Paradigm Shift for Data Center

From

Hardware- to Software Defined

FUJITSU

shaping tomorrow with you

Human Centric Innovation

in Action

FUJITSU

shaping tomorrow with you

Stuttgart 2016

What you will gain

» Overview about Challenges in Data Center, Virtualization, Operation & Management
» New Trends in Data Center Market
» Software Defined
  – What it means
  – How it Impacts the Business
  – Hybrid – IT - Strategies
» Customer Use Cases and Benchmarks

Explaining the Buzzwords

» **Digital Transformation**
  – Refers to the Changes associated with the application of Digital Technology such as Digital Media and Internet in all aspects of Companies and Human Society in General.

» **Software Defined...** (Anything, Network, Data Center, Infrastructures)
  – The Virtualization and Provisioning of Data Center IT Resources such as Server, Storage and Network; acting as "One" Device. Installation, Extension, Operation, and Maintenance will be supported by Software in a holistic approach.
  – Short term: SDX, SDN, SDDC, SDI

» **Edge...** (...IT, ...Location)
  – A Location where End Users access (IT-) Services at the Service Provider.

Explaining the Buzzwords

» **Bi-Modal IT**

   — **Robust IT**

- IT-Landscapes as they are today. Typically Server-, Network- and Storage- based. Also called "Traditional IT" or "System of Record".

   — **Fast IT**

- Concept of IT (- Infrastructure) which will Focus on Business – Centric Aspects such as Collaboration and Interaction with Humans. Also called "New IT" or "System of Engagement".
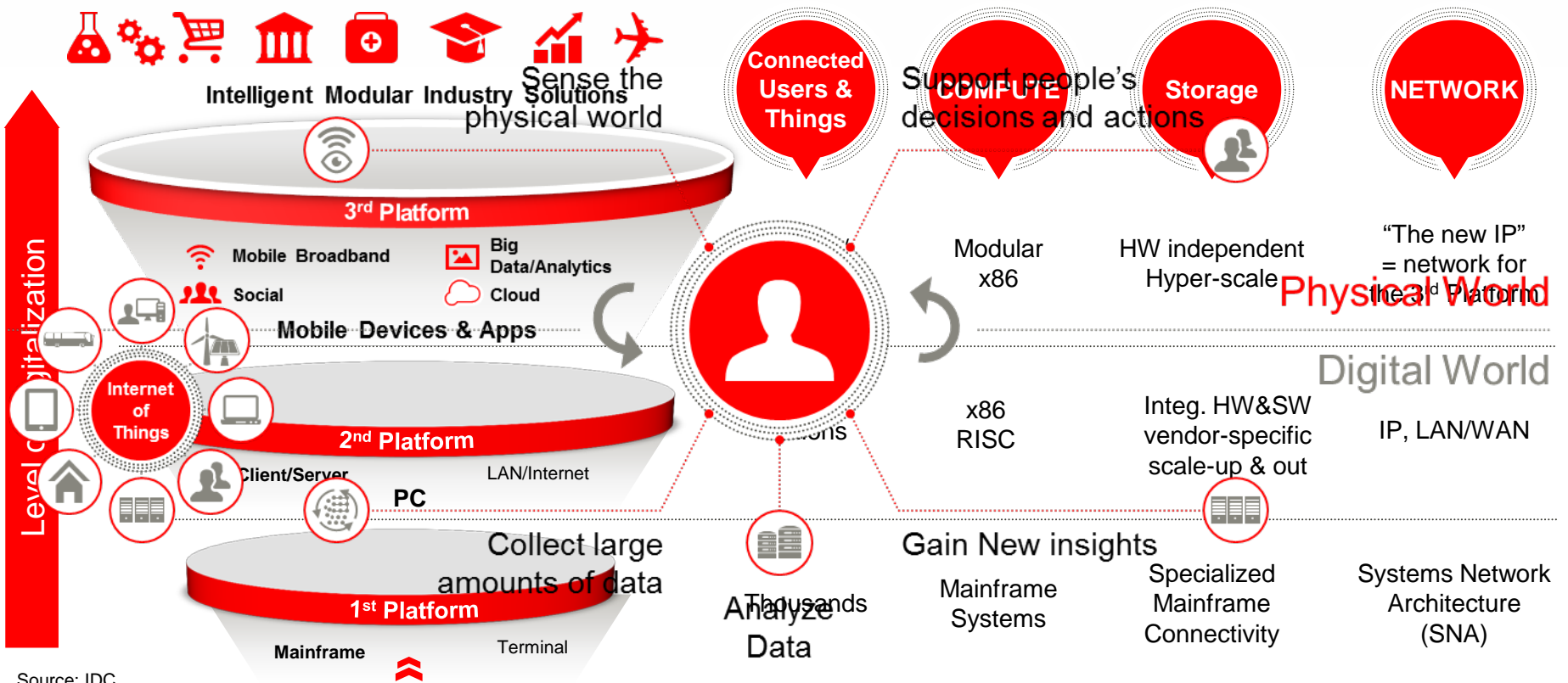
Fusion of the Physical and Digital Worlds – Data Center Trends and Predictions

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Fusion of the Physical and Digital Worlds

Intelligent Modular Industry Solutions

Sense the physical world

3rd Platform

Mobile Broadband
Social
Big Data/Analytics
Cloud

Mobile Devices & Apps

Internet of Things

2nd Platform

Client/Server
PC
LAN/Internet

Collect large amounts of data

1st Platform

Mainframe
Terminal

Analyze Data

Thousands

Gain New insights

Level of digitalization

Connected Users & Things

COMPUTE

Storage

NETWORK

Support people's decisions and actions

Modular x86

HW independent Hyper-scale

"The new IP" = network for the 3rd Platform

Physical World

Digital World

x86 RISC

Integ. HW&SW vendor-specific scale-up & out

IP, LAN/WAN

Mainframe Systems

Specialized Mainframe Connectivity

Systems Network Architecture (SNA)

Source: IDC

Data Center Trends 2016+

ORGANIZATIONAL IMPACT

Companywide — Multi BU — Single BU

1 Workload Realignment

2 Hyperconvergence & SDx

3 DC Obsolescence

4 Hyperscale DC

5 Diversified IT

0-12 12-24 24+

Source: IDC, 2015

TIME (MONTHS) TO MAINSTREAM
Bubble-size indicates compexity/cost to address
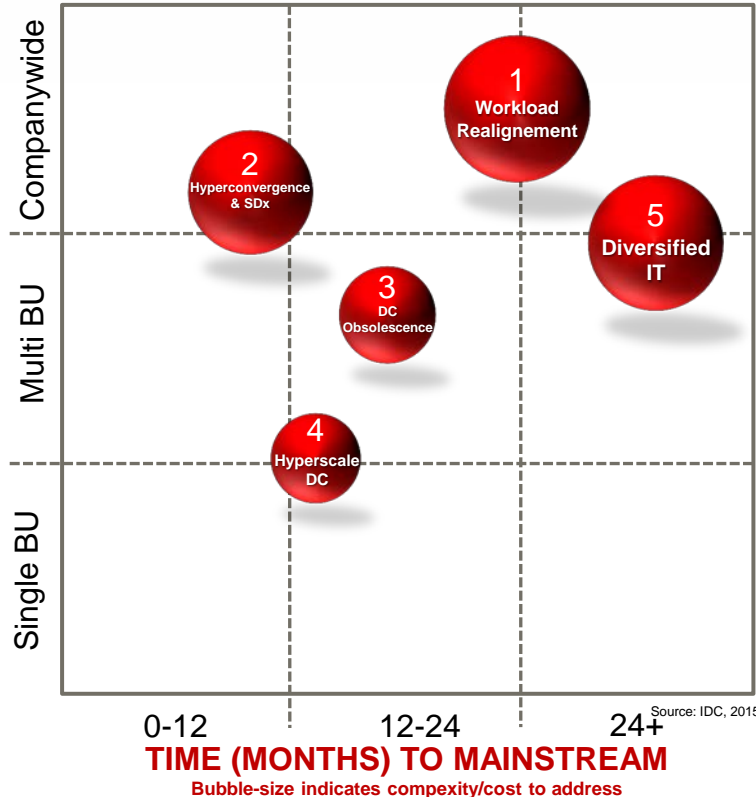
1. **Workload Realignment:** By 2018, 65% of new DC infrastructure investments are for systems of engagement, insight and action rather than maintaining existing systems of record

2. **Hyperconvergence & SDx:** By 2017, next generation converged systems that are optimized for flash and SDI drive >30% consolidations in internal datacenter space and staff

3. **Datacenter Obsolescence:** By end of 2017, 40% of businesses confront facilities mismatches and changed climate risk profiles, reducing spend on upkeep of existing datacenters.

4. **Hyperscale DC:** By end of 2017, hyperscale-based infrastructure providers extend dense compute and deep storage to regional gateway facilities to address data sovereignty fears.

5. **Diversified IT:** By 2018, 65% of companies' IT assets are off-site in colocation, hosting, and cloud datacenters while 1/3 of IT "staff" are employees of third-party service providers.

Data Center Trends 2016+

Level of Virtualization

Network

Storage

Server
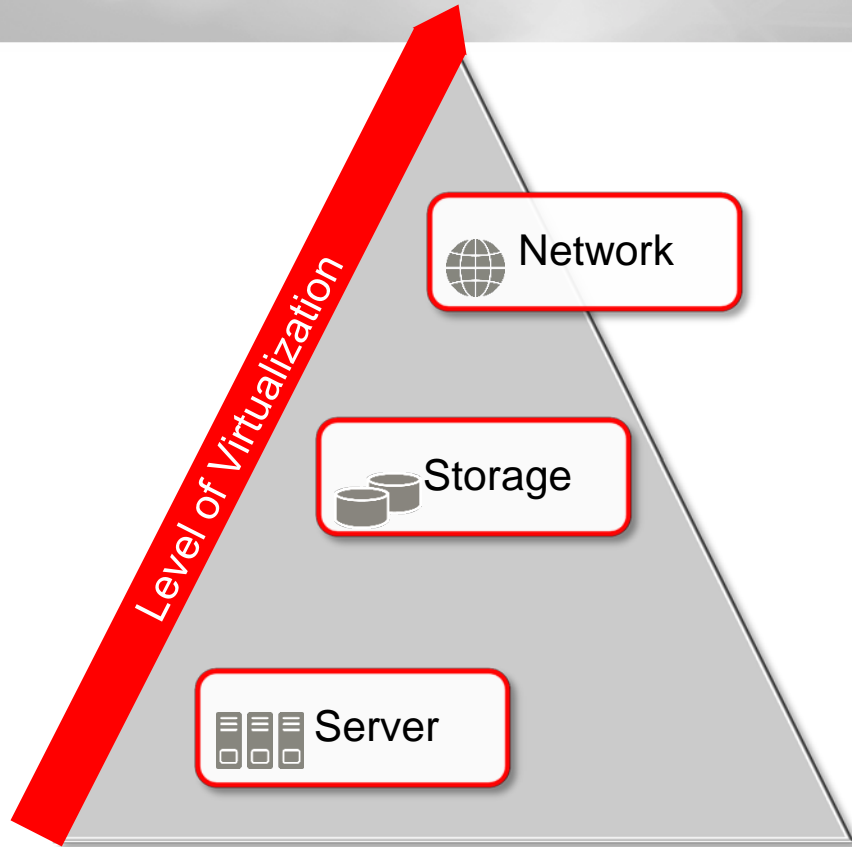
6. **Smart DC:** By 2018, 60% of companies rely on highly instrumented datacenters that use advanced automation to boost efficiency and tie datacenter and IT spend to business value.

7. **Network Transformation:** By 2018, 80% of enterprises transform their networks with SDN-based, flexible networking to connect diversified IT environments and facilitate new data flows.

8. **Edge IT:** By 2018, cloud, mobile and IoT services providers will own/operate 30% of IT assets in edge locations and micro datacenters, posing major asset and governance challenges.

9. **3rd Platform Finance:** By the end of 2016, 50% of companies demand payment models based on usage for major IT and datacenter investments, basing vendor decisions on these programs

10. **Next Generation Power:** In 2018, 8% of new datacenters will be powered by green energy while improvements in cooling technology and rack architectures continue to improve energy efficiency
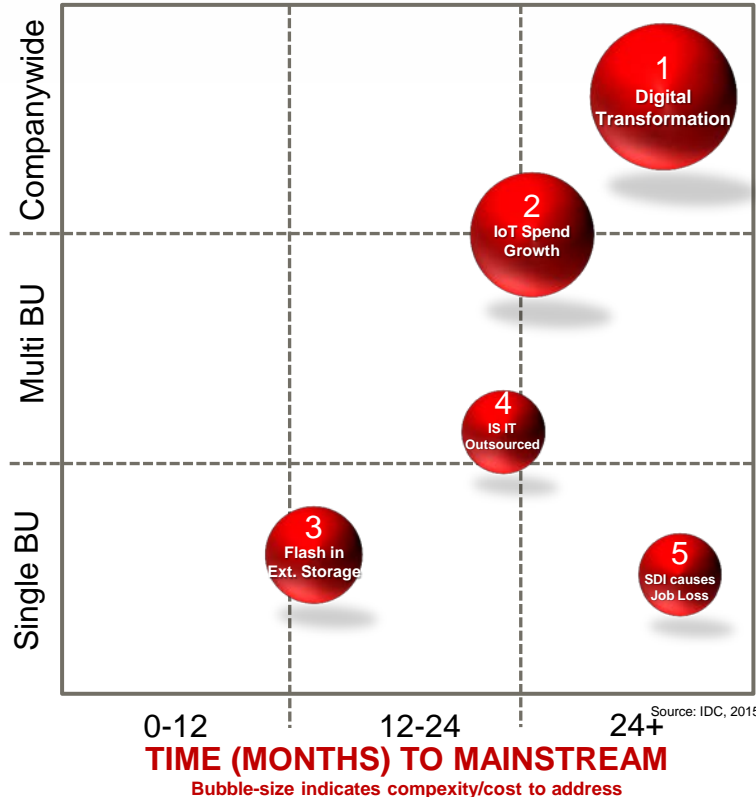
Enterprise Infrastructure Predictions

Enterprise Infrastructure Trends 2016+

ORGANIZATIONAL IMPACT

Companywide

Multi BU

Single BU

1
Digital Transformation

2
IoT Spend Growth

4
IS IT Outsourced

3
Flash in Ext. Storage

5
SDI causes Job Loss

Source: IDC, 2015

0-12   12-24   24+

TIME (MONTHS) TO MAINSTREAM
Bubble-size indicates compexity/cost to address

1. **Digital Transformation:** By 2018, 70% of spend on infrastructure will be related to digital transformation, and will support 3rd Platform workloads

2. **IoT Spend Growth:** By 2018, 15% of server, storage and network spend will be related to IoT workloads, and poised to grow quickly.
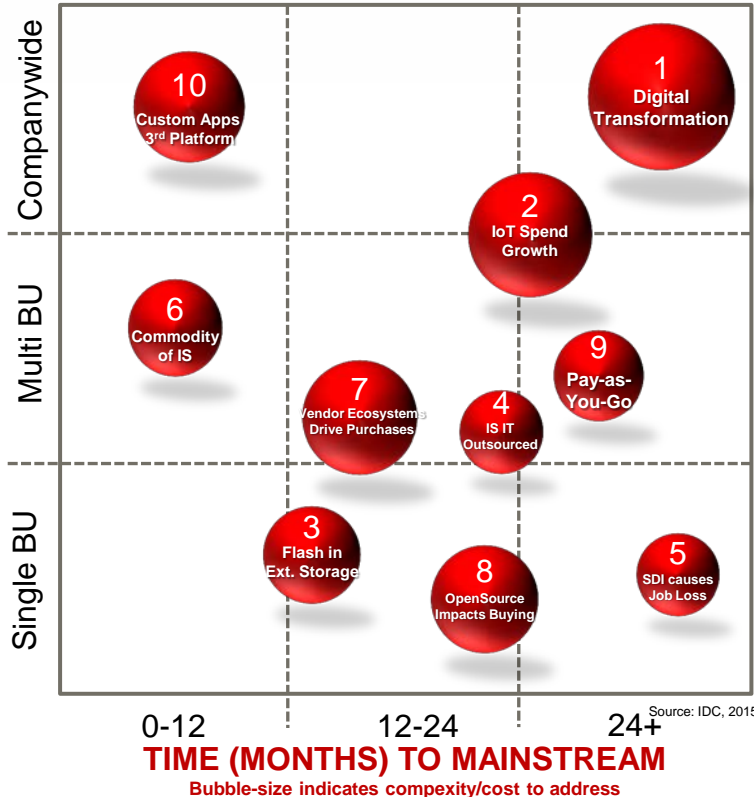
3. **Flash in External Storage:** By 2019, 75% of external storage spending will include flash

4. **Infrastructure IT Outsourced:** By 2019, more than 50% of IT infrastructure operations talent in developed countries works for cloud, outsourcers, and other third party service providers

5. **SDI causes Job Loss:** Software defined infrastructure and cloud eliminate 25% of traditional IT operations job titles by 2019.

Enterprise Infrastructure Trends 2016+

ORGANIZATIONAL IMPACT

Companywide | Multi BU | Single BU

10 Custom Apps 3rd Platform

1 Digital Transformation

2 IoT Spend Growth

6 Commodity of IS

9 Pay-as-You-Go

7 Vendor Ecosystems Drive Purchases

4 IS IT Outsourced

3 Flash in Ext. Storage

8 OpenSource Impacts Buying

5 SDI causes Job Loss

Source: IDC, 2015

0-12 | 12-24 | 24+

TIME (MONTHS) TO MAINSTREAM

Bubble-size indicates compexity/cost to address

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6. **Commoditization of Infrastructure:** Commoditization of storage and storage management, software defined networking and software defined computing affects 75% of datacenter infrastructure purchase decisions by 2018

7. **Vendor Ecosystems drive Purchases:** Vendor ecosystems drive 70% of infrastructure purchase decisions as interoperability trumps best of breed by 2017

8. **Open Source impacts Buying:** Open source impacts 80% of infrastructure hardware buying decisions in 2016

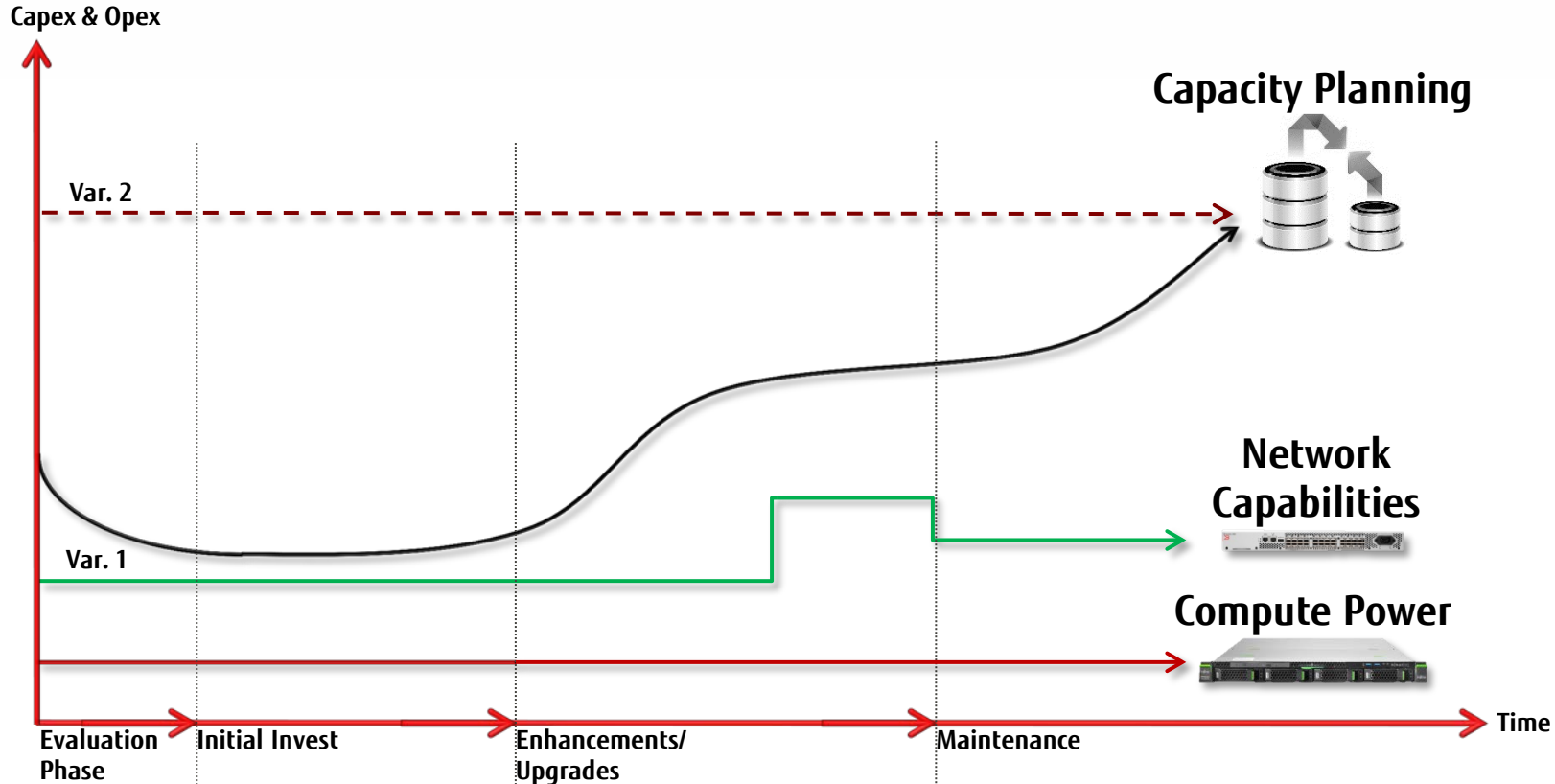9. **Pay-as-You-Go:** By 2020, 80% of IT infrastructure is bought on a pay-as-you-go basis.

10. **Custom Apps Driving 3rd Platform:** The 3rd Platform is being driven by a fresh wave of custom applications, reversing a trend of movement to packaged software among mature 2nd Platform applications.

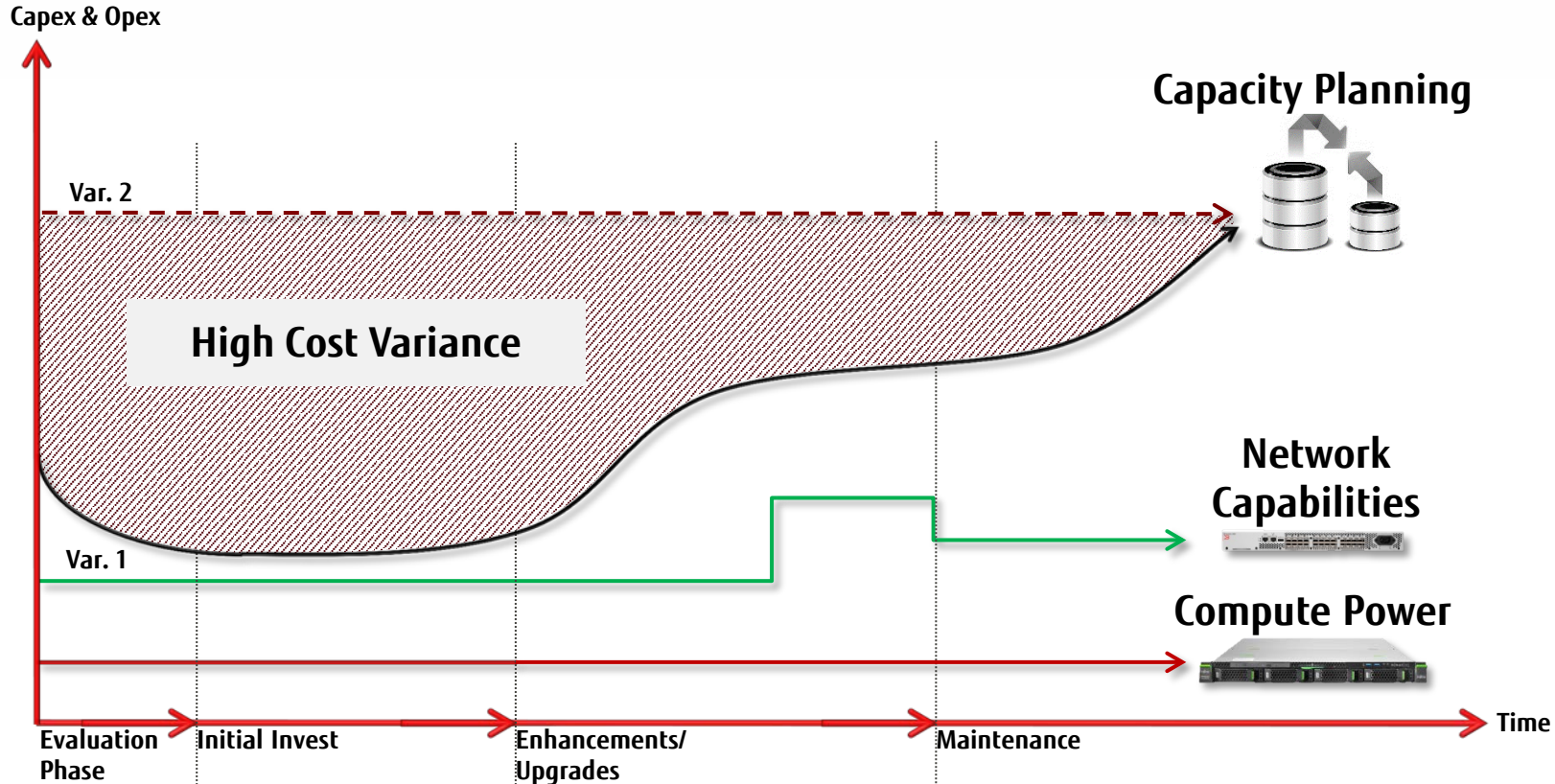# Digital Transformation
and How it Affects IT-Strategy

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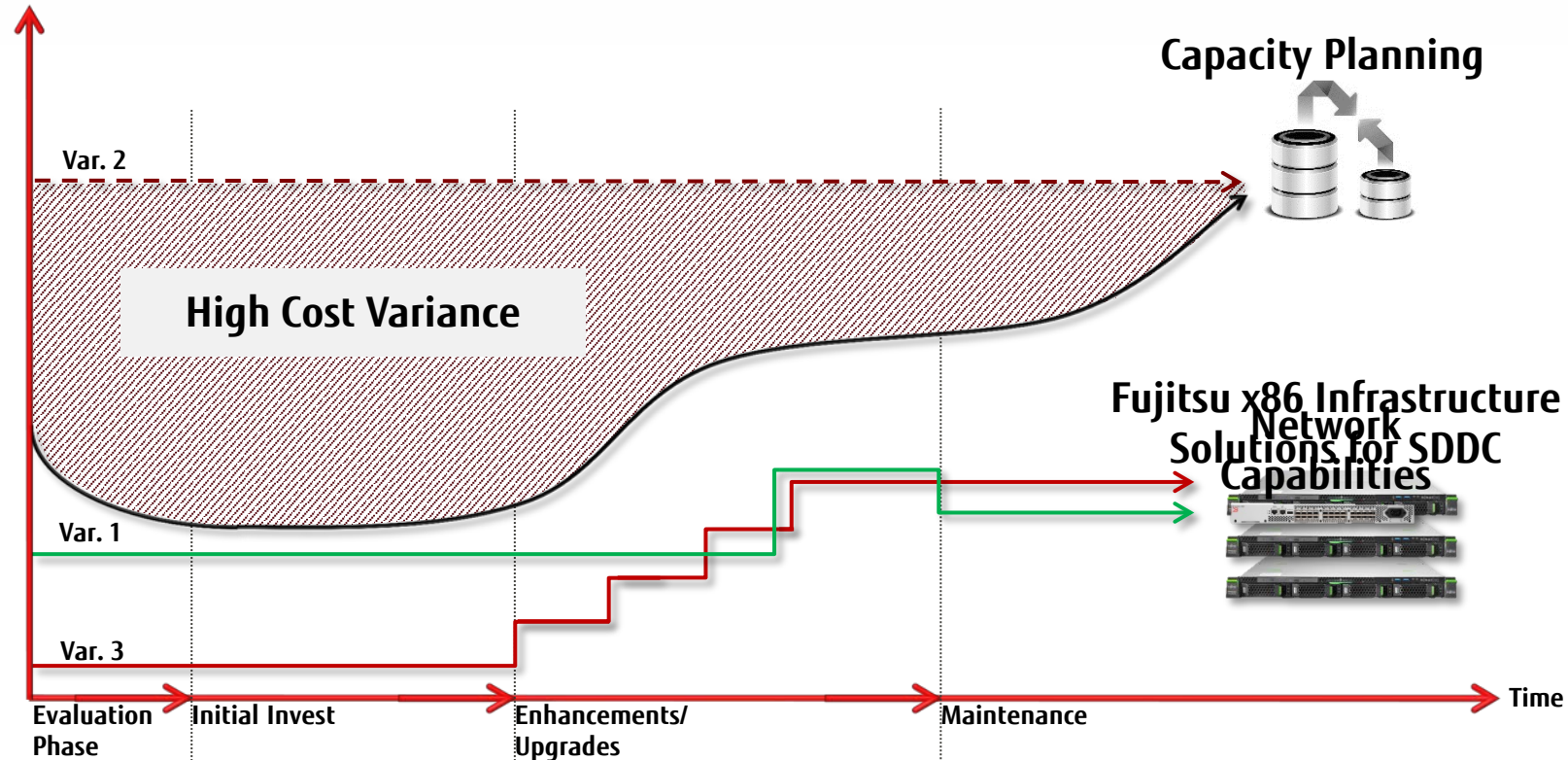# Infrastructure Aspects for Data Centers to support Digital Transformation

Capex & Opex

Var. 2

Var. 1

Capacity Planning

Network Capabilities

Compute Power

Evaluation Phase

Initial Invest

Enhancements/ Upgrades

Maintenance

Time

Infrastructure Aspects for Data Centers to support Digital Transformation

Capex & Opex

Capacity Planning

Var. 2

High Cost Variance

Network Capabilities

Var. 1

Compute Power

Evaluation Phase | Initial Invest | Enhancements/ Upgrades | Maintenance

Time

Infrastructure Aspects for Data Centers to support Digital Transformation

Capex & Opex

Capacity Planning

Var. 2

High Cost Variance

Fujitsu x86 Infrastructure
Solutions for SDDC

Network
Capabilities

Var. 1

Var. 3

Evaluation
Phase

Initial Invest

Enhancements/
Upgrades

Maintenance

Time

Infrastructure Aspects for Data Centers to support Digital Transformation

Capex & Opex

Usage History

400
200
0

1 2 3 4 5 6 7 8 9 10 11 12

—— Usage —— Capacity

Top Consumers

60
40
20
0

Department A
Department B
Department C
Department D
Department E

Var. 2

High Cost Variance

Fujitsu x86 Infrastructure Solutions for SDDC

Var. 1

Var. 3

Evaluation Phase

Initial Invest

Maintenance

Time

Our Solution – Portfolio

SAP

Server Virtualization

Private Cloud

Big Data and Analytics

Microsoft

Desktop Virtualization

HA & DR

HPC

PRIMEFLEX: Family Overview

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SAP
… for SAP Landscapes … for SAP HANA®

Server Virtualization
… vShape … for VMware VSAN … for Egenera PAN … Cluster-in-a-box

Private Cloud
… vShape … for VMware vCloud … for Red Hat OpenStack … for Cloud (planned) … for VMware EVO SDDC*

Big Data and Analytics
… for SAP HANA® … for Oracle … for Analytics

Microsoft
… for SharePoint® … for Exchange® … for Lync® … for OfficeMaster Gate … Cluster-in-a-box

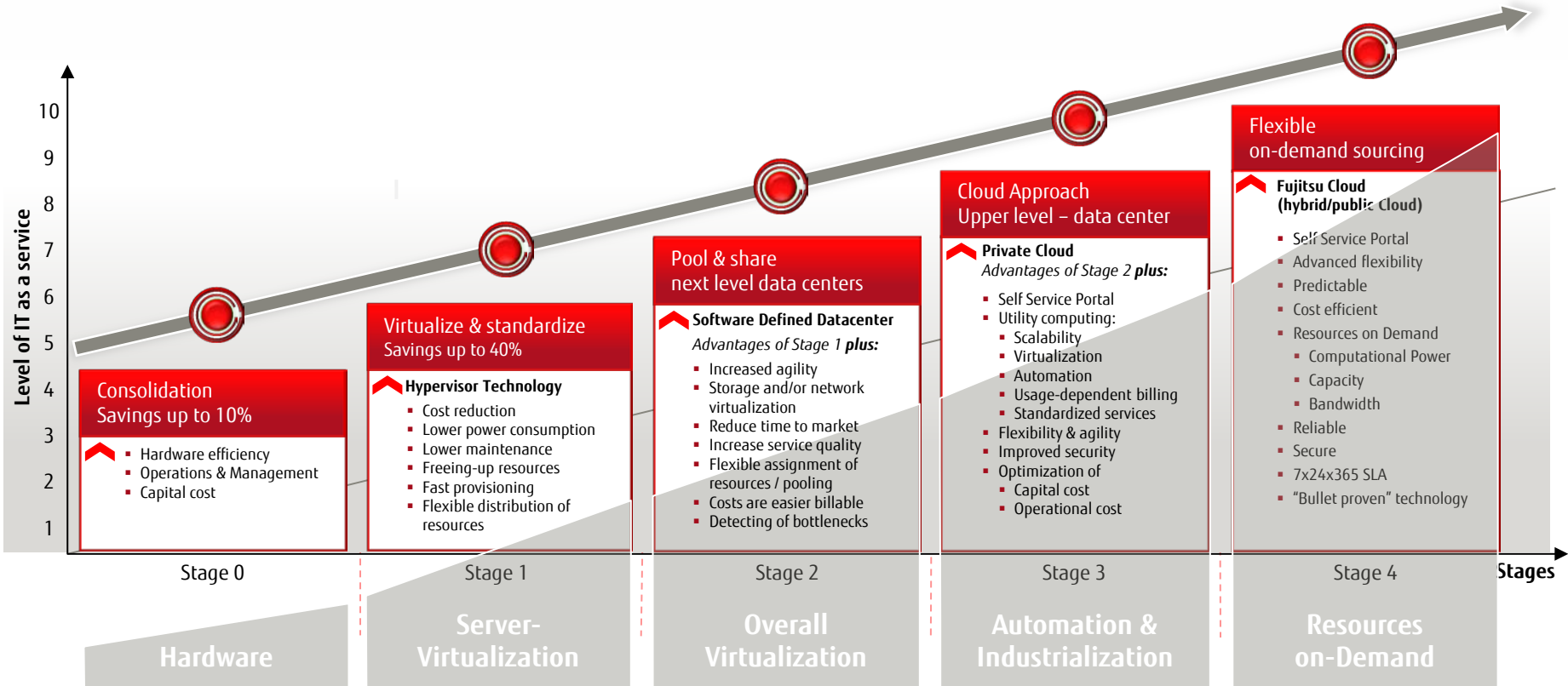| Desktop Virtualization |
|---|
| … for VMware VDI
… vShape
… for VMware VSAN |

HA & DR
… Cluster-in-a-box … for Egenera PAN … for Oracle Database

HPC
… for HPC

*Planned

We support our customers
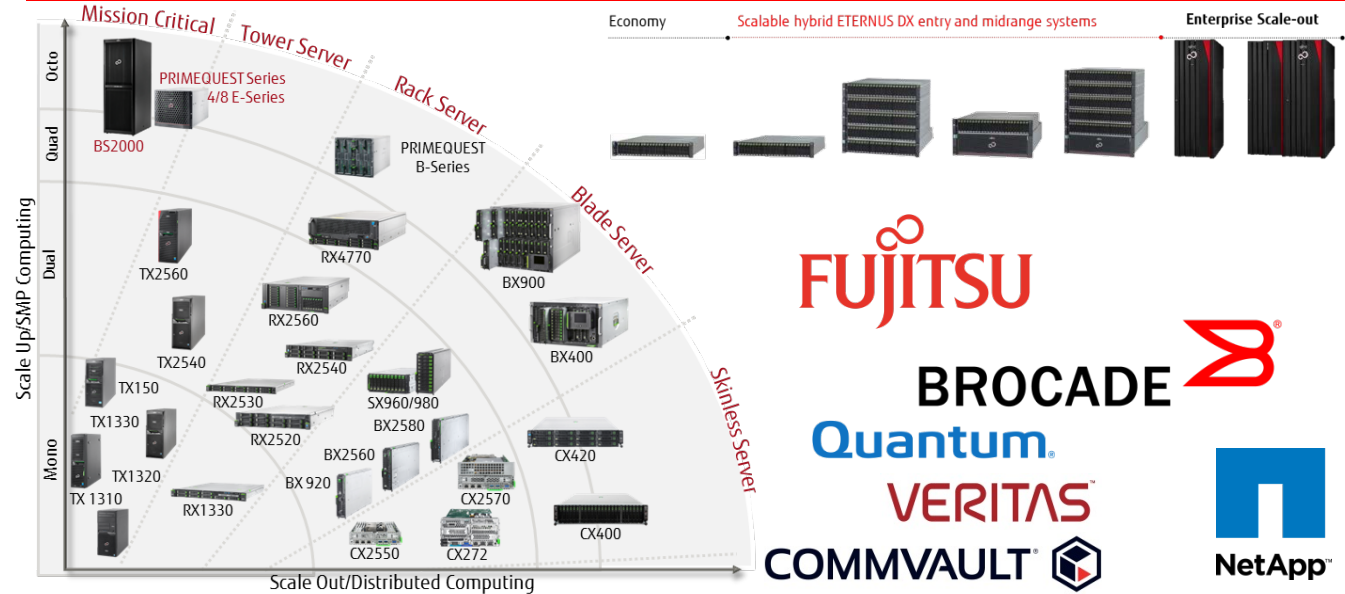## on any level of IT as a service they want to achieve!

Flexible on-demand sourcing

Fujitsu Cloud (hybrid/public Cloud)
- Self Service Portal
- Advanced flexibility
- Predictable
- Cost efficient
- Resources on Demand
  - Computational Power
  - Capacity
  - Bandwidth
- Reliable
- Secure
- 7x24x365 SLA
- "Bullet proven" technology

Cloud Approach
Upper level – data center

Private Cloud
Advantages of Stage 2 plus:
- Self Service Portal
- Utility computing:
  - Scalability
  - Virtualization
  - Automation
  - Usage-dependent billing
  - Standardized services
- Flexibility & agility
- Improved security
- Optimization of
  - Capital cost
  - Operational cost

Pool & share
next level data centers

Software Defined Datacenter
Advantages of Stage 1 plus:
- Increased agility
- Storage and/or network virtualization
- Reduce time to market
- Increase service quality
- Flexible assignment of resources / pooling
- Costs are easier billable
- Detecting of bottlenecks

Virtualize & standardize
Savings up to 40%

Hypervisor Technology
- Cost reduction
- Lower power consumption
- Lower maintenance
- Freeing-up resources
- Fast provisioning
- Flexible distribution of resources

Consolidation
Savings up to 10%
- Hardware efficiency
- Operations & Management
- Capital cost

Level of IT as a service

| 10 |
| 9 |
| 8 |
| 7 |
| 6 |
| 5 |
| 4 |
| 3 |
| 2 |
| 1 |

| Stage 0 | Stage 1 | Stage 2 | Stage 3 | Stage 4 | **Stages** |

| **Hardware** | **Server-Virtualization** | **Overall Virtualization** | **Automation & Industrialization** | **Resources on-Demand** |

Level of IT: Stage 0

Stage 0 – Hardware Layer

Achieving the Base Level for typical Data Center Infrastructures
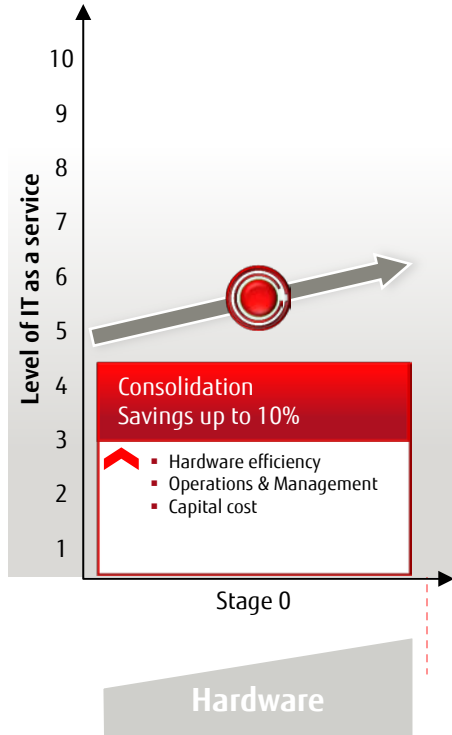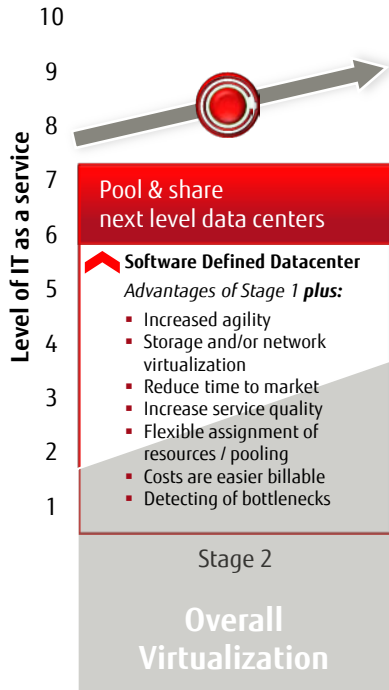

PRIMERGY & ETERNUS - Portfolio

Level of IT: Stage 1

Stage 1 – Server Virtualization

Level of IT as a service (vertical axis, 1–10)

Virtualize & standardize
Savings up to 40%

Hypervisor Technology
- Cost reduction
- Lower power consumption
- Lower maintenance
- Freeing-up resources
- Fast provisioning
- Flexible distribution of resources

Stage 1

Server-Virtualization
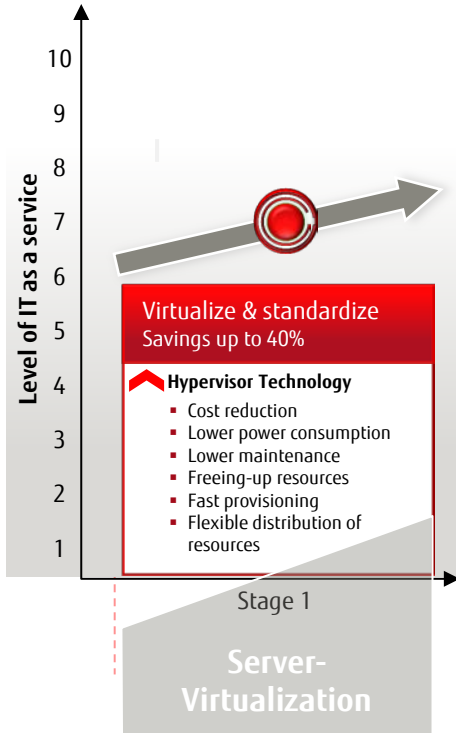
PRIMEFLEX - Portfolio for Server Virtualization

… vShape
… for VMware VSAN
… for Egenera PAN
… Cluster-in-a-box

FUJITSU · intel · BROCADE · egenera · vmware · Microsoft · NetApp · redhat · suse

Level of IT: Stage 2

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Stage 2 –Server, Storage and/or Network - Virtualization

Level of IT as a service

10
9
8
7 — Pool & share
next level data centers
6
5 — ▲ **Software Defined Datacenter**
Advantages of Stage 1 plus:
- Increased agility
4 — - Storage and/or network
virtualization
3 — - Reduce time to market
- Increase service quality
- Flexible assignment of
2 — resources / pooling
- Costs are easier billable
1 — - Detecting of bottlenecks

Stage 2

**Overall
Virtualization**

PRIMEFLEX - Portfolio for the Software Defined Data Center

… vShape
… for Cluster-in-a-Box
… for VSAN
… for VMware VDI
… for VMware EVO SDDC

FUJITSU **intel** **BROCADE** **ORACLE** **SAP**

vmware **Microsoft** **NetApp** **redhat** **suse**

Level of IT: Stage 3

Stage 3 – Overall Virtualization & Self Service - Capabilities

10
9
8

Cloud Approach
Upper level – data center

Level of IT as a service

7

Private Cloud
*Advantages of Stage 2 **plus:***

6
- Self Service Portal
- Utility computing:
5
  - Scalability
  - Virtualization
4
  - Automation
  - Usage-dependent billing
  - Standardized services
3
- Flexibility & agility
- Improved security
2
- Optimization of
  - Capital cost
1
  - Operational cost

Stage 3

**Automation &
Industrialization**

PRIMEFLEX - Portfolio for Private Cloud and Software Defined Data Center

… vShape
… for VMware vCloud
… for Red Hat OpenStack
… for Cloud (planned)
… for VMware EVO SDDC

FUJITSU (intel) BROCADE ORACLE SAP

vmware Microsoft NetApp redhat suse

PRIMEFLEX: Family Overview

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SAP	Server Virtualization	Private Cloud	Big Data and Analytics
… for SAP Landscapes … for SAP HANA®	… vShape … for VMware VSAN … for Egenera PAN … Cluster-in-a-box	… vShape … for VMware vCloud … for Red Hat OpenStack … for Cloud (planned) **… for VMware EVO SDDC***	… for SAP HANA® … for Oracle … for Analytics

Microsoft	Desktop Virtualization	HA & DR	HPC
… for SharePoint® … for Exchange® … for Lync® … for OfficeMaster Gate … Cluster-in-a-box	… for VMware VDI … vShape … for VMware VSAN	… Cluster-in-a-box … for Egenera PAN … for Oracle Database	… for HPC

*Planned

Software Defined and Hybrid IT - Strategy

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The 4 Pillars of SDDC

Manages Ressources to Ensure In-Time Readiness of IT-Services, requested by the Business

Capacity-Management

Capacity-Management
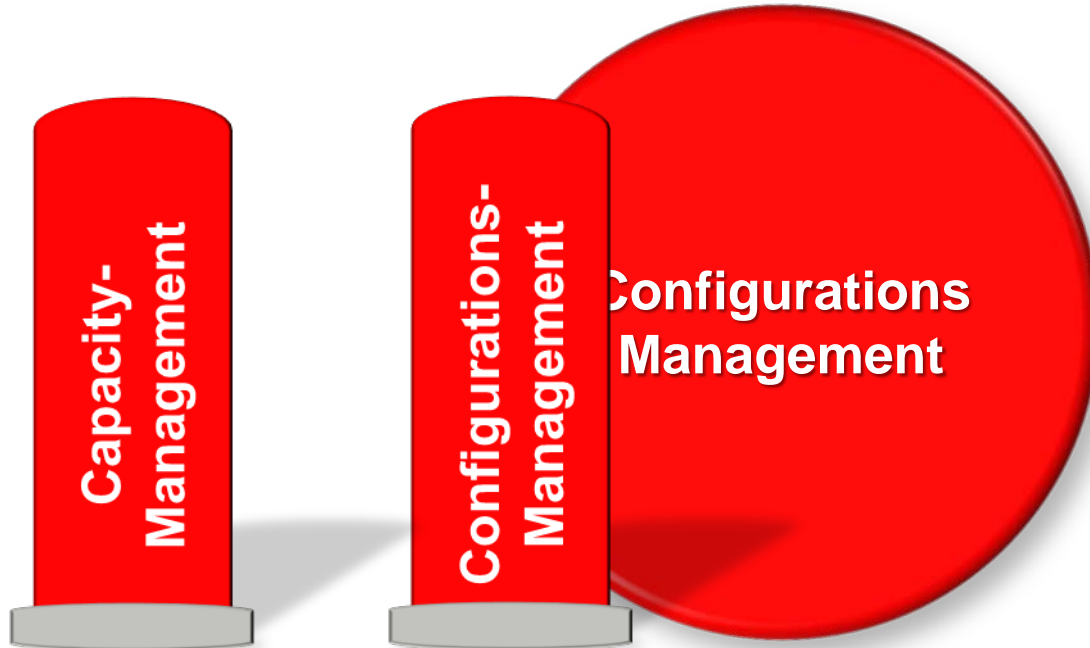
The 4 Pillars of SDDC

Engine to Abstract the Software
from the Hardware
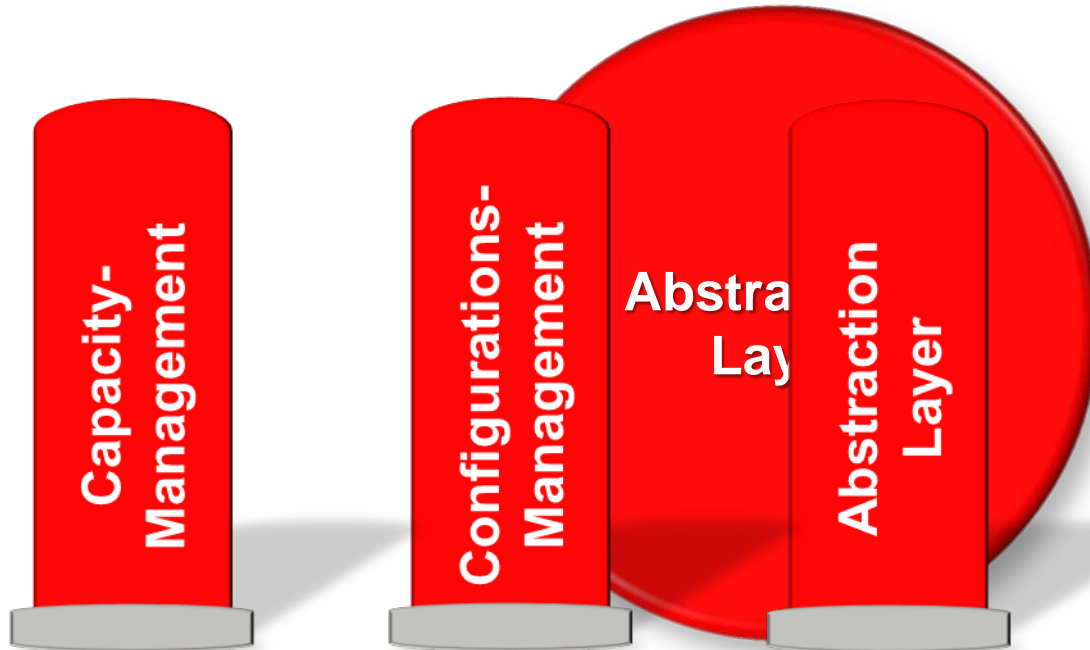
The 4 Pillars of SDDC

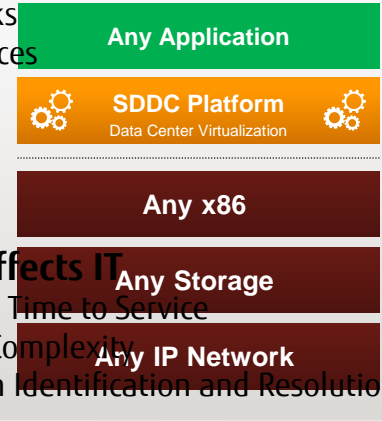Allows the seemless Integration and Management of Cloud-Services from various Vendors

From Hardware – to Software Defined

Applications

Hardware Defined
Data Center (HDDC)

Google / Facebook /
Amazon Data Centers

Compute **Network** **Storage** **Appliances**

Any Application

Custom Application
Software

Integrated x86

Vertical Integration

Integrated Storage

Any x86

Any Storage

Vendor Specific
Network

Any IP Network
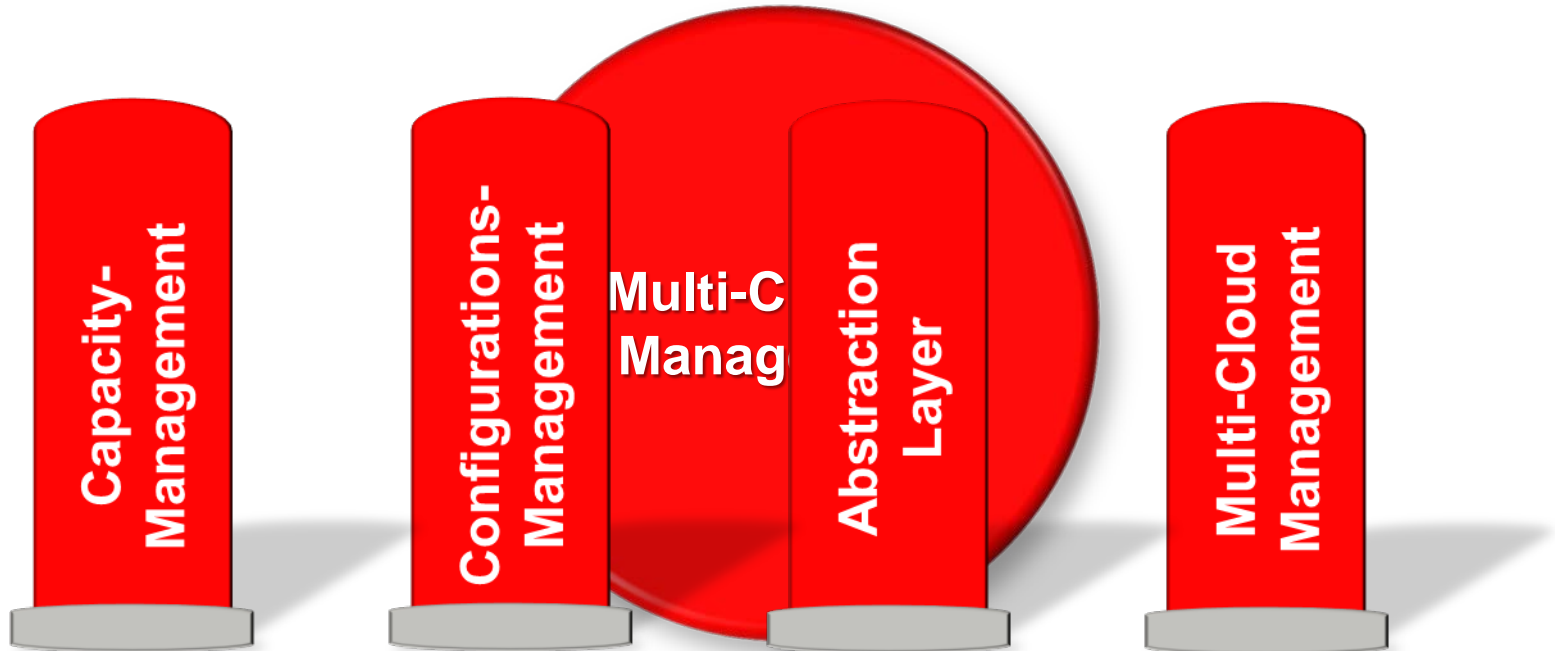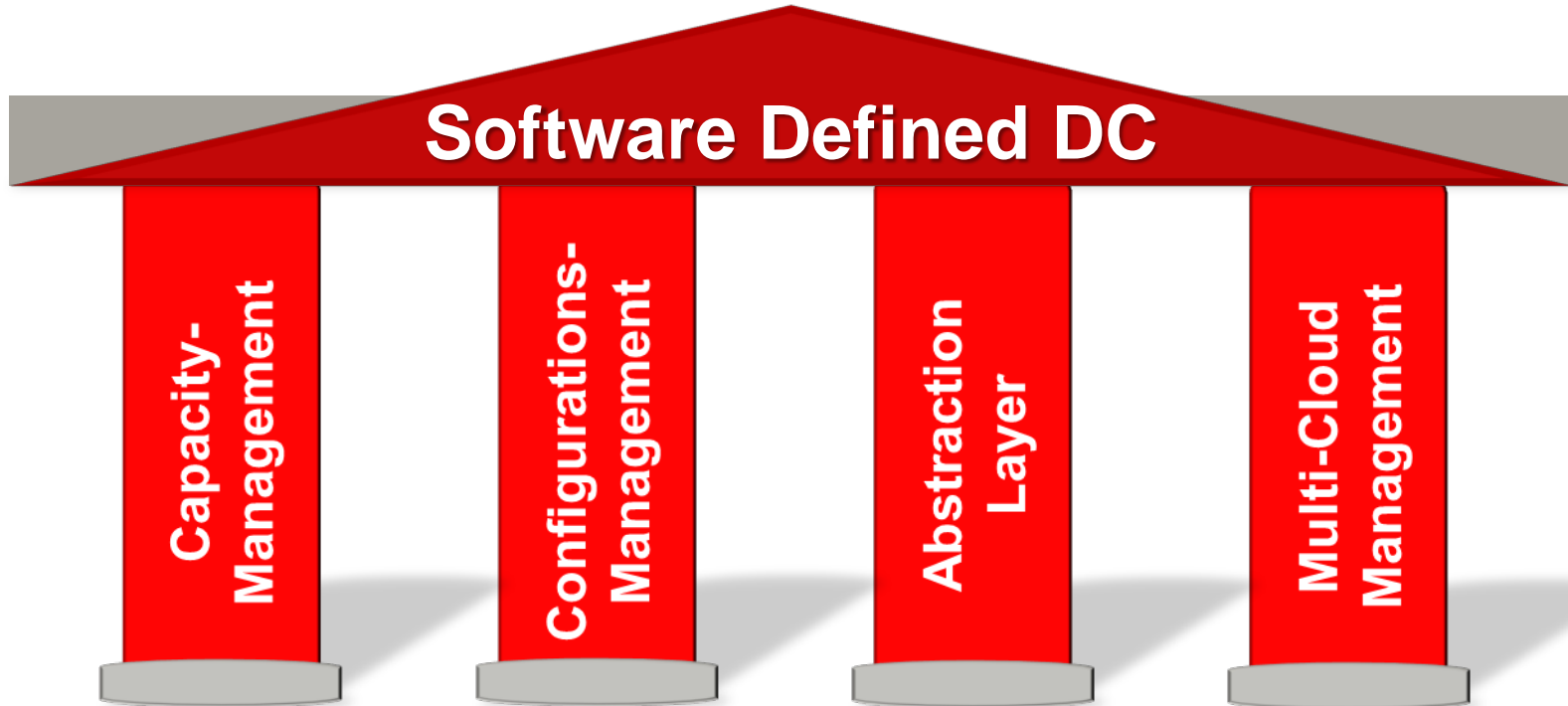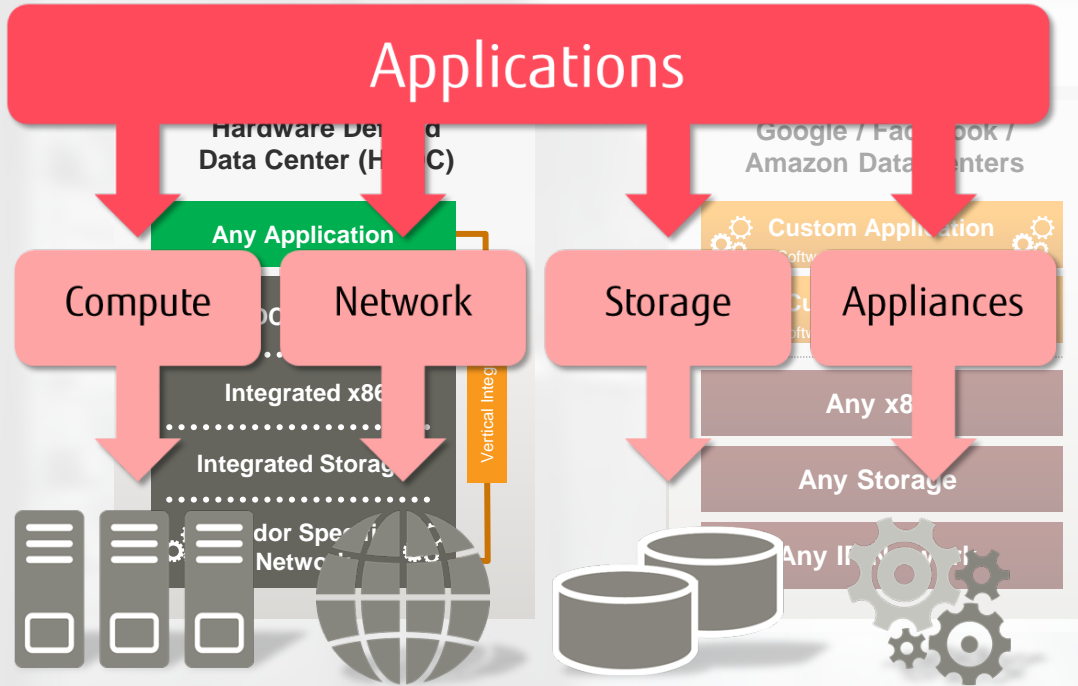
Independent Provisioning and Support
» Virtual Machines
» Server Adapters
» Storage Partitions
» Networks
» Appliances

Software Defined Data Center (SDDC)

Any Application

SDDC Platform
Data Center Virtualization

Any x86

Any Storage

Any IP Network

How it Affects IT
» Delayed Time to Service
» Added Complexity
» Problem Identification and Resolution

From Hardware – to Software Defined

Workloads

Security
Management

Virtualized Server

Virtualized Network

Virtualized Storage

Software Defined Infrastructure

Fabrics

Appliances

Virtualized Data Center
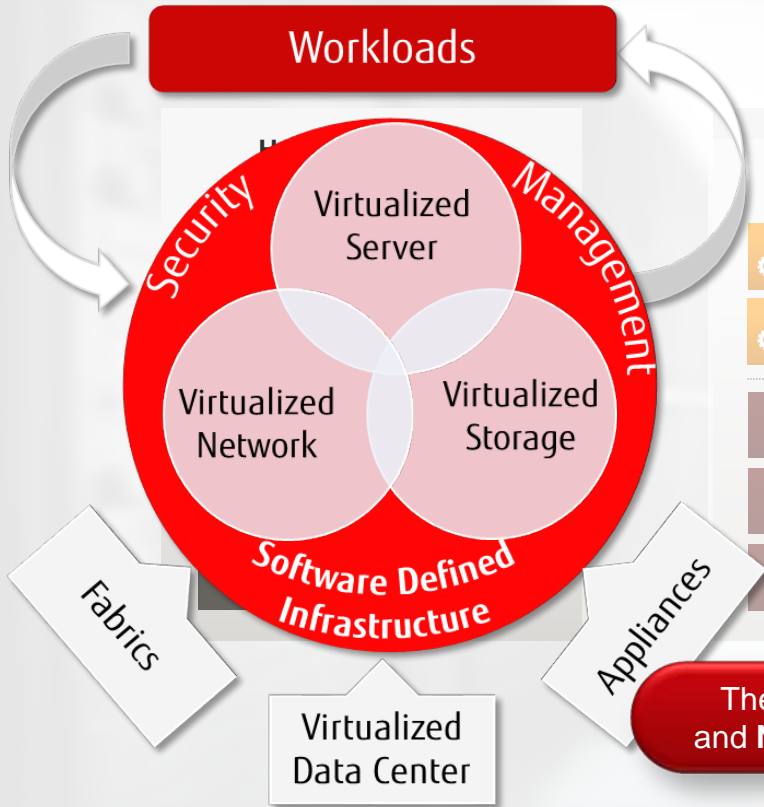
Today´s Policy Engines
» Platform-Specific
» Job-Schedulers
» Manual Correlation Across Tiers

Google / Facebook / Amazon Data Centers

Software Defined Data Center (SDDC)

Custom Application
Software / Hardware Abstraction

Custom Platform
Software / Hardware Abstraction

Any Application

SDDC Platform
Data Center Virtualization

Any x86

Any Storage

Any IP Network

Any x86

Any Storage

Any IP Network

Tomorrow´s Policy Engines
» Platform Agnostic
» Policy driven Workflow
» Automation

Implications
» Inherited Policies Cascading Down
» Significant Security Improvement
» Automated Data Sharing between Engines

The Future Data Center will **Not Focus on Workload, but on Workflow** and **NOT on Where the Work is Located, but on What the Work is Doing**

Organization and Technology – Transformation

Traditional IT

vs.

Software Defined Infrastructures

Storage			
Network			
Server			

Operating	Administration	Self-Service

SDDC – Softwarelayer

Physical IT-Infrastructure

Server & Storage   Network
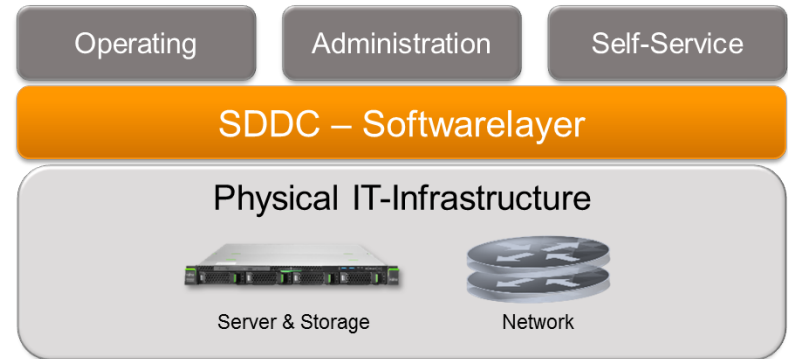
New Demands, Usage and Technology Approaches

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Innovations are typically driven by…

…the **IT-Department**

…by the **Line of Business**

…by the demand of **End Customers**

Speed to Production

Computer - Centric

Productivity improvement

Mainframe

Network - Centric

Business process transformation

Client-Server Internet

Human - Centric

Knowledge creation, activity support

Cloud Mobile Big Data Social

Time

A few Examples for Consuming Hybrid IT - Offerings

Productions (Industry 4.0)

Employees

Mobile Apps

Customers Online

Quality Insurance

Business Partners

Products

IoT

...
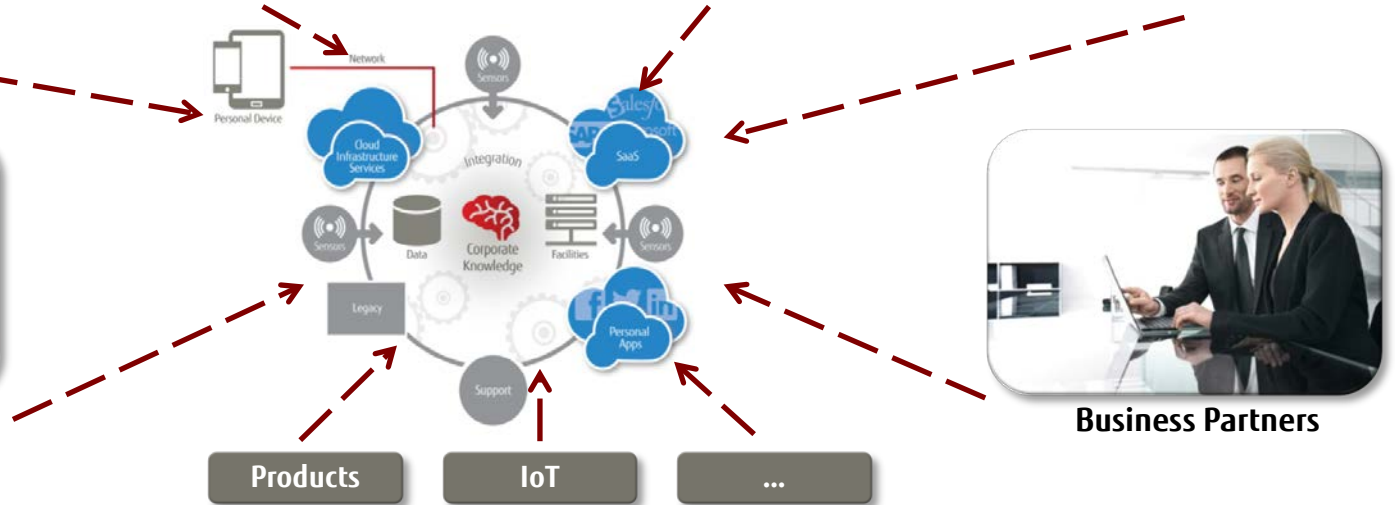
Business Centric Infrastructures
Hybrid-IT - Enablement

PRIMEFLEX

Solutions for Infrastructure

On-Premise

Hyperconverged & Software Defined Infrastructure

Integrated Solutions

VSAN ReadyNodes

Large Scale Storage
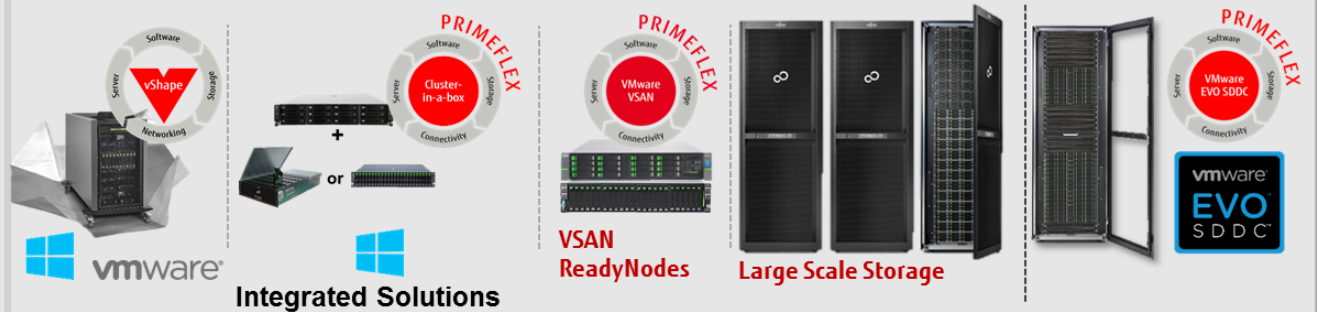
How HPC Business Benefits from these Trends

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1. Convergence of HPC and Big Data

- More workloads that demand both Big Data and Big Compute Power
- Customer demanding same infrastructure to run analysis and simulation
- Need for converged Infrastructure and Software Stack
  to run HPC and Big Data workloads

2. Transition to HPC Cloud

- Need for cost efficient alternatives to an HPC Cluster on-premise
- The HPC cloud usage today grew up to 25.5% from 13.6% in 2011 1)
- From all cloud users 31% of all workloads are performed in the cloud1)
- Need for HPC Management software that support multiple modes of
  compute, including e.g. Cloud Bursting

3. New CPU-Power (Knightslanding; KNL)

- Increased density and boost in performance will enable complex calculations
- At the same time power consumption will significantly reduced
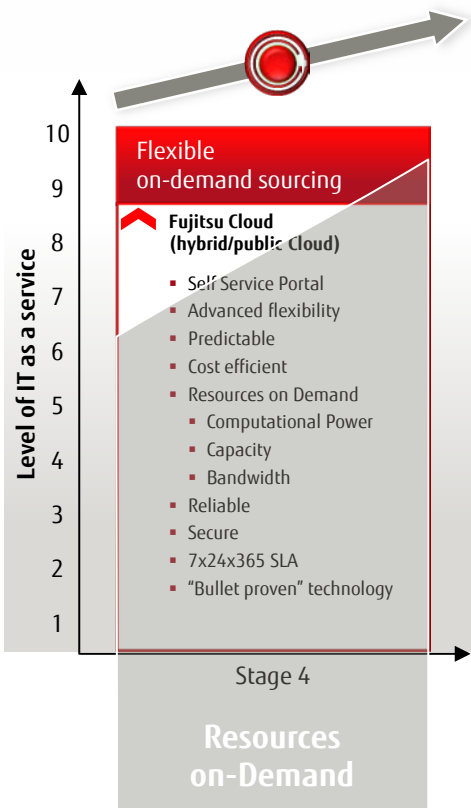- Whole ecosystems will emerge to optimize existing codes to run on KNL
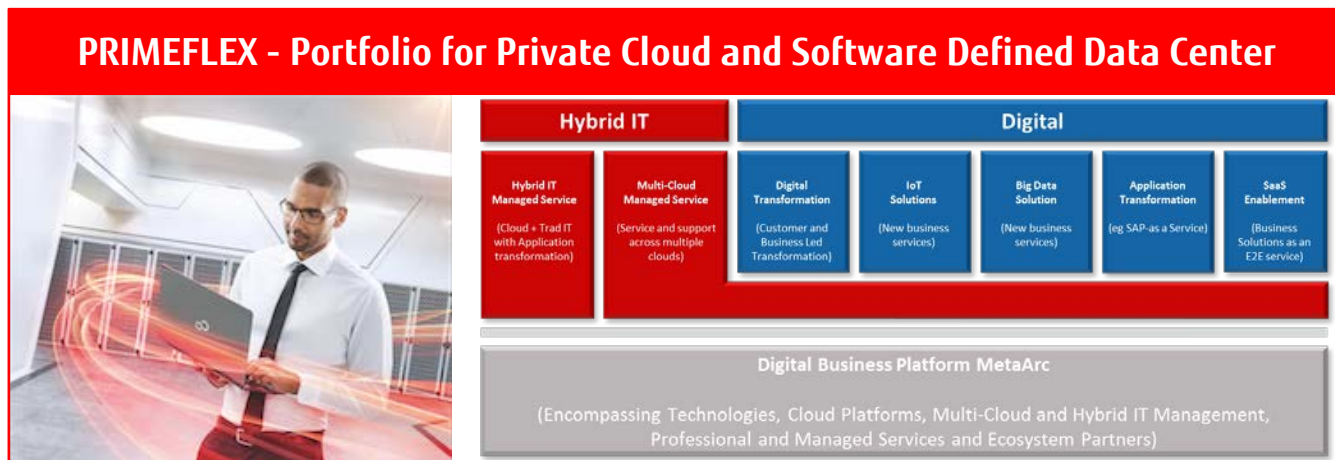
Emerging Real-Time Workflows

Data

Big Data +
Small Compute
e.g. Search, Streaming,
Data Preconditioning

FAST DATA

Big Data + Big Compute
e.g. *Real-Time* Local Weather
Modeling, Convolutional Neural Nets

Small Data + Small
Compute
e.g. EDA

Small Data +
Big Compute
e.g. Mechanical Design, Multi-physics

Solution Urgency

Compute

Source: INTEL

(intel)

Peak Performance

| >500 TFlops | 40 KW | | 96 TFlops | 34 KW |

New CX-xxx

CX-400 Flexible HPC solution

- General purpose and hybrid parallel applications
- Integrated mid-range to high end

- General purpose and hybrid parallel applications
- Scales in storage memory and number of cores

Compute nodes

160*

80*

*assuming 40U rack fully populated
**specific proprietary rack form factor

1) Source: IDC 2015

Level of IT Stage 4

Stage 4 – Software Defined plus Hybrid–IT / Public Offerings

Flexible on-demand sourcing

Fujitsu Cloud (hybrid/public Cloud)

- Self Service Portal
- Advanced flexibility
- Predictable
- Cost efficient
- Resources on Demand
  - Computational Power
  - Capacity
  - Bandwidth
- Reliable
- Secure
- 7x24x365 SLA
- "Bullet proven" technology

Level of IT as a service

Stage 4

Resources on-Demand

PRIMEFLEX - Portfolio for Private Cloud and Software Defined Data Center

Hybrid IT		Digital				
Hybrid IT Managed Service (Cloud + Trad IT with Application transformation)	Multi-Cloud Managed Service (Service and support across multiple clouds)	Digital Transformation (Customer and Business Led Transformation)	IoT Solutions (New business services)	Big Data Solution (New business services)	Application Transformation (eg SAP-as a Service)	SaaS Enablement (Business Solutions as an E2E service)

Digital Business Platform MetaArc

(Encompassing Technologies, Cloud Platforms, Multi-Cloud and Hybrid IT Management, Professional and Managed Services and Ecosystem Partners)

IT – Landscapes will Change
Example: Network

Hyper Converged Infrastructures: SDDC vs. HDDC

Typical IT-Infrastructure
North / South - Network

IP-Switch
Core 1

IP-Switch (Aggr)

IP-Switch (Aggr)

IP-Switch (ToR)

SAN-Switch

Rack 1

Server xy

Server 3

Server 2

Server 1

IP-Switch (ToR)

SAN-Switch

Rack 2

Server xy

Server 3

Server 2

Server 1

IP-Switch (ToR)

SAN-Switch

Rack 3

Server xy

Server 3

Server 2

Server 1

IP-Switch (ToR)

SAN-Switch

Rack 4

Server xy

Server 3

Server 2

Server 1

SAN 1

SAN 2

NAS 1

NAS 2

SAN - Network

Hyper Converged Infrastructures:
SDDC vs. HDDC

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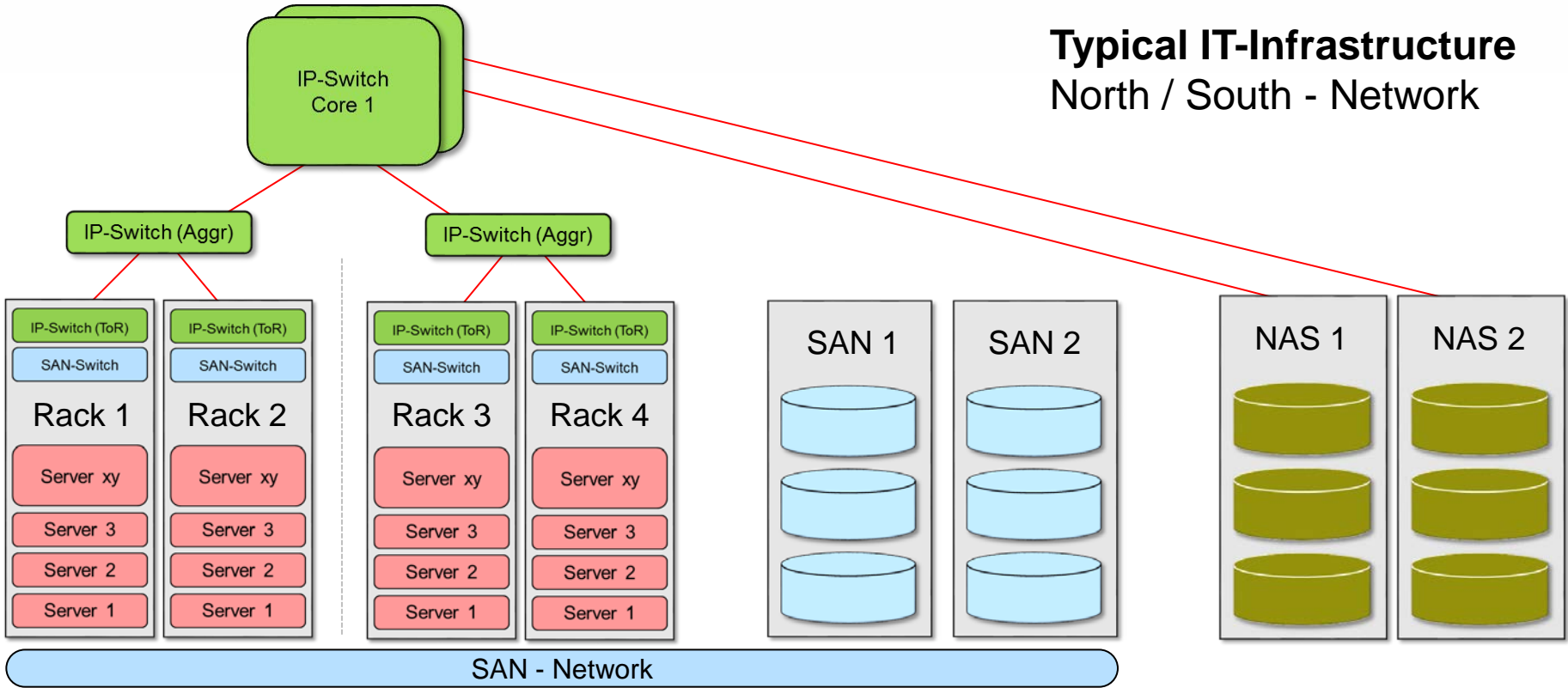
Hyper Converged IT-Infrastructure
East / West – IP based Network

IP – Network (Meshed)

| IP-Switch (ToR) | IP-Switch (ToR) | IP-Switch (ToR) | IP-Switch (ToR) |

Optional

Rack 1	Rack 2	Rack 3	Rack 4
Server xy	Server xy	Server xy	Server xy
Server 3	Server 3	Server 3	Server 3
Server 2	Server 2	Server 2	Server 2
Server 1	Server 1	Server 1	Server 1

NAS 1   NAS 2

Significant CAPEX / OPEX Reduction with SDI

Traditional IT

vs.

Software Defined IT-Infrastructure

Security in Traditional IT Landscapes
The Onion – Principle
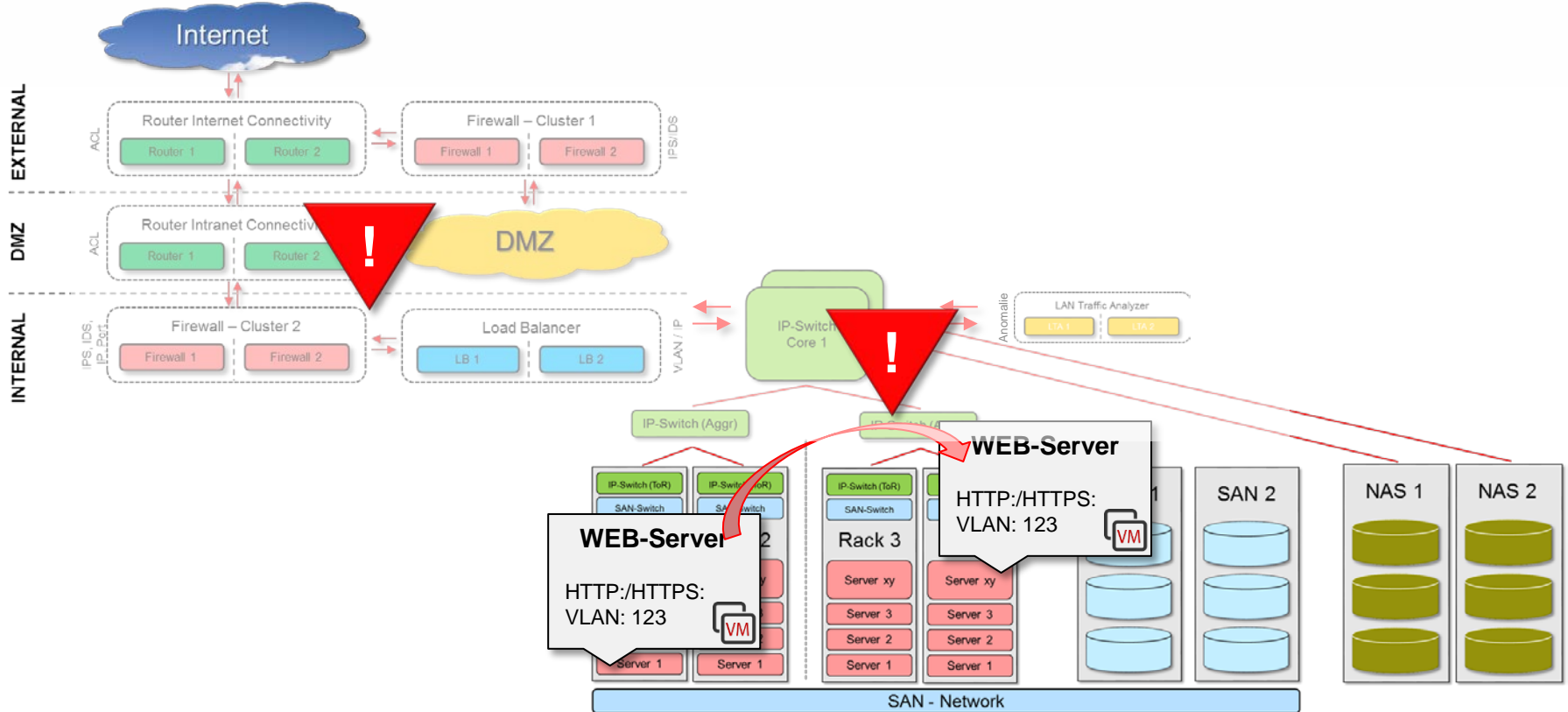
Significant CAPEX / OPEX Reduction with SDI
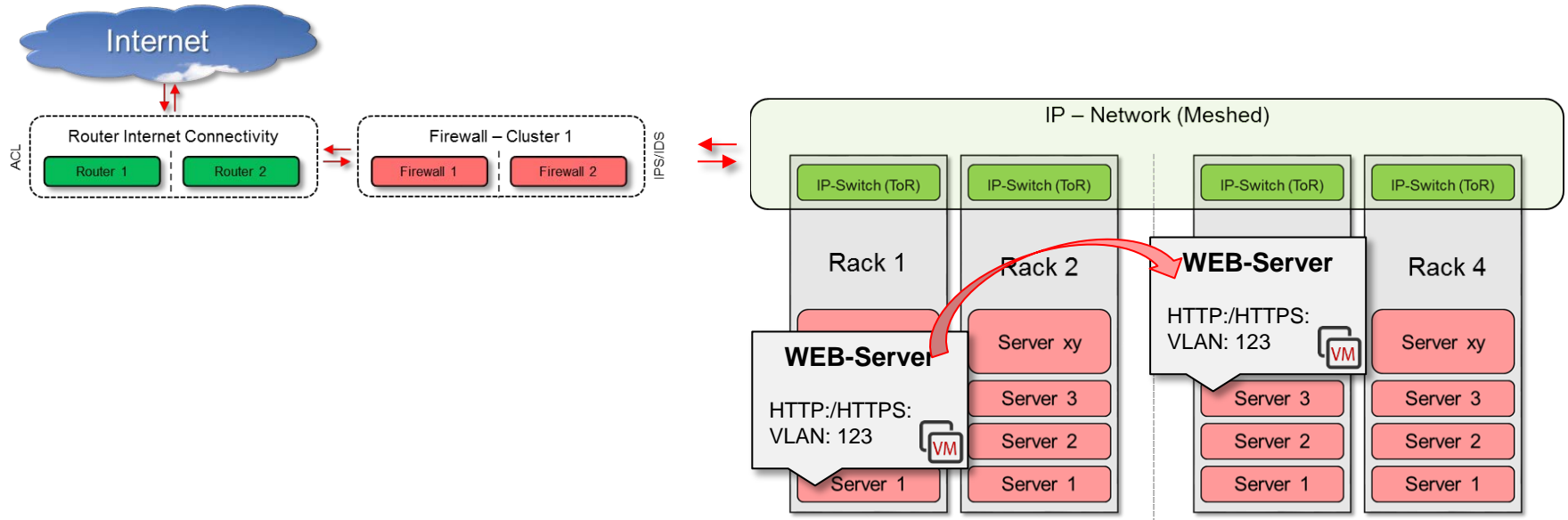
Traditional IT

vs.

Hyper Converged IT-Infrastructure
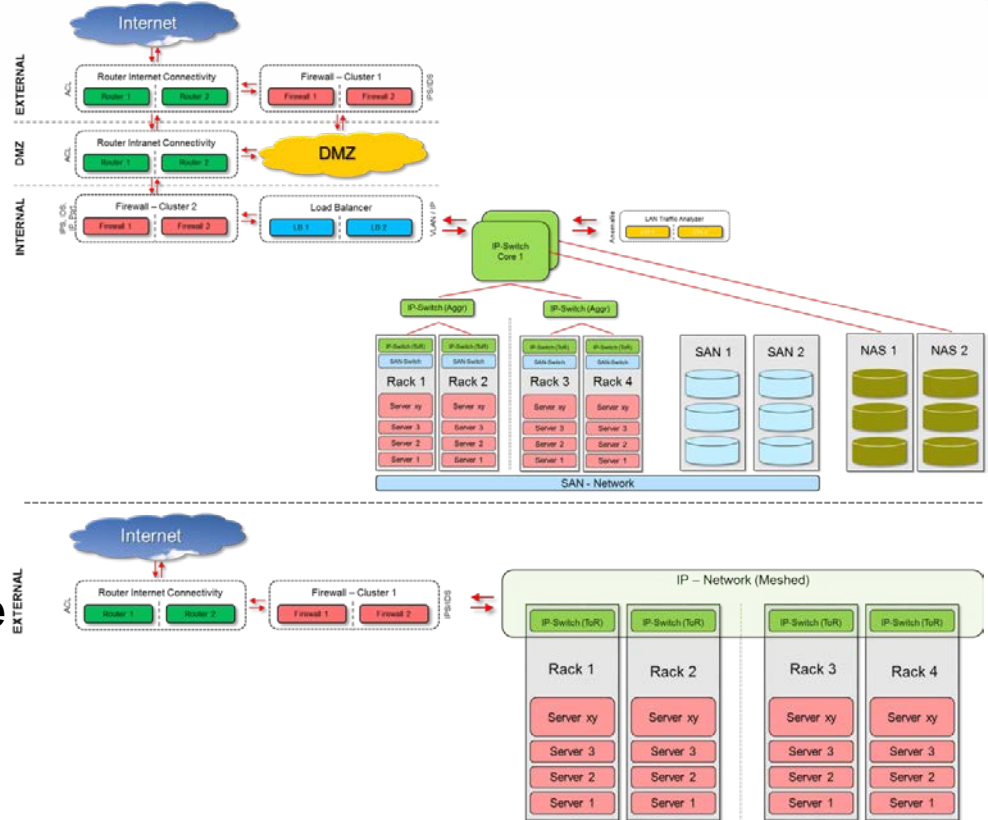
Summary

From Data Center Silos
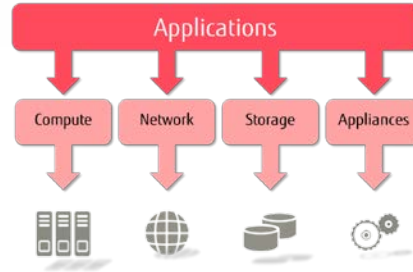
To Software Defined
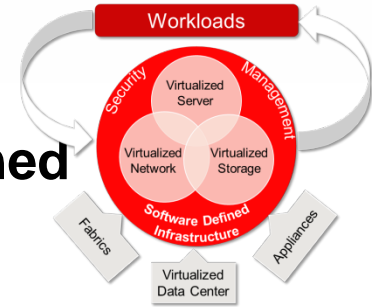
Robust IT

Fast IT
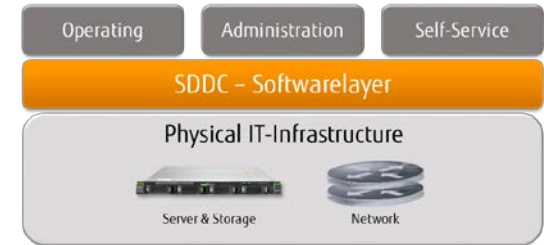
The Digital Transformation Will Not Only Enable The Business Centric Data Center – The Result of the Digital Transformation <u>Will Be</u> the Business Centric Data Center

Server Technology for the SDDC - Era
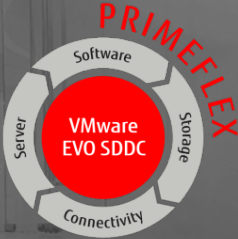
PRIMERGY CX Family

- Compute density optimized
  - Cloud
  - HPC
  - Large scale-out computing

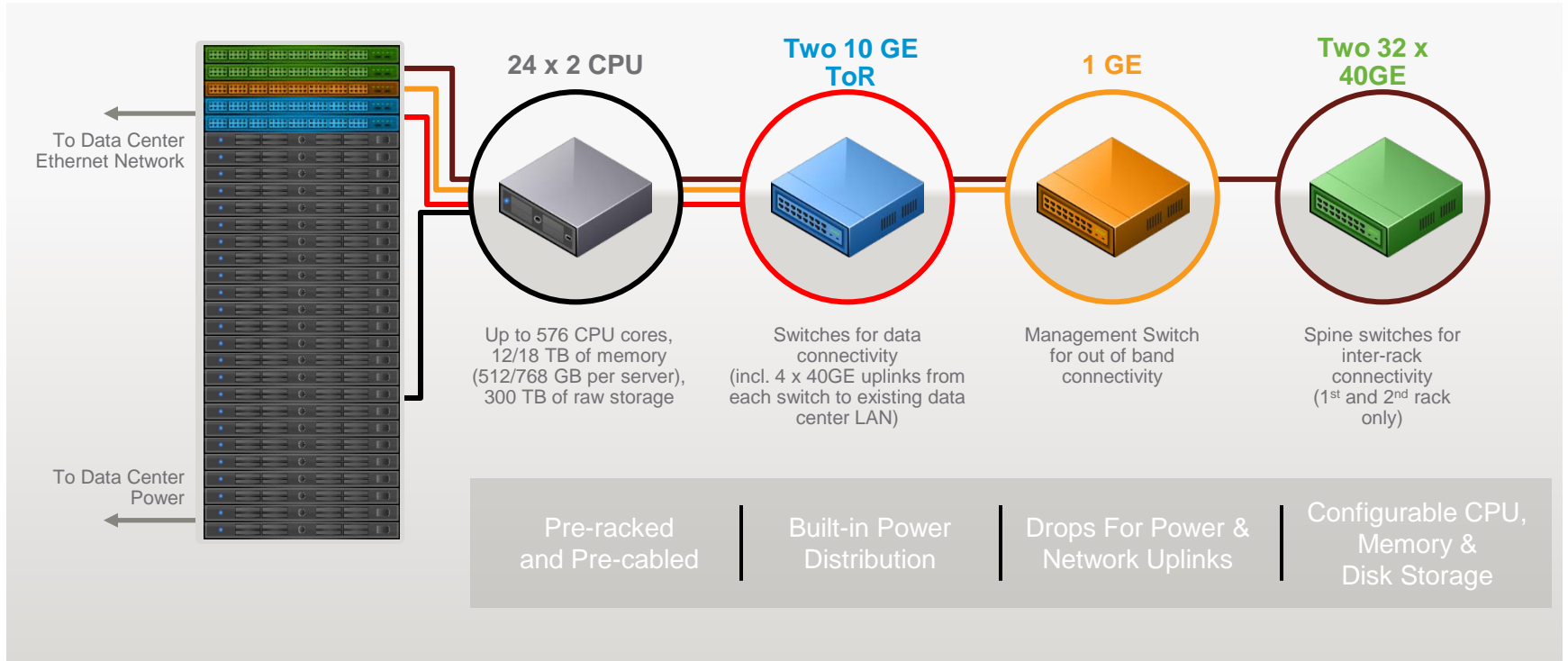**An unparalleled mix of quality, efficiency and agility**

EVO SDDC Ingredients

vmware

vSphere	VSAN	vRealize Log Insight	Horizon Suite
vCenter Server	NSX	vRealize Operations	vRealize Automation

EVO SDDC Software

FUJITSU

BROCADE

Management Switch

ToR Data Switches

Inter Rack Spine Switches

Rack Mount Servers with Storage

Rack Power Distribution
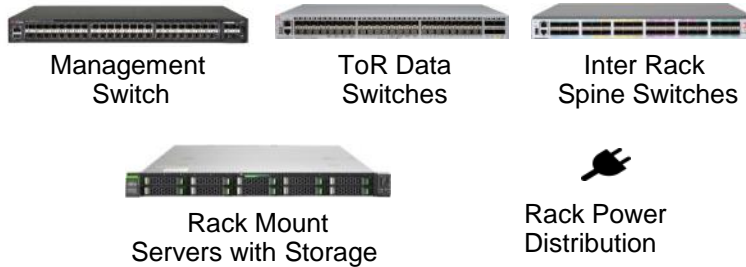
EVO SDDC Hardware

vmware EVO SDDC

EVO SDDC: What´s in the Rack?

24 x 2 CPU

Up to 576 CPU cores,
12/18 TB of memory
(512/768 GB per server),
300 TB of raw storage

Two 10 GE ToR

Switches for data
connectivity
(incl. 4 x 40GE uplinks from
each switch to existing data
center LAN)

1 GE

Management Switch
for out of band
connectivity

Two 32 x 40GE

Spine switches for
inter-rack
connectivity
(1st and 2nd rack
only)

To Data Center
Ethernet Network

To Data Center
Power

Pre-racked
and Pre-cabled

Built-in Power
Distribution

Drops For Power &
Network Uplinks

Configurable CPU,
Memory &
Disk Storage

Physical Infrastructure: Procurement Options

1/3 Rack

Starter Kit
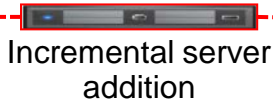
Incremental server addition

1/2 Rack

Full Rack
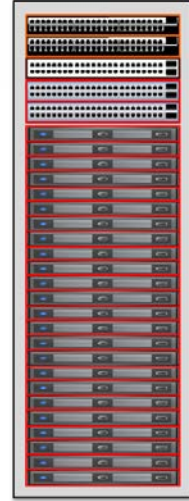
- 8 x 2 CPU Servers with 768GB of Memory each
- 192 Cores, 6TB Memory,
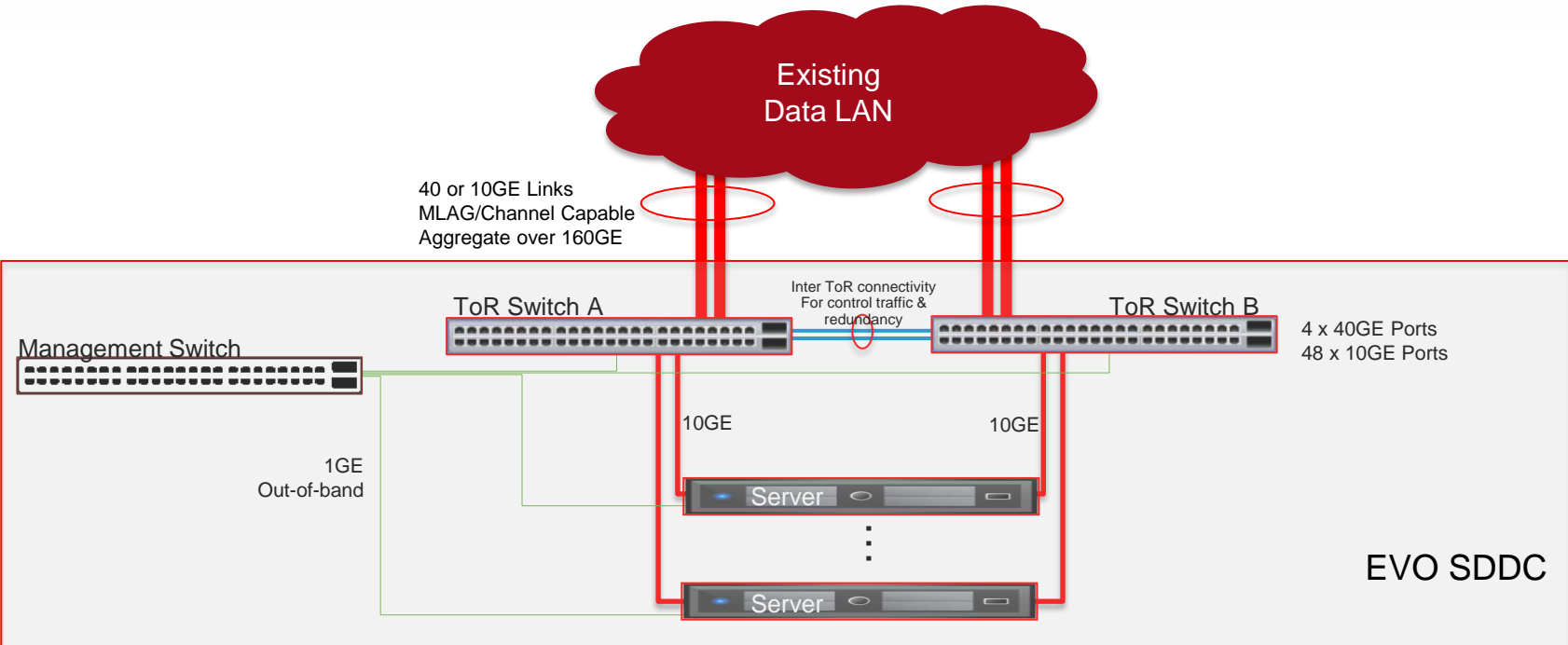- 100TB Storage (raw)
- Approx 230* VMs, 800 Desktops

- 12 x 2 CPU Servers with 768GB of Memory each
- 288 Cores, 9TB Memory,
- 150TB Storage (raw)
- Approx 350* VMs, 1200 Desktops

- 24 x 2 CPU Servers with 768GB of Memory each
- 576 Cores, 18TB Memory,
- 300TB Storage (raw)
- Approx 700* VMs, 2400 Desktops

*Average VM size: 2 vCPUs, 8GB Memory, 160GB Storage

EVO SDDC Network Deployment Model
Preserve Existing Data Center LAN

Existing
Data LAN

40 or 10GE Links
MLAG/Channel Capable
Aggregate over 160GE

Inter ToR connectivity
For control traffic &
redundancy

ToR Switch A

Management Switch

ToR Switch B

4 x 40GE Ports
48 x 10GE Ports

10GE

10GE

1GE
Out-of-band

Server

Server

EVO SDDC

Expanding The Physical Infrastructure
Multi Rack Scaling

- Inter Rack Spine provides 40G connectivity between racks
- Inter-rack east-west traffic ONLY
- All external data traffic goes through ToR switches to datacenter LAN

Existing Data LAN

L3 or L2 connectivity

Inter Rack Spine Switch A

Inter Rack Spine Switch B

EVO SDDC

Physical Rack 1

Physical Rack 2

...

Physical Rack n
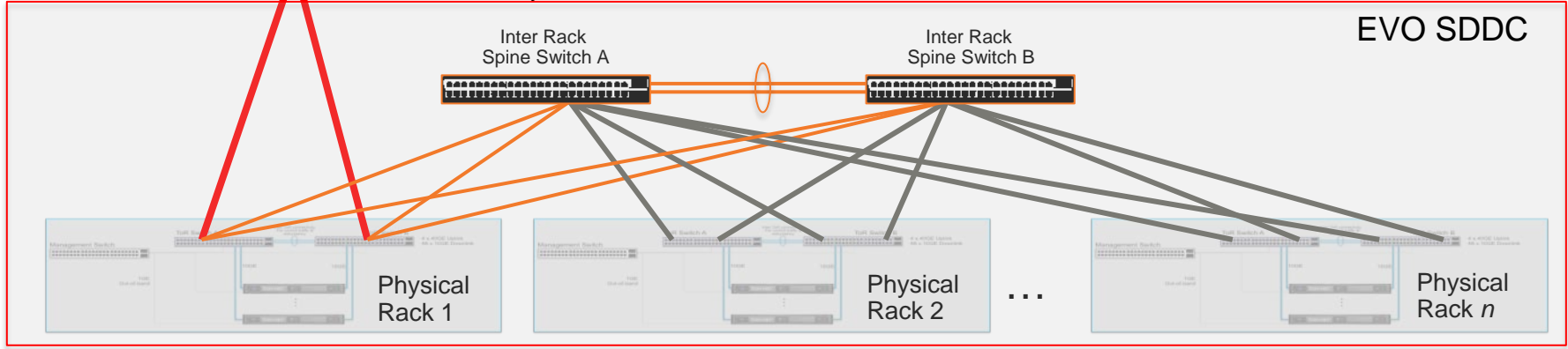
	Uplink to Datacenter Network (2 x 40GE) Additional unused 10GE links can be added
	Inter Rack Ethernet Link (1 x 40GE)
	Inter Rack Ethernet Link (2 x 40GE)

EVO SDDC Software Architecture
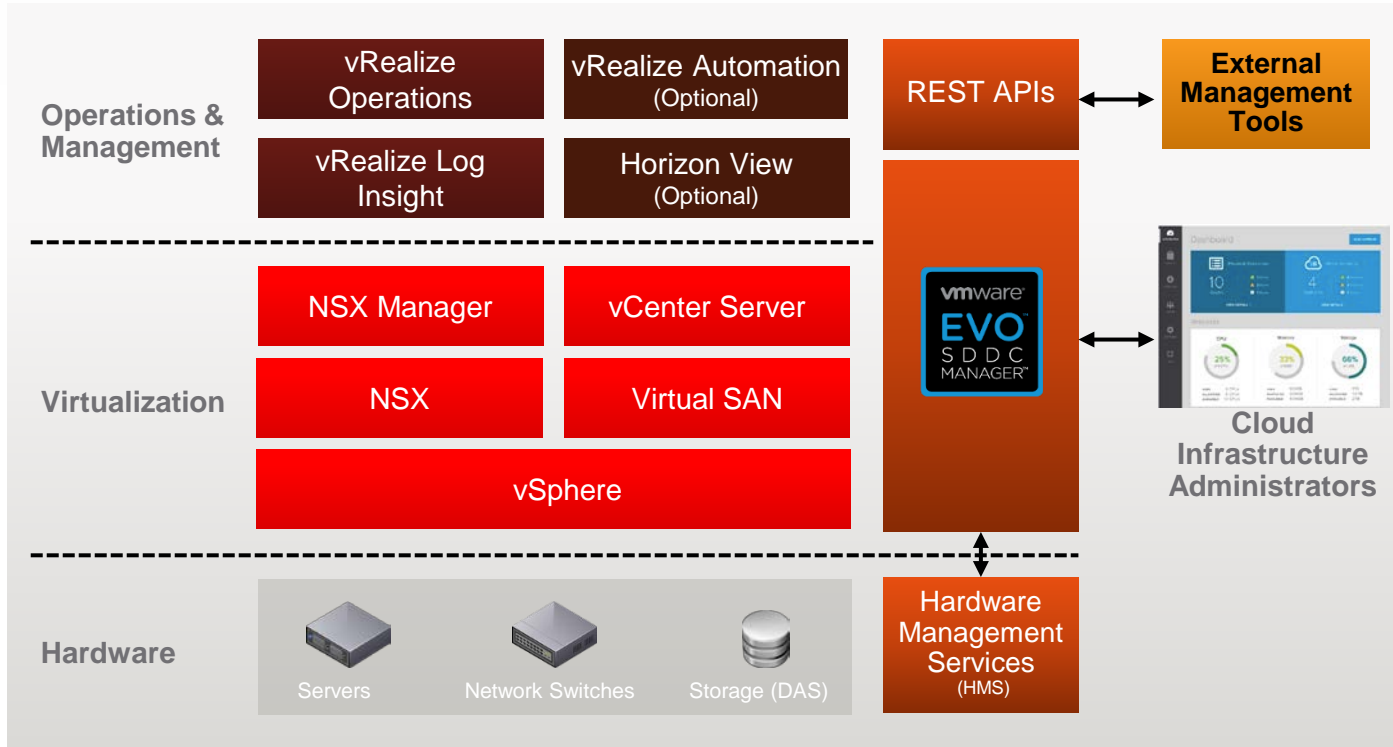
Key Benefits Delivered by EVO SDDC

Simplicity	Fully integrated SDDC software suite
Faster Time to Productivity	Automated bring up, integrated management of physical and virtual infrastructure and lifecycle management of hardware and software
Enhanced Security	Automated and intelligent delivery of network security services to applications
Savings vs. HDDC	Significant Opex and Capex benefits delivered by SDDC capabilities

Why Fujitsu?

FUJITSU

Major Footprint in High Performance Computing

FUJITSU

Fujitsu is positioned at the forefront of the supercomputing space with 30 years' experience in the successful development of high-performance systems.

Australian National University ANU, Canberra Australia

- **1.2 Petaflops - No. 38 in** Top 100 SUPERCOMPUTER list 2014
- 3600 x **PRIMERGY CX250 S2, installed in**
  - 900 x **PRIMERGY CX400 S2**
- Largest HPC Computer in the Australian/Pacific Hemisphere
- Cold-Aisle isolation - no water cooling

3600 x
PRIMERGY CX250 S2

(intel)

900 x
PRIMERGY CX400 Series

The CX-Series demonstrates the impressive computing power capabilities of scaling Intel-based technology **as a base of the new Hyper-Converged Infrastructure appliance**.

Best Climate Solutions for our Planet to Protect the Environment

| Climate Solutions		
Company Ranking		**Score**
1st	Fujitsu	28
2nd	Cisco	24
	Ericsson	24
4th	Vodafone	23
5th	IBM	19
6th	NTT	18
7th	Google	17
	HP	17
9th	NEC	14
	Alcatel-Lucent	14
	AT&T	14
12th	SoftBank	11
	Toshiba	11
	Microsoft	11
15th	Hitachi	10
16th	SAP	9
	Telefónica	9
	Wipro	9
19th	HCL	8
20th	Dell	7
21st	Sprint	5

CLIMATE SOLUTIONS 28/40 1ST PLACE

SUMMARY 44/100 4TH PLACE

GREENPEACE

COOL IT LEADERBOARD
VERSION 6, APRIL 2013

The Cool IT Leaderboard evaluates global IT companies on their leadership in the fight to stop climate change. The IT sector possesses the innovative spirit, technological know-how, and political influence to bring about a rapid clean energy revolution.

Report 6/2013
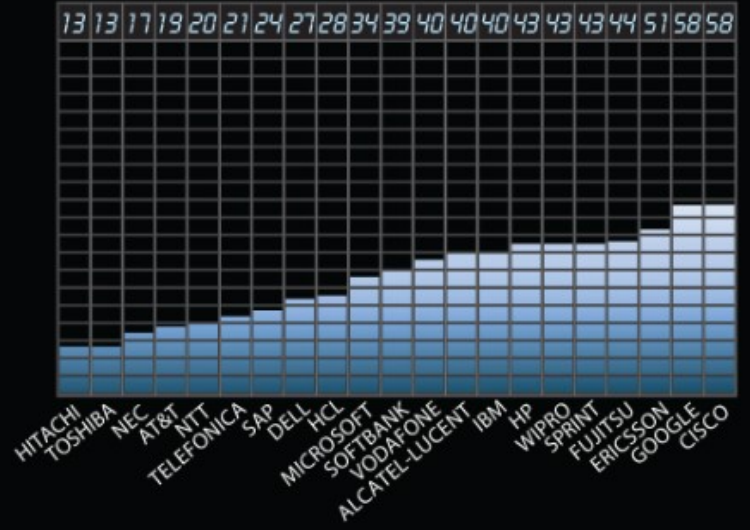
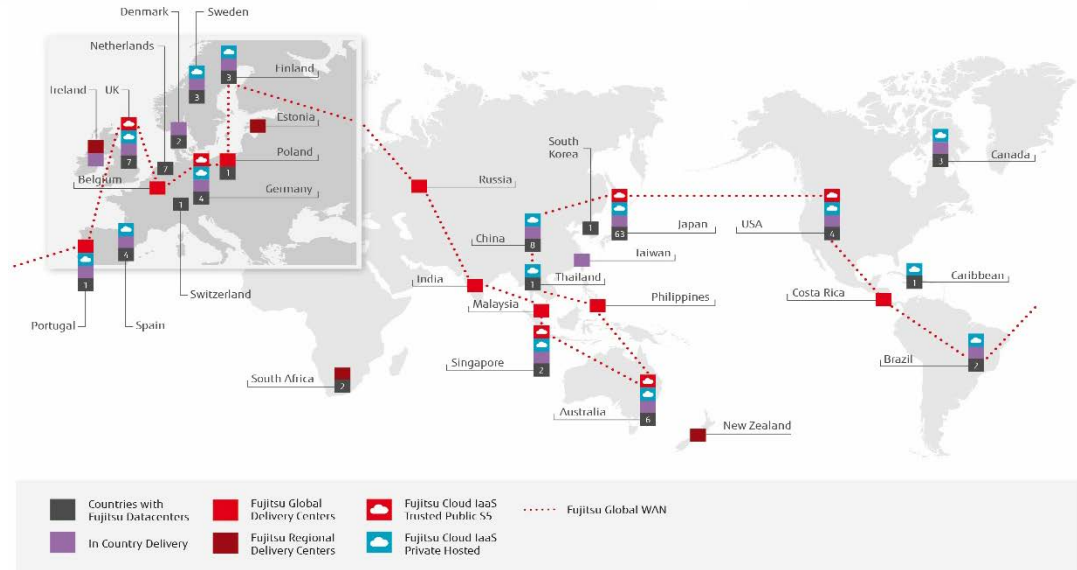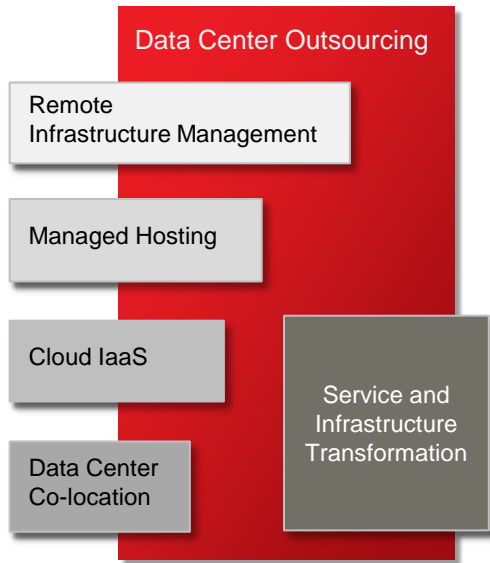# We Protect our Workers and Acting Compliant to Human Rights and Social Standards
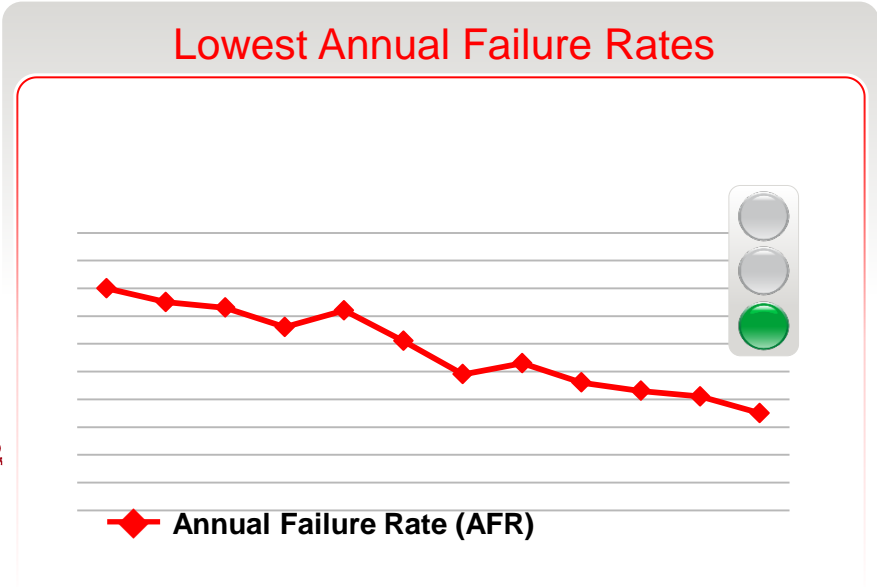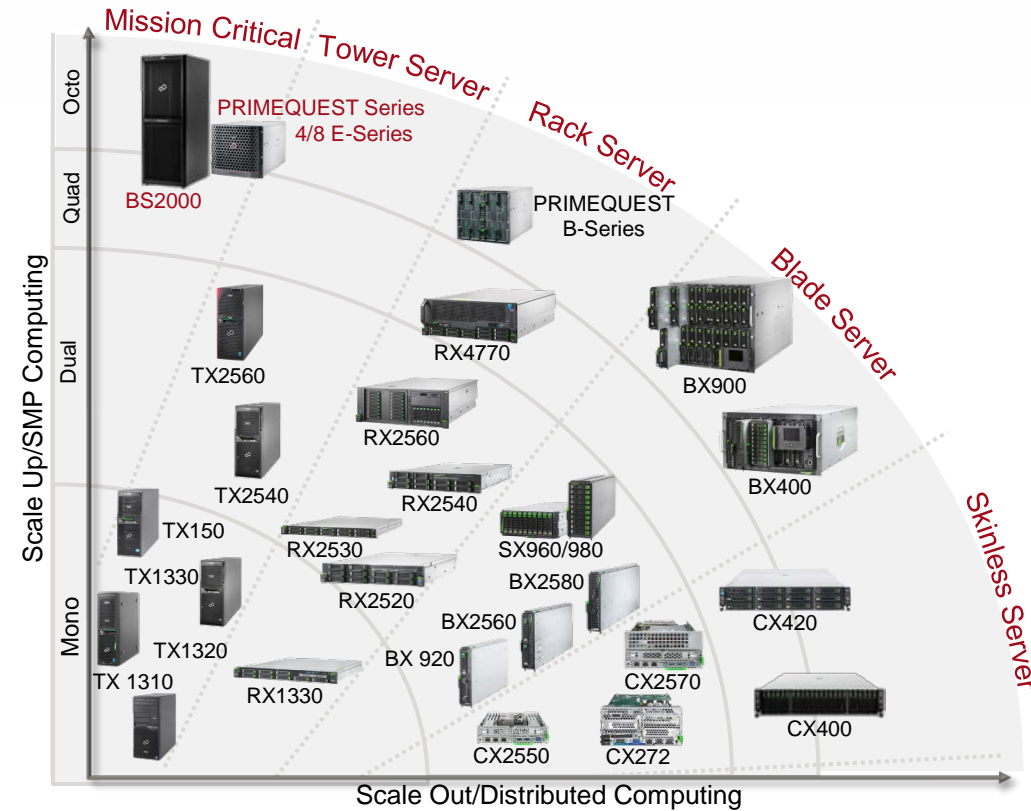
5th largest Service Provider
We know YOUR IT-Business

FUJITSU

Fujitsu Data Center Services landscape

Data Center Outsourcing

Remote
Infrastructure Management

Managed Hosting

Cloud IaaS

Service and
Infrastructure
Transformation

Data Center
Co-location

Legend:
- Countries with Fujitsu Datacenters
- In Country Delivery
- Fujitsu Global Delivery Centers
- Fujitsu Regional Delivery Centers
- Fujitsu Cloud IaaS Trusted Public SS
- Fujitsu Cloud IaaS Private Hosted
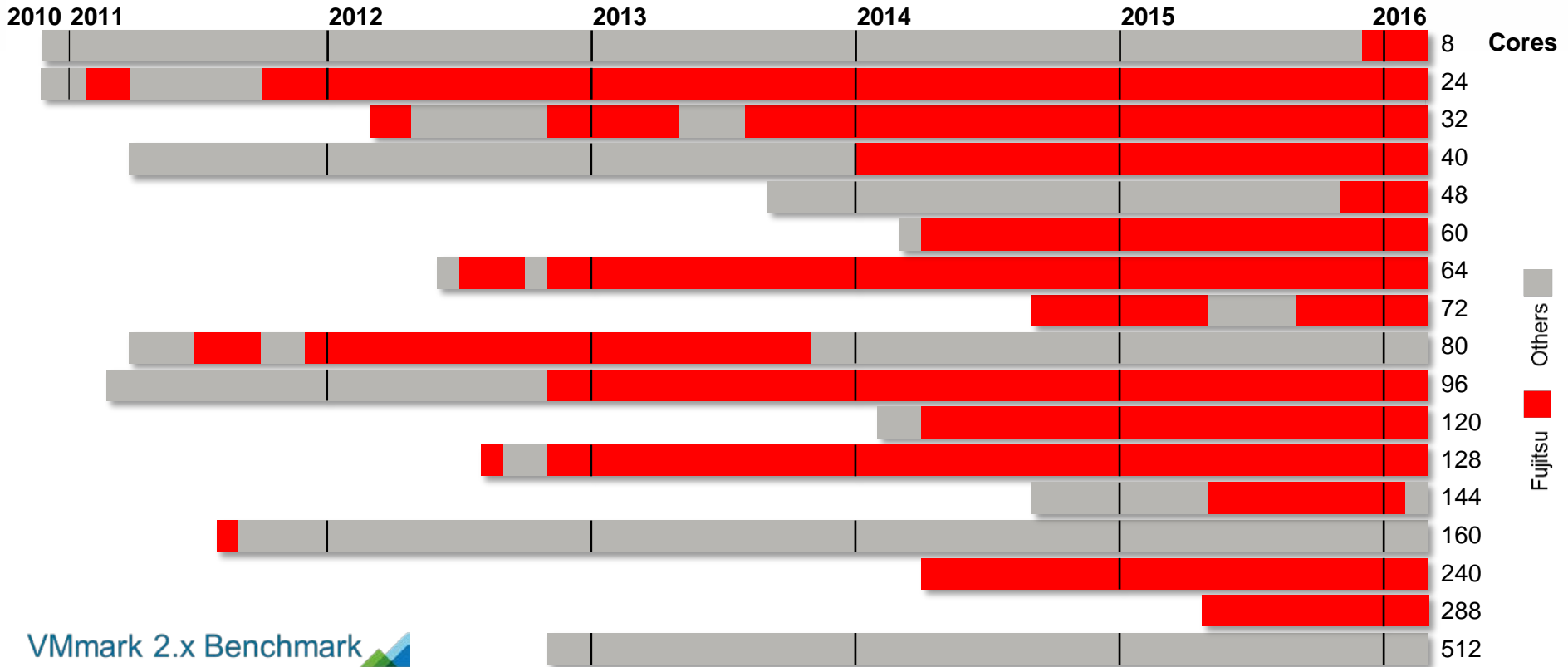- Fujitsu Global WAN

- DCO contracts a combination of ITIL compliant services
- Other services sold separately or in combinations
- Services include professional and consulting services

- 30+ years experience globally.
- 150+ data centers in 19 countries.

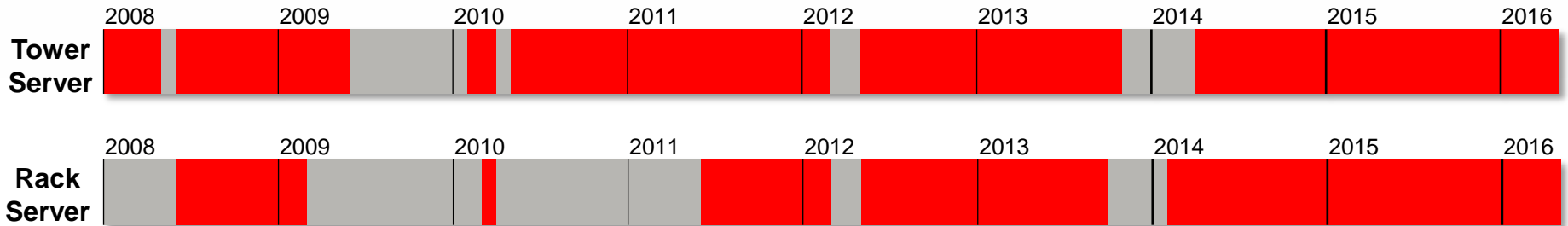- 4,000 RIM staff managing 145,000 servers and 140 PB of data.
- "Leader" in key analysts reports

Lowest Annual Failure Rates in the Market

Dominating the VMmark –
Benchmark for Virtualization & Cloudperformance

FUJITSU

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Cores |

VMmark 2.x Benchmark

Others

Fujitsu

64

Status: February, 2016

Copyright 2015 FUJITSU

Best in Power Efficiency – Savings for Your Data Center

Tower Server

2008	2009	2010	2011	2012	2013	2014	2015	2016

Rack Server

2008	2009	2010	2011	2012	2013	2014	2015	2016

	Hardware Vendor	System	Result	Published
	Non-Fujitsu		12212	Apr 2016
1	Fujitsu	FUJITSU Server PRIMERGY RX2560 M2	12079	Apr 2016
2	Fujitsu	FUJITSU Server PRIMERGY TX2560 M2	12065	Apr 2016
3	Fujitsu	FUJITSU Server PRIMERGY RX2540 M2	11638	Apr 2016
	Non-Fujitsu		10802	Apr 2015
	Non-Fujitsu		10700	Apr 2015
4	Fujitsu	FUJITSU Server PRIMERGY RX2560 M1	10699	Apr 2015
5	Fujitsu	FUJITSU Server PRIMERGY TX2560 M1	10685	Apr 2015
6	Fujitsu	FUJITSU Server PRIMERGY RX2540 M1	10654	Okt 2014
	Non-Fujitsu		10653	Apr 2016

Status: Apr 30, 2016; based on x86 Tower and Rackservers; no Bladecenter. If no Publish date is given, test date is used as reported.

PRIMERGY servers hold 6 out of 10 top positions of all major vendors!

PRIMERGY servers continuously provides leading scores in SPECpower_ssj2008
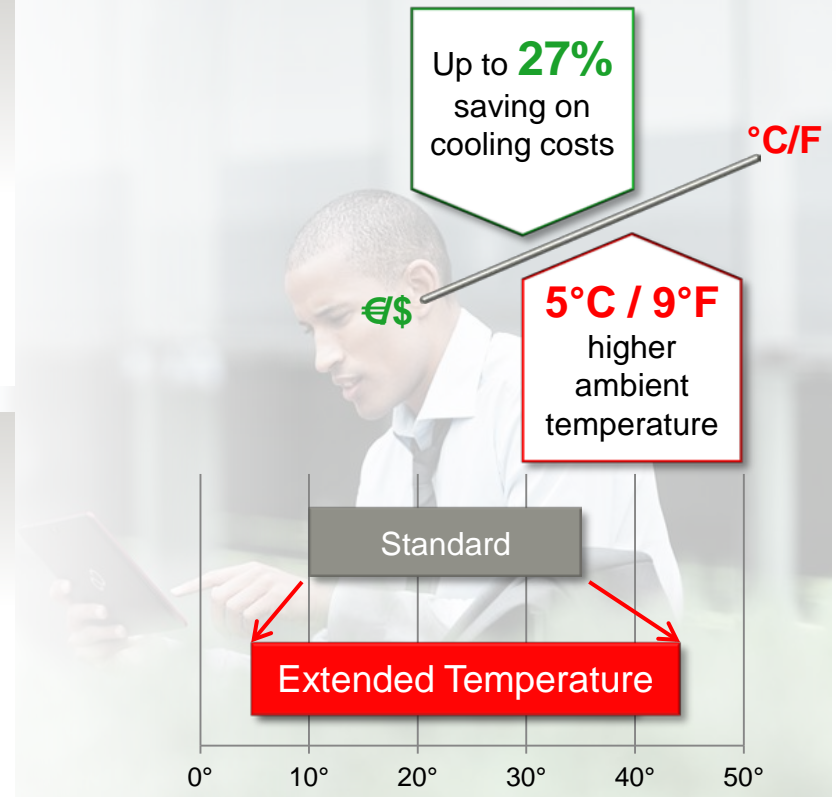
Because of the best Energy efficiency?
For Cooling...

What is it

- **Allows Customers to run Fujitsu Servers and Storage in an Extended temperature range of**
  - 5°C / 41°F
  - 45°C / 113°F

Business Benefits

- Savings on energy costs for cooling
- Reducing infrastructure costs
- System availability guarantee
- No restriction on operation time

Up to **27%** saving on cooling costs

°C/F

€/$

5°C / 9°F higher ambient temperature

Standard

Extended Temperature

| 0° | 10° | 20° | 30° | 40° | 50° |

Fujitsu's Partnerships

Alliances with leading global and local players constitute a strong ecosystem of people, solutions and services for our customers

Strategic Alliance Partners	ca. · CISCO · CITRIX · (intel) · Microsoft · NetApp · ORACLE · SAP Global Partner · Symantec Global Strategic Partner · vmware
International Alliance Partners	BROCADE · commvault · Quantum · redhat · SUSE · salesforce · software AG · verizon
Local Alliance Partners	axway business. in motion · CHECK POINT Software Technologies Ltd. We Secure the Internet. · GUPTA · LANCOM Systems · MATERNA Information & Communications · TREND MICRO
Service Partners	FNEXT AG · microCAT · KUPPER · danubIX open minds. open source. · Raber+Märcker Prinzip Partnerschaft · SOHNIX AG · DIS Daten-IT-Service GmbH · acsn group · CND · CES IT-Systemhaus GmbH · VG Systems GmbH · HORN & COSIFAN Computersysteme GmbH · SCHUSTER WALTHER · D-play
Sales Partners	FUJITSU Registered Partner · FUJITSU SELECT Partner · FUJITSU SELECT Expert approx. 10.300 Channel partners

Questions & Answers