High Level Unbundling Product Construct v1

The purpose of this document is to provide information to customers that will assist in the consultation phase around the high level product construct

Publication Date: October 2018
Document Number: Final

Document Control

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Version History

This table shows a record of significant changes to the document.

Version	Date	Author	Description
0.1	17.09.2018	Peter Coleman	Draft
1.0	05.10.2018	Peter Coleman	Release version

Document Review	This document will be subject to periodic review. It is the responsibility of the Document Owner to initiate and control the review process. The next draft of this document is scheduled for early November 2018, to incorporate feedback from industry consultation.

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1. Introduction

This paper looks at the product construct for Layer 1 PON unbundling and the associated operate implications and puts a stake in the ground around key business decisions.

The primary focus on this paper is unbundling residential passive optical network accesses. However, some considerations for business services are included for discussion.

1.1. Objectives of this Consultation Document

The objective of this consultation document is to:

- Inform service providers and potential unbundlers of the Layer 1 PON unbundling high level product suite that Chorus will offer in UFB1 areas from 1 January 2020;
- To identify the key operational and business characteristics of these proposed Layer 1 unbundling high level product suite that will need to be addressed during the delivery phase; and
- To solicit feedback to support publication of the Layer 1 PON unbundling service description by the end of November 2018.

1.2. Intended Audience

Customers (service providers) and key stakeholders of Chorus.

1.3. Executive Summary

The UFB agreements (NIPA1 and NIPA2) require Chorus to build the capability to offer unbundled Layer 1 PON services from 1st January 2020 in UFB1 areas and 1 January 2026 in UFB2 areas.

In addition Chorus also has a commitment in the Deed of Open Access Undertakings for Fibre Services to make available the unbundled Layer 1 PON fibre access service from 1st January 2020.

Section 1 of this document proposes the product construct for Layer 1 PON unbundling.

Section 2 of this paper looks at the considerations around the operate model for Layer 1 unbundling that will need to be resolved during the delivery project.

Section 3 of this paper covers the first cut of key business decisions and trade-offs proposed.

Section 4 of this paper looks at the additional implications of unbundling business connections.

The contents of this paper are expected to change during the consultation phase and during the delivery of the project.

1.4. Exclusions

This paper is only focused on Layer 1 PON unbundling. It excludes:

- Direct Fibre Access (Point to Point fibre);
- Layer 2 products and roadmap;
- Pricing.

1.5. Relationship to Other Documents

This document should be read in conjunction with the following consultation documents:

- Chorus Technical Document Layer 1 Unbundling September 2018;
- Chorus Technical Document Layer 2 2020 products October 2018 (coming soon).

2. Layer 1 PON Product

This section describes the product construct. It is expected there will be significant consultation during the delivery phase that may result in changes to the service description, features and/or operational processes and interactions.

2.1. Scope of Unbundling

The UFB contracts between Chorus and CIP require Chorus to provide two fibres to each premises, with the second fibre available for unbundling. Chorus is obliged to offer unbundled PON in UFB1 areas from 1 January 2020 and in UFB2 areas from 1 January 2026.

Unbundlers will be able to order services where unbundling is available and:

- The premises has an active working fibre service. In this case the second fibre is available for an unbundled service;
- The premises has previously had an active working fibre service, i.e. is classified as an intact. The second fibre is available for an unbundled service;
- The premises is 'fibre ready' but has never had an active working fibre service. In this case the provisioning of the unbundled fibre service will include the provisioning of the lead-in from the Fibre Access Point to the ITP. The lead-in will provide two fibres, with the second fibre assigned to the unbundled service.

2.2. Product Construct

The Layer 1 PON Unbundling product construct suits a build-provisioning model, where the unbundler prebuilds the FFP and feeder as infrastructure and then adds individual customers either by migration of their own Layer 2 base or acquisition of new customers;

The first end-to-end working service in an FFP coverage area therefore requires two separate service requests that need to be completed in sequence. Coordination can reduce the gap between the first and second service request being completed, but this may increase complexity.

It comprises two offers:

- **Layer 1 PON feeder**, which includes a splitter in an FFP connected to a designated central office.

  It comprises the following components:

  - Installation of the splitter at the FFP;
  - Allocation of the feeder fibre between the FFP and the relevant central office, which could be extended with ICABS to another central office within the same candidate area;
  - Connection of the feeder fibre to the splitter.

  It excludes:

  - Colocation at the local or remote central office, which is a separate service;
  - OLT installation and commissioning;
  - Central office patching of the feeder fibre to an OLT port;
  - Connection of distribution fibre to the splitter, which is part of the Layer 1 PON distribution offer;

  These are pre-requisites to any end-to-end service commissioning testing.

- **Layer 1 PON distribution**, which connects an end user site within the FFP coverage area to the splitter associated with and installed with the Layer 1 PON feeder service.

  It comprises the following components:

  - Connection of the distribution fibre to the splitter;
  - Allocation and installation of the distribution fibre from the customer premises to the FFP, including lead-in and ETP if applicable;
  - Premises wiring from the ETP to the ITP, including installation of the ITP if applicable;
  - Optional CSE for installation and connection of a Layer 2 device to the ITP and any requested service testing.

This construct is shown in the diagram below:

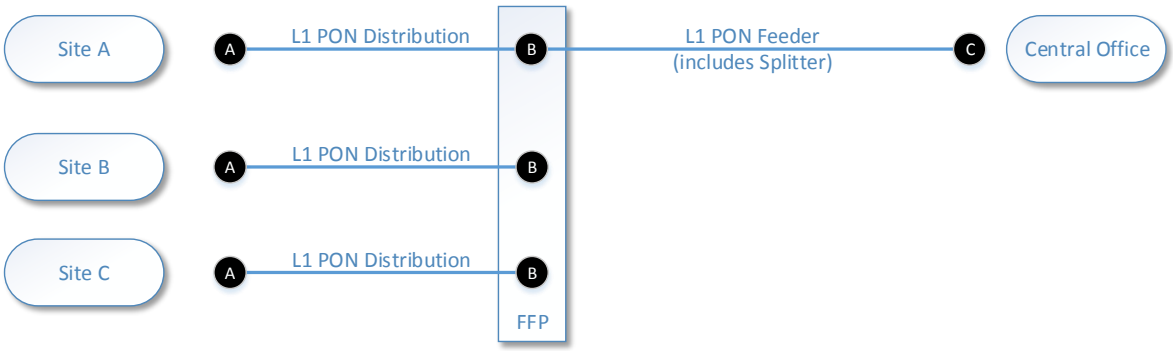


Figure 1. Product Construct Product Model

The following picture maps this product construct to the Layer 1 components:

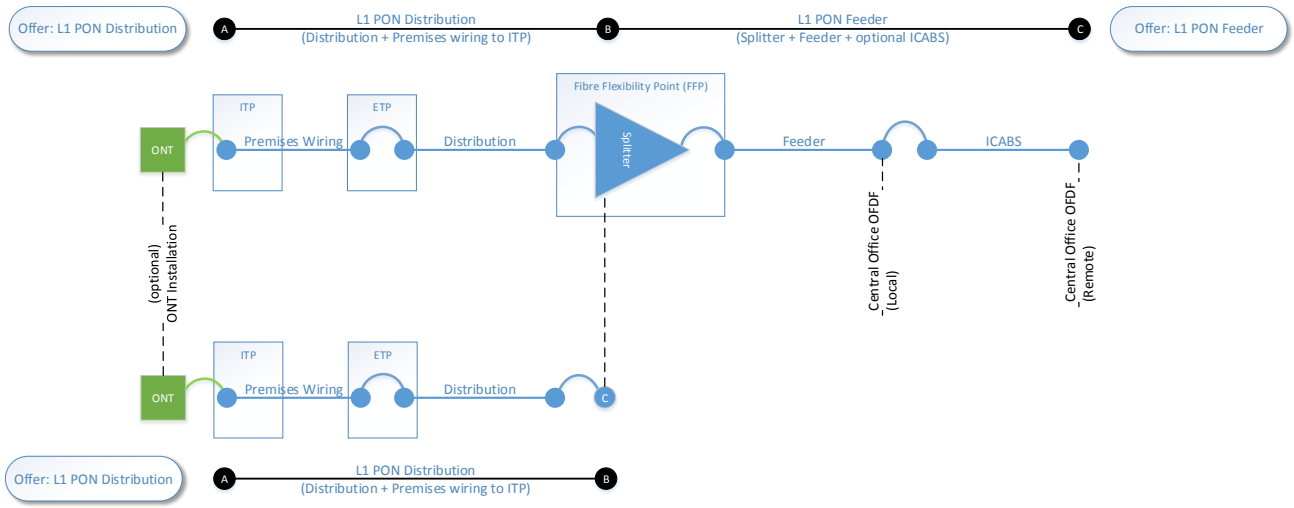


Figure 2. Product Construct Architecture Model

2.3. Customer Experience for Unbundling

As Layer 1 PON unbundling requires activity in the physical network, including integration with the unbundler's active network, unbundlers will need to set customer's expectations and manage their experience. Some considerations include:

Area	Considerations
Coordination of activity	As a general rule, to achieve the optimal experience, activity should be done in the following order: • Unbundler OLT commissioned in central office; • OLT port allocated; • Feeder fibre (and ICABS extension if applicable); • Splitter installed in FFP; • Splitter connection to feeder; • Feeder connection to OLT port; • Customer service provisioned and activated in active network; • Distribution fibre connection to splitter port; • Lead-in and ETP installed, if applicable; • ITP and premise wiring installed and connected to distribution fibre at ETP; • Distribution of the unbundler's ONT to the customer premises; • ONT installed, including connection to the ITP and any premises wiring between ITP and ONT; • Service commissioning tests. There may be some flexibility in activity order and this may also depend on unbundler's internal system capability. However, commissioning even a simple migration will require coordination between a number of different parties including Chorus, service company, unbundler, customer and possibly premises wiring technicians provided by the unbundler.
Integration between Layer 1 and active network	The install and commissioning of the OLT and the subsequent allocation of PON port and connection to the feeder fibre needs to be undertaken by the unbundler. Any lead time for doing this activity needs to be included in setting customer expectations
Layer 1 PON feeder	This is considered an infrastructure build activity and is likely to have a longer lead time than a Layer 1 PON distribution due to the need to allocate space for and install a splitter. This delivery time could be impacted by any feeder or splitter capacity constraints, i.e. augmentation is required, particularly if this capacity has not been forecasted.

Area	Considerations
Requests requiring new lead-in	This would result in a new install to the premises, including • Two fibre lead-in from Fibre Access Point to premise; • Installation of the ETP; • Installation of the ITP; • Premises wiring of two fibres from the ETP to ITP (this may or may not include a splice in the ETP). Connection from the ITP to the unbundler ONT and configuration/installation of the unbundler ONT would be additional to this.
Requests with existing lead-ins (active services, intacts)	The lead time for service availability would be based on scheduling and completing both the FFP and on-site premises wiring and unbundler's ONT installation activity. Note that installing the unbundling ONT in a different location from the ITP would require additional premises wiring from the ITP to the new location. Moving the ITP would need to be undertaken by Chorus technicians.
Service commissioning	The service commissioning customer experience needs to consider aspects such as: • Premises wiring standards, including voice wiring integration, if applicable; • ONT installation standards and integration to ITP; • Service verification – is the customer getting what they are paying for, and demonstrating this to them; • Integration with CPE and home network beyond the ONT – copper or wireless; • Technician test tools, including visibility of the unbundler's active network status and diagnostic tools; • Customer test tools and/or speed meter websites.

2.4. Layer 1 PON Unbundling Test Facilities

It is expected that unbundlers require the ability to test their systems, processes and network equipment prior and subsequent to Layer 1 PON unbundling. The following test facilities are recommended:

Facility	Provider	Description
OSS	Chorus	A test stub to support system and process integration with Chorus platforms for fulfil and assure.
Active network	Unbundler	An integration test facility to support technical and business acceptance testing of end to end services and active network equipment.

Facility	Provider	Description
Passive layer 1	Unbundler	An environment to support development, testing and training of technicians to support the installation and testing of equipment on fibre services. This may be optional if Chorus is providing the installation functions.

These are likely to be extensions of unbundler's existing capabilities.

2.4.1. OSS Test Facility

Chorus will provide test stubs to support system and process integration with Chorus platforms for Fulfil and Assure. These may be existing (Chorus Portal Emma) or new test stubs, to be confirmed.

2.4.2. Active Network Test Facility

The purpose of the active network test facility is to:

- Evaluate new network equipment, including integration with existing network elements;
- Benchmark new network equipment;
- Test the integration of new software releases prior to release into production;
- Test production defects and fixes in a quarantined environment to avoid external contamination that may distort outcomes;
- Develop and test the introduction of new plans, features or attributes prior to deploying into production.

The recommended components of an unbundler's network test facility are:

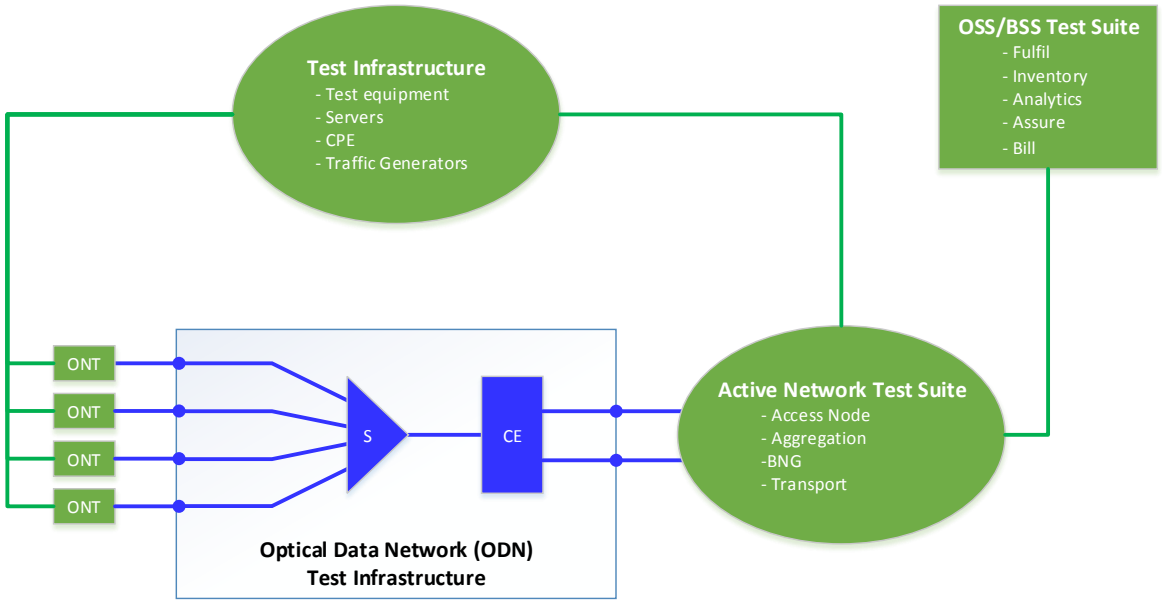


Figure 3. Recommended L1 Unbundling Active Network Test Facility

Component	Description
ONT/CLNE	Customer Located Network Equipment, which may or may not include RGW/BGW functionality. For PON networks, these devices are heavily integrated with the Access Nodes (OLTs).
Optical Data Network (ODN) infrastructure	This comprises fibres, splitters, co-existence elements and other passive infrastructure that allows different layer 1 configurations to be put together as required. This would be self-contained within the test facility. This would include any passive components consumed by the unbundler but are not part of the Chorus unbundled service, such as co-existence elements for combining multiple PON wavelengths on a single feeder fibre.
Active network test suite	This is a combination of components that need to be tested, including OLTs, Transport, BNG and other typical network equipment such as CDN servers, Radius etc.
Test infrastructure	This is the equipment used to test services. It will differ by service provider, but could include: • End customer CPE variations; • Test servers and applications; • Traffic generator/simulator, such as Spirent; • Traffic monitor, such as Wireshark.
OSS/BSS test suite	The OSS/BSS test suite is independent to network testing, but there are benefits in having an integrated test facility, particularly for service testing.

Chorus recommends the following best practices:

- Test environment characteristics:
    - A self-contained environment that is quarantined from production. This is both for security reasons, and to prevent external factors distorting or affecting test results;
    - End to end within one physical location. Testing, by its nature, requires significant hands on adjustment, configuration and manipulation.
- Different test environments:

Environment	Purpose
Develop	Development of products and services and functional testing. May need to support multiple code/version branches, some of which would be prior to production release. Tends to use stub data rather than production.
Test	Formal functional testing, technical acceptance testing and business acceptance testing. Requires the ability to match production and import snapshot data, including the ability to wipe and replace current setup. May include an automated test suite, particularly for regression testing with a predefined test suite and test data.

Environment	Purpose
Pre-production	Mirrors the production environment to verify that implementation of changes will work without issue. Requires the ability to wipe and replace current setup.
Production	Post deployment testing, including basic verification testing.
Prototype and demo	This kind of test facility is generally outside the standard test environments but could be used to showcase solutions or try upcoming technology without having to integrate it with existing networks or test facilities.

Note that it may be possible to combine several functions within a single environment with appropriate environment management procedures.

- Test roles responsibilities

Environment	Purpose
Environment manager	The environment manager is responsible for scheduling test environments, making sure the test infrastructure is in place and maintaining the test tools.
Business owner	The business owner is responsible for the business outcome of a particular release, and therefore approving the test plan and results.
Test manager	The test manager coordinates the testing, ensuring test discipline is followed, producing test collateral and ensuring test results are recorded in a consistent way. They are also responsible for ensuring the test environment configuration is set up to match the test plan.
Tester	Testers run the specific tests, record the results and manage specific defects to resolution.
Developers	Support the testing and defect resolution.

- Test stages

Environment	Description
Functional testing	Test individual functions against specification to ensure they deliver the required functionality.
Technical acceptance	Formal end-to-end testing to confirm the developed solution meets the required business specification.
Business acceptance	Tests the operational and network integration of the solution, making sure the processes match the enhancements being deployed.
Post deployment	Confirms the enhancements have been deployed into production successfully and according to the business specification.

2.4.3. Layer 1 Test Facility

The Layer 1 Test facility is required to test:

- Test the physical integration compatibility of new ONTs with existing ONT/OLT infrastructure;
- Develop installation practices for the introduction of new ONTs, including marketing and technical collateral;
- Train installers on how to install unbundler's ONTs. It is recommended that if multiple ONTs and/or installation practices are offered, that these be replicated in the Layer 1 Test facility.

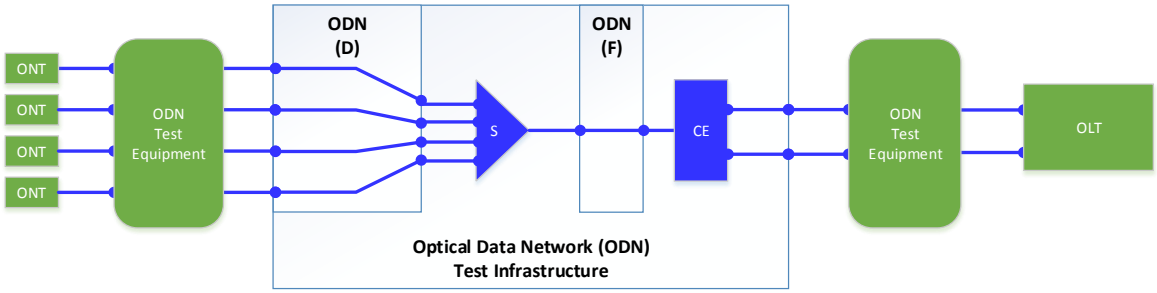


Figure 4. Recommended Layer 1 Test Facility

Key recommendations:

- This should be a self-contained environment. There are no technical advantages, and significant operational disadvantages, in splitting a test environment across multiple physical locations;
- This environment may be integrated with, or separate from, the active network test facility. However, the active network test environment will need at least some Optical Data Network infrastructure;
- This environment should include iterations of all passive infrastructure used in production, including elements that may not be part of the Chorus unbundled service, such as:
  - Exchange-based splitters, to allow an OLT port to connect to multiple feeder fibres, i.e. increase split ratios;
  - Co-existence elements for combing multiple PON wavelengths, such as GPON and 10GPON, onto a single feeder fibre.
- Recommended test tools:
  - Portable power meter;
  - Fibre fusion splicer;
  - Connectorised fibre equipment;
  - Simulated installation environment to test install practices;
  - Demo board showing different devices, ITPs and connection models;
  - Intelligent Optical Link Manager (iOLM) or similar OTDR test device;
  - Fibre Inspection Probe (FIP) to ensure all optical connectors and optical transceiver devices are clear and free from contamination;
  - Optical launch leads to support platform iOLM testing;
  - Examples of different LFC ITPs etc.
- Documented Installation standards and training material, including:
  - Installation of premises wiring and connection to distribution fibre at Chorus ITP;
  - Installation of ONT and connection to premises wiring;
  - Connection of feeder fibre at central office to OLT;
  - Layer 1 and active network testing requirements, including a list of required and approved test equipment.

2.4.4. Chorus Co-Innovation Laboratory

Chorus Co-Innovation Laboratory (CCIL) is part of Chorus' integrated test facility, which allows service providers in Auckland and Wellington to test Chorus Layer 2 services from within their network test facility:

Although limited to Layer 2, it provides some ability to compare services.

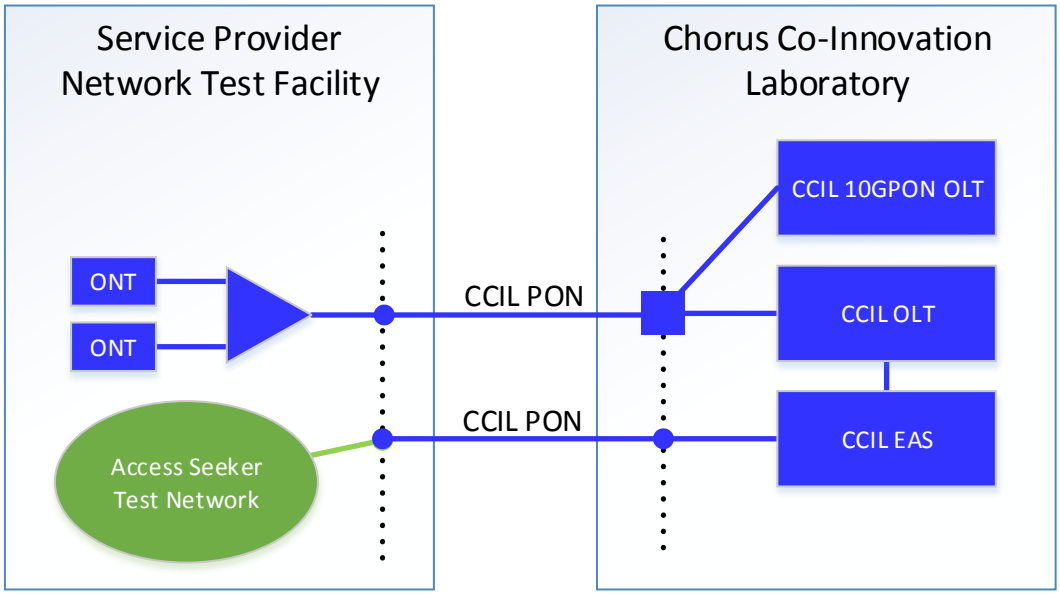


Figure 5. Chorus Co-Innovation Laboratory

Note that as CCIL is a test facility, it may include services, features and software versions that are not available in production yet.

It should also not be used for performance benchmarking as this may be inconsistent with production. For example, it is not practical to operate CCIL as a congestion free network.

3. Physical Fibre Unbundling Operate Model Considerations

This section looks at operating the Layer 1 PON unbundled service. It is not proposing specific processes or solutions, but highlights functions and areas that will need to be resolved during the development process.

Item	Considerations
Service availability	The 'Service Availability' API and Chorus Portal/B2B will include FFP information associated with a site. Footprint reports will not be updated. We would prefer to move away from footprint reports as they are sometimes retained by recipients for some time, resulting in conflicting information being presented to customers.
Optical budget	Unbundlers will need to manage their end to end optical budget, particularly if they include wavelength combiners (co-existence elements) or extend the feeder fibre to a remote location Chorus builds its Passive Optical access Network to ITU-T G.984 standards.
FFP coverage	Chorus will provide a mechanism for unbundlers to see the geographic area covered by a specific FFP.
Order coordination	It is not envisaged that any order coordination will be built into Chorus's provisioning platforms or processes, either to deliver an end-to-end service using multiple orders, or to efficiently connect multiple end users within an FFP for all options. Coordination needs to be managed with Customers, and therefore would be a function of the unbundler.
Customer Service Experience (CSE)	A CSE can be associated with a service request and used to customise the experience for an unbundler or per end user. This CSE would only be required if Chorus were doing premises wiring or ONT installation. This includes moving ONTs or ITPs within a premises, e.g. for renovation purposes. The customisable elements of the CSE will be agreed during the delivery phase. This could be simple elements, ONT model or even allow unbundlers to insert their own work instructions per order.
New connect: Layer 2 Active	Chorus will use an unallocated unbundled fibre to stand up unbundled service where an allocated fibre is available. Priority will be: • Use unallocated unbundled fibre; • Transfer existing unbundled fibre. The gaining service provider would be expected to follow the customer transfer process and provide the ASID of the 'losing' Layer 1 PON Distribution service; • Install additional unbundled fibre, if possible. The fibre supporting the active Chorus Layer 2 service is not available for unbundling.

Item	Considerations
New connect: Layer 2 Intact	Chorus will use a spare fibre to stand up unbundled service where a spare fibre is available. Priority will be: • Use unallocated unbundled fibre; • Install additional unbundled fibre, if possible. The fibre supporting the intact Chorus Layer 2 service is not available for unbundling.
New connect: Premises	Unbundlers can request Layer 1 PON unbundled fibre for a Fibre Ready site that has not yet been connected to the UFB network. This request requires the installation of the fibre lead-in from the fibre access point to the ETP, installation of the ITP and premises wiring from the ETP to the ITP, This will use BAU processes and standards including any required consent processes. This lead in will deliver two fibres to the ITP, with the second fibre available for unbundling. Normal unbundling rules apply once the lead-in is completed. The unbundler may choose their own technicians to do the in-premises wiring from the ITP to the ONT location, and the ONT installation, activation and testing or use a CSE to get the Chorus technician to do this activity.
Infill	Infill is where a new premises is created within an FFP area, e.g. an existing property is subdivided or potentially a property is replaced by multiple dwellings. Infill cannot be unbundled until the new addresses are created and made fibre ready. Unbundlers will be able to request an infill location be added to UFB. Significant customer infill beyond that anticipated during the Layer 1 build design may require FFP infill, see below.
Transfer	A transfer is where an existing Layer 1 unbundled fibre with a working service is taken over by another provider. It does not include replacement of intacts, i.e. where an unbundler service has been relinquished but the fibre is still connected to premises wiring or an ONT. It does not include reuse of the Chorus fibre, which is reserved for Chorus Layer 2 services. Transfers are only used where there are no spare fibres in a location. Gaining service providers are expected to use the customer transfer code prior to transferring a designated service.
Remove unbundled service	The relinquishment of an individual unbundled service will require the distribution fibre to be removed from the splitter. Chorus will not make any changes to the ITP, premises wiring or removal/disposal of the ONT, except by specific request from the unbundler. Unbundlers can make their own arrangement for this activity, or leave their equipment intact and manage their own intact process. Relinquishment of a feeder fibre would require removal of the splitter and disconnect of the feeder fibre from the splitter and the central office. This may be a records only disconnect, to be considered as part of the delivery project.

Item	Considerations
Fibre length considerations	While some fibre length slack is provided at both the FFP and ITP, this spare length can be consumed over time: • Changing the unbundler will require the fibre to be broken in both the ETP or ITP and FFP and reconnected to a new splitter and premises wiring; • The customer may want the new unbundled ONT to be in a different location than their current ONT. If there is insufficient slack to complete a connection then it may be necessary to remove the current fibre and install a new one. This would result in a service outage on all connections fed by the current fibre tube until this fibre is replaced and reconnected. It's unlikely this would be known prior to visiting the FFP and/or premises. It is therefore important to set the right expectations up front with customers.
Identification of ONTs	Unbundling is likely to result in the presence of multiple active devices at the end user site, which could result in confusion and poor customer experience during assure and change activities, particularly as different unbundlers may use the same vendor and ONTs, and the end customer ISP may be different from the unbundler. We may need to consider introducing an industry standard to make it easier to identify ONTs and the associated Layer 1 provider. Examples could be: • ONTs should be clearly branded with the Layer 1 vendor name and preferably be visually distinctive, such as colour; • ONTs should include a web link, possibly via a QR code, that allows a customer or technician to obtain more information about the ONT and Layer 1 vendor; • Installation standards should consider how to make it easy for technically challenged customers to find the ONT serial number or identification label.
Capacity management	The Chorus network is built to the agreed contractual capacity, but includes the ability to expand capacity as required. Depending on the scale of unbundling, there may be the need to augment network capacity, particularly between the FFP and the central office. Chorus will follow standard, published, capacity management regimes: • Unforecasted capacity will be managed based on trending utilisation. Current utilisation and available capacity will be monitored and future capacity requirements estimated based on the rate the available capacity declines. This estimate will drive any augmentation timings. • Forecast capacity will be checked against available capacity, taking into account unforecast capacity estimates. Capacity augmentation will be undertaken based on this result. Unbundlers with forecasted capacity will be prioritised over unforecasted capacity, but would be charged for any Chorus incurred costs if their forecast capacity was not used.

Item	Considerations
Forecasting	We will need to agree a practical and manageable forecast regime that ensures Chorus can manage: • Network capacity, particularly splitters and feeder fibres; • Build, provision and assure resource capacity. If activity is not forecast then Chorus will monitor current capability and manage capacity based on estimated consumption rates. This may result in an impact to SLAs in some areas. If activity is forecast and Chorus gears up resources to meet these targets, and these activities are not actually undertaken then Chorus may need to recover incurred costs. The aim of the forecast regime will be to balance risks while ensuring Chorus can deliver to your business needs. It must be reasonable and practical for all parties.
Assure tools	Chorus currently uses its Layer 2 network analytics to support diagnosis and resolution of Layer 1 issues. This includes access to current and historical diagnostic information, including power levels and PON status. We will need to agree a standard for what information is shared to support resolution of Layer 1 faults, and how this information is shared with Chorus and Chorus technicians, e.g. via APIs. If unbundlers require Chorus service company technicians to use specialised or specific test equipment then this will require specific commercial agreements. Unbundlers are responsible for the supply of Layer 1 and active network test equipment to their technicians.
Commissioning test	Typically service commissioning verifies: • Physical connectivity between the customer premises and the OLT; • Optical connectivity between an ONT on the customer premises and the OLT; • Service integrity, i.e. the customer is configured on the right port and gets the correct active network service; • Basic end-to-end service testing, such as simple internet check; and • Premises network testing, such as confirming WiFi activation. Chorus currently uses its Layer 2 Assure tools to support service commissioning. We will need to consider how service commissioning works in a split operate model.
Product and service instance Ids	The product/service unique ID hierarchy will be used to support: • Product inventory, i.e. what unbundlers order, assure and pay for; • Physical and Logical inventory, for managing split ratios and integration with unbundling active equipment. This will be fleshed out as part of the delivery phase.

Item	Considerations
Rehoming FFPs	Rehoming FFPs is where an FFP that is associated with one central office is changed to associate to a different central office. This is a rare scenario, but may be done where infill means that too many end user sites are associated with a central office such it no longer complies with our network performance and resiliency standards. This would require rerouting of the feeder fibre to the new central office, and potentially to a different unbundler OLT. Given the potential disruption this scenario would cause, it is envisaged that Chorus would provide at least 12 months' notice of the change, to give unbundlers time to redesign their access solution. The actual change would need to be coordinated between parties for minimal disruption to end customers.
FFP 'Infill'	FFP Infill is where standard infill has resulted in too many end customers associated with a single FFP. This scenario typically involves two FFPs splitting into three, where the new FFP takes over some customers from each of the other FFPs. Existing customers would either remain in the current FFP or move to the new one, based on their geographic location. This means that some unbundled customers would lose service unless the unbundler had a Layer 1 PON feeder in the new FFP. Given the potential disruption this scenario would cause, it is envisaged that Chorus would provide reasonable notice of the change, to give unbundlers time obtain L1 PON feeder in the new location. Alternatively the unbundler could consume a Chorus Layer 2 service. Note that lead time could create a poor customer experience for infill customers, as they would not be able to get a fibre service in the meantime, with consequential public relation issues. Further industry consultation is required on how these scenarios are managed. The actual change would need to be coordinated between parties for minimal disruption to end customers.
SLAs	SLAs will need to consider: • Installing a Layer 1 PON feeder will take longer than a Layer 1 PON distribution connection. Both have to be completed for the Customer to receive a working service. • If there is available capacity, i.e. augmentation required; • Whether activities are inside or outside forecasts; • Whether sufficient information has been provided, e.g. access to optical information for assure incidents.
Reporting	Reporting will need to consider: • Service availability; • Offers consumed; • Product and service inventory; • Operational SLAs.

Item	Considerations
Colocation	It may not be possible or desirable for an unbundler to install their active network equipment (OLT) in colocation space in the local central office. Unbundlers can use ICABS to extend the feeder fibre to a remote central office within the candidate area. Feeder fibres will also be able to connect to non-Chorus sites using other Chorus fibre services, such as TPAD or DFAS. Unbundlers need to consider the end-to-end optical budget as part of their network design.
Onboarding	Unbundlers are responsible for making sure their ONTs and OLTs work correctly with the Layer 1 PON unbundling product prior to consumption of the service. It is recommended unbundlers set up a Layer 1 test facility, as described in this document, and test their ONTs and installation equipment prior to on boarding the service. Unbundlers should also establish an active network test facility and test their active network prior to on boarding the service. As part of this pre-on boarding activity, unbundlers should consider: • Design of their end-to-end active network and services; • How optical budget will be managed; • Storage and maintenance of product and service inventory and how this maps to physical and logical network inventory and the consumed Chorus offers; • Installation standards within the premises, i.e. from the ITP to, and including, the ONT; • Lifecycle management of the ONT and OLT; • Operational management methods and procedures; • Assure tools and analytics, including providing access to critical information to Chorus assure technicians; • Fulfil, Assure and Billing integration with Chorus channels.
Split ratios	Unbundlers need to consider what split ratio they require. We require feedback on what options are required, noting that our FFP design is optimised for 1:16 split ratios. Considerations: • The split ratio defines the maximum number of distribution fibres that can be installed on a splitter, but unbundlers can connect less than this. For example a 1:16 splitter supports anything from one to sixteen distribution fibres. • The split ratio impacts the optical budget regardless of the number of actual distribution fibres connected; • Unbundlers can install a splitter between the OLT and the feeder fibre, for example a 1:4 splitter in the colocation space and a 1:16 splitter in the FFP will create a split ratio of 1:64; • Unbundlers may also include wavelength combiners, or co-existence elements, e.g. for combining 10GPON and GPON on the same feeder fibre. This will also affect optical budget.

Item	Considerations
Broadband comparison	Chorus's Layer 2 services have contractual requirements about performance with specific auditable reporting obligations to demonstrate compliance. Unbundlers will not have the same contractual requirements and may build their network to different specifications. Given the impact these differences may have on end customers' experience, the industry needs to consider what information Chorus and unbundlers should transparently provide/publish to allow end customers to accurately compare services. Types of information that might be shared are: • Designed split ratios between OLT port and end customer; • Network resiliency standards; • OLT backhaul standards, e.g. ≤ 10km; • Network congestion and capacity management policy; • Port utilisation and frame loss performance stats; • Service restoration statistics.

4. Key Business Decisions and Assumptions

This section provides our initial first cut of key business decisions and assumptions and our reasoning behind these decisions. These may change as a result of industry consultation.

	Decision	Reasoning
1	Only Chorus technicians will provision and maintain services from the ITP to the central office, including the installation of splitters and connection of feeder and/or distribution fibre to splitters.	The key reasons for this are: • It maintains a clear demarcation of responsibility between Chorus and the unbundler; • It will reduce the number of faults that may be caused by inexperienced or insufficiently skilled technicians; • It ensures accurate and consistent physical records are maintained to Chorus standards. • It ensures consistency of installation with Chorus Layer 2 services and between unbundlers, reducing the barrier for customers and unbundlers; This model ensures Chorus is responsible for all service provisioning and assurance between the ITP and central office OFDF, which provide clear demarcation points. Allowing third party technicians to install splitters and splice fibres within an FFP would result in disputes in the event of a fault. There would be significant issues in identifying in advance or even during resolution as to whether a fault was within the Chorus or unbundler domain, and this could delay resolution of the fault and lead to disputes following the fault over who is responsible. Allowing third parties access to the Chorus Layer 1 infrastructure is likely to result in un-auditable activity and an increase in faults caused by technician mistakes. Given the wide range of skillsets in the industry, we do not believe certification would reduce this risk to an acceptable level. All records associated with the Chorus Layer 1 network need to be entered and maintained to Chorus standards in Chorus systems in order for us to efficiently deliver fibre services. Based on past experience, allowing third party access to this infrastructure will result in a reduction in record accuracy that will ultimately drive cost, complexity and poorer service quality. It is important that the fibre to the ITP meets Chorus installation standards so that Chorus can meet its obligations for Layer 1 and Layer 2 services, including adding unbundled fibre connections and supporting transfers between unbundlers. One of the reasons potential unbundlers have requested access to Chorus FFPs is to allow the feeder/splitter splicing and the premises installation to be coordinated. However, there are multiple possible resolutions to this requirement that would avoid the above issues.

	Decision	Reasoning
2	Chorus provides splitter	Independently of item 1, we believe it would make practical sense for Chorus to provide the splitter hardware for the following reasons: • Our FFPs have been designed with these splitters in mind; • It is an integral part of the Layer 1 service and thus part of the L1 PON unbundled service; • In particular, splitters are inherently associated with the feeder fibre due to the 1:1 association between these elements. Introduction of new splitters would require significant changes to our physical records standards; • It is very unlikely that any benefits associated with third party splitters would outweigh the costs/risks of using them. Unbundlers can install additional splitters within their colocation space, i.e. in serial to the Chorus-provided splitter, but would need to manage end-to-end optical budget.
3	Retention of Chorus Layer 2 services in premises	A key requirement of the UFB network is to provide two physical fibres to each premises, where: • One fibre was allocated to wholesale multi-service Layer 2 services; and • The second fibre was available for physical unbundlers or additional Layer 2 services. Chorus is reserving one fibre for wholesale multi-service Layer 2 services going forward, even after the second fibre is unbundled. It should be noted that the contractual/regulated obligations of Chorus and the unbundler are different. unbundlers are likely to be vertically integrated Telcos and are not currently required to offer wholesale multi-service Layer 2 services to other providers.
4	Unbundler cannot reuse Chorus ONTs	Chorus does not intend to rent or sell current Chorus Layer 2 ONTs for the following reasons: • Chorus requires the Chorus ONT to remain in place and be available for current and future wholesale Layer 2 services. • Unbundlers are expected to brand their ONTs and CPEs differently from Chorus ONTs to avoid confusion. The use of Chorus branded ONTs by unbundlers would create confusion for the customer and/or technician during provisioning and assure scenarios, especially if the unbundler uses their branded ONT in some situations but not others; • Chorus currently has five ONT variations with different possible features or characteristics and this number is expected to increase. Making some or all of these variants available to unbundlers would significantly increase operational and commercial complexity and lifecycle management.

	Decision	Reasoning
5	End user demarcation point (ITP)	Chorus proposes the ITP as the Chorus/unbundler demarcation point for the following reasons: • It provides a clear demarcation between the Chorus Layer 1 service and the unbundler ONT within the customer premises; • It ensures fibre is delivered within the premises in a manner that supports both Chorus Layer 2 services and unbundling, reducing the barrier for a customer to change service providers/unbundlers.

5. Business Offer Considerations

The focus of this paper is on residential services. Use of Layer 1 PON unbundled fibre for business requires the following additional consideration.

Item	Considerations
Classification	The use of fibre for different segments, with different fulfil and assure expectations, would require fibres to be classified by segment. Additional classifications may be required in the future, such as priority medical connections. • Distribution fibre would be classified as either business or residential. • Feeder fibre and splitters could be shared, but would need to be classified by the higher value segment (business). This classification would affect process, inventory, business rules, SLA management, SLA reporting and price.
Business provisioning requirements	Businesses have very different provisioning requirements than residential customers, including: • The requirement for higher-skilled technicians, particularly if they are supporting active network installation and configuration; • Prioritised management and escalation channels; • Different consent rules, including centralised management of end user terms and/or project coordination. There may be access and security considerations that need to be managed.
Business Assure requirements	As fibre is likely to be mission critical, Businesses have very different SLA requirements, e.g.: • 8 hours restore in urban; • Critical response (assure technician onsite within two hours) There may be access and security considerations that need to be managed. Base SLAs assume adequate optical information is provided for assure incidents, and that access is provided to Chorus Assure technicians.
Chorus demarcation point in business MDUs	Business in MDUs may need flexibility in demarcation point, e.g.: • Building OFDF; • Floor comms room; or • Tenancy ITP
Chorus demarcation point in data centres	Data Centres may have very specific requirements for demarcation points, or provide restrictive lists as to who can come on site and install or resolve problems.

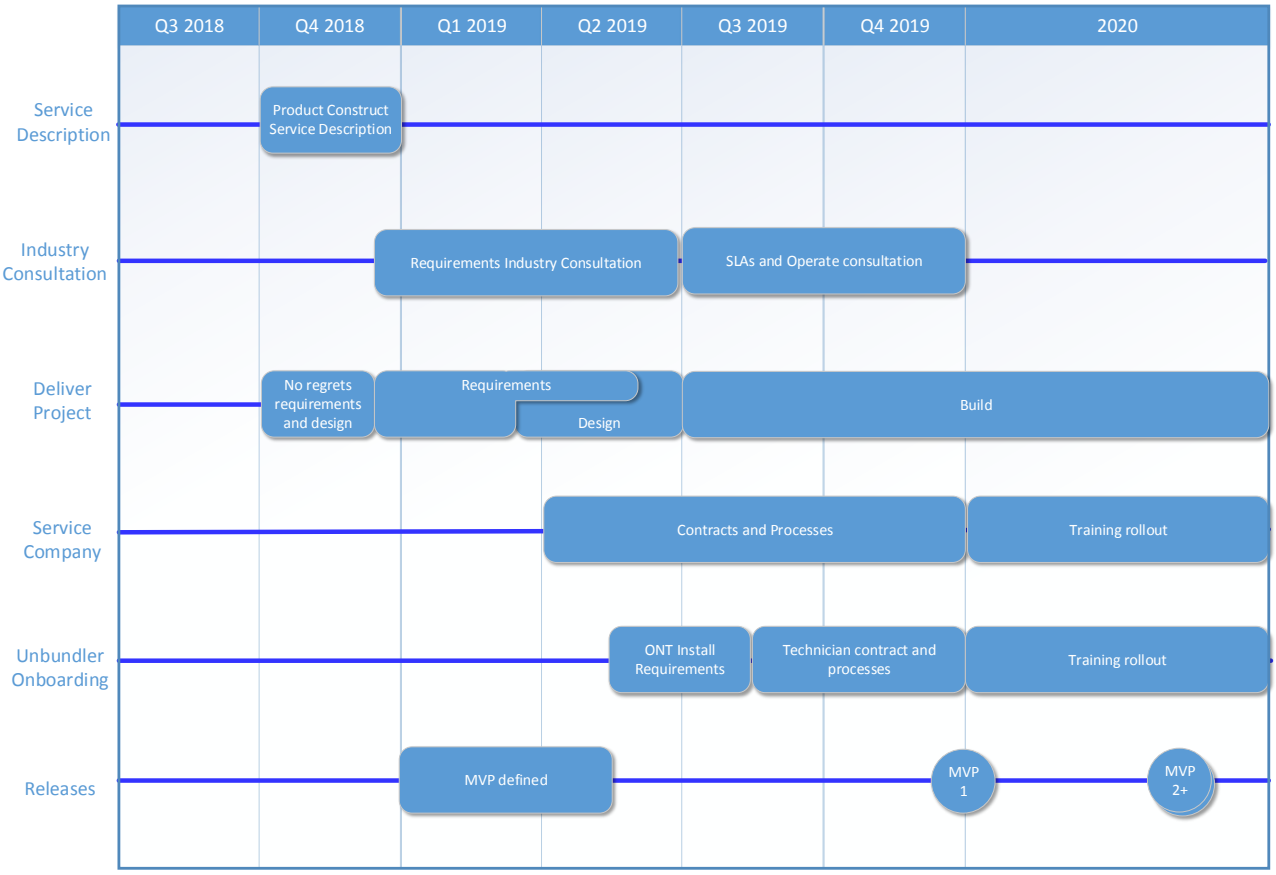
Item	Considerations
Use of third party fibre within a building	Customers may want to extend Chorus fibre with internal building fibre. This presents some challenges: • Third party fibre must meet Chorus fibre standards; • There must be a clear demarcation between Chorus and the third party fibre. Preferably, it will use connectors rather than direct splicing; • Fault identification and resolution could be complicated. Clear rules will be needed for resolving faults and No Fault Found or service demarcation disputes.
Customer Service Experience (CSE)	Businesses are likely to have unique CSE requirements, which allow the physical installation within a premises to be customised. The customisable elements of the CSE will be agreed during the delivery phase. This could be simple elements, ONT model or even allow unbundlers to insert their own work instructions per order.
Temporary connections	A temporary connection is one where the site has a defined lifespan, such as a construction administration office. These lines may need to be physically uninstalled once the temporary use is over – this activity will restore the access network to a known state. Further industry consultation is required on how these kinds of connections are identified and managed.
Assure tools	Businesses, due to their need for higher availability, may need unique assure tools. In general it is expected these would be managed in the active network, not the Layer 1 service, and thus by the unbundler.
Reporting	Product and SLA reporting will need to be able to be filtered based on product/service classification
Event notification	Business services will need to be identified and notified in the event of planned (proactive) and unplanned (reactive) network events that disrupt service. Planned events include FFP infill and capacity augmentation. Unplanned events includes faults.

Appendix A

A.1 Delivery Approach

Timelines for the overall consultation can be found here

The following diagram shows our high level delivery approach:



Notes:

- This high-level timeline is for the delivery project and excludes consultation and milestones for both pricing and commercial agreements;
- Dates are indicative and could change as the project progresses;
- The service description is likely to be reviewed and updated following Q4 2018, to reflect feedback on text and or as a result of reasonable changes identified during the delivery of the project. These updates are not expected to be substantial;
- It is likely the delivery will be decomposed into multiple systems (fulfil, assure, bill, inventory, prequalification etc.) with discrete delivery times, i.e. requirements, design and build may overlap during the project. This will depend on the high level architecture and service description;
- Unbundler on boarding will depend on whether Chorus technicians are used to install the ONT or do premises wiring.

We expect a multiple delivery drop, where:

- Minimum Viable Product (MVP) is a project scope definition for each drop. This means it needs to contain sufficient capability to launch a viable product that can be ordered, fulfilled, assured and billed to a specific scale;
- The MVP for drop 1 will be based on the service description, customer consultation, customer forecasts and what can be practically supported by the Chorus systems, processes and resources;
- MVP1 will deliver the core service, i.e. allow unbundlers to consume Layer 1 PON Feeder and Layer 1 PON Distribution services. Subsequent drops may increase levels of automation.

A.2 Consultation Questions

The following are technical and product questions raised so far during service provider consultation run in September 2018.

These exclude pricing and commercial questions, which will be addressed outside this paper.

Consultation Question	Answer	Document Reference
Is the service you are providing all-inclusive or can we choose components?	All elements between the ITP and the first central office are included in the Layer 1 PON unbundled fibre service. Unbundlers may extend the feeder fibre beyond this first central office using non-Chorus fibre solutions.	§ 2.2 P 6
Can service providers' contractors access all of the Chorus network?	No. Only Chorus technicians can access the Chorus network between the ITP and the central office.	§ 4, item 1 P 21
What are the boundaries between Layer 1 and 2?	The demarcation points of the Layer 1 service are the ITP at the customer premises and the OFDF at the central office. The Layer 2+ service includes: • The ONT, and premises wiring within the customer premises to connect it to the ITP; and • The tie cable, OLT and all upstream network components. Note that these network components may operate at Layer 3 or higher.	§ 2.2 P 6 § 4, item 5 P 23
What is the capacity management process for FFP? Including what happens if the FFP is full?	FFP capacity is currently capacity managed based on trending consumption. This process will likely need to be emended for Unbundling and include forecasted capacity. If an FFP runs out of capacity, e.g. due to customer infill, then it may need to be split. This typically requires two FFPs splitting into three. Under this situation, an unbundler would need an additional feeder fibre to the new FFP to continue service. Chorus will publish a capacity management plan, related SLAs and any associated reporting regime.	§ 3 P 17

Consultation Question	Answer	Document Reference
How will Chorus manage network capacity?	Feeder fibre capacity is managed similarly to FFP capacity. Distribution fibre will be managed as follows: • All fibre ready premises will have two fibres available to be installed as part of the lead-in, with the second available for unbundling; • All fibre active or intact premises will have two fibres installed, with the second available for unbundling; • Any infill premises will be delivered to the above standard. A large number of infill premises within an FFP coverage area may require changes to the FFP coverage, i.e. FFP 'Infill'; • Additional distribution fibre may be available to be installed, on a case by case basis. Installation would result in an outage for all current services on the premises.	§ 3 P 17
Will Chorus provide the FFP addresses and name?	Chorus will provide FFP information as part of service availability. We will also provide FFP coverage information. The format and mechanism for this information has yet to be determined.	§ 3 P 15
Will unbundlers be able to remove or rent the Chorus ONT? If not why? (Please consider sites with no ONTS currently in answer)	The Chorus ONT is reserved for Layer 2 Wholesale services. Unbundlers cannot remove this ONT as it is not their property. Chorus does not intend to rent or sell ONTs to unbundlers.	§ 4, item 4 P 22