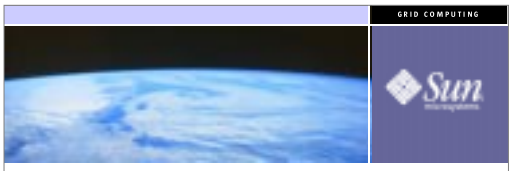
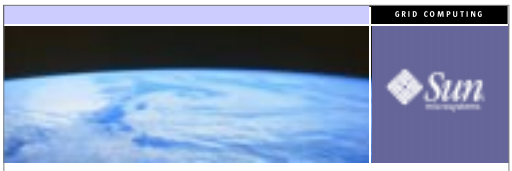


Grid Computing

An Evolutionary Strategy for Industry

Wolfgang Gentzsch
Sun Microsystems, Palo Alto, CA



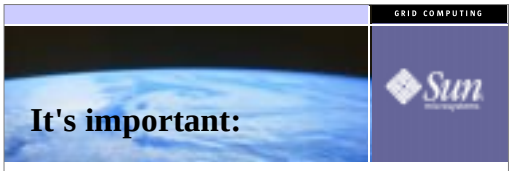
The Grid:

Next-generation Internet

Internet => World Wide Web => Great Global Grid

The Challenge:

how to transform The Grid
into customers' next-generation IT infrastructure
for Departments, Enterprises, and the Internet



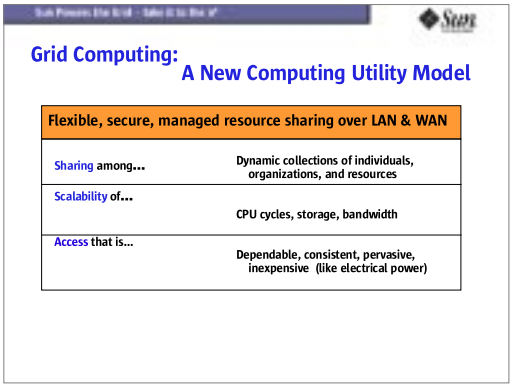
It's important:

"Grid Computing is one of the three next big things for Sun and our customers!"

Ed Zander, COO Sun Microsystems, Oct'2001

"A new era of computing based on continually active computing grids has begun, and IBM is positioned to take a lead in it."

Sam Palmisano, CEO IBM, Feb'2002

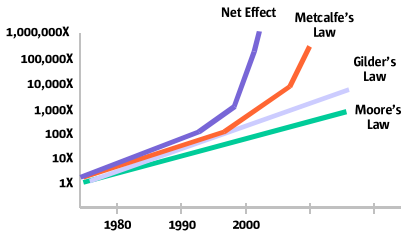


Grid Computing: A New Computing Utility Model

Flexible, secure, managed resource sharing over LAN & WAN	
Sharing among...	Dynamic collections of individuals, organizations, and resources
Scalability of...	CPU cycles, storage, bandwidth
Access that is...	Dependable, consistent, pervasive, inexpensive (like electrical power)

The Net Effect

Users x Devices x Services x Data = Opportunity



Observations

=> Grid Engine distributed resource manager powers 5,000 clusters

=> In a managed cluster, utilization is 90%, vs 30% unmanaged

=> Ease of access and job and resource mgmnt increase systems/engineer by a factor of 5

=> Productivity can increase by factor of 3 x 5 = 15

=> 70% of sales start with architecture discussion

=> Customers are concerned to adopt global grid technology

. . . result in three-stage Grid Computing strategy . . .

Grid Computing Models: Cluster Grids

Usage

- Simplest grid utilization
- Single team:
  - Project
  - Department
- Single site firewall

Benefit

- Maximum compute power for the single team

Grid Computing Models: Campus Grids

Usage

- Multiple teams in one organization share several Cluster Grids
- Single site to enterprise-wide

Benefit

- Maximum compute power for the whole organization
- Facilitates collaboration across the enterprise

Grid Computing Models: Global Grids

Usage

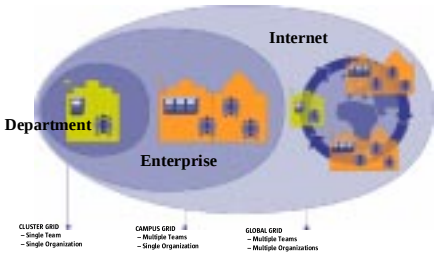
- Linked Cluster and Campus Grids across multiple organizations

Benefit

- Creates one large virtual system
- Facilitates collaboration between organizations

Grid Computing Evolution

For Increasing Customer Requirements



New Services-Centric Model

Old Focus

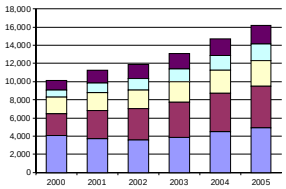
- Cycles
- Large System
- Fastest Processor
- Peak TeraFLOPS
- Heterogeneous System Access

New Focus

- Applications
- Scalability on Demand
- Ease of Use
- Continuous Availability
- Hardware Independent API's

Technical Computing Market Opportunity

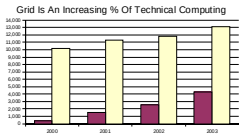
Technical Server and 64bit Workstation Market



Services and storage combined with systems: total market of ~$30B in 2005

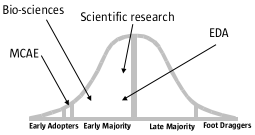
This does NOT include commercial market ($55B systems in 2005)

Grid In Technical Computing



Grid is growing at 50% AAGR

4 application segments
total over 50% of technical market
All are excellent Grid opportunities



Key Grids: 4 Main Segments +5,000 other grids

MCAE: Ford Motor Comp, USA
- 500 SunBlade 1000, 2 CPU
- 1st CPU for 24h simulations
- 2nd CPU 8h interactive, 16h simulations

Bio: Caprion Pharma, Canada
- 6800, 4800, 3800, 280R, SunBlade 100, Sun Ray,
- Sun PS services

Research: Durham Univ, UK
- SunFire 6800, 64 SunBlade 1000s, 5TB of T3 storage
- Supercomputer

EDA: Sony Semiconductor and Devices, UK
- Built Grid with existing systems in 2 days
- 60% throughput improvement

The Sun Grid Value Proposition

=> Reduce costs through better utilization

=> Getting to market quicker

=> Greater quality and innovation

=> Grow the grid with growing demands

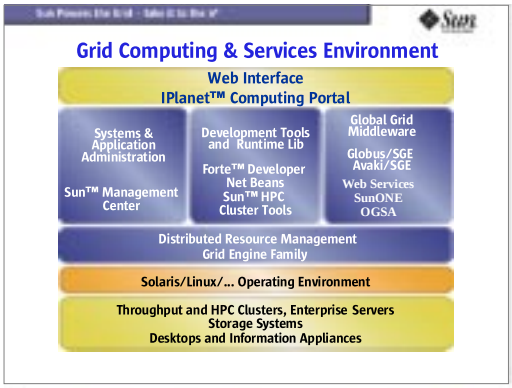
=> Do what used to be out of reach

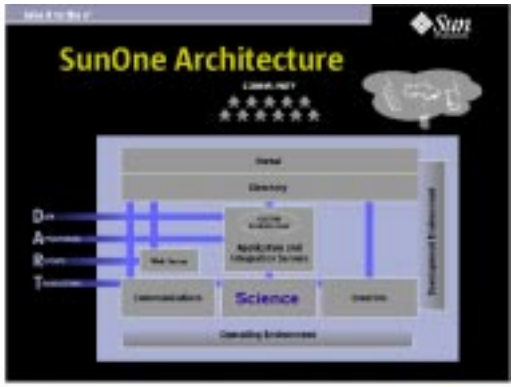
Technical vs Commercial Grids

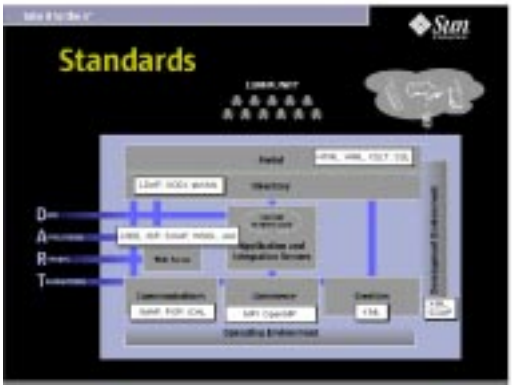
Technical Computing Grids
- High Performance
- High Performance
- High Performance
- Collaboration
- Communication

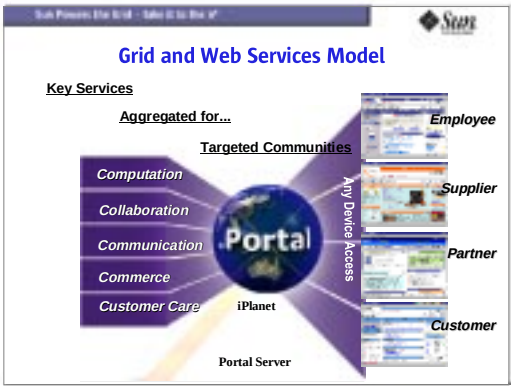
Commercial Grids
- ...
- Scalability
- Manageability
- Availability
- Reliability
- Transparency

> SMART

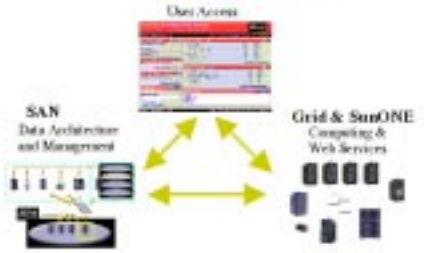

Grid Computing & Services Environment
Web Interface
IPlanet™ Computing Portal
Systems & Application Administration
Sun™ Management Center
Development Tools and Runtime Lib
Forte™ Developer
Net Beans
Sun™ HPC Cluster Tools
Global Grid Middleware
Globus/SGE
Avaki/SGE
Web Services
SunONE
OGSA
Distributed Resource Management
Grid Engine Family
Solaris/Linux/... Operating Environment
Throughput and HPC Clusters, Enterprise Servers
Storage Systems
Desktops and Information Appliances


SunOne Architecture
Science


Standards


Grid and Web Services Model
Key Services
Aggregated for...
Targeted Communities
Computation
Collaboration
Communication
Commerce
Customer Care
Portal
iPlanet
Portal Server
Any Device Access
Employee
Supplier
Partner
Customer

Portal for Grid and Web Services



TCP Highlights

- Dynamic project directory creation
- Job Submission (no UNIX required)
- Dynamic Job Status Review
- Accounting capabilities
- Applications can be moved to the Internet in minutes
- X-window visualization capabilities

TCP in Summary

TCP is a new, technology-based innovation offered only by Sun
- Combines portal capabilities, resource management software, and new point-and-click tools

Brings the operating advantages of portal technology to the HPTC community
- Single, integrated interface to HPTC applications, eServices, and content
- Secure anytime, anywhere access
- Expanded user community (enterprise-wide, partners, suppliers)

Offers simplified access by users to HPTC applications (no UNIX skills required)

The Cluster Grid

CLUSTER GRID
$50K - $5Mio

Ford, Rover, Saab, Synopsys, Motorola, Ulm, Sony, Caprion, Cognigen, Durham, Budapest, Dreamworks,...

Grid Engine Objectives

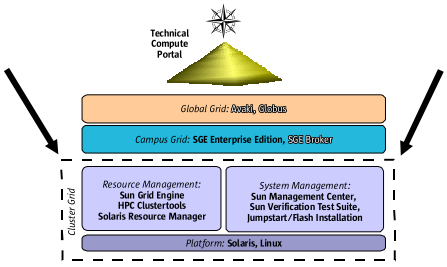
- Standard Load Management System -

- Simplify job management and monitoring
- Centralize control of enterprise-wide networked resources
- Flexible job scheduling
- Scheduling on job characteristics
- Use free resources (such as night and weekend resources)

Funded by CEC Framework III & IV

Cluster Grid Software Stack 1.0

Beowulf for Lintel, Sun ClusterGrid for Solaris



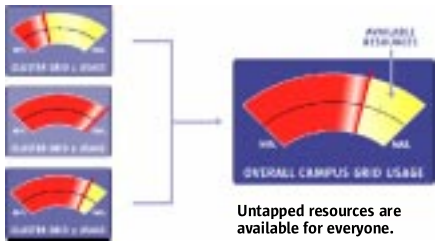
The Campus Grid

BMW, Oxford, Sun Micro, Texas TACC, SDSC, ...

CAMPUS GRID
$500K - $10Mio

Aachen, Brisbane, EPFL, Caspur, HPCVL, Houston,...

Why Campus Grid Model?



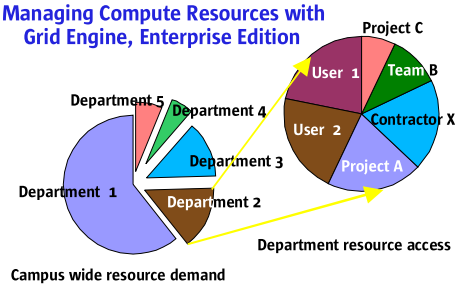
Untapped resources are available for everyone.

Grid Engine, Enterprise Edition
- Resource Management System -

- Equitable usage of resources (fair share)
- Meet priority needs of enterprise (policies)
- Guarantee required resources
- Meet time dominant needs
- Automation of resource management
- Full control over resource utilization

Funded by CEC Framework III & IV

Managing Compute Resources with Grid Engine, Enterprise Edition



The Global Grid

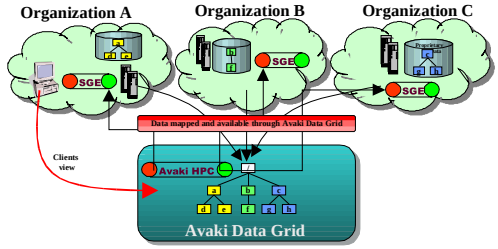
Today: Research oriented

EPCC Edinburgh, Imperial Col., Manchester, UC London, Poznan, Cracow, Sengent, OSC Ohio, ...

Global GRID $????

Globus & Avaki over multiple SGE Clusters

1. SGE does cluster management within an administrative domain and file system area
2. Globus/Avaki knits together resources, handles files, binary management, and high level resource selection (which SGE cluster to use)



What Sun Is Doing In Grid

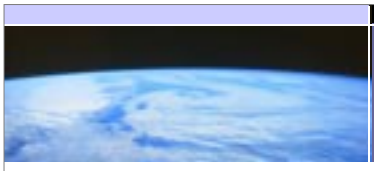
Sun Grid Engine
- Free download since 9/00
- 5,000 Grids; 65% Solaris, 35% Linux
- 60% new to Grid; 92% like SGE

Sun Grid Engine Enterprise Edition
- Beta test Nov 2001; FCS Q4 FY02

Global Grid Strategy
- Work, partner with Globus and Avaki

Other Initiatives
- Open source project
- DRMAA standards initiative through GGF
- Support Web Services and OGSA
- Grid Certification training
  - Trained ~300 people; 30 certified partners worldwide
- Grid software stack
  - Under development; blueprints being created

GRID COMPUTING



Wolfgang.Gentzsch@sun.com

http://www.sun.com/grid