jsc
Management- und Technologieberatung AG

Trends in Virtualization and their Implications

– Survey –

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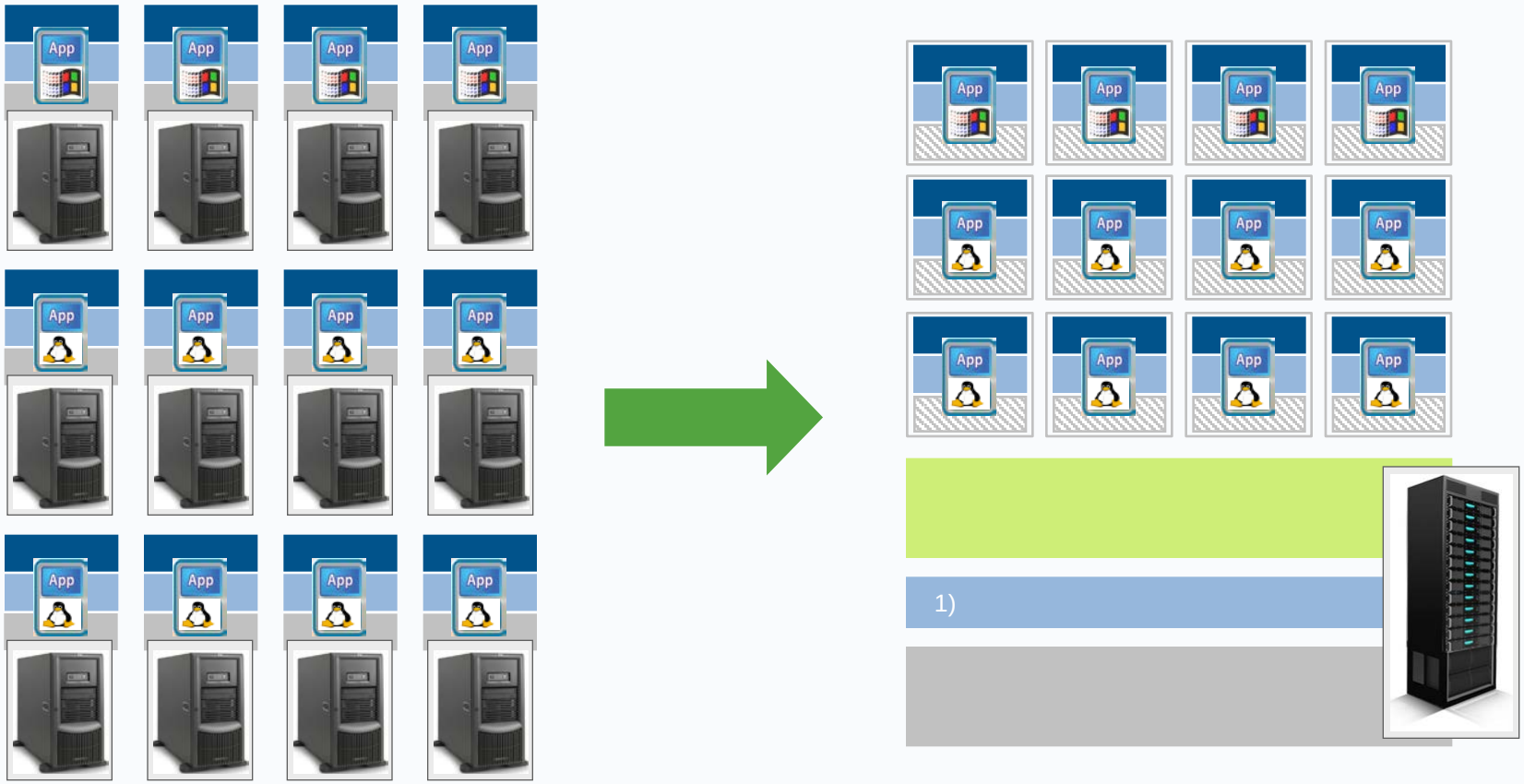
Version 01 Final
January 2012

Table of Contents

Server Virtualization
Starting Point

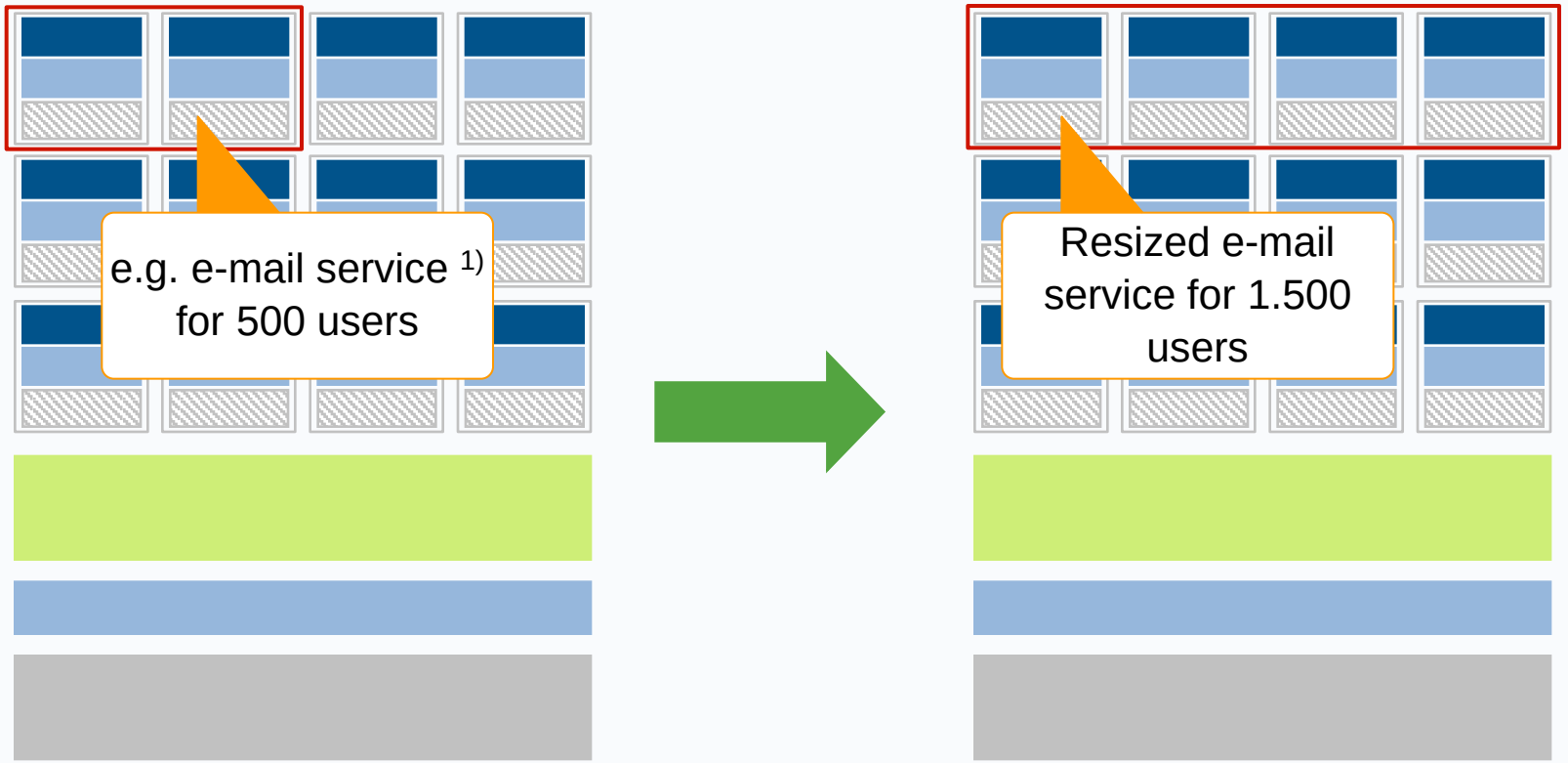
Server virtualization is and will be used to benefit from a consolidation of physical server machines



Application , virtualization software , operating system hardware , virtualized server hardware
Source: JSC, 1) optional

Server Virtualization
Leveraging Service-Oriented Approach

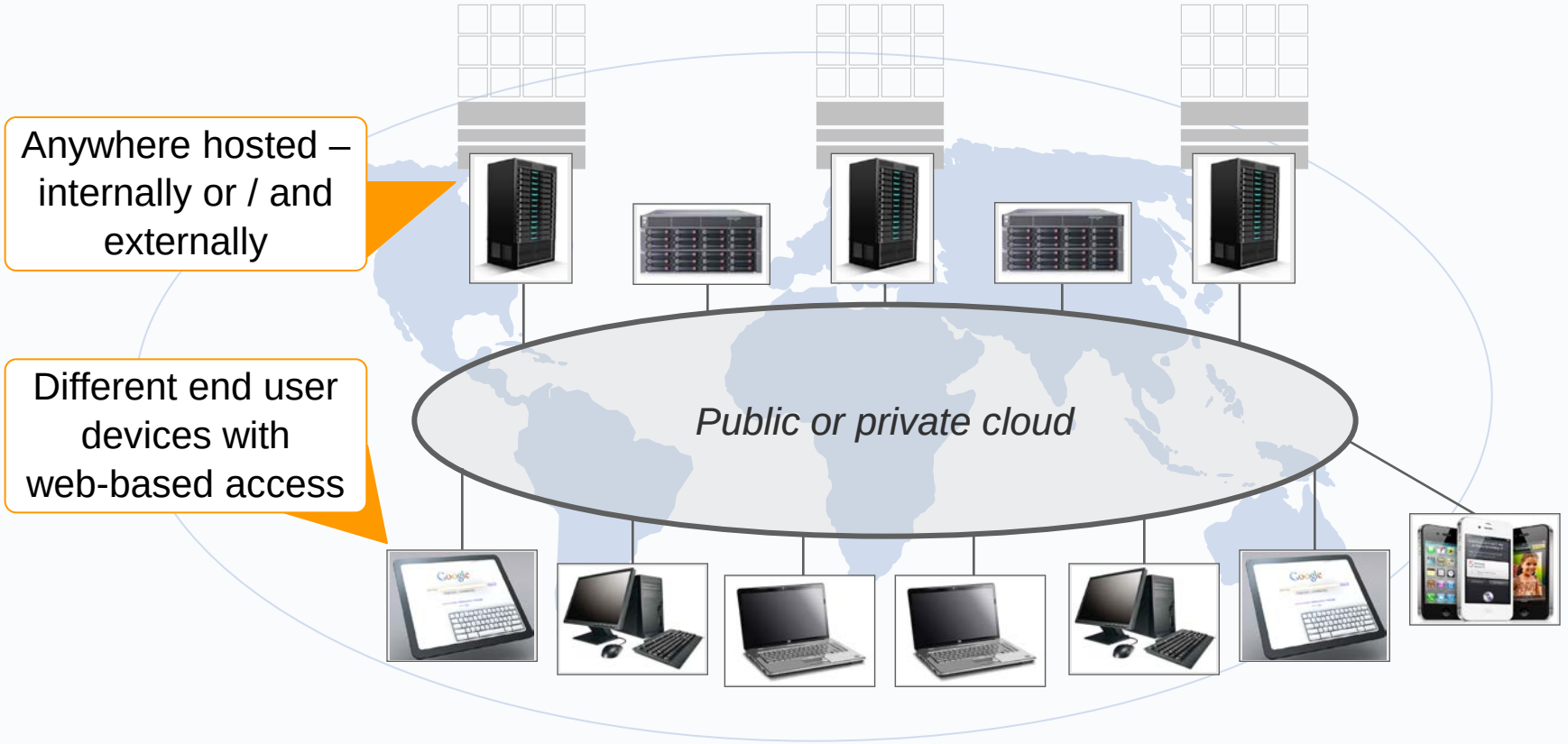
Within a virtualized environment offered IT services can easily be adjusted to demand changes via service encapsulation and dynamic (de)coupling of related virtual machines



Application , virtualization software , operating system hardware , virtualized server hardware
Source: JSC, 1) Service based encapsulation possible, access to the services via standard interfaces (e.g. HTTP/HTTPS)

.. And Cloud Computing
Perspective

Server virtualization in combination with cloud computing will create a dynamically scalable, virtual computing cloud which provides IT services on demand to a variety of end users via Intranet / Internet



Source: JSC

.. And Cloud Computing
Products

As an example, VMware vSphere® 5 in conjunction with VMware vCloud® are showing what is already possible

- vCloud is a framework allowing to shape virtualized environments – i.e. groups of infrastructure components and / or IT services including their communication paths – based on VMware's virtualization environment vSphere 5
- The encapsulated and secured environments can be dynamically moved between private and public clouds under full control of vCloud components such as vCloud Director 1.5
- vCloud allows interoperability for all public cloud providers relying on VMware products
- Pooling and dynamic resource allocation of virtual infrastructure works within private clouds, public clouds or within combinations – so-called hybrid clouds
- Infrastructure components and / or IT services can be grouped into "service catalogues" – IT and / or business units can choose from these catalogues incl. attached service levels – instant provision is possible

Source: JSC, Internet

Benefits and Risks (1)

Intensive virtualization of servers has clear benefits, both for the IT user and for the IT service provider

+ **Cost efficiency** – virtualization accelerates server consolidation on a standardized platform, improves server utilization rates and leads overall to reduced server TCOs as well as lower hardware spending [1)]

+ **Scalability / Business Agility** – … decouples business processes from hardware, allowing to respond on rapid changes on demand and enables enterprises to deploy new IT services with reduced lead-times

+ **Business Continuity** – … allows easier software migration, which makes it extremely valuable for disaster recovery solution not only in a DC

+ **Availability** – … reduces downtime for physical system maintenance
– virtual images are easier to restore and can be installed on different hardware

+ **Security** – … improves overall security level due to a consolidated computing environment, centralized control over applications, and fast and secure restore functionality

Source: JSC, 1) less machines, less administration effort, less power consumption, less required floor space …

Benefits and Risks (2)

… but also some risks

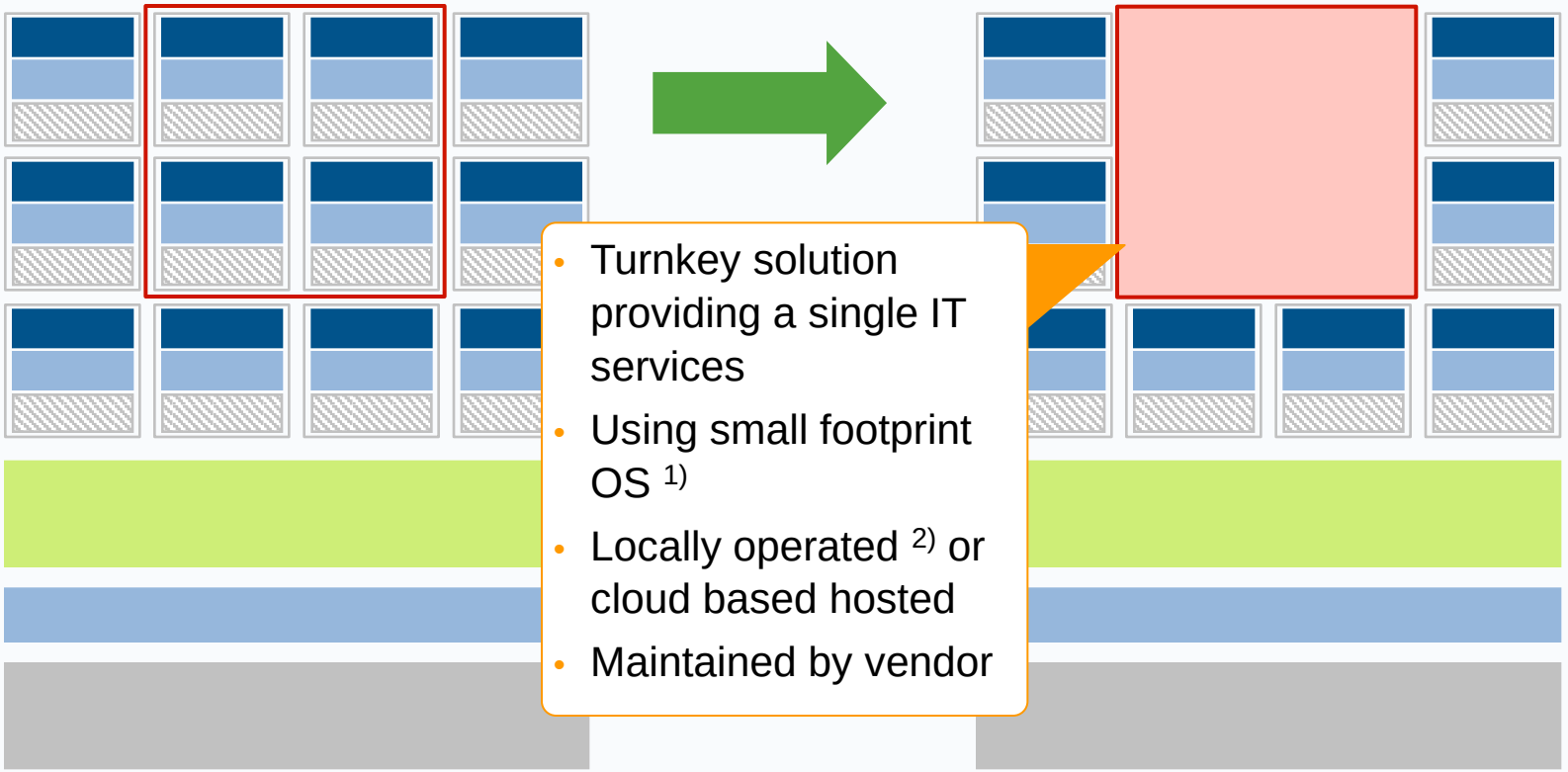
- **Complexity** – virtualization tends to make the environment more complex by adding a new software layer that must be maintained, incl. performance and availability monitoring, upgrades, patches, etc.
- **Controlling** – … complicates cost accounting and licensing – IT has to measure highly dynamic resource usage
- **Security** becomes not necessarily more fragile but certainly more critical – there will be more systems to secure, more points of entry, more holes to patch, and more interconnection points –

  also introduces the risk of attack from entirely new forms of malware [1)]

Source: JSC, 1) root kit infections, low-level hypervisor attacks, deployment of malicious virtual systems

Virtual Appliances

Virtual appliances further extend the development by providing turnkey solutions without the need for their configuration and administration by the own IT



Application , virtualization software , operating system hardware , virtualized server hardware , appliance
Source: JSC, 1) e.g. Ubuntu JeOS, Windows Server Core, 2) e.g. E-mail security appliances from Trend Micro, Collaboration Suite from Zimbra

Implications from Server Virtualization

With respect to the sketched developments JSC addresses 6 implications

1. Due to its evident benefits “classical” server virtualization remains a key technology in the next years
2. But server virtualization also takes the next step towards to a technology allowing IT units to act as a real IT service provider – this will be accelerated by an increased customer demand
3. IT units have pro-actively to decide if they will provide these services by themselves, if they will use an appliance based approach and where these services will be located [1)]
4. They also have to decide if they buy-in some of the services from external service providers
5. “Wait and see” isn’t a real option since server virtualization and cloud computing are strong instruments for external providers in order to further improve their competitiveness
6. It is expected that the majority of services provided by an virtualized environment for end users have to be accessible by using a web frontend –this will finally allow more flexibility regarding the end user devices to be used

Source: JSC, 1) e.g. in a private or public cloud or within combinations

Trends in End User Devices
Overview (1)

Landscape of end user devices will change dramatically within the next years: from traditional PC [1] to tablets and smart phones

Today …

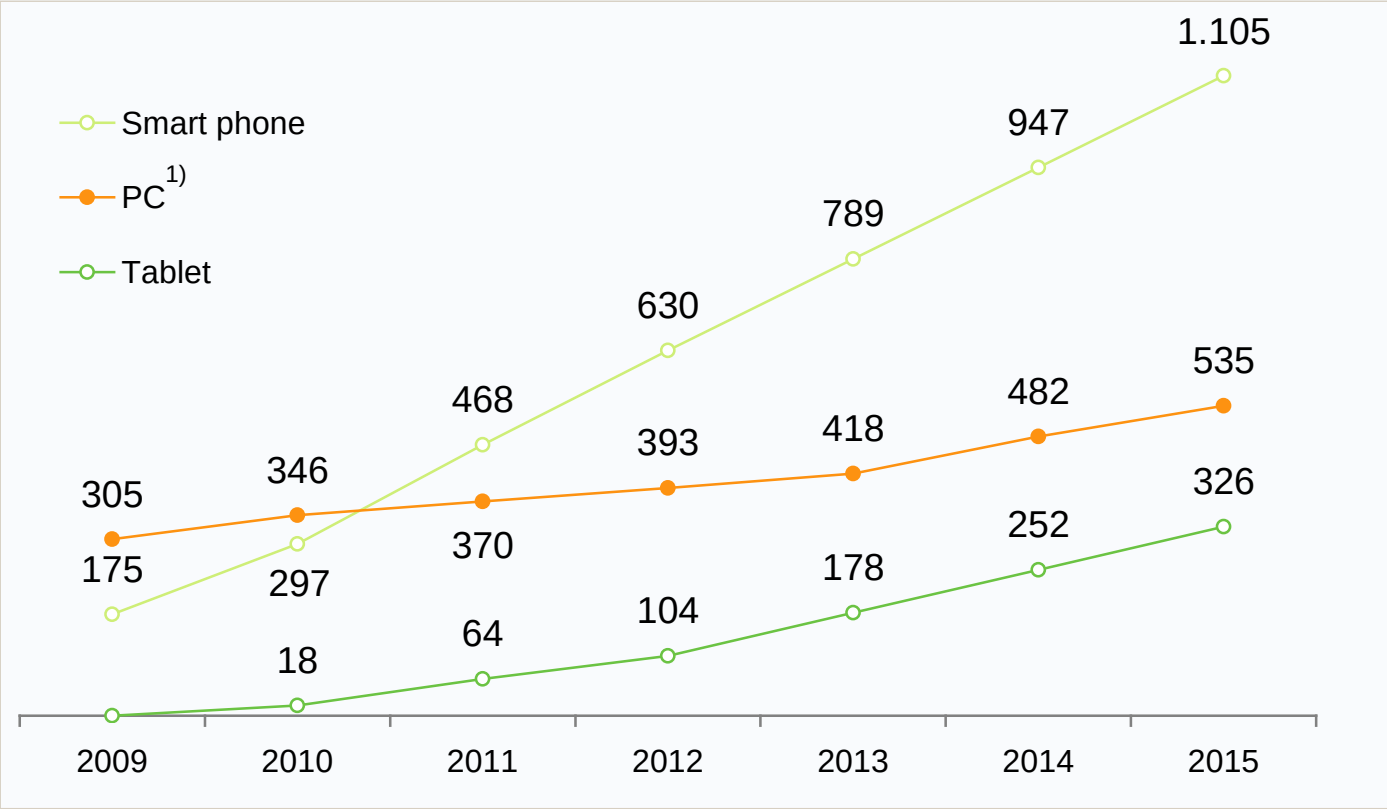
... and in future

Source: JSC
1) Usually x86 based desktops, notebooks, and netbooks

Trends in End User Devices
Overview (2)

Smart phones with open OS together with tablets will already reach ~ 70% of the relevant device market in 2015

Sales of client devices 2009 to 2015 (in millions of units)

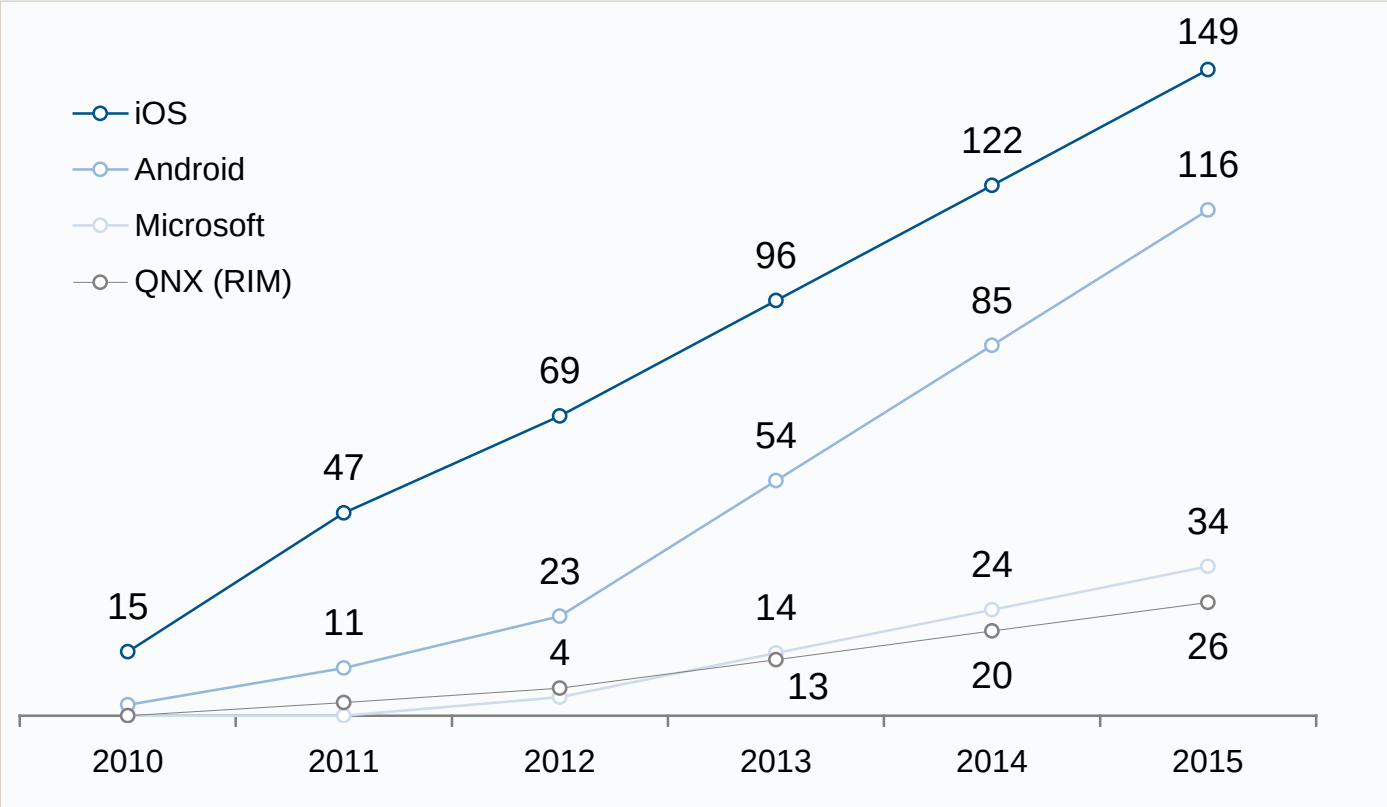


Source: Morgan Stanley Research: Tablet Demand and Disruption – Mobile Users Come of Age (February 2011), Gartner Press Release: Gartner Says Android to Command Nearly Half of Worldwide Smartphone Operating System Market by Year-End 2012, IDC, 1) desktop, notebook, netbook

Trends in End User Devices
Tablets

Apple (iOS) and Google (Android) dominates the tablet market: 98% in 2011 and ~ 80% in 2015

Sales of tablets by OS 2010 to 2015 (in millions of units)

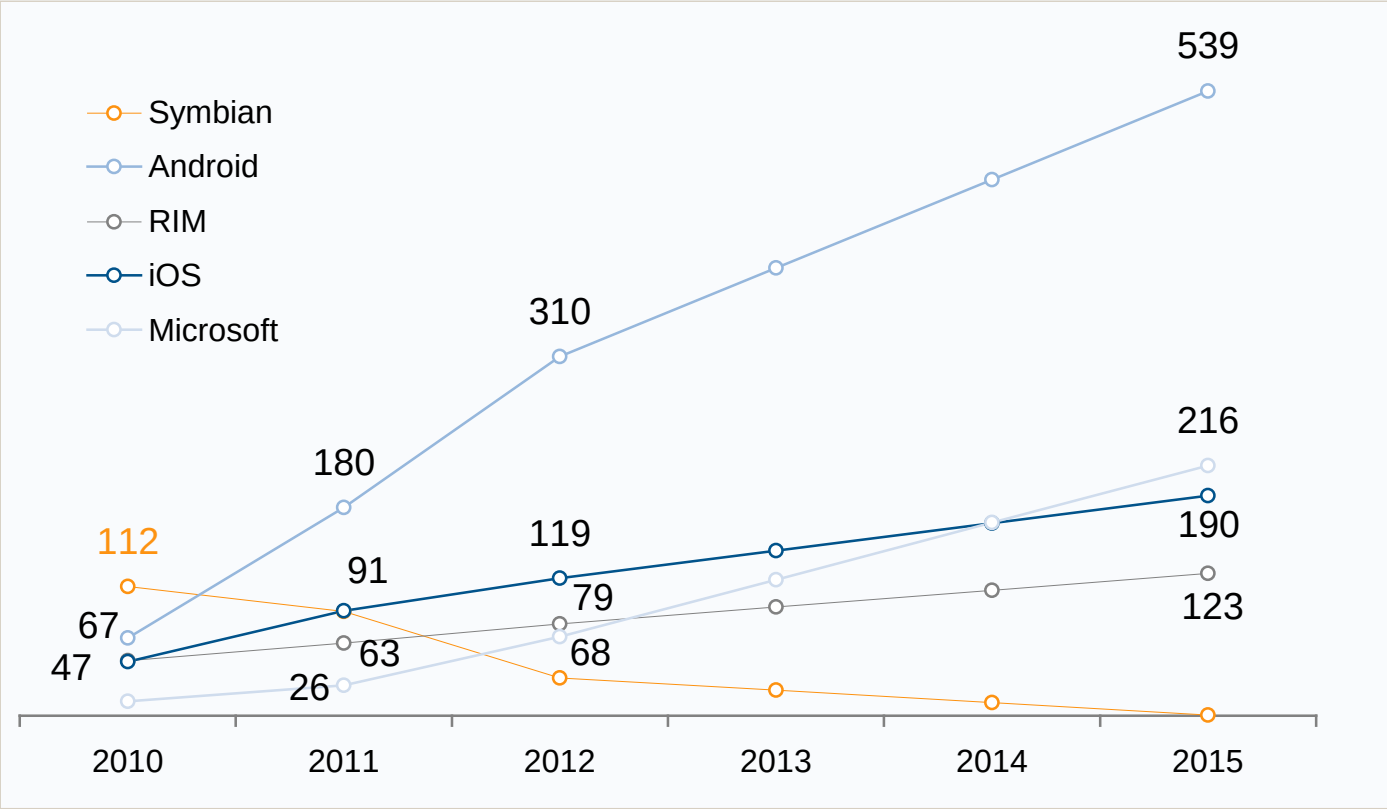


Source: Gartner (in The Guardian): iPad to dominate tablet sales until 2015 as growth explodes, says Gartner, September 2011

Trends in End User Devices
Smart Phones

Android is the most popular OS for smart phones worldwide and will build on its strength to account for 49% of the smart phone market by 2012

Sales of smart phones by OS 2010 to 2015 (in millions of units)



Source: Gartner Press Release: Gartner Says Android to Command Nearly Half of Worldwide Smartphone Operating System Market by Year-End 2012, April 2011

Trends in End User Devices
Challenges

These trends challenge all IT units: integration and support effort rises with each new kind of device and secure integration will be troublesome

	Classical PCs	Tablets / smart phones
Platform	Few OS, classical OS	Many OS, small footprint OS
Interface	Mouse, keyboard	Touch screen, via voice & motion
Administration	Long experiences with central installation and management	How can the same level of security, stability and efficiency be provided?
Security	Secure integration in corporate network established	
Ownership	Enterprise owned	Enterprise and / or privately owned

Source: JSC

Client Virtualization
Classification (1)

The application of virtualization technologies is not limited to servers

Virtualization is defined as a technology for hiding physical characteristics of computing resources from the way how other systems interact with those resources

Storage virtualization

Access of storage by applications or end users w/o being concerned where that storage is located or how it is managed

Server virtualization

Multiple virtual servers run on top on virtual software residing on the physical HW w/o an interfering OS layer or
.. virtual servers run on top on a fully functioning base OS complemented by a virtual machine manager on the base OS

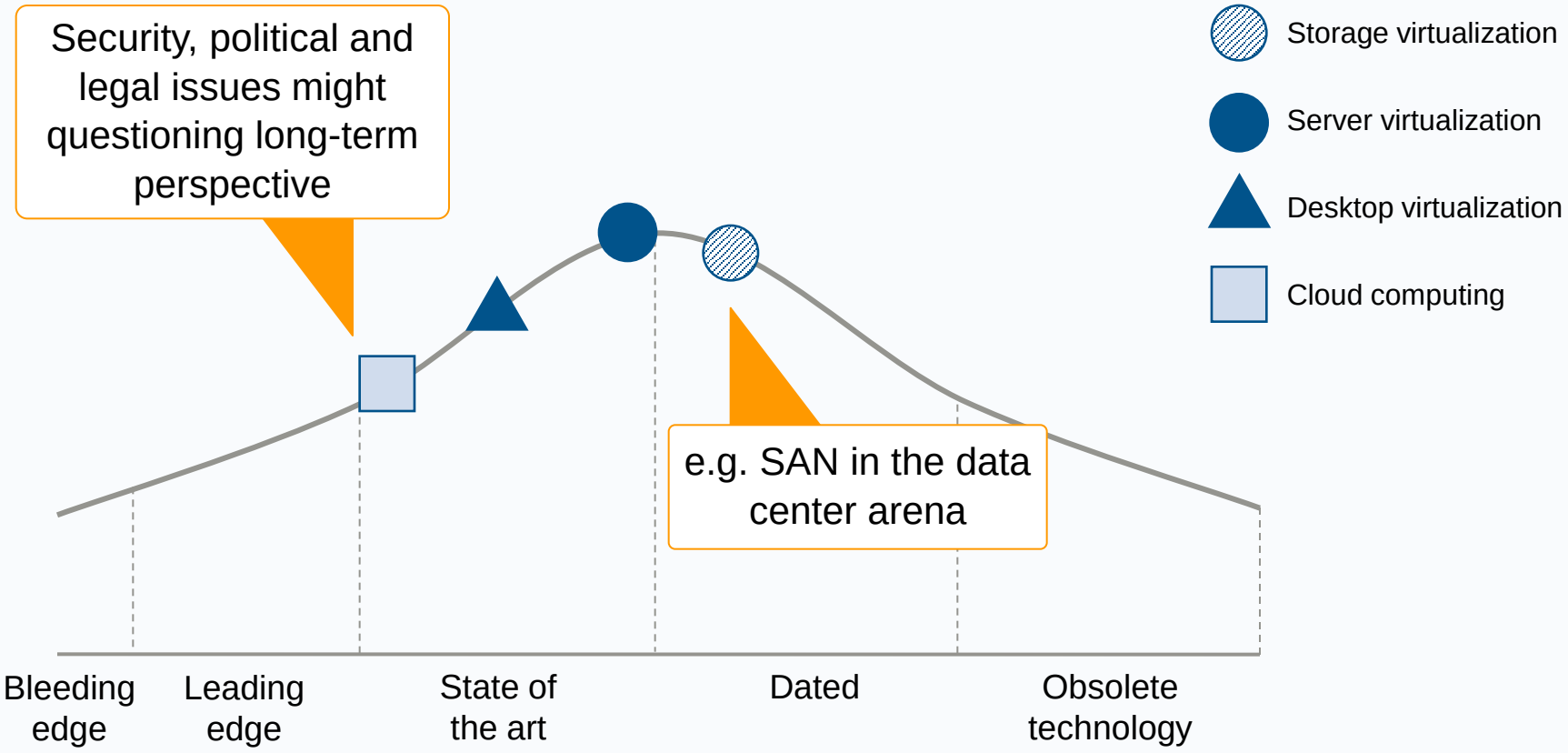
Client virtualization

Hosting and central management of virtual client machines while giving end-users remote access to a full PC desktop environment

Source: JSC

Client Virtualization
Classification (2)

Compared to storage and server virtualization client virtualization is a quite new technology having its potential not yet fully exploited



Source: JSC

Client Virtualization
Different Virtualization Technologies (1)

For physical clients 2 technologies are available allowing either encapsulated applications or running of entire client devices as virtual machines

Application virtualization (on the client)

- Encapsulated application
- Application can be centrally administered
- Security must be safeguarded by local OS

Client virtualization (on the client)

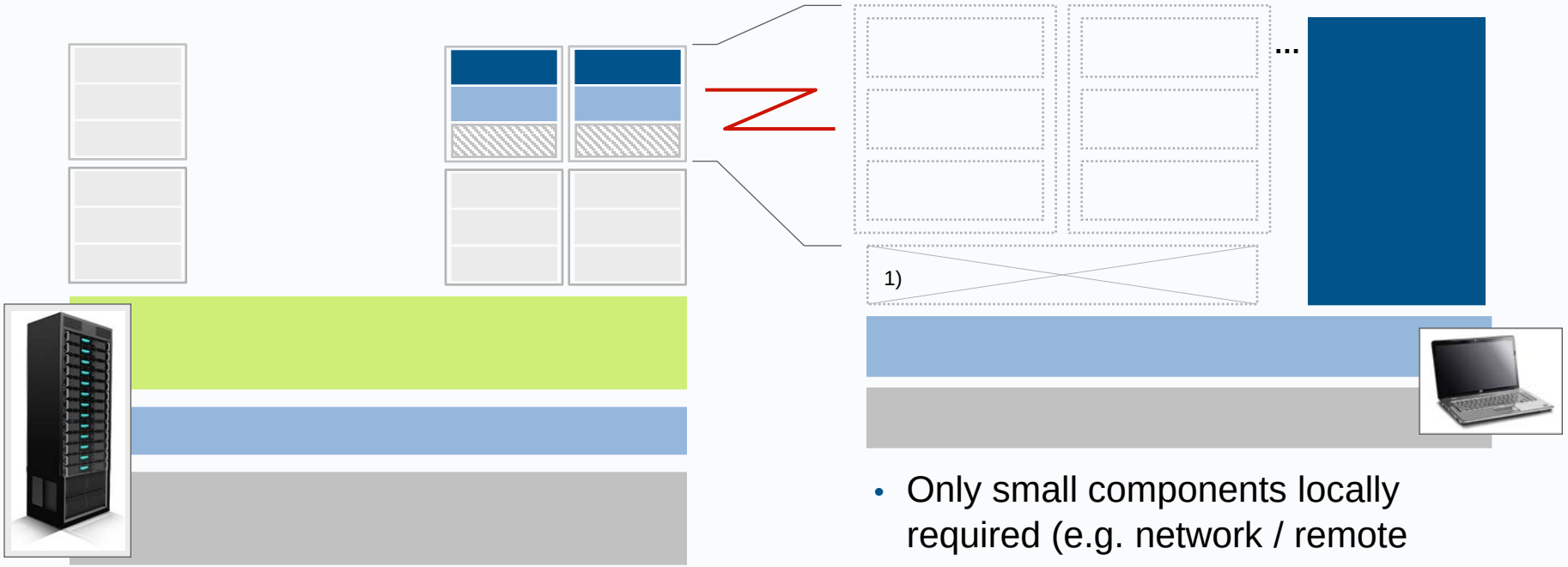
- Encapsulated client computer
- Application can be centrally administered
- Security can be centrally safeguarded

Application , virtualization software , operating system hardware , virtualized client hardware
Source: JSC

Client Virtualization
Different Virtualization Technologies (2)

Virtual client machines on a (virtualized) server fully exploits what is technically feasible and enables a very efficient administration

Client virtualization (on the server)



Virtual client machines with high availability via server (so-called client farm)

- Only small components locally required (e.g. network / remote access)
- Client is configurable by user

Application , virtualization software , operating system hardware , virtualized client hardware
Source: JSC, 1) replaced by a small connection software

Client Virtualization
Different Virtualization Technologies (3)

Between the 3 approaches are few important differences

Application virtualization	Client virtualization (on the client)	Client virtualization (on the server)
• The hosting system matters (e.g. in terms of OS) • The virtualization software, which needs to be installed, can only ensure an encapsulation from other applications • For some scenarios like a secure access to the corporate e-mail system this is sufficient	• The state of the hosting system does not matter • Only the virtualization software has to be installed to provide a unified client package • Only a very limited number of installation images need to be maintained • The hosting system must be powerful enough to run the host as well as the guest system	• The approach is independent from client vendor and client OS • Dynamic scaling approaches as shown for server virtualization can be used • Only a very limited number of installation images need to be maintained • A connection software has to be installed

Source: JSC

Client Virtualization
Products

Several software vendors are committed to provide virtualization solutions for the different device groups – client as well as server based

Application virtualization	Client virtualization (on the client)	Client virtualization (on the server)
• Major application virtualization providers for PCs are – VMware with ThinApp – Microsoft with App-V solution (formerly Softgrid) – Citrix with XenApp • Tablets and smart phones are currently supported by VMware Horizon Mobile and other vendors [1)]	• VMware with PC solutions (Workstation, ACE), Apple Mac (Fusion) and the “Mobile Virtualization Platform” for mobile devices • Citrix with XenDesktop • Microsoft with Enterprise Desktop Virtualization (MED-V) platform [2)] for PC and Parallels Desktop for Apple Mac	• Server based client virtualization is currently supported by all major enterprise virtualization vendors (VMware, Citrix, Microsoft) • Software to access the virtualized clients is available for almost all end user devices (e.g. VMware View, Citrix Receiver)

Source: JSC, 1) e.g. centrally managed and secured e-mail application for Apple iOS / Android devices by Good Technology, 2) limited to Windows XP

Bring Your Own Device

Client virtualization allows CapEx and maintenance cost reducing concepts: “Bring Your Own Device” (BYOD)

- Due to encapsulation devices not supported by the company can be released
- IT unit have only to provide network access and virtualized components
- IT unit must address the connection software required for downloading the virtualized client
- In case of loss of a physical device the local virtual client can be disabled remotely – company information remains secure

+ Physical devices can be purchased by users or by the company
+ Users can buy whatever client they want to use
+ No need for long term client hardware supplier contracts for the company
+ No need to build and maintain numerous, time-consuming installation images for different hardware

Early adopters e.g. Kraft Foods (~ 800 clients), Whirlpool (~ 200 clients – aim for 50% of all clients) [1)]

Source: JSC, 1) CIO Magazine

Implications from Client Virtualization

With respect to the sketched developments JSC addresses 5 implications

1. Client virtualization – mainly on servers – achieves a breakthrough within the upcoming years since required software is proven and attractiveness is high
2. Usage will be tremendously accelerated by an increased use of tablets and smart phones in the corporations
3. The IT departments must be able to provide a controlled and cost efficient virtualized environment, fulfilling company security standards, on almost any end user device
4. This speeds up the transition from the traditional “enterprise owned and managed” clients, where installation images need to be maintained and applications need to be provided, to small footprint web-based end user devices …
5. …which can be provided based on the BYOD approach if CapEx / cost reduction and a high degree of user flexibility are in the focus

Source: JSC

Literature

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JSC
At a Glance

- founded in 1991
- located in Eltville (near Wiesbaden), Germany
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- focus on life science products, chemicals, (fast moving) consumer goods

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- dedicated to quality and striving for first class results
- fact driven and application of sound methodologies

- only senior and management consultants
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- partner network for turnkey solutions

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