Minutes of GGF Telecom Focus Session, GGF 10 Berlin, Germany, March 9, 2004
Robert B. Cohen, Master of Ceremonies

Introduction

Global Grid Forum 10 hosted the first meeting to bring together research networks, telecoms, and vendors of network equipment to focus on grids and the issues of deploying and managing infrastructure to support grids. We expect this pioneering effort to provide a forum for discussion and to kick off valuable discussions, both at this meeting and in the future.

Executive Summary

The session highlighted a number of trends. First, research networks are pushing the boundaries of bandwidth use further and want greater control over their traffic on networks. Second, telcos are winning major contracts for grids and beginning to see support for grids as an important business opportunity. Third, equipment vendors see grids as a way to support applications above Layer 1, but are also concerned that network equipment prices continue to be "commoditized." Fourth, software vendors want to provide middleware but standards are still unsettled.

Several speakers underscored important changes in scientific networks. First, that research networks were becoming a major source of bandwidth demand, perhaps as much as one-third of total demand. In Europe, there are scientific researchers using grids for astronomical and physics research who require speeds of about 100 Gbps and in one case up to 20 Tbps. By 2010, the European VBLI that uses direct lambda circuits will have speeds of 1 Tbps. The US TeraGrid is using a backplane with 50 Gbps. Second, the management of these networks is not very refined, but a work in process and user requirements have not yet been mapped to user requirements. Third, the nature of networks themselves may be changing, with users considering that they can see the network as a "disk sector" and write to it or allocate parts of it. A major issue becomes how users can control the network.

Commercial networks noted their growing involvement with grids. British Telecom noted that the grid is really about a "virtualization" business model across ICT resources that plays to telcos' strengths in the management of distributed resources. In this context, the CIO becomes a resource broker and manages complexity while the telco provides applications. The rise of grids has led telcos to examine how to manage IT resources and leverage grid technologies to do this. Grids are part of an opportunity to service large enterprises. One direction telcos are taking is to use the enterprise's own infrastructure as a start and then add it to the telco infrastructure, using SLAs that let the telco tap into the compute capacity of an enterprise. This extension of the control of telcos contrasts quite dramatically with the research networks' efforts to gain greater control over the network.

Equipment vendors emphasized that applications are the main driver and applications should determine network requirements. Alcatel is building a network and trying to understand the interactions from applications to the network. Cisco felt that the best features of grids are moving applications up a level and supporting manageable and auditable provisioning. But there was a concern that network equipment is becoming a commodity and it was not clear that grids would change this.

In the discussion of what new software is needed for grids and whether telcos are using grids to manage their networks, representatives of the scientific networks felt that work on the control plane work is taking place as part of current research. Other research networks wanted middleware to manage networks and provide on-demand provisioning. IBM believed that ITU will provide the necessary standards and noted that it has customers using grids to manage their operations and improve efficiency. One customer is dynamically provisioning services across 4 cities.

There was a question of how to continue the work begun at this session. Several recommendations were made. One was to create a statement of problem areas with input from the players both on technical and other issues. Another was to have a follow-up session. There was a hope that participants might also address the telco-commercial user interface and create a specific detailed list of standards issues. In addition, one proposed priority was to identify the applications that could be used and the new services that can be provided. Another outstanding issue is how to help telcos and equipment vendors establish a new business model that would underpin wider support for grids and grid applications. A second session is likely to be part of GGF11 in Hawaii.

FIRST PANEL – HOW SCIENTIFIC GRIDS ARE AFFECTING RESEARCH/SCIENTIFIC NETWORKS.

Cees de Laat, University of Amsterdam –

VBLI in JIVE in Dwingeloo today is a Gigaport. It is using radiotelescope data with noise suppression. There are continuous streams of 2 Gigabits. The European VBLI uses direct lambda or GEANT. It will have speeds of 16 Gbps in 2005 and 1 Tbps in 2010. One of the main sites is www.lofar.org, which shows the lambdas that are connected as part of instruments, such as radio detectors in fields. Other science applications may be co-located and piggyback on instrumentation grids. The radio detectors use 20 Tbps over dark fiber optic infrastructure and have had a big impact on Dutch networks.

There are three groups of special applications (slide) that can be classified according to the main access speed they use. First, there is a group that uses about 20 Gbps, with 17 million users at about 0.5 Mbps. Second, there is a group at 40 Gbps, using 0.1 to 1 Gbps with up to 180 customers. Third, there is a group using 100 Gbps, largely the high energy physics and astronomy research community. In this group, HEF-ASTRO uses 80 to 120 Gbps and LOTHAR uses up to 20 Tbps. This group is much smaller in number, with just a few users at any time.

TeraGrid – Charlie Catlett

TeraGrid is an example of extensive interaction with telecoms. It has a petabyte of storage. The network includes 50 OC-192, 50 GigE infrastructure connections and Ciena DWDM transport. Its budget devotes about $17 million plus another $10 million in spending out of its $98 million budget for telecom. There is a 40 Gbps backplane.

TeraGrid is up and running with 30 Gbps into 5 sites. It has invested in IP routers for broadband networking. The challenges are to use more than 1 Gbps there would need to be multiple machines sending data in parallel. So must coordinate across multiple nodes. Lots of work needs to be done at the end points. The new sites have 10 Gbps each. A region can build its own network, but it may need a carrier to maintain it.

Klaus Ullman, DFN, the German Research Network –

When is peak traffic coming? JIVE is an example of using big data sources. The issue is how to get the data to the data evaluation centers. The same issue arises with LHC (Large Hadron Collider) data from CERN's particle physics experiments. We are not sure we need Terabit capacity continent-wide, but it is required on a more regional basis.

Several key issues are 1) what is the time perspective? 2) how can we manage Grid traffic, that is how do we map network technology into a virtual organization? We need to map user requirements to the technology options. The EGEE project's challenge is to manage big infrastructure, reliable transport and middleware.

Artur Binczewski, Poznan Supercomputing and Networking Center–

ATLAS project. We want more than 1 Gbps. The problem is the cost of bandwidth. We can't offer it for free. Utilization is very intermittent but depends on the end user demands. We can use "long fat pipes" that can offer service like at Dwingeloo but they are not always used properly.

We are trying to put fiber optics close to grids, but users are asking for control of the network. But the synergy is not there yet. Radio astronomers are using TCP protocol. When they are using the grid, they say they are getting poor results. Scientists say what they are trying to do worked well in the lab.

Another issue is that the network operator can't tell what has happened to data that has been transmitted. If users manage to send data, the network operator can't tell them what happens, especially if there is a problem. We have 3 administrators and 3 domains and this is the biggest problem.

We can't monitor or control the traffic. We are letting users control the traffic as much as we can.

Dale Robertson – DANTE

GEANT has 9 10-Gbps circuits and 19 2.5-Gbps circuits. Bandwidth use is close to the ends. There are a small number of very demanding projects. EVCBI has 3 sites connected in its first experiment that includes Switzerland, the UK and Holland. DATATAG and DataGrid are testing the performance of DANTE to support grids.

DataTag has a Layer 2 tunnel and operates at 800 Mbps. DataGrid uses TCP and is testing congested conditions to see what happens to premium classes of traffic. In tests so far, classes have performed as expected.

The GNZ project is the successor network to GEANT. It is expecting to have end to end seamless performance across different networks. This is a challenge.

Walter Stewart – CANARIE board

Canarie has user controlled light paths with spikes for some projects. The use of projects is driving the growth of capacity.

One policy issue is the need for a coordinated approach to infrastructure development. CaNet4 is a leased facility and the lease will end. Canarie does not own its infrastructure.

Another policy issue is that we don't understand requirements for the last mile. We need to understand how to link science networks to commercial ones to overcome this issue.

Comments:

Cees de Laat made four points:

1. There is a 40-Gigabit router network in Chicago. Is there packet loss? Packet loss has a big impact on utilization. The further away the network goes, the more it should be Layer 1.
2. If we run transport protocols on fiber, can we leave out congestion controls?
3. Routed network problems in GEANT. Half are transmission. The issue is how effective is this transmission and what protocols is the network trying to use.
4. Networks have long spikes. One observer of fiber networks found that there are 1/10 or 1/100 ratios of fiber switch vs a 64 port 10 GigE. The idea is to keep the traffic as low as possible in the stack and give it no more services than it needs.
5. We need to identify the tasks to completion (tasks that need to be completed?)

6. Opticomputer NSF project. The network is seen as a “disk sector” and users can write to it, read to it and can allocate parts of it. The network becomes part of the infrastructure.

Przybylski, Poznan –

What is the chance of knowing how long the task will take place. With radio astronomy, we can estimate the time. With other applications, we need to know the completion time to offer a good system. We need a bandwidth reservation system. This is hard to get for grid people.

Ullman –

We can only get this for applications.

Franco Travostino, Nortel –

Resource people in GGF are working on this issue, but the network piece is not operating as much.

Przybylski, Poznan –

We would need an idea of the composition of the traffic.

Walter Stewart, SGI -

This raises the question of coordination of infrastructure. There are lots of decisions made on the computation side that don’t consider bandwidth costs.

Cees –

The lambda grid and Canarie are trying to make user controlled research possible. Complexity is in the exposure to the user. I think the user is smart enough. Networks need to do complexity indexing or could go to the edge of the network and detect or reroute to the lambda; this is “IP switching.”

BT –

We need to estimate the network cost as part of the grid

Catlett –

We want an application to run here. TeraGrid needs advanced reservation support that implies use of a network. But we can’t express how much network use is needed. CPU and storage requirements are better known.

BT-

Why shouldn’t the networks provide compute services and storage?

Haley, IBM –

We need to figure out how to solve the telcos’ issue of how to offer services.

Catlett –

We can accelerate Akamai’s ability to make data closer. This is similar in the scientific community. We give data and tell where it needs to be close to.

Przybylski, Poznan –

Grid people. Which networking model is used? Is it one network, one grid or one infrastructure for all grids or networking on demand?

Cees –

Bottom up lambda based community empowered networks. We should be careful in relying on telcos to start grid networks.

SECOND PANEL – HOW TELECOMS ARE THINKING OF PROVIDING GRID SERVICES TO THESE NETWORKS AND COMMERCIAL GRID USERS

Piet Bel, BT Netherlands–

CIOs want BT to manage grids. BT acts as a resource broker.

Frank Falcon, BT Grid Strategy Lead–

Hothouse projects – the BT board has approved these. Grid is really about a "virtualization" business model across ICT resources. This plays to the telco strength in the management of distributed resources. There are savings on operating costs, consistent application performance and the realization of the same in the commercial world.

The grid moves IT resources into the virtualization world alongside VPNs. The Grid supports the PCN agenda that ties into BT's 21st Century Network (see BT web site). The British government plans to use the grid to revolutionize GDP.

BT's Application Assurance Infrastructure – Focuses on business functions. Commercial user steps outside the enterprise boundary. Applications run in "virtual space." The CIO becomes a resource broker and manages complexity. AAI becomes part of the grid toolkit.

The timeline for BT stretches to 2014. By this time, all Web services become Grid services. Applications are run by telcos. In 2004, BT won its first big grid contract, $1.4 billion for a health network for the National Health Service. All enterprise applications are in one delivery mechanism. About 80% of all applications are delivered on the grid. BT establishes itself as a Grid Resources Broker/Service Provider.

Hans-Martin Foisel, T-Systems –

Deutsche Telekom (DT) gets a transport network that is more customer oriented, event driven, including grid computing. It is optimizing the network for private networks. DT wants to understand how customer behavior can be handled. It hopes to offer on the fly connections. Grid and SAN people need to know more about their networks.

I am part of the Carrier Network Working Group for the Optical Information Group. We are developing infrastructure so that the customer can ask for activation. This is dynamic. We are also working on end-to-end performance and provisioning.

Pramila Mullan – France Telecom (FT) –

The types of problems we are working on are similar to BT and DT. We are examining how to manage IT resources and leverage grid technologies to do this. We see an opportunity to service

large enterprises. In general, telcos are trying to understand P2P's impact on network performance and telcos' ability to deal with the implications. How this evolves into business models needs to be worked out.

Matti Hiltunen, AT&T Labs –

Our grid strategy is not published. AT&T is focusing on sharing CPU and resources. We can do QoS, CoS, guarantees on available bandwidth. For grids, we do this in-company, with partners and between R&D and commercial customers. AT&T still has 21 data centers. It also has management capabilities, including security and firewalls. It could manage these and also design networks.

AT&T has a collaboration with SURA that it has just begun. This will identify the requirements for grid traffic. AT&T is also working with other institutions and Andrew Chien of UCSD. This will address the research challenges.

Paul Fernes, Level 3 –

We began working on grids with the origin of GGF. We have a way to provide support but need to develop the business case. On demand computing is available, but interoperability between networks is difficult. We can order OC-3 to OC-192 GigE. National lambda Rail has a 10 GigE LAN.

Our grid applications are part of a 2 to 5 year initiative. We have done work on on-tap and interoperability. On access and the need for the last mile people to be included in the discussion. We are also trying to partner with other telcos and systems vendors. This is part of an effort to marry OGSA to network intelligence.

VoIP gives the user the ability to be the operator. We can do this because our SS& interface is developed. On the data side, Level 3 has been protocol agnostic.

Maurizio Cecchi, Telecom Italia Labs –

1. We are pushing scientific applications. Storage on demand is the first application. We have needed big data transfers.
2. Service development suffers from security issues. This is unresolved. We can't delay a solution.
3. We have a big proposal for a grid.

Grid is useful for distributed searches through the grid. Apply a research engine throughout the grid. Testing search engines on grid networks. We have gridified a search engine and are using it on a semantic web.

Przybylski, Poznan –

We are creating interoperability as the priority.

BT –

Take over management and getting to infrastructure. We see using the enterprise's own infrastructure as a start and then adding this to our own. This is also part of preparing for an intragrid. BT's own resources and also unused resources of customers would be accessed.

BT will organize services on a best-effort basis – third party services must be available. SLAs will include when a corporation's resources are available to BT to offer to other parties. The issue is which commercial organizations will use the grid?

Comments:

Haley, IBM –

What is the measure of success? Is it a 10-fold improvement?

Pramila Mullan, France Telecom –

Add efficiencies to ISPs, but management needs to deal with grids. Complications are associated with searching.

BT --

Kicking off internal grid project. Believe the greatest improvements with be that Grid Systems are seeing telcos using grids.

Steve Crumb, GGF –

What role do the telcos see in creating standards?

Mullan – FT –

Much of standards representation for FT is in Web services in her group. This is largely in W3C, OASIS, and Liberty standards forum. She hopes to initiate work with GGF.

Fernes, Level 3 – The market has pushed standards.

BT—
We have teams working on standards.

Foisel –

We should focus efforts on the gap between the corporate grid and ?

THIRD PANEL – HOW VENDORS OF NETWORK EQUIPMENT AND APPLICATIONS THAT MAY BE PROVIDED OVER NETWORKS ARE PREPARING FOR GREATER GRID TRAFFIC ON NETWORKS

Andrea Westerinen, Cisco –

Technology strategies and market strategists for Cisco tried to figure out what was the meaning of grids. Best features of grids are moving applications up a level. Supporting manageable and auditable provisioning.

Network areas need work. One, discovery. Two, initialization. Three Resource management. Four, on demand bandwidth brokering. Five, performance. Six, security, including how to create a single manageable model.

Network equipment is also becoming a commodity and it is unclear whether the emergence of grids will change this.

Udo Schaefer, Alcatel –

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Applications are the main driver and applications should determine network requirements. Alcatel is building a network and trying to understand the interactions from applications to the network. Alcatel set up a research partner effort with solutions and will move this to grids. What is the understanding about wavelength on demand? There is a need for great efforts to address the issue of wavelength on demand.
Research people in Paris are focusing on grid issues.

Jean-Marc Uze, Juniper –

Grid is part of Juniper's vision of the future of networking. There are two choices – using a different infrastructure for specific applications vs "better networking." Infrastructure Network is using single packeting infrastructure and requires more optical connectivity for some users. The goal is to make advances in standardization.

End users rarely connect to one domain. For the InfraNet Juniper is looking at 1) Infrastructure 2) intercarrier issues 3) the control layer and enabling services to the end user and dynamically setting up an availability of services.

John Reuter, Foundry Networks --

Foundry does lots of clusters and more with grids in the last 6 to 9 months. Manageability is a key issue. The network is complex. Foundry offers managerial pluses, since it offers detail based on requirements of different users. Foundry provides a way to look at the network. It has placed its S-Flow in ASICs. S-flow samples in real time all the traffic in the network. Can see layer information, IP v4, IP v6, and VLAN info. It gives us visibility into what is going on and provides historical information.

Przybylski, Poznan –

What about customer-controlled grid networks?

Foundry –

This is possible.

Travostino, Nortel –

Network revolution involves looking beyond "one size fits all." Technology must adapt.
Nortel wants to support hybrid packages; Lambda Service as a defining design principle: packets for many to many, Lambdas for few to few.

Hybrid packet and optical services should be viewed as the defining principle. The OMNINet test network has no routers, no SONET, no point and click. Lambdas are allocated in 26 seconds.

The Grid agenda should include:
1. Bit Blasting
2. Finesse – granularity of control
3. Virtualization
4. Resource bundling
5. Standards for all of the above

R&E networks are the key advanced audience.

Comments:

Cees de Laat –

Networks are mostly router based and people want to send Layer 1 and 2 on the routers. Is this the most efficient approach?

Travostino, Nortel –

A photon switch with MEMS is very costly. So R&D demand doesn't create an adequate market for them.

Uze, Juniper –

Integration is the issue. We could use Layer 1 for some applications. In other cases there may be no dedicated solution.

Westerinen, Cisco –

Commoditization of equipment and the issue of how to create hardware that scales better (i.e., blades) are important. We do need Layer 1 but we also need to "uplevel" services.

Grids will begin to change the products (in telco networks) and add things, but this realization has come late to people.

Cees de Laat–

We will probably have hybrid networks. We need big routers in the branches.

Schaefer, Alcatel –

Alcatel has purchased lots of Level 2 companies and we believe that products can be adapted. But optimized products are needed.

For the takeoff of grids, we need integration into …

PANEL FOUR – A) HOW ARE TELECOM NETWORKS USING GRIDS TO MANAGE AND MONITOR THEIR OPERATIONS? B) WHAT NEW SOFTWARE MAY BE REQUIRED TO SUPPORT THE GRID APPLICATIONS BEING USED OVER NETWORKS (ABOVE LAYER 1)?

Cees de Laat, University of Amsterdam–

The control plane work is taking place in the research work that is going on. Amsterdam AAA and Starlight, Canarie and UCLP. The research world is mostly focusing on lower layers.

AAA uses an architecture that has functions in different domains. The PIN architecture and EDL use a photonic interdomain negotiator. This indicates how to look at a topology and address the different devices in the domain.

The CaNet4 architecture uses SONET boxes with channels up to a Gbps through the networks. It divides each switch into logical subparts. This tells each user you have 5 lambdas and you can tell the network where you want them to go. This creates user controlled light paths – UCLPs.

Coordination with the Optiputer project. If you publish network elements with UDDI, then people can search for the services. But there are many problems that are unresolved. It is hard to find the route that you may want.

Esther Robles, RedIRIS, Red Espana, the Spanish National Research Network –

You can't manage your own network? We would like to be able to manage our own network and want service providers to make this possible.

We would also like to have on-demand provisioning/access to the network. We need a middleware to insure this access.

Cees de Laat–

You can use SDH, VLANs and a unified counterplane. You can also provide GigE or Ethernet.

Robert Fogel, Intel –

Grids move things to a pervasive modular environment with standards that are very key to support for global proliferation. Telecoms play a natural role, they are used to providing reliability and offering sharing of resources.

In terms of software for grid applications, quite a lot can be done in the compiler to play a role indicating what you know about the application and offerings of services.

Michal Przybylski, Poznan Supercomputing –

We should consider new software; VPNs based on Ethernet VLANs, Cisco ATMs. In middleware, the issue is a lack of standards. In Europe, there is a Task Force for Next Generation Networks that has postings on the Terena Task Force site. New software may be required to support the Grid applications, being used over layer 1 For example, the new generation networks need dark fiber, and the optical network requires it. Additionally, new standards are needed for the quality of service, APIs concerning the Grid and telco networks, and bandwidth/Lambdas on demand. We also need a new business model for telcos – a task force is needed for that.

Michael Haley, IBM –

The scaling required is emerging from the ITU. ITU will also address what functional network things are needed and how can we extend existing standards into a New World. There is an example of one Asia Pacific telco that understands the bottlenecks at the edge of the network, but I am not sure of whether these exist in the other parts of the network.

We are seeing customers shift attitudes. Telcos are using grids for internal operations to do business analytics and acceleration, speeding access to market information and compliance data. They are also using grids for enterprise optimization, such as real-time aggregation and computation. They are starting to gather telco data at the switch.

Telcos are also using grids for new revenue services. We have seen them launch new hub-based services. Telcos are also emerging as managed application providers to their top customers.

One commercial user is dynamically provisioning services across 4 cities.

Is new software required? We need to prove the business value of grids. Now, IBM is using a grid between the US and Germany. It has improved the utilization of human resources by 80%.

IBM has developed ways to measure the benefits of grids. We have an effort underway to estimate the grid's benefits.

In terms of improved monitoring and provisioning, there are now islands of automation and decision-making that are error prone.

OGSA and GGF need to link to the TeleManagement Forum, particularly to the TeleManagement Forum's ETOM for provisioning and monitoring as they are rolled out.

Cees de Laat –

How do we move forward?

WRAP-UP

The end of the panel moved rapidly to a discussion focused on the issue of "Where to go?" from this meeting in Berlin. It identified a need for:

1. A statement of problem areas with input from the players both on technical and other issues
2. If we do this, we need to get something out. Who is planning to attend the next session?
3. We also need to address the telco-commercial user interface
4. We need to create a specific detailed list of standards issues
5. We need to identify the applications that could be used and the new services that can be provided.

There was some discussion concerning the best vehicle for continuing the discussion. Some proposed a working group within GGF; others suggested a Research Group. There was also a suggestion for a second focus session at GGF11 or GGF12 or a meeting prior to GGF 11 at a location that is not as difficult for some telcos to travel to as Hawaii.