



Carnegie Mellon
Software Engineering Institute

Pittsburgh, PA 15213-3890

Software Quality Requirements and Evaluation, the ISO 25000 Series

PSM Technical Working Group
February 2004

Dave Zubrow

Sponsored by the U.S. Department of Defense
© 2004 by Carnegie Mellon University



Background

This presentation reviews the latest developments with the ISO 25000 SQuaRE series of standards. This series on Software Quality Requirements and Evaluation (SQuaRE) is an effort to harmonize ISO 9126 and ISO 14598. The information presented here is based on the current state of the standards/

Note: Many of the slides in this presentation are taken from WG 6 documents and materials, especially slides from Professor Azuma, WG convener.



Outline

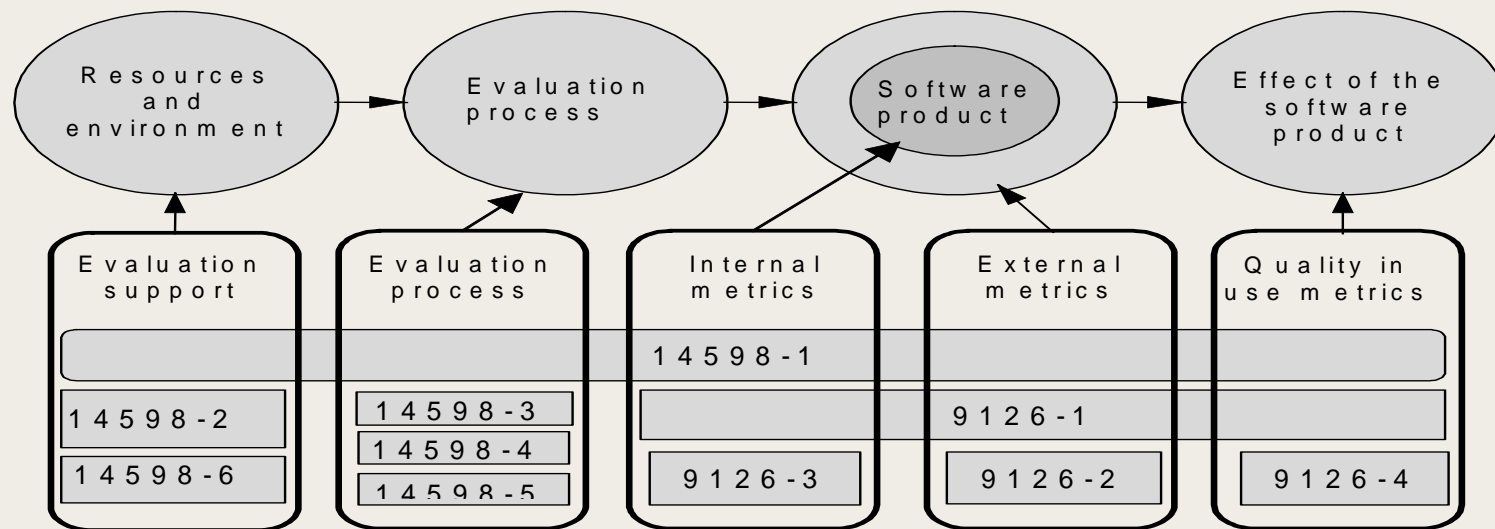
Background and Overview

Concepts and Models

Software Product Quality Measurement

Software Product Quality Requirements and Evaluation

Relationship between ISO/IEC 9126 and ISO/IEC 14598



Relationship and transition process between ISO/IEC 9126, ISO/IEC 14598 and SQuaRE series of standards

CURRENT	SQuaRE
9126: Product quality	25000: Quality Management Division
-1: Quality model	25000: Guide to SQuaRE (NP)
-2: External metrics	25001: Planning and management
-3: Internal metrics	25010: Quality Model Division
-4: Quality in use metrics	25010: Quality model and guide (Rev)
	25020: Quality Measurement Division
New Proposal	25020: Measurement reference model and guide (NP)
Guides to use 9126 & 14598	25021: Measurement primitives (NP)
Base metrics	25022: Measurement of internal quality
Quality requirements	25023: Measurement of external quality
	25024: Measurement of quality in use
14598: Product evaluation	25030: Quality Requirements Division
-1: General overview	25030: Quality requirements and guide (NP)
-2: Planning and management	25040: Quality Evaluation Division
-3: Proc for developers	25040: Quality evaluation overview and guide
-4: Proc for acquirers	25041: Evaluation modules
-5: Proc for evaluators	25042: Process for developers
-6: Doc of evaluation modules	25043: Process for acquirers
	25044: Process for evaluators



State of the Standards

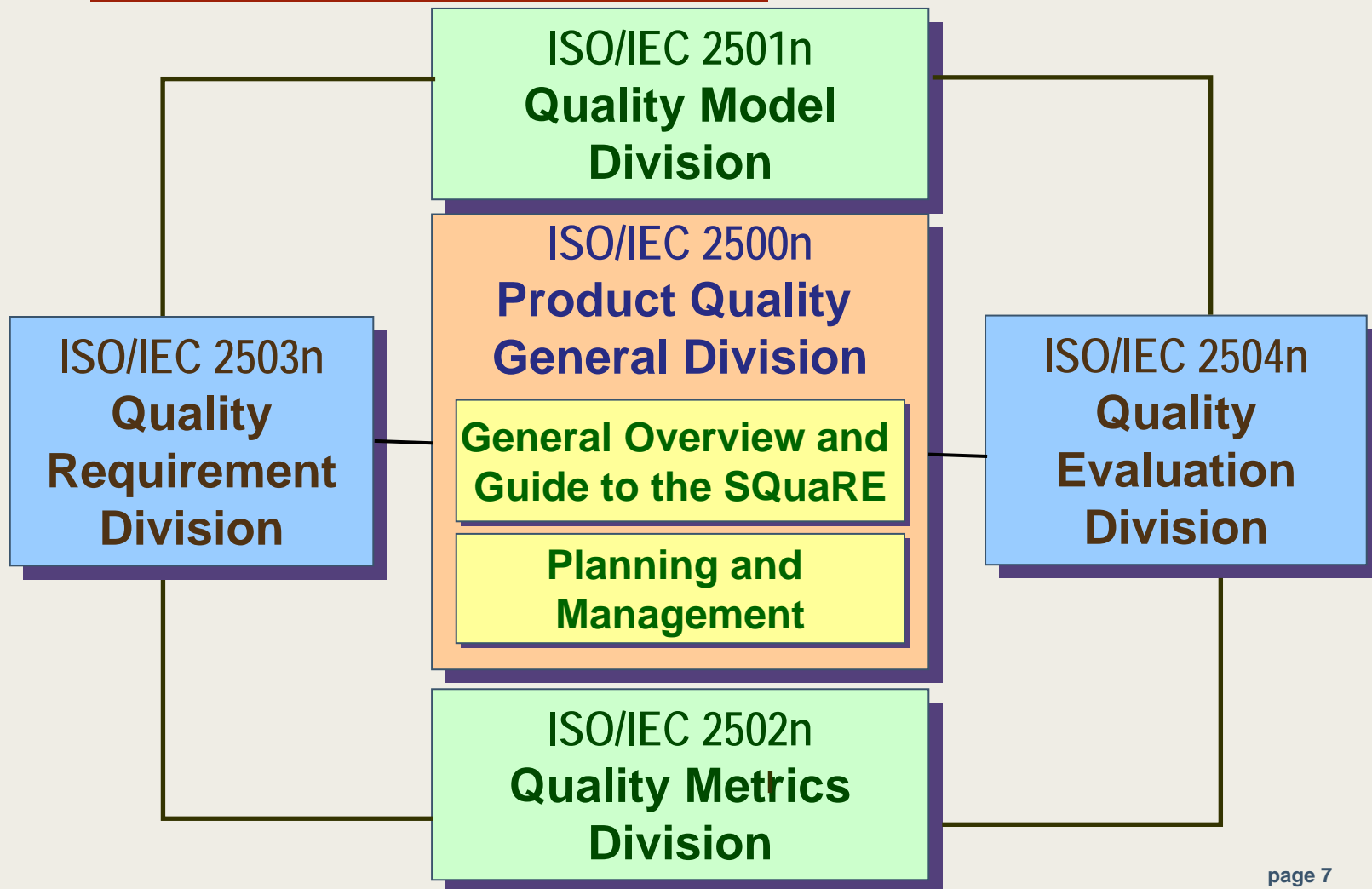
25000, Guide to the SQuaRE series – Ballot out for FCD
25020, Software Product Quality Measurement Reference Model – Ballot out for 2nd CD
25021, Measurement Primitives – Ballot out for 1st CD
25030, Quality Requirements – Ballot out for 2nd CD

All Ballots closing Mid-April to Early May

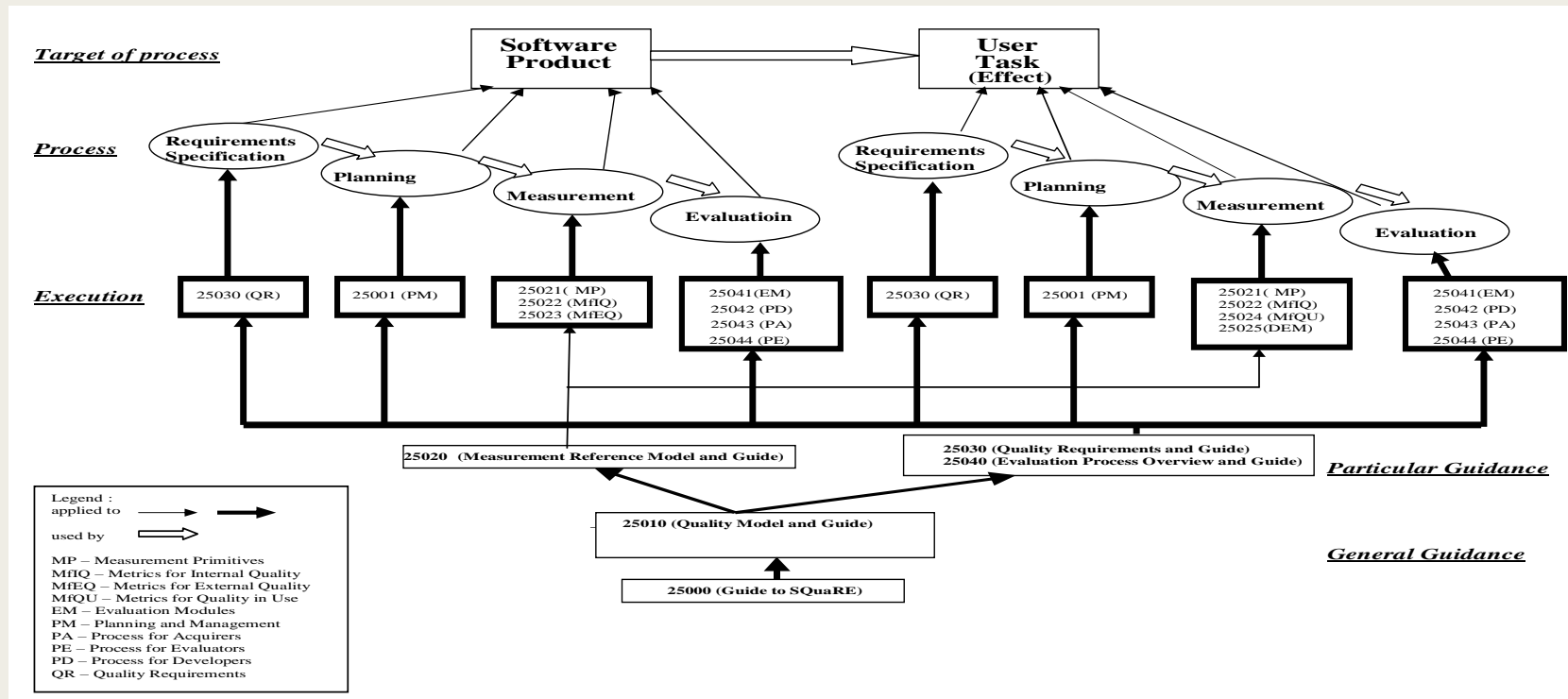
Editors assigned but no drafts out
25010, Quality Model
25023, External Quality Measures



SQuaRE: Architecture



SQuaRE general reference model





Outline

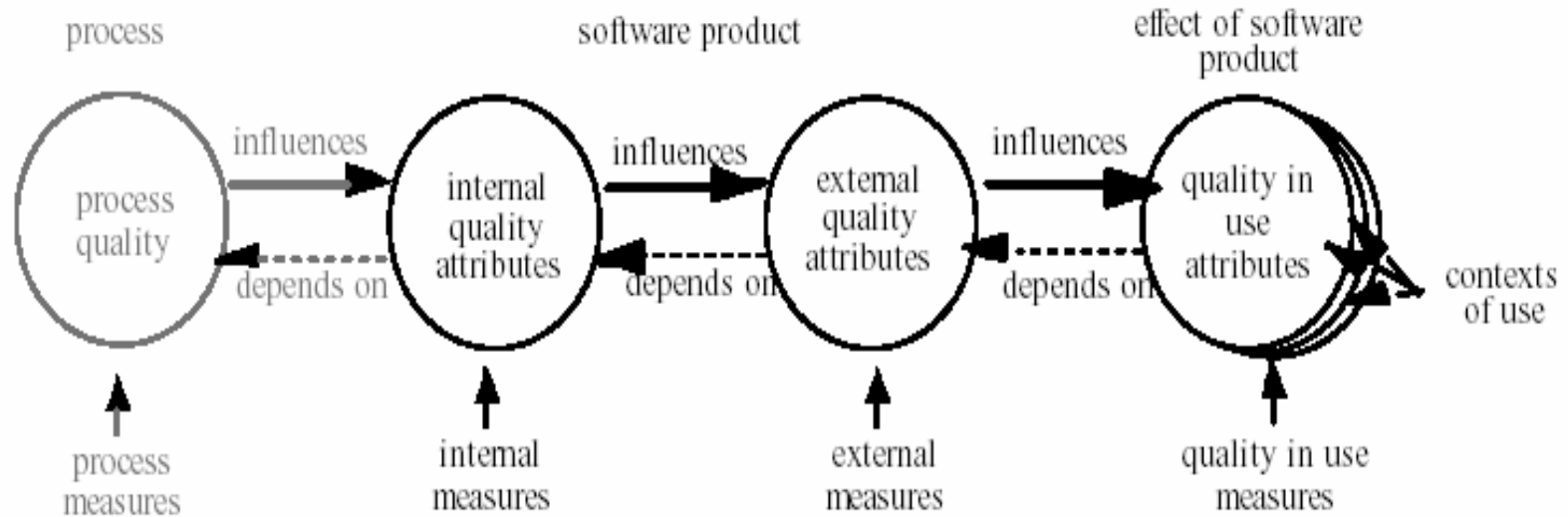
Background and Overview

Concepts and Models

Software Product Quality Measurement

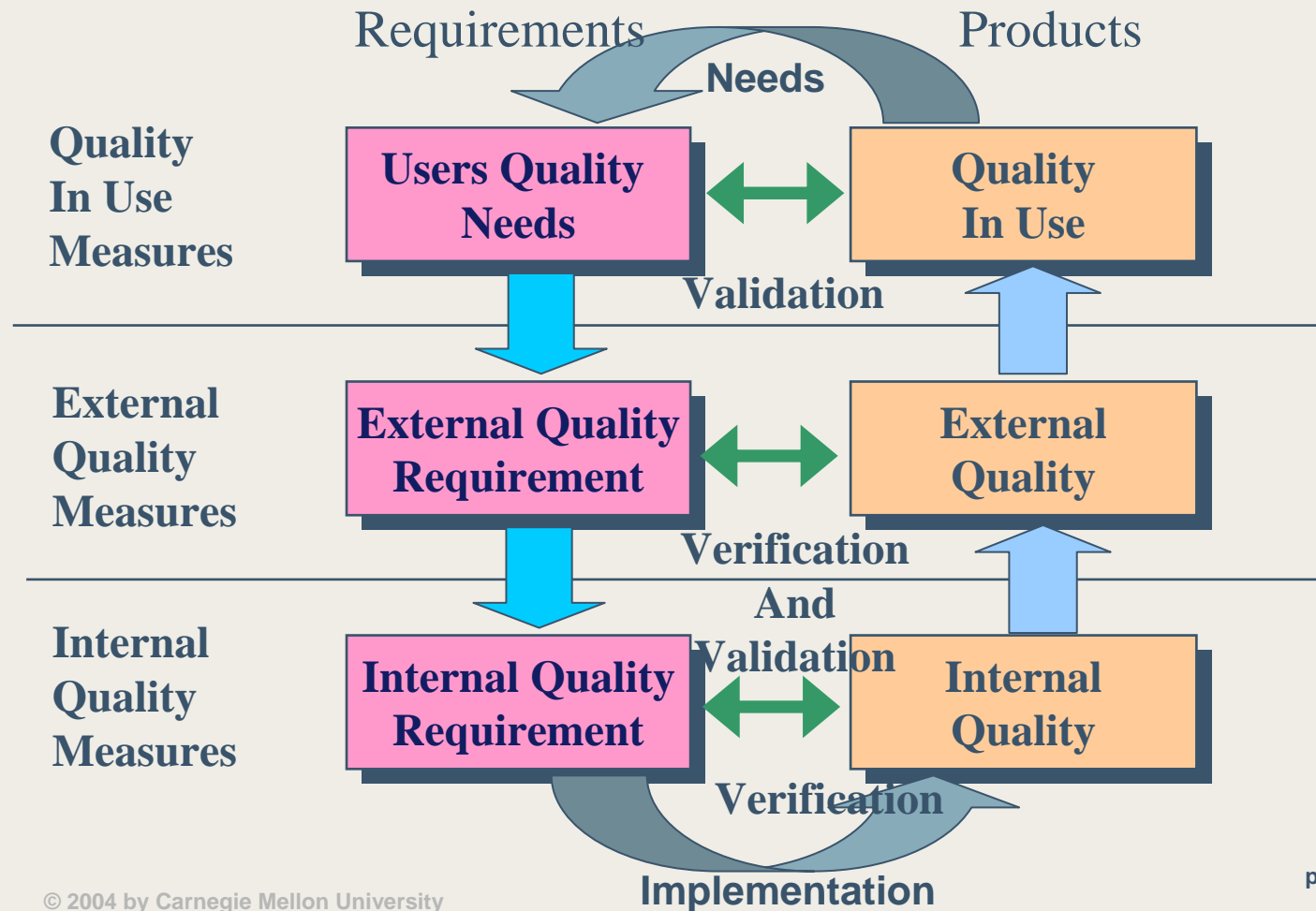
Software Product Quality Requirements and Evaluation

The Product Quality Measurement Reference Model

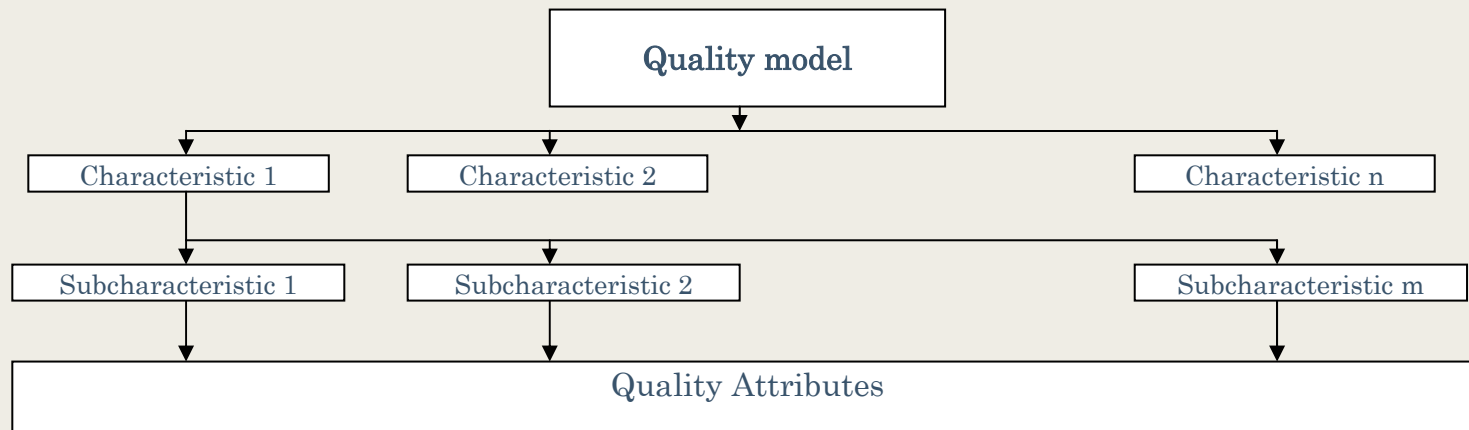




Software Product Quality Life-Cycle and Quality Measures

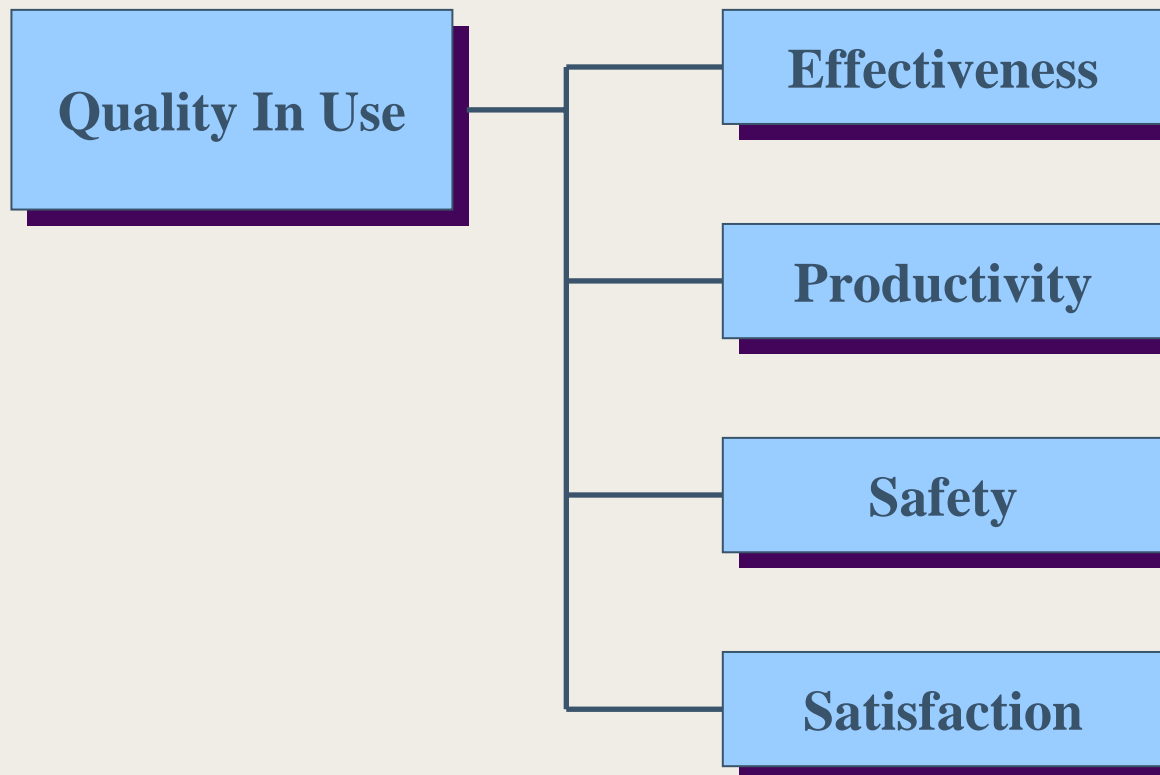


Quality Model





ISO/IEC 9126-1 Quality In Use





ISO/IEC 9126-1 - Quality Model

Quality Characteristics

Subcharacteristics

•Functionality

Suitability

Accuracy

Interoperability

Security

Compliance

•Reliability

Maturity

Fault tolerance

Recoverability

Compliance

•Usability

Understandability

Learnability

Operability

Comp

Attractiveness

•Efficiency

Time behavior

Resource utilization

Compliance

•Maintainability

Analyzability

Changeability

Stability

Testability

Compliance

•Portability

Adaptability

Installability

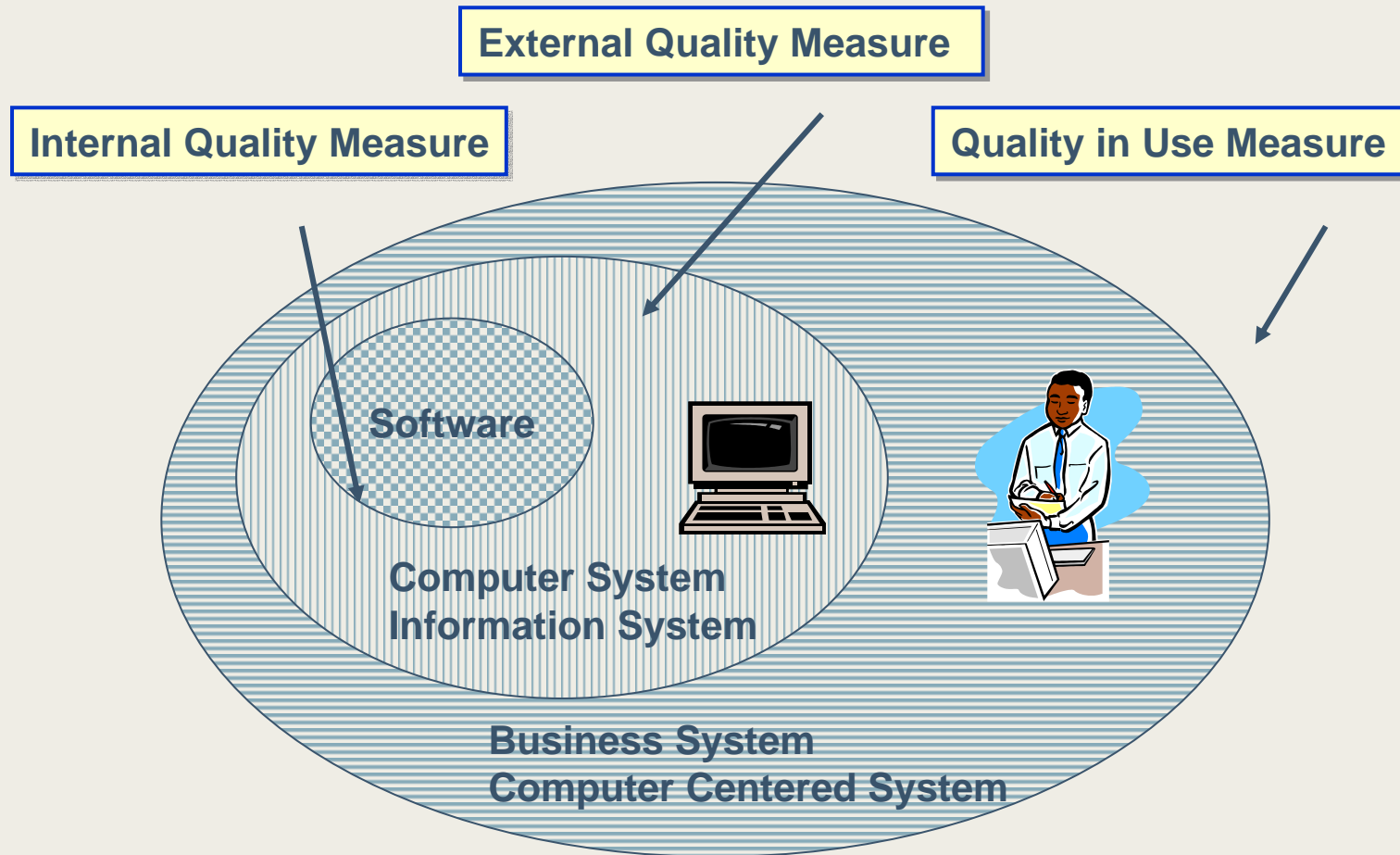
Co-existence

Replaceability

Comp

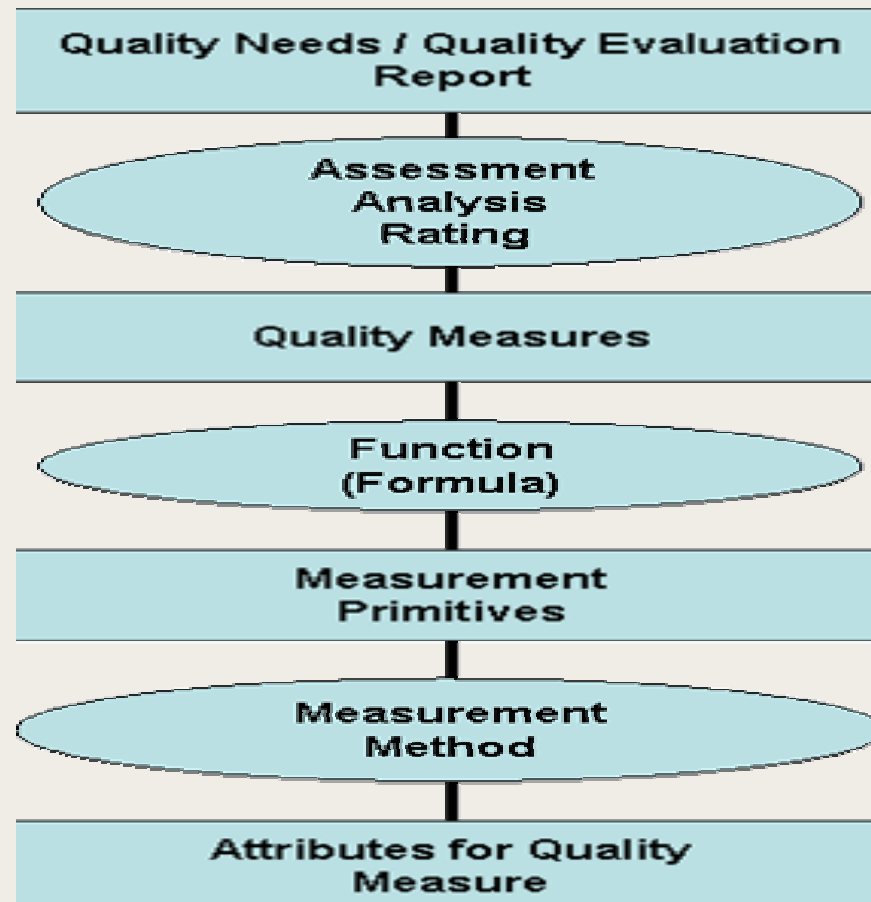


Process and Product Measurement



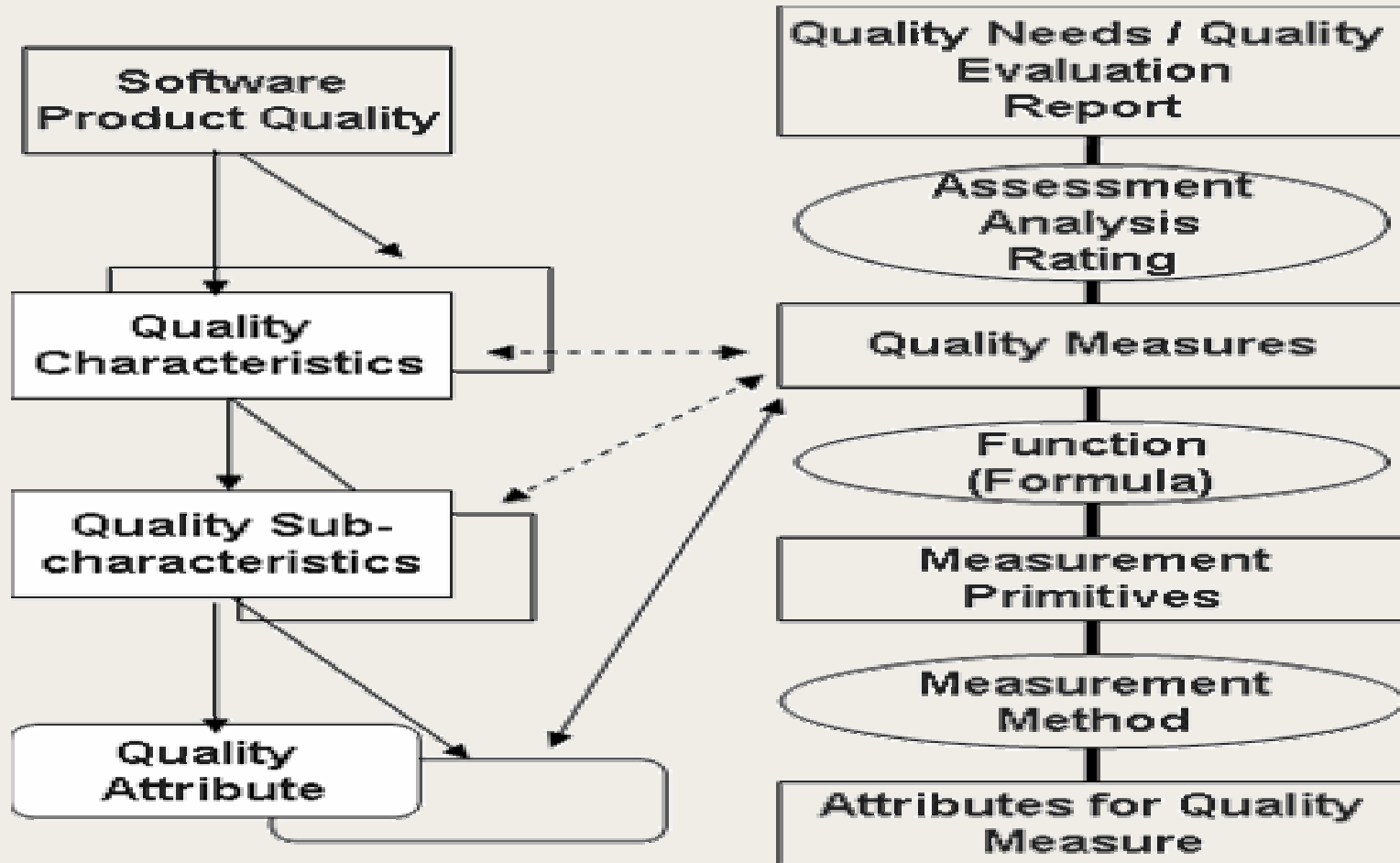


Software product quality measurement reference model (SPQM-RM)

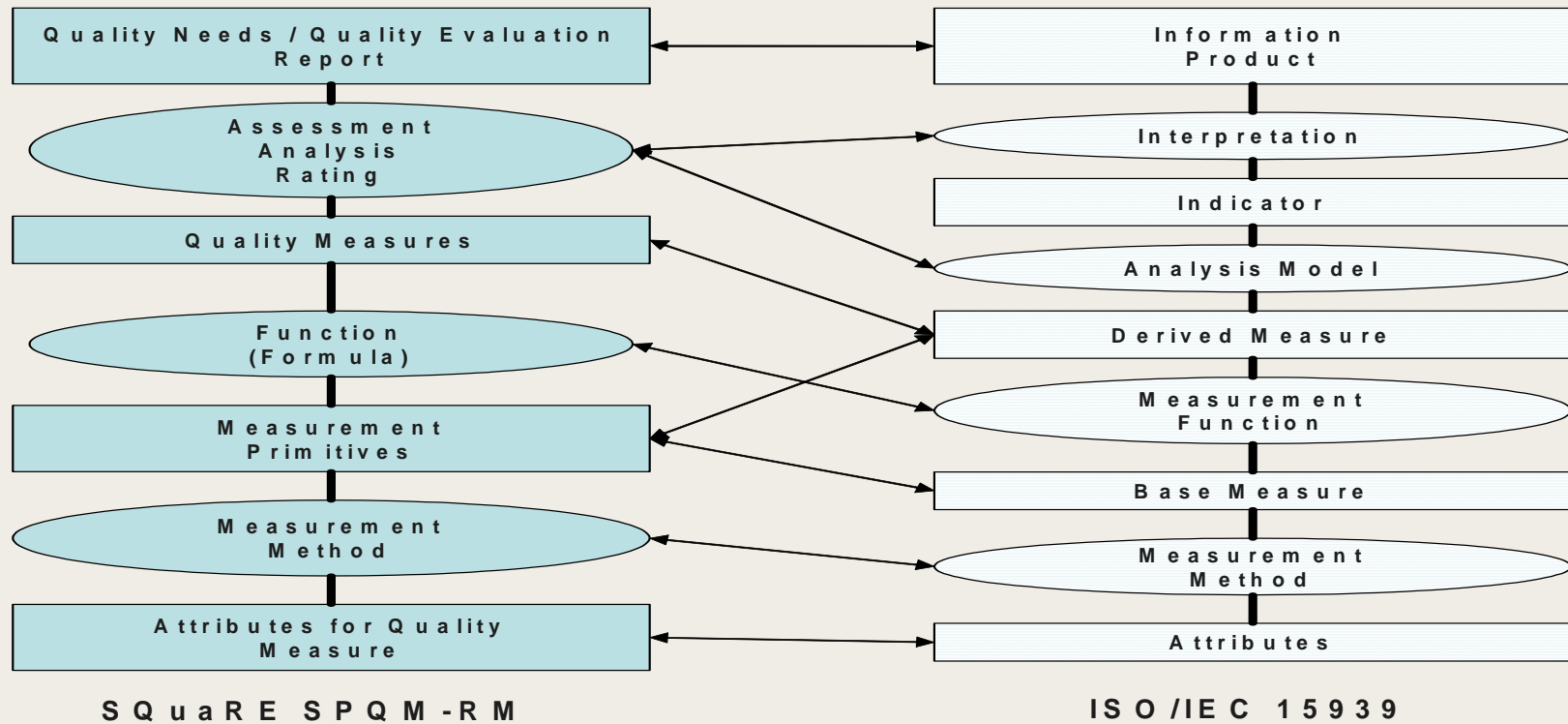




Measurement concept of the SQuaRE model



Relationship between the SQuaRE SPQM-RM and the ISO/IEC 15939 Information Model





Outline

Background and Overview

Concepts and Models

Software Product Quality Measurement

Software Product Quality Requirements and Evaluation



Titles of the Measurement Standards:

2502n

Common:

Software Engineering -

Software product Quality Requirements and Evaluation

(SQuaRE) -

Division: **Software Quality Measurement** (For Explanation
Only)

25020 **Measurement** Reference Model and Guide

25021 **Measurement** Primitives

25022 **Measurement** of Internal Quality

25023 **Measurement** of External Quality

25024 **Measurement** of Quality In Use



Quality Measure and Measurement Method (Concept)

Quality Measures: A variable, *which shows satisfactory levels of a quality characteristic, subcharacteristic or sub-sub-characteristic*, to which a value is assigned as the result of measurement

Quality Measure Set: A set of a Quality Measure, Measurement Primitives that are used for deriving the quality measure, associated Scales and Measurement Methods, a Formula to combine them to generate the value of Quality Measure, and Guide to use them and analyze the results. for a Quality Characteristic or Subcharacteristic. (A line of Quality Measure Table)

Quality Measurement Table: A set of Quality Measure Set for each Quality Subcharacteristic



Application of SQuaRE

	Activity 1	Activity 2	Activity 3	Activity 4	Activity 5	Activity 6	Activity 7	Activity 8
Phase	Requirement analysis (Software and systems)	Architectural design (Software and systems)	Software detailed design	Software coding and testing	Software integration and software qualification testing	System integration and system qualification testing	Software installation	Software acceptance support
25000 (SQuaRE) series model reference	Required quality in use, Required internal quality, Required external quality	Predicted quality in use, Predicted external quality, Measured internal quality	Predicted quality in use, Predicted external quality, Measured internal quality	Predicted quality in use, Measured external quality, Predicted external quality, Measured internal quality	Predicted quality in use, Measured external quality, Predicted external quality, Measured internal quality	Predicted quality in use, Measured external quality, Measured internal quality	Predicted quality in use, Measured external quality, Measured internal quality	Measured quality in use, Measured external quality, Measured internal quality
Key deliverables of activity	Quality in use requirements (specified), External quality requirements (specified), Internal quality requirements (specified)	Architecture design of Software / system	Software detailed design	Software code, Test results	Software product, Test results	Integrated system, Test results	Installed system	Delivered software product
Applicable measures	Internal measures (External measures may be applied to validate specifications)	Internal measures	Internal measures	Internal measures External measures	Internal measures External measures	Internal measures External measures	Internal measures External measures	Quality in use measures Internal measures External measures



User needs, characteristics & weights

Quality in use		
	CHARACTERISTIC	WEIGHT
	Effectiveness	H
	Productivity	H
	Safety	L
	Satisfaction	M

External & internal quality		
CHARACTERISTIC	SUBCHARACTERISTIC	WEIGHT <small>(High/Medium/Low)</small>
Functionality	Suitability	H
	Accuracy	H
	Interoperability	L
	Security	L
	Compliance	M
Reliability	Maturity	L
	Fault tolerance	L
	Recoverability	H
	Compliance	H
Usability	Understandability	M
	Learnability	L
	Operability	H
	Attractiveness	M
	Compliance	H
Efficiency	Time behaviour	H
	Resource utilization	H
	Compliance	H
Maintainability	Analyzability	H
	Changeability	M
	Stability	L
	Testability	M
	Compliance	H
Portability	Adaptability	H
	Installability	L
	Co-existence	H
	Replaceability	M
	Compliance	H



Quality measurement tables

Quality in use measurement category				
	CHARACTERISTIC	MEASURES	REQUIRED LEVEL	ASSESSMENT ACTUAL RESULT
	Effectiveness			
	Productivity			
	Safety			
	Satisfaction			

External quality measurement category				
CHARACTERISTIC	SUBCHARACTERISTIC	MEASURES	REQUIRED LEVEL	ASSESSMENT ACTUAL RESULT
Functionality	Suitability			
	Accuracy			
	Interoperability			
	Security			
Reliability	Compliance			
	Maturity			
	Fault tolerance			
	Recoverability (data, process)			
Usability	Compliance			
	Understandability			
	Learnability			
	Operability			
Efficiency	Attractiveness			
	Compliance			
	Time behaviour			
	Resource utilisation			
Maintainability	Compliance			
	Analyzability			
	Changeability			
	Stability			
Portability	Testability			
	Compliance			
	Adaptability			
	Instability			
	Co-existence			
	Replaceability			
	Compliance			

Internal quality measurement category				
CHARACTERISTIC	SUBCHARACTERISTIC	MEASURES	REQUIRED LEVEL	ASSESSMENT ACTUAL RESULT
Functionality	Suitability			
	Accuracy			
	Interoperability			
	Security			
Reliability	Compliance			
	Maturity			
	Fault tolerance			
	Recoverability (data, process)			
Usability	Compliance			
	Understandability			
	Learnability			
	Operability			
Efficiency	Attractiveness			
	Compliance			
	Time behaviour			
	Resource utilisation			
Maintainability	Compliance			
	Analyzability			
	Changeability			
	Stability			
Portability	Testability			
	Compliance			
	Adaptability			
	Instability			
	Co-existence			
	Replaceability			
	Compliance			



Measurement plan implications

SUBCHARACTERISTIC	DELIVERABLES TO BE EVALUATED	INTERNAL MEASURES TO BE APPLIED	EXTERNAL MEASURES TO BE APPLIED	QUALITY IN USE MEASURES TO BE APPLIED
1. Suitability	1. 2. 3.	1. 2. 3.	1. 2. 3.	(Not Applicable)
2. Satisfaction	1. 2. 3.	(Not Applicable)	(Not Applicable)	1. 2. 3.
3.				
4.				
5.				
6.				



Measurement Primitive

A measure, either a base measure or a derived measure, that is commonly used for deriving internal quality measures, external quality measures and quality in use measures.

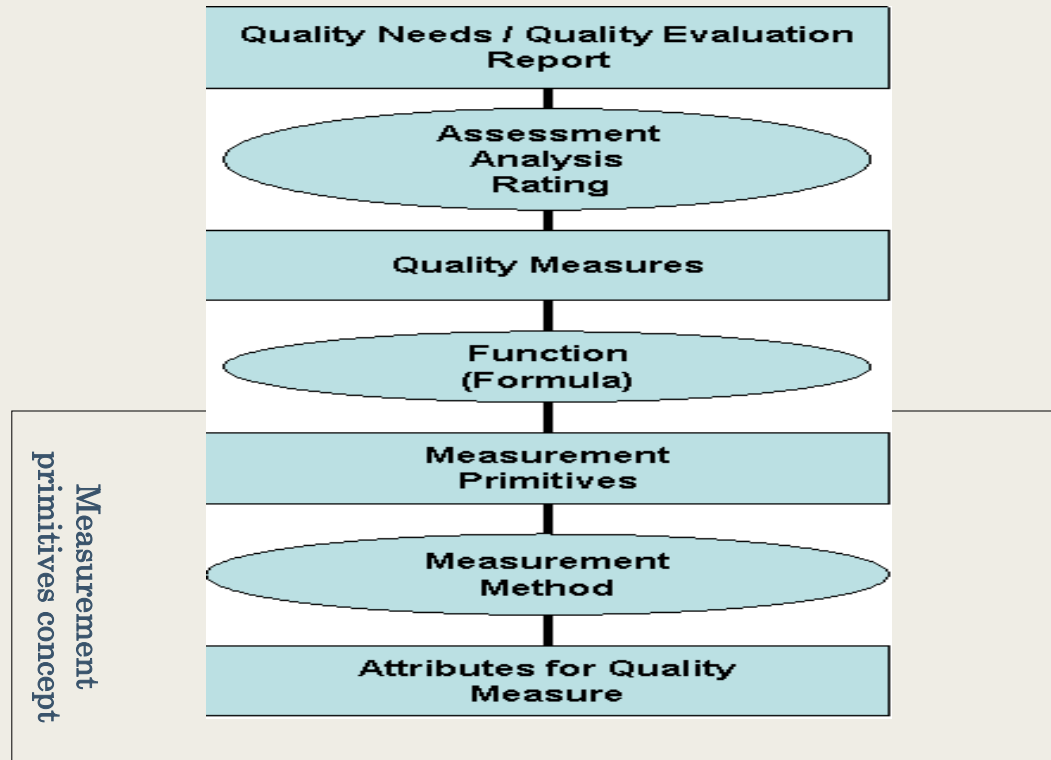
No definition (25000)

measure collected during Software Product Lifecycle from which Internal, External and Quality in Use Measures are derived. (**25020** and **25021**)

Single value of measurement primitive generally does not indicate the quality of the measured entity. NOTE The Quality is measured afterwards by calculating the Quality Measures. (**25020** and **25021**)

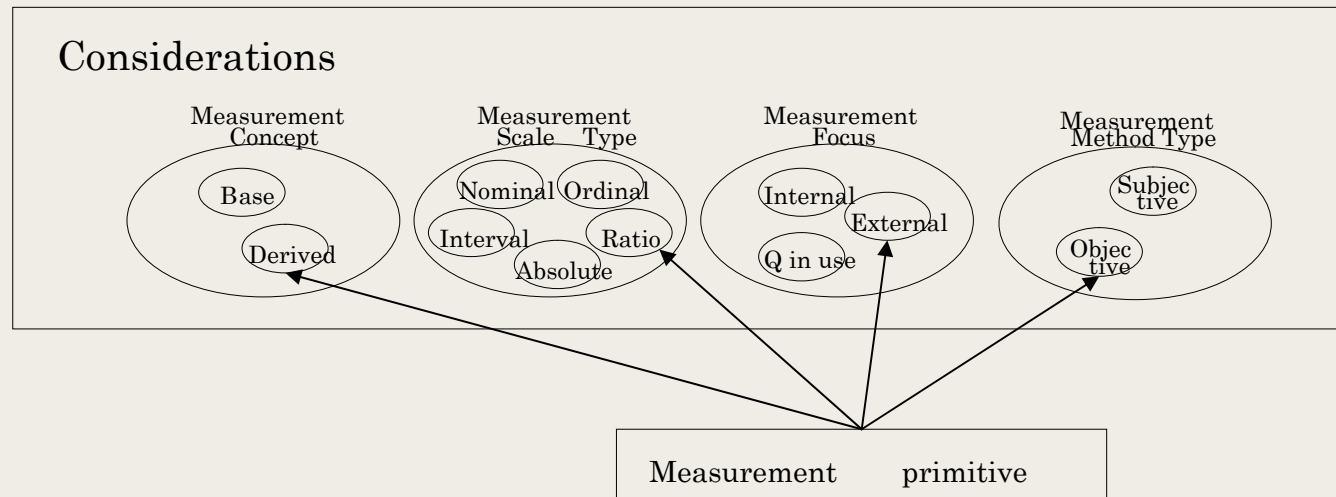


Measurement Primitives in SPQM-RM

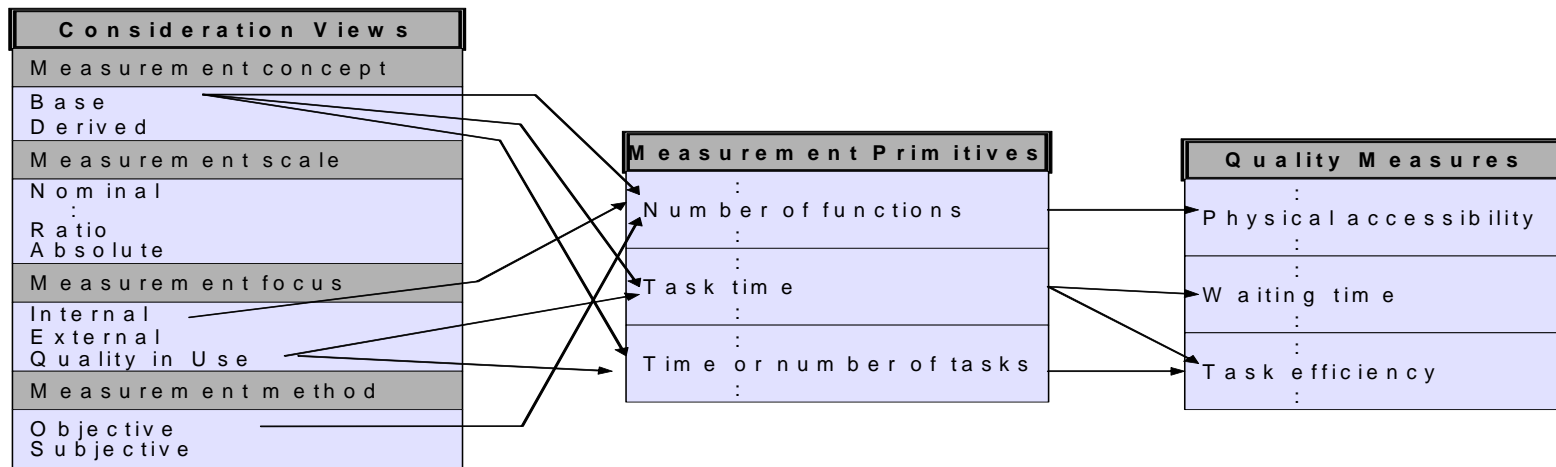




Consideration views



Measurement Primitives Hyperlink Format example





Outline

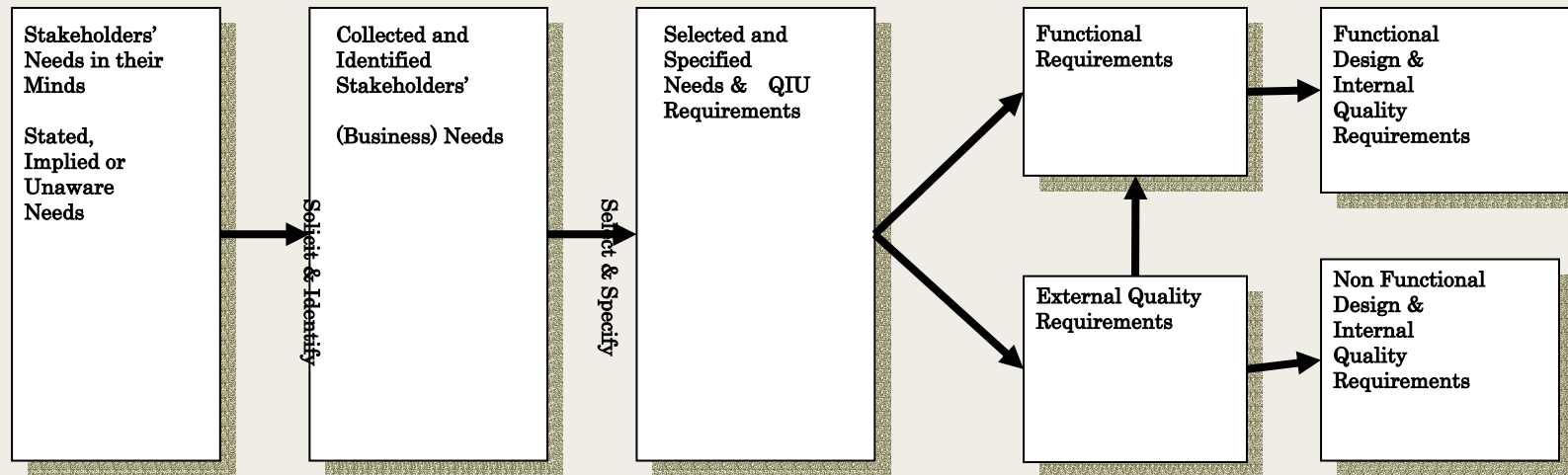
Background and Overview

Concepts and Models

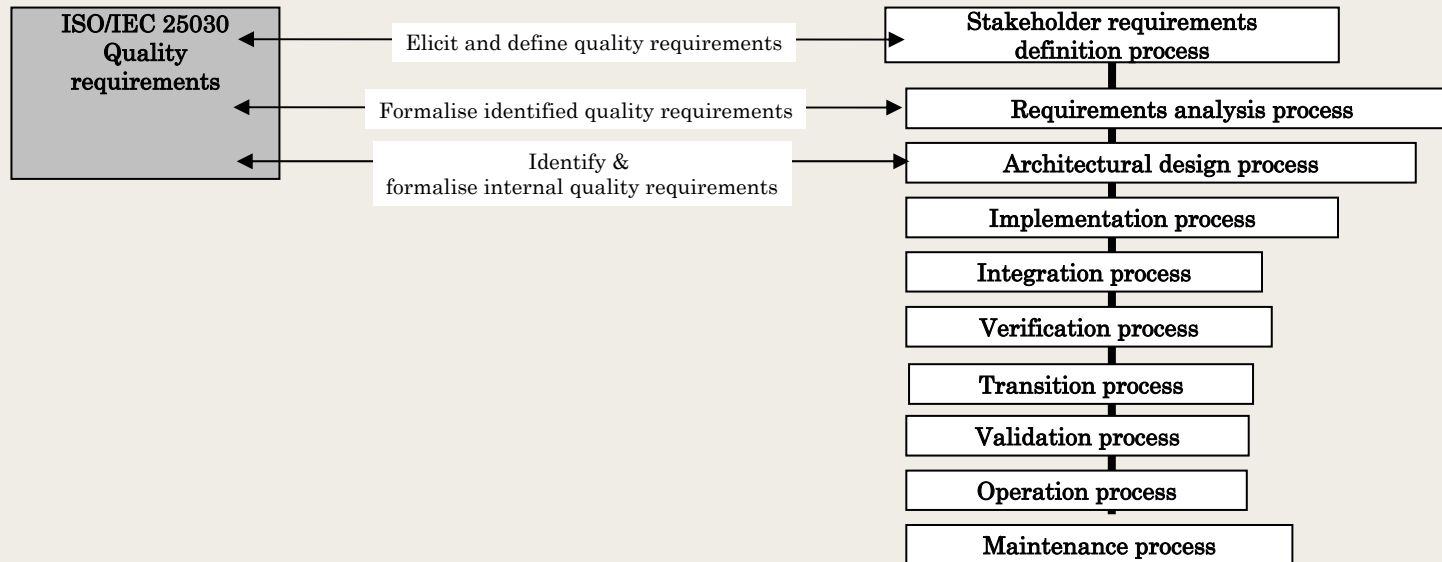
Software Product Quality Measurement

Software Product Quality Requirements and Evaluation

Relationship between Needs and Requirements



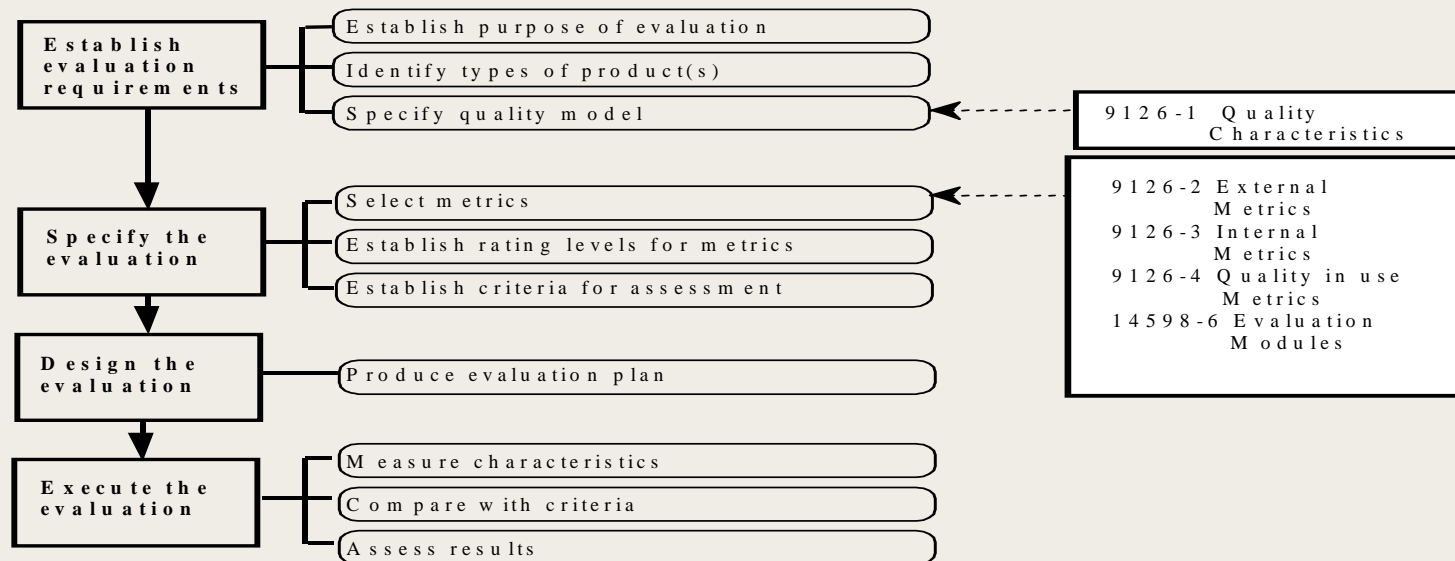
ISO/IEC 15288 System Life Cycle Processes to appear in 25030



SQuaRE

ISO/IEC 15288 (Technical Processes)

Evaluation process view according to ISO/IEC 14598-1





Summary - 1

SQuaRE series addresses requirements and evaluation of software product quality

- Internal, External, and Quality in Use Measures are the link between requirements and evaluation

Software Product Quality Measurement Reference Model is a specific instance of 15939 information model

Additional standards to create catalogues of measures for quality attributes and measurement primitives

Need for validated measures to populate catalogues



Summary - 2

Working to reconcile and harmonize SQuaRE series with other standards

Concern over number of standards and fragmentation of content

Reviewers sought