white paper

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Data Centre Networking

Architecting Server Side Networks

The ongoing drive for organisations to be more efficient in their business operations, and at the same time, flexible in addressing the needs of their stakeholders to maximise business opportunities, is forcing IT systems to evolve. This evolution is evident through mass consolidation of infrastructure, virtualisation of business systems and explosive growth of data volumes needing to be stored and transmitted over the network. These considerations need to be balanced against the ever growing requirements of a highly mobile and tech-savvy worksforce. These changes and transitions are leading organisations down the path towards fundamentally different computing models with an increasingly sophisticated underlying infrastructure to enable it.

The data centre is a focal point for much of this change. Specifically, the network that underpins and supports the data centre is critical to the success of data centre evolution and the move towards cloud computing models, yet it is often overlooked. The network connects users to applications, servers to servers, servers to storage and data centres to one another and is a cornerstone of any IT environment. Evolved and virtualised data centres fundamentally challenge traditional networks and how they are built. Networks must be architected differently to deliver higher levels of performance, scalability, and availability to meet the demands of modern business operations. Beyond ever increasing performance, these data centre networks must fully support and enable virtualisation and offer fault tolerant recovery to protect against server, storage, network, and application vulnerabilities to ensure continued performance and minimise service disruptions.

A host of technology innovations have emerged to assist in enabling the network to support the data centre. These, together with new approaches to network architecture, need to be considered by organisations who are embarking on data centre modernisation projects, or who are considering utilising some form of cloud computing. This paper reviews some of the important elements of network innovation and architecture to ensure that the network continues to be a business enabler in modern data centre environments.

What is a data centre network?

A data centre network is the network infrastructure (networking devices, solutions and architectures) deployed into an organisation's data centre, and includes ethernet switching, storage networking, application delivery and acceleration, IP services and address management and any associated network-level security.

Three network tiers, or two, or perhaps just one?

Traditional networks comprise three tiers (access, aggregation and core) and the majority of organisations' networks have been built in line with this principle. These designs were approapriate for traditional network traffic patterns, however, the introduction of virtualisation, automation and orchestration technologies has resulted in a significant increase in server to server and server to storage network traffic (east-west traffic). East-west traffic currently accounts for up to 75% of traffic running across a data centre network, much of it very sensitive to latency and poor performance. The more simple the network architecture is and the fewer tiers it comprises, the more efficiently it will cope with the increasing amounts of east-west traffic.

In addition, there are choices to be made between 'top-of-rack' (ToR) and 'end-of-row' (EoR) network switching architectures. ToR architectures mean that switches are deployed into the top of each rack of the data centre, or specific section of data centre, while EoR switching architectures call for larger switches deployed at the end of each data centre row. ToR allows for far fewer long cable runs as servers are cabled inside the rack while EoR allows for fewer switches to be deployed. Both have their place and should be considered as part of the desired network architecture.

But we need two networks, don't we?

The majority of data centres have two completely separate networks, one based on Ethernet for server connectivity and another based on Fibre Channel for storage connectivity. These networks require a their own set of network appliances and separate sest of cables. This significantly increases the amount of infrastructure that needs to be invested in and supported.

Ethernet has continued to evolve to deliver the required performance in the data centre with 10GigE now being widely deployed, and the 40GigE and 100GigE standards being ratified. In addition to the higher speeds, Ethernet has also evolved to enable storage traffic to run across it. The combination of higher speeds and the ability to run storage traffic allows for the concept of a converged and unified data centre network. This unified network fabric enables a much more simplified network architecture to be deployed and lowers operational costs that makes it an attractive option for many organisations.

The **ongoing drive** for organisations to be **more efficient** in their business operations, and at the same time, **flexible** in addressing the needs of their stakeholders to **maximise business opportunities**, is forcing IT systems to evolve.

Networks that support virtualisation

Virtualisation technology is being adopted across the entire IT environment and the virtual machine (VM) has emerged as the new compute building block. Server virtualisation has a dramatic affect on the network:

- Having multiple VMs on each physical server increases server utilisation rates which in turn significantly increases the amount of traffic flowing to the network
- Applications running on VMs are mobile and can move from one physical server to another on-demand or when a fault is detected. To allow for this migration, virtualised systems need flat Layer 2 networks, where all the involved servers share a single broadcast domain and IP subnet
- Additional VMs can be provisioned very quickly when the application needs more computing resources. The network and associated network services cannot be so quickly provisioned
- The network edge traditionally stops at the physical server network interface card, which means that the network does not have visibility of traffic flowing to and from the different VMs. This means that the network port and its associated security policy cannot be applied to a specific VM and therefore cannot move with that server during a VM migration

To resolve this requires extending the network edge into the hypervisor of the virtualised server. This ensures that the network has complete visibility of VM network traffic and that security and other network policy (quality of service, acceleration, etc) can be applied directly to VM traffic. This also allows end to end network management to be consolidated for improved management. The result is a network that supports each VM in the same way that is does a physical server.

Other considerations

There are several additional considerations that need to form part of an architecture discussion:

- **Data centre interconnect** – having robust Layer 3 and Layer 2 connectivity between multiple data centres is important for continuity and for enabling long distance VM migrations
- **Spanning tree** – data centres require large Layer 2 networks, potentially across multiple different physical data centre facilities, and overcoming the limitations that the spanning tree protocol introduces, is an important consideration

Conclusion

The business and IT worlds are changing and driving the evolution of data centres and computing models, and the network, which is the foundation of the data centre, is a critical enabler of this evolution. There have been many innovations in networking technology and network architectures in recent years and organisations should consider working with partners who have significant depth of network and data centre knowledge to assist them to navigate their way forward. The result should be a solid data centre network platform in the data centre which will allow for the successful modernisation of data centres and the move to private and public cloud computing models.

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