

Managing Democratic Grids: Architecture and Lessons Learnt

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Grid4All project 2006-2009

(www.grid4all.eu)

A democratic grid infrastructure

Virtual Organizations

Domain: collaboration

Self-* mechanisms enable grids built on conventional computers and networks contributed by participants

Techniques at intersection of peer-to-peer systems, autonomic computing, service oriented computing, and semantic web

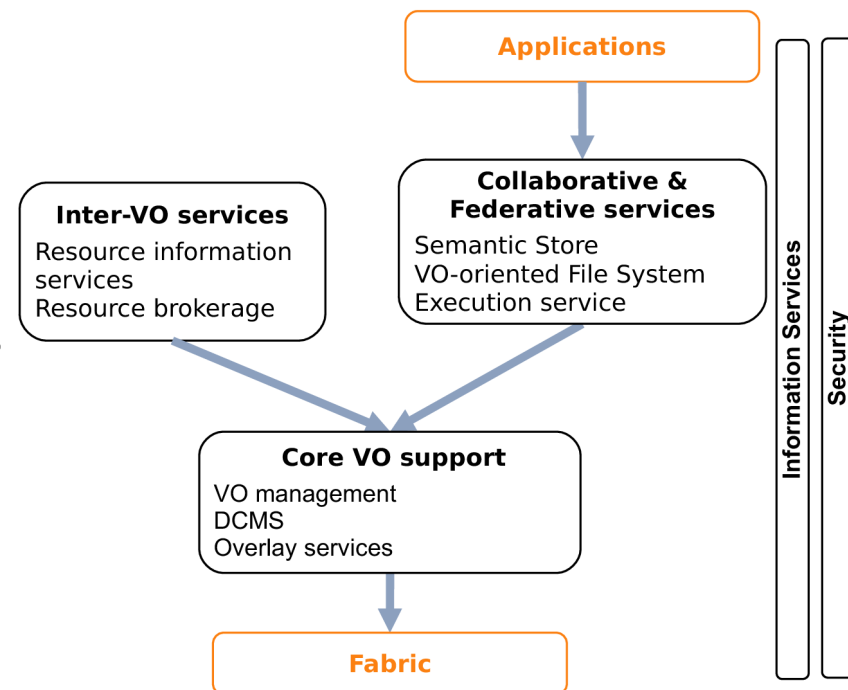
Lessons learnt during the construction and evaluation

Scenario

- Collaborative situations
 - Educational environment
 - (multi-site, project-based projects)
 - Collaboration
 - Extensible to other domains
 - Around virtual organizations
 - People, services and resources together
 - Pooling of resources (including my own computer)
 - Dynamic, churn

Architecture

- Fabric: resources, code → VO by members
- Core VO services:
 - Connectivity (Overlay)
 - Deployment, execution and self-management (DCMS)
 - Resource Discovery and allocation, membership, deployment, security, brokerage (VOMS)
- Inter-VO services:
 - Matching service requests, brokering resources in markets
- Collaborative & federative services
 - Federate files
 - Facilitate update of shared data with flexibility and consistency



Overlay Infrastructure and Programming Models

- Services/Apps deployed, run, managed w/ high rate of churn
 - Self-organization: Structured overlay (DHT): Niche (based on DKS)
- Component model (Fractal)
- Deployment and Self-management
 - DCMS, distributed runtime execution system for self-managing applications and services in dynamic VO
 - Deployment, name-based comm
 - Architecture Description Language → compiled into DCMS instructions
 - Sensors, aggregators, managers
- Lessons and open issues
 - Certain overhead
 - Facilitate development of self-managing applications
 - Efficient monitoring, Information gathering/aggregation, Control methods, High level API and language support

Virtual Organization and Resource Management

- Participants, resources, services: grow and shrink
- Semantic Information System (SIS)
 - Currently centralized → decentralization?
- Marketplace
 - Exchange and trade resources
 - Auctions, currency and market information
 - Decentralized

Data Storage

- New ways of sharing → new styles of cooperative work
 - Namespace: VOFS
 - Concurrent modification w/ conflict detection and reconciliation: Telex
- Lessons and open issues
 - Distributed, replicated, stateful systems hard
 - Better than handling is immunity (commutability)
 - Scalability not big issue

Applications

- Challenging (dynamics, decentralization)
- Lack of tools (expected)
- Harder to deal with additional issues (transparencies)
- Lack of maturity of API
- Applications can work on a wider range (dynamic, dealing with environmental changes)
- Transparencies:
 - Boundaries → Virtual Organizations
 - Additional (elastic) resources → Marketplace, scheduler
 - Sharing, Concurrent write → Telex
 - Common name-space for files → VOFS
 - Sharing complex info → Semantic Information

Summary

- Democratisation of grid or cloud ...
- Fragile infra → Overlay + Self-management
- Pooling resources: contributed (pooled) + market: exchange + acquired (Cloud)
- Difficult problems: deployment, control loops, markets, semantic matching, conflicts and reconciliation, language support / transparencies !!
- ... but useful

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