# Emerging Markets
# for
# Ethernet Technology

**JC Lin, Ph.D.**
**VP, Ethernet Products**
**Micrel, Inc.**
**Oct. 16, 2009**

**MICREL**

Innovation Through Technology™

**Invented by Robert Metcalf at Xerox in 1973 and patented in 1976**
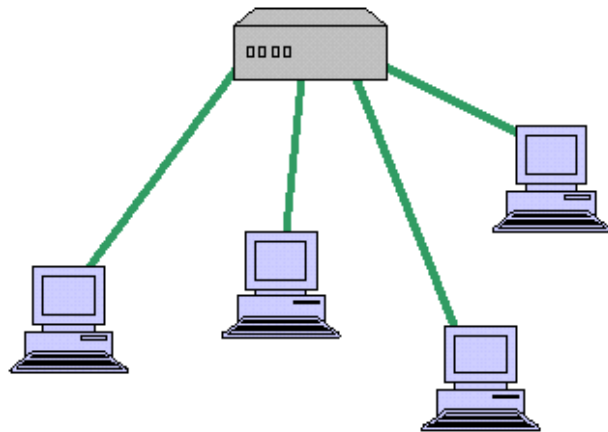


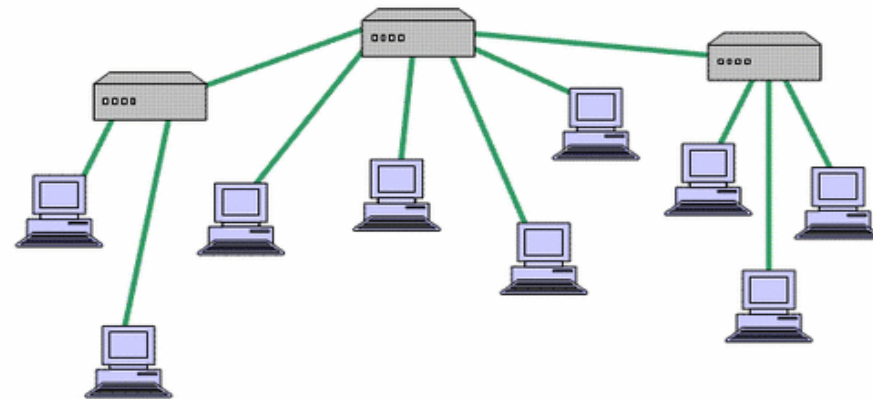Ethernet PHY

Bus
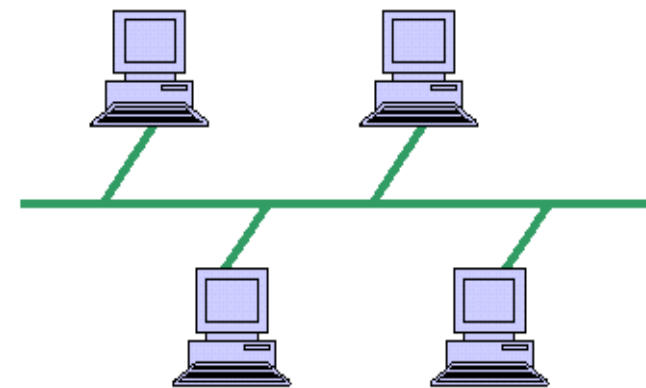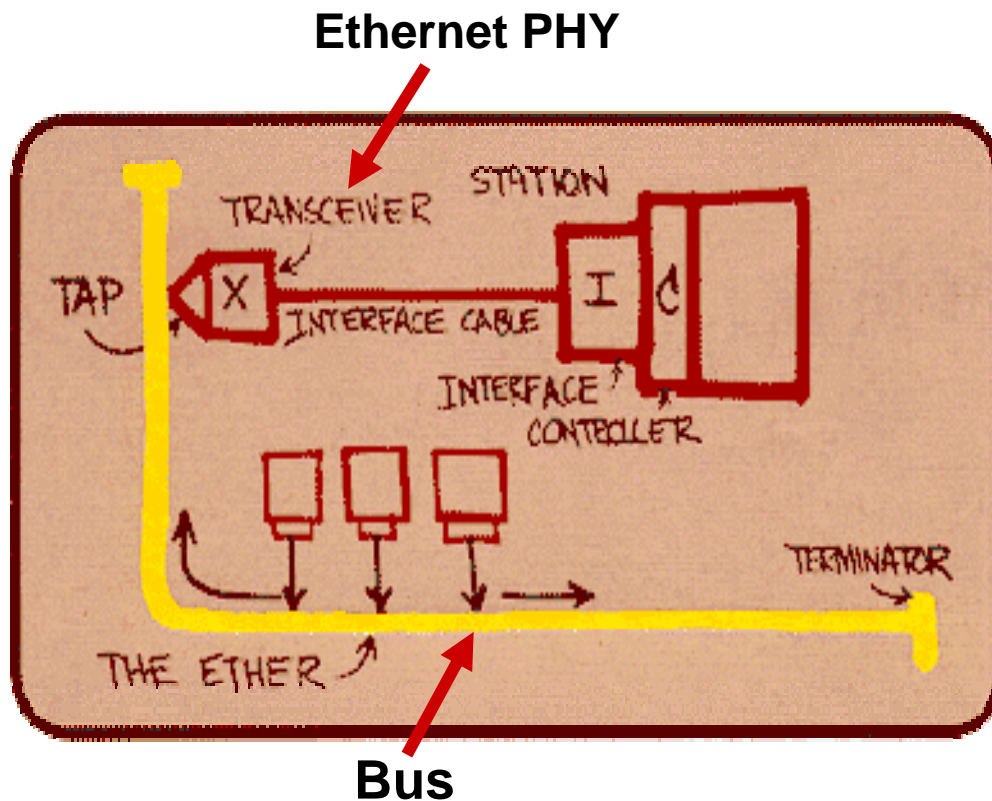
Bus Topology (1985)

# *Ethernet Switch*

**Ethernet Switch allows users to transmit and receive packets at the same time. Network performance improves dramatically.**
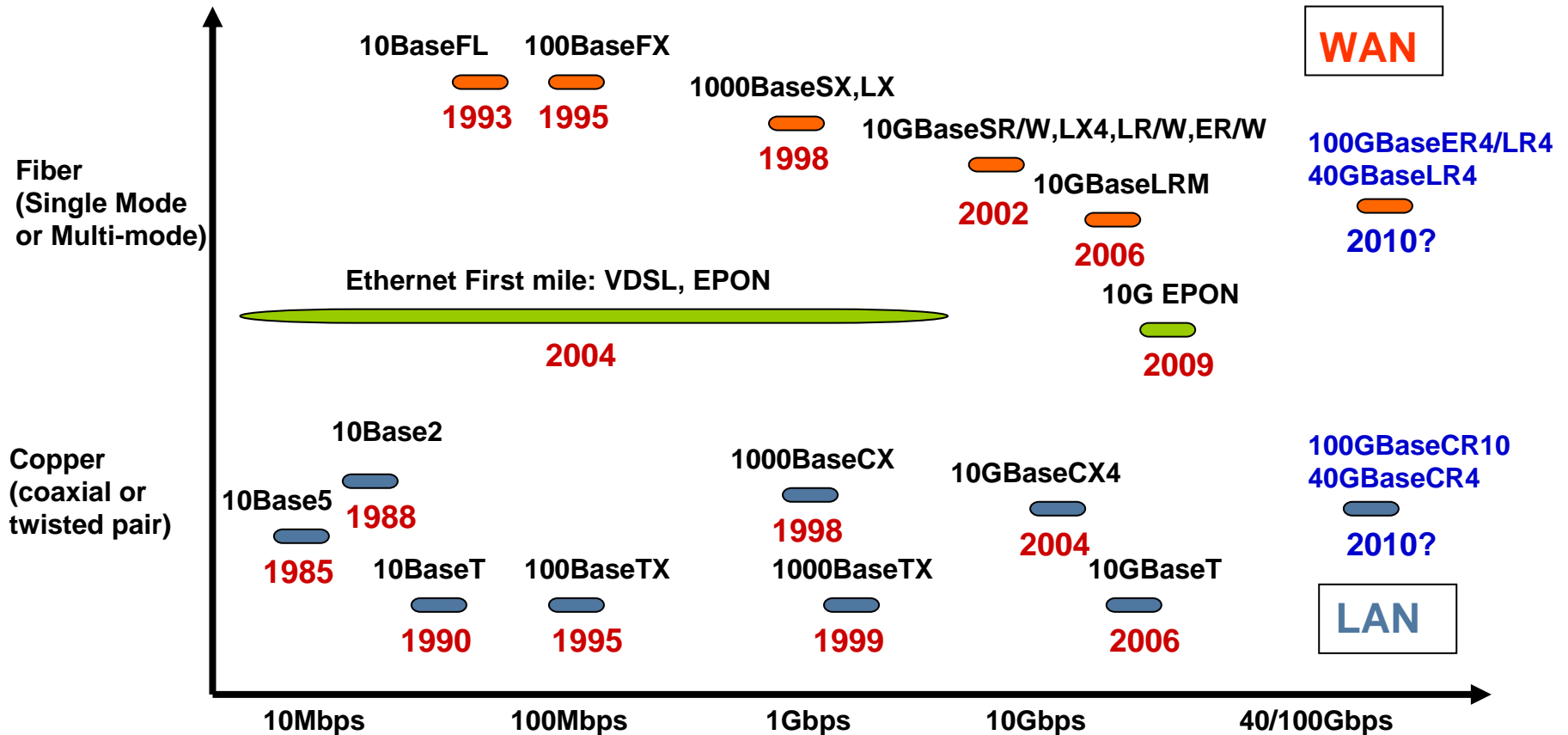
Ethernet Switch

Enterprise Switch

Star Topology (1997)
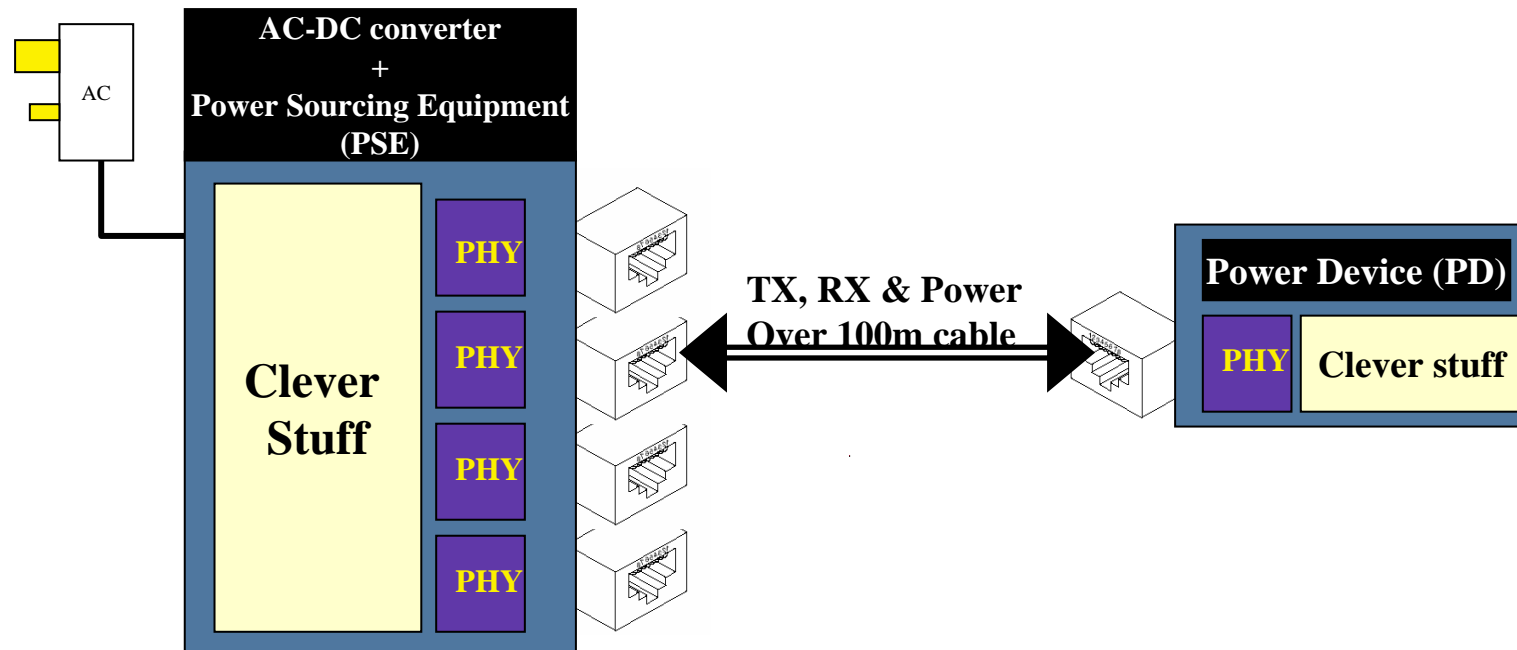
Tree Topology (2000)

MICREL
Innovation Through Technology™

# Ethernet Technologies Evolution



**WAN**

Fiber (Single Mode or Multi-mode)

- 10BaseFL — 1993
- 100BaseFX — 1995
- 1000BaseSX,LX — 1998
- 10GBaseSR/W,LX4,LR/W,ER/W — 2002
- 10GBaseLRM — 2006
- 100GBaseER4/LR4 40GBaseLR4 — 2010?

Ethernet First mile: VDSL, EPON — 2004

10G EPON — 2009

Copper (coaxial or twisted pair)

- 10Base5 — 1985
- 10Base2 — 1988
- 10BaseT — 1990
- 100BaseTX — 1995
- 1000BaseCX — 1998
- 1000BaseTX — 1999
- 10GBaseCX4 — 2004
- 10GBaseT — 2006
- 100GBaseCR10 40GBaseCR4 — 2010?

**LAN**

10Mbps    100Mbps    1Gbps    10Gbps    40/100Gbps

MICREL
Innovation Through Technology™

# *Power Over Ethernet : POE and POE Plus*

**AC-DC converter
+
Power Sourcing Equipment
(PSE)**

AC

**Clever
Stuff**

PHY

PHY

PHY

PHY

**TX, RX & Power
Over 100m cable**

**Power Device (PD)**

PHY | **Clever stuff**

**POE   802.3af (2003) 15.4W → 12.95W (350 mA)**
**POE+ 802.3at (2009) 30W   → 25.5W   (600 mA)**

**MICREL**
*Innovation Through Technology™*

# Power Over Ethernet Applications

IP Camera

AC +

Wireless AP

IP Phone

MICREL
Innovation Through Technology™
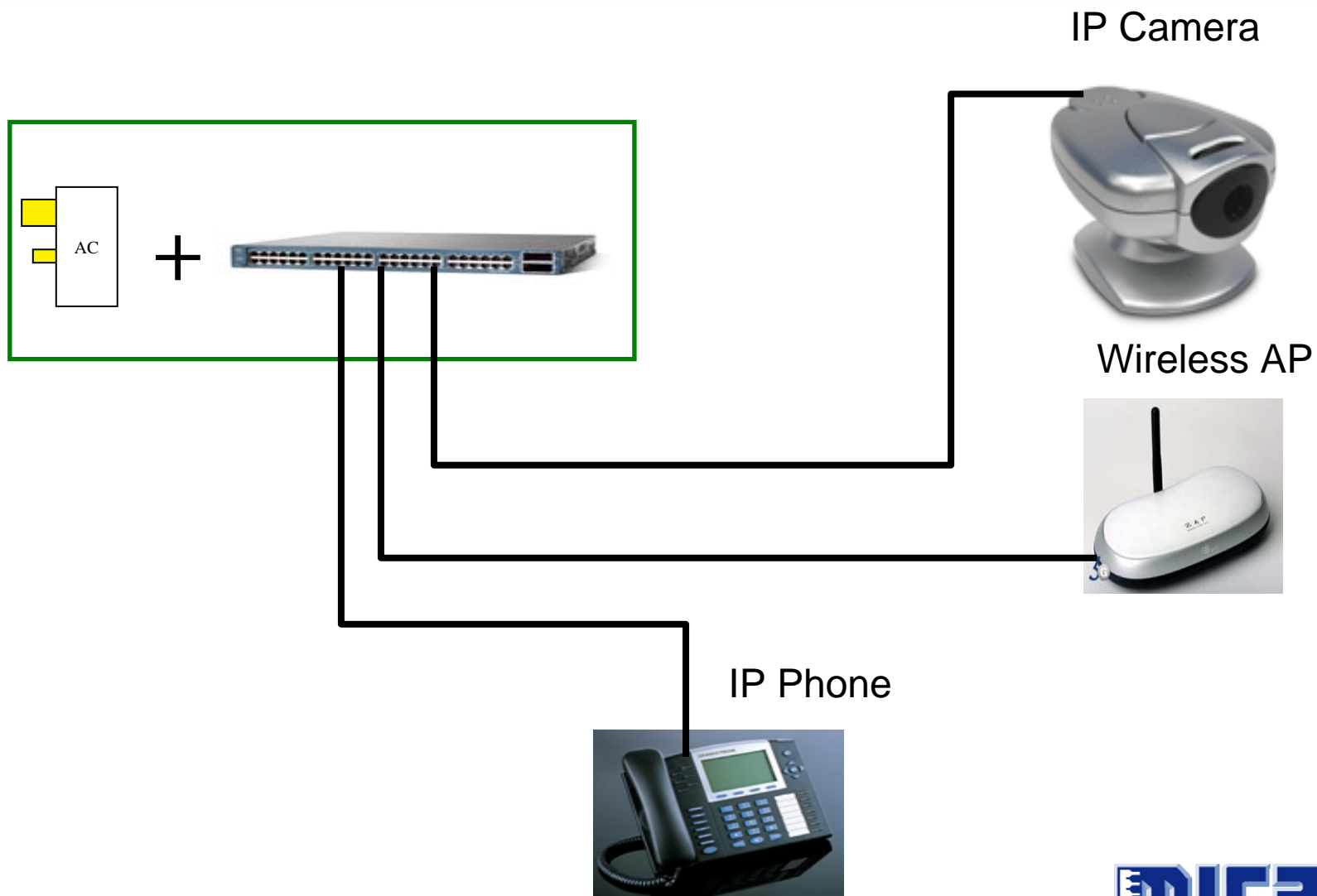
# *Internet Traffic Explosion*

## IP Traffic Growth



Source: Cisco Systems, 2008    **1 Peta Bytes = $10^{15}$ Bytes**
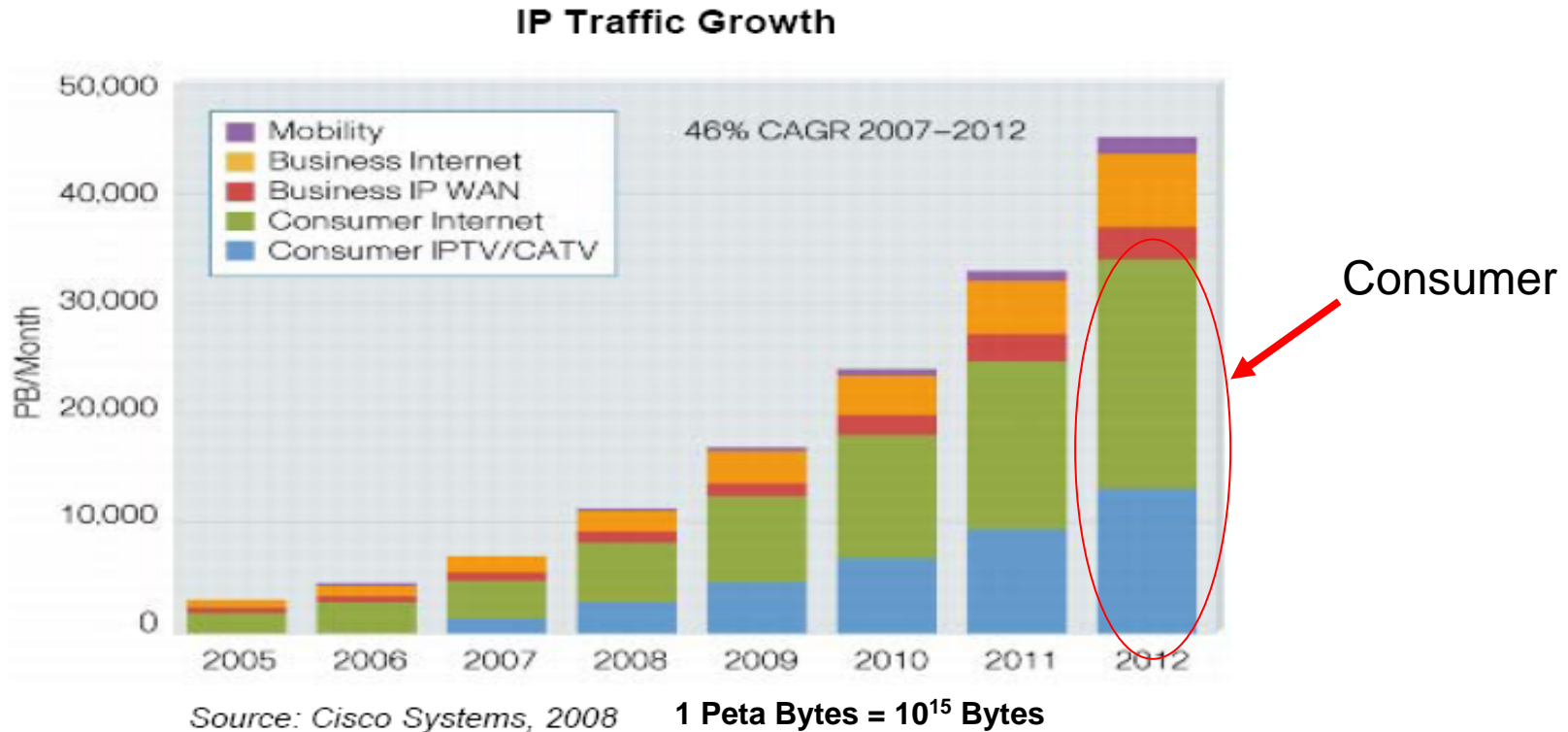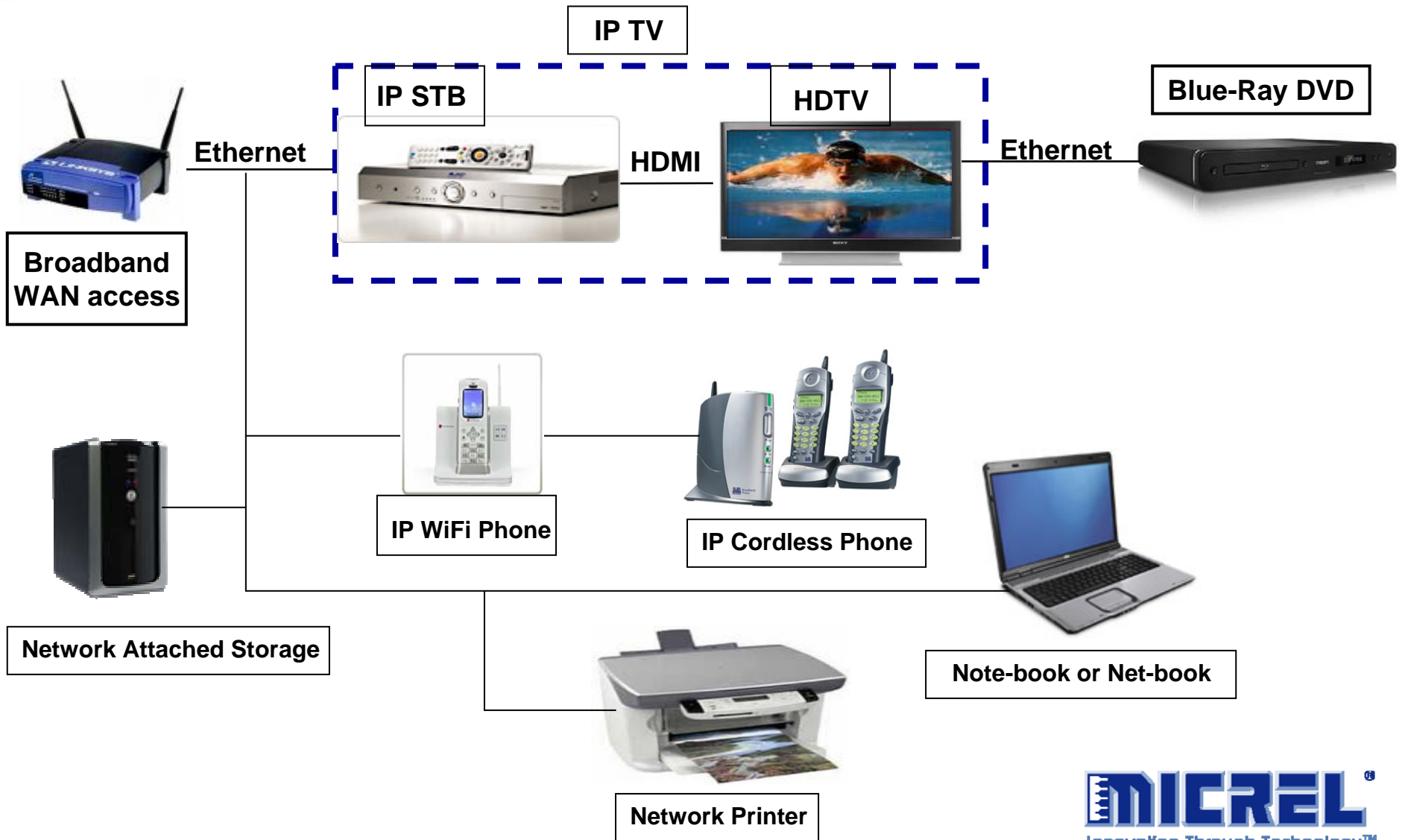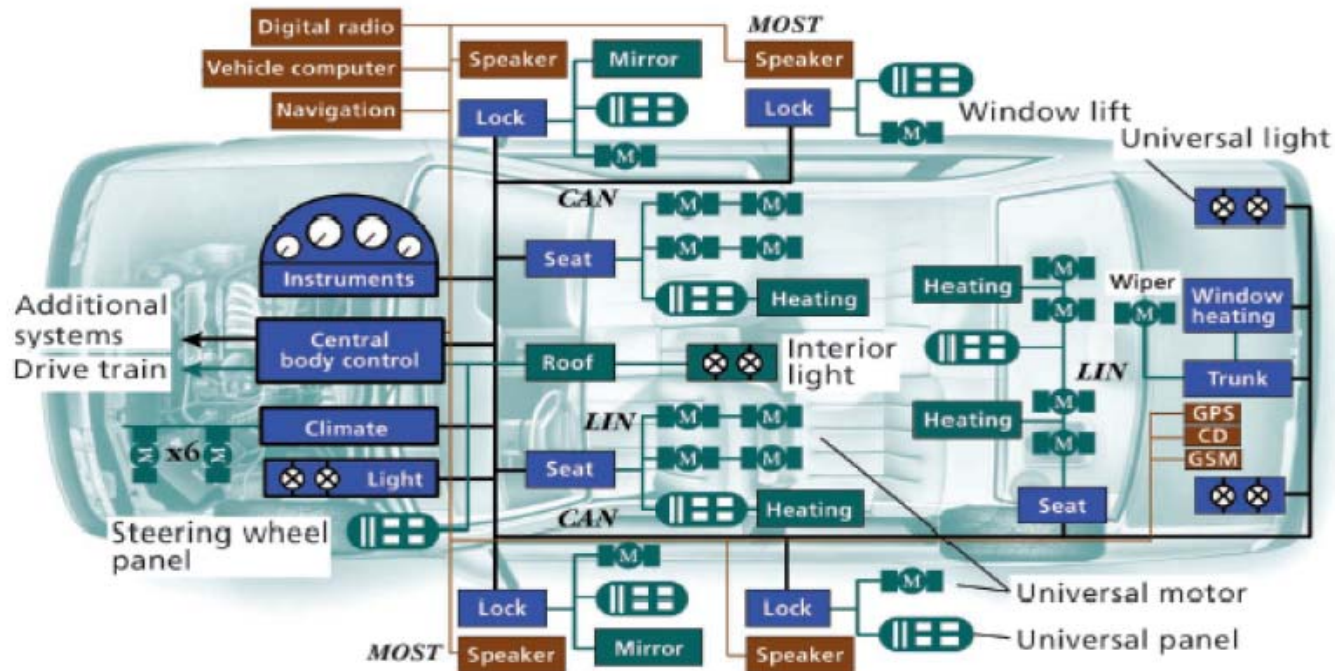
- **Global IP traffic will nearly double every two years!**

- **According to Kevin Kelly of the New York Times, "the entire written works of humankind, from the beginning of recorded history, in all languages" would amount to 50 Peta Bytes of data.**

# *Digital Home*

IP TV

IP STB

HDTV

Blue-Ray DVD

Ethernet

HDMI

Ethernet

**Broadband
WAN access**

**IP WiFi Phone**

**IP Cordless Phone**

**Network Attached Storage**

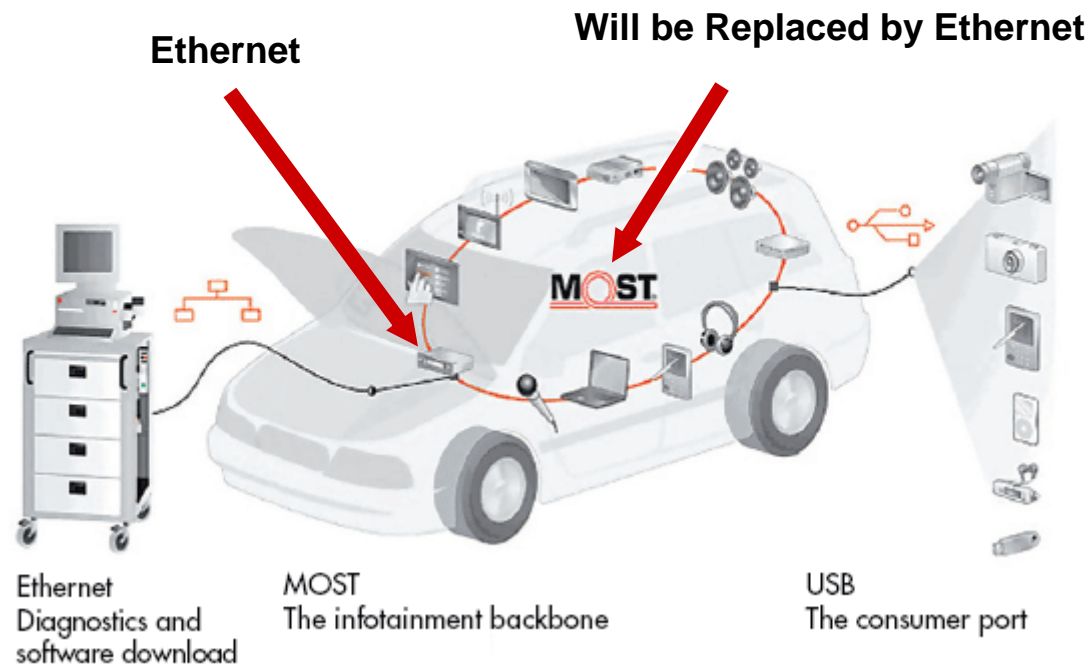**Note-book or Net-book**

**Network Printer**

# Automotive Electronics



CAN    Controller area network
GPS    Global Positioning System
GSM    Global System for Mobile Communications
LIN    Local interconnect network
MOST   Media-oriented systems transport

- CAN
- LIN
- MOST

# Automotive Ethernet Solutions – Diagnostics and Infotainment Backbone

**Ethernet**

**Will be Replaced by Ethernet**



Ethernet
Diagnostics and
software download

MOST
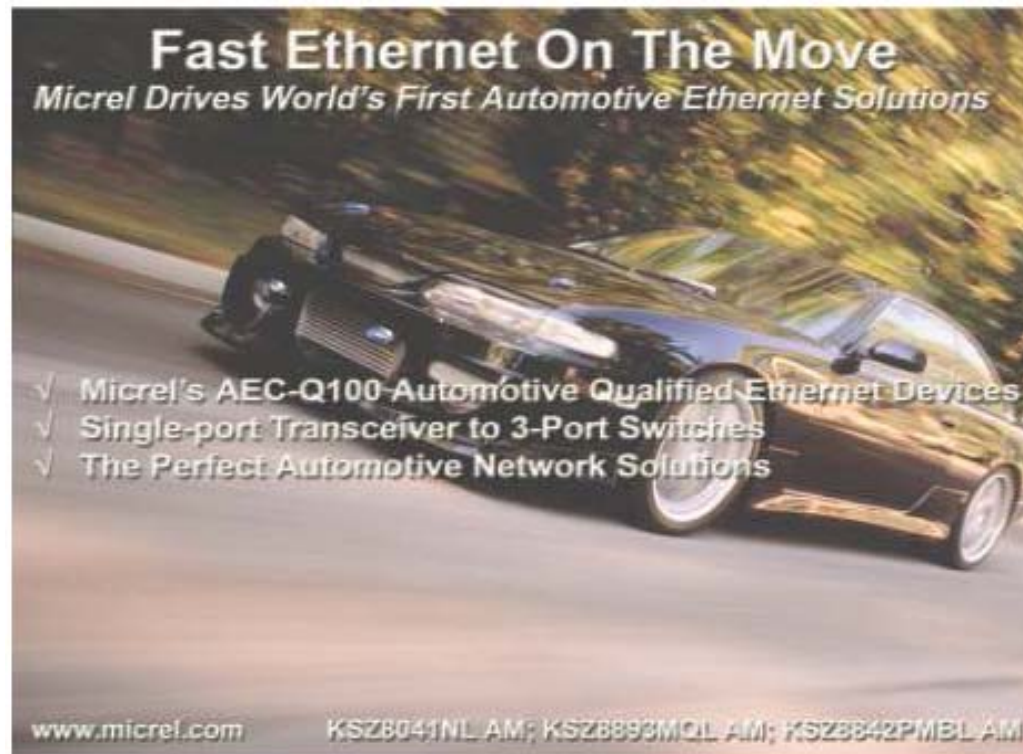The infotainment backbone

USB
The consumer port

- **Ethernet is emerging inside the car**
  - Today nearly 100 processors in high-end car
  - Initial applications are car diagnostics and software downloading replacing CAN

**MICREL**
Innovation Through Technology™

# *Why Ethernet?*

| Technology | Ethernet | MOST |
|---|---|---|
| Usage | Consumer, Communication, Computing, Industrial Control | Car only |
| Standards | Open (IEEE), field proven | Closed (MOST) |
| Media | Copper and Fiber (inc. POF) | POF |
| Speed | 10Mbps to 10Gbps | 25Mbps to 150Mbps |
| Volume production | Hundreds of Million chips per year | A few Million chips per year |
| Suppliers | Many | One (SMSC) |
| Cost | Low | High |

# Ethernet on the Move

**Micrel is the "World's First Supplier of Automotive Qualified (AEC-Q100) Ethernet devices"**

# Micrel Ethernet

- **Founded in 1996 (Kendin Communications Inc)**

- **Acquired by Micrel in 2001**

- **Patented Proprietary Mixed-Signal Fast Ethernet PHY Implemented in Digital CMOS process:**
  - **Lower Power**
  - **Small Die Size**
  - **Lower Cost Per Port**

**MICREL**

Innovation Through Technology™

# GENIVI Alliance

- GENIVI was formed on March 2, 2009 and is headquartered at San Ramon, California

- GENIVI is a non-profit industry association open to automotive, consumer electronic, communication companies committed to driving the broad adoption of an In-Vehicle Infotainment (IVI) open source development platform.

- GENIVI's work will result in shortened development cycles, quicker time-to-market, and reduced costs for companies developing IVI equipment and software.

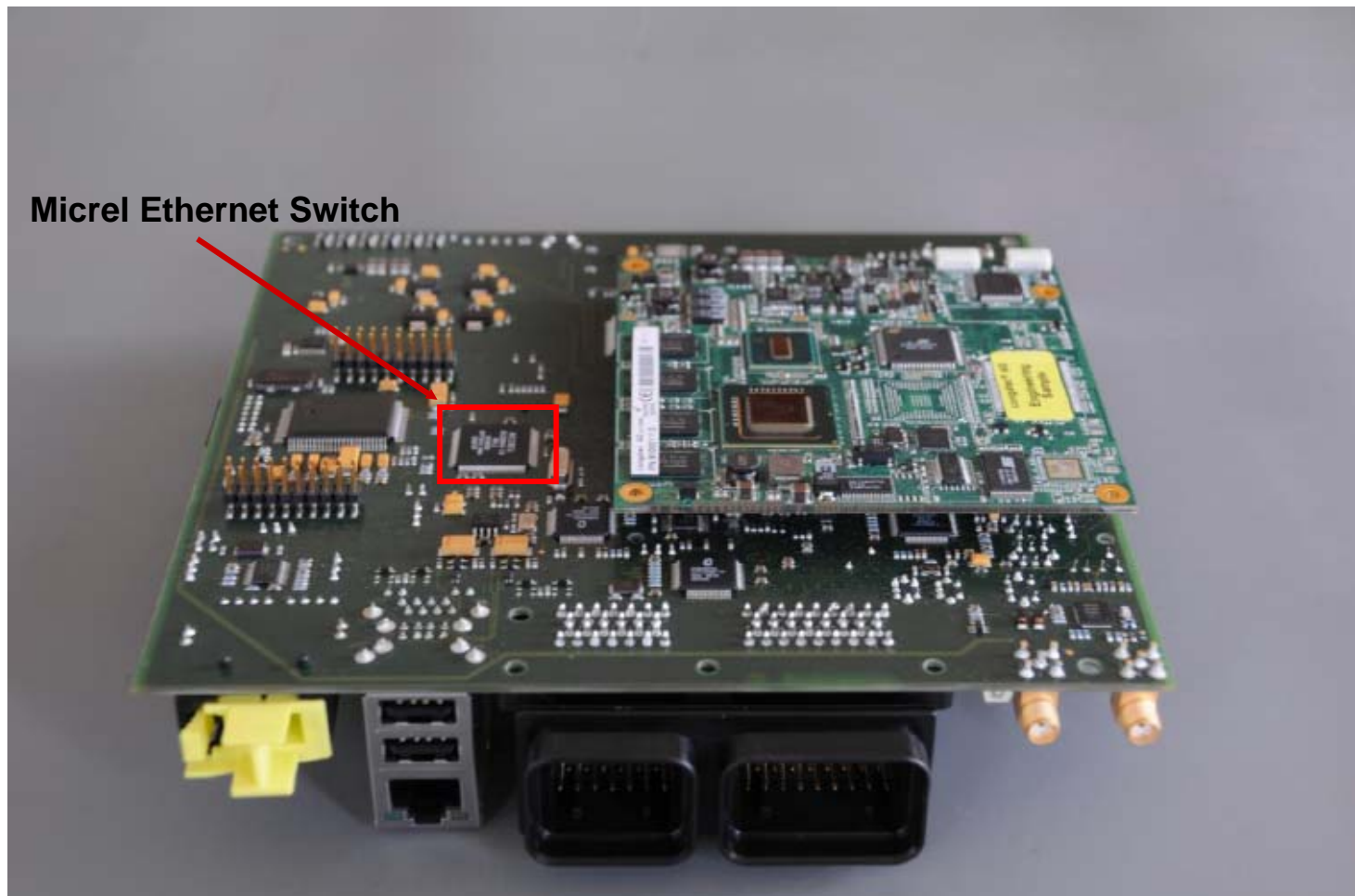# GENIVI Members

# Russellville – In-Vehicle Infotainment (IVI) Open Source Development Platform

## Micrel Ethernet switch used in GENIVI Platform

- Only Ethernet device support with Linux, and Moblin s/w driver



**Micrel Ethernet Switch**

# Smart Grid

- **The smart grid is not just those things owned and operated by the utility; it's everything connected to the electricity network. Every device that consumes electricity is part of the smart grid, including:**
  - **Smart appliances in homes**
  - **HVAC equipment in commercial buildings**
  - **Streetlights in cities and towns**

# World-wide Smart Meter Initiatives

- According to US Federal Energy Regulatory Commission (FERC), the energy savings from the use of smart metering is about 5.8% of peak demand.

- In US, 4.7% of the 140 million energy meters installed are smart capable up from less than 1% in 2006.

- According to Berg Insight, the installed base for smart meters in Europe will reach 96 million units by 2014.

- Sweden has become the first country in the world to achieve 100% penetration for smart meters.

- The U.K. government has announced plans to have smart meters installed in all 26 million U.K. homes by 2020.
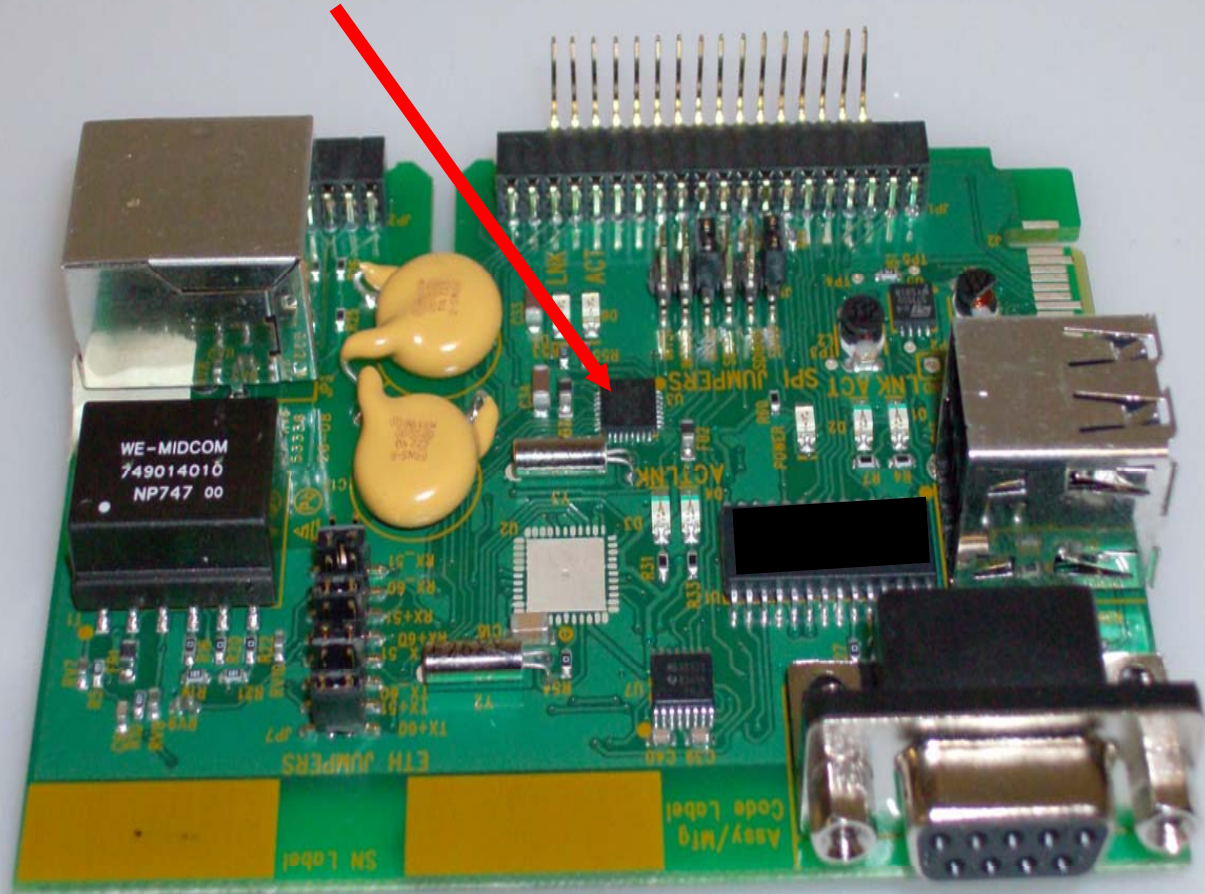
# Smart Power Meter

- **The solid-state digital smart electric meter records hourly meter reads and then transmits the reads to a network device via an radio frequency (RF) mesh network, or IP (Ethernet) network through your home gateway.**



**MICREL**
Innovation Through Technology™
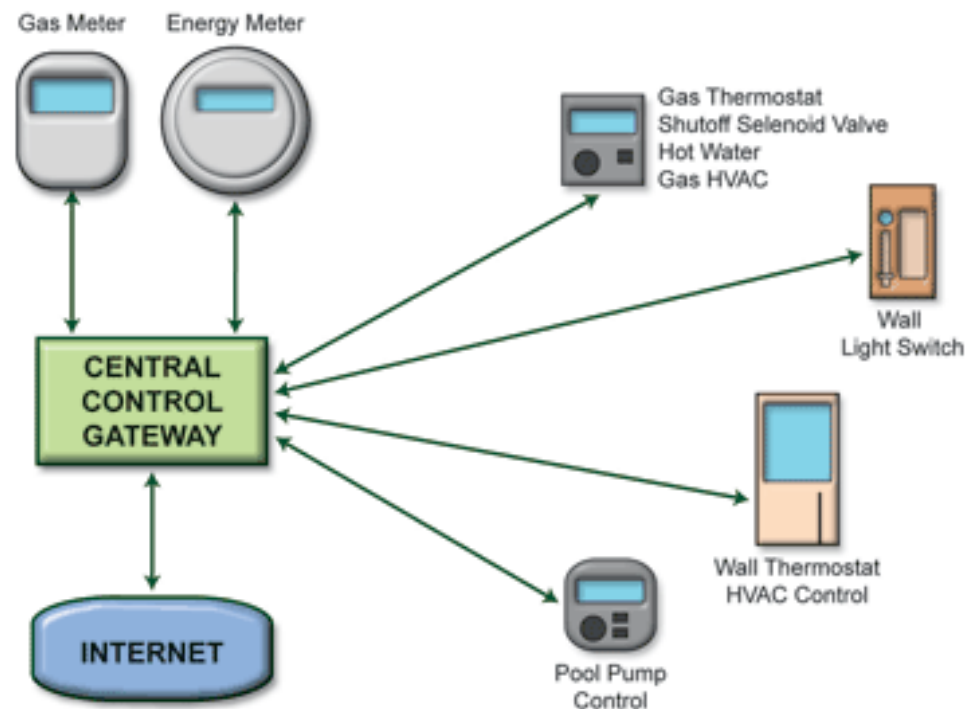
# *Smart Power Meter*



**Micrel Ethernet Controller**

# *Conclusions*

- **Ethernet is the ubiquitous wired technology**
  - **10Mbps to 10Gbps today and can be extended to 100Gbps in the future**
  - **In Wide Area Network (WAN) Ethernet is replacing SONET**
  - **In office, PC's, Note-books, and Printers are connected by Ethernet network**
  - **At home, HDTV, IP-STB, IP-TV, Blue-Ray DVD, Printer, IP-Phone, and other appliances also use Ethernet to move video, voice and data**

- **Further expansion into emerging markets such as Automotive diagnostics and Infotainment systems, and Smart Power Meters is inevitable**

**MICREL**
Innovation Through Technology™

# Ethernet is everywhere – even in space



Innovation Through Technology™