QUality Assessment of System Architectures and their Requirements (QUASAR)

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What is QUASAR?

<u>QU</u>ality <u>A</u>ssessment of <u>S</u>ystem <u>A</u>rchitectures and their <u>R</u>equirements

a Well-Documented and Proven Method based on the use of *Quality Cases* for assessing the *Quality* of:

- Software-intensive *System* / Subsystem *Architectures* and the

- *Architecturally-Significant Requirements* that Drive Them

QUASAR Version 1 (July 2006) emphasized the quality assessment of architectures against architecturally-significant requirements.

QUASAR Version 2 addresses the quality assessment of *both* architectures *and* their architecturally-significant requirements.

QUASAR Method - Phases

Four **Phases**:

1. System Assessment Initiation (SAI)

   For each Subsystem to be assessed:

   2. Subsystem Requirements Assessment (SRA)

   3. Subsystem Architecture Assessment (SAA)

4. System Assessment Summary (SAS)

Phase 2 and 3 may also apply to system as a whole.

What is Quality?

Quality

> the Degree to which a Work Product (e.g., System, Subsystem, Requirements, Architecture) Exhibits a Desired or Required Amount of Useful or Needed Characteristics

Quality of a Work Product is defined in terms of a Quality Model:
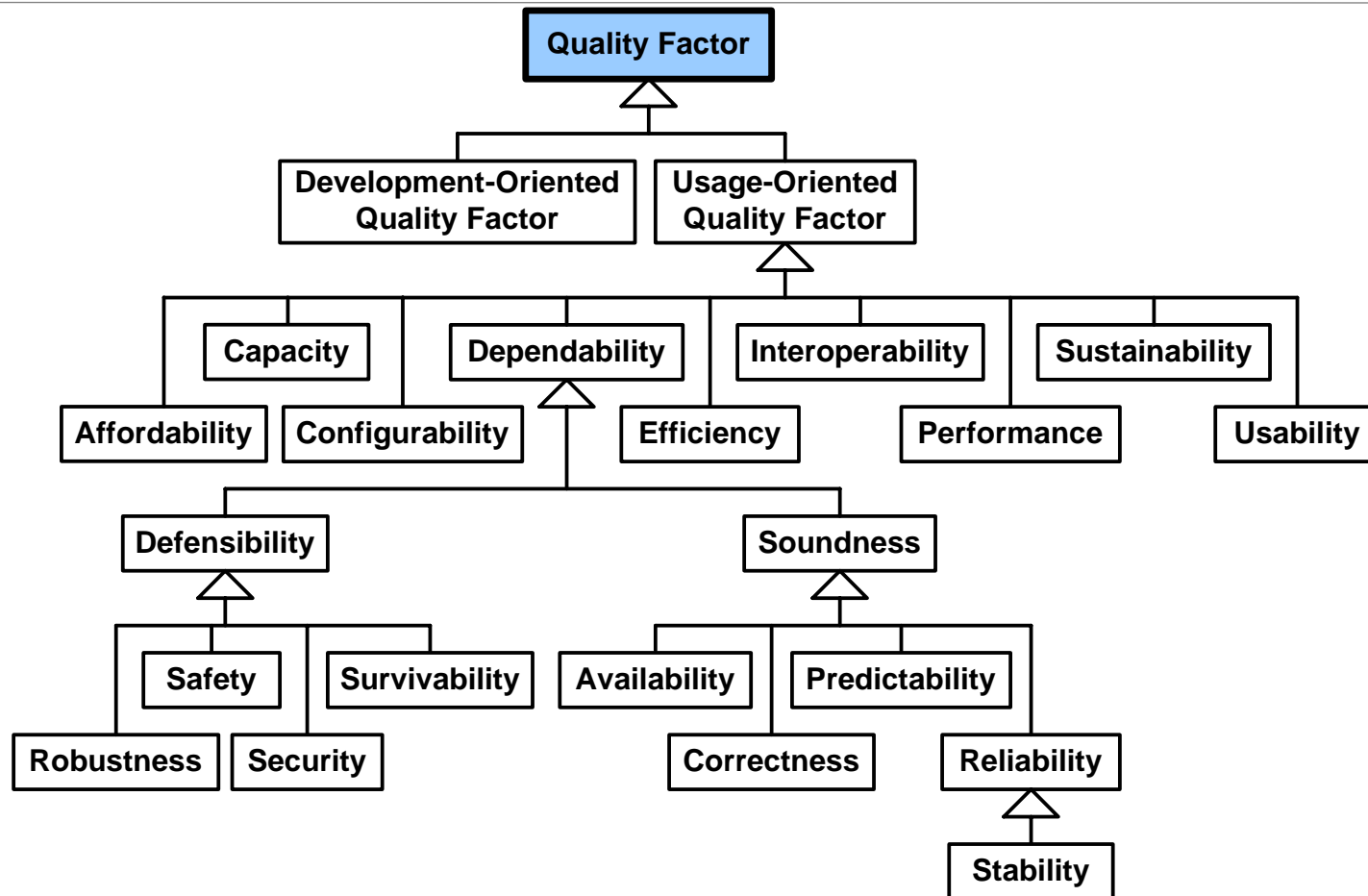
- **Quality Factors**
  (a.k.a., Quality Attributes, Quality Characteristics, 'ilities')
  (e.g., availability, interoperability, performance, reliability, etc.)

- **Quality Subfactors**
  (e.g., jitter, latency, response time, schedulability, throughput)

- **Quality Measures**
  (e.g., milliseconds, transactions per second)

Quality Model
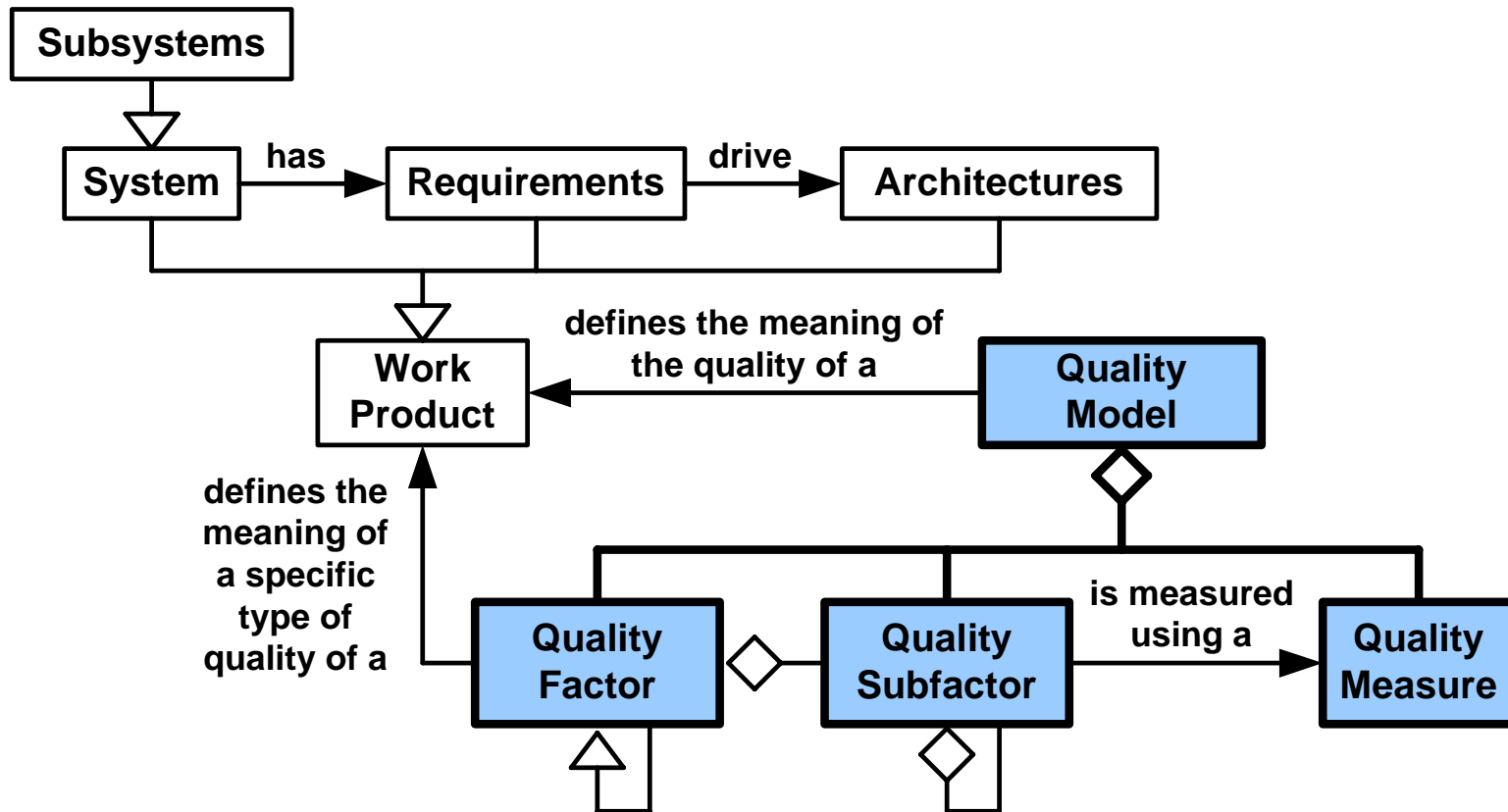
Quality Model – Quality Factors

Quality Case - Definition

Quality Case

> a Cohesive Collection of *Claims*, *Arguments*, and *Evidence* that Makes the Developers' Case that their Work Product has *Sufficient Quality*

A Generalization of Safety Cases from the Safety Community:

- Can Address any Quality Factor and/or Quality Subfactor

Useful for:

- Assessing Quality

- Certification and Accreditation

Quality Cases – Components[1]

A Quality Case consists of the following types of Components:

1. **Claims**
   Developers' Claims that their Work Products have Sufficient Quality, whereby quality is defined in terms of the qualify factors and quality subfactors defined in the official project quality model

2. **Arguments**
   Clear, Compelling, and Relevant Developer Arguments Justifying the Assessors' Belief in the Developers' Claims
   (e.g., decisions made, trade-offs made, rationales, and assumptions)

3. **Evidence**
   Adequate Credible Evidence Supporting the Developers' Arguments
   (e.g., official project diagrams, models, and documents; requirements repositories; simulation results; test results; and demonstrations witnessed by the assessors)

Quality Cases – Components$_2$
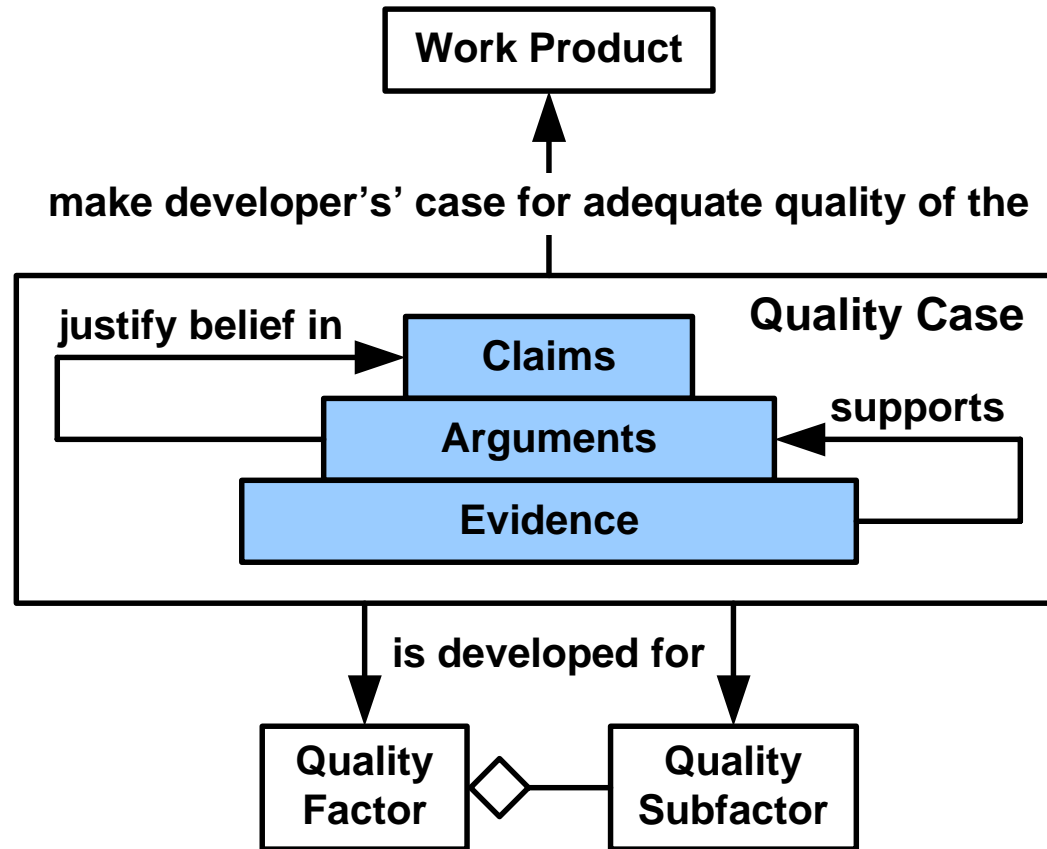
Example Partial Architectural Performance Case Diagram
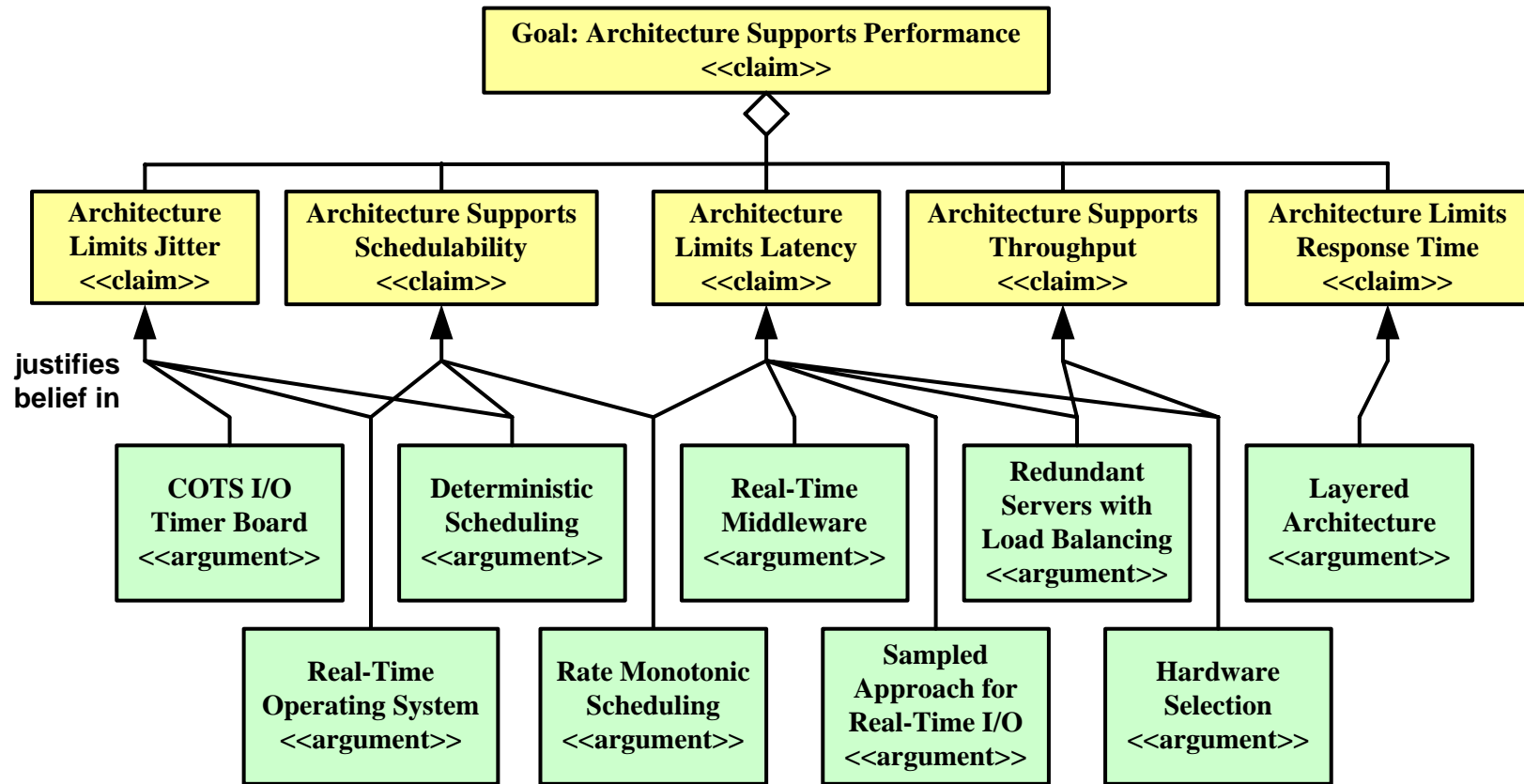

Goal: Architecture Supports Performance
<<claim>>

Architecture Limits Jitter <<claim>>

Architecture Supports Schedulability <<claim>>

Architecture Limits Latency <<claim>>

Architecture Supports Throughput <<claim>>

Architecture Limits Response Time <<claim>>

justifies belief in

COTS I/O Timer Board <<argument>>

Deterministic Scheduling <<argument>>

Real-Time Middleware <<argument>>

Redundant Servers with Load Balancing <<argument>>

Layered Architecture <<argument>>

Real-Time Operating System <<argument>>

Rate Monotonic Scheduling <<argument>>

Sampled Approach for Real-Time I/O <<argument>>

Hardware Selection <<argument>>

System and QUASAR Scope

Tier		
Tier 1	Scope of QUASAR Assessment	System of Systems
Tier 2		System 1 · System 2 · System 3 · ... · System N
Tier 3		Subsystem 1 · Subsystem 2 · Subsystem 3 · ... · Subsystem N
Tier 4		Segment 1 · Segment 2 · Segment 3 · ... · Segment N
Tier 5		Subsegment 1 · Subsegment 2 · Subsegment 3 · ... · Subsegment N
Tier 6		Assembly 1 · Assembly 2 · Assembly 3 · ... · Assembly N
Tier 7		Subassembly 1 · Subassembly 2 · Subassembly 3 · ... · Subassembly N
Tier 8		HW CI 1 ... HW CI N · SW CSCI 1 ... SW CSCI N · Data CI 1 ... Data CI N · Facilities · Manual Procedures · Roles
Tier 9		HW C 1 ... HW C N · SW C 1 ... SW C N
Tier 10		Part 1 ... Part N · SW Unit 1 ... SW Unit N

QUASAR Today

In-use on Largest DoD Acquisition Program

QUASAR Version 1 Handbook Published
http://www.sei.cmu.edu/publications/documents/06.reports/06hb001.html

Provided as SEI Service by Acquisition Support Program (ASP)

Tutorials at Conferences

QUASAR Tomorrow

Future Technical Plans:

- Ensure Architectural Integrity across Multiple Subsystems
- Development of Catalog of Quality Factor-Specific Architectural Styles, Patterns, and Mechanisms to use as Standardized Quality Case Arguments
- Improve Objective Determination of "Sufficient Quality"
- Expand Quality Cases Beyond Requirements and Architecture

Future "Productization":

- More Conference Tutorials and Classes
- Expanded QUASAR Training Materials
- QUASAR Articles
- Use and Validation on more Programs
- QUASAR Book

How the SEI Can Help You

QUASAR is Ready for Use *Now*.

QUASAR Handbook and Training Materials can be downloaded from SEI Website.

The SEI Acquisition Support Program (ASP) offers QUASAR as a Service:

- Consulting and Training

- Facilitation of QUASAR Assessments

- Recommended RFP and Contract Language

Questions?

For more information, contact:

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