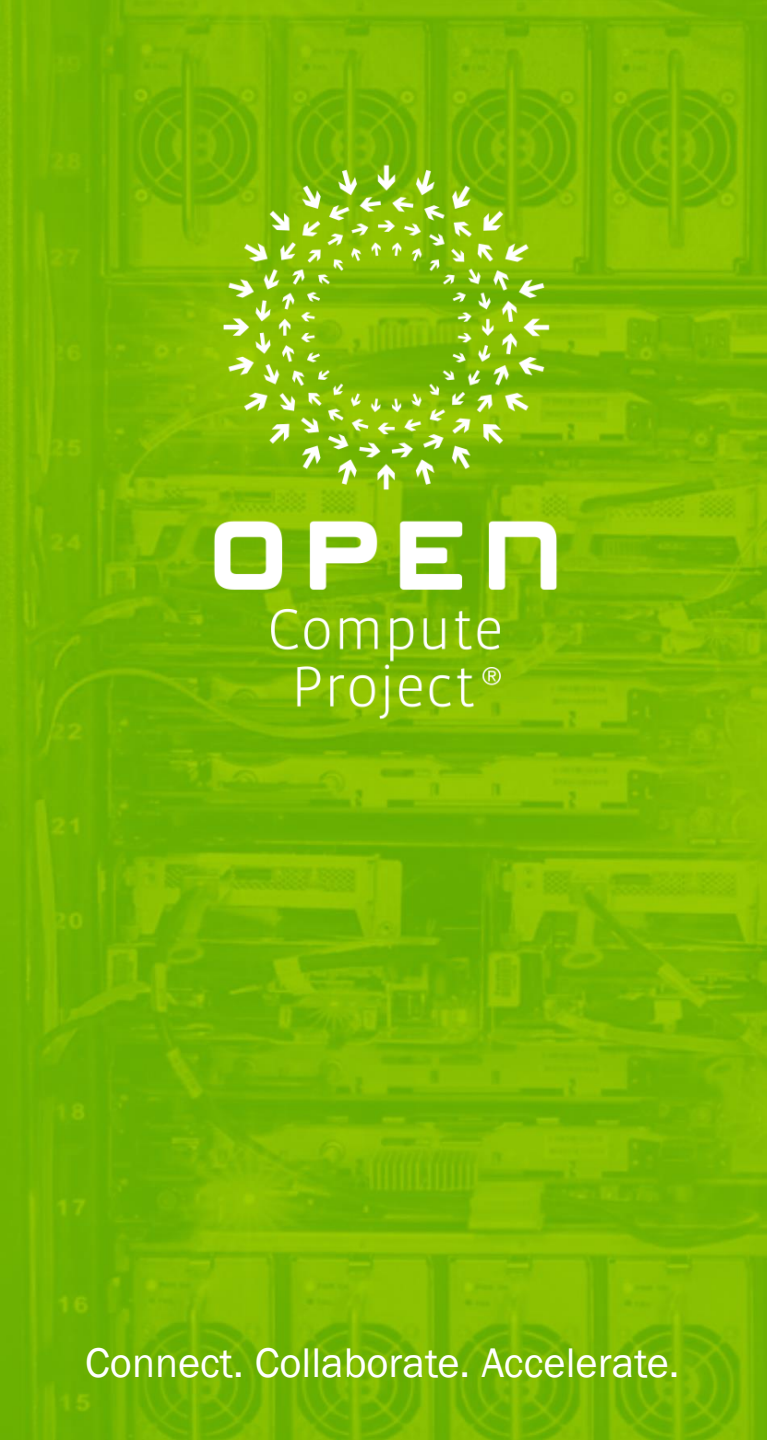
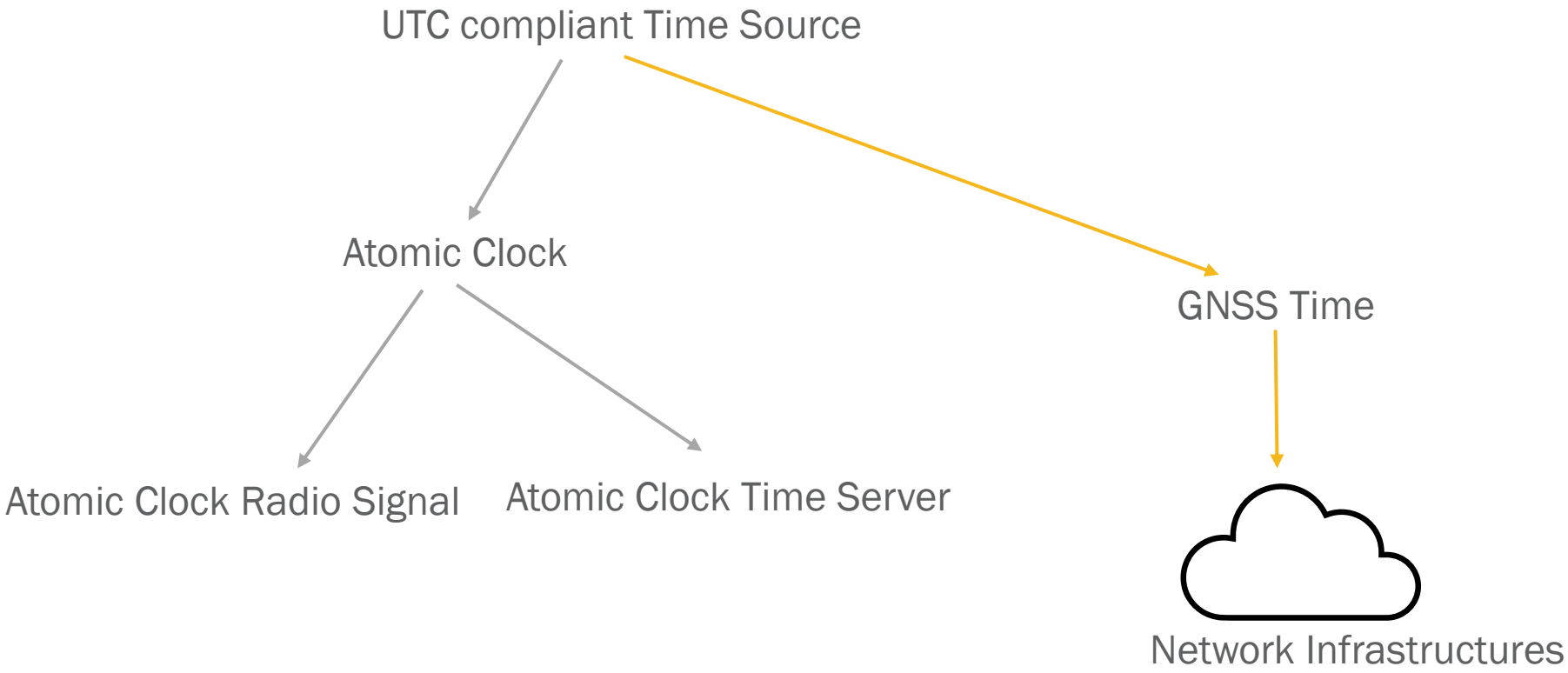


GNSS Timing Receiver

Protempis
(formerly Trimble Timing & Frequency Division)
Dhiman D Chowdhury & Christian Voit

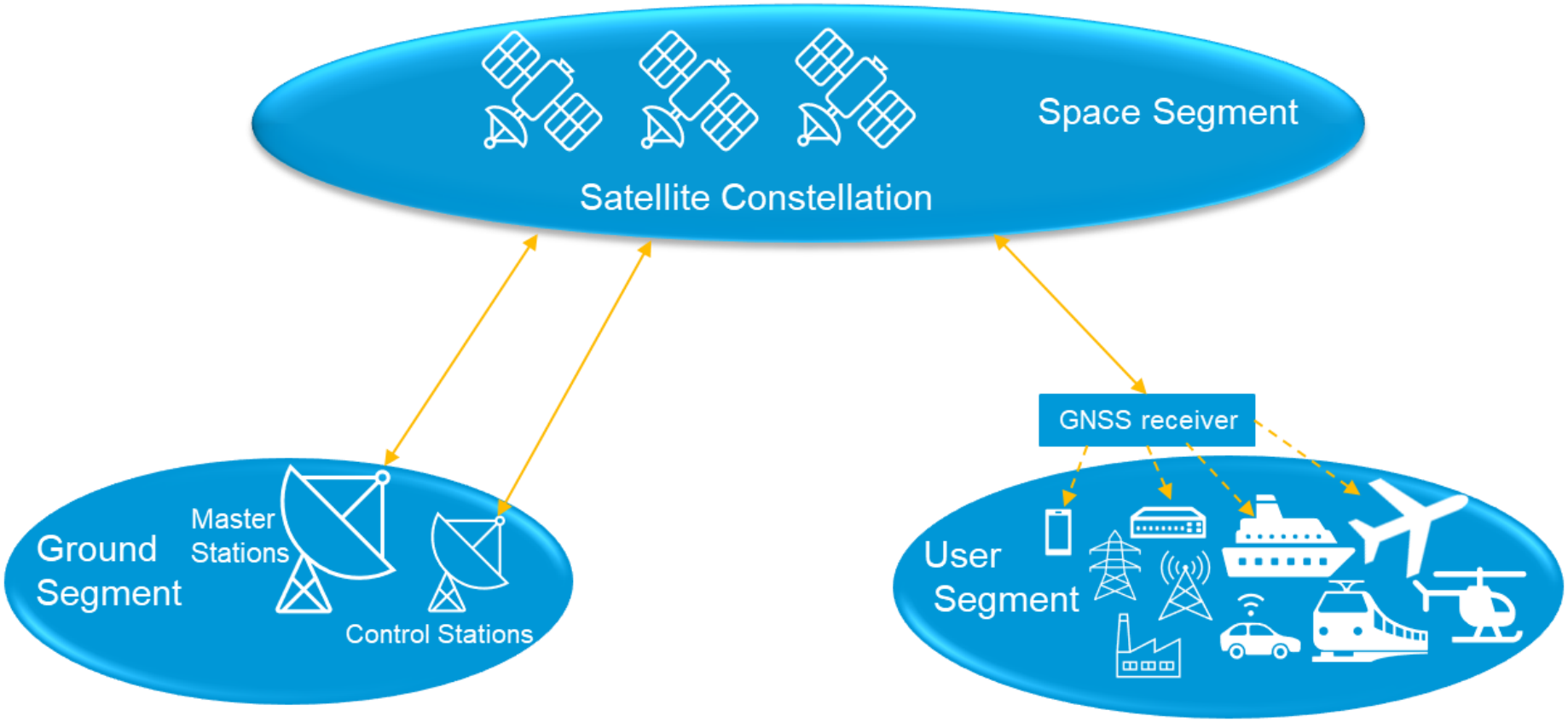
Precise Time Synchronization is essential for various use cases

GNSS Time Source most cost-effective solutions for infrastructure

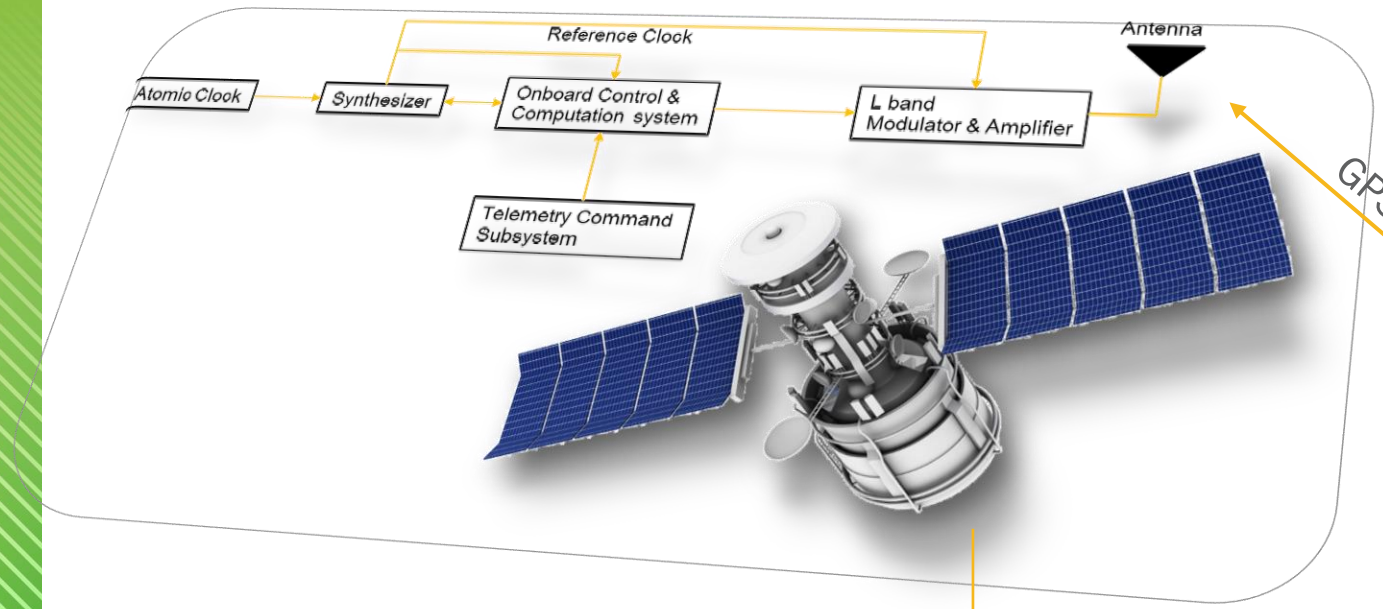


OPEN Compute Project®

GNSS Operational System: Space, Ground and User Segments



GNSS Timing: GPS example



GPS Clock and monitoring

UTC Clock Ensemble

ROYAL OBSERVATORY GREENWICH

l'Observatoire de Paris

NIST

(USNO-UTC Time)

Ground Station Clock

Corrected GPS time

SV NAV msg

GNSS receiver

Connect. Collaborate. Accelerate.

Single band vs Dual Band: Importance in GNSS timing Accuracy

- Realtime Ionospheric Error measurement : Dual frequency comparison provides offset values which can be subtracted as error.
- The L5 signal has twice the signal power than L1 and L2C signals, which lowers the risk of interference and improves multipath protection
- The higher signal strength also makes the data-less signal easier to acquire in unfavorable and obstructed conditions.
- L5 has only civilian codes that are both ten times longer and ten times faster than the C/A code. Since the maximum resolution available in a pseudorange is typically about 1% of the chipping rate of the code used, the faster the chipping rate the better the resolution.
- Unlike L2C, L5 is Safety of Life Signal approved by ITU-T for the Aeronautical Radionavigation Navigation Services (ARNS) worldwide and the band is protected against interference.
- Wider separation of frequency between L5 and L1 than L2c and L1 that allows for better Anti-jamming and Anti-spoofing performance.

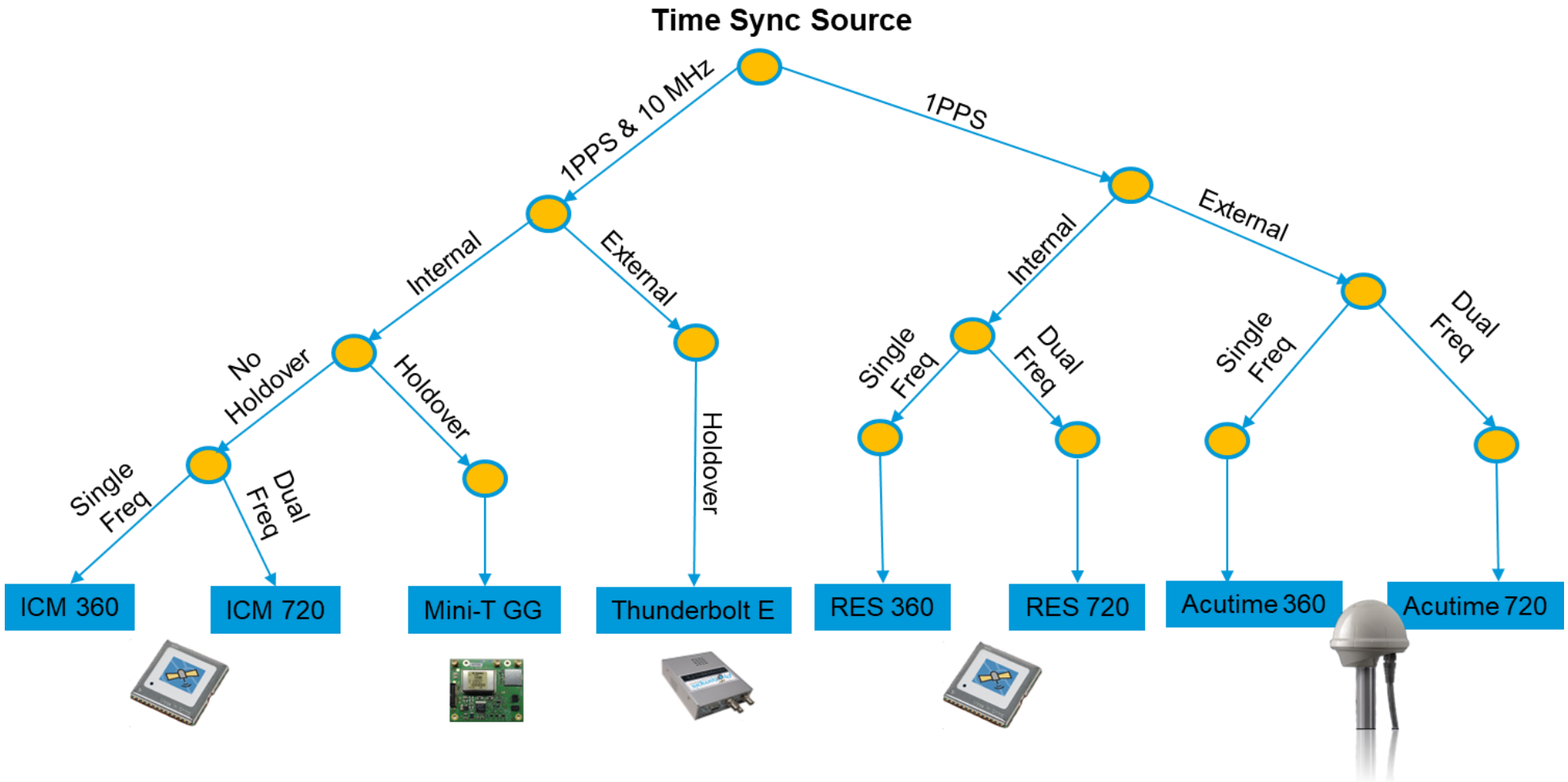
Dual-Band GNSS Receiver: RES720/ICM720

- Multi-Constellation
- 10MHz and PPS output
- Synchronized to within 5ns (1 sigma) of GNSS/UTC
- TSIP and NMEA protocols for communications
- Dual band GNSS
- Secured Boot
- Anti-Jamming & Anti-Spoofing
- Multipath Mitigation

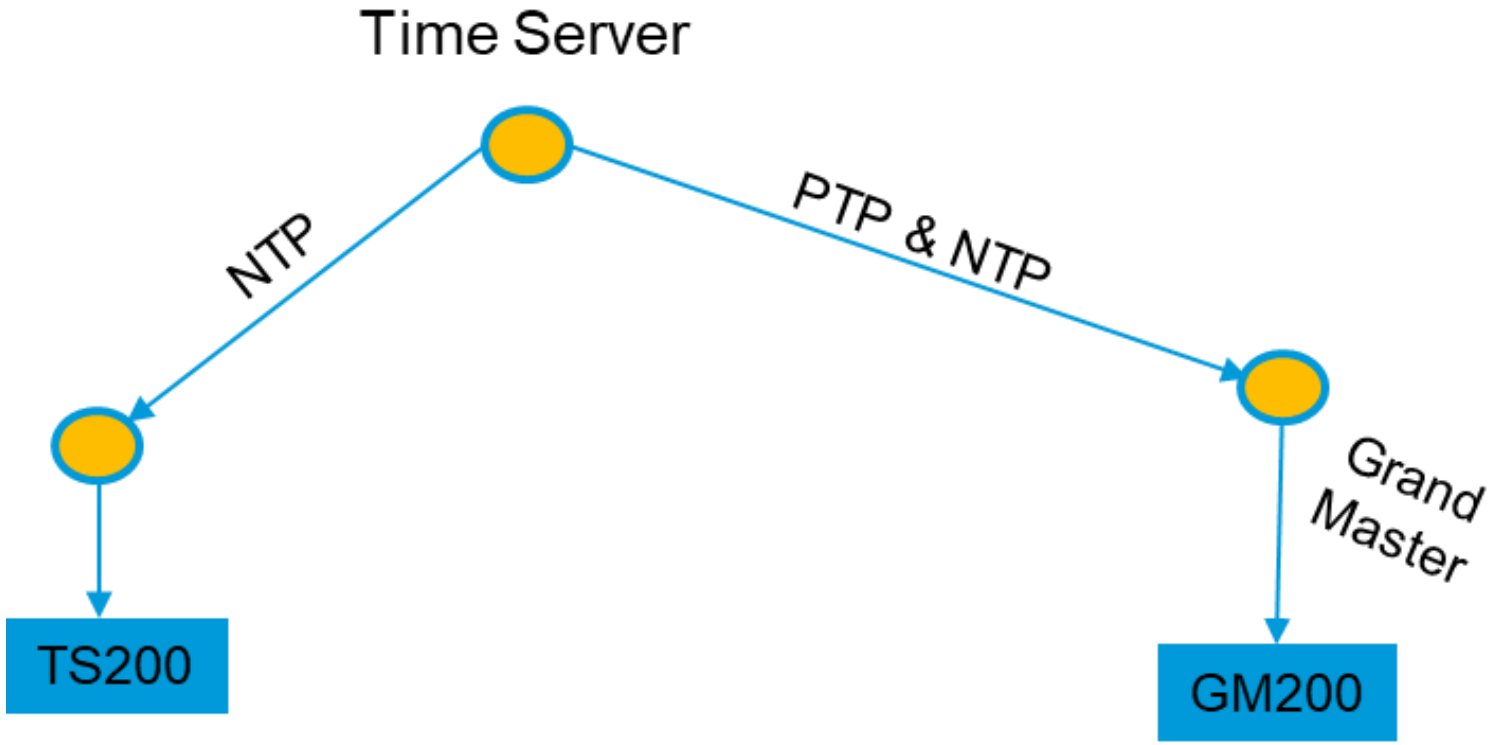
Mitigating multipath and spoofing is essential for data integrity & reliability

- TRAIM performs integrity checking of each pseudorange (timing and ranging calculation).
- Integrity checking allows us detect any signal anomalies and isolate signals from timing solutions.
- Protempis FFT algorithm continuously monitors and evaluates signal parameters for usefulness.
- In Promtepis solution, we can set mask angle to eliminate noisy signals.
- 25 validity indicators provide detailed status information of the current signal condition per satellite, per constellation and per combined solution

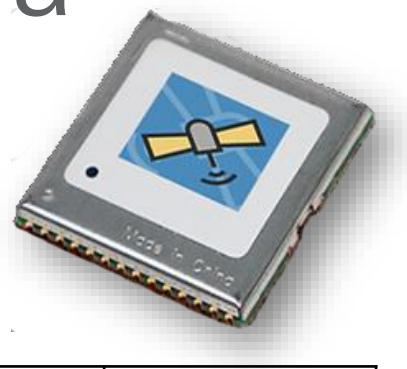
Protempis Portfolio for GNSS sync Source selection



Protempis Time Server Portfolio for NTP and PTP Time Sync solution

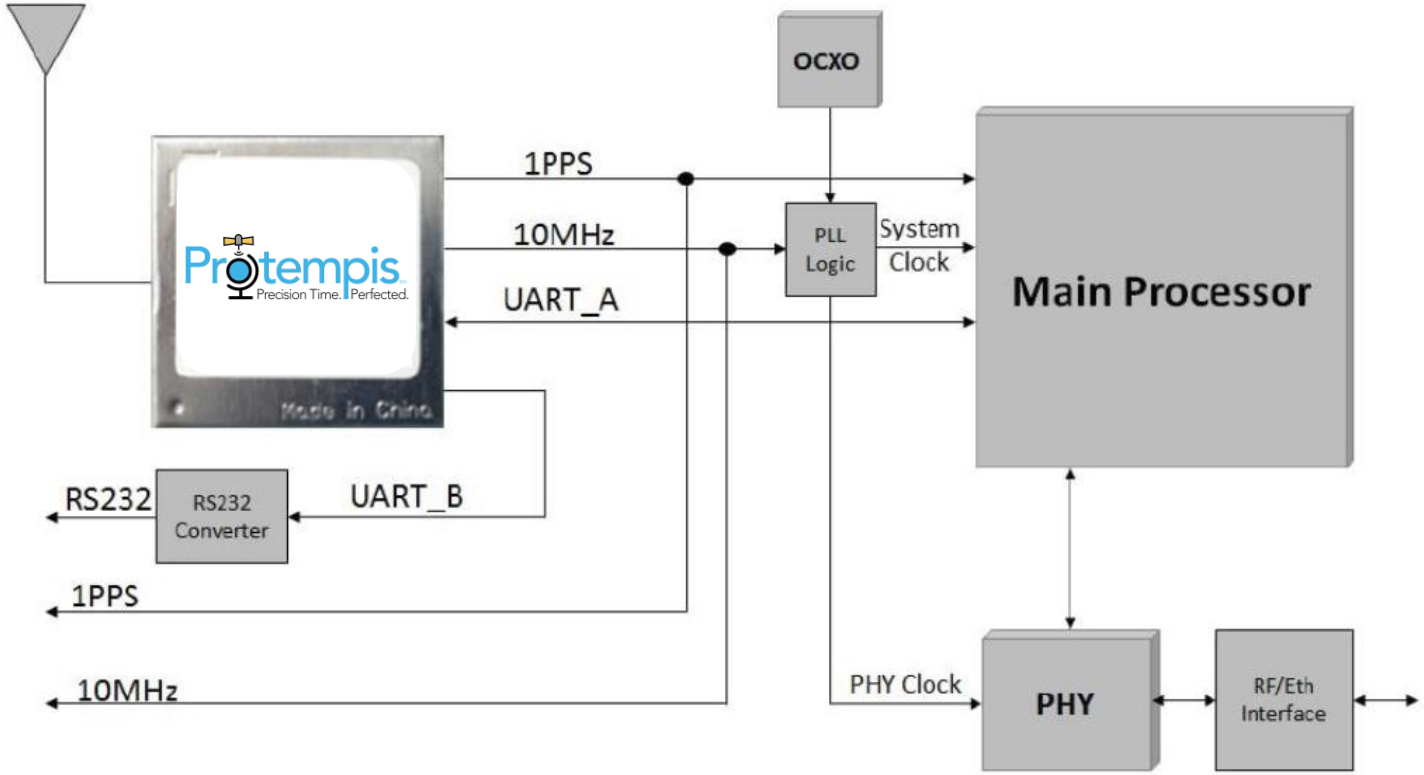


Protempis single band and dual GNSS Timing Receiver selection criteria

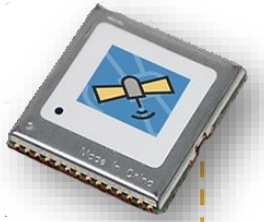


Product	Multi-Constellation	Bands	Accuracy	Frequency Output	Extended Temp	Multipath Mitigation	Anti-Spoofing
ICM720	GNSS (including IRNSS)	L1 & L5	5 ns (1 sigma)	1PPS/PP2S & 10 MHz	Yes	improved	improved
RES720	GNSS (including IRNSS)	L1 & L5	5 ns (1 sigma)	1PPS/PP2S	Yes	improved	improved
ICM360	GNSS	L1	15 ns (1 Sigma)	1PPS/PP2S & 10 MHz	Yes	yes	yes
RES360	GNSS	L1	15 ns (1 Sigma)	1PPS/PP2S	Yes	yes	yes

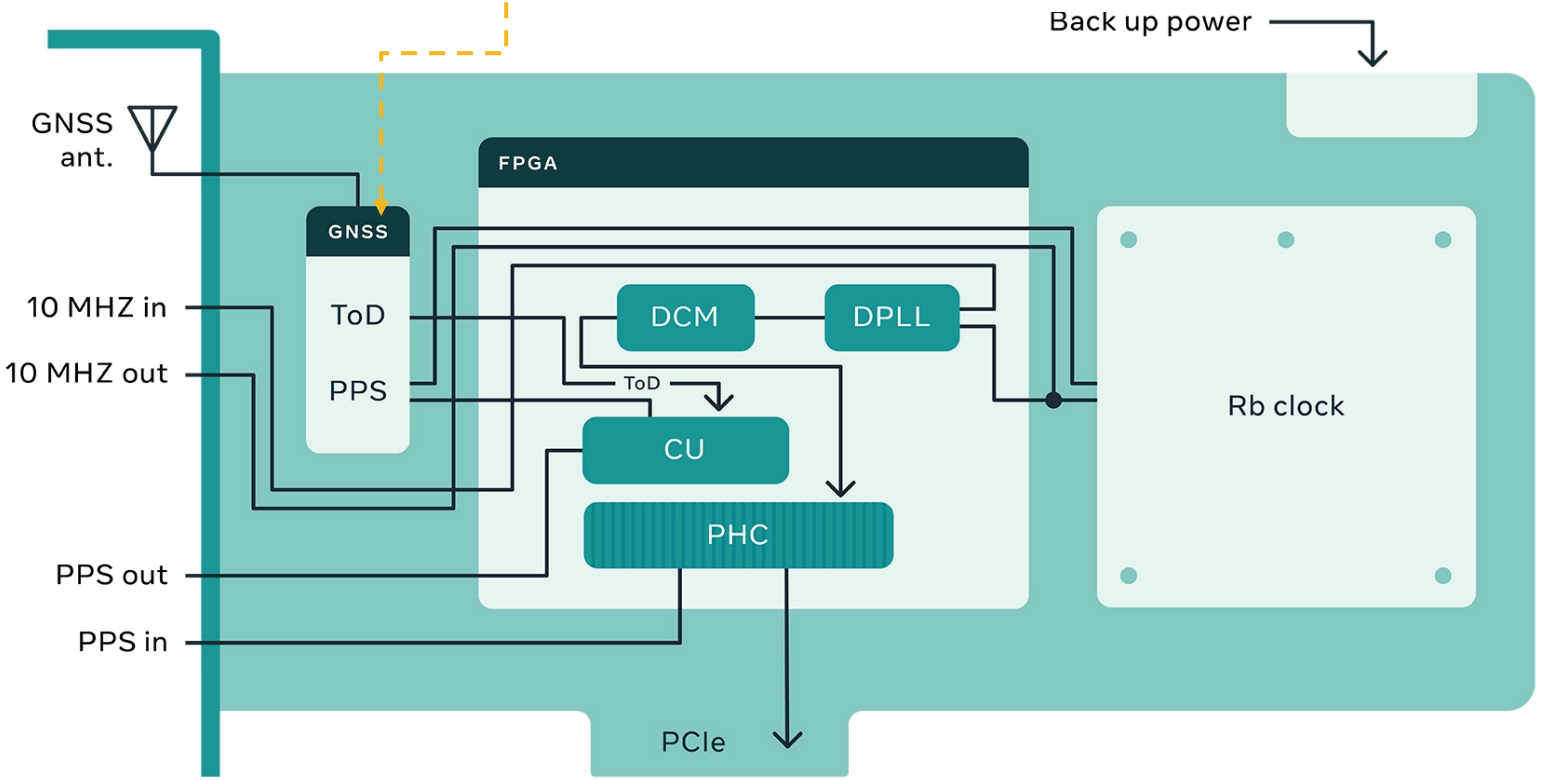
Seamless Integration of ICM720 in Networking Equipment



RES720 in TAP's Time Card



Protempis RES720
on a carrier card



Thank You

Connect. Collaborate. Accelerate.