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The Mindful IT Company
Born **Digital** . Born **Agile**

Network Virtualization

Happiest People . Happiest Customers

Contents

Introduction

Network operators' networks comprises of wide variety of hardware appliances. In a big and globally distributed network; the network would comprise of multi-vendor equipment and variety of proprietary services offered by the vendor.

Any change and/or extension in the existing network would involve cost and effort at multiple folds as below:

- Cost of hardware
- Cost of energy
- Skill
- Physical space for the placement of devices

With the pace of invent of new technologies and current market demands it becomes necessary to upgrade the existing network hardware at regular interval which includes replacement of the devices as well. On top of it there is no direct revenue benefit of the new hardware purchases.

In the current age of fast changing and internet connected world there is need for new ways of network services which should be cost effective, frequent change prone, easy to configure and manageable.

Scope

This document has been produced to provide the information to explain the philosophy of network virtualization and services being offered by different vendors as per current market trends. The documentation is written as a reference guide for all the concerned people from Happiest Minds.

Purpose

The purpose of this document is to provide an overview of the network virtualization services that can be offered and the current market offerings.

Executive Summary

Virtualization technique is highly accepted and has a proven history of implementation in case of servers and other infrastructure domain. When it comes to network virtualization, it is basically the virtualization of different network resources. It is defining a dummy hardware piece on top of a physical box that can work independently and provide its services independently. It is achieved by separating the control and data plane of the logically defined resource from that of the physical resource.

There is a related term to Network Virtualization which is SDN (Software Defined Networking). Since SDN is out of scope so I would only give a brief of the relationship between SDN and Network Virtualization.
The relationship is that Network virtualization provides infrastructure on top of which the SDN runs. However both are independent with each other.

Network virtualization can be implemented in below areas but not limited to:

- Switching elements include Broadband Network Gate, routers and Carrier Grade Network Address Translation.
- Mobile network nodes consist of HLR/HSS, MME, GGSN/PDN-GW, Node B, eNode B,RNC SGSN.
- Functions in set top boxes and home routers create virtualization in home environments.
- Tunnelling gateway elements such as IPsec/SSL VPN gateways.
- Traffic analysis in DPI, QoE measurement.
- Service Assurance, service level agreement monitoring, Test and Diagnostics.
- NGN signalling: SBCs, IMS.
- Converged and network-wide functions for authentication authorization accounting servers, charging platforms and policy control.
- Application-level optimization for load balancers, appli cation accelerators, content delivery network and cache servers.
- Security functions in firewalls, virus scanners, intrusion detection systems, spam protection.

Benefits of Network Functions Virtualization

- Reduced equipment costs and reduced power consumption
- Better scalability
- Running multiple environments on the same infrastruture.
- Geographical independence
- Multi-tenancy
- Improved operational efficiency by taking advantage of the higher uniformity of the physical network platform.

Current market trends

Network virtualization is offered by several equipment and software vendors through:

- Network hardware like switches and network adapt ers. These are also known as network interface cards (NICs)
- Network components like Load balancers, Firewalls, Virtual LANs (VLANs) and containers such as virtual machines (VMs)
- Storage equipments
- M2M elements such as telecommunications 4G HLR and SLR devices
- Mobile elements (End users devices/equipments like smart phones)
- Ethernet and Fibre Channel media

Operators that can benefit from virtualization could be:

- Mobile/fixed network operators
- Network as a service providers
- Virtual mobile/fixed network operator
- Virtual wholesalers
- Exchange brokers
- Resellers
- Virtual network providers
- Resource providers

Network virtualization services comparison

There are 2 types of network virtualization services:

External network virtualization: In this type of service more than one local networks are used and broken down into virtual networks. Intent is to improve the performance, optimize and increase the efficiency of corporate data center network. Prime components of an external virtual network in a corporate data center are VLANs and Switch-es.By implementing VLAN and switch technology, system administrators can easily manage and configure systems physically attached to the same local network into different virtual networks. On the contrary, VLAN technology empowers the system administrators to merge the systems on separate local networks into a VLAN on both sides of the segments of a large corporate network or datacenter.

Internal network virtualization: As the name suggests in internal virtualization service, a single network system is configured using network containers like Xen domain and this is pooled with hypervisor control programs like VNIC. This helps in creating "consolidated network boxes". In this type of virtualization service there is improved efficiency of a single system that is achieved by separating the applications to detached containers.

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Network Virtualization of WAN

Create multiple virtual network "channels" on the same physical network.

Creating virtual channels and passing on each of these individual channels to individual applications. This enables organizations to make certain that every critical application can be flawlessly transferred across the network to ensure that new technology rollouts are not causing any worsening of existing business services .

Merge networks for better performance, bandwidth and management.

Merging several ISPs connections together.

Benefit of WAN virtualization:

Optimum network utilization and high availability: Prime benefit of network virtualization is optimization of network utilization. This is achieved by sharing of physical connectivity by multiple virtual networks, ensuring higher network utilization. Besides this, high availability is the benefit which is achieved by making supporting clusters appear as one device from a network management and topology perspective. This further helps to simplify the WAN architecture and allied WAN management complexity.

Improved Visibility:

Using DCI and WAN virtualization,the data center network appears as dedicated adjoining channels. This is very crucial from policy, security and performance management perspectives. This empowers network managers with the capability of tracing a VLAN from server-to-LAN-to-WAN–to-end user while correlating core physical infrastructure for troubleshooting and capacity planning. This can radically improve mean-time-to-isolate and tackle network performance and security issues.

Benefit of WAN virtualization:

Convergence:Adopting network virtualization helps decrease the number of physical devices followed by reducing operations and improving ease of management.

Improved Security:Virtualization security comprises of three prime aspects: Access control, Path seclusion, and services edge management. Access control means implementing authentication and authorization across the enterprise data center. An example to this can be in the form of a Cisco TACACS+ or a RADIUS server that supports in determining the entity that may access a particular VLAN. Path seclusion happens through MPLS, GRE and Virtual Routing and Forwarding (VRF) to segregate one stream of data from another over the WAN. Lastly, services edge management is used to segregate the application environments and control the interface to storage and computing. These functions are used to extend the contiguous security across the WAN in a convenient manner.

Planning or upgrades required for network virtualization:

- Robust deployment planning
- Bandwidth considerations
- Security considerations while creating multiple virtual networks.
- Upgrade considerations either to 1 or 10 Gigabit Ethernet.
- Switching requirements for virtualization environment.
- CPU and memory considerations of switches/routers to handle the additional workloads in certain scenarios
- Mitigating SPOF or single points of failure and taking remedial action to ensure high availability.
- Need for virtualization friendly management tools that can manage end to end virtual networks

Need for virtualization friendly management tools that can manage end to end virtual networks

To virtualize an enterprise network, basic functional blocks of the modular enterprise must be enhanced to provide the following functionalities:

- Authentication and Authorization must be dynamically done for various user groups.
- Connectivity isolation to promise privacy within the groups.
- Form precise and handy ingress and egress points at the boundary of each Virtual network.
- Impose autonomous security policies on each group at the network boundary
- Centralization of boundary security policies must be enforced on diverse Virtual networks by allowing:
  - Secured collaboration mechanisms within groups
  - Secured sharing of common resources
- Offer fundamental networking services to shared/dedicated groups.
- Offer autonomous routing domains and address spaces to each group

These functional areas provide a framework for the virtualization of networks:

- Transport virtualization
- Edge authorization
- Central services access (VN perimeter)

Virtualization Scope

Support for multi-tenancy has become a core requirement of data centres. Three key requirements needed to support multi-tenancy are:

- Isolating traffic, to ensure that tenant's traffic is not visible to any other tenant
- Address independence to ensure that one addressing scheme does not smash together with other tenant's addressing schemes.
- Supporting the placement and migration of VMs within the data center by overcoming traditional DC network constraints like IP subnet boundaries etc.
- Rapid provisioning of virtual networks
- End to end management of virtual networks that is free of the underlying physical network
- Overcome limitations of physical networks, including VLAN limitations, by creating isolated and overlapping address spaces
- Distributed architecture provides scalability, resiliency and avoids single points of failure
- Works with already configured networks infrastructure and with any existing hardware
- Connect virtual networks with physical networks using VTEP/L2 bridging
- Virtual Switching –distributed on each compute node
- Virtual Routing –distributed on each compute node, provide dynamic routing between virtual and physical networks
- MidoNet API –To integrate with any Cloud Management platform, and to program networks
- Virtual Load Balancer –Provides load balancer as a service
- Virtual Firewall –Provides firewall as a service
- VXLAN and GRE -Support for popular encapsulation protocols like VXLAN and GRE
- Layer 2 Gateway –bridges MidoNet logical networks with physical VLAN enabled networks, offers VLAN tagging and translation
- Layer 3 Gateway-¬-Distributed gateway to connect external networks using eBGP

Our Services

WAN Virtualization

- Global Load Balancers – Provides the edge to manage the traffic intelligently and has seamless fall back provisions
- WAN Accelerators – To optimize WAN link utilization and enhance the application response time
- VRF Aware Protocols – Helps in managing WAN and overcomes there-usage limitation of IP address spaces. It also provides the extra security and helps in implementing VRF based solutions like VPN
- GRE, DMVPN and MPLS services – MPLS, MGRE and GRE based solution helps in segmenting the traffic and allow multiple sharing of a single band width by different business units.

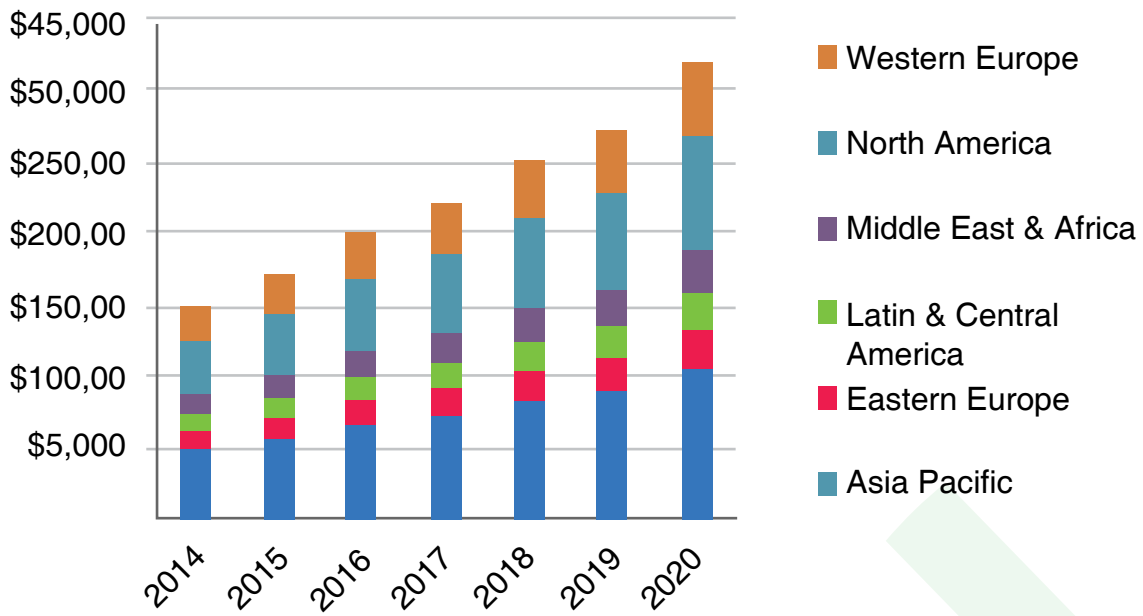
LAN Virtualization

- Access control to recognize and classify legitimate users & devices and authorize them to enter assigned portions of the network
- Path isolation to map validated users or devices to the correct set of available resources. The VLANs, Private VLANS, GRE, VRF Lite and MPLS VPN are some of our techniques used for LAN Virtualization
- Services edge to provide access to services for a legitimate set of user and devices by using central ized policy enforcement.

Sub-Areas

- Switching and Routing
- Security
- Multi-Tenancy
- High Availability
- L2-L4 network services
- L2-L3 Gateway service

Current and future market trend



SDN & NFV Induced Service Provider CapEx Saving Potential by Region: 2014-2050 ($ Million)

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About the Author

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11 years of IT experience, including 3 years in Data center planning and implementation and 2 years in wireless planning and implementation. He has worked in multivendor environment including Cisco, Aruba, HP, Nortel, F5, Watchguard, Fortigate and others. He has also worked in Open source technologies and providing solutions based upon them. Key past project includes: Data center planning for one of the client at Malaysia having multiple sites geographically distributed across the globe, NOC planning and new project implementation for Standard Chartered bank, Wireless implementation for Aruba Networks Inc.

About Happiest Minds

Happiest Minds, the Mindful IT Company, applies agile methodologies to enable digital transformation for enterprises and technology providers by delivering seamless customer experience, business efficiency and actionable insights. We leverage a spectrum of disruptive technologies such as: Big Data Analytics, AI & Cognitive Computing, Internet of Things, Cloud, Security, SDN-NFV, RPA, Blockchain, etc. Positioned as "Born Digital . Born Agile", our capabilities spans across product engineering, digital business solutions, infrastructure management and security services. We deliver these services across industry sectors such as retail, consumer packaged goods, edutech, e-commerce, banking, insurance, hi-tech, engineering R&D, manufacturing, automotive and travel/transportation/hospitality.

Headquartered in Bangalore, India; Happiest Minds has operations in USA, UK, The Netherlands, Australia and Middle East.

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