VRF

In IP-based computer networks, **Virtual Routing and Forwarding** (**VRF**) is a technology that allows multiple instances of a routing table to co-exist within the same router at the same time. Because the routing instances are independent, the same or overlapping IP addresses can be used without conflicting with each other.

Alternative meaning of VRF is a **VPN Routing and Forwarding**, the key element in the Cisco MPLS VPN technology.[1] A VRF is a routing table instance, that can exist in one instance or multiple instances per each VPN on a Provider Edge (PE) router.

VRF may be implemented in a network device by distinct routing tables known as forwarding information bases (FIBs), one per VRF. Alternatively, a network device may have the ability to configure different virtual routers, where each one has its own FIB that is not accessible to any other virtual router instance on the same device.

Simple implementation

The simplest form of VRF implementation is **VRF Lite**. In this implementation, each router within the network participates in the virtual routing environment in a peer-based fashion. While simple to deploy and appropriate for small to medium enterprises and shared data centres, VRF Lite does not scale to the size required by global enterprises or large carriers, as there is the need to implement each VRF instance on every router.

Full implementation

The scaling limitations of VRF Lite are resolved by the implementation of IPVPNs. In this implementation, a core backbone network is responsible for the transmission of data across the wide area between VRF instances at each edge location. IPVPNs have been traditionally deployed by carriers to provide a shared wide-area backbone network for multiple customers. They are also appropriate in large enterprise, multi-tenant and shared data centre environments.

In a typical deployment, Customer Edge (CE) routers handle local routing in a traditional fashion and disseminate routing information into Provider Edge (PE) where the routing tables are virtualised. The PE router then encapsulates the traffic, marks it to identify the VRF instance, and transmits it across the provider backbone network to the destination PE router. The destination PE router then decapsulates the traffic and forwards it to the CE router at the destination. The backbone network is completely transparent to the customer equipment, allowing multiple customers or user communities to utilize the common backbone network while maintaining end-to-end traffic separation.

Routes across the provider backbone network are maintained using an Interior Gateway Protocol - typically IBGP. IBGP uses *extended community* attributes in a common routing table to differentiate the customers' routes with overlapping IP addresses.

IPVPN is most commonly deployed across a Multi-protocol Label Switching (MPLS) backbone as the inherent labelling of packets in MPLS lends itself to the identification of the customer VRF. Some IPVPN implementations (notably Nortel's IP-VPN Lite) utilize a simpler IP-in-IP encapsulation over a pure IP backbone, eliminating the need to maintain and support an MPLS environment.

External links

- Juniper documentation on configuring VPNs and VRFs [2]
- Nortel IPVPN and IPVPN Lite Configuration documentation [3]

References

[1] Cisco document on MPLS & VRF (http://www.cisco.com/en/US/docs/net_mgmt/vpn_solutions_center/1.1/user/guide/VPN_UG1.html)

[2] http://www.juniper.net/techpubs/software/junos/junos85/swconfig85-vpns/frameset.html

[3] http://support.nortel.com/go/main.jsp?cscat=DOCDETAIL&id=731634&poid=9015

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