

**Notes on ASTON Bandwidth on Demand brainstorm meeting
9th September-2002
TERENA, Amsterdam**

Aim of the meeting

The meeting aimed at understanding the needs of NRENs in relation to BoD. Obviously the needs on an academic environment that although running production network services is quite open to do advanced testing.

The meeting would provide input in defining the BoD activity of the Aston project. .

Participants

Joseph Berthold, CIENA
Mauro Campanella, INFN GARR
Valentino Cavalli, TERENA
Jacek Chrostowski, Cisco Systems
Didier Colle, INTEC-RUG
Romain Delavenne, LAMBDANET (partly)
Bernhard Edmaier, BT-Exact (partly via audio conference)
Michael Enrico, DANTE
Leon Gommans, University of Amsterdam
Jean-Marc Uzé/Simon Leinen, SWITCH (via video conference)
Michal Przybylski, PSNC
Victor Reijs, HEAnet (chair)
Jean-Marc Uzé, Juniper Networks

Presentations

All presentations will soon be accessible at:

<http://www.terena.nl/tech/projects/testbed/meetings/2002-09-03/BoD-meeting.html>

Joseph Berthold's presentation, three ways transport types
Dynamically rearranging topologies (point & click)
Dynamically resize bandwidth (scaling up–aggregating wavelengths together and down to bandwidth granularity of 50/155 Mbit/s: around 1% of channel bandwidth)
Cost effective survivability

Management control of bandwidth provisioning.

The question with automated bandwidth increase (so pre-installed equipment and infrastructure), what does this do to initial investments? How cost effective are the possible idle circuits?

Mauro Campanella,

What does on-demand mean, there are 2 issues;

a) time scale (manual provisioning, pre-configured, fully dynamic)
b) Bandwidth provisioning can be done in three ways: Physical link, physical slice, and virtual channel

Physical link (lambda, dark wire) is straightforward, physical slice is protocol independent (like digital wrapper) and so it is less complex to manage, solution similar to packet switching. A physical slice is more similar to circuit switching, a virtual channel (MPLS) can effectively guarantee bandwidth.

It is assumed that a limited amount of fiber will be laid out in future (change in market).

One need to investigate economy of scaling, but also, more technically, the limitations of signaling protocols, routing and addressing on highly meshed networks and more flexible data links. In addition, one needs to pay attention to bandwidth brokerage, use of capacity per single or multiple flows and geographical scale. This investigation should be a specific work package in the ASTON project

Jean-Marc Uzé

BoD is not a new concept, there is a transition from MBS to VPN to Lambda service and to BoD, the concept is also not restricted to optical or to high-bandwidth networks.

What is new with respect to the current service model is the integration of transport infrastructure in IP services. The new service model is three-dimensional integrating: QoS, Isolation and Provisioning. Research needs to focus first on the control plane and inter-domain issues.

End users, NREN's and carriers (passive/active infrastructure) should be involved at some stage.

Understanding of the service model should be part of the work within an active network environment – GMPLS survey.

Leon Gommans

Generic AAA (multi-domain) based BoD, 2 documents: RFC2904 on framework and RFC2903 on architecture. Resource usage, AuthN (access control) in multi-domain environment. Use BoD mainly for GRID applications, only a small number of users have high bandwidth requests at the moment.

Description of light path requests – XML routine environment implements the policy architecture.

Simon Leinen

Is BoD really needed by users? Need to investigate the economic aspect. Telco's are better in doing it. Willingness to pay is a good indication how eager <especially_important_user_groups>'s are.

Another question is if dedicated connections would work: would dynamic provisioning save you anything (money, time, etc.)? Apparently more and more people are interested in costs and reliability then in bandwidth.

Michal Przybylski

Overprovisioning is a method of control.

Owning fiber is a goal of PNCS (owning them is cheaper than leasing).

For certain application, dedicated paths can be provided (isolation at L1-3, like ESCON and fiber channel).

In the core use the KIS principle (without the 'Stupid'!!!).

Point and click services for these paths using VPN/GMPLS.

Peer model in own domain (scalability is an issue), overlay model in inter-domain.

Don't base things too much on TCP, perhaps new protocols are needed.

Romain Delavenne

Fixed bandwidth: wavelength, SDH

Pro: QoS Cons: no flexibility

Flexible bandwidth: MPLS, L2

Pro: flexibility Cons: no control plane between MPLS and SDH

If we can provide today flexible bandwidth, we are not able to manage dynamic bandwidth because of no interactivity between MPLS and SDH as today. This is more an issue of control plan/provisioning than an issue with MPLS/SDH.

Requirements

- integration of optical/IP control plane
- BoD service model/ a number of issues
- New business model

Open issues regarding technology on wavelength (cost?)/Ethernet (in core?)/GMPLS (using current technology/equipment) need to be evaluated with respect to the business model.

Issues regarding the service model include who demands the bandwidth, flexibility for who (end user?), and which applications need it.

Bernhard Edmaier

Reduce opex “without” capex: Interworking/NMS with existing, fast provisioning (point&click), fast restoration.

Research issues – put new technology into **existing** network elements:

Granularity (E1 – 10 Gbit/s), scalability (up to 1000 network elements), network architecture, node architecture, protocols, business cases.

Michael Enrico

GEANT has clear requirements for MBS replacement, but not in large volumes: Some projects request bandwidth but the provisioning time is in the order of a few weeks now. For bandwidth redistribution, provisioning times of days/minutes is necessary.

Issues:

- How much from 155 Mbit/s (multiples) up to 10 Gbit/s perhaps?
- Nature of BoD services?
- How many want also layer2 or layer3 isolation?

Lambda service: the approach should be a pragmatic one (at present: black&white service). True wavelength/(managed)darkfiber not likely at international level.

Long distance: what service do you get from suppliers?

Jacek Chrostowski

BoD is much better at layer3 than at layer1 both for users and carriers.

Ethernet everywhere is now possible, but extended metro (all optical) is still quite expensive.

Want to have an island for experimenting.

Interesting interplay between current network elements from a research perspective.

Is lambda switching cost effective?

What is really needed for GRID (155 Mbit/s, 10 or 40 Gbit/s by a single user or aggregated)? User demands are needed.

No arguments against cost.

Interesting to investigate how you can do all optical in a large scale.

A proper large-scale demo of ITU-T/OIF and E-NNI is needed.

Didier Colle

Lion testbed shown GMPLS UNI and NNI.

Provide spare capacity in the MPLS layer on-demand only when is needed; using soft-permanent/switched connections and/or network survivability mechanisms. So keep BoD inside core network to reduce costs.

Lion workshop, questionnaire outline:

<http://www.ibcn.intec.rug.ac.be/projects/IST/LION/quest.html>

Victor Reijs

Requirements of NRENs are different from carriers, talking to OPTIMIST – EC acknowledged that.

Experiment is also different – we want something practical that can be implemented in a short time.

Service breakout session

(Notes from Michael Enrico)

Joseph Berthold,
Michael Enrico,
Simon Leinen,
Jean-Marc Uzé,
Leon Gommans,
Valentino (chair)

Big issues/questions

- Complexity
- Granularity
- Model?
- Why not just overprovisioning?
- Addresses only QoS, not L2 isolation & provisioning

Questions:

- Problem of integrating transport infrastructure with service layer
- If we assume this integration: then how does this affect relationship with carriers?
- NRENs should decide on most important services that should be provided (and these should not overlap)

Why BoD?

- Way to catalyse R&D projects that do not centre on standard IP
- QoS requirements from applications
- More binary nature of quality is well suited to L1 BoD

What do users want?

Infinite BW at zero cost!!!

How much are they willing to pay?

Need to classify BoD users:

Where do we position BoD?

Need to identify small number of high demand users e.g. GRID users today.

Extrapolation of experience from TEN-155 MBS days does not really lead to clear demand for BoD service.

Definition of BoD related to setup time no requirement for dynamic provisioning

Ethernet presentation is useful since it can provide nature of services that users want.

NRENs are trying to go down the network layers and acquire more control of the infrastructure.

Big question is the scale of the service.

Technical breakout session

(Notes from Mauro Campanella)

Mauro Campanella,
Jacek Chrostowski,
Didier Colle,
Michal Przybylski,
Victor Reijs, (chair)

The user requirements for BoD were, (no comment on their rationality):

- GRID - use of high speed VPN (do they really need VPN?)
- IPv6 - L2 native connections.

The IEEE magazine devoted the April/May issue to generic framing (Y.1303). It is considered important (digital wrapper is a synonym for it).

A connection with Optimist, and experiments like LION is useful for at least two reasons:

- gather experience and view points
- offer them a (large, multi domain) platform for testing.

The requirement of implementation on multiple administrative domain is fundamental.

Setting a dimension goal in terms of the number of possible users of the technology can provide insight to the activities needed.

Probably up to few thousand, single domain, it is already feasible now. If it is larger than that, no one knows if present technology can cope with it.

Need to understand the limits, in term of granularity more than bandwidth, aim for a limited maximum number of users (limited granularity) - or aim at 10.000 - 100.000 users?

But remember it will be outside the scope of ASTON perhaps to test a large scale (assumed directly connected domains max. 5).

Define the interface layer between user and provider, which is the common layer.

The approach of this projects should aim at defining the uniqueness of approach to distinguish from other proposal.

The project has to define a (possible) implementation roadmap.

The cost of the service is a key parameter for the success/request.

Area to understand are routing, authentication QoS.

An investigation of what present service can provide is needed before starting the new study.

BoD can be thought as an end to end service or a way to provide just single link BoD - both might have a sample use case.

Implement a solution that allows different implementation in each domain and obviously one solution will not fit all.

Plenary wrap-up discussion

BoD is correlated to end-to-end signaling it requires a short provisioning time, but this is just one dimension, Layer2 isolation and protection are other essential requirements.

Issues and things to be looked after:

- Cost issues are related to the scale of the service we want
- The real issue is how to scale, what would be the implementation model
- Signaling is important to ensure scaling up of the BoD
- Why do we want to implement it? To support GRIDs, Layer3 VPNs and other applications
- Multiple-domain approach is essential
- Dimension – number of users
- Interface layers between users/providers.

Suggestions can come from LION and other existing projects.

Final comments and recommendations

- Let`s build a tool and do not prevent ourselves from doing BoD in the future because of the impairments of the present.
- Should BoD be provisioned end-to-end? If not it is easier, provided that the core can support it.
- It should always be end-to-end inter-domain, but let`s not confuse inter-domain with signaling.
- Graduation of different possibilities – stepwise approach.
- Economic feasibility – example on 1 link.
- Different NRENs own the infrastructure, some are leasing it others procure it to carriers; the BoD service model **should** be independent from the infrastructure.
- Possibility of deploying an end-to-end service without having the same implementation in each domain. The key point would be the clean interface between the domains. (One example could be an Ethernet service, provided by manual configuration of an Ethernet channel in one domain, and Layer 2 VPN on a second domain. The interface would be (for example) a Ethernet Gigabit VLAN on a 10GE back-to-back link...)
- Would it be interesting to dissociate the notions of IP domain from the carrier/ISP/REN domain? An IP domain is typically an AS number (so IGP domain). A carrier/ISP/REN domain is more related to the perimeter of responsibility.