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Security and security policies

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Learning objectives

- Understand the security risks associated with HPC systems
- Understand the importance of a security policy, and its alignment with ISO-27001
- Get familiar with security best practices
- Determine security issues of a service, and implement some solutions

What makes security for HPC different?

- Scale, performance, Data, Network, users access, and resource sharing
- Importance and objectives of security in HPC
 - ▶ Confidentiality
 - ▶ Integrity
 - ▶ Availability

This distinctive characteristics brings both opportunities and **challenges**.

Hou et al., "Autonomous Security Mechanisms for High-Performance Computing Systems: Review and Analysis"

Challenges

- Scalability
- Data Management
- Application Optimization
- Hardware Complexity

These challenges can also be the source of security threats.

Common HPC security threats

- Cyberattacks: malware, ransomware, phishing, Software bugs or Zero-day vulnerabilities
- Insider threats (e.g. employee misconduct): intentional or accidental data leaks, malicious software installation, or unauthorized access to sensitive data

That can lead to:

- Distributed denial of service (DDoS) attacks
- Data breaches
- Cryptocurrency mining

These threats can be addressed by implementing a good **security policy**.

Bendovschi, "Cyber-attacks—trends, patterns and security countermeasures"

Security policy (1/3)

A security policy describes:

- what has to be secured
e.g: access control, data, resources, etc.
- the ways to secure them
e.g: multifactor authentications, firewalls, encryption, etc.

It can also be aligned with regulations and standards such as NIST Cybersecurity framework, PCI DSS, **ISO-27001**, etc.

Security policy (2/3)

*“**ISO-27001** (or ISO/IEC 27001:2013) is an international standard to manage information security. The standard was originally published jointly by the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) in 2005.”*

The GWDG is certified against ISO 27001.

Security policy (3/3)

Here are three key points of a security policy that aligns with the ISO 27001 standard:

- **Risk Assessment:** should be updated regularly to ensure that new risks are identified and addressed
- **Access Control:** guidance on access control measures, to ensure that only authorized users are granted access to the system
- **Incident Response:** guidance on incident management, including incident reporting, analysis, and response

Security best practices (1/2)

Some best practices can be obtained from the security policy:

■ Password management:

- ▶ Aim for a passphrase
- ▶ Do not reuse it across multiple accounts
- ▶ Use a password manager e.g Pass, KeepassXC, Gopass, etc.

■ 2-Factor Authentication:

- ▶ Phone
- ▶ YubiKey

■ Secure Connections:

- ▶ SSH
- ▶ SSH tunnel
- ▶ Reverse proxy

Security best practices (2/2)

■ **Data Protection:**

- ▶ Do not copy or store data outside the HPC system unless it is necessary and is done securely
- ▶ When working with sensitive data, encrypt data in transit and at rest

■ **Software installations and Updates:**

- ▶ Use internal or external trusted repositories
- ▶ Updates are restricted to authorized admins

■ **Awareness and Compliance**

- ▶ report suspicious activities
- ▶ report phishing emails: [AKTUELLE PHISHING-E-MAILS](#)
- ▶ Participate in security training and awareness programs
- ▶ Follow all established security policies and procedures

Example with GitLab

GitLab is web-based Git repository manager that allows teams to collaborate on code, track issues, and manage software development projects. Some security implications and solutions:

- **Authentication and Authorization:** 2-FA
- **access control:** roles (owner, maintainer, developer, or guest), access tokens (to authenticate external applications or services), visibility (private, internal, and public)
- **Secure Communication:** HTTPS, and SSH communication
- **Secure code review:** branching, review request, review tools
- **Vulnerability management:** SAST, DAST, Security Dashboard, etc.

Exercises

Download the exercise sheet from the course web page, and follow the instructions.

References

Bendovschi, Andreea. “Cyber-attacks—trends, patterns and security countermeasures”. In: *Procedia Economics and Finance* 28 (2015), pp. 24–31.

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