Advancing Towards the Future of Cloud Computing: Intel Open Cloud Vision

Nikos G. Panagiotidis
Market Development Manager
Cisco Connect Athens, 23/4/2013

Growth & IT Challenges Drive Need for Cloud Computing

Growth

>3B
connected users by 2015[1]

2X growth
in information every two years[2]

15B
connected devices by 2015[3]

>11X
increase in mobile data traffic by 2015[4]

Up to 2X or $27B[5]
in additional data center power costs by 2015

IT Challenges

Improve Agility
Reduce service delivery times, improve TCO

Greater Efficiencies
Reduce complexity & deploy new workloads

Gain Better Insights
Via intelligent analytics

Avoid Lock-In
Seek interoperable solutions & services

1 Cisco Global Cloud Index Nov 2011
2 IDC Extracting Value from Chaos June 2011
3 Intel ECG – One Smart Network device forecast
4 Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2011–2016, Feb 2012
5 Datacenter Dynamics Global Datacenter Energy Demand 2012 forecast http://www.datacenterdynamics.com/research/energy-demand-2011-12; projected to 2015 by Intel; Assume $0.10/kWh

Cloud Adoption Growing & Delivers Benefits

Today: 14%
2014: 42%
>40% of IT operations[1]

IT Survey Results

Hybrid Cloud

35% by 2015[2]

Today: 7%
2014: 23%
>40% of IT operations[1]

Intel IT example[3]

	Traditional IT – 2009	Private cloud - 2011
Resource provisioning	90 days	45 minutes
Virtualized Platforms	12%	65%
Asset Utilization	10-20%	>60%
Capacity	Silos	Shared globally
Cost Savings		$9M in savings in 2 years

1 ODCA global member survey, Oct 2011, N=63
2 Gartner, Dec 2010, N=55 The Road Map From Virtualization to Cloud Computing (G00210845)
3 Source: Intel IT- http://premierit.intel.com/docs

Progress Towards Vision of "Cloud 2015"

Today
Silo'd Clouds

Federated

- Growing public and private cloud adoption
- Security, management complexity, app migration

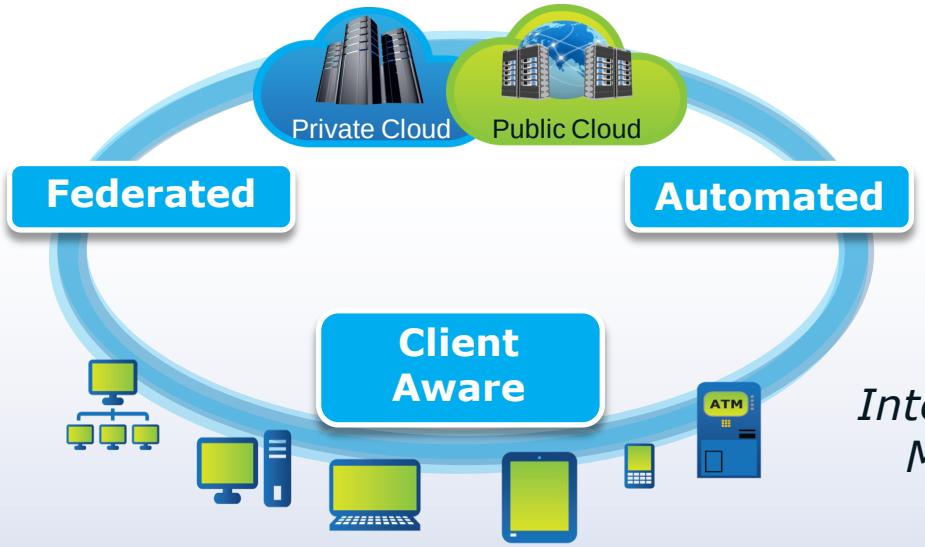
Automated

- Resource Provisioning: Months => Minutes
- Manual processes

Client Aware

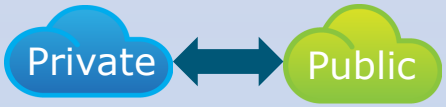
- Context aware growing: screen size, location, identity
- Lack client aware standards

2015 & Beyond: Open Cloud Vision



Open Clouds
Interoperable, Built on Open, Multi-Vendor Solutions & Industry Standards

2015



- Integrated hybrid clouds
- Easy to compare services
- Automated security and resource allocation
- Expanded context awareness

Future

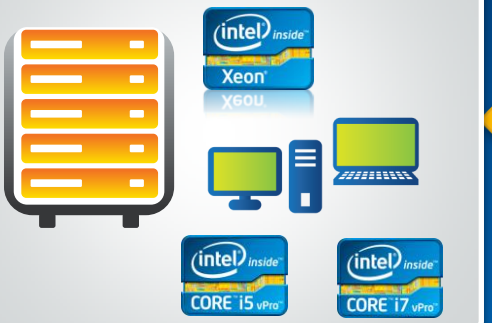
- Services & resources adapt to environment
- Predictive, real-time analytics
- User experience adapts to patterns/behaviors

Intel Strategy to Realize Open Cloud Vision

IT Requirements & Open Standards

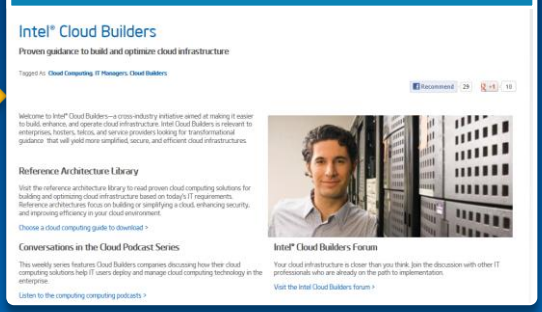
Define and Prioritize IT Requirements & Accelerate Open Industry Standards

Optimized Platforms



Deliver optimized products for more secure, efficient, automated platforms built on a common architecture

Intel® Cloud Builders & Cloud Finder



Enable proven solutions that ease cloud adoption & help guide cloud service provider selection

Barriers to Cloud Adoption

Risk Aversion

Compliance

Quality of Service

Lock In

Technology Maturity

Security

Scale & Automation

Standards

Cultural/ Organizational

Structure

New roles

Skills development

Scaling the Infrastructure

Cloud Security: Lack of control, manual auditing, identity theft

Resource Orchestration: Complex/management silos

Servers

Unpredictable demand
Space/power constrained

Storage

Massive data growth
Inflexible, hard to scale

Networking

Lack flexibility
Complex management

Open Data Center Alliance

Defining requirements & amplifying voice of IT

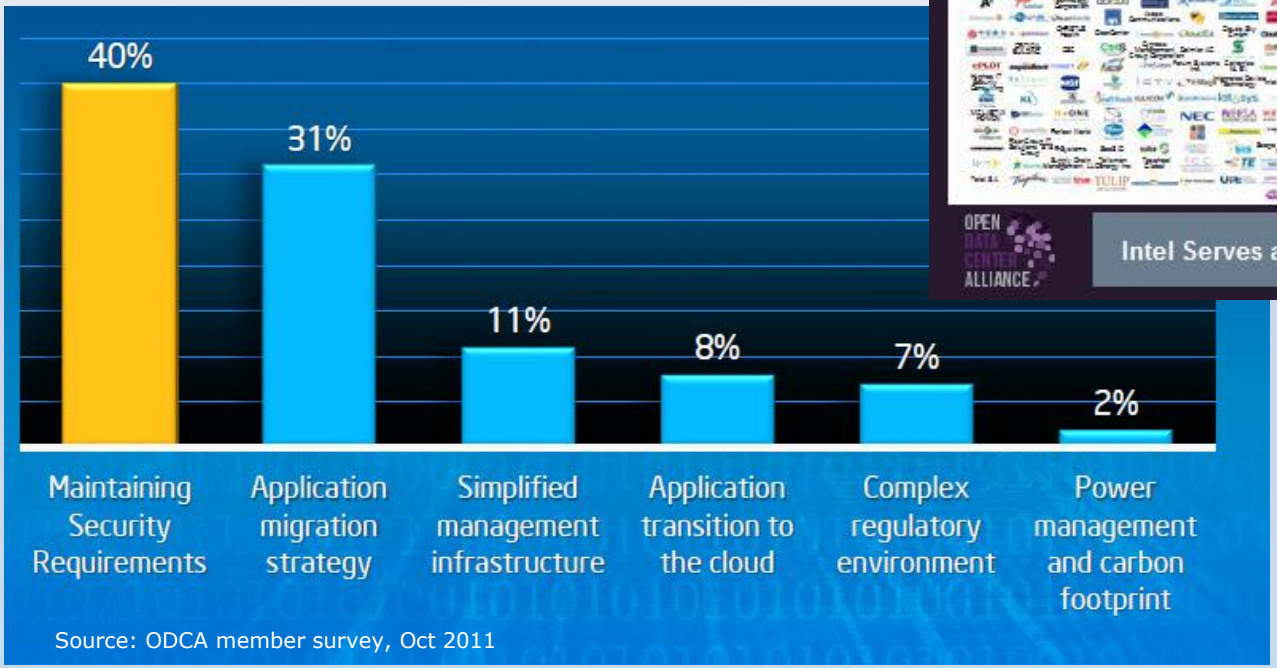
Published IT Requirements for:

- Secure Federation
- Enhanced Identity Management
- Services Transparency & Automation
- Common Management & Policy

Proposal Engine Assistant tool:

- Use ODCA usage models in RFPs

>$100B in annual IT spend



www.opendatacenteralliance.org

OPEN DATA CENTER ALLIANCE

Accelerating Open, Interoperable Standards

ODCA collaborating with multiple industry organizations: CSA, DMTF, Green Grid, OASIS, Open Compute Project, and TMForum

Intel: Technical Advisor

Open source software for building clouds

Intel: Active member

Publishes specs for efficient datacenters, server, storage

Intel: Founding member

Drive standards for development of the web

Intel: Active member

Influence and Take Advantage of Emerging Industry Standards

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Define and Prioritize IT Requirements & Accelerate Industry Standards

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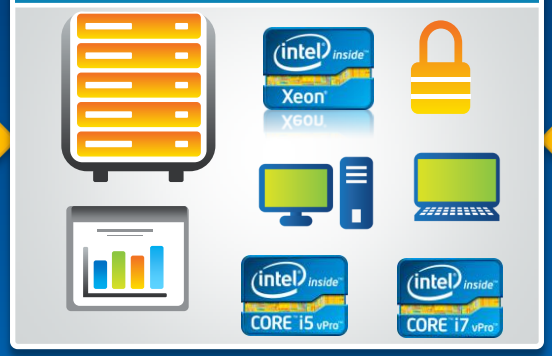

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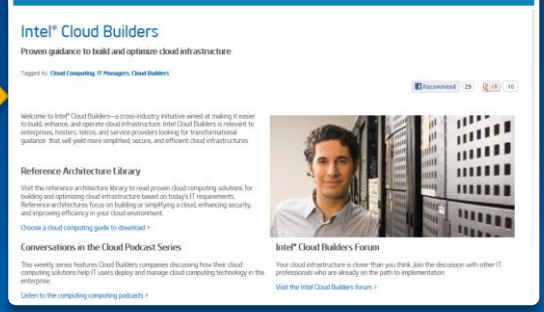


Enable proven solutions that ease cloud adoption & provide guidance on cloud service provider selection

Open Cloud Platform Evolution

Key Attributes

- ✓ **Common architecture** built on **standard high-volume building blocks**
- ✓ **Programmable** for rapid ecosystem innovation in software
- ✓ **Standard management interfaces** for multi-vendor interoperability

Automated Security: Hardware-enhanced client to cloud security enforcement, audit & identity protection

Integrated Resource Orchestration: Integrate and automate via standard management interfaces

Scalable Resource Pools: Converged Servers, Storage, Networking

Efficient, Secure, Highly Scalable Servers

Immensely Scalable, Distributed Storage

Programmable, Software Defined Networks

Servers: Efficient, Secure, Highly Scalable

Environment

Homogeneous, Virtualized
Built in security / virtualization
>16X efficiency gains past 5 years[1]

Challenges

- Improve OpEx: Seek more granular platform controls
- Workload optimized platforms
- Infrastructure security:1,200 new rootkits/day[2]
- Enhance QoS & VM isolation

Future

- Platforms tailored to workloads
- Advanced security, virtualization, power & management controls

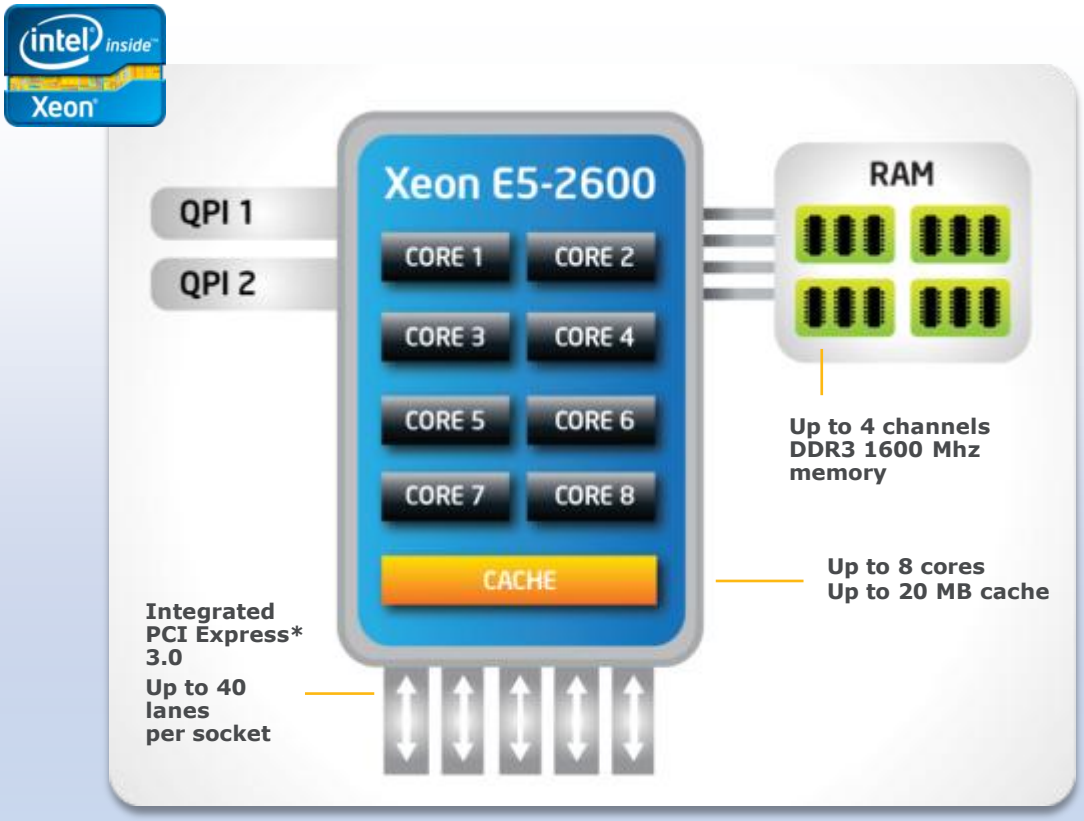
Benefits

- Scale & improved automation
- OpEx & QoS improvements
- More secure infrastructure

1.Source: Intel – based on SPECpower results from 2006 – 2012. Refer to backup for more details.
2.McAfee Labs, Quarterly Threats Report

The Heart of Cloud Datacenters

Intel® Xeon®: The Datacenter's primary building block



Up to **80% performance boost** vs. prior gen[1] at consistent power level

Dramatically reduce compute time with Intel® Advanced Vector Extensions

Performance when you need it with Intel® Turbo Boost Tech 2.0

Intel® Integrated I/O with Intel® Data Direct I/O **cuts latency**[2] while adding capacity & bandwidth

up to **66% reduction in total cost of ownership**[1]

Estimate your refresh savings:
www.intel.com/go/xeonestimator

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.

1 Over previous generation Intel® processors. Intel internal estimate. For more legal information on performance forecasts go to http://www.intel.com/performance
2 Intel measurements of average time for an I/O device read to local system memory under idle conditions. Improvement compares Xeon processor E5-2600 family vs. Xeon processor 5600 series
3 Source: Intel internal analysis (backup); 2008 of 3 yr TCO. 4X power efficiency of 4 year old servers. See www.intelsalestraining.com/xeonestimator
* Other names and brands may be claimed as the property of others

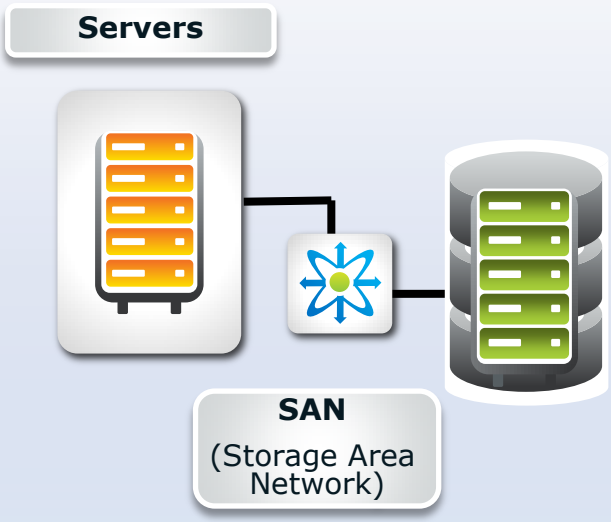
Scalable Cloud **Storage** Advancements

Environment

20%
of all info "touched" by cloud by 2015[1]

50X
Increase in data managed by 2020[1]

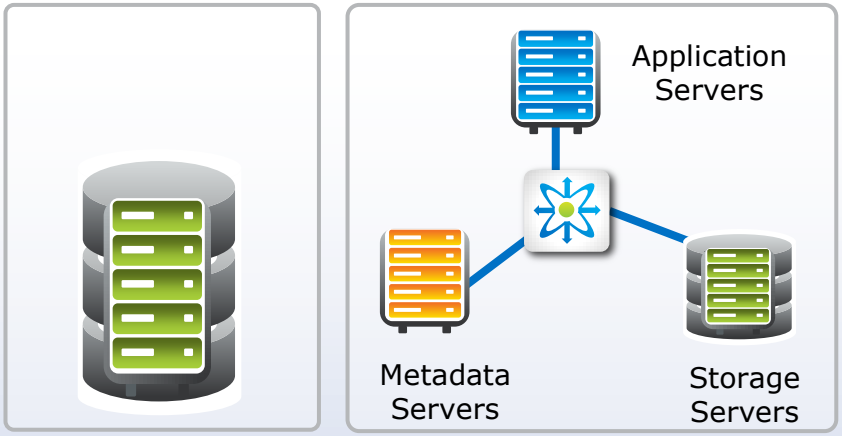
Traditional Centralized Storage



Challenges

- Limited scalability & cost effectiveness
- Long deployment times

Future



Centralized ***Scale out***

- More efficient centralized storage
- Scale out, highly distributed storage
- Advanced storage capabilities

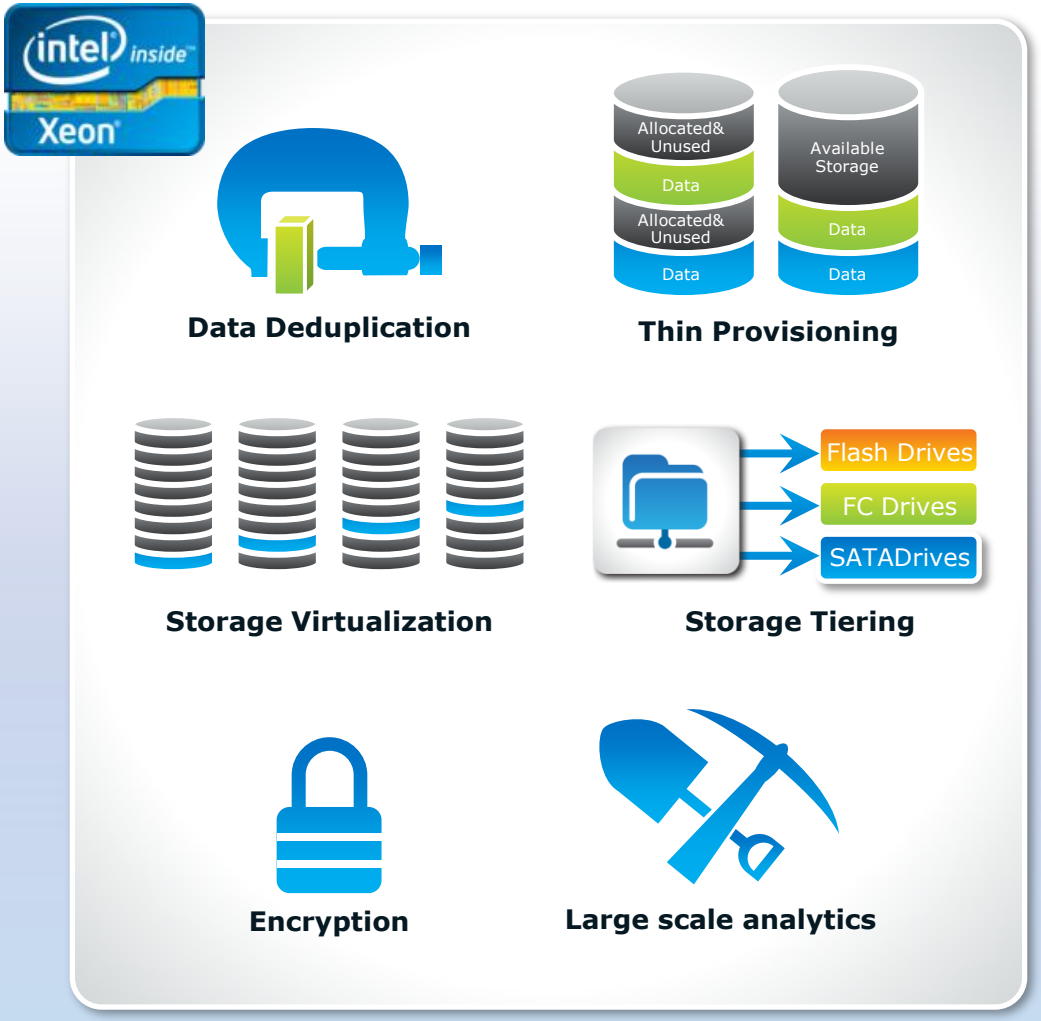
Benefits

- Scale up to Exabytes
- Lower cost $/TB for capacity
- Flexibility

1 IDC Digital Universe Study 2011

Accommodate Data Growth with Scale-out Storage

Intel® Xeon® powers today's compute intensive storage strategies[2]



Many organizations have **data growth of 40%-100% per year**—mostly unstructured data

Scale-out NAS systems required **accommodate this growth by more simply** adding more capacity and compute as needed

Reduce total storage footprint by >50% with storage refresh

Reduce storage device capacity growth by 25% via thin provisioning

Improve storage efficiency by up to 25% with data de-duplication

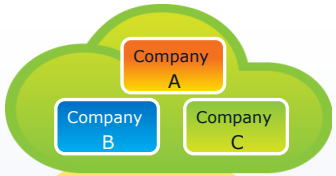
Intel® High Performance SSDs
Increased Performance
Datacenter Endurance
New Safety Features
up to 2X TCO Savings[3]

1. Source for savings claims: IT@Intel Whitepaper "Solving Intel IT's Data Storage Challenges". December 2011
2. Intel Xeon is the storage industry's processor of choice. Xeon MSS of storage market is 80% (2011); Source: IDC WW DSS Tracker FinalHistoricalPivot_2011_Q4 & Intel internal data
3. TCO generated from SNIA* (Storage Networking Industry Association). TCO model for Solid-State Storage. Calculations based on 4K random, 65/35 read writes. 3.5" SAS 15K HDD 48 drives, 73GB RAID 5. TCO model can be found at: www.snia.org.

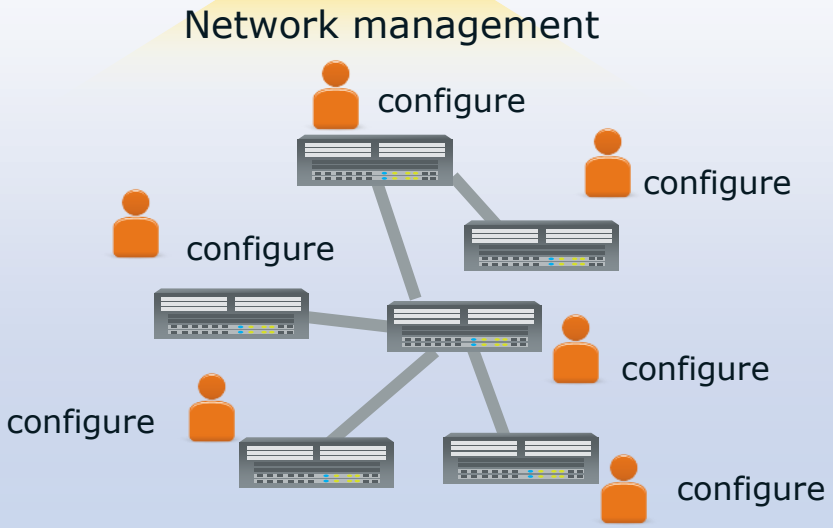
Intel(R) SSD Datacenter Total Cost of Ownership calculator

Optimized **Networking** for Cloud Infrastructure

Environment



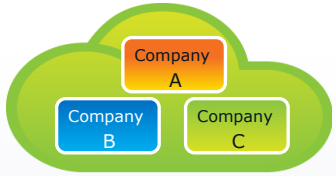
Multi-tenant
Dynamic



Challenges

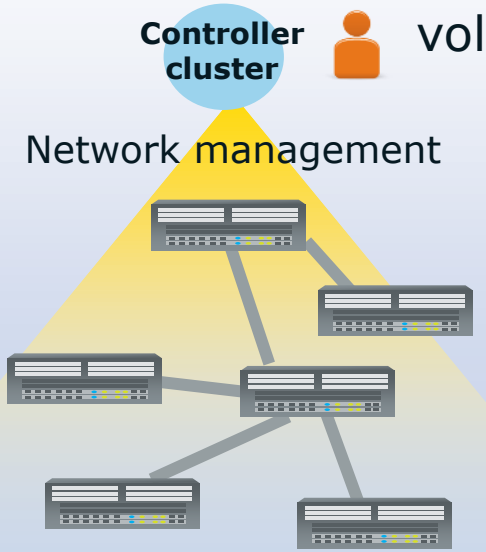
- Complex management
- Isolate multi-tenant networks
- Scale & meet SLAs

Future



Cloud OS

- Programmable
- Open ecosystem
- Standard high volume hardware



Benefits

- Agility, scale, improved QoS
- Network automation
- Increase pace of innovation

Simplify with Intel® 10GbE

The #1 Selling Ethernet Adapter

Simplify

10 X GbE Server Connections → 2 X 10GbE Server Connections

Up to **45%** Reduction in Power per Rack

Up to **80%** Reduction in Cables and Switch ports

Up to **15%** Reduction in Infra-structure Costs

Up to **2x** Improved Bandwidth per Server

Utilize Intel Advanced I/O Technologies: SR-IOV, VMDq, and Intelligent Data Path offload architecture

Unify

FCoE

up to **20%** Lower Total Infrastructure costs[3]

Unify your storage and data networks

>50% of IT shops have >2 storage networks[4]
27% have over five[4]

Intel® Ethernet X520 Server 10GbE Adapter

Intel® Xeon® E5 2600 Integrated I/O and Intel Data Direct I/O

Better Together

Intel® Xeon® E5 2600 brings up to **3X more I/O bandwidth** vs.. prior gen.

Unleash the full I/O capabilities of Xeon® E5 with Intel® 10GbE

1. Ethernet consolidation source: Intel 10GbE ROI Calculator. This ROI calculator is a cost comparison for a highly virtualized solution, using multiple 1GbE connections versus a dual port 10GbE implementation. http://www.event-management-online.de/LAD/calculator.aspx. See back up foils for additional details.
2. Intel® 82599 10 Gigabit Controller and Intel® Ethernet X520 Server Adapter; Intel® 10GbE Adapter: #1 MSS per Dell'Oro Q3'10 Ethernet Report
3. *Source: Intel IT PoC w/ 10GbE and FCoE*
4. http://searchstorage.techtarget.com/magazineContent/4-Gig-FC-1-Gig-Ethernet-dominate-storage-networking

Security: Enhancing Client to Cloud Security

Environment

- Multiple connected devices / user
- Multi-tenant, virtualized, shared

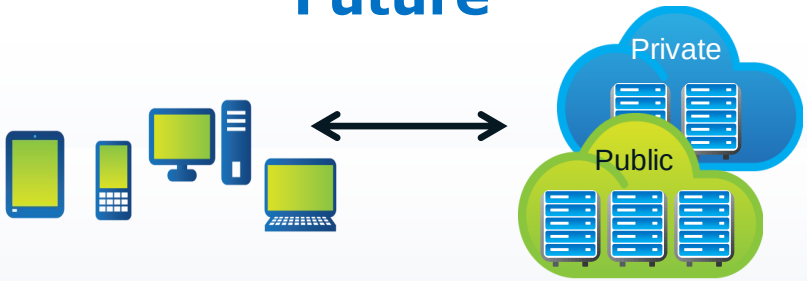
IT Pro survey of key concerns:

55% **Lack of control over data** key concern for *public* cloud adoption[1]

61% **Lack of visibility** inhibiting *private* cloud adoption[1]

57% **Avoid putting workloads** with compliance mandates in cloud[1]

Future



Automated Cloud Security

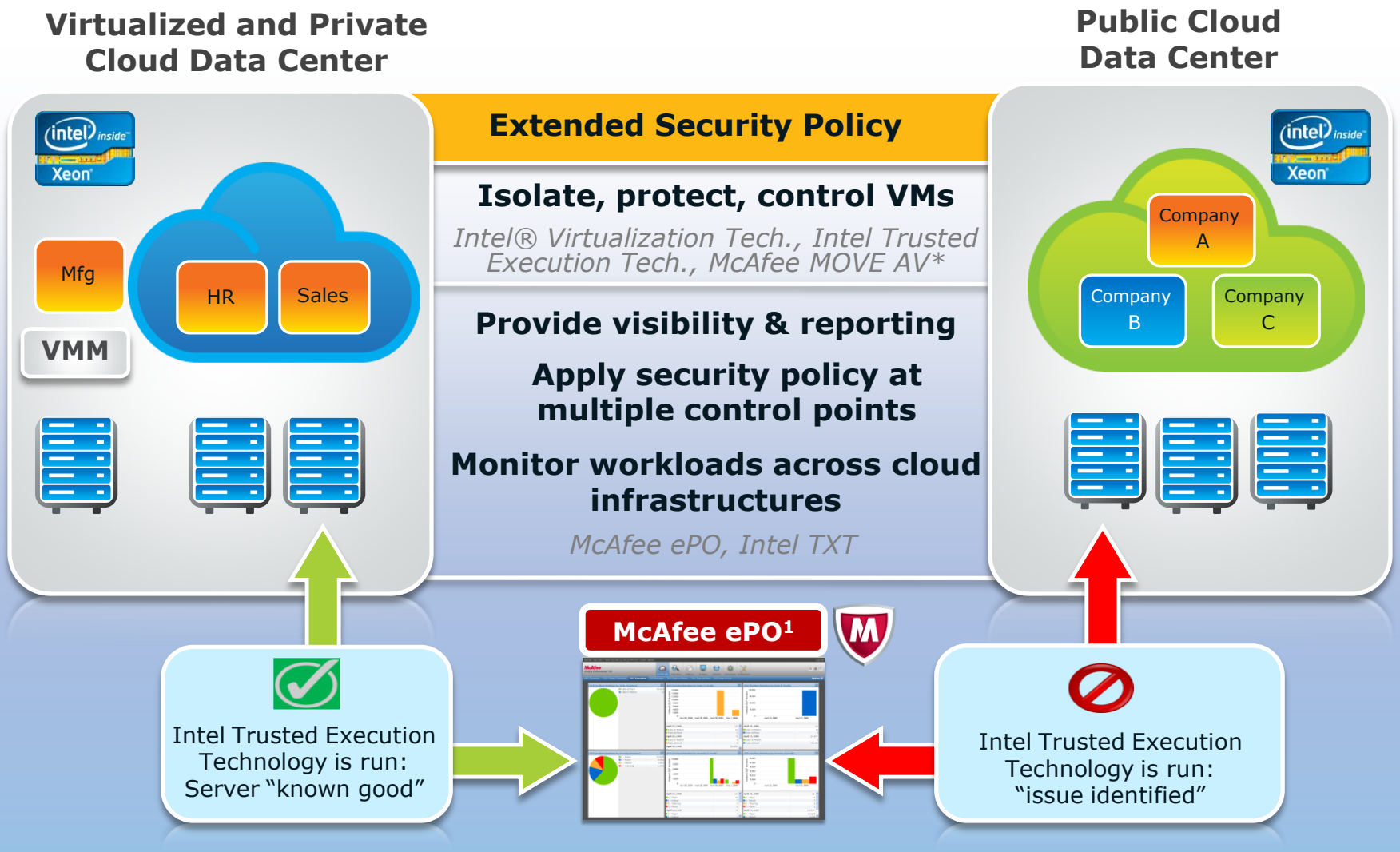
- Auditing & enforcement
- Compare security levels
- Expanded hardware-enhanced security

Benefits

- Better protect data & identities
- Meet compliance requirements
- Efficiency via broad cloud use

1 source: McCann "what's holding the cloud back?" cloud security global IT survey, sponsored by Intel, May 2012

Extending Security Approaches for a Virtual Cloud World



1 Integrating McAfee ePolicy Orchestrator (ePO) with Intel TXT requires custom integration work

*McAfee MOVE AV = McAfee Management of Optimized Virtualized Environments Anti-Virus

Security: Enhancing Client to Cloud Security

Cloud Security Mission: Worry-Free Cloud Computing
In next 5 years, make cloud security equal to or better than traditional best in class enterprise security

Secure Cloud Datacenters

Infrastructure & data protection, audit/compliance

Intel® VT, TXT, AES-NI
McAfee MOVE Anti-Virus
McAfee Application & Change Control

Secure the Connections

Apps, data, traffic

McAfee Cloud Security Platform
McAfee ePO
McAfee GTI

Secure the Devices

Identity & data protection

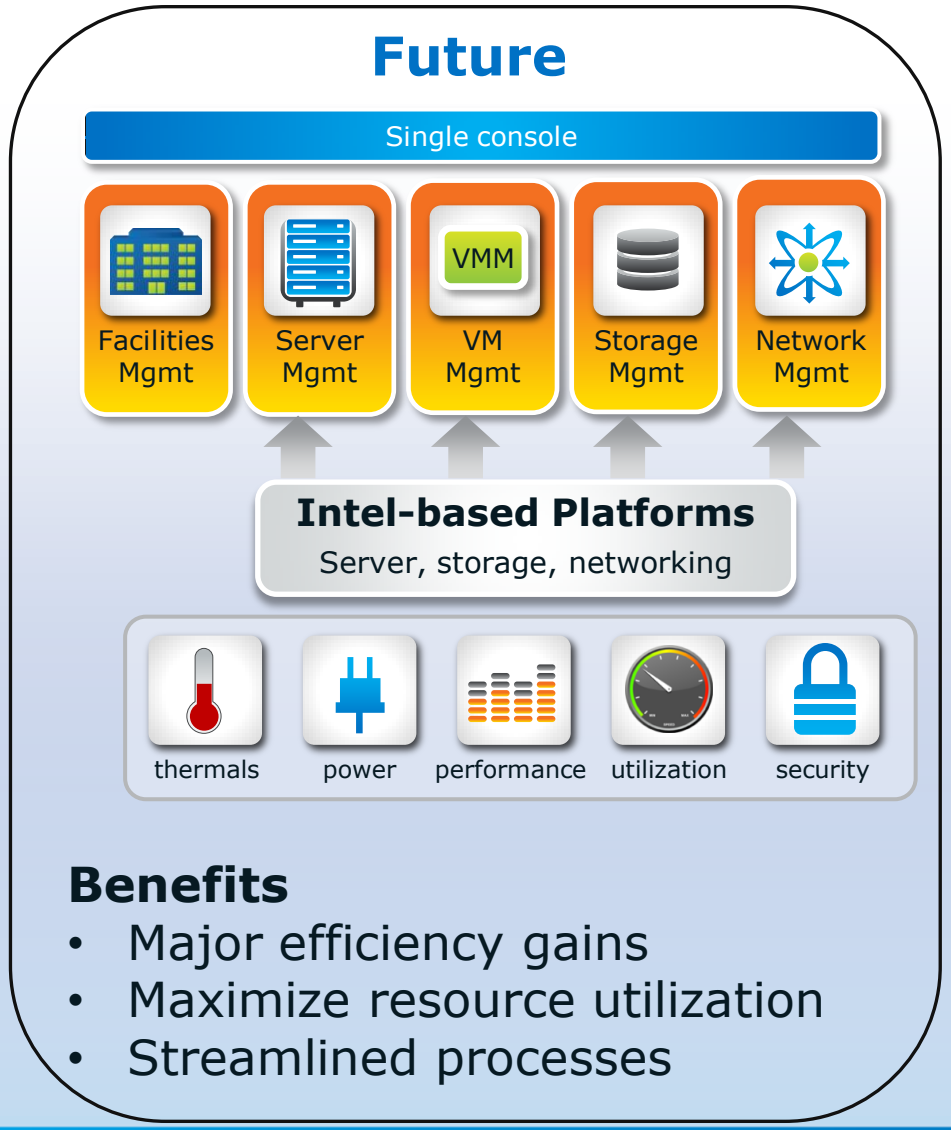
Intel® Identity Protection Technology
McAfee Identity Manager
McAfee Deep Defender

Common Security Standards & Broad Industry Collaboration

Hardware-enhanced security + software & services key to achieve mission

Resource Orchestration
for Cloud Environments

Challenges
- Management silos
- Complexity
- Manual VM migration

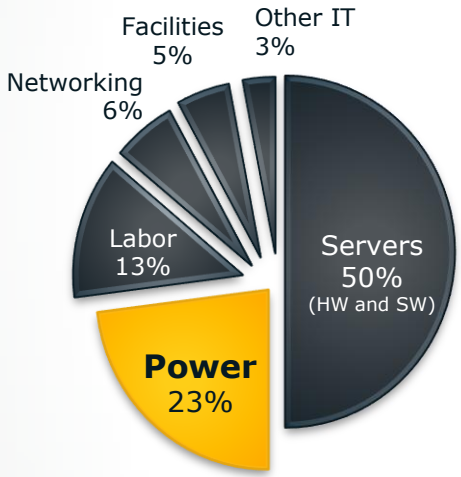


Benefits
- Major efficiency gains
- Maximize resource utilization
- Streamlined processes

Optimized Power Management

Power Management at the Server, Rack and Datacenter Level

Operational Costs of a Typical Large Internet Data Center



Source: Intel internal analysis, 2008 of 3 yr TCO

Intel® Node Manager	Intel® Data Center Manager
up to **30%** power reduction at similar performance[1]	
up to **40%** more servers and performance per rack[2]	
Manage Server Power	**Manage Datacenter Power**

搜狐 SOHU.com

2X server utilization using Intel Virtualization Technology and Intel Node Manager[3]

kt

>$2000/rack annual energy cost savings using Intel Node Manager[4]

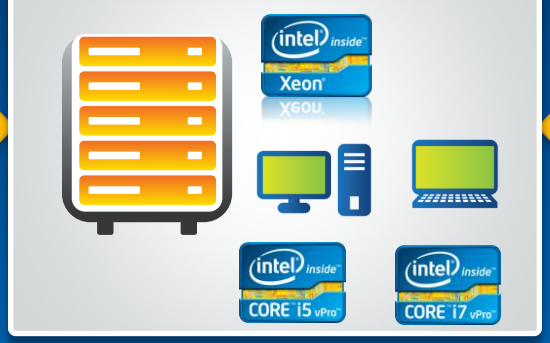
1 Oracle: http://www.intel.com/content/www/us/en/data-center-efficiency/data-center-efficiency-xeon-oracle-changing-the-game-study.html
2 Baidu: http://www.intel.com/content/www/us/en/data-center-efficiency/data-center-efficiency-xeon-baidu-case-study.html
3 http://www.intel.com/content/www/us/en/cloud-computing/cloud-computing-xeon-e5-sohu-case-study.html?wapkw=sohu
4 http://www.intel.com/content/www/us/en/data-center-efficiency/korea-telecom-power-savings-study.html?wapkw=korea+telecom

Intel Strategy to Achieve Open Cloud Vision

IT Requirements & Open Standards

Define and Prioritize IT Requirements & Accelerate Industry Standards

Optimized Platforms



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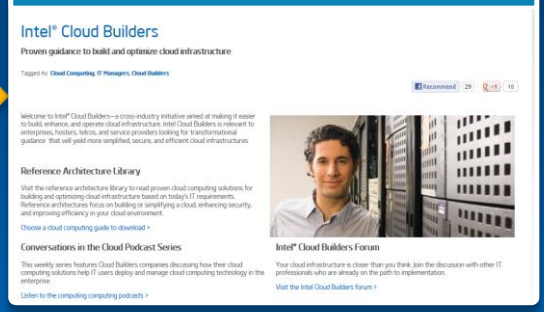

Enable proven solutions that ease cloud adoption & provide guidance on cloud service provider selection

Easing Your Cloud Adoption

Intel® Cloud Builders

Proven, interoperable solutions
>90 Reference Architectures

www.intelcloudbuilders.com

Intel® Cloud Finder

IaaS online search tool

- Qualified Cloud Service Provider list
- Select Provider based on your needs/ criteria
- Matchmaking

Summary

Progressing toward Federated, Automated, Client Aware Clouds

Improved Security, Efficiency, Scalability, Standards Needed

Intel Strategy: IT Requirements/Accelerate Standards, Optimized Platforms, Proven Solutions & Tools

Learn More

Learn more about Intel's optimized products and technologies for cloud

Participate in the Open Data Center Alliance and integrate ODCA usage models into your RFPs

Identify solutions from Intel Cloud Builders library to build & enhance your cloud infrastructure

Gain insights from Intel IT's private cloud development

www.intel.com/cloud

Questions or Comments ???

nikos.panagiotidis@intel.com

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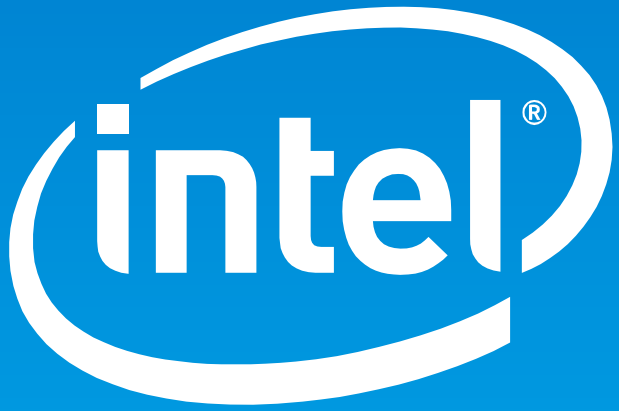
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