

Space systems

RECONFIGURABILITY

using FPGAs

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RECONFIGURABILITY = **Capability to MODIFY the system in a controlled manner**

Reconfigurable FPGAs (SRAM or FLASH) have this capability

- What are we using it for today?
- What could it be used for?
- What are we investigating?

Many potential applications and ways to do it !!

How **to classify** and **to name** the different applications and ways to do space systems modifications by reconfiguring FPGAs? We need to speak the same language to understand each other.

RECONFIGURING FPGAs: many applications and ways. **Terminology**



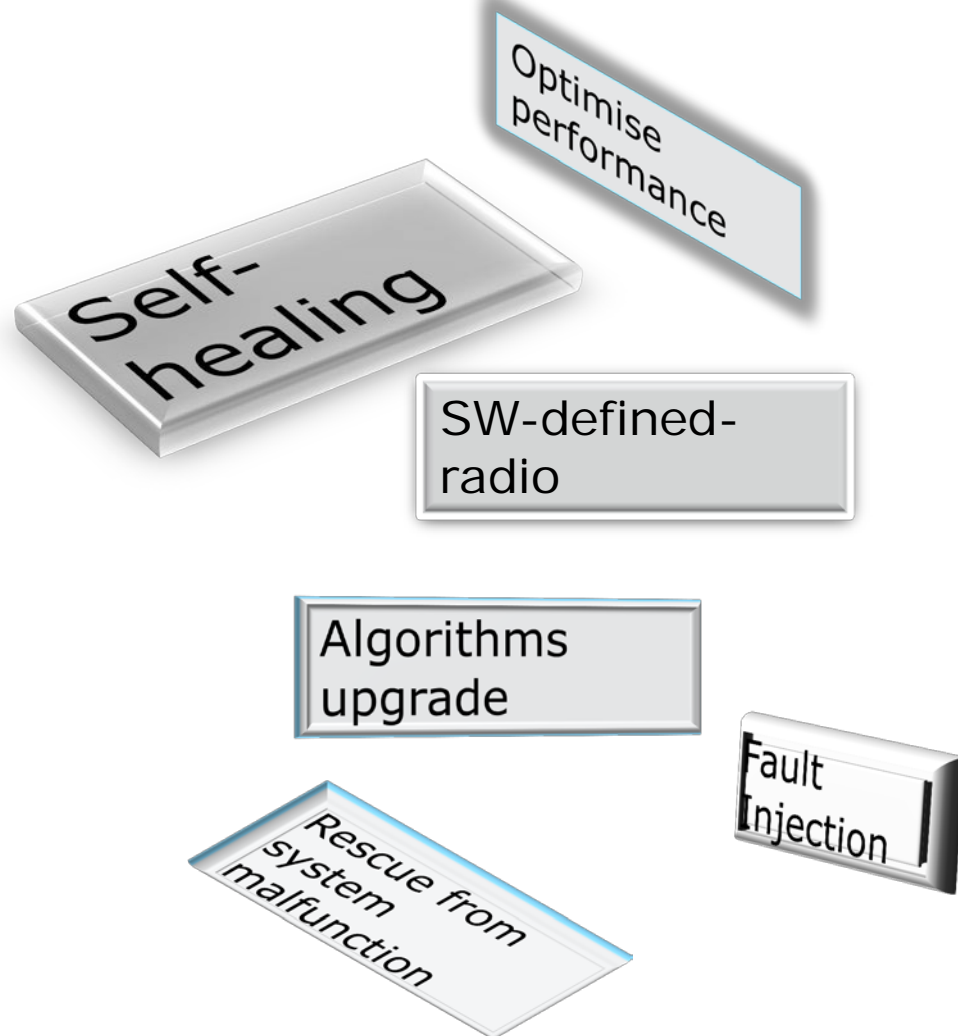
RECONFIGURATION => CONTROLLED MODIFICATIONS

Reacting to **expected** and/or **unexpected** errors, faults, changes, happening **inside** and/or **outside** the FPGA

FPGA reconfiguration can be used for:

1. **Correcting** – **unexpected** problems inside the FPGA
2. **Adapting** – **unexpected** problems **outside**
3. **Transforming** – **expected** system (**outside** or inside) needs
4. **Validating** (prototyping for design debugging and analysis)

RECONFIGURABLE FPGAs: **WHAT** FOR?



RECONFIGURABLE FPGAs: WHAT FOR?



Correcting (internal faults)

- Persistent Rad Effects
- Wear-out
- Silicon Defects
- Design errors

Adapting (unexpected external changes)

- External system faults
- New user demands = system specifications
- System poor definition = late spec changes

Transforming (expected external or internal changes)

- Swapping functions to save real state or optimise internal performance

Validating (testing design behaviour)

- HW test of future ASICs or FPGAs during design phase
- Fault injection / emulation / analysis

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On-Ground

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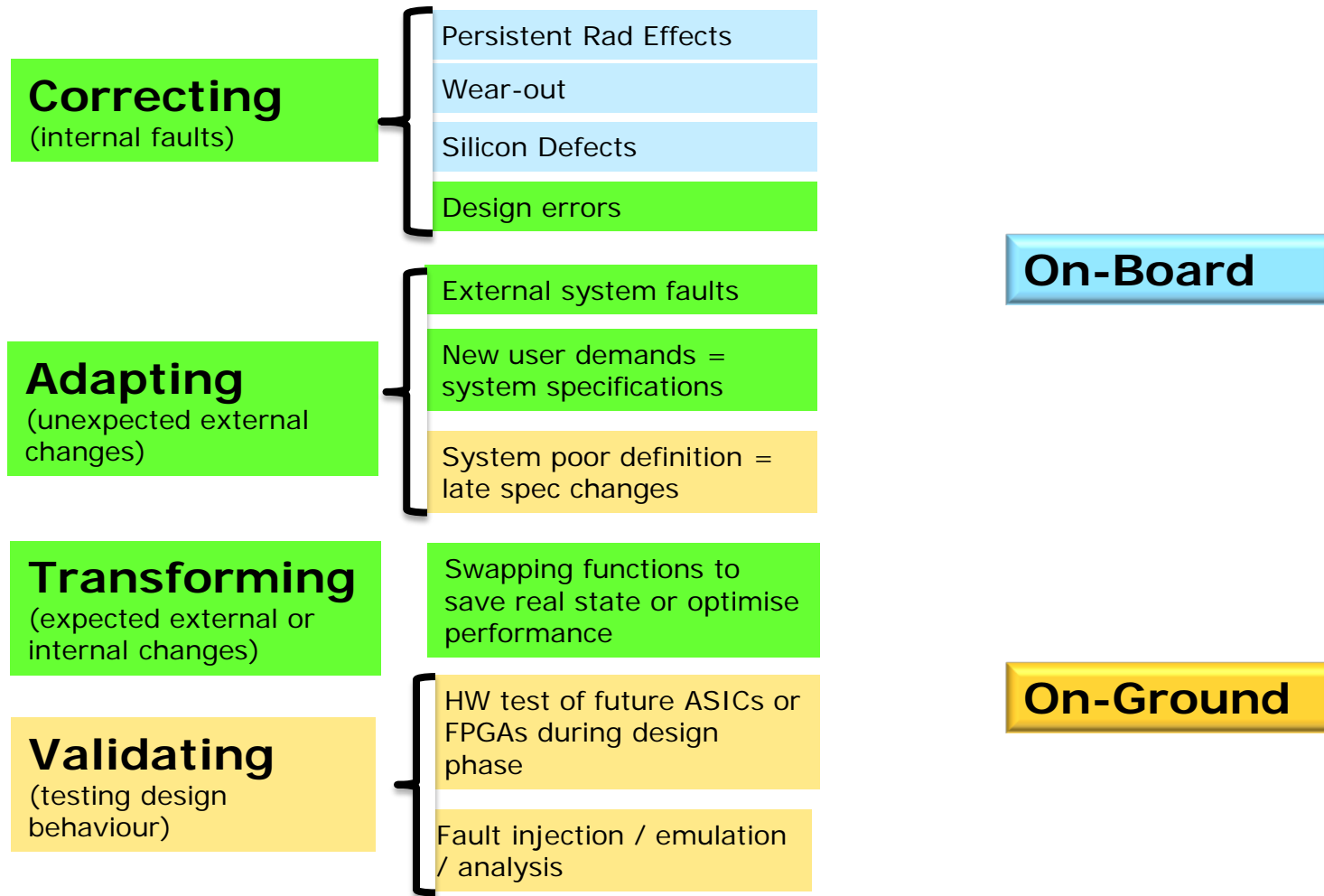
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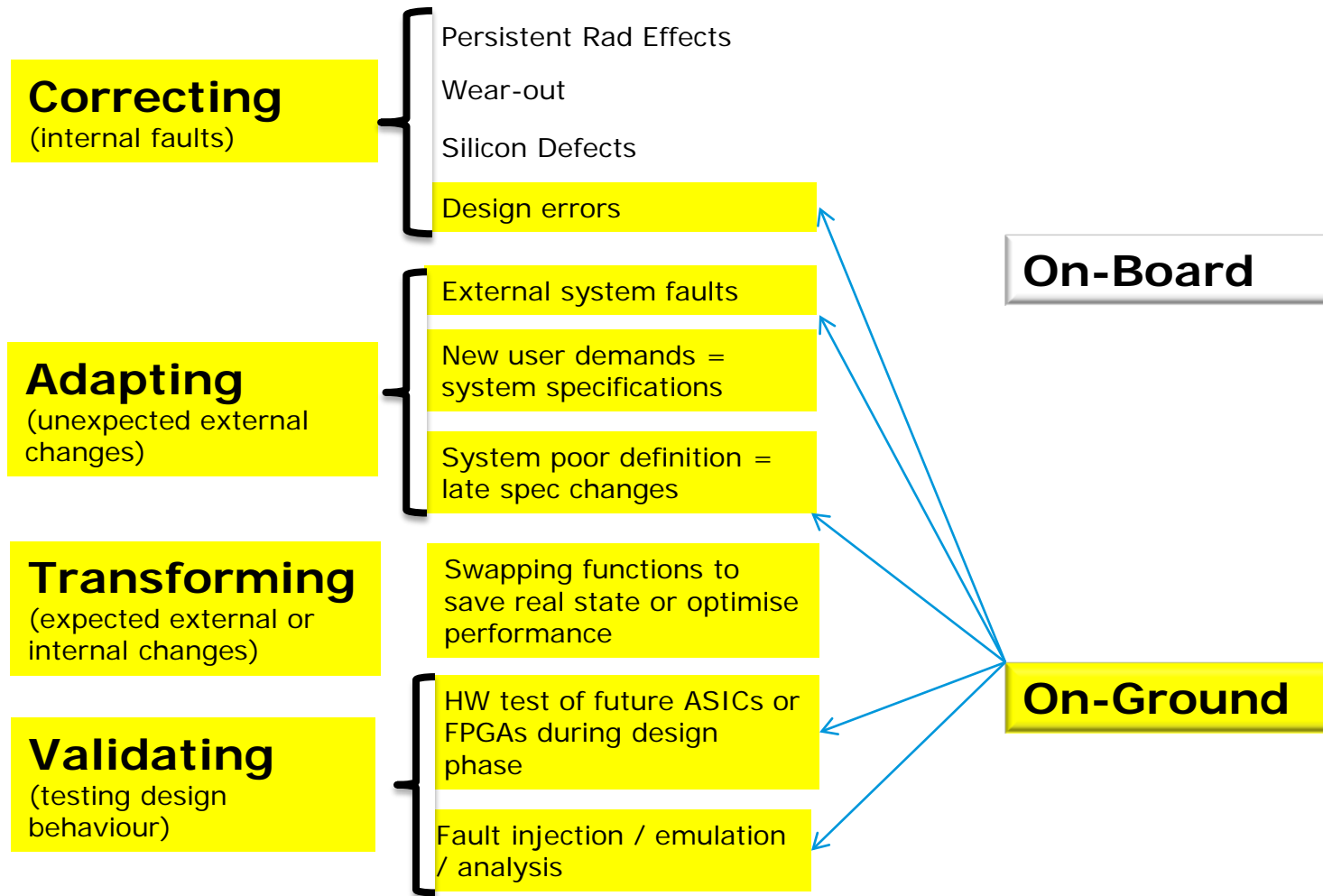
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On-Board

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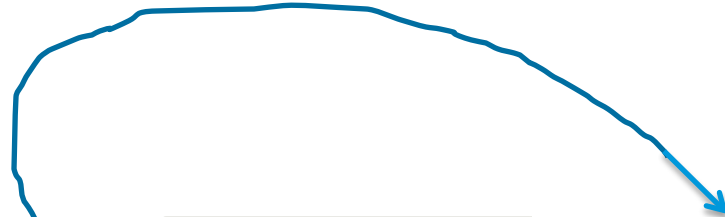
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On-Board

Data and Instructions
"reconfigurations" (or multiple pages) of **on-board computer memories**

On-Ground

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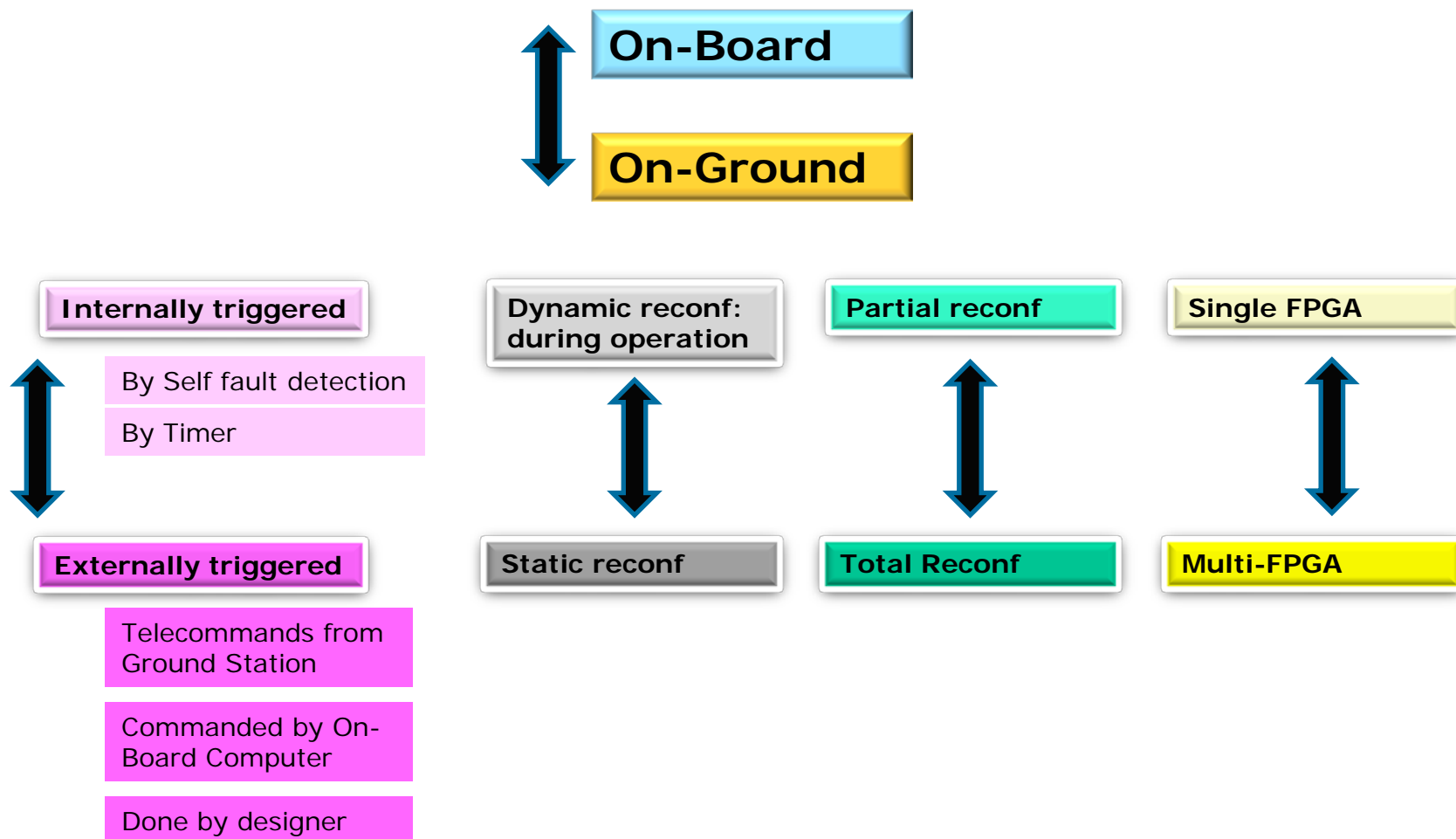
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RECONFIGURING FPGAs: **HOW, WHAT STYLE?**



RECONFIGURABLE FPGAs: **what next?**



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Optimise performance

SW-defined-radio

Algorithms upgrade

