Gerd Breiter – IBM Distinguished Engineer
Chief Architect Cloud Computing
Cloud and Smarter Infrastructure CTO Office

Software Defined Environments based on OpenStack and TOSCA

July 2013

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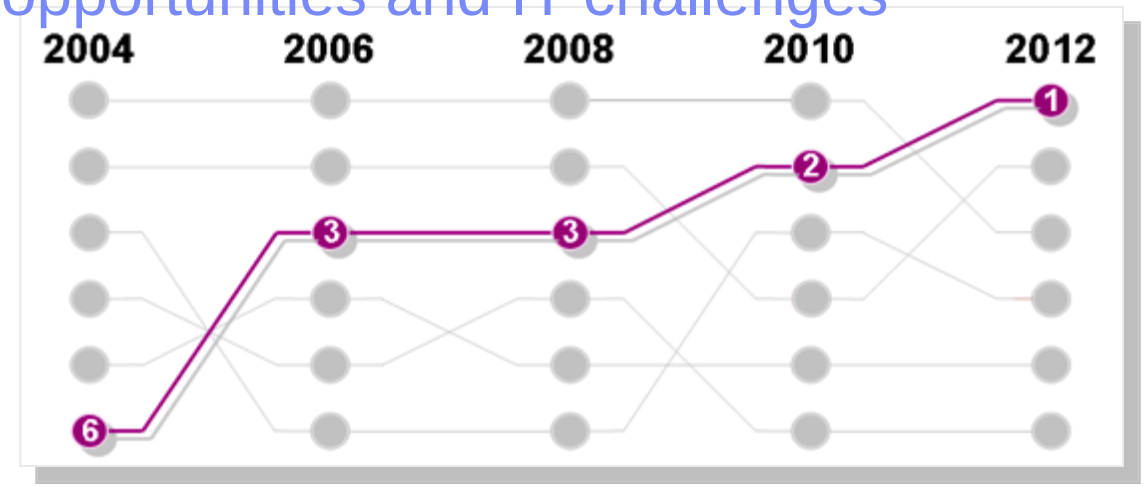
Agenda

- **Introduction**
- OpenStack and TOSCA
- SmartCloud Orchestrator as a first implementation of a „TOSCA Container“ based on OpenStack
- Software Defined Environments
- 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

1Billion

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

New models of product & service innovation

Systems of Record

- Data & Transactions
- App Infrastructure
- Virtualized Resources

Next Generation Architectures

New Modes of Engagement

- Expanding Interface Modalities
- Big Data and Analytics
- Social Networking

Data & Transaction Integrity

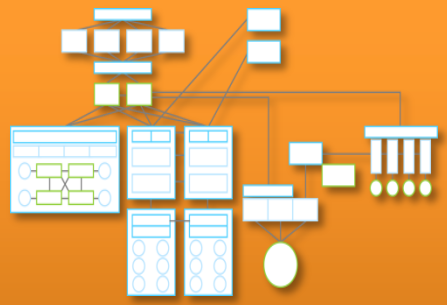
Smarter Devices & Assets

Different levels of orchestration

Heterogeneous hybrid environments…

Resource Orchestration
Onboard, provision, manage

Workload Orchestration
Dynamic optimization



Service Orchestration
Lifecycle of cloud services

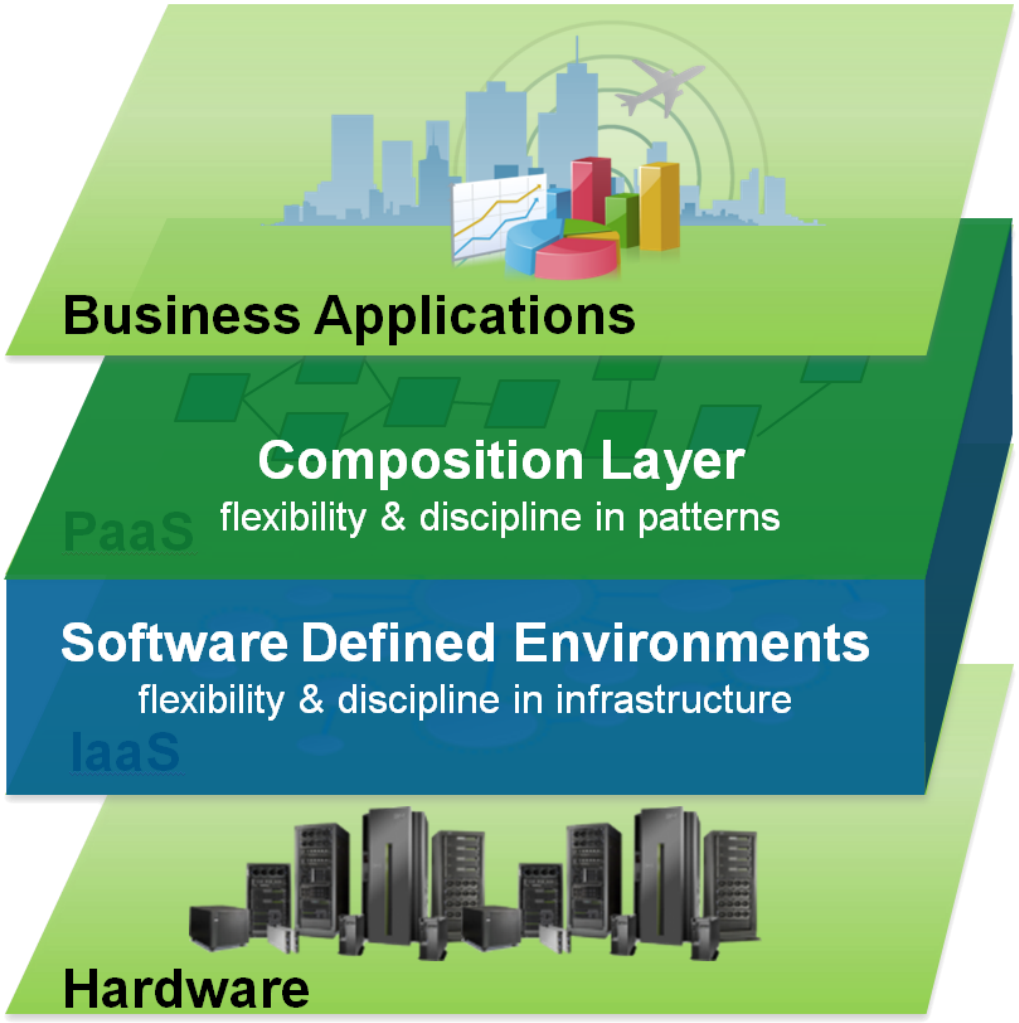
A layered and open cloud architecture is emerging

Business Applications as components
Service Oriented Architecture

Platform Services

Infrastructure Services

Backplane
Fit for purpose



Cloud Standards Customer Council

openstack™

OSLC

OASIS

W3C®

ISO JTC 1 IEC
INFORMATION TECHNOLOGY STANDARDS

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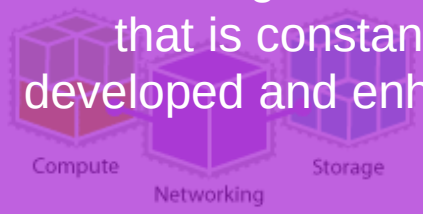
OpenStack in a nutshell

Open source software for building private and public clouds.

openstack™

Working software that is constantly developed and enhanced



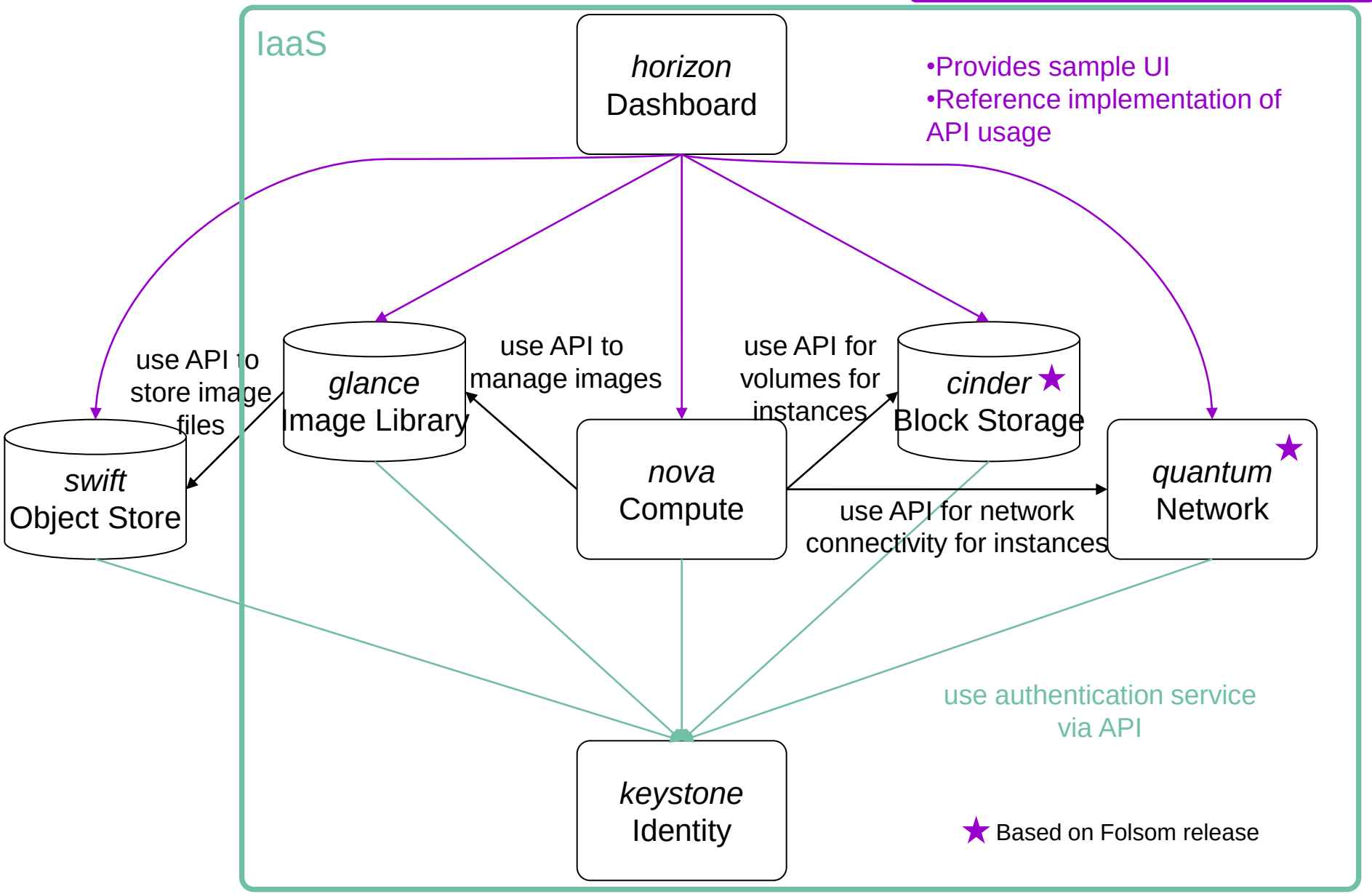
A vivid community of developers and cloud computing experts, driven by different companies

An increasing number of enterprises either base their cloud implementations on OpenStack – or build on top of it!

screenshot from openstack website

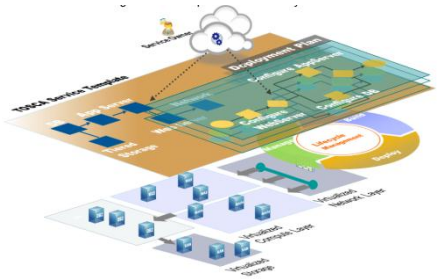
Openstack projects – conceptual architecture

working software

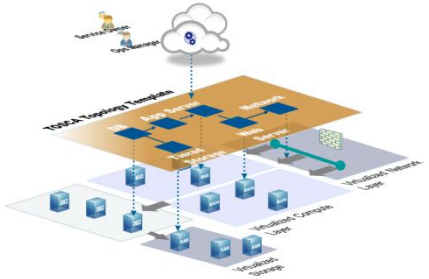


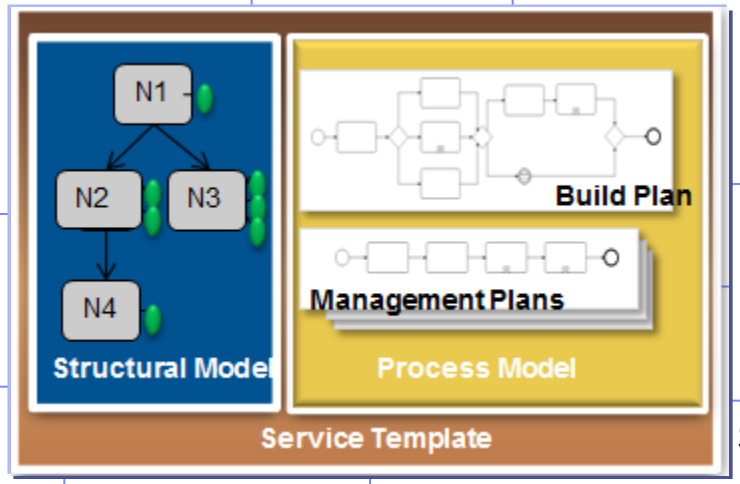
OASIS TOSCA High Level Overview

Topology and **O**rchestration **S**pecification for **C**loud **A**pplications



A declarative model spanning software applications to virtual and physical infrastructure





TOSCA Standard enables

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

Standardization driven with

IBM, CA Technologies, SAP, Capgemini, Citrix, Cisco, EMC², NetApp, PwC, Red Hat, Software AG, HP, WSO2, Virtunomic

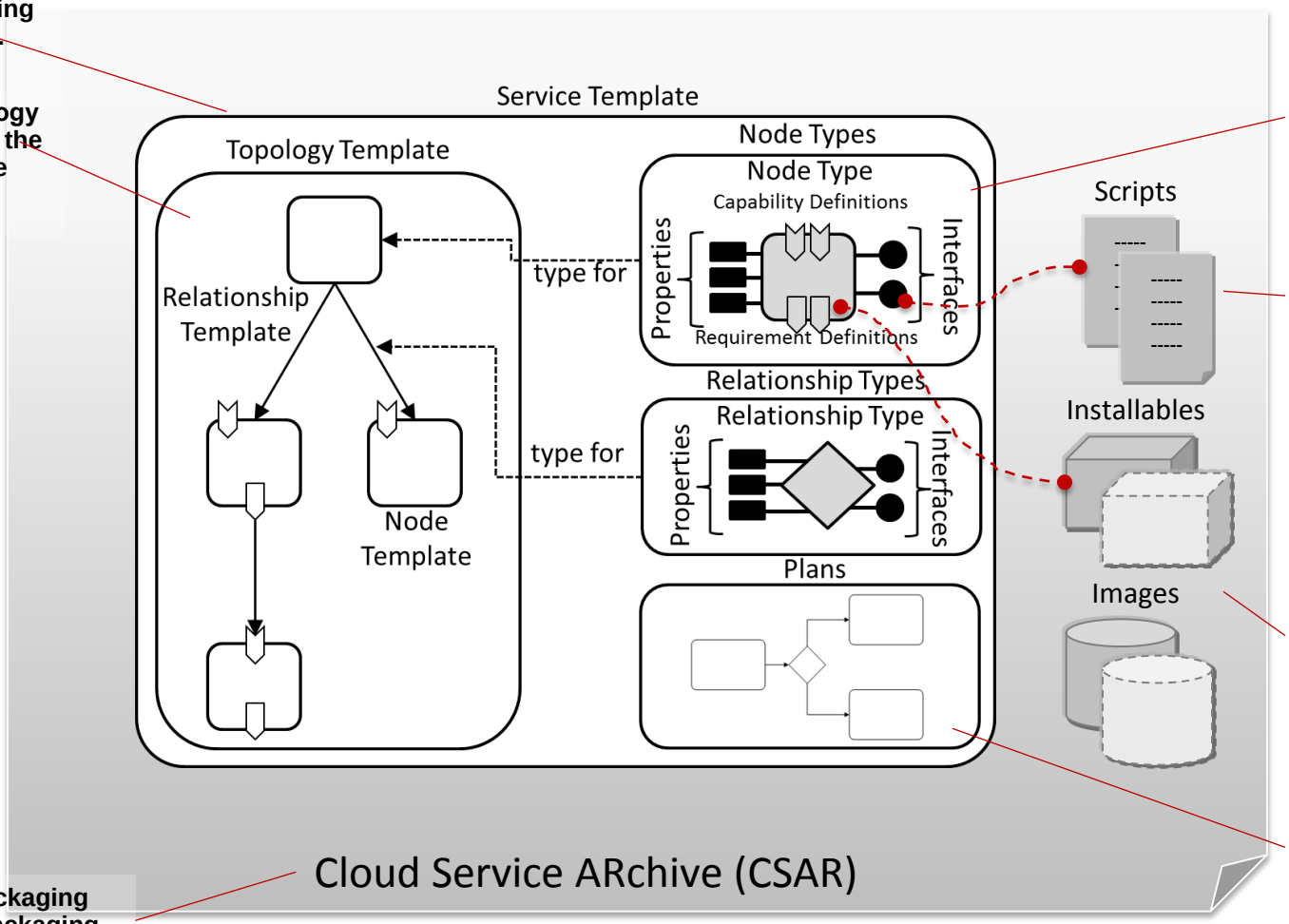
and others

TOSCA – Technical Overview

OASIS Topology and Orchestration Specification for Cloud Applications

A language for defining Service Templates …

… including a Topology Template describing the structure of a service



… including the definition of building blocks for services

… including the definition implementation artifacts for manageability operations

… including the definition deployment artifacts for components

… including the definition plans for orchestrating the application

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

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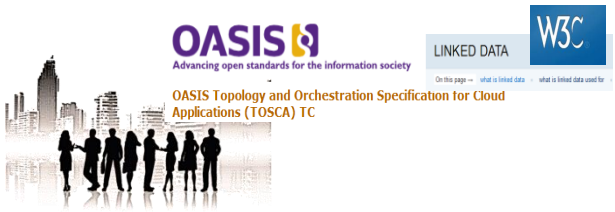
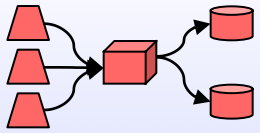
Orchestration of Cloud Services based on a Common Cloud Stack



Leveraging Topology and Orchestration Specification for Cloud Applications (TOSCA)

Workload-driven Patterns



With Flexible and extensible deployment choices

SmartCloud Orchestrator

SmartCloud Provisioning
Automate Optimized Workloads

SmartCloud Entry
Automate IT Delivery

Customer integrated hardware

SmartCloud Provisioning
Automate Optimized Workloads

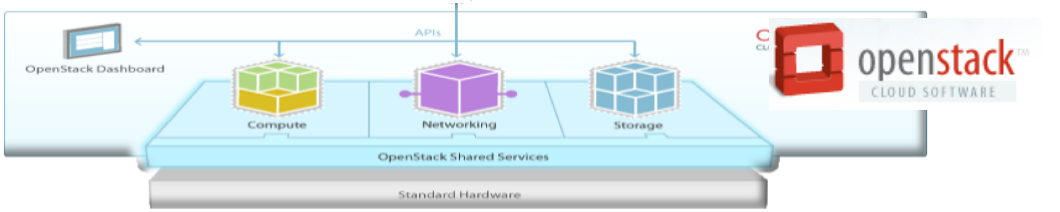
SmartCloud Entry
Automate IT Delivery

PureFlex System

Automate Optimized Workloads

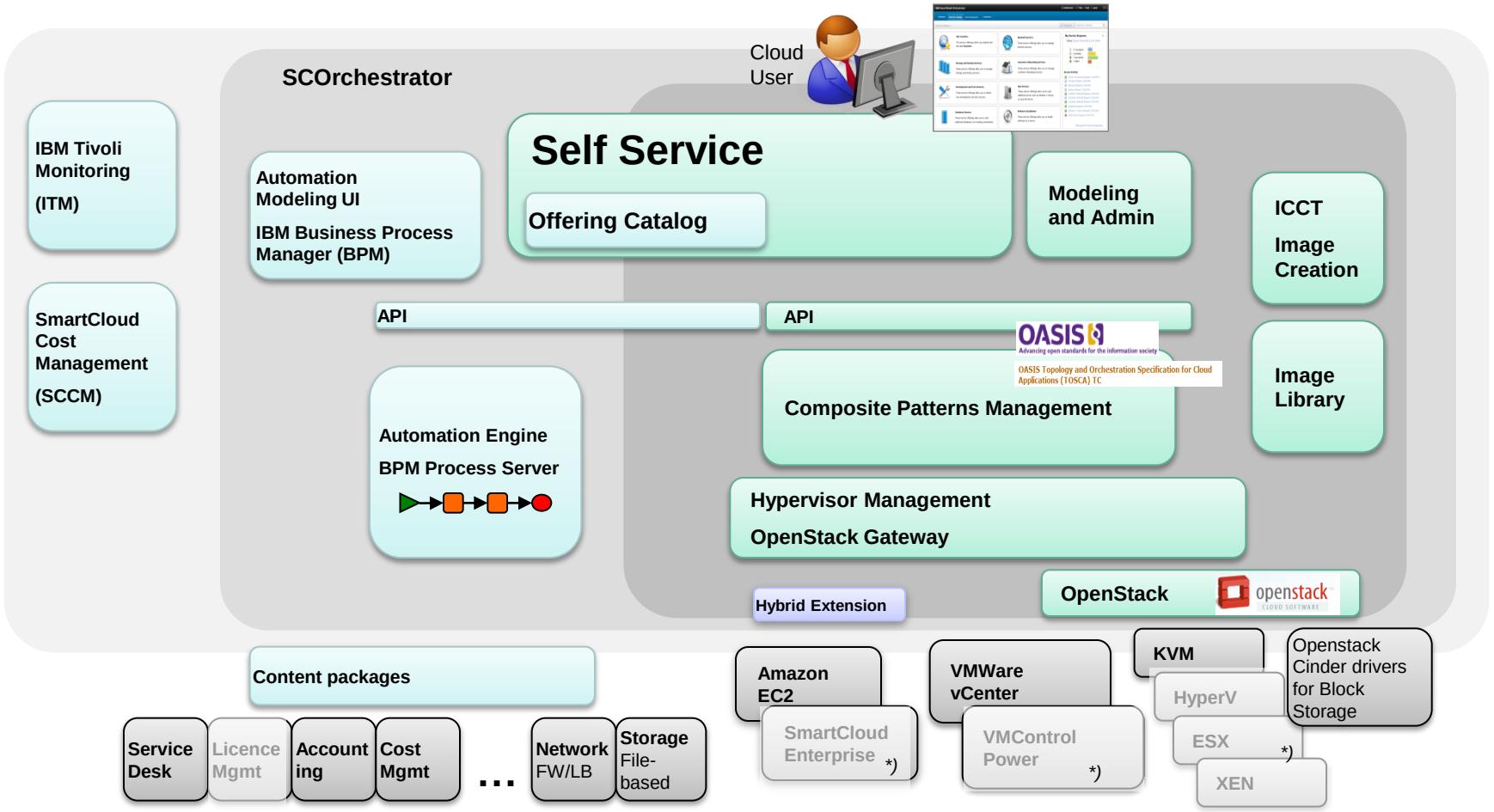
PureApplication System

Exploiting an open infrastructure base



Hybrid Cloud Interaction

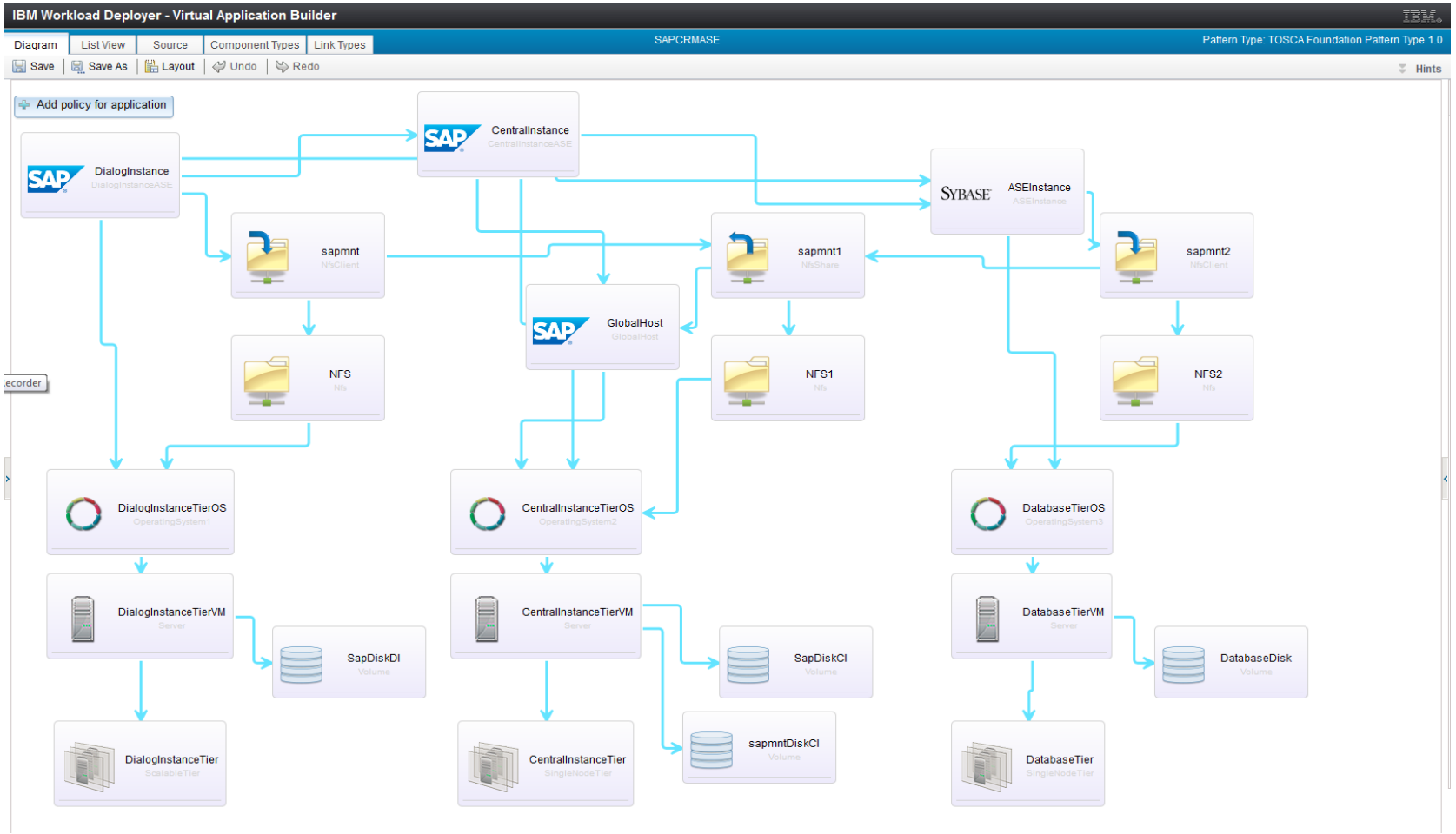
High level architecture
SmartCloud Orchestration and Provisioning



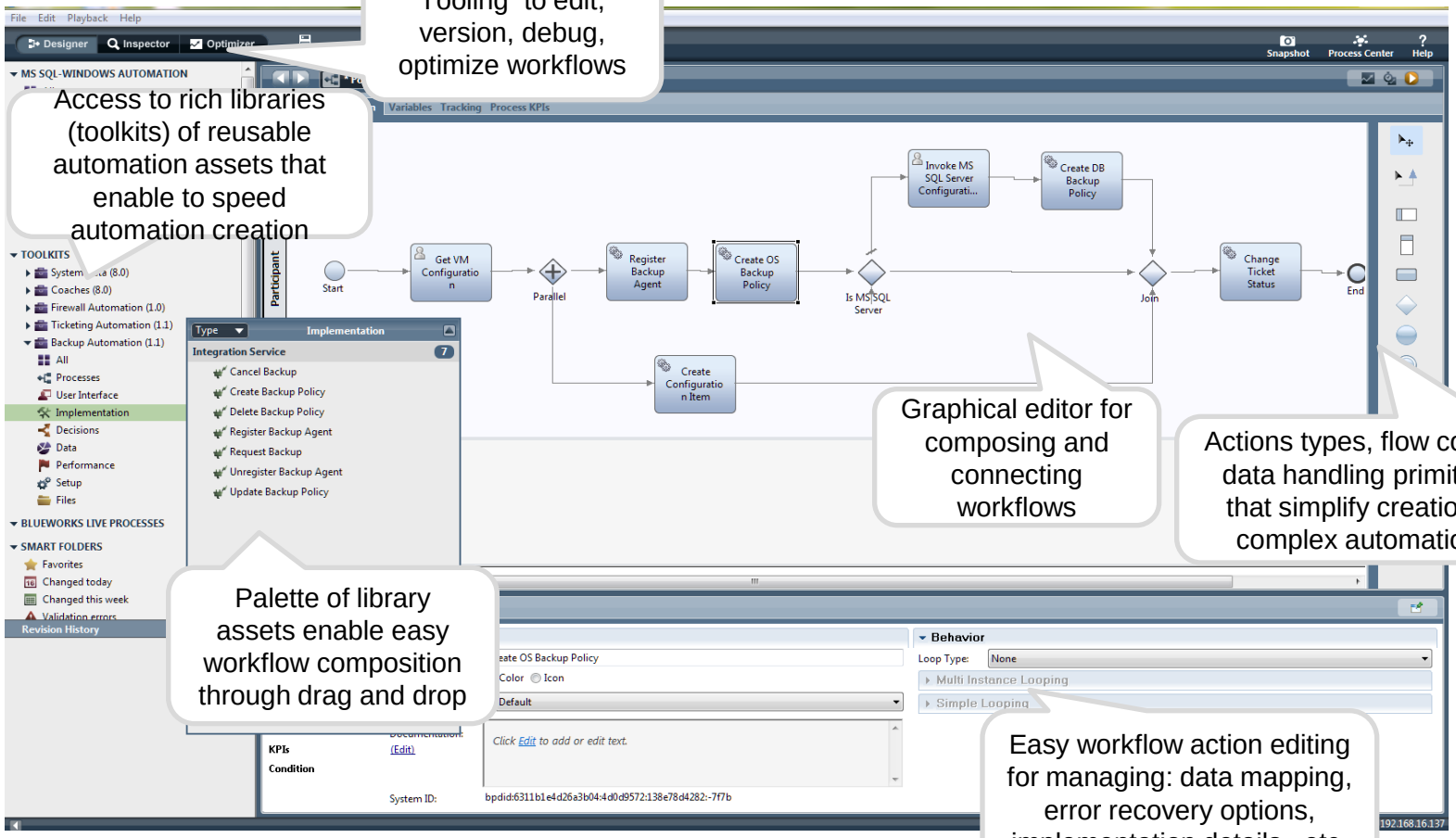
*) supported in following releases

A typical scenario: create a new cloud service to deploy and manage SAP

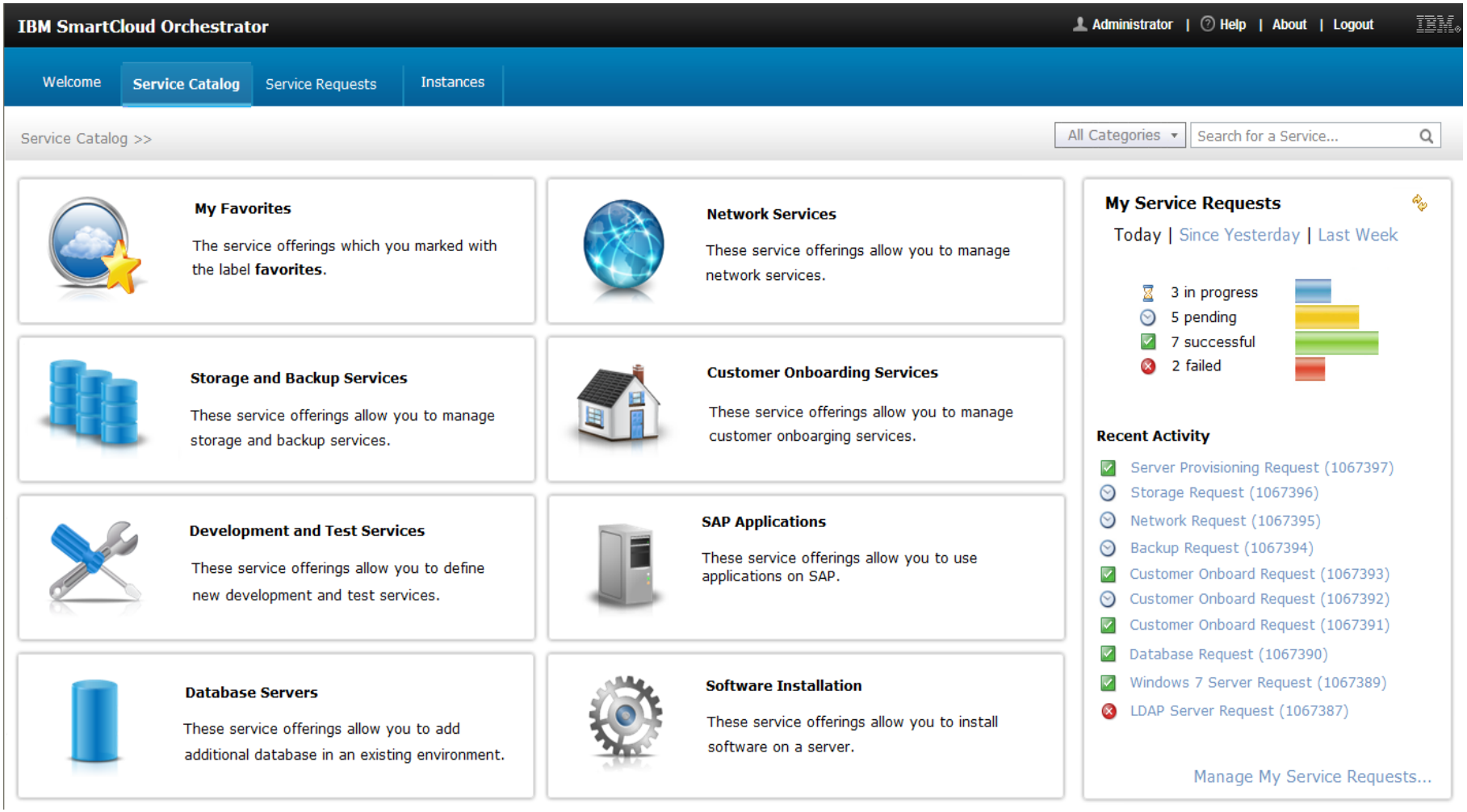
Step 1: Cloud Admin: Import or define the structural model of the Cloud Service



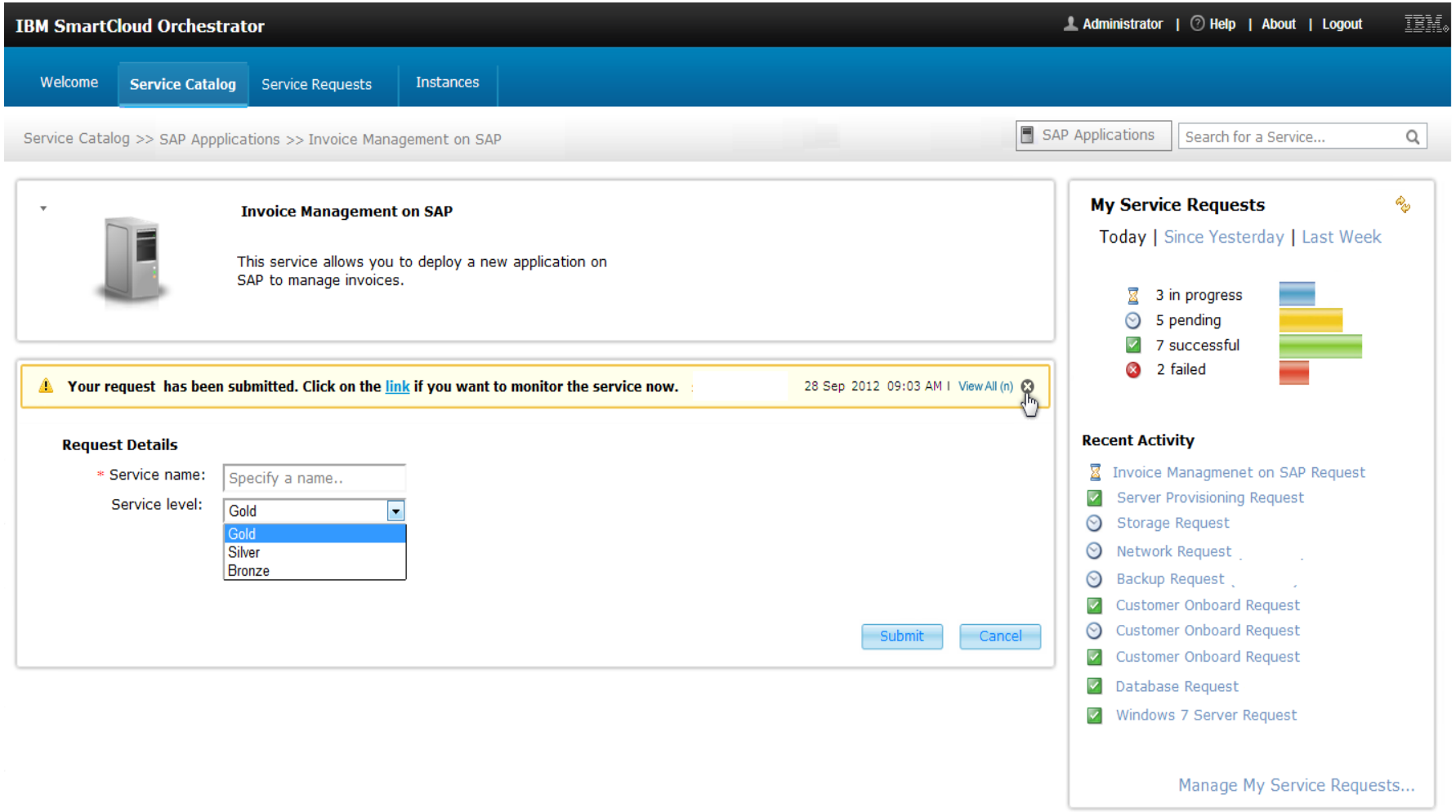
Step 1 cont.: Cloud Admin: Import or define the process model of the Cloud Service



Step 2 : Cloud Admin: Publish service in the catalogue



Step 3 – End User: Request the service –
Fully automated, standardized, with a simple and intuitive interface



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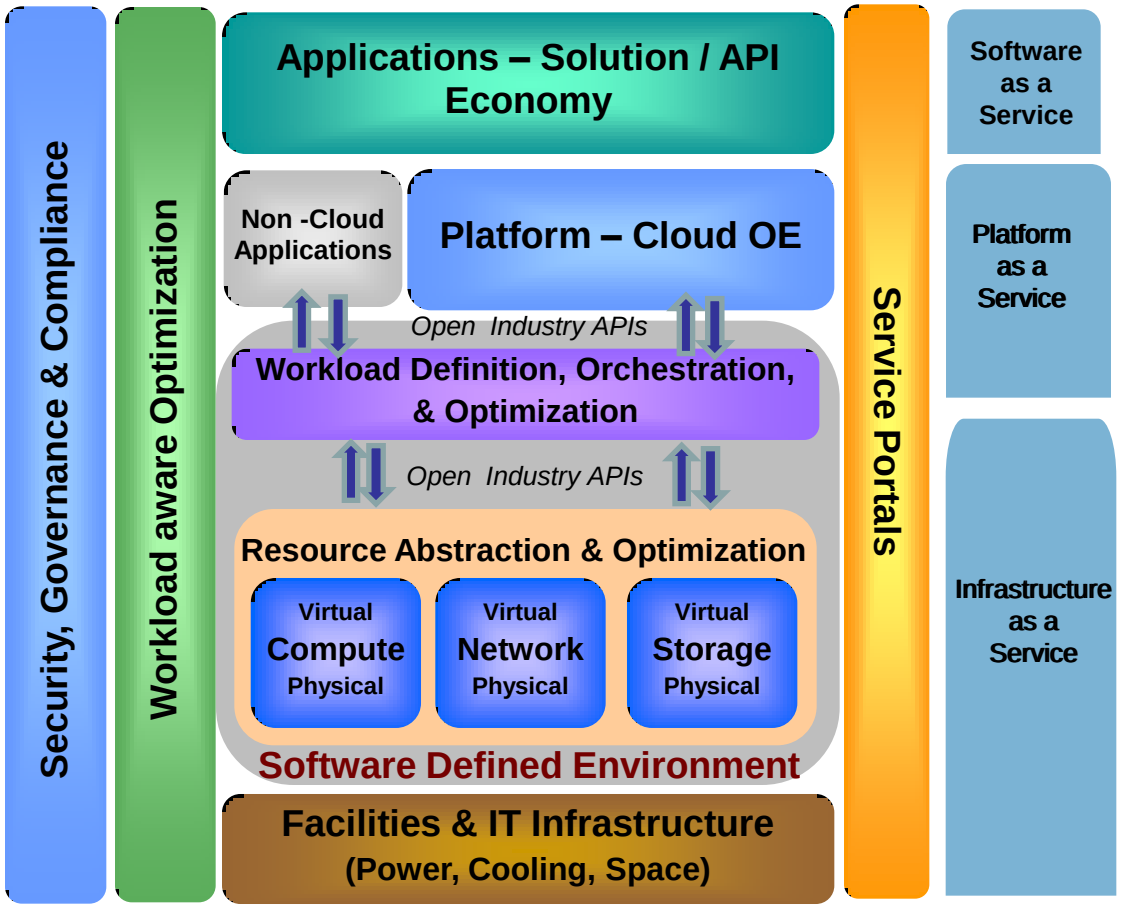
- Summary

What is a Software Defined Environment (SDE)?

A new approach to IT service delivery, utilizing a programmable open standards-based foundation as an enabler for cloud, mobile and other dynamic enterprise solutions



SDE Characteristics

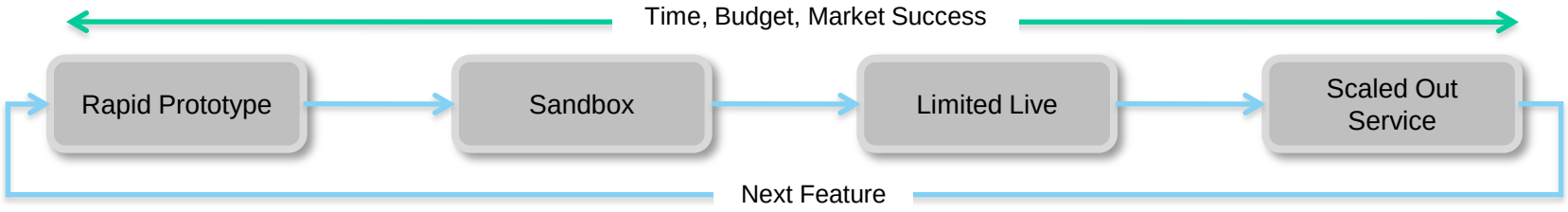
- **Open industry API integration** encourages broad ecosystem of solutions providers
- Workloads **dynamically** assigned to resources based on app characteristics and best available resources
- **Analytics-based** compliance checking reduces security exposure and business risk
- **Continuous optimization** to instantly address infrastructure issues and improve response to business needs
- **Proactive** management of IT resources to improve efficiency and control costs of service delivery

Simple, Responsive, Adaptive

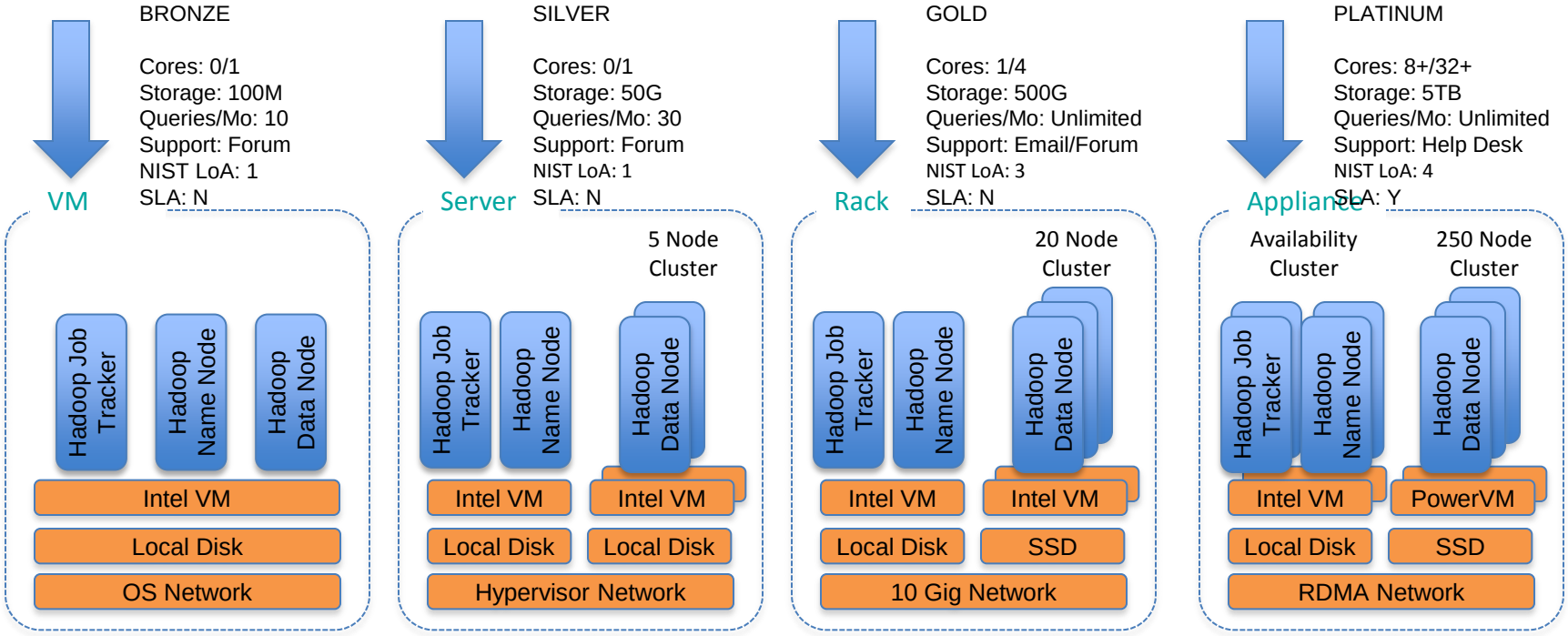
Software Defined Environment Use Case Scenario: Delivery of Hadoop Service

Business Opportunity: New “Ad-fraud detection” application that uses real-time correlation of transaction data with ad click log data

Service Development and Delivery: Using Hadoop service for correlation and log analytics

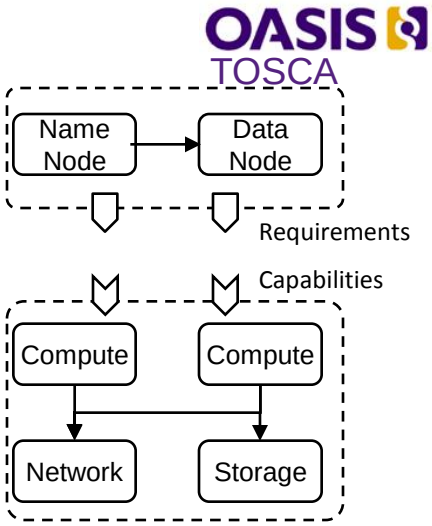


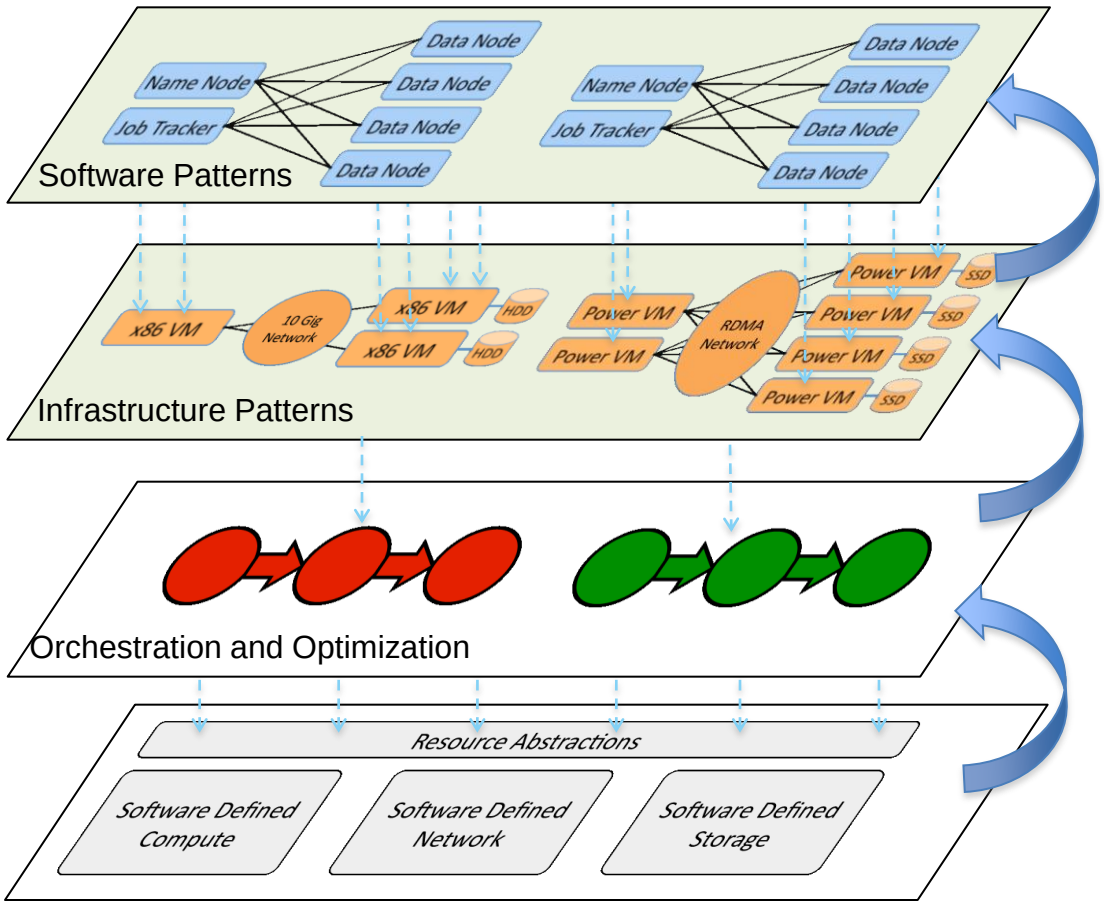
Deployment Configurations: Based on Cost, Performance, Security and Availability Requirements



Orchestration of Software Defined Environments

- Capture the software and infrastructure definition of workloads
- Link software patterns to infrastructure patterns based on requirements
- Automatically orchestrate deployment and update of workloads on SDI
- Enable and differentiate orchestration with analytics





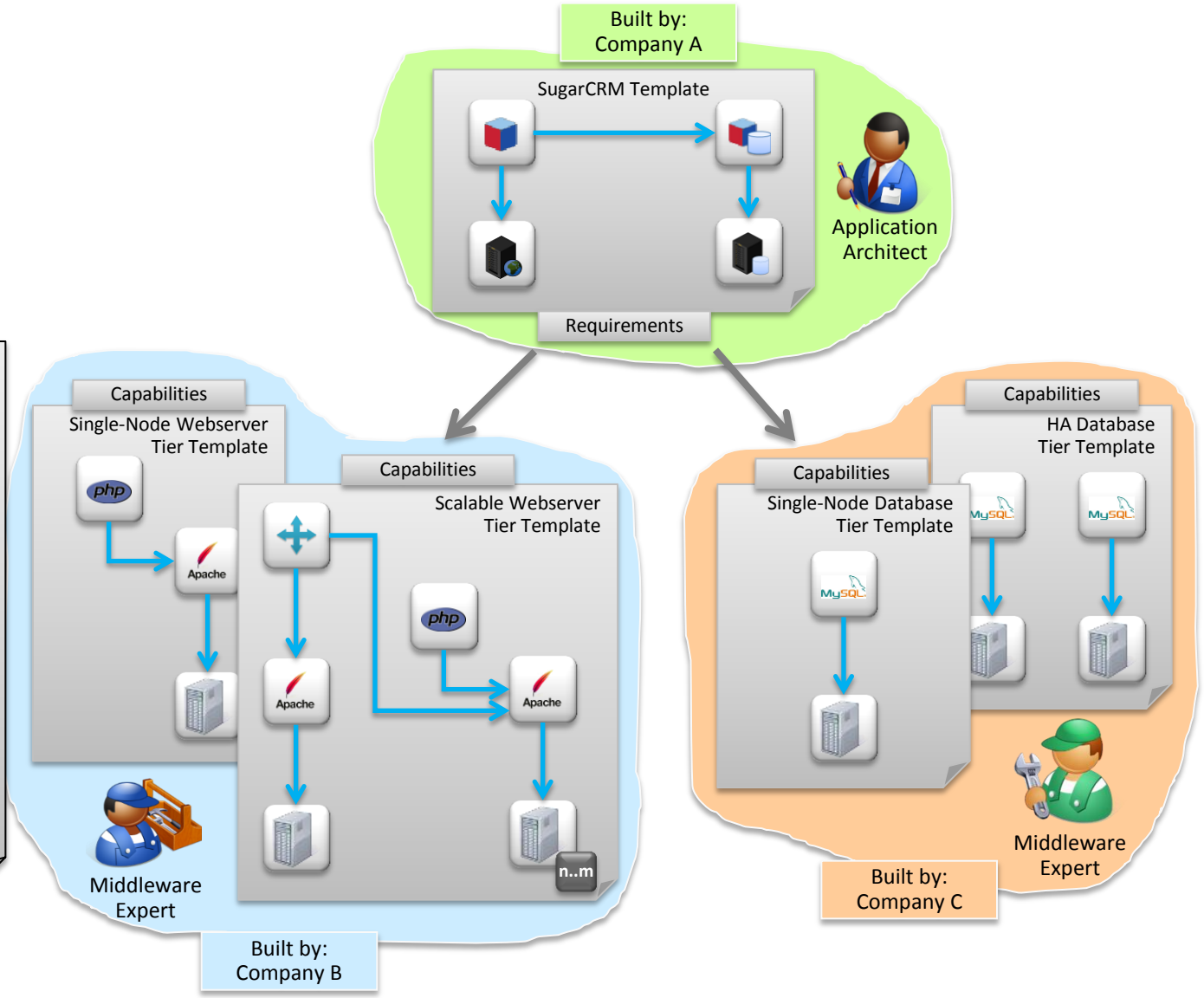
Value: enables rapid and continuous delivery of *diverse* set of workloads with *agility* and *optimization* on programmable heterogeneous infrastructure leveraging *reusable* building blocks

Composable Patterns supporting different roles in the Eco System

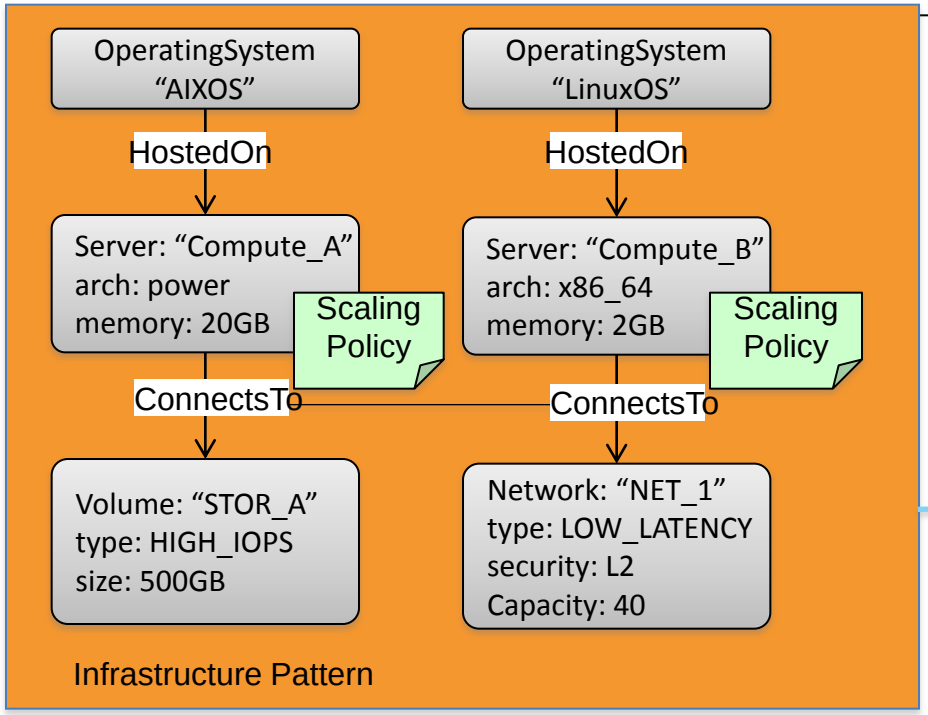
- **Flexible selection of deployment topologies**
- **Separation of concerns**
- **Integration of models delivered by different providers**

Supported use cases from user perspective:

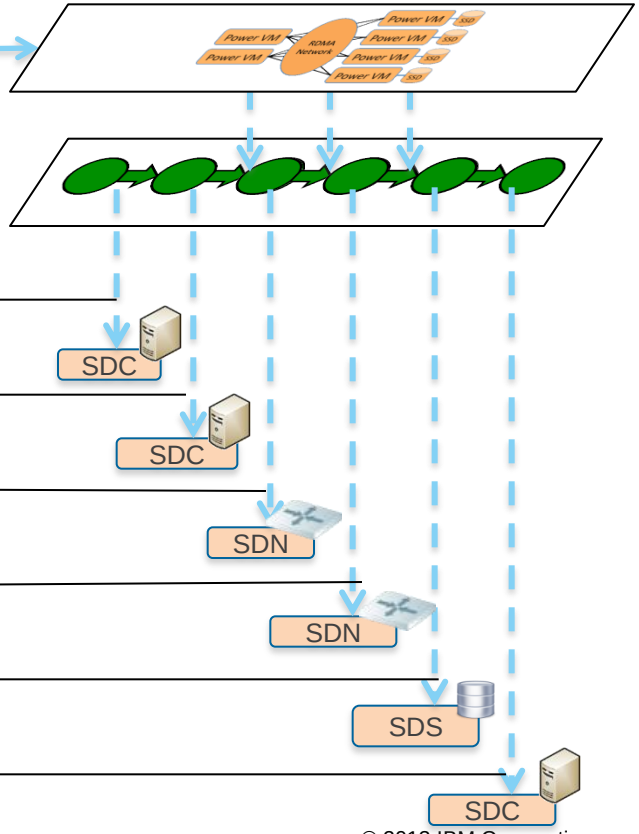
- Import self-contained models from application down to infrastructure
- Deploy fully refined models
- Import componentized models with separation of application and middleware/infrastructure
- Deploy applications with variable selection of infrastructure templates based on policies
- Deploy middleware/infrastructure only patterns
- Edit or create new application or middleware/infrastructure models based on know Node- and Relationship Types



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



CreateNode [name=**Compute_A,** type=**power**; OS=**aixOS15**; cores=**2**, Memory=**20GB**]

CreateNode [name=**Compute_B**, type=**x64**; OS=**linux15**; core=**20,**Memory=2GB]

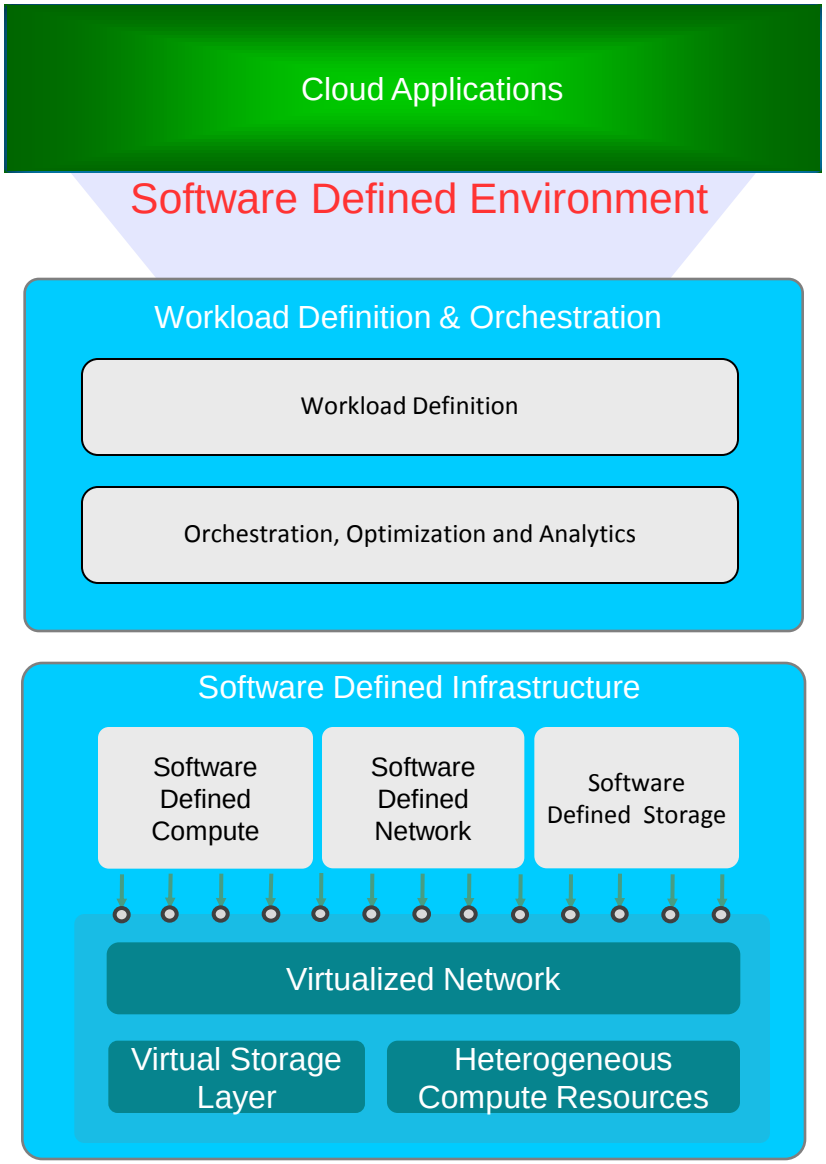
CreateNetwork [name=**NET_1**, type=**LOW_LATENCY**; security=**L2**, Capacity=**40**]

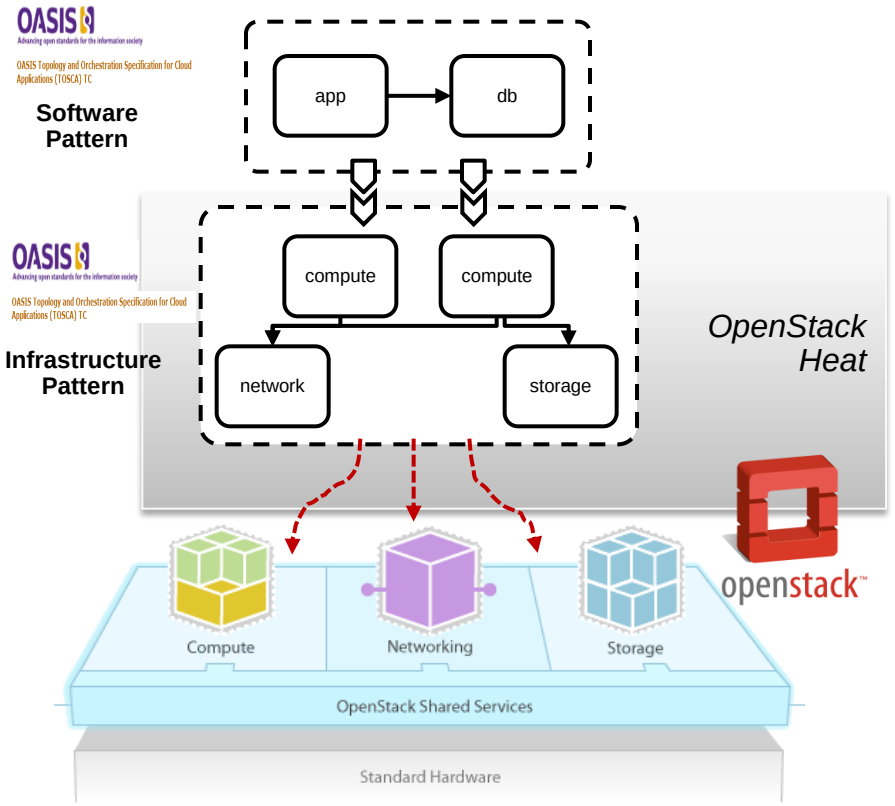
AddMembers [network=**NET_1**; node=**Compute_A.NIC1, Compute_B.NIC1**]

CreateStorage [name=**STORAGE_A**, type=**HIGH-IOPS**; size=**500GB**]

AttachDisk [computeNode=**Compute_A,** disk=**STORAGE_A**]

Software Defined Environments and OpenStack Heat



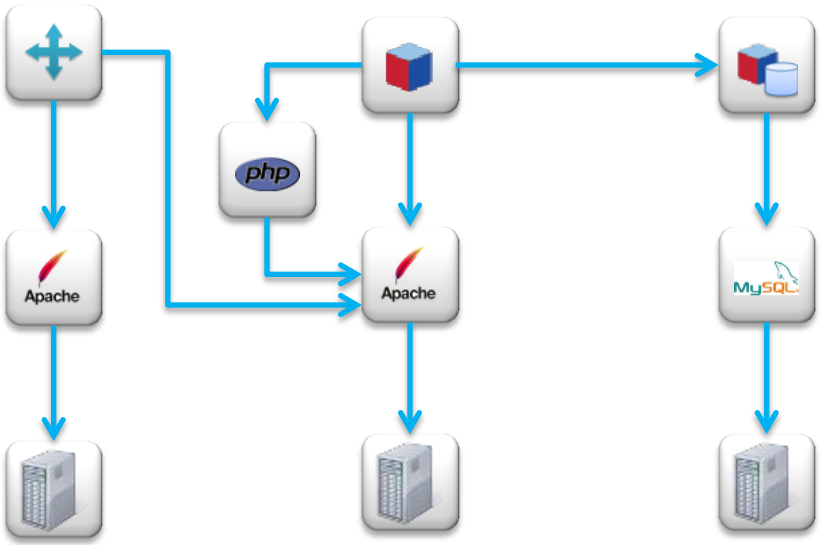


Example for Modelling in SDE

SugarCRM two-tier deployment with scalable web tier

Single, self-contained model

Including scalable components



Building blocks for SugarCRM (TOSCA Node Types)

SugarCRM Application | SugarCRM Database | Apache Webserver | PHP Module | MySQL | Virtual Machine | Load Balancer

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Some Research Questions for SDE orchestration

- 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
- IBMs open cloud architecture is based on emerging standards like OpenStack, TOSCA
- 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

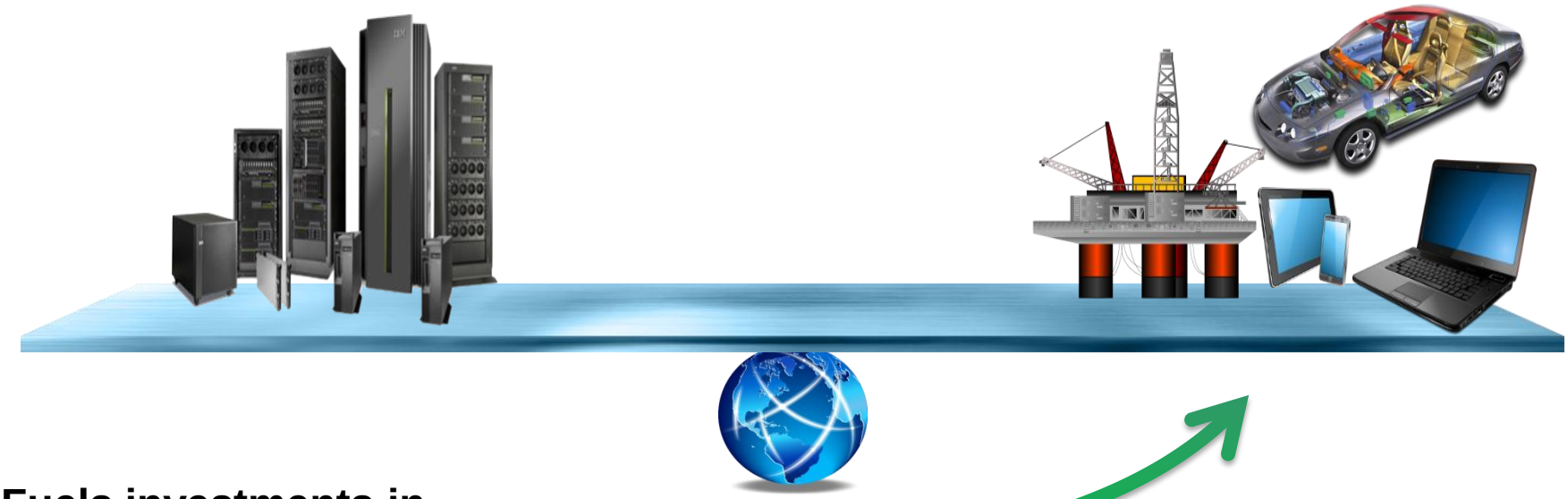
Backup

IT leaders are leveraging the transformational power of cloud to balance optimization of existing systems and innovation

Drives need for continuous IT **optimization**

Optimization

Innovation



Fuels investments in **innovation**