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Software Defined Environments

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Agenda

- Introduction
- New Requirements to Data Center Management
- SDE Concepts
- SDE Components & Technologies
- Implications on Organizations and Resources
- Summary
Some Terms ...

- Software Defined Data Center – SDDC
- Software Defined Environments – SDE
- Software Defined Network – SDN
- Software Defined Storage – SDS
- Software Defined Compute – SDC
- Software Defined Security – SDS
- ??? Software Defined Everything ????
Trends and Observations

• Rigidity of traditional IT environments and organizational boundaries are a significant impediment to rapid development and deployment of applications and services.

• Workload and application requirements are becoming more diverse, more dynamic, and less predictable driving the need for a more flexible and adaptable infrastructure.

• Abstraction and virtualization allows the resource within the IT infrastructure to become “programmable” which enables advanced automation and optimization.

• The value offered by decoupling a virtual infrastructure from hardware is being realized across all elements of the infrastructure including servers, storage and networks.
Examples of Digital Ideas of an Airport …

**Customer Centricity**

- **The Digital Traveller**
  - One App for Real-time Flight Schedules, Car Hires, Hotel bookings, Get indoor Map across all airports

**Operational Excellence**

- **Streamlined Security**
  - without unpacking and undressing, one security model x airports

- **100% Automated Border Control**
  - Pull out only dangerous people based on contextual analytics such as (automated baggage check, eye scan, behavioral analytics)

**Innovation**

- **The “Cool” Airport Experience**
  - e.g. Know how long the check in lasts with Queue Estimator App

- **360° Informed Passenger**
  - Real-time Baggage Tracker App with estimated arrival time, map view, etc.

- **The following baggage**
  - App which makes the baggage following the owner at the airport

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**Innovation Labs & Fast Prototyping**

**Design Thinking & Technology Roadmapping**

**Collaborative Airport**

- greater productivity with Airport Operational Control Centers with views for all stakeholders (airlines, immigrations, ground handler)
What are Software Defined Environments?

- **Software**
  - Software manages resources and components of an IT infrastructure instead of a human administrator
  - Software understands the unique workload requirements

- **Defined**
  - Infrastructure becomes aware of the software that runs on it.

- **Environments**
  - IT infrastructure in general that can distributed across data centers and clouds

In a software defined data center the elements of the underlying infrastructure (networking, storage, CPU) are virtualized. All resources are exposed as services with an API and well defined functionality.
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The Business Needs

- **Time to Impact**
  - The Line of Business (LoB) of an enterprise needs to bring a new offering or product as fast as possible to the market.

- **Standardization**
  - Reduction of the number of variations of the same
  - Definition of a standard and the ability to build it in factory manner

- **Transparency**
  - Knowledge on the status of the IT systems
  - Ability to introspect the IT systems

Accelerate Test and Develop – Enablement for experiment and test new services
Cost reduction – Efficiency in build-up and management of IT systems
The Technology Needs

- Description of target environment
  - Expert knowledge in machine readable format → Software Pattern
  - Points of Variability (PoV)

- Resource Abstraction Layer
  - Ability to configure the infrastructure with manual operation
  - Hiding technical details which are not relevant for the upper layers

- Translated Pattern into a physical system definition
  - PoV are defined
  - Instantiation thru automation
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The Concept of Software Defined Environments

Unified Control Plane allows rich resource abstractions to assemble purpose-fit systems and optimize across heterogeneous resources.

Control plane is separated from the hardware to the software layer.

Programmable infrastructures allow dynamic optimization to respond to business requirements.

Growing number of volatile workloads.

Workload abstractions capture functional and non-functional application requirements that can be discovered as well as specified.

Workload Characteristics (examples):
- Variability in user consumption
- Variability in resource consumption
- Storage optimized
- Compute optimized
- Network Bandwidth optimized
- Level of HA/DR
- Context of service
- Other aggregated services

Source: IBM Global Technology Outlook 2013
Software Defined Environments – Component Overview

Service Definition

Pattern Life Cycle Management
- Pattern Design
- Pattern Transition
- Pattern Operation

Workload Deployment & Management
- Resource Management (Storage, Compute, Network, Image)
- Placement & Brokerage

Service Transition and Operation

Service Management

Infrastructure Management

Virtualized Infrastructure
- Virtual Compute Management
  - x86
  - Power
  - System z
- Virtual Storage Management
  - Block Storage
  - File Storage
  - Object Storage
- Virtual Networking Management
  - vmware
  - Juniper
- Image Management
  - CISCO
  - Image Repository
- Image Repository
Software Defined Environments – Component Overview

- **Pattern Life Cycle Management**
  - Pattern Design
  - Pattern Transition
  - Pattern Operation

- **Workload Deployment & Management**
  - Placement & Brokerage
  - Service Management
    - Compute, Network, Image
  - Chef

- **Virtualized Infrastructure**
  - Virtual Compute Management
    - x86
    - Power
    - System z
    - SUN
    - Microsoft Hyper-V
  - Virtual Storage Management
    - Block Storage
    - File Storage
    - Object Storage
  - Virtual Networking Management
  - Service Management
    - vmware
    - Juniper
    - CISCO
  - Image Management
    - Image Repository

- **Service Definition**
- **Service Transition and Operation**
- **Infrastructure Management**
Software Defined Environments – Implementation Examples

- **TOSCA** is an open standard that enables the interoperable description of application and infrastructure cloud services, the relationships between parts of the service, and the operational behavior of these services.
- **CHEF** is an Open Source configuration management tool capable to model IT infrastructure and automate application delivery.
- **OSLC** is an Open Specification to facilitate and standardize data sharing among software products.
- **OpenStack** is an industry standard approach to control layer programmability. It’s a Cloud Operating System.
- **Open Daylight** is an open source software project to build a Software-Defined Networking platform.
- **Openflow** is an open standard protocol that support SDN by enabling the capability to separate the high level routing decisions (control path) from the fast packet forwarding (data path) functions of a switch.
SDE with Openstack

OpenStack Shared Services
(Componentized Software to manage the Infrastructure)

Source: openstack.org
Software Defined Network

Traditional switch and router vendors being disrupted by the emerging SDN.
Software Defined Network – vmware NSX

**NSX Manager:**
The NSX Manager is the centralized network management component of NSX, and is installed as a virtual appliance on any ESX™ host in your vCenter Server environment. It provides an aggregated system view.

**NSX v Switch:**
NSX vSwitch is the software that operates in server hypervisors to form a software abstraction layer between servers and the physical network.

**NSX Controller:**
NSX controller is the central control point for all logical switches within a network and maintains information of all virtual machines, hosts, logical switches, and VXLANs.

**NSX Edge:**
NSX Edge provides network edge security and gateway services to isolate a virtualized network. You can install an NSX Edge either as a logical (distributed) router or as a services gateway.

Source: vmware
The NSX logical switch creates logical broadcast domains or segments to which virtual machine can be logically wired.

This allows for flexibility and speed of deployment while still providing all the characteristics of a physical network's broadcast domains (VLANs) without physical Layer 2 sprawl or spanning tree issues.

A logical switch is distributed and can span arbitrarily large compute clusters. This allows for virtual machine mobility (vMotion) within the datacenter without limitations of the physical Layer 2 (VLAN) boundary.

A logical switch is mapped to a unique VXLAN, which encapsulates the virtual machine traffic and carries it over the physical IP network.
Software Defined Storage

Vertically Integrated Storage

Console Based HW Configuration

Software Defined Storage APIs

- File API
- Simple Block API
- Transactional Block API
- Key Value Store API
- Object Store API
- Auto Commit API

Storage Orchestrator, Storage Optimizer, Serverization

Storage Services
- { De-duplication, Staging, Compression, Encryption }

Storage Configuration
- { Disk Type, Bandwidth, Latency, RAID, Tier, IOPS }

Physical Storage
- SSD Array
- HDD Array
- Legacy Storage

Virtual Storage
- Virtual
- Virtual
- Virtual
- Virtual

Software Defined Environments
SDE End-to-End - Sample Use Case: Workload Instance Deployment

Potential savings of up to 50-80% of time and people resources

<table>
<thead>
<tr>
<th>No</th>
<th>Key Activity</th>
<th>Component Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Define Workload policy through HOT template</td>
<td>Workload Policy definition Tools</td>
</tr>
<tr>
<td>2</td>
<td>SDE Orchestration layer interprets policy template and derives resource patterns (includes Infrastructure patterns and service definition with NFR and SLA)</td>
<td>Orchestration and Software Deployer</td>
</tr>
<tr>
<td>3</td>
<td>Resource Pattern request analyzed and split into individual infrastructure resource type (compute, storage and network) requests</td>
<td>Workload/ Infrastructure Resources Patterns</td>
</tr>
<tr>
<td>4</td>
<td>Determine resource placement and drive provisioning requests through OpenStack APIs. Also establish the additional provisioning based on the set SLAs</td>
<td>SDE Control and management</td>
</tr>
<tr>
<td>5</td>
<td>Perform the infrastructure resource provisioning of compute, storage and network per resource pattern and SLAs</td>
<td>SDE control and management</td>
</tr>
<tr>
<td>6</td>
<td>Provisioning gets completed on the target infrastructure</td>
<td>Data Center Infrastructure</td>
</tr>
<tr>
<td>7</td>
<td>Deploy the workload</td>
<td>Workload Deployer and Data Center Infrastructure</td>
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SDE and Managed Services

Workload Abstraction

SDE Unified Control Plane

Resource Abstraction

Managed Services

Operation Management

Virtualised Infrastr. Monitoring
Capacity Mgmt & Planning
Event Mgmt
Patch Mgmt
Compliance Mgmt
Backup & Restore

Service Management and Governance

Catalog & Req Mgmt
Problem & Incident Mgmt
IT Asset Mgmt
Change & Conf Mgmt
Release Mgmt
License Mgmt

Software Defined Compute Control
Software Defined Network Control
Software Defined Storage Control

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Objective of an Operational Model is to achieve efficiency regarding the consumption of the given resources (People, Processes and Infrastructure).

Objective of a Service Provider is to apply the best operation model for specific service in a given context.

Improvement in operating model significantly reduce efforts and costs in appropriate resource consumption (processes, people and infrastructure).

Higher degree of automation in processes, infrastructure and applications do have a cost reduction impact in people and processes aligned costs.
Resource Dependencies

- Operational adjustments of one resource has impacts on the others
- Objective is to improve quality or reduce cost, or simply find the optimum of both KPIs
- Each operational adjustment requires a certain initial investment
- The operational adjustment itself should outperform the initial investment from a operational cost savings and quality improvement point of view

The challenge is to find the resource adjustment with the highest benefit on quality and cost - driven by the lowest investment
SDE as Starting Point for Operational Transformation

- People are dependent on business processes
- Business processes are dependent on infrastructure, technology and IT processes
- Because of the complexity of the tool landscapes in enterprise data center, the right decision usually is to consolidate on Infrastructure and technology resources → SDE
- Introduction of new or adapted business processes introduce a higher complexity when the Infrastructure and technology improvements has not been finalized first.
Summary

• The significance of the Software Defined Environment concept cannot be underestimated. It represents a fundamental evolutionary shift that aligns with the way enterprises now make IT decisions today.

• SDE as technology becomes more central to business strategy, new players are joining the conversation.

• Implications
  • Businesses are no longer thinking in terms of standalone IT products.
  • Today, the focus is increasingly on the outcomes that those investments enable.
  • IT and the business side are coming closer together.

• Software Defined Environment is precisely the strategy that can meet joint needs of IT and business.
  • The landscape changes so fast that no enterprise can afford to build systems for a single purpose, either from a time or a cost standpoint.
  • Responding to a new opportunity or competitive threat cannot wait for new hardware to be procured, installed and configured. It has to happen immediately.

• Software Defined Environment can enable that kind of rapid-response agility. It provides the means to enhance the business value of IT by removing the barriers that stand in the way of fast action.
Thank You

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