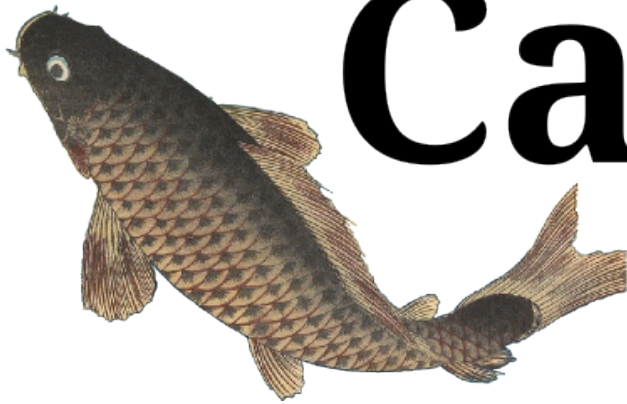




Carpcomm

Space Communication Network

Timothy Stranex
CEO, Carpcomm GmbH
tstranex@carpcomm.com

2012-08-12
Summer CubeSat Developers' Workshop

Space Communication Network

Basic problem: A satellite in LEO is only visible to your ground station for several minutes per day. That limits the amount of data you can download.

Solution: Create a network of ground stations around the world so that other stations can see the satellite when yours can't.

Carpcomm: We are building such a network.



Architecture



Stations

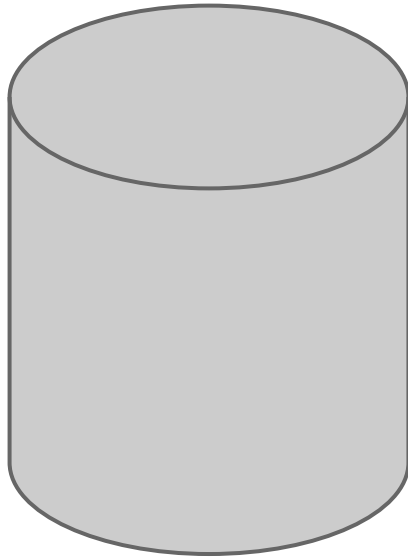


Scheduler

Satellite	Start Time	Duration	Start Azimuth	End Azimuth	Max Altitude
Hiscock Radiation Belt Explorer Explorer-1 Prime	09 Aug 10:26 UTC	2m8s	2.9°	269.3°	61.4°
AO-27	09 Aug 12:31 UTC	2m38s	22.4°	345.9°	87.8°
SwissCube	09 Aug 12:34 UTC	2m32s	7.6°	269.2°	77.5°
HORYU-2 鳳龍式号	09 Aug 12:58 UTC	1m31s	270.1°	311.3°	43.1°
ITUpSAT1 ITÜpSAT1	09 Aug 13:22 UTC	1m45s	315.4°	273.5°	32.2°
PRISM	09 Aug 14:49 UTC	10s	28.7°	30.1°	32.3°
FASTRAC 1 Sara Lily	09 Aug 16:28 UTC	1m6s	30.0°	27.5°	49.8°
Masat-1	09 Aug 17:42 UTC	4m50s	270.2°	353.8°	41.3°
ALMASat-1	09 Aug 18:14 UTC	3m23s	286.6°	337.6°	33.3°
Aeneas	09 Aug 19:40 UTC	2m30s	332.5°	30.4°	74.7°
CSSWE Colorado Student Space Weather Experiment	09 Aug 19:41 UTC	2m33s	331.9°	31.7°	75.9°
CXBN Cosmic X-Ray Background Nanosatellite	09 Aug 19:45 UTC	2m36s	329.8°	30.8°	80.2°
CP5	09 Aug 19:45 UTC	2m36s	329.8°	30.8°	80.2°
Hiscock Radiation Belt Explorer Explorer-1 Prime	09 Aug 19:51 UTC	49s	29.7°	14.5°	37.6°
RAX-2 Radio Aurora Explorer	09 Aug 20:48 UTC	2m14s	270.6°	325.0°	62.5°
Tlsat-1	09 Aug 21:21 UTC	1m30s	29.4°	359.0°	59.6°
ITUpSAT1 ITÜpSAT1	09 Aug 22:57 UTC	1m21s	29.5°	5.1°	49.3°
SwissCube	09 Aug 23:48 UTC	1m46s	270.2°	315.6°	46.4°



Database



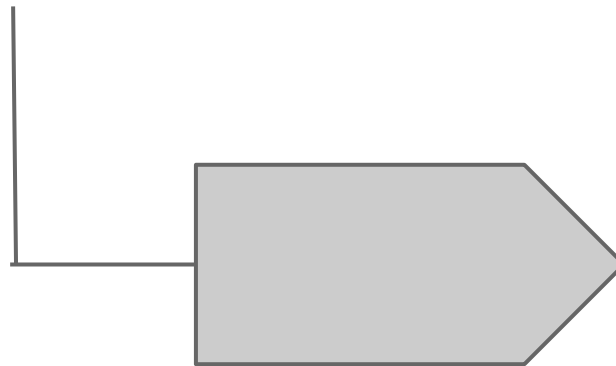
- packets
- telemetry
- raw SDR data



Software-defined radios



Can support any modulation schemes, any kind of framing, any error correction.



10111010110010101



Cloud

Highly scalable and reliable: thousands of stations, thousands of cubesats, billions of packets.



Architecture consequences

SDR: Can support any modulation schemes, any kind of framing, any error correction.

Cloud: Highly scalable and reliable: thousands of stations, thousands of cubesats, billions of packets.

SDR+Cloud: Ability to deploy network upgrades and improvements quickly.



Openness

The Carpcomm Network is open for anyone to join.

Station control software is fully open source:
<http://carpcomm.com/carpsd/>

We're working on an API to let you upload and download packets automatically.



Data in the network



Data transfer rules

Initial model:

For each byte of data you download from your cubesat, you must upload another byte of data for some other cubesat.

We expect this model to evolve over time.



Setting up a ground station is difficult and expensive.



Setting up a ground station is hard

ICOM 910H radio: \$1500

+ antennas, rotators, low-noise amplifiers,
TNCs, dedicated computer, software

It can take a student one whole semester to
set it up.

Some vendors quote more than \$37k for a
complete station.



A new hope



Introducing...

Carpcomm Ground Station 1



Carpcomm Ground Station 1

- Complete ground station solution for receiving cubesats on UHF
- Everything is included: software-defined radio, low-noise amplifier, antenna
- Embedded Linux computer
- Just plug it into your LAN and it will connect itself to the Carpcomm Network
- Get setup in record time
- Operates completely automatically





Carpcomm Ground Station 1

More details:

<http://carpcomm.com/gs1>



Conclusion

- Network is operational
 - Network is open
 - Open source station control software
 - Everyone is welcome to connect
-
- The easiest way to setup a ground station:
Carpcomm Ground Station 1



Questions



tstranex@carpcomm.com

carpcomm.com

blog.carpcomm.com



@Carpcomm



+Carpcomm