Inter-CubeSat Communications: Routing Between CubeSat Swarms in a DTN Architecture

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Presentation Outlines

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The problem

➢ How data can be routed through a predictable Delay Tolerant Network (DTN) consisting of large cooperative and non-cooperative CubeSat swarms (few hundreds of CubeSats)?

CubeSats

➢ Applications
- ➢ Education
- ➢ Space Scientific Researches
- ➢ Example: Earth monitoring and atmospheric measurements

➢ Limitations
- ➢ Small Mass and Size
- ➢ Limited power
- ➢ Storage
- ➢ Orientation

➢ CubeSat Swarms
- ➢ Small size and affordable costs of CubeSats allow for CubeSat swarms
- ➢ QB50 project

Benefits of CubeSat Swarms

➢ Interoperability

➢ Higher Data Rates

➢ Redundancy

    ➢ Power Budget

    ➢ Bandwidth

    ➢ Higher Communication Opportunities

➢ Reducing Mission Failure Rate

➢ Obtaining Global Measurements

Space Delay Tolerant Networking DTN (Review of current protocols)

➢ Multi-Hop Communications

➢ Store, Carry and Forward Mechanism

➢ Bundle Protocol

➢ Licklider Transmission Protocol

➢ CCSDS File Delivery Protocol

➢ Epidemic Routing

➢ **Space Time Graph Routing**

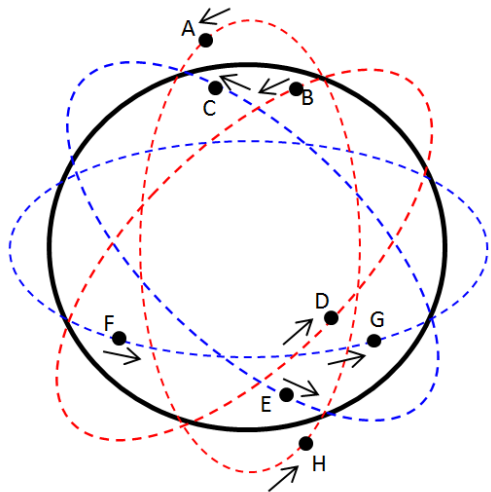# Proposal: Routing Between CubeSat Swarms in a DTN Architecture
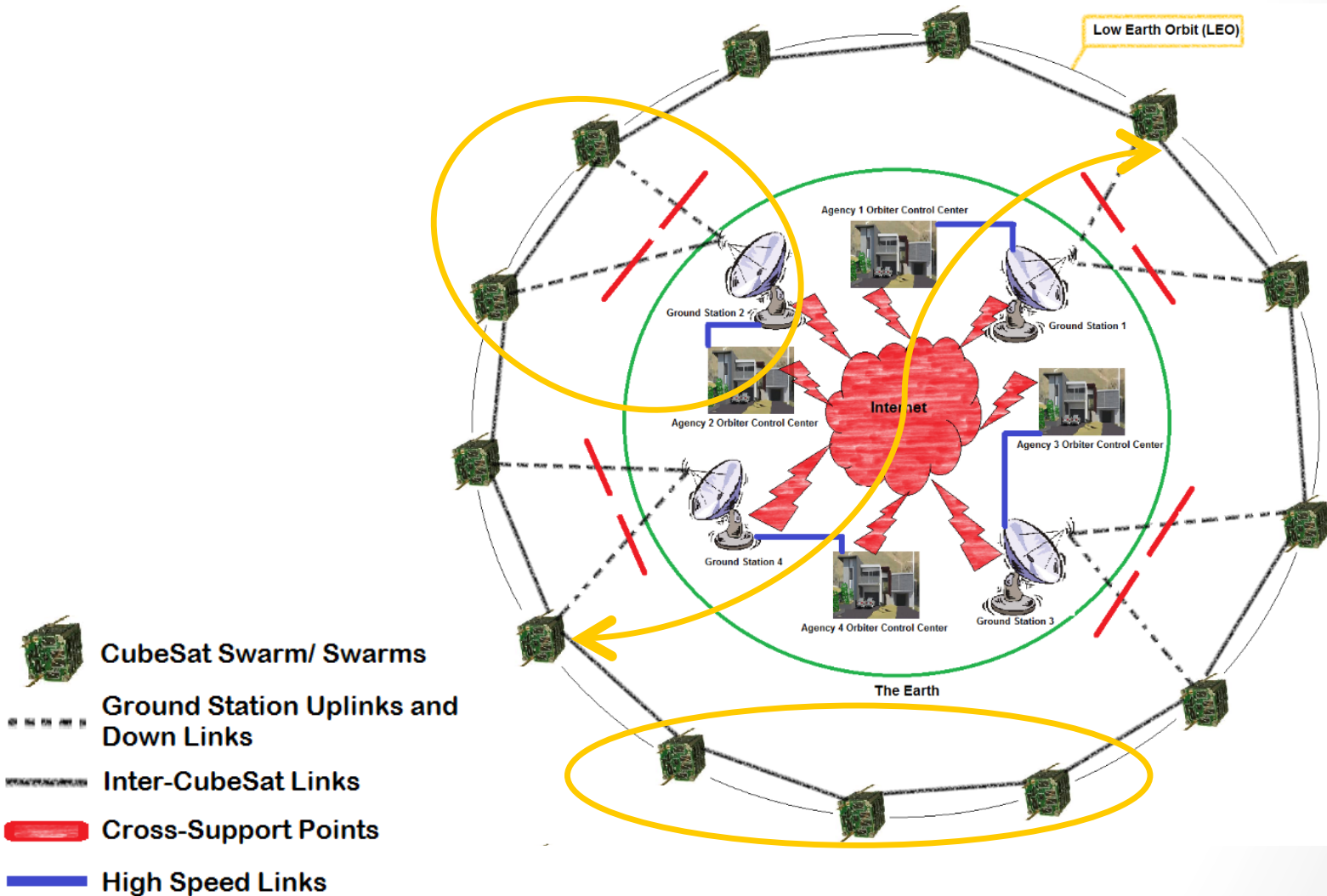
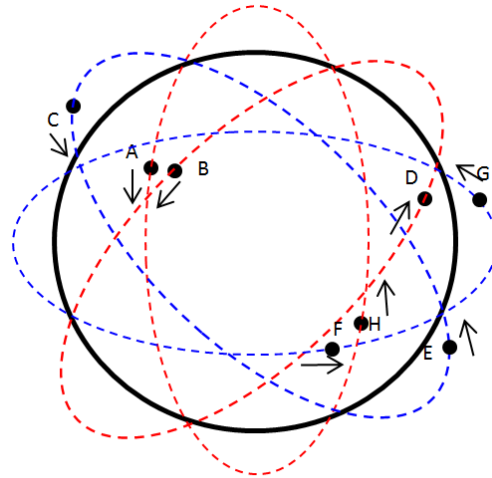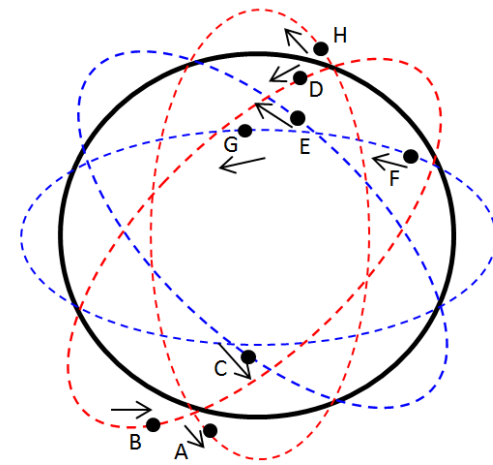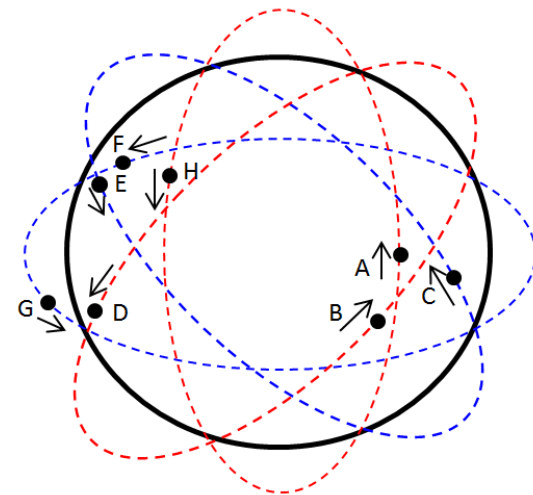# Space Time Graph Routing-Time Evolving Topology

Figure 1

Figure 2

Figure 3

Figure 4

Space

Time (T)

t=1   t=2   t=3   t=4
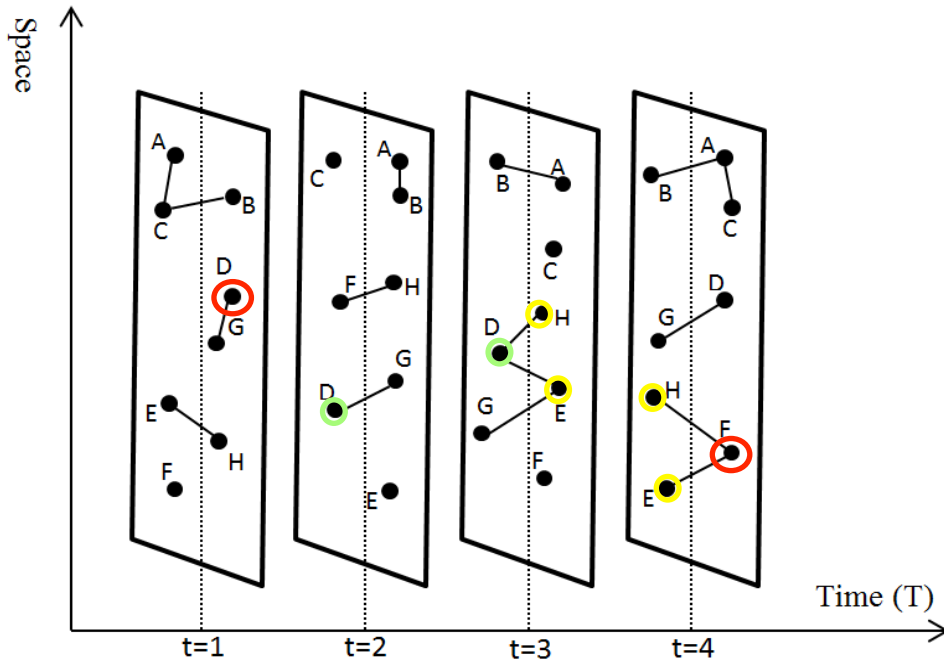
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Inter-CubeSat Communications and Ground stations

➢ STK Simulator
  ➢ Satellite to satellite communication
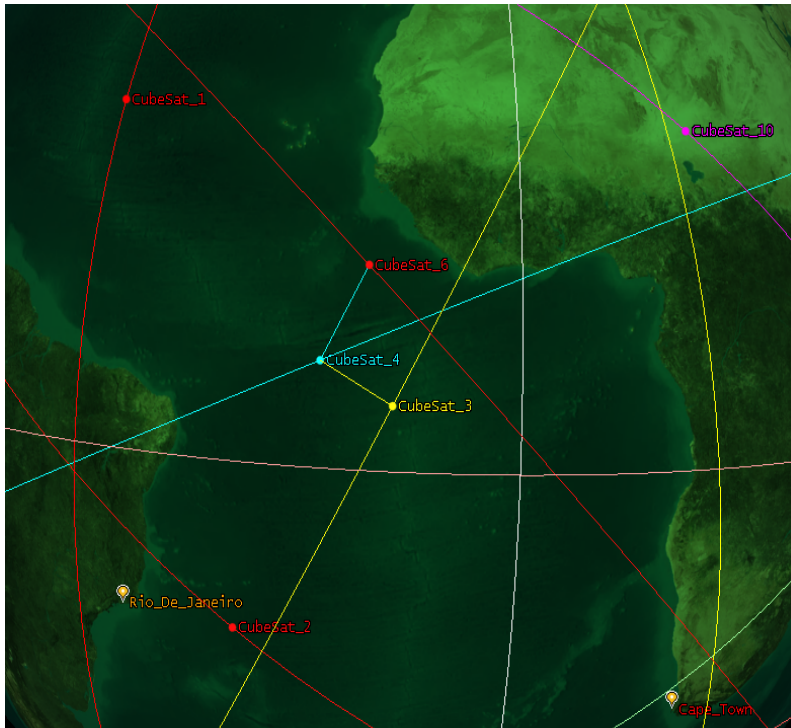 ➢ Ground Stations to Satellite communication
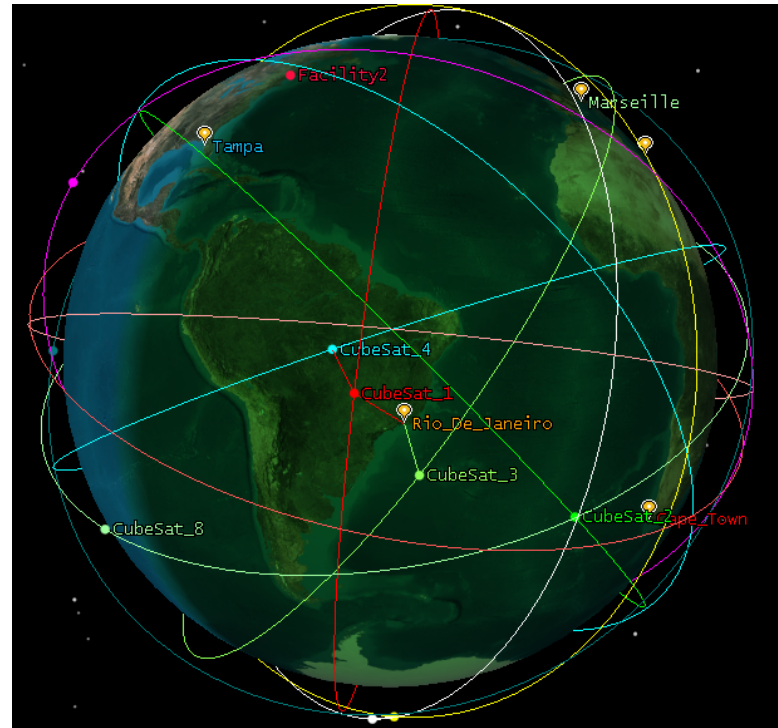

Figure1- Inter-CubeSat communication

Figure2- Ground station communication

THANK YOU FOR YOUR ATTENTION