



SERVICE DESCRIPTION INTERNET TRANSIT

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BROAD|NET

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1 Introduction

This document provides the governing description of Broadnet Internet Transit – a service designed for service providers that resell Internet services. The product is also ideal for Clients who require redundant Internet connections through several Internet Transit service providers (Multi-Home).

On entering into an agreement for Internet Transit, Broadnet will supply access to the Internet, both international and national, with the features and standards defined by Broadnet at any one time.

The document describes all the major details of our offer of services. Additional information will be supplied in a meeting arranged with our experts.

2 Definitions and abbreviations

The table below shows an overview of the definitions and abbreviations used in this document:

Abbreviation	Explanation
AS	Autonomous Systems
DoS	Denial of Service
DWDM	Dense Wavelength Division Multiplexing
IGR	Internet Gateway Routers
IP Transit	Joint traffic with ISPs who offer global IP transport
ISP	Internet Service Provider
KP	Client connection point
NIX	Norwegian Internet eXchange
NOC	Network Operation Center/Broadnet's Operations Center
Router	Network equipment used to link different networks
SNMP	Simple Network Management Protocol
Switch	Network equipment used to link the Client's internal network
LINX	London Internet Exchange Ltd
Delay, also called RTT	The time it takes for a signal that is sent to a destination plus the time it takes to receive confirmation that the signal has been received

3 Service overview – National and International

BROADNET supplies Internet and transmission in the same service (Internet Transit) with the objective of delivering the guarantees and services requested by the Client at any one time. The service is based on that the Client has his own unique AS number.

Internet Transit from Broadnet encompasses the following elements:

- National and International IP Transit
- Access to our private peering partners
- CE/Ethernet Port
- Capacity in Broadnet's own network
- Improved access to selected content



3.1 Geographic cover – Internet Transit

Broadnet is represented on the Internet with its own AS number, AS 2116, nationally and internationally, through joint traffic with participants on:

3.1.1 National

- National Internet eXchange (NIX) 1
- National Internet eXchange (NIX) 2
- Private Peering

The participants who are linked via private peering are major network operators who are represented nationally and are physically linked via their own infrastructure to public joint traffic hubs.

3.1.2 International

Broadnet co-operates with several of the largest international Transit providers. Through these international providers Broadnet also has full access to the various national, continental and global research and university networks that are linked to the Internet.

All Broadnet's Internet providers have been selected after a thorough assessment of physical transmission lines, routing, global infrastructure, redundancy, response times and volume of critical error/fault situations such as: DoS attacks and similar that are generated in their networks. These are a selection of the quality parameters Broadnet defines as minimum criteria when selecting Internet Transit providers.

3.1.3 Google

Broadnet has an agreement on private peering with Google in Stockholm. We also have Google's servers centrally located in our network at two locations in Oslo. This will provide our clients with very good response times and access to Google's international network and applications.

3.1.4 Akamai servers

Broadnet co-operates with Akamai on the placement of a server park in our core network. Broadnet and Akamai have several data interfaces in the core network (two locations in Oslo and one location in Stockholm). Akamai is used by amongst others the largest distributors of international news and media (video, text and image news). In addition a number of major software companies use Akamai for file distribution when upgrading and so forth. This is to the advantage of our clients as it enables all information to be downloaded in the shortest possible time, and all functions are automatically controlled via name server searches from Akamai centrally. In short, Akamai functions as a caching server.

The service is available to all who are connected to Broadnet Internet.

3.1.5 Looking Glass

Broadnet uses Looking Glass proactively up against the various suppliers in regular quality assurance of response times for the various destinations. We also have access to service quality metrics gathered on a general basis against the individual suppliers for response times and packet loss (measured using remotely installed probes).

All participants who supply Internet Transit are terminated at Broadnet's various IGRs (Internet Gateway Routers) with 10 Gbps Ethernet connection. The exchange of routing information between Broadnet and the supplier is accomplished with the BGP-4 protocol.

3.2 Own Peering and Internet infrastructure

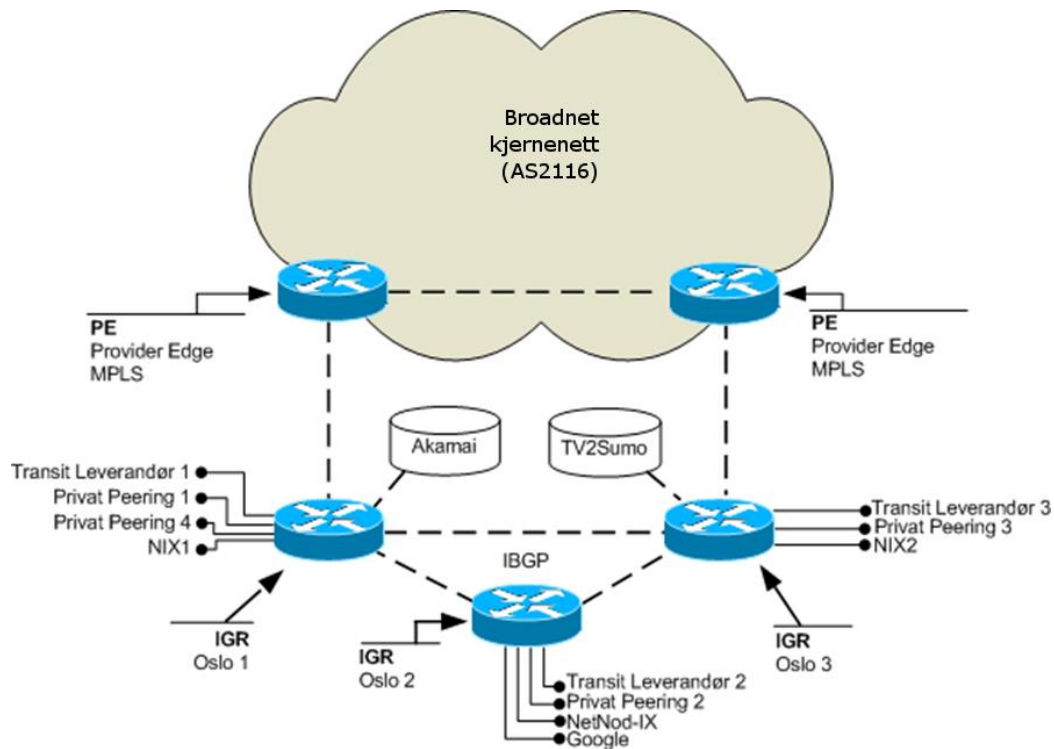
Broadnet has amongst other arrangements fiber links to public National IX points (Internet Exchange) and with several Private Peering partners, where traffic exchange is based on 10 Gigabit Ethernet interfaces. We have also established a number of peering agreements with the majority of participants over NIX 1 and NIX 2 (Internet Exchange), where national joint traffic is exchanged.

Exchanges between the Partner's own AS (Autonomous System) number are accomplished using the BGP-4 protocol.

Broadnet AS' number is: **2116**

We currently practice a selective peering policy, under which we enter into written peering agreements with the companies represented at the various public national IX points and that are qualified to the applicable criteria at any one time for peering with Broadnet. The agreements are normally entered into when the ISPs contact Broadnet's peering group or Broadnet contacts the individual ISP requesting peering.

3.3 Diagram of National and international exchange



3.4 Network design

Broadnet is one of Norway's largest providers of various transport methods and we base our activities on the use of modern technologies between cities/towns and other population base areas in Norway:

- DWDM 2.5 and 10 Gbit/s (wavelengths)
- MPLS (Multi-Protocol Label Switching)

3.5 Service availability

Broadnet's infrastructure is constructed with a national redundant transmission team based on DWDM, and SDH equipment, and we have also built in redundant IP networks based on MPLS in all our kernel nodes.

- DWDM / SDH network redundancy
- SDH re-routing speed (< 50 ms)
- Diversity of routers and node rooms
- Several international partners at global IP terminations
- Redundant National Internet eXchange links
- Own link to NetNod-IX
- Own link to LINX

3.6 Physical interfaces

Broadnet Internet Transit is supplied with electrical interfaces for speeds up to and including 1 Gbps. For speeds above this the interface is optical. Routers can be ordered as an option for all speeds.

4 Network Operations Center and support

The main function of the Network Operation Center (NOC) is to ensure the quality of solutions already supplied to clients.

Amongst other things this encompasses:

- Monitoring the performance of the systems and services supplied
- Specialist expertise in fault-finding and rectification of the above
- Fault rectification is terminal based or via Broadnet field apparatus (also applies to third party field apparatus)
- Responsibility for expert standby arrangements for all services
- Stipulates requirements/standards for agreements with field apparatus and third parties and responsibility for support agreements with suppliers

In order to carry out its responsibilities NOC shall pre-approve all new products and services prior to these being supplied to the Client as well as responsibility for final testing/commissioning and approval of new platforms and network elements prior to these being implemented in the net.

5 Internet protocol – TCP/IP

When using the TCP/IP protocol set unique addresses are used for the linked units. These addresses are administered by Broadnet's Registry Department for amongst others the organizations ARIN (for USA), RIPE (for Europe) and APNIC, which we distribute.

All who wish to utilize TCP/IP as their communications protocol in Broadnet's network must have IP addresses that are approved and registered by one of these organizations. Broadnet can assist Clients in obtaining their own IP addresses by request. Broadnet has the proviso that allocation of address are approved by RIPE.

For the Internet Transit service we utilize IPv4 and official IP-addresses. IPv6 is at the pilot stage and can be supplied to clients on request. RFC 1918 addresses are not supported. Official addresses are only allocated on the basis of approved applications for specified requirements.

5.1 Information DNS, NTP, Multi-homing

5.1.1 DNS Cache Services

The DNS Cache Service is available and is included in the service at no extra cost. In such cases the Client is responsible for handling his own Primary and Secondary DNS servers in his infrastructure.

5.1.2 Network Time

Broadnet Internet supports "Network Time Protocol" (NTP), thus enabling the Client to receive time synchronization (based on an atomic clock) from Broadnet's infrastructure and to synchronize clocks in the Client's network equipment. This functionality is included in the service at no extra cost.

5.1.3 Multi-Homing

For ISPs or Carriers that wish to connect to the Internet via Broadnet and other Internet providers (Multi Homing), the BGP4 dynamic routing protocol is supported. Agreements are negotiated in response to queries.

5.2 SLA – Service Level Agreement (SLA)

The Service Level Agreement (SLA) is described in detail in a separate document. This section provides only a short summary of the periods covered and the quality levels. The service level offered is a combination of service time periods and the standard of quality specified for the service.

5.2.1 Service times

Service time specifies the actual period during the day when the reporting of errors/faults, processing these and rectifying these is possible. Unless covered by a separate, dedicated agreement, standard service times apply. Extended or continuous service time can be ordered as an additional service.

Description	Type of fault rectified	Service time
Basis	All	Working days 08:00 – 17:00
Extended	All	Working days 08:00 – 22:00 Saturdays 08:00 – 22:00
Continuous	All	24/7/365

5.2.2 Quality level

The quality level specifies availability, packet loss, jitter and response times for rectification of access. Unless a separate, specific agreement is entered into, Quality Level 1 applies for the ? access. Higher quality levels can be supplied as an additional service.

5.2.3 Quality levels for the internet access service

The following quality levels are offered for the Internet access service:

Internet access	Level 1	Level 2	Level 3
Minimum accessibility	99.50 %	99.60 %	99.75 %
Physical fault rectification	< 10 timer	< 8 timer	< 5 timer
Terminal based rectification	< 8 timer	< 4 timer	< 3 timer
Access realization	Single	Single	Single
Response time	2 timer	1 time	30 minutes
Reporting	2 timer	1 time	30 minutes
Maximum Jitter	20ms	20ms	20ms
Maximum packet loss	0.50 %	0.20 %	0.10 %

5.3 Packet loss, delays and jitter

The quality of the transmission in Broadnet's national IP net is defined on the basis of the parameters:

- Packet loss
- Delay (RTT)
- Jitter (variation in delays)

Guaranteed internet	Internet
Packet loss	< 0.5%
Delay (RTT) < 1200 Km	55
Delay (RTT) > 1200 km	79
Average jitter	-

The table shows the guarantees for national Internet traffic sent to interface points to other operators.

5.4 Network response times International (Latency, RTT)

Network response time International (latency, round trip time)

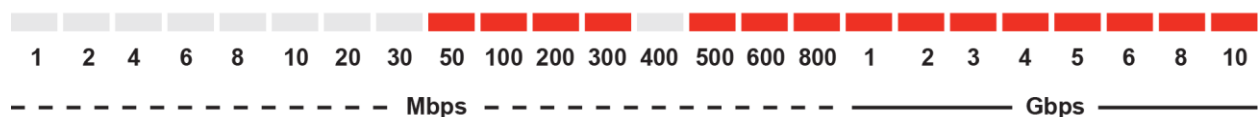
Region	Explanation	Estimated network response times (per month)	Estimated packet loss (per month)
Intra - Europe	Average RTT through links between European kernel nodes	65 ms	0.1 - 0.5 %
Europe - USA	Average RTT through links between European and US (New York PoP)	99 ms	0.1 - 0.5 %
Intra - USA	Average RTT through all links in US kernel nodes	75 ms	0.1 - 0.5 %
North America – Asia	Average RTT between North America and Asia	Hong Kong 220 ms, The Philippines 190 ms, Japan 175 ms	0.1 - 0.5 %
North America - Australia	Average RTT between links in North America and Australia	200 ms	0.1 - 0.5 %
Europe - Asia	Average RTT between links in Europe and Asia	310 ms	0.1 - 0.5 %

RTT = RoundTripTime

The service quality of RTT can deviate to some degree dependent on the provider through which traffic is routed. The values are an average of all providers used by Broadnet.

5.5 Choice of speed

Internet Transit is supplied with the following speed choices (Mbps):



5.6 Internet transit is offered at the following locations

PE node	Speeds
Oslo Sentralbanestasjon (Central Station)	All speeds
Oslo, Nydalen Fernanda Nissens gate 3	All speeds
Oslo, Østre Akervei 19	All speeds
Bergen	All speeds
Stavanger	All speeds
Trondheim	All speeds
Hamar	All speeds
Other locations, please enquire	

6 Limitations in the service

Broadnet Internet Transit is a service adapted for on-sale to end users in companies and the private market. A special application must be submitted by clients who wish to sell-on to on-sellers.

7 Price

7.1 Pricestructure

The service is priced with a start-up price and a monthly price. Start up prices of the service depends on the agreement length and the service type. Additional prices, i.e. internal cabling, relocation and other work in the customer premises, is not included in start-up price.