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
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
  - 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
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

• 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)
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
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

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

*Round trip including application layer
Home Network Use Case I: Different Audio Tracks in Each Room

- Living Room
- Study
- Bedroom
- Dining Room
- Kitchen
- Basement

Digital Audio Player

Speakers

Network Attached Storage or Home Media Server

Digital Audio Player

 Speakers

Digital Audio Player

Speakers

Digital Audio Player

Speakers

Digital Audio Player

Speakers
Home Audio Use Case I

- 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

- Digital Audio Player
- Speakers
- Study
- Bedroom
- Living Room
- Dining Room
- Kitchen
- Network Attached Storage
- Or Home Media Server
- Basement
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

Plug and Play
Next Generation AV Connector

Clean and Simple
The Next Evolutionary Step
(Missing Link with PoE Option)
Ethernet is Everywhere
Ubiquitous, except in the home

• Fast
• Robust
• Very familiar
• Affordable right now
• Very wide product selection
• Growing momentum in CE industry
Next Generation AV Connector

Universal Linkage
Consumer Electronics is Ready for Ethernet
Home Network Potential Market

Seyoun Lim
Samsung
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The home network is at the heart of the digital home

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

<In-Stat/MDR 2003>
• 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
    - 1st class: 100Mbps Ethernet 2 ports
    - 2nd class: 100Mbps Ethernet 1 port
    - 3rd 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.
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…
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
Questions and Answers
Thank You!

We hope to see you at the 802.3 Interim meeting