IP Systems in Netcentric Warfare

*Commercial software and equipment have become available that facilitate the creation of net-centric applications for military use, allowing mobile units to maintain consistent logical addresses for easy communications.*

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The Military’s trend toward net-centric operations – linking field resources together using Internet Protocol (IP) based networking – requires that ruggedized IP nodes and servers be available for constructing the network. Further, these units must be portable and capable of utilizing many different communications channels. Fortunately, a commercial off-the-shelf solution to mobile networking has arisen that provides rugged IP networking elements for mobile applications.

The US Military sees net-centric operations as a compelling mechanism for coordinating diverse resources in field operations. Using IP-based communications, virtually every vehicle, plane, and soldier becomes a node in the network and can share data. This massive data sharing could allow field and strategic commanders to obtain real-time situation awareness for tactical planning, give deployed units immediate access to intelligence information, and allow the tracking of both troop and enemy movement across an entire battlefield. It would also allow for direct, secure voice over IP (VoIP) between any two members of the network despite differences in the communications platforms being utilized.
Motives for Netcentric Design

- Seamless delivery of real-time situational information to the warfighter to save lives
- Need for deployment of updated technology to troops in war zones
- Unite Joint Force’s networks to protect and save lives
- Need for innovative integration approaches to link legacy equipment with leading edge technology

Benefits of Netcentric Design

- Reduce the risk of entry into unknown areas of combat
- Improve Military Netcentric Operations
  - Information Situational Awareness (Blue Force Tracking)
  - Need for Secure Communications (Red/Black LAN)
  - Infrastructure for Mobile Networks to support Joint Force command and control on the move
- Timely delivery of mission critical information to warfighter
- Integration of legacy communications equipment

Networking equipment that can meet the demands of battlefield deployment must satisfy several criteria, however. One is that it must be rugged; able to handle temperature
extremes as well as severe mechanical shock and vibration. Another is that it be portable; both space and weight are significant concerns in military equipment. The equipment must be compatible with a wide range of communications platforms, including wire-line, spread-spectrum RF, optical, and satellite links. Finally, to meet the budget constraints of the modern military, the equipment must be based on commercial technology. As a result, the distinctive advantages of PC/104 - its compact size, PC compatibility, strong vendor support, stackable design, low-power requirements, environmental durability, and simple maintenance – make it an ideal foundation to mobile IP networking.

Integration of Communications

The Mobile IP specification allows for a mobile node to roam across multiple local networks while maintaining continual communications with and a consistent IP address for the wide network. This attribute greatly facilitates communications among nodes by giving each node a unique address that does not change with movement and preventing the continual breaking of and need to re-connect links between nodes. The mobile node thus can roam seamlessly across networks, effectively behaving as though stationary.

The creation of the Mobile IP specification allowed Cisco Systems to develop the Cisco 3200® Series Wireless and Mobile Router for mobile applications. Cisco 3200 Series Routers run Cisco IOS® Software and allow the networking of multiple wireless devices running any variety of communications links. The routers, for instance, can tie nodes using cellular telephony, WiFi (802.11 Ethernet), and satellite communications into a single network. The nodes are free to roam anywhere these links provide coverage, switching links as needed, without losing their unique IP address.

Ruggedized Mobile IP
Another step in enabling ruggedized IP communications came when Parvus packaged Cisco’s 3200 MAR PC/104 modules in an enclosure designed for the hostile environment that equipment faces in military installations. This ruggedized Mobile IP access router, the DuraMAR, is based on PC/104 stacking architecture and includes an internal 150W
power supply that accepts a wide range of input DC and provides isolation against voltage spikes and transients.

Because a router by itself is not enough to provide a network link, the DuraMAR features a distributed architecture that enables the connection of peripheral devices to provide the radio and other communications links as well as end user nodes. The DuraMAR uses Power over Ethernet (POE) and Power with Serial (PwS) to supply power to these peripherals, otherwise known as “nodes”, simplifying their installation and use in a variety of configurations. A DuraMAR node can be a long-range communications channel to the main network, a LAN controller for creating a local wireless network, or a piece of peripheral equipment that needs a network connection.

Military Applications
The availability of COTS-based ruggedized mobile IP networking opens a wide range of possibilities for military applications. For example, the DuraMAR is being deployed aboard Blackhawk helicopters for equipment monitoring and secure communications using IPSEC and other encryption modes. Shipboard, aircraft and ground vehicles are also being fielded. Other potential applications include:

- A vehicle such as a HumVee can be outfitted to provide a mobile WiFi hotspot for field communications. This gives human-transported field equipment the opportunity to use WiFi as its basic link and connect to the network through satellite or other long-range links the vehicle may be offering.
- Aircraft can use VoIP for voice communications with central command, utilizing whatever radio links it currently has available. The need to break communications to switch channels or to another type of equipment is eliminated.
- Central facilities can use the network to monitor the status of field equipment in order to provide just-in-time support as needed, such as scheduling refueling for vehicles and aircraft.
- Remotely piloted and autonomous surveillance vehicles can broadcast their data to the network, allowing field troops to access real-time intelligence about battlefield conditions.

With its modular architecture, PC/104 enables the use of application-specific functionality such as a wireless modem, Ethernet switch, WiFi interface, or MIL-STD-1553 interface card to create a distributed architecture for mobile networking that supports a wide variety of applications.

Because all equipment connects together over the IP network, it does not have to have to be directly compatible. Thus, the Parvus Zypad Wearable PC or WiFi laptop can serve as the communications instruments connecting commanders to field troops, regardless of the type of radio being used in the field as long as each can connect to the network in its own way.
Eliminating the need for direct compatibility also allows ruggedized mobile IP networking to support legacy systems by creating a bridge device. Systems using buses such as CAN, 1553, and LonWorks can then connect through the IP network, reducing the need for cabling and extending the useful system lifetime. Connection through the mobile IP network also extends the legacy system’s flexibility in terms of providing data and being controlled by remote operators and other, previously incompatible, information systems.

By providing IP-based equipment with seamless roaming across networks, Mobile IP sets the stage for net-centric operations in military applications. Using IP as the base protocol, any equipment that can connect to the network can then connect with any other equipment on the network. Ruggedized mobile routers, such as DuraMAR, provide the nucleus of systems that can then link that equipment to the network through any of multiple communications channels and maintain that connection while moving.

**IP Systems for Netcentric Warfare**

To meet the DOD’s growing demand for rugged communication products that enable Network Centric connectivity, Parvus has designed COTS systems which are profiled below:

- DuraMAR and DuraNODE Product Family
- Soldier-Link Wearable PC (Zypad)
- DuraCOR 810 Processor
- DuraVIS Displays

### DuraMAR Product Family

- **DuraMAR Mobile IP Router**
  - Wireless Internet (Wi-Fi, Cell + GPS)
  - Computer (CPU)
  - VoIP
- **DuraNODEs**
  - Ethernet Switch + Serial Hub
  - IP Gateway to 1553/LON/CAN
  - Encryptor
In March 2006, Parvus introduced the Zypad Wearable PC which enables hands free communications to the mobile IP Network. The Zypad is an ideal communications device for mobile command and control on the move:

- Ground force mission planning and execution (i.e. pre-loaded maps and routes, waypoints, blue force tracking, etc.)
- Mission data uploads to a host datalink
- Used to display real-time video feed from UAV to ground troops
- Urban warfare
- Assist convoys in navigating through cities/highways with GPS
- Monitor “Soldier Down” situations


DuraCOR 810
MIL-Std-810 Processor System
• Rugged processor (400 Mhz to 1.4 Ghz) enables realtime, high speed netcentric communications
• Applications include: situational awareness, command and control functions, video/data capture and information distribution


CAPTIONS:

Figure 1 – The Cisco 3200® Series Wireless and Mobile Router was the first step in enabling ruggedized mobile IP, using PC/104 technology to achieve a compact size.

Figure 2 – The DuraMAR system from Parvus Corp provides a rugged enclosure and robust power supply for the mobile router, and simplifies the connection of other equipment by supplying Power over Ethernet to peripherals.