Designing an Entity to Provide Network QoS in a Grid System

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Overview.

Overview.

Introduction.

- Grid systems are highly variable environments, made of a series of independent organizations that share their resources, creating what is known as *virtual organization, VO*.
- This variability makes quality of service (*QoS*) highly desirable, though it is very complex to achieve due to the large scale of interconnected networks.
- We must provide the user who asks for a resource with a kind of "security" about the use of the resource he or she has asked for, but this is not a trivial subject with regard to the network QoS.
- Some efforts have been made to provide network QoS in a Grid, namely GARA, NRSE, G-QoSM, and GNRB.

Introduction.
Grid Meta-scheduling.

Definition.

Allocation of resources to user jobs, where resources may belong to different administration domains, taking into account the job requirements, system throughput, application response time, budget limit, deadlines, ...

Current metaschedulers do not usually pay attention to the network when making their decisions.

What are we doing?

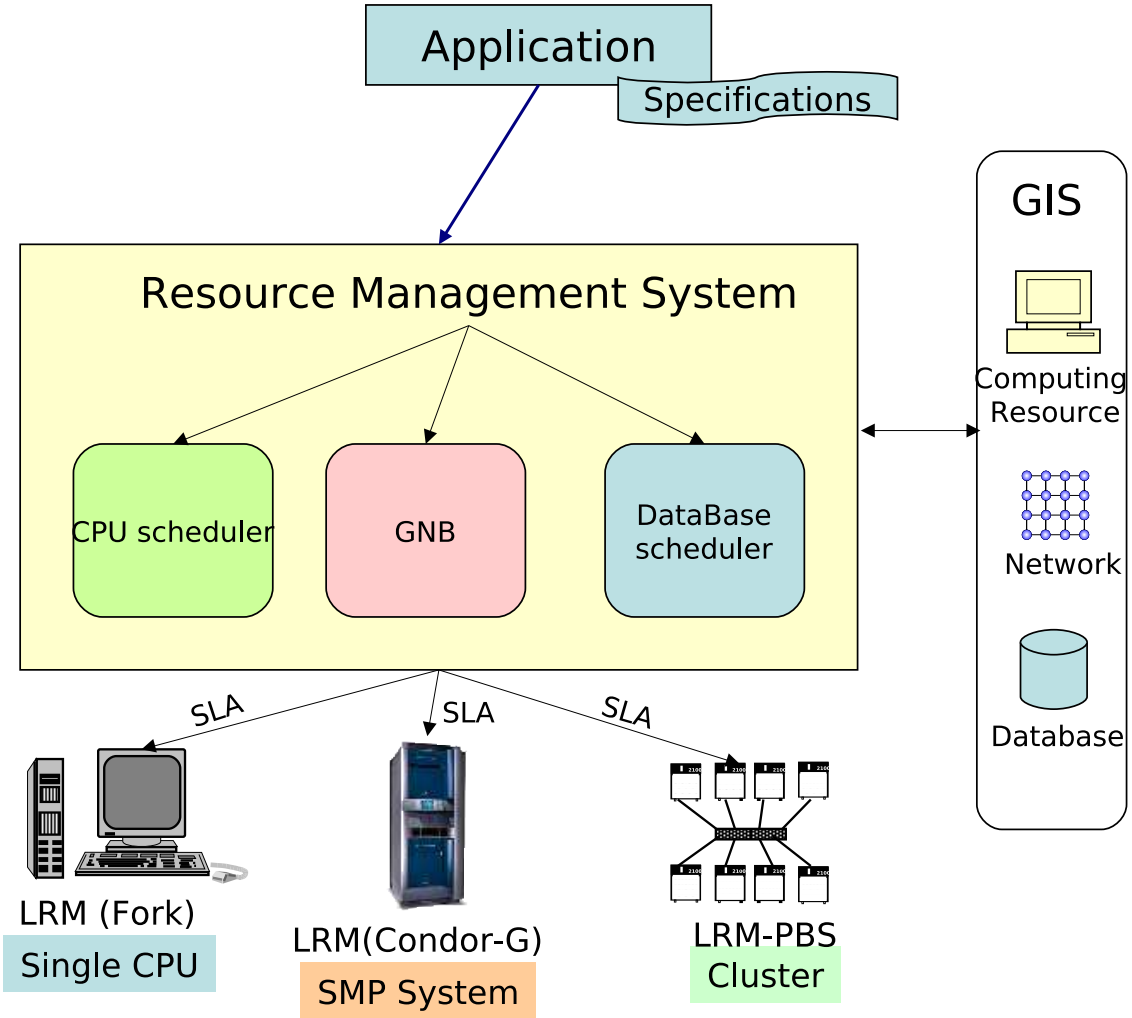
Main aim:

- Our main aim is the development of a grid meta-scheduler that takes explicitly the network into account to take its decisions.
- This entity is called *Grid Network Broker (GNB)*.
- The GNB will perform scheduling of jobs to resources, and network reservations.
- It will be based on the Differentiated Services architecture to provide network QoS.
- This entity is being developed at first using a simulation tool (GridSim), and will eventually be implemented in a real Grid environment.

Overview.

Overview.

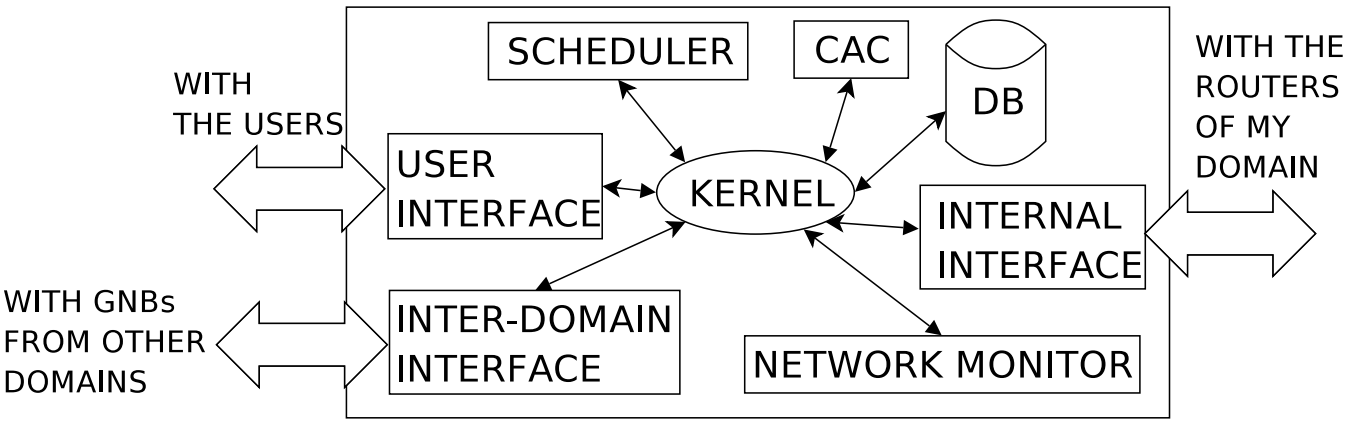
Overview of the model.



Overview.

Overview.

Architecture of our GNB.



Scheduler.

repeat
calculate the power of the resource available for users
calculate the quality of the network path from the user to the computing resource
calculate the quality of the resource based on the power and the network path
until for each computing resource
order resources based on their quality from best to worst

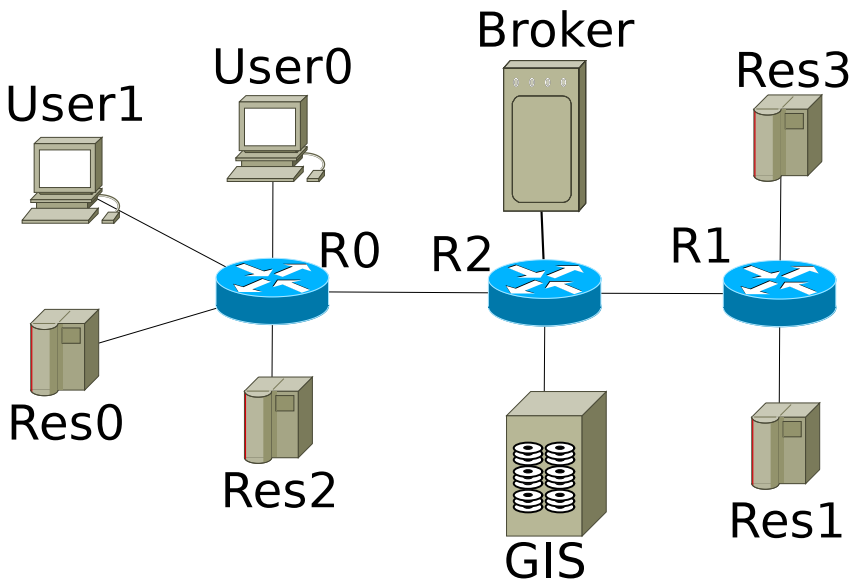
Connection admission control (CAC).

repeat
  try with the best computing resource
  for all link in the path from the user to that resource **do**
    if the link does not have enough available bandwidth **then**
      reject that resource
    else
      go on with the following link
    end if
  end for
until a resource meets the requirements of the user

Overview.

Overview.

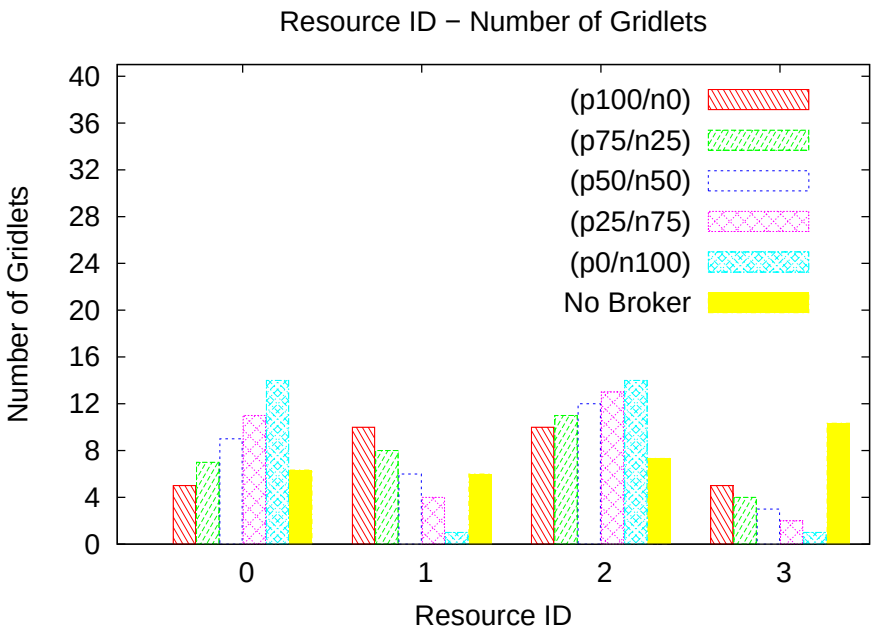
Experiments and Results.
Parameters of simulations.



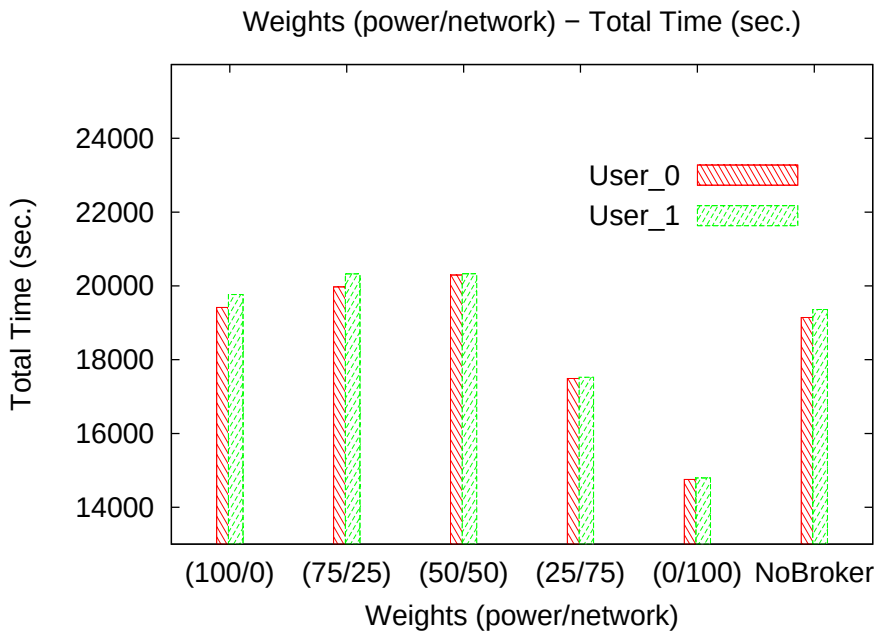
- The more powerful computing resources (Res 1 & 2) have 1 machine made of 4 CPUs with a rating of 1500 MIPS each one,
- The less powerful ones (Res 0 & 3) have the same number of machines and CPUs, but each CPU has a rating of 750 MIPS

- User 0 has more priority than user 1 for network transmissions.
- 15 gridlets per user, each one with these features:
  - input/output files sizes are 70MB,
  - processing power 7000 MI (million of instructions).
- Our links have a baud rate of 2 Mbps, a propagation delay of 10 milliseconds and a MTU of 1500 bytes,
- Our users request the 20% of the link bandwidth for each job.
- We have varied the significance (weight) that the power of a resource and the network have when performing the scheduling.

Comparison of performances.
GNB without CAC.

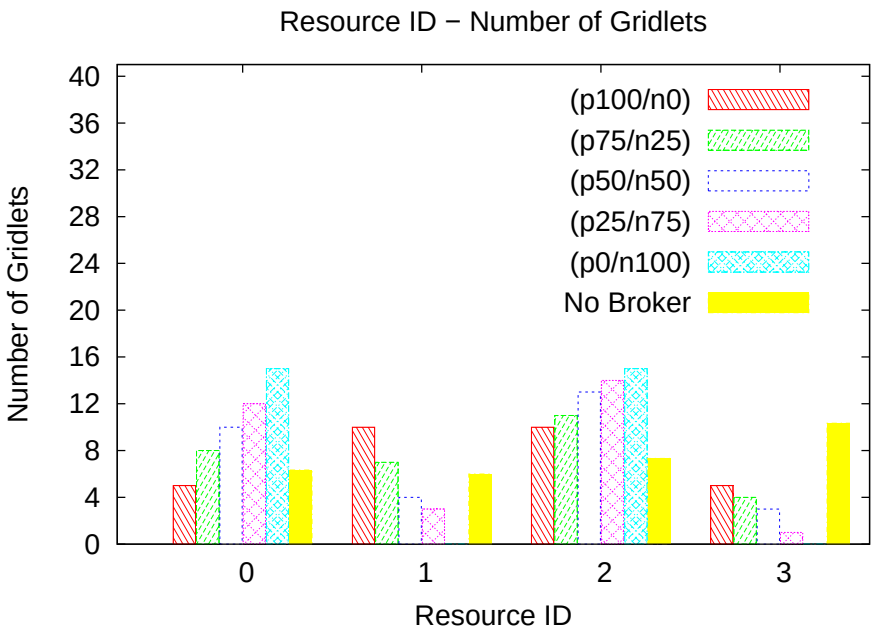


(a) Number of gridlets run at each resource.

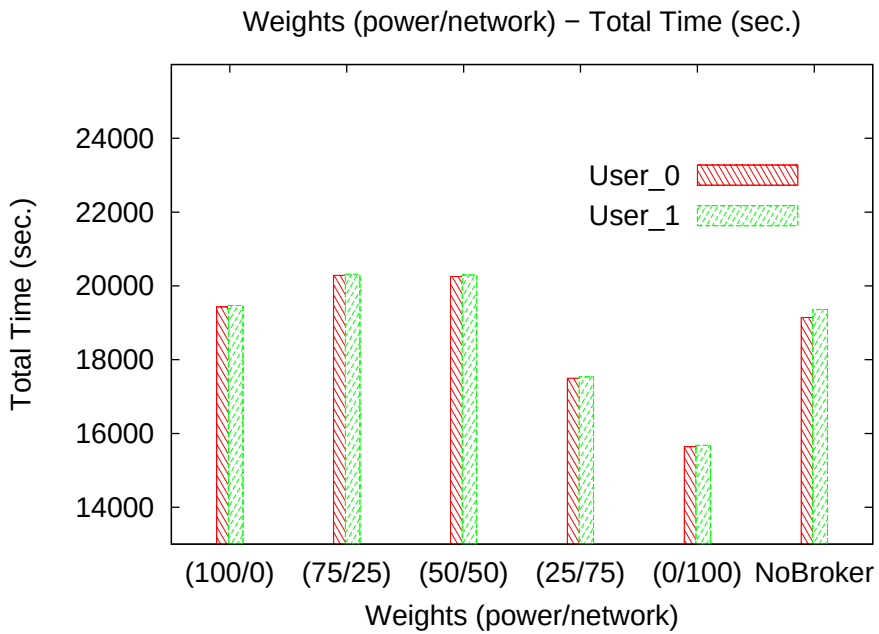


(b) Total time spent by users.

Comparison of performances.
GNB with CAC.



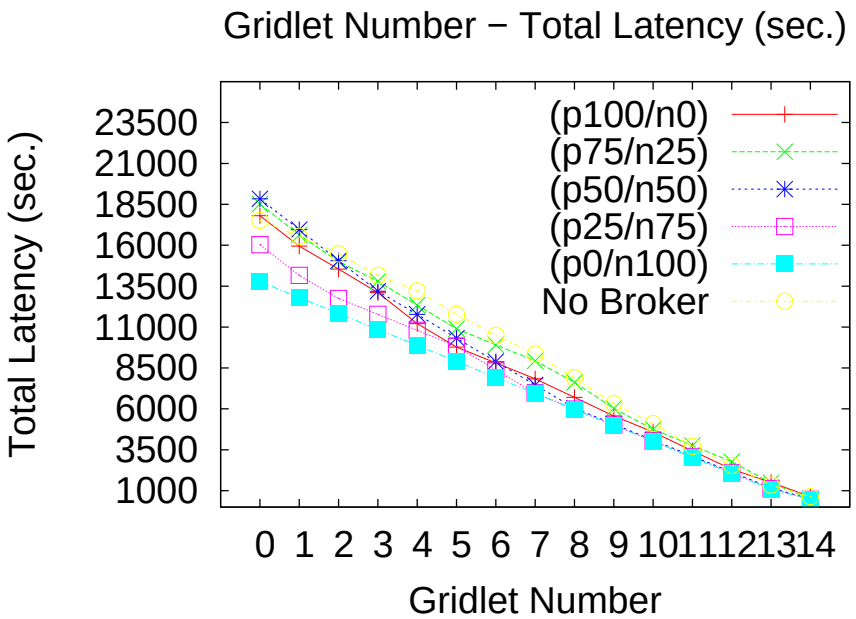
(a) Number of gridlets run at each resource.



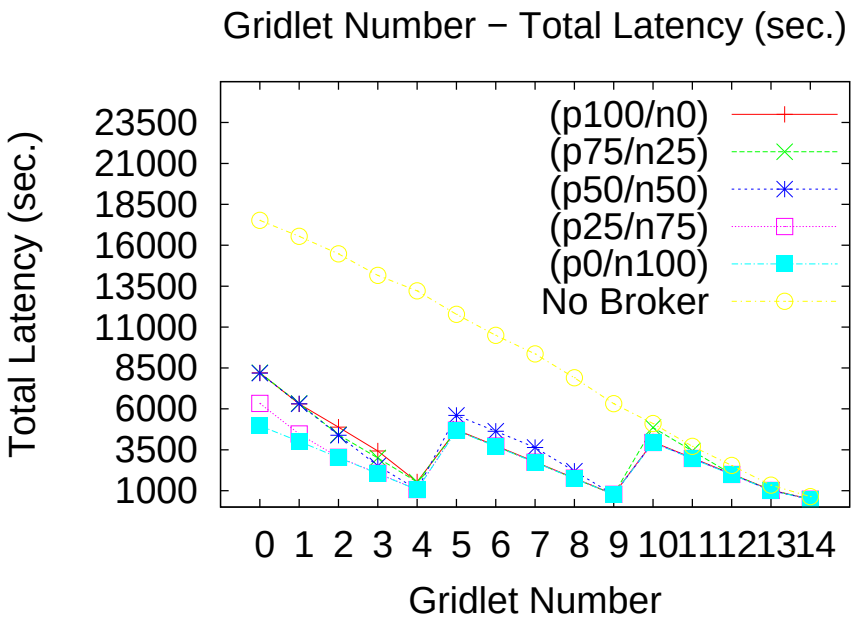
(b) Total time spent by users.

Comparison of performances.

Total network latencies with and without CAC.



(a) Without CAC.



(b) With CAC.

Conclusions and future work.

- We have presented a network-aware grid meta-scheduler, also known as *grid network broker*, or *GNB*. This entity focuses on providing efficient QoS mechanism inside the network environment.
- The GNB would be entrusted with the care of the utilization of the links, so that links do not become overused, thus preventing the entire network performance from degrading.
- The results presented here show that the network performance of a grid system is improved by the utilization of the GNB, as it performs a jobs scheduling and network load balancing that takes advantage of the features the system.

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