NEXT GENERATION DATA CENTRES

HOW DYNAMIC NETWORKS ARE CREATING A MORE RESPONSIVE, EFFICIENT AND COST-EFFECTIVE DATA CENTRE MODEL

Software Defined Networking and Network Function Virtualisation are redefining the data centre fabric. Sooner or later, every enterprise will adopt a next generation data centre network because it offers a more efficient way to match IT with business needs. But what are the challenges? And what's the best way forward?

Next Generation Data Centre Networks with Software Defined Networking and Network Function Virtualisation.

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THE MOVE TO NEXT GENERATION DATA CENTRE NETWORKS

OVERVIEW

Digital disruption is causing unprecedented challenges for enterprise and government IT departments. On one hand, they are virtualising data centres, moving to cloud infrastructure and mining big data. On the other, they need to improve workload portability and the performance of distributed applications while maintaining the security of business data. On top of this, there is the need to reduce costs, align legacy IT with business objectives and deliver new digital revenue streams.

This paper highlights the current challenges with data centre environments. It elaborates on common problems, and provides a set of tactical and strategic solutions to help guide the choice of next generation data centre network architecture and design.

ABOUT THE AUTHOR

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MARKET DRIVERS

> **Emphasis on business objectives** is driving network evolution and spending. Must be able to have **applications/ business** led engagements.
>
> Understanding the Australian NFV Buyer report, Ovum, 2015.

The following are key trends that are driving the shift to next generation data centre architectures in Australia.

- Distillation of Web 2.0 company technology within the market, ie network service programmability
- Business expansion, mergers and acquisitions
- Speed requirements of product/service development and time to market
- Workforce productivity and business improvement demands from the business
- Bundled or integrated 'all in one' offerings simplifying management
- Integration of cloud services and Software-as-a-Service offerings
- Generational change within data centre switching
- New wave of automation and orchestration toolsets.

LEGACY ARCHITECTURE CHALLENGES

With increasing pressure on enterprises and governments, it's becoming obvious that legacy architectures don't deliver the performance and agility that's needed today due to:

Management complexity
Individually managed devices such as routers, switches, firewalls and load balancers that are configured separately work in strained harmony with virtualised application servers.

High operational overheads
Owing to the complexity of many intricate system components, performing basic and advanced tasks tie up too many resources for too long. Changes to a data centre environment are often error prone leading to costly downtime. Maintaining appropriate skilled IT staff is also expensive.

Security vulnerabilities
Cyber-threats are constantly increasing. At the same time, maintaining security for more dispersed and mobile operations is creating additional complexity and load on network equipment.

Impaired visibility
The current network is highly distributed. It's difficult to monitor network health, troubleshoot problems and locate them, and manage capacity.

Lack of agility/scalability
Existing, aging data centre network architectures are static and rigid. Since each device in the network is configured independently to work together, on-boarding new services and applications often requires lengthy re-engineering of the network components.

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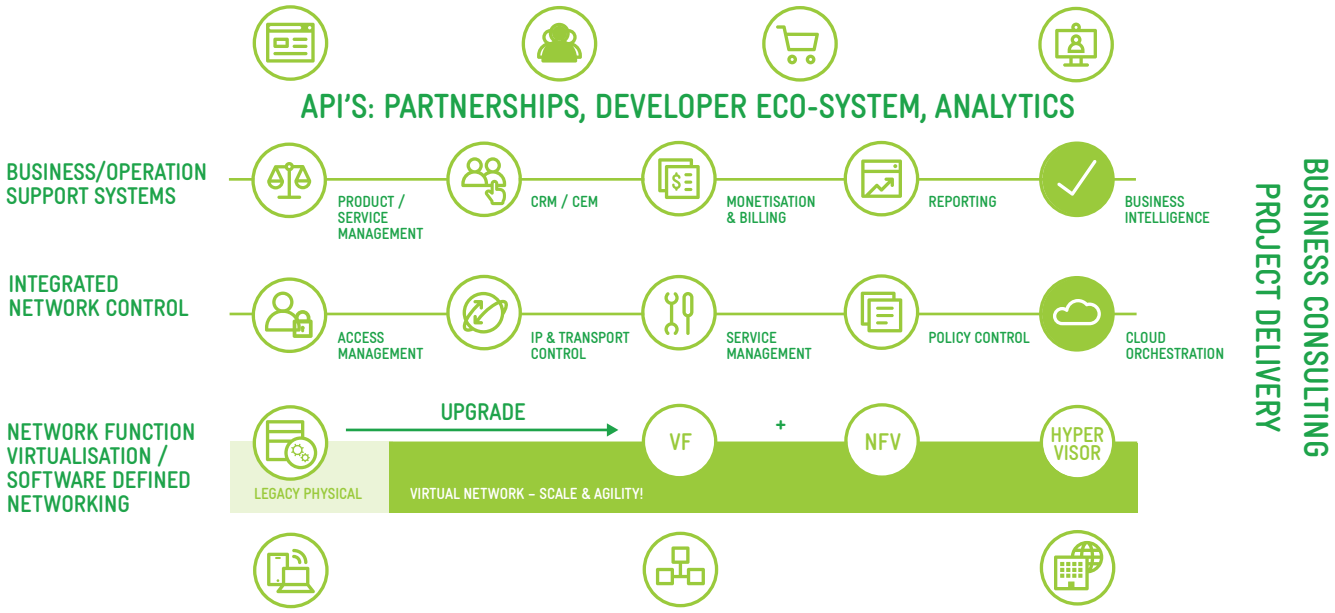

The on-premise data centre is no longer the single dependency for hosting and delivering business applications. Organisations are leveraging the cloud to augment their data centre to deliver applications. This requires seamless integration between the data centre and cloud service providers which through the use of orchestration and automation enables the business more time to deliver true business intelligence. SDN and NFV in the data centre can abstract legacy dependencies on hardware enabling this integration with the cloud to provide scalability and agility.

Next generation data centres offer significant technical and organisational benefits for business:

- **Secure:** Enhanced security through programmability and granular traffic management
- **Productive:** Improved automation and orchestration using common APIs to abstract the underlying network
- **Flexible:** Offer networking/security capabilities required by applications in a timely manner
- **Available:** Consistency and reliability through centralised, automated management and policy
- **Standardised:** Common programming environments integrate applications and networks for improved customisation, application performance and maximum operational efficiency
- **Cost-effective:** Simpler, centralised management of the data centre network with cloud integration to reduce operational costs.

While the terms SDN and NFV have been circling the industry for quite a while now, there is still value in exploring their meaning.

Software Defined Networking (SDN)

To borrow a definition from SDX Central, Software Defined Networking separates the network control (brains) and forwarding (muscle) roles. It offers the promise of building and centrally directing your IT application traffic flows according to programmable business logic and security policies. This contrasts with the error prone and brittle manual engineering approach of the past.

Network Function Virtualisation (NFV)

Network Function Virtualisation complements SDN by moving away from a hardware centric view of network engineering. Virtualised appliances can be flexibly wedged into traffic flows to selectively provide security, traffic routing and visibility functions.

SDN alleviates the quality, complexity, elasticity and labour intensive issues by taking automation and standardisation processes to the next level. Architecture and operations people can focus on delivering application services rather than the mechanics of provisioning VLANs and route policies.

The focus effectively moves away from covering every technical use case with complicated infrastructure tiering. Organisations can holistically consider the infrastructure as just one pillar of the service management, automation and tooling functions that tie service request portals to configuration templates to service instantiation and enrolment. This means business services can be implemented more consistently, reliably and quickly after submitting the change request.

UNDERSTANDING THE MODERN SDN FABRIC

There are three main layers of an SDN fabric within the data centre. The hardware in the infrastructure layer is abstracted by the control and application layers. The control layer is responsible for the programming of the network and is where NFV can be leveraged for additional network services. The application layer interfaces with the control layer providing business intelligence to the network. Communication between the layers is enabled by APIs.

Within the umbrella of SDN and NFV features, there have been some architectural shifts within data centre design. The following table outlines some the key design elements of a modern SDN fabric:

Design Feature	Result
Underlay network	Avoiding sprawling Layer 2 VLANs reduces many reliability issues with Layer 2 switching mechanisms, and greatly reduces failure domains to deterministic and resilient Layer 3 routing. Equal Cost Multi-Path (ECMP) routing also provides higher bandwidth capacity than the old approach of redundant paths that were shutdown to avoid traffic loops.
Overlay networking	VXLAN (Virtual Extension LAN) and NVGRE (Network Virtualization using Generic Routing Encapsulation) are the standards-based secret sauce that supports agility within the data centre. These encapsulations effectively tunnel traffic from one host to another so they appear to be neighbours in the same Layer 2 sub network.
Service Insertion	Overlay networking can also be leveraged as a powerful tool to dynamically insert services such as security or load balancing between users, application servers and infrastructure services driven by applications and business logic. This is much easier than the traditional requirement to design complicated and brittle physical and logical topologies to follow a service policy.
Microsegmentation	Micro-segmentation divides the data centre into smaller, more-protected zones. Service insertion then allows security services such as an application firewall or IPS to be provisioned at the perimeter, between application tiers and even between devices within tiers.
Leaf & Spine physical topology (infrastructure)	Rather than a traditional 3 tier hierarchy of switch blocks, a Leaf & Spine network topology is introduced to deal with the increase in east-west traffic, server virtualisation, high performance computing and distributed computing in the data centre. The leaf nodes are commonly used as Top of Rack (ToR) switches that connect to servers, and the Spine switches provide low latency and redundant high bandwidth connectivity to the leaves. This simplified topology provides greater bandwidth, deterministic performance and allows the network to scale in a predicable manner.
Data Centre Interconnect (DCI)	'Familiar to most infrastructure personnel are the perennial issues that legacy networks struggle with, such as bridging multiple sites as a unified resource pool to allow workload portability, i.e. moving a virtual server without worrying about breaking IP addressing. Integrating Networks for a multi data centre architecture.
Automation & Orchestration	Agility and flexibility in the data centre is enhanced through automation that can better support the dynamic nature of services hosted in the environment.
Programmability	Programmability of the network is leveraged through north and southbound APIs to communicate with network infrastructure or management and automation platforms.

MAPPING THE BEST WAY FORWARD

As we have seen, enterprises are renewing their focus on data centre network architectures. With good reason. Traditional architectures aren't suited for today's enterprises, carriers, and end users. They're complicated and costly to build and operate. They lack security and visibility. Most notably, they are not agile and scalable enough to meet modern business requirements.

PREPARE FOR THESE MIGRATION CHALLENGES

Migrating to a new data centre architecture with SDN and NFV introduces some unexpected new challenges initially. Key factors that businesses should consider when migrating are:

Paradigm shift in skill sets

'Network management is moving away from engineers logging into arcane command line interfaces and entering instructions manually. Configurations are being abstracted and management is enabled via APIs and direct service management integrations. Network engineers will need to evolve into cloud engineers with programming skills and in-depth knowledge of the entire application stack.

Multiple data centre complexity

Careful consideration is required when designing data centres with SDN/NFV across multiple geographic locations. Various vendor solutions will have different requirements for building Data Centre Interconnects (DCI) which may involve new technologies such as MP-BGP EVPN and VXLAN.

Application profiling

With a next generation architecture, the network is abstracted and policy is derived based on application elements. In effect, the data centre is centred around the application. Therefore, a deep understanding of end-to-end service delays, breakdown of traffic volume per application, as well as dependency maps of critical traffic flows between hosts of all applications should be discovered and documented. A visual perspective of objects used in application policy in the next generation data centre is illustrated below:

Integration with legacy networks

SDN abstracts the hardware in the network which provides many benefits. However, it introduces new complexities with Layer 3 routing and Layer 2 forwarding when integrating with legacy networks such as another compute pod, MPLS WAN or internet connection.

Operational models

SDN in the next generation data centre is the perfect toolset for DevOps with its unified vision and control of the network. Although not required, there is significant business benefit in moving to a DevOps organisational structure. This eliminates the traditional silos of server, storage and networking in favour of cloud centric, cross-functional teams. This transformation will be challenging, take time, and impact the way networks are built and managed.

KEY STEPS FOR SUCCESSFUL SDN INITIATIVES

Preparation

- Precisely monitor and document application dependencies, traffic flows and performance characteristics
- Establish mature common infrastructure (IPAM, DNS etc)
- Perform a macro analysis of the people/processes/technology touchpoints in the organisation to plan ahead for the shift in service delivery.

Design

- Prepare a requirements driven design that includes service management
- Utilise a 'Flat' network topology in the style of IaaS cloud service providers, stitching network services 'just in time' when needed
- Assign subject matter experts outside of networking to define validation testing before and after migration changes that can be automated.

Execution

- Clear nomination and empowerment of decision makers
- Maintain resourcing continuity
- Ensure change management freedoms for installation phase, including multiple weekly windows for migration.

HOW TELSTRA CAN HELP

The critical first step in moving to a next generation data centre network is to understand the current state of your network, and its ability to meet future meet demands.

We can help you analyse various vendor SDN and NFV products and recommend the appropriate solution based on your requirements. A next generation data centre environment can be piloted to assist your organisation with this new technology while maintaining connectivity to your existing environment.

Arrange a time to talk with a Telstra expert on how to design, build, deploy and integrate an SDN fabric based on your requirements.

FOR MORE INFORMATION

If you have any questions please contact your Telstra account executive

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