

Towards Quality-aware Composition of Geographic Information Services for Disaster Management

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Outline:

- GI service chaining
- QoS & the QoS challenge
- Geo-service Infrastructure
- QoS Model (4DM)
- Implementing QoS
- Summary



GI service chaining



- Static chaining
 - Realized at design time; tight coupling
 - Clear & stable, long-lived services
 - Potential for integrating GI systems
- Dynamic chaining
 - Realized at run-time; loose coupling
 - Dynamic requirements, short-lived services
 - Potential for evolving flexible & adaptive GI systems & location-based services

QoS - A definition



*The set of qualities of a **service** that determine its **utility** (and usability) in a **use context***

In service-oriented geo-processing chains, QoS encompasses:

- Quality of deliverable geo-information*
- Operational characteristics of service-chain (ad-hoc application)*

QoS-aware GI service chaining



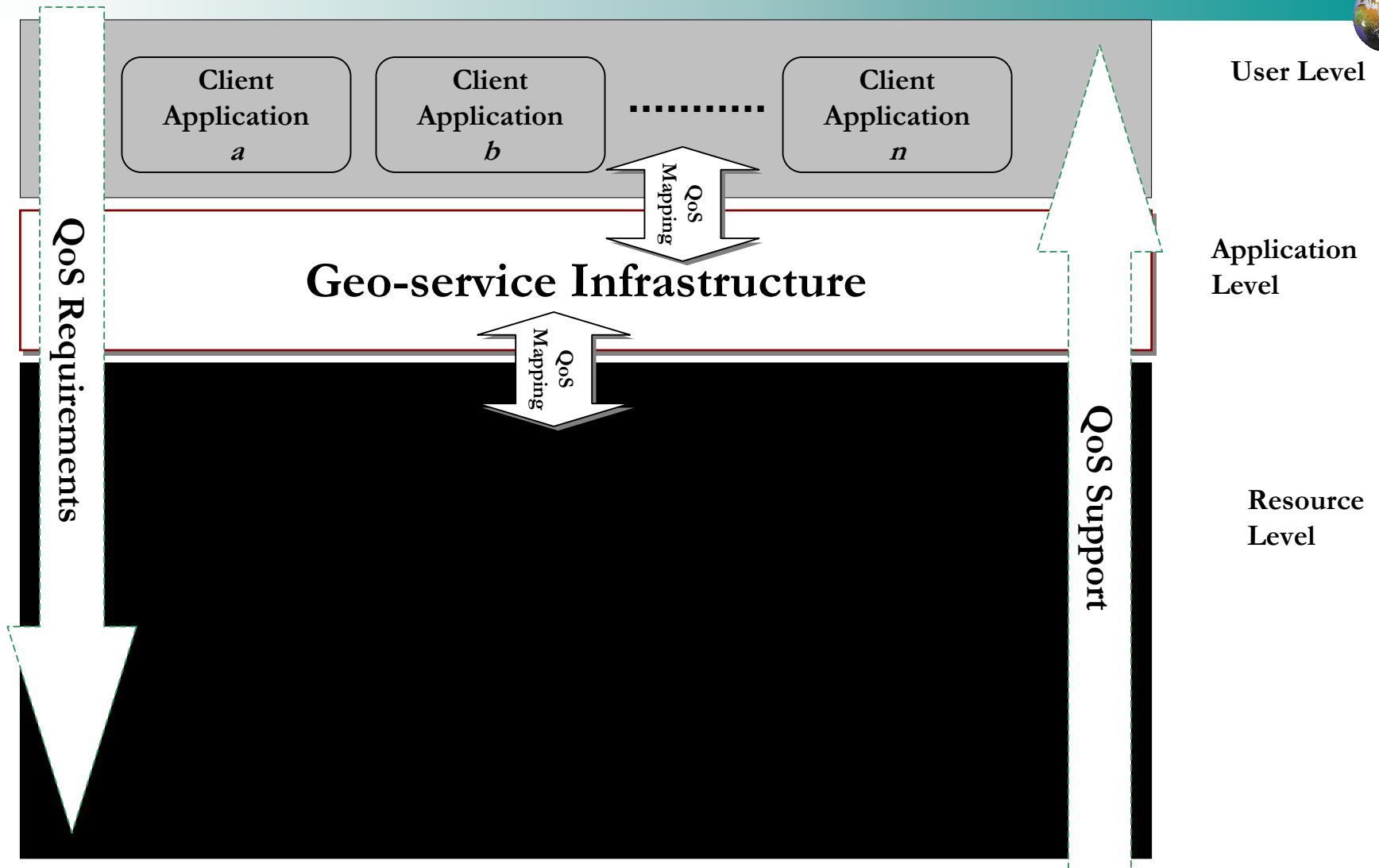
- Prerequisite for commercial use of GI services & on-demand access to GI & value-added services
- Considers functional and QoS capabilities of GI services

QoS - the challenges



- Different user requirements
- Dynamic requirements
- Services with different qualities
- Changing availability of services
- What requirements from whom?
- Which services with what qualities?
- Which service-chain instance for what requirements?

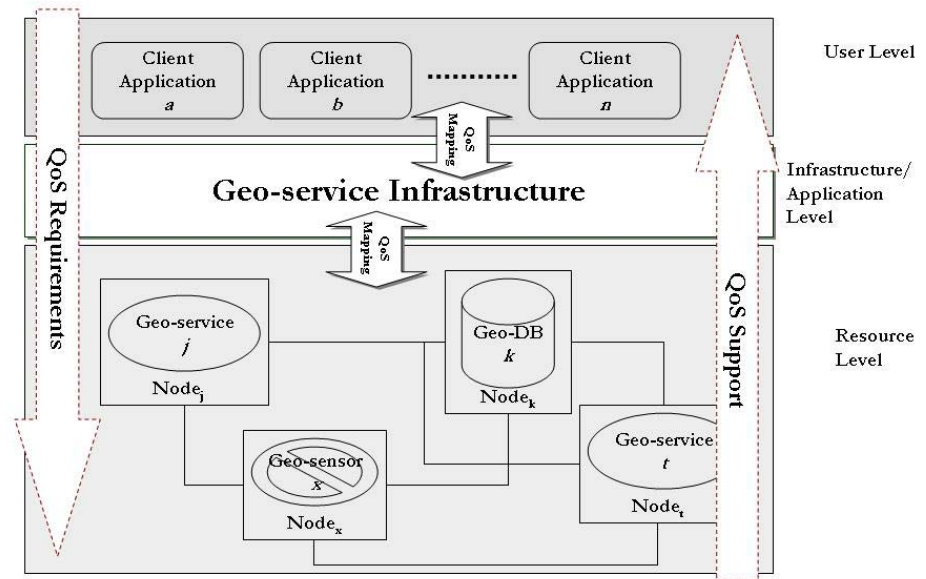
Geo-service Infrastructure



Geo-service infrastructure



- Functions
 - Specification of QoS requirements & offerings
 - QoS mapping
 - QoS composition
 - QoS control & management

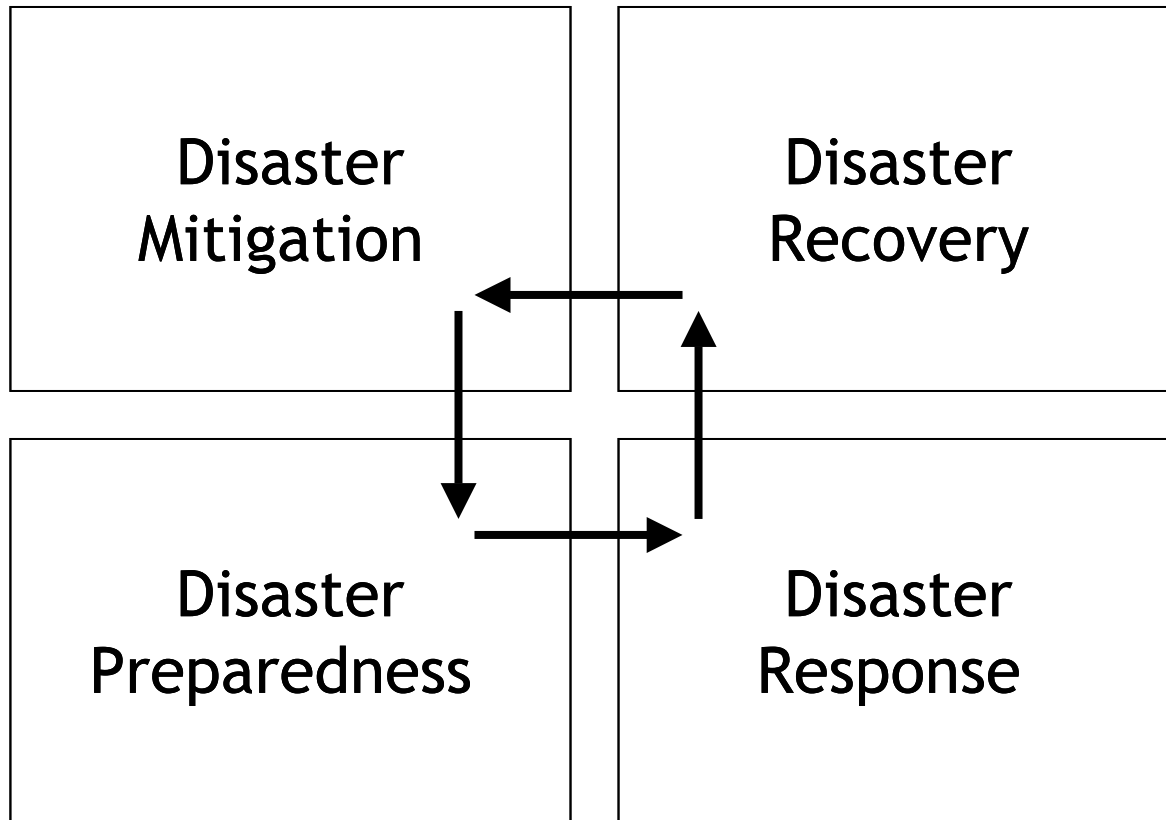


QoS Model 4DM



	Informational dimension	Operational dimension
User-level	<ul style="list-style-type: none">▪ Fitness-for-use e.g. accuracy, fidelity, etc.	<ul style="list-style-type: none">▪ Availability▪ Interactivity▪ cost▪ Dependability
Application-level	<ul style="list-style-type: none">▪ Information quality elements e.g. freshness, accuracy, integrity, etc.	<ul style="list-style-type: none">▪ Reliability▪ Performance▪ Price▪ Security

DM Phases



QoS Requirements in 4DM



□ Predictable, long-lived, clear needs; static chaining

■ Unpredictable, short-lived needs; dynamic chaining

[Service Chaining](#) : [QoS](#) : [Infrastructure](#) : **QoS Model** : [Implementation](#) : [Summary](#)

QoS Classes 4DM



	Gold (DR Wired)	Silver (DR wireless)	Bronze (DM, DP, DRc)
Accuracy	:high	:high	:high
Fidelity	:Good	:Medium	:Good
Availability	: $\geq 99.99\%$: $\geq 99\%$: $\geq 95\%$
Interactivity	: $\leq 2\text{sec}$: $\leq 4\text{sec}$: $\leq 8\text{sec}$

DR - Disaster Response; DM - Disaster Mitigation; DRc - Disaster Recovery

QoS Implementation



- Centralized Vs. distributed architecture
- Implementation technologies:
 - Web services
 - Grid
- Thrust of GI industry efforts focused on Web services
- Convergence of technologies in OGSA

QoS specification

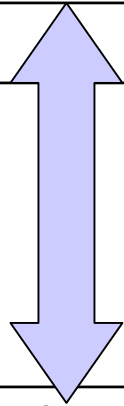


- Resources (GI services) **MUST** be self-describing:
 - Functional capability
 - QoS capability
- Standard means to specify QoS requirements & offerings
 - Feature & property components of WSDL (?)
 - Others e.g. WSLA, WSOL, OWL-S, etc..

QoS Mapping - translation tables



<i>User::Interactivity</i>	<i>Application::Performance</i>	<i>Application::Reliability</i>
<i>High</i>	Guaranteed	Premier
<i>Medium</i>	Best-effort	Moderate



<i>Application::Performance</i>	<i>Resource::Performance</i>	<i>Resource::Availability</i>
<i>Guaranteed</i>	"As-specified"	Guaranteed
<i>Best-effort</i>	Surf-grade	Best-effort

QoS Composition, Control & Management



- QoS composition
 - Algorithms to determine optimal service-chain instance for specified requirements
- QoS control & management
 - Brokers, QoS-aware Inter-enterprise WFMS, coordinators, etc..

Summary



- Service chaining:
 - Static - Integrating systems for DM, etc.
 - Dynamic - Flexible location-based services for DR, etc.
 - QoS-aware dynamic chaining for truly on-demand access to custom GI and value-added services
- QoS
 - Informational & Operational dimensions
 - User, application and resource levels
- Geo-service infrastructure for QoS specification, mapping, control & management



Thank You!!