



Green IT & Energieeffizienz

- Umdenken lässt die Vision Wirklichkeit werden

René Bersier, Systems Consultant, IBM Schweiz

Table of Contents

- **Complexity**
- **Virtualization ?**
- **Some Examples**
- **Building a Dynamic Infrastructure**
- **Green IT....**

Inefficiency is prolific – The need for progress is clear

22% empty

In North America, up to 22 percent of total port volume is empty containers. Port of Jersey has 100'000 empty containers sitting in storage.

40-70% lost

Estimated losses of electrical energy because grid systems are not smart

47'000 lost

In one small business district in Los Angeles alone, cars burn 47,000 gallons of gasoline each year just looking for parking.

85% idle

In distributed computing environments, up to 85% of computing capacity sits idle.

70¢ per \$1

70% on average is spent on maintaining current IT infrastructures versus adding new capabilities.

3% used

On average, for every 100 units of energy piped into a data center, only 3 units are used for actual computing. More than half goes to cooling the servers.

Building a Smarter Planet

IBM's smarter planet vision



let's build a smarter planet

The world has become flatter and smaller. Now it must become smarter.

Four major IBM initiatives

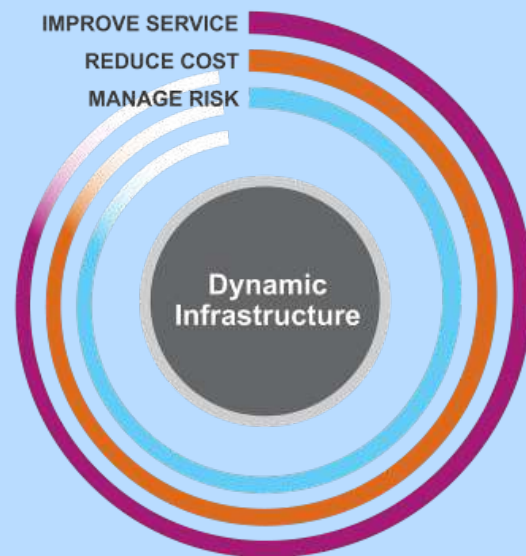
Dynamic Infrastructure

New Intelligence

Green & Beyond

Smart Work

Dynamic Infrastructure

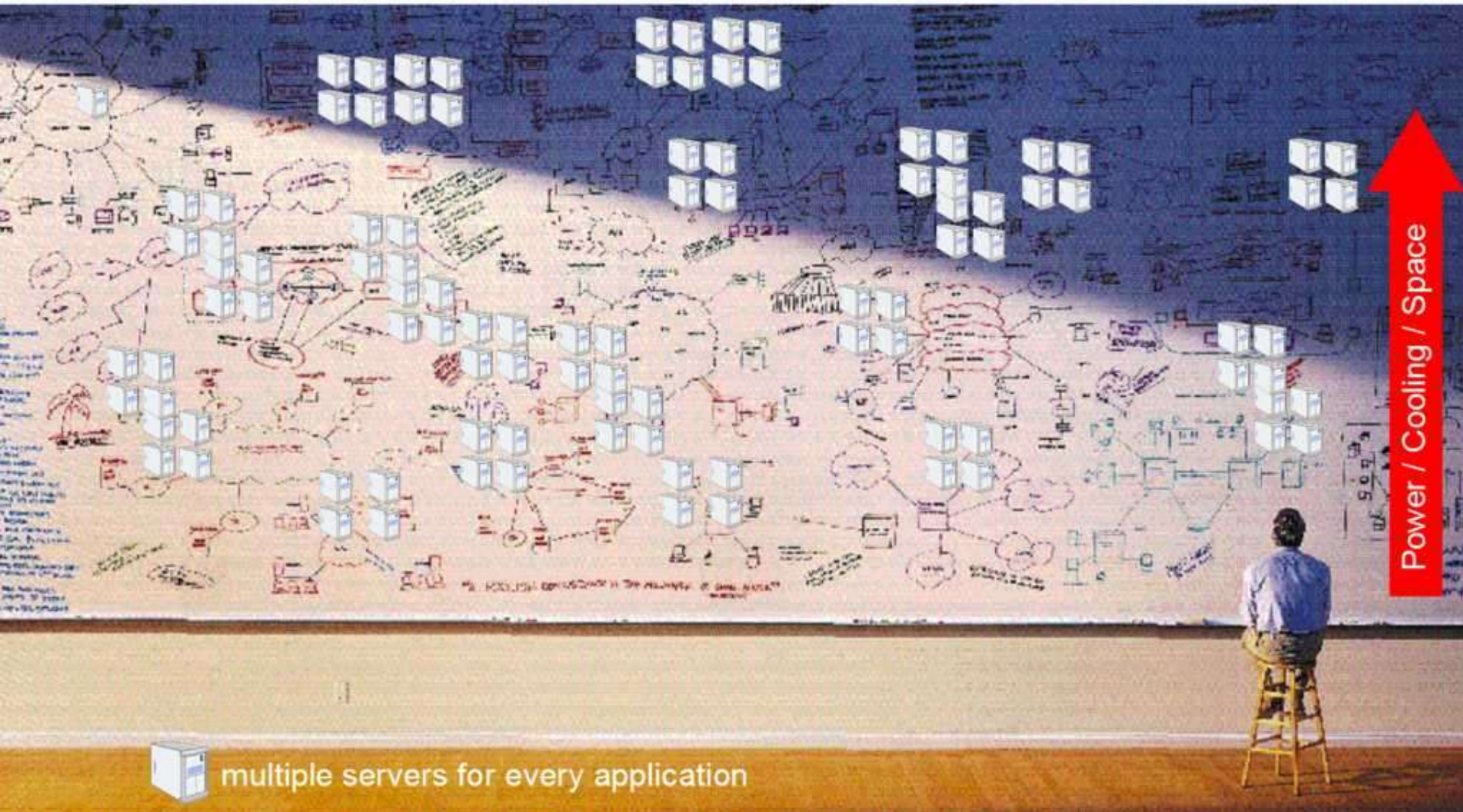


delivers superior business and IT services with agility and speed

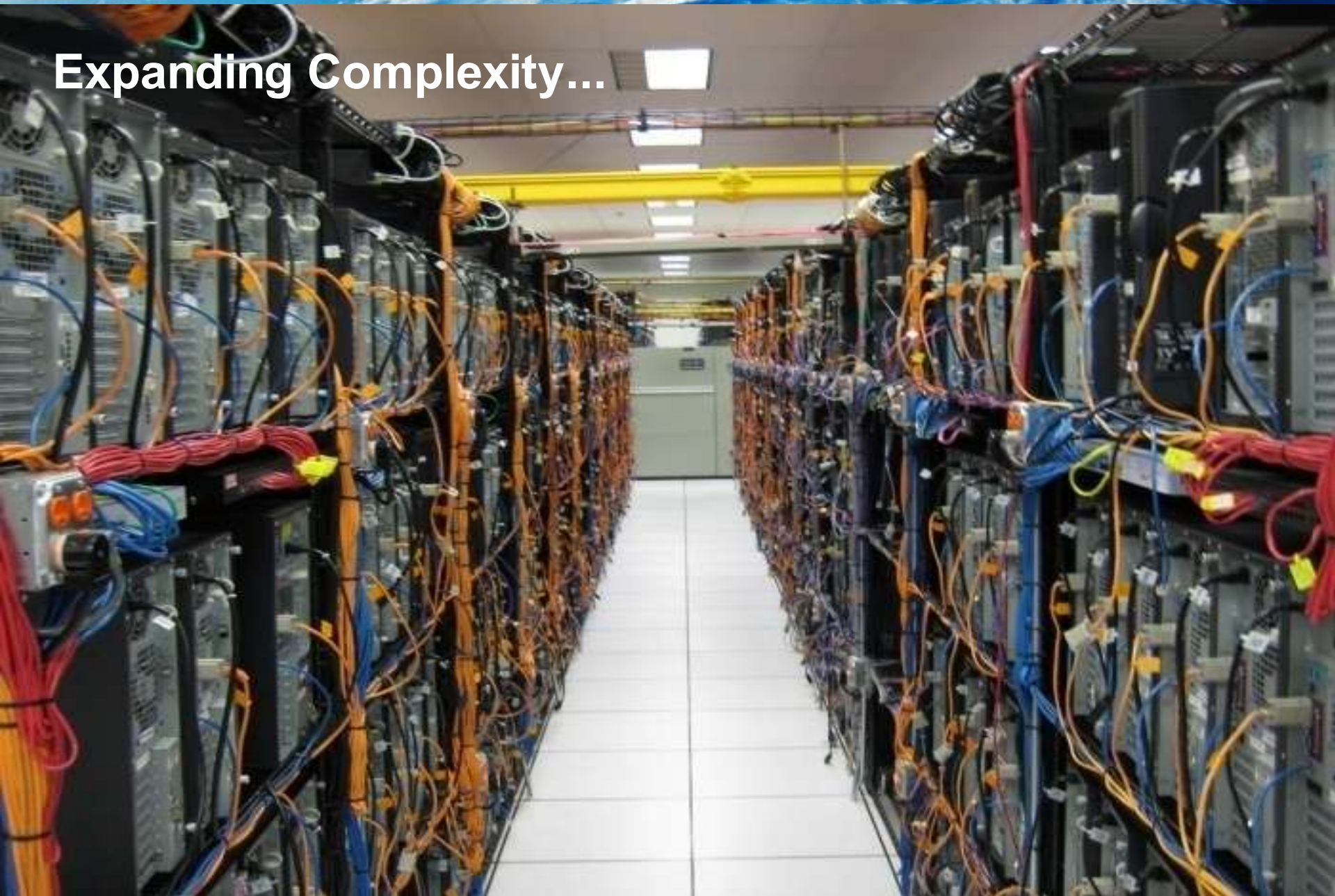
IT Complexity & Green IT...



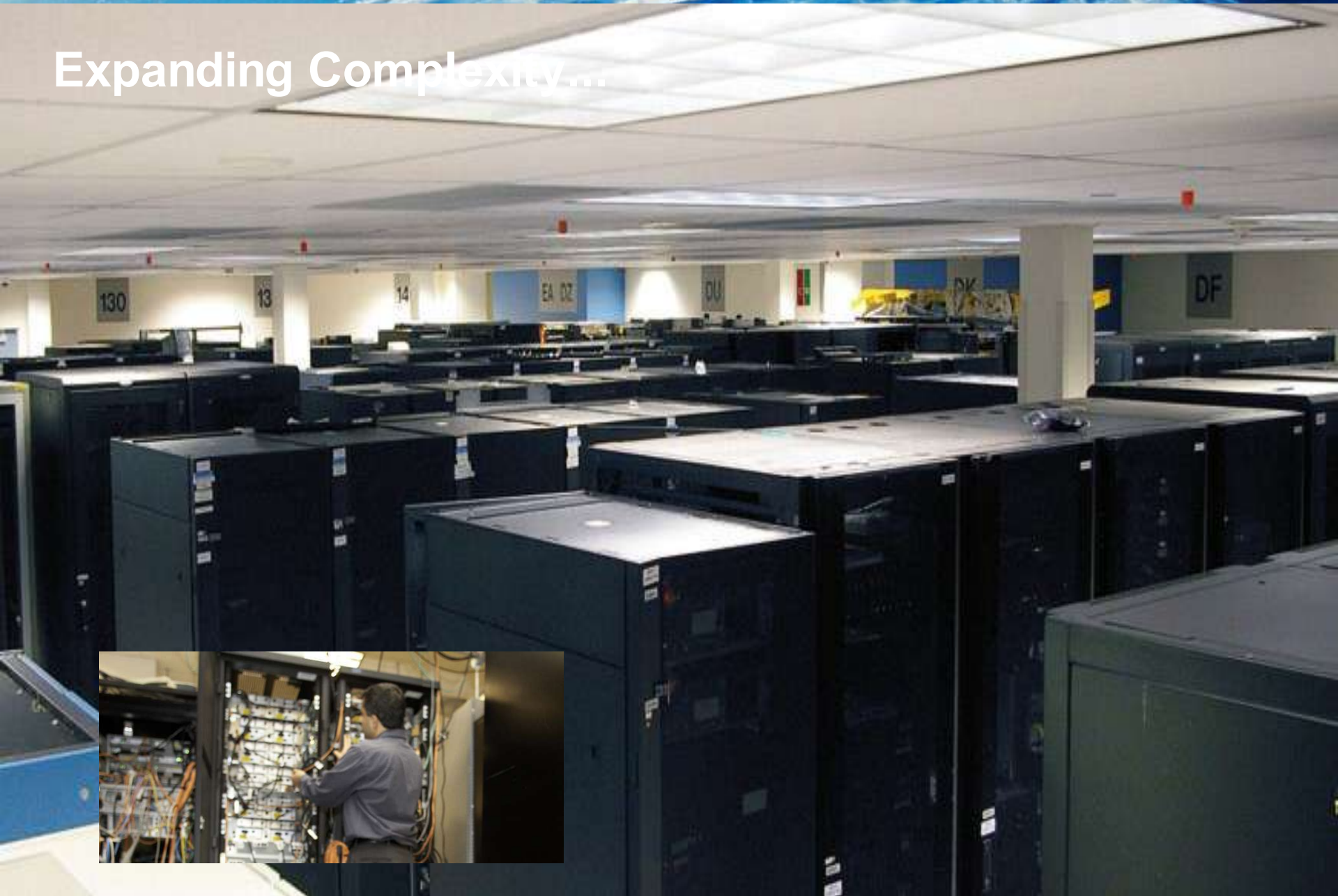
Meet the Challenge in the Datacenter ...



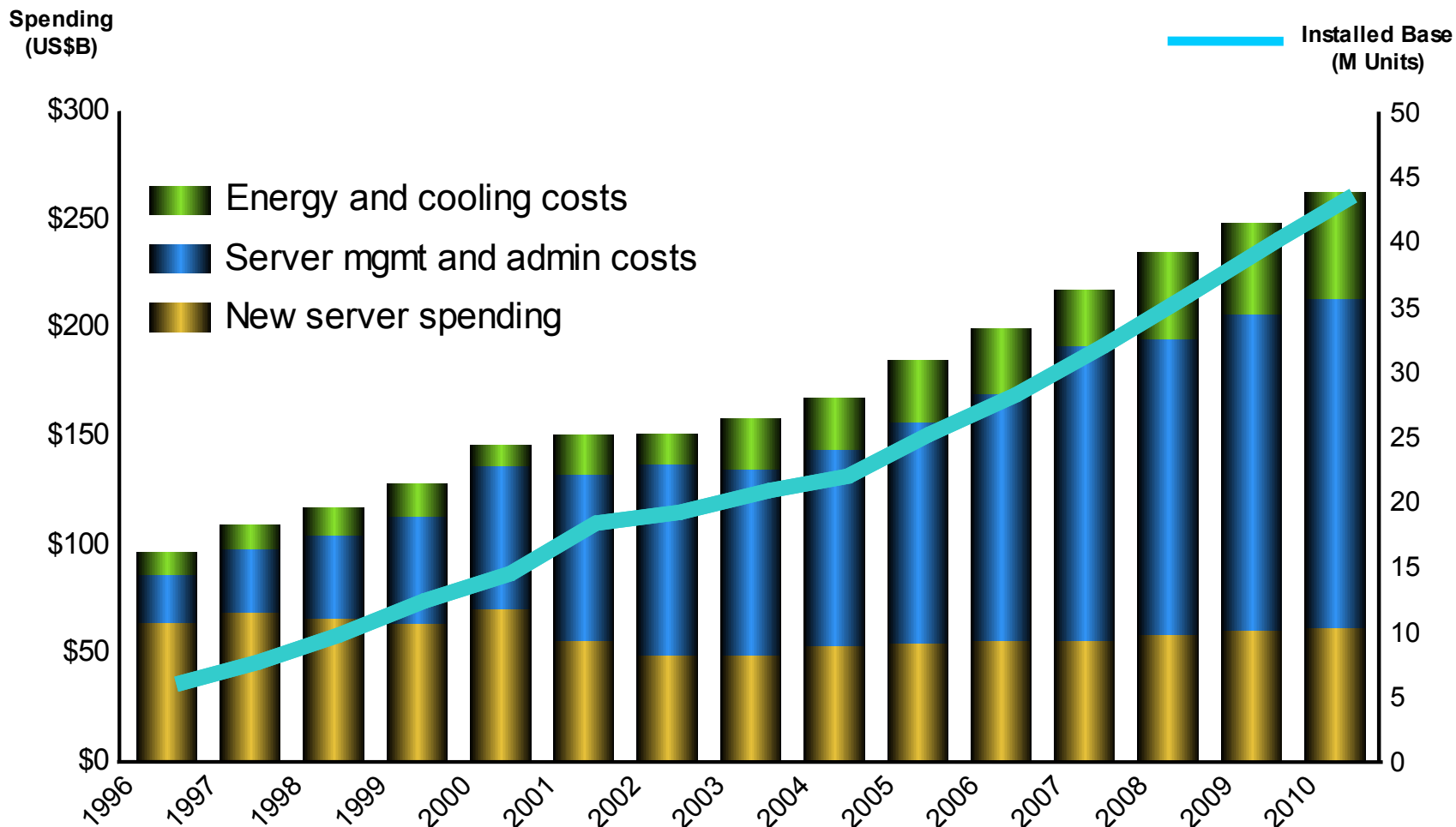
Expanding Complexity...



Expanding Complexity...



Data center cost and complexity on the rise



Source: IDC, Virtualization 2.0: The Next Phase in Customer Adoption, Doc #204904, Dec 2006

CO₂ Footprint for IT equipment ?



Typically, 1kWh of energy production generates 0.5kg CO₂ (on average)

- It's depending of energy generation and region, eg. in Germany to produce 1 kWh generates 0.6kg CO₂ (average)
 - Approx. 30% of all CO₂ emissions in Germany are generated by coal-burning power plants
 - coal-burning power plants burn 480g coal per kWh and produce 1.1kg CO₂ / kWh (on average, ww-base)
 - New coal-burning power plants are more efficient, but still produce 0.75kg CO₂ / kWh



1 kWatt additional power will produce in one year:

$$\bullet \text{ 8'760 kWh} \times 0.5 \text{ kg CO}_2 / \text{kWh} = \textbf{4.38 t CO}_2$$

(24h x 365 days x 1kW = 8'760 kWh/year)

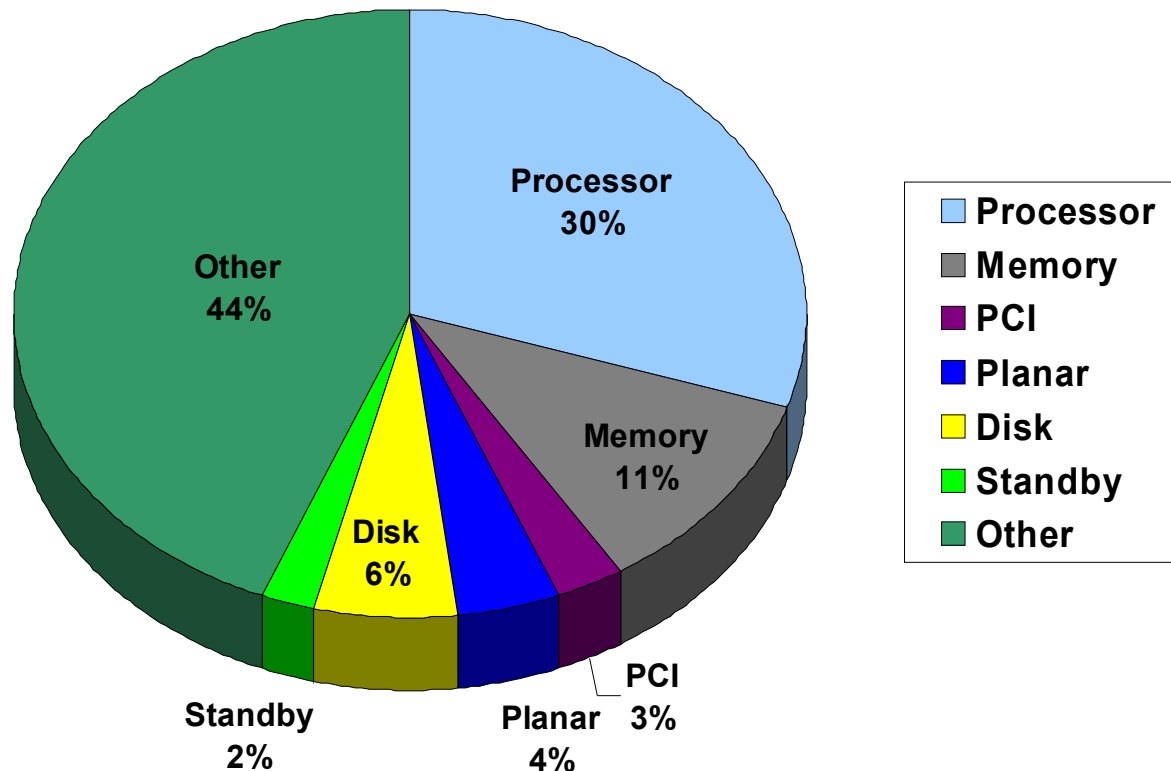


What's using the power?

- The processor power growth is the largest single contributor but there are many other areas- the more you pack into a server the more power it needs!

OTHER?

- AC to DC Transitions
- DC to DC Deliveries
- Fans and air movement



(AC = Alternating Current)
(DC = Direct Current)

What IBM can effect . . . We have

Power deliver

- Super energy efficient power supplies deliver more power to the server – less wasted watts in AC to DC transition

Less parts

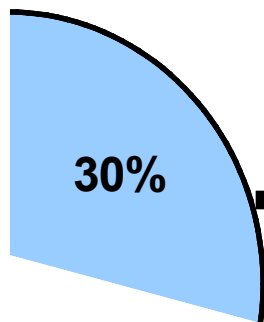
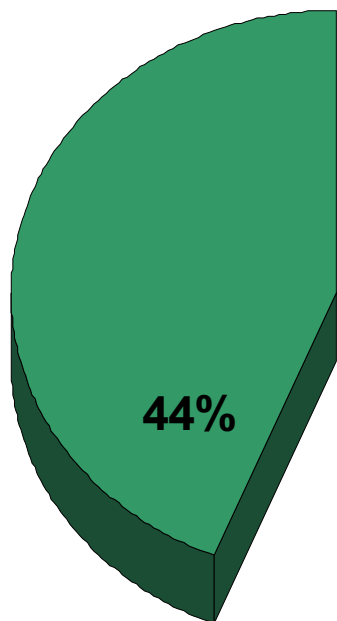
- Smarter shared infrastructure design means less components that draw power – less hardware means less watts

Smarter thermal solution

- Smarter thermal solution (blower count in Blades, XDA and calibrated vector cooling in rack mounted servers)

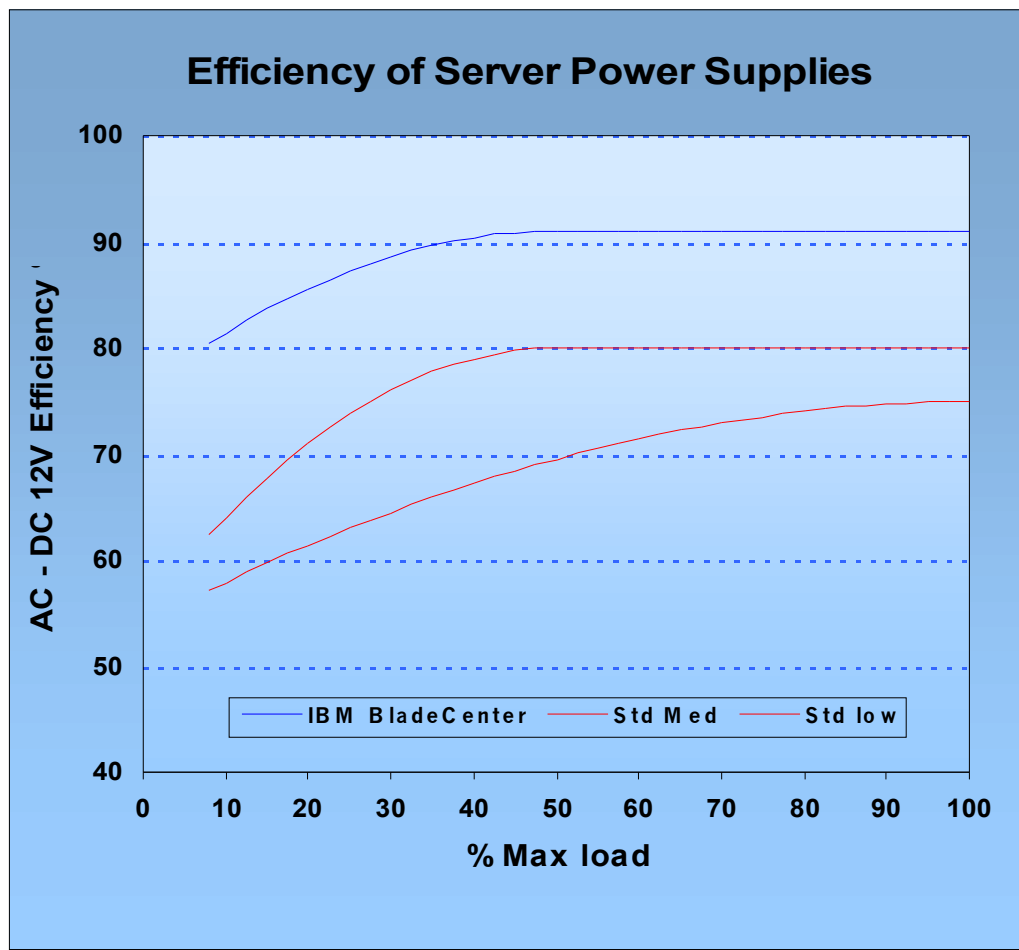
Low Voltage Processor

- eg: Full performance 2.8GHz Xeon processor at substantial power savings over standard Xeon



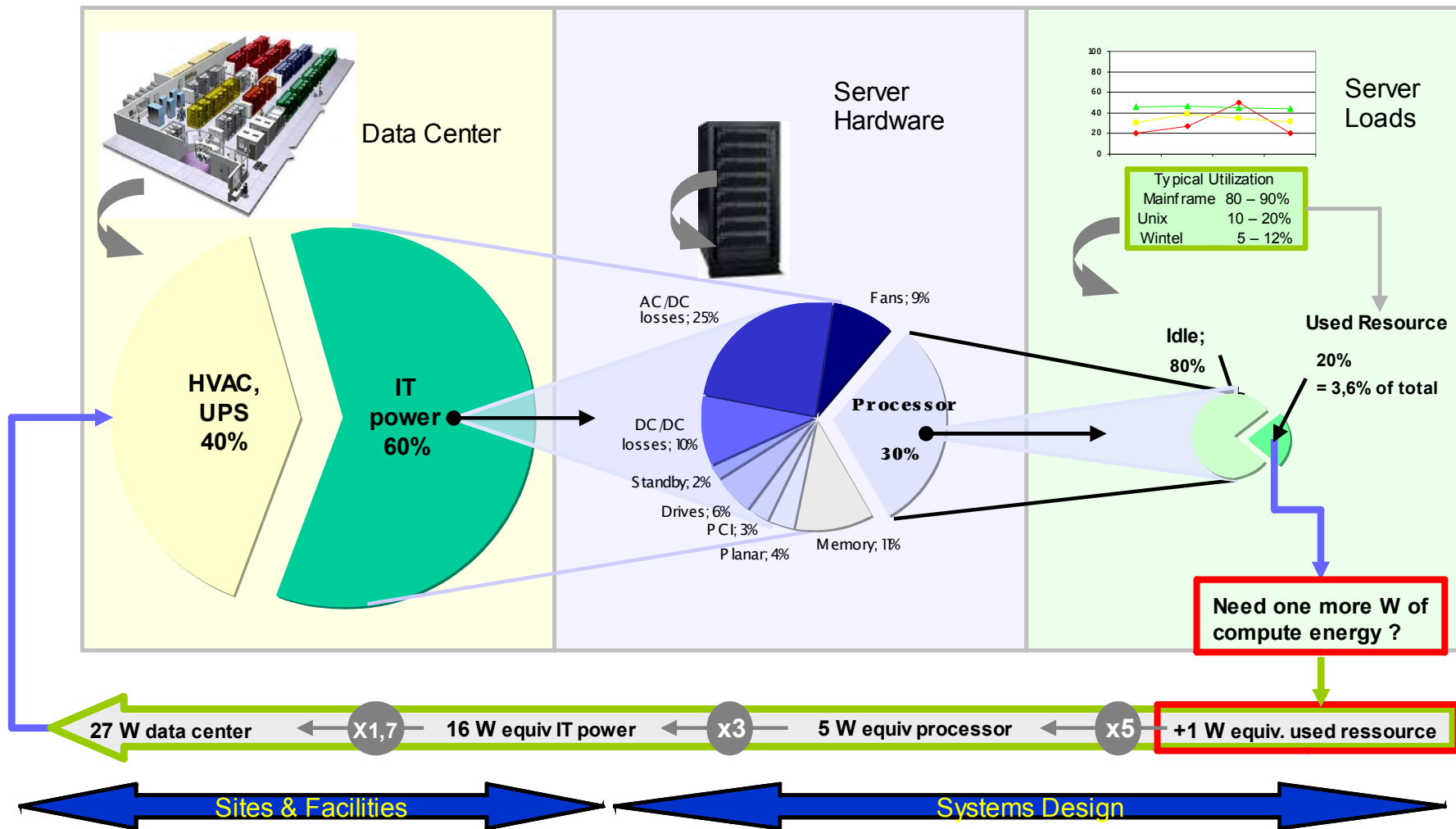
Power Supply Efficiency AC – DC 12V (schematic)

Higher Efficiency → lower Heat



- Typical Load
 - 40-70% normal
 - 20-35% redundant
- IBM Power Supplies >80% at 20%+
 - BladeCenter / high end p / i / z
 - Target for all new IBM Systems
- „Dynamic Power Saver“
 - Switching off Power Supplies automatically if not needed
 - Tries to keep optimal load at approx. 90% max Efficiency
 - Redundant N+1
- „Industry Std“ total efficiency lower
 - At ca. 70-80% (without UPS)
 - DC-DC losses ~10% due to on-board converters used

Where are all those kW consumed ?



Legacy solutions with dedicated systems



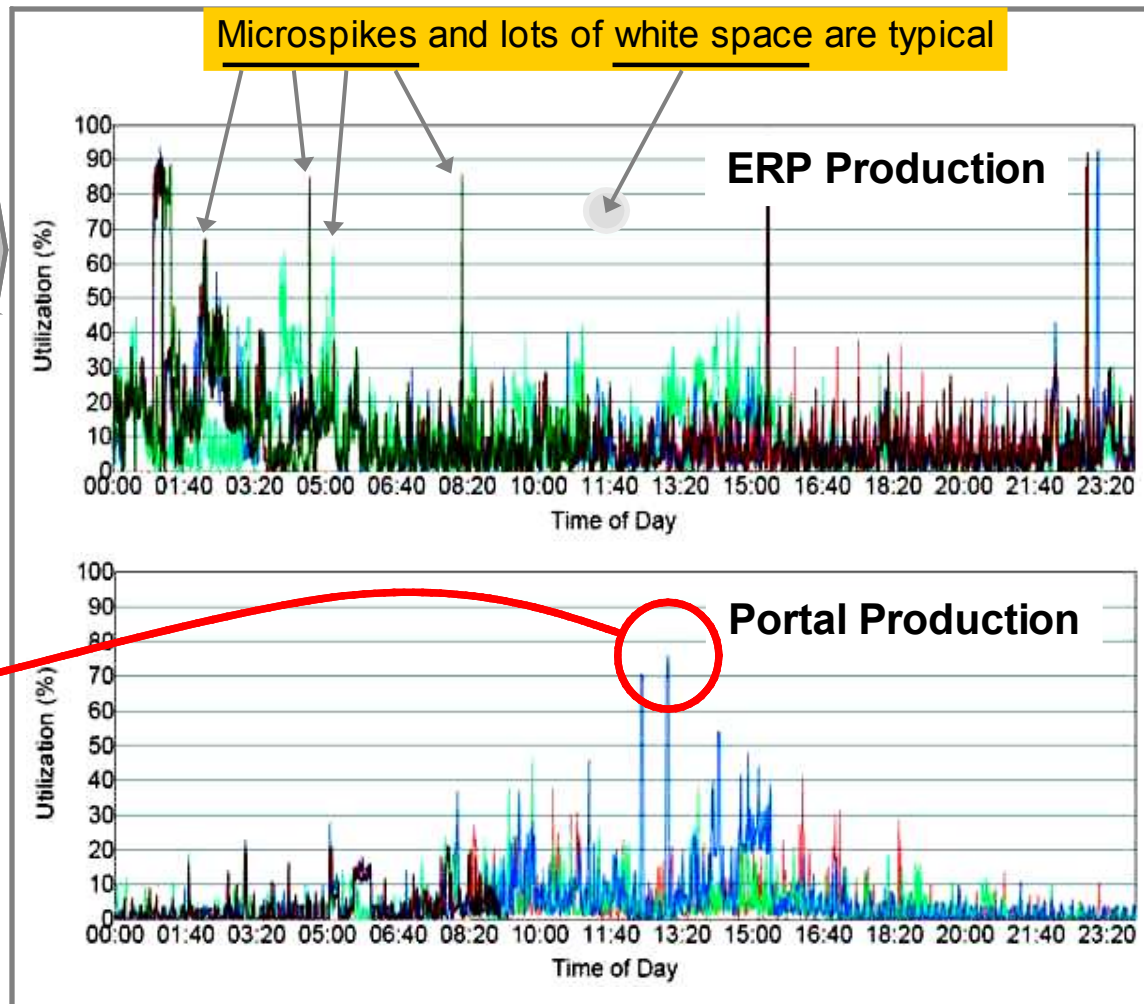
Mean values:

Peak 1 min = 76%

Peak 1 hr avg = 21%

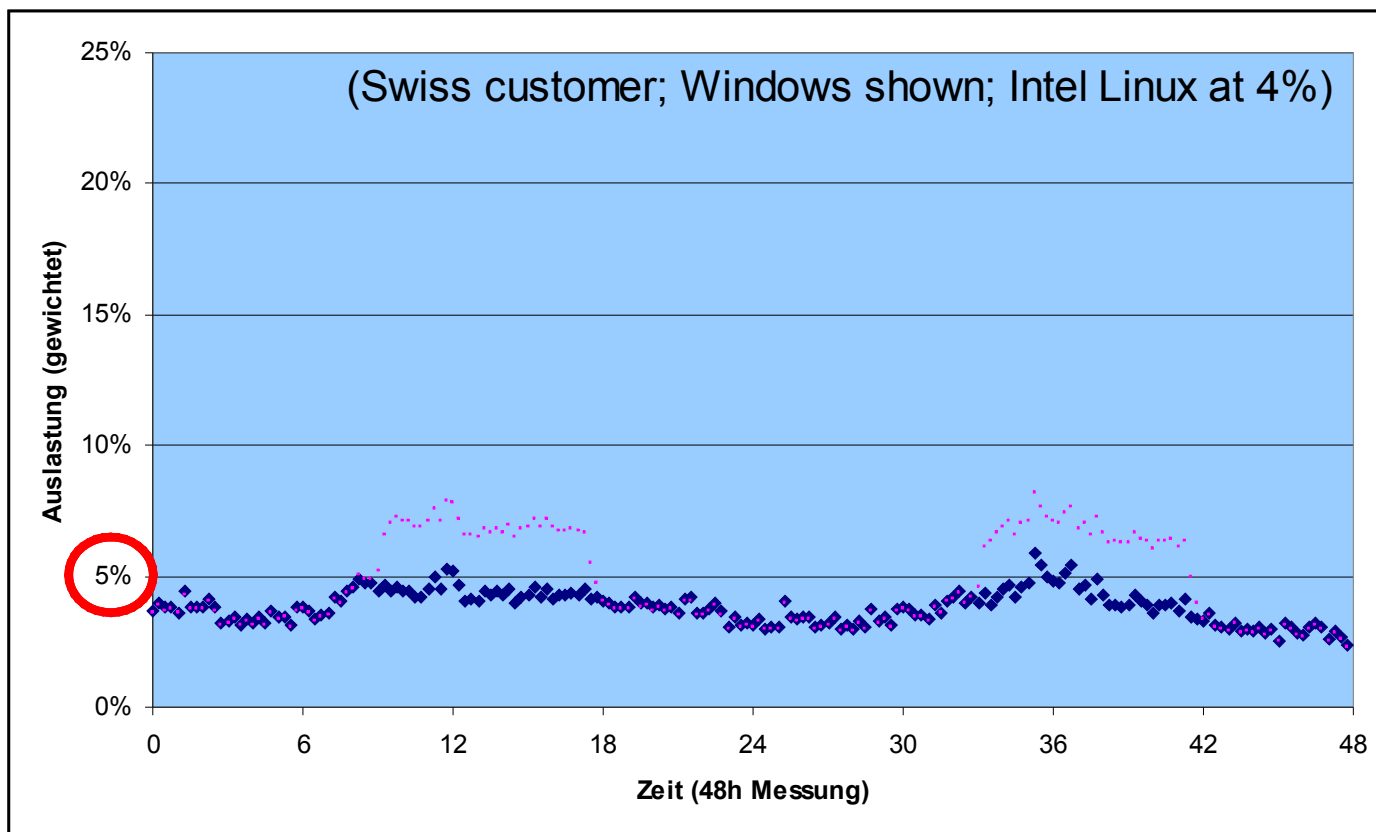
Peak 8 hr avg = 10%

Peak 24 hr avg = 4%



Typical x86 Utilization –

Low for x86 and small UNIX servers



(red dots include 15 servers used for „High Performance Cluster“, 100% utilized)

Current Technology: Air Cooling Concepts

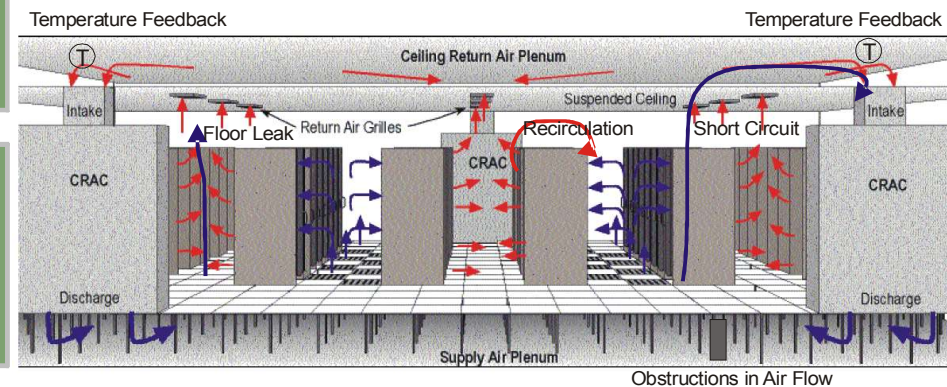
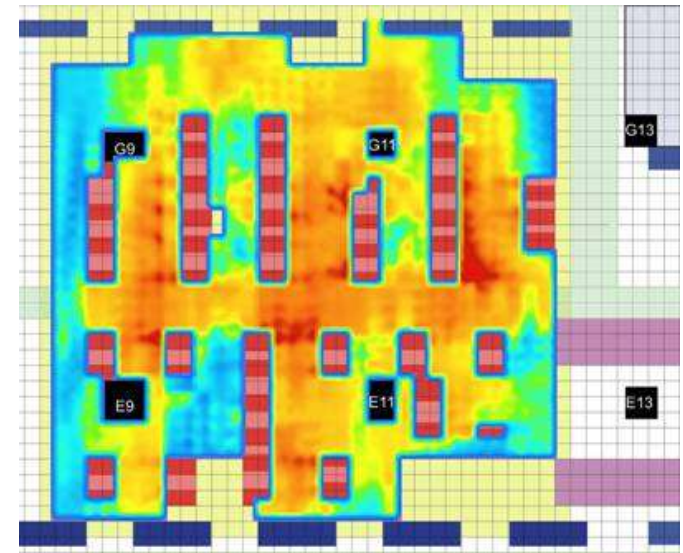
Air cooling inefficiencies

- Non-specific coolant delivery
- Thermal short-cuts due to recirculation from outlet to inlet
- Cross-talk between computer room air conditioners
- Difficult planning and prediction
- Minimal knowledge about temperature distribution

Conclusion

Today's thermal management infrastructure is over dimensioned to keep hot spot's cool

Temperature map of a data center



It's time to start thinking differently
about infrastructure.

Delivering business value with innovation at all levels

Information on Demand

SOA

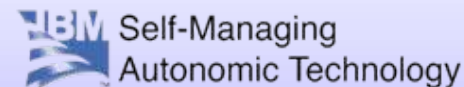
Infrastructure Solutions

Capacity on Demand

Grid Computing

*Supercomputing
Capacity on Demand*

Infrastructure



**Product
Families**



Mainframe



Power



Modular

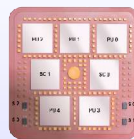


Blades

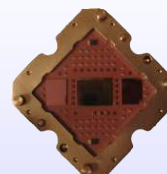


Storage

**Technology
& Packaging**



IBM z/Architecture™



**Power
Architecture™**



**Cell Broadband
Engine™**



X-Architecture™

IBM Systems Family Overview

z/OS, z/VM, z/VSE, Linux for z



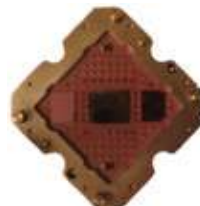
System z
(zSeries, S/390)



AIX, i (i5/OS, OS/400), Linux for Power



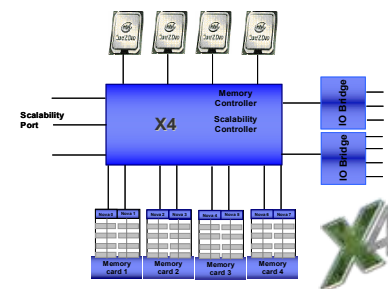
Power Systems
(pSeries, RS/6000 / iSeries, AS/400)



Windows, VMware, Linux



System x
(xSeries, Netfinity)

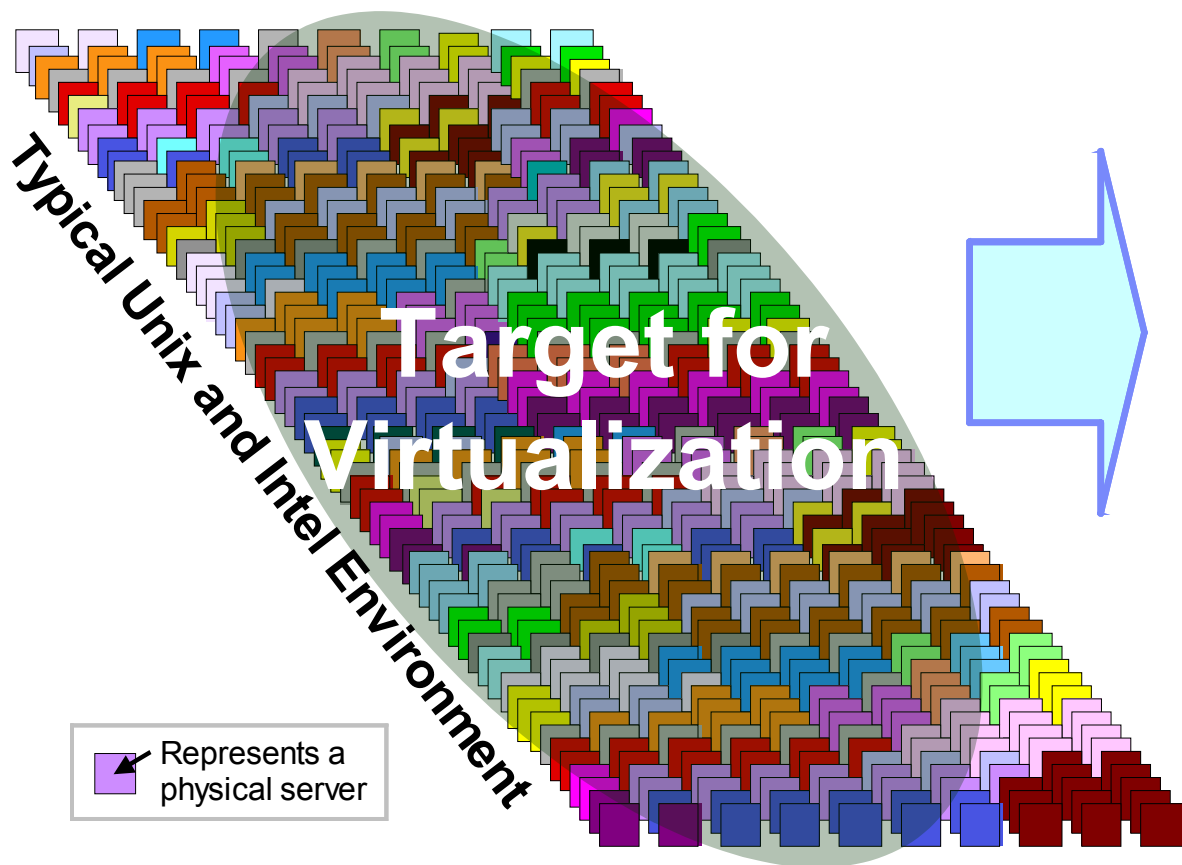




Virtualization ?

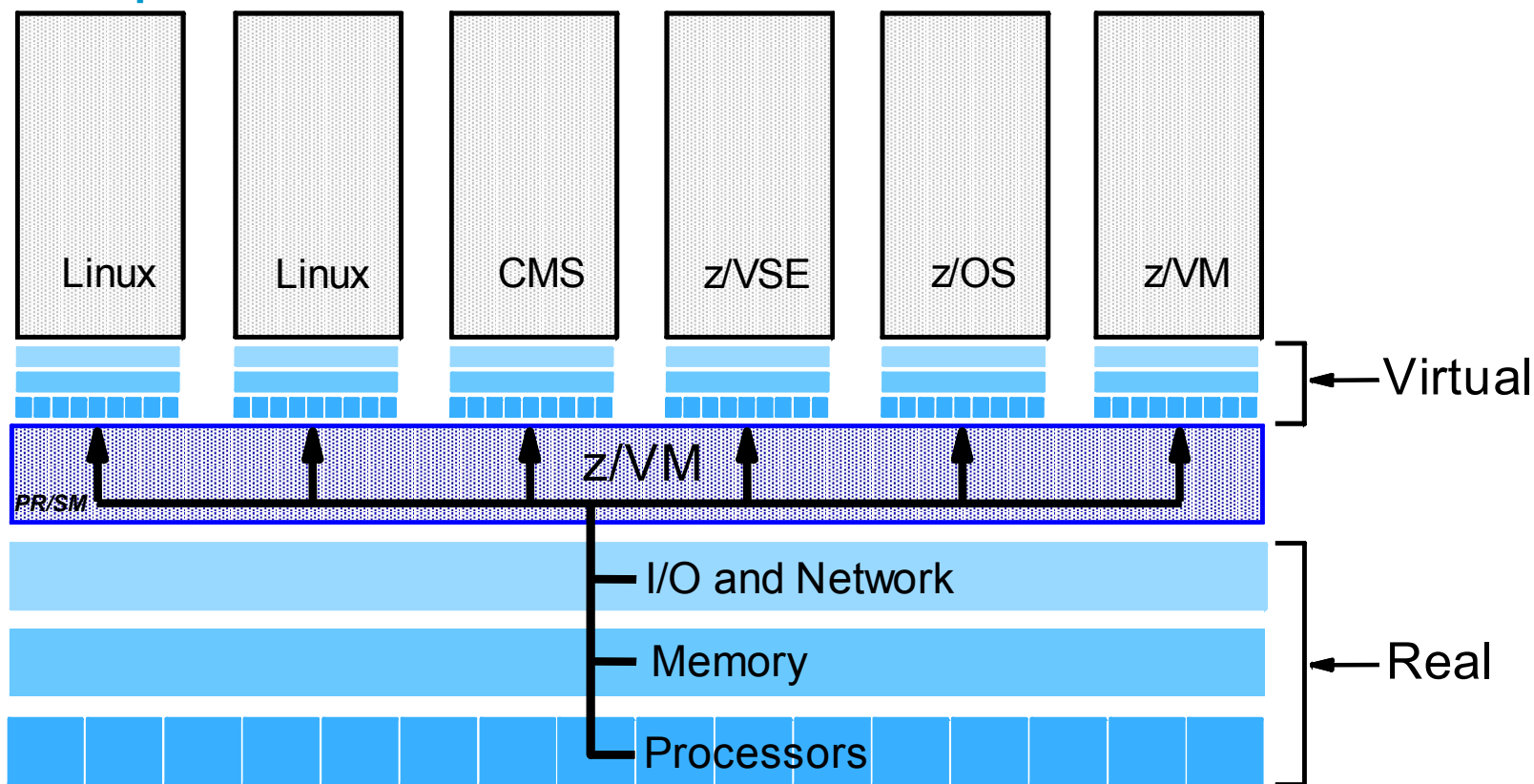
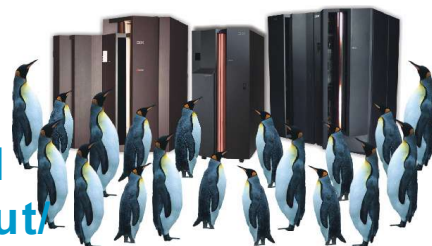


Virtualization and Consolidation saves Energy !

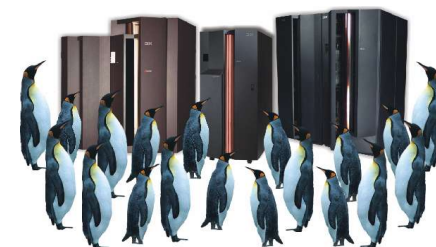
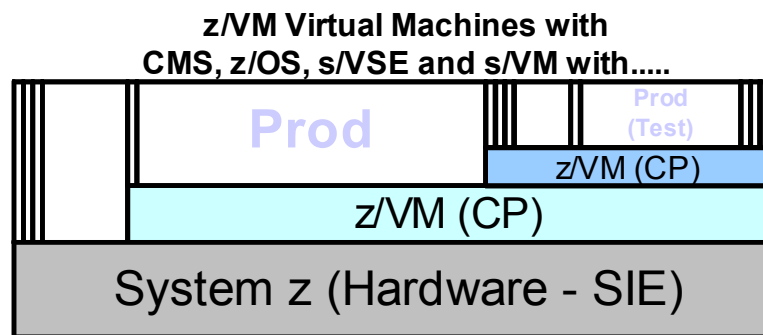


Virtualization Basics

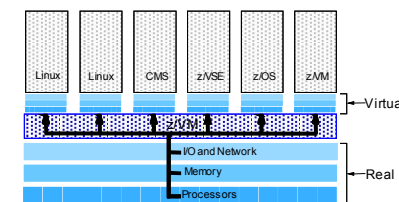
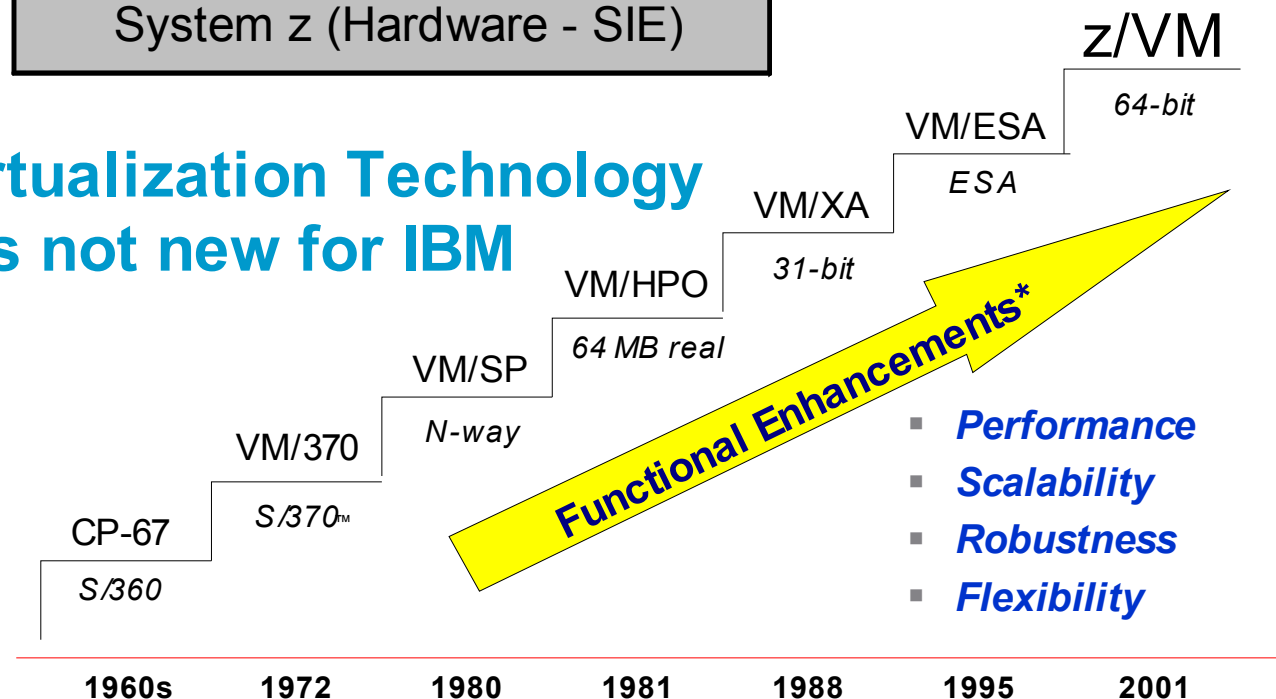
A Virtual Machine simulates the existence of a dedicated real machine, including processor functions, storage, and input/output resources.



Virtualization Technology Evolution



Virtualization Technology is not new for IBM



* Investments made in architecture, hardware, microcode, software

Virtualization can enable benefits beyond consolidation

Virtualize at all layers of the architecture for maximum benefits



Create many virtual resources within a single physical device



Reach beyond the box — pool and manage many virtual resources as one



Dynamically change and adjust across the infrastructure



**Server
Virtualization**



**Storage
Virtualization**



**Network
Virtualization**



**Application
Virtualization**



**Client
Virtualization**

Virtualization creates unprecedented **flexibility and responsiveness**

IBM's long-term focus on virtualization across Systems



System z10
System z



Power Systems
POWER6



System x BladeCenter
4th generation
X-Architecture®



IBM System
Storage

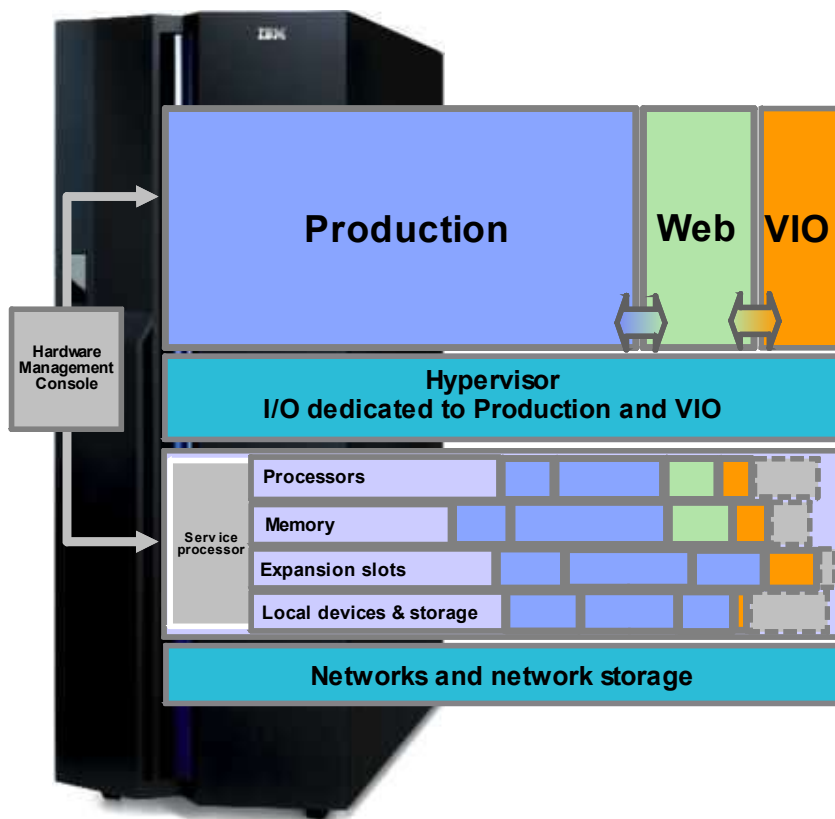
While virtualization sounds complex, it's really a simple idea. IBM Systems can provide virtualization capabilities that are unique in the marketplace

- IBM mainframe virtualization – 45 year history of world-class innovation
- IBM X-Architecture designed for virtualization, shared cross platform
- CoolBlue™ - Power and Cooling designs that lead the industry
- Virtualization Management software that simplifies your environment
- SAN Volume Controller – Storage Virtualization for availability
- Capacity on Demand features integrated with virtualization
- Virtualization features do not require “rip and replace” upgrades

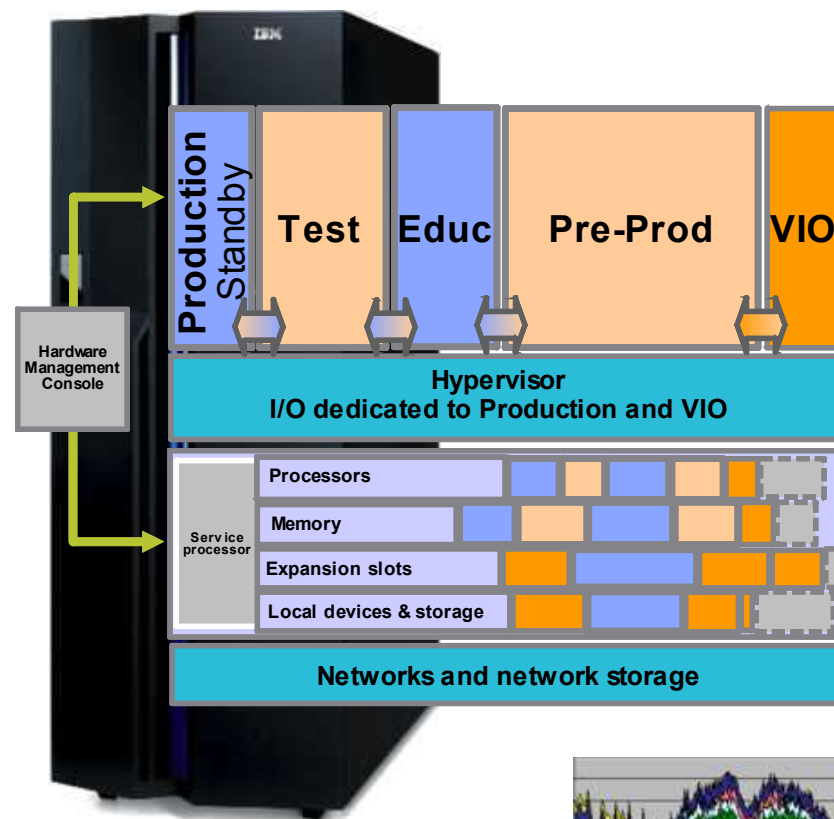
Virtualization Architecture



POWER System #1



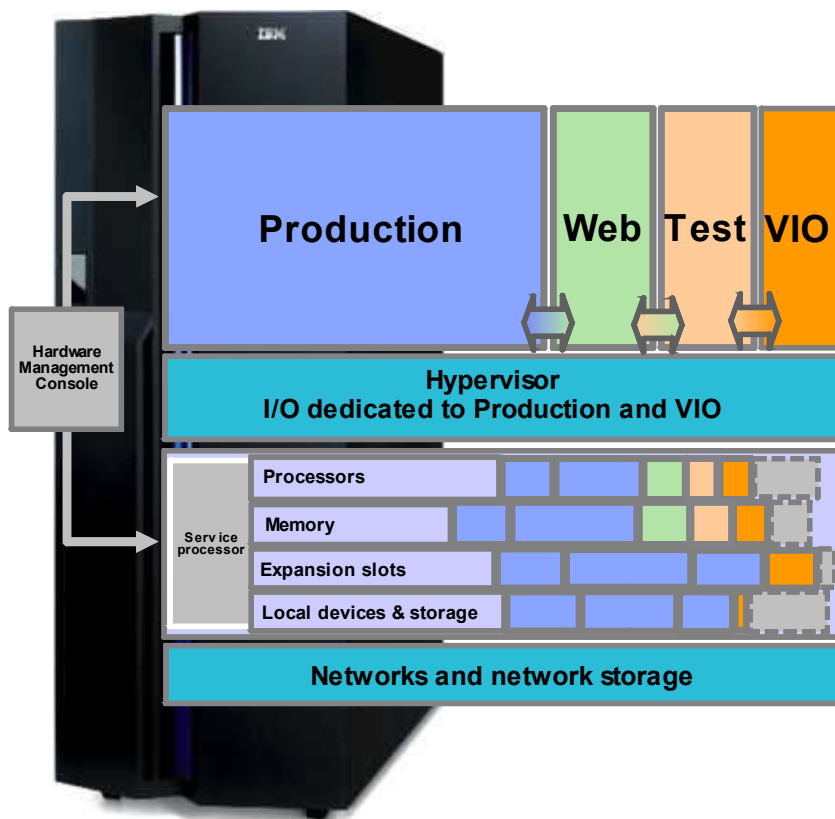
POWER System #2



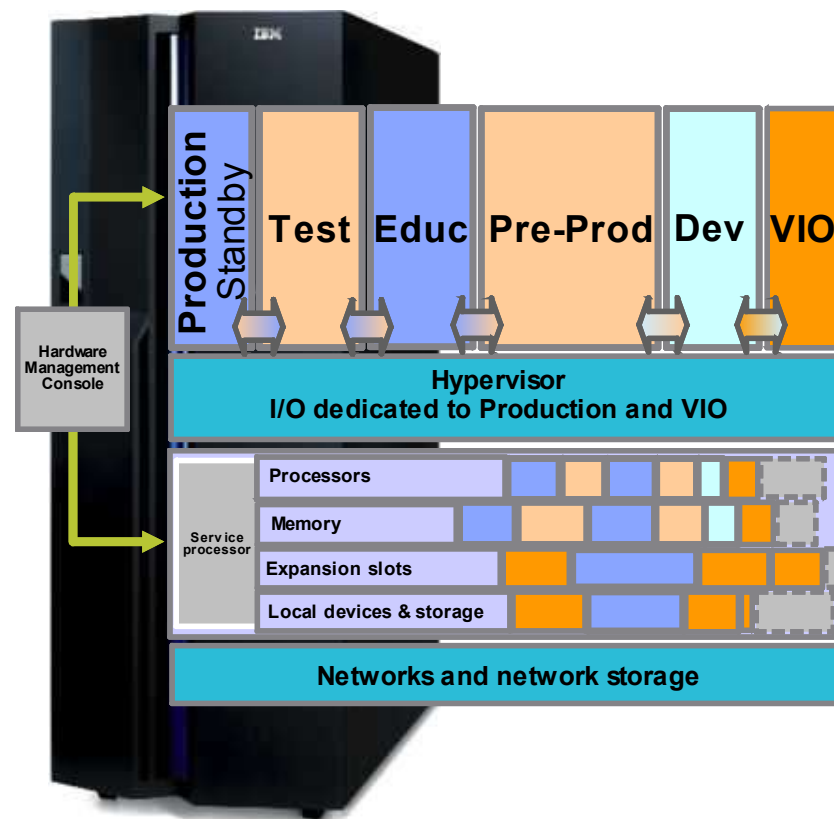
Virtualization Architecture - flexibility



POWER System #1



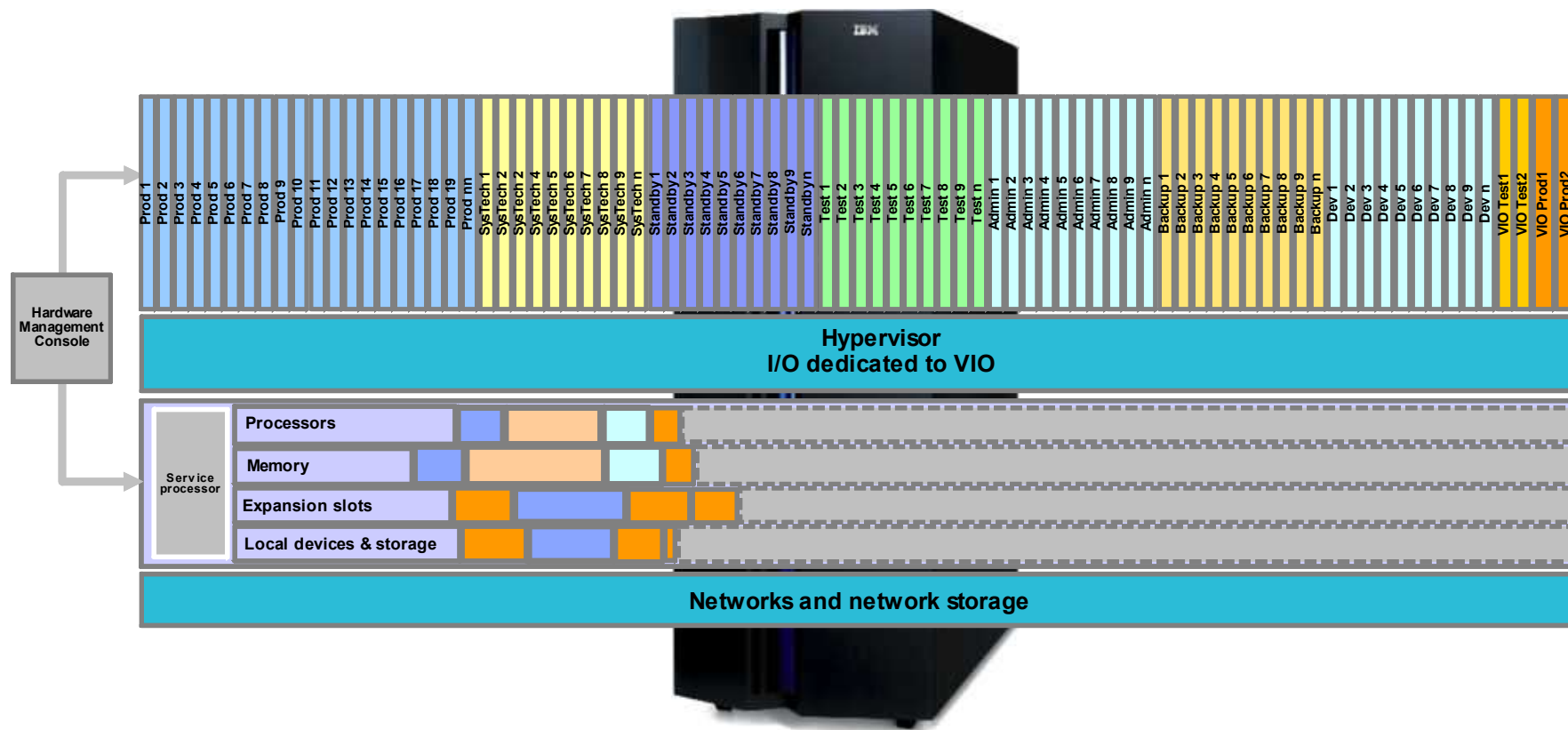
POWER System #2



Virtualization Architecture – Scale UP !



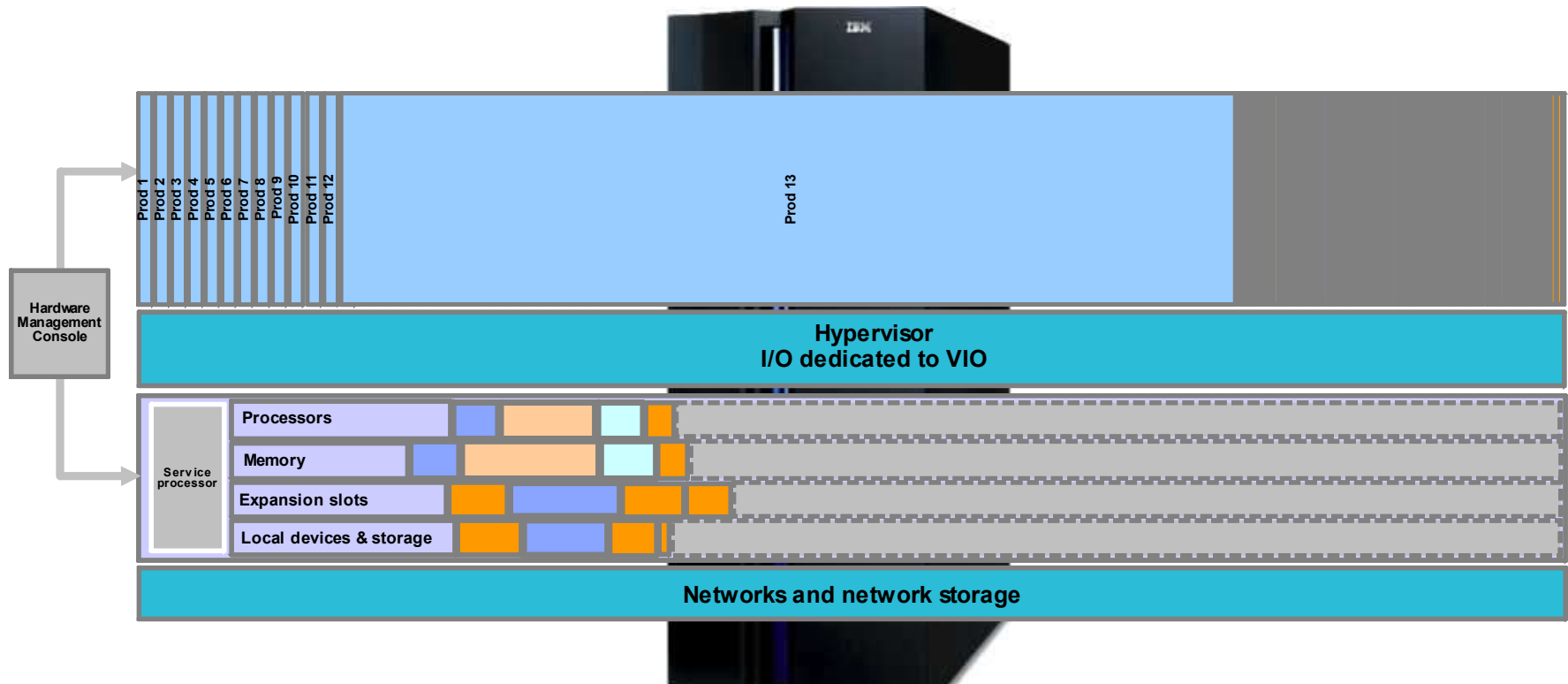
IBM POWER System



Virtualization Architecture – Scale UP !



IBM POWER System



Consolidation and virtualization of servers and storage reducing complexity, energy and labor for \$40M est. cost reduction



“Mainframes” are back



Think about it: 400 Servers down to 1.....

- sharing all resources
- dynamically allocated, automatically, no admin needed
- every virtual system get's the performance of a mainframe
- where have all the cables gone ?
- what should I do with the empty space in my data center ?
- does anyone need some energy ? I have some to spend....
- does anyone need an air conditioner ? I have some....

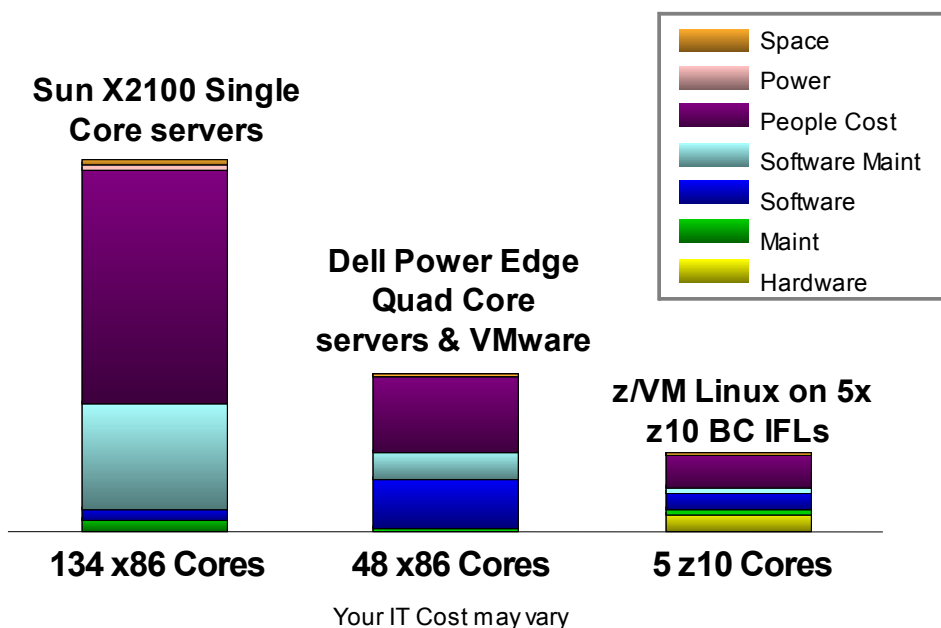


Matching the attributes of a Dynamic Infrastructure:

Reduce cost through consolidation on Linux on System z

Consolidating 134 Linux servers to 5 IFLs Can save up to 50% over x86 w/ VMware

Oracle DB Workload, 3-Year Total IT Cost



Here's a cool example:

IBM will consolidate 3,900 servers to about 30 System z servers with expected reductions in energy consumption of over 80%

Enterprise Linux Server



- **Optimise your IT via consolidation and virtualization with Linux – Smart. Cool. Affordable.**
 - Provides a competitively priced entry Linux only server to encourage net new mainframe customer consolidation of non-IBM distributed workloads onto Linux for System z.
-
- Standard z10BC
 - 2 x 3.5GHz processors (IFL) enabled for Linux
 - 64 GB of memory
 - ficon and ethernet comms
 - z/VM + support for 3 years
 - HW maintenance for 3 years
 - Linear price on remaining capacity
-
- Does not include SUSE or redhat Linux license



starting at a price
of 442'000 CHF*

THINK !

BEISPIEL 1

ENERGIEEINSPARUNG MIT
SERVERKONSOLIDATION**Herausforderung**

Raiffeisen, die drittgrösste Bank der Schweiz, betreibt eine riesige Zahl dezidiert UNIX Systemen. Der durchschnittliche Schnitt zu 14 Prozent aus. Angesichts des prognostizierten Wachstums erwartete die Bank Engpässe in der Stromversorgung und Kosten.

Lösung

Mit der «Neuen Banking»-Strategie realisierte IBM eine Virtualisierung der IBM POWER Architektur. Das neue System p5 595 Systemer ersetzte 14 alte Systeme. Die Energieeinsparungen seit 2007 sind deutlich: Die Leistungsaufnahme sank um 86 Prozent. Bei einem mittleren Anfall von 500 g CO₂/kWh bei der Energieerzeugung wird die Produktion von mindestens 1760 Tonnen CO₂ pro Jahr vermieden. Dies entspricht der Menge CO₂, die 780 Mittelklassewagen ausstossen. Die CPU-Auslastung stieg auf über 50 Prozent, die Kosten für Abschreibungen auf Hardware und Connectivity sanken um 71 Prozent.

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„Wir sind *positiv überrascht*. Die Ziele wurden nicht nur erreicht, sondern übertroffen.“

HANNES SCHLEPFER,
Leiter Systemtechnik Raiffeisen

einsparungen seit 2007 sind deutlich: Die Leistungsaufnahme sank um 86 Prozent. Bei einem mittleren Anfall von 500 g CO₂/kWh bei der Energieerzeugung wird die Produktion von mindestens 1760 Tonnen CO₂ pro Jahr vermieden. Dies entspricht der Menge CO₂, die 780 Mittelklassewagen ausstossen.

DIE ZUKUNFT
IST GRÜN

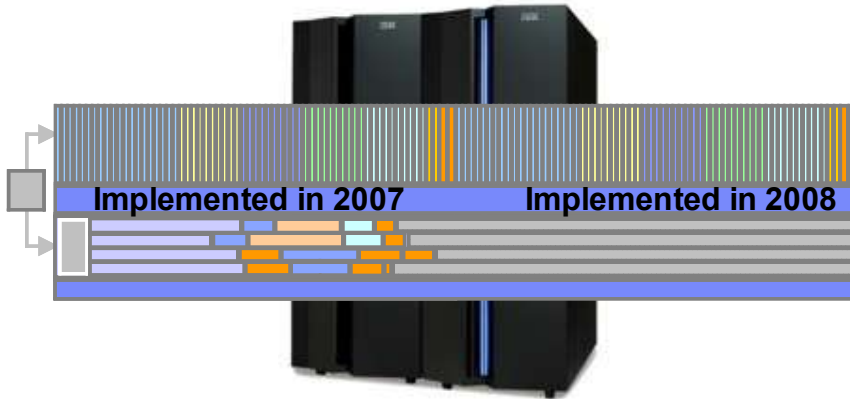
Warum sich Nachhaltigkeit bezahlt macht

IBM

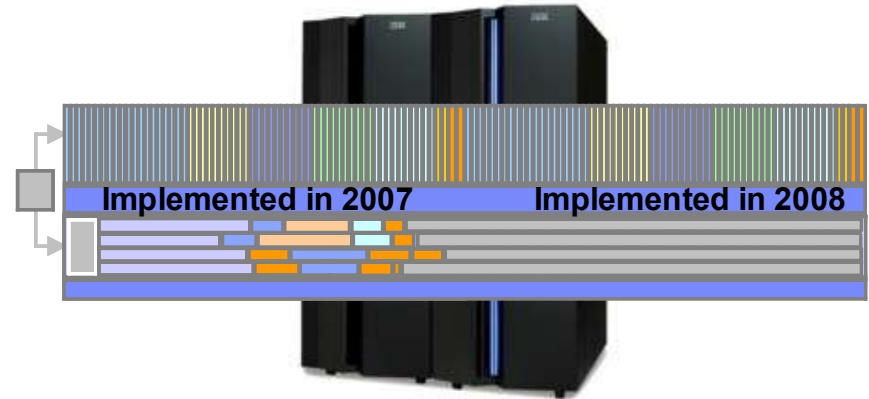


Virtualization Architecture – Scale UP !

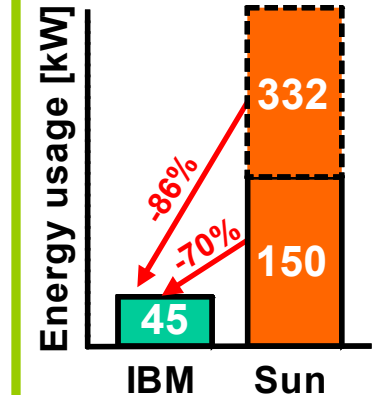
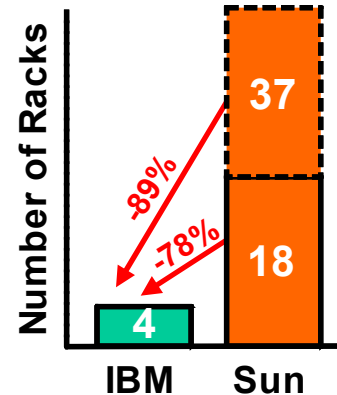
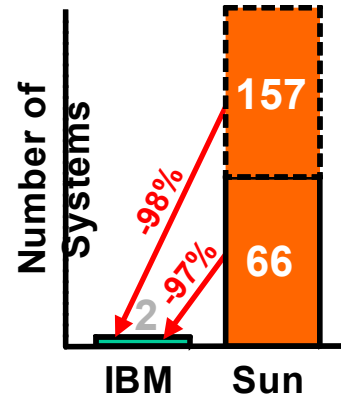
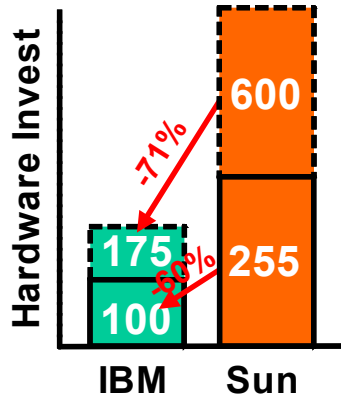
IBM POWER System # 1



IBM POWER System # 2



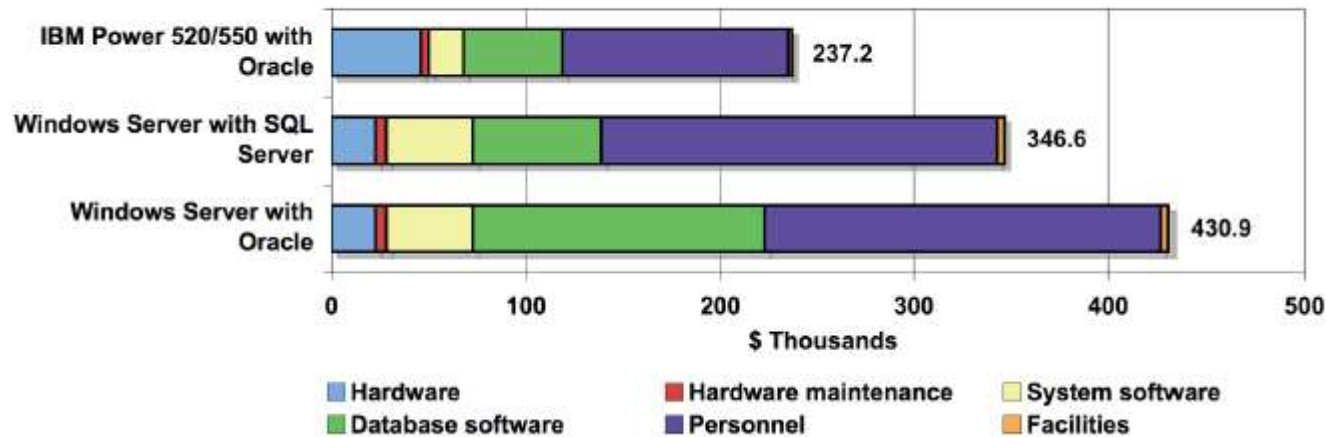
Customer calculated efficiency enhancements after phase 2 (end of 2007):



Phase 1 Phase 2

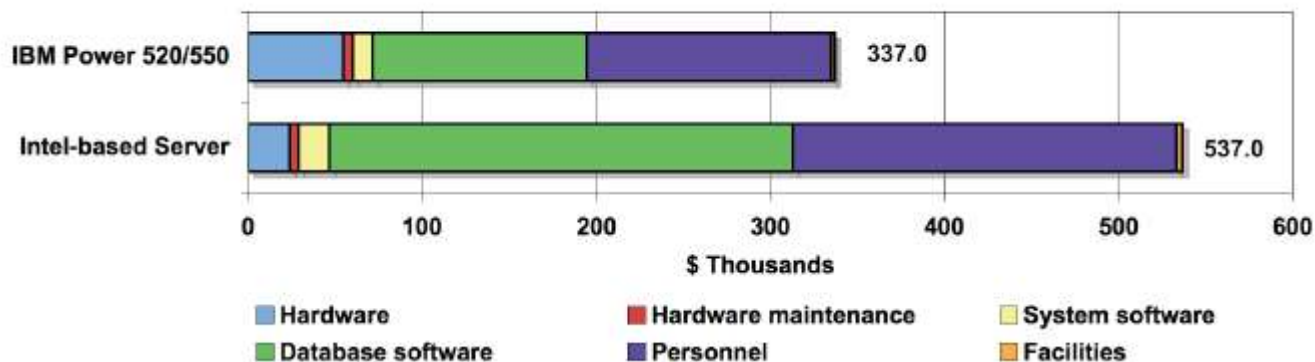
How low can your TCO go using Power System servers with PowerVM ?*

Profiles: Average Three-year Costs for IBM Power and Windows Server Scenarios



Windows / AIX

Profiles: Average Three-year Costs for IBM Power and Intel-based Server Scenarios



Linux



Summary: Dynamic Infrastructure

Building a dynamic infrastructure

Service Management

Provide visibility, control and automation across all the business and IT assets to deliver higher value services.

Asset Management

Maximizing the value of critical business and IT assets over their lifecycle with industry tailored asset management solutions.

Virtualization

Leadership virtualization and consolidation solutions that reduce cost, improve asset utilization, and speed provisioning of new services.

Energy Efficiency

Address energy, environment, and sustainability challenges and opportunities across your business and IT infrastructure.

Business Resiliency

Maintaining continuous business and IT operations while rapidly adapting and responding to risks and opportunities.

Security

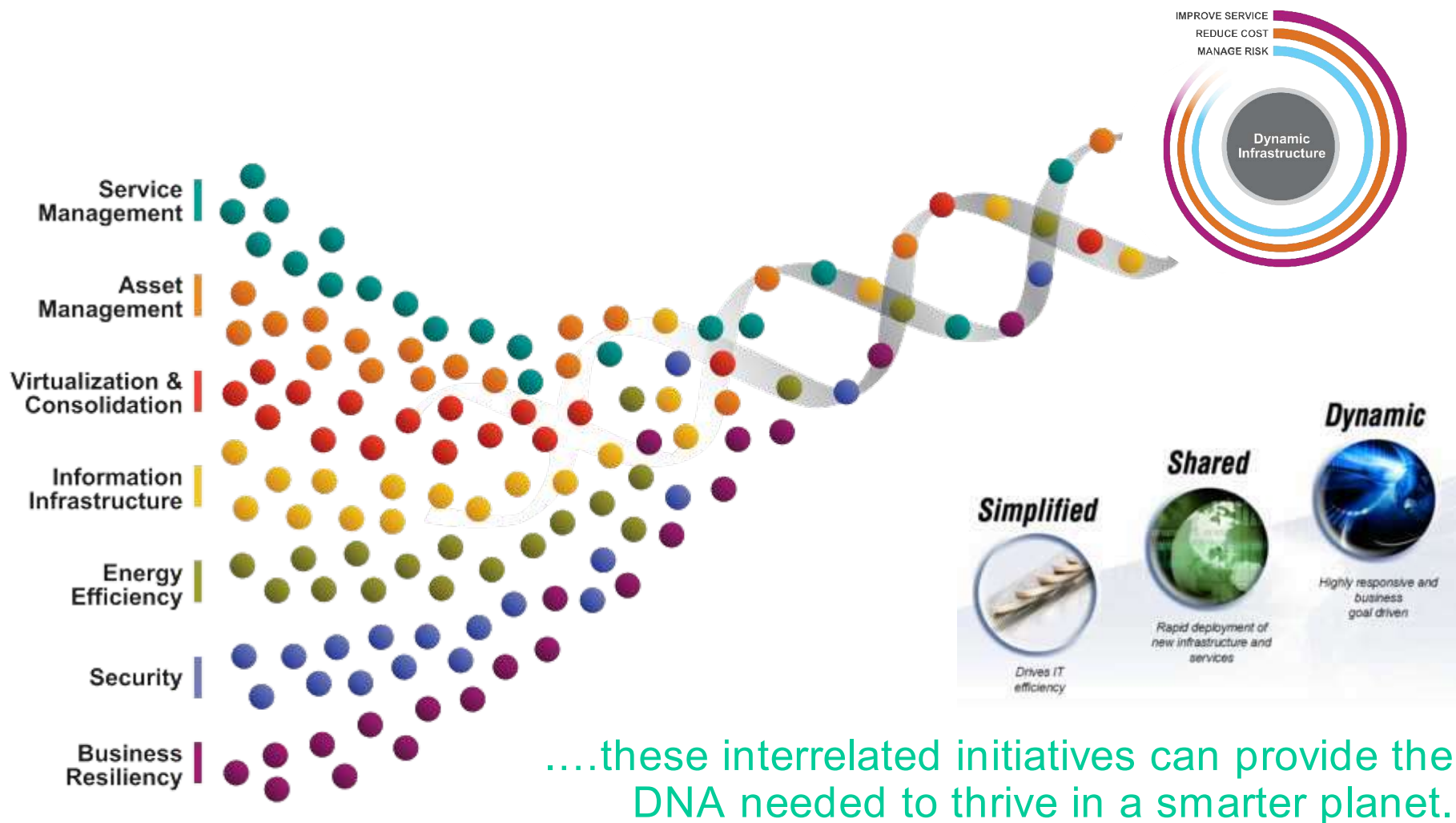
End to end industry customized governance, risk management and compliance solutions.

Information Infrastructure

Helping businesses achieve information compliance, availability, retention, and security objectives.



A dynamic infrastructure is a journey...



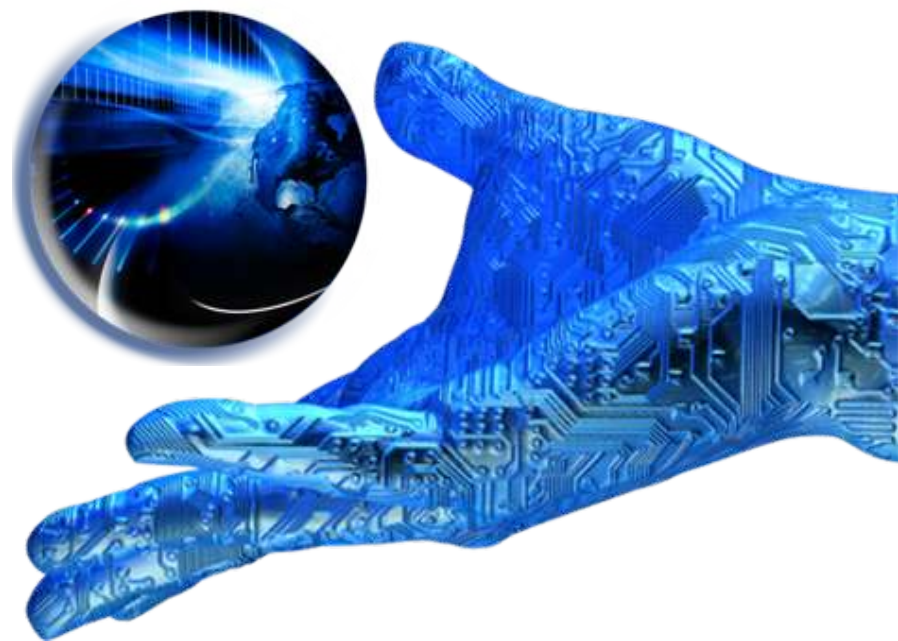
LET'S BUILD A SMARTER PLANET

Start with Dynamic Infrastructure

Thank You

Questions?

René Bersier
IBM Systems Consultant



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|---|-------------------|----------------|-------|
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| IBM (Logo*) | Informix* | System z10 | z/VM* |
| Cognos* | InfoSphere | System z10 | z/VSE |
| DB2* | Maximo* | Business Class | |
| DB2 Connect | Netcool* | Tivoli* | |
| DirMaint | OMEGAMON* | WebSphere* | |
| Dynamic Infrastructure* | Parallel Sysplex* | z9* | |
| Geographically Dispersed Parallel Sysplex | PR/SM | z10 | |
| GDPS* | RACF* | z10 BC | |
| HiperSockets | System p | z10 EC | |
| | System z* | | |

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Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

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