WIK-Consult • Report

Study for the Commerce Commission New Zealand

Comments to the bitstream price benchmarking cost methodology

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1 Introduction

The Commerce Commission (hereafter “the Commission”) is in the process of collecting regulated prices for unbundled bitstream access (UBA) services in overseas jurisdictions and has asked WIK-Consult to review this information and assist the Commission with the benchmarking exercise.

The purpose of the review is to recommend any changes or additions to the data collected in order to obtain benchmark prices for international UBA services that would (or are likely to) reflect a forward-looking TSLRIC outcome for the New Zealand UBA service. As such it is our understanding that the benchmarking exercise may form part of an UBA initial pricing principle (IPP) used to determine UBA prices in New Zealand. We note that the UBA initial pricing principle does not expressly require the Commission to compare the UBA service against similar services. However, it is implicit that the Commission must benchmark against services that are comparable with the UBA service description and hence have the same attributes as those set out in the description of service for UBA in Schedule 1 of the Act.

The Commission has sent out questionnaires to European regulators which have been returned in varying degree of completeness.

Our review should (but is not limited to):

i. assist with filling the gaps in the data provided to the Commission, for example backhaul tariffs and throughput data;

ii. assist with completing the full data set to be obtained from countries that have yet to reply to the Commission’s questionnaire and any additional countries identified by WIK;

iii. advise on the main cost drivers on WBA services for countries using TSLRIC (or similar) cost models;

iv. suggest additional/ alternative approaches to benchmark services similar to the New Zealand service; and

v. suggest an approach to benchmark countries with multiple prices for a particular service speed or technology.

Tasks i) – ii) are related to data collection and verification. Our detailed findings related to the review of the collected benchmark data is set out in a separate spreadsheet. Only a summary is provided in this report. Tasks iii) – v) are specifically related to the mechanics of the benchmarking exercise and the identification of the criteria against which to select the comparison countries to benchmark against. In particular, there is the added complexity and challenge of benchmarking UBA where pricing and product characteristics of UBA can differ between countries and comparability is not immediately apparent.

In the remainder of this report we:

- Provide a summary of data review findings and of the merits of includings the USA in the benchmark (section 2);
- Discuss the cost drivers of UBA (section 3); and
- Review and discuss the tariff structure of bitstream access products in the benchmarked countries and set out options to adjust and or make comparable the various benchmarked prices (section 4).

2 Country analysis

2.1 Summary of findings from European data review

Our main findings on charges are found in a separate Excel spreadsheet. This section summaries the main findings.

Our initial work comprised screening various European countries for eligibility. We screened notifications to the European Commission on regulatory remedies and the latter's responses, decisions of national regulatory authorities and directly discussed with experts of the authorities. In addition, we analysed the cost models used by NRAs themselves where available.

The relevant cost standard for Bitstream in New Zealand is TSLRIC. The initial pricing principle requires that the UBA service be determined with reference to countries that set a forward-looking cost-based price. The Commission has previously relied upon based on a LRIC+ or LRAIC methodology as being equivalent to TSLRIC.[1]

WIK-Consult has screened the following countries regarding their costing methodology. The asterisk (*) marks those countries which the Commission nominated for their initial screening:

1 In addition, the Commission must benchmark the UBA service against the cost in comparable countries. With regard to the latter this report makes no recommendations.

Table 1: Results from country screening

Country	Costing approach	Eligible
Belgium*	LRIC	Yes
Austria	Retail Minus	No
Croatia	Retail Minus	No
Cyprus	Retail Minus	No
Denmark*	LRIC	Yes
Estonia	ECPR national and local level; HC FDC for DSLAM level	No
Finland	None	No
France	FDC	No
Germany*	Ex-post price margin squeeze test	No
Greece*	TD-LRIC for ADSL, BU-LRIC for VDSL	tbd
Hungary*	TD-LRIC for Local BSA; Retail minus for National BSA	tbd
Ireland	Retail minus	No
Italy*	BU-LRIC for the provision of LLU + "economic space".	tbd
Latvia	FDC	No
Luxembourg	Retail minus	No
Netherlands	Low quality: none; High quality: cost orientation	No
Norway	None	No
Poland*	LRIC (HCA)	tbd
Portugal	Retail minus	No
Slovakia	Retail minus	No
Spain*	FDC	No
Sweden*	LRIC	Yes
Switzerland*	LRIC model by Swisscom	Tbd
Turkey	Retail minus	No
UK	Price squeeze tests	No

Source: National Regulatory Authorities, EU Commission

Therefore, our screening leaves the following eight European countries eligible for benchmarking:

1. Belgium
2. Denmark
3. Greece
4. Hungary
5. Italy
6. Poland
7. Sweden
8. Switzerland

Of these we note that Poland uses LRIC but based on historic costs which would appear to contradict the Commission's requirement for a forward-looking approach. Given the EU Commission's comments[2] there remain some doubts about the actual cost standard applied (CCA vs HCA) in Poland. In Greece and Hungary a top-down approach is used. While falling within the family of forward-looking LRIC approaches, top-down models offer challenges in determining truly efficient costs[3]. In addition, Hungary is applying retail-minus to all levels beyond DSLAM access meaning that the only cost-based price point is the bitstream access at the DSLAM. In Switzerland charges are based on a Swisscom (Incumbent) model which has not been reviewed by the regulatory authority.[4]

The prices quoted for Sweden are not directly comparable to the costs that are an output of the Swedish LRIC model as the incumbent TeliaSonera is allowed to mark-up certain bitstream LRIC service costs by between 6-9%. The Swedish regulator PTS terms this "Ekonomiskt utrymme" or translated "economic space", the idea being that additional incentives are given for the move towards infrastructure-based competition. Accordingly, the cost output of the Swedish LRIC model before any uplift for economic space is also provided. Similarly, in Italy bitstream prices have been set starting from the BU-LRIC for the provision of LLU service and adding to such cost an opportune "economic space". The economic space has been set according to the wholesale prices approved by AGCOM before the cost model was developed which was a retail minus

2 We note that the EU Commission in its decision letter dated 23/11/11 concerning "Case PL/2011/1184 *states that the incumbent "was to implement a **Forward Looking Long Run Incremental Cost ("FL LRIC")** model and to set its access prices based on costs incurred*. "

3 Comreg comments on this problem as follows: "A TD cost model uses the accounting information of the operator as a starting point and as a consequence the model is based on an existing network. From this starting point, it is not easy to comply with the principle of maximisation of efficiency as required by LRAIC." Source: Comreg (2008): Proposals for Local Loop Unbundling Pricing Methodologies, p.18.

4 It is important to note that the Swiss regulatory authority BAKOM will only review prices on demand of access seekers! As long as there are no complaints BAKOM will not probe the Swisscom model. Therefore, it cannot be taken for certain that the underlying cost model by Swisscom meets all requirements efficient network cost.

approach. This might be a reason to exclude Italy because the wholesale price is not fully cost-based.

We anticipate that the Commission will want to keep as many countries in the benchmark pool as possible in order to maximize the number of price points. However, regarding said 8 countries some doubts remain.

For the countries that remained from the initial screening the Commission's initial data collection was reviewed and additional information added where necessary. The main findings were:

- There is no benchmarked country with the same product / pricing structure as New Zealand.

- Not one country has adopted the same pricing structure. Each and every country has taken a unique approach, a diversity that appears to be rooted in the network structure and historical pricing practices of the incumbent operators.

- ATM, IP and Ethernet are modelled. In some countries ATM is not available (anymore) or about to be phased out.

- All benchmarked countries report a parent node handover level bitstream product (the only handover provided in New Zealand). However, the Hungarian parent node level price is not cost-based. Furthermore, the parent node handover in Belgium and Switzerland actually happens in every MDF because the first aggregation switch is collocated with the DSLAM. This may pose a problem when comparing benchmarking with the parent node level in New Zealand.
  While Greece, Italy and Hungary have a regulated offer for DSLAM handover, it is our impression that the market demand for this product is non-existent.[5] Most countries also have a distant node or a central core network handover option but sometimes it is not a cost-oriented price.

- Most countries offer a bitstream product that is differentiated by access line speed, i.e. access seekers can buy a product that has certain access line speed capabilities (e.g. 10 Mbps or 20 Mbps). In Belgium, Italy and Switzerland only the access technology (ADSL vs VDSL) matters for the monthly rental charge, thus the access line speed is only addressed implicitly.

- Quality of service parameters are diverse and in some cases unclear or unspecified. While Best Effort is not uncommon there are other options like Low Priority, Medium Priority, Highest Priority, dedicated (uncontended) lines or more specific

5 Unless the incumbent is heavily migrating to NGA and access seekers either do not have the ability to unbundle the copper loop anymore or cannot compete sufficiently with products based on copper unbundling the DSLAM access option is relatively unattractive compared to unbundling.

references like specification of delay times, jitter and cell loss. As we will discuss in Section 4.5 this makes any corrections for quality of service difficult.

- There may be fairly substantial basic set-up charges and on-going charges at a per Access Seeker level. For example, in Sweden an access seeker will pay a one-off charge of SEK 250,000 and annual charges of SEK 50,000.

- Where a backhaul charge for transport between DSLAM and handover point is explicitly defined, this charge may have various units of measurement. For example in Denmark it is measured per Mbps using actual measurements made at the Point of Interconnect, in Belgium both the option of a per Mbit/s charge and a per line charge are available based on the selected product and in Sweden there are charges per month which are dependent on speed (e.g. between 50 – 500 Mbps).

Clearly the heterogeneous nature of the products pose significant challenges to any benchmarking exercise and any normalisation process.

2.2 Comments on merits of including the USA in the benchmark

The Commission also asked for a brief review of the merits for including the United States from the Bitstream benchmarking exercise. Generally, our impression is that it would be hard to obtain useful data on bitstream because of the regulatory framework in the USA. Details on the evolution of the regulatory framework are explained in Marcus / Nooren / Cave / Carter (2011)[6] but a brief overview is provided here.

Regulation of electronic communications in the United States reflects a sharp dichotomy between two legal classifications: *Telecommunication services* are subject to numerous regulatory obligations; *information services* were historically subject to few if any explicit obligations. Contrary to Core Internet services, physical access to the Internet was, historically treated as a regulated telecommunication service. In the early 2000 years bitstream used to exist and was largely regulated at state level. However, all wholesale products together (LLU, line sharing and bitstream) only ever reached 5% of all DSL lines in 2002 and fell back .

The primary reason is the deregulation of the broadband market through a series of decisions and the so-called Triennial Review in 2005. Since then, any network operator who chose to bundle DSL or cable or with Internet access could treat it as an "Information Service", thereby excluding him from nearly all regulatory obligations. Most op-

6 Marcus / Nooren / Cave / Carter (2011): "Network Neutrality: Challenges and responses in the EU and in the U.S.", report for the European Parliament's Committee on the Internal Market and Consumer Protection, section 5.2. http://www.europarl.europa.eu/document/activities/cont/201105/20110523ATT20073/20110523ATT20073EN.pdf

erators, especially the major players, chose to do so and nowadays LLU or bitstream is practically non-existent.

Some telephone companies, especially small to tiny rural ones, still voluntarily *choose* to operate as regulated Telecommunication Service Providers. Thus, there probably are a scattering of regulatory regimes at state level. From our point of view they likely represent small scale and not mainstream service provision. Accordingly, we doubt whether researching comparable regimes would provide meaningful insights for the Commission. Wholesale broadband access effectively does not play a role in the USA.

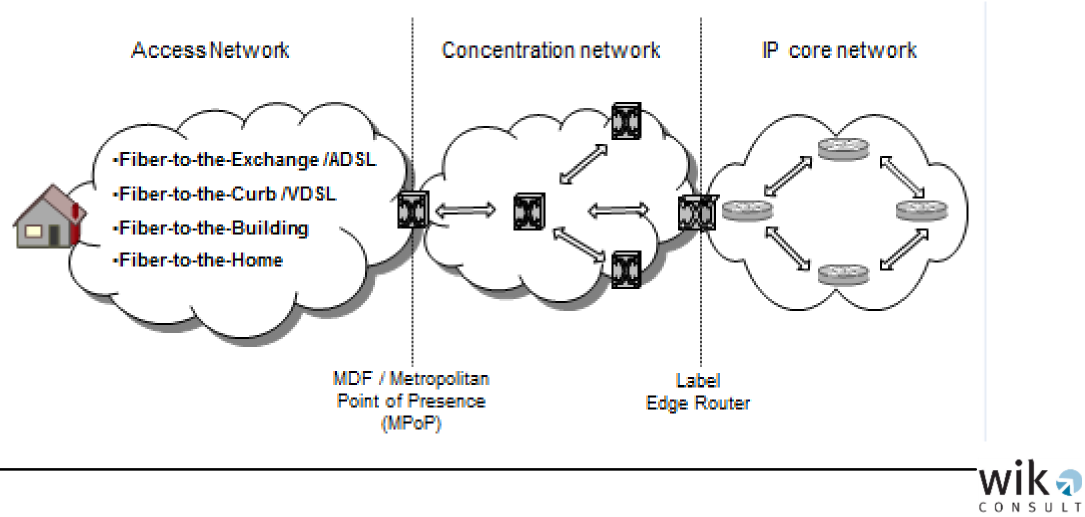
3 Comments on main cost drivers for bitstream services

3.1 Terminology and definitions

Bitstream access is an active wholesale access product that utilises the local loop and the active equipment (the DSLAM for xDSL-networks) at the MDF. In addition it usually includes a transport component from the DSLAM to the handover point from which the access seeker takes over the customer traffic.

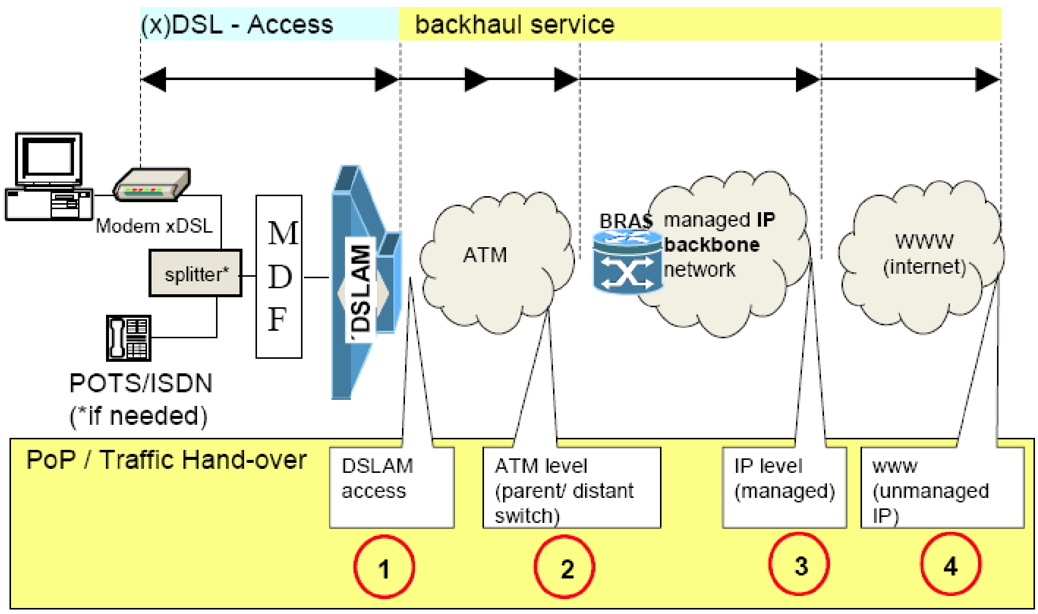
A simple network diagram distinguishes between three large network spheres: the core network, the concentration network and the access network as shown in the following figure:

Figure 1: Broadband network levels



The European Regulators Group (ERG) has used the following figure to differentiate the bitstream products by the level of the handover to the access seeker.

Figure 2: Bitstream schematics according to the ERG



Source: European Regulators Group Common Position on Bitstream Access

A finer differentiation can be realised by looking into switches and facilities on each network level starting on the MDF level where the DSLAM is located. Figure 3 below provides an alternative view, but essentially distinguishes between four different hando-ver points (or levels) for bitstream access:

Level 1. DSLAM access or access at the point closest to the customer. WIK does not know of cases in Europe where competitors are actually using DSLAM access to ADSL2+ from the MDF even though it is part of the reference offer in some countries. However, in some countries (Austria, Italy, UK) it is currently being considered as a replacement product for unbundled access to fibre based access networks called VULA – Virtual Unbundled Access.

Level 2. Parent switch or access at the first (or closest) switch after the DSLAM. Access at this level usually is granted as either ATM[7] or Ethernet.

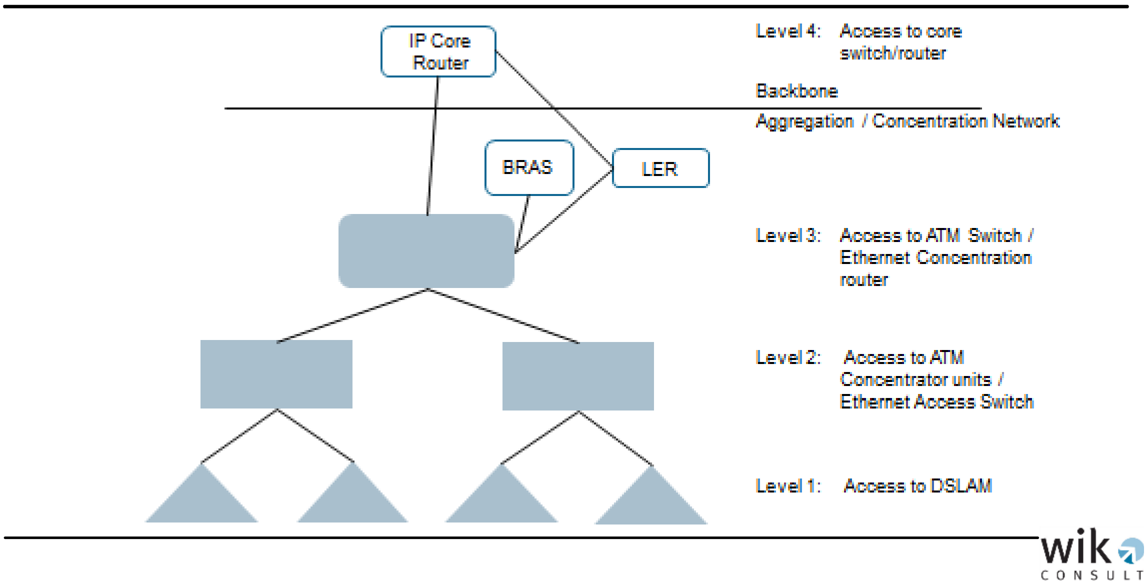
Level 3. Distant switch level or access at the level after the parent switch. Access at this level is usually granted as ATM or Ethernet but can also be IP be-

[7] ATM (Asyonchronous Treansfer Mode) is an outdated technology being replaced by Ethernet

cause the level 2 Switch often is collocated with the IP core router at the same location.

Level 4. Access at core network level. This is the highest possible access point and is usually a highly concentrated handover location (e.g. 1 or 2 locations gathering the traffic from all exchanges of the country). Access is typically IP but could also be ATM/Ethernet.[8]

Figure 3: ATM / Ethernet Broadband Aggregation Network structure



This study uses the term "backhaul" synonymous with "transport from the DSLAM to the handover point" (the “aggregation path” in Chorus terminology). This complies with wording in several European countries. For example Telecom Italia uses the following wording[9] and one may observe the equivalence to Figure 3:

"Backhaul covers the intermediate portion between the DSLAM and the point of interconnect to the Operator's network. The length of this portion may vary considerably, depending on the type of service selected by the Operator. For this purpose, the following options are possible:

- ***Interconnection to the Telecom Italia DSLAM****. In this case the length of the backhaul is practically zero, in that the point of interconnection is in the same location as the DSLAM. This option is available only for Telecom Italia exchanges where there are no lines leased to other Operators under LLU agreements.*

8 The Italian reference offer for the NGA bitstream enables access seekers a central access to an ATM/Ethernet bitstream.

9 Source: Telecom Italia Wholesale website.

- ***Interconnect to the Parent node.*** *The “Parent” node is the first node of the Telecom Italia network encountered when transiting through the network from the DSLAM location. In this case the backhaul portion therefore comprises geographical transport, the characteristics and potentials of which can be differentiated according to the Operator's needs.*

- ***Interconnect to the Distant node****. Any node interconnecting to the Telecom Italia network is considered to be a “Distant” node if it is used to collect traffic originating from access lines terminating at DSLAMs that are not directly connected to the node itself. In this case the backhaul portion therefore comprises a portion of transport between different nodes in Telecom Italia's network.*

- ***Interconnect to the IP (B-NAS) node****. In this case transport to the Operator's network is prolonged until it reaches the backbone of the Telecom Italia IP network."*

We note that "UBA Backhaul Service" provided by Chorus is defined slightly different in that it allows Service Providers to transport their UBA Service from the Chorus bitstream handover point (defined as "Chorus’ first data switch, or equivalent facility, located in the Coverage Area") to their Point of Interconnect. It is also a separate product in New Zealand that may or may not be required depending on whether the location of the end-user is in the same coverage area as the handover point designated for interconnection by the access seeker.[10] In the Chorus terminology the backhaul or transport component of a parent node level bitstream handover as defined above would be the Local Aggregation Path. In order to ensure compatibility with the questionnaires the excel sheet keeps the level numbering as it is (level 1 DSLAM, level 2 parent/distant node, etc.).

3.2 Cost drivers

Cost drivers for bitstream access can generally be divided into two types: those related to the passive network elements and those related to the active network elements.

Cost drivers for the passive network or the access network have been discussed in detail in WIK-Consult's report on UCLL benchmarking.[11] There WIK-Consult stated that one can generally (non-exhaustively) distinguish between the following cost categories for the passive local loop:

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10 In this case "handover point" may have been used ambiguously. Our interpretation is that the bitstream access service is always granted at the parent node (the "handover point") associated with the targeted end-user. If the access seeker does not co-locate at this location then he buys a separate product (UBA Backhaul Service) to connect his chosen interconnection point to the bitstream handover point.

11 UCLL cost drivers and comparability criteria, WIK-Consult (2012), p.3-12.

- *"Network costs such as copper cable, duct and trench, poles, distribution points, manholes etc. Some of these assets may be shared with other utilities of other telecom operator's core or mobile networks. Indeed with the migration to fibre, the legacy copper network and access fibre network will share parts of the network infrastructure in varying ways.*

- *Non-network costs, such as vehicles used by technicians, buildings to house MDFs, computers for preparing technical and financial reports, wholesale billing systems etc. These costs provide a supportive function to the network costs and may be shared in other parts of the network that are unrelated to the access network. These items do not have a direct cost driver based on demand.*

- *Network operating costs such as fault repair, preventative maintenance, power consumption. The main cost categories involved are wages and other costs directly associated with these activities such as tools, insurance etc.*

- *Non-network operating costs are the costs of operating and maintaining the non-network assets. These refer to the costs such as operating buildings (security guards, electricity etc.), fuel and maintenance costs of the vehicles and the costs of administering and billing wholesale services.*

- *Overhead costs such as accounting, human resources etc. are costs that are common to the business of running a telecommunications operator and not specific to the access network or UCLL service."*

The report concludes for the passive access network elements:

> *"Trench length and deployment cost are the two major cost drivers for fixed access networks. This is consistent throughout the screened models and we expect this to be universally so. It was shown that trench length foremost depends on the distribution of customers (and MDF) across the area and how scattering and clustering of customers impacts on the trench length, i.e. it matters where the people are. The cost per meter is influenced by the deployment form, terrain and cost sharing with other infrastructures."*

Non-network costs and overheads will be shared between the active and passive components of the network. Specific cost items that are only related to the active network include DSLAMs, switches and routers and the cost of activating the line. The cost of transport in the aggregation/concentration and core network contains both active and passive components.

As shown in Figure 1 and Figure 3 the purpose of the aggregation network is to concentrate traffic from all MDF locations (level 1) and transport it to the core network. A significant part of the cost of the network is therefore simply defined by the number and location of level 1 nodes that have to be concentrated because every MDF needs to be physically connected requiring trenching. In the real world and in cost models some level 1 node locations (with significant demand) will be chosen to have a higher level function, too. Some of them will also have level 2 facilities and a smaller subset will have level 3 or core nodes collocated.

The number of intermediate concentration levels and the structure of the core network (e.g. just a 1 level "flat" core network instead of a multi-level core network) depend on the specific framework of the country, i.e. the number of level 1 nodes and the number of subscribers and the planning considerations such as the minimum distance between nodes of the same level and maximum number of subscribers per node.

Realising the links between all nodes requires civil works and the passive infrastructure cost drivers can be summarised as the required length, the cost per meter and any sharing of the trench with other networks/utilities. Generally, it is fair to say that - all other factors being equal- the more dispersed the (level 1) nodes are the higher the cost is (especially due to increased trenching requirements). However, the total impact is not as big as in the access network when considering cost drivers in the context of UCLL cost analysis. This is because active electronics are also considered and have a much lower economic lifetime than civil works and hence weigh more when converting from investment to monthly cost.

Generally, bandwidth is the main cost driver for the concentration and core network and an efficient network will be dimensioned according to the required demand. The total service demand depends on the subscribers, i.e. to which level 1 node they belong and what services they demand (bandwidth, QoS) in which intensity. The higher the bandwidth demand the higher the network cost. The technology choice on the transmission layer (e.g. (NG-)SDH or OTN) also impacts on the network cost. The cost-optimal technology depends on the demand level and other framework parameters so it cannot always be stated that one technology is more efficient than the other. However, it is widely accepted that Ethernet is replacing ATM as more the efficient (and less expensive) protocol on the next level.

All previous cost drivers impact on the total network cost but there are also bitstream specific cost drivers. The most important one is the defined level of handover. The higher in the logical network hierarchy the handover occurs the higher the cost of the bitstream is because it uses more resources of the incumbent's network.

The Commission has provided a table (table 1 of the project agenda document) which contains the following cost drivers:

- Technology for access (VDSL, ADSL) and aggregation network (ATM, Ethernet)
- QoS
- Throughput
- Monthly price per line
- Level of bitstream handover

From our point of view this captures the most important cost drivers identified above and hence is an appropriate starting point for collection of information and benchmarking other jurisdictions.

4 Review of benchmarking approach

The UBA service in New Zealand is provided in two ways: Over cabinetised lines and non-cabinetised lines. Where lines are cabinetised the DSLAM is located in the cabinet. In all cases the handover point is at Chorus' first data switch. Chorus offers four variants to the UBA service: a basic UBA service (BUBA), also known as EUBA0 when provided using Ethernet instead of ATM, and three enhanced UBA (EUBA) variants, EUBA40, EUBA90, and EUBA180, which have guaranteed real-time quality of service specifications. The key difference between these variants is the dimensioning to the hand-over (between the exchange and the first data switch). The Commission must determine separate cost-based prices for each variant of the UBA service.

In an ideal world, the Commission would identify perfect matches in the benchmark countries to each of the four bitstream products in New Zealand. However, as summarised in Section 2 bitstream tariff structures and prices are very heterogeneous internationally. Particularly, it is our observation that bitstream tariffs can have some of the following main price components / drivers:

1. Access line: Price depending on the maximum bandwidth (e.g. 25 Mbps per line)

2. Transport between DSLAM and handover point: depending on
   a. The level of the handover point,
   b. the capacity
   c. and/ or the QoS provided

   this component may also be bundled with the price of the access line (1) or the port capacity (3).

3. (Port) capacity at the handover point: depending on the capacity (e.g. 1Gbps)

Outside of the scope of the bitstream access service price there are offers for colocation and realizing the connection between the handover point and the PoP of the access seeker.

The Commission considers that there are likely to be three primary sources of cost differences between bitstream products:

- differences in service and performance characteristics, such as performance expectations, line speed, etc.

- differences in the components of the regulated bitstream service (e.g. additional transport)

- location of the handover.

These are in line with our review of cost drivers and tariffs. In particular the Commission has selected the handover point as the primary differentiator for different bitstream access products. This makes sense in the New Zealand context where there is no access line speed differentiation. However, in most European countries the price for this first component is not flat but depends on the access line speed provided. Furthermore, some countries (such as Greece) only have best effort bitstream services while others (such as Italy) have differentiated and high quality QoS available.

This section first looks at the distinction between passive and active component costs. Then it addresses the question of how to select benchmarking price points when there are potential imperfect matches regarding technology, handover level, access speeds and QoS characteristics. In addition, we suggest an option for transforming monthly or annual capacity cost into cost per line to enable a direct comparison with prices in New Zealand.

4.1 Passive vs. active components

The Commission has used the term Layer 1 to describe the cost of the passive component or UCLS component and Layer 2 as "the additional costs incurred in providing the unbundled bitstream access service."[12] The benchmarking approach is therefore focused on identifying both passive and active component costs.

In terms of the passive component it is our understanding that this will be determined separately based on benchmarking of the UCLS. As such it is important to ensure that the benchmarked charges reflect this and deductions are made where required to the benchmarked charges so that they only reflect the active components.

Our review of benchmarked countries suggests that identification of the passive component is straightforward. It can however, be difficult to assess whether the passive component is or is not part of the quoted charges. Our findings indicate whether the passive component is included or excluded in the quoted bitstream price.

4.2 Different technologies

Bitstream services are currently evolving from the outdated ATM concentration network equipment to a modern Ethernet platform. Beside the technology change in the concentration network, in the access network copper access lines in part or in total have recently started to be replaced by fibre access lines, allowing for higher bandwidth and throughput in the access networks. The improvement of bandwidth by fibre deployment (e.g. FTTC with VDSL) can be included in the benchmark values by defining the appropriate mix of access line speeds (see section 4.4).

12 Schedule 1 of the Act

In countries with distinct prices for ATM and Ethernet in the concentration network we recommend the Commission to focus on the Ethernet prices, since Ethernet is the Modern Equivalent Asset (MEA) technology for the concentration network today[13]. In countries where you find one unique price independent of technology one has to assume that the Ethernet MEA today is the basis of price determination by a bottom-up cost model, thus this unique price should be used for benchmarking.

There also exist WBA products specified by IP as handover protocol. These handover points all are located in level 4 of Figure 3 and therefore are not relevant for the handover points in New Zealand at parent node level. Thus, such products are not eligible as benchmarks.

4.3 Dealing with different handover points

The bitstream product in New Zealand is based on a single handover level at the parent node. Most benchmarked European countries have more than one handover option (except Switzerland) but not all of them have a comparable parent node level handover (Belgium and Switzerland both have the first aggregation switch collocated with the DSLAM in every MDF) or a cost-based price for it (Hungary has cost orientation just for the DSLAM level).

We have identified the following options to deal with the heterogeneity of handover points in the benchmark countries:

1. Determine a simple average for each country using tariffs from all available handover points.
2. Use backhaul tariffs for different handover points to approximate the parent node level cost through subtraction.
3. Use relative cost differences from available cost models.
4. Consider only tariffs with handover at parent node level, the only option in New Zealand.
5. Use all available tariffs and plot a trend line between handover levels in order to approximate an average parent node handover cost. This is the approach sketched out in the Commission's agenda for WIK.

13 Nobody would be likely to deploy ATM in a concentration network today. It may even be difficult to buy any new ATM network nodes today.

4.3.1 Simple average over tariffs from all handover points

One approach is to average across all available bitstream tariffs from all handover points. While this approach is simple it is essentially taking an average over products that are not directly comparable from a costing perspective. In other words, this would be the equivalent of taking an average of different apple varieties. While technically not as bad as averaging apples and oranges, we do not believe this approach would generate a sensible benchmarking point for the Commission and would also be subject to considerable critique.

4.3.2 Using backhaul tariffs to approximate parent node level tariff

Based on correspondence with the Commission it is our understanding that this approach could be helpful when benchmarked countries do not have a parent node level bitstream handover. This approach would involve converting prices of different handover levels to the Level 2 parent node level using information on backhaul tariff / transport component pricing.[14]

For example, where bitstream prices are available at DSLAM level (Level 1) an additional backhaul cost would have to be identified which could then be added in order to estimate the price of the level 2 handover. Alternatively, where prices are available at Level 3 or Level 4 the correct incremental backhaul costs would have to be deducted to approximate a level 2 handover.

This approach assumes: 1) availability of backhaul tariffs, 2) that these backhaul tariffs are appropriate as proxies to either deduct or add to the bitstream prices, and 3) that the unit of measurement for the backhaul tariff is the same or can reasonably be converted to a per line basis.

Based on our review of available tariffs there are three cases in which a parent node tariff would have to be approximated (Belgium, Hungary, Switzerland) because in Belgium and Switzerland the parent node access needs to be taken at every MDF and hence are not truly comparable and Hungarian parent node access prices are not cost-based.

Hungary and Switzerland have no usable backhaul data: Hungary does not have cost-based parent or distant node tariffs and Switzerland only has the "parent node" access option at every MDF and no other options. In Belgium there is a distant node access option for which cost-based prices are available. Under this approach one would need to reduce the backhaul price of the distant node handover bitstream (5 locations in Bel-

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[14] This approach could theoretically also be used to populate a full matrix of price information for all handover levels of all countries in order to maximize the price base for the trend analysis shown in 4.3.5.

gium) by a mark-down factor to approximate the correspondent network level at which handover is granted in New Zealand. However, there is no intuitive and transparent way of determining such a mark-down factor based on the existing bitstream backhaul tariffs.

Alternatively, one could try to "import" the price of parent node level backhaul from the DSLAM from other countries by e.g. subtracting the LLU charge from the parent node level bitstream price. This could be done for all remaining 5 countries and the average could be added to the LLU price in Belgium, Hungary and Switzerland. Obviously, this is quite artificial. With regard to Belgium it might introduce strong distortions considering that the monthly price per Mbps for Ethernet transport between the MDF and the distant node is 1.96€ in Belgium and about 25€ in Italy for best-effort traffic.

Using backhaul tariffs to approximate parent node level tariffs has been proposed as a method when parent node level handover is not available in the considered benchmark country. It is our impression that it is not possible do perform such an approximation for the three relevant countries of Belgium, Hungary and Switzerland due to lack of appropriate data given the specific product constellation in each of the countries.

4.3.3 Using relative per line differences from available cost models

In some of the reviewed benchmark countries backhaul costs are readily visible in the cost models. A good example of this is the Danish LRAIC model that separately identifies the cost of the access component and the core / concentration component on a per line basis for different levels. Based on the model it would therefore be relatively easy to estimate the relative cost difference between different handover points on a per line basis. For example, where a country only has a Level 3 handover price the relative difference from the cost model could then be used to adjust the Level 3 price.

While this approach is fairly simple it does suffer from some drawbacks. Crucially it imports the cost differences from the model used to revise the price and then implicitly places greater weight on that particular country. While it may be possible to use several models to make these adjustments the result is still that greater weight is placed on these particular countries. This holds especially true since (fully parameterized) models are publicly available only for Sweden and Denmark and the relations of these countries would then be applied to all other countries.

This approach is not recommended.

4.3.4 Consider only tariffs for handover at parent node level

This approach takes only those tariffs into account that provide handover at the parent level and ignores DSLAM and distant node level prices. As long as it can be confirmed that the handover level is roughly comparable to that in New Zealand this is a simple and straightforward approach. It should generate a reasonable price point comparison as there is no distortion from products that are not applicable to New Zealand.

This approach is simple, pragmatic and very transparent because it does not require approximations through backhaul tariffs (see 4.3.2) or trending (see suggestion in 4.3.5). It simply matches the product most comparable to the handover point in New Zealand.

However, it has to be noted again that three countries in the benchmark shortlist would not directly allow this approach: First, there is no cost-based parent node tariff in Hungary and second the handover at the first aggregation switch (the definition of "parent node") in Belgium and Switzerland requires the access seeker to collocate at every MDF where he wants to provide service to a customer; there is no concentration (of MDF) occurring as part of the (parent node handover) bitstream service. Accordingly, the parent node handover in these two countries is not directly comparable to New Zealand's parent node handover level because it does not include (parts of) the aggregation network.

Therefore, strict application of considering only (comparable) parent node level tariffs should exclude Belgium, Switzerland and Hungary from the benchmark. We suspect that the Commission would rather find a mechanism to include price points from these countries. If the Commission is willing to go with a smaller sample this will be be our recommendation.

Two adaptions are conceivable that allow adding one or two additional price points to the benchmark:

<u>Adaption 1) Include Belgium and Swiss parent node level tariffs in the sample:</u>

The Commission might simply decide to include the parent node level tariffs from Belgium and Switzerland in the benchmark knowing that the price points are lower than the benchmarked product in New Zealand but valuing a bigger sample of cost-based products higher than close comparability of the two benchmark prices in Belgium and Switzerland.

<u>Adaption 2) Include the Belgium distant node handover tariff in the sample</u>

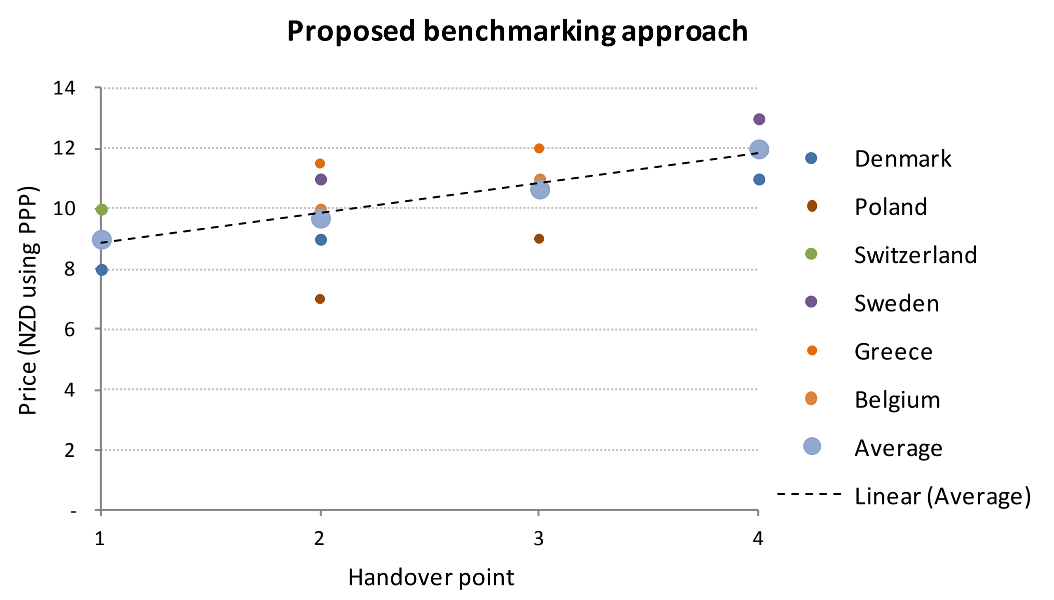
In Belgium one could use the distant node pricing as a proxy instead. On the other hand that means comparing the Belgium network with 5 handover points (distant node level) with 187 handover points at parent node level in New Zealand. However, it is our impression that the relative cost difference between Belgium distant node and New Zealand parent node should be smaller than the difference between Belgium parent node at MDF level and New Zealand parent node level. In other words: The error of choosing the Belgium distant node tariff should be smaller than choosing the Belgium parent node tariff. Treating the Belgium tariff this way still leaves the option of including the Swiss tariff in the benchmark or not. Using the Belgium distant node level price and the Swiss parent node level price might be justified by pointing towards the compensating effect of price overestimation (Belgium) and underestimation (Switzerland). Obviously, this could be a source for criticism but would add two price points to the sample.

The benefits of the basic form or any of the discussed adaptions would be to forego more complicated options such as the one described in the following section (trend line over all handover points). WIK-Consult favours the basic approach and the second adaption over the trend line approach.

4.3.5 Trend line over all available prices on all handover points

The Commission has sketched out an option that involves plotting a trend line between averaged tariffs collected from different countries and handover levels. The Commission also provided the graph below as an example of the proposed approach which would use the trended price point for the handover level rather than only the average of the parent node level handover (in the diagram it seems that this price trend would be a little higher than the average parent node (level 2) handover price).

Figure 4: Proposed benchmarking for different handover points



Source: Commerce Commission

The strength of this approach is its ability to incorporate more price information, not only pricing from countries without cost-oriented parent node level handover (Hungary) or countries where a comparable hand-over does not exist (Belgium, Switzerland) but also all other prices collected for level 1, 3 and 4 bitstream handover. By introducing a linear trend it may be superior to the simple average over all handover levels sketched above under 4.3.1.

However, this also simplifies the cost relation between the different handover points: Effectively, this linear trend assumes equal cost differences between each of the 4 handover levels. That is not true and could be subject to criticism. For example, we suspect that – if distance between the points represented cost weights – the parent node handover point (2) should be much further to the right to account for the large compared to the rest of the broadband network (connection between level 1 and 2 in Figure 3, section 3.1).

Given all the imperfect solutions it is our impression that this approach should be used only if the Commission cannot live with a smaller sample size when using the previous option that only considers parent node level tariffs or any of the adaptions described in section 4.3.4.

4.4 Dealing with multiple access speed price points

In New Zealand bitstream (and retail) broadband products are not differentiated for access line speeds. Since European bitstream offers generally are differentiated according to access line speed, a methodology has to be developed to compare them with the homogenous bitstream products in New Zealand.

This section discusses the following options:

1. Determine a simple average over all speed options
2. Select one representative product based on the average speed characteristics of bitstream lines in New Zealand.
3. Consider only the lowest available access line speed.
4. Weight the different products according to the line speed distribution in New Zealand.
5. Weight the different products according to the line speed distribution in the benchmarked country.

4.4.1 Determine a simple average over all speed options

The most simple approach would consider an average over all available speed options. This might have distortive effects for countries with very different speed options.

4.4.2 Select representative products from each country

In order to select representative tariffs from each benchmarked country a reference product can be defined. This could be based on data on the capabilities of bitstream lines in New Zealand. For example, based on data from Chorus the large majority of lines in New Zealand can support speeds above 10 Mbps. Assuming a maximum of 20 Mbps one could define a range between 10 and 20 Mbps to represent the average speed available in New Zealand. For each of the benchmarked countries one would then select those products which fall within this range and take a simple average to determine a comparable price point. Because data is easily available for both New Zealand and Europe we prefer another option which uses speed categories to weigh all available price points. This is described in section 4.4.4.

It is noted that in Denmark and Sweden the cost models have as an output separate line related cost (access) and traffic related cost (core or concentration network). When setting the price the regulators convert the traffic related costs to different speeds and then add back the access costs to give a total UBA cost with download speed differentiation. In other words, there is an “average” traffic related cost output from the Danish and Swedish models which is independent of speed. This output is not immediately apparent in the Swedish model and would need some re-engineering of the output to obtain, too. However, this information is not available for the other benchmarked countries and hence cannot be used in the current case.

4.4.3 Consider only the lowest available access line speed

New Zealand bitstream products are characterized by a guaranteed throughput which is relatively low (32kbps for the basic UBA service). In light of this an option would be to focus on the lowest access line speed product of European countries using this as the benchmark price. This is a variant of the representative product definition described above which compared European access line speeds with access line speed capabilities in New Zealand.

Obviously, there is a link between access line speed and average throughput provided: the higher the access line speed the more throughput a network planner would account for and dimension the network accordingly. The access line capabilities in New Zealand are (according to Chorus) dominantly in excess of 10Mbps and customers receive the maximum bandwidth their access line can sustain. From our point of view a guaranteed throughput at this low level practically has a best-effort service character. We would assume that the average throughput for (basic UBA) customers in New Zealand is much higher than (the guaranteed) 32kbps.

Furthermore, it appears reasonable to separate access line speed and QoS: An operator may offer a high access line speed product with a best-effort service (e.g. mass market services) and a mid-range access line speed product with a reasonable QoS (e.g. small enterprises). Given the characteristics of the bitstream products in New Zealand we suggest decoupling access line speed and throughput guarantees (QoS) in the benchmarking. Our preferred suggestion for a closer match to the access line speeds is provided in the following section 4.4.4. Suggestions for dealing with different QoS are discussed in section 4.5.

4.4.4 Weighting based on New Zealand speed distribution

Instead of a simple average the Commission could consider a weighted average that takes into account the access line speed distribution in New Zealand. In this case there is the option of using either retail side information (effective speeds sold) or line capabilities (what lines could theoretically deliver given length and other impact factors). Since the retail (and wholesale) pricing in New Zealand does not take access line speeds into account and the Commission has access to line speed capabilities the second source is easier to use.

For any given speed distribution it is possible to allocate the available bitstream offers from a benchmark country to different speed categories and calculate a weighted price based on the speed distribution profile. For simplicity assume that the line speed capability distribution in New Zealand is as follows:

Table 2: Simplified exemplary distribution of access line capabilities in New Zealand

Category	Capable Speed	% of broadband capable lines
A	> 10 Mbps	90%
B	5 to 10 Mbps	4%
C	1 to 5 Mbps	5%
D	up to 1 Mbps	1%

Assume further that a benchmarked country that has two bitstream tariffs, e.g. 2Mbps priced at €10 and 25Mbps priced at €12. Taking into account empty speed categories (category B and D are not represented in this example) in the denominator the weighted price would be calculated as:

$$€10 \times \frac{5\%}{(90\% + 5\%)} + €12 \times \frac{90\%}{(90\% + 5\%)} = €11.89$$

Similarly, for a country with 3 bitstream access speed options, e.g. 1Mbps (€5), 6Mbps (€9) and 12Mbps (€14) the weighted price would then be calculated as follows, again taking account of empty speed categories:

$$€5 \times \frac{5\%}{(90\% + 4\% + 5\%)} + €9 \times \frac{4\%}{(90\% + 4\% + 5\%)} €12 \times \frac{90\%}{(90\% + 4\% + 5\%)} = €\ 11.53$$

This approach is recommended because it accounts for the access line characteristics of New Zealand when determining average prices.

4.4.5 Weighting based on reference country speed distribution

Another way would be to base the averaging on the speed distribution in the country considered. However, this would lead to a benchmark price that reflects the speed distribution in the benchmarked country and not that of New Zealand. In addition, the approach would also require data to be sourced on speed distributions from each country. This approach is not recommended.

4.5 Dealing with different QoS

The Basic UBA Service provides an Access Seeker with an internet-grade ‘best efforts’ bitstream service with a guaranteed throughput of 32 kbit/s. The enhanced Bitstream services have 40, 90 and 180 kbit/s throughput respectively. Basic and enhanced bitstream services also have some limited guarantees for delay and jitter.

Ideally, the benchmark would choose 4 products from each country that have identical QoS parameters. However, the QoS descriptions in the benchmarked countries are not (directly) comparable to these basic guaranteed throughput QoS descriptions of New Zealand. Since QoS and throughput are the key differentiators for the different UBA services in New Zealand any benchmarking approach should adjust for these differences to create comparable benchmark products. In our view the following options are available:

For each of the benchmarking countries

1. Consider only services with the same throughput values
2. Average prices over all QoS classes
3. Try to transform the NZ QoS values into values more similar to the European ones (or vice versa).
4. Only benchmark best-effort services to determine the basic UBA price and determine the enhanced UBA products based on the existing price relation between basic and enhanced UBA

We discuss each of these option in the following subsections:

4.5.1 Consider only services with the same throughput values

This approach involves identifying services which come closest to each of the New Zealand throughput classes. Our analysis of the bitstream offer in the benchmarked countries suggest that this is unlikely to be possible. First, not all offers have specified throughput classes. Second, those that have are not necessarily equivalent to those in New Zealand. Furthermore, any minimum bandwidth found in benchmarked countries is likely to correlate with the access line speed, too.

This approach is not recommended. However, we alternatively suggest to compare European best-effort products to the basic UBA service, even when the European products might not have a minimum throughput value specified (see section 4.5.4).

4.5.2 Average price over all QoS options

The most simple approach would take the average of all observed prices regardless of the QoS class and its similarity to New Zealand. Averaging over all QoS classes will lead to distorted results especially in those countries that have very different, high quality bitstream options that do not compare well with the New Zealand UBA product.

This approach is not recommended.

4.5.3 Transform the QoS values to a common denominator

If the QoS values in New Zealand and in the European benchmark countries could be transformed to a common denominator they could potentially be better comparable.

WIK has developed the concept of “equivalent bandwidth” to deal with QoS in IP network in a bottom-up costing environment. The advantage of WIK’s approach is that the complex theoretic model for dimensioning connection-groups under QoS differentiation is replaced by a limited number of parameters. This allows for a reduction in calculation times while respecting and incorporating the necessary differentiation of QoS.

However, considerable effort is needed to define and apply such a queuing theory based network simulation model and it cannot be guaranteed that the transformed values would actually serve as a better comparability base.

This approach is not recommended.

4.5.4 Only benchmark best-effort services to determine the basic UBA price and determine the enhanced UBA products based on the existing price relation between basic and enhanced UBA in New Zealand

The basic UBA product compares relatively well to best-effort quality bitstream products in Europe. A simple and pragmatic approach could therefore be to determine a benchmarked value for the basic UBA service and subsequently adjusting the value using the current price differential between basic and enhanced UBA in New Zealand to obtain the values for the enhanced services.

One critic that may be raised of this approach is that it implicitly assumes that current price differentials in New Zealand reflect costing differences. This may not be the case and hence further investigation of the current price differentials may be warranted. Nevertheless, this is our recommended approach.

4.6 Transforming monthly / annual capacity price into price per line

In some countries and for some handover levels the backhaul from the DSLAM to the hand-over point has a capacity-oriented price that is not related to an individual end-user; rather the access seeker dimensions this link according to his quality requirements. This price could be transformed into a price per line (per user) when the bandwidth demand per user and the number of users connected to the switch at the handover point is known. These values may be taken from Chorus data to represent New Zealand network structures and bandwidth usage.

According to the bitstream service definition the basic UBA service has a guaranteed throughput of 32kbps. Assume that on parent node switches in New Zealand an average of roughly 5500 users is aggregated per switch. This yields about 5500 x 32kbps = 176Mbps capacity per switch. Assume that the monthly price per Mbps is 18€[15]. In this case the monthly capacity rental per switch amounts to 176Mbps * 18€/Mbps = 3168€. To determine the monthly transport price per user this can be divided by the number of users per switch: 3168€ / 5500 user = 0.58€/user.

In this particular example for the Italian low quality parent node product the results would be as follows:

Table 3: Backhaul capacity price transformation (example with monthly prices from Italy)

WBA price	19.50€
Deduct LLU price	./. 9.28€
Add transformed transport price per user	+ 0.58€
Benchmark price for parent node level access	10.80€

Note: the Italian prices appear relatively high compared to Belgium which is 2€ per Mbps or 0.06€ € per user.

15 Roughly corresponds to the monthly price for the lowest quality Italian backhaul to the parent node.

4.7 Summary regarding benchmarking questions

Summing up the previous discussion we recommend the following approach to deal with the heterogeneity and imperfect matching of benchmarked bitstream products:

- If the Commission could work with a smaller sample size we recommend it consider only those European bitstream tariffs that were reported as parent node level **handover** and optionally choose one of the proposed adaptions to allow additional price points from Belgium and Switzerland. Otherwise, we suggest working with the trend line approach.
- If there are multiple **speed** options use a weighted average according to the access line capability distribution in New Zealand.
- Consider best-effort-like **QoS** in the benchmark product and use this as price base for the Basic UBA service in New Zealand. The enhanced bitstream prices would then be determined on the basis of the relative price interval of current Chorus tariffs.
- If capacity-oriented prices for the **backhaul** need to be converted to a **per-line tariff** this should be done by determining the capacity required to support a New Zealand like network and demand structures. If required, a backhaul price per line can be approximated this way and added to the bitstream charge.