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
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Outline

Background and Overview

Concepts and Models

Software Product Quality Measurement

Software Product Quality Requirements and Evaluation

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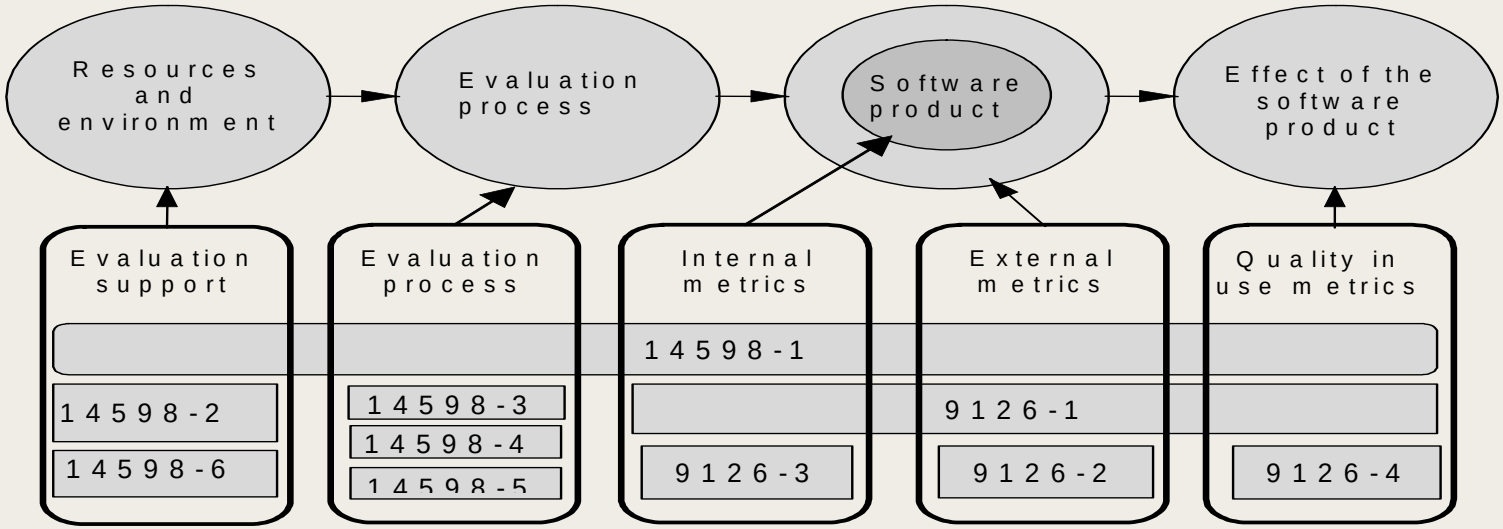
Relationship between ISO/IEC 9126 and ISO/IEC 14598



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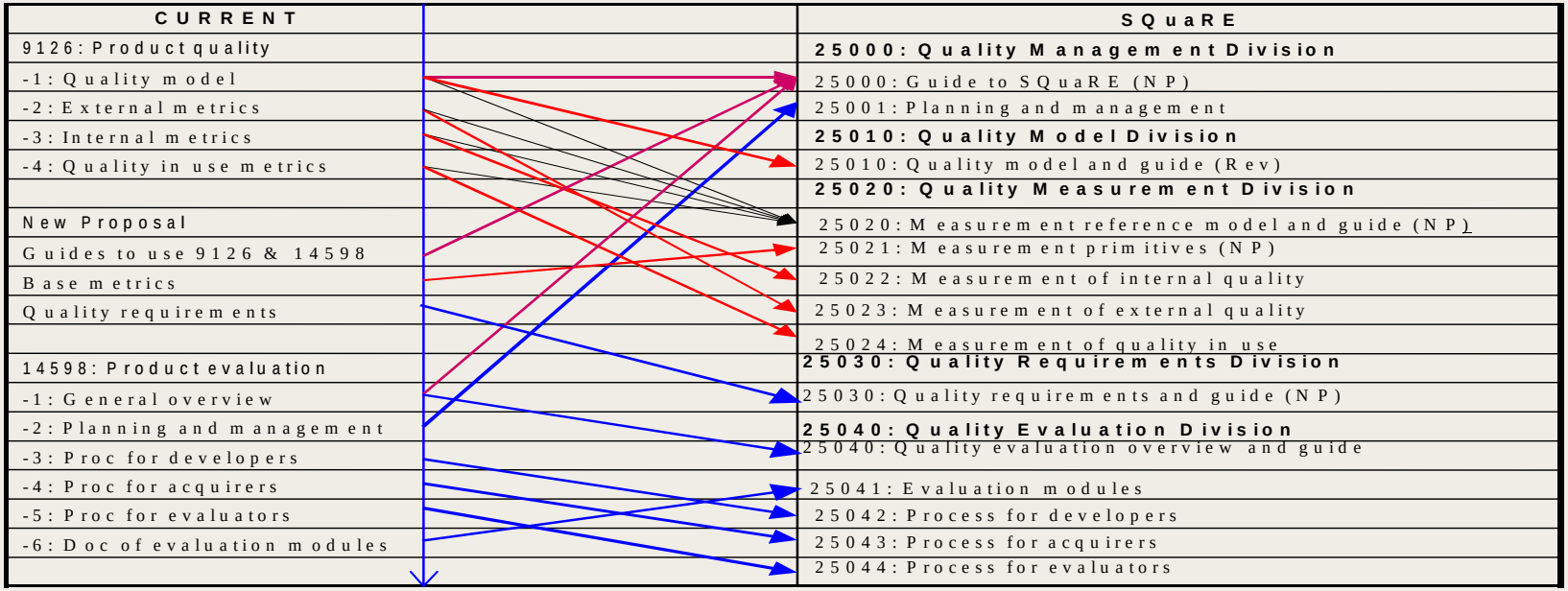
Relationship and transition process between ISO/IEC 9126, ISO/IEC 14598 and SQuaRE series of standards



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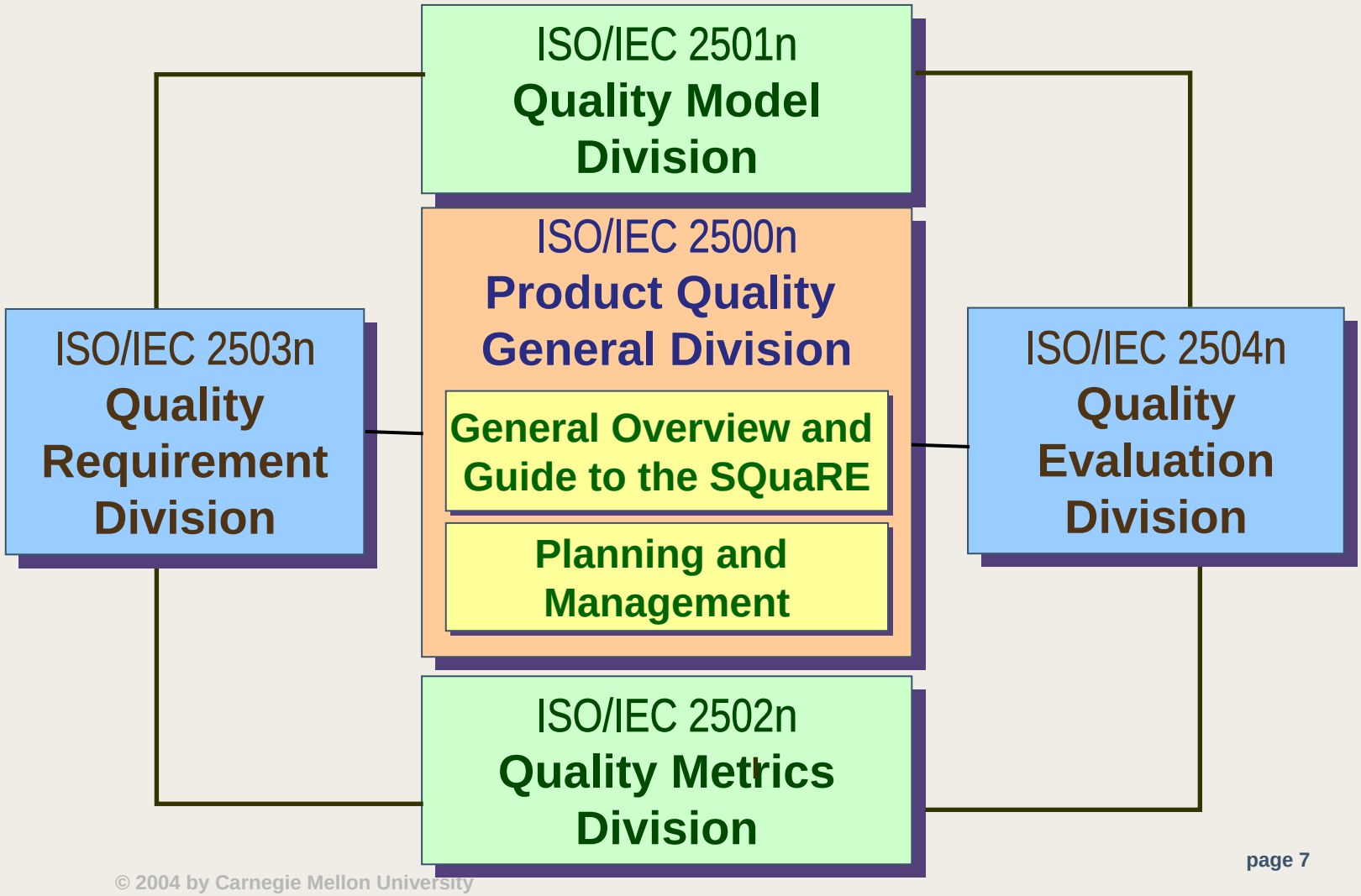
SQuaRE: Architecture



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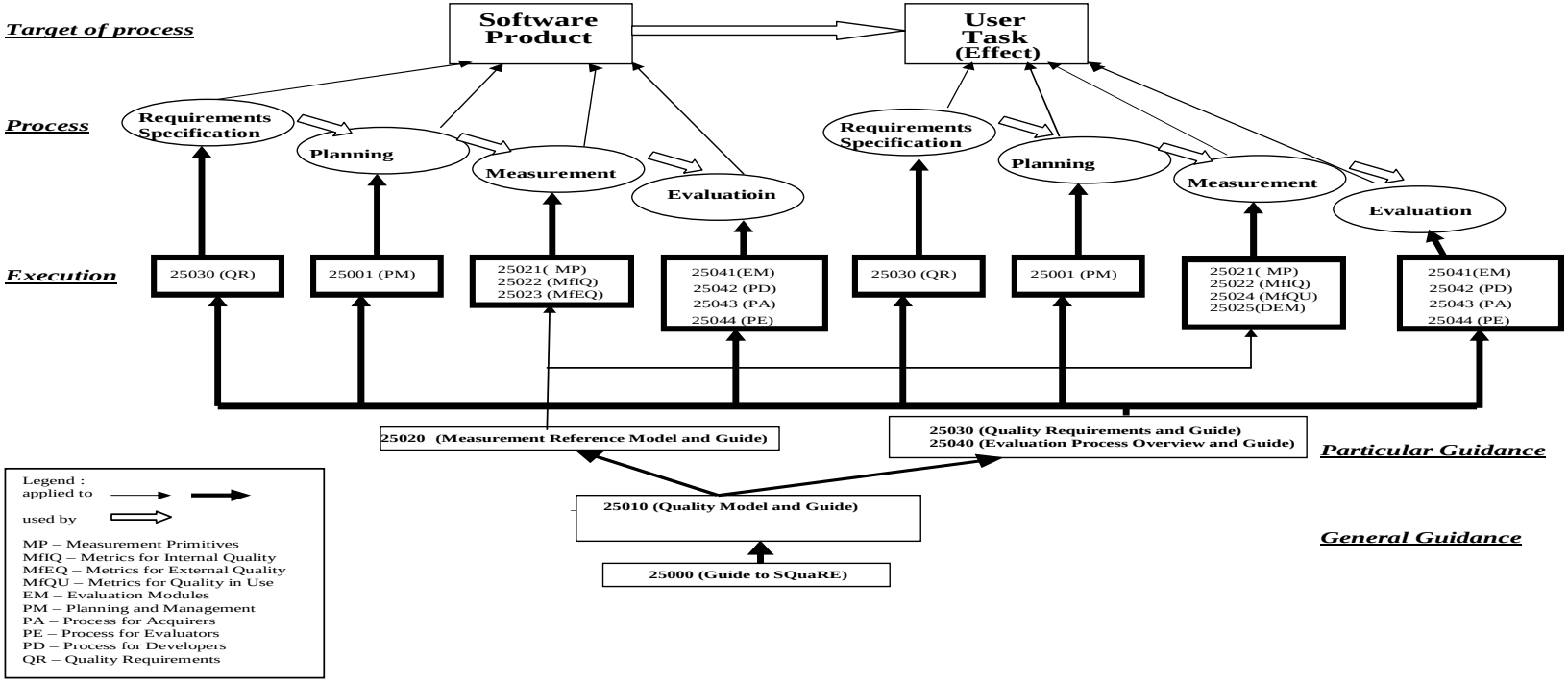
SQuaRE general reference model



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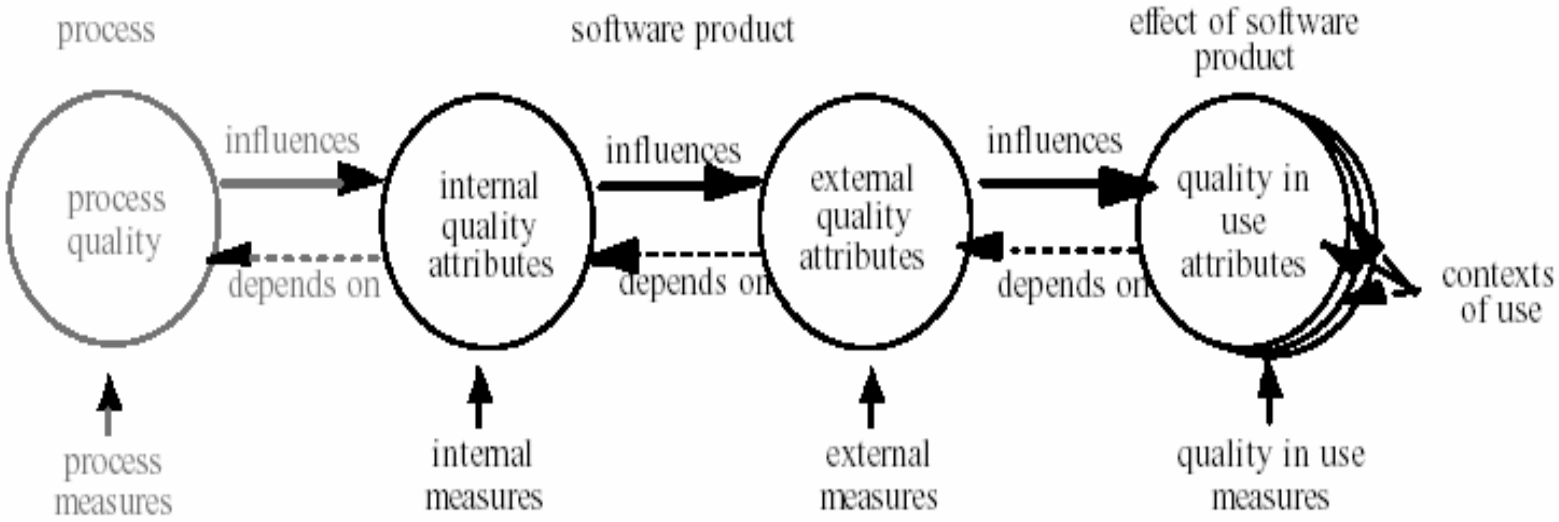
The Product Quality Measurement Reference Model



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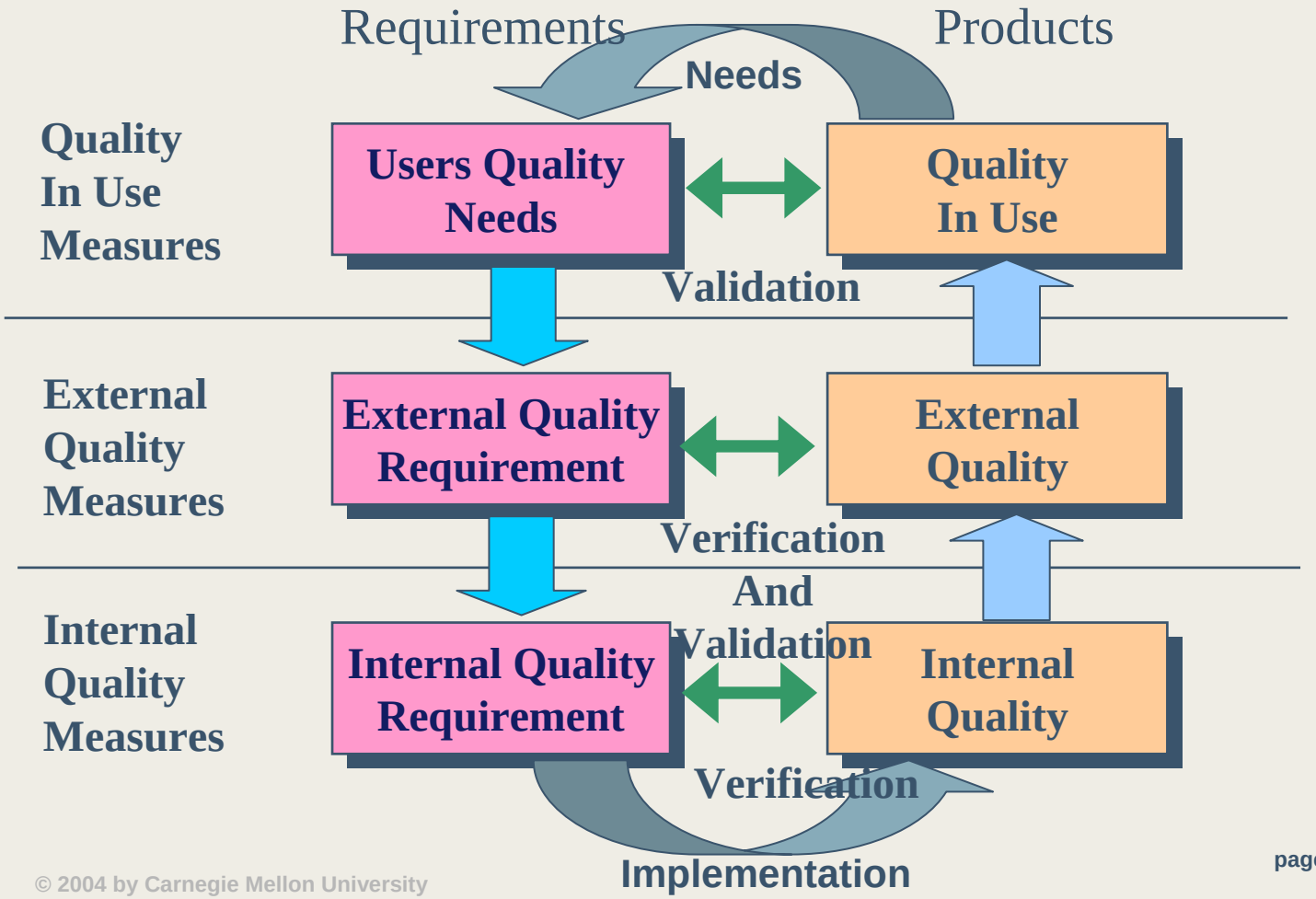
Software Product Quality Life-Cycle and Quality Measures



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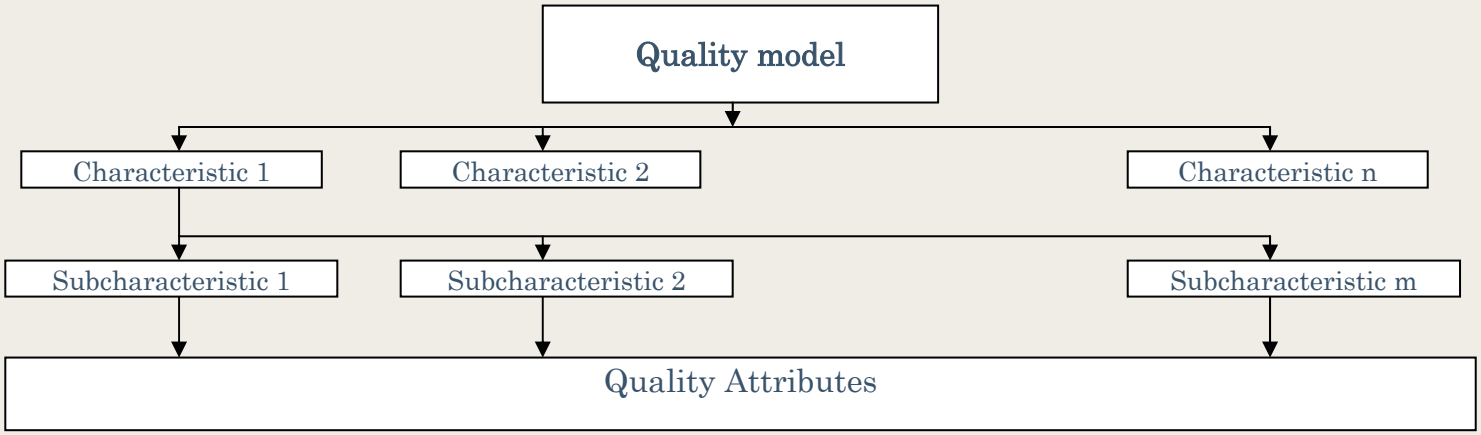
Quality Model



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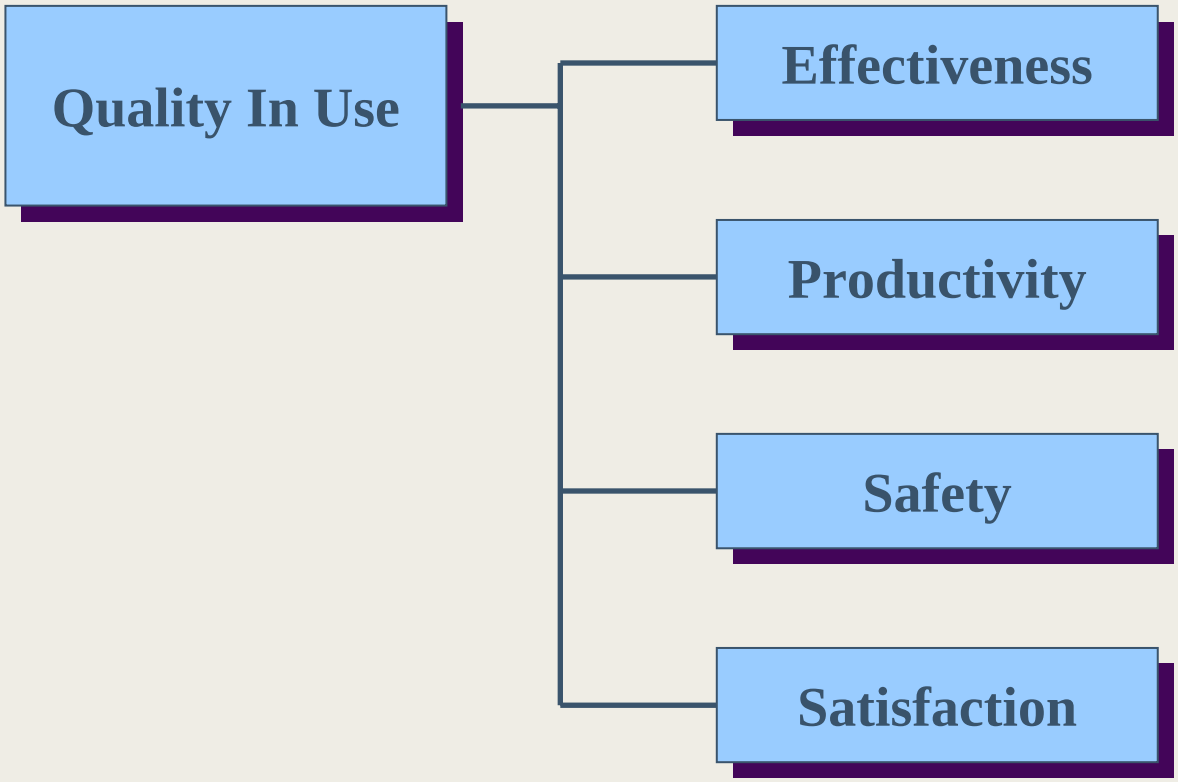
ISO/IEC 9126-1 Quality In Use



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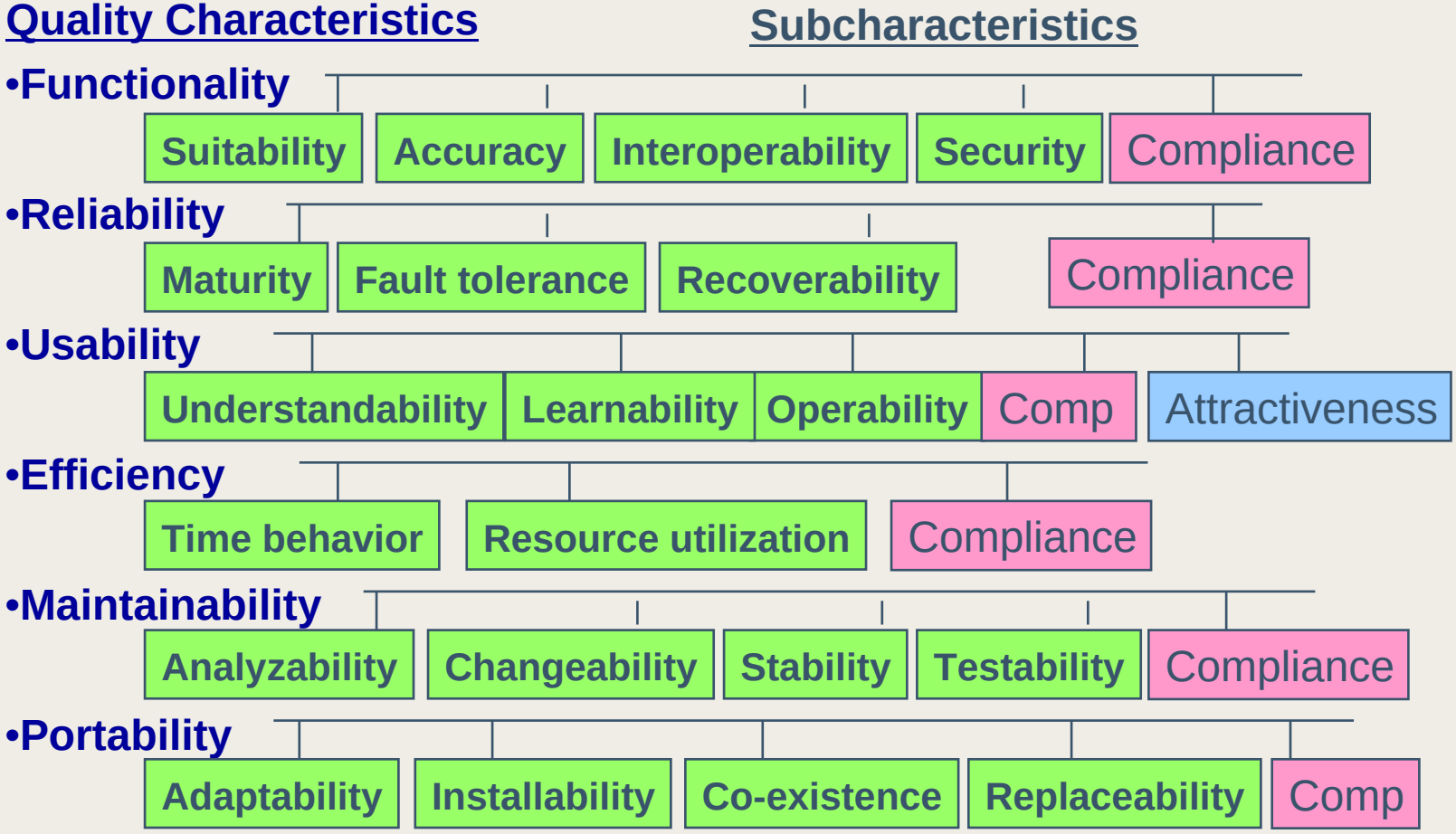
ISO/IEC 9126-1 - Quality Model



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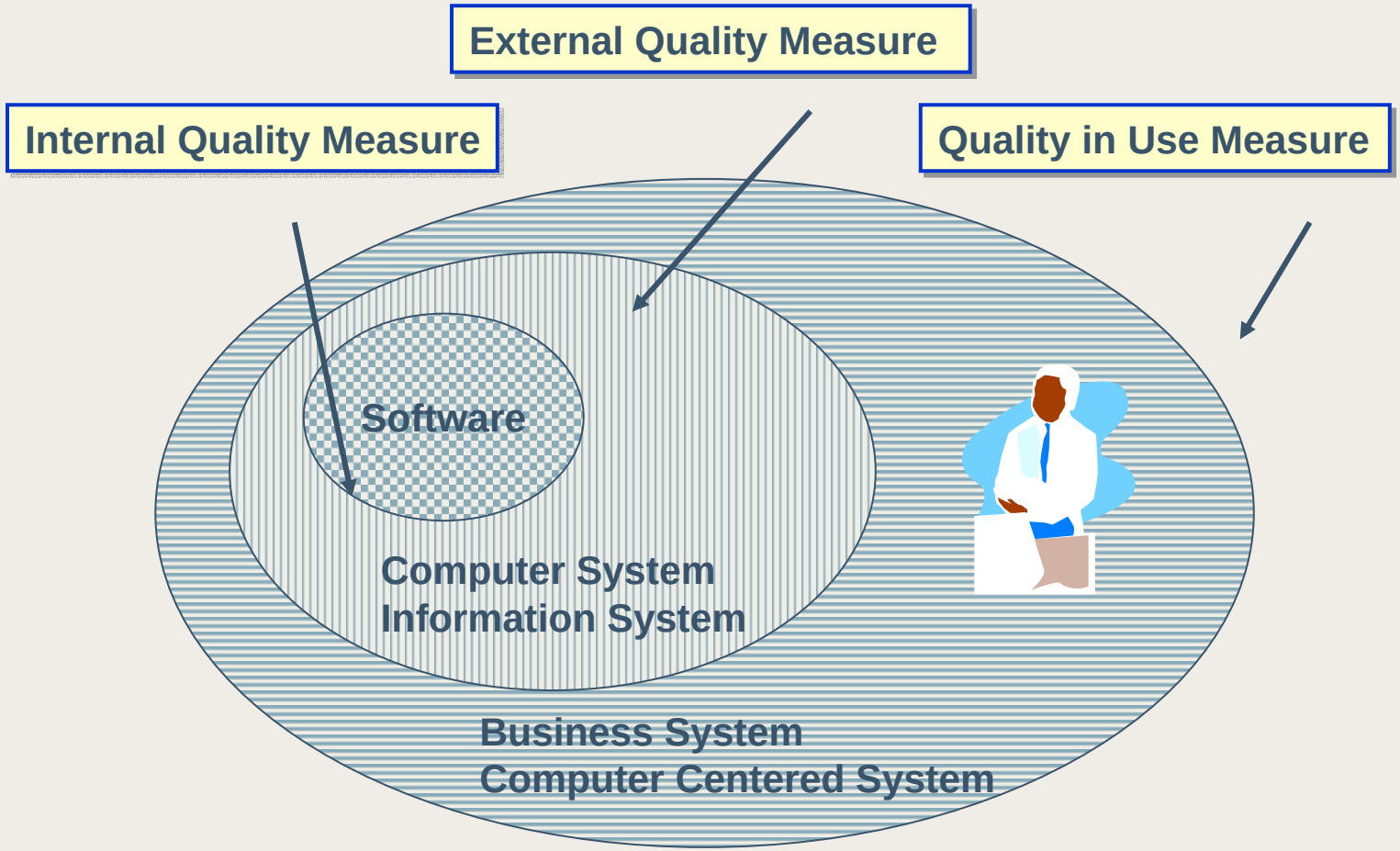
Process and Product Measurement



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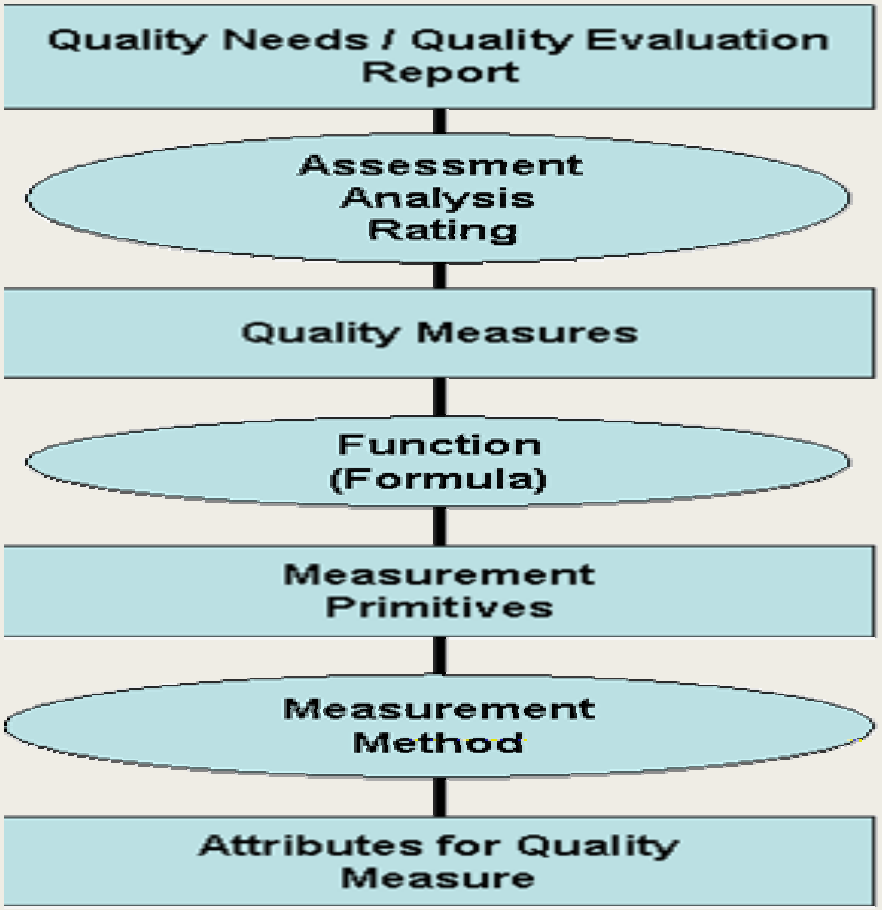
Software product quality measurement reference model (SPQM-RM)



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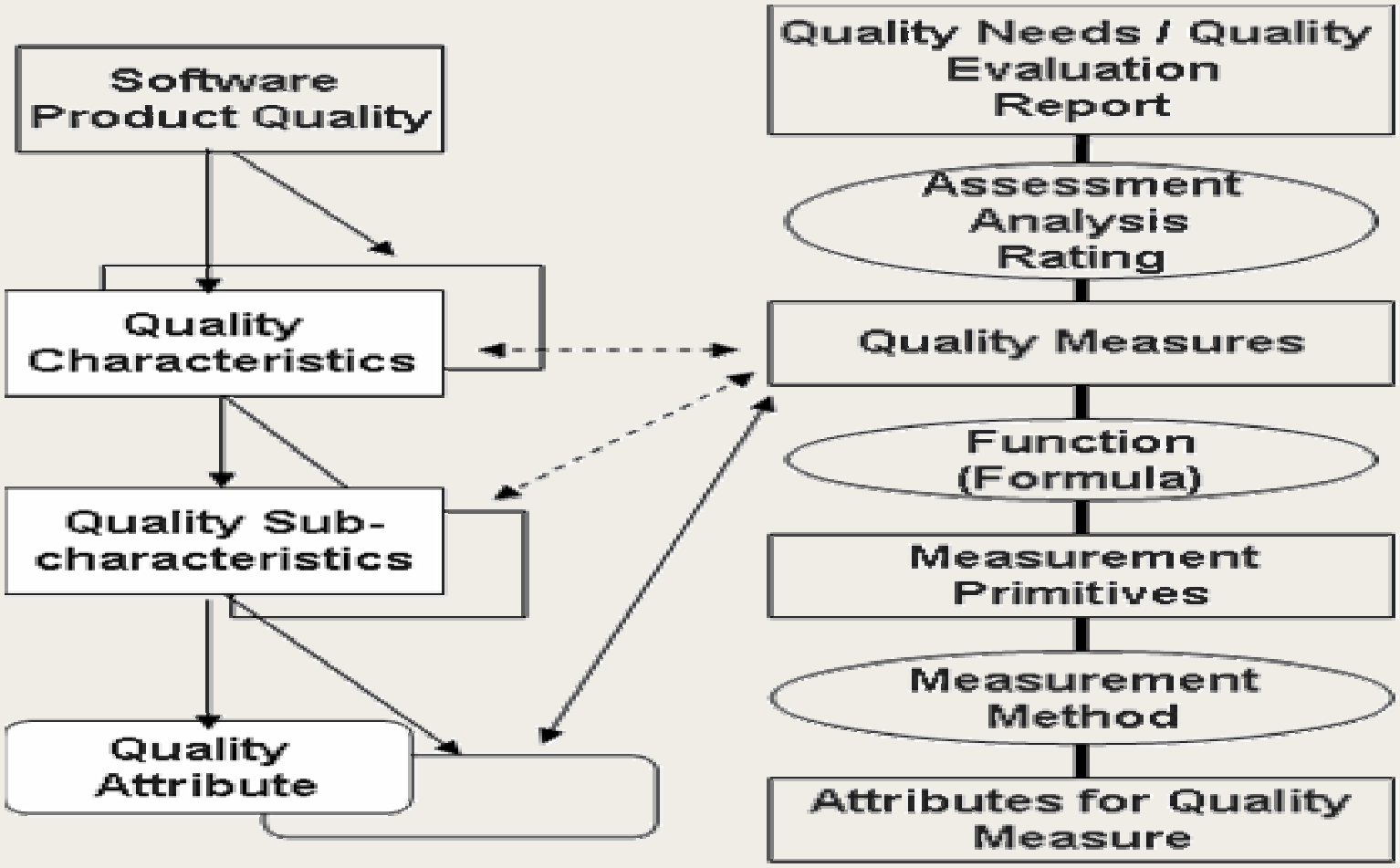
Measurement concept of the SQuaRE model



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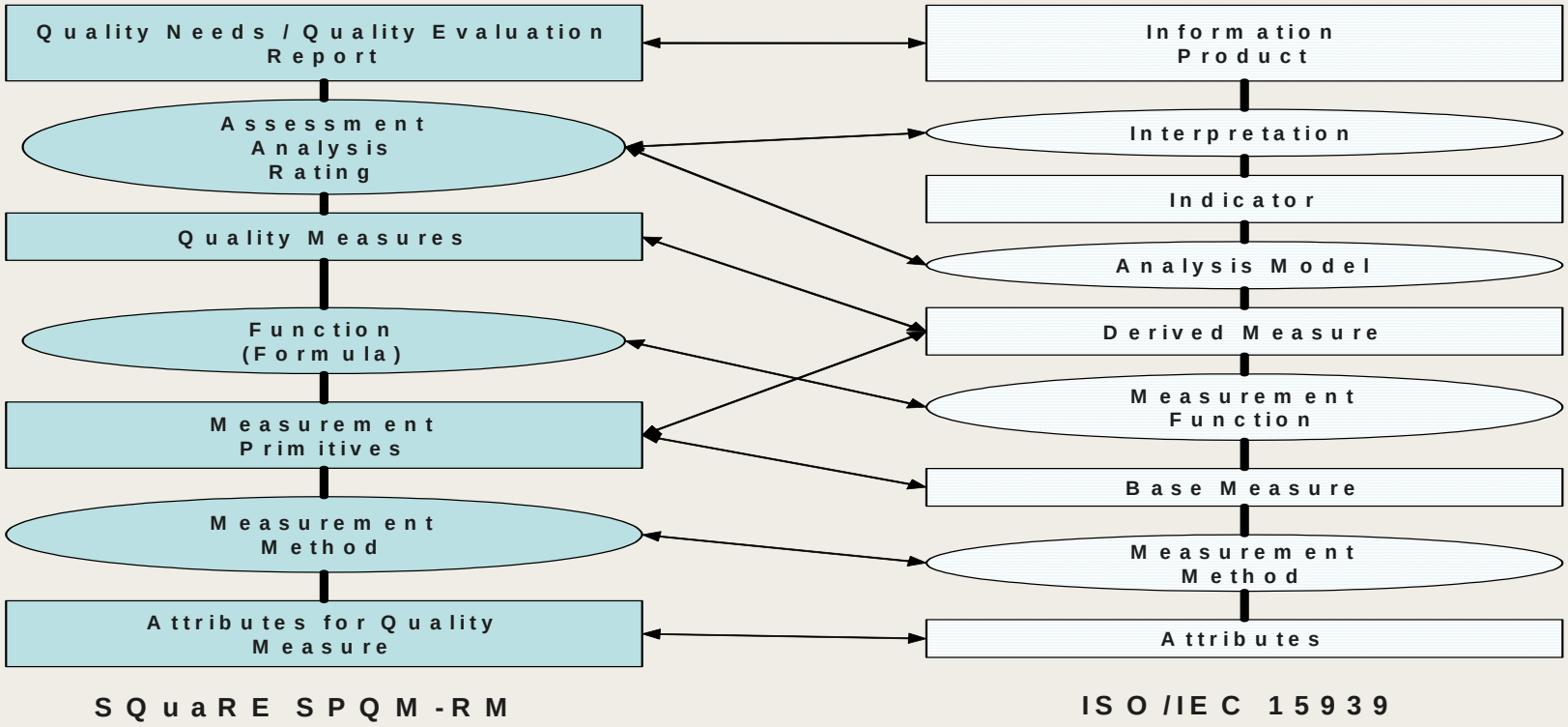
Relationship between the SQuaRE SPQM-RM and the ISO/IEC 15939 Information Model



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Outline

Background and Overview

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Software Product Quality Measurement

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Titles of the Measurement Standards: 2502n

Common:
Software Engineering -
Software product **Q**uality **R**equirements and **E**valuation **(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

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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

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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

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User needs, characteristics & weights

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

External & internal quality		
CHARACTERISTIC	SUBCHARACTERISTIC	WEIGHT (High/Medium/Low)
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

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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			
	Compliance			
Reliability	Maturity			
	Fault tolerance			
	Recoverability (data, process,			
	Compliance			
Usability	Understandability			
	Learnability			
	Operability			
	Attractiveness			
	Compliance			
Efficiency	Time behaviour			
	Resource utilisation			
	Compliance			
Maintainability	Analyzability			
	Changeability			
	Stability			
	Testability			
	Compliance			
Portability	Adaptability			
	Instability			
	Co-existence			
	Replaceability			
	Compliance			

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

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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.				

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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**)

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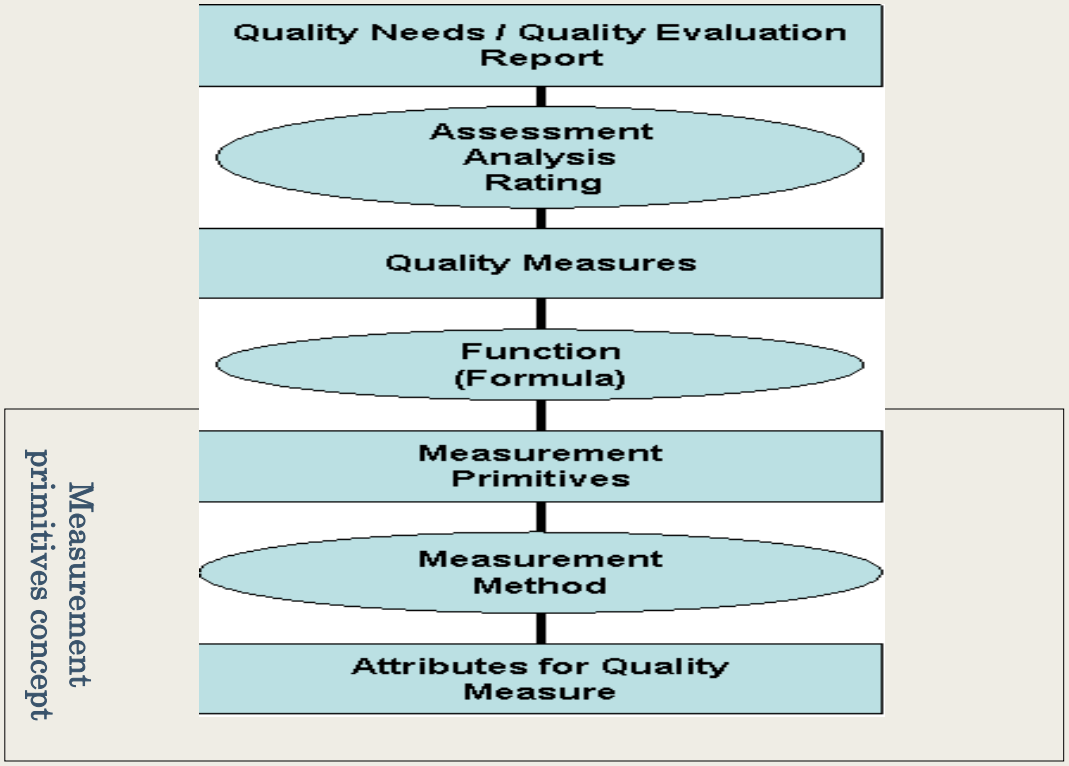
Measurement Primitives in SPQM-RM



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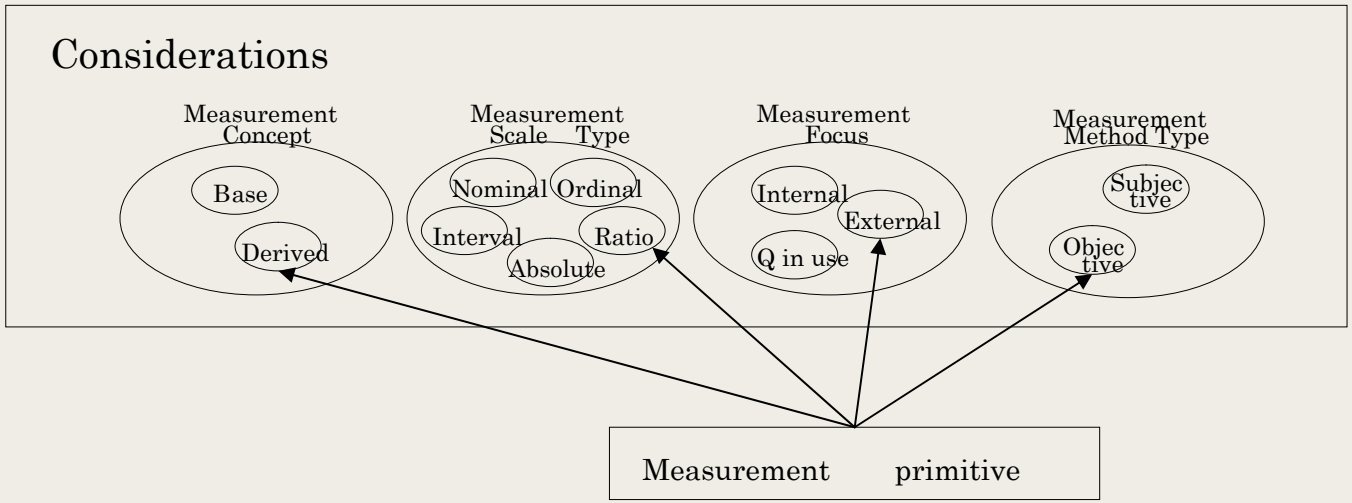
Consideration views



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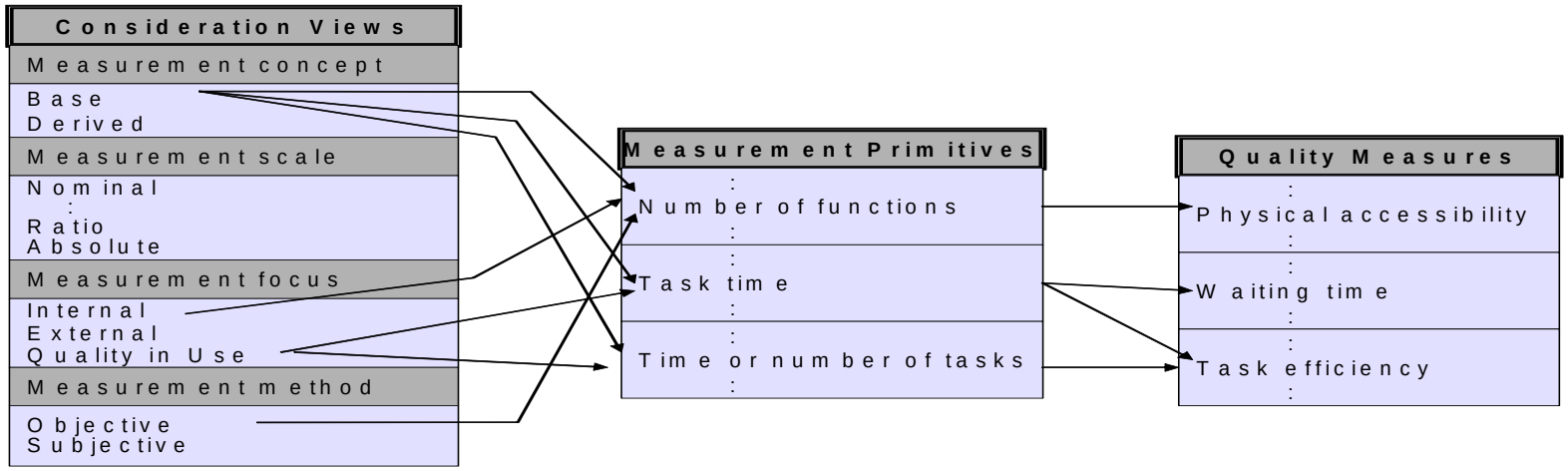
Measurement Primitives Hyperlink Format example



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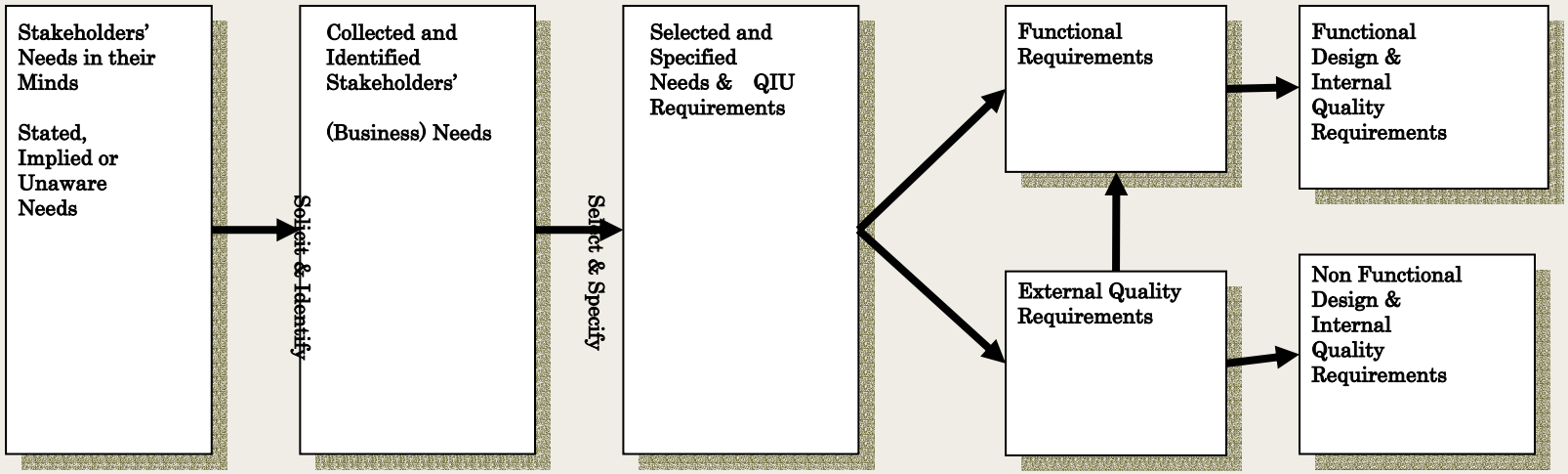
Relationship between Needs and Requirements



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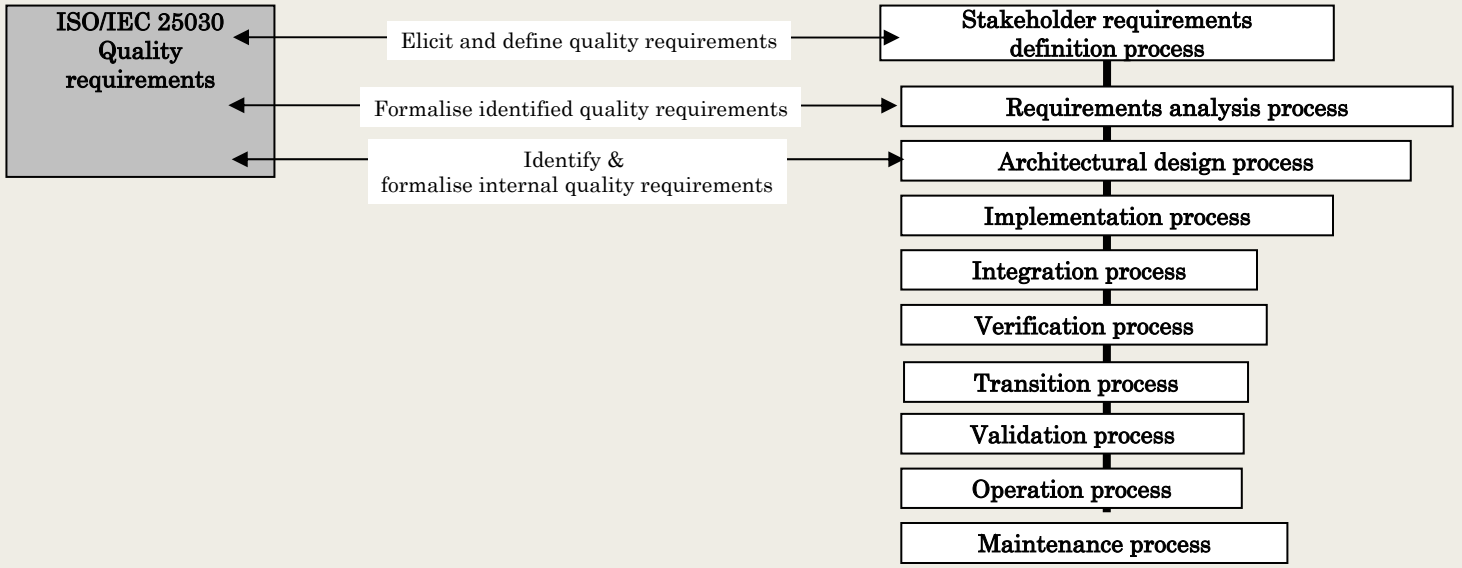
ISO/IEC 15288 System Life Cycle Processes to appear in 25030



SQuaRE

ISO/IEC 15288 (Technical Processes)

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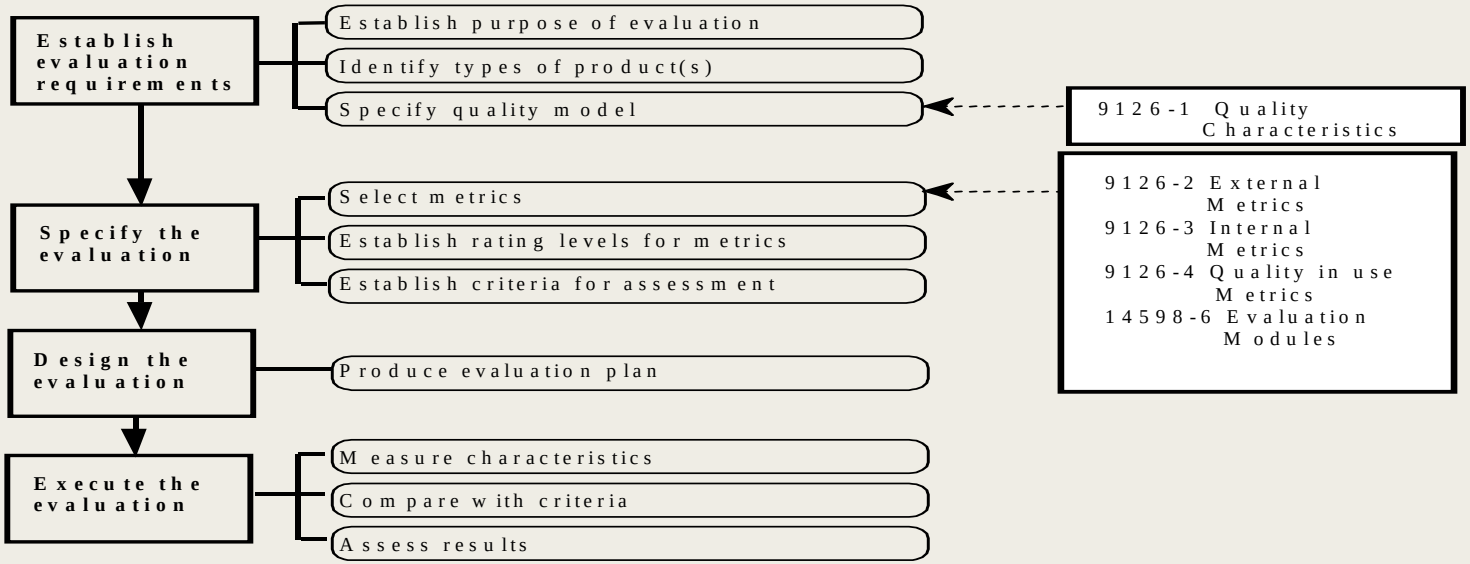
Evaluation process view according to ISO/IEC 14598-1



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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

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Summary - 2

Working to reconcile and harmonize SQuaRE series with other standards

Concern over number of standards and fragmentation of content

Reviewers sought

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