Covering CSA with multipair G.shdsl

IEEE802.3ah EFM
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Agenda

- **Long Reach Application**

- **G.SHDSL – technology and roadmap**

- **How to cover CSA – technology comparison**

- **TCP/IP throughput dependence on BER and Delay**

- **Resiliency**

- **G.SHDSL Aggregation requirements**

- **Case Study**

- **Summary and Conclusions**

Long Reach Application

- **Customer Service Area (CSA):**
  - **9Kft (2.7km) – 26 AWG**
  - **12Kft (3.7km) – 24 AWG**

- **Bandwidth: >=10 Mbps**

- **Pair availability: 4-8 on average (max. 32)**

- **T1.417 (US)/Domestic (EU) spectral compatibility**

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Loop characteristics

- **Variance in**
  - **Attenuation**
  - **X-talk**
  - **Bridge taps**

- **Impulse noise**

- **Micro-interruptions**

- **Line failures**

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Goals

- **10Mbps over CSA or more**

- **Efficient line utilization (non-uniform rates)**

- **Maximize throughput**
  - **Low Latency**
  - **Low BER**

- **Resiliency to micro-interruptions and impulse noise**

- **Recovery from line failures**

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TCP/IP throughput

- **TCP/IP throughput is sensitive to BER and Delay characteristics of underlying transport.**

Put a picture here!

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Technology comparison

Max. Loop length @10 Mbps, 24 AWG, 25 pair binder, 25-N disturbers, 6dB Noise Margin.

Technology	Max. loop length
VDSL	~4-5 Kft
G.shdsl, single pair	N/A
MP G.shdsl, 5 pairs	~9 Kft or more
MP G.shdsl, 8 pairs	~12 Kft or more

Multi-pair G.SHDSL

- **10Mbps over CSA or more**
  - **Multi-pair bonding & graceful degradation**

- **Efficient line utilization (non-uniform rates)**
  - **Graceful degradation**
  - **Optimized Aggregation Algorithm (AA)**

- **Maximize throughput**
  - **Low Latency – provided by AA**
  - **Low BER – calls for FEC**

- **Resiliency to micro-interruptions and impulse noise**
  - **Supported by G.SHDSL, can be improved by FEC**

- **Recovery from line failures**
  - **Calls for Dynamic AA**

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Conclusion

- **G.SHDSL is an existing standard technology with commercially available chipsets.**

- **Multi-pair G.SHDSL answer the Long Reach requirements.**

- **Further study shall be done to enhance baseline Aggregation proposal.**

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