Chorus consultation paper on Passive Optical Network Fibre Access Service (PONFAS) product construct V2

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

Document Control

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

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1.1	08.11.2018	Peter Coleman	Draft update. Added OSS/BSS and feedback from consultation
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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. This document will form the basis of the last round of consultation before a final product description is confirmed, as per the consultation timetable..

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Introduction

This paper looks at the proposed product construct for Passive Optical Network Fibre Access Service (PONFAS) and the associated system and operate implications and puts a stake in the ground around key business decisions.

PONFAS provides an unbundled point to multipoint or aggregated fibre point to multipoint fibre service that provides unbundlers with the ability to offer passive optical network solutions between active equipment located in, or served by, a Chorus Central Office and an ONT installed at an end customer premises.

The primary focus on this paper is unbundling residential passive optical network accesses. However, some considerations for business passive optical network 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 PONFAS high level product suite that Chorus will offer in UFB1 areas from 1 January 2020;
- Identify the key operational and business characteristics of the proposed PONFAS high level product suite that will need to be addressed during the delivery phase; and
- Solicit feedback to support publication of the PONFAS service description by the end of February 2019, and the subsequent development of this PONFAS product.

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 point to multipoint fibre 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 point to multipoint fibre access service from 1st January 2020 to an Equivalence of Inputs (**EOI**) standard.

Section 2 describes the product construct for PONFAS.

Section 3 describes Chorus support system stack and approach for PONFAS.

Section 4 looks at the operate model considerations for PONFAS that need to be resolved with systems, processes or business rules during the delivery project.

The appendices include additional information on how PONFAS will be delivered and provides specific feedback to questions and issues raised during the consultation.

This document will form the basis of the last round of consultation before a final product description is confirmed, as per the consultation timetable.

Consultation on the build, order, assure and customer experience will be ongoing.

1.4.   Exclusions

This paper is only focused on PONFAS. It excludes:

- Direct fibre access (Point to point fibre);
- Layer 2 products and roadmap;
- Pricing;

1.5.   PONFAS and the Chorus Network

This Chorus PONFAS product construct described in this paper is designed around the UFB network and products agreed with the Government and industry as part of the 2010-2011 Ultrafast Fibre (UFB) consultation. This agreement was subsequently laid out in the Network Infrastructure Project Agreement (NIPA), which set the rules and terms for Chorus to provide the Ultrafast Broadband network (UFB1).

As per this agreement, the UFB network was built to support both open Layer 2 access, using the "blue" fibre, from 2011, and PONFAS using the second 'orange' fibre from 1st January 2020.

This has also been reflected in the product construct and OSS/BSS architecture that drive the operational model and customer experience.

We also note that, given that this architecture is embedded in our network, OSS/BSS and operational processes, it would be challenging to significantly vary the product from the original agreed 2010-11 scope within the required timeframe.

1.6.   Feedback Consultation

This paper has been updated to include feedback from multiple phases of consultation with the industry.

Considerable written and verbal feedback has been received from a number of different interested parties. All feedback has been assessed using the following criteria:

- How does it align with Chorus' regulatory or NIPA obligations;
- How does it align with Chorus' commercial drivers; and
- How does it impact customer experience (for all customers on the Chorus network).

Where possible, these items have been addressed either in the document proper, or in the feedback summary in the appendix. It should be noted that due to the nature of both the process and the different interested parties involved, a lot of the feedback received was contradictory and/or would require significant variation to the product envisaged and architected in 2010-11. Chorus has done its best to reconcile these contradictions and variations, noting the limitations described in section 1.5 above.

Some of the feedback we have received is more relevant to our Layer 2 product roadmap and is being incorporated in the Layer 2 whitepaper.

1.7.   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 (coming soon).

2.   PONFAS Product Construct

This section describes the PONFAS product construct and summarises the related industry feedback.

It is expected there will be significant ongoing consultation during the delivery phase of the project and this may result in changes to the service description, features and/or operational processes and interactions.

2.1.   Scope of Unbundling

The 2011 UFB contracts agreed 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 (PONFAS) in UFB1 areas from 1 January 2020 and in UFB2 areas from 1 January 2026.

Unbundlers will be able to request PONFAS 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.   PONFAS Product Construct

The PONFAS product construct suits a build + connect 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.

There are two offers:

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

  It comprises the following components:
  - o   Installation of the splitter at the FFP
  - o   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;
  - o   Connection of the feeder fibre to the splitter.
  - o   Connection of the feeder fibre to the tie cables associated with the unbundler colocation space.

  It excludes:
  - o   Colocation at the local or remote central office, which is a separate service;
  - o   OLT installation and commissioning;
  - o   Central office patching of the OLT port to the OFDF using tie cables;
  - o   Connection of Distribution fibre to the splitter, which is part of the PONFAS distribution offer;

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

The PONFAS feeder offer effectively opens up a geographical coverage area, as defined by the FFP, to be available for unbundling for the specific unbundler. It is not expected to be requested as part of a customer service request, although that is up to the unbundler's operating model.

An unbundler can request multiple PONFAS feeders to be connected to an FFP, but splitter ports on subsequent PONFAS Feeders will only be allocated once previous PONFAS feeders are fully occupied.

- **PONFAS distribution**, which connects an end customer site within the FFP coverage area to the splitter associated with and installed with the PONFAS feeder service.

  It comprises the following components:
  - o Allocation of the distribution fibre and associated splitter port;
  - o Connection of the distribution Fibre to the splitter;
  - o Installation of the distribution fibre from the customer premises to the FFP, including lead-in and ETP if applicable;
  - o Premises wiring from the ETP to the ITP, including installation of the ITP if applicable;
  - o Optional CSE for installation and connection of a Layer 2 device to the ITP and any requested service testing.

The PONFAS Feeder is a prerequisite for this service, i.e. there must be a splitter in the associated FFP for this service to be requested, or else the service request would fail feasibility and be rejected.

There is only one FFP associated with an end customer premises. This association could change over time due to FFP rehoming or infill.

This construct is shown in the diagram below:
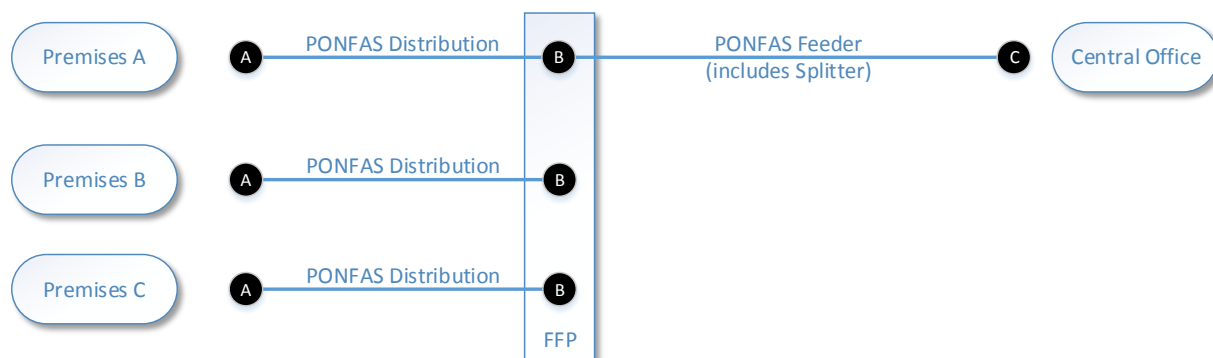
Figure 1. Product Construct Product Model

The following picture maps this product construct to the point to multipoint fibre architecture:
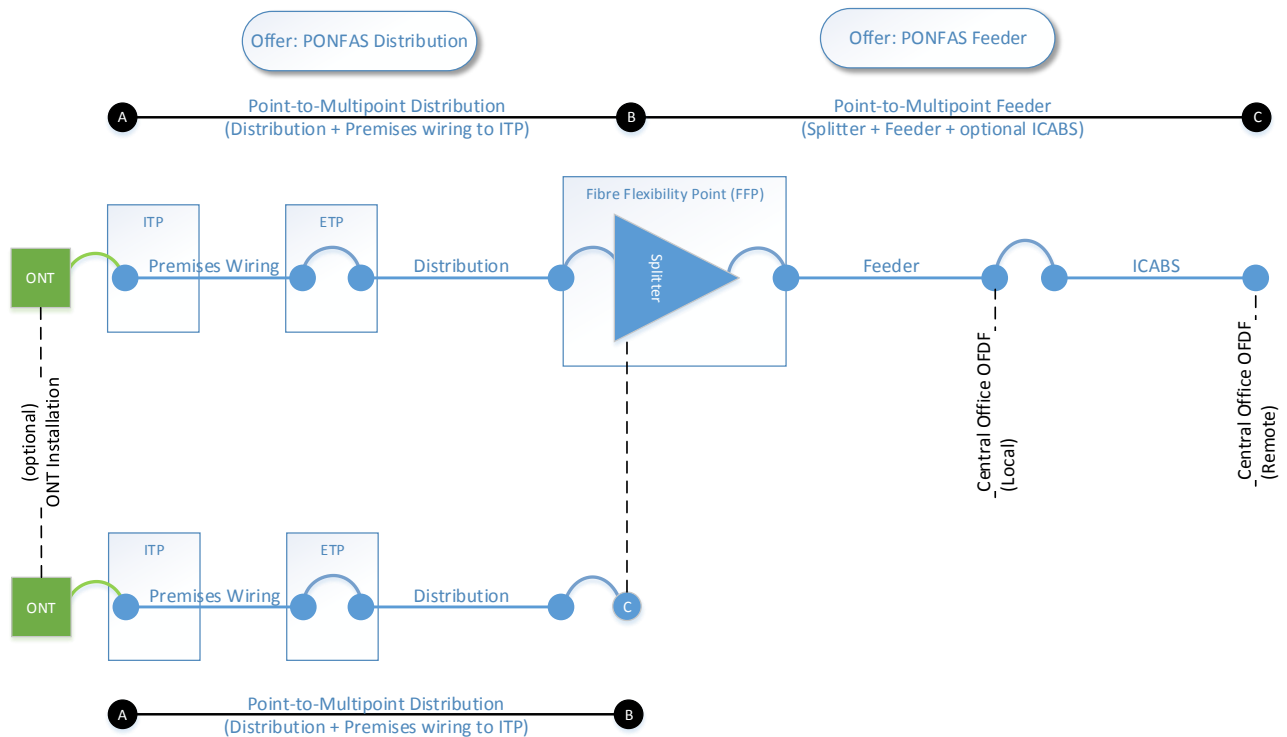
Figure 2. Product Construct Architecture

2.3. Key Business Decisions And Assumptions

This section provides our current cut of key business decisions and assumptions and our reasoning behind these decisions. These decisions will continue to be discussed during the ongoing industry consultation.

	Decision	Reasoning
1	Only Chorus technicians can 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: • Chorus is accountable for any faults within the Chorus network. This maintains a clear demarcation of responsibility between Chorus and the unbundler; • Chorus has a number of regulatory KPIs, resource management act obligations and occupational health and safety obligations with respect to the Chorus network. Allowing third party access to our network would not change our obligations but compromise our ability to meet them. • 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 service regardless of FFP type, since different FFP types have different technical challenges. 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 specific splitters in mind; • It is an integral part of the Layer 1 service and thus part of the PONFAS 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 L2 services in premises	A key requirement of the UFB network, as agreed with the Government and the industry in 2010-2011 and embedded into our systems and processes, is to provide two physical fibres to each premises. In practice this means: • One 'blue' fibre is allocated to wholesale multi-service Layer 2 services; and • The second 'orange' fibre is available for physical unbundlers or additional Layer 2 services. The 'blue' fibre is reserved for wholesale multi-service Layer 2 services going forward, even after the 'Orange' fibre is unbundled.

	Decision	Reasoning
4	Unbundler cannot reuse Chorus ONTs	The Chorus ONT is a layer 2 device, not a Layer 1 device, and is not part of PONFAS. Chorus does not intend to rent or sell current Chorus Layer 2 ONTs for the following reasons: • The Chorus ONT inventory is embedded in our Layer 2 OSS/BSS. It would require complex changes and a new channel to support the selling or renting of ONTs. This does not seem a practical option. • 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.
5	End Customer premises demarcation point (ITP)	Chorus proposes the ITP as the Chorus/unbundler demarcation point in the end customer premises 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 PONFAS, reducing the barrier for a Customer to change service providers/unbundlers.

2.4. Questions Raised During Consultation

The following are specific technical and product issues and questions raised to date during service provider consultations that commenced September 2018.

We have attempted to address these questions as much as possible noting that (a) our processes and systems for PONFAS are under development, (b) several questions and issues raised were contradictory in nature and (c) items related to our Layer 2 services will be included in our Layer 2 whitepaper currently being developed. For more detailed information regarding these questions, see Appendix A.2

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

Consultation Question	Summary answer	Assessment		
		Chorus contractual obligations	Commercial	Customer Experience
Unbundlers would like to unbundle the "blue" intact fibre to avoid truck rolls and customer experience issues when moving from Layer 2 to PONFAS.	Only the "orange" fibre is available for PONFAS.	Chorus is required to provide two fibres to each premises, with the second fibre available for unbundling.	The requested approach would prevent Chorus from efficient use of network assets.	The stated business objective would not be achieved as a Chorus truck roll would still be required to install the unbundler ONT.
Unbundlers would like to rent or buy Chorus ONTs to avoid truck rolls and customer experience issues when moving from Layer 2 to PONFAS.	Chorus will not be offering ONTs as part of, or for use for PONFAS.	The Chorus ONT is not part of the point to multipoint product definition.	This would add significant technical, operational and commercial complexity to a solution. The Chorus ONT supports multiple bitstream services and Chorus reserves the right to continue to provide other services on the ONT.	This would create considerable ongoing customer experience risk due to technical and operational complexity.

Consultation Question	Summary answer	Assessment		
		Chorus contractual obligations	Commercial	Customer Experience
Unbundlers would like to purchase sub-components of PONFAS so they can use their own distribution or feeder fibre and connect it to a splitter.	PONFAS is between the ITP and the Central Office and unbundlers cannot consume individual sub-components of point to multipoint fibre.	Chorus is required to provide two new unbundled services from 1 Jan 2020: • Unbundled Point to multipoint fibre; and • Aggregated fibre Point to multipoint. There is no requirement to sell sub-components. Sub components would not be an equivalent input product to what bitstream services consume.	This would add significant technical, operational and commercial complexity to the solution.	-
Unbundlers are concerned that transfers will be significantly more complex operationally.	We acknowledge that there are significantly more use cases with PONFAS, which will increase complexity.	The requirement for both Layer 2 and PONFAS services with multiple fibres increases the possible use cases.	We would like to work with the industry to minimise complexity.	We would like to work with the industry to maximise customer experience outcomes during these use cases.

Consultation Question	Summary answer	Assessment		
		Chorus contractual obligations	Commercial	Customer Experience
Unbundlers would like to directly engage Chorus service companies for their customer experience and operational needs.	We conceptually support unbundlers engaging service companies directly to create differentiated customer experience for any activities outside the Chorus network, provided such engagement does not affect Chorus commercial relationship with the Service Companies, or our ability to maintain operational, commercial and regulatory integrity and ownership of all activity within the Chorus network. We propose discussing each differentiation opportunity on a case by case basis	Chorus has a number of regulatory KPIs, Resource Management Act and health and safety obligations with respect to the network that will need to be maintained.	Chorus is supportive of this in principle, provided our commercial relationship with the service companies is not affected.	We are happy to work with unbundlers and service providers on practical ways to do this.
Can PONFAS be delivered to other types of locations apart from residential or business premises?	We are currently working through where PONFAS can be consumed.	Under review.	Under review.	-
Unbundlers are concerned about the level of complexity of the product and how difficult that makes it for them to consume PONFAS.	Consuming point to multipoint fibre services is fundamentally complex and we will work with the industry to minimise this complexity as much as possible.	PONFAS is designed to meet our regulatory and contractual obligations.	The consumption of a point to multipoint input product is complex.	We will work with the industry to minimise this complexity as much as possible.

Consultation Question	Summary answer	Assessment		
		Chorus contractual obligations	Commercial	Customer Experience
Unbundlers would like a simple approach for unbundling that focuses on the best customer experience.	We support providing a great customer experience, balanced against our regulatory, commercial and technical requirements.	Customer experience has to be balanced with our point to multipoint obligations defined in the NIPA.	We are happy to look at commercially and technically viable customer experience enhancements.	We will hold joint Chorus and Industry customer experience workshops to optimise the experience within our regulatory, commercial and technical requirements.
Are there any changes to colocation agreements and costs?	There are no planned changes to colocation agreements or costs to support PONFAS.	Our existing colocation services are designed to meet our regulatory and contractual obligations.	Chorus is continuing to look at ways to improve and simplify our colocation product suite as part of colocation's existing roadmap.	-
Having both Chorus and unbundler technicians required for an install could drive costs and poor experience. How can this be optimised?	This is best addressed through joint Chorus and industry customer experience workshops.	Chorus has a number of regulatory KPIs, Resource Management Act and health and safety obligations with respect to the network that need to be met.	We are happy to look at commercially and technically viable customer experience enhancements.	This is best addressed through joint Chorus and industry customer experience workshops.
How many FFPs are deployed in Chorus network?	There are currently 22,057 FFPs deployed in the Chorus network.	FFPs will increase over time to cope with access growth, including infill.	A list of FFPs is available on request. We will be developing a mechanism to show geographic coverage and how many bitstream customers map to each FPPs.	-
Can unbundlers submit a single service request per customer that delivers service from central office to ITP?	No, PONFAS uses two service requests (build + connect).	This model reflects how bitstream services consume point to multipoint fibre.	This aligns the product construct with our OSS/BSS architecture and inventory.	This optimises customer experience by ensuring all customer connection service requests, including the first one on splitter, have the same process and experience.

| Consultation Question	Summary answer	Assessment		
		Chorus contractual obligations	Commercial	Customer Experience
How does infrastructure capacity management impact unbundler service requests?	We will augment capacity to demand but there could still be shortfalls.	We will augment capacity to demand / forecasts. If unbundlers provide committed forecasts but do not consume that forecast within an agreed timeframe then Chorus may charge the unbundler for any reasonable incurred costs.	Capacity augmentation is subject to our standard capital investment rules.	If there is insufficient capacity then service requests will be delayed until capacity is augmented. It is recommended unbundlers forecast capacity requirements to minimise such scenarios.
Can service providers' contractors access all of the Chorus network?	No, only Chorus contractors can access the Chorus network between the ITP and the central office.	Chorus has a number of regulatory KPIs, Resource Management Act and health and safety obligations with respect to the network that need to be met.	This is the same rule as for copper unbundling and follows international best practices for unbundling.	Chorus could not meet our customer experience KPIs.
What are the boundaries between Layer 1 and 2 services?	PONFAS (Layer 1) is between the ITP and central office. The Unbundler provides all active network components.	The PONFAS demarcation points are the connectorised fibre on the ITP and LC connector on the MOFDF.	-	-
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 plan will be updated to support PONFAS.	FFP capacity is currently capacity managed based on trending consumption and forecasts. If FFP runs out of capacity, e.g. to customer infill, then it may need to be split.	Splitting typically requires two FFPs splitting into three. An unbundler would need an additional PONFAS Feeder to the new FFP to continue service.	Chorus would endeavour to provide reasonable notice of splitting, noting that any notice could delay customers.
How will Chorus manage network capacity?	Feeder Fibre capacity is managed similarly to FFP capacity. Distribution Fibre will be managed to meet demand.	Capacity managed based on trending consumption and forecasts.	Capacity augmentation is subject to our standard capital investment rules.	Augmenting fibre to a premises may result in a short outage to all services during augmentation. Chorus will endeavour to implement feeder fibre capacity before capacity is exhausted. This may not always be possible.

Consultation Question	Summary answer	Assessment		
		Chorus contractual obligations	Commercial	Customer Experience
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.	-	Chorus will provide per service and per FFP information.	Per service information will be incorporated in existing channels.
Will unbundlers be able to remove the Chorus ONT?	No. The ONT is part of bitstream service and not part of PONFAS. Unbundlers cannot remove the bitstream ONT.	The Chorus ONT is not part of the point to multipoint product definition Unbundlers cannot remove Chorus property.	The Chorus ONT supports multiple bitstream services and Chorus reserves the right to continue to provide other services on the ONT.	-
Does Chorus have facilities for unbundlers to test their olts and other active network equipment	Yes, but we recommend unbundlers use an internal integrated test environment for flexibility and efficiency.	The expectation is that unbundlers have their own lab facilities for testing their active network equipment.	We can host unbundler equipment to be tested using co-location services if requested.	We recommend unbundlers use an internal integrated test environment for flexibility and efficiency. This is industry best practice.

3. PONFAS Business and Operational and Support Systems

This section looks at business and operational support system approach for PONFAS.

3.1. OSS Context Model

The Chorus fibre OSS/BSS stack is based on tmforum industry standards for service-oriented telecommunication business operations, as shown below:
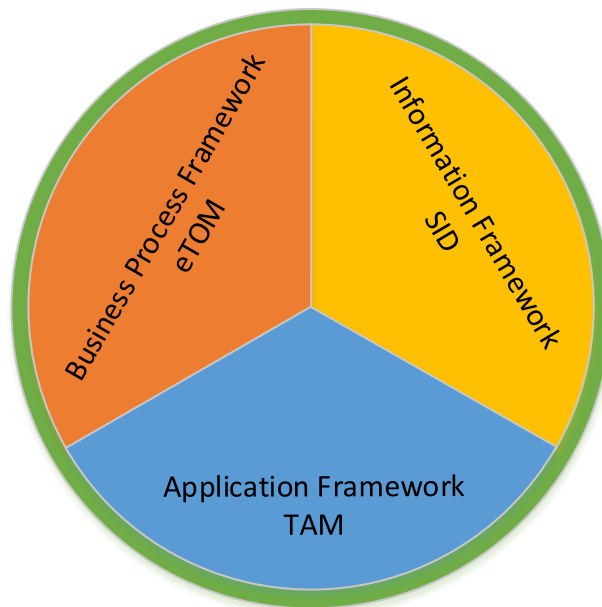
Figure 3. Tmforum-Based Business Operations Framework

Where:

Item	Description
Service Information Framework (SID)	Provides standard definitions, based on Product, Service and Resource (PSR) models, to define how information is managed and flowed through the fibre stack and between Chorus and our business partners.
Business Process Framework (eTOM)	A multi-layered view of the key business processes required to run an efficient, agile telecommunications service.
Application Framework (TAM)	Provides a common language and means of identification across all software application areas.

3.2.   Fibre System Stack

Service Providers currently request and manage Chorus Layer 2 services through our L2 COM (Chorus Portal/B2B). The Layer 2 Systems then consume shared and dedicated Layer 1 systems and resources through internal channels.

The introduction of PONFAS will:

- Add a new PONFAS COM channel that allows unbundlers to request and manage PONFAS offers;
- The PONFAS COM will then access the same internal systems and processes for Layer 1 PON (Point to Multipoint fibre) consumption as the Layer 2 fibre stack.
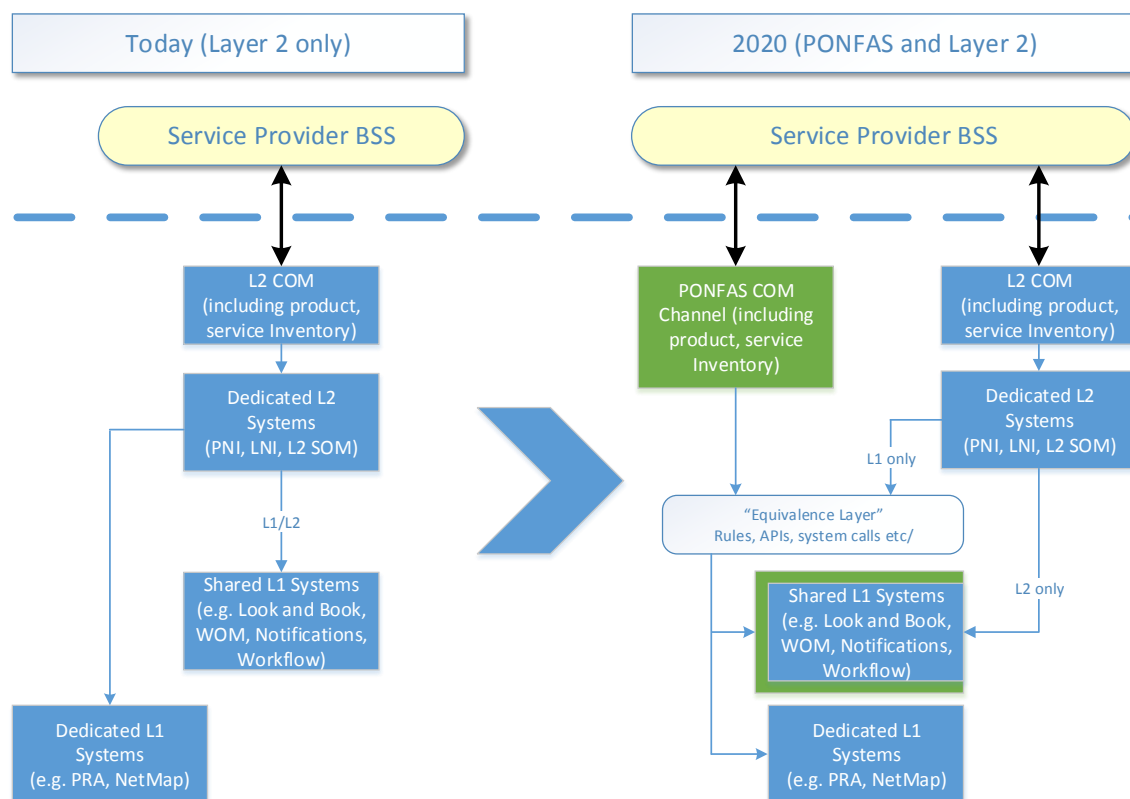
Figure 4. Fibre OSS/BSS System Stack

| Item	Description	Examples
L2 COM	The layer 2 customer order manager. Receives and manages Service Provider bitstream service requests. Stores the bitstream Product and Service inventory using the PSR model.	Chorus Portal, B2B
PONFAS COM	The PONFAS customer order manager. Receives and manages Service Provider PONFAS service requests. Stores the PONFAS Product and Service inventory using the PSR model.	(New, likely a new module within the Chorus Portal)
Dedicated Layer 1 systems	Systems (and related processes) dedicated to managing the point to multipoint Layer 1 fibre resources based on the PSR model.	NetMAP, PRA

Item	Description	Examples
Shared Layer 1 systems	Systems (and related processes) that are shared for both Layer 1 and Layer 2 (bitstream) services. There are primarily support functions, such as assure or service availability, or ones related to work activities in the physical network.	Work Order Management (WOM), OFM, CDW,SAP, Look and Book (scheduling), Service Availability API
Dedicated Layer 2 systems	Systems (and related processes) that are dedicated to managing the Layer 2 resources based on the PSR model, including links to the point to multipoint Layer 1 fibre Resource Facing Services.	Fibre Service Order Manager (FSOM), Check Mate
Equivalence layer	The equivalence layer are common business rules, internal APIs and system transactions that ensure PONFAS COM and the dedicated Layer 2 systems interact with the point to multipoint Layer 1 systems and processes in an equivalent manner.	-

Where:

- NetMAP is our Geographic Information System (GIS) based Layer 1 inventory system;
- PRA (Physical Resource Allocation) is a NetMAP module that associates and reserves Layer 1 inventory to a service;
- OFM (Online Fault Management) is our Assure fault ticket management platform;
- SAP is our billing platform;
- CDW (Chorus Data Warehouse) comprises a number of systems and applications used for reporting and analytics.

3.3. Fibre PSR Model

The Chorus fibre OSS/BSS stack uses Product Service and Resource (PSR) models to delineate responsibilities between applications. The following diagram shows a high level view of our PONFAS and Layer 2 PSR models and how these correlate to our fibre stack:
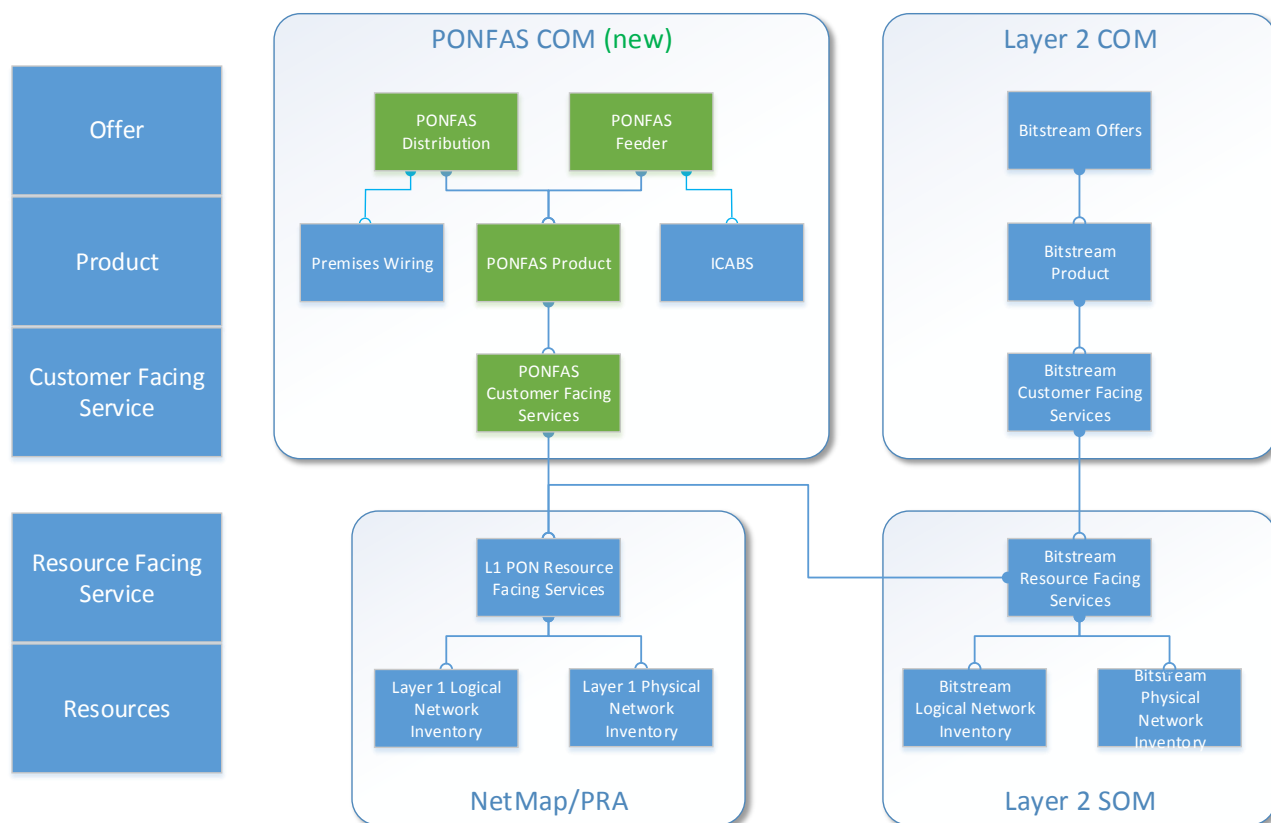
Figure 5. Fibre PSR Model

The PONFAS COM supports the PONFAS offers, product and service inventory:

- Unbundlers submit service requests to Add, Modify or Remove the PONFAS offers;
- The PONFAS distribution offer includes the option to request premises wiring, i.e. physical installation services beyond the ITP, such as ONT installation;
- The PONFAS feeder offer includes the option to request ICABs to extend the Feeder fibre to a remote central office within the UFB coverage area.

The point to multipoint Layer 1 PON resource facing services and resource inventory is managed by NetMAP. PONFAS COM and L2 SOM both request the Layer 1 resource facing services using PRA (Physical Resource Allocation).

3.4.   OSS/BSS Considerations

Item	Considerations
PSR model and alignment with NIPA model	Chorus fibre systems, records and associated processes have been designed for the 'Blue'/'Orange' fibre model agreed with the government and the industry in 2010-2011. Changing this model would require significant low level plumbing of our support systems, which would be difficult and complex to do.
PONFAS COM	Chorus will deploy a new PONFAS COM system to allow unbundlers to request, modify and remove PONFAS fibre offers. The key characteristics of this system are: • Allows unbundlers to access PONFAS COM from an untrusted external network; • Ensures commercial confidential information is handled correctly, i.e. unbundler users can only see information they are entitled to; • Allows the submission of PONFAS fibre service requests, including the ability to schedule truck rolls as required; • Provides unbundlers with the ability to track the progress and manage PONFAS fibre service requests; • Interacts with point to multipoint Layer 1 PON Resource Facing Services to deliver the PONFAS fibre services. As this is a completely new channel, we are still investigating whether this would be delivered as additional modules within our existing channels (preferred) or a completely new channel. This decision will be based on cost, complexity, customer experience and development lead time.
How PONFAS COM and Layer 2 SOM interact with Layer 1 systems	PONFAS COM and Layer 2 SOM are inherently different types of systems: • PONFAS COM is an unbundler-facing system that provides a channel that manages service requests, commercial confidentiality and external network security; • Layer 2 SOM is an internal platform managing Chorus bitstream resource facing services. These differences means that the way they interact with the NetMAP and PRA systems may differ in practice; we will use business rules and processes to ensure they operate in an equivalent manner.
Offer structure	The offer structure provides a 1:1:1 relationship between offer, customer facing service and resource facing service. This reflects a build and connect model, where: • The unbundler submits a service request for the common infrastructure (feeder + splitter), which provides them with access to all customers within a FFP coverage area. This request does not need to be coordinated with an end customer. • The unbundler then submits a service request for each customer to be connected. These requests need to be coordinated with each end customer as it requires a premises visit. This provides equivalence with Chorus' bitstream products.

Item	Considerations
Migration of multiple services	It is anticipated that there will be a need for initial migrations of FFP areas, where multiple customers within an FFP are migrated to PONFAS efficiently, i.e. multiple PONFAS distributions are connected to the same PONFAS feeder at the same time, to avoid unnecessary truck rolls.
	It is not envisaged that any service request coordination will be built into Chorus's provisioning platforms or processes. Any coordination would need to be managed by a managed provisioning wrapper, which would also need to manage exception scenarios.
	Irrespective of FFP coordination, PONFAS Distribution installation activities need access to customer premises and therefore scheduling and coordination of this activity would be a function of the unbundler.
Service availability	The Service Availability API and Chorus Portal/B2B will include FFP information associated with a premises.
	Footprint reports can be updated, but this is not recommended as the information is only accurate at the time the report is generated. Historically, the industry has had issues with this information being retained for long periods, resulting in conflicting information being presented to customers. While FFP information will not change frequently, it will change over time and the footprint report will not be as up to date as the API.
	The actual information available via API will be agreed with potential unbundlers later in the project phase (Q1/Q2 2019).
Migration planning	It is anticipated that unbundlers will require a report that enables them to plan their business case, which includes:
	• A list of FFPs and their associated Central Offices;
	• How many of the unbundler's existing Layer 2 Customers are associated with the FFP;
	• Geographic coverage and total number of potential customers associated with FFP, noting this will change over time due to infill etc.
	These are new report(s) that will need to combine information from multiple systems in a repeatable and auditable way, while ensuring customer confidentiality rules are maintained. The format and structure of these report(s) will need to be defined and agreed.
ONT management	The unbundler will need to manage their ONT lifecycle and inventory.
	It should be noted that the Chorus ONT is managed as part of the Layer 2 Physical and Logical Network inventory, i.e. is not associated with our point to multipoint Layer 1 PON inventory.
Assure fault tickets	Assure Fault Tickets will be submitted through OFM (Online Fault Management). Unbundlers need to ensure faults within their network, including ONT and premises wiring from ITP to ONT, are eliminated before submitting an assure ticket.
	We will need to agree the level of information included with a trouble ticket to ensure the fault can be resolved efficiently.

Item	Considerations
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 PONFAS faults, and how this information is shared with Chorus and Chorus technicians, e.g. via APIs. This has to be sufficient for Chorus assure technicians to isolate and fix faults efficiently within the agreed SLA.
	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.
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.

4. PONFAS Operate Model Considerations

This section looks at the considerations for Chorus and unbundler operate models under PONFAS. 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
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.
First in unbundled line	The Chorus fibre access network has been designed to support unbundling and a second 'orange' unbundled fibre is provided to a customer premises as part of the initial bitstream connection. This fibre is not, however, connected through to the ITP during the installation and this work would need to be done as part of the first-in PONFAS Distribution connection by a Chorus technician. Following this first-in Unbundled installation, the 'Orange' fibre will be presented as a connectorised fibre at the ITP. Subsequent connections to this fibre will not require a home visit by a Chorus technician, unless requested to connect the unbundler ONT, or if the unbundler needs their ONT fibre spliced within the ITP. However the premises is considered an unsecure environment and this state could be changed by the home owner, a previous unbundler or a third party with access to the premises, in which case a Chorus technician will need to restore this state. As this is a passive network, this variation from our recorded state would not be known prior to the ONT installation.
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 customer. 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 service request.
New connect: Layer 2 active	Chorus will use an unallocated unbundled fibre to stand up PONFAS where an unallocated 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' PONFAS distribution service; • Install additional unbundled fibre, if possible. The fibre reserved for provision of a Chorus Layer 2 service is not available for PONFAS.

Item	Considerations
New connect: Layer 2 intact	Chorus will use an unallocated unbundled fibre to stand up PONFAS where an unallocated unbundled fibre is available. Priority will be: • Use unallocated unbundled fibre; • Install additional unbundled fibre, if possible. The fibre reserved for provision of a Chorus Layer 2 service is not available for PONFAS.
New connect: premises	Unbundlers can request PONFAS for a fibre ready premises 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 PONFAS. Normal PONFAS 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 PONFAS with a working service is taken over by another provider. A key challenge with this process is how the distribution fibre is unallocated from the losing unbundler, reserved for gaining unbundler, allocated a gaining unbundler splitter port, physically disconnected from the losing unbundler splitter port, physical connected to the gaining unbundler splitter port and all records updated to reflect the new state. 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 unallocated unbundled fibres in a location. Gaining service providers are expected to use the customer transfer code prior to transferring a designated service.

Item	Considerations
Remove PONFAS distribution	The relinquishment of an individual PONFAS distribution will require the distribution fibre to be removed from the splitter and the records to be updated. This will allow the fibre to be reallocated to a subsequent unbundler.
	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.
Remove PONFAS feeder	Relinquishment of a PONFAS feeder 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.
	All PONFAS distribution services associated with the PONFAS Feeder would need to be removed prior to the PONFAS feeder removal request.
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 FFP the Customer premises (ETP or ITP) 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	PONFAS is likely to result in the presence of multiple ONTs or active devices at the end customer premises, 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 Later 1 provider. Examples could be:
	• ONTs should be clearly branded with the unbundler 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.

Item	Considerations
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, we may 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 reasonable incurred costs if their forecast capacity was not used by any unbundler within an agreed timeframe.
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 provisioning lead timed 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.
Commissioning test	Typically Customer 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.

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 customer premises 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 PONFAS Feeder in the new FFP.
	Given the potential disruption this scenario would cause, it is envisaged that Chorus would endeavour to provide reasonable notice of the change, to give unbundlers time obtain PONFAS Feeder in the new location. Alternatively the unbundler could consume a Chorus Layer 2 service.
	Note that a 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.
Service level agreements (SLA)	SLAs will need to consider: • Installing a PONFAS feeder will take longer than a PONFAS Distribution connection. Both have to be completed for the Customer to receive a working service. • Whether 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; • The number of unbundler bitstream services associated with an FFP to support unbundler coverage planning • PONFAS 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 PONFAS Feeder Fibre to a remote central office within the candidate area. ICABS will terminate between two OFDFs using LCA connectors and will be patched to the access feeder or another ICABS.
	PONFAS feeder services will also be able to connect to non-Chorus premises 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 PONFAS product prior to consumption of the service.
	It is recommended unbundlers set up a Layer 1 test facility, as described in appendix A.4, and test their ONTs and installation equipment prior to onboarding the service.
	Unbundlers should also establish an Active Network test facility and test their active network prior to onboarding the service.
	As part of this pre-onboarding 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.

Item	Considerations
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;
	• The FFPs are designed to support unbundler's splitter(s) in a separate tray (Closures) or OCM module (Cabinets) within each FFP.
	• 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 in the colocation space for combining multiple technologies, such as 10GPON and GPON, on the same feeder fibre. These devices will also affect optical budget.
	• An unbundler can request multiple PONFAS Feeders to be connected to an FFP, but splitter ports on subsequent PONFAS feeders will only be allocated once previous PONFAS feeders are fully occupied.
Broadband comparison	Chorus's Layer 2 services have contractual requirements 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.
FFP build	Unbundlers will require the ability to request a PONFAS feeder to be installed as part of the build process for new FFPs, whether those are for infill or for extending the Chorus network.

4.1. Business Offer Considerations

The focus of this paper is on residential services. This section considers implications of PONFAS for business connections.

Item	Considerations
Classification	The use of PONFAS for different segments, with different fulfil and assure expectations, would require services to be classified by segment. Additional classifications may be required in the future, such as priority medical connections. • PONFAS Distributions would be classified as either business or residential. • PONFAS Feeder could be shared, but may 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 Customer terms and/or project coordination. There may be specific access and security considerations that need to be managed.
Business Assure requirements	As PONFAS-delivered services are likely to be mission critical, businesses have very different SLA requirements, e.g.: • 8 hours restore in urban; • Critical response (assure technician on premises within two hours) There may be access and security considerations that need to be managed. Base SLAs will assume adequate optical information is provided for assure incidents, and that access is provided to Chorus assure technicians.
Chorus demarcation point in business MDUs	Businesses 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 premises 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 experience changes, different ONT models or even provide the ability for Unbundlers to insert their own work instructions per service request.
Temporary connections	A temporary connection is one where the premises 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 will be provided 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.

4.2.   Customer Experience

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

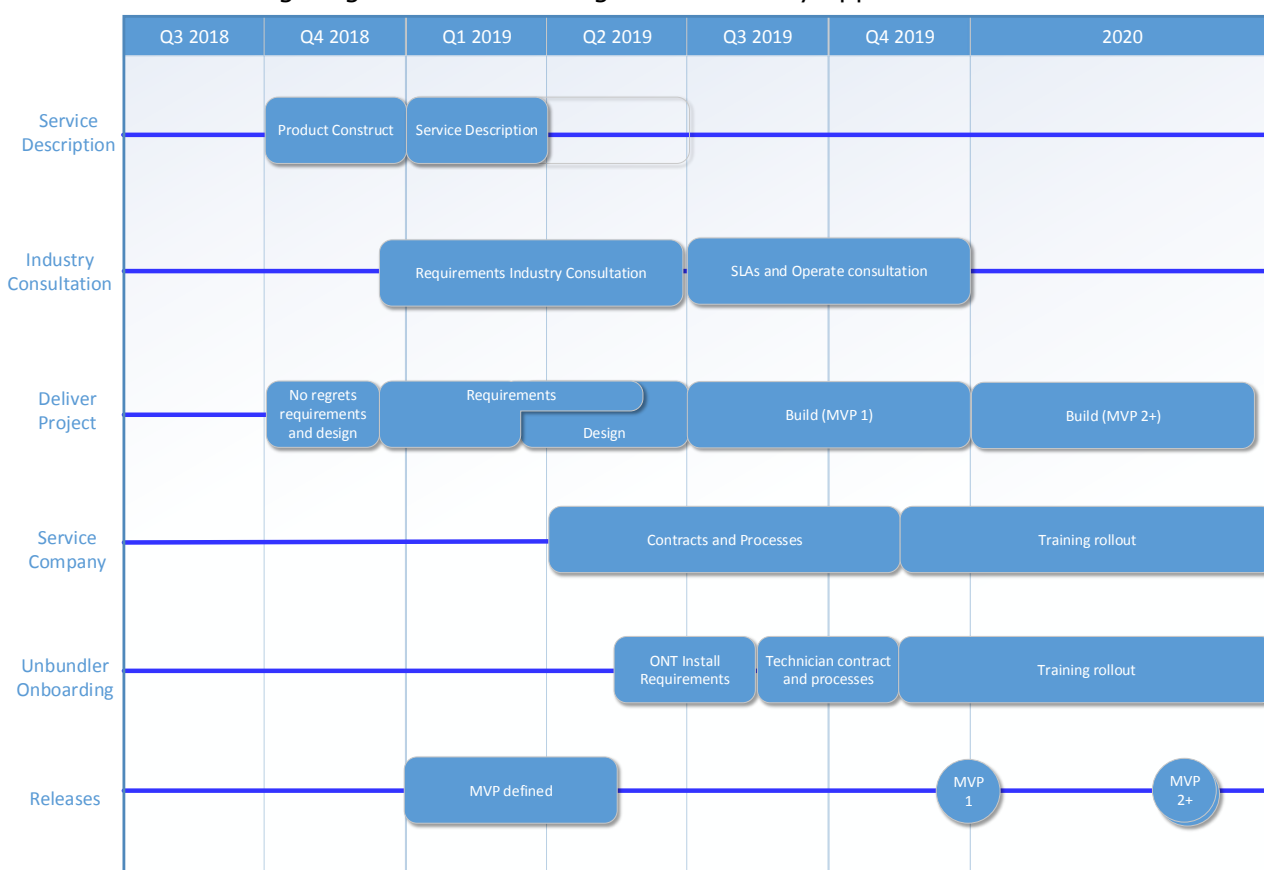| Area	Considerations
Coordination of activity	As a general rule, to achieve the optimal experience, activity should be done in the following sequence: • Unbundler OLT commissioned in central office; • Tie cabling installed between the OLT and the Central Office OFDF; • OLT port allocated; • Feeder fibre allocated (and ICABS extension if applicable); • Splitter installed in FFP; • Splitter connection to feeder; • Feeder connection to the OFDF and jumpered to the tie cable associated to the allocated 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 PONFAS and unbundler's active network equipment	The install and commissioning of the OLT and the subsequent allocation of PON port needs to be undertaken by the unbundler. The connection of the OLT to the central office OFDF needs to be done by a Chorus technician. The connection of the OLT port (at the OFDF) to the feeder fibre, also needs to be done by a Chorus technician. Any lead time for doing this activity needs to be included in setting customer expectations

Area	Considerations
PONFAS feeder	This is considered an infrastructure build activity and is likely to have a longer lead time than a PONFAS 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.
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-premises premises wiring and unbundler's ONT installation activity. Note that installing the unbundler's ONT in a different location from an existing ITP would require additional premises wiring from the ITP to the new location. Moving the ITP, or installing a new 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.

Appendix A

A.1   Delivery Approach

Timelines for the overall consultation can be found here

The following diagram shows our high level delivery approach:

Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q3 2019	Q4 2019	2020

Service Description: Product Construct (Q4 2018); Service Description (Q1 2019)

Industry Consultation: Requirements Industry Consultation (Q1–Q2 2019); SLAs and Operate consultation (Q3–Q4 2019)

Deliver Project: No regrets requirements and design (Q4 2018); Requirements / Design (Q1–Q2 2019); Build (MVP 1) (Q3–Q4 2019); Build (MVP 2+) (2020)

Service Company: Contracts and Processes (Q2–Q3 2019); Training rollout (Q4 2019–2020)

Unbundler Onboarding: ONT Install Requirements (Q2 2019); Technician contract and processes (Q3 2019); Training rollout (Q4 2019–2020)

Releases: MVP defined (Q4 2018); MVP 1 (Q4 2019); MVP 2+ (2020)

Notes:

- This is high level intended to show the overall approach and should not be used to identify specific milestones, which will come through consultations. Dates are indicative and could change as the project progresses
- This high-level timeline is for the delivery project only. It excludes consultation and milestones for both pricing and commercial agreements.
- The service description is likely to be reviewed and updated 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 onboarding will depend on whether Chorus technicians are used to install the unbundler 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 PONFAS feeder and PONFAS distribution services. Subsequent drops may increase levels of automation.

A.2   Questions Raised During Consultation (Detail)

This appendix provides more detailed responses to the questions raised during consultation, and summarised in section 2.3.

Note that, due to the nature of consultation, some questions may cover similar issues and answers.

Consultation Question	Answer	Document Reference
Unbundlers would like to unbundle the "blue" intact fibre to avoid truck rolls and customer experience issues when moving from Layer 2 to PONFAS	Only the "orange" fibre is available for PONFAS Using the "blue" fibre for unbundling would substantially change the model agreed in 2010-11 and effectively strand a significant portion of Chorus's access investment (Orange fibres) Furthermore, Chorus does not believe the stated business objective would be achieved as a Chorus truck roll would still be required to install the unbundler ONT.	
Unbundlers would like to rent or buy Chorus ONTs to avoid truck rolls and customer experience issues when moving from Layer 2 to PONFAS	ONTs are part of our Layer 2 service and will not be available for PONFAS. We do not believe this would benefit Chorus, the customer or the unbundler. At best it simplifies transition, at the expense of significant technical, operational and commercial complexity, considerable ongoing customer experience risk and significantly constrains the ability for the unbundler to differentiate an unbundled service from a bitstream services. Note that unbundlers could choose to allow other unbundlers to use the same unbundler ONT to simplify transitions between them.	
Unbundlers would like to purchase sub-components of PONFAS so they can use their own distribution or feeder fibre and connect it to a splitter	PONFAS is between ITP and central office and unbundlers cannot consume individual sub-components of point to multipoint fibre. All elements between the ITP and the first Central Office are included in the Layer 1 PON unbundled fibre service provided by Chorus. Unbundlers may extend the feeder fibre beyond this first Central Office using non-Chorus fibre solutions but we are not offering the ability to access the distribution fibres at the FFP as part of the unbundled service. The PONFAS product construct is based on the 2010-11 and subsequent discussions with the government and the industry and meets our contractual obligations. Decomposing PONFAS into sub-components would be a substantial change to the agreed product construct and require significant and complex changes to our network architecture, support systems, inventory, processes and business rules.	

Consultation Question	Answer	Document Reference
Unbundlers are concerned that transfers will be significantly more complex operationally	We agree the complexity of transfers will significantly increase and would like to work with the industry to minimise this, and maximise customer experience. However an increase in complexity is unfortunately inevitable given the significant increase in potential use cases.	
Unbundlers would like to directly engage Chorus service companies for their customer experience and operational needs	We conceptually support unbundlers engaging service companies directly to create differentiated customer experience for any activities outside the Chorus network, provided such engagement does not affect Chorus commercial relationship with the service companies, or our ability to maintain operational, commercial and regulatory integrity and ownership of all activity within the Chorus network. We propose discussing each differentiation opportunity on a case by case basis. Note that we do not see this as limited to PONFAS services.	
Can PONFAS be delivered to other types of locations apart from residential or business premises?	We are currently working through where PONFAS can be consumed.	

Consultation Question	Answer	Document Reference
Unbundlers are concerned about the level of complexity of the product and how difficult that makes it for them to consume PONFAS	Chorus understands that consuming point to multipoint fibre services is fundamentally complex. We have, and are continuing to, invest considerable funds and resources in our Layer 2 systems and processes that consume point to multipoint fibre to provide the best experience possible. We will work with the industry to minimise this complexity as much as possible, but it should be noted that many of these systems and processes are, by definition, tightly integrated with our Layer 2 services and unbundlers have explicitly noted that they want to manage this experience themselves. Consuming a Layer 1 product is inherently complex. Hiding the complexity is not practical because: • The complexity is still there and thus would still affect the customer experience; • It would drive cost and complexity into the Chorus solution and affect our ability to meet timelines; • The solution would constrain the ability for unbundlers to innovate and differentiate in the customer experience space; and • It would not be EOI compliant and would risk the operational integrity of the Chorus network.	

Consultation Question	Answer	Document Reference
Unbundlers would like a simple approach for unbundling that focuses on the best customer experience	We support providing a great customer experience, but this has to be within our regulatory, commercial and technical constraints. The PONFAS solution has to balance: • The customer experience associated with connecting a PONFAS connection; • Chorus network integrity and consequential commercial and customer experience impact on all associated bitstream and PONFAS connections; • The cost and complexity of developing a Fulfil, Assure and billing system, and the need to deliver a working solution by 1 January 2020; • The integration of the Fulfil, Assure and billing systems with Chorus' existing physical and logical network inventory platforms. • The operational cost of delivering a solution to both Chorus and the unbundler. Chorus has adopted a solution that reflects our bitstream Fulfil, Assure and billing systems as close as possible. This ensures: • The solution can be delivered on time; • The experience is as close as possible to a bitstream install, except where physical differences between the services require changes; • It reuses the same processes and systems, which not only achieves equivalence but ensures operational integrity of the Chorus network is maintained.	
Are there any changes to colocation agreements and costs?	There are no planned changes to colocation agreements or costs to support PONFAS. However, Chorus is continuing to look at ways to improve and simplify our colocation product suite as part of colocation's existing roadmap.	
Having both Chorus and unbundler technicians required for an install could drive costs and poor experience. How can this be optimised?	Chorus believes this issue is best addressed through joint Chorus and industry customer experience workshops that will look at solutions for multiple scenarios, including: • Large migrations, such as migrating multiple customers within an FFP; • Migrating a single customer; • PONFAS with new fibre installations. These workshops need to balance customer experience, operational integrity, system complexity and cost to both chorus and the unbundler.	

Consultation Question	Answer	Document Reference
How many FFPs are deployed in Chorus network?	There are currently 22,057 FFPs deployed in the Chorus network. This will increase over time as a part of access growth. A list of FFPs is available on request. We will be developing a mechanism to show geographic coverage and customer mapping to FPPs as part of the delivery project.	
Can unbundlers submit a single service request per customer that delivers service from central office to ITP	No, PONFAS uses two service requests (build + connect), which reflects how bitstream services consume point to multipoint fibre: • The unbundler submits a PONFAS feeder service request for the common infrastructure (feeder + splitter), which provides them with access to all customers within an FFP coverage area; • The Unbundler then submits a PONFAS distribution service request for each customer to be connected. A single service request process was investigated, but rejected for the following reasons: • The first service request into an ffp would still have to physically build the feeder and splitter and thus would deliver a very different customer experience and business outcome to the second service request; • The SLA for this first service request in an FFP would need to be different from a subsequent service request to reflect the different work required. This would make it impossible to schedule the customer premises work for the first service request up front, creating a very different customer experience between service requests; • It is significantly different from how bitstream is deployed today, requiring new and complex system development that could not be delivered by 1 January 2020. Note that we would expect that the build PONFAS feeder service request is done as part of a coverage area planning exercise, i.e. before selling an individual unbundled service. Each customer connection will subsequently only require a single PONFAS Distribution service request.	
How does infrastructure capacity management impact unbundler service requests?	Chorus will augment Layer 1 PON capacity as required to meet demand, subject to our standard capital investment business rules. Unbundlers will not be required to request capacity is added, although it is recommended that demand is forecast to minimise any delay while capacity is added.	

Consultation Question	Answer	Document Reference
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. This is to maintain the integrity of the Chorus network and is consistent with international best practice for both copper and fibre unbundling. It should also be noted that Chorus has a number of regulatory KPIs, Resource Management Act and health and safety obligations with respect to the network. Allowing third party access to our network could compromise our ability to meet them.	
What are the boundaries between Layer 1 and 2 services?	The demarcation points of PONFAS are the ITP at the customer premises and the OFDF at the central office. The unbundler 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 the unbundler network components may operate at higher layers than Layer 2.	
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 amended 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 PONFAS Feeder to the new FFP to continue service. Chorus will publish a capacity management plan, related SLAs and any associated reporting regime.	

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 PONFAS; • All fibre active or intact premises will have two fibres installed, with the second available for PONFAS; • 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.	
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.	
Will unbundlers be able to remove the Chorus ONT?	Unbundlers cannot remove the bitstream ONT. The Chorus ONT supports multiple bitstream services and Chorus reserves the right to continue to provide other services on the ONT. If end customers require an ONT to be removed then Chorus will provide a mechanism for them to request this.	
Does Chorus have facilities for unbundlers to test their OLTS and other active network equipment	Chorus can host unbundler equipment to be tested using co-location services if requested. We would not recommend this approach. Our experience is that testing requires flexible physical access to equipment at a higher level than is possible at a colocation environment. We would recommend unbundlers use an internal integrated test environment for flexibility and efficiency. The Chorus Innovation Lab (99 Khyber Pass) and CCIL environments are not suitable and are not available for this purpose.	

A.3   Determining The Product Construct

This appendix provides more information on the following areas raised during product consultation:

- Why we chose this product construct;
- How does the proposed business rules relate to other Chorus products;
- What will be experienced when moving between service providers in a combined bitstream and PONFAS world.

Defining the product construct

The PONFAS product structure balances:

- Compatibility with the solution agreed with the government and the industry in 2011, including:
  - The network architecture and associated records to support both open Layer 2 access, using the "blue" fibre, from 2011, and PONFAS using the second 'orange' fibre, from 1 January 2020;
  - The associated support systems and PSR models designed to manage the Layer 2 bitstream and PONFAS services delivered via this network architecture;
  - The associated build, fulfil and assure operational processes that deliver and support this network architecture.
- Meeting Chorus EOI obligations;
- Keeping the PONFAS product construct as simple as possible by aligning directly with how the Chorus network is built;
- Optimising the customer experience, for both the customer being unbundled, and those who are not;
- Solution development complexity, i.e. delivering a solution that can be ordered on 1 January 2020 and which is delivered by way of the same point to multipoint Layer 1 PON systems and processes as the inputs to Chorus' Layer 2 bitstream services; and
- Maintaining Chorus' network and records integrity.

Comparison with other Chorus wholesale products

Area	Considerations
Multiple services	The purpose of the second fibre is not customer experience. One of the key drivers of the original UFB ITP was to use fibre to create a competitive environment within a premises.
	It achieved this by ensuring that the LFC Layer 2 services were competitive, and that at least two fibres were installed in customer premises.
	This is very different from the copper world, where generally there is only one copper connection in use in a premises and therefore the UCLL service provider is sole provider of services to that end customer.

Area	Considerations
UCLL vs fibre touch points - Central Office to the ITP	As UCLL is only able to take over existing copper connections, the connectivity between central office (or cabinet) and ETP is pre-established, and the only touch point needed is at the central office.
	For fibre we need to connect the Feeder fibre to the unbundler OLT, the splitter to the Feeder Fibre, the distribution fibre to the splitter, and ensure this distribution fibre is delivered to the ITP.
	The original decision to use a second fibre for PONFAS means that the distribution fibre itself has been installed on bitstream connections. However, this fibre has not always been 'pre-connected' to the ITP as this would have been inefficient. We would also have needed to record this pre-connect against a (non-existent) product instance.
	As there was no service provider associated with the second fibre, there was no splitter to pre-connect it to at the FFP.
Service provider technicians accessing Chorus network – UCLL vs Fibre	Chorus is accountable for fulfil and assure of all services using the common infrastructure. We therefore need to ensure all work that is undertaken within our domain is done to our standards and all records are updated correctly.
	UCLL and PONFAS are consistent in only allowing Chorus managed technicians to provision within the Chorus domain, i.e. ITP (fibre)/ETP (copper) to Central Office and connectivity to the Service Provider network/equipment.
	This is consistent with International best practice for unbundling.
	Service provider and Unbundler technicians can continue to access their exchange building footprints and equipment, as they do today.
Two service requests for fibre vs one for bitstream	This follows the same NGA bitstream process that Chorus uses. NGA bitstream is designed around a build + connect model today.
	The build activity is done prior to someone being able to request a bitstream service, so is transparent to the Service Provider requesting bitstream.
	Capacity management rules are applied so that when capacity is predicted to run out, Chorus will install a new NGA splitter and feeder in the FFP.
	Note that at least one NGA splitter is installed in every FFP during the initial build of the FFP.
	Unbundlers will need to use a similar process for their services, i.e. request a PONFAS Feeder to an FFP before requesting a PONFAS Distribution to a customer premises.
	Unbundlers will need to manage the capacity of that splitter and request an additional PONFAS Feeder to be installed prior to the current splitter being fully occupied.

PONFAS and Layer 2 transfer scenarios

The number and type of Service Provider to Service Provider transfer scenarios significantly increases in both numbers and complexity, as listed in the table below.

These are high level use cases only, which will be updated and refined during the PONFAS delivery initiative.

One point to note with PONFAS is that, unlike copper unbundling, some physical activity will always be required in the middle of the Chorus network to commission the PONFAS Distribution service. This cannot be avoided.

These scenarios assume that the PONFAS Feeder has been fully commissioned and is available.

Scenario	Actions
Bitstream to bitstream	Either: • New CPE is sent to customer premises; • New service is stood up on spare ONT port and service is commissioned; • Old service is relinquished; Or • New CPE is sent to customer premises; • Old service is relinquished (service outage) • New service is stood up on same ONT port and service is commissioned;
Bitstream to PONFAS (unbundled fibre available) (first unbundled service)	This is expected to be the most common scenario for migration initially • New CPE is sent to the premises; • A Chorus technician will connect the distribution fibre to the designated splitter at the FFP; • A Chorus technician will connect second fibre in the ETP and ITP and present it as a connectorised fibre on the ITP. • An unbundler technician will connect the unbundler ONT to the ITP and commission the service. This task can also be undertaken by the Chorus technician, if requested. • The Unbundler can then relinquish their bitstream service, which will then be removed from the Chorus ONT. Note that any other bitstream services on the Chorus ONT will be unaffected and will continue to operate.

Scenario	Actions
Bitstream to PONFAS (unbundled fibre available) (subsequent unbundled service)	This scenario will become more common after time. The unbundled 'orange' fibre will be connected through the ETP and presented at the ITP as a connectorised fibre. • New CPE/unbundler ONT is sent to the premises; • A Chorus technician will connect the distribution fibre to the designated splitter at the FFP; • An unbundler technician will connect the unbundler ONT to the ITP and commission the service. This task can also be undertaken by the Chorus technician, if requested. • The unbundler can then relinquish their bitstream service, which will then be removed from the Chorus ONT. Note that any other bitstream services on the Chorus ONT will be unaffected and will continue to operate.
Bitstream to PONFAS (unbundled fibre in use)	The request to connect a new PONFAS distribution will fail feasibility. The options will either be to: • Request a transfer on the current PONFAS Distribution; or • Request additional fibre be installed in the premises. This may or may not be possible, depending on the premises, and may result in a service outage for all services at that premises during the installation of the additional fibres.
PONFAS to PONFAS (unbundled fibre in use)	This is not expected early on, but will become more common over time. • New CPE/unbundler ONT is sent to the premises; • The losing unbundler may object as per the Customer Transfer Code. Chorus will assume that any Customer Transfer Code issues have been resolved between the gaining and losing unbundlers prior to receiving the transfer request. • A Chorus technician will disconnect the distribution fibre from the current losing unbundler splitter; • The Chorus technician will connect the distribution fibre to the gaining unbundler designated splitter at the FFP; • An unbundler technician will disconnect the losing unbundler's ONT and connect the gaining unbundler's ONT to the ITP and commission the service. This task can also be undertaken by the Chorus technician, if requested. The unbundler would need to decide what to do with their ONT.

Scenario	Actions
PONFAS to PONFAS (available additional unbundled fibre)	If multiple unbundling fibres are available in a premises then a similar process can be used as the bitstream to PONFAS scenario. • New CPE/unbundler ONT is sent to the premises; • A Chorus technician will connect the allocated distribution fibre to the designated splitter at the FFP; • A Chorus technician will connect the second fibre in the ETP and ITP and present it as a connectorised fibre on a new ITP. • An unbundler technician will connect the unbundler ONT to the new ITP and commission the service. This task can also be undertaken by the Chorus technician, if requested. • A Chorus technician will disconnect the Losing unbundler distribution fibre from the losing unbundler splitter;
PONFAS to Bitstream (existing Chorus ONT)	• New CPE is sent to the premises; • The bitstream service will be activated on the current ONT; • A Chorus technician will disconnect the losing unbundler distribution fibre from the current losing unbundler splitter;
PONFAS to Bitstream (no existing Chorus ONT)	• New CPE is sent to the premises; • The Chorus technician will connect the Chorus ONT to the ITP and commission the service • A Chorus technician will disconnect the losing unbundler distribution fibre from the current losing unbundler splitter;
PONFAS wholesale to PONFAS wholesale (same unbundler)	This is transparent to Chorus as it is managed internally by the unbundler, but is included for completeness. Either: • New CPE is sent to customer premises; • New service is stood up by the unbundler on a spare ONT port and commissioned; • Old service is relinquished; Or • New CPE is sent to customer premises; • Old service is relinquished (service outage) • New service is stood up by the unbundler on the same ONT port and commissioned;

A.4   PONFAS Test Facilities

This appendix looks at Chorus test facilities and recommends options for unbundlers.

It is expected that unbundlers require the ability to test their systems, processes and network equipment prior and subsequent to PONFAS. 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.
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.
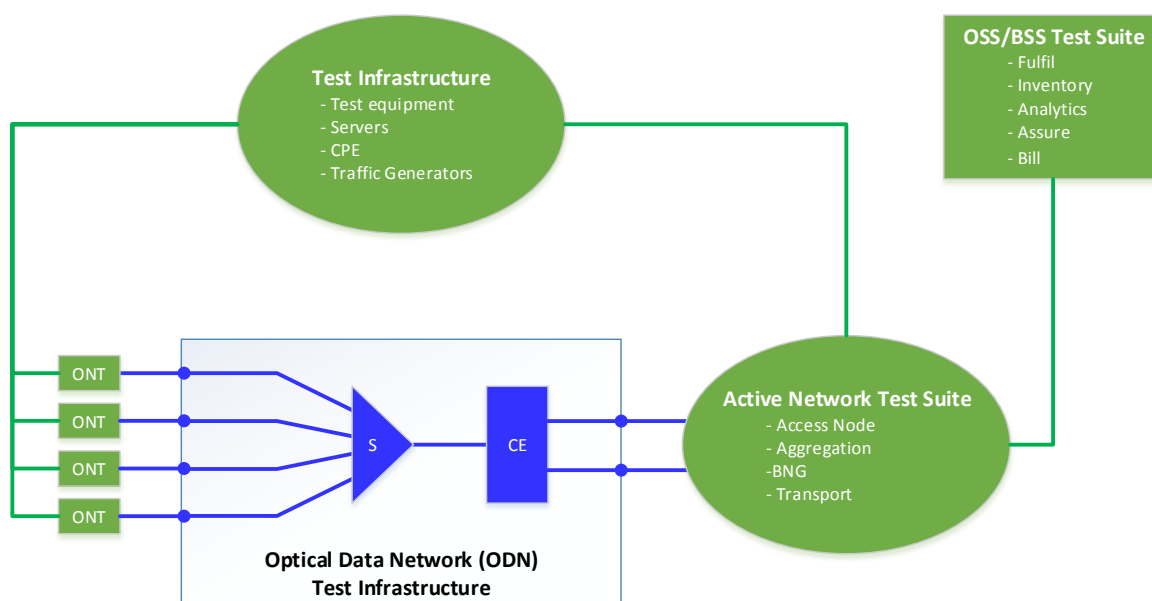
OSS test facility

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.

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 6. Recommended Unbundler 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 distribution 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;

- o 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.
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.

Layer 1 test facility

The Layer 1 test facility is required to:

- 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;
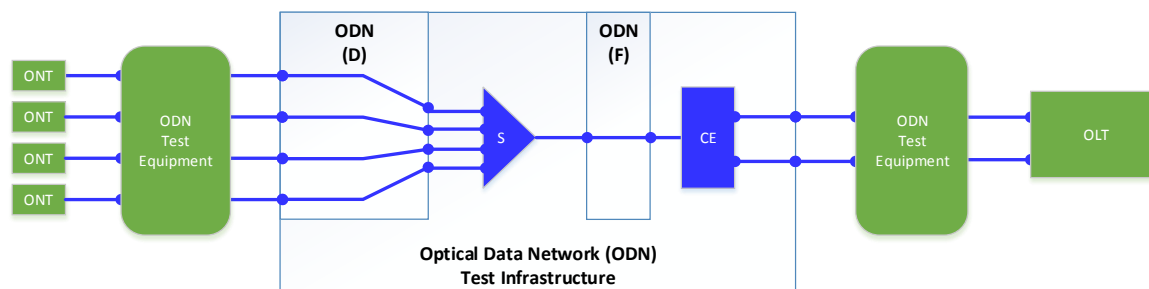
**Figure 7. Recommended Layer 1 Test Facility**

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:
  - o Exchange-based splitters, to allow an OLT port to connect to multiple feeder fibres, i.e. increase split ratios;
  - o Co-existence elements for combining multiple PON wavelengths, such as GPON and 10GPON, onto a single feeder fibre.
- Recommended test tools:
  - o Portable power meter;
  - o Fibre fusion splicer;

- o Connectorised fibre equipment;
- o Simulated installation environment to test install practices;
- o Demo board showing different devices, ITPs and connection models;
- o Intelligent optical link manager (iOLM) or similar OTDR test device;
- o Fibre inspection probe (FIP) to ensure all optical connectors and optical transceiver devices are clear and free from contamination;
- o Optical launch leads to support platform iOLM testing;
- o Examples of different LFC ITPs etc.
- Documented installation standards and training material, including:
  - o Installation of premises wiring and connection to distribution fibre at Chorus ITP;
  - o Installation of ONT and connection to premises wiring;
  - o Connection of feeder fibre at central office to OLT;
  - o Layer 1 and active network testing requirements, including a list of required and approved test equipment.

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.
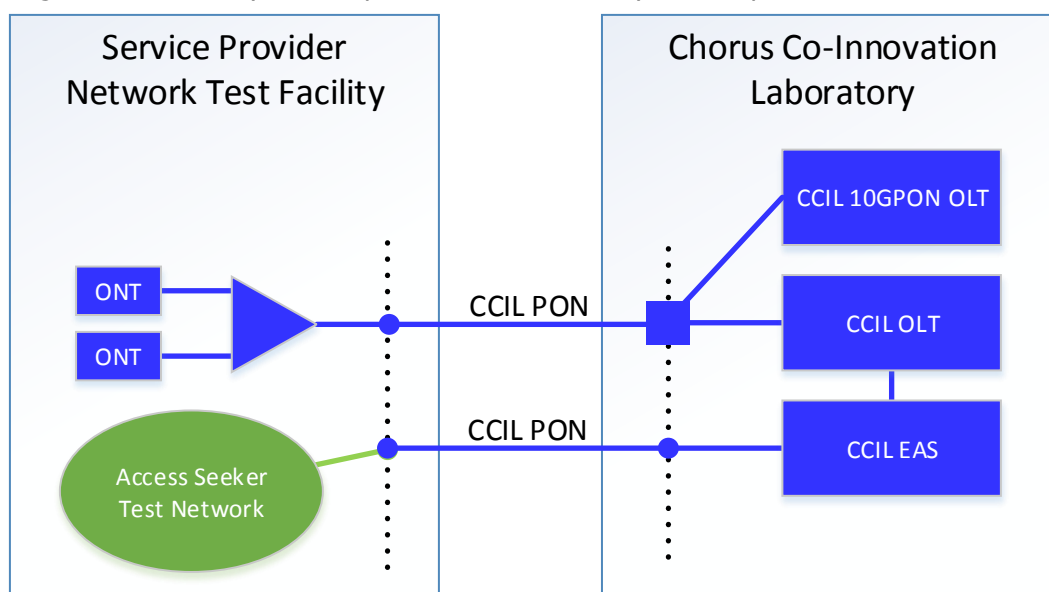
Figure 8. Chorus Co-Innovation Laboratory

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