Architecting
“The Green Data Center”

MSc Kathrin Hebel, WWF Österreich
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Agenda

- Power and IT- Why would we care?

  “Saving the Climate at the Speed of Light..”

- Data Centre Architecting for Power Efficiency
- Diskussion

Saving the Climate @ the Speed of Light

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Inhalt

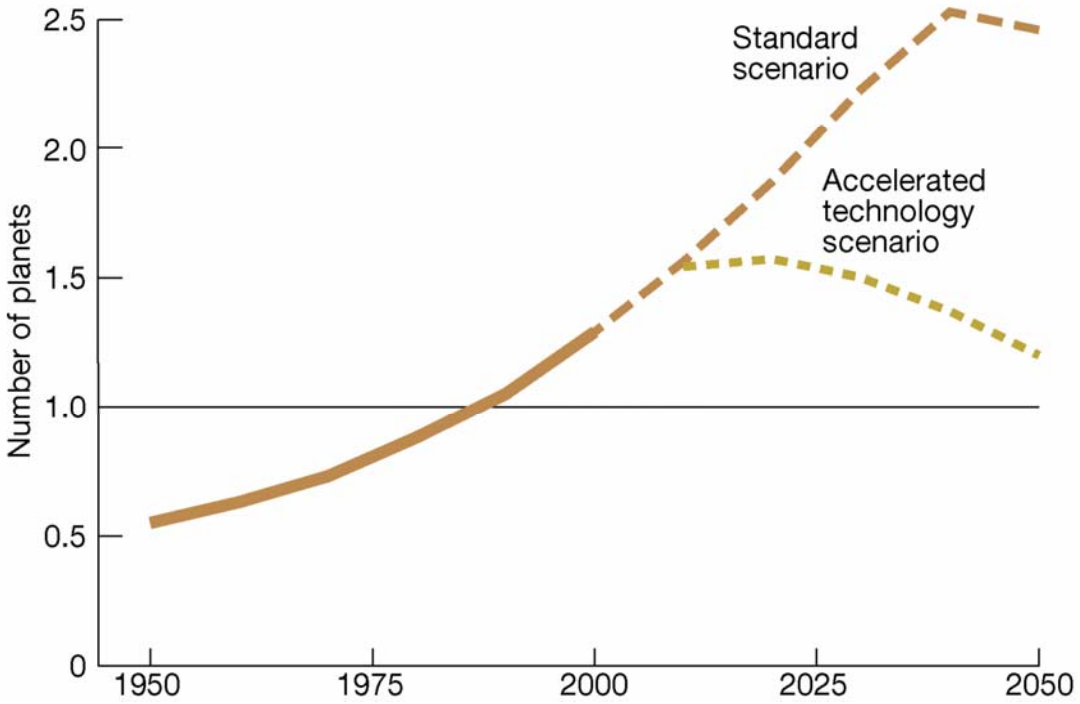
I. Klima geht uns alle an:
   Globale Trends
II. Carbon Footprint der IKT
III. Klima verbindet: IKT & WWF
IV. Gemeinsame Initiativen







I. Globale Trends 1



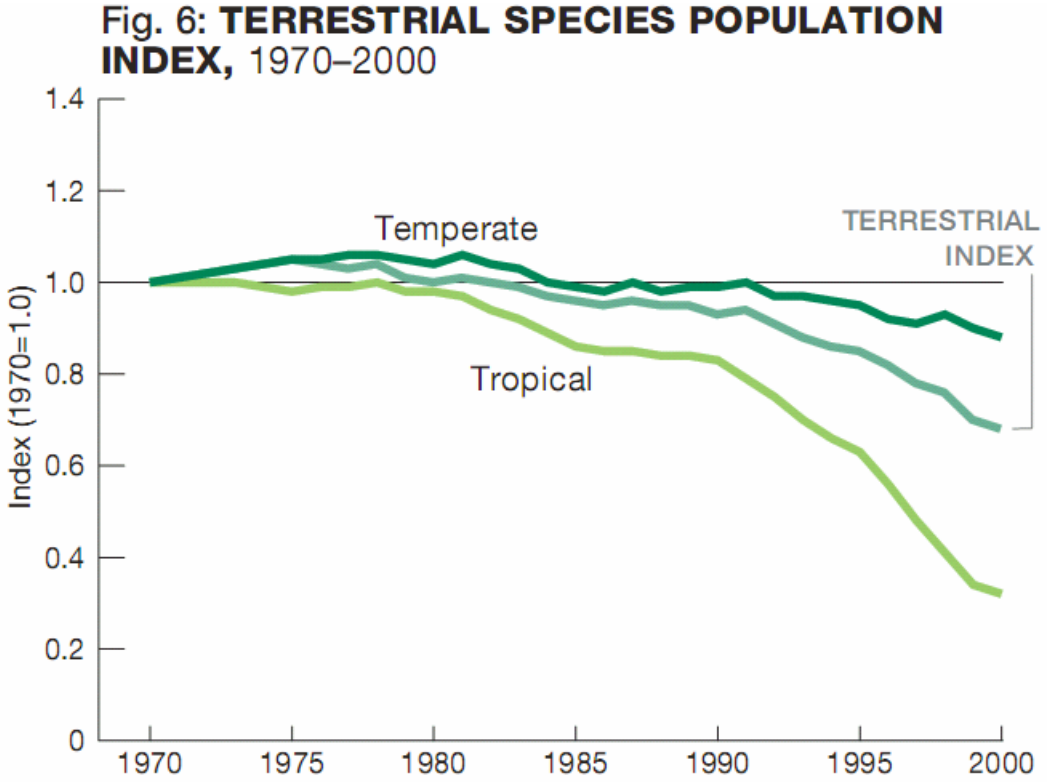
25% mehr Ressourcen als vorhanden: Wir leben über unsere Verhältnisse





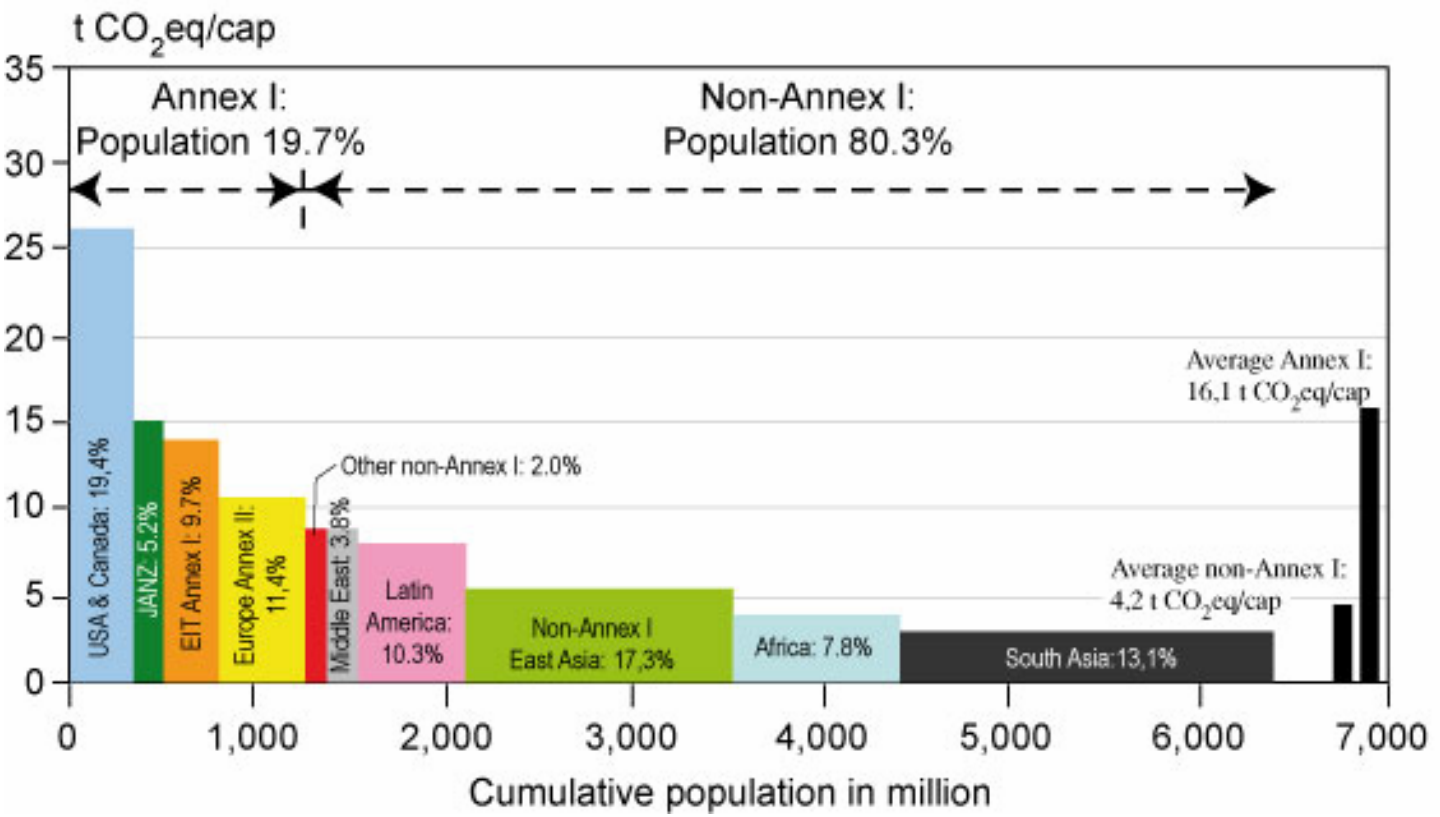


I. Globale Trends 2



20-30% der Tier- und Pflanzenarten sind bedroht wenn die weltweite Durchschnittstemperatur um 1,5–2,5 ° C ansteigt.

I. Globale Trends 3



Bevölkerungsexplosion: 6 Mrd. heute – 9 Mrd. 2050







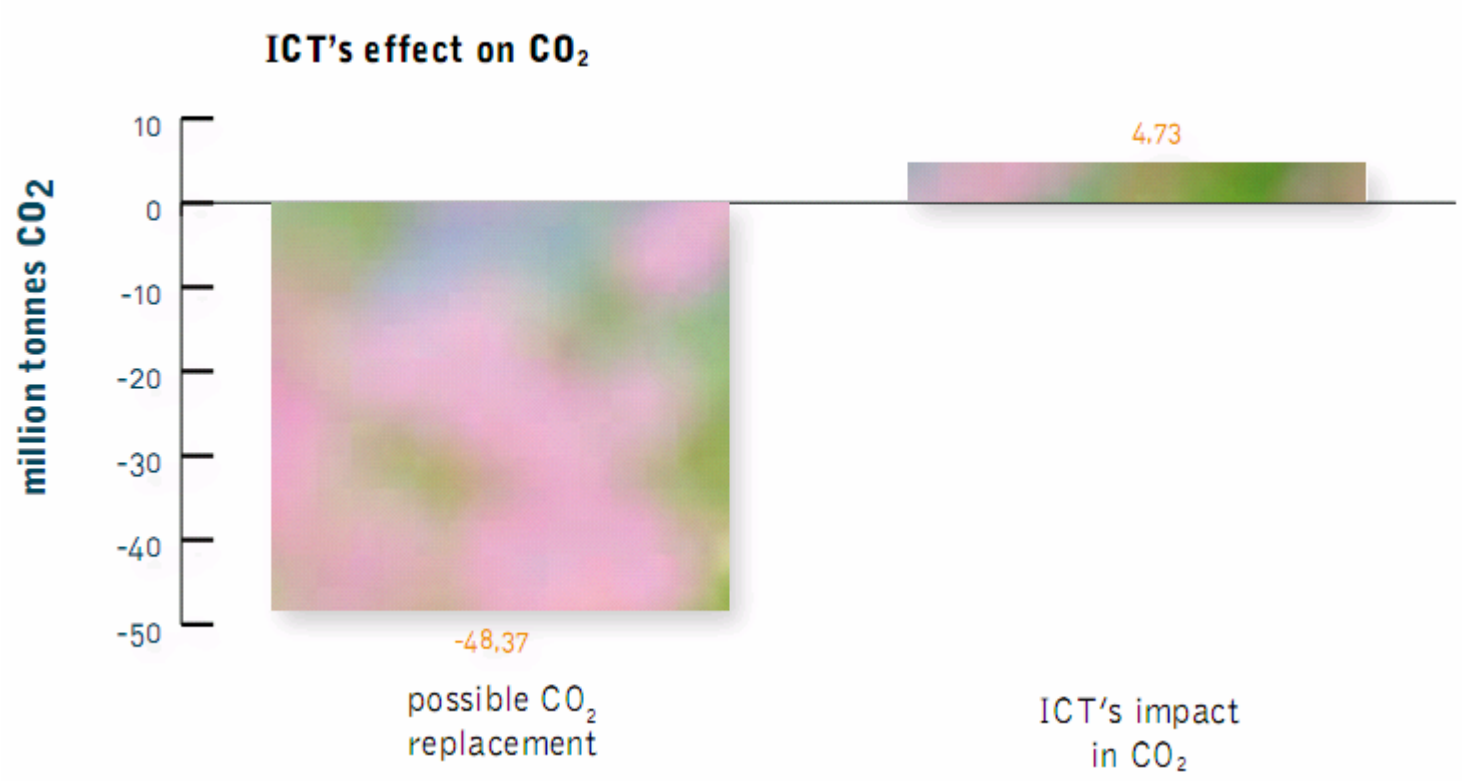
II. Carbon Footprint der IKT







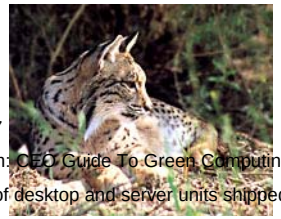
II. Carbon Footprint der IKT



Telekommunikationsunternehmen können 10x mehr CO2 einsparen als zu ihrem Betrieb notwendig (Studie ETNO & WWF)

II. Carbon Footprint der IKT

- Die Hälfte des Stromverbrauchs herkömmlicher Desktop PCs geht als Wärme verloren
- Herstellung eines Notebooks benötigt 30.000 l Wasser und 15 Tonnen Rohstoffe
- 2010: Hälfte der “Forbes Global 2000 Unternehmen” werden mehr Geld für Energie ausgeben als für Hardware wie z.B. Server
- Kunden fragen verstärkt nach der Energieeffizienz von IKT Produkten

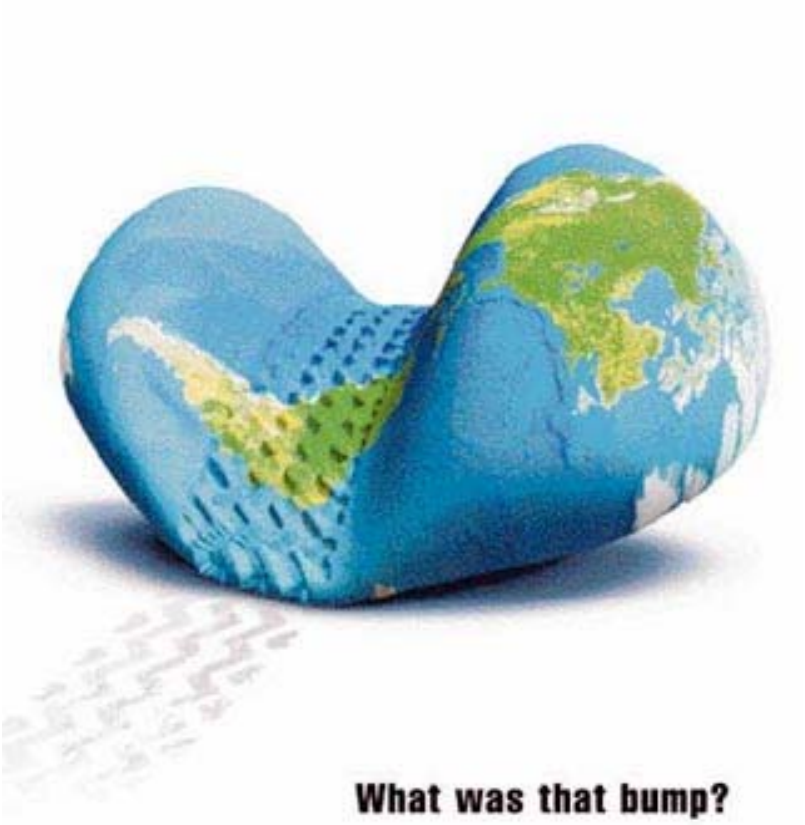



1 Source: Gartner, May 2007

2 Source: Businessweek.com: CEO Guide To Green Computing.

3 Based on IDC projections of desktop and server units shipped, a baseline of typical desktop and server power consumption in the first half of 2007, and an average cost of $0.0885/kWh

III. Klima verbindet: WWF & IKT



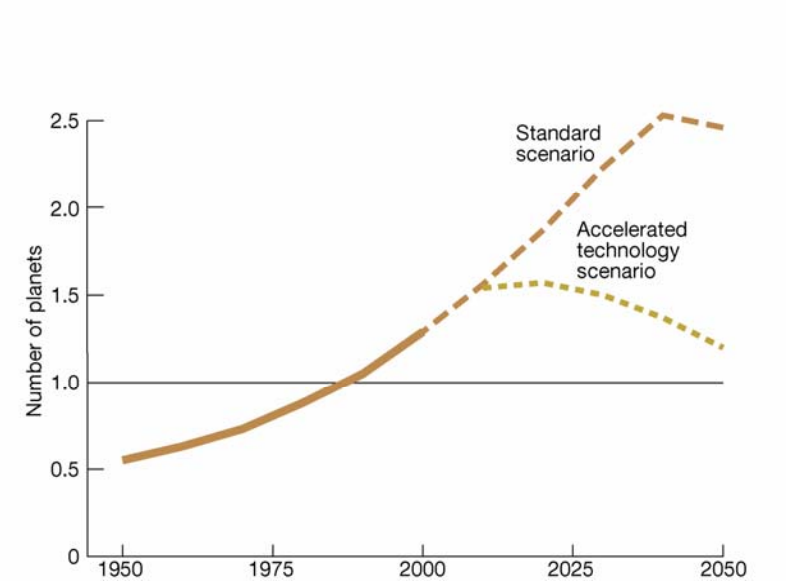
Mission, den Fussabdruck zu verkleinern!







III. Klima verbindet: Rolle der IKT



- **De-Materialisierung**
- **Reise-/Transportverkehr ↓**
- **Verbesserung der Energieeffizienz**
- **Effizienzsteigerung in Transport, Logistik, Produktion**

→ **Nachaltigkeit in Konsum & Produktion**

IKT ist ein zentraler Teil der Lösung in der globalen Herausforderung „Climate Change“!!!

IV. Gemeinsame Initiativen

- Saving the Climate @ the speed of light -

1. IKT wird als wichtiger Teil der Lösung für das Klimaproblem positioniert
2. Staaten und Unternehmen haben als Schlüsselakteure eine Strategie für den Klimaschutz und IKT
3. Konkrete „IKT-Klimawandel-Programme“ werden in Europa bis 2007 erarbeitet

(Klima-Initiativen)

Saving the Climate @ the speed of light

50 million tonnes CO_2 reduction per year with ICT by 2010

- Virtual meetings – reducing around 24 million tonnes CO_2 / year
- Combined measures / Flexi-work – reducing around 22 million tonnes CO_2 / year
- e-dematerialisation – reducing around 4 million tonnes CO_2 / year







Cost of a Vienna – Munich meeting

Method	Financial Cost	Carbon Cost
Short Haul Flight	€ 194.00	96.0 kg
Car Journey	€ 160.00	128.0 kg
Train Journey	€ 202.00	38.4 kg
TelePresence Call - 3 Hours (per person)	€ 3.84	< 5 kg
Unified Communications Call – 3 Hours	€ 0.28	<1.6 kg







IV. Gemeinsame Initiativen

- Climate Savers Computing Initiative -

Google
lenovo
hp invent
climate savers smart computing
WWF
DELL
intel
EDS
Microsoft

Ziel: 50 Millionen Tonnen CO2 durch sparsamere PC und Server







Cisco is Part of the "Green" Industry Initiatives

the green grid™ http://www.thegreengrid.org/#







Architecting
“The Green Data Center”

Johann Strauß

Head of Data Center Infrastructure Technologies
Cisco, European Markets

Power Challenges in the Data Center

- IT Equipment is extremely inefficiently used
- All IT Equipment needs Power Hungry “Support Infrastructure”
- Support Infrastructure Scale directly linked to IT Equipment
- More IT Capacity needed despite inefficient deployment
- Power Availability now becoming a major limitation
- Cost of Energy rising substantially
- Carbon Utilisation likely to attract additional costs
- Corporate Social Responsibility is driving attention to power

Power Flow in a Typical Data Center

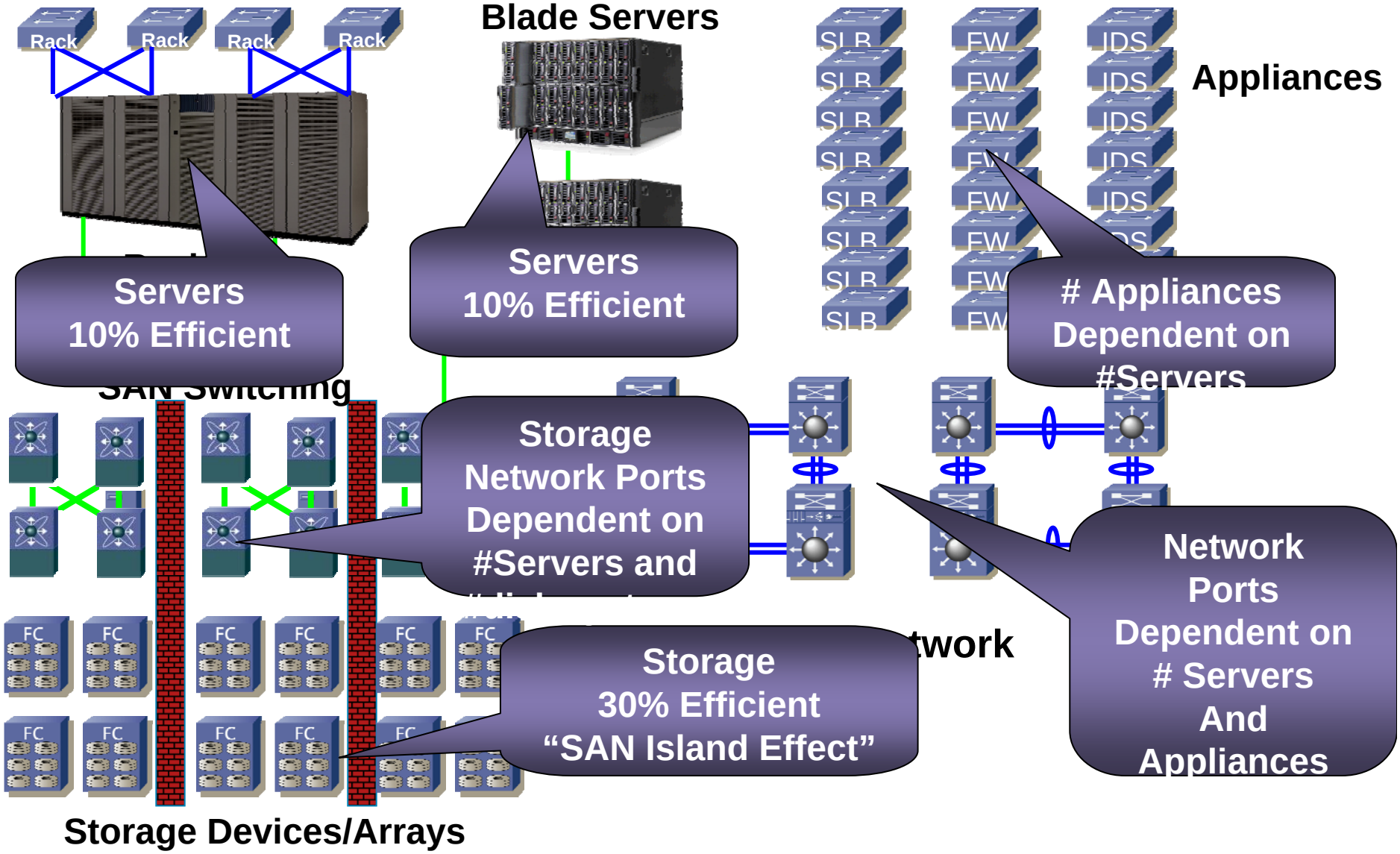
IT Equipment = 30% of power

Data Center Power~3.3 x Equipment

Each Watt of Equipment drives a support equipment load of 1.8 to 2.5 x

Diagram & Analysis courtesy of APC®

Data Centre IT Infrastructure



Potential Data Center Inefficiency

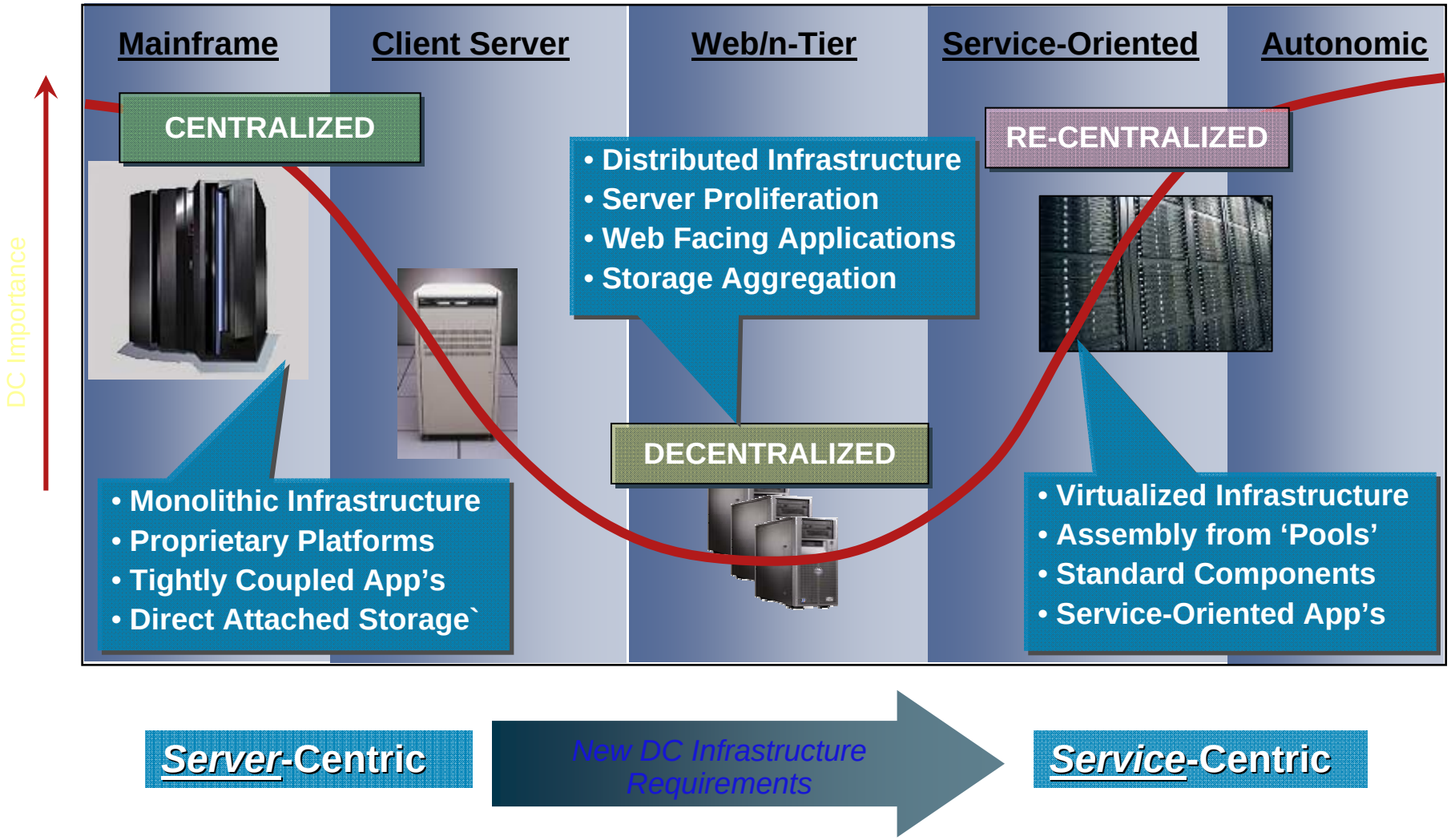
Technology	Medium Deployment *	Large** Deployment	Average Efficiency	Potential Power use Medium DataCentre	Potential Power use Large DataCentre	Potential Power Loss Medium DC	Potential Power Loss Large DC
Rack Servers	1000	6000	10%	200,000W	2,700,000W	180,000W	2,430,000W
Blade Servers	50	200	10%	225,000W	2,400,000W	202,500W	2,160,000W
Firewalls/IDS	200	600	10%	60,000W	450,000W	54,000W	405,000W
Load Balancers	200	600	10%	60,000W			378,000W
Network Switch (ports)	2000	7000	10%	10,000W			44,100W
Storage Switch (ports)	2000	7000					39,200W
Storage Device***	150	300			1,5		1,050,000W
Equipment Power					568,000W	560,0	6,506,300W
Total Power					22,7 0W	1,960,000W	9,518,900W
					Potential Waste	88%	86%
					Potential Excess Annual Cost	€ 1,960,000	€ 19,518,900

~12,000 Tonnes CO_2 Wasted p/a

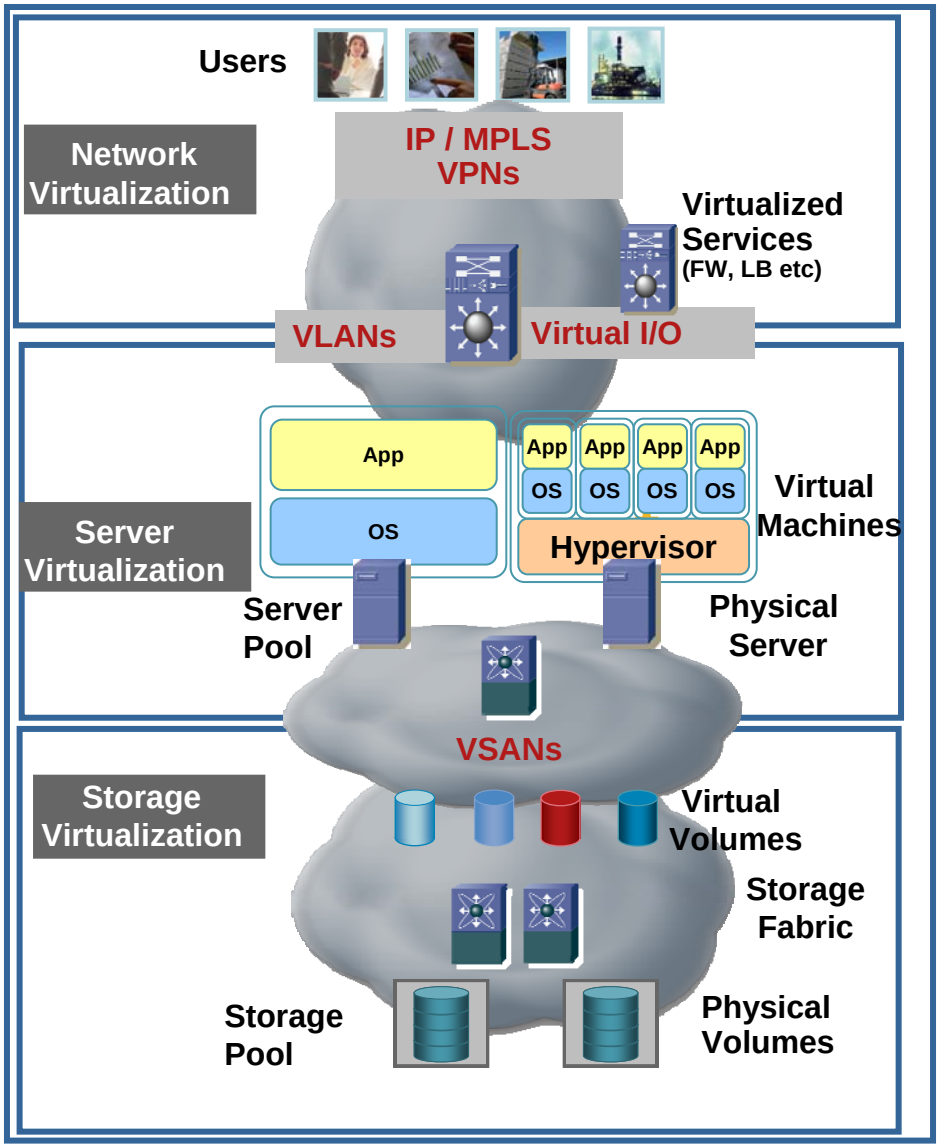
~120,000 Tonnes CO_2 Wasted p/a

* Data Centre for medium enterprise
**Data Centre for Major Investment Bank
*** Storage Equipment assumes
Medium=Disk Subsystems,
Large=Large Arrays

The Data Center is Evolving (again)



Architecting the Green Data Center



Network Virtualization

- Creates isolated, secure application environments
- Network-hosted services (Virtual Appliances) enhance performance, availability, security and flexibility
- Enables greater efficiency, agility & lower power consumption

Server Virtualization

- Enables consolidation of *physical* servers that reduces management, power and cooling, etc
- Virtual Machine mobility allows enhance performance, availability and flexibility
- Rapidly deploy or redeploy servers to support existing or new applications

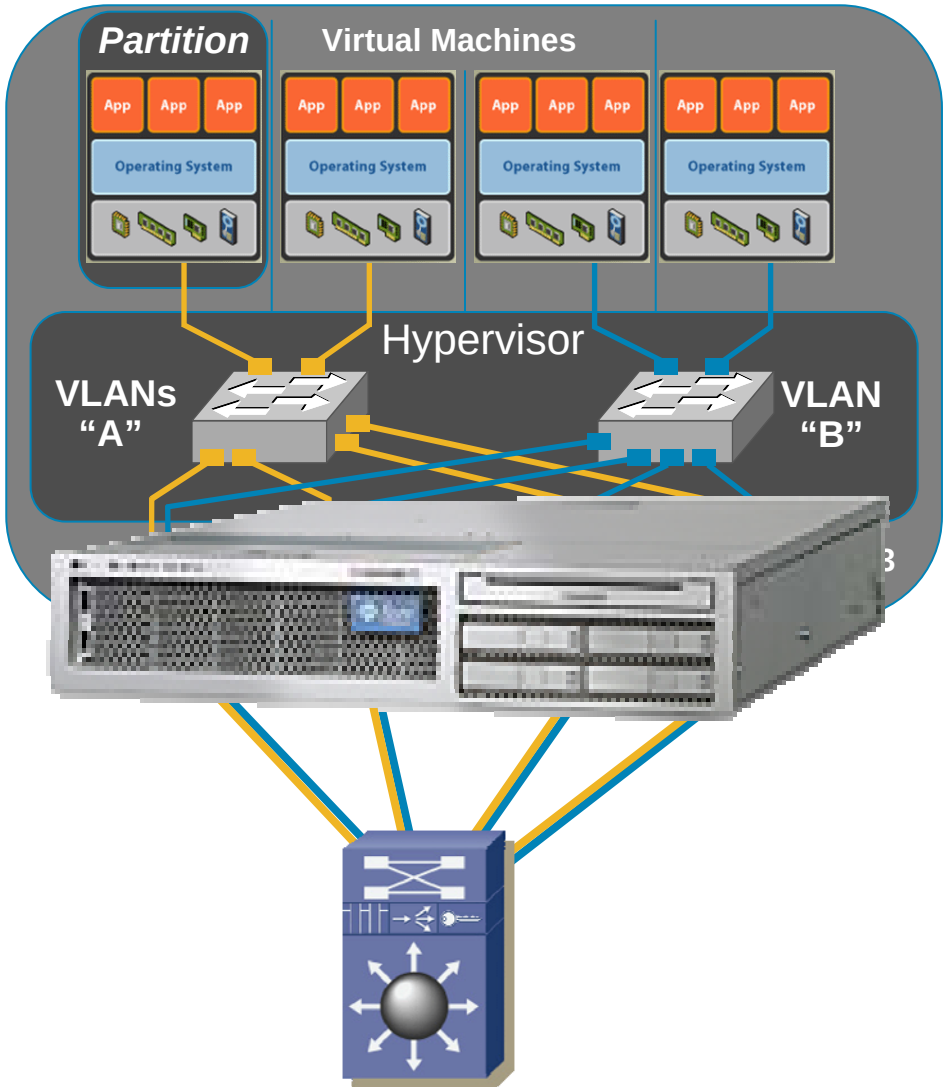
Storage Virtualization

- Network-hosted services enhance scalability, availability and transparency
- Improved data management, security & compliance
- Non-disruptive provisioning & migration of production data
- Enables greater efficiency, flexibility & power consumption

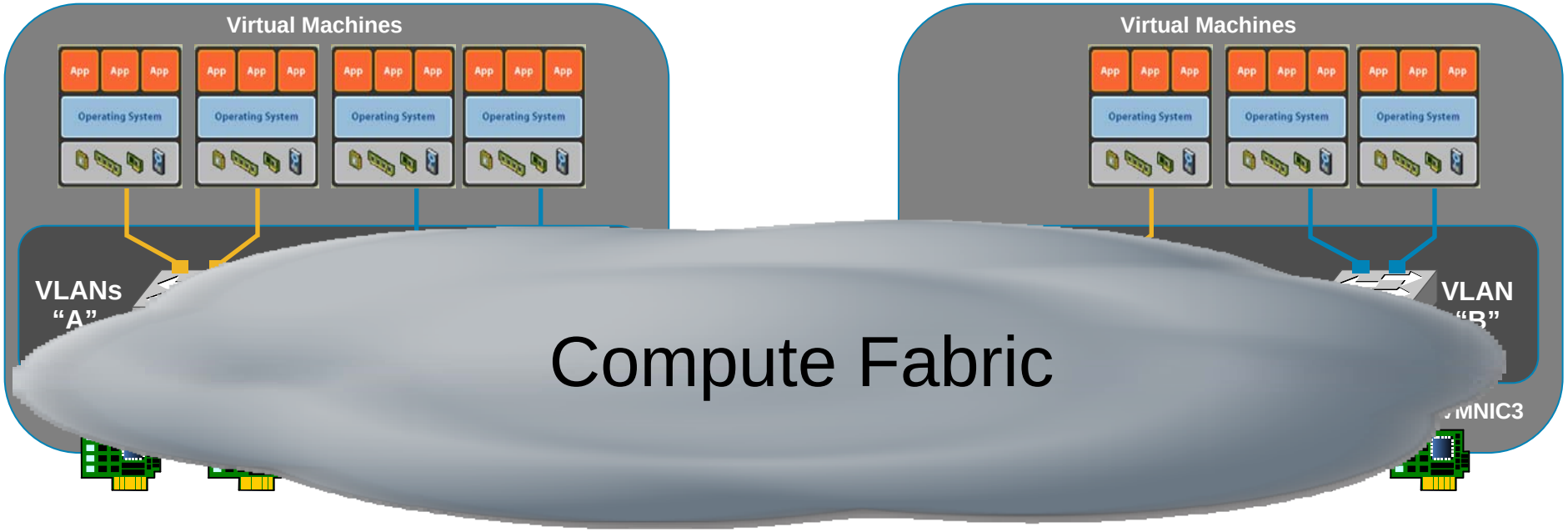
Virtual Servers

Anatomy of a Virtualized Server

- Virtualization enables a single "real" server to host multiple Guest OS + applications
- Partitions resources per Virtual Machine
- Abstracts physical hardware from the Guest OS
- Each Virtual Machine has a unique MAC + IP address network identity
- Each virtual machine may be associated with a VLAN for traffic segmentation & security purposes



The network is an Integral part of the Compute Fabric



- Abstracts physical hardware from OS & Application
- Partitions physical hardware resources
- Enables Application *mobility*
- Server Centric to Compute Fabric Centric

Examples of Server Reduction

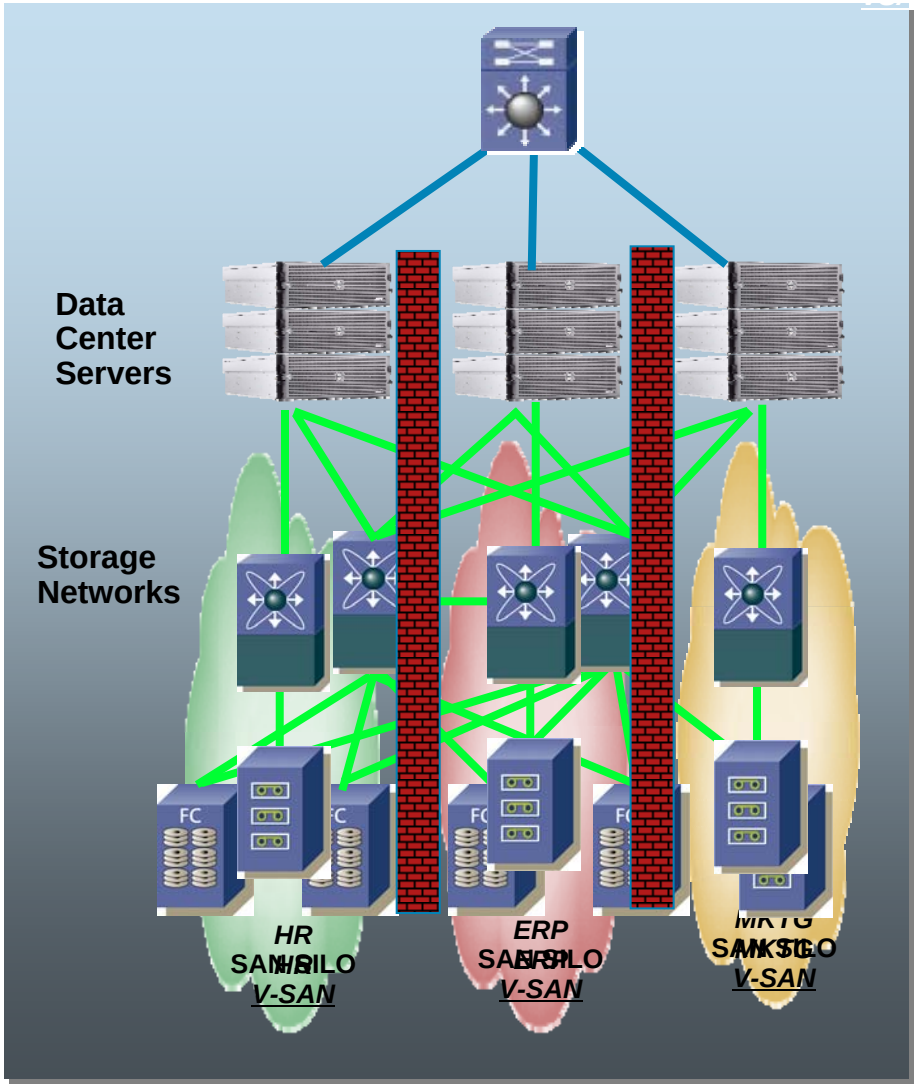
- Major High Street Retail >600 Servers to 25
- Major Telco >2000 Servers to ~50
- Qualcom* >8:1 Reduction
- Cisco >12:1 Reduction

For example, in studying two large companies, We found a number of computers that were unused. "We went through our asset databases and found these servers didn't belong to anybody. So we turn them off and we see if anybody complains. We shut them off and wait until the phone rings. Our success rate in turning those off is something higher than 60%. This is something you can implement in 90 days. All in all- in two companies we found 504 servers out of 4300 live but unused“

Matt A Monroe- Dir Sustainable Computing- Sun Microsystems

Virtual Storage

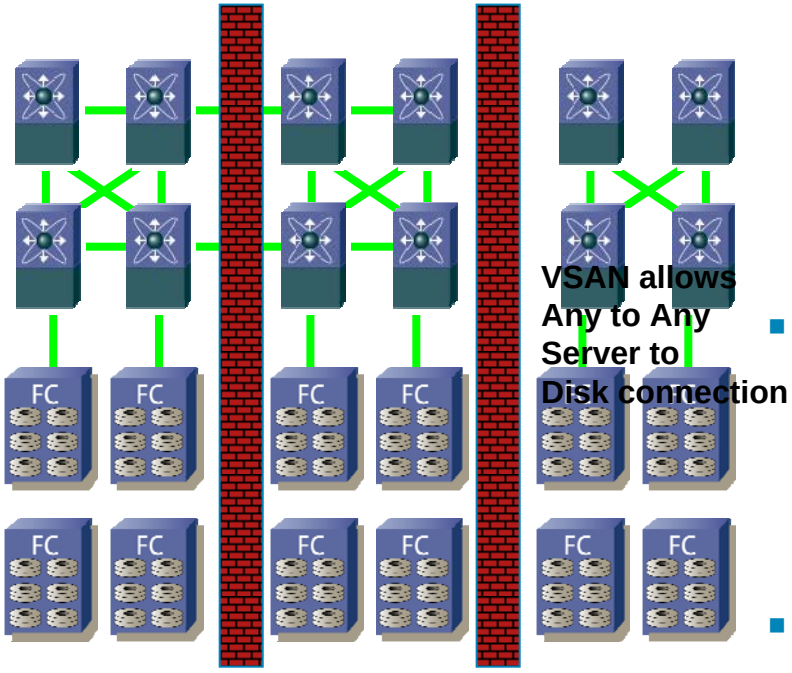
SAN Storage Consolidation & Virtualization



- Storage Area Networks (SAN) and Consolidation Of Disk & Tape Drives & Tape across multiple servers
- Utilization increased to >60%
- 1st Generation Storage Networks architected in Silo's for each application. Servers cannot use disks in other SAN's.
- Leads to SAN Proliferation and 'Islands' of unused storage based on capacity used in that SAN
- Virtual SANs (VSANs) allow the further consolidation and virtualization of SAN islands into a large common resource pool. (VSAN=Cable ONCE….)
- Utilisation often 30% or less overall
- Utilization increases to ~70%
- Virtual Storage for Virtual Servers
- 3 x Disks, space, power, cooling

Disk Subsystem Impact of VSAN

Virtual SAN Switching



Virtual SAN
Storage Devices/Arrays

- Disk Subsystem-Standard SAN
  - 300 Subsystem Units x 5KW
  - 30% utilisation of disks
  - 1.5M Watts Power consumption
  - 1.5M Euros/Year cost (Equipment only..)
- Disk Subsystem Virtual SAN
  - 70% utilisation achieved
  - 150 Subsystem Units
  - .75M Watts Power reduction
  - 750K Euro/Year saving
- Supporting Cooling/UPS Saving
  - 2x Savings on Equipment Power
- Total Potential Savings
  - 2.25M Euros/2.25M Megawatts/Year

Case Study SAN Consolidation

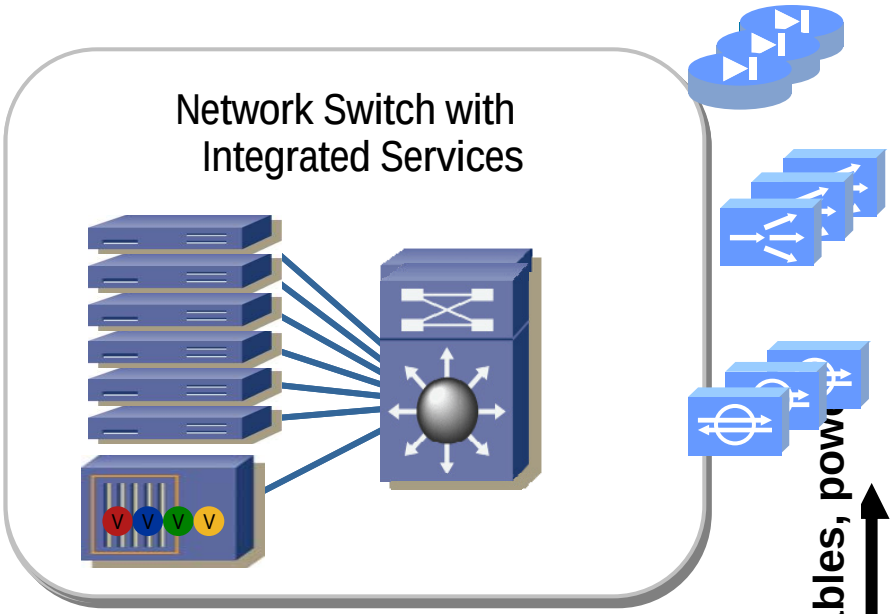
Customer Reference

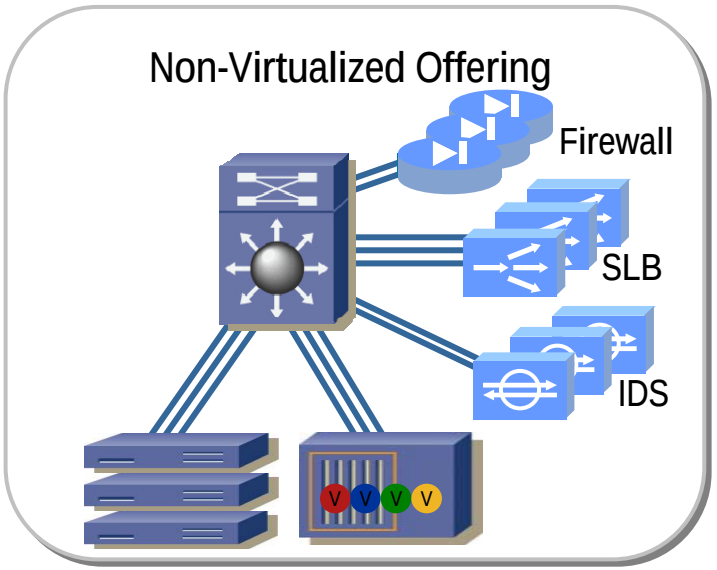
- One of the largest insurance and financial services companies in the world
- Migrated storage infrastructure which includes several hundred terabytes
  - From several SAN islands to a consolidated V-SAN Architecture
  - Designed for availability, recoverability, and growth

- Converted 24 (competitive) fabrics to 4 fabrics over two production data Centres
- Consolidated 102 legacy switches to 11 SAN Directors with V-SAN technology
- Completed project in 90 days

Virtual Appliances

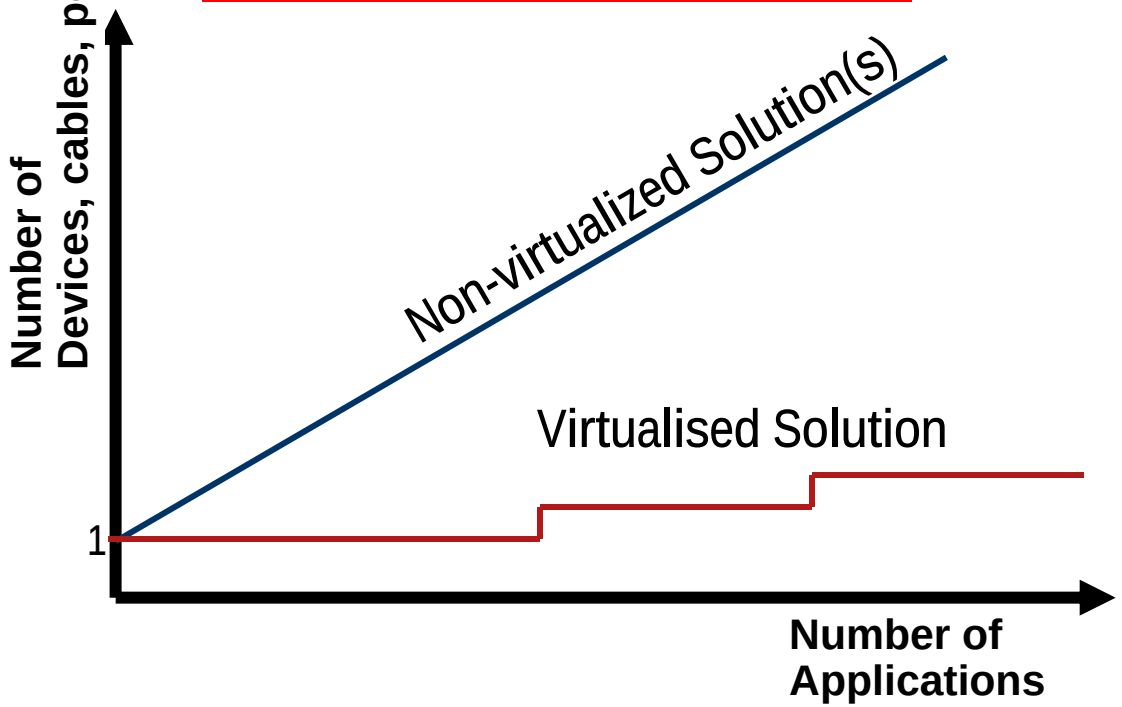
Virtualization Delivers Appliance Service Density





Non Virtual Solution

- Multiple Appliances
- Related to Physical configurations
- Extensive Rack Space
- Additional Ports & Cabling
- Additonal Maintenance Costs



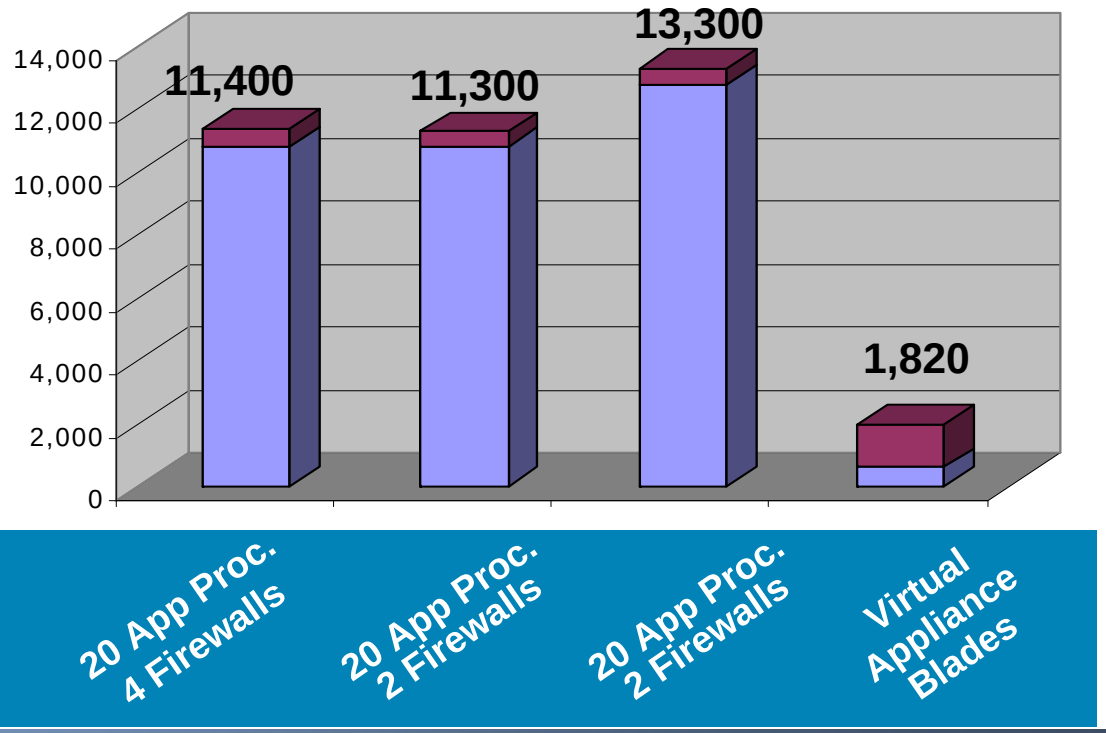
Virtualisation Reduces Appliance Power

Component/Conversion Point Reduction

Design Efficiency

Performance Requirement

- **10 Gbit/s load balancing**
- **20 Gbit/s Firewall**
- **10 Virtual Contexts**
- **High availability**



- **85% power reduction with virtualized, integrated modules ~ 11kW**
- **Rack space saved with virtualized, integrated modules ~30RU**
- **Additional savings from reduced cabling, port consumption and support costs**

Architecting the Green Data Centre

- Data Centers have evolved to “gross inefficiency”
  - Excess Equipment, Power, Space and Cost
  - 85% or more over designed/underutilised
- Much can be gained from good IT design/architecture
  - Architect // Consolidate // Virtualise //Automate
- Virtualisation to gain maximum asset utilisation and reduce IT Power
  - Servers // Storage // Appliances // Networks
- Network infrastructure needs to support virtual approach
  - SAN, LAN, Appliances, Security

Overall Architecture is key to success

In Closing…

- Cisco's virtualization solutions slow the growth of power demand through increased utilization while reducing component count
- Cisco's next-generation products and solutions will further reduce power consumption at the systems level
- Cisco is focused on environmental concerns from executive direction to individual product design
- Cisco's CA group provides services for Power and Cooling auditing as a "Network Readiness Assessment" to assist with facilities support planning

NEXT STEPS

1. **Potenzialerhebung IKT und Klima in Österreich**
2. **Hausaufgaben machen (Energieeffizienz)**
3. **Vision für IKT in Österreich: 2020-2050**
4. **Klimaschutz-Projekte implementieren**
5. **Erfolge kommunizieren**







Diskussion

Vielen Dank für Ihre Aufmerksamkeit!