Tech Brief

TropOS Mesh OS Routing Intelligence

Many networking professionals agree that data networks based on network layer (Layer 3) routing at the core provide much better scalability, security and reliability than those based on Layer 2 bridging or switching. This is why large-scale network systems like the Internet are routed with protocols like Border Gateway Protocol (BGP), and switched primarily at the distribution layers with transport methods like MPLS. In addition, based on over 13 years of designing and building wireless mesh networks outdoors for mission-critical applications, ABB Wireless has concluded that a distributed, wireless-aware Layer 3 routing approach provides much higher levels of availability and survivability than competing approaches based on bridging or switching.

Why does the TropOS Mesh OS approach lead to higher levels of scalability, security and reliability?

Scalability

Challenge: Mesh networks covering large indoor/outdoor areas commonly contain hundreds or even thousands of radios, therefore the ability to scale to large numbers of mesh routers and endpoints, while accommodating large traffic flows in a limited bandwidth environment, is a must.

Layer 2: Layer 2 approaches work well in smaller deployments, but typically incur large protocol and traffic overheads that lead to poor performance at scale.

Wired networking approaches: Legacy approaches that adapt wired protocols such as spanning tree (Layer 2) or OSPF/EIGRP (Layer 3) do not scale well in outdoor wireless environments because the routing overheads grow linearly or quadratically with the network size and can quickly consume most of the limited available bandwidth. In addition, these approaches do not take into account the unique characteristics of the wireless environment such as fading, multipath reflectivity and client mobility. Therefore, the software makes sub-optimal routing decisions resulting in lower performance and reliability. A wireless mesh is highly dynamic; the RF environment changes by the second, minute, hour, day and week. Mesh networks require a protocol that reacts predictably with sub-second response to ensure network stability and high performance.

TropOS Predictive Wireless Routing Protocol (PWRP): By contrast, TropOS products employ a scalable and efficient wireless routing protocol that is designed to maintain very low processing overhead within a distributed Layer 3 network architecture in order to efficiently contain network traffic. The mesh network self-organizes into clusters around backhaul points, and this approach allows the overall network to scale to arbitrary sizes. Cluster sizes can keep growing, and more capacity can be injected through the addition of backhaul points.

Security

Challenge: Mesh networks that carry sensitive traffic for multiple applications require strong access control, authentication and encryption in addition to granular controls over traffic flows.

Layer 2: Bridged or switched approaches such as enterprise wireless LAN architectures rely on centrally-administered polices without strong enforcement capabilities at the network edge. In addition, Layer 2 access points generally lack the ability to implement IP-based firewalling, traffic segmentation and Quality of Service.

TropOS Layer 2/3 security: TropOS routers support standards-based mechanisms for strong AAA, including Layer 2 and Layer 3 mechanisms. In particular, TropOS

routers comply with IEEE 802.11i, 802.1x, etc but also have the capability for granular packet filtering, traffic segmentation, secure peer-to-peer enablement, Diffserv, IPSec VPN tunneling and other Layer 3 QoS and security mechanisms. Multiple user accounts and RADIUS authentication for administrators adds further user control to restrict unauthorized access.

Reliability

Challenge: There are two aspects to reliability: availability (measured by system and service uptime during normal operating conditions) and survivability (which measures the resilience of the system to recover from exceptional events and conditions). Both aspects are particularly important and also difficult to achieve in the wireless setting, where RF environmental conditions are highly dynamic, spectrum is unlicensed and devices are mobile.

Layer 2: Bridged or switched approaches typically employ a somewhat primitive approach to radio resource management. Controller-based Layer 2 enterprise WLAN architectures do have some radio resource management capabilities, but these functions are mostly centralized; they are therefore less effective when dealing with changes occurring on the network edge in a large, distributed RF environment that is highly dynamic.

TropOS Layer 3: TropOS routers employ a distributed and coordinated approach to radio resource management that is wireless-aware (Layer 1 and Layer 2 information is incorporated into the decision metrics), but is integrated with the Layer 3 routing protocol. The advantages of this distributed approach include the ability to quickly respond and react to changes in the radio environment through locally-coordinated adaptation of radio link parameters such as frequency band, operating channel, transmit power and modulation rate. PWRP has the unique capability to discriminate between temporary wireless fades and actual loss of wireless links due to changes in the RF environment or failures of a mesh router itself. Furthermore, since this approach does not require a controller, the system has no single points of failure and is capable of recovering from and gracefully degrading in the event of localized failures. In the unlikely event of an actual failure at any mesh router or wireless link, the surrounding mesh routers will correctly route around the failure and continue to deliver data to the connected devices, including maintenance of wireless client devices' TCP/IP sessions, thereby preserving the users' experience on the network.

1KHA - 001 405 - SEN - 1001- 10.2016

For more information please contact:

ABB Wireless
3055 Orchard Drive
San Jose, CA 95134, USA
Phone: +1 408 331 6800
E-Mail: wireless.sales@nam.abb.com

www.abb.com/unwired