Connected Communication Trends
May 19, 2010
Welcome

A Changing Landscape.
Today’s commercial vehicle and transportation industry is evolving quickly. More and more business owners are demanding advanced on-board diagnostic and telematic systems, while new government regulations are driving the need for clean operating technology and eco-friendly designs. In addition, end users want an increasingly comfortable in-cab experience — much like the ones offered by their own cars and homes.

The Power & Signal Group – Worldwide Connection Systems Resource
Serving the electrical component needs of the transportation industry for over 25 years.

As a global leader in interconnect solutions, Molex has developed solutions that have revolutionized a wide array of industries, including Auto, Industrial, and consumer electronics.

Mike Gardner
Global Marketing Manager
Infotainment In-Vehicle Networks

Kurt Krutsch
Product Marketing Manager
Commercial Vehicle Market
Agenda

- Emerging technologies of the commercial vehicle industry
- Communication trends and the proliferation through commercial vehicle platforms
- Protocols, standards and how new interconnects are supporting the growing needs of the transportation industry
- Consumer and automotive products which are transitioning into the commercial vehicle market
Connected Vehicles

Trends

- A Global Focus for all Countries (America’s, Asia, India, Europe)
- Establishing technologies for the connected infrastructure
- What’s connected?
  - Cars, Trucks, Trains, Airplanes, Boats
  - All vehicles traveling our Roads & Highways, Land, or Water.
- What are the drivers?
  - Users want connectivity (mobility, LBS)
  - Businesses want connectivity for better information, tools to manage fleet operations and assets.
  - General goal by all to improve Safety, Efficiency, Environment, and Services.
- Commerce Opportunities (Fee Collection)
  - Tolls, Smart Parking, Fuel Stops, etc.
Talk on the street

- Segment Talk
  - Infotainment
  - Telematics
  - Driver Assist
  - Connected Services (*Location Based – “LBS”*)

- Application Talk
  - V2V (Vehicle to Vehicle)
  - V2I (Vehicle to Infrastructure)
  - I2V (Infrastructure to Vehicle)
  - P2V (Pedestrian to Vehicle)
What’s needed to make it all come together?

- Communications Standards
- Infrastructure Development

**Types**
- Satellite
- Broadcast
- Cellular
- WiFi
- WiMax
- Short Range (DSRC)
## A Few Methods to Get Data To / From the Vehicle

<table>
<thead>
<tr>
<th>Technology</th>
<th>Types of Data Supported</th>
<th>Examples of Recommend Uses</th>
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</table>
| Consumer Cellular| 2-Way connectivity through consumer device                   | • Off-board Navigation  
                                      • Consumer Applications  
                                      • Interactive Queries |
| Embedded Cellular| 2-Way connectivity through embedded device.                   | • Hybrid Navigation  
                                      • Safety & Security (ACN, Remote Unlock, etc)  
                                      • Vehicle Diagnostics |
| Broadcast        | Streaming data through broadcast                             | • Audio Entertainment  
                                      • Video Entertainment  
                                      • Data Streaming (i.e. Traffic, Dynamic Content) |
| Wi-Fi / Wi-Max   | 2-Way connectivity through 3rd party device                  | • Consumer Applications  
                                      • Vehicle Diagnostics  
                                      • Fleet Management |
| DSRC             | 2-Way connectivity through embedded/3rd Party device         | • Off-Board Navigation  
                                      • Collision Avoidance/Other Hard Safety  
                                      • Tolling |

Current Near Term
Those Involved

USDOT
US Department of Transportation

MDOT
Michigan Department of Transportation

AASHTO

NHTSA

ITS
Intelligent Transport Systems

FMCSA
Federal Motor Carrier Safety Administration

IntelliDrive

SAE
Society of Automotive Engineers

CALM
Continuous Communications for Vehicles

VII
Vehicle Infrastructure Integration

NILIM
National Institute for Land and Infrastructure Management

Caltrans
California Transportation System

HDIO
Highway Industry Development Organization

MLIT
Ministry of Land, Infrastructure, Transport and Tourism, Japan

FHWA
Truck Market Trials
Federal Motor Carrier Safety Administration

**Scope**

715,000
Interstate Motor Carriers

7 Million
Commercial Drivers

8.8 Million Large Trucks and 32,000 Motorcoaches

223 Billion Miles Traveled by Trucks

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5,099
Fatalities

125,000
Injured Persons

446,000
Police Reported Crashes

$60 Billion
Cost to Society

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Large Truck Crash Causation Factors

Driver: Made illegal maneuver(s) – Cargo Shift
Driver: Traveling too fast for conditions
Driver: Inattention
Driver: Inadequate surveillance
Driver: Following too closely
Driver: Fatigue
Driver: Incapacitating Illness
Truck Market Trials
Federal Motor Carrier Safety Administration

- **ITS Solutions to Address Crash Factors**
  - **Network systems**
    - SmartPark
    - Wireless Drayage Updating
  - **Enforcement support systems**
    - Electronic onboard recorders
    - Wireless Roadside Inspections

Driver, vehicle, company safety compliance checks at highway speeds

Provides integrated container tracking and management solution for motor carriers, railroads, and ports

Enforcement Support

Technology for conveying real-time information on parking availability to truckers on the highway
The Infrastructure Hardware

Opportunities beyond the Vehicle

- Beacons
- Edge/Gateway
- Data Centers
- Smart Phones
- Onboard Recorders
- Roadside Control Cabinets
The Digital Convergence

Market Drivers

- The **emotional** driver is “Safety”
- The **volume** driver is “Automotive”
- The **technology** driver is “High Bandwidth”
- The **application** driver is “Connected services”
- The **marketing** driver is “But look how cool it is and what you can do with it!”

✔ **Future buyers choose networking over manufacturer according to Hughes Telematics**

The next generation vehicle buyer will place more emphasis on technology and connectivity than on the brand of the car being purchased -- a dramatic shift in buyer values.
Market Trends

Growing Electrical Content within vehicle architectures.

- Automakers and Commercial Vehicle manufactures claim 35% of vehicle cost is from Electronic content and growing.

Trending Content

- Infotainment
- Connected Vehicle (V2V and V2I)
- Driver Assist (Collision Avoidance)

Complexity Management

- Combine ECU functionality and count
- Zone Architecture
Nearly all architectures are starting with the foundation of USB as the Consumer Access Port for portable media devices.
Automotive Protocols

Technology Convergence:
- Consumer Based
- SerDes (Serialized / Deserialized)

Decades

Vehicle Networks Speeds (mbps)

CAN
LIN
Restraint Bus
GSM
GPS
Bluetooth
USB2.0
LVDS
USB3.0
Ethernet
HDMI
Flexray
Most (25 – 150)
Technology Solutions Trend

3 Primary Digital Links Emerging

- **Consumer Access Port**
  - Bluetooth, USB 2.0

- **Point to Point**
  - LVDS, GVIF, HDMI

- **In-Vehicle Networking**
  - MOST, AVB (Ethernet), 1394Auto

Central Network Challenge

- **Complexity Management**
  - Set Path for sustainable migration
  - Solution supports:
    - Flexibility, Extensibility, Enabling Peer to Peer communications

Technology Key:
- LVDS (2/4 wire)
- IEEE 1394
- USCAR USB
Hardware and Systems need to cross communicate in seamless fashion.

- No lack of approach!
- No lack of opportunities!
All the Building Blocks are available today to deliver an In-Vehicle backbone to the vehicle!
Integration Flexibility

Ford Sync

- Fastest Growing In-Vehicle Infotainment platform.

There is an “Apps” for that!

- Apps are the newest form of quickly reaching new applications and customers.

First iPad after market vehicle install
Market Segments to Serve with Molex Interconnects

Navigation, Comfort and Infotainment
In-Vehicle Network

HSAutoLink™
HSAutoLink II™

Head-end Display
Embedded ECU’s
Driver Assist Sensors/Cameras
Convenience Port (CCP)
Sleeper Cab Display
Head-up Display (HUD)
Sealed and Unsealed
Convenience Media Module

Devices Impacted
Driver Assist Market

- Early Warning Sensor Technology
  - Radar
  - Infared
  - Vision (Camera)

- Supporting Vision Technologies
  - LVDS
  - 1394Auto
  - Ethernet (AVB)

Market to utilize 1 to 5 cameras per vehicle
Molex HSAutoLink™
In-Vehicle Data Bus Family of Products

Product Family supports a wide range of connection and application needs:

- Plug
- In-Line
- Header
- USB Std. ‘A’ (Thumb Latching)
- USB Std. ‘A’ (Slim mount)
- USB 2.0
- LVDS
- 1394Cu
- Ethernet (AVB) (In Development)

Convienience Ports and Repeater Modules
Product Application

HSAutolink™

- Polarization / Product Variations

- Cable Options
  - Short 90/90 cable exit
  - 90/40 cable exit

- Various Convenience Ports
Convenience Ports

Custom Bezel (Latching Style)

Combination / USB / Aux Jack

Customized – CCP Bezel

molex
USB Std ‘A’ to ‘mini B’/USCAR-30

- Separable Interface
  - Allows other packaging options.
HSAutoLink™
In-Vehicle Data Bus

Media / Repeater Modules

- Molex actively engaged with media / repeater module projects
  - USB inputs
  - USB booster (repeater)
  - Power/Analog in/out
  - AUX Jack
  - SD Card, Bluetooth
  - Consumer USB Port(s)

Figure 1

HSAutoLink™
(USCAR USB Headers)
Networks Migrate to Commercial Vehicle Industry.

**Construction/Mining**

**Utility/Municipal**
Specialty truck market presents challenges for commercially viable connectivity.

**Transportation Rail, Marine,**
CAN, USB and harsh duty Ethernet applications exist in addition to passive soft wiring.
Commercial Market Connector Demands

- Environments
  - Severe service demands
  - Longer Service life
  - Process critical applications

- Drivers for networks
  - Efficiency
  - EPA & Fuel regulations
  - Theft
  - Process tracking

- Reasons to migrate networks
  - Speed
  - Existing product availability
  - Cost
  - IT support

Contact reliability?
Brad® Network Connectivity

Brad M12

Ultra-Lock

USB

Sealed RJ45
Brad® Heavy-Duty (M12) Connectors

- New J2839 connector standard published FEB 2010.
  - High Speed Data link Connector for heavy-duty and off-highway vehicles.
  - Backward compatible with IEC 61076-2-101 (M12)

- M12 was chosen for wide breadth of devices already using sealed M12, proven technology.

- Molex participated on SAE committee to develop standard

- Two versions
  - HDM12, withstand 440N (100lbs) pull force on cable in all directions for 1 minute min.
  - HDM12EX, 300 lbs (1336N) pull withstand strength all directions

- Extreme environmental tests based on J2030
  - High pressure wash down
  - 2X initial mate twist force
  - -55 to 125C
  - Outdoor rated
J2839 HDM12 - Heavy Duty M12

- Compatible with “off the shelf M12” but higher Environmental rating:
  - Better key engagement and strength
  - More resistant to pin bending
  - Ability to except 18 AWG heavy duty cable
  - Ability to withstand 445N(100lbs) pull force on cable in all directions for 1 minute min.
  - 100 mating cycles
**J2839 HDM12EX - Extra Heavy Duty M12**

- Similar to HDM12, but stronger. Used in applications with the most extreme environmental concerns.
  - Metal cover protects against impact
  - Withstands water cannon exposure
  - 1335N (300lbs) pull force - all directions.

300 LBS pull
Existing Ethernet Product

- IP69K Ultra-Lock™ & M12 Cables and Connectors
- Threaded RJ-Lnnx & Bayonet
- Ethernet I/O and Switches
- Designed for harsh environments.

Series 130050*
Brad® M12 & Ultra-Lock

Used inside of an enclosure, Cab, or in protected area on chassis.
- -40 C to 85 C temperature rating.
- IP67 or IP69K
- 18 – 26 AWG wire
- Cable pull typically 110 N (30lbs)
- 100 mating cycles

Applications:
Vehicle controllers and Telematics
Sensors, scanners, navigation devices found on
Construction/agriculture/forestry machinery

Series # 13004
What is the Ultra-Lock Connection System?

Ultra-Lock is a push-to-lock alternative to traditional threaded connectors

Designed for performance and reliability.

- Lower Installed Cost
- Fast and secure
- Optimize Uptime
- Reduce Downtime
- Ethernet/USB/Passive versions

Series 120109*
Brad® M12 shielding Performance

EMI test data

Fig. 3.50. Screening attenuation of sample G1

Compliant to applicable vehicle standards.

New CAT 6a & PoE coming soon!
CAN Media

CANopen, DeviceNet, NMEA2000, RV-C, CAN2.0B

- Cables, Receptacles, accessories
- I/O blocks-
- CANopen, DeviceNet
- Diagnostics
- Can be functionally used in J1939 & ISO bus and other CAN based networks.

Series 84854*

37
Brad® Sealed USB & RJ45

USB Bayonet style-
- IP67 when mated.
Molex’s Strengths in the Commercial Vehicle Market

History

- Industry leader for over 70 years
- Leveraging technologies for Vehicles
- Strong focus on harsh environment applications.
Thank you for participating.

If you would like additional information on anything presented today, please contact Cydney Gintert at cgintert@powersignal.com