



# **An Internet Operators Perspective on ADSL technology**

**Dr. Michael Haberler**  
**MD, EUnet Austria Ltd**  
**[mah@austria.EU.net](mailto:mah@austria.EU.net)**

# Who's EUnet, anyway?



largest ISP network operator in Europe + beyond  
26 countries, 275 points of presence  
EUnet Austria '95 revenues \$4M, market leader  
total group '95 revenues \$50M +

# ISP & local loop technology

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traffic profiles, overbooking & flooding

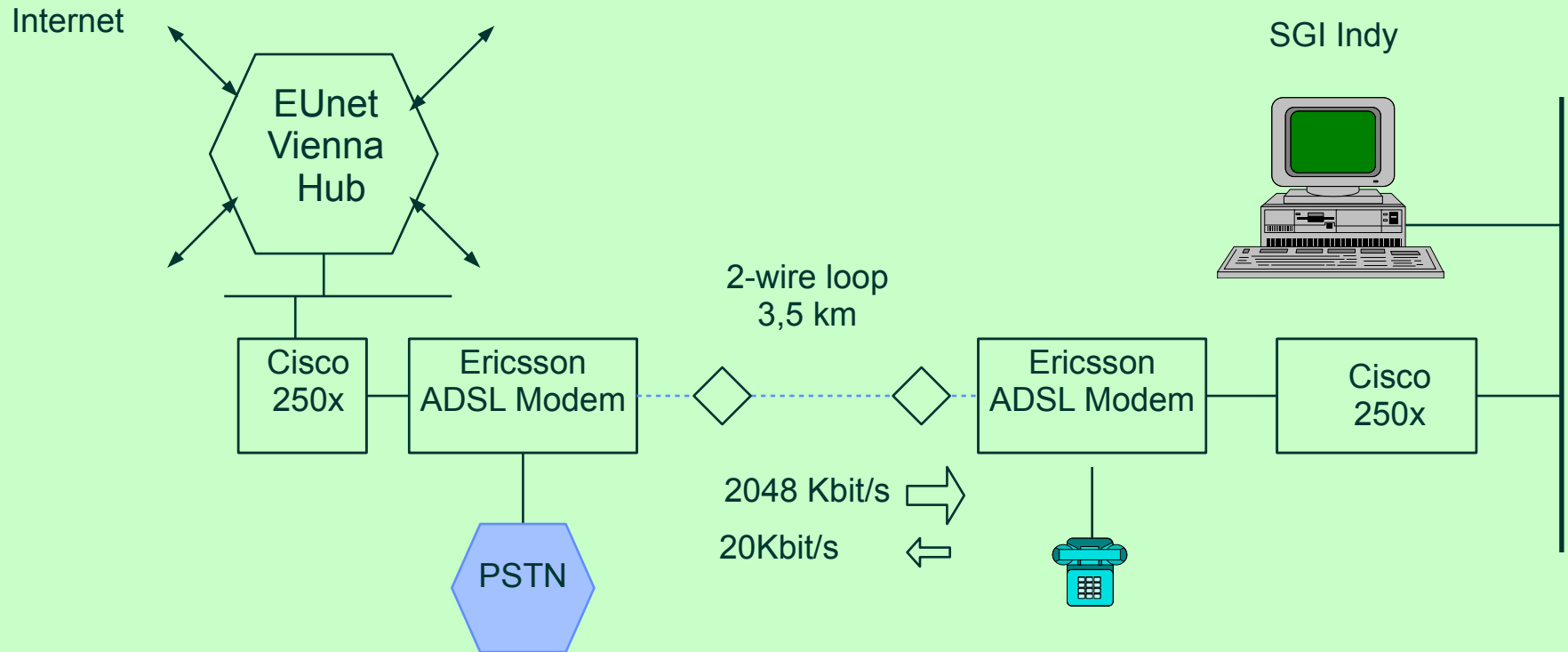
do ISP's actually want/can handle E1 to households?

tariffing by ISP's and carriers

bare copper pricing & availability

price/performance

# Trial setup



# Observations - protocol dynamics

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extreme setup - upstream/downstream bandwidth ratio 1:100

ftp rate 120 Kbyte/s end/end, excellent WWW performance

TCP 'view': pipe with very high delay/bandwidth product

slow 'slow start'

TCP performance bounded by upstream channel

ack size, acks/second, queue drops

UDP based (non-acking) applications can easily use whole downstream bandwidth

Van Jacobson TCP header compression is a must

factor of 5+ backchannel savings possible

MTU, TCP MSS parameters & tradeoffs

# Suggestions & Lessons

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try many TCP implementations - 1:5 throughput  
difference easily seen

use ***ttcp*** to compare but NOT Cisco TCP discard service

dont believe Cisco bits/s figures at low speeds

suggest empirical research with traces and timing  
analysis

definitely need lower bw ratio for more predictable  
performance (1:12..1:25)

# Possible service positioning

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high end single user/office environment, e.g  
graphics/www shops

maybe trickles down the service pyramid

attention to uneven capabilities

PTT's vs ISP's - is ADSL a technology for non-  
PTT type operators?

most successful ISP's are not PTT's  
want one for myself at home!