



IPTV

Services and Technologies

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Overview

What is **IPTV**?

Internet **P**rotocol **T**ele**v**ision

Definition by the International Telecommunication Union:

„... multimedia services such as television, video, audio, text, graphics, data delivered over IP based networks managed to provide the required level of quality of service and experience, security, interactivity and reliability.“

In other words IPTV is...

- ... Television over special IP based networks with a number of additional features
- ... future-proof and ready for new extensions



Overview

Why do we need another way for TV broadcast?

- We have TV transfers over satellite, cable, terrestrial and internet...
- ... but desire of digitalization and compact deliverance of services increases
- More personalized and interactive content is favoured
- Also the subscriber want a whole home entertainment center in one set-top box

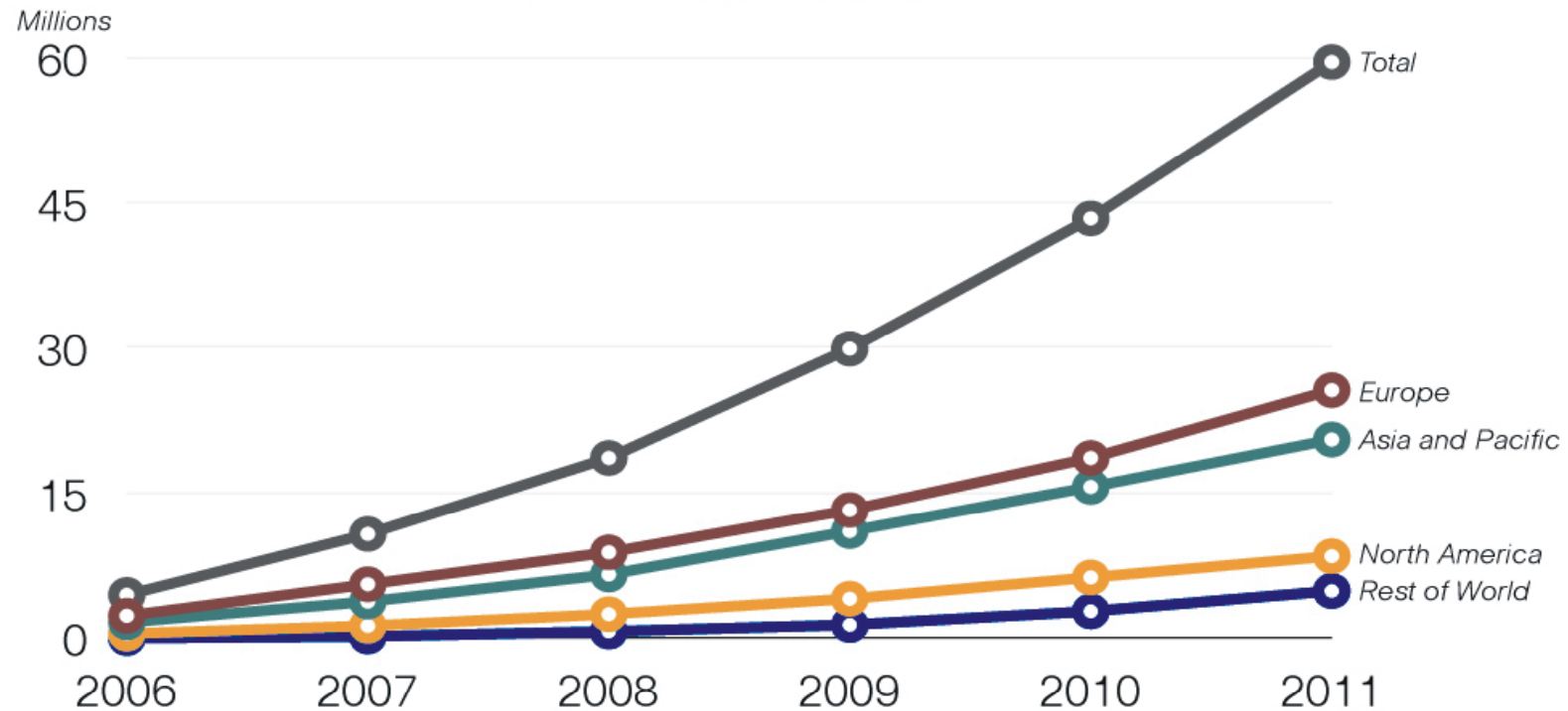
Motivation:

- IPTV is based on the fundamental technology of the internet so it is very popular
- IPTV becomes more and more popular in the world especially in our regions



Overview

IPTV Subscribers



How gets IPTV such a popularity?

Source: [2]



Overview

Main features of IPTV:

- Interactive TV: - 2-way communications between users and contents
- for example: interactive games, Video-on-demand
- Time shifting: - record video-material for later viewing
- look the beginning before the record ends
- Personalization: - analyse of viewing habits
- Low Bandwidth: - only one channel to transmit to end user
- Multiple devices: - not limited to television
- also PCs or mobile devices to access IPTV services

But where is the difference to Internet TV?



Overview

	IPTV	Internet TV
Different Plattformen	secure dedicated private networks based on IP, managed by the provider of the IPTV service	public internet for delivering
Geographical Reach	Limited by fixed geographical areas	Nearly no geographical limitation
Ownership of the Networking Infrastructure	Network is owned by the service provider → Engineered for high quality videos	Public internet, no guarantee of undelayed and high resolution



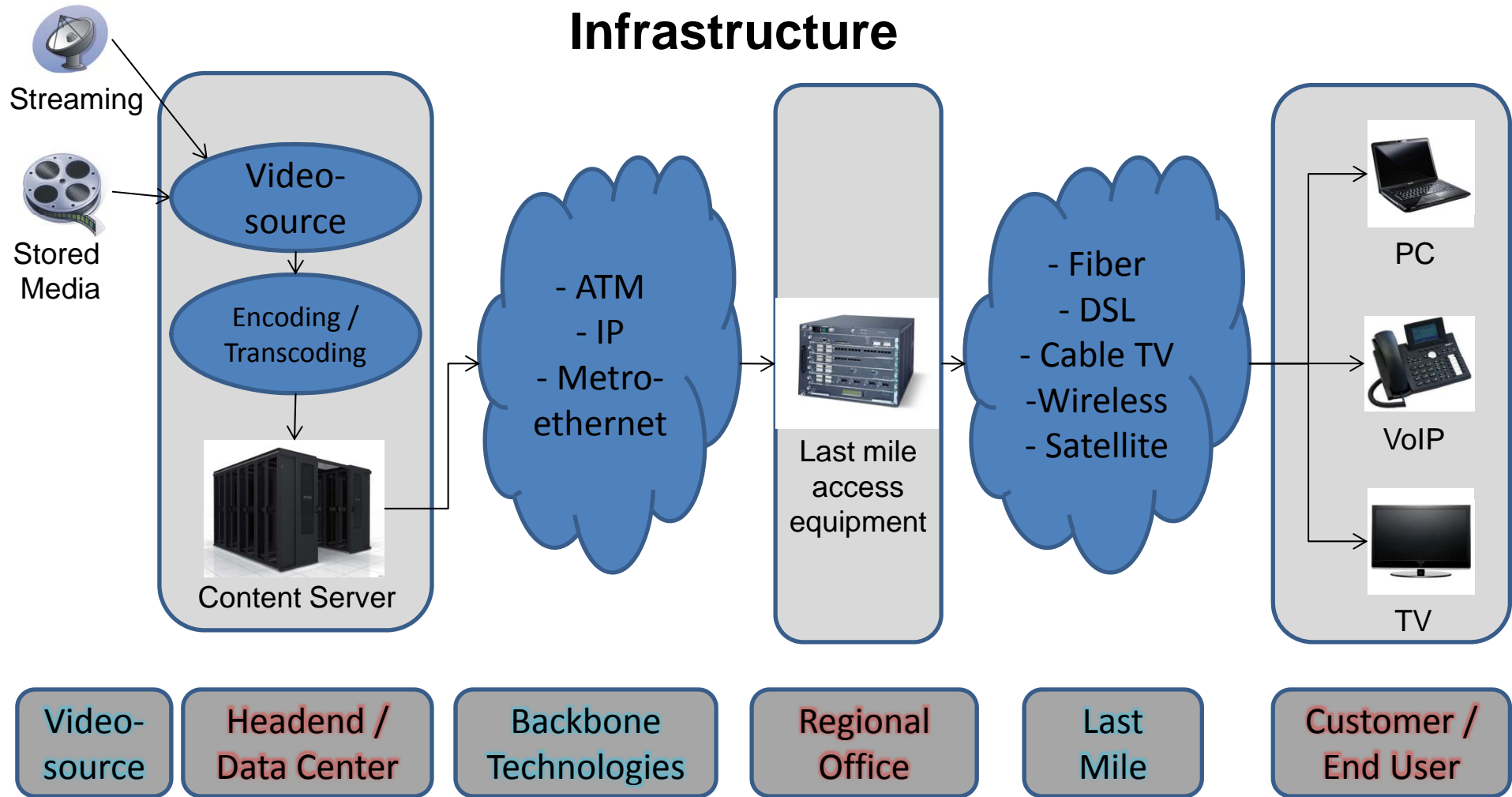
Overview

	IPTV	Internet TV
Access Mechanism	Over a digital set-top box	Nearly always a PC
Costs	Similar to Pay-TV providers, Monthly payment	Mostly free video content
Different Content	Similar to traditional TV over cable and satellite	Small and regional channels



Overview

Infrastructure





Headend / Data Center

Procedure in the Data Center:

1. Video content from:
 - Local videotapes
 - Cable, terrestrial, satellite
2. Encoding of the content:
 - digitization with analog-to-digital convertor
 - encoding
3. Preparing for delivering:
 - insertion into data packets (packetizing)

Subscriber management system for managing the subscribers profiles and payments

Compression methods:

- MPEG-2
- MPEG-4 (H.264/AVC)
- VC-1



IPTV Technologies

IPTV network architecture consists of:

- Centralized or core backbone
 - ATM over SONET
 - IP over MPLS
 - Metro ethernet
- The „Last Mile“ – from the core backbone to the end-user
 - DSL, ADSL, VDSL
 - Fiber network
 - Cable network
 - Satellite
 - Wireless networks



Core backbone

IPTV Backbone Technologies

- Connects the IPTV data center to the „Last Mile“

Three different types:

1. ATM over SONET

- Transmission over coaxial, twisted pair or fiber optic cable
- Protocol named SONET (Synchronous optical network) on the physical layer
- Transmission of multiple data streams „simultaneously“ with TDM (Time division multiplexing)
- Different data rates over optical carrier (for example: OC-1: 51,84 Mbps, OC-768: 40 Gbps)



Core backbone

2. IP and MPLS

- Deploy the internet protocol in the core network
- IP was never designed with features like QoS and traffic segregation
- But with MPLS (Multiprotocol label switching) these features are supported by IP

3. Metro Ethernet

- Integrates ethernet technologies into to core network
- Modern versions transfers data with a speed up to 100 Gbps over long distances
- Ideal for IPTV because of low delay and packet loss features



The last mile

IPTV over a DSL network

- In the last years many telcos have entered into the IPTV market
- Advantage: use their own telecommunication networks, Triple-Play
- Use of fiber cable, last mile: existing copper cable

Bandwidth for delivering IPTV:

- SDTV: 2,5 – 4 Mbps
- HDTV: 8 – 10 Mbps

→ For IPTV transmission we have different DSL technologies such as ADSL, ADSL2+ VDSL and some extensions



The last mile

ADSL: Asymmetric Digital Subscriber Line

- Point-to-point connection
- Around 8 Mbps download, 1,5 Mbps upload
 - 2 x MPEG2 SDTV channels + high speed Internet
- A maximum of 5,5 km distance from the nearest telephone exchange or regional office to end-user

But that's not perfect for delivering IPTV:

- Too slow
- Interaction?
 - ADSL2, ADSL2+, RE-ADSL2 (= ADSL – Reach Extended)



The last mile

VDSL 1: Very high speed Digital Subscriber Line

- Maximum of 52 Mbps download and 11 Mbps upload
- 900 m: 26 Mbps and 5,5 Mbps
- 2 km and further: ADSL level
- No priority during delivering data
 - Not perfect for IPTV
- Designed for multiple dwelling units
- Some extensions: VDSL2 – Long Reach, VDSL2 – Short Reach, VDSL2

VDSL 2:

- Theoretically speed up to 100 Mbps down- and upload
- Downward compatible to ADSL2+
- Several virtually connections over one physical connection → Priorities



The last mile

DSL Flavor	Max. Downstream (Mbps)	Max. Upstream (Mbps)	Max. Distance	Supported
ADSL	8	1	5,5 km	1 SDTV channel
ADSL2	12	1	5,5 km	2 SDTV or 1 HDTV channel
ADSL2+ (ADSL-Reach Extended)	25	1	1,5 km (6 km)	5 SDTV or 2 HDTV channels
VDSL1	55	15	Several hundred meters	12 SDTV or 5 HDTV channels
VDSL2 – Long Reach	30	30	1,2 – 1,5 km	7 SDTV or 3 HDTV channels
VDSL2 – Short Reach	100	100	350 m	20 SDTV or 10 HDTV channels



The last mile

Advantages of IPTV over DSL:

- Usage of existing copper cable
- High data rates at VDSL
- Low equipment costs

Disadvantages of IPTV over DSL

- Data rates too low (ADSL)
- Not interactive for (ADSL) because of asymmetric
- Low range
- Trade-off between distance and bandwidth



The last mile

IPTV over fiber access network

Falling costs in the last years lead to increasing interests in fiber

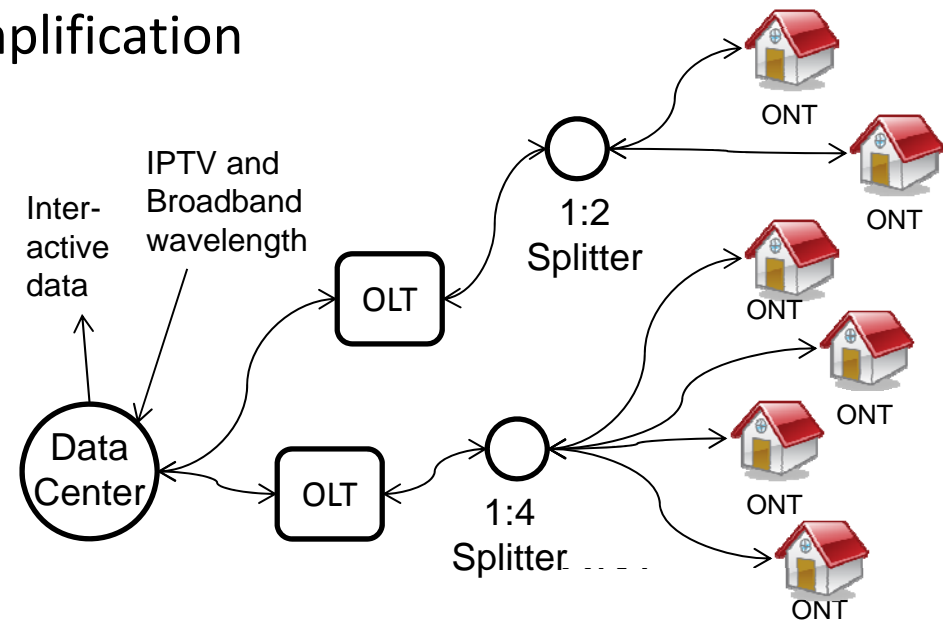
Different types of fiber networks (FTTx):

- FTTR: Fiber to the regional office
- FTTN: Fiber to the neighbourhood
- FTTC: Fiber to the curb
- FTTH: Fiber to the home
- FTTA: Fiber to the apartment

Mostly the delivery of these architectures is enabled through PON

PON: Passive optical network

- point-to-multipoint connection
- Delivering of data through lightwaves in different colors
- No need of electrical components between data center and end-user
- Max distance of 20 km without amplification
- OLTs (Optical line termination) in IPTV data center
- ONTs (Optical network terminals) at the end-users premises
- Splitters to split the optical signal





The last mile

Flavor	Download	Upload
BPON	622 Mbps	155 Mbps
EPON	1.244 Mbps	1.244 Mbps
GPON	2.500 Mbps	1.500 Mbps

Advantages of IPTV over fiber:

- Ready for future because of high bandwidth
- Immunity to electromagnetic interference

Disadvantages of IPTV over fiber:

- High costs



The last mile

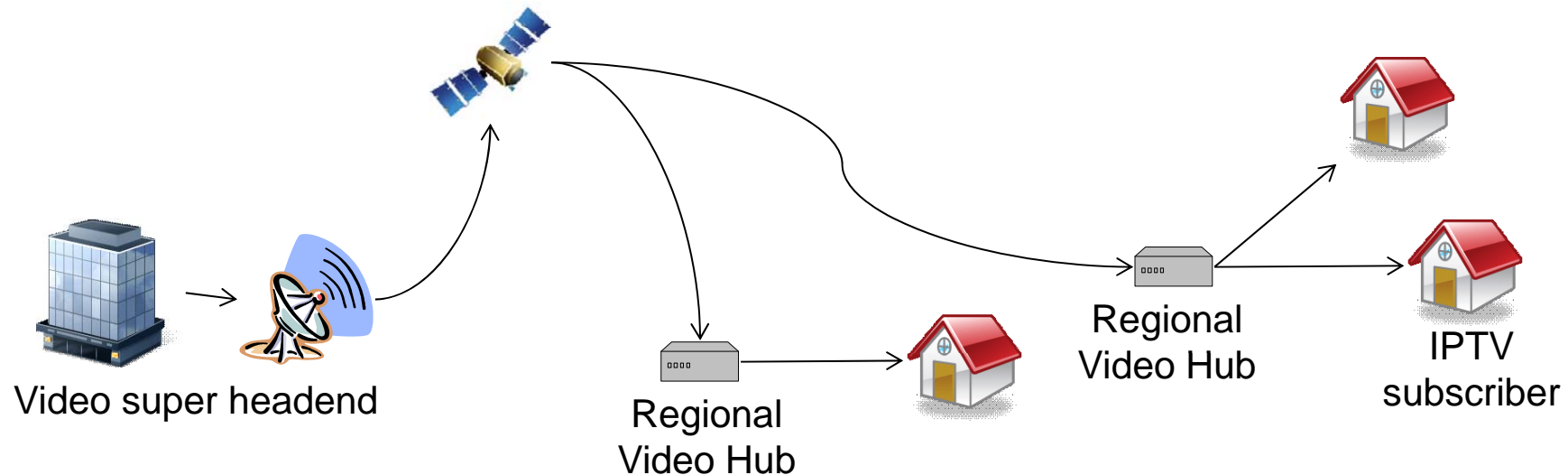
IPTV over next generation cable TV networks

- HFC: Hybrid fiber / coaxial
- Delivering of analog and digital simultaneously
- Only one channel must be delivered
 - more bandwidth for IPTV services
- Cable operators could save which channels are popular
 - adjustment of advertising

Flavor	Max. Downstream	Max. Upstream
DOCSIS 1.0 & 1.1	40 – 55 Mbps	10 Mbps
DOCSIS 2.0	40 – 55 Mbps	30 Mbps
DOCSIS 3.0	160 Mbps	120 Mbps and more

IPTV over a satellite based network

- Transcoded data will be uploaded from satellites operation centers
- So-called video hubs receives the data
- Deliver it to the end-user over cable or wireless networks



- Different types of direct connections to end-user



The last mile

IPTV over wireless networks

Fixed WiMAX – Worldwide Interoperability for Microwave Access:

- Uses licensed and unlicensed frequencies
- Licensed are preferred because of less interference
- Influences of weather, geographical topologies and equipment
→ theoretical max. speed up to 60 Mbps down within an area of
6 - 10 km

Mobile WiMAX:

- Preferred for mobil environment
- Quite young: developed 2005, first products on 2006
- Up to 32 – 46 Mbps → ideal compressed HD content



The last mile

Wireless Municipal Mesh Networks:

- Outdoor usage, for example in cities or parks
- Wireless connection between a few access points (APs)
- One Gateway AP is connected over ethernet to the IPTV data center
- important: to find the best route
- Low data rates of max. 1 Mbps → only for specialized functions

3G Networking technologies:

- EV-DO: data rates up to 4,9 Mbps
- HSDPA: data rates up to 14 Mbps and with bright look-out



The last mile

IPTV over the Internet

- Difference to Internet TV:
 - The internet portal sites for internet TV can't control the underlying infrastructure

- Three different Versions:
 - Streamed internet TV channels
 - Internet downloads
 - Peer-to-peer (P2P) video sharing



IPTV Technologies

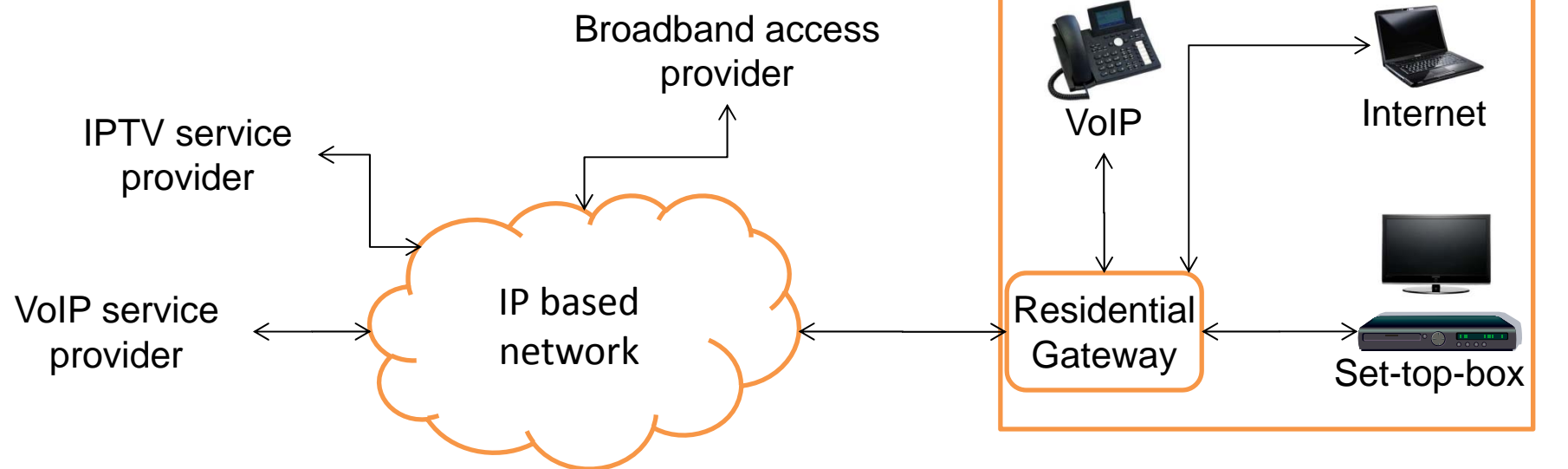
Technologie	Advantages	Disadvantages	Operational area
DSL, ADSL, VDSL	Use of existing copper cable, high data rates	Low range, trade-off between distance and speed	Nearly everywhere
Fiber network	Very high bandwidth, no interference	High costs	Only in big cities
Cable network	High bandwidth by DOCSIS 3.0	Less extension by now	Mostly in big cities
Satellite	High bandwidth, alternative to DSL	Backward channel difficulties, expensive	Everywhere
Wireless network	Mobility, usage with many mobil devices	Low bandwidth, by comparison low range	Cities with access points
Internet	Good speed and availability	No television in the classic form	Nearly everywhere



IPTV Hardware

IPTVCD – IPTV Consumer Devices to use different IP based services on home

- Residential Gateways (RG)
 - IP set-top-boxes
 - Game consoles
 - Media server
- } mostly used





IP set-top-box

Different types of set-top-boxes from entry level to high level have big differences between the functions

Functions of set-top-boxes:

- Usage without special training
- Inexpensive
- Support for interactive TV or multiplayer gaming
- Communication with digital cameras, music servers and so on
- Different set-top-boxes for each type of network
- Large hard disk drives to recording data
- Support of **two-way data communication**



IP set-top-box

The two-way data communication is needed for:

- Video on Demand (VoD)
 - Authorized subscriber chooses the content from an library stored on a server
 - The subscriber can control the stream → play, pause, fast forward, rewind
 - Two broad categories: downloadable and streaming
- Interactive TV
 - A little range of iTV Applications
 - EPG – Electronic programming guide
 - Web-browsing
 - E-Mail
 - Commerce applications
 - Gaming on demand
 - Parental control



Summary

For service providers IPTV means:

- High costs for new hardware and equipment...
- ... but investment for the future
- New revenue stream through personalized e-commerce, advertising and a few more

For consumers IPTV means:

- Much more channels to choice
- Access a range of interactive TV services
- Downloading / streaming and recording of video content
- Many functions in one box: Internet, VoIP, TV



References

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The end...

Thank you for your attention!

Questions?