BROADR-REACH® TECHNOLOGY: ENABLING ONE PAIR ETHERNET

Dr. Ali Abaye, Ph.D.
Senior Director, PHY and Automotive
Broadcom Corporation

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This presentation may contain forward-looking statements within the meaning of the federal securities laws, including the Private Securities Litigation Reform Act of 1995. These forward-looking statements may include the potential growth of the markets in which we compete and the development status and planned availability of new products. In fact, all statements that we make or incorporate by reference in the presentation, other than statements or characterizations of historical fact, are forward-looking statements. It should be clearly understood that these forward-looking statements, and our assumptions about the factors that influence them, are based on the limited information available to us at this date. Such information is subject to change, and we may not inform you when changes occur. We undertake no obligation to revise or update publicly any forward-looking statement to reflect future events or circumstances.

Forward-looking statements are not guarantees of future results and are subject to risks, uncertainties and assumptions that are difficult to predict. Therefore, our actual results could differ materially and adversely from those described in the statements you hear today as a result of various factors. We refer you to our Form 10-K for the year ended December 31, 2011, subsequent and forthcoming 10-Qs and other filings with the SEC, which discuss some of the important risk factors that could contribute to such differences or otherwise affect our business, results of operations and financial condition.

For additional financial and statistical information, including the information disclosed in accordance with SEC Regulation G, please see the Investors section of our website.

Broadcom End Market Segments

Bringing Broadcom Innovation & Know-How to the Car

Agenda

- Ethernet PHY Overview
- Introduction to BroadR-Reach® Technology
- Standardization of BroadR-Reach® Technology
- BroadR-Reach® Technology Use Case
- Summary

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- Ethernet PHY Overview
  - Ethernet PHY Development
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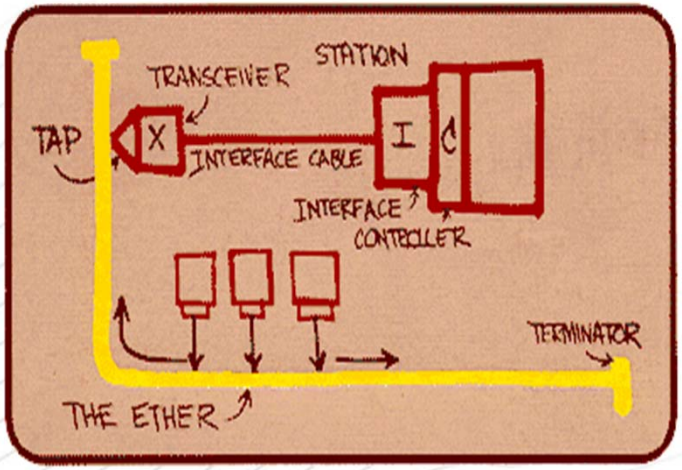
Ethernet Physical Layers

IEEE Standard Physical Layers

- 10BASE-T 1991 Cat-3
- 100BASE-TX 1995 Cat-5

>4B 10/100 ports shipped (switch + client)

- 1000BASE-T 1999 Cat-5 >1B ports shipped
- 10GBASE-T 2006 Cat-6A now shipping

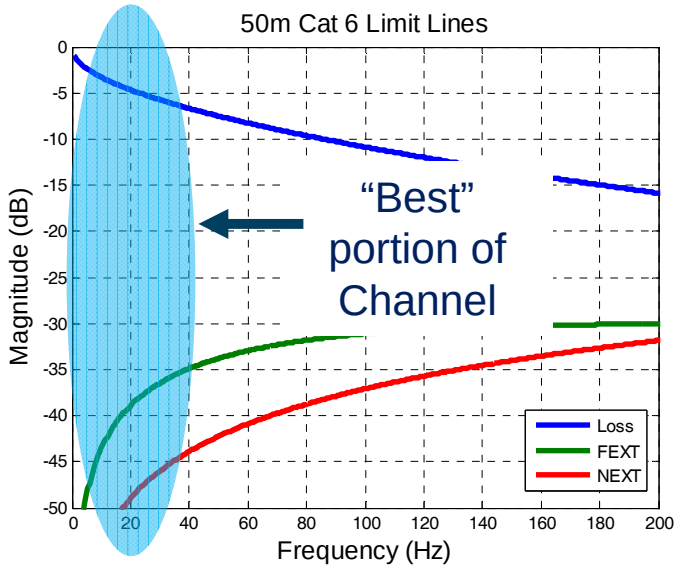


Ethernet drawing by Bob Metcalfe, around 1976

High volume deployment has driven continuous improvements in cost, power, performance, and reliability

PHY Strategy for Twisted Pair Cable Channels

- Twisted pair cable channels favor narrow baseband communications strategies
  - Insertion loss increases with frequency
  - Impairments increase with frequency
    - Crosstalk, return loss
  - *Balance degrades with frequency*
    - Emissions, immunity



- Best strategy is to **minimize bandwidth**
  - Maximizes available channel capacity

- Techniques for bandwidth efficient data transmission
  - Multi-level signaling
  - Equalization
  - Full duplex operation (echo cancellation)

} **Widely Deployed in Std IEEE PHYs**

TP Ethernet Development CATs and PHYs

- TP Cable is developed in parallel to each new PHY
- Each new category is improved with respect to previous one
- Cabling and PHY standards development are coordinated for success
- TP Cabling standards have to date focused on LAN & data centers
- Need for 100Mb/s over one-pair UTP for Automotive Networks

PHY (802.3)	Approved
10BASE-T (i)	1990
100BASE-TX (u)	1995
1000BASE-T (ab)	1999
10GBASE-T (an)	2006

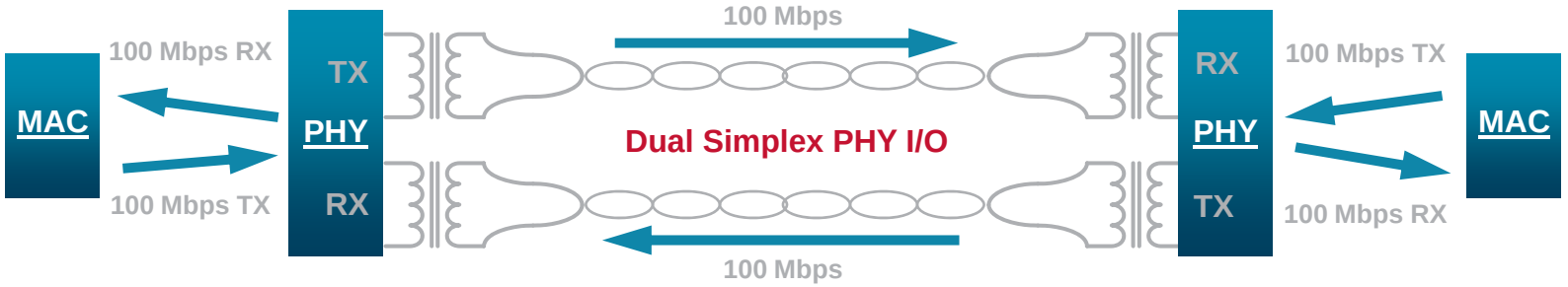
CATEGORY	Approved
CAT 3	1991
CAT 5	1995
CAT 5e	1999
CAT 6	2002
CAT 7	2002
CAT 6A	2007
CAT 7A	2009

Agenda

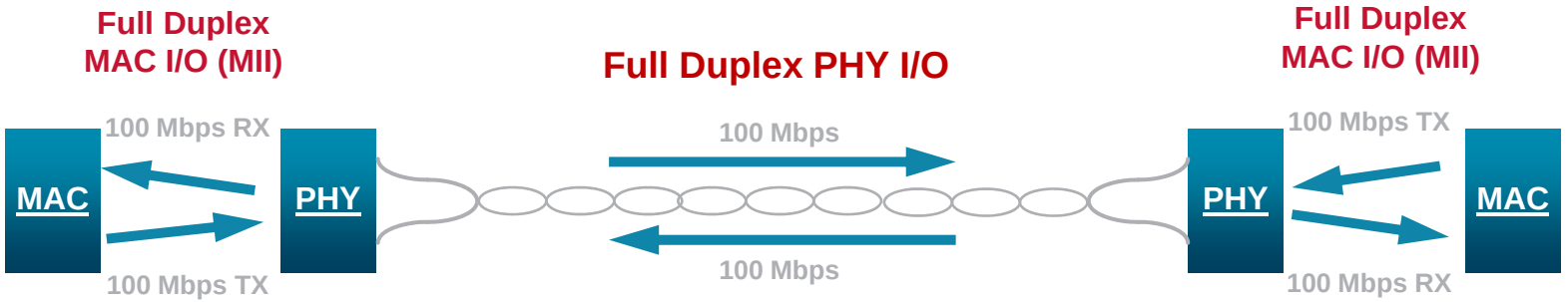
- Ethernet PHY Overview
- Introduction to BroadR-Reach® Technology
  - Bandwidth Efficiency
  - Reach
  - EMC Results
- Standardization of BroadR-Reach® Technology
- BroadR-Reach® Technology Use Case
- Summary

BroadR-Reach®: New Innovation in Ethernet

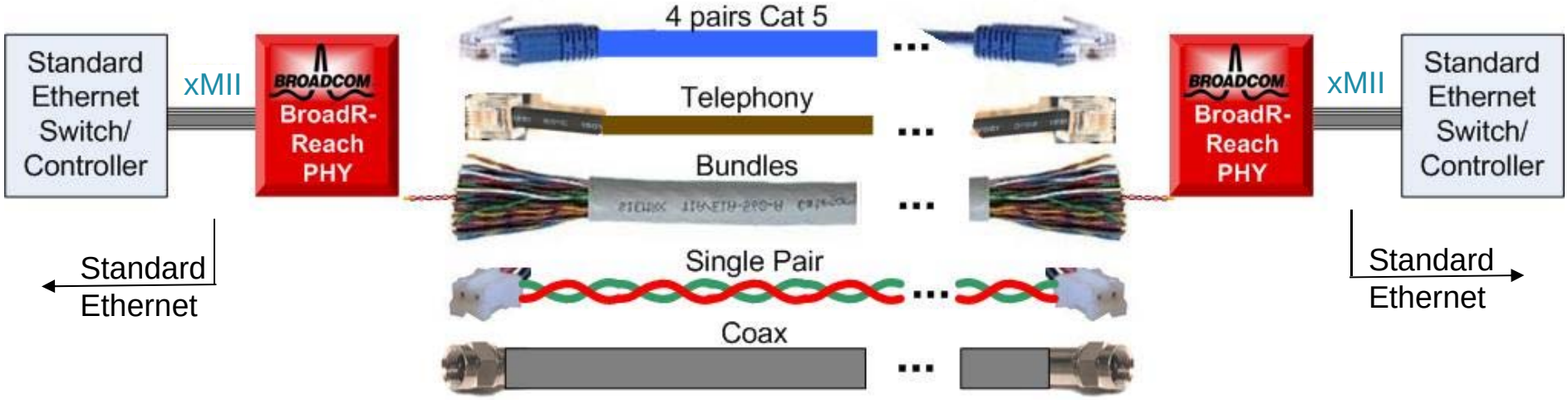
- SerDes, 10BASE-T, 100BASE-TX all operate with unidirectional transmission per wire pair
  - At least 2 wire pairs (4 wires) required for full duplex data transmission



- **BroadR-Reach® PHY, 1000BASE-T, 10GBASE-T all operate with bi-directional transmission per wire pair**



Flexibility with BroadR-Reach Ethernet PHYs



- Higher layer “doesn’t care” beyond the MAC MII interface
  - Higher layers insulated from Physical Layer
  - Media Independent: UTP Copper, STP Copper, fiber, co-ax, POF, …
  - PHY Independent: 100BASE-TX, 100BASE-T2, 100BASE-T4, 100BASE-FX, or **100Mbps BroadR-Reach® Ethernet**

BroadR-Reach® Ethernet "Standards Based" Physical Layer

IEEE Gigabit (1000Base-T) uses 5 level signaling

- Full Duplex
- PAM-5, 125 Msps, 65~80MHz bandwidth
- Four twisted pairs
- Partial response transmit filter
- Additional level for error correction coding
- Echo and crosstalk cancellation in DSP
- Decision Feedback Equalization (DFE)

IEEE 100TX uses 3 level signaling

- Dual Simplex
- MLT-3, 125Msps, 65~80MHz bandwidth
- Two twisted pairs
- Decision Feedback Equalization (DFE)

BroadR-Reach® Ethernet uses 3 level signaling

- Full Duplex
- Echo cancellation
- PAM-3, 66.7Msps, ~27MHz bandwidth
- Single twisted pair
- Decision Feedback Equalization

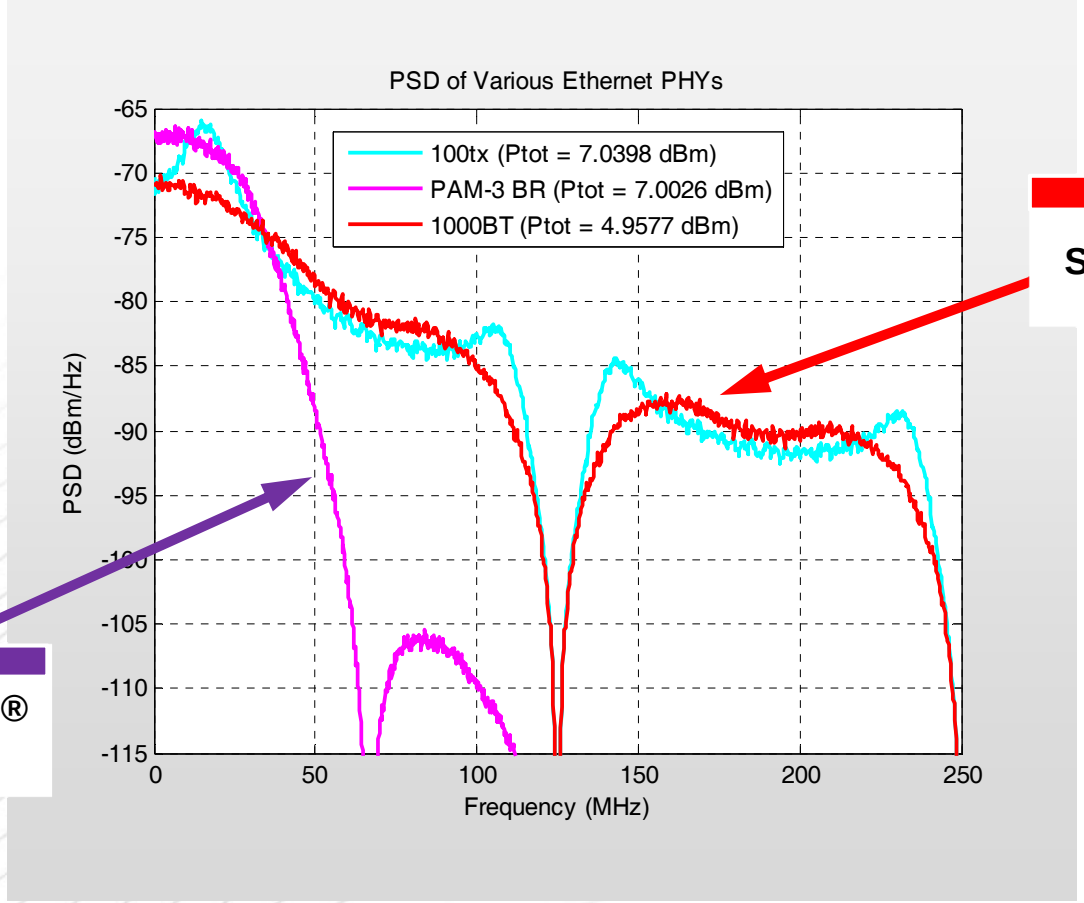
- **Bandwidth reduced by over 2x**
- **Operates over lower quality cabling**
- **Permits aggressive filtering for improved emissions & immunity**

Bandwidth Efficiency of BroadR-Reach® Technology

- Achieves 100Mbps in < ½ the bandwidth and with 2x fewer wire pairs than 100BASE-TX
- Lower emissions, improved immunity

Compared to 100BASE-TX

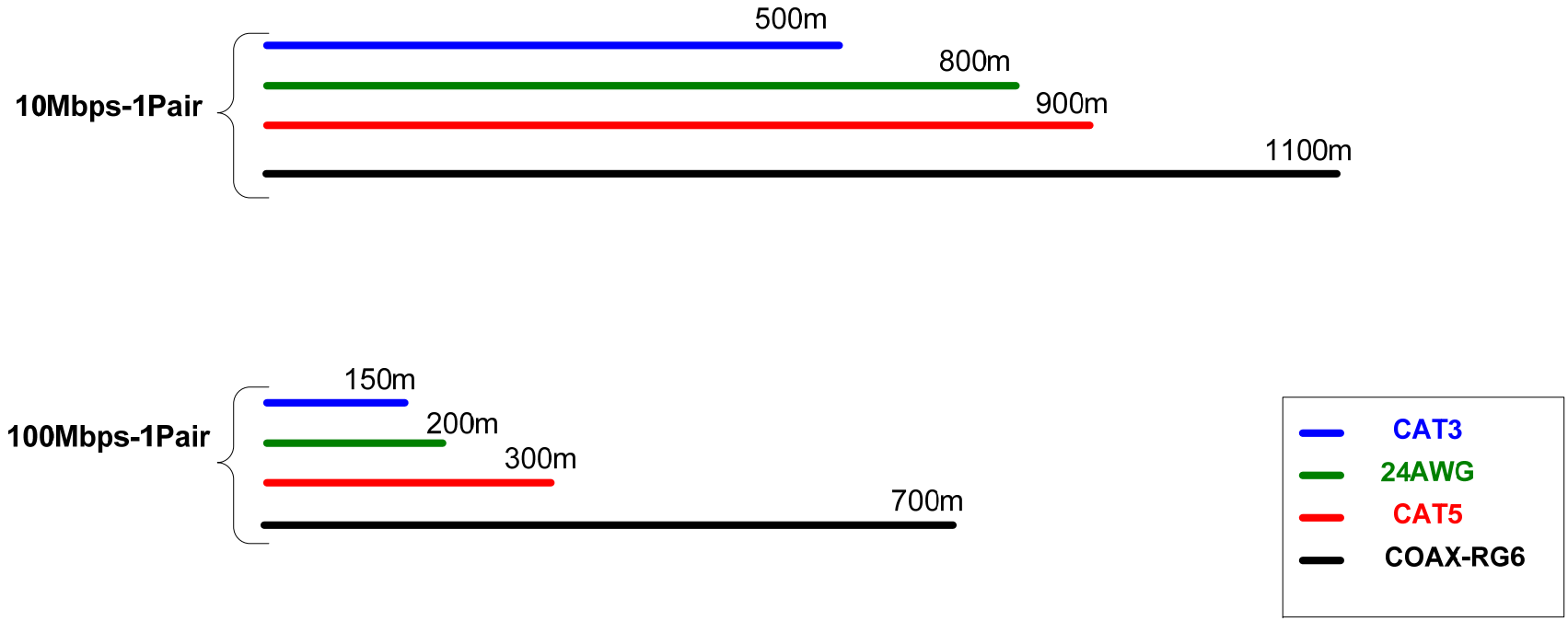
BroadR-Reach ® Ethernet 4x more efficient



Std IEEE PHYs

BroadR-Reach® PHY

BroadR-Reach® Rate/Reach Summary



- The reach is dependent on the application requirements and it can be extended based on the channel and/or data rate
- The BroadR-Reach transceiver is designed to carry ample system margin which can be traded off for better noise immunity performance as dictated by the applications' requirements

BroadR-Reach® 100Mbps EMC Results

- BroadR-Reach® Ethernet PHY, using single-pair UTP, without shielded enclosure, substantially meets automotive component level EMC requirements

- **CISPR 25, Component-level ALSE method**
  - Passes Class 5 with margin

- **Stripline Emission**
  - BroadR-Reach demo boards show adequate performance using a custom limit

- **ISO 11452-4 2005 Bulk current injection, Substitution method**
  - Data transmission not effected
  - Tested at levels far beyond any known requirements, with 100Mbps bidirectional traffic

Agenda

- Ethernet PHY Overview
- Introduction to BroadR-Reach® Technology
- Standardization of BroadR-Reach® Technology
  - OPEN and IEEE
  - Higher Speeds
- BroadR-Reach® Technology Use Case
- Summary

BroadR-Reach® Technology Standardization

IEEE 802.3 reduced twisted pair gigabit Ethernet

- Call for interest accepted in March 2012
- IEEE 802.3 Study group is formed
- Demonstrates clear potential for future of twisted pair cabling for automotive

http://www.ieee802.org/3/RTPGE/

OPEN (One Pair Ether-Net) special interest group

- Enables proliferation of 100Mbps single pair Ethernet, including interoperability and compliance testing
- Driving higher data rate
- Enables migration to open, scalable Ethernet-based network

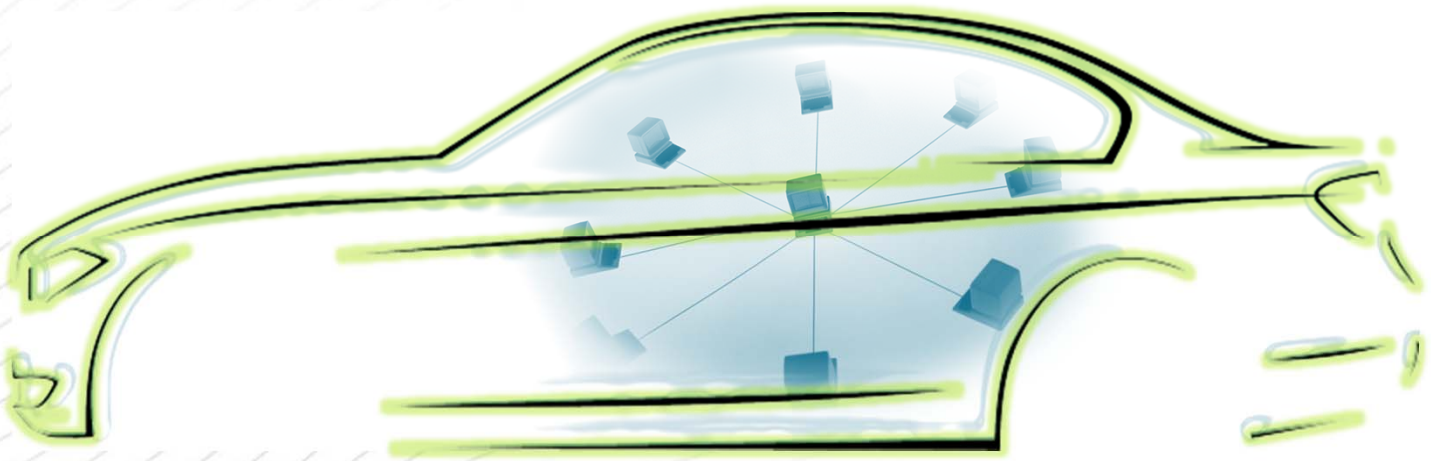
http://opensig.org/

OPEN (One Pair Ether-Net) Special Interest Group

- Establishes Industry Standard for Automotive Ethernet Connectivity
- Enables Migration from Closed to Open, Scalable Ethernet-based Network
- Encourages Joint Development
- Complementary to All Existing Ethernet IP Technologies

OPEN ALLIANCE

www.opensig.org



OPEN Alliance Membership

More than 100 Leading Auto & Tech Members

Agenda

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- BroadR-Reach® Technology Use Case
  - Automotive
  - Announcements
  - Emerging Applications
- Summary

Potential Industrial and Commercial Applications

Traditional Markets

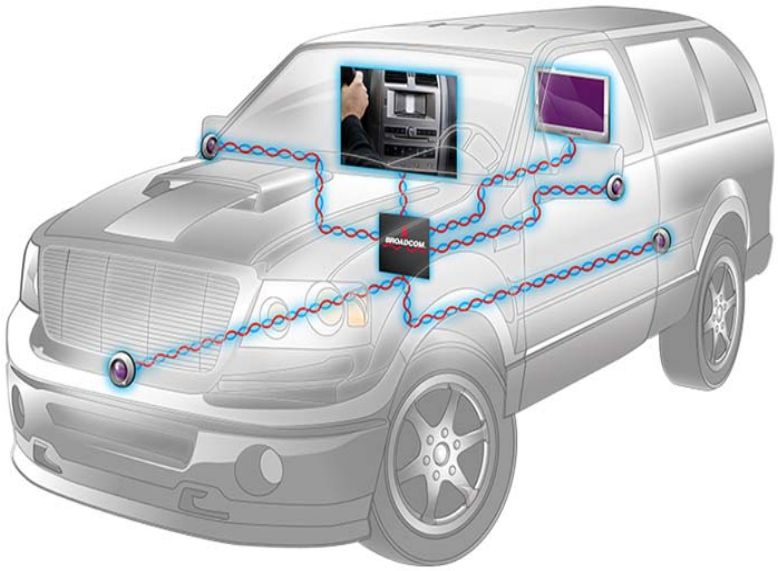
- Industrial Automation
  - Factory Automation
    - e.g. Material handling, Automotive Manufacturing, Transfer lines,
  - Process Automation
    - e.g. Oil, Gas, Chemical / Petrochemical, Food & Beverage
- Energy Automation
  - Power Generation
    - e.g. Fossil Power Plants, Wind Turbines
  - Power Transmission and Distribution
- Building Automation
  - Climate Control
  - Fire Safety

New Markets

- Avionics
  - Fly-by-Wire, Passenger Experience,
- Railway Systems
  - Train Control
  - Railway Traffic Management Systems
- Medical
    - Patient Imaging, Patient Management

Ethernet captures more and more Applications

Use Case: BroadR-Reach® Ethernet for Automotive



BroadR-Reach Automotive Ethernet

- 100Mbps Ethernet PHY
- Single unshielded twisted pair design
- 2 wire Ethernet replaces 4 wire proprietary systems
- Reduces Cost, Reduces Weight
- Meets Automotive EMC requirements

	Cable	Connector (2 ends, on-board & cable)
LVDS		
BroadR-Reach®		

Broadcom, Freescale, and Omnivision Partnership News

- http://www.broadcom.com/press/release.php?id=s613063

Broadcom, Freescale and OmniVision Enable World's First Ethernet-Based 360-Degree Surround View Parking Assistance System

Collaboration results in lower cost, higher resolution solution - technology now accessible for broad range of automobiles

IRVINE, SANTA CLARA, Calif. and AUSTIN, Texas, Oct. 10, 2011 /PRNewswire/ -- Broadcom Corporation (NASDAQ: BRCM), Freescale Semiconductor (NYSE: FSL), and OmniVision Technologies, Inc. (NASDAQ: OVTI), today announced a jointly developed 360-degree surround view parking assistance system — the [illegible] Ethernet-based parking assistance solution.

The collaboration, combining best-in-class semiconductor innovation and automotive electronics expertise, is an important step in the migration from a closed application to an open and scalable Ethernet-based driver assistance network in which several systems can easily access information. The co[illegible] combined with the high image resolution now available from affordable [illegible] opportunity for OEMs to deploy 360-degree parking assistance camera s[illegible] valuable assistance options to luxury and non-luxury markets alike.

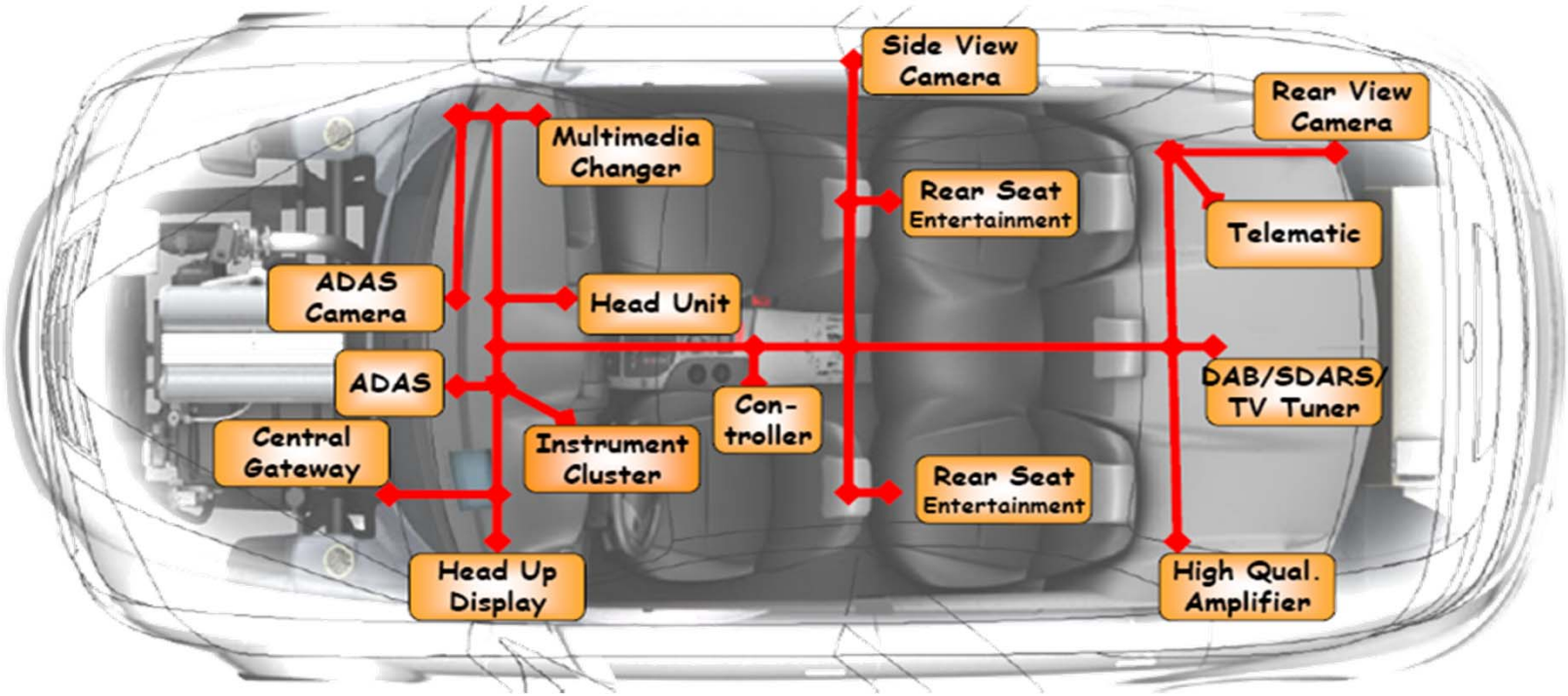
The system is based on the Broadcom® BroadR-Reach® BCM89810 st[illegible] Freescale Qoriwa MPC5604E 32-bit microcontroller (MCU), and OmniVision's AEC-Q100 qualified OV10630 color high dynamic range (HDR) system-on-a-chip (SoC) CMOS image sensor.

The OV10630's unique color HDR SoC structure with fully processed YUV output format enables a streamlined camera module architecture. Using this approach, the video signal can be fed directly into the Freescale Qoriwa MPC5604E MJPEG encoding pipeline without the need for any additional processing ICs for RAW image to YUV format conversion.

- "Broadcom Corporation, Freescale Semiconductor, and OmniVision Technologies, Inc., jointly developed world's first Ethernet-based parking assistance solution."

World's First BroadR-Reach Enabled ADAS Camera

BroadR-Reach® for Infotainment and Backbone



- BroadR-Reach Ethernet supports key requirements:
  - Dedicated bandwidth per port
  - Flexible speed per port
  - Advanced cable diagnostics for each link
  - Redundancy for failover mechanism
  - IEEE standard (AVB) for entertainment audio/video processing

BMW and Broadcom Partnership News

- http://blogs.strategyanalytics.com/auto/?cat=11

23 JUN

Freescale TechForum: BMW, Broadcom Leading Auto Industry into Ethernet Era

Audio/Video, Business Models, Comfort/Convenience, Connectivity, Digital Broadcasting, E/E Architecture, Semiconductors, Sensors, Software, Vehicle OEMs, microcontrollers

No Comments

After leading the industry into the world of MOST and Linux (Genivi), BMW is raising yet a new leadership banner – this time for the implementation of Ethernet in the car. BMW is certainly not the only but the company has made powerful statements at two high profile Broadcom that will transform the industry.

First tipped at the Ludwigsburg Fachkongress Elektronik last week. B solution to the thorny challenge of transporting data and video in th company made yet another presentation of its case for Internet alo within a twisted-pair connection to make its case for the robustness Freescale gateway MCU to show that Ethernet can already be linked

The case for Ethernet is powerful. BMW uses data from Strategy An increasing rapidly driven by rearseat entertainment, in-car TV and camera-based parkin the same time the average number of network nodes in the average car is also expanding rapidly. In fact, according to BMW, again sourcing SA data in part, the number of Ethernet ports to be shipped worldwide, nearly 800M, in 2010 is on re than the 650M automotive ports shipped in the same period, counting broadband, safety bus, CAN, L etc.

BMW points out that Ethernet is proliferating in a wide range of ind cluding everything from aviation to industrial automation and telecommunications. That proliferation t ses lower cost – for hardware, software and development – vs. the main alternative, MOST. In spite of increasing supp ST, the technology remains expensive as do the costs of development and for the engineers with appropriate ski w.

BMW has been pursuing automotive Ether updating for 2008 series vehicles. Also f on entertainment. For model year solution for the X5.

The development co m a cooperation operation ove ted pair. With Bro challenge for MW s partne are to esta made the fir with IEEE to define a sta

To achieve its objective of broad industry ado to open up the technology to licensees. BMW Broadcom's support. BMW is already in talks w avoid the disappointment that has come with and deploy but remains so years after wider industry adoption. BMW does not claim to be replacing MOST with Ethernet, but acknowledges that Ethernet is best suited to MOST-related applications.

Additional insight:

Global OE Automotive Multimedia and Communications Systems Forecast 2009-2017 - Joanne Blight - http://tinyurl.com/24n9nz5

Global Automotive OE Audio/Visual (A/V) Systems Forecast 2009-2017 - Joanne Blight - http://tinyurl.com/2g897ax

Posted by rlanctot @ 6:21 pm

- "For model year 2013, th company intends to bring an Ethernet based videolink to market for a park assist camera solution for the X5."

- "The development comes from a cooperation with Broadcom – using a version of BroadR-Reach technology for enabling full-duplex operation over a single twisted pair."

First In-Car BroadR-Reach Application

Hyundai and Broadcom Partnership News (Announced 10/15/12)

- http://www.prnewswire.com/news-releases/broadcom-and-hyundai-motor-power-next-generation-connected-car-174170081.html

Broadcom and Hyundai Motor Power Next-Generation Connected Car

Joint Development Enables Advanced Infotainment and Safety Features in Hyundai Vehicles

DETROIT, Oct. 15, 2012 **News Highlights:**

- Advances wide-scale adoption of automotive Ethernet
- Extends infotainment and passenger safety features across price points
- Delivers 100Mbps connectivity for in-vehicle networks, with future scalability up to 1Gbps

(Logo: http://photos.prnewswire.com/prnh/20060609/BROADCOMLOGO)

Broadcom Corporation (NASDAQ: BRCM), a global innovation leader in semiconductor solutions for wired and wireless communications, today announced a joint development agreement with Hyundai Motor to power the next-generation connected car. The collaboration will integrate infotainment, telematics, as well as surround view parking and lane departure warning systems in Hyundai features and faster connectivity to a broader number of drivers. Vis

Based on Broadcom's BroadR-Reach® Ethernet technology, the s effective, lightweight 100Mbps connectivity to advance integration the technology at SAE Convergence in Detroit, October 16-17.

As members of the AVB Alliance and OPEN Alliance (One-Pair Et Hyundai Motor have partnered since 2011 to drive wide-scale ado enables a robust, scalable network for powering in-vehicle infotain next generation technologies and multiple networks, improving th for...

BroadR-Reach Ethernet also supports the IEEE 802.1 Audio Video Bridging (AVB) standard, a key technology for achieving high quality audio and video transmission in automotive by providing guaranteed quality of service (QoS), frame synchronization and timing necessary to stream professional-quality audio and video traffic.

For ongoing news, visit Broadcom's Newsroom, read the B-Connected Blog, or visit Facebook or Twitter. And to stay connected, subscribe to Broadcom's RSS Feed.

- "Based on Broadcom's BroadR-Reach® Ethernet technology, the single high-bandwidth in-vehicle network will deliver cost-effective, lightweight 100Mbps connectivity to advance integration of safety applications in the vehicle.

Ethernet going mainstream in high volume cars

Summary

- BroadR-Reach® technology permits standard Ethernet packets to be transferred over a single unshielded twisted pair cable
  - Indistinguishable from a standard IEEE PHY to higher Ethernet layers
  - Single pair operation for lower cost, power, size, and weight
- BroadR-Reach® technology extends reach and data rate over single pair
  - Enabling automotive in-car networks
  - Well suited for other applications like Industrial Ethernet
- BroadR-Reach® 100Mbps products sampling today (Switch & PHY)
- BroadR-Reach® technology already licensed to leading semiconductor suppliers

Thank You