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2025 ASIA-PACIFIC COMMUNITY MEETING

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Beyond Encryption:

Key Management as a Strategic Enabler

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SVP - Compliance and Testing

SISA

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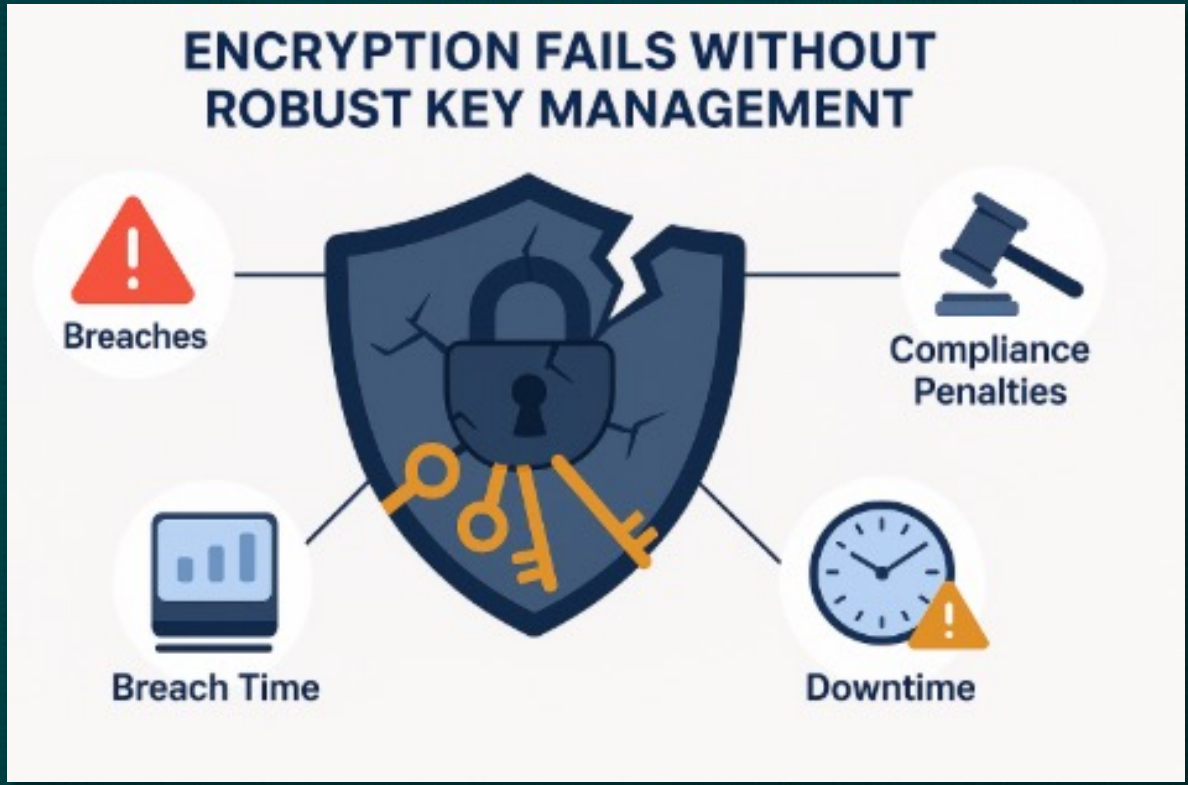
Agenda

- Setting the Stage: The Alarming Truth About Key Management
- Real-World Impact: Lessons from High-Profile Breaches
- Key life-cycle management
- Strategic Framework
- Beyond Compliance: Building a Secure & Agile Organization
- Modern Toolkit: Key Management Technologies
- Aligning Security with Business Objectives
- Future Trends
- Strategic Takeaways

The Alarming Truth About Key Management

SECURITY SPEND IS SOARING; BUT BREACHES ARE RISING EVEN FASTER

While organizations invest heavily in encryption to protect sensitive data, the effectiveness of encryption fundamentally depends on how well cryptographic keys are managed.



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Lessons Learned from Breaches

Rise of Data Breaches:

- **Retail Chain Data Breach (July 2025)** – Encrypt sensitive customer and employee data at rest, and isolate keys from the data they protect.
- **Luxury Brand Breach (July 2025)** – A reported cyberattack targeted internal systems, potentially exposing employee and customer data. Without proper segregation of encryption keys and access layers, attackers can pivot internally after initial access.
- **Ride-Sharing Platform Breach (2022)** – Avoid hard-coding credentials or secrets; instead, securely store keys in vaults and ensure their management, rotation, and auditing.

Lessons Learned from Breaches

Rise of Data Breaches:

- **Open-Source Library Vulnerability (2021)** – Zero-trust access to key management systems is essential. Just patching vulnerabilities isn’t enough; protect backend systems (like KMS) with strict network and identity controls to prevent lateral movement.
- **Supply Chain Attack (2020)** – Keys should not be accessible to compromised systems by default. Implement role-based access controls (RBAC), enforce key usage logging, and monitor for anomalous decryption requests.

Key Lifecycle Management

Key Generation

- Use strong entropy such as Secure RNG (FIPS Certified)
- -Key size: AES-256, RSA-4096
- Generate Keys Inside Secure Boundaries

Distribution and Access Controls

- Secure channels (TLS 1.2+)
- RBAC: Custodians, Users, Auditors
- IAM integration

Secure Storage

- PCI DSS Req 3
- HSMs: FIPS 140-2/3 compliant
- Cloud Key Vault

Key Rotation and Expiry

- Rotation frequency (e.g., annually)
- Rollback & re-encryption planning
- Application support is critical

Key Destruction

- Follow PCI DSS and NIST 800-88
- Use validated-approved tools
- Maintain destruction logs

Governance

- Access Control: Principle of least privilege
- Approval Workflow: No key change should happen without formal review
- Auditability: All actions must be logged and reviewable

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Live Key Rotation: Challenges and Mitigation Strategies

1. Downtime Risks: Rotation may require service restarts or maintenance windows, risking disruption to live systems.
2. Re-encryption Overhead: Bulk re-encryption of data can strain system resources, impacting performance and user experience.
3. Staggered vs. Bulk Rotation: Choosing between gradual (safer) vs. all-at-once (faster) rotation strategies introduces complexity.
4. Backward Compatibility: Systems must handle legacy data encrypted with old keys to ensure seamless access post-rotation.
5. Human Error: Manual processes during rotation can lead to configuration mistakes or key mismatches, increasing security risk.

Strategy Framework

Direct and Action Oriented

By embedding key management into a strategic framework — one that automates governance, enforces rotation, and aligns with compliance mandates — we can turn vulnerability into resilience

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Compliant Org vs Secure & Agile Org

Aspect	Compliant Organizations	Secure & Agile Organizations
Primary Focus	Meeting regulations and audit requirements	Proactive security integrated with business agility
Key Management	Manual or scheduled rotations (basic)	Automated, policy-driven rotations with zero downtime
Encryption Approach	Minimum standards (AES-256, TLS)	Hardware-backed keys (HSMs), zero-knowledge storage
Crypto Agility	Static algorithms; change only when mandated	Designed for quick algorithm/key upgrades
Monitoring	Periodic reviews and compliance checks	Continuous monitoring with anomaly detection
DevOps Integration	Security added post-deployment	Built-in security in CI/CD pipelines (code signing)
Risk Strategy	Reactive – responds to regulations	Proactive – anticipates emerging threats

The Modern Toolkit

Key Management Technologies

Hardware Security Modules (HSMs):

- Examples: CloudHSM, PCI PTS Certified Hardware HSM's
- FIPS 140-2/3 certified for key generation and protection

Cloud-Native KMS Platforms:

- Cloud Key Management Systems
- Integrated IAM, auto-rotation, global key distribution

Third-Party Centralized KM Solutions:

- HashiCorp Vault, Fortanix DSM, CyberArk
- RESTful APIs, multi-tenant support, policy-based key access

Align Cryptographic Operations with Business Objectives

1. Business Continuity - Ensure systems stay available during security processes.
2. Regulatory Compliance – Meet PCI DSS, Hi-Trust, etc
3. Risk Reduction - Minimize data breach and insider threats
4. Performance & Cost Optimization - Avoid high operational overhead while securing data
5. Customer Trust - Preserve brand reputation and ensure secure transactions.

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Future Trends

Staying Ahead of the Curve

- **AI-Powered Anomaly Detection:** Machine learning models are being trained to detect unusual key usage patterns, helping identify potential misuse or compromise in real time.
- **Quantum-Safe Algorithms:** Adoption of post-quantum cryptography
- **Confidential Computing:** Using secure enclaves (e.g., Intel SGX, AMD SEV) to isolate key operations from host OS, ensuring runtime data protection.

Strategic Takeaways

Your Path to Secure Key Management

- Draft a comprehensive Key Management Policy
- Adopt centralized KMS / HSM use
- Implement a Zero Trust security model where keys are accessible only on a need-to-use basis
- Automate key rotation and access logs
- Integrate key management into CI/CD pipelines for automation
- Enforce RBAC and log all access
- Periodic reviews and simulated drills - Use continuous monitoring tools to trigger alerts before key expiry or policy violations.
- Cross-Training and Awareness
- Compliance Dashboards: Visualize key lifecycle, access logs, and compliance status (PCI DSS, ISO 27001) via tools for audit readiness.

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Thank You

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