

JUNOSPHERE LAB AND PACKET DESIGN ROUTING ANALYSIS SOLUTION

Delivering Higher Service Quality Through Layer 3 Network Management Visibility

Challenge

If you are responsible for delivering increasingly sensitive application and service traffic running over more complex, redundant networks, you need comprehensive visibility into network-wide routing dynamics to ensure network service quality and delight your customers while optimizing operations and achieving higher profitability

Solution

Packet Design's Routing Analysis Solution provides real-time visibility into IP/MPLS network routing infrastructure and protocols, including rewindable forensic and troubleshooting history, network modeling, proactive routing health audits, and failure scenario analyses. Integration with Juniper Networks Junosphere Lab brings these same capabilities to the virtual lab environment.

Benefits

- Network-wide routing topology visualization, historical insight, and what-if simulation for Junosphere Lab users
- Faster, more efficient troubleshooting that results in higher network quality and greater customer satisfaction
- More accurate change management that prevents costly mistakes and increases service availability

IP networks are more critical than ever, delivering converged voice, video, and data traffic for revenue producing services or productivity enhancing applications. To ensure fault tolerance, many organizations such as service providers, mobile operators, global enterprises, and government/military agencies have significantly invested in building high levels of redundancy into their IP networks. However, with increased network redundancy and complexity come management challenges due to the dynamic nature of IP traffic routing, and this can impact the quality of applications and services. The lack of understanding of IP-layer network dynamics is a significant challenge to engineering teams seeking to plan, maintain, and troubleshoot the network. The result is increased operations costs, longer application and service impacts, and more frequent planning and change management errors, leading to lower customer satisfaction, competitiveness, and profitability. Next-generation application and service delivery requires precise, network-wide visibility into dynamic IP routing behavior.

The Challenge

Complex, redundant IP networks provide superior resilience in the face of network component failures, but they also make understanding your network much more difficult. Unlike legacy time-division multiplexing (TDM) or ATM networks, where engineers could determine fixed traffic paths through the switched network, IP traffic paths are dynamically calculated and determined by routing protocols running on routers across the network. Dynamic routing is one reason why IP networks have triumphed as the de facto standard for communications around the world, because IP routing protocols such as OSPF, IS-IS, and BGP automatically detect network failures and instantly reroute traffic around links, routers, and networks that are down. The disadvantage of such routing brilliance is that IP network traffic routing is dynamic enough to make it very difficult to understand what exactly is happening in the network. With highly redundant networks having many possible paths that traffic can take between points, just figuring out where in the network application and service traffic is flowing can be frighteningly difficult. Lack of visibility into the actual behavior of application and service traffic routing can impact your key operational and network management processes in a number of ways:

- **Troubleshooting:** Without knowing which precise path the problematic application or service traffic took at the time of an issue, operators and engineers can't localize the problem domain in the network and as a result, many issues—particularly transient or intermittent ones—become exceedingly difficult to solve. This is the reason that so many problems go into the “unsolved mystery pile,” which means that not only will the affected customer not receive a timely response to an issue, but the root causes of those problems are still lurking in the network, living on to cause more problems on another day. Unresolved issues of this nature become a drag on the overall quality of the network and the applications and services that

it delivers, leading to lower customer satisfaction, and in the case of service providers, costly subscriber churn. In addition, engineers spend an inordinate amount of time on troubleshooting the problems that can be solved, raising operations expenses and constraining organizations from proactively attending to strategic requirements and opportunities.

- Change management and maintenance:** Too many engineers have experienced the so-called “butterfly effect” when performing routine network changes and upgrades, where a change that looks completely correct from an individual device point of view ends up wreaking havoc on another part of the network. The problem with change management processes today is that they’re only focused on the “input” side of the change—ensuring version control, correct syntax, etc. However, in order for network change management to be complete, engineers need to understand the “outcome” side of the equation—how will the entire network behave as a result of the change. Unfortunately, it’s impossible to figure this out from lab tests, or by using today’s offline planning tools, which can only provide an approximation of the network rather than an accurate understanding of actual network behavior. Only by understanding network-wide routing dynamics can network engineers increase change management accuracy and prevent costly mistakes to ensure that they meet service-level agreements (SLAs).

The Juniper Networks Junosphere Lab Packet Design Routing Analysis Solution

Juniper Networks® Junosphere™ Lab helps overcome these challenges by providing a virtual environment where users can create and run Juniper Networks Junos® operating system-based networks. Junosphere Lab networks can be exact replicas of their physical networks, and can be used to troubleshoot and experiment with network changes in a risk-free virtual environment.

Packet Design Inc., a leader in routing-aware network management, offers Junosphere Lab users a Routing Analysis Solution that provides comprehensive insight for the network’s routing behavior. The Packet Design Routing Analysis Solution runs as a virtual machine within Junosphere Lab, offering real-time, network-wide monitoring, analysis, modeling, planning, and auditing of IP routing.

Integration with Junosphere Lab allows you to see a real-time topology map of your virtual network, monitor routing changes, perform in-depth analyses (including the ability to rewind network event history), and graphically depict what-if scenarios for failure analysis or to understand the impact of changes before they are deployed.

In Junosphere Lab, route analytics works just as it does in physical service provider and enterprise networks, by passively monitoring the routing protocol exchanges (e.g., OSPF, EIGRP, IS-IS, BGP, RFC2547bis, MPLS VPNs) between routers on the network, then computing a real-time, network-wide topology that can be visualized, analyzed, and serve as the basis for actionable alerts and reports. This approach provides the most accurate, real-time view of how the network is directing traffic, and allows Junosphere Lab users to see a real-time map of their virtual network that includes any change in Layer 3 router and link status.

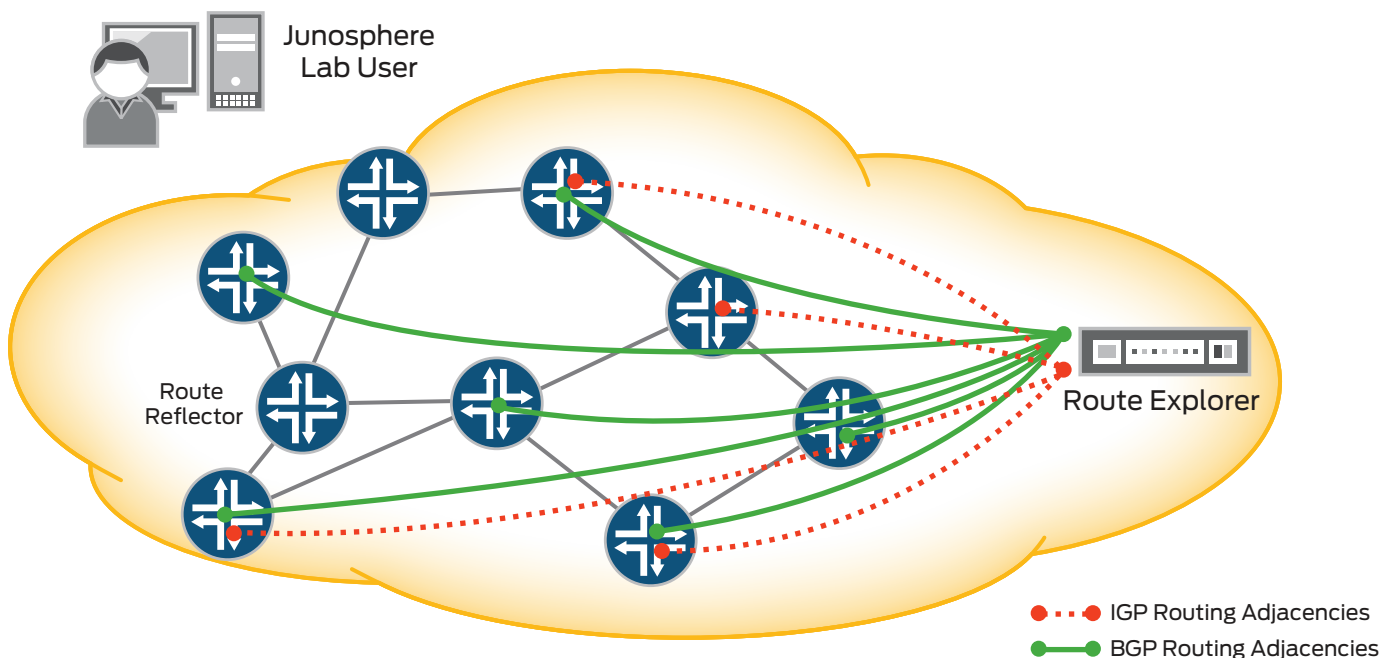


Figure 1: Route analytics acts as a passive routing peer that does not inject routes or forward any traffic. Route analytics records the routing protocol updates (e.g., OSPF, EIGRP, IS-IS, BGP) from its peers, then computes an always accurate network-wide routing topology.

Features and Benefits

- Real-time network monitoring and alerting: Packet Design's Routing Analysis Solution provides your network operators and engineers with an always up-to-date map of all routing activity in the network. Summary dashboards and readouts provide active vs. baseline monitoring of internal, Internet, RSVP-TE, and MPLS VPN customer routing state, while configurable system logging messages and SNMP traps can alert network managers to routing instabilities or outages, lost redundancy, failures or changes in critical network paths, or large-scale changes in BGP routing. Since route analytics listens directly to live routing protocols, which communicate network topology and path changes instantly after they occur, your network operations will be able to learn of critical issues in the network at the speed of the network, rather than waiting for minutes long polling cycles. This real-time monitoring capability enables Junosphere Lab users to more quickly and accurately troubleshoot and replicate issues, lessening the impact of potential problems on the real network and enhancing application and service delivery.
- Rewindable forensic troubleshooting history: By continuously recording the state of all routing changes over time, Packet Design's Routing Analysis Solution can accurately portray an analyzable, network-wide map of all routers and routed links at any point in its recorded history. Engineers can use a History Navigator to rewind the state of the network to the precise moment in the past when a problem was happening, trace the exact path that the traffic took through the network, examine for link flaps, and see if any other routing issues or changes affected the traffic path. This unparalleled forensic capability, along with comparative and in-depth analyses of routing protocol event messages, help engineers get to the root cause of problems much faster, and can help them analyze the effect of changes modeled within Junosphere Lab before implementing the changes in their production networks. The result is higher levels of network and service quality in the long term, while reducing the cost of delivering high quality applications and services.
- Modeling the network-wide impact of routing changes: Junosphere Lab and Packet Design's Routing Analysis Solution go beyond monitoring and analysis to provide operationally accurate what-if modeling. Your engineers can model a number of operationally relevant changes and see the effect on the "as running network" based on its real routing topology. Modeling capabilities include adding, downing, moving, or changing any combination of the following items in the network, then seeing the changes on the network map, as well as detailed before and after analyses that display exactly what changed as a result.

- Routers running any combination of major routing protocols
- Interior gateway protocol (IGP) links or BGP peerings
- Prefixes
- Routing metrics
- BGP community strings, Local Pref, multiple exit discriminators (MEDs)
- MPLS VPNs
- RSVP-TE tunnels

With an operationally accurate view of the effect of planned changes, your engineering team can greatly strengthen change management processes, leading to lower application and service impacts from inadvertent mistakes made in routine maintenance changes as well as saved time normally spent on recovering from those mistakes.

- Comprehensive routing health audits and failure analyses: Packet Design's Routing Analysis Solution provides your engineering team with the means to proactively anticipate and mitigate continuity risks using the Junosphere Lab network. A comprehensive routing health audit function examines every link and path to show engineers where the network topology has weak points such as single points of failure, or links where an inordinate number of routes are being carried, or where your network is out of compliance with network architecture policy such as the incidence of asymmetric routes. With Junosphere Lab and Packet Design's Routing Analysis Solution, your engineering team can stay ahead of the game and prevent costly outages and losses of application and service quality.

Solution Components

Juniper Networks Junosphere Lab is a ground-breaking virtual networking environment, where users can create and run Junos OS-based networks in the cloud. These networks leverage the same Junos operating system that powers Juniper routers and security platforms, providing a highly accurate environment for network design, testing, and training.

Packet Design's Route Explorer is an industry-leading route analytics solution, supporting network engineering and operations best practices in the world's largest OSPF, IS-IS, BGP, and EIGRP networks. Route Explorer functionality is offered free of charge to Junosphere Lab users.

VPN Explorer provides per-customer and network-wide MPLS VPN routing analysis to ensure the VPN reachability, privacy, and routing policy integrity.

TE Explorer provides network-wide visibility into the dynamic behavior of RSVP-TE label-switched paths (LSPs) to ensure the critical services that traverse traffic engineering tunnels

Summary—Get Ahead of the Game with Junos Lab and the Packet Design Routing Analysis Solution

Packet Design's Routing Analysis Solution for Junosphere Lab users provides real-time network monitoring and alerting, rewindable forensic troubleshooting history, what-if modeling of network-wide impact of routing changes, and comprehensive routing health audits and failure analyses. This equips your team with unprecedented network-wide routing visibility, historical insight, and simulation capabilities. It allows you to achieve higher customer satisfaction, operational efficiency, and overall profitability with faster, more efficient troubleshooting and problem resolution. Its unparalleled forensic capability, along with comparative and in-depth analyses of routing protocol event messages, helps you get to the root cause of problems much faster, analyzing the effect of changes modeled within Junosphere Lab before implementing them in your production network. By taking advantage of this solution's superior change management accuracy, you can prevent costly mistakes and significantly increase service availability.

To find out more about Junosphere Lab including Packet Design Routing Analysis Solution, contact your Juniper sales representative. For more information about Packet Design products, please visit <http://www.packetdesign.com>.

About Packet Design, Inc.

Packet Design, Inc. pioneered the field of route analytics and is the leading supplier of network appliances that provide routing-layer visibility into IP networks. The company's products create an accurate Layer 3 topology map, analyze routing events, and provide unique end-to-end network paths including MPLS, letting network engineers quickly pinpoint network problems and accurately model changes. Packet Design solutions help manage networks in hundreds of organizations, including many of the world's largest service providers, global enterprises (financial, retail pharmaceutical, and other firms), government agencies, and educational institutions.

Packet Design was founded in March 2003 by serial entrepreneur and former Cisco Chief Technology Officer Judy Estrin and former Cisco Chief Scientist Van Jacobson. For more information, visit www.packetdesign.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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