The Grid High-Performance Networking Research Group (GHPN-RG)

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GHPN-RG

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GHPN-RG ?

- To bridge gaps between Networking and Grid advanced communities
  - E.g., Grid requirements not yet understood by 'Netheads'
  - E.g., Net rules/features ignored by 'Gridheads'
- while countering any premature ossification around Grid/Net dominant scenarios
  - E.g., Advocacy of Grids using non-traditional mixes of end-systems and net infrastructures
- Outcomes: Informational or BCP Drafts, new RGs/WGs, liaisons with other Groups

A bit about our constituency

Active GHPN participants come from

- Research
  - ANL, University of Essex, CANARIE, University of Tennessee, Universiteit Van Amsterdam, University of Technology Sydney, University of Illinois at Chicago, Northwestern University, Forschungszentrum Jülich GmbH, Ecole Normale Superieure Lyon, Univ. of Cambridge, Boston University, University of Florida, University of Lecce
- Industry Labs and industry
  - Alcatel CIT Research, AT&T, Cisco, MCNC Institute, Nortel Networks

2 Drafts just out of the Publisher's Queue

- draft-ggf-ghpn-opticalnets-2
  - Convergence of optical nets and Grids
  - Greenfield-charting realm
  - Archived as GFD.36

- draft-ggf-ghpn-netissues-4
  - Pain points in attaching Grids to the network
  - Level-set realm
  - Archived as GFD.37

3 More Drafts in the making

- draft-ggf-dt-transportsurvey-1
  - A survey of L4 protocols for bulk data transfer other than TCP
- draft-ggf-ghpn-netservices-usecases-2-3
  - Black-box use cases of Grids setups exploiting network behaviors, and quantitative analysis of the same
- draft-ggf-ghpn-netservices-1
  - Scoping of Grid Network Services that elevate the network resource to being a Grid Managed Resource akin to processing and storage
- PLUS Dimitra's new effort on Grids-over-OBS

Invitation to GFD.36

- Focuses on deployment of photonic network infrastructure for Grid applications
- Motivation:
  - Predictions for deployment of data-intensive Grid applications that will require transfers of Terabytes or even Petabytes of data
  - These applications will require a high bandwidth network environment where bandwidth will be allocated on demand or by user/application driven scheduled reservation
- This draft aims:
  - To suggest solutions towards an efficient and intelligent network infrastructure for Grid taking advantage of recent developments in optical technologies
  - A solution to support high-demand application with potential to support all types of Grid application

GFD.36 (cont'd)

- Grid applications
  - Mainly for data-intensive and/or long-lived applications
  - No widespread applications requiring Grid over Optics
  - Today's applications with large BW requirements (i.e. high energy physic centers, radiotelescopes) belong to well defined communities of users and destinations with typically long lived persistent relationships
  - Additionally, sampled users mentioned emerging application scenarios such as high bandwidth interactive applications, data visualisation applications, applications that require bandwidth to reduce latency

GFD.36 (cont'd)

- Styles of operation
  - Users have IRUs to dark fiber and control the network
  - Users access OVPN, L1VPN services from providers operating commercial DWDM systems
  - In either case, software layers abstract the network as a Grid resource, within the OGSA architecture
- Transport and switching technology
  - Wavelength switching
  - Hybrid IP router/wavelength switching
  - Optical burst switching

GFD.36 (cont'd)

- Testbeds show two Control Plane approaches
  - A fixed optical mesh between users with slow "automated fiber patch panel" switching (OBGP)
  - A shared optical "cloud" with rapid λ switching between users (GMPLS, ASON, OBS)
    - Grid User Network Interface
    - GUNI is seen building upon and extending OIF UNI
    - Scheduled connectivity

Invitation to GFD.37

- Scope and Background
- Use Case Documents

- High-Throughput
- Performance controllability
- Dynamic Network resource allocation and reservation
- High Availability
- Security Controllability
- Multicast

- Sensor Networks and Wireless
- Grid Traffic

GFD.37 -> Use Case Documents

The network must provide:

- High performance transport for bulk data transfer (over 1Gb/s per flow)
- Performance controllability to provide ad hoc quality of service and traffic isolation.
- Dynamic Network resource allocation and reservation
- Security controllability to provide a trusty and efficient communication environment when required
- High availability when expensive computing or visualization resources have been reserved
- Multicast to efficiently distribute data to group of resources.

Other issues have been pointed out by the networking community:

- What is the grid traffic impact on infrastructures and other traffics
- How to integrate wireless network and sensor networks in Grid environment

GFD.37 -> High-Throughput

Requirements:	**1) High average throughput** **2) Advanced protocol capabilities available and usable at the end-systems** **3) Lack of use of QoS parameters**
Current issues	**1)Low average throughput** **2)semantical gap between socket buffer interface and the protocol capabilities of TCP**
Analyzed reasons	**1a) End system bottleneck,** **1b) Protocol misconfigured,** **1c) Inefficient Protocol** **1d) Mixing of congestion control and error recovery** **2a) TCP connection Set up: Blocking operations vs asynchronous** **2b)Window scale option not accessible through API**
Available solutions	**1a) Multiple TCP sessions** **1b) Larger MTU** **1c) ECN**
Proposed alternatives:	**1)Alternatives to TCP (see DT-RG survey document)** **2)OS by-pass and protocol off-loading** **3)Overlays** **4)End to end optical paths**

GFD.37 -> Performance Controllability

Requirement:	**1) Traffic protection** **2) QoS-aware networking infrastructure**
Current issue	**1) API: Form of SLA with measurable parameters constituting a SLS**
Available solutions	**1) Overprovisionning** **2) DiffServ** **3) MPLS-TE with DiffServ Scheduling**
Proposed alternatives:	**BoD, lambdaoD…** **Overlays**

GFD.37 -> Dynamic Network Resource Allocation and Reservation

Requirements:	**1) Advance reservation capabilities**
Current issue	**OIF UNI 1.0 does not provide appropriate functionality yet**
Analyzed reasons	
Available solutions	**GFD-E.5 Advance Reservation API**
Proposed alternatives:	

GFD.37 -> High Availability

Requirements:	**1)Network reliability** **2)Efficient Routing**
Current issue	**IP-Restoration** **QoS-Routing**
Analyzed reasons	
Proposed alternatives:	**MPLS-TE** **Multipath OSPF** **Overlays and P2P** **Ipv6**

GFD.37 -> Security Controllability

Requirements:	**1)Site and Network security** **2)On demand security**
Current issue	**1) that there isn't a "one size fits all" site and network security solution** **2) computing overhead, packet header overhead, high-availability, and policy** **3) Firewalls/NATs and Grids**
Analyzed reasons	
Available solutions	**Middleboxes with L4-7 impact but lead to ossification around a L4 protocol called TCP** **VPN with use L2TP protocol in conjunction with the IPsec protocol and the Internet Key Exchange (IKE) protocol**

GFD.37 -> Multicast

Requirements:	**1)Reliability** **2)Low recovery latency** **3)Efficient congestion control**
Current issue	**Limited deployment** **No real standard** **no ‘one solution fits all’**
Analyzed reasons	
Available solutions	
Proposed alternatives:	**End-system/end-host multicast** **Overlays, P2P**

GFD.37 -> Sensor Networks and Wireless Technologies

Requirements:	**Integration of wireless sensors networks**
Current issue	**power limited** **very dynamic topology** **unreliable communications** **IP overhead** **TCP limits over wireless networks**
Available solutions	
Proposed alternatives	

GFD.37 -> Grid Traffic

Requirements:	**Understand the nature of the Grid traffic and how it may impact the network and the protocols**
Current issue	**Internet Traffic is self similar, what's about Grid traffic? Traffic Phase Effects Flash Crowds**
Available solutions	**Network monitoring**
Proposed alternatives	

Path-oriented Use Cases

	Banwidth	Latency	Jitter	Packet Loss	Mcast	Reliability	Co-Allocation	Data security
Visuali-zation	. Compute/data intensive . distributed data-sets: TBy/PBy . Depending on image resolution: 68/680 Mb/s; 6.8/68 Gb/s	< 200 ms	< 15 ms (if lat= 10 ms)	Yes	Yes	Yes TCP/UDP with forward error correction	Computing/ Storage/ network	No
HEP file replica	Several PBy/year .Tier-0 to Tier-1 sites (raw data, 2 PBy) -re-processed data, from Tier-1 to other Tier-1 - Local copies	No(but dependenc y of TCP on RTT)	No	Yes	Yes	Yes	Computing/ Storage/ Bandwidth, loss	No
EMT	Small data-sets from wireless sensors to PDAs and vice-versa; network capacity used depends on sensor sampling rate	< 1 s	No	0 – 20%	No	Yes	Storage (disconnected operation); bw and latency	Yes

Email über alles

Drafts in the making, new Drafts, comments, ideas, why and why-nots, technical news …

… anything we do, you hear about here:

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http://forge.gridforum.org/projects/ghpn-rg/