
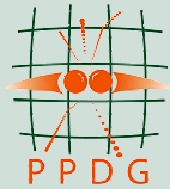
 **PARTICLE PHYSICS DATA GRID** 
and
Grid2003

D. Olson, LBNL

19 Mar. 2004

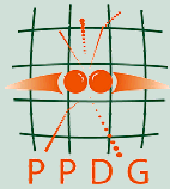
KISTI Visit



Contents



- Overview of PPDG
- Strategy for making grid (eScience) truly effective
- Accomplishments
- Grid2003 & 3+ - Today's shared grid infrastructure
- Current topics for KISTI

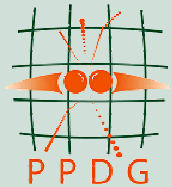


Contents



- Overview of PPDG
- Strategy for making grid (eScience) truly effective
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What's that flower? - A Trillium.
Represents the three US physics grid projects, PPDG funded by DOE, and GriPhyN and iVDGL funded by NSF.



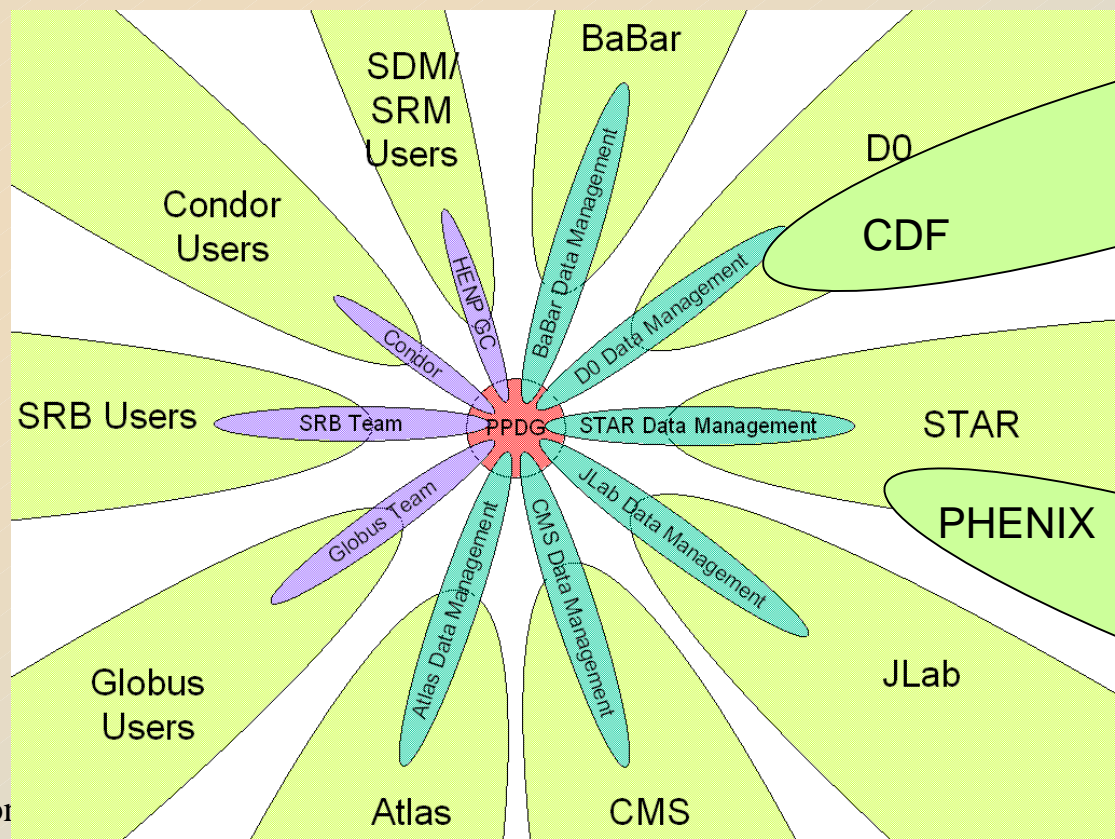
Particle Physics Data Grid



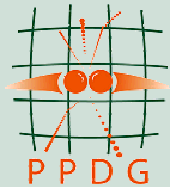
www.ppdg.net

- PI's - Mount, Livny, Newman, Pordes
- Exec. Team - Pordes, Livny, Olson
- HEP
 - ATLAS
 - BaBar
 - CMS
 - D0 (+CDF)
- NP
 - JLab
 - STAR (+PHENIX)
 - ALICE
- CS
 - Condor
 - Globus
 - SDM/SRM
 - SRB

Integrating data grid technology with HEP and NP applications to enable world-wide scientific data analysis, in partnership with GriPhyN, iVDGL (Trillium).



D. Olson

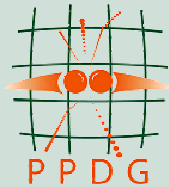


PPDG history

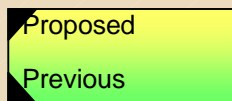
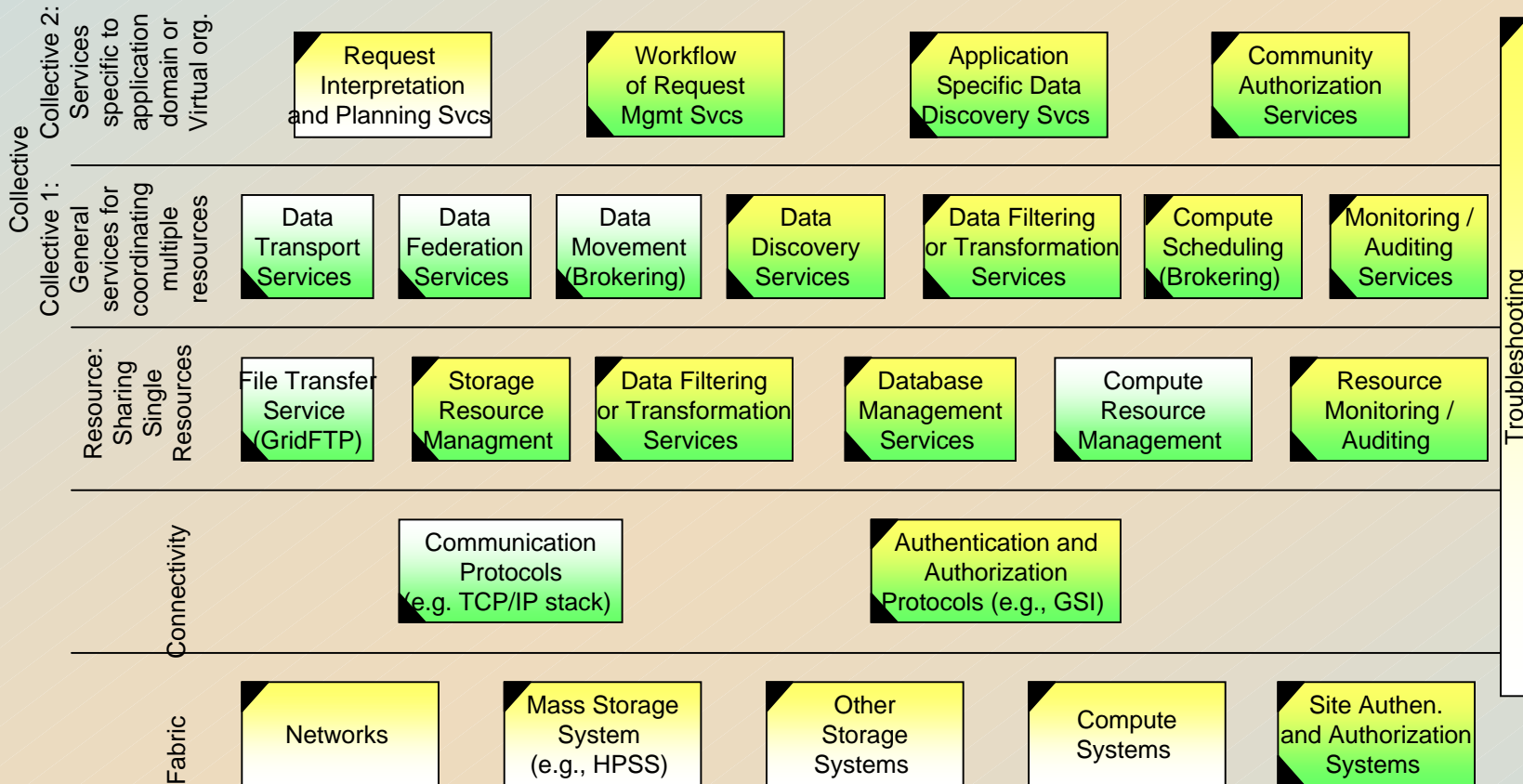


- Collaboration formed in 1999 with NGI funding
 - ATLAS, BaBar, CMS, D0 (HEP experiments)
 - Globus, Condor, SDM, SRB (Computer Science teams)
- Survived 2000 on interim funding
- SciDAC* funding in 2001 (\$3.2M/yr)
 - Include STAR and JLab (Nuclear physics experiments)
- SciDAC renewal proposed in 2004 (2 years)
 - Add emphasis on shared grid fabric of DOE lab computing facilities

* SciDAC - 5 year program across DOE Science Scientific Discovery from Advanced Computing

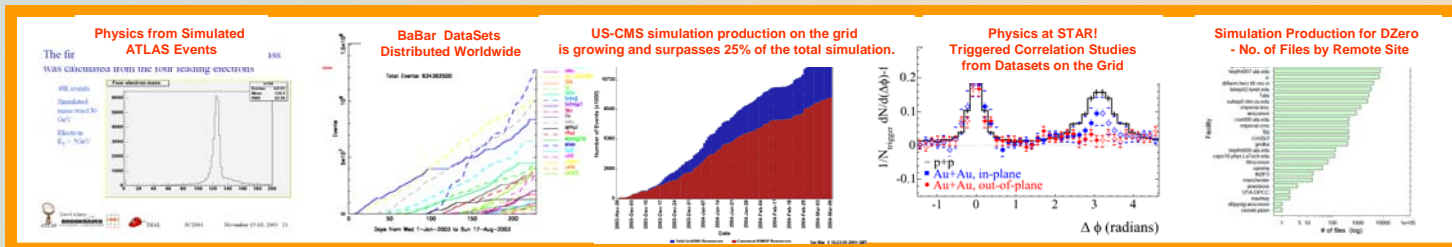


PPDG program of work, past & future

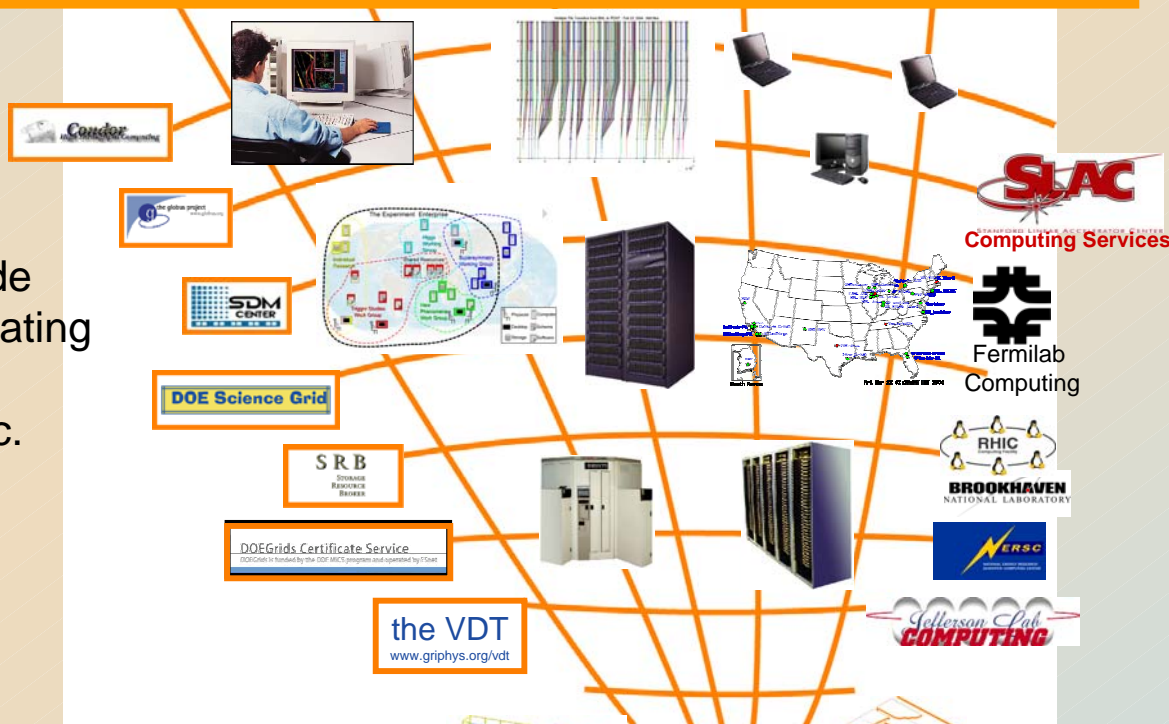


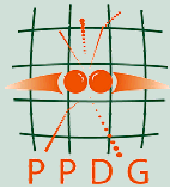
Legend - "Proposed" identifies new work areas and "Previous" identifies areas with significant accomplishments.

Integrating experiments, middleware, and facilities to enable frontier science for international virtual organizations



Previously PPDG has focused on grid-enabling experiment end-to-end applications. Now we include a strong emphasis on integrating computing facilities into a shared grid computing fabric.

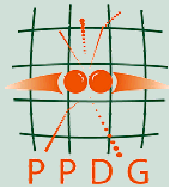




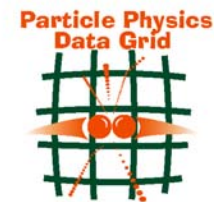
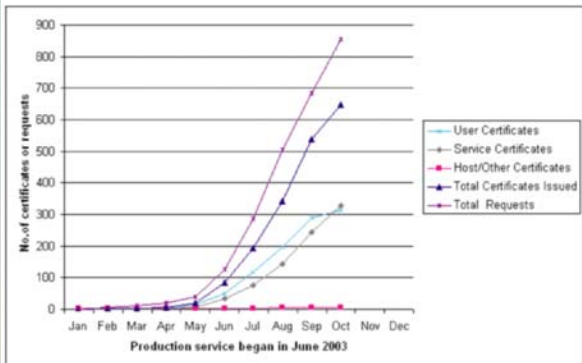
PPDG Strategy



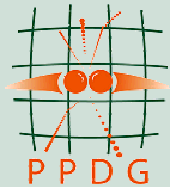
- Fund both application and computer science effort primarily for integration work
 - Pure development effort for applications and grid middleware comes from other sources
 - Application scientists need short term payoff if no explicit funding
- Initial focus on forming pairwise experiment-computer science teams
 - CMS-Condor, STAR-SRM, BaBar-SRB, ATLAS-Globus, ...
 - Bridge the cultural divide between CS and physicists
- Promote broader common projects across experiments
- Promote international PKI federation
- Promote adoption of common middleware across applications
 - All PPDG experiments now using VDT middleware distribution



DOE Grids PKI Federation



DOE Science Grid deployed a Certificate Authority to the international PKI federation that enables scientific collaborations between US DOE, NSF and European colleagues. This new CA started this summer and builds on the large installed base of 650 DOE Science Grid issued certificates.



VDT - now more than Virtual Data Toolkit from GriPhyN



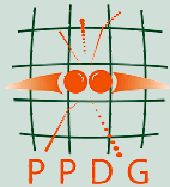
- [Chimera Virtual Data System, v1.2.3](#)
- [Condor/Condor-G 6.6.1](#)
 - [VDT Condor configuration script](#)
- [Fault Tolerant Shell, v2.0.2](#)
- [Globus Toolkit, v2.4.3](#) + [patches](#) (gatekeeper, MDS, GSIFTP, etc.)
 - Alternative Globus Gatekeeper with [authorization callout](#)
 - Globus 2.4.3 replica management
 - [VDT Globus configuration script](#)
 - CA signing policies / tools for the [Globus, DOE and EDG CAs](#)
 - Glue CE, SE, CESEBind Schemas, and information providers
 - Glue CE Schema 1.1 (CVS version 1.2, 23-June-2003) (includes Core Schema, CE Schema and LCG-DataTAG Extensions for monitoring)
 - Glue SE Schema 1.1 (CVS version 1.5, 29-July-2003)
 - Glue CESEBind Schema 1.1 (CVS version 1.2, 29-July-2003)
 - Glue basic information providers 1.1 (CVS version 1.79, 25-July-2003)
 - A basic Glue static information setup
 - [More information about Glue](#)
 - EDG mkggridmap 2.1.0 and related perl modules
 - EDG CRL Update
- [GSI OpenSSH, v3.0](#)
- [Java JDK-1.4.1](#)
- [KX509](#)
- [MonaLisa, v0.95](#)
- [MyProxy 1.11](#)
- [PyGlobus, v1.0](#)
- [UberFTP-Client, v1.3](#)
- [RLS, v2.1.4](#) (MySQL/ODBC optional)
- [VDT Version](#)
- [VDT System Profiler](#)

VDT SDK

- [Globus 2.4.3 SDK](#) + advisories
- [ClassAds 0.9.5](#)
- [RLS 2.1.4 SDK](#)
- [PyGlobus, v1.0](#)
- [Netlogger 2.2](#)
- A Netlogger-instrumented globus-url-copy look-alike program (written in python).
- [VDT Version](#)
- [VDT System Profiler](#)

Other optional packages (actual Pacman package names specified in **bold**)

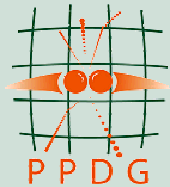
- **Globus-LSF-Setup** - configures GRAM jobmanager/reporter for LSF
- **Globus-PBS-Setup** - configures GRAM jobmanager/reporter for PBS
- **Globus-RLS-Server-Setup-MySQL** - installs [MySQL](#), ODBC and sets up MySQL databases for RLS
- **FBSNG** - [Farms Batch System Next Generation](#)
- **VDT-Test** - [VDT Certification Tests](#)



More Strategy



- Engaged site security personnel in 2003 at 5 DOE labs with seed funding (\$100K/lab)
 - PPDG-SiteAAA project
 - Initiated Global Grid Forum SiteAAA working group
 - Grid security issues are not solved and not trivial
- Now engaging computer facility personnel at 5 DOE labs
 - No extra \$ but directing 25% PPDG effort toward shared grid implementation plus 1 FTE dedicated
- Consider next two years preparation for a persistent shared science grid fabric in the US
 - Open Science Grid (www.opensciencegrid.org)
 - Many operational & funding issues still to be worked out
 - Grid Operations Center(s) distinct from any single computer center
 - Incident handling
 - Support of middleware
 - Accounting and allocations
 - ...



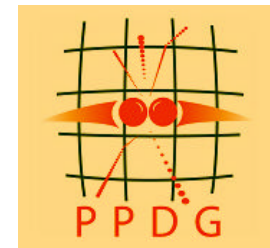
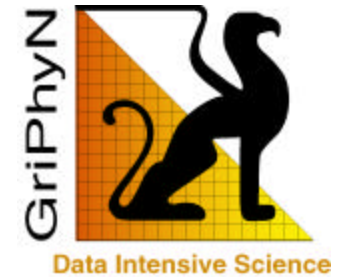
Accomplishments



- Site security staff are engaged and knowledgeable about grid
- Physics experiments are reliably and securely moving TB/day around the world
- Simulation production running with reasonable efficiency (more in Grid2003)
- International PKI security federation established
 - More later about APGrid PMA and including KISTI CA in Grid3+

Grid2003: Using Grids for Science

Paul Avery
University of Florida
avery@phys.ufl.edu

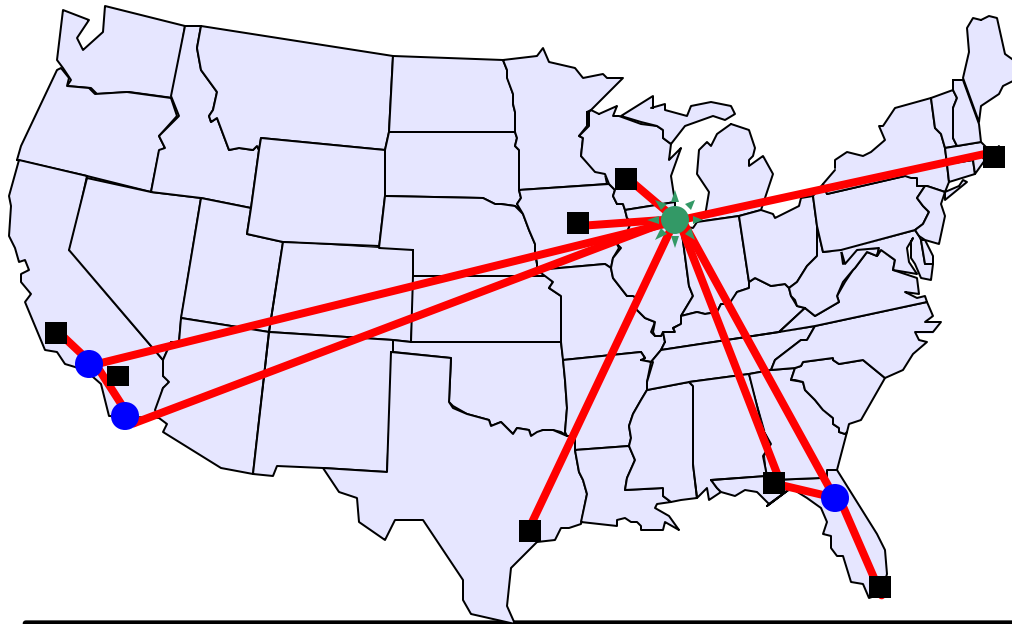


**HEPAP Meeting
Washington, DC
February 10, 2004**



The Grid Concept

- ✍ Grid: Geographically distributed computing resources configured for coordinated use
 - ✍ Fabric: Physical resources & networks provide raw capability
 - ✍ Ownership: Resources *controlled* by owners and *shared* w/ others
 - ✍ Middleware: Software ties it all together: tools, services, etc.
- ✍ Goal: Transparent resource sharing



US-CMS
"Virtual Organization"



Science Drivers for U.S. HEP Grids

✍ LHC experiments
✍ 100s of Petabytes

✍ Current HENP experiments
✍ ~1 Petabyte (1000 TB)

✍ LIGO
✍ 100s of Terabytes

✍ Sloan Digital Sky Survey
✍ 10s of Terabytes

Future Grid resources

✍ Massive CPU (PetaOps)
✍ Large distributed datasets (>100PB)
✍ Global communities (1000s)

2009

2007

2005

2003

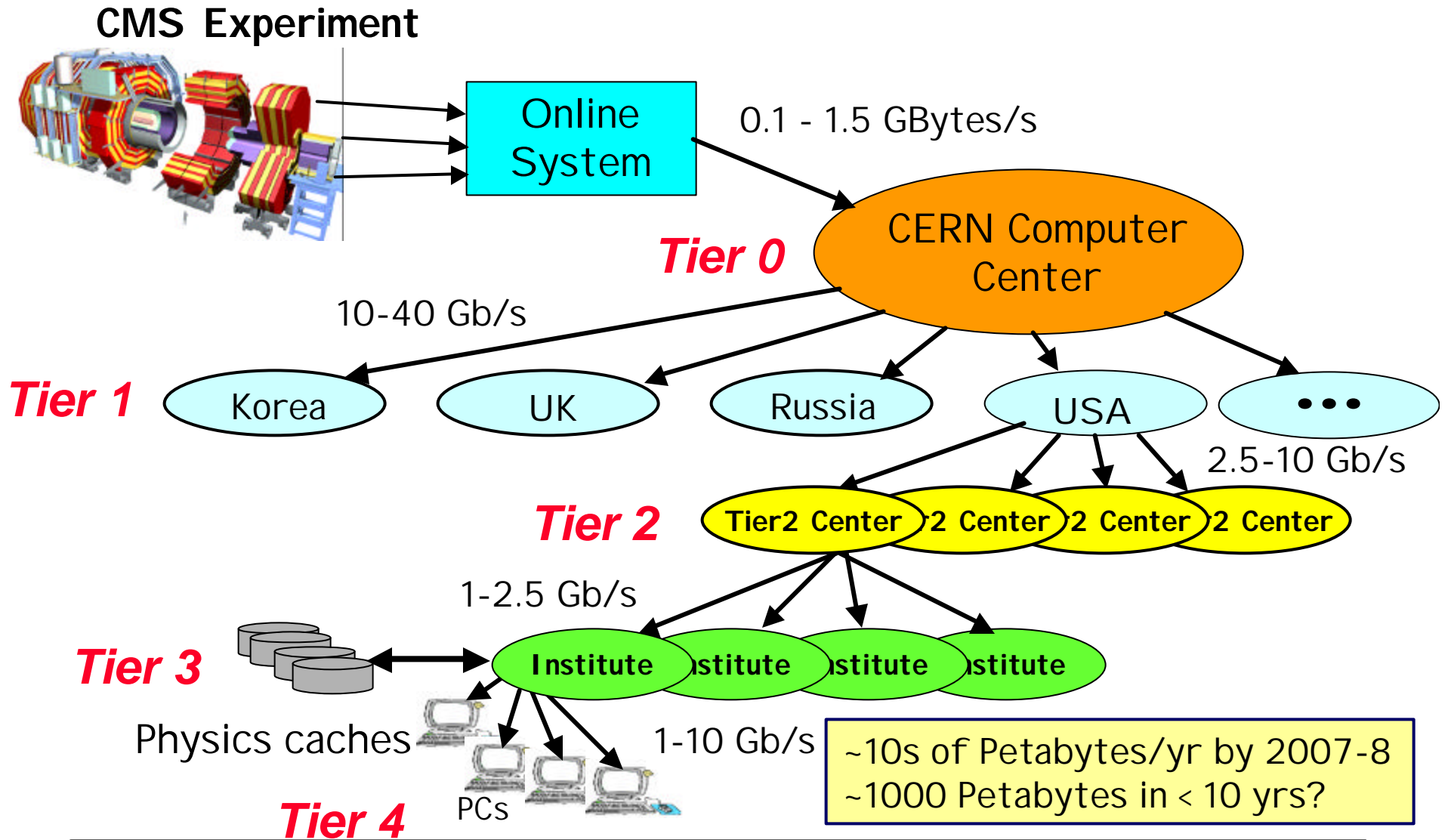
2001

Data growth

Community growth



Global LHC Data Grid Hierarchy





Global Context of Data Grid Projects

Main HEP projects

U.S. Projects

- ✍ GriPhyN (NSF)
- ✍ iVDGL (NSF)
- ✍ Particle Physics Data Grid (DOE)
- ✍ PACs and TeraGrid (NSF)
- ✍ DOE Science Grid (DOE)
- ✍ NEESgrid (NSF)
- ✍ NSF Middleware Initiative (NSF)

EU, Asia projects

- ✍ European Data Grid (EU)
- ✍ EDG-related national Projects
- ✍ DataTAG (EU)
- ✍ LHC Computing Grid (CERN)
- ✍ EGEE (EU)
- ✍ CrossGrid (EU)
- ✍ GridLab (EU)
- ✍ Japanese, Korea Projects

- ✍ **Not exclusively HEP**
- ✍ **But most driven/led by HEP (with CS)**
- ✍ **Many 10s x \$M brought into the field**



"Trillium": U.S. Physics Grid Projects

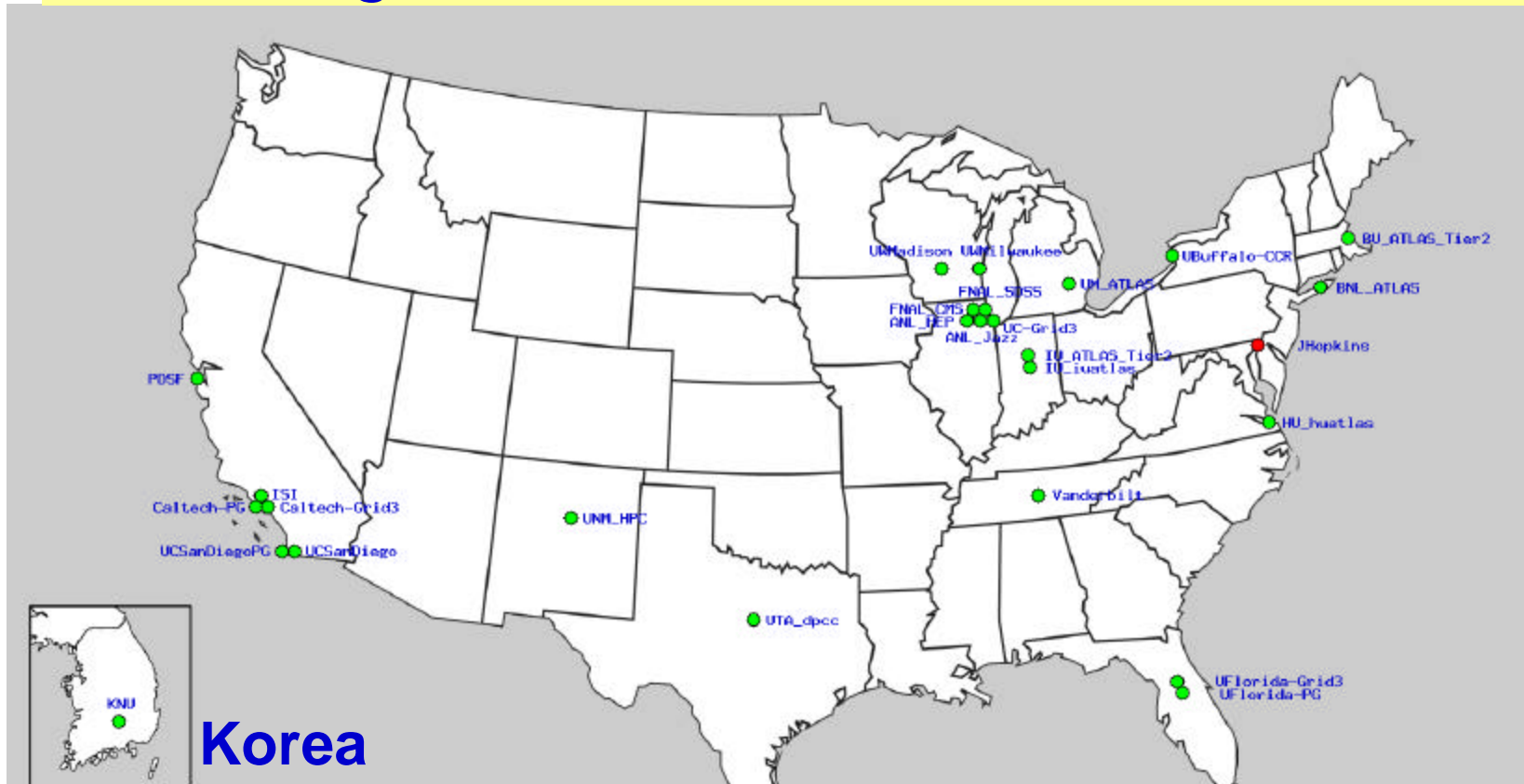
- ✍ Trillium = PPDG + GriPhyN + iVDGL
 - ✍ Large overlap in leadership, people, experiments
 - ✍ HEP members are main drivers, esp. LHC experiments
- ✍ Benefit of coordination
 - ✍ Common software base + packaging: VDT + PACMAN
 - ✍ Collaborative / joint projects: monitoring, demos, security, ...
 - ✍ Wide deployment of new technologies, e.g. Virtual Data
- ✍ Forum for US Grid projects
 - ✍ Joint strategies, meetings and work
 - ✍ Unified U.S. entity to interact with international Grid projects
- ✍ Build significant Grid infrastructure: Grid2003





Grid2003: An Operational Grid

- 28 sites (2100-2800 CPUs)
- 400-1300 concurrent jobs
- 10 applications
- Running since October 2003



Korea

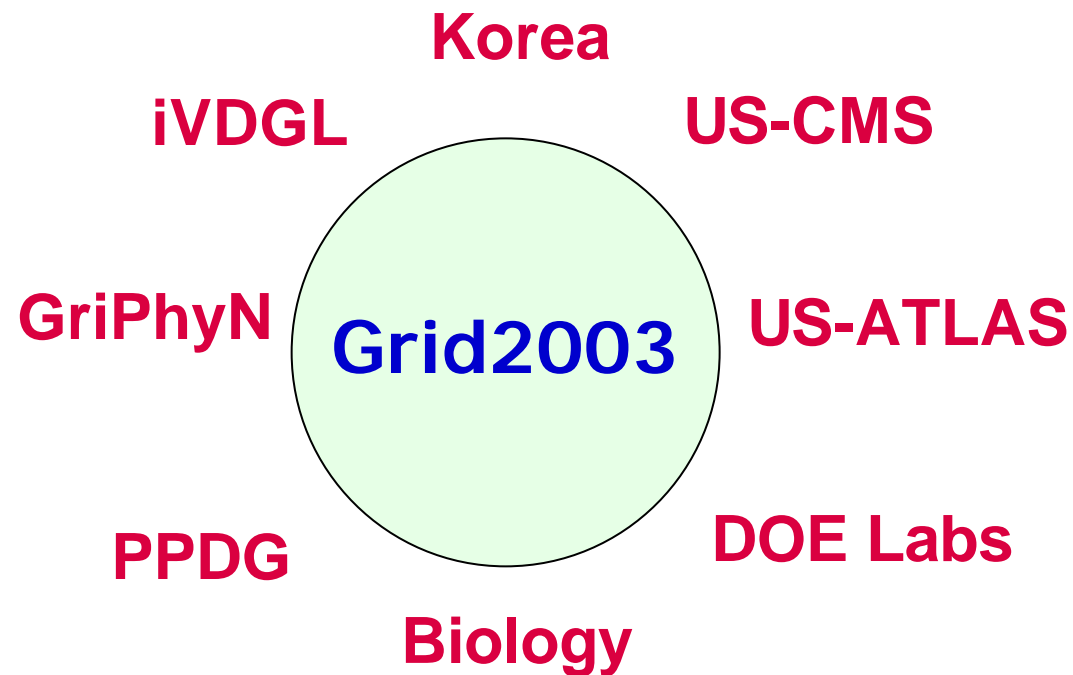


South Korea

<http://www.ivdgl.org/grid2003>



Grid2003 Participants





Grid2003 Applications

✍ High energy physics

- ✍ US-ATLAS analysis (DIAL),
- ✍ US-ATLAS GEANT3 simulation (GCE)
- ✍ US-CMS GEANT4 simulation (MOP)
- ✍ BTeV simulation

✍ Gravity waves

- ✍ LIGO: blind search for continuous sources

✍ Digital astronomy

- ✍ SDSS: cluster finding (maxBcg)

✍ Bioinformatics

- ✍ Bio-molecular analysis (SnB)
- ✍ Genome analysis (GADU/Gnare)

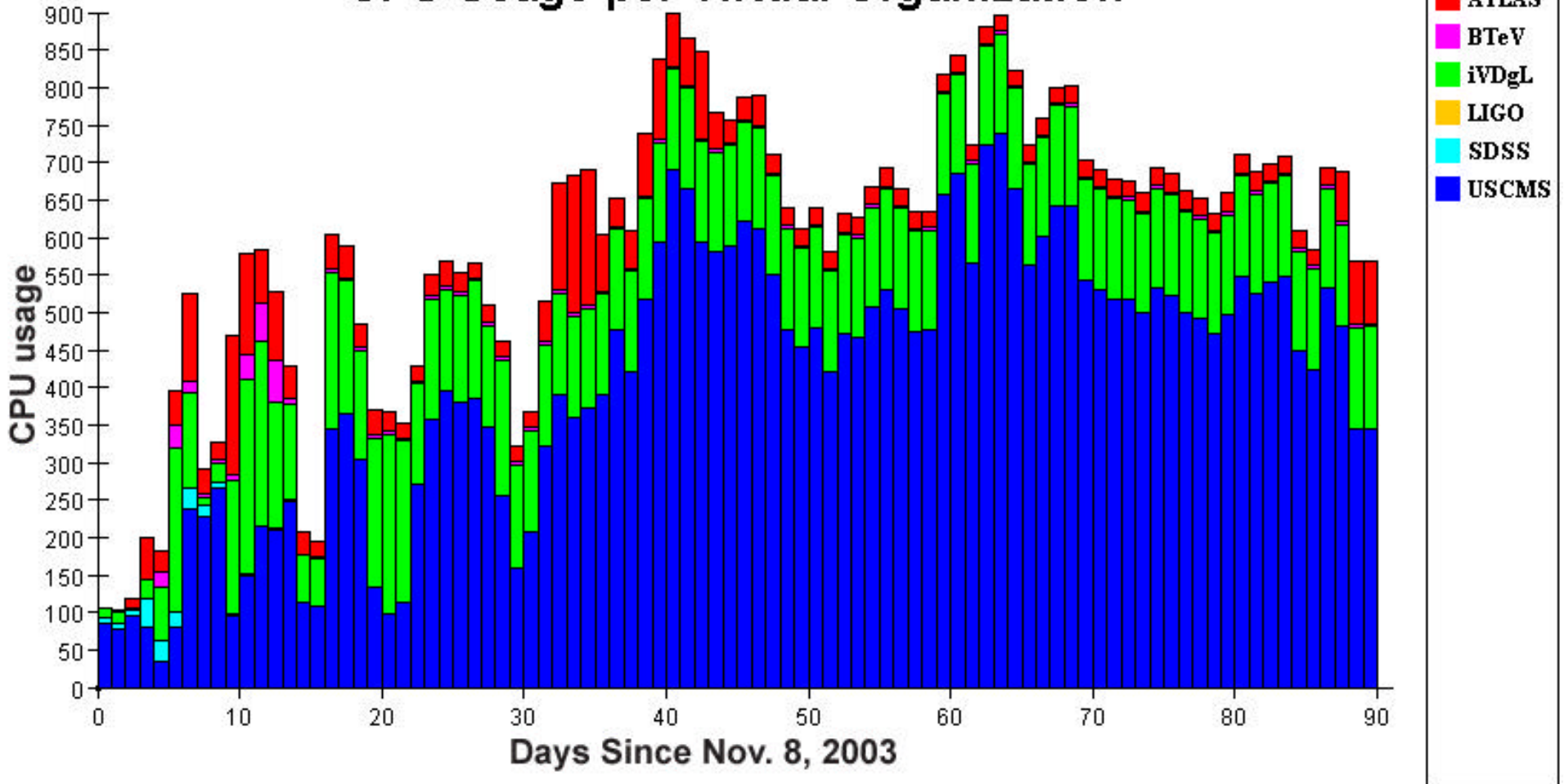
✍ CS Demonstrators

- ✍ Job Exerciser, GridFTP, NetLogger-grid2003



Grid2003: Three Months Usage

CPU Usage per Virtual Organization





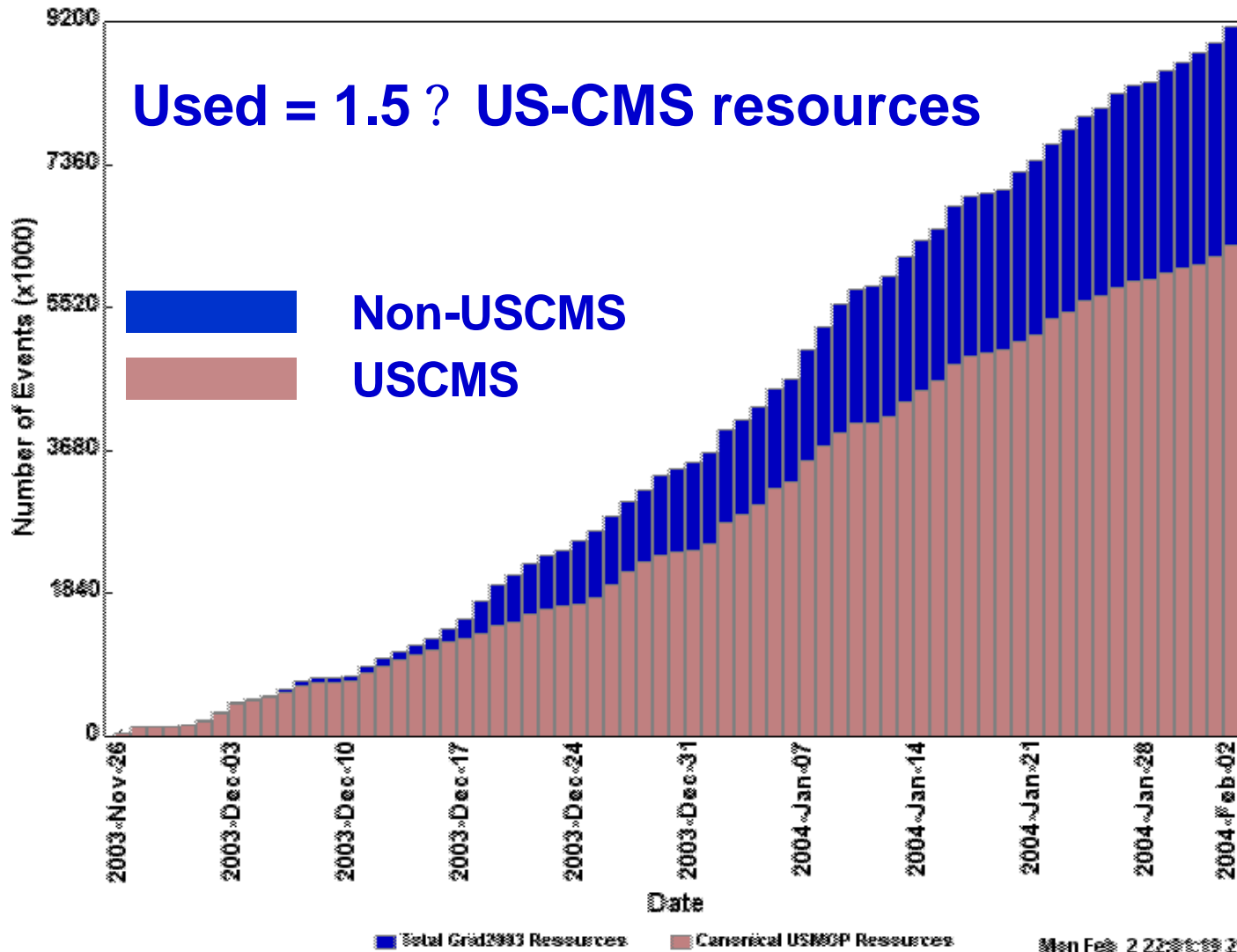
Grid2003 Success

- ✍ Much larger than originally planned
 - ✍ More sites (28), CPUs (2800), simultaneous jobs (1300)
 - ✍ More applications (10) in more diverse areas
- ✍ Able to accommodate new institutions & applications
 - ✍ U Buffalo (Biology) Nov. 2003
 - ✍ Rice U. (CMS) Feb. 2004
- ✍ Continuous operation since October 2003
 - ✍ Strong operations team (iGOC at Indiana)
 - ✍ US-CMS using it for production simulations (next slide)



Production Simulations on Grid2003

US-CMS Monte Carlo Simulation





Grid2003: A Necessary Step

✍ Learning how to operate a Grid

- ✍ Add sites, recover from errors, provide info, update, test, etc.
- ✍ Need tools, services, procedures, documentation, organization
- ✍ Need reliable, intelligent, skilled people

✍ Learning how to cope with "large" scale

- ✍ "Interesting" failure modes as scale increases
- ✍ Increasing scale must not overwhelm human resources

✍ Learning how to delegate responsibilities

- ✍ Multiple levels: Project, Virtual Org., service, site, application
- ✍ Essential for future growth

✍ **Grid2003 experience critical for building "useful" Grids**

✍ **Frank discussion in "Grid2003 Project Lessons" doc**



Grid2003 Lessons (1): Investment

✍ Building momentum

- ✍ PPDG 1999
- ✍ GriPhyN 2000
- ✍ iVDGL 2001
- ✍ Time for projects to ramp up

✍ Building collaborations

- ✍ HEP: ATLAS, CMS, Run 2, RHIC, Jlab
- ✍ Non-HEP: Computer science, LIGO, SDSS
- ✍ Time for collaboration sociology to kick in

✍ Building testbeds

- ✍ Build expertise, debug Grid software, develop Grid tools & services
- ✍ US-CMS 2002 – 2004+
- ✍ US-ATLAS 2002 – 2004+
- ✍ WorldGrid 2002 (Dec.)



Grid2003 Lessons (2): Deployment

- ✍ Building something useful draws people in
 - ✍ (Similar to a large HEP detector)
 - ✍ Cooperation, willingness to invest time, striving for excellence!
- ✍ Grid development requires significant deployments
 - ✍ Required to learn what works, what fails, what's clumsy, ...
 - ✍ Painful, but pays for itself
- ✍ Deployment provides powerful training mechanism



Grid2003 Lessons (3): Packaging

- ✍ Installation and configuration (VDT + Pacman)
 - ✍ Simplifies installation, configuration of Grid tools + applications
 - ✍ Major advances over 13 VDT releases
- ✍ A strategic issue and critical to us
 - ✍ Provides uniformity + automation
 - ✍ Lowers barriers to participation ? scaling
 - ✍ Expect great improvements (Pacman 3)
- ✍ Automation: the next frontier
 - ✍ Reduce FTE overhead, communication traffic
 - ✍ Automate installation, configuration, testing, validation, updates
 - ✍ Remote installation, etc.



Grid2003 and Beyond

- ✍ Further evolution of Grid3: (Grid3+, etc.)
 - ✍ Contribute resources to persistent Grid
 - ✍ Maintain development Grid, test new software releases
 - ✍ Integrate software into the persistent Grid
 - ✍ Participate in LHC data challenges
- ✍ Involvement of new sites
 - ✍ New institutions and experiments
 - ✍ New international partners (e.g., Brazil, Taiwan, ...)
- ✍ Improvements in Grid middleware and services
 - ✍ Integrating multiple VOs
 - ✍ Monitoring
 - ✍ Troubleshooting
 - ✍ Accounting
 - ✍ ...

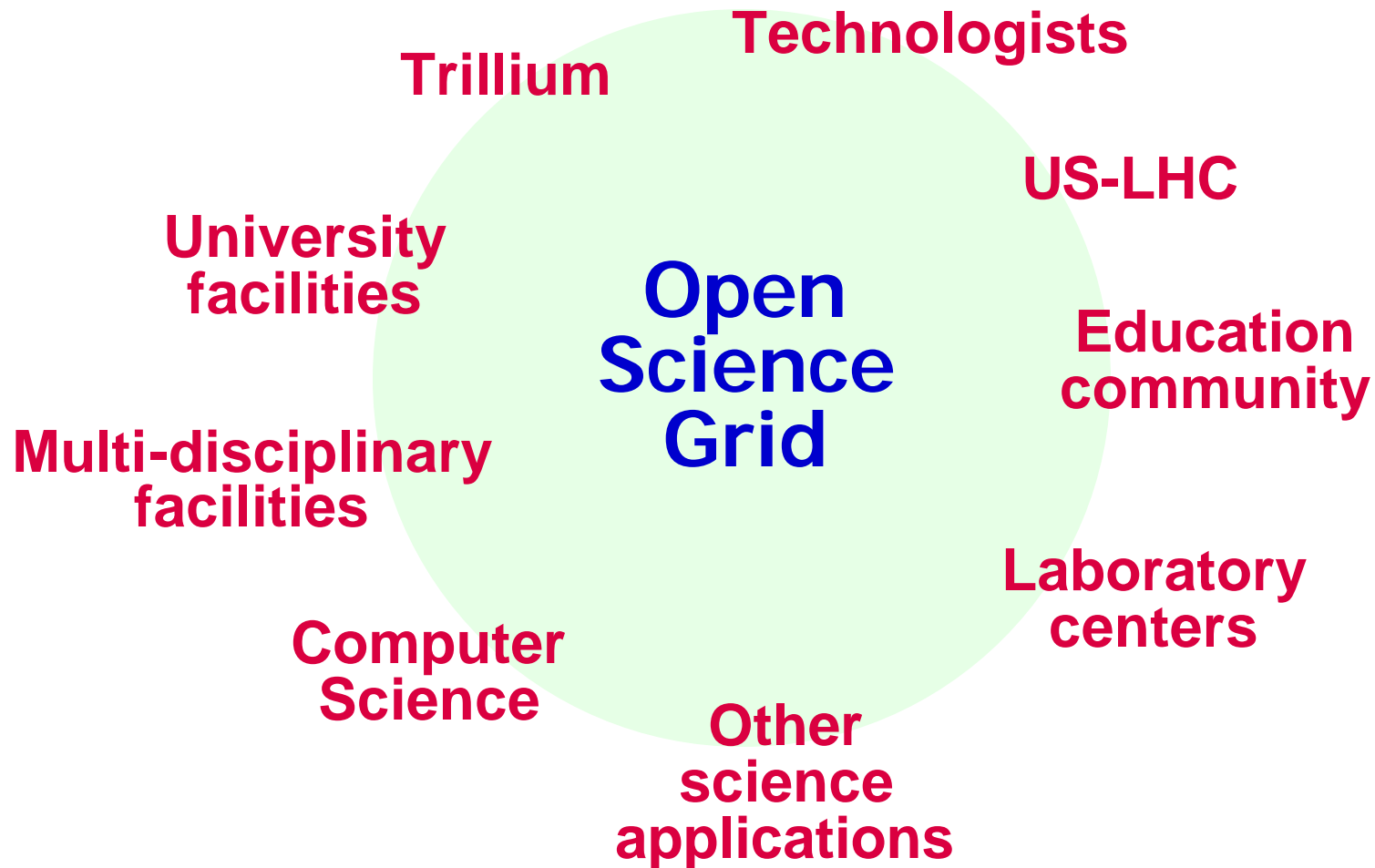


Open Science Grid

- ✍ **Goal: Build an integrated Grid infrastructure**
 - ✍ Support US-LHC research program, other scientific efforts
 - ✍ Resources from laboratories and universities
 - ✍ Federate with LHC Computing Grid
- ✍ **Getting there: OSG-1 (Grid3+), OSG-2, ...**
 - ✍ Series of releases ? increasing functionality & scale
 - ✍ Constant use of facilities for LHC production computing
- ✍ **Jan. 12 meeting in Chicago**
 - ✍ Public discussion, planning sessions
- ✍ **Next steps**
 - ✍ Creating interim Steering Committee (now)
 - ✍ White paper to be expanded into roadmap
 - ✍ Presentation to funding agencies (April/May?)



Inputs to Open Science Grid





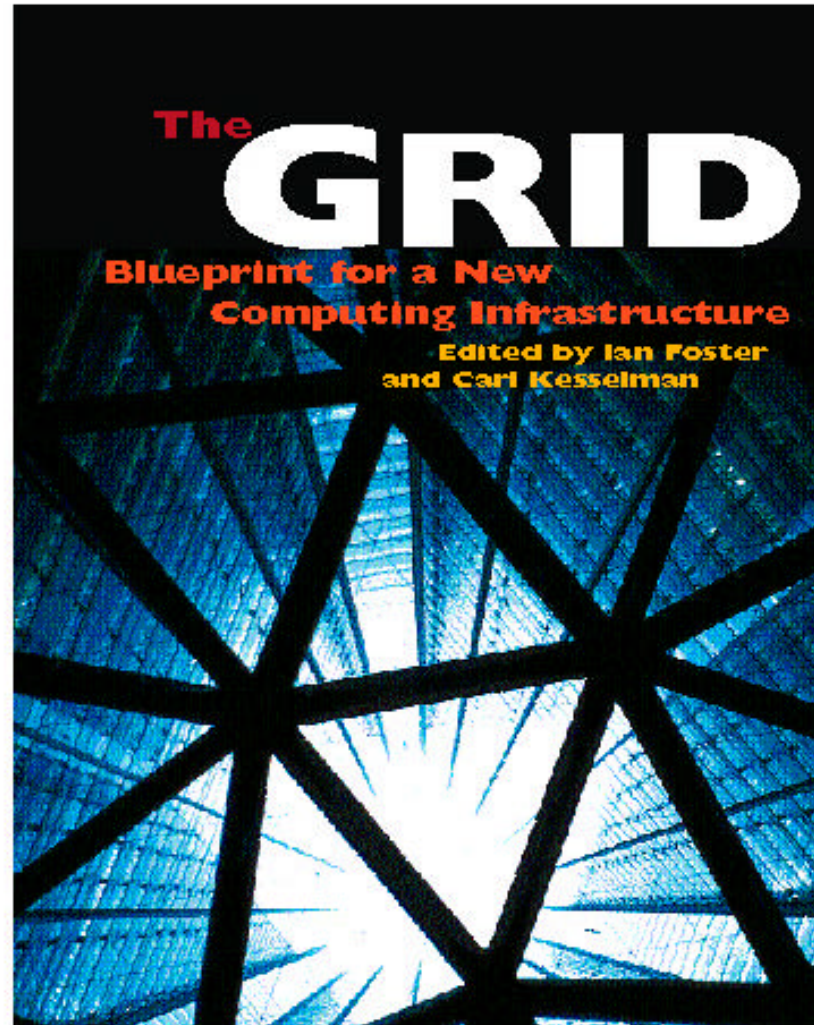
Grids and HEP's Broad Impact

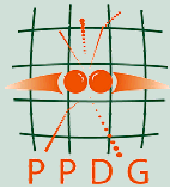
- ✍ Grids enable 21st century collaborative science
 - ✍ Linking research communities and resources for scientific discovery
 - ✍ Needed by LHC global collaborations pursuing “petascale” science
- ✍ HEP Grid projects driving important network developments
 - ✍ Recent US – Europe “land speed records”
 - ✍ ICFA-SCIC, I-HEPCCC, US-CERN link, ESNET, Internet2
- ✍ HEP has recognized leadership in Grid development
 - ✍ Many national and international initiatives
 - ✍ Partnerships with other disciplines
 - ✍ Extensive education and outreach efforts
 - ✍ Influencing funding agencies (NSF, DOE, EU)
- ✍ Grid2003 and its successors will provide a scalable computing infrastructure for scientific research



Grid References

- ✎ Grid2003
 - ✎ www.ivdgl.org/grid2003
- ✎ Globus
 - ✎ www.globus.org
- ✎ PPDG
 - ✎ www.ppdg.net
- ✎ GriPhyN
 - ✎ www.griphyn.org
- ✎ iVDGL
 - ✎ www.ivdgl.org
- ✎ LCG
 - ✎ www.cern.ch/lcg
- ✎ EU DataGrid
 - ✎ www.eu-datagrid.org
- ✎ EGEE
 - ✎ egee-ei.web.cern.ch





Current KISTI Issues



- This week starting discussion of including KISTI CA in Grid3+ for HEP applications
 - Dongchul Son (son@bh.knu.ac.kr)
 - Kihyeon Cho (cho@bh.knu.ac.kr)
- Yoshio Tanaka organizing ApGrid PMA (Policy Management Authority) for Asia Pacific region
 - <https://sf280.hpcc.jp/CA/CertificateAuthorities.html>
- We need KISTI CA to develop policy statement (CP) for ApGrid so it can be evaluated
- Eventually to include KISTI CA files in VDT distribution along with DOEGrids and European CAs.