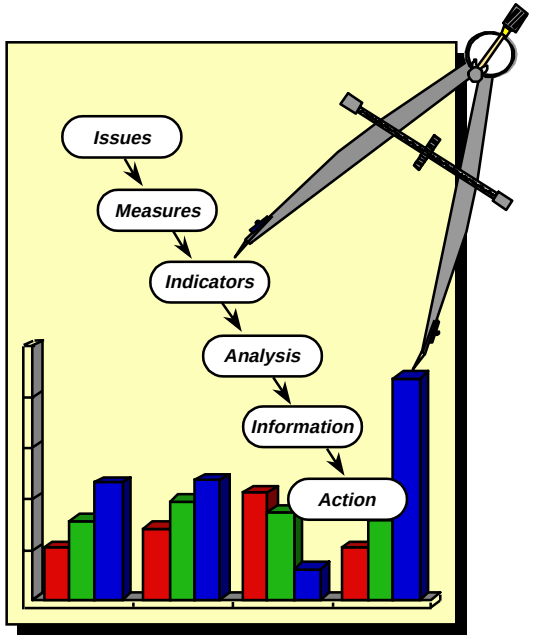
Practical Software Measurement

A guide to objective program insight



Systems Engineering Measurement Workshop

July 23, 1997

Joint Logistics Commanders
Joint Group on Systems Engineering

Office of the Under Secretary of Defense
Acquisition and Technology

Workshop Agenda

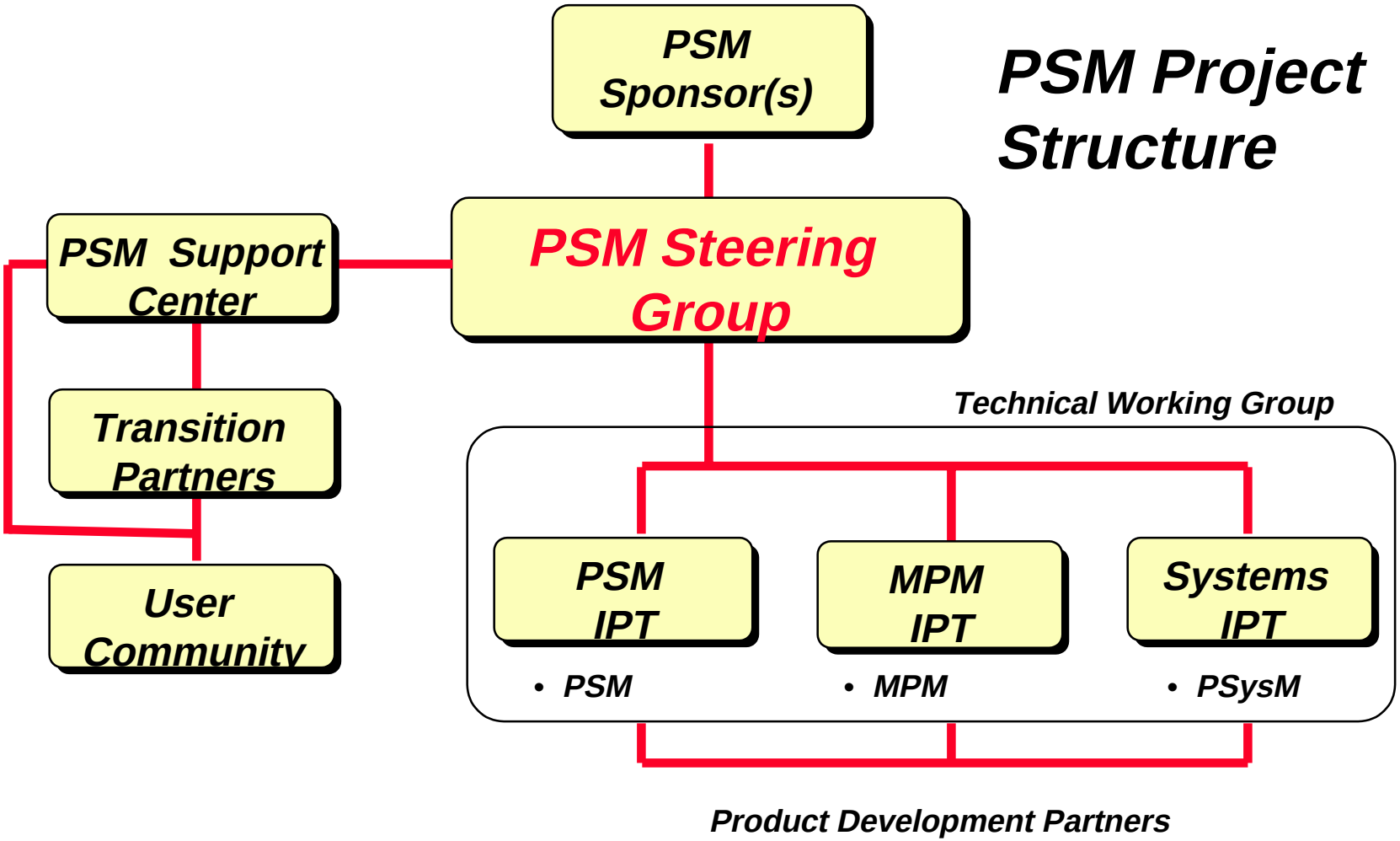
- ***8:30 - 09:15*** ***Review Current PSysM Project Background and Goals***
- ***09:15 - 10:00*** ***Comparison of SW and Systems Measurement***
- ***10:00 - 10:30*** ***Break***
- ***10:30 - 11:00*** ***Links Between SW and Systems Measurement***
- ***10:30 - 12:00*** ***Initial Topics for PSysM***
- ***12:00 - 1:00*** ***Lunch***
- ***1:00 - 3:00*** ***Approach for PSysM Development***
- ***3:00 - 7:00*** ***Free Time***
- ***7:00 - 9:00*** ***Prepare Summary Briefing***

Overview of Background and Goals

Practical Systems Measurement

- ***Objective** - Joint INCOSE-PSM Systems Engineering Measurement Products*
- ***SE Products Based on Existing PSM Approach - Structure***
- ***Foundation - PSM Derived Measurement Process With Specific SE Issues/Measures***
- ***Link Systems and Software Analysis***
- ***Joint Development - Implementation Team***
- ***Phased Development Plan***

PSM Project Structure



PSM Measurement Initiatives

- *PSM Version 3.0 - Estimation and Analysis*
- *Software Product Engineering Measurement*
- *Software Process Improvement Measurement*
- *Systems Engineering Measurement*
- *Commercial Software Engineering Standards*
- *Organizational Performance Measurement*
- *"Cross-Program" Software Measurement*

Benefits of Collaboration

- ***Benefits***
  - ***Reduces effort and development of materials, training, etc.***
  - ***Standardizes across greater part of the engineering community***
  - ***Unified approach will hold more credibility***
  - ***Larger audience of interest***
  - ***More likely to be implemented by DoD customers***
  - ***Compatible and extensible process for whole system and business***

INCOSE Metrics Working Group (MWG)
Charter and Scope

Charter:

- **Promote shared understanding and advancement of systems engineering metrics, measurement practices, measurement tools/support, and the overall measurement process.**
- **Scope:**
- **Measurement addressing:**
  - *Entire system (software, hardware, people, interfaces)*
  - *Entire life cycle (concept through disposal)*
  - *Product, process, and project*

Measurement and Systems Engineering

- *Measurement underlies all levels above level 0 in the SE-CMM*

  "You cannot control what you can't measure" *Tom DeMarco*

- *Measurement provides the insight and feedback to identify what needs improvement and determine whether the improvement actions were effective*

  "Measurements … should primarily be used to help us better understand and adjust our practices." *Bill Hetzel*

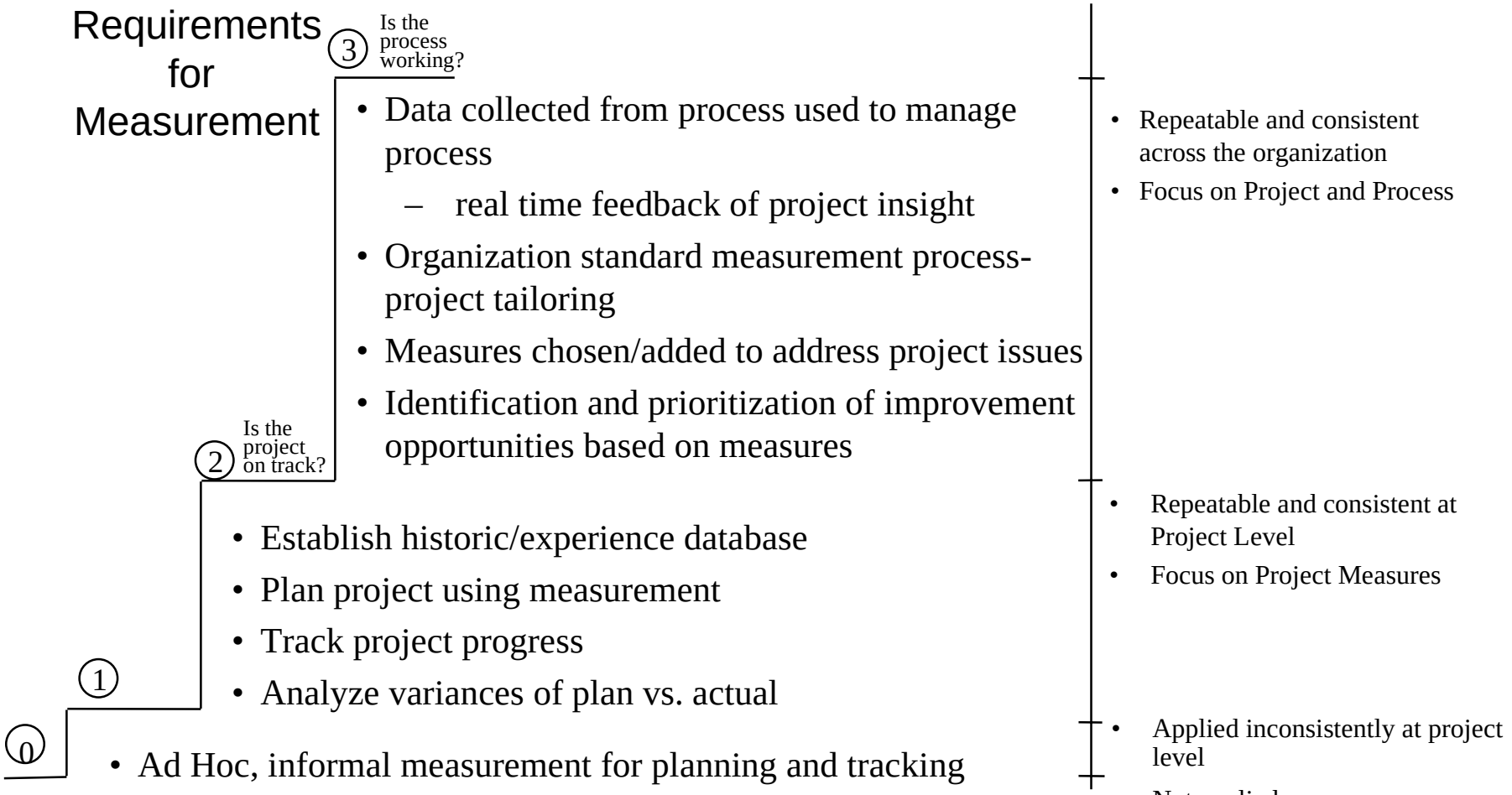
- *Measurement needs to be applied to all aspects of Systems Engineering*
  - *Cost*
  - *Schedule*
  - *Quality*
  - *Functionality*

  "If you measure speed without also measuring quality, you can end up with a lot of junk in a hurry." *Bill Smith*

  "The number one factor common to companies scoring high in quality was that they were quantitative and had instituted measurement programs." *Dr. Curtis Reimann*

Measurement and the SE-CMM

Capability Requirements for Measurement



Workshop Objectives

- *Identify Initial User Requirements To be Addressed in PSysM*
- *Assess Current Plans for PSysM Guidance and Products - Identify Realistic Schedule and Content for Planned Product Versions*
- *Establish Basis for Joint INCOSE - PSM Approach to Systems Engineering Measurement*
- *Establish PSysM Project Plan*

Intended Audience

- ***System Engineering Project and Technical Managers***
- ***PSM Technical Working Group Members***
- ***INCOSE Metrics Working Group Members***
- ***PSM Users with System Responsibilities***

Intended Output

- ***Recommendations for Scope and Content of PSysM Guidance and Products***
- ***Comments on the Proposed Approach to Development of PSysM***
- ***Recommendations for Initial Measurement Topics to be Addressed***
- ***Establishment of PSysM Project Plan***

Comparison of SW and Systems Measurement

Project Objectives

PSM	*PSysM*
• *Help Program Managers Meet Software Cost, Schedule, and Technical Objectives* • *Provide a Basis for Objective Communication and Informed Decision Making* • *Establish a Foundation for Executive Level Performance Measurement*	

Software Management Objectives

Program Management

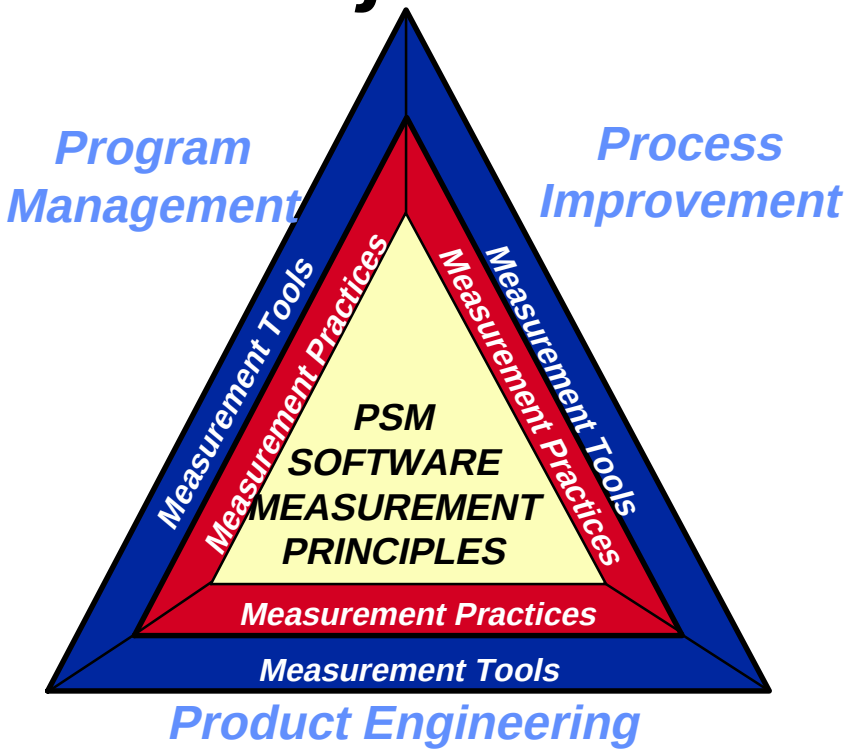
Meet program commitments In terms of delivered software capability, cost, schedule, and quality

Process Improvement

Make improvements in the software development and acquisition processes to meet defined technical and business objectives

Product Engineering

Ensure customer product acceptance and satisfaction



What Are The System Management Objectives?

System Management Objectives

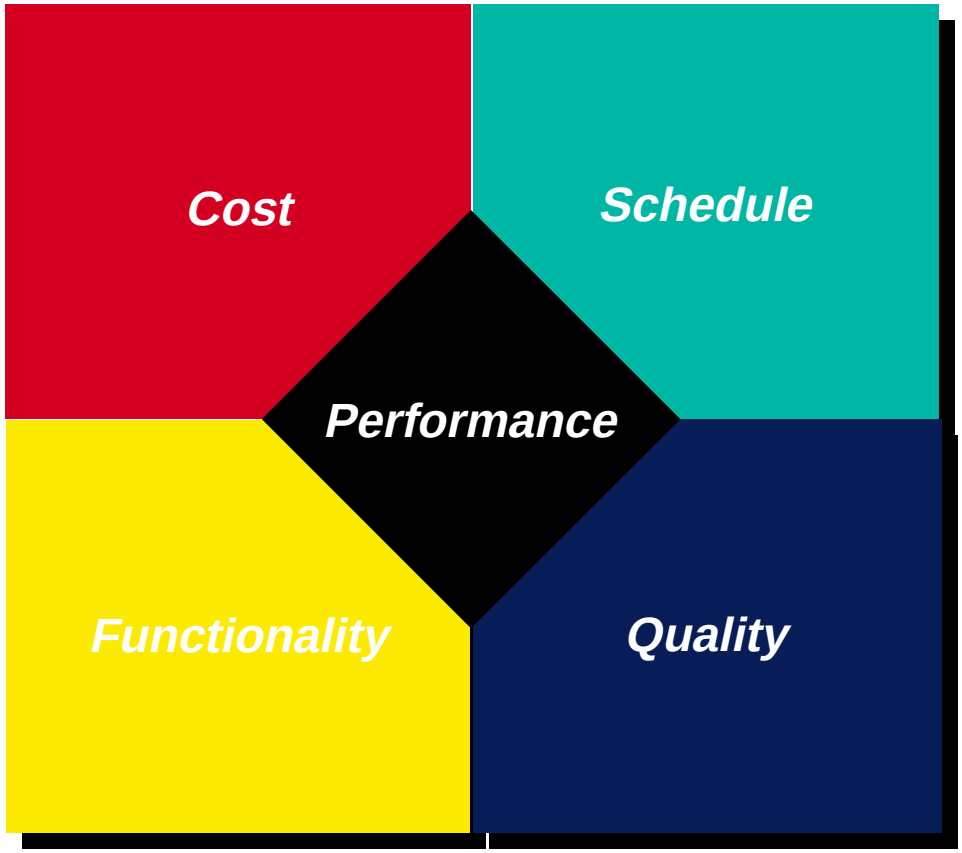
Initiative Scope

PSM	*PSysM*
• *DoD SW Measurement Needs* • *Target Audience is DoD Program Mgr and Development Team* • *AIS, C3I, and Weapon Systems Programs* • *New and Existing Program Implementations* • *Life Cycle Application - All DoD Programs, All Phases* • *Single SW Program Analysis* • *Fundamental Practices - "How To" Guidance*	

Key Concepts

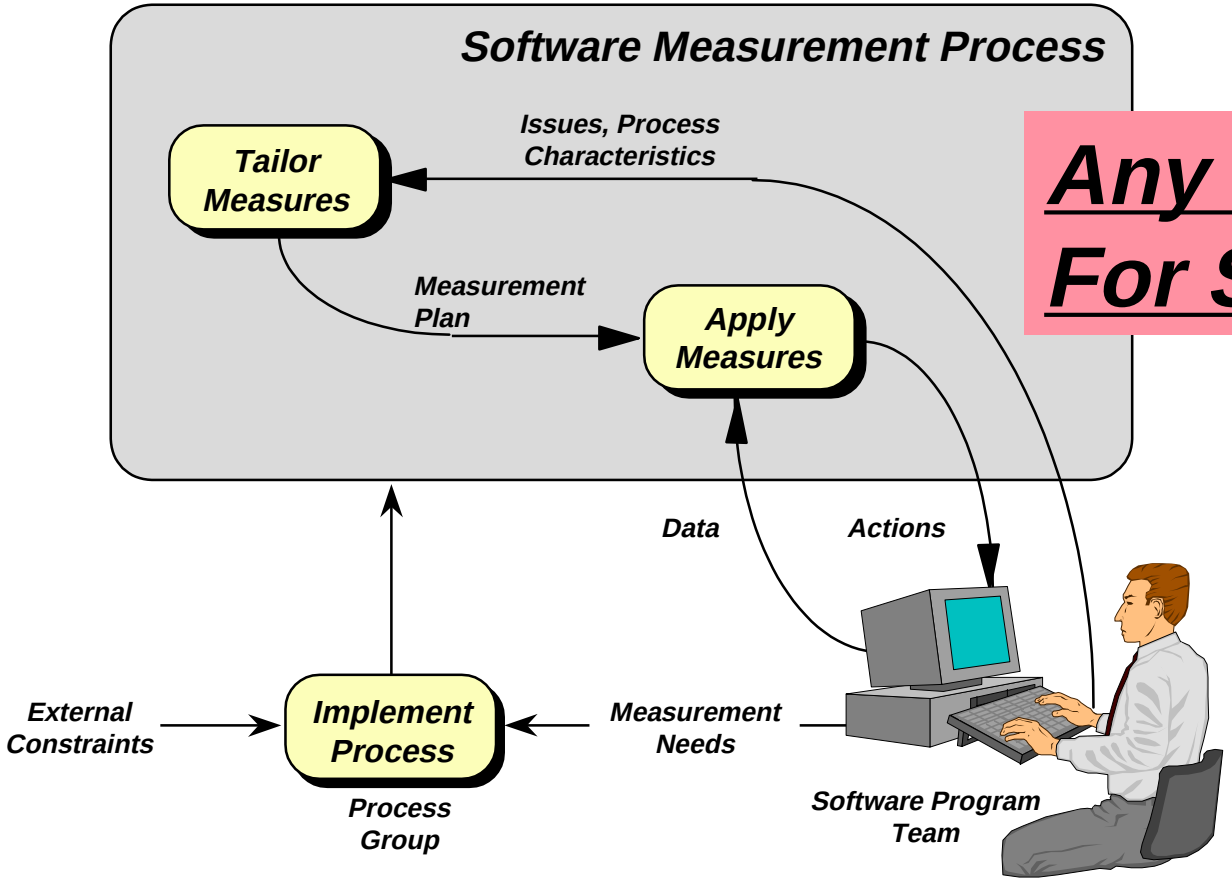
PSM	PSysM
Views Measurement as a Process, not a Pre-Defined List of Measures, Graphs, or Reports Defines a Systematic Method for Selecting Appropriate Measures that address program specific issues Defines a Systematic Method for Analyzing Data incorporating the use of independent analysis to Assess Issues/Risks Effective Program-Level Measurement is a Prerequiste for Enterprise and Process Measurement	

Integrated Software Management



Any Differences For Systems?

Software Measurement Activities



Any Differences For Systems?

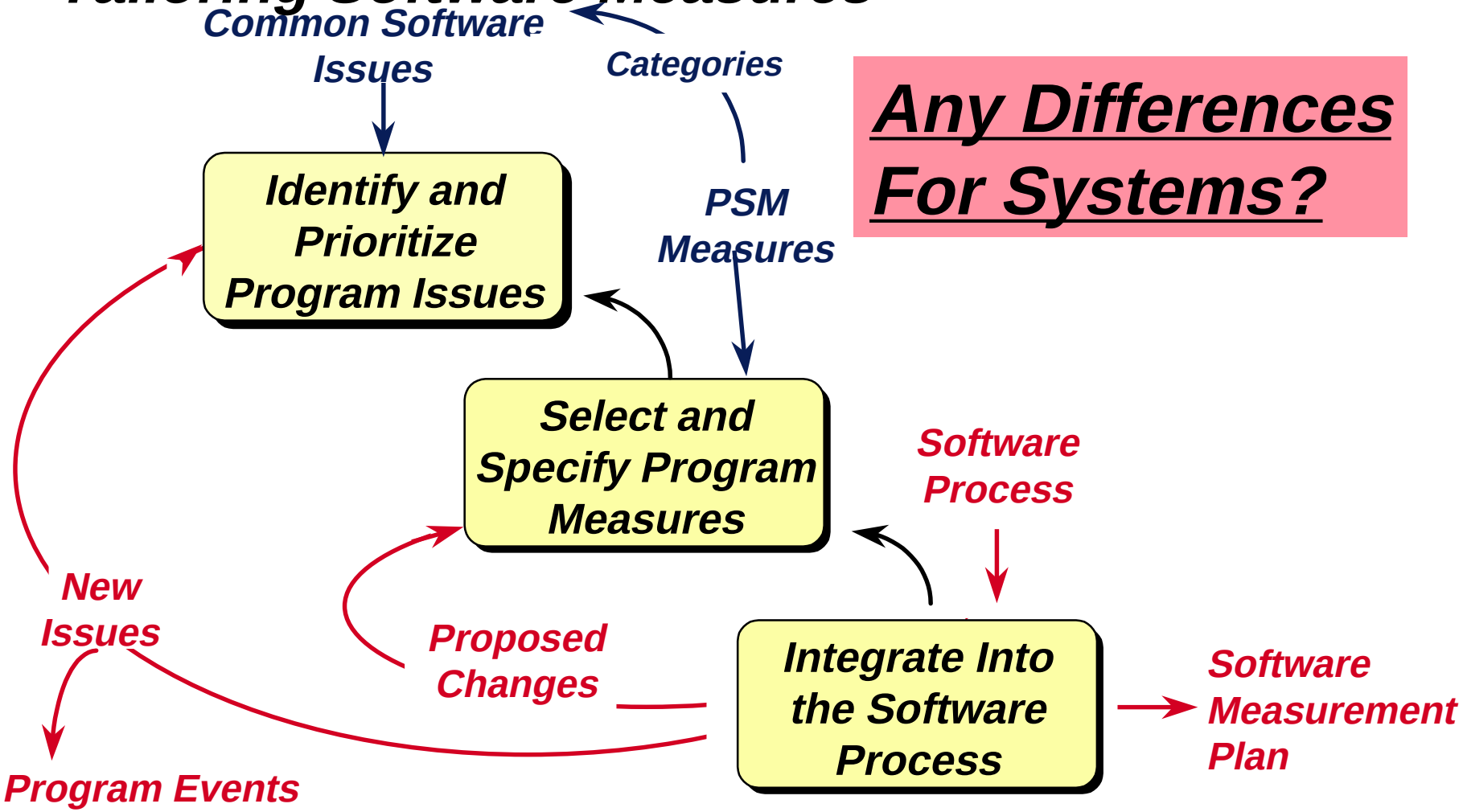
Measurement Principles

PSM	*PSysM*
• *Program Issues and Objectives Drive the Measurement Requirements* • *The Developer's Process Defines How the Software is Actually Measured* • *Collect and Analyze Data at a Level of Detail Sufficient to Identify and Isolate Software Problems* • *Implement an Independent Analysis Capability* • *Use a Structured Analysis Process to Trace the Measures to the Decisions*	

Measurement Principles

PSM	*PSysM*
• *Interpret the Measurement Results In the Context of Other Program Information* • *Integrate Software Measurement Into the Program Management ProcessThroughout the Life-Cycle* • *Use the Measurement Process as a Basis for Objective Communications* • *Focus Initially on Single Program Analysis*	

Tailoring Software Measures



Common Issues

- ***Schedule and Progress***
- ***Resources and Cost***
- ***Growth and Stability***
- ***Product Quality***
- ***Development***

Performance

- ***Technical Adequacy***

Do All These Issues Apply For Systems?

Any Additional Issues For Systems?

Measurement Categories

- *Milestone Performance*
- *Work Unit Progress*
- *Schedule Performance*
- *Incremental Capability*
- *Effort Profile*
- *Staff Profile*
- *Cost Performance*
- *Environment Availability*
- *Technology Impacts*
- *Product Size and Stability*
- *Functional Size and Stability*
- *Target Computer Resource Utilization*
- *Defect Profile*
- *Complexity*
- *Process Maturity*
- *Productivity*
- *Rework*

Do All These Categories Apply For Systems? Any Others?

Measures

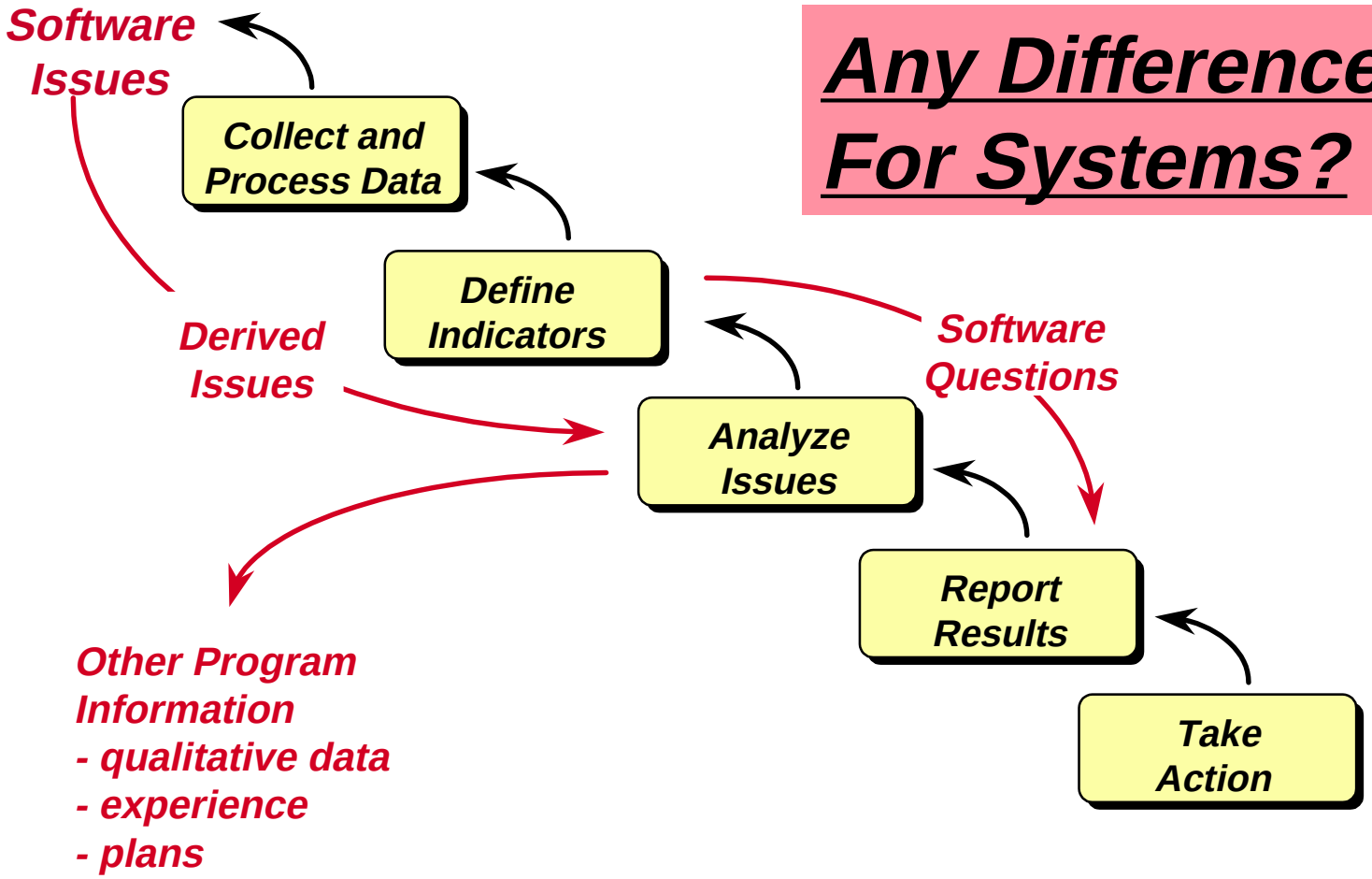
How Many Of The PSM Measures Apply To Systems?

Measurement Plan

Any Differences For Systems?

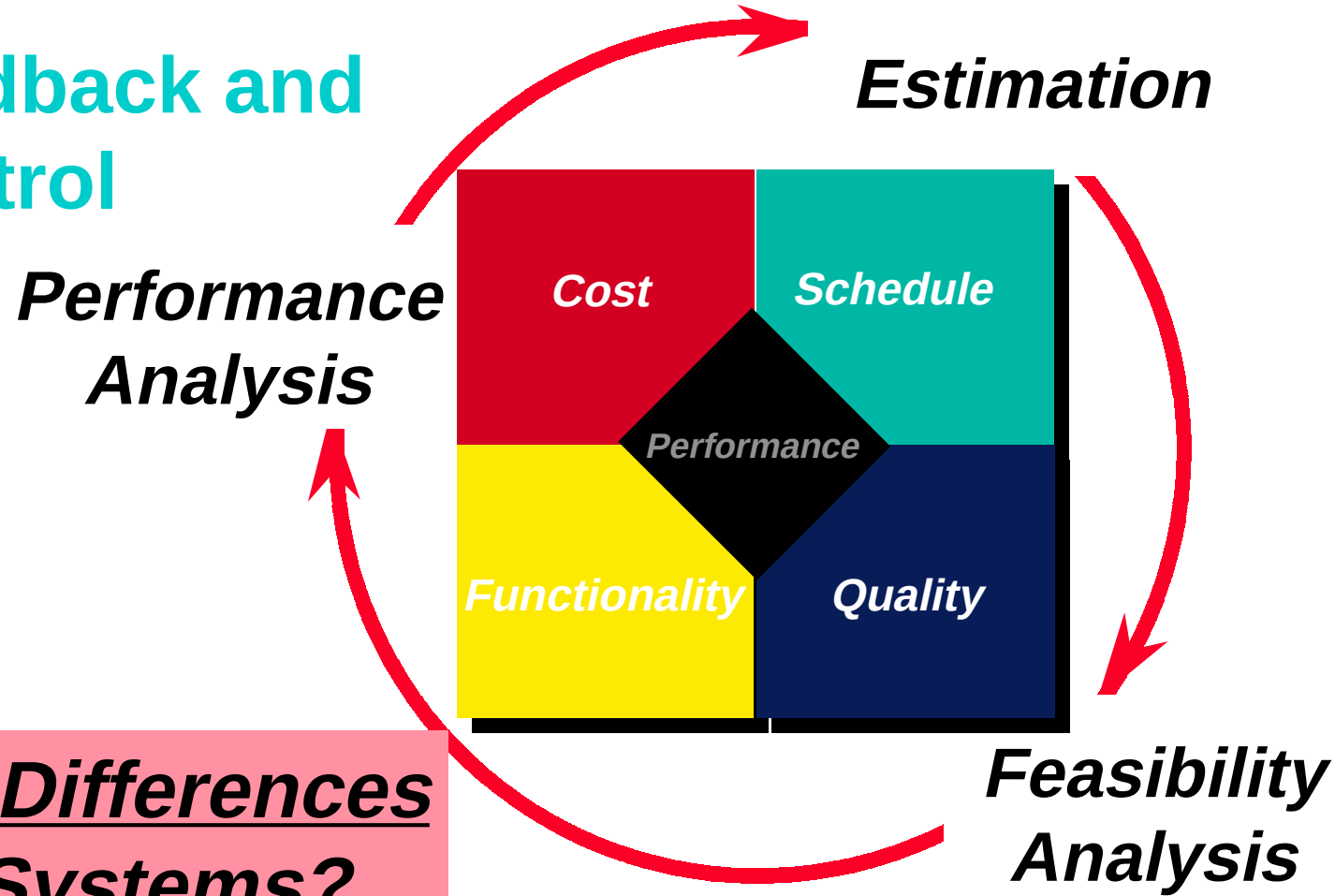
- ***Issues and Selected Measures***
- ***Measurement Specifications and Definitions***
- ***Data Sources***
- ***Measurement Levels and Aggregation Structures***
- ***Frequency of Data Collection***
- ***Methods of Data Delivery***
- ***Lines of Communication and Interfaces***
- ***Frequency of Analysis and Reporting***
- ***Working Document***

Applying Software Measures



Any Differences For Systems?

Feedback and Control



Any Differences For Systems?

Link Between Software and Systems

Brainstorming Session:

- Using standard brainstorming technique identify necessary links between software systems measurement.

- Discuss items identified

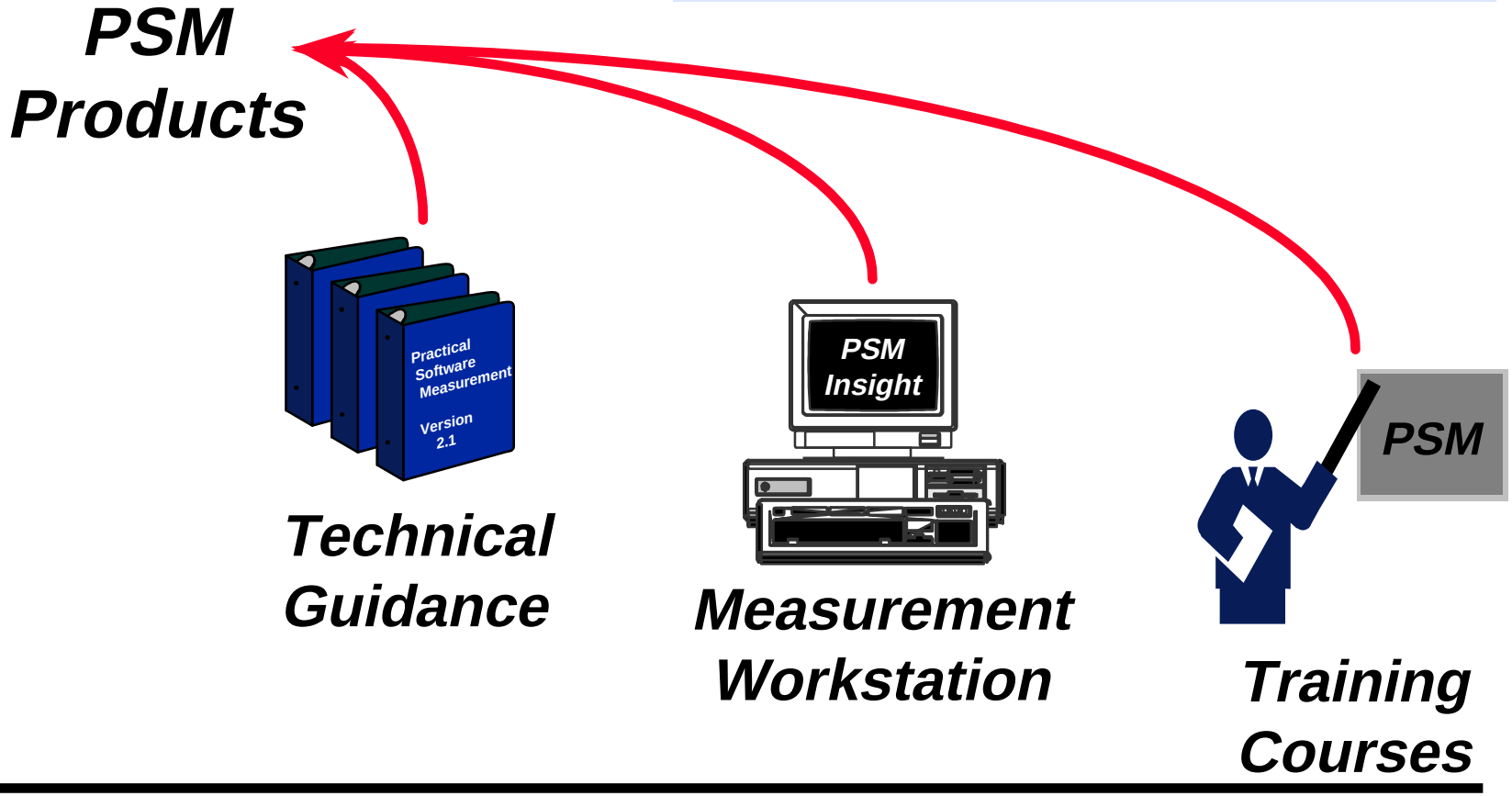
Initial Topics For PSysM

Group Breakout Session:

- Breakout into small groups.
- Derive list of Top 5 topics that need to be addressed in PSysM. (20 minutes)
  - Include rationale.
  - Prioritize the list.
- Present results. (5 minutes per group)
- Consolidate lists and prioritize. (20 minutes)
  - Use results for version planning.

Approach For PSysM Development

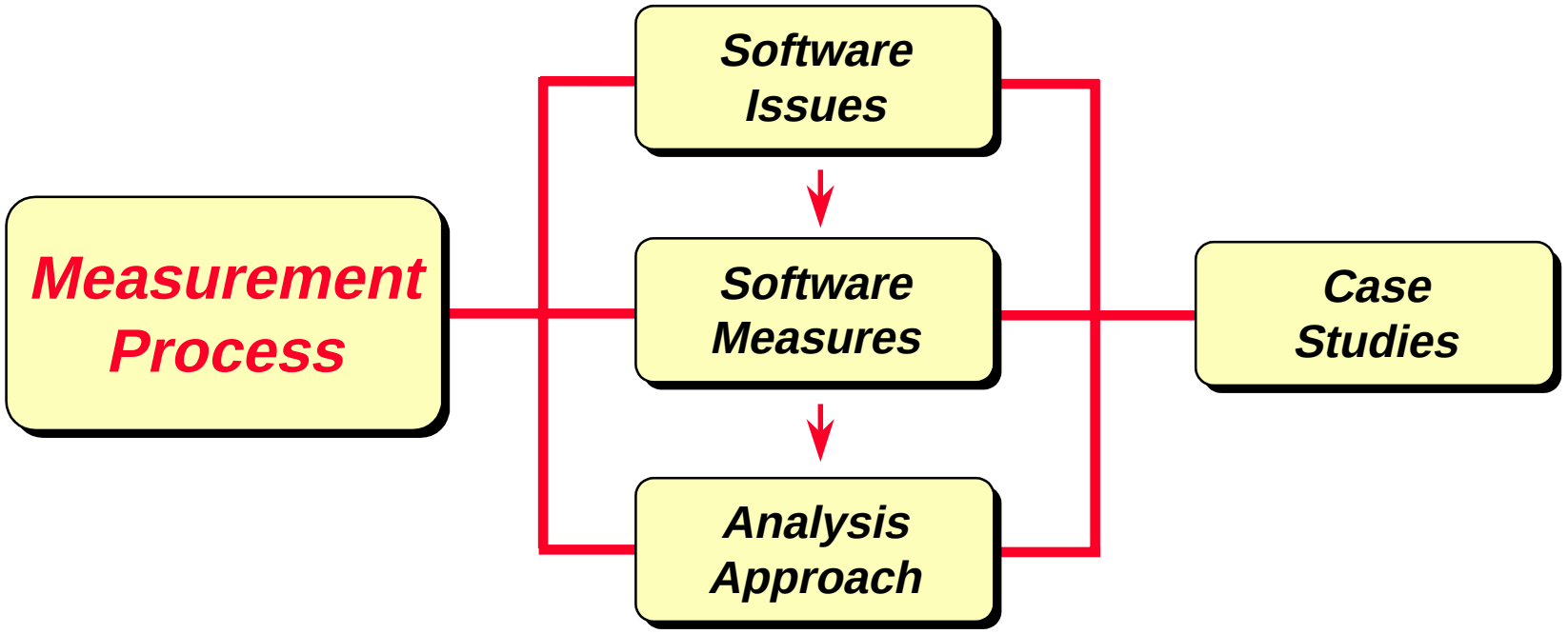
Same Products Are Proposed For PSysM



Collaboration Approach

- ***Build on Current Products***
  - **PSM provides detailed, proven process**
  - **INCOSE Guidebook provides system metrics and orientation**
- ***Documentation***
  - **Use PSM process concepts and documentation directly**
  - **Account for differences between SE and SW**
  - **Use example metrics from current INCOSE guidebook and other sources**
- ***Training***
  - **Reuse much of existing training materials**
  - **Training with same constraints as current PSM trainers**
    - » **Trainers go through Train-The-Trainers course to be qualified**
    - » **Course materials controlled - only approved course materials used**
    - » **Always taught consistently**

PSM Guidance Structure



Proposed Tasks & Schedule

Goal: Establish Realistic Schedule for PSysM Product Development

Proposed: See Next Chart

Considerations:

- ***Results of Product Discussion***
- ***Priorities and Version Content***

Proposed Tasks & Schedule

Development Task	***Scheduled Completion***

- ***Project Plan***
- ***Concept Outline***
- ***Detailed Outline***
- ***Draft PSysM Guidebook***
- ***Draft Training***
- ***Promotional Briefings and Papers***
- ***Version 1.0 of PSysM Guidebook***
- ***Training Course Complete***

PSysM Organization Structure

- *PSM Technical Steering Group*
- *PSM Support Center*
- *PSysM Writer's Group (WG)*
- *PSysM Technical Working Group (TWG)*

How can we optimize effectiveness of this structure? Are roles adequately defined?

PSysM Organization Structure
Support Commitments (TBR)

Writer's Group	*Technical Working Group*	
• *Garry Roedler* • *Bill Farr* • *Sharon Rohde* • *Don Gantzer* • *Patrick Antony* • *Chuck Mills*	• *Garry Roedler* • *Bill Farr* • *Sharon Rohde* • *Don Gantzer* • *Patrick Antony* • *Chuck Mills* • *Chris Miller* • *John Gaffney* • *Jeanmarie MacLean* • *Terry Treadwell*	• *Dave Card* • *Florence Beckmann* • *Alan Weinberger* • *Dennis Brink*

Logistics

- *Meeting Frequency*
  - *WG*
  - *TWG*
- *Meeting Location(s)*
- *Mode of Meetings*
  - *Traditional*
  - *Teleconference*
  - *Video Teleconference*
- *Means of Communication*
- *Other*

Proposed Next Steps

- *Finalize Project Plan*
- *Establish Technical Working Group*
- *Establish Writer's Group*