Grid Computing *and*
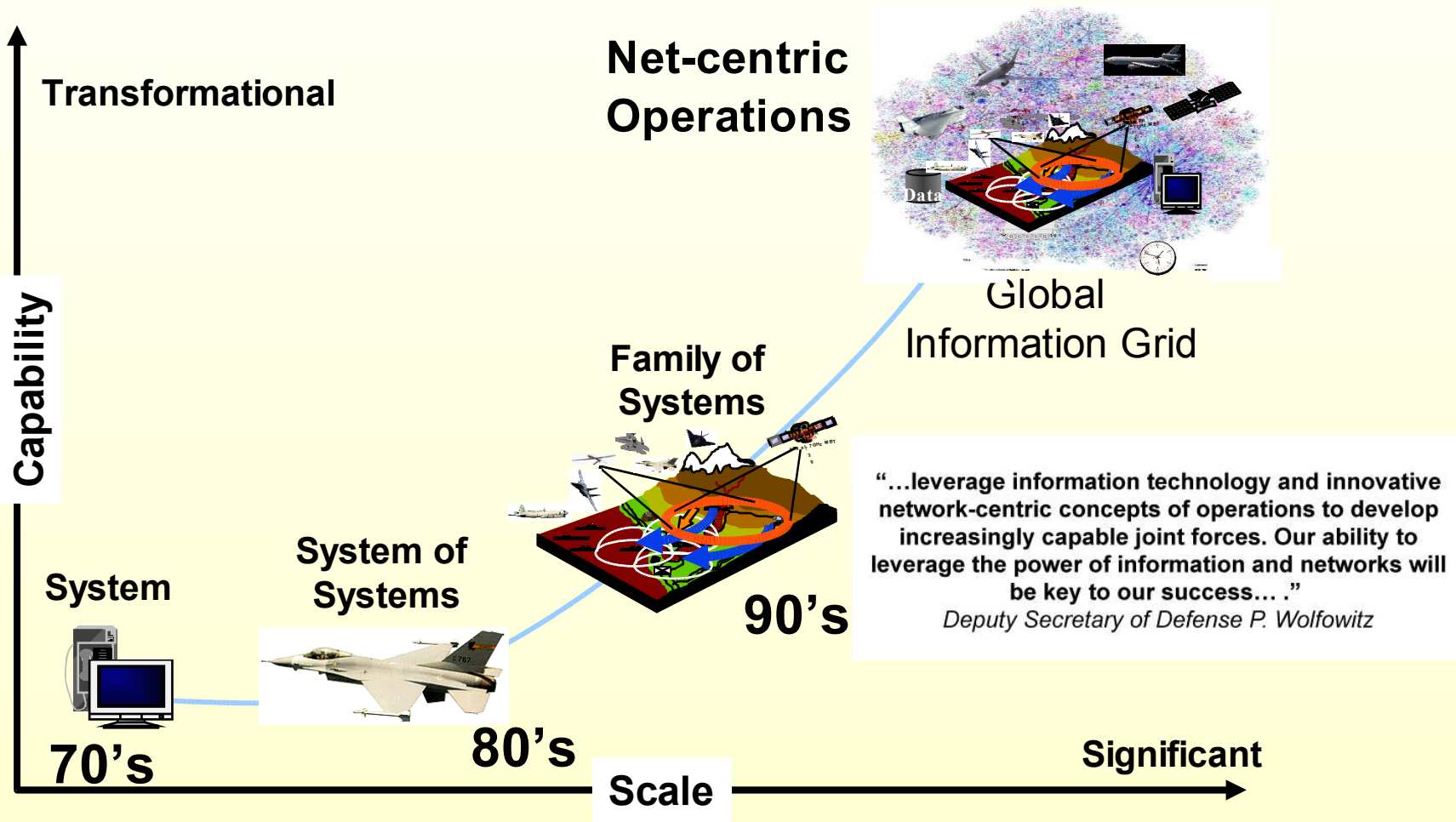
DoD's Global Information Grid (GIG) Enterprise Services (ES) Initiative
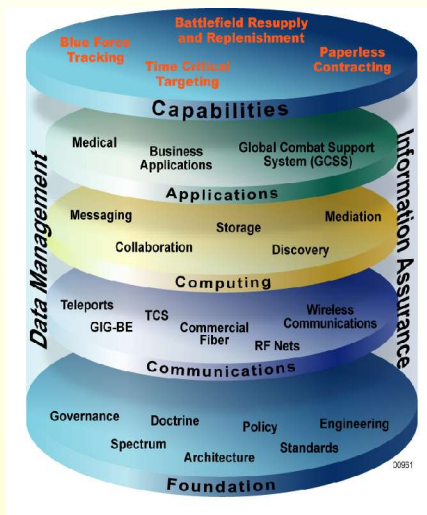
Net-centric Challenge & Payoff

Transformational

Net-centric Operations

Global Information Grid

Capability

Family of Systems

System of Systems

System

"…leverage information technology and innovative network-centric concepts of operations to develop increasingly capable joint forces. Our ability to leverage the power of information and networks will be key to our success… ."
Deputy Secretary of Defense P. Wolfowitz

90's

70's

80's

Scale

Significant

The Key Components of Net-Centric GIG Infrastructure

Foundation → **Provides an approach to manage, operate, and change the culture**

Communications → **Provides a comprehensive terrestrial and space network**

Computing → **Provides services to exploit the network and support applications**

Applications → **Provides tools needed for a capabilities based force**

Data Management → **Ensures all data is discoverable and understandable**

Information Assurance → **Protects the data and the network**

The Enterprise Infrastructure is Greater Than the Sum of the Components

GIG Enterprise Services Scope

Domain & COI Enterprise Services
include levels of services *beyond* the
9 Core, Net-Centric Enterprise Services

Domains and their COI: - Business - Warfighter - Intel
Plus: Cross-Domain COI
Plus: Expedient COI

GIG Services

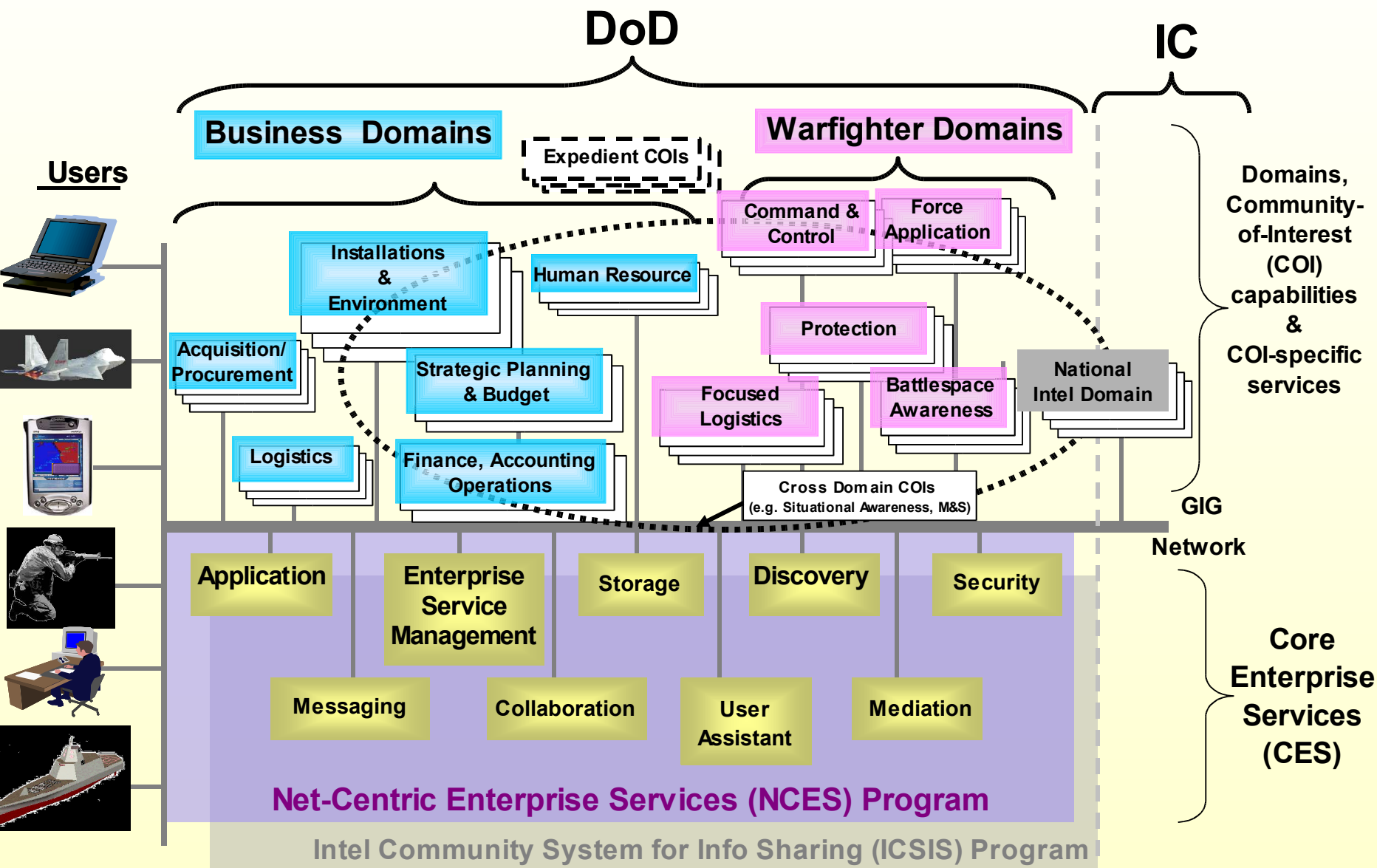**Net-Centric Enterprise Services** (NCES *Program*)

FY04-09: $380M

Milestone B, 2nd QTR FY04

Scope Includes:
- 9 Core Enterprise Services
- Application Program Interfaces (APIs) for CES

GIG Enterprise Services (GIG ES)

What is Grid?
(Our View)

- Parallel *and* distributed architecture that enables sharing, selection, & aggregation of geographically distributed Resources including:

  - **Computers** (PCs, workstations, clusters, supercomputers, laptops, notebooks, mobile devices, PDAs, etc)
  - **Software** (e.g., Service Providers vending content and expensive special purpose applications on demand)
  - **Catalogued data and databases** (e.g. transparent access to unit readiness, weapons characteristics databases etc.)
  - **Special devices/sensors** (e.g., reconnaissance satellites, UAVs etc.)
  - **People/collaborators**

- Deals in resource availability, capability, costs, and user Quality of Service (QoS) requirements

- Traditionally oriented toward efficient use of all available *processing* horsepower

Classes of Potential Grid Applications

- ***Service-Oriented Computing* (SOC):**
  - Market-based Utility Computing: New Net-Centric paradigm, New applications, New industries, and New business
- Distributed HPC (Supercomputing):
  - Computational science
- High-Capacity/Throughput Computing:
  - Large scale simulation/chip design & parameter studies
- Content Sharing (free or paid)
  - Sharing digital contents among peers (e.g., Napster)
- Remote software access/content vending services:
  - Application service provides (ASPs) & Web services
- Data-intensive computing:
  - Drug Design, Particle Physics, Stock Prediction...
- On-demand, real-time computing:
  - Medical instrumentation & Mission Critical
- Collaborative Computing:
  - Collaborative design, Data exploration, education

Grid Requirements

1. <u>Services</u> that enable execution and monitoring of jobs on resources under multiple control authorities

2. <u>Security</u> mechanisms that permit resources to be accessed only by authorized users

3. <u>Tools</u> to:
    a. Grid-enable applications
    b. Translate application processing requirements into requirements for specific computers, network applications hosting and data storage resources
    c. Perform resource discovery, trading, selection/allocation, scheduling and distribution of jobs as well as collecting and pubishing results

DoD View of how GRID applies to Transformation

- <u>Technical Objective</u>: Transform Defense Intranets into powerful, self-managing, virtual computers
  - Enable Processing Environment for full <u>Net-Centricity</u>

- Fits with DoD Global Information Grid (GIG) Vision
  - Next evolutionary step in Distributed Computing

- DoD's Current State:
  - VAST collection of heterogeneous systems, just beginning to share communications and computing resources on Wide Area Nets

- Coming Soon: GIG Enterprise Services (GES)
  - Provides ubiquitous ***Service-Oriented*** access to DoD data
  - Allows rapid, efficient coupling of legacy transactions systems *and* new Warrior or Business applications
  - ***Will begin to address globally distributed computing issues***

Grid Computing and GIG ES

- ## Same Service-oriented, Market-driven model
    - Aimed at efficient use of all available Processing Horsepower
    - Processing resources not pre-allocated!
    - Able to discover free horsepower and harness on demand to do jobs
    - Defense requires hybrid of dedicated and allocable resources

- ## GIG Core Enterprise Service (CES) Grid focal points:
    - Discovery
    - Storage
    - Application Hosting
    - IA/Security
    - Enterprise Services Management (ESM)

Thinking about Specifics
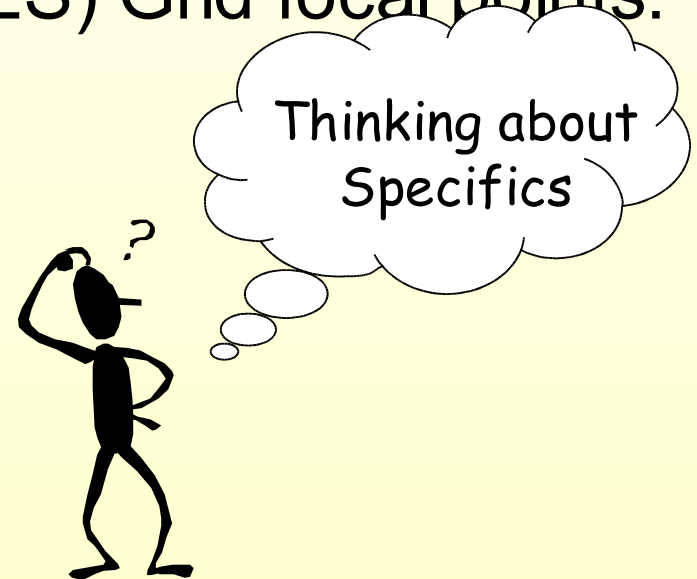
Grid Issues

- Many different definitions; meaning still in flux
  - Marketing (Hype) versus technical (products)
  - Scope
- Control and Security in abstracted Hardware layer
  - Who decides on priorities and how?
  - How to monitor what's happening where?
  - Better on closed, Classified Defense networks than Internet?
- Lots of competing players
  - Commercial directions, market leaders etc. unclear
- Grid Requirements re: Networks as Computers
  - Current concept falls short of full-blown OS
  - Now acquiring Enterprise (Net-centric) Services
  - Where is the sweet spot?

Summary and Conclusions

- Grid Computing = <u>next generation environment</u> to address large scale processing problems
- Fits with GIG Enterprise Services concept . . . *BUT*
- Computing resource management is extremely complex and immature
  - Services must be adaptive, scalable, competitive, and QoS-driven
  - Significant control and security issues
  - Not appropriate for every problem
- Need:
  - Market (vice Command) computing resource allocation and regulation *in non-profit government context*
  - Easy to use tools for creating and managing Grid-enabled applications