



**Using CNES LVCUGEN as  
OSRA Execution Platform**  
*OSRA-EP requirements coverage by LVCUGEN*

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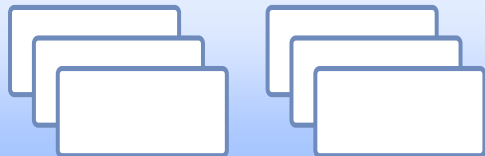
**ADCSS2023, 13-Nov to 15-Nov**

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## Survey

**Who knows OSRA ?**

## Applications



Mission dependent  
(e.g. AOCS, Thermal, Power, P/L  
Manager, System Mode  
Management, Planning / Autonomy)

Interaction layer

## Execution Platform

Automation

Software Execution  
Environment

Monitoring and Control

External System Access

Network & Device  
Access

Protocol Handling

Hardware Execution  
Environment

TSP based Runtime

Classical Runtime

## Execution Platform

### Automation

Time-Based  
Automation

Position-Based  
Automation

Composite  
Commands

Event-Based  
Automation

Onboard  
Control  
Procedures

### Software Execution Environment

Life-Cycle  
Management

Context  
Management

Tasking and  
Concurrency

Partition  
Management

Error Reporting

Support  
Libraries

### Monitoring and Control

Application  
Commanding

Parameter  
Access and  
Reporting

Parameter  
Statistics and  
Monitoring

Event  
Distribution  
and Reporting

Parameter  
Acquisition and  
Pooling

Onboard  
Logging

### External System Access

Remote  
Platform  
Access

Time Access  
and Correlation

Remote Device  
Access

### Network & Device Access

Device  
Commanding and  
Data Acquisition

Subnetwork  
Access

### Protocol Handling

Monitoring and  
Control Protocol  
Handling

Data Transfer  
Protocol Handling

Onboard  
Communications  
Protocol Handling

### Hardware Execution Environment

Platform  
Management

Time Access and  
Distribution

Packet Store  
Access and  
Management

File System  
Access and  
Management

### TSP based Runtime



### Classical Runtime



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## Survey

**Who uses an OBSW architecture / framework  
that can claim a kind of compliance with OSRA ?**

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## **Survey**

**Who uses an OSRA-compliant  
framework supplied by another company (off-the-shelves) ?**

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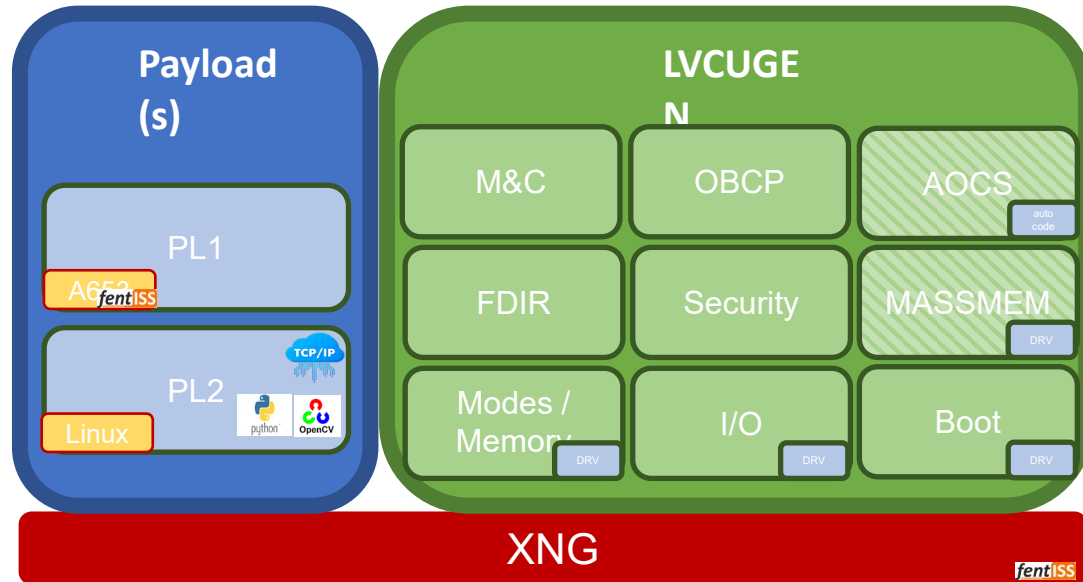
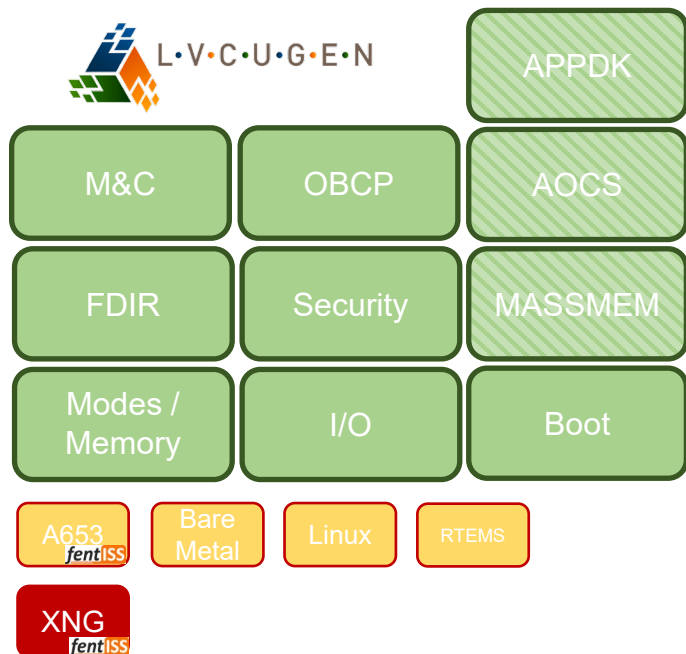
## Survey

**Who has decided not to use on a project an OSRA  
feature / service because this feature was not available /  
already developed ?**

## Introduction

- **LVCUGEN was first designed to implement TSP mechanisms to allow multi-critical applications implementation on the same hardware:**
  - LVCUGEN first aimed at helping to develop payload software, supplying an off-the-shelves “computer + TC/TM PUS management” perimeter strictly segregated from payload applications
  - It quickly grew up to cover many platform needs (including PUS services with the CNES libPUS product)
  - It is now used to develop equipments and platform onboard software at CNES (and is also used outside CNES)
  - It offers a generic execution platform supporting the TSP paradigm
- **OSRA comes from a generic top-down reflection on software architecture**
  - OSRA was designed to improve and standardize onboard software architectures
  - It is based on MDE and CBSE in order to promote independent OBSW components development

# LVCUGEN in a nutshell

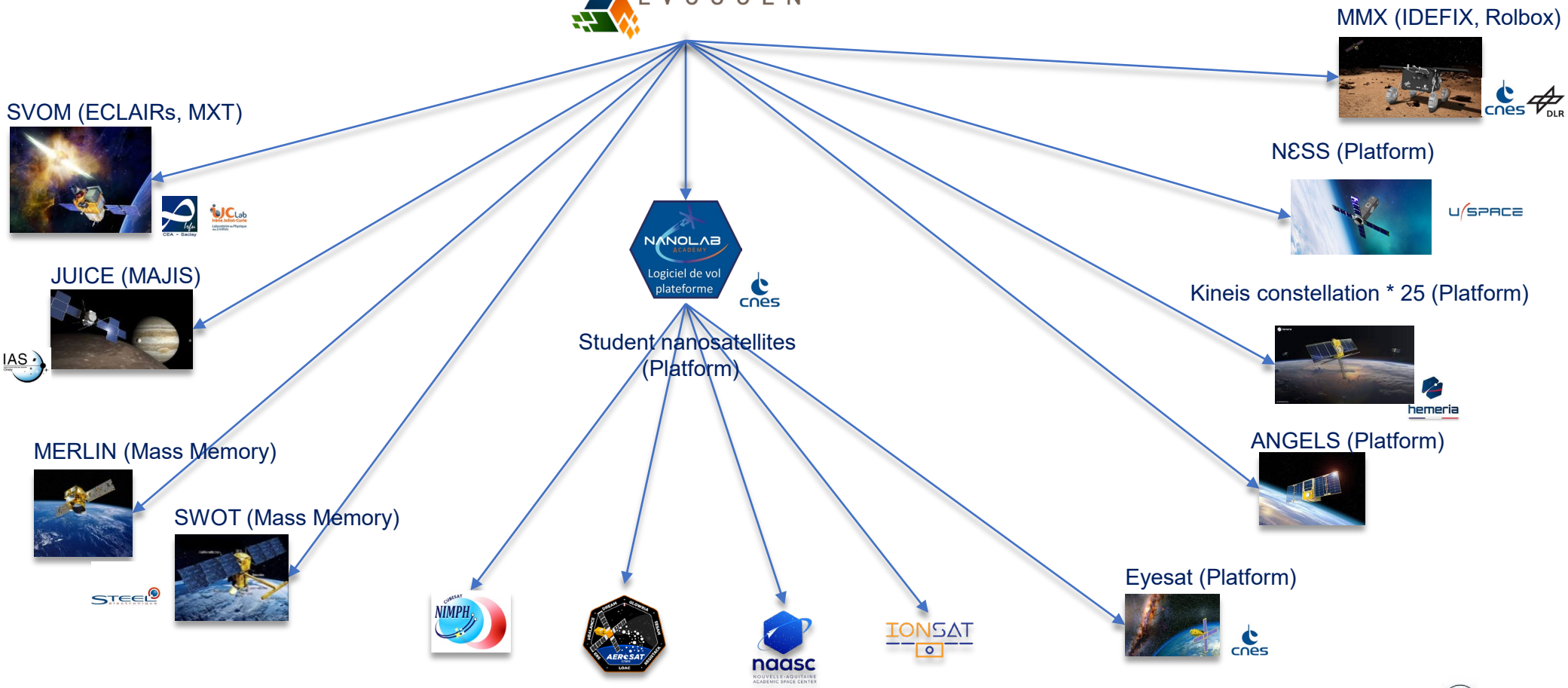


Qualified level B components off the shelves and full devOps

Instanciated OBSW



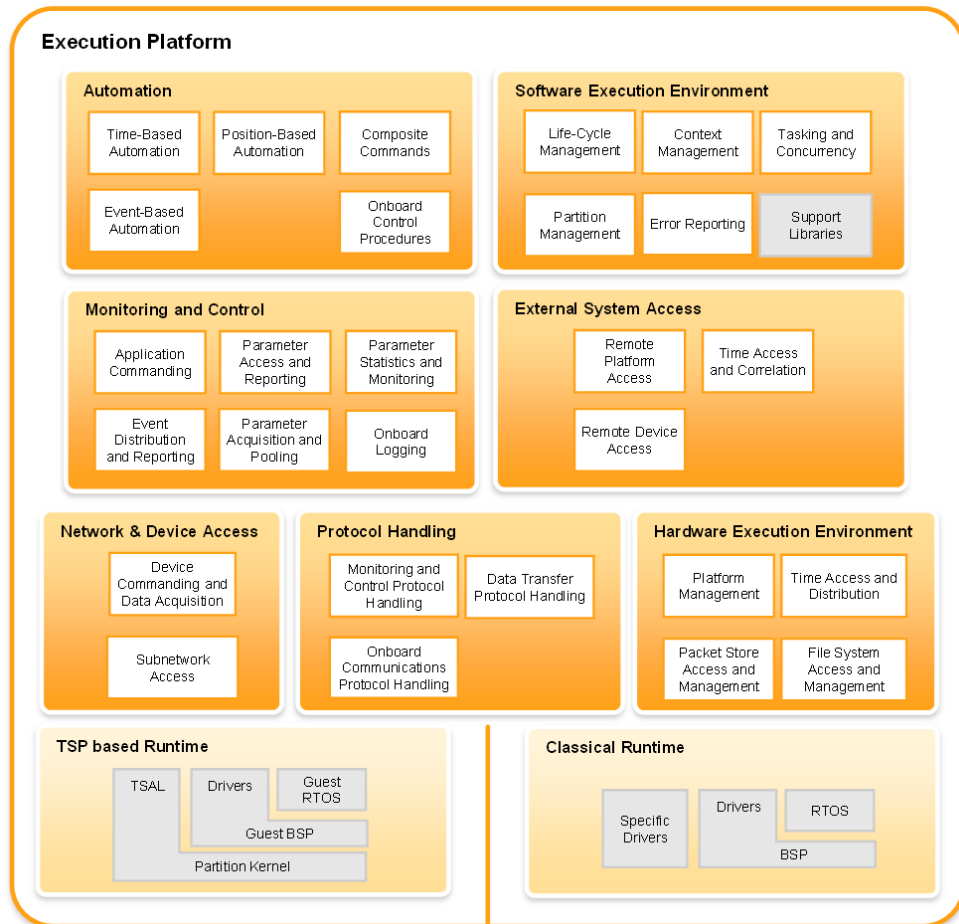
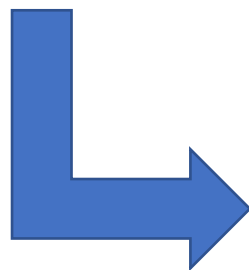
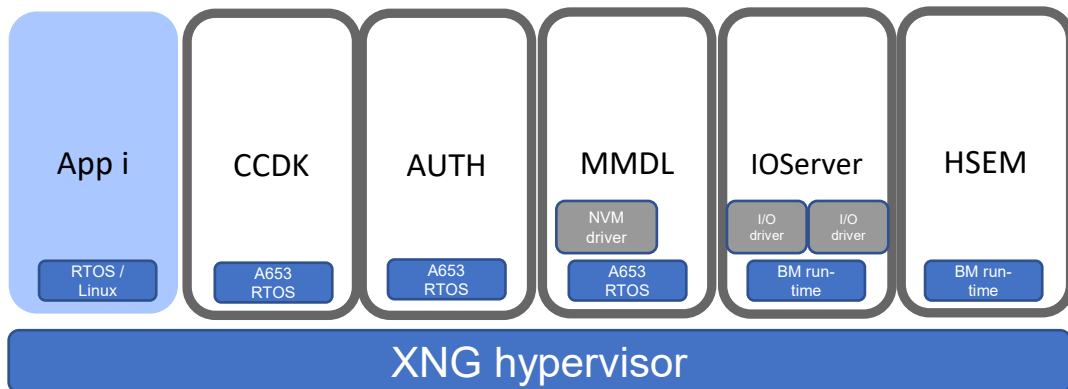
# LVCUGEN deployments



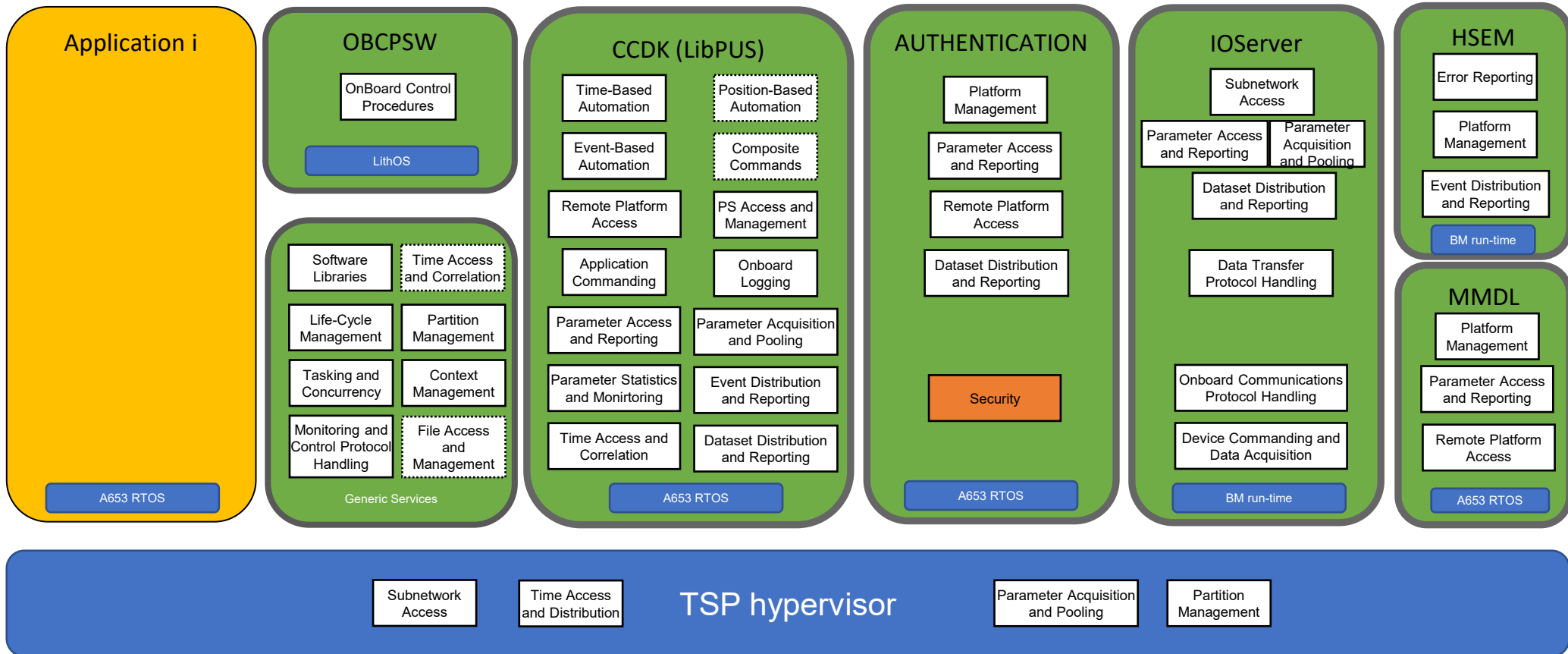
## Generic LVCUGEN vs instantiated LVCUGEN

- **LVCUGEN is « device agnostic »...**
- **...but many OSRA-EP requirements require to know hardware behavior**
- **Coverage of OSRA-EP shall be made with**
  - **Generic LVCUGEN**
    - Lots of « compliant-able », but HW-specific parts (I/O drivers) remain user plugins.
    - Hard to fully cover requirements since the needed functionality often exist in one of the LVCUGEN products but not « off the shelf » (for instance: a context management service exists but only if an application is its client).
  - **Instantiated LVCUGEN**
    - Which hardware to select amongst existing OBSW based on LVCUGEN ?
    - NANOLAB platform SW seems to be a good candidate

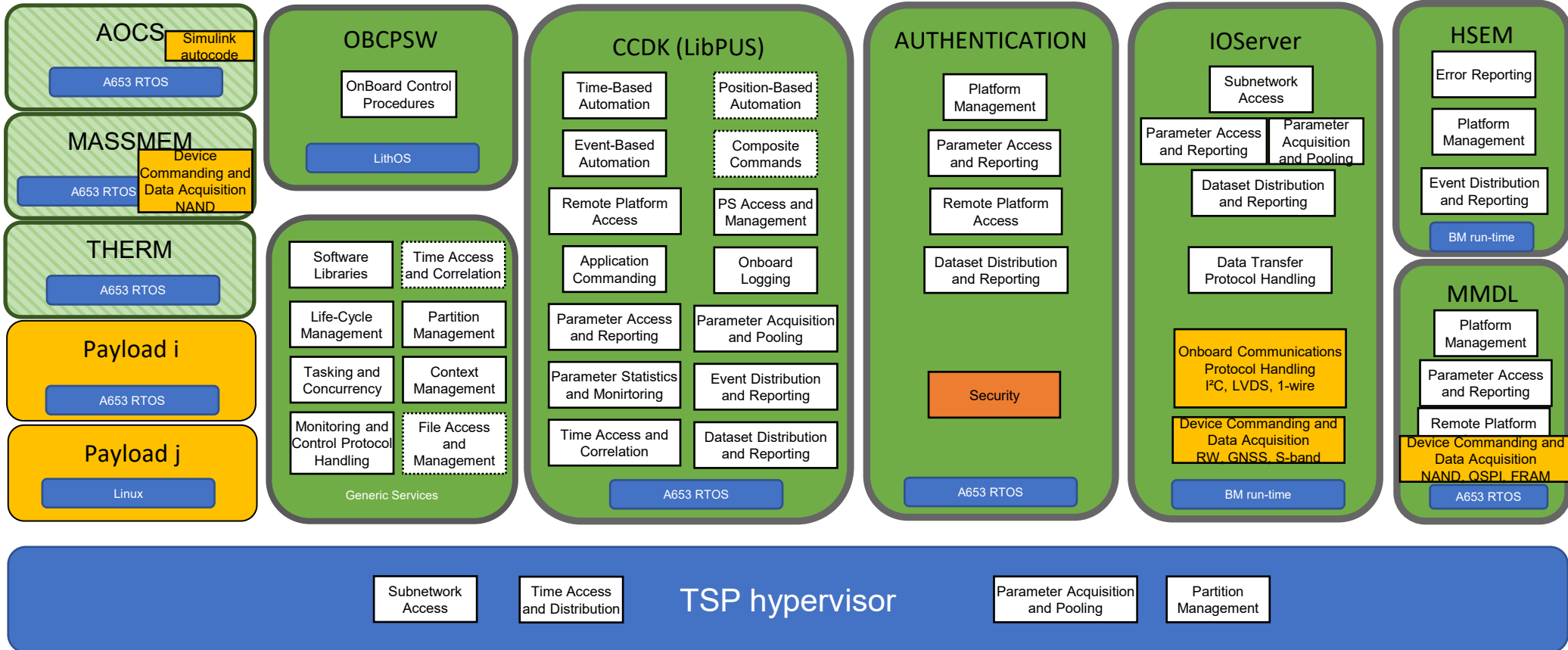
# From LVCUGEN to OSRA-EP



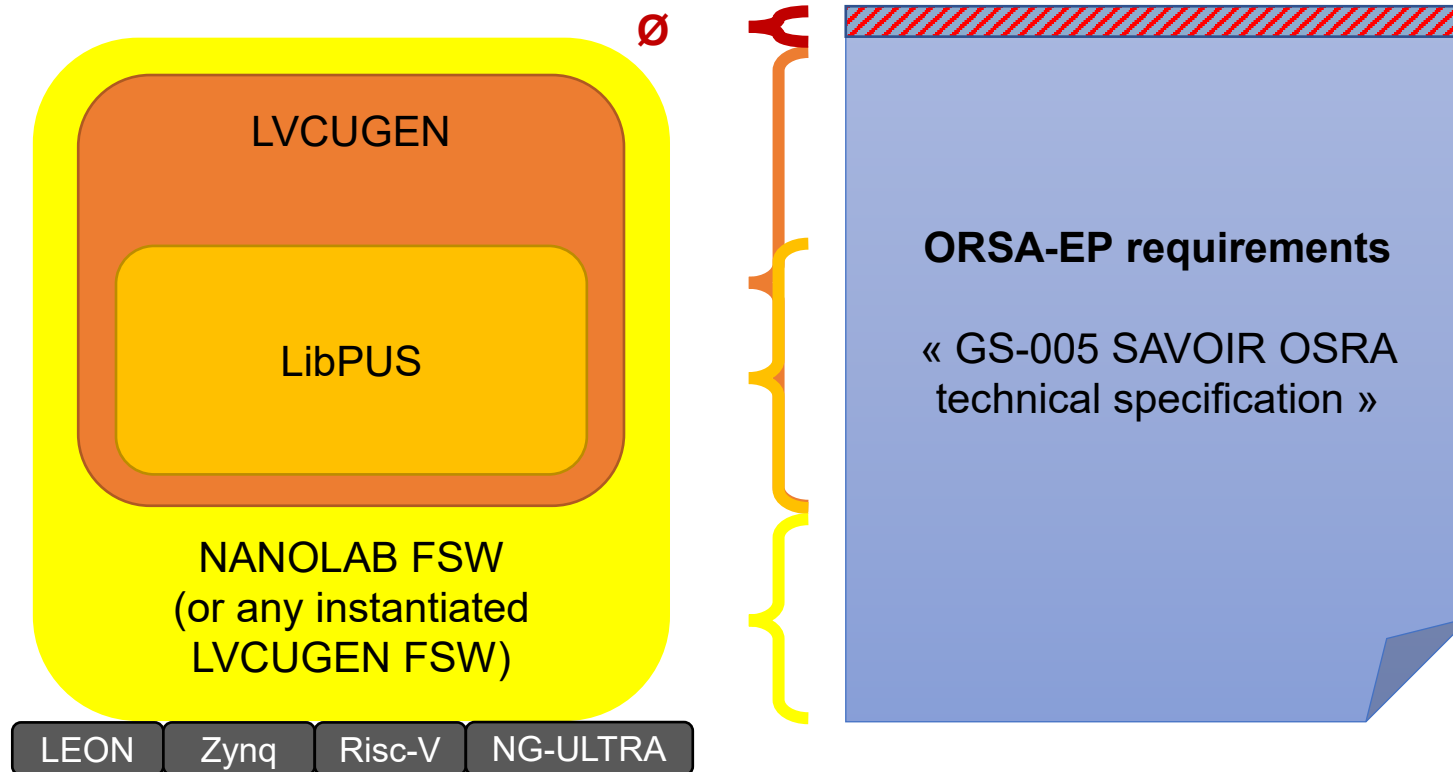
# LVCUGEN dressed up as OSRA-EP



# NANOLAB SW from a OSRA-EP viewpoint



# Big picture of LVCUGEN OSRA-EP coverage



## Conclusions (1)

### ➤ OSRA-EP coverage synthesis

- LVCUGEN is already compliant with a large number of requirements
- “Generic” LVCUGEN cannot be considered compliant to some requirements because the identified functionality remains to adapt to the final hardware (a driver is missing or a client application is missing for a service available).
- “Instantiated” LVCUGEN (i.e. NANOLAB FSW, with drivers developed for specific devices, and final applications) complies with most OSRA-EP requirements

### ➤ Almost all the OSRA requested features are covered

- 177 requirements over 190 are covered
- Interesting (complex) features are available off the shelves
- ... and they are qualified ECSS level B

➤ **LVCUGEN (without XNG) is available under a free license for EU scientific projects.**

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## Conclusions (2)

- **US/NASA already published 2 frameworks (cFS and F') in open source**
  - All the US actors (and even more) can use these frameworks for their space OBSW, focusing on their core added-value.
  
- **Sharing utils qualified OBSW components in our European space developments may be profitable to most of the (small) actors.**