LTE Advanced-Ready Small Cell Backhaul Solution

Juniper Networks ACX Series Routers and Siklu's EtherHaul Wireless Links Deliver Gigabit Capacity to Small Cells

Challenge

As mobile operators expand their MBH networks to support emerging small cell locations, they are looking for a scalable backhaul solution that protects their investment at the small cell site, while providing flexibility to add next-generation technologies quickly and cost-effectively, as needed.

Solution

The joint Juniper Networks and Siklu solution brings cutting-edge networking capabilities, enabling a cost-effective and adaptive service implementation. The solution includes innovative all silicon-based, ultra compact wireless backhaul links with a resilient connectivity to ACX Series backhaul aggregation routers, with optional unified network management.

Benefits

- Optimal backhaul capacity utilization based on advanced networking implementation
- Unmatched performance to support emerging data-intensive services
- Operational intelligence and traffic engineering capabilities
- Proven and deployed timing technology for highest quality of experience (QoE)

Mobile service providers need to deliver bandwidth-intensive services to the emerging small cells, and they are increasingly challenged to cost-optimize their mobile backhaul (MBH) expansion solution kit. The Juniper Networks® ACX Series Universal Access Routers-based backhaul investment for macrocells can be leveraged to deliver gigabit capacity millimeter wave (MMW)-based backhaul links to the small cell footprint as well. The integration of ACX Series routers with Siklu's advanced MMW radio links creates a seamless, scalable, and reliable service delivery platform, perfectly suited for the evolution needs of the new cellular radio access network (RAN) technology called small cells, delivering 3G, LTE, and LTE Advanced mobile services.

The Challenge

Consumers are demanding ubiquitous mobile services—especially bandwidth-hungry data services—and there is no doubt that this trend will continue to accelerate. Therefore, service providers are in the process of enhancing their mobile networks to support this massive growth. The most cost-effective way to enable this growth is through deploying small cells at hot spot locations. Small cells are basically miniature, all-outdoor[1] cellular base stations designed to be located on lighting polls and building facades which are closer to the subscriber. One of the most challenging tasks in designing such a solution is planning a cost-effective backhaul for those new locations.

Planning the optimal solution must take the following considerations into account:

- Small cells will require hundreds of megabits backhaul capacity.
- Only one type of user-to-network interface (UNI) is required—Ethernet.
- Solution must support the macro cellular quality-of-service (QoS) scheme.
- Synchronization (SyncE/IEEE 1588v2) capabilities are essential.
- Protected topology must be supported from day one, even though the protection scheme may be enabled later.
- Multiple physical UNI are required for:
  - Multiple service delivery at the same location
  - Enabling back-to-back connectivity
- Solution needs to have low power consumption with multiple feeding options.
- Solution should enable easy and fast deployment procedures.

[1] Indoor small cells are also deployed for enhancing the coverage or capacity, however, this solution only addresses outdoor small cells.

The Juniper Networks MBH Solution Expanded by Siklu's Millimeter Wave EtherHaul Radio Links

The Juniper-Siklu joint solution provides a cost-effective and field-proven MMW radio technology that expands the provider's MBH network footprint while utilizing the existing investment.

Siklu's EtherHaul radio links support the leading standard for ring protection, G.8032. This standard uses advanced and ultrafast networking features to detect main link failure and route the traffic seamlessly to the backup path.

G.8032 is used to prevent loops in a ringed network by blocking one of the links. This is an alternative to Spanning Tree Protocol/ Rapid Spanning Tree Protocol (STP/RSTP), and the recovery switching is much faster than traditional STP/RSTP approaches. The 10 ms Continuity Check Message (CCM) interval supported by the EtherHaul radio links ensures sub-50 ms recovery times, even if three consecutive failure messages are configured for alternate path switching decision. Figure 1 shows the redundancy concept of the expanded topology:

- The IEEE G.8032 standard is deployed across EtherHaul links.
- Although the two radio nodes collocated next to R1 and R2 are not physically connected, the MPLS network supplies two pseudowire services through the ACX Series routers R1 and R2 to enable logical connectivity.
- The use of two G.8032 instances in parallel enable efficient usage of the wireless capacity in both directions.
- The two pseudowire services are not part of the MBH hierarchical virtual private LAN service (H-VPLS).
- Each remote small cell gets its service over a dedicated VLAN configured at all radio links with access ports at its collocated radio node.
- Each such VLAN for cell site service is delivered to the MPLS network at both ACX Series routers (R1 and R2).
- The G.8032 service configured at the radio links ensures that only one path of any cell site service VLAN is active to ACX Series routers R1 or R2 at any point in time.
- The radio links adopt the QoS options used within the MPLS network and will prioritize, limit, and shape any type of traffic based on various options (VLAN-id, DSCP, p-bit).
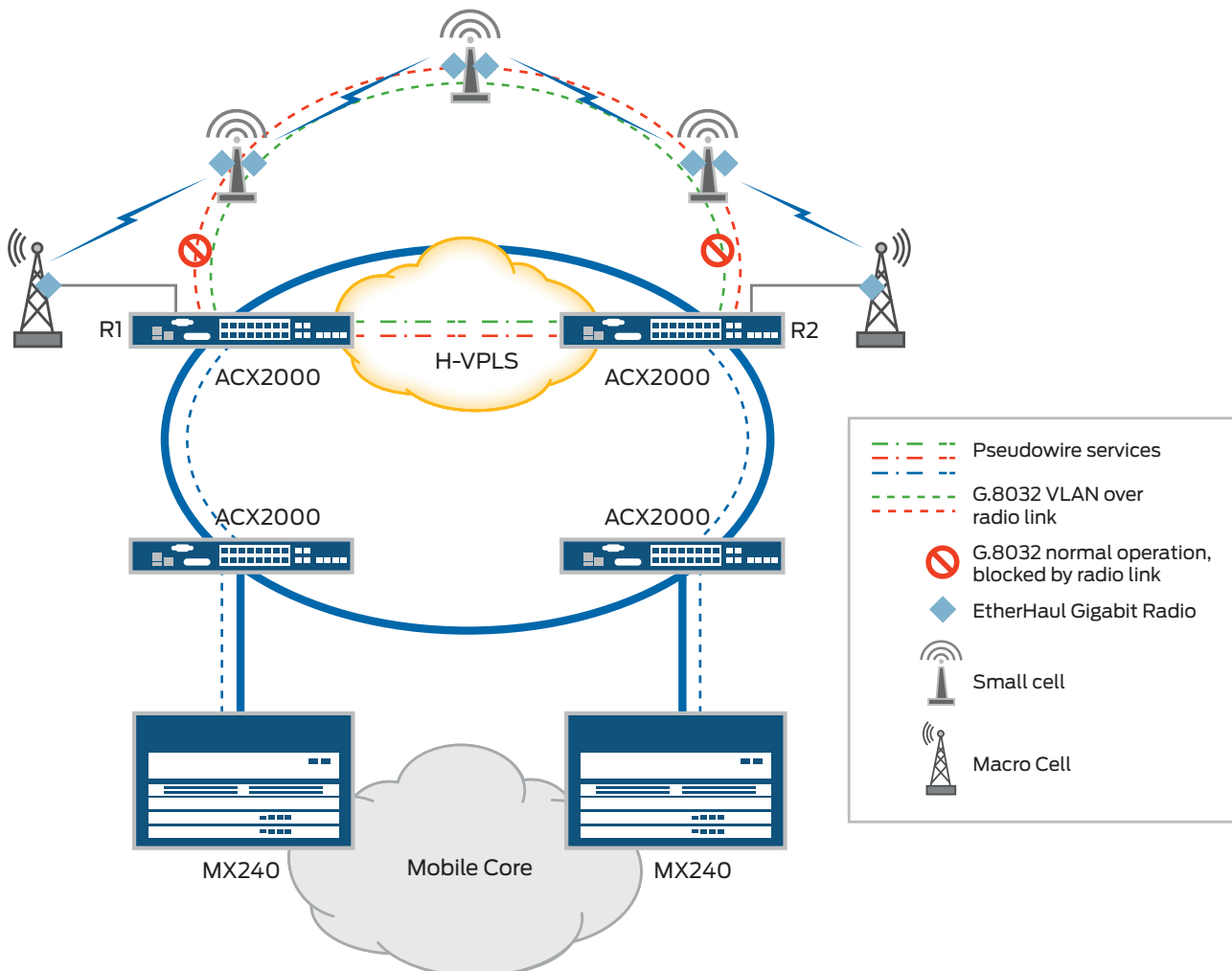

Figure 1. Expanded Juniper-Siklu MBH network to support small cells

It is also possible to use two-stage priority mechanisms. For example, first by DiffServ Code Point (DSCP) and then by VLAN-id.

- The radio links support both L1-based SyncE protocol and packet-based IEEE 1588v2 synchronization. The synchronization scheme used within the MPLS network will be adopted by the radio links and delivered to the remote small cells.

Features and Benefits

- Gigabit capacity for longer investment protection
- Resilient network expansion for all outdoor small cells with sub-50 ms restoration times
- Macro network QoS and synchronization scheme maintained at wireless backhauled small cells
- Standard Ethernet networking-based implementation that allows easy solution expansion
- Dual G.8032 instances to maximize backhaul capacity under normal condition
- QoS policies that ensure hitless smooth continuity to critical services (signaling, sync, voice) while throttling down only lower priority services during a failure condition at one of the solution elements where the ring capacity can drop up to half
- EtherHaul and ACX Series router's connectivity fault management (CFM) compatibilities that enable:
  - Easier end-to-end failure troubleshooting within the MBH network domain
  - Smooth integration with third-party networks that will enable the MBH service provider to sell attractive MBH services to other mobile network operators
- Hitless, QoS-based, adaptive radio modulations for smooth operations in all weather conditions

Solution Components

The LTE Advanced-Ready Small Cell Backhaul solution is the integration of field-proven MMW radio technology-based EtherHaul from Siklu with the industry-leading ACX Series

Universal Access Routers from Juniper Networks. The additional components include Juniper Networks MX Series 3D Universal Edge Routers and Junos® Space Network Management Platform.

Summary

The LTE Advanced-Ready Small Cell Backhaul solution from Juniper Networks and Siklu provides cost-effective, field-proven MMW radio technology to expand your mobile backhaul network footprint while utilizing your existing investment. The resilient gigabit capacity links future-proof your small cell build while providing the same QoS as the macro cellular network.

Next Steps

To learn more about Juniper Networks LTE Advanced-Ready Small Cell Backhaul solution and the ACX Series Universal Access Routers, please visit www.juniper.net or contact your local Juniper Networks sales representative.

About Siklu

Siklu redefines wireless backhaul by optimizing every aspect of MMW system design to enable service providers to boost network capacity and performance, while dramatically reducing costs by 80%. By re-engineering mm-wave system components, and leveraging silicon-based technologies, Siklu provides gigabit-per-second wireless connectivity at the lowest price point in the industry. Siklu's solutions are easily scalable, enabling service providers to evolve their networks from 2G/3G to HSPA and 4G and incorporate capabilities to support future topologies. In addition, Siklu's environmentally friendly design results in easier and quicker deployment and adoption. For further information, visit www.siklu.com.

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.

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