APSYS

AUGMENTED TRUST

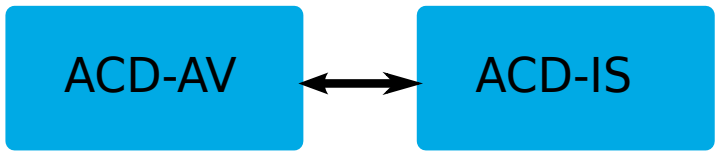
SECURITY ARCHITECTURE

A reference for embedded systems

Domains on real products

ACD-AV

Domains on real products



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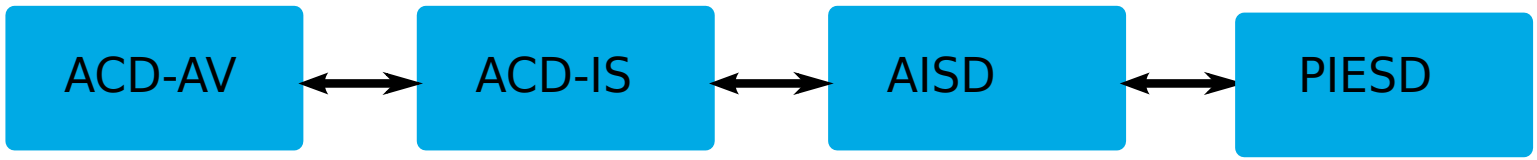
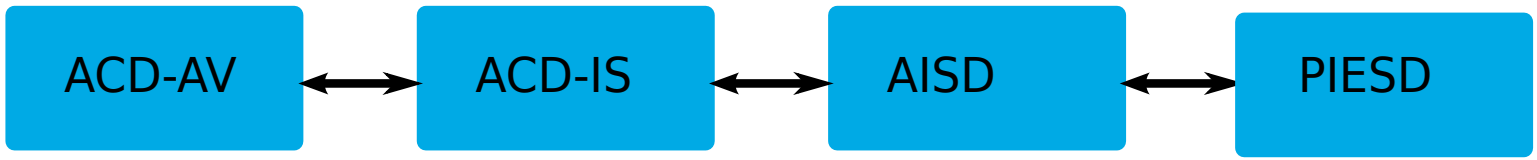


ARINC 811

Domains on real products



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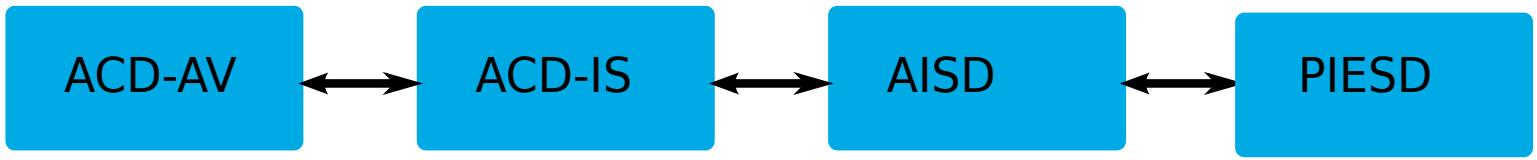

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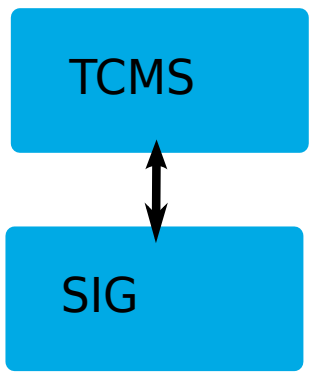

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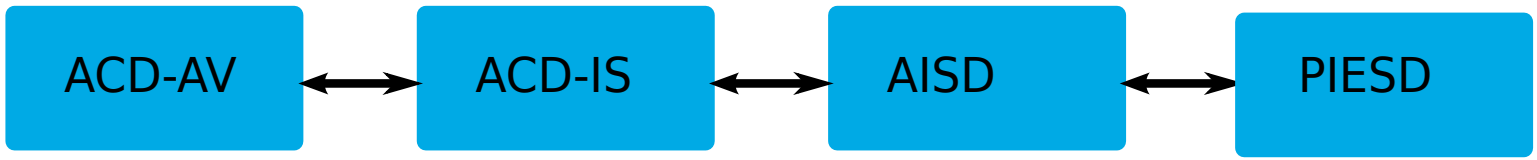

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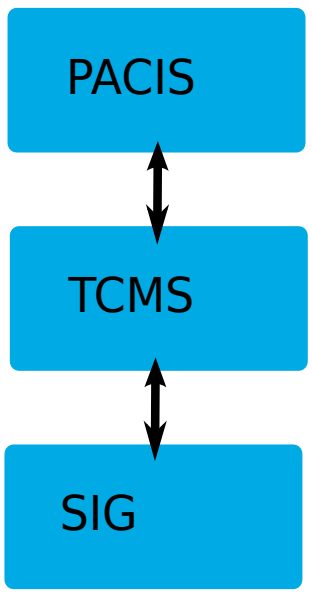

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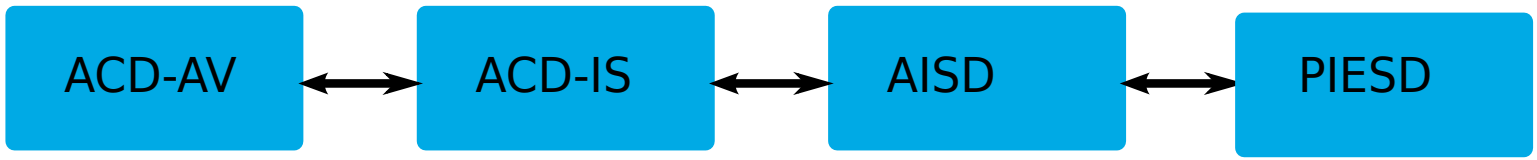

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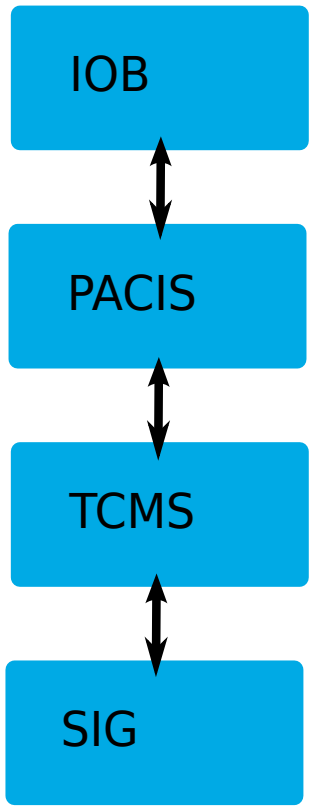

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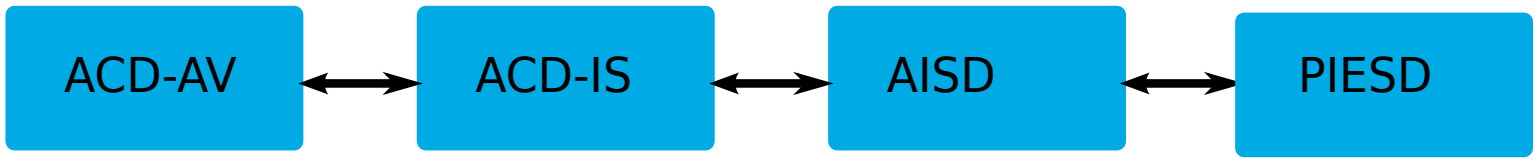

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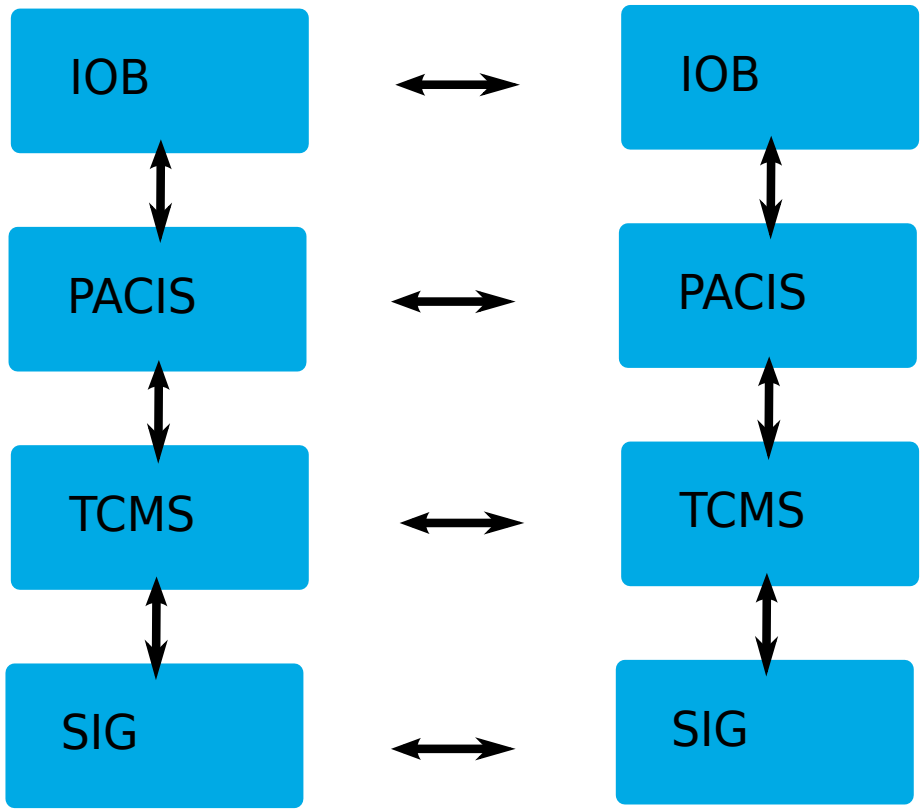

Plan

1. Basic principles of security architecture
2. Typical requirements for embedded systems
3. Consequences on architectures
4. Main security functions
5. Reference architecture

Basic Principles

Security function shall be updatable

- Attacks get better
- Vulnerabilities are discovered

Separate Critical from Security

- Critical functions don't change often and are very costly to certify
- Security functions have to be updated over time
- Separating them makes the update easier and less expensive

Basic Principles

No single vulnerability shall compromise the system

- Do not trust any individual component

Defense in depth

Apply principle of least privilege

Control data entering higher-criticality domains

... using “proxies” or “application-level filters” (ALF)

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Embedded systems requirements

Internet connection

- For updates, non-critical applicative communications
- Wi-Fi for passengers

No Internet connection

- Planes in warehouses
- Helicopters in the wilderness
- Trains in tunnels
- ...

Embedded systems requirements

Critical networks

- Impacts (catastrophic)
- Real-time requirements (i.e. availability)

BYOD : Bring Your Own Device

- E.g. Pilot EFB, Phones in cars, ...
- i.e. uncontrolled equipment connected to our system

Embedded systems requirements

Maintenance

- Software updates
- Testing

all requires access to the entire system

Standard IT solutions do not apply

- No admin
- No SOC
- No real-time reaction

But system entirely defined at design time

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Domains

- Identify domains based on security impacts
- Segregate applications
- Identify dataflows between domains
- Protect Higher-impact domains from lower domains
  - Limit dataflows to specification
  - Limit data rates
  - Verify data format
- Avoid dataflows from domain n to $n + 2$

Each domain is a DMZ for the next domain up

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Changing domains

Going down...

- Firewall (for confidentiality)

Changing domains

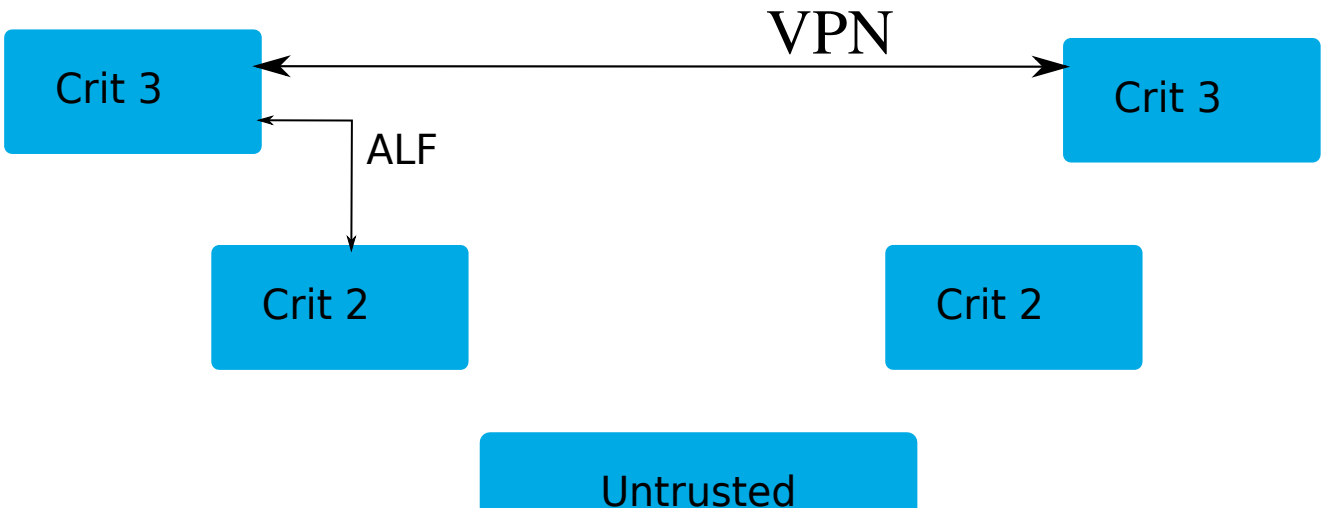
Going up...

Two threats :

- Incoherent corruption
- Coherent corruption

Two impacts : NSE, SE

	NSE	SE
Incoherent corruption	ALF	ALF
Coherent corruption	ALF	VPN to same-level or validation



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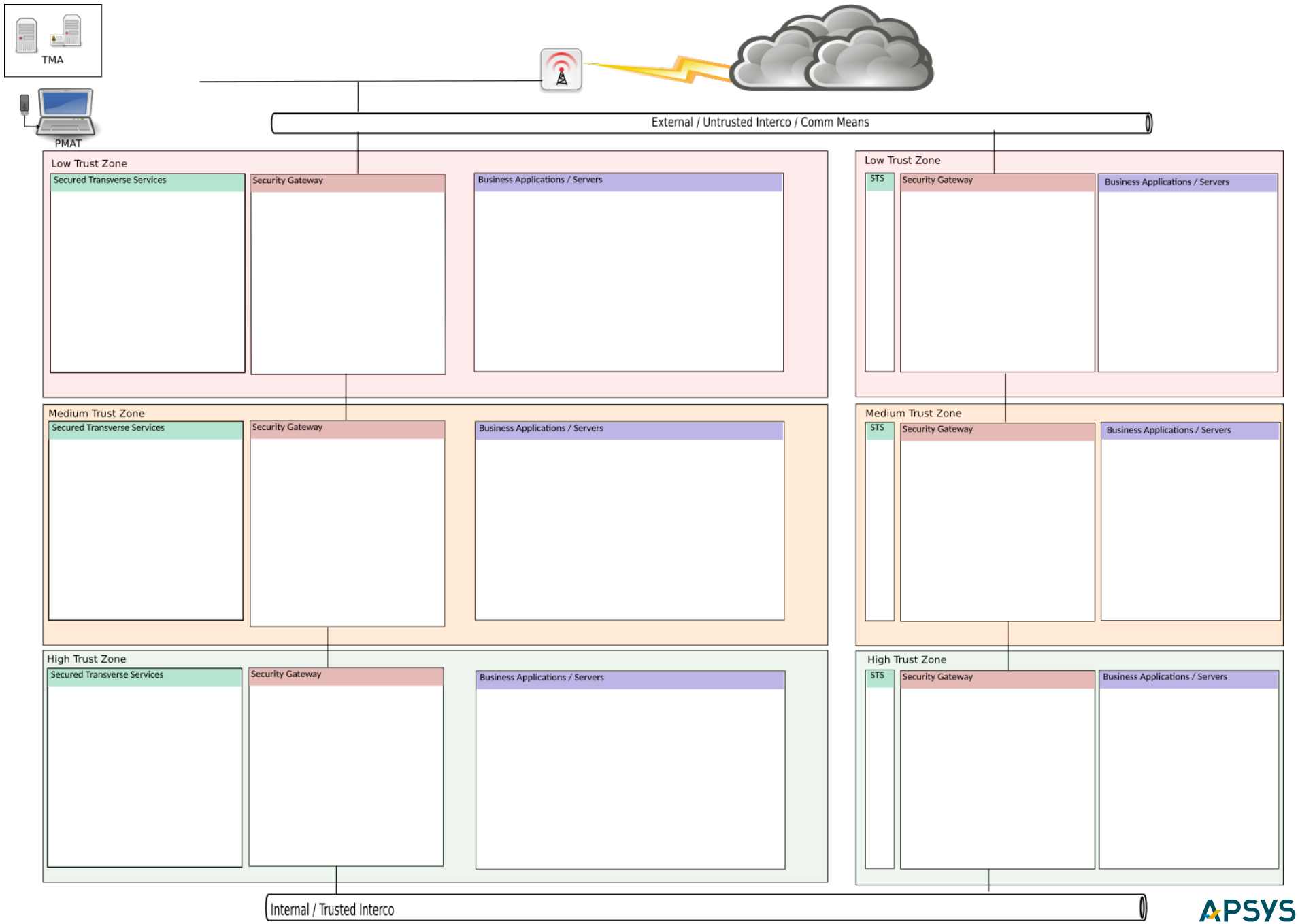
TMA
PMAT
External / Untrusted Interco / Comm Means
Low Trust Zone
Secured Transverse Services
Security Gateway
Business Applications / Servers
Low Trust Zone
STS
Security Gateway
Business Applications / Servers
Medium Trust Zone
Secured Transverse Services
Security Gateway
Business Applications / Servers
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Security Gateway
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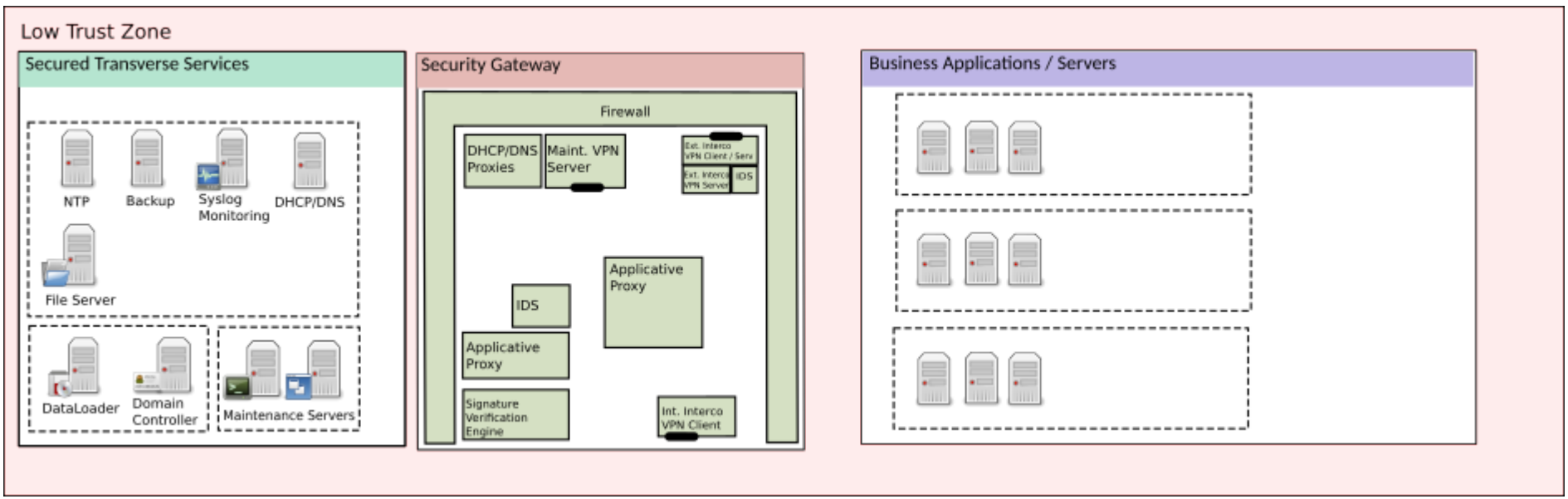
Internal / Trusted Interco

One domain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DataLoader
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Maintenance Servers
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Maint. VPN Server
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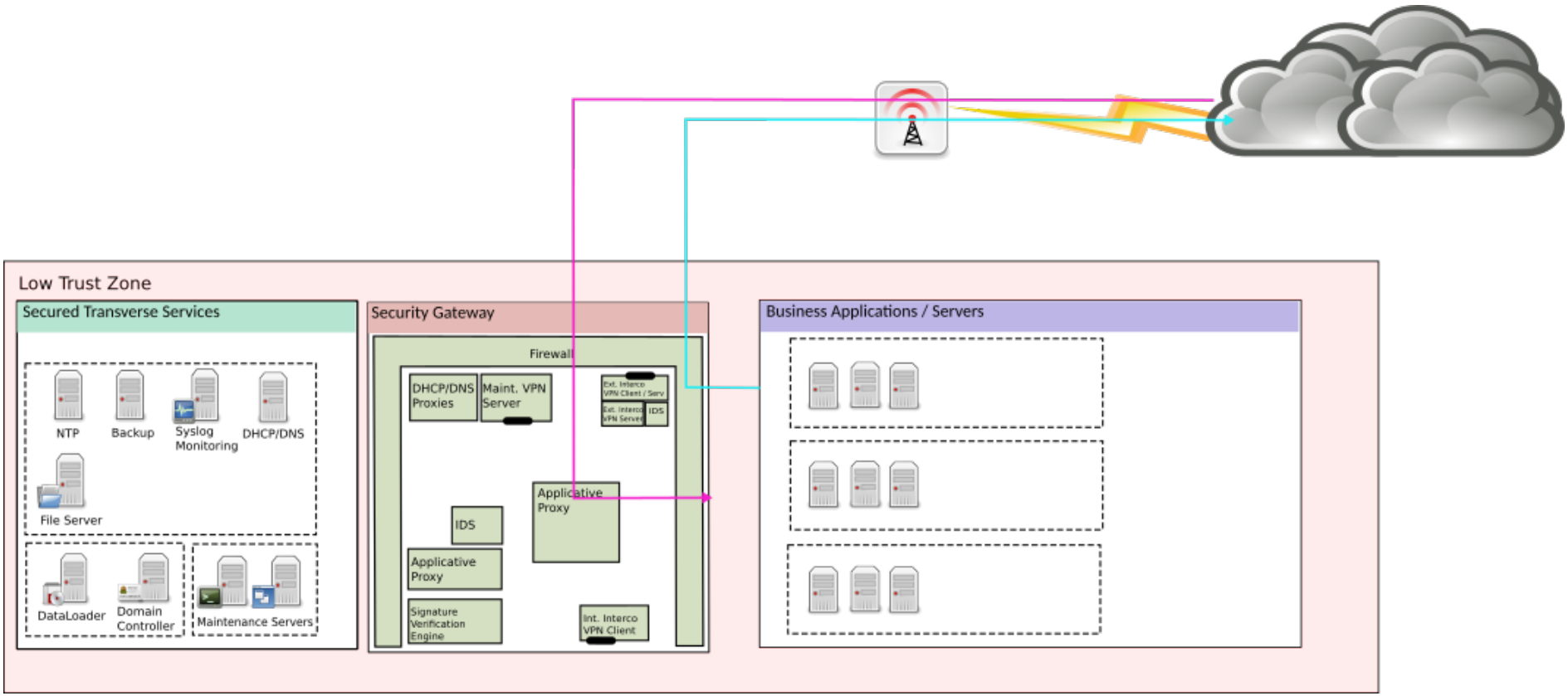
Applicative Proxy
Signature Verification Engine
Int. Interco VPN Client
Business Applications / Servers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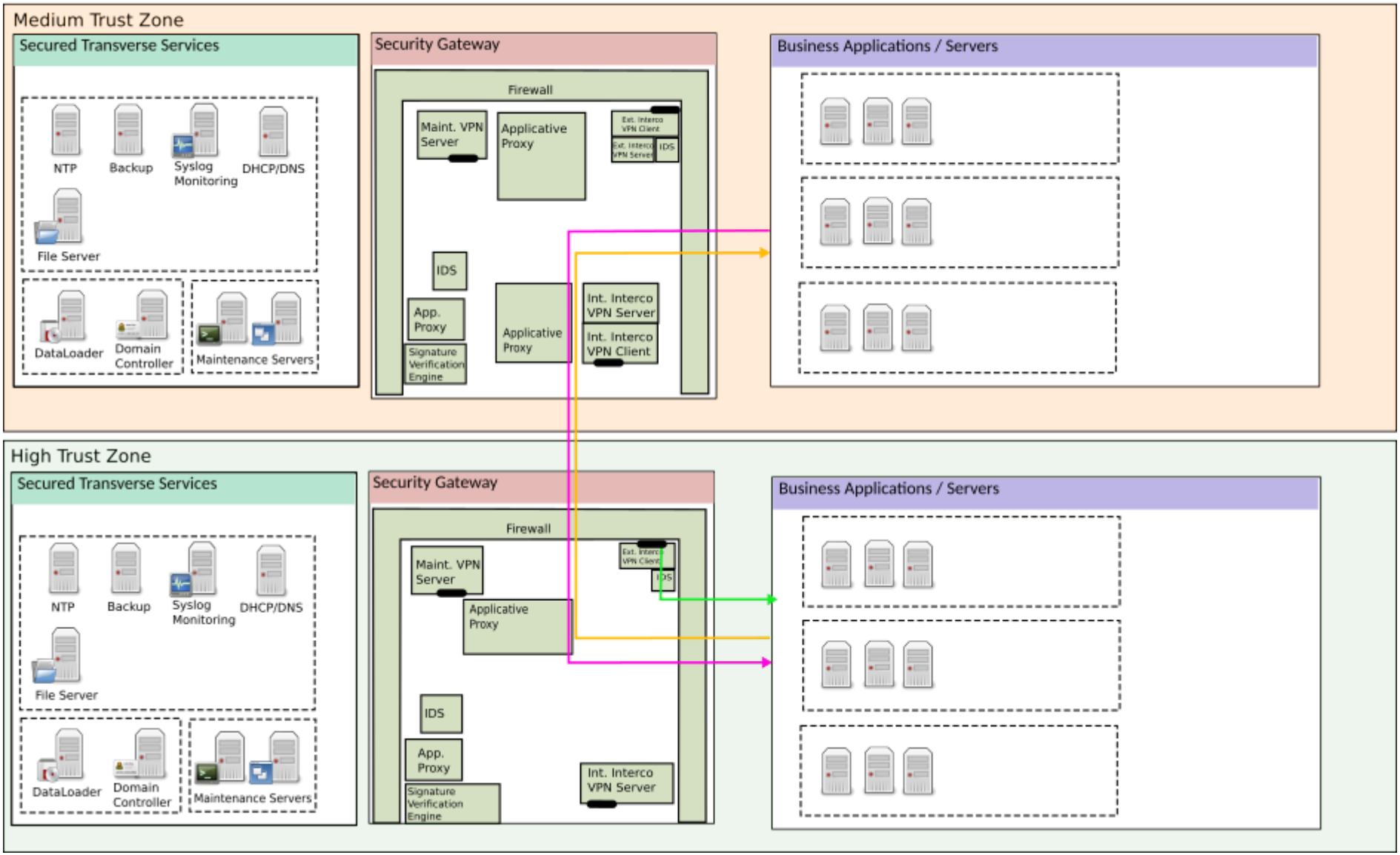
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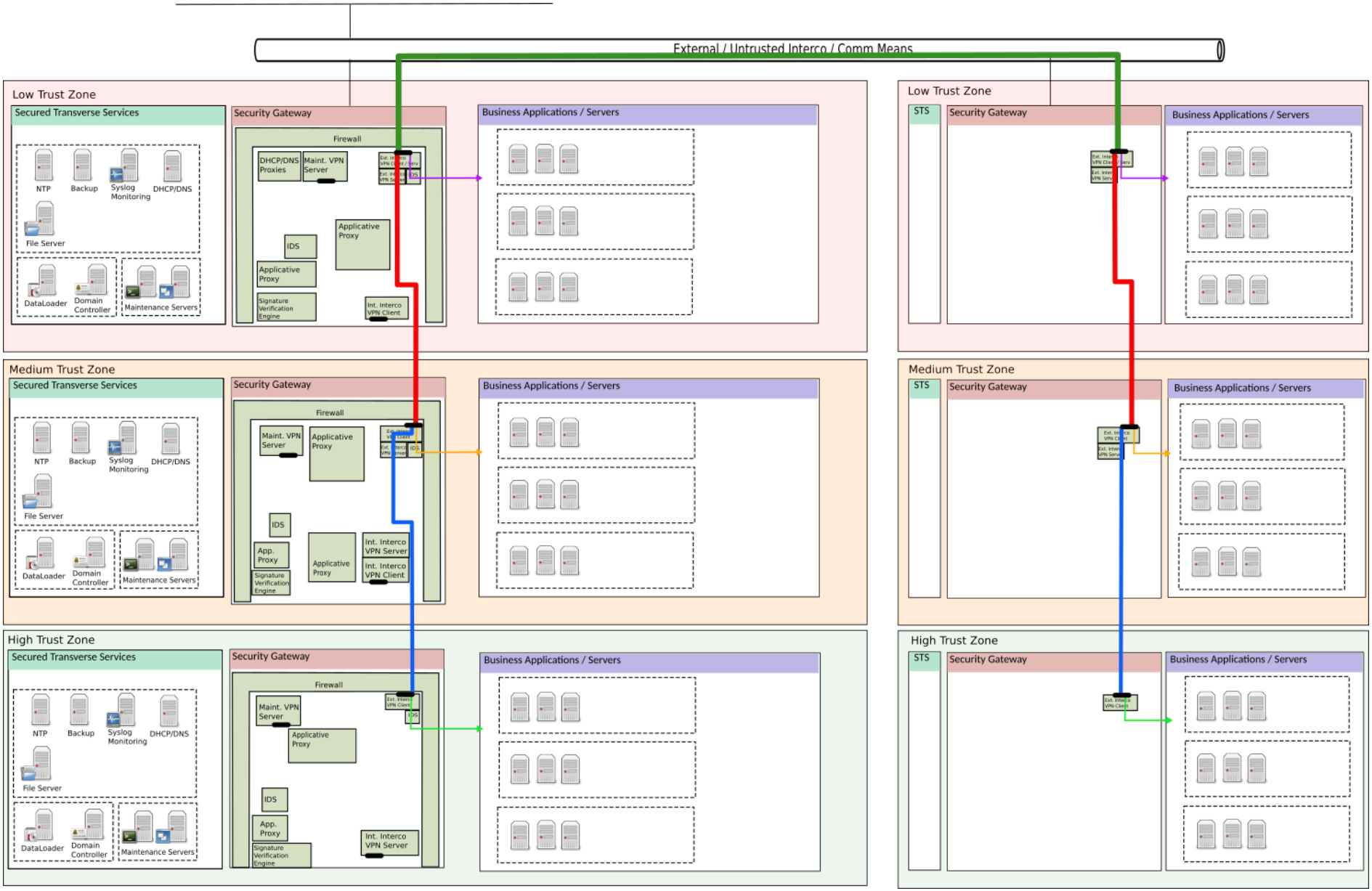
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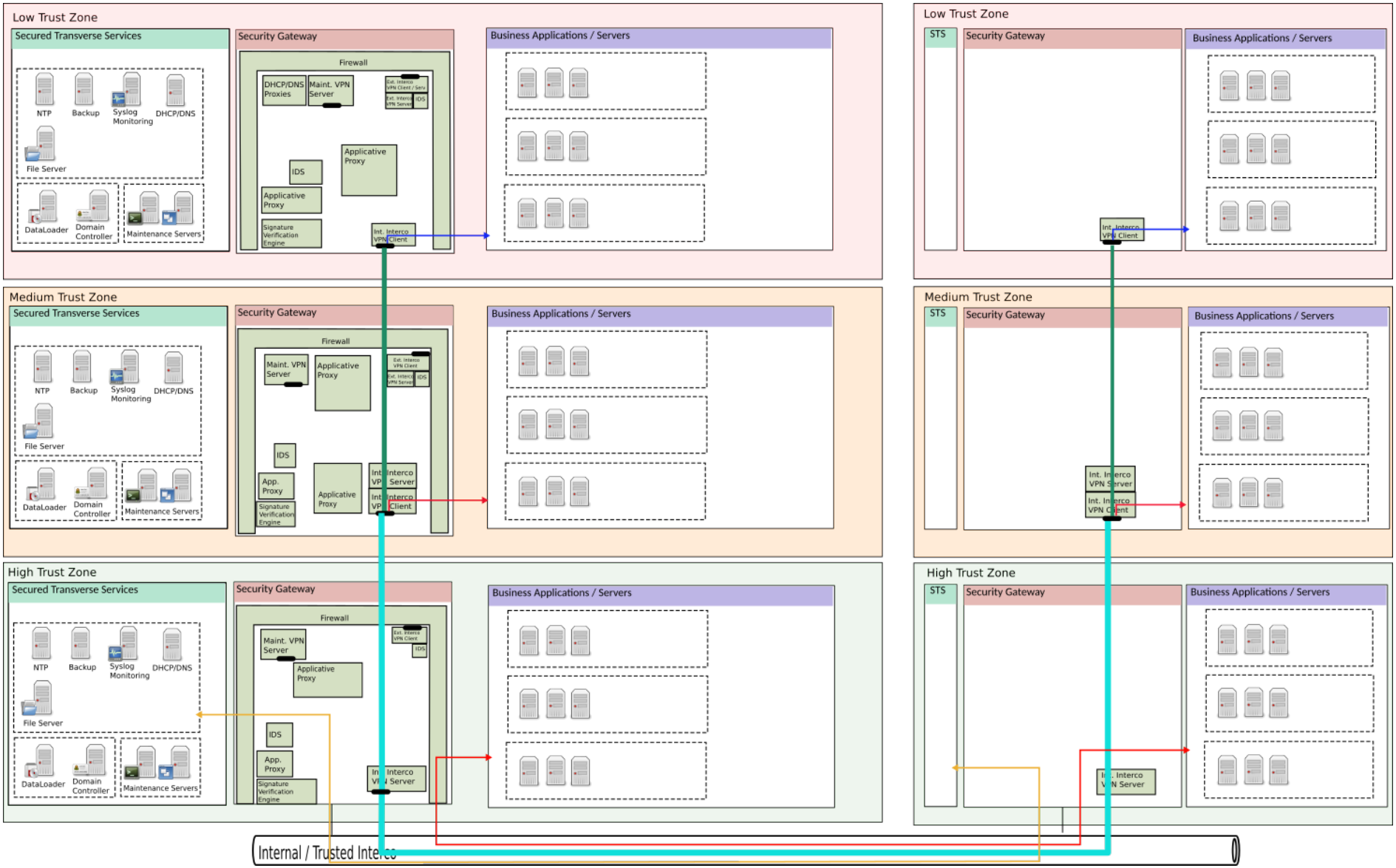
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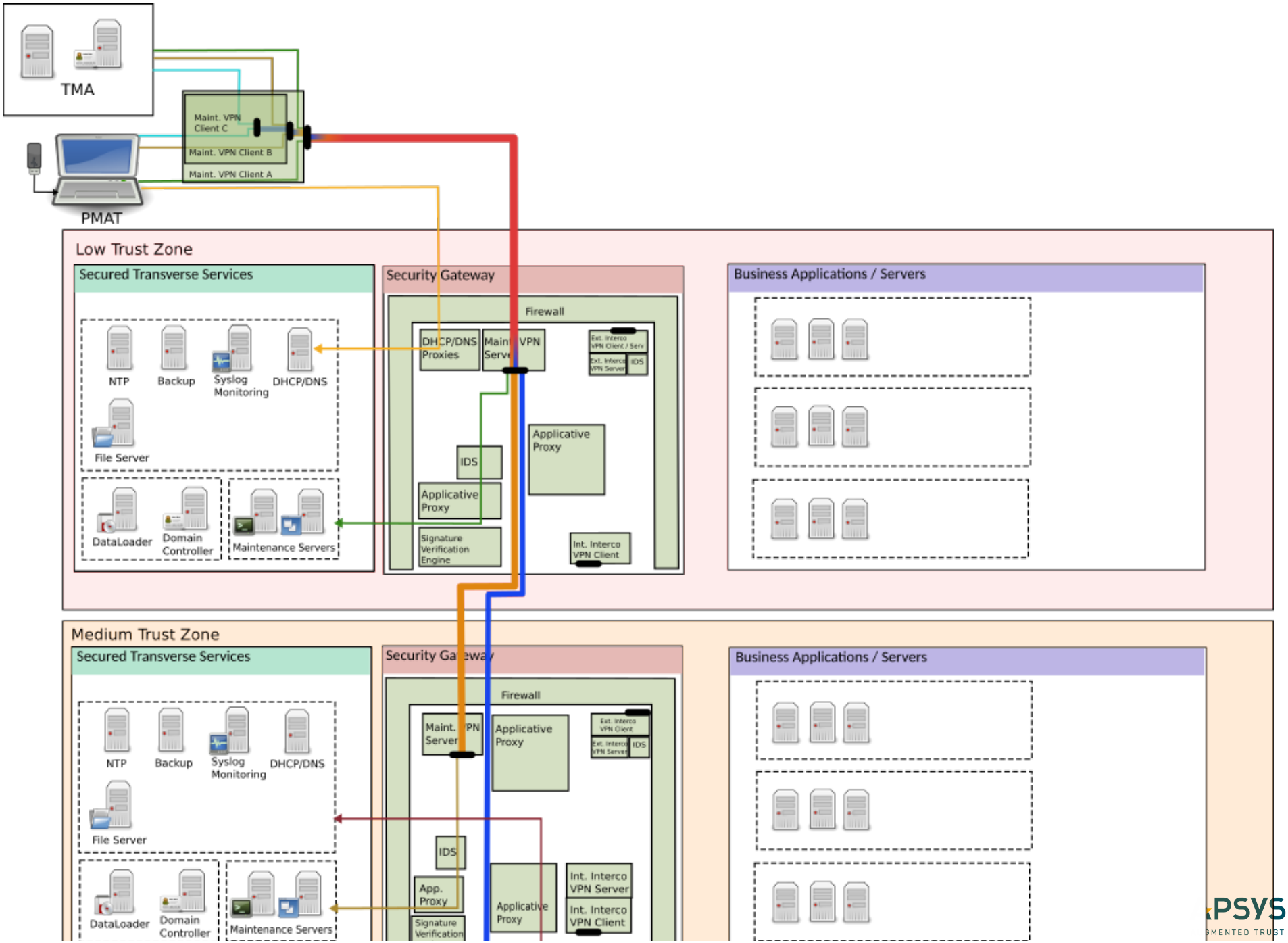
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Questions ?