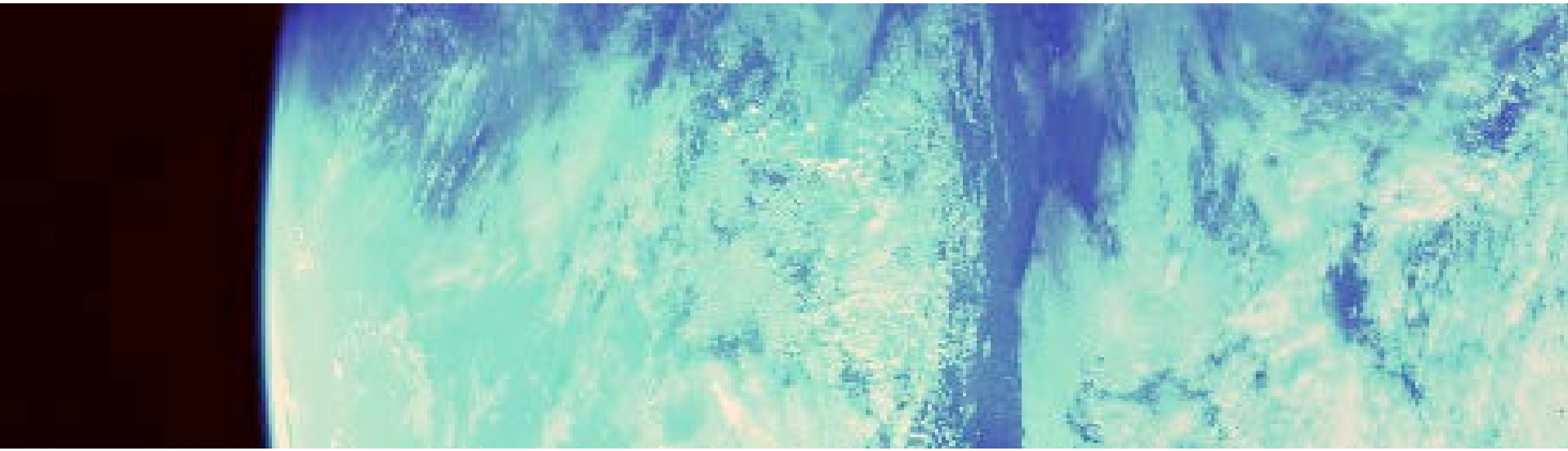
Lower Latency In Ground Station Networks Opens For New Remote Sensing Applications



Dr Mikael Stern

Senior Vice President, Chief Strategy Officer

SSC, Sweden

SSC's Global Presence

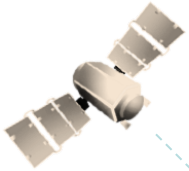
SSC Group
SSC Chile
Universal Space Network (US)
SSC Space Australia
LSE Space (Germany, Dubai)
Aurora Technology (Netherlands, Spain)

600 employees
21 nationalities
18 locations
11 countries

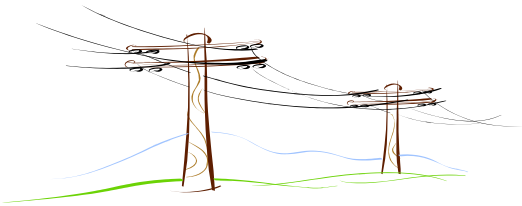
Sales office in China
Sales office in Thailand

www.sscspace.com

Ground Segment Support Services



SSC services



Satellite Mission Centre
- Satellite Control
- Generation of commands

User's Data Centre
- Processing
- Value-adding
- Analyses

Ground Comms

Ground Comms

Ground Stations
- Command uplink
- Payload downlink

Payload data handling
- Archiving
- Pre-Processing

Latency is critical

Latency (= delay) – time from request until data reaches user

Minimizing Latency is central to the value of Remote Sensing data – who is interested in yesterdays weather?

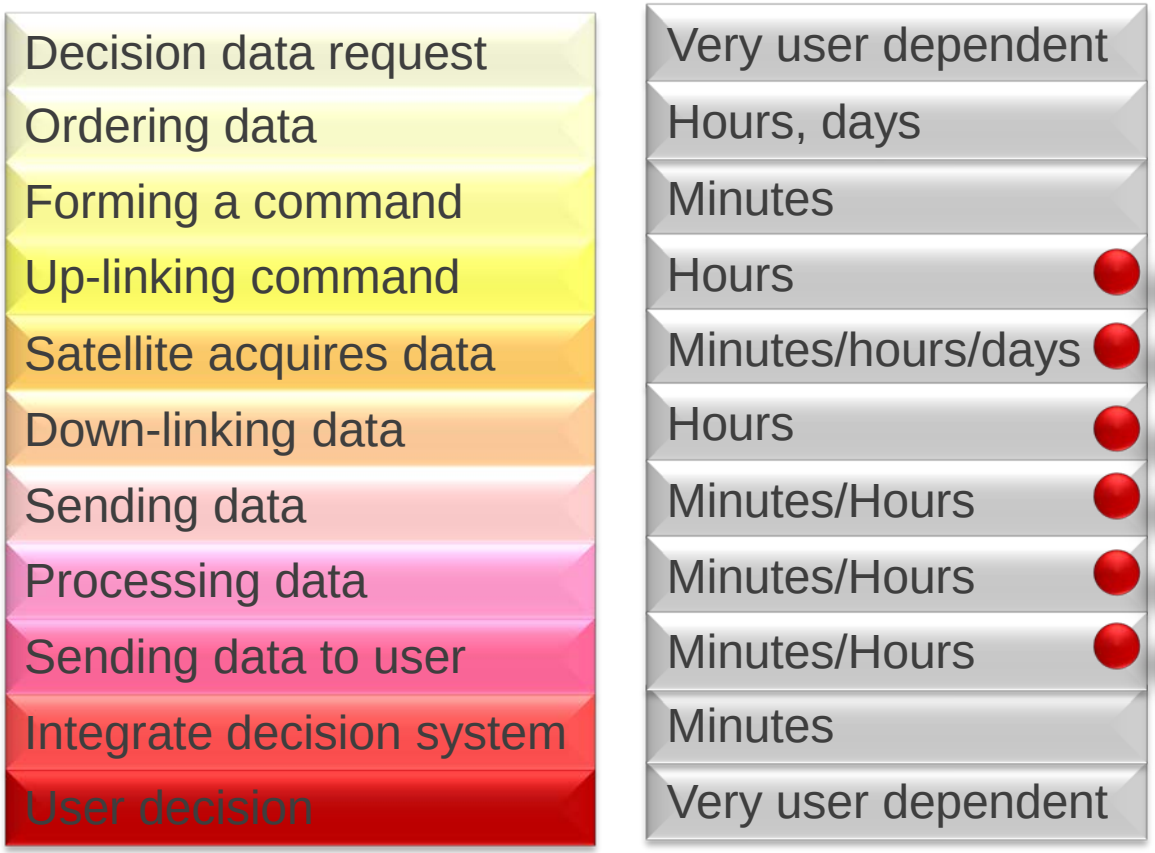
Minimizing Total Latency is especially important to e.g.:

- Meteorology
- AIS
- Military
- Disaster Management

Latency – Chain of Events

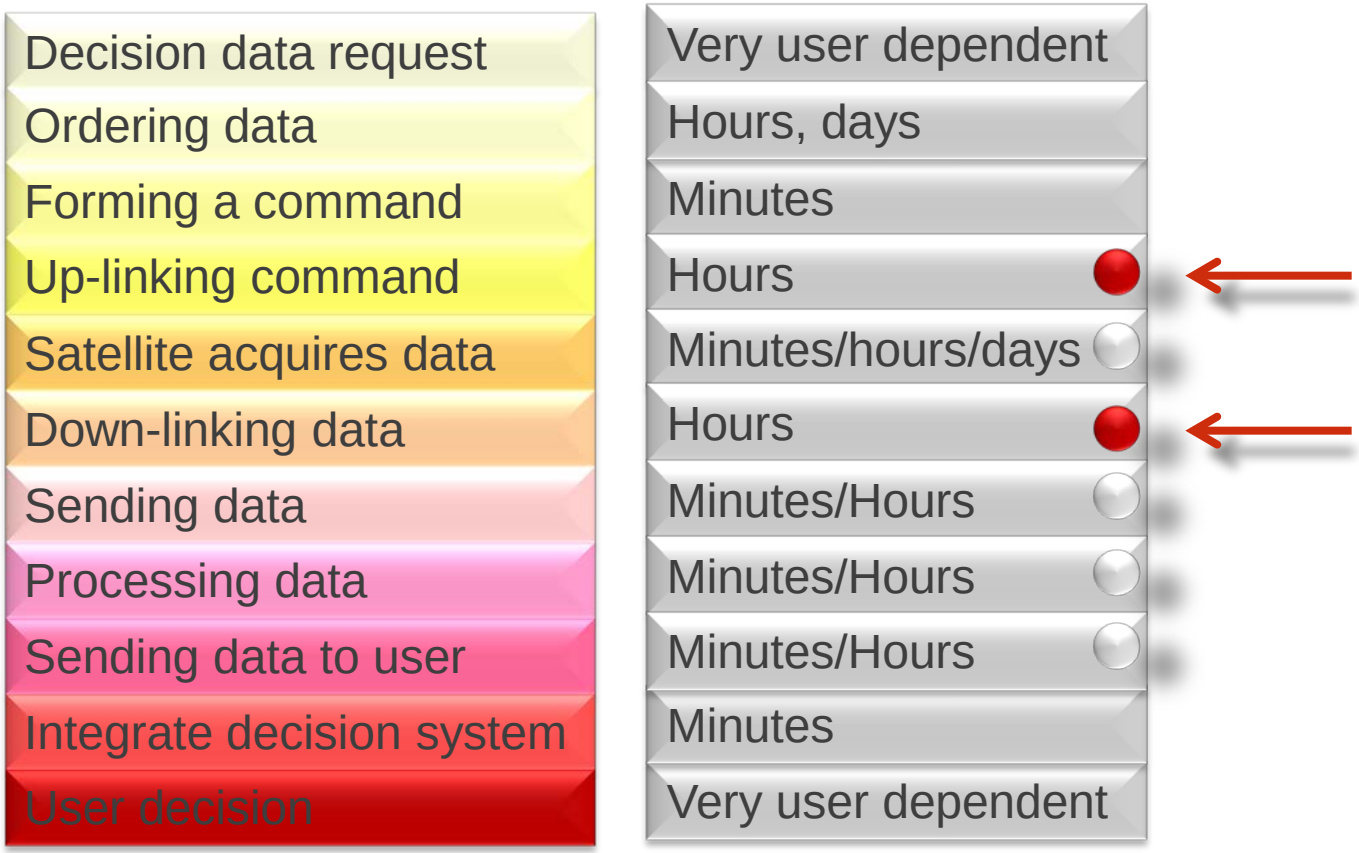
Decision data request	User dependent
Ordering data	Operator dependent
Forming a command	Operator dependent
Up-linking command	Ground Station dependent
Satellite acquires data	Constellation dependent
Down-linking data	Ground Station dependent
Sending data	Network dependent
Pre-processing data	Processor dependent
Sending data to user	Network dependent
Integrate decision system	User dependent
User decision	User dependent

Normal Latency



Where can SSC decrease latency?

Normal Latency



Reducing Latency with multiple Ground Stations

One contact per orbit ≈ 100 minutes between contacts to up-link request or receive recorded data

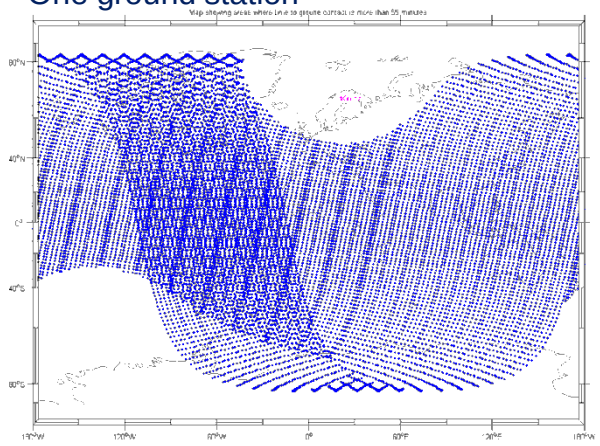
Two contact per orbit ≈ 50 minutes between contacts to up-link request or receive recorded data

Complete coverage of Region-of-Interest reduces reception to 0 minutes

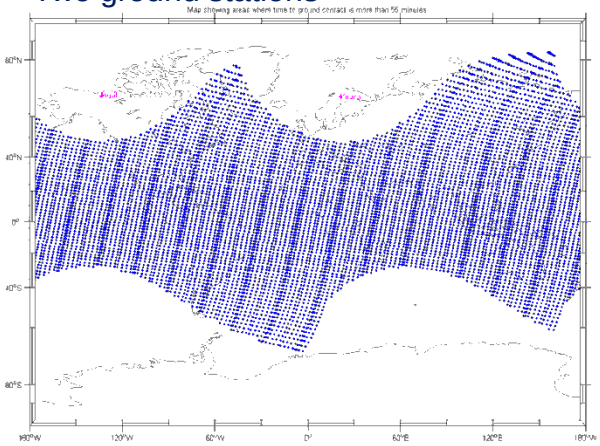
Reducing Latency With Multiple Ground Stations
Time from acquisition to delivered product

White areas = less than 1 hour
Blue areas = more than 1 hour

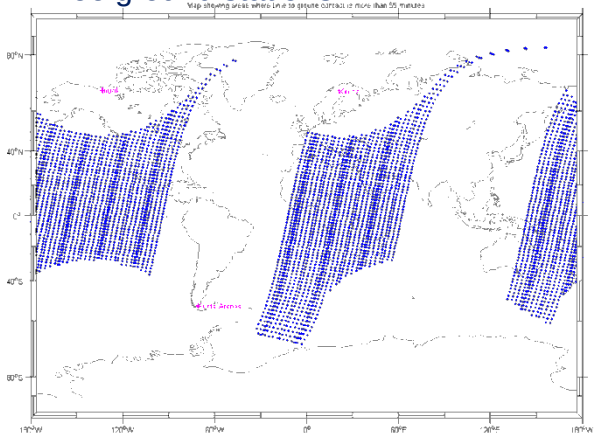
One ground station



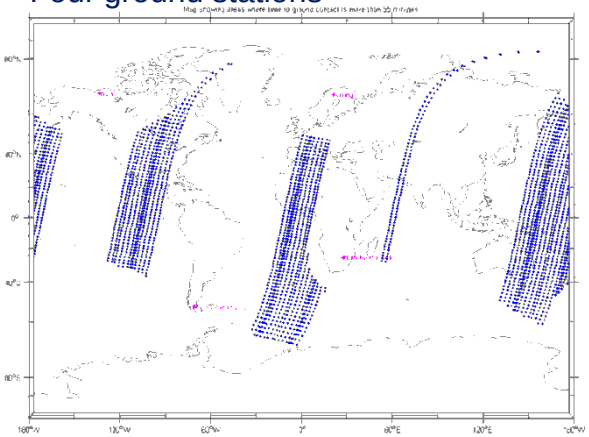
Two ground stations



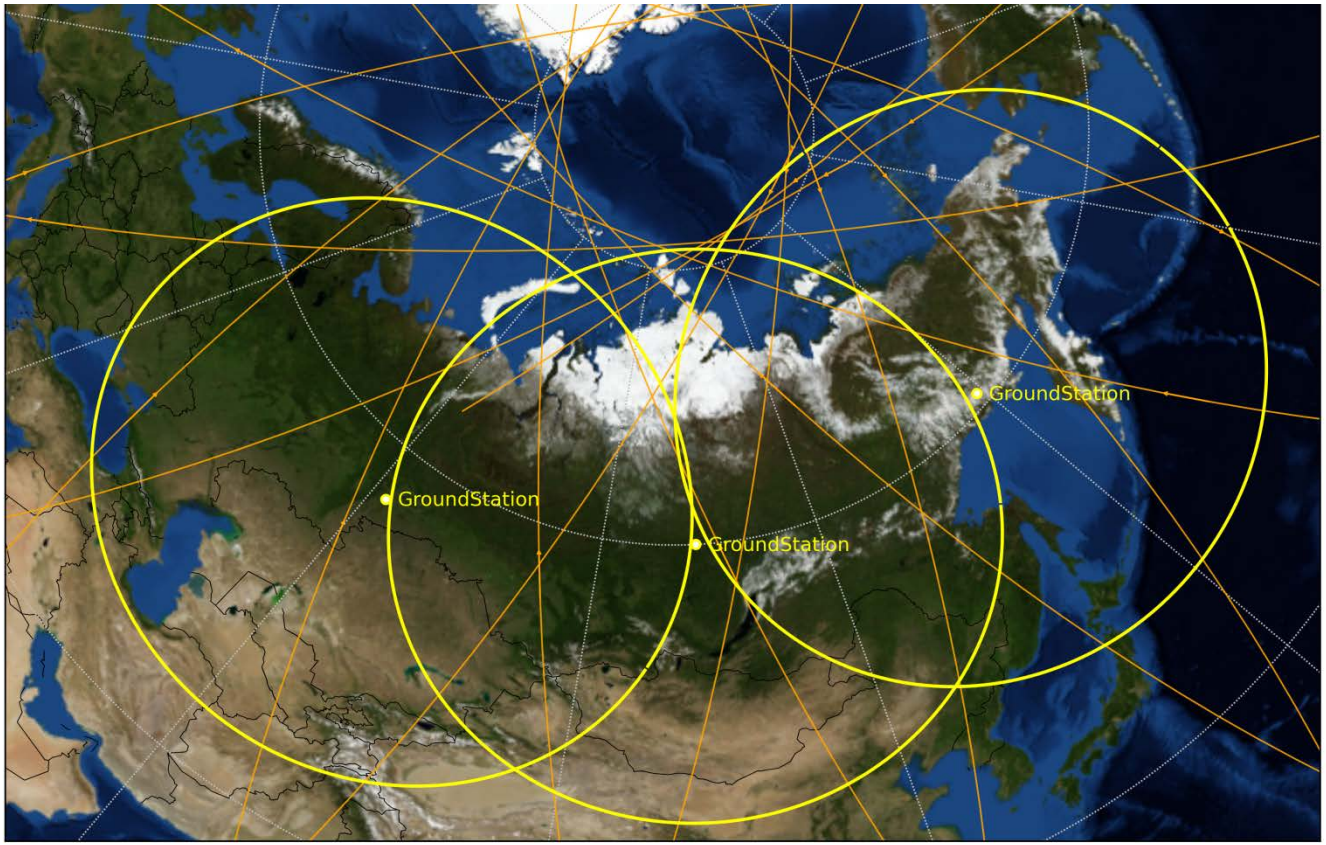
Three ground stations



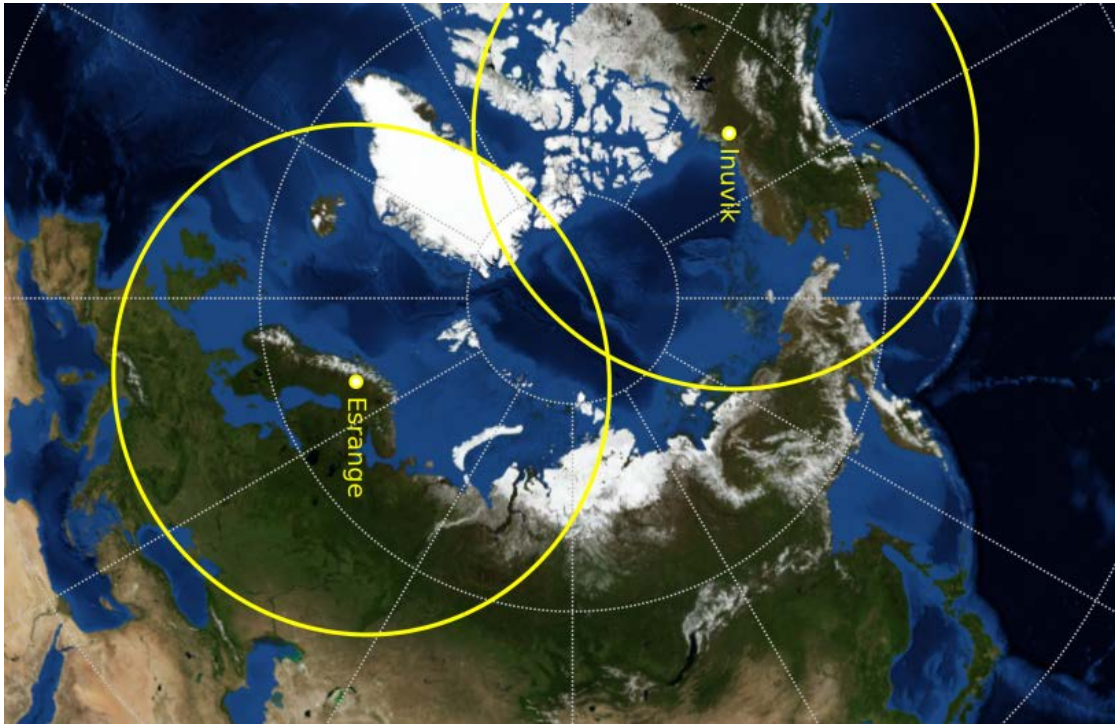
Four ground stations



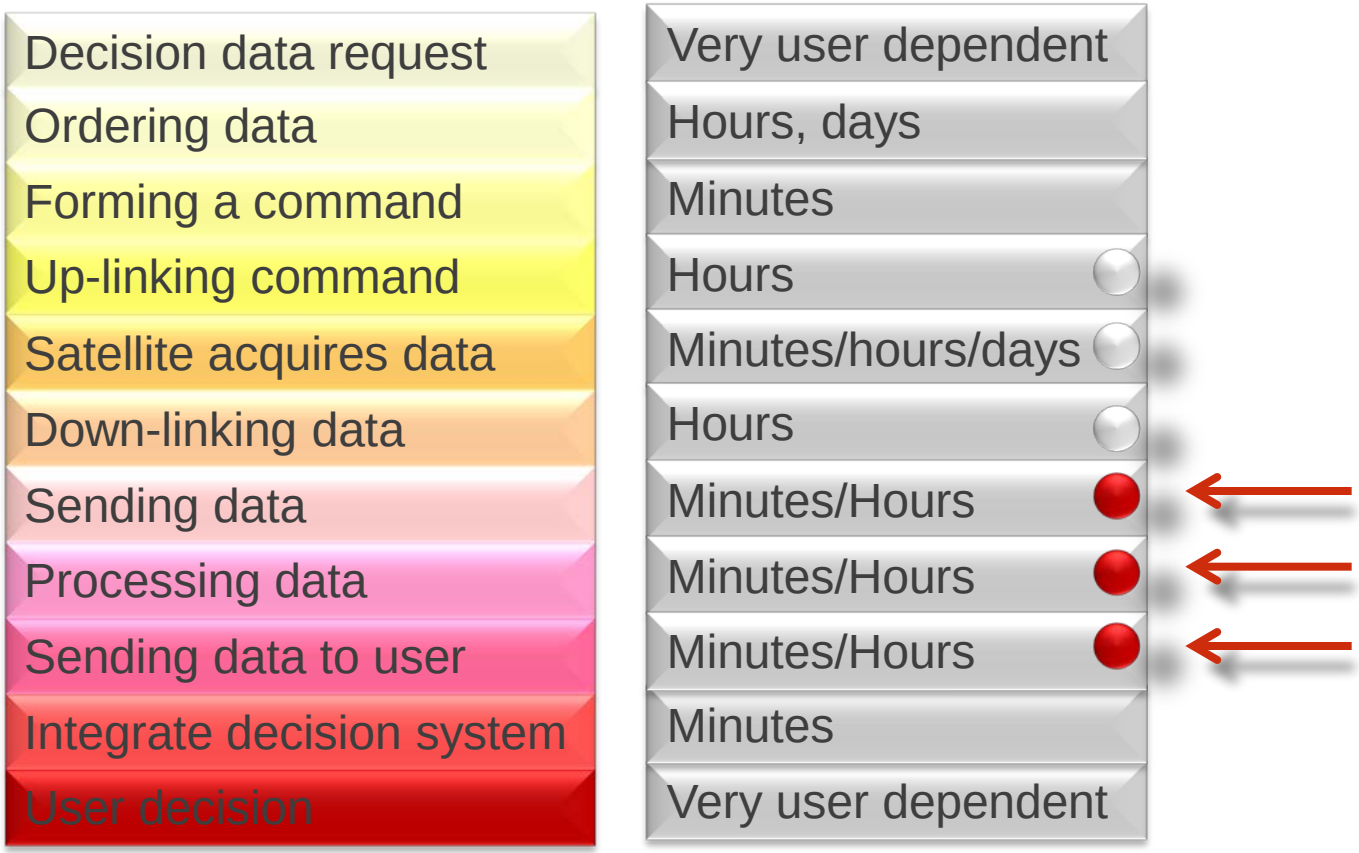
Local ground stations for Russian territories
From acquisition to reception – 0 minutes



Polar stations for Russian territories
From acquisition to reception < 10 minutes (ascending orbits)



Normal Latency



Reducing pre-processing and delivery

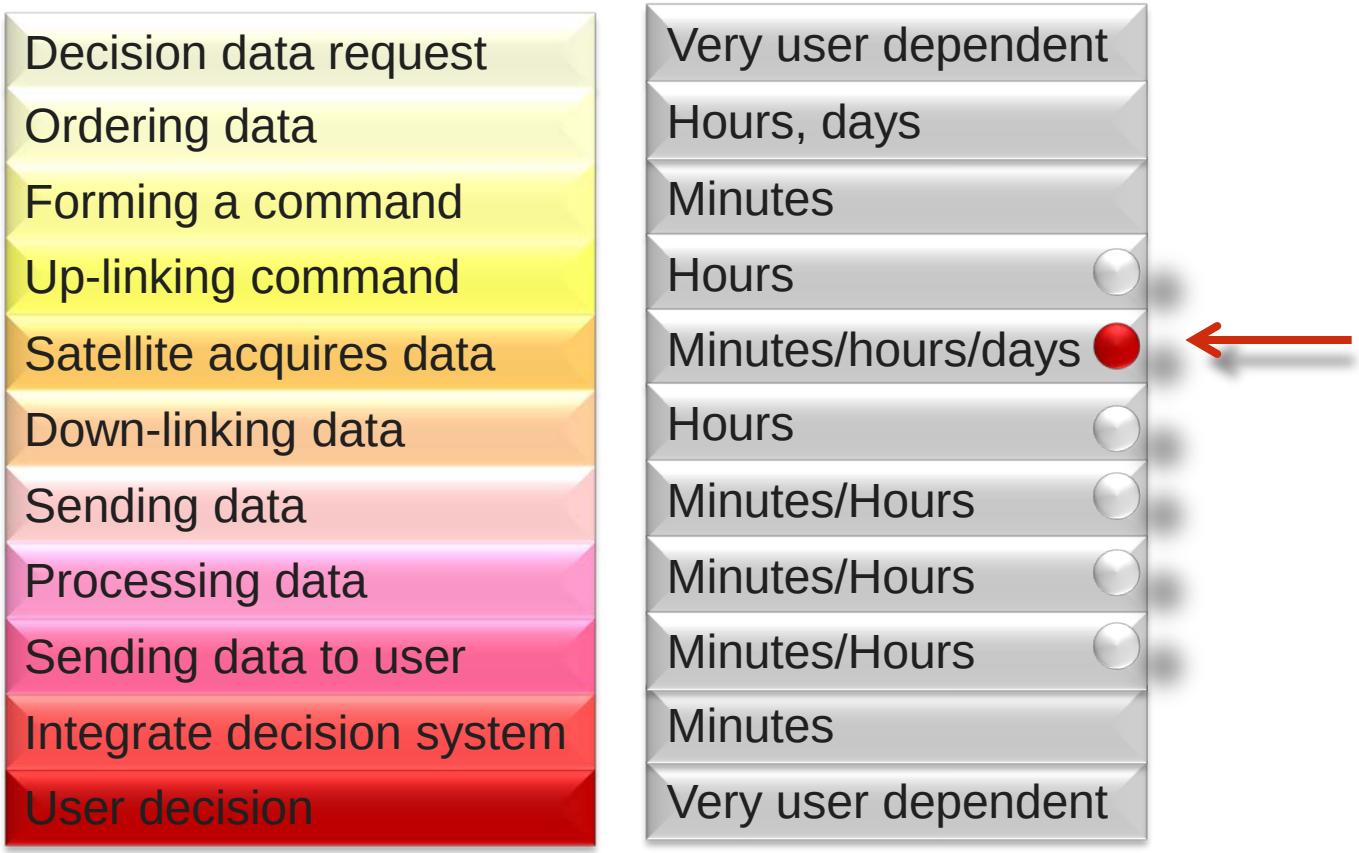
Normal way

- Faster processing systems
- High bandwidth

Faster and cheaper way

- Don’t process
- Don’t deliver
- Only process and deliver the very pixels you need immediately
- SSC has systems in place to deliver geocoded maps < 10 minutes after data reception

Normal Latency



Reducing acquisition latency

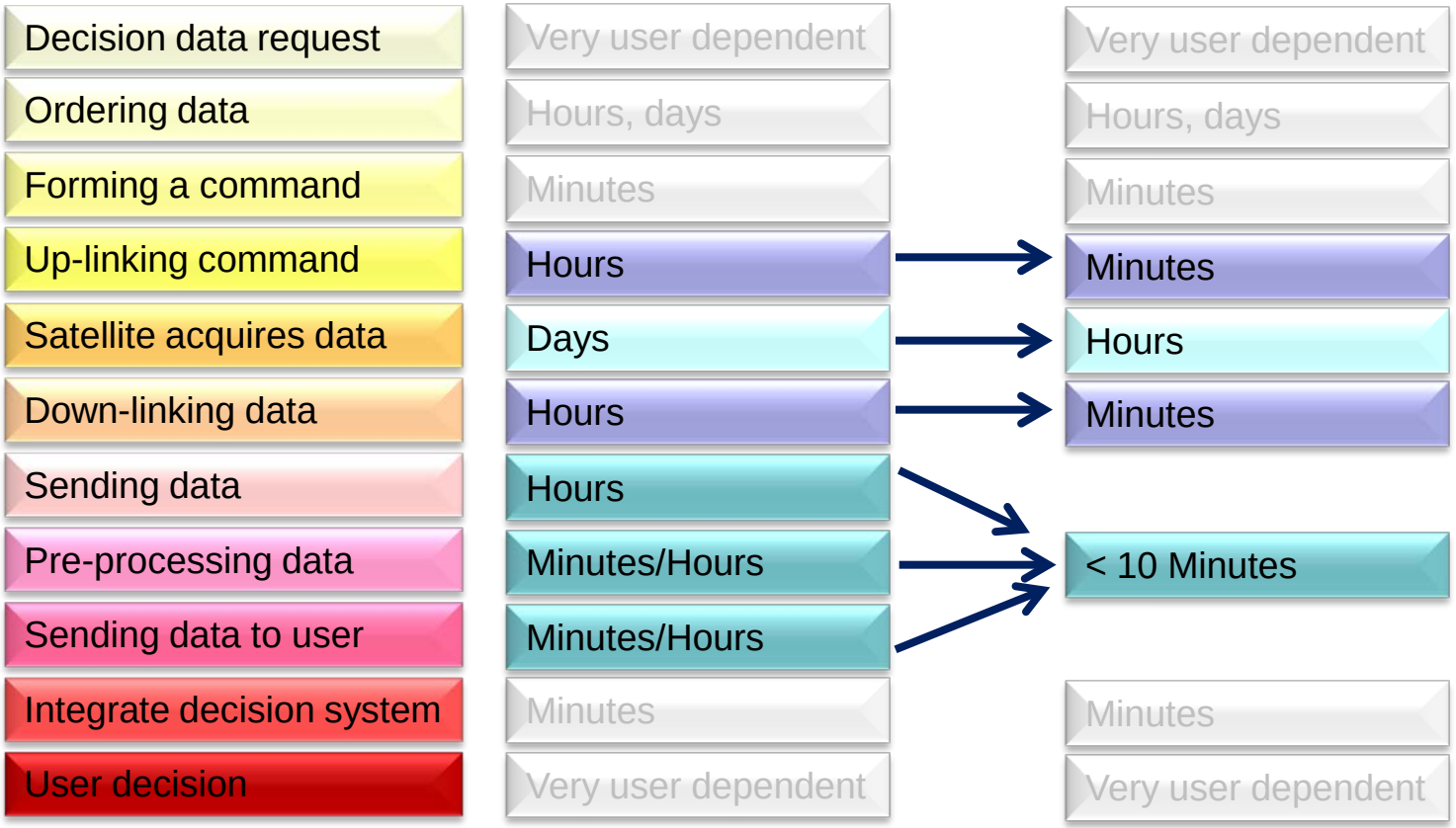
Latency in acquisition depends on

- Number of satellites
- Satellite orbit
- Weather
- Priorities

User’s possibilities

- User can decrease latency by using several satellites
- Independent Ground Network can support User through a “Virtual Constellation”
  - Let several satellites use same network, pre-processing and delivery
  - Help User to avoid cumbersome operations and administration
  - Let several satellite operators compete on fastest acquisition

Summary of current possibilities



Current development to improve latency

New techniques and frequencies for down-loading

- New demodulation techniques
- Use of Ka-band and Optical techniques
- Improves amount of data that can be received
- More efficient ground stations

Data Relay satellites

- EDRS improves latency, very expensive
- BGAN improves latency, very low band-width

5-10 years from now, with combined technologies

- Affordable
- Geocoded data
- Near real-time from satellite
- Continuously around the globe

What does it mean for new applications?

When time from user request to image acquisition shortens,

→ likelihood of catching an image of an on-going short-lived phenomena increases

When time from image acquisition to user analysis shortens

→ then the possibility to take action based on the analysis increases

This means for Disaster Monitoring

Post-event analysis → Disaster mitigation

Lower latency is as important to development of Remote sensing applications as is invention of new analysis algorithms or the use of new spectral bands.

SpaceOps 2012, Stockholm 11-15 June

the only international congress/exhibition focusing on space operations

Earth Observation at SpaceOps 2012

- Plenary Session: “Changing Paradigms in Earth Observations” with reps from Google Earth, Urthecast, CNES, etc
- 35 exhibitors in large exhibition hall
- 350 presentation from 20 countries

Thank you

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