HENP Networks and the HENP Networking WG

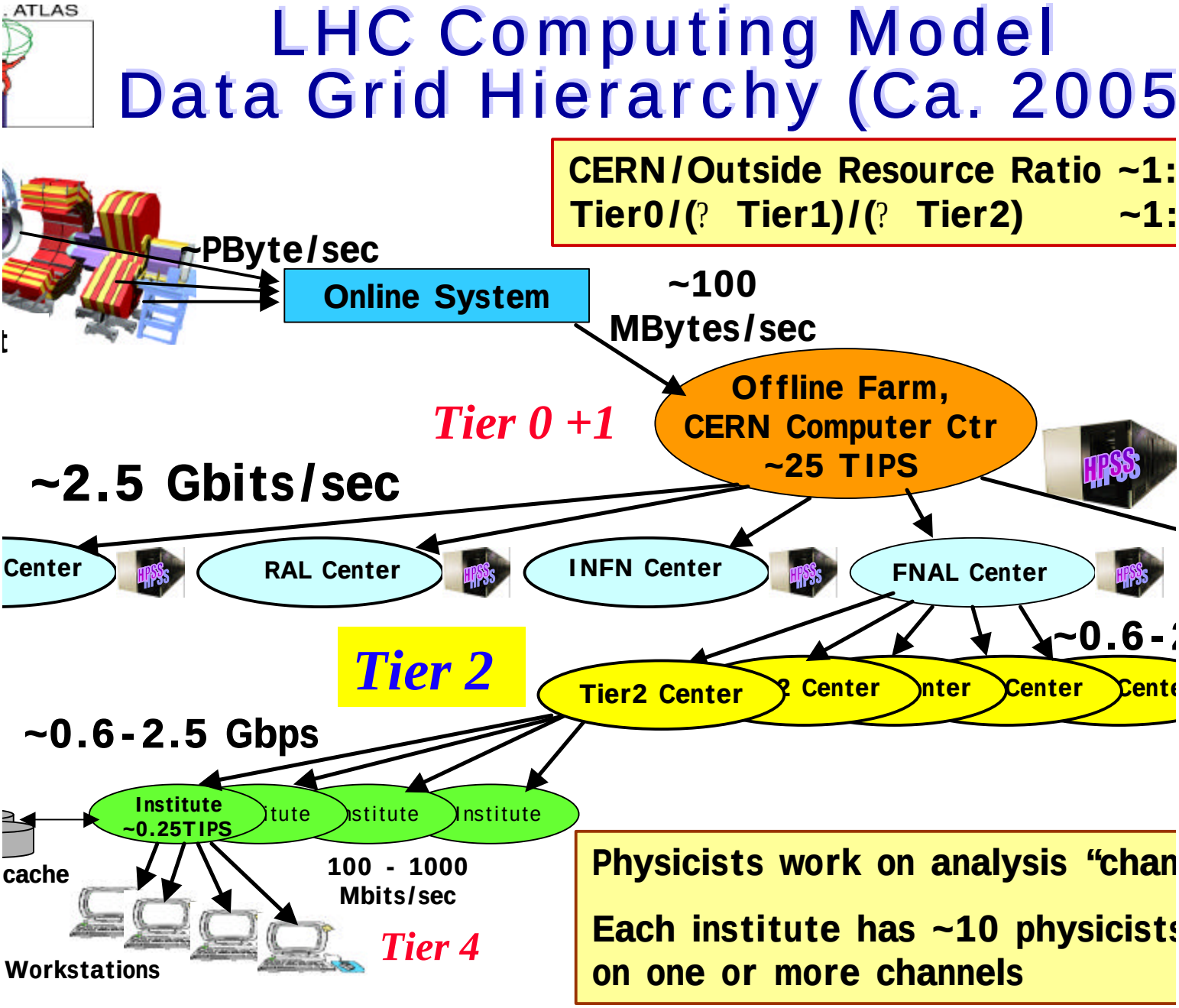
PPDG Meeting, Wisconsin

Harvey B Newman
California Institute of Technology
August 15, 2001

It's the Network !

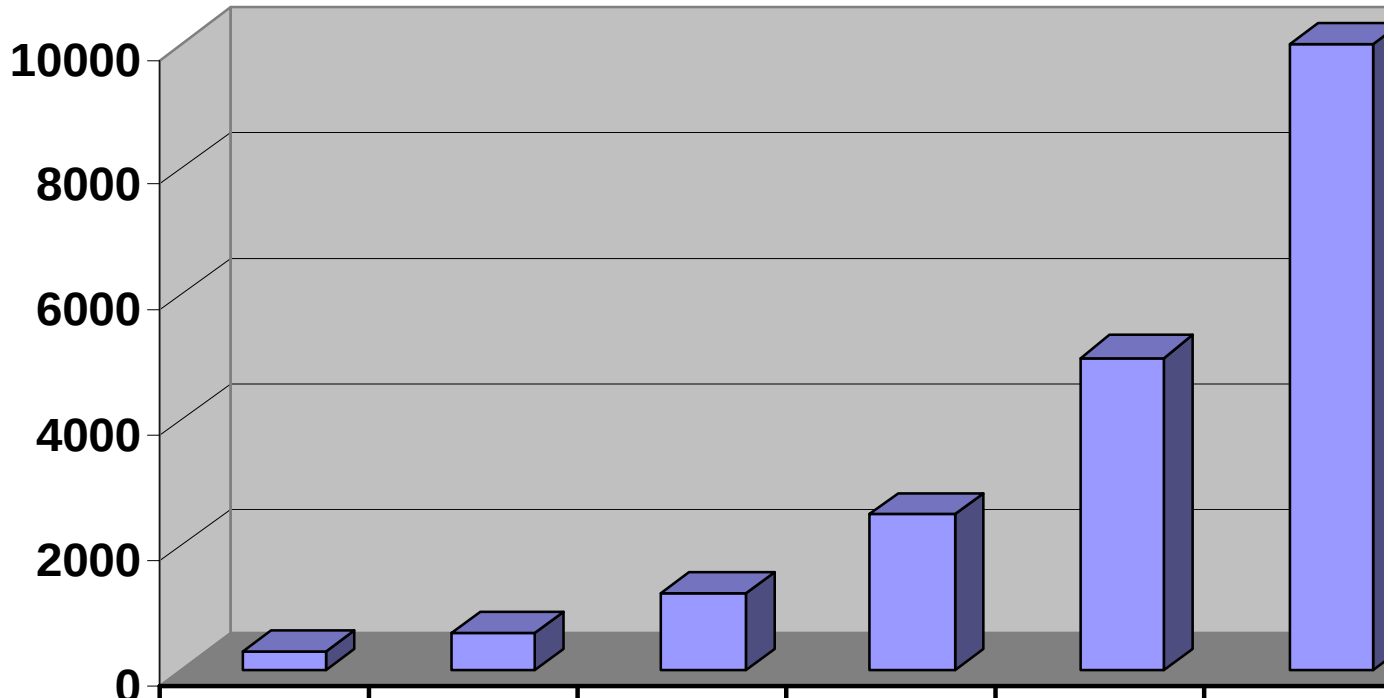
0 years HEP has relied on state-of-the-art networks
nable ever larger international collaborations
collaborations would never have been attempted if
could not expect excellent int'l communications
network is needed for all aspects of collaborative work
ropose, design, collaborate, confer, inform
reate, move, access data
nalyze, share results, write papers
has usually led the demand for research networks
ecause our requirements often exceed those
of other scientific fields
nced integrated applications, such as Data Grids,
on seamless operation of our LANs and WANs
ith reliable, quantifiable (monitored), high performance
orks are among the Grid's basic building blocks
hey should be treated explicitly, as part of the Grid desi

LHC Computing Model
Data Grid Hierarchy (Ca. 2005



Baseline BW Requirements for the US-CERN Transatlantic Link

Link Bandwidth (Mbps)



	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006
lwidth (Mbps)	310	622	1250	2500	5000	10000

Transatlantic Net WG (HN, L. Price
Bandwidth Requirements [*]

	2001	2002	2003	2004	2005	2006
MS	100	200	300	600	800	2500
LAS	50	100	300	600	800	2500
Bar	300	600	1100	1600	2300	3000
DF	100	300	400	2000	3000	6000
0	400	1600	2400	3200	6400	8000
eV	20	40	100	200	300	500
SY	100	180	210	240	270	300
RN W	155-310	622	1250	2500	5000	1000

*] Installed BW. Maximum Link Occupancy 50% Assume

e Network Challenge is Shared by Both Next- a

Present Generation Experiments

Key Network Issues & Challenge

Requirements for High Throughput

reful Router configuration; route stability

ough Router "Horsepower" (CPU, Buffer handling)

rver and PC CPU, I/O and NIC throughput must be sufficient

cket Loss must be ~Zero (below 0.1%); I.e. no "commodity" tworks

P/IP tuning (e.g. large windows) is Absolutely Required

d-to-end monitoring and tracking is Required

Local infrastructure bottlenecks can be tolerated

Gigabit Ethernet "clear path" between selected host pairs

To 10 Gbps Ethernet by ~2003

ne of this scales from 0.1 to 10 Gbps

New (expensive) hardware

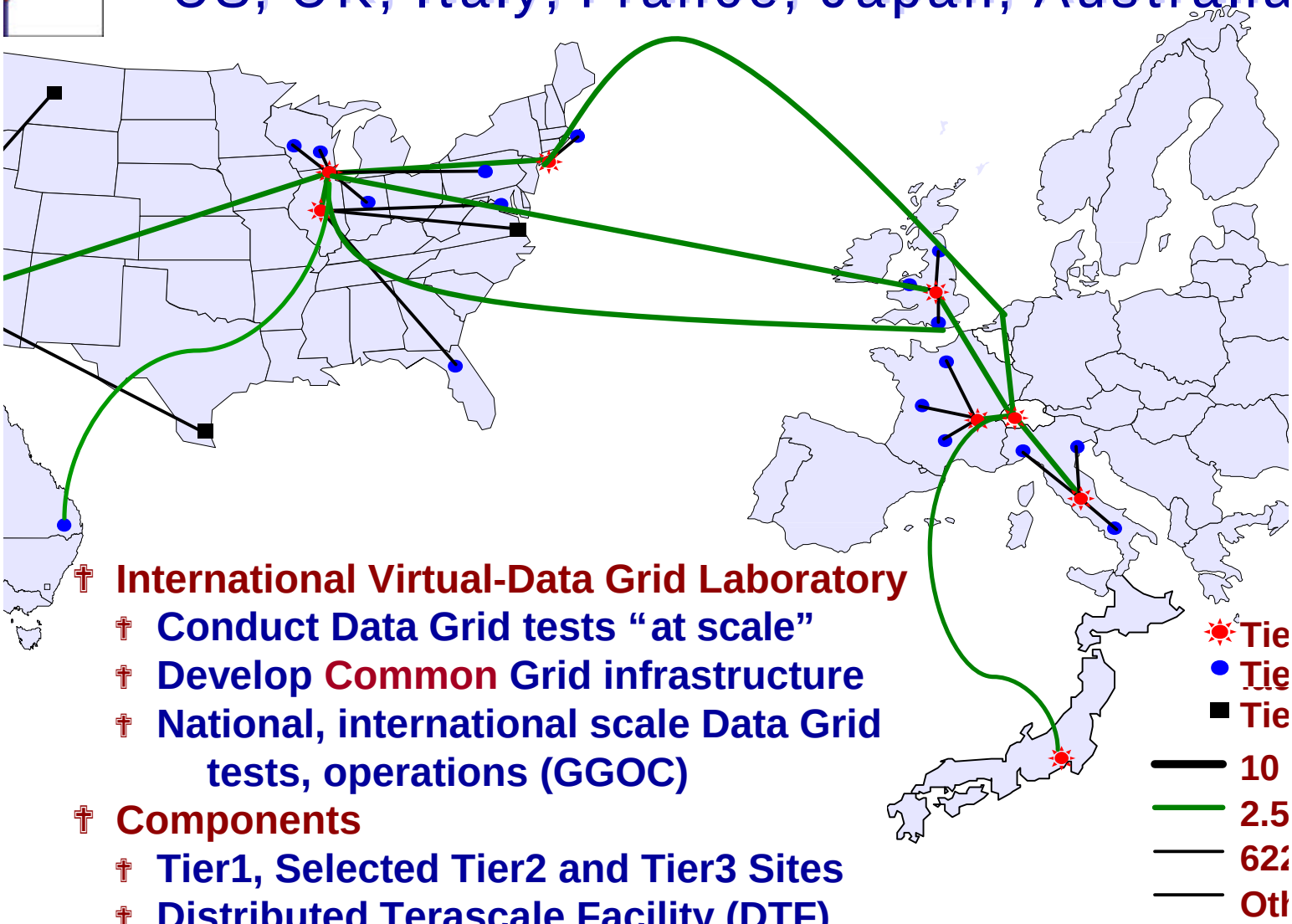
New TCP/IP developments required for multiuser Gbps links

ose collaboration with local and "regional" network gineering staffs (e.g. router and switch configuration).

† US National Network Infrastructure Beyond 2003

GriPhyN iVDGL Map Circa 2002-200

US, UK, Italy, France, Japan, Australia



- International Virtual-Data Grid Laboratory
  - Conduct Data Grid tests "at scale"
  - Develop Common Grid infrastructure
  - National, international scale Data Grid tests, operations (GGOC)
- Components
  - Tier1, Selected Tier2 and Tier3 Sites
  - Distributed Terascale Facility (DTF)
  - 0.6 - 10 Gbps networks: US, Europe, transoceanic

HENP Network WG Background

LHC Common Software and Computing Projects
uary 2001)

llaboration between U.S. LHC Software & Computing Pr

ntify common computing projects, eg.

- Computing Facilities (Regional Centers)
- Networking
- Database Technologies
- Grid Software Projects

ongly endorsed by U.S. LHC Joint Oversight Group (JC

orking Working Group Formed

-Chairs: H.Newman (Caltech), R. Gardner (Indiana)

tial charter developed; encouraged to broaden scope
nclude other HEP experiments as well as NP

HENP Networking WG [*] Mission

help ensure that the required

- **National and international network infrastructures**
- **Standardized tools and facilities for high performa and end-to-end monitoring and tracking, and**
- **Collaborative systems**

e developed and deployed in a timely manner, d used effectively to meet the needs of the US LHC ner major HENP Programs, as well as the general eds of our scientific community.

carry out these developments in a way that is broa plicable across many fields, within and beyond the ientific community

o-Chairs: S. McKee (Michigan), H. Newman (Caltech ith thanks to Rob Gardner (Indiana)

HENP Net WG Goals and Technical Activities

grammatic Requirements

se Cases, Analysis models

niform Requirements Definition

ost Models

kits and Documentation

lake available toolkits and documentation so that existing exp
nowledge and tools for high throughput data transfers, packe
nd throughput-limit monitoring, and collaborative systems ar
idely known; Develop new tools in some cases

upport FAQ pages; develop best practices guides

ison

Vork with network Engineering Staffs of ESNet, Internet2, STA
ne US-CERN link, local site administrators and other expert gr
o ensure that the existing major network links relevant to ATL
MS and other HENP major programs may be used to full capa

HC Program Officers, Institutional CIOs

ENP Software and Computing Projects

HENP Meeting June 1-2 at Indianapolis (IU)

pose:

- **ring together leading user-groups (present and future), xperts representing the key networks and transoceanic nks vital to HENP's and other major scientific programs**
- **eview the status and plans for next generation network nd network technology status and trends**
- **eview the issues limiting high throughput and/or esponsiveness, as seen by networked applications; nd approaches to remove the limits and scale up gener bps networking**
- **o begin to understand the potential impacts of the com self-aware" Data Grid systems on regional, national and nternational scales**
- **orm relationships between end-users and network expe**

HENP Meeting In Indiana [*

proximately 30 attendees

Physicists representing major experiments, software a computing project managers, network engineers from labs and universities, Nat'l network infrastructure prov (I2, ESNet), "responsibles" for transoceanic links (US-C Transpac), DOE representatives; Indiana CIO

lks on

Network needs of the Experiments; the TAN WG

Network connectivity status and outlook at HENP Labs

ESNet, I2 (Abilene and E2E), European Nets, TransPAC CANARIE, STARTAP/StarLight status and outlook

Maximizing End-to-End performance: Where is the bottleneck in the "whole stack" (Hacker);
WANs for "Wide Area Physics": (McKee)

See *http://www.transpac.org/meeting.html* and *http://lexus.physics.indiana.edu/griphyn/henpnet*

HENP Meeting Outcomes

oc Working Groups Formed

pplications requirements (L. Price/ANL, S. Wallace/IU et

- See notes at
http://lexus.physics.indiana.edu/griphyn/henp_issues.t

oadblocks (H. Newman/Caltech, T. Hacker/UM et al.)

- See link to draft summary at
http://www.usatlas.bnl.gov/computing/mgmt/lhccp/hen

ite and mailing list set up (R. Gardner).

ee http://www.usatlas.bnl.gov/computing/mgmt/lhccp/h

st Info. at http://lists.bnl.gov/mailman/listinfo/henp-net-

led to form an Internet2 HENP Working Group, as
propriate framework for this group

oordinate with the Internet2 Applications Strategy Cour
nd the Internet2 E2E Initiative

- HENP and the Visible Human will be the focal
Internet2 E2E disciplines

HENP Network WG
Current and Next Steps

et2 HENP Network Working Group

G Draft Charter Written and sent to Internet2 Management
N; August 4); see http://l3www.cern.ch/~newman/Internet2/
HENPWGCharter_V0.5hbn040801.doc

G welcomed by the Internet2 Applications Director (T. Hanss
d the Applications Strategy Council Chair (T. DeFanti/UIC)

G BOF meeting at the Internet2 Fall Meeting in Austin [*], Oct
review the charter and plan further steps

G Charter will be presented, reviewed by the Applications
rategy Council

op Liaisons

SNet Committees (ESCC and ESSC)

AN-WG or successor Committee on HENP Networking

lobal Grid Forum: A Networking BOF ?

oint Techs Workshop presentations

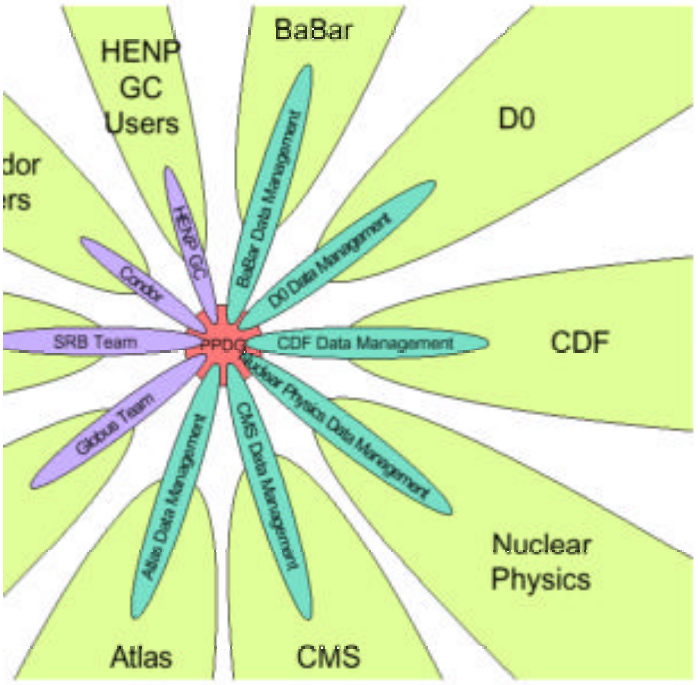
linate with I2 E2E Initiative; Network activities

DG, iVDGL, DataTAG in Europe, and Start Work

ee http://www.internet2.edu/activities/html/fall01.html

Particle Physics Data Grid Collaboratory Pilot (2001-2003)

icle Physics Data Grid Collaboratory Pilot will develop, evaluate and deliver vi
Grid-enabled tools for data-intensive collaboration in particle and nuclear phy
ıechanisms and policies will be vertically integrated with Grid Middleware, exp
applications and computing resources to provide effective end-to-end capabili



Computer Science Program of Wo

- **CS1: Job Description Language**
- **CS2: Schedule and Manage Dat Processing and Placement Acti**
- **CS3 Monitoring and Status Rep**
- **CS4 Storage Resource Manage**
- **CS5 Reliable Replication Servic**
- **CS6 File Transfer Services**
- **CS7 Collect/Document Current Practices and Potential General**

le/object-collection replication, caching, catalogs, end-t
ical orientation: networks, instrumentation, monitoring

HENP Net WG Summary

era of worldwide collaboration, seamless high-perform
orks are crucial to the major HENP and other programs
nd for Grid Developments
ope that advances in technology will bring the
networks we require financially within our reach
ey technical developments for scalable, high throughpu
sponsiveness and reliability also are required
Grids are beginning to transform the way we do scien
ture network requirements may evolve
fast as network technology
P has recently realized that networking must be planned
arge-scale high priority task of major collaborations
e must work to ensure that the necessary tools, as well
obal network infrastructures themselves, will be there i
HENP Network WG could have a key role in these
opments; in coordination with PPDG and the iVDGL G