Hercules: The MVS/380 Project

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Agenda

- What is Hercules, anyway?
- New in Hercules 3.06
- Large real storage support
- MVS 3.8J review
- MVS 3.8J limitations
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- Hercules S/380 architecture
- Getting MVS/380
- Running MVS/380
- VM/380
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- What's coming

What is Hercules, anyway?

- Emulates the hardware of an IBM mainframe computer
- System/370, ESA/390, z/Architecture CPUs
- Most commonly needed peripherals
- Runs on Windows 2000 and above, Linux, Mac OS X, BSDs, Solaris
- Written in portable C
- Hardware emulation only
- True Open Source software, freely available and redistributable

What is Hercules, anyway? continued

- Device emulations
  - DASD
  - Tape
  - Card reader/punch
  - Line printer
  - CTCA/LCS
  - Terminal
  - BSC communications line
  - Beta: 3705, 2703 TTY, 3211 FCB
- What it can't emulate
  - Undocumented hardware: sysplex
  - No hardware to test: 3800, real channels

What is Hercules, anyway? continued

- OS compatibility
  - Public domain OSes
    - OS/360
    - MVS 3.8J
    - VM/370 release 6
    - DOS/VS release 34
    - TSS/370 release 3
  - Linux
    - Both 32- and 64-bit
    - Used for kernel development
  - Other OSes reported to work, but no formal testing

New in Hercules 3.06

- System z/10 enhancements
- HMC console and DVD-RAM drive emulation
- Native 64-bit support for Mac OS X
- Build support for Solaris and BSD hosts
- IFL, z/IIP, z/AAP engine types
- More complete 3490 and 3590 emulation
- Panel enhancements
- Many bug fixes
- Subversion now used for source repository instead of CVS

Large real memory support

- Host OS dependent
- Requires 64-bit host
- Linux: up to main memory plus swap space
- OS X
  - Maximum amount unknown, since swap is dynamically allocated
  - Both Intel and PowerPC architectures
- Windows
  - Development in progress
  - Networking is problematical
    - > Requires 64-bit TunTap DLL, Fish libraries

MVS 3.8J review

- Last public domain version of MVS
- Released in 1979
- Foundation on which later systems were built
- 24-bit addressing
- System/370 I/O subsystem
- Lots of code available
- Prebuilt, ready-to-run turnkey system available for download
  - Includes many public domain enhancements

MVS 3.8J limitations

- The biggest: Limited private address space size
  - Typically 8 MB, maybe 9 with extra effort
  - No room to expand
  - Nobody writes small code any more
- Original I/O subsystem architecture
  - Programming is more complex than in later systems
  - Error recovery can cause greater disruptions

MVS 3.8J limitations

- Porting modern Unix-style tools is difficult or impossible
  - C compiler (gcc 3.2), C library available
  - Building a moderately large program ran out of memory
  - Recompiling gcc natively was impossible
    - > Needs 23 MB of memory for compiler and data storage

IBM's answer: MVS/XA

- Major architectural upgrade
  - 31-bit addressing
  - New and incompatible I/O subsystem
  - More than 2 CPUs supported
- Base for all later systems
- Conversion required massive effort
- Generally unsuitable for Hercules use
  - No known installable copies exist
  - Not public domain

Our answer: MVS/380

- Not a complete rearchitecting
- Relieves address space crunch
- No changes to I/O subsystem
- A few small usermods to MVS code, not a major rewrite
- Compatible with some ESA and z/Architecture programs

Hercules S/380 architecture

- Start with regular System/370
- Add in all ESA and z/Architecture common instructions that don't involve I/O
- Allow BSM and BASSM to switch in and out of 31-bit mode
- Accesses above the 16 MB line are not virtualized
  - Only one address space above the line
  - No memory protection at all
  - No paging implications
  - As much memory as defined is available
  - Data and code can reside above the line

Hercules S/380 architecture continued

- OS support required
  - Simple function: intercept SVC 120 (GETMAIN)
  - Parameters compatible with OS/390, z/OS, and z/VM
  - Above-the-line memory partitioned on MVS
- Program does GETMAIN for at least 16 MB and LOC=ANY
- SVC 120 intercept allocates, tracks memory above the line

Hercules S/380 architecture continued

- Programs need to figure out AMODE and switch if necessary
  - Invoked by OS with AMODE 24
  - Might be called by other programs in AMODE 31
- Not included in standard Hercules source tree or released binaries
  - Current implementation is sufficient for single developer use, but not production
  - Hercules version with full virtualization support for 31-bit memory is being worked on
  - Will be upwardly compatible

Getting MVS/380

- Three components
  - Turnkey MVS version 3
    - http://www.bsp-gmbh.com/turnkey/
    - http://www.ibiblio.org/jmaynard/
  - Turnkey MVS update 1 (TK3SU1)
    - Updates many packages, adds many usermods
    - http://www.open-bpm.org/index.php/mainframes.html
  - MVS/380
    - Version 0.9 is current
    - http://mvs380.sourceforge.net/

Installing MVS/380

- Start with plain vanilla Turnkey MVS
- Add TK3SU1, but do not start it
- Install Hercules/380
  - Build from source if not on Windows
- Commit TK3SU1 updates to base distribution
- Add MVS/380 updates
- Start MVS/380
  - CLPA IPL
  - Cold start JES2
- Apply usermods and install SVC 120 intercept
- Install recent x3270 if needed
  - TK3SU1 has problems with x3270 before version 3.3.6

VM/380

- Architectural enhancement will work with any OS, so why not VM?
- Program interface is the same as MVS/380
- No partitioning
  - Only one user at a time should use memory above the line
- Get it from the Sourceforge MVS/380 site

Added software

- GCC
  - Version 3.2.3 (3.4.6 coming)
  - Compiled programs can run on vanilla MVS 3.8
- PDPCLIB
  - Portable, freely available C library
  - Sequential files only, binary or text
- GNU project tools
  - bison, flex, diff3, more
  - One goal of MVS/380 project: to give developers familiar with other platforms tools they know

Added software, continued

- REXX
  - Regina, ported by Sir Robert of CMS (Robert O'Hara)
  - BREXX
    > MVS and CMS mods now in baseline
  - Eventually integrated into VM/370 (and VM/380)
- Bywater BASIC (BWBASIC)

What's coming

- DOS/380
- OpenCobol
- PDPCLIB in shared memory in VM
- 31-bit RPF support for editing large files
- KICKS under TSO, source compatible with CICS command level
  - Will run in 370 mode as well
- TCP/IP facilities for VM and MVS