

# IP and Ethernet: Master and Slave?

TKK  
Espoo, Finland  
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Seppo Borenius  
R&D Director  
Tellabs Oy

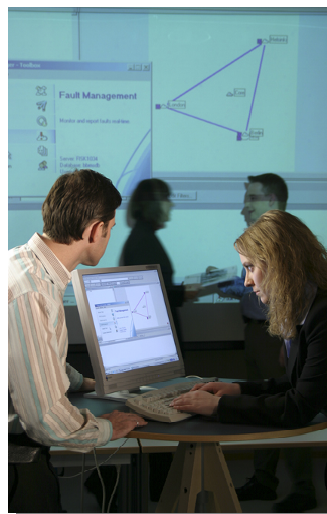


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## Outline




- > **Developing regional and access networks**
  - > Case Tellabs Oy
- > **Concepts**
- > **Trends**
- > **Implementation case**
  - > Tellabs 8600 managed network solution
- > **Summary**



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## Developing regional and access networks Case Tellabs Oy

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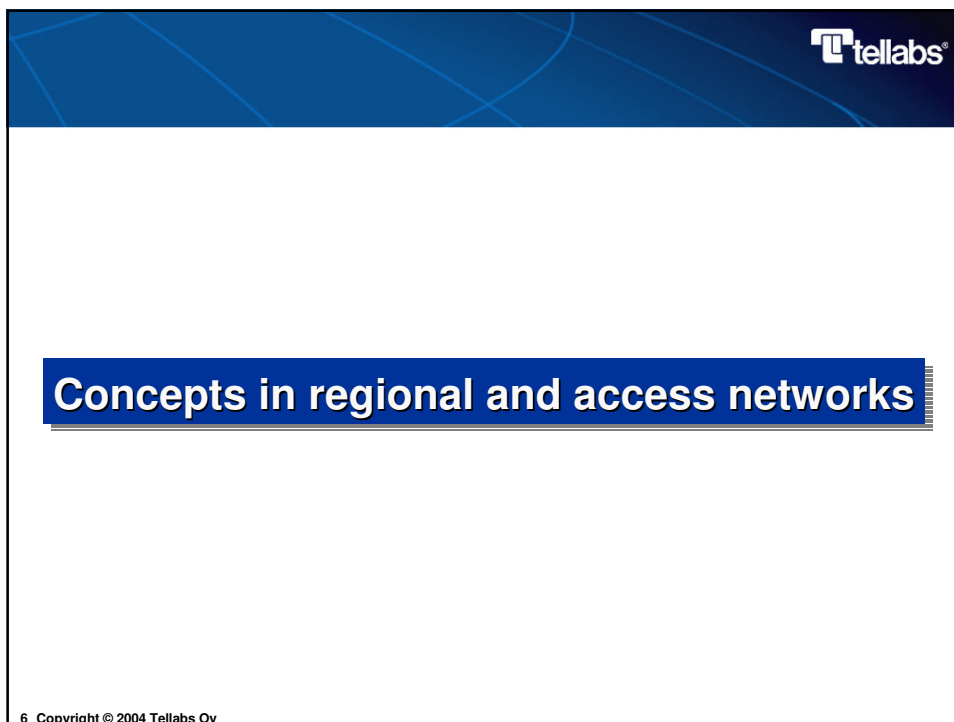
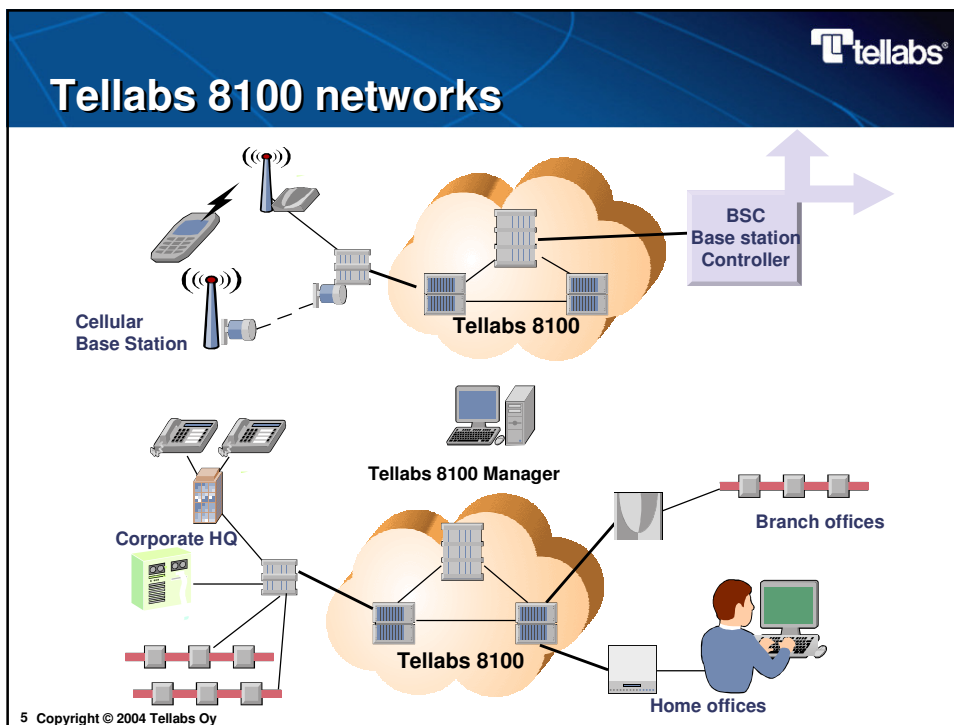


## Tellabs

- > **Tellabs worldwide**
  - > Turnover 980 MUSD in 2003, employees 3100
  - > Headquarters in Naperville, Illinois, USA
  - > Listed in NASDAQ
- > **Tellabs in Finland**
  - > 600 employees in Espoo and Oulu
  - > Over 250 networks delivered in 100 countries
  - > Products: Tellabs 8100 and 8600 telecommunication networks




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# Basic Terminology



Applications

IP

Ethernet and other technologies

**MPLS (Multiprotocol Label Switching)**

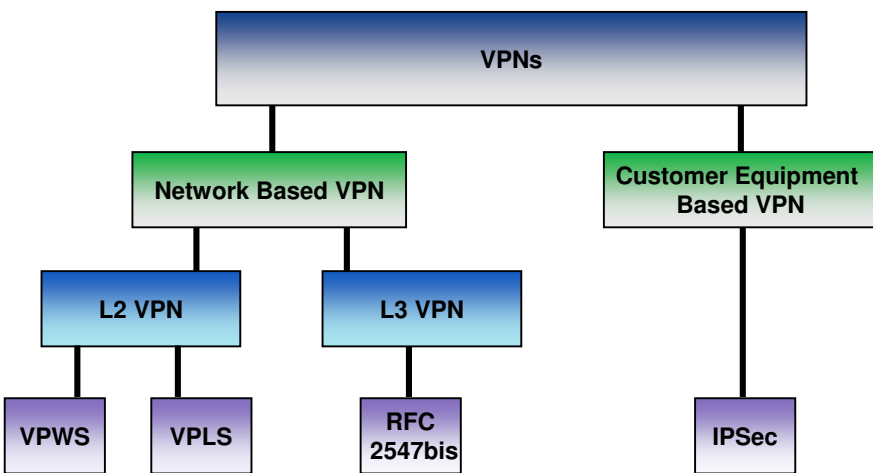
- Hard QoS
- Traffic Engineering
- Reliability and Protection

Ethernet Header	MPLS Label	Layer 3 Header	Data
Ethernet Header	MPLS Label	Ethernet Header	Layer 3 Header
		Data	

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# Virtual Private Network Types (VPNs)

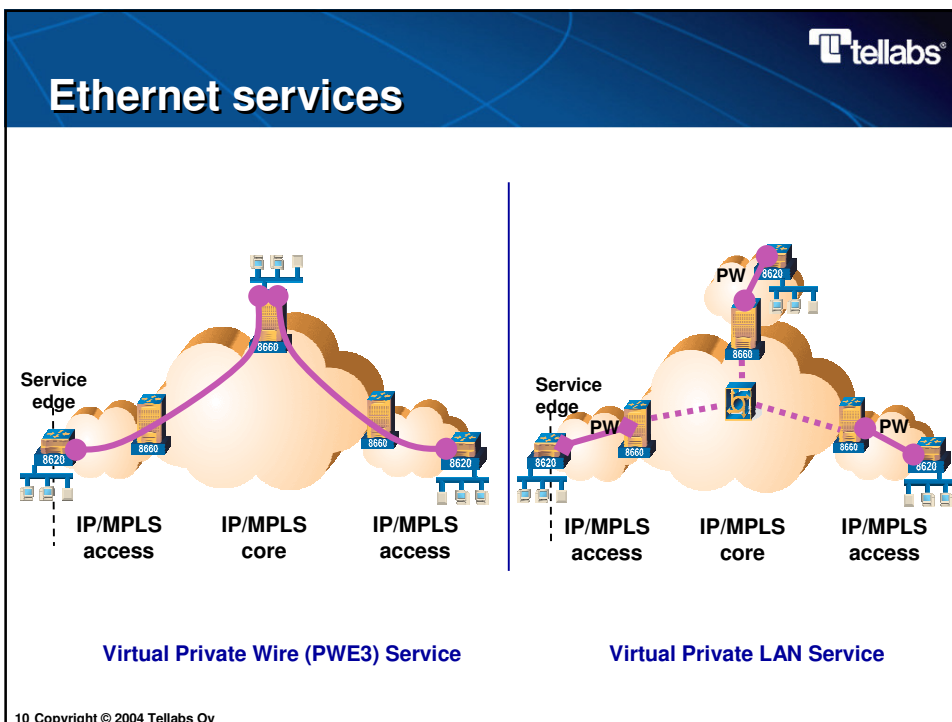
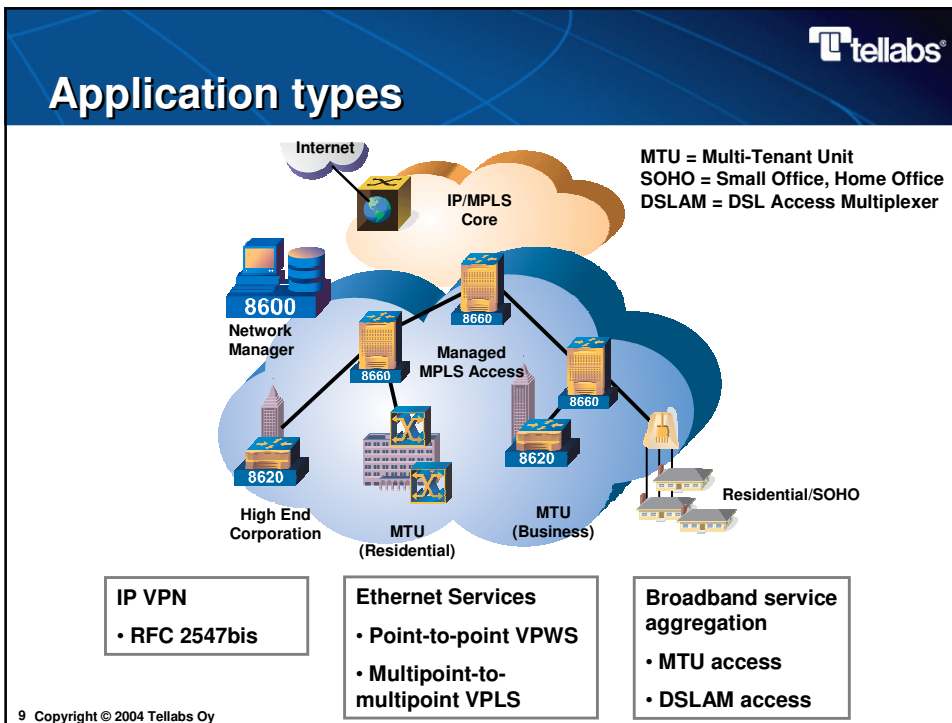


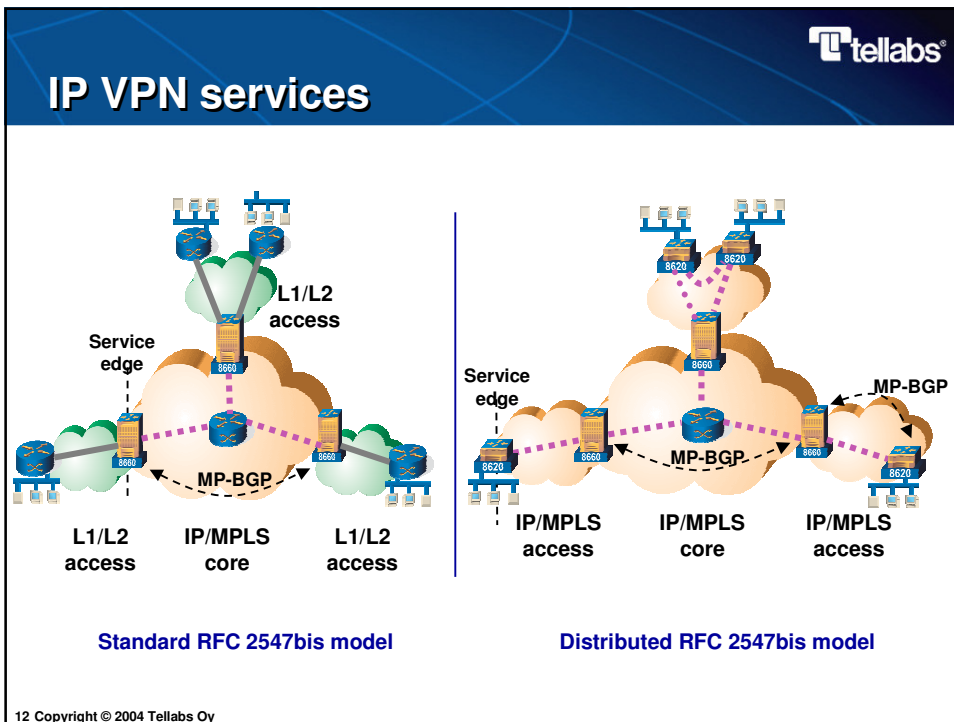
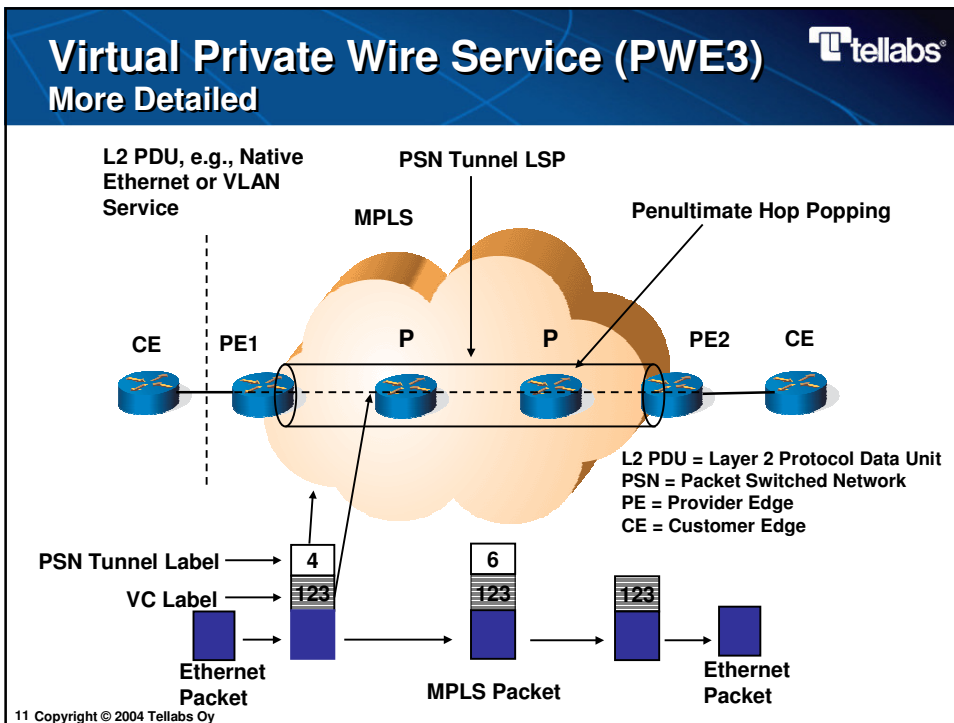
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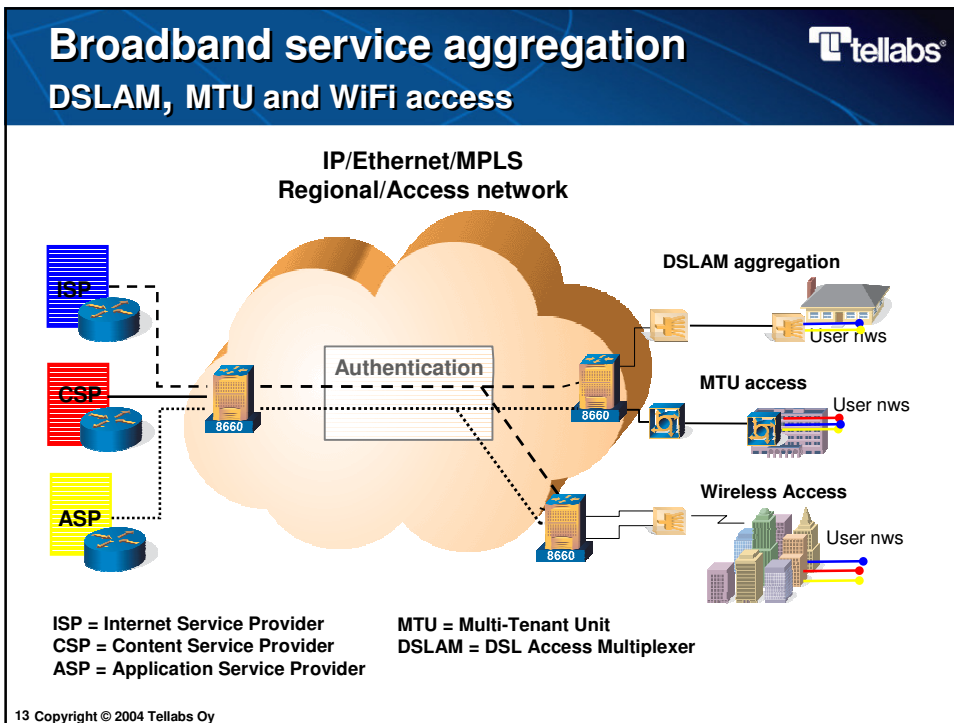
graph TD
    VPNs[VPNs] --> NBVPN[Network Based VPN]
    VPNs --> CEBVPN[Customer Equipment Based VPN]
    NBVPN --> L2VPN[L2 VPN]
    NBVPN --> L3VPN[L3 VPN]
    L2VPN --> VPWS[VPWS]
    L2VPN --> VPLS[VPLS]
    L3VPN --> RFC[RFC 2547bis]
    CEBVPN --> IPSec[IPSec]
    
```

VPWS= Virtual Private Wire Service  
 VPLS = Virtual Private LAN Service

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## Trends in regional and access networks

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## Traffic Trends

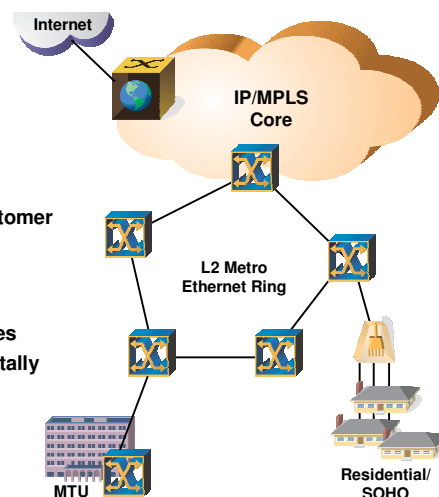
- > Traffic growth 100% annually. This is due to residential broadband access.
- > Digital media content and media convergence to accelerate
- > Enterprise data has modest growth figures
- > Cell based mobile traffic very limited compared to residential broadband
  - > Mobile vs fixed
  - > One or several handsets
- > Pricing models are hard to change



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## Current Metro Ethernet Networks

- > **Benefits for Operator**
  - > Well known technology
  - > Ease of use
    - > Plug-and-play
  - > Cost-efficiency
    - > Low-cost interface for the customer located equipment
    - > On-demand bandwidth
  - > Flexibility
    - > One interface for many services
    - > Bandwidth available incrementally
- > **Pain points**
  - > How to provide QoS
  - > Scalability
  - > Carrier-class quality



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## MPLS in Regional and Access Networks tellabs®

- > Guaranteed service level
- > Management of service
- > Fast recovery operations
- > Enabling management of capacity


VRF = Virtual Routing and Forwarding (table)  
 VSI = Virtual Switching Instance  
 PW = Private Wire / Pseudo Wire

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## Common Infrastructure tellabs®

- > The driver is cost efficiency
- > Packet based
- > Ethernet interface
- > Fiber to home
- > Intelligence – routing – closer to customer


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## Implementation case

# Tellabs 8600 managed network solution


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## Tellabs 8600 Network Components


- > IP
- > MPLS (Multiprotocol Label Switching)
- > Ethernet

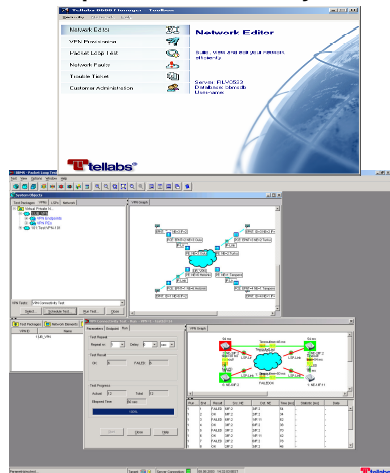
**> Best-In-Class network management enabling operational efficiency**



> Hardware based forwarding


> Sophisticated Quality of Service (QoS) features





<http://www.tellabs.com/products/8000/tellabs8600.shtml>


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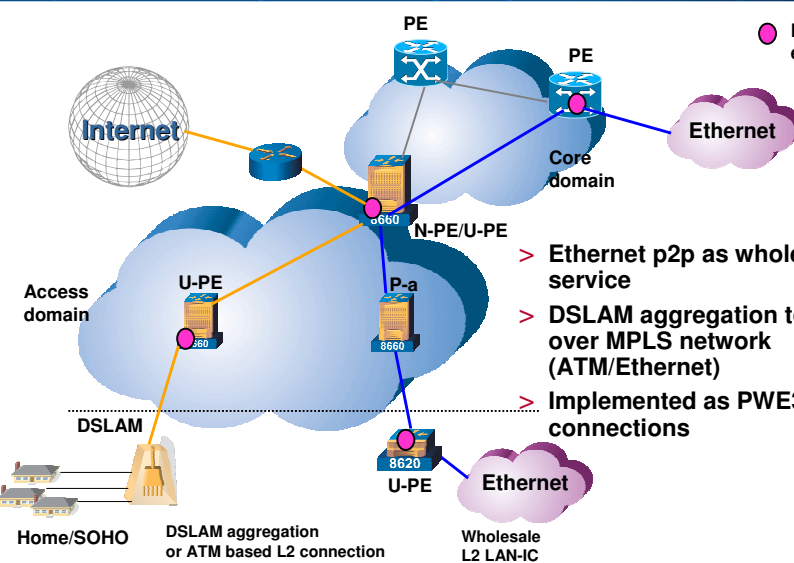
## Tellabs 8600 Key Facts

- > Tellabs 8600 is a managed network solution for regional and access networks that cost-efficiently brings:
  - > MPLS in the regional network level
  - > Ethernet or MPLS in the access
- > Optimizes the capex (capital expenses) and opex (operational expenses)
  - > Pay-as-you grow model in network growth phase
  - > Each network element and service managed through integrated Network Management System
- > Facilitates migration from existing services to new packet based services

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## Virtual Private Wire Service



● Pseudo Wire end-point

- > Ethernet p2p as wholesale or retail service
- > DSLAM aggregation to Internet over MPLS network (ATM/Ethernet)
- > Implemented as PWE3 connections

Home/SOHO      DSLAM aggregation or ATM based L2 connection      Wholesale L2 LAN-IC

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# VPLS – Virtual Private LAN Service

> U-PE-rs and N-PE-rs are switching capable network provider edge routers

The diagram illustrates a VPLS network architecture. It features a central 'Core' cloud containing N-PE-rs (Network Provider Edge routers) and U-PE-rs (User-facing Provider Edge routers). The N-PE-rs are interconnected with each other and with U-PE-rs. The U-PE-rs are further connected to 'Access' networks, which include various devices like servers and PCs. Red dashed lines represent VPLS Virtual Circuit Tunnels connecting the U-PE-rs and N-PE-rs. A legend indicates that a yellow circle represents a 'Virtual Switching Instance' and a red dashed line represents a 'VPLS Virtual Circuit Tunnel'.

● Virtual Switching Instance  
 - - - VPLS Virtual Circuit Tunnel

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# Router Roles in Distributed IP VPN Implementation

- > N-PE Router
  - > = Network Provider Edge
  - > Edge of the core network (PE router)
  - > Full IP/MPLS capability
- > U-PE Router
  - > = User-facing provider edge
  - > Local exchange or POP (Point of Presence)
  - > Full IP/MPLS capability
  - > Also in customer premises
- > P-a
  - > IP/MPLS capable LSR in access network
  - > No service end-points

The diagram shows a hierarchical network structure. At the top is the 'IP/MPLS Core' cloud, which contains an N-PE (Network Provider Edge) router. Below the core is the 'IP/MPLS Access' cloud, which contains a P-a (Provider's Access) router. The P-a router is connected to a U-PE (User-facing Provider Edge) router. The U-PE router is connected to a CE (Customer Edge) router, which is located in the 'Customer Premises' and is connected to various devices like servers and PCs. A dashed line separates the 'Network' (core and access) from the 'Customer Premises'.

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# Distributed IP VPN Implementation

The diagram illustrates a distributed IP VPN implementation. It features an IP/MPLS Core (P) connected to two IP/MPLS Access regions. Each access region contains a U-PE (User Edge PE) and a P-a (Provider Edge PE). The U-PEs are connected to Customer Premises (CE) devices. The P-a devices are connected to the Core. The Core contains a P (Provider) device. The diagram shows BGP connections between the U-PEs and the Core, and between the P-a devices and the Core. iBGP connections are shown between the P-a devices and the Core. The diagram also shows VRFs (Virtual Routing and Forwarding) tables on the U-PEs and P-a devices.

- > Customer routing across core → BGP (Border Gateway Protocol)
- > Customer routing across access → BGP for all customers in one BGP session

VRF = Virtual Routing and Forwarding (table)

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# IP VPN Implementation with Tellabs 8600

- > Tellabs 8600 Solution benefits
  - > Hard quality of service in access
  - > Network scalability
    - > Routing
    - > Operational efficiency
    - > Cost-efficiency

The diagram illustrates the IP VPN implementation with Tellabs 8600. It shows an IP/MPLS Core connected to a Managed MPLS Access region. The Managed MPLS Access region contains a PE (Provider Edge) device and a CE (Customer Edge) device. The PE device is connected to the Core. The CE device is connected to Customer Premises. The diagram also shows an 8600 NMS (Network Management System) connected to the PE device. A red dashed line separates the Network from the Customer Premises. The Service edge (VRF) is highlighted in a red box.

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# Tellabs 8600 - Easy and automated network and service management

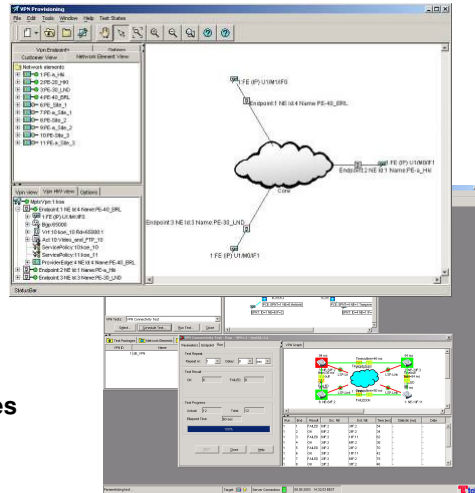


> Main operational advantages

- > Point-and-click service provisioning
- > Automated VPN testing even with SLA (Service Level Agreement) parameters
- > Service level fault and performance monitoring

> Values

- > First time right
- > Fast service delivery
- > Proactive response to changes or faults
- > Automatic documentation of network configuration



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# Tellabs 8600 Managed Edge System User friendly management of service

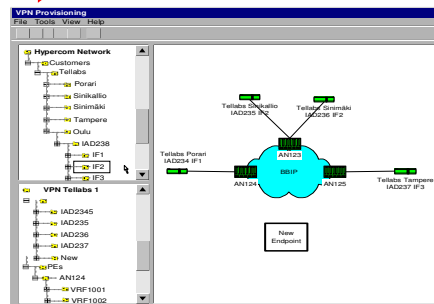


```

Telnet: 193.65.169.92
ServerRouter#sh ip rou
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, 0 - OSPF, IA - OSPF inter area
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default

Gateway of last resort is 10.0.0.1 to network 0.0.0.0


10.0.0.0 is variably subnetted, 7 subnets, 2 masks
O E2 10.0.0.0 255.255.255.252 [110/1] via 10.0.6.1, 00:12:42, Serial0
C 10.0.6.0 255.255.255.252 is directly connected, Serial0
O E2 10.4.0.0 255.255.255.0 [110/1] via 10.0.6.1, 00:12:42, Serial0
O E2 10.0.0.0 255.255.255.252 [110/1] via 10.0.6.1, 00:12:42, Serial0
O 10.0.5.0 255.255.255.252 [110/168] via 10.0.6.1, 00:12:42, Serial0
O E2 10.200.210.0 255.255.255.0 [110/3] via 10.0.6.1, 00:12:42, Serial0
O E2 10.200.225.0 255.255.255.0 [110/1] via 10.0.6.1, 00:12:42, Serial0
11.0.0.0 is subnetted (mask is 255.255.255.0), 2 subnets
C 11.0.2.0 is directly connected, Loopback0
S 11.0.1.0 [1/0] via 10.0.6.1
O E2 193.65.169.0 [110/1] via 10.0.6.1, 00:12:43, Serial0
172.19.0.0 is subnetted (mask is 255.255.255.0), 1 subnets
S 172.19.15.0 [1/0] via 10.0.6.1
O#E2 0.0.0.0 (mask is 0.0.0.0) [110/1] via 10.0.6.1, 00:12:43, Serial0
ServerRouter#LIU_R#
    
```



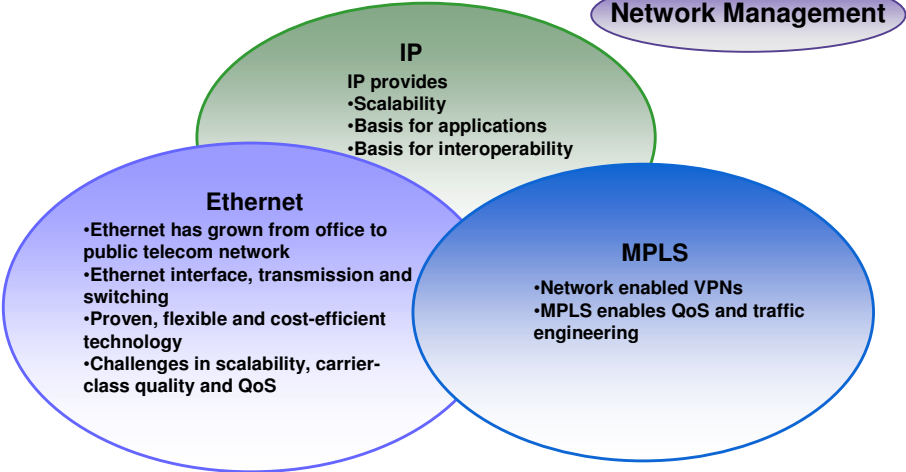
- Extensive use of CLI (Command line based)
- Management on element level
- Graphical and centralized network building
- Fully documented network

**Easier and cost efficient way of building networks and services**

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## Summary: IP, Ethernet and MPLS



**IP**  
IP provides

- Scalability
- Basis for applications
- Basis for interoperability

**Ethernet**

- Ethernet has grown from office to public telecom network
- Ethernet interface, transmission and switching
- Proven, flexible and cost-efficient technology
- Challenges in scalability, carrier-class quality and QoS

**MPLS**

- Network enabled VPNs
- MPLS enables QoS and traffic engineering

**Network Management**

**Both IP and Ethernet have their roles**

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### Our Vision

Deliver to customers technology that transforms the way the world communicates™.



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