

# The SATNet Project

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spring 2014

Towards an Open-source  
Ground Stations Network  
for CubeSats

authors:

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Dr. Antonio J. Vázquez  
Prof. Jordi Puig  
Dr. Naomi Kurahara  
Prof. John Bellardo

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04/25/2014

- 1 State of the Art
  - Ground Station Networks
  - Current Ground Stations
- 2 The SATNet Project
  - Concept
  - Organization
  - Release 1

# State of the Art

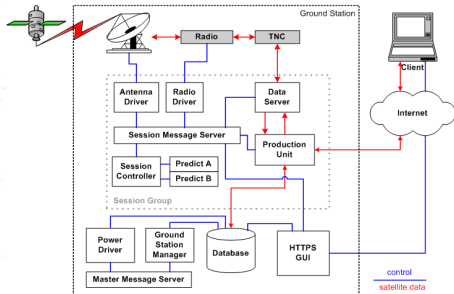
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## Ground Station Networks

Mercury Architecture - Release 1.1.1  
Single pipeline view (multiple pipes possible)

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Log Files:  
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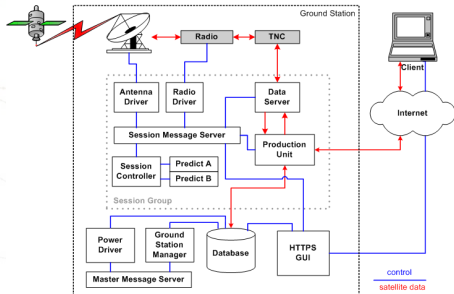
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- Provides: remote GS operation.
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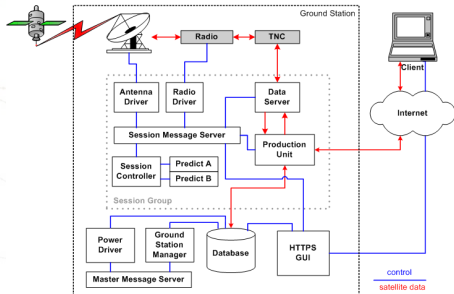


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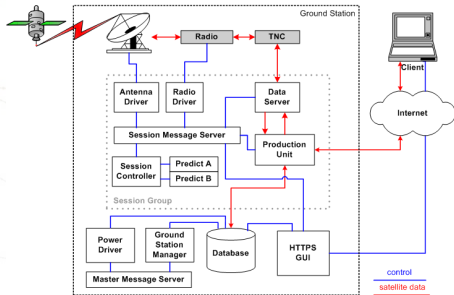


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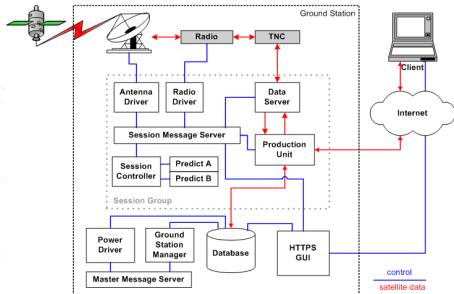


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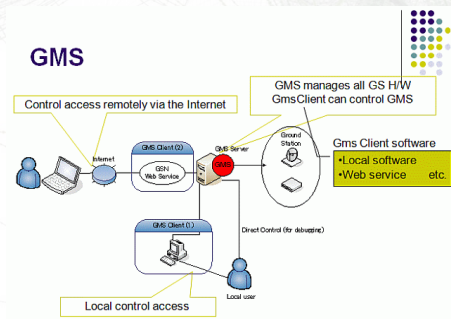
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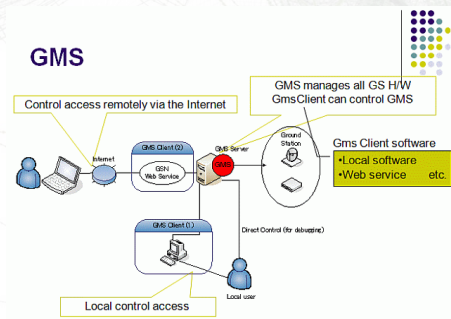
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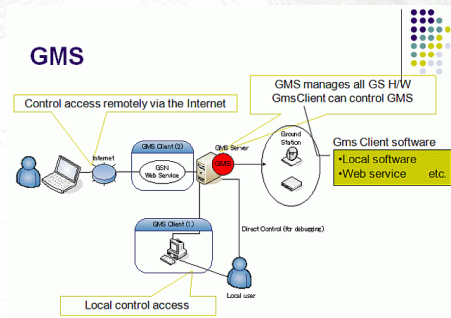
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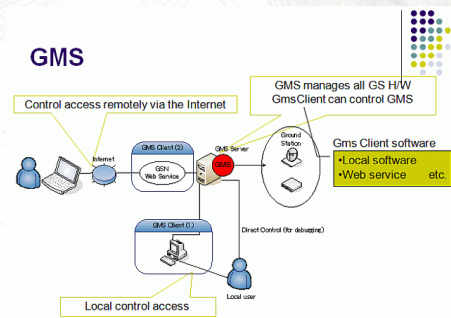
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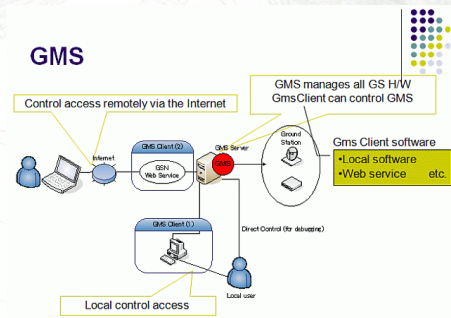


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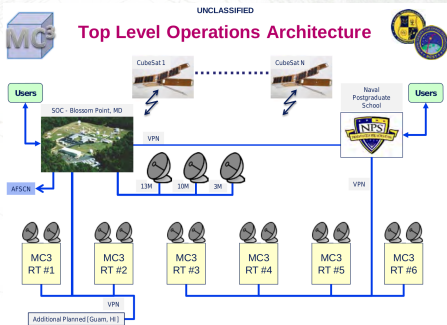


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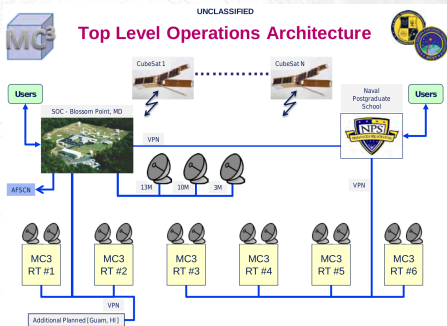
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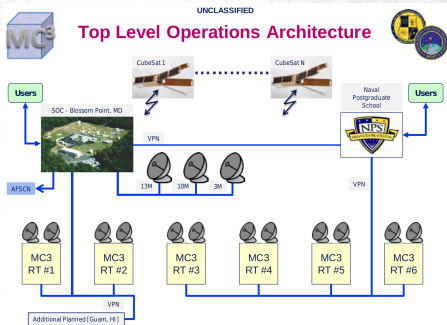
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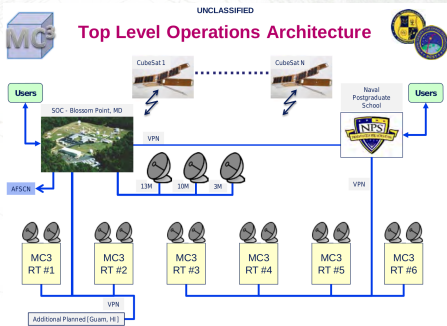
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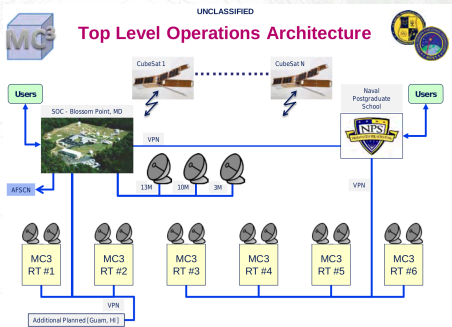
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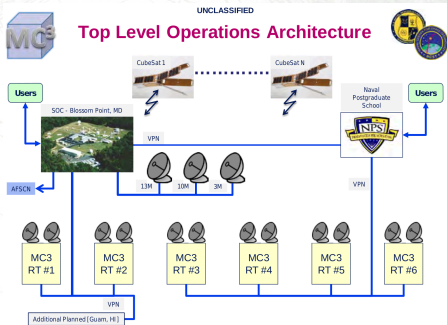
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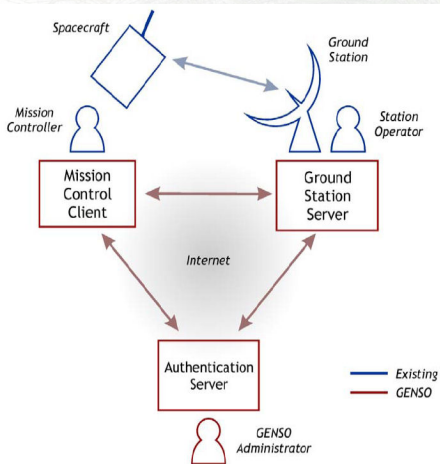


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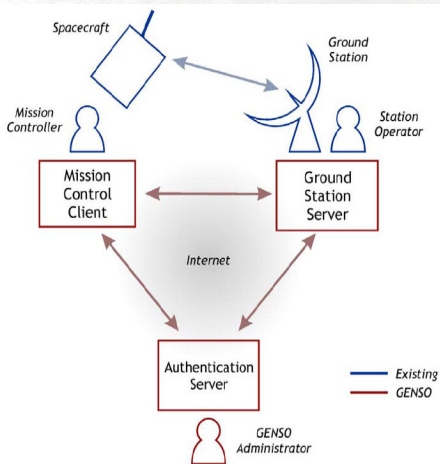
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- MCC/GSS: distributed peers.

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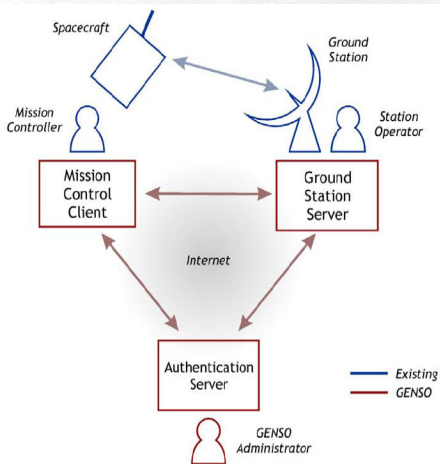
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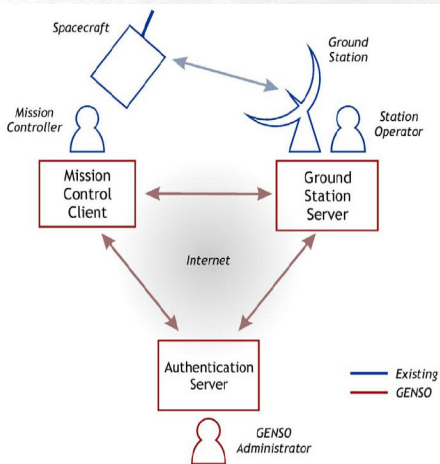
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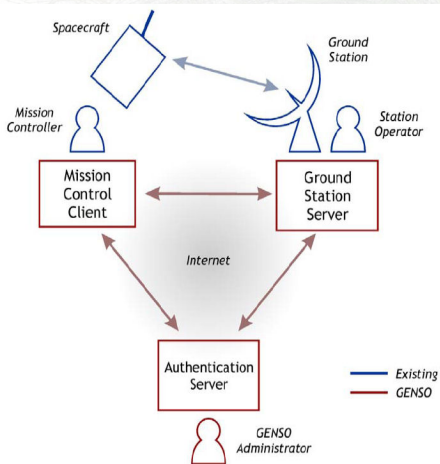
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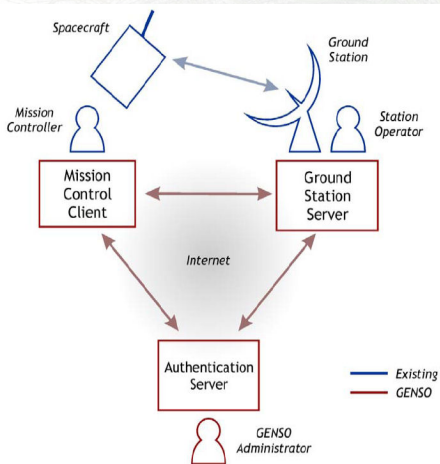
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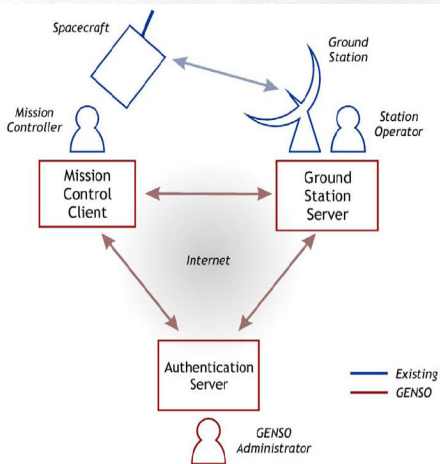
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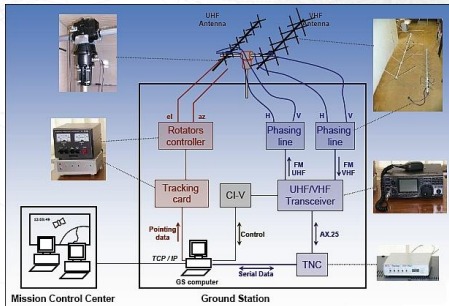
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## Current Ground Stations



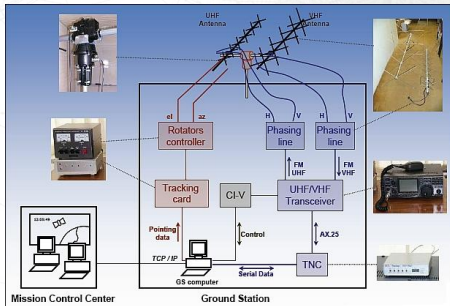
- Specific per-mission hardware support.

- Not many problems for constructing a new station.

- Networks with a full GS client:

- Full GS → you are in.
  - SW inadequate → you are out.

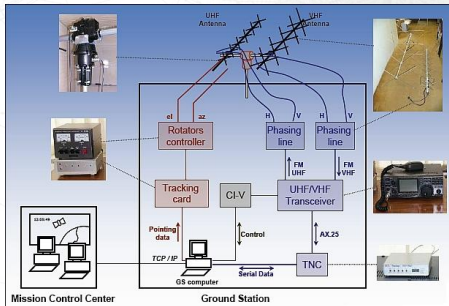
- Some clients might be an obstacle to access the network.



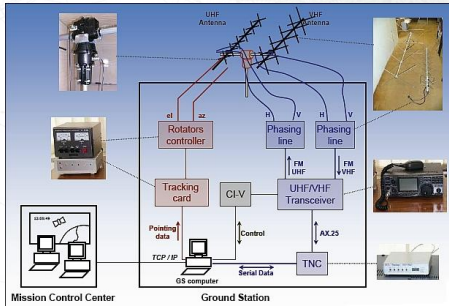
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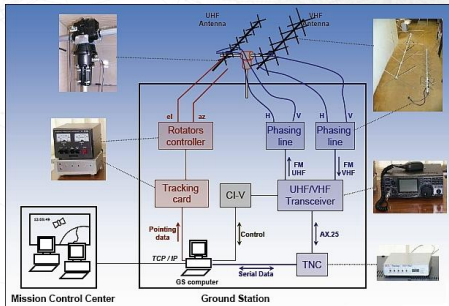
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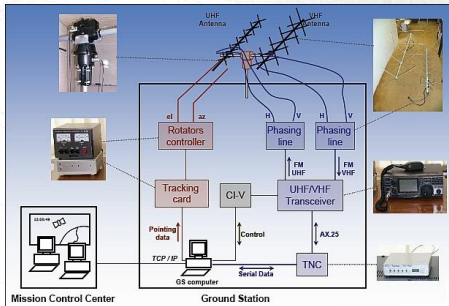


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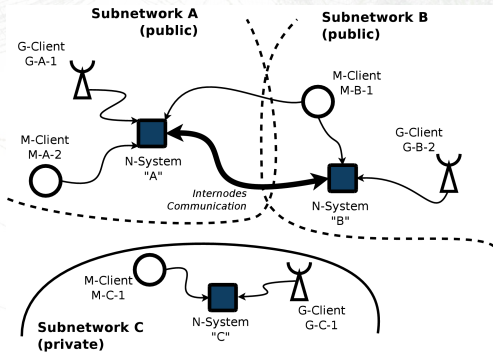


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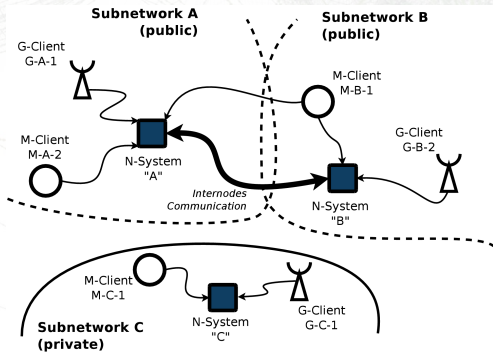
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**Concept**



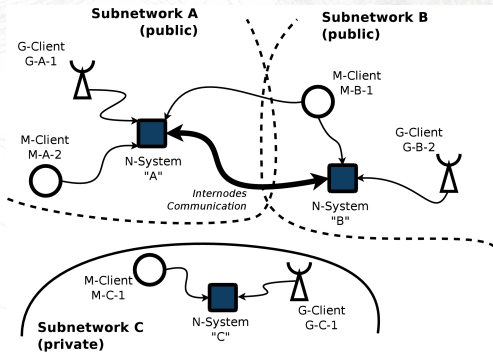
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- N-System: main network node.
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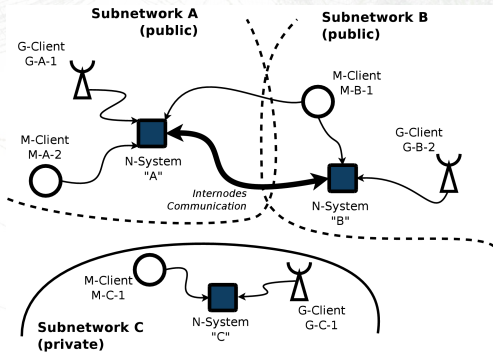
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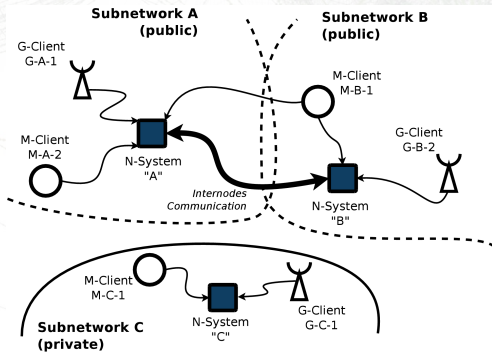
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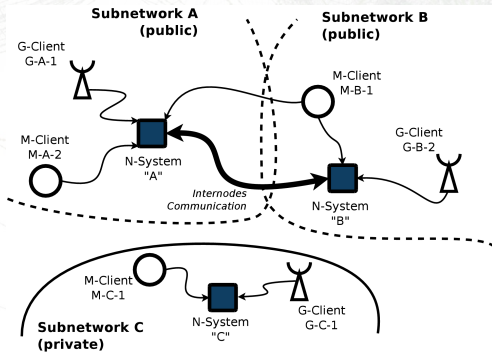
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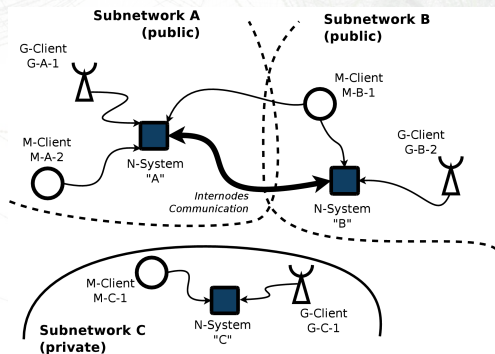
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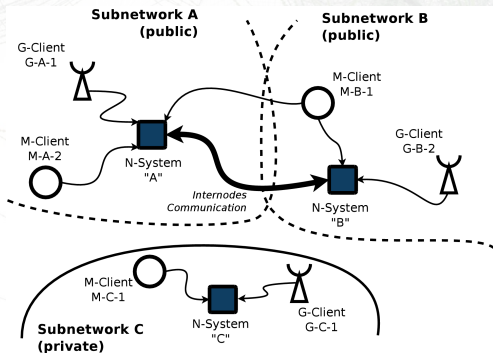


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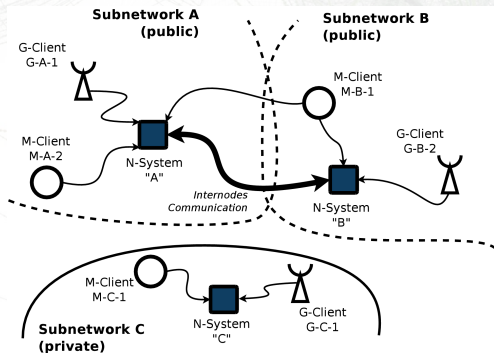




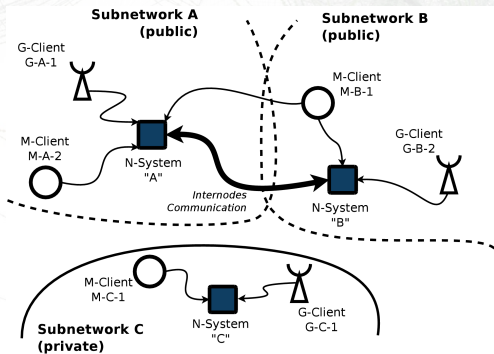
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- Approach similar to IP routers.
- Users decide to interconnect nodes for scaling sub-networks.
- Nodes interconnection:
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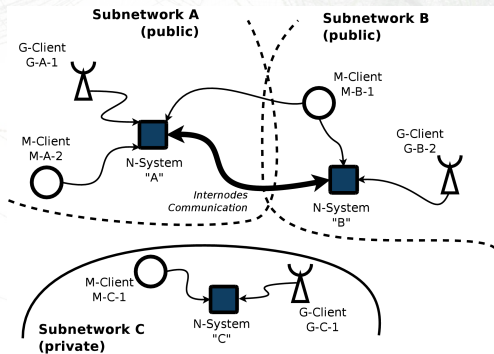


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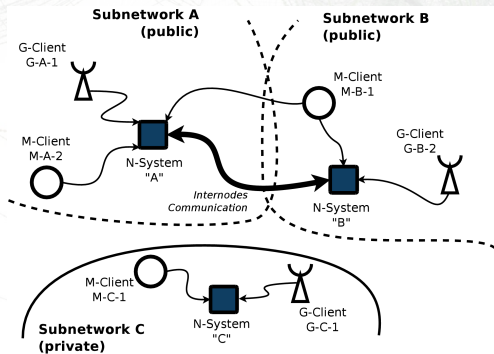


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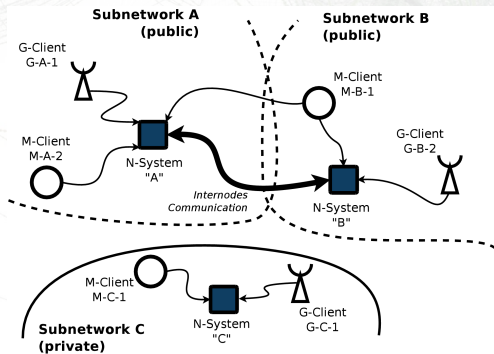
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-	Mercury	GSN	MC3	GENSO	SATNet
<b>Paradigm</b>	Client Server	Client Server	Legacy GCA	Hybrid P2P <sup>1</sup>	Distributed Network
<b>Remote GS</b>	data	data	data	audio	data <sup>2</sup>
<b>Federation</b>	yes	-	yes	-	yes
<b>Scheduling</b>	-	-	Central	Distributed	Hybrid <sup>3</sup>
<b>Security</b>	-	-	Central	-	Distributed <sup>4</sup>
<b>Sources</b>	Source Forge (2003)	-	-	-	GitHub
<b>License</b>	GPLv2	-	-	-	Apache v2

<sup>1</sup> Initially P2P, finally central server (AUS entity).

<sup>2</sup> Custom protocols in between clients.

<sup>3</sup> Distributed through the central nodes, similar to a cloud computing approach.

<sup>4</sup> Through different subnetworks.



# Organization



# GitHub



Fundación Barrié

- Open source (Apache V2).
- Incremental software development:
  - [https://github.com/satnet-project](#)
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JetBRAINS



PyCharm

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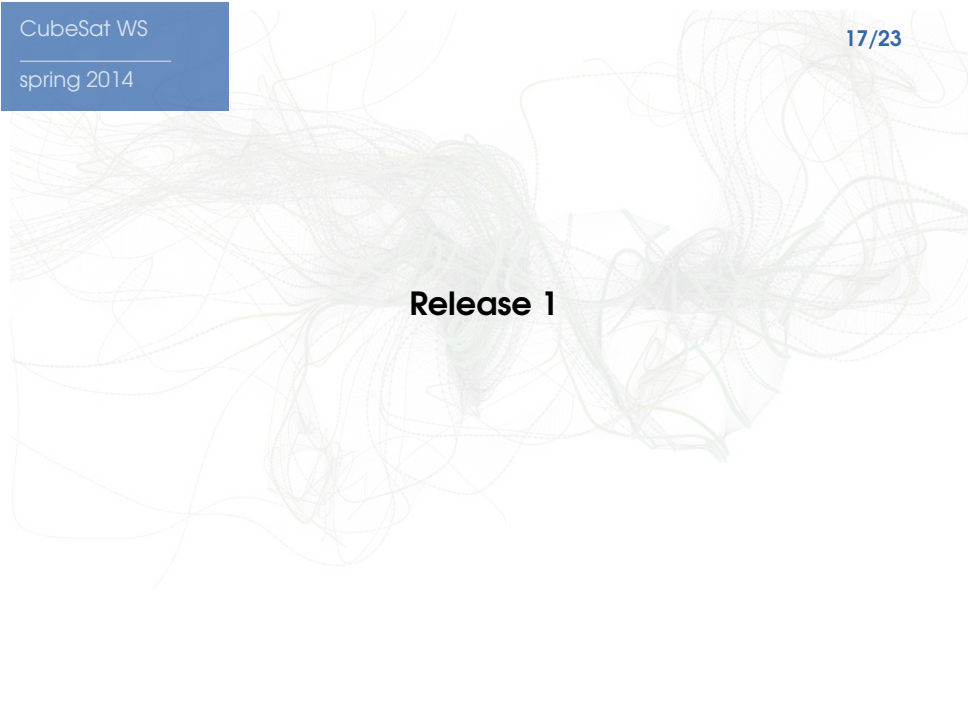
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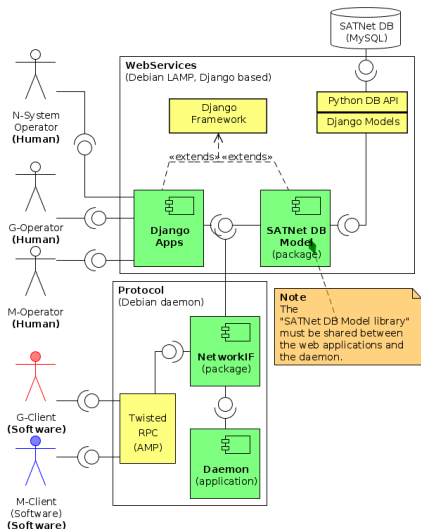
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R#	Date	Management	Scheduling	Communications	Additional
R1	June 2014	User registration	Basic booking	Assisted	
		Basic configuration			
R2	December 2014	Full configuration	Assisted	Non-scheduled	Scalability
					Key distribution
R3	July 2015	Information service	Private	Private	
R4	September 2015				Testing

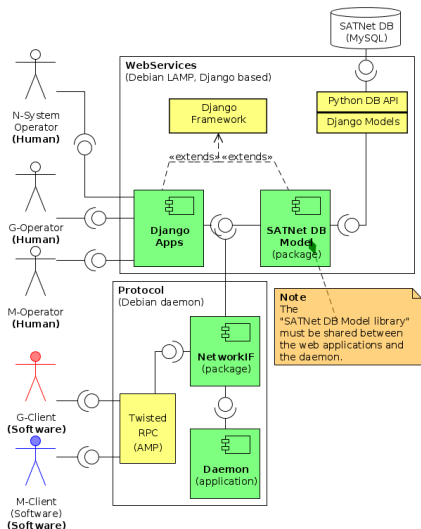


**Release 1**



## ■ Standalone Node → Private Subnetworks.

- WebServices with Django (Python 2.7).
- Database: MySQL.
- Communications Service:
  - Daemon protocol, Twisted over TLS.
  - Better performance for lower delay.
- Operating system: Debian Wheezy.



- Standalone Node → **Private Subnetworks.**

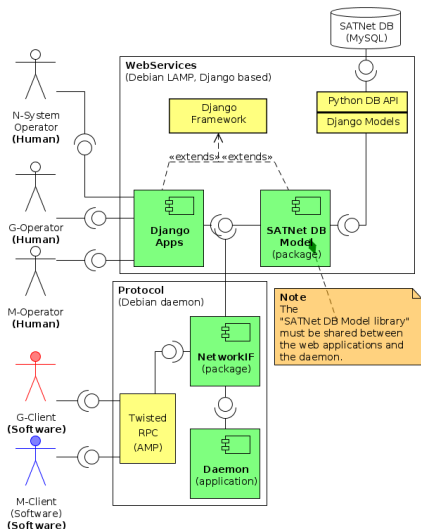
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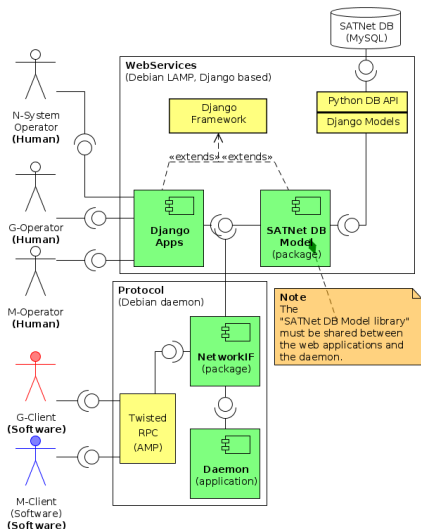
- Database: MySQL.

- Clustering possibility for redundancy.

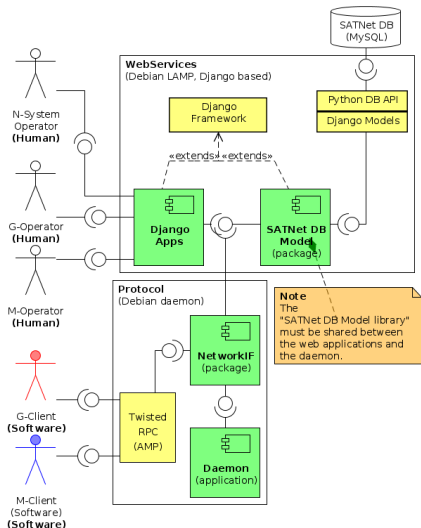
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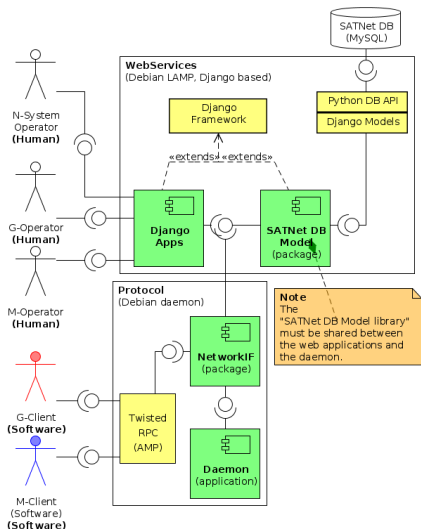


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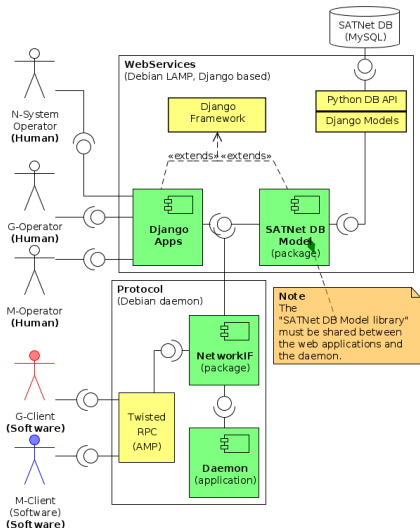


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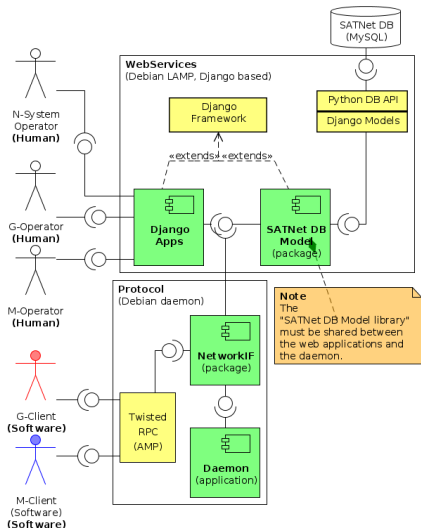




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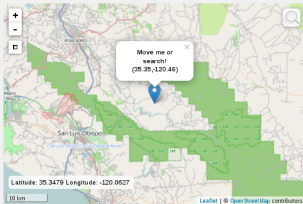
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## (+) Add Ground Station

Owner: rtubio

### STEP 1: Set location

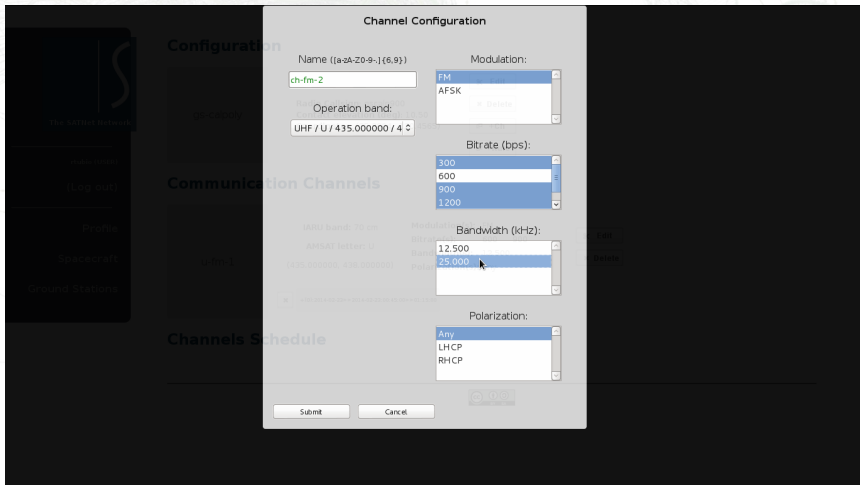


### STEP 2: Define your station

Identifier:

Callsign:

Elevation (deg):



The screenshot displays the CubeSat WS interface. On the left is a dark sidebar with the SATHet Network logo and navigation links: rtudio (USER), (Log out), Profile, Spacecraft, and Ground Stations. The main content area is divided into two sections: Configuration and Communication Channels.

### Configuration

gs-calpoly

Radio Callsign: gscalp900  
Contact elevation (deg): 10.50  
Coordinates: (35.3804, -120.4565)

### Communication Channels

u-fm-1

IARU band: 70 cm      Modulation(s): FM  
AMSAT letter: U      Bitrate(s): 600 900  
(435.000000, 438.000000)      Bandwidth(s): 12.500  
Polarization(s): Any

+101.2014-02-22+> 2014-02-22:00:45:00+>01:15:00

ch-fm-2

IARU band: 70 cm      Modulation(s): FM  
AMSAT letter: U      Bitrate(s): 300 900 1200  
(435.000000, 438.000000)      Bandwidth(s): 25.000  
Polarization(s): Any

*(no rules for ch-fm-2)*

### Channels Schedule

**Thanks for your attention!**