Linux on System z

What's New
for Linux on System z?

Martin Schwidefsky (schwidefsky@de.ibm.com)
Linux on System z Development
IBM Lab Boeblingen, Germany

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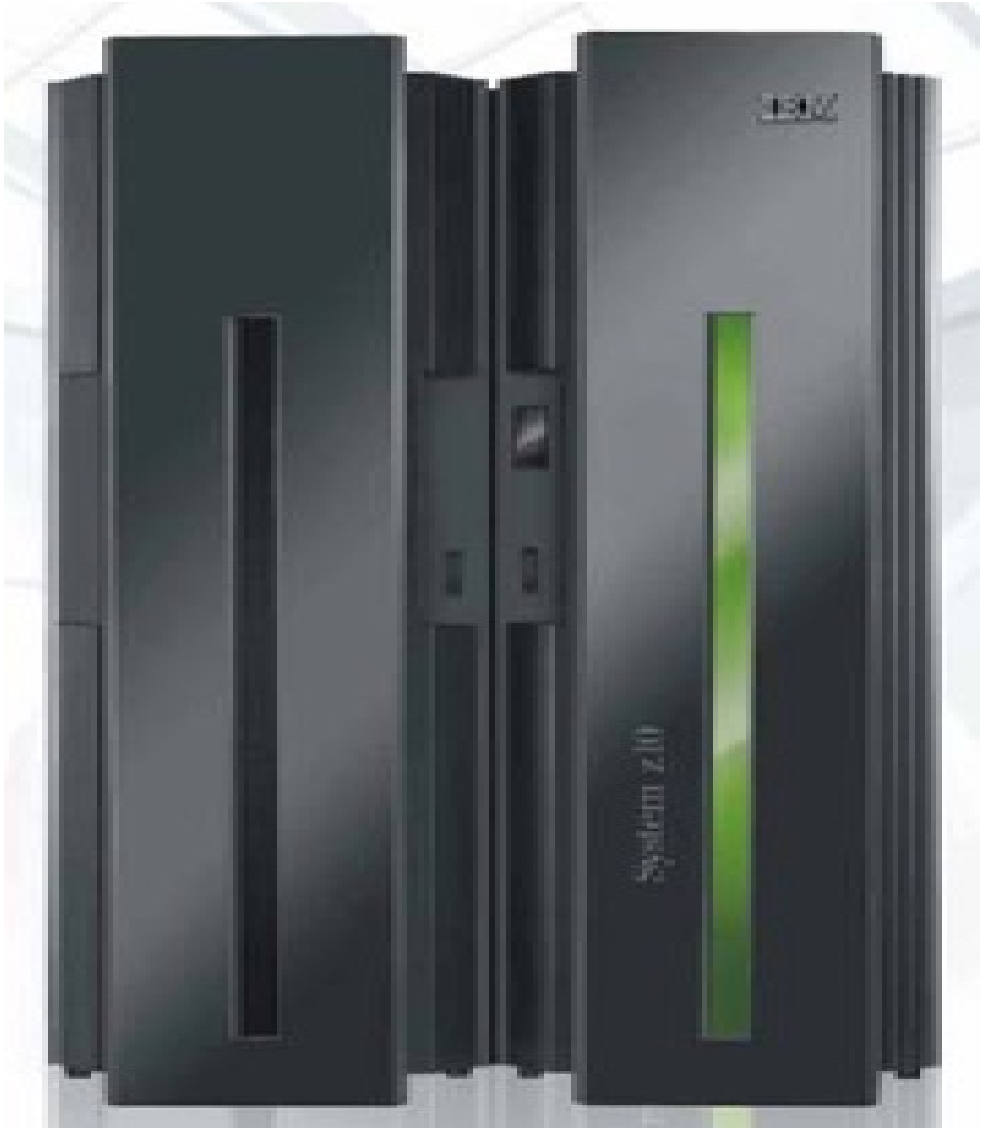


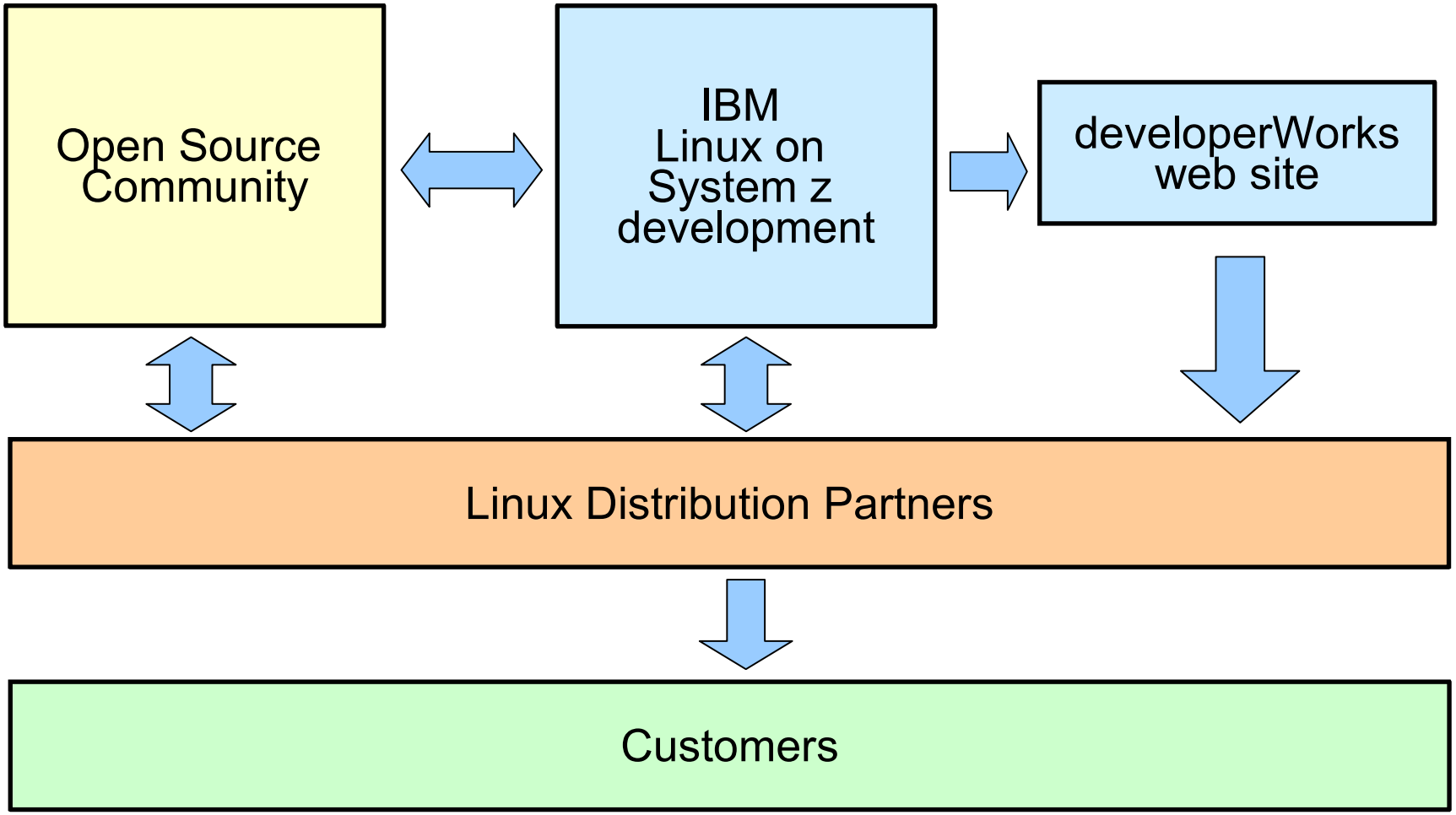
Agenda

- Distributor Support
- Open Source Contributions
- Linux Kernel News
- What's new on System z

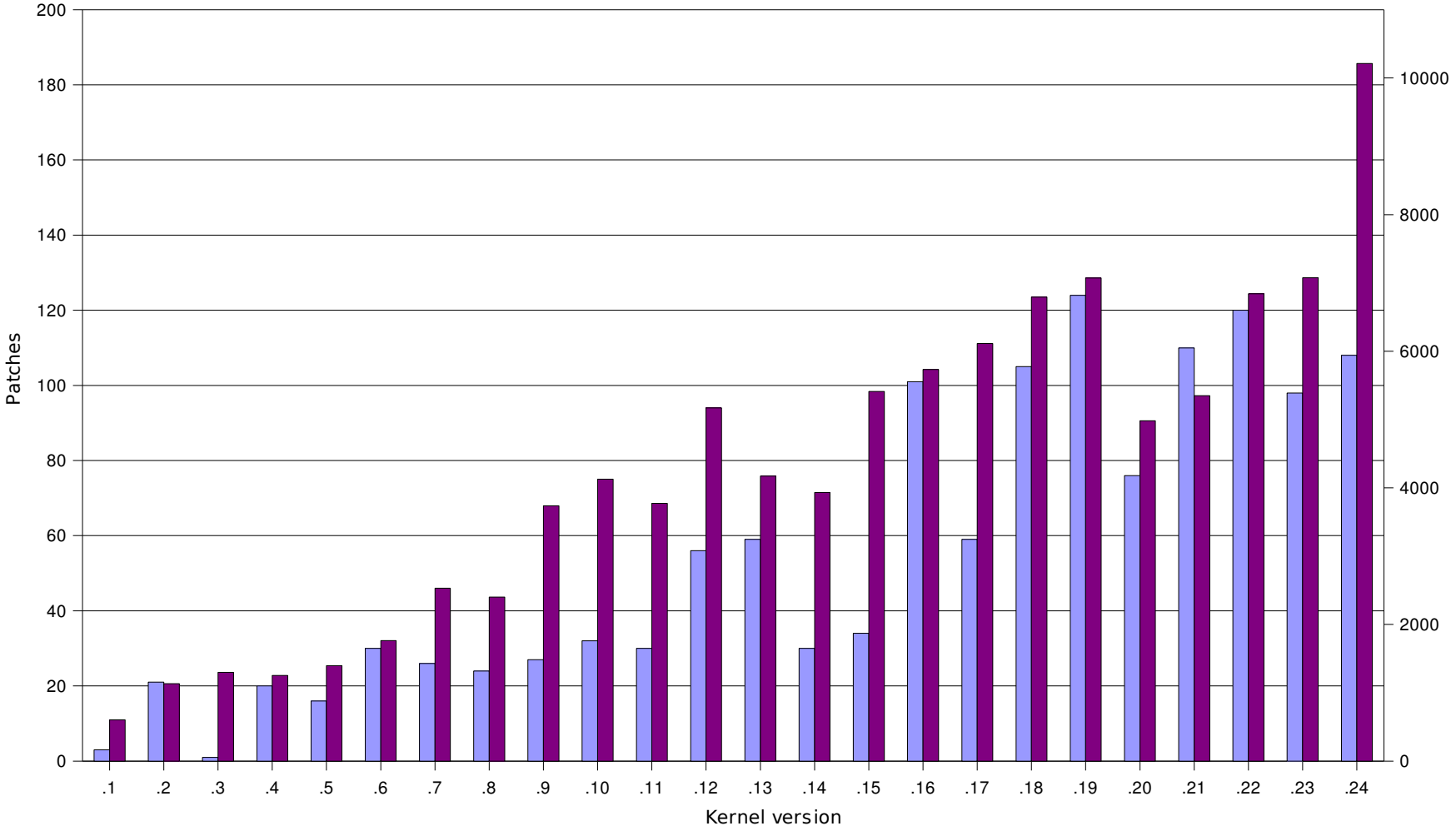
Linux on System z distributions (Kernel 2.6 based)

- **SUSE Linux Enterprise Server 9 (GA 08/2004)**
  - Kernel 2.6.5, GCC 3.3.3
  - Service Pack 4 (GA 12/2007)
- **SUSE Linux Enterprise Server 10 (GA 07/2006)**
  - Kernel 2.6.16, GCC 4.1.0
  - Service Pack 1 (GA 06/2007)
- **Red Hat Enterprise Linux AS 4 (GA 02/2005)**
  - Kernel 2.6.9, GCC 3.4.3
  - Update 5 (GA 05/2007)
- **Red Hat Enterprise Linux AS 5 (GA 03/2007)**
  - Kernel 2.6.18, GCC 4.1.0
  - Update 1 (GA 11/2007)
- **Others**
  - Debian, Slackware, ...
  - Support may be available by some third party

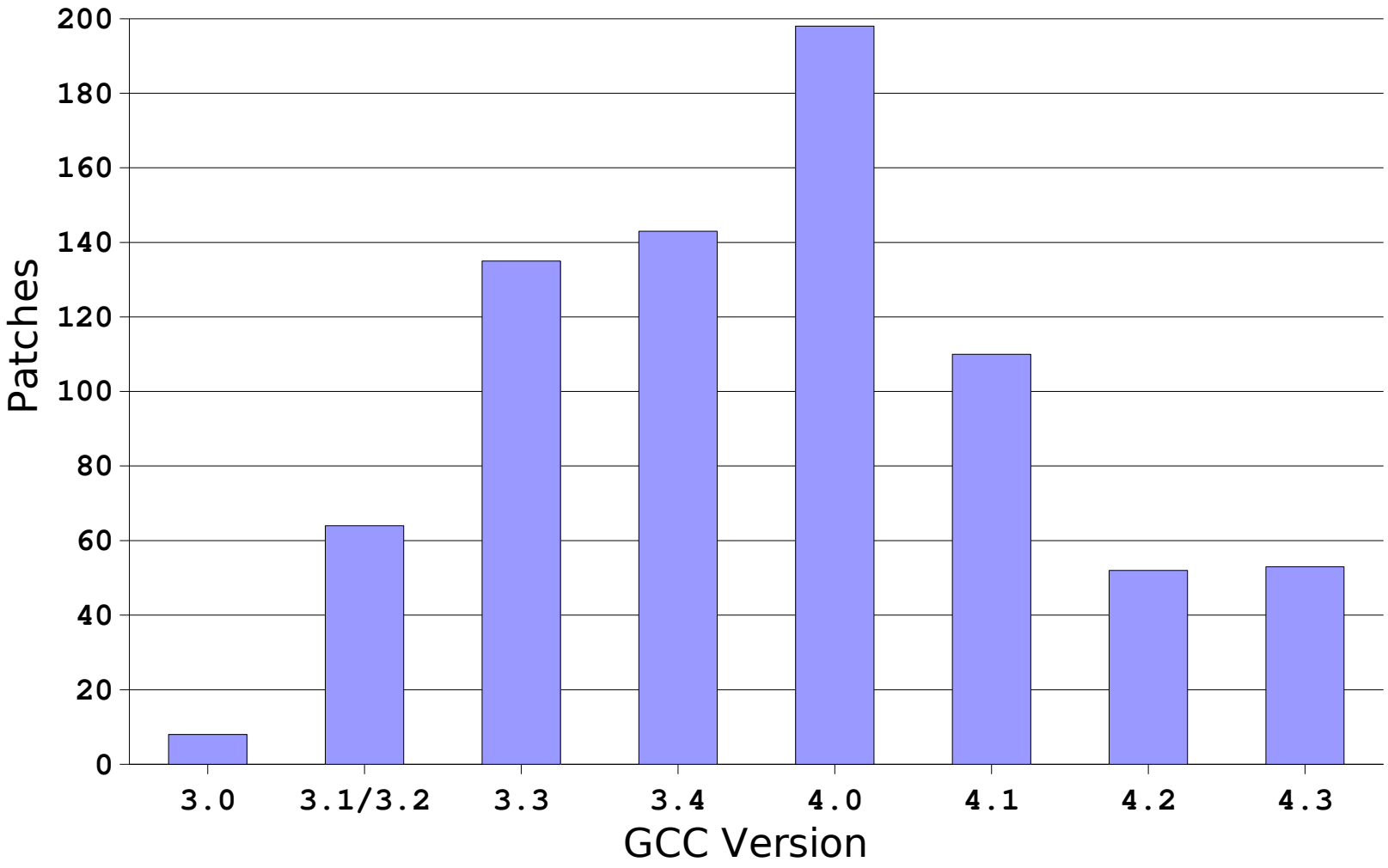
Linux on System z development process



Linux kernel – System z contributions



GNU Compiler Collection – System z contributions



Kernel news – Common code

- Linux version 2.6.19 (2006-11-29)
  - New file systems: GFS2, Ext4, ecryptfs
  - RCU enhancements (sleepable RCU)
  - Vectored AIO support
  - Namespaces for IPC and UTS
- Linux version 2.6.20 (2007-02-04)
  - Kernel Virtual Machine (KVM)
  - Asynchronous SCSI scanning
  - I/O Accounting
  - Relative atime support
  - Bus event notifications

Kernel news – Common code

- Linux version 2.6.21 (2007-04-25)
  - KVM updates
  - Dynticks and Clockevents
  - Dynamic kernel command-line
  - Optional ZONE_DMA
  - GPIO API
- Linux version 2.6.22 (2007-07-08)
  - SLUB in kernel memory allocator
  - Signal/timer events through file descriptors
  - Unsorted Block Images (UBI)
  - Secure RxRPC sockets
  - Process footprint measurement facility

Kernel news – Common code

- Linux version 2.6.23 (2007-10-09)
  - Completely Fair Scheduler (CFS)
  - On-demand read-ahead (readahead trashing x3)
  - fallocate system call to preallocate space in a file system
  - Variable argument length (no more "arg list too long")
  - Movable Memory Zone
  - Use splice for sendfile
- Linux version 2.6.24 (2008-01-24)
  - CFS improvements: performance, fair group scheduling, guest time
  - Anti-fragmentation patches
  - Per-device dirty memory thresholds
  - PID and network namespaces
  - Task Control Groups
  - Read-only bind mounts

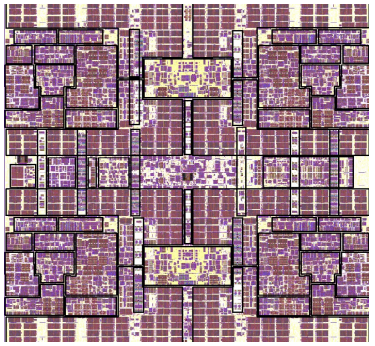
Kernel directions

- Diversity: now 24 architectures (blackfin +1 unification -2)
- Bigger servers (large SGI machines, Mainframes, ...)
- Embedded systems, real-time (Cell-phones, PDAs)
- Appliances (network router, digital video recorder)
- Virtualization (KVM, paravirt, XEN), stronger than ever

- **Linux is Linux, but**
  - Features, properties and quality differ dependent on your platform

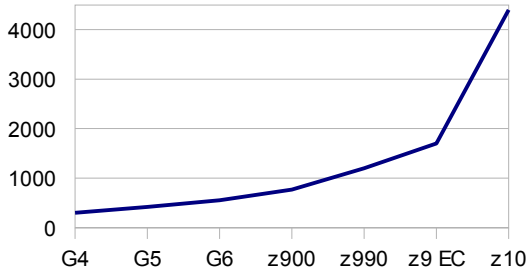
System z kernel features – CPU

- **New hardware support – System z10**
  - CPU node affinity (> 2.6.24, DW 1Q08)
  - Vertical CPU management (> 2.6.24, DW 1Q08)
  - STSI changes for capacity provisioning (> 2.6.24, DW 1Q08)
- **Dynamic configuration**
  - Standby CPU activation / deactivation (> 2.6.24, DW 1Q08)
- **User space tooling**
  - Dynamic CPU hotplug daemon (user space, DW 1Q08)
  - Support for processor degradation (in 2.6.22, DW 4Q07)



System z kernel features – Performance

- **New hardware support – System z10 processor**
  - Large page support (> 2.6.24, DW 1Q08)
- **DASD performance**
  - Hyper PAV enablement (> 2.6.24, DW 1Q08)
  - 4G FICON Express support for DASD (test only, no DW)
- **Network performance**
  - Support for skb scatter-gather (in 2.6.23, DW 4Q07)
- **FCP performance**
  - FCP performance data collection: I/O statistics (> 2.6.24, DW 4Q07)
  - FCP performance data collection: adapter statistics (> 2.6.24, DW 1Q08)
  - FCP performance enhancements: qdio rate improvement. (test only, no DW)
- 4G FICON Express support for FCP (test only, no DW)



System z kernel features – Security

- **New hardware support – System z10 processor**
  - Support user-space AES 192/256, SHA 384/512 (> 2.6.24, DW 1Q08)
  - Support in-kernel AES 192/256, SHA 384/512 (> 2.6.24, DW 1Q08)
- **Generic algorithm fallback**
  - Use software for key lengths not supported by hardware (> 2.6.24, no DW)
- **Crypto driver**
  - Support for long random numbers (> 2.6.24, DW 1Q08)
  - Capability for dynamic crypto device add (in 2.6.19, no DW)

System z kernel features – z/VM and networking

- **z/VM APPLDATA enhancements**
  - Linux process data in monitor APPLDATA (user space, DW 4Q07)
- **z/VM integration**
  - Unit record device driver (in 2.6.22, DW 4Q07)
  - IUCV access to z/VM services (user space netcat, no DW)

- **QETH network driver**
  - HiperSockets MAC layer routing (> 2.6.24, DW 4Q07)
  - QETH componentization (> 2.6.24, DW 4Q07)
  - OSA 2 Port per CHPID support

System z kernel features – Usability and RAS

- **IPL**
  - IPL through IFCC / multipath IPL (s390-tools, DW 1Q08)
  - Shutdown actions interface (> 2.6.24, DW 1Q08)
  - Linux system loader (user space, DW 1Q08)
- **System dump**
  - Intuitive dump device configuration (user space, no DW)
  - Cleanup SCSI dumper for upstream integration (in 2.6.23, no DW)
- **DASD sense data**
  - SIM/MIM handling for ECKD DASD (> 2.6.24, DW 1Q08)
- **Channel subsystem**
  - Dynamic CHPID reconfiguration via SCLP (in 2.6.22, DW 4Q07)

Compiler – Common features

- **General optimizer improvements**
  - SSA-based common optimization infrastructure (GCC 4.0)
  - Inter-procedural optimization infrastructure (GCC 4.1)
  - New data flow analyzer framework (GCC 4.3)
- **Languages and language features**
  - Fortran 95 front end (GCC 4.0)
  - Decimal Floating Point support (GCC 4.2)
  - OpenMP support for C/C++/Fortran (GCC 4.2)
- **Other improvements**
  - Stack Protector feature (GCC 4.1)
  - Builtins for atomic operations (GCC 4.1)

Compiler – System z machine support

- **System z10 processor support (> GCC 4.3)**
  - Exploit instruction new to z10
  - Selected via `-march=z10` / `-mtune=z10`
- **System z9 109 processor support (GCC 4.1)**
  - Exploit instructions provided by the e*xtended immediate facility*
  - Selected via `-march=z9-109` / `-mtune=z9-109`
- **Support for 128-bit IEEE quad "long double" data type (GCC 4.1)**
  - Provide extended range of floating point exponent and mantissa
  - Selected via `-mlong-double-128`
- **Support for atomic builtins**
  - __builtin_compare_and_swap and friends
- **Decimal floating point support (GCC 4.3)**
  - For newer machines with hardware DFP support

Compiler – System z features

- **Software dfp support (GCC 4.2)**
  - For older machines without hardware DFP support
- **Kernel stack overflow avoidance/detection (GCC 4.0)**
  - Compile time detection: `-mwarn-framesize` / `-mwarn-dynamicstack`
  - Run-time detection: `-mstack-size` / `-mstack-guard`
  - Stack frame size reduction: `-mpacked-stack`
- **GCC support for the z/TPF OS (GCC 4.0/4.1)**
  - z/TPF uses Linux / GCC as cross-build environment
  - New target `s390x-ibm-tpf`
- **64 bit registers for 31 bit applications (> GCC 4.3)**
  - Work in progress

Compiler – System z performance

- **Compiler back-end improvements**
  - Improved condition code handling (GCC 4.0)
  - Improved function prologue/epilogue scheduling (GCC 4.0)
  - Improved use of memory-to-memory instructions (GCC 4.0)
  - Added sibling call support (GCC 4.0)
  - Enhanced use of string instructions (SRST, MVST, ...) (GCC 4.1)
  - More precise register tracking (r13, r6, ...) (GCC 4.1)
  - Use LOAD ZERO (GCC 4.1)
  - ICM/STCM, BRCT, vararg enhancements (GCC 4.1)
  - More small optimizations / improvements (GCC 4.3)
- **Overall performance enhancement 14.4% on z9**
  - Industry-standard integer performance benchmark
  - 8% comparing GCC 3.4 and GCC 4.1 on System z
  - 5.9% comparing GCC 4.1 and GCC 4.2
  - 0.5% comparing GCC 4.2 and GCC 4.3

Outlook

- New hardware exploitation
- Enhanced Linux – z/VM synergy
- Basic support for KVM virtualization
- Keep current with open source

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