

# ETHERNET TRANSPORT SERVICE

**Service Description** 

# **Document Control**

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# **BNL ETHERNET TRANSPORT SERVICE**

#### 1 Introduction

This document is an informational document describing the BNL Ethernet Transport Service. It does not form a contractual obligation or commitment. If this document is inconsistent with a BNL Capacity Lease Agreement, the relevant provisions within the relevant Agreement take priority.

Unless otherwise defined below, terms used in this document have the same meaning as in the BNL Capacity Lease Agreement (whichever is applicable, collectively an 'Agreement') and should be read in conjunction with that document.

## **2 Service Description**

The **BNL** Ethernet Transport Service (the Service) is a point-to-point Ethernet communications service offered by BNL between Kiritimati and specified locations on the Southern Cross network.

#### 2.1 Southern Cross Network

With the addition of the Southern Cross NEXT ("SX NEXT") cable, the Southern Cross Network consists of three separate submarine cable paths laid over diverse routes between Australia and the United States West Coast. High capacity, secure fibre optic connections link each of the cable landing stations in the common jurisdictions, such as Australia, New Zealand, Hawaii and the US West Coast. SX NEXT adds diverse landings in Fiji (Savusavu) and new cable landings in both Tokelau and Kiribati (Kiritimati Island).



For the Operators in Kiritimati, BNL now offers international Ethernet transport to anywhere on the Southern Cross network.

Table 1: Southern Cross Network - On Net Locations

Southern Cross Network "On-Net" Locations			
Kiritimati BNL SX CLS to:	Fiji	SX CLS Suva	
		SX CLS Savusavu	
	New Zealand	SX CLS Takapuna	
		SX CLS Whenuapai	
	US West Coast	SX Data Centre PoP – CoreSite LA2	
		SX CLS Morro Bay	
		SX CLS Hillsboro	
	US Hawaii	SX CLS Kahe Point	
		SX CLS Spencer Beach	
	Australia	SX CLS Alexandria	
		SX CLS Brookvale	

#### 2.2 BNL Ethernet Product Overview

BNL offers 1GigE or 10GigE access services, the specifications and performance for these services being consistent with those offered via the Southern Cross GigaPAC (1GbE & 10GbE Layer 2 Ethernet) and GigaNET (10GbE Layer 1 Ethernet) products.

For the 10GbE GigaNET product, Ethernet frames are carried over Southern Cross Layer 1 OTN backbone facilities. 10GbE (GigaNET) services are unprotected, full-rate only configurations and are interfaced directly off the Southern Cross Ciena 6500 equipment at the BNL Landing station. For the layer 1 service, the 10GbE payload is mapped transparently to an OTN ODU-2e payload.

For the 1GbE & 10GbE GigaPAC product, Ethernet frames are carried over Southern Cross Layer 2 MPLS Carrier Ethernet backbone facilities as dedicated pseudo-wires. The 1GbE and 10GbE (GigaPAC) services are available in different configurations and support sub-rated capacities (e.g. 5Gb CIR on a 10GbE interface), discussed further below, and are interfaced directly off the Southern Cross *Ciena 5170* equipment at the BNL Landing station.

The Layer 2 Ethernet product supports both Ethernet Private Line ('EPL') and Ethernet Virtual Private Line ('EVPL') configurations.

BNL Ethernet Transport services are available as a single mode fibre interface 1GbE (only GigaPAC) and 10GbE (GigaPAC and GigaNET).

# 2.3 Layer 1 10GbE (GigaNET) Ethernet Overview

Table 4, Annex 1 summarises the key configuration parameters that a customer connecting to a BNL Layer 1 10GbE service on the Ciena 6500 equipment should be aware of to ensure proper service operation.

## 2.4 Layer 2 1GbE & 10GbE (GigaNET) Ethernet Overview

Tables 5 to 10, Annex 1 summarise the key configuration parameters that a customer connecting to a BNL Layer 2 1GbE or 10GbE service on the Ciena 5170 equipment should be aware of to ensure proper service operation. As the Layer 2 service utilizes MPLS to provide subrated capacity profiling, additional configuration parameters are applicable to those required for the Layer 1 service above.

The Layer 2 Ethernet product supports both "Ethernet Private Line ('EPL')" services, representing an effective single circuit per interface, and "Ethernet Virtual Private Line ('EVPL')" services, where multiple virtual circuits for the same customer can be bundled onto a single ethernet interface.

An EPL circuit and an EVPL circuit are treated as equivalent across the Southern Cross network, with the deployment of either variant dependent on the customer requirement.

#### 3 Protection

The BNL network is an unprotected system – a single submarine fibre optic submarine cable connects Kiritimati into the Southern NEXT network. All equipment, such as repeaters, amplifiers and optical switching nodes, have redundant components and power systems to provide resilience against component failure.

Access Protection and Service Protection is outside the network boundaries of the BNL Network.

#### 4 Backhaul Providers

Within Kiritimati, Operators are required to arrange their own connecton into the Tabwkea Cable Landing Station. To facilitate such interconnection, BNL is providing access to a Radio Tower at the CLS site, and in future may provide a terrestrial fibre optic connection option.

At the overseas end however, Operators will require additional services to be able to efficiently interconnect to and utilise the BNL Southern Cross cable capacity. This section provides information to help identify a range of Service Providers who may be able to provide necessary support.

Southern Cross provides access via two cable stations in each of Sydney, Auckland, Hawaii and the US mainland, and two in Fiji (upon the completion of NEXT). Access is also available via the CoreSite Market Post Tower facility in San Jose, California, the Westin Building (WBX), Seattle, Equinix in San Jose, Coresite 1 and 2 in Los Angeles, Equinix 1 in Los Angeles, Hillsboro and Equinix SY1 and Global Switch in Sydney. It is Operator choice where to egress or interconnect at the distant end, though some off-net locations (refer Table 2 below) may incur an incremental backhaul extension charge, and in most overseas countries on the SX network Operators can connect either directly at the SX Network Interface Point within a cable station or an access point, or obtain access via a Backhaul Provider.

Backhaul Providers provide the connection between BNL's Southern Cross capacity and the respective distant-end domestic network by providing access to relevant Southern Cross cable stations.

Backhaul capacity is available on a competitive basis in terms of pricing, provisioning and operational performance at all destinations on the SX network. Multiple backhaul providers are available in the US mainland, Australia, New Zealand and Hawaii.

Southern Cross provides this list of potential backhaulers to all on-net locations to assist Operators in obtaining services they require. Please go to the following link:

https://southerncrosscables.com/home/network/backhaulers

However, all commercial arrangements for obtaining the backhaul services offered are a matter between each Operator and their selected backhauler. Should you have any queries about the provision of service, please contact the appropriate provider directly.

Besides the on-net locations outlined in Table 1, BNL (via Southern Cross) can also arrange backhaul connectivity to the following Southern Cross "Off-net" locations (Table 2 below). Incremental backhaul extension fees may apply.

Table 2: Southern Cross Network Off-net Locations

Southern Cross Network "Off-Net" Locations			
Kiritimati BNL SX CLS to:	US West Coast	Seattle WBX Exchange	
		Equinix SV1, Silicon Valley	
	Equinix SV8, Palo Alto		
	Equinix LA1, Los Angeles		
	CoreSite LA2, Los Angeles		
		Equinix LA4, Los Angeles	
	Australia	Equinix SY1, Sydney	
		Global Switch, Sydney	

## **4 Service Components and Options**

The BNL Ethernet Transport Service consists of a single orderable component as set out in section 4.1 (Access Ports).

## **4.1 Physical Access Ports**

The Service may be ordered with one of the following standard interface types for the Access Port at each end of the Service. For further specifications on the Ethernet access ports please refer to Annex 1.

Table 3: Ethernet Interface Summary

Interface Type	Nominal Interface Rate	Carriage Format	Applicable Configurations
Layer 1 Ethernet			
10G Ethernet: 10GBASE-LR	10 Gbps	OTN (ODU2e)	Full Rate (10Gbs) Only
Layer 2 Ethernet			
Gigabit Ethernet: 1000BASE-LX	1 Gbps	Ethernet-over-MPLS	Sub-rate CIR supported (see Table X below)
10G Ethernet: 10GBASE-LR	10 Gbps	Ethernet-over-MPLS	Sub-rate CIR supported (see Table X below)

## **4.2 Layer 2 Supported Committed Information Rates**

Layer 2 Ethernet services are provided by dedicated pseudo-wire and support the following Committed Information Rates (CIR), based on selected interface. The Excess In Rate (EIR) is zero for all services.

Table 4: Supported Committed Information Rates

Service Type	Supported CIR
1GbE Service	100 Mbs
	200 Mbs
	300 Mbs
	400 Mbs
	500 Mbs
	600 Mbs
	700 Mbs
	Full Rate (1Gbs)
10GbE Service	1 Gbs
	2 Gbs
	3 Gbs
	4 Gbs
	5 Gbs
	6 Gbs
	7 Gbs
	Full Rate (10Gbs*)

CIR values >700Mbs on a 1GbE Ethernet service are not recommended, as due to ethernet framing overheads a customer may not achieve the desired throughput.

CIR values >7Gbs on a 10GbE Ethernet service are not recommended, as due to ethernet framing overheads a customer may not achieve the desired throughput.

<sup>\*</sup>It is recommended that full rate 10GbE service be provided using 10GbE Layer 1 Ethernet service.

## **5 Service Specifications**

Performance Measure	Specification	Comment
Service availability:	99.9%	Calculated monthly.  Service availability is measured from BNL SX CLS to SX CLS at each location.
Time to switch to backup path:	< 200ms, if backup path exists	
Bit Error Rate:	< 10-12	
Latency: (one-way)	KIR-LA: 25 msec KIR-Takapuna: 45 msec KIR - Fiji: 34 msec KIR-Sydney: 51 msec	
Jitter:	< 1 μs jitter	
Frame Delay Variation	99% within ± 5 ms of Mean Frame Transfer Delay	Ethernet access ports only
Frame Loss Ratio	<0.1%	Ethernet access ports only
Service Coverage Period:	24 x 7 x 365	

# **6 Operator Equipment Requirements**

#### **6.1 Technical Standards**

All Operator Equipment must meet all applicable technical standards, including:

- Operator cabling for circuits interconnecting to Southern Cross or BNL Optical Switches must be Low Smoke Zero Halogen (LSZH) Duplex (dual-core) single-mode optical fibre, with transmit and receive signals on separate nine micron optical cores;
- All Operator interface signals must comply with the optical specifications of G.959.1,
  particularly with regard to maximum mean launched power and consequent power levels at
  BNL's SX receiver interface so as not to damage SX optical receivers. Where a Operator's
  optical signal is measured to exceed the maximum mean received power and BNL's SX
  equipment is damaged as a result, the Operator will be required to reimburse BNL for the new
  replacement cost of the damaged equipment;
- The international standards identified for the applicable Physical Access Ports specifications as outlined above.

#### **6.2 Optical Safety**

All Operator Equipment interfaces must comply with IEC 60825-1 and 60825-2 Hazard level 1M optical safety specifications.

#### **7 Service Levels**

BNL does not guarantee services levels. However, service levels need to be specified to facilitate testing and acceptance of a service. A service is deemed acceptable once verified to be operating within the specifications detailed under item 5.

#### 7.1 Service Availability

The Service Availability performance level applicable to the Service is 99.9% (less than 44 minutes of unavailability per month).

Service Availability is measured from BNL CLS to Distant CLS and is calculated monthly as follows:  $SA(\%) = Uptime/Total Time \times 100$ 

Where:

**Uptime** = Total Time less sum of Unscheduled Outage Times (in minutes in the month); **Total Time** = Total number of minutes in the month, less any permitted downtime such as during Scheduled Maintenance works.

## 8 Monitoring, Repair and Maintenance

#### 8.1 General

BNL monitors the network and services on a 24x7x365 basis and provides a point of contact for Operators to report service difficulties and suspected Faults.

BNL will monitor alarms relevant to the Operator's Services and may open proactive Trouble Tickets as a result of these alarms, as well as in response to a Operator Reported Fault (see section 9 of this Service Description).

## 8.2 Fault Severity Levels

When a Fault is reported to BNL in accordance with the Fault reporting procedure set out in Section 9 of this Service Description, BNL will initially categorize the incident as to its severity level based on the characteristics and impact of the Fault as reported in the Fault Report.

The following table sets out the severity levels used by BNL, the objective measures for severity classification, and the expected interval between updates to the Operator during resolution of the Fault.

Table 5: Fault Severity Levels and Update Periods

Severity Level	Description	Measure	Status Update Period (see section 9.6)
Critical	Service is completely down, or severely impaired so as to be unusable	LOS, AIS and/or CIR Frame Loss Ratio > 50%	30 minutes
Major	Service is usable, but noticeably degraded, or is operating outside the Service Specification	CIR Frame Loss Ratio > 10%	1 hour
Minor	Minor issue, Service remains within Service Specifications	N/A	24 hours or longer as agreed
Informational	Non-service affecting issue, including billing, technical enquiries, and Programmed Maintenance notifications	N/A	N/A

#### 8.3 Proactive Notification

In many cases a Fault within the Operator's network or facilities will be visible to the BNL as an alarm arising from a Operator access network port – for example if the power to the Operator's equipment failed. Where the Operator has registered a contact point for proactive fault notifications, BNL will use reasonable endeavors to proactively contact the Operator's contact point and notify them of the alarms detected within the BNL network, and the resultant impact on the Operator's Services.

#### 8.4 Informational Tickets

An Informational Trouble Ticket will be opened to track Programmed Maintenance Window activities, and the Trouble Ticket number will be notified to the Operator in the Programmed Maintenance Window notice.

An Information Trouble Ticket will also be opened where BNL is notified of scheduled maintenance or other activities of the Operator on its own network that may affect the Service or generate alarms within the BNL network as required.

## 9 Fault Reporting and Diagnosis Procedure

#### 9.1 Own Investigation

A Operator that is experiencing degradation of a Service should first perform its own sectionalisation and testing of the service issue and determine so far as possible whether the degradation is within the Operator's network or network equipment and confirm that the issue arises within the BNL network.

#### 9.2 Contact BNL CSC

The Operator may report a Fault at any time by reporting it to BNL by telephone or electronic mail as set out below:

**BNL Network Operations:** 

Telephone number: tba Email Address: tba Escalation Point: Operations Manager: tba

Telephone Number: tba Email Address: tba

The Operator must report a Fault that it considers to be 'critical' or 'major' (as set out in Section 8.2) by telephone. The Operator may report all other Faults and make any other routine queries and inquiries by e-mail. BNL will not be responsible for delays in opening a Trouble Ticket arising directly or indirectly from a Fault being reported inappropriately by email, as determined by BNL in its absolute discretion.

#### 9.3 Fault Report Information

The Operator must provide enough details in a Fault Report to enable BNL staff to look up the service and site characteristics and diagnose the problem. As a minimum, a Fault Report must contain the information set out below. Opening of a Trouble Ticket may be delayed if BNL staff need to gather further information before the service, site and Operator can be identified.

The following details must be supplied in a Fault Report:

- Operator's Organization Name & Name of person reporting the Fault.
- Contact telephone number and email address of person reporting the Fault.
- Service identification number of the Service experiencing the Fault.

- Location of the site experiencing the Fault & Description of the Fault.
- Estimated time the Fault commenced.
- Any logfile entries or other diagnosis that might assist BNL in investigating the Fault.

#### 9.4 Trouble Tickets

Upon receiving notification of a Fault and the Fault Report, BNL will prioritise the Fault and enter the details in BNL's Trouble Ticket system to track and record the Fault. A unique Trouble Ticket number will be assigned to the Fault, and issued to the Operator. The Operator must use and quote that Trouble Ticket number in relation to any communications or other dealings it has with BNL in respect of that Fault.

#### 9.5 Severity Classification

BNL will initially classify and prioritize a Fault according to the criteria specified in Table 1 of Section 8.2. BNL's initial classification may be changed during the resolution process. If the Operator feels the Trouble Ticket has an incorrect classification, they may escalate the issue to the BNL Duty Manager, who will determine the appropriate classification of the Fault. The BNL staff will continue to manage the Trouble Ticket to resolution at the fault classification determined by BNL while the classification is escalated to the Duty Manager for resolution.

## 9.6 Status Updates

After opening a Trouble Ticket, BNL will endeavor to restore normal service operation as quickly as possible, commensurate with the relevant severity level of the Fault and the impact to the Operator.

BNL will endeavor to contact the Operator to provide progress updates at intervals not exceeding the intervals specified in Table 1 of Section 8.2.

#### 9.7 Service Restoration

When BNL has effected either a permanent or temporary repair and the Service has been restored to an operational state, BNL will note on the Trouble Ticket that the Service has been restored. As soon as reasonably practicable thereafter, BNL will notify the Operator of that fact and request the Operator verify that the Service is operational. Note that a 'Restored' status may mean that a temporary fix has been put in place in order to allow the Operator to use the Service, and a more permanent repair may be required at a later time.

#### 9.8 Closure of Trouble Ticket

After the Service has been restored and a permanent repair has been made, the BNL will make reasonable efforts to contact the Operator and verify that the Trouble Ticket may be closed. The Trouble Ticket will be closed by BNL if no further communication is received from the Operator within 5 business days of any such contact being made by BNL.

#### 9.9 "No Fault" Conditions

If BNL (acting reasonably) determines that:

A Fault arose in or in connection with the Operator Equipment, or the Operator's facilities, networks or systems, or as a result of any wrongful or negligent act or omission by the Operator, its employees, servants, agents or contractors, or any third party; or There was no Fault (a "No Fault Condition"), then BNL may charge the Operator a fee for remedying the Fault or investigating or attempting to remedy the No Fault Condition, together with any out of pocket expenses reasonably incurred by BNL in doing so.

#### **End of Service Description**

# **Annex 1 Configuration Parameters**

# Layer 1 10GbE Ethernet (EPL) Parameters

Table 6: Layer 1 Ethernet - Configuration Requirements

Configuration	10GbE – LAN PHY
Technology	EoOTN
Mapping	ODU2e
Max Frame Size	9216
Auto-Negotiate	ON
Flow Control	OFF
Traffic Shaping Required	No
Burst Size (KB)	N/A
Throughput	100%
Timing	Transparent
Interface	
Classification	10GBASE-LR
Connector Type	LC-UPC
Fibre Type	Single Mode
Nominal Reach	10km
Transmitter	
Nominal wavelength/s (nm)	1290 to 1330
Transmit Output Power (dBm)	-8.2 to +0.5
Receiver	
Wavelength Range (nm)	1260 to 1580
Power Range / Sensitivity (dBm)	+0.5 to -14.4
Minimum Attenuation (dB)	0
Nominal Reach	10km

# Layer 2 1GbE & 10GbE Ethernet (EPL & EVPL) Parameters

Table 7: Layer 2 EPL Interface Configuration Parameters

EPL Parameters	1G	10G		
Interface				
Supported Interfaces	1000BASE-LX	10GBASE-LR4		
Connector	LC-UPC	LC-UPC		
Fibre Type	Single Mode	Single Mode		
Tx Wavelength (nm)	1270 to 1355	1290 to 1355		
Tx Output Power (dBm)	-9 to -3	+8.2 to +0.5		
Rx Wavelength (nm)	1260 to 1580	1260 to 1565		
Rx Power Range (dBm)	-20 to -3	+0.5 to -14.4		
Minimum Attenuation (dB)	0	0		
Nominal Range	10km	10km		
Settings				
Auto-negotiation	Manda	atory ON		
Speed	1Gbps	10 Gbs		
Duplex	Full-I	Duplex		
Flow Control	Disa	abled		
MAC Layer	IEEE 802.3-2012			
Max MTU	9216			
Service Multiplexing	No			
Bundling	No			
All to One Bundling	Yes			
Maximum EVC	1			
Ingress Bandwidth Profile	Per EVC, CIR/CBS only			

Table 8: Layer 2 EVPL Interface Configuration Parameters

EVPL Parameters	1G	10G	
Interface			
Supported Interfaces	1000BASE-LX	10GBASE-LR4	
Connector	LC-UPC	LC-UPC	
Fibre Type	Single Mode	Single Mode	
Tx Wavelength (nm)	1270 to 1355	1290 to 1355	
Tx Output Power (dBm)	-9 to -3	+8.2 to +0.5	
Rx Wavelength (nm)	1260 to 1580	1260 to 1565	
Rx Power Range (dBm)	-20 to -3	+0.5 to -14.4	
Minimum Attenuation (dB)	0	0	
Nominal Range	10km	10km	
Settings			
Auto-negotiation	Mandatory ON		
Speed	1Gbps 10 Gbs		
Duplex	Full-Duplex		
Flow Control	Disabled		
MAC Layer	IEEE 802.3-2012		
Max MTU	9216		
Service Multiplexing	Yes		
Service Demarcation	CVLAN (Ethertype 0x8100)		
Bundling	Yes		
All to One Bundling	No		
Untagged CVID	No		
Maximum EVC	10 10		
Ingress Bandwidth Profile	Per EVC, CIR/CBS only		
Untagged Frames	Discarded		

## **Layer 2 Ethernet Service Parameters**

Where a customer is using the Layer 2 Ethernet service, they should also be aware of the following management domain parameters, package transport handling as well as relevant settings required within their own network routers to ensure appropriate interfacing and service operation.

#### **Connectivity Fault Management & Management Domains**

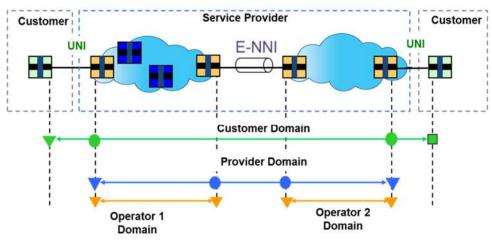


Figure 1: Management Domain Hierarchy

To ensure appropriate interoperability, and visibility across the different operator networks it is necessary that potential customers set the management domain parameters appropriately in their network:

Connectivity Fault Management (CFM) and Management Domains (MDs) [IEEE 802.1ag]:

- Southern Cross will utilise the Operator Domains 0-2, (Default: 1);
- Provider Domains 3-4 have been reserved for BNL;
- Customers of BNL must utilise Customer Domains 5-7.

#### **Protocol Handling**

Table 9 below summarises how the various layer 2 protocols will be handled across the BNL/Southern Cross Layer 2 network for EPL services:

Table 9: Layer 2 EPL Protocol Handling

Protocol	MAC DA	Disposition
STP/RSTP/MSTP	01-80-C2-00-00-00	Tunnel
PAUSE	01-80-C2-00-00-01	Discard
LACP/LAMP	01-80-C2-00-00-02	Tunnel
Link OAM	01-80-C2-00-00-02	Tunnel
Port Authentication	01-80-C2-00-00-03	Tunnel
E-LMI	01-80-C2-00-00-07	Tunnel
LLDP	01-80-C2-00-00-0E	Tunnel
Bridge Block	01-80-C2-00-00-00 to 01-80-C2-00-00-0F	Tunnel

GARP E	Block	01-80-C2-00-00-20 to 01-80-C2-00-00-2F	Tunnel

Table 10 below summarises how the various layer 2 protocols will be handled across the BNL/Southern Cross Layer 2 network for EVPL services:

Table 10: Layer 2 EVPL Protocol Handling

Protocol	MAC DA	Disposition
STP/RSTP/MSTP	01-80-C2-00-00-00	Discard
PAUSE	01-80-C2-00-00-01	Discard
LACP/LAMP	01-80-C2-00-00-02	Discard
Link OAM	01-80-C2-00-00-02	Discard
Port Authentication	01-80-C2-00-00-03	Discard
E-LMI	01-80-C2-00-00-07	Discard
LLDP	01-80-C2-00-00-0E	Discard
Bridge Block	01-80-C2-00-00-00 to 01-80-C2-00-00-0F	Discard
GARP Block	01-80-C2-00-00-20 to 01-80-C2-00-00-2F	Discard

## **Layer 2 Maximum Burst Sizes**

Tables 11 & 12 below summarise the maximum UNI Burst settings for 1GbE and 10GbE Layer 2 Ethernet services based on the applicable allowed Committed Information Rate:

Table 11: 1GbE - Maximum UNI Burst Settings

EVC Bandwidth Profiles					
Speed (Mbps)	1G UNI Supported Rate	1G UNI Burst (KB)			
100	Yes	125			
200	Yes	250			
300	Yes	375			
400	Yes	500			
500	Yes	625			
600	Yes	750			
700	Yes	875			

Table 12: 10GbE - Maximum UNI Burst Settings

EVC Bandwidth Profiles					
Speed (Gbps)	10G UNI Supported Rate	10G UNI Burst (KB)			
1	Yes	1250			
2	Yes	2500			
3	Yes	3750			
4	Yes	4000			
5	Yes	4000			
6	Yes	4000			
7	Yes	4000			