Deploy PoE Anywhere and Everywhere

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Omnitron Systems Technology, Inc.
Deploy PoE Anywhere and Everywhere

Agenda
Introduction
PoE Distance Challenge
PoE Extension Technologies
Case Studies
Q and A
About Omnitron Systems

Corporate Profile

• Design and Manufacture PoE, fiber optic, and Ethernet network connectivity products since 1992

• Corporate headquarters and manufacturing facilities are based in Irvine, California

• Markets Served:
  - Enterprise
  - Government
  - Industrial
  - Telecom
  - Security
  - Data Center
What is PoE?

Power over Ethernet (PoE) is a standard based technology for the safe delivery of data and power to remote devices over copper cabling.

- Uses standard Ethernet UTP cables
  - Ex. Cat 5e or Cat 6 cable
- Power and data co-exist on same copper conductors
PoE Terminology

- **Endspan PSE** – located at the end of a link segment

- **Midspan PSE** – located in the middle of a link segment
## IEEE PoE Standards

<table>
<thead>
<tr>
<th>Spec / Name</th>
<th>Ratified</th>
<th>Pairs needed</th>
<th>PoE Type</th>
<th>PoE Class</th>
<th>Power at PSE</th>
<th>Power at PD</th>
<th>Cable Type</th>
<th>Data Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>802.3af PoE (15 W)</td>
<td>2003</td>
<td>2 Pairs (Alt A&amp;B)</td>
<td>Type 1</td>
<td>Class 1</td>
<td>4W</td>
<td>3.8W</td>
<td>Cat 3, 5, 6, 7</td>
<td>10M 100M Gigabit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Class 2</td>
<td>7W</td>
<td>6.5W</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Class 3</td>
<td>15.4W</td>
<td>13W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>802.3at PoE+ (30W)</td>
<td>2009</td>
<td></td>
<td>Type 2</td>
<td>Class 4</td>
<td>30W</td>
<td>25.5W</td>
<td>Cat 5, 5e, 6, 7</td>
<td></td>
</tr>
<tr>
<td>802.3bt 4 Pair PoE (60/90W)</td>
<td>2018</td>
<td>4 Pairs</td>
<td>Type 3</td>
<td>Class 5</td>
<td>45W</td>
<td>40W</td>
<td>Cat 5e, 6, 7</td>
<td>10M 100M Gigabit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Class 6</td>
<td>60W</td>
<td>51W</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type 4</td>
<td>Class 7</td>
<td>75W</td>
<td>62W</td>
<td>Cat 5e, 6, 7</td>
<td>2.5G 5G 10G</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Class 8</td>
<td>90W</td>
<td>71.3W</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Proprietary 60W plus High-Power PoE

- The High Power PoE market moved faster than standards bodies
  - High Power PoE products have been on the market for years before 802.3bt
- Proprietary, Non-IEEE Standard Implementations
  - High Power PoE (HPoE)
  - Universal PoE (UPoE)
  - PoE++
  - 4-Pair PoE or 4PPoE

Backwards compatible IEEE Standard 15W (802.3af) and 30W (802.3at)
How Do PSEs Determine How Many Watts to Send?

- PSE applies a low voltage on the wires
- If it's not a PD, the PSE will NOT send power (equipment is safe)
  - But WILL still pass data
- A valid PD will let the PSE know how much power it requires
- Power is then supplied by the PSE to the PD

“I need 15W”
Deploy PoE Anywhere and Everywhere

PoE Distance Challenge
Ethernet Data Can Only Travel 100 Meters over Copper

- Placement of PDs is limited by the 100 meter (328 ft) Distance Barrier of Ethernet over Copper Cabling

- The challenge is connecting PoE PDs beyond the 100 meter distance limit
Deploy PoE Anywhere and Everywhere

PoE Extension Technologies
PoE Extension

PoE Extension Technologies
• Ethernet (VDSL) Extenders
• PoE Copper Extenders
• PoE Media Converters
• PoE Fiber Switches

Comparison and Contrast
• Distance
• PoE PSE Power Provided
• Bandwidth
• Availability of Local Power
• Features
• Cable Media
• Price
PoE VDSL Extenders (Very High Speed Digital Subscriber Line)

- Two port or multi-port devices
- Requires external AC or DC power
- Up to 30W PoE+ over short distances

**Strengths**
- Plug and Play
- Up to 2400 meters over RJ11 Copper

**Weaknesses**
- PoE power only at short distances
- Limited bandwidth at long distance
- Proprietary, unique to manufacturer
How do VDSL Extenders Work?

- Where twisted pair or Coax is available, and installing fiber is cost prohibitive.
- Head end device is powered, and requires a power injecting device
- Line power is proprietary over extended cable distance
# VDSL Extenders

<table>
<thead>
<tr>
<th>Criterion</th>
<th>PoE Ethernet Extenders</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distance</strong></td>
<td>Up to 2400 meters over Coax</td>
</tr>
<tr>
<td><strong>PoE PSE Power</strong></td>
<td>Up to 30W PoE+ over short distances</td>
</tr>
<tr>
<td><strong>Local Power</strong></td>
<td>• AC or DC power required for VDSL Extenders</td>
</tr>
<tr>
<td></td>
<td>• May require additional power injectors</td>
</tr>
<tr>
<td><strong>Number of PDs</strong></td>
<td>1 or 2</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>• 100Mbs over short distances (200 to 300 meters)</td>
</tr>
<tr>
<td></td>
<td>• 1 to 4Mbps over longer distances (1000 to 2400 meters)</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>• Typically unmanaged, plug-and-play devices</td>
</tr>
<tr>
<td></td>
<td>• Auto-negotiation of duplex modes and data rates</td>
</tr>
</tbody>
</table>
PoE Copper Extenders

- Two port or multi-port devices
- Functions as both Powered Device (PD) and Power Sourcing Equipment (PSE)
- Requires no external AC power

**Strengths**
- Plug-and-play
- Full Gigabit data rate to end device
- Powers PoE, PoE+, and HPoE devices

**Weaknesses**
- Extender required every 100m
- Head end must provide power
How do Copper Extenders work?

- PoE Extender Receives Power through PD Port
- PoE Extender Provides Power through PSE Port
Voltage Boosting Technology

- Installing PoE Copper extenders with Voltage Boosting Technology guarantees voltage requirement to the PDs

**Extender without Voltage Boosting Technology – Camera cannot link due to Low Voltage**

**Extender with Voltage Boosting Technology**
PoE Copper Extender Distances

- Up to 700m to 802.3af PD, up to 800m to non-PoE (AC/DC powered) device
- Power and distance dependent on:
  - Power provided by PSE (Power Budget)
  - Power consumed by PoE Extenders and PD(s)

Available power at camera is 7.4W using Cat 6
PoE Extender with Drop Locations

- Additional ports enable PD drop locations along daisy chain
  - Power consumption reduces overall distance
  - Provides network design flexibility
# PoE Copper Extenders

<table>
<thead>
<tr>
<th>Criterion</th>
<th>PoE Copper Extenders</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distance</strong></td>
<td>Up to 700 meters in daisy chain (Extender provides power)</td>
</tr>
<tr>
<td><strong>PoE PSE Power</strong></td>
<td>~55W @ 200 Meters, ~25W @ 500 Meters, ~7W @ 700 Meters</td>
</tr>
<tr>
<td><strong>Local Power</strong></td>
<td>No AC or DC power required for PoE Copper Extenders</td>
</tr>
<tr>
<td><strong>Number of PDs</strong></td>
<td>Up to 4 (deployed with drop locations)</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>Gigabit data rate at all distances</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>• Voltage Boosting Technology</td>
</tr>
<tr>
<td></td>
<td>• Typically unmanaged, plug-and-play devices</td>
</tr>
<tr>
<td></td>
<td>• Auto-negotiation of duplex modes and data rates</td>
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PoE Media Converters

• Extend distances to PoE devices with fiber
• PoE Media Converter is powered by AC or DC power
• Multiple Fiber and RJ-45 PoE port configurations

Strengths
- Plug and Play, or Configurable features:
- PoE Force, Remote PoE Reset
- Enables distances up to 140 Km (87 miles)

Weaknesses
- Requires local AC/DC Powering
- Requires fiber
How PoE Media Converters Work

• Use switch fiber ports at the Head End
• Or copper switch with media converters
• Install **PoE Media Converter** near AC or DC power
• Install PDs on Poles, Ceilings, Enclosures etc.
  – 100m Copper max. from the media converter
PoE Media Converter Application

- Media Converter Chassis
- Copper Switch
- Daisy Chain Fiber
- Point-to-Point Fiber
- Redundant Fiber
- PoE Camera
- NEMA Enclosure
- PoE Media Converters
- DC Power
- AC or DC Power
- HPoE Access Point
- PoE Wi-Fi Access Point
- PoE+ Camera
## PoE Media Converters

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<th>Criterion</th>
<th>PoE Media Converters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distance</strong></td>
<td>Up to 140 Km (87 miles). Can be daisy chained for additional links</td>
</tr>
<tr>
<td><strong>PoE PSE Power</strong></td>
<td>PoE, PoE+, HPoE and 4 Pair PoE (802.3bt)</td>
</tr>
<tr>
<td><strong>Local Power</strong></td>
<td>• AC or DC power required for PoE Media Converter</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>Up to 10 Gigabit data rate at all distances</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>• Managed or unmanaged</td>
</tr>
<tr>
<td></td>
<td>• One or Two Fiber Ports</td>
</tr>
<tr>
<td></td>
<td>• DIP-Switch configuration of PoE reset, restore modes, ....</td>
</tr>
<tr>
<td></td>
<td>• Auto-negotiation of duplex modes and data rates</td>
</tr>
</tbody>
</table>
PoE Fiber Switches

- Compact PoE Fiber Switches extend distances to MULTIPLE PoE devices
- Requires AC or DC power
- Enables distances up to 140 Km (87 miles)

**Strengths**

- Configurable features: PoE Force, Remote PoE Reset, Dual Device Mode, VLANs, Heartbeat, QoS, MRP and Spanning Tree Rings
- Powers PoE, PoE+, and HPoE PDs from same PoE Fiber Switch
- Managed or Unmanaged devices

**Weaknesses**

- Requires local AC/DC Powering
- Requires fiber
How PoE Fiber Switches Work

- Same Concept as PoE Media Converters
- Run fiber from head end (fiber switch or copper switch and media converters)
- Install **PoE Fiber Switch** near AC or DC power
- Install PDs
  - 100m Copper max. from the PoE Fiber Switch
PoE Fiber Switch Application – Topologies

Point-to-Point

Daisy Chain

Redundant

Ring
Industrial PoE Fiber Switches

- Also available as ruggedized industrial products
- Similar features as commercial products
- Temperature hardened
- Industrial hardened
- Managed or Unmanaged devices
Industrial PoE Fiber Switch Application

- **Point to Point**
- **Daisy Chain**
- **Redundant**
- **Ring**
Other Industrial PoE Fiber Switch Applications

- Critical Infrastructure
- Perimeter Security
- Historic Sites
- Sports Arenas
- Transportation
- Cell Towers
# PoE Fiber Switches

<table>
<thead>
<tr>
<th>Criterion</th>
<th>PoE Fiber Switches</th>
</tr>
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<tbody>
<tr>
<td>Distance</td>
<td>Up to 140 Km (87 miles). Can be daisy chained for additional links</td>
</tr>
<tr>
<td>PoE PSE Power</td>
<td>PoE, PoE+, HPoE, and 4 Pair PoE (802.3bt) for multiple devices</td>
</tr>
<tr>
<td>Local Power</td>
<td>AC or DC power required for PoE Fiber Switch</td>
</tr>
<tr>
<td>Number of PDs</td>
<td>Typically up to 48 PDs (mixed power levels)</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>Up to 10 Gigabit at all distances</td>
</tr>
<tr>
<td>Features</td>
<td>• Managed or unmanaged</td>
</tr>
<tr>
<td></td>
<td>• One or Two Fiber Ports, and up to 48 RJ-45 PSE ports</td>
</tr>
<tr>
<td></td>
<td>• Remote PoE reset, PoE heartbeat, Dual Device Mode, VLAN, QoS, MRP and spanning tree</td>
</tr>
</tbody>
</table>
## PoE Extension Technology Comparison

<table>
<thead>
<tr>
<th>Criterion</th>
<th>VDSL Extenders</th>
<th>PoE Copper Extenders</th>
<th>PoE Media Converters</th>
<th>PoE Fiber Switches</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distance</strong></td>
<td>2400 M</td>
<td>700 M</td>
<td>140 Km</td>
<td>140 Km</td>
</tr>
<tr>
<td><strong>PoE PSE Power</strong></td>
<td>PoE, PoE+</td>
<td>PoE, PoE+, HPoE</td>
<td>PoE, PoE+, HPoE</td>
<td>PoE, PoE+, HPoE</td>
</tr>
<tr>
<td><strong># of PDs</strong></td>
<td>1 or 2</td>
<td>Up to 4</td>
<td>1 or 2</td>
<td>Up to 48</td>
</tr>
<tr>
<td><strong>Local Power</strong></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Cable</strong></td>
<td>Phone cable or Coax</td>
<td>Copper UTP</td>
<td>Fiber and Copper UTP</td>
<td>Fiber and Copper UTP</td>
</tr>
</tbody>
</table>
# PoE Extension Technology Comparison

<table>
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<tr>
<th>Criterion</th>
<th>VDSL Extenders</th>
<th>PoE Copper Extenders</th>
<th>PoE Media Converters</th>
<th>PoE Fiber Switches</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bandwidth</strong></td>
<td>1Mbps - 100Mbs</td>
<td>Gigabit</td>
<td>Gigabit/10G</td>
<td>Gigabit/10G</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>• Plug-and-Play • Unmanaged • DIP Switches</td>
<td>• Plug-and-Play • Unmanaged • DIP Switches</td>
<td>• Plug-and-Play • Unmanaged • DIP Switches</td>
<td>• Managed and Unmanaged • Advanced Switching</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>$</td>
<td>$</td>
<td>$$</td>
<td>$$$</td>
</tr>
</tbody>
</table>
Deploy PoE Anywhere and Everywhere

Case Studies
Case Study – International Airport

• Due to customer demand, a new Wi-Fi network was installed throughout the airport terminals and concourses

• Required over 300 Wi-Fi access points throughout the 6.8 million square foot terminal complex

• The new Wi-Fi network was installed in less than 30 days

• The network provides access to 15,000 simultaneous users
Case Study – International Airport

• Each concourse has multiple Intermediate Data Frames (IDF)
• Each IDF provides connectivity to Wi-Fi Access Points
• Fiber is used to extend distances to PDs outside the reach of copper
• PoE Power Reset feature saved time and technician costs
Case Study – International Airport

Managed Gigabit Media Converters installed in a high-density Chassis

PoE Switch

To Network Core

IDF

PoE+ Wi-Fi Access Points

PoE Media Converters

Up To 18 Gigabit Fiber Runs

Fiber

UTP with PoE

UTP
Case Study – Smart Building

• Integrates all of a facility's systems into a centrally controlled Ethernet network with IP-based structured cabling

• Benefits include:
  • Energy efficiency
  • Improved safety
  • Reduced labor costs
  • Reduced operating costs
  • Simplified asset Mgt.

• PoE enables PDs at any location, regardless if a site has electrical outlets.
Case Study – Smart Building

PoE Powered Devices
- IP Phones
- LED Lighting
- Sensors
- Access Control
- Wi-Fi APs
- Wi-Fi APs
- IP Cameras
- Displays
- Data Closet

100 Meter Distance Limitation
Case Study – Smart Building

PoE Powered Devices
- IP Phones
- LED Lighting
- Sensors
- Access Control
- Wi-Fi APs
- IP Cameras
- Displays
- Data Closet
Case Study – Casino Floor

PoE Powered Devices
- Wi-Fi APs
- IP Cameras
- Displays
- Data Closet

100 Meter Distance Limitation

- UTP with PoE & Data
- Fiber with Data
Case Study – Shopping Mall – Security and WiFi Installation

PoE Powered Devices
- Wi-Fi APs
- IP Cameras
- Data Closet

100 Meter Distance Limitation

UTP with PoE & Data
Fiber with Data
Case Study – Stadium WiFi – Daisy Chain and Point to Point
Deploy PoE Anywhere and Everywhere

Thank You!
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