Applying Kaspersky Security System technology in CITADEL, trustworthy platform for Critical Infrastructure resilience

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CITADEL
CRITICAL INFRASTRUCTURE PROTECTION USING ADAPTIVE MILS

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Agenda

1. Project overview
2. Demonstrators
3. Why MILS and what is Adaptive MILS
4. State monitoring based on Kaspersky Security System
5. Challenges and current accomplishments

Project Overview

The CITADEL Project is a collaboration amongst market leading industrial organisations who operate critical infrastructures in Europe, leading software tools and platform technology companies, and research organisations that develop advanced technologies for security and reliability.

What is this project about

- Critical infrastructures are the dynamic systems that demand reliability, robustness, **resilience**, security, and other attributes
- These systems while proving high assurance must be developed, certified, deployed, and maintained at an affordable cost.
- To be resilient, a system must be adaptable

Project implements adaptive MILS in new and evolving adaptive systems contexts having strategic focus within the EU, such as Critical Infrastructures and the Internet of Things, where adaptability is a crucial ingredient for the safety and security of future systems

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Demonstrators

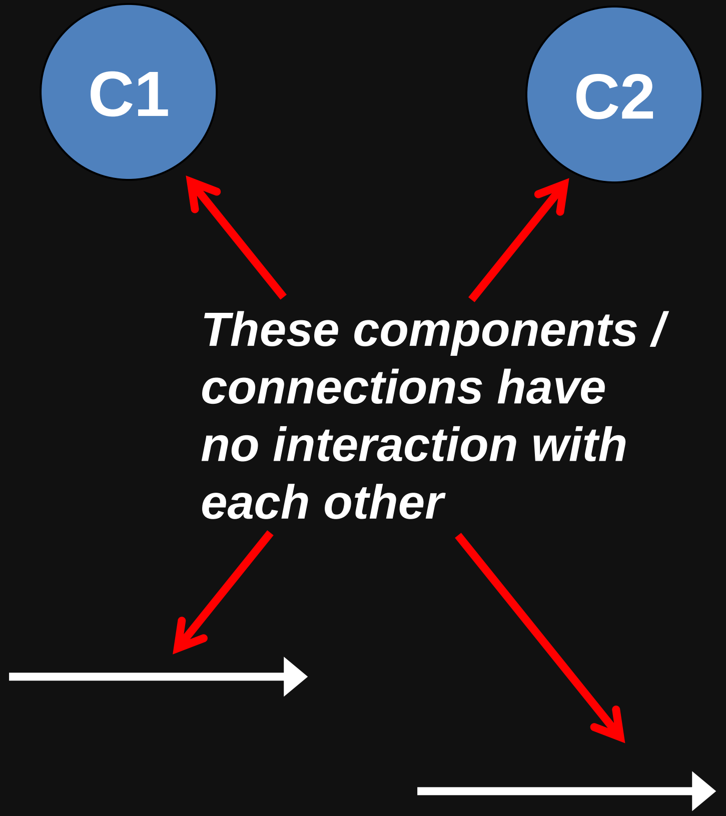
Industrial Demonstration #1: Frequentis Communication Services. A unique class of communications equipment and software that serves very special purposes in safety of life critical and security sensitive areas (civil and military Air Traffic Control, Emergency Call Dispatching, Police , Ambulance and Firefighters, Coastal and Harbor Control etc.)

Industrial Demonstration #2: UniControls / Prague Rail. The objective of the UniControls subway transportation case-study is to develop a novel solution that enhances the security of the existing Prague subway networks.

Industrial Demonstration #3: JWO/OAS Manufacturing. The objective of the JWO/OAS manufacturing case study is to demonstrate the use of the CITADEL solutions to enhance security of production facilities, where a control system provider optimises security of the production processes in a manufacturing client’s factory.

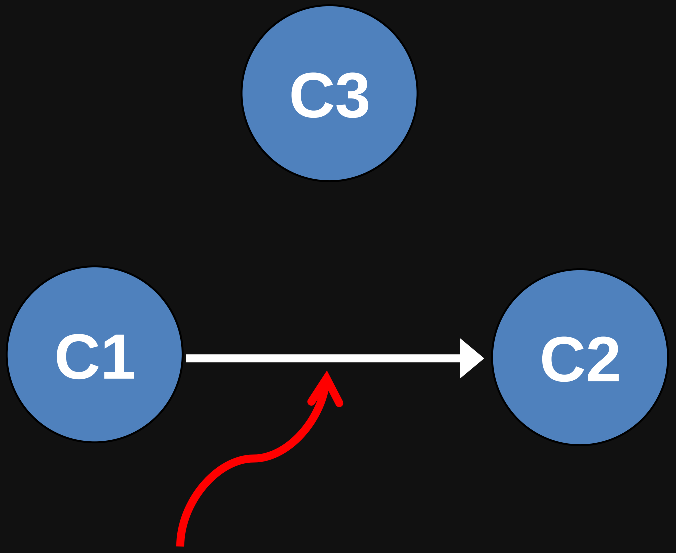
Why MILS and what it is about. Assumptions

1. Isolation



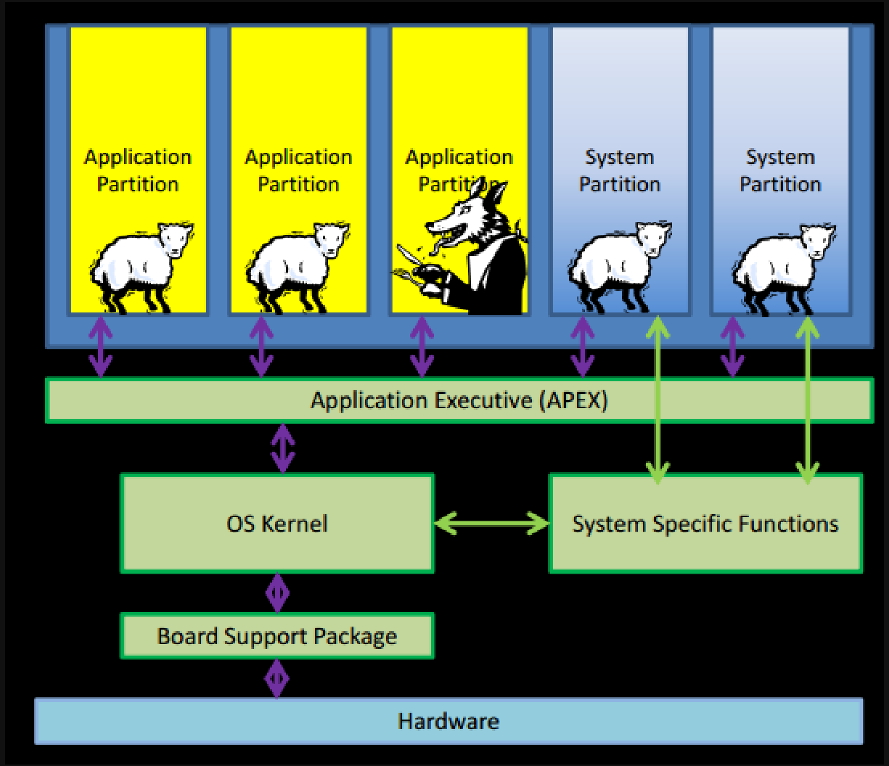
These components / connections have no interaction with each other

2. Information Flow Control

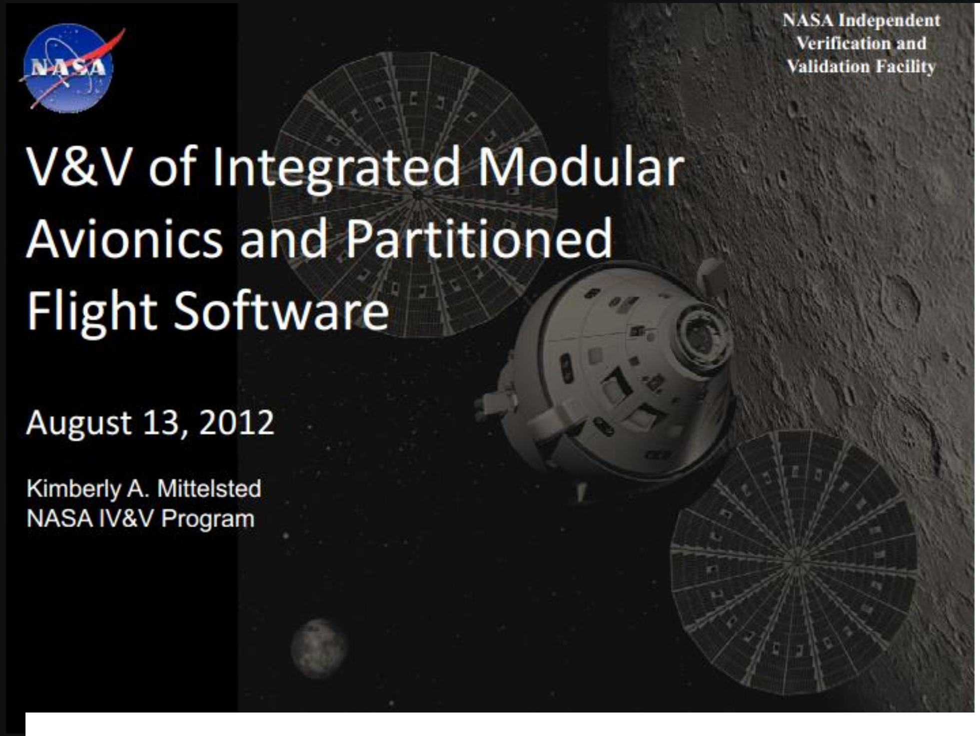


Only *explicitly permitted* causality, or *interference*, is permitted. The architecture *permits* this flow. Only C1 or C2 can *cause* the flow, not C3. The flow is directional and intransitive.

The Roots



Source: https://www.nasa.gov/sites/default/files/3-5b-2012_workshop_presentation_on_arinc_653_20120822_submitted_pdf.pdf



Design and Verification of Secure Systems

Reprint of a paper presented at the 8th ACM Symposium on Operating System Principles, Pacific Grove, California, 14–16 December 1981. (ACM Operating Systems Review Vol. 15 No. 5 pp. 12-21)

John Rushby*
Computer Science Laboratory
SRI International
Menlo Park CA 94025 USA

Evolution of MILS approach*

The idea behind MILS:

— Secure systems are multicomponent systems that cannot be distinguished from distributed ones
— Separation Kernel is a part of Trusted Computing Base

The goals:

— Safety and Security
— High Assurance
— Support of diverse security policies

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Distributed MILS, Dynamic MILS, **Adaptive MILS**, Heterogeneous MILS, Mixed-Critical MILS, Autonomous MILS…

2016
Era of Progressive MILS, 2012-2016 and beyond, built on Modern MILS concepts

2012
The era of "Modern MILS" 2008-2012 – spawned distributed & dynamic MILS

2008
Separation Kernel Protection Profile.
First commercial implementations

2004
Rushby engaged with MILS community in 2004
Research on MILS funded at SRI International 2004-2012

2000
Recognition that commercial partitioning kernels for avionic safety applicable to security.
Rediscovery of Rushby's Separation Kernel

1980-2000
Rushby's work
Separation Kernel as a base for secure systems

*Dates are approximate

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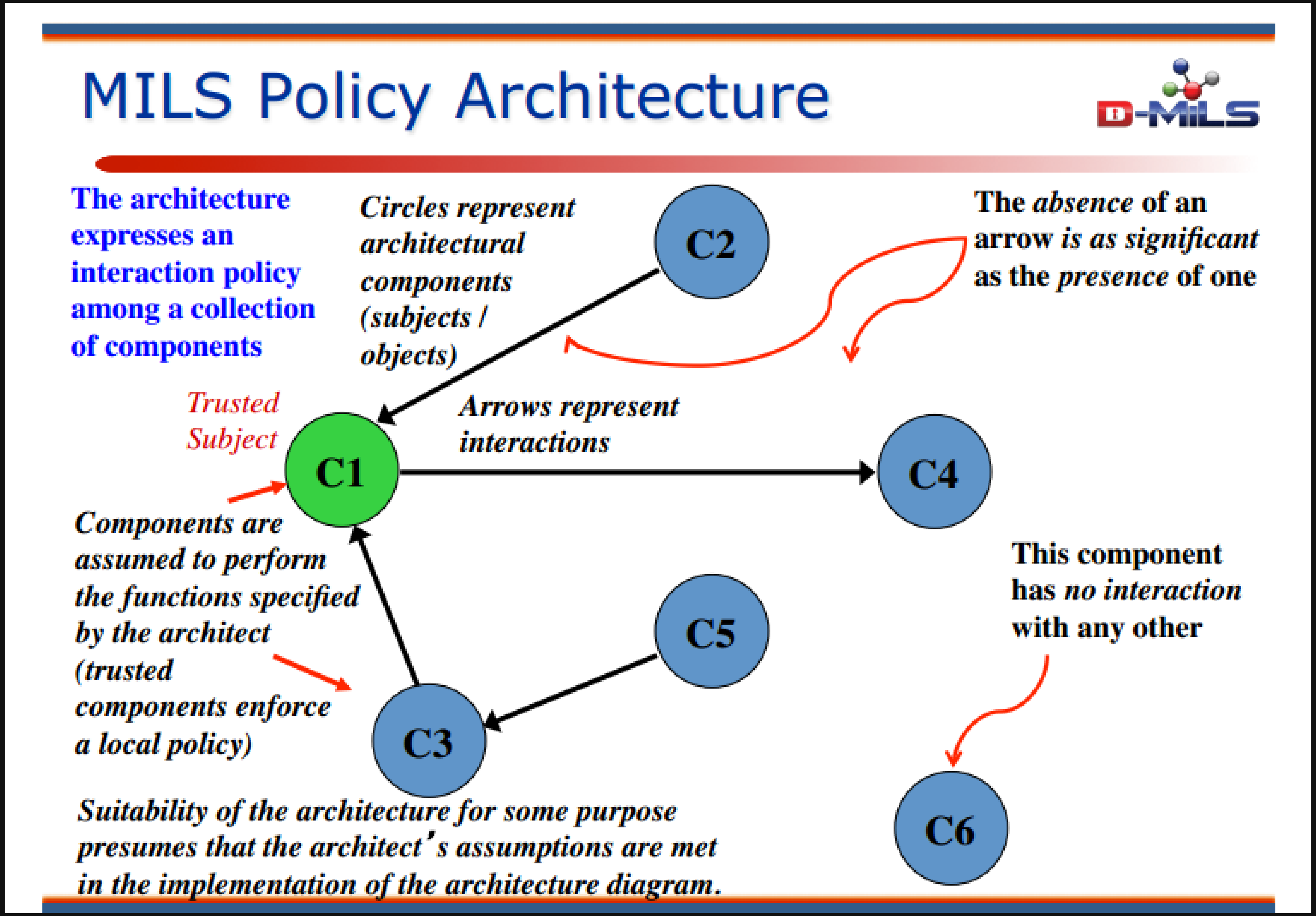
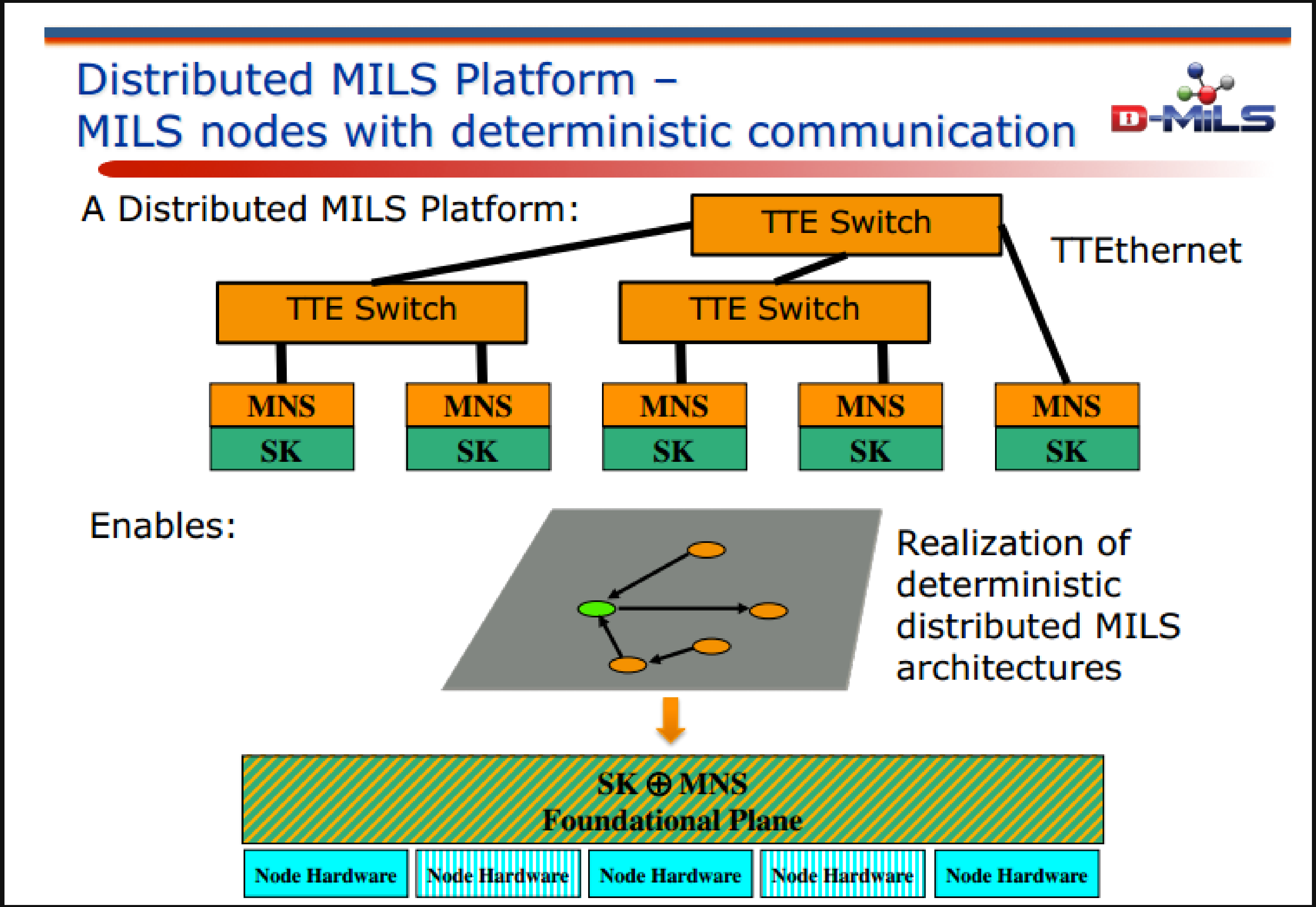
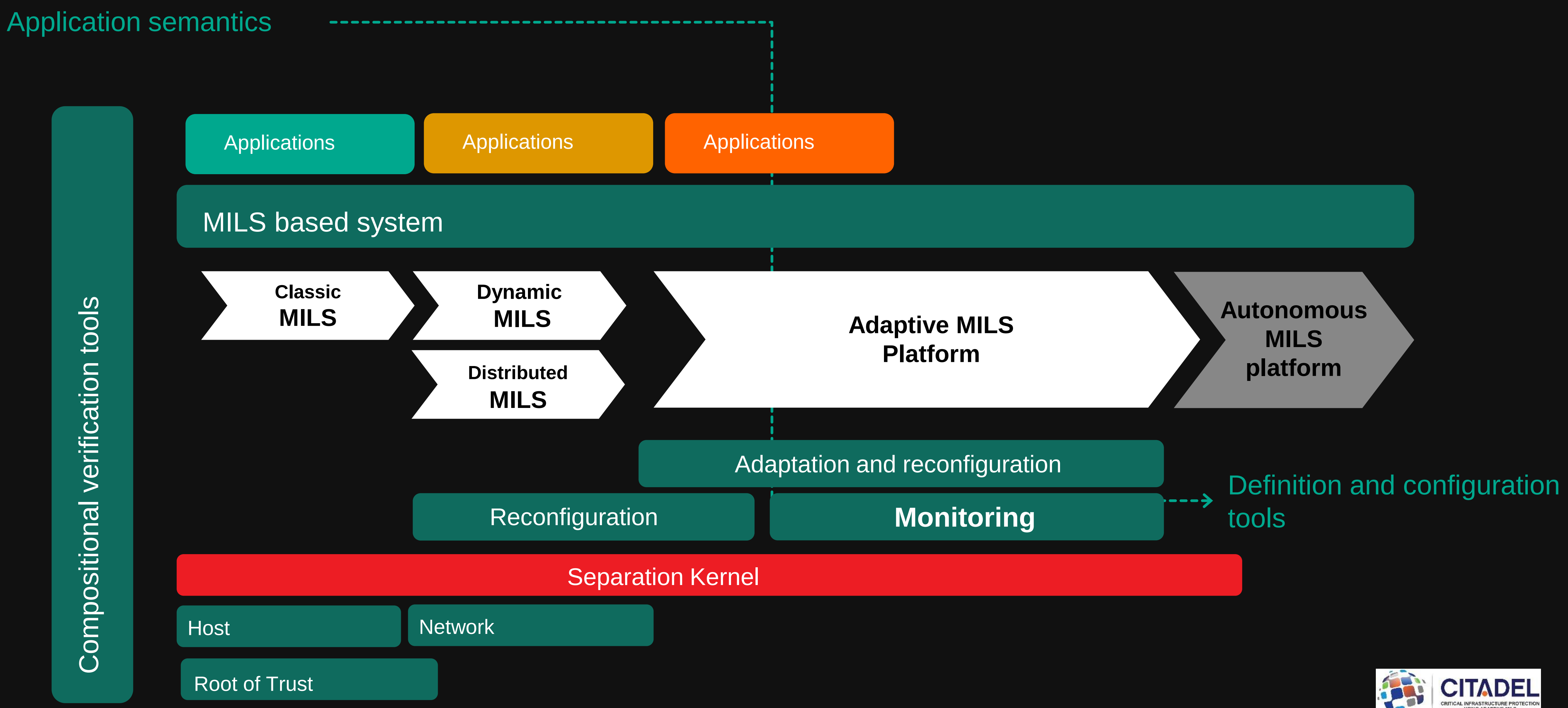
Why MILS and what it is about. Policy Architecture



Distributed MILS (D-MILS Project)



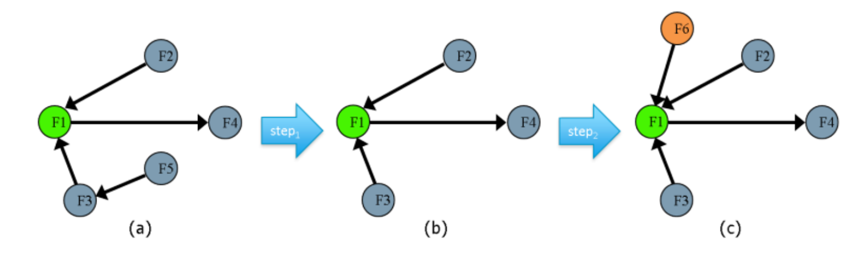
Adaptive MILS Platform



Dynamic MILS и Adaptive MILS for CII Resilience

CII needs to be resilient. The most of CII systems are complex and therefore demonstrate unexpected behavior in case of external impact

Resilient system is adaptable to external impact



Some researchers considers adaptable systems as imitating living organisms
Adaptive MILS is closer to imitation of human behavior

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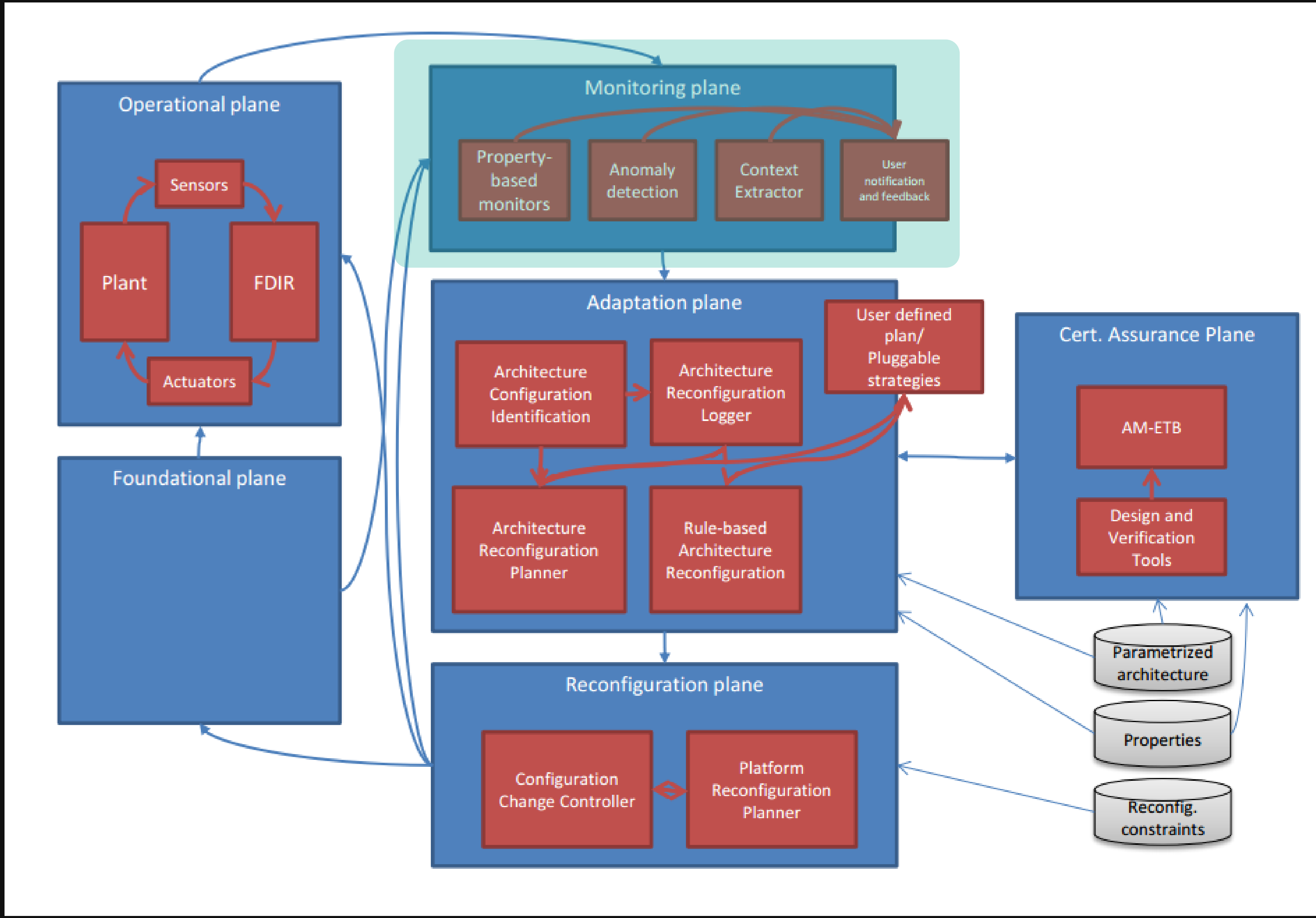
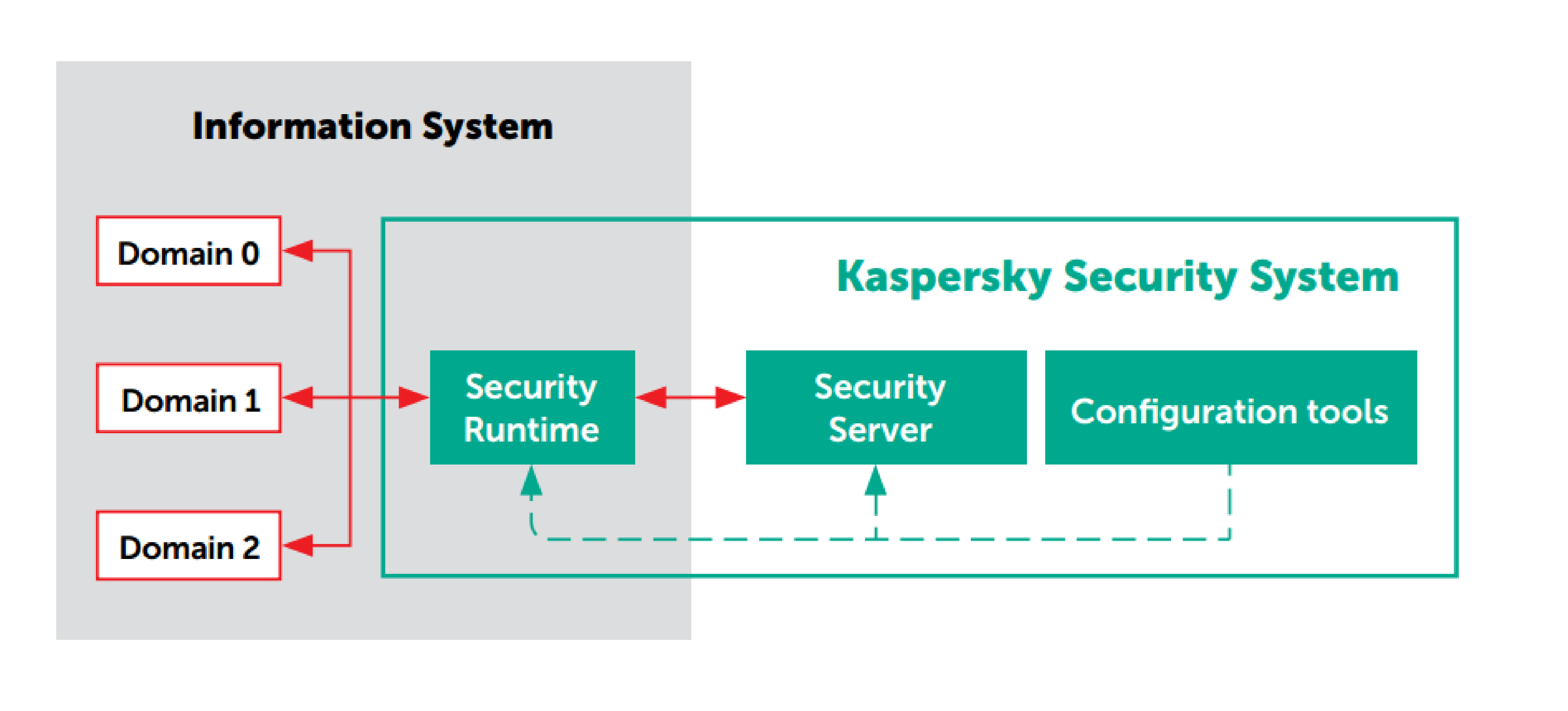
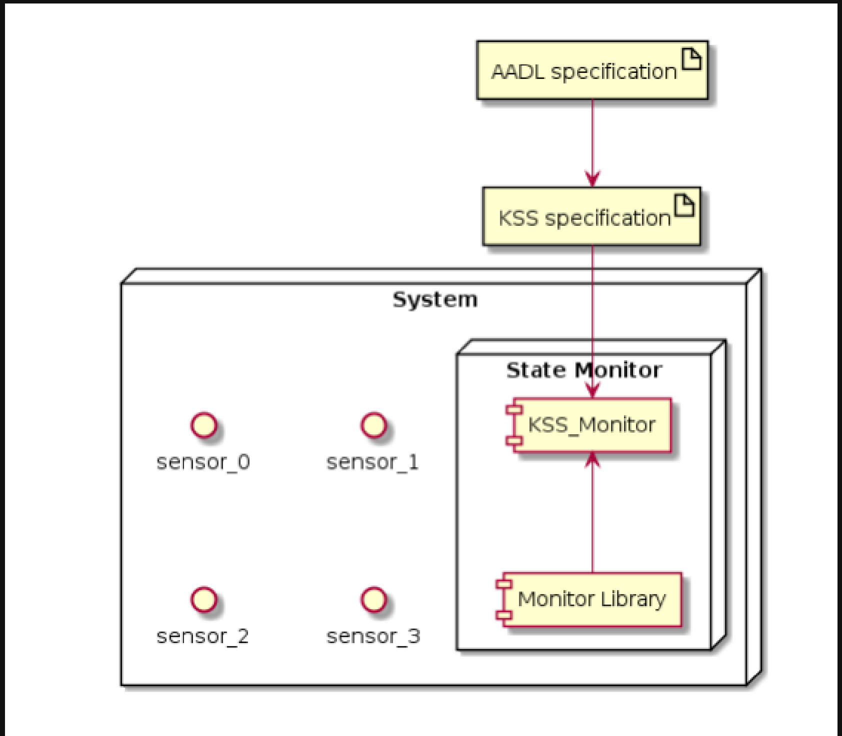
The role of State Monitoring (Kaspersky Security System)

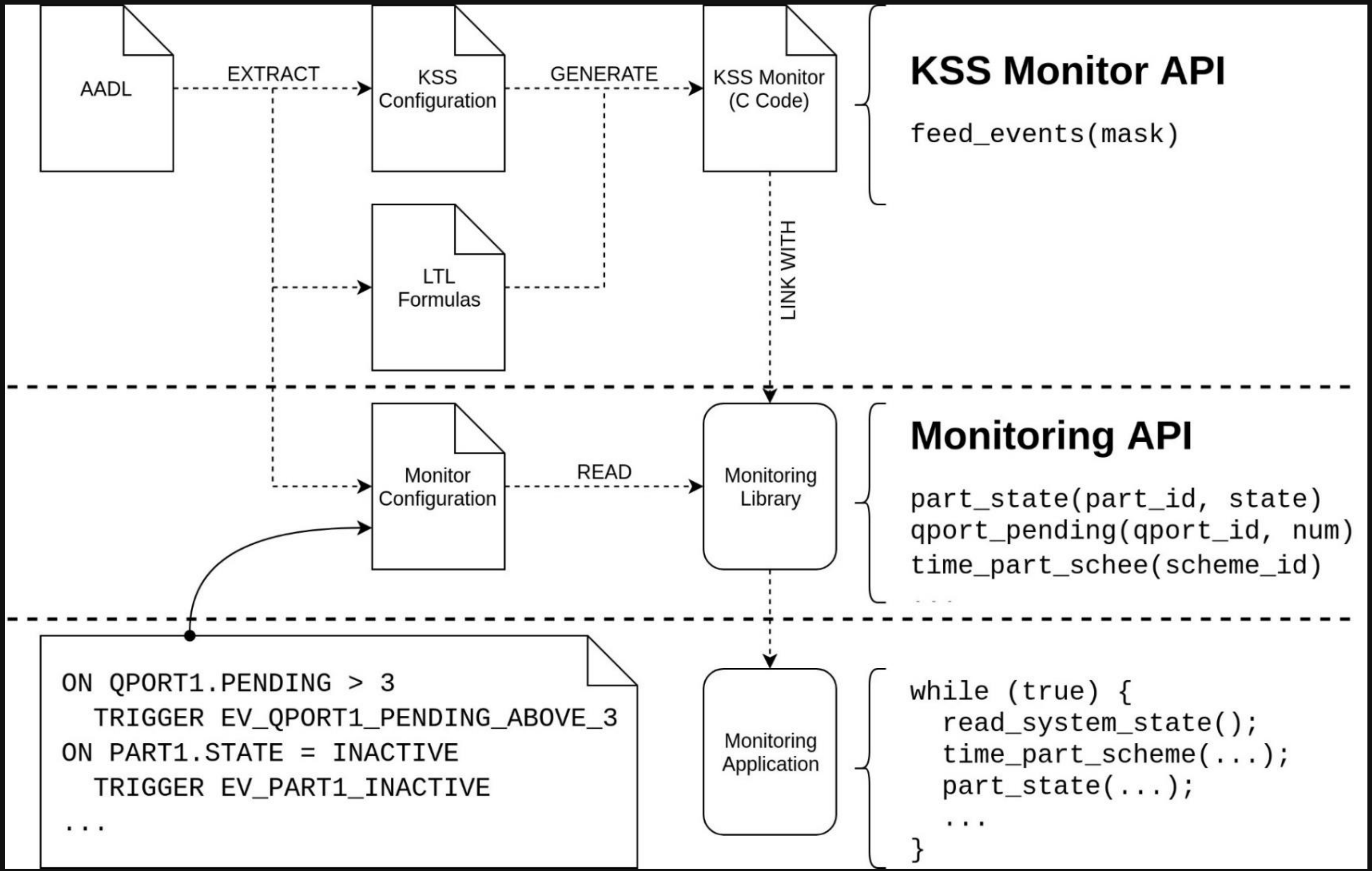


Implementation of state monitoring based on Kaspersky Security System



KSS integration with Adaptive MILS platform





Examples of informal policies :

- Time between heartbeat events should be no longer than 2 seconds.
- No more than 2 mixers should be running at the same time.
- Time between mixer startups must be no less than 1 second.
- Sensor B value can be greater than 0.8 for no longer than 3 seconds.
- If Sensor D value is greater than or equal to 0.5 then Sensor C can be greater than 1.4 for no longer than 3 seconds.

Formal Models

Boundary conditions

Signatures

Linear Temporal Logic

...

Access authorization

Metric Temporal Logic

Counters

Project pitfalls

Varying technology maturity

Responsibility

Implementation comprehensiveness

Integration

Interaction (14 partners!)

External control

Paper work

Questions?