

A background of red, vertically pleated curtains, typical of a theater stage. The curtains are illuminated from the front, creating a gradient of red from dark at the top to bright at the bottom.

Grid Computing

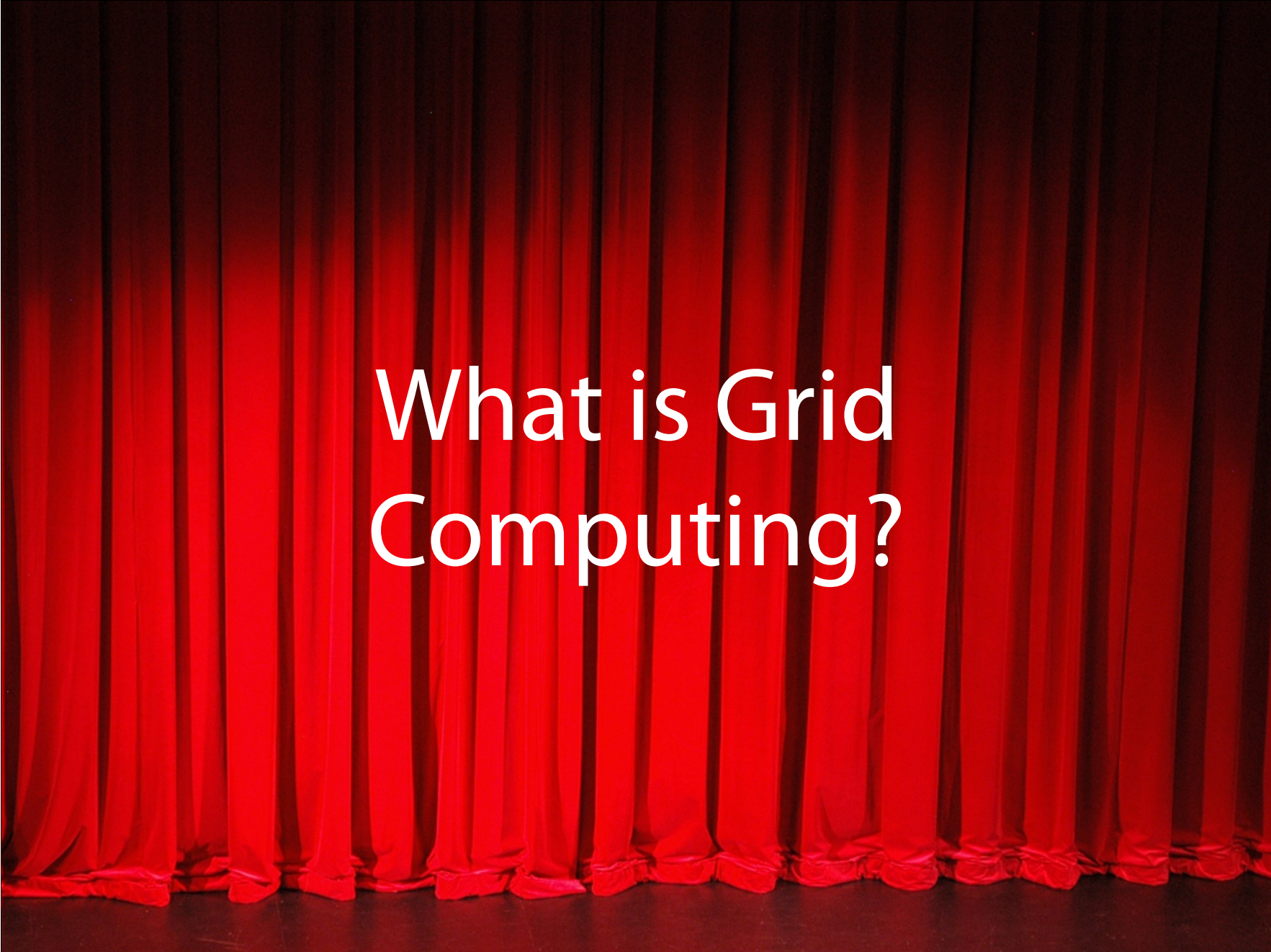
An Introduction

Mathias Dalheimer



Competence Center High Performance Computing

More material:
<http://gonium.net/md>

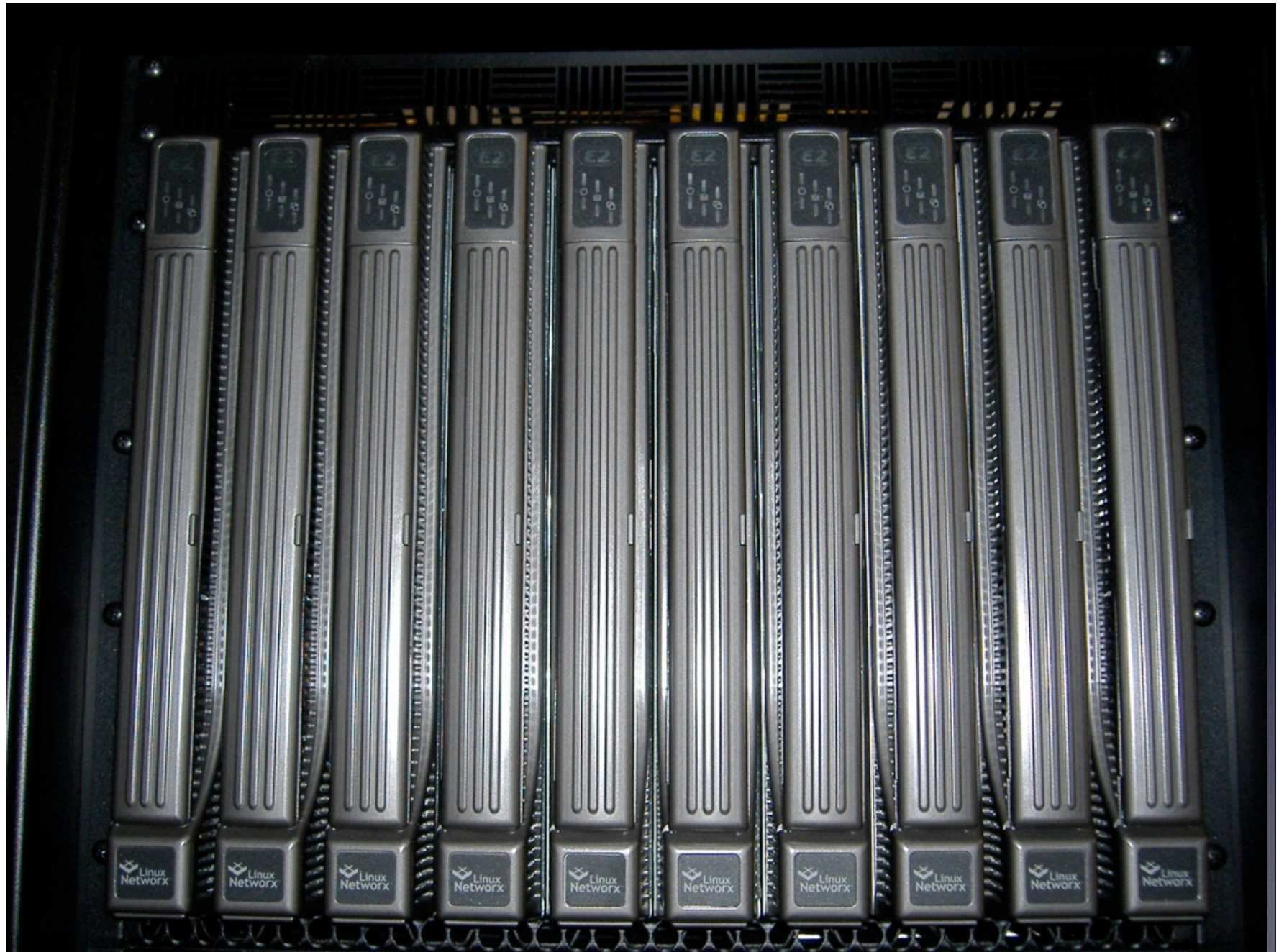
A photograph of a stage with heavy, dark red curtains. The curtains are closed and have a vertical pleated texture. The lighting is slightly brighter in the center, creating a subtle gradient across the fabric. The overall tone is dramatic and theatrical.

What is Grid Computing?

Virtualization

Grid problem:
coordinated resource
sharing and problem
solving in dynamic,
multi-institutional
virtual organizations.

coordinated resource
sharing and problem
solving







coordinated resource
sharing and problem
solving

in dynamic, multi-
institutional virtual
organizations





in dynamic, multi-
institutional virtual
organizations

Virtualization?

Red Hat Enterprise Linux 3 - VMware GSX Server

File Edit View Host VM Power Snapshot Windows Help

Inventory

- Windows XP Professional
- Windows 2000 Cluster Node 2
- Windows 2000 Cluster Node 1
- WinNT IIS Web Server
- Novell NetWare 6.5
- Windows Server 2003
- Red Hat Enterprise Linux 3
- SUSE Linux Enterprise Server 8

Red Hat Enterprise Linux 3 | SuSE Linux Enterprise Server 8 | Windows XP Professional | Windows Server 2003 | Novell NetWare 6.

```

demo@GSXRHEL3VM:~
File Edit View Terminal Go Help
15:28:15 up 1 day, 11:01, 2 users, load average: 0.22, 0.18, 0.11
55 processes: 53 sleeping, 2 running, 0 zombie, 0 stopped
CPU states:  cpu  user  nice  system  irq  softirq  iowait  idle
              total 2.3%  0.0%  0.9%  0.3%  0.0%  1.3%  94.8%
Mem:  254932k av, 241048k used, 13884k free, 0k shrd, 68996k buff
      178272k actv, 45752k in_d, 1500k in_c
Swap: 522104k av, 2148k used, 519956k free 91620k cached

  PID USER   PRI NI  SIZE  RSS  SHARE STAT %CPU %MEM  TIME CPU COMMAND
  1353 root    15  0 30720 12M  4960 S    2.1  4.8 16:19  0 X
  1496 demo    15  0 12832 12M  7988 R    0.5  5.0  1:26  0 gnome-termina
  1538 demo    15  0 1180 1180  900 R    0.3  0.4  6:37  0 top
  1233 root    15  0  764  740  468 S    0.1  0.2  0:24  0 vmware-guestd
  1440 demo    15  0 5860 5860 4924 S    0.1  2.2  1:18  0 magicdev
    1 root    15  0  492  468  440 S    0.0  0.1  0:06  0 init
    2 root    15  0  0  0  0 SW    0.0  0.0  0:00  0 keventd
    3 root    15  0  0  0  0 SW    0.0  0.0  0:01  0 kapmd
    4 root    34 19  0  0  0 SWN   0.0  0.0  0:00  0 ksoftirqd/0
    7 root    25  0  0  0  0 SW    0.0  0.0  0:00  0 bdflush
    5 root    15  0  0  0  0 SW    0.0  0.0  0:06  0 kswapd
    6 root    15  0  0  0  0 SW    0.0  0.0  0:03  0 kscand
    8 root    15  0  0  0  0 SW    0.0  0.0  0:00  0 kupdated
    9 root    25  0  0  0  0 SW    0.0  0.0  0:00  0 mdrecoveryd
   18 root    15  0  0  0  0 SW    0.0  0.0  0:54  0 kjournald

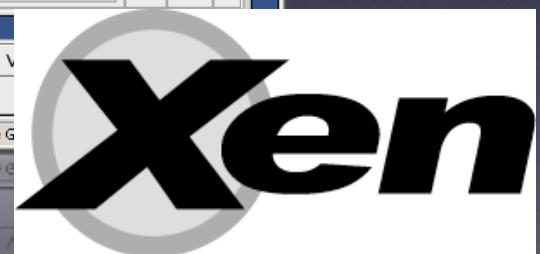
```

VirtualCenter

SERVER FOCUS: SEMINARS

Attend a free seminar for a discussion of the Virtual

demo@GSXRHEL3

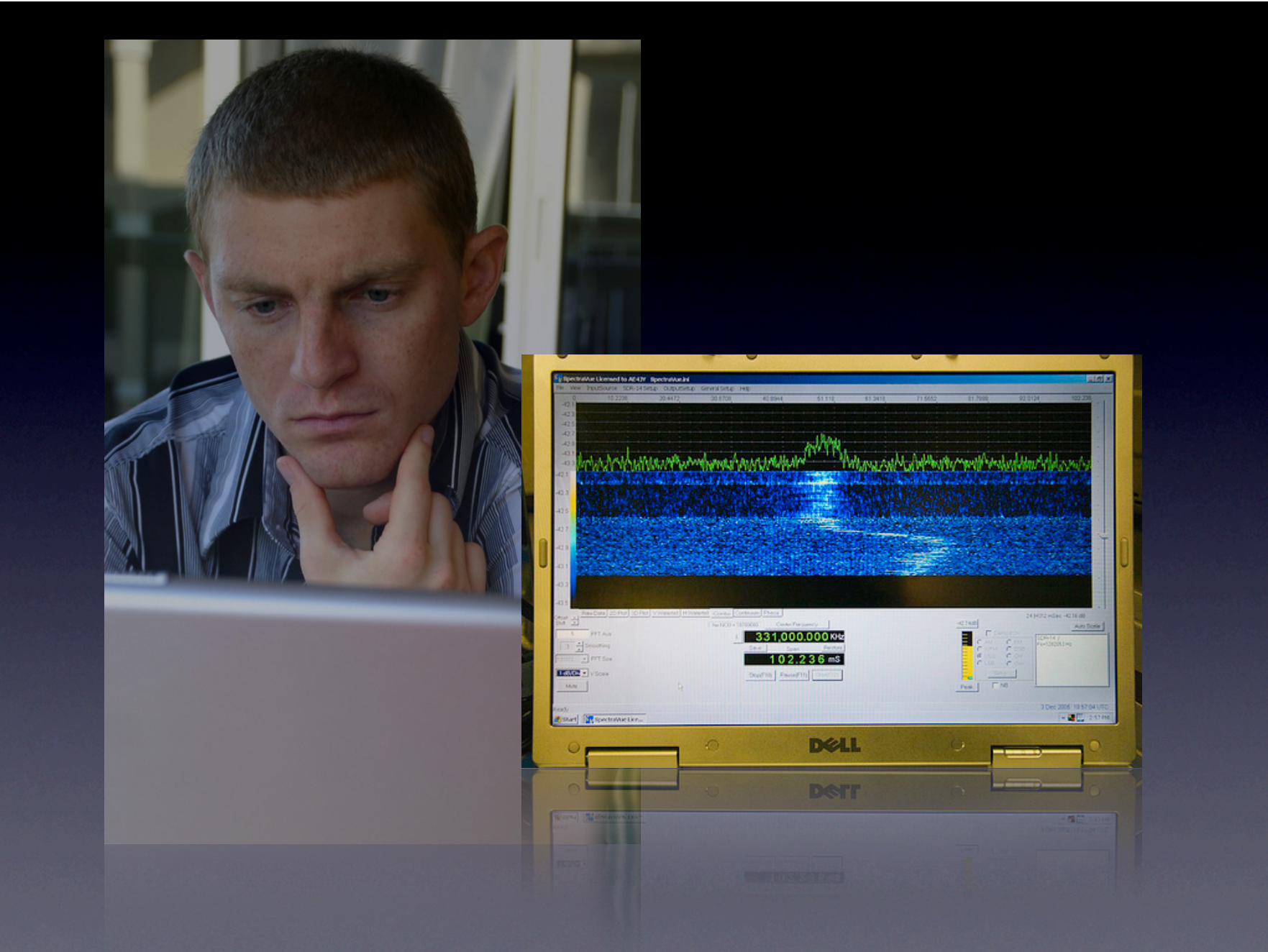




vir-tu-al:

1: being such in essence or effect though not formally recognized or admitted <a virtual dictator>

2: ...

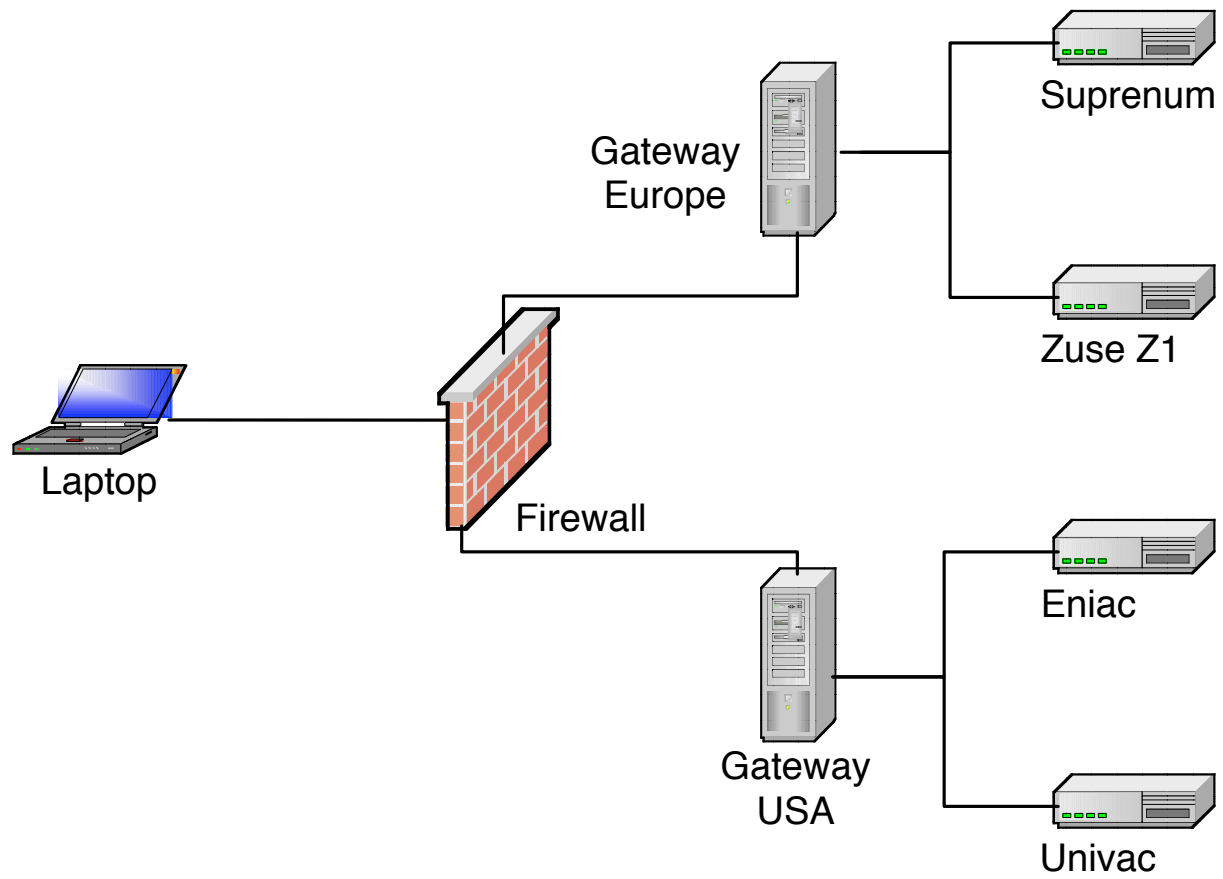




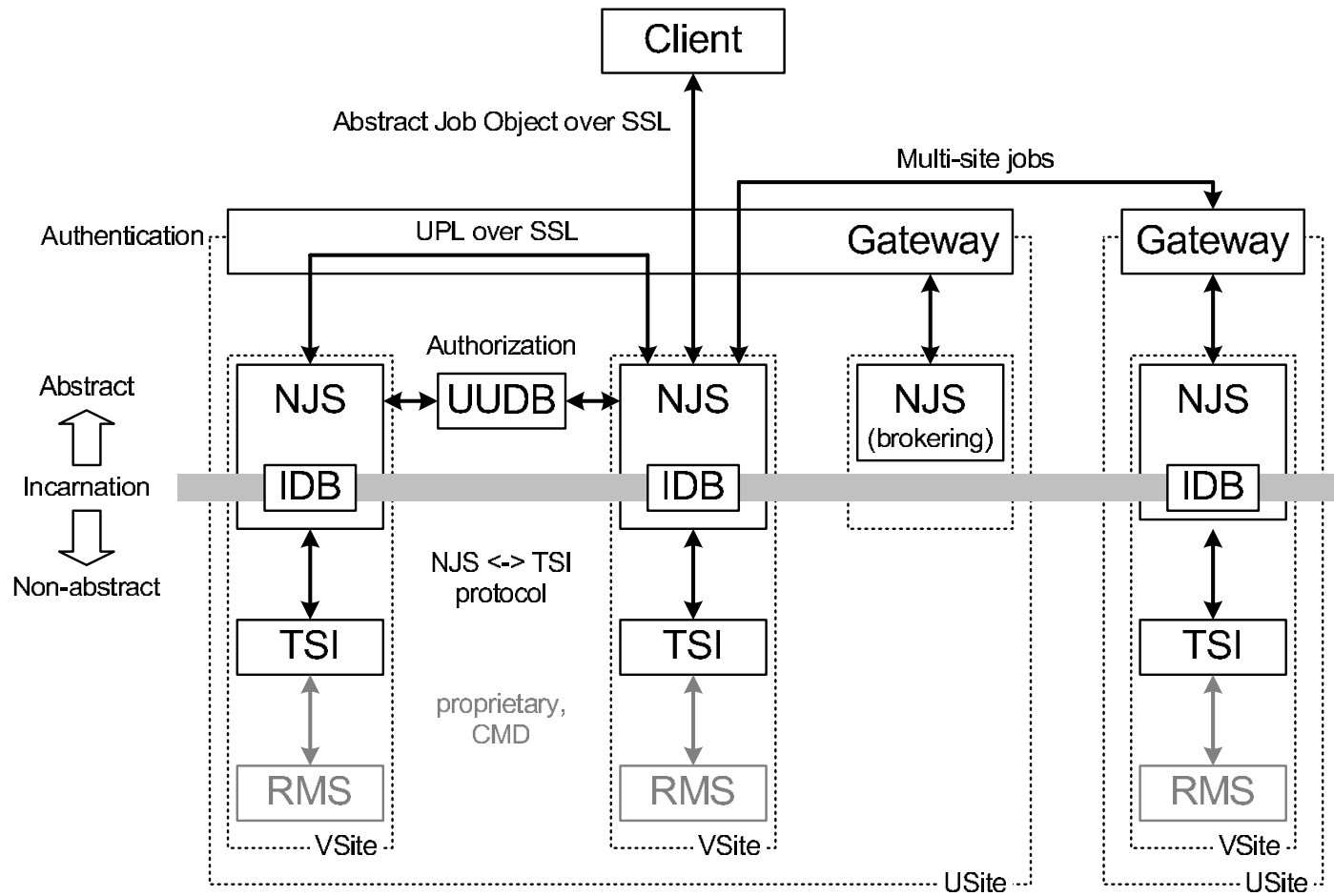
Grid Characteristics

Distributed Systems
Site Autonomy
But also: High security
Virtual resources in a pool

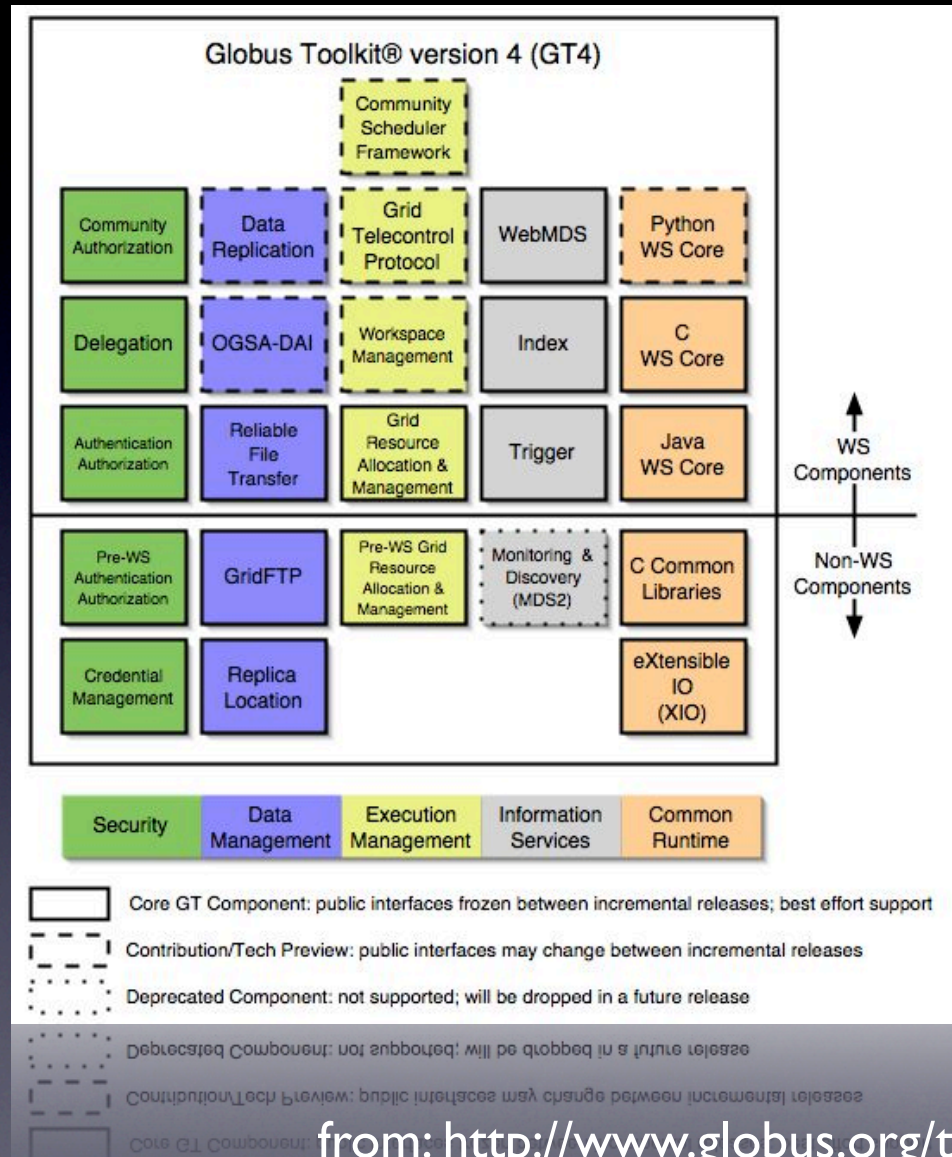


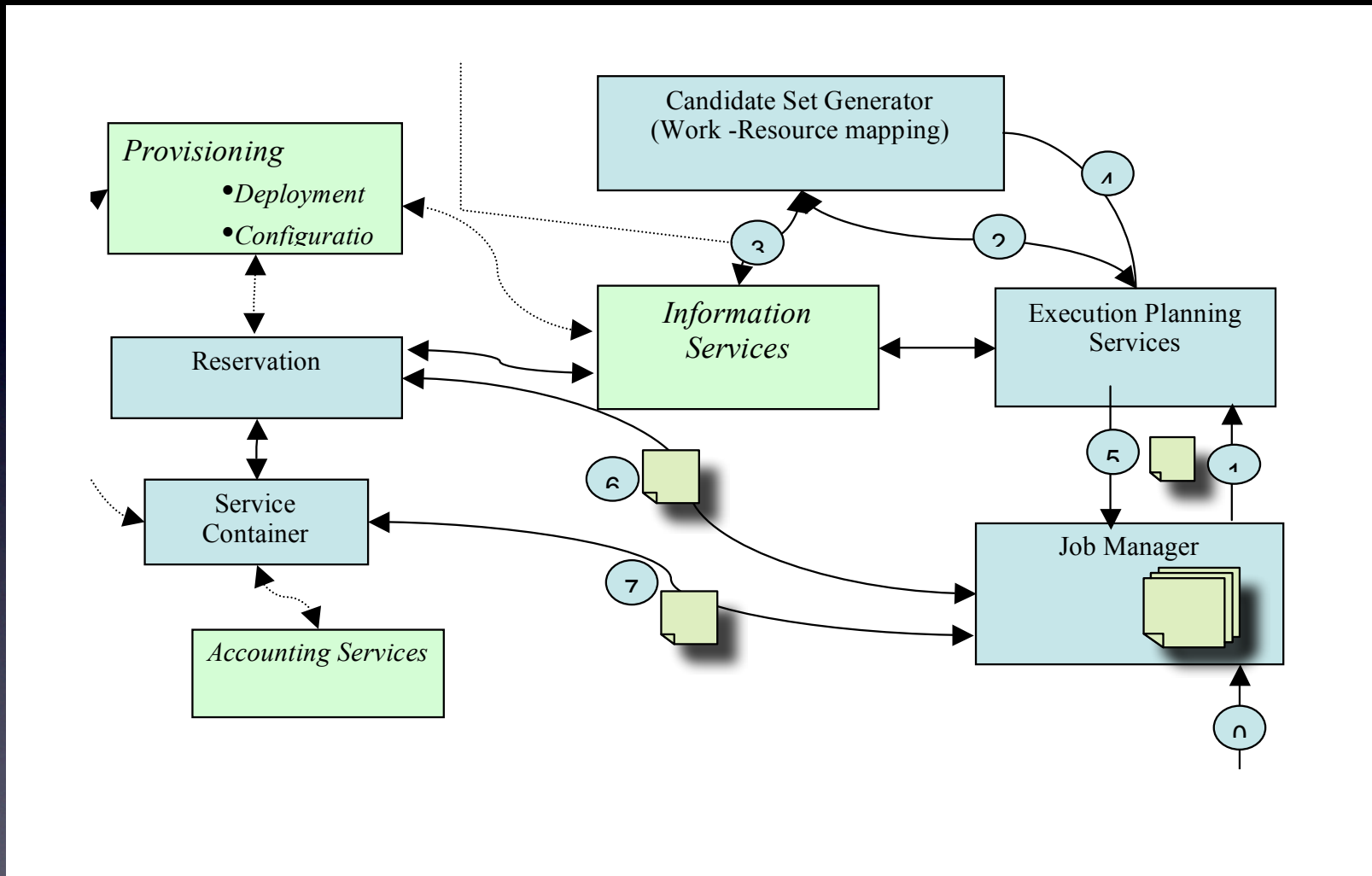


Demo



Streit et al.: Unicore - From Project Results to Production Grids





Key problems

- Security
- Resource Management
- Data Management
- Information Services

A photograph of a stage with heavy, dark red curtains. The curtains are closed and have a vertical pleated texture. The lighting is somewhat dim, with the center of the curtains appearing slightly brighter than the edges. The overall tone is dramatic and formal.

Grid Security


Security = Encryption
+ Authentication
+ Authorization
+ etc.

Encryption

Authentication

Passport: X.509

Mathias Dalheimer

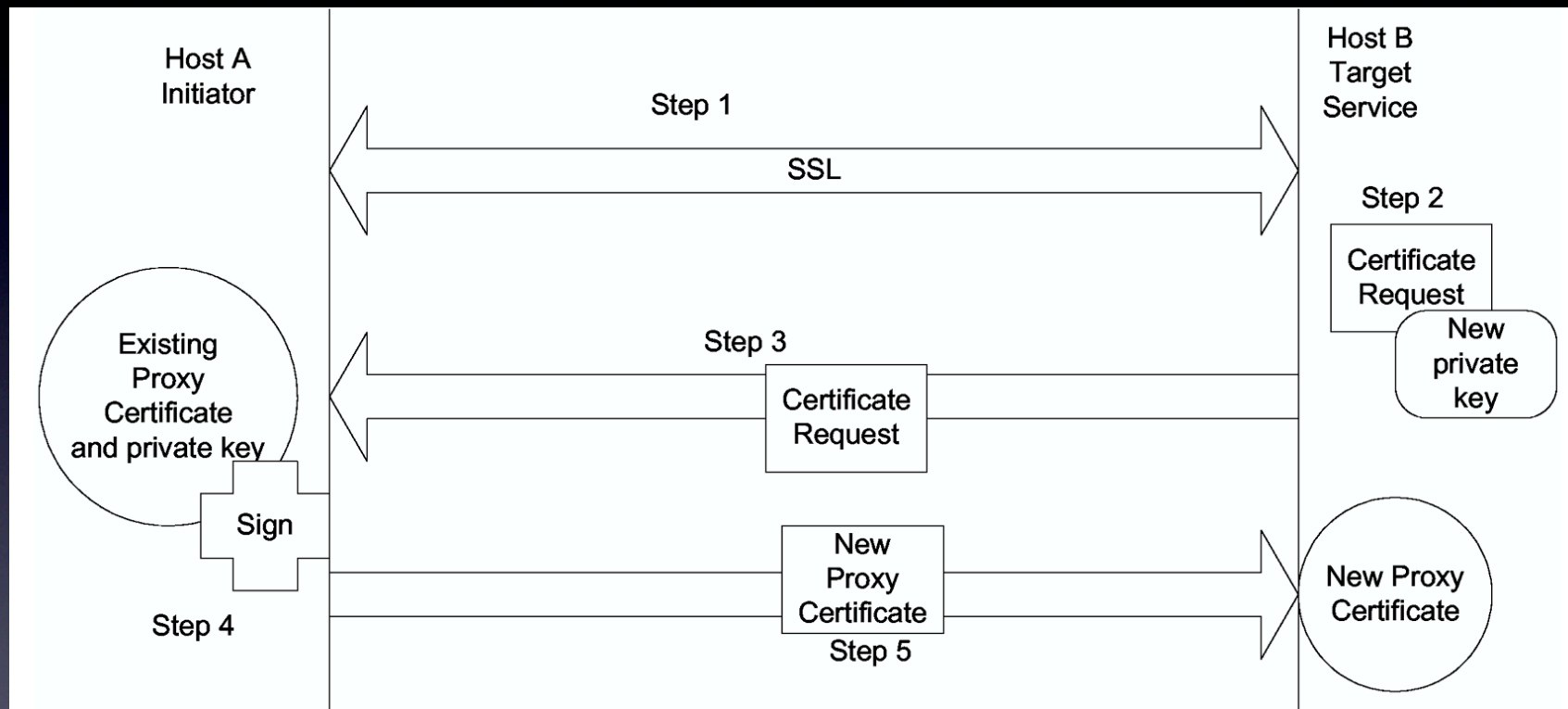
 **Mathias Dalheimer**
Issued by: Fraunhofer-Gesellschaft Root-CA v2
Expires: Tuesday, January 1, 2008 12:00:00 AM Europe/Berlin
✔ This certificate is valid

▼ Details

Subject Name	_____	
Country	DE	
Organization	Fraunhofer	
Organizational Unit	ITWM	
Organizational Unit	People	
Common Name	Mathias Dalheimer	
Issuer Name	_____	
Country	DE	
Organization	Fraunhofer	
Common Name	Fraunhofer-Gesellschaft Root-CA v2	
Version	3	
Serial Number	2189	

X.509 is not enough

- Dynamic delegation of rights to a service
- Delegation to dynamically generated services
- Solution:
 - Different signatures (Unicore)
 - Proxy certificates (Globus)



Welch et al: X.509 Proxy Certificates for Dynamic Delegation

Security = Encryption
+ Authentication
+ Authorization
+ etc.

Authorization

DN -> Privilege mapping

Security = Encryption
+ Authentication
+ Authorization
+ etc.

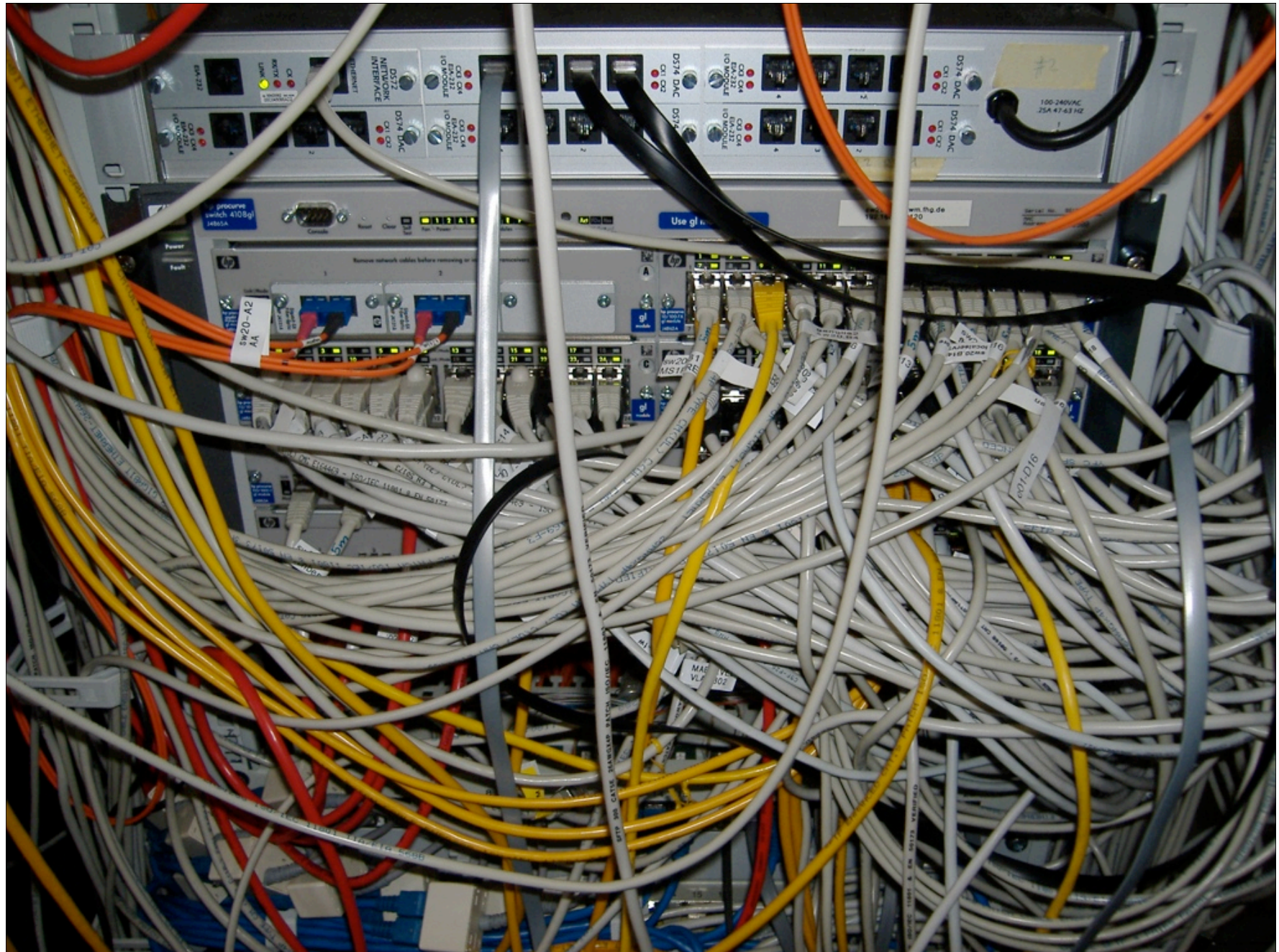
A background of red, vertically pleated curtains, typical of a stage or theater setting. The curtains are a deep red color and hang from the top to the bottom of the frame, with some folds and shadows visible.

Grid Resource Management

What is a grid
resource?



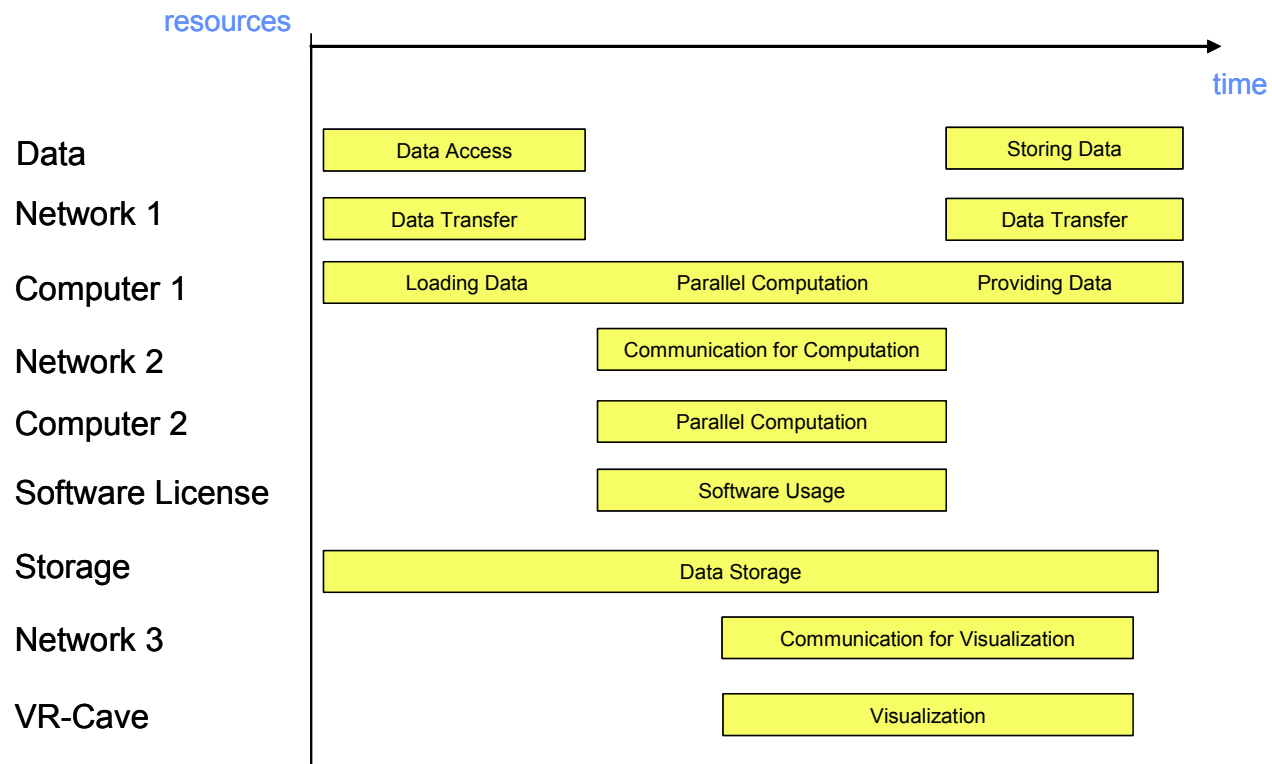








Resource Management



Grid Scheduling Use Cases. Proposed GGF document.



Grid Resource Management

- Resource Discovery
- Information Gathering
- Job Execution

Schopf: Ten Actions when Grid Scheduling

Resource Discovery

- Authorization filtering
- Application requirement definition
- Minimal requirement filtering

Information Gathering

- Dynamic information gathering
- System selection

Job Execution

- Advance reservation
- Job submission
- Preparation tasks
- Monitor progress
- Cleanup tasks

Different architectures

Centralized Scheduling

Hierarchical Scheduling

Decentralized Scheduler

Negotiation

A photograph of a stage with heavy, dark red curtains. The curtains are closed and have a vertical pleated texture. The lighting is somewhat dim, with the center of the curtains appearing slightly brighter than the edges. The overall tone is dramatic and formal.

Data Management



- 80 GB/sec.
continuously
- Data is streamed
to computing
centers across
Europe
- Experiments are
run on the
stored data



Data management challenges

- Manage huge amounts of data
- Provide data where it is needed
- Determine where it is needed
- Help to find specific datasets

GridFTP

- Add-on to FTP:
 - Uses GSI to authenticate users
 - All data transfers are encrypted
 - Allows third-party transfers
 - Striped File transfer
 - Partial transfers

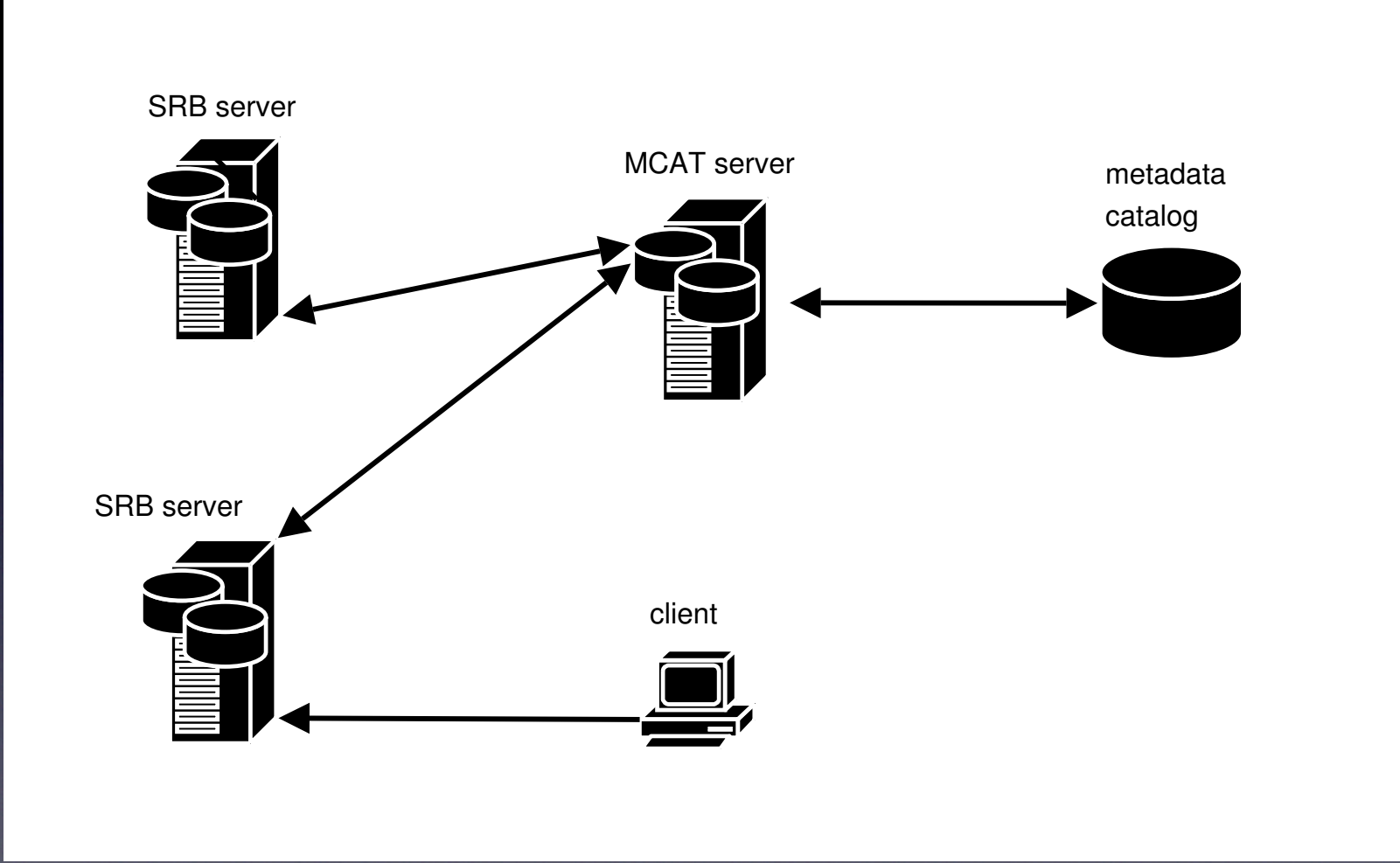
But: Not sufficient

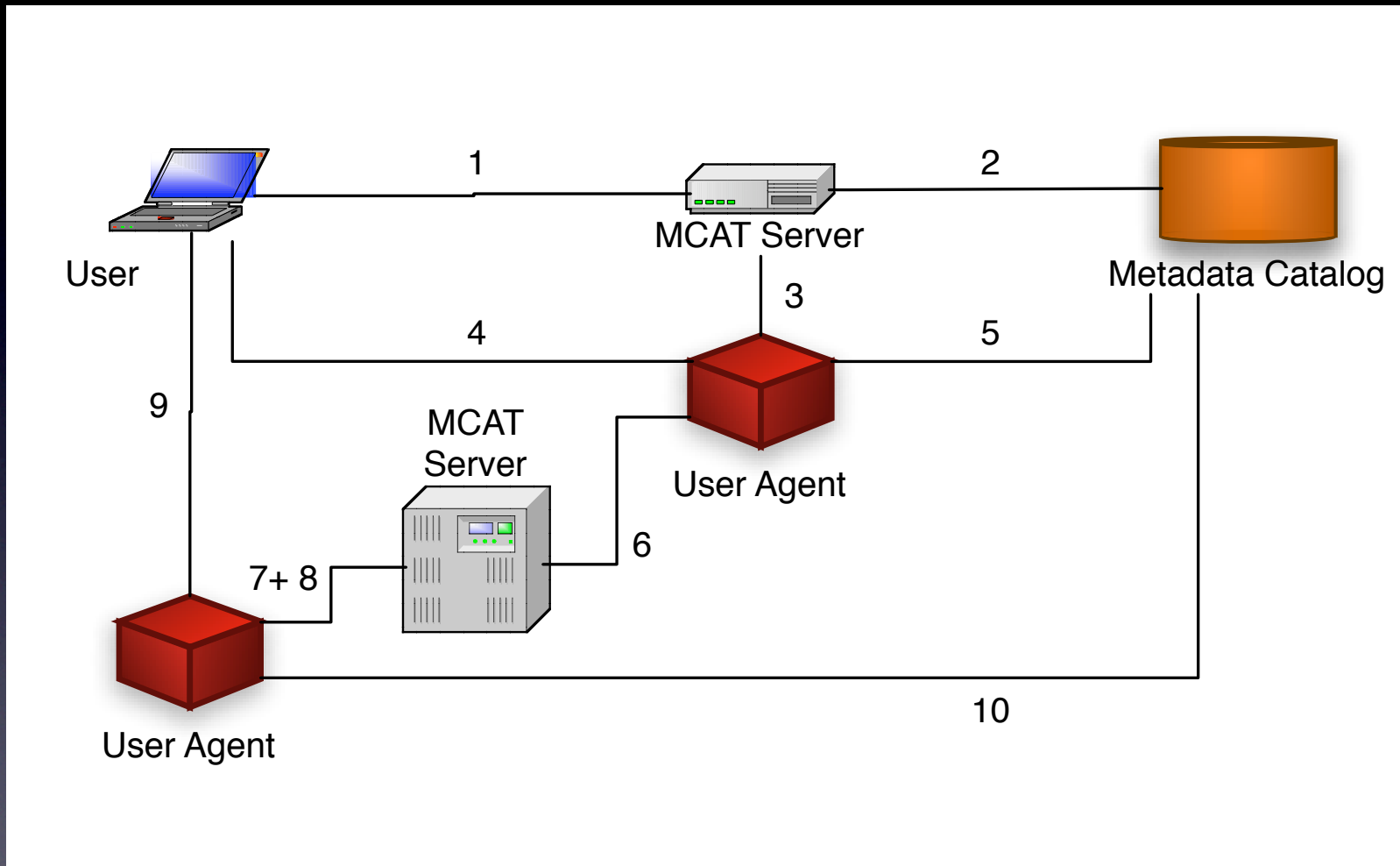
- Doesn't abstract from the resource
- No search mechanisms for specific datasets
- Doesn't integrate different storage technologies
- No support or replicas and caches

realizing cyber-infrastructure



zoneSRB





Additional concepts

- Fine-grained access control
- Ticket mechanism allows temporary access delegation
- Automatic or manual replication of datasets
- Caching on fast media while archiving on slow media

<http://gonium.net/md>



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