User Experiences With Linux for System/390

Session L63 Ross Patterson Computer Associates

Abstract:

Since IBM first released Linux for System/390 in December 1999, there has been a lot of activity and interest in the mainframe user community. In August 2000, IBM announced that several software vendors would be producing products for Linux for S/390, including Computer Associates. This presentation will discuss some of the experiences of the CA mainframe software developers who have been involved in making that promise come true. It will cover systems administration, systems programming, porting from Linux for the Intel x86, and resources available to make one's life in this environment easier, all at a general level.

Agenda



- Why should we want Linux on S/390?
- What choices do you need to make?
- Installation fun and games
- Systems administration
- Systems programming
- Porting from i386 to s390
- Resources

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What Is Linux?



- One "Linux":
 - Whatever Linus Torvalds says it is.
- Many "packages":
 - GNU C Compiler (gcc), Bourne Again Shell (bash), etc.
- Many "distributions":
 - Businesses use Red Hat in USA, SuSE in Europe, Turbolinux in Japan.
 - Over 150 others, business use uncommon

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- •"Linux" is actually the name for the core operating system, and is correctly applied only to the kernel itself. There is only one "Linux", and it comes from the fingers of Linus Torvalds and his happy cadre of volunteer programmers. The current "stable" kernel is release 2.2 (currently at patchlevel 2.2.17). Release 2.4 has been in the works for a long time, but is currently expected to be GA in the first few months of 2001.
- •There are many other "packages" associated with Linux, many of them used in other environments as well. Much of the key software was produced by volunteers under the auspices of the GNU Project. The standard C compiler and shell are examples of multi-system GNU packages. Other packages are peculiar to Linux, but are managed and packaged separately for either historical or logistical reasons. The kernel-module package "modutils" is an example of these.
- •The Linux kernel and assorted packages are grouped together into coordinated "distributions". These collections solve the problem of choosing the right levels of various packages, and often provide important Quality Assurance and telephone support functions. In the US, Red Hat is the standard business distribution. In Europe, the standard is SuSE, owing in no small part to its German provenance. Japan and the rest of the Far East seem to prefer Turbolinux. Hobbyists frequently prefer Slackware or Debian.

What is Linux?



- How can I cope with three Linuxes?
 - "Relax, don't worry, have a homebrew".
 - Charlie Papazian, American Homebrewers Association.
 - The differences aren't large:
 - Primarily installation techniques.
 - Extra packages (demo software, etc.).
 - Small filesystem layout differences.
 - One is:
 - Different levels of runtime libraries.
 - Good news: There aren't many to choose



- •As Charlie Papazian writes at almost every opportunity when discussing home beer production, "Relax, don't worry, have a homebrew". There aren't many differences between these three Linux distributions.
- •All three subscribe to the Linux "Filesystem Hierarchy Standard" (www.pathname.com/fhs), which codifies Unix filesystem layout traditions and tries to resolve some long-standing variations.
- •The largest differences are the levels of assorted run-time libraries shipped with the distributions. If the one your software is compiled against isn't available, life gets very bad very fast. Library creators and distribution builders understand the issue, and try to avoid causing problems.

Why Should We Want Linux on S/390?

- It's Linux: "A rose is a rose is a rose".
- We can provide services for VM users:
 - The new z/VM "SSL server" is Linux with an IBM application running under it.
- We can provide lots of Linux servers:
 - It took 41,400 to maim David Boyes' Test Plan Charlie system.



Why Should We Want Linux on S/390?

- EBCDIC/ASCII is often an issue:
 - Linux/390 is a native-ASCII system.
- For software that already runs on Linux/x86:
 - Porting to Linux/390 is a snap.
- Cost is often an issue.
 - But don't mistake "free software" for "no cost".



Why Should We Want Linux on S/390?

- We can infuse new blood.
 - Tried hiring young mainframers lately?
- We can build new skills.
 - Wanna become an Internet weenie?
- "It's not [just] a Blue world any more".
- Linux is coming anyway, and we're better off with it on System/390.



What Choices Do You Need To Make?

- Is your processor recent enough?
 - Linux/390 requires at least a G2 for the "relative branching" and "halfword immediate" instructions.
 - If not, try the "Vintage" tools.
 - Performance is best at G5 or newer because of the IEEE floating point support.
 - Linux will emulate if not available, but at very high cost



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Peter Shulte-Stracke's "Vintage" tools can make Linux for S/390 run on pre-G2 processors, by post-processing the object code to replace the missing instructions. http://source.rfc822.org/pub/mirror/s390-ibm-linux/Peter.Schulte-Stracke/

What Choices Do You Need To Make?

- Which distribution should you install?
 - Marist the original, but getting stale.
 - SuSE SuSE Linux 7.0 (November 2000).
 - Turbolinux Server 6 (April 2001).
 - Red Hat "Rawhide" beta (April 2001),
 GA expected by June 2001.
 - RYO Build your own!



- Where do you stick the CD-ROMs?
 - HMC/SE/processor console du jour.
 - It's 293 miles from Herndon, VA to Islandia, NY. I wouldn't know one if I saw it.
 - A PC running Linux.
 - Mine is under my desk, with good network access to the z900 on Long Island.
 - Don't use a public-access FTP site.
 - Possibly the slowest alternative, not to mention "network unfriendly".

- IBM recommends some service:
 - http://www.vm.ibm.com/linux/ser vice.html
 - Also see APAR II12444 for Linux under VM information.
 - Some CP APARs you may want.



- Network setup under VM is tricky.
 - Two subnet choices: Same as VM or separate.
 - Separate is better.
 - If using ROUTED, update ETC GATEWAYS.
 - If not, update GATEWAY list in PROFILE TCPIP.
 - Same may be easier for smaller systems.
 - "Proxy ARP" needed, either on VM (APAR PQ37902) or somewhere else.
 - Good info from the Linux-390 archives at http://www.marist.edu/htbin/wlvtype?LIN UX-VM.11018

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- If under VM, either:
 - Set Linux Maximum Transmission Unit (MTU) to same as VM's:
 - /sbin/ifconfig ctc0 ... mtu nnnn ...
 - Or apply VM TCPIP APAR PQ37002 (Path MTU discovery).



Systems Administration

- Creating userids
 - Even easier than on VM:
 - What group will the user belong to?
 - Grouped by function, by department, etc.
 - A group of their own:
 - /usr/sbin/groupadd groupname
 - /usr/sbin/useradd -G groupname username



Systems Administration



- Backing it up
 - Commercial packages (e.g., CA ARCserve, Tivoli TSM client)
 - Robust, automatic, dependable.
 - Bare bones homegrown, ala DDR:
 - •/sbin/dump -0f /dev/dasd?1 | gzip
 > /dumps/dasd?`date "+%Y-%m%d"`.full
 - But make sure /dumps is another filesystem!
 - Even better: /nfs/someplace/dumps/



Systems Administration

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- Housekeeping
 - Log files accumulate in /var/log. Use the logrotate package to keep it tidy.
 - Add the following to /etc/crontab:
 - 01 * * * * root run-parts
 /etc/cron.hourly
 - 02 4 * * * root run-parts
 /etc/cron.daily
 - 22 4 * * 0 root run-parts
 /etc/cron.weekly
- $\begin{array}{cccccc} & -42 & 4 & 1 & * & * & root & run-parts \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ & &$

- Kernel building (RYO)
 - Get the current kernel source from http://www.kernel.org
 - Get the appropriate IBM patches:
 - http://oss.software.ibm.com/develop erworks/opensource/linux390/
 - Apply the patches:
 - •cd /usr/src/linux
 - patch -p1 <patchfilename



- Kernel building (RYO) (cont'd)
 - Update your configuration:
 - make menuconfig
 - Compile the kernel:
 - make dep
 - make image dasdfmt silo
 - make modules



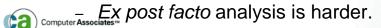


- Kernel building (RYO) (cont'd)
 - Install the kernel:
 - cp -p arch/s390/boot/image /boot
 - cp -p System.map /boot
 - make modules_install
 - cd /boot
 - /usr/src/linux/arch/s390/tools/silo /silo -d /dev/dasd? -f image -p parmline -b ipleckd.boot





- Package installation
 - Most packages are available as RPMs.
 - rpm -ivh packagefilename
- Performance analysis
 - You're kidding, right? This is a Unix environment.
 - Realtime monitoring using top (ala VM Realtime Monitor (aka SMART)).





- Capacity planning
 - Did I mention you're kidding?
 - Linux capacity planning is an open question.
 - Under VM, consider using the usual VM tools and ignoring the workload inside the Linux machine:
 - IBM's VMPRF and VMPAF
 - http://www.vm.ibm.com/perf/perfprod.html
 - Velocity Software's ESAMAP
 - http://www.velocitysoftware.com/esamap.html

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Porting from Linux/i386 to Linux/s390



- Those darn "configure" shell scripts!
 - Patches for config.guess and config.sub are available at Adam Thornton's patches page:
 - http://penguinvm.princeton.edu/patc hes/
- Most packages port with only these two changes.



Porting from Linux/i386 to Linux/s390

- **(a)**
- Watch out for "endian-ness" assumptions.
 - Danny Cohen explained the issue in 1980.
 - •http://www.isi.edu/innotes/ien/ien-137.txt.3
 - s390 is "big endian" (0x12345678), i386 is "little endian" (0x78563412).
 - But if it's been ported to non-Intel CPUs, it's probably OK.



Porting from Linux/i386 to Linux/s390

- Really low-level stuff is harder:
 - Assembler code (".S" files) is completely different.
 - Debuggers and languages often care about calling conventions. Linux/390 convention is extremely efficient but downright weird. Some packages can't cope at all (e.g., Itrace).



Resources

Communication (Control of the Control of the Contro

- The Linux/390 list:
 - Linux-390@VM.Marist.Edu.
 - Send to Listserv@VM.Marist.Edu to subscribe.
- The Linux/390 Community website:
 - WWW.LinuxVM.Org
- IBM's Linux/390 website:
 - WWW.IBM.Com/s390/linux



Resources



- Distribution sites:
 - Marist: http://www.linux390.org/
 - SuSE: ftp://ftp.suse.com/pub/suse/s390
 - Alternate: ftp://ftp.linux.com/pub/mirrors/suse/suse/s390/s use-us-s390/
 - Turbolinux:ftp://ftp.turbolinux.com/pub/product/s390/



Resources



- Interesting stuff:
 - Peter Schulte-Stracke's "Vintage" tools: http://source.rfc822.org/pub/mirror/s390ibm-linux/Peter.Schulte-Stracke/
- Who's using Linux?
 - http://LinuxToday.Com/news_story.php3?lt sn=2000-09-15-001-06-NW-BZ-LF



