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# Hardware project mgt proposal for Open-CMSIS

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# Agenda

# About this document

# Application Project Content

# HW CMP/CFG

# Hardware project file format

# Topic

# Topic

# Topic

# Topic

# About this document

# What is this document about

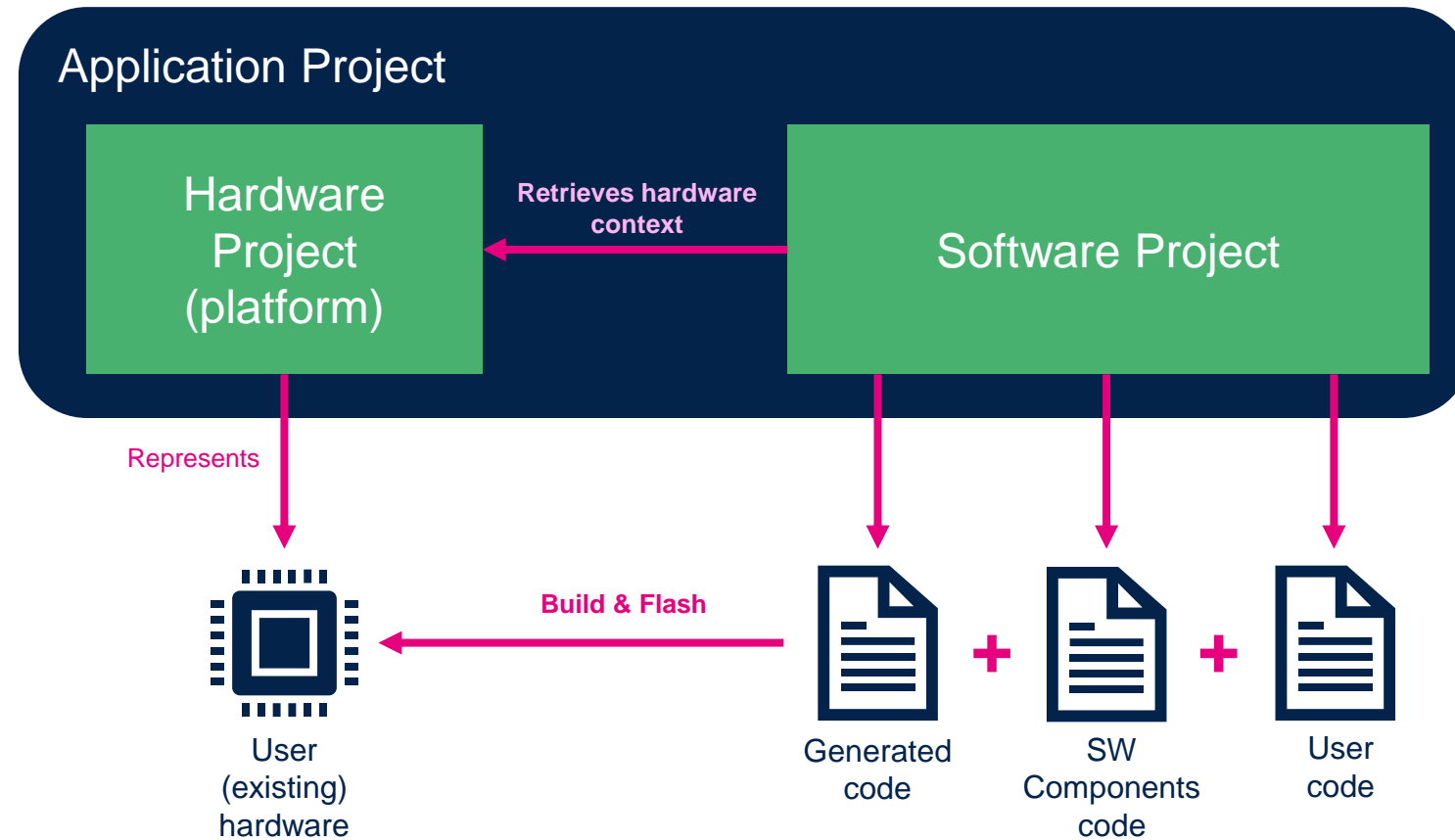
- This document presents a proposal to handle the platform part in Open-CMSIS project format consistent with application project level (csolution.yml) and the way software projects are handled (cproject.yml)
- This proposal aims to become part of the OpenCMSIS standard

# What we are trying to achieve

- Standardize a hardware project files format consistent with software project
  - Define a hproject.yml consistent with application-level csolution.yml project and software project cproject.yml
- Allow for evaluation of “H-conditions” present in some SW Components
  - By listing the HW Parts (expressed as OpenCMSIS objects) that are contained into a hardware project and make this hardware project known to the OpenCMSIS condition evaluation algorithm
  - Introduce the new attribute ‘hcondition’ at the <component> element in the PDSC file to avoid confusion and complexity with existing “condition” attribute
- Automatically import BSPs to software project composition
  - Implement the automatic import of BSPs components into a software project composition by using the evaluation of H-conditions of software components to filter the ones that are relevant to HW Parts listed in the hardware project

# Application Projects Contents

# Simplified projects view



# HW CMP/CFG





# Hardware CMP/CFG

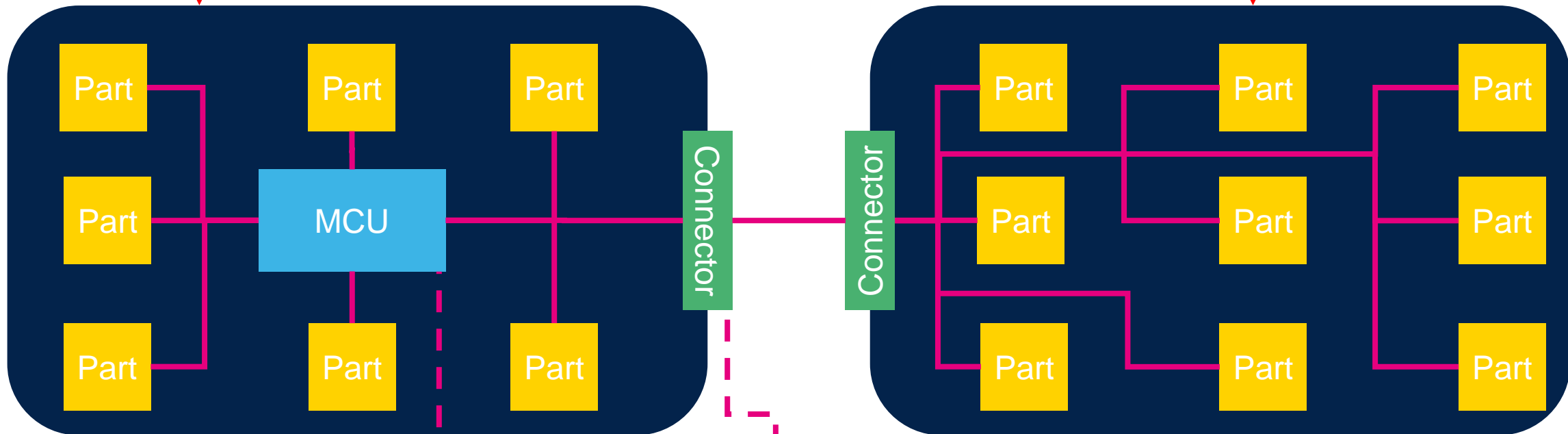
- Hardware composition
  - Define a hardware platform on which the generated code will run
  - Compose a platform
    - Choose and add existing hardware (MCU, boards, parts)
    - Connect boards and parts together
- Hardware configuration
  - Act on configurable hardware parts to put them in different states
  - Configure a platform
    - Set the states of “electrical wiring” parts (jumpers, switches, solder bridges, etc.)
    - Enable / disable hardware parts (“virtual” solder / unsolder)
    - Change parts & boards parameters (bus addresses for example)

# Hardware composition

Hardware platform

Board1 (motherboard function)

Board2 (daughterboard function)



Floating parts



# Hardware project file format proposal



# hproject.yml proposal

- Goals

- Store hardware project composition

- List of boards and parts **and their availability**

- hproject content depends on the current platform configuration, if user make changes that make parts unavailable then **they will appear as unavailable** in the hproject.yml file

- Look-alike existing CMSIS files (cproject.yml) in order to easily add it to the CMSIS standard

- hproject.yml grammar follows as much as possible the one used for cproject.yml

- Out of scope

- Active MCU

- There may be more than one MCU in a hardware project composition but only one of them can be the active MCU (the one on which the code will be executed). This concept of active MCU is **out of the scope** of the hproject.yml, **each MCU should be present in the hproject.yml**



# hproject.yml proposal

Optional, packs could also be reference in csolution.yml

```
project:
  description: hproject example with one board and floating parts
  packs:
    - pack: STMICROELECTRONICS::b-u5851-iot02a_hw-board@0.0.12
    - pack: STMICROELECTRONICS::stm32u5xx_dfp
    - pack: STMICROELECTRONICS::aps64081-3obmx_hw-par
    - pack: STMICROELECTRONICS::ems3080_hw-part
    - pack: STMICROELECTRONICS::hls221_hw-part
    - pack: STMICROELECTRONICS::iis2mdc_hw-part
    - pack: STMICROELECTRONICS::iis330hmc_hw-part
    - pack: STMICROELECTRONICS::lps22bh_hw-part
    - pack: STMICROELECTRONICS::m24256-df_hw-part
    - pack: STMICROELECTRONICS::mp23d001hp_hw-part
    - pack: STMICROELECTRONICS::mx251h51245_hw-part
    - pack: STMICROELECTRONICS::stg3692_hw-part
    - pack: STMICROELECTRONICS::stm32wb5mng_ble_at_hw-part
    - pack: STMICROELECTRONICS::stsafe-a110_hw-part
    - pack: STMICROELECTRONICS::tcp00-m20_hw-part
    - pack: STMICROELECTRONICS::veml6030_hw-part
    - pack: STMICROELECTRONICS::vl5315cx_hw-part
  boards:
    - board: STMICROELECTRONICS::B-U5851-IOT02A@Rev.C
  instances:
    - instance: "1"
      parts:
        - part: AP Memory Technology&STM32U5SAI16Q
          instances:
            - instance: "1"
              available: true
        - part: STMICROELECTRONICS&HITS221TR
          instances:
            - instance: "1"
              available: true
        - part: STMICROELECTRONICS&IIS2MDCTR
          instances:
            - instance: "1"
              available: true
        - part: STMICROELECTRONICS&IIS330HMCXTR
          instances:
            - instance: "1"
              available: true
        - part: STMICROELECTRONICS&M24256-DFMCGTG
          instances:
            - instance: "1"
              available: true
        - part: STMICROELECTRONICS&MP23D001HPTR
          instances:
            - instance: "1"
              available: true
            - instance: "2"
              available: true
        - part: Macronix&MX25LH51245GXD100
          instances:
            - instance: "1"
              available: true
        - part: STMICROELECTRONICS&STG3692QTR
          instances:
            - instance: "1"
              available: false
            - instance: "2"
              available: true
        - part: STMICROELECTRONICS&STM32WB5MNG_BLE_AT
          instances:
            - instance: "1"
              available: true
        - part: STMICROELECTRONICS&STSAFA118S8SP102
          instances:
            - instance: "1"
              available: true
        - part: STMICROELECTRONICS&TCP003
          instances:
            - instance: "1"
              available: true
        - part: Vishay&VEML6030
          instances:
            - instance: "1"
              available: true
        - part: STMICROELECTRONICS&VL5315CXV0GC/1
          instances:
            - instance: "1"
              available: true
  floatingParts:
    - part: STMICROELECTRONICS&M24256-DFMCGTG
      instances:
        - instance: "1"
          available: true
    - part: STMICROELECTRONICS&IIS2MDCTR
      instances:
        - instance: "1"
          available: true
        - instance: "2"
          available: true
```

On STMICROELECTRONICS::B-U5851-IOT02A@Rev.C instance "1" there are 2 STMICROELECTRONICS&STG3692QTR

Composition

There are 2 floating STMICROELECTRONICS&IIS2MDCTR

A board instance with its parts

Floating parts: parts that are not (yet) on a board



# hproject.yml proposal

- About board part list

- A board is described through the *board* element of the pack description file (.pdsc)
  - An example is at the right
  - hproject board element refers to pdsc board element
- Pdsc file is the source of truth about a board, therefore, each part referenced inside a board part list must exist in the board pdsc

## PDSC file

```
boards:  
- board: STMicroelectronics::B-U5851-IOT02A@Rev.C  
  instances:  
  - instance: "1"  
    parts:  
    - part: AP Memory Technology&STM32U585AII6Q  
      instances:  
      - instance: "1"  
        available: true  
    - part: STMicroelectronics&HTS221TR  
      instances:  
      - instance: "1"  
        available: true  
    - part: STMicroelectronics&IIS2MDCTR  
      instances:  
      - instance: "1"  
        available: true  
    - part: STMicroelectronics&ISM330DHCXTR  
      instances:  
      - instance: "1"  
        available: true
```

Must be referenced inside PDSC

```
<!-- B-U5851-IOT02A -->  
<board vendor="STMicroelectronics" name="B-U5851-IOT02A" revision="Rev.C" salesContact="http://www.st.com/stonline/contactus/contacts/index.php">  
  <description>STMicroelectronics B-U5851-IOT02A Discovery Board</description>  
  <image large="Images/b-u5851-iot02a_image_front_small.png" small="Images/b-u5851-iot02a_image_rear.png" bottom="Images/b-u5851-iot02a_image_rear.png"/>  
  <book category="overview" name="http://www.st.com/en/evaluation-tools/B-U5851-IOT02A.html" title="Discovery kit for IoT node with STM32U5 series"/>  
  <book name="Documentation/um2839.pdf" title="user manual" public="true"/>  
  <book name="Documentation/en.mb1551-u5851-c02_schematic.pdf" title="schematic" public="true"/>  
  <book name="Descriptors/netlist/b-u5851-iot02a_netlist.json" title="netlist"/>  
  <book name="Descriptors/configuration/b-u5851-iot02a_conf.json" title="default configuration"/>  
  <environment name="STM32Cube">  
    <file category="netlist" name="Descriptors/netlist/b-u5851-iot02a_netlist.json"/>  
    <file category="configuration" name="Descriptors/configuration/b-u5851-iot02a_conf.json"/>  
  </environment>  
  <mountedDevice deviceIndex="0" Dvendor="STMicroelectronics:13" Dname="STM32U585AII6Q"/>  
  <compatibleDevice deviceIndex="0" Dvendor="STMicroelectronics:13" Dname="STM32U585AIIxQ"/>  
  <algorithm name="Flash/mx25lm51245g_stm32u5851_iot02a.flm" start="0x70000000" size="0x4000000"/>  
  <!-- -->  
  <mountedPart Hvendor="AP Memory Technology" Hname="AP56408L-30BMx" Hvariant="AP56408L-30BM-BA" n="1"/>  
  <mountedPart Hvendor="MXCHIP" Hname="EMW3080" Hvariant="EMW3080BP" n="1"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="HTS221" Hvariant="HTS221TR" n="1"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="IIS2MDC" Hvariant="IIS2MDCTR" n="1"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="ISM330DHCX" Hvariant="ISM330DHCXTR" n="1"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="LPS22HH" Hvariant="LPS22HHTR" n="1"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="M24256-DF" Hvariant="M24256-DFMC6TG" n="1"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="NP230B01HP" Hvariant="NP230B01HPTR" n="2"/>  
  <mountedPart Hvendor="Macronix" Hname="MX25LM51245" Hvariant="MX25LM51245GXDI00" n="1"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="STG3692" Hvariant="STG3692QTR" n="2"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="STM32WB5MMG_BLE_AT" n="1"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="STSAFE-A110" Hvariant="STSAFEA110S8SPL02" n="1"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="TCPPO3-M20" n="1"/>  
  <mountedPart Hvendor="Vishay Semiconductors" Hname="VEML6030" n="1"/>  
  <mountedPart Hvendor="STMicroelectronics" Hname="VL53L5CX" Hvariant="VL53L5CXV0GC/1" n="1"/>
```

# hproject.yml proposal

- About part location
  - A part can be declared inside a board (parts property) or inside the floatingParts list
  - This grammar allows the hproject.yml file to provide more complete information on the project composition
- About instances
  - Boards & parts are instantiable elements.
  - An instance has an id that must be unique within the parent object.
    - It is possible to have two board instances with the same id if they are not instances of the same board (see example at the right)
    - Same logic applies for parts
  - Instance Ids are strings, allowing the tool to use any id format

```
boards:  
  - board: my-mother-board  
    instances:  
      - instance: "1"  
        parts:  
          - part: same-button  
            instances:  
              - instance: "1"  
                available: true  
              - instance: "2"  
                available: false  
              - instance: "3"  
                available: false  
  - board: my-daughter-board  
    instances:  
      - instance: "1"  
        parts:  
          - part: same-button  
            instances:  
              - instance: "1"  
                available: true  
floatingParts:  
  - part: same-button  
    instances:  
      - instance: "1"  
        available: true  
      - instance: "2"  
        available: true
```

# hproject.yml simplified example

- The simplified example on the right indicates that

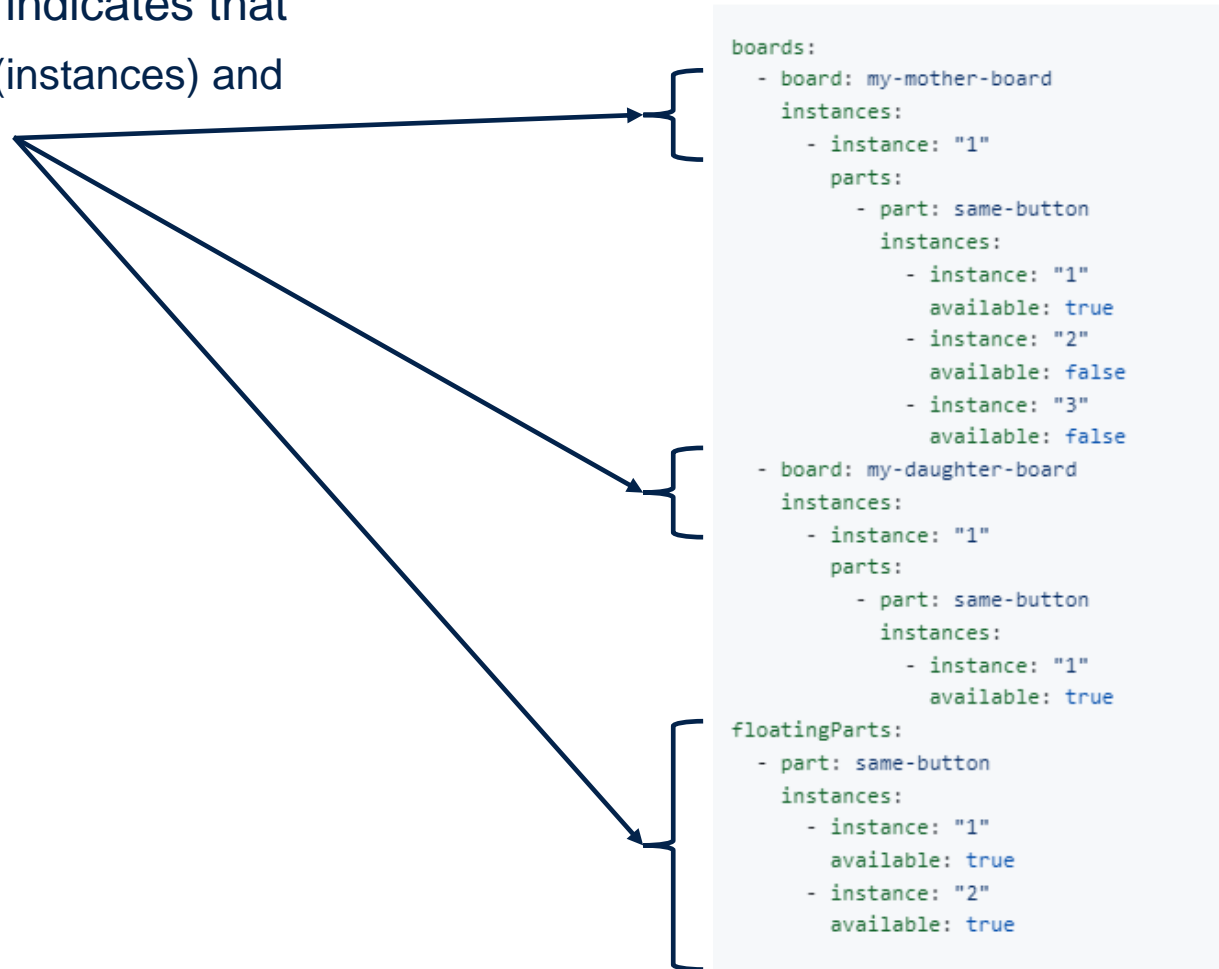
```
boards:
  - board: my-mother-board
    instances:
      - instance: "1"
        parts:
          - part: same-button
            instances:
              - instance: "1"
                available: true
              - instance: "2"
                available: false
              - instance: "3"
                available: false
  - board: my-daughter-board
    instances:
      - instance: "1"
        parts:
          - part: same-button
            instances:
              - instance: "1"
                available: true

floatingParts:
  - part: same-button
    instances:
      - instance: "1"
        available: true
      - instance: "2"
        available: true
```



# hproject.yml simplified example

- The simplified example on the right indicates that
  - My project is composed of 2 boards (instances) and floating parts (instances)



# hproject.yml simplified example

- The simplified example on the right indicates that
  - My project is composed of 2 boards (instances) and floating parts (instances)
  - On my mother board there are 3 instances of the “same-button”

```
boards:
  - board: my-mother-board
    instances:
      - instance: "1"
        parts:
          - part: same-button
            instances:
              - instance: "1"
                available: true
              - instance: "2"
                available: false
              - instance: "3"
                available: false
  - board: my-daughter-board
    instances:
      - instance: "1"
        parts:
          - part: same-button
            instances:
              - instance: "1"
                available: true

floatingParts:
  - part: same-button
    instances:
      - instance: "1"
        available: true
      - instance: "2"
        available: true
```

# hproject.yml simplified example

- The simplified example on the right indicates that
  - My project is composed of 2 boards (instances) and floating parts (instances)
  - On my mother board there are 3 instances of the “same-button”
    - Only one of those instances is available

```
boards:  
  - board: my-mother-board  
    instances:  
      - instance: "1"  
        parts:  
          - part: same-button  
            instances:  
              - instance: "1"  
                available: true  
              - instance: "2"  
                available: false  
              - instance: "3"  
                available: false  
      - board: my-daughter-board  
        instances:  
          - instance: "1"  
            parts:  
              - part: same-button  
                instances:  
                  - instance: "1"  
                    available: true  
floatingParts:  
  - part: same-button  
    instances:  
      - instance: "1"  
        available: true  
      - instance: "2"  
        available: true
```

# hproject.yml simplified example

- The simplified example on the right indicates that
  - My project is composed of 2 boards (instances) and floating parts (instances)
  - On my mother board there are 3 instances of the “same-button”
    - Only one of those instances is available
  - On my daughter board the “same-button” is instantiated 1 time and is available

```
boards:
- board: my-mother-board
  instances:
  - instance: "1"
    parts:
    - part: same-button
      instances:
      - instance: "1"
        available: true
      - instance: "2"
        available: false
      - instance: "3"
        available: false
- board: my-daughter-board
  instances:
  - instance: "1"
    parts:
    - part: same-button
      instances:
      - instance: "1"
        available: true
floatingParts:
- part: same-button
  instances:
  - instance: "1"
    available: true
  - instance: "2"
    available: true
```

# hproject.yml simplified example

- The simplified example on the right indicates that
  - My project is composed of 2 boards (instances) and floating parts (instances)
  - On my mother board there are 3 instances of the “same-button”
    - Only one of those instances is available
  - On my daughter board the “same-button” is instantiated 1 time and is available
  - 2 “same-button” instances are floating

```
boards:
  - board: my-mother-board
    instances:
      - instance: "1"
        parts:
          - part: same-button
            instances:
              - instance: "1"
                available: true
              - instance: "2"
                available: false
              - instance: "3"
                available: false
  - board: my-daughter-board
    instances:
      - instance: "1"
        parts:
          - part: same-button
            instances:
              - instance: "1"
                available: true

floatingParts:
  - part: same-button
    instances:
      - instance: "1"
        available: true
      - instance: "2"
        available: true
```

# hproject.yml simplified example

- The simplified example on the right indicates that
  - My project is composed of 2 boards (instances) and floating parts (instances)
  - On my mother board there are 3 instances of the “same-button”
    - Only one of those instances is available
  - On my daughter board the “same-button” is instantiated 1 time and is available
  - 2 “same-button” instances are floating
  - In total, there are 6 instances of the “same-button” in my composition but only 4 of them are available

```
boards:  
  - board: my-mother-board  
    instances:  
      - instance: "1"  
        parts:  
          - part: same-button  
            instances:  
              - instance: "1"  
                available: true  
              - instance: "2"  
                available: false  
              - instance: "3"  
                available: false  
  - board: my-daughter-board  
    instances:  
      - instance: "1"  
        parts:  
          - part: same-button  
            instances:  
              - instance: "1"  
                available: true  
floatingParts:  
  - part: same-button  
    instances:  
      - instance: "1"  
        available: true  
      - instance: "2"  
        available: true
```

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