LAAS-CNRS

SATRIMMAP

Safety and Time Critical Middleware for future Modular Avionics Platform

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SATRIMMAP

- ANR research project.
- Partners: Airbus, CEA, IRIT, LAAS, ONERA, QoS Design.

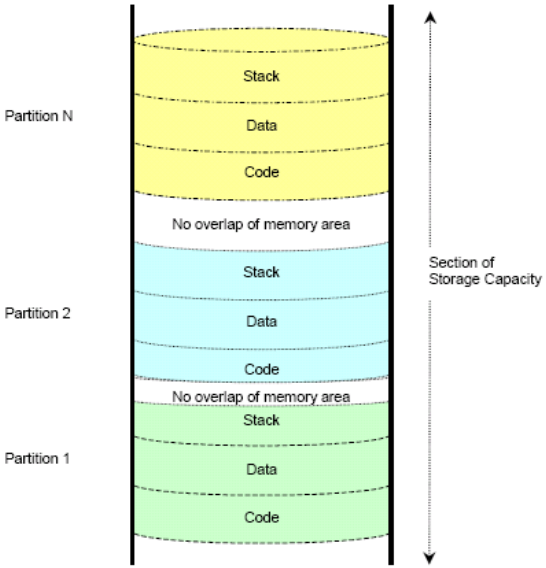
The Architecture

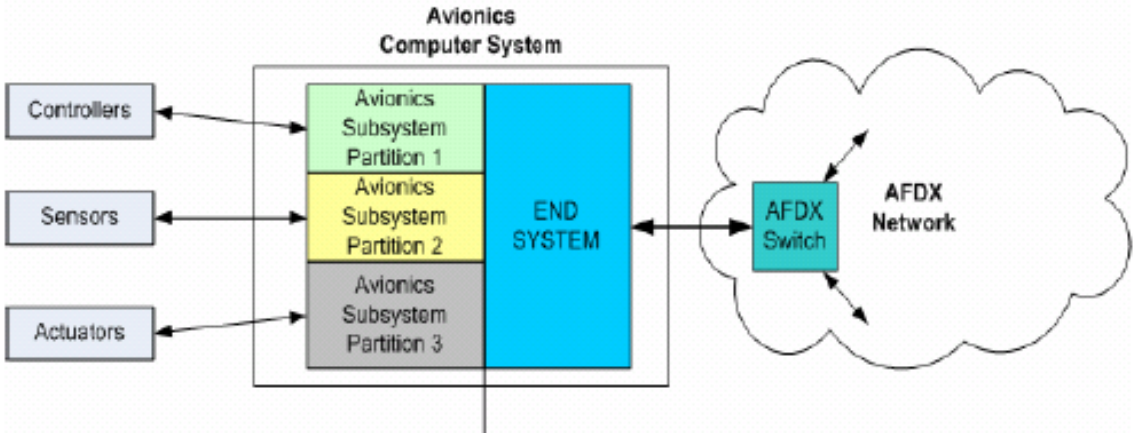
The IMA Architecture

- Integrated Modular Avionics
  - Interconnection of several modules/embedded systems on one platform.
  - Sharing resources and bandwidth.
- Several computing modules capable of supporting numerous applications of different criticality.
- Modules include:
  - CPM: Core processing modules.
  - CPIOM: Core processing and I/O modules.
  - RDC: Remote data concentrator.

Avionics Applications and Partitions

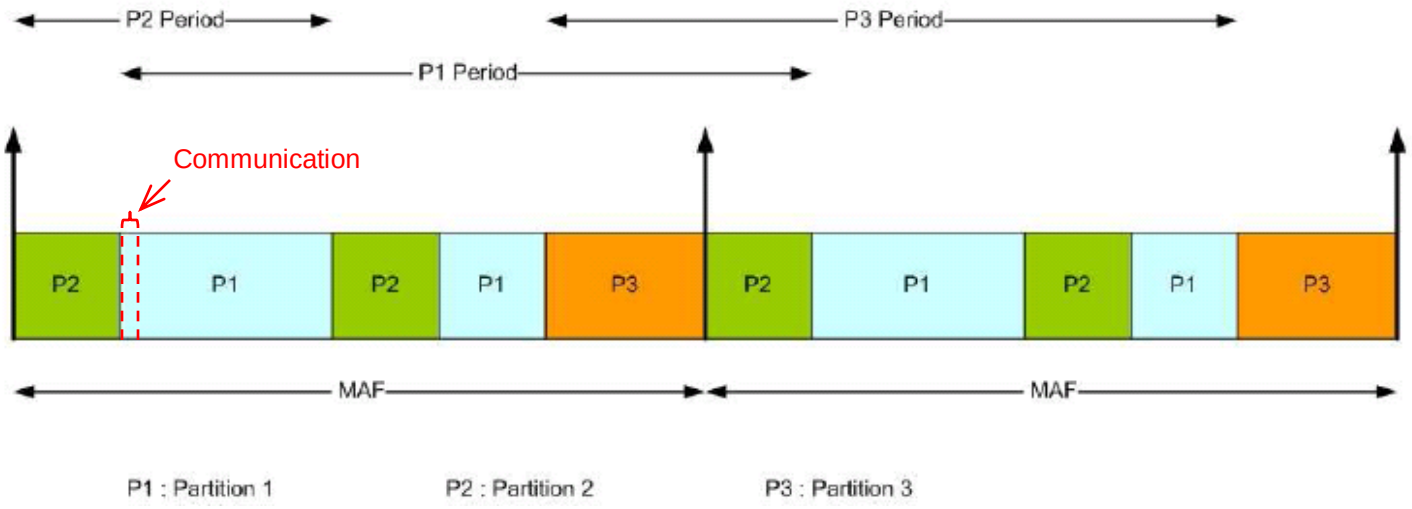
- Several applications resident on a computer system
  - Applications broken up to one or more partitions (pieces of code, data,…) based on criticality variation of its operation
  - Separation in resources and influence by communication only
  - Communication with partitions resident on other computer systems is through AFDX network via ports and an interface (End System)





Partitions

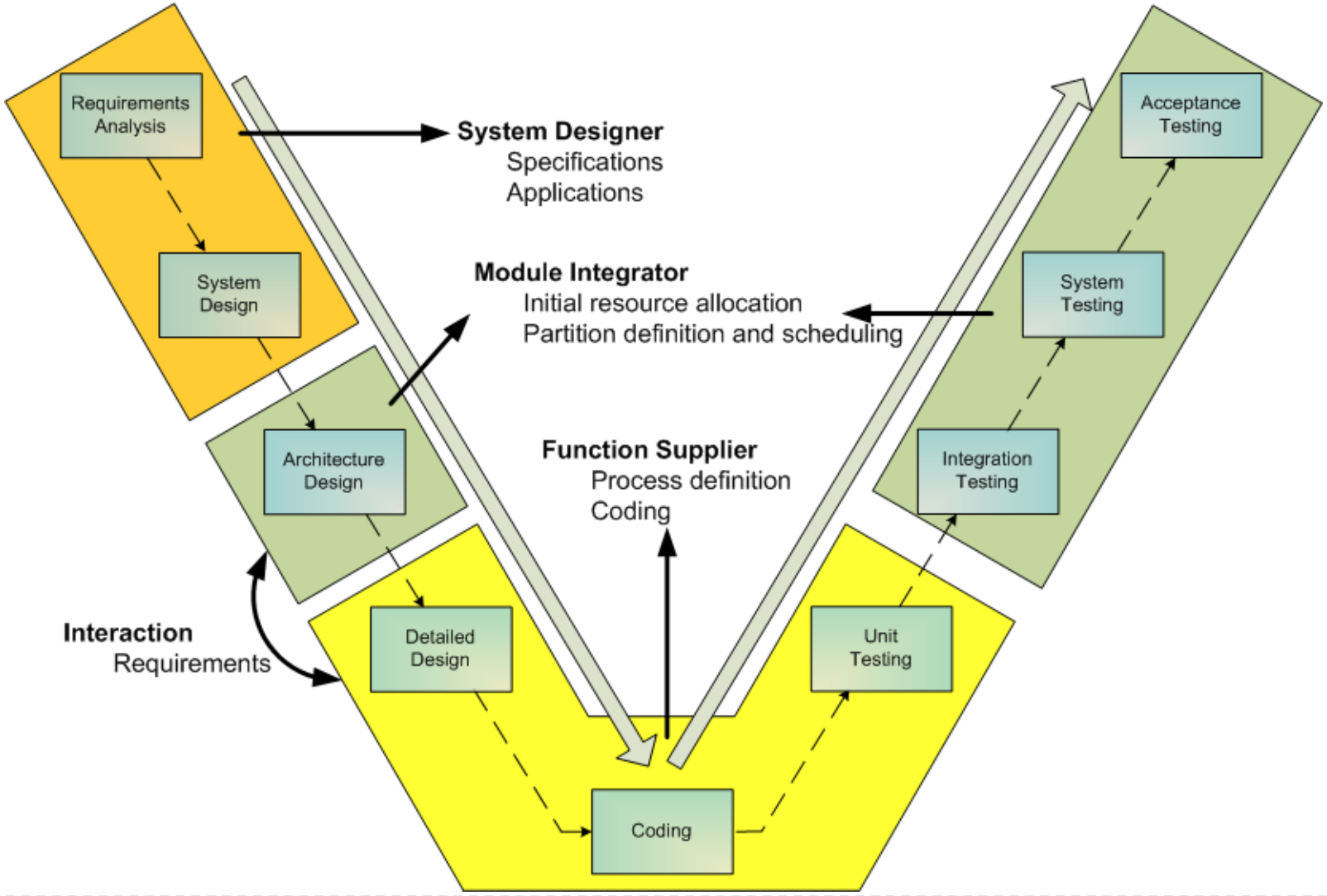
- Partitions have no priority and are periodic
- Scheduling algorithm of partitions is static with fixed periodicity
- Each partition allocated a window for execution



Processes

- Partitions comprised of one or more processes
- Processes have priorities defined statically, hence can pre-empt each other
- Processes may be periodic, aperiodic or sporadic
- Processes allowed to execute in corresponding partition window
- Processes of same partition share resources and communicate via buffers, semaphores,…
- Processes belonging to different partitions communicate via sampling/queuing ports

Software Development Cycle (AIRBUS)



Objectives

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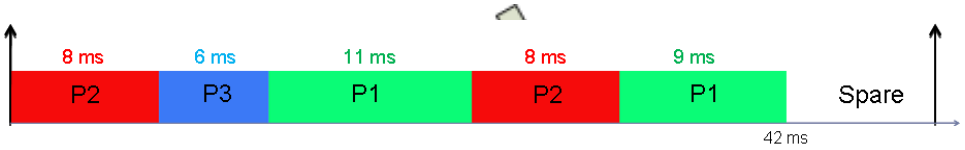
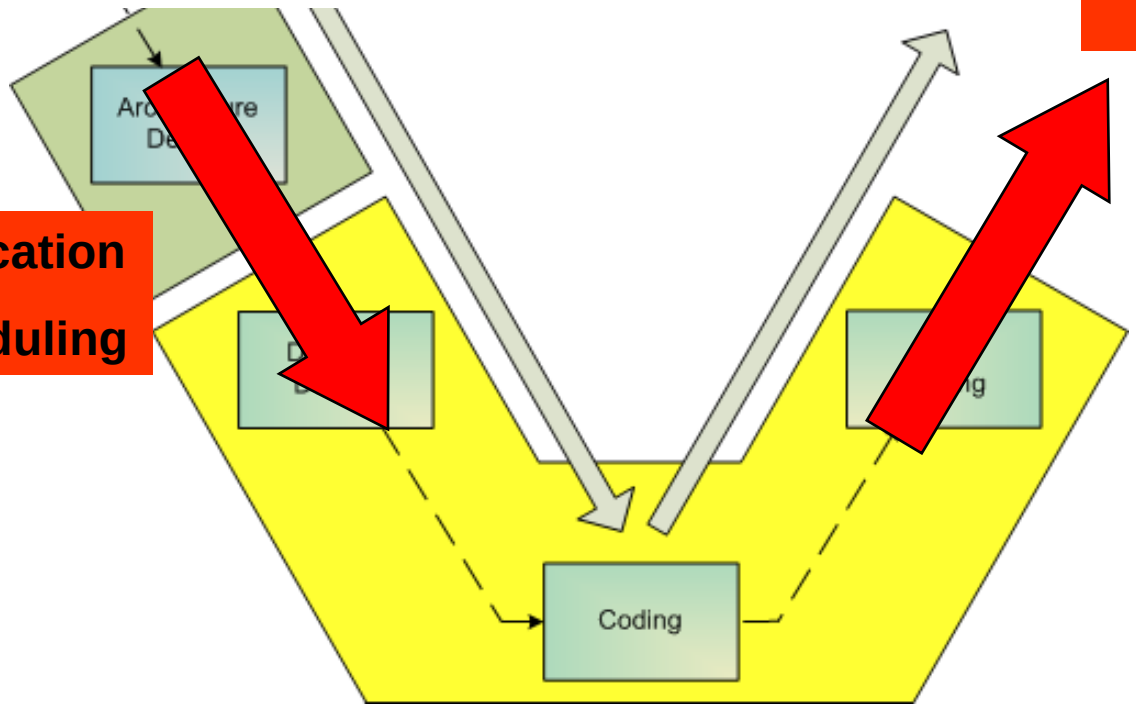
- Initial demand: develop a simulation and evaluation tool which is the primary requirement of our work
- Identifying the goals of the simulation
  - Feasibilty of a system that is designed to be so
- Propose the introducion of new functional aspects to our tool
  - Aiding the designer in constructing the system
    - Resource mapping and scheduling
    - Propose possible and optimal solutions

Contribution (aimed for)





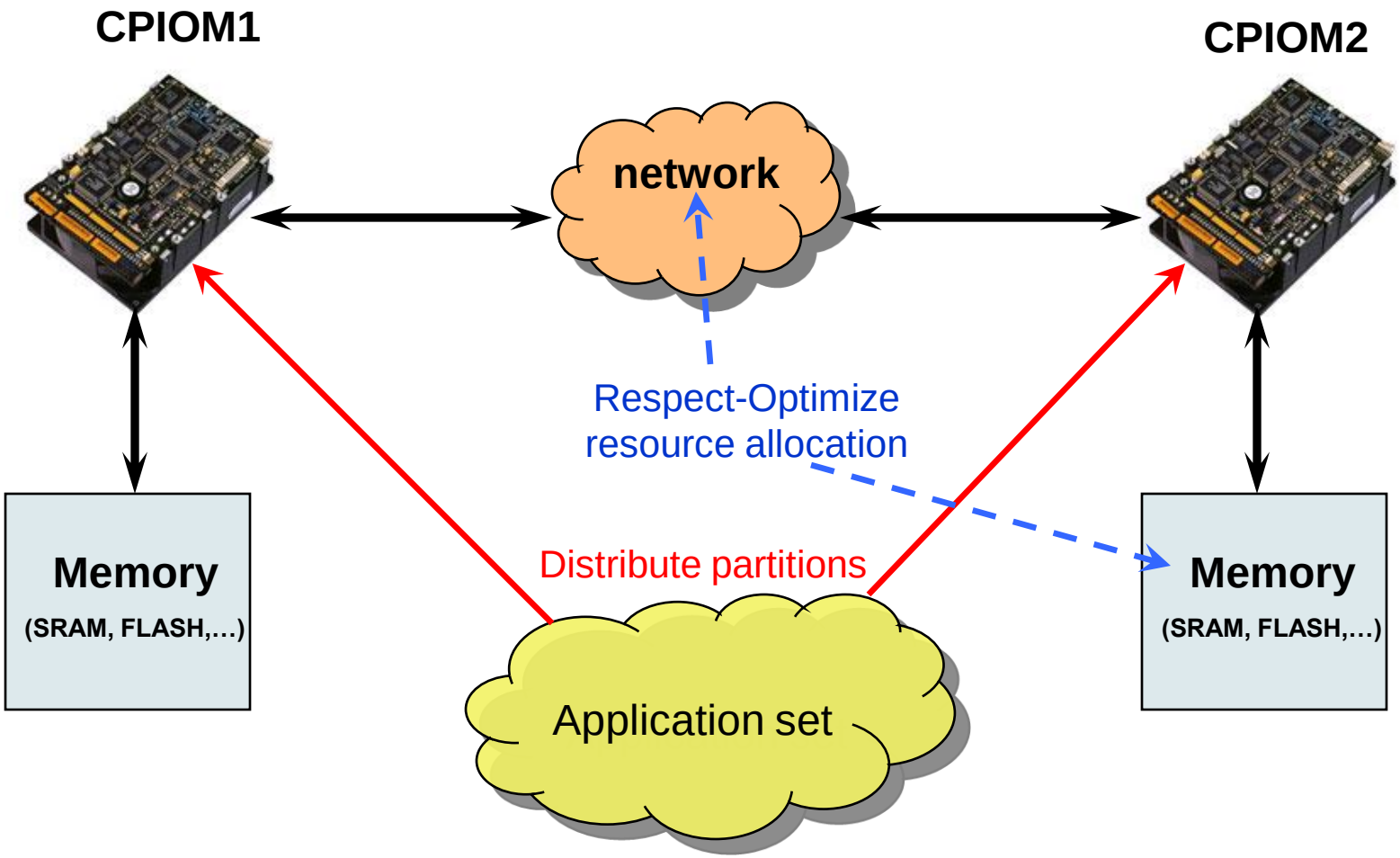
Verification by process level simulation

Resource allocation

Partition scheduling

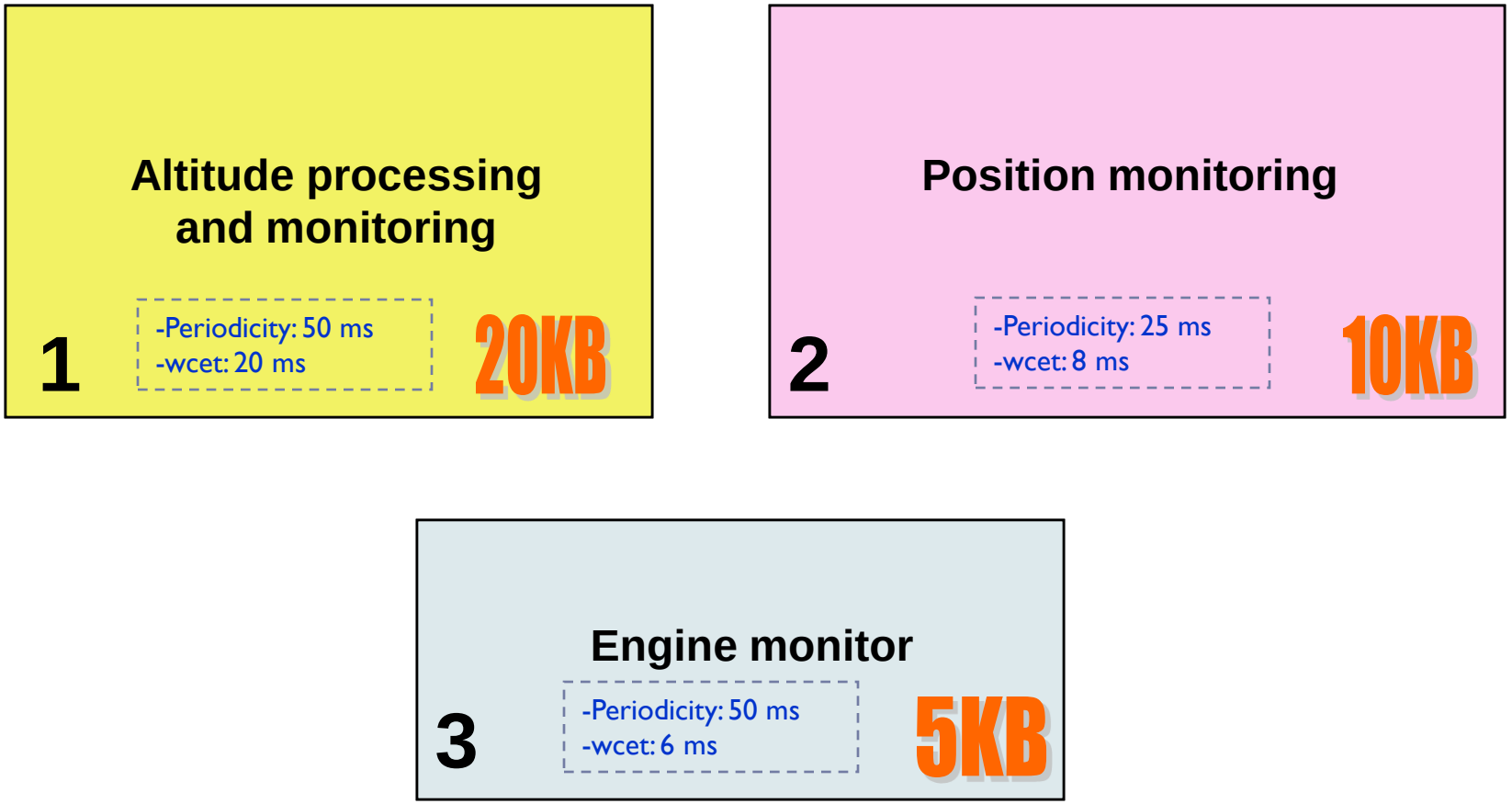
An Example

Environment



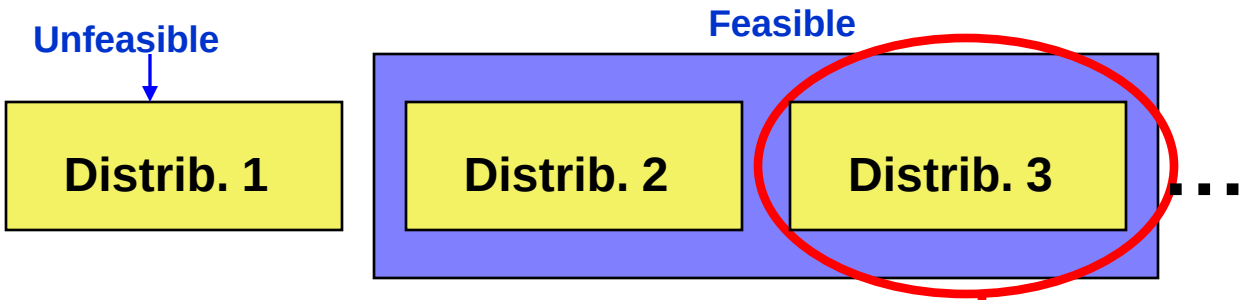
Partition Example

- Application set: For simplicity, only memory as resource constraint



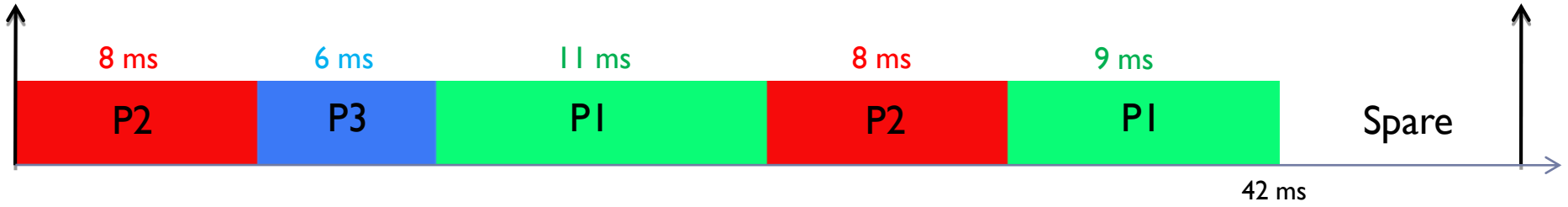
Distribution of partitions

- Choose suitable distribution respecting constraints



1. Search for feasible solutions

2. Select optimum



Process Scheduling Verification

- Process execution simulation:

Conclusion

Conclusion

- Define applications + attributes
- Provide a model for our constraints (partitions, resources, network, etc…)
- Study possible algorithms to solve our distribution and scheduling problem *[thesis-Roux]*.
- After corresponding partition configuration, wait for process definition.
  - Simulate the execution of processes with the above mentioned partition configuration.
- Prospective → Break down partitions into functions