

Cisco PfR: Use Path Control to Solve the Challenges of Application Performance

Bandwidth cost, WAN latency, and lack of availability all contribute to the complexities of running an efficient and cost-effective network that meets the demanding, application-heavy workloads of today's enterprise organizations. This paper discusses the challenges and illustrates how Cisco Performance Routing (PfR), part of Cisco IOS® Software, can help administrators successfully deal with them.

Market Trends and Top Network Challenges

Various market developments, including the proliferation of applications in the cloud and cost pressures, create challenges for enterprise network administrators. As cloud applications move farther away from the end users, network congestion and packet loss significantly degrade application performance and user productivity.

Application Performance Support

As enterprise applications grow and more employees work remotely or from branch offices, the expectation for real-time application performance—and better user experience—has increased. For example, WebEx® meeting applications and videoconferencing are key business tools for many companies. But if an employee hosting a conference has to deal with “freezing video” or a sales professional cannot get a form to load, the business can be affected and IT will hear about it.

Increasing use of private and public cloud-based applications means that network users and administrators:

- Rely more and more on WAN performance
- Need better ways to identify applications; access control lists (ACLs) and well-known ports may not be enough
- Are pressured to increase WAN bandwidth, especially as nonbusiness traffic slows down important business applications

Bandwidth Cost

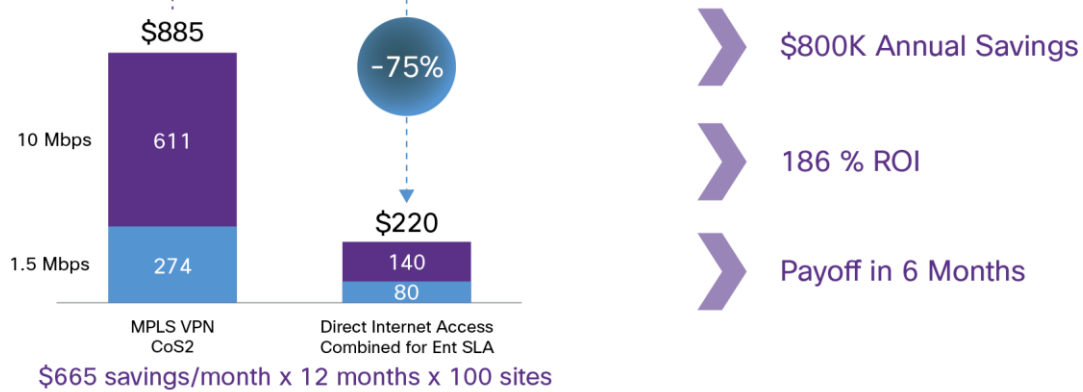
To improve application performance, companies have typically deployed two common solutions: getting additional bandwidth from the provider, and using application-optimization technologies (for example, Cisco® Wide Area Application Services [WAAS]) to reduce bandwidth requirements.

Additional WAN bandwidth may improve aggregate throughput, but may not improve delay or loss for critical applications. Furthermore, additional bandwidth is expensive, and IT budget may not be sufficient to cover these additional network costs. At the same time, the cost of a basic Internet connection in general is rapidly decreasing. Figure 1 compares bandwidth costs to Internet connection costs in San Francisco.

Figure 1. Example of Additional Bandwidth Versus Internet Connection Costs for San Francisco

EXAMPLE:

San Francisco MPLS VPN vs. Dual Business Internet (\$ per month)



Source: Telegeography MPLS VPN pricing for San Francisco as of March 2013; Comcast Web site; Verizon Web site
Assumes average Router upgrade is \$3000; Installation is \$1000 and Support is \$300
CoS2 refers to VPN services providing real-time data and middle priority

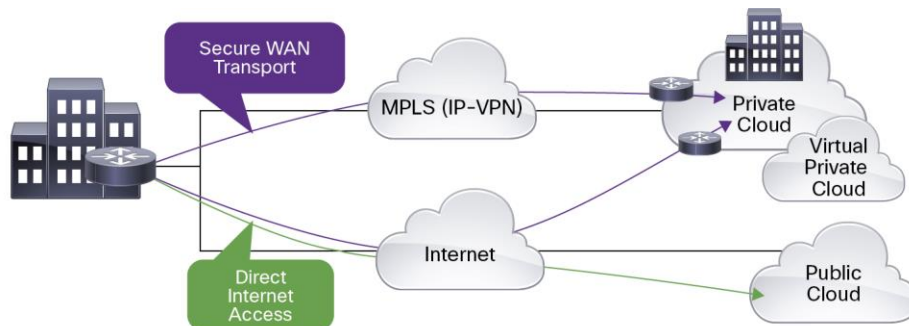
Increasing WAN Capacity and Efficiency

As the volume of content and applications traveling across networks grows exponentially, organizations must optimize their WAN investments. Most enterprise WANs have primary and backup network paths to meet network availability requirements. The backup circuit is typically idle and an unused resource most of the time. What if you could use the backup path to augment the capacity of the WAN? Cisco Intelligent WAN can help administrators accomplish the following (Figure 2):

- Augment the network with multiple links, including lower-cost connectivity options such as the Internet
- Realize the cost benefits of provider flexibility and higher WAN usage
- Increase both application and network availability by mitigating network brownout and blackout events

Offloading best-effort traffic (that is, lower-priority traffic) to the backup path can reduce the load on the primary Multiprotocol Label Switching (MPLS) VPN path, potentially improving performance on the higher-priority applications. In addition, for traffic that goes directly to public cloud services for employees (such as Google, Salesforce.com, Office365, and so on), administrators can use local Internet access to offload these flows from the private WAN altogether. This approach uses the Internet connection not just as a backup but as a real component in dealing with WAN workloads. With the right network technologies to optimize the flows, administrators can reduce overall WAN transport bandwidth requirements and improve application performance.

Figure 2. How Cisco Intelligent WAN Uses the Internet to Best Advantage



- Secure WAN transport for private and virtual private cloud access
- Leverage local Internet path for public cloud and Internet access
- ✓ Increase WAN transport capacity, cost effectively
- ✓ Improved application performance (right flows to right places)

How Intelligent Path Control Can Help

Path control is the process of choosing the network path on which traffic is sent. The basic form is simple: send all traffic down this path unless the path goes down; in that case, send everything through the backup path. The next level of sophistication allows the administrator to specify categories of traffic to send on a specific path as long as that path remains up.

However, this approach is static and does not account for the dynamic behavior of the network. So, for example, when the path selected suffers degraded performance (say, packet loss), the system cannot compensate. Intelligent path control solves this problem by monitoring actual application performance on the path that the applications are assigned to, and assigning traffic to the appropriate path based on these real-time performance measurements.

What to Look for in an Intelligent Path Control Solution

To optimize application performance and to meet service-level agreements (SLAs), administrators need more than just path redirection available from classical routing technology. Proper path control should include the following:

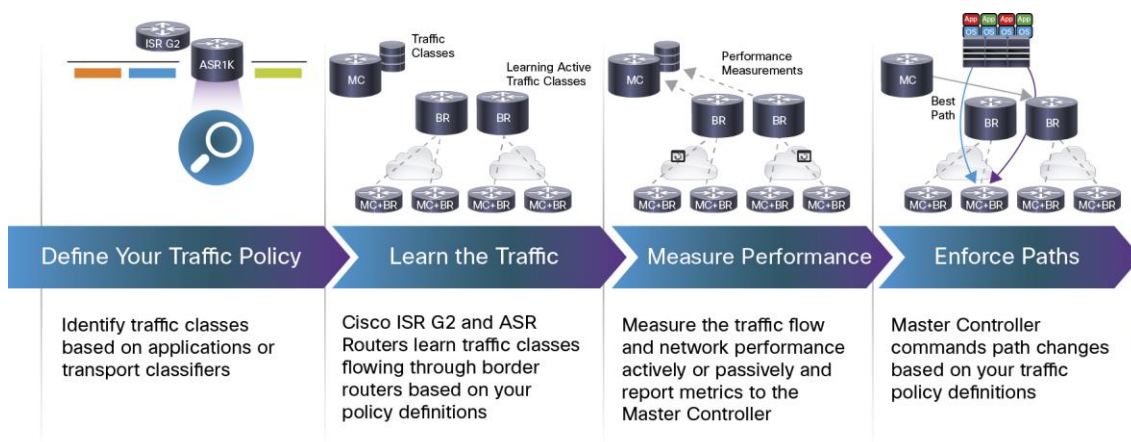
- Detection of problems such as delay, loss, and jitter degradation, before the associated application is affected, to help support SLAs that protect critical traffic
- Efficient load-balancing across all WAN links, with different bandwidth capabilities and SLA characteristics
- Effective, fast reaction to any network outages, before they can affect users or other aspects of the network, including blackouts and brownouts in the WAN provider network as well as path loss caused by other problems
- Application-based policies that are designed to support the performance needs of specific applications (for example, point-of-sale [POS], enterprise resource planning [ERP], and so on).
- Low WAN overhead; make sure that traffic monitoring overhead is not contributing to overall traffic problems
- Easy management options, including single point of administration and the ability to scale without a stacked deployment

Cisco Performance Routing

Cisco Performance Routing (PfR), part of Cisco IOS Software, complements traditional routing technologies by using the intelligence of a Cisco IOS infrastructure to improve application performance and availability. Cisco PfR can select the best path for each application based on advanced criteria, such as reachability, delay, loss, and jitter. In addition, by using cost-based link policies, PfR allows the network to intelligently choose WAN paths on a per-application basis as needed to maintain optimal application performance. Per PfR policy, critical applications can prefer the primary (premium) path, with default traffic directed over the backup (best-effort) path.

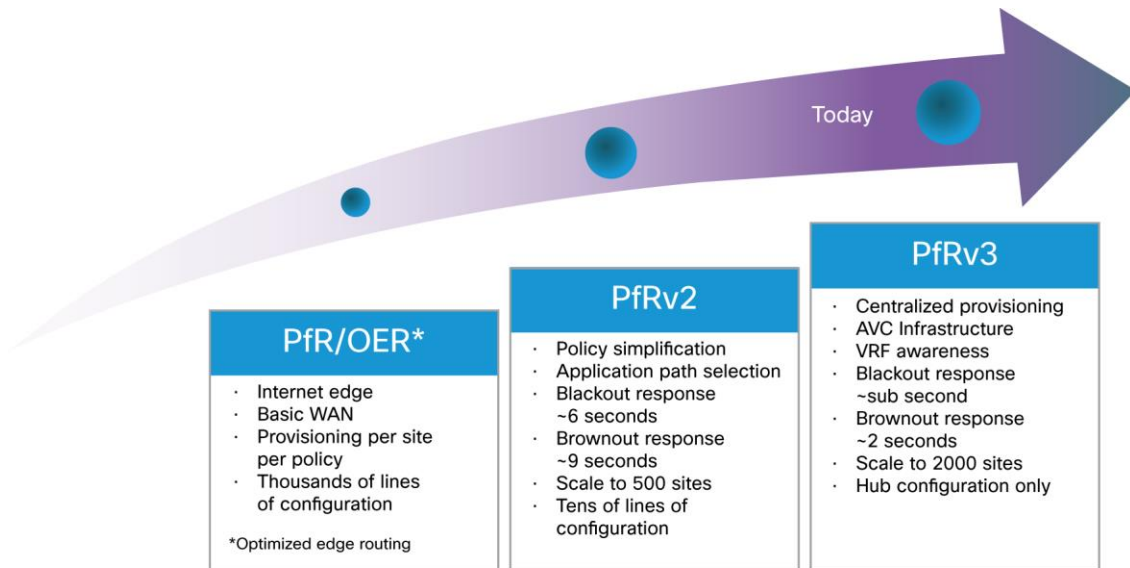
Cisco PfR can increase WAN bandwidth efficiency and decrease costs by intelligently load balancing traffic over all available paths. Figure 3 describes how Cisco PfR works to gain visibility and control the traffic intelligently.

Figure 3. How Cisco PfR Works



Cisco PfR has evolved and improved over several releases, as shown in Figure 4. PfRv3 focused on ease of use and scalability for our customers to make it easy for them to transition to an intelligent network with PfR.

Figure 4. Cisco PfR Evolution—Simplification and Scale



Why Cisco PfR

PfR allows organizations to easily use premium WAN transports and less-expensive Internet transports without compromising application performance or network reliability. PfR helps network administrators:

- **Lower bandwidth cost:** PfR lets enterprises fully use WAN investments and avoid oversubscription of lines. The growth of cloud traffic, guest services, and video can easily be load balanced across all WAN paths
- **Reduce operating expenses:** Automatic performance optimization reduces engineering operating expenses associated with manual network performance analysis and tuning of the routing infrastructure
- **Improve performance:** Automatic performance optimization also helps ensure that mission-critical applications perform with the speed, availability, and reliability required for business success. Let business policies guide network traffic at the application level instead of the traditional IP prefix-based routing
- **Provide improved response times for users:** Automatic detection of network problems and fast routing around poorly performing paths (within 2 seconds) maintains optimal application performance
- **Minimize impact of network outages:** Active detection of and routing around "black hole" conditions in the network (within 1 second) helps minimize the effects of network outages. Deliver up to 99.999-percent uptime over any transport, such as MPLS, Internet, or hybrid WAN deployments
- **Scale easily:** Scale to branch offices over any transport. Scale to thousands of sites (tens of thousands of traffic classes) without stacking deployments. Maintain granular control from the branch office to the data center and out to the public cloud
- **Save WAN bandwidth for real traffic:** Use smart sensing, which turns off probing when it senses real traffic on the WAN links, also improving scalability

Learn More

- Read the Cisco Intelligent WAN Design Guide: <http://www.cisco.com/c/dam/en/us/solutions/collateral/enterprise-networks/intelligent-wan/guide-c07-731952.pdf>
- Watch a demo: <http://www.youtube.com/watch?v=7CHsJrDhuV8>
- Learn more about Cisco Intelligent WAN: <http://www.cisco.com/c/en/us/solutions/enterprise-networks/intelligent-wan/index.html>



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