Data-link communications Aalto-1 satellite

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Background

Borja Tarraso, Software engineer
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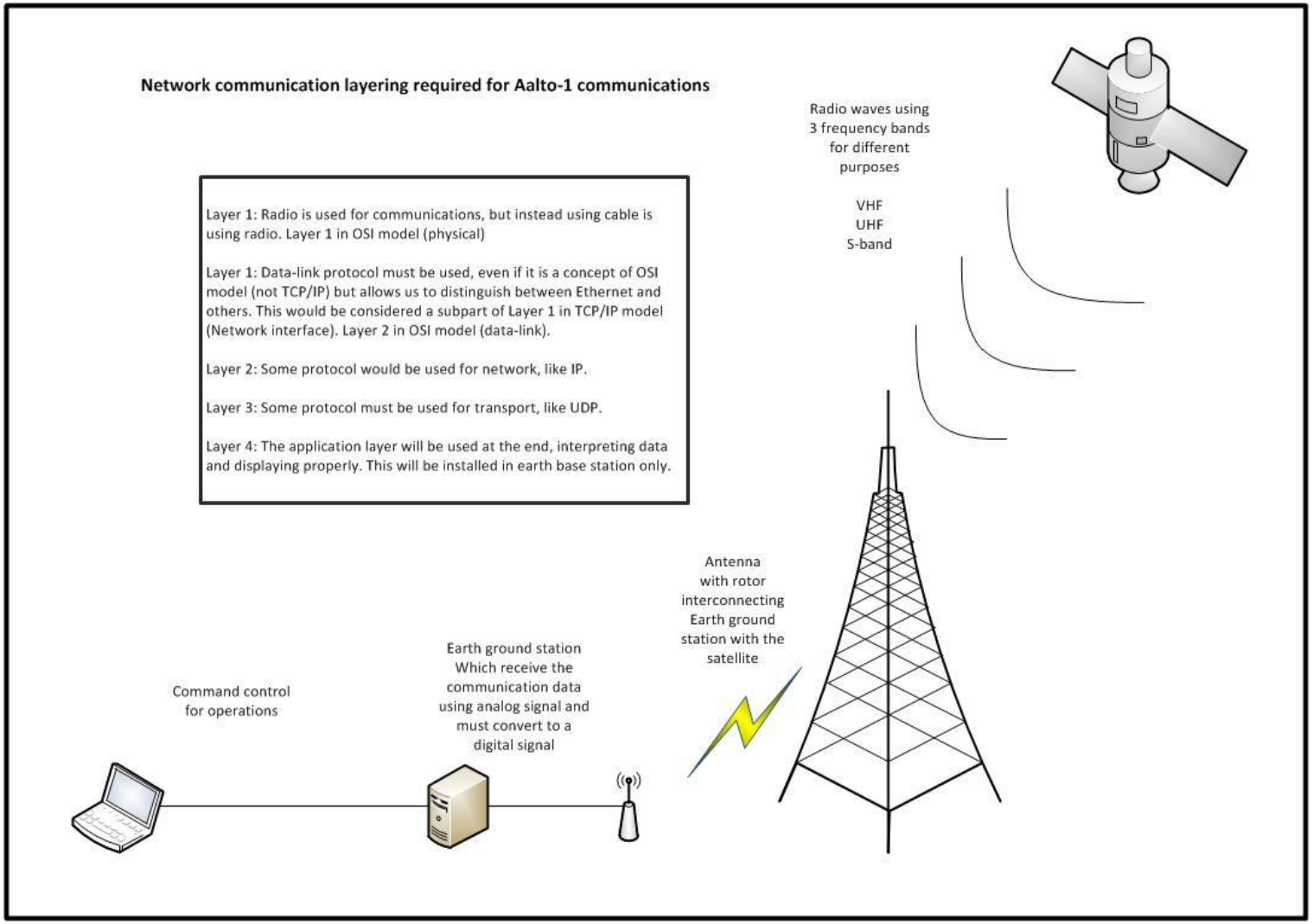
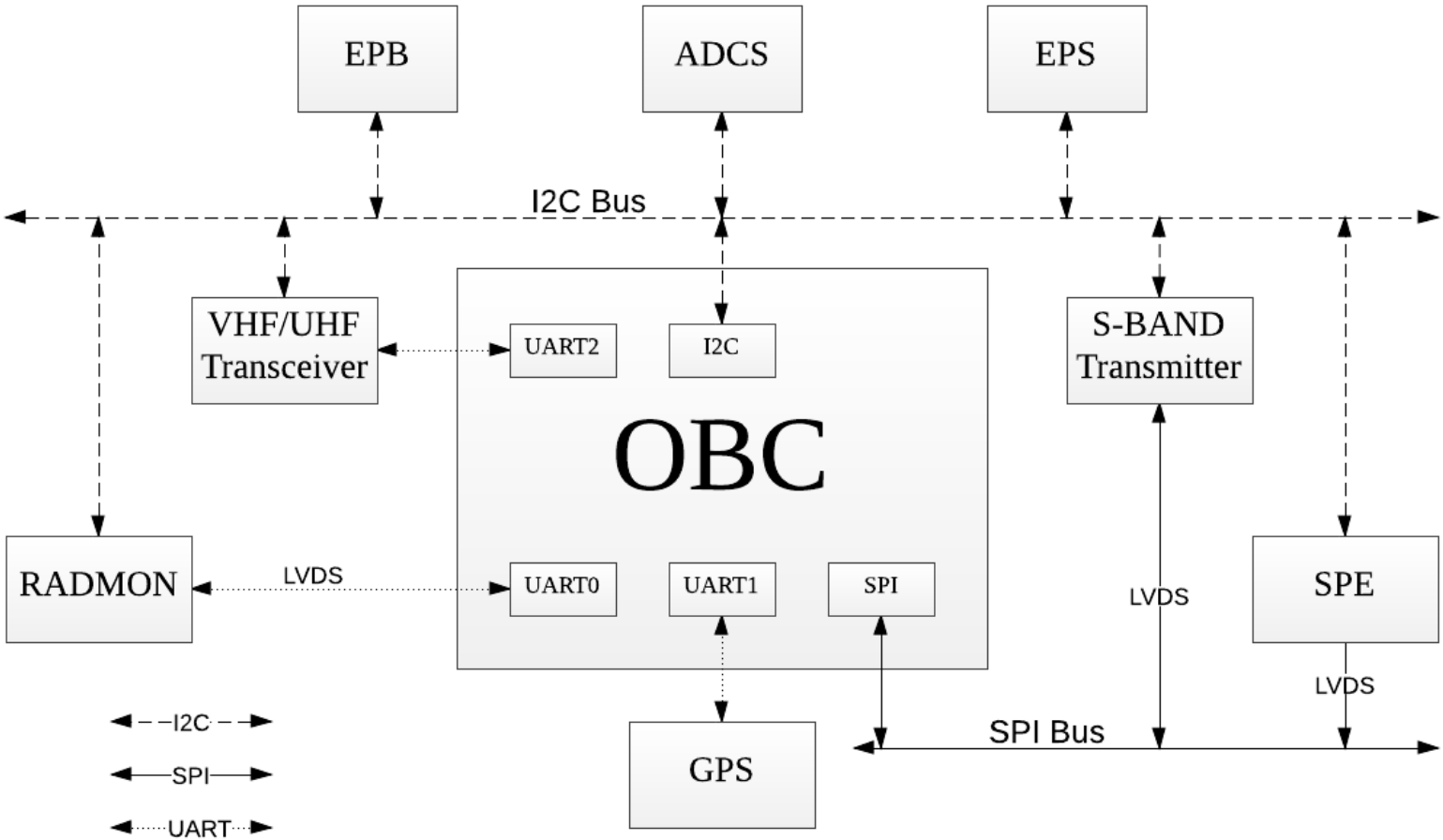
Marko Uusitalo, Senior Lecturer
IP Networks & Network security
Master's Degree Program in Information Technology at Metropolia University of Applied Sciences

Dr. Jaan Praks, Coordinator of Aalto-1 Satellite project
Project for Aalto University
Department of Radio Science and Engineering

Overview (Satellite)



Overview (OBC / COM module)



Technology and business challenge

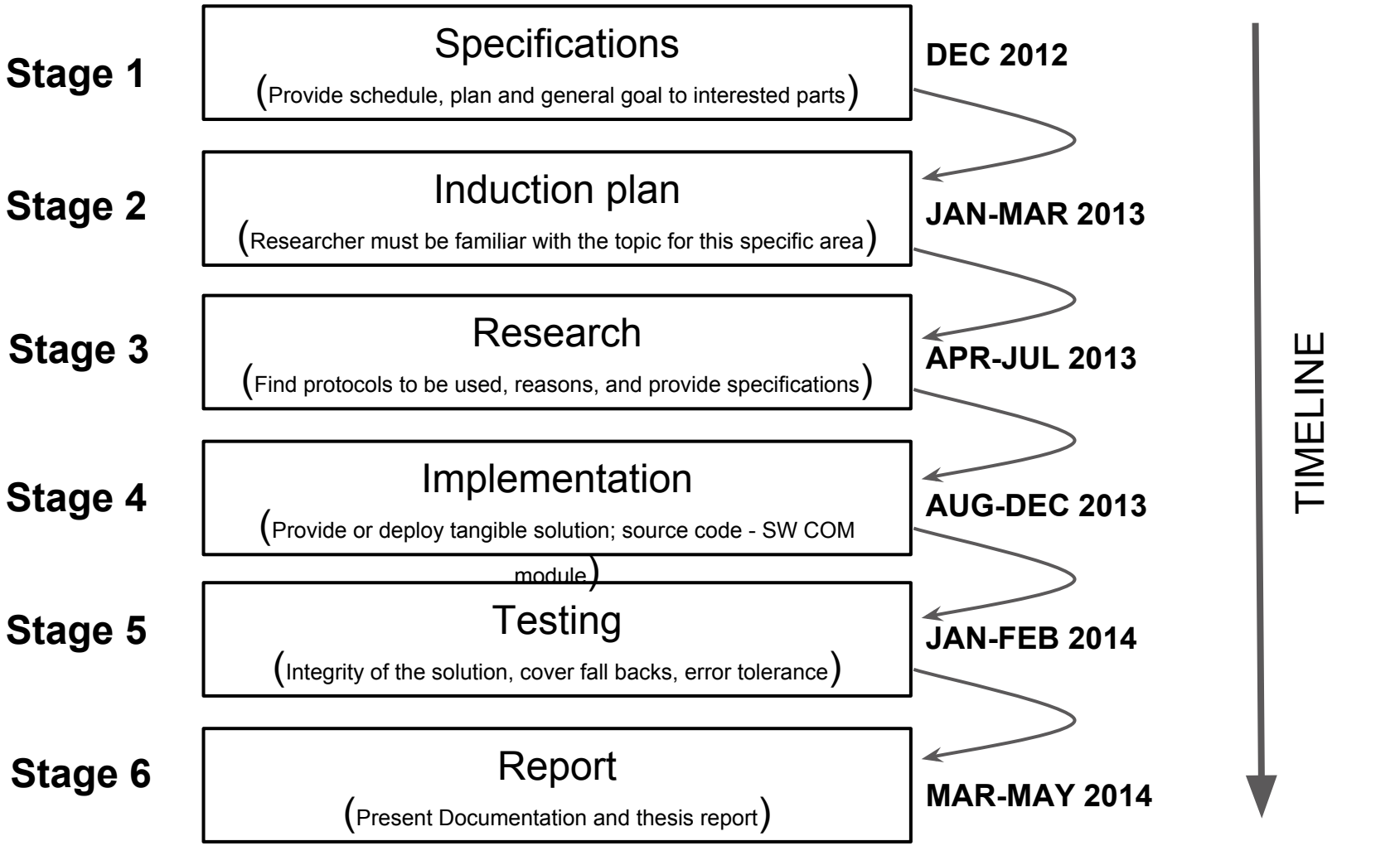
Aalto-1 is a cubesat satellite:

- First Finnish satellite
- Will be equipped with 3 main instruments
  * Spectrometer
  * Radiation monitor
  * Plasma break
- Satellite needs a method of communication with the Earth Base Station
  * Telemetry
  * Enable/Disable instruments
  * Data transmission
- Satellite is based in isolated modules

Research objective

- Design and implement COM module (SW)
    * Deploy data-link protocol on COM Module
    * Fail-overs and redundancy systems
    * Test preparations (load, energy consumption, signal)
    * Communication with Earth Base Station
        - UHF (Ultra High Frequency) 300 MHz - 3 GHz
        - VHF (Very High Frequency) 30 MHz to 300 MHz
        - S-band 3.4 GHz
    * Communication with OBC
        - I2C (Inter-Integrated Circuit)
        - UART2 (Universal asynchronous receiver/transmitter)
    * MSP430 family from TI: MSP430F2274

Research process



Method and material

Method

1. Read current material
2. Follow current specifications
3. Research
4. Propose and provide some design
5. Implementation
6. Test

Meterial

A1-COM-CP-01-v1 DRAFT Communication Protocols

A1-OBH-DS-03-v3 DRAFT OBC Communication protocol

Aalto-1 Project Documents

Aalto-1 Drafts

Structure of the thesis (report)

Title	N/A
Abstract	Overview about the challenge
TOC	Table of contents
Method	Method used: mention agile development, tools, strategy
Analysis	Analysis of the challenge, include other similar projects
Design	Design of the solution: SW and HW relevant parts. UML
Implementation	Implementation: the solution itself, commented
Testing	Testing: unit tests, benchmarks, stress tests, results
Conclusion	Conclusion: write a scientific format paper from all inputs
References	References: list of references and additional info
Appendixes	Appendixes for acronyms, libraries required, env setup

Theoretical background

- Software development
    * Mainly in C / C++
    * Unix systems
- IP Networks
- Security

Missing:

- Research
- Workgroup with COM team in Aalto-1
- Agree with parallel teams in Aalto-1 design issues
- Communication with Aalborg U / GomSpace

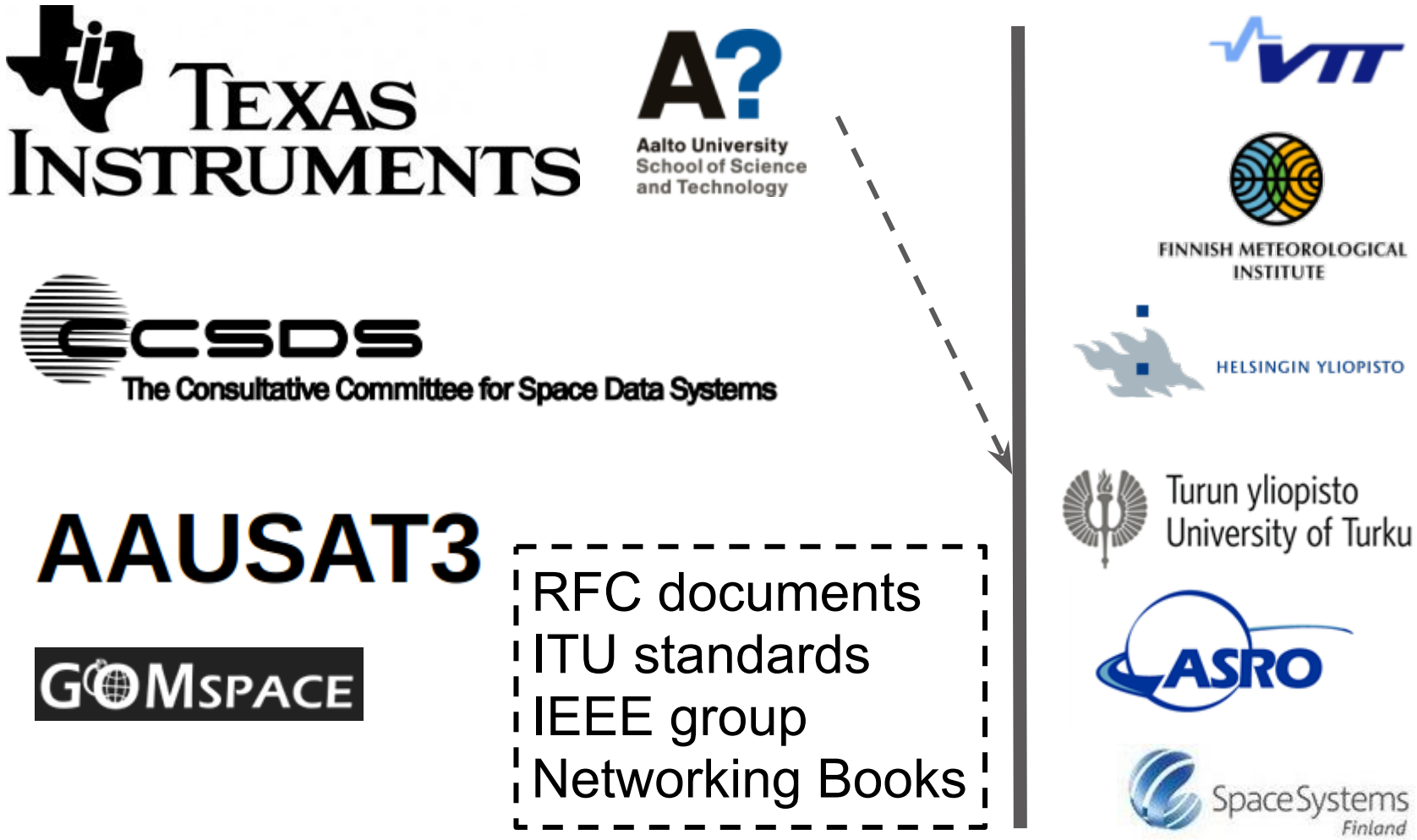
Challenges (more about drawbacks)

- Too many parallel teams:

  * No-experience in the nature of this project.
  * Misleading communication.
  * Dependencies between teams may cause delays: bottlenecks.
  * Difficult to predict real behaviour on the space.
  * Difficult to perform some tests.
  * Unknown technologies or standards.
  * Really ambitious.

Positive motivation spot: But interesting experience after all.

References (overview)



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Questions
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