HomePNA

Networking the Digital Home
The HPNA - Background

• “Technology of choice” for major NA Telco IPTV deployments

• 30 new members in last 12 months: Semi & passive suppliers, gateway and set-top OEMs, CE equipment, Telcom test equipment

• Promoters comprise the TelcoTV food-chain:

  2WIRE®  CONEXANT®

  Scientific Atlanta  at&t  MOTOROLA

  COPPERGATE  SUNRISE TELECOM INCORPORATED
New Focus

• Finalize extension of the standard to cover IP multimedia distribution over mixed coax/phoneline backbones
  - Identify new requirements/address higher system level application needs
• Basic product requirements HW/SW definition
• Interoperability certification procedures and facilities
• Promotion of the technology through PR and Education
• Define installation recommendations
• Liaison with SIGs and Standards Organizations such as the ITU, DSLF, DLNA, UPnP Forum, etc.
• New members joining
HPNA - Milestones

• June 2003 - HPNA 3.0 Approved (240Mbps)
• May 2004 – First HPNA 3.0 products announced
• February 2005 – ITU approves G.9954-2004 (240Mbps)
• November 2006 – HPNA 3.1 Approved (320Mbps)
• November 2006 – HPNA 3.1 Certification Spec released
• November 2006 – First HPNA 3.1 chipset announced
• January 2007 – ITU approves G.9954-2007 (320Mbps)
• March 2007 - Certification and Plugfest
HomePNA Technology
HomePNA V3 PHY

• Frequency Diverse QAM and QAM Modulation Schemes
  - Very efficient in handling deep spectral notches
• 2 to 32 Mbaud with 2-10 bit constellations
  - Peer to peer rate negotiation
• Focus on high bit-rates and robustness
  - High bit rates even in most problematic wiring topologies
  - Immunity to impulse noise and RFI noise
  - Highly adaptable to line conditions
• FCC part 68 and part 15 compliant
FDQAM’s margins exceed that of QAM by at least 3 dB for each reduction in the baud rate.
HomePNA V3 Spectral Allocations

• HPNA V3.1P Over Phone-line
  - Two spectral modes:
    • A (4-20MHz): 2, 4, 8, 16 MBaud (4Mbps - 160Mbps)
    • B (12-28MHz): 2, 4, 8, 16 MBaud (4Mbps - 160Mbps)

• HPNA V3.1C Over Coax
  - Four spectral modes:
    • A (4-20MHz): 2, 4, 8, 16 MBaud (4Mbps - 160Mbps)
    • B (12-28MHz): 2, 4, 8, 16 MBaud (4Mbps - 160Mbps)
    • C (36-52MHz): 2, 4, 8, 16 MBaud (4Mbps - 160Mbps)
    • D (4-36MHz): 2, 4, 8, 16, 32 Mbaud (4Mbps – 320Mbps)

• Hybrid Coax&Phone-line support in spectral modes A and B
HomePNA V3 PHY Interoperability

V3.0 Phone
PHY Masks:
#1 (4-10MHz)
#2 (4-20MHz)
#3 (4-28MHz)

V3.1 Phone
PHY Modes:
A (4-20MHz)
B (12-28MHz)

V3.1 Coax
PHY Modes:
A (4-20MHz)
B (12-28MHz)
C (36-52MHz)
D (4-36MHz)

Interoperability Mask#2<->Mode A
Over phone

Interoperability in mixed-network (modes A, B)
HomePNA V3 Spectral Allocations (cont)

Phoneline & Coax

Coax only

Mode A

Mode B

Mode D

Mode C
Coexistence with ADSL

Phoneline & Coax

Mode A

ADSL 2+

Coax only

0 4 8 12 16 20 24 28 32 36 40 44 48 52
Coexistence with VDSL 8A

- Phoneline & Coax
- Coax only

VDSDL2 8A

Mode B
Coexistence with VDSL2

Phoneline & Coax

Coax only

VDSL2

Mode C
HomePNA 3 Coexistence

• Mode A: 4-20MHz (16MBaud)
  - Coexists with ADSL, TV-Channels
• Mode B: 12-28MHZ (16MBaud)
  - Coexists with ADSL, VDSL2 8A, TV-Channels
• Mode C: 36-52MHz (16MBaud)
  - Coexists with ADSL, VDSL2, TV-Channels
  - Coexists with Mode A/B for HPNA Dual-Band
• Mode D: 4-36MHz (32MBaud)
  - Coexists with ADSL, TV-Channels
  - Interoperable with Mode A and Mode B (16MBaud)
HPNA V3 MAC Highlights

• Supports both Mini-Slots and SMAC with TXOPs

• Default MAC mechanism: Mini-Slots
  - Efficient and Flexible for best-effort traffic control
  - Supports Guaranteed QoS
  - Optimized for both networking and MxU Access applications.
  - Fits both phone and coax environments
    • Eliminates the need for Collision detection. Collision detection mechanism is not applicable in coax networks due to high dynamic ranges.
HomePNA V3 Protocol Stack

- MAC
  - Asynchronous MAC Protocol
  - Synchronous MAC Protocol

- PHY

- LLC
  - Admission Control
  - Flow Management
  - Scheduler
  - Bandwidth Manager
  - Aggregation

- Link Layer Control Protocols

- Management Layer
  - Network Management

- Future Features

- Upper-layer protocols (beyond scope)

- HPNA V3 Protocol Stack

- VoIP, RSVP, FTP, HTTP, TELNET...

- USB
  - Convergence

- 1394
  - Convergence

- VoHPNA
  - Convergence

- IP
  - Convergence

- Ethernet
  - Convergence
The HomePNA V3 Protocol Layers

- Master-controlled, peer-to-peer communication
- Synchronous and Asynchronous MAC Protocol
  - Collision avoidance + Packet aggregation = Protocol efficiency
- Link-Layer Control Protocol
  - Flow setup, Admission Control, Rate Negotiation, MASTER Selection, LARQ
- Convergence Sublayer
  - Bridge to External Networks and Protocols
  - Network synchronization
- Local and Remote Management
MAC Cycle Structure

- Inter-Cycle Gap (ICG)
- Transmission Period
- Inter-Cycle Gap (ICG)
- MAP
- CONTENTION FREE TXOP
- CONTENTION BASED TXOP
- UNALLOCATED TXOP
- Burst
- IFG
QoS Latency Results

Telephony Packets Arrival Latency for PRI scenario

Flow Legend
- V3 - Phone1 Voice
- V3 - Phone2 Voice
- V3 - Phone3 Voice
- V3 - RG Phone1 Voice
- V3 - RG Phone2 Voice
- V3 - RG Phone3 Voice
- V2 - Phone1 Voice
- V2 - Phone2 Voice
- V2 - Phone3 Voice
- V2 - RG Phone1 Voice
- V2 - RG Phone2 Voice
- V2 - RG Phone3 Voice

Unmanaged
Managed
(HPNA V3)
Deployment Scenarios
Target Applications

- **IPTV**
  - Multi-room distribution of IPTV content to multiple TVs and PCs in the home via high-speed, QoS, Plug-and-Play, "no-new-wires" network

- **MDU/MTU Access Systems**
  - Distribution of broadband services over existing coax wires in multiple-apartment dwelling units, hospitality environments and college campuses

- **Multi Room PVR**
  - For Telco’s and Satellite providers
HomePNA 3 in the “Digital Home”
IP Services to Multiple Dwelling Units

Dwellings can use both wired and wireless distribution inside.
Thank you

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