



Tiansuan Constellation: an Open On-orbit Satellite Network Experiment Platform

Shangguang Wang

Department of Computer Science

Beijing University of Posts and Telecommunications

www.sguangwang.com

■ Satellite network has become a global hotspot



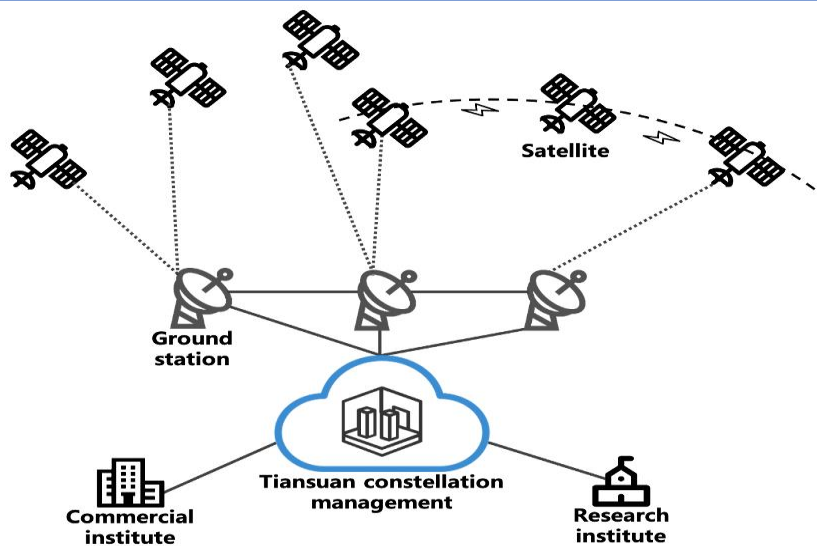
- This exciting development is taking shape rapidly in the industry, while the research community is urgent to do some leading research to bridge the connectivity divide.
- It is urgent to conduct experiment evaluations on real satellites. However, this is difficult because of high bar of space technology, such as deployment cost and unknown risks.

Tiansuan Constellation



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- Building an open research platform facing research need, based on industry-university-research and application



Communication

Computing

Satellite operating system

Security and reliability

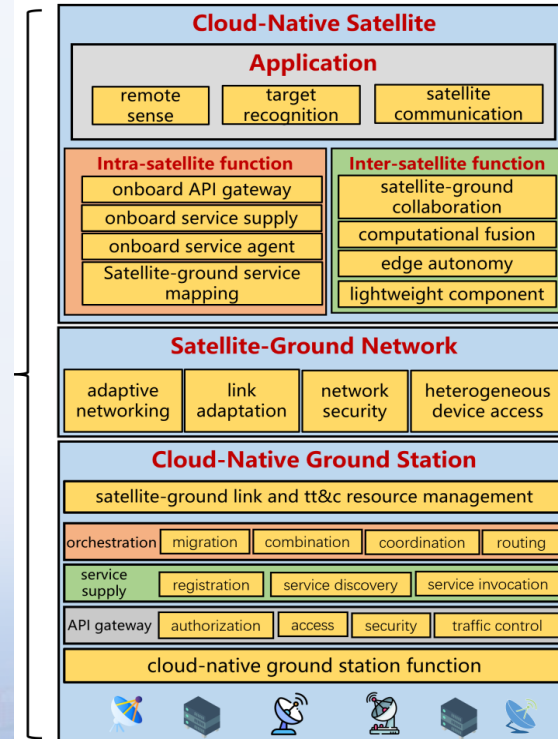
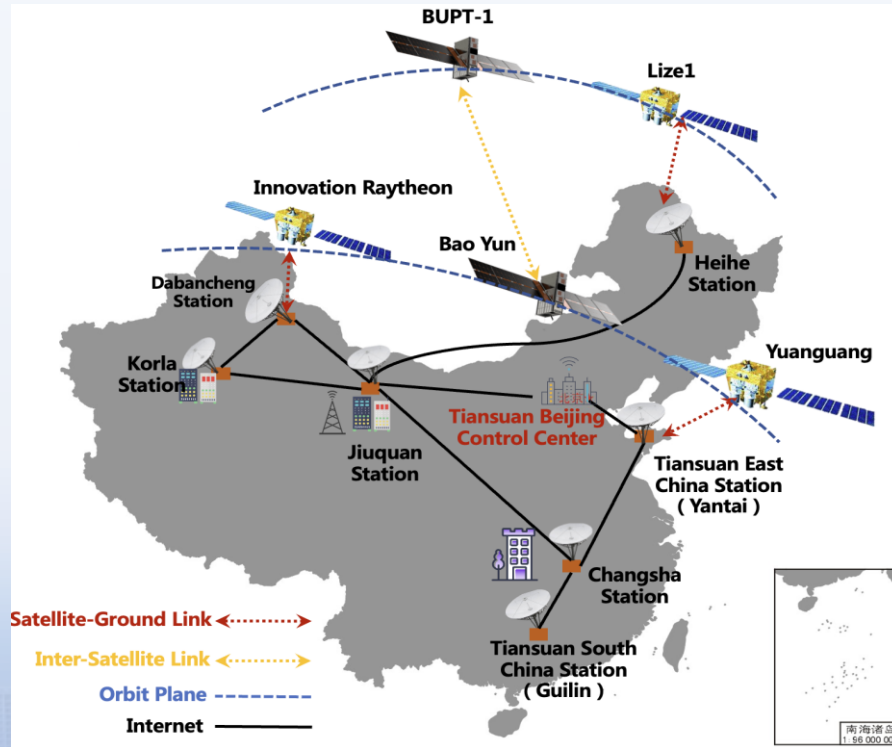
Hardware testing

Current Tiansuan Constellation

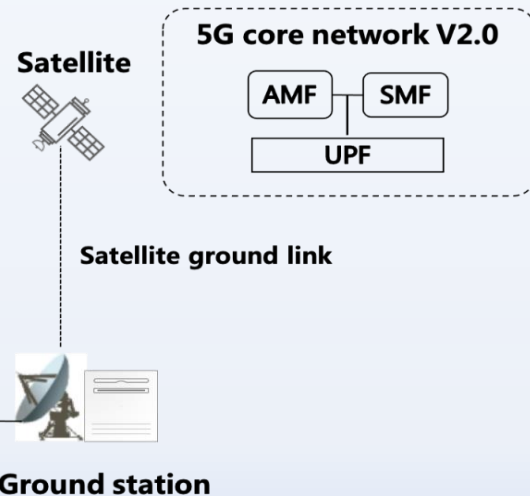
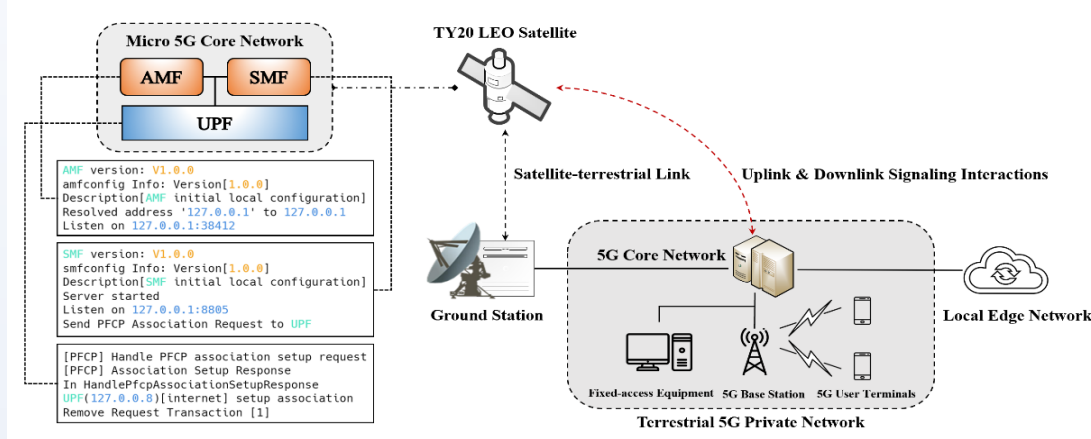


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■ www.tiansuan.org.cn



In-orbit Testing 1: B5G Core Network



R. Xing, et al., From Earth to Space: A First Deployment of 5G Core Network on Satellite, China Communications, 2022, <https://arxiv.org/abs/2210.05405>

In-orbit Testing 1: B5G Core Network



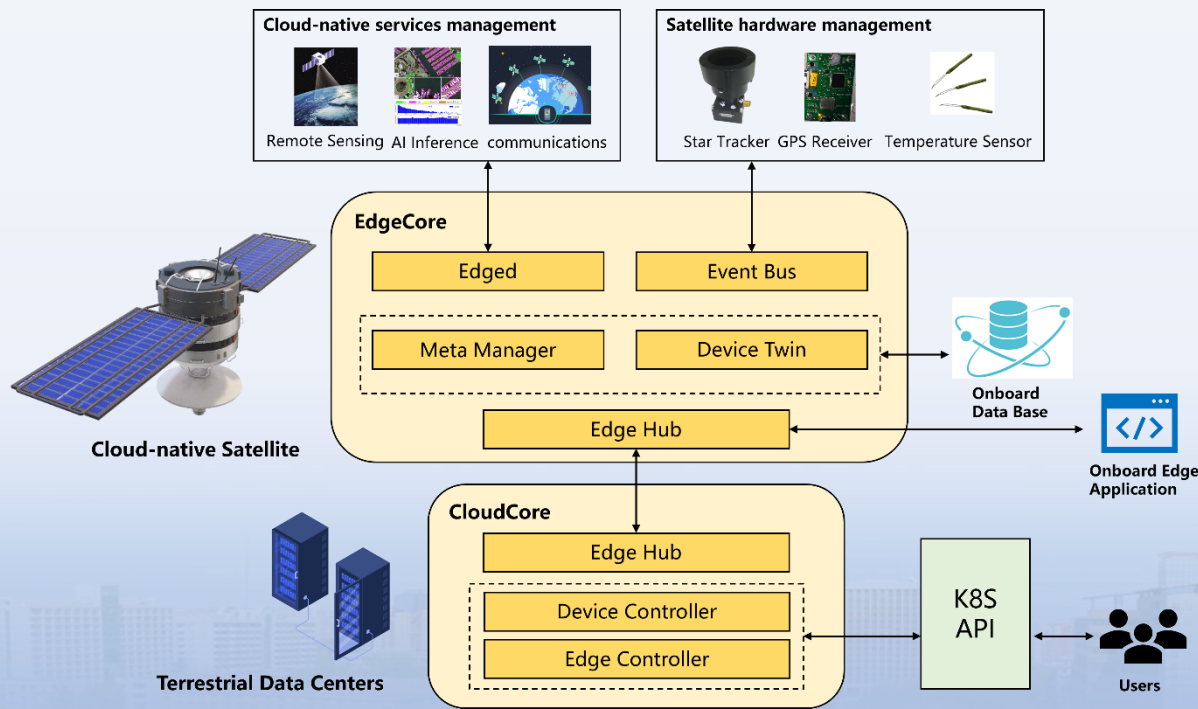
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In-orbit Testing 2: Cloud-native satellite

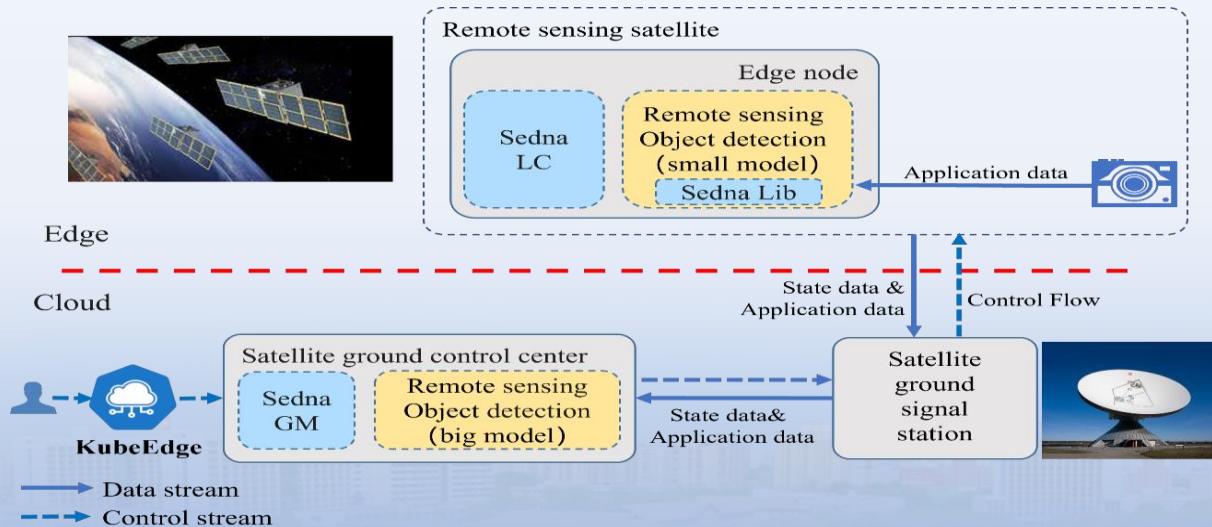


- BUPT and Huawei Cloud jointly developed the world's first cloud-native satellite platform



In-orbit Testing 3: AI inference

- In remote sensing scenarios, the identification accuracy of ground targets in orbit is improved by more than **50%** through in-orbit cloud detection.
- Through in-orbit calculation, the amount of data returned by the satellite is reduced by **90%**



Accuracy rate	Recall rate
99.13%	99.07%



The benefits

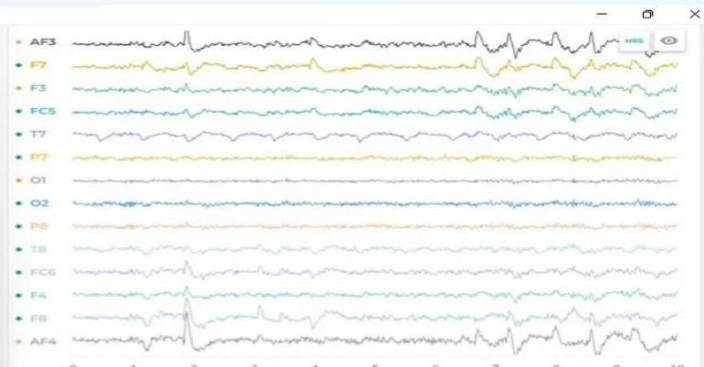
- Improve the accuracy of area statistics ↗
- Reduce satellite energy consumption ↘
- Slow down the satellite-earth traffic ↘
- Reduce transmission costs ↘

In-orbit Testing 4: Controlling Satellite



■ Controlling satellites via brain-computer interface

脑控卫星



```
2023-02-04 16:26:46.107970 filter_handler: filter get :/com/left
2023-02-04 16:26:46.107970 filter_handler: order:Snapshot
2023-02-04 16:26:46.107970 SentToProxy: send to Proxy server: ['type': 'bash', 'data': '/home/HwHiAiUser/project/scripts/exp4_snapshot.sh', 'payload': 1]
2023-02-04 16:26:46.107970 filter_handler: send bash to proxy:/home/HwHiAiUser/project/scripts/exp4_snapshot.sh
```

```
2023-02-04 16:26:54.109920 filter_handler: filter get :/com/left
2023-02-04 16:26:54.109920 filter_handler: order:Snapshot
2023-02-04 16:26:54.109920 SentToProxy: send to Proxy server: ['type': 'bash', 'data': '/home/HwHiAiUser/project/scripts/exp4_snapshot.sh', 'payload': 1]
2023-02-04 16:26:54.109920 filter_handler: send bash to proxy:/home/HwHiAiUser/project/scripts/exp4_snapshot.sh
```

```
2023-02-04 16:27:01.111134 filter_handler: filter get :/com/drop
2023-02-04 16:27:01.111134 filter_handler: order:Rec Start
2023-02-04 16:27:01.111134 SentToProxy: send to Proxy server: ['type': 'bash', 'data': '/home/HwHiAiUser/project/scripts/exp2_rec_start.sh', 'payload': 1]
2023-02-04 16:27:01.111134 filter_handler: send bash to proxy:/home/HwHiAiUser/project/scripts/exp2_rec_start.sh
```

```
2023-02-04 16:27:48.112385 filter_handler: filter get :/com/drop
2023-02-04 16:27:48.112385 filter_handler: order:Rec Stop
2023-02-04 16:27:48.112385 SentToProxy: send to Proxy server: ['type': 'bash', 'data': '/home/HwHiAiUser/project/scripts/exp2_rec_stop.sh', 'payload': 1]
2023-02-04 16:27:48.112385 filter_handler: send bash to proxy:/home/HwHiAiUser/project/scripts/exp2_rec_stop.sh
```



Support networking experiments



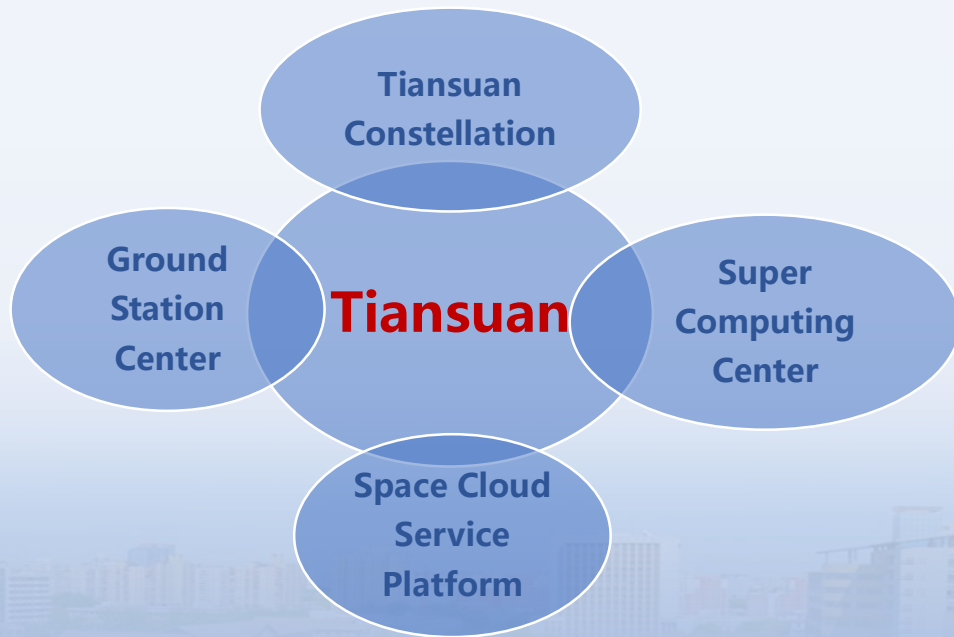
- Satellite edge computing
- Satellite network performance measurement
- New protocols for satellite network
- New access technology for satellite network
- New applications on satellites
-

Tiansuan platform allows any registered users to submit their experiment code directly to real satellites!

Conclusion



- A public, web-based, unified platform that provides services to third-party researchers and practitioners





Thanks!

Shangguang Wang

<http://www.tiansuan.org.cn>