KSAT INC

GSAW 2024

Exploring Ground Segment as a Service (GSaaS) as a Commercial Alternative to Traditional Distributed Architectures

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Who We Are

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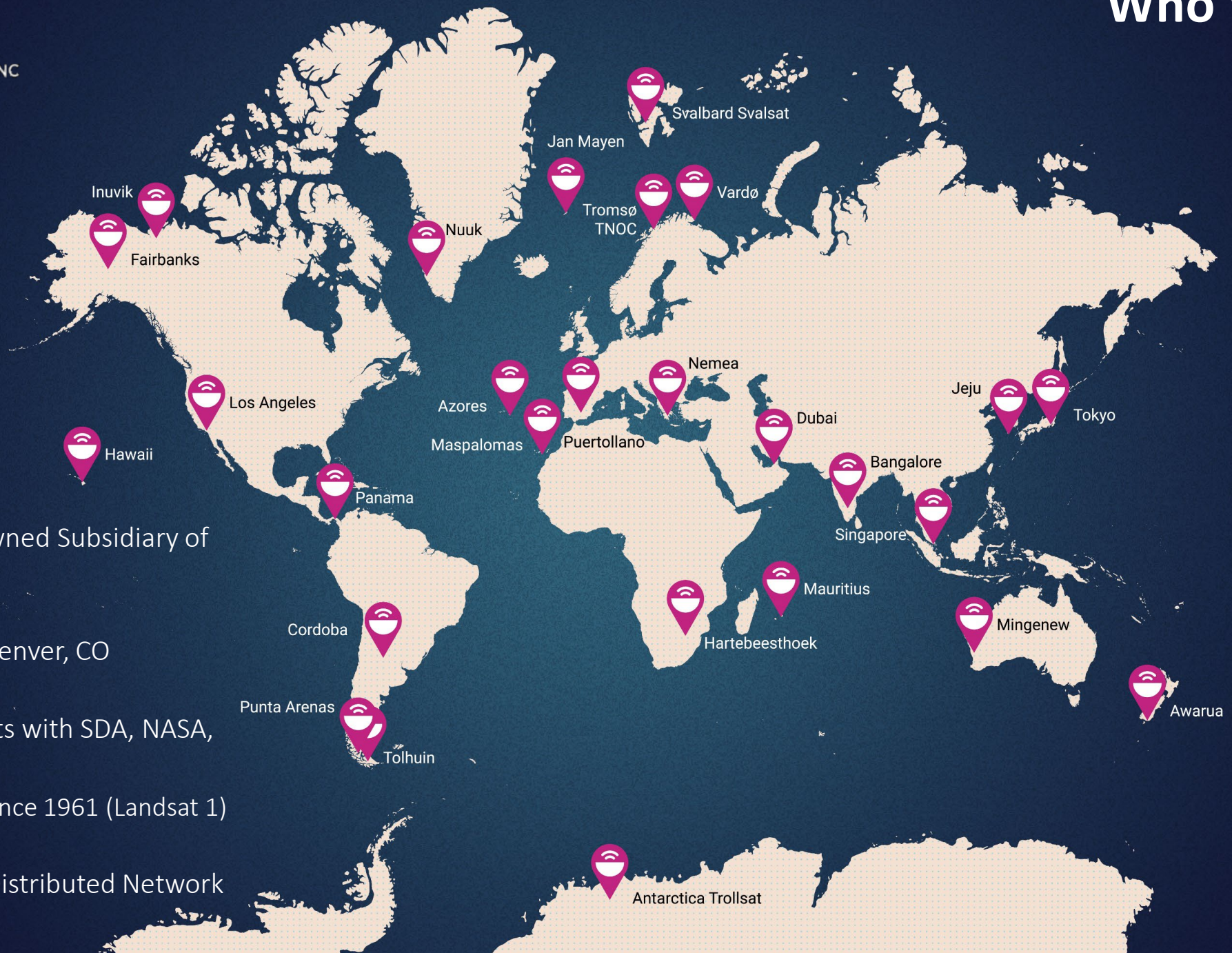

- KSAT Inc. Wholly Owned Subsidiary of KSAT AS, Norway
- Headquartered in Denver, CO
- Current Subcontracts with SDA, NASA, NOAA
  - Supported USGS since 1961 (Landsat 1)
- Access to Globally Distributed Network with 300+ Antennas

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Outline

- Introduction
- Legacy Distributed Ground Segment Architecture
- Proposed Consolidated Ground Segment Architecture
- Key MoEs of a Consolidated Architecture
- Conclusion

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Introduction

A Brief History of the Ground Segment

Image Credit: NASA

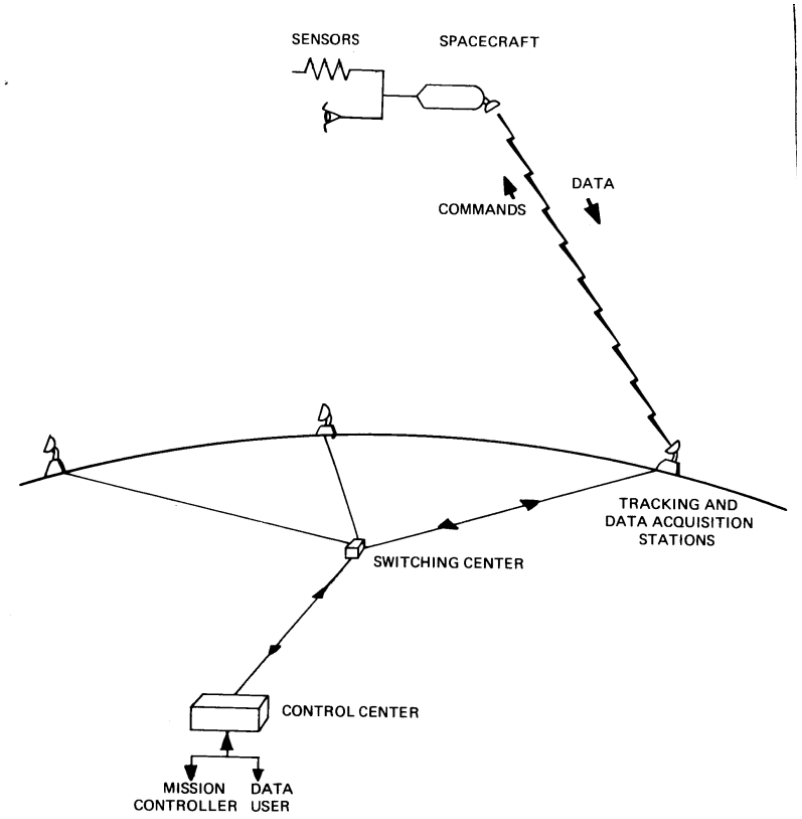

Image Credit: NASA CR-140390

Image Credit: NASA/JPL-Caltech

The Ground Segment began as a consolidated architecture driven by the mission specific requirements of the space program

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Introduction

Commercialization of Space

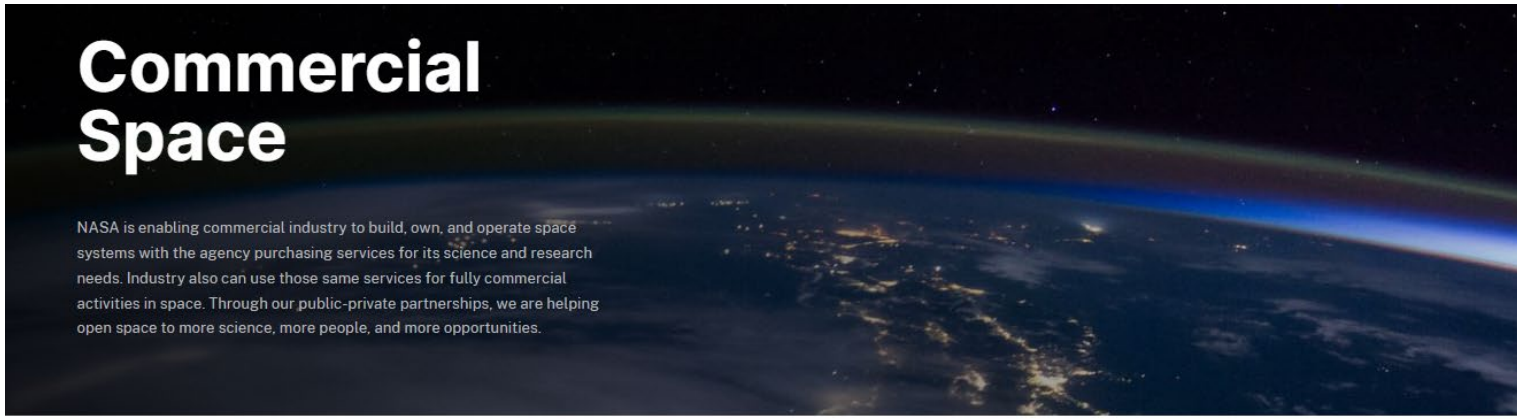


Image Credit: NASA

NOAA is Using New Cloud-Based System and Business Model to Supply Data from Older Environmental Satellite Fleet

November 29, 2023

A trio of polar satellites that were once frontline in NOAA's ability to predict weather and climate from space, are now operated through a new, cloud-based commercial engineering services contract called POES Extended Life.

When NOAA's Joint Polar Satellite Series (JPSS), which features next-generation technology, including a sophisticated ground system, became the new primary mission from the low Earth orbit, the older satellites—NOAA-15, NOAA-18 and NOAA-19—began providing complementary data.

NOAA decided to pursue an innovative approach utilizing a Ground System as a Service (GSaaS) capability to continue operating the older satellites, which are part of the legacy Polar-Orbiting Environmental Satellites (POES) fleet, well into the

Image Credit: NOAA

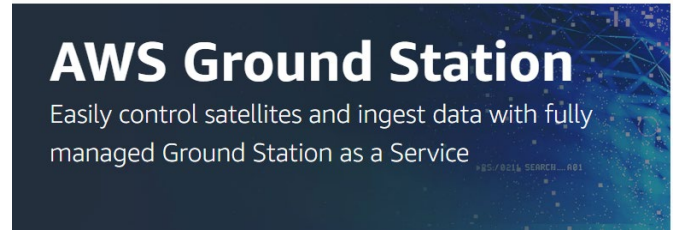
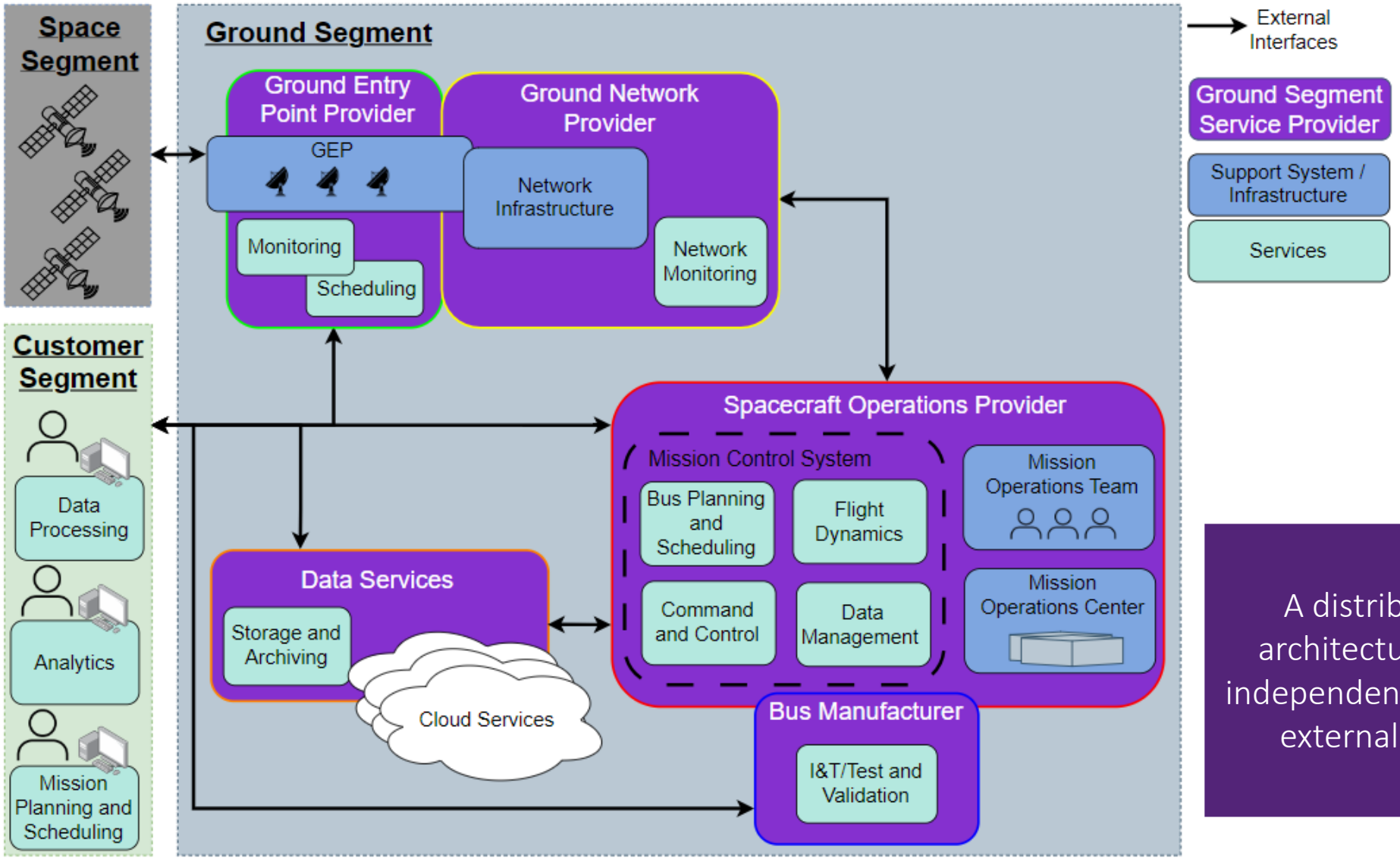


Image Credit: Amazon

The Emergence of the "As A Service Model"

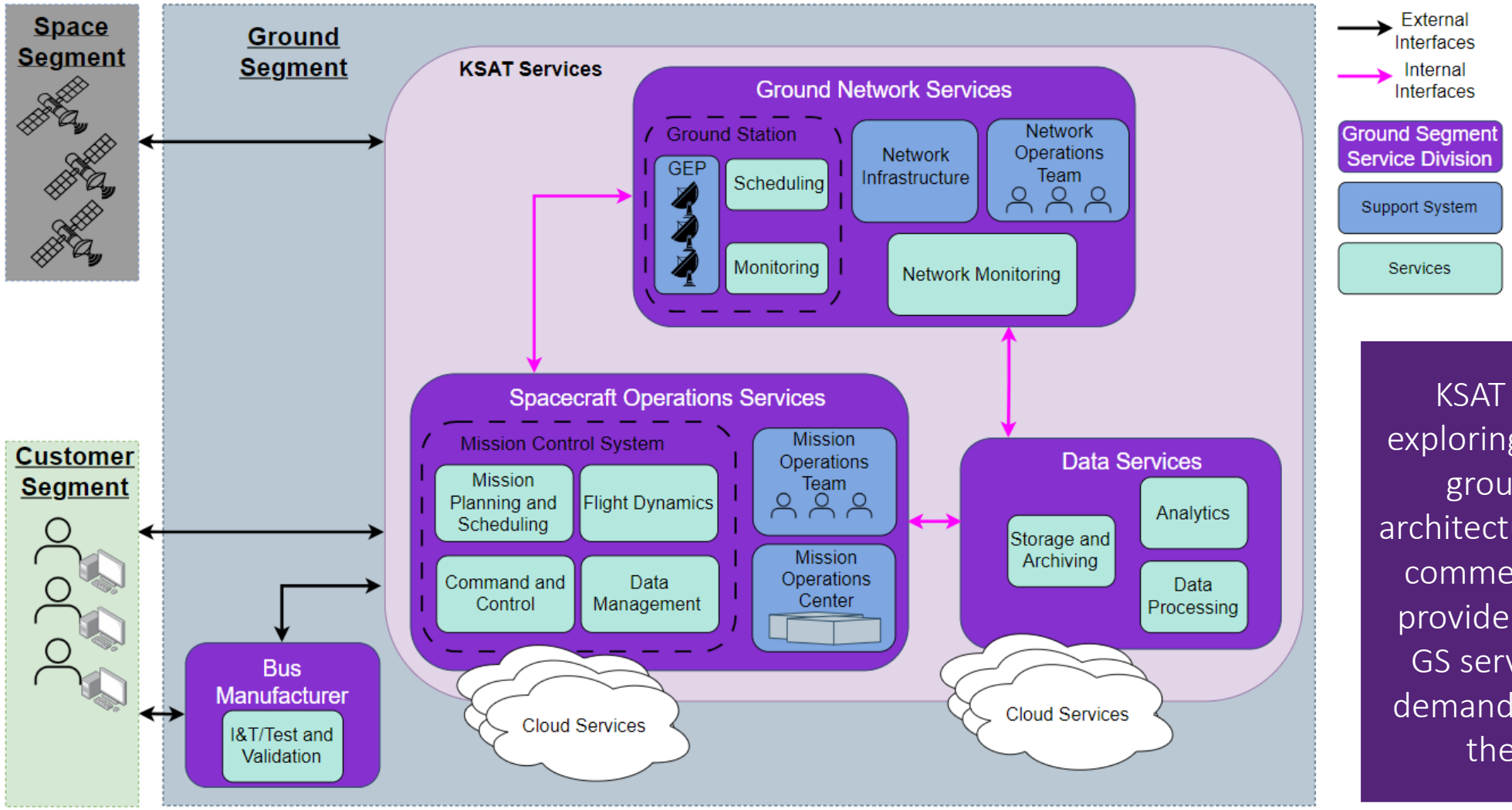
As the needs of the space industry changed and evolved, so did the typical ground segment architecture.

Legacy Distributed Ground Segment Architecture



A distributed ground segment architecture may involve multiple independent providers and numerous external interfaces to manage.

A Consolidated Ground Segment Architecture



KSAT Inc has been exploring a consolidated ground segment architecture in which one commercial entity can provide the majority of GS services, reducing demand and burden on the customer.

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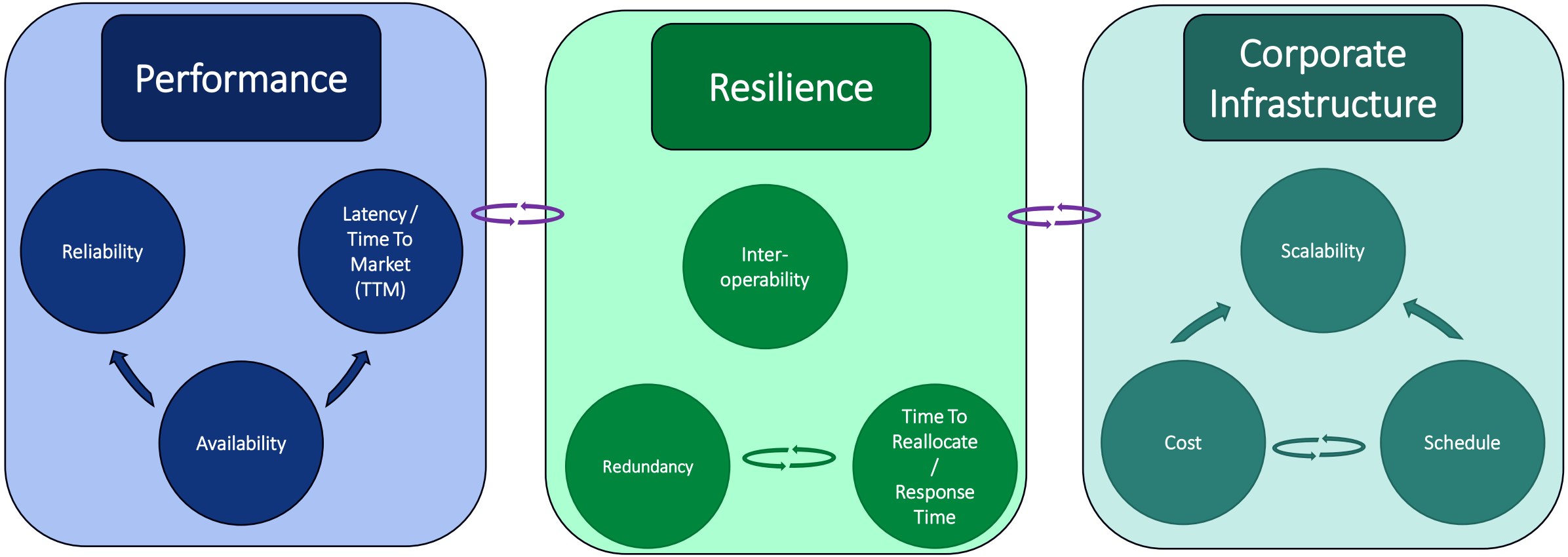
A Consolidated Ground Segment Architecture

Measures of Effectiveness



KSAT is exploring interrelated metrics to assess the benefits of a consolidated GS architecture.

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Example MOE

Time To Reallocate (TTR) / Response Time (RT)

Scenario 1: Ground System Anomaly

Consider an anomaly to the ground system for during an 8-minute pass

Case	Pass Time Lost (%)	TTR (minutes)	TRR Improvement (%)
1: Loss of Pass, Rebook Required *No Redundant Ground System*	100	≥90	-
2: Loss of Pass, Reallocation Required *Redundant Ground Systems*	100	20	77
2: Configuration Error *On-console operator, immediate resolution*	27	2.5	97
4: Antenna Failure *Automated Anomaly Detection, Automated Asset Handover*	6.25	0.5	99

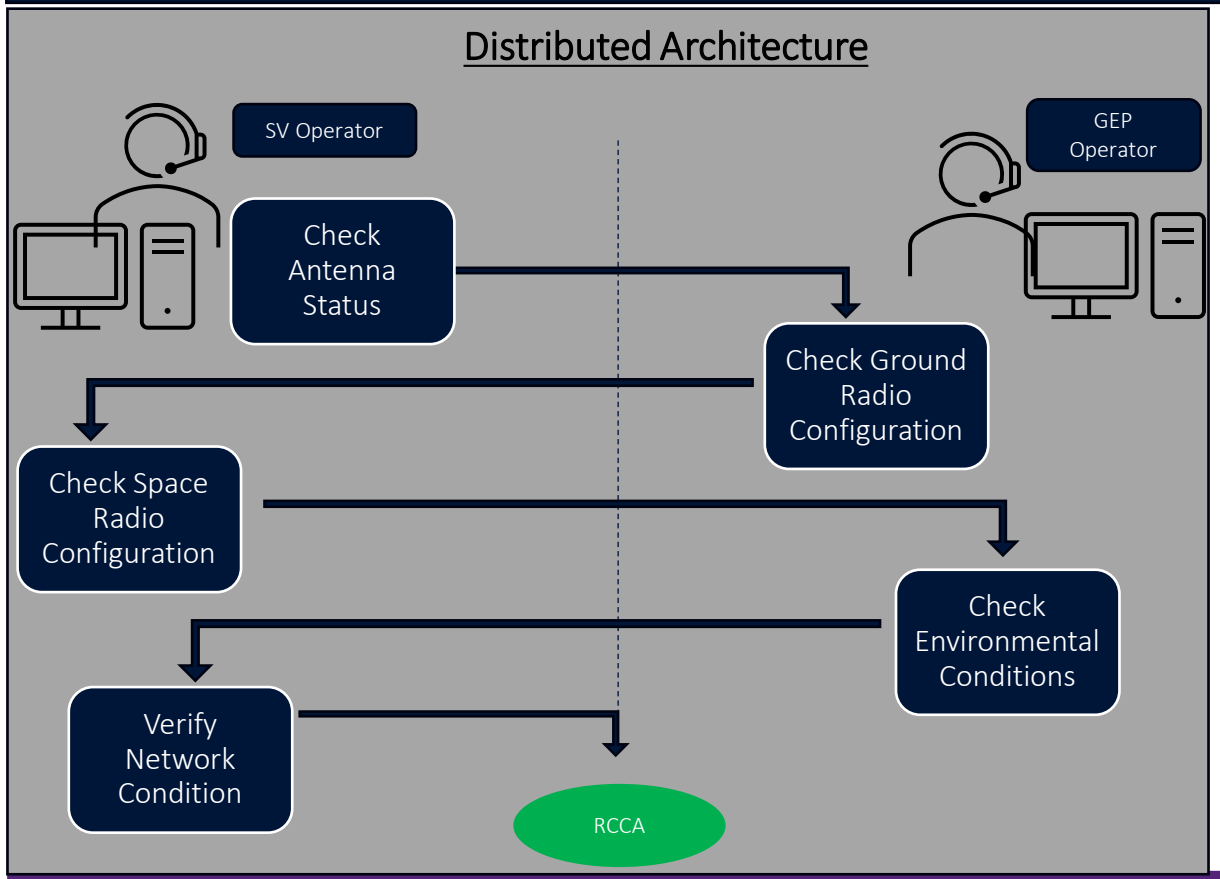
In early 2023, KSAT responded to an emergency request for a recently launched mission – achieved full operational readiness within 24 hours.

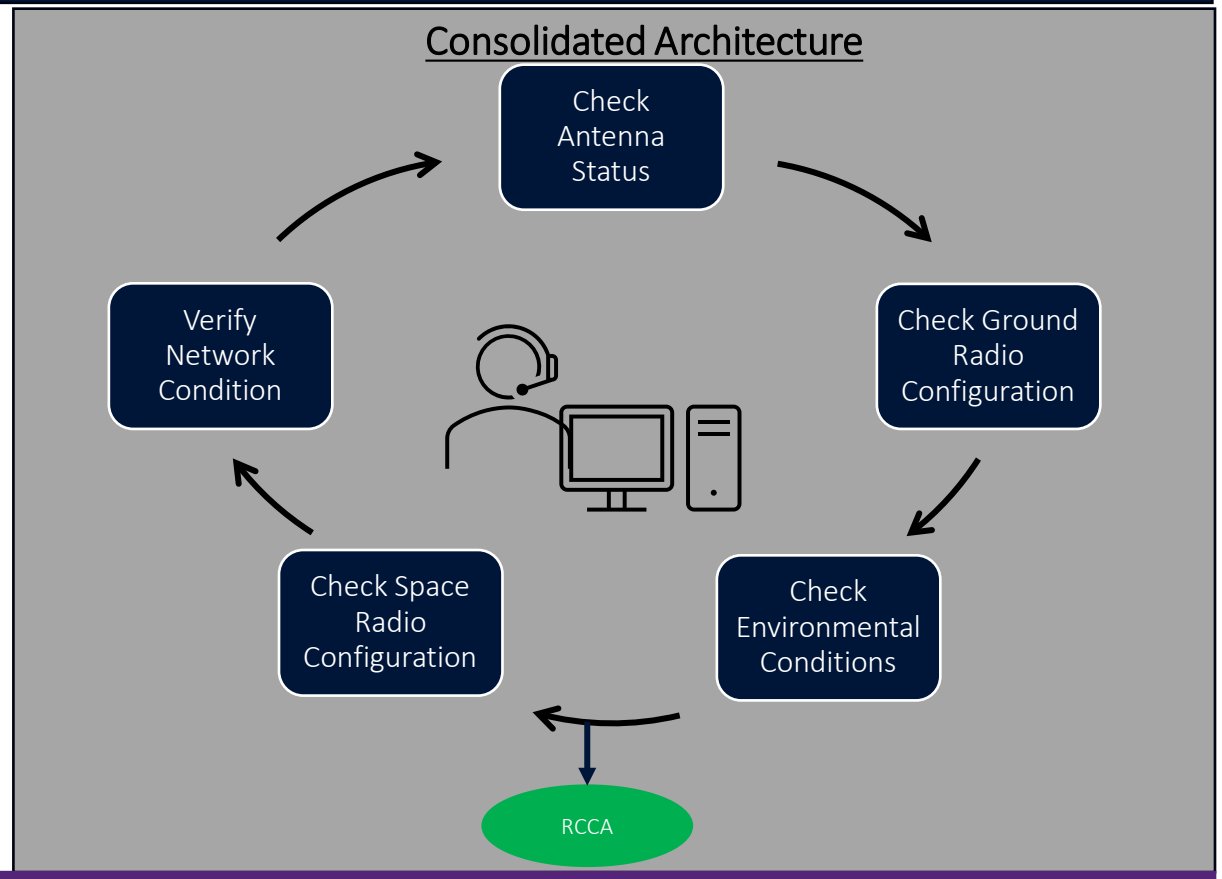
Example MOE

Time To Reallocate (TTR) / Response Time (RT)

Scenario 2: Space Segment Anomaly

Consider an anomaly to space segment that prevented communication with the ground.





Consolidated architecture presents the opportunity to significantly reduce anomaly response time by eliminating cross-system coordination

All-time high for the KSATlite ground network

In the span of just one year, from March 2021 to March 2022, traffic on the KSATlite network has almost doubled, seeing the same amount of traffic on the lite network alone, as KSAT's overall network did this time last year.

High proficiency

Despite the extreme growth in traffic, the network demonstrates a proficiency of 99,7 % over the last 100,000 contacts, from scheduling to data delivery.

With close to 400 antennas and nearly 100,000 passes per month, KSAT achieves >99.5% successful passes.

Example MOE

Data Latency

Term	Latency
Real-time	Less than 1 hour
Near real-time (NRT)	1-3 hours
Low latency	3-24 hours
Expedited	1-4 days
Standard routine processing	Generally, 8 – 40 hours but up to 2 months for some higher-level products

Credit: NASA, Earth Data

- Geographic diversity of ground stations
  - (avg. 20 minutes apart) can reduce time from data capture to ground receipt
- Processing at the GEP with Edge Computing
  - Minimal improvement in latency

Consolidated architecture appears to only minimally improve latency.

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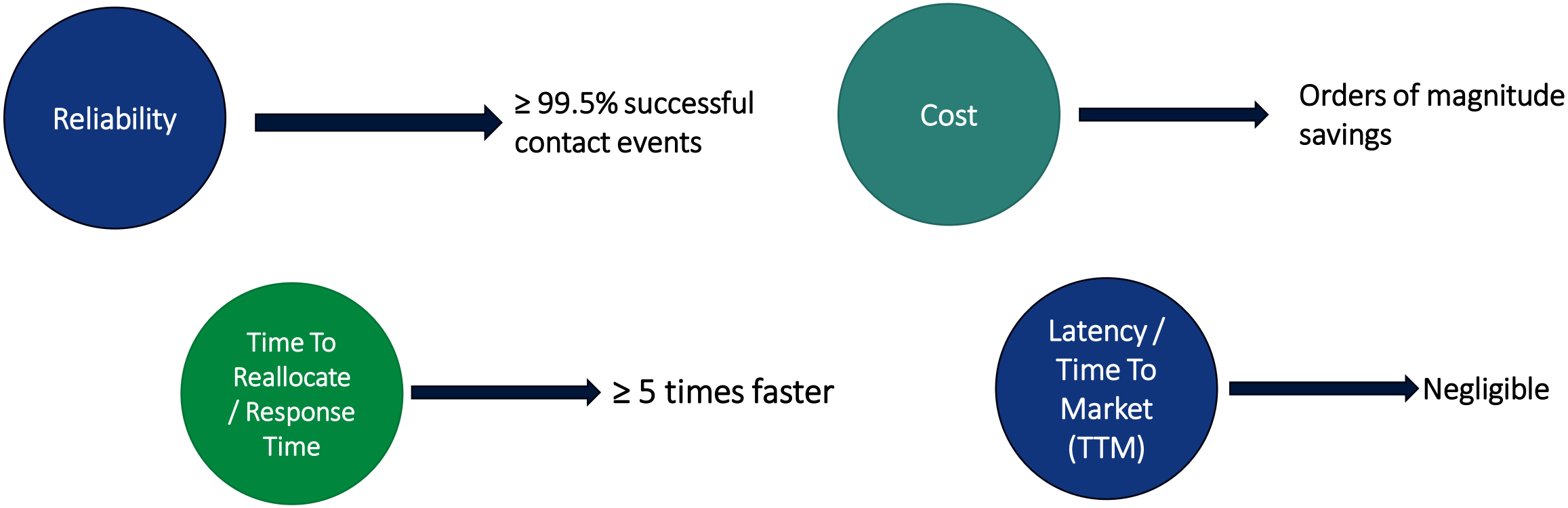
Conclusion

Key Findings



We believe providing the entire Ground Segment as a Service (GSaaS) in a Consolidated Architecture can increase reliability, lower cost, and minimize reallocation and response times.

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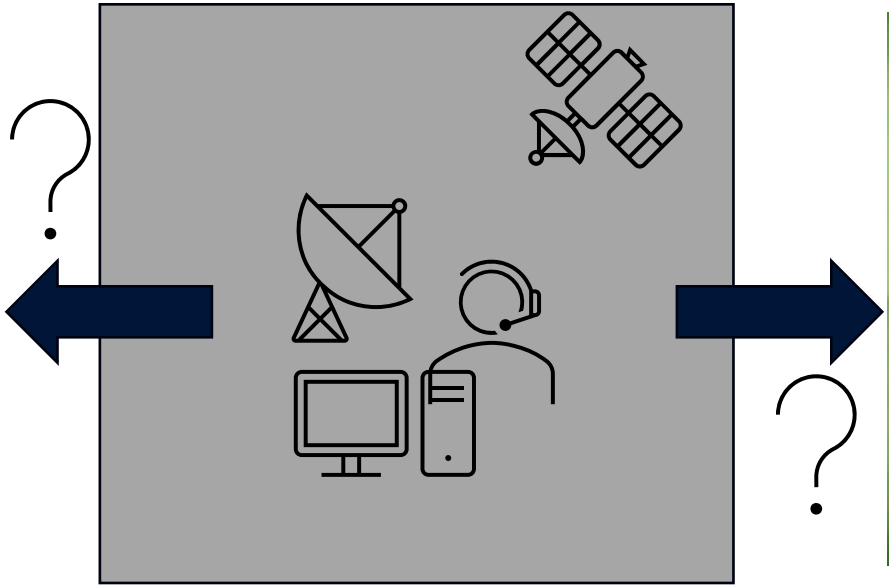
Conclusion

Roadmap for the Future



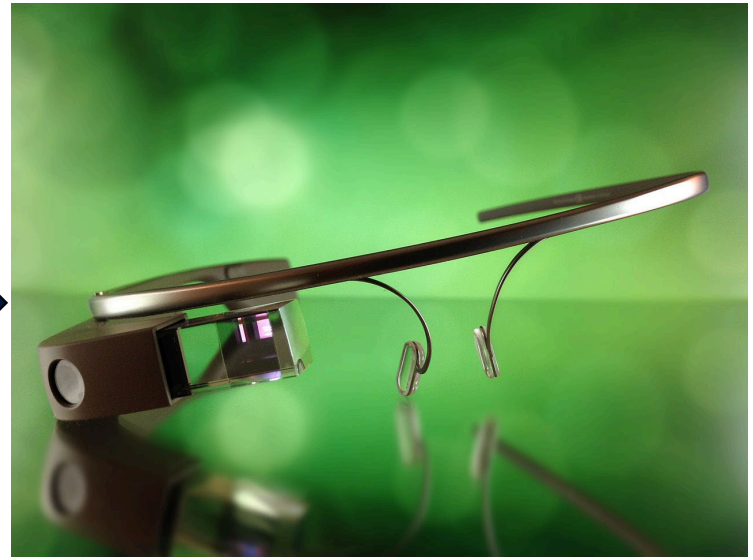


Image Credit: Dan Leveille, twitter.com/danlev

Is Ground Segment as a Service (GSaaS) a technology driven by need?

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Thank You