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Systematically Tailoring the Organization's Standard Process for a Project

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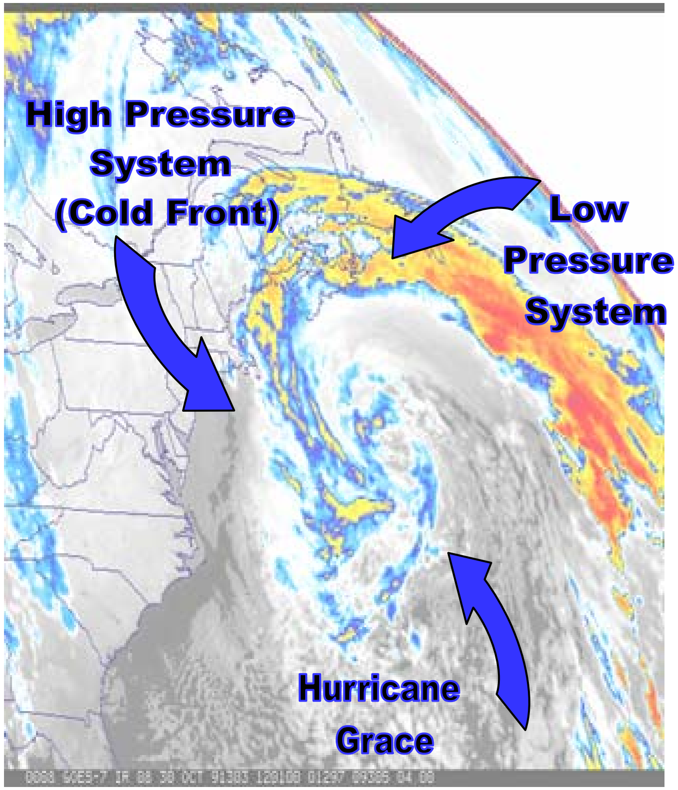
Agenda

- Exponential Growth in Software
  - Expansion in Software Process Assets
- Current State of Practice
  - Large Organizational Standard Processes (OSPs)
  - Manual Tailoring of OSPs to Project Define Processes
- Problems with Manual Tailoring
- Automated Rules-Based Tailoring
- Lessons Learn, Contributions & Road Ahead



"Perfect Storm" Event, October 1991
National Oceanic & Atmospheric Administration

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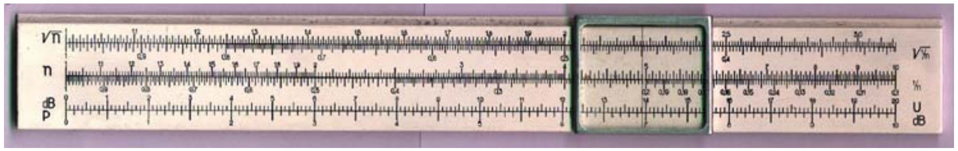
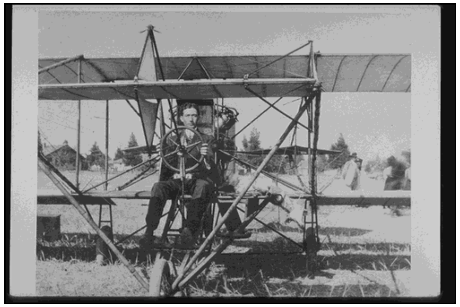
Exponential Growth in Software Usage & Assets

* Provided by Lockheed Martin

In The Beginning





1960's	1970's	1980's	1990's	2000+
				
F-4A 1000 LOC	***F-15A 50,000 LOC***	***F-16C 300K LOC***	***F-22 1.7M LOC***	***F-35 >6M LOC***
				

Market Dynamics: Drivers That Increase the Demand on Additional Systems & Software Assets

Platform → **Enterprise**
Customer Emphasis

Requirements → **Objectives**
Acquisition Model

Dominant Prime → **Strategic Teaming**
Program Execution

"Boxes" → **"Layers & Stacks"**
Integration Challenge

Proprietary → **Plug & Play**
Architectures and Standards

The emerging dynamic is to address both sides, and do so with compressed delivery schedules via improvements in systems engineering

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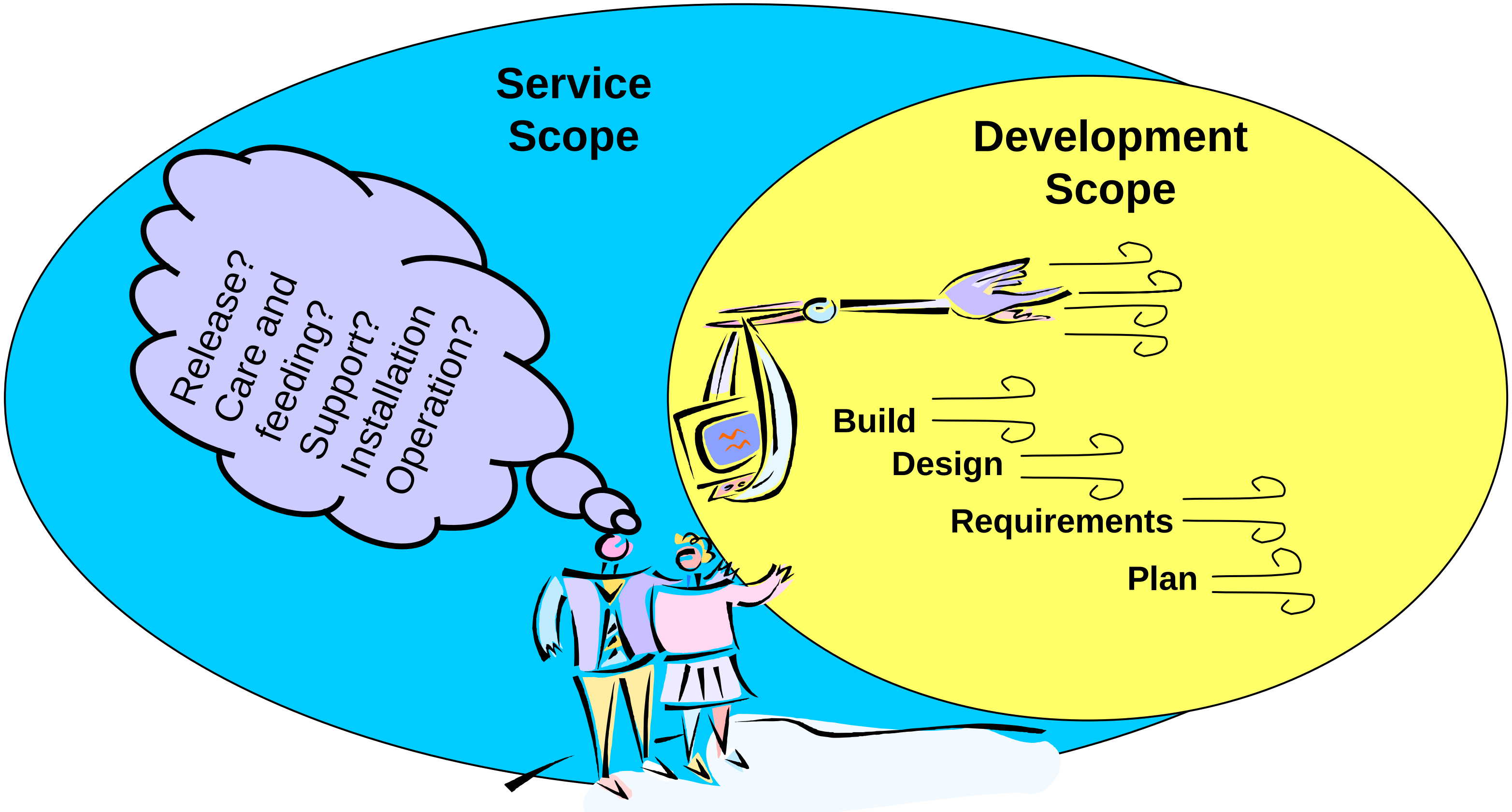
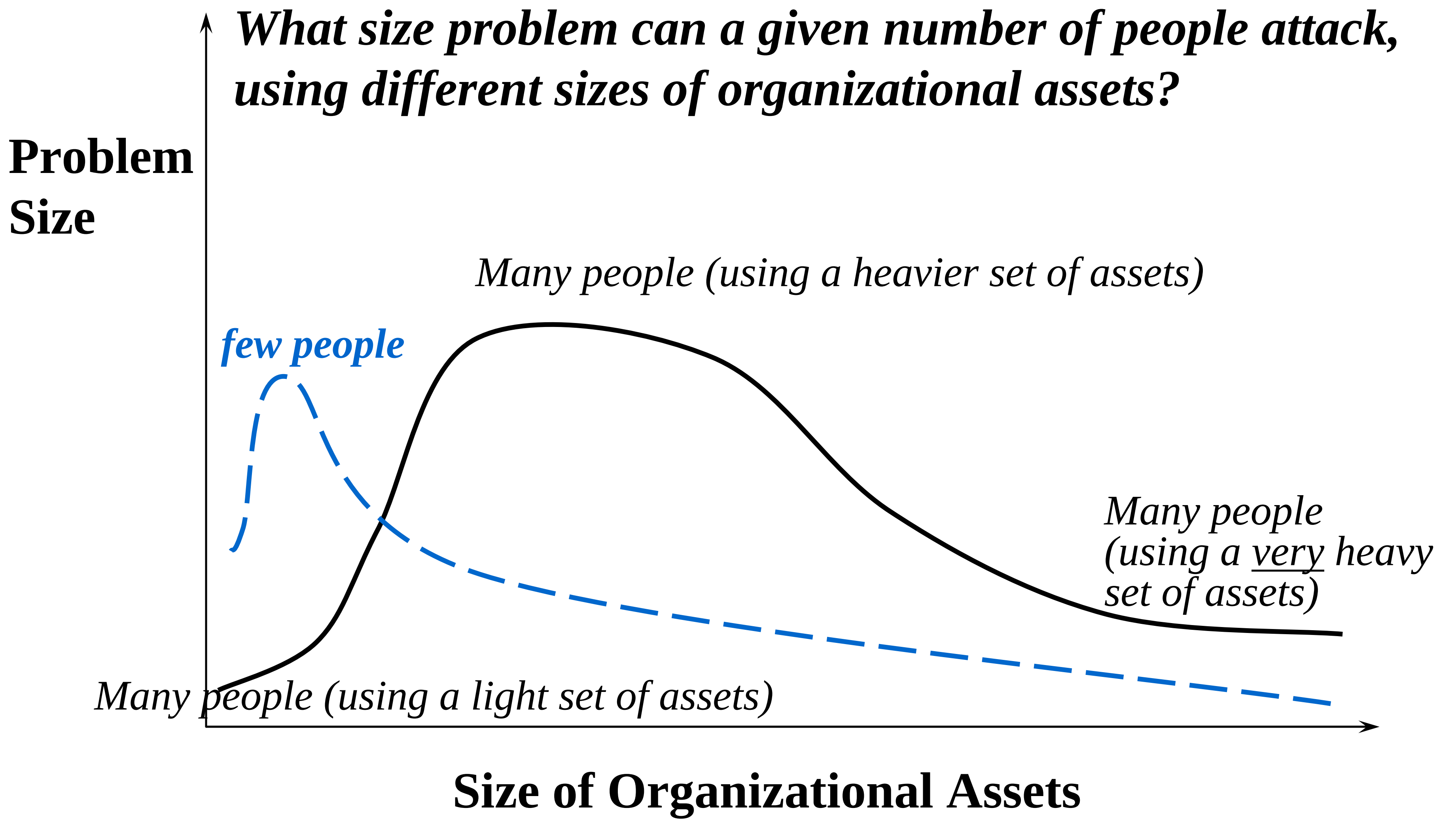
Example: Shift to Service Delivery versus Produce and Delivery Perspective



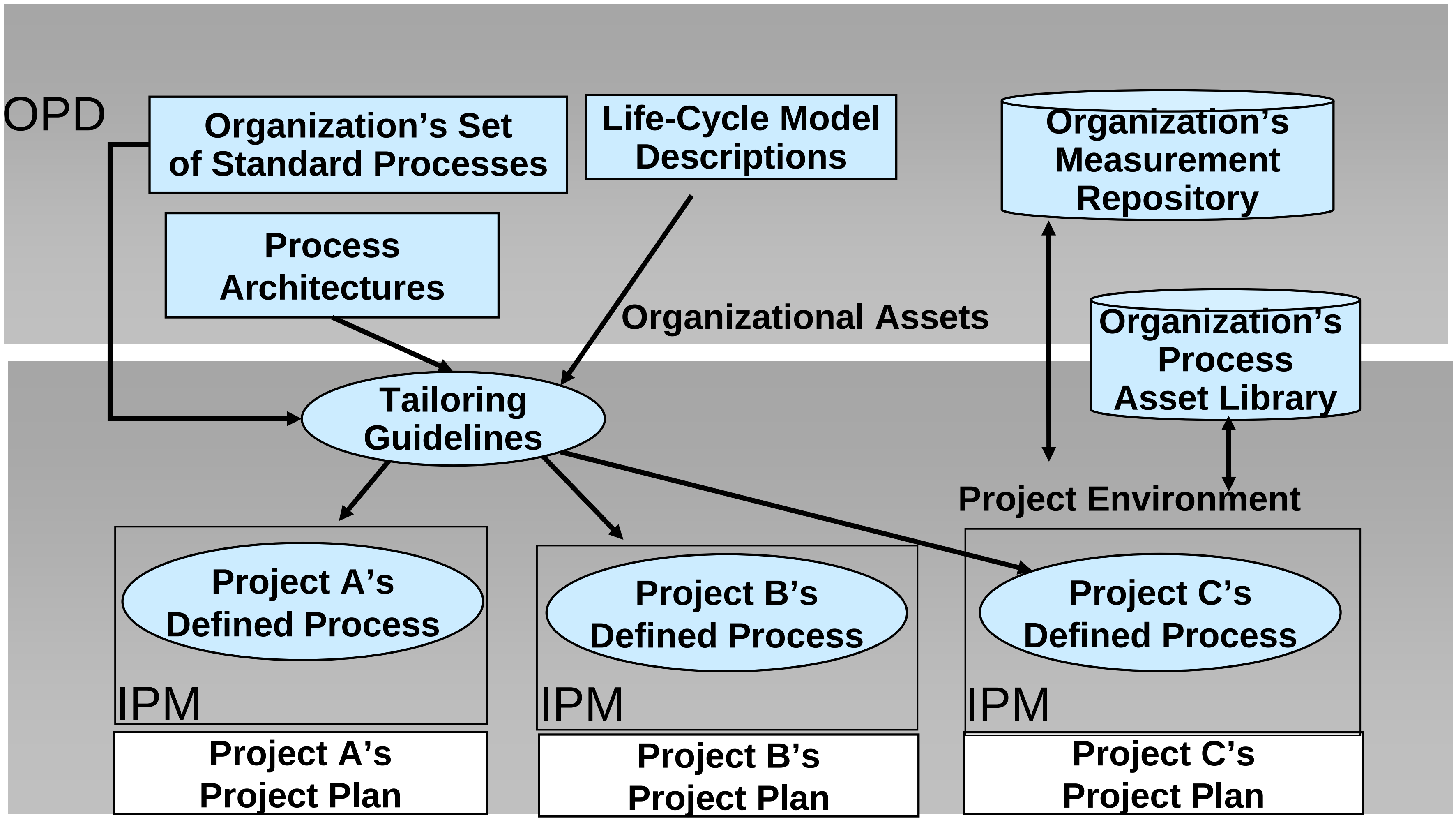
Services represent 80% of the US economy (Source: Paulson, Linda. "Services Science: A New Field for Today's Economy." IEEE Computer Society, August 2006).

Expansion in Process Assets Versus Usage*



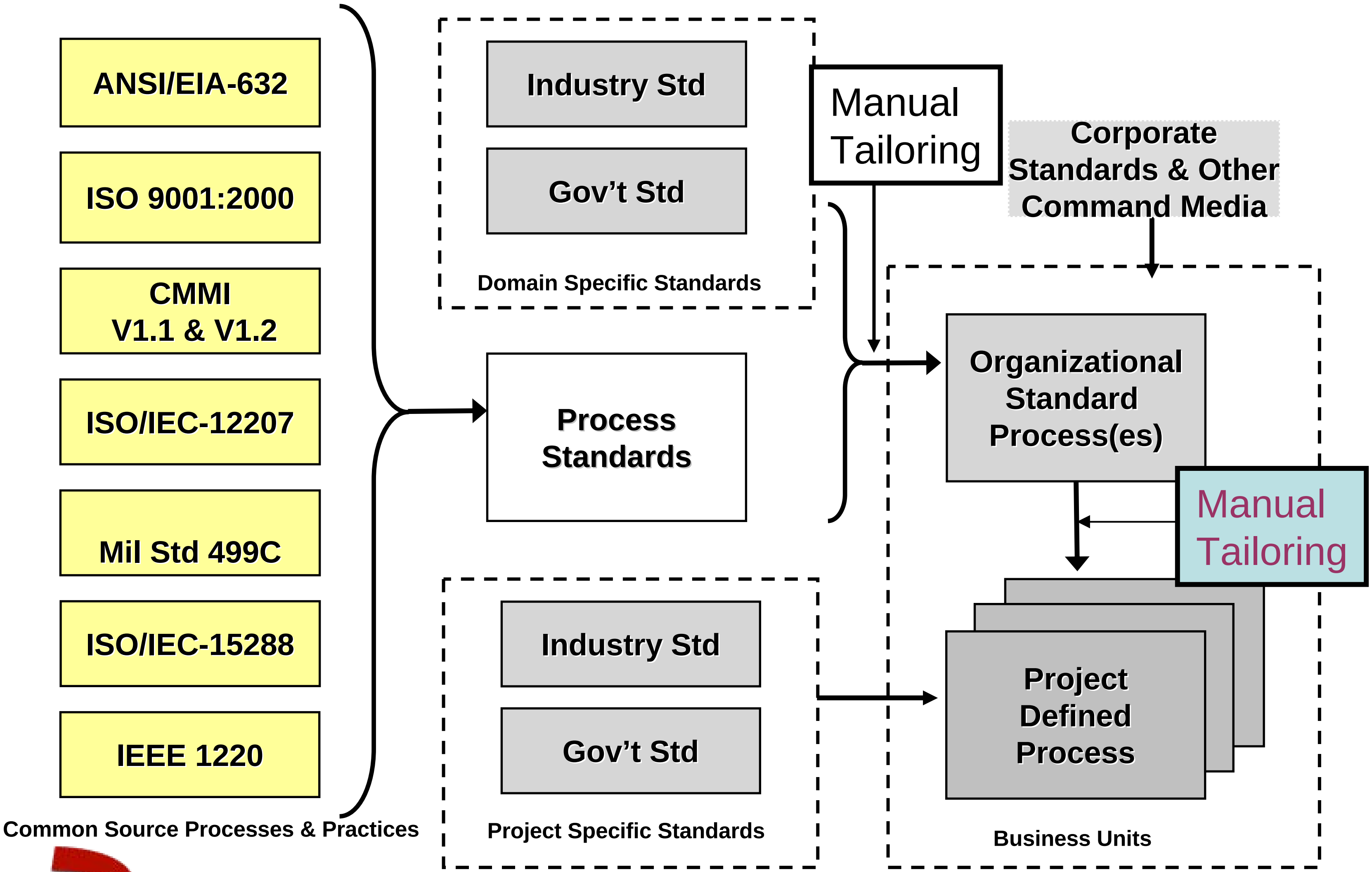
*Slide adapted from Alistair Cockburn, Presentation at SSCI, 3/29/06

Tailoring the Corporate OSPs to Lighter Project Defined Processes



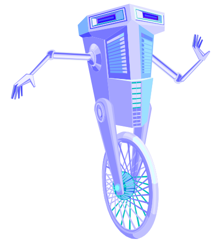
*Training material registered in the U.S. Patent & Trademark Office by Carnegie Mellon University.

Tailoring Example: Software & Systems Engineering Processes & Practices



In Theory, These Steps Should Work:

1. Classify program using characteristics



7. Assemble program defined process

2. Select analogous programs based with similar characteristics

4. Find sources for uncovered processes (OSPs or other)

6. Tailor processes to unique program needs

3. Identify processes with no coverage

5. Select sources for process tailoring

The difference in “Theory” and “Practice” is that in theory they are the same however in practice they often are not

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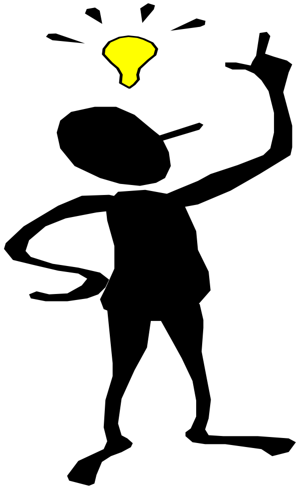
Acknowledged Problems with Manually Tailoring

- Low perceive value by program managers
- Insufficient knowledge and implementation of tailoring rules
- Too much data
  - Organization Standard Process consists of hundreds of process elements; thus, difficult to determine which ones are applicable to their project
- Insufficient planning time available
- Lack of qualified resources
  - Organizations who are lucky enough to have professional members of their technical staff who can manually perform the needed tailoring are often not available

Potential Solution: Automated Rules-Based Tailoring Engine

What is the feasibility to using an intelligent agent (e.g. Tailoring Engine) to inform and direct the selection and tailoring of the OSP based on a set of business rules?



Proof of Concept Approach

- Research the field (please see references)
  - Identified key issues and risks
- Selected a "Proof of Concept" approach
- Develop an engagement plan
  - Defined the problem statement among key stake holders
- Defined the type of OSP we wanted to tailor based on automated process tailoring needs
- Selected a publicly available, accepted and reasonably complete functional process guide as a mock OSP
- Defined the type of tailoring tool we needed based on our tailoring requirements
- Selected the tailoring tool
- Developed a set of tailoring rules for the proof of concept demonstration
- Collected contributions and lessons learned

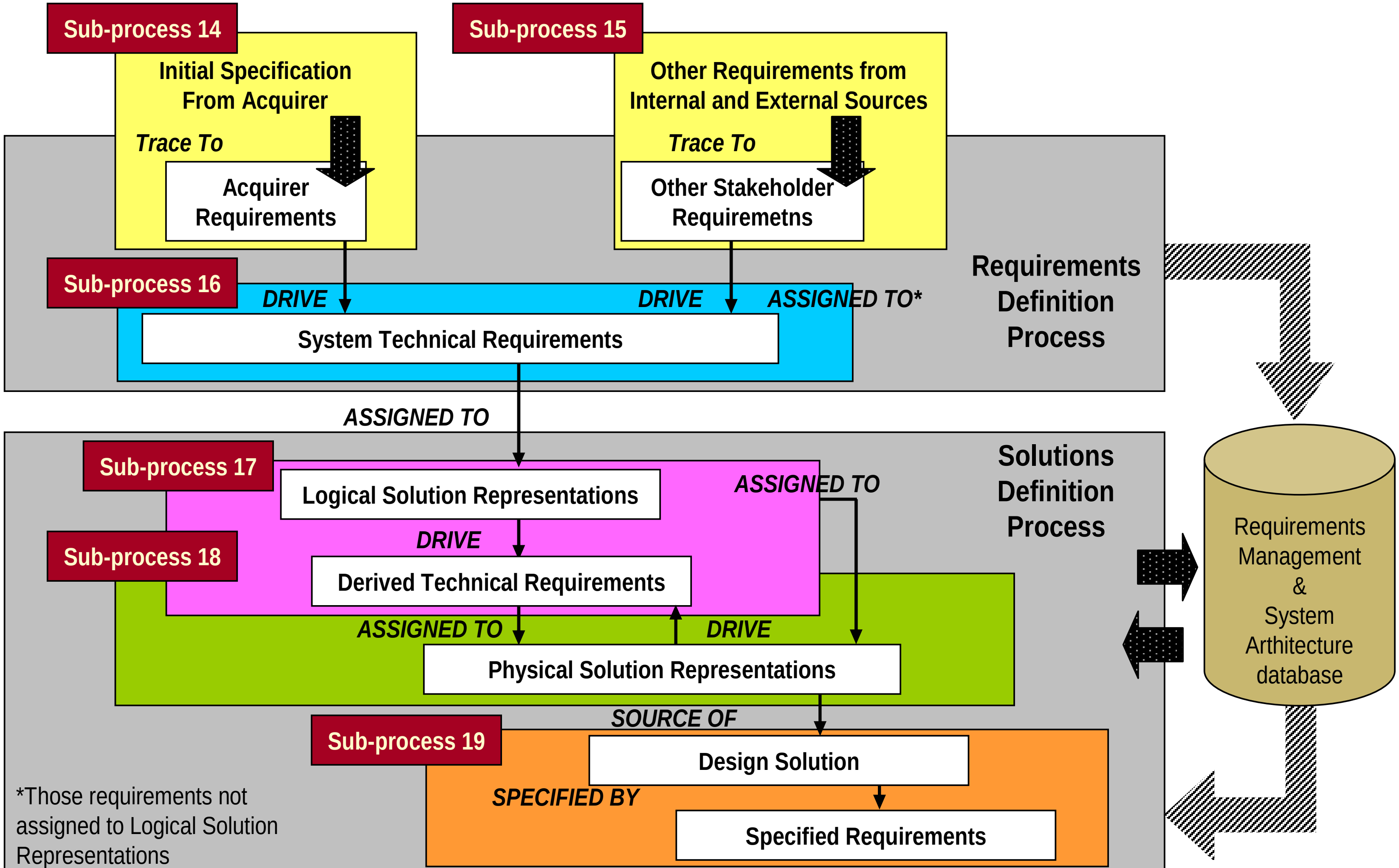
The Formulation of Effective Tailoring Rules Challenging Due to Project Asset Attributes

Common Source Standards

- Project Characteristics
  - Are requirements well known? (Yes: Waterfall, O&M or Incremental life cycles; No: Prototyping, Incremental, or Evolutionary life cycles)
  - Security Requirements?
  - System Size (S, M, L)
  - Level of Risk
- Project Characteristics (cont'd)
  - How complex is the system? (#COTS, #Shalls, #Interfaces, #Users, SOS, #HWCIs, #SWCIs, DP rqts)
  - System Composition (HW, SW, both)
  - Product Intent (Feasibility Study, R&D, Operational Program)
  - Contract Type (FFP, T&M, CPFF, Award Fee)
  - Scope (Formality, Control, Structure)

OSP Example: Systems Engineering Standards

Interdependence of Engineering Sub-processes: Naval Systems Engineering Guide and EIA 632



Deceptive Similarity of Industry Standards

- Because the source standards cover roughly the same ground, we anticipated that "normalizing" them would be relatively straightforward
- We expected to find (and did!) differences in:
  - Scope, terminology and level of detail
- Subtler differences emerged in the source standards' codification of:
  - Product life cycle
  - Development life cycle model
  - Recursive application of process throughout a system hierarchy
- Industry standards do not cover all the necessary processes (e.g. finance, legal, ethics, etc)

“Inter-connectiveness” of Process Steps

Navy SE Sub-Process	Preceding Process	Next Process	Inputs	Outputs
Acquirer Requirements (SP14)	SP 22 Systems Analysis Process, SP26 Requirements Validation Process	SP 2 Acquisition Process, SP4/5/7 Planning Process, SP 10/11 Assessment Process, SP 12 Control Process, SP 16 Requirements Definition Process, SP22 Systems Analysis Process, SP 26 Requirements Validation Process, SP 31 System Verification Process, SP 33 End Products Validation Process	ICD, CDD/ORD, Engineering Investigation Reports, Utilization & Readiness Reports, Specifications from higher level system building blocks, Sponsor high level operational concept graphic architecture (EXT), Effectiveness analysis reports (SP 22), Effectiveness models (SP 22), Acquirers Requirements Validation Revisions (SP 26)	ICD(SP 2/4/7/10/11/16/31/33, Effectiveness Analysis Request (SP 22), Measurement of Effectiveness (SP 5/7/16), CDD or CPD(SP 2/4/7/10/11/16/31/33), Specifications from higher level system building blocks (SP 16), Acquirers Requirements(SP 5/16/26)

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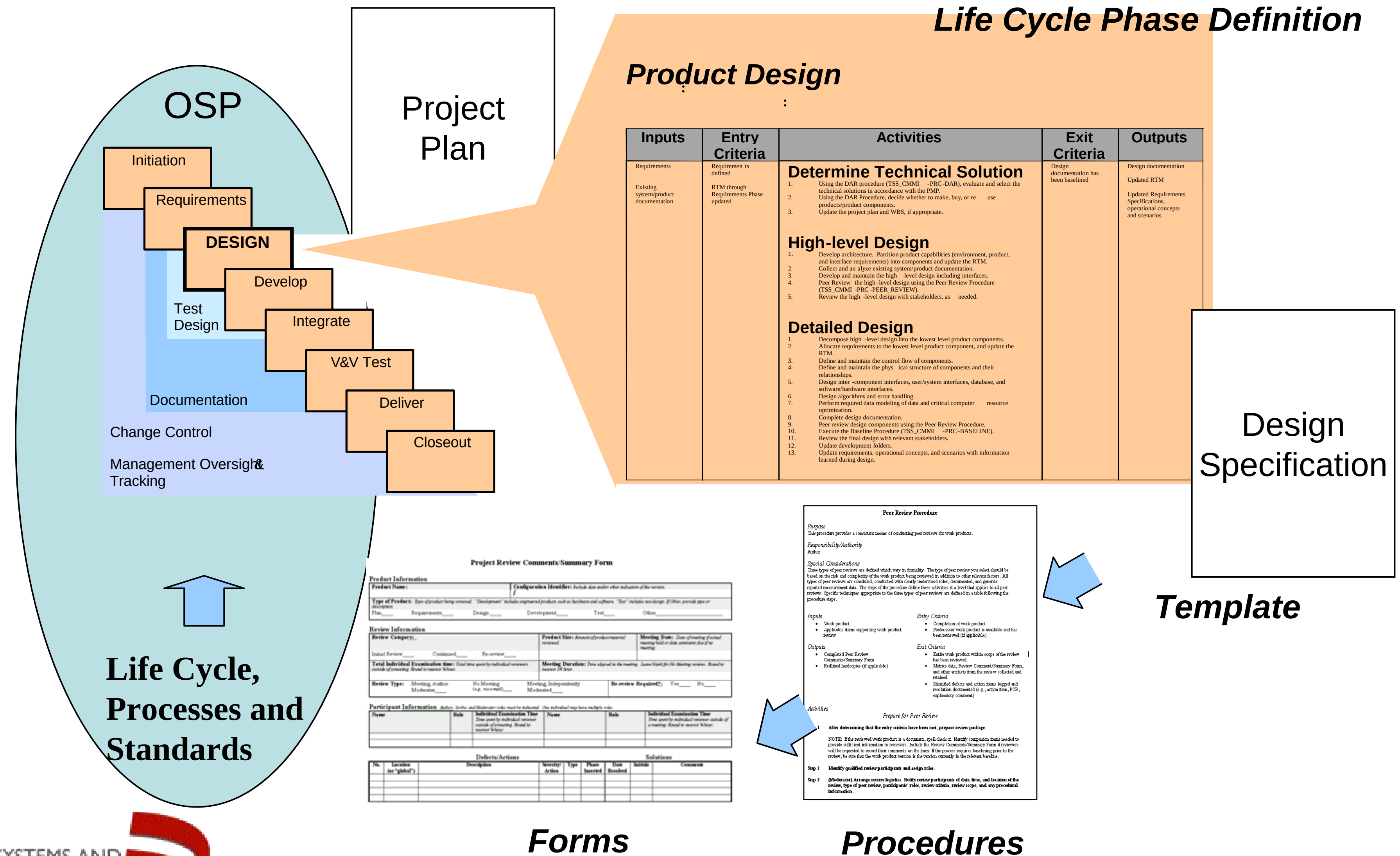
Decomposition - Small Changes in a System Engineering Standard Drive Many Other Changes



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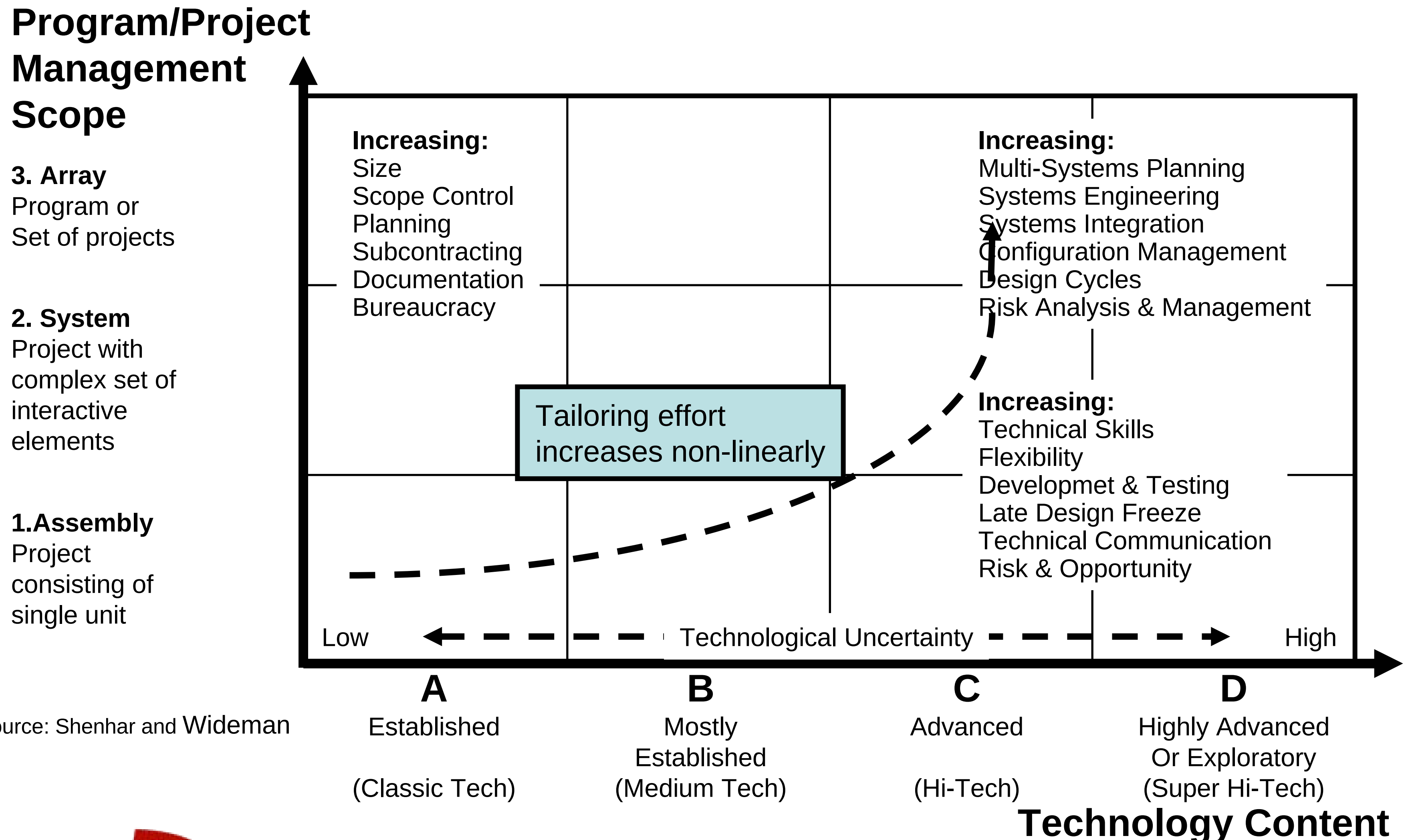
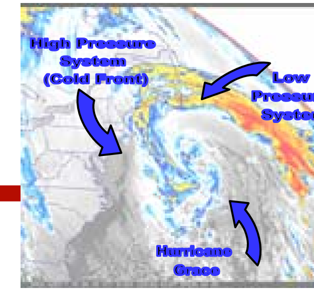
Tailoring Effort Increases Non-Linearly with Program and Technology Complexity



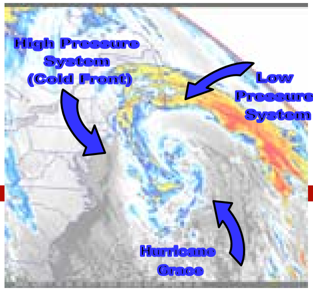
Source: Shenhar and Wideman

What We Determined: Devil in the Details



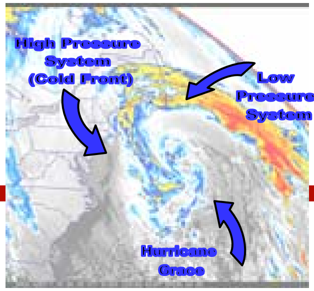
- State of Practice
  - Some on-going research in the area of automated rules-based test engines
  - Existence of a limited set of reasonably mature automated tailoring tools
    - Significant manual-tuning required dealing with most problems
    - Limited number of “universal” tailoring rules
    - Output often compatible with Microsoft tools
      - WBS and Project Plans automatically generated
  - OSPs nominally contain a substantial body of knowledge and data
    - Many different formats and types of artifacts

What We Determined: Devil in the Details



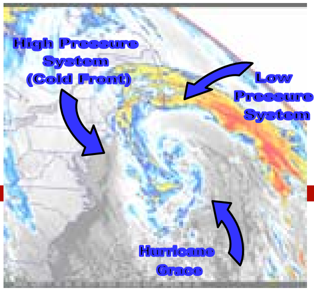
- Technically
  - In general, standard processes are not engineered/architected for tailoring
    - Makes automation difficult
  - Organizational assets are expanding, costly to maintain, and are becoming more difficult to tailor to projects
    - Difficult for an OSP to cover every case and be lean
  - Tailoring rules difficult to establish
    - Numerous attributes drive the process tailoring decisions
    - Strong demand for the establishment of robust tailoring rules

What We Determined: Devil in the Details



- Technically (Con't)
  - Multiple frameworks (e.g. CMMI, ISO, ITIL, etc) are not scalable or easily customizable
    - Different frameworks need different data elements
- Organizationally
  - Corporate committed, projects involved
- Human element
  - Natural tendency to tailor the OSP based on least resistance
    - Information from similar programs
    - Reliance on local process improvement teams
  - Difficult to demonstrate to program managers the ROI
  - Lack of consistency in process definition for most process areas

Road Ahead



- The problem is real
  - The problem is not going away and will grow in importance with time
- In the short run, tailoring responsibility will nominally rest with the process engineering teams
  - Key focus will be the development of tailoring rules and guidelines
  - Rules-based engine research will continue
- In the longer term:
  - Organizations will use process architectures to design and populate their process asset libraries
  - Intelligent agents/rules-based test engines will become more prevalent

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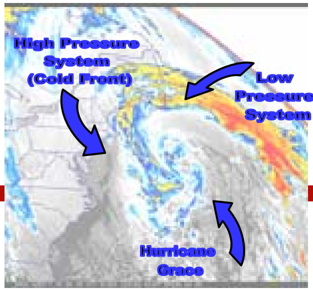
Road Ahead



- Utopia Perspective
  - What could we do differently if we started over?
- Secret of success may be a shift of focus from assets to process execution information
- Approach
  - Define a common set of software and system engineering processes for the organization
  - Map the common set of processes to the organizations lifecycles
  - Apply processes/lifecycles on programs and collect data
  - Store process execution information in the PAL
  - Improve processes based on results and establish tailoring rules

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Road Ahead: Example - Service-Oriented Architecture & Asset Management

- Service-Oriented Architecture is an approach to building IT systems out of common parts
  - Represents a breakthrough in the way we build IT systems
    - Composed of reusable components, called services
    - Service is a building block that performs a distinct function
  - Evolution of client/server architecture
    - Functions of user I/F, application logic and data management are separated and decomposed still further
- Why Now
  - Internet and World Wide Web
  - Business/Quality Focused
  - Standardization (common parts)
  - Vender Market

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Questions?

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