Mainframe Status and Future
6 years Linux on the Mainframe

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The Mainframe is powerful!

- **Rigid platform architecture**
  - **Seven Hardware implementations**
  - **Thirteen Software implementations**
  - **after 40 years „4 ever young"**

- **Broad Customer acceptance**
  - **Base for Technical Integration**
 - **Base for Business Innovation**

zSeries System Structure Evolution

Memory (up to 32 GB)

Level 2 Cache (16MB)

PU	PU	PU	PU	PU	PU	PU	PU	PU	PU

PU	PU	PU	PU	PU	PU	PU	PU	PU	PU

Level 2 Cache (16MB)

Memory (up to 32 GB)

Memory (up to 64GB)

Memory (up to 64GB)

Level 2 Cache (32MB)

Level 2 Cache (32MB)

PU PU	PU PU	PU PU	PU PU	PU PU	PU PU		PU	PU

PU PU	PU PU	PU PU	PU PU	PU PU	PU PU		PU	PU

Level 2 Cache (32MB)

Level 2 Cache (32MB)

Memory (up to 64GB)

Memory (up to 64GB)
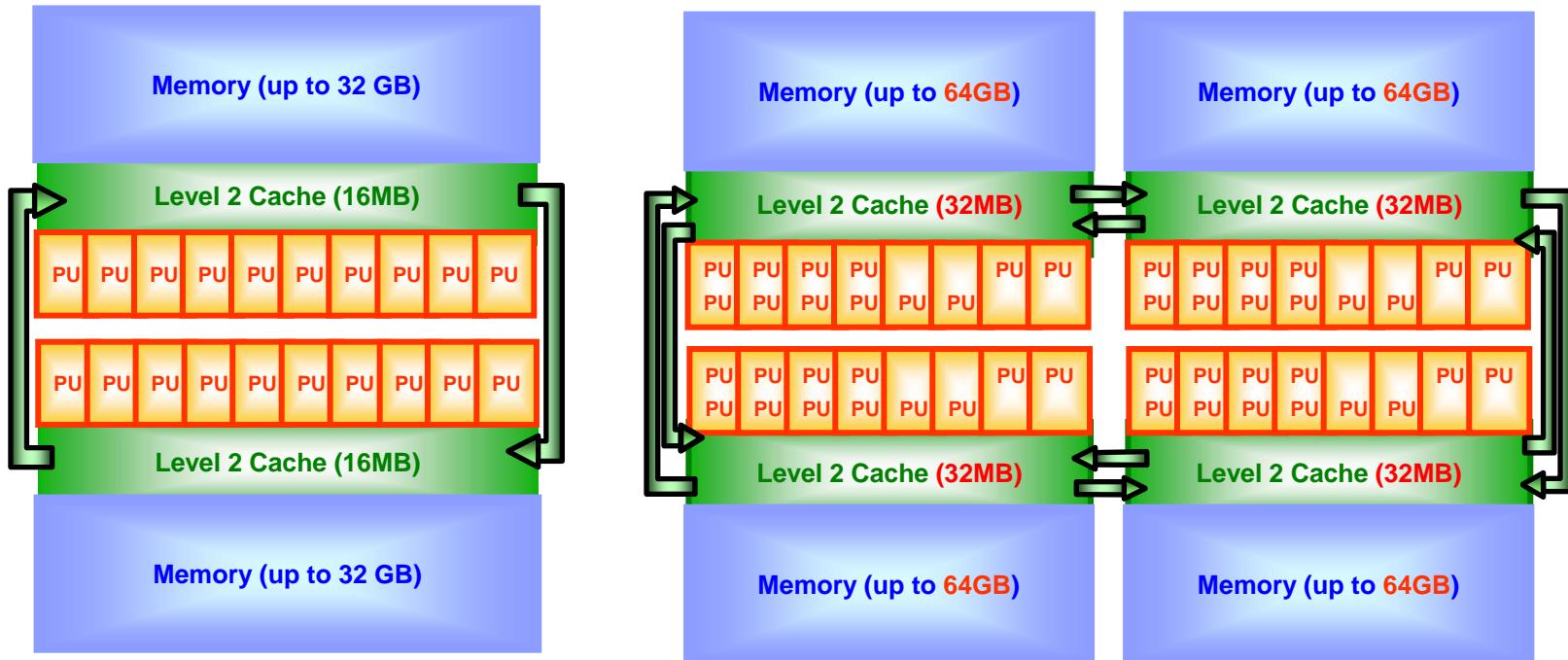
From z900/z800 ...
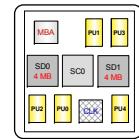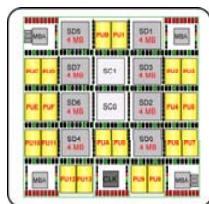
... to modular z990/z890 systems
- **2 processor cores / chip**
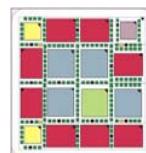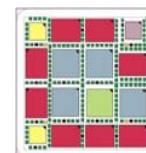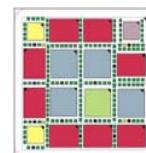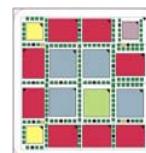
zSystem Structure Evolution continued

Memory (up to 64 GB)   Memory (up to 64 GB)
Level 2 Cache (32 MB)   Level 2 Cache (32 MB)
Level 2 Cache (32 MB)   Level 2 Cache (32 MB)
Memory (up to 64 GB)   Memory (up to 64 GB)

z990

Memory (up to 128 GB)   Memory (up to 128 GB)
Level 2 Cache (40 MB)   Level 2 Cache (40 MB)
Level 2 Cache (40 MB)   Level 2 Cache (40 MB)
Memory (up to 128 GB)   Memory (up to 128 GB)
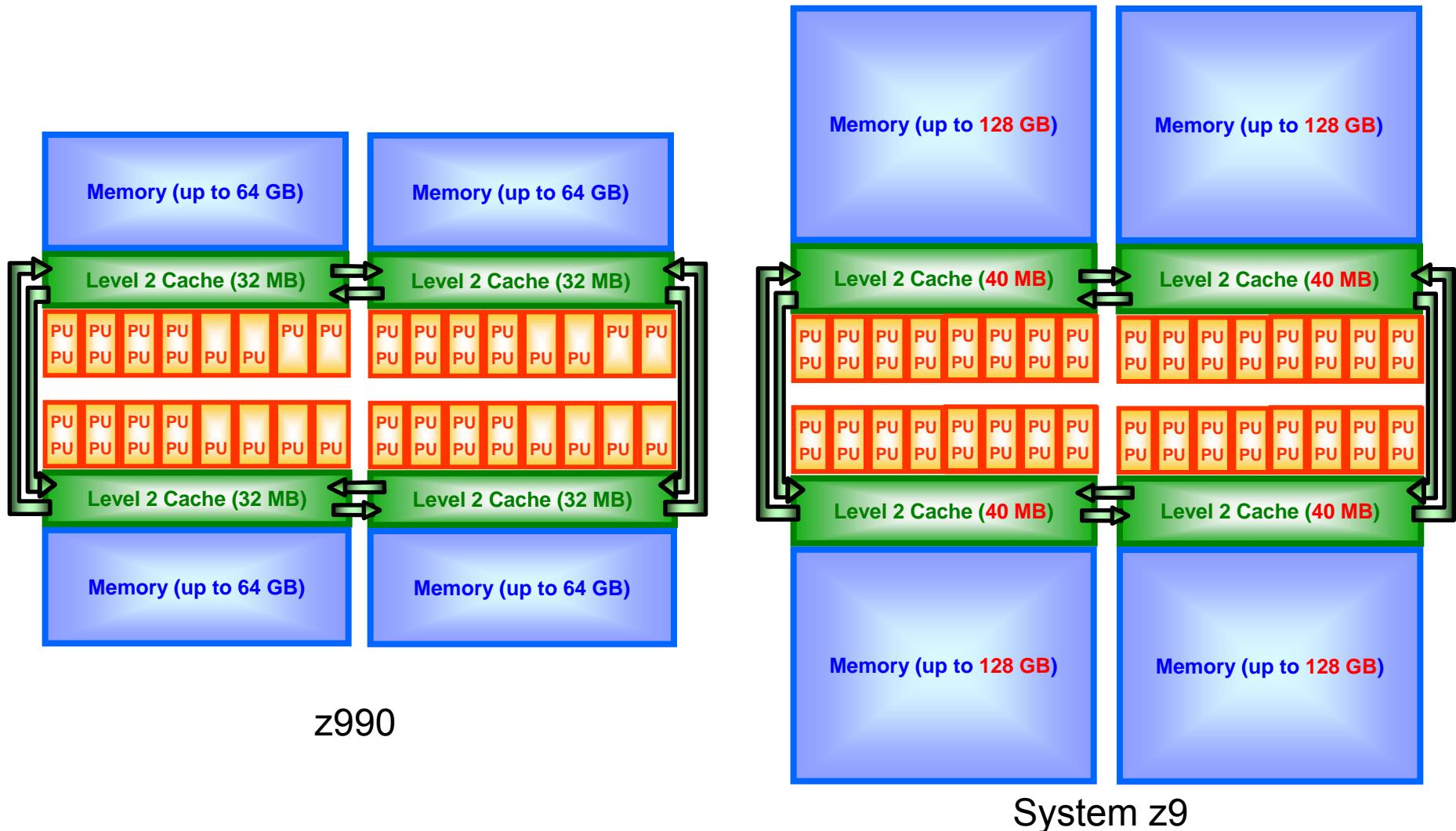
System z9

z9-109 – Under the covers (Model S38 or S54)

Internal Batteries (optional)

Power Supplies

3x I/O cages

Hybrid Cooling

Processor Books and Memory

CEC Cage

STI cables

Support Elements

Front View
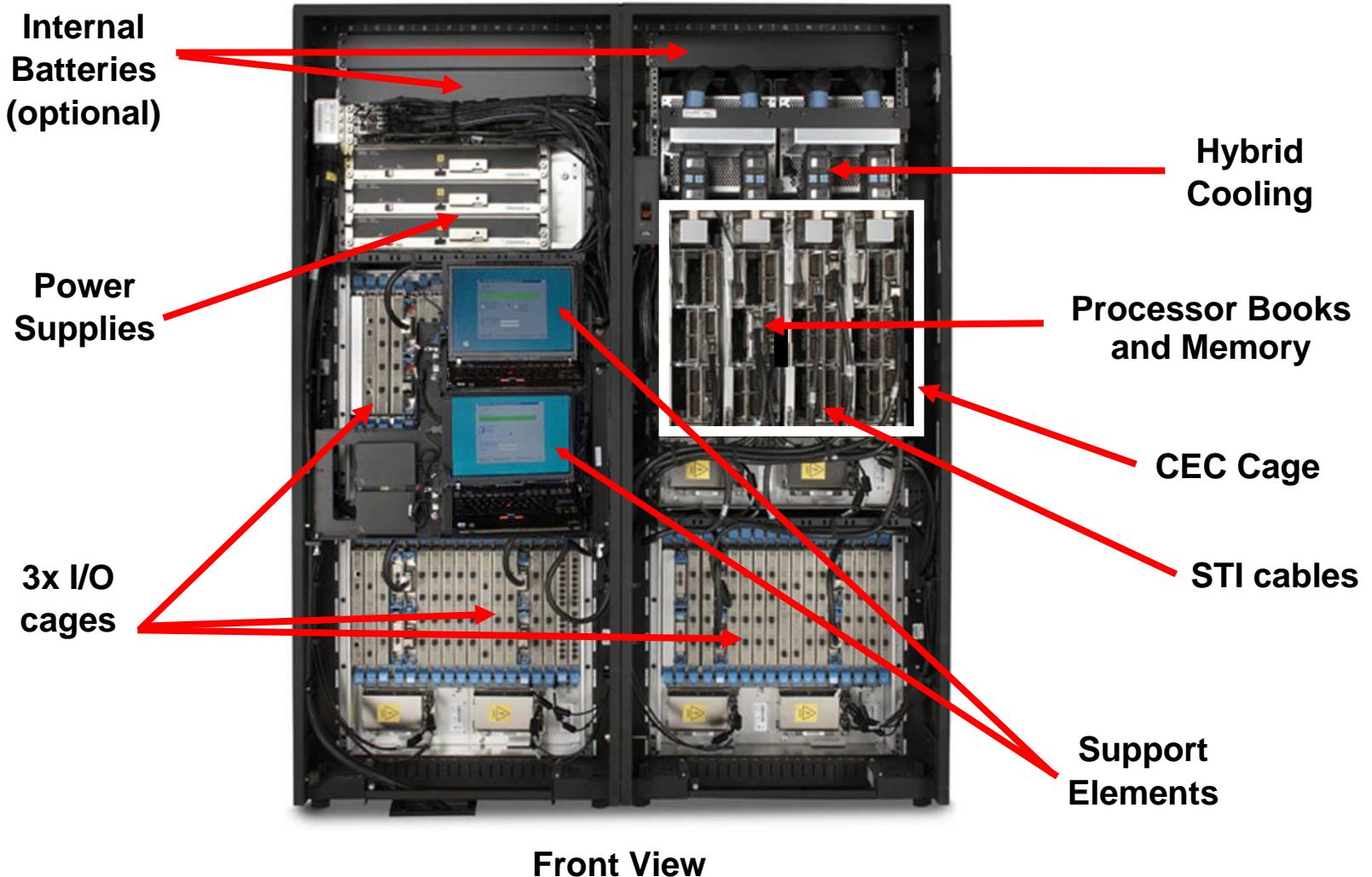
zSeries platform exploitation

Network

ISC | ICB

| Network TCP/IP or SNA |
| WLM |

C F C C

| L | . . . . | L | Apache Web | Web-sphere | OLTP DB2 | Java | DB2 |
| | z/VM | | Linux | Linux | z/OS-VSE | z/OS | z/OS |

PR/SM

| ICF | IFL | CP | ZAAP | ZIIP |

S/390 H/W

March 3, 2006

The Linux Platform

Hardware-dependent Code

GNU C Compiler	**Backend**

< 1%

GNU Binutils	**Backend**

< 1%

Linux Applications

Linux Kernel

GNU runtime environment	**Backend**

< 1%

Architecture independent Code

memory management

process management

network protocols   file systems

generic I/O Driver

S/390 dependent code   arch   arch   **HW dependent Driver**

< 3 % + 8 %

S/390 instruction set and I/O Hardware

Linux on System z9 and zSeries
- Evolution

Enterprise On Demand Computing
- Government
- Infrastructure
- Telco (ISP Access)
- Retail (POS)
- Finance (risk management)
- Banking (portfolio analysis)
- Travel (reservations)
- Media and Entertainment
- Insurance (actuarial)
- Finance (tracing)
- Travel (kiosks)

Application Serving
- Government
- Infrastructure
- Scientific/HPC
- Telco (ISP Access)
- Retail (POS)
- Finance (risk management)
- Banking (portfolio analysis)
- Travel (reservations)
- Media and Entertainment

Static Web Infrastructure
- Government
- Infrastructure
- Telco (ISP Access)
- Retail (POS)
- Finance (risk management)
- Banking (portfolio analysis)

Edge Infrastructure
- Government
- Infrastructure
- Telco (ISP Access)

Industries

Economic Value

Edge Infrastructure:
- Price/Performance
- Lower TCO
- Simplified Systems Management
- Improved Time to Market

Static Web Infrastructure:
- Price/Performance
- Lower TCO
- Simplified Systems Management
- Improved Time to Market

Application Serving:
- Price/Performance
- Lower TCO
- Simplified Systems Management
- Improved Time to Market
- High Reliability
- Open platform/foundation
- Rapid Implementation
- Reusability/flexibility

Enterprise On Demand Computing:
- Price Performance
- Lower TCO
- Simplified Systems Management
- Improved Time to Market
- High Reliability
- Open platform/foundation
- Rapid Implementation
- Reusability/Flexibility
- Better Levels of Service
- Increased IT utilization

Typical Applications
- E-mail Servers
- DHCP
- Apache
- WebLogic
- WebSphere
- Oracle
- e-business applications
- CRM, SCM, ERP
- Enterprise Integration
- Dynamic Business Models

March 3, 2006
z900   z800   z990   z890   z9-109

Linux Market is on Fire!
Linux Server Revenue Growth Continues to Outpace Industry

9th Quarter in a row of $1B in revenue

Worldwide Industry and Linux Server Revenues

(IBM is #1 in Linux server share)
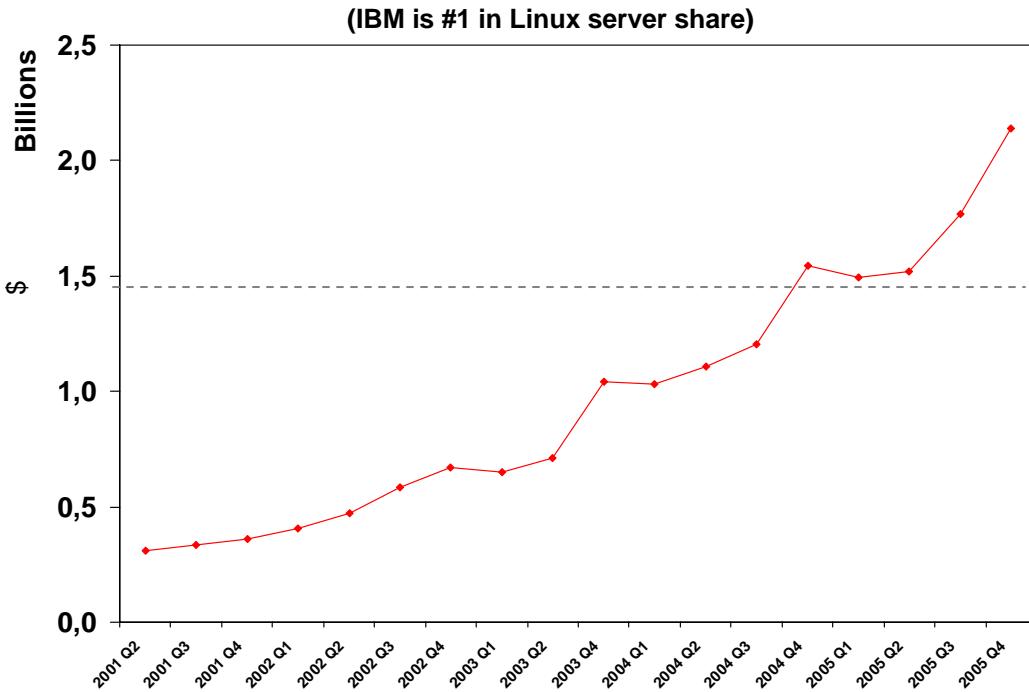
Source: Gartner Quarterly Statistics, Server Market 4Q05

WW Server market (FY2005)			
OS Family	2005 Revenue	Revenue Growth	Unit Growth
Linux	$ 6,916	**35%**	**45%**
Windows	18,619	7%	11%
UNIX	16,251	0%	-4%
Other	9,896	-9%	-26%
	$ 51,683	4%	13%

Source: Gartner Group Q405

Linux growth is
►8X total server Market
►and 5X Windows

4Q04-4Q05
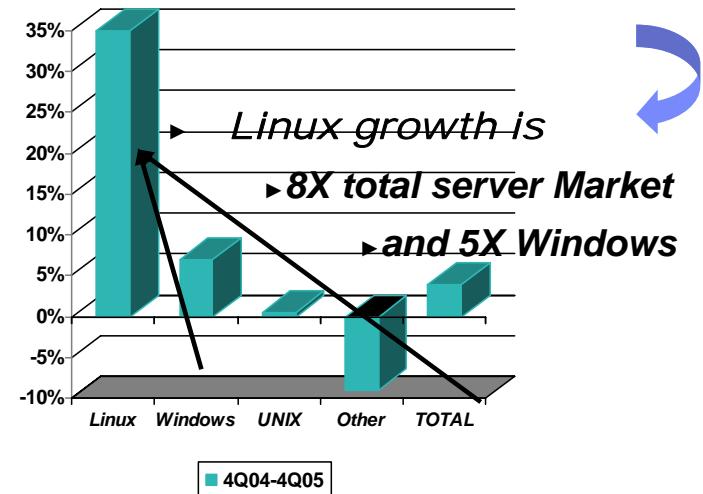
* : On yty basis

Linux is Everywhere

Scalability, Clustering, Systems Management

Enterprise Server

Base Kernel

M	M	M
M	M	M
M	M	M
M	M	M

Architecture-dependent

Base Kernel

M	M	M
M	M	M
M	M	M

Architecture-dependent

Size, RealTime, Device Driver, Input Method

Embedded Systems

Base Kernel

| M | M | M |
| M | M | M |

Architecture-dependent

µClinux –
Derivat des Kernels 2.0,
integriert in Kernel 2.6
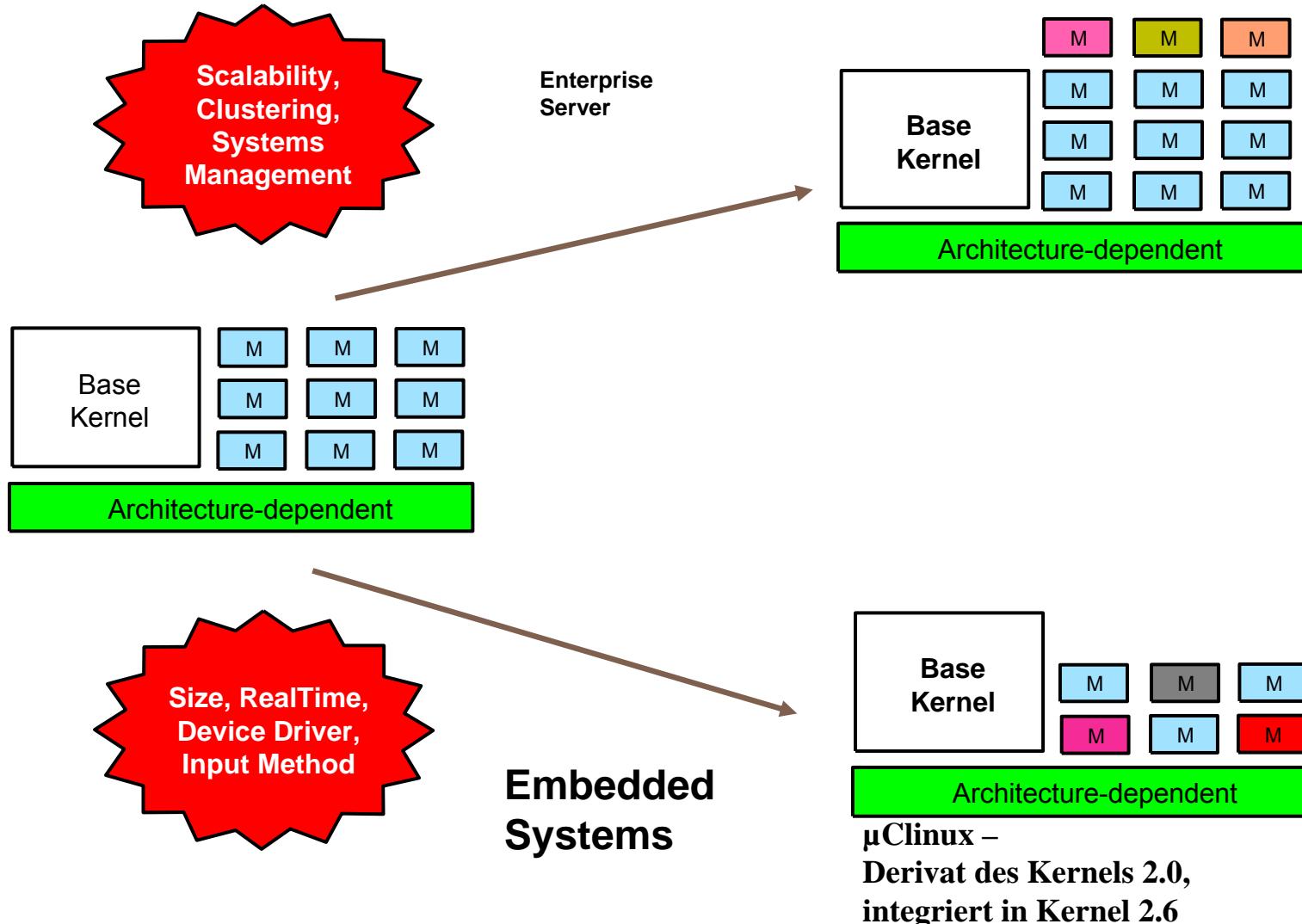
Linux Everywhere

Dreambox
Digital TV-Recorder with IBM PowerPC CPU

Intel Cluster

LinkSys WRT54G Wireless Router
MIPS CPU
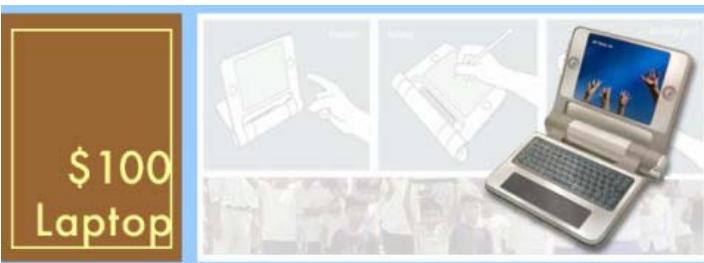
MIT Media Lab
Research Initative to educate the world's children to be distributed through government initatives

$100 Laptop

Motorola Cellphone A760
ARM CPU

The Cell-Processor

100 Billion Neurons
100 Trillian Synapses

Up to 10000 Synapses per Neuron
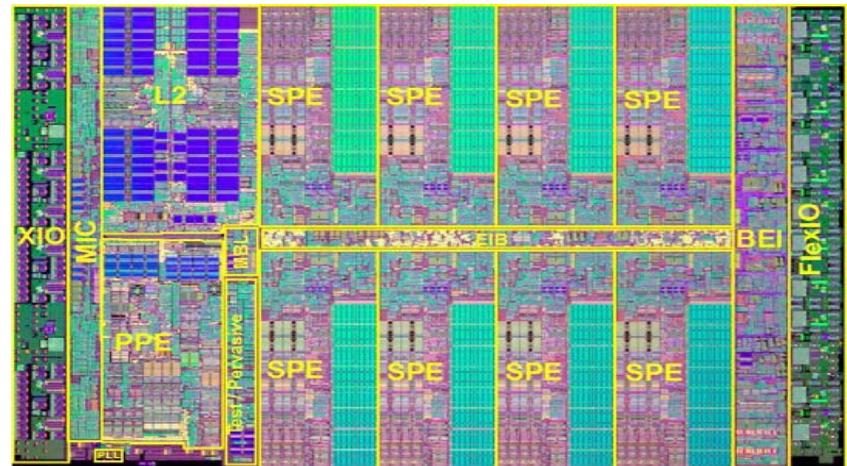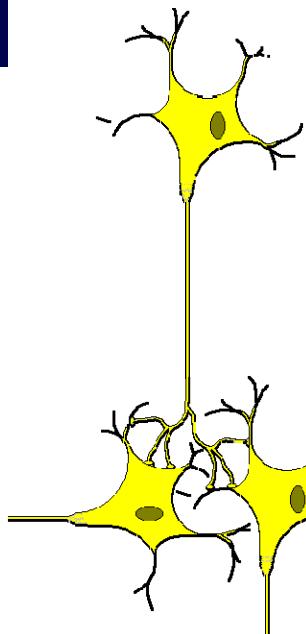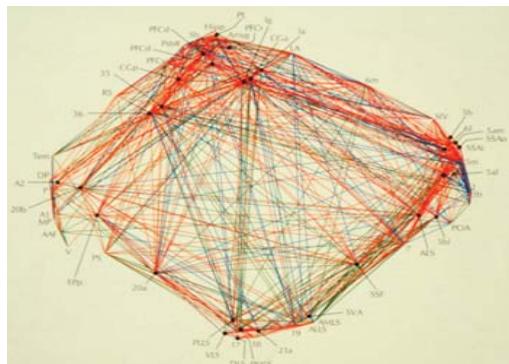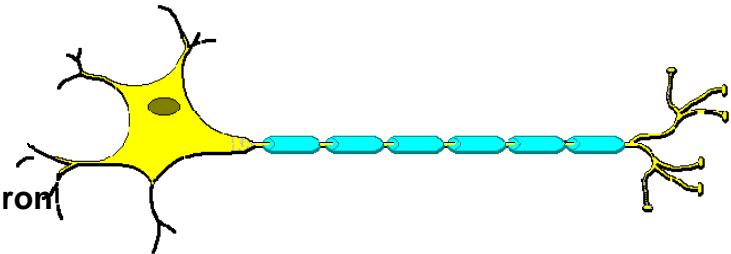
234 Millionen Transistors
3.2 GHz
PowerPC + 8x Synergestic Processor Elements

Linux Support for Cell

- Linux Kernel for Cell   = Power PC 64-Kernel
                              + Cell Architecture Support
                              + SPE Management

- CELL Library Support (Standard API)

- SPE Compiler + Tool Chain (GCC)

- Initial Distribution available
    – Barcelona Supercomputing Center (BSC)

- Cell SDK 1.0 (alphaworks.ibm.com)
    + Dokumentation
    + Simulator
    + XLC Compiler von IBM

- **Cell support officially included into Linux Mainstream 2.6.16**
    – **March 20.06**

Application Areas with Cell Affinity

- **Home Computer Entertainment**
  - Game consoles, home servers, media boxes, …
- **Medical imaging, radar imaging, …**
- **Simulation**
- **High performance computing**
  - Life sciences, seismic, and a few others fit well; broader Cell-based HPC needs Research
- **Video surveillance**
- **Online gaming**
  - Backend servers
- **Digital media – content mgmt & delivery**
  - Backend servers for content providers
- **Digital media – production**
  - Render farms, …

Linux and the OpenSource Culture

Established development process:

→ Cathedral Style
→ Business case driven
→ Closed target driven development
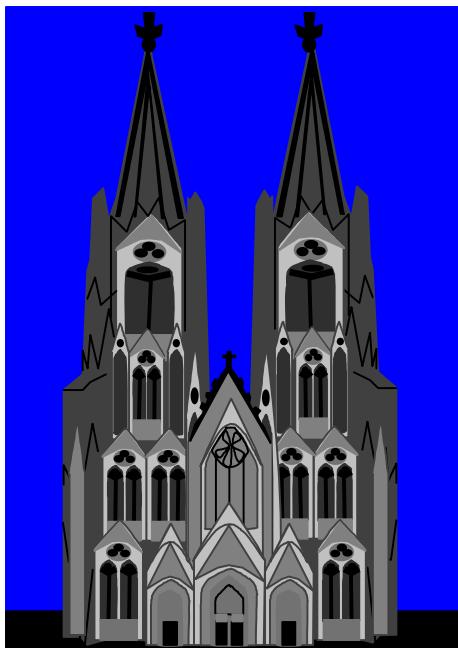
A different culture: Bazaar

→ flexible (re-) organization
→ dynamic processes
→ contents always up-to-date
→ all tasks in parallel
→ no idling
→ designed by participants
→ **Freedom for innovation**

Merge of two cultures

Open Source Development Culture
Maximizes Creativity and Innovation

- Rigid Selfcontrol

- Kernel 2.6 close to be perfect

- Less maybe more!

Uncontrolled Diversifikation would lead to distruction

Business oriented integration culture

- Values Open Source development results

- Creates Business based on Open Source - Components

- Red Hat, Novell SUSE, Debian

- Solution Integrators und Users

The Merge of both Cultures means Success

LiSoG a Catalyst

LiSoG Objectives

Promotes and expands Linux based Business Solutions through an Open Community of:

- Leading IT Companies and their Business Partners
- Small Open Source Development Groups
- Small and medium Business Customers
- Towns, regional and national Governments
- Scientific Partners

Thru

- Creating trust in the industry and the public sector
- Networking on „Linux Based Opportunities"
- Exchange of Best-Practices
- Exploiting Hardware Independence

LiSoG Eco-System
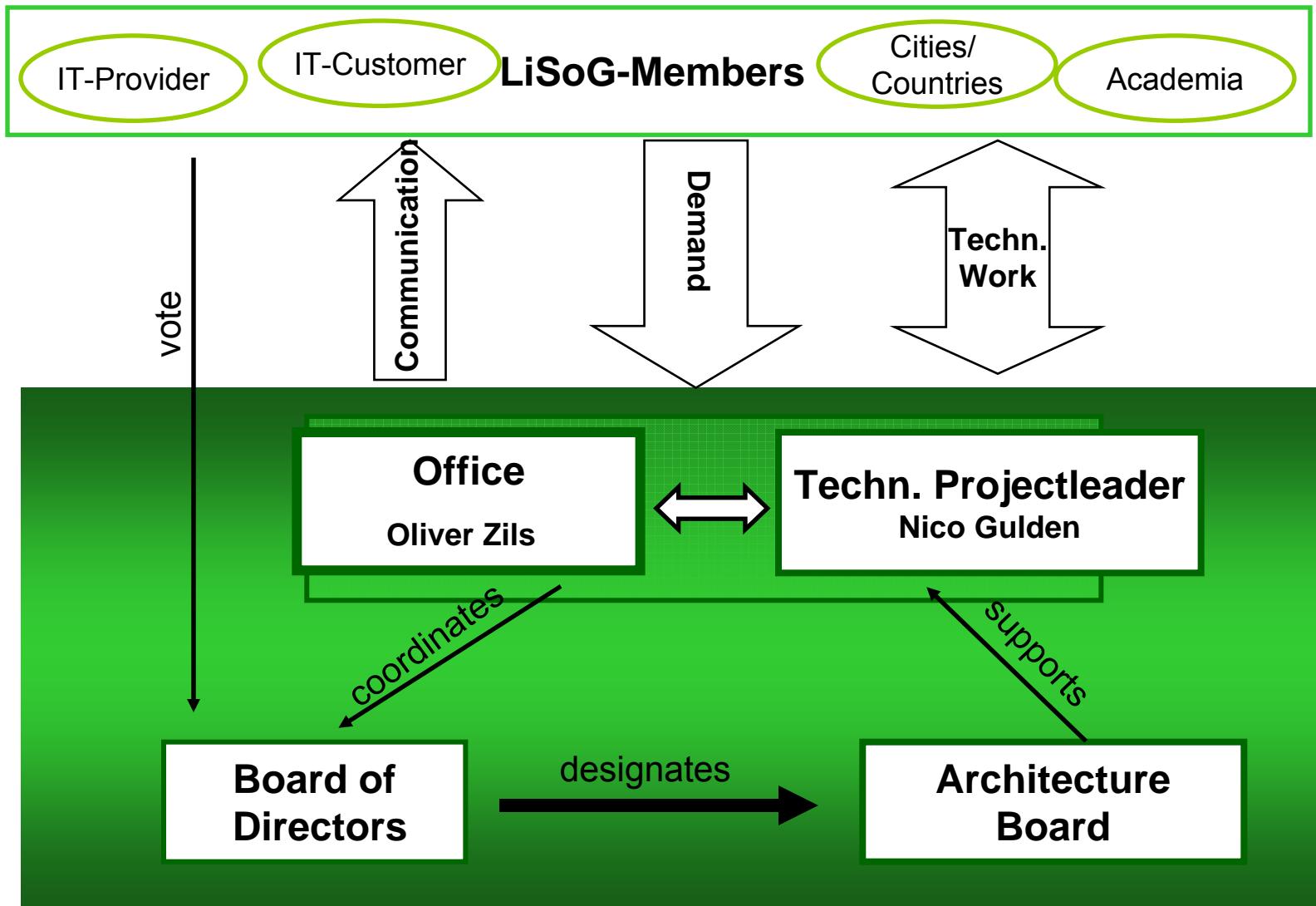
Mode of Operation of the LiSoG association

-Business Models
- Marketing
- GPL/Licensing

Networking & Experinece exchange
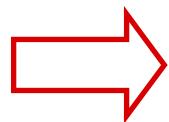
Szenarios & Solution Stacks

- Architectureboard
- Selects
- Reviews
- Recommends enhancements

Solutions & Best Practice
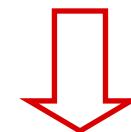
Cooperation
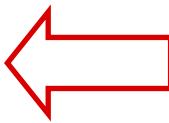
- Public Sector
- Finance
- KMUs

→ regular Events

-Innovative enhancements

-Bounties

LiSoG_Network

LiSoG-Member Structure

- 29 founding members
- Today 50 members

→ **65% growth rate**

- 24 IT-Vendors
- 14 Application Developers
- 6 Scientific Partners
- 3 Towns
- 6 Members in Swizerland
- Austrian daughter being established

www.lisog.org

Members