River STONE NETWORKS

Utfors:
Metro Broadband Services using Gigabit Ethernet

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Utfors supplies the Nordic market's most cost-effective, high-quality broadband communication services, based on next-generation IP networks. Focusing primarily on the corporate market, Utfors aims to be one of the leading suppliers of broadband-based communications services in the Nordic countries.

Utfors selected Riverstone RS routers for its Metro Ethernet service deployment. With more than 4,000 kilometers of fiber in service, Utfors operates the world's largest Ethernet network. Recognizing that Multi-Protocol Label Switching (MPLS) is the key to deploying successful Ethernet services, Utfors chose Riverstone as the market leader in metro MPLS technology for delivering IP VPNs to their corporate customers.

Utfors Broadband Network

In the space of just a few years, Utfors has progressed from being a small challenger among telephony and Internet operators to becoming one of the most exciting and expansive players in the broadband market. During 2000 and 2001, Utfors constructed a broadband network with virtually unlimited capacity. When complete, the network will comprise approximately 7,000 km of fiber and will link approximately 65 of the largest cities in Sweden, Denmark, Norway, and Finland. In the near future, Utfors plans to connect its Nordic network to European and U.S. networks.

Utfors' fiber network uses the latest available technology, both at the optical level with Dense Wavelength Division Multiplexing (DWDM), based on Sycamore optical switches, and at the transport level with backbone IP routers from Juniper Networks.

The advantages of building and owning a nation-wide fiber network deploying the latest technology are:

- Utfors has a higher potential capacity at lower costs than does any other network provider in the Nordic region. Because Utfors owns the network, it can also sell dark fiber to other operators, thus financing a major part of their network expansion.
- Utfors can offer their customers core broadband service offerings at revolutionary levels of price/performance. Utfors IP Port, their core broadband offering, provides services on one connection – IP- or Ethernet-VPN, Internet, and telephony.

RS 38000

Utfors' IP Port has been available since mid-2000 and sales have been growing much stronger than first estimated. The demand is being driven by the continued rationalization and increasing demand for more cost-efficient data and telecommunications services by corporate customers. Many customers are moving away from traditional services such as leased lines and Frame Relay to more flexible, cost-effective Ethernet services, a trend in the data communications industry.

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Utfors' Challenge

Focusing primarily on the corporate market, Utfors' strategy is to be one of the leading suppliers of cost-effective broadband communications services based on next-generation IP networks. By adopting this strategy, Utfors can deliver new applications and multimedia services over a lower cost infrastructure with more simple operation and maintenance than a traditional network infrastructure.

Utfors realized that most corporate customers' communication strategy would be based on a centralized IT infrastructure and on greater utilization of internal and external multimedia communications. Utfors designed new business services that would be attractive to corporate customers, including server centralization and hosting, application hosting, and internal corporate TV and E-meeting services requiring high-quality video conferencing.

> ""Since MPLS is the key to deploying successful Ethernet services, we chose Riverstone as the market leader in Metro MPLS technology for delivering VPNs to our corporate customers."
>
> ***Sten Nordell,***
> *CTO, Utfors AB*

To implement these new business services, Utfors decided to build an advanced Ethernet service network using the existing Sycamore optical infrastructure and the Juniper IP backbone infrastructure. The new network would need to implement a complete set of new capabilities to deliver the new business services to corporate customers, including:

- Internet access at 2 Mbps, 10 Mbps, 100 Mbps and 1 Gbps
- LAN-to-LAN Ethernet services
- Virtual Private Network (VPN) services
- Quality of Service (QoS), low latency for multi-media, Voice over IP (VoIP), and fax over the Internet

Instead of adopting a traditional approach by implementing IP-based services over a SONET/SDH core running over DWDM, Utfors wanted to adopt a more efficient and lower-cost approach by implementing IP-based services over Ethernet running over DWDM. Utfors also required a solution that would meet its existing bandwidth needs but would also allow it to migrate to higher bandwidth in the future.

Riverstone's Solution

Riverstone's proposed solution leverages Utfors' existing investment in Sycamore optical switches and Juniper IP core routers by implementing an MPLS service layer over the existing infrastructure. The solution implements a mesh topology built with Riverstone RS 38000 metro aggregation routers linked via Gigabit Ethernet running over the Sycamore optical network. RS 3000 and RS 8600 metro access routers provide Ethernet aggregation and customer connections.

The RS 8600 edge access routers provide customer access rates of 2 Mbps, 10 Mbps, 100 Mbps, and 1 Gbps. Utfors can also use hardware-based rate limiting on Gigabit Ethernet ports to offer "sub-Gigabit rate" services. The network is configured so that there is no over-subscription, which ensures that Utfors meets strict customer Service Level Agreements (SLAs).

The new LAN-to-LAN, IP VPN, and video services are created and provisioned using MPLS Martini Draft Layer 2 tunnels. Martini is the name given to the emerging IETF standard for transporting Ethernet, ATM, and Frame Relay over MPLS-enabled networks. Open Shortest Path First Traffic Engineering (OSPF-TE)

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is used as the routing protocol and Label Distribution Protocol (LDP) with Resource Reservation Protocol Traffic Engineering (RSVP-TE) as the signaling protocol. Riverstone's MPLS backup capabilities provide network resilience on a per label-switched-path basis, complement the optical network's self-healing capabilities, and give the highest levels of reliability in the market.

The Riverstone solution provides Utfors with point-to-point, LAN-to-LAN services by mapping 802.1Q/p VLAN tags to Martini Draft Layer 2 tunnels with end-to-end QoS for latency or delay-sensitive applications such as Voice over IP. It also provides Internet access and VPN IP services by using Martini Draft Layer 2 tunnels between the Riverstone routers and Juniper core routers.

Utfors will also use the Riverstone solution to implement the new Virtual Private LAN Services (VPLS) based on the Lasserre Draft for Layer 2 tunnels, the emerging IETF standard for multipoint Ethernet over MPLS, and Layer 3 VPNs based on the IEFT RFC2547bis.

Why Utfors Chose Riverstone

Utfors chose Riverstone after extensive lab testing against 5 other vendors. The testing focused on several key requirements:

- Richness of MPLS implementation, including support for Martini Draft Layer 2 tunnels, OSPF-TE, and BGP routing.
- Support for QoS capabilities and rate limiting on Gigabit Ethernet and Packet over SONET interfaces across all platforms.
- Redundancy features and capabilities, in particular carrier-class hardware redundancy and resilience.
- Interoperability with the existing Sycamore optical network and Juniper IP core. Riverstone was able to meet all of Utfors testing criteria. In particular, the testing showed that Riverstone has an industry-leading implementation of MPLS Martini Draft Layer 2 with the first VPLS implementation and the most resilient MPLS solution on the market.

Riverstone's proposed architecture was also the most scalable solution. It is based on an MPLS Service Layer with multiple VPN domains built using Martini Draft Layer 2 tunnels running OSPF-TE and RSVP-TE. Riverstone can support large MAC tables with no MAC caching in the Layer 2 VPN domain and large LSP tables, ensuring that the solution scales as Utfors adds new subscribers and introduces future services.

RS 8600

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Riverstone already supported Utfors' future requirements, including:

- Hardware-based rate shaping for Gigabit Ethernet ports to allow "sub-Gigabit" services without loss of performance.
- VLAN translation to overcome the scarce VLAN resources in a very large metro network.
- QoS continuity by mapping 802.1p and IP Type of Service (ToS) to MPLS using RSVP-TE.

Finally, Utfors required a solution with carrier-class resilience and redundancy. Riverstone's platforms are fully NEBS-compliant with redundant power supply units, control modules, and switch fabric. Riverstone also supports the advanced Hitless Protection System (HPS), part of Riverstone's Carrier Class Metro initiative designed to bring high-availability networking to metropolitan area networks. HPS allows seamless failover between control modules without loss of data or control traffic during system upgrades and maintenance, or if a redundant control module fails during operation.

Utfors shares Riverstone's vision of flexible metro solutions that break the cost paradigm of deploying next generation services on an advanced scalable and redundant infrastructure. By deploying Riverstone's market-leading metro MPLS solution, Utfors can deliver all of the new IP-based services to its corporate customers more efficiently and at a much lower cost than a traditional SONET/SDH-based solution. The Riverstone solution easily meets Utfors existing bandwidth and service creation needs, but provides a future migration path to higher bandwidth and new value-added IP services without incurring significant additional cost.

RS 3000

Metro Routers That Convert Raw Bandwidth into Profitable Services

Riverstone Networks, Inc.
5200 Great America Parkway, Santa Clara, CA 95054 USA

877 / 778-9595 *or* ***408 / 878-6500*** *or* ***www.riverstonenet.com***

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