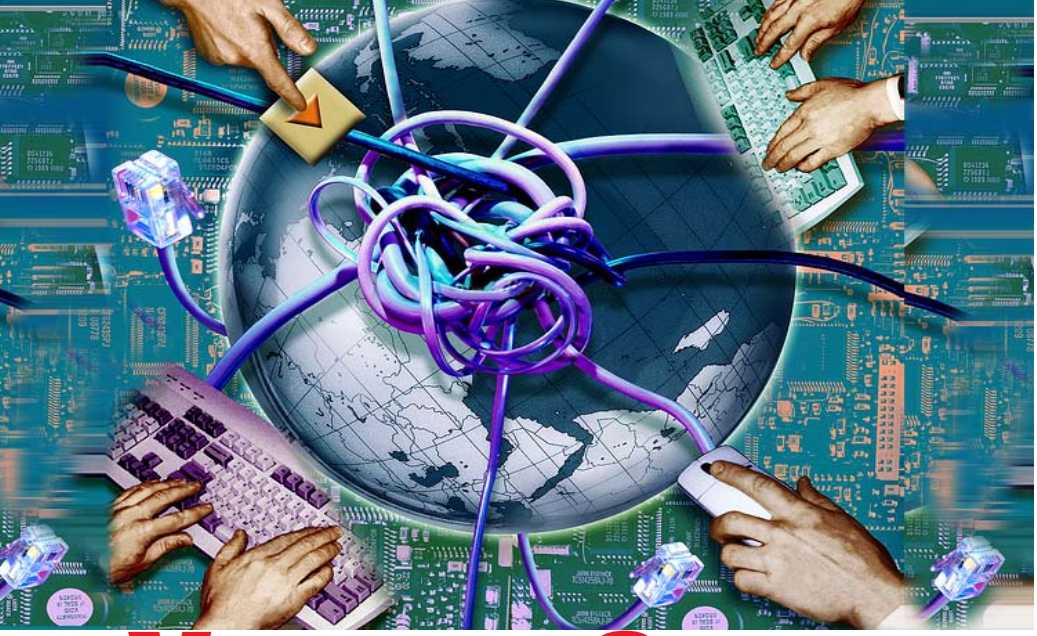

Vegayan Systems
Re-engineering The Network

Converged networks are the wave of the future—in fact, they're being implemented right now! Multi-Protocol Label-Switching networks offer tremendous cost benefits, to both service providers and subscribers. Traffic engineering is a basic requirement for converged, next-generation networks, and Vegayan Systems' work in this field is helping bring next-gen networks to us quicker.

Networks are essential to modern communication needs, but when they go down, tracing the root causes of the outage or degradation, and fixing it remains a problem. Today's organisation grapples with issues like ensuring network resources are optimally used, or providing better quality of service and reliability to premium services and applications. Essentially, when you have mission-critical services, you need a network that is up 24x7.

Dr Girish Saraph, associate professor in Electrical Engineering, IIT Bombay, the founder of Vegayan Systems Private Limited (www.vegayan.com) and his team are working on IP/MPLS, next-generation network products and integrated solutions that eliminate inefficiencies, bottlenecks, and latencies in telecom carrier and enterprise networks.

Ace entrepreneur

Dr Saraph is a veteran in the field of telecommunications. The professor has to his credit a number of publications that are used as benchmarks by the industry and academia. After a successful stint in the US for over 13 years, working on top defence-related projects, exciting opportunities beckoned. But somewhere deep within, there was a genuine desire to return to India and give back to society—and, specifically, to his alma mater, where it all began.

"The idea of nurturing a company was there right from the beginning; the experience gathered over the years both as a research scientist and engineer made me think about new possibilities in network architecture," the professor points out. Now his ideas and research products speak for themselves, and his company's products will be used by some of the top organisations in the country. Vegayan, a high-tech start-up, came into existence by the end of 2005, and is located at the KreSIT building of IIT Bombay. It is one of the several companies hosted by business incubator SINE, Society for Innovation and Entrepreneurship, at IIT Bombay.

Within its first few months of operation, Vegayan Systems received US$ 75,000 in seed funding from DFJ Ventures (Draper Fisher Jurvetson) and Nadathur Investments for winning the India Venture Challenge contest in February 2006. Since then, it has been a winner in almost every competition it participated in, including the TiE-Canaan Entrepreneurship Challenge (December 18, 2006) and "Champion of Champions"—the DST-Intel India Innovations Pioneers Challenge (October 16, 2006).

Dr Saraph says that broadband will soon be a major driver, and to build converged NGN (Next Generation Network) infrastructure, what is needed are services that can be easily integrated with existing infrastructure. They should also have the flexibility to roll out services as they become available in the future—as it will also provide backhaul support to 3G and IMS (IP Multimedia Core Network Subsystem) wireless services.

The demand

Today we have a range of devices and protocols running on multiple networks, accessing disparate services. For this very

reason, operators worldwide are trying to build an efficient network infrastructure that would comprise a converged packet network with embedded intelligence. This would provide global connectivity through intelligent devices and smart services (integrated functionality), which will truly enable the 'network everywhere' concept. However, for this to succeed, there's a lot of work involved in terms of standardisation, Quality of Service (QoS), and service level agreements (SLAs). And let's not forget the ever-changing technology scenario, which would bring heterogeneous systems under a common framework. Undoubtedly, we are talking about NGN—next generation networks.

NGN, from a technical perspective, means converged networks providing broadband services such as voice, data and multimedia. From the user perspective, it means enabling different types of multimedia services over a seamless platform, which can change the characteristics of applications, depending on the user requirement. For example, it would mean working with integrated access technology, cable TV, IPTV, and Video on Demand, where the user has sufficient choice of broadband access over unified-access networks.

For this to happen, we need to have proper broadband and seamless connectivity, and this will be possible only when service providers, on their part, have improved their infrastructure. No doubt, they try their best to make use of the latest technology in maintaining their network architecture's reliability, performance and scalability. However, while doing this, they also have to factor in competition, and keep a sharp watch on the ROI factor. Does that mean there will be a compromise in performance and quality?

The good thing is that most of the underlying infrastructure is based on IP-based networks, and to deliver these services cost-effectively, most service providers are aggressively rolling out converged networks based on IP/MPLS (multi-protocol label switching).

Dr Saraph says, "MPLS has the potential to deliver a lot of value-added services. We can identify them according to our requirements: services that MPLS could support, for example, are voice-over-IP (VoIP), video-over-IP, VPNs (Virtual Private Networks), and application quality management. We provide solutions for efficient network operation, proactive network management, and traffic engineering in these networks."

He elaborates, "IP/MPLS network deployment is critical for your business to stay ahead of the competition, but deployment alone is not enough to gain competitive advantage in the long term. To maintain market leadership, you will need to build systems and processes to operate an IP/MPLS network reliably and cost-effectively." So how does one go about it?

QoS and SLA

Dr Saraph says, "The capability to provide resource assurance and service differentiation so that delay-, jitter-, or loss-sensitive applications can perform satisfactorily is often referred to as quality of service (QoS). This can be achieved through relative prioritisation of resource allocation to different flows/packets in the network."

Regarding SLA, the professor mentions a very important point, "When the service provider builds a single converged network to deliver multiple services and applications, it is crucial to provide secure and assured service delivery for every service/application, as per the requirement of the service/application and the criticality of the service/application to the subscriber."

Network monitoring, operation and traffic engineering

While designing a network, engineers have to design, adapt (scalability—from a few nodes to over a thousand) and be able to optimise their networks, keeping future requirements in mind. Let's focus on an IP/MPLS network. Just as rail and air traffic controllers monitor their networks by using advanced monitoring systems to avoid accidents, and use navigation systems for route optimisation, you will need a similar operations and traffic-engineering system to manage and monitor an IP/MPLS network.

Typically, on any given network, there is packet loss due to irregular flow of data, due to chatting, sharing of music files or heavy downloads. This results in excessive performance degradation or downtime of networks. As a result, there is less bandwidth left for mission-critical service applications. The network engineers must prioritise services of importance, and distribute/regulate the flow of traffic accordingly. For example, during heavy traffic periods, a voice- or video-conferencing application just cannot afford to have information packets (i.e., pieces of the conversation) lost, or even delayed, as the voice and video clarity and continuity will suffer. Such information packets should be given priority

Dr Girish Saraph, associate professor in Electrical Engineering, IIT Bombay

"Broadband will soon be a major driver, and to build converged NGN (Next Generation Network) infrastructure, what is needed are services that can be easily integrated with existing infrastructure."

over simple file downloads. On this, Dr Saraph says, "The goal of traffic engineering in packet networks is to improve the network performance by providing support for congestion management, higher bandwidth utilisation (or throughput), and QoS- or priority-based services."

He adds, "It is essential to keep a tab on the traffic and network conditions, whereby networks are monitored on an online, real-time basis, as well as analysed on an off-line basis to perform failure analysis and simulation. These help in identifying and overcoming bottlenecks through traffic engineering software and path definitions."

Trends

- Video-on-demand and bandwidth-on-demand services
- In carrier technology, IP/MPLS technology has gained general acceptance as the chosen technology for convergence.
- Bundled VoIP, video telephony, and wireless access services
- Bundled services for digital home network access, including broadband Internet, voice and video telephony, digital TV or HDTV

When queried on the path identification process, the professor replies, "Suppose you are travelling from one city to another on a typical expressway, and if the roads are congested, then there should be an alternative to help you reach your destination from point A to point B in the minimum time frame. We have technology that helps you do that in communication networks, and have received a US patent for it." With a detailed study of networks—both existing and new ones—it helps the network engineers to stack up on capacity planning for new service rollouts and footprint enhancement, thereby ensuring effective and optimal use of network resources. This, in short, is the essence of network monitoring and traffic engineering.

The key areas to focus on when building a multi-play infrastructure are:

1. Quality of Service
2. Security
3. Integration and performance with multiple services/applications delivery, simultaneously.

CAPEX, OPEX—the case for ROI

Having multiple networks for varied applications and services has been the norm earlier (in the enterprise scenario), as they take care of specific tasks quite efficiently. Managing them, however, takes a lot of investment in manpower and technical resources. Additionally, one has to uphold multiple SLAs (service level agreements), provide QoS support (QoS parameters must include: delay, jitter, packet loss, throughput, etc), and above all, maintain security.

In most cases, the traditional way has been building a network for a particular application: the examples of which are the TDM (time-division multiplexing) infrastructure for the delivery of voice services to subscribers, and IP networks for the delivery of Internet Services. It has been proved that the IP/MPLS architecture brings down the operating expenditure (OPEX) and capital expenditure (CAPEX) quite significantly. This is one aspect that concerns everyone in the field—from operators and service providers, right down to the end users (subscribers). Dr Saraph says, "The more efficient way is to build a single converged network that can deliver multiple services/applications. This will reduce the CAPEX for building the network, since the service provider avoids building multiple networks. Also, the OPEX is drastically reduced, since there is only one network to manage and maintain. In addition, more next-gen services can be rolled out, enhancing the ROI further." Thus, effective operations yield more satisfied customers, lower operating and capital expenditures, and ensure a higher return on investment.

Getting everything on a single network is fine, but won't there be any compromise in security? Viruses, worms or DOS attacks can bring the entire system down. Dr Saraph advises, "There are various levels of security involved; first and foremost, it is important to build the security fabric into the infrastructure from an early stage, instead of building an overlay security infrastructure." In simple terms, the crux of MPLS technology is in building virtual tunnels or pathways for specific traffic within the shared network. These tunnels are opaque and impenetrable to the rest of the traffic, thus providing the necessary security. For example, when an enterprise uses MPLS-VPN through a shared carrier network, it is equivalent to having its own private network. Packets from outside cannot enter into the enterprise VPN, nor can public hosts or nodes on the Internet sniff information travelling over the VPN.

Key trends, developments and analyses

As we focus on building NGNs and optimising them on MPLS, it is crucial to ensure that the infrastructure is capable of rolling out new services without any major revamp, since sooner or later we will encounter varied access infrastructure in a single service provider environment—these could be FTTH (Fibre to the Home), DSL (Digital Subscriber Line), Wi-Fi, Metro Ethernet, 3G and beyond, WiMax, etc. On this, Dr Saraph points out, "To improve the viability and profitability of any service, the service provider has to ensure that the service is available universally, with no restriction on what access media the end subscriber uses to connect to the network."

So, if you want to future-proof your network, the expert is right here: http://www.ee.iitb.ac.in/~comlab/faculty.htm

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