



# **NETWORK REQUIREMENTS FOR RPR**

**Italo Busi and Vittorio Mascolo  
Alcatel TND**



# NETWORK REQUIREMENTS

- ◆ SERVICES TO BE SUPPORTED BY RPR.
- ◆ MAINTENANCE, FAULT LOCATION, PREVENTIVE MAINTENANCE.
- ◆ MINIMUM TRANSIT DELAY PROTECTION.
- ◆ CARRIER CLASS AND BEST EFFORT PERFORMANCE
- ◆ NETWORK AVAILABILITY
- ◆ SUPPORTING PHYSICAL TOPOLOGIES
- ◆ LINE RATES AND SYMMETRY



# **SERVICES TO BE SUPPORTED BY RPR**

- ◆ **Extended LAN CAGR 74% in the US, with revenues of \$1B in 2001. [The Yankee Group]**
- ◆ **Residential WEB Access in Sweden**
  - **\$200 installation, \$20 a month fees**
- ◆ **Business Access TLS in the US**
  - **Metro LAN services at \$1000 F for a 3-4Mb/s throughput per month.**

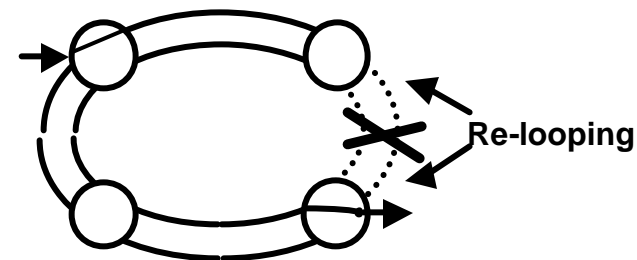
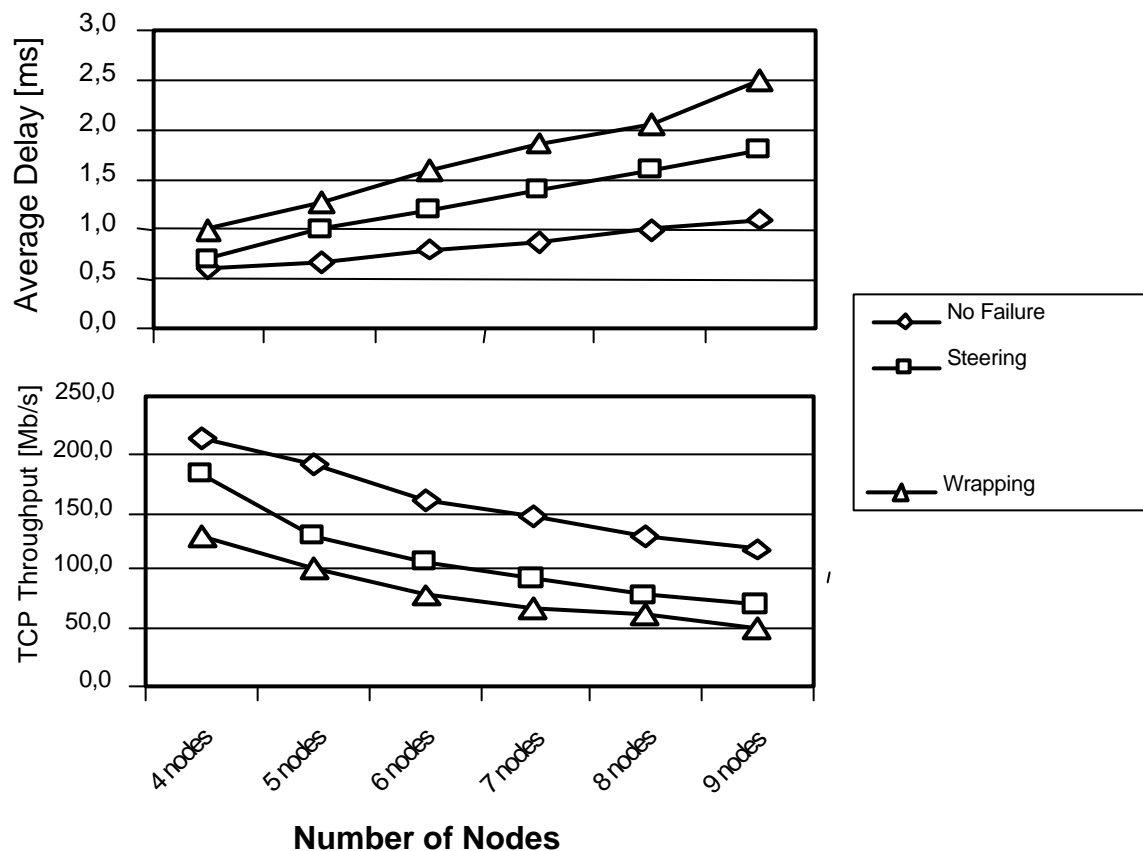


# **MAINTENANCE, FAULT LOCATION, PREVENTIVE MAINTENANCE**

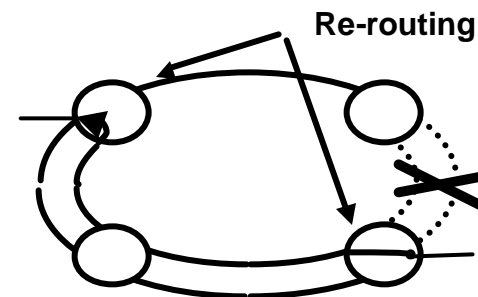
- ◆ **The RPR should process BER to track hard and soft failures.**
- ◆ **Soft failures include dirty connectors, fiber humidity, and lasers degradations. Performance monitoring processing allows to perform quality assessments on the service and preventive maintenance.**
- ◆ **Hard Failure include fiber and interfaces failure.**
- ◆ **This facilitates also protection based on BER.**
- ◆ **SDH interfaces already support maintenance in its broadest scope. If Ethernet is used, it should be re-engineered to provide the same level of maintenance capabilities.**



# MINIMUM DELAY PROTECTION MECHANISM



**Wrapping protection**



**Steering protection**

A decorative graphic consisting of a horizontal line with a globe and network icons on the right side.

# **CARRIER CLASS AND BEST EFFORT PERFORMANCE SERVICES**

- ◆ **Most of the telecom operators revenues come from carrier class services.**
- **Services with committed and guaranteed rate levels.**
- **Services as above with the possibility to exceed committed rate using best effort capacity, if network resources utilization allows.**
- **Best effort services, supporting CoS, will use low priority capacity and implementing overbooking.**

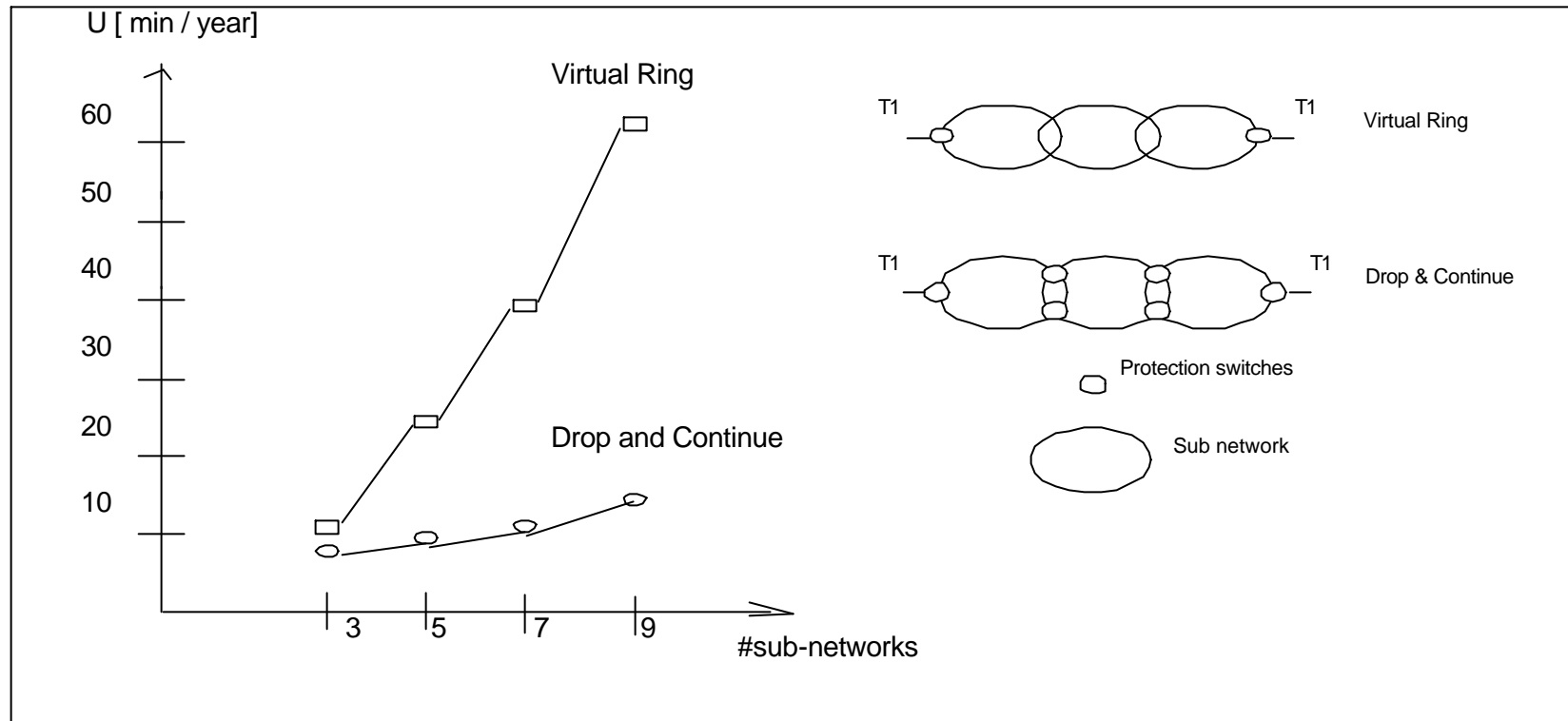


# NETWORK AVAILABILITY

- ◆ **Metro fiber cables break very often:**
  - **Fiber MTTR: 12-24 hours**
  - **Fiber MTBF: 1 Failure every 10-20Km per year.**
- ◆ **So means to improve network availability like dual node interconnection (like Drop and Continue) are also recommended.**



# NETWORK AVAILABILITY







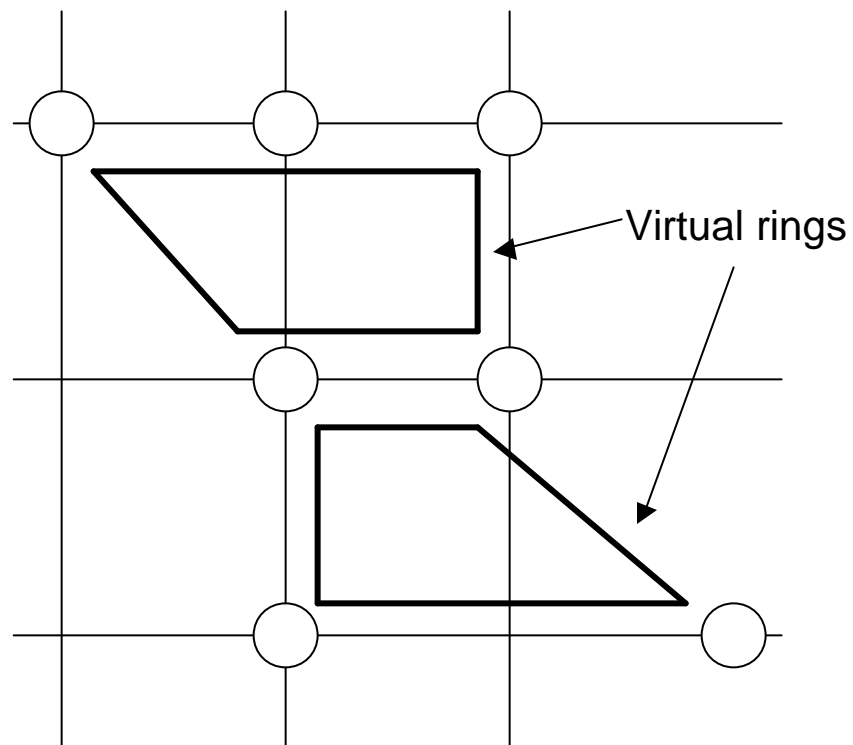
# SUPPORTING PHYSICAL TOPOLOGIES

- ◆ **Established operators have a very well meshed cable infrastructure in the metro area and second operators have very little fiber availability to make their networks.**
- ◆ **The possibility to implement virtual rings irrespectively on the underlying physical topologies is a solution that satisfy meshed and ring requirements for both operators physical topologies.**

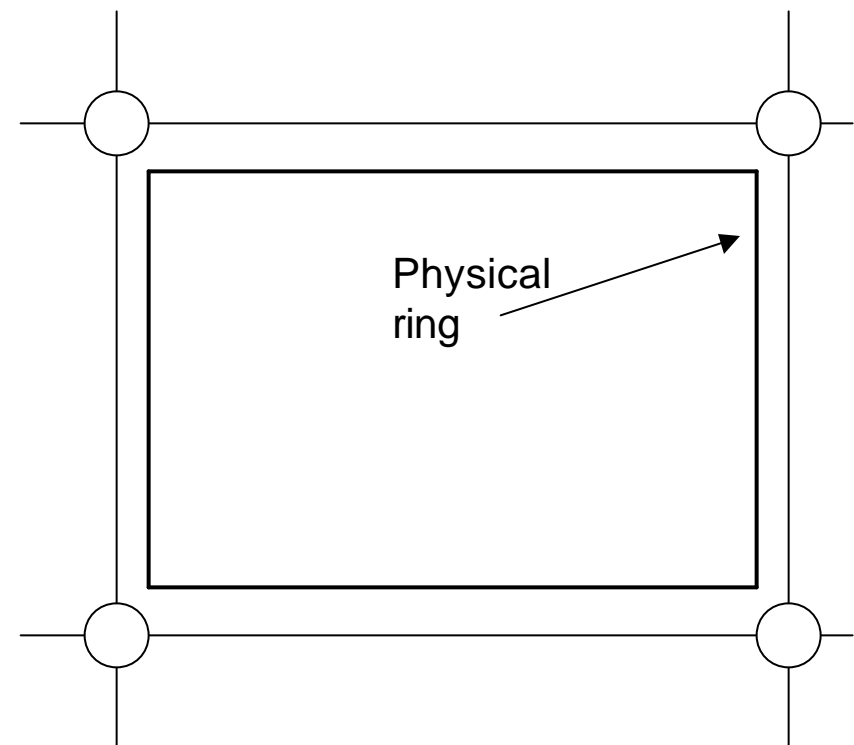


# SUPPORTING PHYSICAL TOPOLOGIES I

*Established operators*



*Second operators*





# LINE RATES

◆ Line rates from STM-1 to STM-64 and above:

→ 1 GBE and 10GBE interfaces

→ STM-1 and STM-4 rings for low density areas

→ STM-16 and STM-64 rings for high rise areas.

→ Above STM-64 for future applications



## CONCLUSIONS

- ◆ **Maintenance is a fundamental network functionality:**
  - ➔ **This is already available in SDH interfaces and paths.**
  - ➔ **The implementation of BER detection and proactive maintenance in GBE interfaces could be left for future study.**
- ◆ **Transmission delay can be minimised using steering protection.**
- ◆ **For multi-ring physical topologies, dual node interconnection improves significantly network reliability .**
- ◆ **In well meshed physical topologies, virtual RPR applications improve fibre utilisation and network availability.**