FROM A RIGID ECOSYSTEM TO A LOGICAL AND FLEXIBLE ENTITY: THE SOFTWARE-DEFINED DATA CENTRE

The demand for cloud infrastructure is rapidly increasing, the world of information is becoming application and software-driven, whilst existing data centres architecture is not flexible enough to support it. Adoption of Technologies such as Software-Defined Networking (SDN), Network Functions Virtualisation (NFV), Software-Defined Storage (SDS) and Cloud Automation will help evolve the Data Centre into a cloud based, dynamic, future-proof and self-sustained environment that can scale up and down to address all present and future needs.

INTRODUCTION

Cloud is currently one of the biggest trends. With the Information Technology (IT) world becoming application-driven (and thus data-driven as well), the future is heading towards a centralised infrastructure, where all the new technologies, as well as the massive amount of data that is being produced all over the world, will be hosted and processed into the Cloud. New content is generated every day by billions of devices. Despite the fact that the last decade has seen a rapid evolution of the concept of data centre and an exponential growth of cloud computing, a point has been reached where traditional architectures cannot scale fast or efficiently enough to cope with the overwhelming demand.

So far, server virtualization has helped in transforming once strictly physical resources into more flexible and dynamic virtual resources that can be spawned, destroyed, cloned and moved relatively easily. This is not sufficient anymore, as these resources, together with network and storage, are still managed in a very static and not holistic way.

Since it is clear that data centres will be one of the key enablers to the future of data and application, the way they are designed, built and operated has to substantially change and evolve.

EVOLUTION OF THE DATA CENTRE ARCHITECTURE

THE TRADITIONAL DATA CENTRE. The current data centre architecture is still designed following a siloed approach, where elements of the infrastructure (compute, storage and network) are still thought, deployed and managed as separately living entities. These silos are usually managed by separate teams of engineers, who often do not communicate or coordinate their activities well, whilst using either minimum or very cumbersome automation and with a very diverse set of tools, usually chosen based on personal preference.
A traditional Data Centre architecture example is illustrated below, in Figure 1..

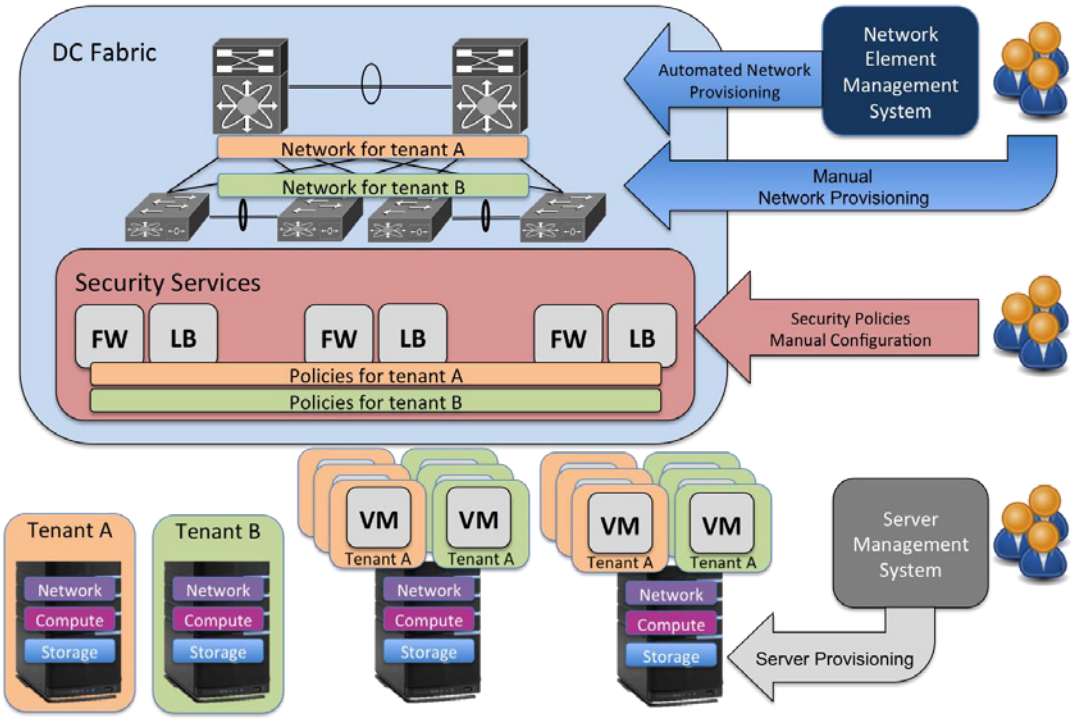

Figure 1: Traditional Data Centre

Starting from compute resources, these are usually managed in different ways depending on whether they are physical, virtual, or a mix of the two. Server operations teams usually utilise some preferred tools and methods to manage the lifecycle of servers and virtual hosts, and these often do not relate well with other components or processes.
The same holds true for storage resources that are usually offered by very static storage area networks (SAN). Here, hard drive arrays are treated as discrete entities, often with different data allocation models depending on storage type, file system and manufacturer.

Finally, the network infrastructure still remains the epicentre for most of the shortcomings in traditional data centre designs. Data centre fabrics are usually very rigid, with very little options for programmability and difficult upgrade paths.

The most common scenario is a static infrastructure, based on closed vendor-verticalised hardware and software stacks that are very much tied to a pre-determined lifecycle. There is insufficient visibility of the network, which makes it impossible to monitor performance indicators and work on optimisation, particularly in medium-large deployments. Part of the challenge is also achieving seamless integration between physical and virtual networking, in deployments involving the use of virtualisation. This is something that, especially with the advent of NFV, has now become mission-critical and is not achievable with traditional networking principles.

Furthermore, multi-tenant scenarios are becoming more and more common in the cloud environment, and the legacy methods of managing tenant and network segmentation, which are used in most data centre environments, neither provide the programmability, nor the scalability that is mandatory for ensuring an efficient infrastructure. Policies have to be defined manually in purely-physical firewall appliances, which often result in being over-provisioned, inconsistently configured and complex to upgrade.

All the above issues make the DC a very stale and rigid ecosystem, where any operation is feared, be it migration, upgrade or scaling, because of the unreasonable amount of time, cost and effort that it takes. Each time a customer issues a new service request, which may require changes or upgrades on some part of the infrastructure, the different teams start conflicting between each other, compatibility issues arise and requests take long time to process. As a result, each process follows a very slow and inefficient path, which hinders business development.

THE SOFTWARE DEFINED DATA CENTRE. In the future data centre, all compute, storage and network resources will be treated as comprehensive pools, from where all applications, belonging to different tenants, will be able to reserve these resources according to a certain set of overall policies defined on the topmost layer, the orchestration layer.
An example of the evolved Software-Defined Data Centre is illustrated in Figure 2.

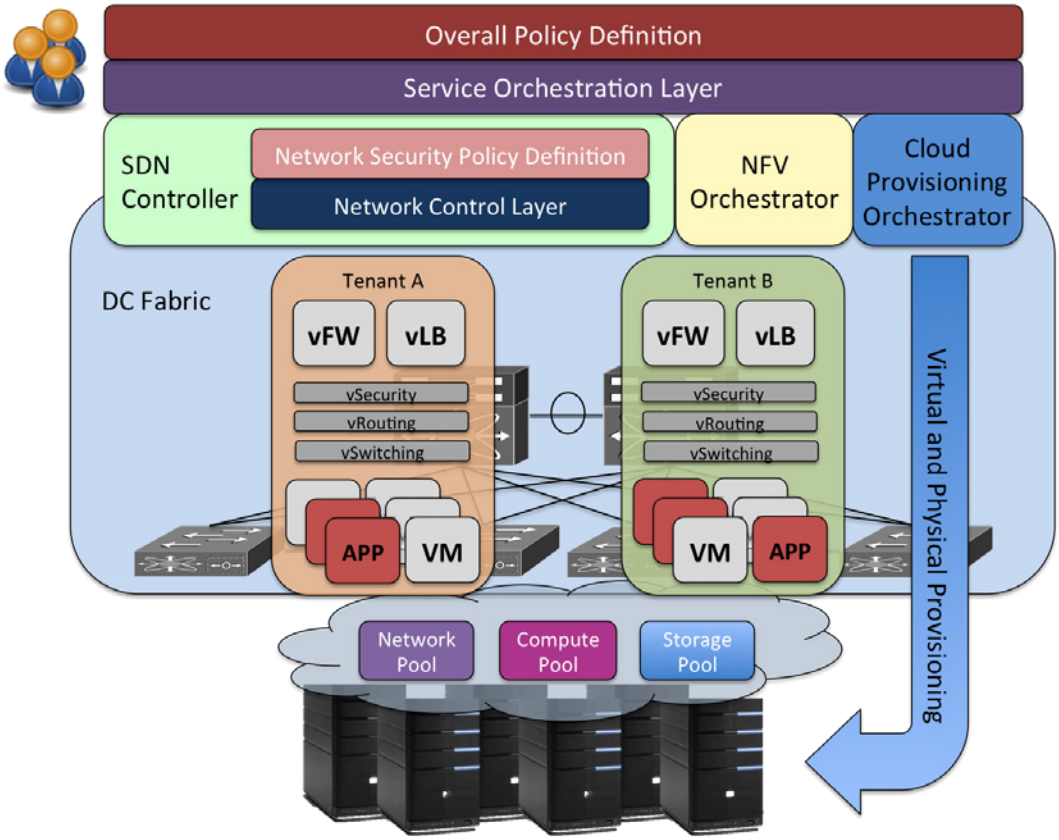

Figure 2: Software-Defined Data Centre

Compute resources, either physical servers (also called "bare-metal") or virtual machines, will be seen, provisioned and managed in a harmonised way, with seamless lifecycle management and from a single logical point, using unified cloud automation tools. Also, the concept of data centre as a physical monolithic entity located in a single facility has to evolve into a more logical design. The Software-Defined Data Centre will be a logical and flexible entity with potentially very diverse deployments spreading over multiple physical points. The physical location of compute resources should not really matter; an organisation should be able to run workloads on their cloud data centre without having to deal with the management of multi-site connectivity, but rather utilising it as a service through clearly defined policy-based service abstractions.

The same will happen with storage resources. The concept and technologies of Software-

Defined Storage (SDS) allows for multiple and diverse storage back ends to be used together in the same common pool. This will allow for all the collective storage to be available through software abstractions, removing the need for specific approaches based on different types and brands of storage supports.

Ultimately, the network will follow a completely new paradigm, where the principles of Software-Defined Networking (SDN) and Network Functions Virtualization (NFV) will transform it into a fully programmable, logically centralised and fully visible fabric. The whole data centre infrastructure will be seen in a holistic way, with layers of abstraction that will translate service requests originating from the Service Orchestration Layer (or even further up, depending on the type of applications that will run on top of it, such as a Telco-over-Cloud infrastructure). Also the overall policies will be defined, all the way down to the physical forwarding nodes in the network, utilising hierarchies of controllers and orchestrators to harmonise the whole ecosystem.

SDN aims to separate the network control from the low-level forwarding operations, making it logically centralised, thus allowing for various degrees of abstraction. Through the SDN Controller, all network appliances will be programmed using standard-based interfaces, regardless of the vendor. This will allow to add, replace and remove network devices from the fabric without affecting the service and without changing the operational model. As a consequence, the lifecycle of these simplified and standardised network devices will follow the DevOps paradigm, and will be managed with the same operational model as the compute resources. This will mean treating network devices, such as fabric switches, in the same manner as standard high volume servers, and provisioning them through the same Cloud Automation and provisioning tools. Another key component will be the optimisation of network functions like routers, firewalls, load balancers and many more, by turning them from physical, dedicated boxes into virtual appliances using NFV concepts and software. This will, by integrating these virtual network appliances into the SDN logic, allow for rapid, flexible policy definition and near-instantaneous scaling of all network services in the data centre.

Multi-tenant environments will be managed together in a harmonised way, with the use of software-defined security policies and micro-segmentation. This will allow to rapidly and dynamically change zoning policies between the different tenants with minimum operational effort and 100% consistency across all areas of the data centre.

BENEFITS & OPPORTUNITIES

Organisations, by evolving their Data Centres and adopting emerging technologies, can realise a number of benefits and opportunities, whilst future-proofing their environments:

- **Noticeably lower CapEx**, achieved through simpler network hardware, purchased through the same supply chain as the compute and storage, and more cost-efficient management of software licenses.
- **Significantly lower OpEx**, achieved by automating most of the provisioning, configuration and lifecycle management processes and operations. The number of human operators required to manage an increasingly large number of resources will be much lower, by relieving the operators from tedious, repetitive configurations that can be abstracted via software.
- **New revenue stream opportunities**, offered by the possibility to translate into business offerings every aspect of the data centre management. Everything will be able to be provided "as-a-Service" to third party customers: Network-as-a-Service (NaaS), Security-as-a-Service (Sec-aaS), Platform and Infrastructure (PaaS, IaaS), as well as much more.
- **Unprecedented flexibility**, as a benefit of the full network, compute and storage programmability offered by the software-defined paradigm. The infrastructure will be able to be transformed and adapted with near-instant timescales, to satisfy constantly changing customer needs and workloads.
- **Faster service and application deployment**, offered by fully abstracted and automated service catalogues, pre-defined with policies, SLAs and service templates that will be able to provide a self-service model for tenants.
- **Future-proof infrastructure**, by following a DevOps lifecycle for all data centre resources end-to-end, continuous upgrade paths will be a natural part of standard data centre operations, allowing the infrastructure to scale-up and upgrade easily and painlessly.
- **Complete view over the network**, which will enable closely monitoring KPIs down to the application-flow level. This will make network troubleshooting and traffic engineering much faster, allowing to make the network much more efficient.

CONCLUSIONS

The Software-Defined Data Centre (SDDC) is a strong use-case for SDN, alongside with other emerging technologies and concepts. Software-Defined Networking, by seamlessly connecting and managing all network devices, will provide the "glue" to turn a rigid network infrastructure (both physical and virtual) into an efficient and flexible fabric that can dynamically transform to provide seamless connectivity between compute and storage resources.

Here, applications, containers and virtual appliances will run on a potentially physically heterogeneous, but logically strongly unified platform called the Future Cloud, or

Technology Centre, for which the concept of Software-Defined Data Centre will be the underlying principle.

SYTEL REPLY'S OFFERING

Through its distinct competencies, Sytel Reply assists clients in realising the benefits and dealing with the impacts of the disrupting technologies on their environments. Sytel Reply leverages real-world experience in SDN & NFV consulting for the TMT market, having worked with global Telco providers and established strong relationships with all major SDN vendors.

Through active collaboration with various vendors and, by forming partnerships with educational institutions, as well as performing internal research & development, Sytel Reply creates and supports innovative projects around new technologies, such as SDN & NFV.
Some of the more detailed offerings in the area of SDN & NFV include, but are not limited to, the following:

- SDN/NFV Requirements Definition
- Solutions Evaluation (including RoI, TCO)
- Architecture Design and Technical Consulting
- Security Assessments
- Proof of Concepts (PoCs) Design, Plan and Testing

Sytel Reply builds upon this knowledge and partners with its clients to define their strategy and identify the trajectory they should follow towards adopting these disruptive technologies, for future proofing their environments and their investments. Sytel Reply builds on the basis of understanding the customer requirements and selecting the optimal solution towards programmability, service agility, automation and openness in their networks, in a vendor agnostic way.

REPLY
SYTEL

Sytel Reply is part of Reply, a leading Consulting, Systems Integration and Digital Services company specialising in the design and implementation of solutions, based on new communication channels and digital media. Sytel Reply UK is the company of the Reply group that is specialised in the Telecommunication, Media and Technology (TM&T) markets in the UK and Ireland.

Sytel Reply, thanks to its in-depth competence and experience, boasts a team of highly skilled professionals with a mission to support clients in managing technology and business disruptions, which they are facing during business transformation and technology innovation programmes.

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