The Container Security in Healthcare Data Exchange System

Bachelor's degree graduation project

Chih-Hsuan Yang

National Sun Yat-sen University
Advisor: Chun-I Fan

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1. List the possible risks
2. Take a clear - cut definition about security
3. Use the container to enhance the healthcare data exchange system
4. The container and the healthcare data exchange system are coupled

Outline

Preliminaries

What focus on?

- Container security
  - Host environment
  - Images Signature
  - Container behavior
  - Continuous Integration / Continuous Deployment
- Database security
  - Access control
  - Encryption
  - Integration
  - Backups

Aimed secutity issues

Secure for what?

- CI/CD (Rolling update)
- Strongly access control (Namespaces)
- Reduce leakage possibility (Namespaces)
- Limited resources (Hooked glibc, CGroups, Capabilities)
- Malicious flow detection (LSM)
- E2EE (Curve25519, chacha20-poly1305)

Risks

Comparison

Possible risks without this project's protection

- Container
  - Malicious images
  - Inner-container permission
  - Container Escalations (RCE)
  - Out-of-date software
  - Infrastructure vulnerabilities
- Database
  - Injections
  - Malicious flow
  - Ownership
    - Broken authentication
    - Encryption failure

Coupled

Stories

Prof. Fan asked: "Is the container and the healthcare data exchange system coupled?"

1. Can it be coupled, just like the blockchain and cryptography?
   - Well yes but actually no. $P \rightarrow Q$
2. How to make these two issues be coupled?
   - How does the cryptography embedded in blockchain?
     - Authentication process.
   - Find the closest part to embed or entangle.
     - Projection matrix.

The level of matrix

Low (0) means those are orthogonal.

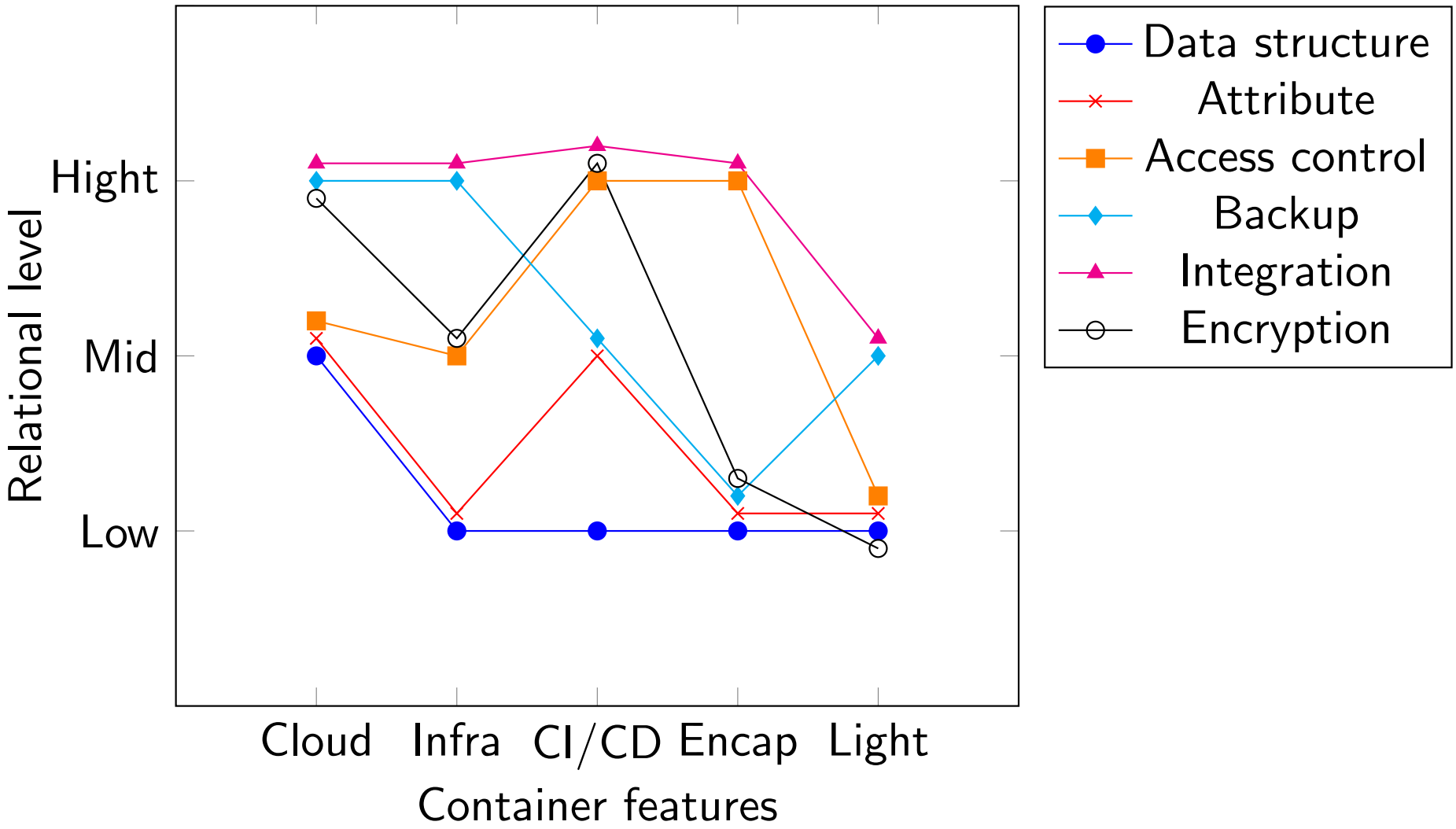
Mid (1) means those are related in some premise.

Hight (2) means strongly bidirectional relation.

Matrix

Relational level between features [0,2]					
	Cloud computing	Infrastructure	CI/CD	Encapsulation	Light weight
Data structure	1	0	0	0	0
Attribute	1	0	1	0	0
Access control	1	1	2	2	0
Backup	2	2	1	0	1
Integration	2	2	2	2	1
Encryption	2	1	0	0	0

Line chart


Relational level
Hight
Mid
Low
Cloud
Infra
CI/CD
Encap
Light
Container features
Data structure
Attribute
Access control
Backup
Integration
Encryption

The reason of matrix

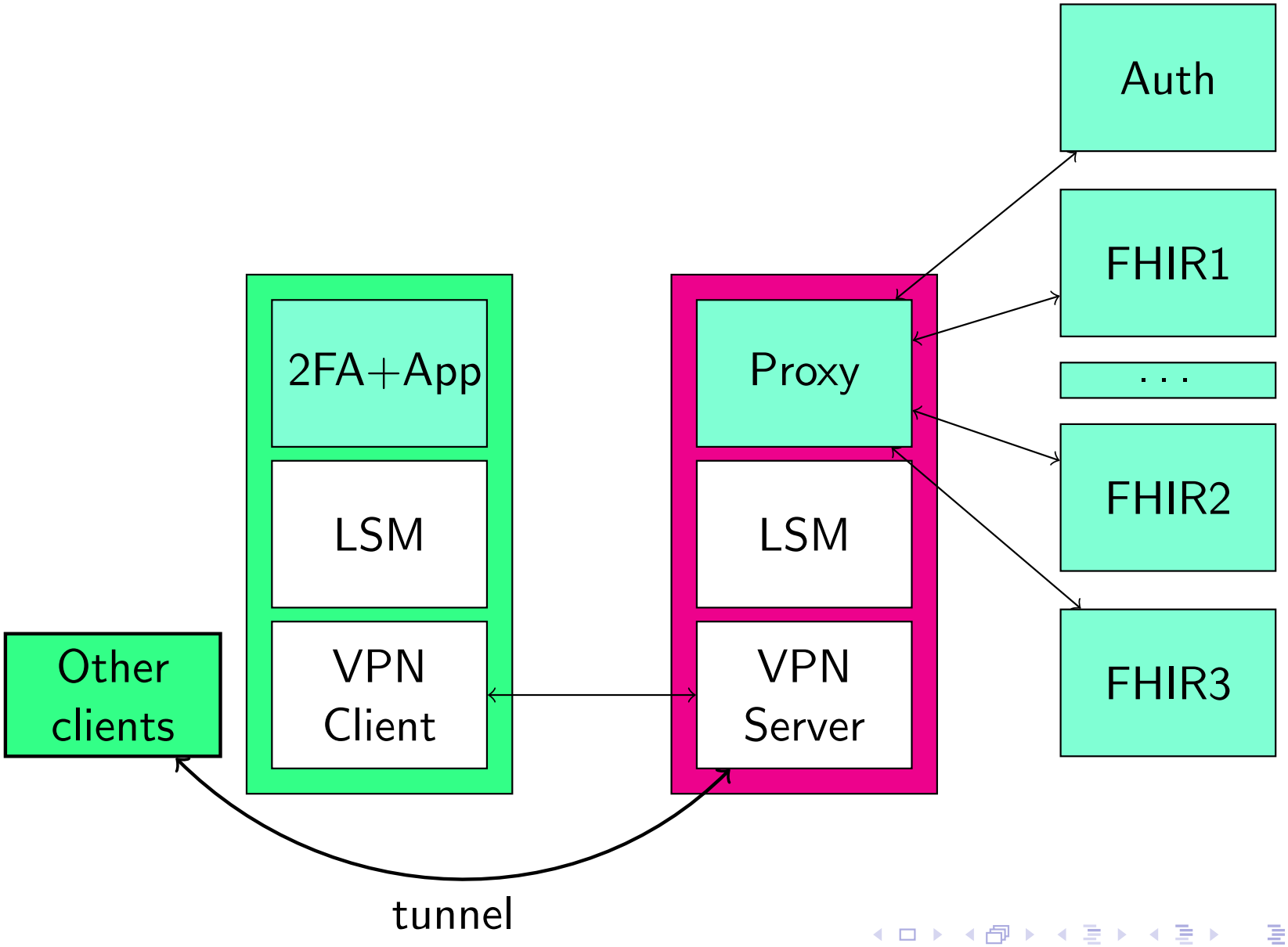
- Data structure: Have some relation in the performance issue.
- Attribute (category): Separate into different containers, dynamic CRUD.
- Access control: Could be included in infrastructure's routing rule (LSM).
- Backup: Reliable (but not saved in long term).
- Integration: Separated database needs to integration those caches, rules.
- Encryption: Keep your privacy.

Why we need the container?

The 2FA can solved the traffic of robots.
Back to the key advantage of the container:

- Increased portability.
- More consistent operation.
- CI/CD.
  - We can deploy those updates continuously.
- Encapsulation.

Architecture



Pros and crons

- Pros:
  - Solved the malicious flow.
  - Truly people authorization.
  - Coupled with Taiwan healthcare system.
- Crons:
  - Modified kernel.
  - Slower.
  - Coupled with OS.

With the container security issue

- The trend of micro-service on cloud computing.
- CI/CD.
- Encapsulation.

Still not solved:

- Hooked glibc.
- Composed system calls (LSM).

Reference

Wireguard kernel module