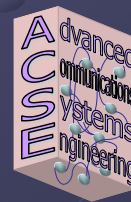


# Resource and Application Models for Advanced Grid Schedulers



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# Problem

- ◆ Heterogeneous and dispersed systems
- ◆ Quest for effective scheduling technique
- ◆ Good scheduling decisions depend on quality and availability of information
- ◆ Importance of resource-efficient information dissemination.

# Motivation - Scheduling

- ◆ Scheduling on distributed, heterogeneous and dynamic Grid resources.
- ◆ Current Schedulers
  - Queuing or Batch:
    - ◆ NQE, PBS, LSF, Load Leveler
  - Application Level:
    - ◆ AppLeS, MARS, SEA, DOME
  - Dynamic, Ranking:
    - ◆ Condor ClassAd language and matchmaker

# Motivation – Info Distribution

- ◆ CU
- LD
- ◆ Li
- fo
- ◆ Ce
- bo
- ◆ SM

The screenshot shows a Windows Explorer window titled "Mds-Host-hn=android-ee11.cs.ucl.ac.uk,Mds-Vo-name=local,o=grid". The window displays a tree view on the left and a list of metadata values on the right.

**Tree View:**

- Browser root
  - SO-GRM GIIS
    - Mds-Host-hn=android-ee11.cs.ucl.ac.uk
      - Mds-Device-Group-name=processors
      - Mds-Device-Group-name=memory
      - Mds-Device-Group-name=filesystems
      - Mds-Device-Group-name=networks
      - Mds-Software-deployment=operating system
      - Mds-Software-deployment=MDS
    - cl=datatag-CNAF
      - scl=sub1
    - host=android-ee12.cs.ucl.ac.uk
    - host=android-ee4.cs.ucl.ac.uk
    - host=android-ee14.cs.ucl.ac.uk
    - host=android-ee11.cs.ucl.ac.uk
    - host=android-ee10.cs.ucl.ac.uk
    - host=android-ee16.cs.ucl.ac.uk
    - host=android-ee13.cs.ucl.ac.uk
  - UCL GIIS

**Metadata List:**

Name	Value
Mds-Cpu-Cache-l2kB	256
Mds-Cpu-features	fpu vme de pse tsc msr pae m...
Mds-Cpu-Free-15minX100	100
Mds-Cpu-Free-1minX100	100
Mds-Cpu-Free-5minX100	100
Mds-Cpu-model	AMD Athlon(tm) XP 2600+
Mds-Cpu-Smp-size	1
Mds-Cpu-speedMHz	2087
Mds-Cpu-Total-count	1
Mds-Cpu-Total-Free-15min...	100
Mds-Cpu-Total-Free-1minX...	100
Mds-Cpu-Total-Free-5minX...	100
Mds-Cpu-vendor	AuthenticAMD
Mds-Cpu-version	6.8.1
Mds-Fs-freeMB	0
Mds-Fs-freeMB	20552
Mds-Fs-freeMB	250
Mds-Fs-sizeMB	1
Mds-Fs-sizeMB	250
Mds-Fs-sizeMB	34990

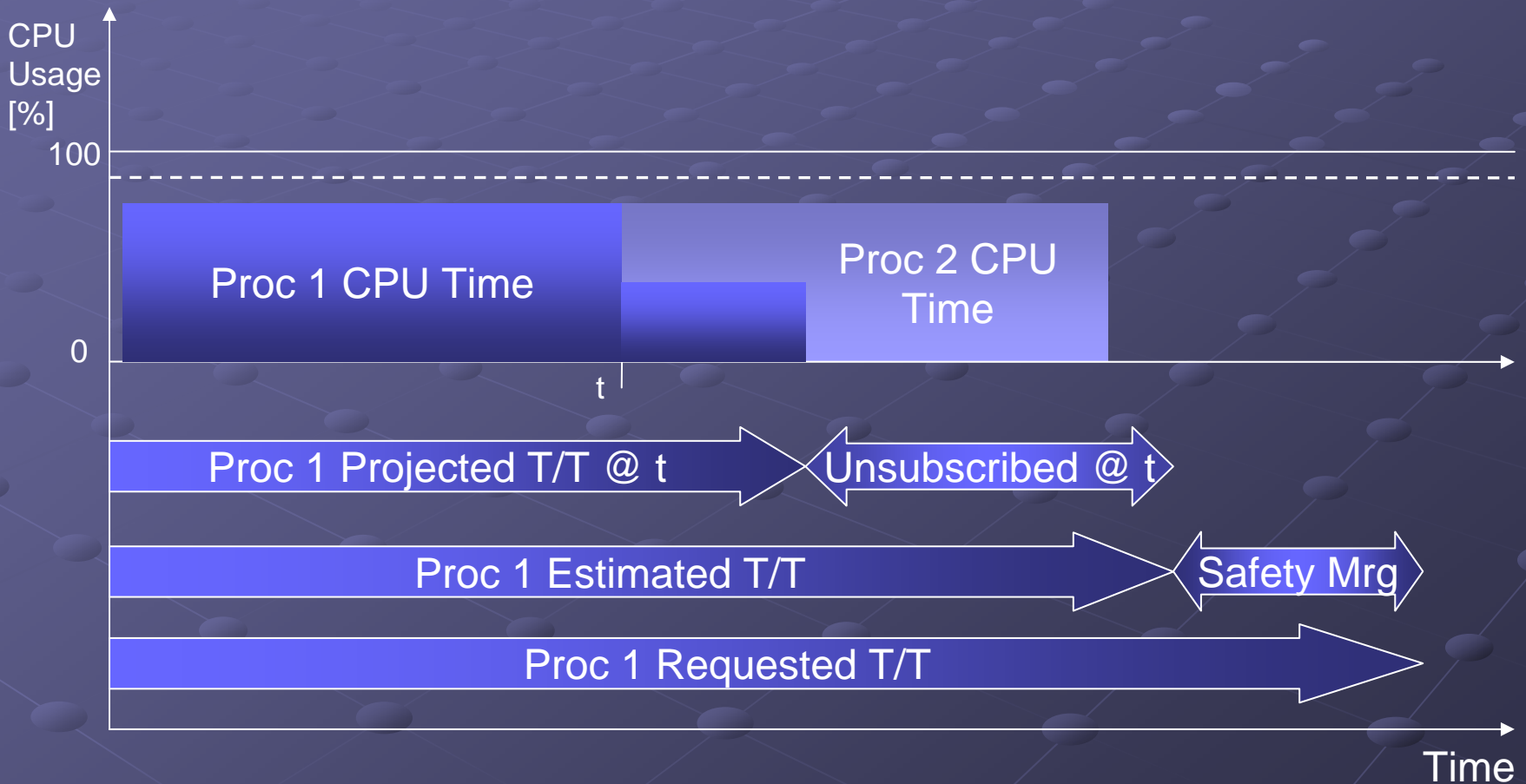
Ready. For Help, press F1

Anonymous Schema loaded

# Bright Ideas - Scheduling

- ◆ Advance reservation and partitioning of resources complex and wasteful.
- ◆ Low-level scheduling in multitasking OS can distort machine loading info.
- ◆ Decouple application load and node computational output
- ◆ Assign jobs based on requested turnaround and unsubscribed capacity.

# Subscribed Load Scheduling



# Application & Node Profiles

- ◆ Distinction between volatile and non-volatile resources.
- ◆ Profiles in XML with modular matchmaker.
- ◆ Nodes self assess the level of fitness for a given request and return a Bid Value.
- ◆ Monitoring and feedback improve confidence levels and reduce safety margins

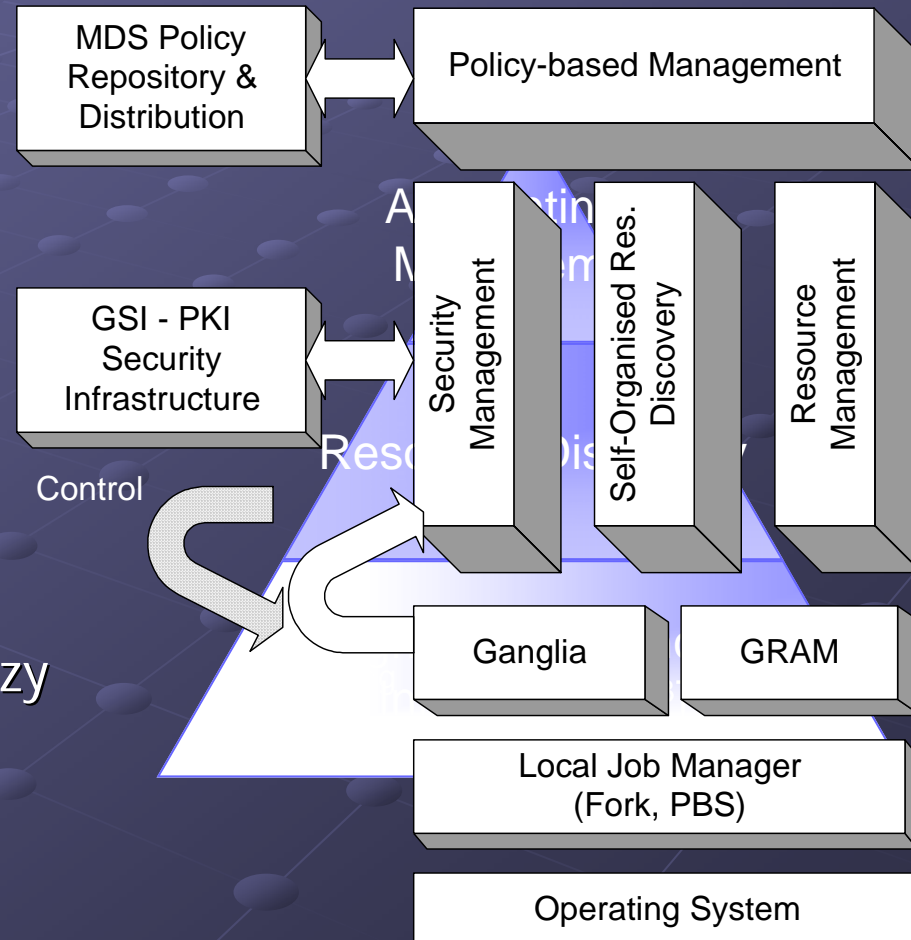
# Bright Ideas - Information

- ◆ Small-Worlds principle – information shared among several neighbours and few distant nodes.
- ◆ Fuzzy picture of the Grid environment – enables “good” but not necessarily “best” decisions.
- ◆ Gaining credibility, good resilience to random node failures



# Information Flows

- ◆ Localised, need-to-know information flow policy
- ◆ 3-Tier Information Flow:
  - Node Current State  
Low-latency, short shelf life
  - Volatile Resources State  
Self-organized, distributed, fuzzy
  - Accounting  
Centralized, reliable, accurate



# Conclusions & Future Work

- ◆ New approaches needed to handle dynamic and heterogeneous resource pool.
- ◆ Reduce complexity and possible points of failure.
- ◆ Develop a prototype meta-scheduler and test on 200 CPU UCL Grid