



PRESENTS

NETWORLD INTEROP

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Ethernet Over Copper First Mile Deployments

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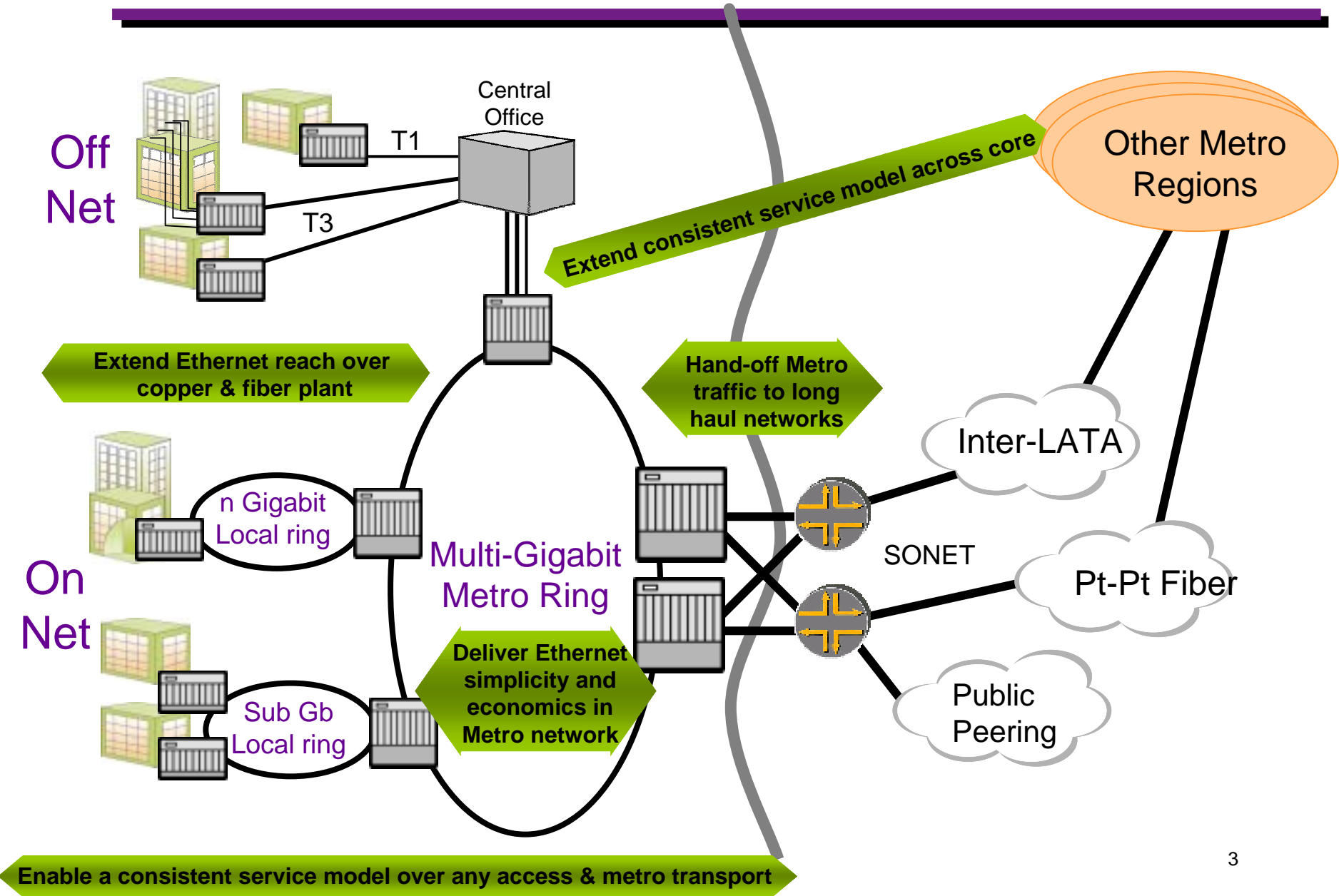
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Ethernet Over Copper

- **PAR Objective**
 - **PHY specification only**
 - **2500ft minimum distance**
 - **10MB aggregate data rate**
 - **Single pair of voice grade copper**
- **In-building Metro Fiber Extension applications**
- **Voice, data, video (full services)**

Where Ethernet Works in the 1st Mile



In-building Deployment

- Leverages single pair of voice grade cabling
- Classic MTU/MDU application
 - Fiber to the Building Extension
 - High Speed Internet Access
 - Transparent LAN Services
 - Voice Tie Line Replacement
 - Video On Demand (Residential)
- MxUs are Low risk...more subscribers increase odds of success
- Significant number of these opportunities
 - 65-70% businesses in MTUs, < 5% have broadband
 - 30-80% Earth's people live in apartments <1% have broadband

Problems with Copper Deployments

- Voice Grade means really bad wire
 - Installed sometime after 1876!!
 - Must run “around” installed service
 - POTS, ISDN, T1
- Cross-talk is a big problem
 - Attenuation increases with speed
 - Impedance mis-matches between short and long runs
 - Bridged taps and wire stubs
 - Unknowns in the bundle
 - xDSL
 - HPNA
 - Other noises – ring voltages, external motors

Ethernet over Copper Proposals

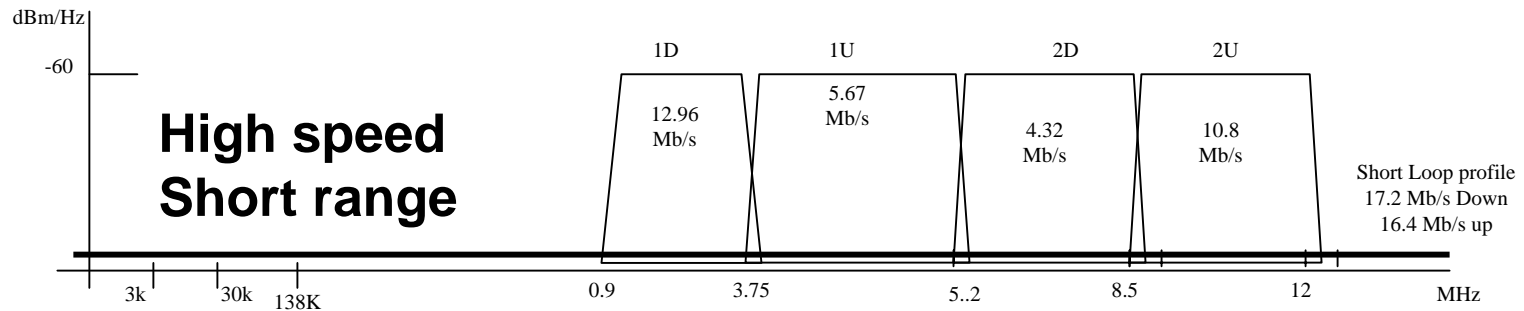
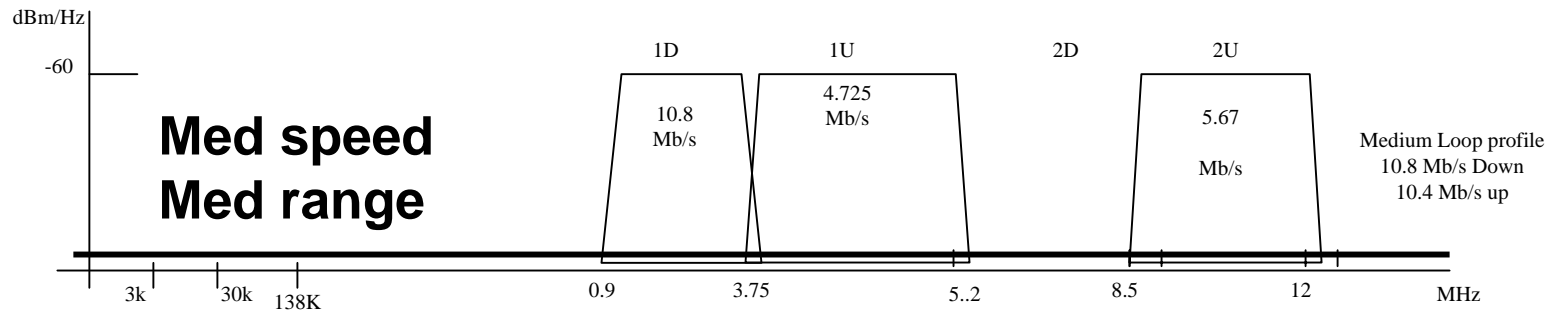
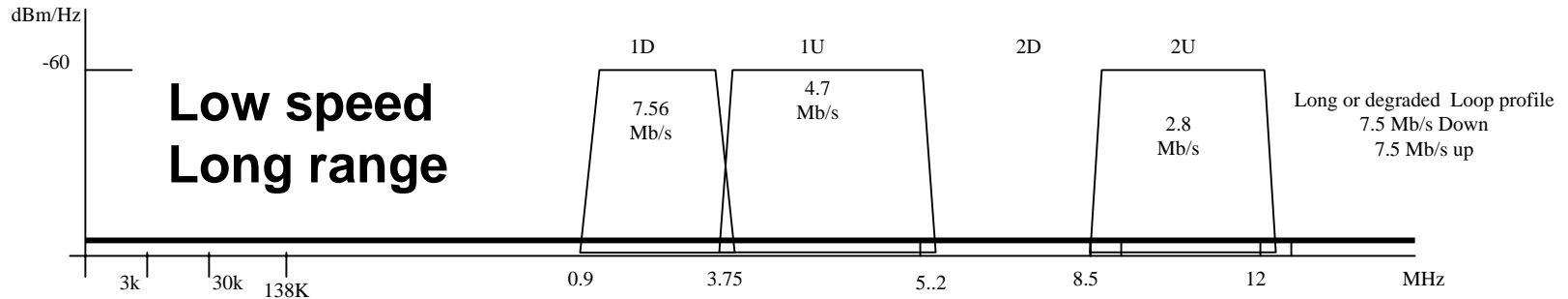
- VDSL – Very High Speed DSL
 - QAM 10MB Symmetrical, up to 52MB Asymmetrical
 - Current VDSL commercial products
 - DMT – Increased distance, increased speeds
- Proprietary alternatives
- Various Alternative PHY Proposals

ETSI 998 VDSL symmetric plans

VDSL Band Order 1U - 1D - 2U - 2D

U= Upstream

D= Downstream

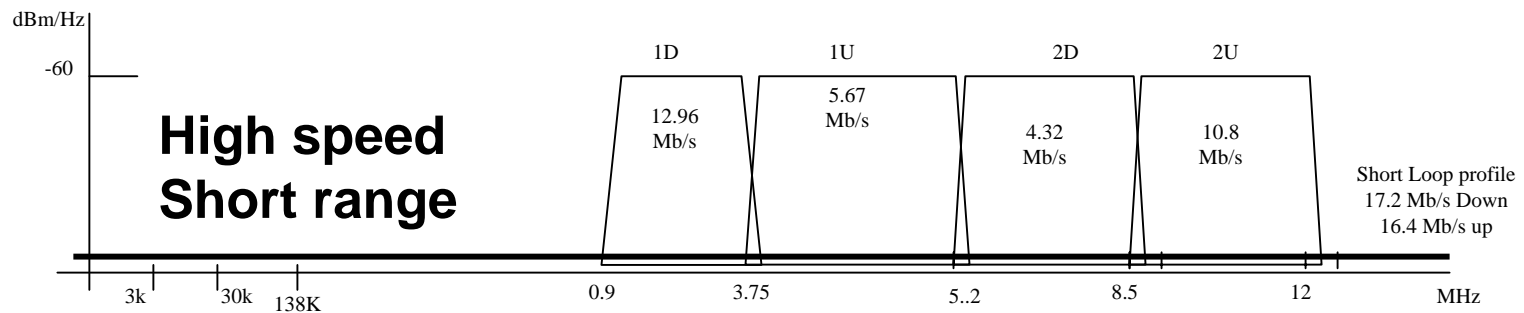
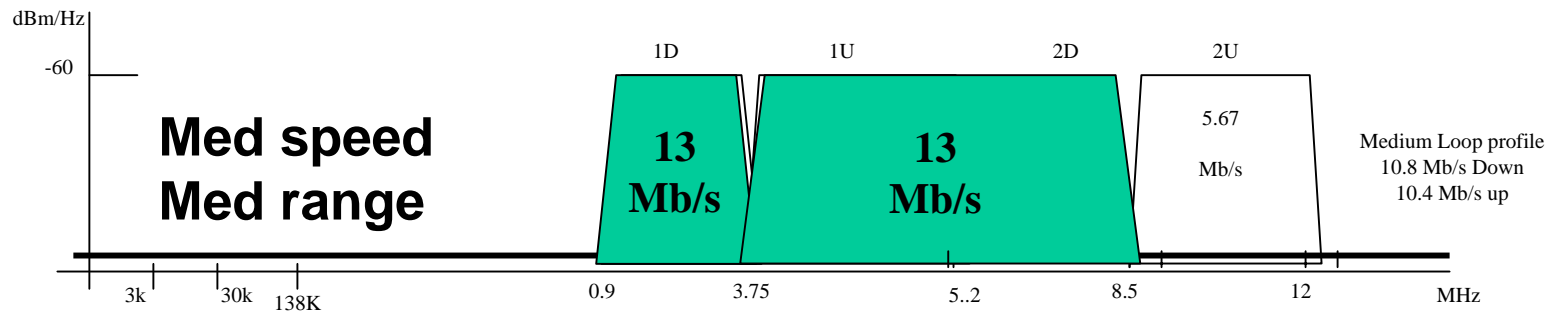
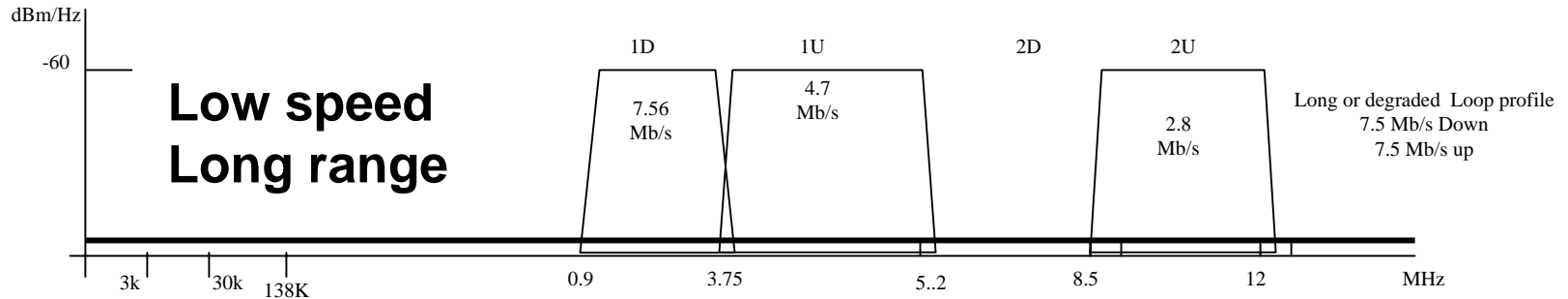


Existing VDSL Implementations

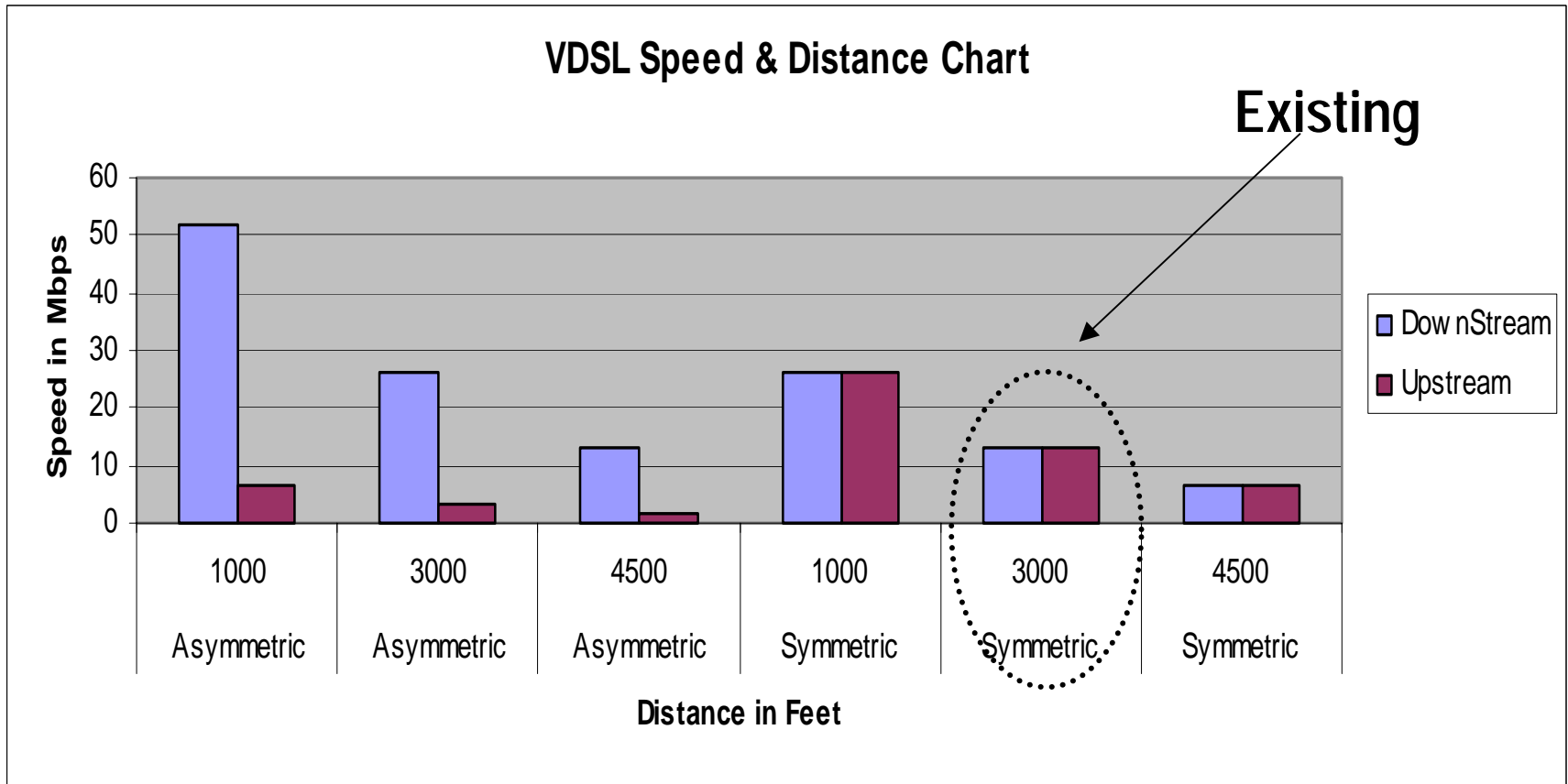
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VDSL Speeds and Distance Table



- **13 Mbps on the VDSL Analog Interface We Support 10 Mbps Half/Full Duplex on Ethernet Side**

Why VDSL for in- Building Wiring

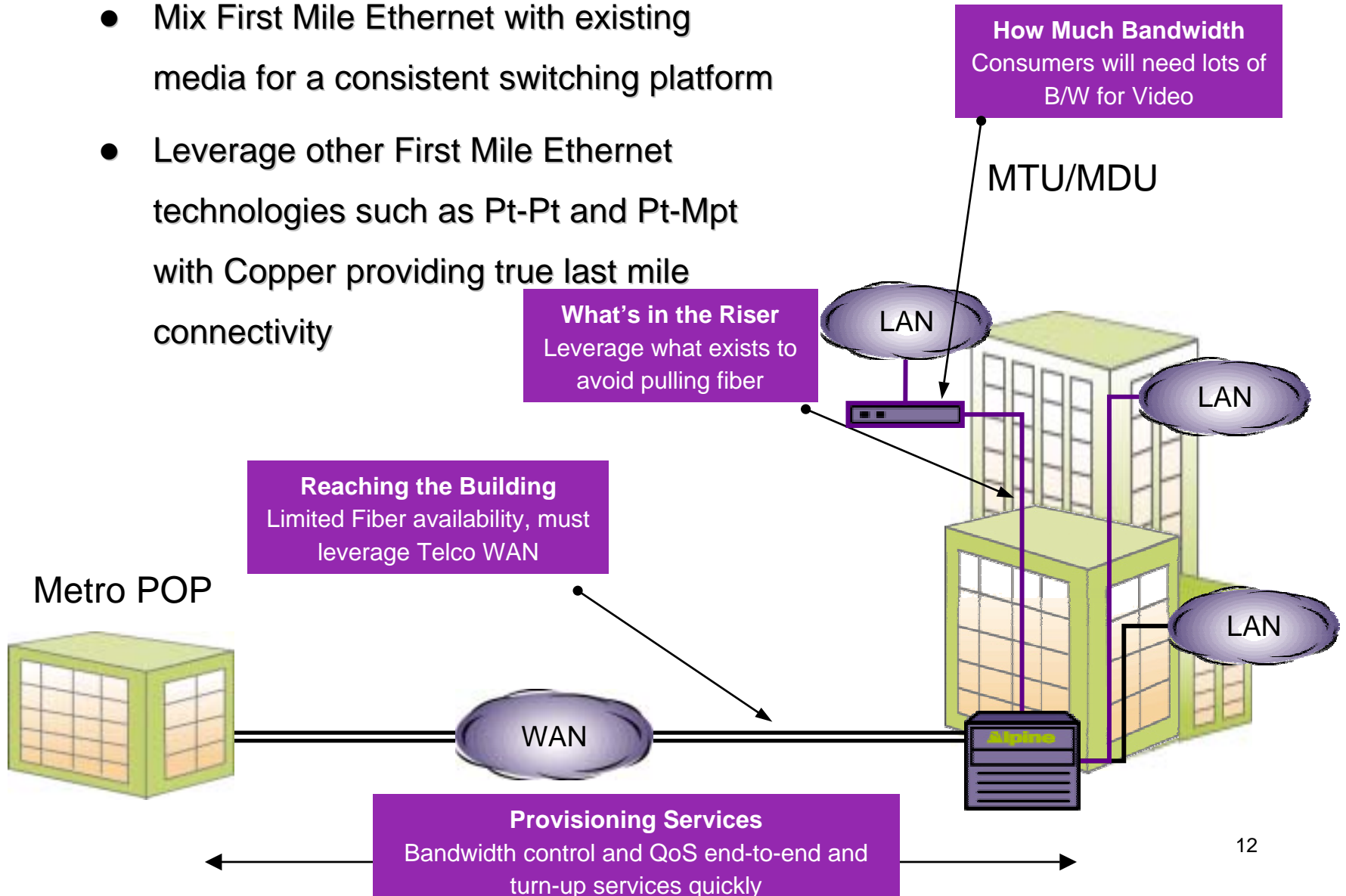
- Highest bandwidth over all DSL alternatives
- Low interference with existing T1s and ISDN
- Standards efforts driving Ethernet/VDSL model
- Range adequate for virtually all MTU applications
- Also suitable for FTTC applications

Why VDSL Not Targeted for COs

- Range < 5000 feet, minimizes potential market
 - Other DSL alternatives have 10,000-18,000 ft range
- Standards, homologation and interference susceptibility
 - Rival standards initiatives - none final yet
 - VDSL not homologated by any Telcos
 - Susceptible to interference from T1, other DSL in same bundle
- CO applicability only likely in central Europe
 - Higher density of COs than US, so more buildings in range
 - Hence SDSL (10K ft) more popular in Europe than in US

Shared Access Deployment

- Mix First Mile Ethernet with existing media for a consistent switching platform
- Leverage other First Mile Ethernet technologies such as Pt-Pt and Pt-Mpt with Copper providing true last mile connectivity



Ethernet Over Copper Summary

- **Ethernet Over Copper standards work is expected to be done in 802.3ah Ethernet in the First Mile Task Force**
 - **VDSL standards**
 - **OAM**
- **Ethernet Over Copper Belongs in the 1st Mile**
 - **Simpler, quicker, more cost-effective service deployment**
 - **Consistent IP/Ethernet service model over voice-grade building wiring**
 - **Subscriber-level provisioning and management end-to-end**
- **Additional Ethernet Over Cu in the 1st Mile Info:**
 - **[contact ceasley@extremenetworks.com](mailto:ceasley@extremenetworks.com)**