BalticGrid Project

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Implementation of User Level SLA for gLite Using Tycoon

Tycoon and gLite Integration

Amir H. Payberah
payberah@kth.se
Kungliga Tekniska Högskolan

Outline

- Introduction
- System Description
- Installation

Introduction

- Purpose of the BalticGrid JRA1 task:
  - User-level service level agreement.
  - The possibility for users to acquire more (or less) resources in a well defined manner.

Motivation

- To avoid disturbing the users of the BalticGrid unnecessarily.
- Providing a heterogeneous gLite system.
  - Some nodes can run the unmodified gLite software, and other nodes can run on Tycoon.

Motivation

- Tycoon as a market-based utility computing infrastructure.

- Creates and manages a SLA-capable environment, hosting unmodified gLite.

Market-Based Resource Allocation

- Makes efficient use of resources.
- Allocates more resources to more important tasks.
  - Tasks are funded according to importance.
- Service level of tasks is determined by its level of fundings.

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Tycoon

Tycoon

- Market-based system

- Managing resources in distributed clusters.

Service Model Abstraction

- Provides users to specify resource demand.
- The resources are allocated to the users who value them most.
- Provides a mechanism to encourage users to truthfully reveal those values.
  - Users use a limited budget of credit to bid for resources.

Service Model Abstraction

- The user submits this bid (h, r, b, t) to the auctioneer on host h.
- The auctioneer: b/t for each bid i and resource r.
- Auctioneer allocates its resources in proportion to the bids.

Architecture

- Agent
- Auctioneer
- Service Location Service (SLS)
- Bank

Agent

- Client programs help users set up and manage accounts and also find and manage resources.

Auctioneer

- Management of local resources
- Collection of bids from users
- Allocation of resources to users
- Advertising of the availability of local resources

Auctioneer

- Users use their agent to contact auctioneers to query the availability and current prices of resources, bid on resources, etc.
- The auctioneer uses Xen for virtualization.

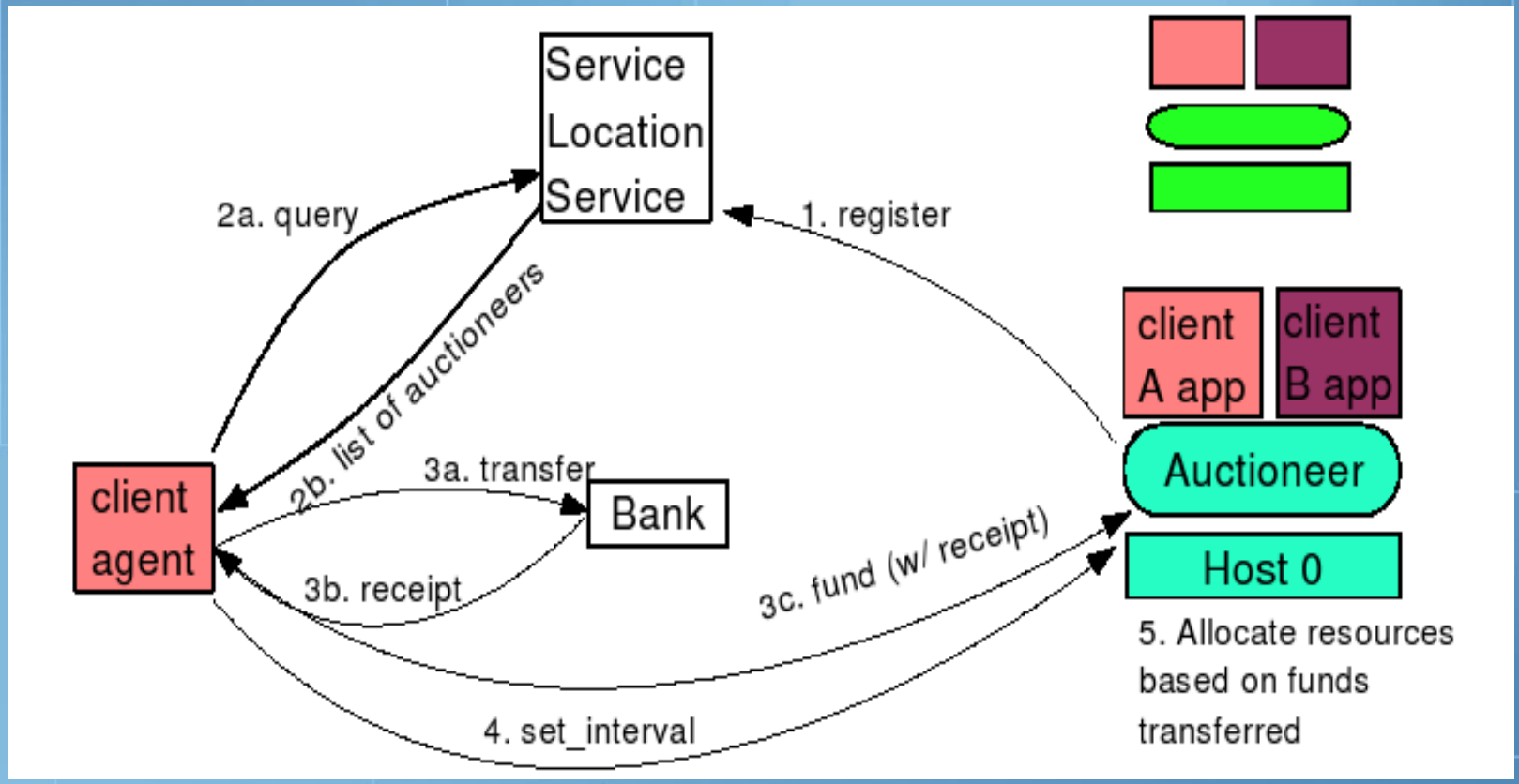
Service Location Service

- Keeps track of which auctioneers are up and what their status is.
- An Internet-wide SLS:
  - tycoon-sls.hpl.hp.com

Bank

- Keeps track of the amount of currency that different users have in their bank accounts.
- An Internet-wide bank:
  - tycoon-bank.hpl.hp.com

How does it work?



Prototype User Interface

- Create an account on a host
  - tycoon create_account host0 10
- Run
  - tycoon_ssh amir@host0 my_program
- Transfer more credits into account
  - tycoon fund host0 cpu 10 1000
- Change bidding interval
  - tycoon set_interval host0 cpu 2000
- Determine current balance, resources allocated, etc.
  - tycoon get_status host0

Setting bids

- Two methods of changing bid:
  - fund
    - Transfers money from the user's bank account to the auctioneer's bank account.
    - High latency
  - set_interval
    - Sets the bidding interval at the auctioneer.
    - Low latency

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gLite

gLite

- The components of the gLite system can be divided into two categories:
  - Site level components
  - Grid level components

Site Level

- Job management system
  - Computing Element (CE)
    - Acts as interface to the Grid level
    - Delegating jobs to the WNs
  - Worker Node (WN)
    - Performs the actual work

- Data management system
  - Storing data
  - Map globally unique ID to local file names
- Information and monitoring service
  - Publishing information of the state of CEs or jobs

Grid Level

- Grid security
- Information services
  - Binding information publishers at the site level and information consumers.
- Data management systems
  - Keeps track of where particular files are stored.

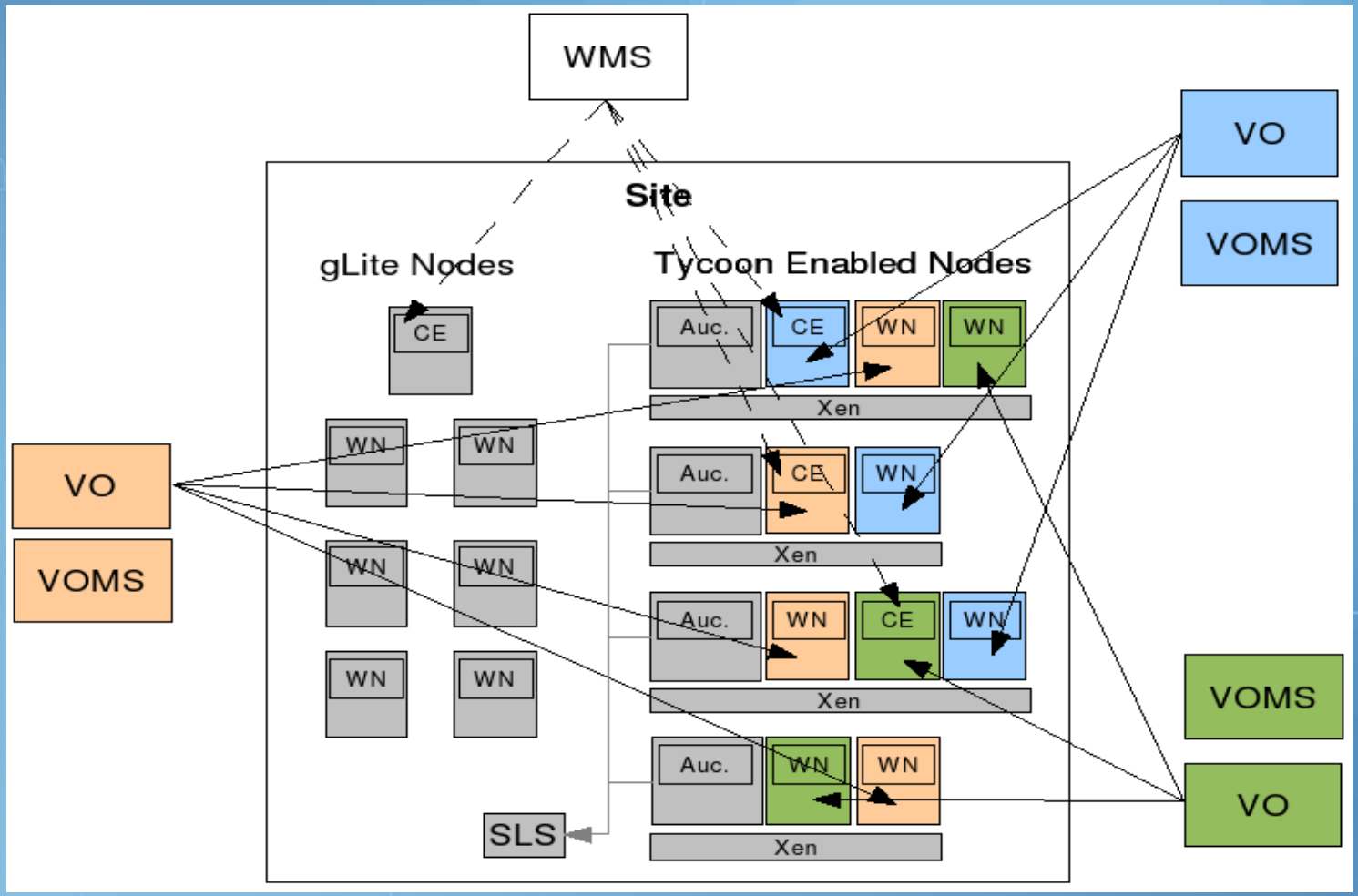
- Workload Management System (WMS)
  - Matching jobs with available CEs.

VOMS

- Repository for information of user authorization.
- Components such as CEs and WMSs, use a VOMS sever's SOAP interface to receive such information.

Tycoon-gLite Integration

Tycoon-gLite Integration



Tycoon-gLite Integration

- The gLite WMS is used for submitting jobs.
- Tycoon SLSs are used for discovering resources for creation of virtual clusters.
  - One SLS for each LAN
- VO managers can request the Auctioneers to create several VMs that together constitute a virtual gLite compute cluster.
  - One CE in each virtual cluster
  - An arbitrary number of WNs
- Only the member of the VO owning a virtual cluster are able to submit jobs to it.

Advantages

- “Easy” to implement
- Unmodified gLite
- Dynamic and secure system useful to trade resources
- Fully transparent for Grid users

Limitation

- Virtual clusters are created on VO level
- VO agent has no information on the priority of individual jobs
- All the nodes of a virtual cluster have to be in the same LAN (for easier communication between CE and WNs and between different WNs)

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System Platform

Platform

- Fedora Core filesystem
- Xen virtualization software
- Tycoon Auctioneer
- ScientificLinux filesystem images for use by the Tycoon-managed CEs and WNs

Installing Tycoon

Tycoon Client

- Install packages
  - yum -y -c http://tycoon.hpl.hp.com/~tycoon/dl/yum/tycoon.repo install tycoon_client
- Leave setup to use the standard SLS and Bank (recommended)
  - tycoon-sls.hpl.hp.com
  - tycoon-bank.hpl.hp.com
- Or install and configure our own SLS and Bank.
- Configure firewall
  - SLS: out TCP port (25955)
  - Bank: out TCP port (8899)
  - Auctioneer: out TCP port (24571)

Create Bank Account

- Generate a ssh public key and configure to log into Tycoon machines
  - $ ssh-keygen -t dsa
  - $ cat .ssh/id_dsa.pub >> .ssh/authorized_keys
  - $ chmod 600 .ssh/authorized_keys
- Setup a Tycoon configuration
  - $ tycoon user setup amir@kth.se amir ~/.ssh/id_dsa.pub
- Use online form and send your public key
  - http://tycoon.hpl.hp.com/wiki/TycoonAccountForm

Create Bank Account

- Verify Bank
  - $ tycoon bank get_balance
  - Account balance: 100
- Verify SLS
  - $ tycoon sls query_cost_efficiency CPU
  - IP Address GHz*Hour/Price GHz Price/Hour
  - 128.142.134.113 4.301e+13 3.600 8.371e-14
  - 128.142.134.111 4.271e+13 3.600 8.430e-14

Tycoon Auctioneer

- Install packages
  - yum -y -c http://tycoon.hpl.hp.com/~tycoon/dl/yum/tycoon.repo install tycoon_aucd_xen3
- Finish the installation
  - iptables -A INPUT -s \! 127.0.0.1 -p tcp --dport 8001:8002 -j REJECT
  - iptables -A INPUT -s \! 127.0.0.1 -p tcp --dport 9601:9699 -j REJECT
  - service iptables save
  - echo 1 > /proc/sys/net/ipv4/ip_forward
- Reboot with new Xen Kernel
- Configure SLS and Bank (same as client)

Configure Tycoon Auctioneer

- Copy the owner's bank account key pair to /etc/tycoon
  - amir@kth.se_bank_private_key
  - amir@kth.se_bank_public_key
- Copy the owner's public key to /etc/tycoon/admin_public_key
  - amir@kth.se_bank_public_key
- Change (or add) the UserName option in /etc/tycoon/tycoon_aucd.conf
  - UserName = "amir@kth.se"
- Configure firewall(s) (Linux and/or external) to open ports auctioneer
  - SLS: out TCP port (25955)
  - Bank: out TCP port (8899)
  - Auctioneer: out TCP port (24571)

Create Account on Host

- Create host on Auctioneer (It boots VM as well)
  - tycoon host create_account 192.168.0.1 10
- Verify the host created VM
  - tycoon_ssh amir@192.168.0.1
  - tycoon_scp a.out amir@192.168.0.1

Account VM

- Auctioneer uses Xen for virtualization.
- It uses configuration file in /var/lib/tycoon/aucd/Xen3/accounts

```
kernel = "/home/amir/kernel/vmlinuz"
disk = ['file:/home/amir/slc3.img,sda1,w']
name = "amir"
root = "/dev/sda1 ro"
memory = 856
vif = [ "mac=aa:00:00:77:66:d4, ip=10.106.212.209/30", "mac=aa:00:00:2b:ca:15" ]
ip = "10.106.212.210"
netmask = "255.255.255.252"
gateway = "10.106.212.209"
hostname = "amir-boogieman.pdc.kth.se"
```

Creating gLite Filesystem Image

gLite Filesystem Image

- Installing Scientific (SL) Linux on QEMU or one partition
- gLite uses yaim as a configuration tool.
- Install CE and WN on SL
  - The CE and WN on image are preinstalled, but not configured.
  - /opt/glite/yaim/scripts/install_node site-info.def glite-CE
  - /opt/glite/yaim/scripts/install_node site-info.def glite-WN
- Copying required keys and certificates to image.

Summary

- Providing a heterogeneous gLite system.
- Tycoon as distributed market-based resource allocation system.
- Each site has:
  - Its SLS
  - Set of nodes with Auctioneer on them
  - gLite prepared filesystem image (CE and WN)

Questions

Comments