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Securing SCADA critical network against internal and external threats

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Plan

Problematic

Related work

Our vision

Advantages & Perspectives

General problematic

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Why are these networks targeted by hackers?

SCADA networks are least protected networks

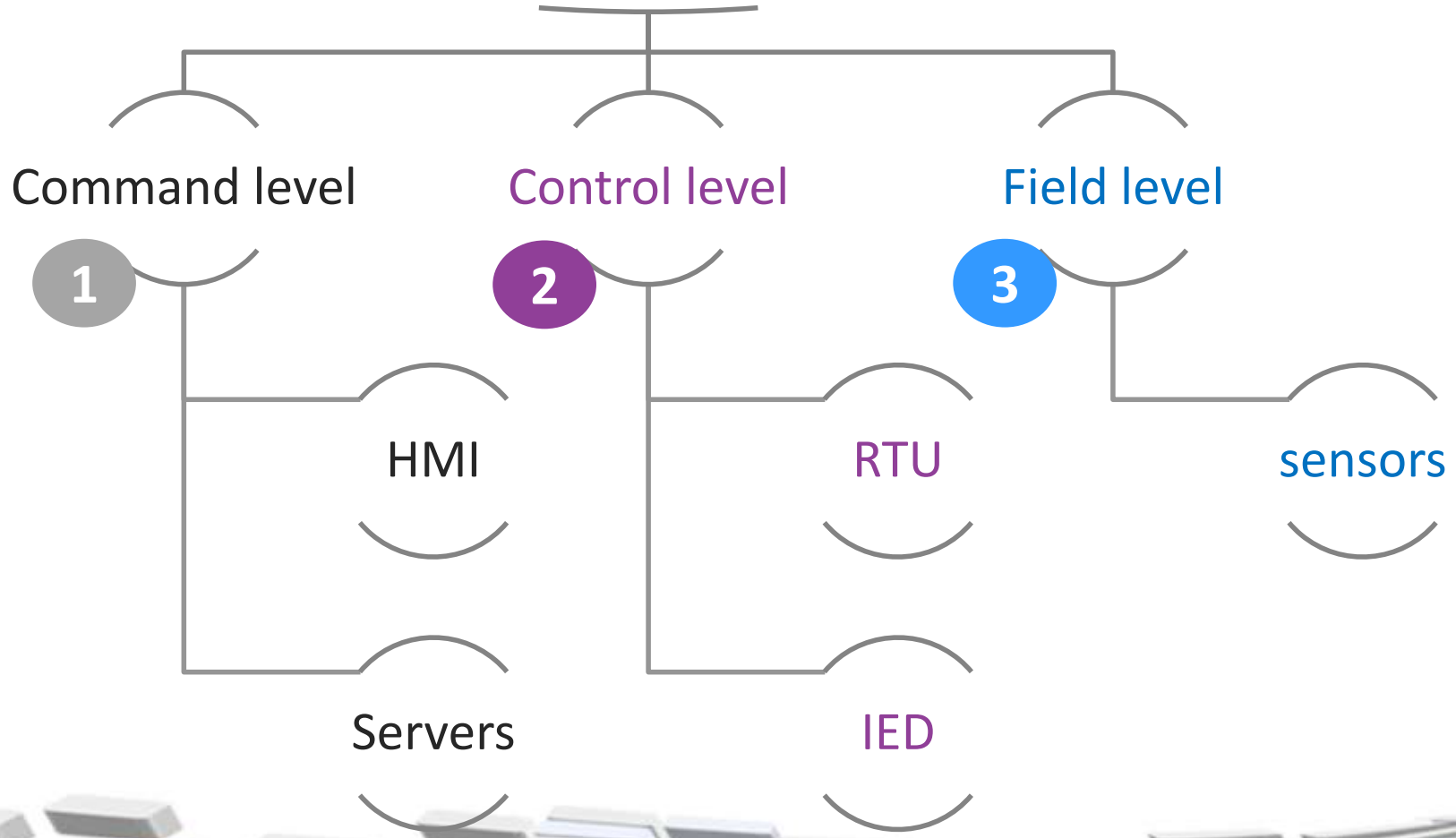
designed to operate 30 years but their openness to other IP networks had not been considered.

physical security has supplanted logical security on these networks [1]

Many new ICS and SCADA systems are open to Internet which allows the access and the use of ICS and SCADA infrastructure. This raised a number of new potential threats and vulnerabilities such as malware infection, DoS attacks, ...etc.

Related work

The SCADA architecture is a cluster architecture, it includes 3 levels:



Related Work

Approaches [8] et [5]

Approach [6]

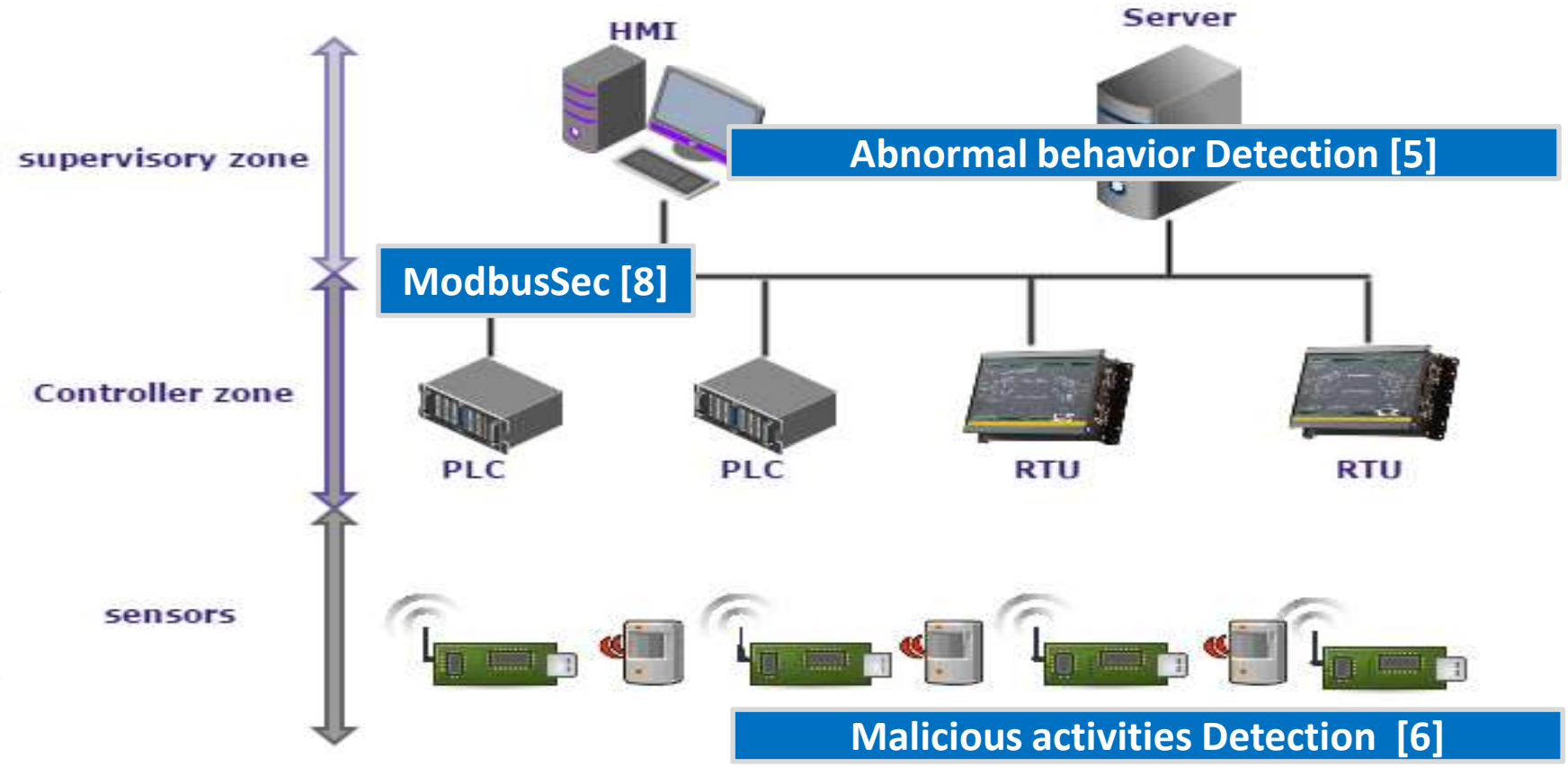


Figure 1: Example of a SCADA network environment

Approach 1 : Log monitoring strategy [5]

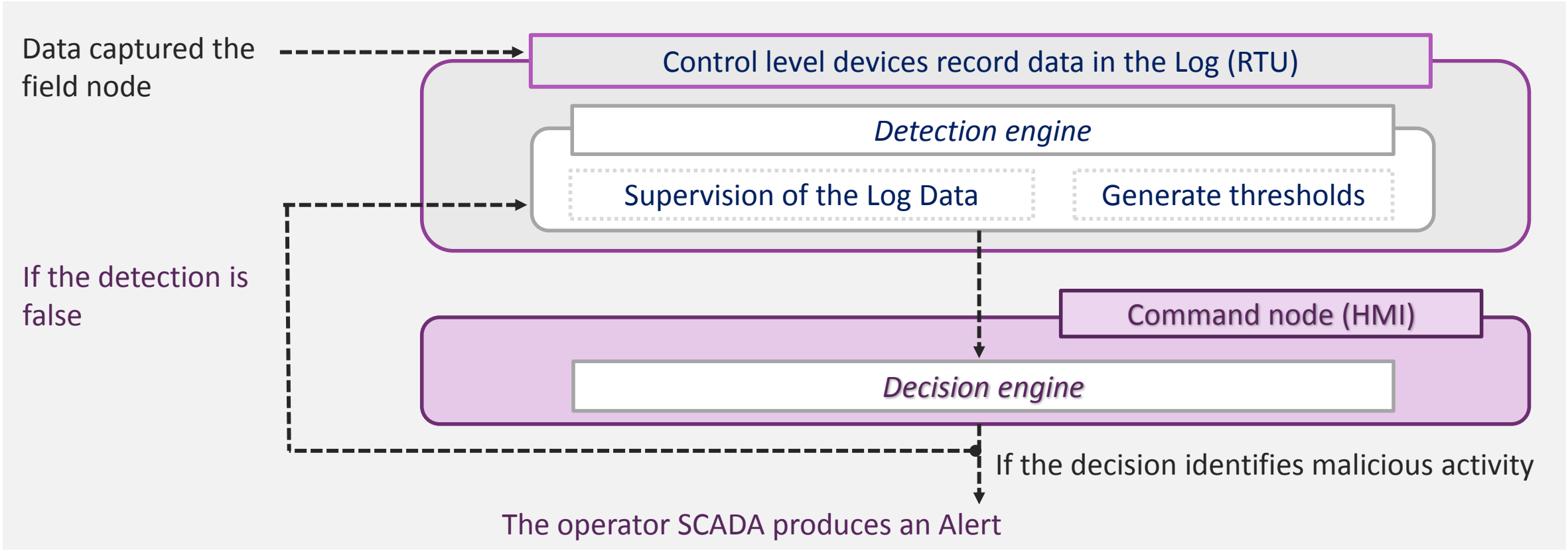
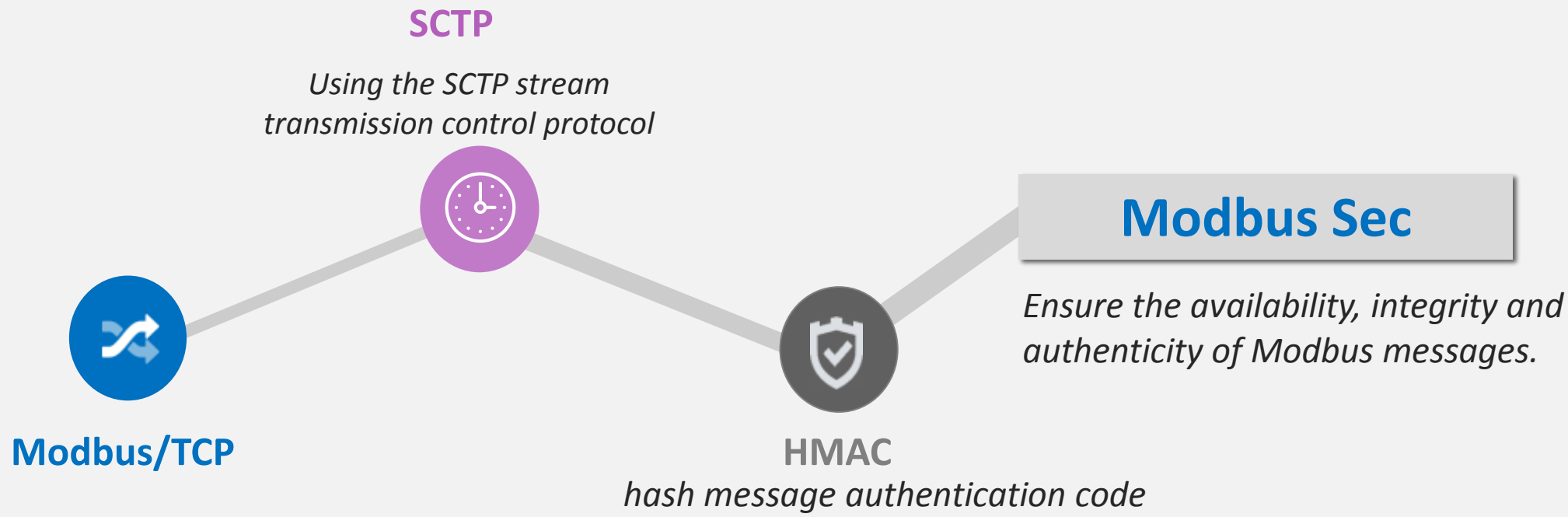


Figure 2 : Log monitoring architecture in SCADA System

Approach 2 : Secure Modbus using SCTP and HMAC [8]

- No Modbus feasible secure implementation exists.
- Modbus dependence on TCP as a transport mechanism has many inherent security risks
  - Increased susceptibility to denial of service attacks



Approach 3 : Modbus/TCP Packet monitoring [5]

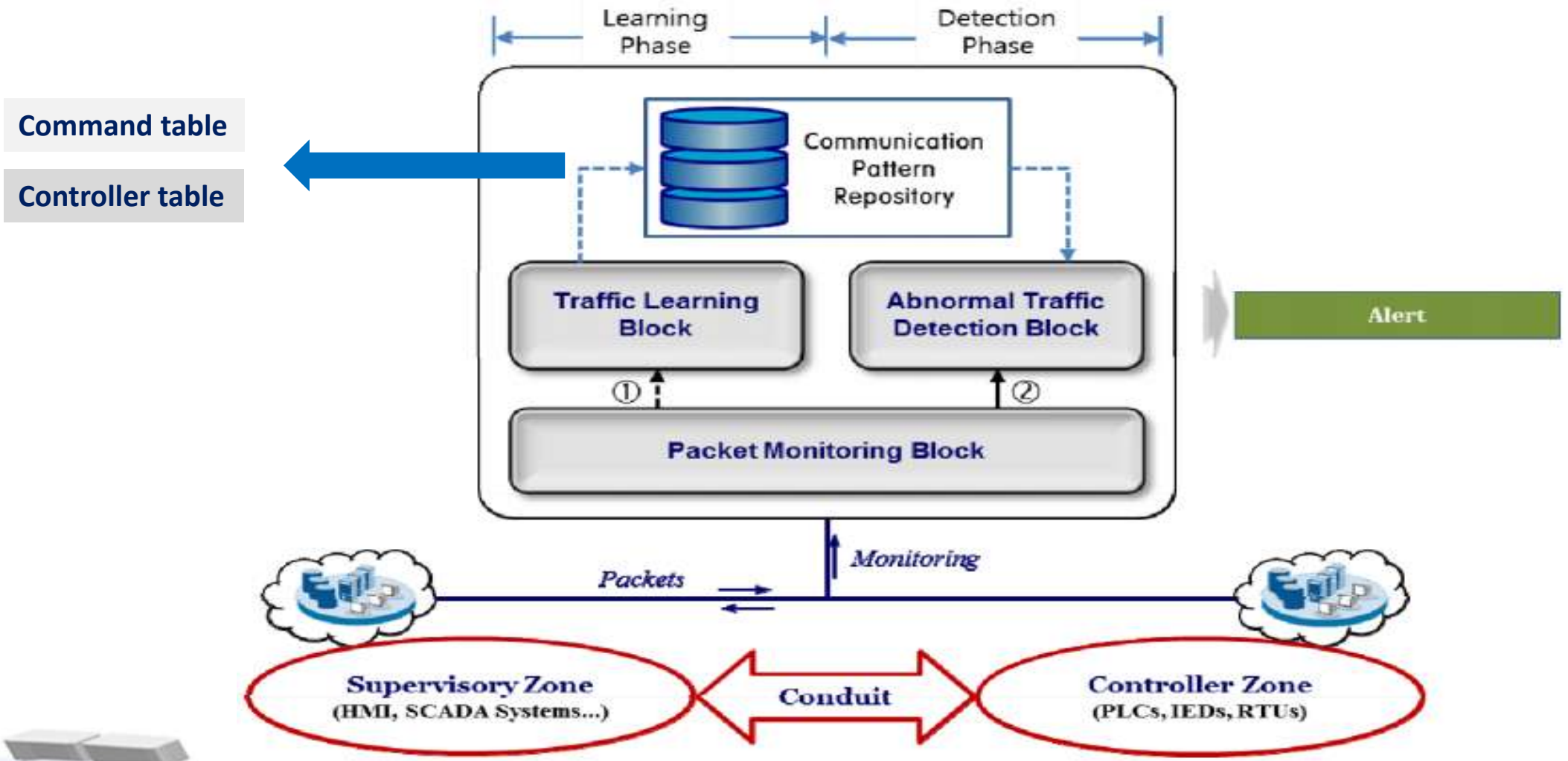
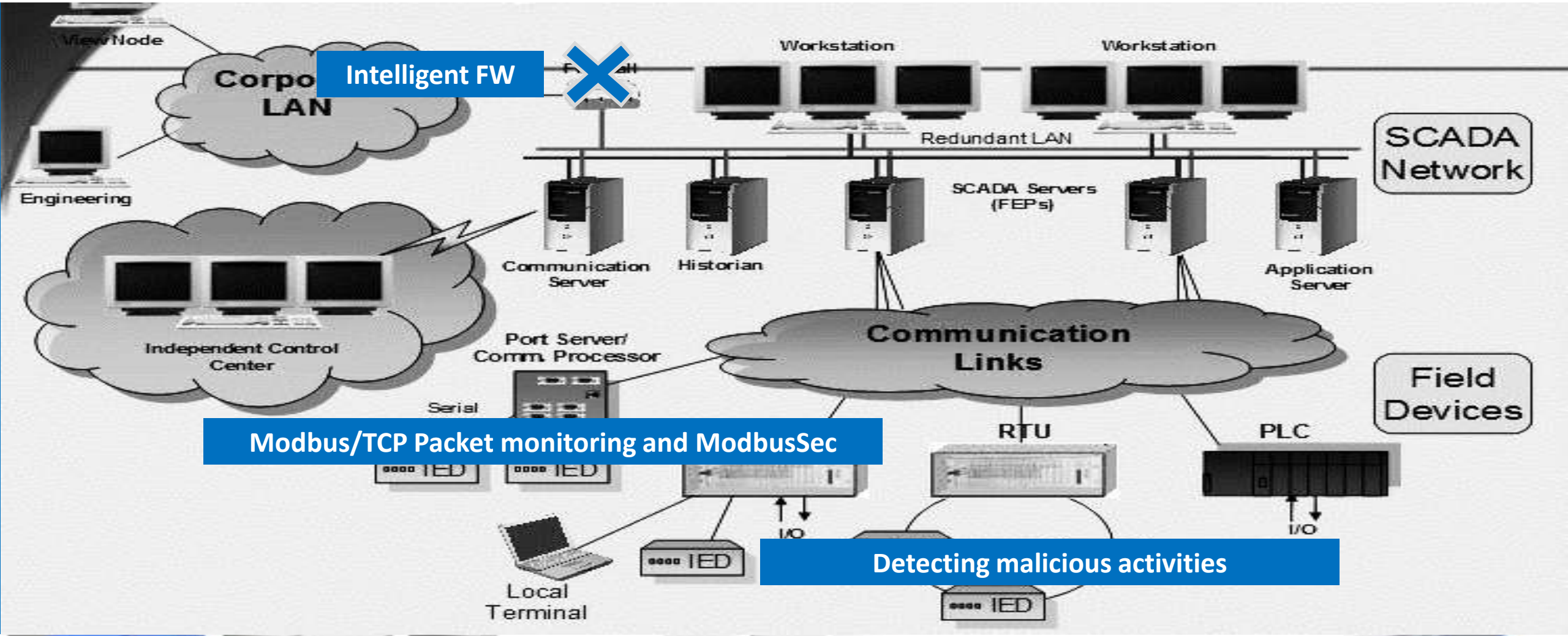


Figure 5 : Modbus/TCP packet monitoring

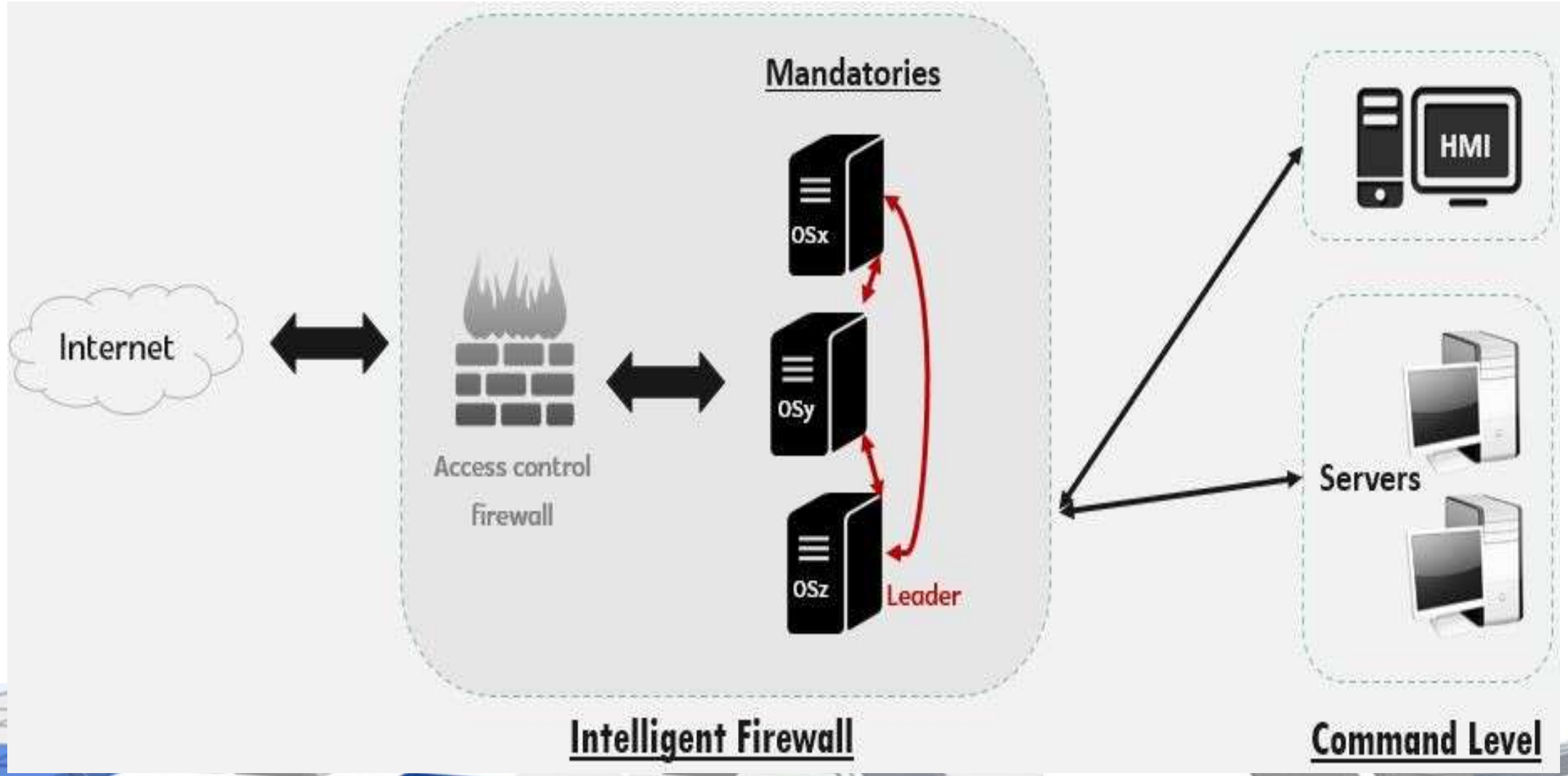
Analysis

1. No protection against Internal threats
2. No protection against External threats
3. No multi level protection
4. No recovery measure

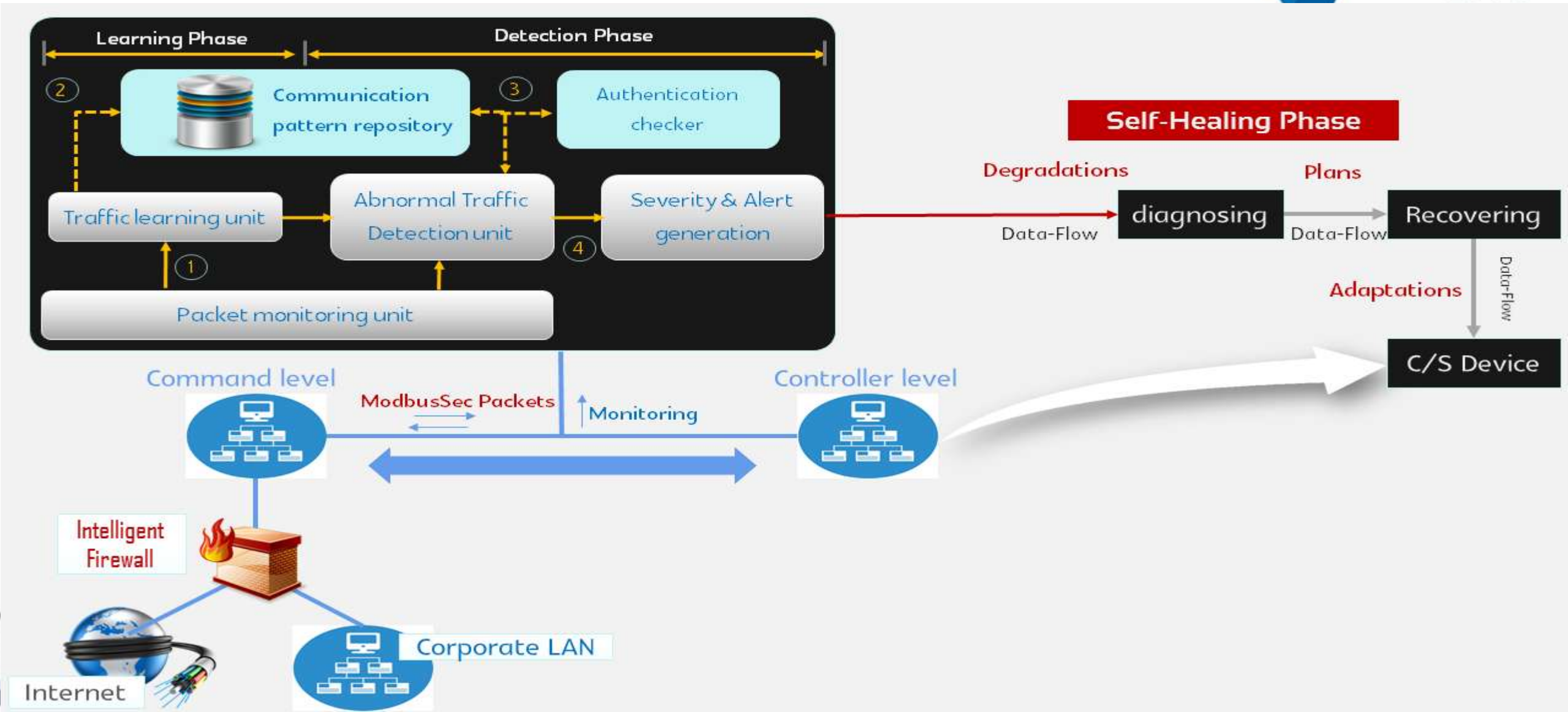
Our Vision


Intelligent FW
Workstation
Workstation
Redundant LAN
SCADA Network
Engineering
SCADA Servers (FEPs)
Communication Server
Historian
Application Server
Independent Control Center
Port Server/ Comm. Processor
Communication Links
Field Devices
Serial
Modbus/TCP Packet monitoring and ModbusSec
RTU
PLC
I/O
I/O
IED
IED
IED
IED
Local Terminal
Detecting malicious activities

The proposed Intelligent firewall



The proposed Architecture



Advantages & Perspectives

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Defense in depth

- Multi Layers protection

Self-Healing

- Recovery

Intrusion Tolerance

- Masking technique

Secure Communication Protocol

- Modbus Sec

Attack	Caused by	Solution	Zone
Any attacks	Internet	Intelligent firewall	Internet and command level
Message spoofing	Lack Device authentication	ModbusSec : HMAC	Command and control level
Replay attacks			
Denial of service			
Man-in-the-middle			
Doorknob-rattling attack	Access control	The occurrence of at least six failed logins in the log within 30 seconds	
Selective Forwarding and Black Hole attack	Compromised nodes	The mechanism uses acknowledgement (ACK)	Control and field level
Sybil attack	Malicious sensors	Our Log records the location with their Ids when a node sends data to its destination. If two identities are recorded from the same Location, Log infers that it is a malicious node.	
Jamming attack	Jammer nodes	If the traffic from the same Node Identity repeats for above or equal to a threshold value it may be from adversaries to cause jamming in the network	

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Slide title

Slide content

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