

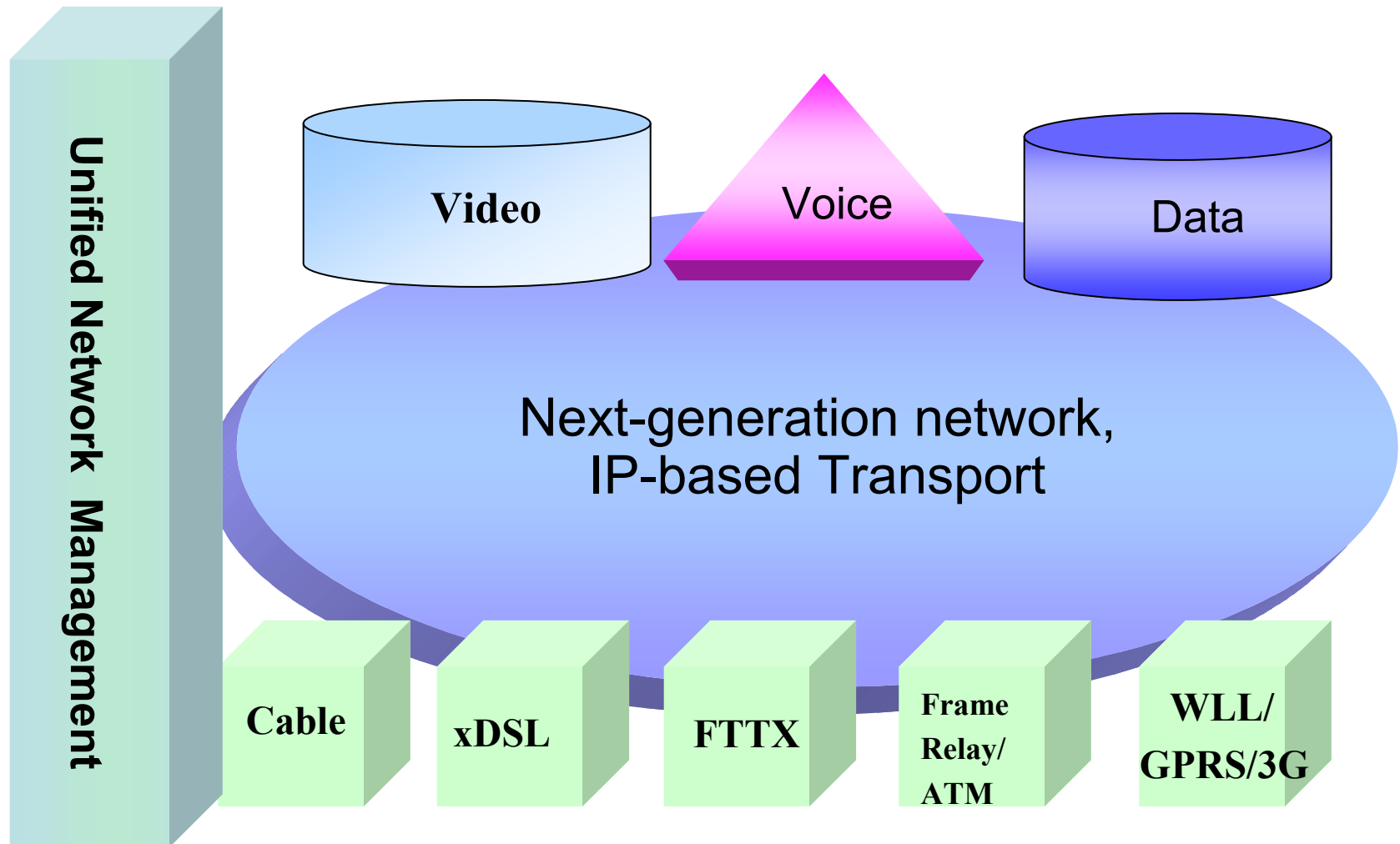
Digital Home Networking Trends

ETSI - [NGN@Home](#)

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IP : Universal aggregation layer



IP vision : IP on everything, everything on IP

Lower layers : LAN Technologies

IEEE 802.x (Ethernet-like) based networks will win the home

- IEEE 1394 will be a peripheral connection
 - for camcorders and HDTV (USA only)
 - There will be no breakthrough for 1394b nor for 1394c
- But PLC and others may mimic Ethernet
- IEEE 802.3 (FE or even GE) will be there at very low price
- IEEE 802.11 will be there but cannot be the unique answer for any home scenario due to QoS limitations

The Home network will be possible without any new wire or it won't be

Quality of Service : Two visions

IT world : historical Internet world (IETF)

- Connectionless networks without any signalling
- Reservation mechanisms exist but did not get momentum
- Trends
 - Increase bandwidth before problems occur
 - Service differentiation as the most efficient technique

Telco world : historical telco operators (ITU-T)

- Connection oriented networks based on strong signalling & reservation protocols
- IP backbones have been deployed for best effort traffic
- How to deal with lack of QoS protocols / measures at IP layer ?

IT vision is going to win

- Telcos have deployed over-dimensioned IP backbones
- No congestion on the backbone
- Congestion occurs only at agregation network / Solved by the right architecture

Home Network QoS vision

Home network QoS will follow access network trends

- Based on IP*
- Use of FE/GE makes QoS reservation useless*
- QoS will be based on Diffserv at least in the beginning*
- WiFi will be there, but with QoS limitations*
- WiFi inclusion and QoS pbs will be solved through the right home network architecture*

Power Line Trends

Power line throughput has increased significantly

- Up to 80 Mb/s in clean environment
- Some MAC QoS is available

Trials and experiments have shown technology potential for video applications

However

- Only proprietary solutions (no interop standard)
 - Might lead to co-existence problems
- Same sort of limitation as wireless
 - Will not work in any house between any locations
 - Performance decreases when (Tx-Rx) distance increases
- Has some specific limitations
 - Performance depend on what the user has plugged in the outlets

WiFi & IEEE802.11 Analysis for DHN

IEEE 802.11 is proposed under three labels WiFi a/b/g

IEEE 802.11b (most popular implementation) does not provide sufficient data throughput (5Mb/s max user data throughput)

IEEE 802.11g gets increased market acceptance and provides increased throughput but possibly restricted due to 11b backward compatibility

- Any IEEE802.11b device working in the same LAN drastically decreases data throughput
- Any IEEE802.11b device, even only associated in the same LAN will also severely decrease data throughput

Backward compatibility to 11b requires specific arbitration before any packet send

Throughput reduced by more than a factor 2 when TCP is used

IEEE 802.11bg operate in 2.4 GHz band : tight, crowded and polluted spectrum

IEEE 802.11a does not suffer neither from tight spectrum, nor from backward 11b compatibility

WiFi & QoS Analysis (PHY Layer)

2.4 GHz band is cheap and ok for data apps, but dangerous for video apps

5GHz band is a safest choice for video apps

Solution : Physical layer service differentiation

- Principle is enable different radio networks for different QoS profiles

Dual radio approach

- Enable 802.11a for video type applications / Reject any best effort STA
- Enable 802.11bg for best effort applications

Single radio with Band switching

- Enable 802.11abg on a single radio interface
- Time division approach for sharing the frame between the two bands
- Requires support in the AP

WiFi & QoS Analysis (MAC layer)

WMM : Wireless MultiMedia

- Corresponds to 11e EDCA (enhanced distributed channel access)
- Based on priorities only (as IEEE Std 802.3-2000 and IEEE 802.1p/q)
- Logical and straight forward mapping of Diffserv
- Has major market acceptance
 - Available in ICs (Intel, Atheros, Broadcom, Conexant, Cisco, ...)
 - Certification tests already started in WFA

WMM-SA : Wireless MultiMedia – Scheduled Access

- Corresponds to 11e HCCA (HCF controlled channel access)
- Based on Polling by the AP, and on Tx Opportunites reservation
- Avoids contentions / Allows bandwidth committments
- Has little/weak industry support
 - Only few ICs claiming WMM-SA support, and not yet available
 - WFA WMM-SA plugfests delayed (lack of implementations)
 - No direct mapping to the IP layer

WiFi : Propagation & performance

Level 1 : good connection (64QAM)

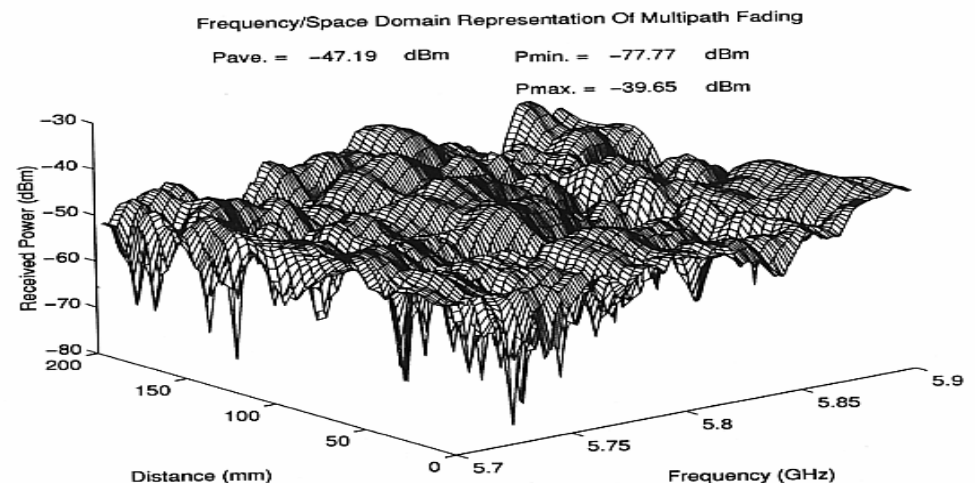
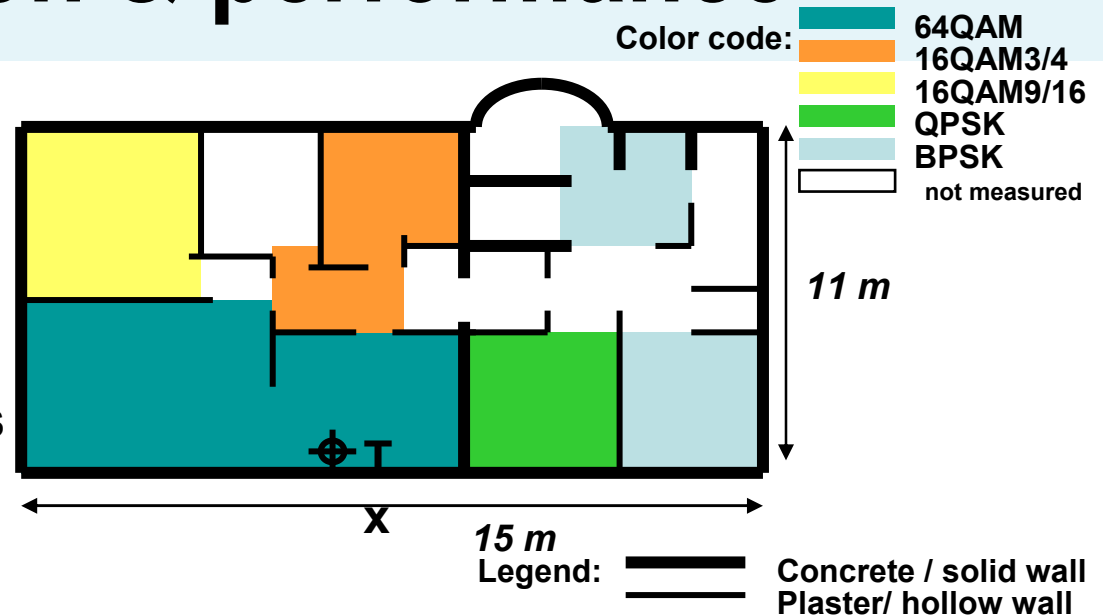
- up to 20 Mb/s unicast
- Suitable for one High definition program or five 4Mb/s SD
- Inside the same room
- Or between two rooms if the wall is thin

Level 2 : medium connection (16 QAM)

- Up to 8 Mb/s unicast
- Suitable for two 4Mb/s SD
- Between different rooms (up to two thin walls), or between two floors (no concrete)

Level 3 : low connection (BPSK / QPSK)

- Below 4 Mb/s
- Only suitable for Audio & data
- In presence of concrete walls or floor.



11a & « PHY diffserv » challenger for video but ...

IEEE 802.11a & PHY layer service differentiation is the safest path for video applications

- 11a does not suffer from 11b/g throughput restrictions
- 5GHz spectrum is wider than 2.4 GHz, so less subject to interferences
- Unicast traffic provides built-in reliable data transfer

But

- Customer shall be educated so that he understands things may not work everywhere and all the time
- Multicast traffic requires additional error recovery on top of MAC
- Fine tuning of MAC is mandatory
 - Physical channel lack of stability may produce high data rate variation (implementation of different link adaptation policies) damageable to video apps
 - Scanning algorithms (interference detection) may be damageable to video apps

Home network vision : Now

Home network will be wired and wireless

WiFi Dual radio 11ag (Phy differentiation) is the safest short term path

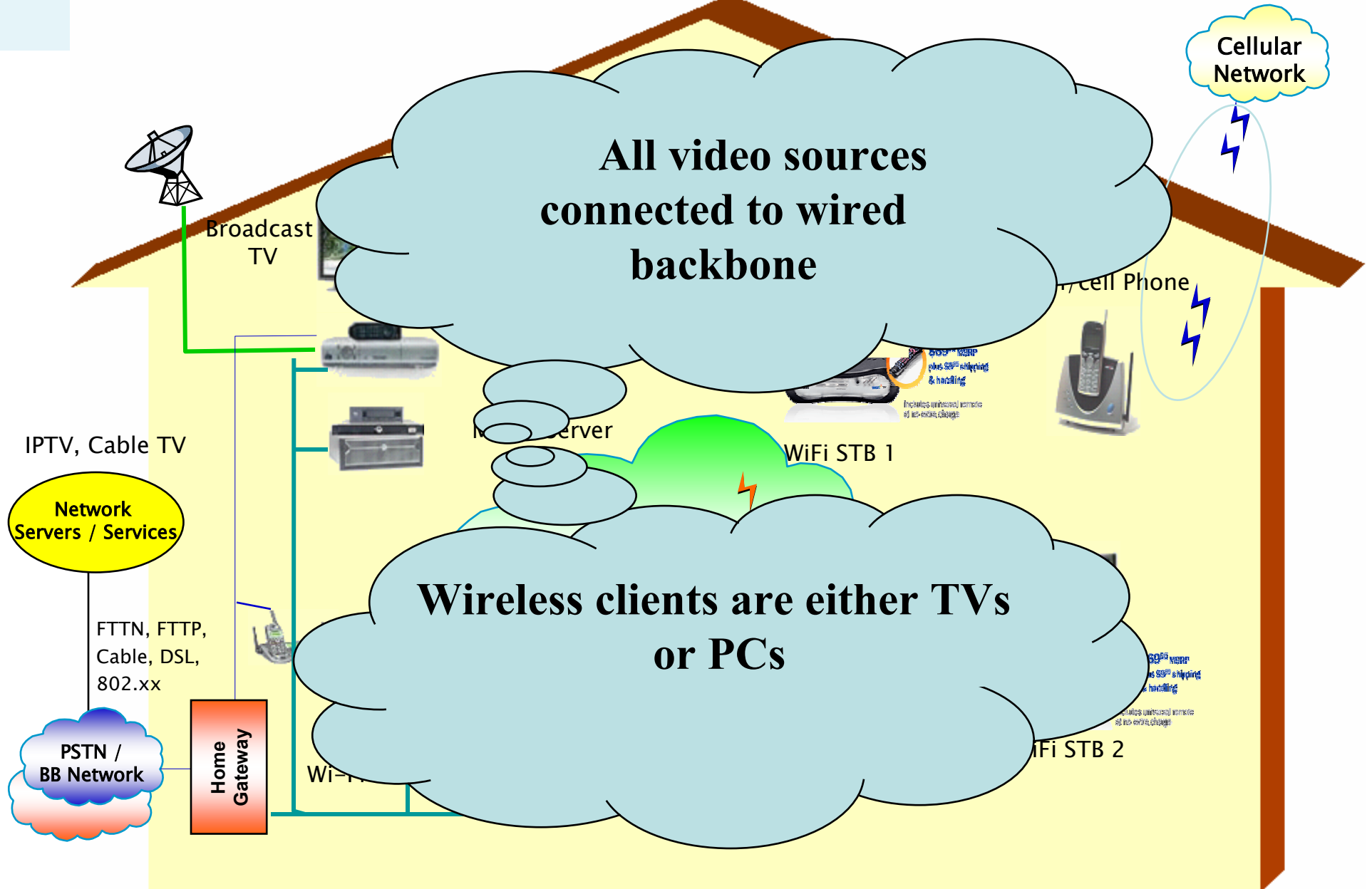
WiFi 11abg band switching will come next

WiFi pre 11n is coming with enhanced coverage

Home Network Architecture can solve WiFi QoS restrictions :

- Connect all BTV video sources to the FE/GE (PLC?) wired network
- Wireless clients can be either video receivers (TVs) or Best Effort devices (PCs)
 - Avoids contention / backoff occurrences for video apps
 - Reduces WLAN load for time shift apps

Consumer's vision : Multimedia Home



Home network vision : Next step

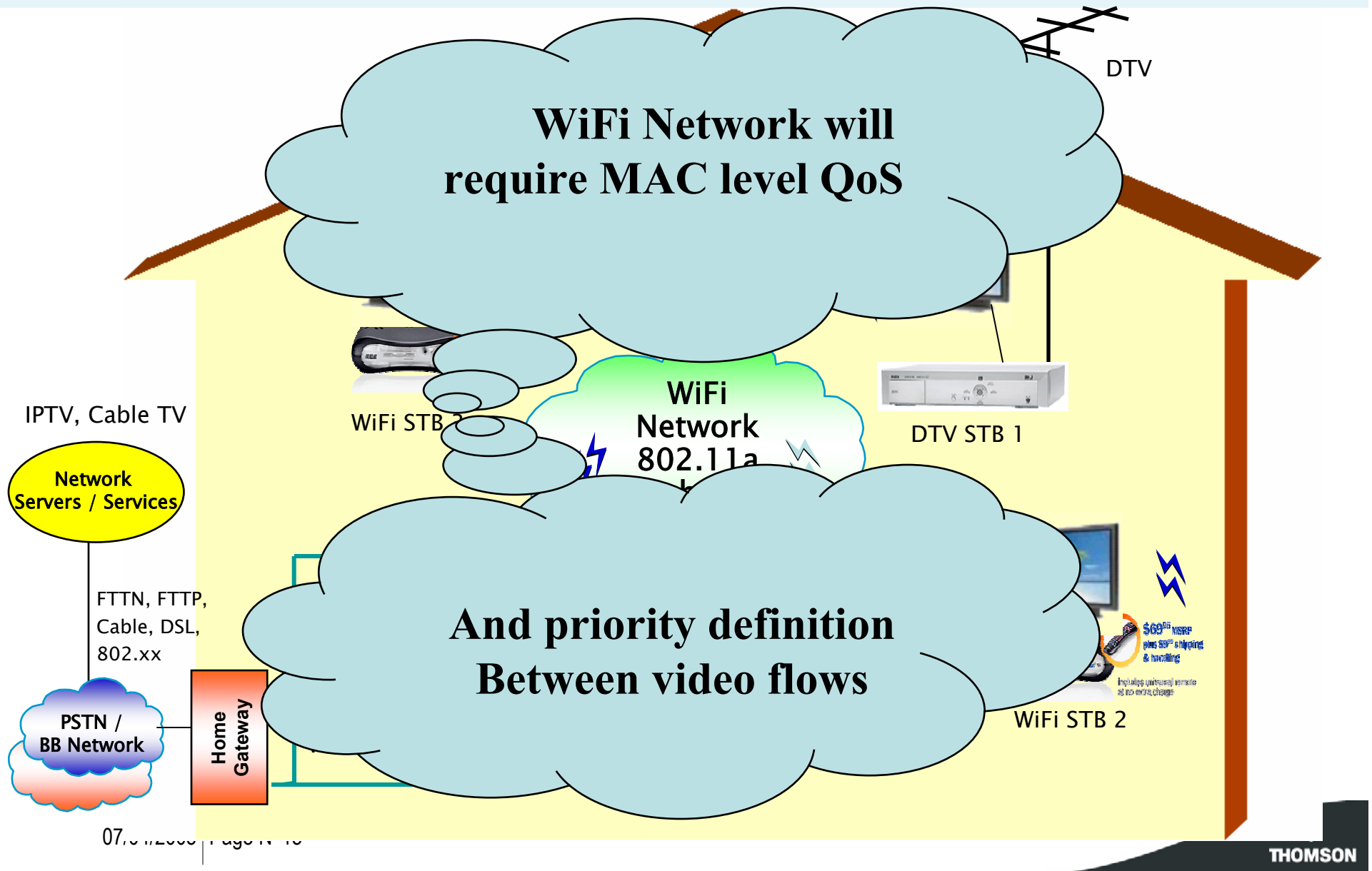
There may be cases where a video source is required behind a WiFi STA

- Broadcast tuner (sat or terrestrial) in the home
- Embedded PVR in a STB that provides time shift feature to other STB

Some QoS will be required at MAC level to manage several flows

- At least WMM is required and would prevent network crash in case of congestion
 - Will allow to remove one service only
 - Priority scheme will be required
- Will WMM-SA be required ?
 - Will certainly provide better efficiency
 - Would require mapping definition to higher layer (UPnP QoS ?)
 - Might be jeopardized by pre 11n or Std 11n

Consumer's vision : Multimedia Home



Upper Layers Trends

Home networking can be divided in two groups :

Access network / Home device

- Refers to delivering access network services to more than one device in the home
- Allows service integration scenarios

=> Watch broadband IPTV

Home device / Home device

- Refers to applications involving communication and interworking between two end user devices (possibly from different brands)

=> Watch DVD

Access Network / Home device DHN

Home Gateway strongly pushed by service operators (FT, Astro, ...)

Motivation is to sell more services (because available on more terminals)

Motivation is to develop new services

- New features enabled by the integration of multi-service access network (Voice / video)
- New services enabled by the integration of new technologies (storage)
- New service enabled by the integration of other DHN devices

Interactive engine and application framework will be the provider choice (DVB-MHP, Java Script, OSGi, ...)

Middleware will be the operator choice, but likely based on UPnP

Reference standardization bodies

- DVB IP for IPTV matters
- DSL Forum for xDSL matters
- Home Gateway Initiative (HGI)

Home device – Home device DHN

Motivation is to sell more CE devices with more advanced features to the user

Current DHN standardization champion is DLNA

- Based on IEEE 802.3 and IEEE 802.11
- Based on UPnP

DLNA Success on the market place still questionable

- Why would it succeed when other failed in the past ?

But things have (slightly) changed

- One unique technology is widely available and accepted (IP and 802)
- IT networks in the home are already there and have been pushed by internet access and gaming apps
- Operators now will push the home network further and will drive the market

Conclusion on Digital Home

The DHN will be based on IP and IEEE 802 LAN technologies

- First step will be IEEE 802.3 and IEEE 802.11
- Available throughput is increasing (GE, 11n)

The DHN architecture can compensate IP & IEEE 802 lack of QoS

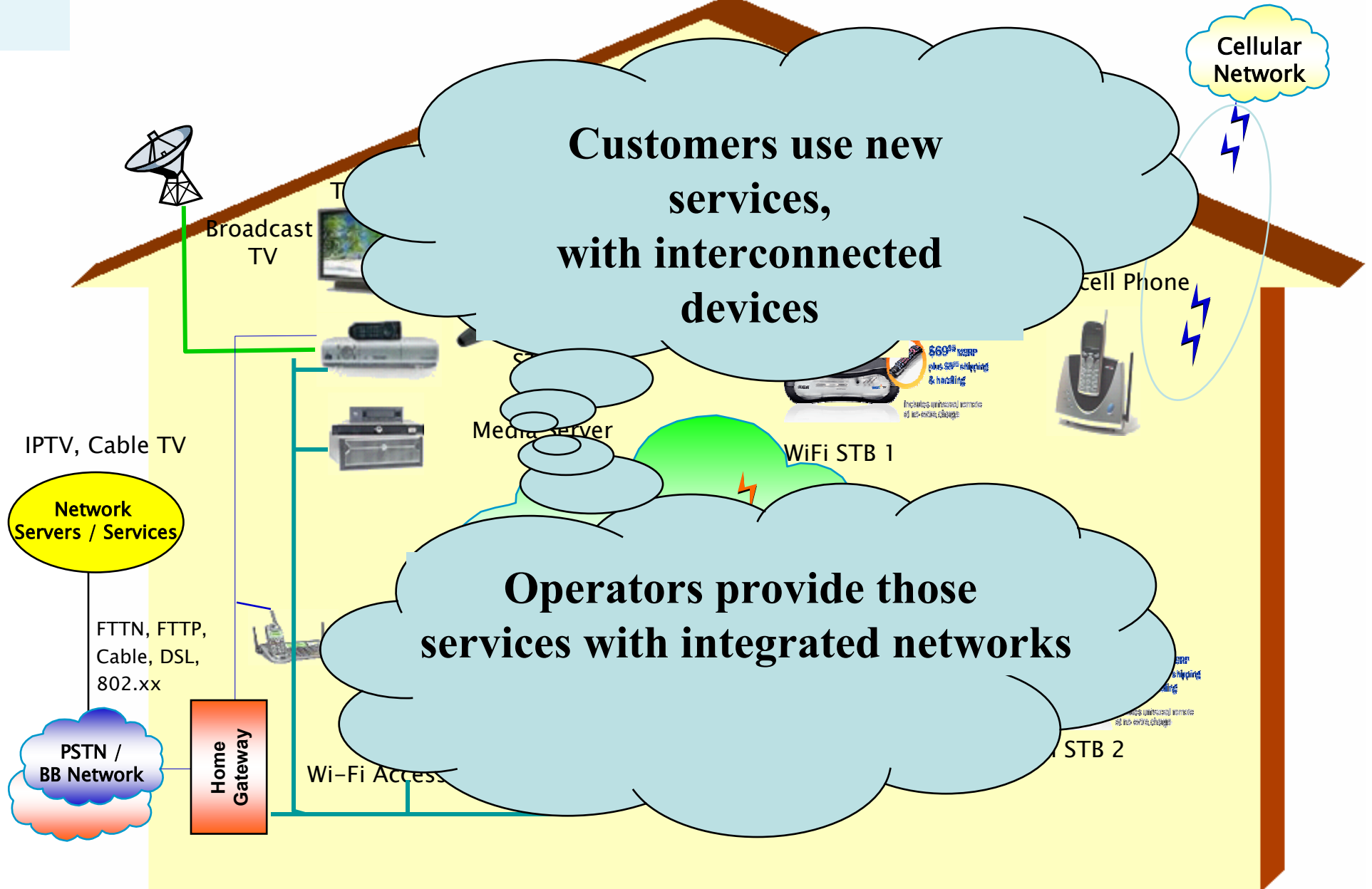
The operators will play a major role in DHN deployment, as well as

- CE manufacturers
- And the increased desire of users for network features

Standards are key to ensure basic interoperability

- WFA, DLNA, DVB, HGI, DSL Forum

Consumer's vision : Multimedia Home



Questions

