Linux for System z at Nationwide Insurance
From Woe to Whoa!

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SHARE 111 - August 2008
Overview and Disclaimer

Disclaimer:

The content of this presentation is for information only and is not intended to be an endorsement by Nationwide Insurance. Each site is responsible for their own use of the concepts and examples presented.

First, a word from our announcer:

With a few exceptions, this is an overview! Where possible there are technical details you may be able to use. As you frequently hear when anyone asks for recommendations, “IT DEPENDS” is the answer and it applies here too. The information in this session is based on our experiences as long-time VM-ers building virtual Linux farms.

Interaction is good! Please ask questions whenever you want. We'll all get the most out of this session that way.
Topics

• Our Linux Decision History
• Our Environment
• What do we expect Linux to do for us
• Direction – What drives our project
• A learning process
• Conclusions
Our Linux Decision History
The story of Woe

• 2000 – Marist Distribution (based on Red Hat)
  – First offering of install lab at SHARE
  – Built one in-house to play with
  – Wrote up recommendation to management; Little interest or direction

• 2002 – SUSE 7
  – Basic demo of Apache and Samba
  – Wrote up recommendation to management; Little interest or direction

• 2004 – Red Hat
  – Intel, pSeries and zSeries pilots planned and started
  – zSeries waned quickly and work ceased
Our Linux Decision History
The story of Whoa!!

- 2005 – The fun begins!
  - New Emphasis on virtualization
    - Fasten your seat-belts!
- Proof of concept system originally had three small business applications
  - Then we had at least seven with more wanting on ASAP
- *Our* initial thought was to tackle File/Print sharing
  - Naaaw! That’s too easy – we started with J2EE servers!
    - WAS, WAS Portal, IHS, DB/2, etc.
      - The Hoover’s of the zLinux workload
- Anticipated having about 120 total servers by year-end 2005
  - It is growing faster than anyone thought it would
Special team assembled for a concentrated effort to decide which hardware and software combination best met all of the defined requirements. Testing was between System P or Z and Suse or Redhat. System z with z/VM 5.1 running Novell Suse Linux was determined best choice.
Be careful what you ask for! 😊
Things grew fast!

And I thought we were busy **before** we got Linux!
Rick Barlow, Aug 1, 2006

![Graph showing zLinux Servers growth from September to July with forecast and actual data points.](image)
Environment – then…

• Before we got serious about Linux
  – 3 z900 processors; mostly z/OS; models 104, 107, 1C8
  – The 104 had 24GB of storage and ran:
    - 4 z/OS LPARs
    - 1 Coupling Facility LPAR (ICF)
    - 2 relatively small z/VM LPARs which used about 200+ MIPs

• For Linux **pilot**
  There was capacity to create another small z/VM LPAR on the 104.
  – Started with 1 and ended up with 3 dedicated IFL engines
  – 8 GB memory
    - 6 GB Central; 2 GB Expanded
Environment – now…

- **Today** – 2 new z9s dedicated to Linux
  - 17 IFL engines for test/dev and 18 IFL engines for production
  - 352GB memory for test, 240GB for production
  - 4 z/VM 5.3 LPARs on each
    - 1 additional test LPAR on development box for sandbox
    - 9 total LPARs
  - **Growing FAST!**
    - Total of 517 zLinux servers (as of June 18)
      - 167 production and 350 test/dev
    - Growing UP instead of OUT
      - Had been forecasted to be at 1000+ servers by now
      - Over 1630 JVMs
IBM z9 Platform (test/dev)

**Processors**
- 16 IFLs
- Max 38
  - (42%)

**Memory**
- 352GB
- Max 512GB
  - (69%)
  - (Each block is 2GB)

**Network**
- 10 OSA Cards
- Max 48
  - (20%)
Problems to solve

• Server Proliferation
  – Space that previously was required to house a few
    mainframes is now mostly consumed by multitudes of all
    type of servers, network hardware, other support hardware
    ▪ Sun, HP, multiple brands of Intel
    ▪ Routers and switches
    ▪ SAN, NAS, data warehouse, etc
Problems to solve

- Provisioning
  - Many requirements for stand-alone server
    - Order and obtain hardware – several weeks
    - Physical install
    - Optional external disk subsystem configuration and connection
    - Network configuration and connection
    - OS load
    - Middle-ware load
    - Application load
  - Many hands and significant time
    - Usually would take several weeks (6-8 at least) or more before the customer would get the box
Vision and Expectations

• Physical space and environmental reduction
  – One z990 IFL engine can support 10-30 (or more) virtual servers
  – A z990 can have up to 32 IFL engines so it *could* replace 300+ servers
    Fact: we had 330+ large servers running on 15 IFLs between two z990s
  – Significant savings in physical space, power, cooling

• Reduce network complexity
  – A small number of physical network connections (OSAs with VSWITCH) can support all of the virtual servers in contrast to every stand-alone server having 2 or more interfaces it must manage

• Quicker provisioning
  – Setting up new server can be as fast as your disk copy tool
    - Depends on software needed on server and amount of manual effort
Direction – getting Linux on z rolling

• Start with technicians then try to influence organization
  – Common with existing zSeries shops; especially those with z/VM already in their shop ("skunk works")
    ▪ Build something and demonstrate function and don't bother to tell anyone what it is and where it is running
    ▪ “We will build it and they will come”
    ▪ Be prepared to have the idea crash and burn when presented to management
  – Challenges
    ▪ Organization barriers – turf wars
    ▪ ‘Opinions’ used instead of good technical evaluations and decisions
    ▪ Workload – real work vs. “fun” stuff like Linux
Direction – getting Linux on z rolling

• Start with CIO (upper management) and direct organization
  – More common as industry accepts zSeries virtualization solution
  – Driven by business need (e.g. space restraints, rapid growth, etc)
  – Typically causes more structured implementation and wider acceptance
    ▪ Some will still kick and scream, though not real loud
Learning – everyone has to!

• Mainframe methodology differs from non-mainframe methodology
  – Repeatable automated processes versus hands-on "hacker" install
    ▪ Typical mainframe person accustomed to well-documented, repeatable processes that permit automation for multiple installs
    ▪ Preference for install once and copy rather than repeated installation
    ▪ Expect software to be installed in one location and configuration in a common location
  – Different philosophy for management:
    ▪ Privilege levels differ for installing OS, installing middle-ware, configuring
  – Different maintenance philosophy
    ▪ Expect to regularly upgrade software on all servers
Distributions

- There are a few options to choose from when selecting a distribution for System z (S/390)
- There are only a ‘few’ parts that are different in the Linux code path to get it to work on z/VM – just a few…
Distributions

• We picked and started with Red Hat and SUSE because they seemed to offer the best support for a large enterprise implementation

• Documentation differs greatly
  – Red Hat
    ▪ Installation instructions begin at loading the RAM disk into memory
    ▪ It appears to have been an afterthought
  – SUSE
    ▪ Shows how to build the virtual server directory and copy the RAM disks to VM
    ▪ It seems to understand the zSeries and z/VM environment
  – Both
    ▪ Incomplete (inadequate) documentation of install parm information for all environments
      • Some not documented
      • Little more than syntax
      • Incomplete or no examples
Distributions – our observations

• Default package list
  – Red Hat
    ▪ Large list of packages in minimum load
    ▪ Security template required omitting load, turning off or disabling many packages
    ▪ Installation required more hands-on and a lot of Google
  – SUSE
    ▪ Smaller list of packages in minimum load – basic runnable Linux
    ▪ Security template required only a handful of changes
    ▪ Installation seemed to be smoother
Linux Basics for z/VMers

• Even z/VM Sysprogs need to understand what Linux is up to.
  – What we know about running VM applications has an impact on how Linux is built on VM and knowing Linux to some degree helps get the points across to the Linux admins
  – Apply some mainframe disciplines / history / concepts to virtual Linux

• Learn how new devices are added, defined and identified in Linux for the distribution you are using.
  – Learn LVM too
    ▪ Differs depending on distribution (kernel level and/or LVM level)
    ▪ Using CKD DASD for virtual servers is likely to cause you to use it

• Learn the terminology differences
  – Like “Storage” vs “DASD” and “Memory” vs “Storage” !
Cloning servers

• Cloning:

  – There are numerous ways to clone Linux images
    ▪ PICK ONE and stick to it – it usually is not trivial work to set up
    ▪ Once you start using it, switching to a different way will be time consuming
  – If you have hardware disk duplication available (IBM Flashcopy, STK Snapshot), it can be a huge benefit to cloning
    ▪ If not, DDR has to be used (slow) or a third-party copy tool (HiDRO)
  – You may want to create "standby" Linux images for quick deployment
    ▪ If you have standard templates for the Linux servers, build a few extras and deploy them as requested
    ▪ Makes you look like a wizard when someone asks for a server and 2 minutes later they can log on to it!
Cloning servers – my take

• Until a vendor solution is obtained, I rolled my own
  – Dirmaint used for directory maintenance… sigh
  – DDR (now HiDRO) for large-volume copy due to storage vendor choice and no tool support for z/VM
  – Multi-stage process so that things can be fixed if they have a glitch
    ▪ Otherwise known as a “finger check” in the control data
• A server can be built from scratch in < 30 minutes
  – My personal best is 28 WAS/Portal servers in 1 hr. 15 mins.
• A picture may tell it best…
Cloning / server builds

Our server build SLA is 10 days; goal is 72 hours from initial request to fully loaded.

99% of all provision requests are done in less than 12 hours now.
Linux workloads

- Linux on zSeries virtual servers *may* be able to run with small(er) memory (storage) sizes
  - "It depends" on what will run and in how much memory
  - A basic Linux virtual server can easily run on 64MB of memory
  - An IBM HTTP Server can probably run in 128-256MB depending on the number of static pages and CGIs, etc
  - An IBM WAS Server probably needs 512MB-1GB
  - An IBM WAS Portal or DB server probably needs 2G or more
  - There are a lot of simpler application options!
    - Firewall
    - DNS
    - Web server
    - File and Print serving
Linux workloads / applications

• *Any* virtualization brings out the best and worst of applications
  – Bad things shine like the sun in Aruba when they are virtualized
    ▪ Memory leaks
    ▪ Spin loops
    ▪ Poor design / configurations
    ▪ Logging and debugging options
    ▪ Intense computations

• Fixing any issues results in a much tighter, better performing application
  – And you can put more than one of them on a single virtual Linux server too
"Experts"? What we learned...

"My definition of an expert in any field is a person who knows enough about what's really going on to be scared.”  - PJ Plauger

• “Total Experts” - Do they really exist?
  – There are many people with varying levels of experience in specific areas
  – There are few (if any) who know enough about everything
  – Make friends with people who have knowledge in:
    ▪ Mainframe disciplines
    ▪ Linux
    ▪ Network
  – Learn as much as possible about all of these areas
    ▪ Or at least learn how to contact the right person when you need to!
The Tool Belt

• As the zLinux project continued, it was fairly obvious that providing some “basic” tools would help everyone

• Access to details about the servers

• Access to easy-to-read CPU charts & information on resource usage by server

• A one-stop panel to see the big picture at once
The zLinux Database – all the details

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CPU overview
The big picture – all in one place

Main LPARs System Overview - Local Time 19:58:19

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8.2%
So, where are we now?

- zLinux Total Cost of Ownership is *far* lower, provides faster roll-out (provisioning) and more services (DR) are included than any other platform alternative
- Over 500 virtual Linux servers active w/over 1600 jvms
- 18+ live production applications
  - [http://www.nationwide.com](http://www.nationwide.com) – the web front door to Nationwide Insurance. It was tested at 22 times its anticipated peak and still performed acceptably
  - More production applications in progress
- Forecasting indicates zLinux growth to continue at a high rate
- The zLinux project *has* and *is* saving *millions of dollars*
So, where are we now?

• You may ask, are we all warm and fuzzy with zLinux now?
  – The short answer is, “Mostly”
  – There are still a few that try to say the mainframe is too expensive
    ▪ We have to repeat the story a few times and show the facts again
    ▪ The biggest challenges are not technical but organizational
    ▪ Some of our best references are the ones we had the most trouble with in the beginning!
  – It is still easily proven that it is the Right Thing to be doing for the business!

• With zLinux, working with z/VM is a COOL place to be now!
So does this stuff really work??!
...and more!

Nationwide Deploys Virtualization Computing Solution on Linux

Intent to save millions over the next three years

COLUMBUS, Ohio, Aug. 15 /PRNewswire/ -- Nationwide, one of the world's largest diversified insurance and financial services organizations, announced it has completed deployment of a SUSE Linux from Novell on IBM mainframe to reduce the total cost of ownership of its sharing the success of the solution by presentation at LinuxWorld on August 16.

GRID today

The Leading Source for Global News and Information from the evolving Global Grid

Operating Systems & Middleware:
IBM Unveils Roadmap for Open Source Beyond Linux

IBM rolled out its next generation blueprint and roadmap to advance key priorities and support for open source business models.

With this news, IBM announced Brazilian-based online gaming pioneer Hoggar, Nationwide Insurance, CommX, and RealPlus are among those pushing the number of Linux-related customer engagements to more than 15,000 worldwide.

SHARE 111 2008 - This information is for sharing only and not an endorsement by Nationwide Insurance
Conclusions

• Linux definitely is Linux – the same on all platforms
  – Code written for Linux on any platform can usually be used on any other platform that supports Linux with only a recompile (usually)

• Linux virtualization on zSeries can and does:
  – Reduce cost
    ▪ Just software costs per engine can save you BIG $$
    • Simple math – note the difference in cost:
      Take 100 servers on dual-core Intels - $LicenseCost$ * 200
      Take 100 servers on 15 IFL z990 (huge!) - $LicenseCost$ * 15
  – Reduce complexity
    ▪ Sharing R/O DASD, less complex network (wires), etc
  – Accelerate provisioning
    ▪ Feasible to provision servers in minutes
  – Reduce human error of manual installation, configuration and even patching
Conclusions

• Not every workload is suited to Linux on zSeries
  – But you have to try it for yourself
  – What wasn’t good even a year ago probably fits now

• Not all software is ready for Linux on zSeries
  – But you really should ask for it to be

• Things are changing rapidly

• Be careful what you ask for because you may get it!
OUR SERVERS ARE USING TOO MUCH ELECTRICITY. WE NEED TO VIRTUALIZE.

I DID MY PART BY READING ABOUT VIRTUALIZATION IN A TRADE JOURNAL. NOW YOU DO THE SOFTWARE PART.

WHY IS YOUR PART TAKING SO LONG?

I HIRED A CONSULTANT TO HELP WITH OUR VIRTUALIZATION PROJECT BECAUSE I DON'T TRUST EMPLOYEES WITH ANYTHING IMPORTANT.

I WILL DO THE HEAVY THINKING WHILE EACH OF YOU PERFORMS YOUR USUAL DUTIES AS OBSTACLES TO PROGRESS.

YOU SAID THIS IS MY PROJECT! I'LL LET HIM UNPLUG SOMETHING.
Light travels faster than sound. That’s why people seem bright until you hear them...

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Article references

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