TrellisWare Waveform Roadmap

Product Management

October 25, 2023

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Waveform Intro

TSM

Katana / WREN NB

Ecosystem & Interoperability

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TrellisWare® TECHNOLOGIES

TrellisWare Waveforms

AES-256 Encryption

TrellisWare TECHNOLOGIES

TSM 6 EAR

TrellisWare TECHNOLOGIES

KATANA™ CUT THROUGH THE NOISE

ITAR

TSM-X ITAR

(TSM 6 + support for Type 1 Encryption)

NSA SAB (Type 1)

STC Security

TSM-X with STC Security ITAR

WREN Security

WREN ITAR

WREN TSM

WREN NB

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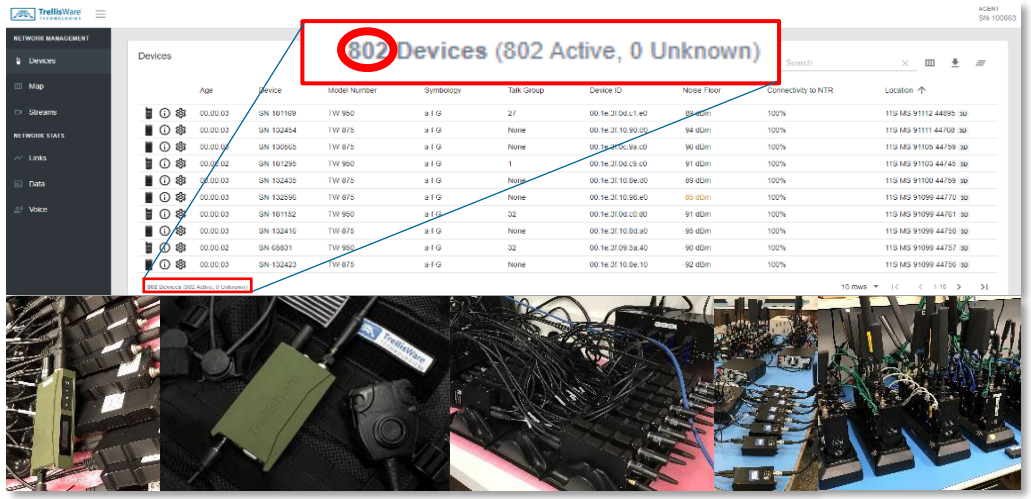
Eco-system Foundation: TSM Waveform

- Resilient wideband mesh network
  - Barrage Relay™
  - Scalability: 800+ nodes/1.2MHz
  - Rapid deployment: <1 second net entry, <10 second 800 node network forming
  - Robustness: range, dynamics, interference
- Simultaneous voice/PLI/data/video
  - Voice: 16 voice channels, 32 talk groups, 2 simultaneous voice
  - Rapid PLI distribution
  - Multiple HD video streams
- Operational Flexibility:
  - 1.2/3.6/10/20/40 MHz bandwidth options
  - UHF/L/S bands
  - Long Range (LR) & High Data Rate (HDR) capability
- Portability: SDR waveform built from ground up



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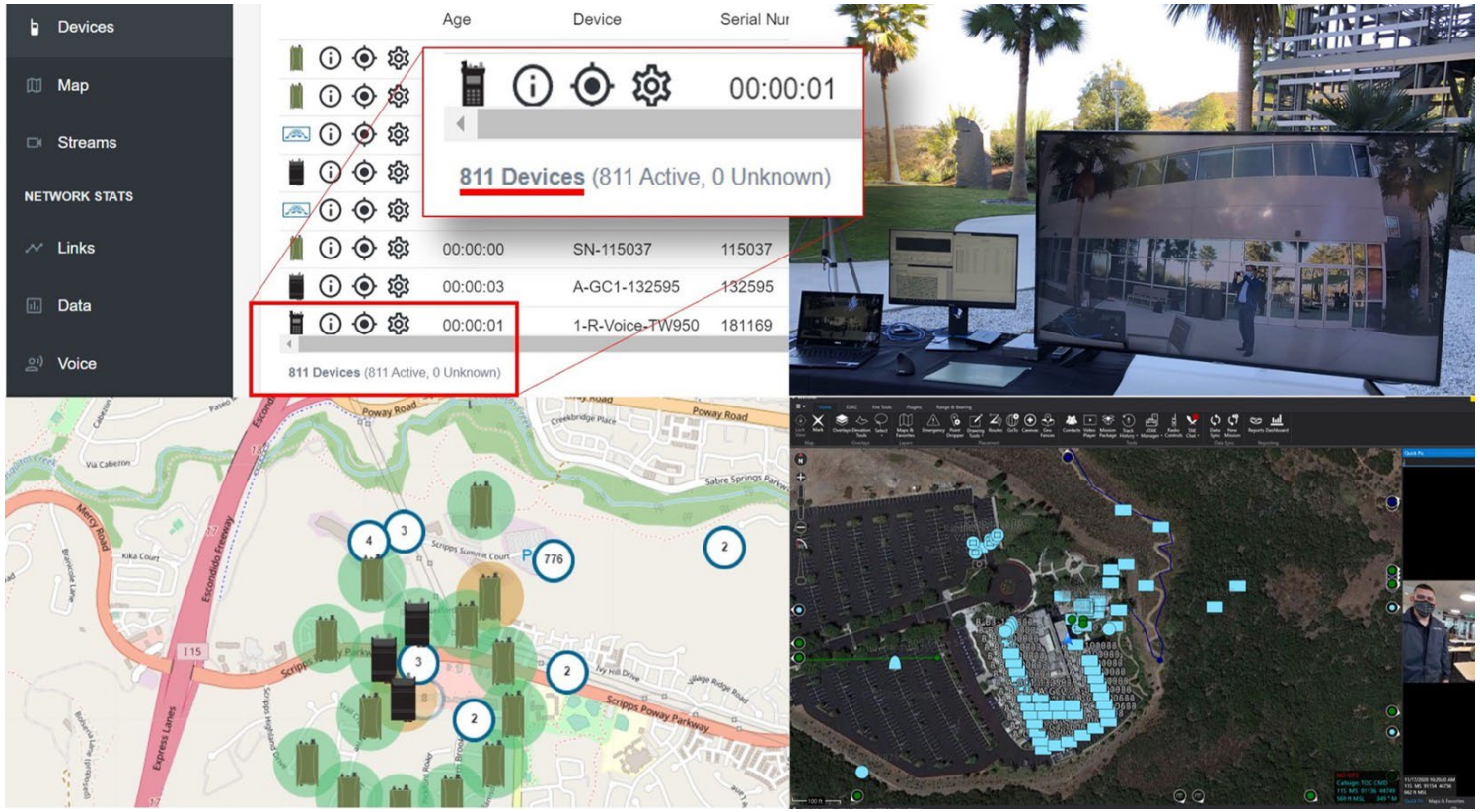
TSM 6.2.1 Features

- **High Data Rate (HDR) Mode**
  - Double throughput (16Mbps => 32Mbps)
  - New adaptive OFDM data modem
  - Retain CPM modem for robust voice, PLI and network maintenance
- **Massive Scalability**
  - 800 nodes scalability
  - Ultra efficient network
  - 5 times faster PLI update rate
- **OTAM**
  - Efficient OTA radio management
- **PLI Proxy / External PLI**
  - Efficient OTA distribution of 3rd party PLI
- **Packet Processing Rules**
  - Fine grain control of packet flows



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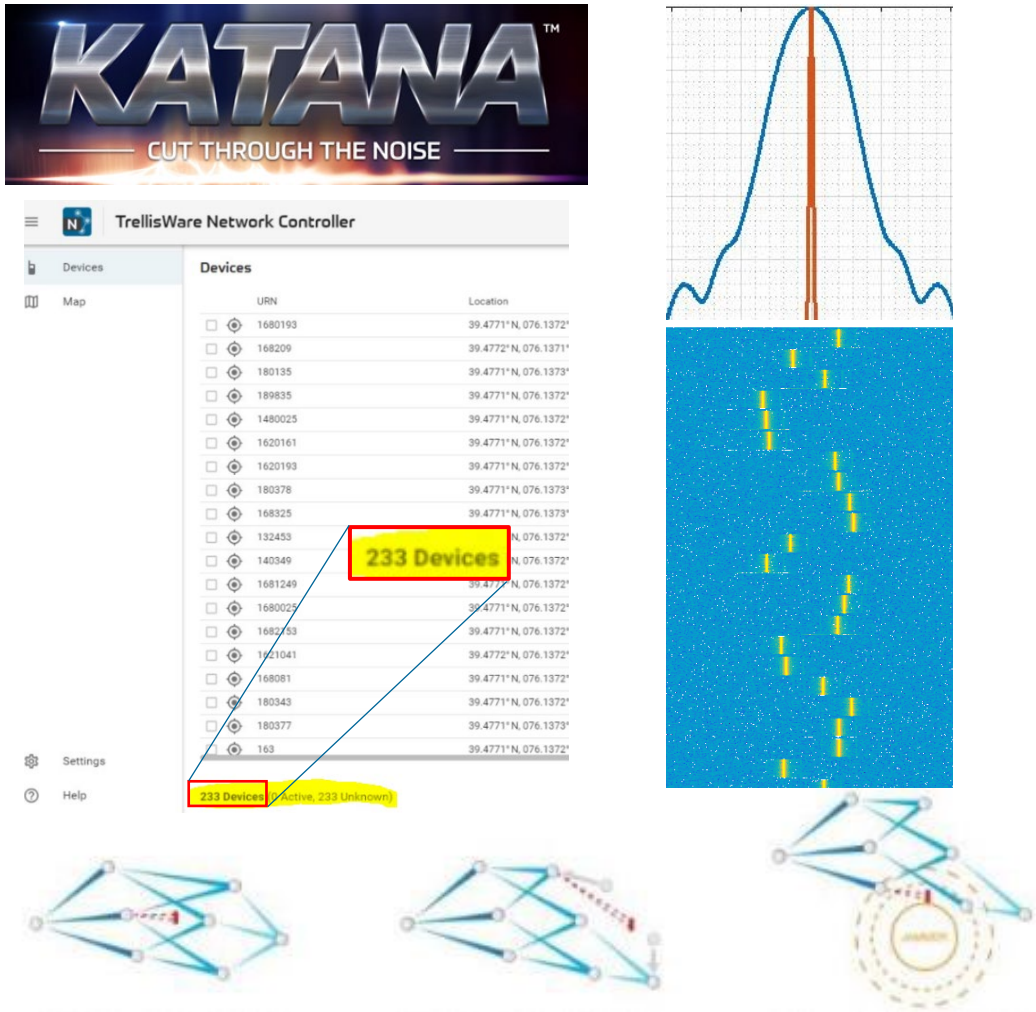
Eco-system Foundation: Katana / WREN NB

- Highly resilient narrowband mesh network
  - Barrage Relay™ for 3 spatial hops
  - ECCM/AJ Protection: fast frequency hopping
    - 50 kHz instantaneous bandwidth
    - Up to 200 MHz frequency hopping bandwidth
  - Scalability: 250+ nodes in single flat network
    - Rapid network formation/join/merge
- Simultaneous voice, PLI, & limited data
  - Voice: up to 128 talk groups, 2 simultaneous voice
  - Rapid PLI distribution
  - Chat & limited data transfer
- Operational Flexibility
  - UHF/L/S bands
  - Simplified IP configuration/planning
- Katana 1.0.0 released Aug 2023
- WREN NB 1.0.0 in testing for release in 2024



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TrellisWare Waveform Capabilities

TSM™

Wideband

- Scalable, self-forming, and self-healing MANET using Barrage Relay networking technology
- Configurable bandwidth of **1.2 MHz to 40MHz**
- **Resilient high-throughput solution** for challenging environments
- Proven scalability of over 800 nodes on a flat network using only 1.2 or 3.6MHz of bandwidth
- Dedicated voice & PLI channels
- Supports variety of data applications including **multiple simultaneous video streams**
- Enables red & black relay on mixed networks
- Widely available on TrellisWare & partner radios
- NSA Type 1 and AES-256 SBU Commercial Security
- SBU version of TSM is **non-ITAR**

Katana™/WREN NB

Narrowband

- Scalable, self-forming, and self-healing MANET using Barrage Relay networking technology
- Up to three spatial hops (60 km per hop)
- Uses only **50 kHz** of instantaneous bandwidth
- Fast frequency hopping within 200 MHz of bandwidth for **interference/jamming resistance**
- Narrowband physical layer for **excellent propagation and sensitivity** performance
- Scalable to hundreds of nodes
- Katana interoperable with WREN NB at SBU level
- **Field-upgradeable** for current generation TrellisWare radios to support both TSM and Katana
- NSA Type 1 and AES-256 SBU Commercial Security

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Ecosystem update

Type1 Multi-Channel Radios

L3Harris
PRC-158

Collins
PRC-162

L3Harris
PRC-167

Thales
PRC-148F

L3Harris
PRC-163

SBU-E Manpack/ Vehicular Radios

TrellisWare
TW-135

Embeddable Radios

TrellisWare
TW-650

TrellisWare
TW-870

TrellisWare
TW-880

L3Harris
SSDL-V3

DTC
SDR-U

SBU-E Single Channel Dismount Radios

TrellisWare
TW-950
(PRC-168)

Thales
PRC-170

L3Harris
PRC-171

TrellisWare
TW-860

Codan
Sentry 6161

Mobile and Fixed Site Radios

Ultra
Orion X650

Ultra
Orion X510

Relay Radios

TrellisWare
TW-875
(PRC-166)

Ultra
Orion X630

Integrated Systems (not a comprehensive listing)

Redcom
Sigma C2 Platform

Spectranetix
SX-610 CMOSS Card

Bounce Imaging
Recce360

Thales
SYNAPS-V TSM Mission Module

Intracom
WiSPR intecom

Lockheed
Indago

Anduril
Altius ALE

C-Astral
Bramor UAV

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TrellisWare Waveform Interoperability

TSM 6

EAR

TrellisWare, TSM 6.2

PRC-148C PRC-170 PRC-171

THALES L3HARRIS

SOCOM STC

First Type 1 version of TSM waveform

TRELLISWARE TSM

ITAR

PRC-167 PRC-163

L3HARRIS

SBU Interoperable

WREN TSM

ITAR

(Aligning to TSM 6.2)

TRELLISWARE TSM

PRC-148D PRC-162 PRC-158 (-5) PRC-163

First WREN TSM certified HH Radio

HMS Manpacks - Fielded with WREN TSM to support SAB

Coming Q1'24

THALES Collins Aerospace L3HARRIS

KATANA

CUT THROUGH THE NOISE

ITAR

TrellisWare, KATANA 1.0

SBU Interoperable

WREN NB

ITAR

(Fielding in 2024)

PRC-148D PRC-162 PRC-158 (-5) PRC-163

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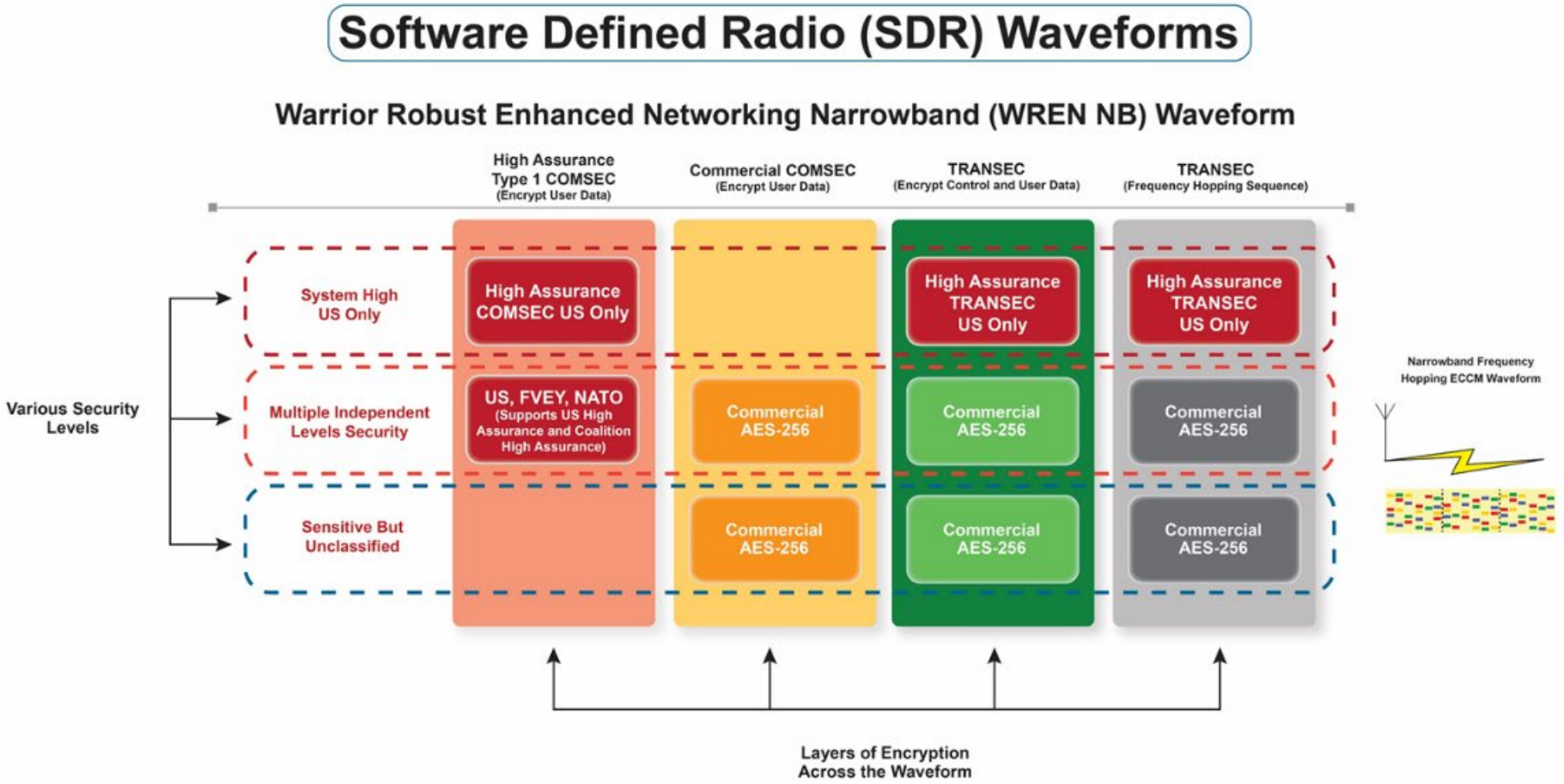
WREN: Multiple Independent Levels of Security (MILS)



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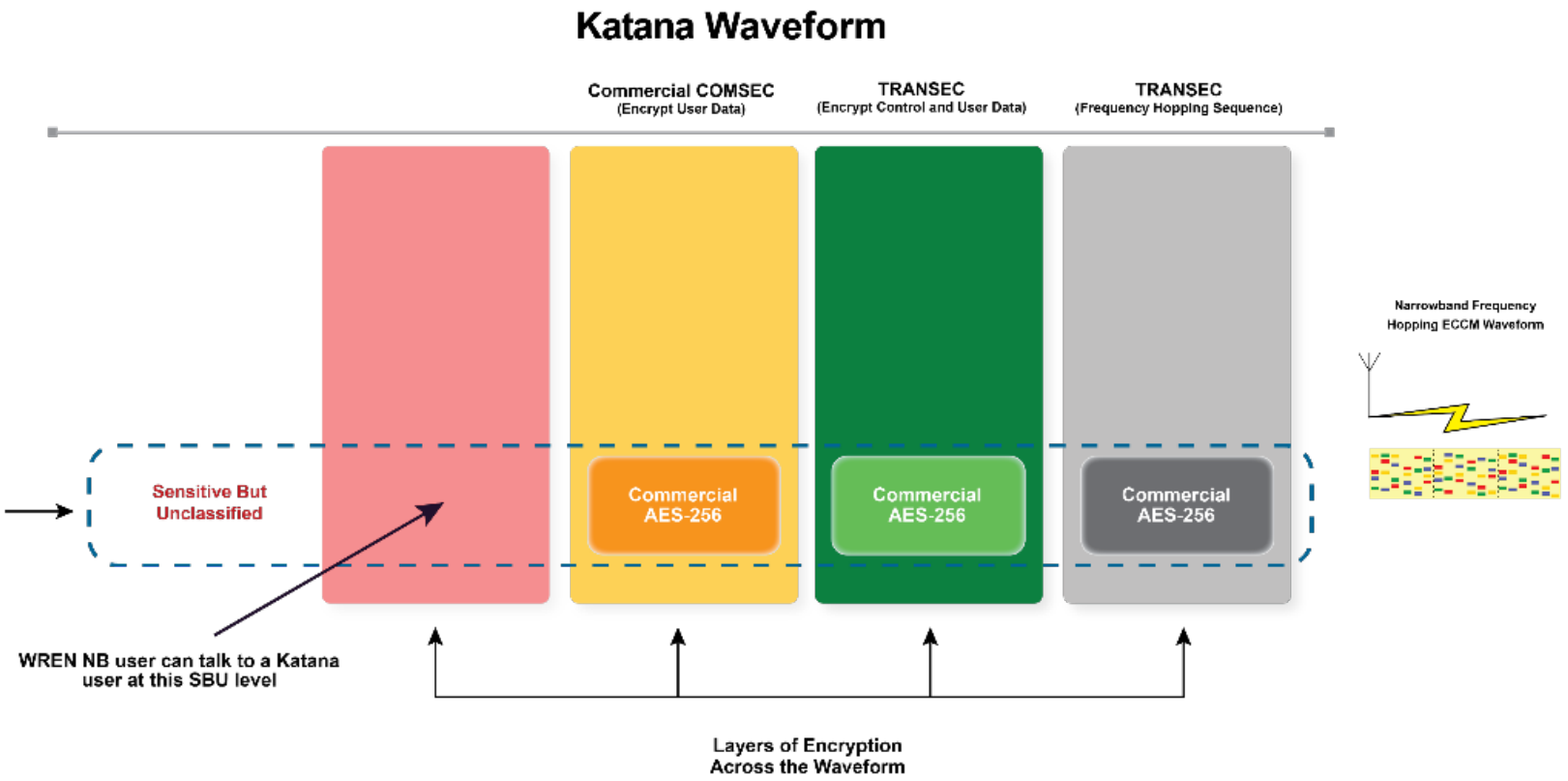
Katana: Interoperable at SBU Security Level with WREN NB

Commercial
AES-256 Security



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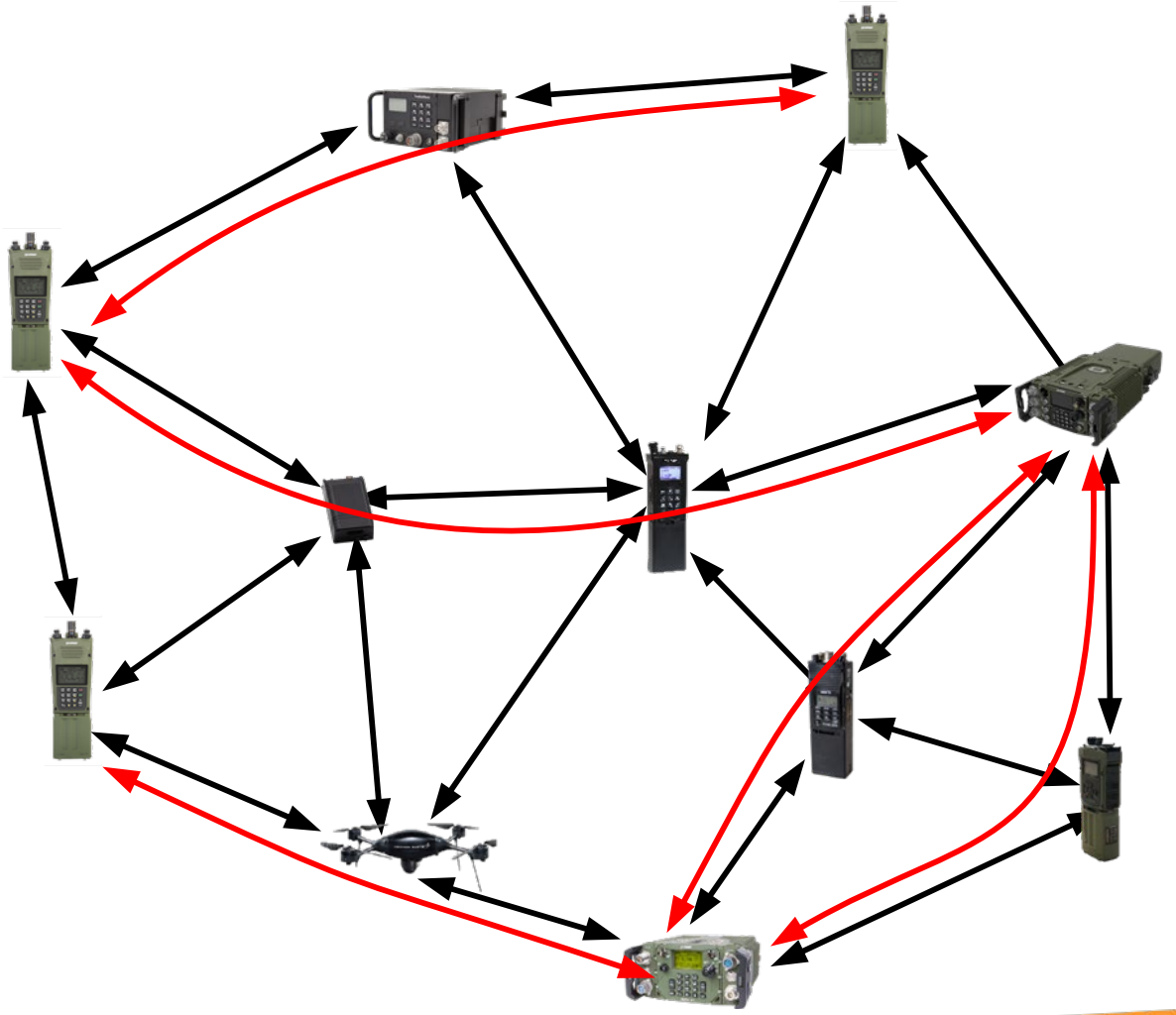
TrellisWare Eco-system Uniquely Enables Direct Interoperability

- Simplified Flat Battle Group Network
- Mixed security network: Type 1 and SBU
  - Black relay
  - Coalition communication
- Densification of Network
  - Reliability benefits
  - EW benefits
  - Requires much higher scalability
- Coalition Interoperability
  - Shared common black side interoperability
  - Form the same physical network
- Sovereign Security
  - API based interface for crypto interface
  - Can interface with sovereign crypto
- Uniquely Supported by TSM & Katana/WREN NB



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Waveform Roadmap

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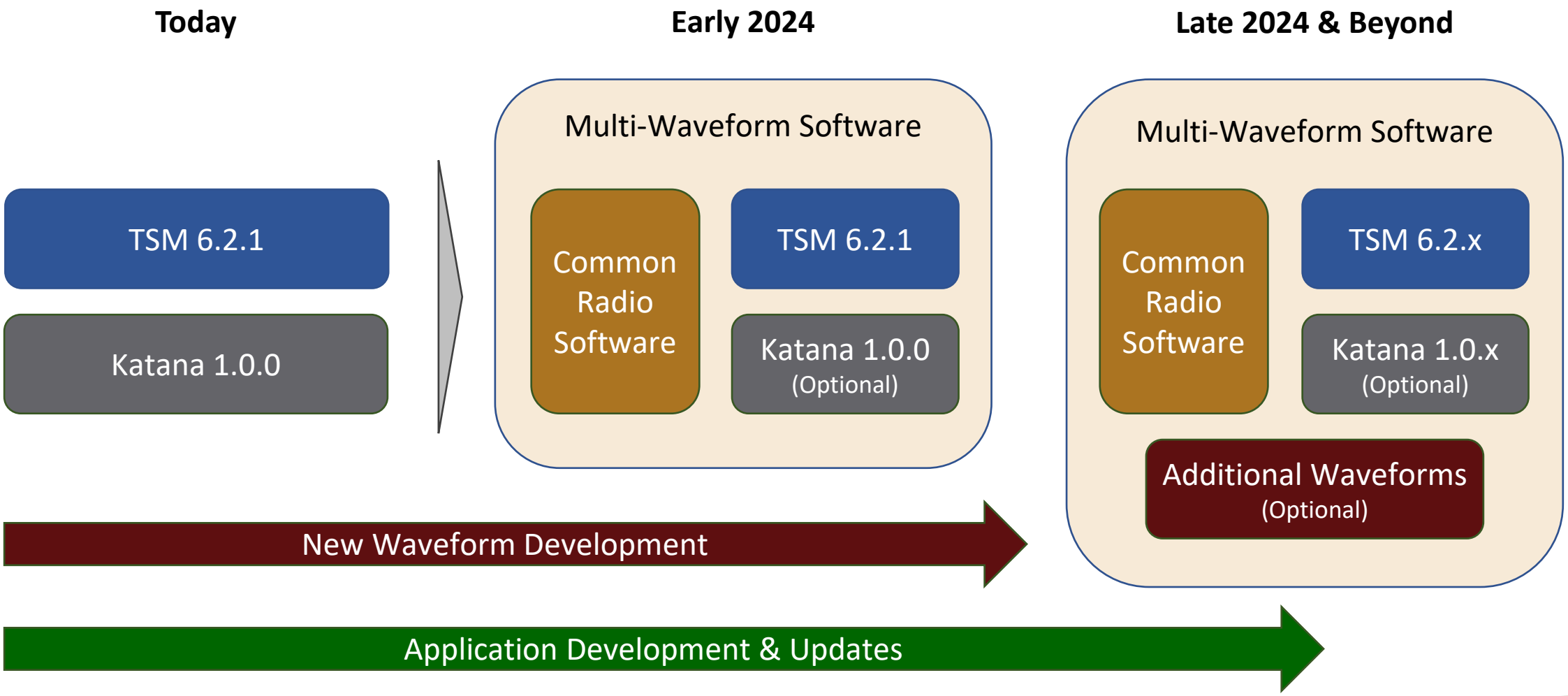
Waveform Roadmap Summary



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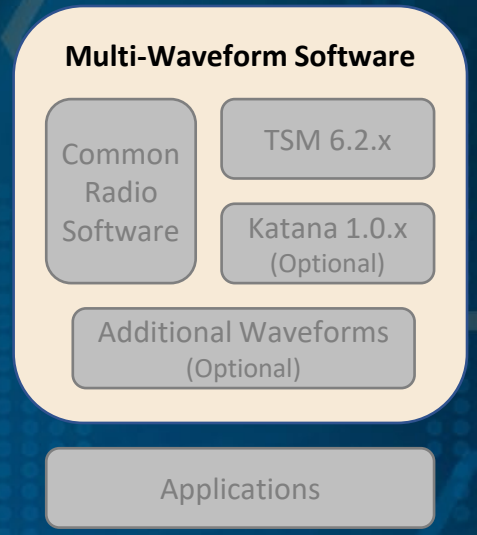
Multi-Waveform Radio Software

TSM + Katana for TrellisWare Radios



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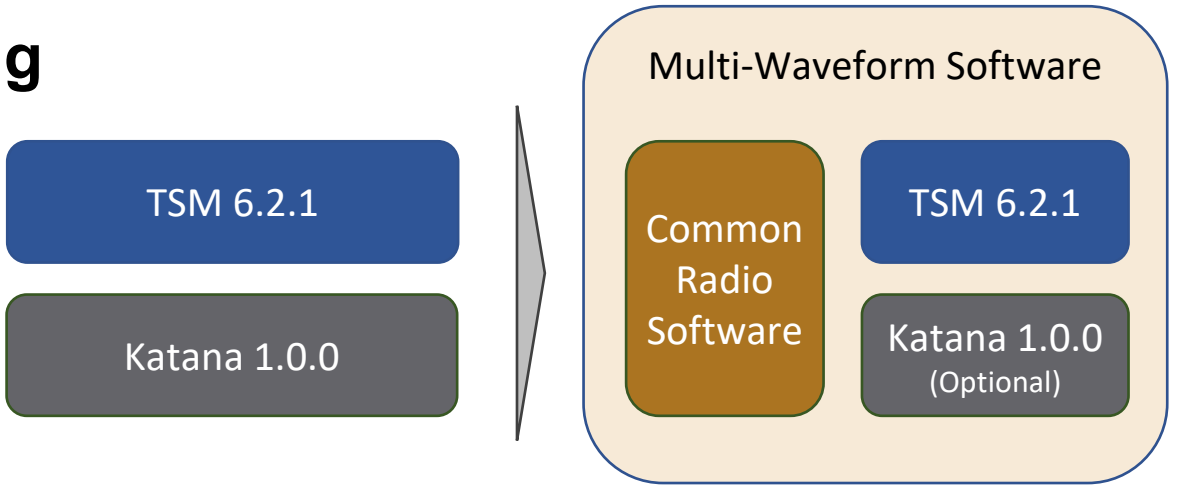
Next Software Release: “The One with Multiple Waveforms”

- **Use Katana when you need to**
- **Use TSM when you can**
- **Supports multiple waveforms in a single software install**
  - TSM 6 and Katana initially
  - More to come in future releases
- **Easy and reliable waveform switching**
  - No radio reboot
  - No software re-load



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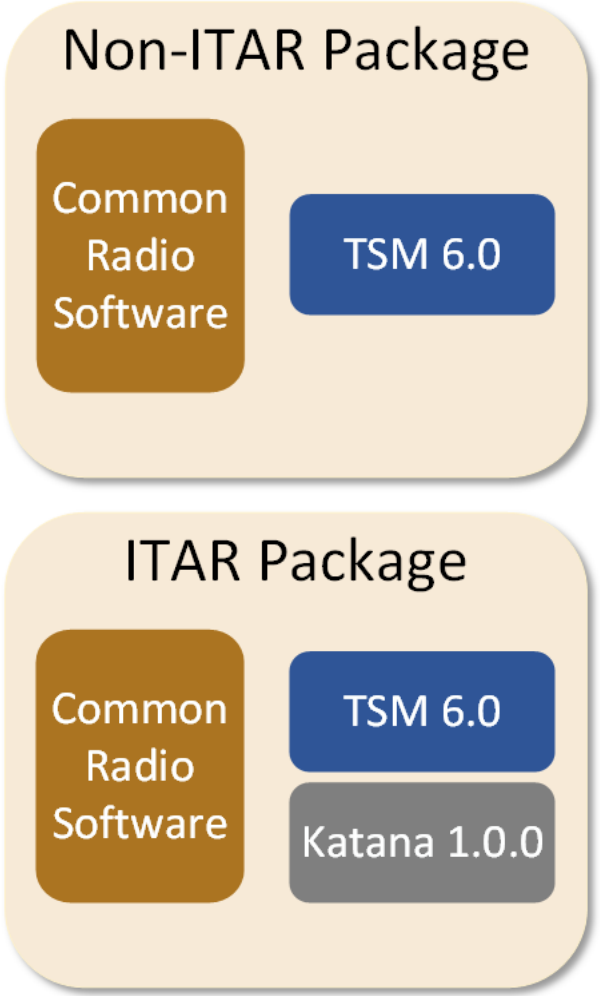
Multi-Waveform Release: Summary

- **Composed of Two Packages**
  - Non-ITAR Package = TSM only
  - ITAR Package = TSM and Katana
- **Content**
  - Wi-Fi dongle with Katana
  - Zeroize Katana presets
  - Supports Katana on all TrellisWare radios
- **Interoperability with WREN TSM & WREN NB**
  - Transmit, receive, and relay AES-256 SBU (Type-3) traffic
  - Relays NSA Type-1 traffic from partner radios



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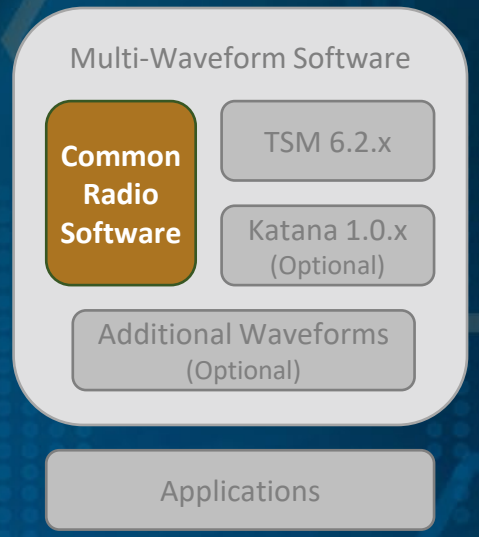
Common Radio Software Roadmap

Networking, Networking, Networking !!!

Virtual Private Network (VPN)

Wi-Fi Client Support

Type-1 Multi-Net Bridge



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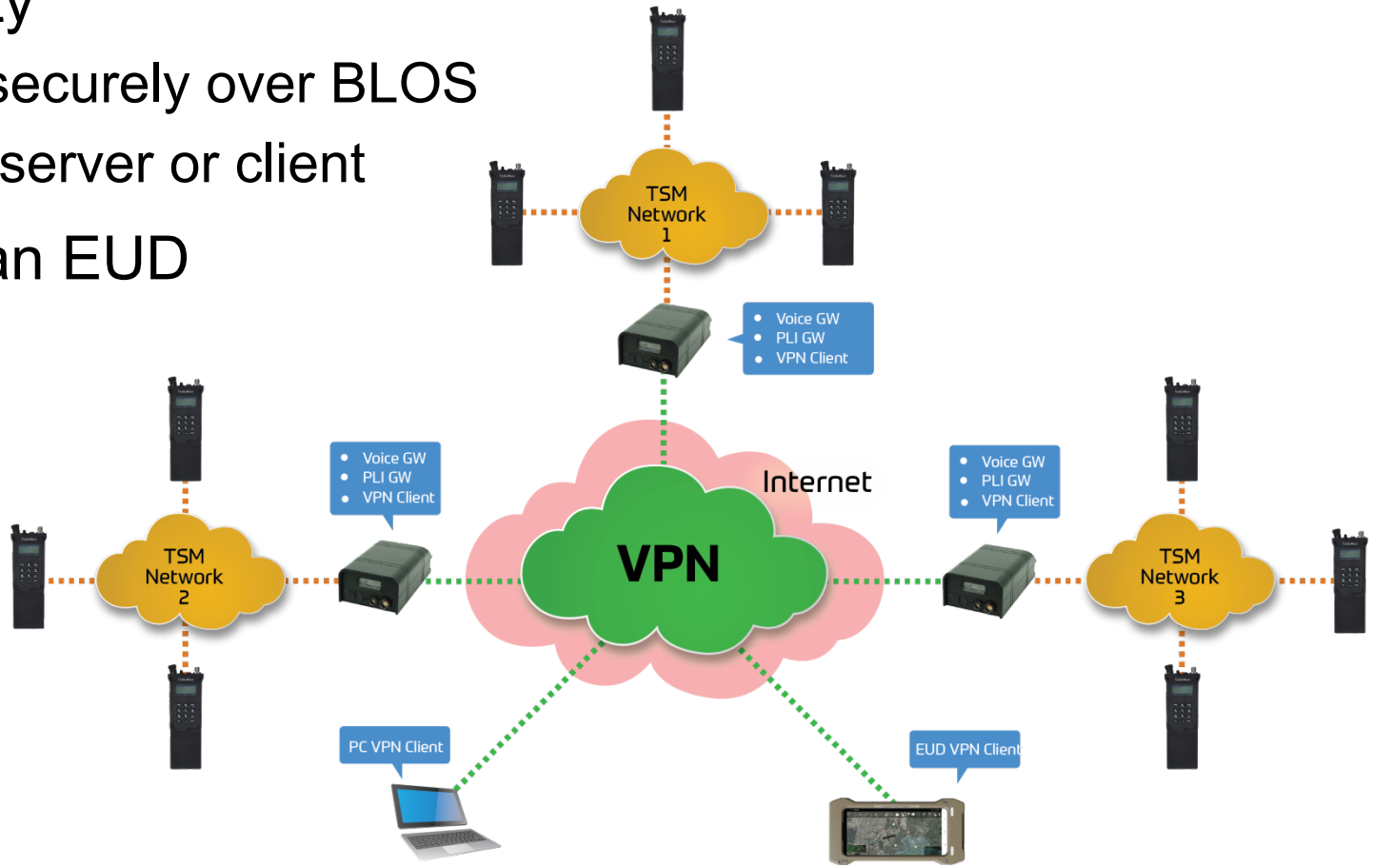
Radio Features: VPN

- Built-in secure BLOS connectivity
  - Bridge multiple TSM networks securely over BLOS
  - Radios can act as a OpenVPN server or client
- In the future, view PLI with just an EUD connected to the VPN



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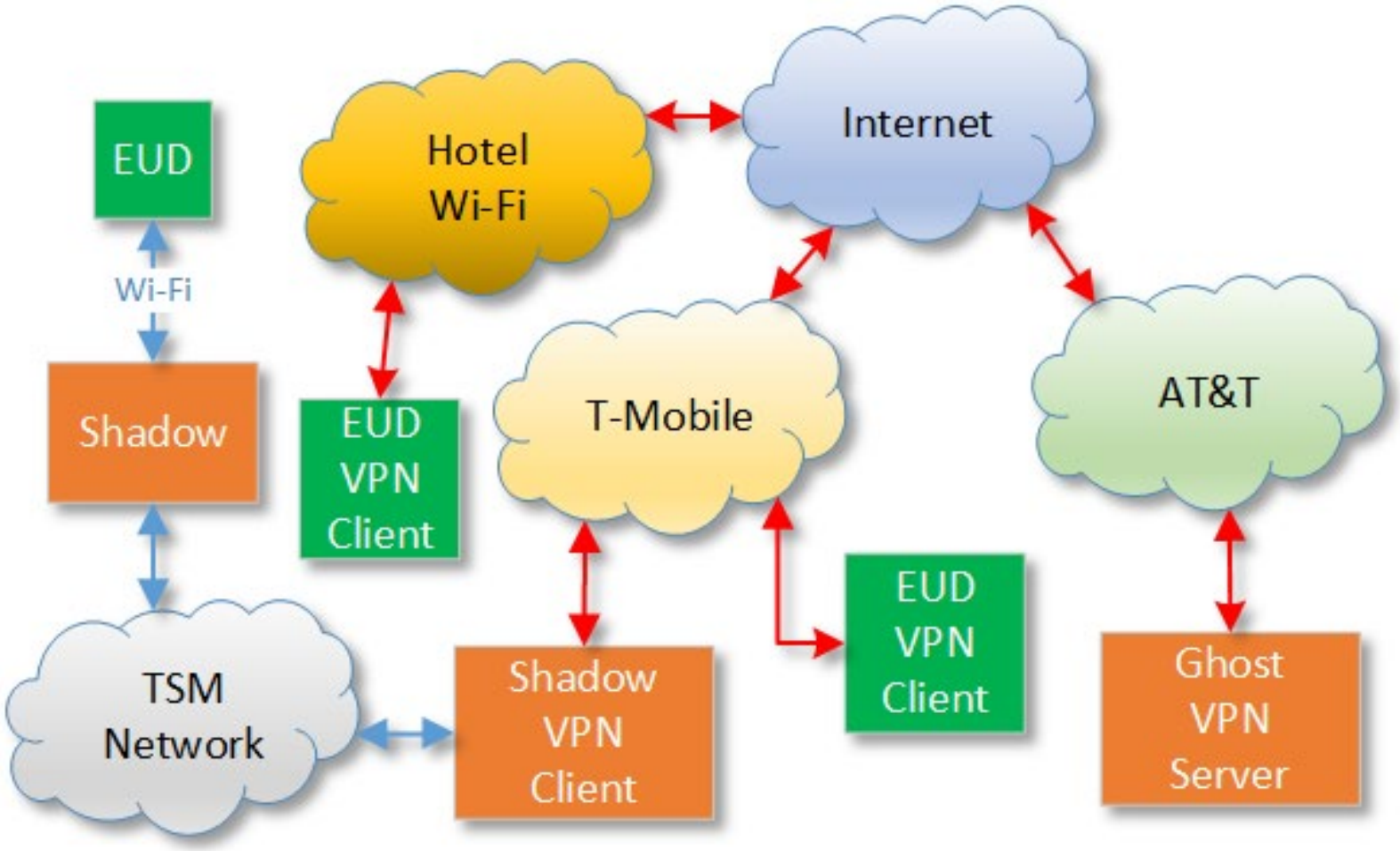
Radio Features: VPN Demo



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Radio Features: Wi-Fi Client

- Radio connects to a Wi-Fi access point
- Manage multiple radios attached to a single router over Wi-Fi
  - Preset loading
  - Software loading
- Wireless connection to a router
- Bridge TSM Networks over Wi-Fi

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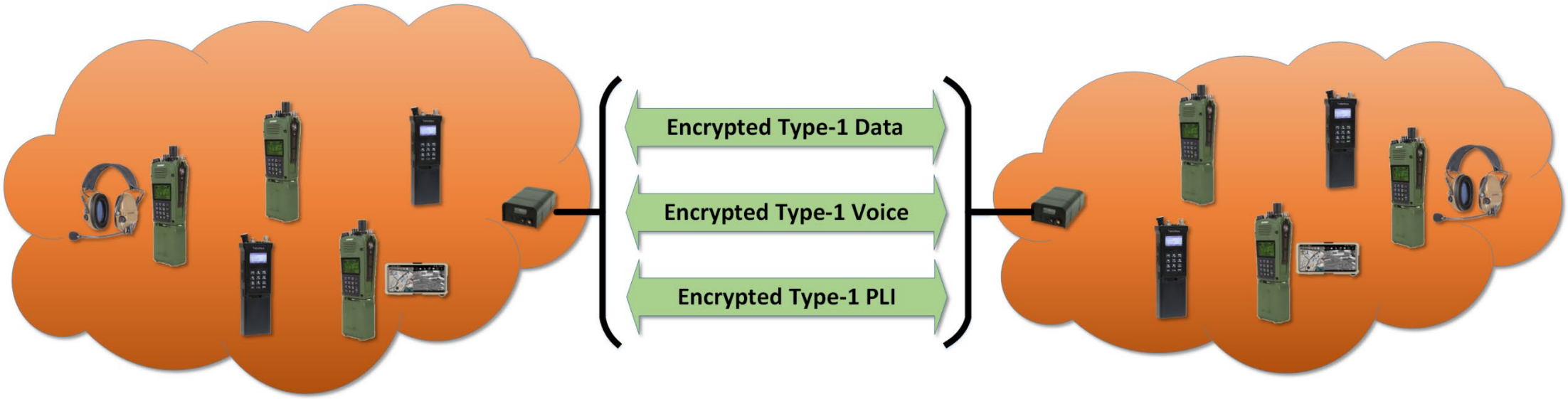
Type-1 Multi-Net Bridge



Connect Type-1 networks over MNB

Situational awareness and interaction with all your TSM networks

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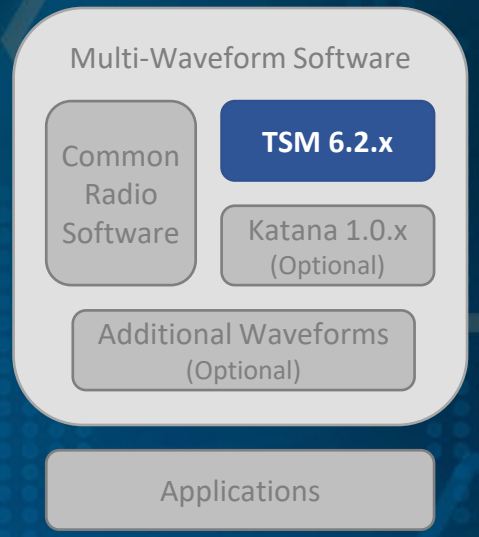
TSM Roadmap

Data Improvements

Unicast Aggregation

Low Latency



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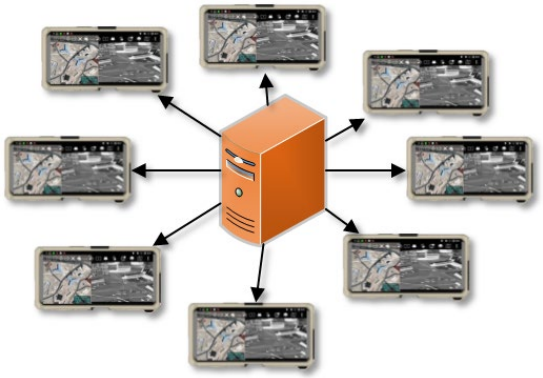
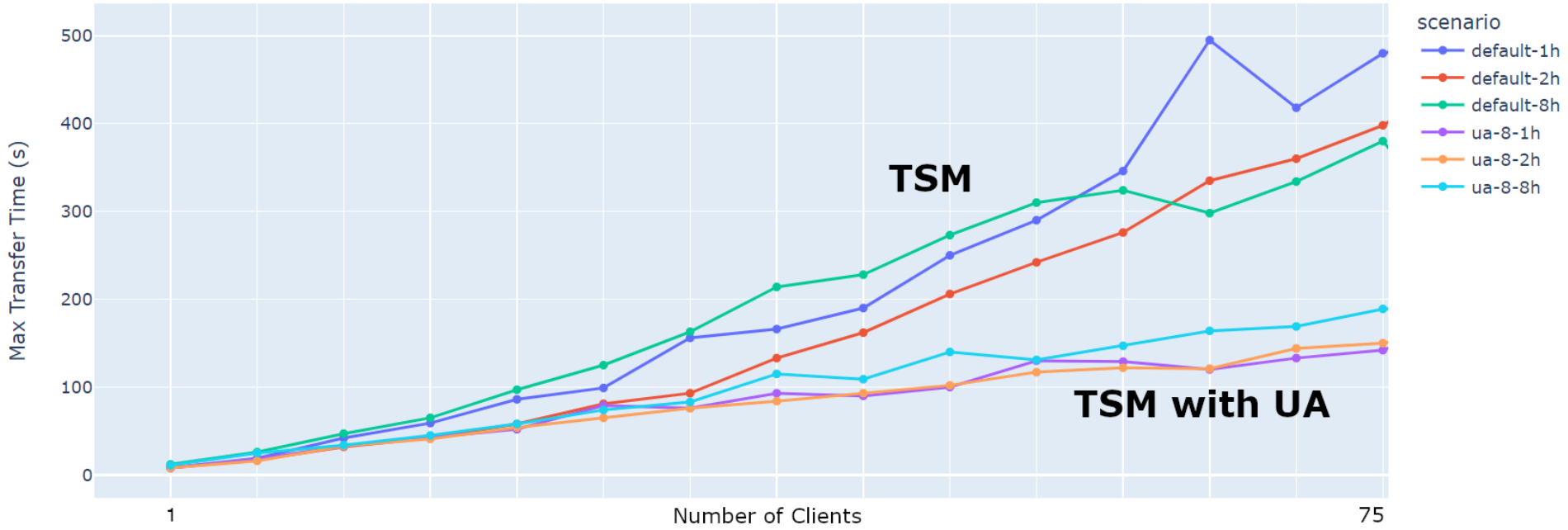
TSM: Unicast Aggregation

- **Improves one to many traffic flows (TCP server/clients)**
  - TAK Server PLI distribution
  - Mission Packages
  - FTP Transfers





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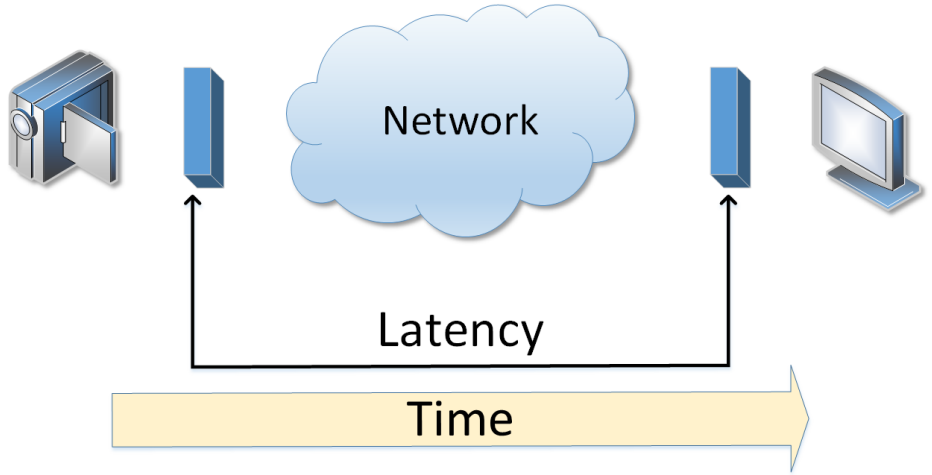
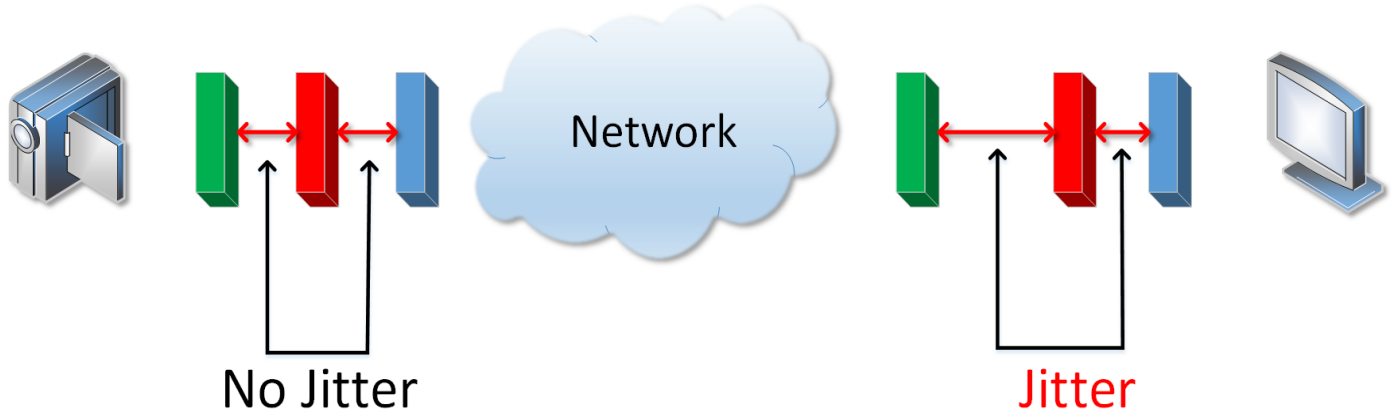
TSM: Low Latency

- Teleops, Fires
- What is latency and jitter?
- Supports < 50 ms of roundtrip latency
- Minimal jitter



- Enabled via Mission Profile
- Configured with PPR
- Supports low latency data and regular data in the same network



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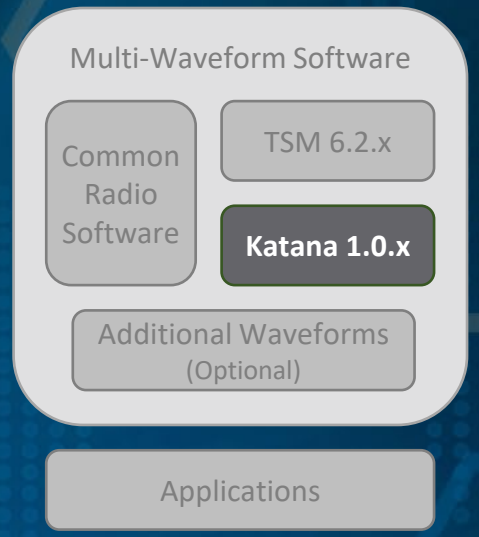
Katana Roadmap

Usability Improvements

Network Situational Awareness

New Waveform Features



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Katana Roadmap: Summary

- **Early releases were focused on waveform functionality**
- **Next round of releases are focused on usability**
  - Improved TAK integration
  - Network situational awareness
  - Improved radio management via TNC
- **While still leaving room for waveform improvements**
  - 4 hop support
  - AMR support
  - EMCON with PTT and PLI

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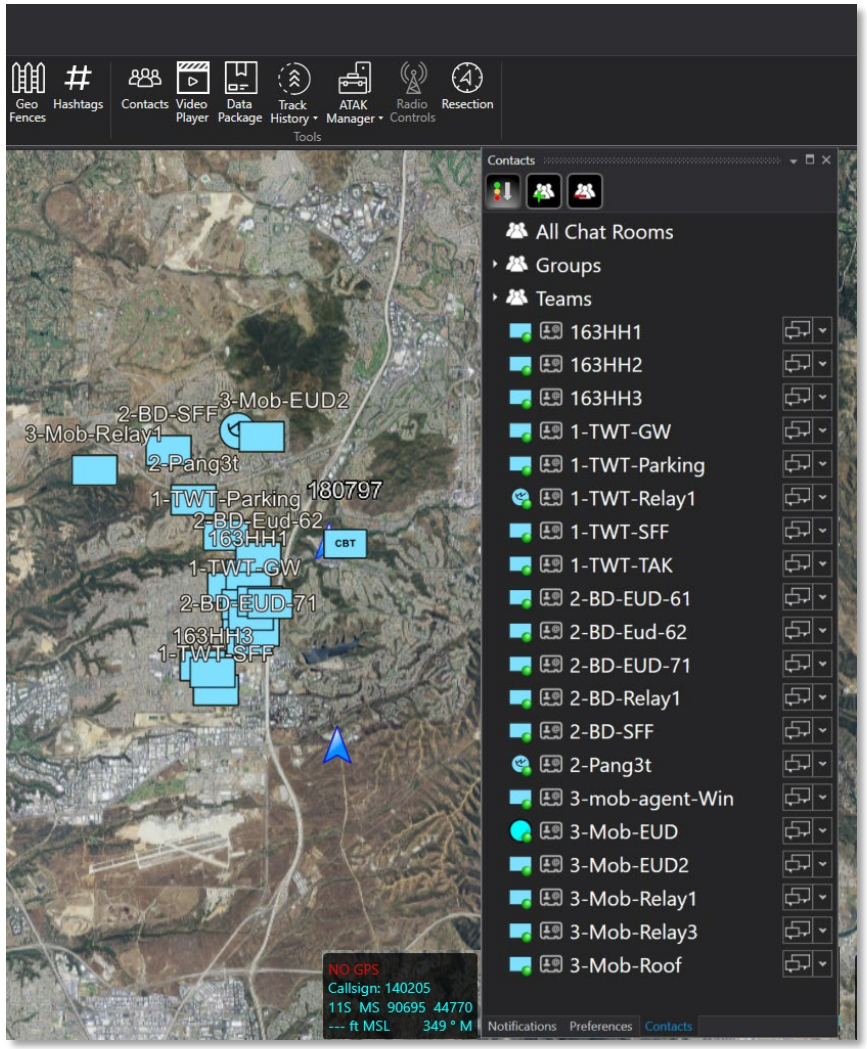
Katana Roadmap: Improved TAK Integration



- **Make it like TSM !!! Callsigns and Contacts**
- **TAK callsigns on par with TSM**
  - Allow callsigns like “**3-three**” instead of just “**33**”
- **Automatic contact list population**
  - An EUD will show up in the contact list when its PLI is received

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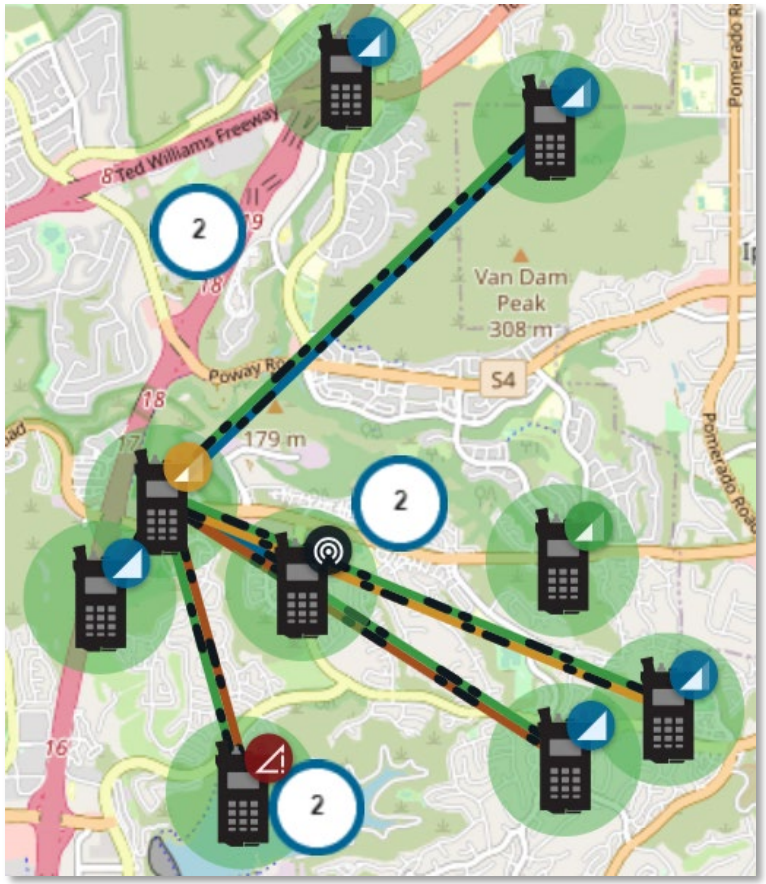
Katana Roadmap: Network Situational Awareness

- **Make it like TSM !!! Links, Noise Info and Connectivity**
- Network strength assessment
- Network planning

- Noise info to convey interference
- Links to convey radio to radio connectivity
- Network connectivity to show the impact of link strength and noise



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Katana Roadmap: Waveform Improvements

- **4 hops**
  - Increase maximum hop count to four (preset configurable)
- **AMR Voice Codec**
  - Support for the AMR codec in addition to MELPe
- **EMCON with Voice and PLI**
  - EMCON with Voice will send PLI and voice with a PTT session

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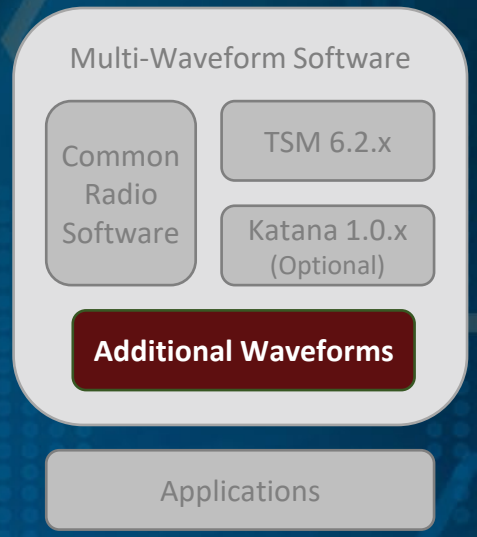
New Waveform Capabilities



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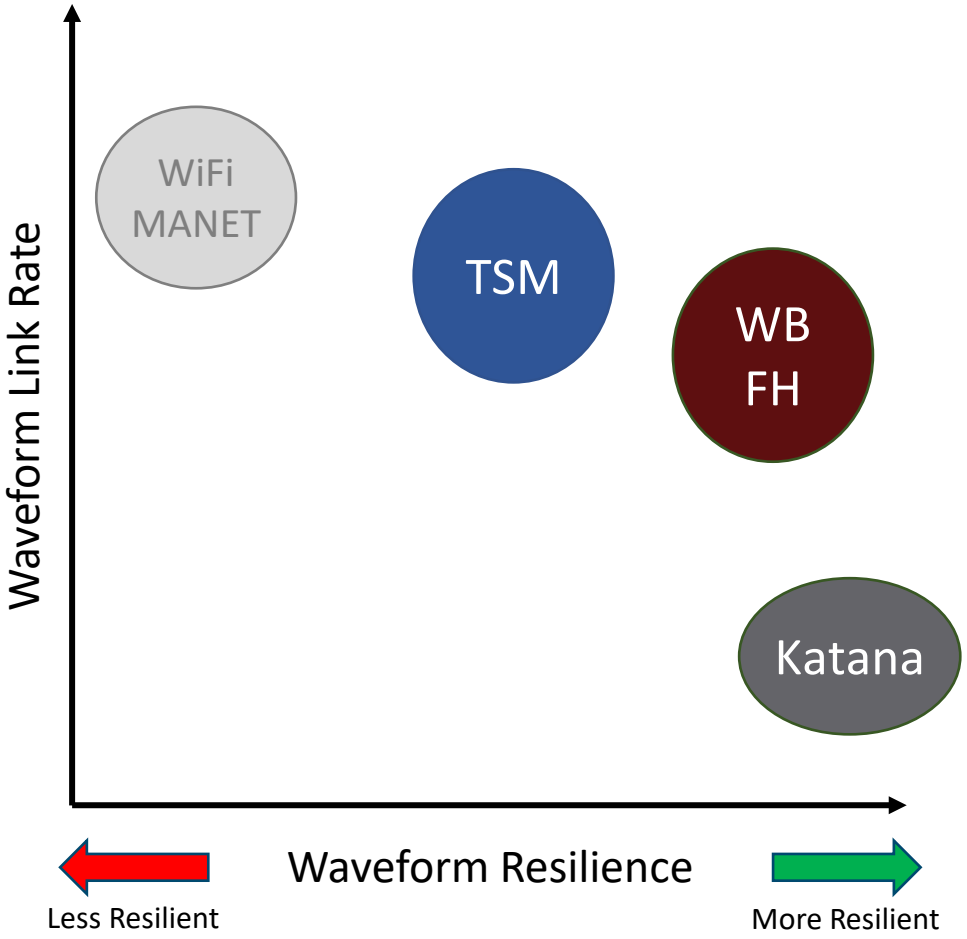
New Waveform Capabilities

- Wideband Frequency Hopping MANET
  - Builds on underlying technologies from TSM & Katana
    - Barrage Relay™ networking
    - Scalability: 800+ nodes
    - Flexibility: 1.2/3.6/10/20 MHz
    - Simultaneous voice/PLI/data/video
  - Configurable frequency hopping
    - Supports >1 GHz hopping bandwidth
    - Full frequency band support: UHF/L/S
  - Increased resilience in interference environments
  - Similar data capability as TSM



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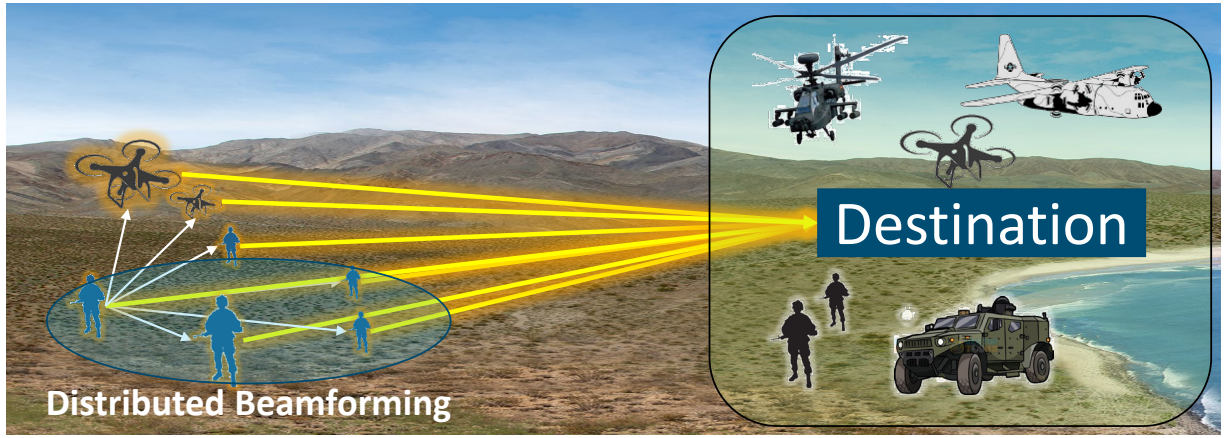
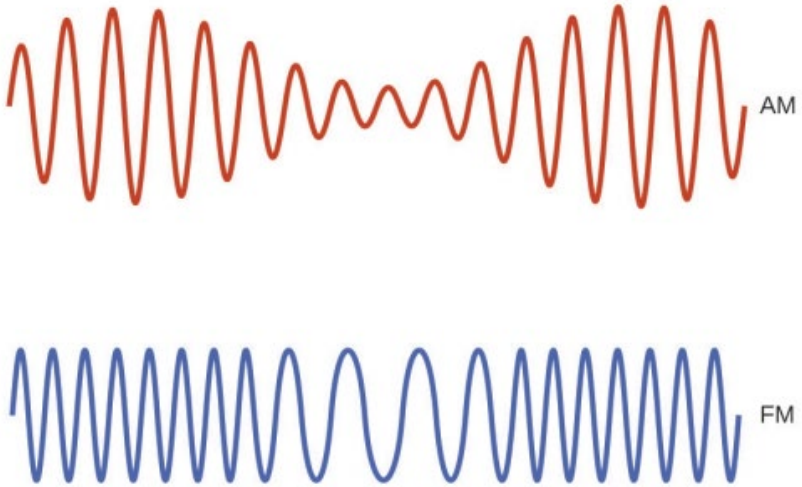
New Waveform Capabilities (2)

- Distributed Beamforming (DBF)
  - Focus combined power from multiple radios toward a selected destination



- Narrowband Line-of-Sight (NB LOS)
  - Previously available (pre-2018) capability returning
  - AM/FM Interoperability
    - 6.25/12.5/25 kHz
  - Support over UHF/L/S bands



- Low Probability Detect/Intercept (LPx)

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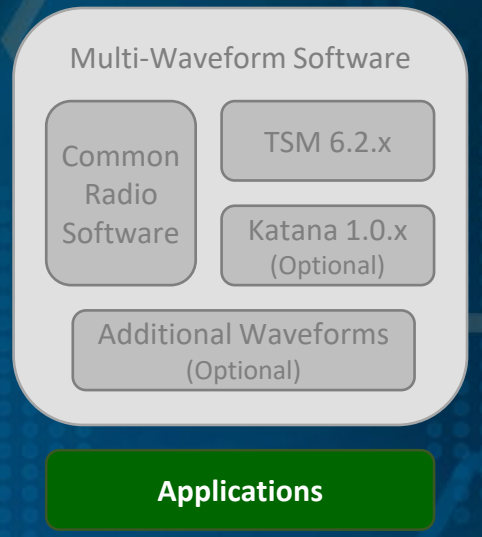
User Applications



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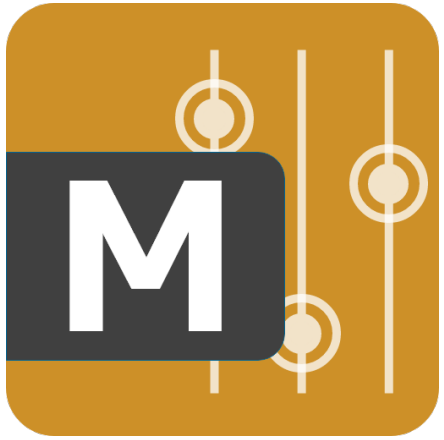
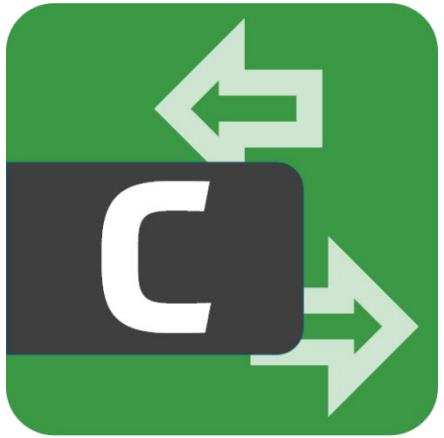
TW Application Suite

TrellisWare Network Controller

TrellisWare Management Tool



TrellisWare Connect



Software Download Tool

Data Capture Playback Tool

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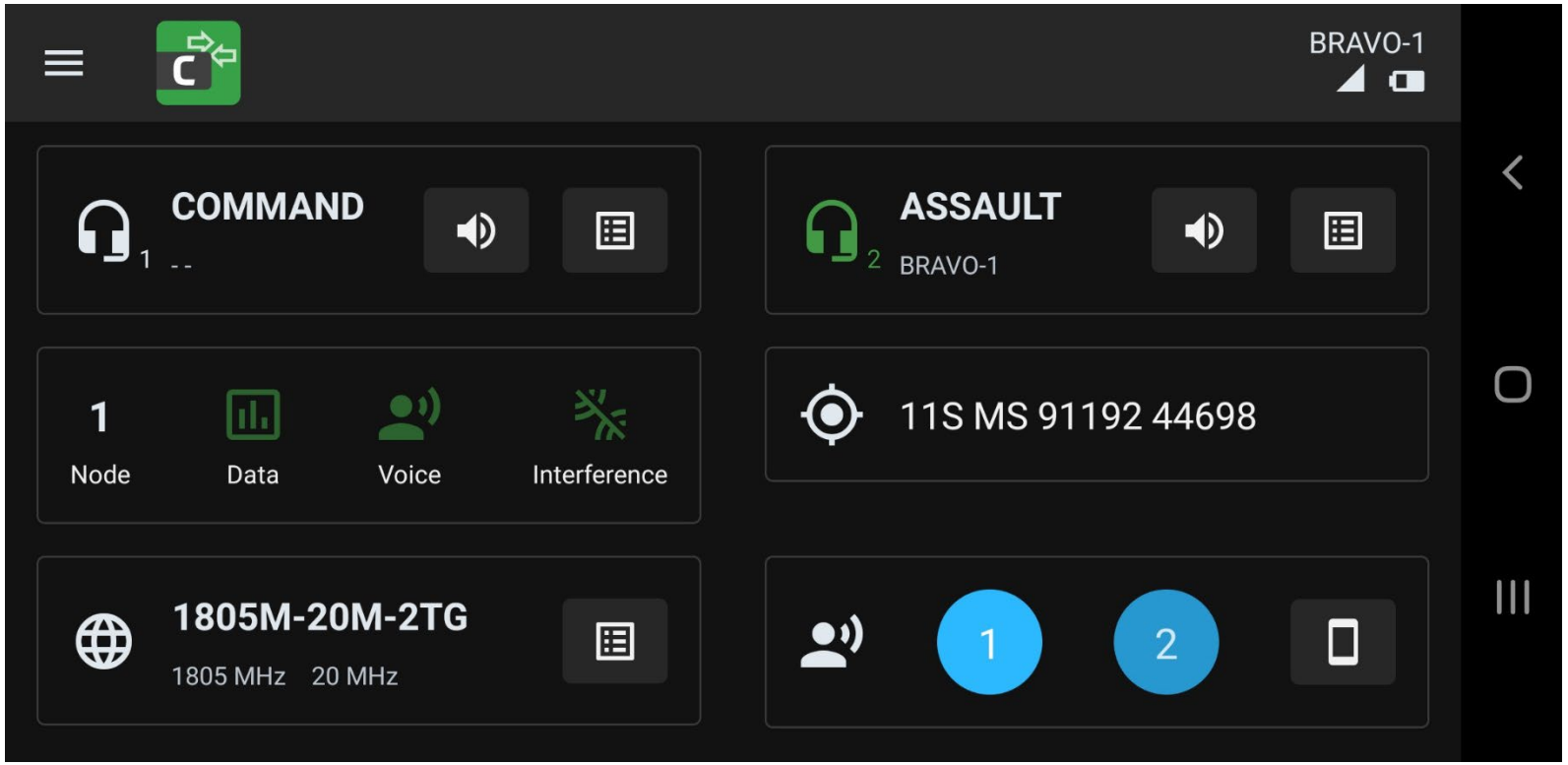
TW Connect

- Android application that allows users to control their personal radio, view limited network information, and use the Android as a PTT audio accessory for the radio
- PTT capability is overlayed in other apps like ATAK
- Evaluated and selected by a US DoD customer, fielding to occur in the coming months
- Version 1.0.0 is available on the TW Support Site



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Familiar Workflow for Easy Adoption

TrellisWare Management Tool

Software Download Tool

TrellisWare Network Controller

Data Capture Playback Tool

TrellisWare Connect

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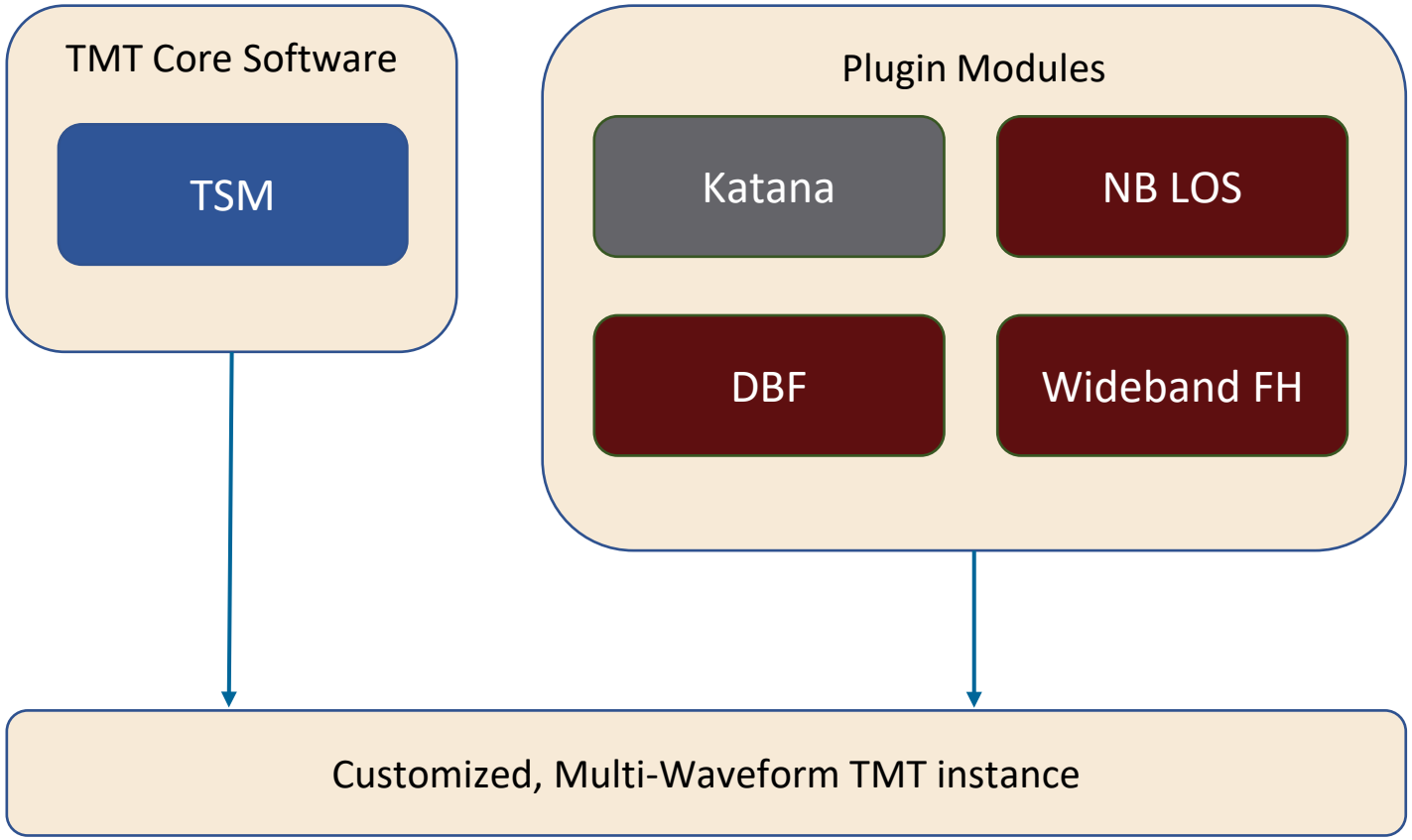
TMT - Improved Multi-Waveform Support

- TSM, Katana support exists today
- Shifting to a modular system for multiple waveform support
- Tailorable to end-user needs
- Future waveform support just requires a new plugin



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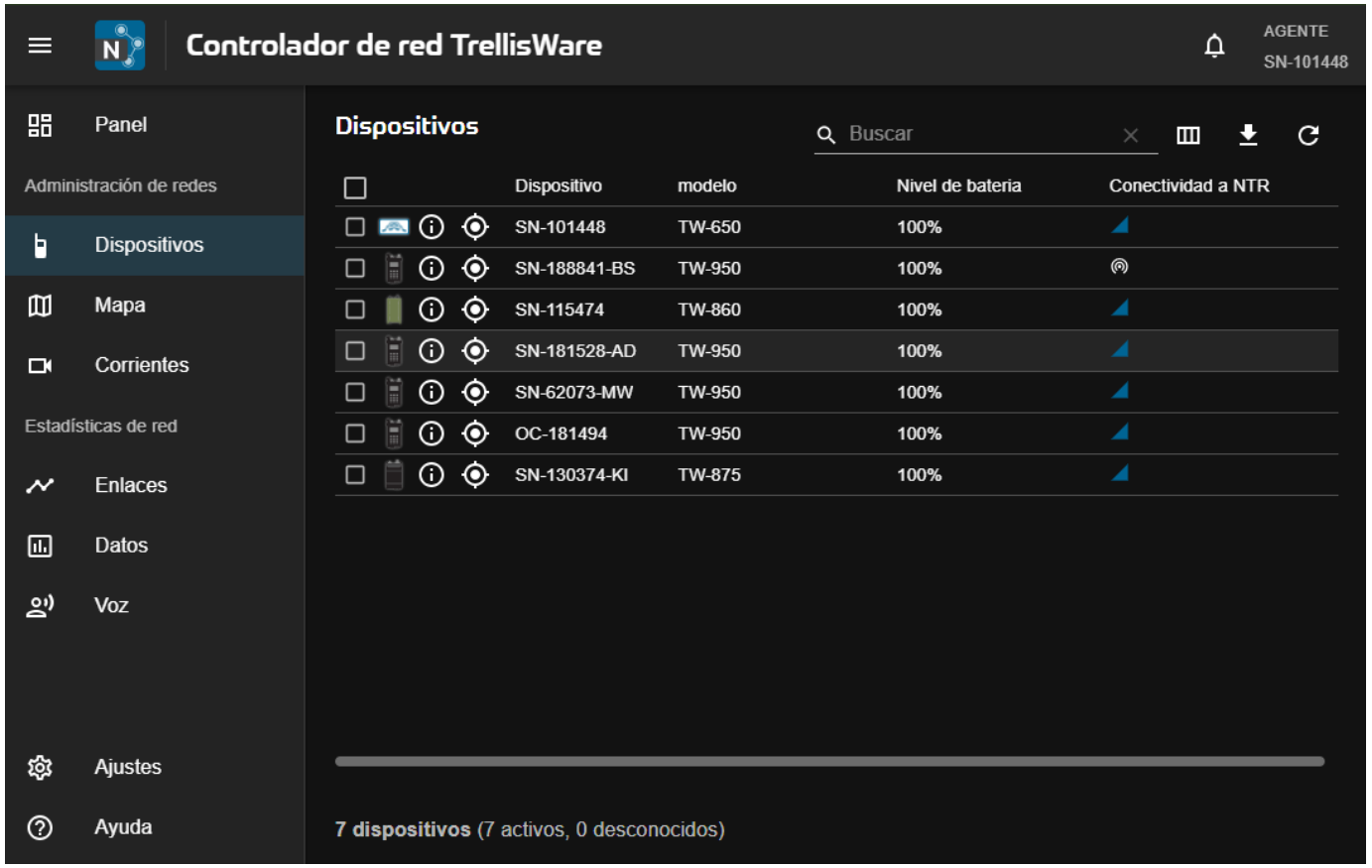
Language Support

- Expanding the supported language options within the apps beyond English
- Ideal for international customers, SOF customers working with partner forces



2023 TrellisWare Working Group

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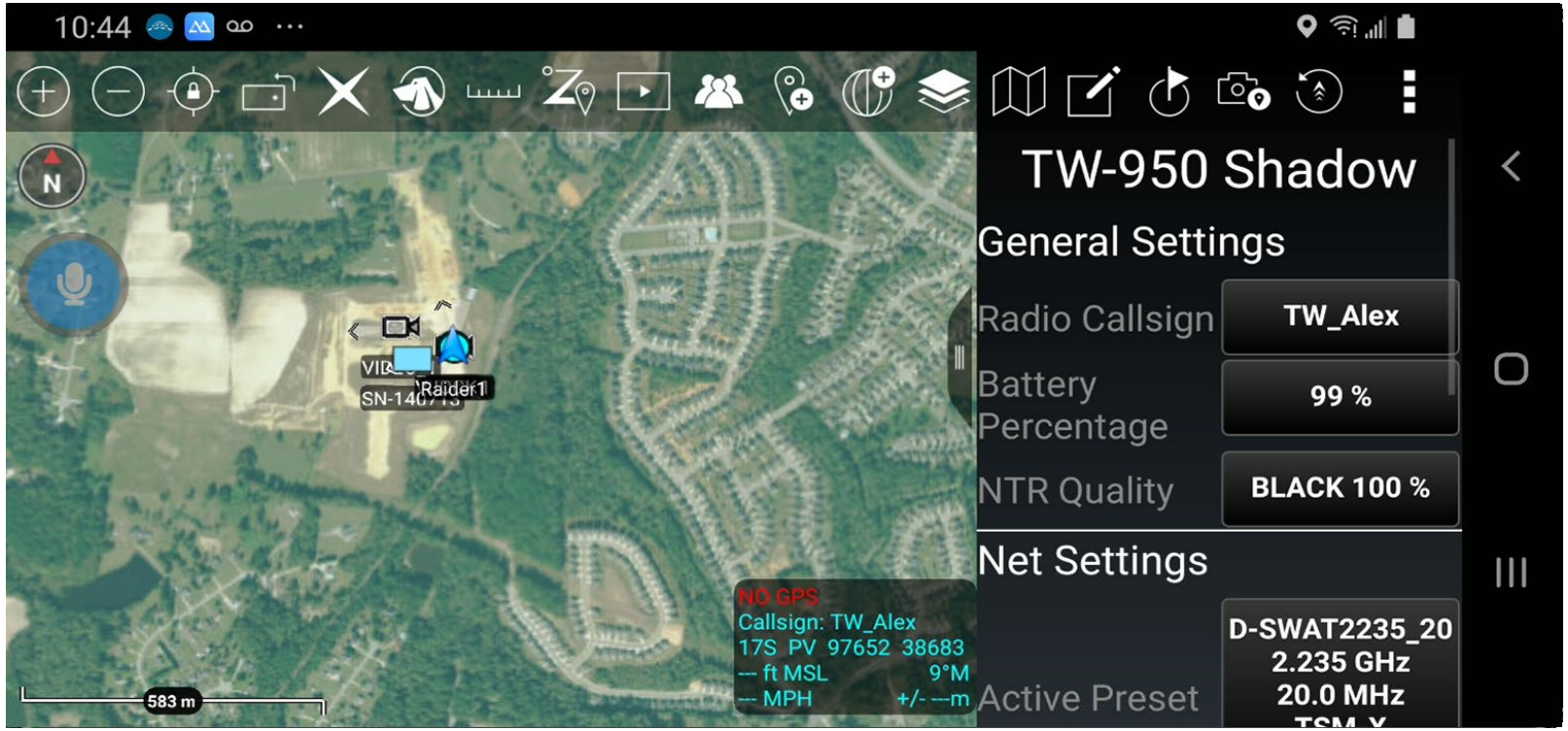
ATAK Applications

- Partnering with Aries Defense to further develop the TW Config ATAK plugin
- TW-developed prototype NORM plugin for improved file transfer over TSM and Katana



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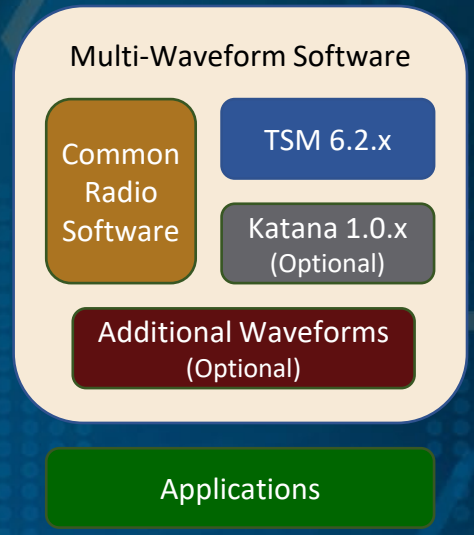
Waveform Roadmap Summary



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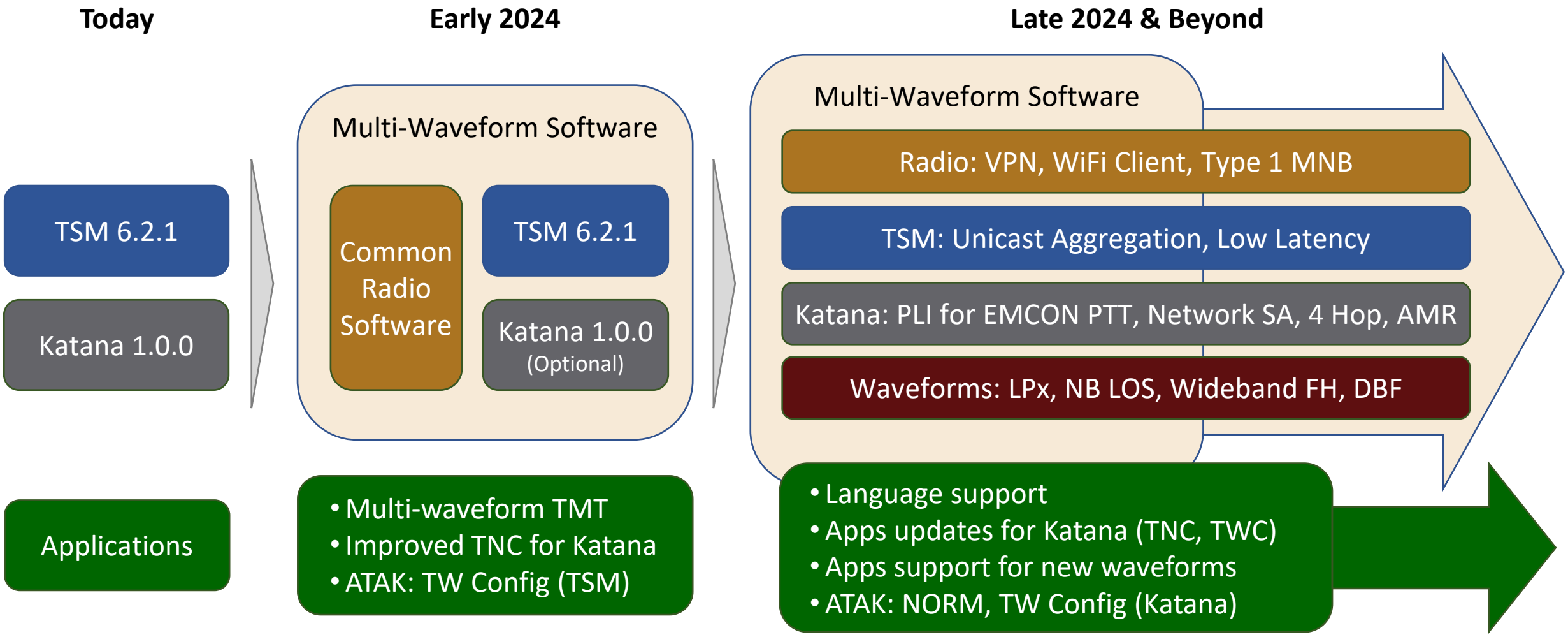

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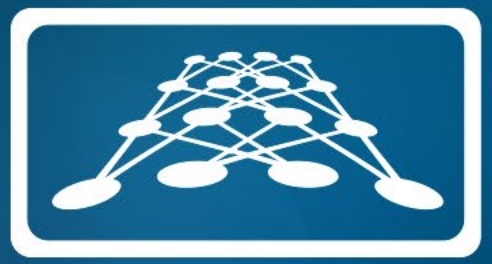
THANK YOU



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