



# \*TV

## From IPTV to mobile TV and over-the-top TV

Alessandro Bogliolo





# Foreword

- Internet video traffic (not including P2P):
  - in 2010 reached 40% of cons. traffic (more than P2P)
  - in 2012 it will reach 50%
  - In 2015 it will reach 62%
- The sum of all forms of video will account for 90% of global consumer traffic in 2015
- High-definition VoD will surpass standard definition by the end of 2011
- Internet video to TV tripled in 2010

Cisco, *Cisco Visual Networking Index: Forecast and Methodology 2010-2015*, 2011



# Foreword

- Compound annual growth rate (CAGR) of Internet traffic per device family:
  - PC (33%)
  - TVs (101%)
  - Tablets (216%)
  - Smartphones (144%)
- Peak traffic grows faster than average traffic
- Mobile data traffic grows 3 times faster than fixed IP traffic
- Mobile and Wi-Fi devices will account for 54% of IP traffic in 2015

Cisco, *Cisco Visual Networking Index: Forecast and Methodology 2010-2015*, 2011



# Agenda

- 1. Introduction**
2. IPTV model
3. IPTV limitations
4. Paradigm shift
5. Current bottlenecks
6. Viable scenarios
7. Conclusion



## IPTV etymology

The genesis of IPTV is written in the acronym, from right to left...



# IPTV**ision**





# IP**T**eleV

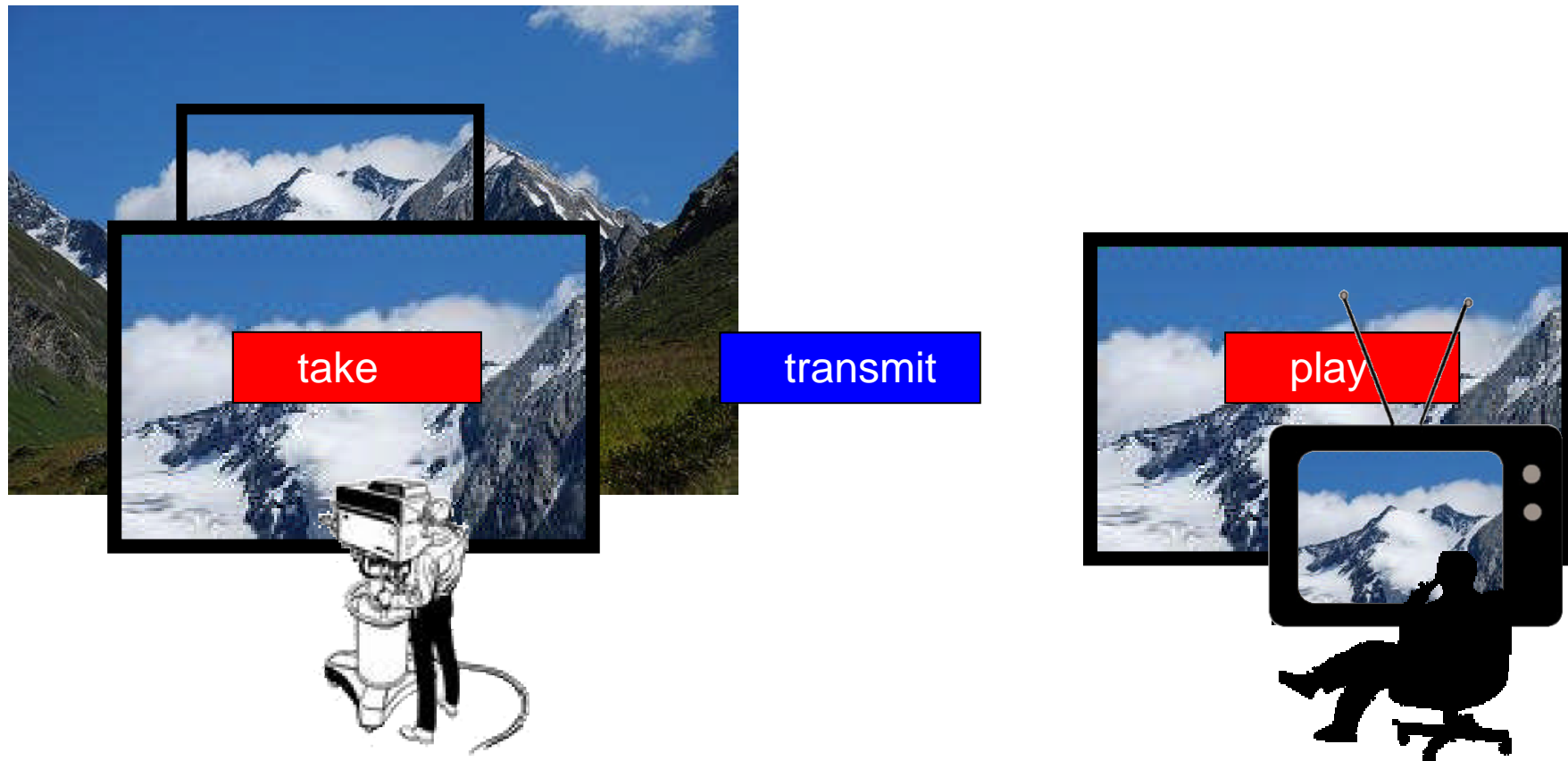
(Vision at the distance)





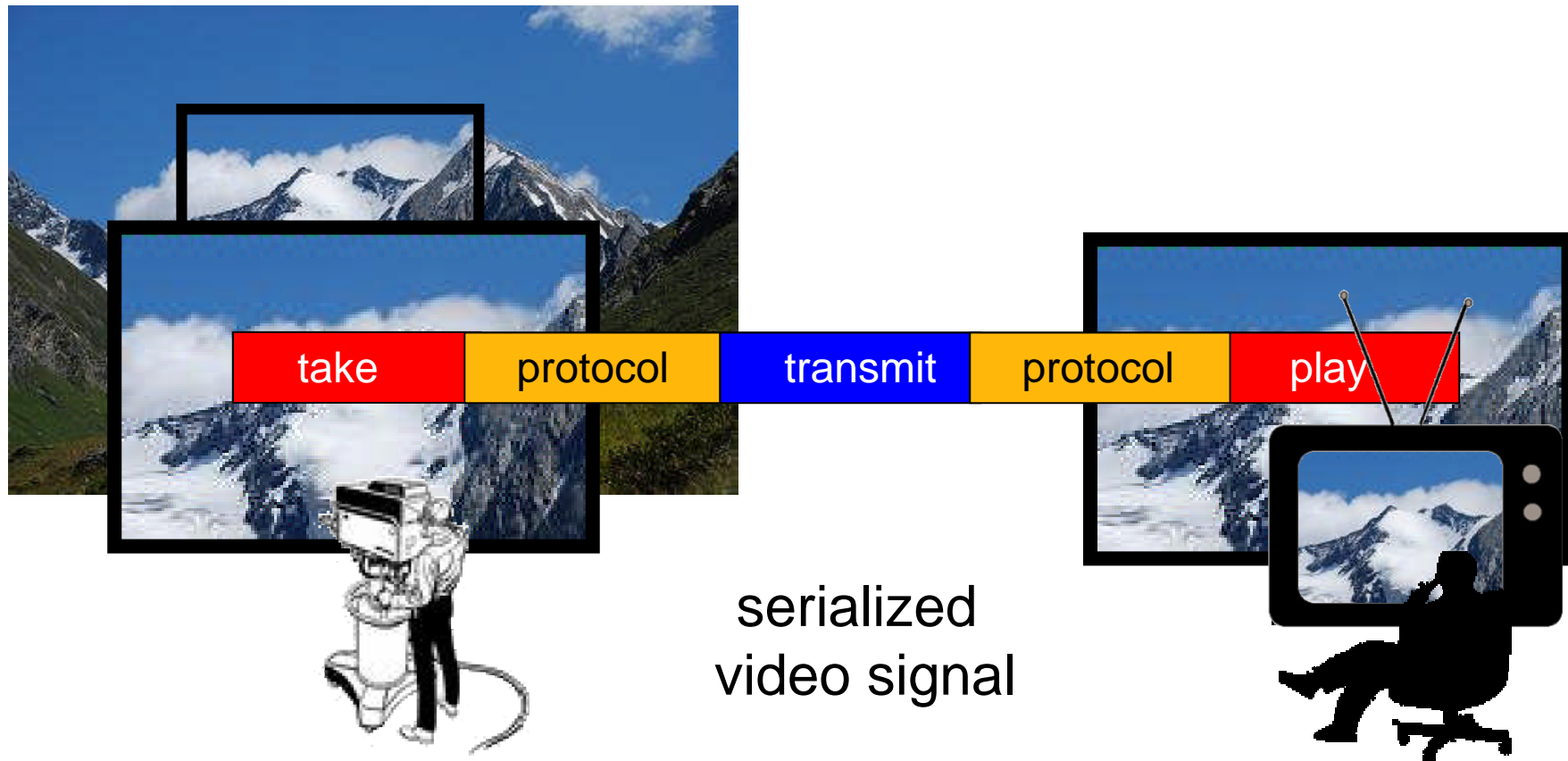
# IP**T**eleV

(Vision at the distance)

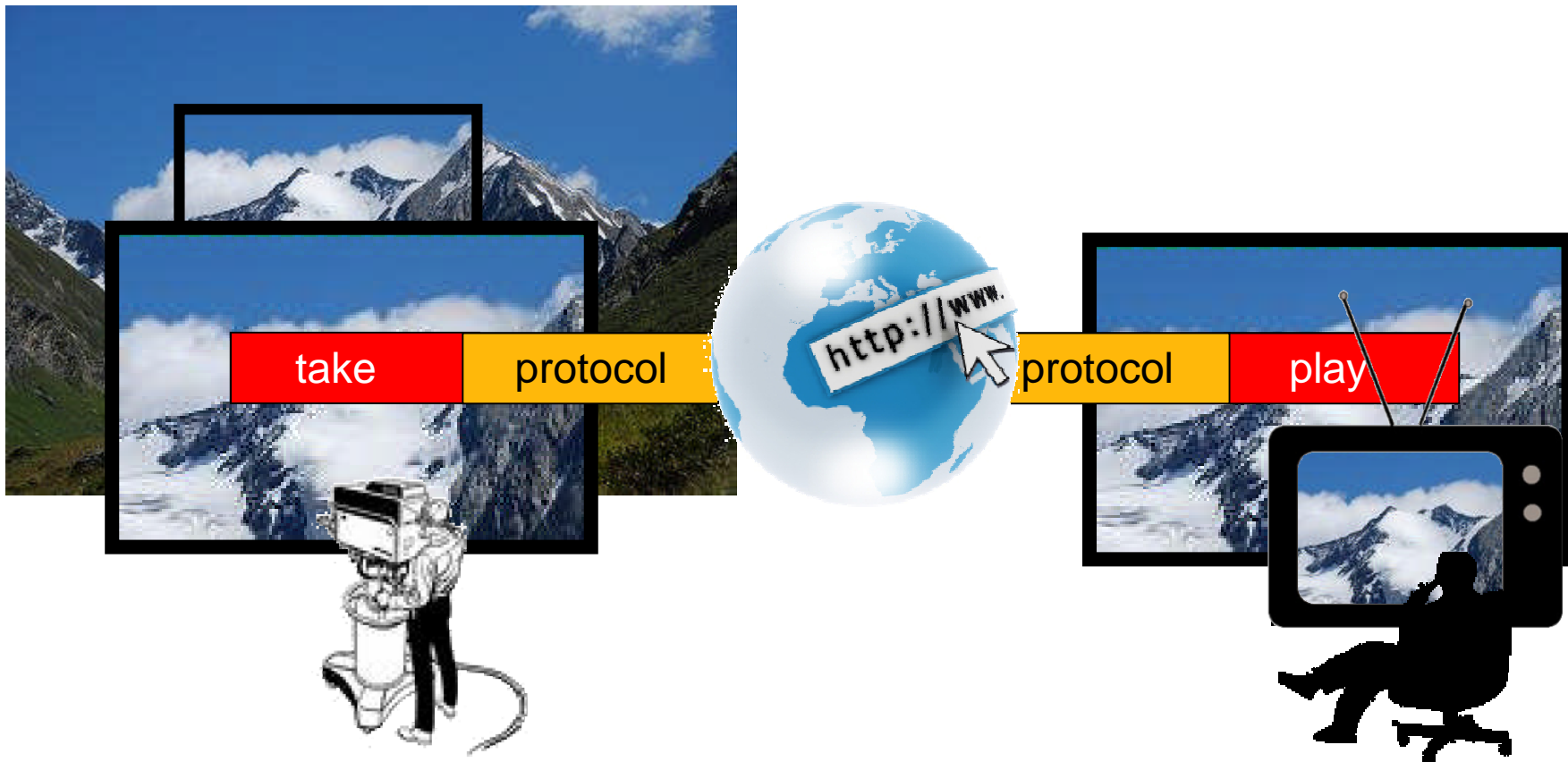




# IProtocolTV



# InternetPTV





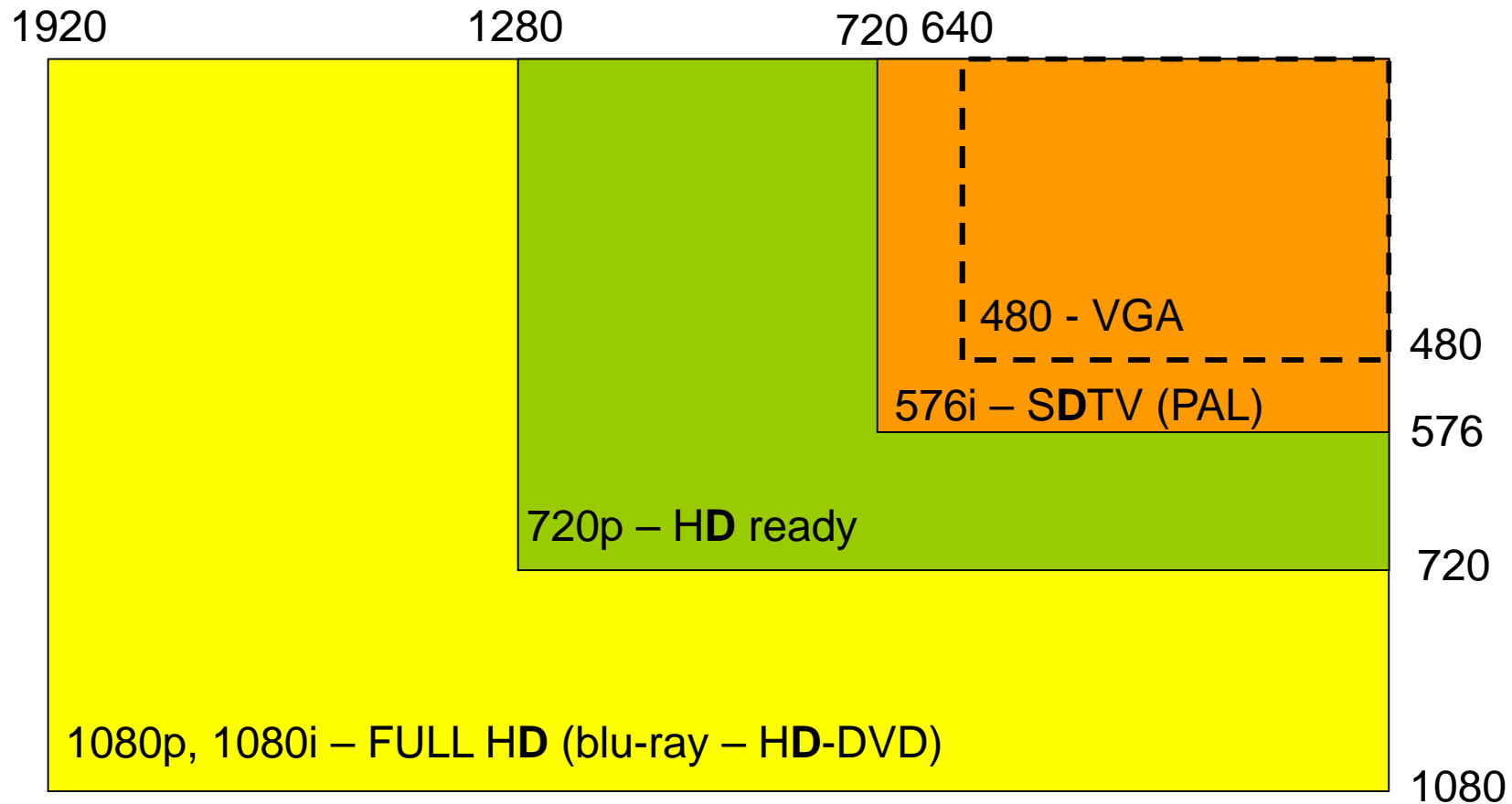
## The implicit **D**

- Everything is digital over IP, so that there is an implicit D in IPTV
- Television was born analog, so that the D was explicitly added to denote the advent of **D**igital TV:
  - **D**VB (digital video broadcasting)
  - **D**VB-T (terrestrial)
  - **D**VB-S (satellite)
  - **D**VB-C (cable)



# Another D

- D is used also to denote **D**efinition





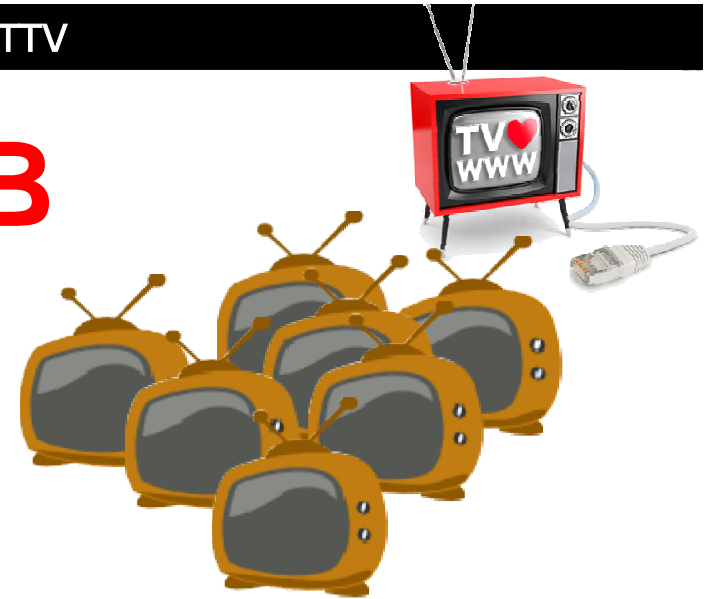
## 3 more D's

- D also denotes Dimensions
- The 2 dimensions of the screen are implicit, while the third one (if apparent) is worth to be mentioned:
  - 3D-TV





## A missing **B**



- Broadcasting was an inherent (implicit) feature of legacy TV
- In the digital era, the B is used to distinguish digital video **B**roadcasting (DVB) from online video contents
- As a matter of fact, the Internet does not support broadcasting

# A different **B**



- At the beginning of the era of connected devices, the so-called “**B**roadband addendum” anticipated the convergence between DVB and the Internet

# A true I



- In spite of the claimed interactivity of DVB, IPTV is truly Interactive thanks to the inherent nature of the Internet





# Analog vs Digital

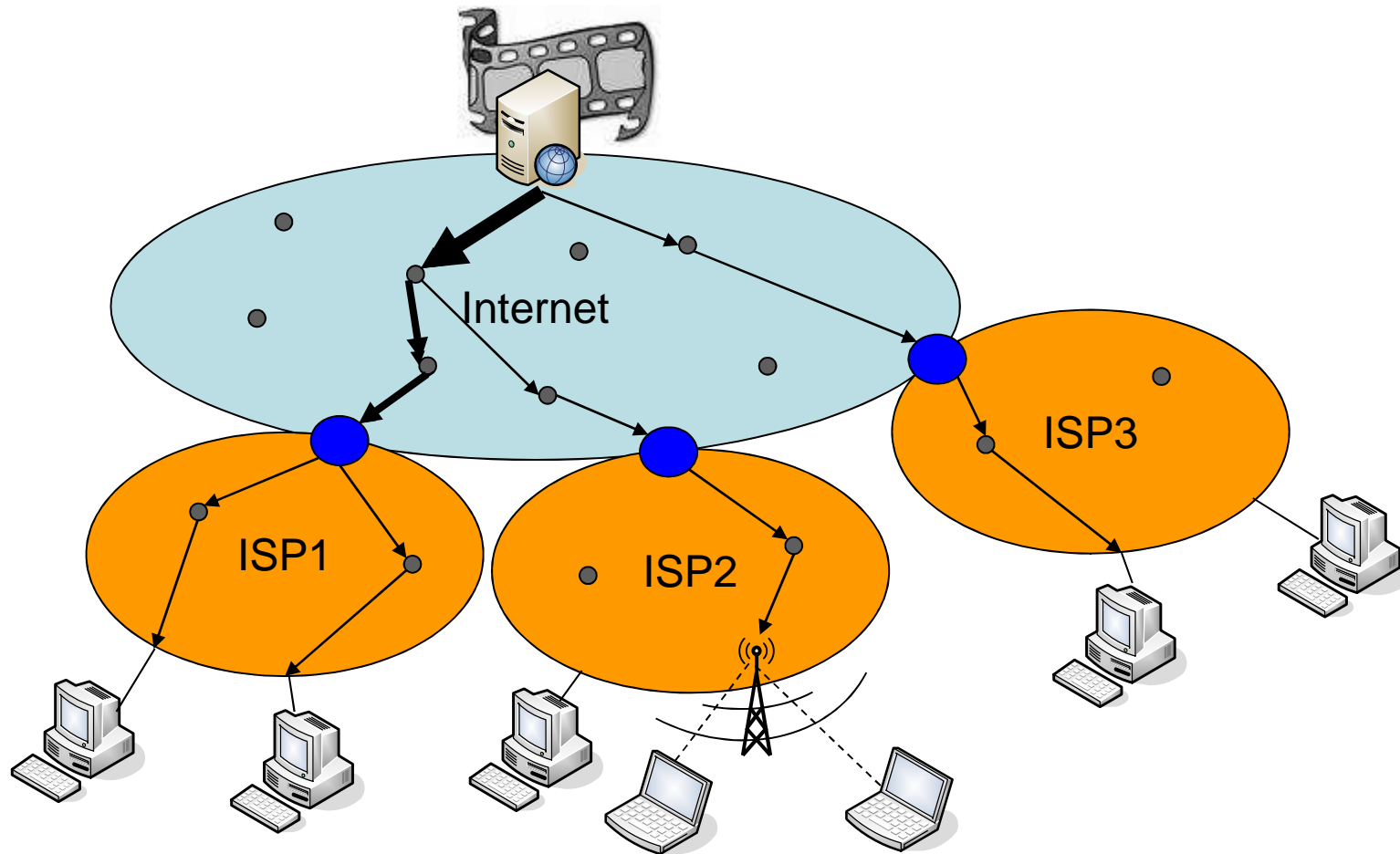
- Analog TV:
  - Monolithic
  - Vertically integrated
  - Synchronous
- Digital TV:
  - Layered (protocol stack)
  - Compressed (codec)
  - **Asynchronous**
    - Encoding / Buffering / Decoding

# Broadcasting vs Unicasting



- Broadcasting:
  - Area coverage
  - Predictable cost – no marginal costs per user
  - Lack of: feedback, interaction, personalization
  - Low access barrier
  - *Lean-back* usage experience
- Unicasting:
  - Unpredictable cost / bandwidth
  - Depend on the No. of users
  - Opportunities of interaction, personalization
  - Access barriers
  - *Lean-forward* usage experience

# Broadcasting vs Unicasting





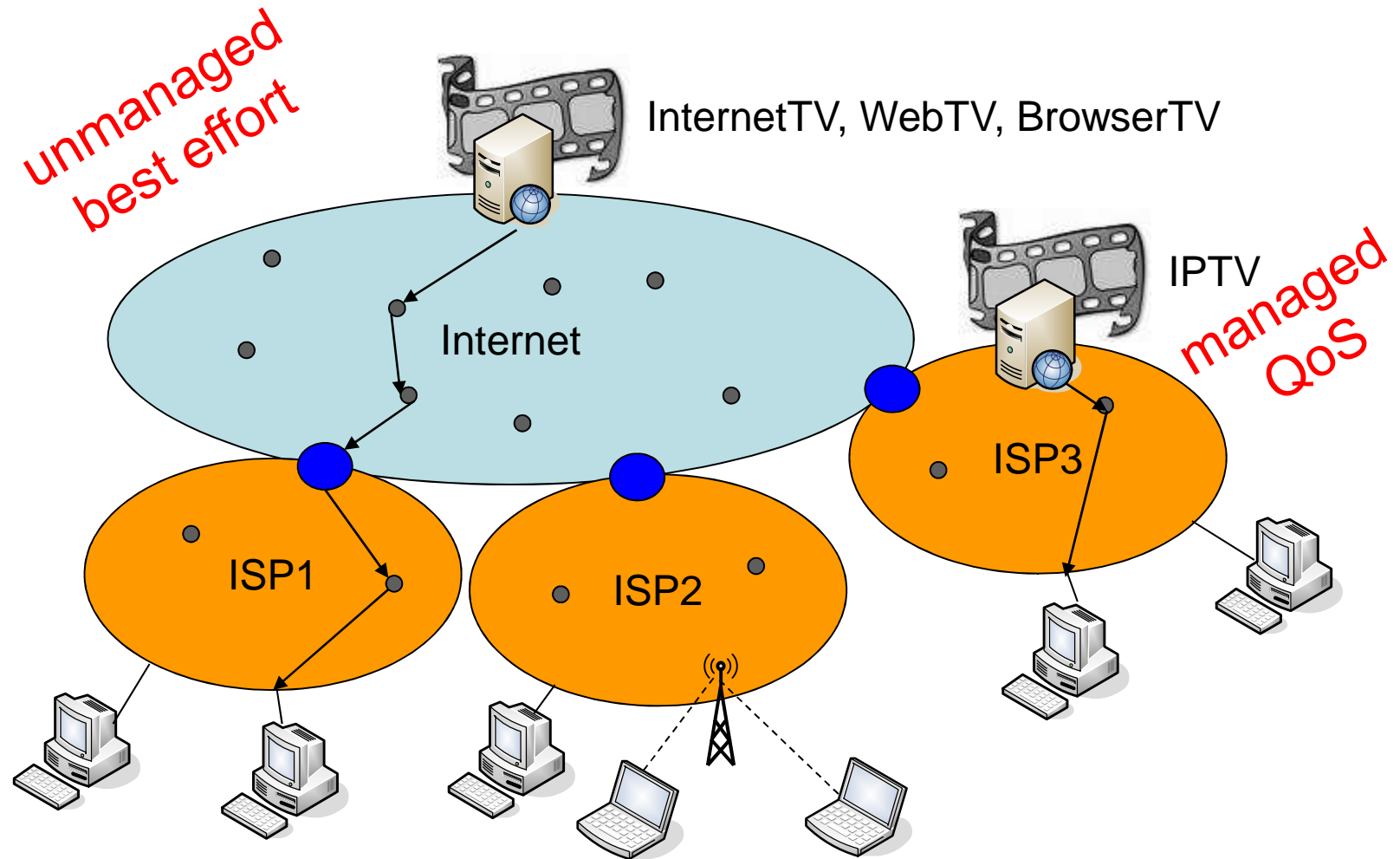
# Multicasting

- If many users request the same stream at the same time, the stream is generated only once, and replicated at network nodes only to take divergent paths
- The workload of the server and the traffic across each link are independent of the number of users

**Not supported  
on the Internet**

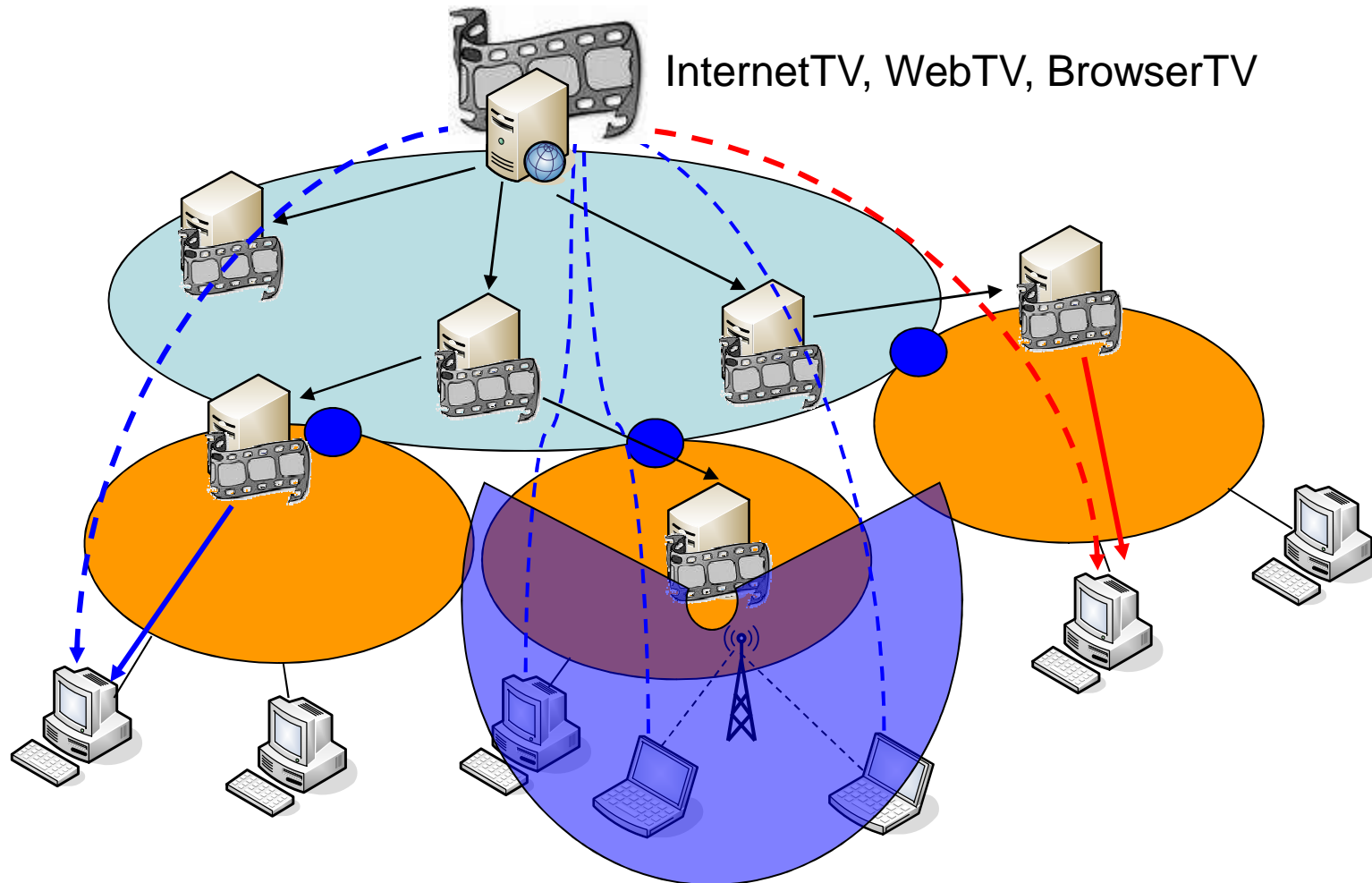


# Managed vs Unmanaged



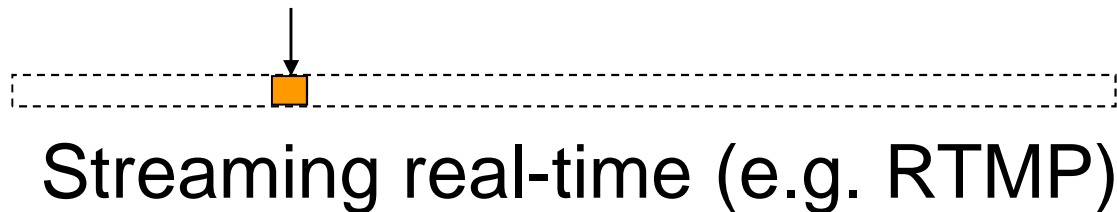
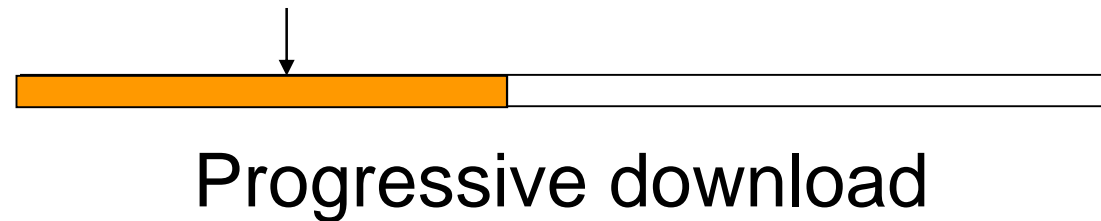
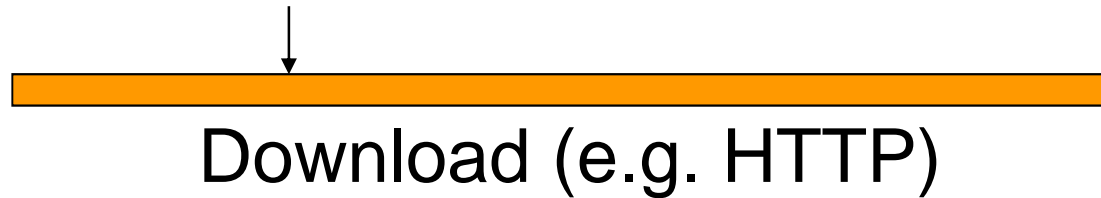


# Content delivery networks





# Is it like television?





# TCP vs UDP

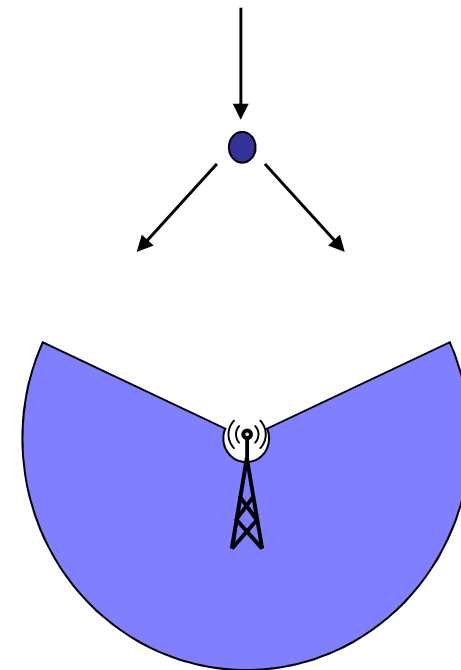
- TCP (Transmission Control Protocol)
  - Reliable bidirectional communication channel
  - Connection oriented
  - Acknowledge and retransmission
- UDP (User Datagram Protocol)
  - Connectionless
  - No Ack required
  - More efficient
  - Less reliable





# Wired vs Wireless

- Wired
  - Stable link quality
  - Point-to-point
  - Replication
- Wireless
  - Time varying link quality
  - Point-to-multipoint
  - Radio broadcasting
- Trade off between
  - bandwidth efficiency (multicasting, UDP)
  - quality (TCP)





# Agenda

1. Introduction
- 2. IPTV model**
3. IPTV limitations
4. Paradigm shift
5. Current bottlenecks
6. Viable scenarios
7. Conclusion

# IPTV service



- Guaranteed quality of service
- Mainly video on demand (VoD) and pay per view (PpV)
- Lean forward attitude
- Web-inspired user interface

# IPTV implementation



- Managed network
- Whole system under operator's control
- Proprietary solution
- Dedicated CPE (or PC)
- Limited contents

# IPTV business model



- Vertical integration
- Triple-play (bundle: Internet, Voice, Video)
- Walled garden
- Scope economies
- Positive externalities



# Agenda

1. Introduction
2. IPTV model
- 3. IPTV limitations**
4. Paradigm shift
5. Current bottlenecks
6. Viable scenarios
7. Conclusion

## IPTV service a critique



- Guaranteed quality of service
  - a promise hard to keep
- Mainly video on demand (VoD) and pay per view (PpV)
  - not scalable
- Lean forward attitude
  - not for everybody
- Web-inspired user interface
  - assume web-browsing experience

## IPTV implementation a critique



- Managed network
  - neutrality and scalability issues
- Whole system under operator's control
  - Deployment/maintenance costs, customer care
- Proprietary solution
  - lack of reuse of end-users' habits
- Dedicated CPE
  - high investments – limited reuse - obsolescence
- Limited contents
  - scalability issues



## IPTV business model a critique



- Vertical integration
  - A tough business model over IP
- Triple-play (Internet, Voice, Video)
  - unbundling/neutrality/antitrust issues
- Walled garden
  - closed market – high access barriers
- Scope economies
  - hard to reach
- Positive externalities
  - hard to trigger



# Agenda

1. Introduction
2. IPTV model
3. IPTV limitations
- 4. Paradigm shift**
5. Current bottlenecks
6. Viable scenarios
7. Conclusion

## IPTV as a SW App



- Market signs:
  - Diffusion/penetration of connected devices
  - Performance of embedded systems
  - Change of usage patterns
  - Success of the app-market model
- Paradigm shift:
  - Connected devices used as trojan horses
  - Proprietary IPTV solutions developed as apps targeting existing connected devices

## Moving over the top



- Market signs:
  - Exponential growth of Internet video traffic
  - Success of over the top services
  - Emergence of new marketing strategies in the big Internet (aggregation, embedding, ...)
  - Misalignment between costs and revenues in access networks
  - Network neutrality enforcement
- Paradigm shift:
  - Emergence of successful over the top TV networks
  - Conversion of existing IPTVs into OTT TV portals

## Moving into the cloud



- Market signs:
  - Cloud computing has become a common practice
  - Content delivery networks make it possible to serve millions of simultaneous users
  - Statistical sharing is cost effective
  - Overlay networks reach a trade-off between best-effort and quality of service
- Paradigm shift:
  - Tight relationships between OTT TVs and CDNs

## Watching TV on the move



- Market signs:
  - Penetration of smart phones and tablet PCs
  - Coverage of 3G/4G networks
  - Convergence between mobile and fixed networks
  - Convergence between 3G/4G and Wi-Fi devices
  - Business opportunities for mobile operators
- Paradigm shift:
  - Mobile IPTV (quadruple play)
  - Mobile OTT TV
  - Mobile 3DTV



# Agenda

1. Introduction
2. IPTV model
3. IPTV limitations
4. Paradigm shift
- 5. Current bottlenecks**
6. Viable scenarios
7. Conclusion



## Access-network congestion

- CDNs do not solve congestion problems within operators' networks
- Too many simultaneous unicast users connected to the same network termination point can saturate the local loop
- Too many unicast users connected through the same access network can saturate backhauling
- Wireless links are subject to interference and loss of quality





## Penetration

- Infrastructural digital divide:
  - Market failure regions
- Socio-cultural-economic divide:
  - Rural areas
  - Families without digital natives
  - Low-income families
- Access barriers:
  - Low perceived value
  - Low appeal of commercial offers
  - Access-first model unsuitable for an experience good



## Inflation of connected devices

- Too many connected devices
  - Underutilization
  - Duplication of configuration/personalization effort
  - Diversity of user interfaces
  - Market fragmentation
  - Portability cost

# Usage paradigm



- Lean forward vs lean back
- Lack of diversification
- Lack of bandwidth-awareness
- Limited scalability



# Agenda

1. Introduction
2. IPTV model
3. IPTV limitations
4. Paradigm shift
5. Current bottlenecks
- 6. Viable scenarios**
7. Conclusion



# Personal STB

- Smart phones (and tablet PCs) are the true personal devices
- People invest a lot of time to configure/personalize them
- 70% of smart phone/tablet owners use them while watching TV
- Using a smart phone (a tablet PC) as a set-top-box would allow end-users to take advantage of their personalized environment in the comfort of their living room

# Targeting non-Internet people



- Lean-back-first GUIs
  - Providing the usage experience offered by a traditional television set controlled by a trivial remote
  - Making advanced features accessible on demand
- Linear TV channels
- Low access barriers
- As free as possible (viewers are the true value)



# Enhancing bandwidth efficiency

- Worldwide CDNs complemented by local content-delivery services provided by network operators:
  - Multicast support
  - Wireless broadcasting
  - Caching/Mirroring/content distribution



# Service-based models

- Open access networks
  - Users grant value to the network
- Service-oriented commercial models
  - Transport included
- Mass contents paid by ads
  - As in traditional TV
- Operators take part in the business of OTT TV



# Free-on-air TV over IP



- Technically feasible
  - In open-access networks with multicast support
- Economically sound
  - The same model adopted by linear broadcast TV channels mainly paid by ads
  - Targeted advertisement
- Potentially disruptive
  - Internet as an experience good
  - Motivate investments in NGN
  - Enhance broadband penetration
  - Help reaching breakeven



# Agenda

1. Introduction
2. IPTV model
3. IPTV limitations
4. Paradigm shift
5. Current bottlenecks
6. Viable scenarios
- 7. Conclusion**



## Conclusions

- The Internet makes unlimited contents (TV channels) available to unlimited users (viewers) without QoS guarantee
  - Bandwidth awareness needed for scalability
- TV over IP could help to bridge socio-cultural digital divide if suitable business models are adopted
- We are witnessing a paradigm shift from IPTV to OTTV
- The TV-over-IP scenario will change significantly in the next 2 years
- Free on air TV over IP could be a benchmark



# THANK YOU!

Alessandro Bogliolo

STI-DiSBeF - University of Urbino

NeuNet cultural association

[alessandro.bogliolo@uniurb.it](mailto:alessandro.bogliolo@uniurb.it)