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'CROSS BORDER COOPERATION FOR CLEAN TECHNOLOGIES'
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pSHIELD

pilot embedded Systems arcHItecturE for multi-Layer Dependable solutions

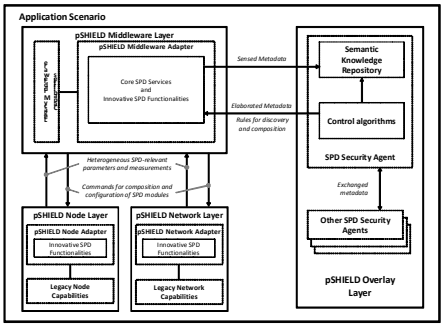
pSHIELD SPD Power Node Prototype

INTRODUCTION

This poster presents the work under development towards the definition of a **Secure-Private-Dependable** Power Node Embedded System **framework**, as a part of the pSHIELD SPD architecture.
The pSHIELD project, co-funded by **ARTEMIS JOINT UNDERTAKING**, aims at being a pioneer investigation addressing Security, Privacy and Dependability (**SPD**) in the context of Embedded Systems (**ESs**) as "built-in" rather than as "add-on" functionalities.
Within this strategy, pSHIELD is proposing and perceiving the first step toward SPD **certification** for future embedded systems.
The project intends to have a great **impact on the ES market** regarding security, privacy and dependability, by addressing **reusability** of previous designed solutions, **interoperability** of advanced SPD technologies and the **standardized SPD certifiability**.

pSHIELD LAYERED ARCHITECTURE

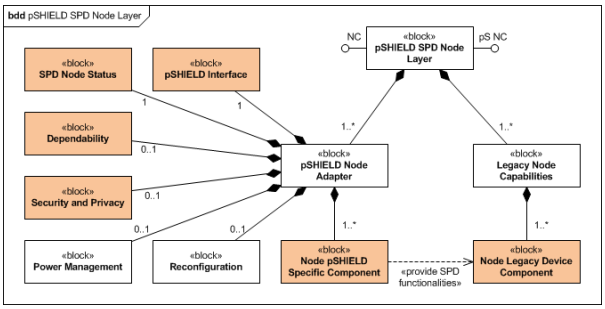
The **pSHIELD framework** is composed of **four layers**: **Node, Network, Middleware** and **Overlay**. The output of each layer is available at the upper level which will take advantage of **SPD features** developed at a **lower level** empowering SPD features of all pSHIELD architecture in a **transparent but manageable** way.



pSHIELD SPD Functional Component Architecture

SPD NODE LAYER ARCHITECTURE

At node layer there may be distinguished **three different kinds** of Intelligent ES Nodes: **Nano Node, Micro/Personal Node** and **Power Node**. These three node types, which can be considered three node levels of **increasing complexity**, represent the basic components of the **lower part** of the **SPD Pervasive System**.



pSHIELD SPD Node Layer Conceptual Model

INTERFACES

- **pS-NC** - pSHIELD Node Capabilities interface with the Middleware Layer:
  - To enable the SPD composability
  - To provide Node pSHIELD-specific functionalities
  - To provide access to legacy Node capabilities
- **NC** - legacy, technology-dependent, Node Capabilities

INNOVATIVE SPD

- **pSHIELD Interface** – physical interface to the pSHIELD Network
- **SPD Node Status** – collection and disclosure of SPD-relevant parameters and measurements. Checks on system health status for self-recovery, self-reconfiguration and self-adaptation
- **Reconfiguration** – module or system reconfiguration for recovery or new functionalities
- **Dependability** – self-dependability at node layer: error detection and system recovery. Checkpointing service provider
- **Security and Privacy** – hardware and software security and privacy service provider.
- **Power Management** – power sources management

LEGACY CAPABILITIES

- **Legacy Node Capabilities** – consist of one or more **Legacy Device Components**, such as CPU, I/O Interfaces, Memory, Battery, etc. By Legacy is meant any third-party or of-the-shelf device
- **pSHIELD Node Adapter** – composed of **Specific Components**, the innovative SPD functionalities provided to each of the Legacy Device Components, such as status, metrics, or checkpoint-recovery

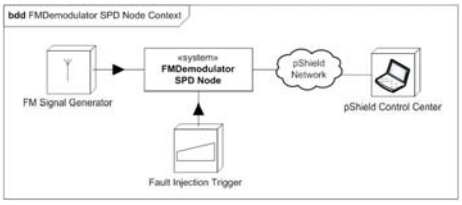
pSHIELD SPD POWER NODE DEMONSTRATOR

Dependable, Secure and Reconfigurable FM Demodulator

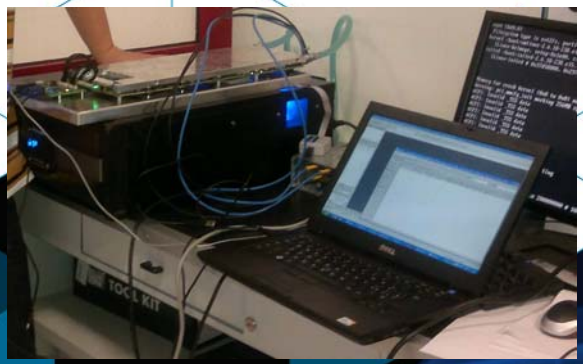
- **Demonstration of**:
  - Node Legacy Device with SPD functionalities:
    - pS-NC interface
    - SPD metrics
    - Self-recovery from hardware transient faults (through fault-injection)
    - Auto-reconfiguration
    - Data encryption
  - Provision of security and privacy services – hardware data encryption/decryption

DEPENDABLE, SECURE AND RECONFIGURABLE NODE DEMONSTRATOR FUNCTIONS

1. **FM signal demodulation**
   - Demodulates incoming FM Signal
   - Processes & analyzes the characteristics of the sampled signal
   - Provides all the valid samples to the pSHIELD Network
2. **Dependability**
   - Rejects the invalid samples
   - Recovers from device failure: FPGA reprogramming
3. **Metrics**
   - Collects performance results
   - Collects dependability and security measurements
4. **Security**
   - Decrypts demodulated data
5. **Reconfiguration**
   - Self-adapts to changes in modulated carrier: FPGA partial reconfiguration



Node Layer Application Scenario



EUROTECH Rugged High Performance Computing Node

Advanced Research & Technology for Embedded Intelligence and Systems

Works conducted in frame of:
pSHIELD WP3 - SPD Node
Task 3.2 - Power node

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