Linux for S/390

Linux is a registered trademark of Linus Torvalds

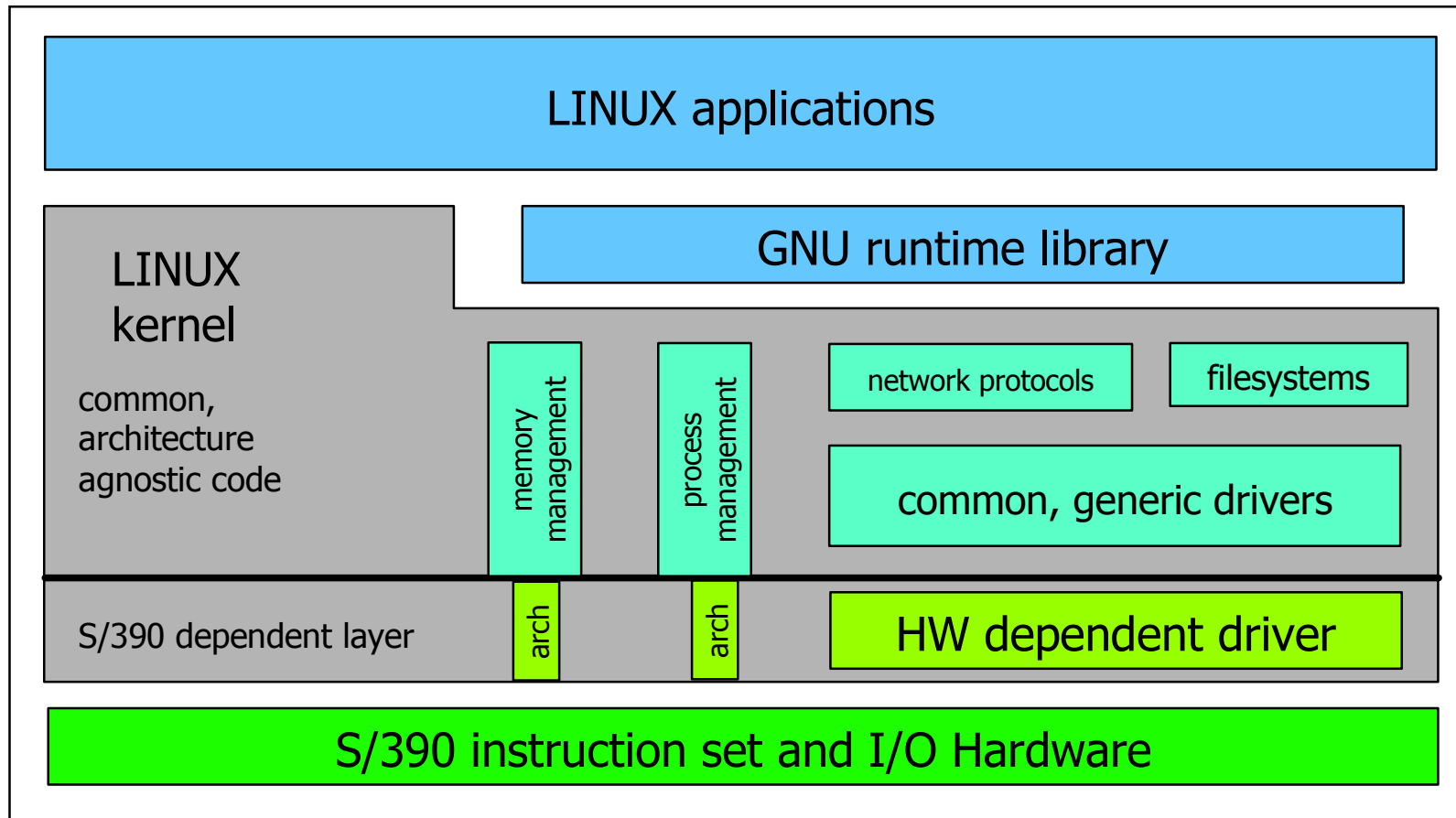**S/390 is a registered trademark of the IBM Corporation**

What is Linux ?

- **Popular UNIX-like operating system**

- **Developed by Linus Torvalds in 1991**

- **Developed & tested by Open Source community communicating via Internet**

- **Open Source Software distributed under terms of the GNU Public License (GPL)**

- **Packaged and distributed by distributors which offer support (SuSE, RedHat, Caldera, Turbo Linux, et. al.)**
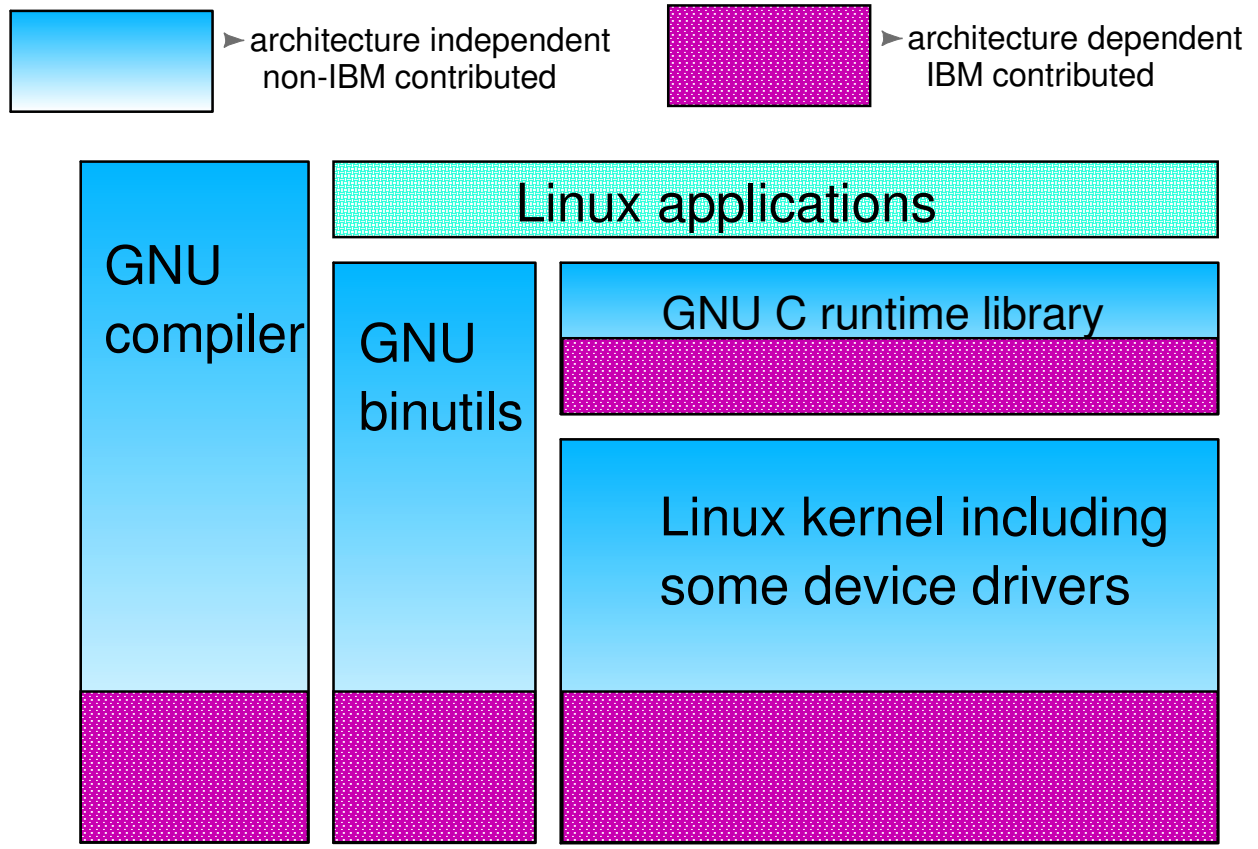
Linux for S/390 structure

LINUX applications				

LINUX kernel		GNU runtime library		
common, architecture agnostic code	memory management	process management	network protocols	filesystems
			common, generic drivers	

S/390 dependent layer	arch	arch	HW dependent driver

S/390 instruction set and I/O Hardware

Linux - modular and highly portable

Linux for S/390 block structure

architecture independent
non-IBM contributed

architecture dependent
IBM contributed

Linux applications

GNU compiler

GNU binutils

GNU C runtime library

Linux kernel including some device drivers

The look and feel of Linux does not change on S/390

More about Linux

- **Rapidly Growing Market**

- **IDC estimates 5 - 7 million users not exclusively on Intel systems**

- **Server sales 700k units in 1998 nearly a threefold increase over 1997**

- **Netcraft estimates 58% of Web Servers Run Open Source Operating Systems**

- **IBM supports the Linux Platform in response to customer demand**

- **IBM provides complete e-business solutions which include hardware, software & support for Linux**

Linux for S/390: a brief history

- **November, 1999**

  - IBM makes Statement of Interoperability for S/390 Operating Systems and Linux on other hardware platforms

- **December, 1999**

  - IBM releases code modifications to Open Source which enable Linux to run on S/390 Hardware
  - IBM begins Joint Project with Customers and internal sites using Linux for S/390
  - Customers world wide download Linux for S/390 from the Internet and begin experimenting

- **February 2000**

  - IBM shows Linux for S/390 at Linux World events in New York and Paris
  - Linus Torvalds mentions significance of S/390 platform in keynote address

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Interesting facts about Linux for S/390

- **Marist College Linux for S/390 Website - over 20,000 hits**

- **Over 1,100 downloads of Linux for S/390**
  - Over 200 unique, identifiable businesses

- **number of participants in Marist College Linux for S/390 discussion group quadruples since December release to Open Source**

- **Download sites for Linux for S/390 established in Europe and USA**

- **One website boasts over 400 packages and applications compiled for Linux for S/390**

- **Early users contributing press articles on Linux for S/390**
  - Scott Courtney - LinuxToday - "S/390: The Linux Dream Machine"

Linux for S/390 - Who's interested ?

- EDS
- Fujitsu
- Motorola
- US Environmental Protection Agency
- Computer Sciences Corp.
- Towers Perrin
- Thinking Objects Software
- El Camino Resources
- Comparex InformationSystems (Germany)
- Sterling Software
- Hitachi Data Systems
- Amdahl
- Supervalu

- EMC
- Cisco
- Thiokol
- Timken Co.
- Ingram Entertainment
- Ameritech
- Bell Atlantic
- Nortel Networks
- Attachmate
- Deutsche Telekom
- Nationwide Insurance
- U.S. Department of Energy
- Oklahoma Department of Corrections
- and others...

Linux for S/390 - Tools and applications examples

- **Apache**
- **Samba**
- **Perl**
- **THE (editor, a clone of xedit)**
- **Regina (REXX for Linux)**
- **OpenLDAP**
- **Xwindows**
- **KaffeJVM**
- **IMAP**
- **SendMail**
- **Bind**

Linux for S/390
What does Linux bring to S/390 ?

- Applications
    - Large selection
    - Rapid deployment

- Skills
    - Large numbers of highly skilled programmers familiar with Linux
    - Strong interest in colleges and universities

- Vendor enthusiasm
    - Major ISV / USV efforts for Linux

- Implementor enthusiasm
   - emerging interest in large datacenters

Linux for S/390
Why run Linux on a S/390 ?

- Reliability
  - The most reliable hardware platform available. Period.
  - Over 35 years of constant improvements

- Scalability
  - 15 Linux images possible on native hardware
  - Virtually unlimited Linux images possible with VM/ESA

- Manageability
  - Centralized Linux systems easier to manage / duplicate
  - Use management functions from S/390 operating systems for Linux
  - (e.g. backup, autostart, etc.)

S/390 Linux advantage

Appl A	Appl B	Appl C
LINUX	LINUX	LINUX

S/390 Apps	LINUX Apps	LINUX Apps	UNIX Apps
S/390			
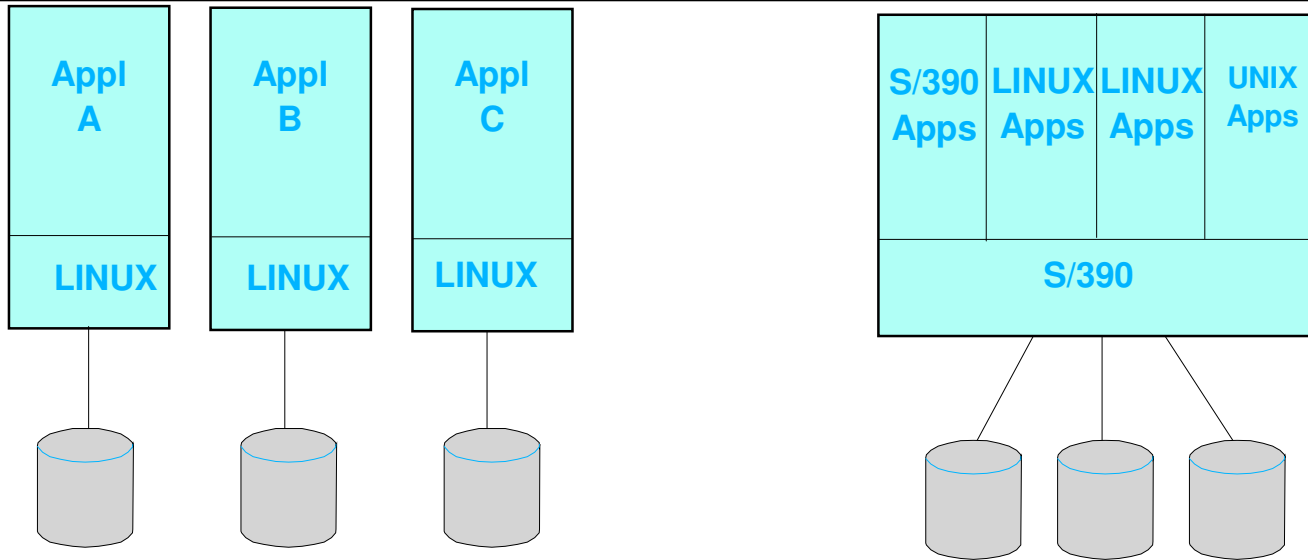
- Single application per server
- Separate/partitioned data bases
- Complex system management
- Complex to integrate applications

- Support for diverse work loads
- Multiple applications per server
- Databases shared with integrity
- Less complex system management
- Interoperability and integration between applications

S/390 hardware value
for Linux environments

- Industry leading reliability, availability, and serviceability
  - Mean time between failure over 60 years
  - Transparent CPU sparing
  - Error detection and correction
    - Memory chip sparing
  - Remote Support Facility (RSF)
    - Download microcode fixes and updates
    - Concurrent microcode updates
    - "Phone home"
  - And much more.....

- Designed to support mixed work loads
  - Processor Resource System Manager (PR/SM)
  - Ability to scale from small to very large processor configurations
  - Multiple images for consolidation
  - Complete work load isolation
  - Eliminate network latency
  - ESCON Multiple Image Facility (EMIF)
  - Highly efficient memory management

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Configuration requirements for native implementation

- Processors
  - G3 - G6
  - Multiprise 2000
  - Multiprise 3000
  - 64MB central storage minimum available for S/390 Linux environment
- Devices
  - DASD support via ECKD driver
    - One 3380 / 3390 / Multiprise Internal Disk volume required
  - Console support (select one, must be available for duration of test)
    - Hardware Management Console
    - 3215 console on coax attached 3174
    - 3215 console on emulated 3174
  - Network support via ESCON CTC or OSA-2 driver (Ethernet or Token Ring)
  - Workstation with CD-ROM for installation (optional)
- Connectivity
  - Access to the Internet to download code and other deliverables

Configuration requirements for VM/ESA Guest implementation

- Processors
  - G3 - G6
  - Multiprise 2000
  - Multiprise 3000
  - 64MB storage minimum available for S/390 Linux environment
- VM/ESA Software
  - VM/ESA Release 2.2 or higher
- Devices
  - DASD support via ECKD driver
    - One dedicated 3380 / 3390 / Multiprise Internal Disk volume required
                        or
    - One 500 cylinder minidisk

  - Console support (choose one, must be available for duration of test)
    - Hardware Management Console
    - 3215 console on coax attached 3174
    - 3215 console on emulated 3174

  - Network support via ESCON CTC or OSA-2 driver (Ethernet or Token Ring)
  - Workstation with CD-ROM for installation (optional)
- Connectivity
  - Access to the Internet to download code and other deliverables

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Linux for S/390 Value Add for VM, VSE and TPF customers

- An alternate application platform for VM, VSE, and TPF customers
  - Linux offers a growing set of server and middleware products not available on VM, VSE, and TPF (e.g., Domino, WebSphere, MQ Server)
  - Linux offers richer Java and UNIX environments
- Linux can surround VM, VSE, and TPF systems without introducing other server platform(s)
  - Promoting exploitation of existing VM, VSE, and TPF applications while opening the door to new technology Linux applications
  - Cost Savings from server consolidation and system administration
  - Accessing VM, VSE, OS/390, and TPF data and applications without requiring network traffic (virtual CTC and IUCV)
- Linux products from IBM and ISVs will be functionally richer than their less dynamic counterparts (e.g., DB2 UDB)

VM/ESA Hypervisor Utility Value Checklist

	OS/390	VSE	TPF	Linux
Performance				
Virtual Disks in Storage		✓		✓
Minidisk cache	✓	✓	✓	✓
DB2 Guest Sharing (S/390 Dataspace exploitaiton)		✓		
High-performance virtual machine networking	✓	✓	✓	✓
N-way processor exploitation	✓	✓	✓	✓
Page fault handshaking		✓		
Transparent S/390 architecture exploitation (native code not req'd)	✓	✓	✓	✓
Fastpath CCW support	✓	✓	✓	
Productivity				
Temporary Disks (TDISK)		✓		✓
Resource simulation and virtualization	✓	✓	✓	✓
Complex environment testing without duplicating real hardware	✓	✓	✓	✓
Virtual processor support for SMP testing	✓	✓	✓	✓
Resource sharing (DASD, printers, I/O, memory, processors, etc.)	✓	✓	✓	✓
PVMG support for VSE VTAM sessions	✓	✓	✓	
Device-independent I/O support				✓
Guest Coupling Facility	✓		✓	
RAS				
S/390 error recovery (processors, I/O, etc)	✓	✓	✓	✓
Dynamic multi-image support for scaleability, hot backup, debug, etc	✓	✓	✓	✓
Operations				
Virtual machine controls, scheduling and automation	✓	✓	✓	✓
Performance measurement, reporting and management	✓	✓	✓	✓
Rapid creation and deletion of guest images	✓	✓	✓	✓
IPL from a VM saved segment	✓	✓	✓	✓
Dynamic I/O reconfiguration, CP Sparing, FICON	✓	✓	✓	✓

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Some important websites and contacts for Linux for S/390

IBM developerWorks website with Linux for S/390 modifications
http://oss.software.ibm.com/developerworks/opensource/linux390/index.html

Marist College Linux for S/390 Download site
http://linux390.marist.edu

Marist College Linux for S/390 discussion group

Listserv@vm.marist.edu
send note with body SUBSCRIBE LINUX-VM your name

Princeton University Linux for S/390 site - compiled tools / applications

http://penguinvm.princeton.edu/

Thinking Objects Linux for S/390 site - over 400 compiled tools / applications
http://linux.s390.org