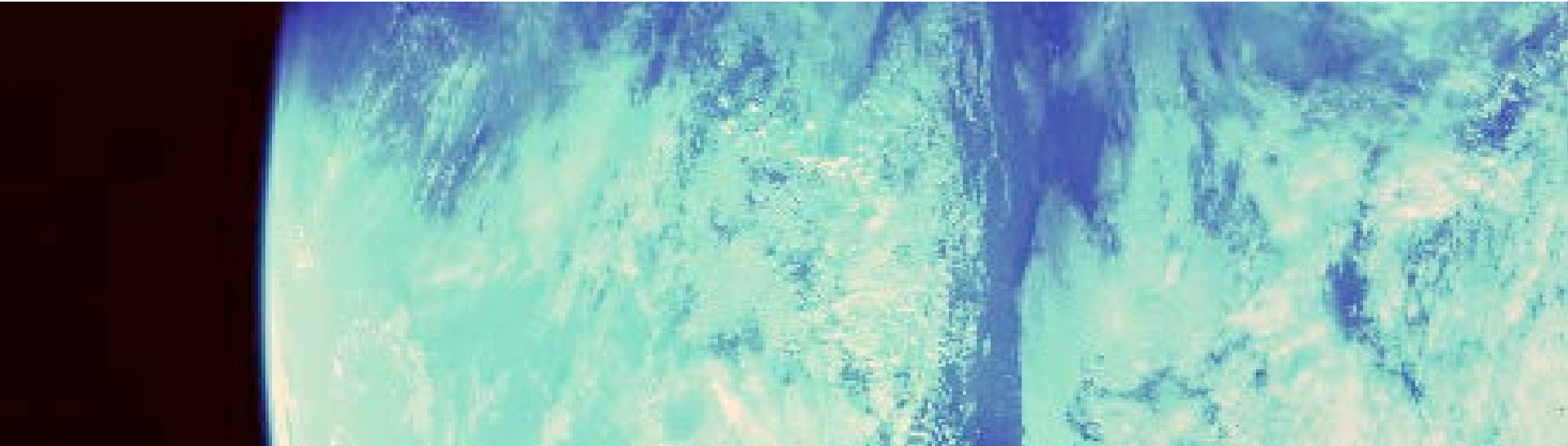


# Lower Latency In Ground Station Networks Opens For New Remote Sensing Applications



**Dr Mikael Stern**

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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)**

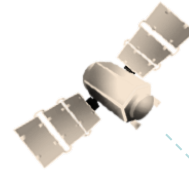
[www.sscspace.com](http://www.sscspace.com)

**600 employees**  
**21 nationalities**  
**18 locations**  
**11 countries**

**Sales office in China**  
**Sales office in Thailand**



# Ground Segment Support Services



## SSC services

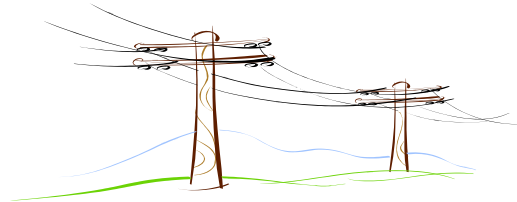


### Satellite Mission Centre

- Satellite Control
- Generation of commands

### User's Data Centre

- Processing
- Value-adding
- Analyses



Ground Comms



### Ground Stations

- Command uplink
- Payload downlink

### Payload data handling

- Archiving
- Pre-Processing

Ground Comms

# Latency is critical

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

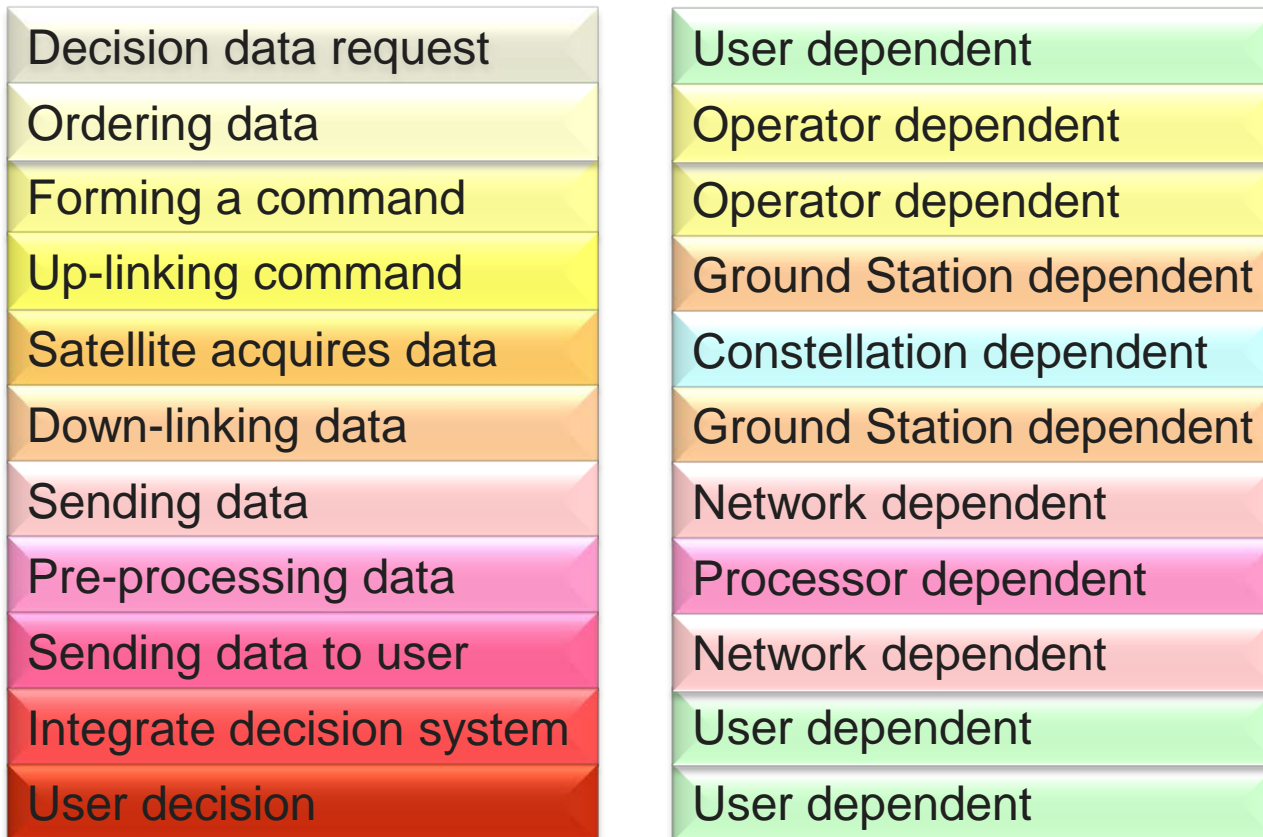
Minimizing Latency is central to the value of Remote Sensing data –  
who is interested in yesterdays weather?

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

- Meteorology
- AIS
- Military
- Disaster Management





# Latency – Chain of Events



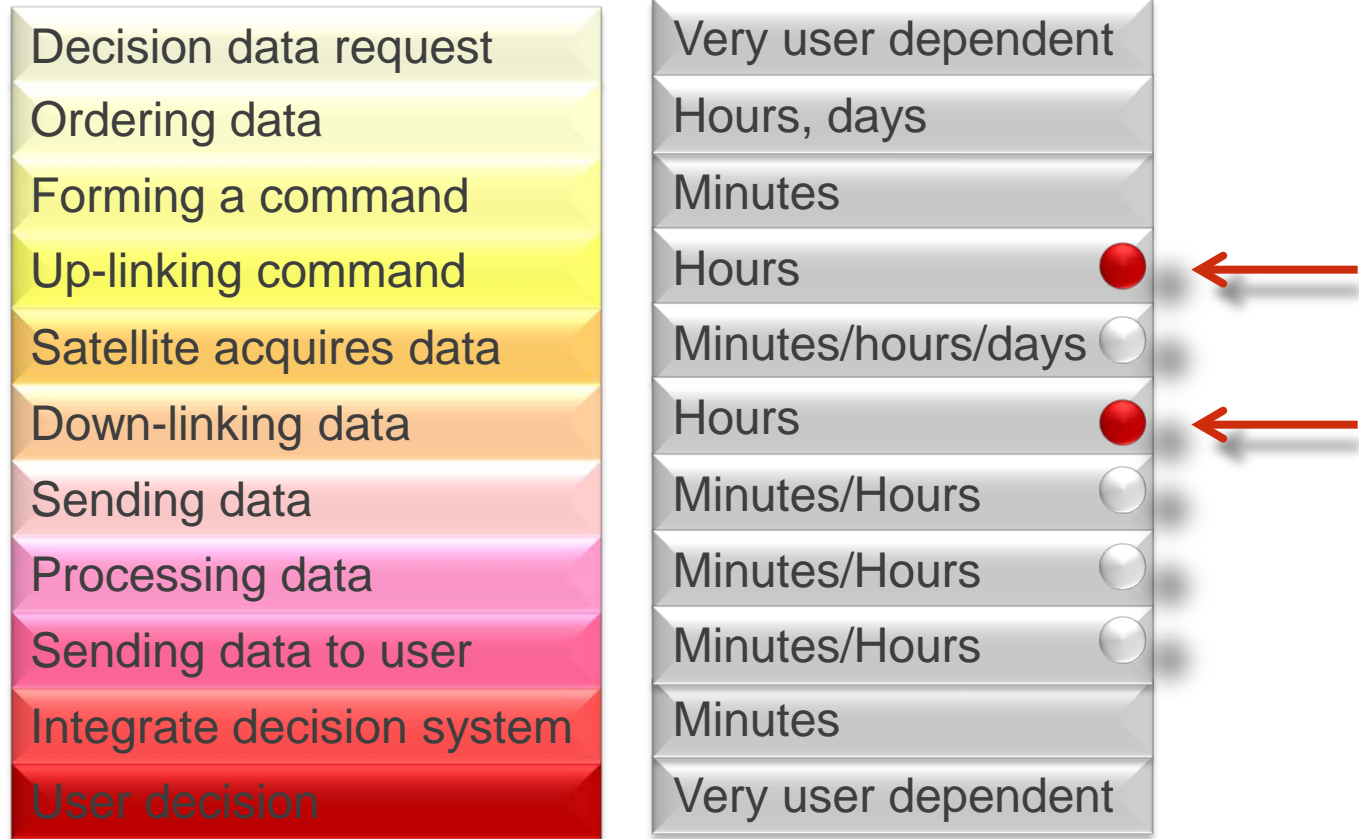
# Normal Latency

Decision data request
Ordering data
Forming a command
Up-linking command
Satellite acquires data
Down-linking data
Sending data
Processing data
Sending data to user
Integrate decision system
User decision

Very user dependent
Hours, days
Minutes
Hours 
Minutes/hours/days 
Hours 
Minutes/Hours 
Minutes/Hours 
Minutes/Hours 
Minutes
Very user dependent

Where can SSC decrease latency?

# Normal Latency



# Reducing Latency with multiple Ground Stations

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

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

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





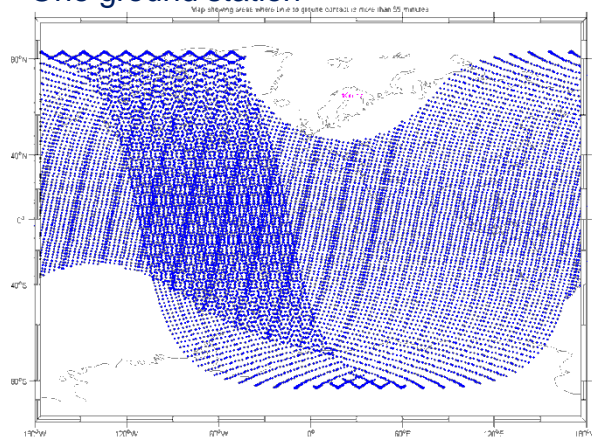
# Reducing Latency With Multiple Ground Stations

## Time from acquisition to delivered product

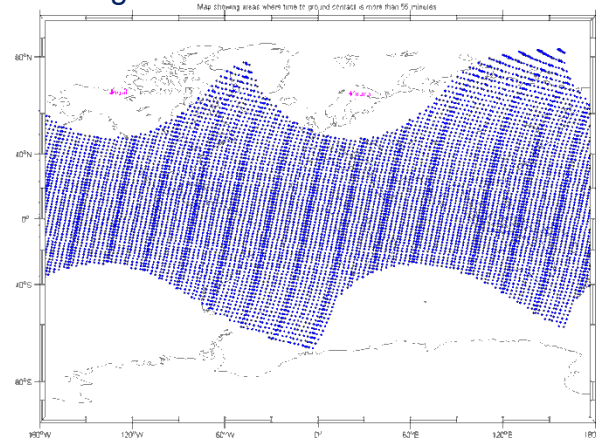
White areas = less than 1 hour

Blue areas = more than 1 hour

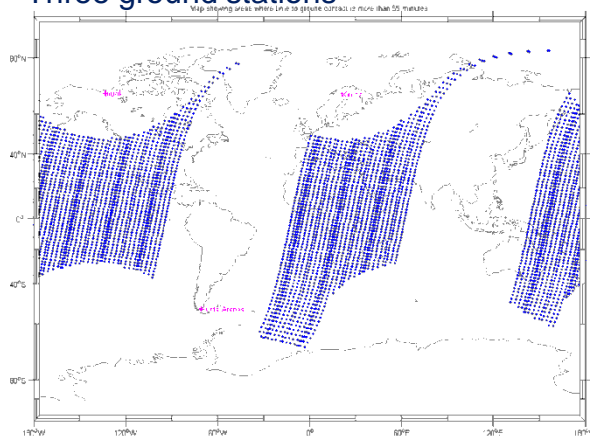
### One ground station



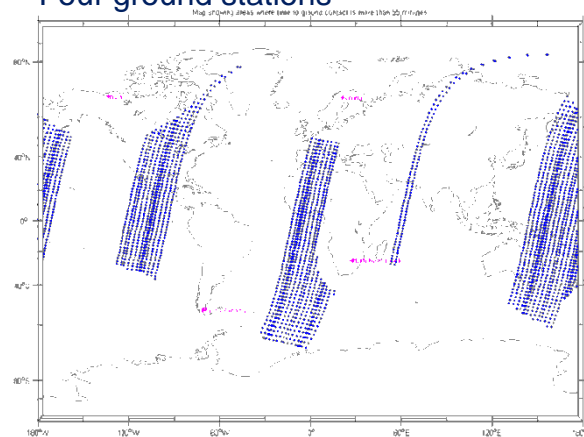
### Two ground stations



### Three ground stations

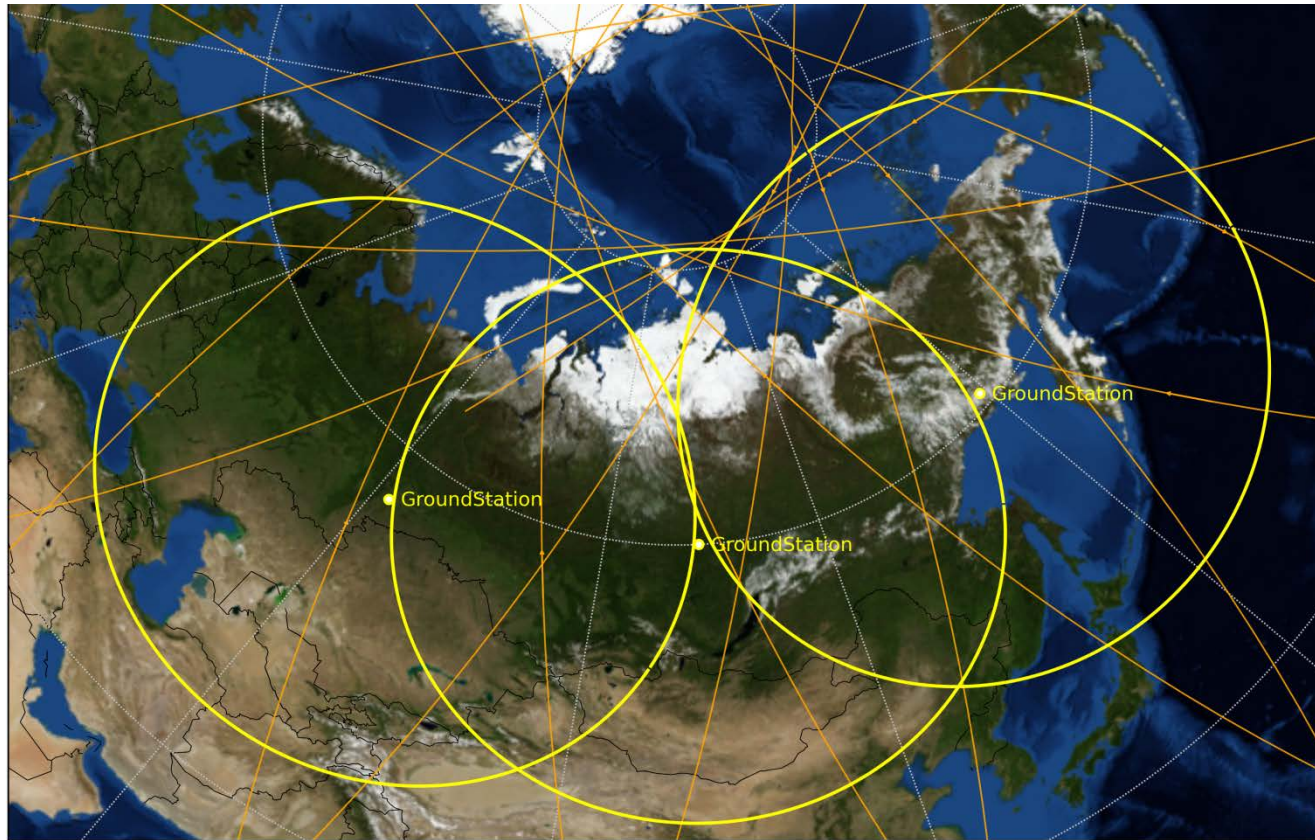


### Four ground stations



# Local ground stations for Russian territories

## From acquisition to reception – 0 minutes

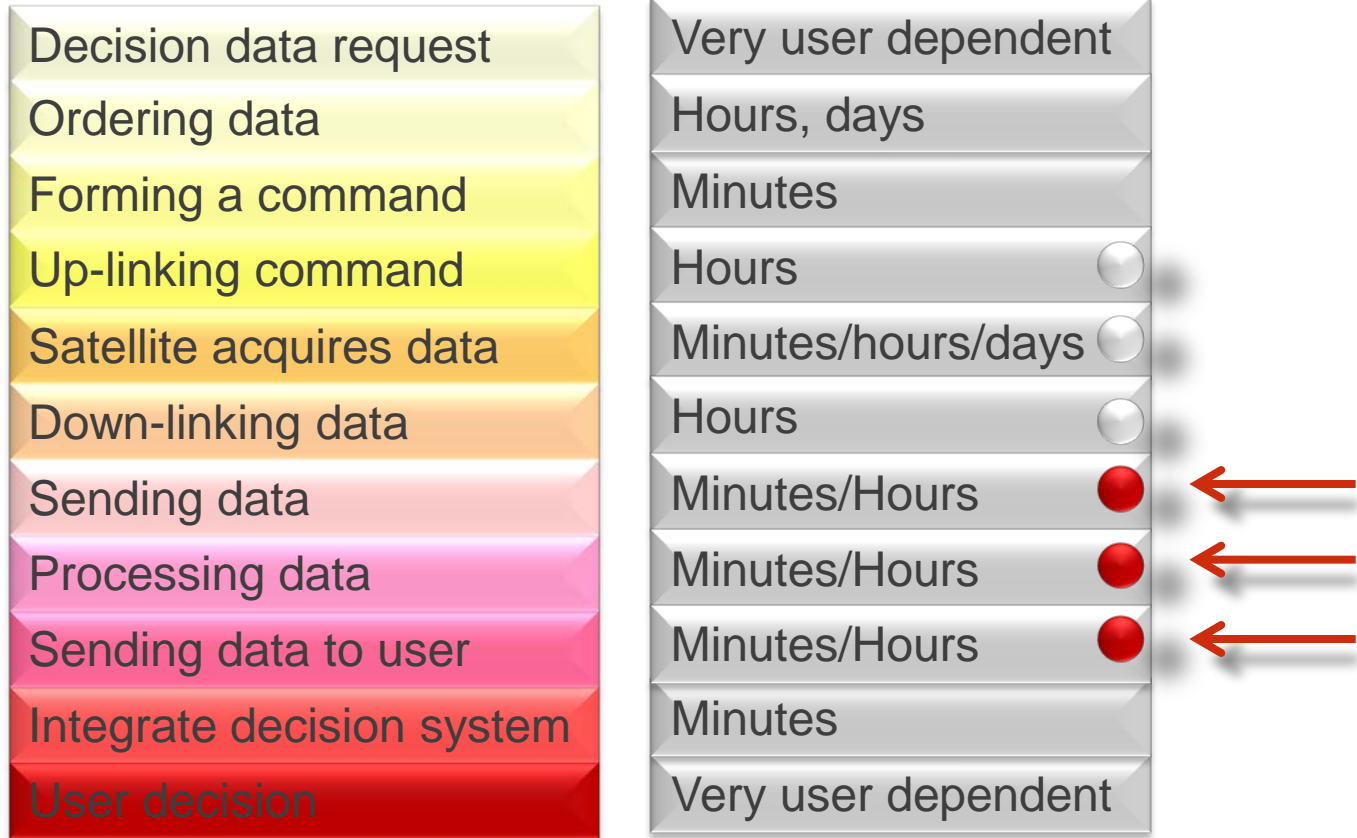


# Polar stations for Russian territories

## 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

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Integrate decision system
User decision

Very user dependent
Hours, days
Minutes
Hours <input type="radio"/>
Minutes/hours/days <input checked="" type="radio"/>
Hours <input type="radio"/>
Minutes/Hours <input type="radio"/>
Minutes/Hours <input type="radio"/>
Minutes/Hours <input type="radio"/>
Minutes
Very user dependent



# Reducing acquisition latency

## Latency in acquisition depends on

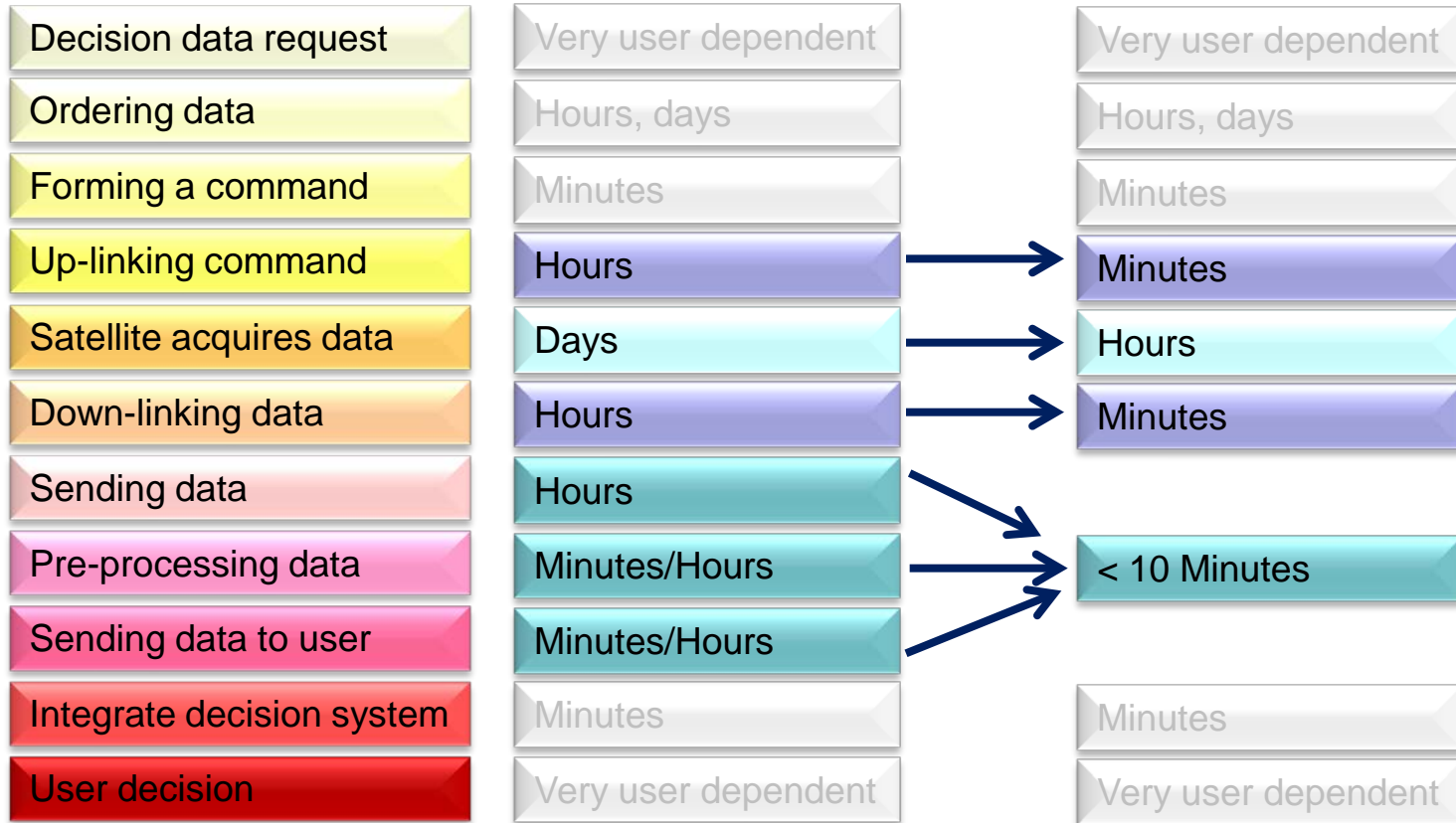
- Number of satellites
- Satellite orbit
- Weather
- Priorities

## 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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