Lessons Learned from Applying PSM to Systems Engineering

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Approach

- **What are systems?**

- **What is Systems Engineering?**

- **Selection of PSM**

- **PSM Measurement Process**

- **General Modifications**

- **Language Barriers**

- **Bridging the Gap**

- **Summary**

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What are systems?

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System Examples

- **Command and control system**

- **Distributed classroom system**

- **Telecommunications network**

- **Radar system**

- **Service request system**

- **Photocopier**

- **Aircraft**

- **Home security system**

- **Internet access systems (ISP)**

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What is 'Systems Engineering'?

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12 Systems Engineering Roles*
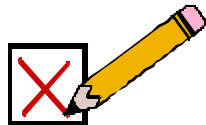
1. Requirements Owner
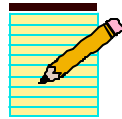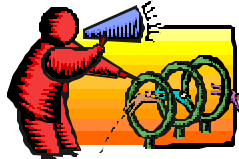
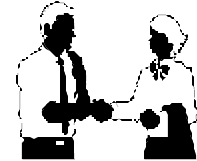2. System Designer

3. System Analyst

4. V &V

5. Logistics/Ops

6. Glue among Subsystems

7. Customer Interface

8. Technical Manager

9. Information Manager

10. Process Engineer

11. Coordinator

12. Classified Ads SE

"Systems Engineering" may mean any or all of the roles

*Originally published in INCOSE proceedings, Sheard 1996

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Selection of PSM

Need for measurement

- **Customer required**

- **Systems engineering maturity models**

- **Corporate directives for performance measurement**

Existing measurement guidance

- **Metrics Guidebook for Integrated Systems and Product Development (INCOSE)**

- **Various domain-specific guidance**

- **Practical Software Measurement**

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PSM Measurement Process

Key Concepts

Principles

Measurement Plan

Measurement tables

Indicators

Issue-Driven Measurement Process

Tailor Measures

Apply Measures

Issues, Process Characteristics

Measurement Plan

Measurement Process and Support

Data

Actions

Implement and Evolve Process

External Constraints

Measurement Needs

Process Group

Program Team

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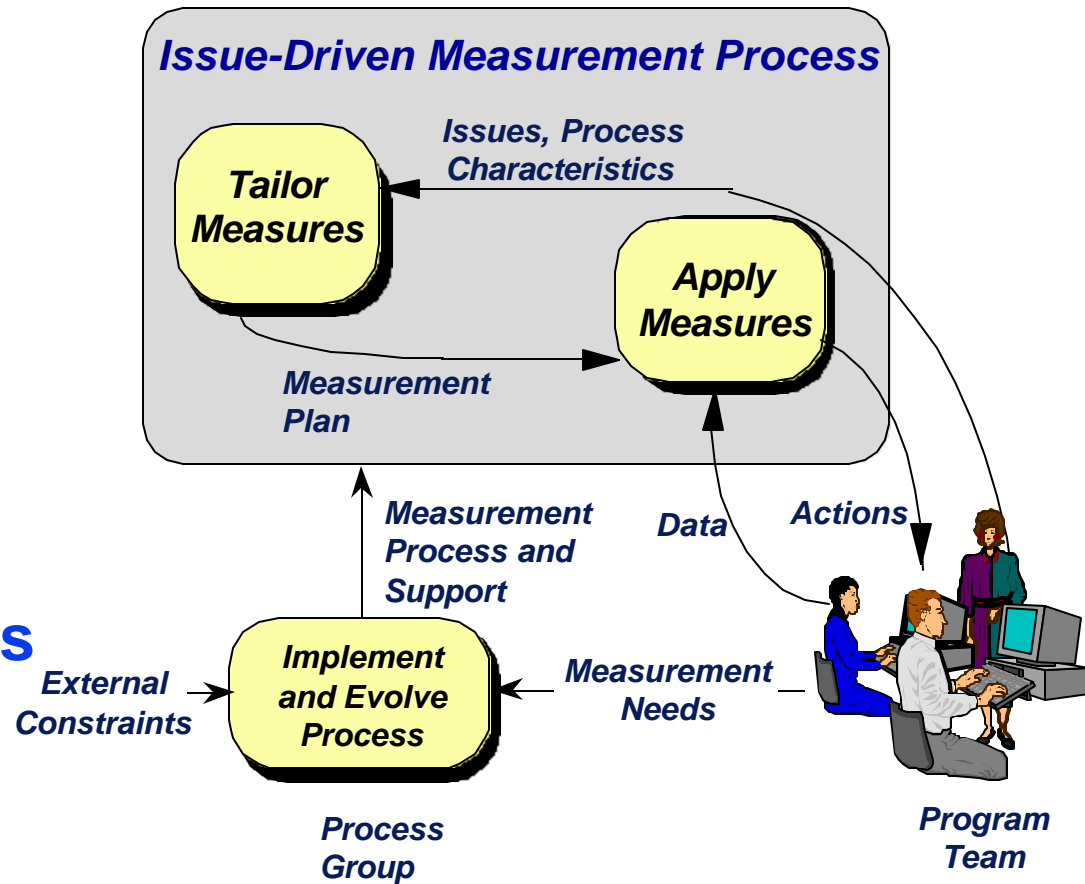
Mapping of Issues-Categories-Measures

- Common issues map to task-oriented work
- Systems' roles affect
  - Size
  - Technologies
- Categories vary in utility
- Measures
  - Don't confuse alternatives with objectives

| Issue	Category	Common Measures
Schedule and Progress	Milestone Performance	Milestone Dates Schedule Dependencies Critical Path
	Work Unit Progress	Requirement Status Problem Report Status Reviews Completed Change Request Status Component / Element Status
	Incremental Capability	Incremental Content - Component / Element Incremental Content - Functionality
Resources and Cost	Personnel	Effort Staff Profile Staff Turnover
	Financial Performance	Earned Value Cost
	Environment and Other Resources	Resource Availability Resource Utilization
Product Size and Stability	Physical Size and Stability	Database Size Components / Elements Interfaces
	Functional Size and Stability	Requirements Change Requests
Product Quality	Correctness	Problem Reports Defects Achieved Accuracy in Performance (Technical Performance Measures)
	Supportability	Recovery Times
	Efficiency	Utilization Throughput Timing
	Portability	Open Systems Compliance
	Usability	Operational Errors
	Dependability	Failures Fault Tolerance
Process Performance	Process Compliance	Reference Model Level Process Audit Findings
	Process Efficiency	Productivity Cycle Time
	Process Effectiveness	Effectiveness of Process Tasks Rework Size Rework Effort
Technology Effectiveness	Suitability	Requirements Coverage
	Insertion Impact	Quantitative Impact of New Technology
	Technology Volatility	Releases or Revisions
Customer Satisfaction	Customer Feedback	Survey Results Performance Award Commendations / Complaints Increased Business

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General Modifications

- **Candidate measures may have limited applicability**

- **Revisit and tailor Measurement Specification tables**

    - **Selection and specification guidance**

- **Different systems engineering roles effects the prioritization of issues**

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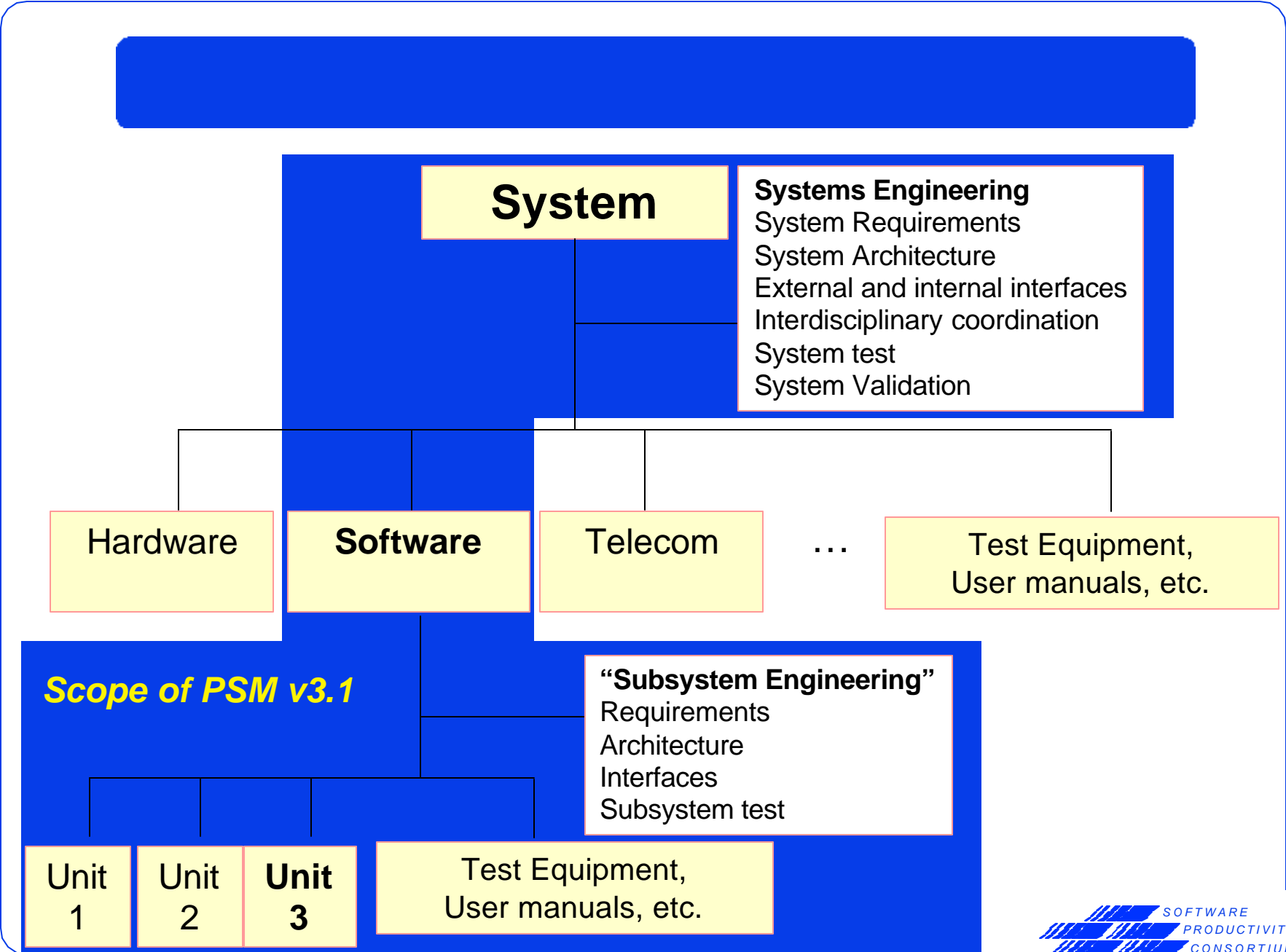
Language Barriers

- **Project focus**

- **'Software' usage**

    — **For example, "the software project manager uses the measures to make informed decisions"**

- **Inability to avoid usage of 'metric'**

- **Training examples (SLOC)**

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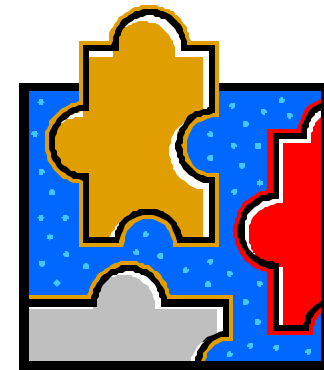
Bridging the Gap

- **PSysM IPT chartered to integrate systems in 1996**

  - **Partnership between INCOSE MWG and PSM**

- **PSM became Practical Software and Systems Measurement last year**

- **PSM Guidebook version 4.1 includes systems**

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System

Systems Engineering
System Requirements
System Architecture
External and internal interfaces
Interdisciplinary coordination
System test
System Validation

Hardware | **Software** | Telecom | … | Test Equipment, User manuals, etc.

Scope of PSM v3.1

"Subsystem Engineering"
Requirements
Architecture
Interfaces
Subsystem test

Unit 1 | Unit 2 | **Unit 3** | Test Equipment, User manuals, etc.

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Summary

- **Systems engineering roles drive issues**

- **PSM is a solid measurement process**

- **Application of PSM to systems requires acknowledgement of PSM Scope (Software-intensive-systems)**

  — **Domain characteristics beyond software are not present**

- **Language barriers may hinder buy-in**

- **Devil is in the details, a comprehensive systems ICM table may be either too generic or overly cumbersome**

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Questions & Comments

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