Payment and Negotiation for the Next Generation Grid and Web

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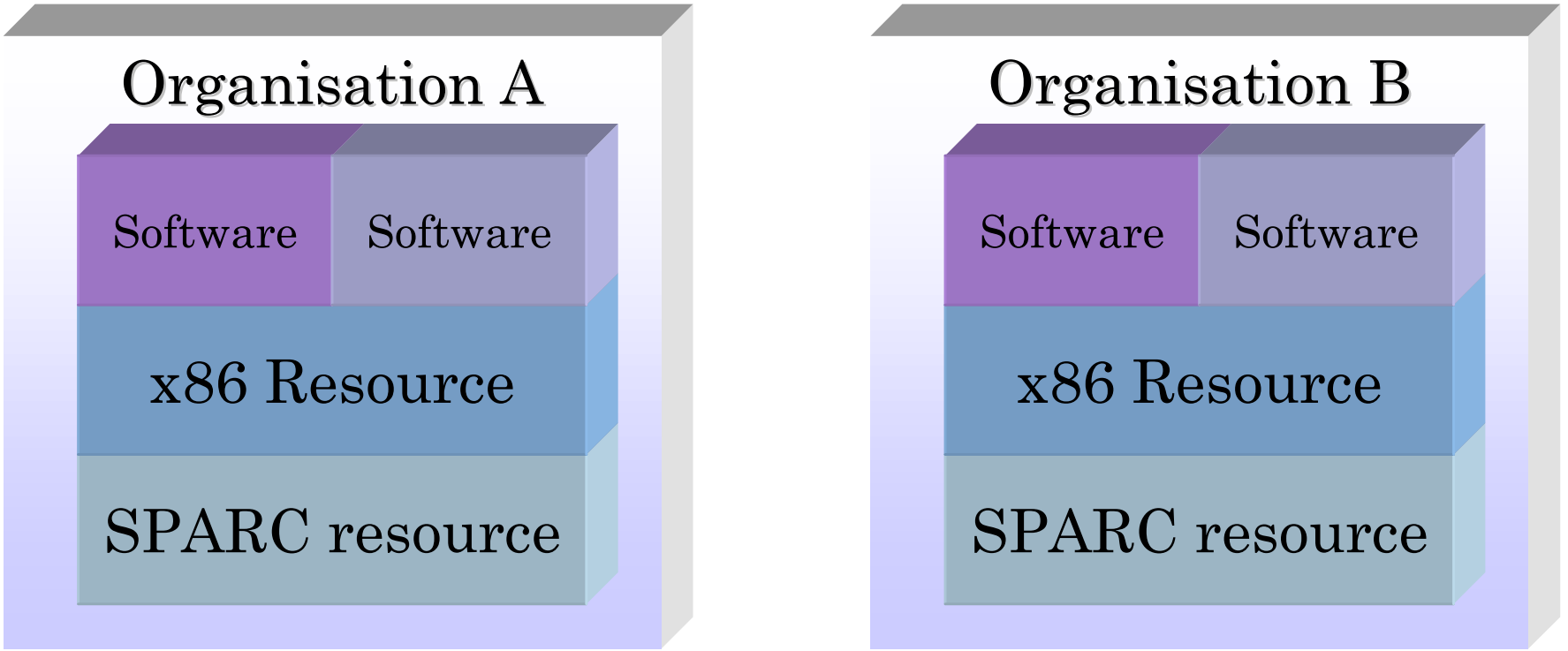
Outline

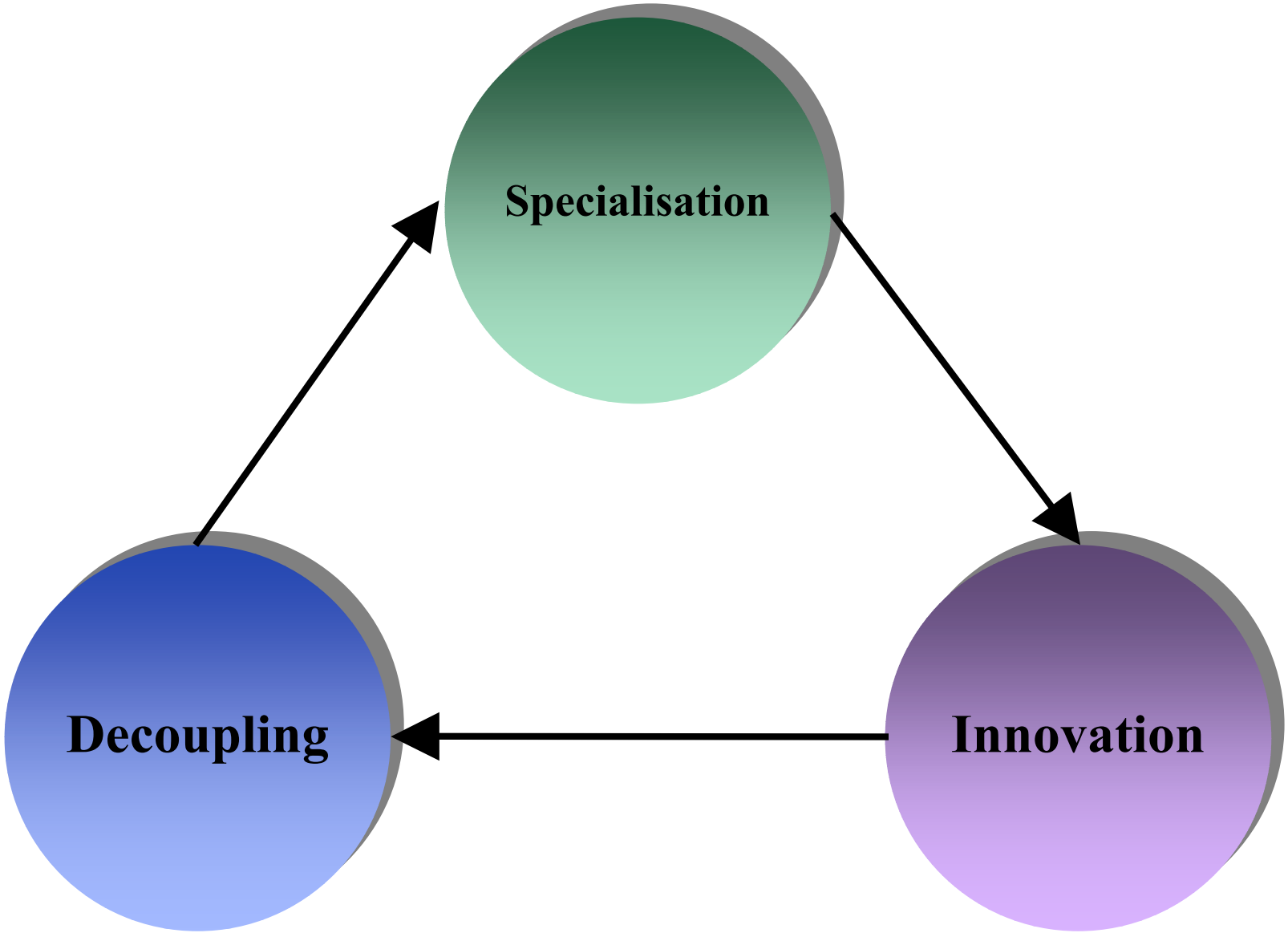
- A Market in Services
- "A Market for Computational Services" project
  - Next generation service Web
  - Negotiation
  - Payment
- Exemplars

A Market in Services

- Existing model
  - Static markets in execution and software



A Market in Services



A Market for Computational Services

A Project in the e-Science Core Technology Programme

Next Generation Service Web

Easy-to-use Encapsulated (Complex) Methods

e-Science + Web Services + Pay-per-Use

PayPal

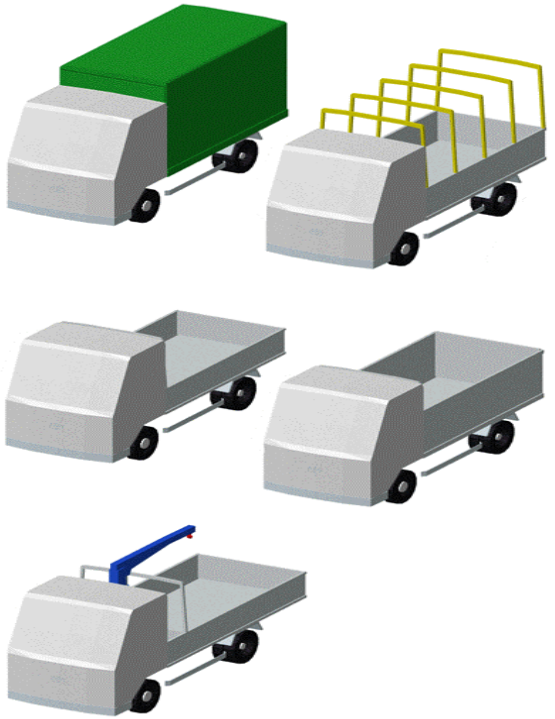
Public Web Market in Consumer Services

- Encapsulated
- Composable
- "Mobile"

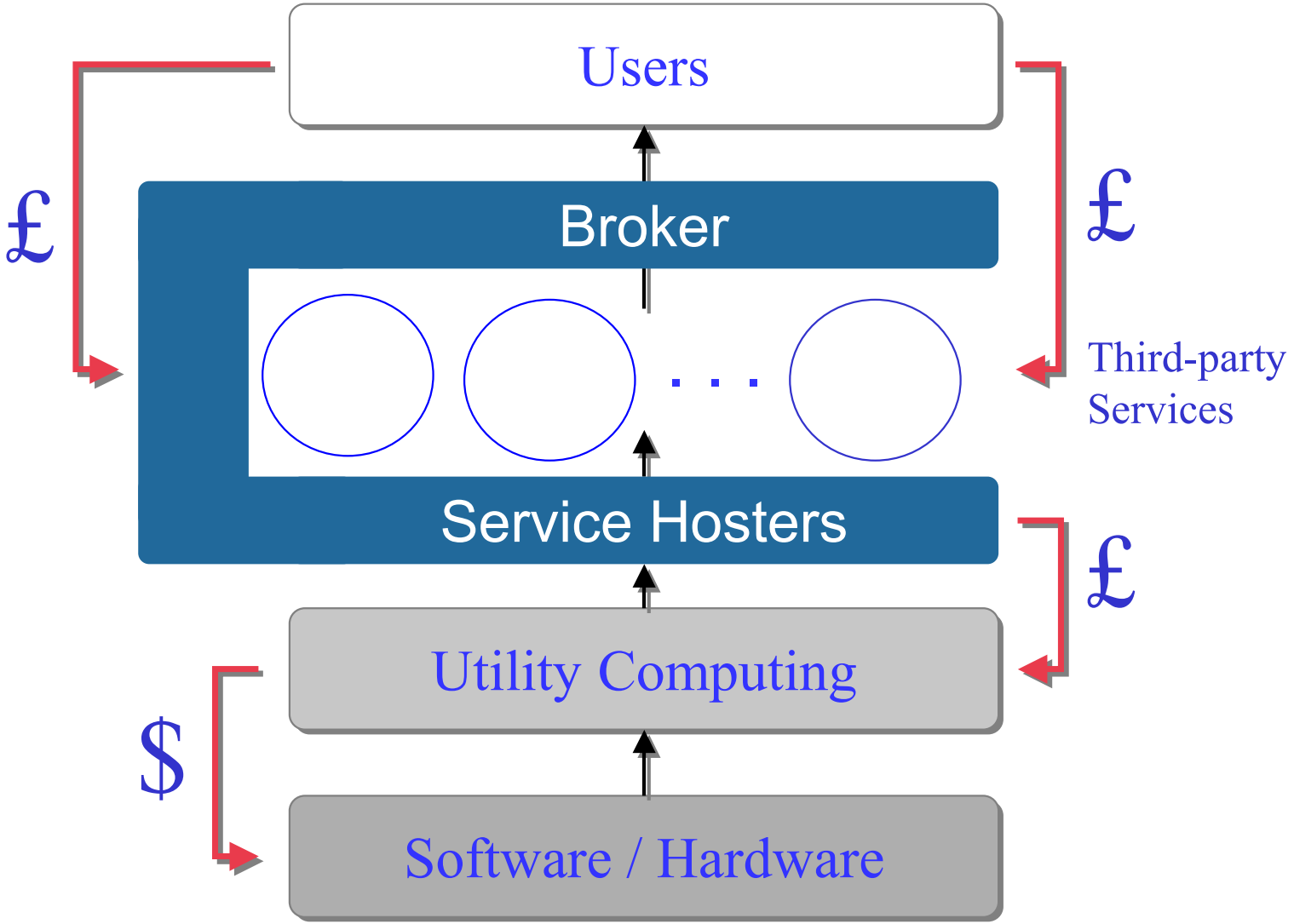
- Use on Demand
- Pay per Use
- Micro-payment

Next Generation Service Web

- Transparent Mapping of Execution
  - –Computational Platforms
    Substitutable
  - –Execution a *Tradable Commodity*
  - –A *Market*
- *Enables Utility Computing*

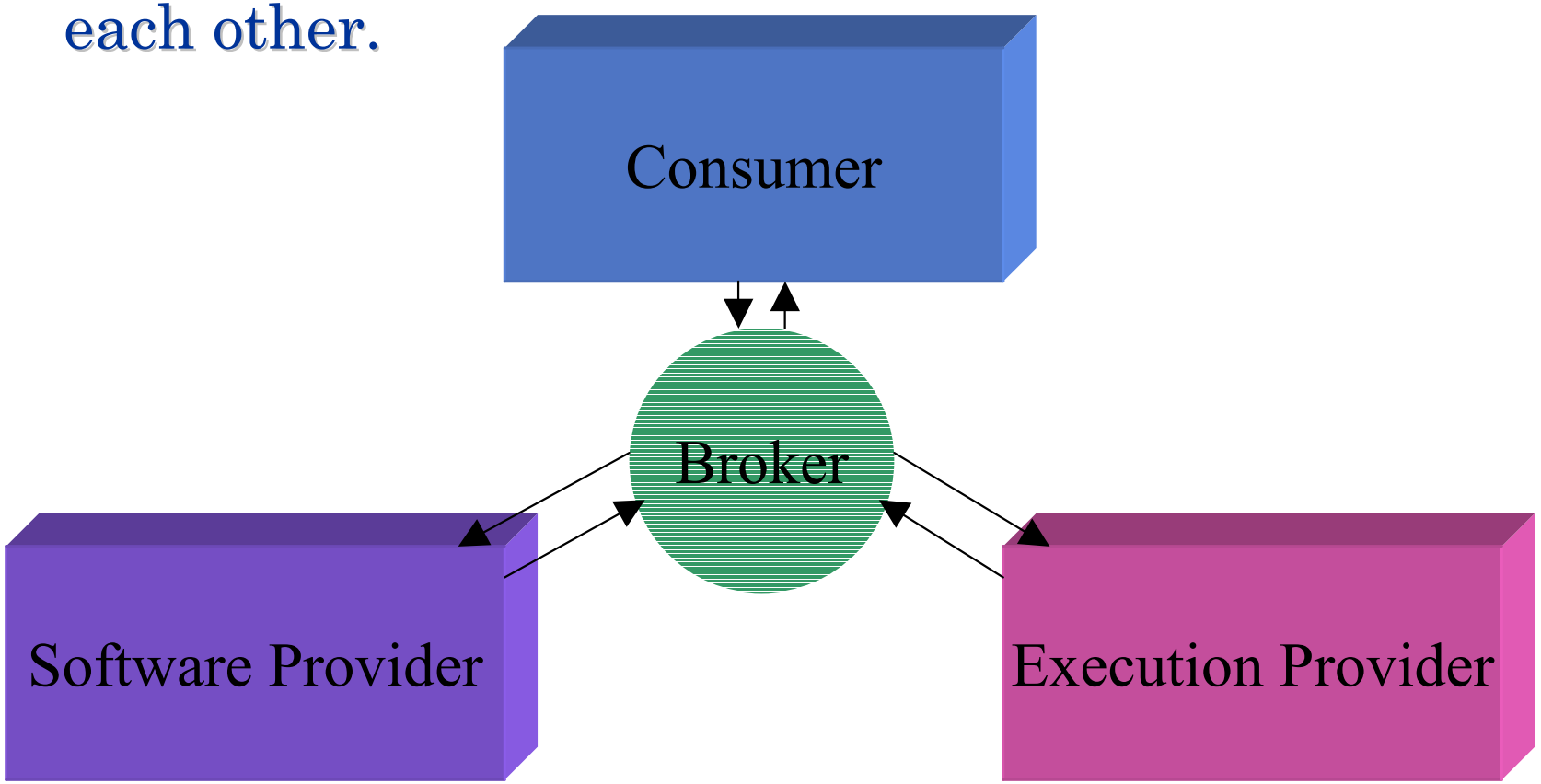


Anatomy of Service Web



Challenges within a Service Market

- Brokering a solution to many problems
- As a trusted 3rd party a broker can act as an interface between two parties who do not know each other.



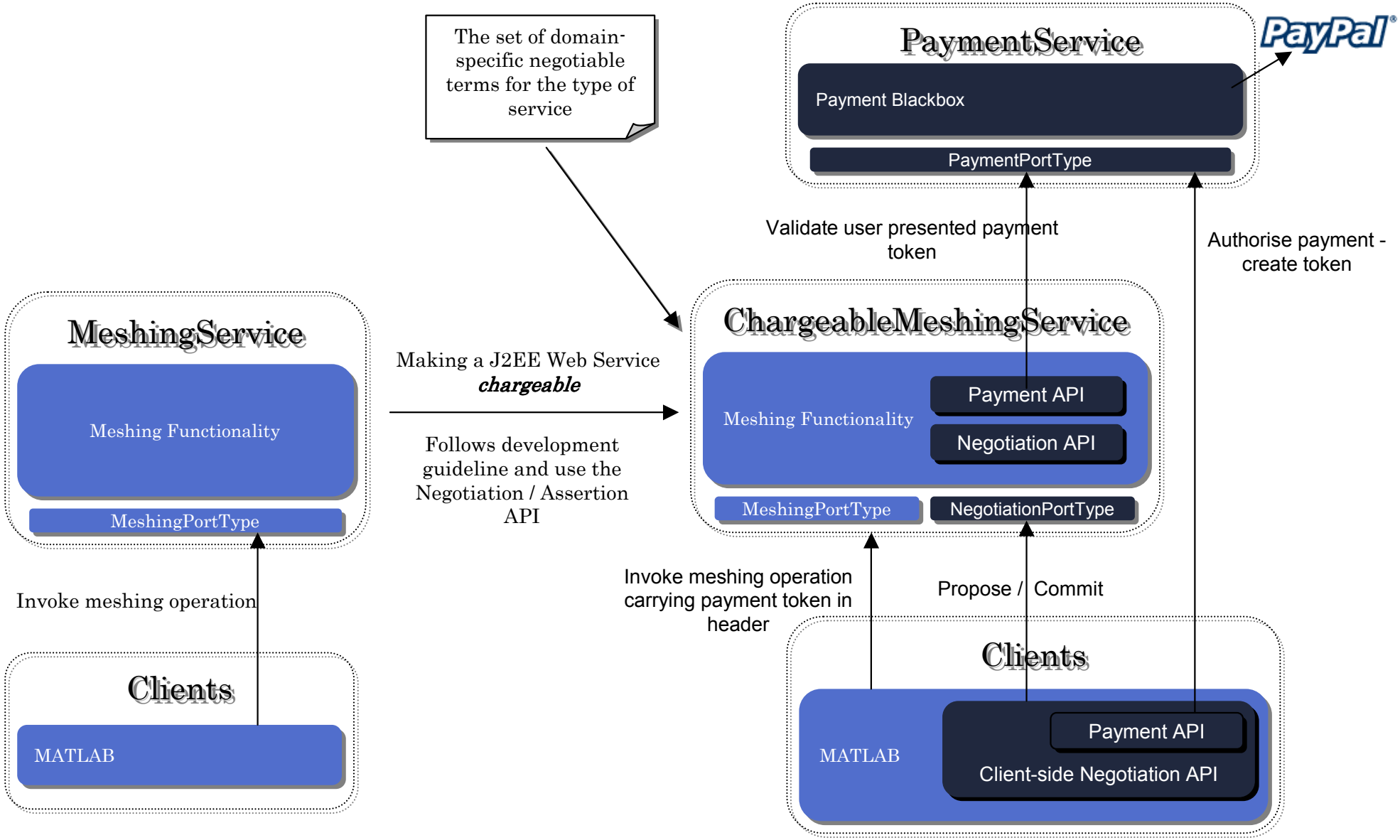
Challenges within a Service Market

- Payment
- Service advertisement / discovery
- Asymmetric information
  - Difficult for buyers to assess the value of a service so quality of goods is forced down – Akerlof's Lemons Hypothesis
- Software and hardware resource pricing

A Market for Computational Services

- JAX-RPC compliant Java J2EE Web Services
- Core services:
  - LeSC Grid Market Toolkit
    - Negotiation framework and API
    - Payment Web Service including PayPal integration and client-side payment API
  - Resource Usage Web Service
- Exemplars:
  - Pay-per-use service market computing
  - GEODISE design optimisation
  - Chargeable telescope brokering
  - Browser-based negotiation and payment portlet

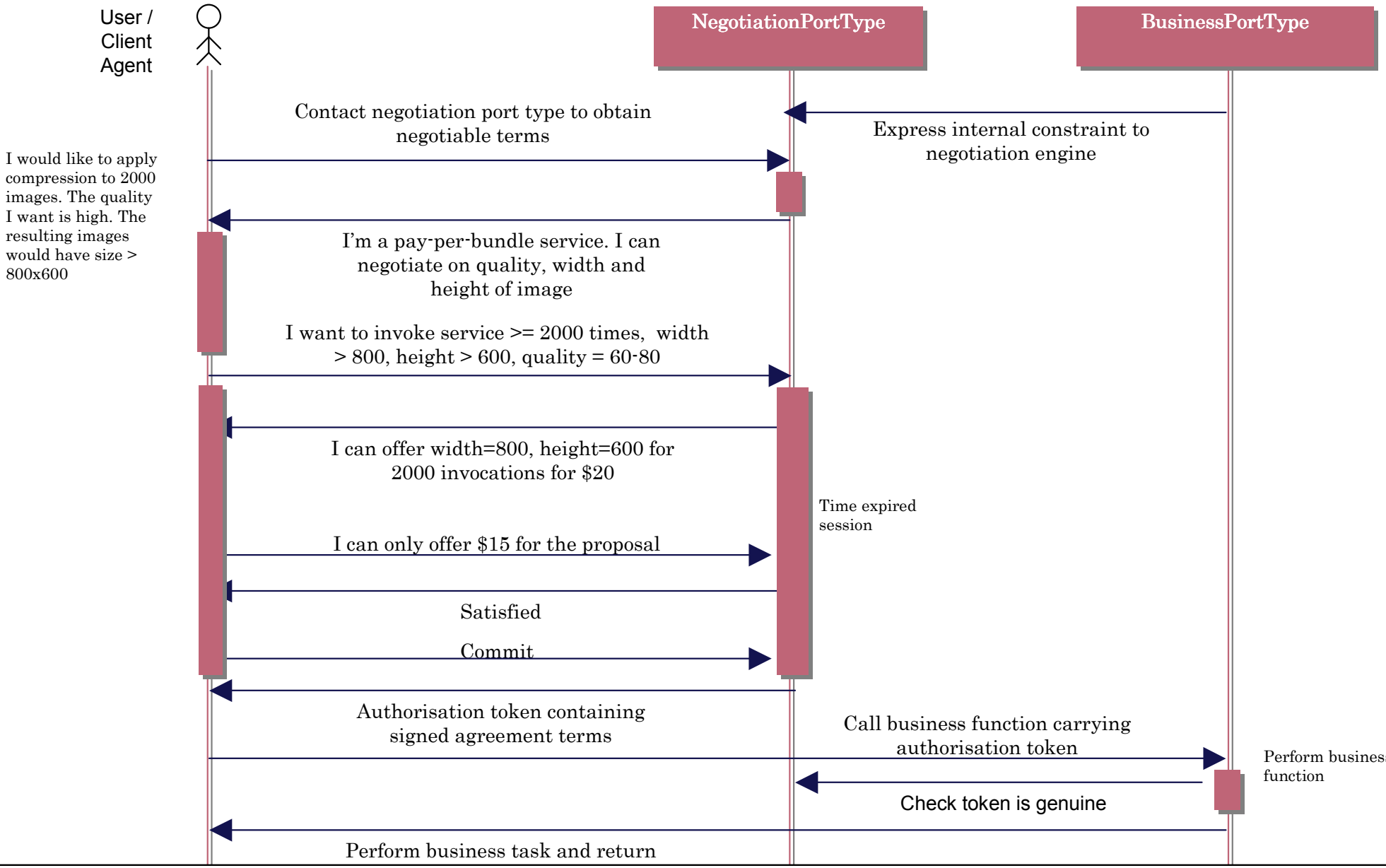
Enabling existing services for negotiation and payment



Negotiation

- Why negotiate?
  - Different services represent different value to different users
  - Process of agreeing on a price and the operating range of parameters
- What we have developed?
  - Protocol for representing a negotiation session and expressing requirements
  - NegotiationPortType to make an existing service negotiable

Negotiation



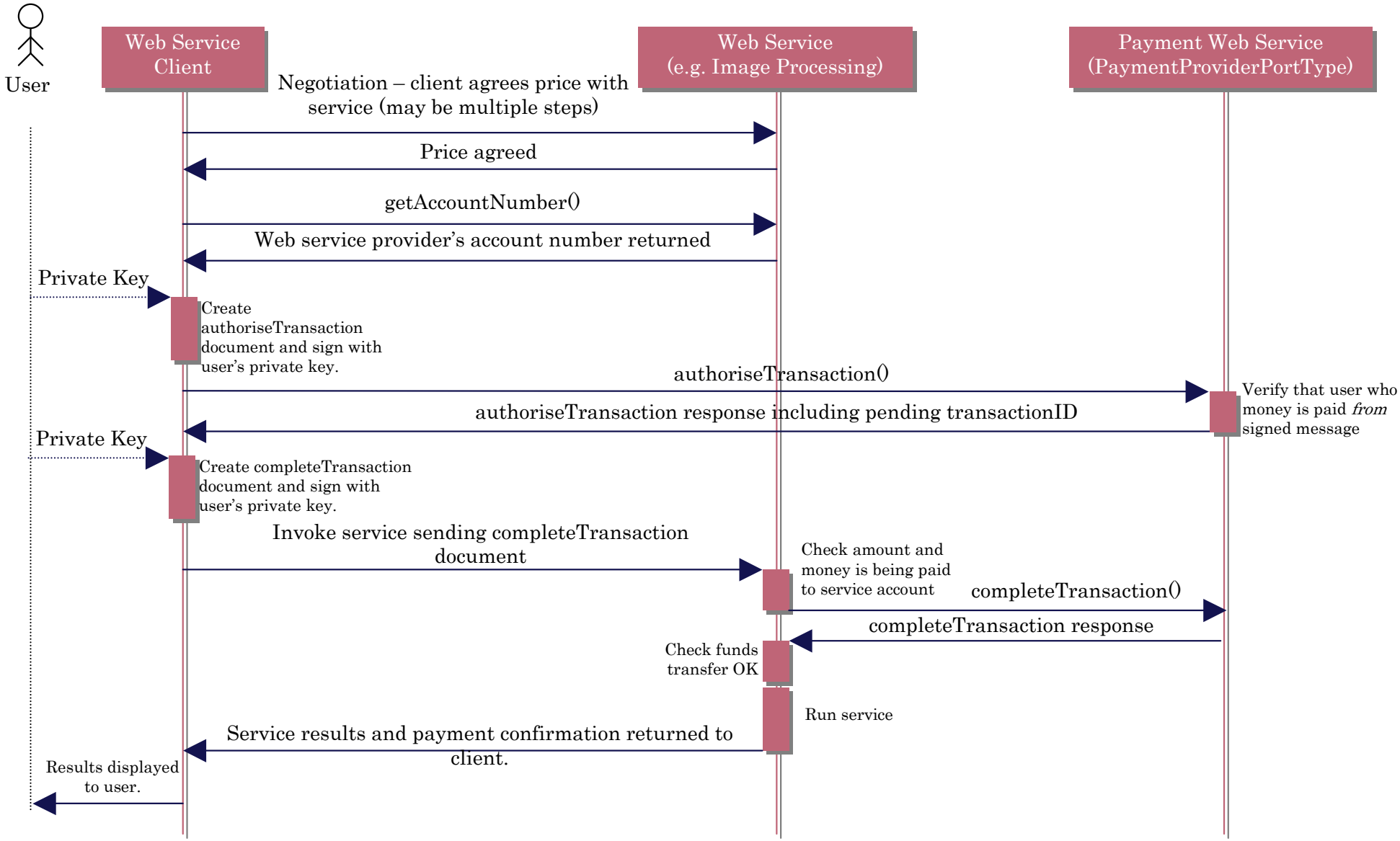
Payment Service

- Two-phase commit protocol for authorisation and payment
- Web service port for programmatic access to payment service
- Client-side library to enable new and existing services for charging
- Integrated with PayPal by Real Time Engineering using PayPal Web Services API

Payment Models

- Standard
  - Payment authorised for a given amount, token submitted to complete transaction for authorised amount.
- Variable Usage
  - Payment authorised for maximum amount, transaction completed for <= authorised amount. Token invalid after completion. Suited to purchase of execution time.
- Partial Payment
  - Allows a given amount of money to be transferred within a given time period.

Payment Service Operation



Web-based Payment Interface

- Browser interface for account registration and information
  - Mutual authentication using X.509 certificates
  - Deposit funds into accounts - potential for linking to existing payment services
  - Account statement providing transaction information including PayPal transaction ID

Exemplars

Pay-per-use Software and Execution Markets

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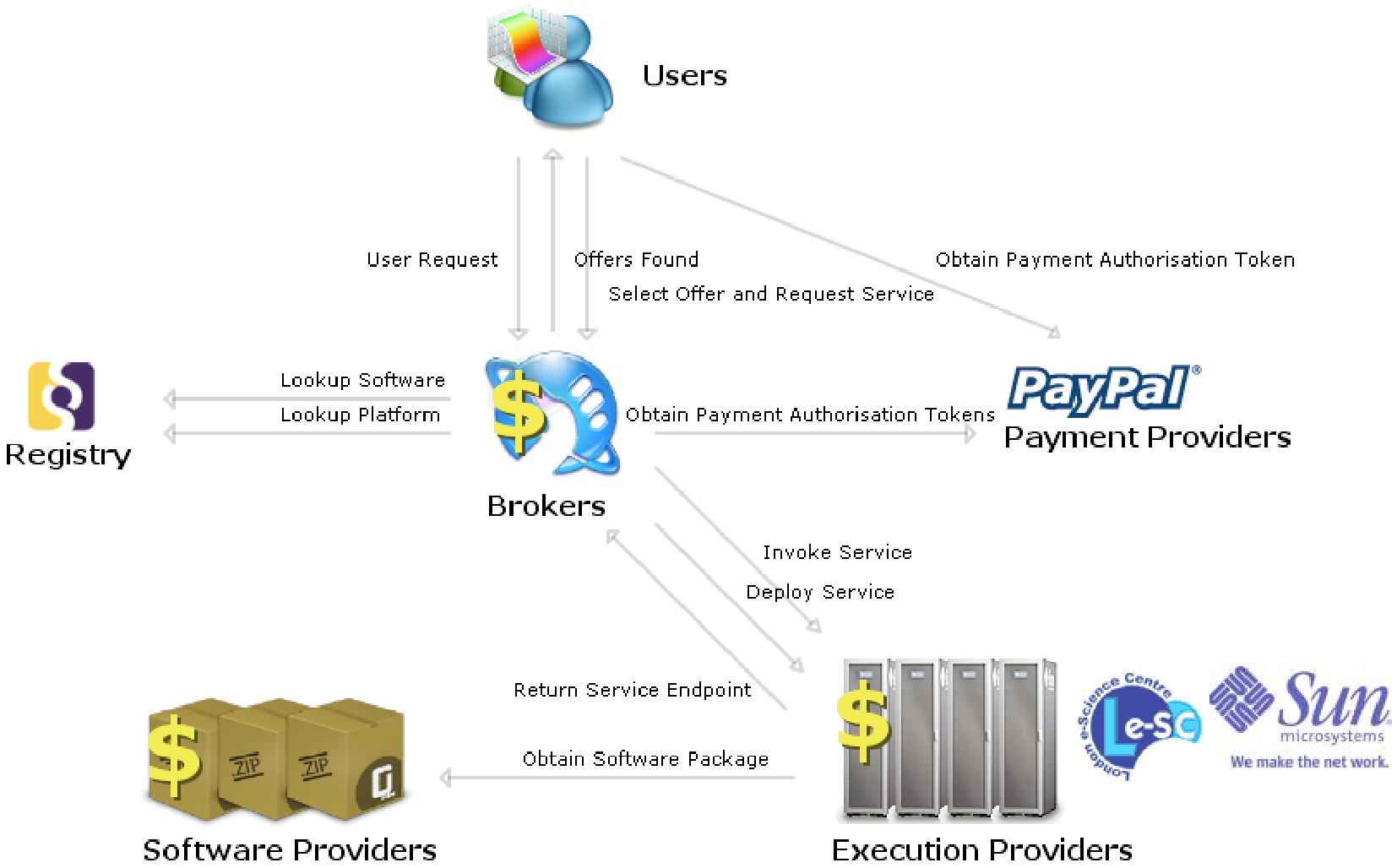

Utilising Sun Grid resources (www.sun.com/service/sungrid)

GEODISE Design Optimisation

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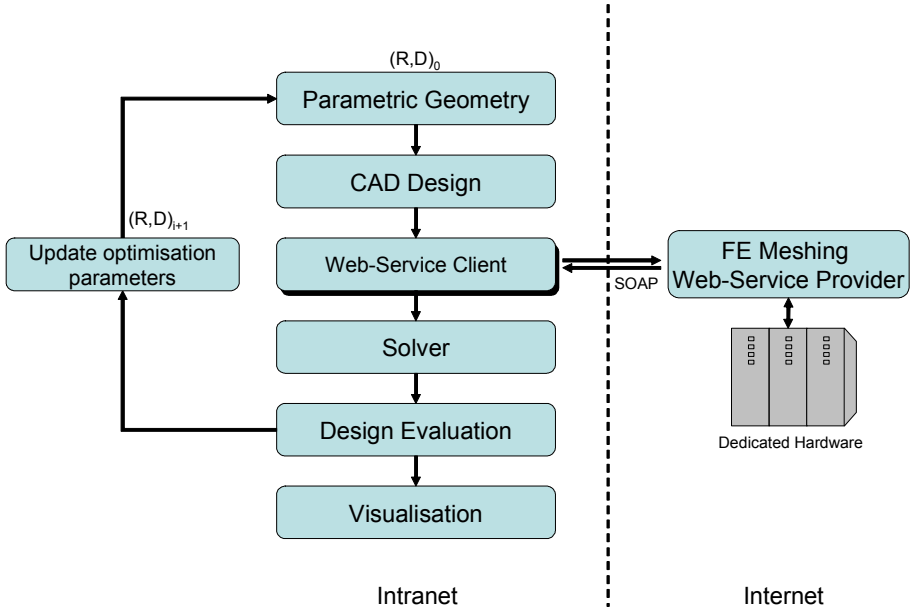
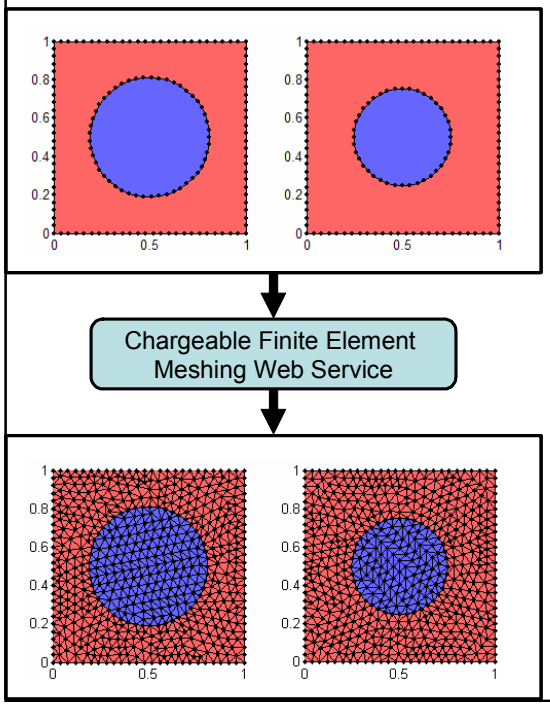
- Integration of specialist finite element meshing Web Service, provided through Southampton and Swansea Universities, with payment and negotiation framework

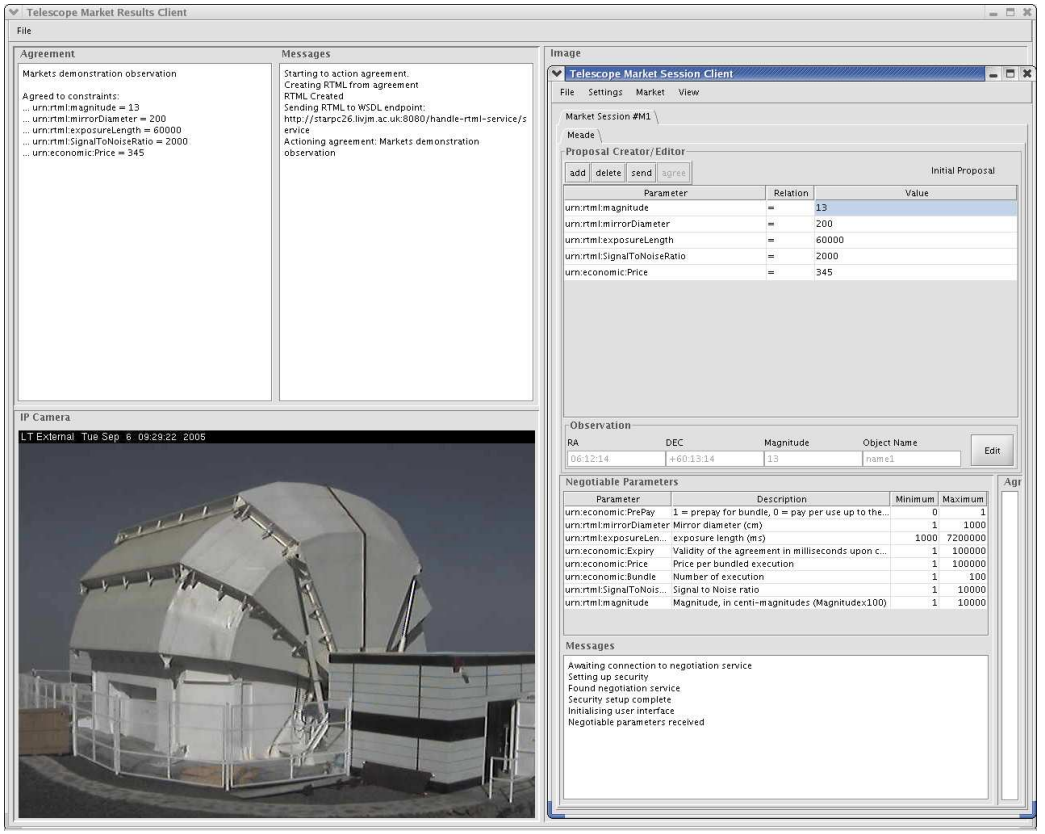




- Engineer negotiates with service via a MATLAB interface. An input file defining polygons is sent to the meshing Web Service which returns a data file containing the finite element mesh.
- Meshing service submits payment tokens to the payment service to obtain payment

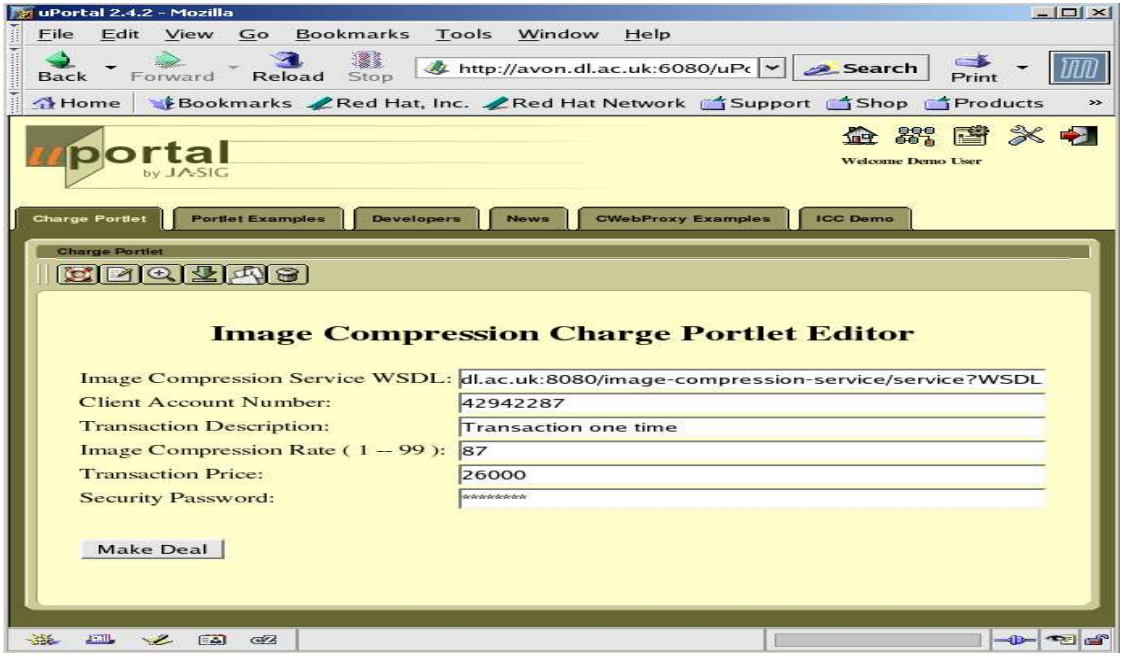
Chargeable Telescope Access

- Provide pay-per-use, service-based access to large-scale robotic telescopes
- Work undertaken by the Astrophysics Research Institute, Liverpool John Moores University
- Negotiable, chargeable Web Service linked to telescope control software.
- User enters observation requirements, negotiates with telescope and agrees access contract.
- Telescope carries out observation and charges user via PayPal enabled payment service



Portlet Interface for Negotiation and Payment

- A platform independent negotiation and payment interface based on the JSR 168 Portlet Specification.
- Work undertaken by Daresbury Laboratory.
- Users can make a proposal specification, negotiate and make a final agreement through an integrated browser-based interface.
- Framework developed against a sample Image Compression chargeable service but can be modified to support any service using the negotiation and charging tools developed within the project.



Thanks to

EPSRC / DTI Core Programme

Project Collaborators

Come to the London e-Science Centre stand for a demo!