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Deliverable DS4.0.3: Review of Global Cost Sharing



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Abstract

This deliverable sets out the principal policy issues and decisions that have been made in GÉANT2 in the context of Global Cost Sharing.

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0 Executive Summary

This deliverable sets out the principal policy issues and decisions that have been made in GÉANT2 in the context of Global Cost Sharing. It looks at some of the underlying cost issues, considers the practical implications of cost sharing agreements, and reviews policy regarding point-to-point services and cost sharing. A companion deliverable deals with other related aspects of global policy (DS4.0.4: Review of Policy issues for Development of Global Connectivity).

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1 Introduction

The National Research and Education Networks (NREN) Policy Committee (PC) appointed a Global Connectivity Committee to examine and make recommendations on a number of aspects of global policy. It concentrated on global cost sharing issues, especially in respect to the emerging portfolio of new services, and particularly on point-to-point services.

A major change is starting to take place in the approach of services that are available globally. In particular, the provision of point-to-point services (where resources are dedicated to individual user groups), has meant a significant re-think in terms of the way costs are shared globally. This global cost sharing deliverable draws on the work of the Global Connectivity Committee, as well as codifying what might be described as “custom and practice” that has existed for several years in respect of global cost sharing.

It is true to say that policy within the GÉANT2 scope is evolving. It is also the case that other world regions are still developing their own technology platforms and approaches to pricing. Global policy can not be set in isolation. The review of global cost-sharing is, therefore, very much a work in progress.

When considering point-to-point services and cost-sharing, it has to be recognised that a point-to-point service has a very different character from the more traditional approach to IP services. In particular, it is obvious that a different approach is needed when it comes to interconnection with research networks in other world regions. For example, the interconnection at IP level between Internet2 and GÉANT provides mutual access to all of the connectivity on the two networks.

2 Factors Affecting Cost Sharing

In looking at the costs of interconnection of networks in other world regions, many factors need to be taken into account:

- Relative Geographic Scope

GÉANT provides connectivity that is made available via the research networks of its members. This is on a continental scale and represents a very large footprint and quantity of connectivity. In considering interconnection with other networks, this scale has to be judged against the scope of connectivity provided by the interconnecting network.

For example; the interconnection between Europe and the US brings broadly similar communities together in terms of scale and access to technology and sophistication. If this is compared with an interconnection to Tristan de Cunah, a small island in the South Atlantic, the balance of benefit is very different and it becomes impossible to justify co-funding connections.

A further, related, point that needs to be considered is whether more closely neighbouring networks should interconnect with GÉANT and be part of the cost structure of GÉANT. The issue of the GÉANT scope is discussed in a companion deliverable on the development of global connectivity.

- Interconnection Costs

Normally the most significant issue for global cost-sharing is the way in which the cost of the circuit needed to interconnect is shared. A factor associated with this is market competitiveness. Although a global connection will normally have a single price for the entire connection, this price is heavily influenced by the telecommunications market competitiveness at each end.

Without looking at the competitiveness issue, and assuming a similar geographic scope, it might be asserted that splitting the costs in half would be a fair approach to cost-sharing. Nevertheless, the overall link costs are strongly influenced by national competitiveness issues. Table 1 below shows the relationships between the costs of a number of international connections between GÉANT2 and research networks in different world regions. It uses, as a comparison, the cost of connectivity between Europe and North America. All other costs shown are relative to this base cost. The analysis makes use of the scaling factors for different connection speeds used in the GÉANT2 cost sharing to normalise the different link speeds and make a consistent comparison. Some care has to be taken with this comparison as the volume of demand on the different routes

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varies considerably. Nevertheless, a comparison of the Singapore-Europe and the India-Europe links is very relevant, as these are both implemented on the same cable system and the Singapore-Europe link is longer than the India-Europe link.

Link	Speed	Relative Cost
Brazil-Europe	622Mbps	3.6
China-Europe	2.5 Gbps	21
India-Europe	45 Mbps	31
Singapore-Europe	622Mbps	3.8
US-Europe	10Gbps	1

Table 2.1: Relative link costs

Nearly all of the difference between the links to Singapore and India is due to the lack of competitiveness of the telecommunications market for international connections to India. It therefore raises the difficult question of how such costs should be shared. In practice, an agreement was reached such that the terrestrial costs within India should be paid exclusively by India, and the remaining price elements would be shared on a 50/50 basis subject to a budget limitation.

In a European context, cost-sharing within GÉANT2 (and also within the previous European models of cost-sharing) reflects the relative competitiveness of international costs of connectivity to a country. This means that cheaper, more competitive countries, do not unreasonably subsidise more monopolistic countries. The same issues arise in respective global cost-sharing, but without any common framework for their resolution.

Table 2.1 illustrates that point. It compares the cost of a 10 Gbps link between the US and Europe and a 45 Mbps link between India and Europe. On a price per unit capacity basis, the US-Europe connection is 200 times cheaper than the India-Europe connection. This reduces to a factor of 31 if the economies of scale that arise from the greater capacity of the US-Europe link are taken into account.

2.1 Practical Cost Sharing

Where interconnection costs are shared, there are two models of cost sharing that apply in practice:

- Mutual provision.
- Shared circuit cost.

In mutual provision, each party is separately responsible for providing connectivity. This is the model in operation between Europe and Japan and between Europe and the United States. However, the details are different between the two. Between Europe (GÉANT2) and Japan (Sinnet representing Japanese Research and Education networks) Europe provides trans-Atlantic connectivity and this is met in New York by matching connectivity from Japan. The current capacity is 2.5 Gbps. In the case of the United States, there are two 10Gbps links funded by GÉANT2. These are matched by two 10Gbps funded by US sources. One 10 Gbps link

is funded by Internet 2. The second 10 Gbps link is funded by the US National Science Foundation on behalf of all the US Research Networking organisations.

Shared circuit cost (sharing the cost of an individual circuit) is used between Europe and China and India respectively. In the case of China a 2.5 Gbps link is provided. This was created by upgrading the original 622 Mbps link funded by TEIN2. The cost of the upgrade is funded by CERNET, on behalf of all Chinese Research and Education Networking together with matching European funds. In the case of the link between ERNET (the Indian NREN) and GÉANT2, the international portion of the link is funded 50/50 by Indian and European funding.

All other links are either part of the aid related projects or are not funded from Europe.

3 Point-to-point Services

In the context of global policy, a Point-to-point circuit is defined as a single Layer1/Layer2 dedicated circuit. This circuit path can be a 10 Gbps wavelength or a sub-wavelength path, which can be a Gigabit Ethernet path or a dedicated SDH slot. As the path crosses multiple domains in a global environment the concept of an end-to-end circuit (that is, the complete interconnection between two Research and Education end-users) is also defined.

As noted above, there is a significant distinction between interconnecting IP services on a global scale and interconnecting point-to-point services. For IP services, all of the users that are interconnected and wish to exploit the interconnection will gain additional connectivity that enhances the IP connectivity that they had before the new connectivity was provided. The issues of global cost sharing essentially come down to the questions of relative geographic scope and interconnection costs identified above.

However, with point-to-point services three new issues arise because of the dedicated nature of the resources:

- Replacement costs for interconnecting links. As more paths are implemented, the interconnecting link between networks becomes filled. There is no stochastic process that can provide shared capacity over long periods of time, as is the case with an IP service. Thus the issue of adding new capacity becomes an important factor.
- The way the dedicated paths are priced within an individual domain. In the context of GÉANT2, it was decided that an incremental cost model should be used for point-to-point services, whereby the bulk of the cost of the network is allocated to the IP service. In a global connection spanning multiple domains, it was decided that GÉANT2 should look for similar cost sharing principles in interconnection agreements with other networks, to avoid European subsidy for global connections.
- Some non-European Research and Education end user groups are interested in bringing connectivity to a Global Lightpath exchange, which is a Level1/Level2 cross connect node aimed at facilitating the provision of wavelength or sub-wavelength global point-to-point circuits. Where such an exchange is associated with a GÉANT2 PoP, the possibility exists for provisioning global end-to-end circuits between GÉANT2 end-users and Research and Education end-users outside the GÉANT2 service area.

Bearing these issues in mind, the NREN PC agreed a special policy resolution regarding cost sharing and point-to-point services. It recognised the need to develop interconnection agreements with non-European NREN's to deal with the seamless provision of point-to-point services, encouraging the completion of Memoranda of Understanding with relevant non-European NRENs where similar principles of cost sharing have

been agreed. At the time of this resolution, agreement had been reached with Internet2 and ESnet in the United States. The resolution also mandated DANTE to initiate the signing of additional relevant MoUs.

In addition, in the case of Global Lightpath Exchanges, it was agreed that they could be directly connected to GÉANT2 PoPs for provisioning global end-to-end circuits between GÉANT2 end-users and Research and Education end-users outside of the GÉANT2 service area, subject to the development of appropriate operational agreements being concluded with a Global Lightpath Exchange operator.

4 Conclusions

There are a number of issues that arise in terms of global cost sharing. In particular, the relative geographic scope of the networks that are being interconnected and the costs of interconnection are important factors. In the case of the latter, there are significant geographic variations in cost that influence cost-sharing policy.

The issue of point-to-point services raises new policy issues because of the dedicated nature of the connectivity provided. The policy positions concerning cost sharing and point-to-point services, both for non-European NREN's where there are interconnection agreements and also via Global lightpath exchanges, is considered and the principle of the requirement for reciprocity of pricing policies is identified.