Route Analytics: Poised to Cross the Chasm

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Introduction

In the early 1990s, IT organizations began to deploy frame relay networks. The vast majority of these networks, like the ATM networks that followed them, were built using a hub and spoke design. That design made sense in large part because it reflected the fact that at that time the natural information flow within an organization was from a branch office to a headquarters facility and back again.

A number of application drivers, however, are causing the traffic flow in most current networks to follow more of a mesh pattern. One such driver is the wide spread deployment of applications such as Voice over IP (VoIP)[1]. VoIP is an example of an application where traffic can flow between any two sites in the network. A network of this type is often referred to as an any-to-any network. Another driver affecting traffic flow is that many organizations require that a remote office have access to applications that reside in multiple data centers. This type of requirement could exist in order to enable effective disaster recovery or because the applications that the remote employees need to access are hosted in only one of the company's data centers. A network of this type is often referred as a one-to-many network.

As a result of application drivers such as the ones described above, current enterprise networks are more likely to have a mesh design than a classical hub and spoke design. While a mesh design is effective in supporting traffic that is any-to-any or one-to-many, it does present some challenges. In particular, due to the combination of the dynamic nature of IP and the meshed nature of enterprise networks, it is often not possible to know what path the traffic took from origin to destination. This lack of knowledge complicates many critical tasks, such as troubleshooting, and this results in network organizations not being able to ensure acceptable application performance.

Route analytics is a technology that was designed to eliminate the problems associated with running IP over a meshed network. In particular, the goal of route analytics is to provide visibility, analysis and diagnosis of the issues that occur at the routing layer. Route analytics has typically been regarded as a niche technology. As will be shown in this Kubernan Brief, there is strong evidence that route analytics is poised to cross the chasm [2] and become a mainstream technology for IT organizations that have complex meshed networks that support business critical applications.

The Problem Definition

The problem that route analytics is designed to address does not affect all networks. In particular, the question being addressed by this Kubernan Brief is "Is route analytics poised to cross the chasm for complex, meshed networks that support business critical applications?"

The problem that route analytics is designed to mitigate has several components [3]. They are:

- ***The Lack of a Single Repository of Routing Information***

One of the many strengths of the Internet Protocol (IP) is its distributed intelligence. For example, routers exchange reachability information with each other via a routing protocol such as OSPF (Open Shortest Path First). Based on this information, each router makes its own decision about how to forward a packet. While this distributed intelligence

[1] 2005/2006 VoIP State of the Market Report, Steven Taylor, www.webtorials.com

[2] In 1991, Geoffrey Moore published a book entitled *Crossing the Chasm* and presented the argument that there is a chasm between the early adopters of a product and the early majority.

[3] The Application Delivery Handbook, www.kubernan.com, chapter 8

is a strength of IP, it is also a weakness. In particular, while each router makes its own forwarding decision, there is no single repository of routing information in the network.

- ***The Variability of Traffic Through an IP Network***

The lack of a single repository of routing information is an issue because routing tables are automatically updated and the path that traffic takes to go from point A to point B may change on a regular basis. These changes may be precipitated by a manual process such as adding a router to the network, the mis-configuration of a router or by an automated process such as automatically routing around a failure. In this latter case, the rate of change might be particularly difficult to diagnose if there is an intermittent problem causing a flurry of routing changes typically referred to as route flapping.

- ***The Impact of Variability on Application Delivery***

The variability of how the network delivers application traffic across its multiple paths over time can undermine the fundamental assumptions that organizations count on to support many other aspects of application delivery. For example, routing instabilities can cause packet loss, latency, and jitter on otherwise properly configured networks. In addition, backup paths might not be properly configured for QoS. As a result, applications perform poorly after a failure. Most importantly, configuration errors that occur during routine network changes can cause a wide range of problems that impact application delivery. These configuration errors can be detected if planned network changes can be simulated against the production network.

What are IT Organizations Saying?

Factors such as route flapping can be classified as logical as compared to a device specific factor such as a link outage. To quantify how often a logical factor vs. a device specific factor causes an application delivery issue, 200 IT professionals were given the following survey question:

> "Some of the factors that impact application performance and availability are logical in nature. Examples of logical factors include sub-optimal routing, intermittent instability or slowdowns, and unanticipated network behavior. In contrast, some of the factors that impact application performance and availability are device specific. Examples of device specific factors include device or interface failures, device out of memory condition or a failed link. In your organization, what percentage of the time that an application is either unavailable or is exhibiting degraded performance is the cause logical? Is the cause device specific?"

Of the survey respondents who supplied an answer other than "don't know", over forty percent indicated that logical issues were as likely or more likely than device specific issues to cause an application to degrade or be unavailable.

In preparing this brief, four IT professionals were also interviewed. One of these professionals works for a large government organization and is a team leader for network engineering. Another is a network engineer for a large utility. The third works for a financial services organization as the global manager of network design. The fourth is a system communication analyst and works in the medical industry. As is typically the case, these professionals cannot be referenced by name or by organization in this brief. Hence, these professionals will be referred to respectively as The Team Leader, The Network Engineer, The Global Manager and The System Analyst.

The Team Leader stated that his network is impacted more by device specific factors than it is by logical factors. He added, however, that device specific factors are easy to identify because traditional network management tools tell you when these factors occur and what they are. He also pointed out that resiliency is very important to his organization. To exemplify the need for increased resiliency he said that he regarded VoIP as "the ugly application". By that he meant that VoIP requires extremely high degree of availability.

As a result of deploying applications such as VoIP, The Team Leader has a number of projects in place the goal of which is to increase the resiliency of the network. A key component of their overall resiliency strategy is to rely on OSPF (Open Shortest Path First) to identify alternative paths through the network. However, as The Team Leader stated "a single mis-configuration on a backbone router causes havoc." He pointed out that before they implemented route analytics they typically didn't know that there was a routing problem until a user complained. Once they determined that there was a problem, their traditional approach to

troubleshooting OSPF required them to analyze each individual component of the network. The Team Leader stated that the primary value of route analytics is that it helps them to identify that there is a problem before the end user notices it and it reduces the amount of time that it takes to resolve the problem. This reduces the amount of time that applications are either performing poorly or are not available.

The Network Engineer said that one of the real benefits provided by route analytics is that it provides an in-depth view of his routing infrastructure. He added that prior to deploying route analytics, he had to piece that view together on a product-by-product basis. Like The Team Leader, The Network Engineer stated that increasing the availability of the network was a key goal of his organization and that part of their strategy to achieve that goal was the acquisition of appropriate tools. Before deploying route analytics, his organization responded to a routing problem by "digging really deep and going device to device". The Network Engineer stated that the value of route analytics is that it reduces the amount of time that it takes to resolve a problem with the routing infrastructure. He added that he believes that organizations with large complex networks would definitely see value from implementing route analytics.

The Global Manager stated that the value of route analytics is that "In the event that the infrastructure had issues, that they were not scratching their head as to why something did not work in the past." He pointed out that his organization used route analytics extensively when they were designing and building out their MPLS (Multi-Protocol Label Switching) network. He added that a recent earthquake in Asia disrupted their network. By using route analytics his organization was able to understand when things failed, how they failed, how the service degraded and whether or not the network performed as they intended it to. According to The Global Manager, route analytics provides a depth and breadth of network insight that "you hope to God that you never need, but if you do need it you are delighted that you have it."

As was the case with the other interviewees, The System Analyst stated that part of the value of route analytics is that it can eliminate routing problems before they impact application performance and can also reduce the amount of time that an application is performing poorly by helping the network organization to quickly identify the source of the problem. The System Analyst also described other ways that route analytics adds value. He said that he uses route analytics to model changes to his network and uses it to answer questions such as "What happens if I increase the bandwidth on this link?" or "If this link goes down, what happens to my traffic flow?" He stated that he also uses route analytics to minimize the finger pointing within his organization. He elaborated by saying that in his company if an application is performing badly, it is assumed that the network is the source of the problem. Route analytics allows him to better identify those instances in which the network is indeed the source of the problem and to understand how to avoid the problem in the future. The System Analyst concluded by saying that route analytics is "not the only tool you need, but it is one of many that are required."

What are Vendors Saying?

Packet Design is the pioneer and market leading provider of route analytics products. According to Alex Henthorn-lwane, Vice President of Product Marketing at Packet Design, "IT managers are starting to see route analytics as a 'must-have' technology due to the pressure of being 'graded' on application delivery and performance. Many large IT shops have made huge investments in monitoring end-to-end application performance and prioritizing problem response based on an application's business criticality. Yet, at the end of the day, if engineers can't even see which part of the network is carrying application traffic at a given time, they can't plan any more accurately or troubleshoot any faster. Route analytics fills a critical visibility hole in the network management portfolio."

Henthorn-lwane went on to say that "Route analytics also has a proven track record. Since pioneering the technology, Packet Design has deployed route analytics solutions globally for hundreds of enterprise, service provider and government organizations. As these deployments have continued to grow in number and volume, it has become commonplace for IT managers to hear about peers who have successfully deployed route analytics, making it that much easier for IT organizations to adopt it"

If Packet Design were the only provider of route analytics, it would be easy to make the argument that route analytics is a niche market. However, two very large vendors in notably different segments of IT have also begun to offer route analytics products.

One of these vendors is HP. Klaus Muehlbradt, Product Marketing Manager at HP stated "Route analytics is becoming a core component of network management software for large corporations and service providers. It closes a gap in network availability and performance management, effectively helping to prevent network outages and brown-outs that could disrupt critical applications and business services." Muehlbradt added, "Ultimately, what businesses care about are the applications and services running over the infrastructure. HP offers route analytics technology integrated within its network management software to address the need for IT engineers to respond to infrastructure issues in order to enable positive business outcomes."

Another company that has developed products using route analytics technology, with a focus on solving control plane issues in carrier networks, is Alcatel-Lucent. According to Lindsay Newell, VP Marketing in Alcatel-Lucent's IP Division, "A significant portion of service failures, provisioning problems and troubleshooting delays can be directly attributed to control plane mis-configuration, undetected routing topology changes and the lack of simple tools that would help network operators understand the control plane's impact on services. In large service provider networks, the impact of these operational inefficiencies is multiplied, because the networks carry traffic for thousands of paying customers."

Summary and Conclusions

Routing issues are not as common as device specific issues. However, as was pointed out by The Team Leader, "a simple mis-configuration on a backbone router causes havoc." This havoc typically leads to the organization's key applications either performing badly or not being available.

One of the reasons that routing issues are so difficult to resolve is that the traditional IP network does not have a single repository of routing information. Route analytics overcomes this limitation of IP by providing visibility, analysis and diagnosis of the issues that occur at the routing layer. Another reason why routing issues are so difficult to resolve is because traditional network management tools cannot detect when there is a routing problem, nor can they detect the source of the problem. As was pointed out by The Network Engineer, IT organizations traditionally resolve routing problems by "digging really deep and going device to device". The lengthy process associated with digging really deep and going device-to-device increases the amount of time that the organization's key applications are performing poorly.

Route analytics is not for everyone. For example, route analytics is not appropriate for companies that run a simple hub and spoke network. Route analytics, however, is appropriate for companies that have complex meshed networks that support business critical applications. As attested to by the four interviewees, route analytics is appropriate for these networks because of the complexity of the routing in these networks combined with the need to both minimize the number of times that routing impacts application performance and to reduce the amount of time that it takes to resolve routing-related issues that are impacting application performance.

At one time, route analytics products were only available from focused companies such as Packet Design. Because of the value that route analytics provides to IT organizations, large vendors such as HP and Alcatel-Lucent now provide route analytics technology. As Henthorn-lwane stated, "IT managers are starting to see route analytics as a 'must-have' technology due to the pressure of being 'graded' on application delivery and performance." This combination of demand from IT organizations combined with the growth in the number and type of vendors providing products indicates that route analytics is poised to cross the chasm and become a mainstream technology.

A Word from the Sponsor – Packet Design

Packet Design, Inc. is the leader in route analytics and traffic analysis solutions, which are deployed by over 200 leading Service Providers, global enterprises, and government agencies. Route analytics provides the critical management link between application performance and the underlying network device infrastructure by providing visibility and analysis into the logical operation of IP networks.

Route Explorer is the industry's leading route analytics solution, supporting network engineering and operations best practices in the world's largest OSPF, IS-IS, BGP, and EIGRP networks.

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

Traffic Explorer provides network-wide, integrated routing and traffic monitoring, analysis and modeling on the as-running network with full historical replay. Traffic helps optimize use of network assets, streamline network operations, and speeds top-down monitoring and troubleshooting for effective application and service delivery.

For more information, please visit http://www.packetdesign.com

About Kubernan™

Kubernan™, a joint venture of industry veterans Steven Taylor and Jim Metzler, is devoted to performing in-depth analysis and research in focused areas such as Metro Ethernet and MPLS, as well as in areas that cross the traditional functional boundaries of IT, such as Unified Communications and Application Delivery.

Kubernan's focus is on providing actionable insight through custom research with a forward looking viewpoint. Through reports that examine industry dynamics from both a demand and a supply perspective, the firm educates the marketplace both on emerging trends and the role that IT products, services and processes play in responding to those trends.

Kubernan is the Greek root word for *helmsman* as well as the phrases to guide and to steer. As such, the name Kubernan reflects our mission of guiding the innovative development and usage of IT products and services.

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