EVOLVING CARRIER ETHERNET

towards managed services and cloud computing

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Carrier Ethernet presents both challenges and opportunities that to service providers in the context of services delivered to enterprise customers and home users, says Nigel Stephenson. Here, he examines how the reduced 'cost per bit' Carrier Ethernet services can be complemented with 'value per bit' managed services to deliver new, higher margin and more sustainable business models. He also tracks the evolution of new services such as Cloud Computing and 'X-as-a-Service' (XaaS).

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A SHORT HISTORY OF CARRIER ETHERNET

Carrier Ethernet represents a tremendous opportunity for service providers to deliver the bandwidth and connectivity scalability that enterprises need, with a reduced operational cost when compared to (multiple) legacy Wide Area Network (WAN) services. Advances such as Global Interconnect driven by the Metro Ethernet Forum expand the reach of Ethernet services well beyond the original metro environment.

Carrier Ethernet represents a large market. In recent years, Carrier Ethernet has been widely adopted, responding to a diverse demand: business services, broadband aggregation, wireless backhaul, Next Generation Network (NGN) deployments, etc. According to telecoms market watchers, US enterprises and consumers alone are expected to spend more than $27 billion over the next five years on Ethernet services provided by carriers. The market is growing at around 25% per year to 2014 - a rare double digit growth spike in a telecoms market. Some researchers believe that the economic downturn will give the technology a boost as it is less expensive to deploy than alternative legacy equipment such as Time Division Multiplex (TDM) and as a consequence, is currently growing faster than overall telecommunications capital expenditure.

The early implementations of Carrier Ethernet by service providers around the world were led by business services and the demand to lower the cost of high speed data connections – a 'cost per bit' driver. With almost 98% of the data traffic across the WAN originated and terminated on Ethernet ports, an Ethernet optimised transport network is seen as offering both cost savings and simplification by replacing costly customer premise equipment with more basic Ethernet switches and routers.

Initially Metro Ethernet Networks were deployed as parallel infrastructures, completely separated from the existing networks and dedicated exclusively to provide a simple enterprise data service. Carrier Ethernet networks were based on enterprise switches relying on Spanning Tree protocols and simple Virtual Local Area Network domains.

Today, the industry has realised the importance of Ethernet to the service provider's success. As broadband was getting more popular, the bandwidth requirements were growing exponentially and digital subscriber line access

As markets become saturated, the challenge for providers is to differentiate their offering.

multiplexor (DSLAM) vendors introduced high-speed Ethernet uplinks (or 'backhaul') to reduce the cost of the infrastructure – the cost per bit. The result was that Ethernet was gradually deployed to every service providers' central office, extending availability of Ethernet for business users.

The architecture has evolved from dedicated Ethernet infrastructure to converged metro networks with full carrier grade attributes. Scalable Carrier Ethernet Multi-Protocol Label Switching (MPLS) platforms were introduced to provide layer 2 and layer 3 services including Internet Protocol-Virtual Private Networks (IP- VPNs) and a full range of Metro Ethernet Forum services.

Although not a topic for these pages, it's worth noting that, with the growth in wireless data services, Ethernet is again being asked to solve the backhaul component. Existing attributes such as scalability, huge bandwidth and availability are insufficient however and Carrier Ethernet is now expected to provide Clock Synchronization and stronger operations and management techniques to effectively replace TDM in the mobile backhaul marketplace.

DARK CLOUDS AHEAD?

Although Carrier Ethernet is an exciting new service capability with an enthusiastic end user audience, wide area Ethernet services have the potential to be the providers' own worst enemy. Let's be honest here, most end users see Ethernet services as low cost, high bandwidth connectivity that simplifies their business and reduces operational expense. Most service provider propositions do little to alter this perception. Little room then for the service provider to differentiate, leaving the spectre of commoditisation standing uncomfortably close; ready to sweep up another great new concept and deposit it in the land of competition on price and margin erosion.

The commodity curve

If we want to avoid falling into the commodity trap, it helps to understand product life-cycles and how commoditisation comes about.

Figure 1 shows a simplified service life-cycle in terms of the service revenue, cost and operational margin. The service provider will initially make an investment to establish a service ahead of taking the service to market and starting to generate income. This is shown on the margin curve as a negative margin at point of service release.

As the service is released and customers are acquired, the service enters the market adoption phase. In this phase, the market is undersaturated and successful services will have a good customer appetite that results in a rapid service and revenue growth and healthy price points. As a result, margins are healthy and return on investment is good. During this period the provider can sustain a successful business with limited, if any, differentiation.

DIFFERENTIATING SERVICES

After a period of initial market growth, the customer base will start to become saturated and the service enters a new phase. The challenge for the provider in a saturated market is to differentiate the service offer such that it can win market share from competitive providers rather than simply find new customers to connect. Thus customer acquisition costs become much higher and impact margins. Equally, other providers will be trying to win over existing customers and so customer retention starts to become an issue.

All of this puts pressure on the provider to differentiate the service and, all too often in services with little fundamental differentiation built-in, or where the provider's brand is insufficiently strong, the initial result is falling prices. Unless the underlying cost model has somehow changed, this directly impacts on service margins.

In response to this, the provider can look to inject new features to the service to 'prop up' the underlying offer value. These new features may come at a cost and so may have their own margin pressure. Equally, a poorly differentiated feature will itself become a micro-commodity and the value it initially brought will fade, perhaps resulting in yet another new feature being added and so the cycle repeats. This pattern of small and frequent feature upgrade may help

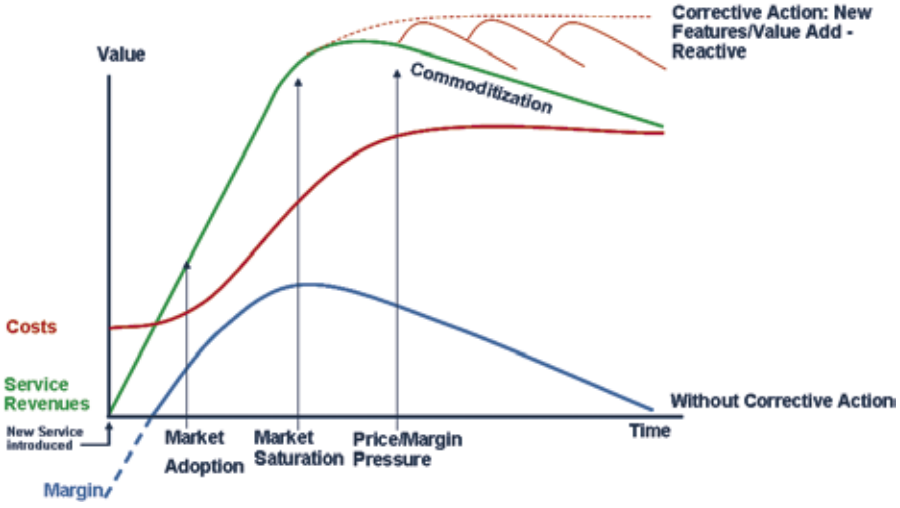

***Figure 1**: Operators need to avoid the commodity curve*

maintain margin and price points but the added expense of the constantly changing service definition, management, tariff, etc. will absorb additional margin and so the service will never re-gain the original margins it achieved at first release.

A good example of the above pattern is seen in the mobile sector. Initially customers paid high tariffs for mobile services. As the market became saturated, providers started to differentiate with pricing bundles – flat rate fees, bundled voice minutes, text messaging packages. In effect, the service entered a price war. To help differentiate and maintain revenues, new services were conceived starting with ring tone downloads, then additional data services such as news alerts, sports updates, music video downloads – all suffering the 'micro commodity' effect. (And incidentally triggering a shift to data-based packet backbones and more recently mobile data backhaul networks based on Carrier Ethernet!)

Ensuring long term profitability

In order to avoid this commodity trap, the service must have a strong value proposition at day-1 and built-in flexibility to allow innovation and change with minimal cost implications in the longer term, so that the service provider can maintain differentiation beyond the point of market saturation.

In the context of Carrier Ethernet, we must understand its role in the overall marketplace and how it can support key market trends. One such trend is Managed Services and within this area the concept of cloud computing. Understanding how carrier Ethernet can play a role in enhancing the cloud computing proposition is therefore key to the longer term success of the platform.

A CLOUD WITH A SILVER LINING

Cloud computing could well revolutionise the way applications are developed and delivered to end users, from consumer to large enterprise. Interestingly, it could also become a significant, addressable opportunity for service providers who regard this whole development as an opportunity and not a threat. A number of recent announcements from service providers such as Verizon also prove that this market, although early in its cycle, is here and is real.

In essence, the surge of interest in cloud-based services, such as Software as a Service (SaaS)as shown in Figure 2, presents the opportunity for the service provider to capture a share of the adjacent software market revenue streams by establishing and locating these applications in the cloud and proactively supporting and managing the user-to-application transactions. Given that the enterprise employee

> "A pool of highly scalable, abstracted infrastructure, capable of hosting end-customer applications, that is billed by consumption."

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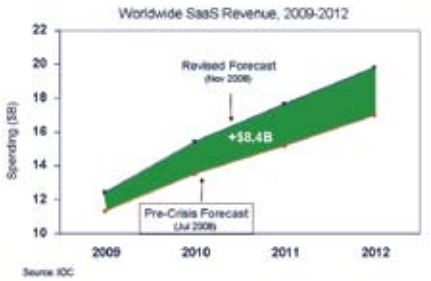

***Figure 2**: SaaS market grows as economies suffer*

software licence market is estimated to be more than twice the managed network services market, this represents an attractive and lucrative new revenue stream to the provider.

The question becomes 'how to tap into the software licence revenue stream through cloud computing?' The answer comes from ensuring that the very essence of the cloud, the service provider infrastructure, provides embedded and perceived value to the services delivered by it. In offering a perceived value the service provider has the potential to command incremental revenue streams from upstream customers (the application providers) and downstream customers (the application consumers).

A CHANGE IN THINKING

To do this, we need to change our traditional thinking about what managed network services offer. Traditionally we think of services that connect people and offices, often for a fixed fee, and are invisible to a large part of the enterprise community that uses them. The service definition and Service Level Agreement (SLA) will probably be based on availability, throughput, time to respond and so on. There is no obvious or visible link between the service provider brand and the business applications running over their services. Individuals relate to the application vendors they access through the services and the performance of these applications, not the underlying network infrastructure that delivers them. Indeed, the managed service is probably only thought about when a problem occurs or when performance is slow, and then often unfairly.

From the service provider perspective, a key point is that cloud computing is more than the application, more than the data centre, more than

the network: it should be viewed as a comprehensive experience-oriented managed service offer to consumers and enterprises of any size, based on market need and opportunity. That places the service provider in a potentially extremely advantageous position and could lead to cloud computing becoming a major, positive business inflection point for those providers that choose to view this development proactively.

Cloud-based services therefore present two avenues for the service provider to explore:

- Connectivity services delivering the applications to the consumers of the applications.
- Intelligent services that interact with the application and consumer to affect the experience of that application delivery.

Connectivity alone will remain a 'cost per bit' strategy. That is to say, the pricing is largely based on a fixed-fee model and there is little differentiation, so increasing price pressure and the need to minimise the cost per bit sent across the network. Maximising scale is the only way to ensure profitability in a cost per bit model. Indeed, if we look at fixed rate tariffs in the mobile industry we see a resulting increase in traffic (a cost to the mobile operator) that is 'disconnected' from the revenues the operator is attracting. The increased traffic is associated with alternate revenues going to alternate content providers.

Adding intelligence to the way bits are delivered that has a positive impact in the user experience, is a 'value per bit' strategy; one where the value added over and above the simple transport of the data is seen and desired by the consumer and by any upstream content or application provider. A 'value per bit' strategy develops a differentiation in the market place and sustains a more profitable business models.

This then becomes a more transactional landscape where the downstream revenue will likely contain a fixed fee for the service access (connectivity) but the incremental downstream and upstream revenue may be transactional, based on the ability to deliver a quality of experience at the time of use.

Carrier Ethernet is well positioned to leverage both a 'cost per bit' and 'value per bit' strategy. Its inherently lower operational cost and increased scalability has already led to 'cost per bit' service propositions. As a major and growing component of the service provider's Internet Protocol (IP) infrastructure, Carrier Ethernet deployments are well placed to adopt a leading role in the delivery intelligent 'value per bit' services and hence provide a significant opportunity for the future development of cloud services.

BEHIND EVERY CLOUD LIES AN INTELLIGENT NETWORK

The development of Internet-based offerings, such as the over-the-top (OTT) delivery of applications to end customers, has led some to suggest that the only role for service providers in this scenario is that of a simple bit pipe provider, providing raw capacity to content players and users alike and adding little else in terms of any added value. The reality will be that there will be different models at play that service different parts of the customer base but, interestingly, the service providers are the only players in the end-to-end value chain that can ultimately shape the overall end user experience. That experience is based on knowledge of who the application consumers are, where they are, what device they are using, what access to bandwidth they have, what bandwidth is required for the application and what security posture they/it requires. When combined with the ability to treat this whole environment as a transactional business at scale, the unique role of the service provider becomes clear.

This experience shaping takes on extra significance as cloud computing develops, from a predominantly consumer-based OTT offer to a mainstream business-critical service offering with demanding SLAs as a pre-requisite.

A number of studies from various industry watchers and analysts have repeated common themes when asking enterprise customers their opinions on the business appeal of cloud computing. The positive perceptions typically revolve around reduced cost, speed of deployment and 'pay for what you use'. The top three concerns typically focus on security, performance and availability. Whilst it is true that many may well be thinking of application security, performance and availability when asked the question, it is clear that when any application is delivered remotely, its security, performance and availability has to be considered end-to-end from the point of ingress to that of usage. This is why the ability that service providers have to shape experience, puts them right at the top table in terms of unique value-add to the delivery of cloud computing.

Delivering this experience requires a policy and control layer as shown in Figure 3 within the network that allows the applications to have linkage to the underlying infrastructure. Using existing technologies such as Web 2.0, SOAP, SOA, DIAMETER[1] and so on, a policy and control layer can be established that will interact with applications, not only embedded within the service providers own 'Walled Garden' of services, but also with third party applications and partners in an 'Open Garden' model. It is the ability to add value to the Open Garden applications that is key to the scalability

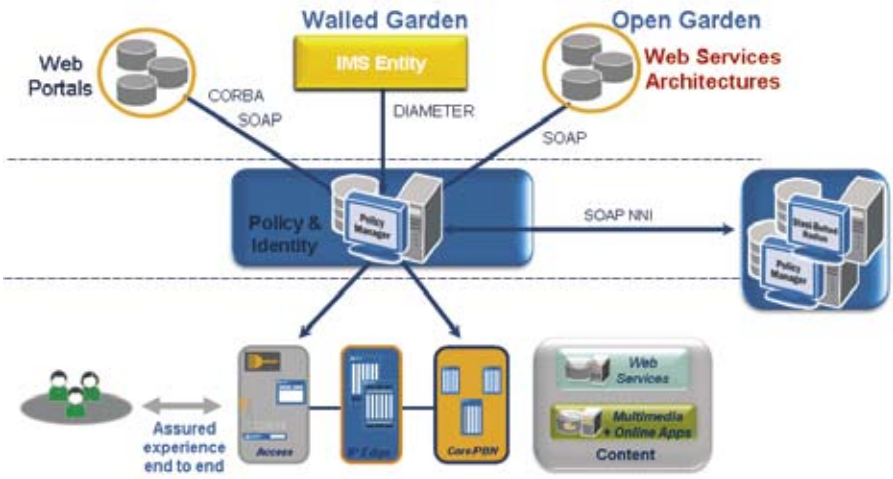

***Figure 3**: Normalised policy and control*

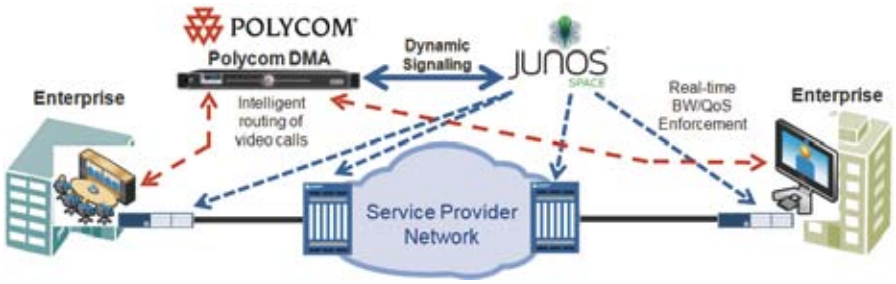

***Figure 4**: Junos Space delivers a 'Network API' to third party applications*

of delivering the application consumer experience and hence the ability to leverage that value in the form of revenue share from upstream customers.

A specific example of applying intelligence within the network to deliver a user experience around a business application can be seen in the alliance announced in January 2010 between Juniper Networks and Polycom, Inc. focused on improving the reliability, cost-effectiveness and quality of the customer experience for tele-presence and video conferencing services. The exploding interest in visual communication has created an urgent need for a more reliable and cost-effective model for delivering assured quality video services. Leveraging Junos Space, an open platform for ecosystem partners, Juniper and Polycom are creating a unique solution that will enable carriers to maximise the value of their existing networks to deliver scalable, high quality video services. This will help carriers to move away from siloed networks toward more intelligent and efficient converged networks that are more sustainable and profitable in the long-term.

Junos Space shown in Figure 4, which is packaged as a real or virtual appliance within the network, provides a 'Network Application Programming Interface (API)' to, in this case, the Polycom Distributed Media Application (DMA) video control platform. As the Polycom environment is called upon to deliver video services to the users, the network infrastructure interacts through Junos Space to ensure the correct levels of service are available, appropriate routing is taken and if necessary access control can be applied when a minimum level of service cannot be provided.

By working within the larger landscape of cloud computing as a key service platform for the delivery of applications with an attached level of experience for the application consumer, policy and control embedded within Carrier Ethernet deployments will ensure they are well-positioned as markets saturate and the need to differentiate at the service level increases. This will result in a greater ability to maintain end user price points and attract upstream revenue shares from content and application owners

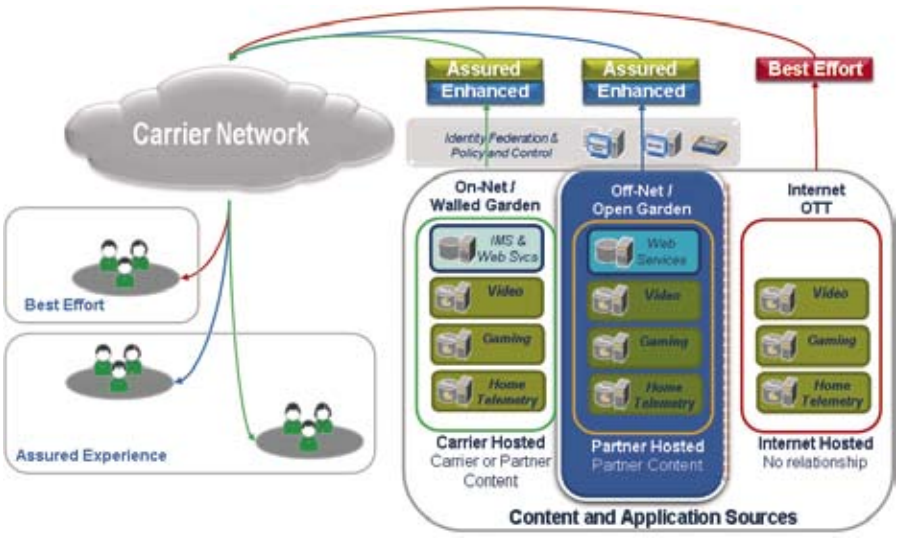

***Figure 5**: Content relationships and network value*

It seems that there will be three business models at play (as illustrated in Figure 5) within the cloud computing space that will impact the sustainability of the delivery platform:

1. The continued delivery of OTT Internet-based services, that are simply carried without any real value-add by the service provider, will increase downward price pressure and commoditisation.
2. A "Walled Garden" model where the provider owns the complete application infrastructure and network delivery. This may be more suited to 'Infrastructure as a service' opportunities where the service provider is responsible for the application delivery hardware, data centre and network and 'rents' that capacity to third party software houses / application delivery organisations or enterprises themselves.
3. An 'Open Garden' model based on customer demand, where the service provider partners with an 'off-net' cloud content / application owner to enhance the experience of delivery to customers. This model may be most applicable to services such as 'software as a service' or 'platform as a service' where the service provider does not have the business desire or skill to become involved in the intricacies of the application, but can play a key part in delivering application-level SLAs as part of a Focusing on the open and walled garden business models, the potentially dynamic nature of cloud-based services and the concept of flexible demand and delivery may well trigger a key architectural transition in network design and thinking – the move from a predominantly static IP NGN to a much more dynamic and agile environment. In this scenario, resources will be demanded at scale from the network at an application level and the network has to not only deliver on those demands and meet end-to-end application-level SLAs but also deliver the ability to transact for those occurrences at the desired scale.

in return for a better experience by the service provider's and application providers' now joint customers.

CLOUD BUSINESS MODELS

So what does all this mean to the continued development Carrier Ethernet as a flexible platform for innovative new managed service deployments?

Cloud computing could revolutionise the way applications are developed and delivered to end customers. Carrier Ethernet has a leading role as the delivery platform for these services but it must rise above the current service definitions and value propositions to offer more than simple connectivity to its users. Such simple propositions will be successful in the short term but, as the market saturates, it will be those who have developed the built-in flexibility to manipulate the service experience of the user who will be able to maintain the greatest value, command the upstream and downstream revenues and retain customers.

AUTHOR'S CONCLUSIONS

Carrier Ethernet is a tremendous short and long term opportunity if the provider looks to implement infrastructures with a view to the future - in particular, ensuring that the built-in flexibility, policy and control mechanisms exist in order to maintain competitive differentiation at a point of market saturation.

Cloud computing offers a managed service opportunity for the service provider that could take the application-infrastructure-consumer supply chain relationship to a new level. It could generate common end customers (and resulting upstream revenue shares) with the content and application providers that is by-passed in the OTT model currently.

While there are technical implementation challenges to the expansion of Carrier Ethernet services to incorporate the potential of cloud computing, such as the policy and control systems and interfacing to adjacent access technologies such as for mobile users, there are some interesting organisational aspects that need to be addressed. In a world of cloud computing and micro service SLAs, the responsibility for the service definition, deployment and operation spans multiple organisations within the provider that are currently autonomous. The providers who best manage the organisational as well as the technical challenges of cloud computing will best capitalise on this exciting managed service opportunity.

ABBREVIATIONS

API	Application Programming Interface
DMA	Distributed Media Application
IP	Internet Protocol
LAN	Local Area Network
NGN	Next Generation Network
OTT	Over-The-Top
SaaS	Software-as-a-Service
SLA	Service Level Agreement
TDM	Time Division Multiplexing
WAN	Wide Area Network
XaaS	X-as-a-Service

FOOTNOTES

[1] SOAP: Simple Object Access Protocol (XML protocol), SOA: Service-Oriented Architecture. DIAMETER is a new framework in the Internet engineering task force for the next-generation authentication, authorization and accounting management server.

ABOUT THE AUTHOR

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