The D-Grid Billing Framework

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Agenda

• What is Billing?
• Motivation of Billing in D-Grid
• Results of the requirements analysis
• Concept for a Billing-Framework in D-Grid
• Open questions
• Conclusion
What does Billing mean?

Basically:
• Limiting access to resources and services to those who have enough credits (or money) to „pay“ for the resources or services
• Users of resources and services take a share of the costs of the resources and services they are using
• Resource and service providers charge the costs for their resources and services

Questions to be solved:
• Which and how many „currencies“ are used for charging these costs?
• Who keeps accounts for the „money“ (or equivalent) and how?
• How does this work together with other services, providers, users, etc.?
• What additional services are necessary in this context?

What does it not include? (which is still necessary…)
• **Accounting**: determining who used what for how long
• **Pricing**: determining resource and service prices / price equivalents
• **Service-Level Agreements (SLA)**: determining the conditions under which a contract on resource or service usage is made
Motivation

• Why Billing in D-Grid?
  – allows control of resource usage by regulating access to resources via distribution of Grid Credits or (real) money
  – commercial users from industry shall share the cost of D-Grid infrastructure and services
  – D-Grid users shall eventually also share the cost of commercial resources and services attached to D-Grid (e.g. valuable data, software licences, etc.)

⇒ so we need Billing in D-Grid
⇒ and therefore also
  ⇒ Accounting
  ⇒ Pricing
  ⇒ SLA Management
Results of the Requirements Analysis

Resource provision currently
- only within community (except special invest resources)
- no compensation for resource providers

Readiness for resource sharing with users / providers from other communities
- generally very low
- expectation of compensation => need for billing

Main obstacles on the way to resource sharing
- legal issues (mainly data protection laws)

D-Grid currency preferences
- 2 communities say the need real money
- majority: virtual D-Grid currency

Pricing
- common sense: no central regulation
- apart from that: total diversity of opinions
Results of the Requirements Analysis

Banking service
- mostly controversial
- majority prefers decentralized banking service

Grid-Infrastructure
- GT4, Unicore 5, gLite (each at all special invest sites)
  => support for all three required
  => Grid service approach necessary

Accounting/Billing Infrastructure Components
- SGAS, APEL, GRASP, gLite Resource Broker, proprietary custom tools in computing centers
  => maximum diversity!
  => Grid service approach necessary

Resource Usage Records
- unclear how they will be produced and in what format(s)
- Proposed solution (End 2006): OGF-RUR

Security Infrastructure
- PKI-based A&A
- GridShib-based A&A
Roadmap:

- we need to agree on the cornerstones of a service infrastructure for accounting and billing
  - what will be billed?
  - what types of components/services/daemons will be involved?
  - what is optional and what is required?
  - who makes the pricing?
  - what „currencies“ will be supported?

- then the interfaces shall be defined in detail
  - which data/data types are exchanged between the different components/services/daemons?
  - what protocols will be supported?

- development/implementation
  - every player is free to use the system he likes as long as it provides the interfaces defined for D-Grid
  - one reference implementation should be provided
Concept for a D-Grid Billing Framework

Users → Resource Broker → Monitoring-Daemon for gathering information on hardware workload → Hardware (CE, SE, etc.) → Input

Resource request → SLAs → Selection → Valuable resources: applications → Data → local ERP system

Subscription of price information → Grid-Clearingcenter → Release for payment → Advice of settlement, blocking of accounts, etc...

Res. Info / SLAs / Selection → Resource Broker → Monitoring-Daemon for gathering information on hardware workload

Job status / issuing of invoices → Grid-Clearingcenter → Account Mgmt., advice of settlement, blocking of accounts, etc...

Connection to finance market → Grid-Clearingcenter

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Options

- One or more Clearing Centers:
  -> low complexity vs. high complexity
  -> recommendation: start with one

- Resource Broker or not:
  Virtualization vs. no virtualization
  (i.e. „to Grid or not to Grid“…)
  -> recommendation: start with (only) one

- Grid Workflow Management / Multisite-Job-Submission:
  someone has to control job submission and execution in multi-site Grid jobs! (also: complex single-site jobs…)
  -> recommendation: start with (only) one

- pricing daemon vs. price database:
  flexibility vs. easy solution
  -> recommendation: start simple, use a database

⇒ keep it simple as long as you can!
⇒ raise complexity afterwards
Data in the Billing Process

Security relevant data

• Accounting data:
  – should never leave the resource or service provider, except for user invoice („directly“ to the user)
  – should be used to define prices locally

• Monitoring data:
  – might be interesting for competitors in order to find out about product development status (indicated by huge jobs / large data…)

• „Bank“ account information:
  – should never leave the Clearing Center, except for
    • user-self-info
    • Resource Broker needs to know account ID for advice of settlement and blocking of accounts

Not security relevant data:

• Resource / service price information:
  – should be publically available
Open Questions I

- issuing an invoice (for real money)
  - requires a legal person
  - computing centers are not legal persons
- efficient utilization of resources
  - free price regulation by providers necessary if no guarantees for resource consumption are given
  - overbooking of resources necessary
  - legality of such measures unclear
- multi currency system
  - strict separation of currencies necessary
  - consequences for interoperability between funded resources and commercial ones
- pricing requirements for funded resources / virtual currencies
  - control body and rules for distribution of usage budgets necessary
  - resources need to be comparable
- leading edge problem
  - in a real market no risks will be taken
    => no investments in leading edge technology
Open Question II

- **liability issues**
  - breakdown / blackout of resources:
    who takes the risk?
    => provider vs. user vs. insurance

- **providing funded resources to commercial users**
  - commercial users should pay for funded resources
  - who gets the money then?
  - is this kind of competition lawful or is it hidden subsidy

- **providing commercial resources to funded users**
  - currently not probable as unattractive to commercial providers
  - but in case: how do funded users get the money for consuming commercial resources

- **pricing model(s)**
  - micropayment (providers favourite)
  - fixed prices
  - flat rates
  - ...
Conclusions

- Billing is necessary in terms of
  - controlling resource usage
  - interacting with industry
- Cornerstones of billing infrastructure are clear
- Necessary next steps:
  - agreement on cornerstones
  - agreement on interfaces between components of a billing infrastructure
  - massive requirement for development / implementation of software / service components