



Education

# **SNIA Storage Security Best Practices**

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## ➤ SNIA Storage Security Best Practices

With the increasing importance and emphasis on security in mind, the Storage Networking Industry Association (SNIA) had developed and published a set of storage security best current practices (BCPs). This vendor neutral guidance has a broad scope, covering both storage systems and entire storage ecosystems. Specific elements include, but are not limited to, storage management, protocols, compliance, encryption, key management, and long-term archive. This session provides an introduction to the BCPs as well as information that that will help organizations exploit the BCPs in their own environments.

- Organizational IT governance rarely extends to storage ecosystems
- Risk is often not appropriately factored into storage ecosystem decisions
- Storage ecosystems have emerged in isolation with a focus on data availability and resiliency
- Data traceability is challenging and rarely done
- Auditors and security professionals frequently treat storage ecosystems as nothing more than direct-attached storage

# Why Does this Matter?

- Organizations live and die based on the availability and integrity of their data
- Mishandling of sensitive data can result in severe consequences
- Organized crime has discovered that cyber crime is more profitable (and safer) than drug trafficking
- Data is no longer safely tucked away behind servers; it may be readily available

## ➤ Threat categories (% breaches / % records)

- ◆ Hacking **64%** / **94%**
- ◆ Malware **38%** / **90%**
- ◆ Misuse **22%** / **2%**
- ◆ Deceit **12%** / **6%**
- ◆ Physical **9%** / **2%**
- ◆ Error (cause) **1%** / **0%**
- ◆ Environmental **0%** / **0%**

**91%** of all compromised records were linked to organized criminal groups.

## ➤ Who is behind data breaches?

- ◆ **74%** resulted from external sources
- ◆ **20%** were caused by insiders
- ◆ **32%** implicated business partners
- ◆ **39%** involved multiple parties

Errors contributed to or enabled **67%** of all successful attacks.

*Source: 2009 Data Breach Investigations Report*



# What is Storage Security?

- Technical controls, which may include integrity, confidentiality and availability controls, that protect storage resources and data from unauthorized users and uses.  
– SNIA Dictionary
  
- **Convergence** of the storage, networking, and security.
  
- Simply a part of **Information Assurance**
  - ◆ Measures that protect and defend information and systems
  - ◆ Encompasses system reliability and strategic risk management
  - ◆ Provides for restoration of information systems using protection, detection, and reaction capabilities

See Also: SNIA Technical Proposal, *Introduction to Storage Security, v2.0*, © 2009, [http://www.snia.org/forums/ssif/knowledge\\_center/white\\_papers/](http://www.snia.org/forums/ssif/knowledge_center/white_papers/)

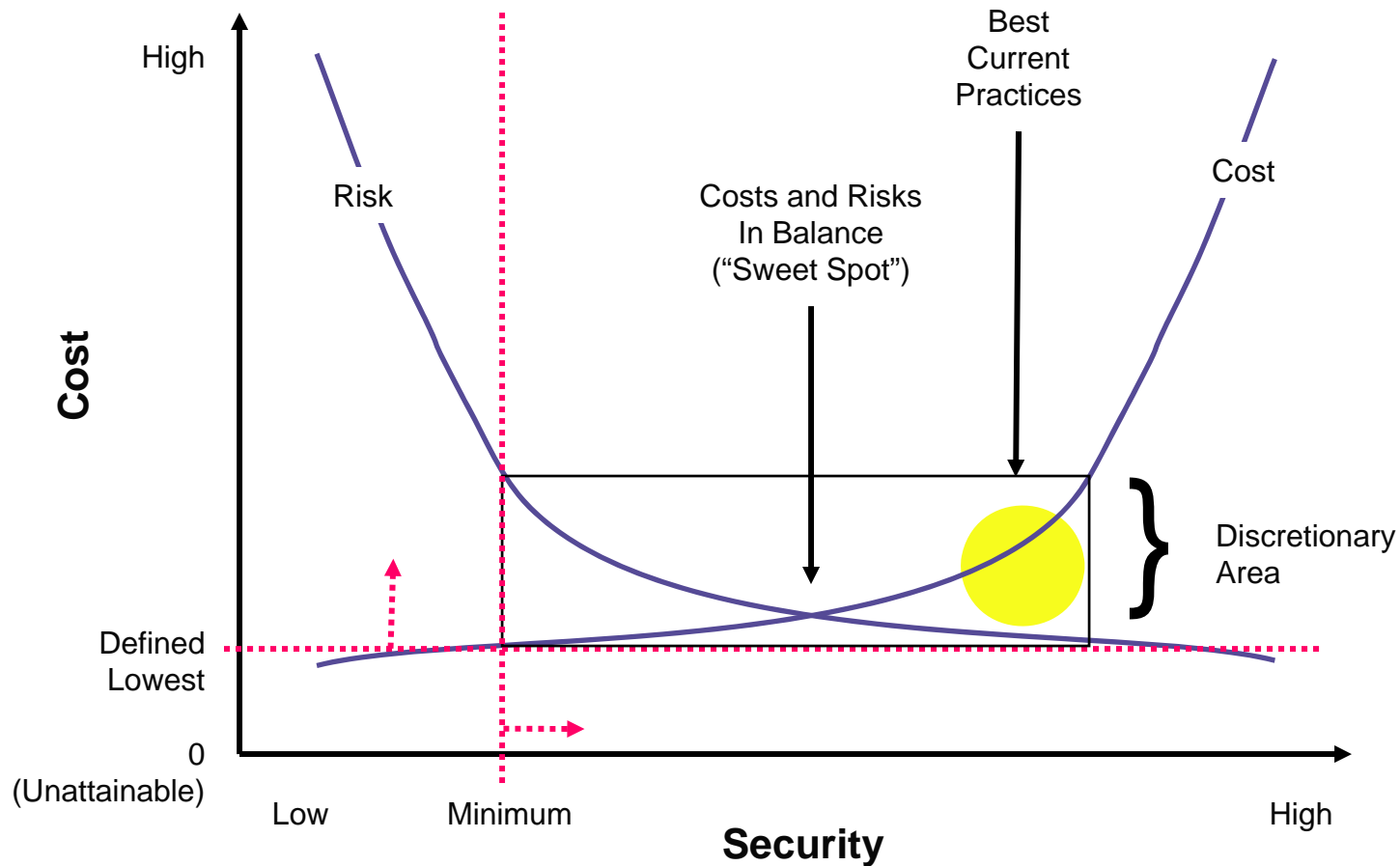


# What are Best Practices?

- Best practice is an idea that asserts that there is a technique, method, process, activity, incentive or reward that is more effective at delivering a particular outcome than any other technique, method, process, etc. - Wikipedia
- For the purpose of the SNIA storage security best practices, they provide broad guidance to organizations seeking to secure their individual storage systems as well as their storage ecosystems.



# Balancing Cost & Security



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Source: Ray Kaplan, CISSP, *A Matter of Trust*, Information Security Management Handbook, 5<sup>th</sup> Edition. Tipton & Krause, editors.

# SNIA Storage Security Best Current Practices (BCPs)

**SOURCE:** Storage Networking Industry Association Technical Proposal, *SNIA Storage Security – Best Current Practices (BCPs) Version 2.1.0*, © 2008 by SNIA, [http://www.snia.org/forums/ssif/programs/best\\_practices/](http://www.snia.org/forums/ssif/programs/best_practices/)

- Developed and maintained by the SNIA
- Vendor neutral guidance
- Written in layman terms – avoids techno babble
- Minimal assumptions
  - ◆ Some familiarity with either storage or security
  - ◆ Basic working knowledge of practices and concepts
- Target audience includes
  - ◆ Technologist – practitioners & IT architects
  - ◆ Management – IT managers & corporate executives

# Introduction to the BCPs

- Cover storage systems & storage ecosystems
- Grouped into two categories:
  - ◆ **Core BCPs**
    - › apply to all storage systems/ecosystems
    - › cover basic storage security elements
  - ◆ **Technology Specific BCPs**
    - › above and beyond the core BCPs
    - › may or may not apply
    - › multiple categories could apply for a given environment

# Using the BCPs

- They are not a checklist
- They do not represent a minimum set of requirements to determine compliance
- Must strike a balance between
  - ◆ Mitigating risks and minimizing the impacts
  - ◆ Cost, complexity, throughput, availability, scalability, etc.
- Each organization must make its own trade-off decisions
  - ◆ Its unique situation (e.g., deployed infrastructure, legal and regulatory requirements, and due care expectations)
  - ◆ Importance of its data

## ➤ Core:

- ◆ General Storage Security (GEN)
- ◆ Storage Systems Security (SSS)
- ◆ Storage Management Security (SMS)

## ➤ Technology Specific:

- ◆ Network Attached Storage (NAS)
- ◆ Block-based IP Storage (IPS)
- ◆ Fibre Channel Storage (FCS)
- ◆ Encryption for Storage (ENC)
- ◆ Key Management for Storage (KMS)
- ◆ Long-term Information Security (ARC)

- GEN01 – Identify & Assess All Storage Interfaces
- GEN02 – Create Risk Domains
- GEN03 – Monitor & Control Physical Access
- GEN04 – Avoid Failures Due to Common Mistakes
- GEN05 – Address Data Security Compliance
- GEN06 – Implement Appropriate Service Continuity
- GEN07 – Align Storage and Policy

- Identify technology & data assets; do a basic classification
- Make sure storage participates in and complies with policy
- Use risk domains to limit access and damage (for example, management, data access, data protection)
- Make sure storage participates in the survivability measures
- Never underestimate the damage from incompetence or foolishness

# Focus Areas: Core - GEN

- Limit physical access, which can be hazardous to data
- Ensure that virtualization doesn't create undesired risks to data
- Pay attention to compliance, privacy & legal requirements
  - ◆ Significant drivers for security programs
  - ◆ Accountability, traceability, risk management, retention & sanitization

# Storage Systems Security (SSS)

- SSS01 – Understand the exposures
- SSS02 – Utilize Event Logging
- SSS03 – Secure Backups and Replication
- SSS04 – Use Trusted and Reliable Infrastructure

# Focus Areas: Core - SSS

- Understand the security posture of your storage systems/ecosystems and adjust appropriately
- Ensure storage participates in the centralized audit logging and meets the evidentiary requirements
- Ensure that backups and replication don't become a source of unauthorized data access or disclosure
- Avoid attacks and failures because of inappropriate infrastructure dependencies

# Storage Management Security (SMS) Education SNIA

- SMS01 – Secure the Management Interfaces
- SMS02 – Harden Management Applications
- SMS03 – Tightly Control Access and Privileges
- SMS04 – Restrict Remote Support
- SMS05 – Include Configuration Management

- Protect the management interfaces from unauthorized access and reconnaissance
- Control and monitor your vendor access to storage systems
- Implement least privilege controls and separation of duties for privileged users
- Ensure that remote support is performed securely and in compliance with policy
- Employ change controls and configuration management practices

## ➤ Core:

- ◆ General Storage Security (GEN)
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- ◆ Storage Management Security (SMS)

## ➤ Technology Specific:

- ◆ Network Attached Storage (NAS)
- ◆ Block-based IP Storage (IPS)
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## ➤ NAS01 – Network File System (NFS)

- ◆ NAS01.A Control NFS Network Access and Protocols
- ◆ NAS01.B Apply Access Controls to NFS Exported Filesystems
- ◆ NAS01.C Restrict NFS Client Behaviors
- ◆ NAS01.D Secure Data on NFS Filer

## ➤ NAS02 – SMB/CIFS

- ◆ NAS02.A Control SMB/CIFS Network Access and Protocols
- ◆ NAS02.B Apply Access Controls to SMB/CIFS Exported Filesystems
- ◆ NAS02.C Restrict SMB/CIFS Client Behaviors
- ◆ NAS02.D Secure Data on SMB/CIFS Filer

- Limit access to the network interfaces
- Secure the file access protocols (NFS, SMB, CIFS, HTTP, NCP)
- Employ user-level authentication whenever possible
- Avoid granting “root” or “administrator” unrestricted access to files on NAS or file server
- Only enable multi-protocol access to files for those users who actually need this functionality

# Block-based IP Storage (IPS)

## ➤ IPS01 – Secure iSCSI

- ◆ IPS01.A Control iSCSI Network Access and Protocols
- ◆ IPS02.B Implement iSCSI Security Measures

## ➤ IPS02 – Secure FCIP

- ◆ IPS01.A Control FCIP Network Access and Protocols
- ◆ IPS02.B Implement FCIP Security Measures

# Focus Areas: Tech - IPS

- CHAP authentication is available in all iSCSI implementations (initiators and targets), so use it
- Avoid connecting iSCSI and FCIP interfaces to general purpose LANs; segregate for security and performance
- Remember that VLANs are not the same as physically isolated LANs
- Use IPsec to secure the communication channel when sensitive data could be exposed
- Use discovery services cautiously

- **FCS01 Secure FCP**
  - ◆ FCS01.A Control FCP Node Access
  - ◆ FCS01.B Implement FCP Security Measures
- **FCS02 Secure Fibre Channel Storage Networks**
  - ◆ FCS02.A Implement Switch-based Controls
  - ◆ FCS02.B Interconnect Storage Networks Securely

- Limit access to storage, using WWN-based access controls (LUN masking and zoning)
- Leverage ANSI 426–2007 FC-SP features (like authentication and in-flight encryption) for trusted in-band management and trusted storage networks
- Restrict switch interconnections (e.g., ACLs, binding lists, FC-SP policy)
- Configure switches, extenders, routers, and gateways with the least amount of access

# Encryption for Storage (ENC)

## ➤ ENC01 – Protect Externalized Data

- ◆ ENC01.A Secure Sensitive Data on Removable Media
- ◆ ENC01.B Secure Sensitive Data Transferred Between Data Centers
- ◆ ENC01.C Secure Sensitive Data in 3<sup>rd</sup>-party Data Centers

## ➤ ENC02 – Pedigree of Encryption

- ◆ ENC02.A Encryption Algorithms
- ◆ ENC02.B Symmetric Encryption Modes
- ◆ ENC02.C Strength of Encryption



**Check out SNIA Tutorial:  
*ABCs of Encryption***

- **ENC03 – Risk Assessment in Use of Encryption**
  - ◆ ENC03.A Identify and Classify Sensitive Data
  - ◆ ENC03.B Analyze Risks and Protection Options
  - ◆ ENC03.C Mitigate Risks with Encryption
- **ENC04 – Encryption Issues**
  - ◆ ENC04.A Point of Encryption
  - ◆ ENC04.B Align with Data Reduction Services
  - ◆ ENC04.C Proof of Encryption

See Also: SNIA Technical Proposal, *Data At-rest Encryption: A Step-by-step Checklist, v2.0*, © 2009, [http://www.snia.org/forums/ssif/knowledge\\_center/white\\_papers/](http://www.snia.org/forums/ssif/knowledge_center/white_papers/)



**Check out SNIA Tutorial:  
Self Encrypting Drives**

- SNIA position on encryption (for sensitive/regulated data):
  - ◆ Off-site backup tapes and other removable media must be encrypted when leaving the organization's control
  - ◆ Data transmitted to/between trusted, but remote datacenters must be encrypted in-flight
  - ◆ Data transmitted and stored in third-party datacenters must be protected both in-flight and at-rest, using encryption
  - ◆ For primary data, treat encryption as a measure of last resort
- Ensure the pedigree of the encryption is up to the job
- Ensure that encryption is driven by appropriate risk analysis and business needs
- Avoid huge challenges by identifying the appropriate point of encryption, aligning the encryption with data reduction mechanisms, and creating appropriate audit trails

# Key Management (KMS)

- **KMS01 – Key Management Principles**
  - ◆ KMS01.A Observe Important Properties of Keys
  - ◆ KMS01.B Implement and Use Key Management Safely
- **KMS02 – Key Management Functions**
  - ◆ KMS02.A Establish Keys Securely
  - ◆ KMS02.B Ensure Proper Operational Use
  - ◆ KMS02.C Key Disposition
- **KMS03 – Key Management Issues**
  - ◆ KMS03.A Comply with Import/Export Controls
  - ◆ KMS03.B Plan for Problems



**Check out SNIA Tutorial:**  
*Introduction to Key Management  
for Secure Storage*

# Focus Areas: Tech – KMS

- Recognize that key management is the more difficult aspect of cryptograph and standards continue to lag
- Adhere to basic principles associated with keying material as well as implementing key management
- Understand and obey government **import** and **export** regulations associated with encryption and key management
- Consider escrowing keying material used to protect business/mission critical information

## ➤ ARC01 – On-line Fixed Content

- ◆ ARC01.A Secure the On-line Fixed Content
- ◆ ARC01.B Provide Governance and Compliance Functionality

## ➤ ARC02 – Off-line Fixed Content

- ◆ ARC02.A Establish Off-line Fixed Content Policy
- ◆ ARC02.B Maintain Off-line Fixed Content Security

- Establish and enforce data retention requirements, including Legal Hold requirements (e.g., e-Discovery)
- Preserve the evidentiary nature of the data through the careful use of authenticity, integrity, and chain of custody mechanisms
- Identify the types of data to be accepted as well as the preservation period
- Ensure that the cryptographic assurances of confidentiality and authenticity are maintained

# Final Thoughts

- Due to the increased activities of **organized crime** groups and government entities, external threats are a more likely source of data breaches
- A significant number of breach could have been avoided if **simple or intermediate security controls** had been in place at the time of the incident.
- Protect critical/sensitive/regulated data when it leaves your control
- Manage the risks **or** mitigate with the consequences
- Have a plan to deal with data security incidents

- Security is basically a people problem... computers don't just wake up and start attacking their neighbors on their own...at least not yet!
- The attackers are adapting to our current protection strategies and inventing new ways to attain the data they value.
- It is not a matter of **IF** you will be attacked, but rather **WHEN** and if you will **KNOW** that you have been attacked.

- Please send any questions or comments on this presentation to SNIA: [tracksecurity@snia.org](mailto:tracksecurity@snia.org)

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**SNIA Security TWG**

# For More Information

## ➤ SNIA Security Technical Work Group (TWG)

- ◆ **Focus:** Requirements, architectures, interfaces, practices, technology, educational materials, and terminology for storage networking.
- ◆ [http://www.snia.org/tech\\_activities/workgroups/security/](http://www.snia.org/tech_activities/workgroups/security/)

## ➤ Storage Security Industry Forum (SSIF)

- ◆ **Focus:** Marketing collateral, educational materials, customer needs, whitepapers, and best practices for storage security.
- ◆ <http://www.snia.org/ssif>