QUality Assessment of System Architectures and their Requirements (QUASAR)

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What is QUASAR?

QUality Assessment of System Architectures and their Requirements

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

Subsystems

System

Requirements

Architectures

defines the meaning of the quality of a

Work Product

Quality Model

defines the meaning of a specific type of quality of a

Quality Factor

Quality Subfactor

Quality Measure

is measured using a

drive

has
Quality Model – Quality Factors

- Quality Factor
  - Development-Oriented Quality Factor
    - Capacity
      - Affordability
      - Defensibility
        - Safety
        - Robustness
    - Configurability
    - Interoperability
      - Efficiency
      - Soundness
        - Correctness
        - Reliability
          - Stability
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:

• Asssessing Quality

• Certification and Accreditation
Quality Cases – Components

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 quality 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

- Work Product
- Quality Case
  - Claims
  - Arguments
  - Evidence
- Quality Factor
- Quality Subfactor

make developer’s’ case for adequate quality of the Work Product

justifies belief in

Quality Case supports

is developed for
Example Partial Architectural Performance Case Diagram

Goal: Architecture Supports Performance

- Architecture Limits Jitter
- Architecture Supports Schedulability
- Architecture Limits Latency
- Architecture Supports Throughput
- Architecture Limits Response Time

justifies belief in

- COTS I/O Timer Board
- Deterministic Scheduling
- Real-Time Middleware
- Redundant Servers with Load Balancing
- Layered Architecture

- Real-Time Operating System
- Rate Monotonic Scheduling
- Sampled Approach for Real-Time I/O
- Hardware Selection

Deterministic Scheduling

Hardware Selection

Rate Monotonic Scheduling

Real-Time Middleware

Redundant Servers with Load Balancing

Layered Architecture

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Layered Architecture

Real-Time Operating System

Sampled Approach for Real-Time I/O

Hardware Selection
System and QUASARAR Scope

Tier 1
Scope of QUASAR Asssessment
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?

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