3000-CDI-002-003

The ITEC Network™

Mobile System Operation And Technical Overview

July 2001

The ITEC Network™
A Division of ITEC Entertainment Corporation™
Orlando, Florida

Mobile System Operation and Technical Overview

July 2001

Submitted By

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Change Information Page

List of Affected Pages	
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Document History		
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1 Introduction

1.1 Identification

This document is submitted as a White Paper to discuss the overall capabilities and operation of The ITEC Network Mobile System.

1.2 Scope

This document incorporates operational capabilities of the Media Engine, Media Monitors, Station Servers and Network Center operations.

1.3 Purpose and Objectives

The purpose of this document is to allow the reader a full understanding of the operation and capabilities of each component of The ITEC Network.

1.4 Document Status and Schedule

This document reflects a summary of system technical capabilities and operational criteria. This is the General Release that incorporates all review meeting notes and changes.

1.5 Document Organization

The document is organized into nine (9) sections

Section 1 Introduction, contains the identification, scope, purpose and objectives, status and schedule, document organization, and referenced documents.
Section 2 Overview
Section 3 Media Engine
Section 4 Smart Window
Section 5 Station Server
Section 6 RF Communication System
Section 7 Media Monitors
Section 8 Network Center
Section 9 Abbreviations and Acronyms

1.6 Referenced Documents

This document references the following document:
3000-CDI-003-003 **The ITEC Network Smart Window Display Overview**.

2 Overview

The following document outlines the overall system technical and operational capabilities for The ITEC Network™ mobile system. The intent of this document is to give the reader an introduction to the system and equipment types that make up The ITEC Network mobile system. An overview of the mobile system is shown in Figure 1 - The ITEC Network Mobile System Overview and a block diagram of the vehicle equipment is shown in Figure 2 - Vehicle Block Diagram. The reader is also exposed to the operation and interaction of these systems.

Figure 1 - The ITEC Network Mobile System Overview

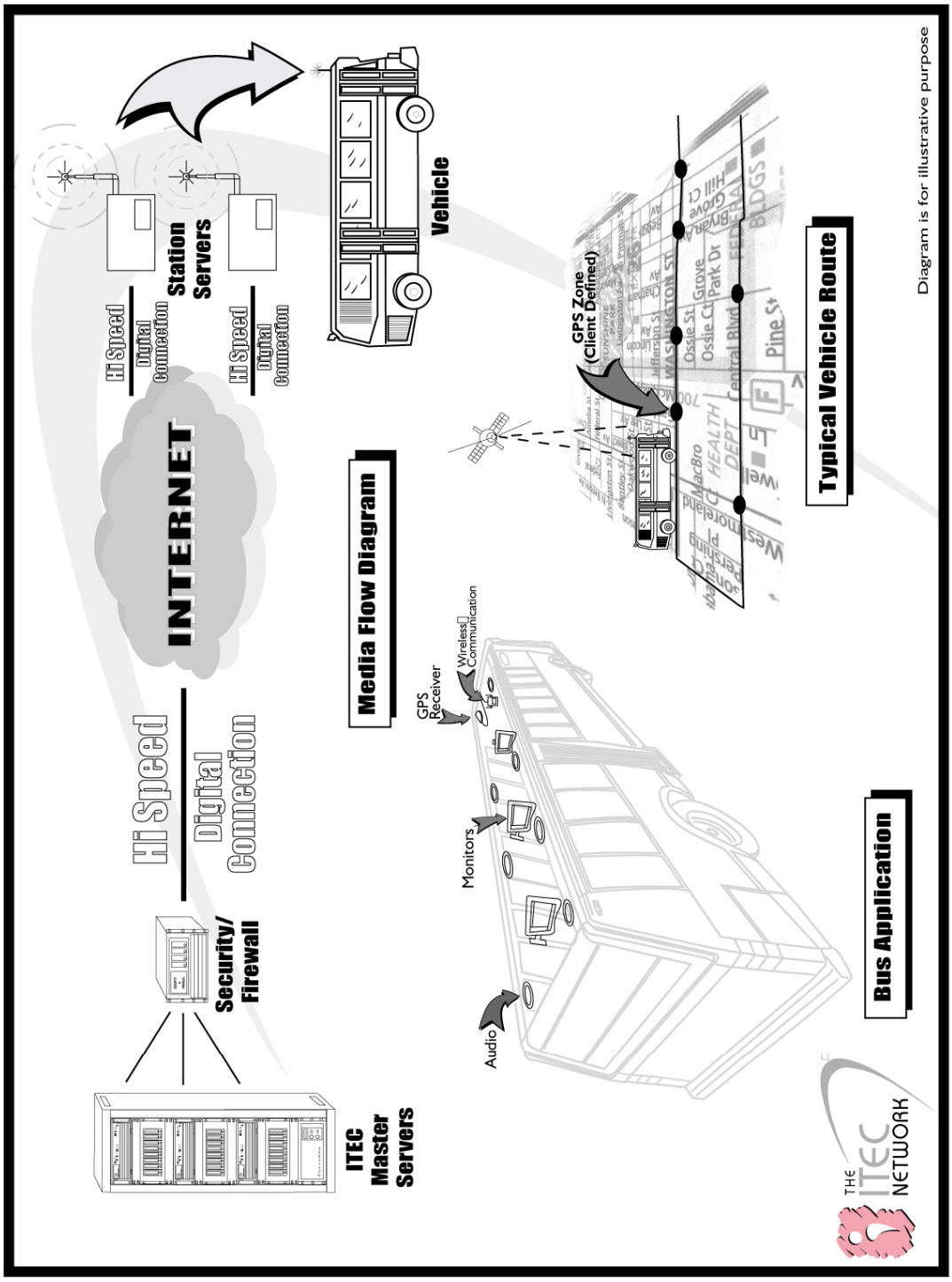

Figure 2 - Vehicle Block Diagram

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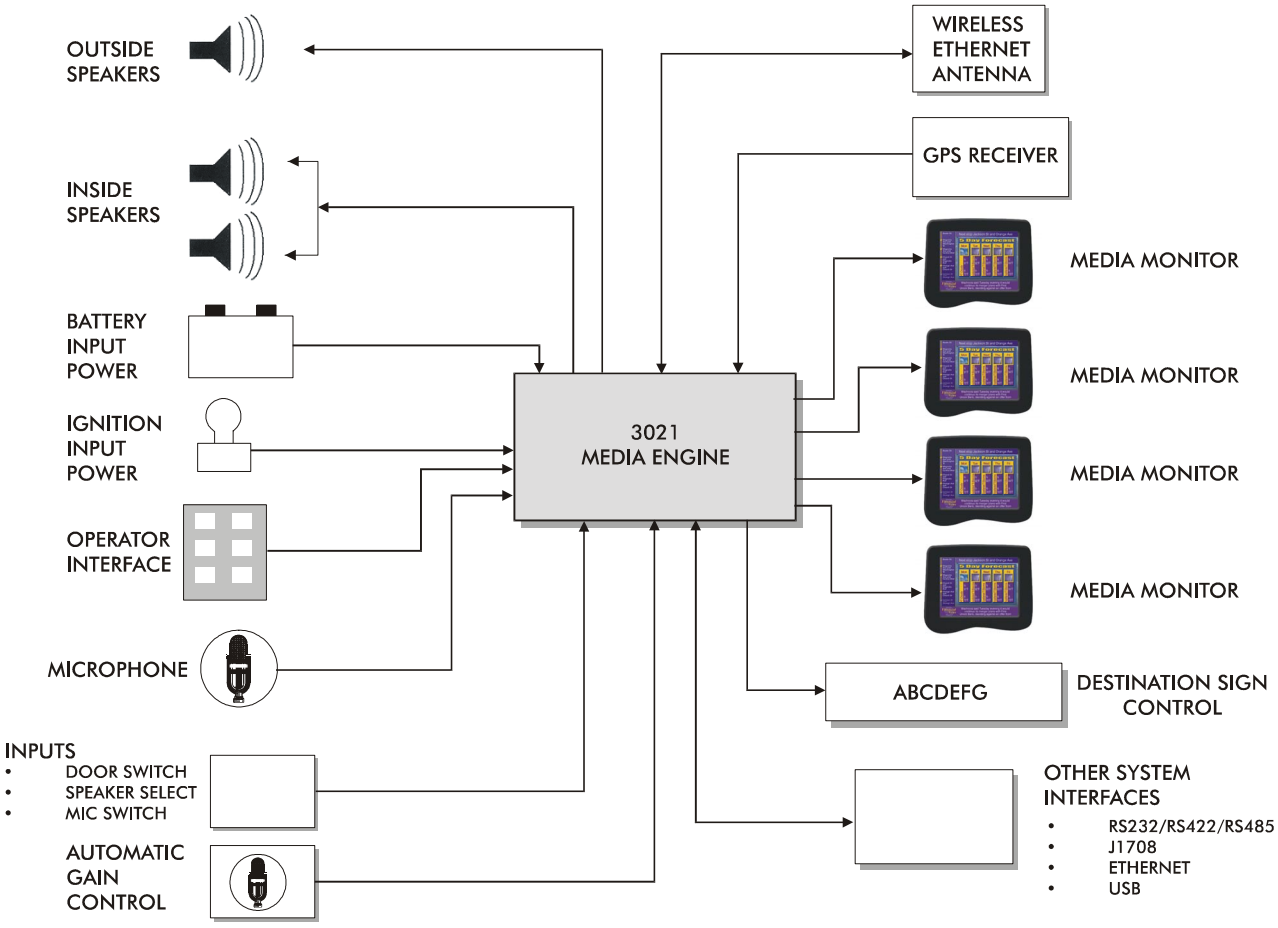


Media Engine

The Media Engine is the on-board controller or “brain” that controls all aspects of the on-board experience. The Media Engine is in a small shock resistant enclosure, which incorporates power filtering, system CPU, memory, local storage, and audio components. The major components of the Mobile ITEC Network system, including the Media Engine or model 3021, are shown in Figure 2 - Vehicle Block Diagram. This model of the ITEC Network has been specially designed for a mobile environment.

3.1 General

The Model 3021 Media Engine is comprised of a single small enclosure than can be mounted in a variety of mobile locations. Each Media Engine has the following base capabilities.

- Based on Intel Pentium series CPU Technology
- Input voltage range (12 to 24 volts DC)
- Power filtering and protection
- Current consumption of less than 100 watts
- Enclosure size of 15” long by 7” wide by 3 “ tall
- Enclosure weight of 6 pounds
- Operating temperature range of -10°C (14°F) to 60°C (140°F)
- Video and graphic segments triggered by time
- Stop announcement information triggered by GPS location
- Auto sensing audio level control
- Smart window display

3.2 Storage Capabilities

Each Media Engine contains a single media storage unit. These units utilize rotating hard drive technology that is specially designed for high vibration environments. Each storage unit has the following specifications:

- Video Storage capacity greater than 6 hours of media
- Audio Storage capacity greater than 1000 messages, limited only by storage unit total capacity.
- Vibration rated to over 150 G

3.3 GPS Triggered Media

The Media Engine is connected to a GPS receiver positioned for maximum view of the sky. The Media Engine uses these devices to determine when to trigger events like a stop announcements.

3.4 Media Fragments

The media stored on the Media Engine is stored as Media Fragments. Media Fragments are small logical chunks of the overall media program. The media program is stored as these Media Fragments because the Media Engine has the capability to splice the fragments together into new media programs. This is an important aspect of the technology as individual Media Fragments can be updated without updating the overall media program. Existing Media Fragments can be re-spliced into new programs without downloading or storing all of the different media variants. These Media Fragments are spliced together before displaying on the monitor.

3.5 Stop Announcements

Each Media Engine is capable of playing audio and a graphical announcement before each stop. The Media Engine uses industry standard MP3 formatted audio files for storage. This allows for reproduction of standard human voices (not computer generated) with CD quality sound. Audio announcements are also supplemented with graphical information on the Media Monitors. See Section 4 for more information on the Stop Announcements.

3.6 Automatic Media Update

The most important function of the Media Engine, apart from reproducing the media program, is the ability to update media fragments automatically without operator intervention. Each Media Engine is equipped with a High Speed RF Modem. When the vehicle arrives in a location handled by a Station Server (See Section 5), the Media Engine makes connection to the Station Server. The Media Engine then performs the following steps:

- Checks for a new or removed media file. Based on this information the Media Engine downloads or deletes media fragments to/from its local storage unit.
- Synchronizes the Media Engine clock to the Station Server clock.
- Logs Off

This is a basic overview of the Automatic Media Update process; there are other communication and diagnostic actions that occur. In general this process assures that every time a vehicle comes in range of a Station Server, the Media Engine attempts to update itself. Refer to Section 5 and Section 6 for a greater understanding of the Station Server and RF system.

4 Smart Window

The model 3021 Media Engine provides an innovative form of visual output to the on-board vehicle monitors called the Smart Window. The Smart Window is explained in detail in **The ITEC Network Smart Window Display Overview** (3000-CDI-003-003).

5 Station Servers

As outlined in the previous section, each Media Engine can store large amounts of video or graphic information (Media Fragments). The Media Engine can also determine the playback schedule based on the Media stored on each Media Engine. This capability eliminates the need for each Media Engine to be in constant contact with the Network Center.

5.1 Station Server Function

Each Media Engine needs to be able to receive updates of media throughout its operational time, as well as when the vehicle is not in operation. Typically, areas of vehicle latency are chosen for Station Server locations, such as maintenance depots, fueling stations, transfer stations and guest stops. The base station server location requirements are areas that the vehicle would normally be stopped for a longer period of time than a normal vehicle route stop. This allows the Media Engine to communicate with the Station Server and download any new media fragments that are available.

It is important to note that Station Servers are only necessary to update media fragments on the Media Engines, and do not play media. For example, a system with one Station Server would operate as follows: The Media Engine would operate normally throughout the day playing Media Fragments. It would only get new media at the single location where the Station Server was deployed, once the vehicle entered the Station Server Zone. The greater number of Station Servers that are deployed, the more frequent the media fragments can be updated system wide.

5.2 Station Server Media Transfer and Data Connection

The Station Servers connect to the Network Center in Orlando to each Media Engine. Station Servers are connected to the high-speed network Center via the Internet typically through ASDL, DSL, ISDN, CABLE, or other Network connection means. This connection enables the Station Server to connect to the Network Center Master Server and transfer media fragments.

5.3 Station Server RF Communication System

Each Station Server broadcasts media to each Media Engine in the vehicles via a wireless communication sub-system. Station Server antennas are sized and located

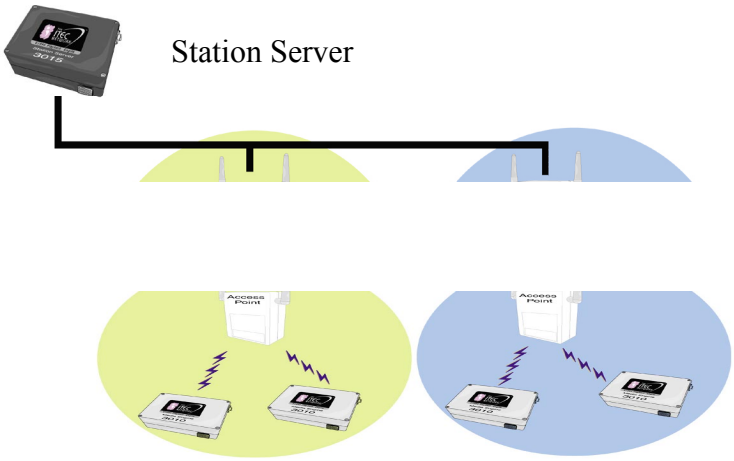
to meet the specific needs of the installation. Station Servers can be located in virtually any location that has power and telecommunications access. See Section 6 for a more detailed description of the RF Communication System.

6 RF Communication System

6.1 Introduction to Station Server RF Communication

Wireless RF Communication allows the Media Engines to communicate with and access the Station Servers using radio propagation as the transmission medium. The basic building block of the Station Server RF communication system is the Cell. This is the area in which the wireless communication takes place. The coverage area of a cell depends upon the strength of the propagated radio signal and the type and construction of walls, partitions and other physical characteristics of the environment. In general, a cell covers a more-or-less circular area. Media Engine equipped vehicles can move around freely in the cell. All radio communication in the cell is coordinated by a traffic management function. In the Station Server system, a unit called an Access Point performs the radio traffic management function. Each Access Point provides a single cell of the RF communication system. Each Station Server can be equipped with multiple Access Points to provide multiple cell regions as shown in Figure 3 - Station Server RF Communication Diagram.

Figure 3 - Station Server RF Communication Diagram



Two Cells with one Access Point and two Media Engines each

6.2 Station Server Cells

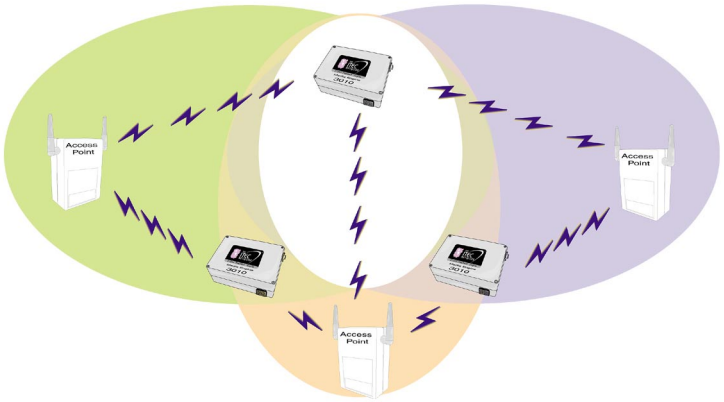
The basic cell is comprised of the access point and Media Engine equipped vehicles present in that cell. The maximum number of Media Engines capable of being supported per cell depends on the amount and type of data traffic. In a "busy" environment a cell might contain 30 Media Engines while in a more "relaxed"

environment 5 Media Engines might be supported. The Media Engines communicate with the Station Server via the Access Point that manages the data traffic in the cell.

6.3 Overlapping Station Server Cells

Several access points can be positioned in such a way that their coverage areas converge, thus creating a multi-cell application. Cell coverage and topology will vary with individual installations. One way of creating a multi-cell is by connecting several Access Points to external directional antennas instead of omni-directional antennas. The Access Points are positioned at different locations in the area to be covered with their directional antennas pointing towards the area that will form the focus of the multi-cell as shown in Figure 4 - Overlapping Cell Diagram. Stations inside the multi-cell area automatically "choose" the Access Point with the best possible communication. This is useful in areas where heavy network traffic is expected. A multi-cell, with its multiplicity of Access Points, provides constant system backup capability and ensures reliable fail-safe operation of the RF communication system.

Figure 4 - Overlapping Cell Diagram



6.4 Roaming Between Cells

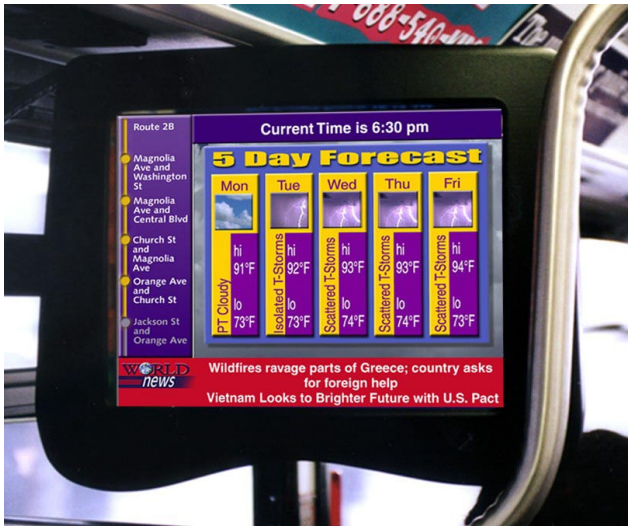
Media Engine equipped vehicles can move freely between overlapping Station Server cells, continuously maintaining their network connection. This ability to freely move around cells is called "Roaming". Roaming is seamless, that is, a communication session between a Media Engine and Station Server can be maintained when moving from cell to cell while the Media Engine experiences, depending on the traffic, only a momentary break in the data flow. A Media Engine implements its roaming capabilities by automatically "choosing" the access point in its area that provides the clearest signal. Some major sources of RF Wireless Communication are multipath propagation radio wave signals (when propagated in an environment, "bounce off"

reflective and semi-reflective surfaces such as walls, partitions, and equipment), microwave ovens, and other ISM (Instrumental, Scientific and Medical Band) interference.

7 Media Monitors

To provide the optimum viewing device for the output of the Media Engine, The ITEC Network manufactures the Model 3220 Media Monitors, which is shown in Figure 5 - Media Monitor.

Figure 5 - Media Monitor



These Media Monitors are impact resistant and tamper-proof with an additional layer of safety glass. The imaging units are based on high-resolution active matrix TFT LCD flat screen technology. These screens have been designed to provide for wide viewing angles and high contrast, which is all-important to providing the optimal viewing experience for each rider.

The Model 3220 Media Monitors have the following capabilities:

- 15” Active Matrix Screen
- Operating temperature range of -10°C (14°F) to 60°C (140°F)
- Power Consumption of less than 35 watts
- 1024 x 768 native screen resolution
- Over 1 million different colors
- Industry Standard Analog VGA input signal
- Provide 200 nits of illumination
- Provide better than 200-to-1 Contrast
- Size is 17” (w) x 15.5” (h) x 3.5” (d)
- Weight is 15 pounds

- Powered by 12 Volts DC

The Media Monitor is comprised of ABS plastic that offers style, durability and a low profile. The Media Monitors can be mounted in a variety of orientations based on vehicle design and desired viewing; mounting configuration is determined by ITEC for each vehicle type. The design allows for internal cable routing, so that there are no exposed wires to be seen or vandalized. The Media Monitor uses tamper-proof security hardware. The Media Monitor has been design for easy replacement and is modular in design to allow for easy repair and replacement of parts.

8 Network Center

The Network Center handles all of the day-to-day operations necessary to keep The ITEC Network™ service in smooth operating order. The Network Center has all of the Servers that contain the media, graphics, and audio files for the specific transportation system. Typically, a dedicated Master Server is assigned to service all Station Servers for each transportation system.

8.1 Media Preparation

Client Media Specialists (CMS) process all of the media and execute the programming at the Network Center around the clock. The CMS team prepares the programming for each client group connected to the network and monitors the operations of that client group. Once media is processed, it receives a final quality check for accuracy by the on-duty Media Manager before being transmitted to the appropriate Station Server location.

8.2 Master Server Function

Each Station Server needs to be able to receive updates of media throughout the operational day. In the Network Center, a Master Server is assigned for each transportation system. The maximum number of Station Servers that can be handled by one Master Server is 100. The Master Server contains all of the media, graphics, and audio files for the client system.

8.3 Master Server Data Connection

Master Servers are connected to the Internet typically through T1 Digital lines or DSL/ADSL lines. This connection provides the ability for the Master Server to effectively connect to and service multiple Station Servers.

8.4 Master Server Log File

When each vehicle's Media Engine connects to a Station Server, a log file is sent to the Station Server. This log file contains information on the health and operation of the Media Engine. When the Station Server checks the Master Server for new information, it transfers these Media Engine log files to the Master Server. This allows technicians in the Network Center to monitor and track the operation of each

Media Engine remotely from the Network Center, providing accurate and up-to-date diagnostic information

8.5 Posting Server

There is a Posting Server for large geographical regions of the country. A Posting Server provides the final approval checkpoint for all media and data to be transmitted to the system. The Posting server also handles all security encryption of all files. A Posting Server serves multiple Master Servers based on Master server transmission load. There is a Master Server for each city or transit operator. All of the data files and media for a city or transit operator is located on this server. Multiple Station Servers (see section 6) are served by a single master Server. see Figure 6 - Server Configuration Diagram.

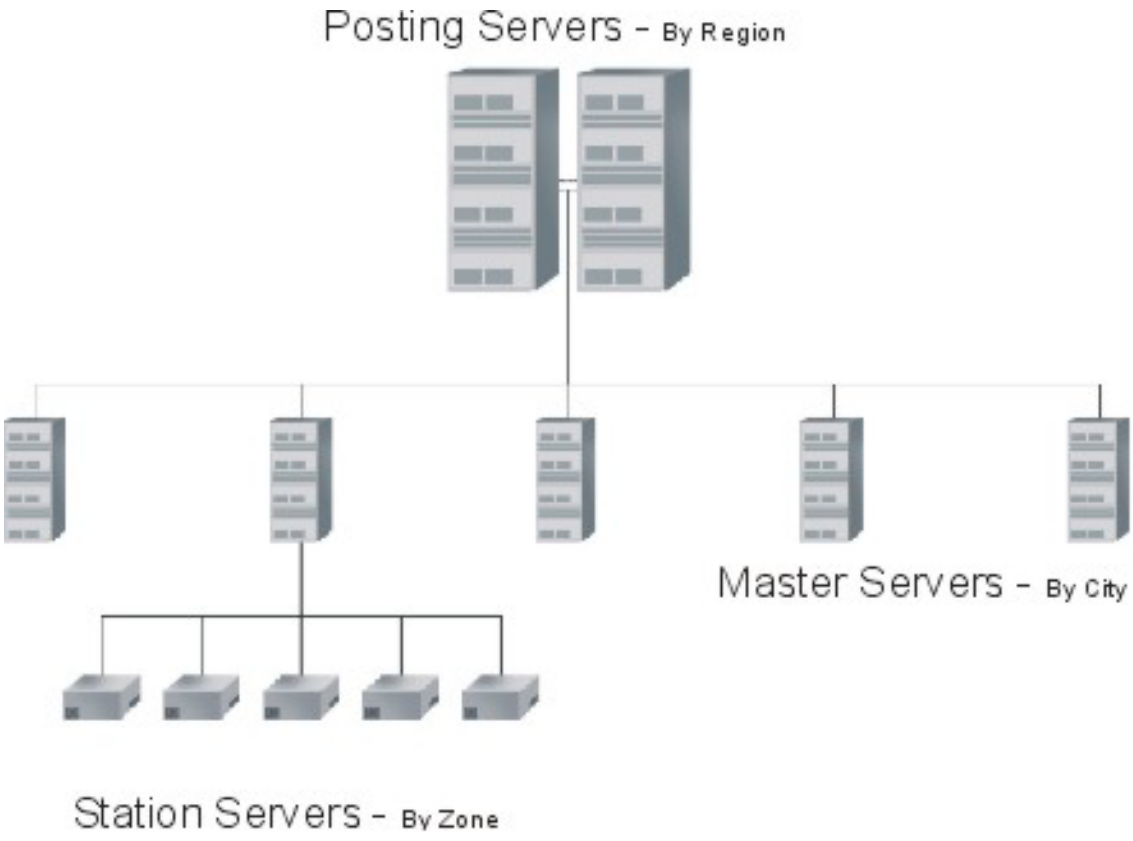


Figure 6 - Server Configuration Diagram

8.6 Help Desk

Complete customer support and technical help desk activities are located at the Network Center. The ITEC Network staff constantly monitors the system via the log file monitoring system. The Master Servers send a variety of diagnostics messages on the status of the Station Server and Media Engines as well as reporting transfer speeds. This information is monitored at the Help Desk staff computers, and critical messages are sent to the Help Desk management staff for tracking and follow up.

9 Abbreviations and Acronyms

The following is a list of abbreviations and acronyms that are used in this document.

ADSL	Asynchronous Digital Subscriber Line
CABLE	Cable Modem
CMS	Client Media Specialist
RF	Radio Frequency
T1	High Speed Digital Line
VGA	Video Graphics Adapter
VOC	Vehicle Operator Console