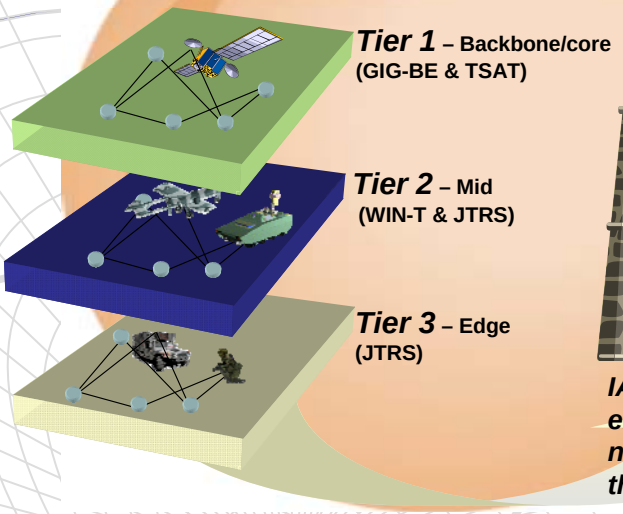
- DISN-NG (GIG-BE)
- SATCOM
  - TSAT & AEHF
  - WGS - WIN-T/JNN
  - MUOS
  - HC3, NMT, FAB-T
- Tactical terrestrial equipments / networks
  - JTRS
  - WIN-T
  - CDL and variants

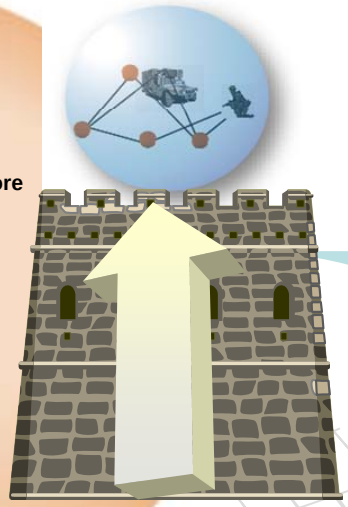






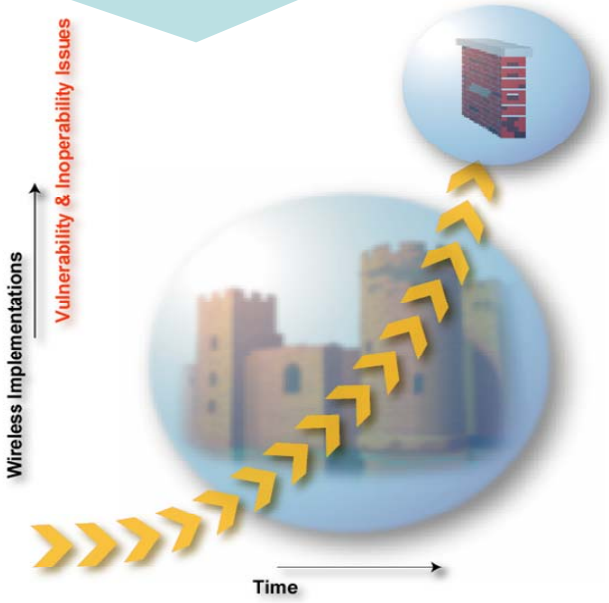
GIG Transport Tiers and IA





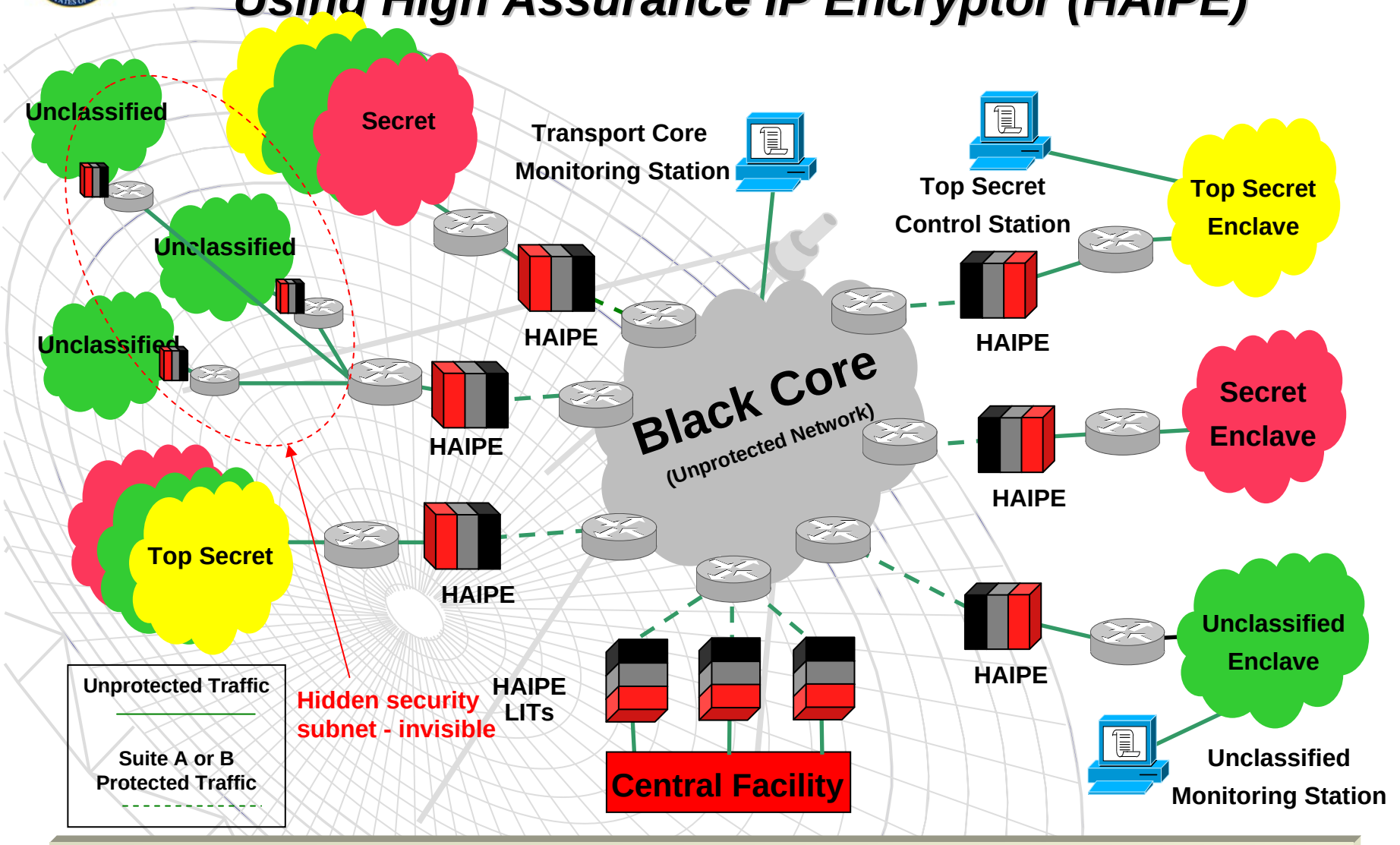
IA – Remains a major element to a unified GIG network – protection of the network & information

- **System IA challenges**
  - BLACK IP routing
  - Key management
  - Data and CDS access
  - Application assurance
- **Solution – Integrated IA**



The GIG is more than an all IP unified network - contains architectural security (IA) based on an integrated IA enterprise solution

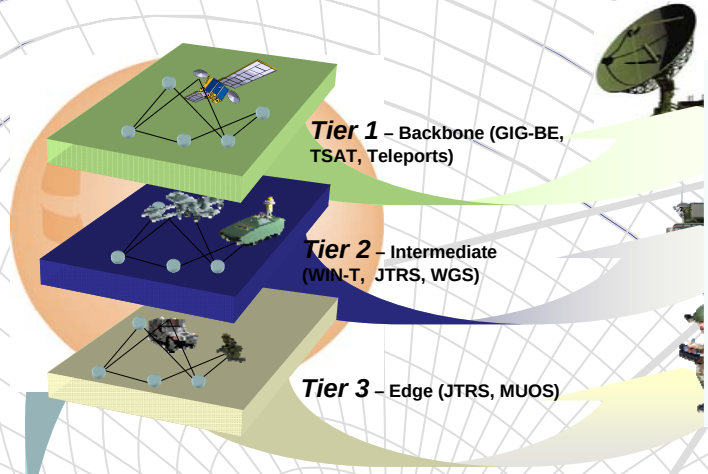
Securing The Network:
Using High Assurance IP Encryptor (HAIPE)

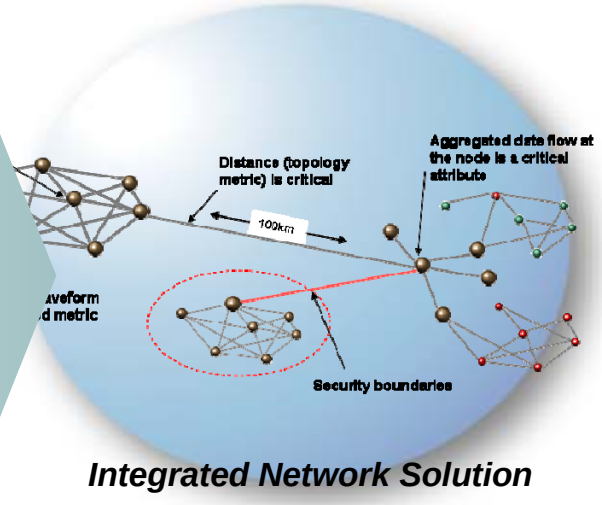


IA is not confined to the transport mechanism, but includes the key enterprise services including access and CDS considerations

Incomplete Network Solution - Losing Sight of the Network

Network Topology Relationships



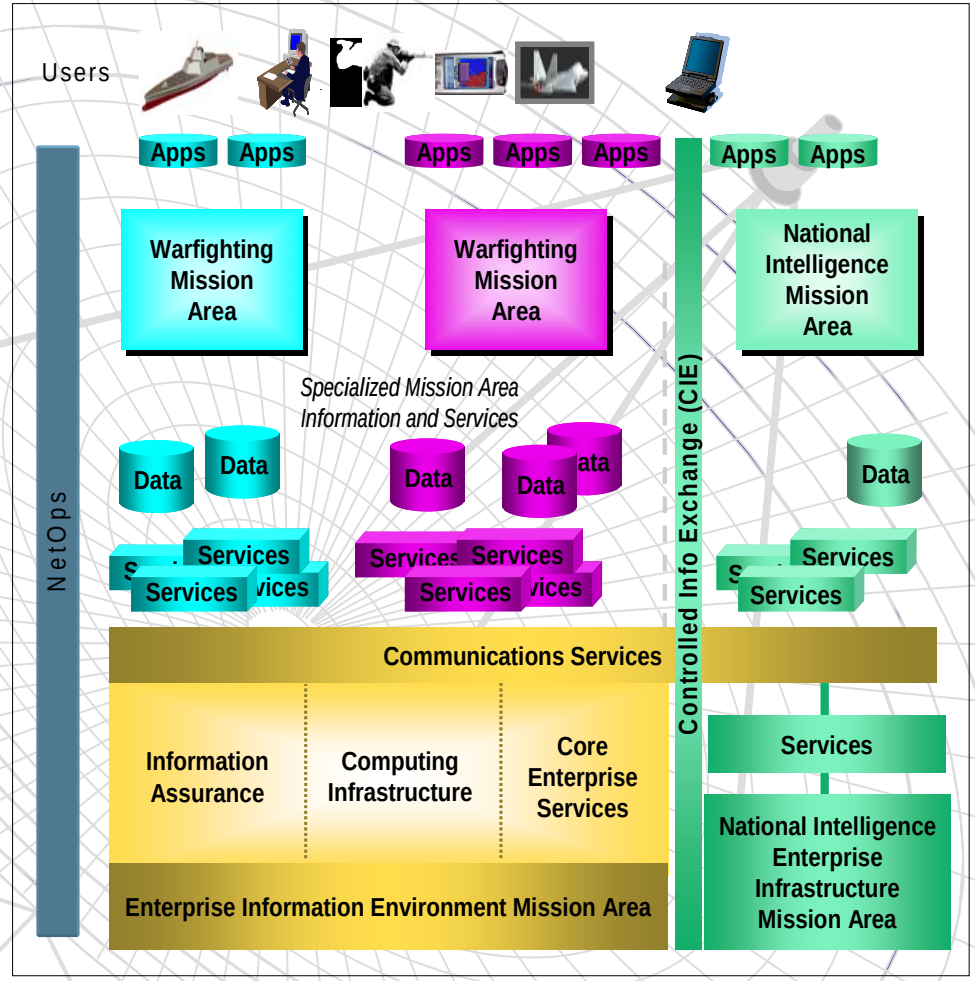


Integrated Network Solution

- Understanding the entire network is critical so to not compromise a cost and warfighter effective solution (Interoperability)
- Forcing the core and tactical edge networks to be addressed an integrated structure
- Network and Enterprise programs are NOT independent
- Network is part of the GIG – requires relationship to the services and applications, BUT information (data) is the critical element
- Interoperability with more than a single Service element or a partial force – total force including the all Services and coalition forces

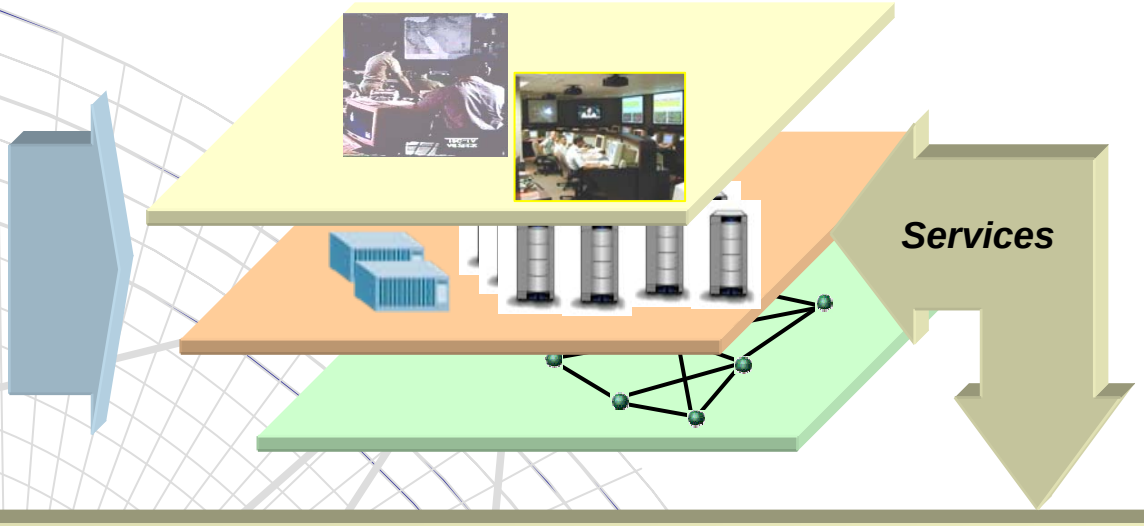
DoD Services Vision

DoD Net-Centric Environment (NCE) will evolve to an enterprise SOA



- **Supported by the required use of a common and shared infrastructure provided by the EIEMA**
- **Populated with mission and business services provided and used by each Mission Area**
- **Governed by a cross-Mission Area board chaired by the DoD CIO**
- **Managed via GIG NetOps**

Services - NCES Objectives

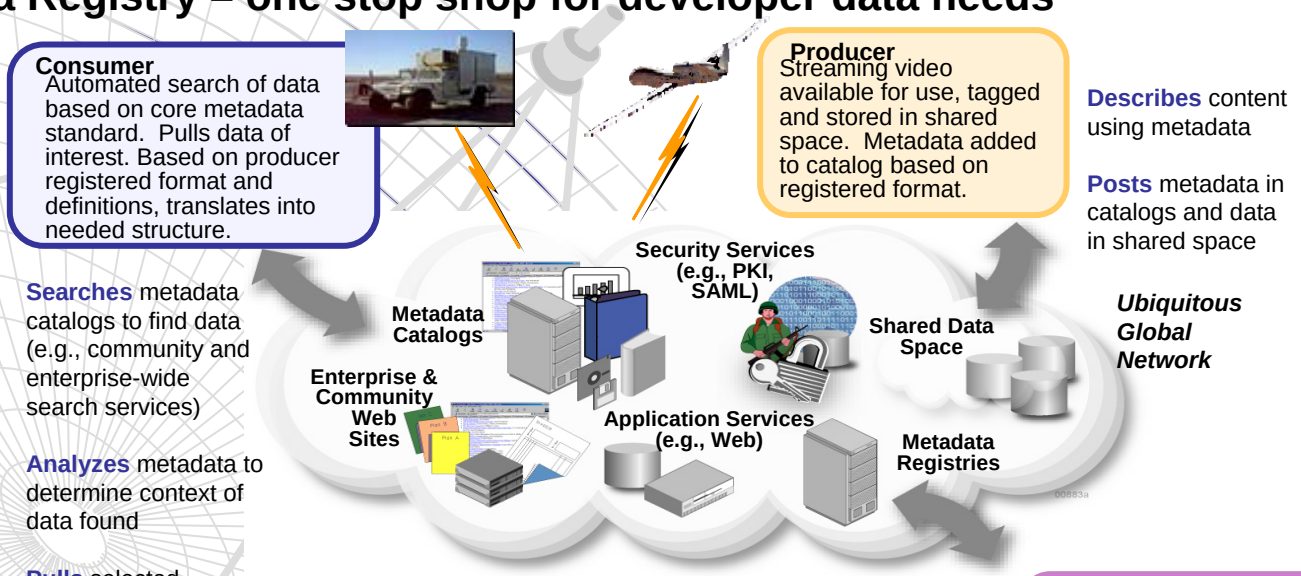


- Deliver capabilities-based service infrastructure for ubiquitous access to timely, secure, decision quality information by edge users
- Enable information providers to post any information they hold
- Enable edge users to:
  - rapidly and precisely discover and pull information resources
  - dynamically form collaborative groups for problem solving
- Provide security for, and coordinated management of, netted information resources
- Data interoperability versus application interoperability

Data Strategy and Enterprise Services Tier

Data Management

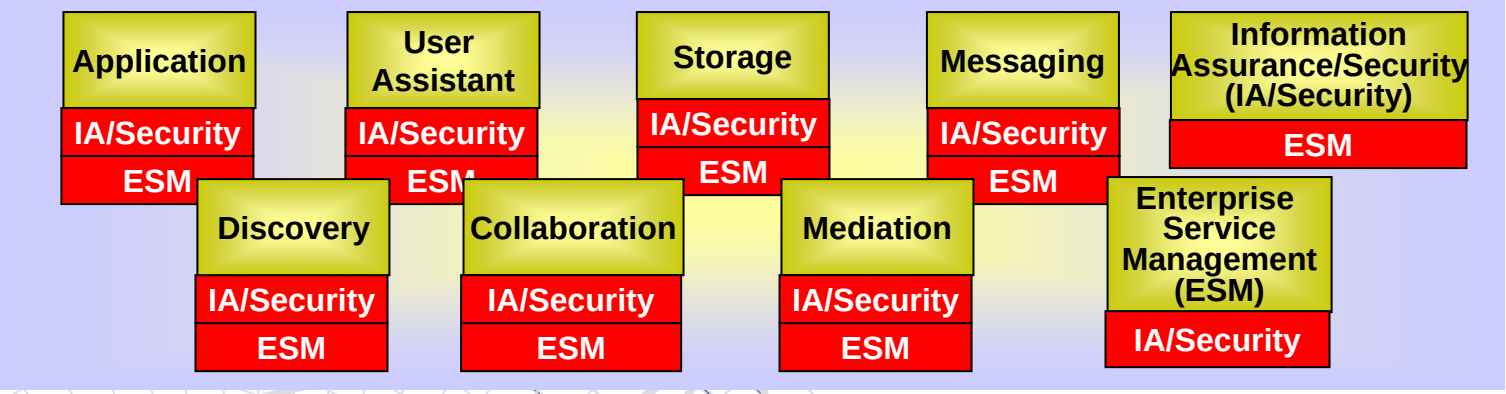
- **DoD Discovery Metadata Standard (DDMS) – enables visibility, understandability and trust for all posted data**
- **DoD Metadata Registry – one stop shop for developer data needs**



Enterprise Services

- **NCES - Storage, cross domain-IA security, collaboration, messaging, discovery, mediation, ESM, applications**

Core Enterprise Services Delivered by NCES



Application - The set of services necessary to provision, host, operate and manage the GIG ES assured computing environment.

User Assistant - Automated capabilities that learn and apply user preferences and patterns to assist users to efficiently and effectively utilize GIG resources in the performance of tasks.

Storage - The set of services necessary to provide on demand posting, storage and retrieval of data.

Messaging - Provides services to support synchronous and asynchronous information exchange.

Collaboration - services that allows users to work together and jointly use selected capabilities on the network (i.e., chat, online meetings, work group software etc.)

IA/Security - The set of services that provide a layer of Defense in Depth to enable the protection, defense, integrity, and continuity of the information environment and the information it stores, processes, maintains, uses, shares, disseminates, disposes, displays, or transmits.

Discovery - services that enable the formulation and execution of search activities to locate data assets (e.g., files, databases, services, directories, web pages, streams) by exploiting metadata descriptions stored in and or generated by IT repositories (e.g., directories, registries, catalogs, repositories, other shared storage).

Mediation - services that enable transformation processing (translation, aggregation, integration), situational awareness support (correlation and fusion), negotiation (brokering, trading, and auctioning services) and publishing.

ESM - services that enable the life cycle management of the information environment and supports the performance of the NetOps activities necessary to operationally manage information flows in the information environment.

Service Oriented Architecture

Invoke

(Bind)

Service Produc

Data and applications available for use, accessible via services. Metadata added to services based on producer's format.

Service Consumer

Automated search of data services using metadata. Pulls data of interest. Based on producer registered format and definitions, translates into needed structure.

- **Describes** content using metadata
- **Posts** metadata in catalogs for discovery
- **Exposes** data and applications as services

- **Searches** metadata catalogs to find data services
- **Analyzes** metadata search results found
- **Pulls** selected data based on metadata understanding

Publish

(Post)

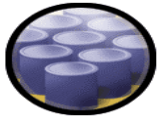
Enabled Int

Discover

(Find)

Service Registries

Messaging Services

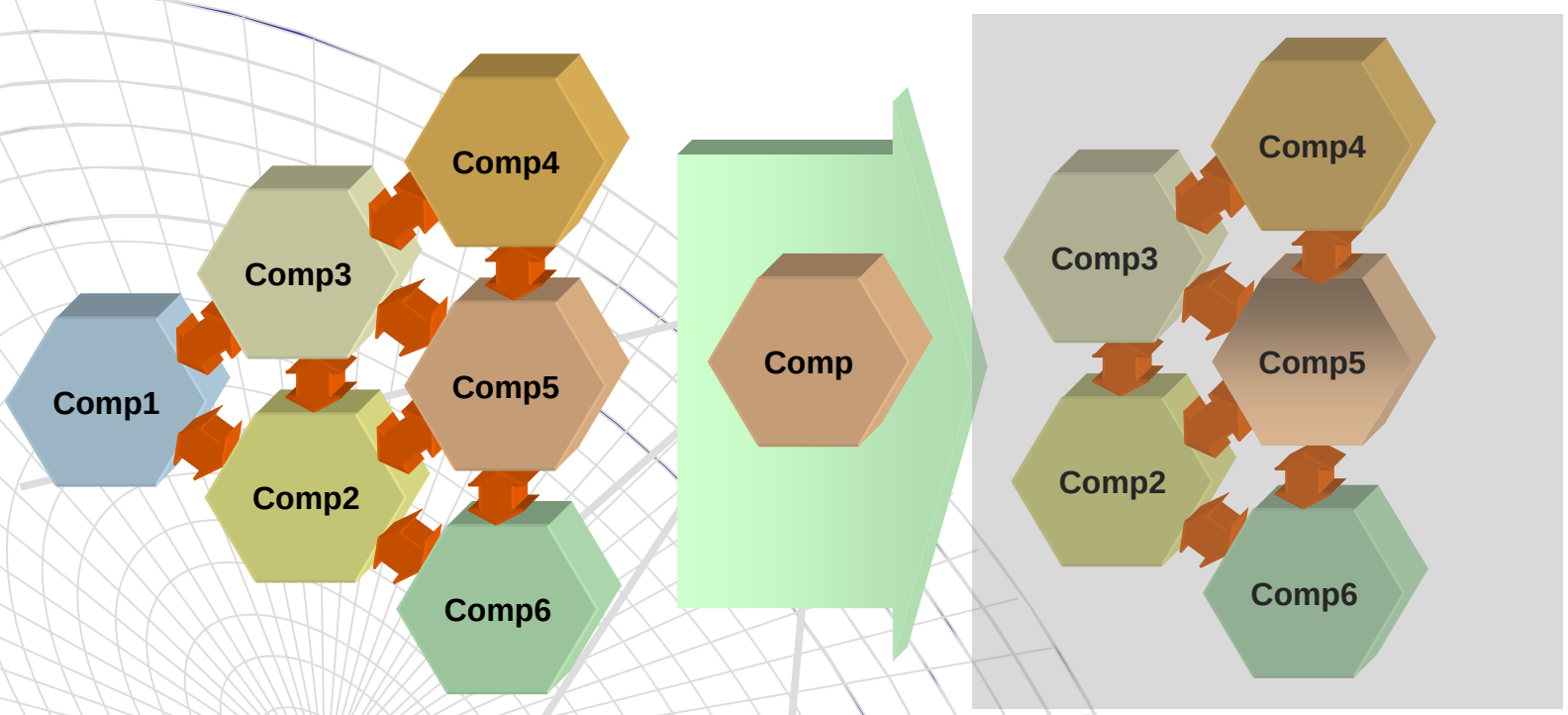


Data Services

Transformation Services

Arch

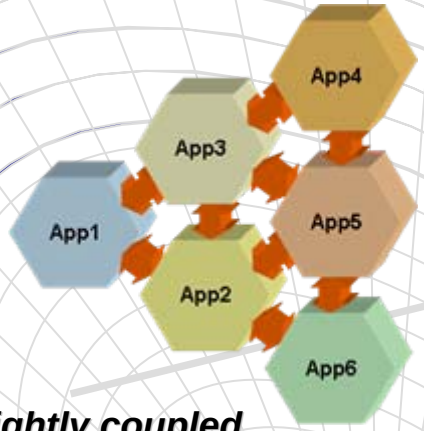
The Tightly Coupled Solution Issue



- Previous system approaches emphasized tightly coupled systems having closely specified interfaces and highly optimized processing flows
  - Unfortunately, changing a single component had effects on numerous other subsystem component
- The JNO is supporting the newer “Internet” approach of loosely coupled system demonstrating rapid adaptability and minimal interface interference/dependence

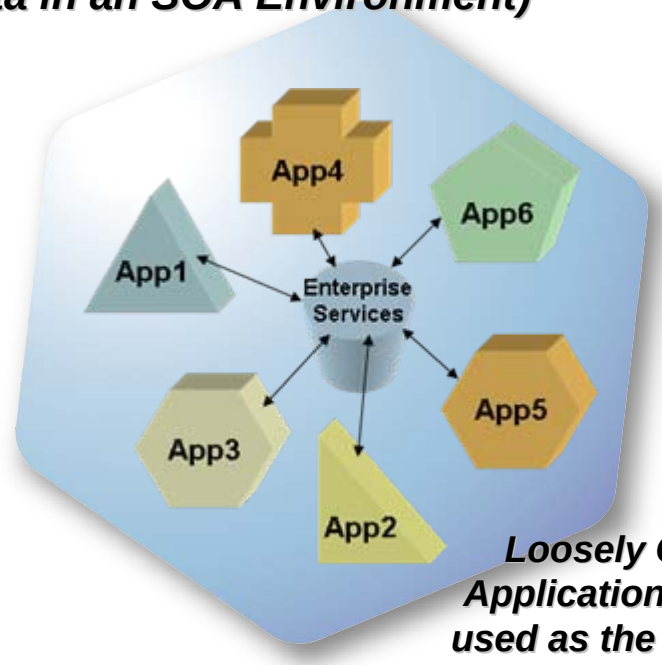
C2 Applications Using Data as the Integrating Element

(The Importance of Data in an SOA Environment)

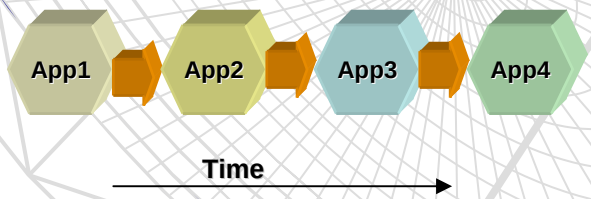


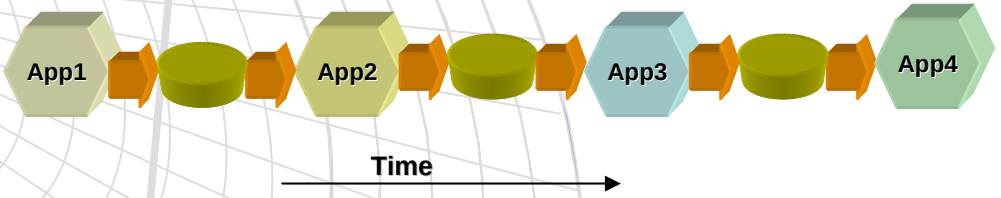
Tightly coupled applications with detailed and interactive interfaces

SOA



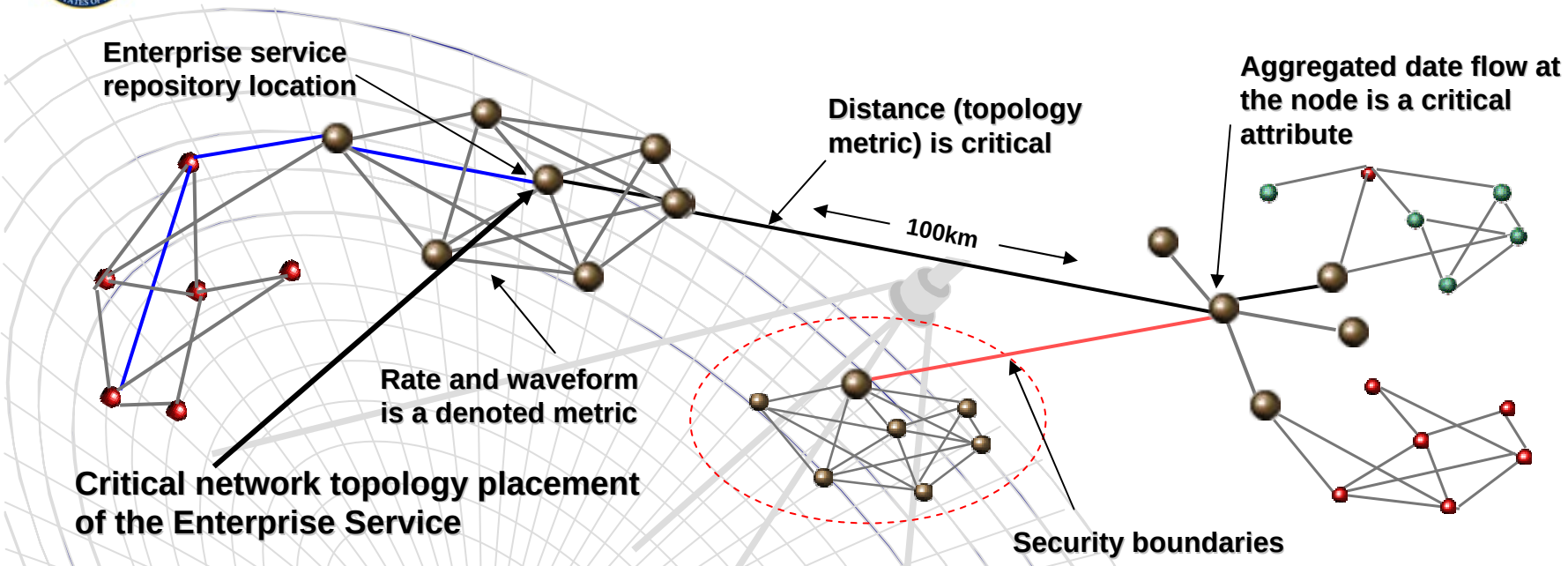
Loosely Coupled Applications – data is used as the integrating element





The use of data as the integrating element instead of fixed physical or database I/F offers extreme flexibility and adaptability

C2 – Network Topology Architecture



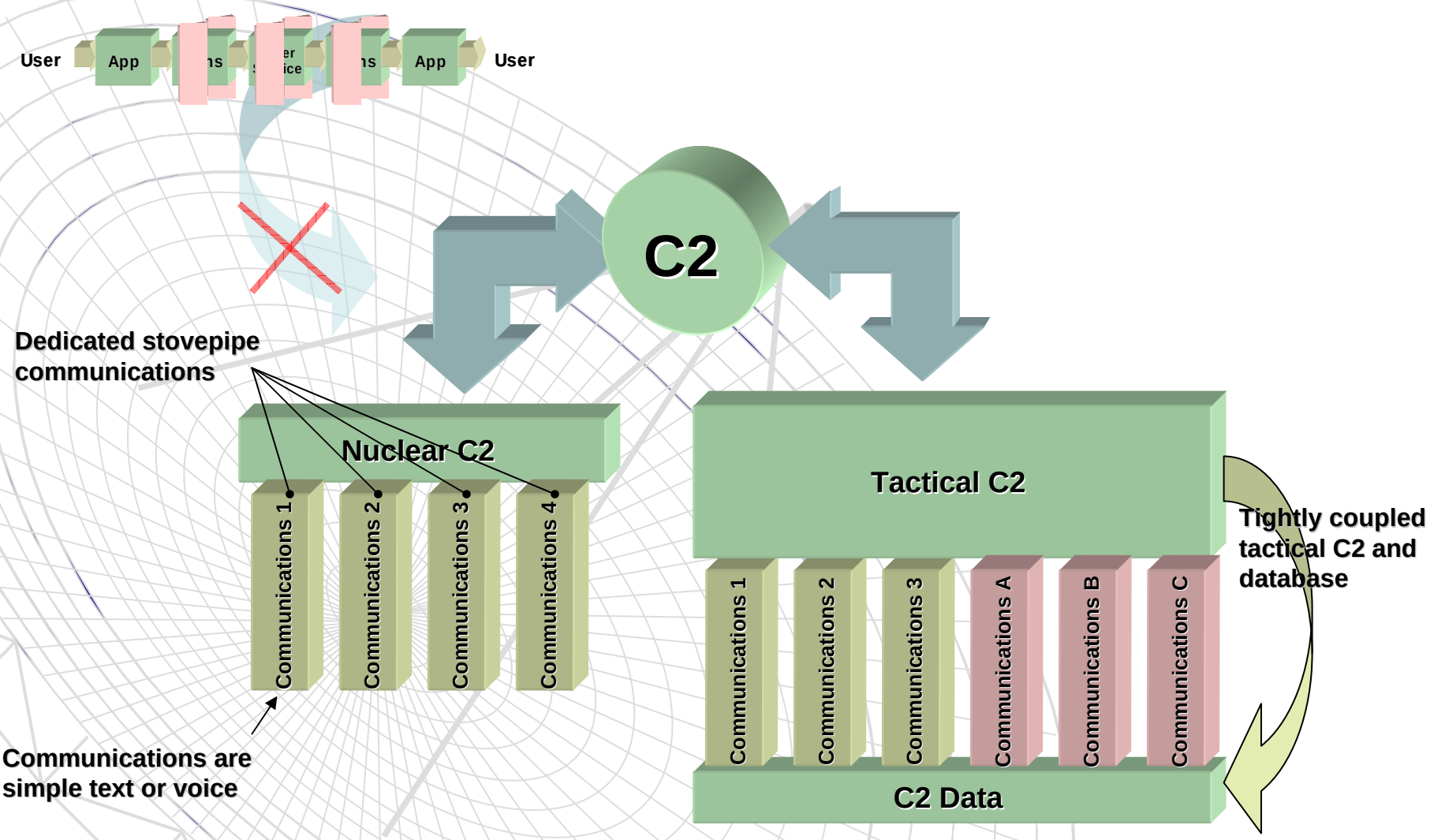
- Understanding the network topology is critical for determining the network performance and application – also to address the fundamental network requirements
  - Often only links solutions are determine without regard for the enterprise requirement
  - The aggregated nodal information flow in relationship to the enterprise services point provides a architectural construct to the network
  - Mobility of the nodes and the connectivity characteristics relative to path / link characteristics is required
- The network topology becomes an important tool for determining not only the network structure and engineering focus but addressing investment and programmatic interoperability issues
  - It is critical to place the topology in a chronological perspective having a minimal three slice views
  - IA including critical protected performance is essential to the successful objectives of a GIG implementation

Data Strategy

Foundation

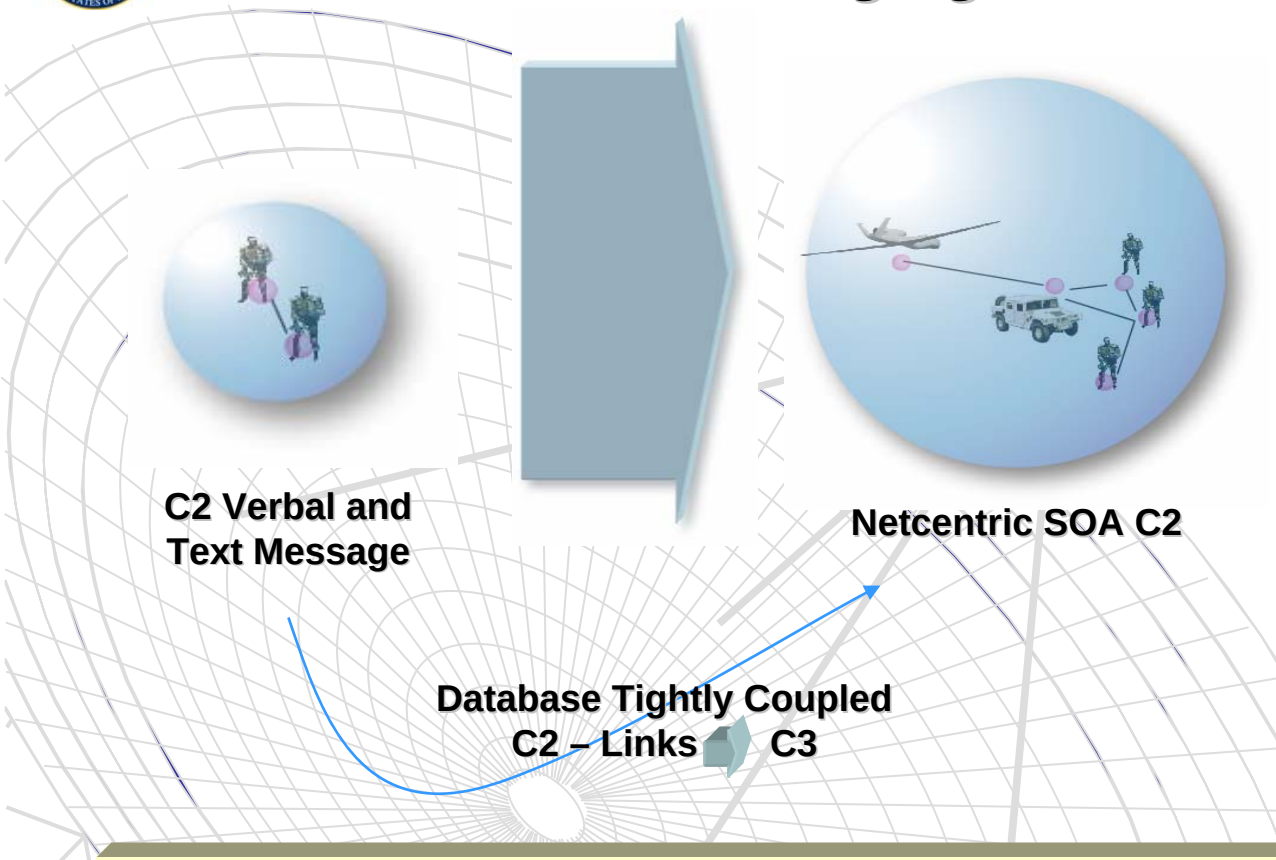
- Ensures data are visible, accessible, and understandable
- Accelerates decision making by having data where needed and when needed
- Accommodates known and unanticipated users
- "Tags" data (intelligence/non-intelligence; raw/processed) with metadata to enable discovery
- Requires data and services registries to describe, post and store
- Posts data to shared spaces for users to access based on identity and role
- Organizes around Communities of Interest (COIs) using a shared vocabulary to exchange information

Past C2 Views and Implementations



- Past C2 systems were tightly coupled – strong coupling to communications and database schemas

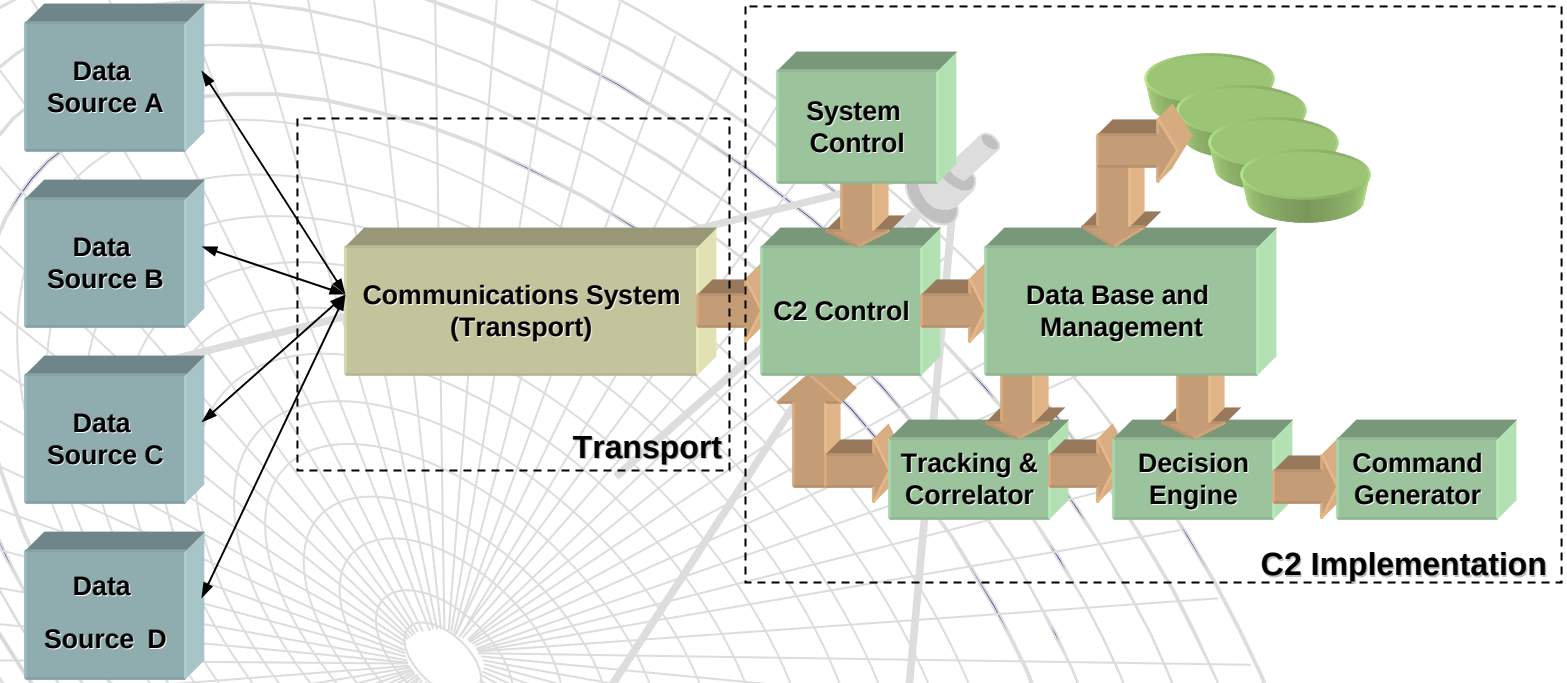
C2 Changing Environment



- Enabling connectivity
- Commercial implementation based on loosely coupled apps
- Data methodology enabling distributed repositories
- Service Level Agreements offered commercially

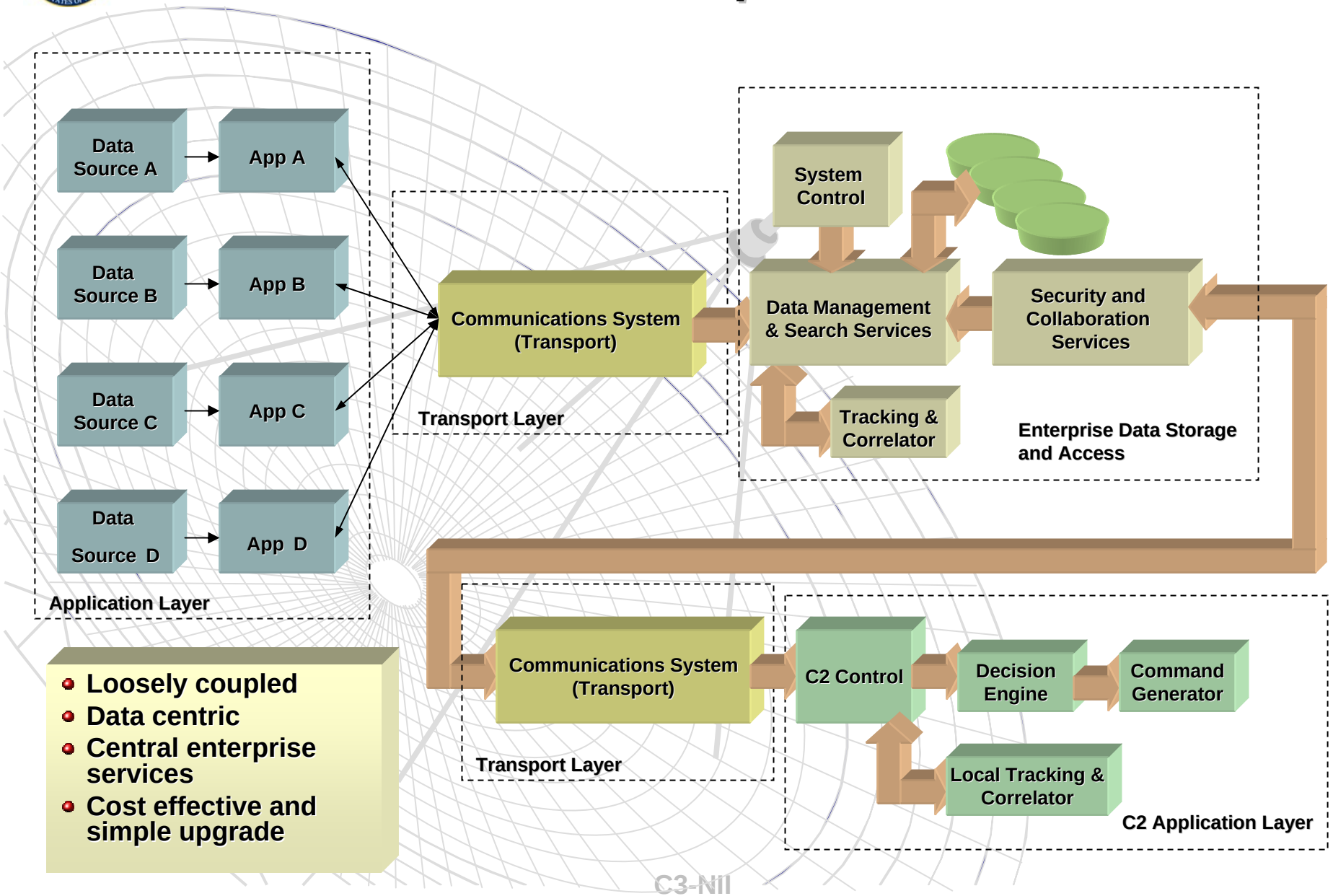
- **Past C2**
  - Given: voice/text capability C2 = voice or text message required C3
- **Netcentric C2**
  - Given: enabling connectivity C2 = applications required data access
  - Emphasis is on tagged data in a SOA structured implementation with SLAs
  - Treatment of C2 as an application with emphasis on data attribbute definition and data importance

Past Typical C2 Perspective



- Database is tightly coupled with the data sources through a dedicated communications subsystem.
- All of the C2 functional components are highly dependent and tightly integrated into a highly tuned system

Netcentric C2 Implementation



- Loosely coupled
- Data centric
- Central enterprise services
- Cost effective and simple upgrade

ECMs Support Mission Threads

Time Sensitive Targeting Mission Thread example

The Warfighter Owns and Shapes The mission thread

Guides ECM Development

Establishes Integration Environment

Operational construct For testing & assessment

Mission Thread

Find, Fix, Track, Target, Engage, Assess

Mission Thread

WHAT

FIND

FIX

TRACK

TARGET

ENGAGE

ASSESS

Evaluation Capability Modules (ECMs)

HOW

Geospatial Information Search ECM

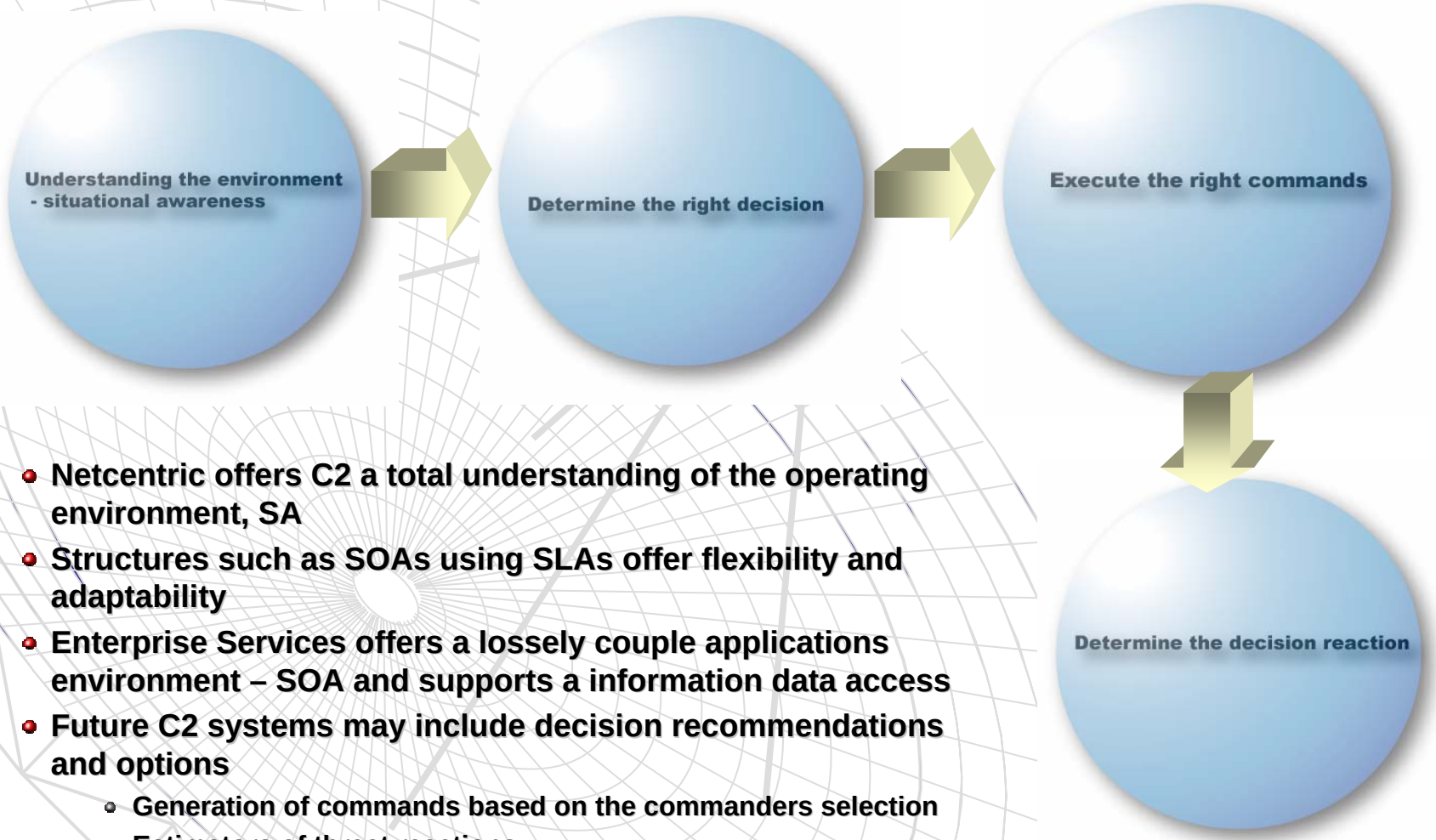
Operational Context ECM

Attack Analysis ECM

Weapons Target Pairing ECM

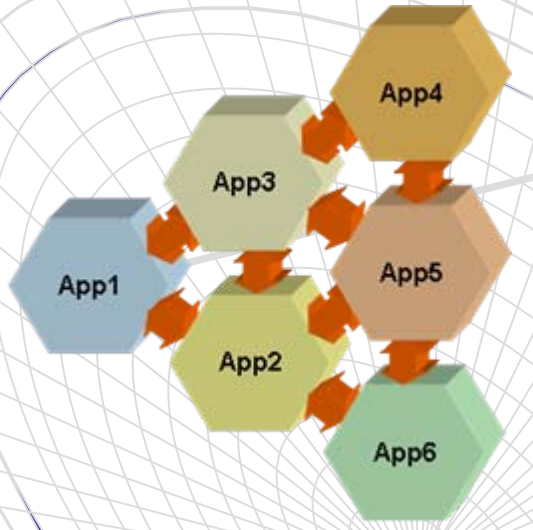
UAV Video ECM

Future C2 Implementations



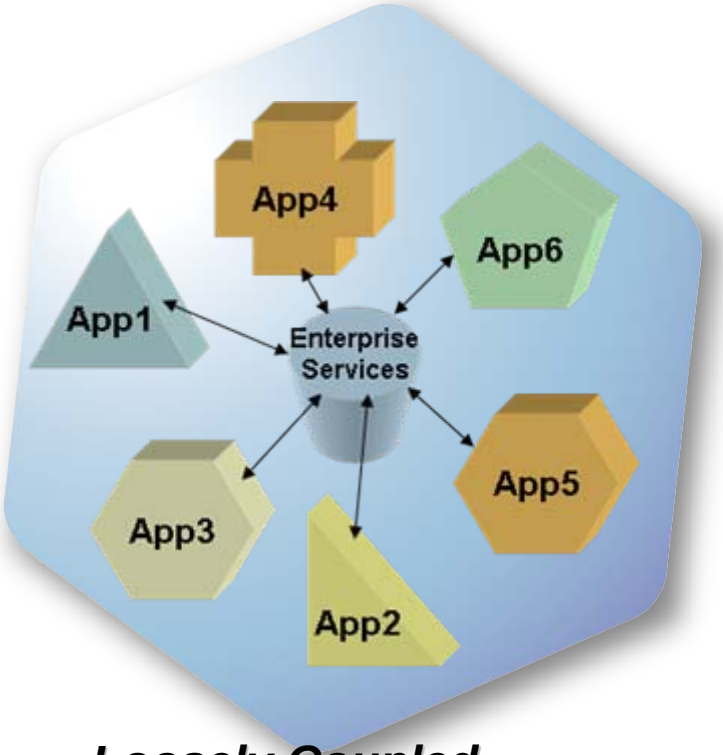
- Netcentric offers C2 a total understanding of the operating environment, SA
- Structures such as SOAs using SLAs offer flexibility and adaptability
- Enterprise Services offers a lossely couple applications environment – SOA and supports a information data access
- Future C2 systems may include decision recommendations and options
  - Generation of commands based on the commanders selection
  - Estimators of threat reactions

Applications Transformation to an SOA Environment



Tightly Coupled Applications

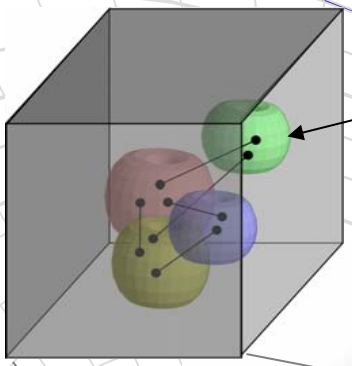
SOA Transformation



Loosely Coupled Applications

The transformation to an SOA has enabled a massively different approach to C2 and other applications as being demonstrated by NECC

Application Development Transformation



Evaluation Capability Modules (ECMs)

Operational Capability Modules (OCMs)

Sandbox

Development

Development Piloting

Operational Piloting

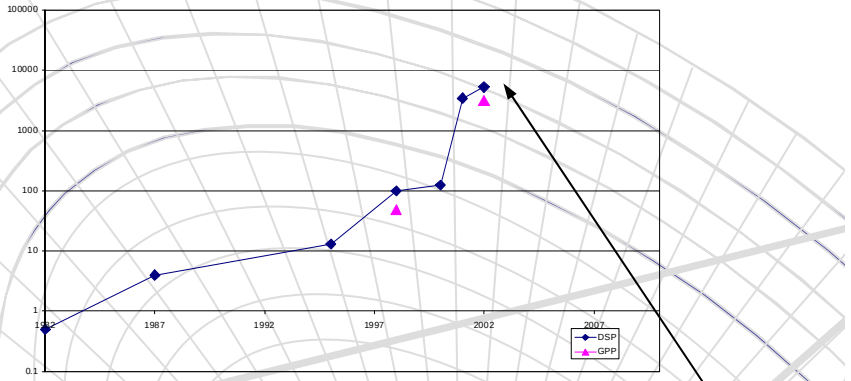
Operational Maturity →

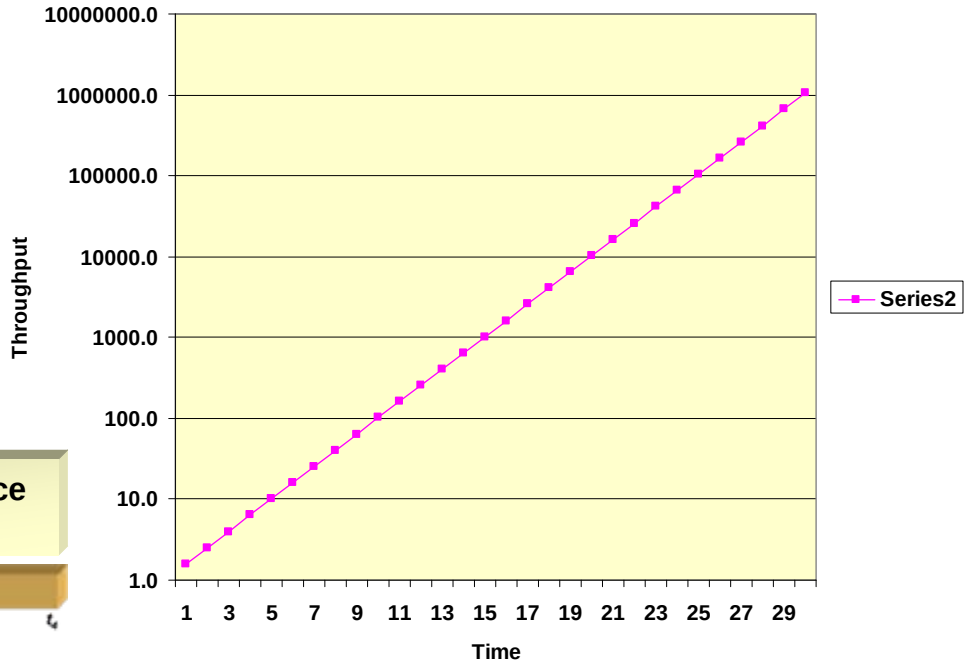
Operational System

FDCE

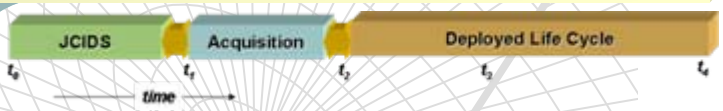
DISA is incorporating a different SOA development and test approach in cooperation with JC2 portfolio (JFCOM)

Commercial Turns vs. DoD Turns





Key – both DSP and GPP processors performance is increasing at ~10x every five to seven years



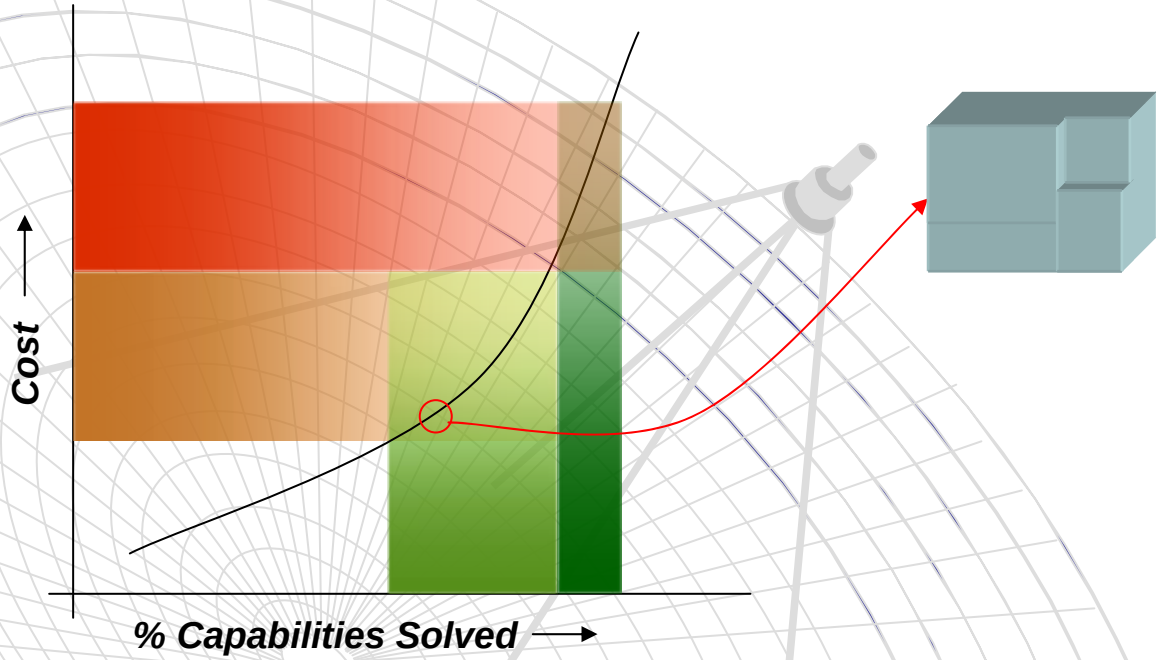
Begin **Acq Start (10x)** **IOC Start (100x)**

DoD Process **DoD Capabilities/Requirements and Acquisition Time**

Commercial Industry 1 2 3 4 5 6 7 8 9 10

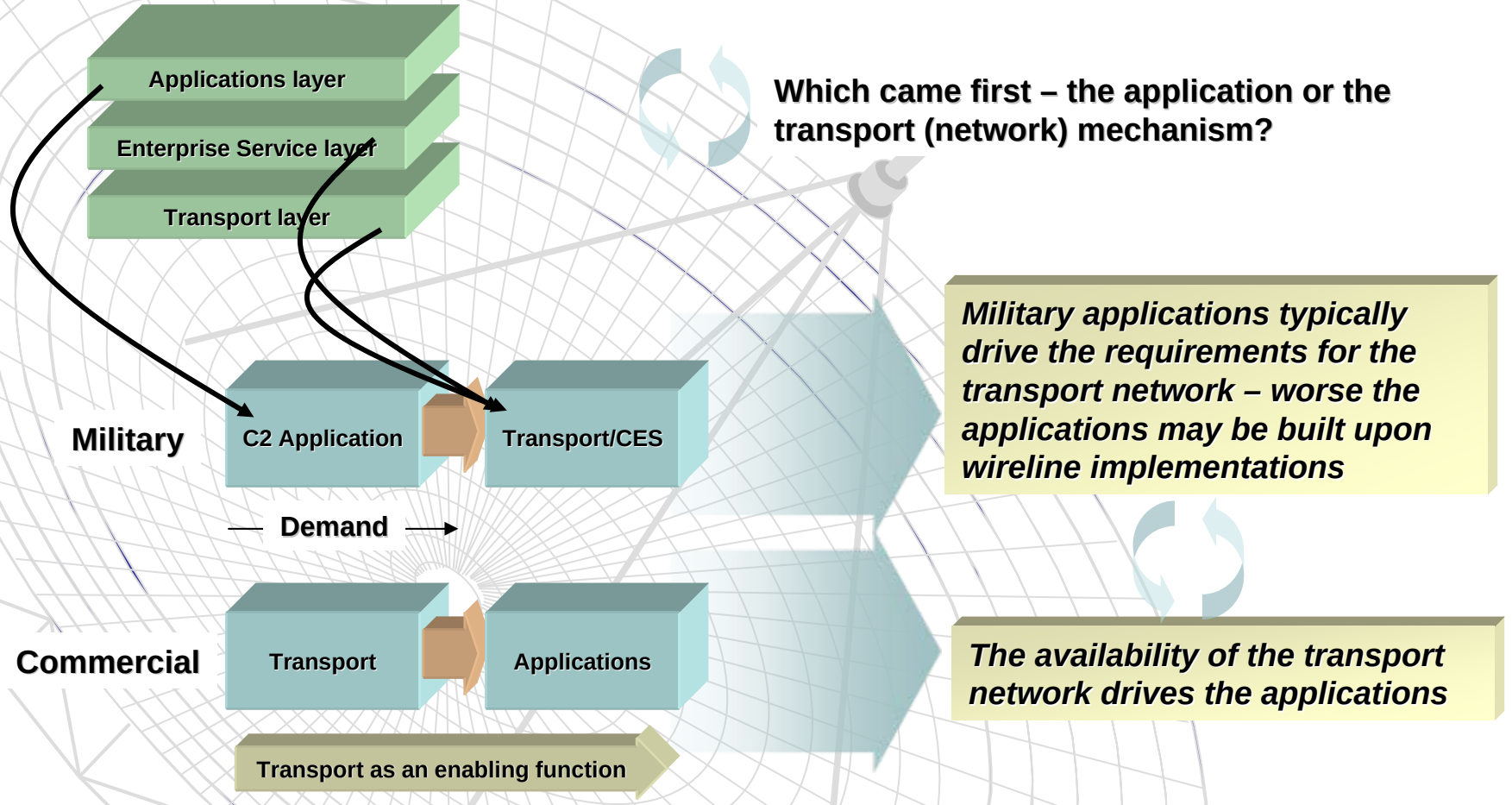
- ***The use of the same process for IT products as for major development platforms forces a development turns time producing products which are already behind the commercial product capabilities***

The Almost Existing Solution Issue



- Cost impact for capabilities – which capabilities
- Not all requirements are the same
- Cyclic assessment / design approach
- Where is the issue – distributed?
- Accuracy of the capability solution vs. cost analysis

Enabling Function Order Difference – Military and Commercial



- Commercial applications are driven by the availability of the network (transport) while military applications are not tied to the network as the enabling entity like the commercial equivalents

Summary

- GIG and Netcentric structures
- Enterprise Services and data strategy (access) is an enabler for future C2 applications
- C2 in the GIG is an application
- Transport is an enabler, but is separate from C2
- C2 is being transformed:
  - Loosely coupled SOA environments
  - Massive information and data access driven by COI and data tagging
  - Unified C2 enterprise approach
  - Enterprise Services and data represent the key solutions for future C2 implementations
  - New development techniques for inclusion of warfighter evaluation and assessments – based on commercial models
- New approaches in IT and GIG components