Tasking Framework

Parallelization of Computations in Onboard Control Systems

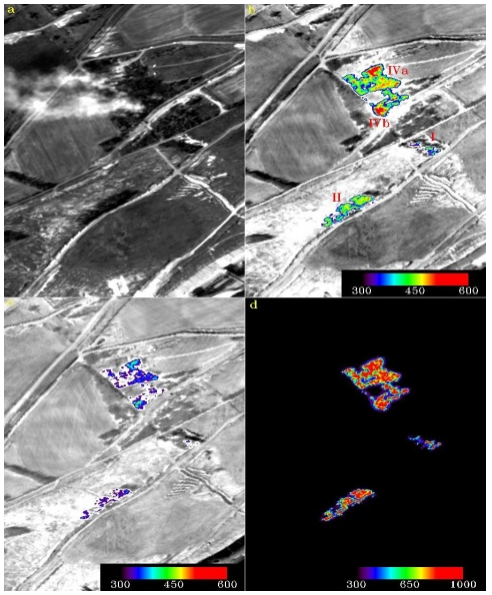
Overview

- Introduction
  - Future Challenges in Space Application
  - Sensor Data Fusion
  - ASAP Scheduling
- Tasking Framework
  - Principal
  - Elements
  - Process
- OBC-NG (On-Board Computer – Next Generation)
  - Redundancy Concept
  - Reconfiguration
  - Configuration DSL

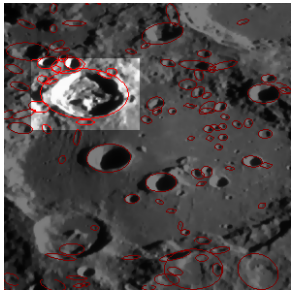
Introduction: Future Challenges in Space Application

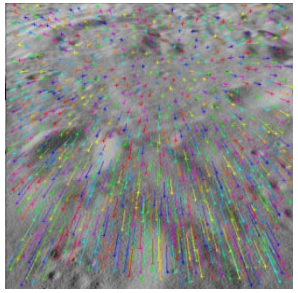
- Onboard data processing
  - Reduce amount of data
  - Preprocessing of scientific data
    - Scientific Products
    - Catastrophe Management
    - Onboard Planning

- Optical Sensor Systems
  - Image Processing
    - Rectification
    - Object Identification
    - Feature Tracking
    - Optical Flow
    - Stereo Matching

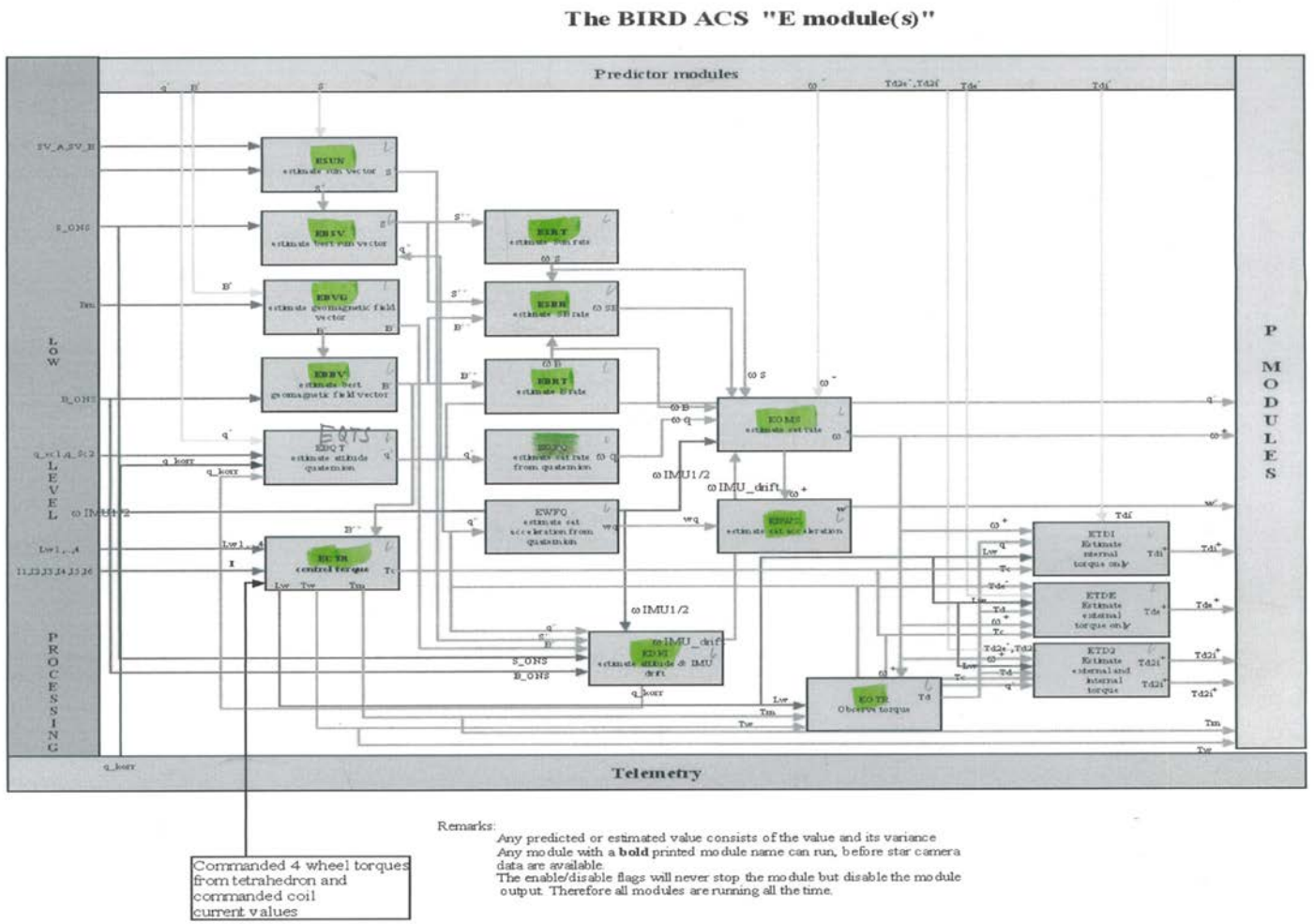


DLR: Firebird



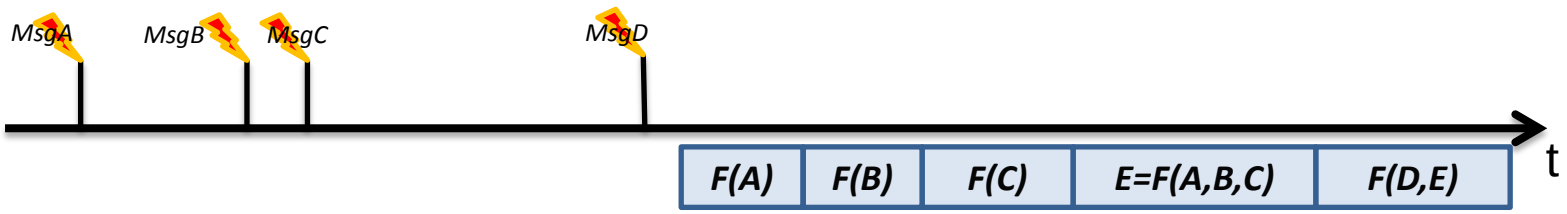

DLR: ATON

Introduction: Sensor Data Fusion

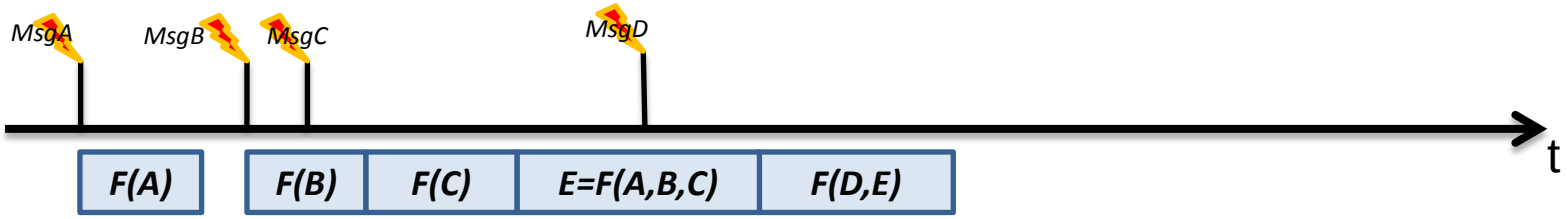


Introduction: ASAP scheduling

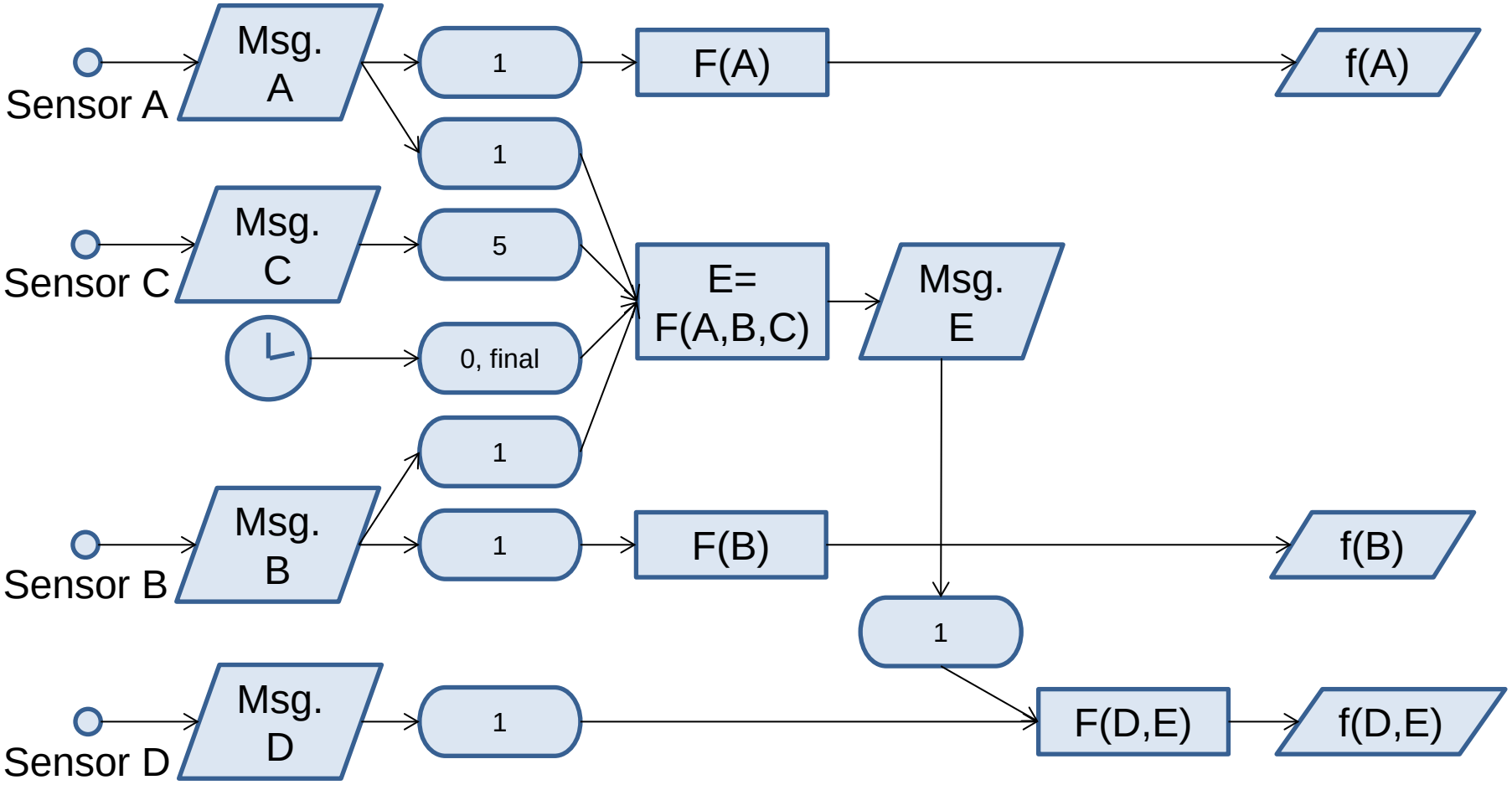
Conserative scheduling in one code block:



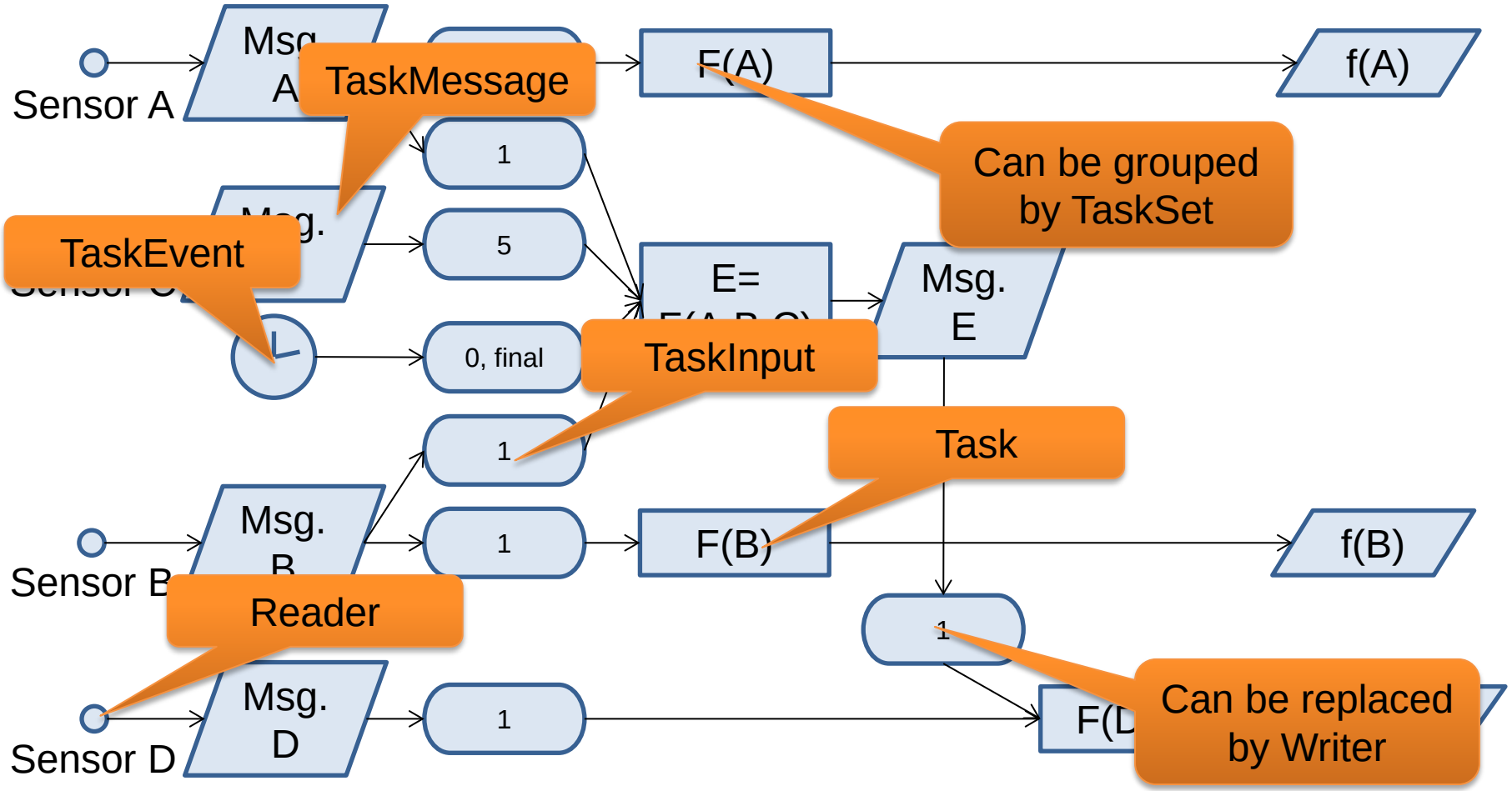
Tasks with ASAP scheduling:



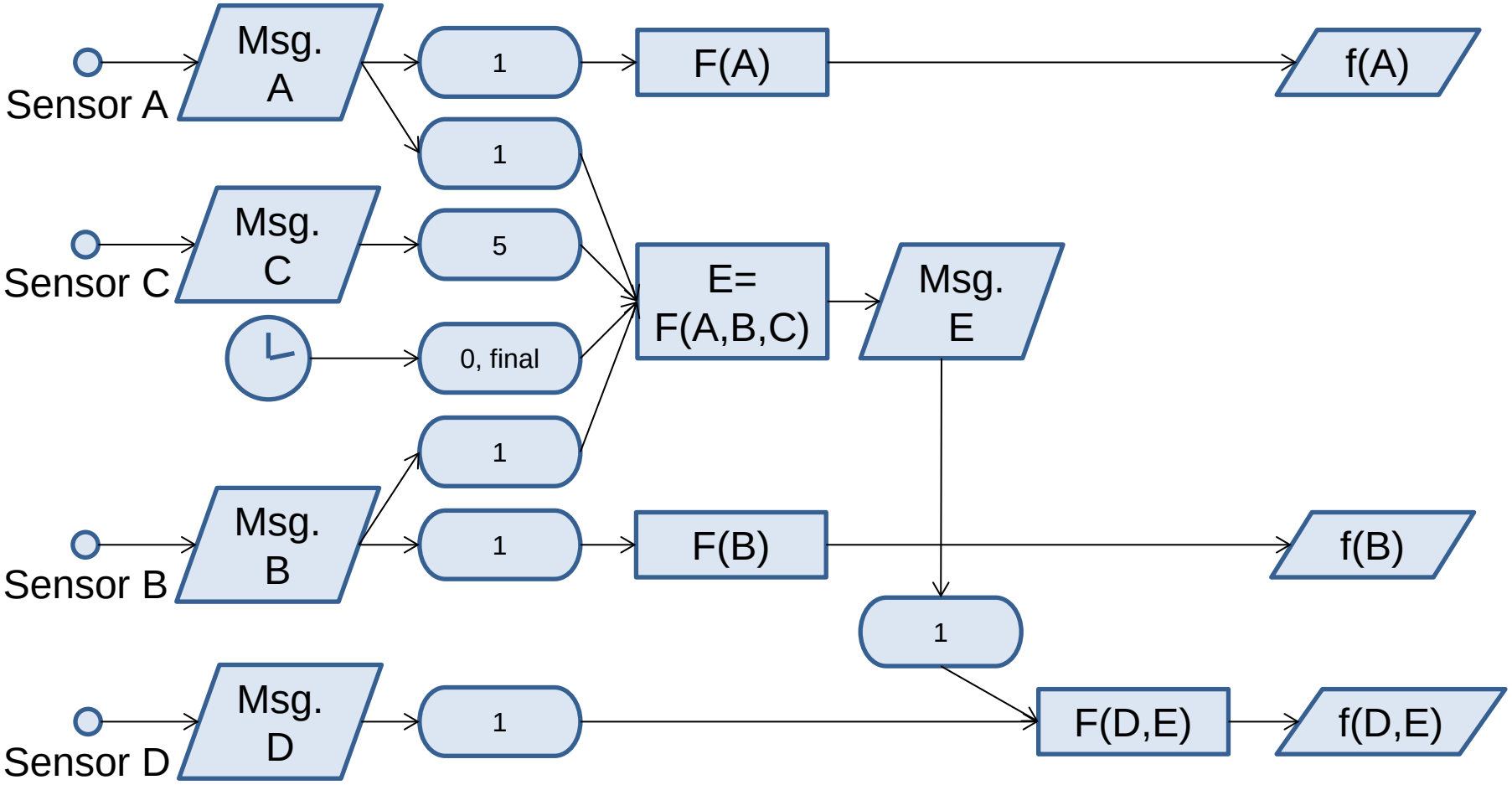
Tasking Framework: Principal



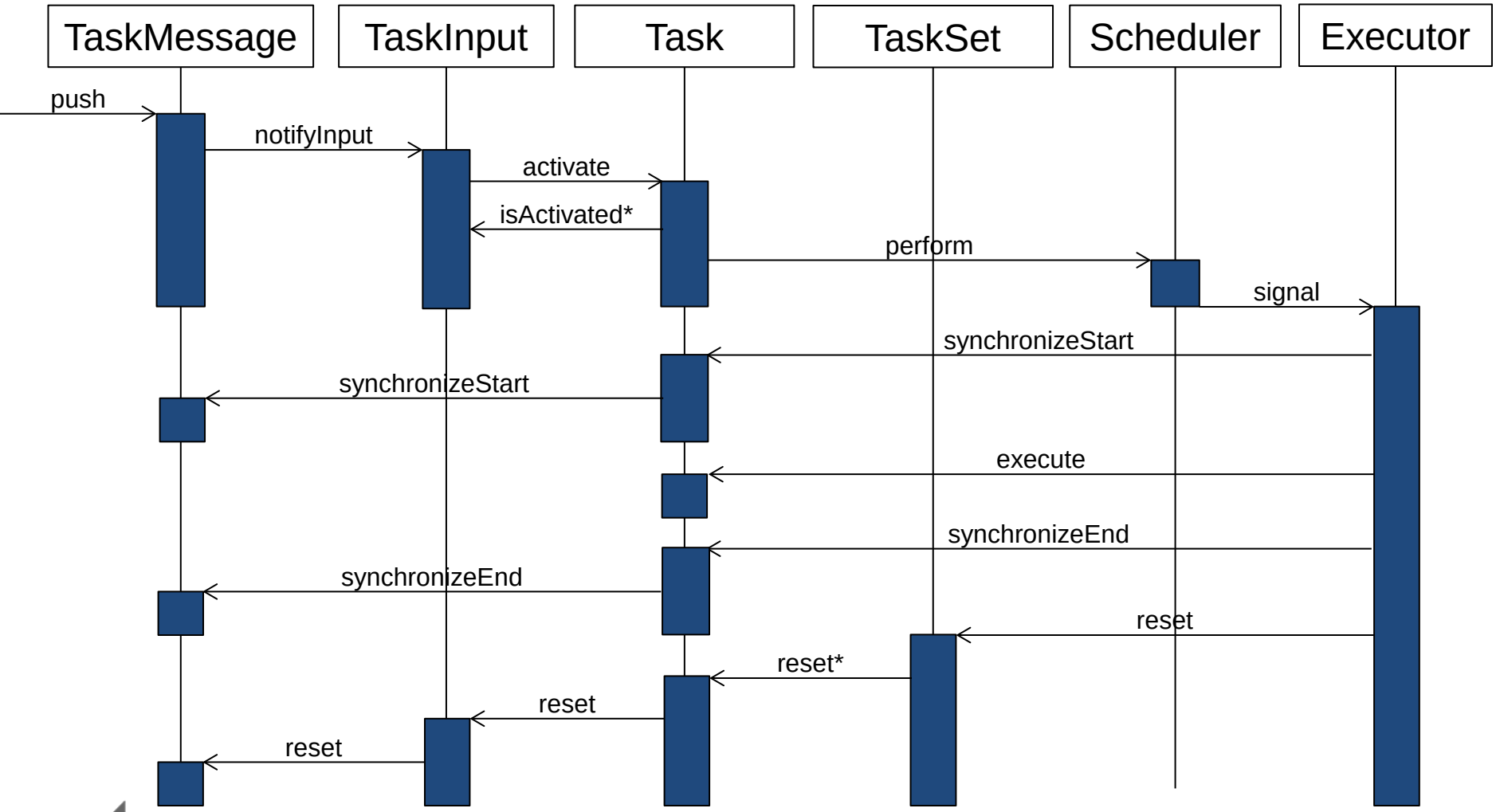
Tasking Framework: Elements



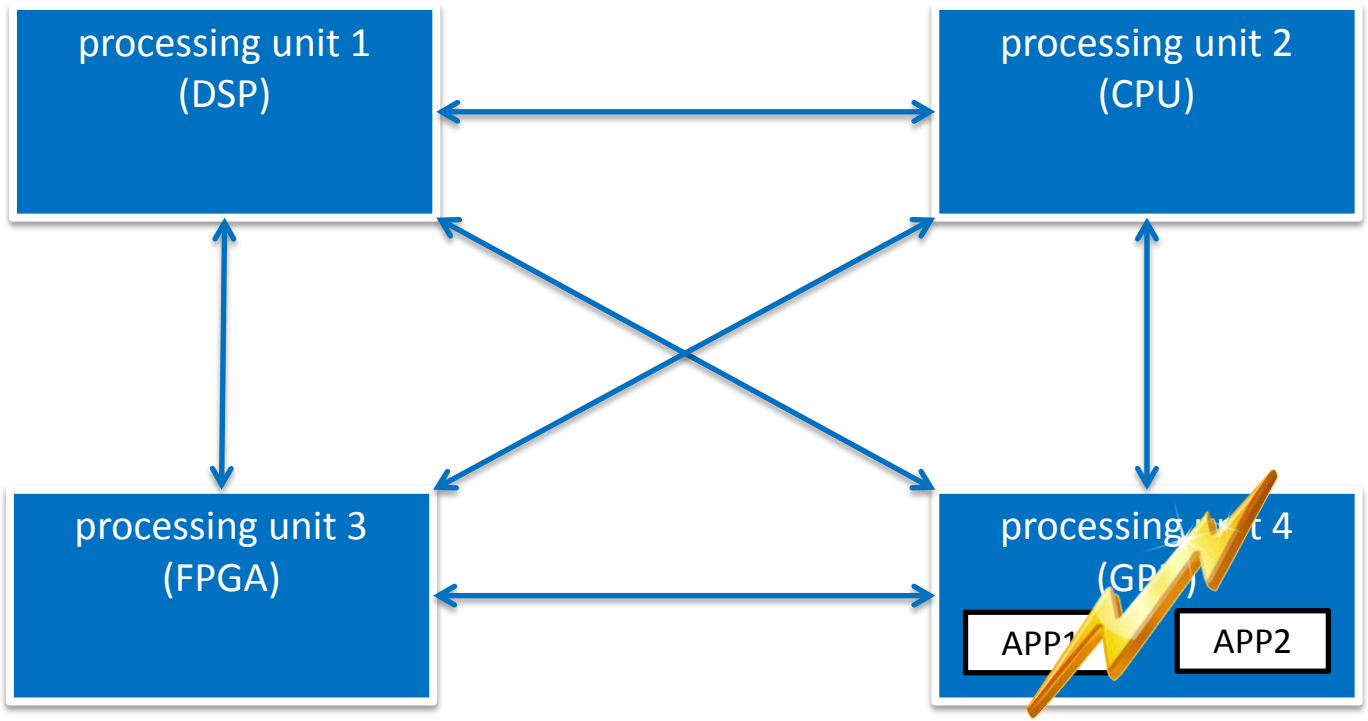
Tasking Framework: Example



Tasking Framework: Process

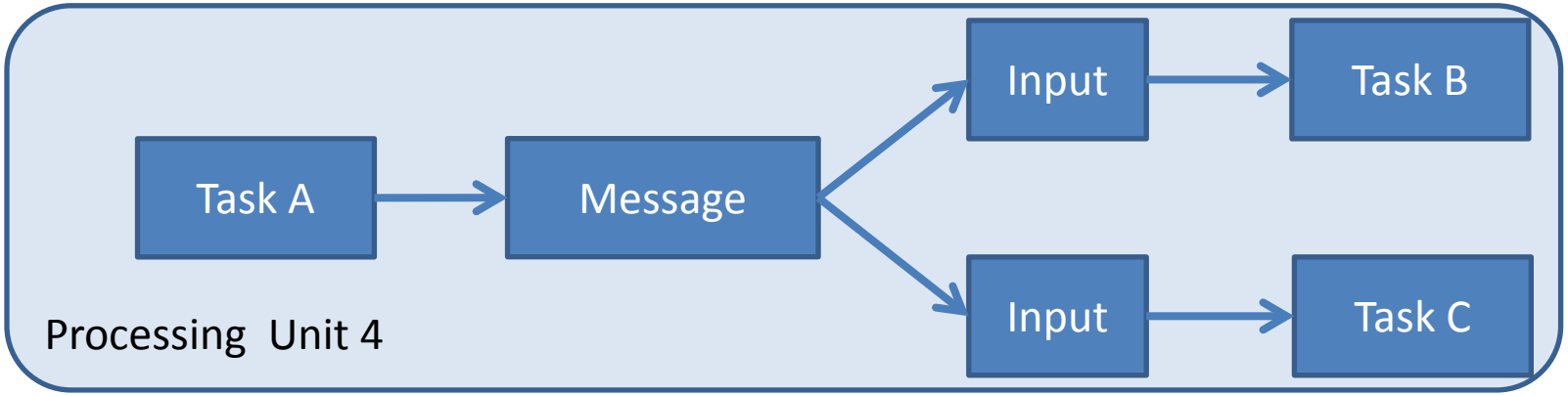


OBC-NG: Redundancy Concept



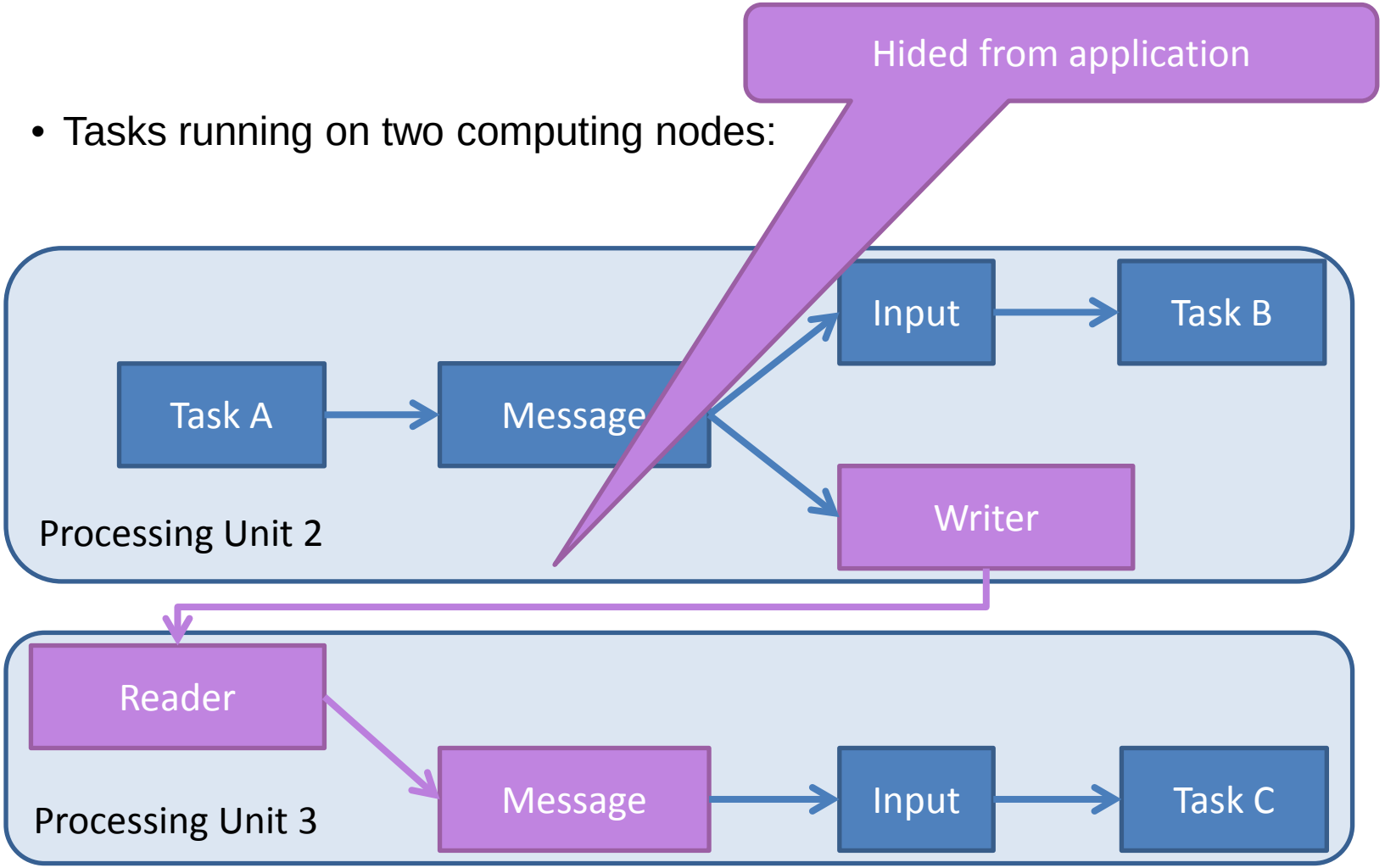
OBC-NG: Task Reconfiguration

- Tasks running on one computing node:



OBC-NG: Task Reconfiguration

- Tasks running on two computing nodes:

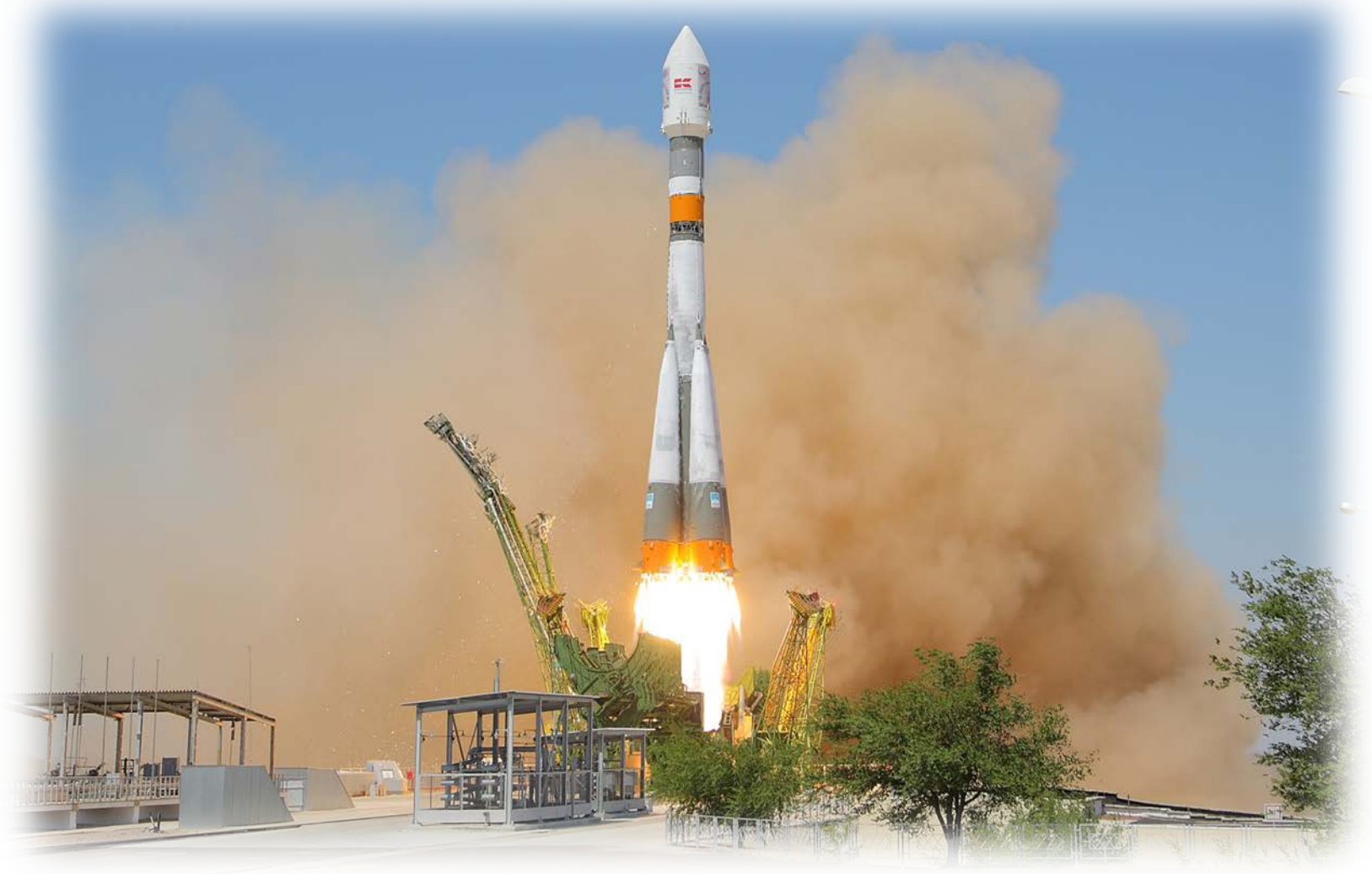


OBC-NG: Task Concept Configuration DSL

- Name the tasks
- Name the messages
- Assign messages to tasks
  - Input messages (number of arrivals/final flag)
  - Output messages
- Distribute tasks over processing nodes
  - for different node configurations
  - for mission phases

Conclusion and Outlook

- Tasking Framework
  - Data and event driven scheduling
  - Low management overhead
  - Petri Net oriented way → Good way to parallelize computations
  - Proved in one complex software currently (ATON)

- OBC-NG
  - Configuration by DSLs
  - Reconfiguration Concept
  - Easy to set up redundant on-board computations
  - Applicable for heterogeneous distributed systems

- On-going work
  - Design of hardware and software for OBC-NG
  - Apply Tasking Framework in a flight software (Planned launch 2016)