Can Commercial IEEE 802 Technology Be Leveraged to Develop Network-Enhanced Telemetry for the T&E Community?

By G. Derrick Hinton

Military test and evaluation (T&E) data communications (that is, telemetry) focus on point-to-point transmissions. Large quantities of telemetry data are broadcast from a test platform to a ground test center over a one-way datalink. In fact, even range destruct (uplink) and time-space-position information (TSPI) tracking (downlink) are point-to-point communications.

The Central Test and Evaluation Investment Program (CTEIP) is reengineering telemetry by creating a telemetry network that will enhance the traditional point-to-point telemetry link with bi-directional platform-to-platform and platform-to-ground data transmissions. It is envisioned that this network could, in time, support other range datalink functions, to include TSPI and target control.

Because the T&E application is a small market, there is little incentive for industry to invest in new technology to develop this T&E network. Instead, the test community must capitalize on the vast investments in commercial and military wireless technology products. For example, a common commercial technology is WI-FI, which is part of the family of IEEE 802 wireless technologies.

The IEEE 802 LAN/MAN Standards Committee develops Local Area Network (LAN) standards and Metropolitan Area Network (MAN) standards. The standards are primarily for the lowest two layers (that is, the physical and the link layers) of the International Standardization Organization (ISO) reference model for the Open Systems Interconnection (OSI). The most widely used standards are for Ethernet, Token Ring, Wireless LAN, as well as for the growing IEEE 802 series of wireless standards.

The IEEE 802 committee coordinates with other national and international standards groups, where some standards have been published by ISO as international standards. The primary active IEEE working groups involving wireless technologies include: IEEE 802.11 LAN; IEEE 802.15 Personal Area Network (PAN); IEEE 802.16 MAN; IEEE 802.20 Mobile Broadband Wireless Access; and IEEE 802.22 Wireless Regional Area Networks. These working groups have corresponding standards that are represented in *Figure 1* in terms of intended mobility versus data rates.

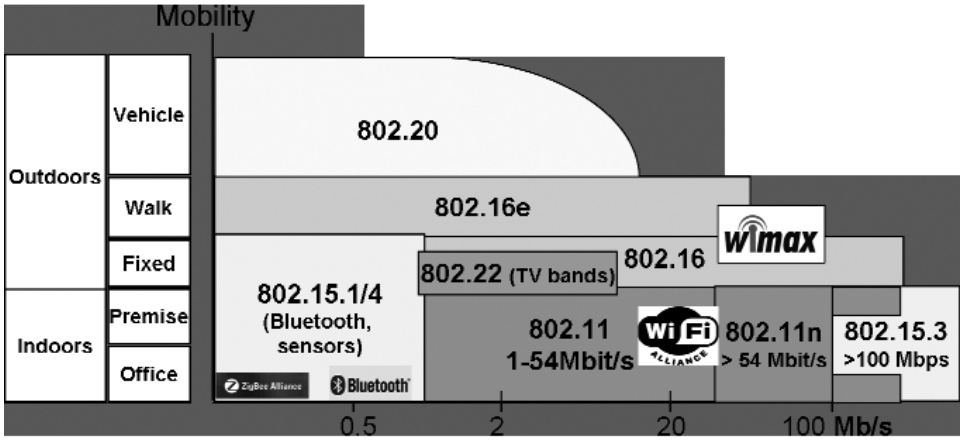

Figure 1. IEEE working groups' corresponding standards in terms of intended mobility versus data rates

Data rate

Because of the growing need to have interoperable ranges, the Department of Defense (DoD) must develop its own wireless (W) standards or adopt the prevailing IEEE 802 wireless standards to meet some of its most challenging requirements and to ensure the required level of quality of service. To investigate the feasibility of IEEE 802 technology for T&E applications, the CTEIP sponsored the 2-Way Robust Acquisition of Data (2-RAD) demonstration, which was conducted by the U.S. Army's Yuma Proving Ground (YPG) and the Johns Hopkins University's Applied Physics Laboratory (APL).

YPG has been using commercial off-the-shelf (COTS)-based 802.11b in wireless mesh architecture, probably the first use of this technology at very long ranges. The YPG WLAN is shown in *Figure 2*.

The backbone nodes (1 watt into an 11 dBi omnidirectional antenna) can theoretically be separated by a line-of-sight distance of 70 km. This radiated power level is only slightly beyond the indoor Federal Communications Commission (FCC) regulation for 802.11. One of the challenges of the 2-RAD program was to demonstrate that COTS-based 802.11b technologies could still operate in a high Doppler environment. A proof-of-concept test was completed with a 2.75" rocket, where the physical rate in-flight was measured to be the usual 11 Mbps.

Due to the success of programs such as 2-RAD, CTEIP intends to leverage the IEEE 802 technology (and other networking technologies) in executing the integrated Network-Enhanced Telemetry (iNET) program, which will augment conventional point-to-point telemetry with a network architecture. The iNET systems engineering approach will evaluate the feasibility of supporting other datalink range functions, to include TSPI, destruct and target control. Network-enhanced telemetry should provide for safer test programs that deliver better weapon systems in less time and at lower cost. ❑

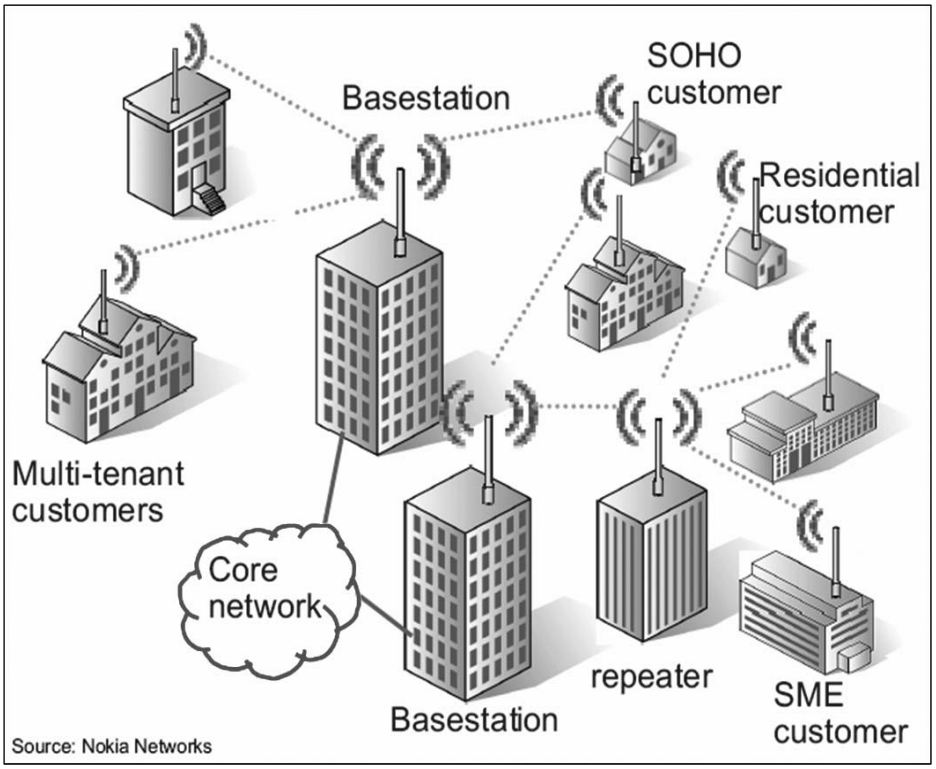

Figure 2. The Yuma Proving Ground WLAN

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