



IBM IT Education Services

L54

Mike Wojton

Domino 6.5 for Linux on zSeries

zSeries Expo

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Agenda

- Messaging and collaboration are vital
- The value of Domino 6
- The value of Linux on zSeries
- The value of Domino for Linux on zSeries
- Domino 6.5 for Linux on zSeries
 - ▶ What performance characteristics are we seeing now
 - ▶ z/VM and Native Linux Configurations and Tuning
 - ▶ CPU and physical memory
 - ▶ Domino Service and Automatic Restart

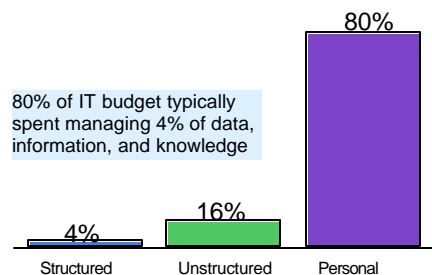
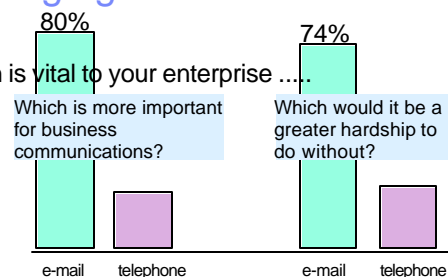


.... more than e-mail.



The Business Realities of Messaging and Collaboration*

- e-mail messaging and collaboration is vital to your enterprise



- AND e-mail messaging and collaboration make up the majority of business data, information, knowledge in your enterprise



Source: <http://www.techweb.com/wire/story/11WB20030422S0008>

The impact

- e-mail is mission critical and as such has to be treated as mission critical
- Improving the productivity and the efficiency of your e-mail and collaboration systems will have a big positive impact on your enterprise

"Business Impact: The business criticality of e-mail will force organizations to upgrade e-mail infrastructure to enable delivery of higher levels of uptime as well as enhanced hygiene and security services.

Bottom Line : The changing nature of e-mail and the growing reliance of organizations on the messaging infrastructure will dramatically alter IT group priorities for managing infrastructure. Organizations must adopt data center disciplines to increase reliability to a 99.999% uptime level."

-- "E-Mail Concerns in 2007", Meta Group, June 2003

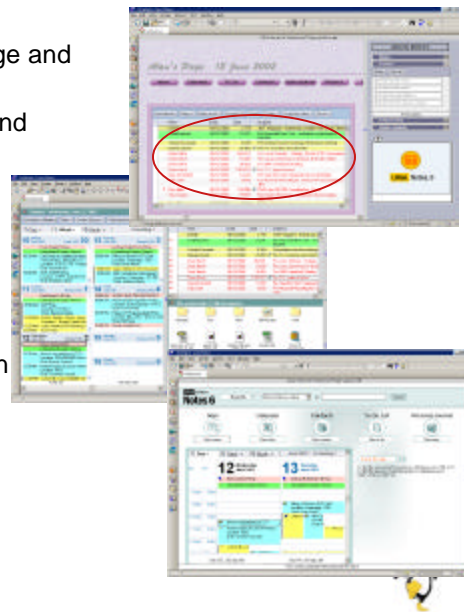


The value of Domino 6



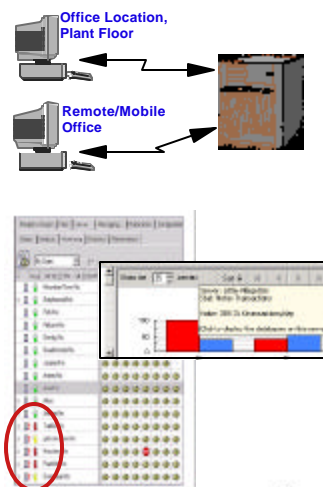
Domino 6 provides productivity boosters for end users

- Color coded inbox to more easily manage and prioritize correspondence
- Mail rules and Swift File to streamline and automate processes
- Unread in folder for organizing content
- Attachment handling (edit in place)
- Enhanced Calendaring & Scheduling:
 - ▶ Integration with Sametime
 - ▶ Drag & Drop Calendar entries
- Quick Notes for rapid document creation
- Drag and drop between desktop
- Copy view as table
- Background processing
- Enhanced and simplified replication
- ... and more



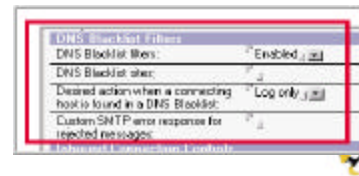
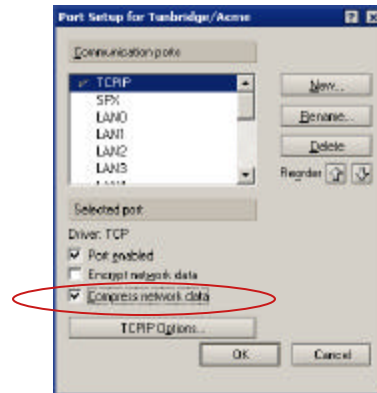
Productivity boosters for administrators

- Smart Upgrade
 - ▶ Drive down the cost of Notes client deployment
- Multi-user Workstation Support
 - ▶ Enables multiple users to access Notes on a shared PC (Windows specific)
- Roaming User Support
 - ▶ Enables a user to have their Notes information follow them no matter what PC they are using (all client platforms)
- Policy Administration
 - ▶ Tailor user settings to suit any subset of an organization
- Transaction logging improvements
- Tivoli Analyzer (Server Health Monitor and Trend Analysis)
 - ▶ Monitors, analyzes, and provides proactive notification of problem areas
 - ▶ Increase the number of servers an administrator can support
- ... and more



Improve the corporate bottom line

- Streaming replication and attachments
 - ▶ Decrease replication time by 25%
 - ▶ Users who replicate mail can start working before replications completes
- Network compression
 - ▶ 25% or higher saving of network bandwidth for uncompressed data
 - ▶ Faster response time when opening mail on server
 - ▶ Easy to implement
- Anti-Spam Support
 - ▶ Intercept and take action on mail from Blacklisted servers
 - ▶ New Redbook: Lotus Domino 6 Spam Survival Guide for IBM eServer (SG24-6930)
- Multiple language servers
 - ▶ Concurrently on a single Domino 6 partition
- and more



Domino 6.5 -- Building on the success of Domino 6

New user interface* ... collaboration enhancements

Integration: With Lotus instant messaging and awareness

Flexibility: Support for Notes clients, browser (including Mozilla running on Linux desktop), and Microsoft Outlook

Usability: Customizable Workplace layout

Productivity: Follow-up, junk mail handling, Quick Rules for automated handling, and much more...

*Pre-Release Interface- Subject to Change



Domino 6.5 delivers on the Lotus Vision

- Innovate Rapidly
 - ▶ Significant enhancements from release to release
- Deliver cross-portfolio integration
- Deliver TCO-focused value
- Whether you are considering a new Domino 6 installation or upgrading an existing Domino 5 system
 - ▶ Domino 6.5 for Linux on zSeries may give you what you need



.... more than e-mail.



The value of Linux on zSeries



Linux and zSeries are a great combination



- What Linux brings to zSeries
 - ▶ Large portfolio of applications, tools and enablers
 - ▶ The ability to enhance an existing zSeries infrastructure
 - ▶ Large numbers of trained programmers and administrators



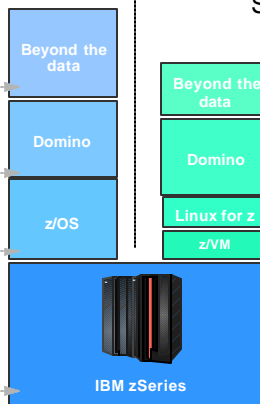
- What zSeries brings to Linux
 - ▶ The most reliable hardware available anywhere. Period.
 - ▶ Designed to support multiple diverse workloads
 - ▶ Complete workload isolation
 - ▶ Unmatched scalability
 - ▶ Simplified systems management
 - ▶ The ability to run many Linux servers on a single hardware platform



z/OS and Linux on zSeries

■ z/OS

- ▶ Customers requiring large database support and high Quality of Service together with significant integration with existing back end systems
- Backup and recovery solutions, workload management, IRD, security features, Parallel Sysplex
- Enterprise messaging
- Robust z/OS operating system
- Legendary availability, systems management tools, hardware resource sharing, and dynamic capabilities



■ Linux on zSeries

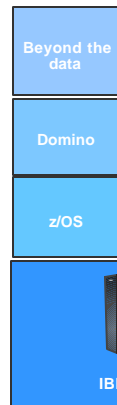
- ▶ Customers requiring speedy deployment with less stringent Qualities of Service requirements



Linux on zSeries

■ z/OS

- ▶ Customers requiring large database support and high Quality of Service together with significant integration with existing back end systems



■ Linux on zSeries

- ▶ Customers requiring speedy deployment with less stringent Qualities of Service requirements

Domino on Linux may be right for you



- Backup/ recovery, systems management, scalability
- Enterprise messaging
- Rapid application development for Linux with multidimensional virtualization flexibility of z/VM Hypervisor
- Legendary availability, systems management tools, hardware resource sharing, and dynamic capabilities



Why Domino for Linux for zSeries

- For those of you who want to improve on existing distributed Windows or Linux Domino solutions, then server consolidation to Domino for Linux on zSeries may be appropriate
- Domino for Linux on zSeries benefits:
 - ▶ Linux on zSeries - Virtual Linux Server Environment
 - Linux or Intel server consolidation
 - Centralization of expertise and hardware
 - Improved system management, backup and recovery
 - ▶ A scalable Linux solution using sys_epoll based Domino Thread Pools
This Domino Thread Pool support by Linux for zSeries is a scalability enhancement over Domino on Intel solutions.
 - Developed by IBM Linux Technology Center
 - Approved for 2.6 Kernel Standard
 - Backported to 2.4 Kernel (available to major distributors)
 - Overcomes barrier to single instance Intel Linux scalability
 - ▶ Rapidly growing z/VM / Linux Customer base



The value of Domino for Linux on zSeries



zSeries Availability Overview

- Concurrent Upgrade
 - ▶ z990 books
 - ▶ Processors (engines)
 - ▶ Memory (within card boundary)
 - ▶ I/O, Coupling Facility, and network adapters
- Hot swappable
 - ▶ Power, cooling
 - ▶ I/O, coupling link, crypto, and network adapters
 - ▶ Service Subsystem
- Legendary RAS capabilities
 - ▶ Extended thru z/VM and Linux
 - Inherent stability of multiple OS images managed by z/VM Hypervisor
- Capacity BackUp (CBU)
 - ▶ Nondisruptive emergency upgrade/ downgrade¹
- Capacity Upgrade on Demand (CUoD/ CIU)
 - ▶ IBM or customer initiated
 - ▶ Additional processor and memory activated quickly and nondisruptively¹
- New IBM ^ On/Off Capacity on Demand (On/Off CoD)
 - ▶ Temporary capacity to relieve spikes in your workload (z990)¹



Less Domino system downtime means less lost business



¹Requires contract negotiation in advance

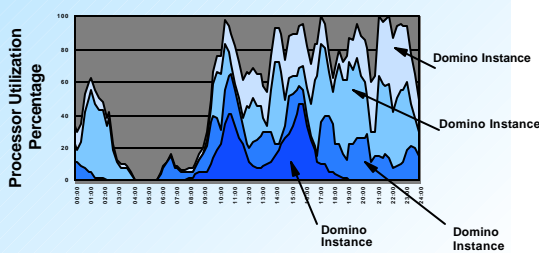
Capacity upgrade is designed to meet the needs of your business -- saves you time and effort

- Three capacity upgrade scenarios for Domino
- The upgrade that you get little or no notice to plan for
 - CBU contract on all boxes in your organization
 - If one box fails, then could use CBU temporarily to get back to full capacity¹
 - The upgrade you can plan for in advance -- adding additional Domino users
 - "We know that we will need more capacity, we're just not sure exactly how much or precisely when we will need it"
 - With CUoD, you can shortcut the upgrade process to just a few days, and then install it nondisruptively¹
 - The upgrade driven by server consolidation
 - Customer plans to consolidate Domino and re-platform to zSeries
 - Detailed project plan requires several hardware upgrades over time
 - CUoD can be used to do this exactly when needed
 - Nondisruptive and flexible to adjust to schedule changes¹
- ¹Requires contract negotiation in advance

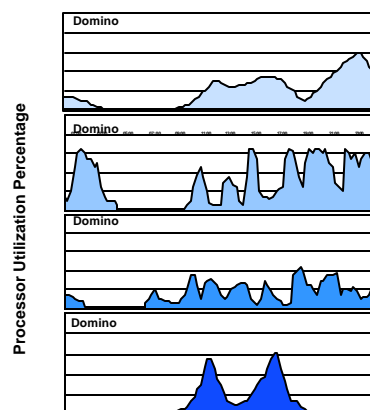


More server utilization means less work for you

- zSeries - Mixed workloads integrated and centrally managed
 - ▶ Consolidate servers
 - ▶ Virtual underutilized/ idle servers consume little server resource
 - ▶ Virtual servers are dynamic and can respond to immediate end user needs

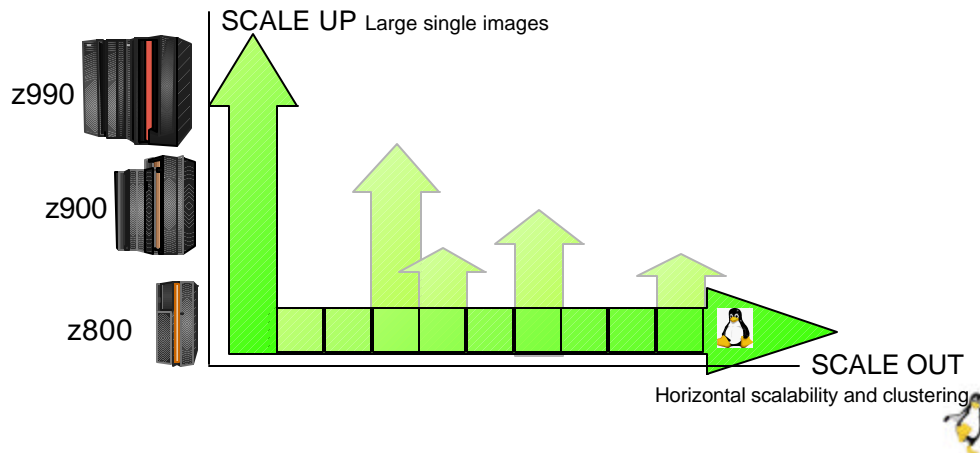


- Intel - Mixed workloads not integrated and kept on separate servers
 - ▶ More hardware, more software, more people costs to manage
 - ▶ More work for you!



zSeries = Scalability

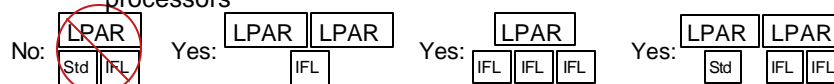
- Scale up for large Domino instances
- Scale out for horizontal clustering
- ...or any combination in between



Integrated Facility for Linux

Add capacity for Linux to your mainframe economically

- IFLs are processors dedicated to Linux-only workloads
 - Allocated from the set of spare processors on a MCM
 - Less expensive than standard processors
 - Support Linux workloads exclusively
 - Only usable in LPAR mode; cannot be mixed with standard processors
- Available with 9672 G5/G6, Multiprise 3000, zSeries servers
 - One standard engine must exist before IFLs can be added
 - Except z800 model 0LF - runs Linux exclusively
- Adding IFLs does not change a server's model designation
 - No increase in fees for IBM or vendor software installed on standard processors



Domino for Linux on zSeries



Pre-Reqs of Domino 6.5 for Linux on zSeries

- zSeries (z900, z990, z800) or S/390 G6/G5 Hardware
- Runs on United Linux v1.0 Service Pack 2
 - ▶ SuSE Linux Enterprise Server 8.0 with SP2
 - ▶ 31 bit mode only
- 2.4.19 Kernel, C/C++ Compiler gcc 3.2, and glibc 2.2.5
- DB2 V7 UDB
 - ▶ DECS support
- Use of epoll - I/O readiness APIs (significant higher scalability)
- z/VM may be used but not required

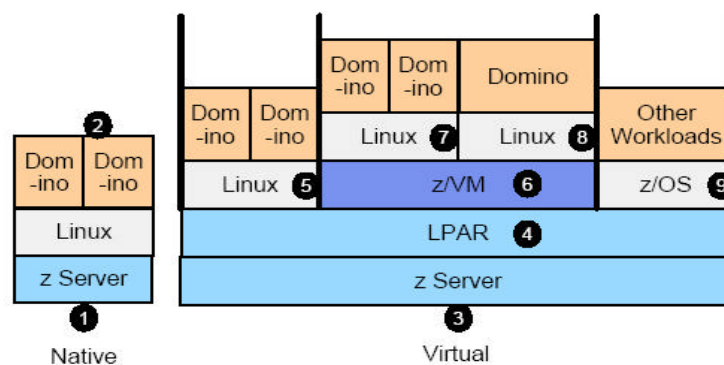


Review of Domino 6.5 for Linux on zSeries

- The EPOLL I/O Readiness APIs available only with United Linux v1.0 Service Pack 2
 - ▶ SuSE Linux Enterprise Server 8.0 with SP2
- To be sure that EPOLL I/O Readiness APIs has been installed into the kernel issue this command.
 - ▶ `rpm -qa | grep epoll`
- The result should be:
 - ▶ `linuxb:~ # rpm -qa | grep epoll`
epoll-1.0-9



Review of Domino 6.5 for Linux on zSeries



Under the Covers Look at Domino Development

- Domino 6.5 for Linux on zSeries is very similar to all the core platforms.
- Do not assume that z/OS unique Domino functions apply to Domino 6.5 for Linux on zSeries
- Development in Poughkeepsie for both z/OS and Linux on zSeries is now integrated with Westford development of core platforms. This will/has resulted in zSeries development changes and performance improvements showing up in other platforms much earlier.



Planning Choices that Affect Performance

- zSeries (z900, z990, z800) versus S/390 G6/G5 Hardware
- Number of LPARs and DPARs
 - ▶ Maximum of 15 LPARs (30 LPARs on z990)
- Physical Memory Size per LPAR
- Running Linux on zSeries Native or z/VM
- Number of Logical to Physical CP defines
 - ▶ Cross LPARs and VM Guests
- OSA Ethernet Network Cards
- Disk and Channel configurations for optimal disk response
- Linux file system (ext3, ext2, jfs, or ReiserFS)



Users per DPAR Test Results

- Number of users per Domino Server (DPAR) is consistent with other platforms.
 - ▶ Users per DPAR no longer an issue for Linux on zSeries
 - ▶ Made possible by EPOLL I/O Readiness APIs, asynchronous network I/O, and Domino thread pool design. (Eliminates one thread per client connection)
 - ▶ EPOLL I/O Readiness APIs on Linux **is a zSeries exclusive** which supports significantly more users per DPAR than Linux on Intel
 - ▶ In the Lab, test results have run over 8,000 NRPC mail notesbench active users in one DPAR for R5 Mail and over 7000 NRPC active users for Release 6 Mail (Note: Many customer production servers have less than 1,500 active users per DPAR)



Number of CPUs

- Domino is one of those applications that runs best with lots of CPUs or IFLs.
- We have successfully run Linux with good results configured with 1,2,3,and 4 CPUs.
- 1 CPU (IFL) versus More than 1 CPU (IFL)
 - ▶ Domino may be run in an LPAR with one dedicated/shared CPU or more than one CPU
 - ▶ Depending on the workload, test results have shown that some customers may improve TCO when Domino is configured to run in an environment with more than one CPU.
 - Domino administrative and/or management task (Adminp, Update, etc..) can be very CPU intensive and impact client response times in a single CP LPAR.



Native Performance NRPC Mail Test Results Indicate

Both CPU cost per user and CPU cost per transaction is ABOUT THE SAME for both z/OS and Native Linux on zSeries.

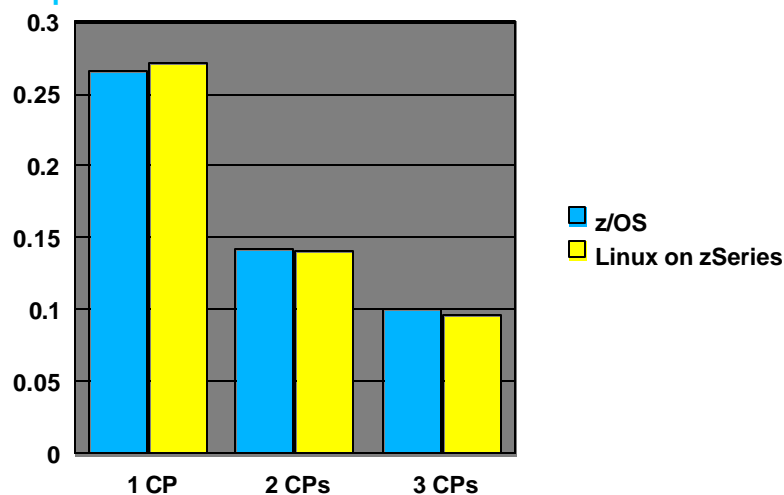
Comparison measured for 1 to 3 CPUs and 1 to 3 DPARs on a z900. Ext3 file system was used.

Latter comparison between ext3 and ext2 file systems running the same test showed little difference.



Domino 6.5 on z900 NRPC Mail

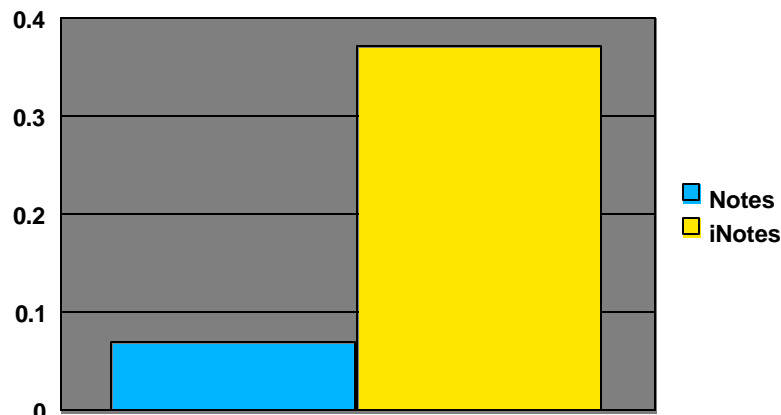
CPU per active user on z/OS and Native Linux on zSeries



iNotes Domino 6.5 for Linux on zSeries

With the data we have at this time, the average CPU per user for iNotes is 5 times higher than Notes for lab bench mark which is consistent with other platforms. Depending on workload. Production iNotes environments may experience different results.

CPU/user for iNotes on z900



Things to keep in Mind

- Linux is limited to 2G real/central storage
- Linux has a limit to the number of threads supported in an OS regardless of the number of Domino DPARs
- While a single DPAR/LPAR Domino for Linux on zSeries and Domino for zOS on zSeries are similar, zOS can:
 - ▶ Support greater than 2G of central storage
 - ▶ Support more users per LPAR with more DPARs in a single LPAR
- Therefore the scaling guidelines are not the same for large numbers of users.
 - ▶ Requires Customer to scale the number of users per DPAR and not run small DPARs



z/VM and Linux on zSeries - a great team



- z/VM Provides Easier Configuration and Mgmt.
 - ▶ REXX execs can be used to easily create/replicate/upgrade Linux on zSeries guest operating system instances
- Ability to share physical memory between guest operating system will reduce hardware cost of physical memory
 - ▶ LPARs can share CPUs but can not share physical memory
- Additional z/VM tools to capture Linux performance data
 - ▶ For example, z/VM can display disk response time.
 - ▶ Better tools mean faster service from IBM
- Future z/VM releases will make Linux running on z/VM even better



Performance Monitoring with RMF PMS Tool for Native Linux on zSeries

- RMF PMS may be down loaded from IBM's RMF Web site



velocity-software.com application

- Ability to obtain CPU and memory usage for each Domino process
- Zoom in capability for specific days and times
- Example: Customer had a large number of users calling in complaining that server was not available or had poor response time the day before from 10:30am to 11:00am. This application makes it possible to determine CPU and memory usage for each Domino process during that time period, without a large overhead in collecting the data.



velocity-software.com - excellent application for providing detailed accurate Linux performance data on z/VM

Screen: ESAHST1 IT80 z/Domino Redbook
1 of 1 LINUX HOST Software Analysis Report

ESAHST1 V3.3 08/08 14:45-14:52
NODE * LIMIT 500 2066 71CE3

Time	Node	Name	ID	Type	Status	Total	Interval	CPU Pct	Storage(K)
14:52:31	LINUXC	snmpd	760	Applic	Running	15	0.14	0.23	2920
14:51:31	LINUXB	snmpd	802	Applic	Running	14	1.05	1.74	2928
		pickup	0	Applic	ResWait	0	0.07	-	1468
	LINUXC	snmpd	760	Applic	Running	15	0.41	0.69	2920
		pickup	0	Applic	ResWait	0	0.01	-	1468
		snmpd	0	Applic	Running	15	16.89	-	2908
		bash	0	Applic	Invalid	0	0.00	-	0
	LINUXA	lostat	2875	Applic	ResWait	0	0.03	-	604
		Y5815591	2874	Applic	ResWait	0	0.05	-	1196
		pickup	1667	Applic	ResWait	0	0.03	0.04	1468
		snmpd	1663	Applic	Running	225	8.54	13.79	2924
		update	1295	Applic	ResWait	0	0.03	0.04	13116
		server	1217	Applic	ResWait	2	0.11	0.10	30660
		server	1186	Applic	ResWait	0	0.03	0.04	30660
		server	1176	Applic	ResWait	0	0.03	0.04	30660
		server	1156	Applic	ResWait	5	0.16	0.27	30660
		sched	1145	Applic	ResWait	1	0.05	0.09	22428
		adminp	1144	Applic	ResWait	6	0.38	0.63	25076
		event	1044	Applic	ResWait	0	0.03	0.04	16828
		event	1043	Applic	ResWait	0	0.03	0.04	16828
		event	1041	Applic	ResWait	0	0.05	0.09	16828
		event	990	Applic	ResWait	1	0.03	0.05	16828
		java	872	Applic	ResWait	0	0.03	0.05	11888
		Y4465986	0	Applic	ResWait	0	0.03	-	1196
		Y2112767	0	Applic	ResWait	0	0.05	-	1196

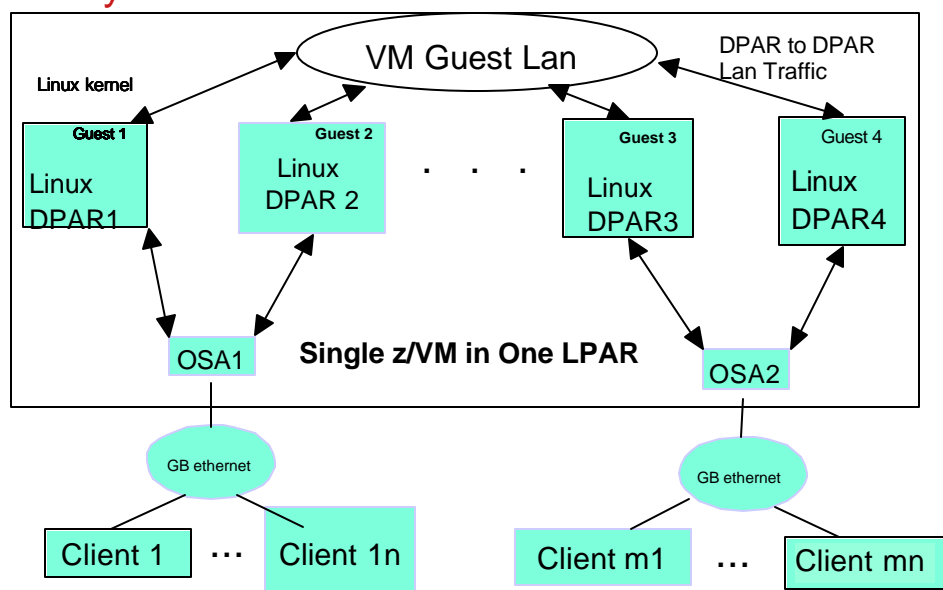


z/VM Guest LAN Advantage

- VM Guest LAN does memory to memory moves between DPARs running on different Linux guests
 - ▶ Memory to memory moves for network mail routing between DPARs running on different Linux guests
 - ▶ Improved cluster replication between DPARs running on different Linux guests. Works even when LAN is slow or not responding.
- Flavors of Guest LAN
 - ▶ type hipersocket - best and easy to use
 - Requires z/VM 4.3
 - ▶ type QDIO



z/VM Multiple Guest Linux Operating Systems with Domino 6.5



z/VM Performance Factor

- Domino performance characteristics on z/VM and Linux is right in line with other applications such as Websphere.
- When running Domino 6.5 for Linux on zSeries under VM, the additional CPU capacity needed for VM [will range from 20-35%](#), depending on factors like the number of VM guests configured, the CPU percentages, and the ratio of virtual to physical CPUs.
 - ▶ More granular performance results will be done on Domino 6.5 for Linux on zSeries under z/VM in the next few months



Avoid Paging to Disk

- Native 31 bit Linux on zSeries supports 2 Giga bytes of physical memory
 - ▶ For large workloads use of 1 to 2 Giga bytes of XPRAM is recommended for Native Linux to page/swap to expanded memory rather than disk.
- On z/VM each Linux on zSeries instance also supports up to 2 Giga Bytes of memory
 - ▶ VDISK and diagnose instruction makes it possible for Linux page faults to be intercepted by z/VM.
 - ▶ Diagnose instruction and VDISK provides a very fast z/VM paging technology to expanded memory.
 - ▶ Use of z/VM VDISK and diagnose instruction is recommended for Linux paging to z/VM's expanded memory rather than paging to disk.
 - ▶ z/VM is better at paging then Linux



File System Flavors

- ReiserFS (Default for SLES 8 and United Linux)
 - ▶ best throughput with journaling
 - ▶ highest CPU
 - ▶ high LPAR/CP overhead
- EXT3
 - ▶ Low CPU overhead (CPU significantly better than ReiserFS)
 - ▶ second best throughput with journaling (throughput close/competitive with ReiserFS)
 - ▶ Good performance (i.e. good CPU versus throughput ratio)
- EXT2
 - ▶ by far best throughput of all file systems
 - ▶ lowest CPU of all file systems
 - ▶ no journaling and more chance of **data loss !!!!!**
 - ▶ high i/o rate resulting in long elapsed time if many guests do file system checks
- JFS
 - ▶ performance throughput sub optimal



Linux Configuration

By default, the Linux kernel limits the number of file descriptors that any one process can open; the default is 1024. This default must be overridden by modifying the file `/etc/security/limits.conf`

Edit `/etc/security/limits.conf` using root and add or modify the lines:

```
domsrvr soft nfile 20000
domsrvr hard nfile 49152
```



Linux Configuration

If you choose Domino will automatically set Linux configuration for you.

Setting `export DOMINO_LINUX_SET_PARMS=1` results in the following upon server startup:

```
svtfvt@svtfvt6:/notesdata> server
/proc/sys/fs/file-max has been set to the recommended value of 131072
/proc/sys/net/ipv4/tcp_fin_timeout has been set to the recommended
value of 15
/proc/sys/net/ipv4/tcp_max_syn_backlog has been set to the recommended
value of 16384
/proc/sys/net/ipv4/tcp_tw_reuse has been set to the recommended value of 1
/proc/sys/net/ipv4/ip_local_port_range has been set to the recommended
value of 102465535
/proc/26610/mapped_base has been set to the recommended value of 134217728
```

Lotus Domino (r) Server, Build V65_07202003NP, July 20, 2003
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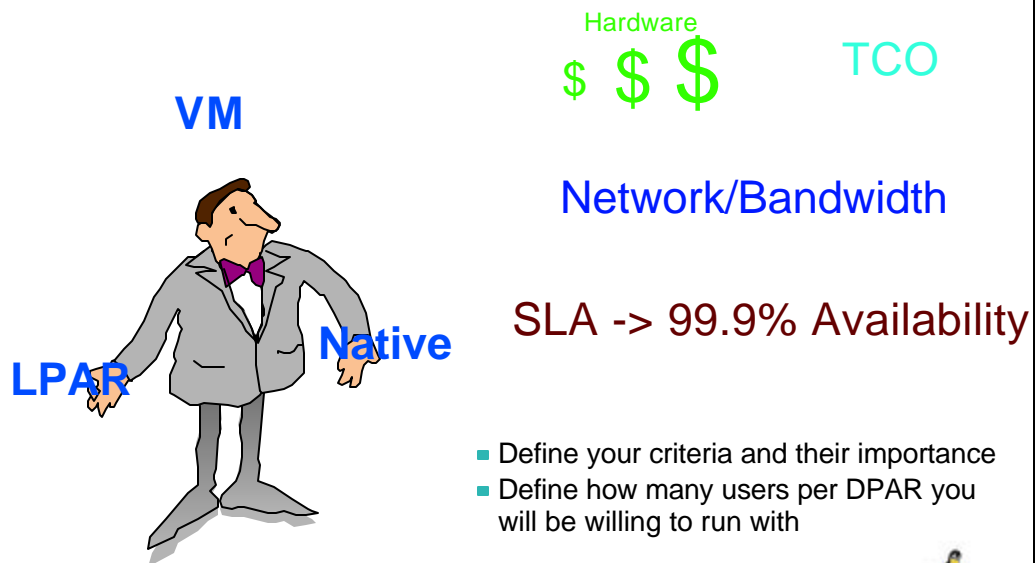


Domino Service for Linux on zSeries

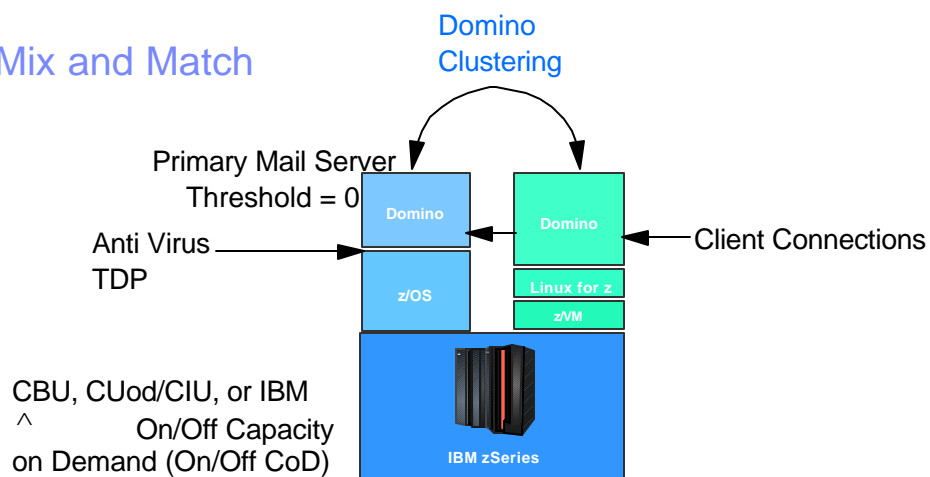
- Even with careful server maintenance, you may occasionally encounter unexpected problems.
- NSD and memcheck are Supported
- It is recommended you enable fault recovery in the server document
- Fault recovery will automatically restart the sever after a Domino server panic
- For optimal service enable CORE dumps (core.xxxx) with notes.ini variable:
 - ▶ `DEBUG_ENABLE_CORE=1`
- Core dumps provide significantly more problem determination data to help solve Domino problems.
- CORE dumps can be rather large and the default location is NOTESDATA, it is recommended that you direct core dumps to a different directory with more space using the notes.ini variable:
 - ▶ `DEBUG_CORE_PATH=/path.....`



What is the Best Way to Run?



Mix and Match



You can mix and match features from both environments as you grow and define your environment



Additional Information

- www.ibm.com/servers/eserver/zseries/software/domino/
- Documentation on LDD
 - ▶ <http://www.lotus.com/ldd/doc>
- Redbooks
 - ▶ SG246926 - Linux on IBM eServer zSeries and S/390 - Performance Measurement and Tuning
 - ▶ SG247021 - IBM Lotus Domino 6.5 for Linux on zSeries Implementation

