



Model-based System Engineering #5

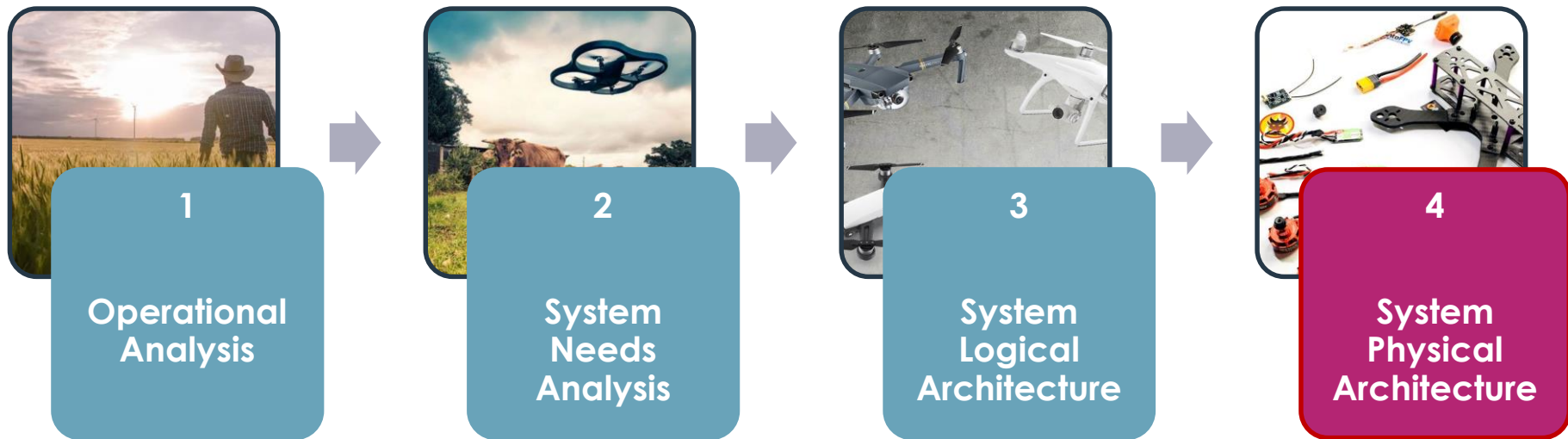
ENSTA ROB 308





Session #5 : Physical Architecture

Methodological Overview



Objectives

- Define the solution at a sufficient level of detail to specify the developments and acquisitions of all constituents to be implemented, and to define and orient the system integration, verification and validation phases
- Introduce the choices and constraints related to implementation and production technologies
- Establish clear development contracts for the identified components

Main activities

- Define the structuring principles of the architecture and behavior
- Detail and finalize the expected system behavior, including interfaces, finalize the architecture in terms of components
- Define and determine the sizing and performance of resources and materials necessary for the implementation of the specified behaviors of the solution

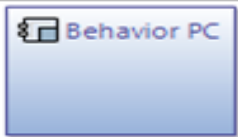
Finalizing the architecture

Iterate on functional analysis

- Greater level of detail resolving ambiguities of definition
- Design decisions choosing among various implementation options
- Enrichment/confrontation with reused assets
- Functions required for technical and technological implementation constraints.

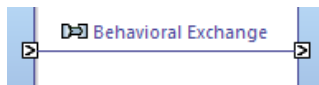
Detail the way to implement the functional contents (behaviour)

- Grouping or separation of functions into behaviour Components (BC)
- Implementation of BC into hosting physical Components (IC or nodes)
- Behaviour component interfaces and exchanges, deduced from functional data flows (e.g. by grouping)
- Implementation Components interfaces and physical links (e.g. bus, network, power line) on which behavioural exchanges will be allocated
- Reused assets



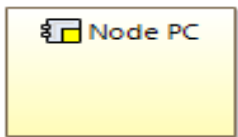
Behavioral Component

- System component in charge of implementing / realizing some of the functions devoted to the system



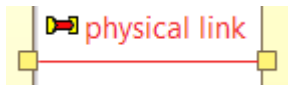
Behavioral Component Exchange

- An interaction between two components to exchange some items through behavioral ports



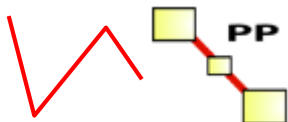
Hosting Implementation Component / Node

- Component hosting a number of behavioral components , providing them with the resource they require to function and to interact with their environment



Physical Link

- Means of communication, transport or routing between two hosting physical components, used as a support for behavioral exchanges



Physical Path

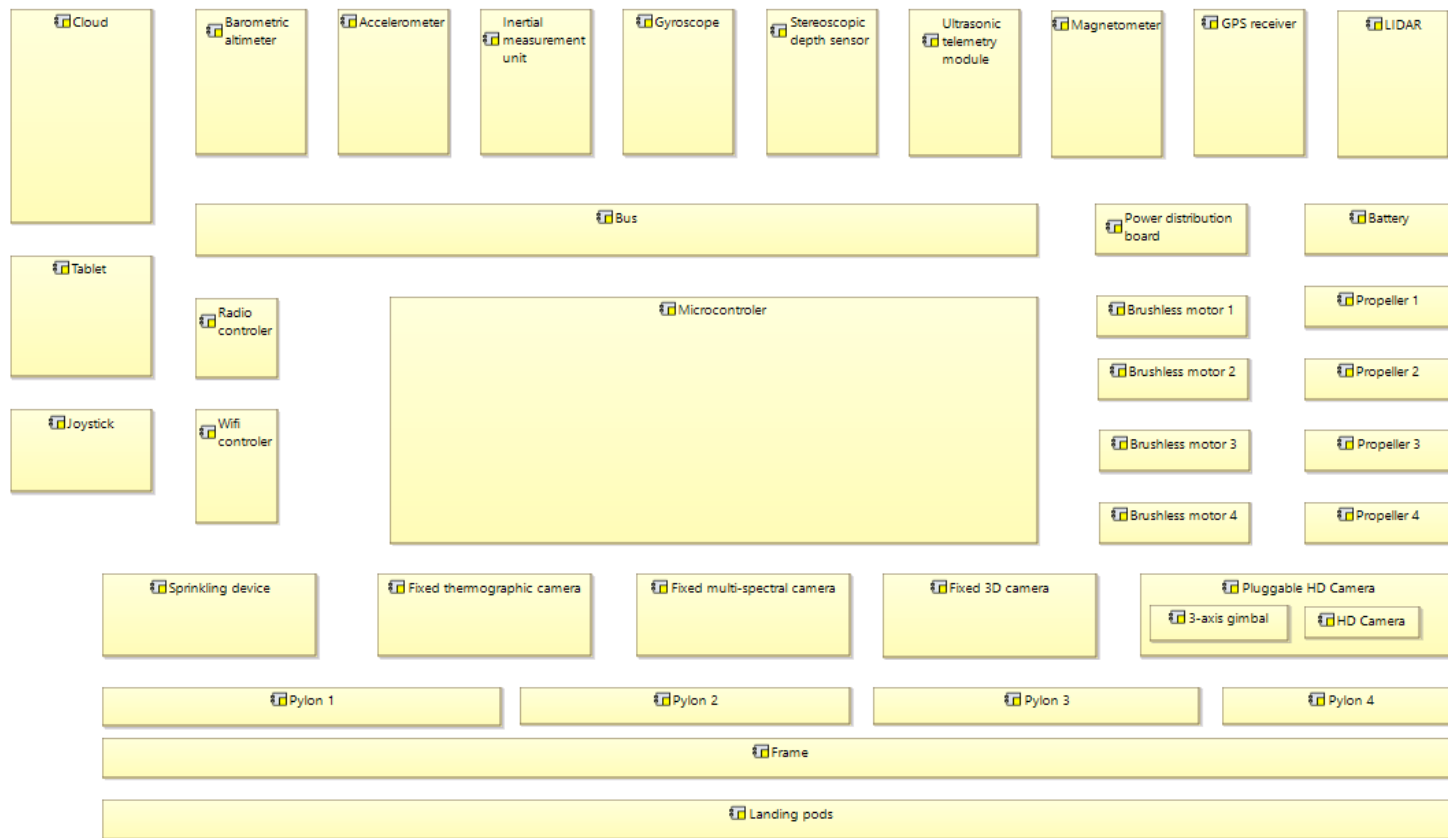
- Set of Physical Links defining a continuous path likely to route one or more behavioral exchanges

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QUESTION

What are the
implementation
components of our
system?





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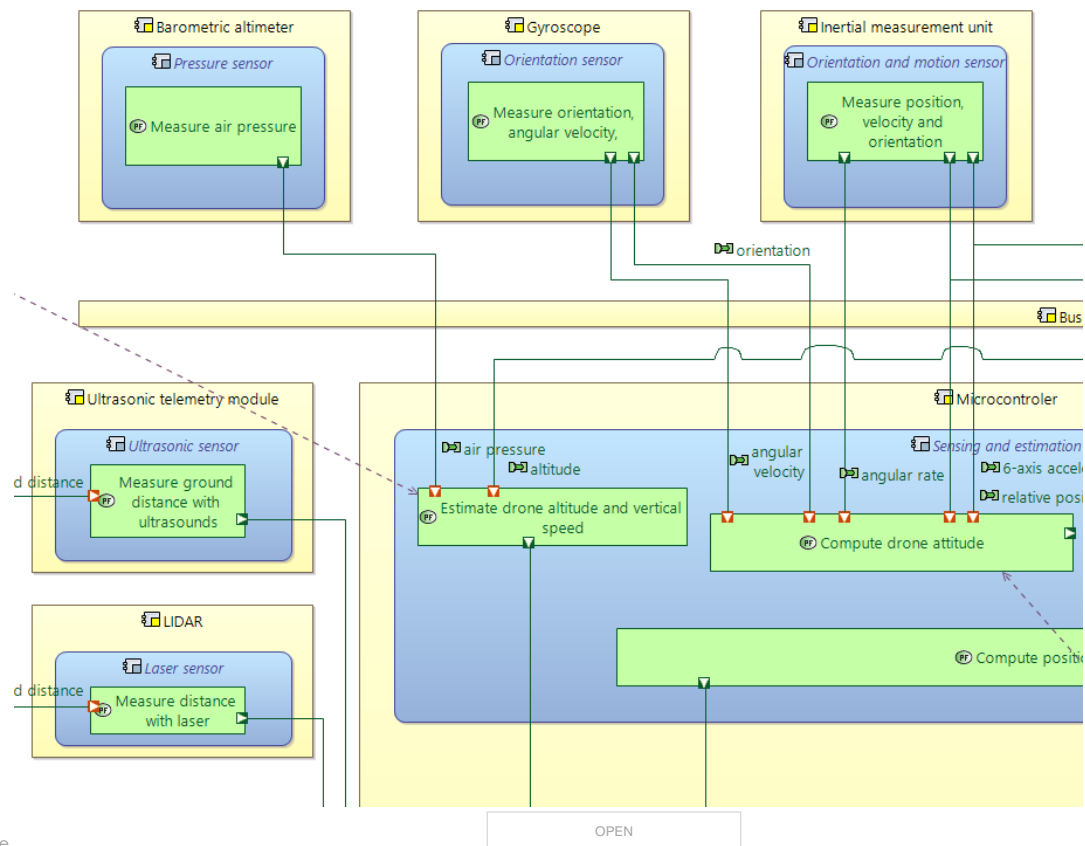
QUESTION

Find 2-3 examples of
functional allocation
alternatives



System Physical architecture

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Define the interfaces

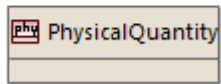
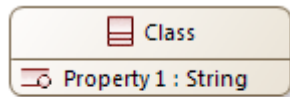
- Deduce/justify exchanged between components based on the functional exchanges
- Describe the format of the exchanged data
- Take into account several levels of interface description

Main new concepts



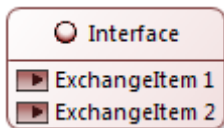
Exchange Item

- Ordered set of references to elements carried together during an interaction or exchange between functions, components and actors. The elements are carried simultaneously, in the same conditions, with the same non-functional properties. The “elements” are called data



Data structure

- To be taken in its broadest form: can represent a signal, an image, information, but also the physical state of a fluid (pressure, temperature, viscosity, etc.), a physical quantity (force, torque, velocity, etc.)



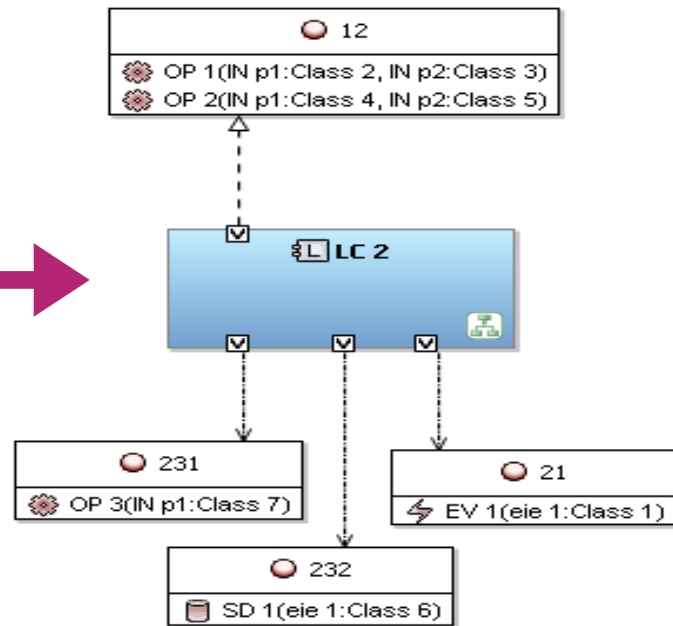
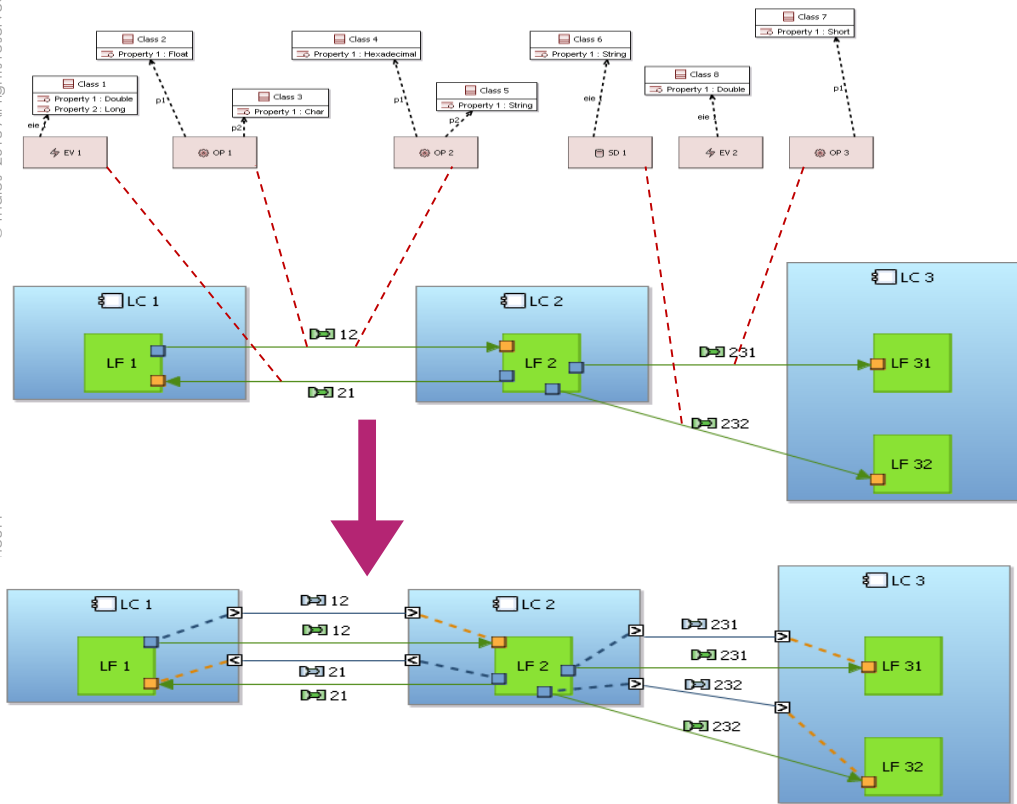
Interface

- A set of semantically coherent exchange items, allowing two components (and the system and actors), to communicate, according to a communication “contract” shared between them.

From functional exchanges to interfaces

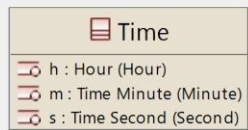
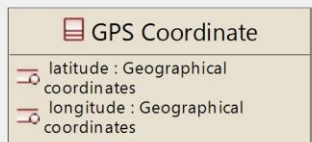
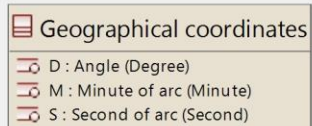
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Example of detailed content of exchange items

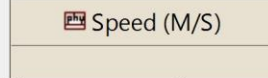
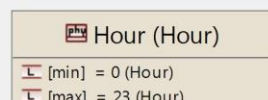
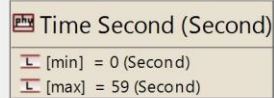
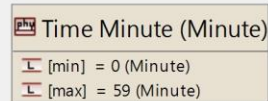
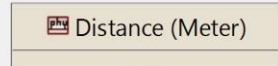
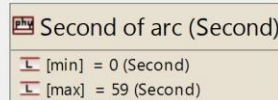
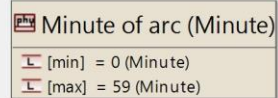
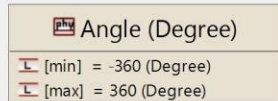
Structured types



timestamp

coordinates

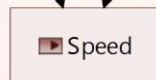
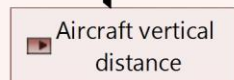
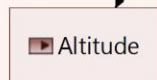
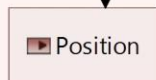
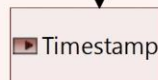
Physical quantities



vertical

horizontal

Exchange Items



Units

Meter

Degree

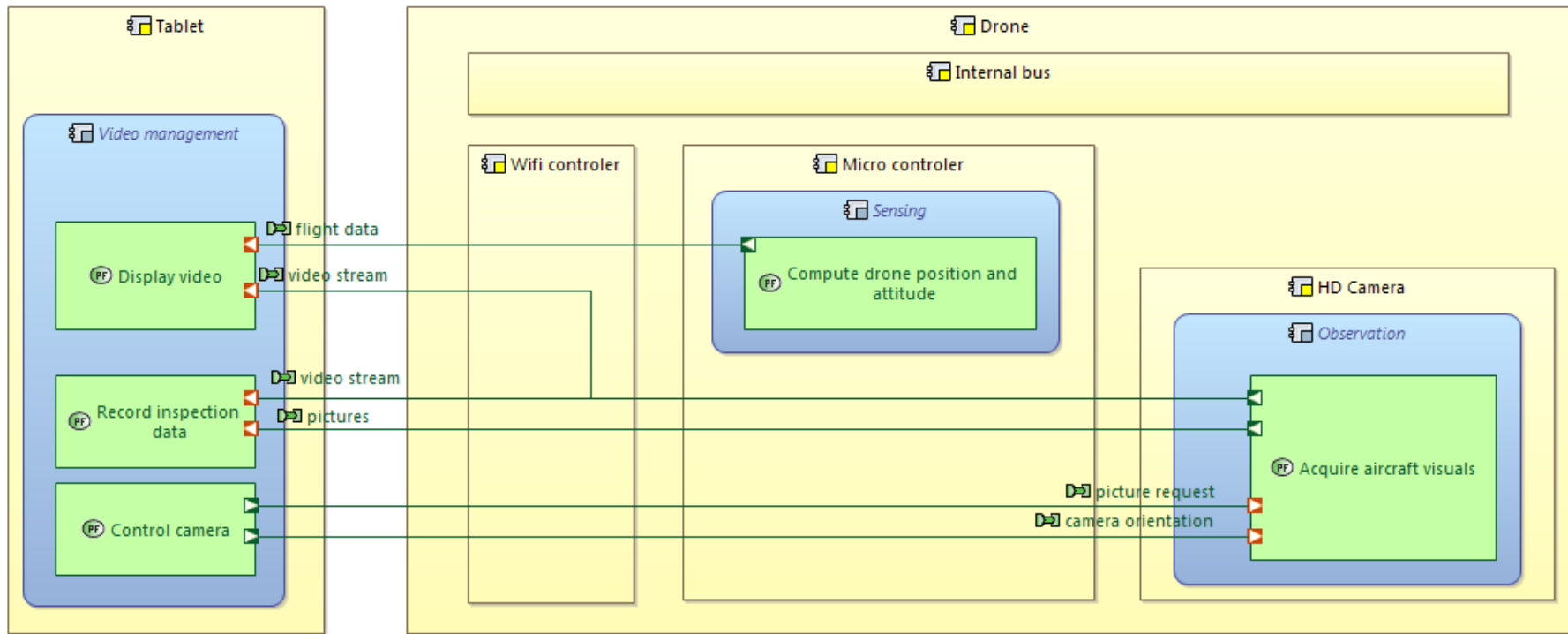
Hour

Minute

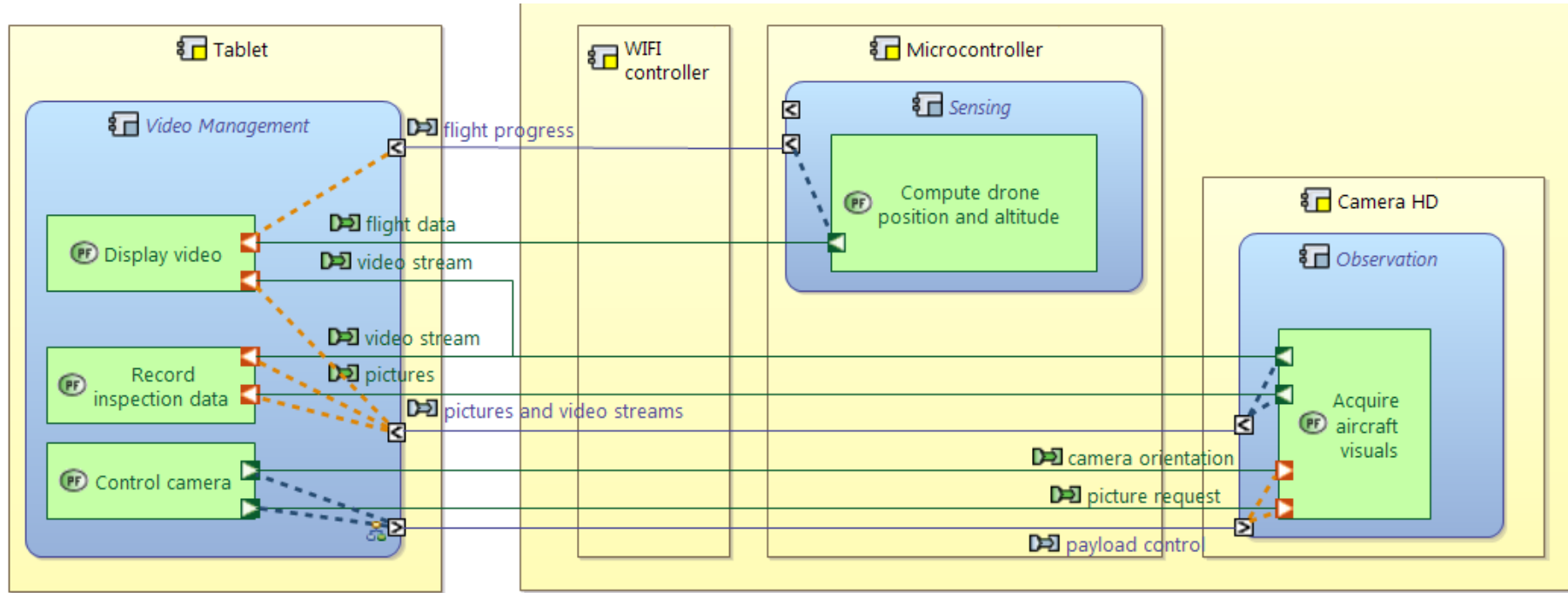
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M/S

Focus on “Video Management” interfaces

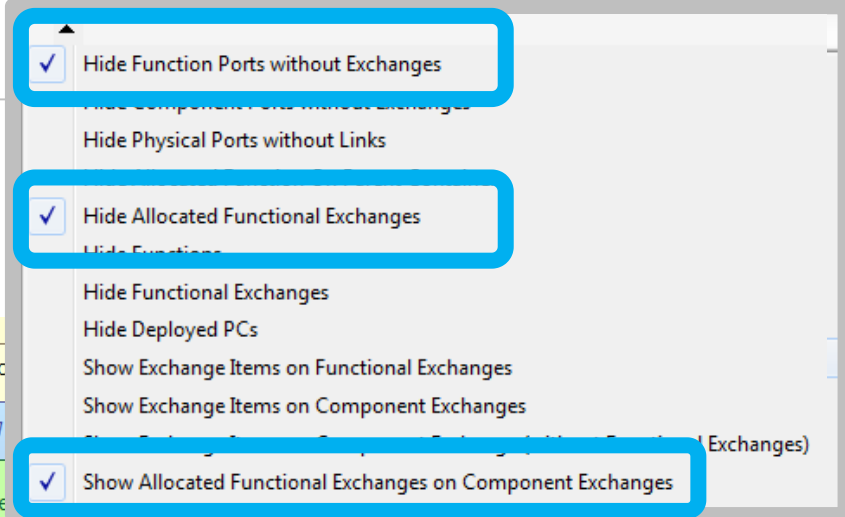
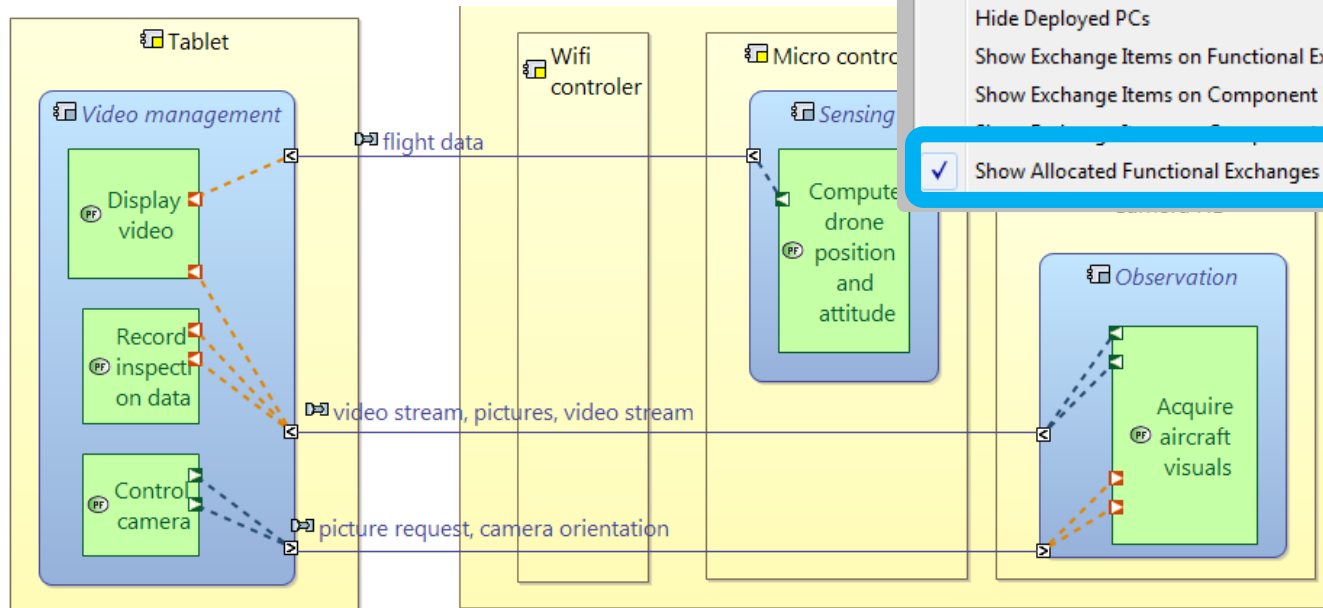


Component exchanges and port allocations

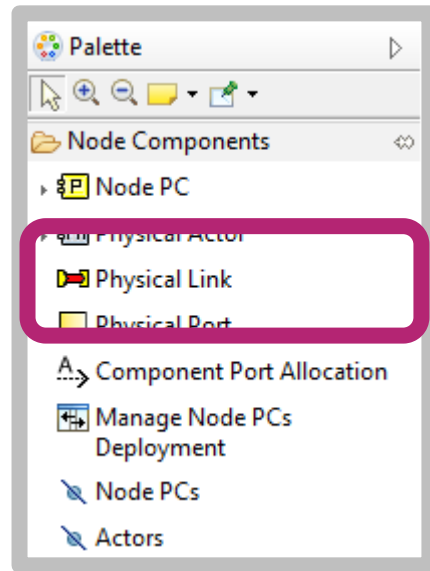
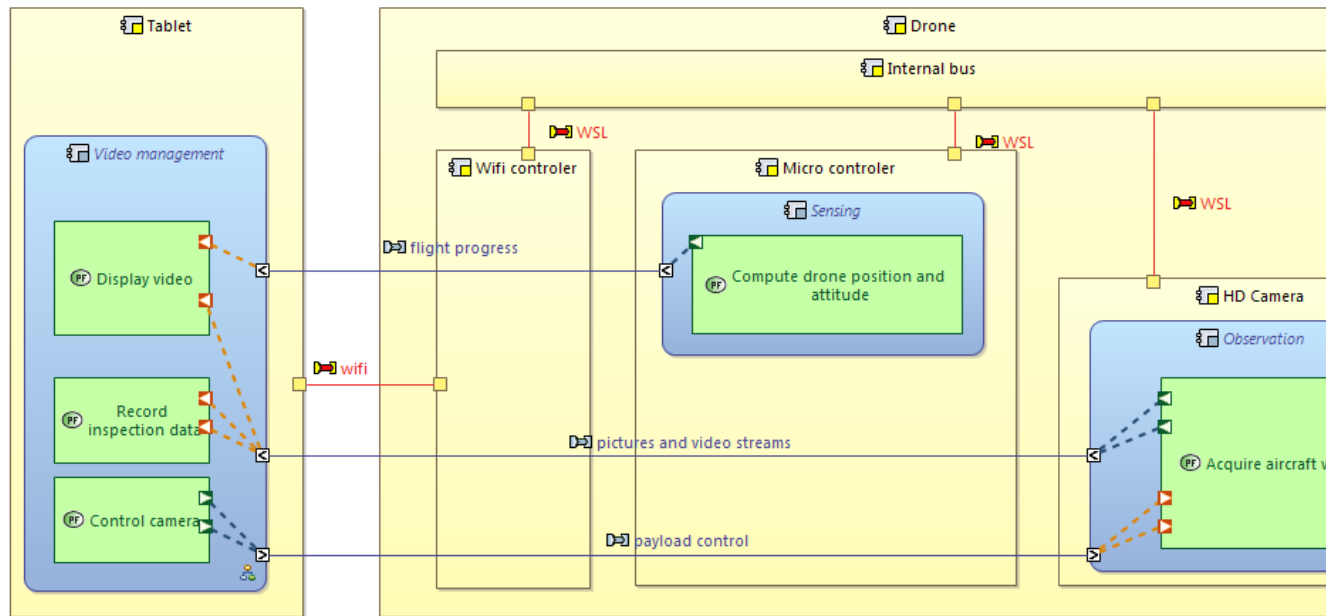


Component exchanges (filters)

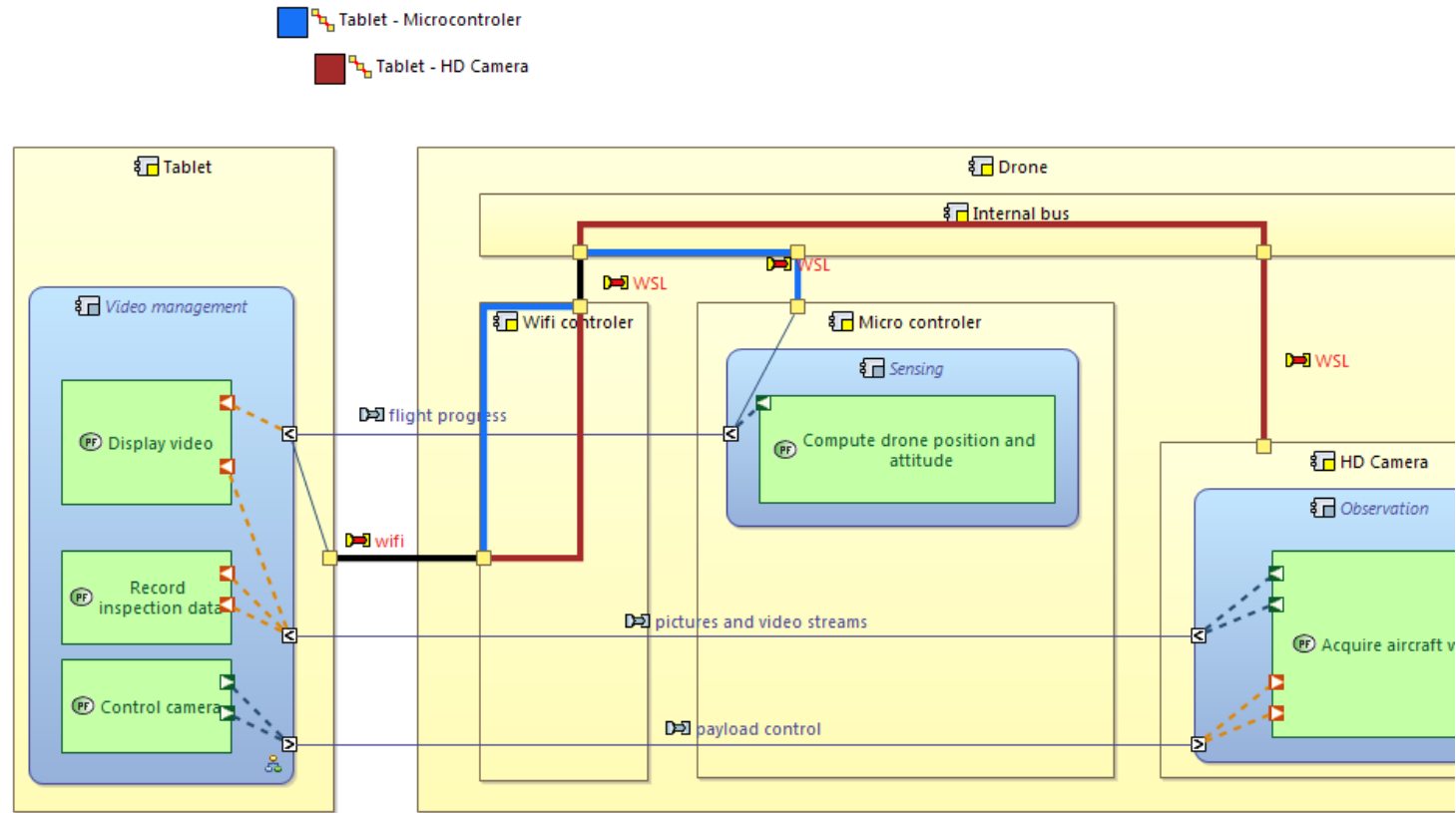
The name of the Component Exchange is not displayed anymore



Physical links

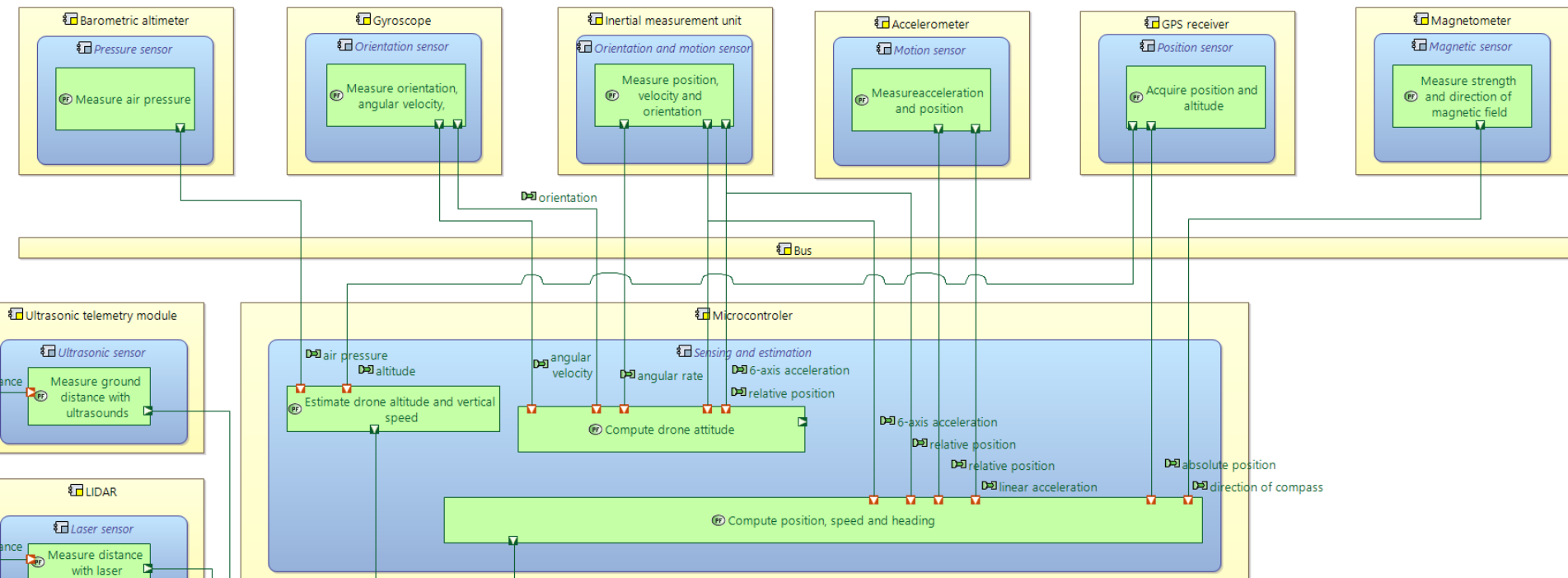


Physical paths



Example of Physical Architecture

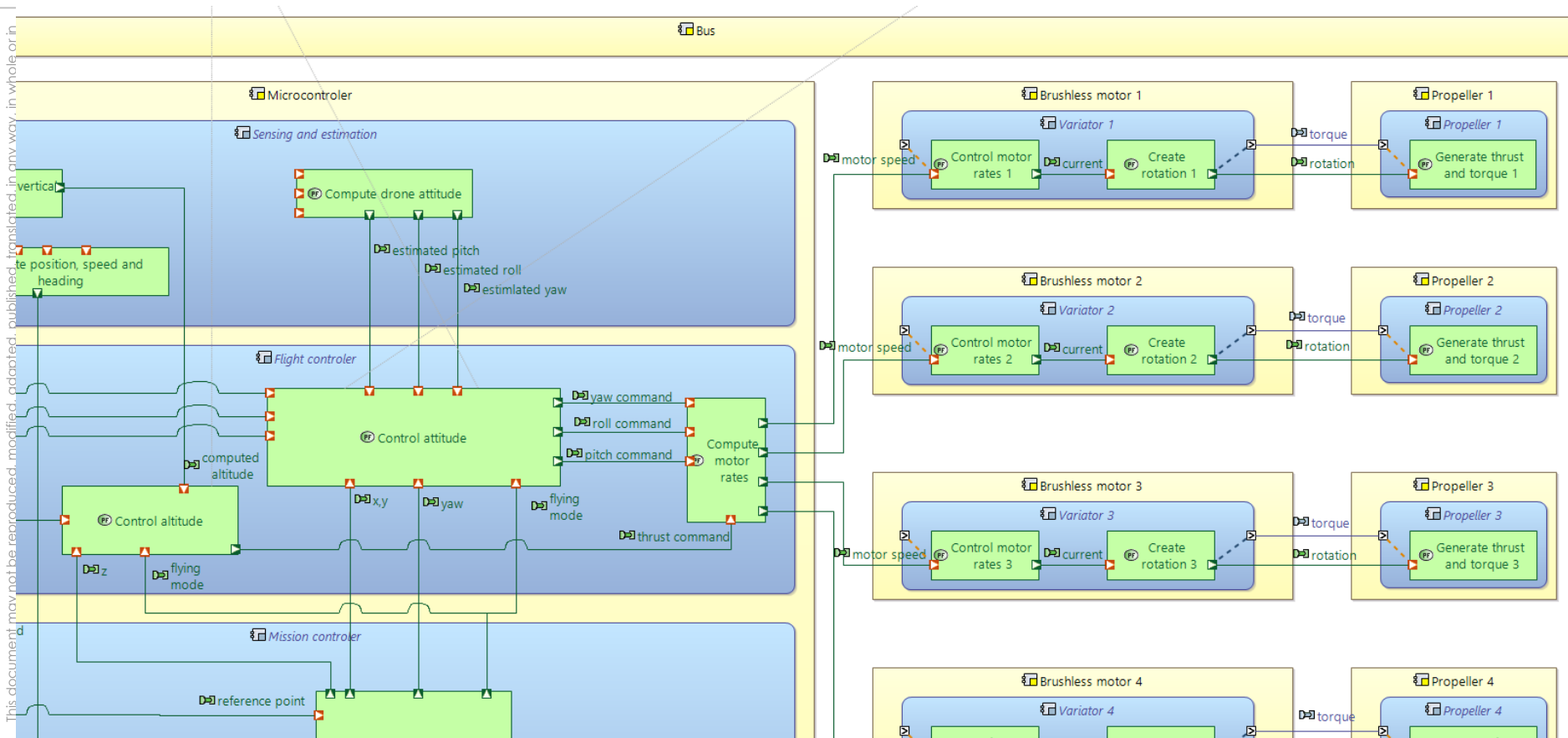
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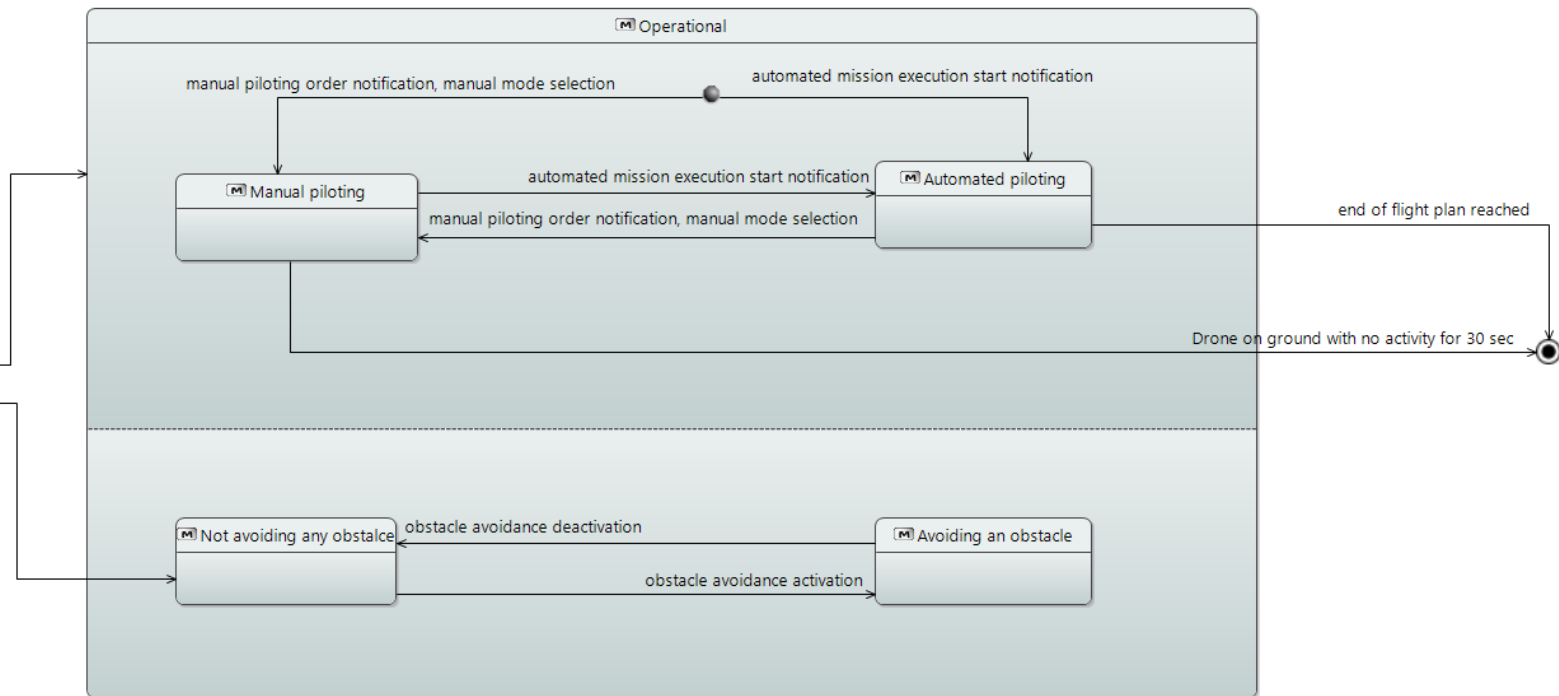
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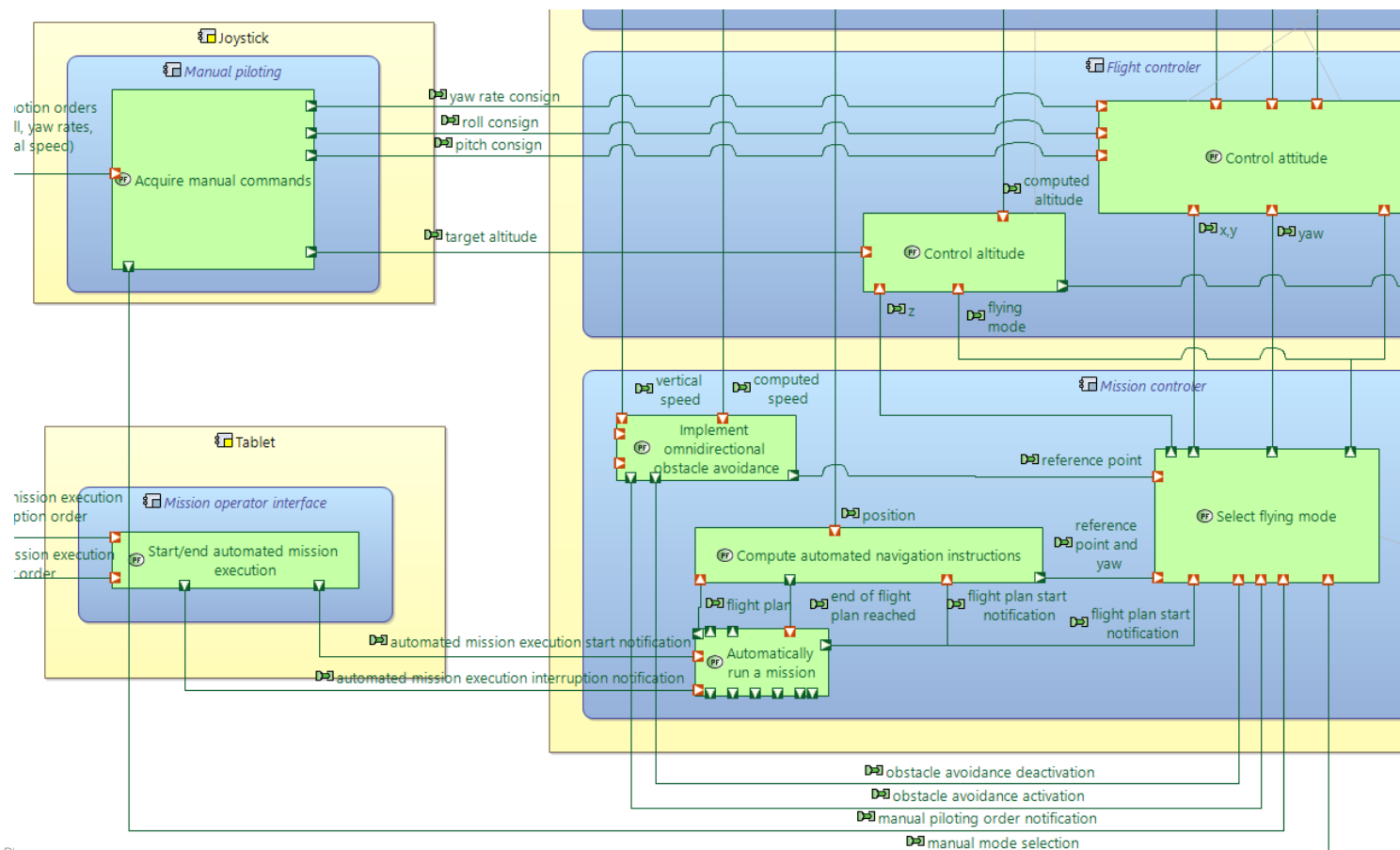
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Example of Physical Architecture



Example of Physical Architecture

