SOEN 384
Management, Measurement and Quality Control

http://users.encs.concordia.ca/~s384_2/

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Lecture 3:

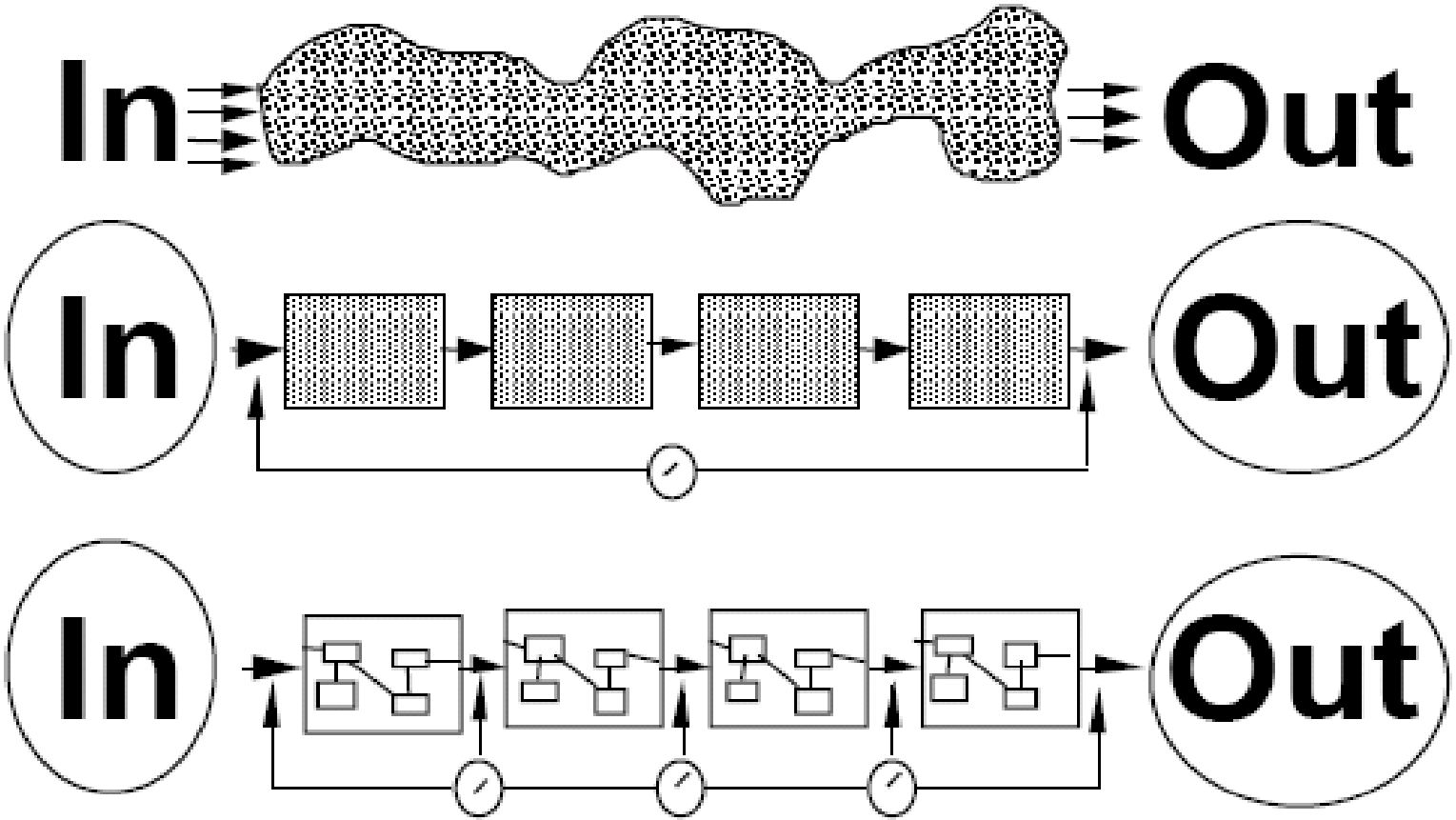
Planning the Measurement Process. ISO 15939 Standard

ISO 15939

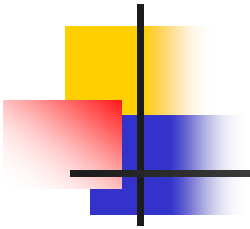
Agenda

- Software Measurement – a key software engineering discipline
- Information-driven measurement approach to support organization's objectives [ISO 15939]
- Software measurement process [ISO 15939]
- Integrating the Measurement Process into Project Management Processes: Software Measurement Plan [ISO 15939]

Software measurement provides visibility into the project



Software Measurement – a key software engineering discipline



- Measurement required in Level 2 of the CMMI
- Supports an organization's business and technical objectives
- Integrated with existing technical and managerial activities that define a software project

Information-driven measurement approach to support Organization's Objectives

- Measures are defined and implemented to address the specific **Information Needs** of the project decision makers

- How? *Goal Question Metric (GQM)*

Goal-Question-Metric Approach

- Primary question in goal-based measurement:
  - *"What do we want to know or learn?"* **instead of**
  - *"What metrics should we use?"*

- Because the answers depend on your goals, no fixed set of measures is universally appropriate.

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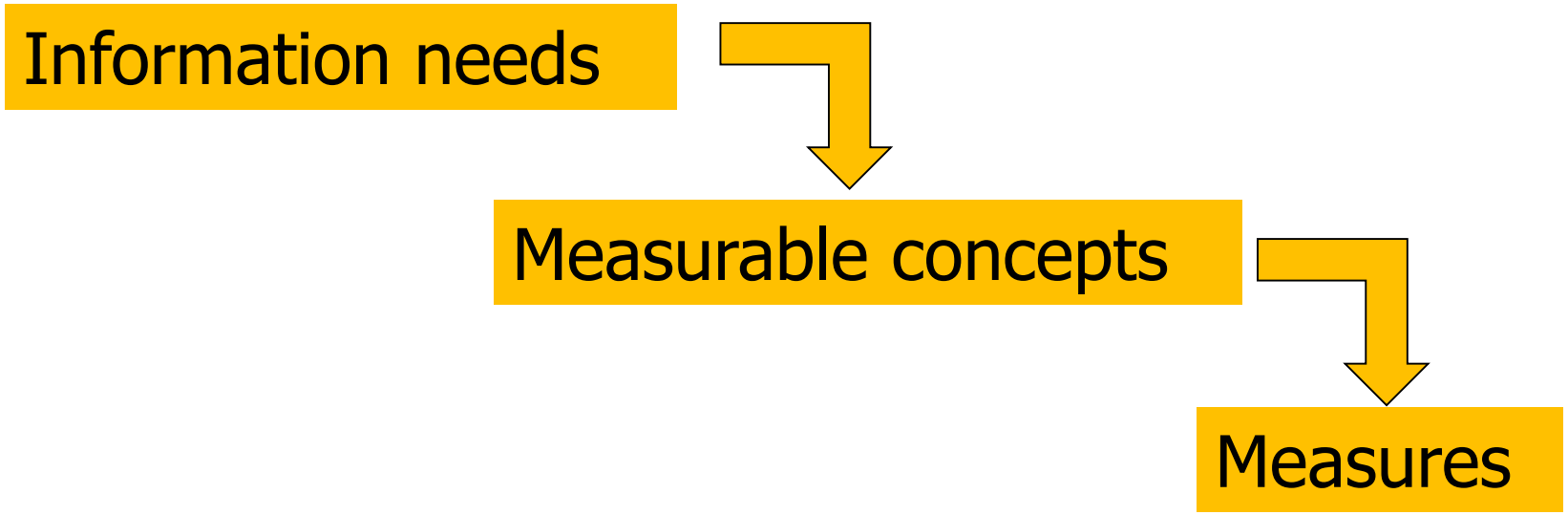
How to Select and Specify Measures [ISO 15939]



GQM

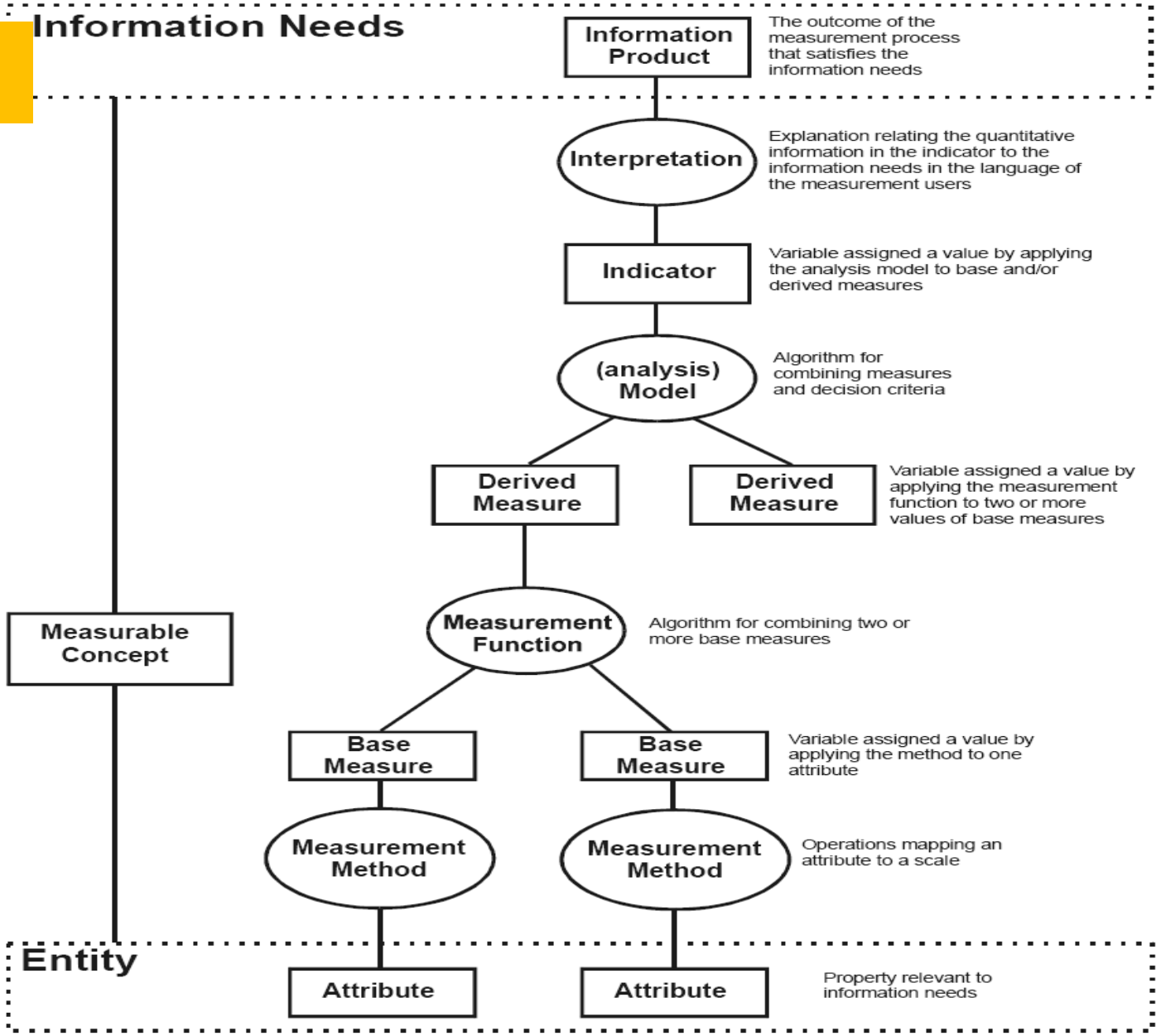
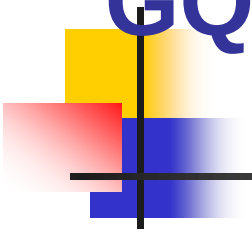


Figure A.1 — Key relationships in the Measurement Information Model

GQM Approach: Key Points



- GQM Ensures that Measurement is Relevant to an Organization.
- GQM Helps Managers Focus on Metrics that Relate to Project and Organizational Goals
- You are using Goal-Question-Metric paradigm to derive information needs, decide on the measurable concepts and identify the attributes relevant to the information needs.

Design Quality Example (ISO 15939 std.)

- **Goal:**
  - The decision-maker in this example needs to evaluate detailed design quality as the design is being produced.
- **Question:** What should be measured in order to satisfy the information need?
  - design quality is related to defect density expressed in terms of the amount of design produced and the number of defects found

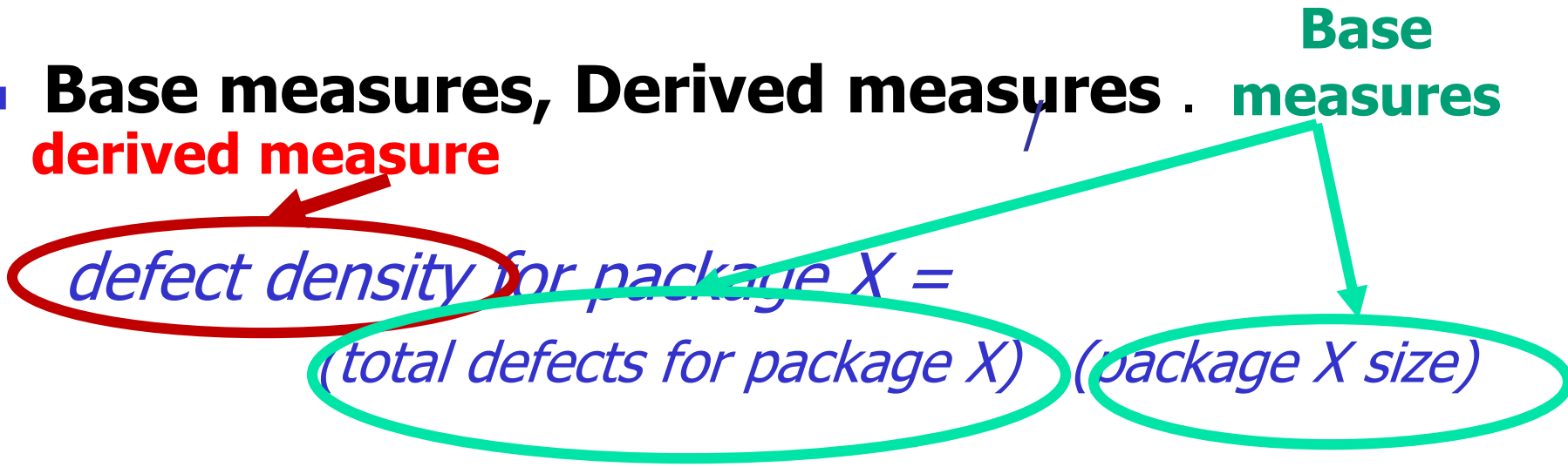
measurable concept that addresses the defined information need

Design Quality Example (ISO 15939 std.)

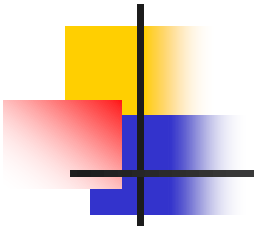
- defect density:
  - Normalization of a design package quality will allow for a basic comparison: If the defect rate on any package is different enough from the average it should be reviewed or even redesigned.
- **Relevant Entities, Attributes:**
  - design package X; Package X size
  - inspection report; Total defects for package X

Measurement Construct – Quality Example

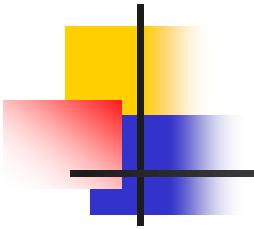
- **Base measures, Derived measures .**



Measurement Method



- A **measurement method** is the assignment of a value to a **base measure** according to some rule
  - *Count the total defects for a package listed in the inspection reports*
  - *Count the number of lines of text for each package*



Measurement Function

- An algorithm for combining two or more measures to assign a value to a **derived measure** value
  - *Divide total defects by package size for each package*

Measurement Construct – Quality Example

defect density for package X =

(total defects for package X) / (package X size)

- Data collection and analysis:
  - Define an analysis model
    - *Compute process centre and control limits using values of defect density*
  - Define rules for interpretation of an indicator (decision-criteria)
    - *Results outside the control limits require further investigations*

Information Need	Evaluate product quality during design
Measurable Concept	Product quality
Relevant Entities	1. Design packages 2. Design inspection reports
Attributes	1. Text of inspection packages 2. Lists of defects found in inspections
Base Measures	1. Package X size 2. Total defects for package X
Measurement Method	1. Count number of lines [illegible] package 2. Count number of [illegible] each report
Type of Measurement Method	1. [illegible]
Scale	[illegible]s from zero to infinity [illegible]tegers from zero to infinity
Type of Scale	1. Ratio 2. Ratio
Unit of Measurem	1. Lines 2. Defects
Derive	Inspection defect density
M [illegible] nction	Divide Total Defects by Package Size for each package
Ind	Design defect density
Model	Compute process centre and control limits using values of defect density
Decision Criteria	Results outside the control limits require further investigations

Measurement Information Model

GQM

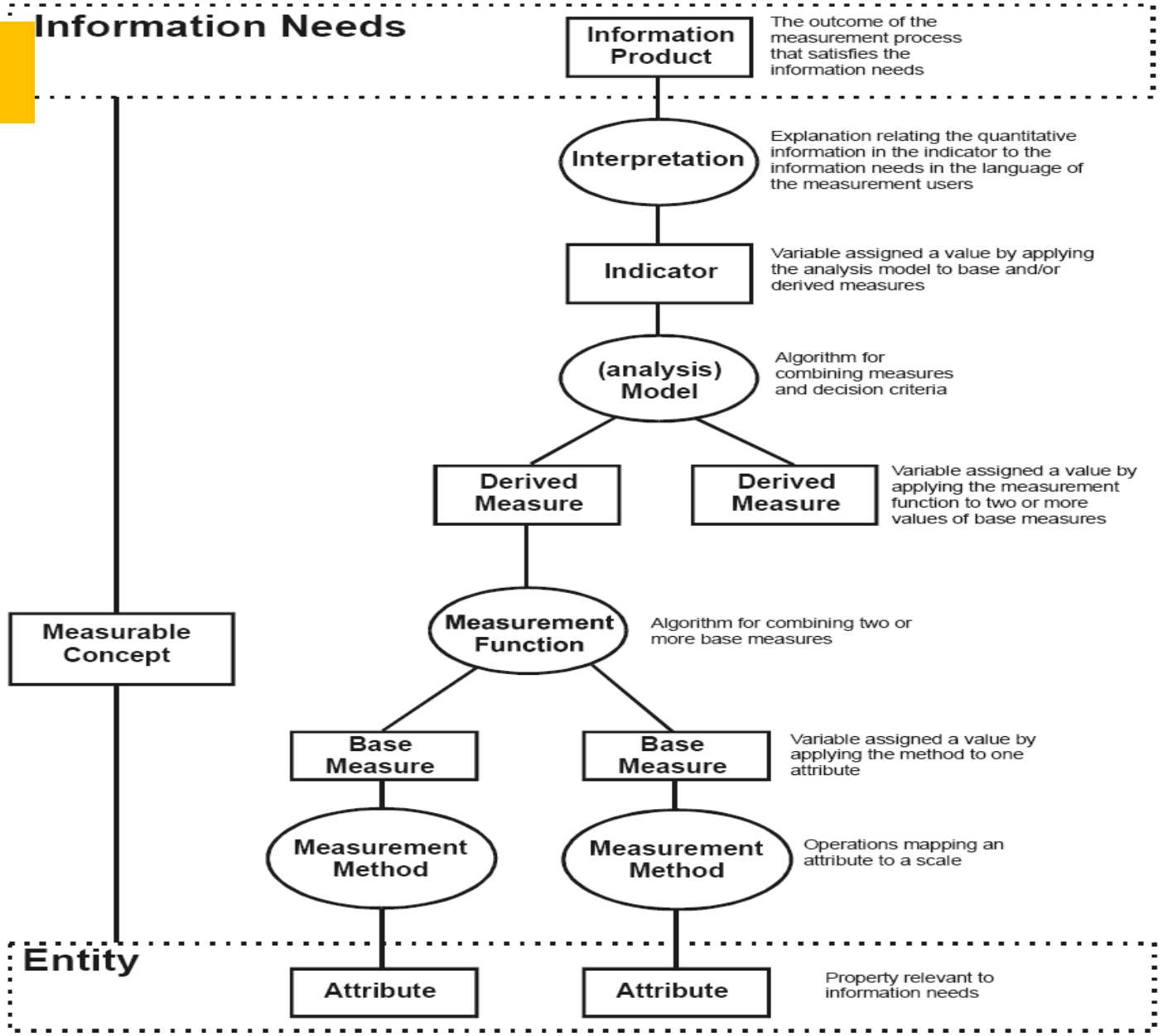
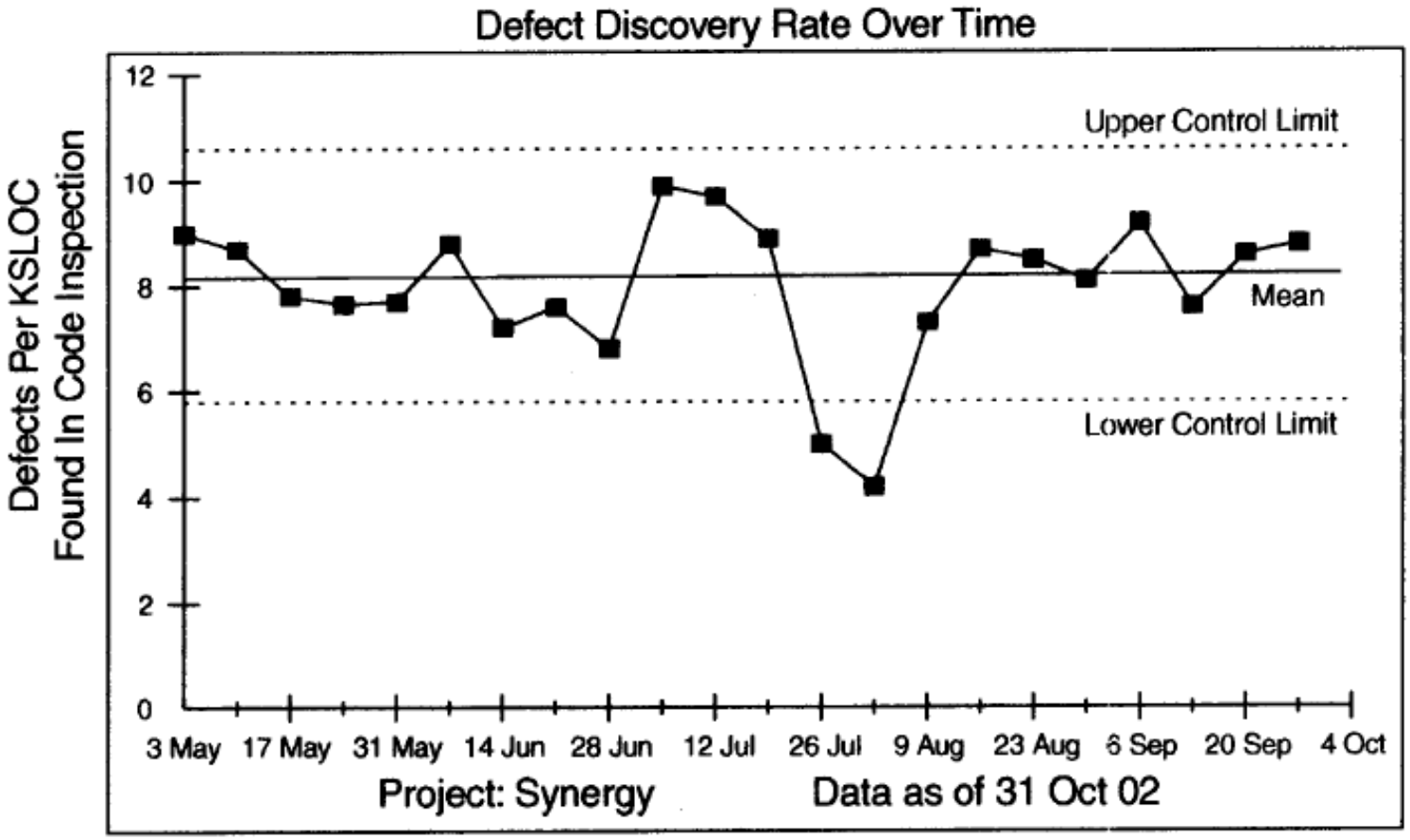


Figure A.1 — Key relationships in the Measurement Information Model

Example of a measurement model for design quality



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Definition of a measurement process

Process for:

- establishing,
- planning,
- Performing, and
- evaluating

measurement within an overall project, enterprise or organizational measurement structure

Purpose of the measurement process [ISO 15939]

- Purpose:

  to collect, analyze, and report data relating to the products developed and processes implemented within the organizational unit, to support effective management of the processes, and to objectively demonstrate the quality of the products.

- The activities are sequenced in an iterative cycle allowing for continuous feedback and improvement.

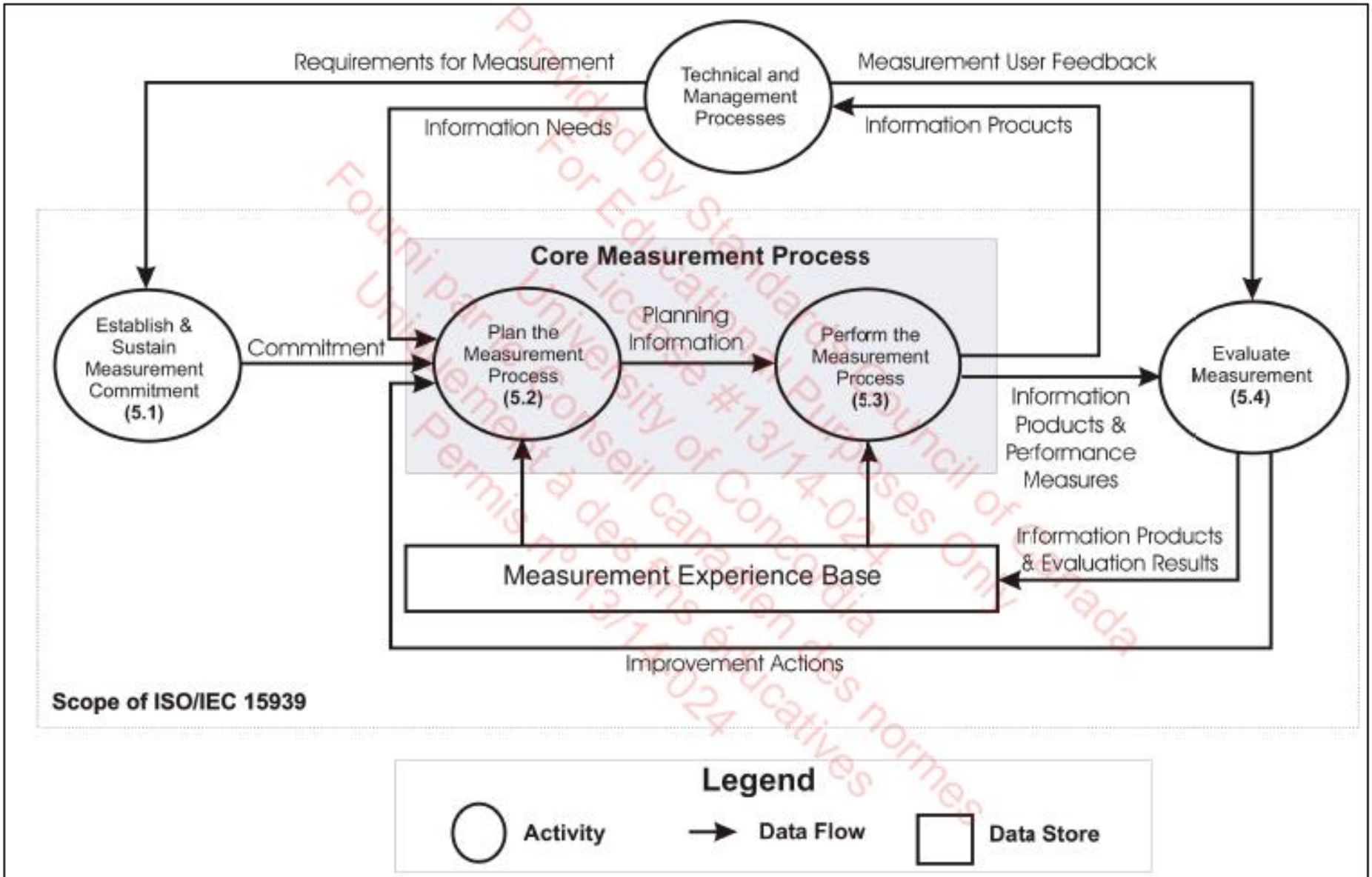

Figure 1: Measurement Process Model.

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Outcomes of the measurement process [ISO 15939]

- organizational commitment for measurement is established and sustained;
- the information needs of technical and management processes are identified;
- an appropriate set of measures, driven by the information needs are identified and/or developed;
- measurement activities are identified;
- identified measurement activities are planned
- the required data is collected, stored, analyzed, and the results interpreted
- information products are used to support decisions and provide an objective basis for communication
- the measurement process and measures are evaluated
- improvements are communicated to the measurement process owner

Evolution of an information need into a measurement plan

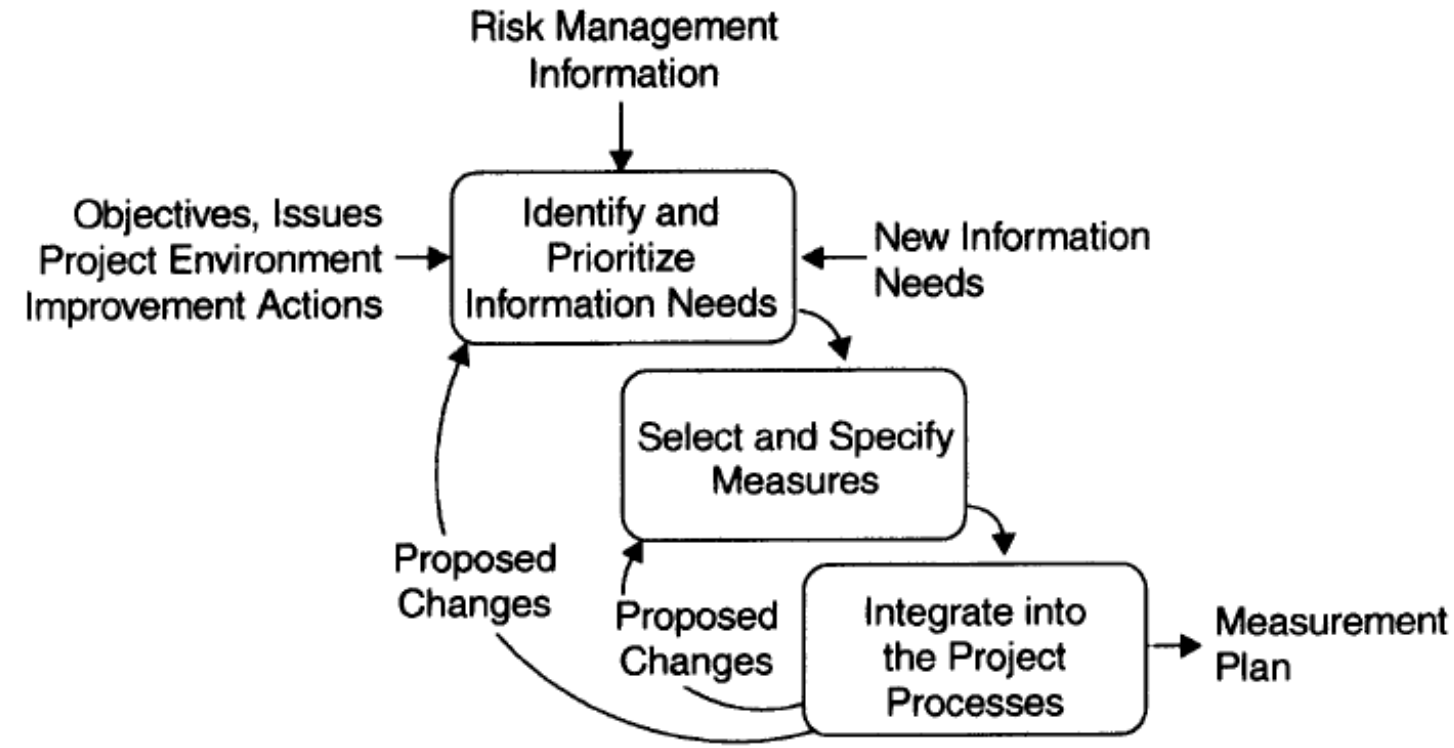


Figure 3-1 Plan Measurement activity

Software Measurement Key Tasks

Define goals
- Goal-Question-(Indicator)-Metric
- process objectives

Define measures
- document definitions
- storage
- change procedures

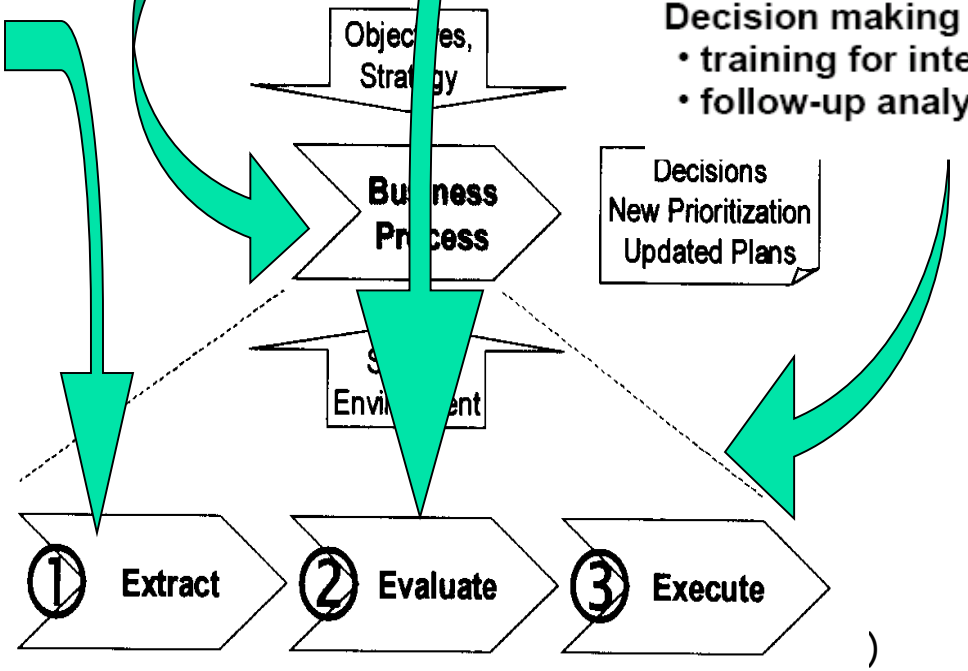
Data collection
- forms
- training
- automation
- procedures

Data storage

Data analysis
- must support decision making
- must be appropriate for type of measure

Data reporting
- meet timeliness requirements
- understandable content and format

Decision making
- training for interpretation
- follow-up analysis capability



Integrating the Measurement Process into Project Management Processes

- Integrating data collection procedures into processes providing data
  - Periodicity, responsible individuals, source,
- Integrating analysis and reporting procedures into decision-making processes
  - analysis and reporting mechanisms, configuration management

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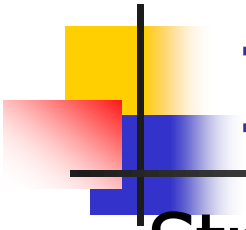


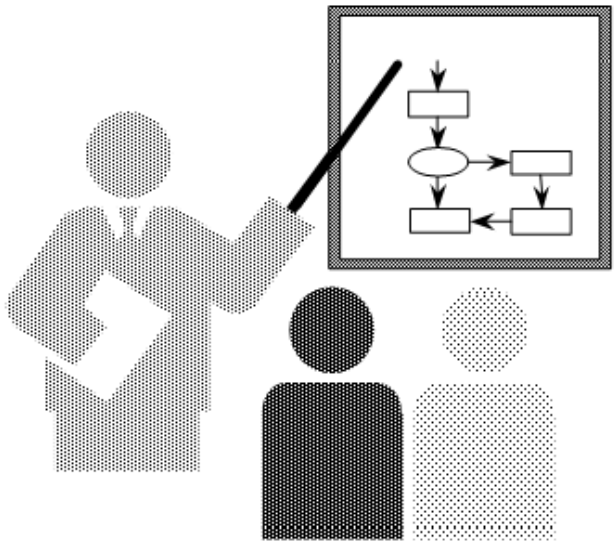
Integrated

- Structured and repeatable **Measurement Process**
  - Project Measurement Activities and Tasks associated with planning, performing, and evaluating measurement – related tasks within an overall project or organizational structure to accomplish the organization's goals
  - Iterative process, in place throughout the existence of the project

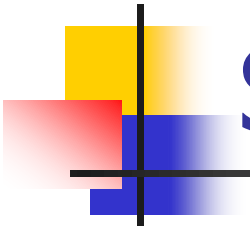
Template: SMP Template TM-SPTO-03 v1.0 5/20/02

SOFTWARE MEASUREMENT PLAN

Version 1.0[1]



SOEN384-F14-L3: ISO 15939
(Plan the Measurement Process)



Section 1

- Purpose
- Organizational Description
- References

Plan the measurement process: 1.1 Purpose

This section should address the importance of the Software Measurement Plan (SMP) to the success of the project and/or organization in the conduct of both current and future efforts. This section is a summary of the expected benefits from the use of the measurement results and should be a summary of the reasons for the efforts.

Example:

The purpose of the Software Measurement Plan (SMP) is to specify the core measurements to be used by all production life cycle support projects within the Division. The goal is to develop a set of metrics that will improve the management of risks and provide a database of information to be used in estimating future work effort.

Plan the measurement process: 1.2 Organizational Description

This section should define the organizational scope affected by the SMP. The nature of the organization's work should be described in brief.

Example:

The Division is the Space and Naval Warfare (SPAWAR) Software Support Activity (SSA) for computer-based Command, Control, Communication, Computers and Intelligence (C4I) Systems. Tasking includes system analysis, systems engineering, design integration, test and evaluation, installation, training, and life cycle support for these systems. …

Plan the measurement process: 1.3 References

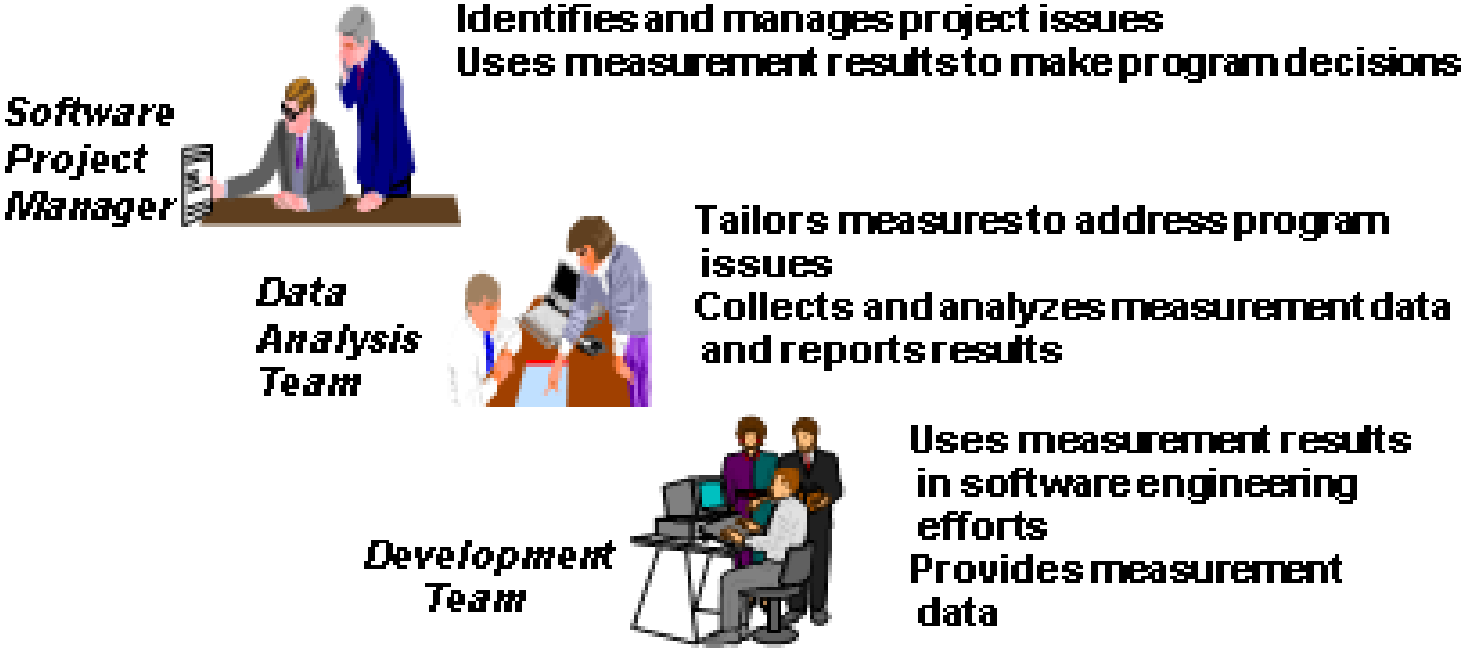
This section should list the number, title, revision, and date of all documents referenced and or used in the developing the SMP.

Example:

1. Software Project Plan V1.1
2. *…*

Plan the measurement process: SECTION 2. Organizational Measurement Roles and Responsibilities

Section 2 of the SMP should establish the key positions, roles and responsibilities for the conduct of the measurement approach. Figure 2-1 illustrates a hierarchy of roles and responsibilities.



Plan the measurement process: SECTION 3. Software Project Measurement Specifications

3.1 Measurement Information Needs and Objectives

Use the GQM technique to identify and clarify the information needs. Provide the rational for selecting which information needs are going to be satisfied.

3.2 Measurement Information Models

Measurement needs and objectives are refined into precise indicators and quantifiable measures. Use the ISO15939 template to specify the Measurement Information Model for each Information Need

Plan the measurement process:
SECTION 4. Measurement Process

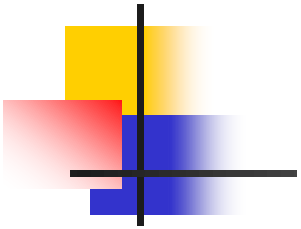
This section outlines the strategy for Executing the Measurement Plan

4.1 Data Collection and Storage Procedures

Explicit specification of collection methods helps ensure the reliability of the collected data (see Lecture 9 for definition of reliability of measurement data). Proper attention to storage and retrieval procedures helps ensure that data are available and accessible for future reference.

4.2 Schedule

This section contains work breakdown for the main measurement activities Extract, Evaluate, Execute by Milestone.



Part 1—Introduction
- Purpose and Scope

Part 2—Project Description
- Technical and Project Management Characteristics

Part 3—Measurement Roles, Responsibilities, and Communications
- How Measurement Is Integrated into the Project Processes
- Measurement Points of Contact (acquirer, supplier, subcontractors)
- Measurement Responsibilities
- Organizational Communications and Interfaces
- Tools and Databases
- Phased Implementation (if applicable)
- Evaluation Criteria

Part 4—Description of Project Information Needs
- Organizational Goals/Issues
- Prioritized List of Project Information Needs

Part 5—Measurement Specifications (include for each identified information need)
- Measurable Concept
- Relevant Entities
- Attributes
- Base Measures
- Measurement Method
- Type of Method
- Scale
- Type of Scale
- Unit of Measurement
- Derived Measure
- Measurement Function
- Indicator
- Analysis Model
- Decision Criteria

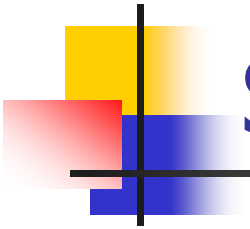
Part 6—Project Aggregation Structures
- Component Aggregation Structure (CIs, units, etc.)
- Activity Aggregation Structure (such as requirements analysis, design, implementation, and integration and test)
- Functional Aggregation Structure

Part 7—Reporting Mechanisms and Periodicity
- Reporting Mechanism and Periodicity
- Content of Reports

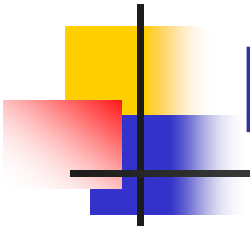
Software Measurement Plan: key Points

- **Measurement** is the *mechanism* to provide feedback on software quality.
- A **measurement plan** without a clear purpose will result in frustration, waste, annoyance, and confusion.
- To be successful, a measurement plan must be viewed as one tool in the quest for the improved engineering of software.

Making Software Measurement a Success: the business perspective

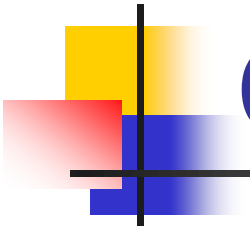


- Introduction cost of a measurement program: 1-2% of the total R&D or IT effort
- Up to 10-20% of immediate savings
  - Why?...



NEXT

- Perform the Measurement Process



Questions?

- ...