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# **Residential Ethernet IEEE802.3 Call for Interest**

**Richard Brand, Nortel Networks  
Steve Carlson, High Speed Design  
John Gildred, Pioneer  
Seyoun Lim, Samsung  
Dirceu Cavendish, NEC  
Onn Haran, PASSAVE**

# Supporters

- John Gildred, Dennis Lou, Pioneer
- Seyoun Lim, Samsung
- Dirceu Cavendish, Tetsu Koyama, NEC
- Geoff Thompson, Richard Brand, Glenn Algie, Nortel
- Onn Haran, Passave
- Steve Carlson, High Speed Design
- Kevin Brown, Broadcom
- John D'Ambrosia, Tyco
- Khaled Amer, AmerNet
- Alexei Beliaev, Gibson Guitar
- Henry Sariowan, Path1
- Paul Brant, SMSC
- Milton Chang, Transwitch
- Michael D. Johas Teener

*Pioneer* sound.vision.soul



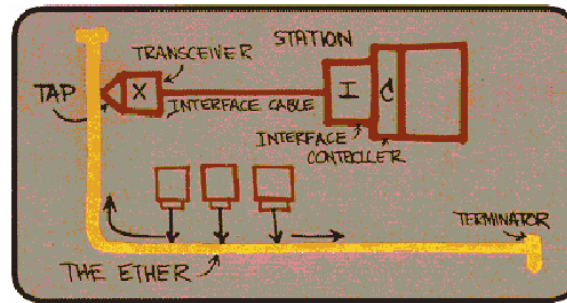
# Why Are We Here?

- To measure the **interest** in forming an 802.3 Study Group to investigate:
  - The additional application of Ethernet to time sensitive consumer Audio/Video Devices
    - Time and phase sensitive applications within a limited space
    - New networking requirements created by Digital Media
- **Not to**
  - Fully explore the problem
  - Debate strengths and weaknesses of solutions
  - Chose any one solution
  - Write a PAR and 5 Criteria
  - Write a standard or specification

# Why now?

- This CFI has been in gestation for over a year
  - Bob Metcalfe challenged us last year to support new applications

Year 32



- Voice and video home entertainment will be networked
- Pioneer and Gibson Labs attended the July 2003 Plenary
- Off-line discussions ensued prior to November 2003 Plenary
- “Ad hoc” meeting held at November 2003 Plenary
- Gibson Ethernet Guitar demonstrated during 802 Orlando Social

# Goals for Tonight

- Presentations:
  - Steve Carlson
  - John Gildred
  - Seyoun Lim
  - Dirceu Cavendish
  - Onn Haran
- Q&A
- CFI Poll
- Polls
- Develop presentation for closing 802.3 plenary
- Q&A leftovers

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# Ethernet in the Consumer Marketplace

Steve Carlson  
High Speed Design

# “Consumer Ethernet”

- It's already here
  - SOHO networking equipment
    - Switches
    - Router/Firewalls
    - WLAN access points
    - Combo units – all of the above
- It's sold in retail outlets in bubble pack
  - Computer stores
  - Electronic stores
  - Even DIY stores!
- It's inexpensive
- It's high performance
- **It's getting easier for non-technical end users to setup**

# Consumer Marketplace

- It's huge!
  - Market for all consumer electronics (\$96 B 2003)
- Pace of new product introduction is rapid
  - Product cycles are ~ 3-6 months (sometimes less)
  - Rapid change in features and performance
- Products are mass produced with tremendous economies of scale
- Enormous market pressure for low-cost high-performance exciting products



# Why now?

- Several companies have home A/V equipment with Ethernet ports now, more to follow
- Digital media is the norm for home and professional A/V
  - DVD for videos
  - CD, SACD, DVD-Audio for audio
  - Digital cable, digital satellite, High Definition TV
- Convergence:
  - It's not just a buzzword, it's really happening
  - Computers are used to play videos and music
  - “Consumer media servers” with hard drive recorders
- Increased penetration residential broad band access

# Home Physical Infrastructure

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- New homes are now being wired with UTP cable
- According to the Consumer Electronics Association, 52% of new homes in the U.S. are constructed with structured wiring plants
- ISO/IEC has just approved the standard for residential structured wiring plants (SC25/WG3)

# It's already happening

Digital Living Network Alliance (DLNA, was DHWG) is already developing higher-level protocols that use Ethernet as the physical layer

- Professional audio has used several proprietary solutions for almost a decade
  - It's very popular, but the solutions are **proprietary** (non-standard)
- Professional video is looking for similar solutions
- Using Ethernet will **standardize** the interface across computers and A/V equipment

# In Summary

- The home networking market has **already** chosen Ethernet for data
  - The “home” part of SOHO is growing rapidly each year
  - There are already products on the market from several manufacturers--and there are more to come
- The home audio/video industry is now **deliberating** about whether to choose Ethernet
- The expansion of Ethernet into audio/video will potentially create a new market segment
  - Tens of millions of new Ethernet ports per year
- With increased broad band penetration and the completion of EFM, the home is the next Ethernet challenge for A/V apps

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# **A/V Home Entertainment Requirements**

John Gildred

Pioneer

Alexei Beliaev

Gibson Labs

# A/V Has Time Sensitive Applications

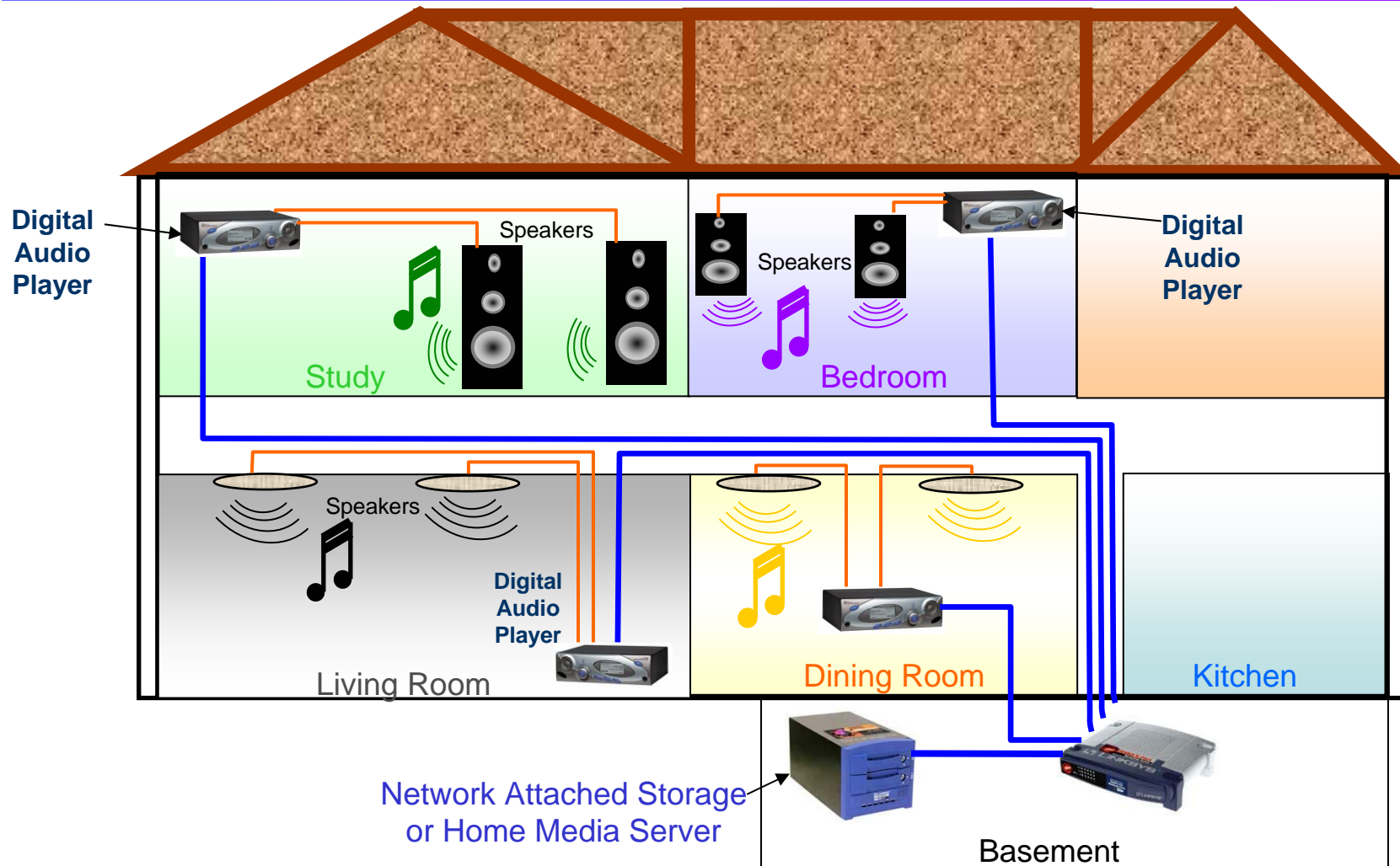
- **Multi-Room Synchronization**
  - Audio playback synchronized across multiple rooms
  - Video playback synchronized across multiple rooms and maintaining lip-sync
- **Network Trickplay**
  - Multiple HDTVs accessing recorded shows on a Digital Video Recorder
  - Each TV attempts slow/fast playback at same time
- **Jam Session**
  - Multiple instruments with live effects and mixing
  - Turn on instruments and immediately begin playing
  - 500uSec max latency, zero long term jitter
    - Gibson Guitar experience at 100Mbps

# A/V Application Example Requirements

<i>Application</i>	<i>Data/time guarantee</i>	<i>Maximum latency</i>	<i>Long term jitter</i>
Multi-room synchronous audio playback	Required	500 usec	Asym. 0
Jam session (live performance)	Required	500 usec	Asym. 0
A/V Conferencing	Required	<100mSec*	Asym. 0
Network Video Trickplay	Required	<100mSec*	N/A

\*Round trip including application layer

# Home Network Use Case I: Different Audio Tracks in Each Room



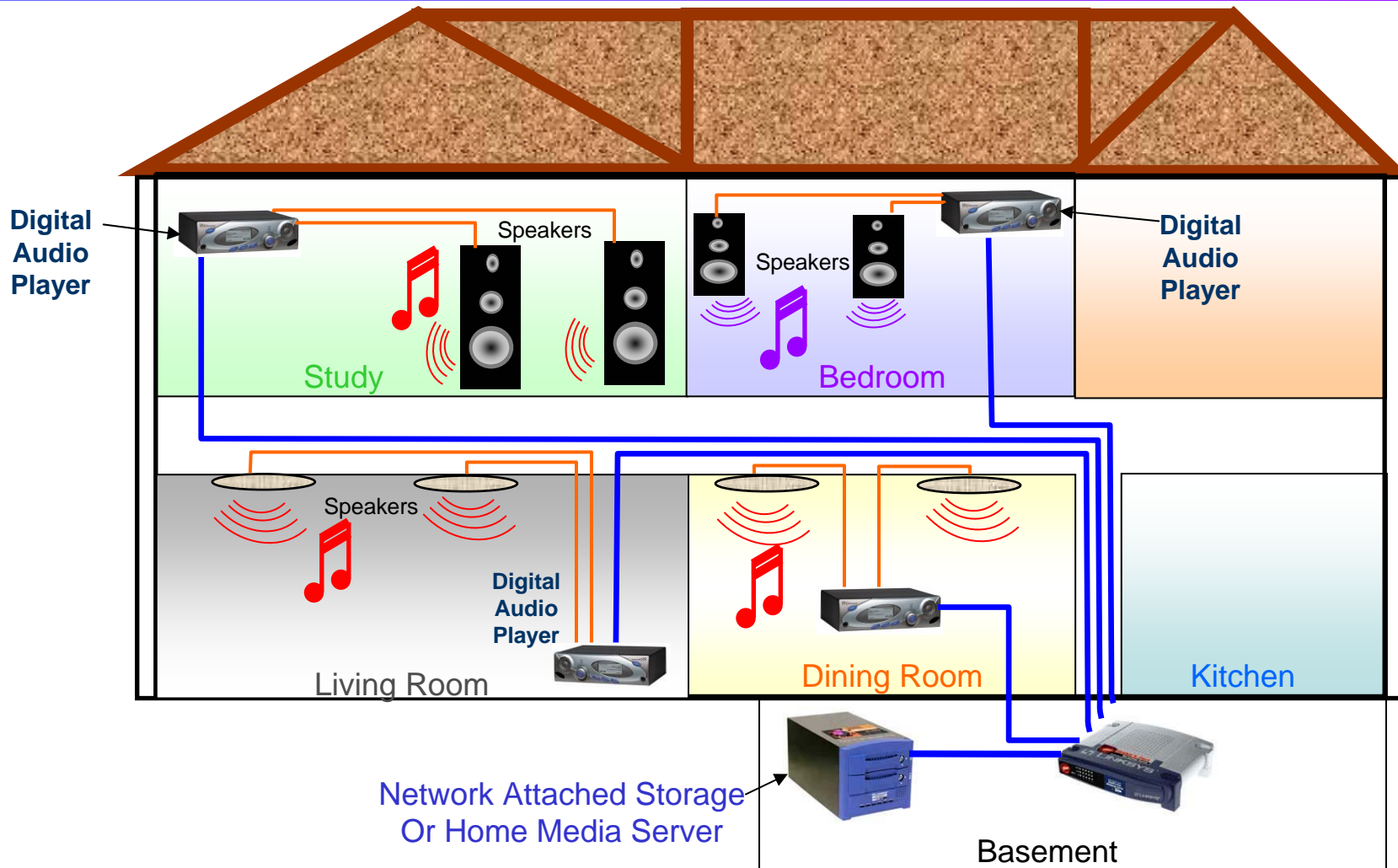


# Home Audio Use Case I

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- User stores all his music files on a Network Attached Storage (Media Server) box connected via an Ethernet switch
- Each room has a digital audio receiver, connected to Ethernet, which can access and play any song from the Media Server
  - Digital audio receivers drive local speakers over ordinary speaker wire

# Home Network Use Case II: Same Track in Multiple Rooms



# Home Audio Use Case II

- Sometimes, the user wants one digital audio receiver to be the “master” and control what songs are played in other rooms through “slave” receivers
  - A single song in the whole house
  - A single song in selected rooms; e.g. living room, dining room, and study, but not bedroom
- Simultaneous audio playing in multiple rooms requires synchronization and phase control of audio within the limits of human hearing to prevent “reverberation” throughout the house

# Time Sensitive Requirements

- **Precise End-Point Synchronization**
  - Data/time synchronization must be sufficiently precise at little or no cost
  - Ethernet today does not provide data/time synchronization
- **Bounded Jitter and Latency**
  - Bounded jitter and latency per A/V application is required
- **Bandwidth Allocation Guarantee**
  - Guaranteed protection from interfering streams is required
- **Plus All the Existing Benefits of Ethernet**
  - e.g. minimum packet loss

# Next Generation AV Connector

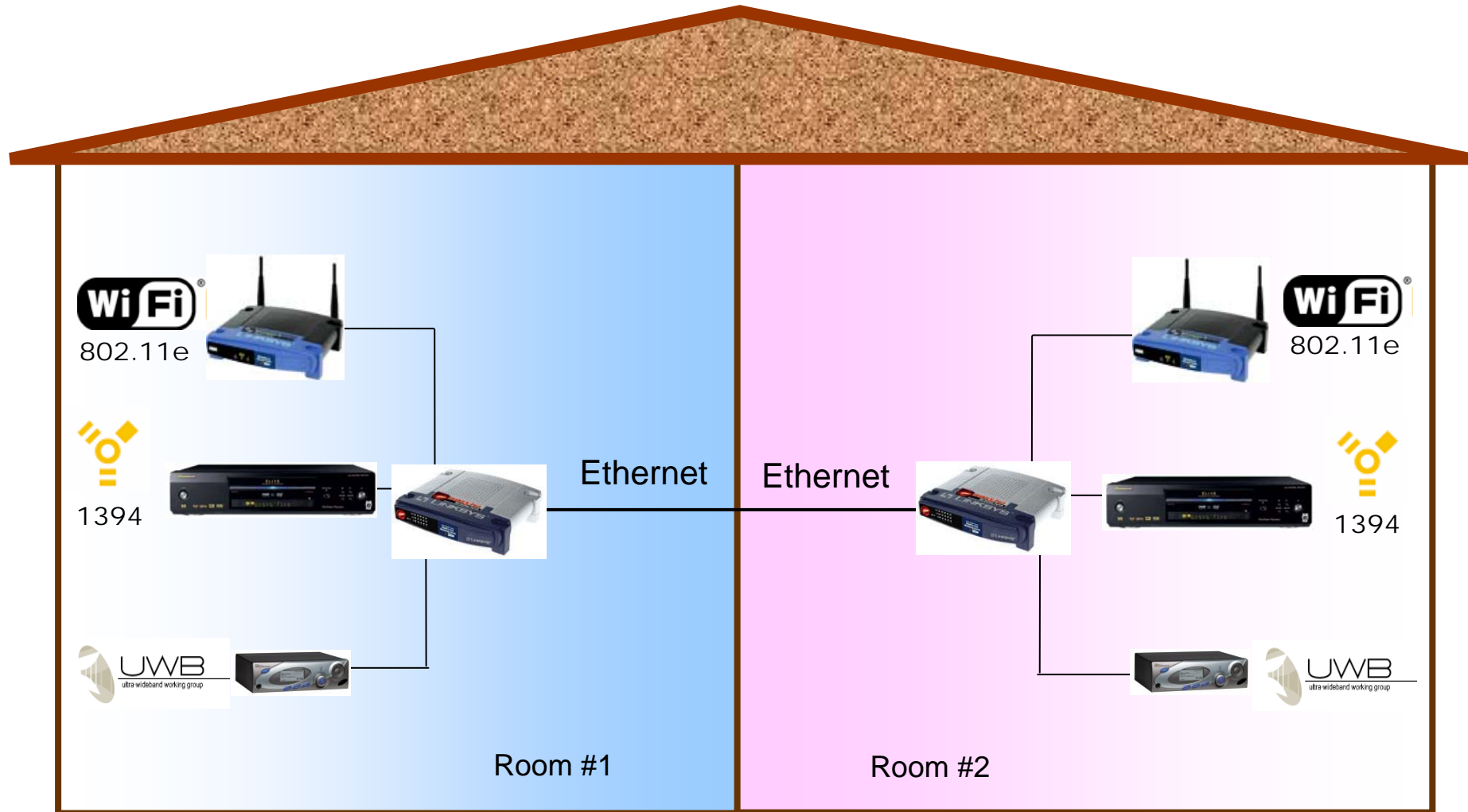


# Next Generation AV Connector



Clean and Simple

# The Next Evolutionary Step (Missing Link with PoE Option)



# Ethernet is Everywhere

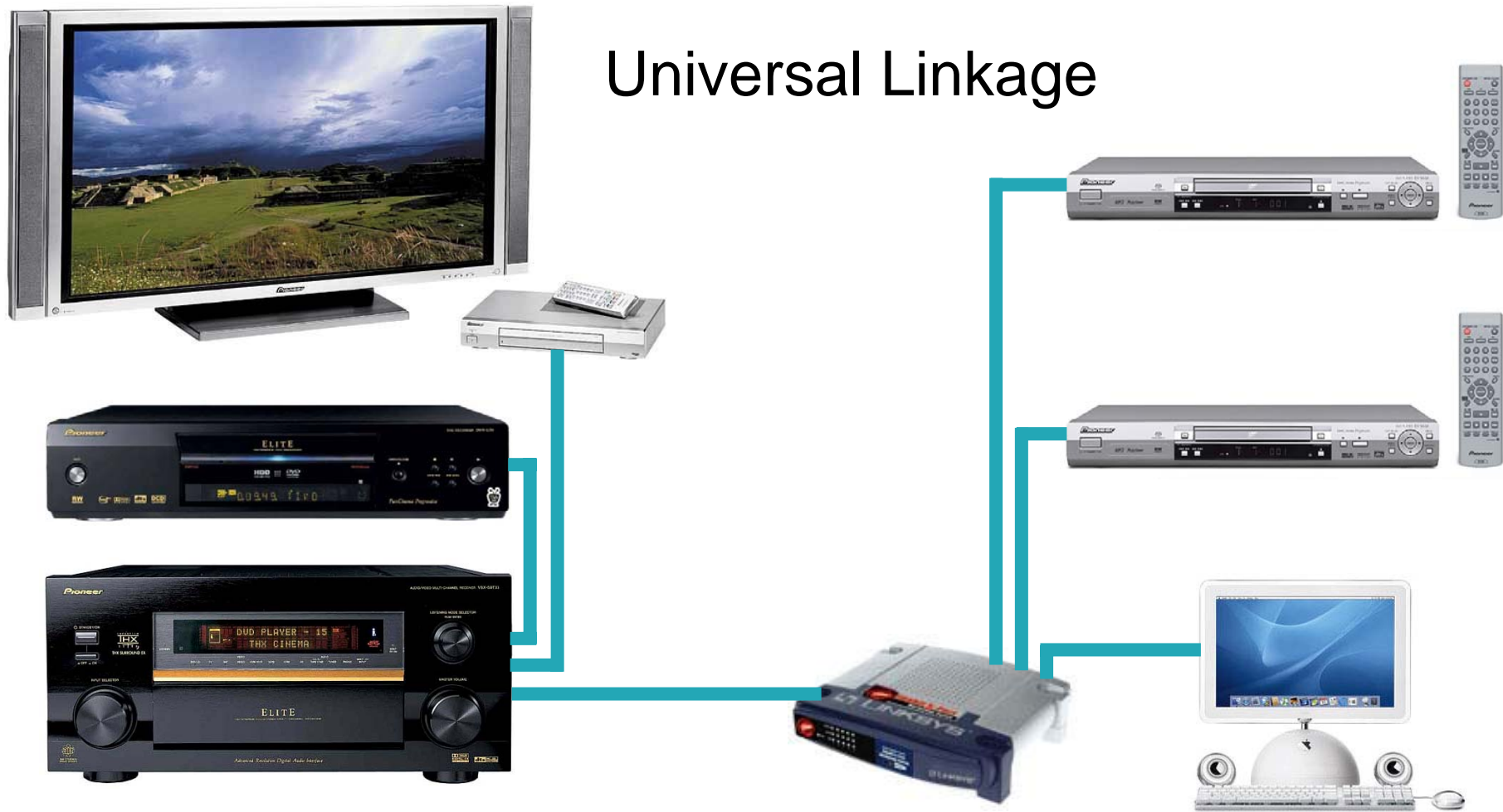
## Ubiquitous, except in the home

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- Fast
- Robust
- Very familiar
- Affordable right now
- Very wide product selection
- Growing momentum in CE industry



# Next Generation AV Connector



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# **Consumer Electronics is Ready for Ethernet**

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# Home Network Potential Market

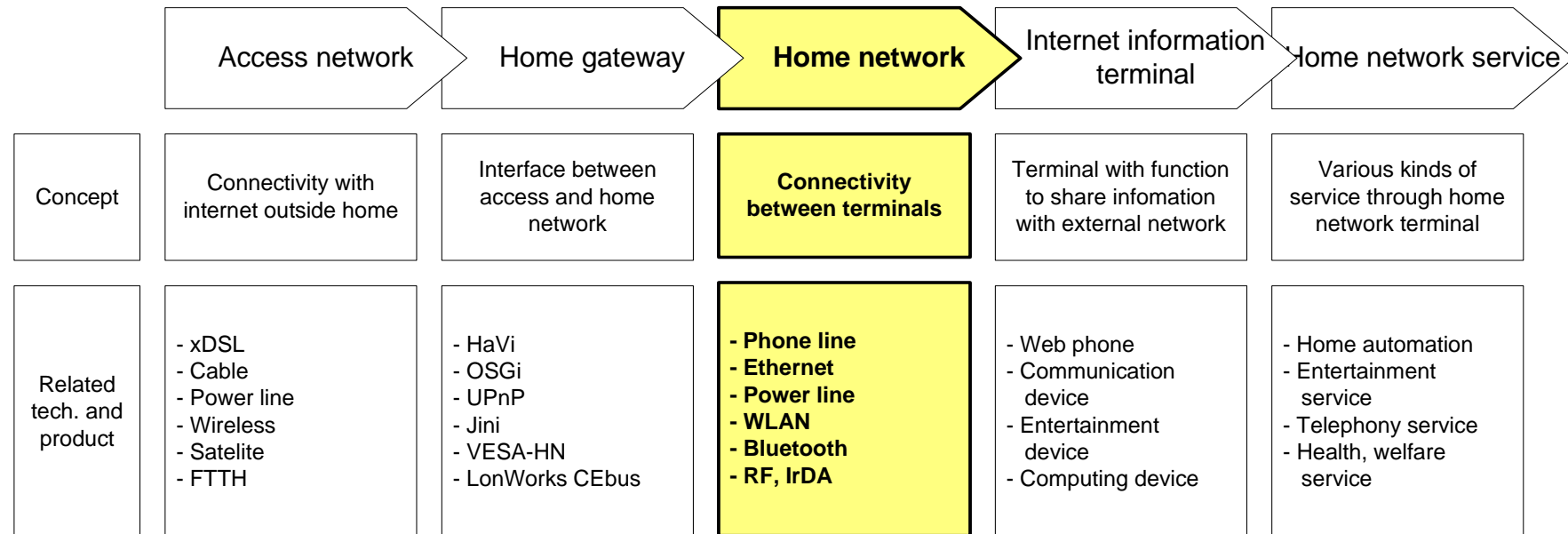
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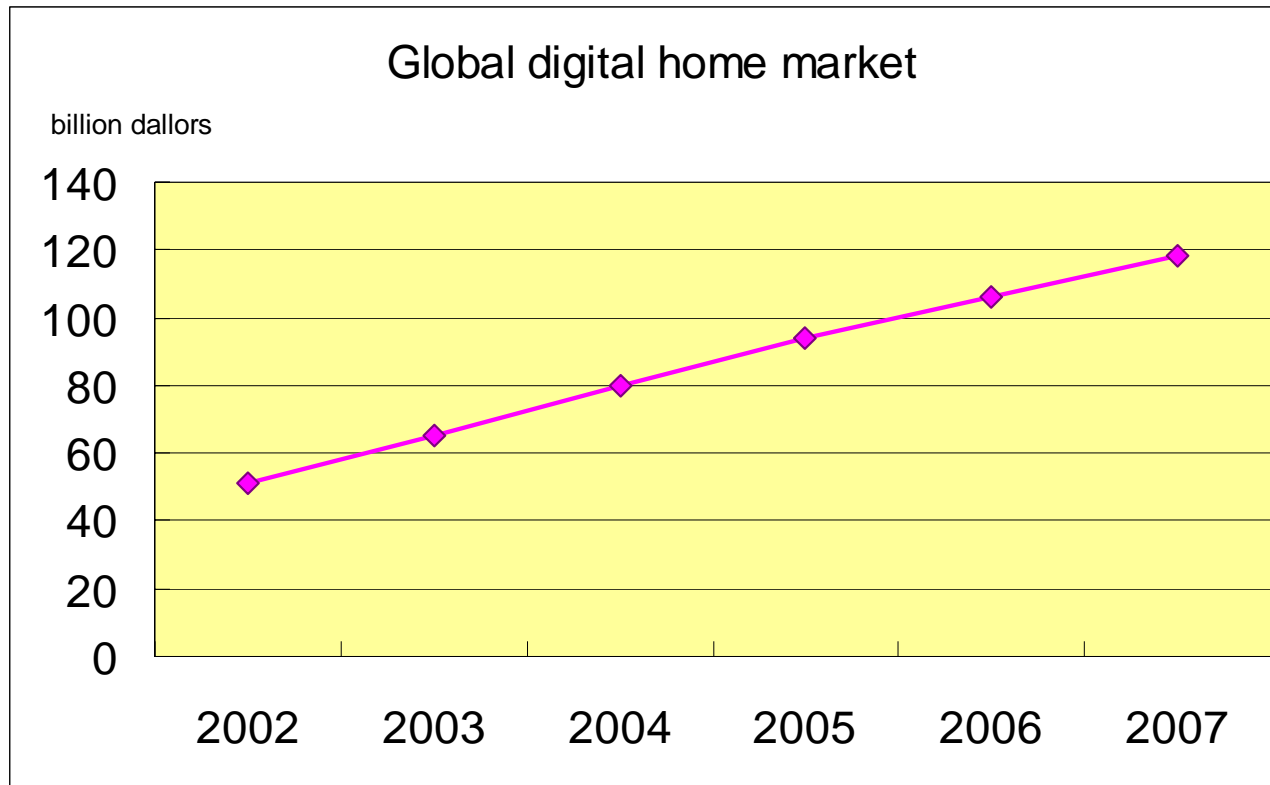
# The home network is at the heart of the digital home

<In-Stat/MDR 2003>



- Enabling home entertainment networks is key to opening up several large potential markets.

# Global home network market



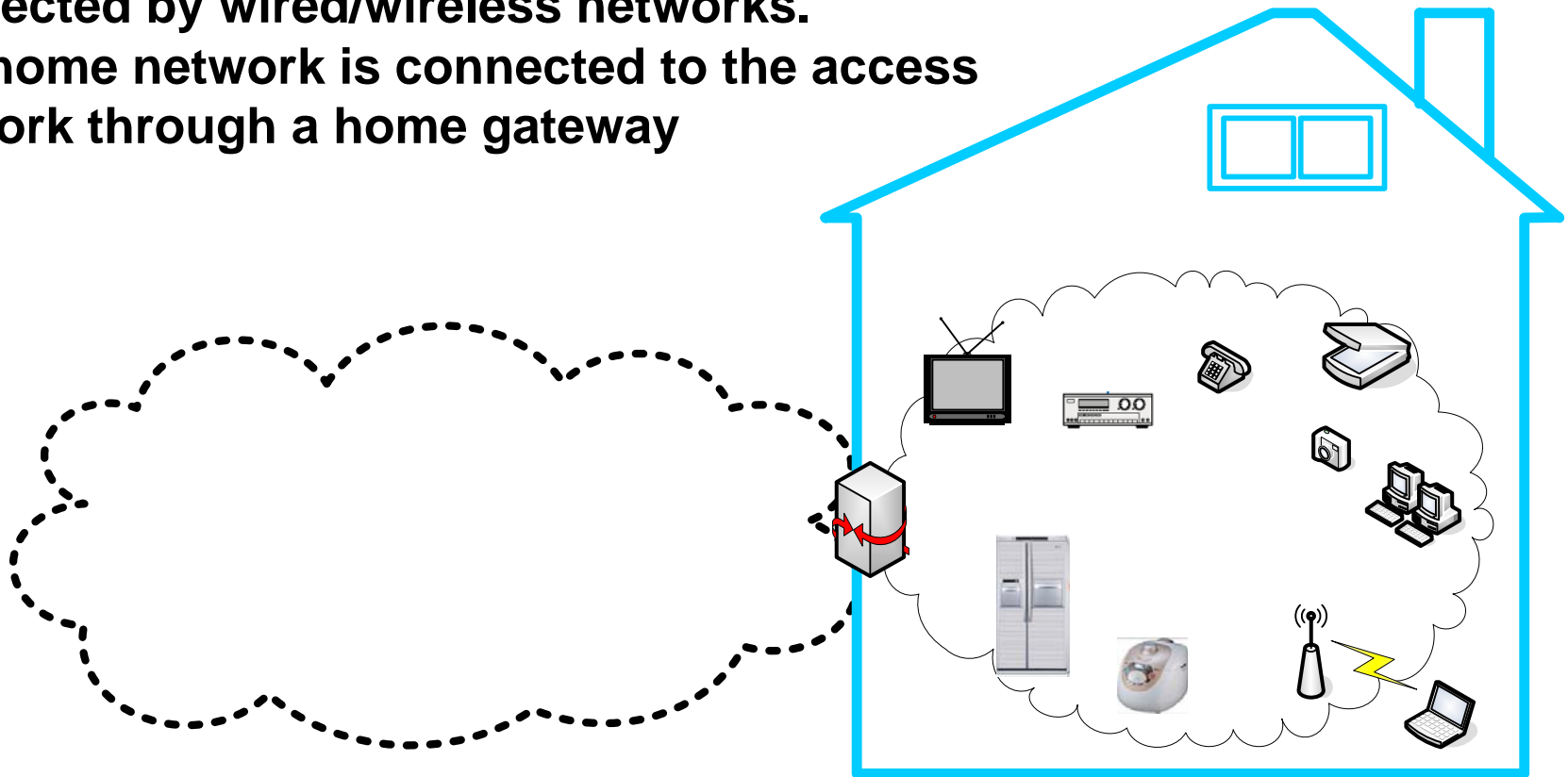
- The market size of the digital home (wired/wireless network, home gateway, portable/fixed terminal, consumer electronics) is growing rapidly at 18% a year (Gartner May 2002)

# Home networks in Korea

- The government leads to activate digital home industry
  - Digital home project (July 2003)
    - more than 10 million digital homes (61%) by 2007
  - Smart home project (July 2003)
  - Cyber building regulations Broadband Certification (September 2003)
    - Super class : over 100Mbps
    - 1<sup>st</sup> class : 100Mbps Ethernet 2 ports
    - 2<sup>nd</sup> class : 100Mbps Ethernet 1 port
    - 3<sup>rd</sup> class : 10Mbps Ethernet 1 port
- Consortium organization  
(communication, CE, construction industry, broadcasting etc.)
  - KT consortium : KT, KTF, Samsung, KBS, Bank etc.
  - SKT consortium : SKT, Hanaro telecom, LG, Daewoo, SBS etc.

# Future digital home in Korea

- Multiple services in the home
- Home appliances and information terminals are connected by wired/wireless networks.
- The home network is connected to the access network through a home gateway



# Conclusion

- The home appliance market is large and growing rapidly
- Korea is on the leading edge of broadband access to the home
- Korean home networking will happen regardless
- *Residential Ethernet* is expected to be a valuable technique of home networks
  - A/V applications
  - Other applications such as home surveillance, health care etc.

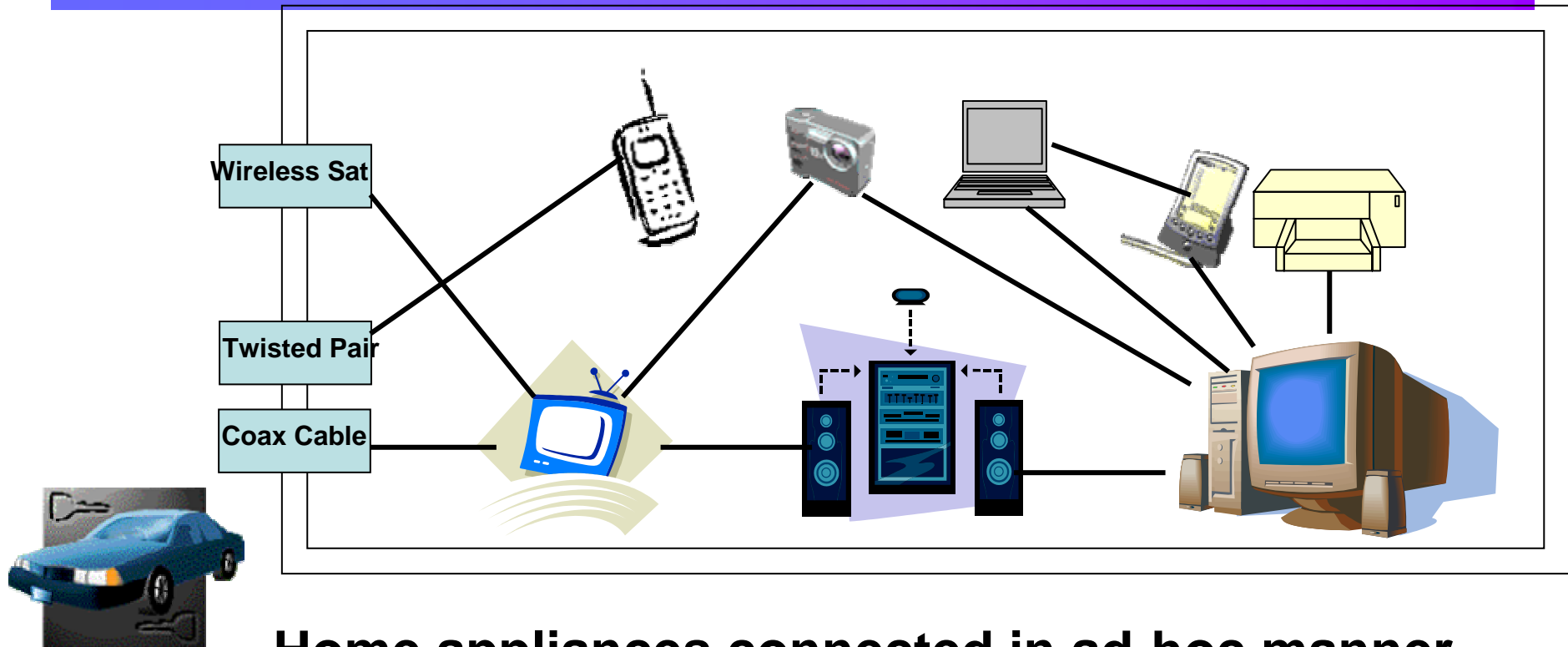


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# Study Items

Dirceu Cavendish  
NEC Labs America  
Onn Haran  
Passave

# Home Connectivity Today



## Home appliances connected in ad-hoc manner

- Peer-to-peer communication only
- No real networking
- No IT admin in your home

# Network Requirements

- **Physical Connectivity**
  - Large bandwidth (> 100 Mb/s)
  - Home reach (< 200 meters)
  - Power over Ethernet
- **Logical Connectivity**
  - Digital Home (DLNA) requirements
    - Plug and play
    - Device/Service discovery
  - Time sensitive requirements (A/V)
    - Precise End-Point Synchronization
    - Bounded Jitter and Latency
    - Bandwidth Allocation Guarantee
    - Minimum packet loss

# Ethernet Home Network

## Ethernet Networks Today



- Plug-and-play
- Large bandwidth (up to 10Gb/s)
- Network management
  - Neighbor Discovery
  - Virtual Network Support
  - Traffic prioritization



- No end-point synchronization
- No data/time support
- No bounded latency support
- No bandwidth allocation

# Potential Study Items

## **Study Item 1: What type of synchronization support does a HN need?**

- Clock synchronization at “end-points” only
- Clock distribution
- Over-provisioning for acceptable delay/jitter
- Real time traffic prioritization
- TDM type of service

## **Study Item 2: What constraints should an in-Home Ethernet have?**

- Speeds
- Connectivity

## **Study Item 3: Investigating existing mechanisms**

- 802.3 Clause 64, Clause 65
- 1394 isochronous
- Gibson MaGIC

## **Study Item 4: Interactions with 802.1**

- Ex: 802.1d, 802.1p, 802.1q, etc...

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# Summary

# In Our 32th Year

- 802.3 was created to transport data applications
- New Consumer Electronics apps place additional quality requirements on Ethernet in the home
  - *Require real* application quality of service
  - Guaranteed network access
  - Plug and play with reliability for QoE
  - No “HELP” line for on-site fault services
- New apps bring new network timing requirements
  - Latency
  - Jitter
  - Differential delay

# In Summary

- The home brings new challenges for Ethernet as the “Converged” transport for PC’s & Audio/Video
- High quality ***and*** low cost are mandatory
- Many other organizations now focused on home
  - DLNA, CEA, UPnP, ITU-T, ETSI, and more
- Residential Ethernet should also provide a backbone for 802.11 and 1394
- Proprietary solutions exist and their number will expand unless IEEE802.3 addresses these issues

**We ask for your support for this new Study Group**



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# Questions and Answers

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# **Thank You!**

**We hope to see you at the 802.3  
Interim meeting**