



Services and Applications Guide

Where does the money come from?

Edition 1

World of Applications Committee

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Contents

1.	Why this guide?	5
2.	Foreword	6
3.	Acknowledgements	7
4.	Operator Models and Revenue Splits	8
4.1.	Vertically integrated operators	8
4.2.	Serving only specific vertical segments	8
5.	Over-the-Top	9
5.1.	The Role of Net Neutrality	9
5.2.	Gamechangers: OTT SVOD Services	10
5.3.	Virtual Reality and Augmented Reality, 360 Degree Video	10
5.4.	Who pays the bill?	10
5.5.	OTT Services are not bad, they do drive fibre business	11
5.6.	Compete against OTT services	11
6.	Levelling the playing field	12
6.1.	Competing against US service providers	12
6.2.	First Come, Technology Advantages, Economy of Scale, Funding	12
6.3.	Fibre TV Services competing with Satellite Reception	12
6.3.1.	Payments to collection societies	12
6.3.2.	Retransmission of Free-To-Air channels	13
6.3.3.	Integrating Pay-TV-Channels	13
6.3.4.	Local Recording versus Network Recording	13
7.	Incoming Revenues: Where does the money come from?	15
7.1.	Section “Telco / Inter-Operator Business”	15
7.1.1.	Ducts	15
7.1.2.	Dark Fibre	15
7.1.3.	Wavelength	16
7.1.4.	Datalinks (bandwidth)	16
7.1.5.	Housing/Rack space	16
7.1.6.	Providing Bitstream Access	16
7.1.7.	Special considerations for 3G/4G Mobile Operators	17
7.1.8.	Special considerations for 5G	17
7.2.	Section “Business Services”	17
7.2.1.	Introduction	17
7.2.2.	Services Requirements Summary	18
7.2.3.	Service Level Agreements	19
7.2.4.	Business Internet Access	19
7.2.5.	Telephony Services	20
7.2.6.	Advanced Data links/Leased Lines	20
7.2.7.	Dark Fibre/Wavelength	20
7.2.8.	Housing/Rack space	20
7.2.9.	Hosting / Virtual Servers	20
7.2.10.	Storage Services	21
7.2.11.	Backup Services	22
7.2.12.	Security Services	23
7.2.13.	Virtualized Firewalls	23

7.2.14.	Hosted Exchange	25
7.2.15.	Virtual Desktop	26
7.2.16.	Virtual Machines.....	27
7.2.17.	Replication Services for Virtualized Machines.....	28
7.3.	Section “Consumers/Residential Users”	28
7.3.1.	Introduction.....	28
7.3.2.	Product Differentiation	29
7.3.3.	Internet Services.....	30
7.3.4.	Voice Services	31
7.3.5.	Mobile Voice and Data	32
7.3.6.	TV Services via HF Overlay.....	32
7.3.7.	IPTV Services.....	32
7.3.8.	Internet Security Services for Residential Users.....	41
7.3.9.	Cloud Storage	42
7.3.10.	Gaming	42
7.3.11.	Smart Home Services.....	42
7.3.12.	Smart Metering	45
8.	The Fifth Generation Mobile Network (5G)	46
8.1.	Introduction.....	46
8.2.	What is 5G?	47
8.3.	New technologies and opportunities	49
9.	The Role of IPTV and TV Replay in Switzerland	50
9.1.	How everything started	50
9.2.	Retransmission of TV signals	50
9.3.	Easy Administration.....	50
9.4.	How everything developed since then	51
9.5.	Huge Amount of IP Traffic	52
9.6.	Only fibre can deliver	52
9.7.	Replay TV – Value Added by the Swiss Operators.....	53
10.	Weblinks and References	54

1. Why this guide?

The growing demand for fibre rollouts all around Europe has gained momentum over the past years. We estimate that there are hundreds of fibre projects in various stages of completion on-going at the present time. All of these projects are based on business plans which have taken into consideration both the cost of building and operating the networks as well as the incoming revenue streams. The FTTH Council Europe provides several guides on how to efficiently build fibre networks. Today we are very well aware of the costs to rollout and operate such networks. In addition the FTTH Council Europe also provides substantial knowhow on how to fund projects.

This guide focuses on the incoming revenue streams.
And highlights the basic question “Where does the money come from?”

What services can be provided using fibre networks to raise the ARPU?

What are the revenues from inter-operator businesses?

What are the revenues from business services?

What are the revenues from services for residential users?

What is the impact of mobile networks, looking forward also to 5G?

What is the impact of today’s OTT SVOD services on future revenue streams?

2. Foreword

Welcome to the first edition of the Services and Applications Guide.

Fibre networks offer the bandwidth for an immense range and number of services and applications; to an extent that was unimaginable a few years ago.

The intention of this guide is to group all these applications and list the ones that are most relevant. Some applications are already highly relevant today, but rarely seen from the operator's perspective. We will focus a little more on these.

Fibre networks are changing the way companies build, structure and operate their IT infrastructures thus impacting heavily on traditionally classic IT system integrations. Should they backup or replicate their business data to distant locations? Can they add storage services on demand? Distribute their enterprise applications on virtual servers, some onsite, some operated remotely by service providers. Share applications with their customers and suppliers. Prepare for disaster recovery in the event of ransom ware attacks. There is an extensive range of options that smart operators can consider when developing new business options, and these are not limited to bandwidths and internet access.

Some services will be provided over-the-top. Others will involve a degree of trust between interested parties. Some will require relatively short distances while others need a very low latency. Operators need to be aware of their own strengths and how to position themselves. There is a large number of options that can be available regionally and locally.

This is also true for services to residential users. It is not just about internet. There is a large number of OTT SVOD services available, that "just" require a certain fibre bandwidth, but there are also services that the operators shall provide on their own. Indeed there are several reasons why operators should consider providing those services themselves. One such reason can be a trust relationship for smart home applications, another could be net neutrality regulations that prefer a specific operator over others when providing TV services. Clever bundling might be another motive.

The intention of this guide is to highlight new business opportunities that you may not yet have considered.

The aim is to think about what can be done; and to think about new incoming revenue streams.



Hans Kühberger
Chair of World of Application Committee
FTTH Council Europe

3. Acknowledgements

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4. Operator Models and Revenue Splits

This guide will consider all fibre network revenue streams, regardless of the vertical model.

4.1. Vertically integrated operators

If a network operator is vertically integrated, he is building the passive network, running the network layer and also providing the services. Thus all revenue streams presented in this guide are relevant.

4.2. Serving only specific vertical segments

If the network operator is only building or operating specific vertical segments of the network, then only the respective parts of this guide should be considered. Vertical segments can be:

- Passive Network (building, ducts, fibre)
- Active Network (“enlightening” the fibre, connecting consumers with service providers)
- Service Providers (delivering and operating the applications)

5. Over-the-Top

Many services nowadays can be delivered over-the-top (OTT) - meaning on top of any standard internet access. In the event of an over-the-top model, the OTT service provider is connected to the internet anywhere in the world and the only customer relationship of such an OTT service provider is with the consumer. There are no contractual relationships between the OTT service provider and the network operator.

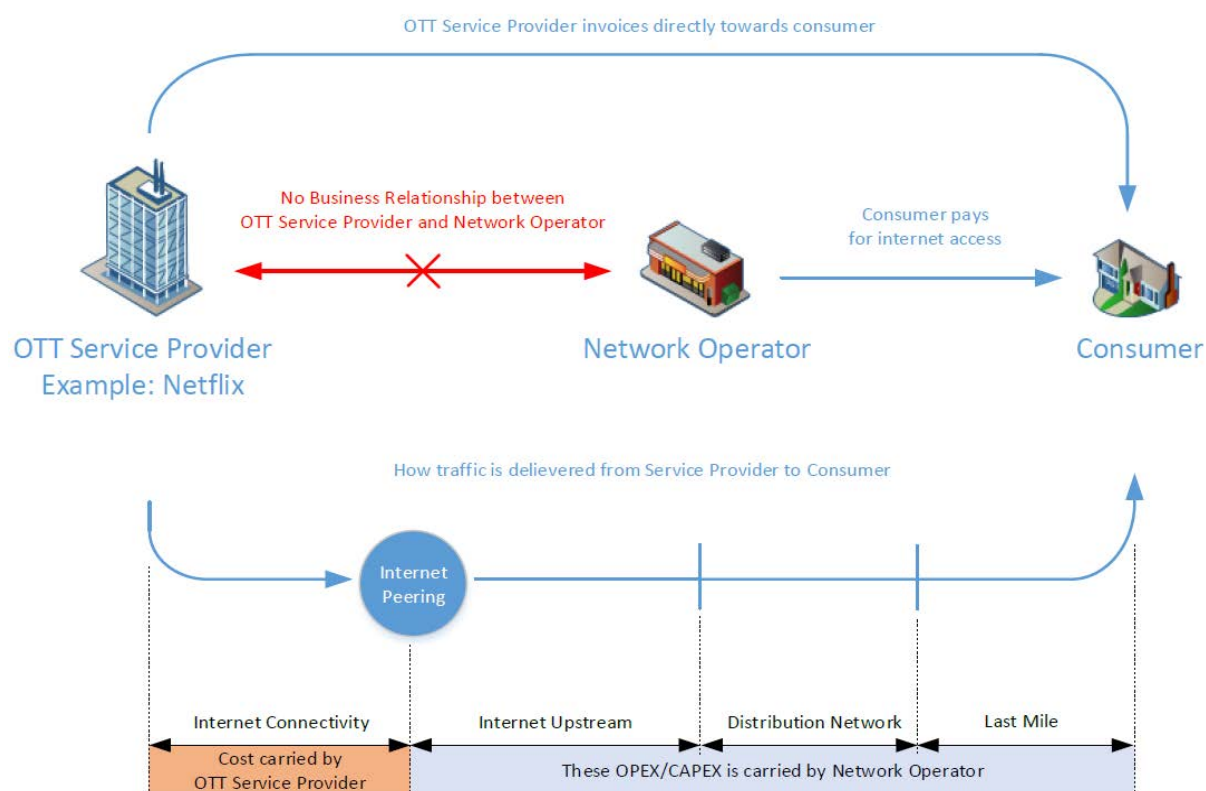


Figure 1: OTT Business Relations and Traffic Flow. Source: Ocilion

OTT is certainly not limited to SVOD services. SIP telephony can be delivered over-the-top. Cloud storage can be accessed via internet and is therefore also an OTT service. Indeed most services that can be subscribed to on the net, are OTT services. This is what makes the internet so successful.

5.1. The Role of Net Neutrality

OTT services are subject to net neutrality rules. A network operator is not allowed to apply transport advantages (priority) or transport disadvantages to specific services. All services have to be served equally. This is not a problem for most services as the majority of them deliver data more or less occasionally and are therefore not dependent on guaranteed delivery.

5.2. Gamechangers: OTT SVOD Services

However, the rise of OTT free or subscription video on demand services over the last few years has changed the game. Services such as YouTube, Netflix or Amazon Prime Instant Video require substantially high bandwidth for hours, even several days a week.

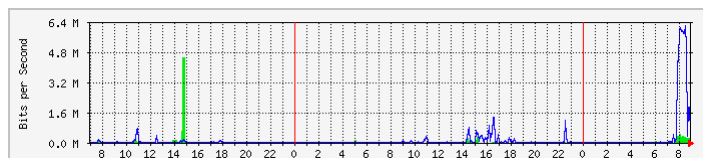


Figure 2: Internet usage of a typical household, right before the OTT SVOD hype started. Source: Infotech

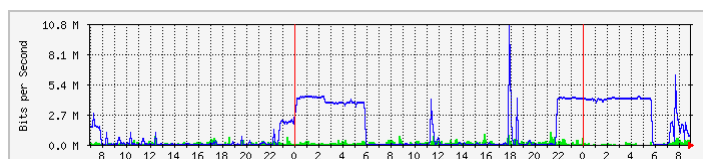


Figure 3: Typical internet usage with OTT SVOD usage patterns. Source: Infotech

5.3. Virtual Reality and Augmented Reality, 360 Degree Video

Virtual reality, augmented reality and mixed reality, as well as 360 degree video are new video options that combine video delivery with device sensors (location/direction). Some of these are expected to be available on operator provided IPTV, like 360 degree for sports transmissions; however the majority will be delivered over-the-top. These services have a high bandwidth demand (and low latency) hence will have a huge impact on the network.

5.4. Who pays the bill?

These new usage patterns drive up the cost of purchase for the operator. He will need to increase his own upstream bandwidth connections; and therefore be forced to reduce internet overbooking. Both these factors are highly relevant purchase calculations of internet service providers.

A matter that has been discussed extensively is why the operator has to pay the bill for the new usage patterns, when the OTT services provider doesn't – even though it is only the OTT service provider that is earning money with such deliveries. This is the result of the last year's net neutrality discussions and is today part of EU regulations.

5.5. OTT Services are not bad, they do drive fibre business

Having taken a closer look, it is clear that OTT does not just drive up the cost of purchase, but also drives the fibre business in total. OTT boosts both, fibre take up rates as well as the average revenue per user:

- Attractive video services such as YouTube, Netflix or Amazon Prime Instant Video are, in many cases, the primary or sometimes even the only reason for consumers to connect to fibre networks. Therefore such services are highly relevant considering the take up rate.
- Consumers pay for the internet access and may also wish to upgrade to a more powerful package.

5.6. Compete against OTT services

However, OTT services can also compete against the operators' own services. And in many cases it does seem difficult for a regional service operator to keep up with big companies like Amazon, Netflix, Google and others.

In many cases there are good reasons for consumers to select the services offered by regional operators, and it is up to the operator himself to help consumers understand and see the advantages:

- For some services there are exclusions from net neutrality, such as TV services. Operators are expected to deliver TV in guaranteed quality; this is a clear advantage against OTT.
- For some services, especially those related to the business sector, the short distance to a local/regional operator is a big advantage. Fibre channel services for example, have a clear limitation in distance. Backup and storage services sometimes need dedicated bandwidths and guaranteed low latency; these can be delivered much more cost efficiently from a local/regional operator
- Consider the trust relationship of a local/regional operator. Whom would you ask to store or backup your sensible data, if you are able to choose?
- In addition, in some states legislation is in place that forces service providers to grant access to its secret services to operator's data vaults. Services located in the USA are not a safe haven for your data.
- Sometimes customers explicitly select services available from local/regional operators in order to raise the operators ARPU, thus helping operators to commit to installing fibre in new regions.

This guide lists various services that can be delivered by local/regional operators. By putting yourself into the shoes of your customer you are able to imagine what would make him choose your services above a competitor.

6. Levelling the playing field

6.1. Competing against US service providers

In many cases European service providers – also local/regional operators – find themselves bound by laws and regulations that put them at a disadvantage to US overseas service operators who are not limited by similar restraints. This means that European and US services operate under different conditions. From a European point of view, it would seem that US services are often advantaged.

European service providers may find they are disadvantaged through existing data privacy regulations. Services which collate user patterns and collect users' private data can combine such data for further deep analysis thus providing very accurate recommendations, even cross market (like Amazon in market place, music and video services).

However, as mentioned above, the stricter European data privacy regulations can also be the reason why European services and in particular services provided by local/regional operators should be considered. It's not always black or white.

6.2. First Come, Technology Advantages, Economy of Scale, Funding

Sometimes it is not existing legislation that gives advantages to US service providers, but simply the fact that those service providers began offering their services much earlier and have been able to further develop their technological expertise. They have also been able to make use of economy of scale and most probably have easier access to funding. The result is that it would be extremely difficult to break into those markets with new competing services. Examples for US service providers are search engines (Google), voice recognition (Amazons echo), and subscription video on demand services (Netflix, Amazon Prime Instant Video).

6.3. Fibre TV Services competing with Satellite Reception

Why should households pay for fibre delivered TV services when TV reception from satellite is available for free in many countries such as in German speaking countries?

Cable operators have been providing TV services for decades. Usually they have focused on urban areas where it is difficult or often even prohibited for households to mount their own satellite dishes.

However, in rural areas, households already receive TV from satellite, so when building fibre in these areas it is very difficult to convince residential users to switch from free satellite reception to a fibre delivered TV service, for which they have to pay. For most European operators, pushing their networks into rural areas, means they often find themselves in a "competition against zero cost" situation. This is especially true in rural areas where it is very important to make use of any opportunity to raise the ARPU to cover the higher cost of building the networks - higher costs due to longer distances in rural areas.

6.3.1. Payments to collection societies

Network operators are obligated to pay monthly fees per subscriber for TV retransmissions. Satellite operators do not.

6.3.2. Retransmission of Free-To-Air channels

Network operators have to sign retransmission agreements for each channel or group of channels, and sometimes even have to pay for channels that are available free of charge via satellite. Also, small operators have difficulty in being granted retransmission agreements.

You may ask if there is any chance of solving this problem. Perhaps yes! If we look towards Switzerland where all FTA channels can be retransmitted by a network operator without having to sign retransmission agreements. Operators are required to pay a retransmission fee to the collection societies, which is equal for any operator in Switzerland, both small and large.

6.3.3. Integrating Pay-TV-Channels

While it is reasonably easy to retransmit encrypted pay TV channels on cable networks, it can be quite difficult to integrate pay TV channels into IPTV service channel line-ups. As always it is a matter of scale; and once again, especially difficult for smaller operators. Usually the incumbent operators are already well integrated with the pay TV operators, making it even more difficult for smaller operators to compete.

How can this situation be resolved? The solution may be that pay TV operators provide standardized provisioning interfaces, rules and procedures, and have an open ready-to-distribute policy.

6.3.4. Local Recording versus Network Recording

Any home user can utilise his personal video recorder to record (and replay) TV shows. The legal framework for this is called “home copy”. Hard disk recorders are mainly produced in the Far East, which means there is very little value add in Europe.

In this context the term “network recording” means that the TV show is no longer recorded at home and instead occurs in the data centre of the TV service provider. The recording itself does not differ from the one recorded at home.

Of course, similar to that of the IT sector, state of the art storage systems are needed and techniques, such as “deduplication” allow for efficient processing of the recordings. Deduplication simply means, that if 100 households record the same specific TV programme, it is not physically recorded 100 times but only once with 100 reference points towards that shared copy. This results in a saving of hardware resources as well as energy, and in addition is completely invisible to the consumer who still sees “his own private recording”.

This all sounds relatively easy, but it isn’t. In many European countries network recording is still not a natural follow-up to the personal recorder. While network recording needs a fibre network to replay the recording in top HD quality, and while network recording has an almost 100% value add in Europe, there are still many legal obstacles in the way. For example, the legislation in some countries does not allow deduplication (shared copy), and some do not allow network recording at all.

In the meantime, millions of hard disk recorders are imported from the Far East every year. These hard disk recorders represent a huge investment, which could be easily diverted to fibre rollout. Network recording and fibre networks would then be logical partners to push broadband rollout.

If we return to Switzerland once again. In 2009 it was decided that local recordings and network recordings should be treated equally. Since then, Swiss operators have been obliged to pay a copyright fee every month

to cover those households using recording services; this is regardless of whether it was recorded locally or centrally. Deduplication is included, of course.

Finally, network recordings provide better recording features than local recordings.

- Advantages for end-user:
 - Multiple concurrent Recordings
 - When recording on the set-top box, the number of channels that can be recorded simultaneously is limited to the number of tuners in the set-top box, or the extra bandwidth available beside the channel that is currently being viewed.
 - With network recording this can be unlimited. For example, in the Netherlands, KPN offers up to 6 simultaneous recordings
 - Multiroom Recording
 - All set-top boxes (and all mobile devices) in a household can record and playback the same TV recordings. For example, start replaying in the living room, continue in the bedroom.
- Advantages for the service provider
 - Save on operational costs
 - Statistically, 5% of the hard disks in set-top boxes fail per year and need to be replaced
 - Generate additional revenues (e.g. KPN in the Netherlands charges an extra 5 EUR/month)

7. Incoming Revenues: Where does the money come from?

This chapter groups and lists several services and applications that can generate revenues for operators.

The chapter is grouped into the follow sections

- a) Telco/Inter-Operator-Business
- b) Business Services
- c) Residential Services

Some services can easily be provided by the operator himself, some are quite complex to build and even more complex to run.

It is always best to consider whether to make or buy. Complex services can run on the operators' own servers in their data centre which is well connected to their own fibre network, and still be built and operated by a supplier.

7.1. Section "Telco / Inter-Operator Business"

An operator provides services to another operator.

In this section the term "customer" refers to the other operator.

Please note that pure passive components also require a service level agreement.

In inter-operator-businesses high availability is usually a requirement.

7.1.1. Ducts

The operator owns available duct systems within its service region and is willing to rent some or parts of the ducts on a monthly/annual basis to the customer.

It is the responsibility of the customer to install fibre units or fibre cables into the ducts.

Rental of ducts may also require access to street cabinets or housing centres.

7.1.2. Dark Fibre

The operator has fibre units or fibre cables within its service region and is willing to rent some fibres for a monthly/annual fee to the customer.

Dark fibre means "without active networking equipment".

This means the customer has to light the fibre with his own equipment.

Renting fibre may also require access to street cabinets or housing centres, and in addition the need to rent rack space for the customers' active components.

7.1.3. Wavelength

Where there is a shortage of fibre and where the customers are required to run their own active networking equipment, the operator can offer to rent out multiple wavelengths for a monthly/annual fee.

The operator can multiply the capacity of a dark fibre by providing optical splitters on both ends. Lasers with selected wavelengths can then transmit data parallel and independent of each other.

This makes it necessary for the customers to run their own active network components, as in the case of the dark fibre.

As mentioned above, renting wavelengths may also result in the need to access street cabinets or housing centres, thus requiring the customer to rent rack space for their active components.

7.1.4. Datalinks (bandwidth)

The operator provides a data link involving certain technical parameters such as bandwidth, maximum round trip time, jitter, committed information rate (CIR) and interfaces to the customer for a monthly fee.

The higher the data rates and the higher the technical requirements, the higher the monthly fee.

Using data links instead of dark fibre or wavelengths does make sense if the bandwidth/technical requirements are comparably low, if the customer cannot or does not wish to run its own active components due to commercial or technical reasons, or simply if there are no dark fibre or wavelengths available.

7.1.5. Housing/Rack space

The operator provides housing capacity/rack space to the customer for a monthly/annual fee. Housing capacity or rack space can be provided in datacentres or in street cabinets.

The term “housing” is used for one or multiple full/half racks.

The term “rack space” usually refers to relatively low demands. A metric rack unit is 44mm and a full rack offers 40-45 rack units.

Providing housing capacity/rack space results in physical access to the datacentre/cabinet with accompanying rules in place. Housing and access also result in extended security measures that include video monitoring.

In addition to the housing capacity/rack space, the operator has to provide uninterruptable electrical power, cooling, physical security and of course access to outgoing data links/wavelengths/fibres/ducts.

7.1.6. Providing Bitstream Access

The term “bitstream access” is used to describe a highly standardized and efficient delivery of IP data from central backhaul interfaces to multiple endpoint access interfaces aimed at residential and business users. Each endpoint is assigned a profile describing the technical parameters, including bandwidth and quality of service.

The operator provides bitstream access to endpoints against a monthly fee per endpoint. The size of the fee depending on the profiles selected. The operator also provides central backhaul connectivity against a monthly fee, based on the number and type of required backhaul interfaces (e.g. 10Gig interfaces).

The term “virtual unbundling” can be used instead of “bitstream access”.

End-user access lines could be fibre – both point-to-point and GPON – as well as ADSL/VDSL copper lines. The term is used for wireline connections only.

7.1.7. Special considerations for 3G/4G Mobile Operators

There are a number of special considerations if the customer is a mobile operator.

Mobile operators have to connect their distributed wireless infrastructure with their central routers and switches. There are a relatively low number of antenna locations for 3G/4G networks, as the required bandwidth per antenna location, compared to 5G, is still low. Previously, mobile operators used professional wireless links to connect this type of antenna location, however they are moving more and more towards fibre wireline connections. Operators can rent ducts, dark fibre, wavelengths or data links to mobile operators. It is expected that in the coming years all mobile operators will go for 5G.

7.1.8. Special considerations for 5G

Compared to 3G/4G, the next generation of mobile networks – 5G – does require higher bandwidths and a substantially higher number of antenna locations. Both higher bandwidth and increased antenna locations make it more difficult to run professional wireless links. Finally only fibre can deliver the required bandwidth and density. 5G has a big overlap with FTTH networks, as it not only requires higher antenna density thus generating higher rental fees for the provision of backhaul access to the antennas, it also competes to a certain extent with direct FTTH internet access residential user revenues. Residential users that do not require the full FTTH bandwidth power may find it sufficient using a 5G wireless link instead.

See also chapter 8, special considerations for 5G.

7.2. Section “Business Services”

7.2.1. Introduction

Long before real fibre-to-the-home was even talked about, businesses and enterprises required bandwidth, security and availability that could only be provided by fibre. So it is not surprising that today there exists a broad range of business services that generate revenues for network and service operators.

These business services are consuming a growing market share from the previously traditional IT business sector.

File servers, backup, security and many other services which had, up to a few years ago, been running using the company’s own servers and operated by their own staff, are now more likely to be operator-services that a business can subscribe to on demand. Previously businesses invested in hardware and license software, now they spend the money on monthly fees for their chosen services.

This opens up a new and exciting market share for operators and offers fantastic opportunities for growth. Even if these business services are provided by other service operators, they still require high bandwidths, low latency and high availability – capabilities only fibre can deliver.

7.2.2. Services Requirements Summary

Accessing the internet

Upon closer consideration, the basic requirement for internet access for a company is not that basic anymore. High availability, service level agreements, redundant fibre links, even multi-homed internet access, are just some of the many options available. The good news is, only fibre can deliver.

Company Internal Multisite Networks – Connecting Company Sites

Basic point-to-point or more sophisticated private multipoint networks are still commonly used, offering inbound security, well defined and guaranteed bandwidth as well as round-trip capabilities, all regardless of the internet usage of anyone outside the company. However those direct links do come at a price. Thus today, they are more often being replaced by VPN site-to-site links, requiring just a “normal” internet link on the left and right hand side. VPNs by design do not provide guaranteed bandwidth, nor guaranteed round-trip times, and they are just as secure as the VPN devices and standards and configurations used. And they do need high bandwidth internet access on all sites.

Storage and Backup

Being able to provide high bandwidth access makes it possible for servers and storages to be physically located not only within the internal network, but also at any other location outside the company. Only fibre links provide the 100 megabits, the gigabits and the 10gigabit links that are necessary to allow such scenarios to develop and grow. Always relevant in such considerations are security and availability. Security not only address the obvious threats by hackers, but also threats by other countries secret services. It is wise to bear in mind the very recent discussions regarding Microsoft being forced by US agencies to provide access to customers’ data vaults with the aim of fighting terrorism. Edward Snowden should also be remembered. European data centres changed their services to include “Stored in the EU”, and often the local network operator has a much better trust relationship with the customer than any global player or anonymous storage host. Regarding availability, it has become obvious that a relatively short link to the local operator usually means fewer options to fail than a link to a provider located at the other end of the world. So in both aspects, security and availability, the local operators quite often offer substantial advantages in being the better trust partner in terms of storage, backup, remote servers and security. Network operators that can combine their networking resources and their IT storage, backup and computational resources into fully packed services usually do a very good job, thus making it difficult for international conglomerates to compete.

Capacity on demand

Cloud based storage, backup and computational resources can be chosen on demand; making it possible, if and when needed, to double storage capacities at short notice or add computational power for extensive calculations that are necessary for a short period of time; or backup to a remote site providing enough capacity whenever it is needed. All of these services require extensive bandwidth for cloud service connection. High bandwidth, low latency and high availability are only possible using fibre.

Any Place, Any Time, Any Device

Accessing business applications from any place at any time using any device are requirements of a growing number of enterprises. Either the enterprise chooses to buy virtual desktops from the cloud, or alternatively, runs its own cloud services, but as always it is only fibre that can deliver.

7.2.3. Service Level Agreements

Businesses are very dependent on connectivity and insist on high availability and explicit service level agreements. Operators need to be prepared to meet these growing demands. Services are more expensive if higher service level agreements are requested, or if the level of services in an agreement are charged separately.

Example of differentiation of various service levels:

	Bronze	Silver	Gold	Platinum
Contact Hours	Mo-Fr 07:30-17:00	Mo-Fr 07.30-19:00	Mo-Sa 07:30-19:00	Mo-So 00:00-24:00
Availability	99,30%	99,50%	99,70%	99,90%
Response Time	<= 4h	<= 4h	<= 3h	<= 2h
Upfront info to maintenance windows	1 day	3 days	7 days	7 days
Repair outside contact hours	Extra Charge	Extra Charge	Extra Charge	Included

7.2.4. Business Internet Access

Many smaller businesses often raise the question as to why they are charged a higher rate for internet access than a residential customer, even though both have access to the same bandwidth.

How can business internet access be differentiated from residential internet access?

In reality, most businesses have substantially higher requirements towards internet access than residential users. They are often prepared to pay a premium if their higher requirements are addressed and fulfilled. Operators need to be prepared to fulfil these higher requirements. Such requirements can include:

- Professional Network termination devices (CPE)
- Bandwidth upstream/downstream
- Symmetric access
- Data transmission Policy (unlimited, fair-use, included transmission volume in GB/TB)
- Included official IP addresses
- Guaranteed availability/Service Level Agreements
- Redundant fibre links for premium availability
- Multihomed access (independent BGP AS)
- Technology (for example, point-to-point instead of GPON for residential user)
- Lower latency
- Monitoring/Alerting
- Included IP services (email, domain name services, web space)
- Add-on services, such as security, secure mail, secure web etc.

7.2.5. Telephony Services

A large number of businesses and enterprises still maintain an extensive number of wireline calls.

Operators can provide wireline telephony services via fibre link on a monthly basis with additional voice minute charges.

Telephony services that have been delivered via POTS/ISDN interfaces previously, are nowadays based on IP SIP protocols and SIP trunks.

Operators can provide the voice links only, or alternatively extended telephony services that include a complete virtualized voice switchboard.

7.2.6. Advanced Data links/Leased Lines

Operators provide private data links to connect company sites or to connect one company with external business partners.

Private data links are provided on a monthly fee basis, with the price depending on parameters such as bandwidth upstream and downstream, committed information rate (CIR), committed maximum latency, availability, technical interfaces etc.

Private data links can be point-to-point or a multipoint mesh.

Private data links are completely isolated from internet traffic.

7.2.7. Dark Fibre/Wavelength

Sometimes businesses require dark fibre connections or even private wavelengths.

One example is a fibre channel cross-site connection that is commonly used for storage systems.

Therefore operators need to be ready to provide dark fibre or wavelengths for a monthly fee.

7.2.8. Housing/Rack space

Businesses also ask for external housing, for example, to run a replicated storage system at a safe distance from the company's head office.

This involves the same rules and parameters as providing housing/rack space to telcos.

7.2.9. Hosting / Virtual Servers

Hosting involves an operator running specific services (e.g. a web services or a virtual server session) on operator owned hardware. Customers pay per month and service, depending on feature and capacity.

Operators can run multiple hosting services on each individual server, so renting a hosted service is usually much less expensive than buying/renting the full server.

For security or availability reasons businesses are interested in running specific applications on separate virtualized server instances. Such applications do not often require extensive resources but they need to run in a separate “sandbox”. Operators can provide the necessary virtualized server instances at a monthly rate, based on allocated CPU, RAM, disk and networking resources.

7.2.10. Storage Services

Operators provide disk storage capacity on demand.

Businesses pay a monthly rate, depending on capacity and technical parameters.

Pricing mainly depends on storage technology used: Superfast, solid-state disks (SSD) are more expensive than traditional SATA disks. Archive type storage may only require cheaper SATA disks, whilst others are best served with SSD speed.

The use of deduplication technology increases the efficiency of storage space usage, as it saves the same file only once.

Storage can be provided to a client’s private interface or to the public internet.

Private storage may be used to replicate internal data or to backup internal data to external locations, without running into internet-like security threats.

Storage can also be provided to any authorized client on the public internet, combining the flexibility of cloud storage with the access-from-anywhere feature.

7.2.11. Backup Services

The operator provides backup-as-a-service to the client company and replaces onsite tape-based backup solutions. The client only has to install encryption client software to the relevant servers and setup the encryption key. Whenever a backup or recovery is requested, the data will already be encrypted at the client's server and only leaves the company as an encrypted version. Operators do not know the encryption/decryption keys.

Backups can be disk based or tape library robots based.

Backups can be multi-staged, for example, disk based overnight from the clients server to the operators backup storage vault and further replicated to tape on a third location.

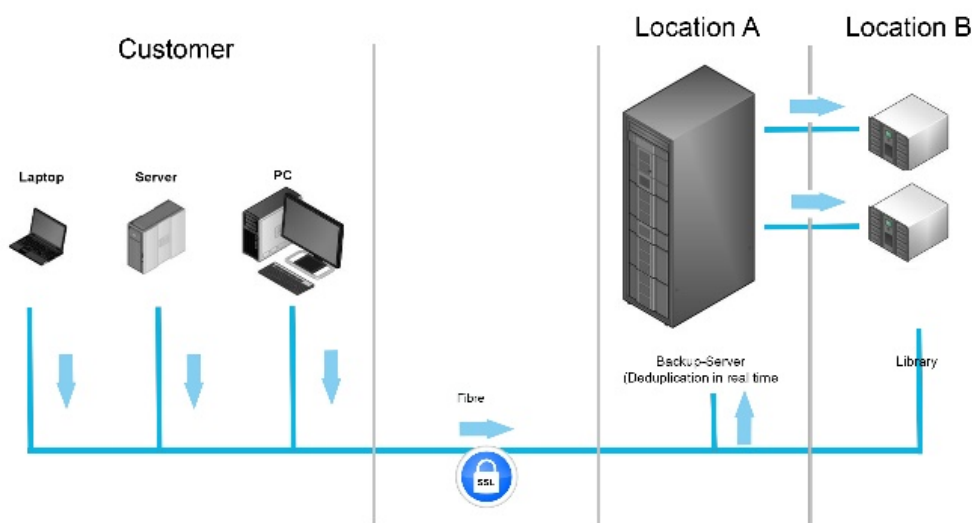


Figure 4: Multistage Backup as a Service. Source: Infotech

Companies look for operators whom they can trust both in availability and security perspective, and local/regional operators usually have a very high trust relationship with customers.

Companies seek backup services in their own state or at least within Europe.

Some companies have only very short daily operational windows for backup thus they may prefer the multi-staged approach where stage 1 is a rapid disk-to-disk copy procedure.

A number of companies require “continuous operation while backup” features, if the operation requires a 24h per day uptime no backup window may be available at all.

Companies may ask for backup of servers, but can also ask for client backups.

A company may ask at any time for a recall of operator backed up files.

Companies can select the minimum number of file versions or the minimum number of days a backup shall be available, which in effect means they have a customised service.

7.2.12. Security Services

Demand for security services is very high and in some cases it makes sense to have them outsourced, but at a close distance. This is another revenue opportunity for operators.

7.2.13. Virtualized Firewalls

Operators can run virtualized firewalls to protect company servers from outside threats.

7.2.13.1. Application Gateways / SecureMail

Operators can provide application gateways to secure a customers' incoming and outgoing email traffic.

Unprotected incoming emails are a major security threat for any company and definitely need to be covered, either internally or by an external SecureMail service.

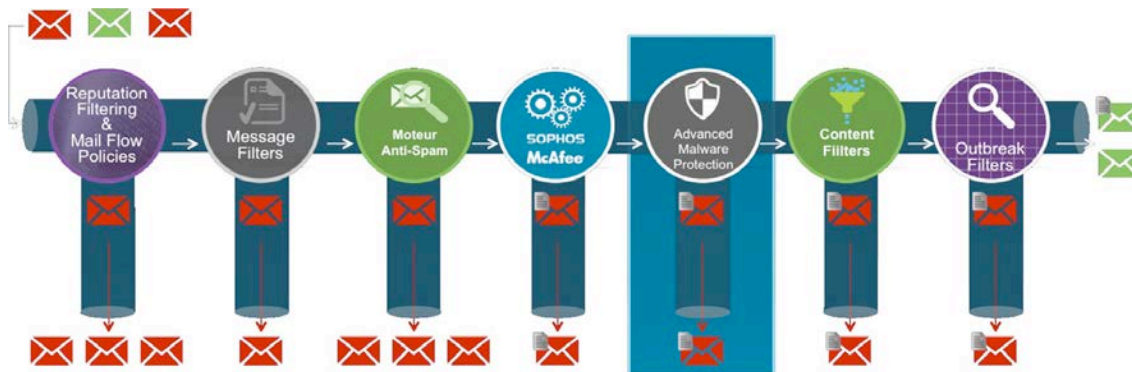


Figure 5: Email Security as a Service. Source: Infotech

Current SecureMail services include a series of protection mechanisms that pass through any incoming mail in an automated workflow. Identified threats are either deleted or quarantined.

Features available are virus protection, spam protection, malware protection etc.

Optional features are email signature and email encryption.

7.2.13.2. Application Gateways / Secure Web

Operators can run an application gateway for outgoing client web requests.

This type of application gateway can run on real-time URL filters both for security reasons (avoids downloading/accessing security critical content) and to enforce company web usage policies. Such policies can, for example, block pornographic content or limit usage of social media to certain times during the day.

Further features that can be included are:

- Application Visibility and Control
- Virus scanners
- Reputation-Based Malware Protection
- Time-Based Policies
- Proxy Caching
- User-Based Rules
- Active Directory Integration



Figure 6: WebSecurity as a Service. Source: Infotech

7.2.13.3. Authentication services

Operators can run token-based authentication services to enforce enhanced access control.

Companies rely on secure access to company resources and sometimes need strong authentication measures in place; authentication that goes far beyond simple username/password credentials. Extended token-based security can also be implemented as a service.

Once authentication has been confirmed, data transmission is protected by strong VPN encryption.

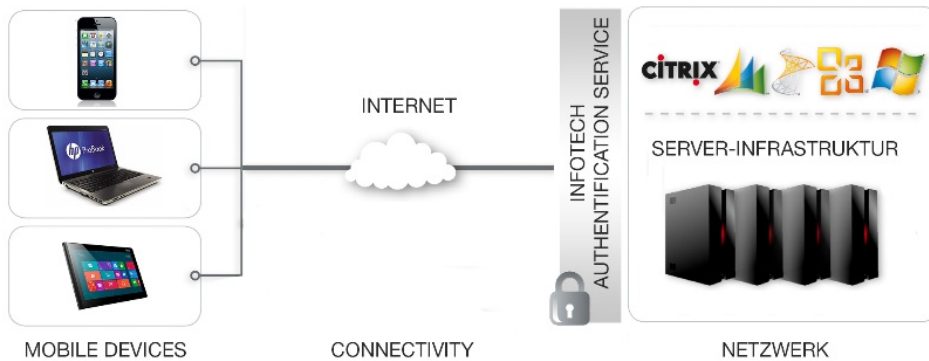


Figure 7: Authentication as a Service. Source: Infotech

To gain access, users are required to sign in with password and token. Tokens are provided by hardware (such as RSA secure tokens), by app (mobile) or can be SMS-delivered and are always dynamically generated and have a life span of a few minutes only.



Figure 8: Authentication Devices, Messages, Apps. Source: Infotech

7.2.14. Hosted Exchange

Operators can run a hosted version of Microsoft Exchange charging a monthly fee, per account.

Companies can have access to all features of Microsoft's well known email messaging system, from all relevant clients.

Hosted Exchange can be successfully combined with SecureMail services.

7.2.15. Virtual Desktop

Operators can run a virtual desktop service based on Microsoft or Citrix Software Technology. Services are billed per account and number of months. Application software licensing can be included.

The virtual desktop can be opened anytime, anyplace and on virtually any device. Virtual desktops are linked to virtual servers and storage and these services not only provide applications, but also the customer's data.

A backup service for the company's data can also be added.

Virtual desktop solutions further allow for flexible scaling from 1 to thousands of users, negating the need to re-dimension the company's internal server infrastructure.

Virtual desktop solutions are secure, as no data is stored on the actual local devices.

Client software installation and updates are managed centrally avoiding update delays.

7.2.16. Virtual Machines

Operators can run virtualized server machines for customers, based on a monthly rate.

Companies tend to distribute their server applications to smaller virtualized machines that are well sandboxed from each other. There are a number of security reasons for this, but also there is great demand to keep independent software separated from each other instead of installing all software on one central server, as has been the case in the past. As a result, if for some reason one software fails to work, or has increased security threats, only the virtual server that houses the particular software is impacted.

Virtual machines are independent from the physical server below and can easily be moved from one server hardware to another or from one site to another using fibre links connecting the sites.

Virtual machines can be efficiently combined with storage and backup services

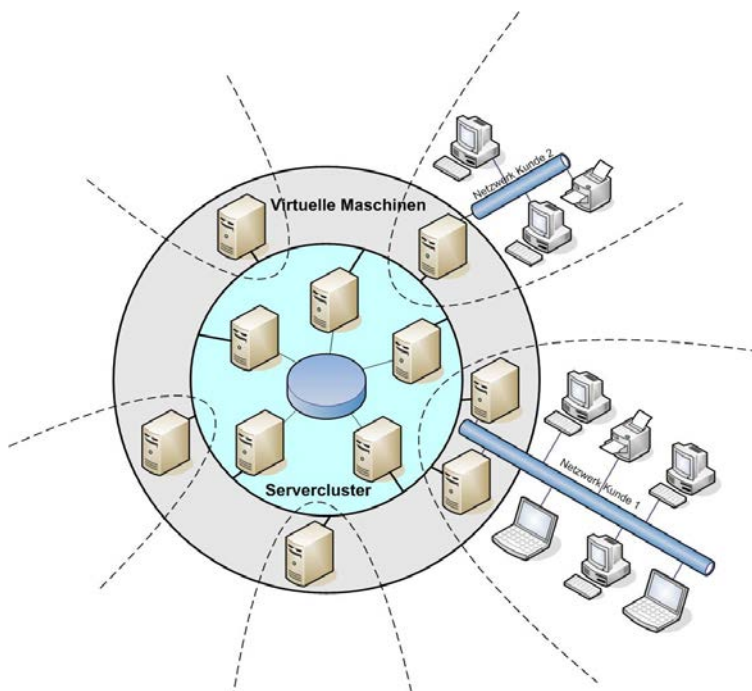


Figure 9: Schematic diagram of Virtual Server Domains. Source: Infotech

For many customers it is mandatory to run their applications and store their data on systems located within the European Union, and choose to work with an operator they have an excellent trust relationship with. Local/Regional operators that can also provide necessary fibre links are a perfect choice.

Operators also have options to license software for virtual servers on a monthly fee basis.

7.2.17. Replication Services for Virtualized Machines

Finally, if a company teams its own virtual machines with operator hosted virtual machines, connecting them together with fibre links and building an automated failover management on top of it, this is a perfect redundancy for high system uptime. In such setups, not only is the data mirrored to two locations, but also the virtual machines. Scenarios can be completed with operator provided storage and backup.

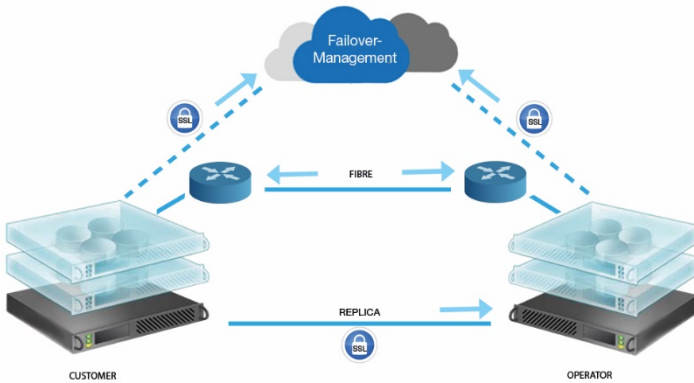


Figure 10: A company's Virtual Machines, live replicated to an Operator Virtual Machine Service.

Source: Infotech

7.3. Section "Consumers/Residential Users"

7.3.1. Introduction

Serving residential users with fibre access can be a difficult business case, given the high costs to build a fibre network and the low ARPU that can be expected from residential users. Any additional services that help to raise the ARPU are always highly welcome.

In addition, established networks service portfolios can be extended to improve the existing business case.

This chapter lists a few of those services aimed at residential users and provides additional business case comments.

This chapter will also cover options to differentiate from competition in the race for the residential user. Differentiation is important as not only ARPU matters, but also take-up rate.

7.3.2. Product Differentiation

7.3.2.1. *Differentiate from Copper (ADSL, VDSL, VDSL vectoring and G.fast)*

To differentiate fibre Internet from copper seems to be easy. Endless bandwidth is now available on fibre, both upstream and downstream; in comparison copper networks only offer very limited bandwidths. The latest standards for VDSL vectoring and/or G.fast for example, can deliver very high bandwidths of 100Mbit and even more to the residential user, however, the distance from DSLAM is very limited, several 100 meters only for the higher bandwidths. The maximum available bandwidth then drops rapidly to 30Mbit at apx 1km and lower the greater the distance. Upstream bandwidth is limited to a few Mbit only, which is substantially below fibre. Compared to that, fibre has no relevant bandwidth degrading at all, 100Mbit or 1Gbit upstream and downstream can be easily delivered on distances exceeding 10km with today's technology. And if 10Gbit is required in the future, it will be just a matter of replacing the active components. Choosing between fibre and copper is simple if the residential user asks for a bandwidth of 100Mbit or above. However, the choice may still prove tricky, if the user prefers his VDSL link, feels comfortable with 30Mbit downstream and 3Mbit upstream and is unwilling to pay more than his present level. Fibre can win with performance, but won't win a price fight with VDSL. However, as soon as 30Mbit is not enough, the customer will be more interested to change products.

7.3.2.2. *Differentiate from Mobile Internet (3G/4G)*

To differentiate from Mobile Internet (3G/4G), it will be necessary to make sure the user understands the term "Shared Media". Wireless connections are always a shared media. If only a few customers make use of the internet access, it is amazingly fast, however if customer numbers start increasing, with more and more using mobile internet and connection from the same base station, internet performance can drop dramatically. Unfortunately, it is not possible to predict the level of internet use of neighbours at any given time. Those residential users that have experienced a degradation in shared media are more likely to be positive to fibre internet. This differentiation is of course only valid for mobile internet that is used as a wireline replacement. There is a clear advantage for mobile internet services if it is to be used on mobile devices, such as smartphones or tablets outside the home.

In the home, state of the art WLAN with a powerful fibre internet remains the better choice.

7.3.2.3. *Differentiate from DSL IPTV*

Delivering IPTV via DSL requires the TV signals to be transcoded to a lower and constant bitrate. As physical DSL bandwidth degrades with rising distance from the DSLAM location, efficient video transcoding is very important in order to reach the maximum number of homes around a given DSLAM. If the TV signals target bandwidth can be reduced by 50%, it will be possible to increase the potential households by a factor of 4. However, reducing the bandwidth also reduces the quality of the TV signals.

Thus usual IPTV solutions on DSL networks offer deficient TV picture quality.

There is no reason for fibre networks to down squeeze the quality.

Fibre can deliver the best TV signal ever seen.

An additional drawback for DSL based IPTV is that multiple TV sets require multiple concurrently delivered TV signals. A further limitation that results in low bandwidth. If an IPTV set-top box is used to view a local recording, another TV signal has to be delivered in parallel – if that is still possible. If not then it may not be possible to record the programme on a local hard disk.

7.3.2.4. From Terrestrial TV reception (DVB-T and DVB-T2)

Terrestrial TV distribution always offers fewer TV frequencies and even when using the better video codecs, like HEVC, there is a maximum limit of around 20-30 SD channels, or even less for HD channels. To squeeze more channels into a given DVB-T transmission system, encoding needs to be reduced thus affecting TV picture quality.

Compared to terrestrial TV, Fibre TV can deliver a limitless number of channels with the best HD TV picture quality available from the broadcasters.

Other than DVB-T, which is broadcast, fibre TV can build on a bi-directional connection allowing for on demand services, whereas DVB-Ts broadcast is good for live TV transmission only.

In the past, analogue and DVB-T reception was free of charge, but this is changing over time – as even DVBT infrastructure has to show a return on investment. Therefore, DVB-T/DVB-T2 is often no longer free and a switchover to fibre based TV by the residential user, is now no longer economically negative.

7.3.2.5. Differentiate from TV satellite reception (DVB-S)

When satellite TV reception is free of charge, as is the case in German speaking countries, it is difficult to sell fibre based TV.

But even here fibre has the power to win the race.

While satellite is a broadcast-only transmission and therefore limited to live TV signals, fibre based TV services can make use of the bi-directional connection, and also the unicast bandwidths to each individual users' TV device. Fibre based IPTV services can provide not only live TV, but also deliver a wide variety of network recorded content (pause/resume, single recording, replay recording) at any given time. An additional advantage of fibre networks is that such IPTV solutions can also ask for additional information, such as still images or additional extra text/data when describing a TV show on EPG. And fibre will also deliver VOD to IPTV set-top boxes, at any time and always in the best quality available.

7.3.3. Internet Services

For most residential users, highspeed internet access is the main reason to connect to fibre. Fibre easily provides 100Mbit/sec or even 1Gbit/sec downstream bandwidth, and the same upstream.

Asymmetric internet bandwidth (high downstream, “low” upstream) is still quite common for residential users, although fibre itself has no specific limitations in upstream direction. Reasons why asymmetric bandwidths are offered can be found in the technology and in product differentiation.

- GPON technology provides very high downstream bandwidth but limited upstream bandwidth. GPON is somewhat cheaper to implement than point-to-point, as it only requires one central upstream port for up to 64 homes. It requires no active components in the street cabinets, but only passive optical splitters.
- Product differentiation against higher priced symmetric products for residential users.
- Product differentiation against higher priced business internet access products.

A well-planned fibre passive layer makes it possible to start with GPON and upgrade to more powerful point-to-point at a later stage.

Given today's usage patterns, there is huge amount of downstream traffic (mainly video) and a comparable low level of upstream traffic. For most residential users an asymmetric GPON connection would be sufficient. If requirements change, only the active components need to be replaced.

7.3.3.1. *WAN Access Point*

For residential users, an integrated WLAN access point is mandatory.

As WLAN can be quite complex, a ready-to-go plan B with dedicated WLAN access points, WLAN repeaters or other technology to enlarge the WLAN coverage for bigger homes is recommended.

7.3.3.2. *WLAN Clouds*

A good option is to combine all WLAN access points of all the residential users, add several public access points and allow users to use this complete WLAN Cloud with one login credential. This requires that the in-home access points provide a second public SSID. The residential user might receive a primary SSID with full fibre bandwidth access for himself, while the second – the public – SSID provides a good but lower bandwidth. Guests, that are also customers of this operator, can use the public SSID without specific login procedure. The same SSID and the same username/password are used in the entire region. Vice versa, the residential user can enjoy the same easy access when he visits friends or if he is in close vicinity of one of the public access points. General terms and conditions with residential users need to cover this double usage.

7.3.4. *Voice Services*

Fixed line voice services sometime seem to be out-dated in times of extensive mobile coverage, but there remains demand for this service and it is easy to implement. Voice services can be provided as POTS (plan old – analogue – telephony service) or also as SIP connections. Wireless SIP phones are widely available.

The most basic business model available involves the operator providing the voice service at a monthly rate, with voice time being charged by the minute. Advanced models may include flat tariffs, free on net calls, free national calls and other variations.

The monthly base fee can be part of a bundle offering. And once the POTS/SIP connection is active, as it is part of a bundle, it will also be used and provide additional per minute rate revenues.

7.3.5. Mobile Voice and Data

Mobile Voice and Data per se are not a fibre service, however in some markets it makes sense to expand the usual triple play (internet, TV, voice) with a personalised mobile offering, to form extended bundles for residential customers. Mobile services can be sourced from the large mobile operators and passed on as a trading product, or alternatively, those services can be acquired using MVNO offerings.

7.3.6. TV Services via HF Overlay

A classic DVB-C like TV service can be provided on fibre using HF overlay technologies. How does this work? A digital DVB-C or even analogue TV signal is delivered using a separate fibre or a separate downstream wavelength. The CPE converts the signal into a traditional cable output to be distributed within the home. HF overlay is one-way and broadcast only. Classic DVB-C encryption services and smartcards can be used to deliver optional pay TV bouquets or to pass through already pre-encrypted DVB-C content similar to “Sky” in Germany. HF overlay does not provide upstream connectivity as available on traditional cable networks using the DOCSIS standard. However, the upstream IP connectivity is available via the primary wavelengths IP connection.

HF Overlay does not provide options for advanced TV services, but it does provide a highly standardized classic TV broadcast service similar to cable networks. Any TV set that can accept DVB-C signals can receive the TV channels without the need for a set-top box in between. Most of the currently available TV sets have a built-in DVB-C receiver. Some also provide local recording options.

While HF overlay is easy to implement, it requires more expensive specific networking equipment both at home and centrally to provide this extra HF transport capability.

7.3.7. IPTV Services

Advanced IPTV services make use of the IP connectivity that is part of the basic FTTH service and does not require specific HF capable networking equipment.

IPTV services are able to deliver traditional live TV signals as well as any kind of on-demand video services, such as video-on-demand, network recordings, network replay/catch-up services and much more. A major advantage of advanced IPTV services is that all of those services are packaged together into one product thus providing all services via one user interface. Those services also allow searching content cross media as well as presenting cross media recommendations. IPTV is always two-way, and therefore provides access to optional services including payment requests and confirmations. IPTV can provide a powerful auto-upselling platform. In addition IPTV deliveries can be customized per user, per region, per city.

Although IPTV offers unprecedented access to a large number of media assets, it still remains primary TV and traditionally, that is a lean back media. The major controlling devices for an IPTV set-top box is the good old remote control, which has been a well-known device for all TV users for decades. Even though there are some adopted keys for IPTV, the basic features such as zapping (p+/p-) and volume control (v+/v-/mute) remain firmly in place. Easy-to-implement infrared transmission technologies are still foremost in use, but there is an ongoing shift to use standardized radio frequency technologies like Bluetooth Low Energy. Radio does not require a line of sight (which means that the set-top boxes can also be stored behind the TV or hidden somewhere else), and it offers new options, such as voice control, which is also an upcoming trend. Just say “Tagesschau” and the TV system will select the latest news programme of that name.

7.3.7.1. Features

Advanced IPTV Services provide a number of features. Below are just a few of them with explanations.

- Extensive EPG metadata including still images and trailer videos.
 - EPG metadata includes title, short and long text description, the people involved, technical information about the show (including length of content, available audio tracks etc.), series information (season and episode) and much more. Most of this information is not available on traditional DVB-S or DVB-C TV services.
 - Using still images and clear crisp fonts within the user interface instead of plain teletext type UI – as seen on many TVs and satellite receivers.
 - EPG data is presented while zapping through the channels as well as in matrix EPG views. Detailed EPG data can be shown on demand.
- Fast Zapping
 - Traditional DVB-C/DVB-S standards provide zapping times of 1-2 seconds minimum. It is very difficult to improve (=reduce) such times. Zapping times on broadcast media will even increase as encoding improves, due to longer GOP structures.
 - IPTV solutions can provide zapping times of 0.1-0.2 seconds, as it can access server based helper services in the back office. With those excellent times, even “normal” live TV zapping is fun.
- Access Pay TV Packages
 - Provides access to browse through available pay TV packages
 - Package subscription effective immediately
- Pause/Resume
 - Very simple feature, easy to use, easy to understand, still very helpful
- Recording of TV shows
 - Recording is a well-understood feature, now integrated into the TV experience
 - Recording can be performed locally or centrally (→ network recording)
 - Network recording also works, if the set-top box is offline during recording
- Replay Features (30h/7d)
 - Some countries/channels allow for the content to be pre-recorded centrally and replayed within a certain amount of hours/days, commonly used are 30 hours and 7 days.
 - A powerful feature as users do not need to pre-record shows they want to watch later
 - See chapter 9 (Switzerland replay) for more details
- “Record from yesterday” (Record from Replay)
 - If the replay feature is available, then specific TV shows can also be recorded from the past. If a viewer missed a programme from the previous evening he can record it a day later. A powerful concept, combined with Replay.
- Series recording
 - Series recording allows the viewer to record all the episodes from the entire series. Technically the EPG metadata fields “SeriesID”, “Season” and “Episodes” are used to identify the right content to record.
- Subscribe to additional network recording space
 - If the viewer wants to record a programme but the recording space is full, he can subscribe on screen to an upgrade of the recording space. Available immediately.

- Video-on-Demand
 - Top rated films can be accessed from the viewers own IPTV user interface
 - Receive films recommendations on the home screen
 - Rent top films to be viewed within 48h
 - Purchase films to be viewed at a later time (EST = electronic sell through)
 - Browse through videos, watch trailers
- Search
 - Search all media available
 - Text search
 - Voice search
- Recommendation
 - Receive recommendations based on settings or based on usage patterns
 - Recommendations can be live TV shows, TV shows available on replay, as well as available VOD titles
- Mobile Integration
 - Connect mobile phones to the IPTV subscription
 - Use the smartphone as a remote control
 - Browse through TV shows, access EPG Matrix on the mobile
 - Browse through available VOD titles
 - Programme PVR recordings from distance
 - Access live TV, recordings, replays or videos directly from your mobile device
 - Redirect a show being viewed on your mobile to the screen at home, or vice versa
- Photo View
 - Access photos and videos from cloud storage
 - View a slide show on your home screen
- Access to regional news and info, on the IPTV home screen
 - Examples
 - Regional RSS news
 - Regional weekly video messages
 - Regional mountain/river/seaside/weather cams



Figure 11: IPTV Main Menu

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Images © ORF

Die Insel der besonderen Kinder © 2016 Twentieth Century Fox Film Corporation.

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Figure 12: IPTV Electronic Programme Guide / Matrix View

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Image „Vorstadtweiber“ © ORF

Sendungsdetail

Die Vorstadtweiber

19:35

Di, 17. Jänner 2017

ORF eins HD

Scheinwelten

Staffel 2, Episode 13

Heute, 20:15 bis 21:15

Das Projekt Nordautobahn macht wieder Schlagzeilen. Minister Schnitzler hat dafür gesorgt, um seine Erpresser bloßzustellen. Sabine kann als seine aufgezwungene Beraterin schadlos aussteigen. Nicht so Georg. Er ist absolut pleite. Hadrian und Bertram bedrängen ihn, das in Ordnung zu bringen. Schließlich hängen ihre Frauen als Grundbesitzerinnen in diesem Spekulationsgeschäft mit drin...

Ansehen

Zum Sender

Aufnehmen

Darsteller

Gerti Drassl (Maria)

Maria Köstlinger (Waltraud)

Nina Proll (Nicoletta)

Adina Vetter (Sabine)

Martina Ebm (Caroline)

Regie

Harald Sicheritz

Figure 13: IPTV Electronic Programme Guide Detail View
 User Interface Copyright Ocilion
 Image „Vorstadtweiber“ © ORF

Suche

19:35

Di, 17. Jänner 2017

Q M

25 Ergebnisse

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z Leer

01	Madagascar 2 - Animationsspaß mit den Malman, Alex und den Ping...	Animation, Kinderfilm	Film
02	Muttertag	Komödie	Film
03	Margret I. - Schicksalsjahre einer Königin	zdf.neo	02.11.2016 18:20:00 Replay
04	Massive Attack Live in Köln - Konzert	HD	02.11.2016 22:05:00 Replay
05	Million Dollar Baby - Romanverfilmung	ORF eins HD	03.11.2016 20:15:00 Replay
06	Monsterball	RTL	05.11.2016 13:22:00
07	MacGyver - Schnappschüsse	RTL	06.11.2016 09:00:00
08	Messiegeschichten	RTL HD	29.10.2016 15:00:00 REC
09	Miracle	ATV	02.11.2016 21:16:00 REC

Figure 14: IPTV Content Search
 User Interface Copyright Ocilion

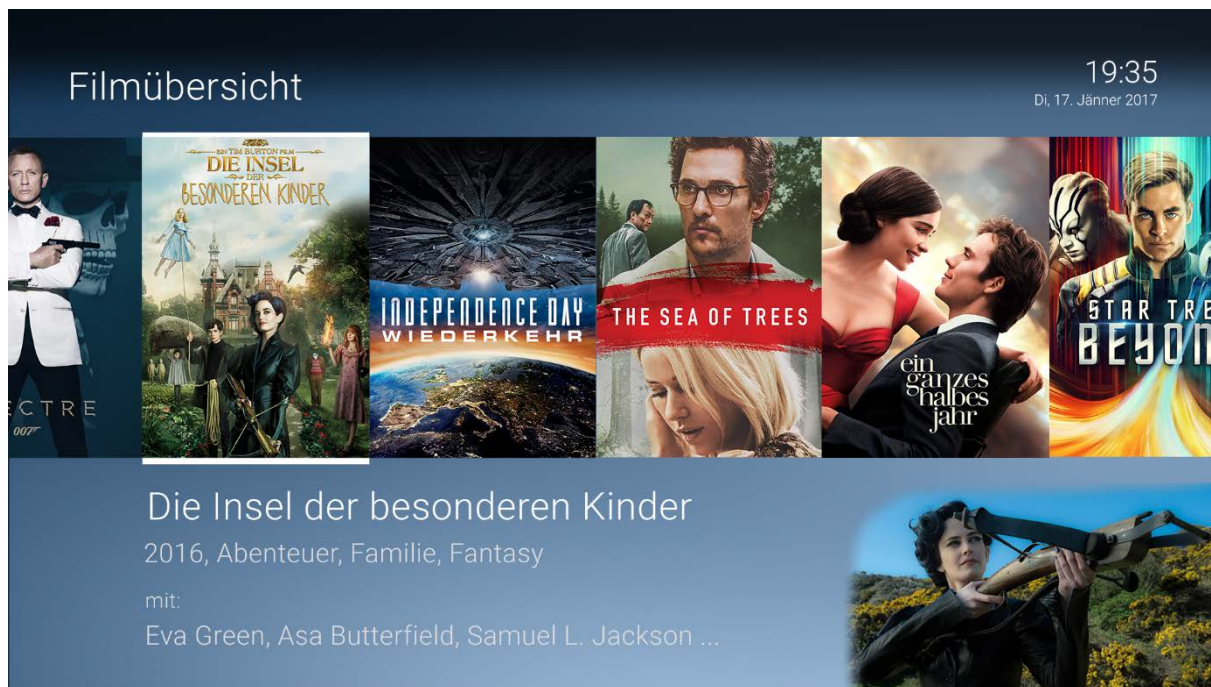


Figure 15: IPTV Video On Demand Cover Flow

User Interface Copyright Ocilion

Spectre © 2015 Danjaq, LLC, Metro-Goldwyn-Mayer Studios Inc., Columbia Pictures Industries, Inc. *SPECTRE*, 007 Gun Logo, and related James Bond Trademarks © 1962-2016 Danjaq, LLC and United Artists Corporation. *SPECTRE*, 007 Gun Logo and related James Bond trademarks are trademarks of Danjaq, LLC. All rights reserved. *Die Insel der besonderen Kinder* © 2016 Twentieth Century Fox Film Corporation. All rights reserved. *Independence Day: Wiederkehr* © 2016 Twentieth Century Fox Film Corporation. All rights reserved. *The Sea of Trees* © Elite-Film AG *Ein ganzes halbes Jahr* © 2016 Warner Bros. Entertainment Inc. and Metro-Goldwyn-Mayer Pictures Inc. All rights reserved. *Star Trek Beyond* © 2017 Paramount Pictures. *STAR TREK* and related marks are trademarks of CBS Studios Inc.

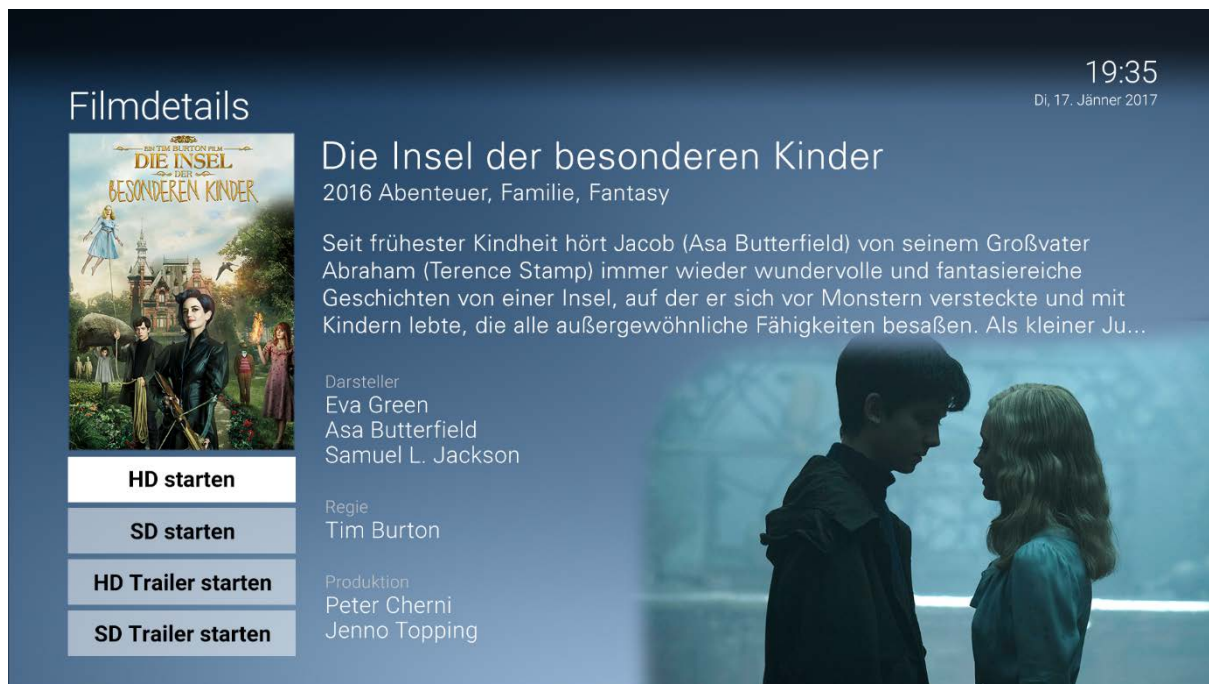


Figure 16: IPTV Video-On-Demand Detail View

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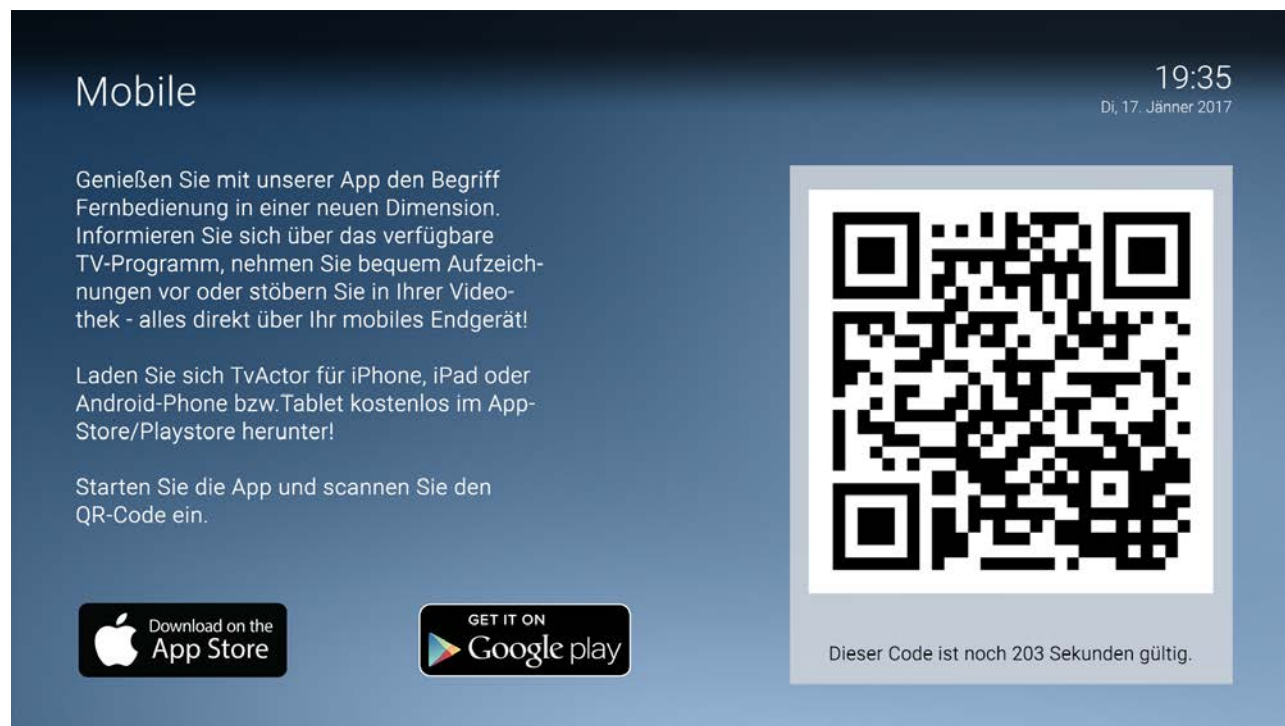


Figure 17: IPTV Mobile Connect Screen. Start the Mobile App, Scan the QR Code and you are connected and paired

User Interface Copyright Ocilion



Figure 18: IPTV Live TV Zapper View
 User Interface Copyright Ocilion
 Scene Landkrimi © Copyright ORF

7.3.7.3. Set-top boxes

Some of the current TV sets already provide IP connectivity as well as smart TV features (with CPU and graphics power on-board), however a standardised implementation of an IPTV software-only client is still not available.

At present all IPTV services deliver content using an operator provided set-top box. Set-top boxes interface with TV sets via HDMI ports, which is well standardized. There is HDMI 1.3/1.4 for HD, and HDMI 2.X for UHD devices respectively, both of which are upwards and downwards compatible.

The cost of an IP set-top box today is very low, being more or less comparable to the additional cost of HF overlay equipment as described above. However, the cost of IP set-top boxes is only relevant to those who subscribe to an IPTV service, while HF overlay equipment is usually rolled out to all customers regardless of TV subscription status.

Operators in general avoid rolling out extra devices into residential homes where possible. However set-top boxes have established themselves as a very welcome interfacing device:

- The operator is very familiar with his own set-top box. If the helpdesk agent receives a support call, he has access to well-predefined support procedures and is probably able to help the caller. In addition the operator offers a number of remote diagnostic features to aid the agent in solving any issues that might arise. As a result the consumer will receive efficient and speedy assistance as well as a positive customer experience.
- Smart TVs are capable of operating a software only app client for an IPTV service, but that scenario is coupled with drawbacks:

- Smart TV App platforms are not standardized. Several different smart TV app platforms have to be supported
- Smart TV App behaviour is heavily dependent on type of smart TV platform and version of smart TV software. At present there are a large number of versions and platforms available which are very difficult to detect and maintain.
- Consumer TV sets have a very short lifecycle, with new consumer products often appearing in less than six months after the previous version has been rolled out. As a result, there is, in addition to a great number of platform versions, also an increasing number of hardware platforms. These platforms differ substantially, both in software and hardware capabilities.
- When a consumer calls the helpdesk agent for support, it is often very difficult for the agent to identify the exact type of Smart TV in question, and even more difficult to provide proper support. As a result, the consumer very often cannot receive the support they seek, which results in a negative customer experience.
- A further argument for using a set-top box is the “full screen appearance”. Set-top boxes dominate the user experience in total. In comparison the smart TV user experience is initially that of the smart TV vendor. The operator only appears as an app, one amongst many others. Therefore the smart TV lacks the necessary integration and API interfaces that would have been expected by operators. This is not likely to change short term.



Figure 19: IPTV Set-top box with Remote Control
Copyright Ocilion

7.3.7.4. IPTV as proposition against OTT SVOD Services

IPTV has great potential to co-exist beside OTT SVOD services, as it allows operators to earn extra monthly revenue with services that can be generated on net. One major advantage for the operators IPTV is it combines guaranteed quality of service with national TV content. It should be noted that this relates to both IPTV and OTT SVOD.

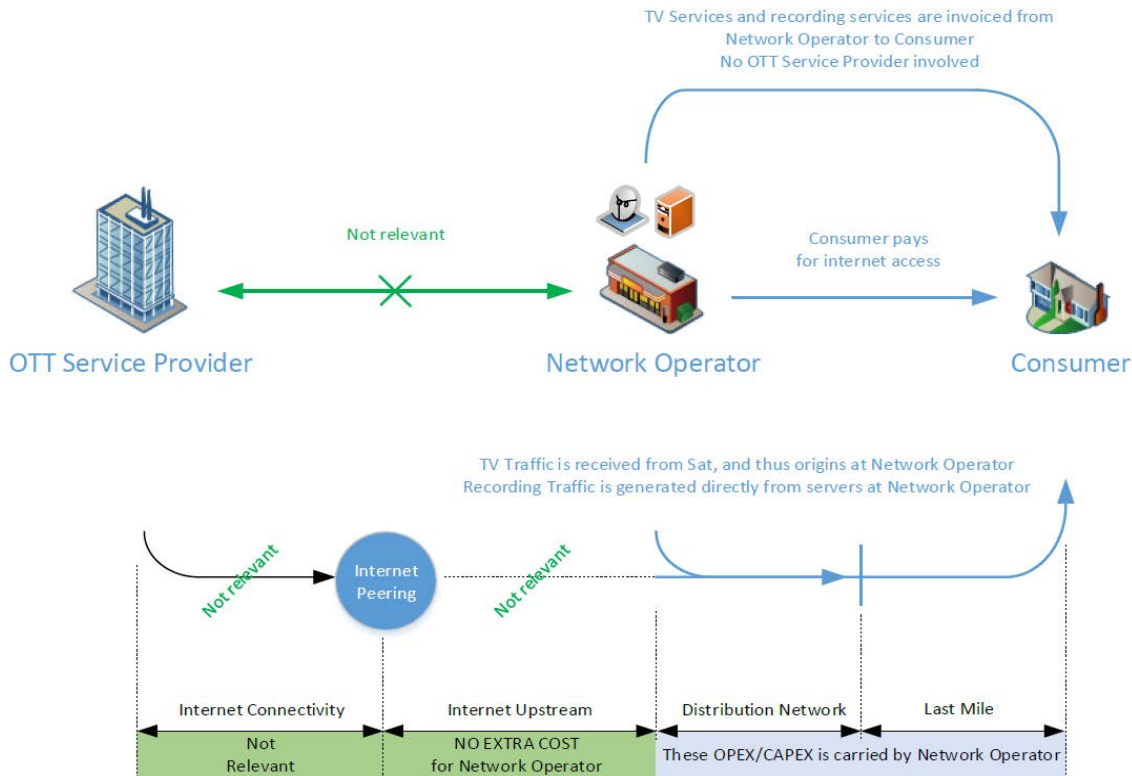


Figure 20: IPTV Economical and Data Traffic Flows

Source: Ocilion

7.3.8. Internet Security Services for Residential Users

Internet security services for residential users needs to be highly cost efficient, however it is possible to offer additional services that can generate a few extra EURs revenue per month, or alternatively, security services can be included in higher level bundles. To a certain extent such security services also serve as self-protection for the operator, as, in the case of successful attacks, residential users are very likely to contact the operators' helpdesk for support first.

Some suggestions:

- 1) Mail Security, Anti-Virus, Anti-Spam, Malware Protection. Can be a limited home edition of the Secure Mail offerings for businesses.
- 2) Antivirus with update services.
- 3) Firewall to protect against incoming threats. Sometimes a basic Network/Port Address Translation will do the job quite well as it allows any outgoing traffic to pass out and answers to pass in, but does not allow any incoming traffic at all.
- 4) WLAN access passwords. Provide strong passwords as default. Avoid 1234.

7.3.9. Cloud Storage

The operator can provide cloud storage for the residential user. This offering can be part of an internet service, part of a bundle or an extra subscription service. Residential users may store their photos or videos on the cloud, which they can access from anywhere, or simply backup their local files to the cloud as an additional storage facility. Optional revenues can come from cloud storage upgrades as some residential users might be interested in gaining more space than is already included and are prepared to pay for that service.

There are a number of cloud storage options available that can be used by the operator as well as a selection of ready to go solutions on which to build and run an own-cloud-space at the operators' premises. Incorporating a cloud storage service for consumers also deepens the trust relationship with the operator as well as keeping traffic inside the network. This is especially relevant for storing/recalling large video files. Having the files inside the operator's network does allow the residential user to access the files in perfect speed. More information is available in the chapter, Business Storage Services.

7.3.10. Gaming

Online Gaming is a fast growing future market that requires high bandwidth and low latency, which is available through fibre. So without the need to invest much energy into attracting gamers, they will choose fibre whenever possible.

It may make sense to run the gaming servers within the operator's own network to further reduce latency time. Some gaming platforms support such local approaches to improve customer experience.

It is very likely that there is no direct revenue from gaming for the operator, but there are quite good indirect revenues as games prefer fibre.

7.3.11. Smart Home Services

Residential users ask for ready-to-go home security and home automation solutions.

With an existing fibre link, the operator can provide these smart home solutions as a service that is more profitable than simply implementing devices onsite.

7.3.11.1. Home Security

For example, a video surveillance solution can comprise of home mounted network cameras with a centrally operated 24h video storage. Residential users can access the video storage from their own devices, smartphones, PCs, as well as the operators IPTV, both from in the home and from other locations.

Cameras can be fixed or moveable.

There are a number of other home security sensors in addition to the cameras:

- Motion sensors
- Contact sensors (door, window)
- Glass break sensors
- Surface contact sensors
- Smoke sensors
- Temperature and water sensors

Residential users may grant access to such devices – via the operator - to local security firms that may take further action in the event of an alarm or in the event of emergency.

Residential users prefer a service provider who maintains the system and is available on-call when needed. Home security services can be successful, especially if there is an existing trust relationship between the residential user and the operator.

7.3.11.2. Home Automation

Residential users are also interested in accessing their home devices. They want device status updates, to be able to control the heating, the lighting, check for solar power generation or the in-home solar battery system. There is a large array of solutions on the market today.

Given an existing fibre link, there are options for the operator to offer home automation service for the residential users.

Residential users like having someone that is taking care and someone that they can call in case of error or if they have a query. Again home automation services can be successful due to existing trust relationship.

Home automation and home security can easily be combined to one family of service offerings.

Home automation services can be combined with other services, like IPTV.

7.3.11.3. Smart Energy

Use data from the home (temperature, humidity, activity, etc.) to decide a course of action.

For example, use the data to control the thermostat.

Or switch off the lights if no one is at home. This can be done for individual rooms or for the entire home.

7.3.11.4. Elderly Care

Elderly care is all about leveraging on the three other smart home services – security, automation, energy - to provide a safe, secure and comfortable environment for elderly people, so that they can stay in their own homes longer.

7.3.11.5. Smart Home Examples in Europe



Figure 21: Example Telefonica 'Movistar Verisure Hogar' Home Security

Copyright Telefonica

Source: Nokia

<https://www.telefonica.com/es/web/press-office/-/telefonica-starts-the-quintuple-play-era-in-spain-with-the-launch-of-movistar-verisure-hogar->

AT&T

Minimum 24 month contract

Smart Security

\$39.99 / month

Features

- 24/7 professional monitoring
- Free standard professional installation
- Remote access from your smartphone, tablet or computer
- Text and email alerts
- Wireless communication - no home phone required
- Compatible with most high-speed Internet providers

Package includes:

- Indoor siren
- Keypad
- Motion sensor
- Recessed contact sensors (2-pk)
- Surface contact sensors (3-pk)

Smart Security and Automation

\$54.99 / month

Features

- 24/7 professional monitoring
- Free standard professional installation
- Remote access from your smartphone, tablet or PC
- Text and email alerts
- Wireless communication - so no home phone is required
- Compatible with most high-speed Internet providers

PLUS:

- View live or recorded video of your home
- Remotely lock or unlock your door

Package includes Smart Security PLUS:

- Outdoor camera
- Touchscreen door lock
- Touchscreen control

Premium Security and Automation

\$64.99 / month

Features

- 24/7 professional monitoring
- Free standard professional installation
- Remote access from your smartphone, tablet or PC
- Text and email alerts
- Wireless communication - no home phone is required
- Compatible with most high-speed Internet providers

PLUS:

- View live or recorded video of your home
- Remotely lock or unlock your door
- Manage temperature and smart appliances
- Detect moisture and ambient temperature

Package includes Smart Security and Automation PLUS:

- Carbon monoxide sensor
- Glass break sensor
- Indoor smart plugs (2)
- Smoke sensor
- Temperature and water sensors (2)
- Thermostat
- Touchscreen control

Figure 22: Example AT&T Security Offerings

Copyright AT&T

Source: Nokia

28/05/2015

Telefónica starts the quintuple-play era in Spain with the launch of “Movistar Verisure Hogar”

- Available exclusively for Movistar customers from 17 June onwards, for 16 euros per month for the service fee and 9 euros for the equipment rental
- The service is managed from a smartphone via an application downloaded by the user and, in principle, it will be available for iOS and Android
- Movistar Verisure Hogar provides a 24-hour, 365-day emergency service (run by VERISURE), access control and video cameras with remote recording
- These services are possible using Movistar

Figure 23: Telefonica launched ‘Movistar Verisure Hogar’ in May-15, as part of a quint play offer

Partners: Verisure (home alarm provider)

Includes a 24/7 immediate emergency response service

Copyright Telefonica

Source: Nokia

7.3.12. Smart Metering

Operators can provide data access to smart meters and charge a monthly/annual fee. In this case the customer is most likely not the residential user, but the operator of the regional electricity network, or the operator of the regional natural gas network.

8. The Fifth Generation Mobile Network (5G)

8.1. Introduction

The fifth generation of mobile technology 5G addresses the demands and business contexts of 2020 and beyond. There is much interest and hype about 5G even though there are no standards available and no frequency bands assigned as yet. 5G is both evolution of existing mobile technologies and revolution in terms of new features not seen before. It is a necessity for real-time applications such as autonomous vehicles and Internet of Things (IoT) systems and is based on new architectures, technologies and features.

Today's mobile networks are designed primarily to provide mobile broadband. They were not engineered to support the expected growth in demand for digital content and connectivity to machines. Market researchers, vendors, and operators foresee tremendous requirements for massive capacity and connectivity. 5G is all about anytime, anywhere support for:

- Massive traffic growth and high density on demand
- A wide variety and variability of services consumed
- Critical machine-type communication (MTC and M2M) that requires immediate, synchronized eye-to-hand feedback for virtual reality applications that will allow users to remotely control robots, creating the tactile Internet
- Massive MTC that connects billions of sensors and machines, from watches to refrigerators, to parking meters and cars.
- Stringent demands for real time communications.

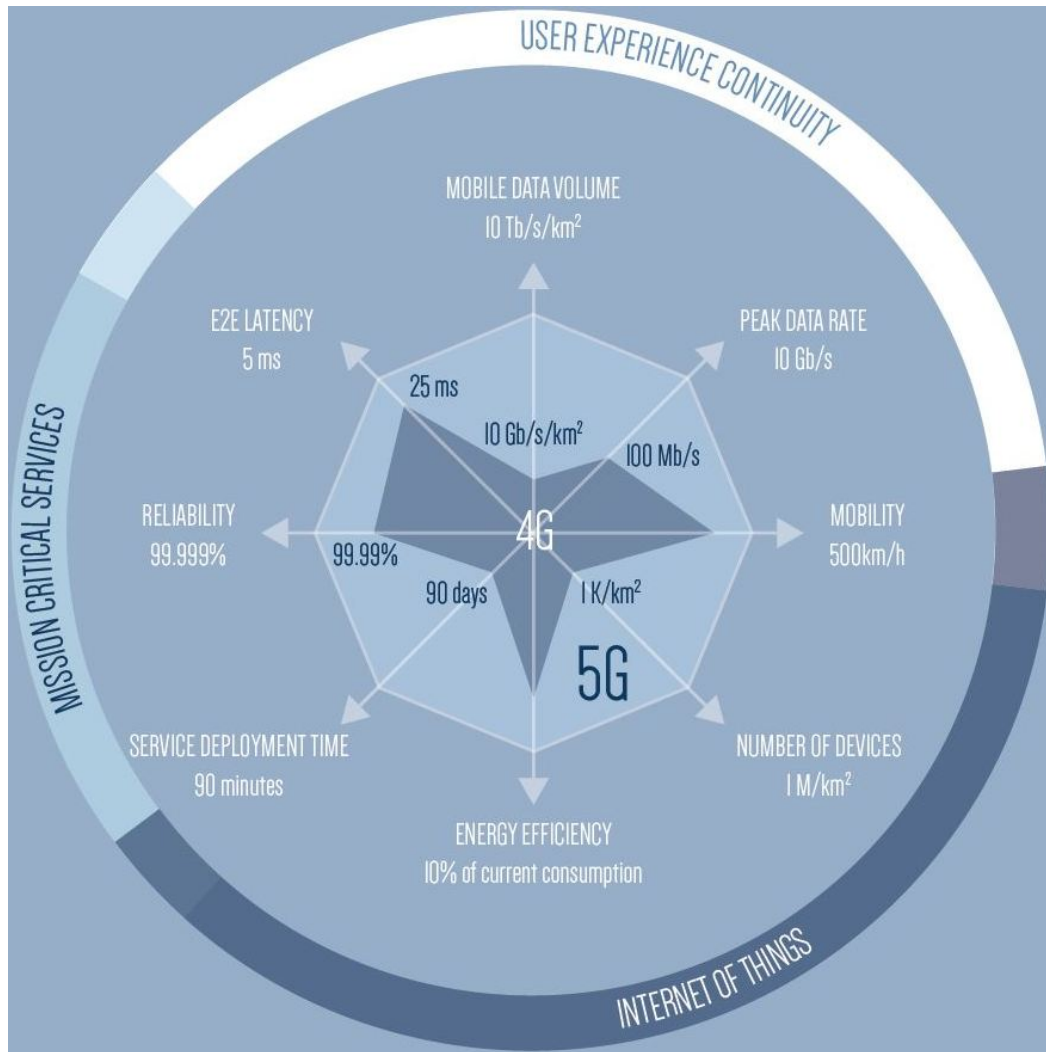


Figure 24: Comparison of features between 4G and 5G

Source: European commission

8.2. What is 5G?

The NGMN Alliance – currently comprises 86 Partners from the telecommunications industry and research community: 25 mobile network operators (Members), 37 vendors/manufacturers (Contributors), and 24 universities or non-industrial research institutes (Advisors) – published in February 2015 a 5G White Paper. This Alliance has a clear vision concerning next generation of mobile communications: “5G is an end-to-end ecosystem to enable a fully mobile and connected society. It empowers value creation towards customers and partners, through existing and emerging use cases, delivered with consistent experience, and enabled by sustainable business models.”

There will be a large number of new use cases ranging from delay-sensitive to ultra-low latency applications, and from best effort applications to reliable and ultra-reliable, such as health and safety. NGMN is focusing on eight case families with some given examples:

- Broadband access in dense areas – pervasive video
- Broadband access everywhere – 50+ Mbps in all areas
- Higher user mobility – high speed train communications
- Massive Internet of Things – sensor networks
- Extreme real-time communications – tactile Internet
- Lifeline communications – natural disaster
- Ultra-reliable communications – e-health services
- Broadcast-like services – local broadcast services, news and information.

5G also will expand to new business models to support different types of customers and partnerships. Operators will be able to support vertical industries by configuring network slices to actual requirements. Furthermore 5G will use new network technologies and infrastructures to provide the actual capacities needed to humans and machines.

The concept for 5G is both an evolution of wireless networks to meet future demands for data, and a revolution in architecture to enable a flexible and cost efficient network that can be efficiently scaled. The following features of 5G are currently under discussion in various forums such as NGMN, ITU, 5GPPP, European Commission, IETF, and IEEE:

- 1,000 X in mobile data volume per geographical area reaching a target $\geq 10 \text{ Tbps/km}^2$
- 1,000 X in number of connected devices reaching a density $\geq 1 \text{ Mio terminals/km}^2$
- 100 X in user data rate reaching a peak terminal data rate $\geq 10 \text{ Gbps}$
- 1/10 X in energy consumption compared to 2010
- 1/5 X in end-to-end latency reaching 5 ms for e.g. tactile Internet and radio link latency reaching a target $\leq 1 \text{ ms}$ for e.g. Vehicle to Vehicle communication
- 1/5 X in network management OPEX
- 1/1,000 X in service deployment time reaching a complete deployment in $\leq 90 \text{ minutes}$ (compared to currently 90 hours)

In addition, 5G services will complement and largely outperform the current operational capabilities for wide-area systems, reaching the following high-performance indicators:

- Guaranteed user data rate everywhere $\geq 50 \text{ Mbps}$
- Aggregate service reliability $\geq 99,999 \%$
- Capable of human-oriented terminals $\geq 20 \text{ billion}$
- Capable of IoT terminals $\geq 7 \text{ trillion}$
- Serving over 7 billion people
- Mobility support at speeds $\geq 500 \text{ km/h}$ for ground transportation
- Airplanes connectivity – 80 per plane, 60 airplanes per 18.000 km^2
- Accuracy of outdoor terminal location $\leq 1 \text{ meter}$
- Ensuring for everyone and everywhere the access to a wider panel of services and applications at lower cost

5G is not just another generation of mobile networks. It is a new network concept that enables the integration of a ubiquitous access continuum composed of cooperative, cognitive fixed and heterogeneous wireless resources, with fixed optical access reaching at least the 10 Gbps range, while implementing new functionalities that allow simplified and unified control. There is a shared awareness that the development of new communication networks is dependent on the emergence of globally accepted standards in order to ensure interoperability, economies of scale with affordable cost for system deployment and end users.

The launch of 5G will happen on an operator and country specific basis. Some operators might plan to launch in 2020 – others will plan for a later deployment. The first public trial of a 5G system is expected to be in operation for the Olympic Winter Games in Pyeongchang, South Korea in February 2018. SK Telecom has already deployed the world's largest 5G trial network and demonstrated the world's first 5G-based connected car in November 2016.

8.3. New technologies and opportunities

5G will build on earlier generation mobile technologies and bring additional capabilities. The complete new feature “Network Slicing” defines a collection of 5G network functions and specific radio access technologies (RAT) settings that are combined together for a specific use for a case or business model. Thus, a 5G slice can span all domains of the network: software modules running on cloud nodes, specific configurations of the transport network supporting flexible location of functions, a dedicated radio configuration or even a specific RAT, as well as configuration of the 5G device.

To meet the requirements of extreme low latencies between terminals and base stations as well as end-to-end throughout the whole network new switching methods are required. Circuit and packet switching will be replaced by a new technology called network coding. Processing of data will be transferred to the network edge and instead of cloud computing we will see more and more fog computing.

Finally to provide the necessary capacities the 5G architecture comprises so called small cells. In comparison with 4G there are at least 10 times more antennas required. Each of these need to be connected with a fibre infrastructure, the only solution to deliver high capacity and provide high availability and low latency. Operators around the world are already deploying new antenna locations to be ready for the next generation of public mobile networks. Here is the chance for planners, vendors, and operators to build the high performing network of the future.

9. The Role of IPTV and TV Replay in Switzerland

Switzerland is an excellent example of how efficient copyright rules can generate a tremendous positive impact on fibre rollouts. It is also a success story about fibre.

9.1. How everything started ...

Starting 1 January 2009 Switzerland decided that local TV recording and network based TV recording should be treated equally from a copyright fees perspective. At that time collection society SuissImage published a new common tariff called GT12 that defined a fee to be paid by network operators offering TV recording features, the fee to be paid per recording subscriber per month. This fee has to be paid by all network operator equally regardless of type of network and size; the fee is the same for small local operators as well as for big operators like SwissCom.

Over the years, GT12 has been renegotiated and updated from time to time.

Today GT12 differentiates between three levels of recording services:

- PVR only
- PVR and 30 hours of replay
- PVR and 7 days of replay

The legal framework is based on “home copy”, which means that all users must initiate their recording themselves. If the user wants to gain access to a 7 day replay offering, he needs to start that 7 day recording himself, and it will take 7 days until the recording is fully available.

Technical deduplication is allowed, without any discussion, which is very efficient for the operators. If hundreds or thousands of users record the same TV show, the operator only needs to physically record it once and use references towards this recording. However the operator needs to ensure that home copy rules are not violated: No playback of content that has not been recorded before by that user.

9.2. Retransmission of TV signals

A second very important rule that has been in place in Switzerland over a long period of time, involves retransmission of TV signals. Again SuissImage provides a common tariff called GT1 that defines the fee that has to be paid by the operator, per subscriber per month. Using these rules, Swiss operators are free to retransmit any TV signal that can be received free-to-air, regardless if it is a DVB-S or DVB-T reception. The only binding condition is that the receiving antenna and receiving equipment must be inside Switzerland, and the signal must be free-to-air. The sum of all GT1 payments are then distributed to the various broadcasting stations inside and outside Switzerland. Again the GT1 fee is identical for both small and large operators.

9.3. Easy Administration

Furthermore, the administrative efforts to start-up and run a TV service in Switzerland is very low. All it requires is a signature on the SuissImage agreement, payment of the monthly fees and everything is ready

to go. Swiss operators do not need to negotiate directly with broadcasting stations or other content owners. If they want to retransmit TV signals they sign up for GT1, if they want to provide a recording service on top, they sign up for GT12.

GT12 allows for the recording of all TV shows from any channel that is covered by GT1 retransmission rights. There are no exceptions, no recording holes and no channels that are exempt from being recorded.

9.4. How everything developed since then

Eight years on, it is very interesting to look back and see how things have developed for the service provider and of course, as this is a publication by the FTTH Council Europe, how they have impacted on fibre rollouts.

Access to the data is easy: SuissImage publishes yearly reports that specify the annual figures of the various common tariffs. By collating all annual reports from 2009 and drawing a chart of GT1 and GT12 tariffs the result is a very interesting picture (figures of 2016 not yet available):

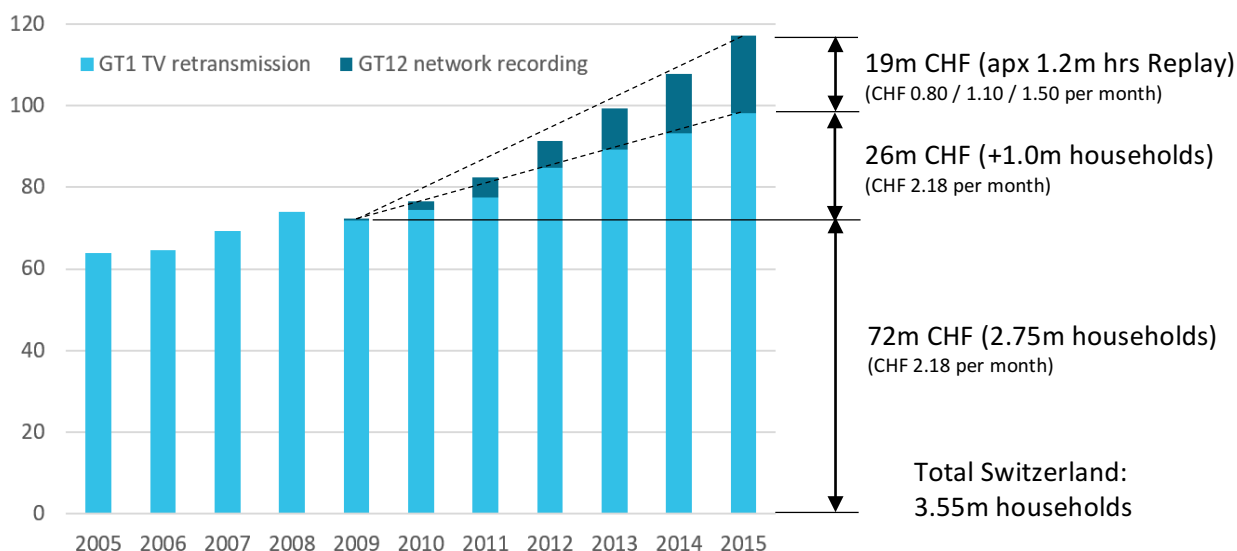


Figure 25: Common Tariffs GT1 and GT12; Annual fees over time

Compilation by Ocilion

Source: suisseimage.ch; eschk.ch

Swiss operators have been very successful in implementing services based on GT1 and GT12. As can be seen for the period from 2009, an additional total of more than 1m households chose to sign up for a TV service (see GT1), whilst at the same time even more households (those who signed up for a new TV service as well as those who already had subscribed to TV earlier) have also signed up for a variation of a TV recording service. Given the figures, the majority of the households obviously signed up for at least a 30 hour replay service, with increasing numbers switching over to the 7 day version.

It has been ascertained that Replay TV is probably being used by almost half of all Swiss households (end of 2016). This is a huge success given the fact, that it had not been available at all just a few years ago.

9.5. Huge Amount of IP Traffic

As should only be expected, and also confirmed by Mediapulse, the average usage rate of replay services has increased year on year. In 2016 partially more users were watching replay TV than live TV. This is where it becomes relevant to talk about fibre rollouts.

Replay TV is mainly used at the first screen and users expect to view TV programmes in the best HD quality available, 8-12Mbits/sec H264. Replay TV is unicast only, each TV set gets its own individual stream and each stream is delivered in real-time from the operator's video servers. Many households have multiple TV sets using Replay TV at the same time. It is already apparent that just a few TV sets showing HD replay TV consume 30-40Mbits per second for hours. This relates solely to TV, and for the full picture add internet usage, secondary in-home streams on mobile devices.

It is also necessary to consider the high concurrency of the unicast streams. Traditional cable networks with DOCSIS 3 shared bandwidth approaches have to be operated very carefully to keep track with the data volume explosion. Cable segments have to be split and split again, and further active DOCSIS capacities have to be added. DSL networks, even VDSL2 and vectoring simply cannot provide the bandwidths needed.

9.6. Only fibre can deliver

Fibre networks however do not have any issues at all with such demanding usage patterns. This is certainly the reason why even traditional cable operators began transforming their own networks from HFC hybrid fibre cable to FTTH. The major IPTV provider Swisscom, coming from copper, invested heavily into rebuilding their access networks and going directly to FTTH.

Today, Switzerland has one of the best fibre coverages in Europe.

9.7. Replay TV – Value Added by the Swiss Operators

Replay TV traffic is generated within Switzerland.

Operators themselves receive the TV signals from the air and run the recording servers.

Operators generate immense traffic themselves, efficiently positioned in the centre of their own networks.

Operators do not need to sign up for expensive international interconnections to cater for this huge IP traffic as it is their own service.

Even though the operators must pay the SuissImage fees, it is still very good business.

Finally, operators generate additional revenue and are therefore willing and able to fund fibre rollouts.

Most of the value added is generated by Swiss operators within Switzerland.

10. Weblinks and References

Business Services

www.infotech.at

Residential IPTV Services

www.ocilion.com

Residential Smart Home Services

<https://networks.nokia.com/solutions/smart-home>

Switzerland Media Usage

www.mediapulse.ch → TV → Publikationen → Semesterzahlen → Zeitversetzte Nutzung

Switzerland Collection Societies

<http://www.suissimage.ch/> → Downloads → Tarife

<http://www.suissimage.ch/> → Downloads → Geschäftsberichte