RAFT Technologies

a bit faster

Approaching HF Radio With Your Eyes Wide Open

Tamir Ostfeld, Deputy CEO and COO

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ABOUT ME

Tamir Ostfeld
Deputy CEO & COO, Raft Technologies

- 25 years of experience leading development in Networking and Connectivity groups
- With Raft since 2017 – early HF trials
- Overseeing network development – R&D and Ops

HF-BASED ULTRA LOW LATENCY WIRELESS NETWORK

Let’s talk about HF performance:

- What powers it?
- What performance can you expect?
- How far can we get (latency, distance, bitrate, uptime)?

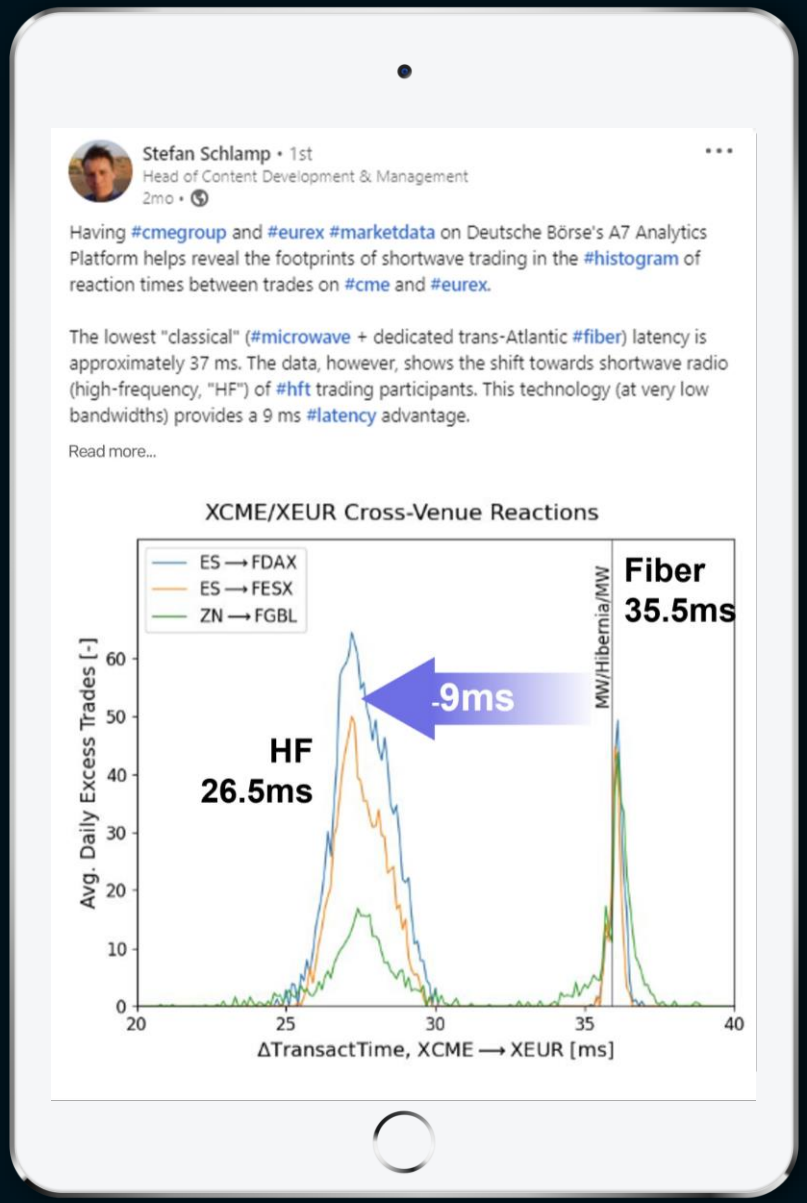
SKYWAVES (HF / SHORTWAVE RADIO) TRAVEL LONG DISTANCES AT THE SPEED OF LIGHT

Skywaves propagate back from the atmosphere, acting as a mirror

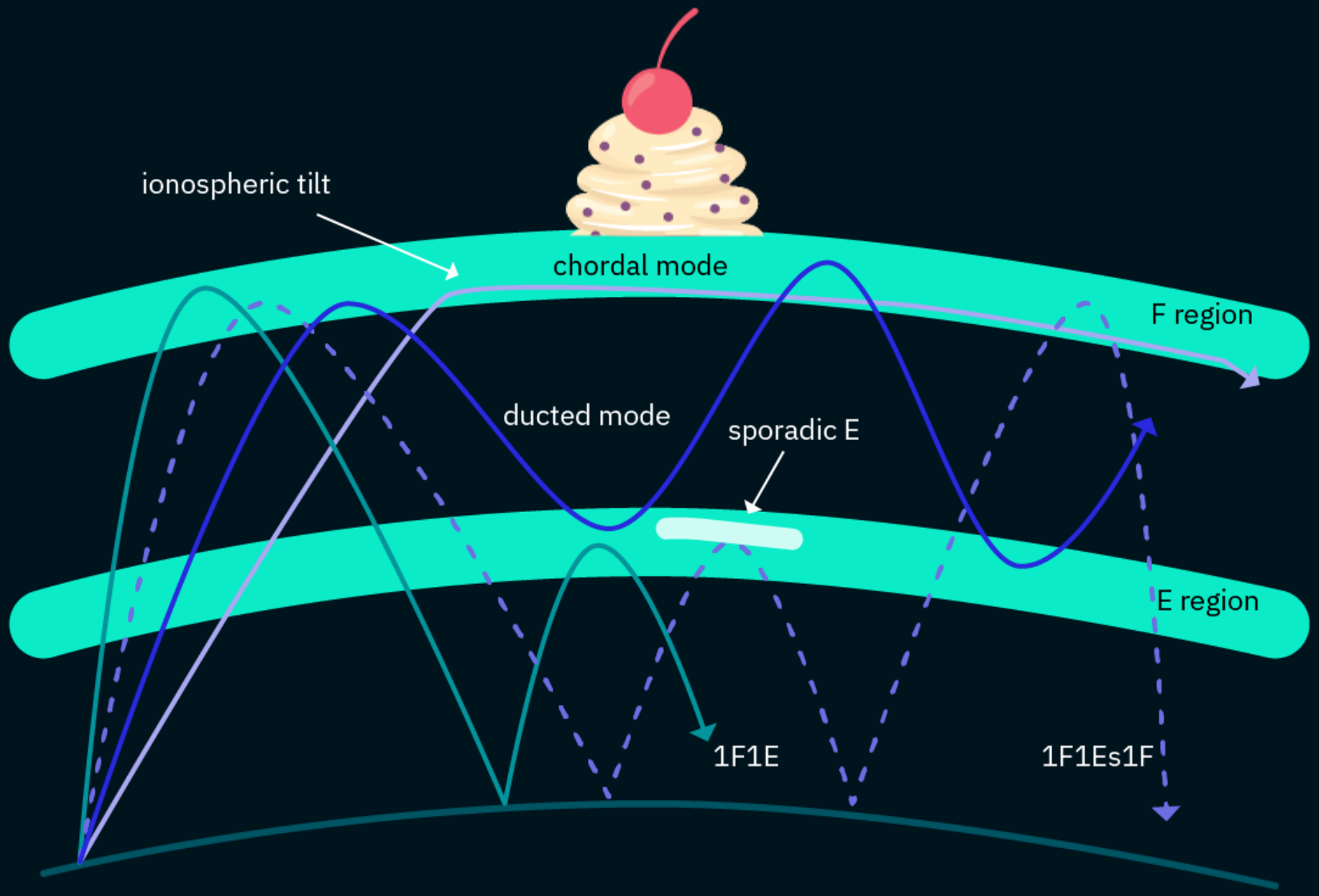
HF ADOPTION HAS STARTED

Deutsche Börse cross-correlation analysis

Showing trades in Frankfurt following trade events in Chicago

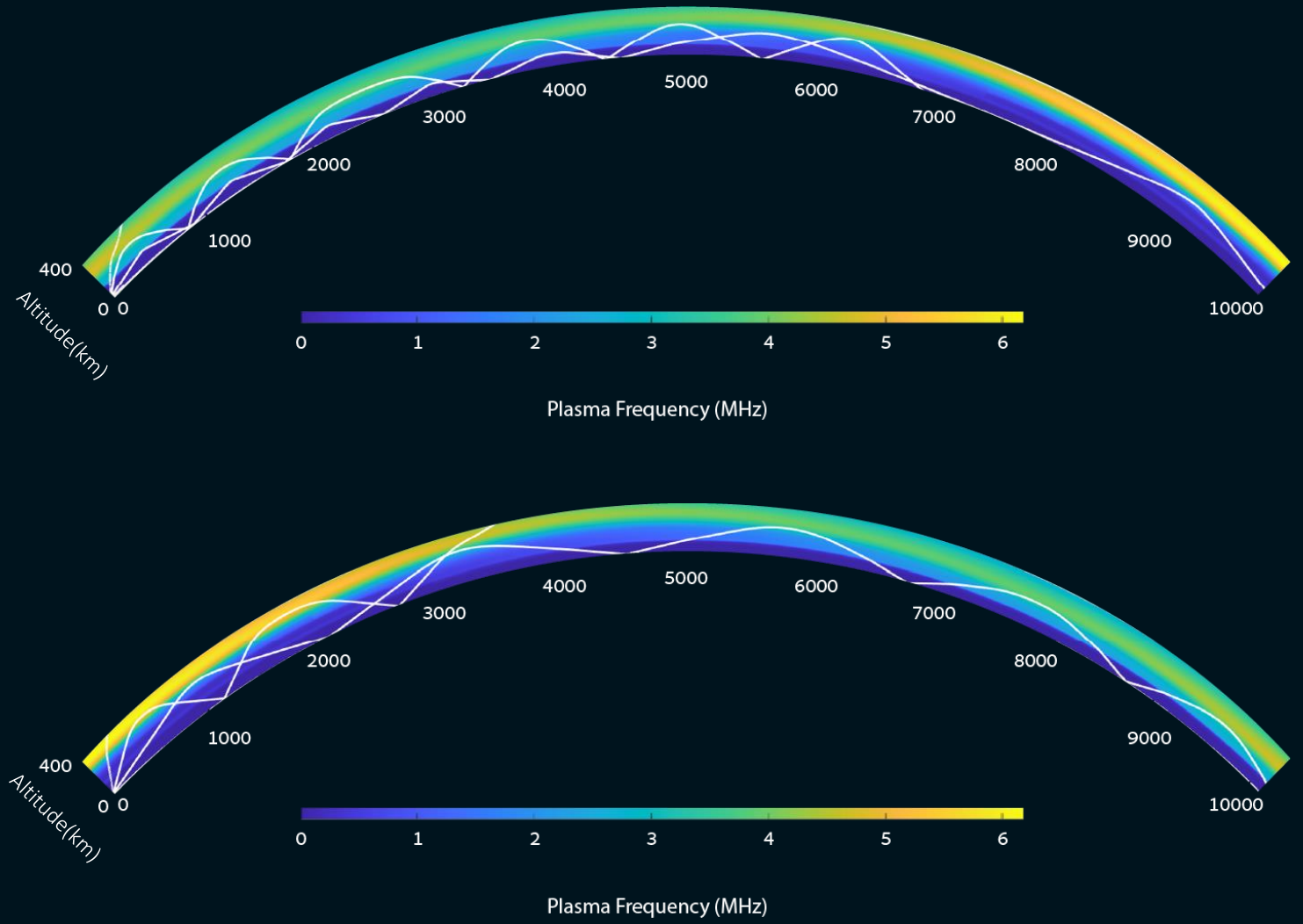


REFRACTIVE EFFECTS OF THE IONOSPHERE (LAYER CAKE)



REFRACTIVE EFFECTS OF THE IONOSPHERE

Signals take different paths



CYCLES DEFINING HF SERVICE AVAILABILITY

Day-night Cycle

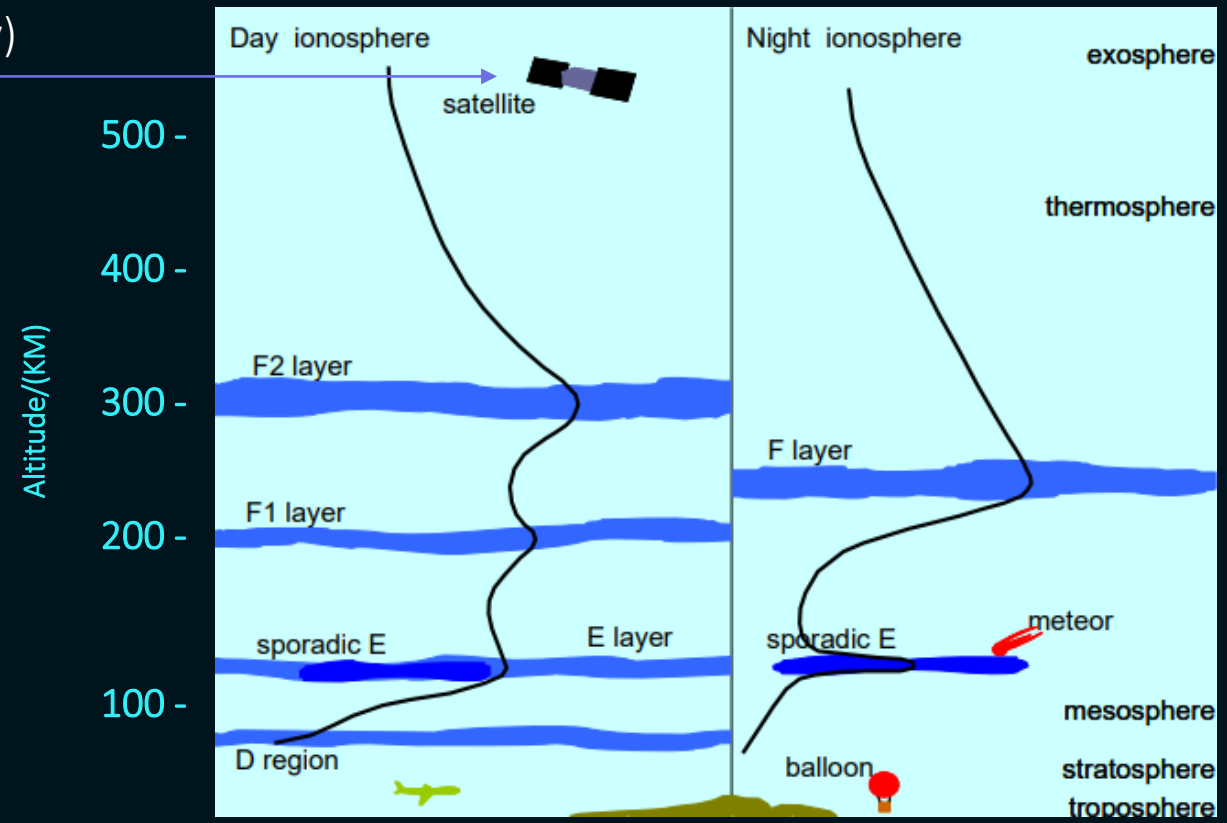
Seasons Cycle

Solar Cycle

1D

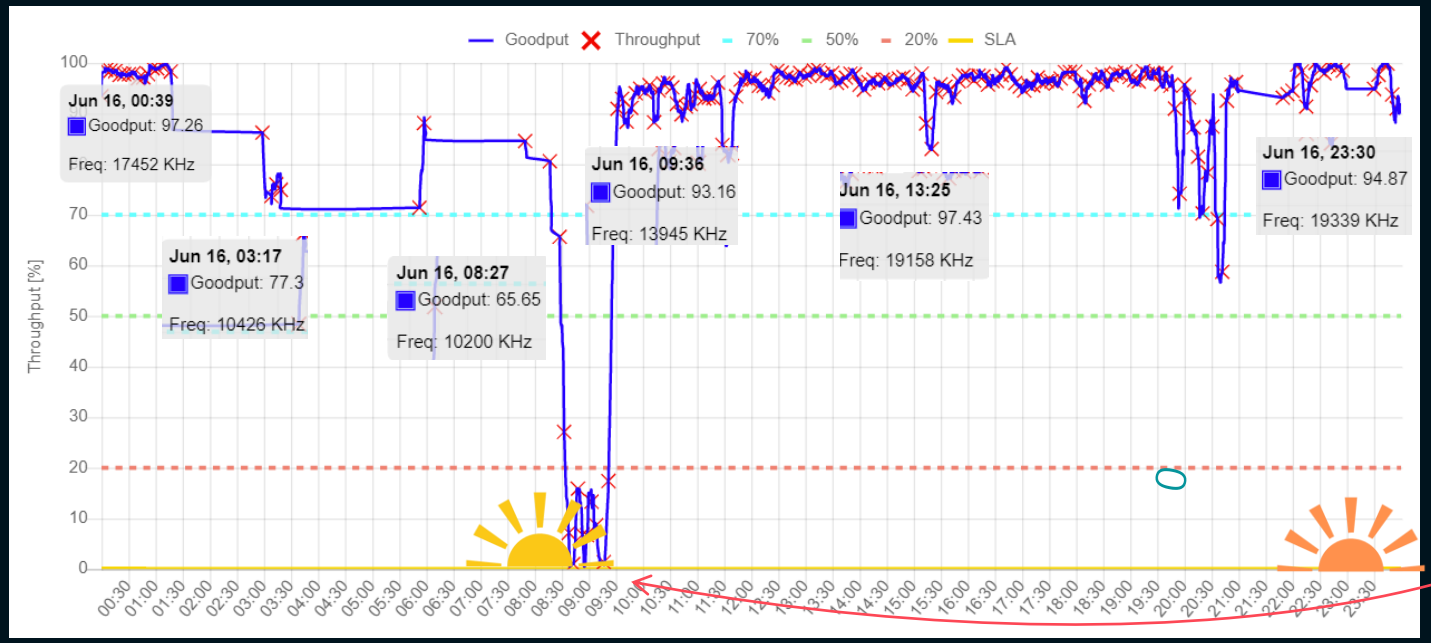
DAY-NIGHT CYCLE IONOSPHERE LAYERS CHANGE

(LEOs are higher in the sky)



DAY-NIGHT CYCLE IONOSPHERE LAYERS CHANGE

Date: June 15, 2022



Just before dawn,
“battery drains out”

12M

SEASONAL CYCLE DAYLIGHT HOURS CHANGE

The Earth Axial tilt ≈23 Degrees

December Solstice

June Solstice

12M

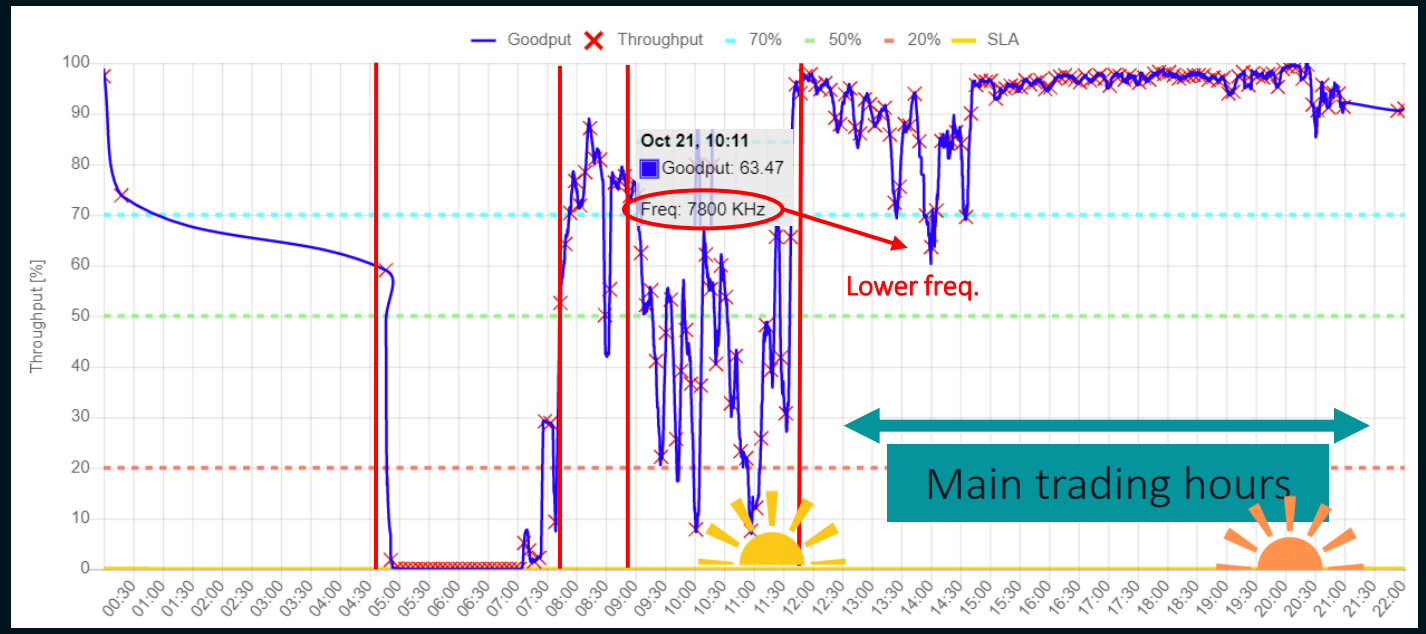
SEASONAL CYCLE DAYLIGHT HOURS CHANGE

December

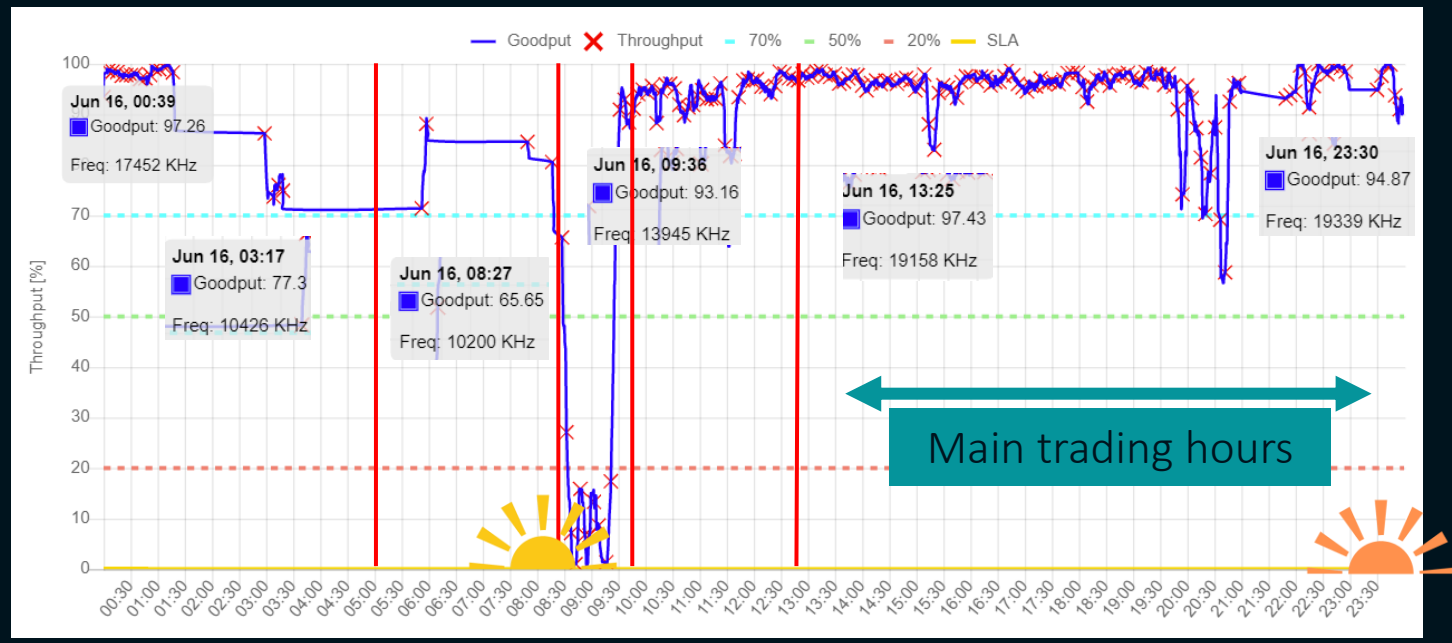
June

SEASONAL CYCLE DAYLIGHT HOURS CHANGE

Winter day



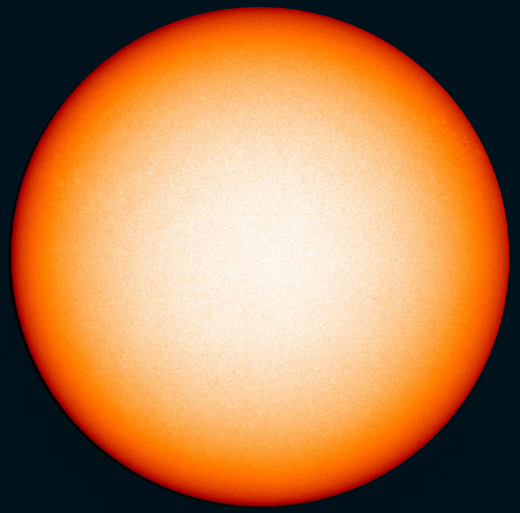
Summer day



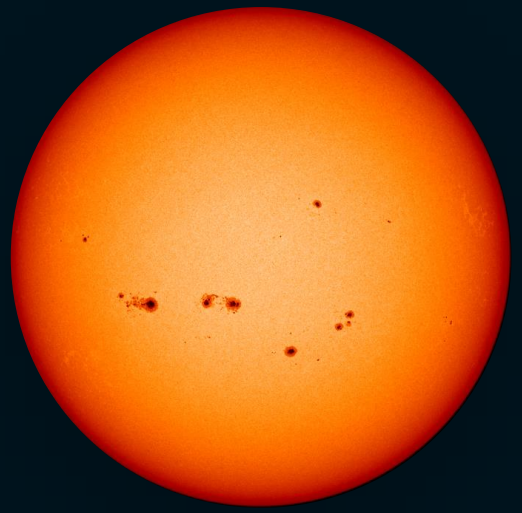
SOLAR CYCLE THE SUN'S MAGNETIC FIELD

Sunspots – the more the better

Solar **Minimum**

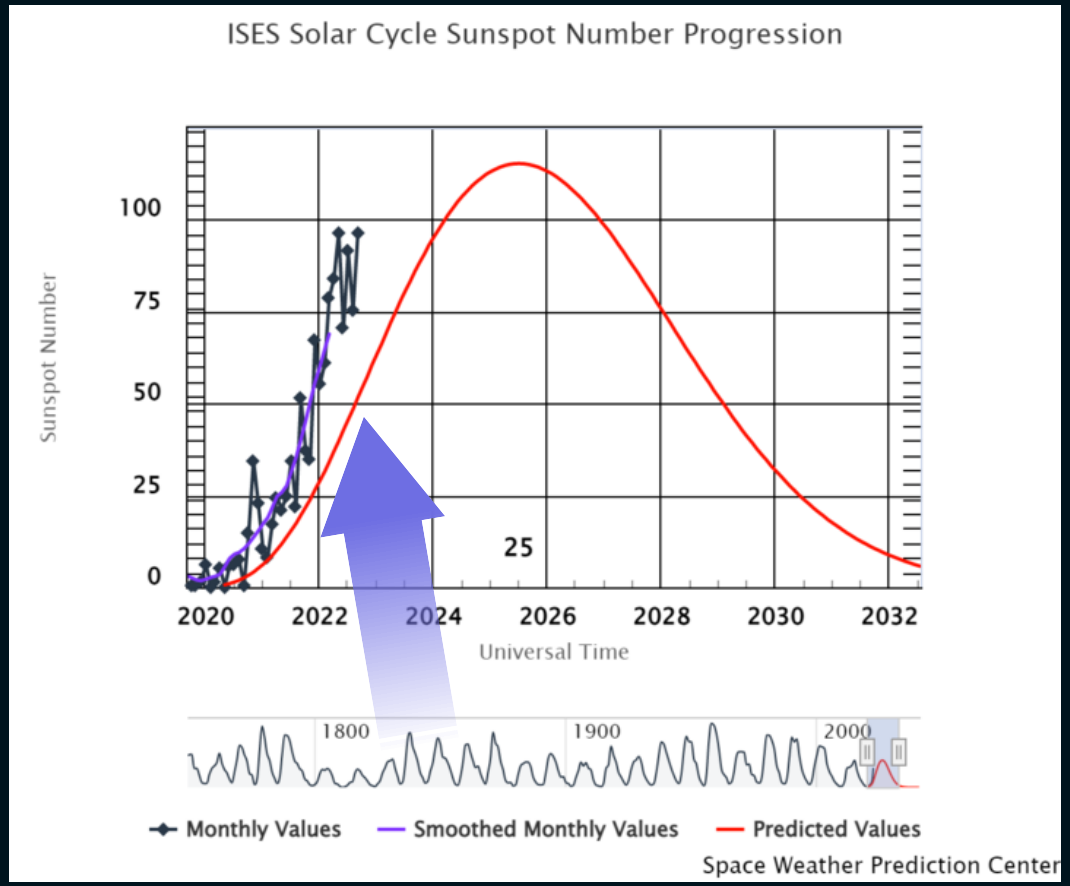


Solar **Maximum**



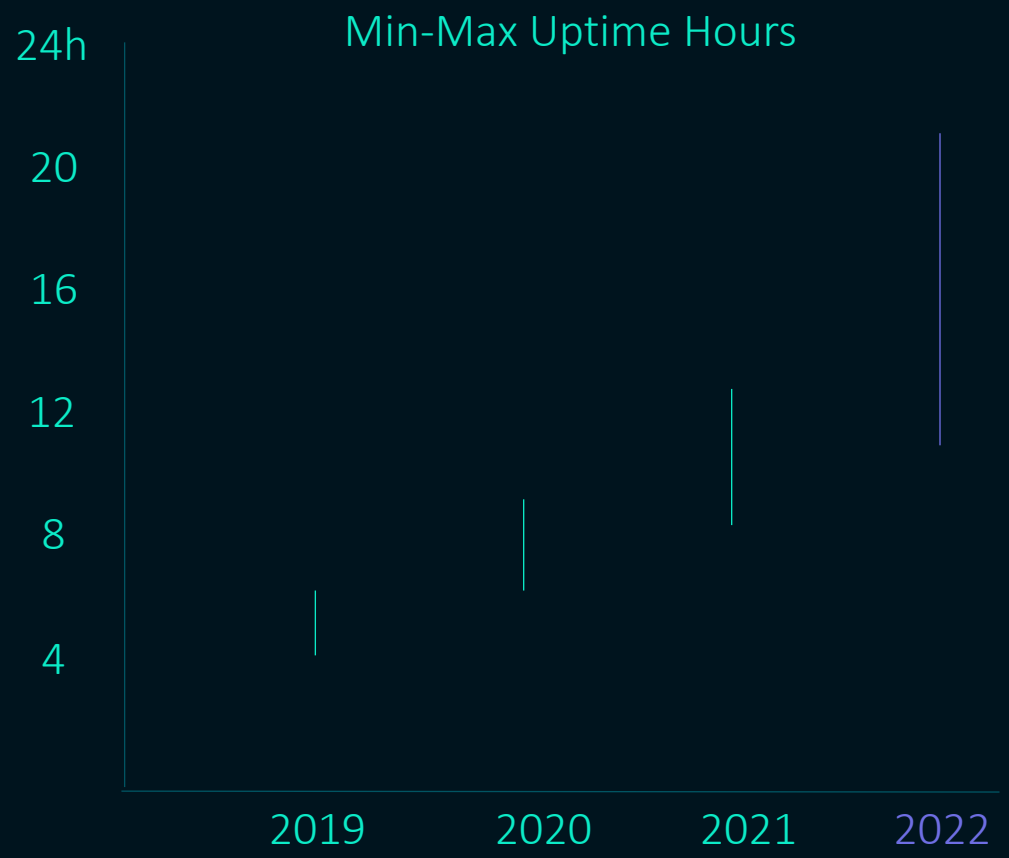
SOLAR CYCLE THE SUN'S MAGNETIC FIELD

There's a good tailwind for HF



HF NETWORK KEY PERFORMANCE INDICATORS

Latency	HF delivers the shortest latency ever
Capacity	0.5-1.2 Kbps
Goodput	75-95%
Uptime	Near 24h, summertime cross-Atlantic
Error Rate	In the 10EXP-5 zone



WEATHER FORECASTS – IN SPACE, NOT ON EARTH

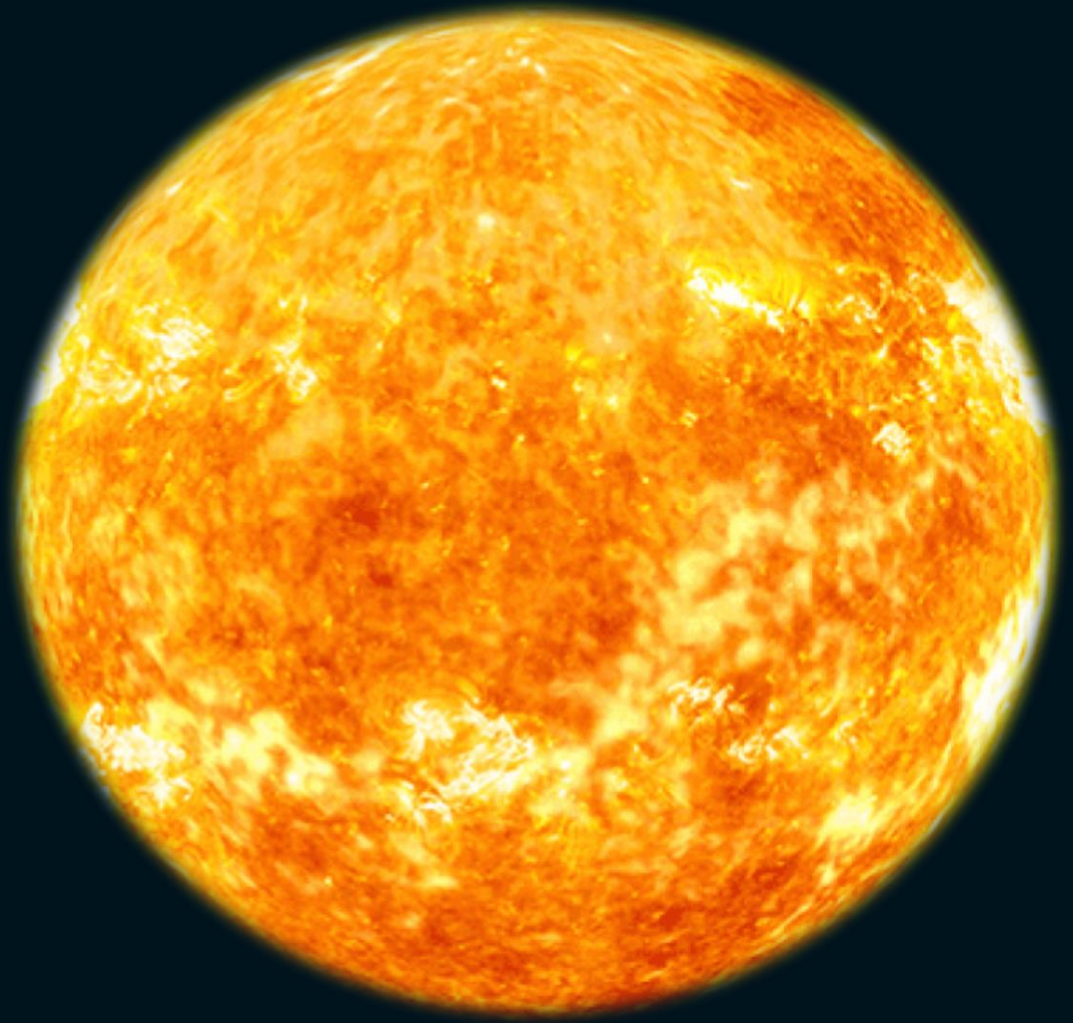
Positive

- Active Regions
- Sunspots

Negative

- Solar-Flux
- X-Rays

A master indicator: K-Index



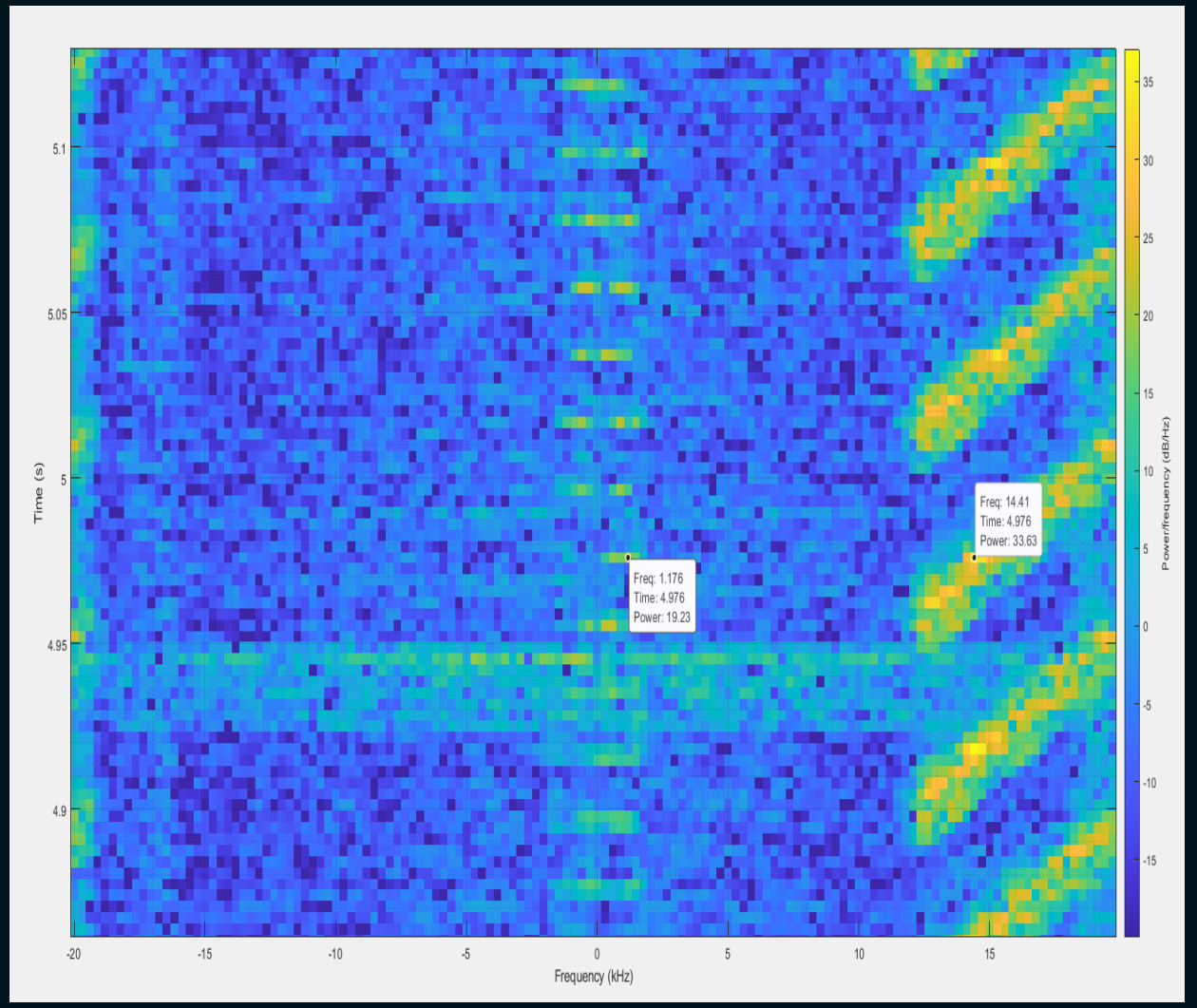
HF CHALLENGES RECEIVING A SIGNAL

Man-made noise

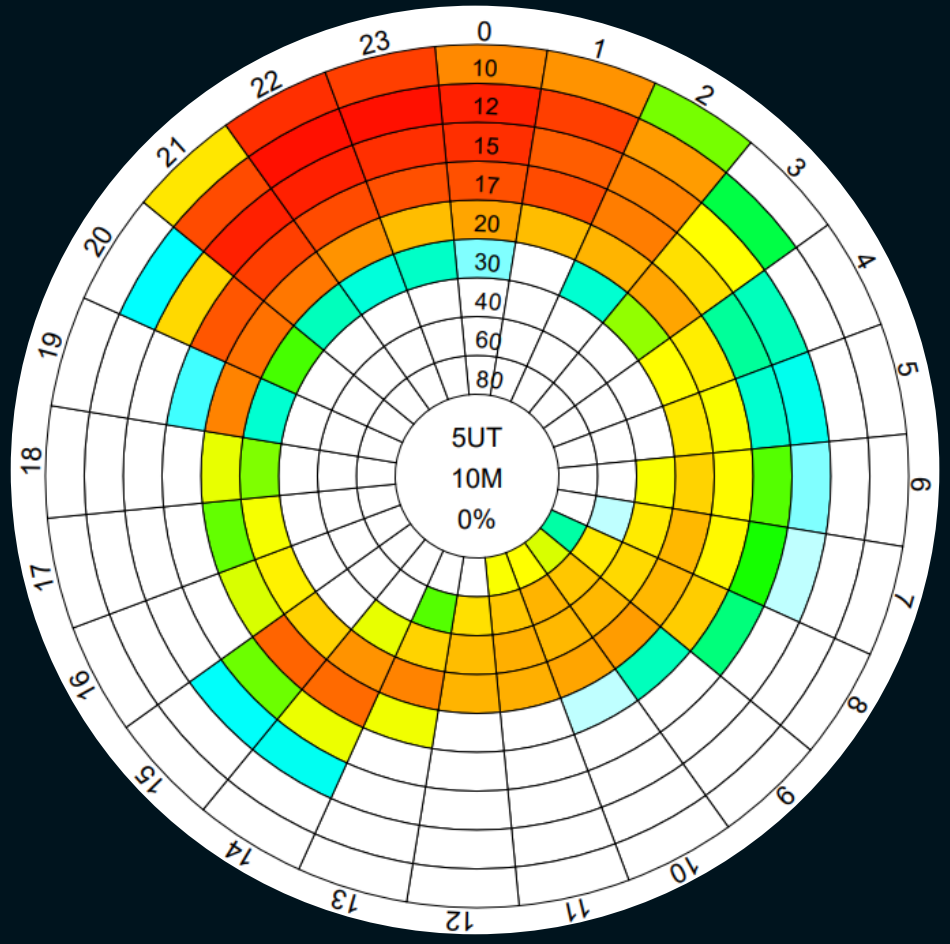
- Crowded spectrum
- Narrow-band noise
- Chirp-type noise

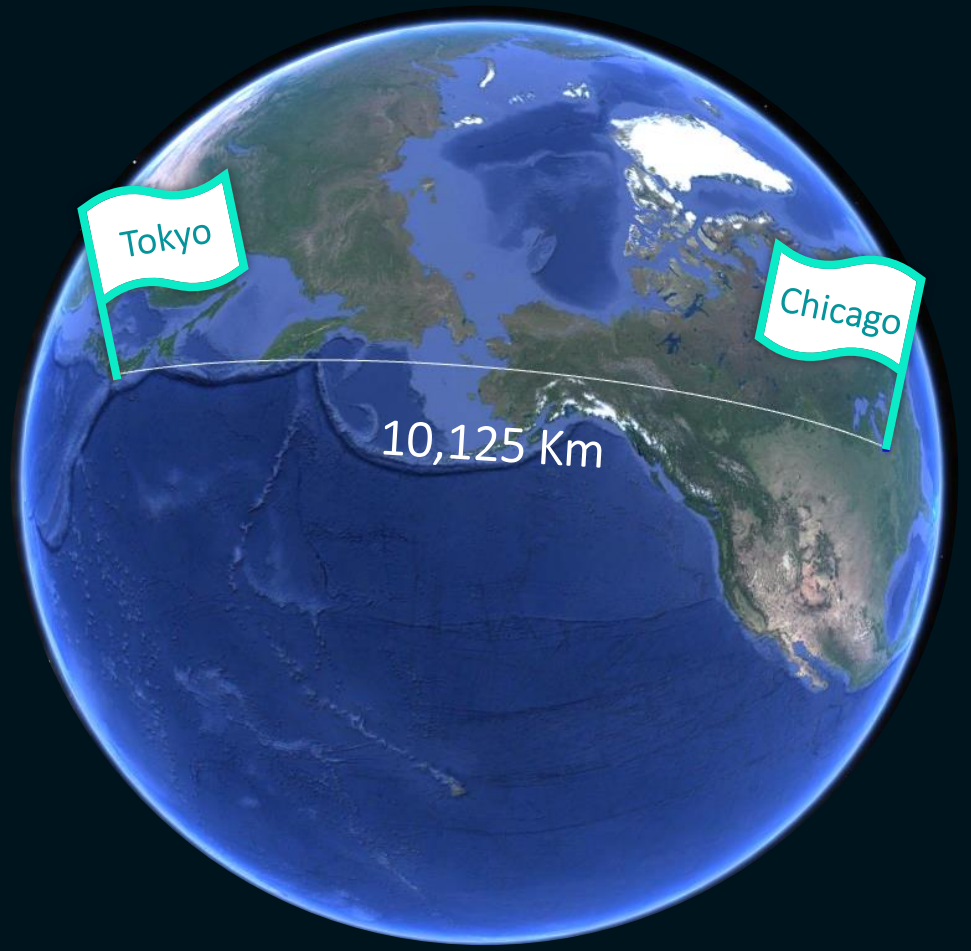
Your own “noise”

- Multipath
- Long path / 2nd time around



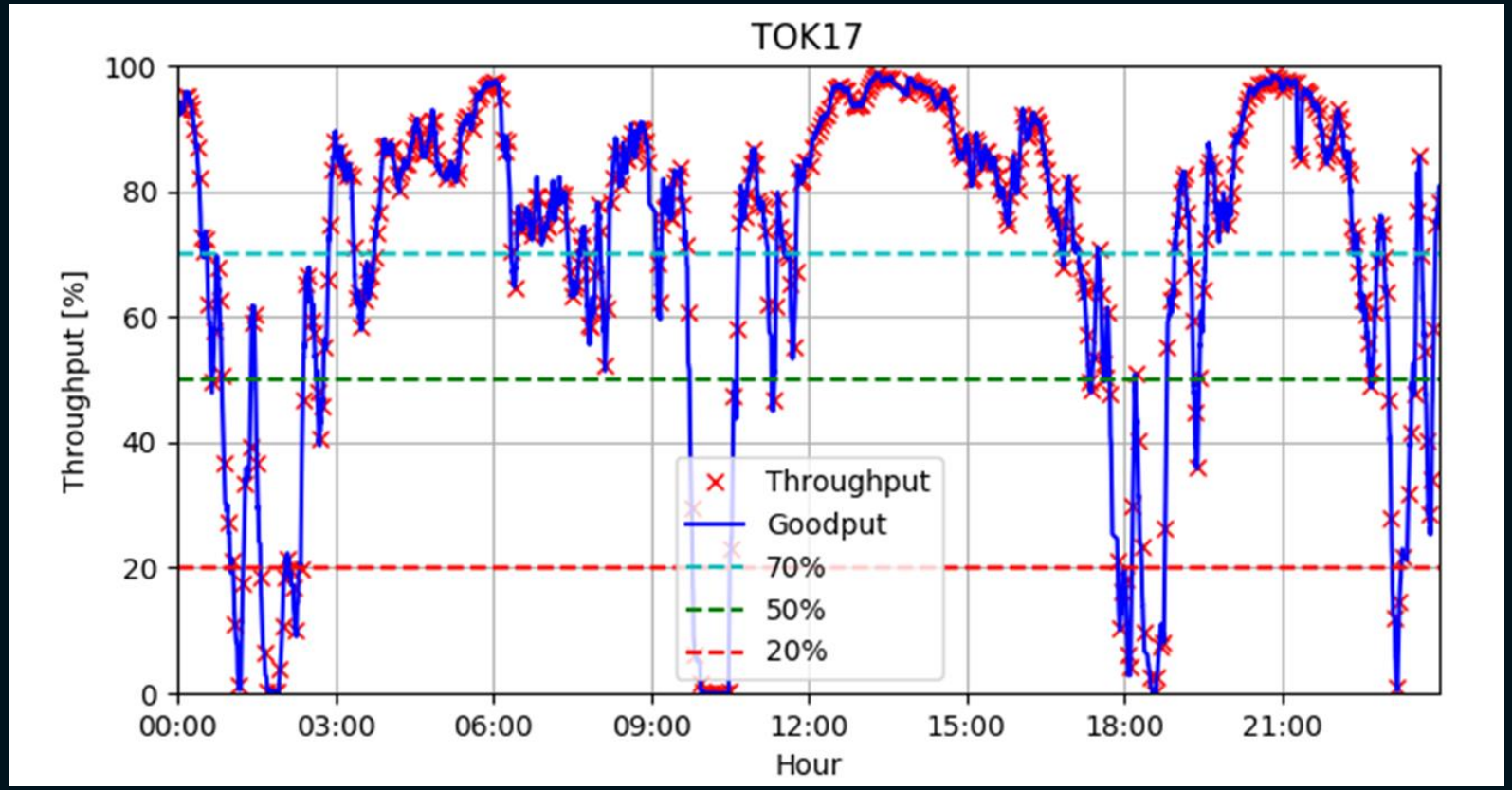
EXAMPLE: CHICAGO TO TOKYO LINK





EXAMPLE: CHICAGO TO TOKYO LINK

- Distance: 10,125 Km
- No repeater (!)
- End-to-end latency (colo to colo): below 50ms…



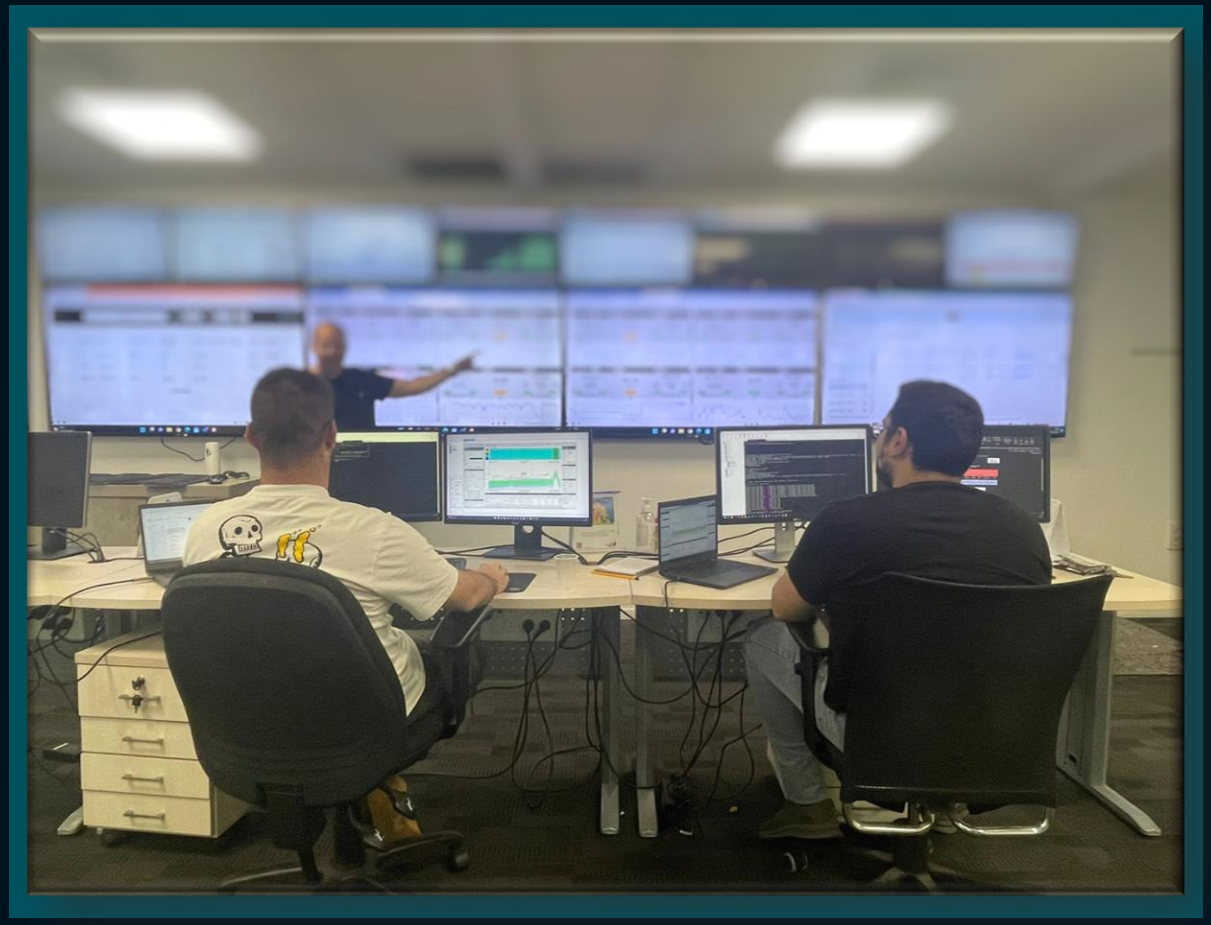
CONTINUOUS INCREASED PERFORMANCE

NOC

Developed procedures for link mgmt.

ANOC (Autonomous NOC)

AI-powered link monitoring and control

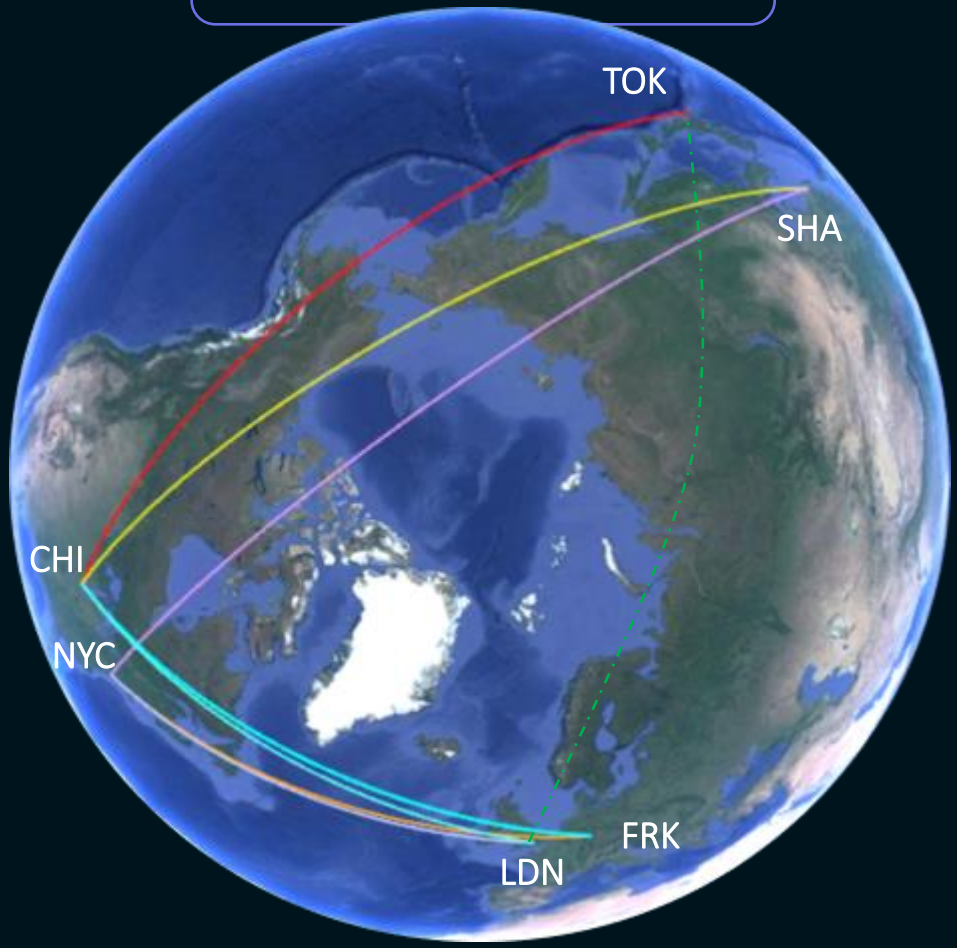


HF NETWORK KEY PERFORMANCE INDICATORS

Current focus

Latency	Pushing toward the physical limit
Capacity	x10
Goodput	75-95%
Uptime	Near 24h year-round
Error Rate	In the 10EXP-5 zone

Global Network



Q&A

Thank you!

"Any sufficiently advanced technology is indistinguishable from magic"

Arthur C. Clarke

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a bit faster