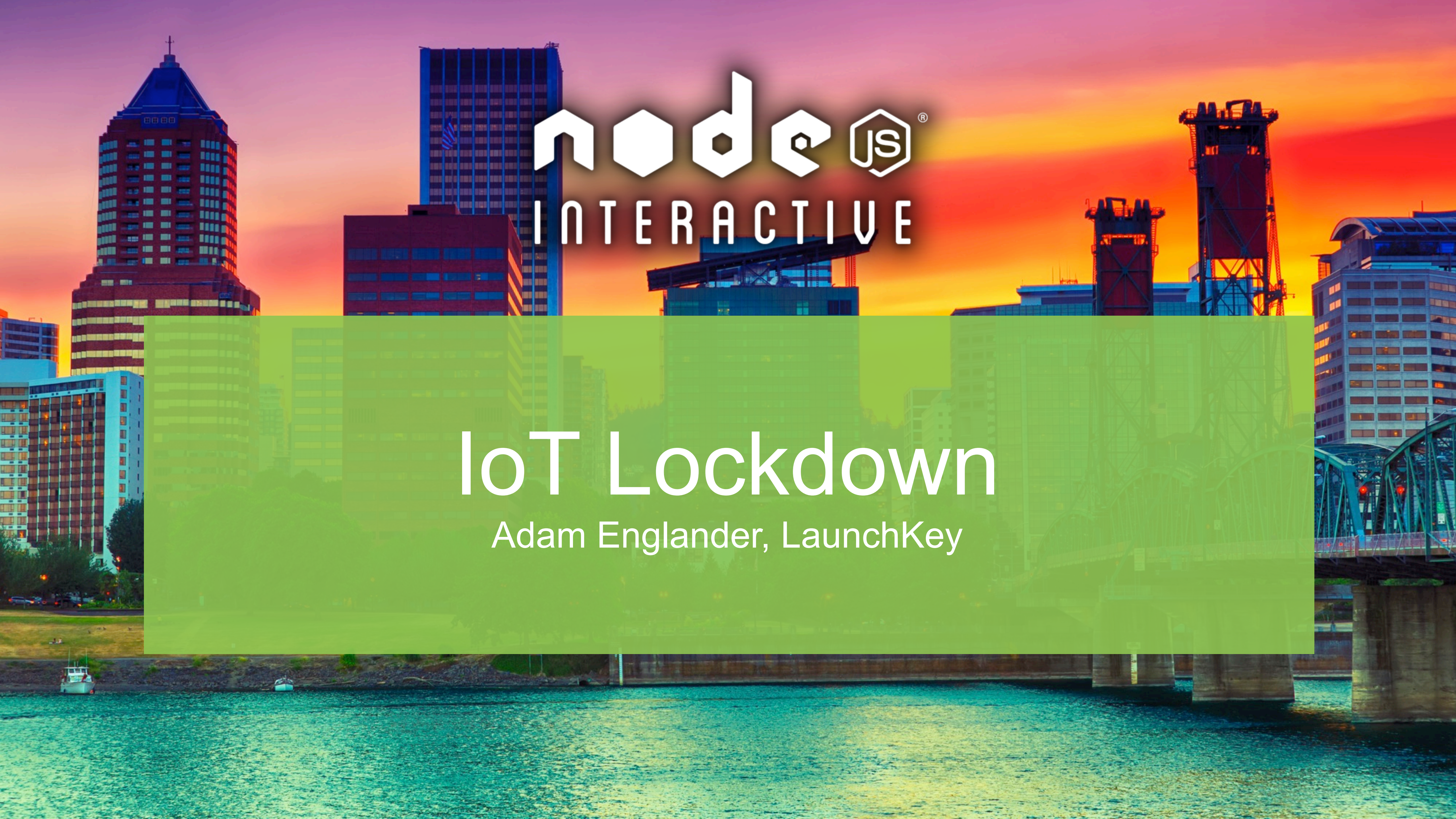
node JS®
INTERACTIVE



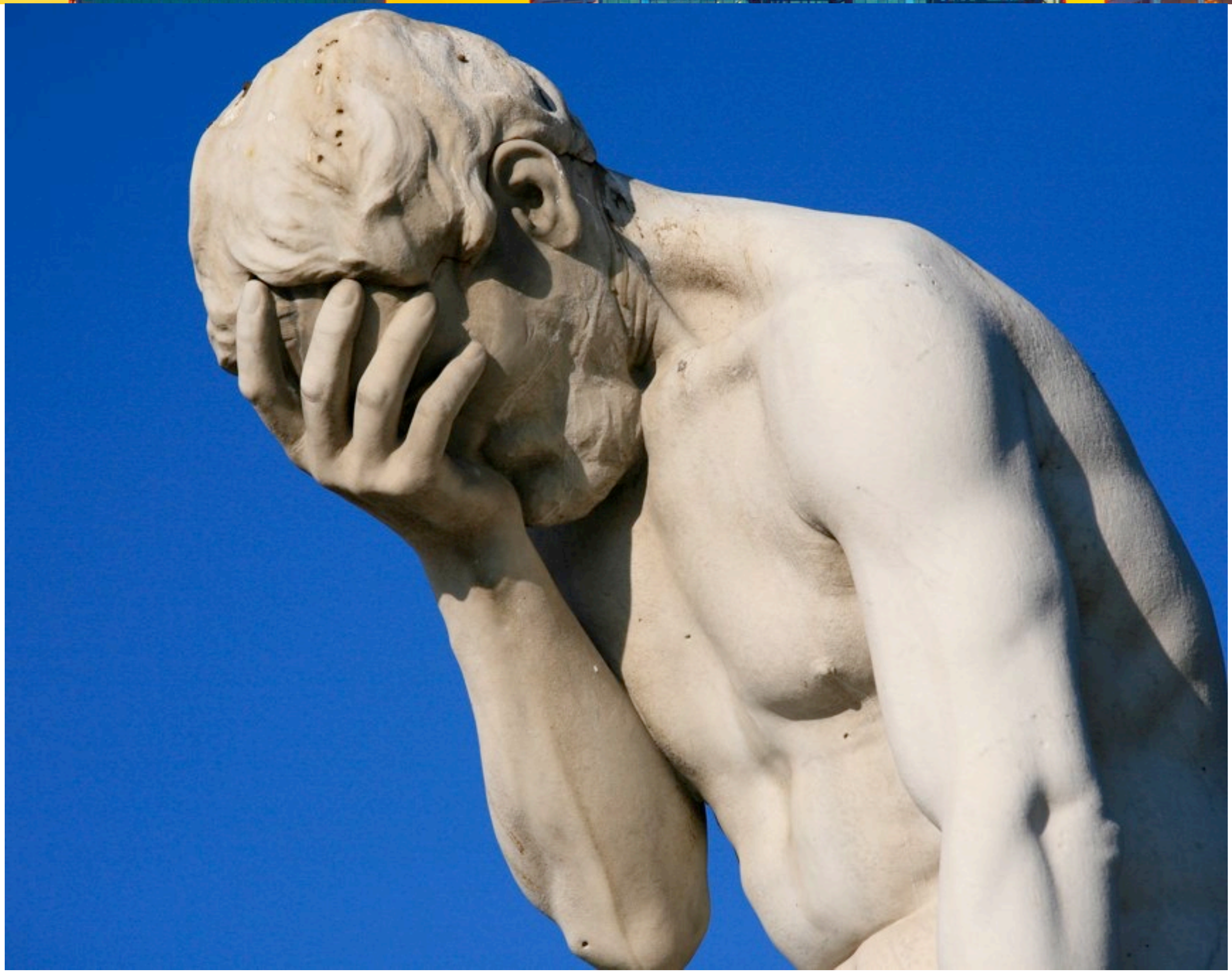
node JS®
INTERACTIVE

IoT Lockdown

Adam Englander, LaunchKey

Know This

- You will be attacked
- You will be exposed to a Zero Day vulnerability



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Security is like an Ogre…

…it has layers

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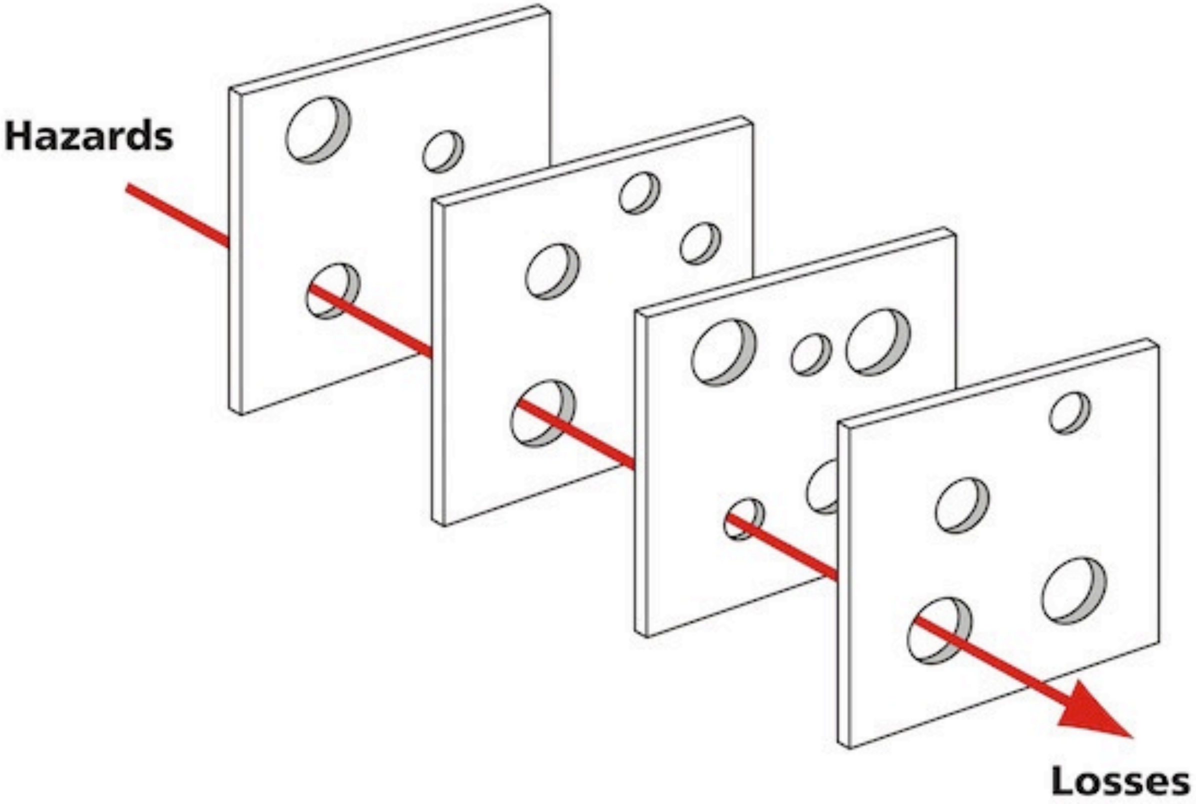
Layered Security

- Prevents single point of vulnerability
- Increases the cost of penetration by an attacker



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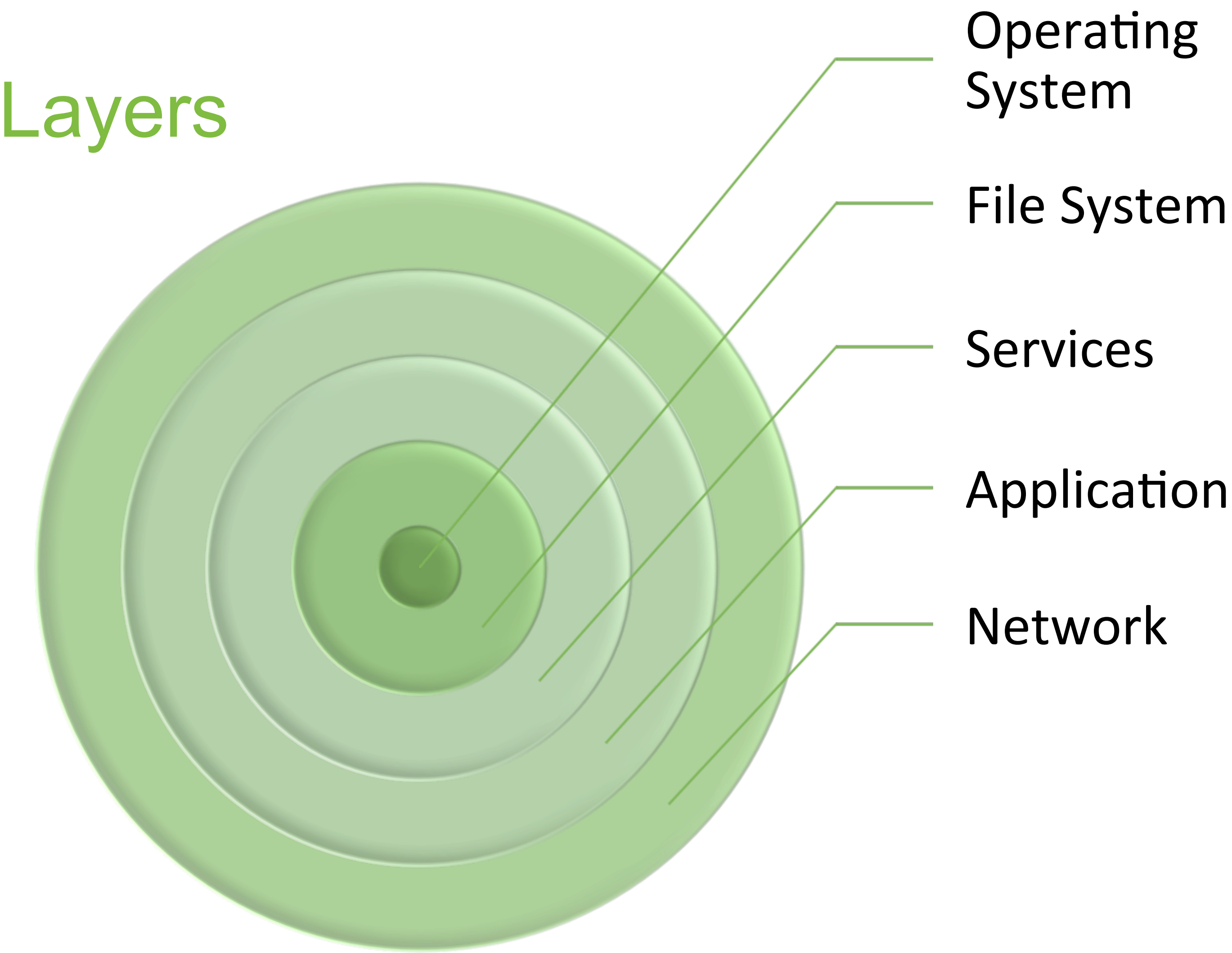
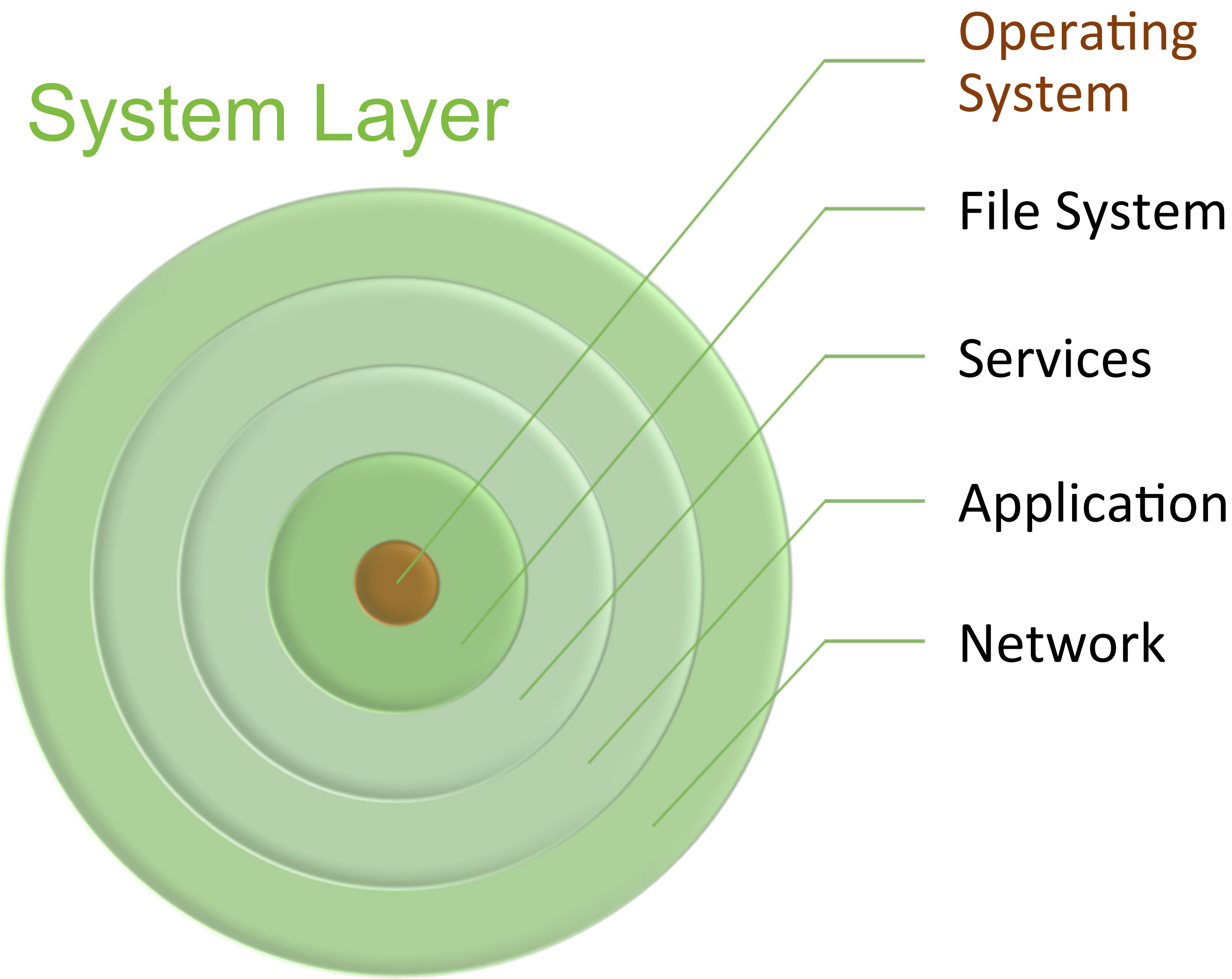
Security Layers



Operating System Layer



Operating System

File System

Services

Application

Network

Operating System Security

- Randomize user passwords
- Disable unused ports
- Encrypt the file system

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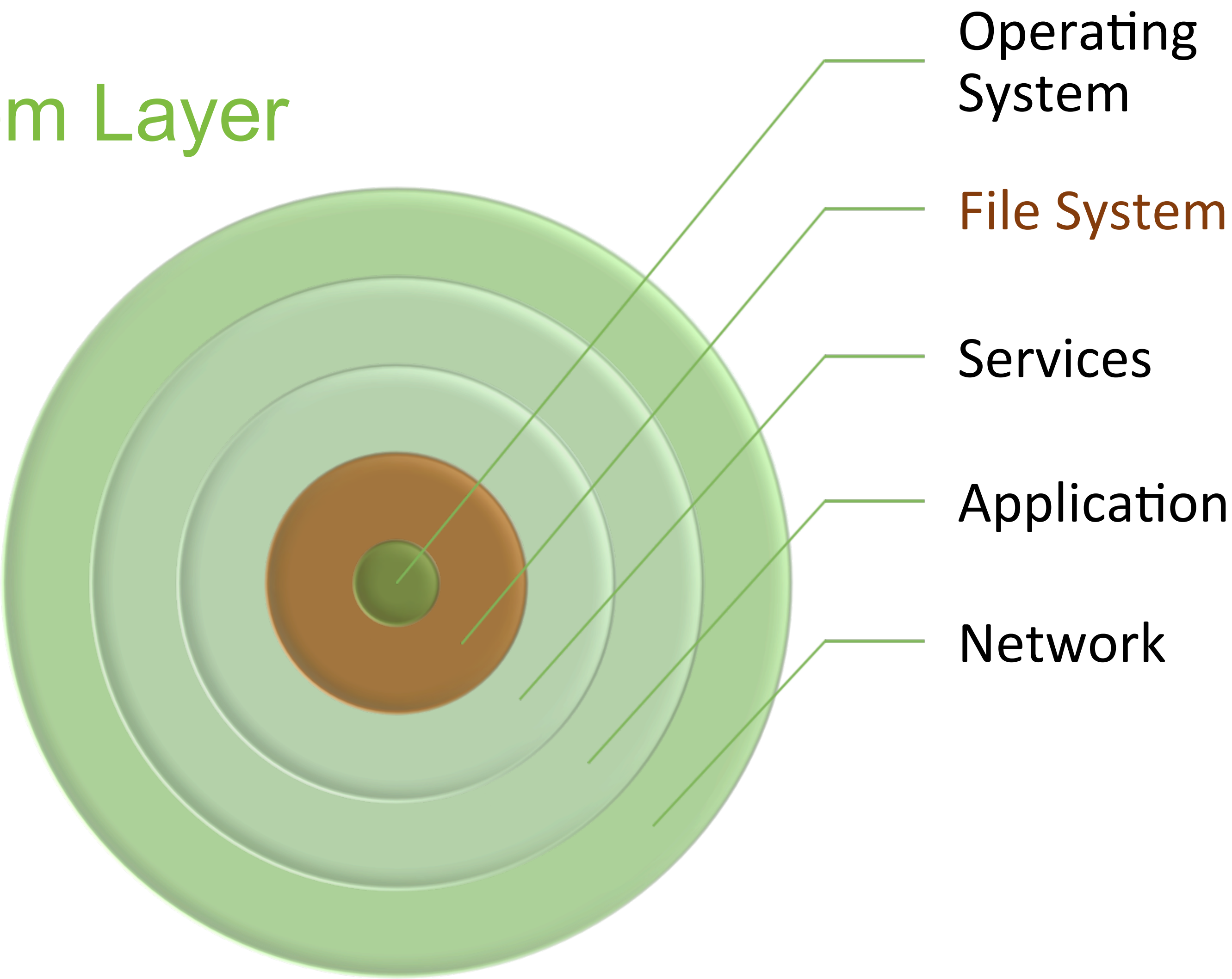
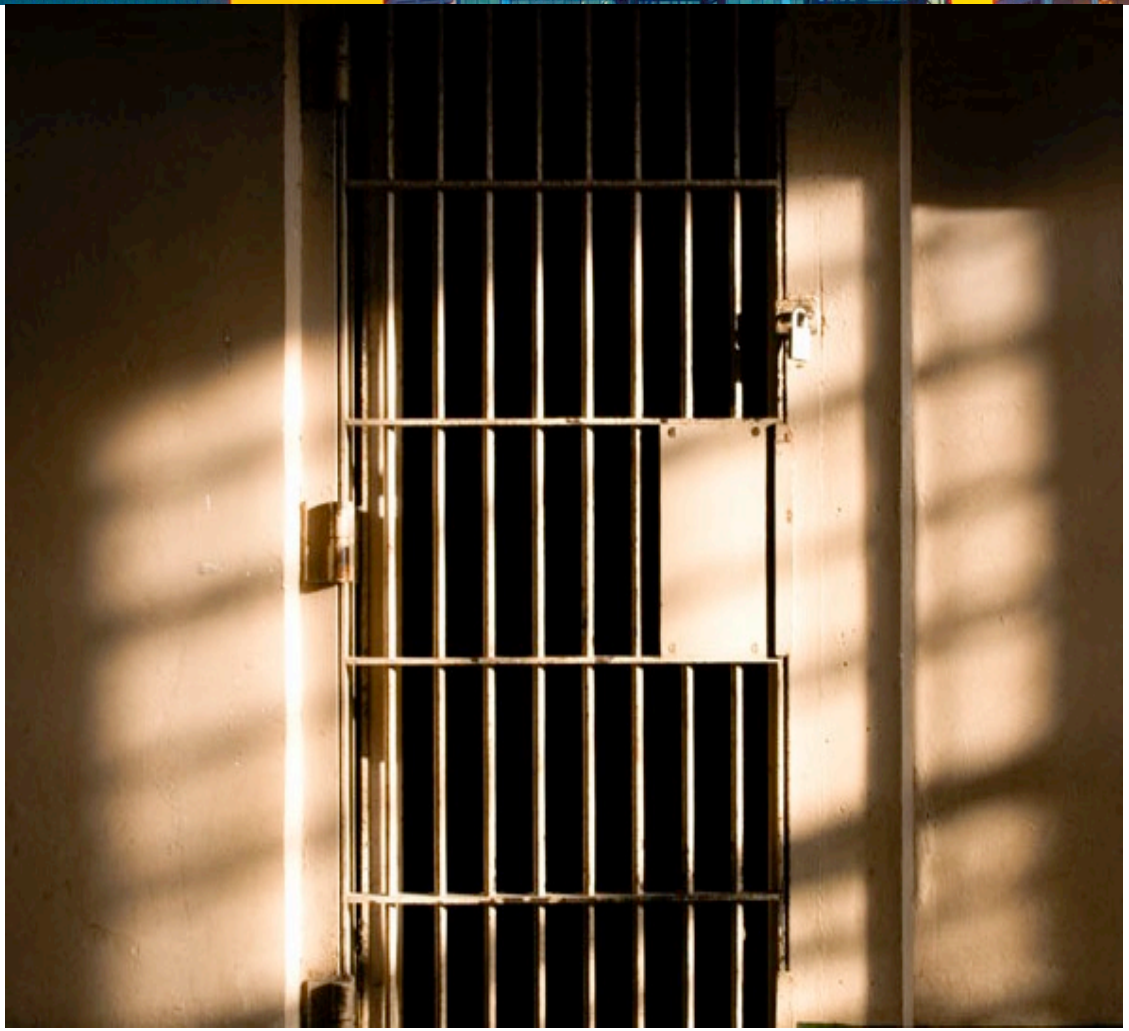
File System Layer

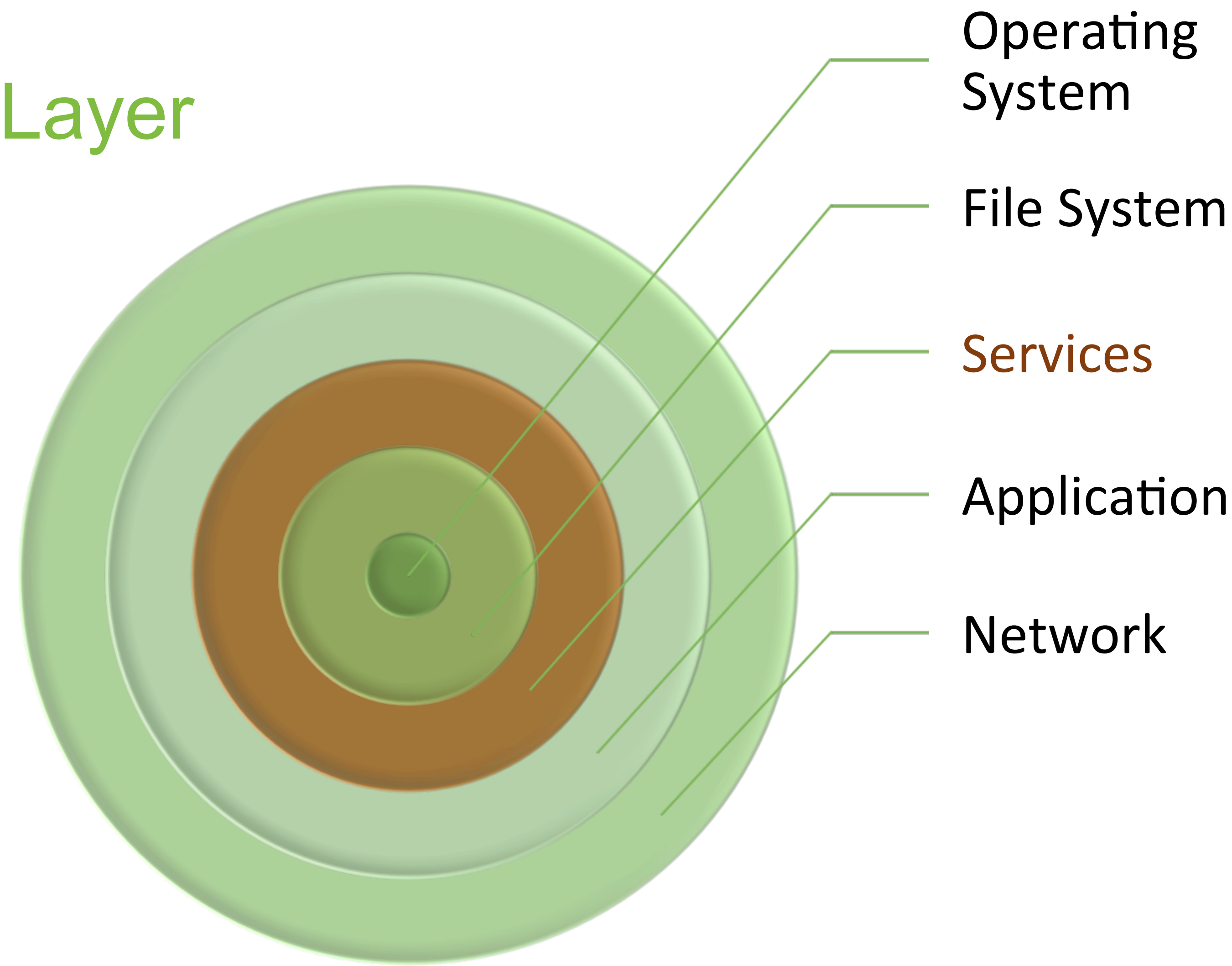


File System Security

- Named application user
- Remove "everyone" access where possible
- Restrict app user to files necessary to run
- Avoid write access – use pipes



Services Layer



Service Security

- Use web services for communication
- Remove all non-essential services (SSH, FTP, etc)
- Use authentication on remaining services
- Be as secure as possible with service data

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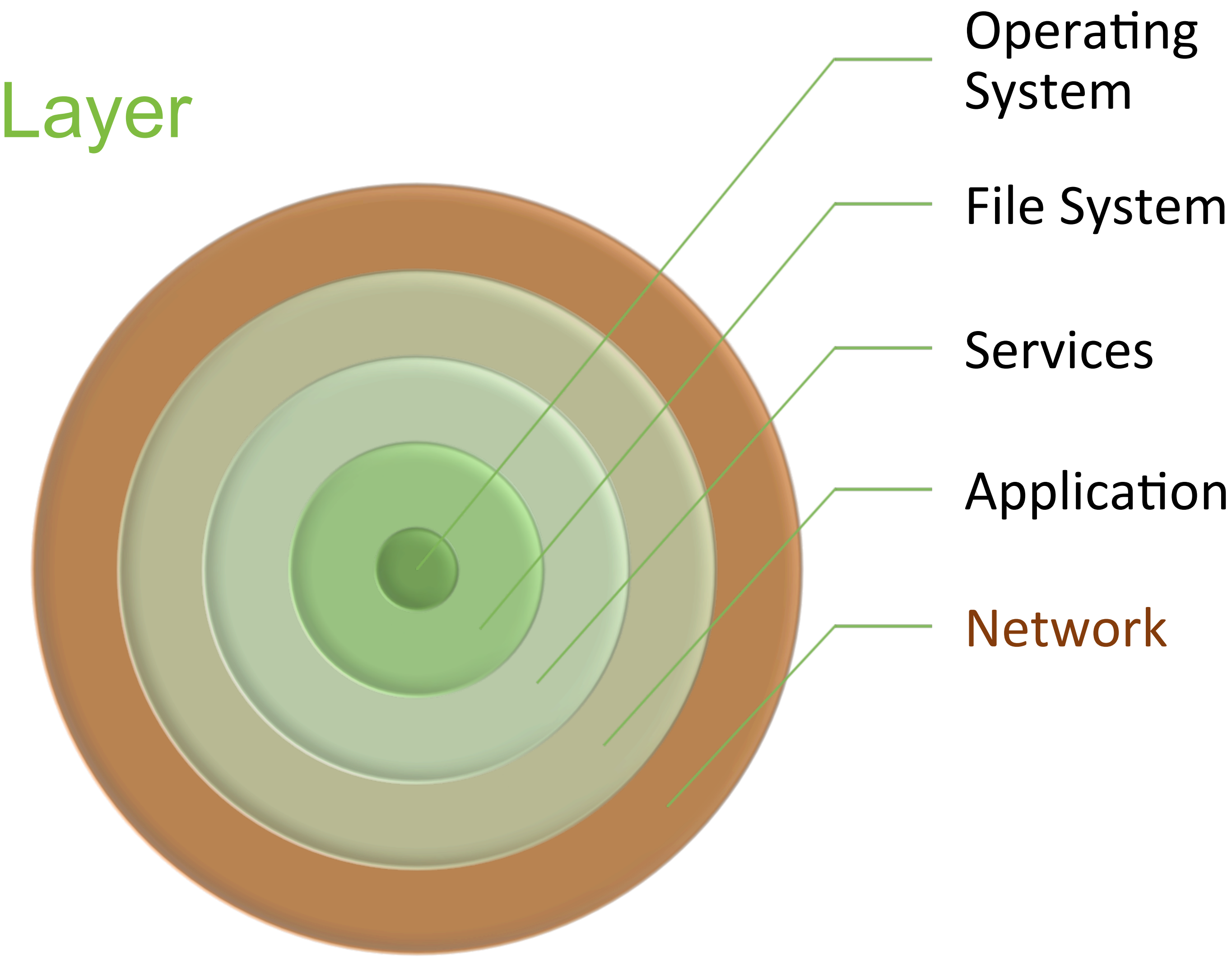
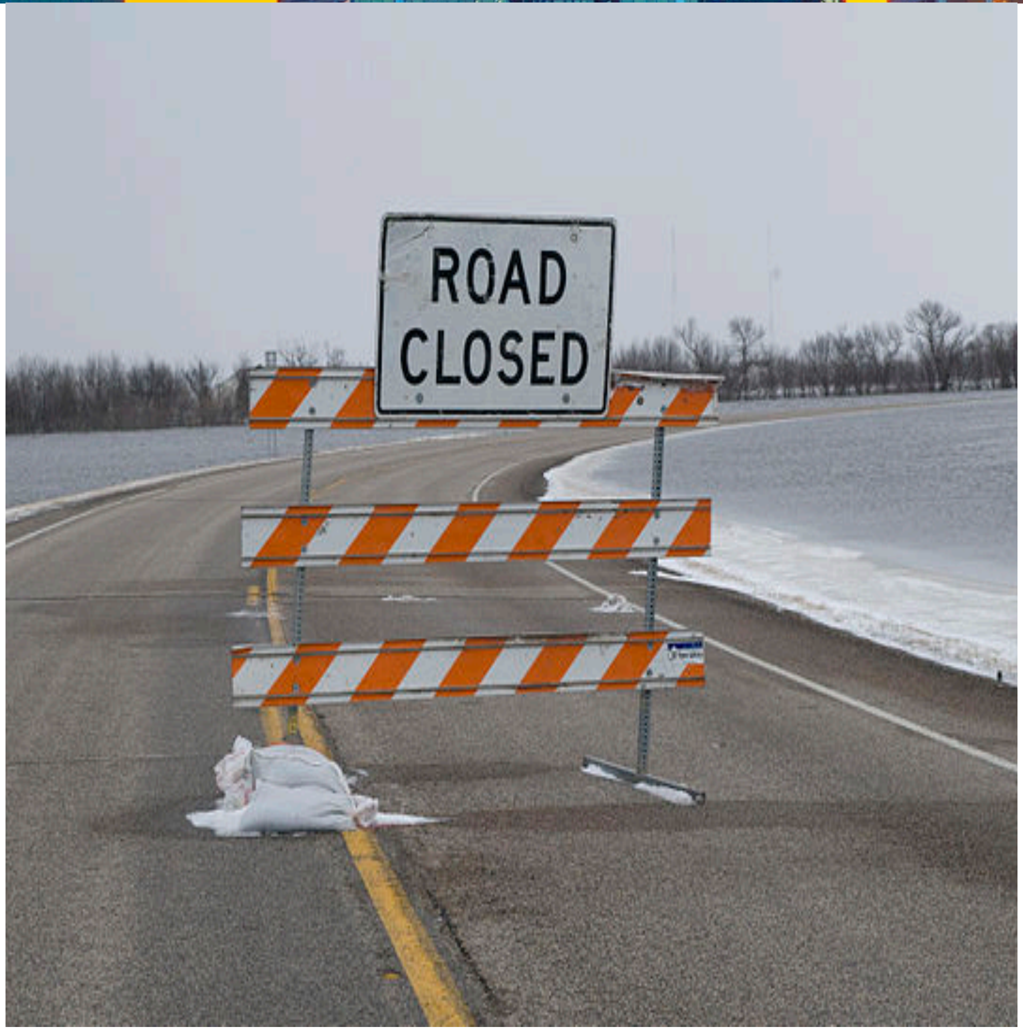
Network Layer



Network Security

- Devise a system with only outbound IP traffic
- Restrict inbound and outbound IP traffic
- Only allow paired Bluetooth devices to connect
- Pair Bluetooth devices with challenge-response



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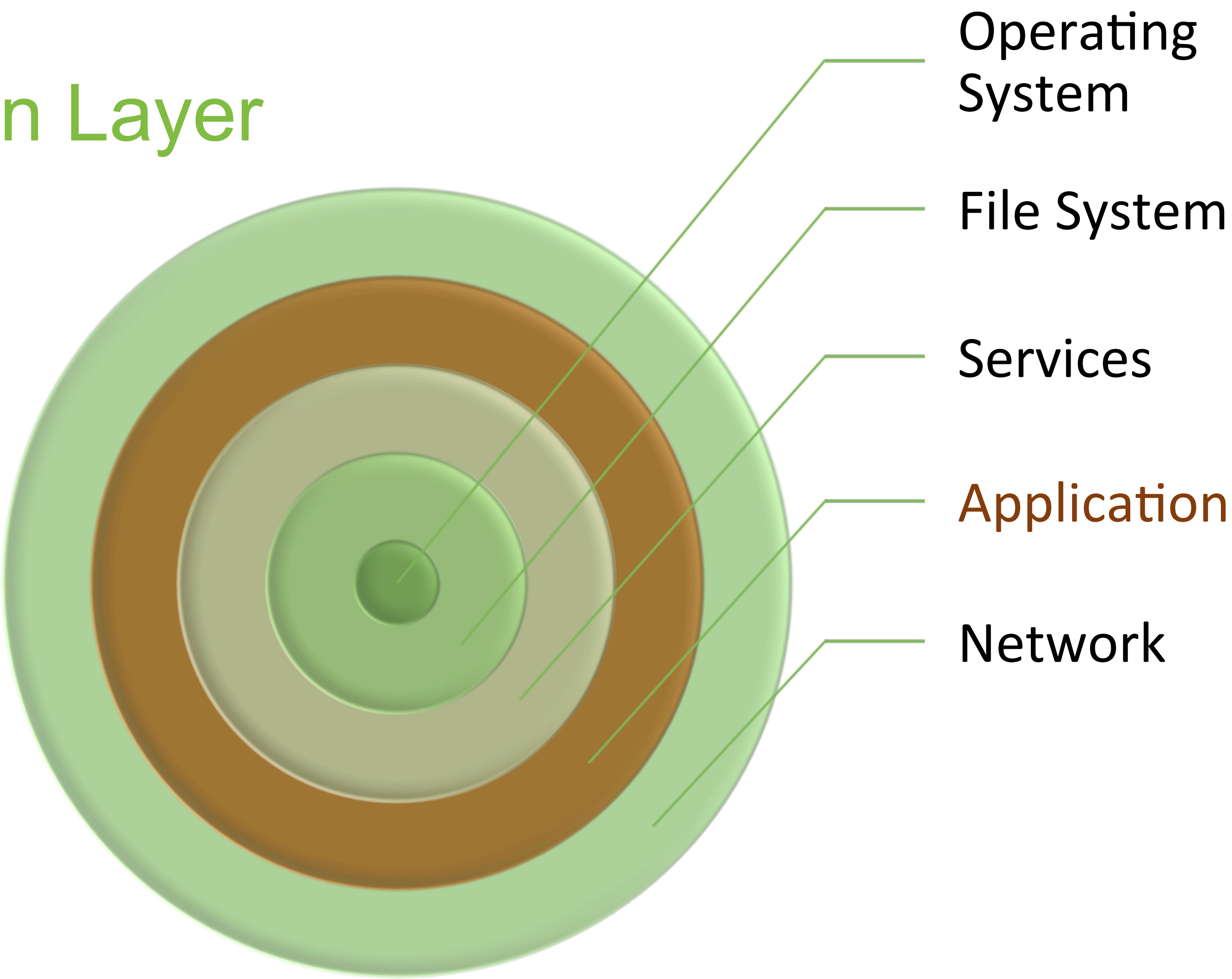
Application Layer



Operating System

File System

Services

Application

Network

What You Are Preventing

Account Hijacking

Sensitive Data Exposure

Escalation of Privilege

Denial of Service

Remote Code Execution

Sensitive Data Exposure

- Protect data in transit by:
  - utilizing TLS
  - not following redirects
  - pinning SSL certificates
  - using DNSSEC to verify DNS
  - encrypting data
- Protect data at rest with encryption

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SSL Pinning

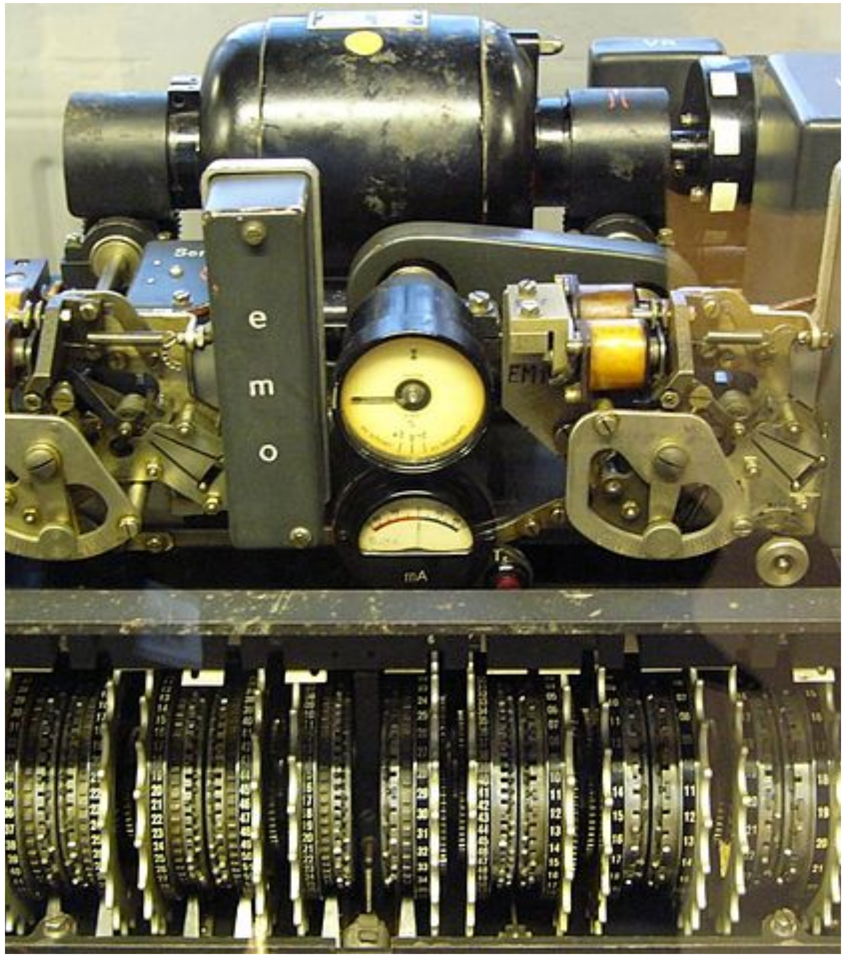
- Certificate verification via fingerprint

  res.socket.getPeerCertificate().fingerprint

- Have backup fingerprints to quickly rotate when primary is compromised.
- Additional certificates must use different private keys to have a different signature.

Encrypting Data

- Data at rest can use symmetric encryption as secret is not shared but local.
- Data in transit should use asymmetric encryption. It’s more complex and slower but does not require transmitting your secret.
- Both are available natively via the “crypto” package.



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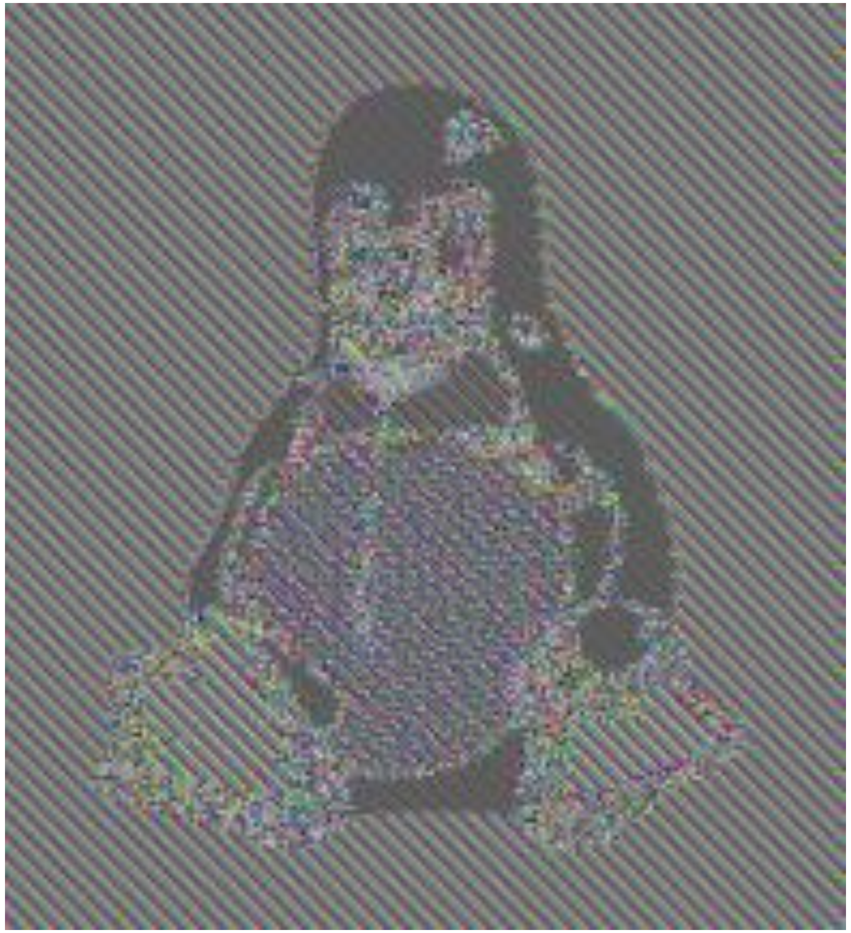
Symmetric Encryption

- Uses shared "secret" key.
- Uses initialization vector (IV).
- Use crypto.randomBytes() for cryptographically random IV.
- Always use some sort of block chaining or cipher feedback to ensure pseudo-randomness.
- aes-256-cbc is a good standard



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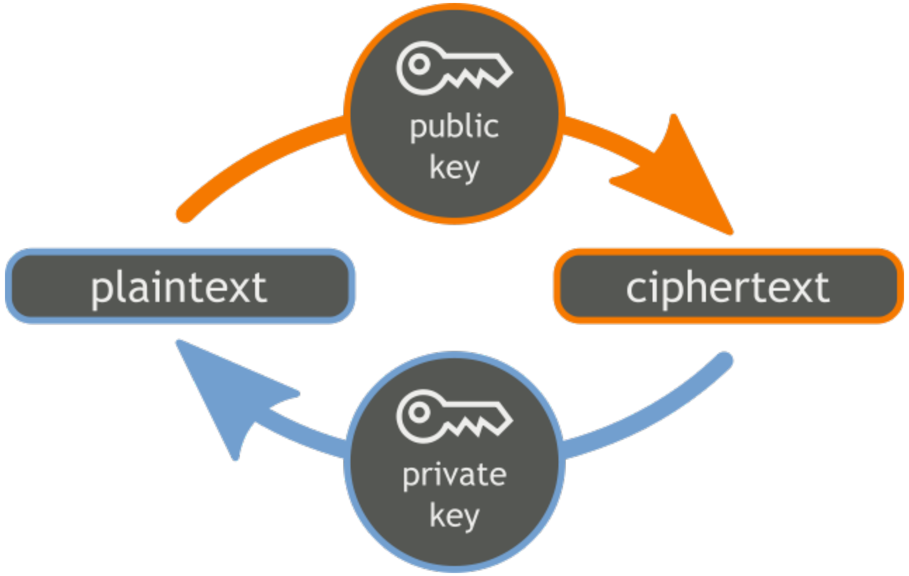
Asymmetric Encryption

- Uses public/private key pairs.
- Private and public key can encrypt and verify signature.
- Only private key can decrypt and create a signature.
- Private key should be password protected.
- Key size at least 2048 bytes but 4096 bytes is preferred.



Account Hijacking

- Never use plain text credentials
- Use strong hashing:
  - PBKDF2 is in crypto package
  - 32+ character random SALT
  - 10,000+ iterations
  - sha256 digest
- If you use email for username, hash the value for storage
- Alert for changes to accounts

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Encryption vs. Hashing

- Hashing is one way
- Encryption is reversible
- Hashing is more secure than encryption
- If you do not need to decrypt sensitive data, consider hashing it

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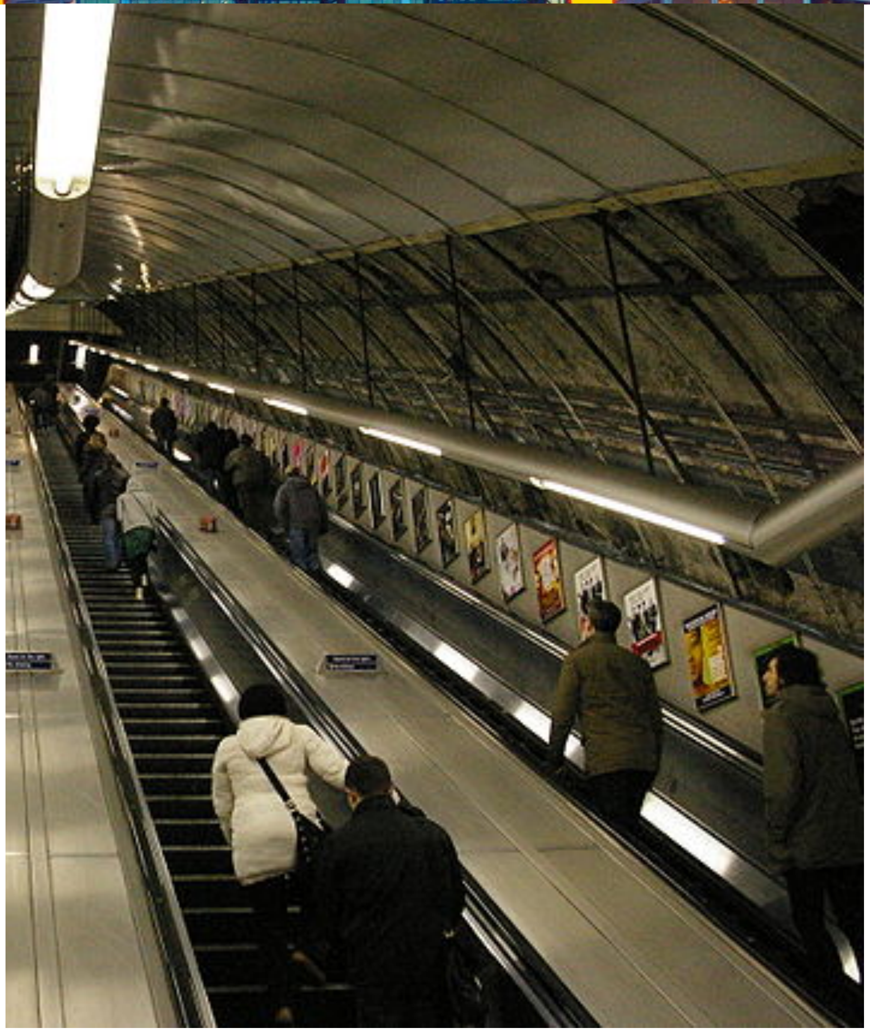
Escalation of Privilege

- Always use TLS
- Set "secure" and "HttpOnly" flags for session cookies
- Use a CSRF token (nonce)
- Strict-Transport-Security
- Expire your requests
- Sign API requests including credential data and location



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Nonces

- Used only once
- Must be cryptographically random
- Provided by crypto package with randomBytes()
- Should expire

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Digital Signatures

- Verifiable hash of supplied data
- HMAC or RSA is provided by crypto
- RSA is preferred
- JOSE is IETF standard

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Denial of Service

- Detection
  - Honey Pot
  - Request frequency
  - Request signatures
- Mitigation
  - Black list IPs
  - Black hole (no response)
- Detect early in process

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Remote Code Execution

- Content Security Policy
  - Restrict to local source
  - No inline CSS/JS
- No eval(), ever!
- Prepared statements in SQL
- Code Object with Scope in MongoDB

Further Reading

- https://en.wikipedia.org/wiki/Layered_security
- https://en.wikipedia.org/wiki/Defense_in_depth_(computing)
- https://www.owasp.org/index.php/OWASP_Internet_of_Things_Project
- https://en.wikipedia.org/wiki/JSON_Web_Token