Nodes

**Overview**

Identical craft to those of the EDSN Sats but with “enhanced software”

Used left over EDSN craft

“will test new network capabilities for operating swarms of spacecraft in the future.”

Much more command and control oriented than EDSN

<http://nodes.engr.scu.edu/>

Mission successfully demonstrated: indirect command, CubeSat science crosslink before DL and autonomous reconfiguration of the network setup to insure best DL

“After two weeks it is expected that the satellites will be more than 60 miles (100 kilometers) apart, making it difficult for them to communicate with their UHF radios”

**Technology and Capabilities**

EDSN: S-Band S2G

EDSN: UHF ISL

EDSN: UHF Beacon (60s)

As before CAP and LT nodes. CAP collects, aggregates and downlinks

CAP is dynamically chosen.

All comms are scheduled to insure max power saving

Neat: “Six torque coils embedded in the solar panel PCB are used for control”

Very simple Ack/ReTX approach for comms

“Custom protocol”

Each session is a “transaction” which entails passing a command (Ack) and then receiving data

CAP keeps special queue for commands destined for the LT

Data sessions start with 12 pings (ID and Checksum) over 110 seconds

After 120s after getting a successful ping LT starts sending data (Starts w/ SOH) - **NEW**

No Ack/Nack for data comms

**“It is anticipated that future enhancements to the architecture will provide greater guarantees of data transmission either through ACK/NACK of DTNs”**

Queues and stacks are the sames EDSN (See other doc)

At start of each new CAP cycle CAP will request metrics from LT to compare to own, if better sends promote command

LT with promote command will send a demote command to the CAP …

3-4 comm sessions are scheduled per 25 hours

CAP is responsible for determining when it will be over the ground station

Clock effects could leave nodes 12s out of sync

All **comms have buffers at beginning and end to account for potential drift**

Who do they exchange or agree on or negotiate schedules?

**Performance**

Over 14 days

356/470 packets (Size?)

Node K: 145/180

Node J: 211/290

5 Successful captaincy negotiations

Asym links lead to multiple transmissions of the same command as Acks were lost

Last successful crosslink was 7 days into mission at 100km

A total of 12 crosslink successful crosslink sessions took place

**See Nodes paper future work**



