

16c. Wireless LAN

16c.1 INTRODUCTION

This section describes the Wireless Local Area Network (WLAN) system for the Commonwealth of Virginia. An overview of the system and design assumptions are included.

16c.2 Commonwealth of Virginia System Overview

The WLAN system will provide the Commonwealth of Virginia mobile data users with a method of accessing the STARS Wide Area Network (WAN) from their vehicles. This provides mobile users with the ability to access information that is not mission-critical and does not need to be obtained in real-time. Mobile users will drive to a WLAN “hot spot,” which is a location equipped with WLAN devices. These locations include facilities such as Virginia State Police (VSP) Division Headquarters or Area Offices, as well as specific offices and residencies associated with Virginia Department of Transportation, Department of Environmental Quality, Department of Emergency Management, and the Department of Mines, Minerals and Energy.

The WLAN operates through the use of Access Points, which are devices that provide a bridge between the wired network and wireless environment at the access location. In addition, WLAN functionality in the mobile computer provides the interface between the mobile client and the wireless world.

Since the WLAN sites have not been surveyed, the WLAN system is categorized on a “per site” basis, reflecting the following typical site types:

VSP Division Headquarters
Remote WLAN site (e.g. Area Office)

Subsequent to a site survey, each location will be categorized as to one of these two site types. This categorization determines the type and quantity of equipment used at the site.

This contract allows for up to one Access Control Server at each of the seven VSP Division Headquarters locations. The total number of wireless access locations in this system is four hundred forty (440). The WLAN system pricing is based on three Access Point devices at each WLAN site. The final number of Access Point devices at a particular site is based on the local conditions as determined during the site survey.

The WLAN client card will be built into the Motorola ML900 mobile data computer. The WLAN will operate in accordance with IEEE 802.11g guidelines.

16c.2.1. System Performance

This section discusses performance topics associated with the Wireless LAN and contains descriptions of the radio frequency technique to be used in the Commonwealth of Virginia WLAN to transmit and receive information over-the-air.

16c.2.1.1. Spread Spectrum Technology

The WLAN system will use spread-spectrum technology; a wideband radio frequency technique originally adopted by the military for use in reliable, secure, mission-critical communications systems. Spread-spectrum is a technique where a modulated wave is modulated a second time (spread) in order to generate an expanded bandwidth wideband signal that appears as Gaussian noise to other signals. Spread spectrum carrier frequencies are non-licensed. That is to say that all spread spectrum frequencies can be used by anyone in any location without the need for FCC approval.

16c.2.1.2. Range and Coverage

The distance over which WLANs can communicate is a function of propagation path, environmental conditions, and hardware design (including transmitted power and receiver design). Interactions with typical building objects, including walls, metal, and even people, can affect how energy propagates, and determines what range and coverage a particular system achieves. Motorola will evaluate the coverage that exists at the time of implementation and advise the Commonwealth as to the optimum WLAN coverage areas at a site.

16c.2.1.3. Throughput

As with traditional wired LAN systems, the actual throughput in a WLAN is product and configuration dependent. Factors that affect throughput include the number of active users, type of traffic being sent over-the-air, propagation factors such as fading and multipath, interference, the type of wireless LAN system used, as well as the latency and bottlenecks on the wired portions of the LAN. Published raw (user data plus overhead) data rates for most widespread commercially available wireless LANs are in the 1.6 Mbps – 11Mbps range, with 54Mbps available in the upcoming IEEE 802.11g standard. As mentioned above and described in the following sections, actual system throughput and functionality is product and system dependent.

Wireless LAN equipment has various throughput specifications. It is important to note that Motorola does not guarantee the accuracy of these specifications or the level of throughput performance.

16c.2.1.4. Interference and Coexistence

Since WLANs reside in the 2.4 GHz unlicensed Industrial, Scientific and Medical radio frequency band, other products that transmit energy in the same frequency spectrum can potentially provide some measure of interference. Other products that might cause interference in the 2.4 GHz band are: microwave ovens, Bluetooth enabled devices, cordless phones, and the co-location of multiple wireless LANs.

16c.2.1.5. Security

Wireless LAN users of the enterprise network will be subject to the same network security policies and procedures outlined in the WAN section of this contract. In addition, Motorola has implemented several security features designed to protect the wireless portion of WLAN data. However, no security method is completely or indefinitely invulnerable to attack. The WLAN security scheme used in this design is based on dynamic encryption keys and mutual authentication to mitigate potential security threats.

The WLAN security plan includes the use of an Access Control Server (ACS), which will allow mutual authentication of the client based on a username and password. The WLAN Access Point will reject network-bound traffic from the WLAN user until the mutual authentication process has been successfully completed. Once completed, the ACS and client determine the dynamic encryption key to be used for the duration of the session. This key is unique to the specific mobile client.

16c.2.2. Specifications

In the event that the Commonwealth of Virginia supplies mobile computers for use with the WLAN, the minimum client hardware and software requirements are listed below.

16c.2.2.1. WLAN Client

Each WLAN-equipped mobile user must have a properly equipped mobile data computer to participate in over-the-air information transfer. Each mobile data computer must meet the following minimum requirements:

16c.2.2.1.1. Hardware

- 166 MHz Pentium processor (or faster)
- 233 MHz Pentium processor (or faster) for Windows NT/2000
- 32 MB of RAM (or greater)
- 64 MB of RAM (or greater) for Windows 2000
- 10MB available storage
- Internal WLAN capability, conforming to IEEE 802.11g standard, licensed for Cisco LEAP/ACS operation
- Available PCMCIA slot

16c.2.2.1.2. Software

Windows® 95 OSR2, or
Windows 98, or
Windows 2000, or
Windows NT with Service Pack 3 (or later)

16c.2.2.2. WLAN Server Hardware

The specifications for the Access Control Servers that will be used in the WLAN system are shown in Appendix 5.

16c.2.2.3. Design Assumptions

The development of the Wireless LAN system is based on a number of factors that can affect the system operation and quantities of equipment required. Final definition of the WLAN design will take place subsequent to a site survey at each access location. Since the sites for the WLAN system have yet to be surveyed, Motorola has based the system design and pricing on the following assumptions.

There will be one Access Control Server (ACS) and up to three Access Point (AP) devices deployed at a VSP Division Headquarters location. These devices will be connected to an Ethernet switch, supplied as a part of the WLAN subsystem.

Up to three Access Point devices will be deployed at a Remote WLAN location. These devices will be connected to an Ethernet switch, supplied as a part of the WLAN subsystem.

The Access Control Servers and Access Point devices are intended to be logically connected to the Commonwealth of Virginia STARS WAN and communicate using TCP/IP.

The existing LAN traffic and WLAN system will flow through the provided router and WAN links. The traffic associated with the existing LAN or WLAN must not exceed the traffic guidelines outlined in the WAN section of the contract. Replacements, expansions or upgrades of equipment, firmware, software or WAN link capacity due to the traffic exceeding these guidelines are beyond this scope. Motorola can evaluate expansion requirements on a case-by-case basis and provide pricing as requested.

It is assumed that up to ten WLAN clients may simultaneously be using the WLAN system at a given location.

It is assumed that up to three hundred WLAN clients may simultaneously be using the WLAN system division-wide.

It is assumed that the maximum file size to be transferred is ten (10) Megabytes. Outdoor configurations are beyond this scope. If Access Points must be located outdoors, they will require a heated/cooled outdoor enclosure, LAN connectivity and AC power at each outdoor location. The feasibility and pricing of outdoor configurations can be developed on a case-by-case basis.

The system is based upon the use of Motorola ML900 mobile data computers with an internal WLAN card.

The use of unlicensed spread spectrum WLAN equipment introduces the possibility of interference, which can impact the performance of the WLAN data transfer capability. Motorola therefore can make no guarantee as to the throughput realized by the WLAN system.

Due to the WLAN use of unlicensed frequencies, Motorola cannot provide coverage predictions or guarantee coverage of the WLAN equipment. However, Motorola will demonstrate the coverage that is available at the time of optimization. This will be accomplished by driving through the WLAN “hot spot” with a WLAN client and site survey software. A representative from Motorola and the Commonwealth will observe the signal readings from the site survey software.

System pricing is based on 440 WLAN site locations as provided by the Commonwealth.

In some cases, WLAN operation at a site may not be feasible. If an original WLAN site is determined to be unfeasible, Motorola will survey one other site as an alternate location for the WLAN equipment. If additional site surveys are required, Motorola can provide price quotes if requested.

The implementation service pricing is based on the Commonwealth of Virginia compilation of all information necessary for Motorola to configure the WLAN Access Control Servers. This information includes, but is not limited to, client usernames and passwords, client-to-group assignments and group access rights/restrictions. Motorola will use this information to set up authentication of the clients in the ACS. Pricing includes the configuration of up to 3000 clients and 50 groups system-wide. It will be the responsibility of the Commonwealth of Virginia to determine how these quantities are allocated among individual agencies and divisions. If additional client and/or group configurations are required, Motorola can provide pricing based on the additional quantities required.

It is assumed that the WAN subsystem has been implemented at all of the proposed WLAN sites. The WAN and WLAN subsystems at the site will flow through the WAN router, as outlined in the WAN section of the contract. Each remote site must have WAN connectivity to the appropriate Division Headquarters. If the remote site is outside the scope of those listed in the contract and this equipment and WAN connection are not in place, Motorola can evaluate the feasibility of providing connectivity to the network and provide pricing on a case-by-case basis.

The design of the WLAN system makes use of the hierarchical WAN design proposed to the Commonwealth of Virginia. An Access Control Server is provided for use at the Division Headquarters within each division. All WLAN users must be authenticated with the ACS in order to gain access to the wired network. Therefore, the WLAN equipment at the Division headquarters must be deployed prior to the implementation of any remote sites within that division.

Due to diversity in the applications and normal usage per mobile client, there is no guarantee that the design estimates will match the user profiles of the actual mobile clients. If these profiles are found to exceed the parameters described in the WLAN contract, less than optimal operation may result. In a case where the performance is unacceptable, an expansion of the system may be required as well as an evaluation of the network user profiles. Any additional work and equipment required to perform this evaluation and complete an expansion are outside of the scope of this contract.

Pricing is considered fixed for the equipment and configurations as outlined. Any system or site configuration found to be inconsistent with the assumptions of this design is outside this scope and pricing for additional equipment, work or schedule impacts can be quoted on a case-by-case basis.