Software Defined Environments
Agenda

- **Introduction**
- Open Cloud Architecture based on Open Standards
- Software Defined Environment
- Cloud Orchestration in a Software Defined Environment
- Summary
Mobility, big data, analytics, social collaboration and cloud are creating a new wave of business opportunities and IT challenges.

1. **Technology factors**
2. People skills
3. Market factors
4. Macro-economic factors
5. Regulatory concerns
6. Globalization
7. Socio-economic factors
8. Environmental issues
9. Geopolitical factors

**IBM Global CEO Study**

- **Speed Value**
  - 90% view cloud as critical to their plans
- **Extended Reach**
  - 1 Billion Smartphones and 1.2 billion mobile employees by 2014
- **Responsiveness**
  - 20B+ Intelligent business assets
- **New Insights**
  - 2.7ZB of digital content in 2012, up 50% from 2011
Some Use Cases

**INSURANCE**
- LOB need for new solutions to “...get closer to their customers...”
- Address millennial generation of customers and interaction models (social, mobile)
- Enhance current Sales System with a multi-channel integration system that provides for sales (quoting) and service of all products to Agents, Call Centers and direct to Policyholders

**RETAIL**
- LOB need for new solutions to engage customers in-store and over web channels
- Address customer acquisition, customer retention, customers interaction in-store (coupons, promotions) and metrics such as average revenue per user (social, mobile, analytics)
- Enhance current retail systems with a multi-channel interaction

**GOVERNMENT & PUBLIC SECTOR**
- New solutions to engage citizens driven by Smarter Cities & Government
- Address citizen interaction with local government resources (social, mobile, analytics)
- Integrate current systems (e.g. work order management systems) with a multi-channel interaction leveraging GPS, GIS and mobile devices

**IBM Social Business**
- Making the work environment for sellers & sales managers simpler, social, more integrated, and insightful...”
- Applications that utilize CRM tools and integrates IBM Sales tools to deliver an integrated solution
- Enhanced with social network mapping and expertise location (e.g. LinkedIn)
- Integrating CRM applications with social, mobile and analytical capabilities

**MARKETING & SALES**
- LOB capabilities for short-term marketing campaigns aligned to events (e.g. sporting events)
- Dynamic engagement of customers and end-users (e.g. ASICS “Support Your Marathoner” multimedia campaign at the ING NY City marathon)
- Rapid creation of applications and integration with variable demands leveraging social, mobile, multi-media and analytical capabilities
Traditional Systems of Record are being extended via Systems of Engagement

Systems of Record
- Data & Transactions
- App Infrastructure
- Virtualized Resources

Systems of Engagement
- Expanding Interface Modes
- Big Data and Analytics
- Social Networking

Next Generation Architectures

Data & Transaction Integrity

Smarter Devices & Assets
Today’s Leaders are Leveraging Cloud to Balance Optimizing their Existing Systems with Innovation
Focus on Operational Costs

- Consolidation (solutions & infrastructure)
- Operations Automation (reduce skills & risk)
  - Move from manual policy enforcement to analytics driven enforcement & optimization

Focus on Speed and Agility

- Assemble solutions from verified software components & services
- Dev / Ops process enables fast iterative development
- Fast deployment & redeployment of infrastructure resources using Software Defined Environments

OPTIMIZATION
Reduce Cost & Minimize Risk

INNOVATION
Rapidly Add Business Value
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A layered and open cloud architecture is emerging.
The OpenStack Foundation is Open for Business

OpenStack is a global collaboration of developers & cloud computing technologists working to produce an ubiquitous Infrastructure as a Service (IaaS) open source cloud computing platform for public & private clouds.

OpenStack Compute (core)
Provision and manage large networks of virtual machines

OpenStack Object Store (core)
Create petabytes of secure, reliable storage using standard HW

OpenStack Dashboard (core)
Enables administrators and users to access & provision cloud-based resources through a self-service portal.

OpenStack Image Service (shared service)
Catalog and manage massive libraries of server images

OpenStack Identity (shared service)
Unified authentication across all OpenStack projects and integrates with existing authentication systems.

Exponential growth in participation
As of APR 2012
150 Orgs
2600 Individuals

As of JAN 2013
850 Orgs
6600+ Individuals

Code available under Apache 2.0 license. Design tenets – scale & elasticity, share nothing & distribute everything

http://openstack.org
TOSCA Standard enables

- Portability and Interoperability of Cloud Services
- Model Driven Cloud Service Management
- "Appstore" for Cloud Services
- Open Hybrid Clouds

TOSCA High Level Overview

A declarative model spanning software applications to virtual and physical infrastructure

Standardization driven with

IBM, Capgemini, Cisco, Citrix, EMC, Red Hat, and others
A language for defining Service Templates …

… including a Topology Template describing the structure of a service

TOSCA defines a packaging format (CSAR) for packaging models and all related artifacts.

… including the definition of building blocks for services

… including the definition implementation artifacts for manageability operations

… including the definition plans for orchestrating the application

Cloud Service ARchive (CSAR)
TOSCA based Ecosystem – demonstrated live

OASIS Interop

Design tools
- Vnomic Service Designer
- IBM Workload Deployer

Service marketplaces
- ISM Cloud Marketplace
- SAP HANA Marketplace

Cloud managers
- Fujitsu FlexFrame Orchestrator
- HP Cloud Services
- IBM Workload Deployer and SmartCloud
- Huawei Telco Cloud Solution
- Zenoss Cloud Monitoring

Other design tools
- IBM Workload Deployer
- SmartCloud

Other marketplaces
- SAP HANA Marketplace
- Other clouds

Other clouds optimization tools

Shown at Eurocloud/ICS 10/15 – 10/16 2013 Luxembourg
Not shown in this demo
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The Old Static View
Evolving IaaS to a More Dynamic, Analytics Based Software Defined Environment

Value
Simplified & standardized management
Agile infrastructure
Understanding & programming workloads

Capability
Embedded analytics
Workload-aware optimization
Integrated security & governance

Software Defined Environment

Value

Workload definition, Optimization, & Orchestration

Software Defined Compute
Software Defined Storage
Software Defined Networking

Resource Abstraction, Optimization & Security

Workload definition
Orchestration
Optimization

OSLCEmbedded analytics
Workload-aware optimization
Integrated security & governance

SmartCloud

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Evolving IaaS to a More Dynamic, Analytics Based Software Defined Environment

**Value**

Simplified & standardized management
Agile infrastructure
Understanding & programming workloads

**Software Defined Environment**

- Workload definition
- Orchestration
- Optimization

- Resource Abstraction, Optimization & Security
  - Software Defined Compute
  - Software Defined Storage
  - Software Defined Networking

- OSLC
- TOSCA
- Chef
- Openstack
- OpenDaylight

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How Patterns enable automation and optimization?
Example: A Hadoop Application for Transaction Fraud Detection

Varying resource requirements through the application lifecycle
Automation and Optimization with Patterns of Expertise – (I)

Develop Hadoop fraud detection app

- Write application code (fraud detection logic)
- Expertise to operate Hadoop or virtual infrastructure not required
Automation and Optimization with Patterns of Expertise – (II)

**Pick Software Pattern for Hadoop**

- Captures established best practices for running a Hadoop service
- Pick from a library or build once, use often
- Specify desired Quality of Service (QoS)

Abstracts Workload “As Code”
**Automation and Optimization with Patterns of Expertise – (III)**

*Abstracts Infrastructure “As Code”*

**Pick Infrastructure Pattern**
- Pre-defined pattern of infrastructure resources for the chosen QoS of the workload
- Defines VM, storage, network type and topology
**Automation and Optimization with Patterns of Expertise – (IV)**

**Automated orchestration & optimization**

- Optimal placement of server, storage and network resources
- Non-disruptive adjustment of resources based on workload and infrastructure events
Example for Modelling in SDE

SugarCRM two-tier deployment with scalable web tier

Building blocks for SugarCRM (TOSCA Node Types)

Single, self-contained model
Including scalable components
SugarCRM two-tier deployment with scalable web tier, and storage
Example for Network Modelling in SDE

SugarCRM two-tier deployment with scalable web tier, and networking

Building blocks for SugarCRM with networking support (TOSCA Node Types)

- SugarCRM Application
- SugarCRM Database
- Apache Webserver
- PHP Module
- MySQL
- Virtual Machine
- Load Balancer
- Network Service
- IP VLAN
- Network Area
- Firewall
Composable Patterns supporting different roles in the Eco System

Flexible selection of deployment topologies

Separation of concerns

Integration of models delivered by different providers

Supported use cases from user perspective:
- Import self-contained models from application down to infrastructure
- Deploy fully refined models
- Import componentized models with separation of application and middleware/infrastructure
- Deploy applications with variable selection of infrastructure templates based on policies
- Deploy middleware/infrastructure only patterns
- Edit or create new application or middleware/infrastructure models based on known Node- and Relationship Types
OpenStack Infrastructure Management Software
The open framework for IBM Software Defined Environments

Open Interfaces
- Industry Driven
- Open Ecosystem

Workload-Aware
Tops down; workload centric optimization

Extensible
IBM Differentiation for Performance, Availability and Security

Integrated Infrastructure
Integrated Server, Storage & Network

Heterogeneous Compute
- System x
- Power System
- System z

Open Device APIs
Vendor led drivers for server, storage and network

Workload Definition, Orchestration, & Optimization
OpenStack API++ for software defined storage, compute and network

IBM Differentiation provided via extensions and value added services
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Different levels of orchestration

Heterogeneous hybrid environments...

Resource Orchestration
Onboard, provision, manage

Workload Orchestration
Dynamic optimization

Service Orchestration
Lifecycle of cloud services
Resource- and Workload orchestration in IBM SmartCloud Orchestrator

- Interlock with workflow orchestration during deployment and application life time
- Pattern layer requests necessary infrastructure resources
- Infrastructure resources are requested from OpenStack
- Agent configures software using parts in automation library
- OpenStack
High level architecture
SmartCloud Orchestration and Provisioning

SCOrchestrator

Self Service
Offering Catalog

Modeling and Admin

ICCT Image Creation

Image Library

API

Composite Patterns Management

Hypervisor Management
OpenStack Gateway

OpenStack

Hybrid Extension

Content packages

IBM Tivoli Monitoring (ITM)

SmartCloud Cost Management (SCCM)

Automation Engine
BPM Process Server

Automation Modeling UI
IBM Business Process Manager (BPM)

API

Composite Patterns Management

Amazon EC2

VMWare vCenter

KVM

Openstack Cinder drivers for Block Storage

*) supported in following releases
A typical scenario: create a new cloud service to deploy and manage SAP

Step 1: Cloud Admin: Import or define the structural model of the Cloud Service
Step 1 cont.: Cloud Admin: Import or define the process model of the Cloud Service

- Access to rich libraries (toolkits) of reusable automation assets that enable to speed automation creation
- Palette of library assets enable easy workflow composition through drag and drop
- Tooling to edit, version, debug, optimize workflows
- Graphical editor for composing and connecting workflows
- Actions types, flow control, data handling primitives that simplify creation of complex automations
- Easy workflow action editing for managing: data mapping, error recovery options, implementation details, etc.
Step 2: Cloud Admin: Publish service in the catalogue

IBM SmartCloud Orchestrator

Service Catalog

Welcome | Service Catalog | Service Requests | Instances

Service Catalog >>

My Favorites
The service offerings which you marked with the label favorites.

Network Services
These service offerings allow you to manage network services.

Storage and Backup Services
These service offerings allow you to manage storage and backup services.

Customer Onboarding Services
These service offerings allow you to manage customer onboarding services.

Development and Test Services
These service offerings allow you to define new development and test services.

SAP Applications
These service offerings allow you to use applications on SAP.

Database Servers
These service offerings allow you to add additional database in an existing environment.

Software Installation
These service offerings allow you to install software on a server.

My Service Requests
Today | Since Yesterday | Last Week

- 3 in progress
- 5 pending
- 7 successful
- 2 failed

Recent Activity
- Server Provisioning Request (1067397)
- Storage Request (1067396)
- Network Request (1067395)
- Backup Request (1067394)
- Customer Onboard Request (1067393)
- Customer Onboard Request (1067392)
- Customer Onboard Request (1067391)
- Database Request (1067390)
- Windows 7 Server Request (1067389)
- LDAP Server Request (1067387)

Manage My Service Requests...
Step 3 – Cloud Service Requester: Request the service – Fully automated, standardized, with a simple and intuitive interface
Software Defined Environments and OpenStack Heat

Workload Definition & Orchestration
- Workload Definition
- Orchestration, Optimization and Analytics

Software Defined Infrastructure
- Software Defined Compute
- Software Defined Network
- Software Defined Storage

Virtualized Network

Virtual Storage Layer

Heterogeneous Compute Resources

OpenStack Heat

Software Pattern

Infrastructure Pattern

OASIS TOSCA

HOT

Compute

Networking

Storage

OpenStack Shared Services

Standard Hardware
**Example: Orchestrating an Infrastructure Pattern**

- Flexible composition of patterns (re)using **standardized** building blocks
- Allows an **ecosystem** of content providers and content **reuse**
- “Deployment workflows” dynamically created based on pattern and policies

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**Infrastructure Pattern**

- **CreateNode** [ name=Compute_A, type=power; OS=aixOS15; cores=2, Memory=20GB ]
- **CreateNode** [ name=Compute_B, type=x64; OS=linux15; core=20, Memory=2GB ]
- **CreateNetwork** [ name=NET_1, type=LOW_LATENCY; security=L2, Capacity=40 ]
- **AddMembers** [ network=NET_1; node=Compute_A.NIC1, Compute_B.NIC1]
- **CreateStorage** [ name=STORAGE_A, type=HIGH-IOPS; size=500GB ]
- **AttachDisk** [ computeNode=Compute_A, disk=STORAGE_A ]
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Some Research Questions for SDE

- Generic Modelling Questions
  - Declarative vs. Imperative – when to use what? Define and Describe best practices
- Definition of the Base Model for SDS, SDN and SDC
  - What is the right granularity?
  - How do we link Software Patterns to Infrastructure Patterns?
  - Can we use more than one pattern engine and connect them via Reqs and Caps? If so, how do those engines interact?
- How do we manage SLAs and NFRs in SDE
  - How do we model and implement the autonomic behaviour of the SDE beyond deployment?
  - Implications on the TOSCA standard? For example: Need for standardization of eventing, signalling?
  - Imperative vs. Declarative approach wrt. NFRs and Policies?
  - „Autonomic Managers“ on various levels – how do they interact?
  - Where do we put optimization in the stack?
Summary

• Mobility, big data, analytics, social collaboration and cloud are creating a new wave of business opportunities and IT challenges
• IBM’s Open Cloud Architecture is based on emerging standards and open communities like TOSCA and OpenStack
• The Software Defined Environment (SDE) is composed of Software Defined Compute (SDC), Software Defined Storage (SDS), Software Defined Network (SDN) and an Orchestration component which allows to fully programatically compose deploy and manage all the elements which constitute the individual IT services.
• Resource and Workload Orchestration in SDE enables rapid and continuous delivery of diverse set of workloads leveraging reusable building blocks
• OpenStack Heat is an evolving orchestration engine for Software Defined Environments
• A new language called HOT based on the principles of TOSCA is currently being created for Heat
Links:

- CC RA Whitepaper:

- CC RA Open Group Submission:

- TOSCA V1 Public Spec draft
  - http://docs.oasis-open.org/tosca/TOSCA/v1.0/csprd01/TOSCA-v1.0-csprd01.html

- TOSCA primer

- TOSCA OSLC Demo

- IBM Next Generation Cloud Platform
  - www.bluemix.net
Backup