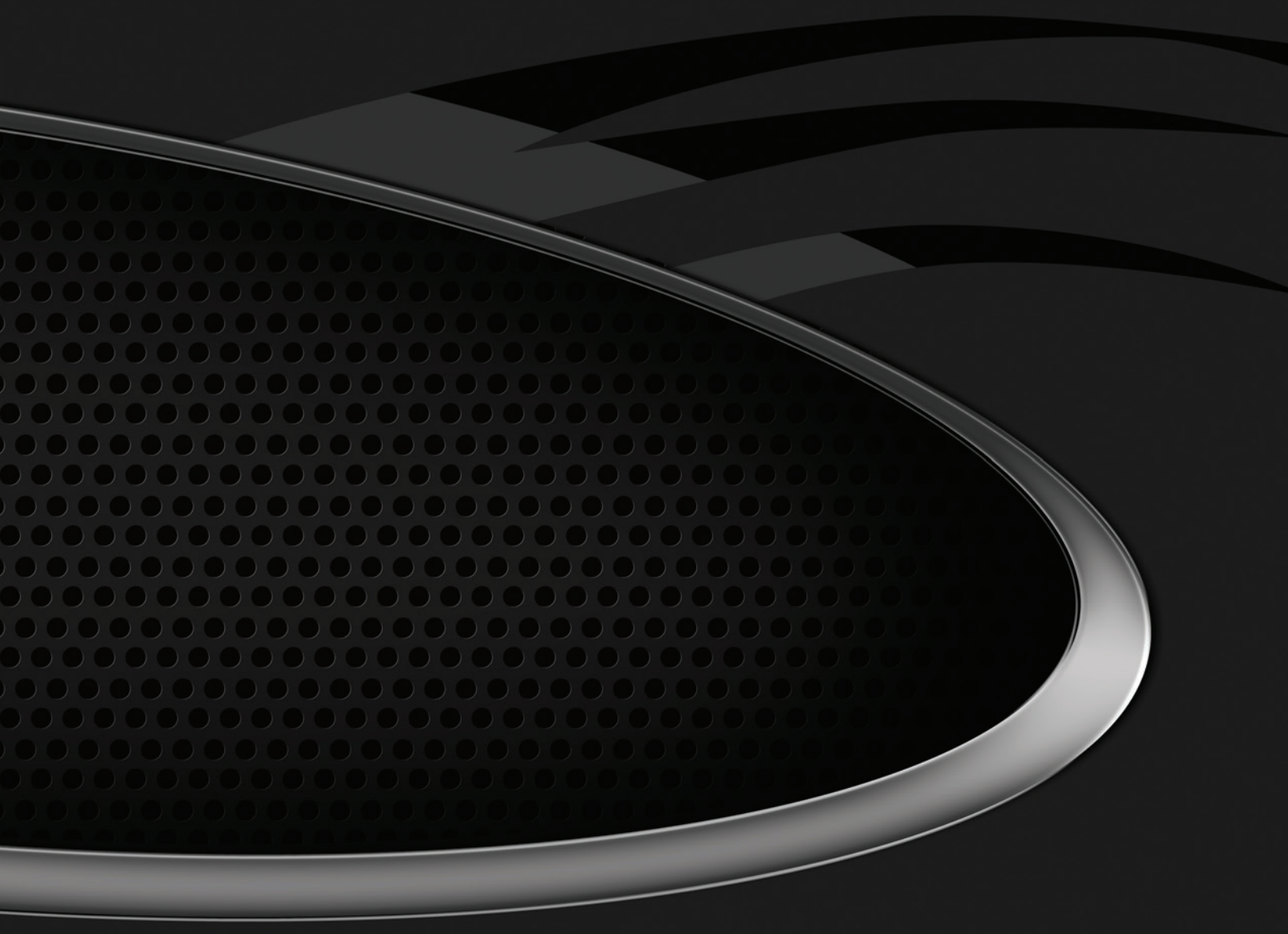# Riverbed® Cascade®
Product Family

riverbed®

Overview

When business-critical applications fail, the consequences can be serious. Revenue can be lost, brands can be irreparably damaged, employee productivity can decline, and customers may switch to competitors.

But applications don't run in a vacuum. There are many things that can affect application performance – poorly performing databases, storage, load balancers, web servers, network, etc. Since the network is the backplane for distributed applications, it is the ideal vantage point for managing performance. It provides the best combined breadth and depth into application performance, as well as visibility into the relationship between infrastructure and applications.

Cascade® is an application-aware network performance management (AANPM) platform from Riverbed Technology that provides intelligent, actionable information about application performance from the network perspective, enabling IT operations teams to proactively monitor and rapidly troubleshoot performance and availability issues.

The Cascade Difference

- Simplifies performance monitoring
- Speeds problem identification and resolution
- Improves IT collaboration and operational efficiency
- Protects user experience
- Maintains business continuity

The Cascade Difference: Intelligent, Actionable Information

The Cascade suite provides actionable, real-time information into network and application performance to enable smarter decision-making and faster, easier problem diagnosis. A complete solution that will not only alert you to problems but also help you understand where the problems are and what's causing them.

Cascade software is intelligent because it automates the analysis of dozens of key performance metrics on a per-site and per- application basis to provide early warning of unexpected changes in behavior. It displays these analytics alerts in an easy-to-use service dashboard that provides an at-a-glance view into the complete health of the application service. The Cascade service dashboard helps IT operations and IT management understand the relationship between the applications and infrastructure, the consequential impact of performance problems on the business, and how best to prioritize triage.

Additionally, its top-down, application-focused workflow mirrors IT troubleshooting processes. IT operations personnel can quickly and seamlessly drill down from application-focused dashboards to transaction- and packet-level details to accelerate problem diagnosis and resolution.

Key Benefits

The Cascade suite helps to ensure that end users experience is consistent, reliable and always available, regardless of where on the network users sit and what devices they use to access the network. It accomplishes this by improving IT operational efficiency and collaboration by providing a set of common views and metrics that span the network, infrastructure, applications, and users. Its analytics early warning notification helps identify brewing problems earlier so they can be resolved before developing into business-impacting issues. And, when slowdowns or outages do occur, Cascade speeds problem identification and resolution, minimizing downtime and the impact it can have on business revenue or reputation. Finally, it helps save money by identify opportunities for consolidation, virtualization, and optimization, and helps avoid costs, such as bandwidth upgrades, by identifying and eliminating non-business use of the network.

"We see IT travel costs savings as high as $1 million per year thanks to Cascade"

CIO, Tiburon Associates

The Cascade Architecture

Cascade passively monitors network traffic utilizing two sources of information: flow data and packet data. Each provides a different type of visibility and collectively can provide a complete view of performance.

Flow data (NetFlow, sFlow, IPFIX, etc.) is summarized data that provides a simple, effective, and scalable way to gain visibility into traffic types and bandwidth usage on the network without having to install probes everywhere. Most routers, switches, and other network devices can produce flow data.

Packet data contains the exact details of what took place on the network, adding insight into application experience. However, the scope of information is limited to the specific interfaces to which the probe is physically attached. In other words, flow data provides a broad but shallow view while packet data provides a narrow but deep view. Using both sources of data together provides comprehensive visibility that is both broad and deep. Cascade products can be deployed and configured as necessary to match how widely and how deeply IT needs to monitor performance and availability.

The Unified Performance DataStore

The Cascade suite is unmatched in its ability to combine flow and packet data into a single logical, deduplicated record. The Cascade unified performance datastore enables broad and deep visibility with minimal instrumentation. The advantage of the Cascade architecture is that it provides greater visibility and management at a significantly better price than other solutions.

The Cascade unified performance datastore deduplicates flow and packet information, and then coalesces data from multiple sources to create one super record, keeping one set of the common information plus any data that is unique to a source. This integrated approach has several benefits:

- Facilitates hop-by-hop visibility across a network to simplify identification of where change has occurred – for example, at which device packet loss occurred or where QoS tags were changed

- Enables knowledge sharing between data sources, which means rich application information collected by packet-based sources can be shared with less detailed flow sources in the aggregated flow for better visibility with fewer appliances

- Accelerates the troubleshooting workflow by seamlessly transitioning from high-level dashboard views to flow metrics, to transaction or packet details

- Deduplicates common flows for greater accuracy of data and better efficiency of storage

"Implement flow-based monitoring technologies extensively, and leverage probes where detail is needed. Using a single platform for both makes management easier... Ensure an understanding of the flow deduplication method used by the vendor."

Gartner, When Is NetFlow 'Good Enough'? March 30, 2012

The Cascade Product Family

From the data center to branch offices, and even to employee laptops, Cascade captures and monitors both flow and packet data including virtualized data across the entire network. The complete family of products includes:

Cascade® Profiler software: The centralized analysis and reporting console for the Cascade family, Cascade Profiler software correlates application-enriched network information collected by Cascade® Shark products, Cascade® Gateway appliances, Cascade® Sensor products, and even Riverbed® Steelhead® products to provide centralized monitoring, analysis, and reporting on network and application performance. The Cascade Profiler console enables enterprises to proactively monitor and troubleshoot applications and the network, automate discovery and dependency mapping, and assure a consistent and reliable end-user experience.

The Cascade® Profiler Express appliance combines flow collection, deep packet inspection, analysis, and reporting into a single appliance to provide an "instant-on" monitoring and troubleshooting solution for small to mid-size enterprises.

Cascade Gateway appliance: The Cascade Gateway appliance collects flow data (NetFlow, sFlow, J-Flow, IPFIX and other popular flow statistics) from network devices, de-duplicates common information, and then forwards the data to the Cascade Profiler console for analysis. Deploying Cascade Gateway appliances in conjunction with Cascade Profiler software provides an easy and cost-effective way to gain end-to-end visibility into the types and usage of traffic on the network.

Cascade Shark appliance: Cascade Shark appliances deliver scalable, high-performance continuous packet capture and long-term storage, enabling real-time and back-in-time forensic analysis and reporting of network and security events. Cascade Shark appliances are typically deployed wherever detailed and historical analysis is needed, such as within the data center, headquarters, or key branch offices. It can be used as an integral part of the Cascade visibility solution or as a stand-alone troubleshooting solution.

Virtual Cascade® Shark software: Virtual Cascade Shark is a software version of the Cascade Shark appliance that has been virtualized to run on VMware ESXi environments. It taps into the virtual switch in the ESX hypervisor to monitor the performance of all inter-VM traffic. Virtual Cascade Shark is unique in that it can simultaneously send data to the Cascade Profiler console for analysis and reporting and continuously capture packets and store them on the local server or on a storage area network (SAN) for back-in-time analysis with Cascade® Pilot software.

Virtual Cascade Shark can also be used to "build your own" packet capture appliance. Leverage any virtualized server running VMware ESXi – such as an existing virtualized branch office server or a Cisco SRE

blade on a Cisco Integrated Services Router (ISR G2) – to gain cost-effective remote visibility. Monitor branch LAN traffic by spanning from the switch to the physical NIC on the server in addition to monitoring intra-server (VM-to-VM) traffic.

Cascade Sensor appliance: The Cascade Sensor appliance performs deep packet inspection to supplement flow-based data with Layer 7 application classification, end-user experience, and performance metrics. It is usually deployed in each data center.

Cascade® Sensor- Virtual Edition (VE) software is virtualized Cascade Sensor software that runs on the Riverbed Services Platform (RSP) on Steelhead appliances to continuously monitor branch LAN performance.

Cascade Pilot software: A robust packet and transaction analysis console, Cascade Pilot software provides fast analysis of multi-terabyte packet recordings on remote Cascade Shark and Steelhead products without having to transfer large packet captures files across the network. Fully integrated with Wireshark®, the leading open source protocol analyzer (sponsored by Riverbed), Cascade Pilot an intuitive graphical user interface that maximizes user productivity by rapidly isolating the packets needed to diagnose and troubleshoot complex performance issues.

Steelhead products: All Steelhead models (Steelhead appliances, Virtual Steelhead®, Cloud Steelhead® and Steelhead® Mobile) can provide remote site visibility for the Cascade solution, enabling continuous monitoring of the optimized WAN environment and performing on-demand packet capture of application traffic on the WAN and branch LAN.
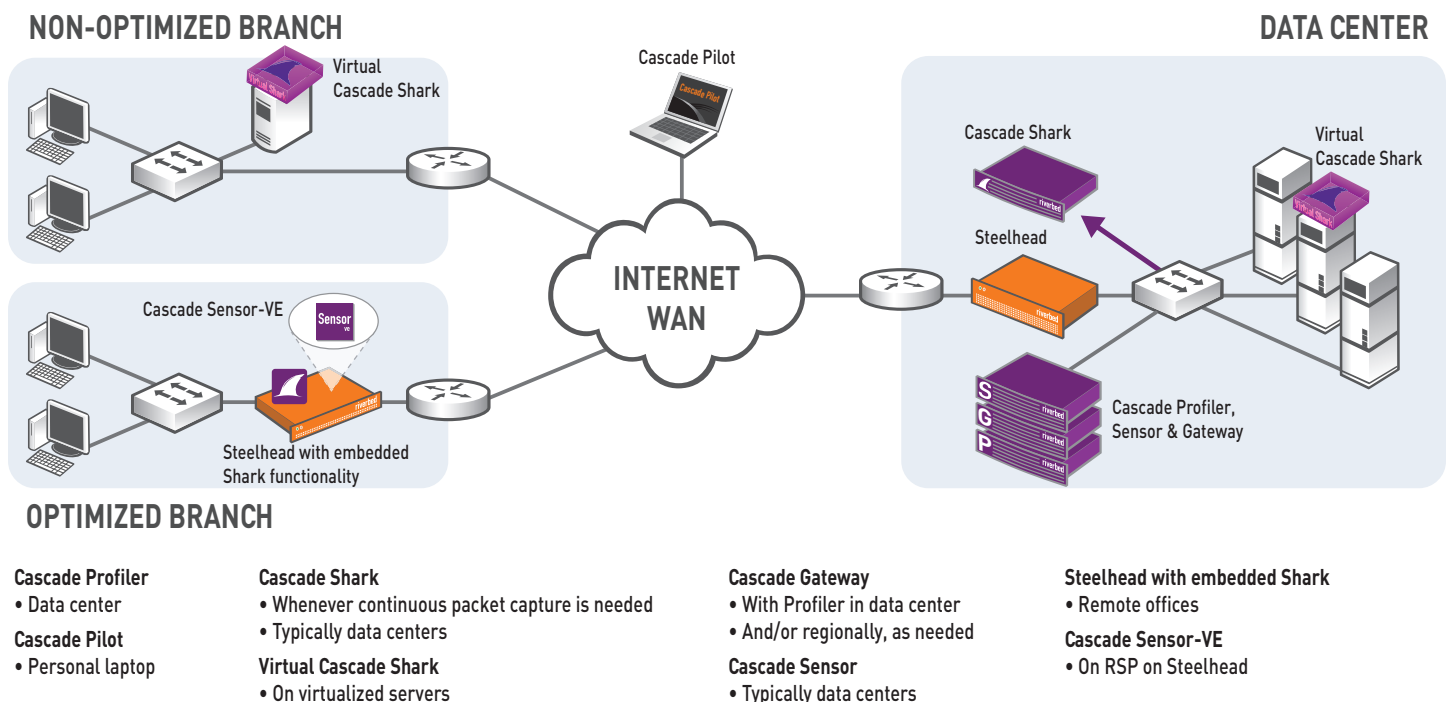

Cascade Profiler	Cascade Shark	Cascade Gateway	Steelhead with embedded Shark
• Data center	• Whenever continuous packet capture is needed	• With Profiler in data center	• Remote offices
Cascade Pilot	• Typically data centers	• And/or regionally, as needed	**Cascade Sensor-VE**
• Personal laptop	**Virtual Cascade Shark**	**Cascade Sensor**	• On RSP on Steelhead
	• On virtualized servers	• Typically data centers	

Figure 1: Cascade solutions and where they are typically deployed within the network.

Use Cases

Customers use the Cascade suite for a variety of reasons. Most typically it is used to monitor and troubleshoot network and application performance, but can also be used for planning and troubleshooting new IT projects or application deployments such as virtual environments or VOIP, and to assure the network meets security and compliance standards.

Application Performance

Applications are the lifeblood of any organization. If end users cannot access an application, they typically cannot do their job effectively. Cascade often provide the best vantage point for monitoring and troubleshooting application performance as it not only provides end-to-end visibility into the applications traversing the network, but also:

• Real-time end-user experience monitoring

• Transaction analysis

• Network utilization and deep packet analysis

• The relationship between infrastructure components used to deliver an application

Network Monitoring & Troubleshooting

As network demands and complexity increase, the need to monitor capacity, utilization, and other detailed information about traffic flowing on the network becomes even more essential. Cascade offers deep and accurate insight into how applications traverse the physical and virtual network across a broad range of infrastructure, such as load-balanced or redundant configurations, and 10G, QoS, MPLS, VPNs, and optimized WAN services. The Cascade suite provides options for monitoring and troubleshooting network traffic from the data center to the remote branch, to effectively track and manage network services across the entire organization.

Strategic IT Initiatives

Cascade can facilitate the successful completion of many IT projects such as consolidation, optimization, and virtualization initiatives, or new application deployments, including VoIP. The solution can be used throughout the project life cycle to save time and money, and to realize project benefits sooner. Specifically, the Cascade suite can help organizations:

• Baseline the existing environment to provide insight into which applications, servers and sites could benefit most from new technology initiatives, as well as provide a comparison point for pre- and post-project utilization and end-user experience measurements

• Enable faster, more accurate discovery and dependency mapping to facilitate planning to help mitigate the risks of infrastructure change

• Accelerate network and application troubleshooting during project implementation to ensure a quality deployment experience and successful outcome

• Continuously monitor and troubleshoot the post-implementation environment for optimal performance at all times
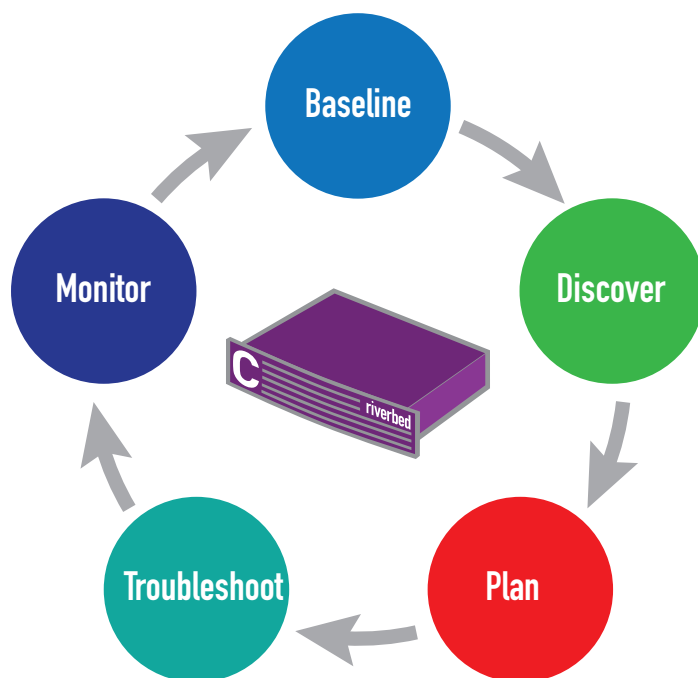

Figure 2: Cascade provides value throughout the entire project lifecycle.

Audit & Compliance

Cascade solutions come with automated discovery capabilities that can also help with establishing and reviewing security and compliance policies. Understanding where IT assets sit in the network and their dependencies enables the IT organization to focus and rationalize investments. Cascade products help uncover all the moving parts of an application, including the hosts, paths, ports, and protocols that need to be secured or monitored for compliance. It helps identify and secure any gaps in coverage and it also helps find unrelated systems that need to be treated at the same trust level due to proximity.

In addition, security analytics automatically monitor for unusual changes in behavior and proactively alerts on changes that could indicate an emerging security issue. Activity that Cascade software can detect includes unusual surges in bandwidth characteristic of denial of service (DoS) attacks, host or port scans, the addition of new hosts or server ports, and suspicious connections.

Key Features

As one of the most comprehensive network performance manage-
ment solutions on the market, Cascade comes with myriad features and
advantages for unsurpassed visibility:

Application recognition and monitoring – Cascade monitors a variety of
application types, including well-known, custom-developed, virtual-
ized, peer-to-peer, and web-based applications and URLs. Cascade also
reports on VoIP quality metrics such as jitter, packet loss, MOS and
R-Factor, as well as QOS markings for H.323, SIP and Cisco SCCP (Skinny
Call Control Protocol) signaling protocols.

Transaction analysis – Fast, efficient analysis of complex multi-tier appli-
cation transactions provides a service-oriented view into a user session
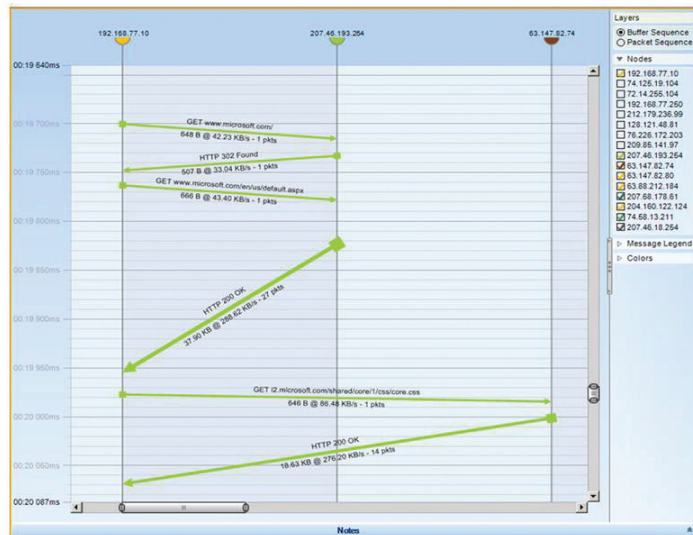for Web, VOIP, FIX, MySQL and MSSQL applications.

*Figure 3: Cascade Pilot's intuitive graphical interface enables fast analysis of packet
and transaction details, as well as provides the ability to analyze multiple trace files
simultaneously.*

End-user experience monitoring – More than just simply tracking
response time and latency metrics, Cascade also tracks and analyzes
bandwidth and error conditions – such as TCP resets, TCP retransmission
bandwidth, average connection duration, number of new connections,
etc. – to provide a richer understanding of application performance
from the end-user perspective.

Application discovery and dependency mapping – A surprising number
of organizations don't know what's running on their network – spe-
cifically which applications, servers, and users use the network and
what dependencies exist between them. Automating the process of
mapping applications to the underlying infrastructure and application

interdependencies – including discovering through application delivery
controllers (ADCs) such as Riverbed Stingray™ Traffic Manager and F5
Local Traffic Manager is an essential component of the Cascade solu-
tion. Cascade uses network conversations to passively map IT assets and
their dependencies within hours, quickly identifying all the components
involved in delivering an application to the end user. These components
can include web servers, application servers, databases, authentication
services, etc., which are then aggregated into a comprehensive, unified
view of the application service. The service models created become the
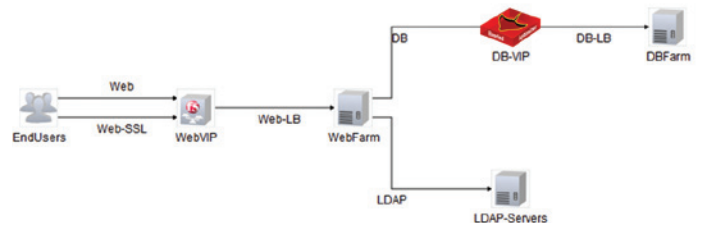basis of Cascade's service dashboard.

*Figure 4: Service maps are created using the Cascade discovery wizard to ensure
that all components involved in delivering the service to end users are account
for. They help visualize the relationship between the application, network, and
infrastructure.*

Dynamic and advanced analytics – The practice of applying static
thresholds to protocols across segments of a network is no longer
practical in today's complex environments. Rather, Cascade applies a
dynamic approach to analytics that continuously "learns" network and
application behavior to build a historical baseline of "normal" behavior.
It then correlates current performance to the historical baseline and
alerts on statistically significant changes in activity that reflects dete-
riorating user experience or security threats. Because Cascade analytics
alert on meaningful changes in behavior rather than waiting for static
thresholds to trip, it provides earlier and more intelligent notification.
Together this early notification and contextual evidence accelerates the
troubleshooting process, often enabling IT operations to correct the
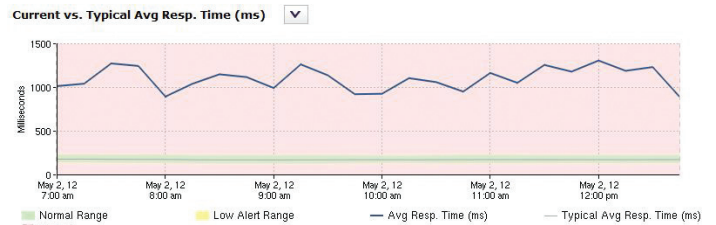problem before users notice or the business is impacted.

*Figure 5: Cascade analytics compares current performance to the historical normal
range of performance to identify unusual changes in behavior, typically before
static thresholds are triggered or users notice the deterioration in experience.*

Service dashboard – Cascade service dashboard provides a quick view into the health of critical application services in a way that aligns business objectives with how users consume services. Service dashboards provide the common metrics and views that enable a range of IT stakeholders – network operations, application developers/managers and IT management – to work together to resolve performance and availability issues. Cascade service dashboard accelerates the understanding of the impact slowdowns and outages have on the business and it helps IT prioritize triage efforts.

The dashboard is automatically created using the discovery wizard to ensure that service definitions are complete and accurate. All tiers of a multi-tier service and all dependencies involved in delivering the application to the end user are identified and captured. It reduces dashboard creation time from days to hours.

The red-yellow-green health status indicators are driven by Cascade analytics, which automatically detect and alert on meaningful changes in performance to provide proactive notification of brewing issues.

Figure 6: Service dashboards provide a visual view of how users are experience application performance.

ADC Visibility – Application delivery controllers (ADCs) create a significant hole in the ability to map all the interconnected servers or end users based on network communications, and therefore monitor application performance end to end. Cascade automates the process of discovering and mapping the ADC virtual IP (VIP) address to its backend pool of servers, to enable reporting and monitoring of load balanced applications and services. Supported ADCs include Riverbed Stingray Traffic Manager, F5 Local Traffic Manager (LTM), and others.

Virtualization –The Cascade solution brings much needed transparency into virtualized data centers by providing continuous packet capture and storage for retrospective analysis while simultaneously exporting application-enhanced traffic metrics to the Cascade Profiler performance management dashboard. This enables unified monitoring and analysis of applications that routinely traverse both virtualized and physical environments.

WAN optimization analysis – Every Steelhead appliance can act as a Cascade probe, sending CascadeFlow data to the Cascade Profiler console as well as providing on-demand packet capture. Cascade Profiler provides robust analysis of optimized WAN environments and quality of service (QoS) settings, enabling network managers to easily plan for WAN optimization, assess the impact of the deployment, and quantify benefits.

Wireshark integration – Riverbed is the corporate sponsor of Wireshark software so it's not surprising that Cascade products seamlessly integrate with this leading open source protocol analyzer. Simply right click on a view and send the selected traffic to Wireshark for deep packet inspection and decoding.

Multi-segment analysis (MSA) – Cascade Pilot simplifies the task of correlating and analyzing related traffic streams captured from multiple locations or sources to quickly identify where on the network performance issues are occurring. Packet capture sources can include:

- Cascade Shark appliances
- Virtual Cascade Shark software
- Steelhead appliances
- Third-party packet capture solutions that support the standard PCAP format, such as WireShark software

riverbed®

About Riverbed

Riverbed delivers performance for the globally connected enterprise. With Riverbed, enterprises can successfully and intelligently implement strategic initiatives such as virtualization, consolidation, cloud computing, and disaster recovery without fear of compromising performance. By giving enterprises the platform they need to understand, optimize and consolidate their IT, Riverbed helps enterprises to build a fast, fluid and dynamic IT architecture that aligns with the business needs of the organization. Additional information about Riverbed (NASDAQ: RVBD) is available at **www.riverbed.com**.

InfoWorld 2011 TECHNOLOGY OF THE YEAR AWARDS

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GCN LAB PRODUCTS OF-THE-YEAR

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