



# A Market for Computational Services

A Proposal to the e-Science Core Technology Programme

by

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TAG Markets

# Market for Computational Services - The Missing Link in the Grid



- Evolution of the Grid constrained by the fact that users can only use machines where they have accounts
  - No advantage to the user to traditional tty/login-based approaches
  - No motivation, which means no take-up for real use
- In a “real” Grid, users can use machines they’ve never heard of (while respecting the policies of the user and resource owner)
- So what’s missing?
  - Various Resource Brokers have been written
    - so users can find resources.
  - Issues regarding Community Authorisation are being addressed by various groups, with software solutions already existing (CAS, VOMS)
    - so users can access resources.
  - But there’s no Grid-enabled way to account and charge for anything
    - so users can’t pay for resources!!
- “The Grid will not be free” Bill Johnston, Chief Architect, NASA Information Power Grid

# Market for Computational Services - The Missing Link in the Grid



- This project will remove this final barrier, enabling the Grid to evolve to its full potential
- Such an essential component will arrive sooner or later
- UK must act quickly to capitalise on our current lead in this area
- Grid computing could form a key part of the UK's future economy.
- This fits well with the UK economy's current (and increasing) service-based orientation.

# Vision

Grid = Open Market in Services

Services

Independently Sourced

Separately Acquired

Composed and Used

Independently Paid For

Service

Software

Data

Execution Environment

Network Capacity

...

Proper Charging  
Essential for

“Service  
Economy”

# New Businesses

# The Life of a Service



Register/Advertise

Negotiate Contract

Perform Service

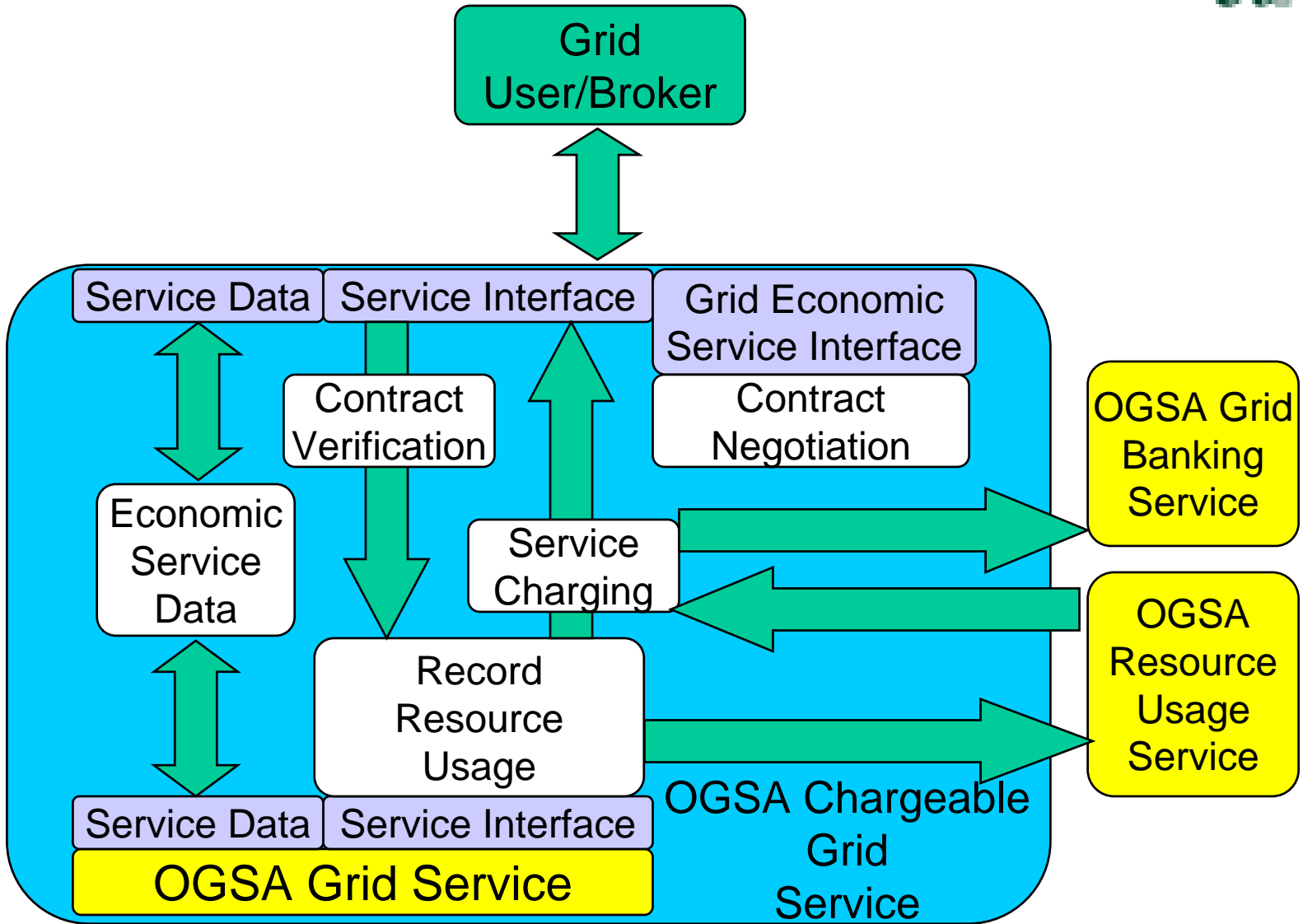
Monitor Contract

Log Usage

Charge

Organise Payment

# Architecture



# Proposed Scope



- Core Logging & Accounting Services
  - For contribution to GT3
- Secure Charging and Payment Mechanisms
  - Define interfaces that leverage existing infrastructures
- Performance Engineering and Brokering
  - Prediction and optimisation of execution time
- Computational Economics
  - Development and reference implementation of negotiation protocols
  - Exploration of advanced mechanisms (e.g. futures)
- Deployment within UK e-Science Grid and elsewhere
  - Utilise UK's Grid Infrastructure
  - Exposure to real environment, users & applications
  - CSC Real Life Deployments
  - Astronomical instrumentation

# Project Stages

Economic Models and Use Cases

Exemplar e-Science Applications

Protocol and Service Specification

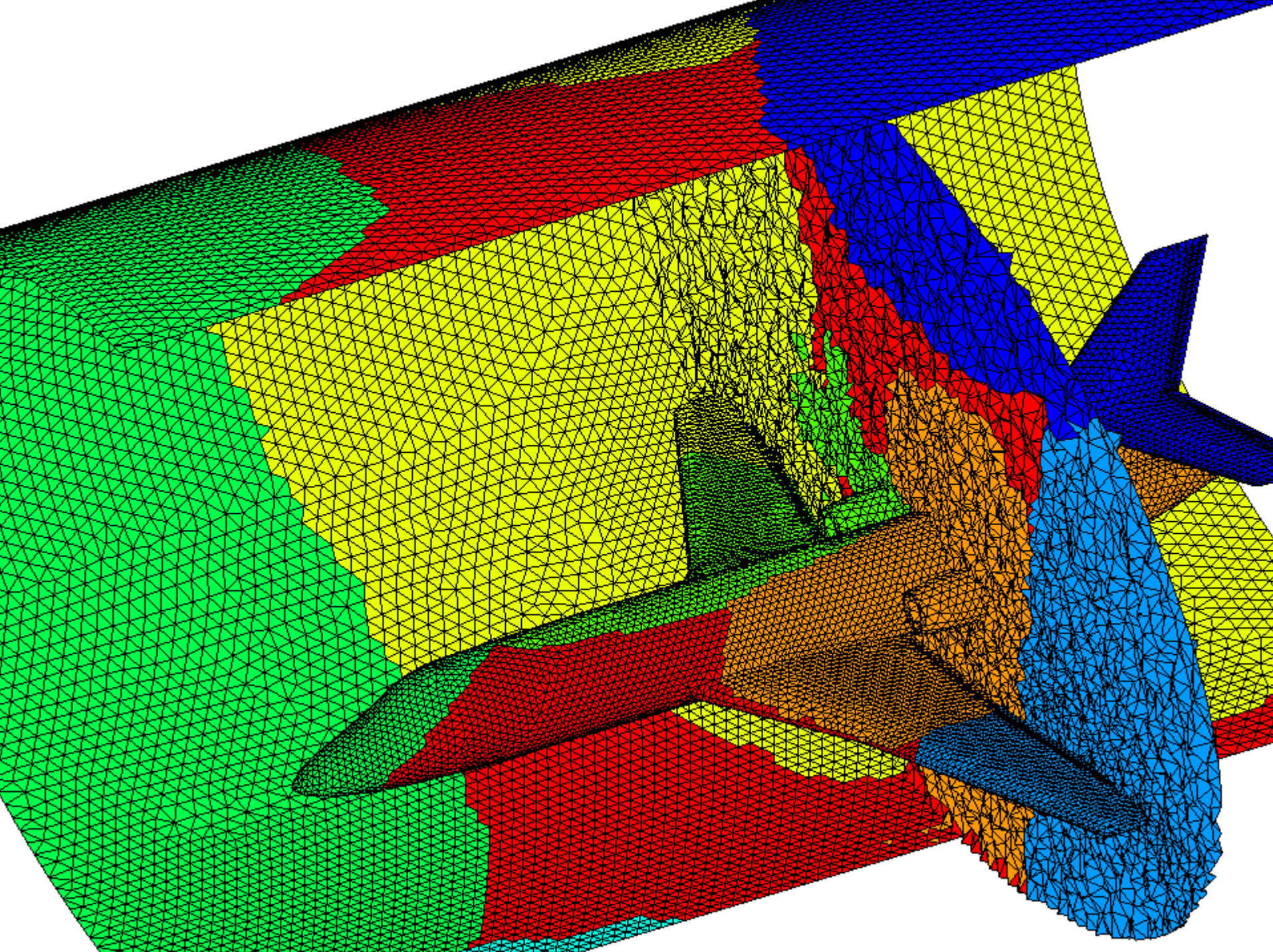
Grid Accounting Service

Grid Banking Service

Negotiation Protocols

Grid Brokering Service

Trial Deployments



# Project Contributions



- **OGSA Developments**
  - OGSA Accounting Service
  - OGSA Chargeable Service
  - OGSA Banking Service
  - Economic Service Data
  - Policy Service Data
- **Computational Economics**
  - Define open extensible architecture
  - Define negotiation protocols
- **Standardise results through the Global Grid Forum**

**UR-WG:** Usage Record Working Group. Specifying the basic information that needs to be gathered when a resource is used (Jian Zhang, Xcerla co-chair, Stephen Pickles very active).

**RUS-WG:** Resource Usage Service Working Group. Designing an OGSA-style service which will access usage record information (Steven Newhouse co-chair).

**GESA-WG:** Grid Economic Service Architecture Working Group. Designing OGSA-style services that will allow Grid services to be charged for flexibly (Steven Newhouse, Jon MacLaren co-chairs).

GESA-WG
RUS-WG
UR-WG

This arrangement of GGF groups will allow the Markets project to directly influence the standardisation process for OGSA accounting and economic protocols. Conversely, the Markets project can also provide early implementations to the Grid community which support these protocols.



Internet/Wireless Accounting Systems

Winner US NIST ATP 2002 Competition

Scalable and Reliable Accounting Engine for Inter-Networked Services

"The new resource accounting system will enable a broad spectrum of services ranging from next-generation wireless to broadband access services, and from grid computing to Web Services"

\$1,161,000, 1.5 yrs

Dr. Jian Zhang, Active in GGF, Close Relationship Manchester

Keen to Participate in Markets Project

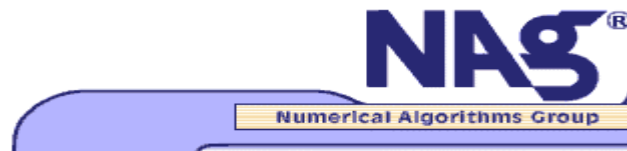
# Market Opportunities



Astrophysics Research Institute



ORACLE®



GridX



# Software Production



The Project will Produce Code!

( + Definition of Service Specifications and Protocols)

Major Resource ~ e-Science Centres

Reference Implementations for GT3 and OGSA

Ongoing Projects with Commercial Organisations will Assist Best Practice and QA and Provide some Dedicated Manpower

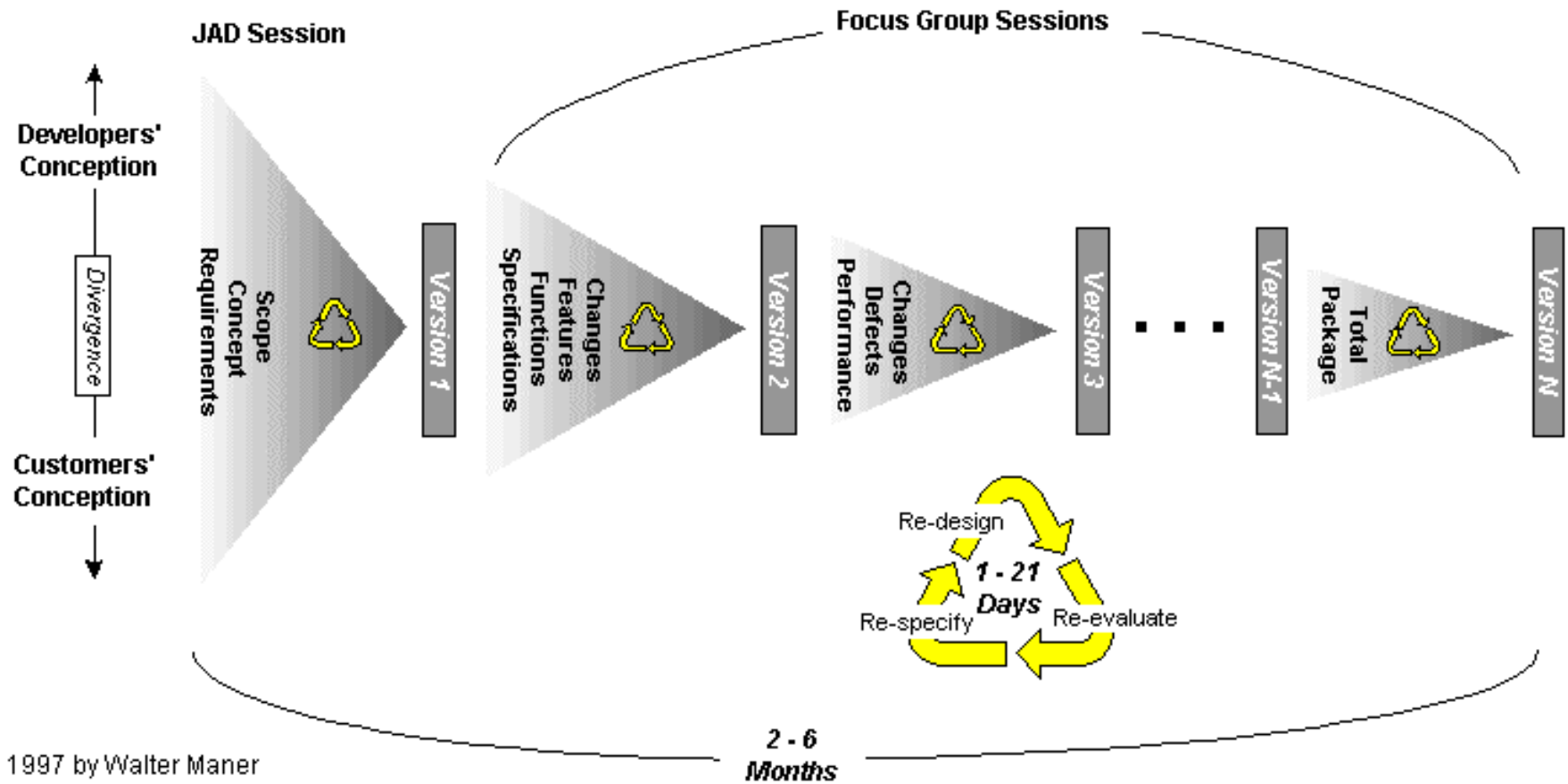
Commercial Organisations May Produce Internal Versions

## Rapid Applications Development approach:

- converge to final solution
- iterate between CS and applications to improve design
- copes with changing middleware/software environment: particularly crucial in Grid
- operate and deliver in fixed timescales

Adopted Successfully by GEODISE

# RAPID APPLICATION DEVELOPMENT USING ITERATIVE PROTOTYPING



(c) 1997 by Walter Maner

# Response to Referees



## Referee 1

“exactly what I believe the DTI should be supporting in the e-science initiative”

... but expensive and risky

This is an exciting and ambitious Global enterprise - boldness is needed to secure the UK's position

Trials and deployment are a major goal - significant part of CSC's contribution

Moving target - as is everything - not tied to GT3, OGSA more open

Over ambitious - WP1 - mainly thought about -GESA-WG use cases, WP2 perhaps, not defining new banking service

Overtaken - already very active in GGF, strong links to major players, let's get on with it!

## Response to Referees ...



### Referee 2

Have been working at 2 GGF's since submission to address exactly these issues - show's we have already taken international lead to do exactly what is suggested

Unspecific - no implementation structure? Commitment to OGSA and use cases drive implementation, Will develop open GGF standards

Complains don't reference previous work but doesn't say which, Nimrod?

Aware of P2P work (Link Intel VGC Milan Milenkovic)

GGF interfaces covered, involvement grown considerably since submission, GESA, RUS & UR WG's started work

Architecture OGSA based but not dependent. Current release has sufficient functionality to start development, LeSC early adopters. Industrial partners technology providers and users.

## Response to Referees ...



Referee 3

Sensible Chap!

Management experience growing