1 Introduction

Radio IP MTG™ is a software solution that extends your corporate LAN to a wireless network on most private or public systems. This allows your wired LAN to extend the reach of any server program outside the bounds of physical wiring. Radio IP MTG manages a set of wireless network controllers and relays appropriate data to the mobiles on the road.

Radio IP MTG uses virtual network interface cards which link mobile applications to LAN servers. A streamlined version of TCP/IP optimizes data transport. In effect, Radio IP MTG is a router or gateway and does not hook directly to your corporate LAN. Instead, it creates a separate network segment in your IP address range for use by Radio IP MTG Server and mobiles running Radio IP MTG Client. Clients send traffic to their gateway which in turn forwards requests to appropriate LAN servers. Likewise, LAN applications can open connections to mobiles.

In the Radio IP MTG environment, both server and clients assume gateway, routing, and filtering capabilities. As a gateway, the MTG server can interface a number of radio networks with the corporate LAN. This implies translating the transported information from a network to the next. Routing applies to Radio IP MTG Client. Connected through one or a chain of network links, clients are able to decide which one to use for faster or more economic delivery. Filtering capabilities refer to the system's ability to determine valid traffic on the basis of issuing IP addresses, ports, and source applications.

A client application on one computer requests services from another computer running server software. A network contains many more clients than servers because a single server can satisfy hundreds (sometimes thousands) of client requests. For example, mobile clients can work anywhere, at any time, as long as their mission-critical applications are accessible.

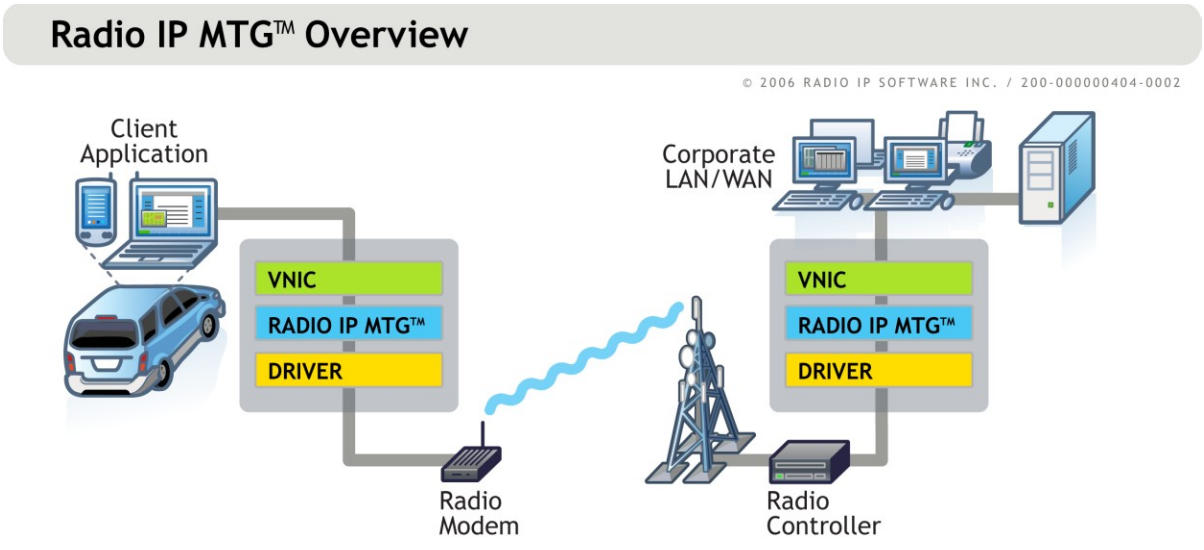

***Figure 1**: MTG System Diagram*

On the client side,

- The TCP/IP transport protocol is substituted with Radio IP's optimized wireless over-the-air TCP/IP protocol which, among other things, eliminates the duplicate packets normally generated by the standard TCP/IP.
- Before leaving the mobile system, data packets are compressed at a rate of up to 90%.
- Unnecessary overhead is removed and a 7-byte header is created (instead of the usual 40-byte header).
- Radio network confirmation is used instead of TCP/IP confirmation.
- Data travels to the radio controller via radio antenna.

On the server side,

- Once information leaves the radio controller, it goes through the same process used on the client side.
- Once the information reaches the corporate network, the data stream is reconstructed in the correct order.

1.1 Overview

Radio IP MTG is a software service that uses a driver as a virtual network card. Working as an NDIS driver, it connects corporate LANs to wireless networks, providing optimized TCP/IP connectivity. To your computer operating system, it operates just like a standard network adapter.

All mobile units equipped with MTG benefit from the enormous selection of off-the-shelf and specialty applications available, regardless of what private or public wireless network is used. Any software application that runs on a LAN, WAN, Internet, Intranet, and mainframe can be easily extended to the field worker without any modifications to the applications. MTG connects wired corporate networks to the wireless world.

If data is transmitted while the mobile user is out of coverage, MTG buffers the information until it can be transmitted. It provides a virtual connection by keeping the TCP/IP sockets open and buffering data while the wireless device is out of coverage. For example, if the wireless connection is dropped during an upload of information, the whole process does not have to be restarted, it will simply continue from where it left off. The amount of time allowed out of wireless coverage is programmable. This buffering of information makes any wireless system look like a seamless connection to the corporate network.

Every radio network has its own peculiarities and a protocol that handles the transfer of information between the host application and the radio network. The data is manipulated in order to remove or add information specific to that radio network. Framing has no effect on the quantity of data transferred by the system.

Radio IP MTG employs a very efficient compression algorithm. Compression ratio depends on the type of data transferred: simple text or xml files are highly compressible whereas zip files already have a high compression ratio. In cases where compression serves no useful purpose such as zip files, the data is transmitted unchanged. The effects of compression are especially important for wireless data networks. Those networks usually offer limited bandwidth, and/or are very expensive to use, so data volume must be kept to a minimum.

Confidentiality on a radio network is a must. The data exchanged between stations and applications in a data network is very often confidential or even classified. Packet encryption is a standard feature offered by Radio IP MTG. A standard encryption algorithm is used to assure that your data is transferred securely.

1.2 What MTG Offers

This section lists the main features which make up the Radio IP MTG™ server/client environment.

Automatic IP Addressing

- Ease of deployment with automatic IP addressing (MDHCP - Mobile Dynamic Host Configuration Protocol). Mobile IP addresses may be server-allocated during installation.
- MDHCP helps networks conserve addresses by not wasting them on computers that are not using them. Addresses are recyclable by setting the expiration delay of a machine's address if it is not used. For example, if you enter lease duration of 3 days and if an address has not been used for 3 days, it will then become available for use on another mobile.
- A network-segment "scope" can be specified upon mobile installation. This feature allows grouping a set of mobiles by name within the same IP segment when many such segments are used. As a result, mobiles are easier to identify and statistics are easier to read.

Extensive User Notification

- MTG benefits from agile diagnostic tools measuring and reporting statutes in a timely manner. Critical errors or state changes are displayed using bubble messages on server. Mobile clients rely on a retrievable activity list view convenient for field troubleshooting.
- Messages are intended for all users.

Coding and Decoding (Encryption)

- Radio IP MTG can use different encryption algorithms such as AES, DES, triple DES, all compliant with FIPS 140-2. Single DES encryption is used in countries that fall under the American Export Regulation Restrictions.

Compression/Decompression

- Radio IP MTG compresses data using strategies and algorithms depending on the license authorisation and system configuration. Compression is either port-based or socket-based, implying a different scope for the underlying dictionary. Compression ratios are excellent.
- Socket-based compression builds a dictionary from the start of the connection to the end of the connection. It is best used when data accessed by different mobiles is mostly different, or when data changes quickly with time or according to file formats.
- Port-based compression builds a permanent dictionary for all connections made to a port. This method is best used on website ports, where large chunks of traffic do not change in time or according to the client.

HTTP Socket Optimization

- Packets from HTTP compliant applications are compressed at the port level. If an HTTP compliant application opens several sockets at the same time, on the same port, the packets are combined together shrinking even further the size of the transferred traffic. The dictionary is preserved across connections (sockets) thus resulting non-decreasing statistical significance of the dictionary.

Optimized Data Communication

- Optimization for wideband communications systems, such as IEEE802.11b (wireless LAN).
- Substitutes TCP/IP transport protocol with optimized wireless over-the-air TCP/IP protocol.
- Streamlines overhead and keeps the standard 40-byte TCP#IP header to a minimum.
- Eliminates duplicate packets generated by the TCP/IP protocol.
- Uses the radio network confirmation instead of the TCP/IP confirmation.

Optimization for Wide-Band Networks

- You can select a compression mode for each interface in a roaming configuration enabling you to bypass the compression, thus resulting in a higher throughput on wide-band communication links. The wide-band drivers supporting this feature will require minimal configuration.

Packet Data Transmission

- Working as a NDIS driver, it intercepts and converts the data in a suitable wireless format thus making the wireless network look like any TCIP/IP environment.
- Each mobile PC is given a unique IP address.

Roaming

- The Roaming feature enables wireless data users to automatically and seamlessly roam to and from any installed wireless network. It finds the fastest, most efficient way to transmit data in a world of discrete networks. The connection is always active, therefore keeping the communication open and optimized based on the modem used.

Standard TCP/IP Commands

- Any of the standard TCP/IP commands can be used end-to-end. For example, a mobile PC in the radio environment can be pinged and will respond as if it were connected to a wired network.

Universal Radio Gateway

- MTG is a universal radio gateway that permits end-to-end TCP/IP connectivity on any wireless data network.
- Private radio networks including Motorola DataTAC, M/A-Com EDACS, and Dataradio, as well as public wireless networks including 802.11, 1xRTT and cellular, are among the wireless networks supported by Radio IP MTG.

User Authentication, LDAP

- Simple user-password authentication is also provided based on different schemes.
- MTG uses Windows NT or Active Directory Authentication or LDAP (Lightweight Directory Access Protocol)
- As the Administrator, you can also decide to use groups to control access to the mobile network.

Packet Forward and Filtering

- This feature gives administrators even more control over their networks by the use of customer-defined parameters with the ability to determine over which networks and under which conditions an application data can be transmitted.

Cluster-Aware

- Radio IP MTG fully supports the Microsoft® Cluster Service when used with the Quorum driver. The program can be installed on a cluster computer, allowing software nodes to be transferred from a hardware node to another in case of physical failure.

Error Detection and Activity Reporting

- Use of the Event Log enables reporting of critical errors, change in the internal status (start / stop) and other relevant information.
- The System Log feature facilitates audits and network performance analysis by saving numerous mobile statuses as well as key MTG system conditions to CSV-type files. Logs can optionally be sent to third-party SysLog servers.

1.3 Hardware and Software Requirements

Before planning deployment of the Radio-IP MTG software, consider the following hardware and software requirements.

Server

Radio IP recommends a maximum of 1000 mobiles per server depending on bandwidth or traffic

Small System (1-100 Concurrent Mobiles)

	Minimum	Recommended
Type	Pentium IV	Pentium IV
CPU	1.9 GHZ	2.6 GHZ
RAM	512 MB	1 GB
HD	200 MB free disk space 10/100 Network Adapter	200 MB free disk space 10/100 Network Adapter
OS	Windows® 2003 Server	Windows® 2003 Server SP2

Medium System (101-249 Concurrent Mobiles)

	Minimum	Recommended
Type	Pentium IV	Pentium Xeon
CPU	2 GHZ	2 GHZ
RAM	1 GB	2 GB
HD	200 MB free disk space 100 Network Adapter	200 MB free disk space 100 Network Adapter
OS	Windows® 2003 Server	Windows® 2003 Server SP2

Large System (Over 250 Concurrent Mobiles)

Radio IP recommends a maximum of 1000 mobiles per server depending on bandwidth or traffic.

	Minimum	Recommended
Type	Pentium Xeon	Pentium Dual Xeon
CPU	2.4 GHZ	2X 3.2 GHZ (dual CPU)
RAM	2 GB	2 GB
HD	200 MB free disk space 100 Network Adapter	200 MB free disk space 100 Network Adapter
OS	Windows® 2003 Server SP1	Windows® 2003 Server SP2 or later

Windows Mobile Clients (Wireless modem - 802.11x(WiFi) or cellular connection)

	Minimum	Recommended
Type	Pentium IV Mobile	Intel Centrino
CPU	1.7 GHz	2 GHz
RAM	1 GB	2 GB
HD	50 MB free disk space 10/100 BASE-T Network Adapter	50 MB free disk space 10/100 BASE-T Network Adapter
OS	Windows® XP SP2	Windows XP SP2 or Vista SP1

Windows Mobile Clients (802.11x(WiFi), cellular connection or Bluetooth)

	Minimum	Recommended
Type	Intel X-Scale™ Processor	Intel X-Scale™ Processor
CPU	624MHz	624MHz
RAM*	64 MB SDRAM	128 MB SDRAM
Storage	Media card slot	Media card slot
Comm.	Broadband Cellular	WiFi, Broadband Cellular or BT
OS**	Windows Mobile 5.x	Windows Mobile 6.0

* 15 MB allocated to MTG.
** Requires .NET framework update.