

*EMEA DevXchange 2017*

# Tech Talk: Monitor Your Cloud Infrastructure Beyond the Simple Metrics Provided by Your Cloud Vendor and in Context with Your On-Prem Infrastructure Too

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10 May 2017



# Agenda

1 CA UNIFIED INFRASTRUCTURE MANAGEMENT FOR HYBRID CLOUD OVERVIEW

2 MONITORING AZURE

3 MONITORING AWS

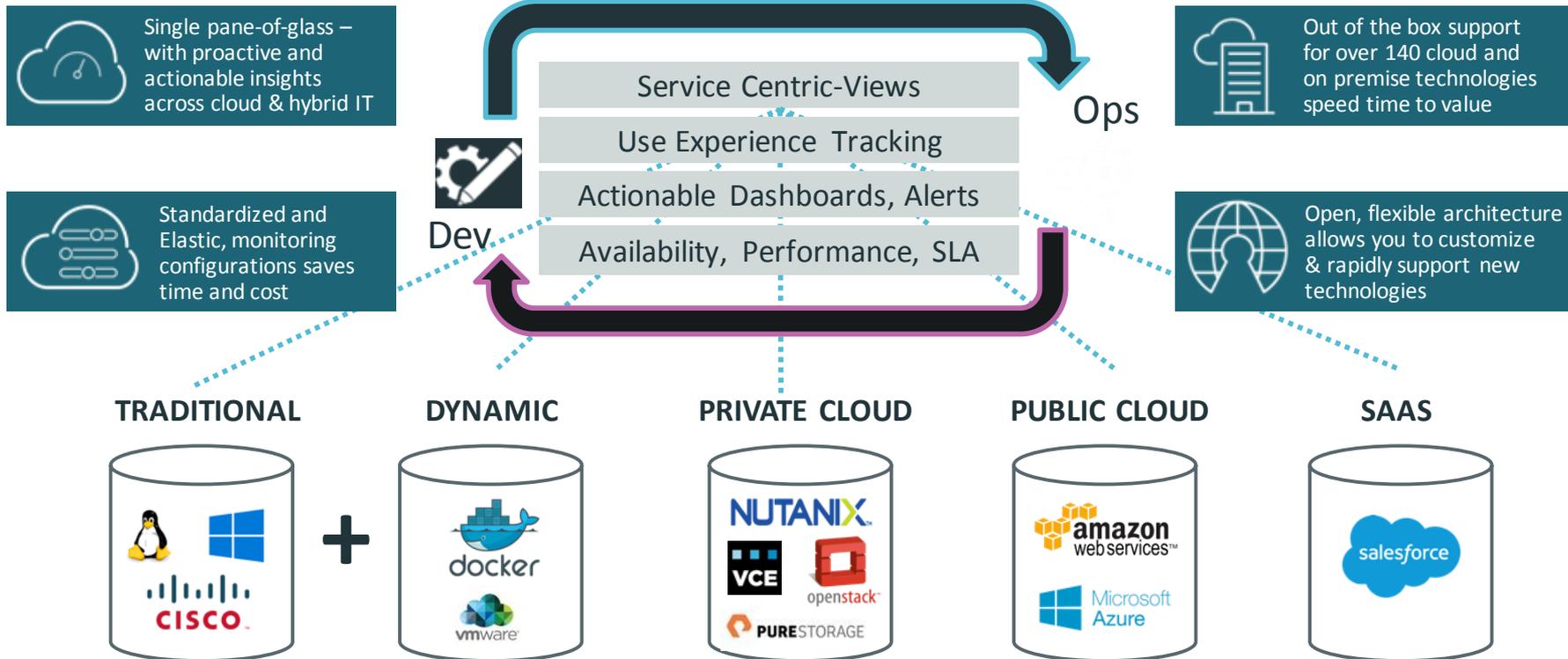
4 MONITORING DOCKER

5 MONITORING NUTANIX

6 MONITORING OPENSTACK

# CA Unified Infrastructure Management Overview

# Most Comprehensive Cloud & Hybrid IT Monitoring



# Optimizing Performance of Hybrid Cloud and Modern IT Infrastructures



Covers nine key AWS services, custom metrics and billing data processes with consistent tags/workflows



Monitors the health and performance of OpenStack enabled cloud deployments



Monitors Azure infrastructure and services spanning VMs, storage and websites.



Reports and collects data about the health and availability of Nutanix cluster, host, VM, storage pool, container, and disk components.



Comprehensive support for enabling technologies spanning virtualization (vSphere), converged infrastructure (Vblock) and cloud (vCloud)



Monitors Docker environment and the processes or services running on them.

# Cloud – Some Concepts

# What is Cloud Computing?



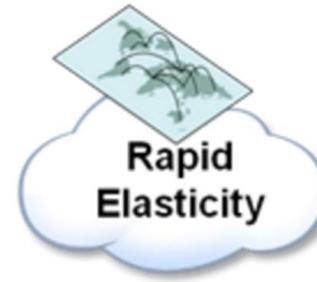
- Faster Time to Market
- Less Overhead
- Better Quality of Service



- Universal Access to IT Services



- Higher Resource Utilization
- Breaks Barriers
- Drives Consistency



- Scale Up and Down with Business Demand
- Responsive Services



- Pay for Use
- Cost Control
- Better Forecasting
- Value Driven IT

# Cloud Computing – Deployment Models



## Private

- Single tenant implementation
- Owned and operated by IT organization
- Define your own data management policies
- Self-service and automation capabilities provide new agility



## Hybrid

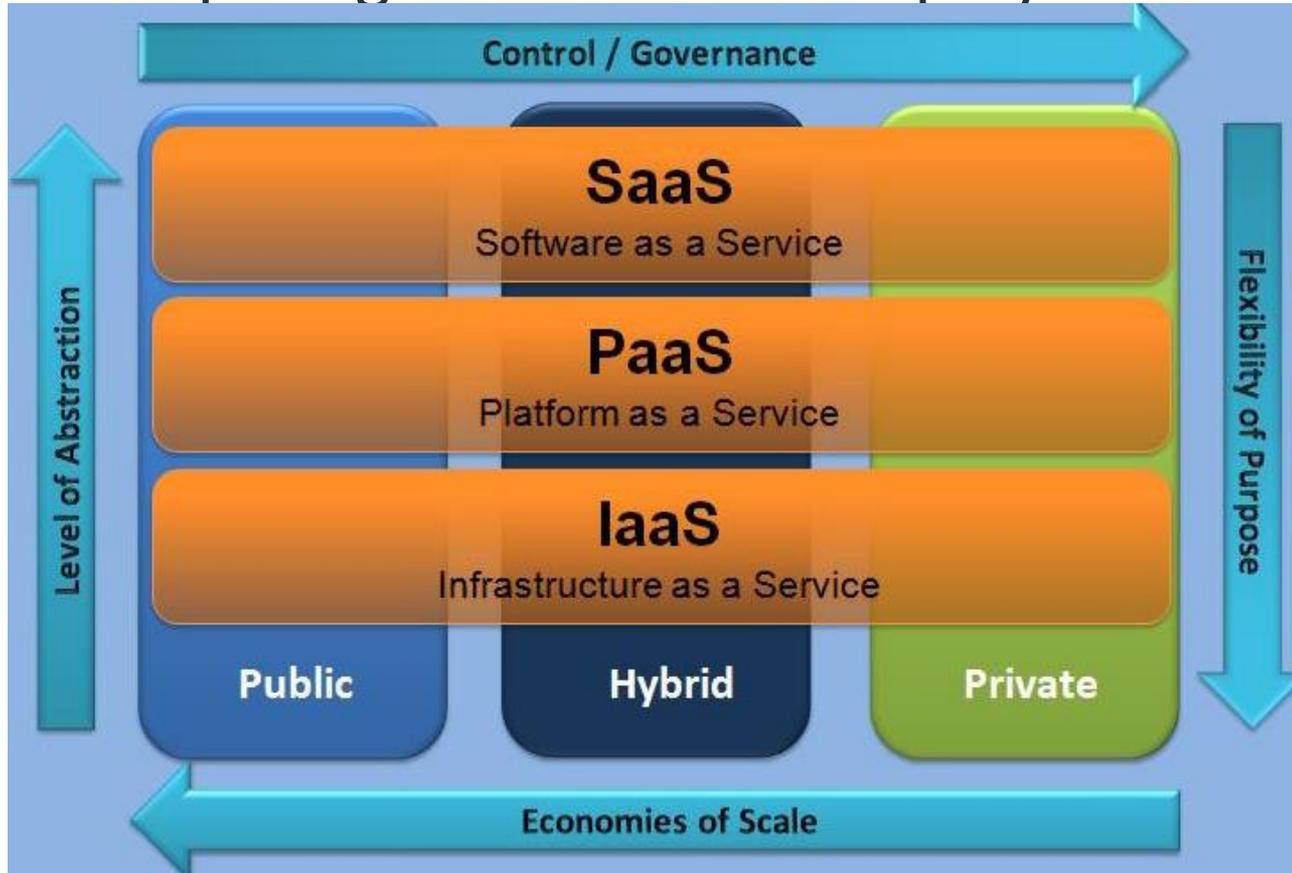
- Combination for Private & one or more public clouds
- Allows IT organizations to become brokers of services



## Public

- Multi-tenant implementation
- Owned and operated by Service Provider
- Bound by multi-tenant data management policies
- Similar self-service and automation capabilities as Private Cloud

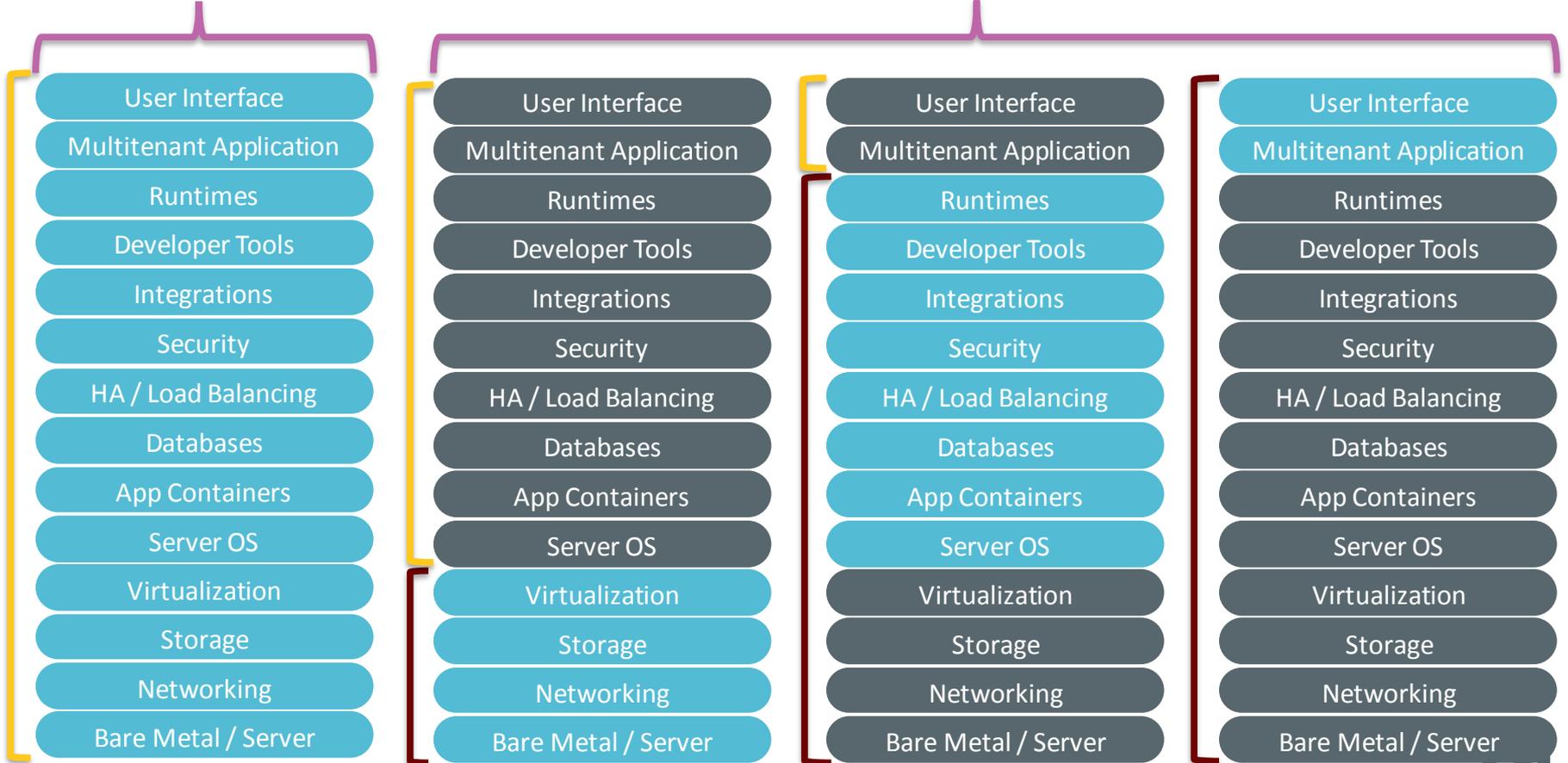
# Cloud Computing – Service and Deployment Models



# Cloud Computing – Service Models

On Premises

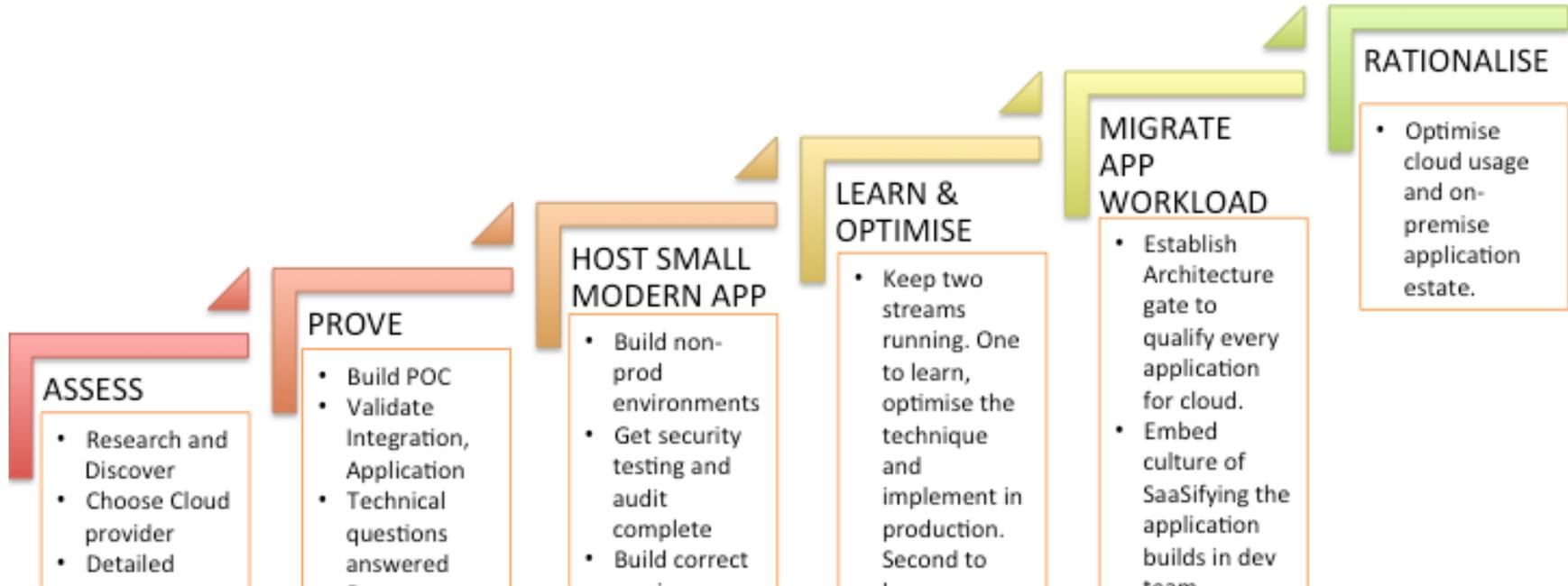
Cloud



# Cloud Computing – Benefits and Barriers

| Benefits   | Adoption barriers   |
|--|---|
| <ul style="list-style-type: none"><li>• Flexibility</li><li>• Lowered costs for infrastructure, storage, etc.</li><li>• Business agility</li></ul> | <ul style="list-style-type: none"><li>• Data security and privacy</li><li>• Real costs – associated with storage snapshots, DR, etc.</li><li>• Service proximity/locality</li><li>• Legacy architectures and migration issues</li></ul> |

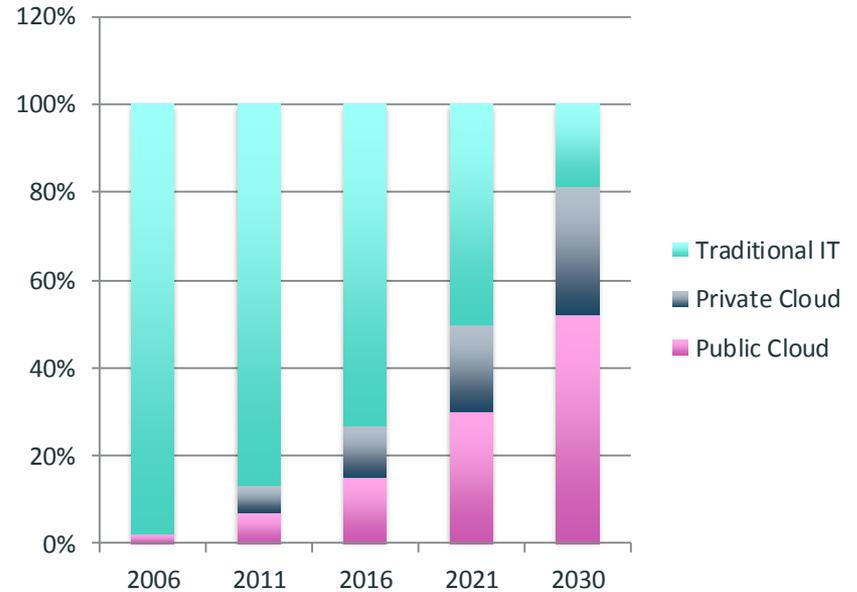
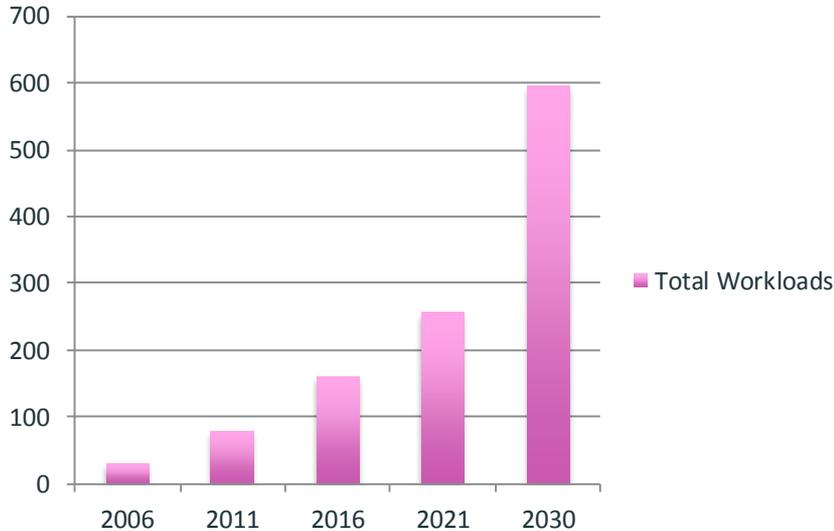
# Stages of Cloud Adoption



# Cloud – Market Overview

# Cloud Transformation and Workload Migration

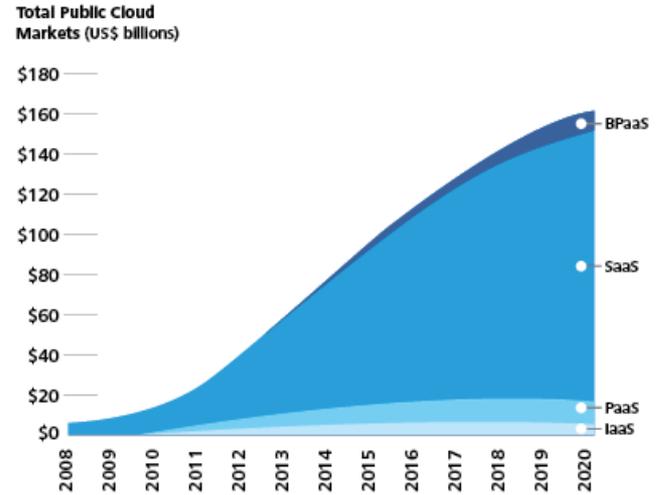
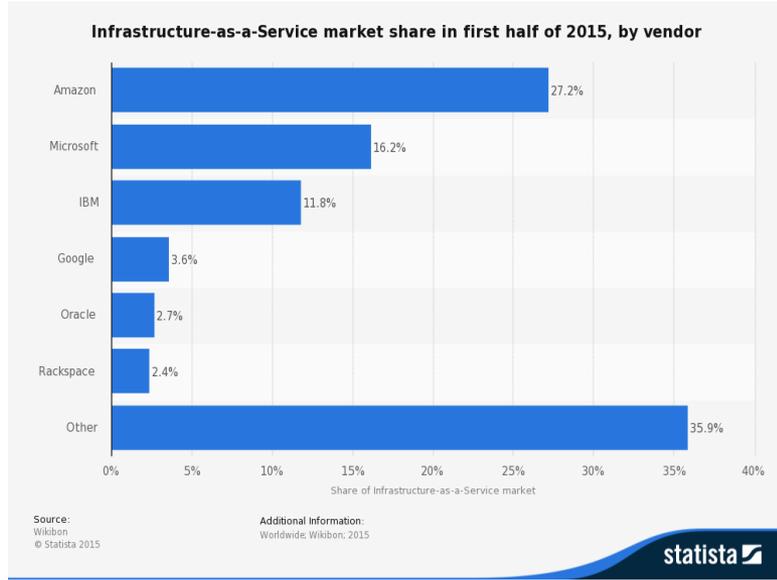
## Total Workloads



- Despite the tremendous growth public cloud runs ONLY 15% of all workloads today – so plenty of room to grow<sup>1</sup>
- 2021 will be the tipping point<sup>2</sup> at which traditional IT market share will be <=50%

1, 2 – VMworld 2016 TechTarget research

# Cloud Market – Overview and Growth Rates

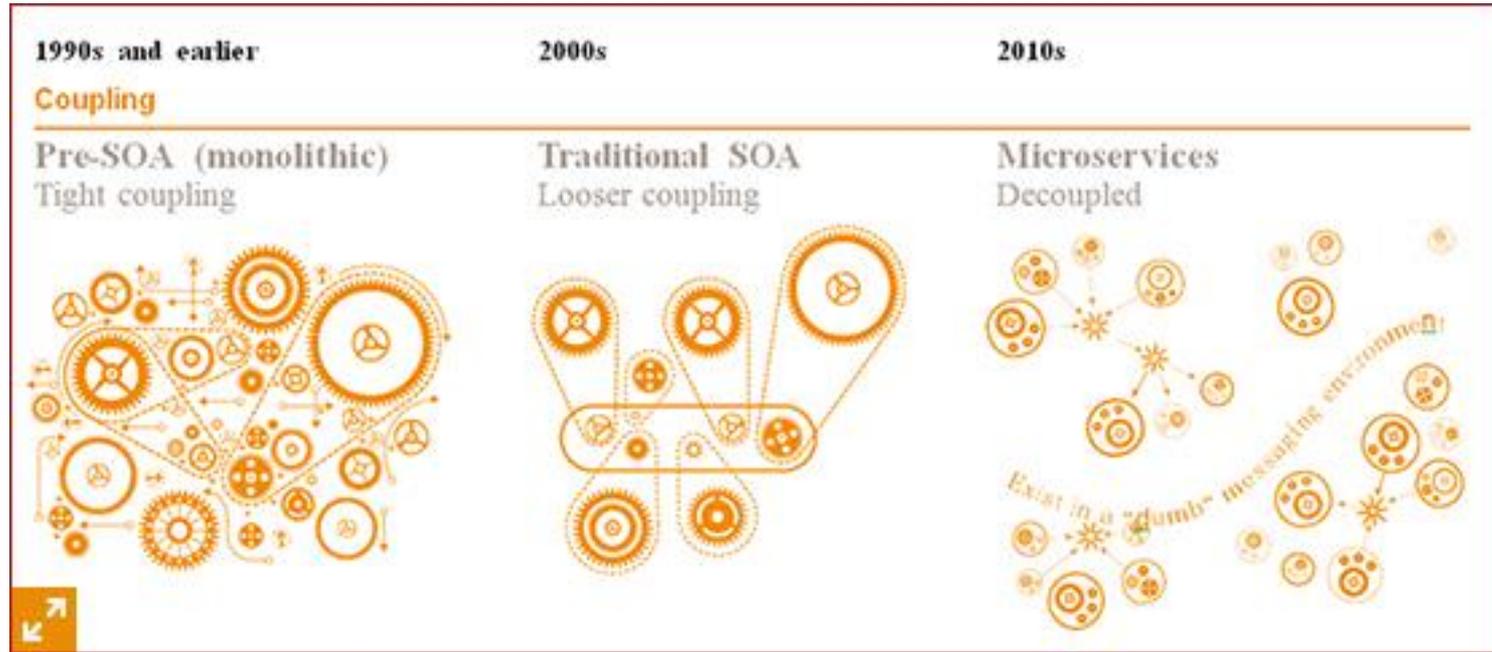


By 2020 SaaS will account for \$133 billion of the \$160 billion industry, while IaaS will make up \$5 billion, PaaS \$12 billion, and BPaaS \$10 billion.

- \$111B aggregate cloud spend today expected to grow to \$216B in 2020<sup>1</sup>
- IaaS the fastest-growing segment of the cloud market this year, anticipated to expand 38.4% to \$22.4 billion in sales, according to Gartner.<sup>2</sup>
- The PaaS market is expected to grow by 21.1% in 2016 to \$4.6 billion, exceeding its 16.2% growth in 2015.<sup>3</sup>

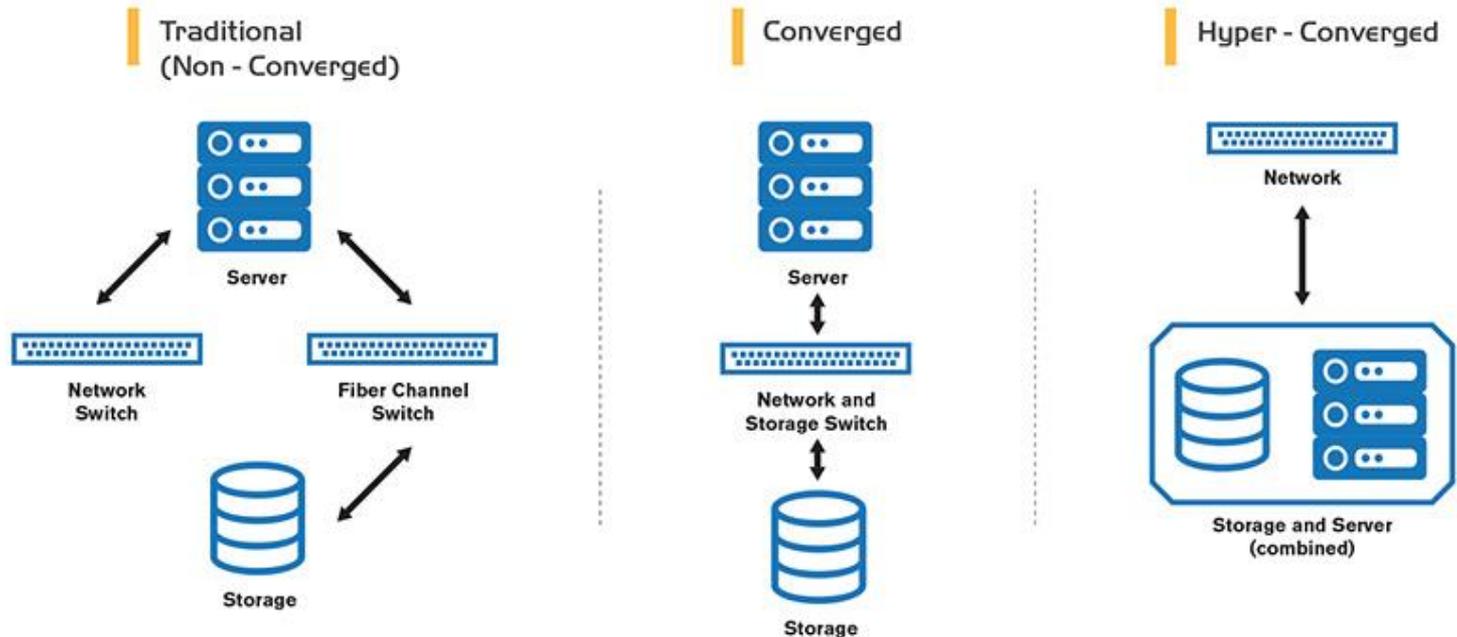
1, 2, 3, - Gartner, "Market Insight: CloudShift — The Transition of IT Spending from Traditional Systems to Cloud."

# Increasing Complexity of Infrastructures



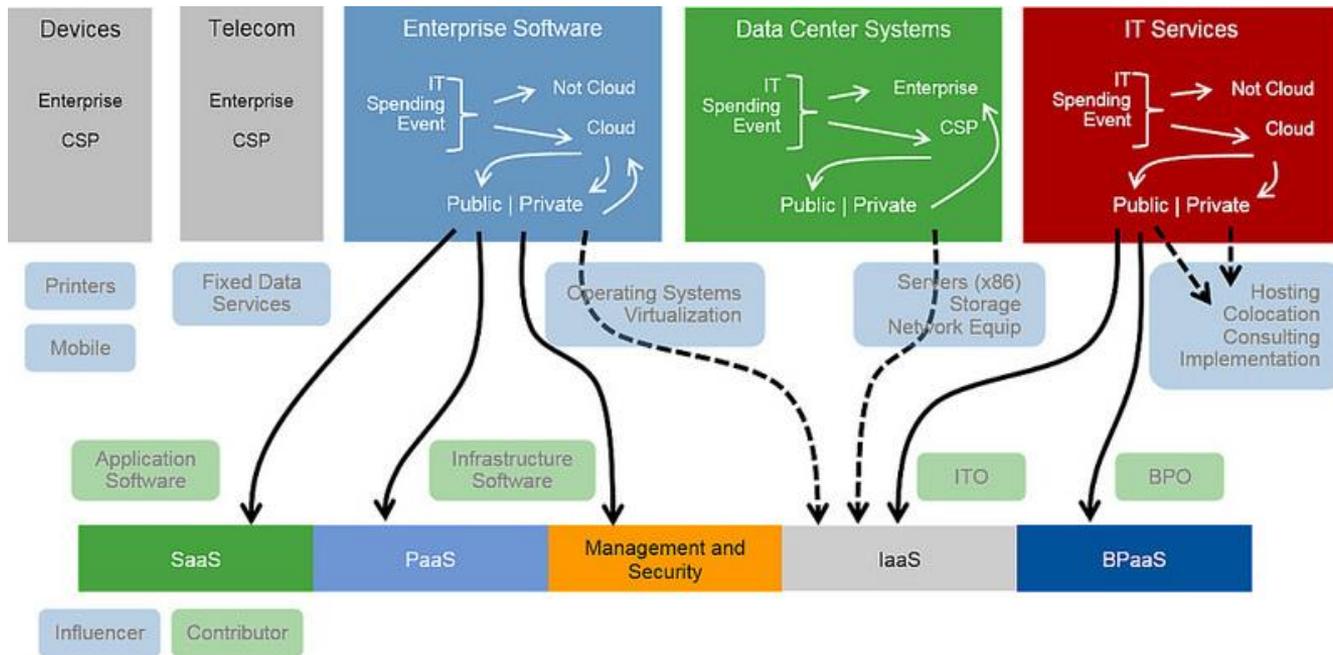
Increased adoption of cloud services and technologies result in increased management complexity (one of the key barriers to cloud adoption)

# Increasing Complexity of Infrastructures



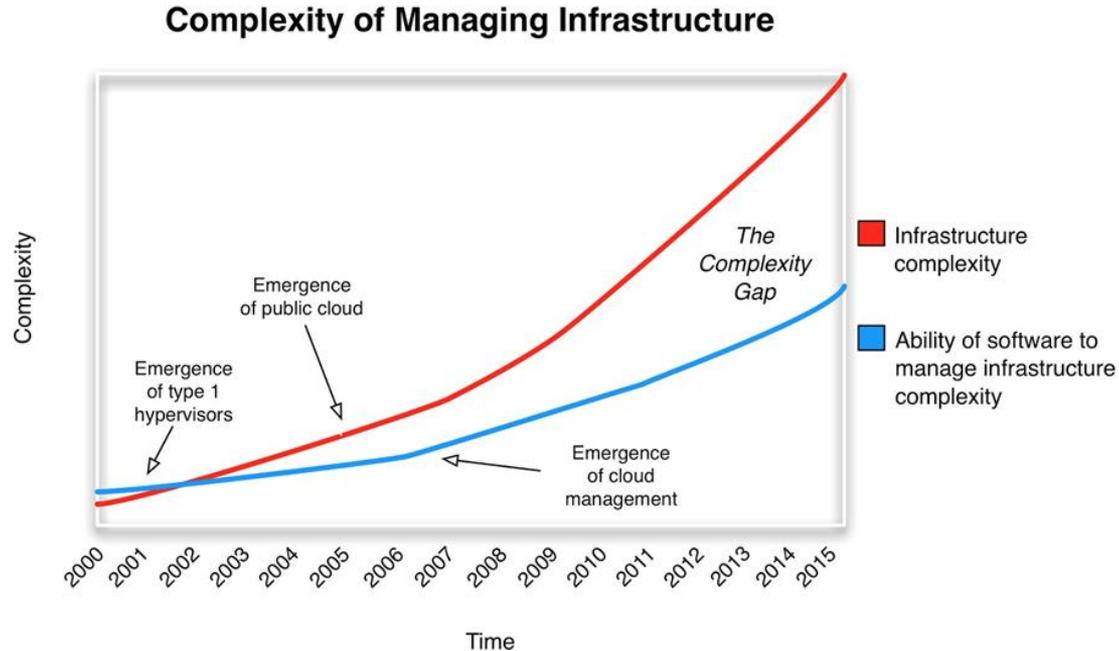
Increased adoption of cloud services and technologies result in increased management complexity (one of the key barriers to cloud adoption)

# Increasing Complexity of Infrastructures



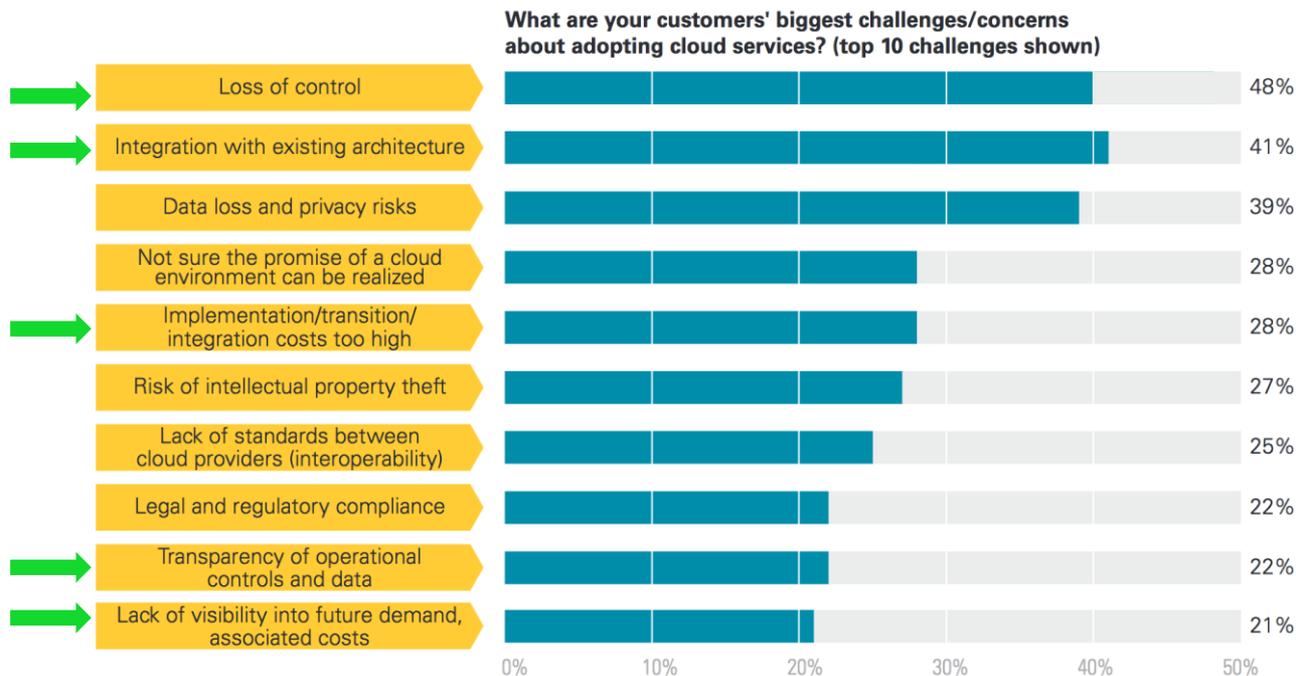
Increased adoption of cloud services and technologies result in increased management complexity (one of the key barriers to cloud adoption)

# Increasing Complexity of Infrastructures



Increased adoption of cloud services and technologies result in increased management complexity (one of the key barriers to cloud adoption)

# Key Barriers to Cloud Adoption



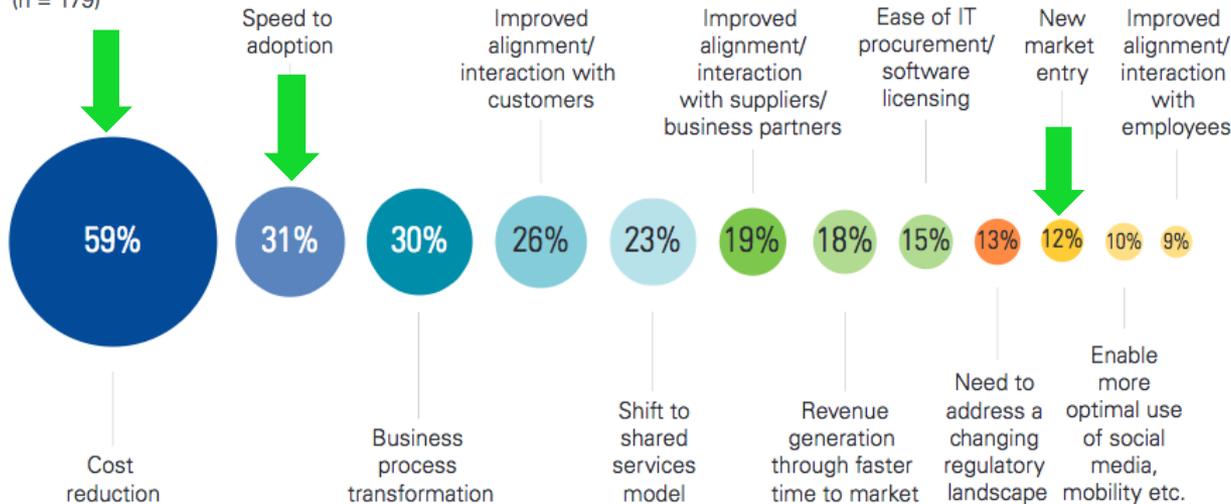
Source: KPMG International's 2012 Global Cloud Providers Survey.

(n = 179)

# ROI Conversations – Impacting Both Top & Bottom Line

What are your customers' main reasons for using cloud environments?

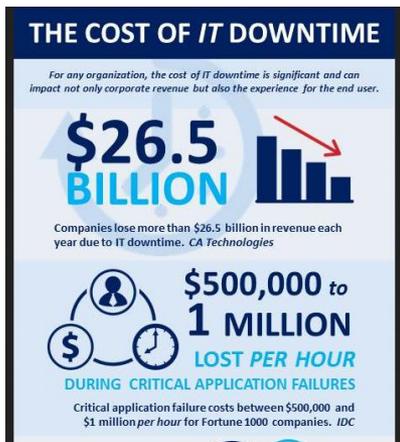
(n = 179)



Source: KPMG International's 2012 Global Cloud Providers Survey.

Cloud services ROI conversations are changing from impacting the bottom line to impacting the top line where the multipliers and stakes are higher.

# ROI Conversations – Impacting Both Top & Bottom Line



## Balance Sheet, Assets:

|   | Year 1           | Year 5         | Year 10        |
|---|------------------|----------------|----------------|
| Real Estate (Gross Assets)                | 1,000,000        | 1,000,000      | 1,000,000      |
| (-) Minus <b>Accumulated</b> Depreciation | <b>0</b>         | <b>250,000</b> | <b>500,000</b> |
| Net Real Estate (Net Assets)              | <b>1,000,000</b> | <b>750,000</b> | <b>500,000</b> |

## Income Statement

|   | Year 1        | Year 5        | Year 10       |
|---|---------------|---------------|---------------|
| Revenues                                | 200,000       | 200,000       | 200,000       |
| Expenses                                |               |               |               |
| Operating Expenses                      | 100,000       | 100,000       | 100,000       |
| Interest Expense                        | 40,000        | 40,000        | 40,000        |
| Annual Depreciation                     | <b>50,000</b> | <b>50,000</b> | <b>50,000</b> |
| Total Expenses                          | 190,000       | 190,000       | 190,000       |
| Net Income (Revenue - Expenses)         | 10,000        | 10,000        | 10,000        |
| Funds From Operations (FFO)             | <b>60,000</b> | <b>60,000</b> | <b>60,000</b> |
| (FFO = Net Income + Depreciation + etc) |               |               |               |

{ A 1 SECOND DELAY IN PAGE RESPONSE CAN RESULT IN A 7% REDUCTION IN CONVERSIONS. }

If an e-commerce site is making \$100,000 per day, a **1 second page delay** could potentially cost you **\$2.5 million** in lost sales every year.

Cost of IT downtime is increasing – between \$250k - \$500k per hour of downtime <sup>1</sup>

Cloud services ROI conversations are changing from impacting IT infra costs to impacting end user experiences and therefore impact both top line and bottom line.

# Cloud Market Trends - 2017

- Hybrid Cloud Is the Preferred Enterprise Strategy, but Private Cloud Adoption Fell
- Cloud Users Are Running Applications in Multiple Clouds (avg 1.8)
- Companies Run a Majority of Workloads in Cloud (40%)
- Enterprise Central IT Teams Take a Stronger Cloud Role
- Cloud Challenges Decline Overall: Expertise, Security, and Spend Tie for #1 (governance and cost)
- Significant Wasted Cloud Spend Drives Users to Focus on Costs (> 15%)
- Docker Shoots Into the Lead for DevOps Tools
- Azure Increases Market Penetration, Reducing the AWS Lead
- Public Cloud Users Still Have a Larger Footprint in AWS
- Private Cloud Adoption Flattens

# Comparing the Cloud Leaders

|                         | Azure  | AWS  | GCP   |
|-------------------------|--|--|---|
| Geographical Reach      | 34 regions (4 more announced)                | 16 regions<br>42 availability zones per region<br>1-6 datacenters per zone<br>50k servers each<br>Approx 79.2M Servers | 8 regions, 23 zones                         |
| IaaS                    |  | Pricing Leader   | Minute Level Increments                     |
| PaaS                    |  | Most comprehensive (Lambda, Poly)  | Big Data, AI, Machine learning (TensorFlow) |
| Enterprise capabilities | Most enterprise friendly<br>ELA MSDN credits |  |   |
| Hybrid                  | Stated strategy                              |  |   |
| Customers               | BMW, 3M, GE Health                           | Netflix, CapOne  | Apple, SnapChat                             |

# Key Cloud Use Cases

# Hybrid Cloud – Jobs to be Done

| JTBD  | Persona           | Category               |
|---|-------------------|------------------------|
| Monitor performance of instances and services               | IT Ops            | Performance Monitoring |
| Troubleshoot issues across tiers to lower MTTR              | IT Ops            | Dependency Mapping     |
| Choose optimal infrastructure size based on workload demand | IT Ops            | Cloud Usage            |
| Identify underused, unused cloud resources                  | IT Ops            | Cloud Usage            |
| Generate cloud billing report monthly, yearly               | LOB owner, IT Ops | Cloud Usage            |

# Prospecting Questions

- What cloud technologies are you currently using?
- Is there a broader cloud adoption planned within your organization? [?]
- Are you able to monitor the performance and SLA of your public/private cloud?
- How do you ensure smooth migrations to the cloud? [?]
- How many monitoring tools do you use? Are you satisfied with their *cloud* support?
- Can you get an end to end view of your cloud and traditional infrastructure?
- Do you have visibility into utilization and cost of your cloud infrastructure?

# Why CA Unified Infrastructure Management ?

- MOST comprehensive coverage for cloud & hybrid IT
- Open flexible architecture and APIs – deploy, extend and automate monitoring to efficiently meet the needs of today’s highly dynamic and cloud environments
- Standardized, rapid configuration – leverage templates across your cloud or on premise infrastructures boost staff productivity and agility

# Customer Examples Of Platforms (Private & Hybrid Cloud)

## Private Cloud



Switched private cloud platforms from VMware based infrastructures to OpenStack due to high licensing cost.

## Hybrid Cloud



They have built their own cloud as service offering using VMware technologies (vCloud). They chose VMware as they saw them as a more valuable partner for business. But AWS is being used by a lot of their internal application group.

## Hybrid Cloud



Manage and integrate customer's Nutanix infrastructures. Adding Monitoring as a Value ad service. Internal customer marketing applications being migrated to AWS along with a few customer sites.

# Cloud – IT Operations Jobs to Be Done



- How do they perform in the cloud?
- Can I scale my server fleet?
- Can apps run anywhere?

# Public Cloud



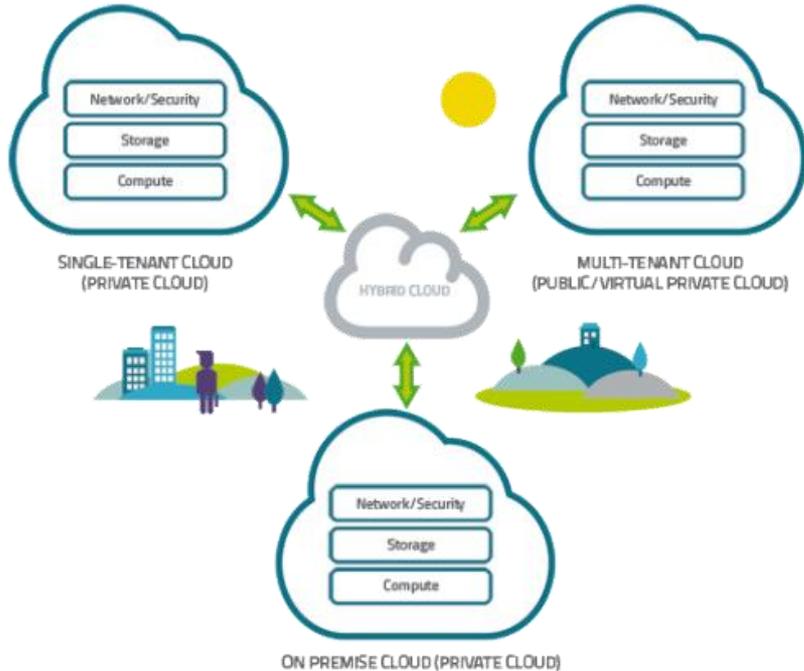
- Track SLAs and performance of all your Cloud services such as AWS EC2, RDS, S3 and more
- Get deeper, predictive insights on the applications and processes running on them to rapidly find performance bottlenecks
- Better manage your cloud resources through intelligent alerts on cost & utilization

# Private Cloud



- Track SLAs and performance of all your infrastructure in your turnkey or custom private cloud or converged infrastructures
- Get deeper, predictive insights on the applications and processes running on them to rapidly find performance bottlenecks
- Integrate with other ITOM tools and automate monitoring deployment for seamless operations

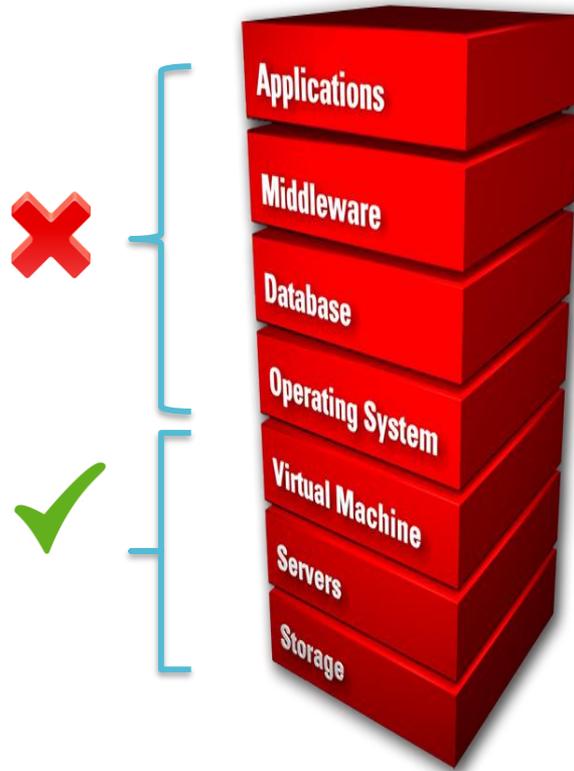
# Hybrid Cloud



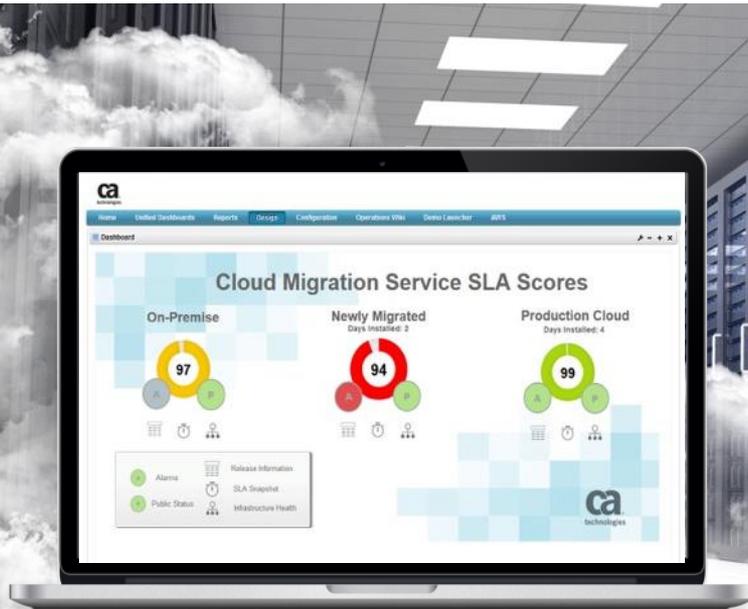
- Proactively and holistically track end to end user experience across cloud and on premise infrastructures
- Single view, eliminates “swivel” chair integrations to boost issues resolution and staff productivity
- Single console to rapidly manage all your monitoring configurations boosts cloud adoption and application deployments

# AWS Cloudwatch

- Hypervisor perspective
  - EC2
  - Hardware (CPU/disk/networking)
- Doesn't know about
  - Guest OS
  - Memory/file system
  - Processes
  - Application
    - Response times
    - Latency
    - Error rates
    - Internal insights \*\* Changing with Xray (lite tracing)

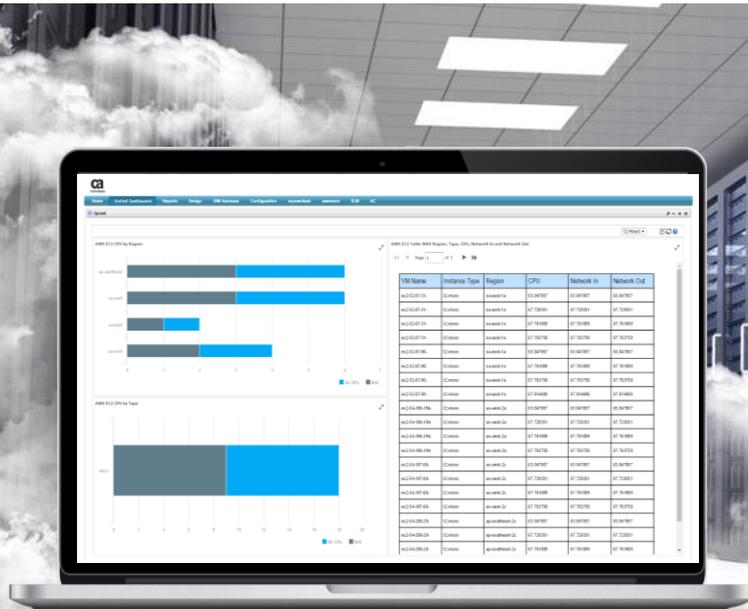


# Workload Migration



- Get insights on infrastructure utilization throughout the migration process; both pre (on premise) and post (cloud)
- Holistically monitor newly migrated workloads to ensure a smooth transition
- Ensure Cloud SLAs are consistent (or better) than on premise
- Proactively run “tests” to confirm success

# Cloud Utilization



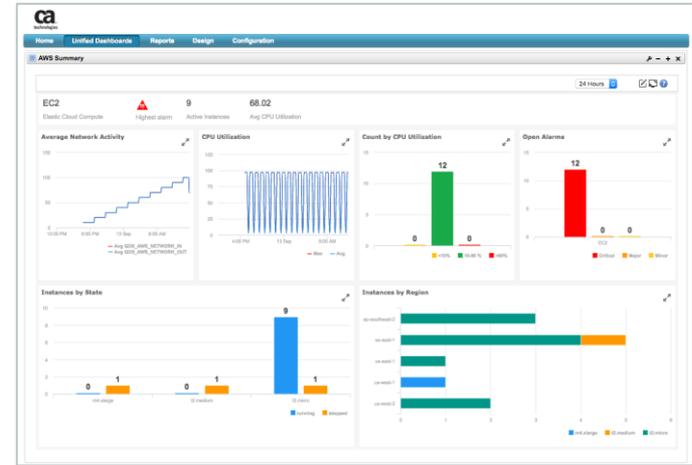
- Analyze historical data to better plan for capacity and budgetary needs
- Correlate various cloud and on premise metrics for root cause identification
- Get predictive alerts on performance and budget threshold based upon utilization data

# Amazon Web Services

# Amazon Web Services (AWS)

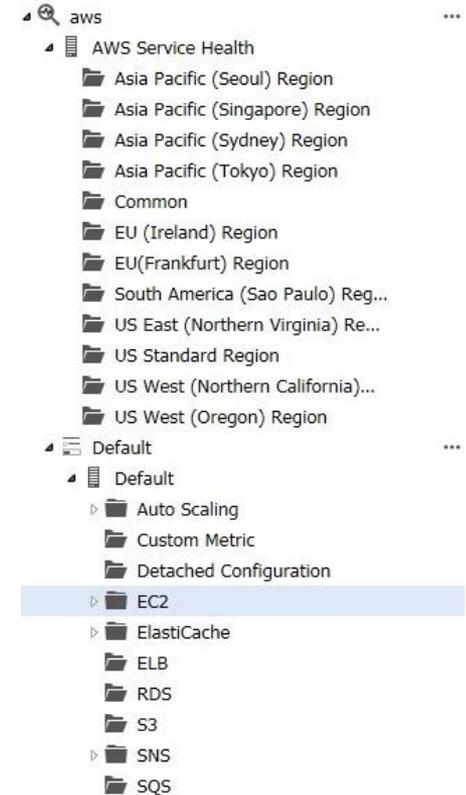
## Market Share Leader For Public Cloud

- Leads public cloud market in share and revenue
  - Now reached \$14 billion+ run rate for Amazon
  - Offers numerous IaaS, PaaS and SaaS services
  - Global presence offered through a growing number of regional data
- CA Unified Infrastructure Management AWS Probe 5.25
  - Automated discovery of AWS EC2 instances and 12 other AWS services
  - New OOTB dashboards using CA Business Intelligence based on JasperSoft



# AWS Services Supported by CA UIM Today

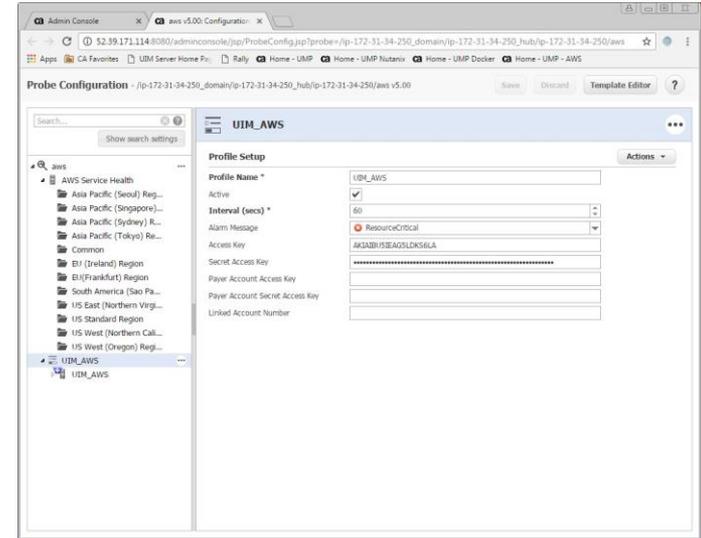
| AWS Service                       | Description   |
|-----------------------------------|---|
| AWS Service Health                | Status of AWS services across all regions                     |
| CloudWatch                        | AWS monitoring service provides metrics and estimated charges |
| EC2 – Elastic Compute Cloud       | IaaS – Compute Instances                                      |
| EBS – Elastic Block Storage       | IaaS – Block storage volumes                                  |
| ELB – Elastic Load Balancing      | IaaS – Load balancing service                                 |
| Auto Scaling                      | IaaS – Group of EC2 instances that can scale up or down       |
| S3 – Simple Storage Service       | IaaS – Object Storage   |
| RDS – Relational Database Service | PaaS – Relational database as a service                       |
| Elasticache                       | PaaS – Caching service  |
| SQS – Simple Queue Service        | PaaS – Message queuing service                                |
| SNS – Simple Notification Service | PaaS – Push notification service                              |
| ECS – EC2 Container Service       | IaaS – Container management service                           |
| Route 53 – DNS                    | IaaS – Domain name services                                   |
| DynamoDB                          | PaaS – NoSQL database as a service                            |
| Lambda                            | FaaS – Serverless compute service                             |



# Amazon Web Services

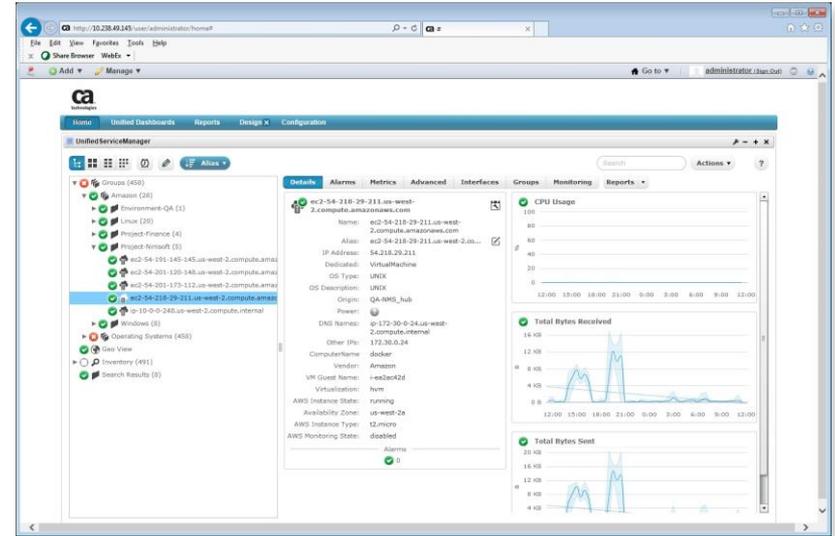
## *Probe Configuration*

- Configuration options
  - Probe discovery and collection intervals (this can affect costs)
  - Account credentials (don't confuse your access key and secret key
    - To collect billing data separate credentials may be required
  - EC2 label property = determines whether instance ID, primary IP, or name tag are used in probe oriented configuration
  - Proxy info; parameters for configuring a proxy



# Amazon Web Services in Unified Service Manager (USM)

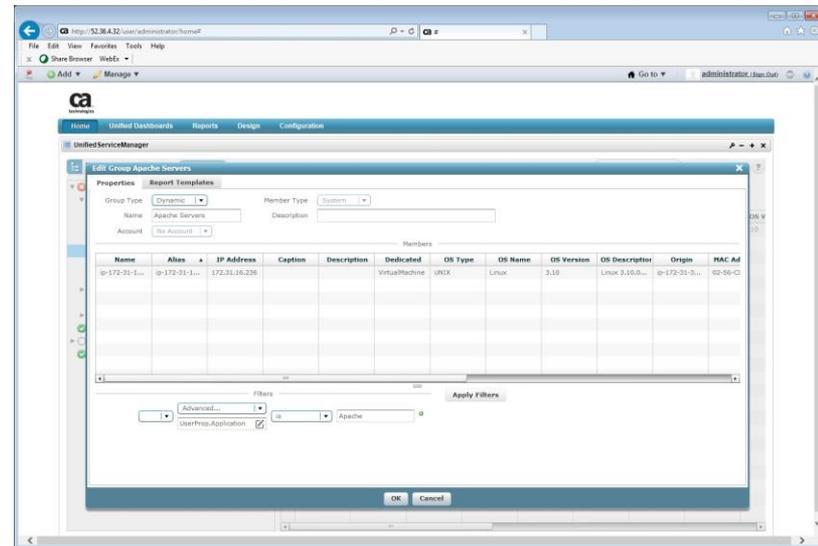
- USM details tab
  - Contains additional EC2 instance information in the left pane
  - Graphs from AWS CloudWatch are displayed
- USM tree view
  - EC2 instances and AWS Service Health show as computer systems
  - The AWS Profile/Resource shows as a computer system
    - Non-IP services metrics found here



# AWS Probe Dynamic Groups

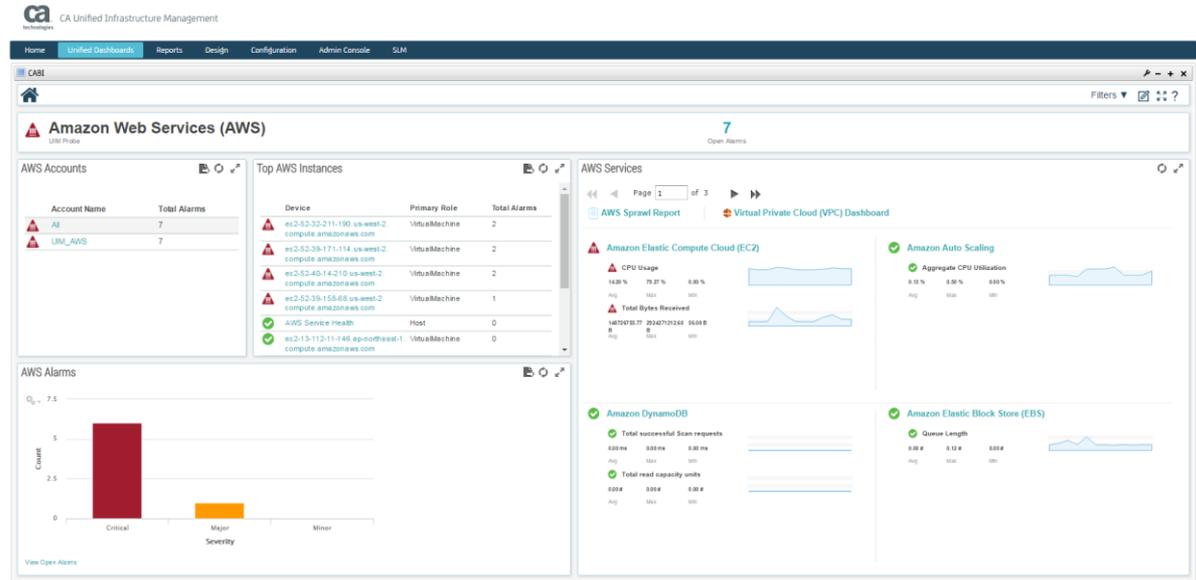
## *Grouping by Tags or Properties*

- Dynamic Grouping by Tags or Properties
  - Groups automatically created for Amazon, then by OS
  - For tags, in the group editor, amazon tags are found in the filters section underneath advanced; look for UserProp<tag>
  - Groups can also be created using other attributes such as region or type



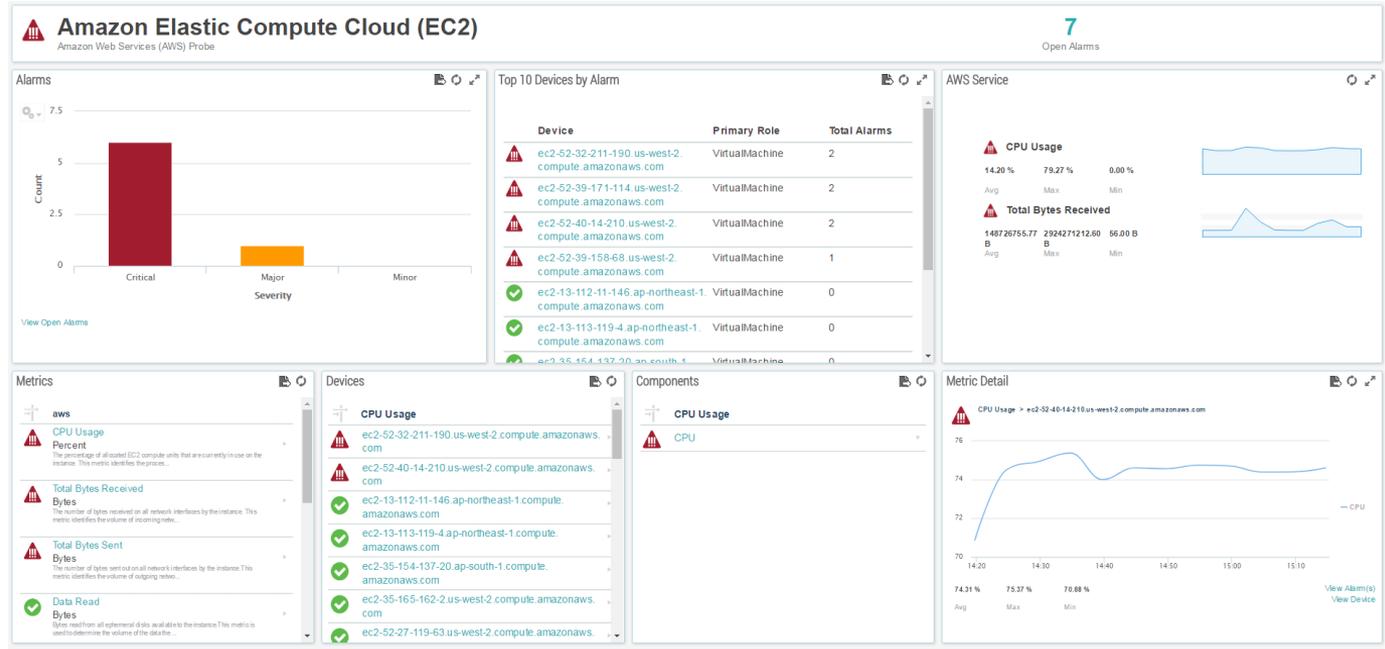
# AWS CA Business Intelligence Dashboards – Summary

- AWS probe includes out-of-the-box CA BI dashboard summarizing health and KPIs for AWS services



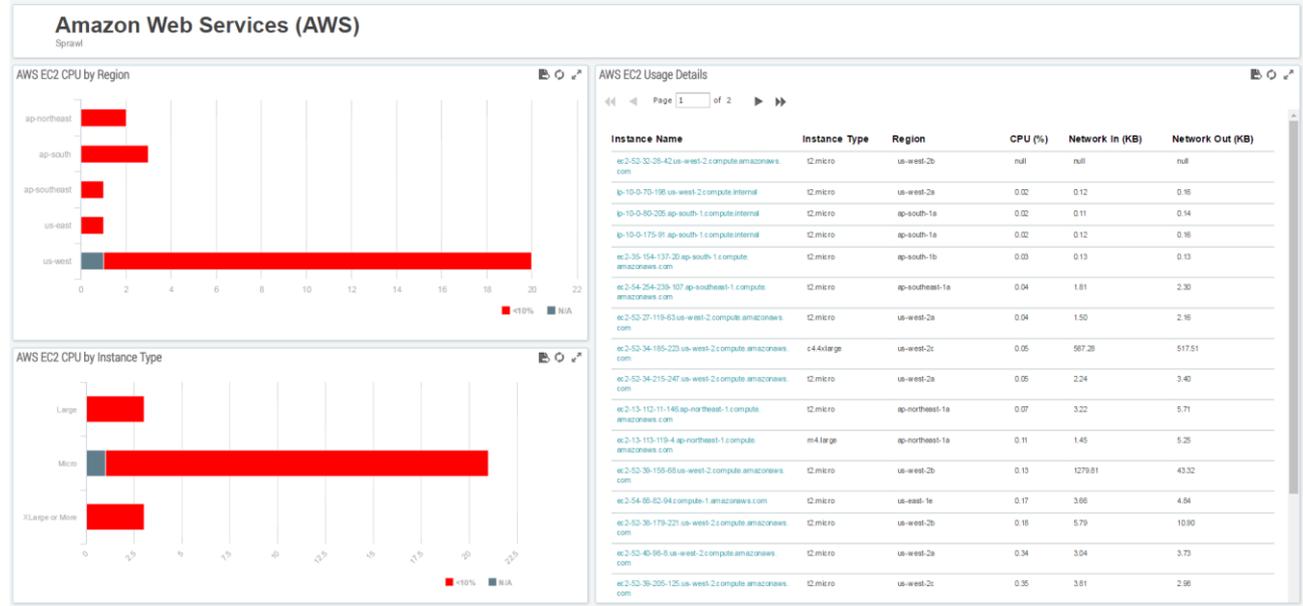
# AWS CABI Dashboards – Service Drilldown

- AWS service dashboards display key usage and performance metrics for each service



# AWS CABI Dashboards – Sprawl

- AWS service dashboards helps identify cloud “sprawl” to better optimize utilization and control costs



# Microsoft Azure

# Microsoft Azure

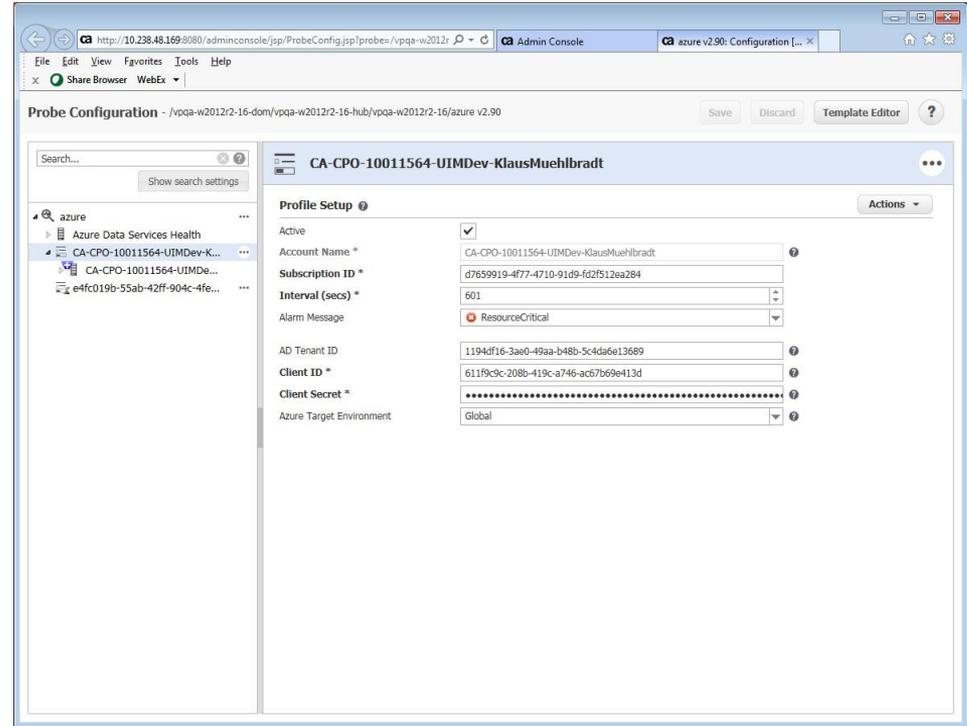
- Second in market share to AWS but growing faster
  - Still seeing triple digit growth
  - Strong in both IaaS and PaaS, used as platform for Microsoft SaaS offerings such as Office 365 and Dynamics 365
  - Global presence offered through a growing number of regional datacenters
- CA Unified Infrastructure Management Azure Probe 3.00
  - Support Azure Resource Manager (ARM) model
  - OOTB dashboards using CA Business Intelligence based on Jaspersoft

# New Azure Probe 3.02

- Support for Azure Resource Manager (ARM) model
  - New API based on Resource Groups
- Azure VMs and Azure Storage
  - Substantially more metrics and properties available from new API
  - Support for Azure Managed Disks with VMs
- Support for Web Apps App Service (formerly Websites) with expanded metrics
- Support for Azure SQL database service

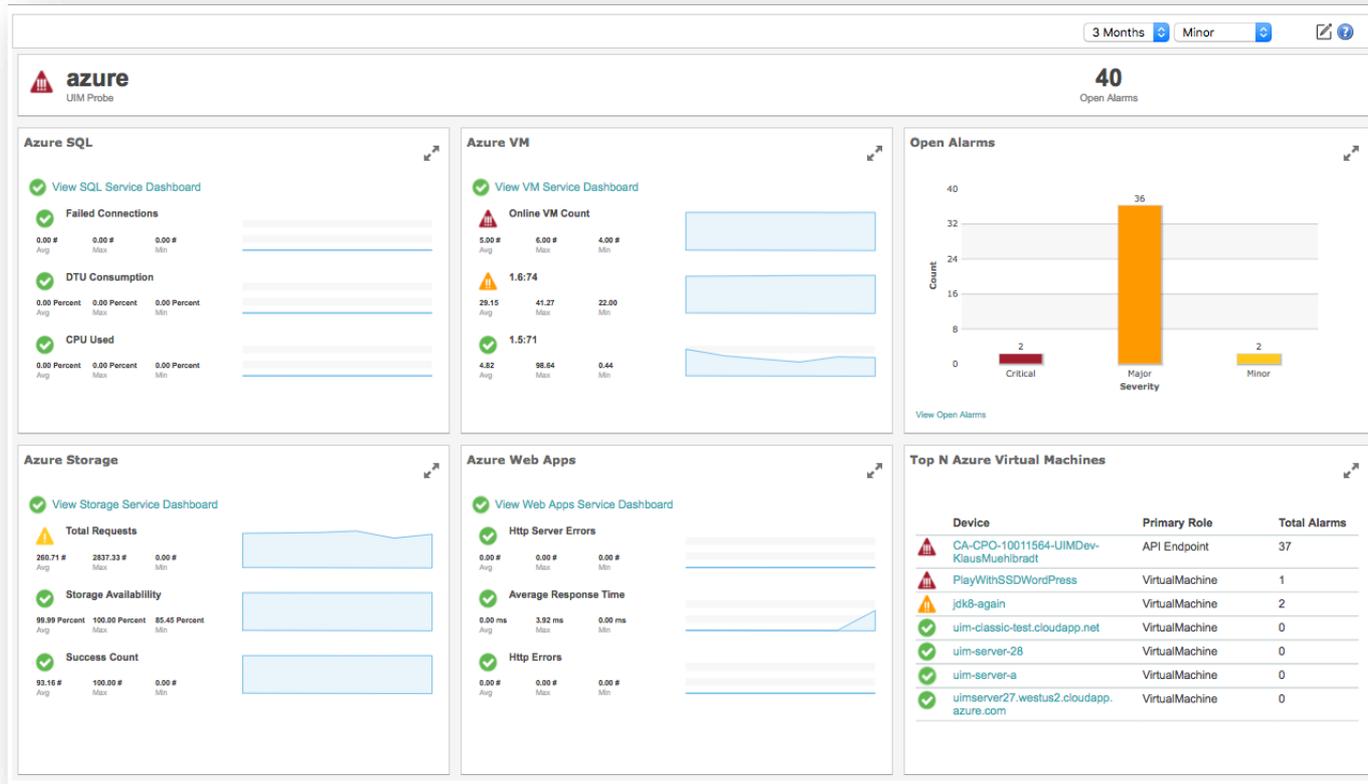
# Azure Probe Authentication

- Azure probe supports data from ARM model and Classic model with single authentication

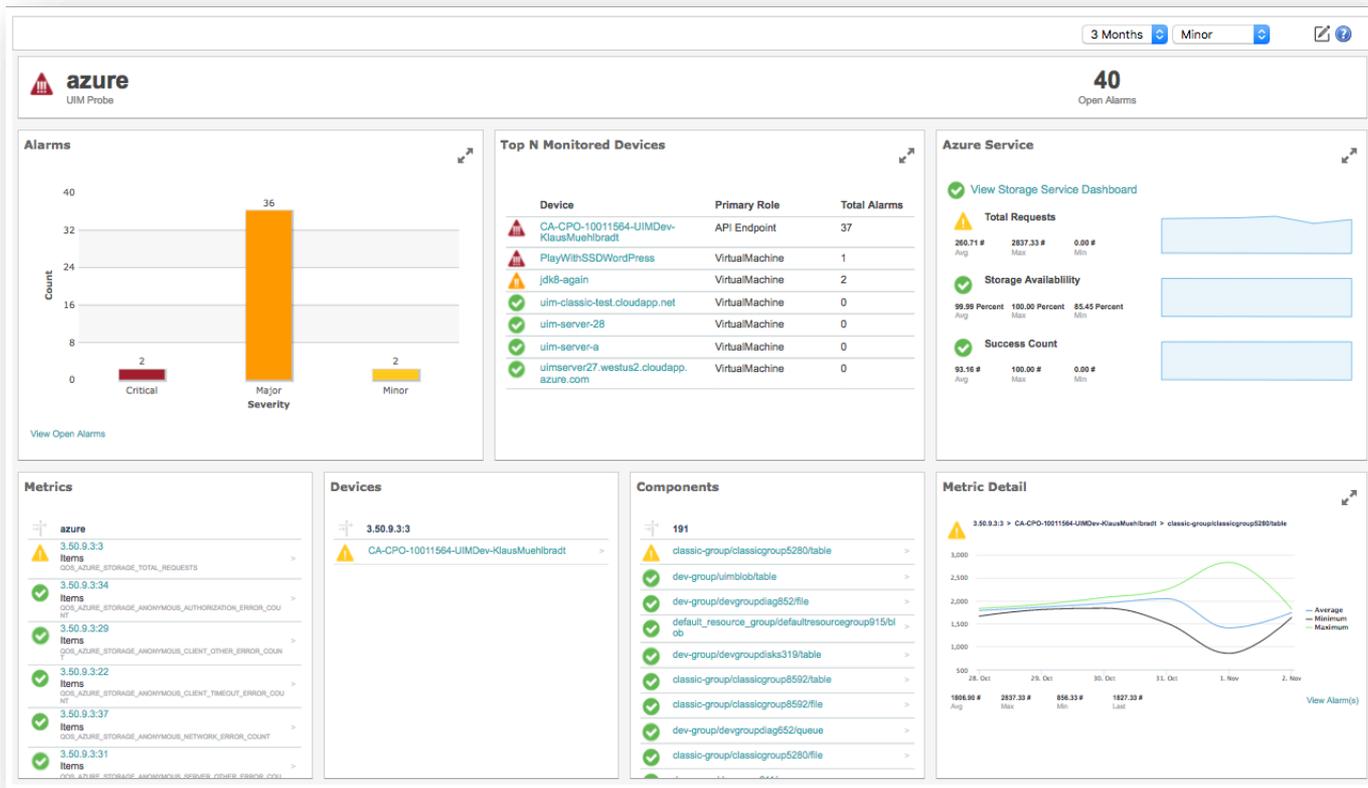




# Azure Summary Dashboard



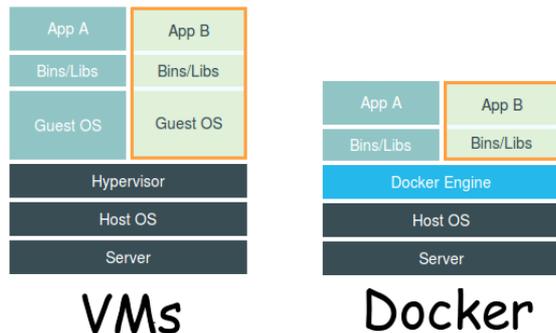
# Azure Storage Service Dashboard



# Docker

# Docker Overview

- Containers, not VMs
- Intended to run a single application
  - Repeatable
  - Isolated
- De facto delivery vehicle for cloud applications; second most popular open source project after OpenStack
- Highly scalable, milliseconds to start a container, vs. minutes for a VM
- Used by customers to drive DevOps style software development



# Docker Monitoring

- Docker probe monitors the Docker Engine API
- Host (Engine) Metrics
  - Container and image counts
  - CPU
  - Memory
  - Disk
  - Network
- Container Metrics
  - Status
  - CPU
  - Memory
  - Disk
  - Network
  - Processes in container

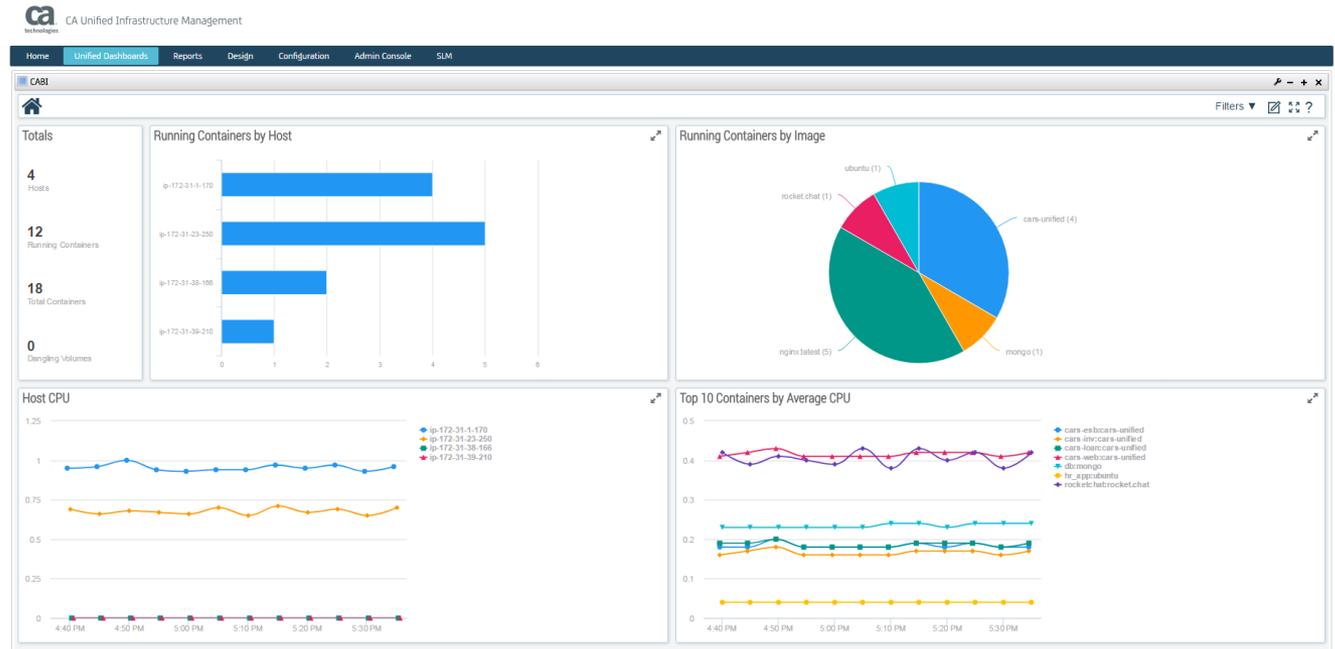
# The Docker Probe

## *Prerequisites and Configuration*

- Requirements
  - Docker version 1.9 or greater, Linux only
    - %docker – version to check, %docker ps to make sure Docker is running
- Configuration
  - Unix socket file or TCP; when using a Unix socket file, the probe must be located locally to the Docker engine

# Docker CA Business Intelligence Dashboard

- At a glance view of key performance and usage indicators for your Docker environment



Nutanix

# Nutanix Overview

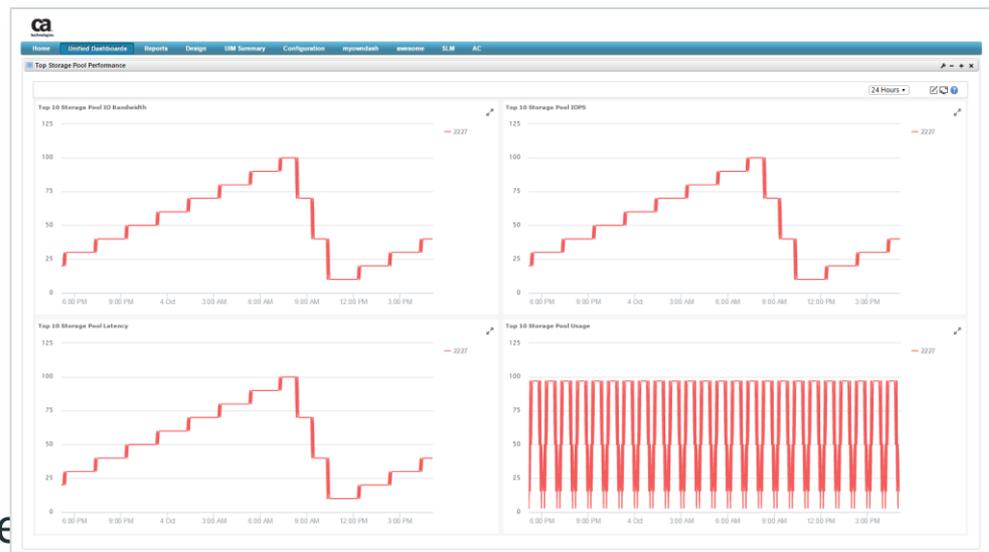
- Market leader in hyper-converged integrated systems (per Gartner MQ)
  - Market growing rapidly, 84% YoY revenue growth, IPO on Sept 30, 2016
  - A server appliance, cloud platform in a box
  - Supports hypervisors such as ESX, Hyper-V, or its own Acropolis
- System storage or a replacement for SAN
  - Each appliance includes SSD and HDD that cluster together to form the Nutanix distributed filesystem
- Our probe retrieves information from the Prism API



# Nutanix Probe 1.33

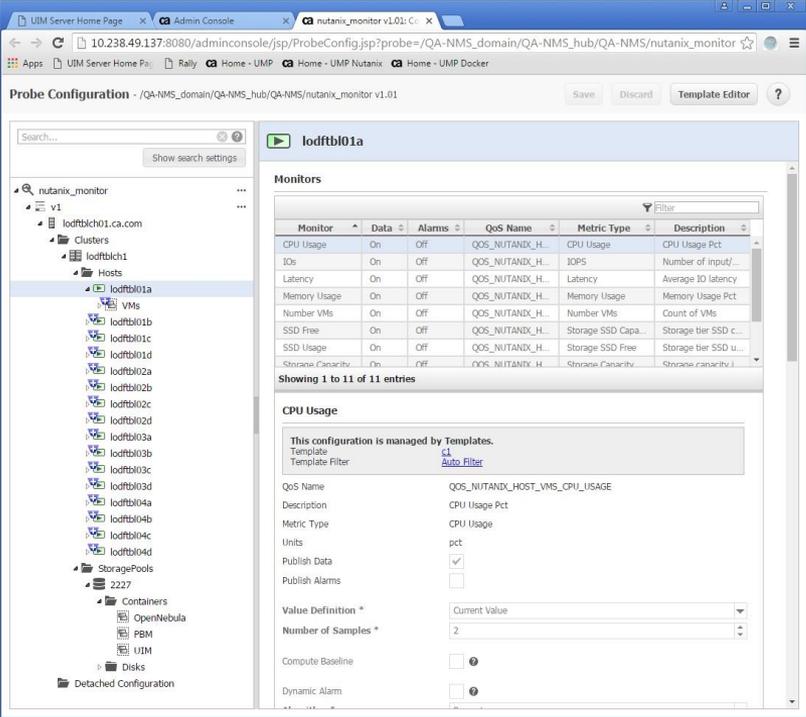
## *What Do We Monitor?*

- Cluster metrics
- Host metrics
- VM metrics
- Storage pool metrics
- Container (subset of a storage)
- Disk metrics



# The Nutanix Probe Details

- Requirements
  - Tested with Prism 4.6 and 4.7
- Configuration
  - Hostname, port, username, password
  - Monitor VMs: When enabled VMs will



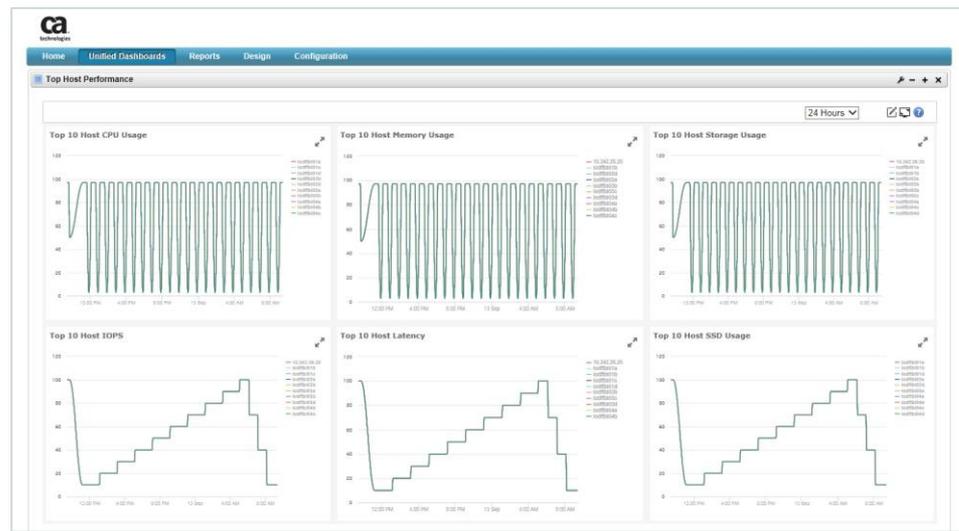
The screenshot displays the Nutanix Monitor Admin Console interface. The browser address bar shows the URL: `10.238.49.137:8080/adminconsole/jsp/ProbeConfig.jsp?probe=/QA-NMS_domain/QA-NMS_hub/QA-NMS/nutanix_monitor`. The page title is "Probe Configuration - /QA-NMS\_domain/QA-NMS\_hub/QA-NMS/nutanix\_monitor v1.01".

The interface is divided into several sections:

- Search:** A search bar with a "Show search settings" button.
- Navigation Tree:** A tree view on the left showing the hierarchy: `nutanix_monitor` > `v1` > `lodftblch01.ca.com` > `Clusters` > `lodftblch1` > `Hosts` > `lodftbl01a`. Other items include `VMs`, `StoragePools`, `Containers`, `OpenNebula`, `PBM`, `UJM`, and `Disks`.
- Monitors Table:** A table listing various system metrics. The columns are: Monitor, Data, Alarms, QoS Name, Metric Type, and Description. The table shows 11 entries, including CPU Usage, I/Os, Latency, Memory Usage, Number VMs, SSD Free, SSD Usage, and Storage Capacity.
- Configuration Panel:** A detailed view for the selected monitor "lodftbl01a". It shows that the configuration is managed by a template named "QOS\_NUTANIX\_HOST\_VMS\_CPU\_USAGE". The description is "CPU Usage Pct", the metric type is "CPU Usage", and the units are "pct". The "Number of Samples" is set to 2.

# Nutanix CA Business Intelligence Dashboards

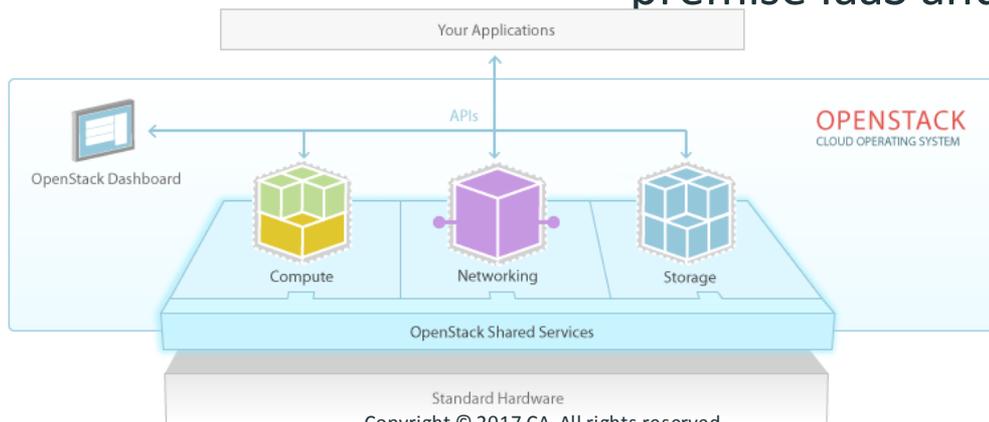
- Nutanix summary
- Average performance of clusters
- Performance by cluster
- Top 10 VM consumers
- Top host performance
- Top storage pool performance



# OpenStack

# OpenStack Overview

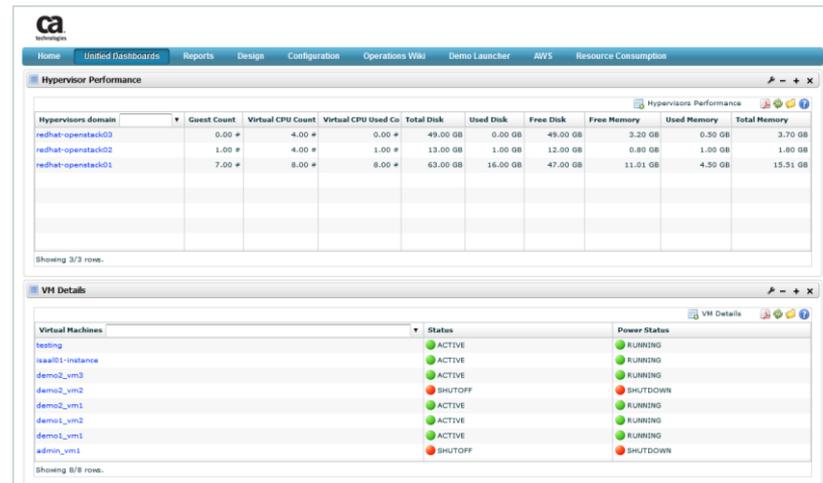
- Private cloud provider, also used by service providers to provide cloud services
  - Started in 2010 by Rackspace and NASA
  - Open source solution, releases every 6 months; current release Newton
- Openness that comes with complexity
- Often referred to as build your own cloud
- Primarily used to provide on premise IaaS and reduce costs



# OpenStack Probe 1.36

## What Do We Monitor?

- Service endpoints – are OpenStack services running?
- Controller node status
- Compute node metrics
- Instance metrics
  - CPU, memory, disk and network
- Project metrics
- Quota metrics
- Volume metrics



The screenshot displays the OpenStack Probe 1.36 interface. The top navigation bar includes links for Home, Unified Dashboards, Reports, Design, Configuration, Operations Wiki, Demo Launcher, AWS, and Resource Consumption. The main content area is divided into two sections: 'Hypervisor Performance' and 'VM Details'.

**Hypervisor Performance**

| Hypervisors domain | Guest Count | Virtual CPU Count | Virtual CPU Used Co. | Total Disk | Used Disk | Free Disk | Free Memory | Used Memory | Total Memory |
|--------------------|-------------|-------------------|----------------------|------------|-----------|-----------|-------------|-------------|--------------|
| redhat-openstack03 | 0.00 #      | 4.00 #            | 0.00 #               | 49.00 GB   | 0.00 GB   | 49.00 GB  | 3.20 GB     | 0.50 GB     | 3.70 GB      |
| redhat-openstack02 | 1.00 #      | 4.00 #            | 1.00 #               | 13.00 GB   | 1.00 GB   | 12.00 GB  | 0.80 GB     | 1.00 GB     | 1.80 GB      |
| redhat-openstack01 | 7.00 #      | 8.00 #            | 8.00 #               | 63.00 GB   | 16.00 GB  | 47.00 GB  | 11.01 GB    | 4.50 GB     | 15.51 GB     |

Showing 3/3 rows.

**VM Details**

| Virtual Machines | Status  | Power Status |
|------------------|---------|--------------|
| testing          | ACTIVE  | RUNNING      |
| isaal01-instance | ACTIVE  | RUNNING      |
| demo2_ym3        | ACTIVE  | RUNNING      |
| demo2_ym2        | SHUTOFF | SHUTDOWN     |
| demo2_ym1        | ACTIVE  | RUNNING      |
| demo1_ym2        | ACTIVE  | RUNNING      |
| demo1_ym1        | ACTIVE  | RUNNING      |
| admin_ym1        | SHUTOFF | SHUTDOWN     |

Showing 8/8 rows.

# The OpenStack Probe

## Details

- Configuration
  - Utilizes standard OpenStack APIs
  - Interfaces with Keystone service on controller node for authentication and services
    - Supports Keystone v2 or Keystone v3 with domains
  - Interfaces with several additional services including Nova, Neutron, Cinder, and Ceilometer for inventory and metrics

The screenshot displays the OpenStack Admin Console configuration page for a probe named 'redhat-openstack01'. The left sidebar shows a tree view of the OpenStack environment, including services like cinder, glance, keystone, nova, and swift. The main content area features a 'Monitors' table with columns for Monitor, Data, Alarm, QoS Name, Metric Type, and Description. Below the table, there are configuration options for the selected monitor, including 'Compute Baseline', 'Dynamic Alarm', and 'Algorithm' settings.

| Monitor      | Data | Alarm | QoS Name          | Metric Type             | Description   |
|--------------|------|-------|-------------------|-------------------------|---|
| Free Disk    | On   | Off   | QOS_OPENSTACK_HYP | Disk Free               | Size of the local disk not used by hypervisor.        |
| Free Memory  | On   | Off   | QOS_OPENSTACK_HYP | Free Memory             | The hypervisor's local free memory.                   |
| Guest Count  | On   | Off   | QOS_OPENSTACK_HYP | Number of Virtual Mach. | Number of Virtual Machines running on the hypervisor. |
| Total Disk   | On   | Off   | QOS_OPENSTACK_HYP | Disk Size               | The hypervisor's total disk size.                     |
| Total Memory | On   | Off   | QOS_OPENSTACK_HYP | Total Local Memory      | The hypervisor's total local memory.                  |
| Used Disk    | On   | Off   | QOS_OPENSTACK_HYP | Disk Usage              | Size of the local disk used by the hypervisor.        |
| Used Memory  | On   | Off   | QOS_OPENSTACK_HYP | Used Memory             | The hypervisor's local memory usage.                  |

# What Questions Do You Have?

THANK YOU!