BtB Interfaces: Meeting the needs of Next Generation Access

Final Report

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Ofcom

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Executive Summary

As the telecommunications industry begins to deploy next generation access (NGA) networks, it is expected that business-to-business (BtB) interfaces, the means by which wholesale partners can electronically submit orders and other requests, will become an increasingly important influencer of competition within the sector. This is driven by a combination of an increasing reliance on 'active' wholesale products over infrastructure-based competition, and the probable fragmentation of the access network as competing operators build-out a patchwork of next generation access infrastructure.

In addition, the development of the BtB interface is likely to be a major cost item for Communication Providers (CPs) and Infrastructure Providers (IPs) alike, thus raising the possibility that the BtB interface could in future represent a significant competitive bottleneck.

Recognising this, Ofcom is keen to support industry in moving towards a fit-for-purpose BtB interface implementation that will meet broad industry needs. This report represents the first step in this process. It is based on interviews with industry stakeholders and three phases of work: a review of Openreach's existing interface, characterisation of the ideal BtB interface, and an analysis of migrating to a new BtB interface. The purpose of the report is to stimulate and contribute to an industry debate on the design and implementation of a new BtB interface.

Today, the most significant BtB interface in the UK telecoms sector is the Equivalence Management Platform (EMP), operated by Openreach. Through EMP, CPs order and manage services from Openreach. Going forwards, Openreach intends to develop EMP further to support a wider range of services including its next-generation broadband access service. The purpose of reviewing EMP in this report is to draw out lessons learned from its implementation and use. The report is not intended to be an assessment of EMP's performance.

EMP has experienced a number of operational and design issues since its launch in 2006. Openreach has taken steps to improve the platform, with noticeable positive results, but substantial issues remain. Although EMP already compares favourably with BT's other BtB interfaces, and stakeholders have generally positive expectations of its future, it will require a considerable amount of further work before it fully satisfies the requirements of an ideal BtB interface. Openreach is working actively with its customers, through a number of industry forums and bodies, to progress EMP along this path.

Stakeholder interviews, undertaken during the study, were used to identify characteristics of an ideal BtB interface. Findings from these interviews were then synthesised into five key characteristics. These key characteristics describe a BtB interface that meets industry's requirements for next generation access and supports Ofcom's objectives in competition, consumer experience, innovation and efficient investment. An underlying assumption behind the set of ideal characteristics is that they will be implemented in a manner that preserves the Equivalence of Inputs principle, embodied in EMP.

The five characteristics are:

1. ***'Multi-provider support'***. The interface should allow IPs and CPs to connect cost-effectively to multiple partners through common interface processes, and permit industry to delivery a quality customer experience during end user migrations.
2. ***'Permits full access to service features'***. The interface should support all business-to-business transactional needs, promote competition by permitting deep network access and ensure transparency in the case of a vertically integrated IP.
3. ***'Cost-effective consumption model'*** addresses the management of the interface's upgrade cycle. It ensures interface functionality can be added or changed without placing unnecessary burdens on interface users, and allows interface functionality to be added or changed without placing unnecessary burdens on interface users.
4. ***'Implements IT best practice'*** minimises the potential for implementation and in-life service problems by requiring a suitable test environment, adequate documentation, reliable message handling, data validation and good quality coding and schema design. It also ensures smaller IPs and CPs can access the interface cost-effectively by not requiring use of specific proprietary software.
5. ***'SLA-backed performance'*** guarantees that the interface allows CPs to deliver service to end users in a timely, cost-effective and secure manner.

Aside from the characteristics of an NGA BtB interface itself, there are issues around its implementation and governance. Today's CPs need only connect to Openreach's EMP interface to achieve near-national coverage. However, the future NGA market is expected to comprise fragmented access network of multiple smaller IPs. This, combined with the introduction of next-generation 'active' wholesale products, will cause the network of relationships between infrastructure players and CPs to become significantly more complex.

Under this scenario, CPs wishing to provide a national service would need to develop interfaces with a number of smaller IPs in addition to Openreach. This is unlikely to be practical for many businesses, as the investment required to develop and manage an interface with a new partner will need to be justified by sufficient revenue upside in a business case decision. This could lead to a market failure, where consumers in some parts of the country may be unable to receive a competitive NGA service. Therefore, an implementation model will be required that addresses these issues.

Four potential industry structures can be envisaged, characterised by differences in the degree of centralisation and route to standardisation. These four structures are outlined below:

- ***'Heterogeneous'*** is characterised by little or no centralisation or regulation. In this situation, any CP wishing to take wholesale products from multiple IPs would need to implement an interface with each IP, with little or no standardisation between interfaces. This model fails to meet industry and

Ofcom needs, leaving barriers to entry for both CPs and IPs unacceptably high.

- ***'Mandated Standardisation'*** imposes an industry standard BtB interface on IPs, resulting in each IP still interfacing directly with CPs, but using an industry standard definition that allows CPs to connect cost-effectively to all IPs. This offers a feasible solution, supporting strong IP service differentiation and in-life responsiveness. However, it does not address the cost of supporting multiple commercial relationships between CPs and IPs, and could add cost and delays to implementation.
- ***'Clearing House'*** describes a regulated centralised industry body that owns and operates the interface. The Clearing House would interconnect with any CP or IP, and manage transactions between parties. While this model does satisfy criteria for service differentiation and low barriers between CPs and IPs, it would suffer from high development cost and complexity, likely leading to a prolonged implementation period and unwieldy end solution.
- ***'Competitive Integrators'*** is a potential market-led solution, where multiple competitive TPIs (Third Party Integrators) act as intermediaries. A CP would typically partner with a single TPI, which then manages interfaces to any IPs the CP decides to take services from. CPs and IPs are still free to interface directly, as would likely be the case between Openreach and large CPs. This model also appears a feasible solution, addressing the criteria for IP differentiation, barriers to entry, development cost, implementation speed and in-life responsiveness, but does carry some risk of leaving smaller IPs out of the wholesale value chain.

Based on the analysis in this report, an approach which begins with the 'Competitive Integrators' model, and moves towards 'Mandated Standardisation' if necessary, appears to present a feasible and adequate solution to the issues expected in the future NGA market.

Should an industry standard be required, EMP would clearly be a contender for the basis of the standard given its current position and level of adoption. While there are substantial gaps between EMP's current implementation and an ideal interface, our analysis suggests that the interface definition used by EMP could be adapted to form the basis for an ideal NGA interface.

Stakeholder opinion is divided on whether the benefits of leveraging EMP outweigh the disadvantages of imposing upon industry what is essentially a BT-designed interface standard. The upcoming transition to NGA is a discontinuity that potentially warrants a move to a new industry-agreed interface based on a widely used standard such as Web Services and a re-engineered consumption model.

Following on from this study, these are the recommended next steps for industry:

1. Collaborate via industry forums (e.g. BSG COTS) to build consensus on the five key characteristics as the basis for NGA interface solutions.
2. Promote industry interface standardisation, specifying and adopting a required set of interface elements and parameters.

3. Establish consensus on the short term benefits of evolving EMP for use in an industry standard versus the long term benefits of disruptive change, in particular with regard to technology choice and consumption model.
4. Facilitate the emergence of the 'Competitive Integrators' model by bringing TPIs into interface and general NGA discussions, and working with them to develop satisfactory business models.
5. For TPIs and industry suppliers, explore NGA interfaces as a future business opportunity and begin research into customer needs and potential solutions.
6. Collaborate with relevant international bodies to share knowledge and standards, as appropriate.

Relevance to Industry

The evolution of BtB interfaces, and hence the contents of this report, has the potential to affect players throughout the telecoms value chain.

For Communications Providers, the evolution of BtB interfaces will have a critical impact on the provision of superfast broadband services. This report will help CPs to understand the issues raised by the transition to multi-provider NGA networks and potential future interface developments required to address these.

Infrastructure Providers with NGA networks may face challenges in finding sufficient retail channels for their wholesale products. Understanding industry and regulatory requirements for future BtB interfaces, possible interface implementation options, and pitfalls already found in existing BtB interfaces, will help IPs meet these challenges.

Third Party Integrators will find in this report analysis of a number of issues likely to be faced by clients and partners. This includes both current matters regarding Openreach's EMP, and future topics around the development and implementation of BtB interfaces.

Suppliers to the telecoms industry, looking to gain an understanding of the needs of businesses during the move to next generation access, will find an analysis of these needs in terms of interface technology, software and integration requirements.

The complex interface and business process requirements of the developing NGA market and associated systems and process developments represent a substantial business opportunity for integrators and suppliers. With sufficient up front investment and the right solution, third parties could potentially save CPs and IPs millions of pounds in interface development and operational costs.

Finally, other countries facing similar issues of access network fragmentation and increasing reliance on 'active' wholesale products may find the report relevant to their local issues.

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1 BACKGROUND

1.1 Context

The opening of the telecommunications sector to competition has led to an increasing need for wholesale services. Unlike the vertically integrated state monopolies of the past, modern communication providers often build retail services using wholesale inputs from infrastructure owners sitting upstream in the value chain.

The competitive communications marketplace has created an increasing demand for wholesale inputs and a corresponding rise in the number of transactions associated with their ordering, assurance and billing. To manage this volume of transactions efficiently, Infrastructure Providers (IPs) have embraced automation and have developed business-to-business (BtB) interfaces through which communication partners can electronically submit orders and other requests.

In the UK, the most significant BtB interface in the telecoms sector is that of the Equivalence Management Platform (EMP), operated by Openreach. Through EMP, UK Communications Providers (CPs) order and manage services from Openreach including Local Loop Unbundling (LLU) and Wholesale Line Rental (WLR). Openreach intends to develop EMP further to support a wider range of services including its next-generation broadband access service, Generic Ethernet Access (GEA).

In the future, it is likely that BtB interfaces such as EMP will become an increasingly important component of competition within the sector. The economics of next-generation access (NGA) are expected to result in less infrastructure-based competition than today. CPs will therefore be more reliant on active inputs from infrastructure owners. As active inputs are typically more configurable and customizable, the BtB interface definition will be critical in shaping the ability of CPs to differentiate and compete in an NGA world.

A further issue posed by NGA is the probable fragmentation of the access network as competing operators build-out a patchwork of NGA infrastructure. There are already several regional infrastructure businesses rolling out fibre access networks. In the future, communication providers will probably need to source access products from several different infrastructure owners to provide broad coverage, each one with its own BtB interface. In the absence of a common interface definition, CPs will need to develop separate systems and processes to consume services from each of the NGA operators, increasing both cost and complexity in service provision.

Recognising the importance that BtB interfaces are likely to play in next-generation networks, Ofcom is keen to support industry in moving towards a fit-for-purpose implementation that will meet broad industry needs. This report represents the first step in this process.

1.2 Project Scope

The scope of the study consisted of three phases of work: a review of the existing Openreach EMP interface, characterisation of the ideal BtB interface, and an analysis of migrating to a new BtB interface.

When discussing NGA infrastructures, the most obvious examples are fibre-based access technologies such as fibre to the cabinet (FTTC) and fibre to the premises (FTTP). The emphasis of the report is on active access products, as these are expected to be more widely adopted than passive products. However, the work attempts to be technology neutral and maintain relevancy to any next generation broadband access technology.

1.3 Project Approach

The project took a primarily interview-based approach, gaining input from a representative base across industry. Stakeholders interviewed included CP customers of Openreach, competitive IPs and other industry stakeholders. A list of contributing parties is shown in Appendix A.

Secondary research was also conducted to support a high-level analysis of EMP.

The project was undertaken over a ten-week period ending in September 2009.

2 INTRODUCTION

2.1 Market Structure

Historically, most telecommunications services were supplied by vertically integrated providers. This same business was responsible for the entire end-to-end solution, from owning the transport medium to managing end user relationships.

Today, the structure of the telecoms market involves multiple types of infrastructure provider, wholesale provider and retail end user-facing business. A typical broadband service might use the incumbent's copper last mile, an LLU operator's exchange equipment, backhaul from a national fibre network owner, and customer relationship management from a retail CP.

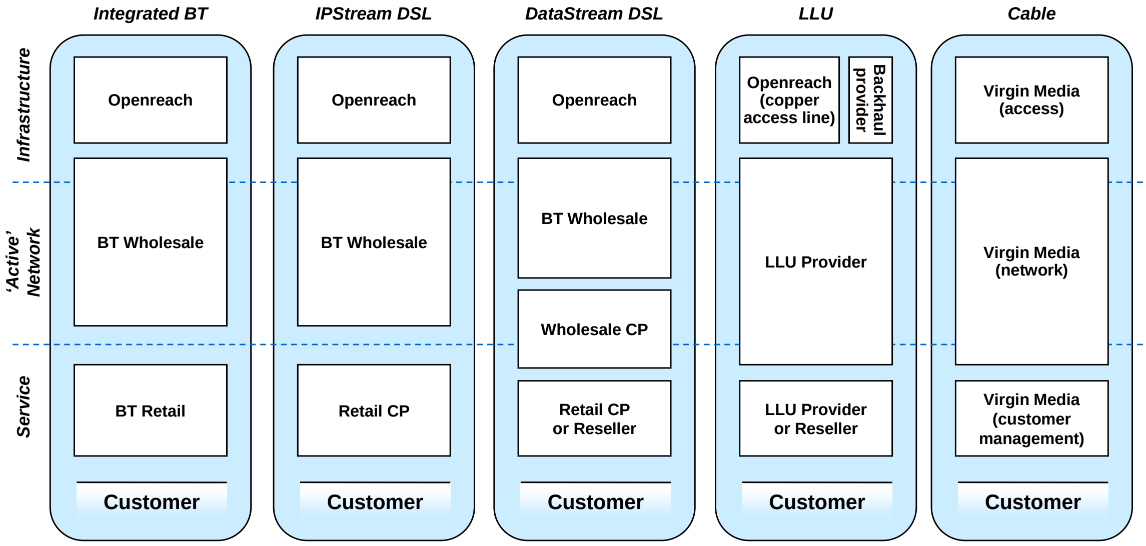


Figure 1: Example Telecoms Wholesale Relationships

Regulation allowing LLU providers to gain 'passive' access to Openreach's copper network, and use their own network equipment for the remainder of the service provision, has opened up infrastructure-based competition in the broadband market. This has resulted in greater choice and improved pricing for end user consumers and businesses.

However, in the future, given the challenging economics of deploying fibre-based access infrastructure, the opportunity for competition in 'passive' access such as Sub-Loop Unbundling (SLU) is likely to be much reduced. For this reason, the dominant form of access to NGA infrastructure is expected to be based on 'active' access products, which remove the need for network equipment to be installed locally by multiple providers.

Additionally, rather than a single nationwide incumbent, fibre access networks are also expected to be built by a number of smaller regional players. This will create a patchwork of access networks, each with their own product definitions and wholesale offers. There is also likely to be some overlap between networks, further complicating industry relationships. While some consolidation may occur between these networks, it seems unlikely that there would be a comprehensive buyout by a single large player, at least in the short to medium term.

2.2 Purpose of BtB Interfaces

Given the high volume of wholesale partnerships involved in delivering a telecoms service, inter-provider operational interfaces have been developed to facilitate transactions between partners.

These BtB interfaces typically automate the processes of placing customer orders, provisioning a new service and handling faults. In principle, they can also be involved with billing, but this is often excluded from the primary interface.

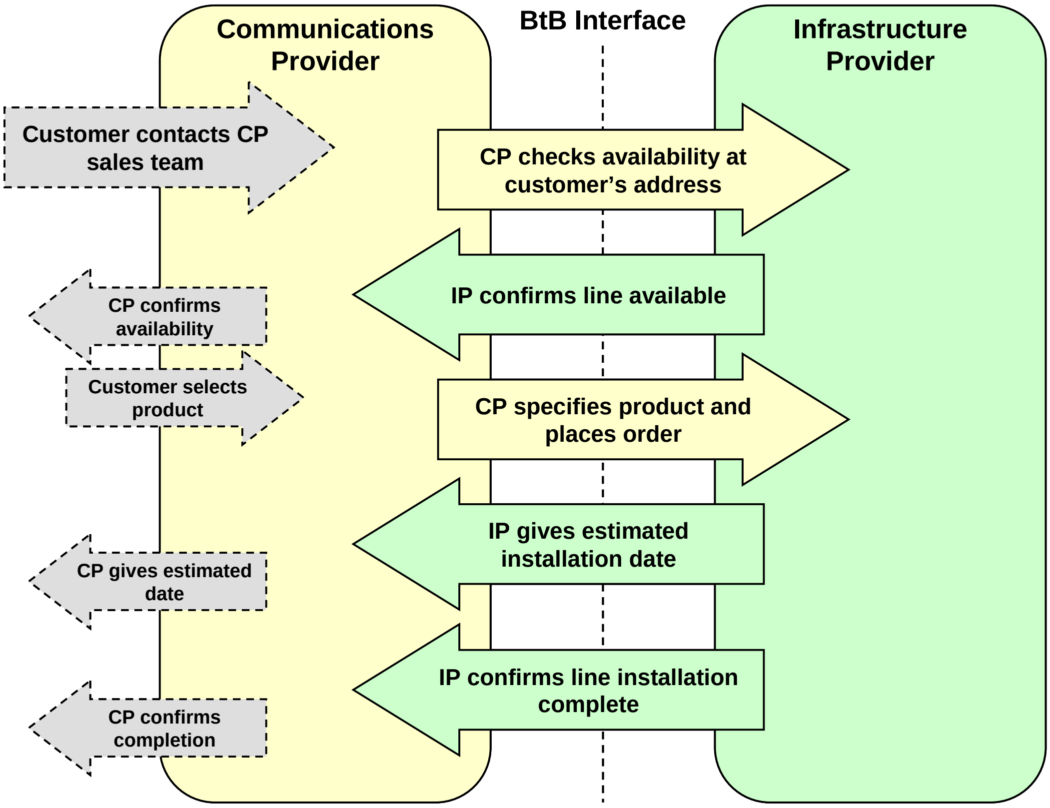


Figure 2: Illustrative BtB Interface Order Process

The primary BtB interface for current generation access products is Openreach's Equivalence Management Platform. This was introduced as part of BT's Undertakings (arising from Ofcom's strategic review of the telecoms sector) as the main vehicle by which the principle of Equivalence of Inputs is delivered.

With the introduction of active access as the primary means of competition in the NGA industry, CPs' control over product configuration and service delivery will be affected to a much greater extent by the openness of the interface they have with their wholesale infrastructure partner. Therefore, BtB interfaces are expected to have a much larger impact on the speed at which services can be brought to market, how efficiently they can be used to generate revenue, and the quality of the end user experience. The development of the BtB interface is also likely to be a major cost item for CPs and IPs alike, thus raising the possibility that the BtB interface could in future represent a significant competitive bottleneck.

2.3 Interface Technology

BtB interfaces in operation today in telecoms and other markets use a variety of technologies. Smaller businesses with low volumes of transactions typically have very different requirements from larger players handling thousands of orders each day.

The simplest types of BtB interface use email, phone or fax messages to communicate data. While there is some potential for automation, these interfaces include a significant level of manual intervention. For a business requiring only a handful of daily transactions, this level of interface is often the most practical and cost-efficient solution.

More complex interfaces use web portals to manage partner transactions. These are generally highly automated on the interface owner's side, with the portal effectively providing an external front-end to the internal operational support systems (OSS). They can provide varying levels of automation, incorporating manual elements such as keying in data fields by hand, or selecting which file to upload. Web portals are typically used by medium sized businesses, or by large business for niche or low-volume services.

Interfaces that need to support the highest volumes or complexity of transactions typically use machine-to-machine (M2M) gateways. These provide a way for the two parties' IT systems to communicate directly, supporting potentially fully automated processes. This type of solution is most often used by businesses with large volumes of interface transactions.

Most wholesale providers in the telecoms market provide several types of interface, to meet the needs of a range of different customers and services.

2.4 Regulatory Relevance

Ofcom's interest in the area of BtB interfaces stems from its objectives to promote competition, consumer experience, innovation and efficient investment. In particular, there is concern that BtB interfaces to NGA infrastructure providers could potentially be a key economic bottleneck in the future telecoms market.

Ofcom Objectives

- **Promotion of:**
  - Competition
  - Consumer experience
  - Innovation
  - Efficient investment
- **Subject to feasibility:**
  - Technical
  - Economic

Figure 3: Ofcom's Objectives in Terms of BtB Interfaces

As described in the sections above, it is expected that next generation broadband access networks will be fragmented, with different geographical areas each having their own 'incumbent' infrastructure provider. Any CP wishing to provide a service with national coverage would therefore need to take wholesale products from, and implement an interface with, each of these regional IPs.

This is unlikely to be practical for many businesses, as the investment required to develop and manage an interface with a new partner will need to be justified by sufficient revenue upside in a business case decision. This leads to a potential market failure, where consumers in some parts of the country may be unable to receive a competitive NGA service. Therefore, a new model will be required that addresses these issues.

A second issue that may create a competitive bottleneck in BtB interfaces is the expected 'active' nature of NGA wholesale products. Because CPs will have less in-house control of the end user experience than with 'passive' products, the flexibility and configurability of the wholesale product will be critical for service differentiation. The functionality and performance of the IP's BtB interface will have a significant effect on this.

Therefore, Ofcom's goal is that the BtB interfaces in the NGA industry should directly support the promotion of competition and consumer experience, and indirectly support innovation and efficient investment. Ofcom recognises that any solution will be subject to both technical and economic feasibility.

A critical consideration in the development of a new BtB interface is the preservation of the principle of Equivalence of Inputs, in order to ensure that major integrated players with downstream operations are not able to distort competition at the retail level.

3 OPENREACH EMP

3.1 Overview and History

In the UK, the most significant BtB interface in the telecoms sector is that of the Equivalence Management Platform (EMP), operated by Openreach. Through EMP, UK CPs order and manage services from Openreach. Openreach intends to develop EMP further to support a wider range of services including its next-generation broadband access service.

Due to EMP's significance in the current market, an analysis of its strengths and weaknesses makes a suitable starting point from which to develop the key characteristics of an ideal interface. This analysis focuses on EMP in the context of NGA, rather than making an assessment against the function for which it was originally developed.

EMP has its origins in Ofcom's 2005 Strategic Review of Telecoms (TSR). BT's response to the TSR, the Undertakings, dictated that some products would be delivered to CPs on an Equivalence of Inputs basis by its new functionally separate business unit, Openreach. In order to ensure that these products could be managed effectively through a common interface, Openreach developed the strategic platform EMP.

EMP first went live in 2006. LLU was supported from launch, with WLR products added in the form of WLR3 soon after. Since its initial release, Openreach has continued to improve EMP's functionality, developing ten major software upgrades, with the most recent R1100 going live in July 2009.

EMP supports a comprehensive set of customer and service lifecycle transactions. Lead-to-Cash (L2C) transactions cover the fulfilment of end user services, from initial customer enquiries, through the sales process, to a completed service installation. Trouble-to-Resolve (T2R) manages the assurance of existing services, handling trouble ticketing and fault resolution. Finally, Dialogue Services provides a way for Openreach to automate communications with its CP customers, providing, for example, address lookups and service availability checks.

Dialogue Services	Fulfilment	Assurance
• Query Address	• New Service Provide	• Create Trouble Ticket
• Request Test	• Cease Service	• Amend Trouble Ticket
• Request Line Characteristics	• Modify Service	• Escalate Trouble Ticket
• Request MAC status	• Migrate Service	• Cancel Trouble Ticket
	• Amend Request	
	• Cancel Request	

Figure 4: Example EMP Transactions

All of the UK's LLU players and around 40 WLR providers take products from Openreach using EMP, serving a base of over six million end users. The platform currently handles around 50,000 LLU orders per week.

3.2 Implementation Details

3.2.1 *Interface Structure*

EMP is a set of systems owned and managed by Openreach. It provides CPs with an interface into Openreach's back office IT systems and network, and is governed by Openreach business processes. To access EMP, a CP needs to implement an interface between EMP and its own back office IT systems and network. This structure is displayed in the figure below.

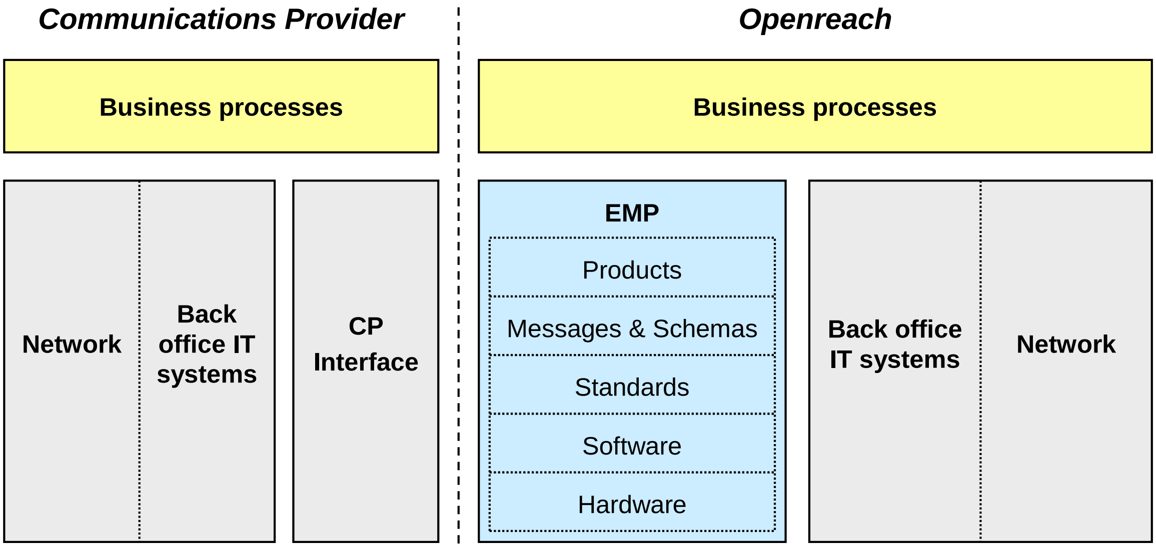


Figure 5: EMP Interface Structure and Relationships

The structure of EMP itself can be further described in terms of its internal elements. At the top level, it supports a number of Openreach products, notably LLU and WLR as described above. Communications between Openreach and CPs regarding these products are transmitted using defined messages and schemas, using specific standards. Messages and transactions are handled by software programs, which are run on physical hardware.

In general in this document, the term 'EMP' refers to this full set of elements.

Further detail on EMP's standards and software implementation are given in the following subsections.

3.2.2 *ebXML Standard*

Openreach selected ebXML (Electronic Business Extensible Markup Language) as the communication language behind EMP. ebXML is a family of XML-based standards sponsored by OASIS (Organization for the Advancement of Structured

Information Standards) and UN/CEFACT (United Nations Centre for Trade Facilitation and Electronic Business).

In the context of EMP, ebXML provides a standard format for communications between CPs and Openreach through the interface. Schemas are defined for each type of message that can be sent across the interface, with fields describing the data that may be included in the message.

The diagram below outlines the nested structure of a fulfilment document. The root node (in this case, ‘AddOrder’) is an ebXML wrapper for the main document type (‘Order’) and is used to indicate the function of the document for routing purposes.

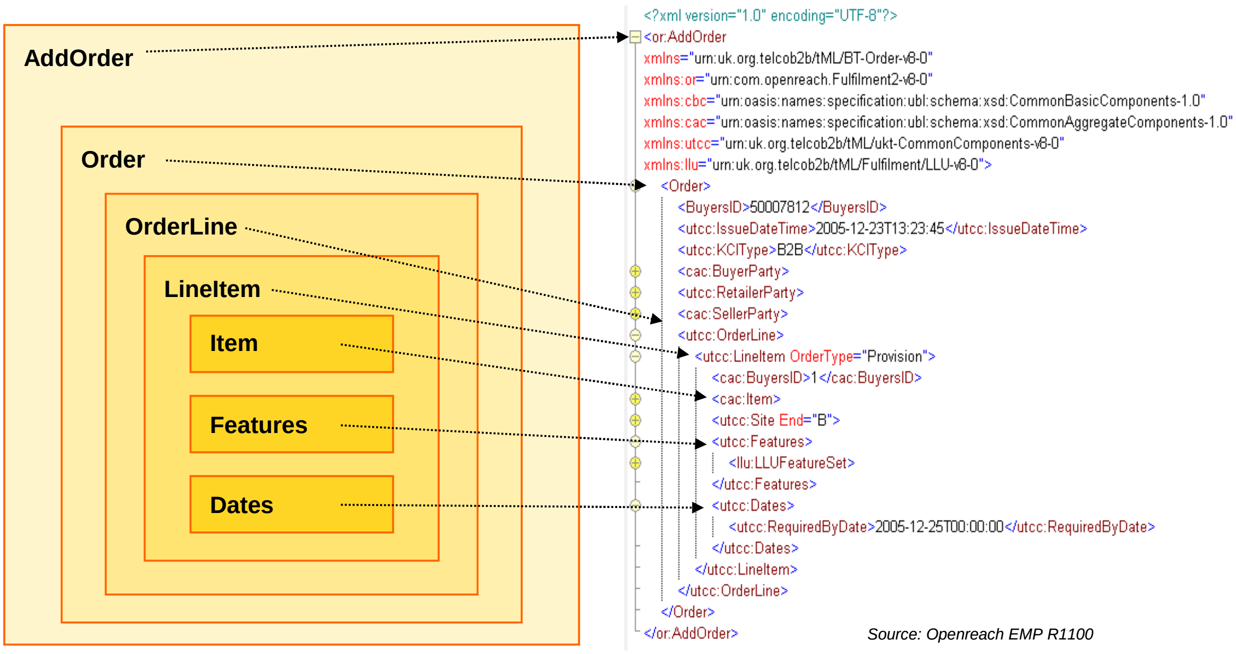


Figure 6: EMP ebXML Document Structure

3.2.3 Interface Software Implementation

As with any BtB interface, each business wishing to work with EMP requires internal systems and software to process the messages and manage interactions with the interface. In general, depending on the nature of the business and interface, these systems may be anything from a simple software package running on a server to a full enterprise-class system stack.

In the case of EMP, Openreach chose to build their systems using Cyclone Activator, a proprietary ebXML handler software solution from Axway. Cyclone was heavily involved in the development of the ebXML implementation for EMP, and a number of proprietary features and extensions were added such that the ebXML used in EMP does not strictly adhere to generic ebXML standards such as OASIS.

3.2.4 Versioning and Upgrade Cycle

Openreach uses a versioning methodology for EMP's upgrade cycle, which allows it to simultaneously run and support multiple versions of the process and schema design. This enables new functionality to be added, via a new version, while maintaining some level of backwards compatibility.

Old versions of EMP are unaffected when a new version goes live. CPs therefore may choose to continue with their current version, and upgrade to a new version at a time of their choosing to gain access to new functionality.

However, Openreach supports only a limited number of previous versions, typically the current and two previous versions. Once a version reaches end of life, any CPs still using that version must upgrade to a newer release.

3.3 Comparison of LLU and WLR

3.3.1 Market Structure

This section focuses on WLR3, Openreach's WLR product that uses EMP, rather than legacy WLR products on other interfaces.

Players from both the LLU and WLR markets take wholesale products from Openreach, which they then sell on to end users. However, the LLU and WLR markets are very different in terms of their structure and the type of players involved.

There are currently only around a dozen LLU operators in the UK. Due partly to the high fixed cost in building and maintaining a suitable network, and partly to recent industry consolidation, these are typically either large businesses serving over a million end users each, or niche players serving a limited geographical area.

Most LLU CPs connect directly to Openreach through EMP on the upstream side, and have direct retail relationships with end users downstream. While some also sell through retail service providers or resellers, there are relatively few third parties involved in the value chain.

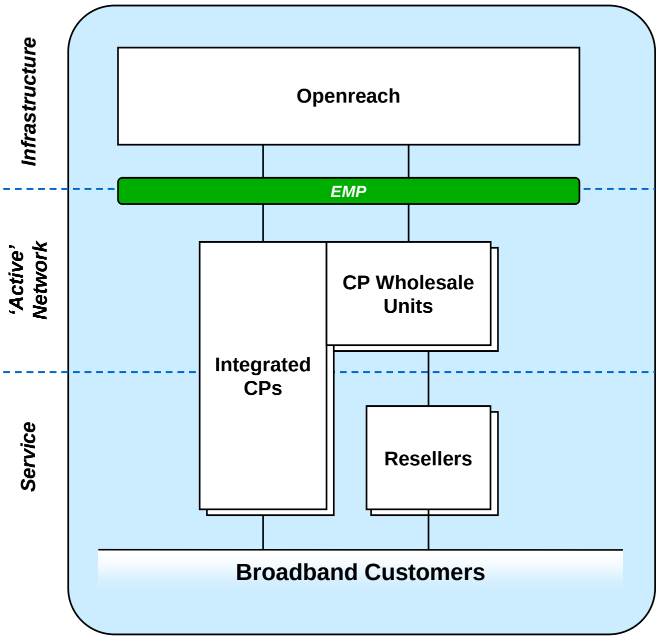


Figure 7: LLU Market Structure

In contrast, while there are a handful of large WLR players, the WLR market also contains several hundred smaller players and a more complex value chain. Nearly all of the CPs using WLR through EMP do not connect directly to the interface, but instead go through a Third Party Integrator (TPI) such as Vangent or Strategic Imperatives. There are also many WLR resellers, which manage the customer relationship but have little or no network of their own.

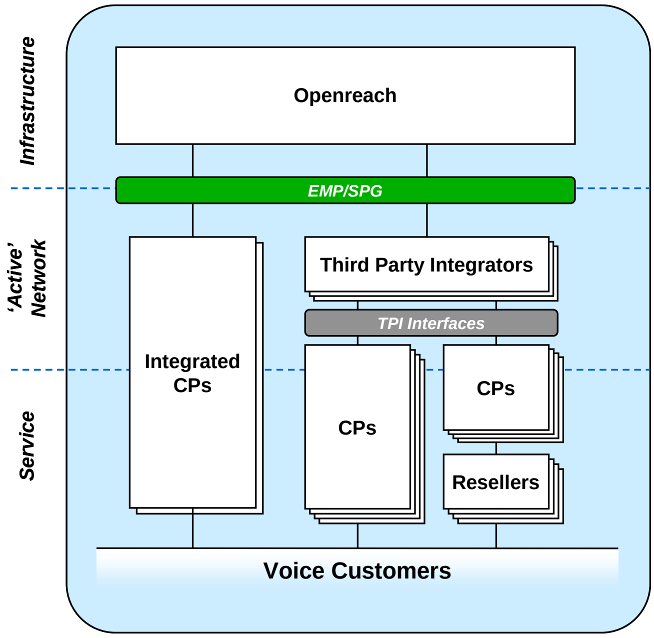


Figure 8: WLR Market Structure

TPIs bring a scale advantage to smaller WLR CPs, offering access to systems that enable the CP to consume WLR from Openreach without requiring prohibitive spend on systems and interface development. TPIs typically provide a simplified interface downstream to CPs, which may be tailored to individual customer needs, offering functionality such as Customer Relationship Management, Workflow Management and Billing. This removes some of the complexities of line and network management from CPs, and allows them to focus on their core business areas.

3.3.2 Differences in Experience

While both WLR and LLU CPs have criticisms of EMP, as detailed below, WLR-focused CPs and TPIs have generally found the experience of migrating to and working with EMP to be less troublesome than have LLU-focused CPs.

Three reasons for these differences have been identified.

Firstly, the TPI community tends to have a shared view on best practices. This presents Openreach with a relatively unified voice on requirements and priorities, simplifying the management of EMP development. LLU CPs, in contrast, have had more divergent views on interface and product development.

Secondly, LLU has required considerably more development by Openreach and CPs than has WLR. LLU was essentially a new product, needing manual steps and hardware reconfiguration, whereas WLR already existed on legacy platforms and primarily required only software changes. This created a more difficult task, resulting in more challenges during the development process.

However, even the migration of WLR to EMP is not a simple task. For example, some WLR users have chosen to stay with WLR2 over the previous interface SPG (Service Provider Gateway), rather than switch to WLR3 and EMP, due to functionality in WLR2 that is not yet available over EMP. This is expected to be delivered in a future release.

A third difference is found in the LLU and WLR test environments, as described in the following section.

3.3.3 Test Environment

A key difference in experience between LLU and WLR CPs is the level of interface testing made available to them by Openreach.

LLU CPs currently have to rely on a proxy CP tool, run by Openreach, to test each new release. The proxy CP uses virtual lines to test how the interface responds during transactions. Openreach then works to resolve any faults discovered, and gives weekly briefs to the CP community.

While this method does test the interface’s basic functionality, it does not allow CPs to test their own systems with the EMP interface. Due to the complexity of interactions handled by EMP, there are often slight differences in interpretation and implementation between different CPs. This means that even if the interface works as expected with the proxy CP, it is unlikely to work first time with other CPs' live operational systems.

Furthermore, CPs have little control over what is tested during this process. CPs can make requests in a form's notes field, but there is no structured process for asking for specific tests to be carried out. Some CPs, including Carphone Warehouse, have found that the usefulness of the proxy CP is further limited by poor documentation.

The shortcomings of the test process provided by Openreach for the LLU interface have forced CPs to develop their own solutions. Carphone Warehouse uses a volunteer-based live system for testing, while Cable & Wireless went as far as purchasing a simulator from a third party in order to test its interface systems.

In contrast, Openreach offers WLR users access to a CVF (Customer Verification Facility) during the development of each release. This enables CPs to test their own systems' interactions with the interface before it goes live, significantly reducing complications and faults in the eventual live environment upgrade.

However, some WLR CPs find even the CVF unsatisfactory, as it only enables testing of the interface front-end rather than the full end-to-end system stack. This has been the subject of discussions between Openreach and industry, but the cost of developing an end-to-end testing solution is seen as a significant barrier.

WLR users have noted some issues with the management of CVF, in particular with consistency between the test and live environments. For example, Vangent, a TPI, has sometimes found that the live environment is ahead of the test environment in terms of version control.

CPs have also experienced issues ensuring their systems correctly handle 'bad' data sent through EMP from Openreach. While some data errors are to be expected in such a complex system, Openreach does not provide CPs with any way to test how their systems react to such errors. Vangent has even had to build a 'BT emulator' to enable them to test their systems in this scenario.

The extent of the difference in test environments available to LLU and WLR CPs is a factor in the time it takes CPs to adopt new EMP releases. Most LLU CPs wait a year or more before adopting a new release, while WLR CPs typically upgrade after around three months provided they require the additional functionality and are satisfied that errors have been addressed. Although there are clearly other factors involved, many users of EMP highlighted testing as one of the major causes of upgrade delays.

As part of its efforts to collaborate with industry and meet customer demands, Openreach is now in the process of making CVF available to LLU players.

3.3.4 Implications for NGA

These differences in experience between WLR and LLU operators have two major implications for the future NGA market, for CPs, Openreach and other IPs.

Firstly, the different testing experiences demonstrate the importance of a satisfactory physical test environment, which allows CPs to test their own systems comprehensively with the interface prior to a live launch. This will be particularly important for products based on newer technologies such as FTTC and FTTP, due to the additional development required by both CPs and IPs.

Secondly, the effect of the TPI community on improving the experience for WLR CPs shows how a competitive, widely used market of third parties can aid the development of an interface by presenting a comparatively unified voice to IPs. The potential role of TPIs in the NGA industry is discussed further in section 5 below.

3.4 Users Views of EMP

3.4.1 Overview

EMP has suffered from a number of operational and design issues since its launch in 2006. Openreach has taken steps to improve the platform, with noticeable positive results, but substantial issues remain. Although EMP already compares favourably with BT's other BtB interfaces, and stakeholders have generally positive expectations of its future, it will require a considerable amount of further work before it fully meets the demands of its users.

Openreach is working actively with its customers, through a number of industry forums and bodies, to progress EMP along this path. Stakeholders generally feel they have a good working relationship with Openreach and appreciate the helpful attitude and technical knowledge of its staff.

Positives

- Working relationship
- Collaborative attitude
- Improvements over previous systems
  - Functionality
  - Interface availability
  - Data quality
  - Level of automation
  - Backwards compatibility
- Operational performance improvements since release

Negatives

- Cost to deploy and maintain
- Upgrade cycle management and cost
- Choice of ebXML
- Implementation
  - Testing
  - Documentation
  - Message 'push' structure
  - XML implementation
  - Proprietary software
- Initial operational performance

Figure 9: EMP High Level Stakeholder Views

3.4.2 Deployment

Several CPs found the initial deployment of EMP in their businesses to be far more challenging than they thought reasonable. Difficulties typically centred on the complexity of EMP's implementation of ebXML, and were exacerbated by insufficient testing capabilities and poor documentation.

Implementing the EMP interface typically cost CPs up to £500k. This varies by the size of the CP and other factors such as the amount of previous BT-related experience in the business, but gives an indication of the financial challenge for a small player wishing to work directly with EMP.

3.4.3 Upgrade Cycle

Users of EMP are generally unsatisfied with current upgrade cycle management.

The main criticism by users, in particular by LLU-focused CPs, is that they are often forced to upgrade to a new version because their current version is reaching end of life, even when there is no additional functionality in the new version of interest to them. Indeed, several CPs commented that the most common driver of EMP upgrades in their business is that their current version is no longer being supported.

These upgrades can be expensive for CPs and, providing no associated revenue or cost benefits, make for a business case that is very difficult to justify.

CPs understand that it would not be feasible for Openreach to simultaneously support a large number of EMP versions, due to both operational complexity and the volume of regression testing that would be required. Nevertheless, they believe there must be a better solution than is currently in place. This is discussed further in the Key Characteristics section below.

A secondary criticism is that EMP version changes occur too frequently. New releases are currently pushed out every three to six months. Comparing this to the three to twelve months it takes for CPs to adopt new updates demonstrates the inefficiencies and implementation issues created by this frequency. Some CPs stated that they would prefer a rate closer to one or two releases per year. The current release frequency is partly caused by specific demand from individual CPs to develop additional functionality, which can result in long lists of requirements that are difficult to include in a single release.

A related issue mentioned by Vangent is that the problem is not so much that the version changes are too frequent, but rather that there is no clear roadmap or commitment to deliver certain functionality at certain times. For example, functionality planned for a particular release is often dropped off and pushed to a later release.

Version retirement is still the focus of debates within the industry, with the OTA currently mediating between Openreach and industry to address upgrade cycle issues. This covers a number of areas, including how to allow CPs to pick up new functionality without requiring new releases, and processes to consolidate the list of new functionality requirements and thereby reduce the need for frequent changes.

Some CPs are confident that this Consumption Model work will lead to an acceptable solution. However, others suggested that more drastic alterations might be required such as switching to a patch release process. There are also concerns that the move to NGA may intensify some issues by increasing the list of new functionality requirements.

3.4.4 Upgrade Costs

CPs also commented on the operational side of upgrade implementation in addition to the issues with management of the upgrade cycle as described above.

Implementing a single upgrade typically costs a CP £200k to £250k, and can take a team of engineers several months to complete. Several CPs feel that this is too heavy a resource burden, and that emphasis would be better placed on improving more central business areas such as product development or network quality.

CPs with downstream service provider relationships face additional complications when deploying a new release. For example, Cable & Wireless has to give its resellers 90 days notice of changes to its Web Services API, which can be affected by changes in EMP.

3.4.5 Choice of ebXML

Some users commented that EMP was a very flexible, robust and future-proof system, due in part to Openreach's choice of the ebXML standard. The schemas have an abundance of fields to cover all eventualities, and the interface is expected to be sufficiently configurable to handle all Openreach's products in the foreseeable future.

However, this comes with the trade-off of increased complexity in development, deployment and processing load, and some users believe that the choice of ebXML has caused the interface to become unwieldy.

For example, Cable & Wireless commented that it currently only uses a fraction of the available XML fields. However, the remaining fields still need to be handled by both its own systems and EMP's, creating an unnecessary load on both parties.

The most common alternative suggestion was that a system built on lighter-weight Web Services, instead of ebXML, might better suit EMP's requirements. This type of system would typically also use XML, but the XML document would use a different envelope to indicate where it should be routed. This might use the SOAP (Simple Object Access Protocol) standard and be defined in machine-readable format in a WSDL (Web Services Description Language) document.

Most CPs with wholesale relationships downstream to retail service providers have created an interface to these customers based on Web Services. It is a commonly held view that this provides service providers with an interface that is easier and less costly to implement and run. Sky described its downstream interface, that uses Web Services to connect the network division to retail divisions, as "low cost, light weight and highly efficient". Another CP noted that most software used in today's telecoms systems comes with a built-in Web Services interface, simplifying deployment and integration.

For example, due to customer demand, Cable & Wireless created a trouble ticketing Web Services-based interface for its customers to use instead of directly using EMP's ebXML. This interface uses XML schemas, which are based on EMP's schemas, but exchanged using SOAP instead of ebXML.

No stakeholders taking part in the study used ebXML in any system other than EMP. In addition, with the significant exception of the UK's NHS, ebXML is not widely deployed in other industries. This can create difficulties for new users of EMP finding technical staff with experience of ebXML.

3.4.6 Documentation

Poor quality of documentation was a common complaint by users of EMP. The range of issues described begins with the difficulty of locating and obtaining the correct documentation from Openreach. Once CPs do obtain the materials, they often find they are fragmented, lack sufficient detail or are simply incomplete. For examples, vital schemas might be shown as examples rather than being clearly described.

Openreach, under an industry programme, is currently working on improving the quality of its EMP documentation.

3.4.7 XML Implementation

This proprietary nature of EMP's XML implementation, using Cyclone's ebXML handler, created issues for some CPs during the development of their EMP-facing systems. Initial attempts to interact with EMP using systems based on other off-the-shelf or open source software were largely unsuccessful, as the software was unable to understand the proprietary Cyclone elements. CPs noted that there are standardised software solutions for ebXML, so this issue is with the specific software implementation rather than choice of standard.

Most large CPs have now instead decided to purchase the same Cyclone software for their own systems, paying £80k or more each for a licence plus incremental installation and ongoing support costs. Some CPs have even purchased multiple instances of the software, to enable them to access particular interface functionality or simultaneously use multiple versions of EMP. While this is not a particularly significant issue for large businesses, smaller WLR players and TPIs have more difficulty justifying such an expense.

In addition, some interviewees consider EMP's implementation of ebXML to be below best practice. The issues are mainly around either poor enumeration and validation, or the complexity of schema definition.

The interface does not perform any immediate validation to enforce data integrity, and there is no 'data cleansing' of bad Openreach or CP internal data. For example, the definition allows a telephone number field to contain any kind of text. This means that a data entry error would remain unnoticed by the interface, and would not be found until later in the process, potentially causing delays or further errors.

Complex schemas, as well as increasing the difficulty of implementation for CPs, also make mistakes or errors in the schemas themselves harder to rule out. This has led, in some cases, to schemas being lax or not fully defined.

3.4.8 Message Status Queries

EMP is designed such that parties on both sides of the interface can ‘push’ messages to the other party. However, there is currently no way for a CP to request, or ‘pull’, a message from Openreach.

This means that if a system error by either party causes no response to be sent, the CP can only continue to wait, with no way to request a status update. The process then breaks, with significant adverse consequences for the end user experience. One CP commented, “We would prefer a ‘read/write’ system over the current ‘read-only’, to allow assurance checks on our orders.”

3.4.9 Web Portal

Openreach’s smaller LLU customers typically use a web portal interface to access EMP, rather than a machine-to-machine interface. This too has suffered from significant problems, similar to those found by larger users of EMP.

Issues cited include documentation that is hard to find and difficult to understand, the large amount of information required for even a simple LLU order, and inadequate data validation in the order verifier. Rutland Telecom commented that, due to combinations of these issues, “Every single order we have put through has gone wrong in some way”.

However, Openreach are addressing the web portal’s problems, and users have seen significant improvements. A new portal is currently being trialled, which was developed with input from stakeholders.

3.4.10 Operational Performance

EMP suffered from considerable performance problems after its initial release. Since then, Openreach has worked to resolve these issues, and CPs are now satisfied with the performance of the interface.

Availability was initially poor in general and in particular during upgrades. The entire system would typically be taken down for the whole weekend of an upgrade, sometimes pushing into the following week. In contrast, during the most recent upgrade to R1100, the Dialogue Services platform was only down for a few hours during the early morning, during which time a tactical alternative system was made available to CPs to enable them to continue taking orders from customers. The entire platform was back online and operational by 10:30am.

LLU-focused operators tended to suffer from more frequent and longer periods of down time than did WLR-focused players.

Dialogue Services latency was also poor when EMP was first deployed. The availability and performance of Dialogue Services is considered the most time-critical aspect of the interface, due to the role it plays in the customer-facing sales process. While performance requirements in fulfilment or assurance transactions might be measured in hours, the most critical dialogue services transactions may require a response with seconds. CPs require a response time of under two seconds on critical services such as the line availability checker, so that operations can be performed in real time while a customer is waiting.

In the past, latency on the availability checker could be ten seconds or more. Despite the SLAs still being considered too slow by some CPs, most now find the actual performance of Dialogue Services to be acceptable.

3.5 Comparisons with Other BtB Interfaces

Despite the above criticisms, there is a commonly held view amongst stakeholders that EMP is a significant improvement over previous BT interfaces, and to similar current BT Wholesale systems.

Comments from CPs included favourable comparisons in availability, data quality, level of automation and backwards compatibility. Vangent noted that timeliness of documentation is also much better, recalling, “The first WLR2 release was going live on the Saturday; on the Friday they sent out a schema with 702 changes in it. They’re now significantly better than that.”

The functionality available in Dialogue Services is also improved in EMP over previous platforms. For example, to make an engineer appointment in WLR2, the CP is offered three possible dates and has to hope that one of them fits. In EMP, the CP can see engineer availability, choose an appointment, and use the system’s automated address matching capability.

4 Characteristics Of An Ideal BtB Interface

4.1 Interview findings

The stakeholder interviews were used to identify the characteristics of an ideal BtB interface. Findings from these interviews, combined with Ofcom's objectives, are articulated by 11 'must have' requirements and 2 'nice to have' requirements. The 'must have' requirements, following validation through further stakeholder interviews, are synthesised into five key characteristics.

These key characteristics describe a BtB interface that meets industry's requirements for next generation access and supports Ofcom's objectives in competition, consumer experience, innovation and efficient investment. An underlying assumption behind the set of ideal characteristics is that they will be implemented in a manner that preserves the Equivalence of Inputs principle.

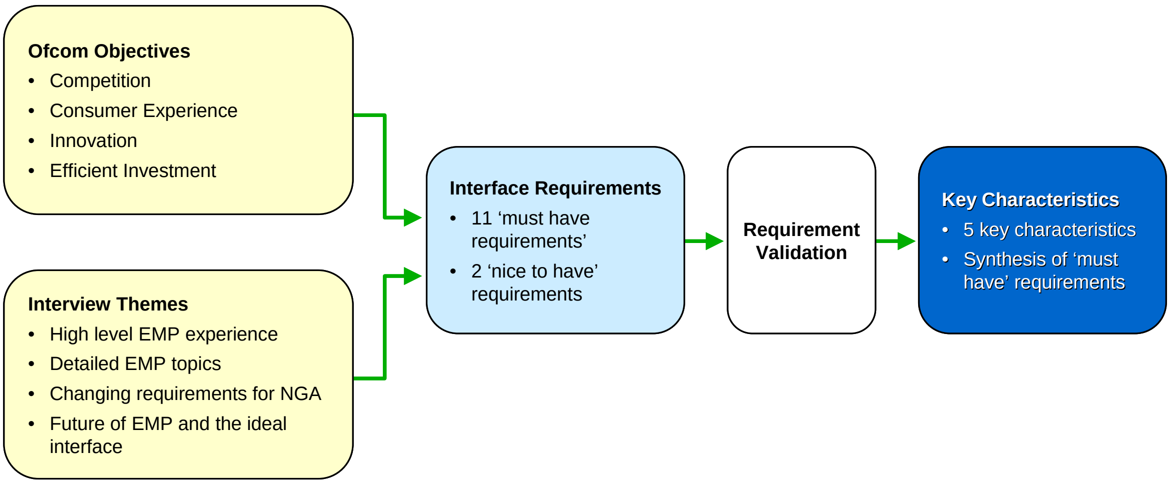


Figure 10: Key Characteristic Development Process

4.2 Key Characteristics

4.2.1 Summary

The five key characteristics are summarised below, followed by more detailed descriptions of the 'must have' and 'nice to have' requirements.

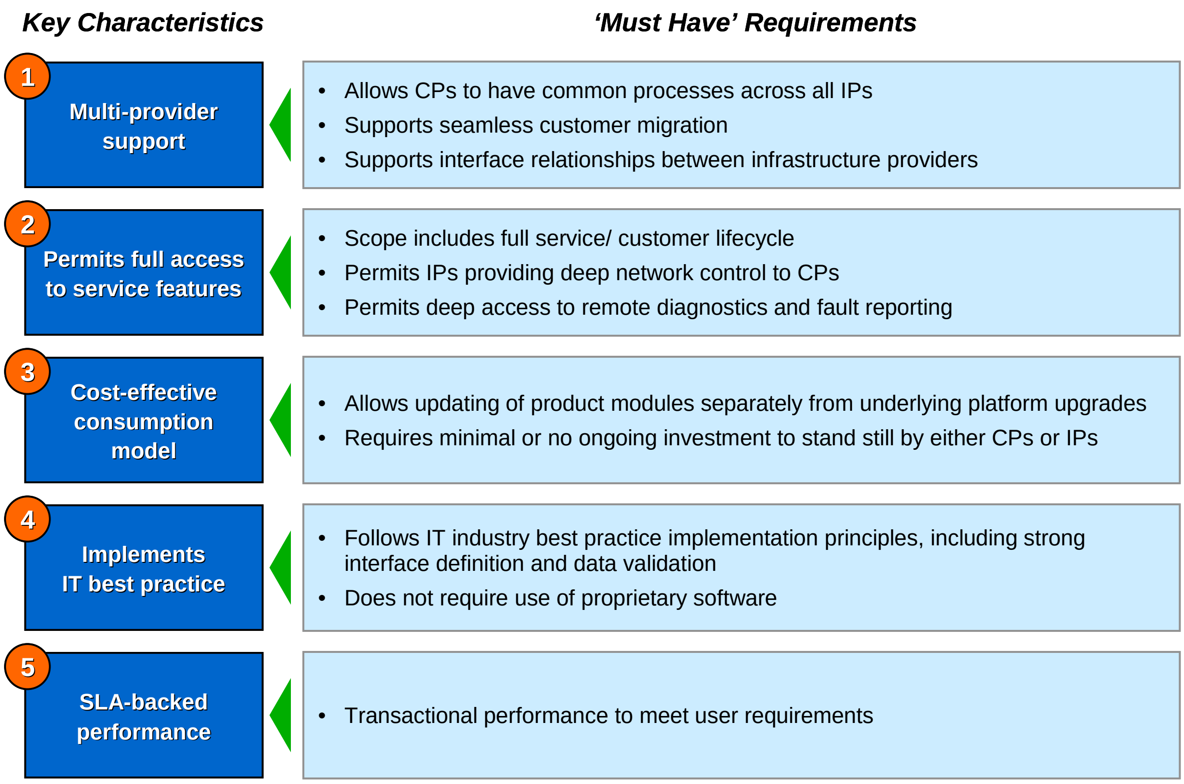


Figure 11: Key Characteristics

'Multi-provider support' describes how the interface is capable of working effectively within the envisaged NGA market structure of multiple IPs. To adhere to this characteristic, an interface should allow IPs and CPs to connect cost-effectively to multiple partners through common interface processes, and permit industry to delivery a quality customer experience during end user migrations.

'Permits full access to service features' ensures the interface can allow access to all the service features provided by the IP's network that the IP has chosen to expose. The interface should support all business-to-business transactional needs, promote competition through deep network access and improve transparency in the case of a vertically integrated IP.

'Cost-effective consumption model' addresses the management of the interface's upgrade cycle. It ensures interface functionality can be added or changed without placing unnecessary burdens on interface users, and allows interface functionality to be added or changed without placing unnecessary burdens o interface users.

'Implements IT best practice' reduces the potential for implementation and in-life service problems by requiring a suitable test environment, adequate documentation, reliable message handling, data validation and good quality coding and schema design. It also makes sure that smaller IPs and CPs can access the interface cost-effectively by not requiring use of specific proprietary software.

'SLA-backed performance' guarantees that the interface does not become a barrier to CPs delivering service to end users in a timely, cost-effective and secure manner.

4.3 Requirements for 'Multi-Provider Support'

4.3.1 Allows CPs to have common processes across all IPs

4.3.1.1 Objective

IPs and CPs should be able to use the interface to connect cost-effectively to multiple partners.

4.3.1.2 Description

CPs should be able to use the same processes for dealings with all IPs. Some additional development may be required for new relationships between CPs and IPs, but the cost should be minimal.

Whilst the interface itself should be the same for any size of IP and CP, the implementation and specific system architecture may differ depending on scale and other factors.

In addition, the interface should be technology agnostic, supporting products from any feasible access technology.

4.3.1.3 Usage Example

A CP sales agent takes an enquiry from a potential customer. The agent uses the interface, via the CP's internal system, to find out to which IP the customer's home is connected. The order can then be placed through the same system, whichever IP is involved.

4.3.2 Supports seamless customer migration

4.3.2.1 Objective

The objective of this capability is to enable the industry to deliver a quality customer experience during end user migrations.

4.3.2.2 Description

The interface should not be a barrier to industry achieving seamless customer migration to and from any technology, interface, IP and CP. This should include migration from new products back to legacy as well as legacy to new.

4.3.2.3 Usage Example

A consumer lives in an area supplied by both the incumbent's copper access network, and a regional provider's FTTC network. The consumer is currently taking a service from a major national CP over the regional provider's fibre, but wishes to move back to copper-based DSL with a different CP. The consumer is able to switch service within a reasonable timeframe, with very little down time during the migration.

4.3.3 Supports interface relationships between infrastructure providers

4.3.3.1 Objective

This supports the above characteristic regarding seamless customer migrations, with the same objective to allow industry to deliver a good customer experience during migrations.

4.3.3.2 Description

To the extent required to enable seamless customer migrations, the interface should support transactions between any two IPs.

This may be necessary where multiple IPs are capable of delivering service to the same premises, and an end user wishes to migrate from one IP to the other. This process can become particularly complex where the migration requires physical engineering work or management of the voice traffic path.

4.3.3.3 Usage Example

A business wishes to switch from the incumbent's copper-based DSL to a fibre provider's FTTC-based service. During the migration process, the incumbent and fibre provider communicate over the interface to ensure a mutual understanding of when the old line should be disconnected, when engineering work is scheduled to take place, and when the new one will be reconnected. Additionally, they work together to ensure the end user's voice service is maintained. This means that the business only loses data service for a short period over a weekend and the migration is successful.

4.4 Requirements for 'Permits Full Access to Service Features'

4.4.1 Scope includes full customer/service lifecycle

4.4.1.1 Objective

The interface should meet all business-to-business transactional needs, so that CPs and IPs do not need to develop or use separate interfaces for related tasks. This supports objectives for both customer experience and competition.

4.4.1.2 Description

The interface should comprehensively support fulfilment and assurance transactions, as per the Operations section in the eTOM model (enhanced Telecom Operations Map). Billing may be excluded.

It should also have the flexibility to allow users to use only a selection of services if they choose, simplifying initial deployment.

4.4.1.3 Usage Example

Using a single system connected to the BtB interface, a CP's customer-facing agent can test a potential customer's line, request a migration, query installation status and manage trouble tickets.

4.4.2 Permits IPs providing deep network control to CPs

4.4.2.1 Objective

This characteristic is intended to promote competition by improving the ability for both IPs and CPs to differentiate. It also improves transparency in the case of a vertically integrated IP.

4.4.2.2 Description

The interface should allow IPs to offer access to all configurable product parameters and network elements in real time, that the IP has chosen to expose. The extent of this access would be defined by the IP in its product specification, and could be made available both in-life and during fulfilment.

For example, an IP might allow a CP to manage its customers' bandwidths directly, alter line options such as interleaving or noise margin, configure multicast groups or control line cards.

Increased levels of access will require corresponding security functionality to ensure that CPs are limited to approved parameters and network elements. For example, temporary security credentials could be created for each CP transaction.

It should be noted that the level to which any individual IP offers deep network access is beyond the scope of the interface definition. While some IPs may see an opportunity to add value and provide differentiation, others may prefer to provide only higher-level access in order to better optimise bandwidth on their networks, maintain control of SLA-sensitive elements, or simply avoid additional costs. The balance of these factors may differ depending on each IP's network architecture.

4.4.2.3 Usage Example

A CP's end user customer wishes to boost bandwidth for 6 weeks during the 2012 Olympics. The user logs on to the CP's portal, and selects the bandwidth upgrade. The CP's systems interface directly with the IP's network, immediately making the configuration change with no manual steps required.

4.4.3 Permits deep access to remote diagnostics and fault reporting

4.4.3.1 Objective

This capability should increase the ability for CPs to differentiate on fault resolution, and improve transparency on fault resolution in a vertically integrated IP.

4.4.3.2 Description

The interface should provide access to all diagnostic and fault tools offered by the IP including, for example, direct access to alarms, counters and line tests.

Sufficient security must be built in to the interface to prevent unauthorised access. For example, CPs should only have access to tools related to their own customers or data paths, and not those of other customers or generic network information.

This capability would be particularly beneficial where the IP's fault resolution does not meet CP expectations. For example, some CPs commented that Openreach is currently poor at performing root cause analysis of faults, often failing to tie individual incidents to a common underlying problem. With deeper access to remote diagnostics, CPs would be able to do more of their own tests to find the cause of a fault.

As with the requirement to permit IPs providing deep network control, the level to which an IP offers deep access to remote diagnostics is beyond the scope of the interface definition.

4.4.3.3 Usage Example

A CP's end user customer contacts technical support about a suspected line fault. Using the BtB interface, the technical support agent is able to access the IP's network diagnostic tools in real time to identify the issue, without waiting for any input or support from the IP.

4.5 Requirements for 'Cost-effective Consumption Model'

4.5.1 Allows updating of product modules separately from underlying platform upgrades

4.5.1.1 Objective

This allows interface functionality to be added or changed without placing unnecessary burdens on interface users, thereby supporting competition by not imposing disadvantage on smaller players with less development resources.

4.5.1.2 Description

The interface should have the flexibility to accommodate new products while requiring minimal adjustments to the underlying platform.

This would potentially involve separating product modules from a set of generic supporting functions, analogous to how PC applications are separate from the PC operating system. In the same way that a word processing application may be updated without affecting a spreadsheet application or necessarily requiring any change to the operating system, an FTTC module could be updated with no effect on DSL users.

4.5.1.3 Usage Example

An IP that currently offers only FTTC wishes to extend into FTTP. The IP adds a new product module onto its existing interface, adding new functionality and processes but not requiring any large investment to modify the existing interface. CPs that do not plan to take any FTTP products are not affected.

4.5.2 Requires minimal or no ongoing investment to stand still by either CPs or IPs

4.5.2.1 Objective

CPs and IPs should be able to use existing interface functionality without requiring excessive costs to maintain and upgrade their systems.

4.5.2.2 Description

Interface users should not need to invest significant amounts into upgrading the interface, unless they are gaining additional functionality in return. Backwards compatibility will need to be provided where feasible, although there are clearly technical and financial limitations to this.

This will require governance of the upgrade process and functionality additions to be managed carefully, ideally by a representative industry forum.

4.5.2.3 Usage Example

A CP uses an interface to take a voice product from an IP. The IP adds a set of additional functionality to the voice product. However, because the CP is not interested in any of this new functionality, it does not require any additional investment to maintain its current voice product.

4.6 Requirements for ‘Implements IT Best Practice’

4.6.1 Follows IT industry best practice implementation principles

4.6.1.1 Objective

The objective of this characteristic is to reduce the potential for implementation and in-life service problems, creating a more cost-effective operational and consumption model.

4.6.1.2 Description

Generic IT best practice principles should be adhered to during the development and management of the interface. This should include a suitable test environment, adequate documentation, reliable message handling, data validation, good quality coding and schema design, and adopt widely used standards and technologies.

A test environment should be made available prior to each major interface change, enabling users to test the interface with their own systems without needing to build their own test environment. Ideally, this should be capable of modelling changes of location and access method, and would allow both interface-only testing as well as full end-to-end process testing.

While developing a test environment is costly, in terms of both money and time, a single environment built by the interface owner improves efficiency by sharing costs, and offers a more complete solution.

Messages should be handled in a manner that allows users to confirm their successful delivery, ensuring that processes do not become stalled due to a party being unable to discover their status. This will require a ‘pull-response’ mechanism, whereby the CP may send a request to ‘pull’ the state of a specific process from the IP.

This will involve additional interactions between the interface and the IP’s back-office IT systems to provide consolidated, up-to-date status information across the interface. The functionality is likely to be high-usage, as CPs may potentially want to check the status of every order once the order is accepted, and again the day before installation. The IP’s IT systems would therefore need to be capable of handling this level of traffic.

A ‘pull-response’ mechanism would bring an additional advantage that it should reduce the number of use case exception paths needed, and the frequency with which they are travelled. User stories could be modified to use status checks to improve reliability and increase automation, so that a higher proportion of orders go down the primary route.

Documentation should be provided for the interface in a timely manner, be easy for users to access and understand, and provide sufficient detail to support implementation.

Finally, design and coding of messages and schemas should be to a high standard. Schemas should be free of errors, and best practise data validation should be used, such as address formatting and completeness of data.

Several of these requirements are likely to be easier to implement using a widely-used standard with a large pool of knowledgeable resource such as Web Services, rather than ebXML. The discussion in section 3.4.5 ‘Choice of ebXML’ above is also relevant to choice of standard, in particular the increased complexity in development, deployment and processing load attributed to ebXML. This suggests that an implementation based on Web Services carries significant advantages over ebXML.

4.6.1.3 Usage Examples

A CP engineer is attempting to implement an IP’s interface definition in the CP’s systems. The CP is only able to find out-of-date documentation, which does not explain a particular process in enough detail. This leads to an intermittent error in the CP’s order process XML that, due to poor XML validation, is not noticed until late in the process. This causes delays of several days to some customers’ broadband activations.

A CP suffers a temporary system failure, during which it loses some order responses from the IP. Using the status ‘pull’ mechanism, the CP is able to recover from the failure using automated processes. Without that mechanism, manual exception assistance would be required from the IP.

An IP has a network outage, causing a delay to a planned install for a CP's new customer. Due to a system failure on the IP's side, the notification for this delay does not reach the CP. However, the CP has a pre-emptive automated process to 'pull' the status of every order the day before install, so it discovers the delay, notifies the customer, and maintains a good customer experience.

4.6.2 Does not require use of proprietary software

4.6.2.1 Objective

Smaller IPs and CPs should be able to access the interface cost-effectively, and no single software supplier should be able to impose monopoly pricing power on interface users.

4.6.2.2 Description

Users should be able to build systems to access the interface without the use of specific proprietary software.

The interface design should permit use of alternative software, without requiring unreasonable incremental integration work. No single supplier should be given a *de facto* monopoly over CP or IP interface software.

For example, a one CP could choose to purchase commercial off-the-shelf software to access the interface, while another would still be able to use an open source package to manage interface transactions.

4.6.2.3 Usage Example

A local IP has built an access network serving a few thousand homes. When it builds a system to support the interface, it has a choice of several open source and commercial off-the-shelf products to form the basis for the system. This allows it access to the system without requiring out-of-scale expenditure.

4.7 Requirements for 'SLA-backed Performance'

4.7.1 Transactional performance to meet user requirements

4.7.1.1 Objective

This assures that the interface does not become a barrier to CPs delivering service to end users in a timely, cost-effective and secure manner.

4.7.1.2 Description

The interface should deliver acceptable performance as agreed with its users, in areas such as throughput, response time, availability, scalability and security.

Depending on the implementation of the interface, it should support suitable SLAs in terms of interface and IP performance that are realistic to deliver but meaningful to

CPs. In the case of a centralised approach, an industry forum may be the most suitable way to define these SLAs.

4.7.1.3 Usage Example

Early EMP releases required a system shut down for a whole weekend. This has been improved such that on the most recent R1100 release, the business-critical Dialogue Services capability was kept on up parallel system throughout the upgrade. This enabled CPs to take orders, leaving the upgrade transparent to end users and potential customers.

4.8 ‘Nice to Have’ Requirements

4.8.1 Supports legacy products where practical

4.8.1.1 Objective

Where practical, the interface should allow access to the full set of products, thereby avoiding multiple internal CP and IP systems and processes.

4.8.1.2 Description

The interface should be capable of supporting legacy products, unless considered not economically or technically practical.

For example, a copper access product supplied by the incumbent and used by an FTTC provider may be suitable to include on the interface, while other copper products could be ring-fenced onto a different interface.

Support for legacy products within a single evolved BtB interface is a ‘nice to have’ characteristic. Decisions around which products are supported will depend on the approach and implementation option adopted by industry.

4.8.1.3 Usage Example

An infrastructure player that offers both copper and fibre access products to an area supports both products on the same interface. CPs are able to manage copper and fibre customers on the same interface, and migrate from one access technology to the other, creating a consistent and high quality customer experience.

4.8.2 Minimises disruption in transition from current interfaces

4.8.2.1 Objective

This aims to minimise the new investment required by industry in terms of both cost and time, and to protect investments already made in establishing current interfaces.

4.8.2.2 Description

While this is a transitional consideration in moving to a new interface, rather than a key characteristic of the end result, it is included here to balance the above ideal characteristics with a need to minimise disruption and unnecessary cost to CPs and IPs.

Potential implications include a preference for re-using current interface functionality and business processes where possible. Ring-fencing existing products may also help to reduce investment requirements.

4.8.2.3 Usage Example

A large national CP, which already uses EMP, wants to set up an interface to buy wholesale fibre access from a regional IP. The IP uses a standard EMP-like interface, so the CP needs only to make minor adjustments to its internal systems to connect to the regional IP.

4.9 Trade Offs and Implementation Challenges

4.9.1 Summary

Inherent in the definition of the above key characteristics are a number of trade-offs and implementation challenges. While an ideal interface would satisfy every characteristic, there are technical and economic limitations to what is possible to develop in reality. This section describes the most important considerations in this area, which will need to be resolved in the next stage of development.

4.9.2 Deep Access into Infrastructure vs. Common Processes

Providing CPs with granular control of network elements and diagnostics increases their ability to differentiate, thereby promoting competition and improving end user services.

However, providing this deeper access may mean that developing common processes across IPs would become more challenging.

Network abstraction, while reducing the ability for CPs to differentiate, would better mask the network differences between multiple IPs and simplify use of the interface for CPs. This may reduce the costs for CPs to work with multiple suppliers, making it easier to justify a business case for expanding into new geographies. Limiting network access may also provide greater security and control from the point of view of an IP.

Enabling deep infrastructure access through the BtB interface may also create procurement issues for IPs. In order to ensure compatibility with the interface and CP systems, IPs are likely to have a narrower selection of vendors for their network equipment and a multi-vendor strategy would be less feasible.

4.9.3 Legacy Support vs. Upgrade Cycle Management

Maintaining support for legacy products means that IPs and CPs need only use a single interface, rather than an NGA interface plus a legacy interface.

However, it also places additional burden on the interface, in particular to its upgrade cycle. Attempting an excessive level of product backwards compatibility may require trade-offs in the number of versions of NGA products that can simultaneously be supported by the interface. Additionally, it may challenge a modular upgrade system as described above by requiring the underlying interface to be modified too frequently.

4.9.4 Software Choice vs. Interoperability

Allowing users of the interface to have a choice over the software they use in their own interface-management systems provides significant benefits, in particular to smaller players who may be unable to afford expensive proprietary solutions.

However, even small differences in implementation can introduce interoperability issues. While it is clearly possible to design systems to work together using different software packages, it is likely to create additional technical challenges and may increase development costs.

4.9.5 Implementation of Common Processes

There are likely to be significant challenges in implementing common processes between very differently sized players, even in those processes which are directly interface-related. Interface design must ensure that large enterprise-style internal processes are not forced on smaller players.

In addition, standardisation and common processes may limit the ability for individual IPs to customise their interface and differentiate their products

4.9.6 Implementation of Seamless Migration

While the goal of providing end users with seamless migration between infrastructure players is considered vital, there will be significant implementation issues to overcome.

A relatively high level of physical engineering work will be required in many types of NGA migration, which will require elevated levels of communication and organisation between parties. The interface must be capable of facilitating these transactions.

There will also be special cases to be supported by the interface. For example, where an end user is currently taking service from the cable provider, Virgin Media, BT may have disconnected the copper line. Should this customer then wish to switch to an FTTC provider’s service, all three organisations will need to be involved in the migration process.

4.10 Sample User Stories

‘User stories’ are one of a number of techniques designed to facilitate the development of systems, processes and products, and describe the range of transactions required between CPs and a single IP. They are intended to be product independent, and cover the full range of fulfilment and assurance transactions.

For existing BtB interfaces, 108 user stories have been defined by the NICC in a collaborative process with industry. These are loosely based on EMP processes, and are designed for use with today's generation of technologies.

The ideal BtB interface for the NGA industry will require additions and changes to these existing industry standard User Stories, to meet the additional requirements of the key characteristics. Initial analysis suggests that 12 of the 108 user stories would require some modification, and 11 further user stories would need to be added.

In this context, a changed user story implies some changes may be required to processes or systems, but can just mean minor modifications to XML schemas. An entirely new user story represents a transaction that is not covered by the current interface definition.

To demonstrate how these characteristics translate into actionable interface design requirements, some example User Stories have been developed and included with this report using the process below.

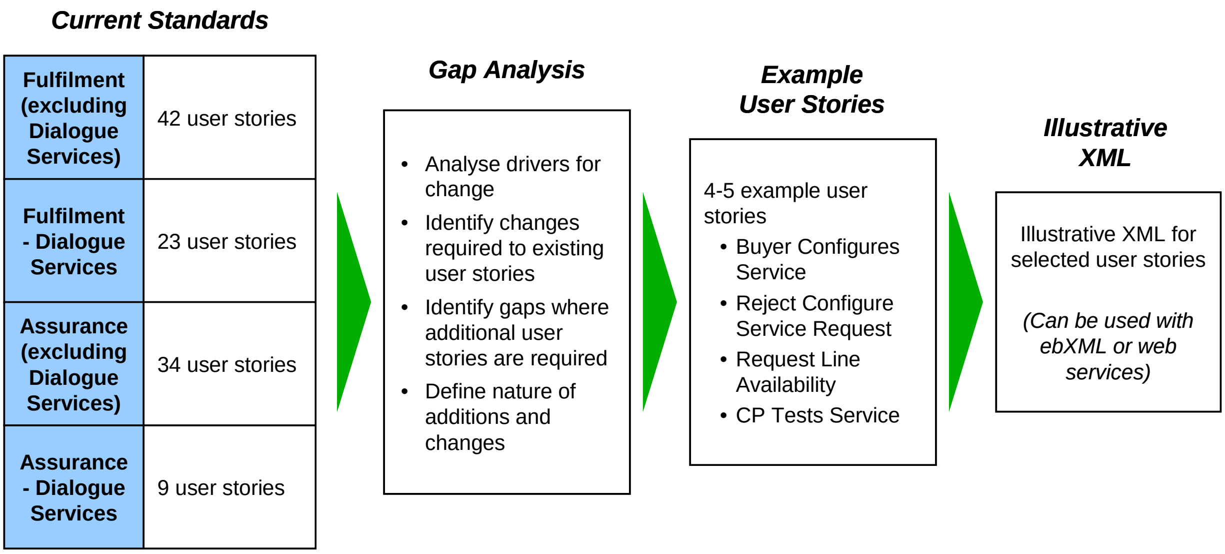


Figure 12: User Story Development Process

For example, the process for a CP configuring an IP's wholesale service, "Buyer Configures Service" will require a new user story due to the active nature of typical NGA wholesale products and the key characteristic to allow IPs to offer deep network access to CPs.

Transaction Name	As a …	I want to …	So That …	Success Criteria
Buyer Configures Specific Service	Buyer	Change the configured parameters of a working service, within the contractually agreed parameters	I can provide a flexible level of service. Ensure the service offered meets the end users requirements. Control the configurable parameters of the service on demand.	**Performance (Non-functional)** **Right First time;** Message delivery is successful first time There is a contractual agreement in place allowing the Buyer access The type of parameter changes are allowable for the service, this is specified when access is requested Configuration changes are successful first time The new parameters are returned / confirmed in a clear and simple manner If the parameter changes fail, the response indicates the action to be taken %times manual exceptions occur in sending acknowledging the message **Cycle Time;** Response time <x seconds (expectation is transaction is real-time) % Automation to be determined by specific implementations % System Availability to be determined by specific implementation **Process (Functionals)** 1) End User requests enhanced service 2) Buyer agrees parameter changes required 3) Buyer requests access to IP’s Network Controller for specific service and parameters to be changed 4) IP provides access, Network Controller ID and temporary security details 5) - IP refuses access – See “IP rejects configure service request or stops configure service action” 6) Buyer access’s Network Controller and re-sets parameters - Parameter re-set fails, re-start at step 3 7) IP returns Service ID, new parameters and activation dates 8) Buyer reviews response and confirms acceptance 9) - Parameter re-set fails, restart at step 3 10) Buyer confirms enhanced service details to End User

Figure 13: New User Story “Buyer Configures Specific Service”

Several further User Story examples and illustrative XML are included in Appendix B.

4.11 Comparison of EMP to the Ideal Interface

4.11.1 EMP Support for Key Characteristics

Due to EMP’s significance in the current telecoms market, an assessment of its current characteristics versus the ideal offers useful learnings for the development of future BtB interfaces capable of satisfying the new demands of an NGA market. In addition, , it is important to understand EMP’s suitability for a role in a future NGA market. Using the above set of key characteristics as a framework, this section compares the current implementation of EMP to an ideal future BtB interface.

The figure below shows the level of EMP’s support for each requirement. ‘Full support’ indicates that EMP already fulfils the requirements. ‘Partial support’ indicates that EMP addresses the requirement to some extent, but further improvements would be required for it to be described as ideal in that area. ‘Little or no support’ indicates that EMP does not currently have any significant support for that requirement.

	Requirements	Current EMP Implementation
1 Multi-provider support	Allows CPs to have common processes across all IPs	✗
	Supports seamless customer migration	✓
	Supports interface relationships between infrastructure providers	✗
2 Permits full access to service features	Scope includes full service/ customer lifecycle	✓✓
	Permits IPs providing deep network control to CPs	✗
	Permits deep access to remote diagnostics and fault reporting	✗
3 Cost-effective consumption model	Allows updating of product modules separately from underlying platform upgrades	✗
	Requires minimal or no ongoing investment to stand still by either CPs or IPs	✗
4 Implements IT best practice	Follows IT industry best practice implementation principles where feasible	✓
	Does not require use of proprietary software	✓
5 SLA-backed performance	Transactional performance to meet user requirements	✓
'Nice to Have'	Supports legacy products where practical	✓✓
	Minimises disruption in transition from current interfaces	✓✓

Key

- ✓✓ *Full support for characteristic*
- ✓ *Partial support*
- ✗ *Little or no support*

Figure 14: EMP Support for Key Characteristics

As EMP was designed specifically for a single IP, Openreach, it has poor support for the first key characteristic, ***'Multi-provider support'***. There is no capability in EMP to support transactions between IPs. The requirement to support seamless customer migration is partially supported by EMP, as end users are currently able to switch CPs with acceptable levels of interruption. However, it has not yet been tested whether this will still apply to more complex migrations, such as those involving FTTC.

EMP's user stories allow for only high-level access to Openreach's network and diagnostics, so it has little support as yet for the key characteristic ***'Permits full access to service features'***. It does support the requirement to include the full service/customer lifecycle: Lead to Cash, Trouble to Resolve and Dialogue Services in BT's terminology.

EMP does not currently satisfy the requirements of a ***'Cost-effective consumption model'***. Its versioning system does not allow updating of product modules separately from underlying platform upgrades, although this is being considered as a future development. Related to this, CPs are required to make ongoing investment in EMP to move to more recent versions, even if they do not plan to use any new functionality.

The key characteristic ***'Implements IT best practice'*** is partially supported by EMP. Best practice principles have not been adhered to in some of EMP's implementation, in areas such as test environment, documentation, interface definition and data validation. Additionally, while proprietary software is not a strict requirement for access to EMP, companies attempting to build EMP-facing systems using open source or off-the-shelf software have met considerable implementation challenges.

The platform's transactional performance has improved significantly since launch, and is now acceptable to most users. However, some SLAs are still considered too slack, obliging CPs to rely on EMP's actual performance being superior to its SLAs in order to meet requirements. EMP therefore has partial support for ***'SLA-backed performance'***.

EMP fully supports both of the 'nice to have' requirements. Firstly, EMP has the flexibility to support legacy products, and already includes WLR3, MPF and SMPF. Secondly, if EMP were to be used as the basis for an NGA industry interface, then it would be expected to fulfil the Transitional Consideration to minimise disruption in transition from current interfaces.

4.11.2 User Story Comparison

The high-level differences between EMP and the ideal interface outlined above have implications for lower-level interface design. As explained in section 4.10 above, this level of transaction design can be described by user stories.

NICC's stories differ slightly from EMP's stories as defined by Openreach. EMP's definition has 59 stories across the Operations Support & Readiness, Fulfilment and Assurance groups of the eTOM processes. A comparison of this to the ideal interface reveals that 6 user stories would need to be modified and 13 added to bring EMP's user stories up to the level of an ideal interface.

This method of analysing the ideal interface – using EMP as a starting point and assessing changes and additions required to meet the key characteristics – ensures that the ideal interface will be capable of carrying out all transactions that EMP can currently perform.

4.11.3 Adapting EMP to meet the Ideal Interface requirements

As could be expected for an interface designed for current generation telecoms services, and for a single IP, EMP would require considerable modification for it to fulfil the requirements of an ideal interface in an NGA market. A high-level outline of the necessary changes is shown below, using the list of key characteristics as a framework. A quantitative cost-benefit analysis of the changes is also shown below.

	EMP Developments Required for Full Support
1 Multi-provider support	• Systems and transactions to support multiple IPs • Demonstrated ability to seamlessly migrate customers across different types of access technology • Systems and transactions to allow relationships between IPs
2 Permits full access to service features	• Transactions and security to enable IPs to provide deep network control to CPs • Transactions and security to enable deep access to remote diagnostics and fault reporting
3 Cost-effective consumption model	• Extensive modifications to upgrade and versioning model • Improvements to upgrade and versioning management
4 Implements IT best practice	• Improvements to test environment, documentation, data validation and XML schemas • Changes to underlying message coding
5 SLA-backed performance	• Translation of current actual performance levels into defined SLAs

Figure 15: EMP Developments Required to Support Key Characteristics

The first two key characteristics, ***'Multi-provider support'*** and ***'Permits full access to service features'*** both describe functionality that would need to be added to the interface definition. Improvements here would primarily involve additions to the current system, such as transactions, processes and security, rather than structural changes. While significant development work may be required, and there may be challenges in implementation, there are no major technical barriers apparent. Furthermore, these changes should have a minimal impact on existing functionality. Consequently, the cost and complexity of developing new schemas and processes to enable EMP to support these characteristics should both be relatively low. In contrast, the potential benefits of improving these characteristics are very high, as doing so would allow EMP to function within the multi-IP NGA market and support Ofcom's objectives for competition and consumer experience.

The characteristic ***'Cost-effective consumption model'***, enabling modular interface updates and minimal ongoing investment, is more complex to address. EMP's current consumption model is based on packaged interface releases. New functionality is incorporated into new releases of the entire interface, rather than as stand-alone modules. Completely changing the consumption model would require redesign of the underlying software architecture, which would be a long and complex process. However, Openreach and industry are looking at smaller-scale changes in this area, which are expected to move EMP towards support for this characteristic.

Partial support for the characteristic ***'Implements IT best practice'*** could be achieved through improvements to EMP documentation, schema quality and the test environment. Openreach has already agreed to improve the test environment situation, and addressing issues with documentation and schema quality should not involve any insurmountable technical barriers. The cost of a test environment will depend on how the interface is implemented, rather than the interface standard. These improvements will deliver operational benefits to users of the interface, reducing the effort required to develop interfacing systems.

Fully supporting this characteristic would also require removing EMP's current dependency on proprietary software. Satisfying this requirement would help to allow smaller IPs and CPs to access the interface in a cost-efficient manner. However, as the software is a fundamental to the message handling design it may be expensive to remove. In addition, it would force change on EMP customers, many of whom have also invested in the Cyclone software.

Defining new SLAs to fully support the characteristic ***'SLA-backed performance'*** should be relatively inexpensive. This is an important factor in guaranteeing an interface's operational suitability. Achieving full support is largely a matter of defining and agreeing SLAs, rather than improving performance, as most users now consider EMP's actual transactional performance to be acceptable

The figure below summarises the qualitative assessment of the relative costs of adapting EMP to meet the key characteristics of an ideal interface, and the potential benefits of doing so. This assessment has been made from an external perspective, without any input from BT.

	Requirements	Current Support	Cost to Improve	Potential Benefit
1 Multi-provider support	Allows CPs to have common processes across all IPs	✗	££	↑↑↑
	Supports seamless customer migration	✓	£	↑↑↑
	Supports interface relationships between infrastructure providers	✗	£	↑↑
2 Permits full access to service features	Scope includes full service/ customer lifecycle	✓✓	-	-
	Permits IPs providing deep network control to CPs	✗	£	↑↑↑
	Permits deep access to remote diagnostics and fault reporting	✗	£	↑↑↑
3 Cost-effective consumption model	Allows updating of product modules separately from underlying platform upgrades	✗	££	↑↑↑
	Requires minimal or no ongoing investment to stand still by either CPs or IPs	✗	££	↑↑↑
4 Implements IT best practice	Follows IT industry best practice implementation principles where feasible	✓	££	↑↑
	Does not require use of proprietary software	✓	££	↑↑
5 SLA-backed performance	Transactional performance to meet user requirements	✓	£	↑↑
'Nice to Have'	Supports legacy products where practical	✓✓	-	-
	Minimises disruption in transition from current interfaces	✓✓	-	-

Figure 16: Cost-benefit Analysis of Adapting EMP to Meet the Ideal Interface Requirements

This analysis suggests that, with appropriate investment, EMP could be adapted to fulfil the majority of the ideal interface requirements and hence satisfy the key characteristics. Potential risks to industry, given the level of CP reliance on the system, as well as the effects of change on current and future users of EMP, would need to be taken into account before implementing any of these changes.

If development budget were not sufficient to carry out all of the required work, the first characteristics to consider compromising on, in terms of cost-benefit, would be ***'Implements IT best practice'*** and ***'Cost-effective consumption model'***. However, this would fail to address many of the issues described by current users of EMP in section 3.4.

5 IMPLEMENTATION OPTIONS

5.1 Need for a New Industry Model

Aside from the requirements of an NGA BtB interface itself, there are issues around the implementation and governance of such an interface or interfaces. In today's telecoms market, CPs typically need only connect to Openreach's EMP interface to achieve near-national coverage. However, the future NGA market is expected to involve a fragmented access network of multiple smaller IPs. This, combined with the introduction of next-generation 'active' wholesale products, will cause the network of relationships between infrastructure players and CPs to become significantly more complex.

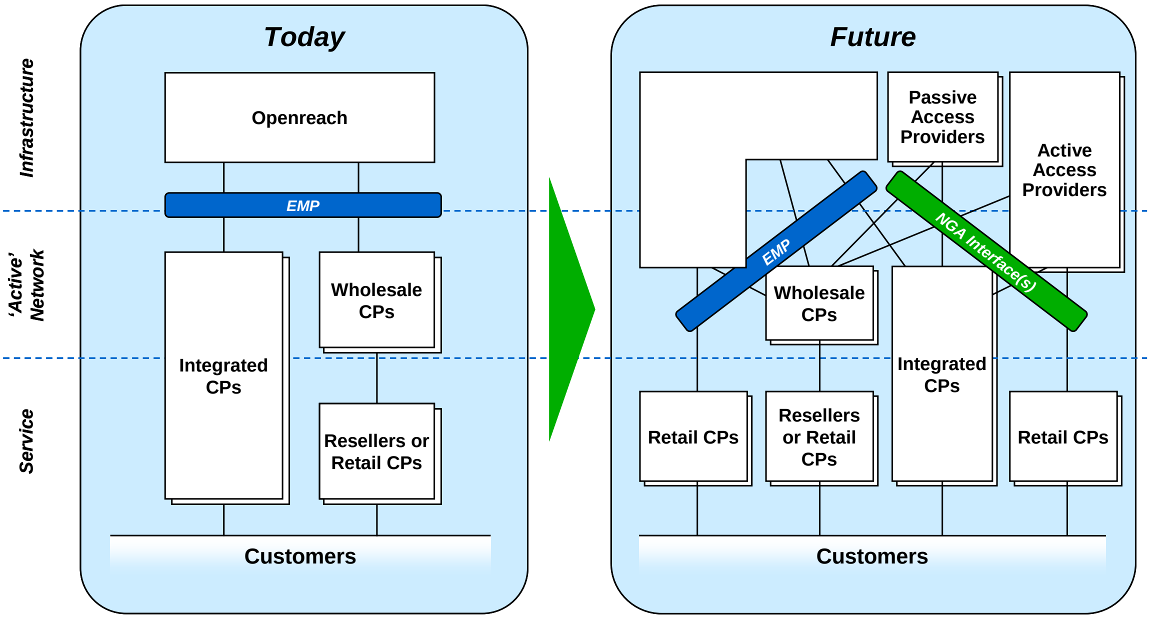


Figure 17: Network of NGA Relationships

Under this scenario, CPs wishing to provide a national service would need to develop interfaces with a number of smaller IPs as well as Openreach. This is unlikely to be practical for many businesses, as the investment required to develop and manage an interface with a new partner will need to be justified by sufficient revenue upside in a business case decision. This leads to a potential market failure, where consumers in some parts of the country may be unable to receive a competitive NGA service. Therefore, a new model will be required that addresses these issues.

In addition, even with interfaces to the relevant IPs, CPs may have difficulty knowing to which IP a potential customer is connected. Unless an all-inclusive database is provided of which networks are present in which geographical areas, CPs might potentially be left with the only option of contacting each IP individually to query whether they are able to serve a particular customer. This could become a costly and time-consuming exercise, worsening the case for dealing with multiple IPs.

A lack of national infrastructure database would also prevent consumers from easily finding out which services were present in their local area. While consumers are currently able to use Openreach's online availability checker or third party sources such as SamKnows to determine the current-generation broadband services available to them, no such functionality would necessarily exist for NGA services.

5.2 Interface Management and Clearing House Models

5.2.1 Summary

There are several alternatives, in terms of interface management, that potentially address the need for a new model as described above. At a basic level, these can be described under two dimensions: the driver of standardisation, and the degree of centralisation.

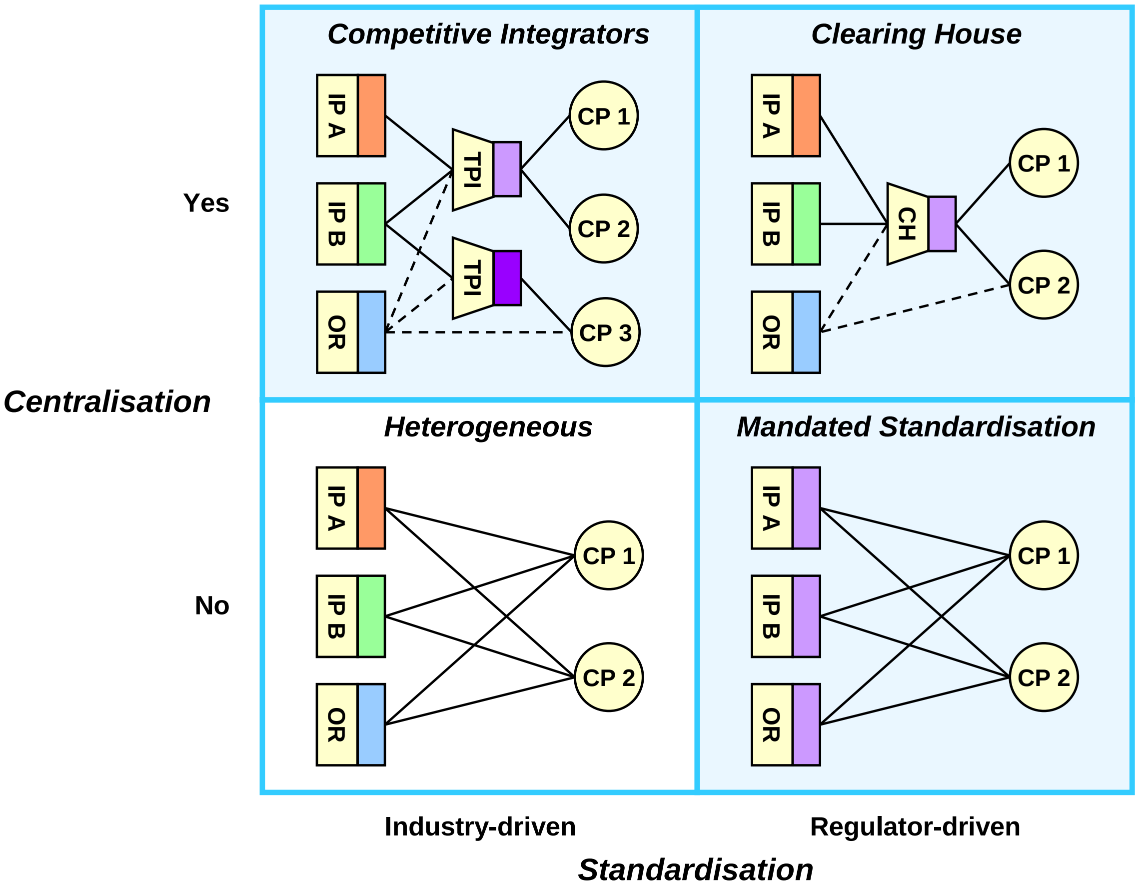
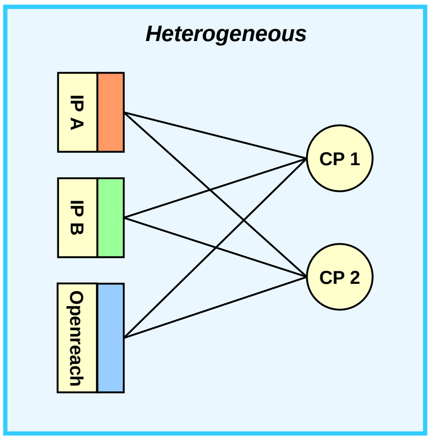


Figure 18: Potential Interface Management and Clearing House Models

These models are deliberately simplified representations of complex relationship networks. It is probable that, in reality, any new industry structure would be formed of some combination of these models. However, these simplified representations help to clarify the analysis of the different types of possible relationship.

5.2.2 Heterogeneous

This model is characterised by little or no centralisation and industry-led approach to standardisation. In this situation, any CP wishing to take wholesale products from multiple IPs would need to implement an interface with each IP, with the likelihood of limited standardisation between interfaces.



Pros	Cons
• Requires little industry collaboration and no regulation • Allows free choice of interface by IPs	• May lead to market failure in areas served by small IPs • Separate solution required for a network database

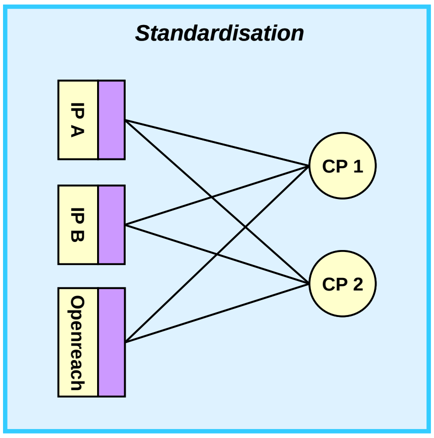
Figure 19: Analysis of 'Heterogeneous' Model

This model does have some advantages. No industry collaboration is needed and IPs are free to design their own interfaces, so will not be limited by standards or third parties in differentiating their products.

However, this model fails to address the issues described in section 5.1 above, 'Need for a New Model'. The cost to CPs of developing and managing multiple different interfaces is likely to prohibit them dealing with small IPs, leading to a market failure where consumers in areas served by small IPs have little or no choice of CPs.

5.2.3 Mandated Standardisation

Imposing an industry standard on a de-centralised model would result in each IP still interfacing directly with CPs, but using an industry standard definition that allows CPs to connect cost-effectively to all IPs.



Pros	Cons
• Allows IPs to retain greater control of their own customer interfaces • Little or no third party involvement required	• Requires CPs to develop direct relationships to multiple IPs • Requires industry collaboration to define and maintain standard • May require some regulatory intervention • Separate solution required for a network database

Figure 20: Analysis of 'Mandated Standardisation' Model

This model has the advantage of reducing complexity by requiring little or no third party involvement. IPs may retain greater control of their own customer interfaces, allowing them to build and run their interface as they choose, provided it conforms to the industry standard.

However, this means that CPs need to develop direct relationships with multiple IPs, which, even with a standardised interface, may reduce the economic feasibility of working with smaller IPs.

While the level of industry collaboration is less for this option than a centralised Clearing House, development of a mandated standard would still require significant amount of effort. A robust process would also be needed to ensure continued adherence to the standard as the interfaces develop over time.

In addition, with no centralised body, an alternative solution would be needed for a common line availability checker. While not essential for the delivery of NGA products, this eases the process of CPs discovering which IPs are able to serve a particular customer. It could take the form of an industry body with the sole responsibility of maintaining this database, or functionality built in to the standard interface to enable IPs to filter out availability requests outside of their network areas.

5.2.4 Clearing House

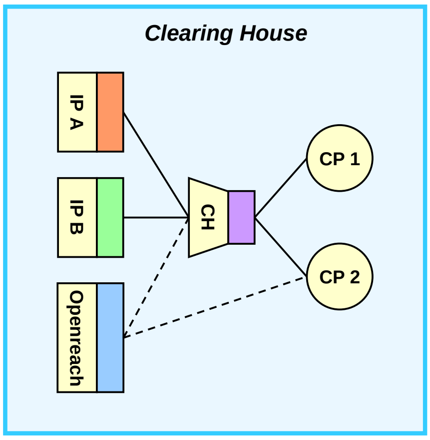
The 'Clearing House' model describes a regulated centralised industry body that owns and operates the interface. The Clearing House would offer an interface to any CP or IP, and manage transactions between parties.

No definitive interface standard would need to be set between IP interfaces, as the Clearing House would be capable of mediating transactions between different types of interface. However, there would likely be pressure for some level of standardisation, to ensure the costs to the Clearing House of managing multiple upstream interfaces remain reasonable. Indeed, the Clearing House would have a useful function as an aggregator of small IPs, even if the IPs all used the same standard interface.

A key consideration in the implementation of a Clearing House is the governance of such a body. General opinion amongst interviewees was that it should be a ‘not for profit’ body, managed by a representative set of stakeholders and taking input from all parties involved.

There are also a number of options for funding arrangements. Typical alternatives are to charge users with either a flat periodic fee for access to the interface, or a charge per interface transaction. Smaller-scale businesses were obviously keen that their costs should be in line with their usage. The SSNf commented, regarding the funding structure of the Swedish industry interface, “Right now it’s a flat fee, but we’re discussing with the market regarding how the fees will be handled; it’s pointing towards usage-based tiered charges.”

Openreach’s level of involvement with the Clearing House is a further consideration. Excluding it would prevent the interface from being burdened with the incumbent’s larger traffic volumes, and provide a clear-cut way to ring-fence legacy products. However, this would require CPs to two run separate interfaces, one to Openreach and one to the Clearing House. This could prove too expensive for some CPs, causing them to disregard alternative IPs and only take products from Openreach. However, over time, Openreach could migrate its NGA products into the Clearing House if appropriate.



Pros	Cons
• CPs only need a single interface connection to work with all IPs that supply the clearing house • Allows variation in interfaces between IPs and the clearing house • Provides a suitable location for a central network database	• May limit ability for IPs to differentiate • High cost and complex funding • Requires high level of collaboration to develop and maintain • Slow to develop and implement • Likely to require regulatory intervention

Figure 21: Analysis of ‘Clearing House’ Model

The main advantages of this are in the ease of interaction between IPs and CPs. Once in place, the Clearing House enables a full network of connections between all IPs and all CPs. IPs would have a greater choice of interface, meaning small IPs with less complex requirements could use a simpler solution that only supported the required subset of functionality. CPs would only need to manage one interface to gain access to every IP that supplies the Clearing House. This model creates the lowest barriers for new IPs to offer wholesale services to national CPs.

There are also potential advantages with the Clearing House playing a role in a centralised database of network rollouts and end user line availability. IPs would keep an up to date record of which addresses they were able to service in a secure database within the Clearing House, which CPs could then access to determine which IPs they should contact regarding each potential customer.

However, the complexities of designing, building and maintaining the Clearing House present a number of disadvantages. The Clearing House is likely to be costly, have complex funding arrangements, require a high level of industry collaboration and take more time than other models to implement. These points were raised by several interviewees, and represent the primary concerns about this model amongst stakeholders.

The inclusion of a third party system may also restrict the ability for IPs to differentiate, as functionality and innovation may be limited or watered down by the central Clearing House. During operation, the Clearing House adds risk by presenting a common point of failure for the industry.

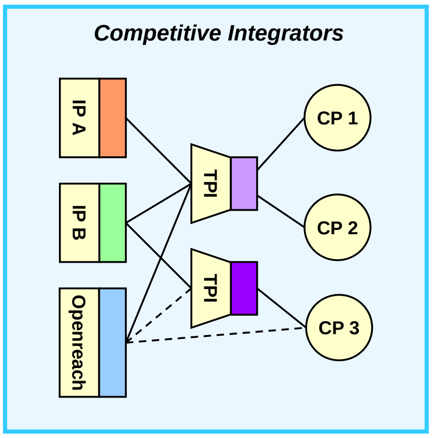
An additional concern brought up by CPs was how the interface's development and upgrade cycle would be managed. Given the difficulties already experienced with EMP, adding the complexity of support for multiple IPs is an overly hazardous proposition to some.

A high degree of regulatory intervention is likely to be required for this model in supporting collaboration and ensuring adherence.

5.2.5 Competitive Integrators

A potential market-led solution is for multiple competitive TPIs (Third Party Integrators) to act as intermediaries. A CP would typically partner with a single TPI, which then manages interfaces to any IPs the CP decides to take services from. CPs and IPs are still free to interface directly, as would likely be the case between Openreach and large CPs.

While this model does not involve an imposed industry standard, it is likely that TPIs would require some level of standardisation between IPs to ensure that interfacing with these IPs could be achieved cost-effectively.



Pros	Cons
• Increased ability for IPs to differentiate • Allows some choice of interface by IPs and CPs • Does not require significant industry collaboration • Competitive TPIs should lead to low overall cost to industry • Free market solution that requires little or no regulatory intervention	• Market response may be harder to predict than regulation • Risk of smaller IPs facing higher barriers to entry • Separate solution required for a network database

Figure 22: Analysis of 'Competitive Integrators' Model

The main advantages of this model centre on the market-led nature of the solution. IPs and CPs have a choice of interface, limited only by the ability of TPIs to meet their requirements. TPIs should also enable IPs to differentiate their services to CPs. No standards or industry bodies are involved, so requirements for industry collaboration are kept to a minimum. Finally, market forces should lead to a low overall cost to industry.

However, the market response may be less predictable than a regulatory-supported model. The business case for TPIs, and hence CPs, to work with smaller IPs is unproven, so there is a risk that small IPs will face higher barriers to entry. Additionally, a separate solution will need to be found if industry wishes to build an NGA network database.

The complex interface and business process requirements of the developing NGA market and associated systems and process developments represent a substantial business opportunity for integrators and suppliers. With sufficient up front investment and the right solution, third parties could potentially save CPs and IPs millions of pounds in interface development and operational costs. In addition, there may be further pull-through business on associated process and systems development for CPs and IPs.

5.2.6 Hybrid Solutions

As discussed above, it is likely that any real industry structure would be best described by a mixture of the above models, which may evolve over time. In addition, the same model might not provide the best fit for the whole industry.

For example, market pressure in the 'Competitive Integrators' model could mean that TPIs are unable to balance the costs of handling multiple non-standard interfaces, and begin requiring their IP suppliers to adhere to an industry standard. This would then inherit some of the pros and cons of the 'Standardisation' model.

It may be also suitable for small players to use a different solution to large ones. For example, large IPs could feed directly to large CPs, while small IPs aggregate through TPIs. This again requires CPs to maintain multiple separate interfaces, but requires little industry collaboration.

From its conversations with CPs, IFNL believes that this type of solution would still require some level of interface standardisation, giving interfaces that were similar if not identical, to ensure CPs could still make a case for taking services from every IP.

5.3 Comparative Summary

The diagram below shows a comparative summary of the pros and cons of each model described above assessed against a set of six criteria.

Assessment Criteria	Heterogeneous	Mandated Standardisation	Clearing House	Competitive Integrators
Potential for IP Service Differentiation	✓✓	✓✓	✓	✓✓
Low Barriers to CPs working with multiple IPs	✗	✓	✓✓	✓
Low Barriers to Entry for IPs	✗	✓	✓✓	✓
Low Overall Cost to Industry	✗	✓	✗	✓
Rapid Time to Implement	✓	✓	✗	✓✓
Quick In-life Responsiveness	✓	✓✓	✓	✓✓
Total	4	8	6	9

Key

✓✓	*Full support for criteria*
✓	*Partial support*
✗	*Poor support*

Figure 23: Implementation Option Assessment Criteria

The 'Heterogeneous' model clearly fails to meet the criteria. While it does allow IPs to differentiate their products by using their own interface design, barriers to entry for both CPs and IPs are unacceptably high. It is also likely to create high overall costs to industry, as a lack of standardisation or centralisation will lead to inefficient duplication of costs. This does not sufficiently support Ofcom's objectives for competition and consumer experience, and is not considered a viable solution.

A centralised Clearing House is also unlikely to meet industry needs. While it does satisfy criteria for service differentiation and low barriers between CPs and IPs, it would suffer from high development cost and complexity, likely leading to a prolonged implementation period and unwieldy end solution. A lighter-weight option would be a dark fibre-only clearing house, such as that used by the SSNf in Sweden (described in section 6.2.1 below). This would involve a much less complex interface, lower costs, and could host a national fibre network database. However, an alternative solution would still be required for active wholesale fibre products.

The remaining two models, 'Mandated Standardisation' and 'Competitive Integrators' both offer feasible solutions. They support strong IP service differentiation, are highly responsive in-life, and allow comparatively low-cost and rapid implementation. However, while barriers between CPs and IPs are much lower than the 'Heterogeneous' model, some would remain under both scenarios. In addition, developing an industry standard could add cost and delays to implementation, and relying on TPIs risks leaving smaller IPs out of the wholesale value chain. With either of these two models, a separate solution would be required for a national fibre network database.

As stated earlier, these models are deliberately simplified representations of complex relationship networks, and it is likely that any new industry structure would be formed of some combination of two or more of these models.

In particular, encouraging the involvement of TPIs in the NGA market does not preclude the development of an industry standard. Indeed, TPIs are likely to promote IP interface standardisation to some extent, to reduce their own costs of working with multiple IP suppliers. Therefore, based on this analysis, an approach which begins with the 'Competitive Integrators' model, and moves towards 'Mandated Standardisation' if necessary, appears to present a feasible and adequate solution to the issues expected in the future NGA market.

5.4 Interface Standardisation

5.4.1 Development of Standards

In both the 'Mandated Standardisation' model, and in the 'Competitive Integrators' model, there are many potential benefits to having a detailed and well-defined interface standard, to both CPs and IPs.

Allowing CPs to connect to multiple IPs using exactly the same systems would minimise the costs of having multiple suppliers, significantly improving the case for serving areas supplied by smaller IPs.

For example, Cable & Wireless commented that an ideal situation would be one where "all you had to do was change the URL on your interface systems." Other CPs agreed that a common interface amongst regional providers would probably be sufficient to justify the business case.

However, there are concerns over the time and cost of developing a sufficiently detailed standard. Businesses are keen to bring NGA products to market quickly, and to avoid unnecessarily protracted industry debates.

Stakeholders were also concerned about whether a standard would be sufficiently adhered to. The OTA noted that even subtle differences in implementation can mean systems fail to interoperate. It is therefore likely to be beneficial to standardise more than just the technical interface to facilitate trading between CPs and IPs, perhaps also including some process and implementation details. Industry forums such as the BSG's COTS Initiative (Commercial, Operational and Technical Standards) are already beginning to explore some of these issues.

5.4.2 Scope of Standards

Developing an interface standard will require choices as to the scope of the standard. Too wide a scope will unnecessarily constrict interface users, while too narrow a scope may cause interoperability issues.

A potential approach to this is to define an interface standard in terms of a small number of primitive elements, such as 'Fulfil', 'Assure' and 'Discover', each with a wide range of well-defined invocation and return/exception parameters. This would enable the interface to provide an abstracted link between the wide range of business operations, and the complexities of network equipment and internal business processes.

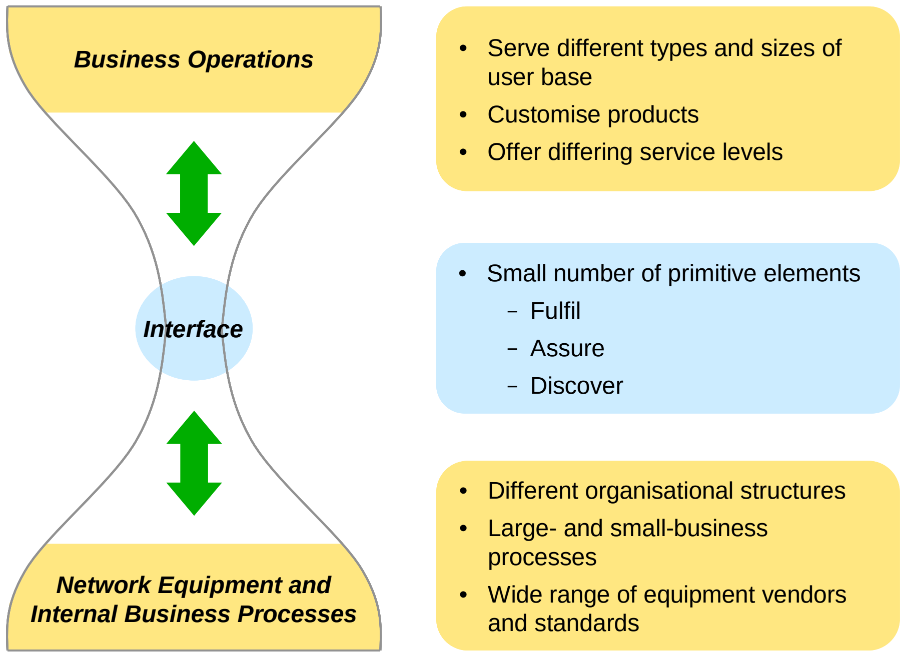


Figure 24: Interface Scope Relating to Business Operations and Processes

5.4.3 EMP as a Standard

Given EMP's current position and level of adoption, its interface definition is clearly a contender for the basis of a future interface standard. The gap analysis described in section 4.11.1, above, suggests that the interface definition used by EMP could be adapted for it to be used as the basis for an ideal NGA interface. The scope of this standard would use EMP's schemas, transactions and message standards, but would not replicate its software, hardware, business processes or related back office IT systems.

Even those stakeholders in favour of basing a standard on EMP agree that considerable changes would need to be made to create something suitable for industry as a whole. As well as addressing the criticisms of EMP described above, stakeholders agree the standard would need to be modified to accommodate smaller players, multiple IPs and active NGA products.

An option related to using the full definition of EMP as a standard is to take only the transaction schemas from EMP to use as a basis for an industry-wide interface. These could then be wrapped with an alternative to EMP's proprietary implementation of ebXML, such as Web Services.

Using EMP's standards to only a limited extent in this way has the additional advantage of allowing improvements to other areas, such as a move away from the current consumption model.

Indeed, at least two wholesale providers, Cable & Wireless and IFNL are considering or have already begun developing interfaces along these lines, using EMP-like XML schemas but different interface systems.

However, there is also considerable opposition to any use of EMP as an industry standard. Vangent believes that, while EMP is used by many players in the telecoms industry, it is BT's proprietary structure and is therefore unsuitable as an industry standard. IFNL noted that CPs' investment in developing systems to work with EMP has made it harder for competitive IPs to enter the market. Other stakeholders raised similar concerns that use of EMP may offer a competitive advantage to BT, or impose large-business processes on small infrastructure players.

Stakeholder opinion is clearly divided on whether the benefits of leveraging the existing system outweigh the disadvantages of imposing upon industry what is essentially a BT-designed interface standard.

There are important short and long term trade-offs between basing a new industry standard on EMP versus designing a new standard. Historically, the telecoms industry has sometimes stayed too long with legacy systems, attempting incremental improvements to resolve new issues, rather than making the jump to a longer-term solution. The upcoming transition to NGA is a discontinuity that potentially warrants a move to a new industry-agreed interface based on a widely used standard such as Web Services and a re-engineered consumption model.

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6 FURTHER CONSIDERATIONS

6.1 UK Initiatives

6.1.1 NICC

The Network Interoperability Consultative Committee (NICC) is a technical forum for the UK's telecoms industry. Its role is to develop interoperability standards for public communications networks and services. Initially established as a committee reporting to Ofcom, NICC is now an independent industry body, owned and managed by its members.

Beginning in 2006, NICC has been developing a framework of BtB standards. These include technical and process standards, as well as best practice guides. The standards appear to be loosely based on current EMP processes, but are designed to be CP and product independent. Billing is specifically excluded from the standard.

6.1.2 BSG

Broadband Stakeholder Group (BSG) is a UK industry-government forum. It addresses topics across the broadband industry, including next generation access, digital media and convergence.

BSG recognises access network fragmentation as a key issue. It has recently launched an industry led project, COTS (Commercial, Operational and Technical Standards), to examine what needs to be done to address this issue. The project involves stakeholders from fixed and mobile infrastructure providers, CPs and other interested third parties.

6.1.3 CBN

Established in 2004, the Community Broadband Network (CBN) is a consultancy supporting and developing community-owned broadband schemes. It is involved in the analysis of the future of broadband in the UK, and also works with partners to deliver community-based broadband services.

In 2008, CBN created the Independent Networks Co-operative Association (INCA) to act as a unified voice for local 'open access' IPs and promote common standards. It aims to address the issue of access network fragmentation through the development of a 'Joint Operating Network' (JON), providing technical and operational support to local IPs.

6.2 Interface Examples from Other Markets

6.2.1 Swedish Urban Network Association

The Swedish Urban Network Association (Svenska Stadsnätsföreningen in Swedish, also known as SUNA or SSNf) is a not-for-profit trade association of Swedish IPs with about a hundred members. It manages an interface system, 'CESAR' (Centralt

System för Accesser Caesar' (or Central System for Access), which enables CPs to discover and order dark fibre from IPs.

SSNf introduced the CESAR system in 2007, when the incumbent TeliaSonera began to limit sales of its wholesale dark fibre product. This accelerated an already increasing demand from CPs for access to alternative fibre access providers. However, as the access market in Sweden is structured with many city-based local IPs, this led to a requirement for a common interface that enabled large CPs to work cost-effectively with multiple small IPs.

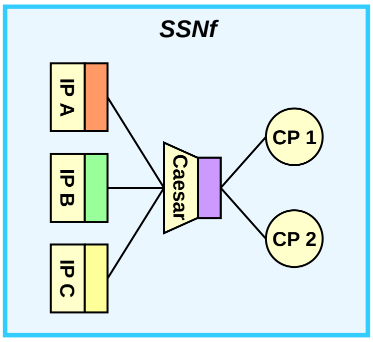

Figure 25: Swedish fibre interface structure

CPs and IPs access the system through a web portal interface. CPs can look at a particular geography, find an open supplier in that area, define where they want to connect and then send tenders to IPs. The system handles further dialogue between CP and IP, and can manage delivery scheduling. IPs can also access the system to update information about their network. Service assurance is handled by a separate system, which is linked to CESAR. For example, the two systems use common transaction ID numbers.

Inclusion in the CESAR system requires CPs and IPs to adhere to common terms and conditions. Networks must also meet defined standards of quality and openness.

The interface is implemented using open source software, as decided by the SSNf's members, and is supported by web-based documentation. It currently handles an average of 300 to 400 orders per month. SSNf is considering developing a machine-to-machine interface for use by larger operators, and intends to build more automation into the next version.

SSNf and CESAR are funded by member operators and city networks. Fees are built into the system, currently using a flat fee model. However, discussions are ongoing regarding a switch to a variable fee structure, with tiered charges dependent on usage or value of business generated. The handling of the system is outsourced, with a total of around £1m spent since the start of development. Ongoing annual fees are kept low due to the non-profit nature of SSNf.

Governance of the system is based around 'cooperation groups', subsets of interface users, which decide features before sharing findings with the larger group. For example, the most recent meeting involved a group of five operators and three city networks presenting findings to other SSNf members.

6.2.2 Examples from Other Industries

6.2.2.1 Mobile SMS

The sending of SMS text messages between carriers in Europe resembles the ‘Competitive Integrators’ model described above. While Tier 1 carriers typically have direct signalling connections set up with other Tier 1 carriers, and can send SMS using these connections, smaller carriers typically use third party SMS Hubs to assist with the transmission of messages.

For example, a small carrier in one country may have an agreement with a local SMS hub provider to manage its international SMS connectivity and interoperability. This carrier would then gain access to foreign carriers without needing to develop any further direct relationships. In some cases, the SMS hub provider may need to go through a second hub in order to reach another small carrier.

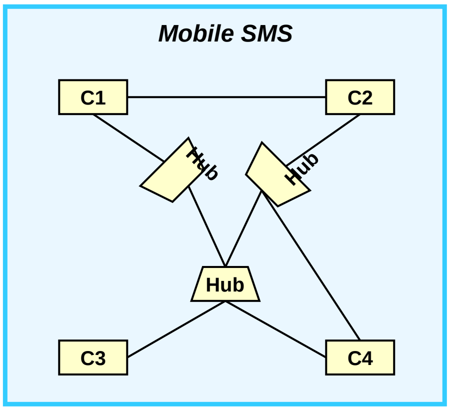

Figure 26: Mobile SMS interface structure

Although some standardisation and interoperability is provided in Europe by the GSM standard, SMS hub providers can also translate messages between standards, such as when one party uses CDMA.

6.2.2.2 SITA - Aviation

SITA is a multinational IT company serving the aviation industry. It was founded in 1949, under the name Société Internationale de Télécommunications Aéronautiques, by 11 airlines as an industry body to provide communications between airports. It now has over 550 members, including airlines, airports and governments. The organisation’s remit has evolved to provide managed communication, infrastructure and outsourcing services to its members and other commercial customers, but is still owned by its members and solely serves the aviation industry.

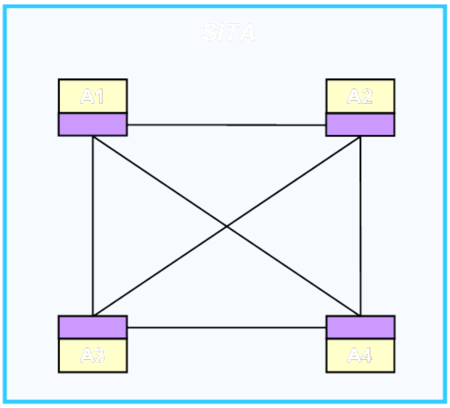

Figure 27: Aviation industry interface structure

As well as offering data transport services, SITA offers an interface product, SITATEX. This provides operational messaging support, using the aviation industry standard Type B messaging, for communications within and between companies. The interface uses IP, and is described by SITA as “highly secure and reliable, cost-effective, quick to implement and easy to upgrade.” SITATEX currently supports over 20,000 users.

6.2.2.3   NBP - Gas

The NBP (National Balancing Point) is a notional balancing point on the UK gas supply system. Established in 1996, it acts as a trading hub for the gas industry, providing the basis for gas supply contracts and enabling gas-to-gas competition. Largely due to this hub, the UK gas market is considered one of the most liquid in Europe.

Trades on the NBP made via the On-the-day Commodity Market are managed by the assigned market operator APX Group, an Anglo-Dutch energy exchange company. APX provides an interface between parties, enabling anonymous trading and ensuring contracts are cleared and settled.

6.2.2.4   SWIFT - Finance

SWIFT (Society for Worldwide Interbank Financial Telecommunication) provides the communications platform, products and services to allow financial institutions to exchange information, and acts as a collaborative industry body. It was founded in 1973 as a cooperative society of 239 banks in 15 countries, owned and controlled by its shareholder members. Its initial goal was to create a shared global communications link and common standards for international financial transactions. SWIFT now has 9,000 live users, of which over 2,300 are members, and handles around 15m messages per day.

SWIFT acts a secure data carrier between financial institutions, offering a range of interface products to enable its customers to automate and standardise transactions. It carries solely messages (mostly payments and securities), rather than holding funds or storing financial information.

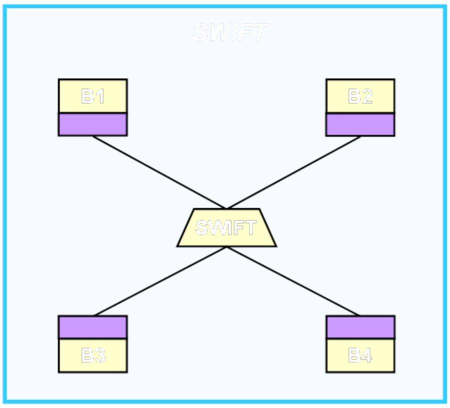

Figure 28: Financial industry interface structure

6.3 International Standardization

If an implementation option were chosen that requires an industry-wide interface standard, there would be additional benefits if the interface were standardised at an international level.

The main advantage of an international standard would be to reduce the work required for global communication providers to connect to access infrastructure in new markets. This would give infrastructure players a greater variety of CP customers, and potentially benefit consumers with superior services through competition. An international standard could also allow some sharing of development costs.

The BSG and SSNf, industry bodies in the UK and Sweden respectively, both see value in an international standard. The European Commission also commented recently in a consultation document that national regulators should cooperate with each other, international stakeholders and industry stakeholders to develop common technical standards for NGA protocols and interfaces

There are, however, substantial challenges to developing and implementing an international standard. Given the complexities of finding an NGA interface solution for a single country, as described earlier in this report, attempting to do so simultaneously for multiple countries may prove unfeasible. Industry collaboration, such as deciding interface requirements and implementation options, becomes significantly more demanding when more than one country is involved. This could lead to higher development costs and longer delays in implementation. The SSNf noted these challenges, commenting that "it would be hard to do, but could be achieved using small steps."

7 CONCLUSIONS

7.1 Openreach EMP

EMP has suffered from a number of operational and design issues since its launch in 2006. Openreach has taken steps to improve the platform, with noticeable positive results, but substantial issues remain.

- CPs have found the interface expensive to implement and maintain, with implementation costing up to £500k and an additional budget of up to £250k required for each interface upgrade. This creates a clear financial challenge for a small player wishing to work directly with EMP.
- Users of EMP are generally unsatisfied with current upgrade cycle management. The main criticisms are the frequency of version changes, and forced upgrades due to version retirement, even when there is no additional functionality of interest in the new version.
- Poor quality of documentation remains a problem for many users, particularly concerning its poor availability, fragmentation, level of detail and accuracy.
- The complex subject of Openreach's software implementation has led to some issues. Related criticisms include unwieldiness, the 'push' nature of the interface, poor data validation and the difficulty of building interface systems without using proprietary software.
- Finally, the availability and quality of test environment has been unsatisfactory for CPs, in particular for LLU operators.

Nevertheless, EMP compares favourably with other similar BtB interfaces. Users view it as a significant improvement over previous BT interfaces, and to similar current BT Wholesale interfaces.

EMP will require a considerable amount of further work before it fully meets the demands of its users, but stakeholders have generally positive expectations of its future. Openreach is working actively with its customers, through a number of industry forums and bodies, to progress EMP along this path.

While there are substantial gaps between EMP's current definition and an ideal interface, analysis suggests some of these gaps could be closed without complete re-design. If development budget were not sufficient to carry out all of the required work, the 'sweet spot' may be to compromise on the 'Cost-effective consumption model' characteristic. However, this would have significant repercussions later in the life of the interface.

7.2 Key Characteristics of an Ideal Interface

Based on stakeholder interviews and further analysis, the ideal interface can be described at a high level by five key characteristics. The key characteristics describe an NGA BtB interface that meets industry's requirements and supports Ofcom's objectives in competition, consumer experience, innovation and efficient investment.

1. ***'Multi-provider support'*** describes how the interface is capable of working effectively within the envisaged NGA market structure of multiple IPs. To adhere to this characteristic, an interface should allow IPs and CPs to connect cost-effectively to multiple partners through common interface processes, and permit industry to delivery a quality customer experience during end user migrations.
2. ***'Permits full access to service features'*** ensures the interface can allow access to all the service features provided by the IP's network that the IP has chosen to expose. The interface should support all business-to-business transactional needs, promote competition by permitting deep network access and improve transparency in the case of a vertically integrated IP.
3. ***'Cost-effective consumption model'*** addresses the management of the interface's upgrade cycle. It ensures interface functionality can be added or changed without placing unnecessary burdens on interface users, and allows interface functionality to be added or changed without placing unnecessary burdens o interface users.
4. ***'Implements IT best practice'*** reduces the potential for implementation and in-life service problems by requiring a suitable test environment, adequate documentation, reliable message handling, data validation and good quality coding and schema design. It also makes sure that smaller IPs and CPs can access the interface cost-effectively by not requiring use of specific proprietary software.
5. ***'SLA-backed performance'*** guarantees that the interface does not become a barrier to CPs delivering service to end users in a timely, cost-effective and secure manner.

7.3 Implementation Options

There are several alternatives, in terms of interface management, that potentially address the need for a new industry interface model. Any new industry structure is likely to be formed of some combination of the following models:

- ***'Heterogeneous'*** has little or no centralisation or regulation. In this situation, any CP wishing to take wholesale products from multiple IPs would need to implement an interface with each IP, with little or no standardisation between interfaces. This model fails to meet industry and Ofcom needs, leaving barriers to entry for both CPs and IPs are unacceptably high.
- ***'Mandated Standardisation'*** imposes an industry standard BtB interface on IPs, resulting in each IP still interfacing directly with CPs, but using an industry standard definition that allows CPs to connect cost-effectively to all IPs. This offers a feasible solution, supporting strong IP service differentiation and in-life responsiveness. However, it does not address the cost of supporting multiple commercial relationships between CPs and IPs, and could add cost and delays to implementation.

- ***'Clearing House'*** describes a regulated centralised industry body that owns and operates the interface. The Clearing House would offer an interface to any CP or IP, and manage transactions between parties. While this model does satisfy criteria for service differentiation and low barriers between CPs and IPs, it would suffer from high development cost and complexity, likely leading to a prolonged implementation period and unwieldy end solution.
- ***'Competitive Integrators'*** is a potential market-led solution, where multiple competitive TPIs (Third Party Integrators) act as intermediaries. A CP would typically partner with a single TPI, which then manages interfaces to any IPs the CP decides to take services from. CPs and IPs are still free to interface directly, as would likely be the case between Openreach and large CPs. This model also appears a feasible solution, addressing the criteria for IP differentiation, barriers to entry, development cost, implementation speed and in-life responsiveness, but does carry the risk of leaving smaller IPs out of the wholesale value chain.

Based on the analysis in this report, an approach which begins with the 'Competitive Integrators' model, and moves towards 'Mandated Standardisation' if necessary, appears to present a feasible and adequate solution to the issues expected in the future NGA market.

7.4 EMP as an industry standard

Given EMP's current position and level of adoption, it is clearly a contender for the basis of an industry standard interface, should one be required.

Processes, transactions and security would need to be added to the existing interface definition to adequately support multiple IPs and permit full access to service features. Some modifications are required to meet IT best practice implementation principles, and SLAs should be defined to guarantee performance. Finally, substantial changes would be needed to create a cost-effective consumption model.

Even with this conclusion that it should be possible to base a future standard on EMP, stakeholder opinion is divided on whether the benefits of leveraging the existing system outweigh the disadvantages of imposing upon industry what is essentially a BT-designed interface standard. This remains an open question for industry and Ofcom.

Market-based solutions could provide additional answers, such as taking only the transaction schemas from EMP to use as a basis for an industry-wide interface. These could then be wrapped with an alternative to EMP's proprietary implementation of ebXML, such as Web Services.

8 RECOMMENDATIONS FOR INDUSTRY

Following on from this study, these are the recommended next steps for industry:

1. Collaborate via industry forums (e.g. BSG COTS) to build consensus on the five key characteristics as the basis for NGA interface solutions.
2. Promote industry interface standardisation, specifying and adopting a required set of interface elements and parameters.
3. Establish consensus on the short term benefits of evolving EMP for use in an industry standard versus the long term benefits of disruptive change, in particular with regard to technology choice and consumption model.
4. Facilitate the emergence of the 'Competitive Integrators' model by bringing TPIs into interface and general NGA discussions, and working with them to develop satisfactory business models.
5. For TPIs and industry suppliers, explore NGA interfaces as a future business opportunity and begin research into customer needs and potential solutions.
6. Collaborate with relevant international bodies to share knowledge and standards, as appropriate.

APPENDIX A: INTERVIEWEE LIST

The project took a primarily interview based approach, gaining input from a representative base across industry. These stakeholders gave insights and opinions regarding all major subject areas in the report, and their contributions are well appreciated.

Organisation
Broadband Stakeholder Group
Cable & Wireless
Carphone Warehouse
Digital Region
Independent Fibre Networks Ltd
O2
Ofcom
Office of the Telecoms Adjudicator
Rutland Telecom
Sky
Swedish Urban Network Association (SSNf)
Vangent

APPENDIX B: USER STORY EXAMPLES

'User stories' are one of a number of techniques designed to facilitate the development of systems, processes and products, and describe the range of transactions required between CPs and a single IP. They are intended to be product independent, and cover the full range of fulfilment and assurance transactions.

For existing BtB interfaces, 108 user stories have been defined by the NICC in a collaborative process with industry. These are loosely based on EMP processes, and are designed for use with today's generation of technologies.

The ideal BtB interface for the NGA industry will require additions and changes to these existing industry standard User Stories, to meet the additional requirements of the key characteristics. Initial analysis suggests that 12 of the 108 user stories would require some modification, and 11 further user stories would need to be added.

In this context, a changed user story implies some changes may be required to processes or systems, but can just mean minor modifications to XML schemas. An entirely new user story represents a transaction that is not covered by the current interface definition.

To demonstrate how these characteristics translate into actionable interface design requirements, some example User Stories have been developed and included with this report.

User Story Gap Analysis

Category	Use Case Changes	Driver of Change	Nature of Addition/Change
Fulfilment (excluding Dialogue Services)	• 40 use cases unchanged • 6 use cases added – Buyer Configures Service – Buyer Configures Multiple Services – Reject Configure Service Request – Request Network Build Quotation – Review Quotations – Request Quotation Period Extension • 2 use cases modified – Request Service Quotation (L2C3) – Notify Performance Data (L2C53)	• Full access • Full access • Full access • Multi-provider • Multi-provider • Multi-provider • Multi-provider • Diagnostics	• Deeper configuration options • Multiple simultaneous requests • Allows IPs to reject configuration • Allows IPs to quote for network build • Multiple quotations from multiple IPs • During discussions with multiple IPs • Location served by multiple IPs • IP service degradation ad-hoc report
Fulfilment - Dialogue Services	• 13 use cases unchanged • 1 use case added – Buyer Commissioning Test • 10 use cases modified – Query Address Search (L2C37) – Query Address Details (L2C38) – Query Address Match (L2C39) – Request Temporary Address (L2C40) – Request Line Availability (L2C41) – Request Network Availability (L2C42) – Request Network Capability (L2C44) – Request Number Availability (L2C45) – Request Number Import Check (L2C47) – Request Number Portability Check (L2C48)	• Full access • Multi-provider • Multi-provider • Multi-provider • Multi-provider • Multi-provider • Multi-provider • Multi-provider • Multi-provider • Multi-provider • Multi-provider	• Deeper Access testing options • Centralised address checker • Centralised address checker • Centralised address checker • Centralised address checker • Centralised availability checker • Centralised availability checker • Centralised availability checker • Centralised number checker • Centralised number checker • Centralised number checker
Assurance (excluding Dialogue Services)	• 34 use cases unchanged • 2 use cases added – CP Tests Service – CP Tests Multiple Services	• Diagnostics • Diagnostics	• Deep access testing options for T&D • Deep access testing options for T&D
Assurance Dialogue Services	• 9 use cases unchanged • 2 use cases added – IP Advises CP Of Service Degradation – IP Advises CP Of Problem Report	• Diagnostics • Diagnostics	• Allow CP to undertake deeper T&D • CP aware and deeper T&D delayed

Sample User Stories

Transaction Name	As a …	I want to …	So That …	Success Criteria
Buyer Configures Specific Service	Buyer	Change the configured parameters of a working service, within the contractually agreed parameters	I can provide a flexible level of service. Ensure the service offered meets the end users requirements. Control the configurable parameters of the service on demand.	**Performance (Non-functional)** **Right First time;** Message delivery is successful first time There is a contractual agreement in place allowing the Buyer access The type of parameter changes are allowable for the service, this is specified when access is requested Configuration changes are successful first time The new parameters are returned / confirmed in a clear and simple manner If the parameter changes fail, the response indicates the action to be taken %times manual exceptions occur in sending acknowledging the message **Cycle Time;** Response time <x seconds (expectation is transaction is real-time) % Automation to be determined by specific implementations % System Availability to be determined by specific implementation **Process (Functionals)** 1) End User requests enhanced service 2) Buyer agrees parameter changes required 3) Buyer requests access to IP's Network Controller for specific service and parameters to be changed 4) IP provides access and temporary security details 5) - IP refuses access – See "IP rejects configure service request or stops configure service action" 6) Buyer access's Network Controller and re-sets parameters including activation dates 7) - Parameter re-set fails, re-start at step 3 8) IP returns Service ID, new parameters and activation dates 9) Buyer reviews response and confirms acceptance 10) - Parameter re-set fails, restart at step 3 11) Buyer confirms enhanced service details to End User

New User Story: Buyer Configures Service

Transaction Name	As a …	I want to …	So That …	Success Criteria
Reject Configure Service Request Or Stop Configure Service Action	IP	Protect the Network capacity. Protect working services.	Ensure the network capacity is not overloaded leading to disruption of services.	**Performance (Non-functional)** **Right First time;** Message delivery is successful first time Notification includes reason text / code %times manual exceptions occur in sending acknowledging the message **Cycle Time;** Response time <x seconds (expectation is transaction is real-time) % Automation to be determined by specific implementations % System Availability to be determined by specific implementation **Process (Functionals)** 1) IP receives service configuration change notification. 2) IP reviews the configuration changes to be applied. 3) - If meets acceptance criteria provides access and temporary security details. 4) - If fails acceptance criteria i.e. outside agreed parameters for the service, network capacity not available or planned engineering works are schedule, send a rejection notification with reason. 5) An "in flight" service configuration may be jeopardised if; network capacity is compromised or engineering works become necessary. IP sends stop notification with reason 6) Buyer receives reject / stop notification and can pursue alternative action. This can include a request to reconsider to the IP or via a manual process

New User Story: Reject Configure Service Request or Stop Configure Service Action

Transaction Name	As a …	I want to …	So That …	Success Criteria
Provide Service – Address Confirmation and Infrastructure Availability	CP/SP	Obtain address and service availability information on my customers location	I can provide the correct service at the correct location to meet my customers requirements	**Performance (Non-functional)** **Right First time;** Message delivery is successful first time Address information is in the agreed format Returned information is presented in clear and simple terms %times manual exceptions occur in sending acknowledging the message **Cycle Time;** Response time <x seconds (expectation is transaction is real-time) % Automation to be determined by specific implementations % System Availability to be determined by specific implementation **Process (Functionals)** 1) CP/SP enters a structured address for customer and requests address check 2) Centralised database, (i.e. Sam Knows / Broadband Checker / Broadband Finder,) checks address and returns full address information 3) - If fails request address clarification from customer, re-start 4) CP/SP enters parameters for service / location 5) Centralised database checks for compatible available infrastructure and returns details of all serving IPs 6) - If fails refer to manual process

Amended User Story: Provide Service - Address Confirmation and Infrastructure Availability

Transaction Name	As a …	I want to …	So That …	Success Criteria
Provide Service – Request Service Quotations	CP/SP	Obtain quotations from available IP's to provide service at my customers location	I am aware of the full price of obtaining service (s) and delivery. I can decide which IP with whom to place a service order. I can provide the correct service to meet my customers requirements	**Performance (Non-functional)** **Right First time;** Message delivery is successful first time Request includes all the CP/SP's detailed service requirements including any contractual conditions Quotation covers all the CP/SP's requirements including contractual requirements Quotation details the IP's contractual conditions, i.e. valid till, site access requirements etc. %times manual exceptions occur in sending acknowledging the message **Cycle Time;** Quotation sent within agreed time from request % Automation to be determined by specific implementations % System Availability to be determined by specific implementation **Process (Functionals)** 1) CP/SP requests quotations from all available IP's for service / products 2) IP's assess the requirements and produce quotations 3) IP's submit quotation (s) to the CP/SP for consideration 4) CP/SP reviews the quotations and decides which to accept. See "Request Convert Quotation to Order" 5) - CP/SP reviews the quotations and requests additional information 6) - IP (s) provide requested information – re-start at 4 above

Amended User Story: Provide Service - Request Service Quotations

Transaction Name	As a …	I want to …	So That …	Success Criteria
CP/SP Conducts Test and Diagnostics (T&D)	CP/SP	Check a specific service which has been reported faulty	I can diagnose the route cause of any issues with a specific service which I own	**Performance (Non-functional)** **Right First time;** Message delivery is successful first time There is a contractual agreement in place allowing CP/SP access CP/SP updated with all necessary information / test results first time The test results are presented in a clear and simple form Expectation is that CP/SP diagnoses any service fault %times manual exceptions occur in sending acknowledging the message **Cycle Time;** Response time <x seconds (expectation is transaction is real-time) % Automation to be determined by specific implementations % System Availability to be determined by specific implementation **Process (Functionals)** 1) End User reports service faulty 2) CP/SP collects all relevant information, including internal T&D results 3) CP/SP determines or suggests issue lies in IP's domain 4) CP/SP requests test access with all relevant test details 5) IP provides access, test controller ID and temporary security details 6) - IP refuses access – Know problem already in progress, add to Problem Report and return problem details to CP/SP 7) CP/SP co-ordinates with End User if Intrusive testing required 8) CP/SP access's IP test controller and carries out identified test (s) 9) CP/SP reviews test results 10) - If test results not clear, repeat testing 11) - Test results confirm route cause within IP's domain – raise Problem Report 12) - Test results confirm cause within CP/SP domain – raise internal Problem Report 13) - CP/SP find no fault diagnosed 14) Advise End User of outcome and actions 15) End User advises fault still present – refer to manual process

New User Story: CP Conducts Test and Diagnostics

GLOSSARY

'Active' wholesale product – Wholesale access to the network infrastructure through electronic equipment.

Business-to-Business (BtB) Interface – A means by which businesses can automate communication with other businesses.

Communications Providers (CPs) – Companies which provide services to a customer's home, such as telephone and internet services, and which usually own some infrastructure.

Customer Verification Facility (CVF) – A test environment provided by Openreach to enable users to test their own systems' interactions with the EMP interface.

ebXML – A modular suite of specifications that enable businesses to exchange messages, conduct trading relationships and transfer data over the internet, using XML-based messages.

Enhanced Telecoms Operations Map (eTOM) – A framework for telecommunication business processes developed by the TM Forum and recognised by the Telecommunication Standardisation Sector.

Equivalence Management Platform (EMP) – A platform owned and operated by Openreach, including a BtB interface, which allows wholesale customers to buy and manage Openreach products.

Fibre to the Cabinet (FTTC) – An access network structure in which the optical fibre extends from the exchange to the cabinet. The street cabinet is usually located only a few hundred metres from the subscriber's premises. The remaining part of the access network from the cabinet to the customer is usually copper wire but could use another technology, such as wireless.

Fibre to the Premises (FTTP) – An access network structure in which the optical fibre runs from the local exchange to the end user's living or office space.

Generic Ethernet Access (GEA) – An Openreach wholesale product providing an Ethernet connection over either FTTP or FTTC infrastructure.

Infrastructure provider (IP) – A business that owns telecoms access infrastructure.

Local Loop Unbundling (LLU) – The process where an incumbent operator makes its local access network available to other CPs, by allowing them to deploy equipment in the incumbent's local exchange and offering connectivity to the access network.

Machine-to-machine (M2M) gateway – A business-to-business interface involving communications solely between IT systems on both sides.

Next Generation Access (NGA) – Telecoms access networks capable of providing substantial improvements in broadband speeds and quality of service compared to today's networks; most often refers to fibre-based access, but can be based on a number of technologies including cable, fixed wireless and mobile.

Operational Support Systems (OSS) – Computer systems used by telecommunications service providers to support processes such as provisioning services, configuring network components, and managing faults.

Service Level Agreement (SLA) – A negotiated agreement between the provider and customer of a service, regarding levels of availability, performance, or other attributes of the service; may involve agreed penalties if the service does not meet these levels.

Service Provider Gateway (SPG) – A legacy interface used by BT to deliver WLR to wholesale customers.

Sub-Loop Unbundling (SLU) – Like local loop unbundling (LLU), except that service providers interconnect at a point between the exchange and the end user, usually at the cabinet.

Third Party Integrator (TPI) – A company that assists CPs in consuming upstream wholesale products from an IP.

User Story – A technique designed to facilitate the development of telecoms systems, processes and products, describing a particular interface transaction.

Web Service – A software system designed to support interoperable machine-to-machine interaction over a network, typically using XML-based messages.

Wholesale Line Rental (WLR) – A wholesale product that allows a CP to offer voice services to end users using the incumbent's access network.

eXtensible Markup Language (XML) – A set of rules for encoding documents or data in machine-readable format.

CONTACT DETAILS

CSMG is a specialist strategic consultancy focused exclusively on the telecoms and digital media sectors. With offices in North America, Europe and Asia, we work for wide range of companies around the globe in these converging industries.

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