

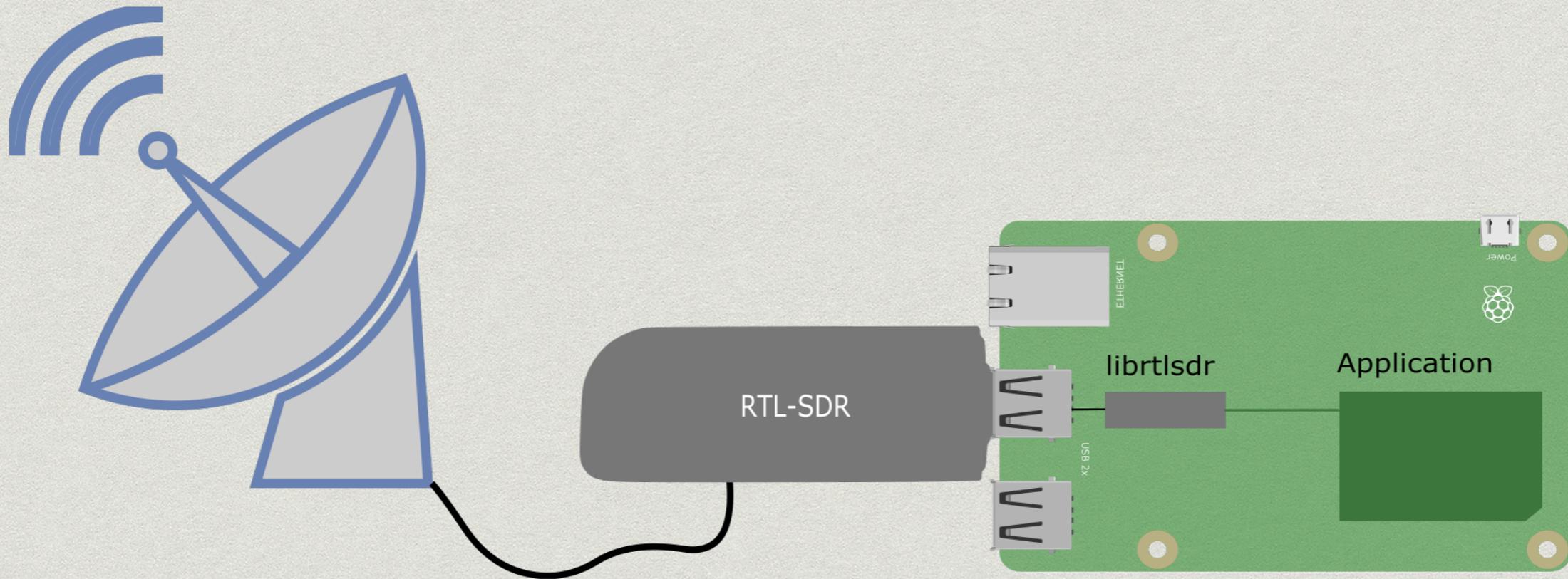
SDR-SERVER

SHARE RTL-SDR BETWEEN MULTIPLE USERS

By Andrey Rodionov for Open Source Cubesat Workshop 2021

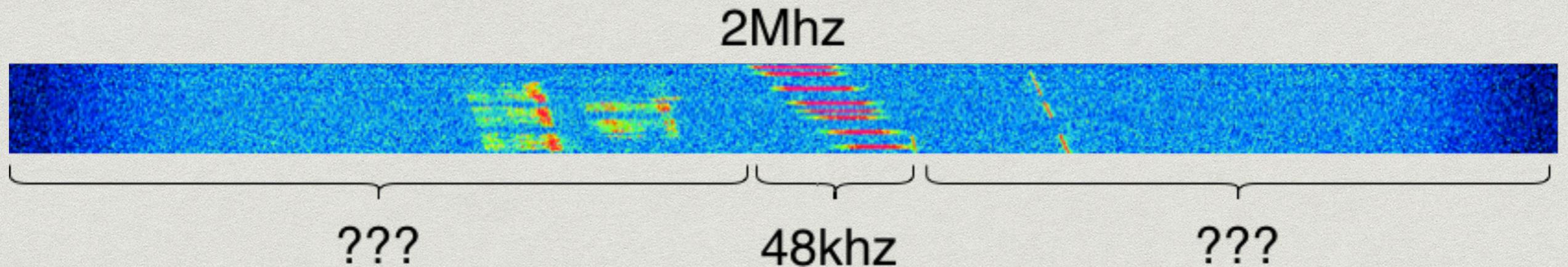
Problem statement

One SDR - one application



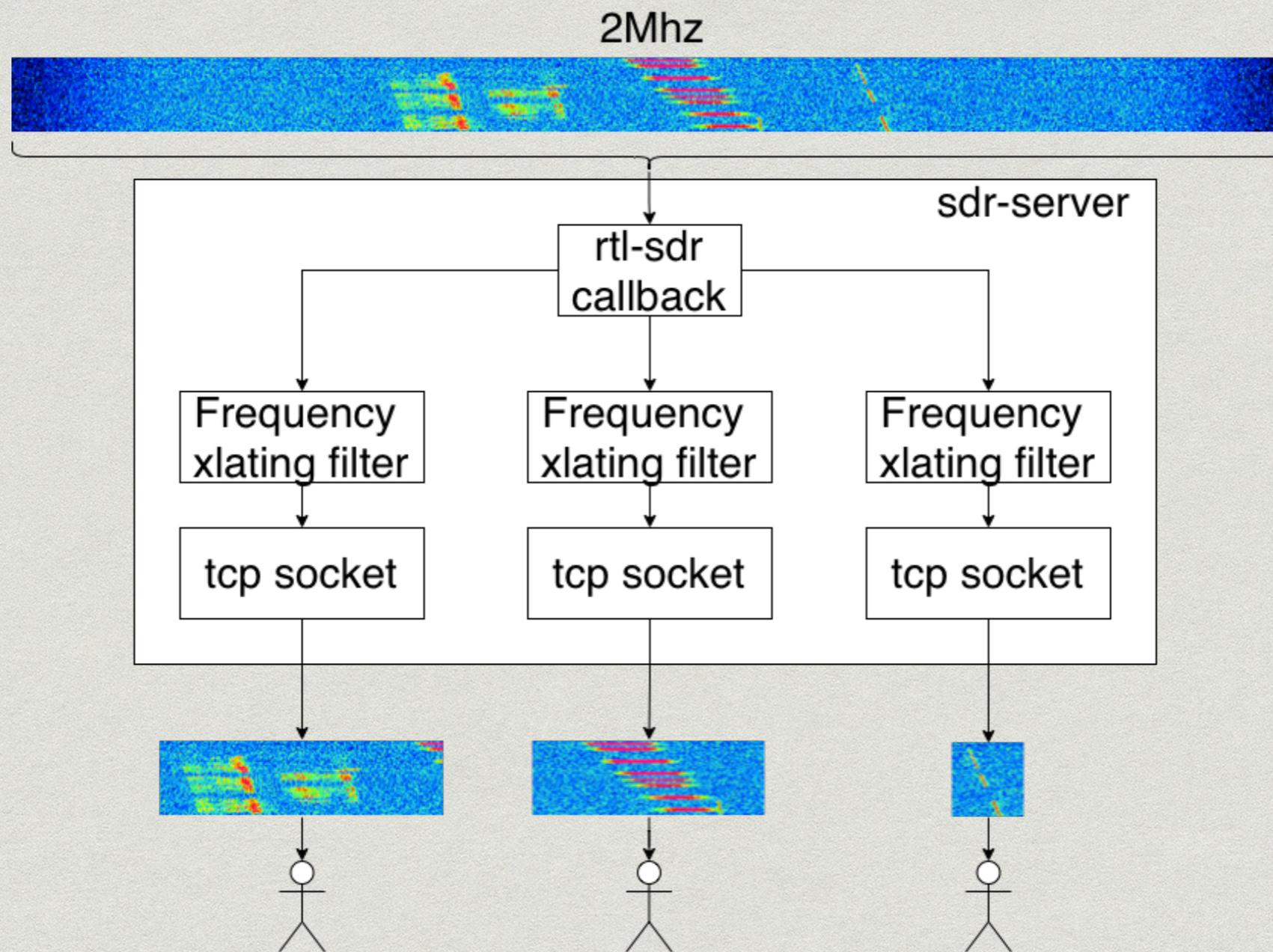
Problem statement

One SDR - one application



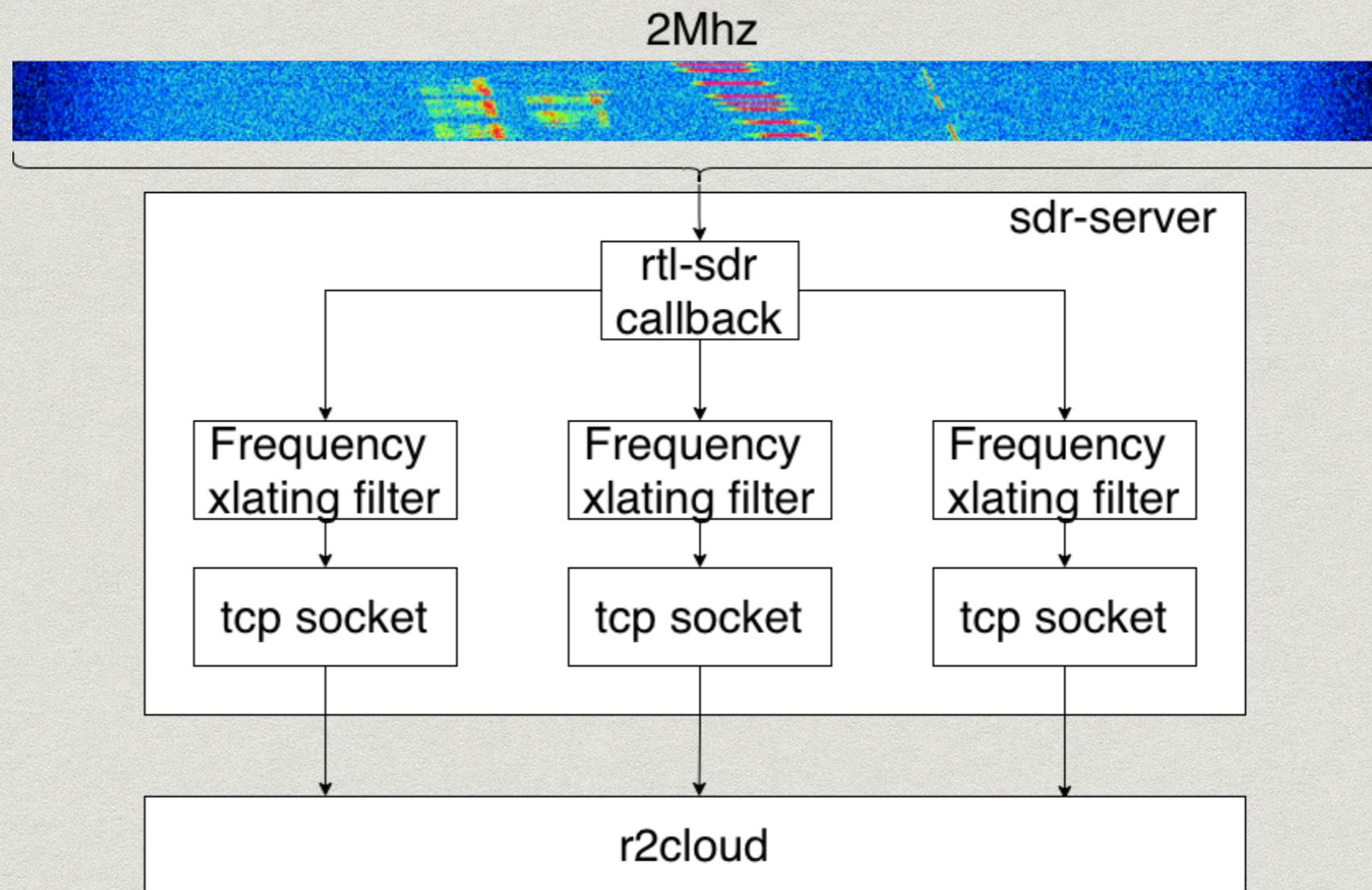
SDR-server

One rtl-sdr - multiple users



SDR-server

One rtl-sdr - multiple observations



Auto scheduler

How to maximise hardware utilisation?

- * Can't schedule 2m and 70cm at the same time
- * 70cm is wide - more than 2Mhz
- * All satellites are equal
- * NP-complete task

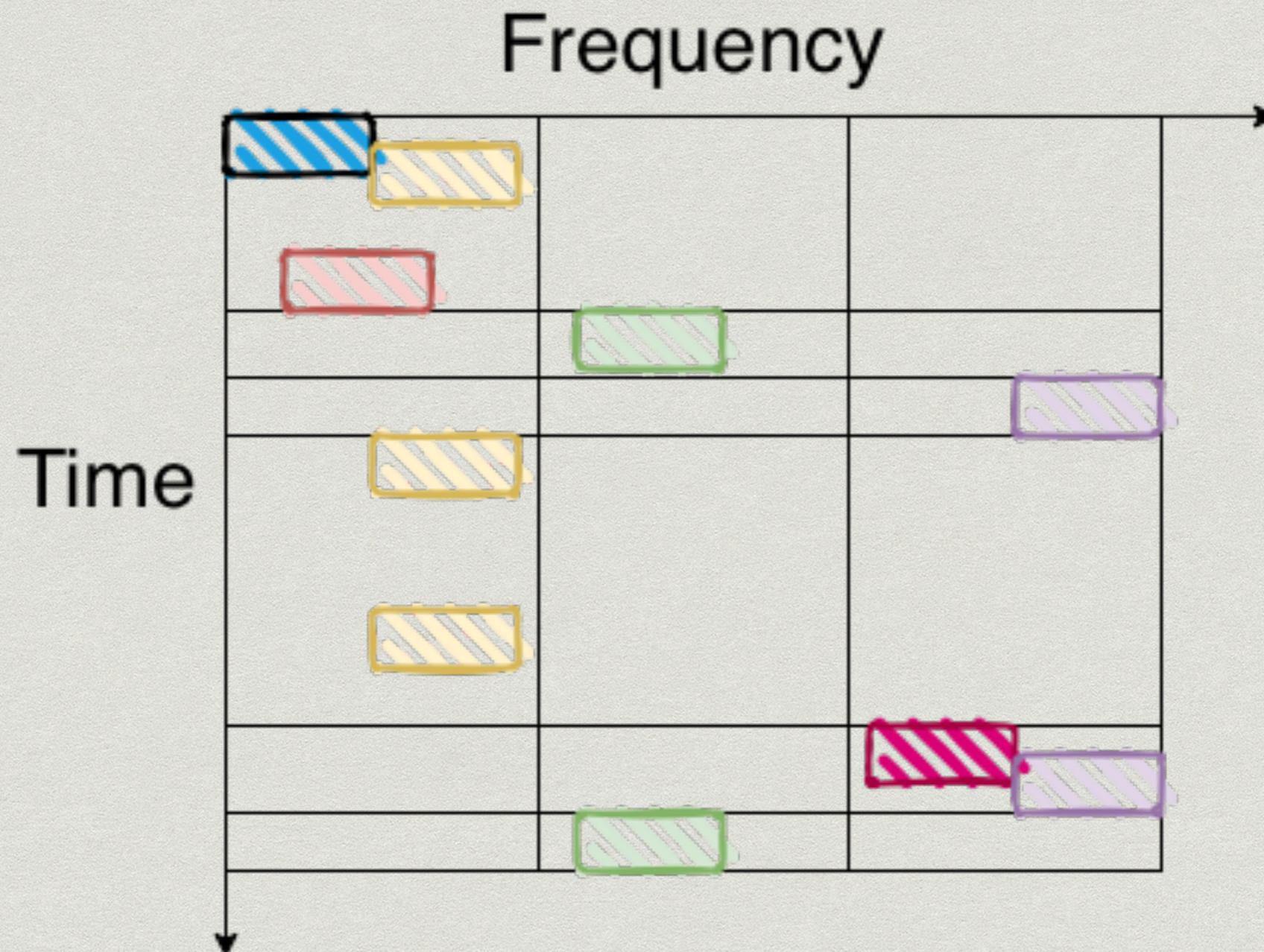
Auto scheduler

Solution: Split range into several “bands”

```
Dec 04 14:55:12 raspberrypi java[24362]: scheduled next pass for MIR-SAT 1(48868). start: Mon Dec 06 14:47:45 UTC 2021
Dec 04 14:55:12 raspberrypi java[24362]: observations rescheduled. next update at: Mon Dec 06 14:55:30 UTC 2021 [ru.r2c
Dec 04 14:55:12 raspberrypi java[24362]: active bands are: [ru.r2cloud.satellite.Scheduler logBandsForSdrServer]
Dec 04 14:55:12 raspberrypi java[24362]: 400503000 - 401511000 [ru.r2cloud.satellite.Scheduler logBandsForSdrServer]
Dec 04 14:55:12 raspberrypi java[24362]: 401651000 - 402659000 [ru.r2cloud.satellite.Scheduler logBandsForSdrServer]
Dec 04 14:55:12 raspberrypi java[24362]: 434928000 - 435936000 [ru.r2cloud.satellite.Scheduler logBandsForSdrServer]
Dec 04 14:55:12 raspberrypi java[24362]: 435878000 - 436886000 [ru.r2cloud.satellite.Scheduler logBandsForSdrServer]
Dec 04 14:55:12 raspberrypi java[24362]: 436836000 - 437844000 [ru.r2cloud.satellite.Scheduler logBandsForSdrServer]
Dec 04 14:55:12 raspberrypi java[24362]: 437703000 - 438711000 [ru.r2cloud.satellite.Scheduler logBandsForSdrServer]
```

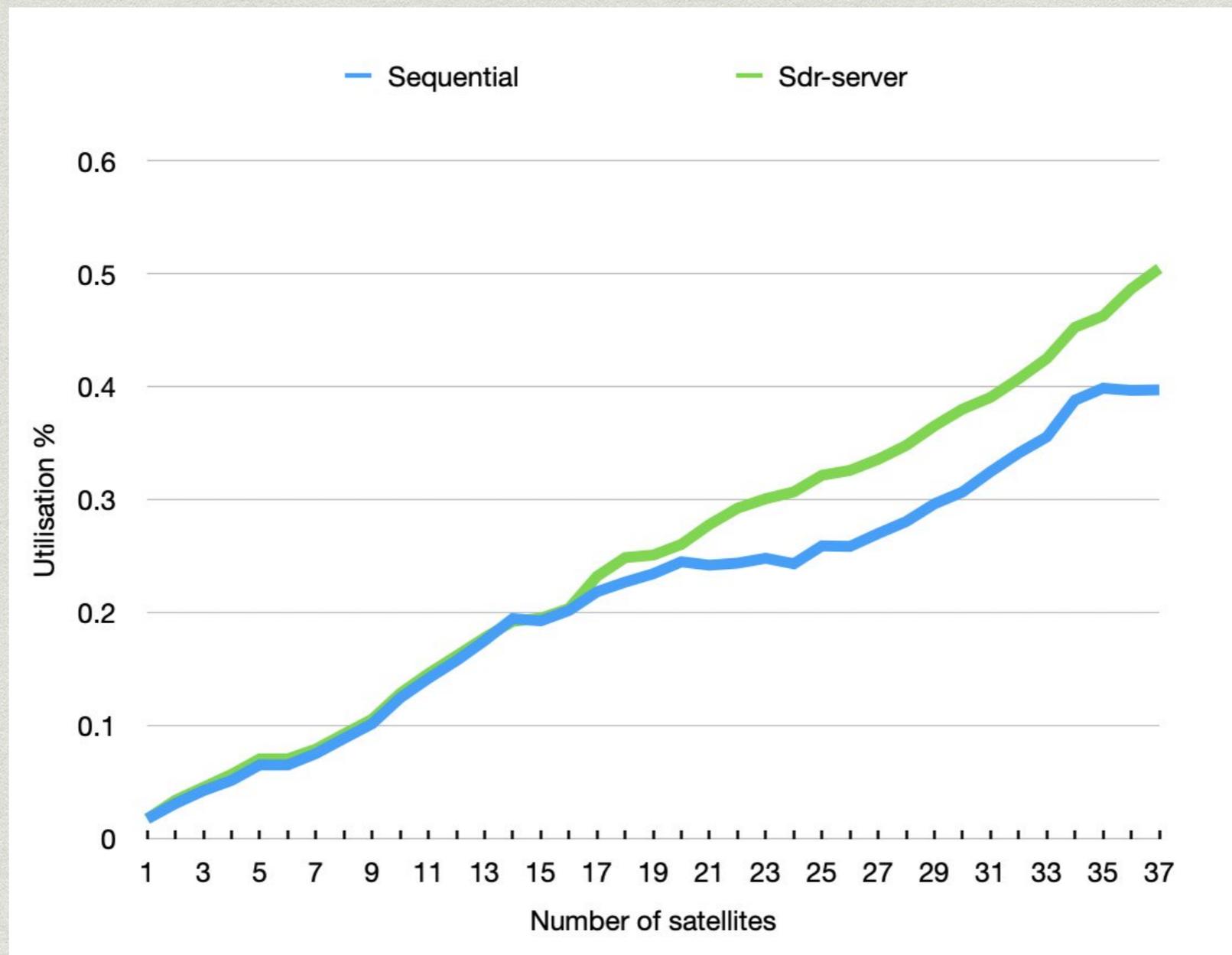
Auto scheduler

Solution: Schedule observations in each “band” separately



Simulation

Sequential (naive) vs sdr-server - 10% increase



Practice

AAUSAT4 + BUGSAT-1

Meta	
Satellite	AAUSAT 4
NORAD id	41460
Start	11:29 26-Mar-2021
End	11:40 26-Mar-2021
Gain	15.0
Frames decoded	6
Frequency	437424000
Actual frequency	437424000
Sample rate	48000
Bandwidth	7000

Telemetry Spectrogram TLE

Name	Date	Frames
AAUSAT 4	11:29 26-Mar-2021	6
BUGSAT-1 (TITA)	11:29 26-Mar-2021	13

Practice

Before sdr-server...

			07:00:37
46	OK2FCO-JN88tw	110366	2020-03-21 08:33:46
47	M7RED-LO33sr	109716	2020-04-05 14:20:17
48	K4KDR-MM87ts	107212	2020-03-03 03:16:31
49	YC3BVG-OJ78dh	105140	2020-01-17 01:30:37

Practice

...After.

Top 7 daily contributor
at SatNOGS

Recent Contributors

Data - Last 24h

- MAUSyagi - 36809 frames
- UY0LL - 15120 frames
- G7GQW - 11176 frames
- ACRI-ST - 8754 frames
- EA6TC - 5349 frames
- YC5YC - 3901 frames
- M7RED - 2600 frames
- Piszkesteto UHF - 2301 frames
- F6HDW - 2271 frames
- SP7THR-UHF - 1701 frames
- GAO UHF - 1423 frames
- ZR1ADC - 1332 frames
- EU1AEM - 1250 frames
- VE2DSK-VHF-UHF - 1119 frames
- UX5UL - 893 frames
- KB6LTY - 782 frames
- notch - 773 frames
- Goldford - 652 frames

Limitations

- * Omnidirectional antenna
 - * Use band pass filter
- * Can't schedule 70cm and 2m at the same time
 - * Reduce number of "bands"
- * More users more load
 - * Limit number of concurrent observations
- * Custom binary TCP-based protocol

Project details

- * Written in C
- * Critical sections use libvolk2
- * GPLv2
- * Hosted on Github

Future

- * Support more SDRs
- * Support more operating systems
- * Offload computation to GPU?

Q&A

SDR-SERVER:

<https://github.com/dernasherbrezon/sdr-server>

CONTACTS:

<https://dernasherbrezon.com>

<https://github.com/dernasherbrezon>

