Fusing Safety and Security on a Solid Foundation for ERTMS

A Platform Approach

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Safety & Cyber Security

Safety: « The state of being free of risk or danger and the means/actions to obtain this state ». The « digital transformation » of Rail Systems requires increased attention on Cybersecurity,

- to avoid operational disruption (availability),
- access to user confidential data, and
- ensure safety is not impaired (system integrity).

Cyber Security: « The protection of information systems from theft or damage, as well as from disruption or misdirection of the services they provide ». 
TAS Platform Use

- Vital HW & SW Platform, common for all Thales signalling applications in Ground Transportation Systems (GTS)
- Enables hardware independent signalling applications
- CENELEC EN50129 SIL4 Certification
- Used in more than 70% of Thales GTS sales:
  - Route control systems: electronic interlocking - LockTrac
  - Field equipment: digital axle counters, warning system
  - Train control systems: ETCS standards L1, L2, L3 - AlTrac
  - Urban rail management control systems - SelTrac
  - Traffic management systems: NetTrac Aramis, operation management centre
Safety: Layered Architecture and Design

- Currently EN 50159 Cat. 2 for Safety is in place.
- Safety is ensured end-to-end
- Security has not been explicitly focused on in the past
  - Products use COTS security components for encryption
TAS Platform – A Generic Safety Case

TAS Platform-based products
- Main Line Rail
- Urban Mobility

Core System TAS Platform SW
Subsystems: OCS, MNT, J4S
- Check of HW-CS SAC
- Validation on HW-CS
- Approval with HW-CS

Safety Application Conditions (SAC)
- SW components
  - Analyses
  - Verification
  - Validation
- HW components
  - Analyses
  - Verification/Validation
  - Manufacturing

Generic TAS Platform
Generic CENELEC approval

ETCS
Interlocking
On Board
Field Elements

TAS Platform Engineering & Environment

TAS Platform-based products
- Main Line Rail
- Urban Mobility

Safety Application Conditions

TAS Platform Services
- HW Core System
  - Analyses
  - Verification/Validation
  - Safety Case
  - Manufacturing
  - Approval

Distributed Development / Maintenance (Thales)
Overview TAS Platform – A Closer Look

- Safety approval according to CENELEC 50129 SIL 4
- Safety layer
  - Fault tolerance
  - Health monitoring (Online Hardware Testing)
- Board support package
  - Communications interfaces / drivers
- Based on COTS hardware / operating system
  - Kernel patches to address safety, security, and maintainability
- Support 25 years of application business logic (with changing underlying hardware and software)
- Security functions supplied with COTS components (OS and libraries)
Security Management

- Process definition based on ISA/IEC 62443
  - Customer requirements are considered
  - TAS Platform as „Component“
    - ISA/IEC 62443-4-1
    - ISA/IEC 62443-4-2
- Apply defined Security process
- Security process in-line with safety process
Security Vulnerability Management

- Part of the security process
- CVE management tool developed by Thales
- Automatic scan of used Linux packages for possible affected CVEs
- Based on CVE NIST database

<table>
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<tr>
<th>CVE Statistics</th>
<th>Count</th>
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<td>CVEs with pending analysis</td>
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<td>Reviewed CVEs</td>
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<tr>
<td>Summarized CVEs</td>
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</table>
TAS Platform in Unsecure Networks

- Several security requests received (partly implemented, in implementation, or planned)
  - Move to “category 3” networks according to CENELEC EN 50159 (unsecure networks)
  - Deployment of system development processes which consider security throughout the development
  - Additional “typical” requirements: Logs, patch management, authentication modules, ...
- Challenges:
  - Long-term availability in field and safety conservative update challenge system security (legacy)
  - Legacy applications (need continued support) – “don’t change interface/hardware/...”
TAS Platform Security – Patch Management

- Following standards: IEC TR62443 2-3 for Patch Management
- Separate safety and security life-cycles
  - Using suitable architectures and processes or physical separation of security and safety functions

TAS PLF Safe and Secure Releases

Provide safety and security releases (security releases verified only according to security process)

TAS PLF Additional Security Releases

NOTE 3 Sometimes it can be necessary to balance between measures against systematic errors and measures against security threats. An example is the need for fast security updates of SW arising from security threats, whereas if such SW is safety related, it needs to be thoroughly developed, tested, validated and approved before any update.

Safety and Security Life Cycle is Different

Comment in draft norm (prEN50129:2016)
Security Zone and Conduits #1

- Zones and conduits defined according to ISA/IEC 62443-3-3
- Up to now all components are in one zone
- Only up to EN 50159 Cat. 2 network is possible
Security Zone and Conduits #2

- Security Features (CyberGate as integrated firewall)
- Connection to other zones possible by conduits
- Enabled for EN 50159 Cat. 3 network
- TAS Platform (A) is exchangeable without re-certification of safety-critical functionality and TAS Platform (B)
Security Zone and Conduits #3

- Isolation Layer / MILS Platform (Multiple independent levels of security)
  - Separate security from safety
  - Performance / resource usage by security features must be restricted and predictable
  - Availability through redundancy (independent boards, links, and CyberGate instances)
  - Safety-critical functionality is always provided with redundancy
Summary

▲ Security is becoming a real concern
▲ Multiple security assessments and customers have driven and are driving improvements of Thales applications and TAS Platform
▲ TAS Platform architecture has already been ready for security extensions – simple integration of security functions
▲ Overlaps in processes in achieving security and safety

We are ready!
And, never stop improving ...
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