CMMI® for Acquisition and CMMI® for Development: Potential Favorable Contributors to the Rapid Acquisition of IT Systems in Support of Public Law 111

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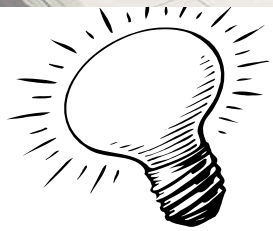
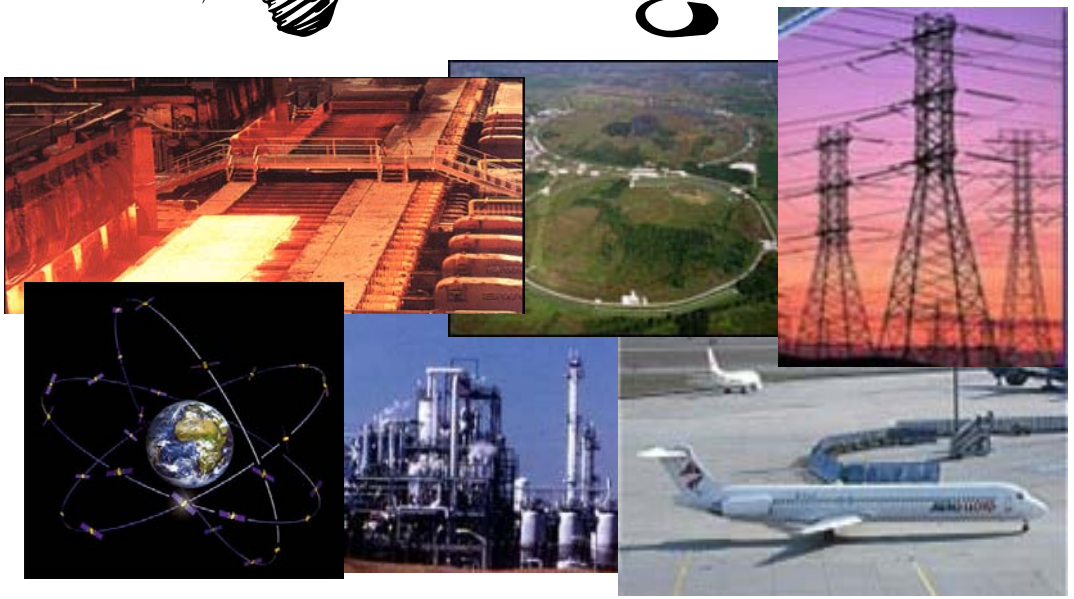
Overview

- Background
- Overview of Proposed Changes
- Challenges
- Summary





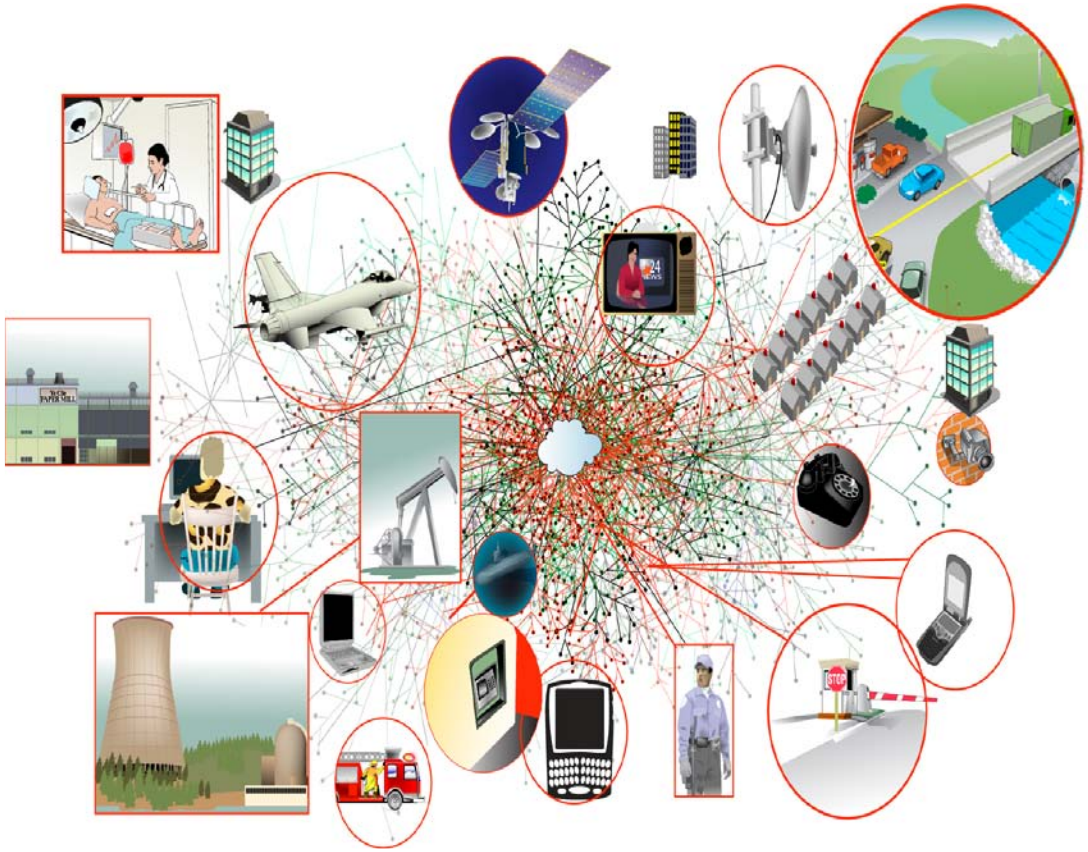
This presentation focuses on the *past, present,* and *future* of IT acquisitions

Source: SEI

What is the Information Technology (IT) Environment?

Includes all

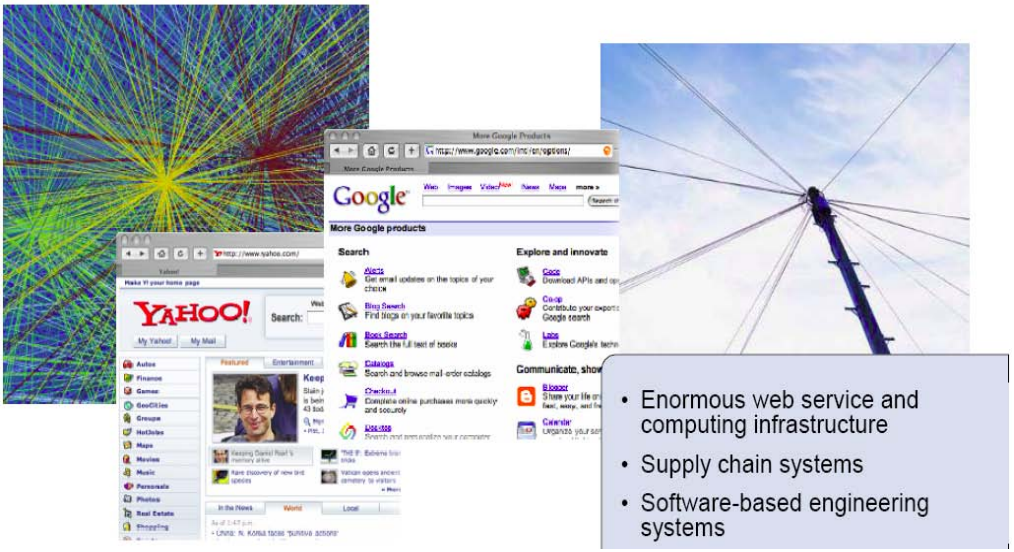
- System of Systems
- Architecture
- Services
- Networked Hardware/ Platforms
- People who digitally connect to cyberspace



Often difficult to distinguish IT systems from other types of systems because they are networked systems!

Source: SEI

Examples of Emerging Ultra-Large IT Systems

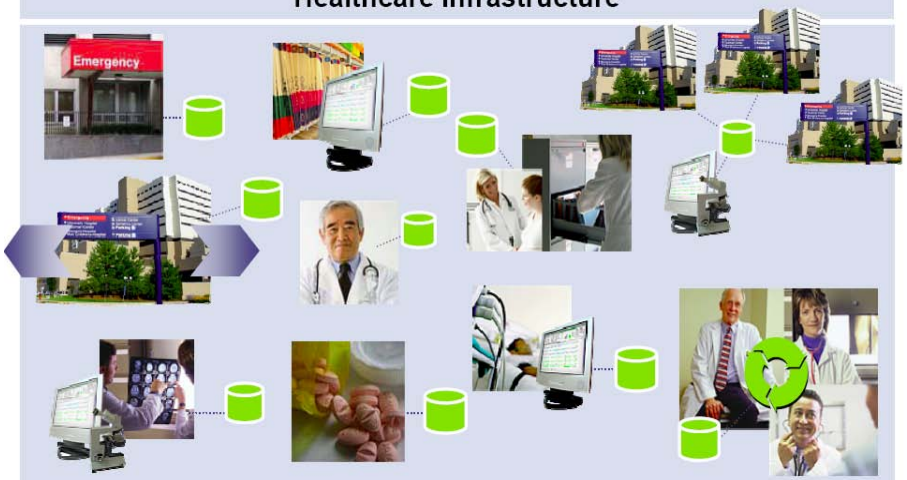


- Enormous web service and computing infrastructure
- Supply chain systems
- Software-based engineering systems

Networked Automobiles

Homeland Security

Healthcare Infrastructure



Source: www.sei.cmu.edu/uls

Optimizing Information Technology*

- Adaptable IT Infrastructure Center on
  - Cloud Computing
  - Common Services
  - Network/Desktop Consolidation
- Streamlined IT Acquisition Processes 
- Robust Cyber Security Implementation
- Information Sharing Approaches
- Information Assurance
- Renewed Focus on Using Facilities on Reducing Overall Environment Consumption (e.g., power, space, cooling)

* Partial List

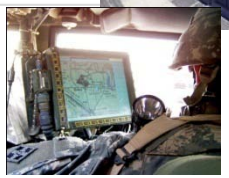
Sources: Department of Defense (DoD) Chief Information Officer (CIO) Campaign Plan Baseline (Oct, 2011) and SEI Discussions with CIOs (2010)

Acquisition: IT Systems are Different from a Weapon System — and Critical to Enable a more Resilient Cyber Environment

Weapon Systems

- Weapon platform centric
- Military unique requirements
- Development of military-unique, breakthrough technologies
- Development cycle of decade or more
- Production decisions for unique hardware
- Service lives extending into decades

IT Systems

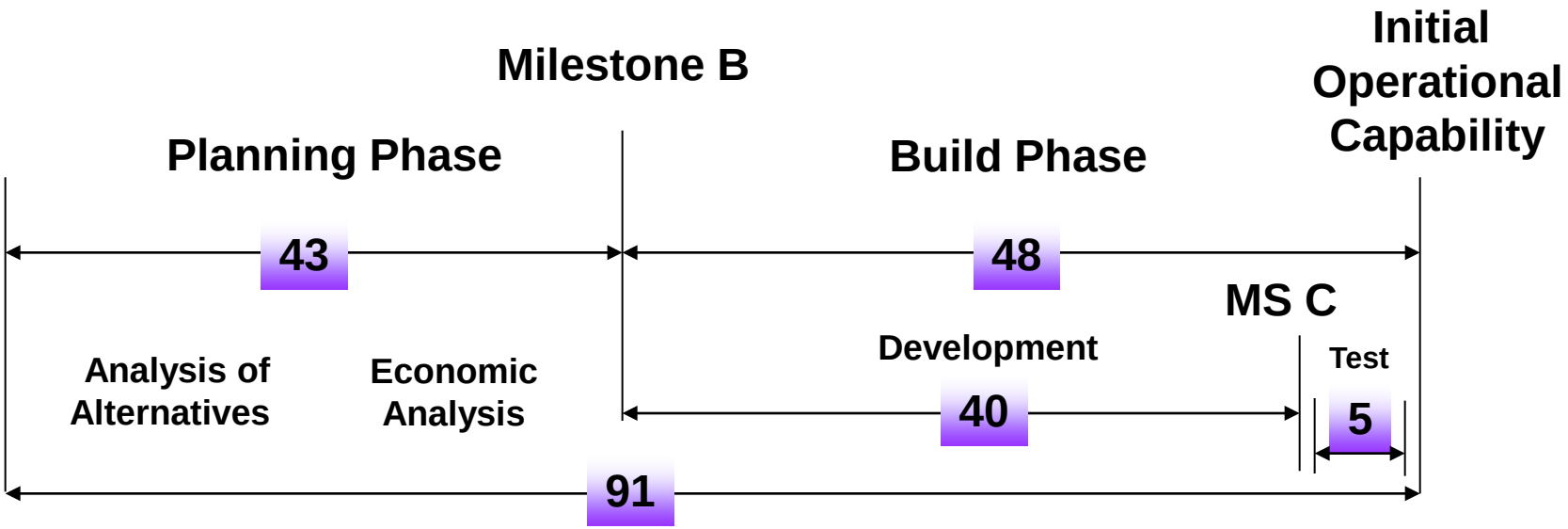


- Enterprise network centric
- Adapt commercial capabilities for military needs
- Leverage commercial technologies
- Technology cycle 12-18 months
- Procure commodity hardware
- Periodic technology refresh to avoid obsolescence

Demand Different Acquisition Life Cycles and Processes

Sources: IT Acquisition Reform Task Force/MITRE Corporation

DoD IT Acquisition Cycle Time - 32 MAIS



Cycle Time Driven by Processes Developed to Counter a Cold War Adversary In Industrial Age Society

Source: Defense Science Board Report, March 2009

The Opportunities

MAIS Program Avg = 91 Months

Adaptability

Speed

Agility

Previous DEPSECDEF Bill Lynn established a new goal: 18 months

Source: A New Approach for Delivering IT Capabilities in DoD, Report to Congress, November 2010

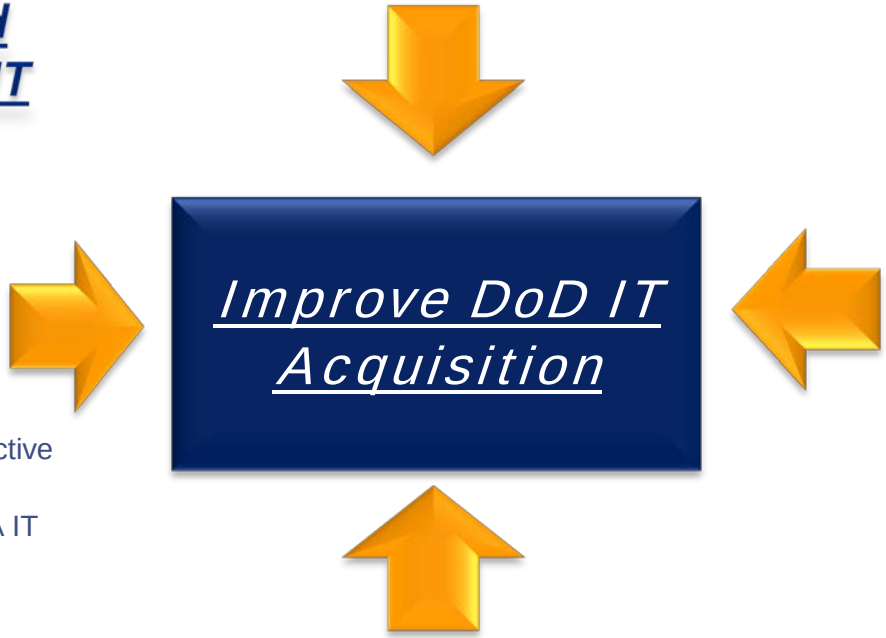
IT Acquisition Reform Imperative

Congress

- **Develop and Implement a new process for Acquiring IT (FY10 NDAA* Section 804)**
- **HASC** Panel on Defense Acquisition Reform Finding and Recommendations (23 March 2010)**

Widely documented Problems with DoD IT Acquisitions

- Defense Science Board
  - Jan 09 – Integrating COTS
  - Mar '09 – IT Acquisition
  - Apr '09 – Fix the Acq process
  - Jul '09 – Rapid Acquisition
- Industry Associations
  - AFEI, TechAmerica,
- National Academies - Achieving Effective Acq of IT in DoD 2010
- Business Leads – Aug '08 Joint DISA IT Review



Federal CIO

25-Pt Implementation Plan to Reform Federal IT Management

Vivek Kundra, U.S. CIO, December 9, 2010

DoD Senior Leadership Vision

"First step [for DoD to succeed in delivery of IT] is to acknowledge that simply tailoring the existing processes in not sufficient" **(National Research Council, DEC 2009)**

NDAA: National Defense Authorization Act ; HASC: House Armed Services Committee;
AFEI: Association for Enterprise Information; DISA: Defense Information Systems Agency

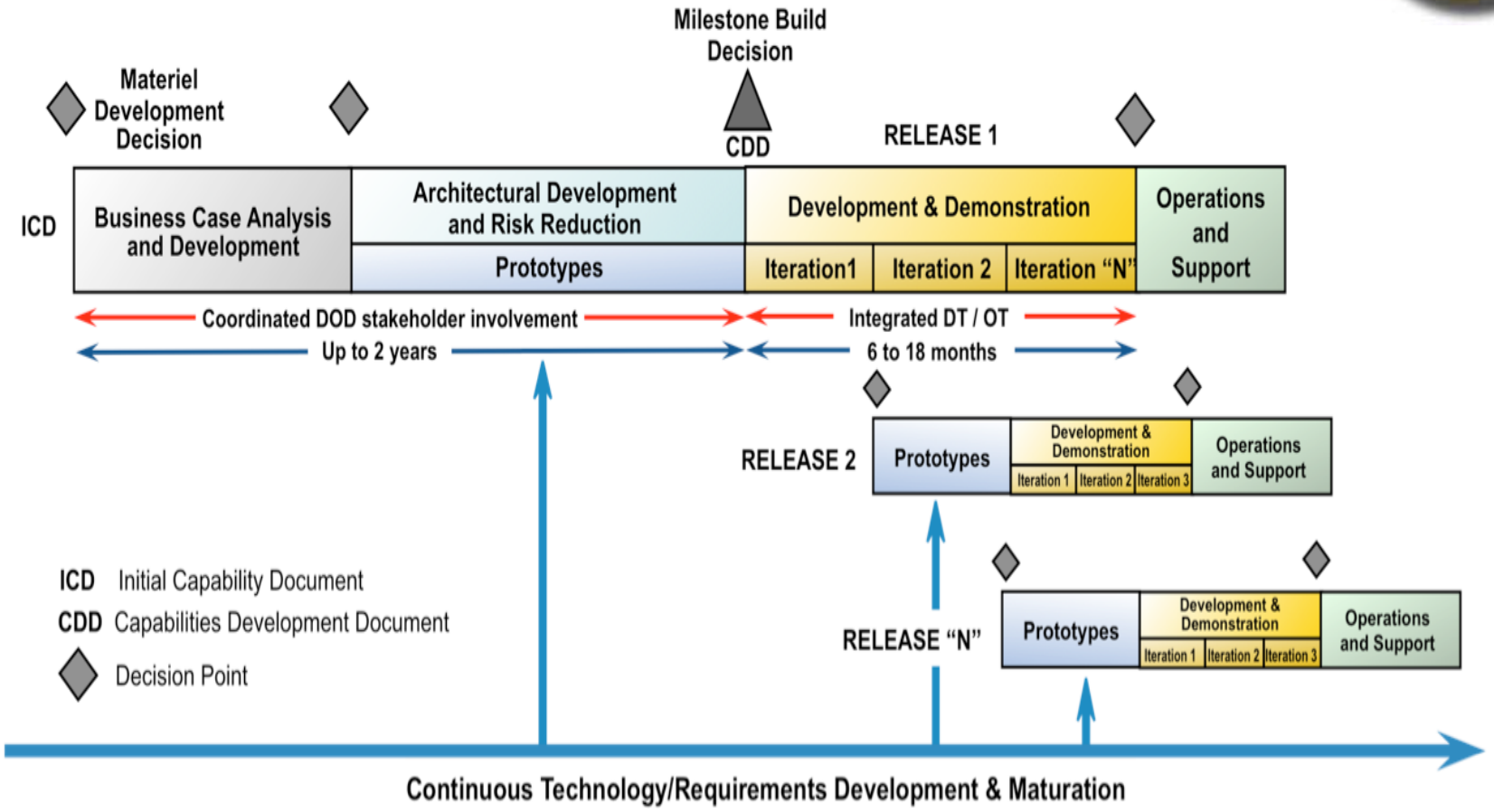
Defense Science Board Report & Public Law 111 (Section 804) 2010 National Defense Authorization Act

Selected Statements (paraphrased):

- NEW ACQUISITION PROCESS REQUIRED -The Secretary of Defense shall develop and implement a new acquisition process for information technology systems

- To the extent determined by the Secretary, be based on the recommendations in Chapter 6 of the March 2009 report of the DSB Task Force on DoD and Procedures for the Acquisition of Information Technology

A New Acquisition Process for Information Technology



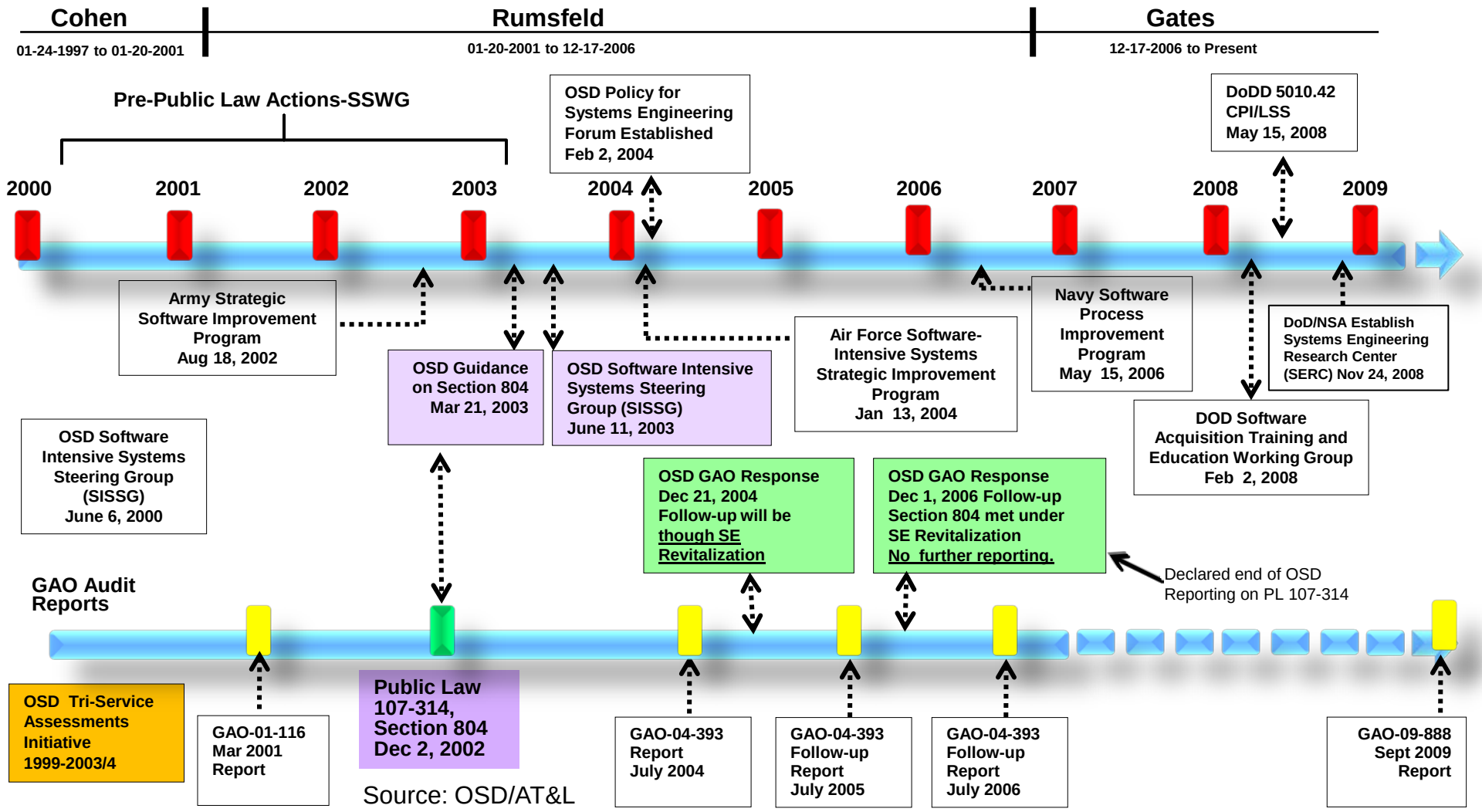
Source: Defense Science Board Report, March 2009

Guiding Principles

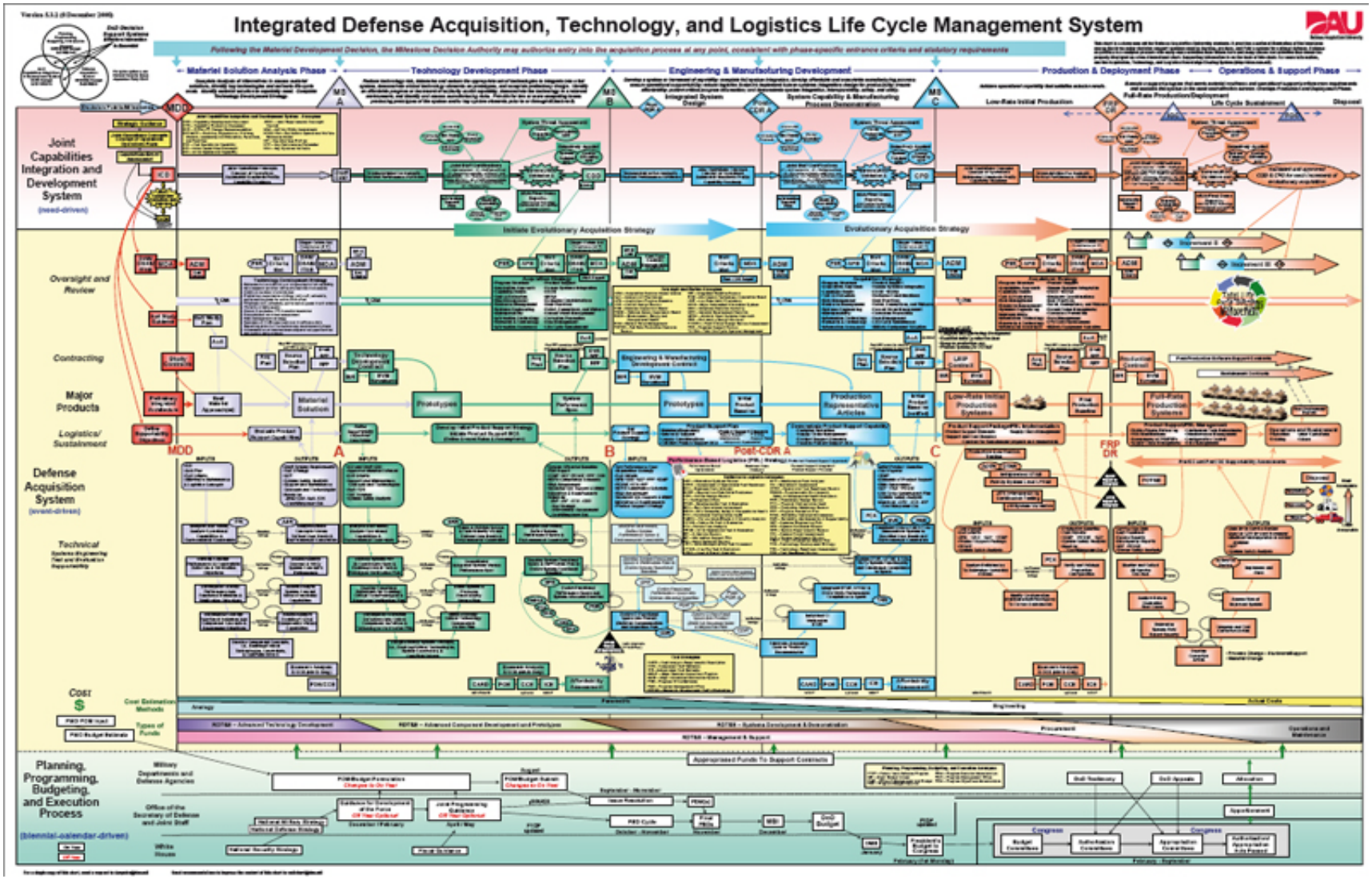
1. Deliver Early and Often
2. Incremental and Iterative Development and Testing
3. Rationalized Requirements
4. Flexible/Tailored Processes
5. Knowledgeable and Experienced IT Workforce

Sources: Defense Science Board Report, March 2009 and A New Approach for Delivering IT Capabilities in DoD, Report to Congress, November 2010

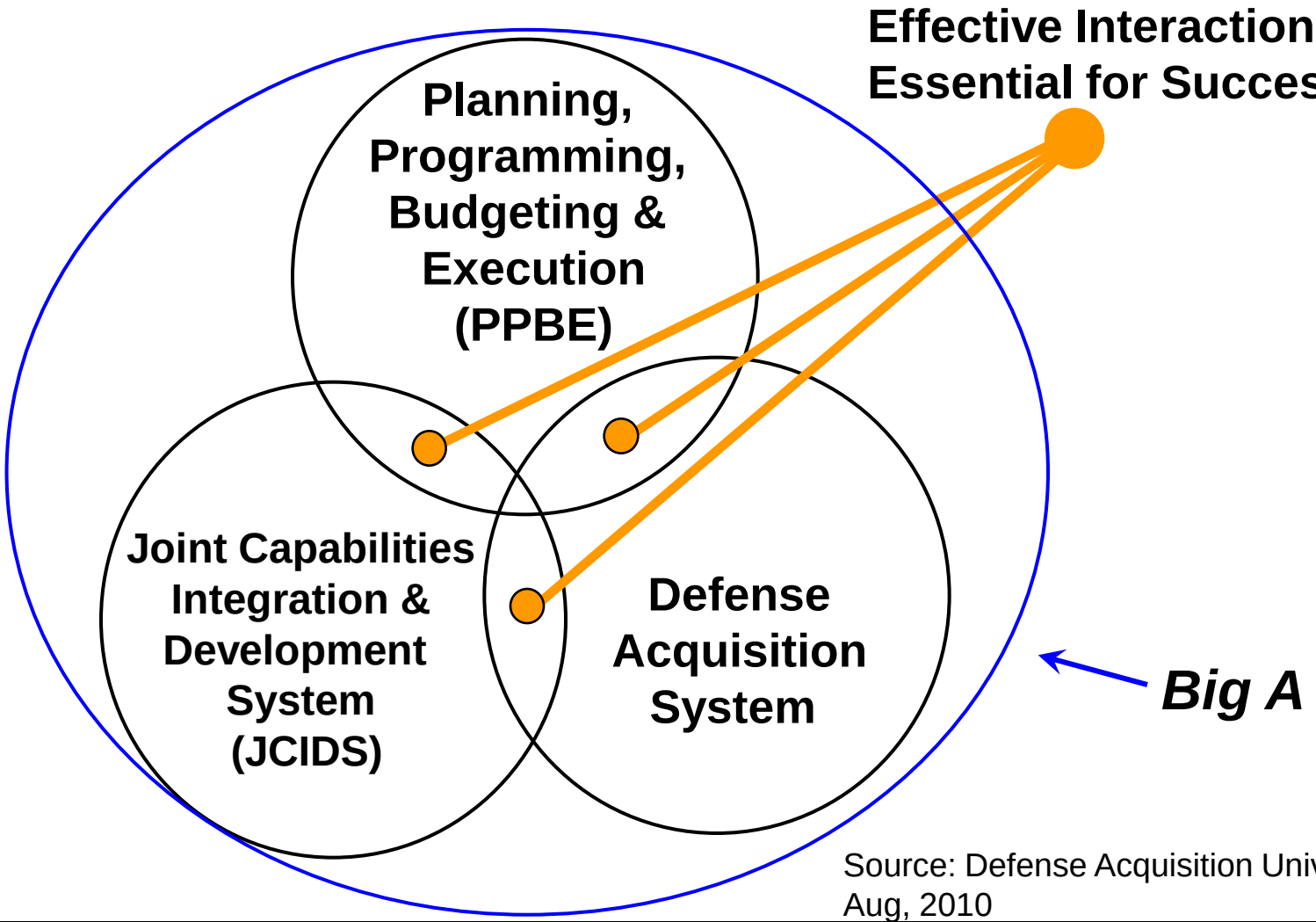
DOD Software Acquisition Process Improvement Programs, DoD Major Events, and Leadership Rotation



An Effective Process for Major Defense Systems - but not very agile for IT Systems



Better Alignment: Three Major DoD Decision Support Systems

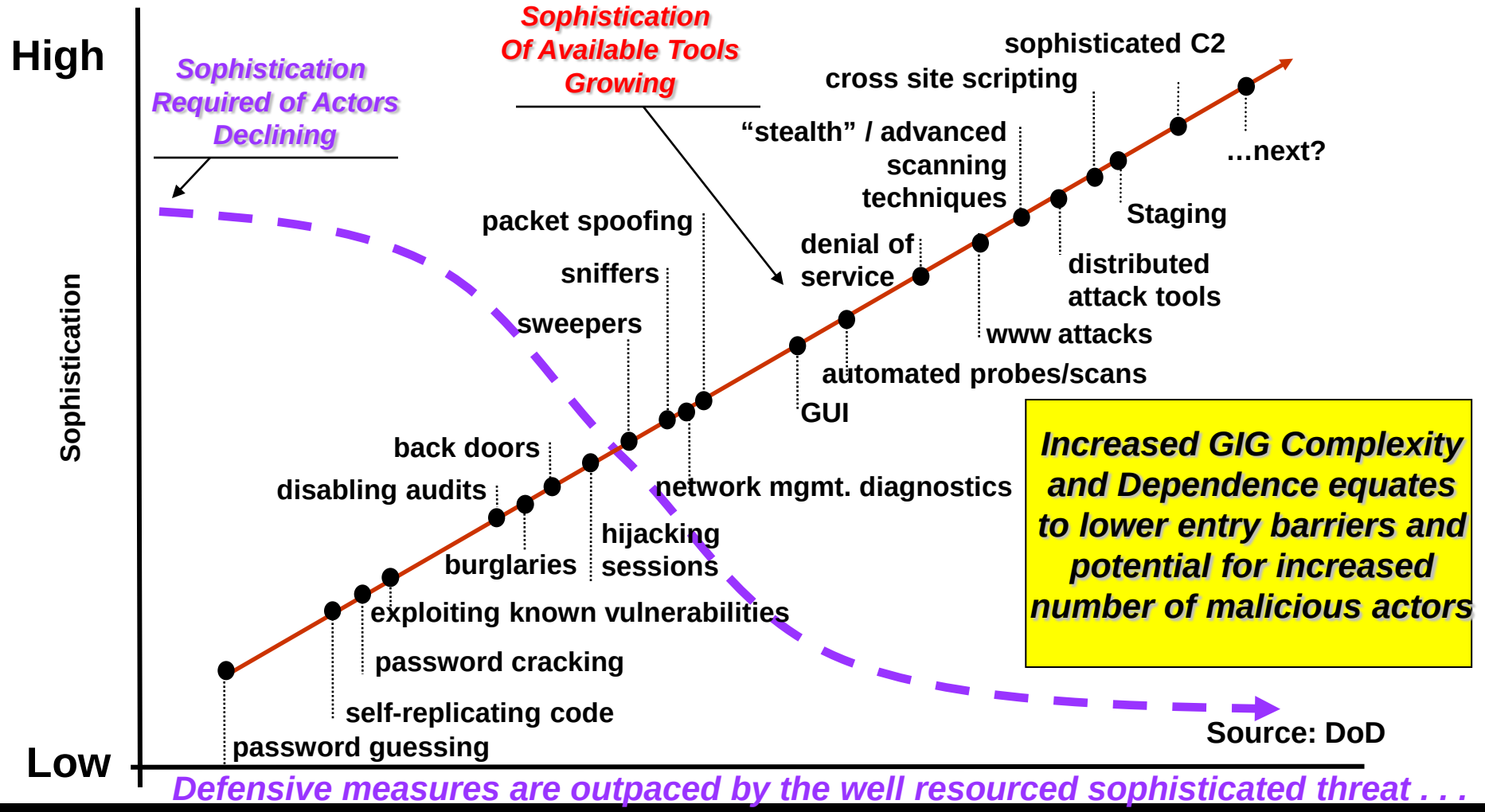


Source: Defense Acquisition University Aug, 2010

Challenges: Information Technology (IT) Environment

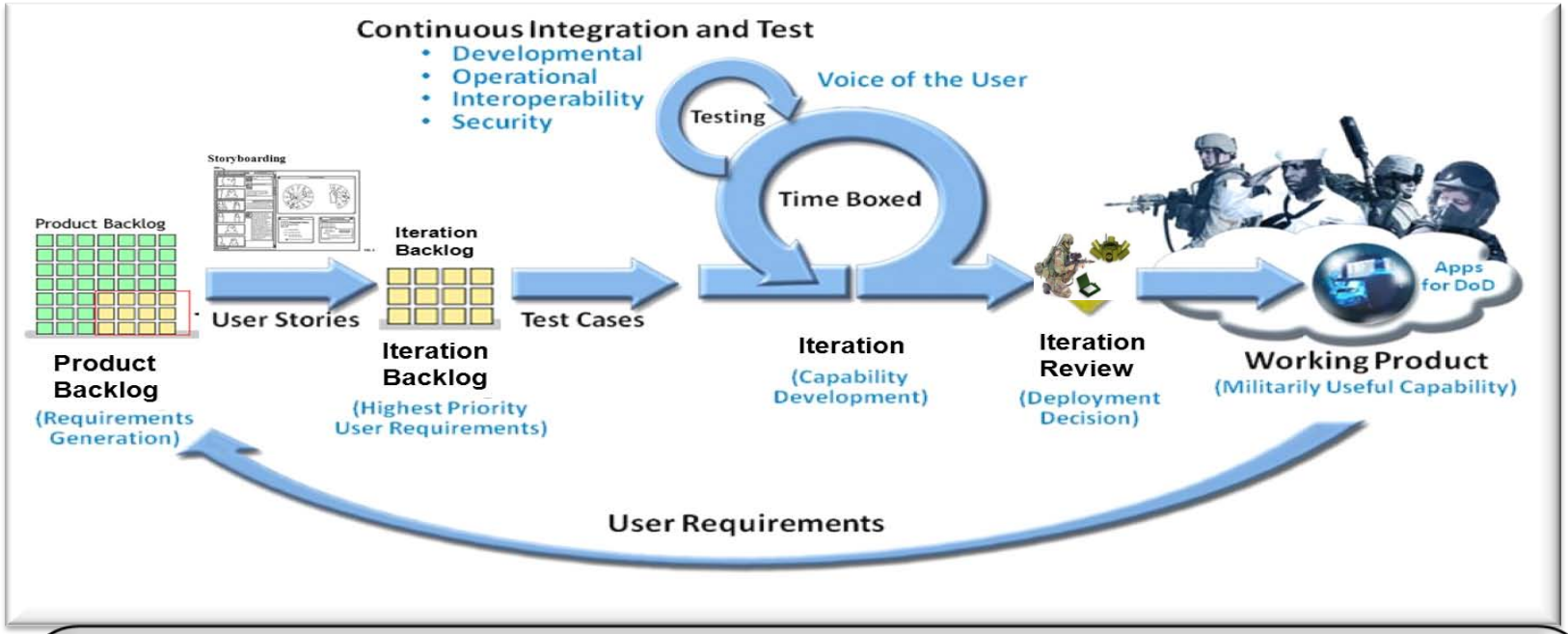
Source: www.sei.cmu.edu/uls

Rate of Adoption
The Cyber Domain is Hotly Contested



Defensive measures are outpaced by the well resourced sophisticated threat . . .

Agile Development Process: A Building Block for Constructing Capabilities

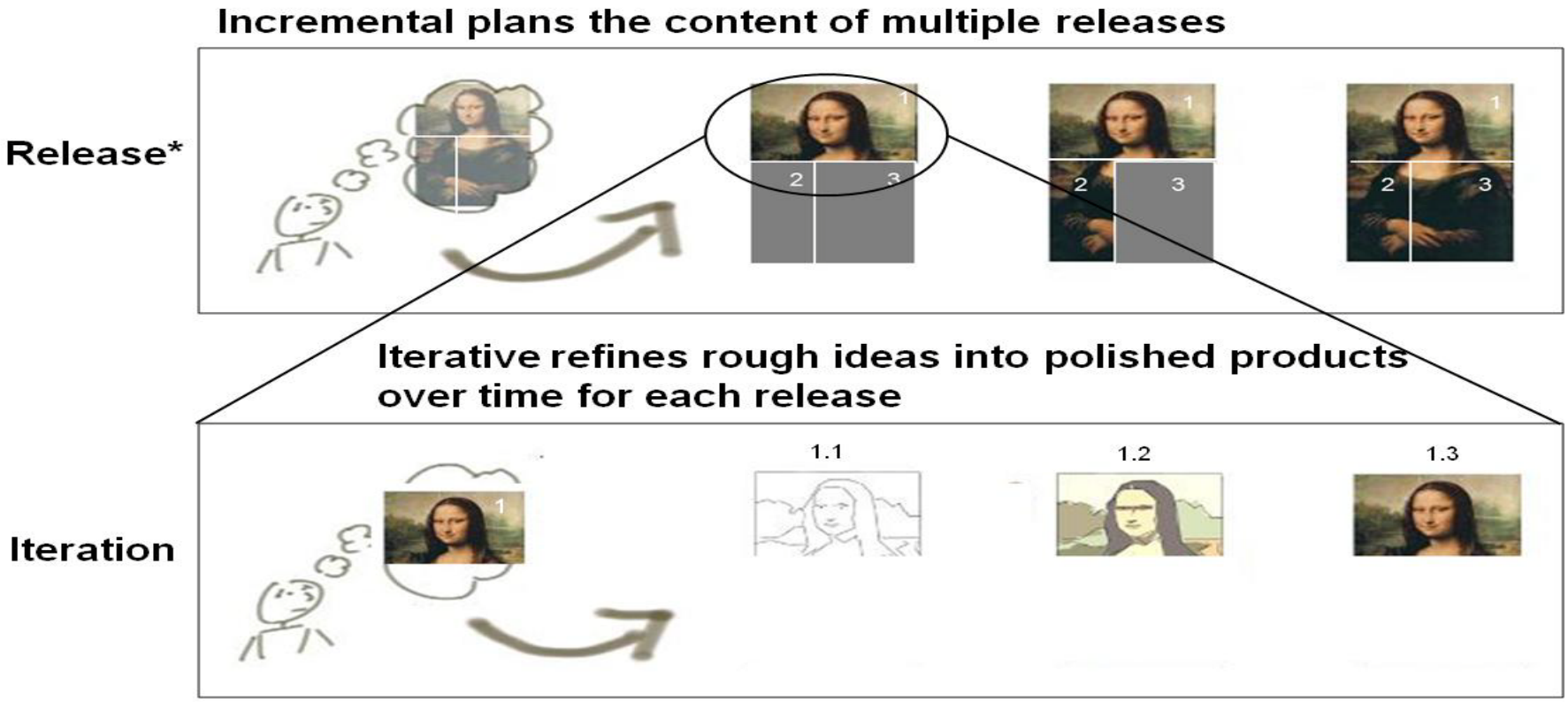


Agile methods emphasize early and continuous delivery of valuable products and services

- **User immersion in development for clarification and feedback**
- **Iterative development**
- **Testing occurs throughout (instead of at the end)**
- **Working product is the primary measure of progress**

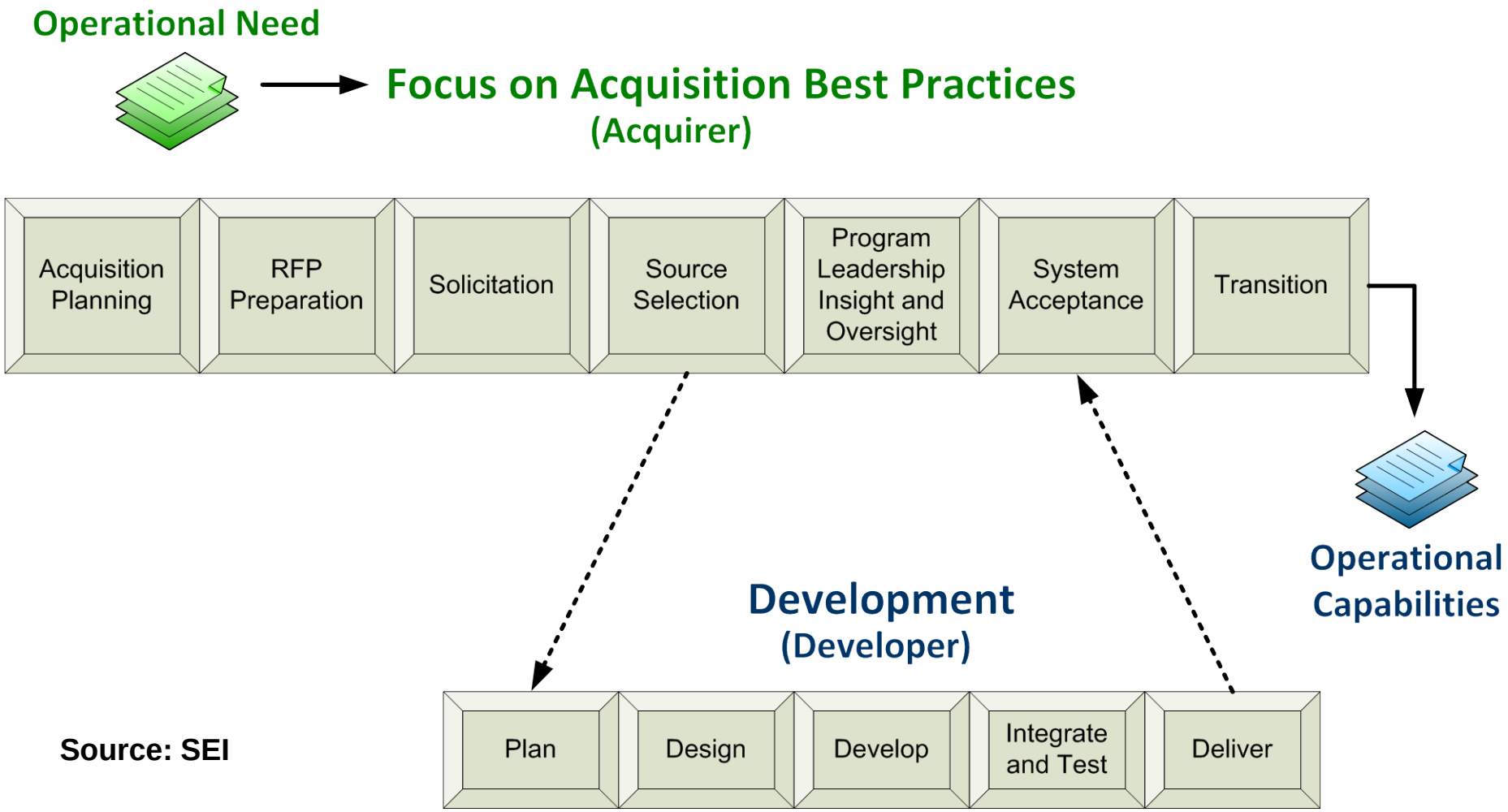
Sources: IT Acquisition Reform Task Force/MITRE Corporation

Agile is Not One-Size-Fits-All



Note: The diagram which was created by the MITRE Corporation team on the IT Acquisition Task Force Initiative is only for illustrative purposes and not necessarily representative of any specific agile approach

Assessment Framework: *CMMI®-ACQ*



Source: SEI

CMMI® -ACQ Categories and Process Areas

Category	Process Area
Acquisition	**Agreement Management (AM)** **Acquisition Requirements Development (ARD)** **Acquisition Technical Management (ATM)** **Acquisition Validation (AVAL)** **Acquisition Verification (AVER)** **Solicitation and Supplier Agreement Development (SSAD)**
Process Management	Organizational Innovation and Deployment (OID) **Organizational Process Definition (OPD)** Organizational Process Focus (OPF) Organizational Process Performance (OPP) **Organizational Training (OT)**
Project Management	**Integrated Project Management (IPM)** **Project Monitoring and Control (PMC)** **Project Planning (PP)** Quantitative Project Management (QPM) Requirements Management (REQM) Risk Management (RSKM)
Support	Causal Analysis and Resolution (CAR) Configuration Management (CM) Decision Analysis and Resolution (DAR) Measurement and Analysis (MA) Process and Product Quality Assurance (PPQA)

CMMI® -ACQ model was developed to codify best practices to help organizations improve acquisition processes

CMMI® reference models have gained significant traction across commercial and defense community and are widely used throughout world [CMMI Product Team 07]

Source: SEI

CMMI ® -ACQ (V1.3) Project Planning – Comparison*

Project Planning		
PP	CMMI Pratice	Scrum Practice
SG 1	Estimates of project planning parameters are established and maintained	
SP 1.1	Establish and maintain the acquisition strategy	Concept of Operations or Scrum product vision
SP 1.2	Establish a top-level WBS to estimate the scope of the roject	The standard tasks used in a Scrum process combined with specific project tasks (Scrum Backlog)
SP 1.3	Establish and maintain estimates of the attributes of the work products and tasks	Story points, used to estimate the difficutly (or relative size) of a Story (requirement)
SP 1.4	Define the project lifecycle phases on which to scope the planning effort	The Scrum Process
SP 1.5	Estimate the project effort and cost for the work products and tasks based on estimation rationale	Scrum time estimate (similar to billable hours or Full Time Equivalents)
SG 2	A project plan is established and maintained as the basis for managing the project	
SP 2.1	Establish and maintain the project's budget and schedule	1. Scrum estimates; 2. Estimates of what work will be in each release; 3. Sprint Backlog; 4. Project Taskboard

Reference: N. Potter and M. Sakry, Implementing Scrum (Agile) and CMMI ® Together, March 2009

IT Compared with Other Sciences

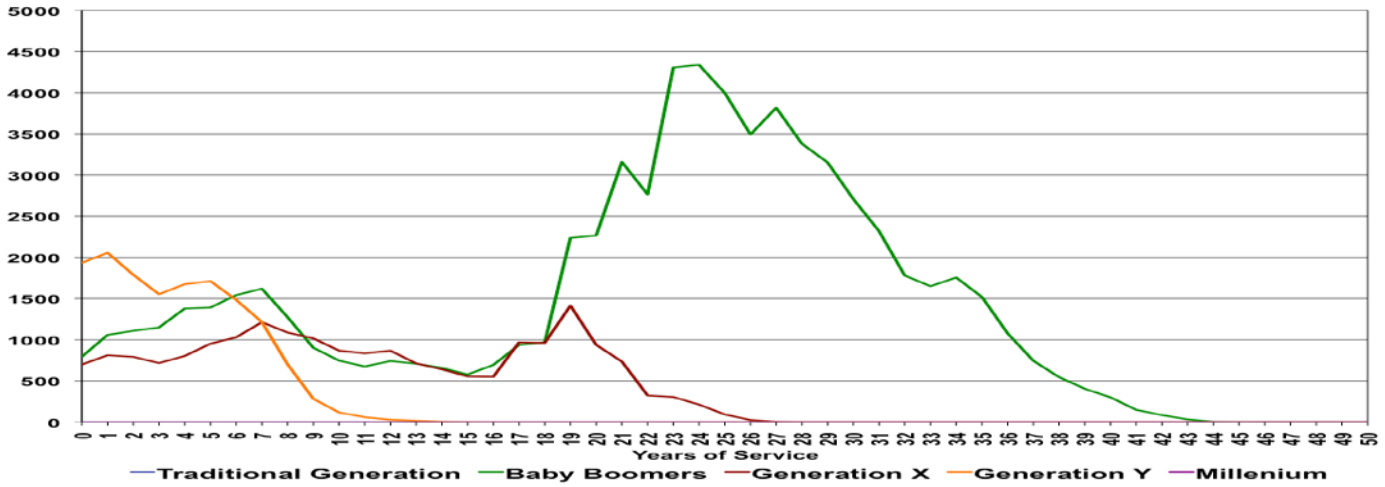
	PHYSICAL SCIENCE	BIOSCIENCE	IT- COMPUTER/SOFTWARE/CYBER SCIENCE
Origins/History	Begun in antiquity	Begun in antiquity	Mid-20th Century
Enduring Laws	Laws are foundational to furthering exploration in the science	Laws are foundational to furthering exploration in the science	Only mathematical laws have proven foundational to computation
Framework of Scientific Study	Four main areas: astronomy, physics, chemistry, and earth sciences	Science of dealing with health maintenance and disease prevention/treatment	• Several areas of study: computer science, software/ systems engineering, IT, HCI, social dynamics, AI • All nodes attached to/relying on netted system
R&D and Launch Cycle	10-20 years	10-20 years	Significantly **compressed**; solution time to market needs to happen very quickly

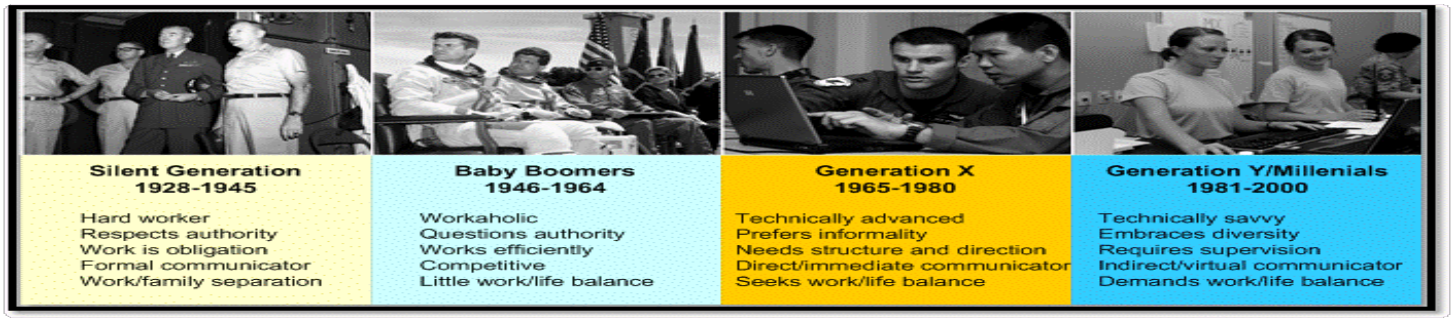
Source: SEI

HCI: Human Computer Interaction; AI: Artificial intelligence

Opportunity - 21st Century Acquisition Workforce

- Acquisition Guidance, and Training Programs Need to Be Updated to Support the 21st Century Acquisition Workforce





Sources: DoD (AT&L) and SEI

Why are Software Intensive IT Projects Difficult?

According to Fred Brooks software projects are difficult because of accidental and essential difficulties

- Accidental difficulties are caused by the current state of our understanding
  - of methods, tools, and techniques
  - of the underlying technology base
- Essential difficulties are caused by the inherent nature of software
  - invisibility - lack of physical properties
  - conformity
  - changeability
  - complexity

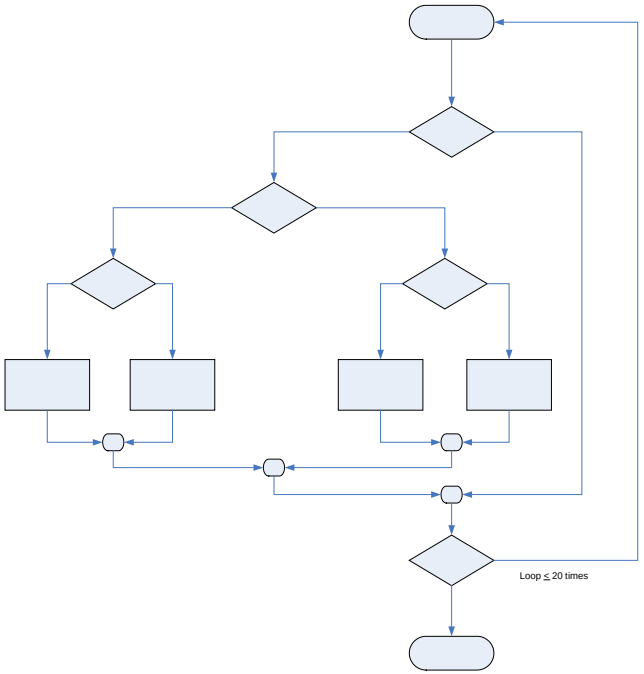
Source: *The Mythical Man-Month* by Fred Brooks, Addison Wesley, 1995

Realities of Software Quality

The flowchart might correspond to a 100 LOC module with a single loop that may be executed no more than 20 times.

There are approximately 10^{14} possible paths that may be executed!

For any but the smallest programs, complete path coverage for defect detection is impractical.



Lehman Laws:

1. **The Law of Continuing Change – programs must change to be useful**
2. **The Law of Increasing Complexity – programs that change become more complex**

Source: Adapted from Pressman, R.S., *Software Engineering: A Practitioner's Approach, Third Edition*, McGraw Hill, 1992

Software Evolution and Maintenance Cost Is Increasing

Year	Proportion of software maintenance costs	Definition	Reference
2000	>90%	Software cost devoted to system maintenance & evolution / total software costs	Erlikh (2000)
1993	75%	Software maintenance / information system budget (in Fortune 1000 companies)	Eastwood (1993)
1990	>90%	Software cost devoted to system maintenance & evolution / total software costs	Moad (1990)
1990	60-70%	Software maintenance / total management information systems (MIS) operating budgets	Huff (1990)
1988	60-70%	Software maintenance / total management information systems (MIS) operating budgets	Port (1988)
1984	65-75%	Effort spent on software maintenance / total available software engineering effort.	McKee (1984)
1981	>50%	Staff time spent on maintenance / total time (in 487 organizations)	Lientz & Swanson (1981)
1979	67%	Maintenance costs / total software costs	Zelkowitz *et al.* (1979)

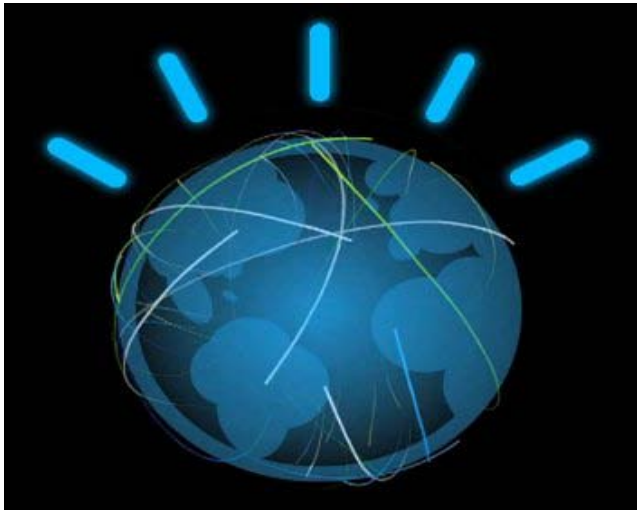
Source: Jussi Koskinen, Department of Computer Science and Information Systems, University of Jyväskylä P.O. Box 35, 40014 Jyväskylä, Finland

Federal IT Market Growth

"In the next five years, IT contractors will see the federal market for their services increase by a compound annual growth rate of 5.4 percent to a total of $111.9 billion by 2015."

-- Ben Bain
Federal Computer Week
April 8, 2010

Proposed Changes: Think and Perform Differently



Watson's Avatar, Inspired by the IBM “Smarter Planet" Logo

CMMI® for Acquisition and CMMI® for Development Can Have a Potential Impact on the Rapid Acquisition of IT Systems

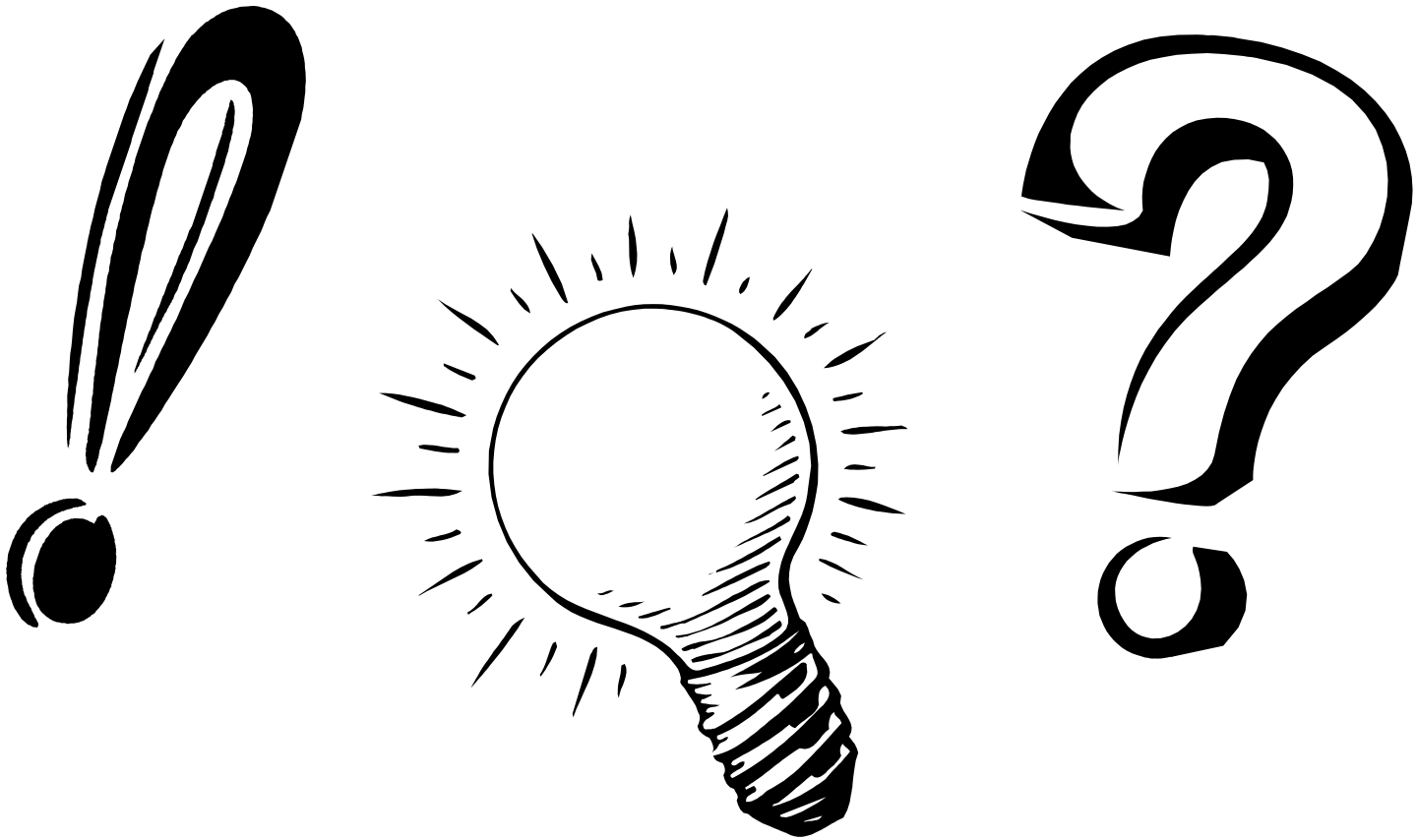
Source: Wikipedia - IBM Watson: The Face of Watson on You Tube

Summary

- The IT Acquisition Task Force Initiative concepts may have to be quite radical to meet the IT Acquisition Reform Guiding Principles (Section 804)*
  - Deliver Early and Often – *Be responsive to the users needs*
  - Incremental and Iterative Development and Testing
  - Rationalized Requirements – *Balance user needs with constraints*
  - Flexible/Tailored Processes – *Customize to IT category*
  - Knowledgeable and Experience IT Workforce – *Understands IT uniqueness*
- CMMI® for Acquisition and CMMI® for Development Can Have a Potential Impact on the Rapid Acquisition of IT Systems
- General acknowledgement that we can and must do better!

Source: A New Approach for Delivering IT Capabilities in the DoD, Report to Congress, November 2010

Wrap Up



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