Addressing Quality Requirements in GIS Architectures

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High Quality GIS

- Attention is often paid to GIS functionalities.
- However, quality aspects are insufficiently addressed. A GIS would be:
  - Ineffective if it processing misses deadlines
  - Unreliable if it is not available when it should be
  - Unusable if it is difficult to understand
- Hence, high quality GIS systems depend on qualities, such as:
  - Efficiency
  - Reliability
  - Usability
  - Security

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Problems with GIS Quality Requirements

- Complexity and large volume of geographic information
- Often not systematically captured & documented
- Common to find ambiguous statements such as:
  - "System shall be portable"
  - "System shall be highly secured"
  - "GIS operations shall be efficient"
- Hence, no feasible means to assess whether the system has met its quality requirements or not

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Solution: Architectural Framework

- Based on two architectural techniques from the Software Engineering Institute (SEI):
  - Quality Attribute Scenarios
  - Attribute Driven Design Method (ADD)

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Quality Attribute Scenarios

- SEI quality attribute scenarios consist of 6 yardsticks:
  1. Source of stimulus
  2. Stimulus
  3. Environment
  4. Artifact
  5. Response
  6. Response measure

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Attribute Driven Design Method

- Attribute Driven Design Method (ADD) is a recursive approach to software architecture design based on the quality attributes the software needs to achieve

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Achieving GIS Quality Requirements using ADD

- **Quality requirement scenarios addressed:**
  - Performance
    - Editing a Geographic Feature
    - Retrieve Data
  - Modifiability
    - Change GIS Data Format
    - Add GIS Component
    - Interface GIS with an External Software System

First Level of Decomposition

- **Scenarios addressed at this stage:**
  - Add GIS Component
  - Change GIS Data Format
  - Editing a Geographic Feature
  - Retrieve Data

- **Architectural Decisions:**
  - Maintain a semantic coherence
  - Published interfaces
  - Client-Server
  - Minimize clients & servers interaction

Second Level of Decomposition: Applications Subsystem Decomposition

- **Scenarios addressed at this stage:**
  - Mediator design pattern
  - Use geographic information standards
  - Separation and operation

- **Architectural Decisions:**
  - Interface GIS with an External Software System
  - Editing a Geographic Feature
  - Retrieve Data

Evaluation: GIS Quality Attribute Scenarios

- **Understandability:** scenarios unambiguously define factors controlling the achievement of quality attributes
- **Precision:** response and response measure offer specific means for assessing GIS architectures
- **Traceability:** decomposing each quality attribute into scenarios enables traceability of how an attribute is addressed during the architectural design and evaluation

Evaluation: GIS Architecture Design

- **Attribute Driven Design Method:**
  - Simplifies architectural design process
  - Systematic consideration of quality attributes
  - Mapping between quality attribute scenarios & architectural decisions

- **Design Documentation:**
  - Well organized architectural documentation
  - Record of architectural design decisions applied, resultant architectural views and underlying design rationale
Q&A