MPLS Multi-Vendor Provisioning

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Agenda

- **Why Interoperability?**
- **Types of VPNs**
  - Industry Standards
- **Interoperability – the players**
- **Market options**
- **Challenges**
- **Interoperability Examples**
  - LSP
  - Layer 2 Martini
  - Layer 3
- **Questions and Answers**

Why Interoperability?

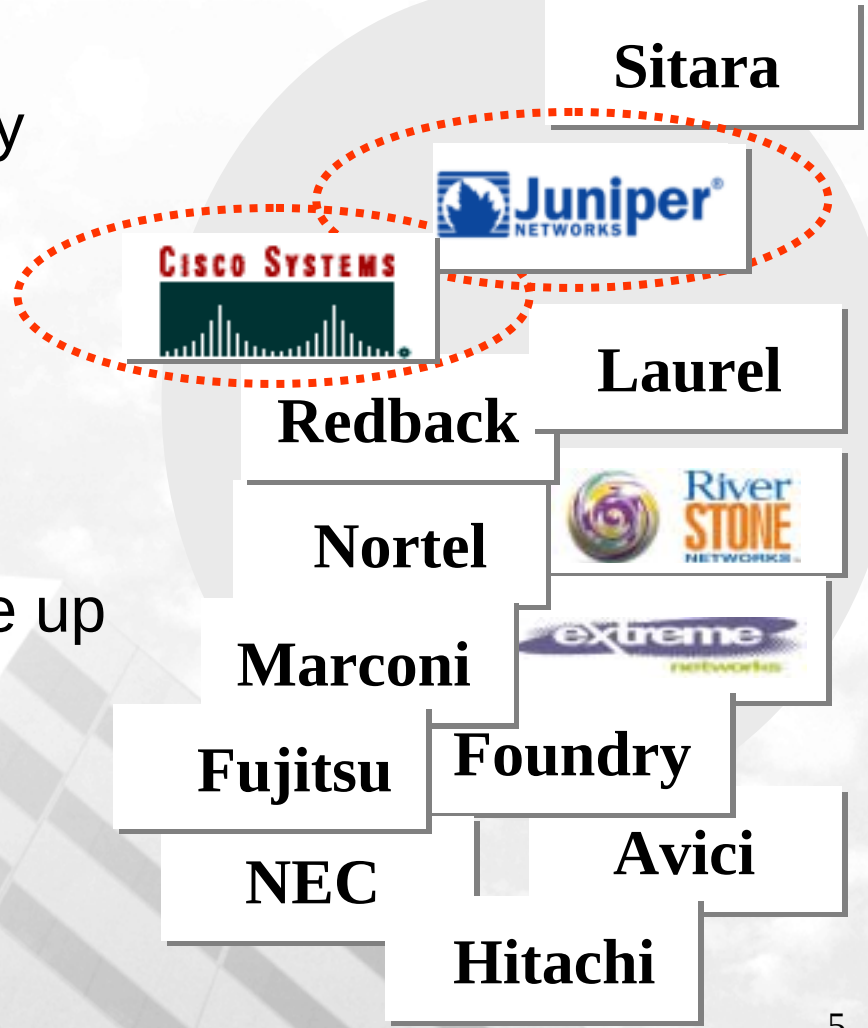
- **Many Service Providers / Enterprises may already own devices from multiple vendors**
- **May gain new types of devices via acquisition**
- **Necessary to use all of the devices in the network**

Industry Standards

- **LSP Tunnels**
- **Layer 3 VPNs: RFC 2547-bis**
- **Layer 2 VPNs**
  - Martini
  - Kompella

Interoperability

- End-to-end provisioning requires operator proficiency with each device's specific interface
- Mix of vendors offering MPLS VPNs
- Two vendors currently make up majority of MPLS networks



Market Options

- **Options for multi-vendor MPLS provisioning**
  - Build application in-house
  - Handle through CLI
  - Single solution per vendor; integrate solutions
  - 3rd party applications – few, but available

Challenges to Interoperability Provisioning

- **Normalize information common to all vendors**
- **Allow users to specify vendor- or model-specific information**
- **Values must be verified on a per-vendor or per-model basis**
  - Further complicated by interface modifications between different OS versions of the same vendor

Challenges to Interoperability Provisioning

- **User experience (workflow) must be consistent between services on different vendors**
  - Minimizes training time for new users
  - Allows users to become familiar with new hardware rapidly
- **Different devices may have different modes of communication**
  - CLI (standard)
  - SNMP
  - XML (Juniper's JUNOScript)

LSP Interoperability Example

- **Uni-directional; must be configured on both devices**
- **Device-specific configuration:**
  - LSP Name / Number
  - Bandwidth
  - Paths:
    - Juniper: 0-1 Primary / 0-n Secondary
    - Cisco: 0-n paths

LSP Interoperability: Configuration Samples

- **Cisco:**


```
! Create an MPLS LSP tunnel between PEs
interface Tunnel31000
 ip unnumbered Loopback0
 no ip directed-broadcast
 no ip route-cache cef
 mpls traffic-eng tunnels
 tunnel destination 200.200.200.166
 tunnel mode mpls traffic-eng
 tunnel mpls traffic-eng autoroute announce
 tunnel mpls traffic-eng priority 7 7
 tunnel mpls traffic-eng bandwidth  100
 tunnel mpls traffic-eng path-option 1 dynamic
```

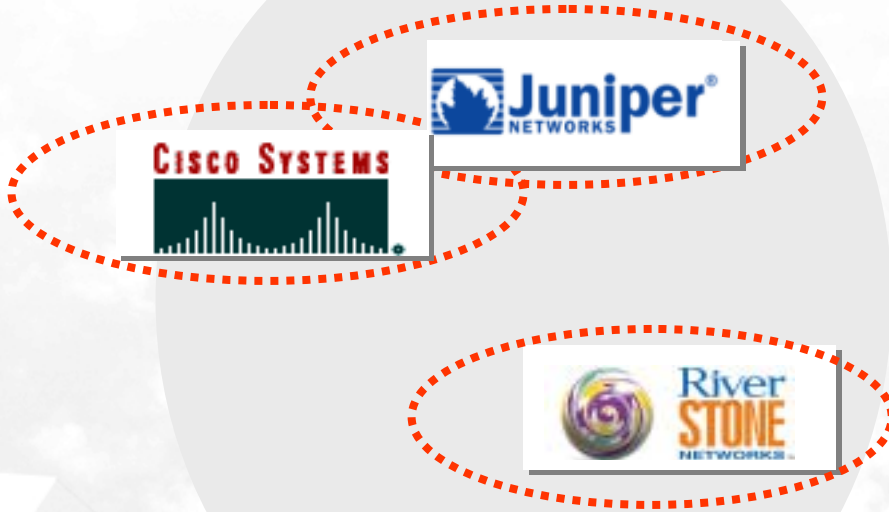
LSP Interoperability: Configuration Samples

- **Juniper M/T:**

```
label-switched-path lsp_one {
        enable;
        to 200.200.200.118;
        bandwidth 22m;
        class-of-service 0;
        hop-limit 255;
        adaptive;
        primary np_one {
            bandwidth 22m;
            class-of-service 0;
            hop-limit 255;
            optimize-timer 0;
            preference 7;
            priority 7 0;
            record;
        }
```

Layer 2 Martini VPN Interoperability Example

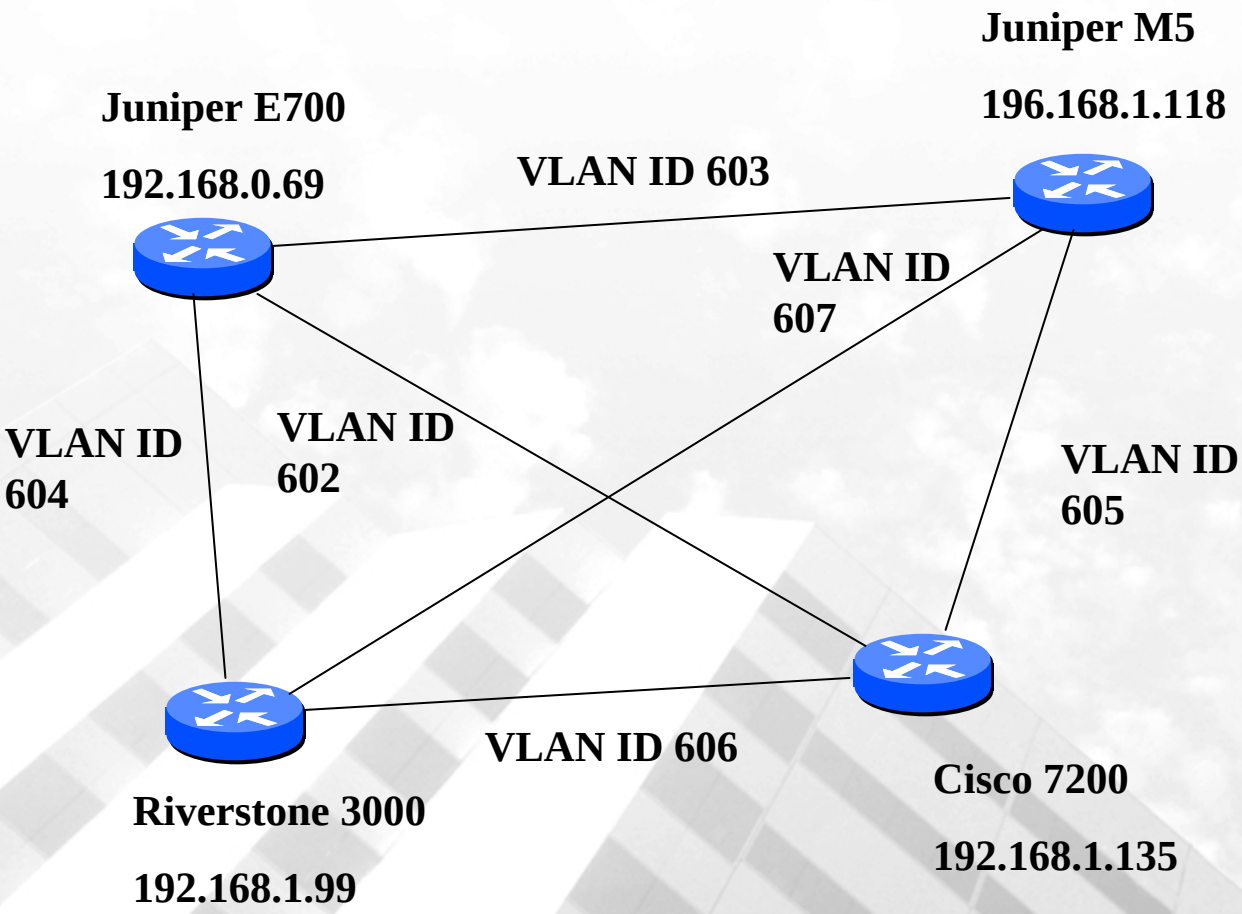
- **Point-to-point tunnel between two interfaces**
- **Standard configuration**
  - Interface
  - Route to connect to
  - Virtual Circuit ID (VCID)



Layer 2 Martini VPN Interoperability Example

- **Interoperability between 4 routers:**
  - Juniper M5
  - Cisco 7200
  - Riverstone 3000
  - Juniper E700

Layer 2 Martini VPN Interoperability Example



Layer 2 Martini Interoperability: Configuration Samples

- **Juniper M/T:**

```
l2circuit {
   neighbor 100.100.100.69 {
      interface ge-0/2/0.603 {
        virtual-circuit-id 2;
      }
   }
  neighbor 200.200.200.135 {
     interface ge-0/2/0.605 {
      virtual-circuit-id 4;
     }
   }
  neighbor 200.200.200.99 {
     interface ge-0/2/0.607 {
       virtual-circuit-id 607;
      }
     }
}
```

Layer 2 Martini Interoperability: Configuration Samples

- **Juniper E:**

```
interface fastEthernet 6/0.602
 vlan id 602
 vlan description l3Mixmart-CIscoL2_135
 mpls-relay 200.200.200.135 1
!
interface fastEthernet 6/0.603
 vlan id 603
 vlan description l3Mixmart-JuniperL2_ge
 mpls-relay 200.200.200.118 2
!
interface fastEthernet 6/0.604
 vlan id 604
 vlan description l3Mixmart-RSL2CS_99
 mpls-relay 200.200.200.99 604
```

Layer 2 Martini Interoperability: Configuration Samples

- **Cisco:**

```
interface FastEthernet1/0.602
 description l3Mixmart-ERXL2_VR
 encapsulation dot1Q 602
 no cdp enable
 mpls l2transport route 200.200.200.69 1
!
interface FastEthernet1/0.605
 description l3Mixmart-JuniperL2_ge
 encapsulation dot1Q 605
 no cdp enable
 mpls l2transport route 200.200.200.118 4
!
interface FastEthernet1/0.606
 description l3Mixmart-RSL2CS_99
 encapsulation dot1Q 606
 no cdp enable
 mpls l2transport route 200.200.200.99 606
```

Layer 2 Martini Interoperability: Configuration Samples

- **Riverstone:**

335 : port enable 8021p port et.1.6

89 : vlan create l3Mixmart604 port-based id 604

121 : vlan add port et.1.6 to l3Mixmart604

!

302 : ldp add l2-fec vlan 604 to-peer 100.100.100.69

90 : vlan create l3Mixmart606 port-based id 606

122 : vlan add port et.1.6 to l3Mixmart606

!

303 : ldp add l2-fec vlan 606 to-peer 200.200.200.135

91 : vlan create l3Mixmart607 port-based id 607

123 : vlan add port et.1.6 to l3Mixmart607

!

304 : ldp add l2-fec vlan 607 to-peer 200.200.200.118

Layer 3 VPN Interoperability Example

- **Standard configuration**
  - Interface configuration
    - MPLS
    - IP address
  - VRF configuration
    - Name
    - Route Distinguisher
    - Route Target
  - PE/CE Routing protocol configuration
    - BGP
    - Static
    - OSPF
    - RIP

Layer 3 VPN Interoperability Example

- **Juniper M/T device-specific configuration**
  - Routing Instance
    - Interface(s)
    - Route Distinguisher
    - Import/Export Policies
    - PE/CE Routing
  - Policy Statements
    - Import/Export
  - Community
    - Route Target

Layer 3 Interoperability: Configuration Samples

- **Juniper M/T:**

```
routing-instances {
  l3test {
     instance-type vrf;
     interface fe-0/3/0.0;
     route-distinguisher 10.50.1.1:1;
     vrf-import l3test-i;
     vrf-export l3test-e;
     protocols {
        ospf {
           area 0.0.0.155 {
              interface fe-0/3/0.0;
           }
        }
     }
```

Layer 3 VPN Interoperability Example

- **Juniper E device-specific configuration**
  - VRF
    - Associated Virtual Router
    - Route Distinguisher
    - Import/Export Targets
  - Virtual Router
    - Interface(s)
    - PE/CE Routing

Layer 3 Interoperability: Configuration Samples

- **Juniper E:**

```
virtual-router default
ip vrf L3ERX_Test
 rd 192.168.0.69:1
 route-target both 192.168.0.69:2
! ------------------------------------------------------------------------
virtual-router default:L3ERX_Test
!
interface fastEthernet 6/0.3000
 vlan id 3000
 ip address 204.2.3.2 255.255.0.0
 ip proxy-arp
!
no ip source-route
router rip
 network 2.3.0.0 255.255.0.0
 address 204.2.3.2
 redistribute bgp metric 0
```

Layer 3 VPN Interoperability Example

- **Cisco device-specific configuration**
  - IP VRF
    - Route Distinguisher
    - Import/Export Route Targets
  - BGP router
    - Address family
    - PE/CE routing

Layer 3 Interoperability: Configuration Samples

- **Cisco:**

```
ip vrf l3test
 rd 1000:1
 route-target export 7505:2
 route-target import 7505:2

 !  Set up routing-instance to l3test
 address-family ipv4 vrf l3test
 redistribute connected
 redistribute ospf 10 match internal external 1 external 2
 no auto-summary
 no synchronization
 exit-address-family
```

Questions and Answers

- **Any questions?**

MPLS Multi-Vendor Provisioning

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