New capabilities with agile satcom ground systems

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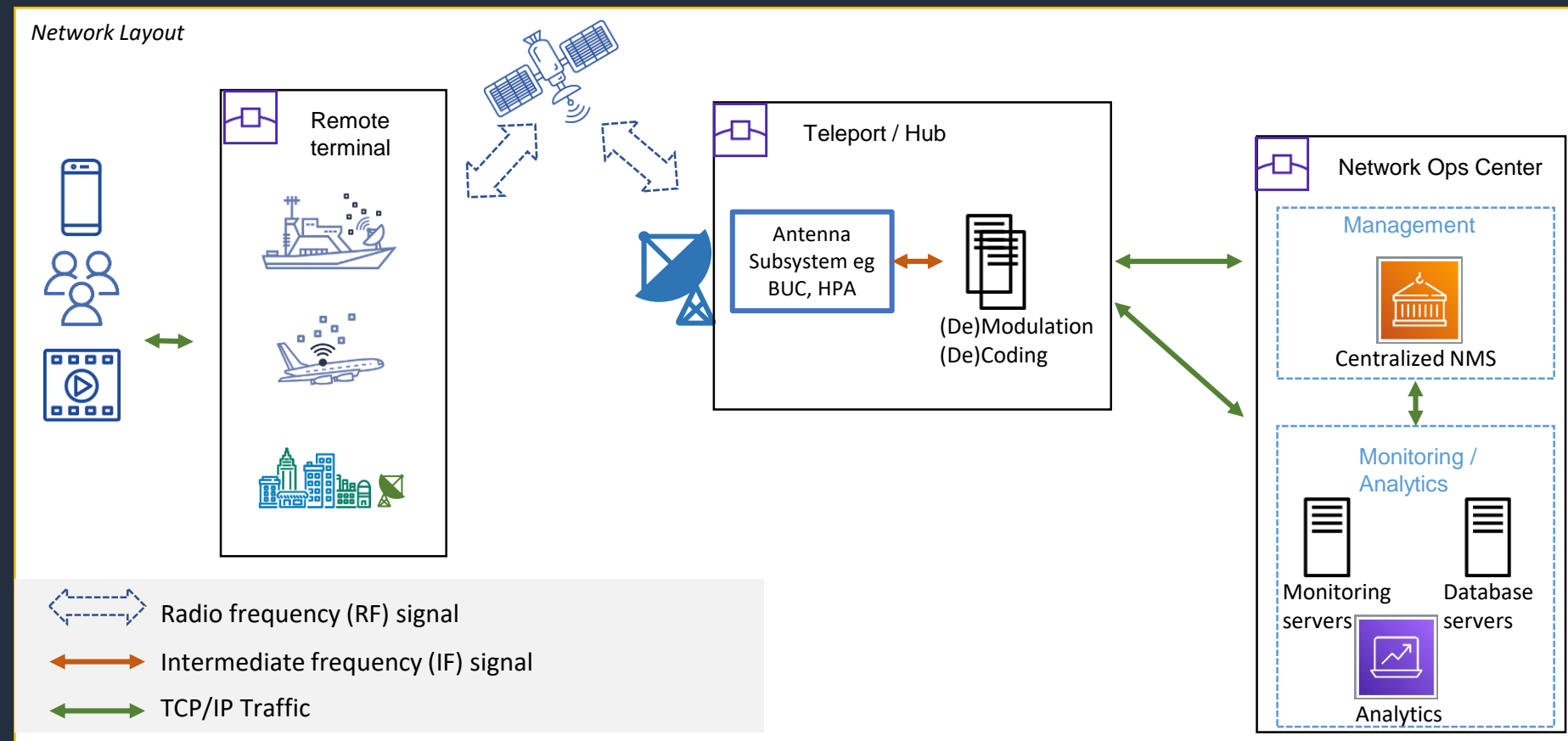
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Background

Traditional Satellite communications : Fixed hardware at teleports and Network Operations Center
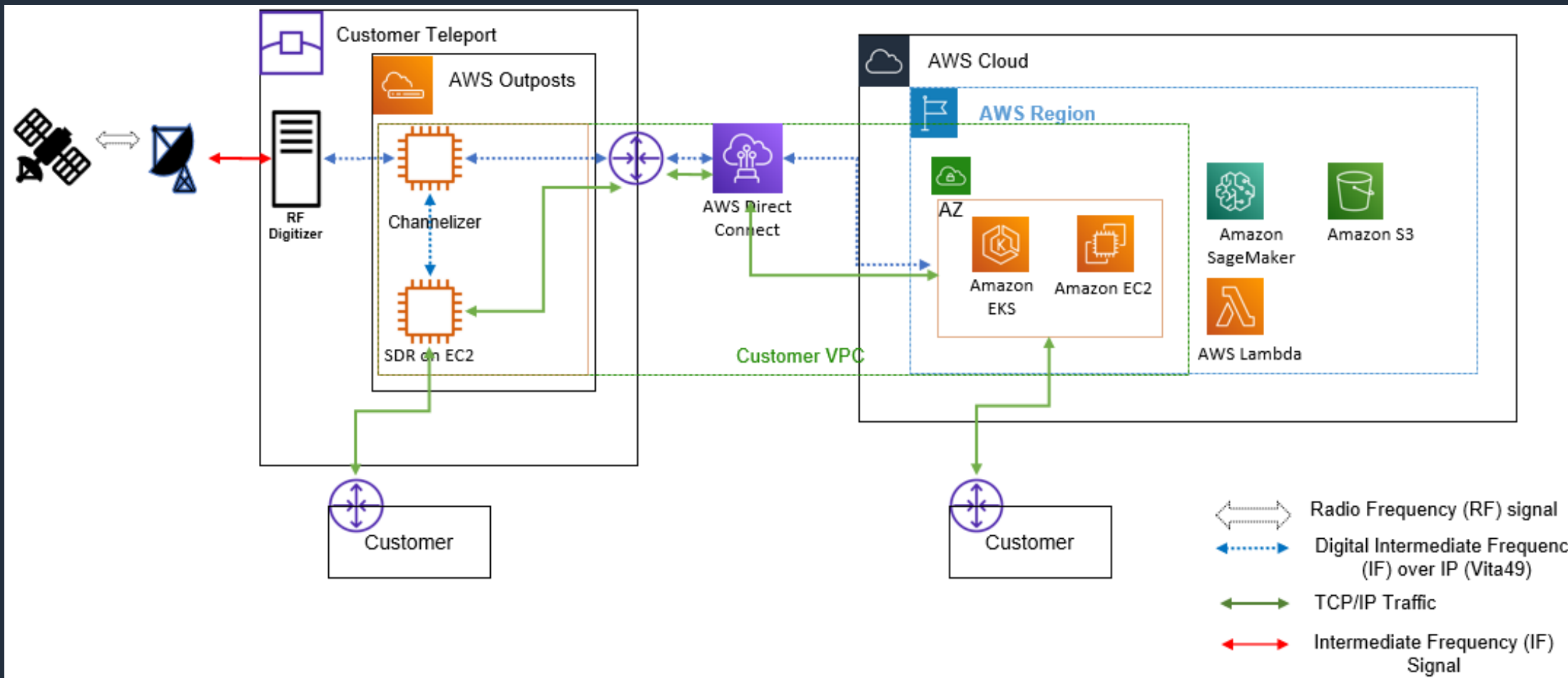

Disadvantages
- Inflexible – difficult to scale up/down
- Upfront capex – cost of modulators, demodulators
- Operations overhead – onsite maintenance at 10s of teleports
- Large physical infrastructure footprint – cooling etc.
- Vendor lock
- Complex to upgrade

Agile satcom

New Satcom : Cloud-based modulation/demodulation (SDR), high-availability Network Management, AI/ML
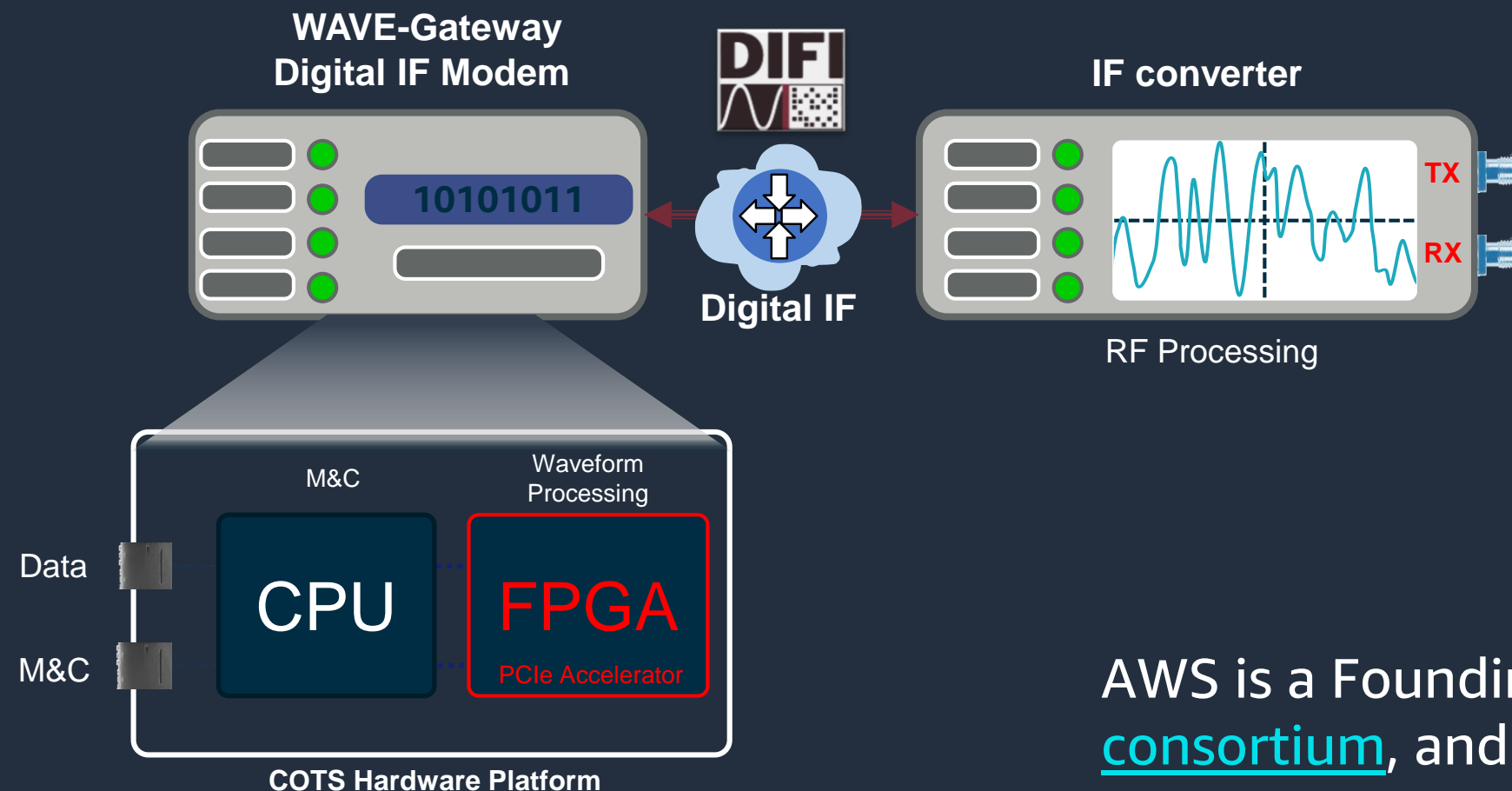

Advantages

- Scale – add/remove EC2 instances
- Flexibility – edge or Region
- Opex model
- Simplify Operations – remote admin
- Reduce physical infrastructure footprint
- Avoid vendor lock
- Performance - upgrade to new instance types

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WAVE – a new standard driving the Satcom industry

<u>W</u>aveform <u>A</u>rchitecture for <u>V</u>irtualized <u>E</u>cosystems

Mission : *"transform the SATCOM industry towards a fully interoperable ecosystem by using intelligent, open, and virtualized networks and providing standardized architectures and specifications"*

**WAVE-Gateway
Digital IF Modem**

DIFI

10101011

Digital IF

IF converter

TX

RX

RF Processing

M&C

**Waveform
Processing**

Data

CPU

FPGA

M&C

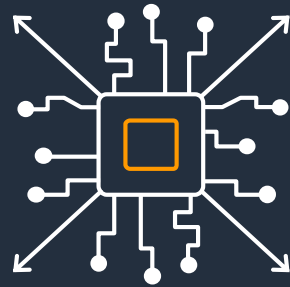PCIe Accelerator

COTS Hardware Platform

Impact

- New RFIs being issued requesting WAVE
- Incentivizing modem vendors to virtualize waveforms
- Driving cloud vendors to enable solutions

AWS is a Founding member of the <u>WAVE consortium</u>, and sits on the Board of Directors

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Amazon EC2 accelerated computing instances

Specialized EC2 instances that use Hardware Accelerators

Hardware accelerators
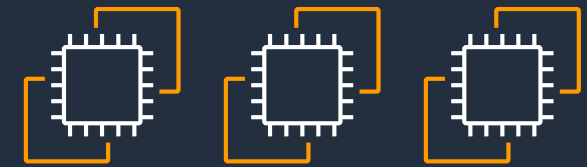for computationally
intensive workloads

Offer more parallelism
for higher throughput

Higher efficiency
than software
on CPU

Perform functions—such
as floating-point number
calculations, graphics
processing, or data pattern
matching—more efficiently

Broad portfolio
of accelerator
choices

Address various workloads using
GPU, FPGA, or custom ASIC-
based instances

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What new capabilities are there with an agile satcom ground system?

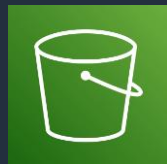# AI/ML - IQ Constellation noise pattern signature

Description

Leverage Digitized RF samples to: -
- Performs ML data processing on IQ Constellation plot
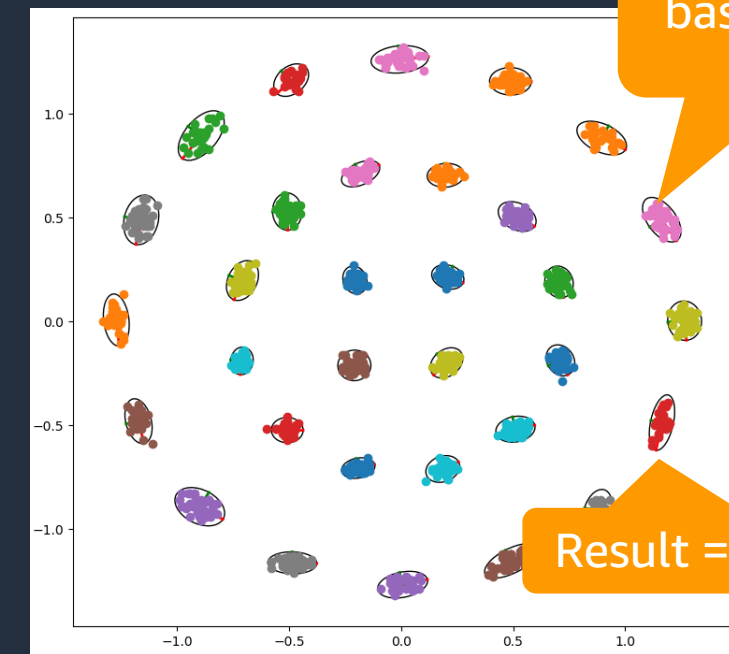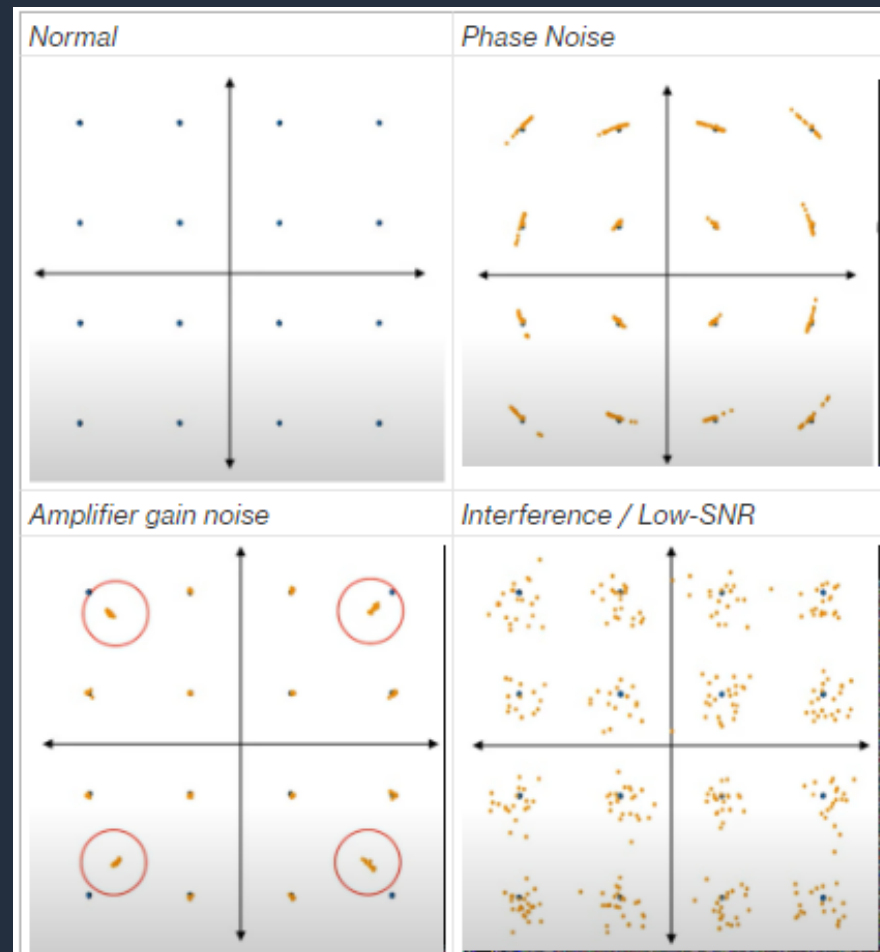- Detects Phase v Amplifier noise v Interference based on shape of clusters

Amazon SageMaker

Amazon Simple Storage Service (Amazon S3)

- *Code-repository here*

Extract metrics based on blob shapes

Result = Phase Noise
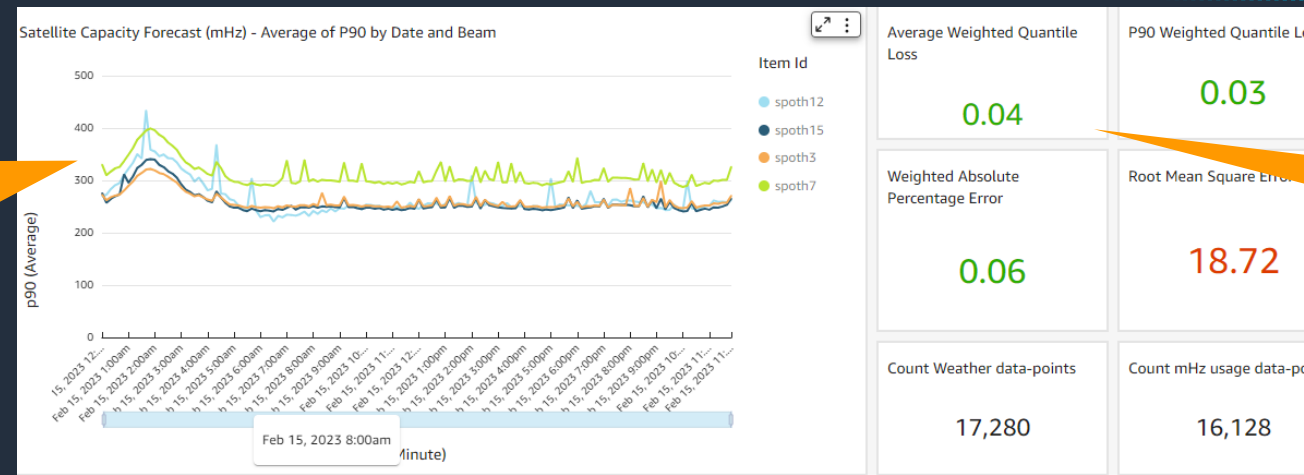
Write summary report to S3

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AI/ML – Satellite Capacity forecasting

Description

Generate satellite capacity forecast per beam
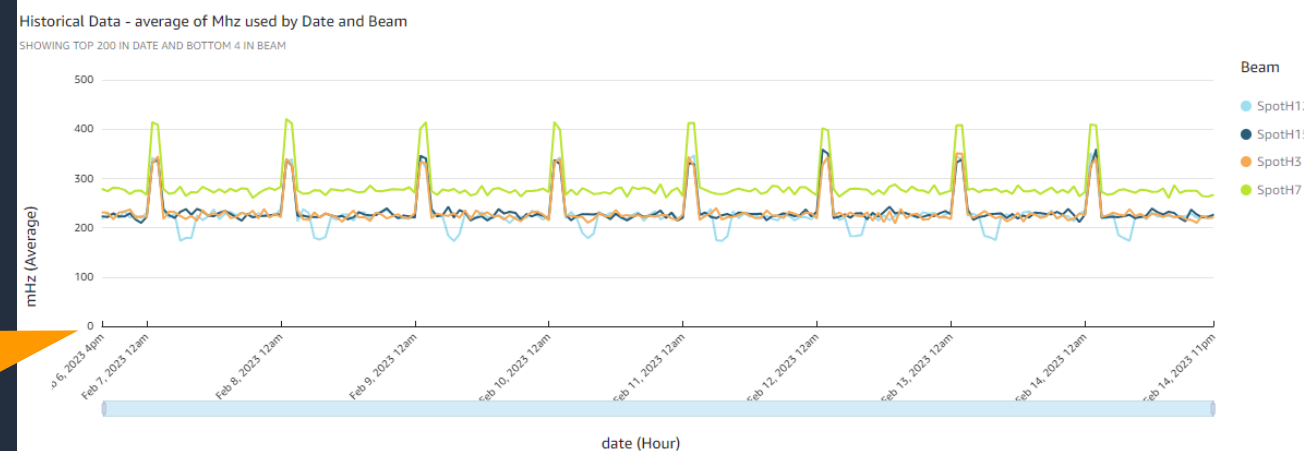- Include weather in model (e.g ocean Buoy air-pressure)
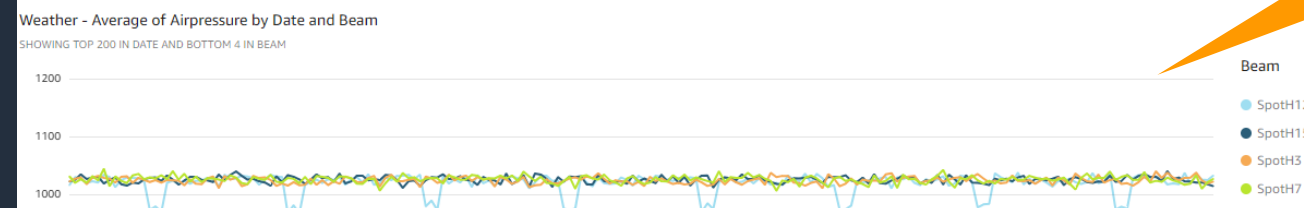- Account for peak surges

Amazon SageMaker
Autopilot Timeseries

Amazon Simple Storage
Service (Amazon S3)

- *Blog & code-repository here*

Predicted Sat Capacity (MHz)

Accuracy metrics

Historical data (usage)

Historical & forecast data (weather)

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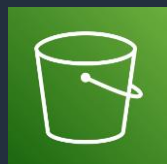
Summary

- Opportunity to deliver more agile satcom ground systems

- Modulate/demodulate more RF bandwidth using accelerated compute

- Enables additional use-cases (AI/ML, 5G NTN) on top

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Thank You

aws solutions architecture

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