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# Toy OBDH system

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# Overview

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- The aim of this project is to build a simple mockup of a satellite OBDH system performing basic housekeeping telemetry
  - ▶ periodic sensor sampling
  - ▶ periodic basic telemetry
  - ▶ on-request housekeeping telemetry with recent data

# Functional requirements

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- A temperature sensor is periodically sampled with period  $T_s$
- A basic TM message is sent periodically with period  $T_B$ . The message contains the average value of the temperatures measured since the last basic TM
- The system can receive a TC from the ground station requesting a temperature report. It replies with a housekeeping TM message including the values of all temperatures stored since the last basic TM message and their respective reading times.
- TM messages are stamped with the current time.
- Time stamp values are given in seconds from the system start time, with a resolution of at least 1 ms.

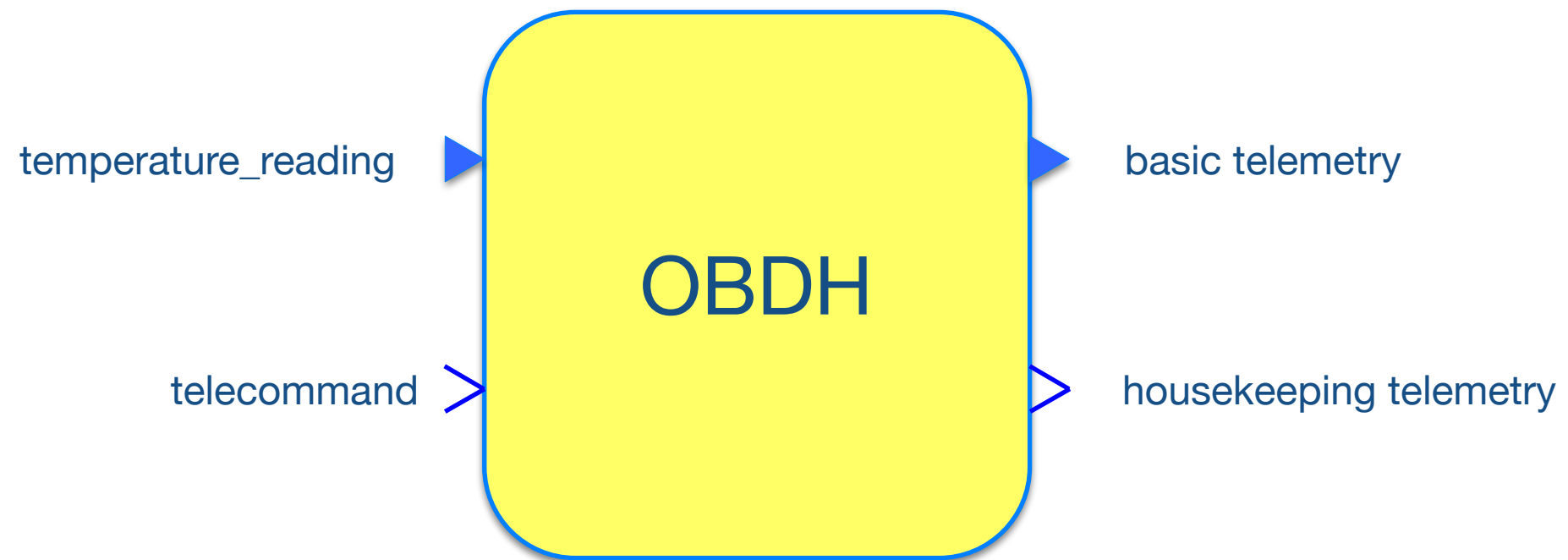
# Temporal requirements

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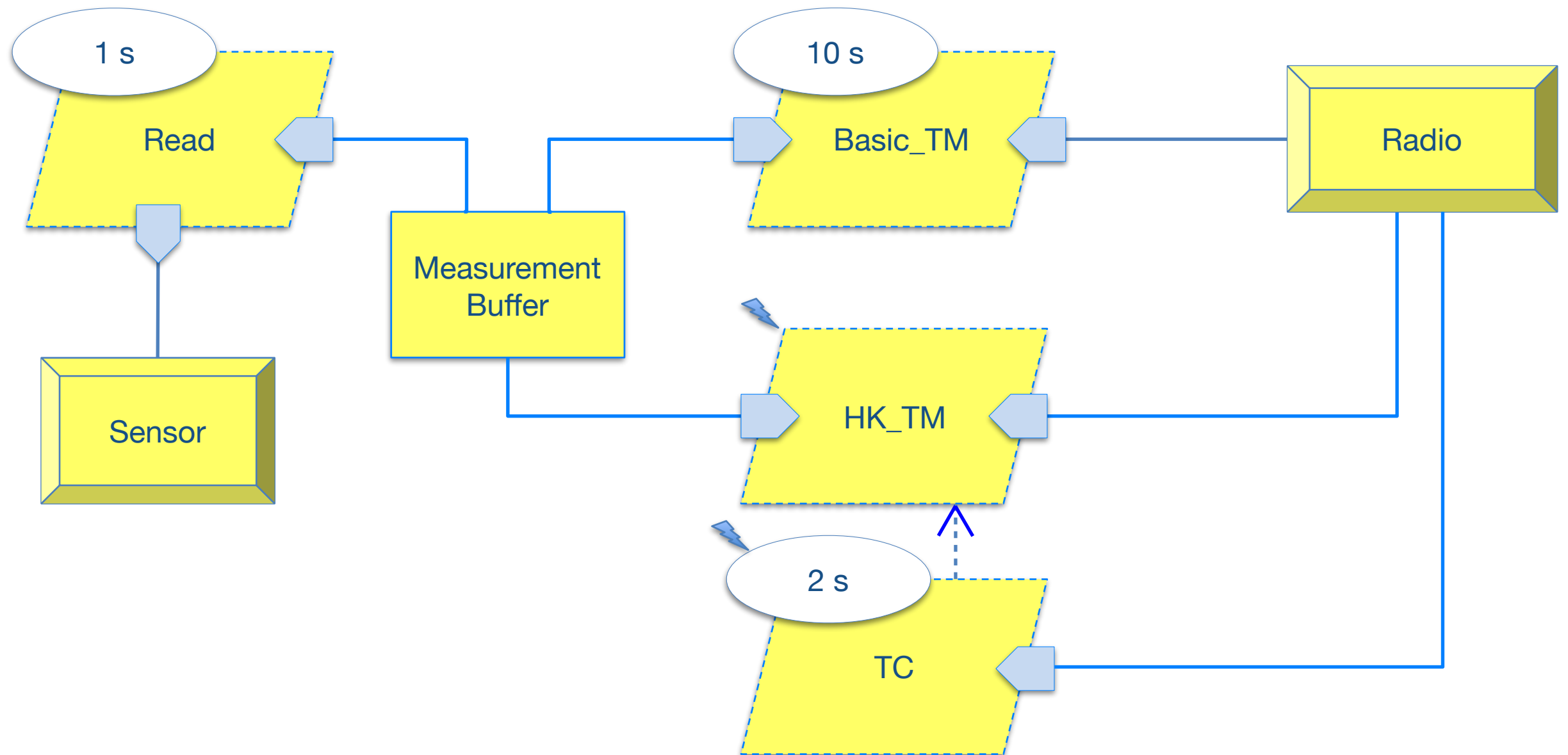
- Temperature must be sampled every  $T_S = 1 \text{ s}$ 
  - ▶ reading to be completed before  $D_S = 0.1 \text{ s}$
- Basic telemetry must be sent every  $T_B = 10 \text{ s}$ 
  - ▶ message must be sent before  $D_B = 0.5 \text{ s}$
- Telecommands are separated by at least  $T_C = 2 \text{ s}$ 
  - ▶ processing must be completed before  $D_C = 0.05 \text{ s}$
- Housekeeping telemetry messages are sent after reception of a TC
  - ▶ message must be sent before  $D_H = 0.2 \text{ s}$

# Context diagram

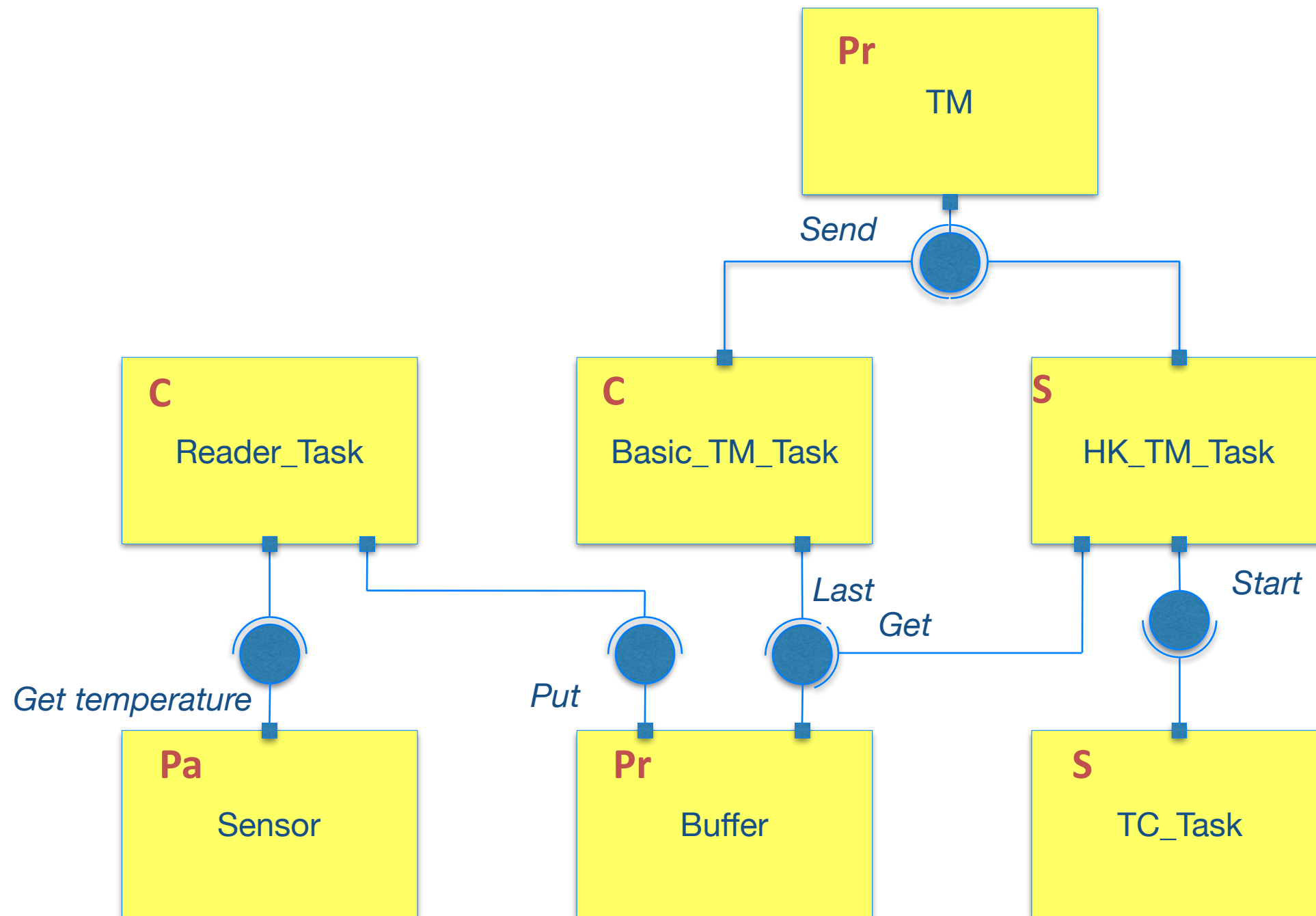
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# Architectural design (AADL)

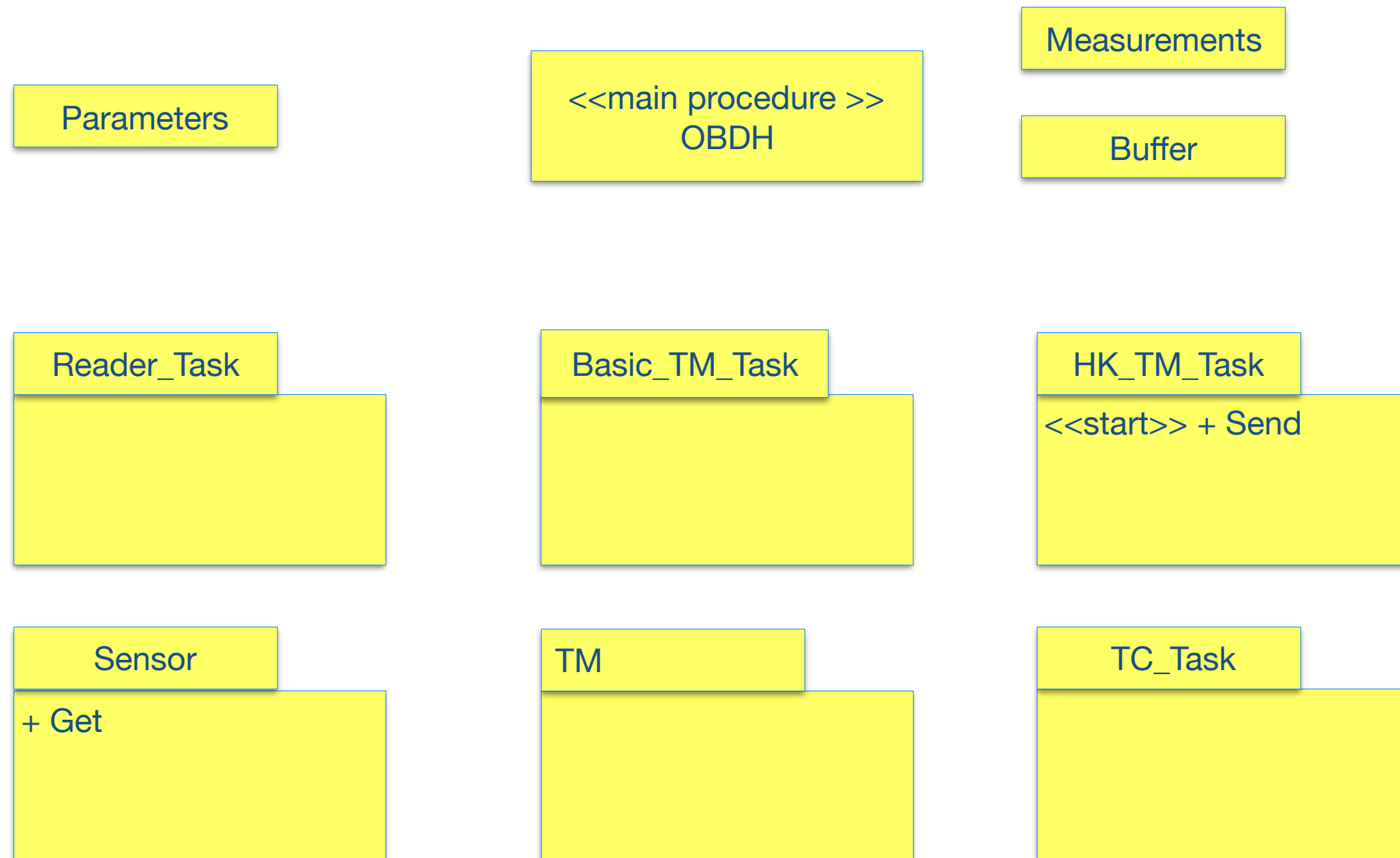


# Architectural design (UML)



# Detailed design

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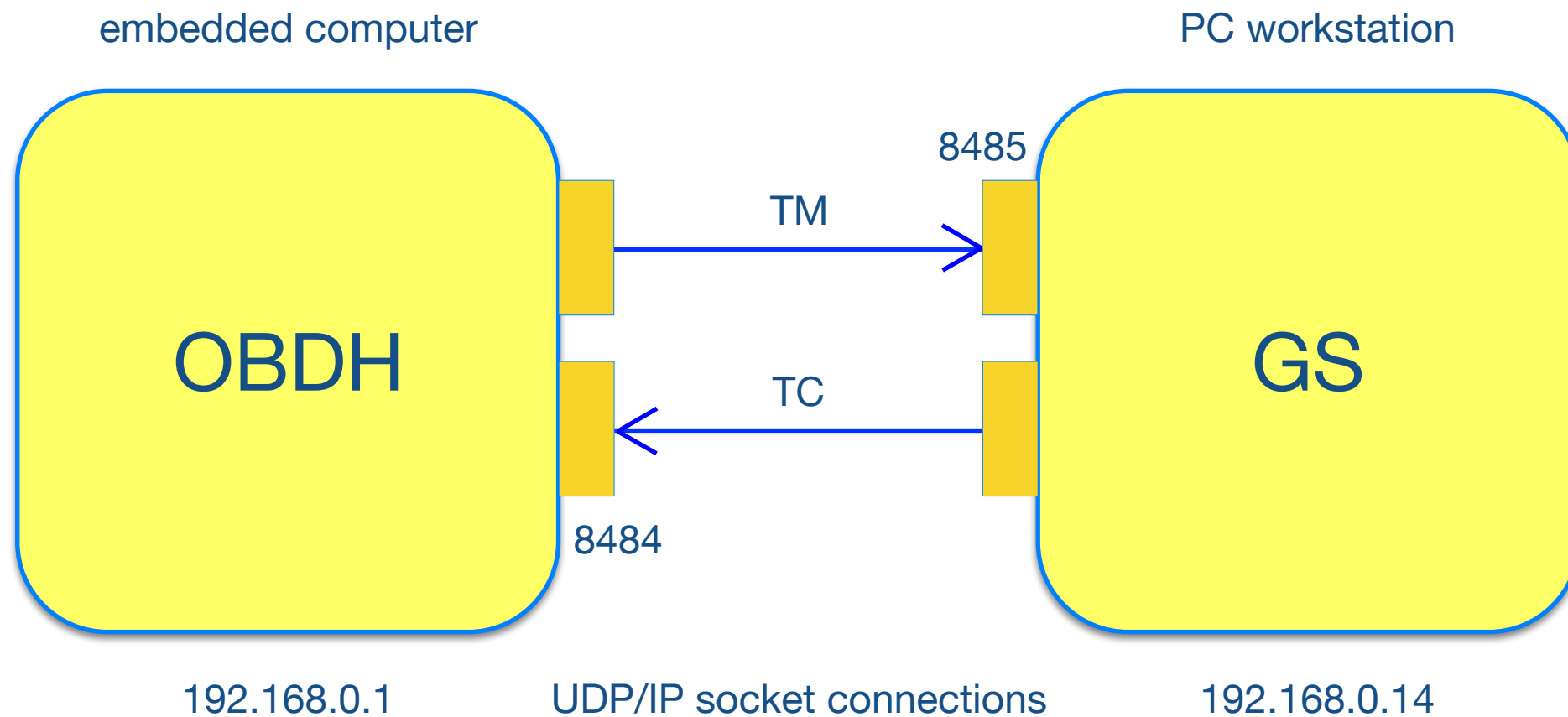


# RT Analysis

Task		P	T	C	B	R	D
TC	S	4	2,0	0,020	0,001	0,021	0,050
Reader	P	3	0,1	0,010	0,002	0,032	0,100
HK_TM	S	2	2,0	0,12	0,005	0,165	0,200
Basic_TM	P	1	10,0	0,050	0,000	0,210	0,500
PO							
HK event		4		0,001			
TC event		4		0,001			
Buffer		3		0,002			
TM		2		0,005			

# Ground station

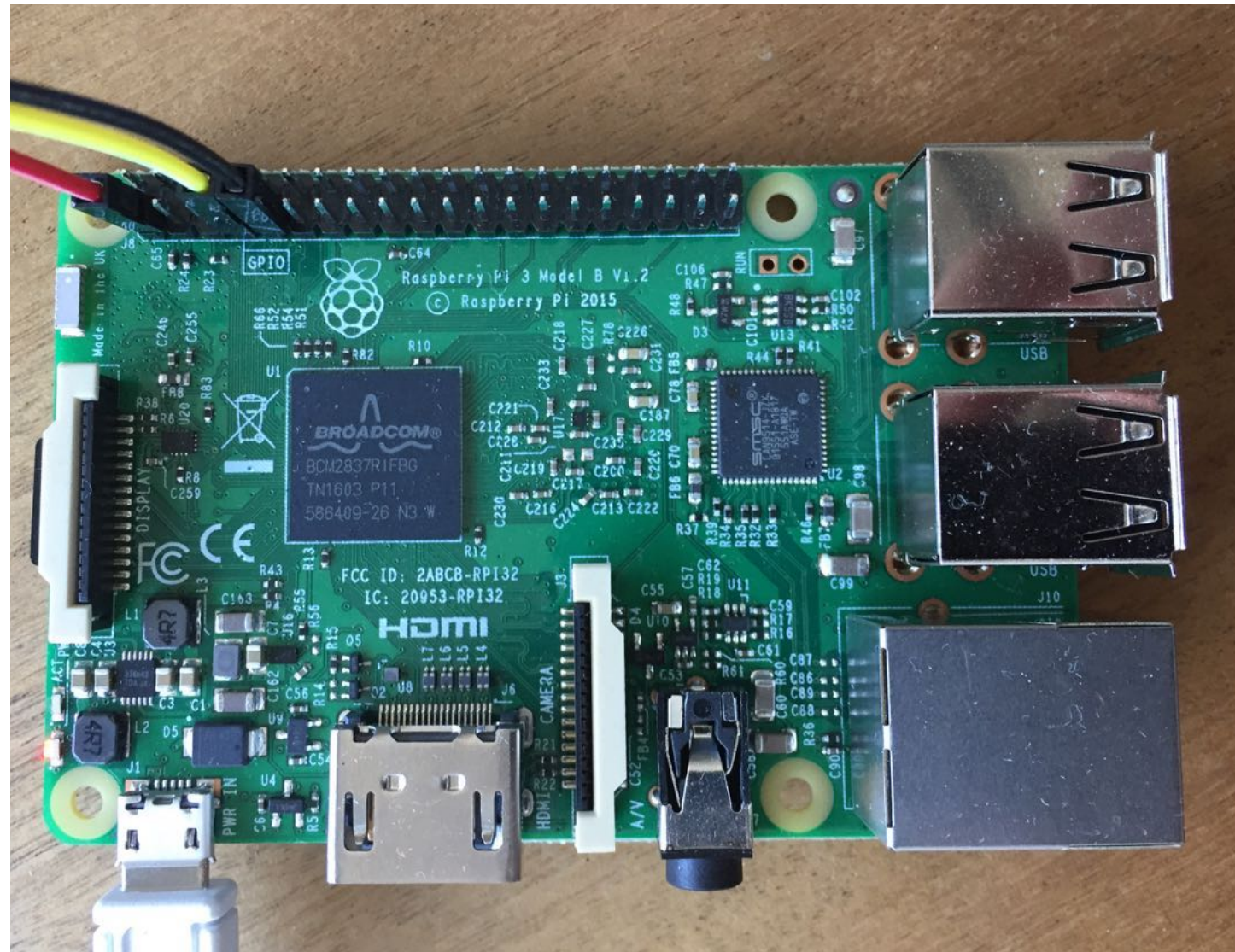
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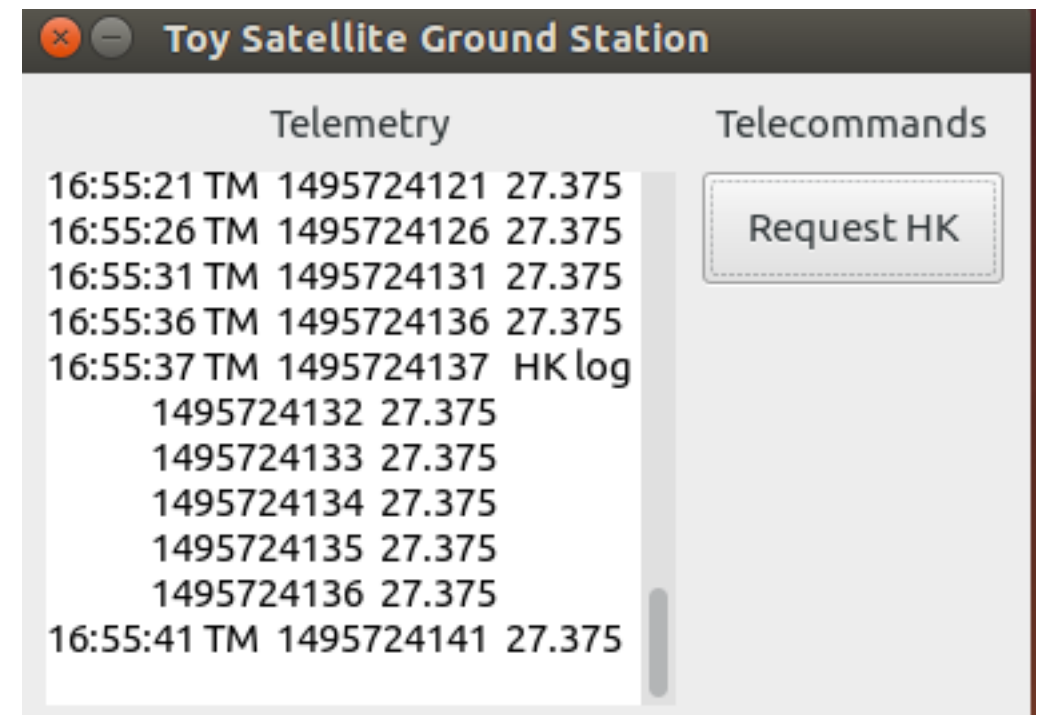
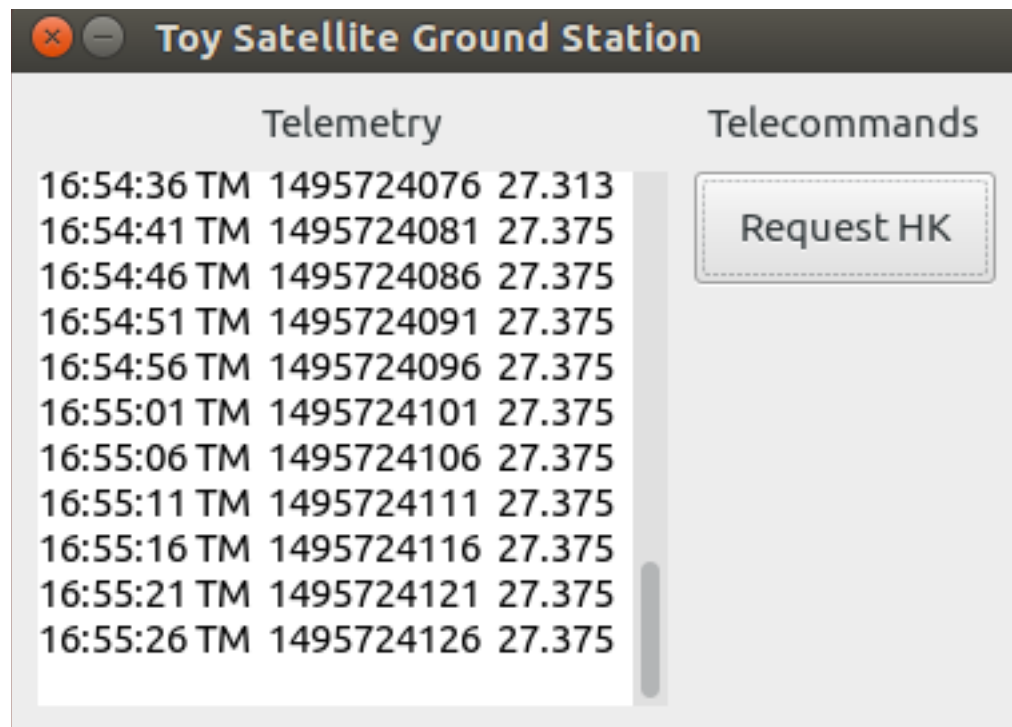
# Embedded computer

## RaspberryPi 3B

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# Ground station



runs on Ubuntu

# Implementation

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- **obdh**: compile on development platform (linux)
  - ▶ download code from [STR-UPM Embedded Ada Examples](#)
  - ▶ compile and build with raspberrypi-linux compiler
  - ▶ upload through wifi connection
- **gs**: compile on linux workstation
  - ▶ requires a native GNAT compiler and the GtkAda library