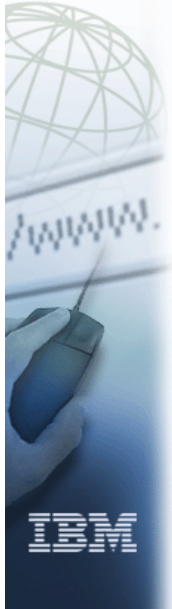**ibm.com**

IBM Lotus Domino 6.5 for Linux on zSeries Implementation

ITSO Workshop Introduction

e-business

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Workshop materials

Version 1.1

You can get the latest version of these presentations at:

- http://w3.itso.ibm.com/itsoapps/material.nsf/webbydate (list of materials)
- http://wtscpok.itso.ibm.com/~wsweb/POK00616/2003MAE.zip
- ftp://www.redbooks.ibm.com/redbooks/itso_zseries_workshops_2003/2003MAE.zip
- Password: itso2003

Related redbooks

- http://www.ibm.com/redbooks
- http://w3.itso.ibm.com
- Search on: Domino AND zSeries

Redbooks

ibm.com/redbooks

For More Information

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+1 845 519 1063

Workshop Description

Title
- IBM Lotus Domino 6.5 for Linux on zSeries Implementation

- **Audience**
  - Technical professionals who will participate in the installation and administration of Lotus Domino servers for Linux on zSeries
    - Roles include: zSeries hardware, z/VM, Linux, Domino administrators

- **After this workshop day, you should be able to:**
  - Understand the value of Domino and Linux on zSeries
  - Describe the benefits of running under z/VM
  - Install and administer a Lotus Domino server on Linux on zSeries
  - Understand the performance and capacity considerations

Agenda - 1

01 - ITSO Workshop Introduction

02 - Product Overview
- What is:
  - Lotus Domino and What is New in R6.5
  - Linux
  - zVM - virtual machines, operation, minidisks, networking
  - zSeries hardware, disks, and LPAR
- Value of Domino on Linux on z (with and without z/VM)
  - zSeries and z/VM advantages

03 - Planning
- Planning
- Disk configuration
- Networking

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Agenda - 2

04 - Installation of z/VM and Linux

05 - Domino Installation and Setup

06 - Administration and Systems Management
- Domino Administration
- Systems Management (administering the environment)

07 - Capacity Planning and Performance Tuning

08 - Other Topics
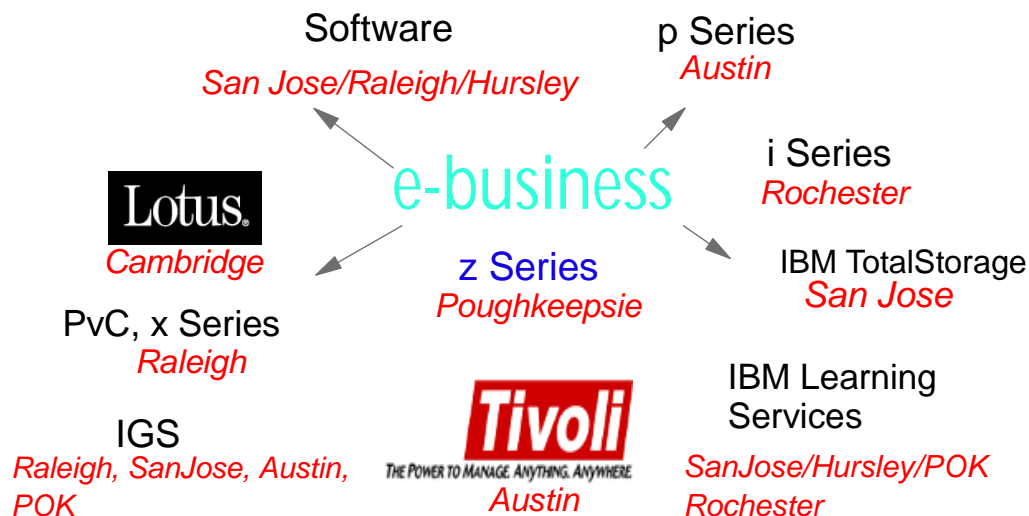- Connectivity
- Migration

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Agenda - 3

Other workshops in track
- Linux for z Technical Update - tuning, security, new features
- Linux for z Connectors, BI and ERP Solutions

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ITSO Centers - where the competence is

Software
San Jose/Raleigh/Hursley

p Series
Austin

e-business

i Series
Rochester

Lotus
Cambridge

z Series
Poughkeepsie

IBM TotalStorage
San Jose

PvC, x Series
Raleigh

IGS
Raleigh, SanJose, Austin, POK

Tivoli
THE POWER TO MANAGE. ANYTHING. ANYWHERE.
Austin

IBM Learning Services
SanJose/Hursley/POK Rochester

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ITSO Today

- **Mission**

  Accelerate marketplace acceptance of all IBM products and solutions through key enablement activities

- **The role of the ITSO is to:**
  - Serve as the engine of technical, practitioner-oriented collateral for the external marketplace
  - Provide marketplace skills enablement, using the ITSO technical collateral as a base
  - Ensure that the ITSO technical collateral is made readily accessible in the marketplace and across IBM
  - Feedback to M&D on product requirements, pre-GA and early GA

- **The ITSO deliverables:**
  - Support sales and accelerate product acceptance in the marketplace
  - Increase customer satisfaction
  - Enhance field practitioner and customer productivity
  - Reduce technical support costs by enabling customer self-service
  - Serve diverse customer delivery requirements

ITSO is renowned for:
- ★ The IBM Redbooks brand - quality & trust for 25 years
- ★ Highly skilled project leaders
- ★ Strong partnership with IBM development labs
- ★ WW authors & perspective
- ★ Technical workshops for successful field enablement
- ★ Innovative residency model
- ★ Exceptional technical editing & publishing
- ★ Global web delivery strategy & broad audience

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How does the ITSO create materials?

Residents
- Real field experience
- World wide perspectives
- Selected subject matter experts
- Close collaboration
- Short timeframe
- Access to developers
- Hands-on, flexible infrastructure

Project Leaders
- Recognized technical experts
  - Scarce, sought- after personnel
- Project management skills
- World wide perspectives
- Flexible workforce
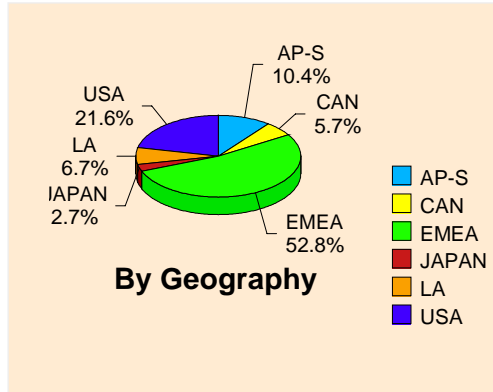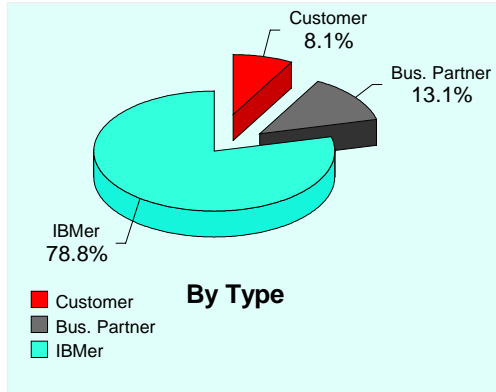- Value delivered to the geos

Results
- Popular, practical Redbooks
- Global applicability
- Skills transfer - readers & residents
- Building IBM's intellectual capital
- Driving IBM products/solutions

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ITSO Residents

By Type
- Customer 8.1%
- Bus. Partner 13.1%
- IBMer 78.8%

Legend:
- Customer
- Bus. Partner
- IBMer

By Geography
- AP-S 10.4%
- CAN 5.7%
- EMEA 52.8%
- JAPAN 2.7%
- LA 6.7%
- USA 21.6%

Legend:
- AP-S
- CAN
- EMEA
- JAPAN
- LA
- USA

MetLife • AT&T • First National Bank • PACIFIC BELL • SuSE • BOEING

Sprint • Deutsche Bank • PEPSI

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Impact of the ITSO Residency Programs

Increased Productivity

# of Residents responding

20 15 10 5 0

10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Productivity increase after Residency experience

■ Business Partner ■ Customer ■ IBM

Skills Transferred after Residency

- IBMer 17
- Business Partner 11
- Customer 19

■ Business Partner ■ Customer ■ IBMer

95% of all managers surveyed responded "Yes" to "Would you sponsor another employee as an ITSO resident?"
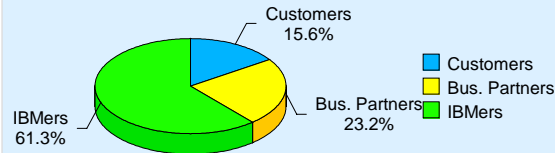
Approximately 1,000 residents per year

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ITSO Workshops

Workshop Sessions by attendees

- Customers 15.6%
- Bus. Partners 23.2%
- IBMers 61.3%

Legend:
- Customers
- Bus. Partners
- IBMers

Workshop Sessions by Geography

- 12.7%
- 5.2%
- 34.7%
- 8.9%
- 13.7%
- 24.7%

Legend:
- AP-S
- Canada
- EMEA
- Japan
- LA
- USA

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Summary - **ibm.com**/redbooks

"they come"

Visits

- Visits
- non ibm user %

Y-axis left: Thousands (0–500)
Y-axis right: Percentage (0–100)
X-axis: April, May, June, July, Aug

"they find"

Content Access

- Search
- Downloads
- Abstracts

Y-axis: Thousands (0–800)
X-axis: June, Sept, Dec98, Mar, June, Sept, Dec99, Mar, June, Sept, Dec00, Mar, June

"they use"

Content Delivery

Y-axis: Gigabytes (0–2500)
X-axis: Sept, Dec98, Mar, June, Sept, Dec99, Mar, June, Sept, Dec00, Mar, June

"they are the market"

Subscribers

Y-axis: Thousands (0–80)
X-axis: Customer, Partner, Soln Developer, IBM, Other

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August 2001 data

Google - proves the power of the brand name

Barnes & Noble - 1309 titles - the library

Amazon.com - top 50 bestsellers are featured

Customer Experience...

It's an excelente web site.
Cordialmente,

Juan Antonio Acevedo Melo
Gerente de Producto
Global Datatel de Colombia S.A.
Telefono 5300350 Ext.126
e-mail: juan_acevedo@tutopia.com

Dear IBM,
You have probably the best online tech documentation around.
New to IBM products, I'm now convinced that IBM delivers quality.
Francis de Briey
Software Architect
Midas-Kapiti International, Luxembourg

I am a brand new IT Architect employee in IBM Canada. I am also an author and technical writer of many technical books.

I was amazed to find these books and i am positive they will be my primary source for technical information (although most of my skills are in Microsoft Internet products and XML). I hope to get involved as i progress with IBM, but just a note to say how useful these are to me !!

Thanks,
Steven <slivings@ca.ibm.com>

Please let me just state that the information published in the Redbooks is extremely use- and helpful and is well appreciated. It helps me leverage on the ever developing Notes and Domino environment like no other source available.

Jeroen Meijer (Lotus/IBM BP)

I just had a customer grab me saying he's really impressed with the web site and serving up books online as you are.
He further indicated that he's got a FileNet system that was suppose to do the same thing (a project called DocGen) and it's failing miserably.

Sincerely, Peter Cram
Client I/T Architect, IBM

Redbooks

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zSeries redbooks on Domino 6 and R5

IBM Lotus Domino 6.5 for Linux on zSeries Implementation, SG24-7021

Lotus Domino 6 for z/OS: Performance Tuning and Capacity Planning, SG24-6904

Domino R5

- Lotus Domino for S/390 Release 5: Installation, Customization and Administration, SG24-2083-02
- Lotus Domino for S/390 Release 5: Enterprise Integration Using Domino Connector Products, SG24-5682
- Lotus Domino for S/390 Release 5: Performance Tuning and Capacity Planning, SG24-5149-02
- Lotus Domino for S/390 Release 5: Problem Determination Guide, SG24-5599
- Lotus Domino for S/390: Running a Large Domino System, SG24-5984
- Build a Portal with Domino: A S/390 Example, SG24-6231

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Additional Information

- Domino for zSeries Home Page
  - ► http://www.ibm.com/zseries/domino

- Documentation on LDD
  - ► http://www.lotus.com/ldd/doc

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IBM

Domino for Linux on zSeries

Product Overview

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For More Information

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mikeebb@us.ibm.com
+1 845 519-1063

Thanks to Dr Andreas Gallus for this presentation

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Topics

What is Domino

What is Domino for Linux on zSeries

Why Domino on Linux for zSeries

What is new in Domino 6.5

What Lotus is doing with Linux

What is Linux

What is z/VM

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What is Domino?

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Domino = Messaging Server

SMTP	POP3	IMAP	LDAP	HTTP	NNTP	IIOP	NRPC

WAP

Object Services API
(Java, Java Script, LotusScript, C, C++, OLE, COM)

Routing	View Indexing	Directory	Replication	Digital Signatures
		Container		

Domino

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+ Application Server + Infrastructure Framework

SMTP	POP3	IMAP	LDAP	HTTP	NNTP	IIOP	NRPC	T120	H323	HTTP NRPC

Object Services API
(Java, Java Script, LotusScript, C, C++, OLE, COM)

Routing Workflow	View Indexing	Directory	Replication	Digital Signatures	Awareness	Replication & Transfer Data Services
					Conversation	
Access Control	Calendaring	Container	Full-Text Indexing	Script Engine	Shared Objects	
Trans Log. & Failover		Domino	DECS		Sametime	LEI

Connectors   Connectors

ERP   RDBMS   Transaction

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What is Domino for Linux on zSeries?

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Introduction

Domino 6.5 for Linux on zSeries

- Announced at LinuxWorld
- Initial offering in Domino 6.5 (2H2003)
- Runs natively or as a guest under z/VM
- Supported on United Linux v1.0 Service Pack 2

Domino 6.5 for Linux on zSeries will be delivered, the same as Domino on other platforms, through Lotus Passport Advantage

Current pricing plan:

➡ One Time Charge (no Monthly License Charge)
➡ Separate service agreement is available
➡ No price change between Domino 6 and Domino 6.5

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Why Domino for Linux on zSeries

For those of you who want to improve on existing distributed Windows or Linux Domino solutions, then server consolidation to Domino for Linux for zSeries may be appropriate

Domino for Linux on zSeries benefits:
- The MOST scalable Linux solution. Uses epoll I/O readiness facility APIs and Domino thread pool architecture
  - Overcomes barrier to single DPAR instance Intel Linux scalability
  - Developed by Davide Libenzi
  - Approved for 2.6 Kernel Standard
  - Backported to 2.4 Kernel by IBM Linux Technology Center
- Linux on zSeries - virtual Linux server environment
  - Linux or Intel server consolidation
  - Centralization of expertise and hardware
  - Improved system management, backup and recovery
- Rapidly growing z/VM / Linux customer base

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What is new in Domino 6.5?

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IBM Lotus Domino 6.5

Provides a highly secure messaging and collaboration platform for sharing
data and connecting your employees and extended communities

- New platform support:
  - ► Linux on IBM zSeries
  - ► Microsoft Windows 2003 Server
- Database unread marks can now replicate between clustered servers
- Administration enhancements:
  - ► Unified interface for Fault Recovery and Cleanup Scripts
  - ► Advanced diagnostic tools for memory and semaphore management
  - ► Automatic diagnostic collection tool
  - ► Free running Memcheck to validate in-memory data structures
  - ► Timestamps in SEMDEBUG.TXT

IBM Lotus Domino 6.5 - 2

Provides a highly secure messaging and collaboration platform for sharing
data and connecting your employees and extended communities

- Domino for z/OS native hardware cryptography for SSL
- Statistics and monitoring platform statistics for Domino on Linux
- Server.Load with new workloads for Domino Web Access, IMAP, and R6Mail.
- Mobile support
- Application development
  - ► Java, COM, and CORBA bindings for new LS classes in 6.0
  - ► Java, COM, and CORBA bindings for XML
  - ► Exposure of LS registration class

IBM Lotus Notes Client 6.5
Productivity and Usability

- Improved product integration
  - ▸ Sametime integration
  - ▸ Export views to CSV
- Productivity
  - ▸ Customizable workplace
  - ▸ Follow-up on e-mail
  - ▸ Replied to and/or forwarded flags
  - ▸ Junk mail handling
  - ▸ QuickRules
  - ▸ Unread e-mail view
- Usability
  - ▸ Rename a resource
  - ▸ Drag and drop between inbox, calendar and todo
  - ▸ Print e-mails without distribution list
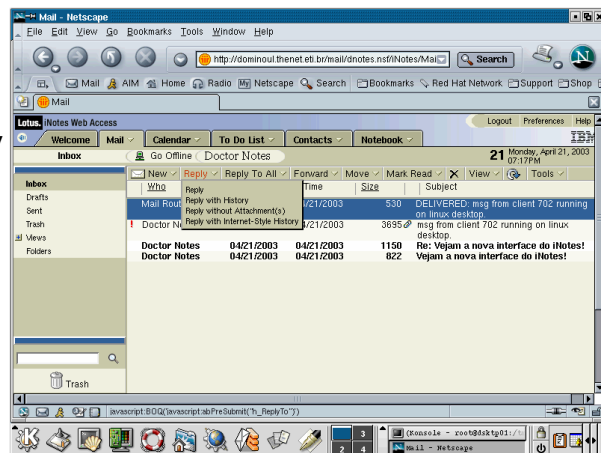- Set Notes as default e-mail client

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IBM Lotus Domino Web Access 6.5

Browser-based access to Lotus Domino for messaging, collaboration and PIM capabilities
helps integrate people with business processes

- The leader in collaboration now offers an
  end-to-end, client-server solution for Linux

- Integrates Lotus Instant
  Messaging functionality

- New features improve user productivity

- Helps reduce total cost of ownership

- Improved scalability and performance

- Provides a security-rich environment

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Lotus & Linux

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Lotus Linux Initiatives/Deliverables for 2003

Domino 6 for Linux

- The market leader in collaboration on Linux
- Enterprise grade messaging and collaboration
- Packed full of features and function to reduce TCO
- Domino 6.5 for Linux on zSeries

IBM Lotus Enterprise Integrator for Domino 6.5 Linux support (not zSeries)

Domino Web Access (formerly iNotes Web Access) - browser based client

- Native browser support "Mozilla" 2H 03 - Domino 6.5

IBM Lotus Workplace Messaging – 2H 03

- Server-side support
- Native Browser support for "Mozilla "

IBM Lotus Workplace 1.1 in Q4

- Deliver Linux support for various collaborative applications including Awareness, Instant Messaging, Teaming, etc.

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Lotus & Linux: Complete end-to-end client-to-server solution

Lotus software for Linux offers a compelling platform for world class collaboration

- Lotus Domino Web Access 6.5 now supports Mozilla browser 1.3.1 running on a Linux desktop client
- Lotus Domino 6.5 adds Linux support for IBM eServer zSeries®
- Lotus Enterprise Integrator 6.5 offers support for Linux

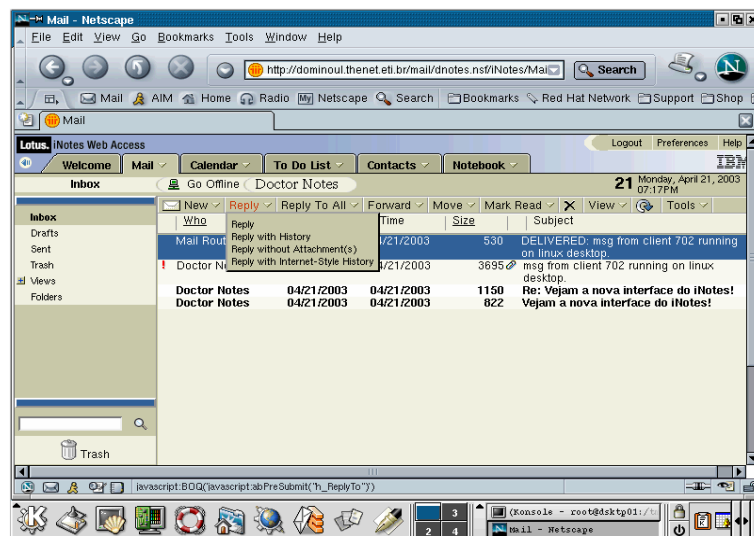**Competitive Upgrade Entitlement from any Linux messaging vendor**

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Linux Domino Web Access 6.5

Mozilla support for Domino Web Access (DWA)

Complete Linux Solution

- End-to-End –> Client-to-Server
- Drive Down Costs

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Lotus Domino future directions

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Getting to Lotus Workplace

2003   2004   2005

Domino 6

Domino 6.5

Domino …

Lotus Workplace

Low TCO Smart Upgrade

Portal "feel" "Live Names"

DB2

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Domino Applications Roadmap

1. Continue to use and build apps for Notes clients
2. Expose Domino Applications to Web clients
3. Use Portlet Factory to incorporate in portal solutions
4. Access Domino apps/services from new JSP apps
5. Leverage Domino quality RAD to J2EE

Expanding Domino Customer Capabilities

Layering in standards based infrastructure as part of the Domino platform

- WebSphere Application Server
- Tivoli System Management
- LDAP v3 Directory
- DB2 in Domino 7

Portal Integration

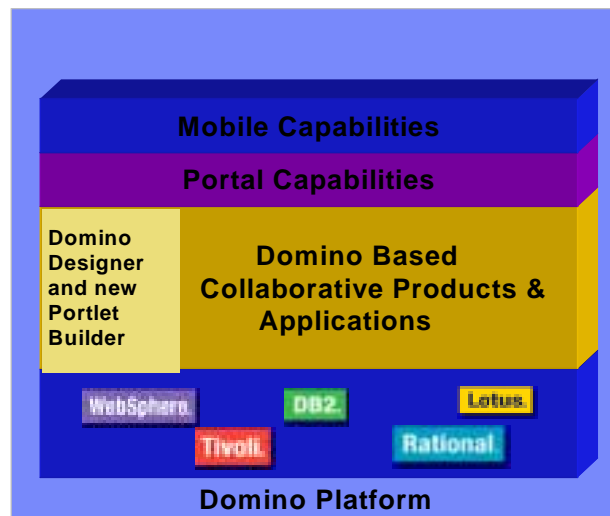- IBM portlets for all Domino-based products

Mobile Integration

- Domino-based products available via mobile devices

Domino Portlet Builder

- Create custom portlets for all Domino-based applications

Mobile Capabilities

Portal Capabilities

Domino Designer and new Portlet Builder

Domino Based Collaborative Products & Applications

WebSphere DB2 Lotus
Tivoli Rational

Domino Platform

What is Linux?

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Linux Defined
A Radical New Concept in Software Development

- UNIX-like operating system
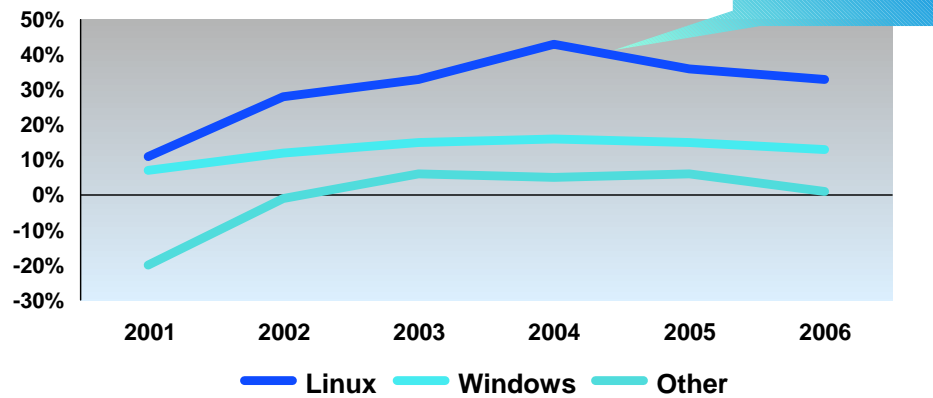- Supported by a global community
- Unprecedented flexibility

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Established and Growing

Server Shipments by OS
% Growth

Linux
CAGR 35%

50%					
40%					
30%					
20%					
10%					
0%					
-10%					
-20%					
-30%					

2001   2002   2003   2004   2005   2006

▬▬ **Linux**   ▬▬ **Windows**   ▬▬ **Other**

IDC Server Market Forecaster
September 2002

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Linux Value

Reliability	
Acquisition Costs	
Performance	
Value of OpenSource	
Security	
TCO	
Scalability	

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%

Source: IBM Market Research 2002

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How Customers are Using Linux

Workload Consolidation

Linux Clusters

Application Solutions

ISV Applications

IBM Middleware

eServer

Distributed Enterprise

Infrastructure Solutions

Redbooks

Linux in the Marketplace

AIR NEW ZEALAND

Mainichi

WETA. DIGITAL

7 ELEVEN

Merrill Lynch

NASA Jet Propulsion Laboratory

New Industries   *New Workloads*   *New Customers*

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IBM's Linux Strategy

Prepare for Future

Grow the Market

Win in "High Affinity" Segments

- **Business Applications**
- **Blades**

- **e-business**
- **Commercial Clusters**
- **Telco carrier-grade**

- **Infrastructure**
- **Scientific Clusters**

Economic Value

IBM's Commitment to Linux Technology

- Linux Technology Center
- Linux Integration Center
- Open Source Development Lab
- Linux Porting Centers
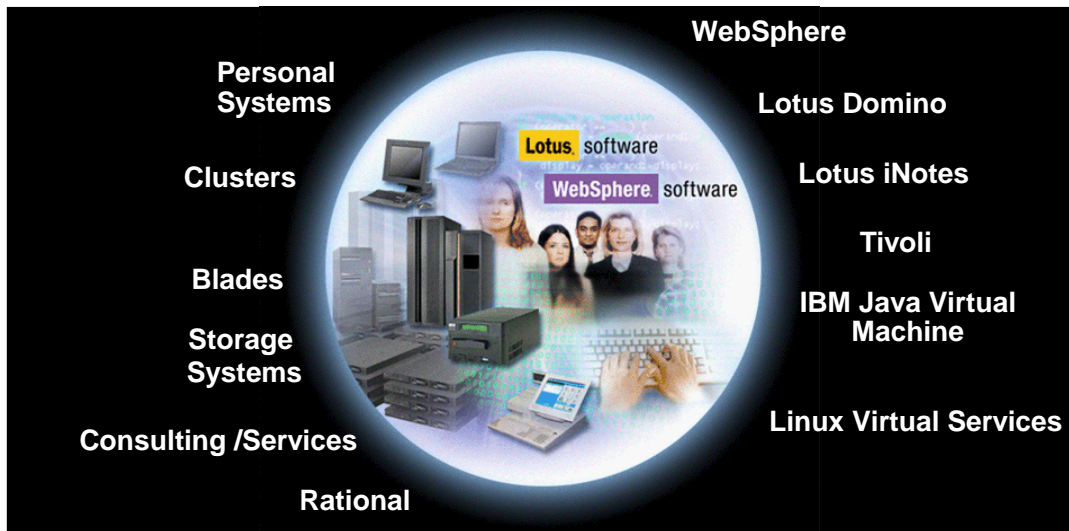- Linux for Service Providers Lab
- Linux Competency Centers
- Global e-business Solutions Center

IBM's Linux Portfolio

WebSphere

Personal Systems

Clusters

Blades

Storage Systems

Consulting /Services

Rational

Lotus Domino

Lotus iNotes

Tivoli

IBM Java Virtual Machine

Linux Virtual Services

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Linux Ecosystem

Redbooks

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Linux in Sum

- Reduces customer costs
- Increases freedom of choice
- Fosters innovation
- Promotes a culture of open standards
- Rewrites the rules for operating systems

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What is z/VM?

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IBM Mainframe Virtualization Technology Evolution

The Virtual Machine Concept is not new for IBM

z/VM
64-bit

VM/ESA®
ESA

VM/XA
31-bit

VM/HPO
64 MB real

VM/SP
N-way

VM/370
S/370™

CP-67
S/360

Functional Enhancements

► Performance
► Scalability
► Robustness
► Flexibility

| 1960s | 1972 | 1980 | 1981 | 1988 | 1995 | 2001 |

zSeries virtualization starts on the chip...a combination of hardware, architecture, firmware, and software functionality

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Virtual Machine Technology: More than Partitioning

A _Virtual Machine_ simulates the existence of a dedicated real machine, including processor functions, storage, and input/output resources.

| Linux | Linux | Linux | CMS | VSE | z/OS |

z/VM can provision a virtual machine with a mix of virtual and real resources.

← Virtual

z/VM

I/O and Network

Memory

← Real

Processors

Linux on z/VM is the industry's most advanced _virtual_ blade solution

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z/VM Version 4 product information

- Requires IBM G5 processor technology or later
  - IBM ^ ™ zSeries™ 800, 900, and 990
  - IBM 9672 G5/G6 and Multiprise® 3000
- Runs on IFL processors as well as standard processors
- IPLA software product (5739-A03)
  - One-time charge license fee, priced on a per-engine basis
  - Ordered via the System Delivery Option (SDO) (5739-A04)
- Optional Software Subscription & Support product (5739-SWS)
  - Required to receive telephone defect support
  - Entitles customers to future z/VM releases and versions
  - Annual, renewable license charge
- Includes IPLA-priced features
  - Directory Maintenance Facility: DirMaint™
  - Performance monitors: RTM, PRF, **Performance Toolkit for VM** [1]
  - Security: RACF® for z/VM

[1] New with z/VM 4.4.0

The Value of z/VM for Linux
Why run Linux on z/VM?

- Server consolidation
  - Consolidate distributed, discrete servers
  - Improve qualities of service
  - Exploit built-in systems management
- Speed to market
  - Deploy servers, networks, and solutions *fast*
  - React quickly to challenges and opportunities
- Technology exploitation
  - Linux with z/VM offers more function than Linux alone
  - Linux can exploit unique z/VM technology features
  - Build innovative e-business solutions

**e-business on
Linux for zSeries**
Open and ready to go

z/VM Virtual Networking
point-to-point connections

IUCV or virtual CTCA used to connect to virtual routers

L06 L07 L08 L09 L10

Subnet 2

z/VM virtual networking is memory-to-memory data transfer (fast!)

L01 L02 L03 L04 L05

Linux or VM TCP/IP

L11 L12 L13 L14 L15

Subnet 1

Subnet 3

Linux

Virtual Routers

Linux or VM TCP/IP

One OSA subchannel serves many Linux images

z/VM CP

= Firewall

Virtual routers access the physical (real) network

OSA

LAN

Network

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z/VM Virtual Networking
Using z/VM guest LANs

- A guest LAN is a virtual LAN created by the z/VM control program
- OSA Express (QDIO) and HiperSockets™ guest LANs can be created
  - ► Point-to-point, Multicast, and Broadcast (QDIO) connections are supported
- Linux images can connect to one or more Guest LANs
  - ► And connect to real network adapters at the same time
  - ► This enables a Linux image to provide external routing and firewall services for other images

Linux Linux Linux Linux

Guest LAN #2

Guest LAN #1

Linux

Linux Linux Linux

Linux

Real Network

Linux

Linux

Linux Linux Linux

Linux

Guest LAN #3

Linux Linux Linux Linux

z/VM

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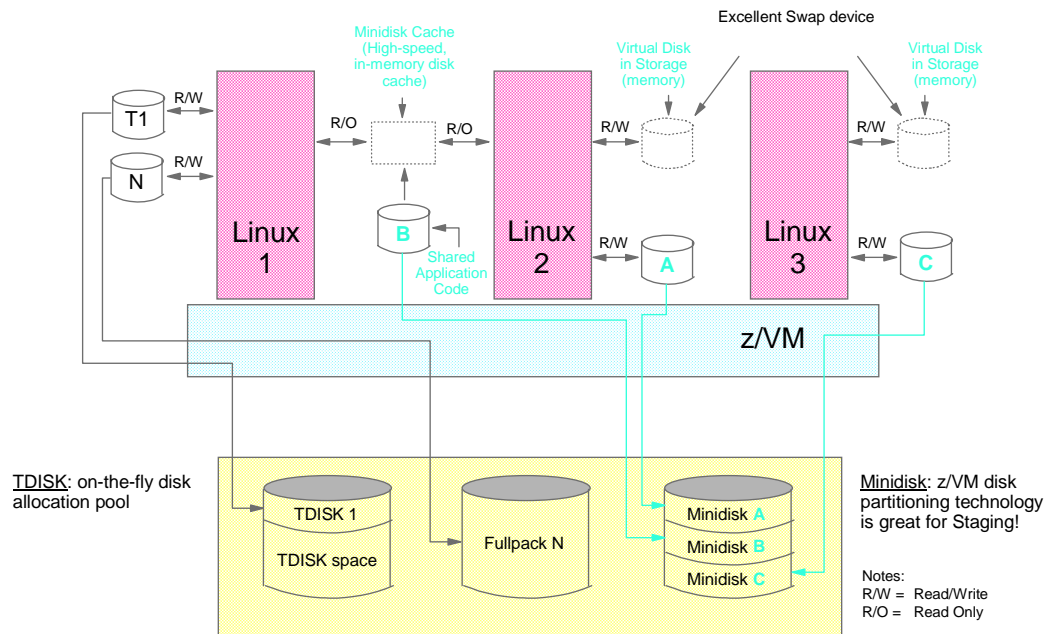
z/VM Disk Technology

- Use z/VM minidisks to partition and share disk storage among Linux virtual servers
- Exploit minidisk cache (MDC) for high-speed access to read-only data (e.g. Linux kernel files, applications)
- z/VM virtual disks in storage (VDISKs) provide memory-to-memory data transfer speeds for read **and** write operations
- Temporary disks (TDISKs) can be dynamically attached to Linux servers when additional disk space is needed for ad hoc operations (e.g. downloading a tar file)
- z/VM 4.3.0 supports the direct attachment of FCP channels to Linux guests, enabling Linux use of SCSI devices

z/VM Technology - Disk

z/VM Technology - Data Backup

```
┌─────────────┐  ┌─────────┐   Virtual Connection          ┌─────────┐
│ Production   │  │  TSM    │                               │         │
│ Application  │  │ Client  │   ·····   ·····               │  TSM    │      ┌──────────┐
│             │  │        │      ····· ·····               │ Server  │ <──> │          │
│             │  │        │                                │         │      │          │
│   Linux     │  │ Linux   │                               │         │      │          │
└─────────────┘  └─────────┘                               └─────────┘      └──────────┘
┌──────────────────────────────────────────────────────────────────────┐
│                                                                        │
│                                        z/VM                            │
└──────────────────────────────────────────────────────────────────────┘
┌────────────────────────────┐
│  ESS        ┌──┐  ┌──┐      │   ■ Use Tivoli Storage Manager™ Server to backup Linux data
│             │  │  │  │      │      ▸ Virtual connections between clients and server means fast
│             └──┘  └──┘      │        data transfer without real network complexities
│             201   202       │   ■ Minimize the down time of your Linux application by
└────────────────────────────┘     exploiting z/VM's Shark FlashCopy™ support
                                      ▸ FlashCopy your data using z/VM
                                      ▸ Run the TSM client code in a separate Linux server image
                                      ▸ Your production application is back online in seconds
```

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Domino for Linux on zSeries

Planning -- Software, Disk configuration, Networking

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For More Information

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Thanks to Brian Macfaden and Faheem Ashraf for this presentation

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Topics

Building a Team

Deciding how to Run Linux on zSeries
- Native LPAR
- VM Guest

Planning
- Required hardware and software
  - sysepoll
- Linux Planning
  - Default kernal values
  - Tune kernal values
  - z/VM considerations
  - Native Linux considerations
- VM Planning
- Domino Planning
  - Administation
  - Domino server options
    - Running Multiple Domino servers
    - Domino server consolidation

Disk Configuration
- VM planning
  - Shared file systems
  - Minidisks
  - Vdisk
- Linux filesystem
  - Linux vs. Windows filesystem
  - Filesystem types
  - Recommendations
- LVM
- Domino file structure
  - Recommendations

Networking
- z/VM networking
- Linux networking
- Domino networking
- Troubleshooting

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Building a Team

Teamwork is a critical success factor
- Domino administration
- Linux administration (could be UNIX skills)
- VM system programming (if VM is used)
- zSeries hardware configuration
- Disk management in a zSeries environment
- Networking
- Operations and systems management from all of the above viewpoints

Plan as a team

Implement as a team
- Gain an appreciation of all the components and their interaction

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Deciding how to run Linux on zSeries

Running Linux natively
- One Linux operating system owns all the server resources
- Linux may not be able to use all the resources on a large system
  - Processors, memory
- More appropriate for smaller systems

Running Linux in an LPAR
- Maximum of 30 LPARs on z990, 15 on other zSeries servers
- Processors can be shared between LPARs
- Can share a server with other Linuxes, z/OS, VSE/ESA, z/VM
- Starting Linux and changing LPARs requires access to hardware management console -- restricted access

Deciding how to run Linux on zSeries - 2

Running Linux as a VM Guest
- Can run hundreds of versions of Linux
  - Provided sufficient hardware resources are available
- Processors and storage are shared between guests
- Linux console can be any workstation that can log in to VM
- VM systems programming skills are needed

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Planning

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Hardware Pre-reqs

Hardware

- S/390 G5 / G6, Multiprise 3000, or zSeries (z800, z900, z990)
  - Linux requires IEEE floating point hardware feature
  - Standard zSeries processors or Integrated Facility for Linux processors (IFLs)
  - At least two processors for Domino
  - Minimum memory for test is 128MB, 256MB for a pilot, more for production
  - TCP/IP network connection
- A workstation with a CD-ROM and a connection to Linux on zSeries where Domino will be installed
- DASD volumes for the Domino program and Domino data directories
- DASD volumes for Linux swap space and (if used) VM page space

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Software Prereqs

Software
- United Linux v1.0 for IBM S/390 with Service Pack 2
  - 2.04.19 Kernel
  - 2.2.5 glibc
  - eg SuSE Linux Enterprise Server 8 (SLES 8) for IBM Mainframes with Service Pack 2
    - http://www.suse.de
- If running under VM
  - z/VM Version 4.3 or higher, or VM/ESA Version 3.1
- If using DECS--DB2 UDB V7
- Web browser on client workstation
- Telnet or ssh client, to log in to Linux on zSeries
  - Example ssh client is PuTTY - free download
    - http://www.chiark.greenend.org.uk/~sgtatham/putty/
- Domino 6 Administrator with Remote Server Setup
  - During Domino Administrator 6 Client installation, select Remote Server Setup
  - To verify
    - Start ->Programs ->Lotus Applications, you should see "Remote Server Setup"

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Domino 6.5 for Linux on zSeries epoll APIs

epoll - I/O readiness change notification facility APIs are new in United Linux Version 1.0 Service Pack 2

- Provides the ability for a pool of threads (e.g. 40 threads) to process asynchronous network I/O to 10s of 1000s of clients.
- Similar asynchronous network I/O architecture was first implemented by Domino 5.0.0 on platforms z/OS, AIX, Sun Solaris, and Windows

Use of epoll APIs by Domino significantly improves scalability and is currently a zSeries exclusive

Domino 6.5 for Linux on zSeries is not supported on other versions of Linux that do not support epoll APIs

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Linux planning

Check that you have the right level of Linux
- ➡ uname -a
- – The result should be
  - ➡ linuxb:~ # uname -a
  - ➡ Linux linuxb 2.4.19-4suse-SMP #1 SMP Thu Jun 5 23:01:37 UTC 2003 s390 unknown
- – The date on your system may be later than Jun 5, 2003

The sys_epoll function is required to run Domino
- – To check if it is installed on your system, issue:
  - ➡ grep epoll /boot/System.map*
- – The result should be
  - ➡ >grep epoll /boot/System.map*
  - ➡ 000797d8 T sys_epoll_create
  - ➡ 00079854 T sys_epoll_ctl
  - ➡ 000799b8 T sys_epoll_wait

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Setting the Default Kernel Values

The following kernel files contain default kernel parameters that should be modified for the Domino environment.

- Note that these are system-wide values; there is no mechanism for changing them specifically for the Domino server application.
- The recommended values have come from attempts to scale Domino for Linux on zSeries with large numbers of mail users in a lab environment, finding bottlenecks, and tuning these kernel parameters to overcome them.

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Setting the Default Kernel Values

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 nofile   20000
- domsrvr hard nofile   49152

- where "domsrvr" is an example of the user that will run the Domino server; specify the UNIX user name in the first column that is the owner of the notesdata directory specified during Domino installation. If you have more than one Domino installation on the same Linux for zSeries platform, repeat these lines for each user name.
- The "soft" value specifies the new default file descriptor limit (ulimit -n), and the "hard" value specifies the maximum file descriptor limit that may be set by the user.

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Setting the Default Kernel Values - 2

- On United Linux 1.0 systems, it has been discovered that the "hard nofile" specification above causes subsequent SSH logins to fail. In fact, any specification that sets the hard file limit above the default 1024 value has this side-effect.
- The failure is limited to the user ID(s) specified. Therefore if "*" (an asterisk) is placed in the first column, only the root user can subsequently login via SSH. We are working to correct this problem in a future Linux distribution.

The Domino server user must login after /etc/security/limits.conf is saved

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Tune Kernel Program

For the best scalability it is recommended that some of the base Linux settings be modified. If these settings are not changed, the following will result upon server startup:

- srvfvt@svtfvt6:/notesdata> server/proc/25135/mapped_base has been set to the recommended value of 134217728
  The value in /proc/sys/fs/file-max is 196608, which does not match the recommended value of 131072
  The value in /proc/sys/net/ipv4/tcp_fin_timeout is 60, which does not match the recommended value of 15
  The value in /proc/sys/net/ipv4/tcp_max_syn_backlog is 1024, which does not match the recommended value of 16384
  The value in /proc/sys/net/ipv4/tcp_tw_reuse is 0, which does not match the recommended value of 1
  The value in /proc/sys/net/ipv4/ip_local_port_range is 32768 61000, which does not match the recommended value of 1024   65535

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

The following parameters are contained in the /proc filesystem. /proc is a virtual file system which is actually a window to kernel memory. Many of the "files" under /proc directories exist only to view and or set kernel parameters.

Each parameter shows the recommended value, and the default value. To set the recommended value, from a root user terminal session, enter each setting as:

- echo recommended-value > parameter-file-name

For example:

- echo 131072 > /proc/sys/fs/file-max

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Tune Kernel Program

Recommended settings for Domino for Linux on zSeries:

- /proc/sys/fs/file-max 131072 (default is 196608)
  - maximum number of file handles allowed for each process
- /proc/sys/net/ipv4/tcp_fin_timeout 15 (default is 60 seconds)
  - time to hold a socket in FIN-WAIT-2 state if it is closed by Domino
- /proc/sys/net/ipv4/tcp_max_syn_backlog 16384 (default is 1024)
  - maximum number of connection requests that are remembered, but have not received acknowledgment from the connecting client
- /proc/sys/net/ipv4/tcp_tw_reuse 1 (default is 0)
  - allow reuse of TIME-WAIT sockets
- /proc/sys/net/ipv4/ip_local_port_range 1024 65535 (default is 32768 61000)
  - expand the range of port values

Tune Kernel Program

Unfortunately, these changes are not permanent. The /proc filesystem is reloaded with default values during each boot.

In order to avoid resetting /proc parameters after each boot, Domino will set them for you at Domino startup.

You must set the environment variable DOMINO_LINUX_SET_PARMS to "1", like this:

- export DOMINO_LINUX_SET_PARMS=1

Tune Kernel Program

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

- srvfvt@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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Linux planning

Linux sysstat package

- Domino can collect platform statistics for display on the Domino Administrator client
- Needs the Linux iostat command

Linux user IDs

- The root (uid = 0) for extracting the TAR file and installing the binaries
- One ID (not 0) for each Domino server
  - During installation this ID is needed to setup and configure the server
- A user ID to FTP the Domino code from workstation to Linux server
  - Root is normally not allowed to use FTP
- Linux group to which the Domino servers belongs -- default is notes

Linux network

- One IP address for each Domino server
- FTP and telnet or ssh access to your Linux system

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z/VM planning

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Some Advantages of Virtualization with z/VM and Linux on zSeries

Multiple Linux operating systems on z/VM

- z/VM can compensate and make many Linux guests perform better
- Example 1 -- Letting z/VM do all the memory paging is better than letting Linux perform the paging
- Example 2 -- 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

Single guest Linux on zSeries operating system using z/VM does not utilize the value of z/VM

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z/VM Configuration Key Tuning Factors

# of guest operating systems (OS)

# of virtual CPUs per guest OS
- Current recommendation no more then 3 virtual to 1 real CPU ratio
- For VM itself, a 1 to 1 ratio

Real storage given to each OS
- Let VM do the paging

Central storage

Expanded storage
- Give VM 25-30% of available real storage

Use of VM guest LAN for memory-to-memory move

OSA cards and TCPIP stack

Performance Issues for Running Native Linux

If you are running native Linux (no z/VM), it is recommended that you use XPRAM for large Domino work loads requiring more than 2 GB of real memory.
- XPRAM makes it possible for Linux to page to extended memory rather than disk.

Steps to Configure XPRAM from the Install Guide
- Configure some extended memory from the hardware console. Linux on zSeries will automatically detect that.
- After that, you can configure the xpram driver.
- The following commands set swap space 1GB from a 3GB partition that was made into a file system and mounted off of the xpram_fs directory
  - insmod xpram devs=1 sizes=2000000
  - mkswap /dev/slram0
  - swapon /dev/slram
- Make sure the xpram swap has higher priority than other disk swap.
- Remember that these commands go away on a reboot. If you want to keep this active, you can place these commands into /etc/init.d/boot.local

Domino Service for Linux on zSeries

NSD and memcheck are supported

It is recommended you enable fault recovery in the server document

- Fault recovery will automatically restart the server after a Domino server panic

For optimal service, enable CORE dumps (core.xxxx) with notes.ini variable:

- DEBUG_ENABLE_CORE=1
- Core dumps provide additional 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...
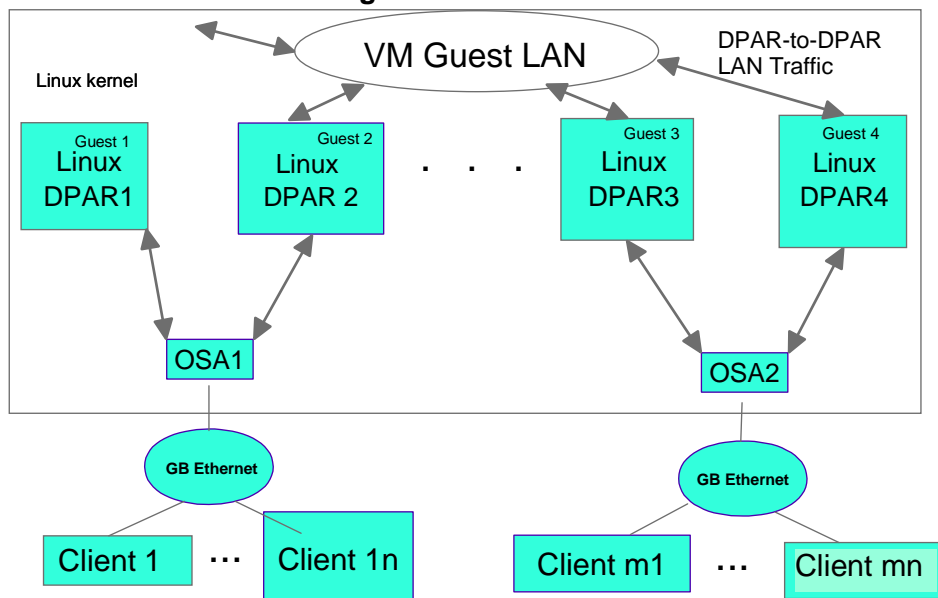
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z/VM: Many Guest Linux Operating Systems with Domino 6.5 for Linux on zSeries

Single z/VM in One LPAR

Redbooks

VM planning

One VM User ID for each Linux guest

- Sample definition with minimal DASD
  ```
  USER LINUXB AAABBB5G 256M 512M G
  IPL CMS PAMR AUTOCR
  MACHINE ESA
  DEDICATE 2C08 2C08
  DEDICATE 2C09 2C09
  DEDICATE 2C0A 2C0A
  MDISK 0191 3390 1545 50 VMLU1A MR
  MDISK 0200 3390 0001 3338 LX1518 MR
  MDISK 0201 3390 0001 3338 LX1558 MR
  MDISK 0202 3390 0001 3338 LX1598 MR
  MDISK 0203 3390 0001 3338 LX15D8 MR
  ```
- Processors -- at least 2 logical and physical
- Memory
- Minidisks

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Domino planning

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Domino planning

A successful production environment requires strong Domino administration skills.

If this is your first installation of Domino, there are many things to plan, including:

- Defining an organizational structure including domain and certifiers
- Setting up the Domino server infrastructure
- Defining user and server naming conventions
- Choosing a pilot application
- Planning a replication strategy
- Defining a mail routing topology
- Planning the Domino directory structure

---

zSeries is simply another Domino server platform

Domino for Linux on zSeries server is just another server platform to Domino.

- The Notes architecture means that the server platform is transparent to the users.

Users see no difference:

- Users access in exactly the same way that they access any other Domino server.
- It looks the same, and the users cannot tell what the underlying platform is.

Domino for Linux on zSeries supports all the clients:

- Notes
- Domino Web Access (DWA, formerly known as iNotes)
- POP3
- IMAP

Domino administration

Administration using:

- Domino Administrator client
- Domino Console

Only difference:

- No native console function on the zSeries processor.
- This results in some minor operational differences. For example, you cannot start a Domino server from the Domino Administrator client, although you can start it from the Domino Console.

This means that there is very little Domino planning that is unique to Linux on zSeries.

If you are moving servers from Windows platform, there are a few differences.

- Domino on Linux is case-sensitive.
- Domino on Linux requires TCP/IP for networking.
- Some applications, such as fax or telephony, won't run on zSeries because the hardware support is not available.

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Domino Planning

Consider consolidation

- Fewer Domino servers and operating system images reduces complexity, support effort and cost

Domino information needed to install the Domino server

Parameter	Default value	Settings used in the redbook
Domino server name	none	domserva/ITSO
Domino domain	none	ITSO
Domino certifier	none	ITSO
Linux user ID for Domino server	notes	domserva
Linux group for Domino server	notes	notes
Install directory for Domino code	/opt/lotus	/opt/lotus
Notes Data Directory	/local/notesdata	/domserva/notesdata
Notes Mail Directory	/local/notesdata/mail	/domserva/notesdata/mail1, 2, n
VM user ID for Linux guest	none	LINUXA
DNS domain	none	itso.ibm.com
Domino server hostname	none	domserva.itso.ibm.com

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Running Multiple Domino Servers

You can run multiple Domino servers in one Linux
- Partitioned servers -- share the same executable Domino code
- Independent servers -- have their own executable Domino code
- With partitioned servers, upgrading Domino is easier
- Linux supports 2GB of memory, so having too many servers in one Linux will result in memory paging

Running multiple instances of Linux
- Both LPAR and z/VM allow you to run multiple Linux instances
  - LPAR maximum is 30 or 15
  - z/VM maximum is hundreds (theoretically thousands) but Domino users use many resources so tens is more realistic
- Running Domino in separate Linux instances gives greater server isolation -- testing, upgrades, operations

Domino Servers - Few or Many

Advantages of a Few
- More efficient in resource use
  - Memory, mail routing

Advantages of Many
- Easier to find window to take a server down for maintenance
- Separate workloads
  - Test, development, production
  - Mail and applications
  - Different customers or departments

Find a balance

Domino Server consolidation

Consolidate existing Domino servers to a single hardware
- Maintain existing logical structure
- Eliminate the network traffic -- all in memory
- Example: 15 physical servers moved to 15 Linux images, each running 1 domino server
- Possible with LPAR and z/VM. z/VM has an advantage in optimizing resources

Consolidate the number of Domino servers
- Move your servers to the new platform and reduce the number of Domino servers by exploiting the scalability of the zSeries platform
- Example: 15 physical servers moved to 1 or 2 Linux guest machines, each running a larger Domino server
- Both possible with LPAR and z/VM

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Disk configuration

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DASD planning

VM planning
- Shared file systems
- Minidisks
- Virtual disk

Linux planning
- Directory tree
- File permissions
- Journal or non-journal filesystem

Mountpoints

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Shared file systems

VM allows you to share DASD across guest virtual machines
- typically in read only mode

Filesystem might be shared among many Linux guests

Linux Directory	Use for .....
/bin	Linux shells and commands
/boot	Linux Kernel and kernel support items
/lib	Shared libraries that are dynamically linked
/opt	Product package code for additional software products typically each in their own subdirectories
/sbin	Programs requiring root or superuser access
/usr/bin	User applications
/opt/lotus	Domino product code

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Sharing advantage

The advantage of sharing the Domino binaries is that you can update all your Domino servers on every Linux (under the same VM) in one single step.

- Keep in mind that we are sharing at the minidisk level. Directories that span multiple minidisks grouped into logical volumes are not candidates for sharing.

Note: You cannot share directories with Domino databases inside, because any Domino server needs exclusive access to its databases.

Minidisks

VM employs the concept of minidisks

- Physical DASD can be split into smaller sizes, or minidisks, and assigned to individual VM user IDs or guest systems. Minidisks can be as small as 1 cylinder or as large as the all cylinders on a DASD, commonly called a pseudo fullpack minidisk.
- Linux views the minidisks as though they were hard drives which can be addressed natively.
- A minidisk is a contiguous portion of a physical DASD, similar to a partition in Windows, that is defined for exclusive use by a specific owner user ID

Remember:

- The size of a minidisk cannot exceed the number of cylinders on a disk.
- Cylinder 0 is used exclusively by the operating system. Minidisks can not span physical DASD.

Linuxc 200

Linuxa 202

Free space

Linuxb 206

Minidisk size

Depending on your DASD type:

DASD Model and capacity

Model	Number of Cylinders	Approximate capacity native	Linux capacity
3390-1	1113	924 MB	789 MB
3390-2	2226	1.8 GB	1.54 GB
3390-3	3339	2.7 GB	2.3 GB
3390-9	10017	8.12 GB	7 GB
3390-27	32000	25.9 GB	22.1 GB

Virtual disks

Virtual disks are disks emulated by VM in memory

- The z/VM operating system automatically manages the virtual disks. Typically they are defined in the guest users' directory entry by address along with the memory to allocate for them.
- Contents of the virtual disk will NOT be available after a shutdown and IPL of the z/VM system.

Typical use of virtual disks by Linux will be for swapping

- For Domino, you can also make use of virtual disks, for example as a place temporarily store the data for rebuilding the database indices while running the update task.

Linux file system vs. Window filesystem

The Linux file system differs from the filesystem used by Windows or DOS in several ways.

Things to remember:
- Linux is case sensitive
- Slash (/) instead of backslash (\) as delimiter
- Tree hierarchy
- Pathnames
- Symbolic links
- File permissions
- Same things have different names. A 'directory' in Linux is a 'folder' in Windows
- Linux does not recognize the file type by file extensions. For example, .exe does not make an executable and .txt does not link the file to a text editor.

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Linux file system types: Journal or non-journal

The difference between a journaled and non-journaled file system is that a journaled file system file offers rapid restart capability after a systems crash.
- There are multiple types of file systems available under Linux for zSeries.

ext2
- A non-journaled file system that we used in some of our test implementations of Linux for zSeries running Domino.

ext3, JFS, or Reiser
- All journaled file systems are equally valid for running Domino, and have been used in testing of Domino for Linux for zSeries at IBM.

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Recommendations:

If Linux crashes:

- When using ext2, a non-journaled file system, it may not be able to be mounted until it is consistency-checked using the e2fsck command.
- With one of the journaled file systems, changes are replayed from a checkpoint in the journal in much the same way as Domino transaction logging replays transactions against databases after a Domino crash. *This can greatly shorten the amount of time that a server is down when a Linux crash has occurred.*

However, everything has its price.

- The journaling under Linux requires a certain amount of overhead.
- This overhead may effect Domino server performance.

The benefits gained from running a journaled file system far outweigh the costs.

It is recommended that the journaled file system ext3 be used for running Domino under Linux for zSeries. It seems to have the least overhead.

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Logical volume manager (LVM)

LVM addresses the issue of disks cannot span more than one physical DASD volume.

- Therefore for most applications you have to combine several physical volumes into one bigger logical volume.

What is a Logical Volume Manager?

- A fundamental way to manage UNIX storage systems in a scalable, forward-thinking manner.
- Implementations of the Logical Volume Management concept are available for most UNIX Operating Systems.
  - One, created by the Open Software Foundation (OSF), serves as a base for the Linux implementation of LVM, which is covered here.
  - LVM for Linux is similar to LVM for AIX and other UNIX implementations.

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Logical volume manager (LVM)

Benefits of Logical Volume Management

- Disk management and scalability
- Not intended to provide fault-tolerance or extraordinary performance. For this reason, it is often run in conjunction with RAID, which can provide both of these.

Costs of Logical Volume Management

- Logical Volume Management does extract a penalty because of the complexity and system overhead it occurs. It adds an additional logical layer or two between the storage device and the applications.

Defining LVM terminology:

We need some definitions for the special LVM terminology:

- A DASD volume is called a physical volume (PV), because that's the volume where the data is physically stored.
- The PV is divided into several physical extents (PE) of the same size. The PEs are like blocks on the PV.
- Several PVs make up a volume group (VG), which becomes a pool of PEs available for the logical volume (LV).

High level overview of creating LVM

Major steps:
- Get some DASD defined to the VM user ID
- Add the DASD in Linux
- Format each DASD, carve into a single partition and verify
- Create physical volumes for each DASD
- Verify physical volumes
- Create the volume group and verify
- Create a striped logical volume using most of the volume group
- Create a journalled file system and mount the logical volume

Domino filesystem structure

Recommendations for separate mount points:
- Notesdata directory
- Translog
- Mail directory
- Executables go to /opt/lotus

Whenever a mount point is created for Domino, the owner and group of the mount point must be changed to be the correct owner and group for that mount point.
- For example, if the mountpoint is to be used by "domserva" and is part of the group "notes", execute the following:
  chown -R domserva:notes <mount point>

Example of a mail server mount points

- The directories in bold and italics indicate that these are separate mount points.

```
                    / 
                    └── /domserva
                            └── notesdata
                                    ├── /mail_01
                                    ├── /mail_02
                                    ├── /mail_03
                                    ├── /mail_nn
                                    ├── /translog
                                    └── ...
```

Example of an application server mount points

- The directories in bold and italics indicate that these are separate mount points.

```
                    / 
                    └── /domservb
                            └── notesdata
                                    ├── /appl01
                                    ├── /appl02
                                    ├── /projectdb
                                    ├── /teamroom
                                    ├── /translog
                                    └── ...
```

Recommendations

Transaction log

- The disk subsystem must also be able to handle continuous writes at a speed of at least 80 MBytes/sec.
- Place the transaction log on a dedicated device and a dedicated controller, or low-volume.
  - The recommendation for a dedicated controller is due to the requirement of being able to deliver a constant stream of transactions to the disk subsystem at the fastest possible transfer rate.
- Enable the fast-write cache on your DASD

Names.nsf

- Normally on same mountpoint as notesdata
- However there may be times when it is a good idea to configure a mountpoint with a dedicated minidisk or volume to hold the Domino directory.
  - Full-text indexed Domino Directory with frequent indexing, such as an online company phone and address book
  - If you do this, you will need a database link for the DD. By default the server expects the DD to be in the notesdata directory.

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Recommendations

mail.boxes

- Most heavily used and most dynamically changeable databases
- In most cases, placing the mail.box database within notesdata provides adequate performance to meet your needs.
  - If mail performance is determined to need improvement, the mail.box database can be placed on a separate filesystem on its own mount point.
- Because the data is only kept for a very short time in the mail.boxes, you place can place them on a virtual disk. However, data is lost at shutdown.
  - If you do this, be sure you check the mail.boxes for dead mail more frequently. This may not be a viable option if the server is acting as an inbound or outbound SMTP gateway, as mail will sometimes be backed up in the mail.box.
- If you place the mail.box on a virtual disk, you should implement a different shutdown procedure for your Domino servers.
  - First shut down the router, then check the mail.boxes for dead or held mail, copy them out of the mailbox and then shut down the server. Place mail.boxes only on virtual disk if you fully understand their concept and limitations.
- Tip: Disable the transaction log for your mail.boxes

Redbooks

Recommendations

Log.nsf and log files for the Java Console (dcntrlr*)

- Put the files in a separate directory.
  - This is not a performance hint. Doing so helps you to clean up your notesdata directory. The log files for remote Domino java console can be configured with an expiration date and therefore be fairly tightly controlled.

Indexing and other temp files

- We suggest that you place the temporary files for rebuilding the index of a database on a virtual disk.
  - notes.ini variable: View_Rebuild_Index_Dir=your/directory.
- The same for your antivirus software for scanning and decompressing attachments to a virtual disk.
- Also you might think of placing the gtrhome directory on a virtual disk.
  - Gtrhome is the directory in which the index engine stores its temporary results from queries and where it builds temporary indexes when users full text search databases that do not have indexes (usually through one of the APIs or an agent).

Important: Put only non-permanent data onto a virtual disk!

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Recommendations

Use of database and directory links

- Both Linux and Domino offer symbolic links for directories and files to databases.

We do not recommend the use of Linux symbolic links

- But the deployment of Domino database or directory links can help you structure your environment without struggling with the Notes client settings.
- For example, you can direct all mail users to a directory called mail. Inside this directory the database links redirect the user transparently to the physical location of their mail file. To accomplish this, you have to create a database link for every mail database in your system. When deleting or adding a user, you have to remember to delete or create not only the database, but also the link.

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Placement of other Domino databases

Mail and application files

- The mail and application databases should go into a separate file system below the notesdata directory of the Domino server.
- Calculating space
  - The total size of the databases (including fulltext index) and the growth rate of your mailfiles (define quota is always a good idea).
- Be careful if you put all files in one big filesystem. Assess how long it takes for a full recovery of one directory.

Recommendations

Estimating DASD space for mail/application

- Depends on the amount of data that each user will store.
  - Normally in the range of 50 to 150 megabytes per user. Will typically grow as the users become more advanced in their use of Domino. Installations with thousands of users will therefore require hundreds of gigabytes (GB), if not terabytes, of DASD space.

Estimating DASD for Domino code

- The binaries for products installed will typically be placed in a subdirectory under /opt.
  - Root (/) and /opt should be defined as separate mount points and not combined into a single filesystem.
- The Domino binaries need about 1.3 GB and for the installation additional 600 MB are needed for the TAR file.
- A good starting point might be to size the root (/) and /opt filesystems at about 5 GB or two 3390 mod-3 full pack minidisks combined in a LVM.
- Plan for /swap space, although it is better to use virtual disk rather than real DASD, at least in z/VM environment

Lesson learned

A lesson learned during testing

- We failed to take into account the size of the /domserva and notesdata directories and placed them under root (/). We found that we had to move the notesdata into a separate filesystem. This caused a considerable amount of work which could have been avoided.

Recommendations

Naming convention

- We recommend that you use a self-describing, self-documenting naming convention for for file systems and LVMs with in your DASD configuration.

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Networking

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Networking Topics

z/VM networking

Linux networking

Domino networking

Troubleshooting

Two common network methods

Two common ways to connect Linux images in zSeries over a TCP/IP network are:

- Directly over a shared OSA adapter (shown below on left)
- Over a z/VM guest LAN with TCP/IP as a router (on right)

OSA

z/VM

LINUXA LINUXB LINUXC

OSA

z/VM

z/VM TCPIP

Guest LAN

LINUXA LINUXB LINUXC

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Two new network methods

Two new ways to connect Linux images in zSeries over a TCP/IP network are:

- VSWITCH (z/VM V4.4)
- VLAN (IEEE 802.1Q)

VSWITCH eliminates the need for a router.

- With z/VM Guest LAN, either the z/VM TCPIP stack or a Linux stack had to do the routing. This takes up CPU cycles.
- VSWITCH allows all Linux images under z/VM to appear to be on the same LAN that is plugged into the OSA.
- Also, you can utilize two OSAs plugged into the same LAN and define the second OSA as a backup in the DEFINE VSWITCH command. This can give high Availabilty on all Linux network interfaces.

VLAN is a group of workstations with a common set of requirements, independent of physical location, connected by switches.

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VSWITCH and VLAN - 2

This diagram represents the VLANs (including z/VM Virtual Switch) as labelled rectangles within the switch. A guest's membership of a VLAN is indicated by a solid circle in the rectangle.

In the VSWITCH, the ability to generate and receive untagged frames is shown membership to the '—' VLAN. For example, the guest LNXSU7 belongs to VLAN 201, but because we granted it access to VLAN ANY it can also generate and receive untagged frames. LNXRH2, on the other hand, was granted access to VLAN 201 only.

The diagram also shows a HiperSockets Guest LAN with a single VLAN, as well as the relationship between the VSWITCH OSA Express port and the controller TCPIP service machine.

For more information on VSWITCH, see redpaper REDP3719
For more information on VLAN, see redbook SG24-5948

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z/VM networking

There are two z/VM user IDs that provide basic TCP/IP services.

- TCPIP
  - ➜ The TCPIP user ID provides the primary TCP/IP service called the stack. When it is logged on or disconnected, TCP/IP should be running. When it is not logged on, TCP/IP is down.
- TCPMAINT
  - ➜ Owns TCP/IP production resources — the 198, 591, and 592 disks. It is the user ID traditionally used to maintain the TCP/IP environment in z/VM.

---

z/VM TCP/IP files

At the minimum, the following configuration files must be updated to connect the z/VM TCP/IP to the network:

- TCPIP DATA
  - ➜ The TCPIP DATA file defines system parameters used by TCP/IP client applications. It is used to specify configuration information such as the host name of the z/VM host, the user ID of the TCPIP virtual machine, the domain name, and name servers. This information is similar to what you find on Linux in the file /etc/resolv.conf.
- PROFILE TCPIP
  - ➜ The PROFILE TCPIP file contains the information required by TCP/IP to connect to the network. Minimally one pair of DEVICE and LINK statements has to be defined. The link is assigned a home address. The network routing environment is established with static routes and a default route. Finally, the device has to be started. On a Linux system this information would be found in several places: /etc/route.conf, /etc/modules.conf, /etc/inetd.conf, /etc/sysconfig/network/ifcfg-eth0 for example.
- SYSTEM DTCPARMS
  - ➜ The file can be used to separate system programming and network programming responsibilities. The sections that follow do not address this the use of this file. Rather, all definitions that can be configured via the file are placed in the USER DIRECT or TCPIP PROFILE files.

z/VM and Linux networking tasks

Some basic networking tasks that are commonly done in a z/VM and Linux environment

- Give OSA addresses to Linux user IDs
- Add a guest LAN to the system
- Add NICs to Linux user IDs
- Customize TCP/IP
- Start or stop TCP/IP

Linux networking

If a guest LAN is defined and the z/VM Linux guests have a NIC defined and coupled, a network interface to a Linux guest can be added as follows.

- Update the file /etc/chandev.conf to define the device
- Update the file /etc/modules.conf to associate a driver to an interface
- Create a configuration file in the directory /etc/sysconfig/network/

Domino, Linux, and VM configurations

z/OS		z/OS		z/OS
Domino				
LPAR 1				

Linux / Domino / LPAR 2

z/VM — Linux 1 / Domino, Linux 2 / Domino, Linux 3 / Domino

z/VM — Linux / Domino Domino Domino

LPAR n

Linux in an LPAR Native

Linux under z/VM 3 guest / 3 Domino Servers

Linux under z/VM 1 guest / 3 DPARs

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Domino networking

- NRPC communication
  - Domino servers offer many different services. The foundation for communication between Notes workstations and Domino servers or between two Domino servers is the Notes remote procedure call (NRPC) service.
- Notes network ports
  - During the server setup program, Domino provides a list of Notes network ports based on the current operating system configuration. If these ports are not the ones you want to enable for use with the Domino server, you can edit the list during setup.
- Notes named networks
  - A Notes named network (NNN) is a group of servers that can connect to each other directly through a common LAN protocol and network pathway—for example, servers running on TCP/IP in one location. Servers on the same NNN route mail to each another automatically, whereas you need a Connection document to route mail between servers on different NNNs. The next foil shows an NNN example. The servers are in the same domain and use the same network protocol.

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Notes Named Network

Domino networking

- Resolving server names to network addresses in NRPC
  - Communications between Lotus Notes and Lotus Domino run over the NRPC protocol on top of each supported LAN protocol. When a Notes workstation or Domino server attempts to connect to a Domino server over a LAN, it uses a combination of the built-in Notes Name Service and the network protocol's name-resolver service to convert the name of the Domino server to a physical address on the network

- TCP/IP: Domino on Linux
  - There is an issue with the default size of the network queue as set on Linux with the kernel parameter tcp_max_syn_backlog. The default value is 5, but under certain conditions that may not be large enough. On other UNIX systems the default is 20, which is a better setting.
  - It is recommended that the user change this parameter in their kernel by changing the value stored in /proc/sys/ipv4/tcp_max_syn_backlog (/proc/sys/ipv6/tcp_max_syn_backlog for ipv6) such that it is no less than 20.
  - Since this is a parameter in the running kernel, it must be done each time the system is booted. An easy way to accomplish this is by making an entry in your startup scripts (such as rc.local).

Troubleshooting

For Notes and Domino to work properly with TCP/IP, the protocol stack must be configured properly. In other words, Notes connectivity relies on TCP/IP communication.

Note: In all TCP/IP troubleshooting, first verify basic TCP/IP connectivity and configuration.

- Ping necessary addresses and names
  - If Ping fails here, TCP/IP is not set up properly on the local machine. The site's network administrators should be contacted for technical assistance.
- Examine Notes Server Documents
  - In the Server Document of the Domino Directory, make sure the Notes Server's Common name in the TCP port's Net Address Field is the same name as the TCP Host name. If this is not the case, a name resolution alias is required in the HOSTS file or in the DNS table.
  - If any of these changes are made, you must restart the involved Domino server before changes to the Server Document will be enacted.

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Troubleshooting

Here are some other helpful commands when debugging network problems.

- TRACEROUTE
  - Issue the command TRACEROUTE to determine what lies between the source and the destination of IP traffic.
- NSLOOKUP
  - NSLOOKUP is to DNS as PING is to general IP connectivity—the first tool you turn to for testing.
- NETSTAT
  - Use NETSTAT to see what IP address is connecting to the server and on which port. The format will be <IPAddress>:<port> (for example: 10.10.10.10:1352).
- HOMETEST
  - HOMETEST verifies that the host tables or name server (depending on the NSINTERADDR statement) can resolve the fully qualified domain name.
    - Note: Verify that the TCPIP virtual machine has been started before you use the HOMETEST statement.

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**Domino for Linux on zSeries
Installation -
z/VM, LPAR and Linux**

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Thanks to Dr Andreas Gallus for this
presentation

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Topics

Installation overview

Install and configure zSeries server

IPL Linux
- In an LPAR *or* natively
- Under z/VM

Install and configure Linux

Install Domino
- See next presentation

Installation steps

Install and configure zSeries server

Install and configure z/VM

IPL Linux in an LPAR

IPL Linux under z/VM

Install and configure Linux

Install Domino

What you need

z/Series server
- An LPAR with sufficient memory, disk, and network (TCP/IP) connection

z/VM
- Optional

Linux distribution
- With sys_epoll thread pooling code
- With an NFS or FTP server

Domino distribution

Desktop PC

Notes client code

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Install and configure zSeries server

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zSeries server

Install hardware

Define resources to be used by operating systems
- Logical partition (LPAR)
- Operating system can be z/VM or Linux

Resources
- Processors
  - In LPAR-- dedicated, or shared with weightings
- Memory
- I/O - defined in IOCDS
- Network connections - with OSA card or alternative
- Disk space

Specialist zSeries skills to install and configure the server

Integrated Facility for Linux (IFL)

IFLs are processors dedicated to Linux-only workloads
- Allocated from the set of spare processors on MCM
- Less expensive than standard processors
- Will not support traditional mainframe operating systems
- Only usable in LPAR mode; cannot be mixed with standard processors

No: LPAR / Std IFL   Yes: LPAR LPAR / IFL   Yes: LPAR / IFL IFL IFL   Yes: LPAR LPAR / IFL IFL IFL

Available with zSeries servers, 9672 G5/G6, Multiprise 3000
- One standard engine must exist before IFLs can be added
  - Exception: z800-0LF is configured with IFL processors only
- Some servers don't have spare processors available for IFLs

Adding IFLs does not change a server's model designation
- No increase in fees for IBM or vendor software installed on standard processors

Sample IFL Configuration

z900 2C6

z/OS	z/OS	z/OS
LPAR1	LPAR2	LPAR3

| CP0 | CP1 | CP2 | CP3 | CP4 | CP5 |

Production Systems — Linux

Devmt & Test Systems — Linux

z/VM
LPAR4

| LN0 | LN1 | LN2 |

IFL engines have no impact on z/OS and associated software fees.

3-processor z/VM V4 charges* (U.S. prices)

Year 1	$168K	OTC plus S&S
Year 2	$33K	S&S
Year 3	$33K	S&S
3-Yr Total	$234K	

* As of June 1, 2003

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Further reading

Redbooks:

- S/390 Partners in Development: EFS Systems on a Linux Base, SG24-6834-00
- Technical Introduction: IBM eServer zSeries 800, SG24-6515-00
- S/390 Partners in Development: Netfinity Enabled for S/390, SG24-6501-00
- S/390 Partners in Development: ThinkPad Enabled for S/390, SG24-6507-00
- FICON Native Implementation and Reference Guide, SG24-6266-00
- IBM eServer zSeries Connectivity Handbook, SG24-5444-01
- IBM eServer zSeries 900 Technical Guide, SG24-5975-00

"Linux on the Mainframe", J. Eilert et.al., 2003

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Prepare and IPL Linux in an LPAR

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Steps to install Linux in an LPAR

Obtain a Linux for zSeries distribution
- On CD

Create a boot tape for zSeries
- Using z/OS or z/VM
- On tape or disk
- Or use CD in HMC

IPL the zSeries server from the Linux boot tape
- Whole machine (except newest models) or one LPAR
- From the hardware management console (HMC)
- Load address is the tape drive or DASD

Linux loads into zSeries memory (central storage)
- Talks to the HMC as its console

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Linux installation worksheet

Description	Value
OSA addresses	
DASD addresses	
Fully qualified host (DNS) name	
Linux IP address	
Gateway IP address	
DNS server IP address	
MTU size	
Subnet mask	
NFS or FTP server with install CDs - IP address	
File path to distribution CD	
File path to SP2 update CD	
FTP server user ID/password (for FTP)	

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FTP the Install Files to z/OS

The install files are on a CD on a client

FTP the files from client to z/OS using TSO

```
ftp <workstation FTP server>
(enter ID and password at prompt)
bin
ftp> quote site lrecl=1024 blksize=8192 recfm=fb track pri=260 sec=50
ftp> bin
ftp> get
Remote file cd1/boot/initrd
Local file linux390.initrd
125 Storing data set <hilevqualifier>.LINUX390.INITRD
ftp: 8060928 bytes transferred in 90.287 seconds. Transfer rate 89.28 Kbytes/sec.
ftp> quote site lrecl=1024 recfm=f blksize=1024 track pri=1
ftp> get
Remote file get cd1/boot/parmfile
Local file linux390.parmfile
125 Storing data set <hilevqualifier>.LINUX390.PARMFILE
. . .
```

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FTP the install files to z/OS - 2

FTP the files from client to z/OS using TSO (cont.)

ftp: 54 bytes transferred in 0.017 seconds. Transfer rate 3.18 Kbytes/sec.
ftp> quote site recfm=fb lrecl=1024 blksize=8192 bl pri=200 sec=100
ftp> get
Remote file file cd1/boot/tapeipl.ikr
Local file linux390.tapeipl.irk
125 Storing data set <hilevqualifier>.LINUX390.TAPEIPL.IRK
250 Transfer completed successfully.
ftp: 2328576 bytes transferred in 29.617 seconds. Transfer rate 78.62 Kbytes/sec.
ftp> quit

Attributes of the files on z/OS

Dataset Name Tracks %Used Device Dsorg Recfm Lrecl Blksize
<hilevqualifier>.LINUX390.TAPEIPL 31 100 3390 PS FB 1024 8192
<hilevqualifier>.LINUX390.INITRD 207 100 3390 PS FB 1024 8192
<hilevqualifier>.LINUX390.PARMFILE 1 100 3390 PS F 1024 1024

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Create an IPL tape on z/OS

Create an IPL tape from the installation files

- Use IEBGENER to copy the files to tape
  - 3 steps, one per file
- Bypass tape label processing
  - LABEL=(1,BLP) on JCL for tape device
- If non-labelled tape is not possible
  - Use a standard-label tape
  - IPL two to five times
    - First few will fail - tape labels
    - Last IPL should succeed

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FTP the install files to z/VM

The install files are on a CD on a client

Log on to z/VM and IPL CMS

Access ftp on z/VM
- link tcpmaint 592 592 rr
- acc 592 f

Define a temporary disk to hold the install files
```
def t3380 as 192 cyl 30
format 192 b
DMSFOR603R FORMAT will erase all files on disk B(192). Do you wish to continue?
Enter 1 (YES) or 0 (NO).
1
DMSFOR605R Enter disk label:
temp
Formatting disk B
30 cylinders formatted on B(192)
```

FTP the install files to z/VM - 2

Ftp the files from client to z/VM
```
ftp 9.9.9.9
VM TCP/IP FTP Level 430
Connecting to 9.9.9.99, port 21
220 ready, dude (vsFTPd 1.1.0: beat me, break me)
USER (identify yourself to the host):
joeuser
>>>USER joeuser
331 Please specify the password.
Password:
>>>PASS ********
230 Login successful. Have fun.
locsite fix 1024
bin
>>>TYPE i
200 Binary it is, then.
get cd1/boot/initrd SLES8.INITRD.B
150 Opening BINARY mode data connection for cd1/boot/initrd (8060811 bytes).
226 File send OK.
. . .
```

FTP the install files to z/VM - 3

FTP the files from client to z/VM ...

```
8060928 bytes transferred in 90.287 seconds. Transfer rate 89.28 Kbytes/sec.
get cd1/boot/tapeipl.ikr SLES8.TAPEIPL.B
150 Opening BINARY mode data connection for cd1/boot/tapeipl.ikr (2328576 bytes)
226 File send OK.
2328576 bytes transferred in 29.617 seconds. Transfer rate 78.62 Kbytes/sec.
asc
>>>TYPE a
200 ASCII tastes bad, dude.
get cd1/boot/parmfile SLES8.PARMFILE.B
150 Opening BINARY mode data connection for cd1/boot/parmfile (52 bytes).
226 File send OK.
54 bytes transferred in 0.017 seconds. Transfer rate 3.18 Kbytes/sec.
quit
221 Goodbye.
```

Create an IPL tape on z/VM

Attach a tape drive - needs a privileged VM user ID
ATT B30 LINUXC AS 181

Insert a blank non-labelled tape

Create and run a REXX EXEC to copy the boot files to tape
```
REW 181
'FILEDEF IN DISK SLES8 TAPEIPL B'
'FILEDEF OUT TAP1 (RECFM F LRECL 1024 BLOCK 1024 PERM)'
'movefile in out'
'FILEDEF IN DISK SLES8 PARMFILE B'
'movefile in out'
'FILEDEF IN DISK SLES8 INITRD B'
'movefile in out'
```

Rewind tape for an immediate IPL

Tape or DASD installation

To create a boot file on disk
- Get bootstrap JCL from: http://home.iae.nl/users/rvdheij/linuxipl.txt

IPL Linux from the address of the tape or disk
- Using the HMC

When IPLed
- Execution control passes to the kernel's self loading routine
- Kernel reads the parmfile to get the first time boot parameters
- The RAM disk is then loaded
  - Contains all of the programs, scripts, etc. required to install LINUX

IPL Linux without any other operating system

Place the CD in the CD-ROM drive in the Hardware Management Console (HMC)

On the HMC
- Select the CPC that contains the Linux LPAR
- Select the target LPAR to install Linux on
- Double-click on LOad from CD-ROM or Server
- Source of software - HMC CD-ROM Radio button
- FTP - select FTP source - OP address, user ID, password, path
- Scans root directory of CD
- Select the first file

System
- Retrieves the code
- Performs a clear reset, loads the LPAR with the installation kernel

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Install and configure z/VM

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z/VM basics

Runs on a real zSeries server

Supports multiple virtual servers

Each virtual server (virtual machine) runs an operating system (a guest)

- Any zSeries operating system
- z/OS, Linux, VSE/ESA, even another z/VM (runs second level)
- The operating system thinks it has its own set of resources
  - Processors, memory, disks, I/O connections, printers

z/VM maps the virtual resources for each virtual machine to the real resources

- Control Program (CP)
  - Partitioning
  - Sharing
  - Emulating

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zSeries Server

zSeries system image

CPO
CP1
CP2
.
.
.
CPn

expanded storage

central storage

Operating System

console

CU

channels

control units

CU CU CU CU CU CU

disk

magnetic tape

card reader

card punch

line printer

Virtual Machines

OS/390 virtual machine

S/390 system image

CPO
CP1
CP2
.
CPn

expanded storage

central storage

Operating System

console

CU

channels

control units

CU CU CU CU CU CU

disk

magnetic tape

card reader

card punch

line printer

Linux for S/390 virtual machine

S/390 system image

CPO
CP1
CP2
.
CPn

expanded storage

central storage

Operating System

console

CU

channels

control units

CU CU CU CU CU CU

disk

magnetic tape

card reader

card punch

line printer

VSE/ESA virtual machine

S/390 system image

CPO
CP1
CP2
.
CPn

expanded storage

central storage

Operating System

console

CU

channels

control units

CU CU CU CU CU CU

disk

magnetic tape

card reader

card punch

line printer

CPO CP1 CP2 ... CPn

VM/ESA Control Program

central storage

expanded storage

channels

control units

CU CU CU CU CU CU CU

disk

magnetic tape

card reader

card punch

line printer

console

The CP Directory

```
USER LINUXC XXXXXXXX 256M 1G G 1
IPL CMS PARM AUTOCR 2
MACHINE ESA 4 3
DEDICATE 2C0C 2C0C 4
CONSOLE 0009 3215 6
SPECIAL 0600 HIPER 3 SYSTEM GUESTLAN 7
SPOOL 000C 3505 A 8
SPOOL 000D 3525 A 8
SPOOL 000E 1403 A 8
LINK MAINT 0190 0190 RR 9
LINK MAINT 019E 019E RR 9
LINK MAINT 019F 019F RR 9
LINK MAINT 019D 019D RR 9
MDISK 0191 3390 1595 50 VMLU1A MR 10
MDISK 0200 3390 0001 3338 LX1519 MR 10
MDISK 0201 3390 0001 3338 LX1559 MR 10
MDISK 0301 FB-512 V-DISK 409600 MR
SPECIAL 808 CTCA 12
SPECIAL 809 CTCA 12
```

VM Device Support

Processors	Each virtual machine can have up to 64 defined. CP maps virtual processors onto real processors - shared or dedicated.
Storage (Memory)	Virtual machine has dedicated virtual memory. CP manages pages in real storage, expanded storage or paging device.
Minidisks	Virtual disk devices - part of or a whole real disk volume. Can be shared between virtual machines.
Temporary minidisks	Allocated as requested by virtual machine. Reside in a defined pool of disk storage.
Virtual minidisks	Temporary minidisks allocated in memory.
Reader, punch, printer	No associated with real devices, but managed by CP spooling system. Provides input and output from real devices, or between virtual machines.
Console	Primary user interface. The screen you logon to VM from. Can enter CP commands, and IPL an operating system. Can disconnect and virtual machine keeps running.
Channel to channel device	Virtual channel to channel connection implemented within CP.
Dedicated devices	Preferred guest performs I/O without intervention from CP.

CMS

Conversational Monitor System (CMS)

- Unique z/Series operating system
- IPLed in a virtual machine
- Provides a single user interface to the server
- Can issue commands, run applications, and execute EXECs

---

z/VM Planning

z/VM base installation

- z/VM Guide for Automated Installation and Service, Version 4, Release 4.0, GC24-6064
  - http://www.vm.ibm.com/pubs/

Define Linux virtual machine

- User ID
  - Use the DIRMAINT command or the USER DIRECTORY file
- Storage or memory
  - Central storage and expanded storage
    q stor
    STORAGE = 2097148K
    q xstor
    XSTORE= 2048M online= 2048M
    XSTORE= 2048M userid= SYSTEM usage= 4% retained= 768M pending= 0M
    XSTORE MDC min=0M, max=2048M, usage=4%
    XSTORE= 1280M userid= (none) max. attach= 1280M

z/VM Planning - 2

Define Linux virtual machine

- Number of Processors
  - Minimum of two physical and logical CPs is recommended for Domino
    DOMINO performs better in a multiprocessor environment
- Query the number of physical CPUs:
  ```
  q processors
  PROCESSOR 00 MASTER
  PROCESSOR 01 ALTERNATE
  ```
  - Maximum number of virtual CPs is in user directory for each z/VM user ID:
    MACHINE ESA 4
- Set number of virtual CPs:
  ```
  define cpu 2
  ```

Redbooks

---

z/VM planning - 3

z/VM page and spool space

- Rule of thumb: Page space on DASD = 2 x Sum of total virtual storage
  - Includes z/VM and all guests
  - If z/VM has 2GB of central storage, plus 12 Linux guests each with 512MB
    `2 * (2 + 12 * 0.5) = 16 GB  -  equates to 7 x 3390-3 paging volumes`
- Rule of thumb: z/VM should use average of 30% or less of page space
  - Else abends with a code of PGT004
- Query page space in use
  ```
  q alloc
  DASD 3708 VMLRES 3390 CKD-ECKD (UNITS IN CYLINDERS)
       TDISK TOTAL=000100 INUSE=000000 AVAIL=000100
       PAGE  TOTAL=000059 INUSE=000005 AVAIL=000054
       SPOOL TOTAL=000090 INUSE=000090 AVAIL=000000
       DRCT  TOTAL=000017 INUSE=000001 AVAIL=000016, ACTIVE
  DASD 3F01 VMLPST 3390 CKD-ECKD (UNITS IN CYLINDERS)
       TDISK TOTAL=001000 INUSE=000000 AVAIL=001000
       PAGE  TOTAL=001000 INUSE=000001 AVAIL=000999
       SPOOL TOTAL=001270 INUSE=000304 AVAIL=000966
       DRCT  TOTAL=000000 INUSE=000000 AVAIL=000000
  ```

Redbooks

z/VM planning - 4

Disk space for Linux and Domino
- Domino needs a lot of disk space
- Plan it carefully - see the DASD section

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---

z/VM Useful Commands

q n	Query names	Lists the user IDs that are logged on
q da	Query DASD	List DASD available
q PROC	Query Processors	Display real processors & usage
q V ALL	Query Virtual all	List virtual storage, devices, processor information
dirm	Dirmaint	Maintain the user directory - add users, change user definitions
IPL		Issue an Initial Program Load (boot) for your virtual machine

See the redbook for more commands

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Prepare and IPL Linux under z/VM

International Technical Support Organization

Steps to install Linux under z/VM

Get a z/VM user ID

Ftp the install files to z/VM
- Linux kernel - vmrdr.ikr
- Parameter file - parmfile
- Initial RAMdisk - initrd

Punch these files to the z/VM guest reader

IPL Linux

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FTP the install files to z/VM

The install files are on a CD on a client

Log on to z/VM and IPL CMS

Access ftp on z/VM
- link tcpmaint 592 592 rr
- acc 592 f

Define a temporary disk to hold the install files

```
def t3380 as 192 cyl 30
format 192 b
DMSFOR603R FORMAT will erase all files on disk B(192). Do you wish to continue?
Enter 1 (YES) or 0 (NO).
1
DMSFOR605R Enter disk label:
temp
Formatting disk B
30 cylinders formatted on B(192)
```

FTP the install files to z/VM - 2

FTP the files from client to z/VM

```
ftp 1.111.11.1
USER (identify yourself to the host): <FTP user name>
Password: <password>
ftp> cd /mnt/sles8cd1/boot
ftp> asc
ftp> locsite fix 80
ftp> get parmfile sles8.parmfile.b
ftp> bin
ftp> get initrd sles8.ramdisk.b
ftp> get vmrdr.ikr sles8.kernel.b
ftp> quit
```

FTP the install files to z/VM - 3

Check the files

- filel sles8 *

```
Cmd    Filename Filetype Fm Format Lrecl    Records     Blocks
       SLES8    EXEC     A1 V          50         10          1
       SLES8    RAMDISK  A1 F          80      87865       1717
       SLES8    KERNEL   A1 F          80      27060        476
       SLES8    PARMFILE A1 V          50          2          1
```

Punch the files to VM guest reader

Punch the three install files to the guest VM reader

- This is a virtual card reader
- Can then IPL from this device
- Must be punched in correct order
- You can use this EXEC - SLES8 EXEC

```
/* REXX EXEC for loading SUSE SLES-8     */
say 'Loading files for SuSE SLES-8 into reader...'
'CP CLOSE RDR'
'CP PURGE RDR CLASS L'
'CP SPOOL PUN * RDR CLASS L'
'PUNCH SLES8 KERNEL A (NOH'
'PUNCH SLES8 PARMFILE A (NOH'
'PUNCH SLES8 RAMDISK A (NOH'
'CP SPOOL RDR KEEP CLASS L'
'CP IPL 00C CLEAR'
```

IPL Linux

If you run the previous EXEC, Linux IPLs automatically

- Last line of EXEC is: 'CP IPL 00C CLEAR'

If the files are already in the reader, you can IPL manually

- IPL 00C CLEAR

      sles8
      Loading files for SuSE SLES-8 into reader...
      0000003 FILES PURGED
      RDR FILE 0004 SENT FROM LINUX4 PUN WAS 0004 RECS 027K CPY 001 L NOHOLD NOKEEP
      RDR FILE 0005 SENT FROM LINUX4 PUN WAS 0005 RECS 0002 CPY 001 L NOHOLD NOKEEP
      RDR FILE 0006 SENT FROM LINUX4 PUN WAS 0006 RECS 088K CPY 001 L NOHOLD NOKEEP
      0000003 FILES CHANGED
      hwc low level driver: can write messages
      hwc low level driver: can not read state change notifications
      hwc low level driver: can receive signal quiesce
      hwc low level driver: can read commands
      hwc low level driver: can read priority commands
      Linux version 2.4.19-3suse-SMP (root@s390l5) (gcc version 3.2) #1 SMP Thu Oct 17
       11:03:16 UTC 2002
      We are running under VM (31 bit mode)

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Linux installation worksheet

Description	Value
REXX EXEC to IPL from reader (under z/VM)	
OSA Express port name (for OSA devices)	
Fully qualified host (DNS) name	
Linux IP address	
Gateway IP address	
DNS server IP address	
MTU size	
Subnet mask	
NFS or FTP server with install CDs	
File path to distribution CD	
File path to SP2 update CD	
FTP server user ID/password (for FTP)	
Installation method (X Window, VNC or ssh)	
DASD addresses to be used	

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Disk details

DASD address	Linux device file name	File system over which to mount

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Install and configure Linux

Redbooks
International Technical Support Organization

Linux installation and configuration steps

1. Answer the networking questions
   - Sets up TCP/IP connectivity
   - On the client, mount the CDs as ISO images and loopback
2. Begin graphical installation process
3. On the side, format the DASD from an ssh or telnet session
4. Complete graphical installation process
5. Reboot Linux system from disk and finish basic install
6. Apply the SLES-8 service pack 2 CD
7. Install the sys_epoll RPM
8. ReIPL with the new kernel
9. Set up logical volumes
10. Set up swapping to virtual disk
11. Turn off unneeded services
12. Make a copy of the root file system - optional

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Domino for Linux on zSeries specific tasks

We focus on following SLES 8 installation steps:

3. Format the DASD from an ssh or telnet session
6. Apply the SLES-8 Service Pack 2
7. Install the sys_epoll RPM
10. Set up virtual disks as swap devices

Everything else is typical Linux installation activity.

Complete installation description can be found in the redbooks:
- *IBM Lotus Domino 6.5 for Linux on zSeries Implementation* (SG24-7021)
- *Linux for S/390* (SG24-4987)

Redbooks

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3. Format the DASD from an ssh or telnet session

The SLES-8 installation process cannot format and partition zSeries DASD.
You *must* manually do this with an ssh or telnet session for each DASD

Use
  `cat /proc/dasd/devices` to list the DASD devices

then format with
  `dasdfmt -b 4096 -f /dev/dasda` *(then dasdb, dasdc, etc.)*

and build a partition using
  `fdasd -a /dev/dasda` *(then dasdb, dasdc, etc.)*

Format - 2

```
# cat /proc/dasd/devices
0200(ECKD) at ( 94:  0) is dasda : active at blocksize: 4096, 600840 blocks, 2347 MB
0201(ECKD) at ( 94:  4) is dasdb : active at blocksize: 4096, 600840 blocks, 2347 MB
...
# dasdfmt -b 4096 -f /dev/dasda
Drive Geometry: 3338 Cylinders * 15 Heads =  50070 Tracks

I am going to format the device /dev/dasda in the following way:
   Device number of device : 0x200
   Labelling device        : yes
   Disk label              : VOL1
   Disk identifier         : 0X0200
   Extent start (trk no)   : 0
   Extent end (trk no)     : 50069
   Compatible Disk Layout  : yes
   Blocksize               : 4096

--->> ATTENTION! <<---
All data of that device will be lost.
Type "yes" to continue, no will leave the disk untouched: yes
Formatting the device. This may take a while (get yourself a coffee).
Finished formatting the device.
Rereading the partition table... ok
# fdasd -a /dev/dasda
auto-creating one partition for the whole disk...
writing volume label...
writing VTOC...
rereading partition table...
```

6. Apply the SLES-8 service pack 2 CD

Commonly applied using YaST2
- Set DISPLAY environment variable to point to a desktop with an X server running
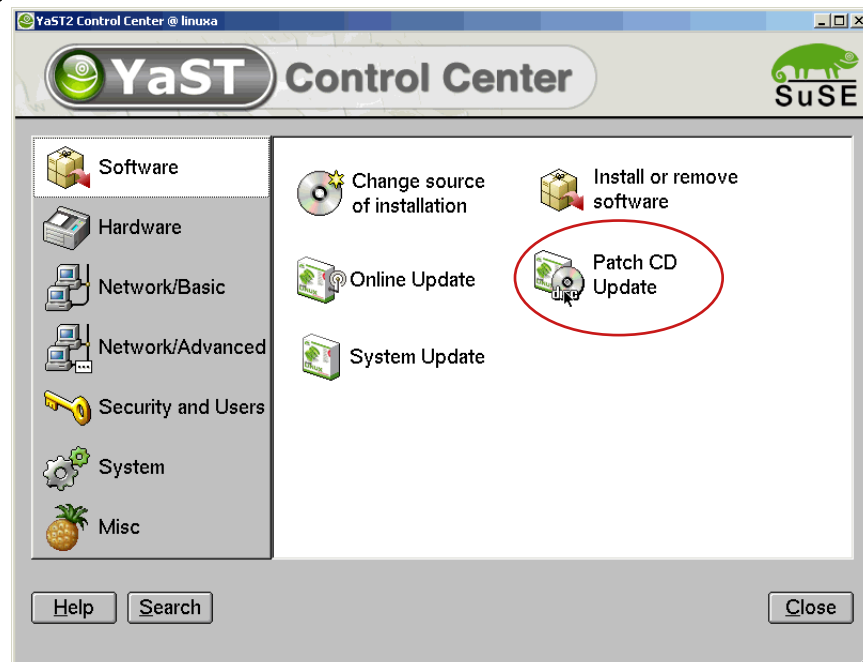- Start YaST2 in background

In YaST2 Window
- Select "Patch CD Update"
- Select "Automatic Update" and appropriate URL type
- Type in necesary Network data
- Watch the Update process work for you

SP2 - 2

SP2 - 3

YaST Online Update

YaST2@linuxa

Welcome to SuSE Package Update

SuSE Online Update is the easy way to get all recommended patches and security fixes from a SuSE ftp/http server.
Automatic Update will connect to the server, fetch the files, and install the patches.

Manual Update will display all available patches and you can choose which patches should be installed.
Information about the last update will be shown if you click on the **Details** button.

After clicking **Expert**, select a local installation source instead of an FTP or HTTP server or select another FTP or HTTP server.

System information
Product: SuSE SLES
Version: 8
Base architecture: s390

Choice of update
○ Automatic Up
● Manual Upda

Choice of installa
Installation sourc
`cd:///`

YaST2@linuxa

Select Type of URL:
○ Directory
● FTP
○ HTTP
○ Samba
○ NFS
○ CD
○ DVD

[OK] [Cancel]

[Expert]

[Back]　[Abort Update]　[Next]

SP2 - 4

YaST Online Update

YaST2@linuxa

Online Update Confirmation
Package Update information

After connecting to SuSE server, YaST2 will download all selected patches. This could take some time. Several details are shown.

When the download succesfully was finished, the patches will be installed. The progress is shown in the log window. If there are special messages associated with patches they will be shown in an extra dialog, when the patch is being installed.

After patches are installed the downloaded data isn't needed anymore. If you want to delete this data, activate the option 'Remove source packages after update.'

Retrieving patch–3414: "Recommended update for package seccheck" Ok
Retrieving patch–4018: "Security update for webalizer" Ok
Retrieving patch–4046: "Security update for MySQL" Ok
Retrieving patch–4053: "Security update for package cups" Ok
Retrieving patch–4065: "Recommended update for xntp" Ok
Retrieving patch–4126: "Security update for libpng" Ok
Retrieving patch–4146: "Security update for fetchmail" Ok
Retrieving patch–4312: "Security update for package susehelp" Ok
Retrieving patch–4526: "Recommended update for package bc" Ok
Retrieving patch–4578: "Security update for SuSEfirewall2" Ok
Retrieving patch–4585: "Security update for openldap2" Ok
Retrieving patch–4693: "Security update for mod_php4" Ok
Retrieving patch–4732: "Security update for OpenLDAP" Ok
Retrieving patch–4903: "Security update for package libmcrypt" Ok
Retrieving patch–4950: "Security update for OpenSSL" Ok
Retrieving patch–4970: "Recommended update for package star" Ok
Retrieving patch–4977: "Security update for package w3m_ssl" Ok
Retrieving patch–5161: "Recommended update for Linux kernel (k_deflt)" Ok
Retrieving patch–5231: "Security update for package tcpdump" Ok
Retrieving patch–5293: "Security update for package wget" Ok
Retrieving patch–5363: "Security update for package file" Ok
Retrieving patch–5373: "Security update for package gpopper" Ok

☐ Remove source packages after update.

[Back]　[Abort Update]　[Next]

7. Install the sys_epoll RPM

Install sys_epoll RPM manually (YaST is also an option)
- Use ssh or Telnet to connect to the Linux server
- Mount the CD with the RPM
- Install the RPM using the **rpm** command

```
# ls /mnt
.  ..
# mount 10.107.69.42:/mnt/sles8sp2cd1 /mnt
# cd /mnt/s390/update/SuSE-SLES/8/rpm/s390
# rpm -ivh epoll-1.0-9.s390.rpm
epoll                      ####################
.....
```

---

10. Set up virtual disk swap

Set up virtual disks for use by a VMID running Linux as follows.
- Ensure that there is enough space defined for virtual disk creation
- Define the virtual disks
- Format the virtual disks
- Reserve all of the space on the virtual disks for swap space

Drive the virtual disks with the Diagnose I/O driver in Linux!

Virtual disk

Ensure space for virtual disk creation:

- Use `syslim` command if all virtual disks are defined in the user directories
  - `-query vdisk syslim`
  - `-VDISK SYSTEM LIMIT IS INFINITE,        1500000 BLK IN USE`
- Use `userlim` command if you allow the creation of virtual disks by a user
  - `-query vdisk userlim`
  - `-VDISK USER   LIMIT IS INFINITE`

Create the virtual disks:

- VDISK definition in user's directory - 10 virtual disks each with 50000 blocks:
  - `-MDISK 0301 FB-512 V-DISK 50000 MR`
  - `-...`
  - `-MDISK 0310 FB-512 V-DISK 50000 MR`
- Virtual disks created by user:
  - `-DEFINE VFB-512 AS 323 BLK 50000`
  - `-DASD 0323 DEFINED`

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Virtual disk - 2

Use the CMS `format` command to format the disk to the 512 block size

```
    format 323 b (blksize 512
 DMSFOR603R FORMAT will erase all files on disk B(323).
     Do you wish to continue?
 Enter 1 (YES) or 0 (NO).
 1
 DMSFOR605R Enter disk label:
 LNXSWP
 Formatting disk B
 50000 FB-512 blocks formatted on B(323)
 q disk b
```

LABEL	VDEV	M	STAT	CYL	TYPE	BLKSZ	FILES	BLKS USED-(%)	BLKS LEFT	BLK TOTAL
LNXSWP	323	B	R/W	FB	9336	512	0	32-00	49968	50000

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Virtual disk - 3

Reserve swap space on virtual disk with a CMS `reserve` command:

```
 RESERVE LINUX SWAP b
   DMSRSV603R RESERVE will erase all files on disk B(323).
      Do you wish to continue
    Enter 1 (YES) or 0 (NO).
   1
   Reserving disk B
   Ready; T=0.01/0.01 09:50:32
   q disk b
   LABEL  VDEV M  STAT   CYL TYPE BLKSZ   FILES  BLKS USED-(%) BLKS LEFT  BLK TOTA
   LNXSWP 323 B   R/W    FB 9336 512        1      50000-99         0      5000
   Ready; T=0.01/0.01 09:50:41
   listfile * * b (date
   FILENAME FILETYPE FM FORMAT LRECL    RECS     BLOCKS   DATE     TIME
   LINUX    SWAP    B6 F       512     49574     49574  8/19/03  9:50:32
```

For more information

SuSE
ftp://ftp.suse.com/pub/suse/s390/

Thinking Machines - approximately 500 RPMs for S/390
http://linux.s390.org/ (home page)
ftp://linux.s390.org/pub/ThinkBlue/RPMS/s390/

http://www.linuxvm.com/
http://www.linuxvm.org/

http://www.ibm.com/linux/news/lotuslinux.shtml
http://www.ibm.com/servers/eserver/zseries/os/linux/
http://www.ibm.com/developerworks/linux/
http://www10.software.ibm.com/developerworks/opensource/linux390/index.shtml

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Domino for Linux on zSeries

Domino Installation and Setup

Redbooks

International Technical Support Organization

IBM

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Topics

Pre-Installation Steps

Domino Code Installation

Domino Server Setup

Starting the Domino Server

Running Multiple Domino Code Levels and Partitioned Servers

Common Install Problems

Contents of the Domino CD

Documentation

- start.txt   Where to find online documentation and instructions to install Acrobat
- readme.txt   Last minute notes not contained in Release Notes
- readmes.nsf   Release Notes - Notes database
- readmes.pdf   Release Notes - Acrobat file
- HELP65_ADMIN.NSF Install Guide   - Notes database
- Install.PDF   Install Guide   - Acrobat file

Tar file

- Zlinux6500.TAR   Domino Server code
- Zlinux6500Client.TAR Domino Java setup client code

Table of Information You Need

Item	Value
Domino user account on Linux	
Group for Domino user on Linux	
IP address of your Linux server	
Path for notesdata directory	
Mountpoint for notesdata directory	
Path for transaction log	
Mountpoint for transaction log	
Path for mail or application directory	
Mountpoint for mail or application directory	
Domino server name	
Domino certifier name	
Domino domain name	
DNS entry for Linux and Domino server	
Webserver port number	
Other applications used - eg DB2, virus scanner	

File System Structure for mail server

File Created by the Installation

/opt/lotus/bin
- ../tools   (links to startup, etc.)
- ../tools/diag/nsd.sh
- ../.install.dat   (install summary file)

/opt/lotus/notes/60xx/zlinux   (Domino executables)
- ../lib
- ../res
- ../jvm

/notesdata   (notesdata directory and files)
- ../domino
- ../help
- ../iNotes
- ../mail
- ../modems

Redbooks

Preinstallation Steps

Read the Release Notes on the Installation CD
- Special section for Domino for Linux on zSeries

Read the Install Guide on the Installation CD

Define a group in Linux for all Domino servers to use
- groupadd notes

Define a user ID in Linux for each Domino server
- Different for each servers
- Must not be superuser (uid=0) or Domino will not start
- useradd -d /domserva/notesdata -g notes -p password domserva
  - Set home directory to notesdata so ready to start server, edit notes.ini

Check notesdata directory has owner = Domino server account, group = notes

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Preinstallation Steps - 2

Check disk space
- 870Mb for executables
- 480MB for the notesdata directory
- 650MB for the tar file (temporary)
- Command df -h

Check connectivity to server
- ping its IP address

Check for Lotus Notes 6 client
- With the remote server setup program

Temporarily
- Disable screen savers on client
- Turn off virus detection software

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Domino Code Installation Steps

Place the tar file on your Linux file system
- Transfer Domino server tar file (e.g. Zlinux6500.TAR) from CD-ROM on your workstation to the Linux on zSeries filesystem using ftp
- Transfer tar file in binary mode to directory /opt/lotus

Extract the files
- cd /opt/lotus
- tar -xvzf Zlinux6500.TAR   - use correct file name
- Unpacks the tar file to paths below /opt/lotus
- ls -al   - check that the sub-paths exist.
- rm Zlinux6500.TAR   - to delete the tar file

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Domino Code Installation Steps - 2

Run the installation script

- Interactive mode
  - Screen prompts for the installation settings
  - Recommended for first install
  - cd /opt/lotus/zlinux
  - ./install
- Script mode
  - Specify the installation settings in a file, e.g. script.dat
  - copy /opt/lotus/zlinux/script.dat /tmp/script.dat
  - vi /tmp/script.dat
  - /opt/lotus/zlinux/install -script /tmp/script.dat
  - Useful for setting up multiple servers and documenting the input

---

Interactive Mode Installation - Welcome

```
========================================
========================================
    Welcome to the Domino Server Install Program.


    Type h for help on how to use this program.
    Press TAB to begin the installation.


-------------------------------------------------------------------------------
    Type h for help
    Type e to exit installation
    Press TAB to continue to the next screen.
-------------------------------------------------------------------------------
```

Inputting Responses

```
============================================================
                    Domino Server Installation
============================================================


    Select the type of installation you want.


    ----------------------------------------------------------------------------
      Type h for help.
      Type e to exit the Install program.
      Press ESC to return to the previous screen.
      Press the Spacebar to change the setting until you get the one you want.
      Press ENTER to edit a setting
      Press TAB to accept a setting and continue to the next screen.
    ----------------------------------------------------------------------------


    >>> Select Setup type : [Domino Mail Server      ]
```

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Installation Screens

Screen	Comment
Welcome page	Press TAB
License agreement	Multiple screens, press TAB
Agree to License agreement	Press SPACEBAR to get [Yes], then TAB
Install additional partitions	No for first install
Type of Install - Utility, Messaging, Enterprise	Select type
Install all templates	Yes
ASP functionality	No

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Installation Screens - 2

Screen	Comment
Program directory	/opt/lotus
Data directory information	Press TAB
Run more than one server partition	No
Path for data files	/domserva/notesdata
Domino UNIX user name	domserva
Domino UNIX group	notes
Server setup	Remote

End of Input

```
=============================================
                Domino Server Installation
=============================================


    Your configuration of the Install program is complete.

    By continuing, the Install program will first allow
    you to review your configuration settings before
    beginning the installation.



    ------------------------------------------------------------------
      Type e to exit the Install program.
      Press ESC to return to the previous screen
      Press TAB to continue to the next screen.
    ------------------------------------------------------------------
```

Review Input

```
=====================================
              Domino Server Installation
=====================================
Installation settings:

    Installation type        :  Domino Enterprise Server

    Install template files    :  Yes
    Server Setup Method       :  Remote Server Setup
    Configure to ASP Server  :  No

     Program directory        :  /opt/lotus
     Data directory           :  /domservb/notesdata
       UNIX user              :  domservb
       UNIX group             :  notes

Press the Escape key to re-configure the settings
  or
Press the Tab key to perform the installation...
```

Installation Messages

Validating...

For the latest patch DB please go to http://www.lotus.com/ldd/checkos
This will check the Operating System level and tell you what is missing. Note, no patch list if all patches are present.
The OS appears to have the correct patches .
Installing Domino Server kits ...
The Domino Server installed successfully.

Configuring Domino Server from
Unix user name: domservb
Unix group name: notes
Domino program directory: /opt/lotus
Domino data directory: /domservb/notesdata
/proc/2841/mapped_base has been set to the recommended value of 134217728
The value in /proc/sys/fs/file-max is 26214, which does not match the recommended value of 131072
The value in /proc/sys/net/ipv4/tcp_fin_timeout is 60, which does not match the recommended value of 15
The value in /proc/sys/net/ipv4/tcp_max_syn_backlog is 1024, which does not match the recommended value of 16384
The value in /proc/sys/net/ipv4/tcp_tw_reuse is 0, which does not match the recommended value of 1
The value in /proc/sys/net/ipv4/ip_local_port_range is 32768   61000, which does not match the recommended value
of 1024   65535

Installation Messages - 2

./java -ss512k -Xoss5M -cp jhall.jar:cfgdomserver.jar:Notes.jar lotus.domino.setup.WizardManagerDomino -data /domservb/notesdata -listen
Remote server setup enabled on port 8585.

The Domino setup server is now in listening mode.
A remote client can now connect to this server and configure Domino.

To connect to this server, launch the Remote Domino Setup program from a command-prompt as follows:
From a Domino administrator client: serversetup -remote
From a Domino server: server -remote

To end this server, launch the Remote Domino Setup program from a command-prompt as follows:
From a Domino administrator client: serversetup -q linuxb
From a Domino server: server -q linuxb

For more information, see the printed guide Setting Up Domino Networks and Servers.

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Script Mode

Settings in script.dat
- Keep a backup copy
- See documentation in the file
- # is a comment

Setting Type	Recommended Value
Domino server installation type	Domino Enterprise Server : 2
Install template files	template_install_option = 1
Install server code	add_data_directories_only = 0
Install ASP server	asp_install_option = 0
Program directory	/opt/lotus
Create /opt/lotus soft link	opt_lotus_softlink = 0
Data directory	/domserva/notesdata
UNIX User name	domserva
UNIX Group name	notes

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Multiple partitions

If you partition the server, multiple instances of Domino will share one set of program files, but each installation will have a separate data directory.

- The new Domino 6 feature that allows multiple installs requires separate program files, as well as separate data directories, for every instance, and so requires more disk space than partitioning.

Steps necessary using the install script:

- Decide whether the new Domino servers will belong to an existing Domino domain.
  - If yes, register the new Domino servers and save the server id files.
- Linux user ID and group
- TCP/IP adress
- Create and mount the notesdata directory for each new server
  - Make sure they belong to the Domino user ID and that the permission bits are set correctly

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Multiple partitions - 2
Steps necessary using the install script:

Update your script.dat file with:

- add_data_directories_only=1
- Set "installation_type"
- Specify original program directory
- Only specify new server's notesdata at data_directories.

Run the install script

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Domino Server Setup

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Setting Up the Domino Server

At this stage
- The Domino code is installed in the correct directories
- Notesdata directories have been set up for each Domino partition
- File permissions are set correctly

But
- The Domino server does not have a name
- An administrator has not been defined
- Server options have not been set

Server setup does those steps

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What Server Setup Does

Domino Server Setup configures new servers
- Do not execute for a code "upgrade" on an existing 6.x system
  - You want to keep your existing ID files and databases

It does not require any special classpath or libpath settings

Backup notes.ini
- Logon to Linux with user ID that "owns" the /notesdata directory
- cd notesdata   (use correct name)
- Make backup copy of notes.ini
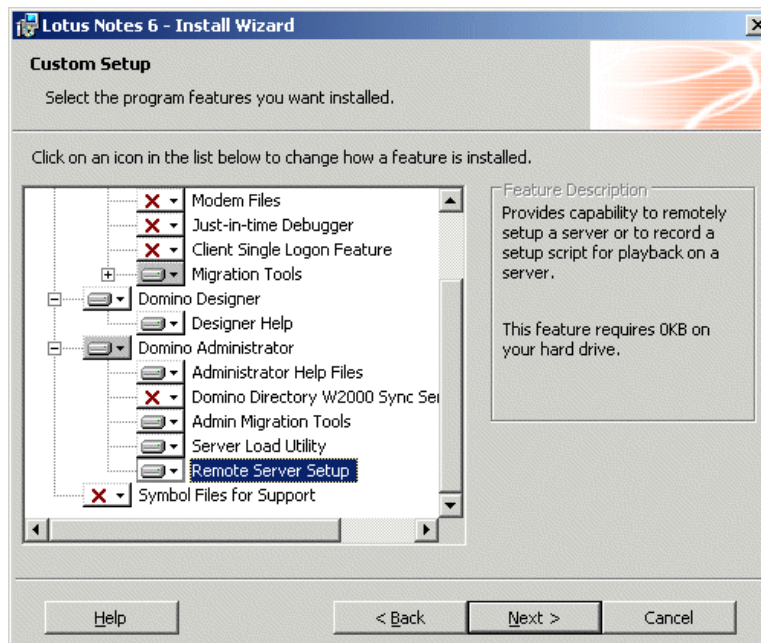
If you need to rerun server setup
- See "If Setup Fails" before rerunning it

Client Install - Remote Server Setup

Start the Domino Server Listener Process

If you selected Remote Server Setup

- Domino server should already be running in listen mode
    - Remote server setup enabled on port 8585.
    - The Domino setup server is now in listening mode.
    - A remote client can now connect to this server and configure Domino.

If you selected Manual Server Setup

- Log on to linux with Domino user account (domserva)
- cd /domserva/notesdata
- /opt/lotus/bin/server -listen 8585
- This starts the remote listener process

Start the Remote Setup Program

On the Notes Admin client

- Start Programs -> Lotus Applications ->Remote Server Setup
- or
    - cd /lotus/notes
    - serversetup -remote
- This starts the Java-based server setup program

Server Setup **- 2**

Enter host name or network address of the remote server you wish to set up
- Port is 8585
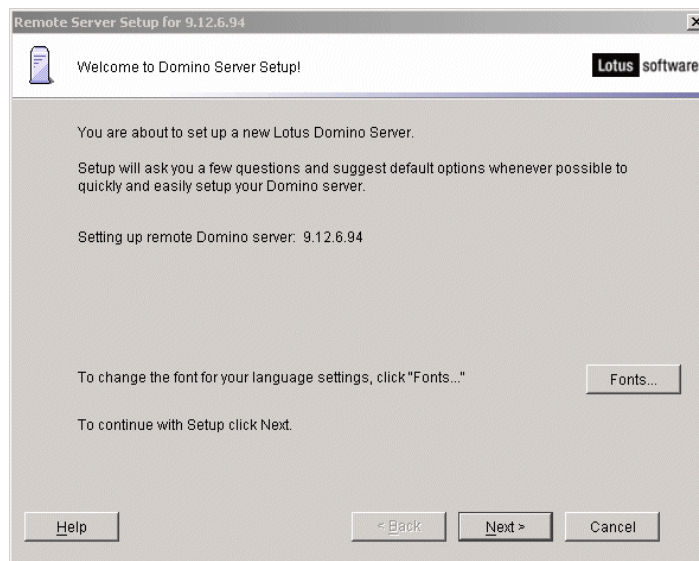- Click ping to ensure connectivity
- Click OK

Server Setup **- 3**

Introduction
- Click Next

Server Setup - 4

Set up first server or standalone server
- Usual option for first install

Set up an additional server
- Into an existing Domino domain
- Server must be registered in Domino Directory
- Will be asked for location of server.id
- Will be asked for name of this server

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Server Setup - 5

Server name
- Choose carefully
- Same as host name
- Put in DNS

Server title
- A description

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Server Setup - 5

Organization Name
- e.g. IBMUS, ITSO

Organization Certifier Password

Use existing certifier ID file
- If rebuilding Domino domain

Certifier ID file
- Name is cert.id
- Rename to include Domino domain name
- Remove from server
- Store securely

Server Setup - 6

Domino domain name
- Domain is a collection of servers sharing same Domino directory
- Administration grouping
- Choose name carefully

Server Setup - 7

Administrator name and password

Save a local copy of ID file
- To save on workstation
- Asks for path and filename

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Server Setup - 8

Select internet services this Domino server will provide
- HTTP
- SMTP, POP3, IMAP
- LDAP

Can add these later
- Domino Directory
- notes.ini
- Console

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Server Setup - 9

Network settings
- Port - TCP/IP
- Host name - ....

Should be detected

Customize button if necessary

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Server Setup - 10

Security
- Prohibit Anonymous access to all databases and templates
- Add LocalDomainAdmins group to all databases and templates

Both should be selected

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Server Setup - 11

ID files to be created
- server.id
- cert.id
- admin.id

Stored on server

Make additional copies
- On client

Remote Server Setup for 9.12.6.94

Make optional copies of ID files

Lotus software

Server Setup will create these new ID files:

[/domservb/notesdata/server.id]
[/domservb/notesdata/cert.id]
[/domservb/notesdata/admin.id]

These ID files will be stored on the server. To make additional copies of these ID files, click the checkbox below and specify where to store them. Otherwise, click Next.

☑ I want to make additional copies of the ID files: Browse...

C:\notes6

To continue with Setup click Next.

Help   < Back   Next >   Cancel

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Server Setup - 12

Review the options
- Server name
- Server type
- Data directory
- Organization name
- Domain name
- ACL
- System Group

Back - make changes

Setup - set up server

Remote Server Setup for 9.12.6.94

Please review and confirm your chosen server setup options

Lotus software

Please review the following options you have chosen for your Domino server setup:

Setting	Current selection
Remote server name	domservb/ITSO
Server type	Set up the first server or a stand-alone server
Data directory or partit...	/domservb/notesdata
Organization name:	ITSO
Domino domain name:	ibm
ACL	Prohibit anonymous access to all databases and templates.
System Group	LocalDomainAdmins created with "Manager" access to all templ...

To make any changes, click "Back".

To setup your server with the above options, click "Setup".

Help   < Back   Setup   Cancel

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Server Setup - 13

Setup Progress

Server Setup
Domino Server Setup

Creating the Domino Directory for your domain...
40%

Congratulations.
Domino Server Setup
is now complete

Setup summary   Lotus.

Congratulations, Domino Server Setup is now complete!

Click "Finish" to close Setup.

Server Setup - 14

Should the setup server listener be stopped?
- Yes

Server setup

? Should the setup server listener be stopped

Yes   No

If Setup Fails

To set up the server again
- On linux server
  - cd /servername/notesdata
  - Copy the saved skeleton notes.ini.orig to notes.ini
  - Remove names.nsf (if any)
  - Remove admin4.nsf (if any)
  - Remove setupdomwizard.nsf (if any)
  - Remove server.id, cert.id, server.id created during previous setup session
- Restart server setup

To terminate setup for some reason
- On client - Ctrl-Break
- On Linux server console
- kill -9 for the following processes and make sure to clean up any dangling resources using nsd -kill
  - /bin/sh /opt/lotus/notes/latest/zlinux/serversetup -listen -data /notesdata

---

What Domino Server Setup Does

Creates
- A server ID (server.id) for the first server in /notesdata
- A certifier ID (cert.id) in /notesdata
- A user ID (admin.id) for the administrator
  - Attached to person doc in directory unless you also saved it locally

Builds a public Domino directory (names.nsf)
- Also known as Domino name and address book

Populates notes.ini with more information:
- ServerTasks=Replica,Router,Update,Stats,AMgr,Adminp,Sched, CalConn,Event,HTTP,POP3,SMTP

If server setup uses existing IDs, those IDs are not re-created

Server is ready to be started

Starting the Domino Server

Starting the Domino Server

Logon to linux with the Domino user account

Ensure you are in the notesdata directory
- Set this as the home directory for this user
- Or: cd /domserva/notesdata

Start the server
- /opt/lotus/bin/server -jc -c
  - jc starts the Domino Controller - see "Administration"
  - c stops the messages coming to the Domino console that you started Domino from
    - Do not specify -c if you want to see the server start messages
    - However you will stil see the message about the kernel value settings

Server Starting

domserva@linuxb:/domserva/notesdata # /opt/lotus/bin/server -jc -c

/proc/3019/mapped_base has been set to the recommended value of 134217728

The value in /proc/sys/fs/file-max is 26214, which does not match the recommended value of 131072

The value in /proc/sys/net/ipv4/tcp_fin_timeout is 60, which does not match the recommended value of 15

The value in /proc/sys/net/ipv4/tcp_max_syn_backlog is 1024, which does not match the recommended value of 16384

The value in /proc/sys/net/ipv4/tcp_tw_reuse is 0, which does not match the recommended value of 1

The value in /proc/sys/net/ipv4/ip_local_port_range is 32768   61000, which does not match the recommended value of 1024   65535

Note: If the Domino Server requires a password, you must first connect to the Domino Server Controller from the Domino Console and enter the password to start the Domino Server.

Domino Server Controller started at 8/15/03 5:29 PM.
Host name is linuxa.itso.com/10.32.16.24
Listening for connect requests on TCP Port:2050

Domino Server started at 8/15/03 5:29 PM.

Add users and send mail

First

- Start the Notes client
- Connect to the Domino server
  - You may need to use the IP address if you do not have the server name in the DNS

Then

- Add users
- Send mail
- ...

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Running Multiple Domino Code Levels and Partitioned Servers

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Multiple Versions vs. Partitioned Servers

Domino 6 allows the installation of multiple Domino servers with different level of executing code in the same LPAR

- Server code is installed at different directory locations:
  - /opt/T6/Install1/lotus   ---   Domino 6.x code
  - /opt/T6/Install2/lotus   ---   Domino 6.y code

Each of these installations can have multiple DPARs

- DPARs are known as "partitioned" servers
- They share the same executable code

Notesdata Directory	Server Code Directory
/notesdata11	/opt/T6/Install1/lotus
/notesdata12	/opt/T6/Install1/lotus
/notesdata21	/opt/T6/Install2/lotus
/notesdata22	/opt/T6/Install2/lotus
/notesdata51	/opt/lotus
/notesdata52	/opt/lotus

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Partitioned Servers

Partitioned servers can belong to one or many domains.

Adding another /notesdata directory using the script.dat file.

domain x

| /notesdata11 |
| /notesdata12 |

prgm dir

/opt/T6/
Install1/lotus

domain y

| /notesdata21 |
| /notesdata22 |

prgm dir

/opt/T6/
Install2/lotus

Part of domain z

| /notesdata51 |

prgm dir

/opt/lotus

| 1 | domain z |
| 2 | |

prgm dir

.install.dat

usually
/opt/lotus

Doing an install defining an additional notesdata directory

| 3 |

Beside populating the new notesdata directory, it updates the .install.dat file with the additional info. Original /notesdata directories are unchanged.

Incremental Install

Incremental install upgrades existing Domino code

- tar file size can be between 40% and 100% of the size of a Maintenance Release tar file
- Incremental install is a delta tar file
- The base level must be installed first
  - The install code will check if the correct level is installed
    - eg 6.5.x can only be applied on 6.5
- Its purpose is to replace the changed files

Download tar file(s) from the Web (most likely 2 tar files)

Transfer tar file(s) to the zLinux filesystem like full install

Might want to back up notesdata, IDs, and .nsf files

Incremental Install - 2

Untar the file like full install tar file

If server installed at other than /opt/lotus, set environment variable with its location: $NUI_NOTESDIR

Invocation
- zlinux/install or interactive with no questions
- zlinux/install -script xxx/script.dat for non-interactive mode but MUST NOT use full install's script.dat
  - Program files and /notesdata files will be replaced

DO NOT run Domino Server Setup -- this an upgrade

If you need to upgrade and there are a number of MRs between where you are and where you want to go, using the newest CD with a full install is the quickest path

---

Common Install Problems

Setup Fails
- See foil "If Setup Fails"

Installing Domino on a non supported version of Linux
- Domino needs the epoll I/O readiness facility
- Error messages:
  This Linux kernel does not have the required epoll I/O readiness notification facility
  Listener task exited: Failed to create an IOCP port
- Notes client sessions will not be able to connect to the server
- To verify that the Linux kernel has epoll support installed, issue command:
  grep epoll /boot/System.map*
  - If this command finds the epoll package, these lines will be displayed:
  000797d8 T sys_epoll_create
  00079854 T sys_epoll_ctl
  000799b8 T sys_epoll_wait

Common Install Problems - 2

Invoking Install not using the current script.dat file
- The script.dat file supplies values used by the install code
- The install code checks for the correct version.

Linux for zSeries may automatically start processes that will interfere with the Domino Server
- Apache Webserver, SMTP
- If so, close them down

The program directory or data directories may not be large enough
- Check the disk space needed before starting

Starting Domino from a superuser
- Server will not start - message is "Do not run Domino as root"
- Switch to correct user ID before starting Domino

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Domino for Linux on zSeries

Administration and Systems Management

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Thanks to Dr Andreas Gallus for this presentation

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Topics

Domino Administration
- Starting and Stopping the Server
- Monitoring Performance & Availability
- Upgrading an Existing Server
- Transaction Logging
- Problem Determination

Linux Administration
- Monitoring
- Backup/Recovery

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Domino Administration

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Topics

Ways to Administer the Server

Starting and Stopping the Server

Using the Domino Console

Monitoring Performance & Availability

Upgrading an Existing Server

Adding a Domino Partition

Problem Determination

Backup & Recovery

Ways to administer the Domino server

1. **Domino Controller and Domino Console**

2. **Domino Administrator client**

3. **Web Administrator client**

Domino Controller and Domino Console

Domino Controller

- New in Domino 6
- Java code can be used to start server
- Routes server output (console) to Domino Console and logfile
- Routes input (commands) from Domino Console to specified server

Domino Console

- New in Domino 6
- Platform independent Java-based GUI
- Use to connect to a Domino 6 server through Domino Controller
- Can connect to a server that is not responding to Notes clients
- Send commands to the Domino server or to the operating system

---

Domino Controller and Domino Console

DomServA/ITSO,Build V65_07292003 - Lotus Domino Console

File Edit View Help

```
User:      admin
Platform: Linux for zSeries
Server:   DomServA/ITSO,Build V65_07292003
```

Resume ▶

```
Lotus Domino (r) Server (Build V65_07292003 for UNIX) 08/20/2003 08:45:53

Server name:            DomServA/ITSO - ITSO Domino Server A
Server directory:       /domserva/notesdata
Partition:              .domserva.notesdata
Elapsed time:           15:33:17
Transactions/minute:    Last minute: 366; Last hour: 449; Peak: 2018
Peak # of sessions:     306 at 08/20/2003 07:53:08
Transactions:           409554
Member of cluster: ITSO Cluster
Availability Index:     88 (state: AVAILABLE)
Mail Tracking:          Not Enabled
Mail Journaling:        Not Enabled
```

Domino Command: [   ]   Send ▼   Commands... ▼

Domino Administrator

The administration client for Domino

- Use it to perform almost every administration task
  - For example: to open and manage Notes databases, register users and servers ...
- Only available for Win32 and MacOS

Domino Administrator

Web Administrator

Use a Web browser to manage and view settings for a Domino server

- Can be used for most administration tasks
- Administration access for Web Administrator can be restricted in ServerSecurity Tab in Serverdocument
- Uses the Web Administrator database (WEBADMIN.NSF)
- webadmin.nsf is created the first time HTTP task starts

Starting and Stopping

Manually starting the Server Controller and Domino Server

- Use ssh or telnet to connect to Linux using the Domino user ID
- From notesdata, issue command:
  `/opt/lotus/bin/server -jc &`
  to start the Server Controller and the Domino Server in the background (&)
- When using X-Windows on your Client, the Domino Console will also be started
- Two optional arguments: -c and -s
- `server -jc -c` will start the Domino Controller and the server but not the Domino Console
- `server -jc -s` will start the Domino Controller and the Domino Console but not the Domino server

Manually starting the Server Controller and Domino Server

```
domservc@linuxc:/domservc/notesdata> /opt/lotus/bin/server -jc &
[1] 9394
domservc@linuxc:/domservc/notesdata> /proc/9394/mapped_base has been set to the recommended
value of 134217728
The value in / proc/sys/fs/file-max has been set to the recommended value of 131072
The value /proc/sys/net/ipv4/tcp_fin_timeout has been set to the recommended
value of 15
The value in /proc/sys/net/ipv4/tcp_max_syn_backlog has been set to the recommended
value of 16384
The value in /proc/sys/net/ipv4/tcp_tw_reuse has been set to the recommended value of 1
The value in /proc/sys/net/ipv4/ip_local_port_range has been set to the recommended
value of 1024   65535

The Domino Console cannot be started on zOS/zSeries:  No native GUI available.
Use the DISPLAY environment variable to redirect the Domino Console.
The Domino Console will not start unless the DISPLAY environment variable is set.

Domino Server Controller started at 8/18/03 4:15 PM.
Host name is linuxc.itso.company.com/184.156.23.129
Listening for connect requests on TCP Port:2050


Domino Server started at 8/18/03 4:15 PM.
```

Stopping and Starting the server from the Domino Console

Stopping the Server
- Select from the menu File -> Stop Server

Starting the Server
- Select FILE -> Start Server

Stopping and Starting the server from the Domino Console - 2

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Using Domino Console

Logging server output

- Server Controller automatically logs server output to files:
  dcntrlr<creationdate&time>.log (i.e. dcntrlr08141345.log).

Set ControllerLogExpiration=days	Specifies the number of days server keeps log files. Default is 7 days
Set ControllerLogFileName=path filename	Specifies the name and path of log files. Defaultpath is notesdata Default name is dcntrlr +creation date + creation time + file extension.log
Set ControllerLogType=value	0 -- Do not create log files 1 -- Create .log files that log only data normally seen at a console Setting takes effect immediately

Logging Output Locally

- Select the server, then select Edit -> Local Logging to specify the local logging parameters.
- select File > Local Logging to enable logging

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Using Domino Console - 2

Periodic commands

- Use Domino Console to send one or more commands to a server or group of servers at specified intervals
- Allows you to quickly and easily set up one or several commands on your servers

Sending controller and shell commands

- You can also use the Domino console to send commands to the controller or to issue shell commands
- Controller command
  - Send a Controller command, use the prefix #
  - `#Show Processes`
- Shell command
  - use the prefix $
  - `$ ls *.log`

Monitoring performance and availability

System Monitoring Tools

- Domino statistics
  - To process Domino statistics, you can:
    - View them in the statrep database
    - View them using the Administrator Client
- Platform statistics
  - Logical disk: Statistics for individual disks and total percent use of all disks
  - Memory: Statistics showing memory allocation and use, including available memory
  - Network: Statistics for individual network adapters and cumulatively for all the network adapters on the system
  - Paging file: Statistics that show use of paging files
  - System: Statistics on the information captured -- for example, a summary of system CPU use and queue length
  - Time: Time that platform stats were last collected and sampling interval in minutes

Monitoring performance and availability - 2

- Statistics and reporting database
  - If you run the reporter task on the server, a set of reports will be created at scheduled intervals.
  - These are put in the statistics and reporting database statrep.nsf.
  - Domino 6 includes a number of improvements that make it easier for administrators to view server reporting information.

Feature	Description	Benefit
Statistic Charting	Administrators can now see current and historical graphing of Domino and platform statistics from the Administrator client	Administrators can assess server performance and behavior in a historical context and in real-time
Database monitoring	Reorganized DB monitor form, single-click creation of new database usage, activity, replication, and ACL monitors.	Simplified access to monitoring.
Event Description	Right-click access to more detailed information about console messages.	Contextual access to information.

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Monitoring performance and availability - 3

- Activity logging
  - Activity logging can be used to collect information about the activity in your enterprise. This information charge users for the amount they use your system, monitor usage, conduct resource planning, and determine if clustering would improve the efficiency of your system.
  - Domino writes the activity logging information in the Domino log file (LOG.NSF). To create activity logging reports, you write a Notes API program to access the information in the log file. You can also view the activity logging information by using Activity Analysis.
  - In a hosted environment, enable activity logging on all of your ASP servers; these are the servers used to house and maintain your hosted organizations

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Monitoring performance and availability - 4

Tivoli Analyzer for Lotus Domino includes two system management tools

- Server Health Monitor, which offers real-time assessment and recommendations for server performance
- Activity Trends, which provides data collection, data exploration, and resource balancing

A separate product offering from Tivoli Systems

Monitoring performance and availability - 5

To set up the Server Health Monitor, complete these steps:

- Install the IBM Tivoli Analyzer for Lotus Domino.
- Run the install program (SETUP.EXE) from the Tivoli Analyzer directory.
- Start the Domino server monitor.

To view the health of your server:

- From the Domino Administrator, click the Server - Monitoring tab.
- In the Health column, the Server Health Monitor uses icons to indicate the server's overall health:
  - Green thermometer: The server's overall health rating is Healthy
  - Yellow thermometer: The server's overall health rating is Warning. One or more server components being monitored are approaching unacceptably poor levels of performance.
  - Red thermometer: The server's overall health rating is Critical. One or more server components being monitored are failing to perform within acceptable tolerance levels

Monitoring performance and availability - 6

Server		Last Modified Time	Index	Rating	Value	Comments
DomServA/ITSO						
	🚫	08/21/2003 01:28 PM	Overall Health	Server Down	100	The Domino Server is not responding to any requests
	▼	08/21/2003 01:24 PM	Overall Health	Critical	97	The "Disk Utilization" component is reporting critically
			CPU Utilization	Critical	57	
			Disk Utilization	Critical	1	
			Mail Delivery Latency	Healthy	1	
			Network Utilization	Critical	1	
			NRPC Name Lookup	Healthy	1	
			Server Response	Critical	97	

Refresh View

ne × | Health Monitoring - (Historical... × | for DomServA/ITSO × | DomServA/ITSO ×

Upgrading an existing server (script-mode)

Optional add notes.ini Settings:
- SERVER_UPGRADE_NO_DIRECTORY_REDESIGN=1
- SetupLeaveServerTasks=1

Upgrade Steps:
- Shut down the server.
- Back up /opt/lotus (library and program files).
- Make a copy of: cert.id, server.id, notes.ini, .profile, httpd.cnf, dcontroller.ini
- Remove all files and directories from /opt/lotus
- Check diskspace on /opt/lotus -> Refer to the Install Guide for new requirements
- FTP the tar file from the CD to /opt/lotus directory (binary mode)
- Telnet into the Linux as a root user and un-tar file
  - `tar -xvzf zLinux65xxx.TAR`

Upgrading an existing server - 2

Upgrade steps:

- Go to /opt/lotus/zlinux and copy script.dat to domino65.dat
- Update the following lines in "domino65.dat":
  - installation_type = 2   <Domino Enterprise Server>
  - program_directory = "/opt/lotus"
  - template_install_option = 0   <do not install template files>
  - data_UNIX_user = "ADMINA"
  - data_UNIX_group = "notes"
- You will need one data_directories section for each Domino server:
  - data_directories: "/domserva/notesdata"
- # Uncomment either of the following lines to override the defaults
  - data_UNIX_user = "domserva"
  - data_UNIX_group = "notes"
- Install the new code: **./install -script ./domino65.dat**
- Copy the files from step 2 back to notesdata.
- Reinstall any third party software that loads files into /opt/lotus

---

Adding a Domino Partition (DPAR)

Add Domino partitions using the install script

- Decide whether the new Domino servers will belong to an existing Domino domain.
- If yes
  - Register the new Domino servers in that domain
  - Save the server ID files on your local workstation.
  - Edit the server document in the Domino Directory (server security, ports, task, ...)
  - Make sure you have a way to copy it the ID files to Linux (FTP)
- Set up a Linux user ID for all new Domino servers
- Define a dedicated TCP/IP address for every Domino server
- Create and mount the notesdata directory for each new server
  - Check permission bits and user settings
- Update your script.dat file with **add_data_directories_only=1**. This will prevent the program directory from being written.

Adding a Domino Partition (DPAR) - 2

Add Domino partitions using the install script
- Set "installation_type"
- Specify original program directory.
- Only specify new server's notesdata at data_directories.
  - Important: Do not list any server's data directory that was already installed
- Run the install script.
- Copy the server ID files from step 1 into the appropriate notesdata directory.
  - If your new Domino server belongs to a separate Domino domain, you have to run the server setup and create the new certifier and server ID.
- Log on with the Linux user ID that belongs to the Domino server and start the server.
- Run server setup for each Domino partition you want to install.

Problem determination

Notes System Diagnostic (NSD)
- A diagnostic script that gathers information
- NSD and memcheck come with Domino 6
- NSD is the default debugger since Domino 6
- Send the output of NSD to Lotus Support to help diagnose problems
- NSD output is in plain text:
  - Basic configuration information
  - Current running processes (ps command)
  - notes.ini, general system information (Linux version, local disks, etc.)
  - memcheck information
- NSD options
  - help   Displays the nsd help list
  - info   Report system info
  - memcheck   Run the Notes memory checker only
  - kill   Stops all Notes processes, cleans up related IPC resources

Problem Determination - 2

Fault recovery
- Automatically restarts server
- Invokes cleanup script

CORE dumps
- Provide more problem determination data to help resolve Domino problems
- DEBUG_ENABLE_CORE=1
- DEBUG_CORE_PATH=/path...

Notes log (log.nsf)
- Do we need emphasize how helpful log.nsf information can be?

Fault Recovery	
Run This Script After Server Fault/Crash:	(This script must not run NSD)
Run NSD To Collect Diagnostic Information:	☑ Enabled
Automatically Restart Server After Fault/Crash:	☑ Enabled
Cleanup Script / NSD Maximum Execution Time:	300 seconds
Maximum Fault Limits:	3 faults within 5 minutes
Mail Fault Notification to:	LocalDomainAdmins

Backup & Recovery

For Domino data, there are three distinct recovery situations:
- Full recovery: Common disaster recovery situations, like failure of a disk subsystem. All databases contained on the subsystem must be restored.
- Database level recovery: A single database may have been corrupted, recovery by restoring the last backup of the database.
- Document level recovery: One or more documents in a database have been lost, either deleted or corrupted. Normal recovery in this situation involves restoring the backup of the database to a temporary location and then from it, copying the required documents to the active version of the database. Or by doing a point in time restore of the database using the backup and recovery APIs in Domino.

All three situations can be handled with:
- Tivoli Storage Manager (TSM)
- IBM Tivoli Storage Manager for Mail:Data Protection for Lotus Domino for Linux (formerly called TDP)

Backup & Recovery - 2

Tivoli Storage Manager:

- Administrative clients that allow the TSM administrator to control server activities, define storage management policies, and set up schedules for automated backup and archive
- Support for backup archive clients that allow users to retrieve files from a TSM server
- Support for backing up and archiving files on a variety of devices and broad cross-platform and storage device support.
- Base TSM provides two important functions:
  - Backup/Restore: IBM Tivoli Storage Manager includes multiple techniques to reduce data transfer sizes to their minimums to make backups and restores as fast as possible.
  - Archive/Retrieve: Tivoli Storage Manager can move data to offline storage to archive it and to free online disk space for more important active data. Once you need that data again, IBM Tivoli Storage Manager can retrieve it for you.

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Backup & Recovery - 3

Tivoli Data Protection for Lotus Domino uses the backup and recovery APIs in Lotus Domino to provide online backup and restore capabilities using a Tivoli Storage Manager server.

Data Protection for Lotus Domino allows you to:

- Backup online Domino databases
- Maintain multiple versions of Domino databases
- Archive Domino transaction log files, when archival logging is in effect
- Restore backup versions of a Domino database and apply changes made since the backup from the transaction log
- Restore Domino databases to a specific point in time
- Expire database backups automatically based on version limit and retention period
- Expire archived transaction log files when no longer needed
- Automate scheduled backups

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Backup & Recovery - 4

- Data Protection for Lotus Domino provides two types of database backup (incremental and selective) and a log archive function.
  - *Incremental* backup provides a conditional backup function that creates a full online backup of Domino databases, when necessary. The specific conditions that determine when a new backup is necessary vary, depending on whether the database is logged or not.
  - *Selective* backup unconditionally backs up the specified databases, unless they are excluded from backup through exclude statements.
- When *archival logging* is in effect, changes to logged databases can be captured in between full backups by archiving the transaction log.
- Even if you choose not to enable transaction logging, Data Protection for Lotus Domino can still provide benefits. It provides the only way to guarantee a consistent backup for an online Domino database, because it can access the pre-image data buffers through the Domino backup and recovery API.

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Linux Administration

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International Technical Support Organization

Topics

Linux Administration
- The file system
- Users
- Monitoring
- Performance monitoring
- Backup & Recovery

Managing the file system

Formatting and partitioning:
- To format a single DASD with a block size of 4 KB:
  ```
  dasdfmt -b 4096 -f /dev/dasdg
  ```
- To split a DASD into partitions:
  ```
  fdasd -a /dev/dasdg
  ```
  - a is to auto-create **one** partition in non-interactive mode

Creating a file system:
- To create an ext2/ext3 filesystem:
  ```
  mke2fs [-b <block size>] /dev/dasd<n>1 |
  /dev/xpram<n>
  mke2fs -b 4096 /dev/dasdg
  ```
- To create a journaling filesystem (ext3):
  ```
  mke2fs -j -b 4096 /dev/vg01/lv01
  ```

Managing the file system - 2

Mounting a file system

- A mount point is a directory that is usually empty. If not, any files inside it are hidden as long as a file system is mounted over it.
- to manually mount:
  ```
  mount -t type dev mountpoint
  ```
- The following command mounts the file system that is on /dev/dasdg1 over the directory /mnt:
  ```
  mount -t ext2 /dev/dasdg1 /mnt
  ```
- To automatically mount a file system on startup, edit /etc/fstab

Monitoring the file system size

- To display the size of the filesystem: `df -h`

```
root@linuxa:/ > df
Filesystem          1K-blocks      Used Available Use% Mounted on
/dev/dasdb1          2259188    1067352   1191836  48% /
/dev/dasdc1          2403184    1538872    864312  65% /opt
shmfs                 257140          0    257140   0% /dev/shm

/dev/dasdt1          2365444    1453272    792012  65% /domserva
```

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Managing users

Adding and deleting a user entry

- To add an user entry:
  ```
  useradd [-d <home>][-g <group>] [-G additional
  groups>] [-m] [-s <shell>] [-u <uid>] [-p passwd]
  <username>
  ```
- For example:
  ```
  useradd -m -d /home/user1 -p dummypw  user1
  ```
  adds user named user1, with the password dummypw and the homedirectory /home/user1
- To delete an userentry:
  ```
  userdel -r user2
  ```

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Monitoring

Top

- The top command gives you a comprehensive look into what your Linux system is doing. It shows a table of active processes that is continually updated. The processes using the most CPU are displayed at the head of the list.
- Top lets you interactively kill or send signals to individual processes. Its behavior, including update intervals and sorting order, can be adjusted, either interactively or by startup options.
- To run top, type **top**
- To exit top, press **enter q**
- To see processes by CPU utilization, type **p**

Top - 2

```
10:19am  up 18:41,  9 users,  load average: 1.43, 1.83, 2.36
246 processes: 242 sleeping, 4 running, 0 zombie, 0 stopped
CPU0 states: 15.0% user,  6.1% system,  0.0% nice, 78.5% idle
CPU1 states: 11.3% user, 28.2% system,  0.0% nice, 60.0% idle
Mem:   255220K av, 252240K used,    2980K free,       0K shrd,    1896K buff
Swap:  247760K av,  90428K used,  157332K free                  198460K cached

  PID USER     PRI  NI  SIZE  RSS SHARE STAT %CPU %MEM   TIME COMMAND
29036 domserva  15   0 99660  94M 95720 S    21.9 37.8  6:38 compact
   17 domserva  21   0  1168 1168   840 R    21.0  0.4  0:22 top
32633 domserva  15   0  8972 6832  1240 S     3.6  2.6  0:23 java
26557 domserva  15   0  8972 6832  1240 S     3.4  2.6  2:03 java
    8 root      15   0     0    0     0 SW     1.7  0.0  3:00 kswapd
    6 root      34  19     0    0     0 SWN    1.1  0.0  1:12 ksoftirqd_CPU0
26536 domserva  15   0  8972 6832  1240 S     0.7  2.6  0:32 java
27163 domserva  15   0 41964  34M 33012 S     0.4 13.6  0:00 server
    7 root      34  19     0    0     0 SWN    0.3  0.0  3:33 ksoftirqd_CPU1
27222 domserva  15   0 67596  63M 64004 S     0.3 25.2  0:04 sched
27113 domserva  15   0 41964  34M 33012 S     0.1 13.6  0:00 server
28611 domserva  15   0 48472  44M 45260 S     0.1 17.8  0:00 cldbdir
    1 root      15   0    76   60    36 S     0.0  0.0  0:01 init
    2 root      0K   0     0    0     0 SW     0.0  0.0  0:00 migration_CPU0
    3 root      0K   0     0    0     0 SW     0.0  0.0  0:00 migration_CPU1
    4 root      25   0     0    0     0 SW     0.0  0.0  0:00 kmcheck
    5 root      15   0     0    0     0 SW     0.0  0.0  0:00 keventd
    9 root      15   0     0    0     0 SW     0.0  0.0  0:24 bdflush
```

Monitoring - 3

vmstat

- Reports important data in the categories of CPU, memory utilization, and disk I/O.

  ```
  vmstat interval_seconds number_of_intervals
  ```

- Without parameters, it displays the averages since system reboot.

  ```
  domserva@linuxa:~> vmstat
  procs                     memory      swap          io     system
  cpu
   r b w  swpd  free   buff   cache  si  so   bi    bo   in   cs  us  sy
  id
   0 0 0  1760  4824  34320  324736   0   0   90    91    0 1241   4   4
  92
  ```

sar

- System activity reporter
- Collects and reports information about system activity, including CPU, paging, file I/O, network, etc.
- The sar command displays from /var/log/sa/sadd, dd indicates the current day.

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Monitoring - 4

ps and pstree

- ps command displays a list of the currently running processes.
  - **-ps -ef**   displays a list of all currently running processes with full details
  - **-ps -efww**   the ww option displays each process' command line options
  - **-ps --help**   displays help for the ps command
- pstree command displays all processes in a "graphical" tree format
  - **-pstree -u**   displays uid transitions (child uid <> parent uid)
  - **-pstree -l**   wraps the lines instead of truncating them
  - **-pstree userid**   displays the portion of the tree related to that user.

ipcs

- ipcs command provides information on shared memory and semaphores. It has following options:
  - **-**m   shared memory segments
  - **-**q   message queues
  - **-**s   semaphore arrays
  - **-**a   all (this is the default)

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```
DOMSERVA/ITSO:/domserva:pstree
init-+-atd
     |-bash---java---java---9*[java]
     |-bdflush
     |-cron
     |-keventd---qethsoftd0000
     |-kinoded
     |-klogd
     |-kmcheck
     |-kreiserfsd
     |-ksoftirqd_CPU0
     |-kswapd
     |-kupdated
     |-lvm-mpd
     |-master-+-pickup
     |        `-qmgr
     |-mdrecoveryd
     |-migration_CPU0
     |-mingetty
     |-nscd---nscd---5*[nscd]
     |-portmap
     |-snmpd
     |-sshd-+-sshd---sshd---bash---bash---server-+-event---event---8*[event]
     |      |                                    |-logasio---logasio---2*[logasio]
     |      |                                    `-server-+-69*[server]
     |      |                                             |-server-+-adminp---adminp---2*[adminp]
     |      |                                             |        |-amgr-+-amgr---3*[amgr]
     |      |                                             |        |      `-2*[amgr---amgr---amgr]
     |      |                                             |        |-calconn---calconn---calconn
     |      |                                             |        |-replica---replica---2*[replica]
     |      |                                             |        |-router---router---2*[router]
     |      |                                             |        |-sched---sched---3*[sched]
     |      |                                             |        `-update---update---4*[update]
     |      |                                             `-server---Y5626585.sh---iostat
     |      |-2*[sshd---sshd---bash]
     |      |-sshd---bash---su---bash
     |      |-4*[sshd---bash]
     |      `-sshd---sshd---bash---pstree
     |-syslogd
     `-xdm
```

Performance monitoring - 5

Resource Measurement Facility Performance Monitoring (RMF-PM) for Linux

- RMF PM with support for Linux Enterprise Server (RMF PMS) monitors various resources in a Linux on zSeries system. It is used in conjunction with the RMF PM client to gather and analyze data.
- Using RMF PM, you can:
  - Gather historical performance data
  - Store the data in spreadsheet format
  - Use a graphical user client to access performance data
  - Generate graphical trend reports
- RMF-PMS for Linux is a part of a larger family of RMF products. There is an RMF-PM tool for z/OS.
- The same workstation client tool can be used to analyze z/OS and Linux systems

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Performance monitoring - 6

The following lists present a few examples of the available metrics.
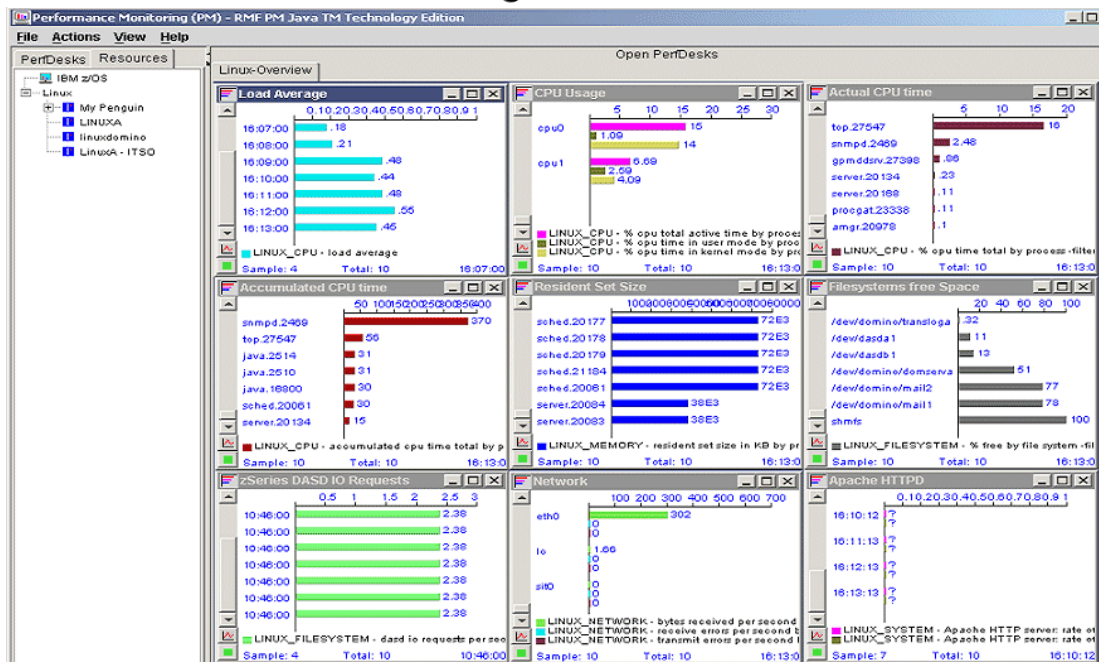
- CPU resource metrics
  - Load average
  - Percent of CPU total active by processor
  - Percent of CPU idle time
  - Percent of CPU time in kernel mode by process
  - Accumulated CPU time in user mode by process
- Network resource metrics
  - Bytes received/transmitted
  - Packets received/transmitted by network device
  - Receive/transmit errors

- File system resource metrics
  - Space available
  - Size of all file systems
  - DASD I/O requests per second
  - Percent of space used
  - DASD I/O average response time per request
- Memory resource metrics
  - Memory used
  - Swap space used
  - Cache memory
  - Number of pages swapped in/out
  - Shared memory
  - Total memory size

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Performance monitoring - 7

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Backup & Recovery

TSM Backup/Archive client

- Use TSM client for Linux on zSeries to backup and restore data at operating system level.

- TSM can back up your system interactively. Issue this command:
  `dsmc i`
  The session will be displayed to your screen as the backup is processed, with a summary of the session upon completion.
- Starting the scheduler daemon (the most common way to use TSM), you can let the TSM server determine when the system is backed up. The simplest way of using the scheduler is by putting the following in your /etc/rc.d/rc.local script:
      /opt/tivoli/tsm/client/ba/bin/dsmcad

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Domino for Linux on zSeries

Capacity planning and performance tuning

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Capacity planning

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Topics

Capacity planning today

Performance reporting tools
- ESALPS

Profile of a Domino server

Processor analysis
- Processors planning
- Idle servers

Storage planning
- Swapping / memory
- Virtual disk
- MiniDisk Cache (MDC)
- VM paging

DASD planning
- DASD tuning

Single DPAR - Multiple DPAR planning

Monitoring Requirements

Analyzing Processor Performance

Case study: Linux console goes to holding state

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Capacity Planning Today

Capacity planning is the science of taking existing knowledge about resource requirements, and projecting future needs based on known changes to workload or environment.

When servers started to be implemented on low-cost platforms instead of on mainframes, it became less expensive to buy a new server.

A production workload has a mix of many types of users.

Collect performance data for a period of time, analyze the requirements, and then use that data to calculate requirements.

Purchase only the IT infrastructure that is required to run your business. Small percentages of inefficiency add up.

Performance reporting tools

TOP
- is the most common performance monitor in a *single server dedicated environment*. But the resource requirements of top are not suitable to a shared resource environment.

NETSNMP
- Various tools relating to the Simple Network Management Protocol
- from sourceforge.org was on installed an all three Linux servers

ESALPS
- Velocity Software tool for collecting, analyzing, and presenting the data
- Uses standard monitoring data collection interfaces

When an agent inside Linux under z/VM or LPAR performs CPU measurements, Linux assumes and reports the data based on 100% of the machine. This leads to sometimes very exaggerated values. ESALPS corrects these errors based on the z/VM-based data.

Linux Server Processor report showing accuracy problem

```
Screen: ESAUCD4  ITSO z/Domino Redbook

                <Processor Pct Util> NICE
Time      Node     Total Syst User Idle Time
-------- -------- ----- ---- ---- ---- ----
13:24:00 LINUXC2   28.1 12.6 15.5  171  0.0
         LINUXB2   28.1 15.0 13.1  171  0.0
         LINUXA2   23.1 10.3 12.8  177  0.0 ==> uncorrected Linux data provided by Linux
         LINUXB    19.9 10.6  9.3  170  0.0
         LINUXC    29.8 14.2 15.6  169  0.0
         LINUXA    18.1  8.6  9.6  174  0.0 ==> Linux data corrected by ESALPS
13:23:00 LINUXC2   31.5 14.6 16.9  168  0.0
         LINUXB2   30.4 17.0 13.4  169  0.0
         LINUXA2   34.8 18.3 16.5  165  0.0
         LINUXB    19.2 10.0  9.3  173  0.0
         LINUXC    30.6 14.0 16.6  170  0.0
         LINUXA    17.9  8.3  9.6  173  0.0
```

Profile of a Domino server

For each server, the number of processes, the number of active processes (those using some amount of CPU during a one minute interval), the number of running processes, and the number in resource wait are summerized.

The total percentage of processor used by each process group is provided with CPU seconds and average CPU per process. This summary was found useful in understanding how the CPU requirement was distributed.

LinuxA - 1 DPAR / Linux server

```
--------------------------------------------------------------------------------
Node/      Process/    <-Application Process Counts------> <-----Processor---->
Date       Application                                     <---Utilization---->
Time       name        Total active Running ResWait Loaded Percent seconds Avg
--------   -----------  ----- ------ ------- ------- ------ ------- ------- ----
19:00:00
LINUXA                                                  One DPAR / Linux Server
           event         6.0    6.0     2.0     4.0      0     0.7    25.3  0.1
           java         14.0   14.0     1.0    13.0      0     9.1   327.5  0.6
           ksoftirq      2.0    2.0     1.0     1.0      0     1.5    54.7  0.8
           kswapd        1.0    1.0       0     1.0      0     0.7    25.4  0.7
           kupdated      1.0    1.0       0     1.0      0     0.0     0.3  0.0
           router       13.0   13.0     3.0    10.0      0     2.8    99.1  0.2
           sched         5.0    5.0     1.0     4.0      0     0.4    14.7  0.1
           server       68.0   68.0     2.0    66.0      0    11.3   405.6  0.2
           snmpd         1.0    1.0     1.0       0      0     2.6    92.2  2.6
           update        6.0    6.0     1.0     5.0      0     9.2   332.5  1.5
```

LinuxC - 2 DPAR / Linux server

```
---------------------------------------------------------------------------------
Node/      Process/    <-Application Process Counts------> <-----Processor---->
Date       Application                                     <---Utilization---->
Time       name        Total active Running ResWait Loaded Percent seconds Avg
--------   -----------  ----- ------ ------- ------- ------ ------- ------- ----
LINUXC                                               Two DPARs in one server
           event        13.0   13.0     3.0    10.0      0     1.2    44.4  0.1
           iostat        4.0    4.0       0     3.0      0     0.0     0.2  0.0
           java         32.0   32.0       0    32.0      0    15.5   557.3  0.5
           ksoftirq      2.0    2.0     1.0     1.0      0     2.8   101.4  1.4
           kswapd        1.0    1.0       0     1.0      0     3.4   124.1  3.4
           router       32.0   32.0     3.0    29.0      0     5.7   203.9  0.2
           sched         9.0    9.0       0     9.0      0     0.1     4.3  0.0
           server      137.0  137.0    10.0   123.0    4.0    24.0   864.5  0.2
           snmpd         1.0    1.0     1.0       0      0     4.5   161.0  4.5
           update       11.0   11.0       0    11.0      0    18.2   656.5  1.7
```

Processor analysis

Processor capacity planning should begin by analyzing the requirements of the workload. Ideally, performance would be gathered for several weeks or months to understand when the workload peaks and how much resource is required during those peaks.

The data that can be collected depends on what agents are installed. Using the SNMP interface provided by ESALPS, there are two types of data that can be acquired, processor data and process data.

- The next foil contains an ESAMON display showing 5 minutes of processor data provided by a Linux server running the NETSNMP implementation.
- The foil after shows the process data for one of those one-minute intervals.

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Linux processor utilization example

Node/										<---------Rates Per Second------>		<
Date/	<Processor Pct Util>				NICE	<-Swaps->		<-Blocks>		Switch	Intrpt	<
Time	Total	Syst	User	Idle	Time	In	Out	In	Out	Rate	Rate	1
--------	-----	----	----	----	----	----	----	----	----	------	------	-
08:31:00												
LINUXA	130.0	82.0	48.0	69.1	0	24.0	8.0	111	348	158.0	0	
08:32:00												
LINUXA	128.5	80.2	48.3	70.4	0	24.0	8.0	111	348	158.0	0	
08:33:00												
LINUXA	104.1	58.3	45.8	91.2	0	24.0	8.0	111	348	159.0	0	
08:34:00												
LINUXA	109.3	60.4	48.9	95.2	0	24.0	7.0	111	347	160.0	0	
08:35:00												
LINUXA	104.6	56.5	48.1	90.3	0	24.0	7.0	111	347	160.0	0	

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Linux process utilization - drilldown

Node/ Time	Name	ID	Type	Status	Total	Intrval	CPU Pct	StgSize (Bytes)
08:32:00 LINUXA								
	init	1	Applic	ResWait	0.9	0.0	0.0	61440
	kjournal	95	Applic	ResWait	2.5	0.0	0.0	0
	db2fmd	596	Applic	ResWait	0.3	0.0	0.0	573440
	sshd	1081	Applic	ResWait	0.4	0.0	0.0	204800
	event	10787	Applic	ResWait	19.5	0.0	0.0	11188K
	snmpd	10861	Applic	Running	193.4	4.2	7.1	1492K
	adminp	11452	Applic	ResWait	58.5	0.0	0.1	13848K
	server	11525	Applic	ResWait	1.0	0.1	0.1	35720K
	server	11533	Applic	ResWait	4.3	0.0	0.0	35720K
	server	11537	Applic	Running	44697	58.3	99.2	35720K
	java	13024	Applic	ResWait	0.0	0.0	0.0	6632K
	java	24016	Applic	ResWait	1.9	0.0	0.0	6632K
	java	24024	Applic	ResWait	4.9	0.0	0.0	6632K
	server	24192	Applic	ResWait	19.0	0.1	0.1	35720K
	java	26352	Applic	ResWait	0.4	0.0	0.0	7320K
	sshd	26477	Applic	ResWait	0.2	0.0	0.1	2028K

Processor planning

The best method would be to capture the performance data for a month to determine existing processor requirements.

If the data from the above ESAHSTA report was captured for a month from one platform, it is then possible to estimate CPU requirements on another platform.

For example, if the total requirement is an average of 10% of a 1 GHz Intel-based processor, you could estimate an average requirement of about 25 mips requirement on a z800 or z900.

This calculation is an estimate based on "Barton's Number" of 4, which calculates the MHz requirement, in this case 100 MHz, and divides by 4 to get an estimate of MIPs requirement.

For Linux, Barton's number may be 5 or 6; it has not been tested

Idle servers

When running large numbers of servers, there is a cost that should be recognized. An idle server still requires some amount of storage and processor resource as it constantly polls for new connections.

- The cost of this seems to be about 2-3% of a z800 processor.

In an environment where resources will be shared by two or more virtual servers, any resources used by one process reduces the amount of resources available to other servers.

The cost of running non-required or inefficient processes thus reduces the overall workload capability of the system. All additional processes should be evaluated for suitability.

- For example, if you find cron jobs that start regularly but are not always necessary, this is work that is easily eliminated.

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Storage - z/VM storage hierarchy

VM storage overview, paging hierarchy

- Storage hierarchy that z/VM has implemented for performance reasons
- This three-level storage hierarchy is very efficient and provides a very effective caching architecture for the paging devices
- Linux servers can take advantage by over-commitment of storage
- There is no good rule of thumb for the amount of over-commitment that provides good performance.
- The paging algorithms in VM have been developed over many years and very high page rates can be supported

Page volumes

Paging Cache | MDC

Expanded storage

Linux A | VDisk / VDisk | MDC

Linux B | VDisk / VDisk

Linux C | VDisk / VDisk

VM storage

Central processor storage

Redbooks

Storage planning

Assumptions made from the other platforms are not valid in this environment.

- If an Intel-based server is running 1GB of RAM, it likely will run very well in a virtual machine that is much smaller.

In planning for storage, you should minimize the amount of storage used for cache. It is dedicated to Linux and will be active storage.

- With current DASD technology that can provide close to 1ms response time, there is less need for an internal data cache.

Under z/VM, the minidisk cache also provides a dynamic cache of which Linux will take advantage.

- A benefit of the minidisk cache is that when workloads on one server are at a peak, more of the minidisk cache will be used for that server. Thus you have a shared resource that will be utilized by each server as they become heavily used, and then will be made available to other servers as heavily used servers become idle.
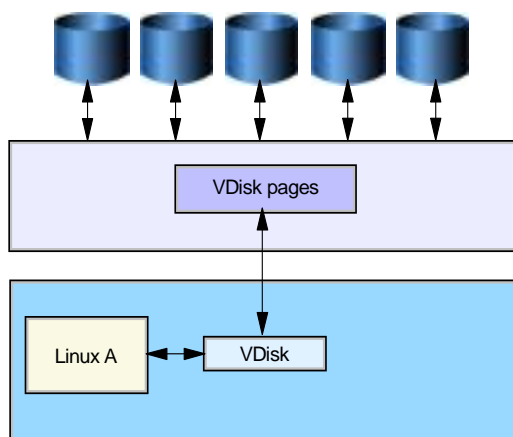
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Avoid swapping

Conventional wisdom: Avoid paging and swapping

- Linux installation documentation often refers to swapping to a real disk. This can lead to poor performance if your storage requirements are larger than your virtual memory. As Linux fills up memory, it moves pages to the swap device. In times of heavy swapping, Linux could be attempting to swap hundreds of I/Os to a single device. This can be a significant bottleneck. The only real caching hierarchy for this configuration is in the storage processor (DASD controller).

Linux storage SWAP to Vdisk

VDisk pages

Linux A → VDisk

VM storage

There are advantages to swapping to z/VM virtual disk. Most Linux and UNIX administrators are taught that swapping is bad and greatly impacts performance. But in the virtual disk case, during tests with swapping at 1000 swap pages per second, very good performance was maintained. The reason is that virtual disks provide a storage hierarchy that has not been used before. However, there is a trade-off of increased CPU usage.

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Trade-off for swapping: CPU usage

- As virtual storage and overall storage requirements dropped, CPU requirements to support swapping to the virtual disk had a cost. In the 256MB virtual machine experiment with a 1500 user load, swapping to virtual disk was about 1000 swap pages per second.

- The cost of performing this activity is charged to the kswapd daemon. The cost is about 9% of one of our processors (on z800) to perform 1000 swap I/Os per second. This is the Linux guest CPU usage. The z/VM CPU usage must also be monitored in order to get the total picture.

- Linux and z/VM both implement a type of LRU algorithm to allocate pages and these do not combine well.

Memory Utilization

Conventional wisdom: Reduce memory utilization

- Our follow-on experiments were to reduce the machine size first to 196 MB, then to 128 MB. The run with 196 MB provided equivalent response time, with the swap rate averaging about 10% higher, and the kswap daemon also about 10% higher.

- The 128 MB experiment proved the case that the swap rate is linearly proportional to the CPU required by the kswap daemon. At the one complete interval shown, swapping was 4 million for the interval, or over 4000 per second. The processor utilization was close to 200% across the two processors, as compared to about 130% across two processors for the previous run.

- The sum of virtual machine size and Linux swap space depends on the application requirements. The virtual machine size depends on what you can afford or are willing to give to the Linux server. You cannot choose an optimal size without knowing the resources available on z/VM.

Virtual disk for swapping

There was a 400 megabyte requirement for each Linux server, including storage and virtual disk, for the workload tested.

- Early requirement was 500MB to support a small workload (300 users).
- By reducing storage sizes, one of the runs showed a total of 360MB requirement to run a large workload (1500 users).

z/VM allows you to vary storage based on workload.

- Using virtual disks for swapping requires very little resource, but when the workload requires more storage, it is available.
- Virtual disks reside in real storage when active; extremely fast.

Virtual disks in z/VM provide a new tool for performance.

- Linux admins would not consider swapping at 1000 pages/second.
- However, one of the experiments did this with no ill effect on end user response times.

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Minidisk cache (MDC)

Another trade-off is the amount of storage allocated to minidisk cache, the benefit received, and the amount of storage left for the virtual storage of the virtual Linux servers.

The benefits increase as more of the referenced data is shared across multiple Linux guests.

- As an example for three servers, the minidisk cache hit ratio was 47-48% of all read I/O performed by the servers. The relationship between the percentage of minidisk cache hits, and the amount of storage allocated to minidisk cache is very workload dependant. *No conclusions should be drawn from this specific data, other than to understand the benefit being provided and the cost of that benefit.*
- In this case, the minidisk cache was much larger that one would see in most environments. Under main store, the average size of the minidisk cache was 380MB, and under expanded storage, an additional 2GB was used. Typical production environments should see a total of less than 500MB.

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Operating system service levels

Reset the Linux timer

- The normal Linux timer pops every 10ms by default, 100 times a second. The impact of this is twofold—one, it uses processor time and two, it keeps the virtual machine active and ineligible to page. The patch reduces this time patch to only run when necessary.

z/VM 4.3: APAR63282

- Allows servers using qdio, hipersockets, and vctca for communications to drop from queue. This allows those servers to be reduced and their page working sets calculated effectively.
  - The impact of this APAR has not been analyzed, but expectations are that overall storage requirements will drop significantly. This APAR was installed as part of the project, but not evaluated to determine its impact.
  - APAR part of z/VM 4.4

See redbook *Linux on IBM eServer zSeries and S/390: Performance Measurement and Tuning*, SG24-6926

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VM paging capacity planning

Page space has two requirements:

- Enough space:
  - Add up all of the virtual machine sizes you will support, add up all of the virtual disks that will be used, and multiply by 4. This is conservative, but will ensure you do not run out of storage. The multiplier of 4 is for performance reasons.

- Enough devices.
  - The device calculation is based on workload and device technology. A target maximum device busy of 20% is reasonable.
    - If you are paging to the RVA devices on ESCON channels with 15-20 ms response time, then each device can support about 10 I/Os per second.
    - if the page devices are on ESS with FICON channels with 1-2 ms response time, then each device will support over 100 I/Os per second.
  - Since we had no opportunity to run tests in a storage-constrained environment, there was very little paging.

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z/VM page space vs. Linux swap space

There is a trade-off between having a Linux swap disk on real versus virtual disk.

- When the swap space is on a real disk, it will be a single point of contention. The sustained swap rate can reach 100 or more, depending on your DASD. The Linux server will have very poor performance.
- When the Linux swap space is on virtual disk, there is no additional resource cost until the virtual disk is used.

Example:

- Problem: 50 servers each with 2GB of real disk allocated for swap require 100GB. Since each of those disks are dedicated to a server, all swap activity from one server will go to one disk.
- Solution: Define those 50 disks as page devices.
  - Under times of very heavy swapping, and when z/VM does need to offload pages, the I/O is now spread over the 50 page devices. This increases the total real I/O bandwidth potential by each individual server to 50 times what could be supported on just one device.
- The total supportable load for the system has increased significantly, and provides the ability for each individual Linux guest to page at very high rates with no ill effect on performance. This is a tremendous advantage of virtual disk over any other swapping technology.

Linux swapping

TIP: Use diagnose driver for swap and use virtual disks.

- For more detail on this recommendation, see Chapter 5, "Examining Linux swap device options" in *Linux on IBM eServer zSeries and S/390: Performance Measurement and Tuning,* SG24-6926.

If the overall requirement is estimated at 1GB of swap space, then having 10 disks of 100MB each will reduce the load on each individual disk.

Virtual disks are NOT allocated prior to use. Linux sees the virtual disk as a full disk ready for use. But until Linux writes something to this disk, z/VM will not allocate resources. Thus the cost of many large disks is really very small until the disk is utilized.

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Linux Swapping

Linux formerly swapped out an entire process so that another running process could have its memory.

- This was expensive memory management due to context switching.
- The current swap algorithm affects only those pages no longer in use.

The kswapd daemon wakes up during two time frames:

- Every 5 minutes, to check the dirty list to free up memory,
- On demand, each time a process uses more than the last 20% of memory, to get memory use down below 80%.

On VM, virtual disk can be used to swap in memory.

- It reserves an amount of swap space for the Linux guest, but it does not take central storage until it is needed.
- For different amounts of swapping, have multiple virtual disks defined as swap devices rather than one big disk. Only the virtual disks that are used will take up central storage.

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The cost of swapping

As we lowered the available virtual and overall storage, processor requirements to support swapping to the virtual disk increased. This is a trade-off for efficient memory management. It has a cost.

- In our measurement of the 256 MB virtual machine experiment with a 1500-user load, swapping to virtual disk was nearly 1000 per second over the 900 second reporting interval.
- The cost of performing this activity is charged to the kswapd daemon.
- The cost is about 9% of a z800 engine to perform 1000 swap I/Os per second.
- In addition to the Linux swapping cost, the CPU usage of VM should be added in.

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DASD planning

Plan for both initial use and monitor for usage

Initial use:

- When moving existing workloads to other servers, the disk requirement is a known factor. In our example, root required 1507 megabytes of space. If this is shared between many servers, then this space is only required one time.

Monitor usages:

- Check on a regular basis to avoid outages from disk full conditions. Some volumes are more volatile, and disk space utilization of greater than 60 or 70% (such as in /domserva/notesdata at 94% space utilization) may be a risk.
- Use **df -h** to displays capacity and free capacity on different physical devices, option -h displays free space in MB or GB

DASD tuning

DASD response time has 4 components:

- queue time
- disconnect time
- pend time
- connect time

Our findings:

- RVA response time is in the 16 ms range
- ESS is in the 2 ms range

DASD tuning

Connect time

- The ESS uses FICON channels with the capacity of over 100MB per second
- The RVA was on 4 ESCON channels at 17MB per second. On the ESCON channels, connect time accounted for about 7ms per I/O; this decreased to just over 1ms on the ESS with FICON channels. This was one measure of the improvement and the source of one of the improvements.

Disconnect time

- More to do with the caching function in the storage controller, given equivalent DASD workloads. The ESS shows consistently improved disconnect times, though it was not quite as static as the connect time.

Pend time

- This is the time to start the I/O. The ESCON had four channels to the RVA, so this was expected to be quite good compared to just two channels on the ESS. But the Pend time only dropped from 1-2ms to .2 - .3ms.
  - This could be due to the ability of the FICON channel to queue I/O actions to four devices at once while the ESCON channel can queue only one at a time

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Single vs. multiple DPAR

Linux A and Linux B :

- Each with a Domino server, each in their own virtual machine,

Linux C:

- Two Domino servers, running in the same virtual machine with twice the storage definition. Each of the Domino servers supported the same workload.

We found that the processor requirement for each Domino server was the same.

Thus from a capacity planning perspective, there seems to be no recognized added cost for a second DPAR.

  - However the total storage requirement of Linux C was more than double what we expected. But this storage could likely have been reduced.

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Single vs. multiple DPAR

```
Report: ESAUSR2     User Resource Utilization   Domino Redbook  ESAMAP 3.4.0 08/25/03  Page  32
 Monitor initialized:         on 2066 serial 71CE3    First record analyzed: 08/24/03 18:00:00
-----------------------------------------------------------------------------------------------
           <---CPU time--> <--------Main Storage (pages)--------> <------Paging (pages)------->
 UserID    <(seconds)> T:V <Resident> Lock <-----WSS----->        <---Allocated---> <---I/O--->
 /Class    Total  Virt Rat Totl Activ  -ed Totl Activ  Avg Resrvd Total ExStg  Disk  Read Write
 --------  ----- ----- --- ---- ----- ---- ---- ----- ----- ------ ----- ----- ----- ---- -----
 08/24/03
 19:00:00  5843  5436 1.1 204K  204K 6421 204K  204K 4878     32 66412     6 66406     3     4
 ***Top User Analysis***
  LINUXC   2884  2652 1.1 100K  100K 3076  97K 97365  97K      0     0     0     0     0     0
  LINUXA   1489  1406 1.1  48K 47672 1482  46K 46055  46K      0  3653     6  3647     0     0
  LINUXB   1387  1306 1.1  48K 48020 1565  46K 46455  46K      0  2909     0  2909     3     0
 ----------------------------------------------------------------------------------------------
 20:00:00  5794  5390 1.1 204K  204K 6522 204K  204K 4877     32 66314     6 66308     7     3
 ***Top User Analysis***
  LINUXC   2874  2641 1.1 100K  100K 3153  97K 97165  97K      0     0     0     0     0     0
  LINUXA   1472  1392 1.1  48K 47672 1556  46K 46254  46K      0  3589     6  3583     0     0
  LINUXB   1374  1295 1.1  48K 48025 1515  47K 46630  47K      0  2875     0  2875     6     0
 ***********************************************Totals*****************************************
  System: 17580 16356 1.1 204K  204K 6471 204K  204K 4875     96 66306     6 66301    24    10
  LINUXC   8716  8014 1.1 100K  100K 3098  97K 97181  97K      0     0     0     0     0     0
  LINUXA   4450  4205 1.1  48K 47673 1537  46K 46170  46K      0  3600     6  3594     6     0
  LINUXB   4173  3932 1.1  48K 48025 1538  47K 46523  47K      0  2857     0  2857    14     0
  Others: 25.78 22.08 1.2 4978  4977   16  11K 10874  312     96 55834     0 55834     1    10
 ----------------------------------------------------------------------------------------------
  Total  17580 16356 1.1 204K  204K 6471 204K  204K 4875     96 66306     6 66301    24    10
  Rate/Sec 1.63  1.51 1.1   19    19    1   19    19    0      0     6     0     6     0     0

  Per User 418.6 389.4 1.1 4863  4863  154 4856  4855  116      2  1579     0  1579     1     0
```

Single vs. multiple DPAR - constrained system

Linux memory analysis for 3 servers

```
Report: ESAUCD2   LINUX UCD Memory Analysis Report    Domino Redbook   ESAMAP 3.4.0 08/25/03  Page  83
 Monitor initialized:       on 2066 serial 71CE3      First record analyzed: 08/24/03 18:00:00
 ------------------------------------------------------------------------------------------
 Node/     <----------------------Storage Sizes (in MegaBytes)------------->
 Time/     <--Real Storage--> <-----SWAP Storage----> Total <--Storage in Use-> Error
 Date      Total  Avail Used  Total Avail Used   MIN   Avail Shared Buffer Cache Message
 --------  ------ ----- ----- ----- ----- ----- ----- ----- ------ ------ ----- -----------
 08/24/03
 19:00:00
 LINUXA    186.0    2.6 183.4 484.1 393.1  91.0  15.6 395.7     0    4.2  141.2
 LINUXC    383.6    2.5 381.2 968.3 740.4 227.9  15.6 742.9     0    6.5  303.9
 LINUXB    186.0    2.6 183.4 484.1 403.9  80.2  15.6 406.5     0    4.1  142.2
 20:00:00
 LINUXA    186.0    2.6 183.4 484.1 392.3  91.8  15.6 394.9     0    4.2  141.3
 LINUXC    383.6    2.5 381.1 968.3 735.8 232.5  15.6 738.3     0    6.4  304.3
 LINUXB    186.0    2.5 183.5 484.1 403.0  81.1  15.6 405.5     0    4.0  142.3
 ------------------------------------------------------------------------------------------
 21:00:00
 LINUXA    186.0    2.5 183.5 484.1 389.2  94.9  15.6 391.7     0    4.1  140.7
 LINUXC    383.6    2.5 381.2 968.3 728.0 240.3  15.6 730.5     0    6.4  303.1
 LINUXB    186.0    2.5 183.5 484.1 398.1  86.0  15.6 400.5     0    4.0  141.9
 *********************************************Summary***************************************
 LINUXA    186.0    2.6 183.4 484.1 391.5  92.6  15.6 394.1     0    4.2  141.1
 LINUXC    383.6    2.5 381.2 968.3 734.7 233.6  15.6 737.2     0    6.4  303.8
 LINUXB    186.0    2.5 183.5 484.1 401.6  82.5  15.6 404.2     0    4.0  142.1
```

Capacity planning - conclusions

Capacity planning requires measurement, analysis, and knowledge based on experience.

- We have shown some of the more relevant areas to measure. Using these techniques, you have the ability to measure your existing platforms and project your requirements to a zVM environment.

For processor utilization, you have the ability to measure the existing workload on Intel or other platforms and project the requirement on a zSeries processor.

Virtual disks in z/VM provide a completely different aspect of performance for both the Linux knowledgeable and the VM knowledgeable.

- By using virtual disks as swap, very little resource is consumed by the virtual disks, but when the workload requires more storage, it is available. Because the virtual disks reside in real storage when active, they are extremely fast.
- For example, Linux administrators would never consider swapping at 1000 swap pages per second. However, one of the experiments we ran did this with no ill effect on end user response times.

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Our Observations

Expected storage constraints did not materialize under the loads applied.

Performance was as good as, or better than, early projections.

Run with small virtual machine size and use virtual disk to alleviate Linux storage contention.

Projecting capacity requirements from an Intel-based server to a mainframe can be done by using 'Barton's number':

- 4 megahertz per MIP
- Usage on Intel in MHz divided by 4 provides the MIPs
- 20% of 1GHz (200 MHz) / 4 = about 50 MIPS

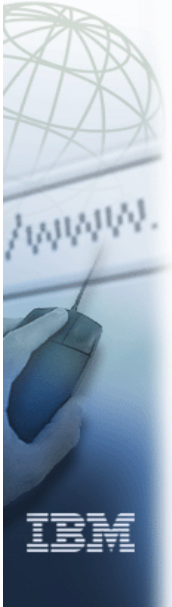**All of the measurements were made on Linux systems running under z/VM.**

The conclusions of the performance experiments were very positive.

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Performance tuning

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Monitoring requirements

Capacity planning
- Long term data in a performance database is needed as input to long term capacity planning and trend analysis using data extraction tools.

Performance analysis
- Trend data enables detection of performance changes in potential problem areas. A performance database allows analysts to determine which changes occurred in the system.

Real-time performance
- Real-time performance analysis is needed for all subsystems, user activity, and servers (including Linux). Network data is also needed real time.

Linux data
- Linux server farms on z/VM require performance data.

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Analyzing Processor Performance

The process for analyzing performance data for the processor should start at a high level.

Monitor
- processor utilization
- I/O rate
- paging to expanded storage
- paging to DASD

In a Linux server environment, there is not much value in measuring the transaction values provided by z/VM.
- These are not a measure of work performed inside Linux, but a measure of the whole virtual machine.

In Linux, there is no distinction between threads and processes and though storage is shared between threads, the reporting of the storage will contain large overlaps.
- Processes using such large amounts of processor resource should be identified and a determination be made if it is appropriate or not.

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Formatting Linux disks

We experimented with various types of disk and channel configurations, as well as with different formatting methods.
- LVM: allows you to have a large virtual volume made up of physical volumes
- Striping: allows you to have portions (stripes) of logical volumes across a number of physical volumes, channels, etc. for performance
- ESS vs.RVA
- FICON vs. ESCON

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Case study: Linux console goes into holding state

Problem:

If Linux console goes to holding state all screen including Linux reports, will show that nothing was happening in either VM or Linux for this Linux guest.

- This is important to know, as this is something that can happen when the Linux console is a 3270 terminal.

Solution:

To correct this problem, the CP SET RUN ON command should be issued in the Linux VM ID's profile.

- This will not allow the session to go into the `CP Read` state.
- Also TERM HOLD OFF should be issued

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Monitoring with SRM

To see the effect of changing SRM parameters in VM, see topic 6.4.1 in *Linux on IBM eServer zSeries and S/390: Performance Measurement and Tuning*, SG24-6926. This has a detailed description of the different SRM parameters and how they affect VM.

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Web servers

There are several ways to serve HTTP pages from a zSeries system.

- Integrated Domino HTTP server
- WebSphere Application Server
- IBM HTTP server (Apache server on Linux)

Domino HTTP server

Advantages
- The Domino HTTP server requires no additional setup or configuration, making it easy for you to get started. Domino HTTP is also fully integrated with the Domino Directory, so your user IDs can be managed from a single location.

Disadvantages
- The Domino HTTP server does a very good job with Domino data, but is less capable at serving non-Domino data.

When to use
- Use the Domino HTTP server for servers that are mostly serving Domino applications; for example, a mail server where you are giving the users access through Domino Web Access (DWA, formerly known as iNotes).

WebSphere Application Server
- A standards-based, Web server deployment platform that enables you to use Java servlets and JavaServer Pages (JSPs) and provides connections to back-end database systems

Advantages
- Websphere is a powerful server that can serve many kinds of enterprise data, not just Domino data. If you have to serve lots of data from different sources, WebSphere is a good choice.

Disadvantages
- While Websphere is powerful, it can be difficult to set up and configure, especially for those with little previous WebSphere experience.

When to use
- We recommend that you use Websphere on those servers that are going to be serving many different sorts of data and in organizations that have WebSphere experience to set up and manage the server.

IBM HTTP Server (Apache)

- The IBM HTTP Server for Linux is based on the Apache HTTP Server, which is the most popular server on the Web. The version that comes with Linux on zSeries can be used to replace the Domino HTTP stack.

Advantages

- There are many plug-ins for the Apache server that provide a wide range of functionality. Apache also excels at serving static HTML pages.

Disadvantages

- Apache can be difficult to configure; also management must be done outside of the Domino environment.

When to use

- If there is a need for some specific function that Apache provides, then use it as a replacement for the Domino HTTP stack.

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Connecting to external data sources

Domino Enterprise Connection Services (DECS)

- For DB2 7.1 or higher
- The DB2 database must be on the same system as the Domino server, or you must configure a connection to another DB2 database

Data Connection Resource (DCR)

- New in Domino 6, an add-on to DECS
- Access external databases from your Notes application without going through the DECS administration database
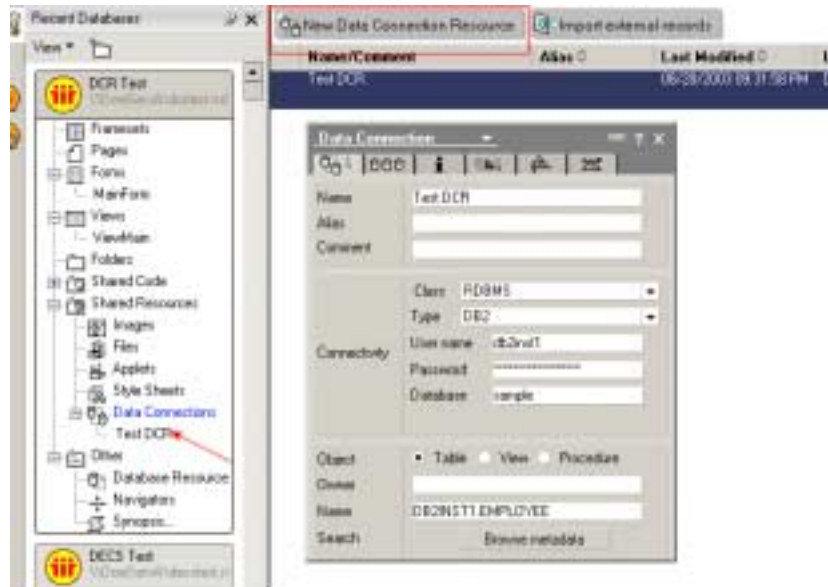
Not included in Domino 6

- No Lotus Enterprise Integration (LEI)
- No DECS Connectors for any product other than DB2

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Creating a DCR

Defining and filling in the fields

- Pressing browse allows you to select the DCR, table, and DB2 field that you want mapped to your Domino field.

Using a DCR

- When you open the document, DECS will pull the data from the DB2 database and populate the form. You can then use the Notes client to update and maintain the DB2 database, and use Domino replication to distribute the data throughout your organization.

DispName ⊤

Employee Number: EmpNum ⊤

First Name: Firstname ⊤ , MI ⊤

Last Name: Lastname ⊤

Sex: sex ⊤ Birthdate: Birthdate 📅

Age: Age ℯ

Department: Dept ⊤

Pulaski, Eva D

Employee Number: 000070
First Name: EVA, D
Last Name: PULASKI
Sex: F Birthdate: 05/26/66
Age: 37
Department: D21

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Upgrading from 6.0 to 6.5

If you start from Domino 6.0.x, there should not be much to do.

- Test your business-critical applications
- Test your customized Lotus standard templates such as pubnames.ntf.

After successful testing, you can apply the new Domino 6.5.x version to your servers.

Note: Do not change or customize any of the standard templates!

Upgrading from R4 or R5

Before you upgrade

- From R4 or R5, read redbooks about upgrading to Domino 6, such as *Upgrading to Lotus Notes and Domino 6*, SG24-6889.
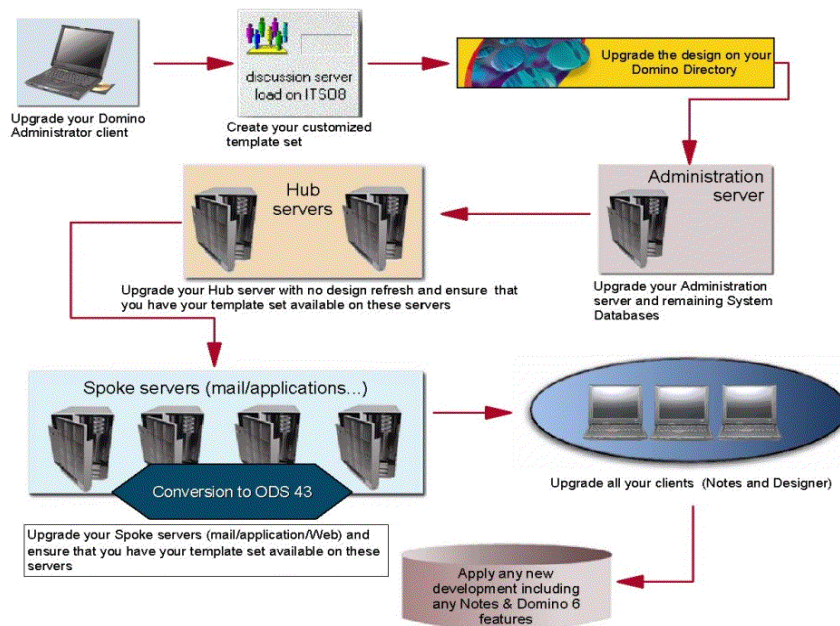
Upgrade strategy (see diagram following)

- Begin with the administration clients
- Check all your customized templates
- Upgrade your Domino Directory
- Upgrade the administration and hub servers
- When all those servers are stable, upgrade your remaining servers
- Upgrade the Notes clients

Upgrade strategy from R5/R4

Upgrade your Domino
Administrator client

discussion server
load on ITSO8

Create your customized
template set

Upgrade the design on your
Domino Directory

Hub
servers

Upgrade your Hub server with no design refresh and ensure that
you have your template set available on these servers

Administration
server

Upgrade your Administration
server and remaining System
Databases

Spoke servers (mail/applications...)

Conversion to ODS 43

Upgrade your Spoke servers (mail/application/Web) and
ensure that you have your template set available on these
servers

Upgrade all your clients (Notes and Designer)

Apply any new
development including
any Notes & Domino 6
features

Platform migrations: UNIX, Linux

It is very easy to migrate from one UNIX platform to another.

However, when migrating from Domino on z/OS to Linux on zSeries:

- There are filesystem changes (DASD instead of HFS or zFS datasets)
- The character sets are different for z/OS and Linux (EBCDIC vs. ASCII)

Platform migrations: Wintel

Changing from a Windows platform to Linux is slightly more complicated than from UNIX to Linux.

UNIX is cAsE sEnSiTiVe!
- Name every file only using lower case. In this way it will be easier to find misspelled filenames.

Backslash
- The backslash \ is not present in UNIX. Just as with web addresses, use the forward slash / between directories. In the Domino Directory the Domino server uses the \ for path names and converts it when accessing the UNIX filesystem. However it may be a good idea to use the / wherever possible.

Code pages
- Windows and Linux may have different interpretations about special characters.

Redbooks

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Server consolidation types

There are two choices for migrating your Domino infrastructure to Domino for Linux on zSeries:
- Combining servers (fewer Domino servers on Linux on zSeries)
- Without combining servers (same number of Domino servers as before)

When you plan your new environment, it is a good time to re-think the way you use your Domino servers.
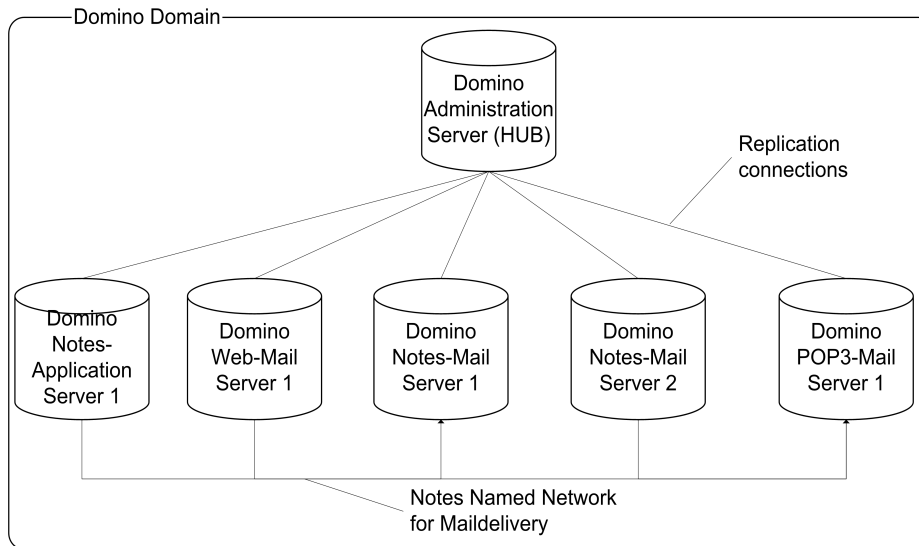- Separate your servers by function.
- Have a dedicated server for Notes mail, for POP3 and SMTP mail, for Notes applications, for web applications, one admin server.
- It is easier to fix problems, to maintain updates, to tune and administer servers that have dedicated workloads than servers with a mixed workload.

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An ideal Domino domain

Domino Domain

Domino Administration Server (HUB)

Replication connections

Domino Notes-Application Server 1

Domino Web-Mail Server 1

Domino Notes-Mail Server 1

Domino Notes-Mail Server 2

Domino POP3-Mail Server 1

Notes Named Network for Maildelivery

Redbooks

Migration methods: replication

Migrating from one Domino platform to another means moving a lot of data, mostly in Domino databases.

- A special type of replication that can be very useful for migration is provided by Domino clustering.

Steps to prepare for migration using replication

- Create the replica stubs on the new server for all the databases you want to move.
- Create a connection document pointing from your old to your new Domino server.
- Enable the replication and check the Domino log for possible replication errors.
- Inform the users and their Notes clients about the new database location. If you choose cluster replication, the failover process will handle this automatically.

Redbooks

Migration methods: FTP

FTP is also a good, standardized, reliable data transportation method.

- FTP does not look inside the data. So it does not care about ACL, replication, or encryption settings.
- Shut down the target and the source Domino servers before doing the transfer.
- After the transfer, make sure the ACL settings allow the new server to access the databases you transfer.

Concurrency vs. replacement

Two migration scenarios

- Run the new and old Domino servers concurrently for a certain time.
- Or replace the existing old server with the new Domino server.

Both scenarios are valid in various situations. We recommend the first scenario.

- It is more fault-tolerant and there is a built-in fallback if things go wrong.
- You can make your migration more granular and slowly ramp up the load on the new Domino server.

Avoiding migration pitfalls

When migrating your applications, the Decommission Server Analysis Tool will give you detailed information about the connections, databases, and other items that two servers have in common.

- It can be used as a starting point for migrating your servers to your zSeries system.
- The Decommission Server Analysis Tool is found in the admin client, on the Server > Analysis tab, under the Analyze tool.

Steps to avoid pitfalls

- 1. Create an inventory of your existing Domino applications. Include: replicas (on which servers?), database properties, clustered, ACL settings, size, path, last used, inherits design from, is template.
- 2. Find out who is responsible for the application and if it is still needed.

Redbooks

Avoiding migration pitfalls - 2

- 3. Find out how important the application is for your organization and how much workload it will generate on the server. This information is important for deciding onto which server and when to migrate the application.
- 4. Archive and delete old and no longer used applications
- 5. Analyze the remaining applications for possible incompatibilities, such as dependencies on third party products, external data source as DB2 or Oracle, or specific hardware (such as a fax modem). Check the application using the design synopsis feature of the Notes Designer client or other designer (e.g. Teamstudio) and appropriate filter rules (R4-R6, R5-6).

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Avoiding migration pitfalls - 3

- 6. Make the appropriate changes to the design of the database
- 7. Test the application on the new platform.
- 8. Plan the distribution of your applications (which server, which directory, cluster).
- 9. Transfer the databases to the target server.
- 10. Notify the users and the Notes clients of the new database location.
- 11. Monitor the migration process

Check your applications

- The default fonts in Notes 6 have changed
- Formula Language has been rewritten in Notes 6, but is 100% compatible
- MQSeries Lotus Script Extension (MQLSX) incompatible with Domino 6 and is not supported by Lotus after 31 December 2004
- Strict Date/Time field interpretation has been restored in Notes 6, but you can turn it off in a checkbox in user preferences
- Some JavaScript events have been changed in Notes 6
- @Command([ToolsUserLogoff]) and password prompt

Check these other sources for more information:

- Chapter 14 in *Domino 6.5 for Linux on zSeries*, SG24-7021
- Domino Designer Help
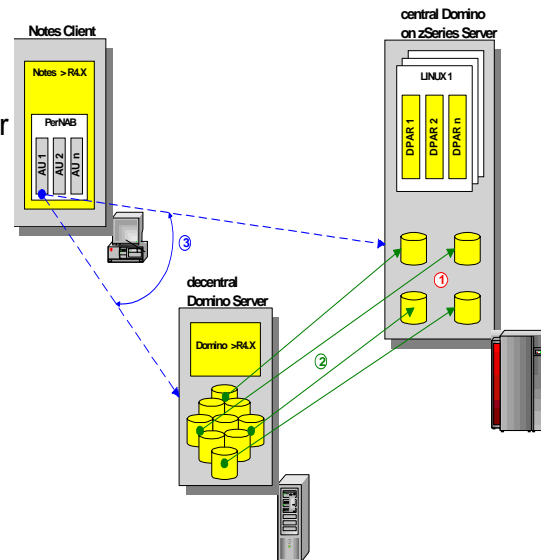- http://www.lotus.com/ldd/today.nsf/lookup/designer_rnext_technical_overview

Migrating mail servers

Overall scheme for migrating your mail servers

- 1. Plan for a well-balanced distribution of the databases (server and directory) and define the filesystem on your new Domino server.
- 2. Transfer the databases from the old servers to the new Domino server.
- 3. Redirect the Notes Client to the new server. Customize other client settings to meet the requirements for the new Domino server version and platform.

Notes Client

Notes >R4.X

PerNAB

AU 1 | AU 2 | AU n

③

decentral Domino Server

Domino >R4.X

②

central Domino on zSeries Server

LINUX 1

DPAR 1 | DPAR 2 | DPAR n

①

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Migrating mail servers - 2

Perform these tasks to help ensure a successful mail migration

- Identify the users you want to migrate by using certain criteria
- Generate a balanced distribution of mail databases on the target Domino server
- Transfer the databases using FTP or Domino replication
- Adapt the Domino Directory
- Adapt the essential parameters in the clients' location documents
- Use this migration time to clean up your mail environment

Redbooks

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Questions

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www.ibm.com/zseries/domino