



## ROADMAP

Future very integrated avionic for satellite platform base  
on hi-rel component NanoXplore NG-Ultra and Dahlia SoC

DSO/TB/ET, DSO/TB/LV, DSO/AVI/AV, DSO/AVI/VS CNES

(Presenter: L. CLARAC DSO/AVI/AV)



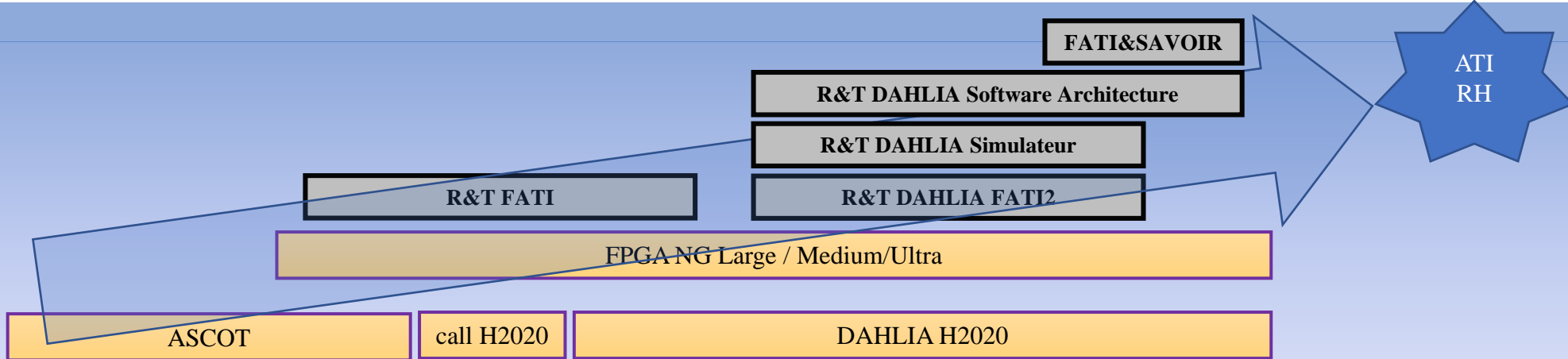
ADCSS 14/11/2019

## Context

### □ Initiative for Hi-Rel solutions for avionic & space applications

- ✓ Preparation of the next generation of de System-On-Chip in the frame 2020-2025
- ✓ ASCOT (Arm Spacecraft Controller On 65nm Technology) and FATI (“Future Avionic Très Intégrée”)
- ✓ Assessment of the impacts of more compact on-board avionics systems
- ✓ Development of competitive FPGA products by European company NanoXplore

2013    2014    2015    2016    2017    2018    2019    2020    2021    2022



### □ CNES Research & Technologies Plan and the Projet H2020 DAHLIA

## Context: Projet DAHLIA H2020

DAHLIA is an answer to the H2020 topic “*COMPET-1-2016: Critical Space Technologies for European Strategic Non-Dependence*”

<http://dahlia-h2020.eu>

DAHLIA solution is an ARM-based System on Chip implemented in 28nm FDSOI technology designed to boost competitiveness and ensure strategic non dependence of future European Space

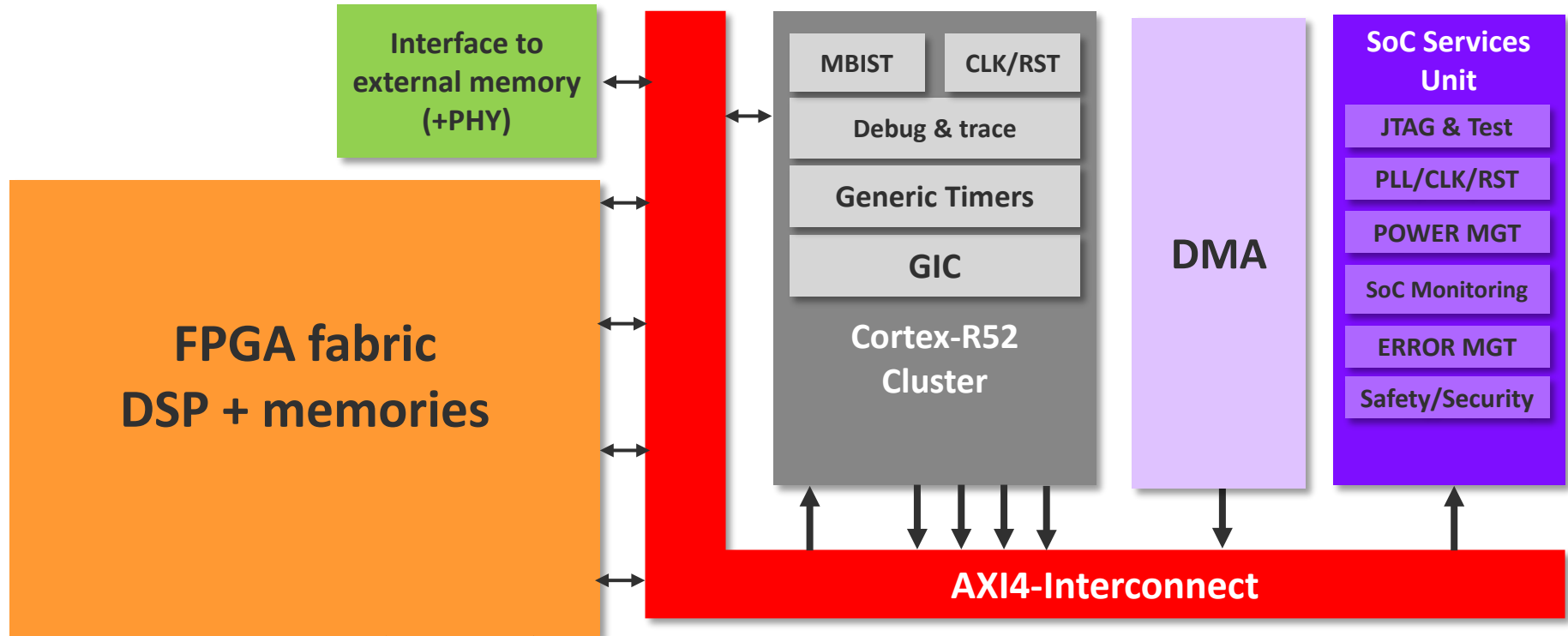
## H2020 project organization



Consortium: 7 partners – 4 countries

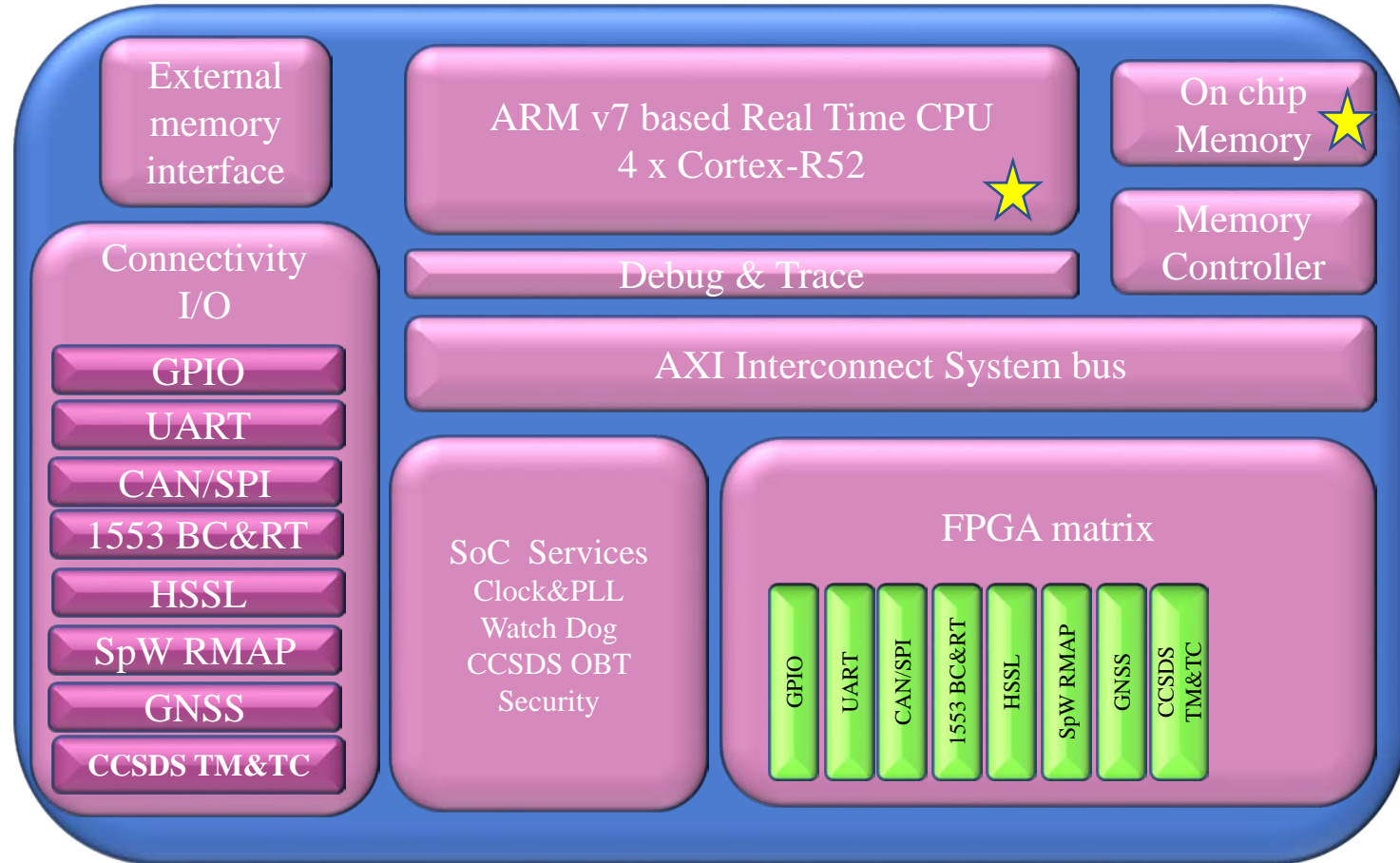
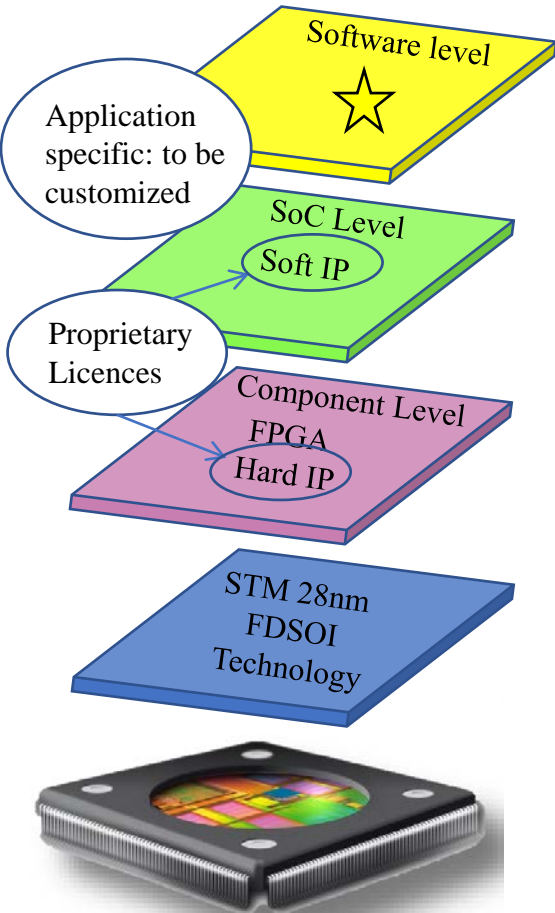
- ST France, coordinator
- Airbus D&S Germany& France
- Thales Alenia Space Italy& France
- ISD Greece& NanoXplore France





Architecture BRAVE NG-Ultra

# Context: Multi Processor SoC defined in H2020 DAHLIA project



## Future areas of work

**1- Define  
Integrated  
Avionic  
Architecture**

**3- Enhance  
maturity of  
development  
environment**

**5- New roles for  
actors in  
integrated  
architecture**

**2- Development  
Qualification of  
NG-ULTRA  
component**

**4- Produce  
Building blocks  
for Integrated  
Avionic**

**6- Enable New  
comers & Users  
for integrated  
avionic**

## Future areas of work

# 1- Define integrated Avionic Architecture

## 1.1 Integration level definition: HW/SW partitioning integration choice

- ✓ Choice of centralises or de-centralize architecture
- ✓ Choice of functions to integrate with impact on functions and equipment design

## 1.2 Integration of new functions

- ✓ Impact on architecture of payload function integration

## 1.3 Data and control stream analysis

- ✓ Choice of the interfaces and buses

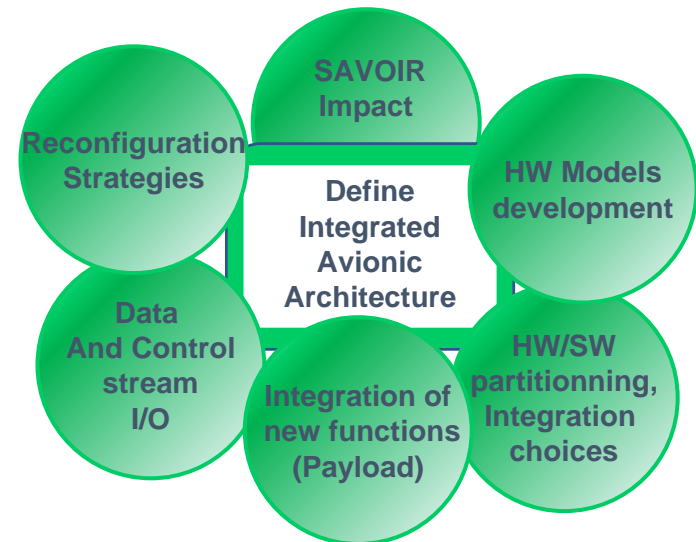
## 1.4 Reconfiguration and redundancy strategy

- ✓ Failure modes and reset tree, Reliability Analysis
- ✓ Use of DTC and eTM

## 1.5 Identification of impact on SAVOIR

## 1.6 HW models development

- ✓ EBB or EM OBC module for a proof of concept of integrated architecture



## Future areas of work

# 2. Development and qualification of NanoXplore NG-ULTRA component

## 2.1 Development of the multi-processor SoC solution

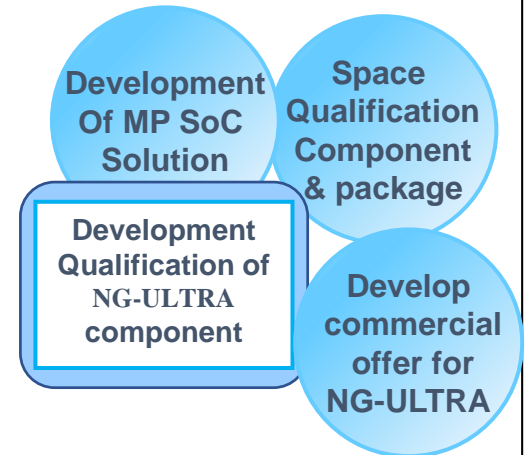
- ✓ Definition and development of SoC in **H2020 DAHLIA project** + NG-ULTRA component

## 2.2 Space qualification of the component and the packaging

- ✓ Technology 28nm FDSOI qualification
- ✓ NG-ULTRA component and packaging qualification

## 2.3 Commercial offer for NG-ULTRA product

- ✓ NG-ULTRA is part of the NanoXplore product line
  - Development environment for hardware design: NanoXmap solution
  - Starter Kit and evaluation board
  - Hardware and Software libraries





## Future areas of work

# 3. Enhance maturity of development environment

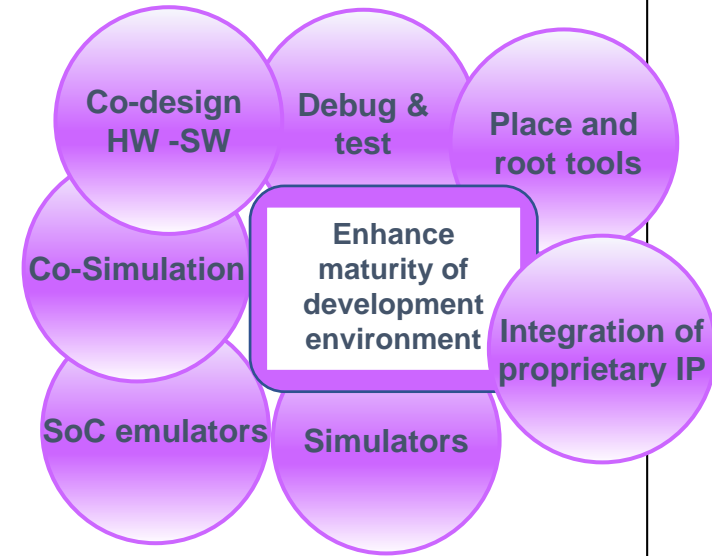
### 3.1 Simulation environment for application and system with NG-Ultra

- Co-design d'IPs HW/SW
- Co-simulation RTL for complex IP
- Proprietary IP integration

### 3.2 SoC Emulator & NG-Ultra virtual platform

### 3.3. Simulators

- Software development environment for early Flight SW
- System simulator for operations
- System simulator for AIT



## Future areas of work

# 4- Produce Building blocks for integrated avionic

### 4.1 Software

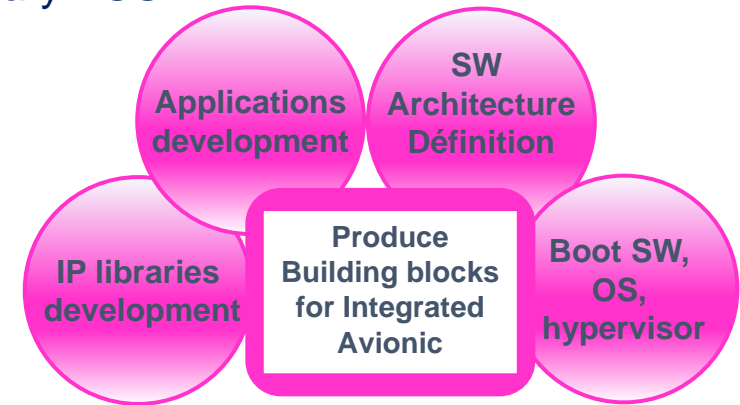
- ✓ Software architecture definition
- ✓ Development and qualification of OS, Hypervisor, Library PUS
- ✓ Development of applications
- ✓ IP libraries

### 4.2 Hardware IP librairies (in the FPGA matrix)

- ✓ SoC services and specific
- ✓ Avionic functions
- ✓ Specific application

### 4.3 Intellectual Property and licences

- ✓ Ensure acceptable licences condition for tools and libraries
- ✓ Equipment provider need to develop proprietary IPs (and new hardware) for integration in the architecture



## Future areas of work

## 5- New roles for actors in integrated architecture

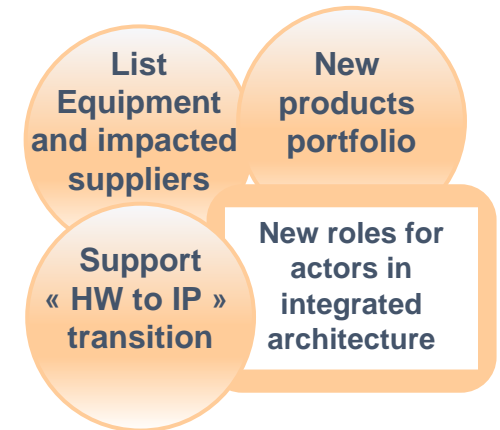
### 5.1 List Equipments and impacted suppliers

- ✓ Avionic candidates functions for integration are numerous: SCAO, Star tracker, GNSS, TM/TC...
- ✓ Only numerical functions will be executed on the System-on-Chip

### 5.2 New products Portfolios for the equipment providers

- ✓ New product development
- ✓ IP of the integrated function to be integrated in the SoC

### 5.3 Support « HW to IP » transition



## Future areas of work

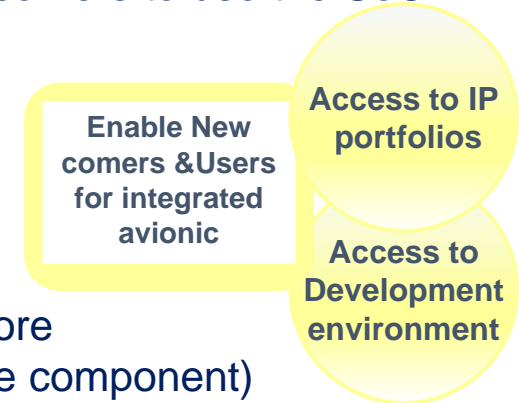
# 6- Enable New comers &Users for integrated avionic architecture

### 6.1 Objectives

- ✓ Identify key IPs for space applications and enable their development for NG-ULTRA
- ✓ Ensure that all the documentation and tools are available to new comers to use the SoC
  - Lab for scientific missions
  - Small companies
  - Equipment suppliers

### 6.2 What is needed ?

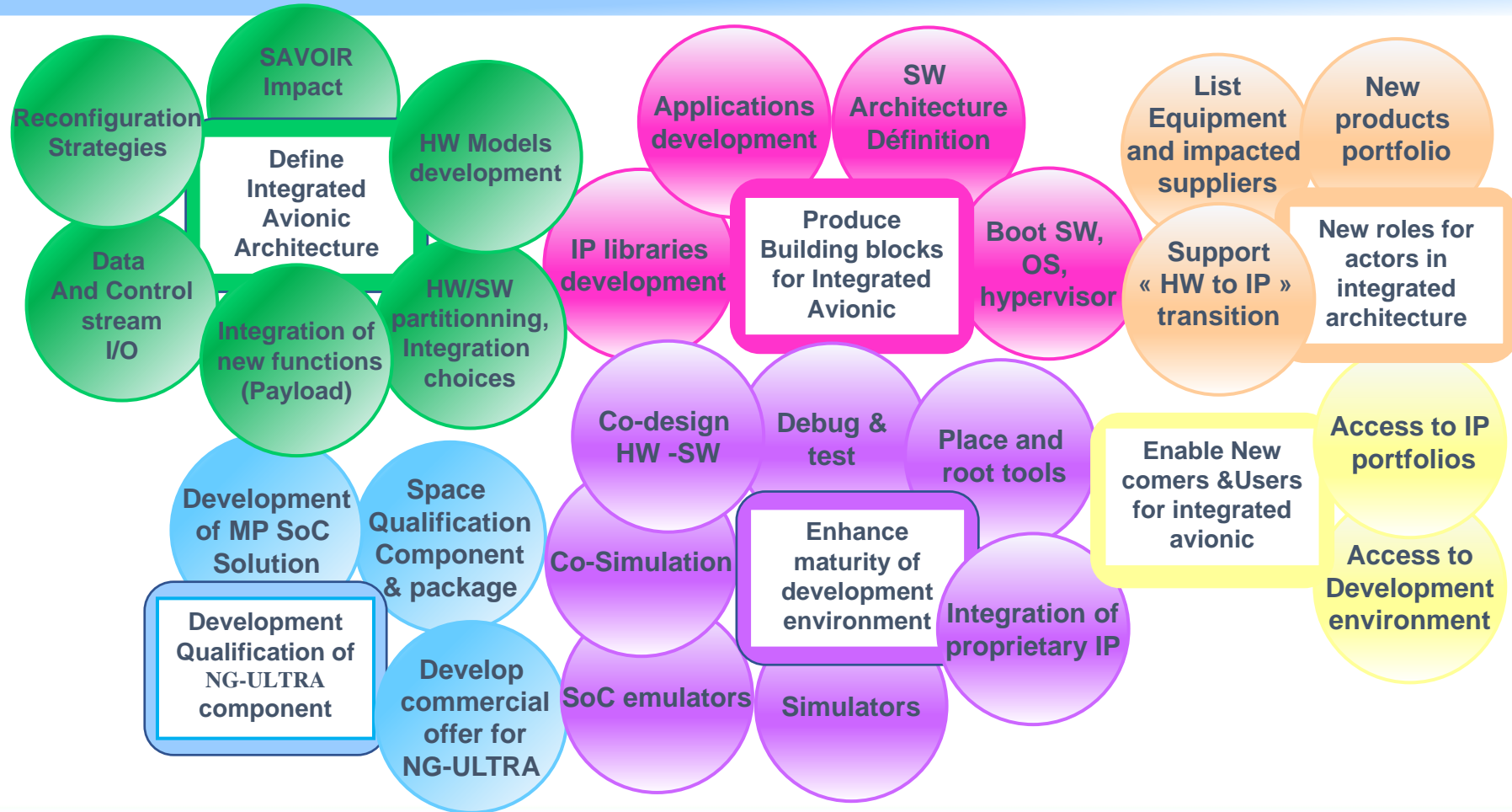
- ✓ NG-ULTRA product with development tools available by NanoXplore
- ✓ Simulations tools for IP development ( before the availability of the component)
- ✓ Availability of building blocks ( component with development board, simulators, IP library)
- ✓ Initiate strategic IPs development with affordable licences conditions for new comers



## CONCLUSION

- ❑ Building block for very integrated avionic core need to be available in 2020-2021
  - NG-ULTRA prototypes
  - OBC architectures
  - IP portfolios
  - Software architecture
  - Simulations tools
  
- ❑ Need to enable the use of the technology by new comers: scientific community, small companies: Documentation, licences, test benches
  
- ❑ Prepare evolutions of SAVOIR specifications with ESA and industry to take into account specificities of very integrated avionic

## Conclusion -Future areas of work



End of the presentation  
Thank you