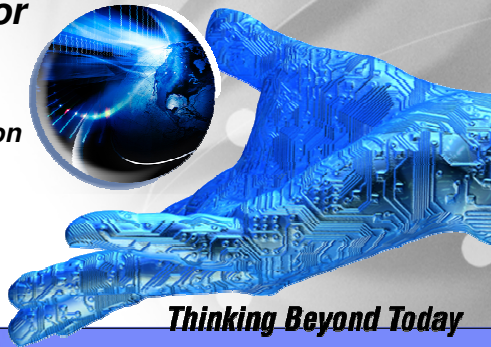


Leveraging System z for Linux Workloads: Security & Enterprise Integration

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Thinking Beyond Today

**IBM's Vision For The New
Enterprise Data Center**

Agenda



- Quick Security Level Set
- Key Security Technologies

- What does System z bring to Linux Security
 - ▶ Isolation and Certification
 - ▶ Cryptography
 - ▶ Integration

- Platform Synergy (z/OS, z/VM, & zLinux)
 - ▶ Network Security
 - ▶ Administration
 - ▶ Configuration

- References & Backups

Linux for System z is not ...



Linux® for System z is not z/OS®

Linux for System z is not RACF®
z/OS Communication Server

Linux for System z is not ICSF
System SSL

Linux is ...



Linux for System z has security-rich features.

Linux for System z is open, no security through obscurity, anyone can see flaws and fix them.

Linux has a large active developer base enabling a thorough code review.

Linux has a worldwide user base which allows testing on a wide range of hardware and diverse scenarios.

Linux benefits from almost immediate response to security advisories and rapid implementation of new technologies.

Distributions Embracing Security




- **Hardening**
- **Secure shell**
- **Enhanced Audit Capability**
- **Enhanced Authentication Options**
- **Virtual Private Network**
- **Enhanced Firewall Management**
- **Intrusion Detection Systems**
- **Cryptographic Libraries and Access to Hardware**
- **Host and Network Scanning Tools**
- **Certifications**



**Key
Security
Technologies**

z/VM Users' Group – NYC Area

Linux on System z Security Building Blocks




Access Control (for Linux)	SELinux, AppArmor, sudo, IBM Tivoli® Access Manager, CA eTrust Access Control for Unix
Access Control (for Web)	IBM Tivoli® Access Manager, CA Siteminder
Anti-Virus/Anti-Spam	ClamAV, OpenAntiVirus, AmaViS, MIMEDefrag, TrendMicro's ServerProtect & ScanMail, Network Associates, Roaring Penguin's CanIt
Directory Services	Open LDAP, NIS/NIS+, IBM Tivoli Directory Server, CA's eTrust Directory, PADL's XAD, Quest's VAS
Digital Certificates	Freeware PKI, z/OS PKI Services
Firewall	IPTables/NetFilter, ISS PSL for Linux on System z, webApp.Secure
Intrusion Detection	Snort, AIDE, Snare, PortSentry, TripWire, OSSEC, LIDS, IPLog, ISS PSL for Linux on System z, PredatorWatch, SafeZoneNet

Vendor Product
Open Source Product

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Linux on System z Security Building Blocks



Secure Network Communications	OpenSSH, GnuPG (OpenPGP compliant), USAGI IPv6, FreeS/WAN, CA's eTrust VPN, SecureAgent Software, PGP Command Line
Secure Socket Layer (SSL)	OpenSSL, PKCS#11, GSKIT
System Hardening	Bastille, Tiger, RedHat, Novell
Secure Data	dm-crypt, ppdd, CFS, Network Associates' e-Business Server
Identity Integration	PAM, OpenLDAP, IBM Tivoli Directory Server for z/OS, IBM Tivoli Directory Integrator, CA's eTrust Directory
Identity Management	IBM Tivoli Identity Manager
Proxy Server	Proxy Suite from SuSE, IBM Edge Server, IBM Tivoli Access Manager WebSEAL (secure proxy)

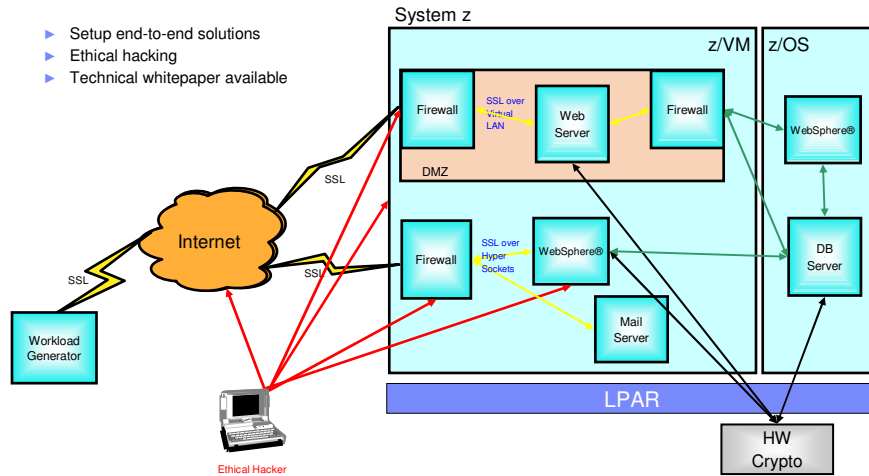
Vendor Product
Open Source Product

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Ethical Hacking



- ▶ Setup end-to-end solutions
- ▶ Ethical hacking
- ▶ Technical whitepaper available



For details see:
•Linux Security: Exploring Open Source Security for a Linux Server Environment (GM13-0636-00)
•zSeries Platform Test Report for z/OS and Linux Virtual Servers



Isolation & Certification

What z10 EC brings to Linux Customers

- 4.4 GHz... Quad Core Processor Up to 64 IFLs
- Up to 1.5 TB memory
- Large Page Support
- Hardware Decimal Floating Point
- Just in Time Deployment for capacity offerings – permanent and temporary
- 6.0 GBps HiperSockets
- SCSI IPL
- OSA-Express3 10 Gbps
- HiperSockets Layer 2 Support



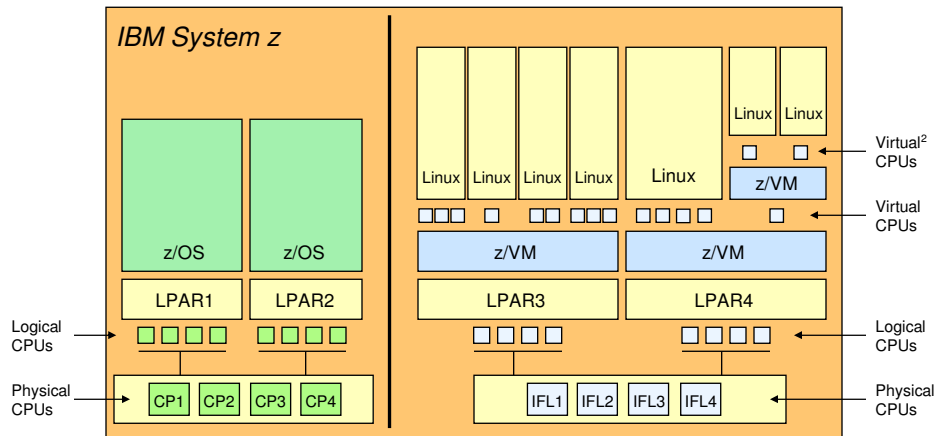
System z Advantage Summary



- Image Isolation and Certification
 - ▶ LPAR
 - ▶ z/VM®
- Common Criteria Certification and z/VM System Integrity Statement
- Hardware Encryption
 - ▶ Asymmetric Cryptography provides SSL performance enhancements
 - ▶ Symmetric Instructions - DES, TDES, AES, and SHA
 - ▶ Secure key cryptography
- HiperSockets™ Provide Physical Security
- Qualities of Service – specialty engines
- Integration with IBM Software
 - ISS Proventia
 - Tivoli Access Manager, e-Business and AM-OS provide enforcement and management of security policy across platforms
 - Tivoli MQSeries®
 - Tivoli Identity Manager
 - Tivoli Federated Identity Manager

IBM System z Virtualization Leadership

Extreme Levels of CPU Sharing



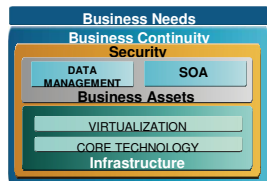
13

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System z ensemble

System z Future

System z Mainframe



Integrated Systems Management firmware



- Integrate, monitor, and manage multi-OS resources as a single, logical virtualized system
- Single WLM, Security, and System Management interface across all resources

Accelerators

- Extend and accelerate System z workloads
- Lower cost per transaction while improving application response time for CPU intensive applications

Application Serving Blades

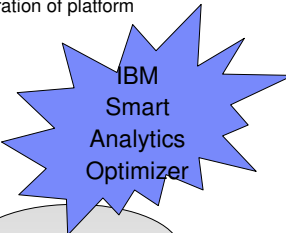
- Logical device integration between System z resources and application serving commodity devices
- Providing competitive price-performance and improved QoS for applications with a close affinity to mainframe data

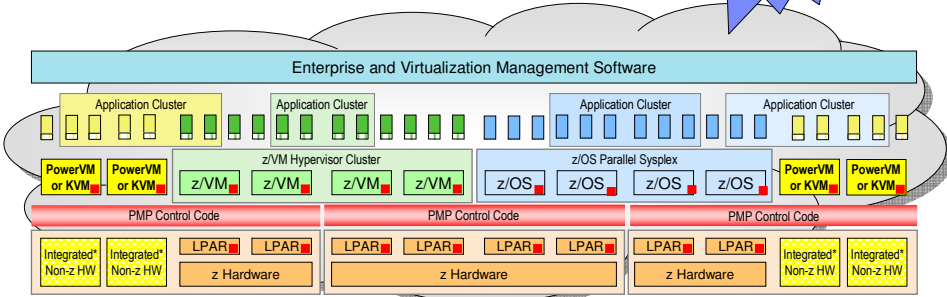
14

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IBM multi-architecture virtualization – Conceptual view *System z multi-system, federated Hypervisor configuration*

- The System z Platform Management Partition (PMP) will host a federation of platform management functions, including:
 - Resource monitoring
 - Workload management
 - Availability management
 - Image management
 - Energy management
- Integrates with hardware management and virtualization functions
- Controls hypervisors and management agents on blades
- Open integration to enterprise-level management software






■ = Code that interfaces with Platform Management Partition (PMP) * E.g., Cell Broadband Engine, DataPower, Power Blades, x86_64

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Logical Partition (LPAR) Certification



- IBM eServer zSeries 990 (z990)
 - ▶ 10/04 Common Criteria EAL4/EAL5
- IBM eServer zSeries 890 (z890)
 - ▶ 6/05 Common Criteria EAL4/EAL5
- IBM System z9 109
 - ▶ 3/06 Common Criteria EAL5
- IBM System z9 EC & BC
 - ▶ 8/06 Common Criteria EAL5
- IBM System z10 EC
 - ▶ 3/08 Common Criteria EAL5
- IBM System z10 BC
 - ▶ 10/08 Common Criteria EAL 5

z/VM Certification

- Statement of System Integrity
- Common Criteria
 - z/VM 5.1 certified 2Q 2005
EAL 3+ for LSPP & CAPP
 - z/VM 5.3 certified 3Q 2008
EAL 4+ for LSPP & CAPP

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Linux for System z Certifications by Distribution




Version	Certification Level	Status
Novell SUSE		
SLES 8	CAPP – EAL 3 +	Complete
SLES 9	CAPP – EAL 4 +	Complete
SLES 10	CAPP – EAL 4 +	Complete
RedHat		
RHEL 3	CAPP – EAL 3 +	Complete
RHEL 4	CAPP – EAL 4 +	Complete
RHEL 5	CAPP / LSPP – EAL 4 +	Complete



Crypto

z/VM Users' Group – NYC Area

Crypto Hardware Availability



Name	Supported HW	Linux Support	Remarks
CP Assist Instructions	z990, z890	Yes	DES, TDES, SHA-1
CP Assist Instructions	System z9 EC System z9 BC	Yes	AES-128, SHA-256, PRNG
CP Assist Instructions	System z10 EC System z10 BC	Yes	AES-192 / 256, SHA-384 / 512


PCI Cards

Name	Supported HW	Linux Support	Remarks
PCICA	z990	Yes	5 processors/card
PCIXCC	z990 GA 2, z890	Clear Key SSL only	1 card per adapter
CEX2C	z990 GA 4, System z9	Clear Key SSL only	2 cards per adapter (cards same as PCIXCC)
CEX2 (Coprocesor & Accelerator)	System z9 EC, System z9 BC, System z10 EC, System z10 BC	Clear key SSL + secure key	2 cards per feature, each card can have a 2A or 2C personality On BC, 1P = 1 card per feature

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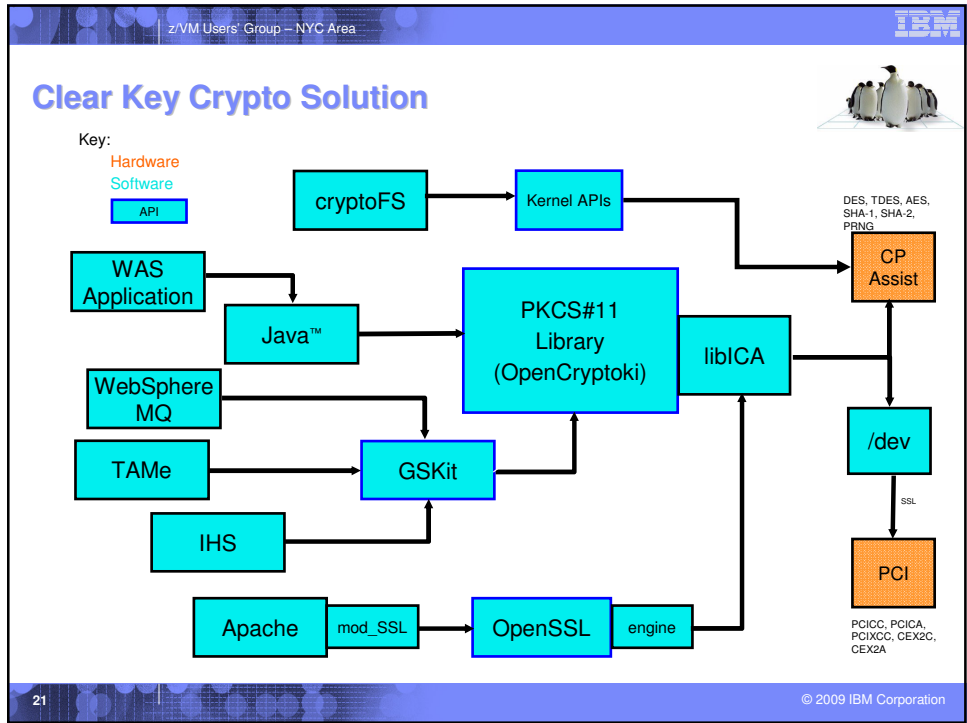
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Cryptography – Clear Key



- **Hardware Acceleration**
 - **Asymmetric**
 - Acceleration of RSA handshake
 - PCICC
 - PCICA
 - PCIXCC
 - CEX2
 - Crypto Express2 Coprocessor and Accelerator (CEX2C & CEX2A)
 - **Symmetric/HASH**
 - DES, TDES, AES, SHA-1 and SHA-2
 - **PRNG**
- **Software Libraries for crypto access**
 - Kernel APIs
 - OpenSSL
 - PKCS#11
 - GSKit

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- z/VM Users' Group – NYC Area
- ## Cryptography – Secure key
- Hardware Acceleration
 - Asymmetric, Symmetric and Financial
 - CEX2C
 - Software Libraries for crypto access
 - CCA – Common Cryptographic Architecture
 - PKCS#11 – Limited
 - key generation/encrypt/decrypt for TDES & RSA
 - Java/JCE – Limited as above
 - Card Management
 - Trusted Key Entry (TKE)
 - Linux CCA Utility
 - Configure via z/OS then re-assign to Linux
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Secure Key Distribution Requirements

Novell.

SUSE Linux Enterprise Server

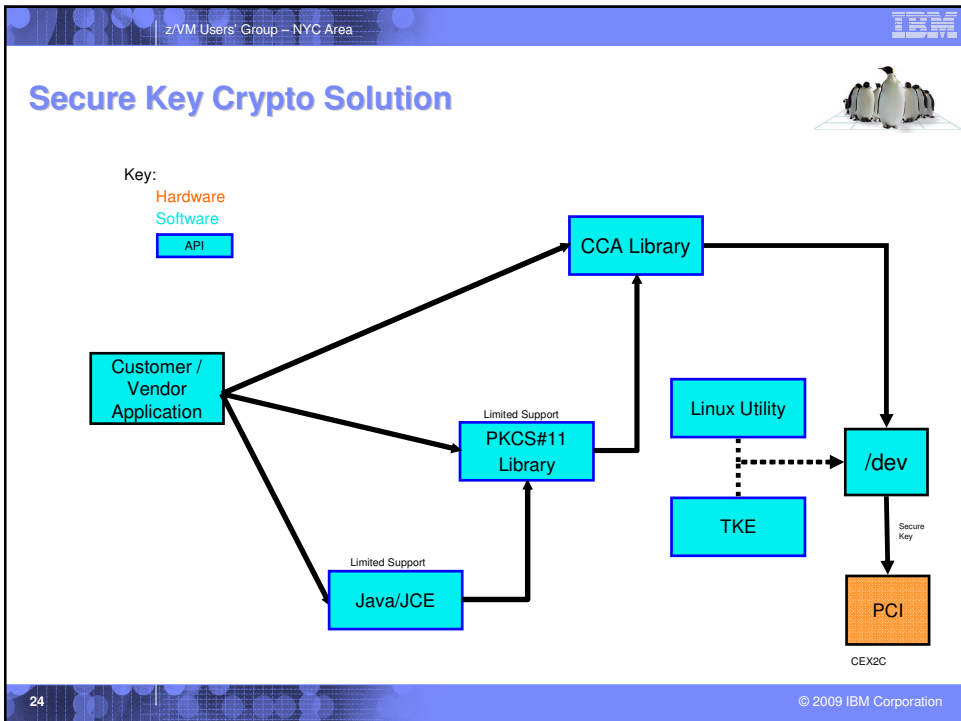
- SLES 10 SP 1

redhat.

Red Hat Enterprise Linux

- RHEL 5.1 – Device Driver
- RHEL 5.2 – PKCS#11 support

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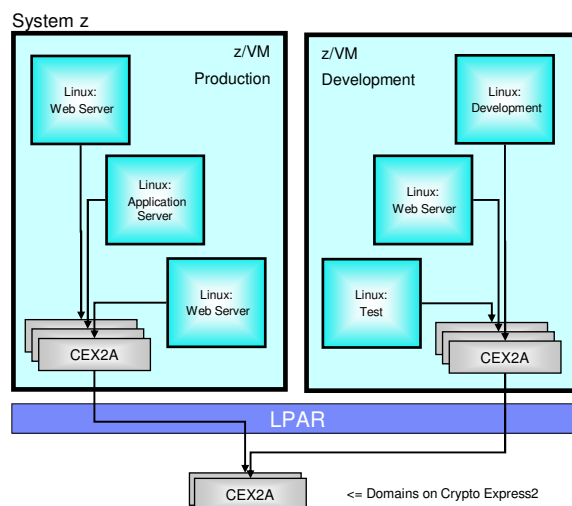


The Role of z/VM Crypto on Linux for System z



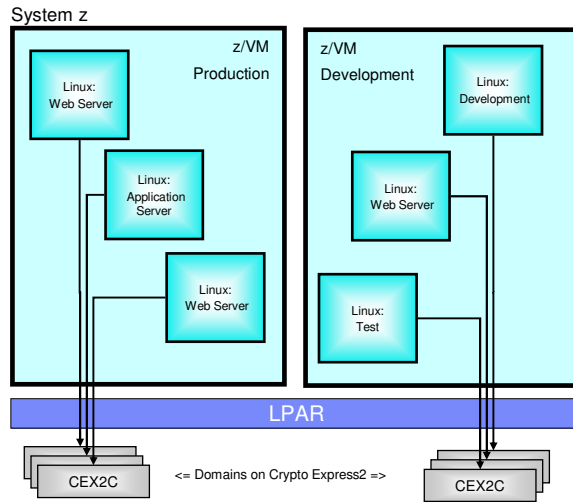
- CPACF
 - ▶ Tracing capability for instructions
- Clear key
 - ▶ Virtualization mode
 - Provides the ability to share crypto card resources
 - One or more z/VM Guests can access virtual crypto queues that can be linked to one or more hardware domains in the PCI Crypto card
 - Requires the **APVIRTUAL** parameter for the **CRYPTO** command
- Secure key
 - ▶ Dedicated mode
 - Enforce isolation of crypto card resource
 - One z/VM Guests can be linked directly to one or more hardware domains in the PCI Crypto card
 - Requires the **APDEDICATED** parameter for the **CRYPTO** command

z/VM- Virtualization Mode



- CryptoExpress2 in Accelerator mode
- z/VM Virtual Queue mode

z/VM - Dedicated Mode



- CryptoExpress2 in Coprocessor mode
- z/VM Dedicated Queue mode

Platform Synergy



Synergy Outlook

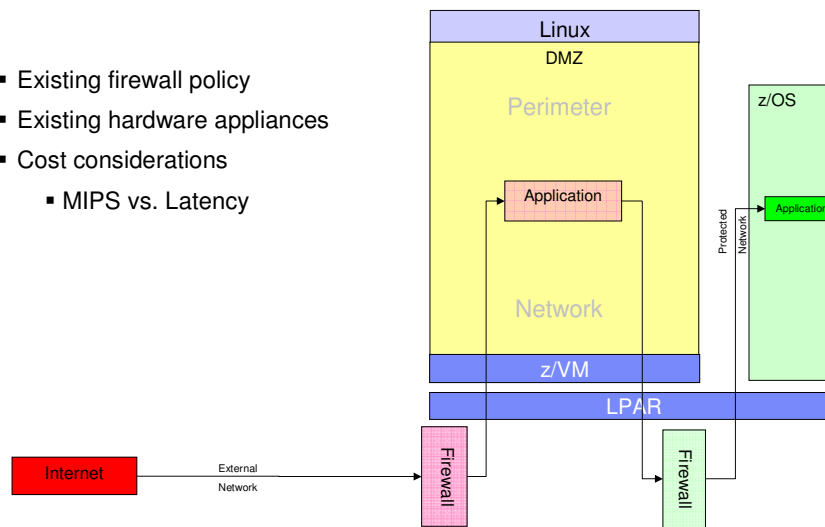


- Network Security
- Centralization with z/OS and z/VM
 - ▶ Authentication
 - ▶ Audit
- Other z/VM Highlights

External Firewalls



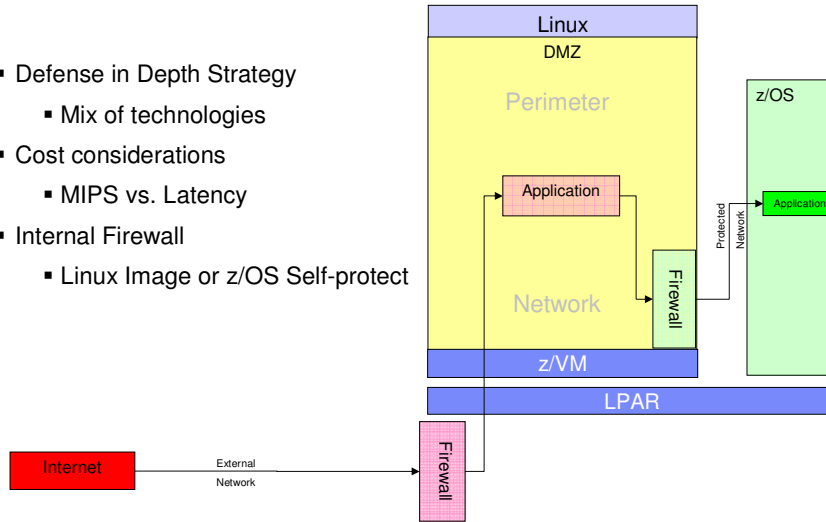
- Existing firewall policy
- Existing hardware appliances
- Cost considerations
 - MIPS vs. Latency



Mix of Firewalls



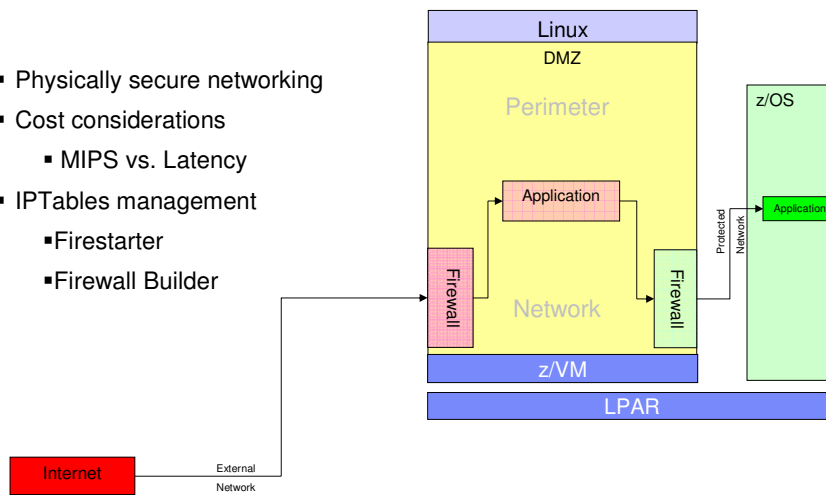
- Defense in Depth Strategy
 - Mix of technologies
- Cost considerations
 - MIPS vs. Latency
- Internal Firewall
 - Linux Image or z/OS Self-protect



Internal Firewalls



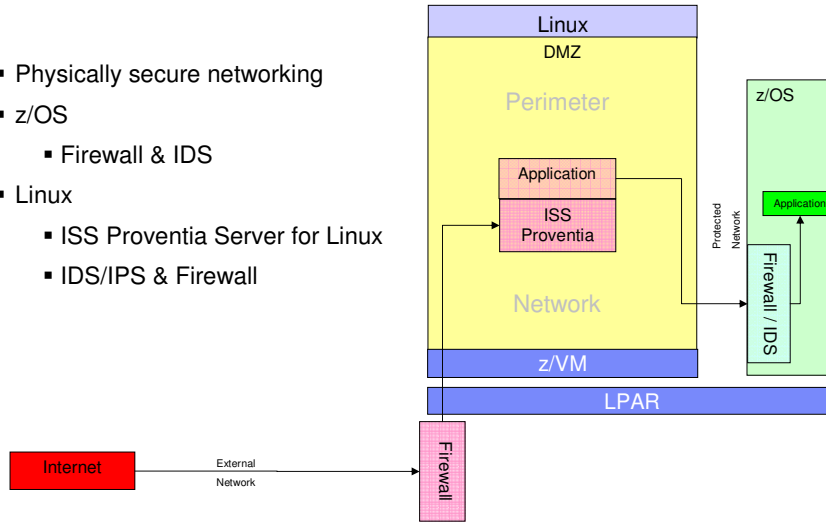
- Physically secure networking
- Cost considerations
 - MIPS vs. Latency
- IPTables management
 - Firestarter
 - Firewall Builder



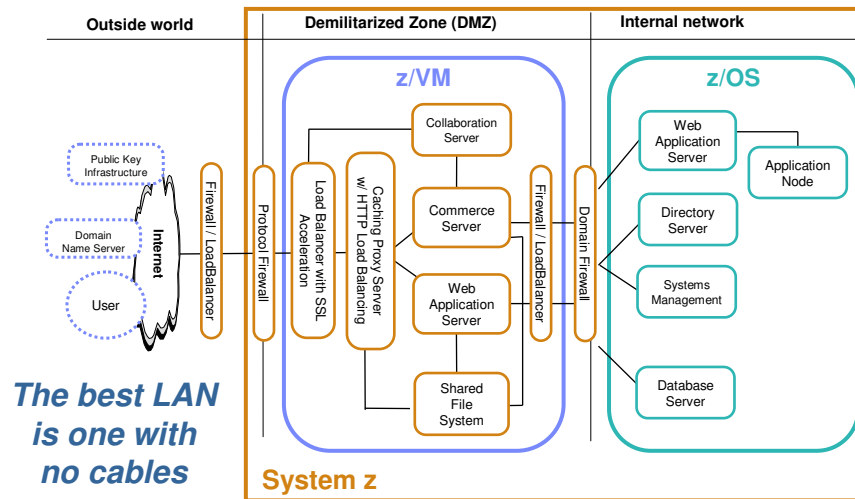
Host Firewalls



- Physically secure networking
- z/OS
 - Firewall & IDS
- Linux
 - ISS Proventia Server for Linux
 - IDS/IPS & Firewall



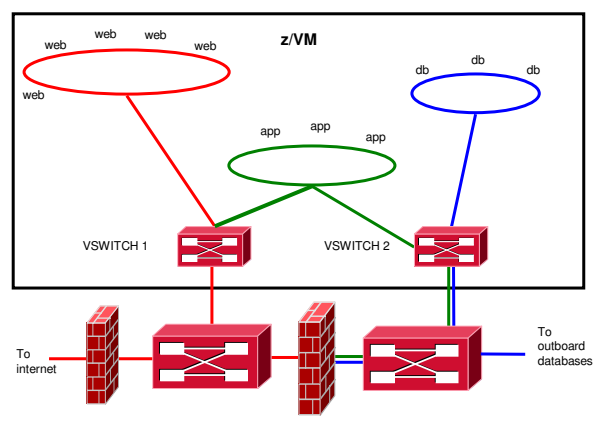
Application serving with Linux on System z



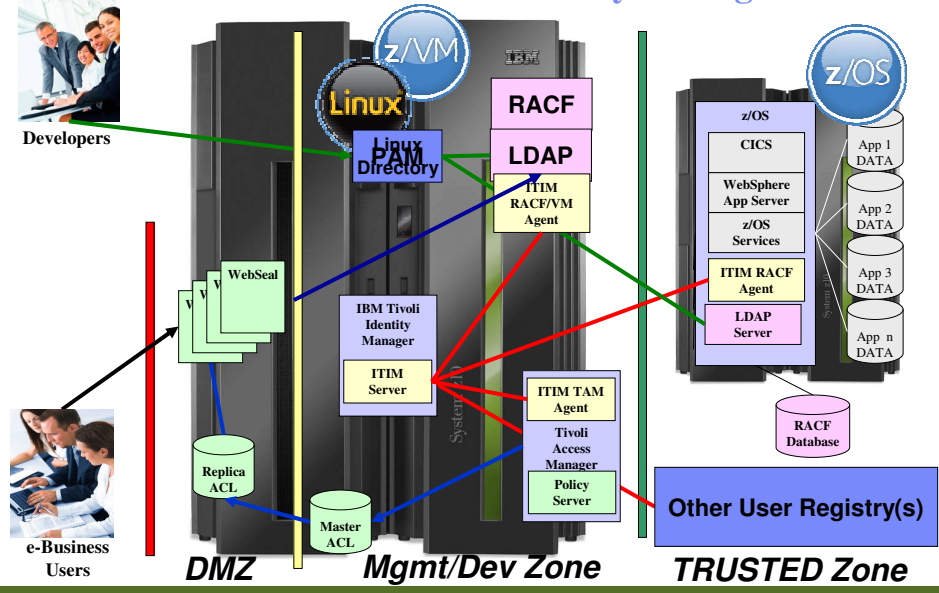
Virtual Network Management Multiple Security Zones

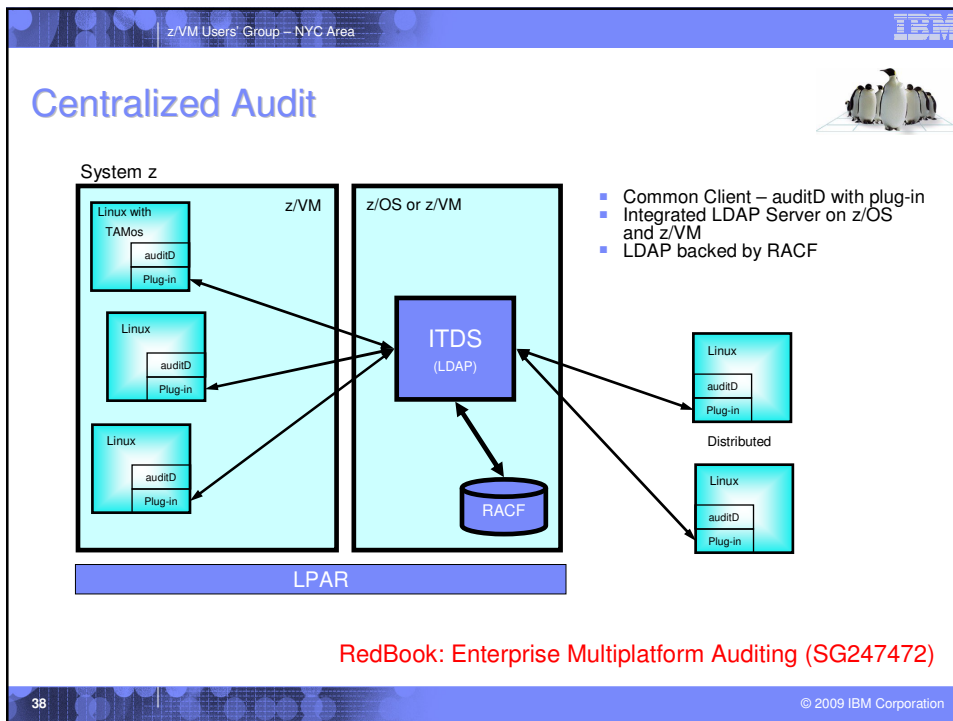
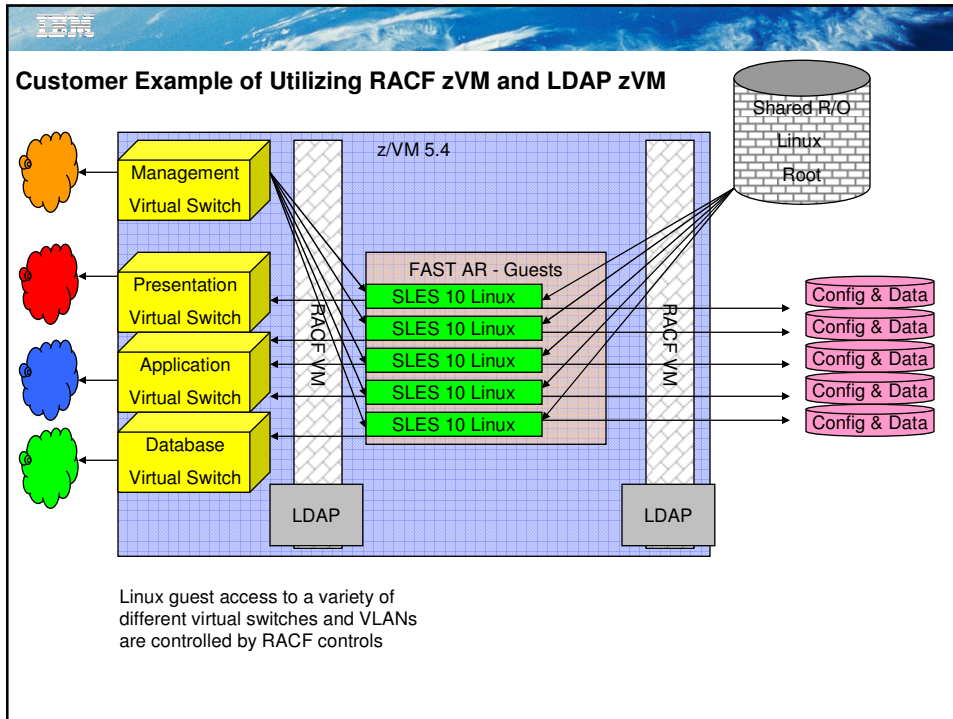
Use z/VM RACF Security Server to control and audit Linux and other virtual server access to networks.

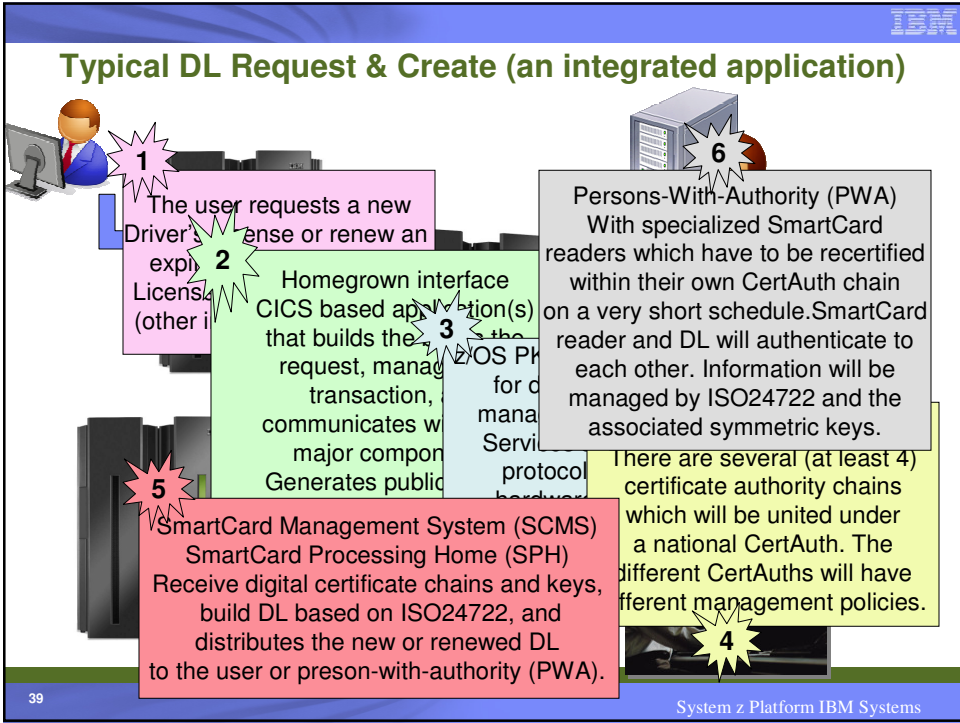
- Control access to Virtual Switch (VSWITCH)
- Control access to specific VLANs on a VSWITCH
- Control and audit guest sniffing of virtual networks
- Better control of multi-tenant environments



Architecture overview for Identity Management







Solution Edition for Security: Highlights

- 5 security solutions that contain hardware, software, and services
 - Each includes a recommended comprehensive list of non-integrated Security products
 - You choose what you need!
 - Each is available on one of the following: z10 EC, z10 BC, z9 EC, z9 BC, or an LPAR on an existing z9® or z10 System z® processor
 - Each includes 400 hours of services for implementation / configuration
 - Each sold at highly discounted prices!

▪ Enterprise Fraud Analysis

- Record and playback insider actions, forensic analysis to discover relationships, real-time prevention workflow applied to operations

▪ Enterprise Encryption and Key Management

- Protecting personally identifiable data; enterprise encryption: Discover, audit and monitor and serve encryption keys

▪ Centralized Identity & Access Management

- Cross platform user provisioning and management; cross platform authentication services

▪ Securing Virtualization: z/VM®, Linux® on System z®

- Easily secure new virtualized workloads; security lifecycle management of server images running in Linux for System z, improved readiness for private cloud

▪ Compliance / Risk Mitigation / Secure Infrastructure: z/OS®

- Audit and Alert processing, Simplified management operations, Data anonymization for development and test

Enterprise Fraud Analysis Solution

- Customer Challenges
 - › Internal and external fraud cost billions of dollars in losses
 - › Reduction in brand equity and substantial financial losses
 - › Executives face personal fines, penalties and legal repercussions
- Solution Capabilities
 - › Provides automated policy enforcement, centralized reporting and analysis, centralized auditing controls, risk mitigation
 - Record and playback insider actions
 - Forensic analysis tools, real time prevention workflow
 - Discover relationships via analytics
- Solution Components
 - IBM Tivoli zSecure Manager for RACF z/VM
 - RACF® Security Server feature for z/VM
 - z/VM® V5
 - z/VM V5 DirMaint™ Feature
 - ISPF V3.2 for VM
 - Entity Analytic Solutions (EAS) V4.2
 - Option: Intellinx zWatch



Enterprise Encryption and Key Management Solution

Customer Challenges

- Encryption can be complex to implement and manage
- Without encrypted data, companies face great exposure risks
- Many PKI solutions from third parties can be costly

Solution Capabilities

- Provides encryption capabilities
- Uses auditable granular access controls
- Provides auditing and monitoring of encryption keys
- Protects integrity and confidentiality of data and transactions
- Low cost digital certificates and PKI infrastructure

Solution Components

- z/OS® V1.10 includes: z/OS Security Server RACF, DFSMS, DFSORT, RMF, SDSF
- DB2® for z/OS V9
- Optim™ Data Privacy Solution
- Encryption Facility for z/OS V1.2
- Data Encryption for IMS and DB2 Databases V1.1
- Crypto Express2 Features
- TKE Workstation
- OSA Cards
- Tivoli® Key Lifecycle Manager (TKLM)
- IBM System Services Runtime Environment for z/OS V1.1



Optional:

- 1) IBM Distributed Key Management System (DKMS)
- 2) Venafi Encryption Director Provisioning Edition

Centralized Identity and Access Management

Customer Challenges

- > Increased complexity of security administration and monitoring
- > More security exposures and an expanding list of identities and access controls increases complexity
- > Business portals increase need to better manage and monitor identities
- > Cost of management and administration is too high

Solution Capabilities

- > Provides reduced infrastructure, simplified security management
- > More efficient centralized identity lifecycle and access management
- > Centralized auditing controls, and improved ability to meet compliance needs
- > Cross platform user provisioning and authentication

Solution Components

z/OS version includes:

- z/OS Security Server RACF, DFSMS, DFSORT, RMF, SDSF
- DB2 for z/OS V9
- WebSphere for z/OS V7
- IBM Tivoli Security Management for z/OS
- Tivoli Federated Identity Manager
- Tivoli Identity Manager

Linux version includes:

- IBM Tivoli zSecure Manager for RACF z/VM
- RACF Security Server Feature for z/VM
- z/VM v5
- z/VM v5 Dirmaint Feature
- ISPF V3.2 for z/VM
- IBM Tivoli Identity and Access Assurance V1.0



Securing Virtualization: z/VM®, Linux® on System z®

Customer Challenges

- Secured virtualized environment needed both for traditional and virtualized environments
- Virtualization offers compelling TCO but needs to be secure as well
- Customers are considering secured private cloud environments
- Cost effective security management is needed to avoid air gapped solutions

Solution Capabilities

- Proven secured virtualization for decades, common criteria ratings
- Centralized Auditing and Reporting
- Workload isolation, common criteria, architecture design
- Easily to secure new workloads

Solution Components

- IBM Tivoli Secure Manager for RACF z/VM
- RACF Security Server Feature for z/VM
- zVM v5
- zVM v5 Dirmaint Feature
- ISPF V3.2 for VM
- IBM Tivoli Identity and Access Assurance V1.0



Compliance / Risk Mitigation / Secure Infrastructure: z/OS

Customer Challenges

- > Security breaches, identity theft are growing
- > Companies face large financial losses
- > PCI and HIPAA compliance are required by law
- > Many environments are plagued by viruses and a continued cycle of patches

Solution Capabilities

- > Security certifications (z/OS EAL 4+, LPAR EAL 5, FIPS 140-2 Level 4), System z/OS integrity statement
- > Centralized security controls, auditing and administration
- > Anonymous data for development and test

Solution Components

- > z/OS V1.10 including: z/OS Security Server RACF, DFSMS, DFSORT, RMF, SDSF
 - > DB2 for z/OS V9
 - > WebSphere for z/OS V7
 - > Optim Data Privacy Solution
 - > Encryption Facility for z/OS V1.2
 - > Data Encryption for IMS and DB2 Databases V1.1
 - > CryptoExpress2 Features
 - > TKE Workstation
 - > OSA Cards
 - > IBM Tivoli Security Management for z/OS
 - > DB2 and IMS Audit Mgt. Expert for z/OS 2.1
 - Tivoli® Key Lifecycle Manager (TKLM)
 - IBM System Services Runtime Environment for z/OS V1.1
- Optional:**
- IBM Distributed Key Management System (DKMS)
 - Venafi Encryption Director Provisioning Edition



What System z brings to Linux

- **The most reliable hardware platform available**
 - Redundant processors and memory
 - Remote Support Facility (RSF)
 - Built-in encryption hardware
- **Centralized Linux systems are easier to manage**
- **Designed to support mixed work loads**
 - Allows consolidation while maintaining one server per application
 - Complete work load isolation
 - High speed inter-server connectivity
- **Availability**
- **Scalability**
 - System z10 EC scales to 64 application processors
 - System z9 EC scales to 54 application processors
 - System z9 BC scales to 7 application processors
 - Dedicated I/O processors
 - Hundreds of Linux virtual servers

z(END)

- Questions?
- Comments!
- Suggestions?





z/VM Users' Group - NYC Area

Secure Key Crypto - Information & Download

- **Crypto Cards – select “PCI-X Cryptographic Coprocessor”**
 - ▶ ibm.com/security/cryptocards/
 - ▶ **Hardware Overview**
 - ibm.com/security/cryptocards/pcixcc/overview.shtml
 - ▶ **Hardware Summary**
 - ibm.com/security/cryptocards/pcixcc/overproduct.shtml
 - ▶ **CCA Overview**
 - ibm.com/security/cryptocards/pcixcc/overcca.shtml
 - ▶ **Programmer's Guide**
 - ibm.com/security/cryptocards/pcixcc/library.shtml
 - ▶ **CCA Library Download**
 - ibm.com/security/cryptocards/pcixcc/ordersoftware.shtml
 - ▶ **Hardware Order Information**
 - ibm.com/security/cryptocards/pcixcc/order.shtml
 - ▶ **Crypto Support**
 - ibm.com/security/cryptocards/pcixcc/support.shtml

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Java Crypto Resources



- **Java Security Page:**
 - ▶ ibm.com/developerworks/java/jdk/security
- **How to use the IBM Java Hardware Crypto Providers:**
 - ▶ ibm.com/developerworks/java/jdk/security/142/HardwareCryptoHow-to.html
- **The IBMPKCS11Impl Provider Guide:**
 - ▶ ibm.com/developerworks/java/jdk/security/50/secguides/pkcs11implDocs/IBMJavaPKCS11ImplementationProvider.html
- **IBM Java PKCS#11 Supported Devices**
 - ▶ ibm.com/developerworks/java/jdk/security/50/secguides/pkcs11implDocs/IBMPKCS11SupportList.html

Linux for System z General Information



Linux for System z	ibm.com/zseries/linux/
z/VM and Linux on System z Resources	ibm.com/zseries/vm/linux/
Linux for System z Redbooks	publib-b.boulder. ibm.com/cgi-bin/searchsite.cgi?query=Linux+AND+zSeries

Linux for System z Security Resources



- Linux on zSeries Security ^(White paper)
 - ▶ GM13-0488, ibm.com/zseries/library/techpapers/pdf/gm130488.pdf
- Linux on zSeries Security ^(Presentation)
 - ▶ ftp://ftp.software.ibm.com/systems/z/linux/pdf/linux_on_z_security.pdf
- Linux Security: Exploring Open Source Security for a Linux Server Environment ^(White paper)
 - ▶ GM13-0636, <ftp://ftp.software.ibm.com/eserver/zseries/misc/literature/pdf/whitepapers/gm130636.pdf>
- z/VM Security and Integrity ^(White paper)
 - ▶ GM13-0145, ibm.com/zseries/library/techpapers/pdf/gm130145.pdf
- Linux on IBM eServer zSeries and S/390: Best Security Practices ^(Redbook)
 - ▶ SG24-7023, publib-b.boulder.ibm.com/abstracts/sg247023.html?Open
- Security Web pages for Linux on System z
 - ▶ ibm.com/systems/z/os/linux/security/

General Security Sites



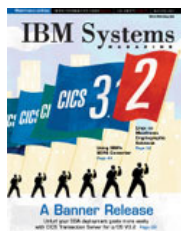
- **General Security**
 - ▶ www.linuxsecurity.com
 - ▶ www.securityportal.com
 - ▶ www.ibm.com/developerworks
- **Security Vendors**
 - ▶ www.trendmicro.com
 - ▶ www.stonesoft.com
 - ▶ www.websecurity.com
 - ▶ ca.com/solutions/linux
- **Secure Distribution Info**
 - ▶ novell.com/linux/security
 - ▶ redhat.com/security
 - ▶ nsa.gov/selinux
 - ▶ www.rsbac.org
- **Security Related Tools**
 - ▶ www.apache-ssl.org
 - ▶ www.bastille-linux.org
 - ▶ www.openssl.org
 - ▶ www.tripwire.org
 - ▶ www.tripwiresecurity.com
 - ▶ linux-firewall-tools.com/linux

Common Criteria Sources



Novell SUSE	
SLES 9	http://www.commoncriteriaportal.org/public/files/epfiles/0256a.pdf
SLES 10	http://www.niap-cc-evs.org/cc-scheme/st/?vid=10271 http://www.commoncriteriaportal.org/public/files/epfiles/st_vid10271-vr.pdf
RedHat	
RHEL 4	http://www.niap-cc-evs.org/cc-scheme/st/?vid=10072
RHEL 5	http://www.niap-cc-evs.org/cc-scheme/st/?vid=10125 http://www.commoncriteriaportal.org/public/files/epfiles/st_vid10125-vr.pdf
z/VM	
z/VM 5.1	http://www.bsi.de/zertifiz/zert/reporte/0258a.pdf (Certification Report) http://www.bsi.de/zertifiz/zert/reporte/0258b.pdf (Security Target)
z/VM 5.3	http://www.bsi.de/zertifiz/zert/reporte/0472a.pdf (Certification Report) http://www.bsi.de/zertifiz/zert/reporte/0472b.pdf (Security Target)

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IBM Systems Magazine: Mainframe edition
May/June 2007

Cutting-Edge Cryptography

<http://www.vm.ibm.com/devpages/spera/ISM0507.pdf>

z / JOURNAL

z/Journal
June/July 2008

Secure Key Cryptography:

Linux Application Building 101

<http://www.vm.ibm.com/devpages/spera/zJJune08.pdf>

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IBM Systems Magazine: Mainframe edition January/February 2007

Living Next Door to the DMZ

<http://www.vm.ibm.com/devpages/spera/ISM0107.pdf>



z/Journal
August/September 2008



*Web Application Firewalls
and the PCI Standard*

<http://www.vm.ibm.com/devpages/spera/zJAugu08.pdf>

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