



Chorus UFB Services Agreement
Bitstream Services:
Service Description for 100Gbps UFB Handover Connection

Commercial Offer

October 2017

1 Interpretation

- 1.1 References to clauses or sections are references to clauses or sections in this Service Description unless expressly provided otherwise. The definitions set out in the General Terms and the Operations Manual apply to this Service Description unless expressly provided otherwise.
- 1.2 References to the Operations Manual are references to the operations manual for the Bitstream Services.

2 The 100Gbps UFB Handover Connection Service

- 2.1 The 100Gbps UFB Handover Connection Service is a linking service that provides the inter-network connectivity between the other Bitstream Services and the Service Provider networks. The 100Gbps UFB Handover Connection Service is part of the family of Bitstream Services set out below:

Bitstream 2	Based on the TCF Mass Market service.
Bitstream 3	Based on the TCF Business service.
Bitstream 3a	Based on the TCF Business service with Low Priority options.
Bitstream 4	Based on the TCF Business Premium service.
UFB Handover Connection	Based on the TCF E-NNI specification.
100Gbps UFB Handover Connection	Based on the TCF E-NNI specification, 100Gbps interface
Multicast	Based on the TCF Ethernet Multicast Access (EMA) service.
ATA Voice	An analogue telephone access service.

- 2.2 A diagram of the configuration for the 100Gbps UFB Handover Connection Service is set out in Appendix A. The 100Gbps UFB Handover Connection Service provides the bitstream ENNI functions at the POI that enables a Service Provider to access and interconnect with the LFC Network.
- 2.3 The 100Gbps UFB Handover Connection Service is an input service which a Service Provider can combine with other Bitstream Services (and the Service Provider's own network or wholesale services provided by other providers) to provide fibre based telecommunications services to End Users.

- 2.4 The 100Gbps UFB Handover Connection Service has the following key characteristics:
- 2.4.1 Provides the inter-network connectivity for the following Bitstream Services¹:
- (a) Bitstream 2 including accelerate variant;
 - (b) Bitstream 3 including accelerate variant;
 - (c) Bitstream 3a;
 - (d) Bitstream 4 (currently under development²); and
 - (e) Multicast.
- 2.4.2 Operates as an Ethernet bitstream linking service that allows up to 4093 Service VLANs, each with 4093 End User VLANs, to be passed to the Service Provider.
- 2.4.3 Supports multiple physical links using Link Aggregation Grouping (LAG) in the following configurations:
- (a) 1+1: one active and one standby link;
 - (b) 2+2: two active and two standby links
- Where
- (a) Standby links must be in the same POI as the active link³.
 - (b) The active/standby status of links is controlled by Service Provider equipment using Link Aggregation Control Protocol (LACP).
- 1.1.2 Complies with the E-NNI services specified in the *TCF Ethernet Access Service Description v24, 19 January 2011*.

2 100Gbps UFB Handover Connection Service and implementation activities

Installation Services

- 2.1 The 100Gbps UFB Handover Connection Service includes a Standard Install (in each case to the extent that the relevant provisioning works are not already complete for the relevant Service Order). A Standard Install for the 100Gbps UFB Handover Connection Service includes:
- 2.1.1 one or two active 100 GigE physical ports at the POI;
 - 2.1.2 one or two standby 100 GigE physical ports at the same POI as the active links; and
 - 2.1.3 two fibre cables from each physical port to the POI MOFDF.

Core 100Gbps UFB Handover Connection Service

- 2.2 The 100Gbps UFB Handover Connection Service is comprised of:
- 2.2.1 A 100Gbps Ethernet E-NNI Service that supports the pass-through of other Bitstream Services to an MOFDF at the POI.
 - 2.2.2 Uses double-tagged 802.1ad frames on the E-NNI at the POI. VLAN allocation is based on the bitstream access services mapped to that E-NNI:
 - (a) Outer tag (Service) VLAN Identifiers (SVID) can be between 2 and 4094;

¹ ATA Voice is a low-bandwidth service and, while technically compatible, is not suitable for 100Gbps Handover Connections.

² 100Gbps Handover Connection cannot support HSNS (Bitstream 4) but will support the new NGA Business Premium service currently under development.

³ The ability to have the standby links in a different POI, but within the same Coverage Area, is planned as a future development.

- (b) Inner tag (Customer) VLAN identifiers (CVID) can be between 2 and 4094 or carried according to the Bitstream service;
- (c) Bitstream VLAN Identifier allocation rules are as follows:

<u>Bitstream service</u>	<u>VLAN ID allocation rules</u>
Bitstream 2 including accelerate variant	SVID, CVID per service instance
Bitstream 3/3a including accelerate variant	SVID per service instance. CVID = transparent
Bitstream 4	SVID per service instance. CVID = transparent
Multicast ¹	SVID or SVID,CVID per service instance

¹ As Multicast is delivered through the Product Development Process final VLAN allocation rules will be defined per Service Template.

- 2.2.3 VLANs are allocated per service by either:
- (a) Automatically, where the next available VLAN appropriate for that service is allocated; or
- (b) Manually, where the Service Provider requests a specific VLAN, as exercised by Service Request. The VLAN must be a valid VLAN for the service and available.
- 2.2.4 100Gbps UFB Handover Connections include an optional SVID whitelist that can be defined by 100Gbps UFB Handover Connection.
- (a) The whitelist is a range of SVIDs that can be allocated on the specific handover.
- (b) It is shared by all services on the handover, regardless of whether manual or automatic VLAN allocation;
- (c) The whitelist is defined as N-M, where:
- $$2 \leq N < M \leq 4094$$
- 2.2.5 Tagged traffic is treated according to the individual Bitstream Service traffic management rules as set out in the relevant service description.
- 2.2.6 The 100Gbps UFB Handover Connection Service supports 100GigE Speed. This speed represents the maximum bandwidth available to all other Bitstream Services delivered through the 100Gbps UFB Handover Connection Service.
- 2.2.7 LAG allows two physical ports to be combined into a single 100Gbps UFB Handover Connection Service to increase capacity of that 100Gbps UFB Handover Connection Service. In the event of the failure of one physical link, the traffic management rules apply. Only same speed links may be combined into a LAG group.

Traffic Management Rules

- 2.2.8 On ingress (downstream), bitstream traffic policies are applied, as described in the relevant bitstream service description.
- 2.2.9 On egress (upstream) High Priority traffic is strictly prioritised over Low Priority traffic.
- 2.2.10 The sum of High and Low Priority traffic profiles of all services delivered at a 100Gbps UFB Handover Connection can exceed the 100Gbps UFB Handover Connection line rate. If there is insufficient line rate to deliver the traffic then frames will be randomly discarded, based on their Class of Service precedence, and performance characteristics for that

Class of Service do not apply. It is therefore the Service Provider's responsibility to shape and queue traffic appropriately.

Support for multiple bitstream access services

2.3 One instance of the 100Gbps UFB Handover Connection Service can support any combination of other Bitstream Services up to the service cap and subject to the maximum bandwidth of the 100Gbps UFB Handover Connection Service.

2.4 The following service caps apply:

2.4.1 1+1 configuration supports a maximum of 31,900 services;

2.4.2 2+2 configuration supports a maximum of 63,800 services;

Operations, Administration and Maintenance

2.5 The 100Gbps UFB Handover Connection Service will transparently support Ethernet Service Operations and Maintenance (OAM) for service integrity testing, fault diagnostics and performance measurement using ITU Y.1731.

Service Requirements

2.6 To use the 100Gbps UFB Handover Connection Service the Service Provider must have the capability to access and interconnect with it, by one of the following:

2.6.1 co-locating Service Provider equipment at the POI using the Central Office and POI Co-location Service;

2.6.2 connecting to third party co-location space at the POI with the third party taking the Central Office and POI Co-location Service;

2.6.3 connecting to a backhaul service that connects to the MOFDF at the POI; or

2.6.4 by using a Direct Fibre Access Service to connect to Service Provider equipment at a remote location within the Central Office area.

2.7 100Gbps UFB Connections are available at a limited set of POIs, as detailed in the Operations Manual.

Additional Service Characteristics

2.8 The technical specification of the 100Gbps UFB Handover Connection Service is set out in Appendix B.

2.9 The LFC will provide certain support and other assistance as part of the 100Gbps UFB Handover Connection Service including:

2.9.1 an automated facility for Service Requests; and

2.9.2 an automated facility for fault notifications,

each as more particularly set out in the Operations Manual.

2.10 The 100Gbps UFB Handover Connection Service specifically excludes:

2.10.1 any other Bitstream Service;

2.10.2 provision or maintenance of any cabling or connection or active device beyond the Service Demarcation Points described in clauses 4.1 and 5.1;

2.10.3 configuration, monitoring, operation, on-going support or maintenance of Service Providers' or End User's applications, equipment or networks; and

2.10.4 supply of AC Mains & UPS Power, accommodation space, heating, ventilating, air conditioning and other similar services and facilities at the POI.

3 End User facing Service Demarcation Point

- 3.1 The End User facing Service Demarcation Point is a nominal point located on the trunk side of the handover EAS. There is no physical demarcation point and no ability to directly connect to this nominal point.

4 Service Demarcation Points at POI

- 4.1 The Service Demarcation Point for the 100Gbps UFB Handover Connection Service at the POI is the MOFDF in the POI.

5 LFC and Service Provider Responsibilities

- 5.1 Other LFC and Service Provider responsibilities are detailed in the General Terms and the Operations Manual.

6 100Gbps UFB Handover Connection Service Levels

- 6.1 Service Levels for the 100Gbps UFB Handover Connection Service are set out in the Service Level Terms for the Bitstream Services.

7 100Gbps UFB Handover Connection Diversity

- 7.1 The 100Gbps UFB Handover Connection Service provides dual links between the Bitstream Services and the Service Provider's network.

- 7.2 If the Service Provider requires diversity of the 100Gbps UFB Handover Connection to the Service Provider Premises, their options are either:

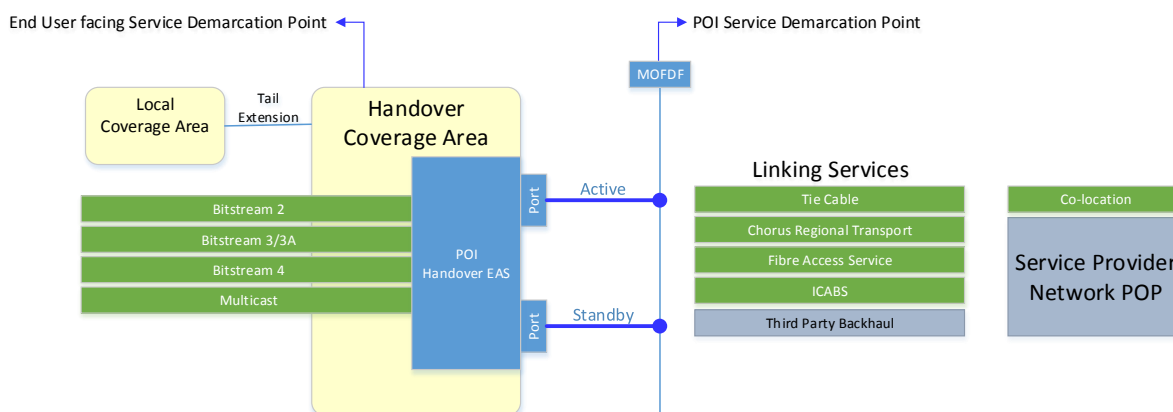
7.2.1 request the two links from their 100Gbps UFB Handover Connection Service at Central Office be configured with diversity between the Central Office and either the same or different Service Provider Premises (additional costs may apply); or

7.2.2 request two or more instances of a 100Gbps UFB Handover Connection Service in the same region but at different Central Offices, with the dual links for each configured if necessary with diversity between the Central Offices and either the same or different Service Provider Premises (additional costs apply).

- 7.3 Where available the diverse optical paths will be in separate fibre cable sheaths, and if requested in separate cable routes. The diverse cable routes will be a minimum of the width of a street apart, and should not share any manholes or access points. Separate entries into the Central Office will also be used where available.

There may be practical limitations to providing full physical diversity to some sites. The provision of a separate entry to an LFC Central Office will have unique site specific engineering considerations and will attract additional costs.

Appendix A – Diagram

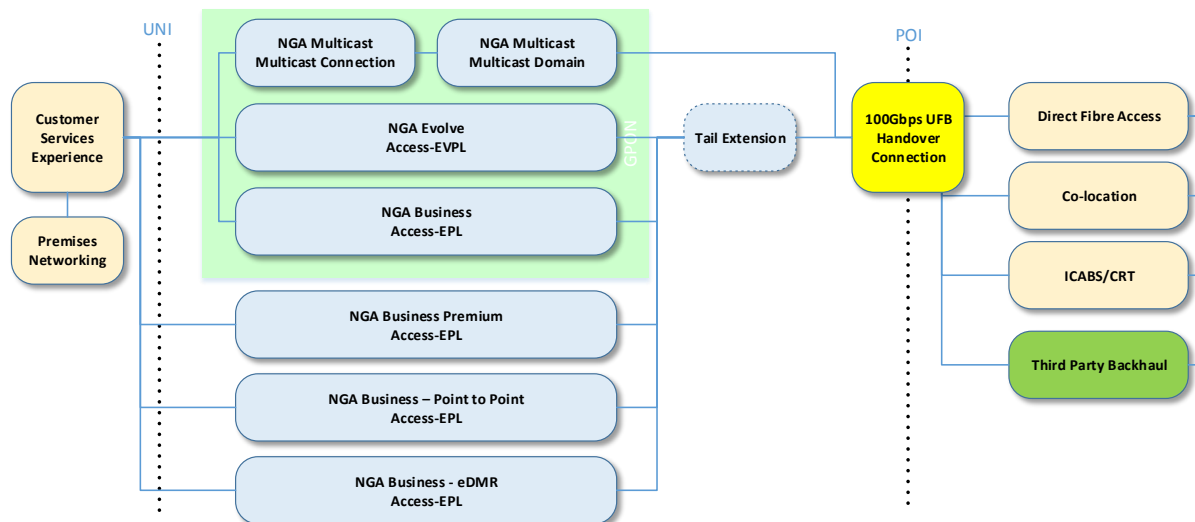


This is a generic diagram showing the standard configuration and service demarcation points. It is not intended to represent every situation or detailed physical architecture. The following points should be noted:

- Link Aggregation Grouping (LAG) comes as standard, supporting the following two configurations
 - 1+1 – one active and one standby 100 GigE physical links; or
 - 2+2 – two active and two standby 100 GigE physical links.

Where:

- Each link comprises 2 x fibre connections (Rx/Tx).
- Each link comes from the same handover EAS. The ability to deliver these links from different handover EAS is planned as a future development..
- The 100Gbps UFB Handover Connection Service is a linking function that enables Service Providers to interconnect with and consume other UFB services as follows:



- The 100Gbps UFB Handover Connection Service provides the E-NNI function for the other Bitstream Services. The specific E-NNI attributes are defined in the service descriptions for the other Bitstream Services.
- The linking services connect the 100Gbps UFB Handover Connection Service to the Service Provider Network Point of Presence as follows:
 - Tie Cables can connect the 100Gbps UFB Handover Connection Service from the MOPDF to Co-location Footprints at the POI. The Footprints can be the Service Provider’s Footprint or third party Footprints. Tie Cables to third party Footprints require agreement between the LFC, the Service Provider and the third party.

- Backhaul is a service that can be provided by LFC (ICABS/Chorus Regional Transport), the Service Provider or a third party.
- Direct Fibre Access Service can be used to connect to Service Provider equipment at a remote location within the POI Central Office area.

Appendix B – Technical Specification

Technical Specification	
Ethernet	<ul style="list-style-type: none"> • 802.1ad VLAN (SVID, CVID); or • Double tagged QnQ.
100Gbps UFB Handover Connection (E-NNI)	E-NNI <ul style="list-style-type: none"> • 100 GigE 100GBase-LR4 CFP <ul style="list-style-type: none"> ○ Dual fibre working <ul style="list-style-type: none"> ▪ 1295.6 nm; ▪ 1300.1 nm; ▪ 1304.6 nm; and ▪ 1309.1 nm
Fibre	External fibre must comply with ITU-T specification G.652D or 657A. Internal building fibre cables must meet appropriate fire regulations i.e. be Flame-Retardant, Non Corrosive, Low Smoke, Zero Halogen (FRNC/LSZH).
Connector Type	Fibre terminations must be SC/APC type connectors (complying with the IEC 61754-4 standard) or LC/APC also known as LCA type connectors (complying with the IEC 61754-20 standard) as appropriate.
Optic Path	Laser types and path characteristics are expected to be designed to a minimum standard which are contained in IEEE 802.3 Section 5 standard or ITU-T G.984 standards.
Fibre Testing Layer 1	<p>All commissioning Layer 1 network testing (LFC site OFDF to end of Communal Network) is by OTDR at two wavelengths, 1310nm and 1550nm using Bi-Directional method in accordance with Chorus standard described in ND0556.</p> <p>The methodology used will be based on bi-directionally testing all fibres in the Communal Network required to complete the service.</p> <p>Network test results are provided by agreement verifying performance features. Refer to the Direct Fibre Services Operations Manual for details.</p> <p>All Layer 1 network restoration testing will be LFC site OFDF to Premises termination point.</p> <p>Testing for power loss will be at either 1310 or 1550 nm.</p> <p>In the event of a fault restoration testing will be to the standard in Optical Performance table below.</p> <p>The wavelengths of 1625 nm and 1650nm are reserved for network maintenance testing purposes, (live GPON network) compliant with ITU-T L.41.</p>

Technical Specification	
Optical Path performance	<p>Communal Network performance</p> <p>Total GPON Insertion Loss (ITU-T G984) = $\leq 28.5\text{db}$</p> <p>Network Return Loss = $\geq 32\text{db}$</p> <p>LFC GPON system margin (lifetime ageing factor) = 1.5db</p> <p>Total GPON insertion Loss OLT to ONT design target is = $\leq 27.0\text{db}$ (28.5db – 1.5db)</p> <p>Optical Fibre Attenuation Co-Efficient (L) (ITU-T G.652. & G657.A) = $\leq 0.4\text{db/km}$</p> <p>Splice Loss (S) = $\leq 0.15\text{db}$</p> <p>Mated Connector loss (C) = $\leq 0.3\text{db}$</p> <p>Mated Connector Reflection = $\geq 55\text{db}$</p> <p>Total Insertion Loss of network (IL) is calculated from $IL = 0.4L + 0.15S + 0.3C$ (excluding PON splitter)</p> <p>Splitter performance</p> <p>1:32 = $\leq 17\text{db}$</p> <p>1:16 = $\leq 14\text{db}$</p> <p>1:8 = $\leq 11\text{db}$</p> <p>1:4 = $\leq 7.3\text{db}$</p> <p>1:2 = $\leq 4.0\text{db}$</p>
Network Testing Layer 2	Network test results will meet the performance criteria listed in the Bitstream Service Level Terms (for the relevant service).