~~Open Source Virtual Satellite~~ Group 2 Open Source Space Systems Simulator; OS^4

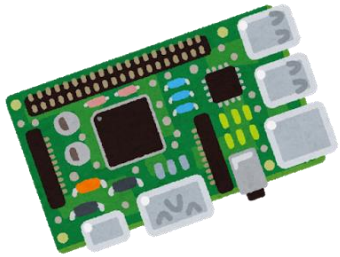
6th UNISEC Global Meeting, ISU, 20th Nov. 2018

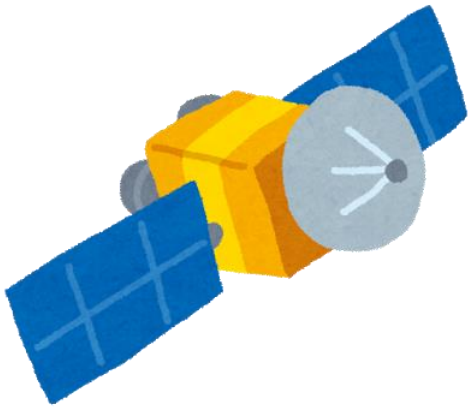
Group 2 members

- 9 members
- From
  - Taiwan
  - Lebanon
  - Malaysia
  - Luxembourg
  - Japan
  - Canada

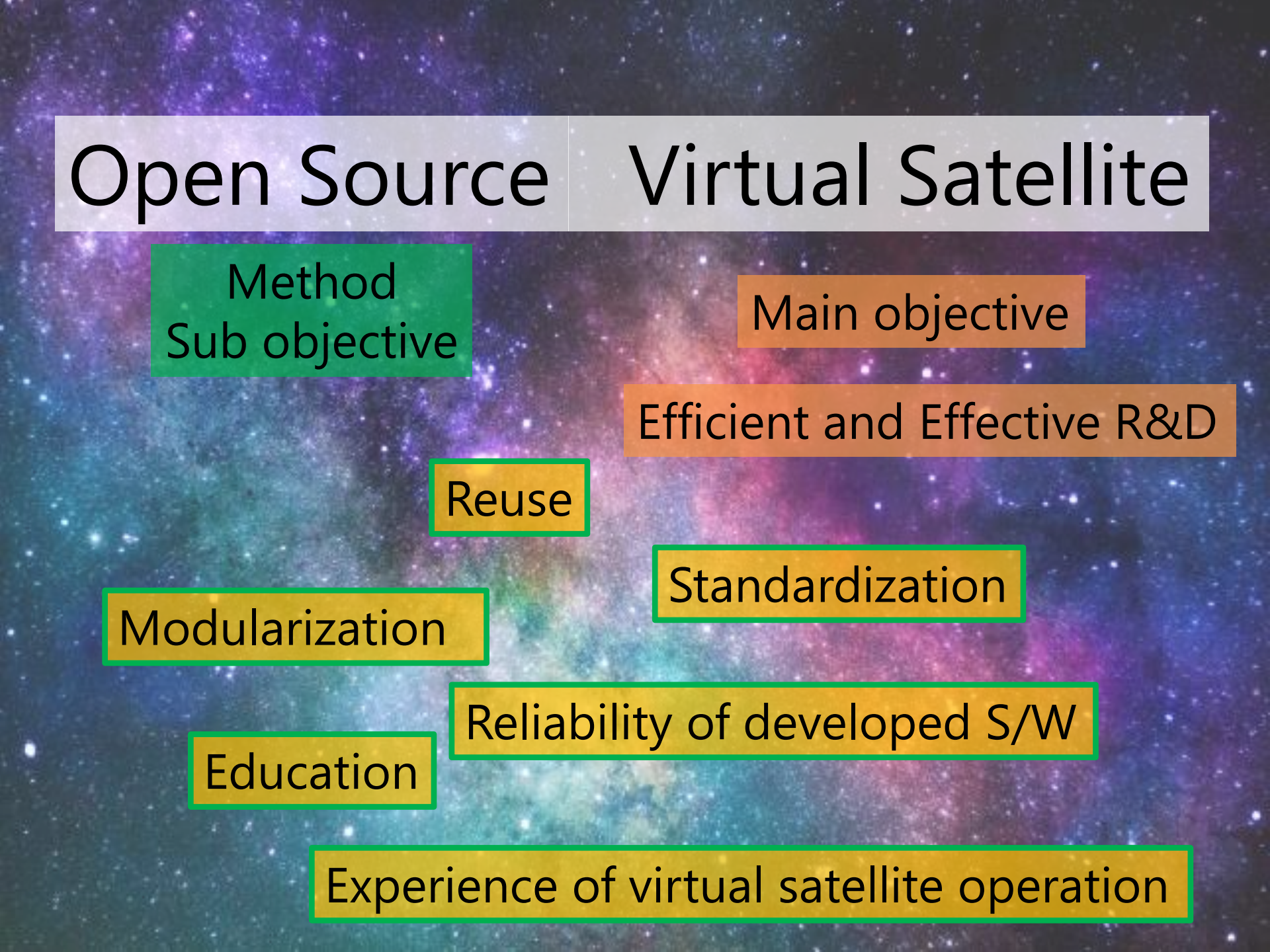
My dream

- I want to develop, evaluate, and demonstrate
  every S/W related to space activity
  in a virtual space in PC
  - Every S/W: On-board C&DH, ADCS, Thermal, Power etc…
    On-ground C&DH, image processing, etc…
- The virtual space **must seamlessly connect with real** hardware components





Seamless Connection

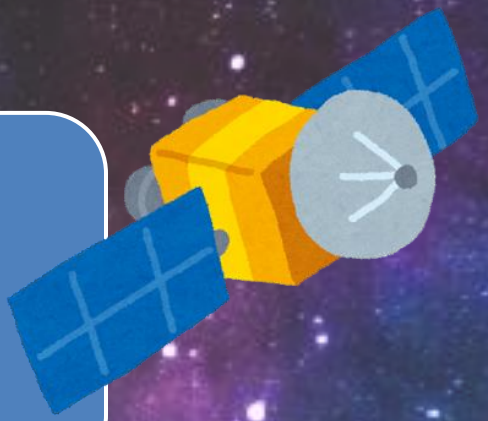

Open Source
Virtual Satellite
Method
Sub objective
Main objective
Efficient and Effective R&D
Reuse
Standardization
Modularization
Reliability of developed S/W
Education
Experience of virtual satellite operation

My Dream

Spacecraft

Algorithms

Components



Simulator

Space Environment

RF & Antenna

Algorithms

Ground Station

Discussion-1: 40 min

What kind of functions do we need?

Discussion-1
What kind of functions do we need?

- In spacecraft emulator
  - Power; battery/solar cells, component on/off
  - Sensors
  - Actuator
  - Communication TT&C
  - Deployable stuff (Solar panel, antenna,)
  - Physical parameters
    - Mass, moment of inertia
- in space environment simulator
  - Orbit / sun direction,
    - Eclipse
  - Disturbances
    - J2, air drag, solar radiation,
  - Ground station acquisition

Discussion-1
What kind of functions do we need?

- in ground station emulator
  - Multi-ground station/network
  - Hand over command
  - Antenna direction control(accuracy and speed)
  - Weather
- UI/GUI of simulator
  - File format to decide the component
  - GUI of orbit, attitude respect to sun, power info
  - Export and import system with another software(STK, CAD, Thermal Desktop, ESA TAN, Matlab/Simulink, ROS etc…)
- Or do we need another elements?
  - Multi-satellite

Discussion-2: 30 min

How to build the team?

Discussion-2
How to build a team for this project?

- Team member
  - Project management
    - WBS
  - Experts of spacecraft, space environment, ground station
    - Actual specification & requirement, definition
    - Testing
  - Core SW architects
    - Expert of S/W
    - Expert of spacecraft
    - Small group (2-3 members)
  - Senior developers
    - Reviewing source code
  - Developers
    - students

Discussion-2
How to build a team for this project?

- Tools for international development
  - Code management / version control / release management
    - Github
  - Communication
    - slack, skype
  - Asana(project management tool)
    - Schedule management tool
  - Development tools depends on language
  - Open source tools
    - Compiler, IDE,

- What programing language?
  - C, C++ could be core language
  - ROS; C++/Python
  - Verilog for FPGA

Discussion-3: 30 min

What can we do as a first step?

Discussion-3
What can we do as a first step?

- We have to start small scale
- ROS is good starting point
- Cubesat basic motion should be covered
  - T&C with ground
  - Power generation/consumption, battery
  - Attitude
    - Direction of sun, earth
  - Orbital motion
    - Eclipse, ground position
  - Documents Google docs
    - Call for participation
    - Specification & guideline are written later
  - Website?
    - github
- How to agree with one specific framework?
  - Making de facto standard
  - Continually promoting

Action items

- Until the next skype meeting
  - Internal discussion in each university
    - Finding volunteer students and faculties
    - Key person, Ph.D stutdent
      - ERASMUS+
      - ISU individual project
  - Satoshi make slack group, skype (zoom) group, google docs, mailing list until next meeting
- Skype meeting
  - Monthly
    - Next; December 10th, 10 am UTC
- Next action item
  - Share the current S/W of spacecraft
  - Pick up some task for some thesis theme will be managed by faculty members
  - Make list of theme