GRID ECONOMICS

Group:
Nguyễn Thị Ái Anh -10070470
Nguyễn Kim Ngân -11070460

LOGO

Contents

LOGO

GRID ECONOMICS

- **Economic**: production, distribution, consumption and transfer of wealth. (*OXFORD dictionary*)
- The **Grid**, as we use it in this seminar, is a system of interconnected, virtualized computing resources. Those computing resources can be located in a few data centers around the world or can be highly distributed.

LOGO

GRID ECONOMICS

- Advantages of Economic in Grid:

☞ reduce cost

+ combine processing power of geographically distributed servers

☞ reduce time-to-market of products

☞ reduce staffs

LOGO

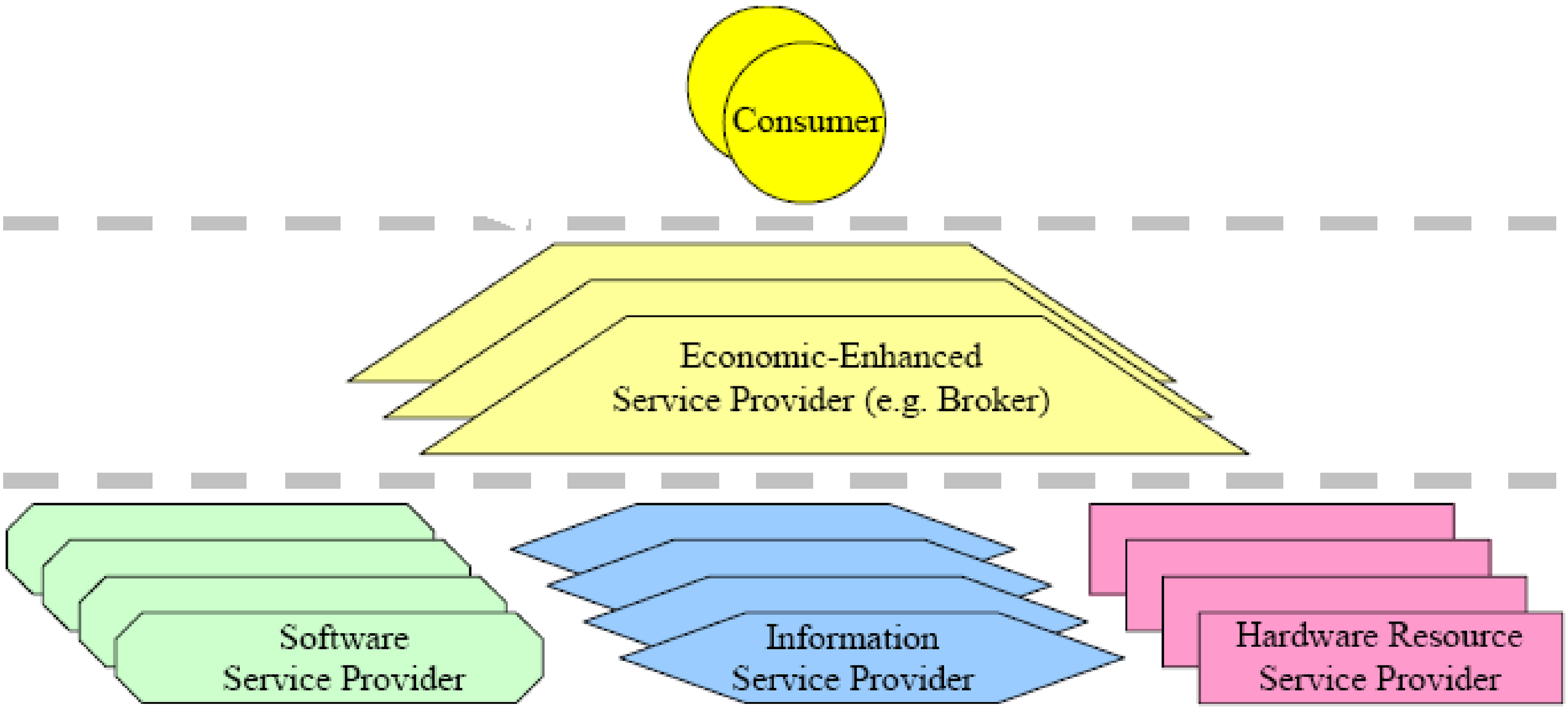
GRID ECONOMICS

- Economic Objectives for Adopting the Grid:

- Optimization of Processing Power in a Single Organization
- Sharing of Complementary Resources in Multi-provider Environments
- Offering Utility Computing Services

LOGO

ARCHITECTURE



LOGO

ARCHITECTURE

1. Consumer
2. The Economic-Enhanced Service Provider will provide tools to help the participants evaluate the risk of relying on outside-company resources, lack of trust, risk in commitment to resource purchases.
3. *Grid Service Providers* (GSP)
4. *Grid Trading Server* (GTS)
5. *Grid Resource Brokers* (GRBs) representing *consumers*

LOGO

ARCHITECTURE

* **Characteristics**:

+ any market participant could act as a resource provider or resource seller.

+ allow several providers and consumers to be interconnected and to trade services

LOGO

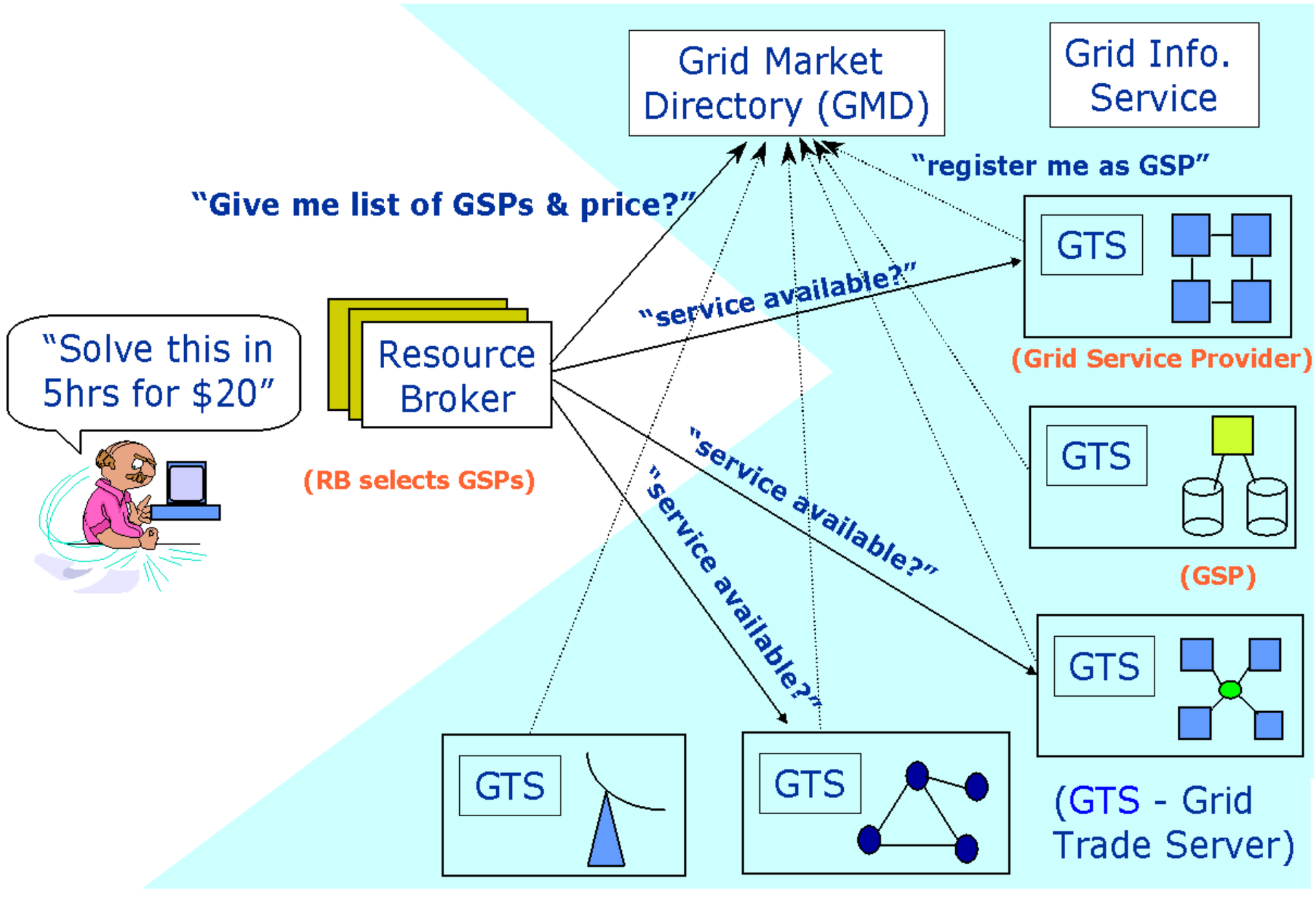
ECONOMIC MODELS IN GRID

- ☞ Commodity Market Model
- ☞Posted Price Models
- ☞ Bargaining Model
- ☞ Tendering/Contract-Net Model
- ☞ Auction Model
- ☞Bid-based Proportional Resource Sharing Model
- ☞Community Model
- ☞Monopoly Model

LOGO

ECONOMIC MODELS IN GRID

1. Commodity Market Model



LOGO

ECONOMIC MODELS IN GRID

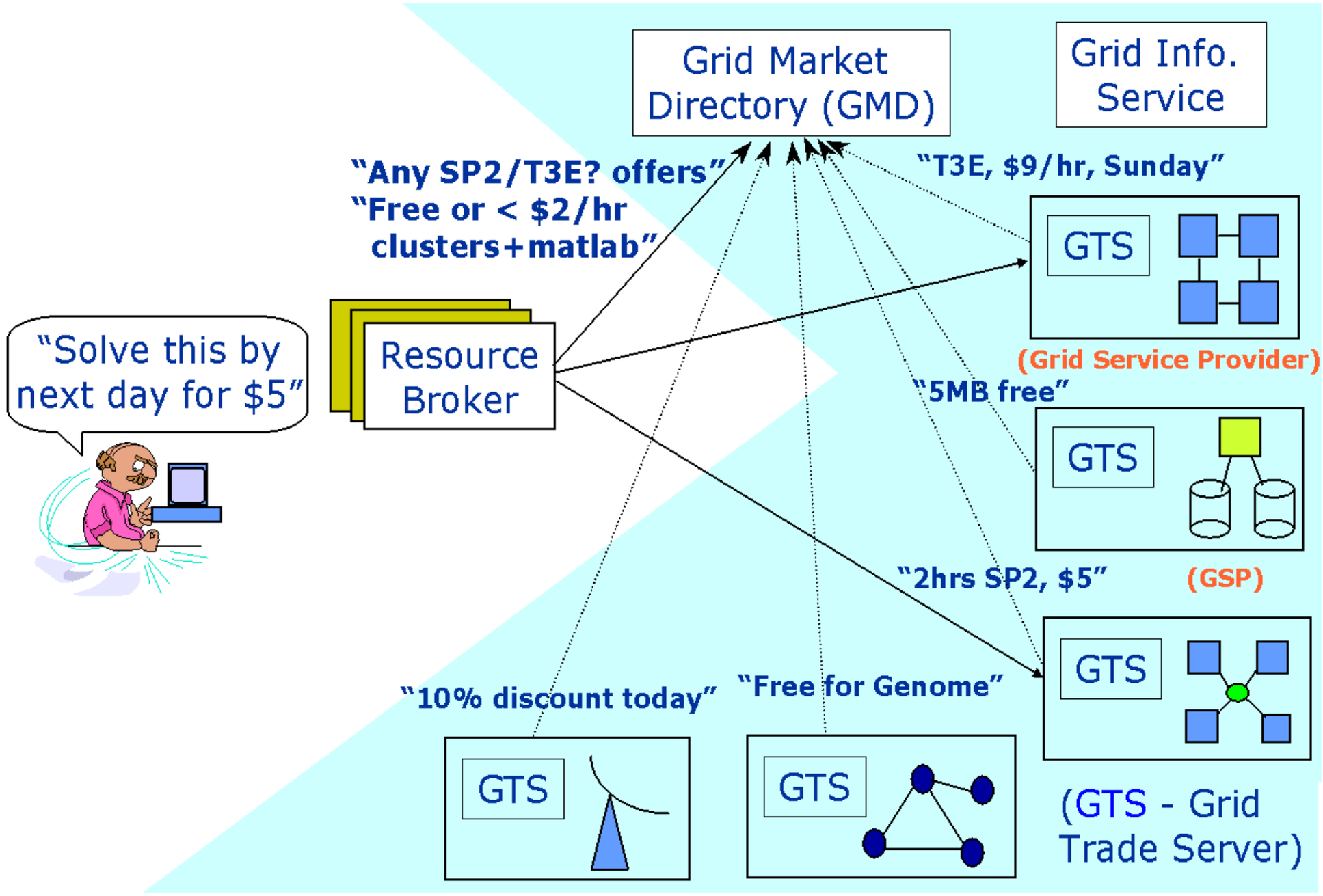
- Resource owners specify their service price and charge users according the amount of resource they consume.
- The resource broker can carry out the following steps for executing applications:

a. The broker identifies resource providers
b. It identifies suitable resources and establishes their prices (GMD and GTS)
c. It selects resources that meet objectives (lower cost and meet deadline equirements). It uses heuristic techniques while selecting resources and mapping jobs to resources.
d. It uses them and pays them as agreed.

LOGO

ECONOMIC MODELS IN GRID

2. Posted Price Model



LOGO

ECONOMIC MODELS IN GRID

- The posted price model is similar to the commodity market model, except that it advertises special offers in order to attract (new) consumers to establish market share or motivate users to consider using cheaper slots.
- The activities :

a. Resource/Grid Service Providers (GSPs) posts their service offers and conditions etc. in Grid Market Directory.

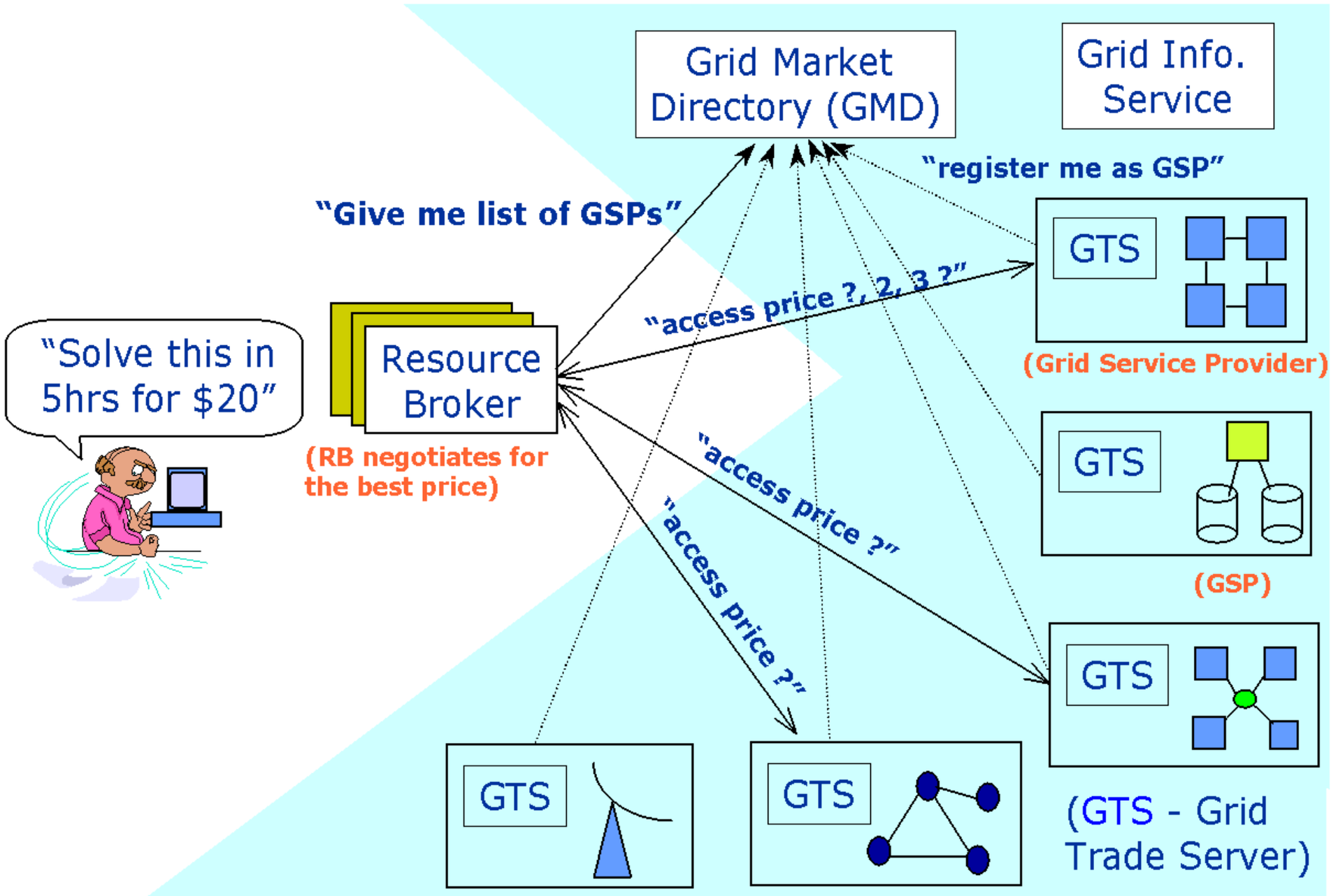
b. Broker looks at GMD to identify if any of these posted services are available and fits its requirements

c. Broker enquires (GSP) for availability of posted services.

LOGO

ECONOMIC MODELS IN GRID

3. Bargaining Model



LOGO

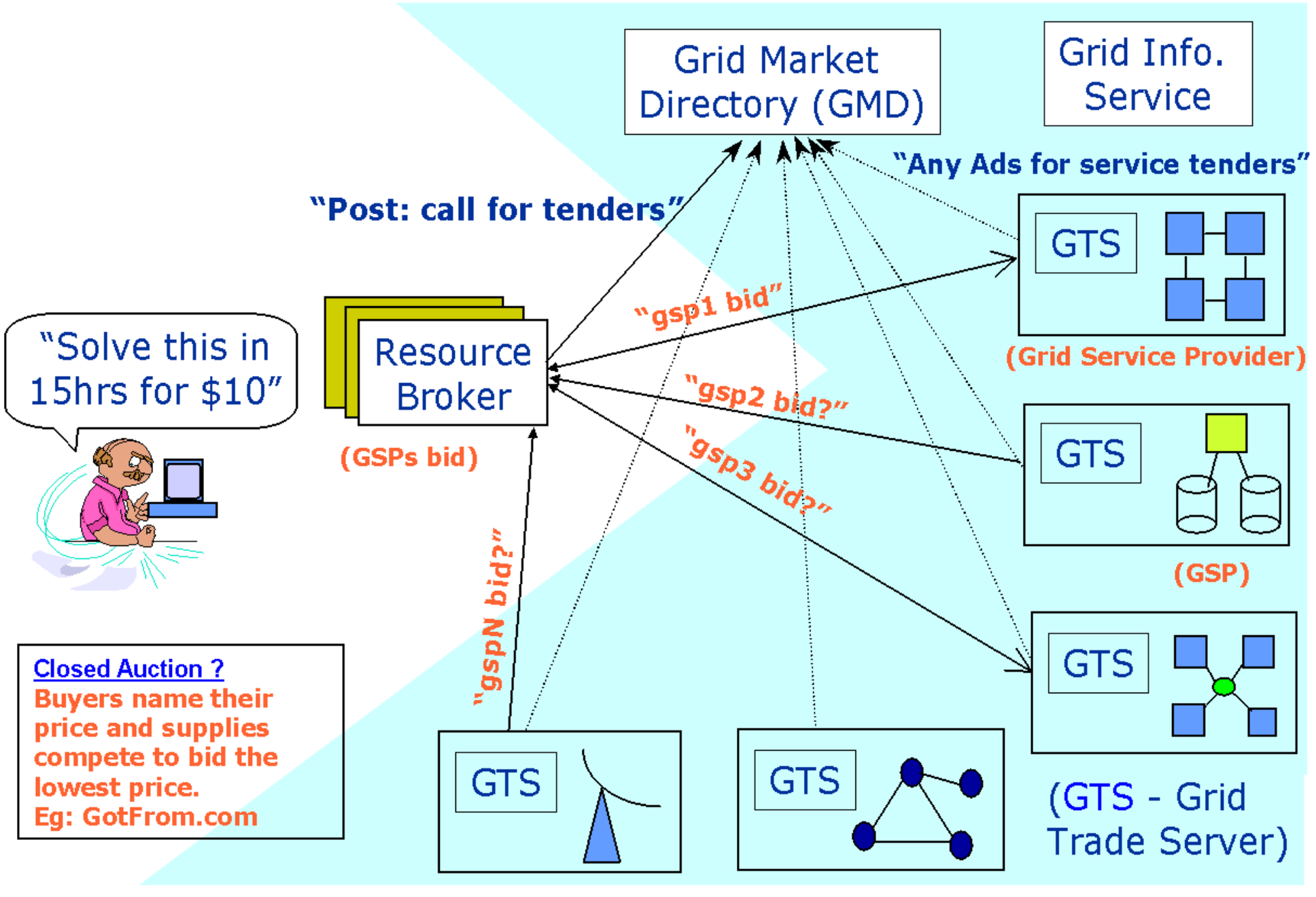
ECONOMIC MODELS IN GRID

- Resource brokers bargain with GSPs for lower access price and higher usage duration. Both brokers and GSPs have their own objective functions and they negotiate with each other as long as their objectives are met.
- The brokers might start with a very low price and GSPs with a higher price. They both negotiate until they reach a mutually agreeable price or one of them is not willing to negotiate any further.

LOGO

ECONOMIC MODELS IN GRID

4. Tender/Contract-Net Model



LOGO

ECONOMIC MODELS IN GRID

- Tender/Contract-Net model is one of the most widely used models for service negotiation in a distributed problem-solving environment.
- It is modeled on the contracting mechanism used by businesses to govern the exchange of goods and services. It helps in finding an appropriate service provider to work on a given task.-

LOGO

ECONOMIC MODELS IN GRID

A manager's perspective:

1. Consumer (Broker) announces its requirements and invites bids from GSPs.
2. Interested GSPs evaluate the announcement and respond by submitting their bids
3. Broker evaluates and awards the contract to the most appropriate GSP(s)
4. The broker and GSP communicate privately and use the resource

LOGO

ECONOMIC MODELS IN GRID

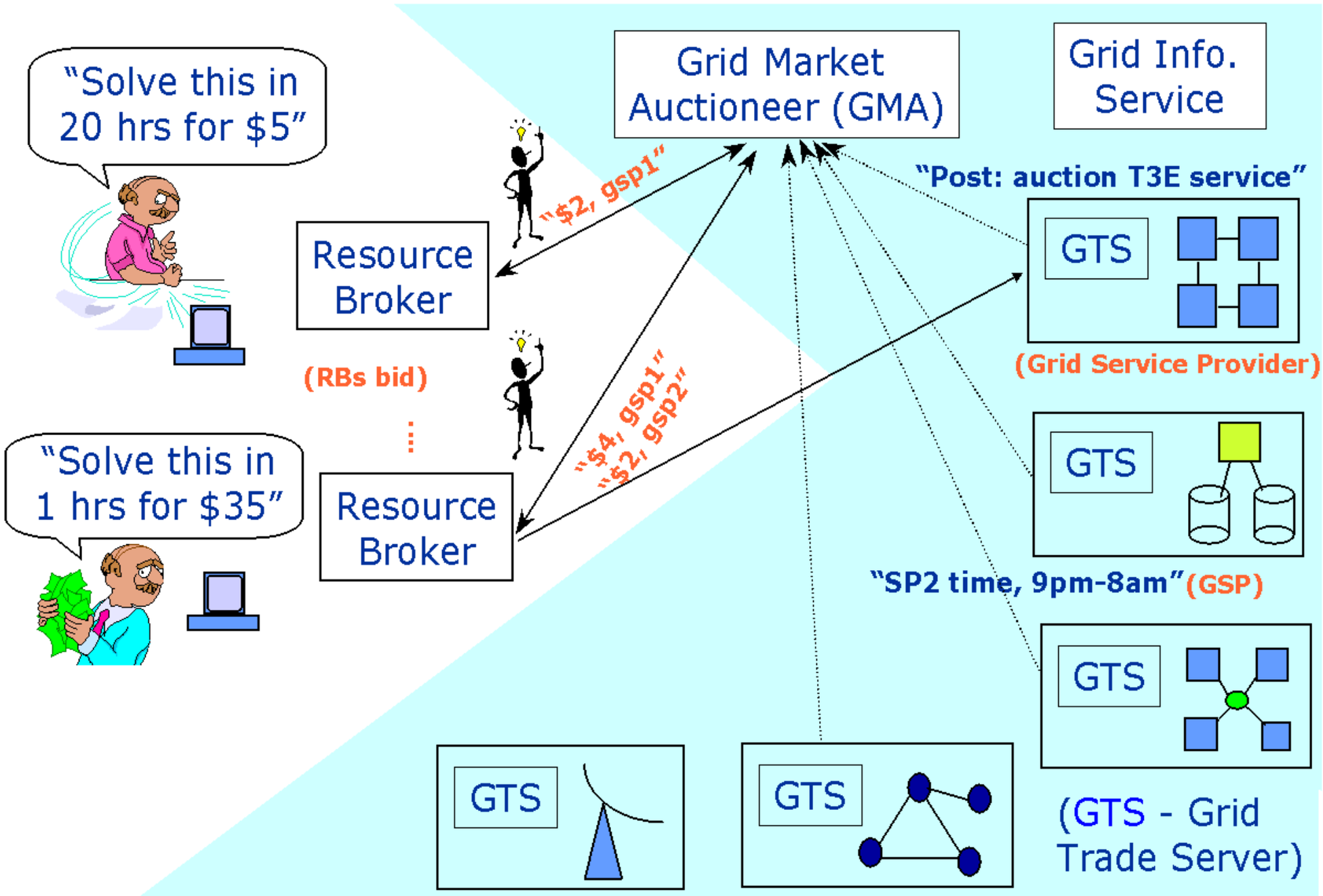
- A contractor's/GSP perspective:

1. Receive tender announcements/advertisements
2. Evaluate service capability
3. Respond with bid
4. Deliver service if bid is accepted
5. Report results and bill the broker/user as per the usage and agreed bid.

LOGO

ECONOMIC MODELS IN GRID

5. Auction Model



LOGO

ECONOMIC MODELS IN GRID

- The auction model supports one-to-many negotiation, between a service provider (seller) and many consumers (buyers), and reduces negotiation to a single value (i.e., price). The auctioneer sets the rules of auction, acceptable for the consumers and the providers. Auctions basically use market forces to negotiate a clearing price for the service.

LOGO

ECONOMIC MODELS IN GRID

-The steps involved in the auction process are:

a. GSPs announce their services and invite bids.

b. Brokers offer their bids (and they can see what other consumers offer if they like - depending on open/closed).

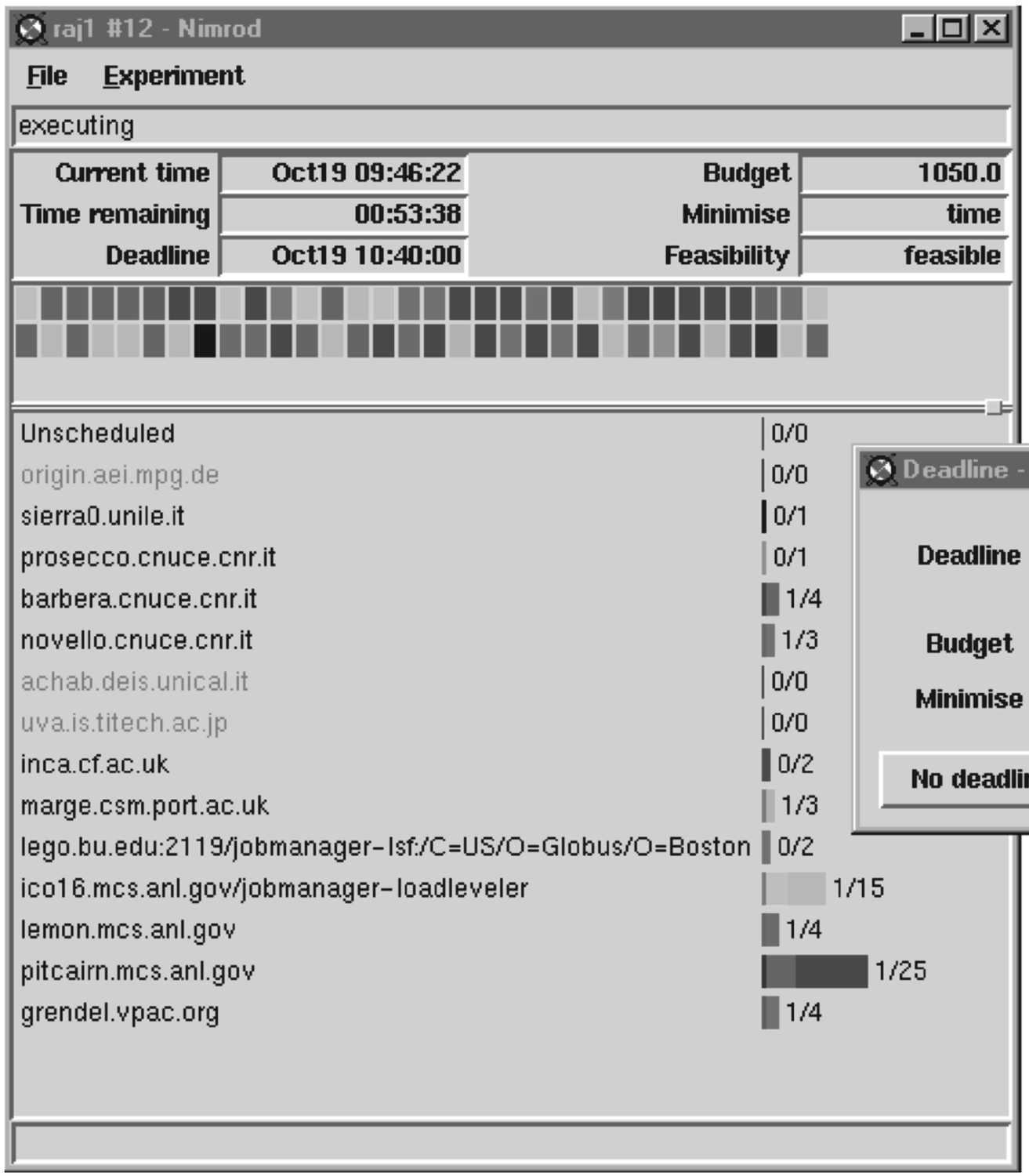
c. Step (b) goes on until no one is willing to bid higher price or auctioneer may stop if minimum price line is not reached or owner’s any other specific requirements are not meet.

d. GSP offers service to the one who wins

e. Consumer uses the resource

LOGO

EXAMPLE



LOGO

EXAMPLE

- Nimrod-G is an Architecture for a Resource Management and Scheduling System in a Global Computational Grid.
- Using the Globus middleware services for dynamic resource discovery and dispatching jobs over computational grids.

System Architecture:

- Client or User Station
- Parametric Engine
- Scheduler
- Dispatcher
- Job-Wrappe

LOGO

EXAMPLE

-The parameters of the scheduling system to be considered include:

- Resource Architecture and Configuration
- Resource Capability (clock speed, memory size)
- Resource State (such as CPU load, memory available, disk storage free)
- Resource Requirements of an Application
- Access Speed (such as disk access speed)

…

LOGO

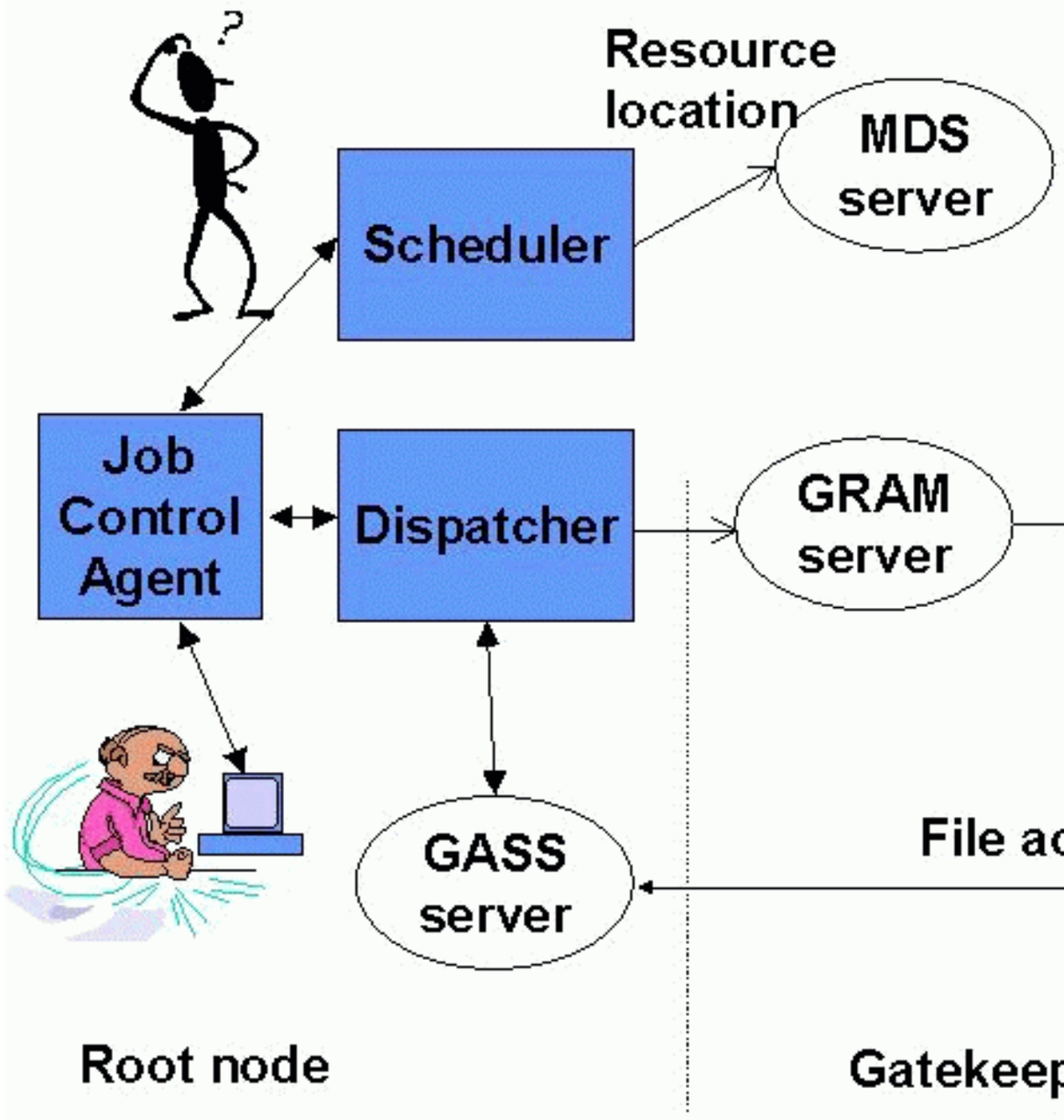
EXAMPLE

-The important parameters:

- Resource Cost (set by its owner)
- Price (that the user is willing to pay)
- Deadline (the period by which an application execution need to completed)

LOGO

EXAMPLE



Additional services used implicitly:
- GSI (authentication & authorization)
- Nexus (communication)

Resource allocation

LOGO

CONCLUSION

- In future, an open market (together with its trading system) is an essential part, where a huge variety of electronic services are traded.
- Based on these markets, sustainable Grid business models could be created. These new business models would allow participants in the Grid economy to buy services and sell enhanced services at the same time.

1. **Weighted cloud costing**

- Inderected method to dividing up the cloud service costs.
- Dividing up the cloud service costs based on the weighted percentage.
- Esiest but least accurate way.

2. **Tiered cloud costing**

Each tier requires greater resources than the tier below it.

CLOUD COMPUTING COST MODEL

3. Costing that differentiates service and infrastructure.

- Separate your infrastructure costs from your application costs.

4. Consumption cloud costing

- The most accurate costing method
- pay – per – use model

LOGO

CLOUD COMPUTING COST MODEL

New Amazon EC2 Reserved Instances Pricing as of August, 2009

Three Year Term			
Instance Type	**Instance Price**	**Hourly Charge**	**Effective Hourly Rate***
m1.xlarge	$2800.00	$0.24	$0.347
m1.large	$1400.00	$0.12	$0.174
m1.small	$350.00	$0.03	$0.043
c1.xlarge	$2800.00	$0.24	$0.347
c1.medium	$700.00	$0.06	$0.087

On-demand

new cost floor

One Year Term			
Instance Type	**Instance Price**	**Hourly Charge**	**Effective Hourly Rate***
m1.xlarge	$1820.00	$0.24	$0.448
m1.large	$910.00	$0.12	$0.224
m1.small	$227.50	$0.03	$0.056
c1.xlarge	$1820.00	$0.24	$0.448
c1.medium	$455.00	$0.06	$0.112

Source: http://aws.typepad.com

From http://ebizq.net/blogs/enterprise

CLOUD COMPUTING COST MODEL

Pay only for what you use!!!

Note that Amazon's EC2 regular pricing for on-demand instances remains at $0.10/hour for Unix/Linux and $0.125 for Windows instances.

LOGO

CLOUD COMPUTING COST MODEL

Microsoft Azure Cloud Computing Price Model as of Mid-2009

on-demand cost

Windows Azure:
- Compute @ $0.12 / instance hour
- Storage @ $0.15 / GB / month stored
- Storage Transactions @ $0.01 / 10K

SQL Azure:
- Web Edition – Up to 1 GB relational database @ $9.99
- Business Edition – Up to 10 GB relational database @ $99.99

.NET Services:
- Messages @ $0.15/100K message operations , including Service Bus messages and Access Control tokens

Source: http://blogs.msdn.com/windowsazure

From http://ebizq.net/blogs/enterprise

LOGO

CLOUD COMPUTING COST MODEL

Google App Engine Pricing Model as of August, 2009

Billable Quota Unit Cost

The cost for computing resources is as follows:

Resource	Unit	Unit cost
Outgoing Bandwidth	gigabytes	$0.12
Incoming Bandwidth	gigabytes	$0.10
CPU Time	CPU hours	$0.10
Stored Data	gigabytes per month	$0.15
Recipients Emailed	recipients	$0.0001

on-demand cost

Source: http://code.google.com/appengine/docs/billing.html

From http://ebizq.net/blogs/enterprise

LOGO

REFERENCES

•[1] Jörn Altmann, Costas Courcoubetis, John Darlington, Jeremy Cohen, *GridEcon –The Economic-Enhanced Next-Generation Internet*, GECON 2007, Workshop on Grid Economics and Business Models, Springer LNCS, Rennes, France, August 2007.

•[2] Rajkumar Buyya, David Abramson, Jonathan Giddy, and Heinz Stockinger, *Economic Models for Resource Management and Scheduling in Grid Computing*, Journal of Concurrency: Practice and Experience, Grid computing special issue 14/13-15, 2002, pp 1507 –1542.

•[3] Rajkumar Buyya, David Abramson, and Jonathan Giddy, *Nimrod/G: An Architecture for a Resource Management and Scheduling System in a Global Computational Grid*, Proceedings of the 4th International Conference and Exhibition on High Performance Computing in Asia-Pacific Region (HPC ASIA 2000), May 14-17, 2000, Beijing, China, IEEE CS Press, USA, 2000.

•[4] Chris Kenyon, *Grid Economics -Grid Value and Practical Realization*, Slide of Zurich Research Lab.

•[5]URL: http://cloudcomputing.sys-con.com/node/2225618