

Cold start: Finland boosts army networking

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Key Points

- Finland is continuing its roll-out of packet switched network
- SDR networking infrastructure will enable MANET implementation

The grounds of Kainuu Brigade in North Finland are home to one of the country's three readiness formations, along with Pori in the West and Karelia in the East. The north is also home to the North Finland Signals Battalion and is the epicentre of activities surrounding the Finnish Army's tactical command, control (C2), and communications systems.



1521987 - Interior view of Command Post (CP) Module A currently under testing with the Finnish Armed Forces. (IHS/Peter Felstead)

With temperatures averaging -15° Celsius during the winter months, it is hardly a hospitable climate for electronics and communications hardware, but it provides the Signals Battalion with a realistic environment to test and deploy its next-generation C3 infrastructure.



1521988 - Exterior view of CBRN-protected Command Post (CP) Module A being tested as part of the M18 C3 system. CP Module A has workspace for up to five operators. (IHS/Peter Felstead)

For many years, the Finnish Army relied on the YV1/2 analog and digital circuit switching formation communications system to establish the tactical backbone for its Combat Network Radio (CNR) inventory as well as to provide connectivity with the national core fixed network.

YV1 has in the last decade received incremental upgrades to increase bandwidth, as well as support field Ethernet services through ATM switches at the command post (CP) level, therefore providing the first base for C2 integration.

Over time though, as commercial technologies and standards developed, the military decided to overhaul its existing systems at the brigade/division levels, but also more importantly in the battalion and below.

However, at this juncture, it was clear that YV1 could not support the transition. The world was moving from voice circuit switching to voice over internet protocol (VoIP), and from tailored to open source POSIX-compliant operating systems (such as Linux). Today, this entire legacy infrastructure is being retired as the army is rolling out the next-generation M18 IP-based packet switching system.



1521989 - Interior view of the expandable Command Post (CP) Module B under testing for the M18 system. CP Module B features workspace for up to 16 operators and has a set-up time of 30 minutes once deployed. Visible here are the communications cabinets with switching/routing and power electronics, as well as multimedia projectors and VoIP terminals. (IHS/Peter Felstead)

From a technology perspective, a digital or analog circuit switched network would transfer complete and uninterrupted streams of information between users, while in packet switching these same streams would be broken apart into small "packets", which are routed into the wide-area network (WAN) and then re-assembled at the final destination.



1521990 - Exterior view of Command Post (CP) Module B (expanded mode) (IHS/Peter Felstead)

In principle, the shift to fully digital packet switching offers benefits to the end-users in terms of information security, effective use of bandwidth, greatly increased capacity, network resilience, and greater interoperability with other military and homeland security (HLS) communications infrastructures.

An example illustrating the capability leap from YV1/2 to M18 is that the former could offer up to 1 Mb/s capacity - accommodating only voice and messaging - while M18 enables up to 40 Mb/s, with AES-128 cryptography for voice messages, data, and video.

At the core of the M18 modernisation effort is the locally developed EB Tactical Wireless IP Network (TAC WIN) by the Elektrobit Corporation. In close collaboration with the Finnish Army and the Kainuu-based Signals Battalion, Elektrobit's innovative approach introduces a software-defined network and routing infrastructure into the battlefield, enabling self-configurable mobile ad hoc networking (MANET) through an easily scalable, low capital expenditure (CAPEX) solution.



1521991 - Powered up view of the M18 Communications Trailer E module. Visible here are the Band I antenna, Multiplexing, CNR and EB Radio Head I Unit (Band I). (IHS/Konstantinos Tigkos)

In the past, the IP networking upgrades (such as CISCO switches/routers in the past decade) only focused on Brigade CP or the Core network but left much of the lower tactical echelons intact. EB TAC WIN offers the army a truly tactical IP backbone supporting the three required topologies for point-to-point high-capacity line-of-sight links (between battalion/brigade CP and above at 40 Mb/s, NATO Band IV), Point-to-Multipoint (P2MP) broadband access (at battalion level CP at 20 Mb/s, NATO Band III) and high data rate MANET (between battalion/companies/platoons at 10 Mb/s, NATO Band I), in addition to a zero-RF (radio-frequency) option for high-speed wired connectivity at rates exceeding 5 Mb/s.

The new system replaces the old style point-to-point microwave links with a resilient and adaptable broadband network, while also enabling waveform portability (such as ESSOR HDR and WNW) without the need to replace hardware.

Considering other formation communications programmes across Europe, M18/EB TAC WIN is a small footprint solution enabling the Finnish Defense Forces to connect their inventory of Elbit V/UHF IP CNRs or other commercial off-the-shelf (COTS) network infrastructure (CISCO and HP switches), while bringing more services to the end user, as well as establishing a bridging platform for commercial wireless access (WiFi, 3G, LTE, WiMAX), satellite communication (SATCOM) or fixed WAN.



1521993 - Interior view of the M18 Communications Vehicle A mission cabin showing the operator COTS workstation, VoIP terminals, VHF CNR, and EB Radio Head I/III. Vehicle A Communications node is the IP gateway to Battle Groups, as well as the VHF interface to CNR deployed with dismantled and other tactical units. EB Tactical Router is at the core of CP-to-CP data communication. (IHS/Peter Felstead)

More importantly, EB TAC WIN represents a leap in ease of deployment and set-up through smart directional beam antennas that no longer need to be aligned or pointed precisely in order to establish connectivity. The new system is also not as skill-intensive as its predecessor, making it ideal for deployment with lower tactical echelons where an engineer might not always be available. In terms of current configuration, the Signals Battalion is testing three different communications nodes with one trailer-based variant and two vehicle-mounted systems (soft-skin 4x4 and tracked vehicles).



1521992 - Exterior view of M18 Communications Vehicle A all-terrain module. Clearly visible is the Band I/Band III antennas, as well as a stowed mast for Band III/IV point-to-point and point-to-multipoint transmissions (without the antennas fitted). (IHS/Peter Felstead)

Additional work is taking place at the CP level with three configurations currently undergoing testing (Main CP level Modules A/B containerised and Tactical CP level with soft-skin 4x4 vehicles). In essence, all communications vehicle and CP fittings are similar in architecture, just varying in the number of routers or radios installed as required by mission profile.



1521994 - Exterior view of the M18 Communications Vehicle E showing the VHF, Band I, and GPS antennas. Currently the Toyota Hilux platform is used for testing purposes. (IHS/Peter Felstead)

Core components in each case include the EB Tactical Router and EB Radio Head Units. The Radio Head module would typically operate in the 225-400 MHz, 1,350-2,400 MHz or 4,400-5,000 MHz range (NATO Bands I/III/IV) and connect directly to the EB Tactical Router. The router unit itself connects with the CNR through serial/audio interfaces, with other

EB Tactical Routers through G.SHDSL field wire and with SATCOM/WAN/LAN/3G/LTE/WiMAX through dedicated gigabit Ethernet, USB, LAN, and WAN interfaces.



1521995 - Part view of the M18 Communications Vehicle E cabin with the tactical COTS workstations running the army's C2/Battle Management, as well as the VHF CNR. The M18 Vehicle E module is the main connection between Jaeger companies, Artillery batteries, logistics, and engineer companies. The vehicle is also fitted with the EB Tactical Router and EB Radio Head I (Band I). (IHS/Peter Felstead)

With the addition of GPS I/O, the Tactical Router also provides for easy integration with existing C2 systems and as the army demonstrated with its dismounted or vehicular battle-management system (BMS), a cost-effective solution could be straightforward to implement using COTS workstations (Panasonic Toughbook handheld and vehicular mounts), mission software, and EB TAC WIN as the foundation.

The potential pool of applications through a scalable and resilient system such as EB TAC WIN is immediately apparent even outside the traditional tactical networking scope at battalion/company levels.

At first sight, it does offer much-improved connectivity between the Jaeger companies, artillery/mortar units, logistics and engineering companies, but a more detailed analysis suggests that it could also easily be used as a tactical edge in disaster response scenarios.

Other possible deployments involve forming the communications backbone for electronic warfare and other sensor networks (such as in border control) or even ship-to-shore transmissions. The system is interoperable with IP-based transceivers produced by other vendors and can relatively simply plug into civilian cell/basestation infrastructures making integration of TAC WIN into existing networks a straightforward approach to international upgrade and retrofit markets.