Serial Data Multicast Application

iMPath i-Volution implementation

Application notes

Multicast Data

iMPath Networks

1431 Merivale Road

Ottawa, Ontario K2E 1B9

Tel: (613) 226-4000

Fax: (613) 226-4602

www.impathnetworks.com

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1 INTRODUCTION

1.1 Overview

Serial data applications typically operate in a point-to-point network and are well suited for analog and Ethernet (IP) communication networks. Over the years, serial data applications have evolved and introduced multi-addressing protocols that provide the ability to use a single serial interface at the host end to propagate the same information to a multitude of remote stations over a serial analog network. This is a very efficient way for many applications to communicate to a large number of remote devices such as Camera PTZ, Traffic Controllers, Radar Detectors and Virtual Message Signs to name just a few. Unfortunately, these protocols do not integrate well with point-to-point Ethernet (IP) networks. Alternative Ethernet (IP) communication protocols are required to address this widely used application.

The intent of this document is to provide information on alternative solutions that are best suited to meet the requirements of serial data broadcast applications.

1.2 Typical Serial Data Broadcast Installation

One of the most common applications in this industry is probably CCTV camera control. We will use this application as an example to better understand the communication characteristics of serial data broadcast.

Serial Data Broadcast applications consist of a central PTZ (Pan Tilt and Zoom) controller sending information to a multitude of locations simultaneously from a single interface. To ensure only one camera responds to the PTZ command, each camera has a unique address. This ensures that only the corresponding camera will react to the controller command.

This application may use uni-directional or bi-directional data traffic. In the case of bi-directional data, the protocol ensures that only one station responds at any given time to ensure there is no data collision on the received signal.

When the cameras are deployed in proximity to the controller, an RS 422 or RS 485 buss wire network is used as illustrated in Figure 1. The number of remote devices is practically un-limited.

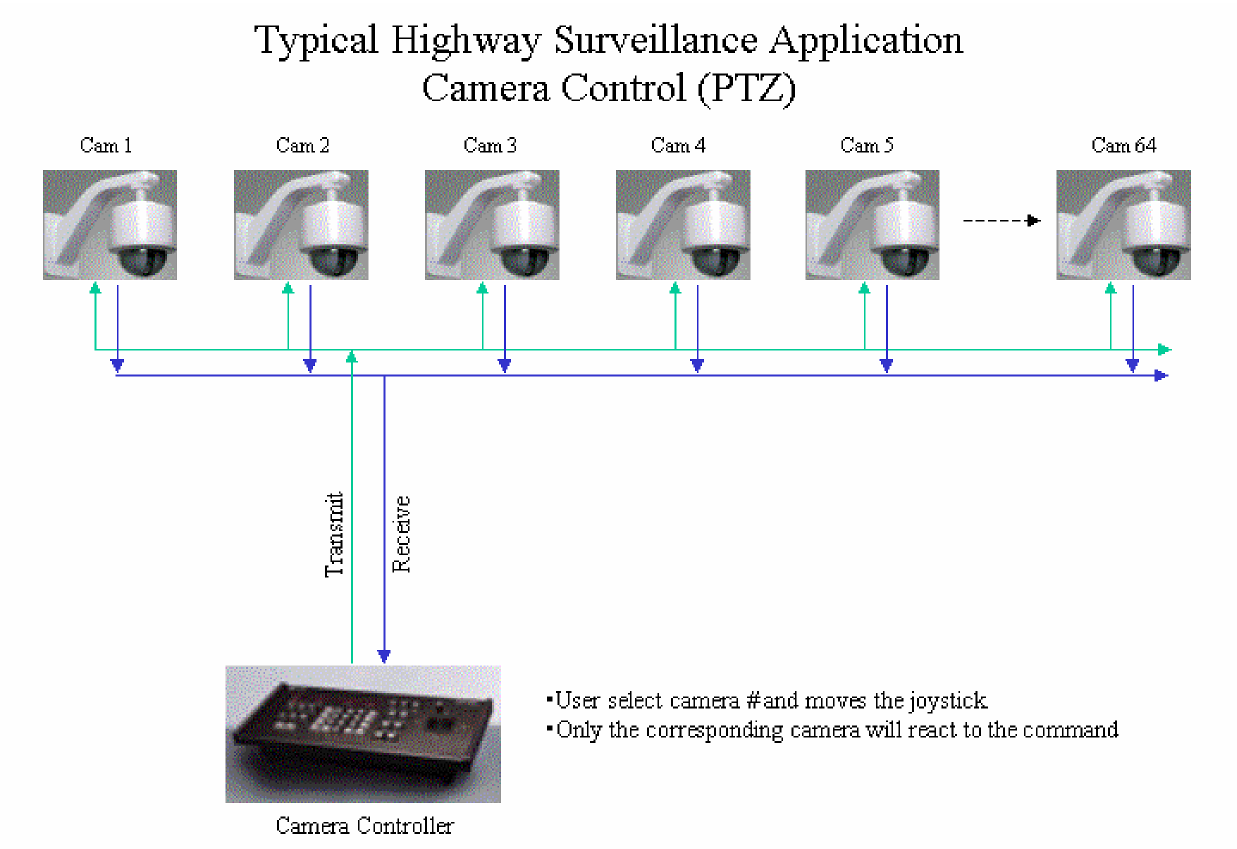

Figure 1

In larger networks, communications equipment is used to relay the serial data signal from the central site to the remote sites. Different technologies can be used to provide this functionality.

Figure 2 illustrates a communications network-utilizing analog FDM (Frequency Division Multiplexer). This transmits the data in the same manner as a buss wire would. A single input signal can be transmitted to an unlimited number of destinations simultaneously.

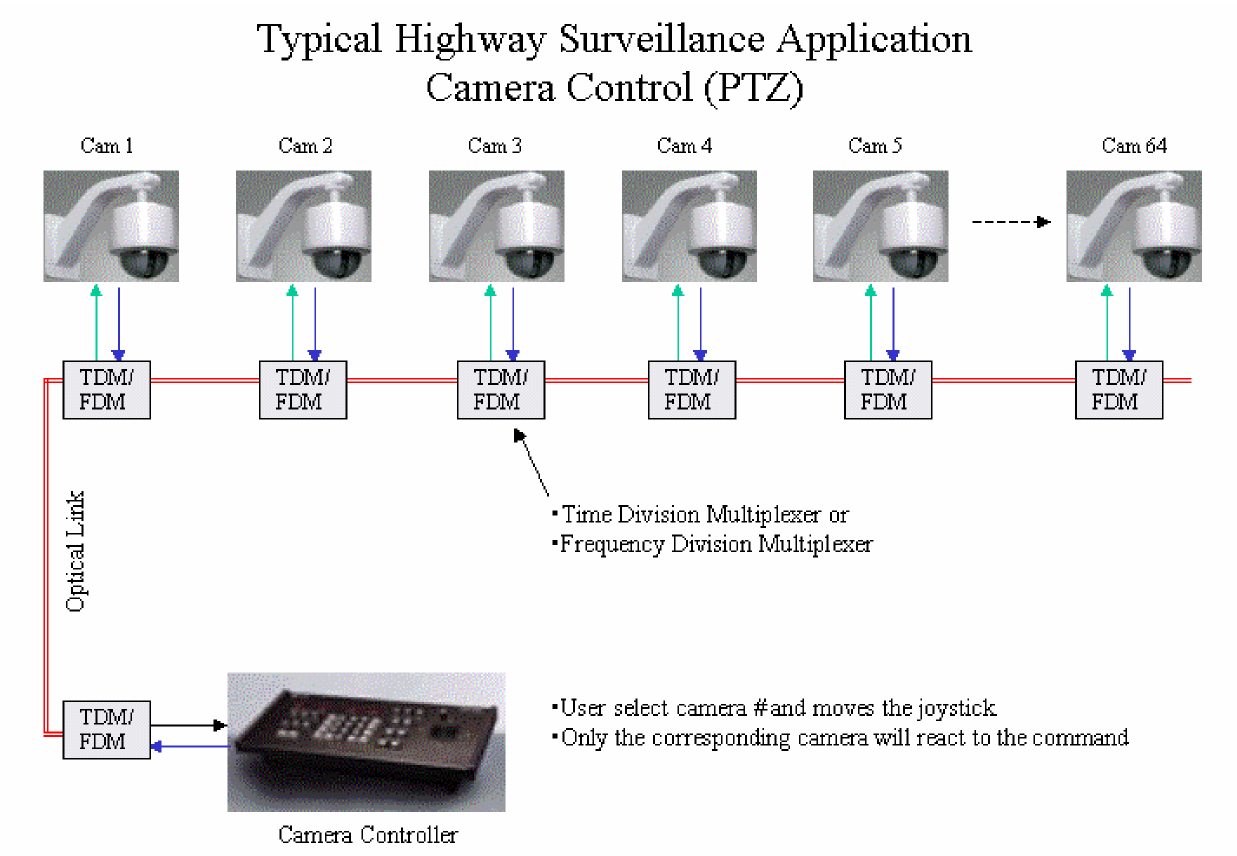

Figure 2

The use of point-to-point fiber modems is also very common in this industry. To propagate the serial data to all the remotes requires a signal splitter that will distribute the same source data to multiple locations.

Figure 3 illustrates the use of Port Sharing Devices also known as 'modem multipliers' which distribute the signal. Port Sharing devices are available in different port configurations.

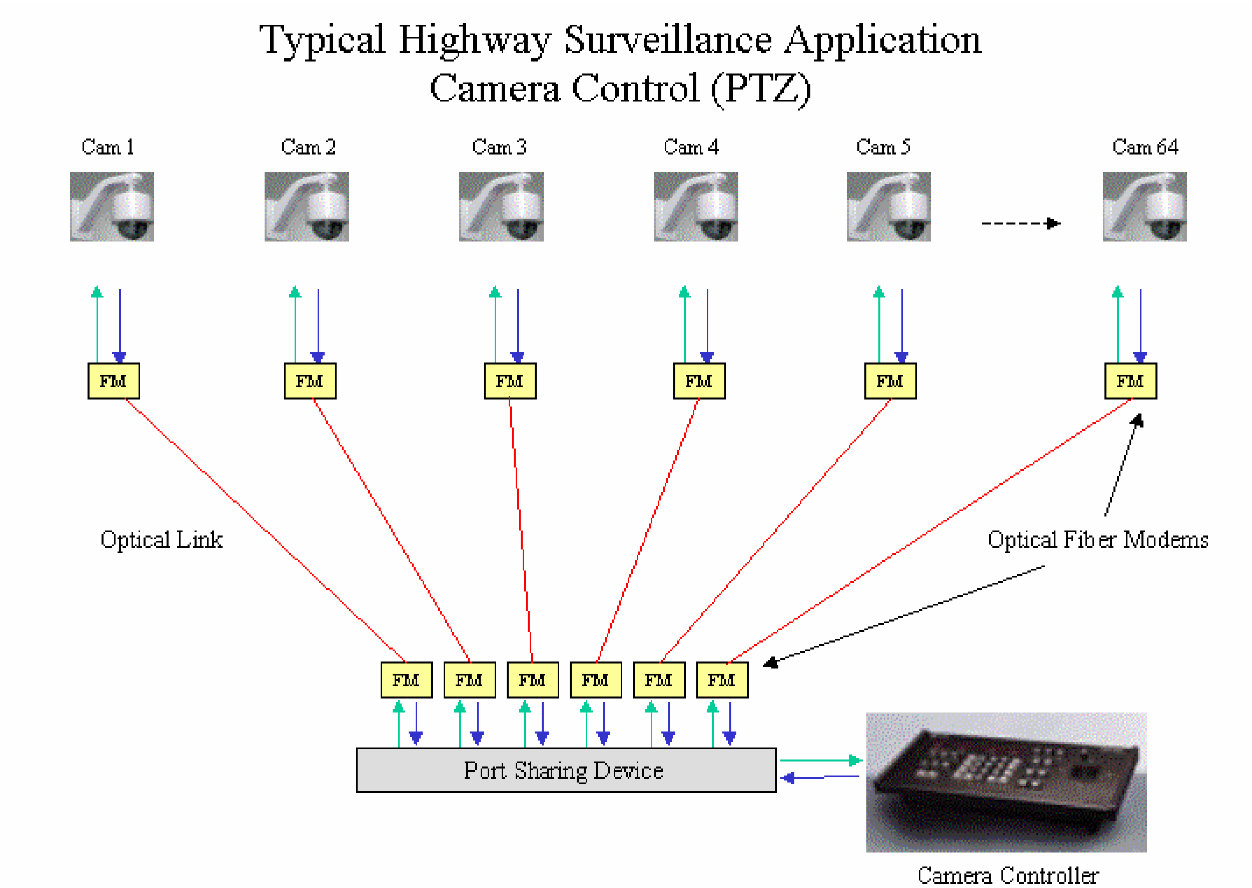

Figure 3

2 Serial Data Broadcast on Ethernet

Ethernet networks do not operate in the same mode as TDM or FDM but more like point-to-point modems. Sending a serial data signal to Ethernet networks requires a device that will packetize the serial data within an Ethernet packet. This device is called a Terminal Server. The most common Ethernet protocol used for Terminal Server applications is TCP/IP.

TCP/IP is a protocol that will establish a connection between two points in the network to transmit data without any degradation to the data content of the packet. It is very efficient and it is used for most Ethernet applications. However, this protocol is not well suited for serial data broadcast applications since it establishes a point-to-point data path between only two locations. To facilitate a serial data broadcast application, multiple point-to-point communication channels are needed. External Port Sharing devices are generally used to distribute the same data signal to various different point-to-point destinations.

Figure 4 illustrate the typical use of Terminal Servers and Port Sharing devices to distribute the serial data for broadcast applications over IP networks.

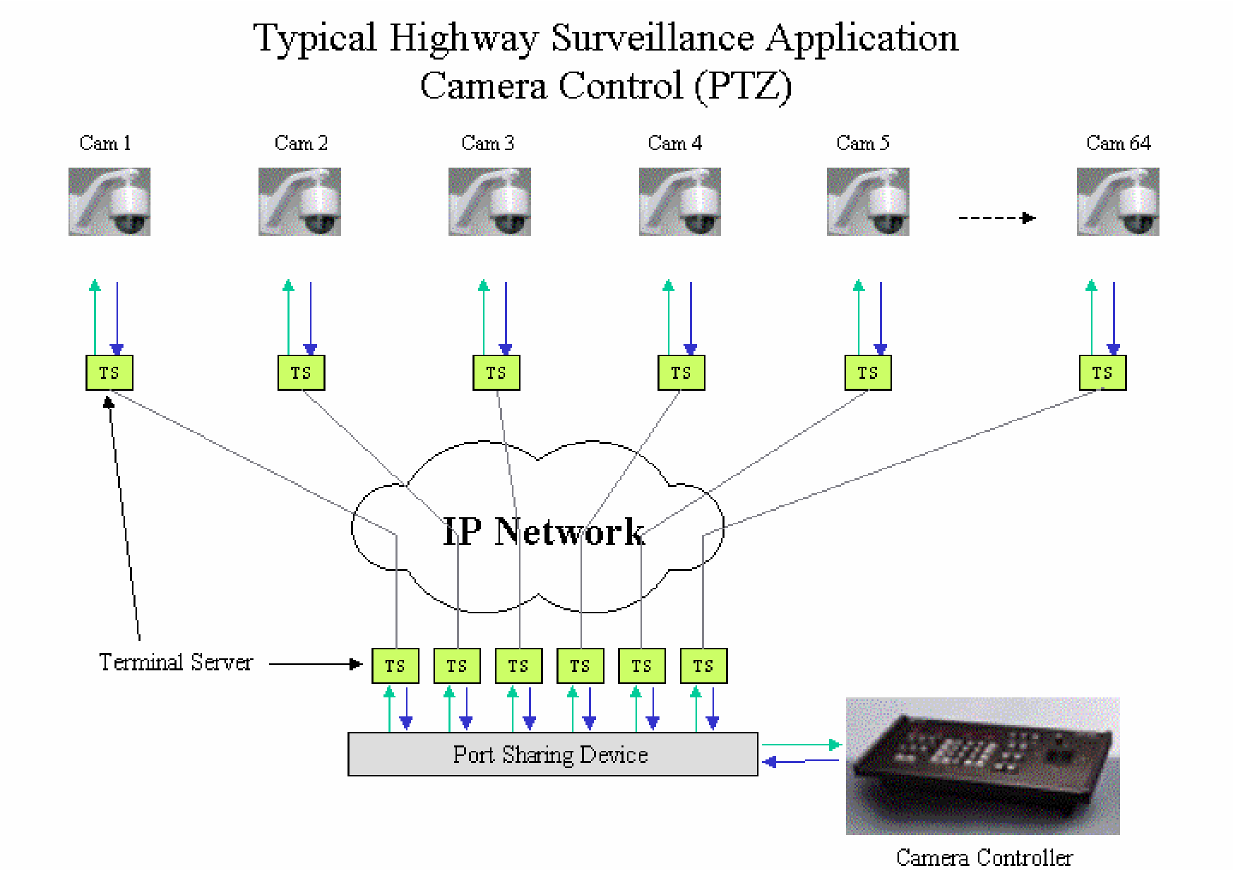

Figure 4

Terminal server functionalities can now be found in a wide variety of Ethernet products on the market. However, today's surveillance networks are much more comprehensive and often require multiple Terminal Servers to be deployed in a large installation. Just imagine a 60 camera system; you would need one or multiple Port Sharing devices with 60 serial ports inter-connected with 60 serial cables to 60 Terminal Server serial ports and 60 Ethernet ports tied to your Ethernet Switch. This solution is not the most efficient from both a cost and operational point of view in large networks. A more efficient and simplified solution suited for serial data broadcast over Ethernet networks is needed to pave the way for future applications.

2.1 Alternative broadcast solution on Ethernet

With Ethernet, there is a multitude of standard protocols used to pass data from different devices and the most common one is TCP/IP. As described above, TCP/IP has its limitations and is excellent for most applications but not for serial data broadcast application. iMPath has reviewed several different alternative solutions and has retained two that are simple to use and implement.

2.2 Multi-Unicast solution

Multi-Unicast provides a solution that creates a data path from the host location to a multiple pre-determined destination. In this case, the host Terminal Server creates a UDP connection to a number of remote Terminal Server ports. This provides the ability to broadcast the same data message to numerous different remote sites without the need for multiple serial port and Port Sharing devices at the central site. The Terminal Server, the host unit, is programmed with all of the destination IP addresses of the remote Terminal Servers. In return, the remote Terminal Servers are programmed to return the data to the host IP address.

Figure 5 provides an overview of how the data is transmitted over the IP network.

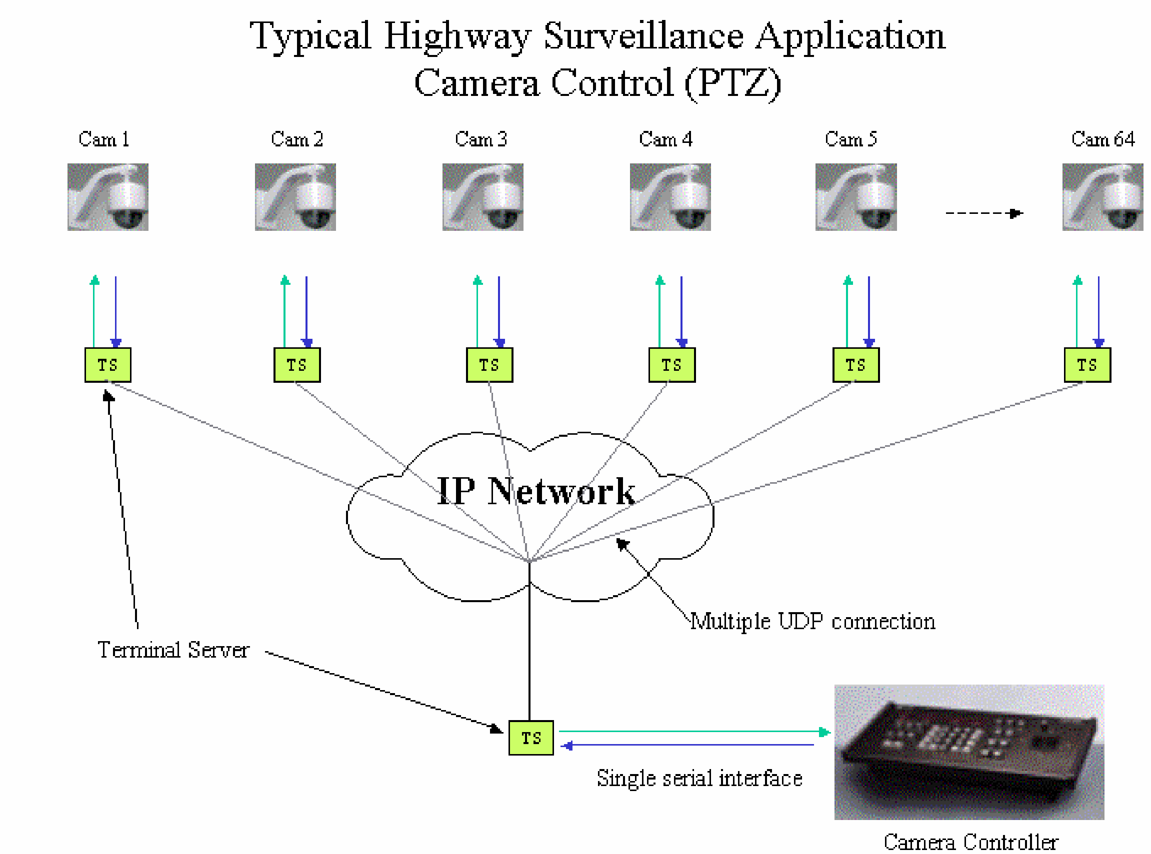

Figure 5

Figure 6 provides an example of the configuration menu found in some Terminal Server host port configurations. This example uses the DIGI Terminal Server model TS-4H.

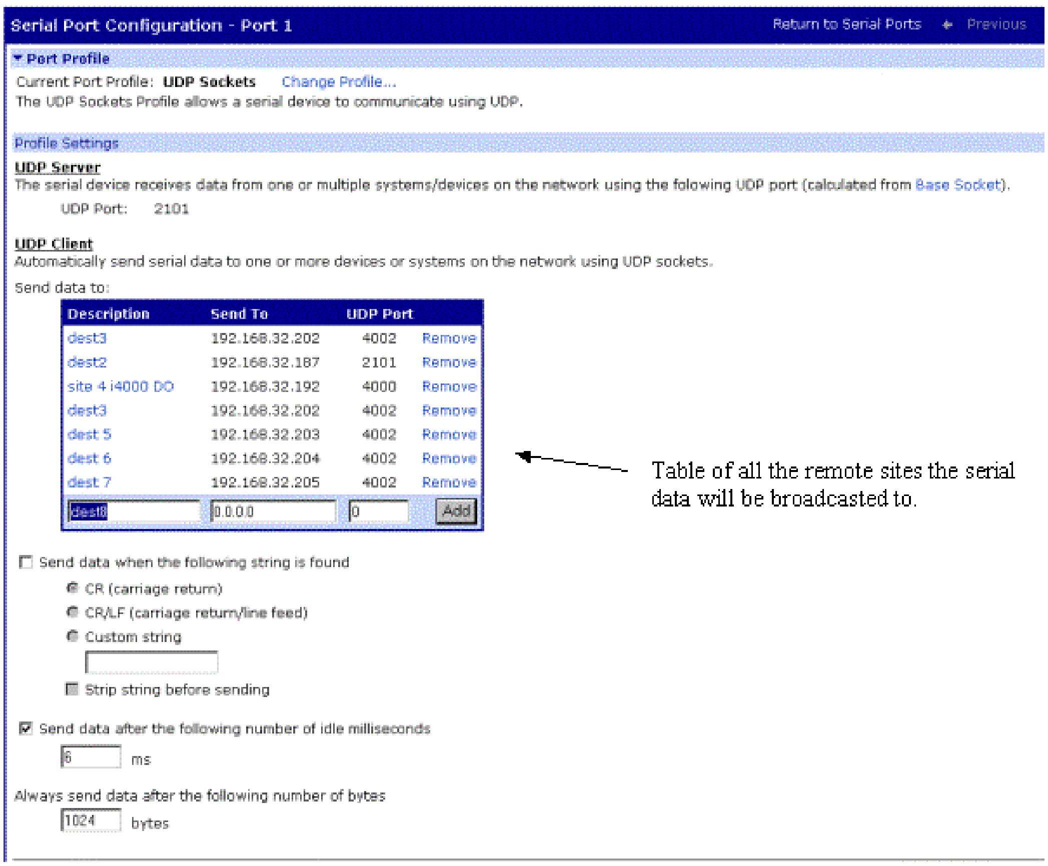

Figure 6

Figure 7 provides an example of the configuration menu found in some Terminal Server remote port configurations. This example uses the DIGI Terminal Server model TS-4H.

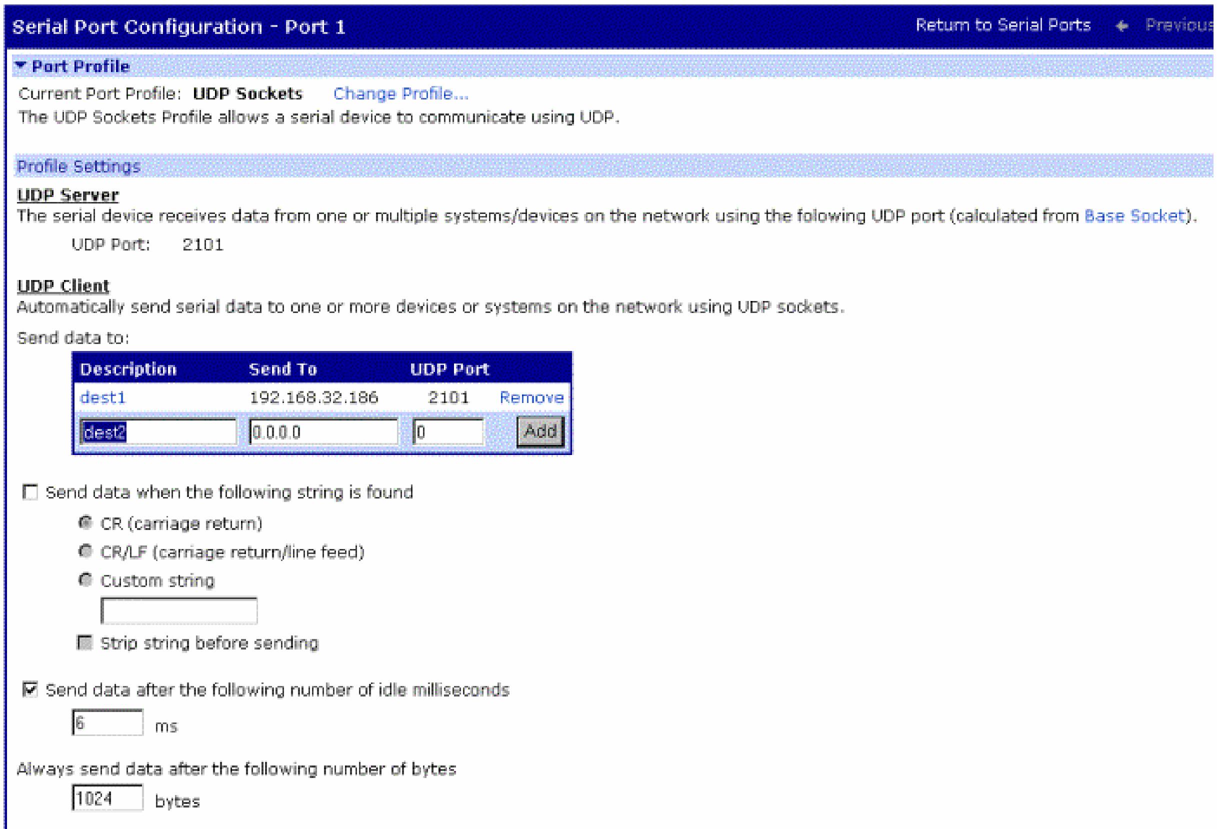

Figure 7

iMPath has added support for Multi-Unicast into all i-Volution products to operate within multi-vendor network solutions such as the one in this environment. The support of Multi-Unicast enables iMPath Encoders to be deployed at remote sites along with the DIGI TS-4H products. In this application, the DIGI product is required at the host end. Full interoperability testing has been performed in our lab to confirm product compatibility. This function is called “Unicast UDP” on iMPath products.

Figure 8 provides an example of an application where DIGI and iMPath’s combined solution can be deployed into a network.

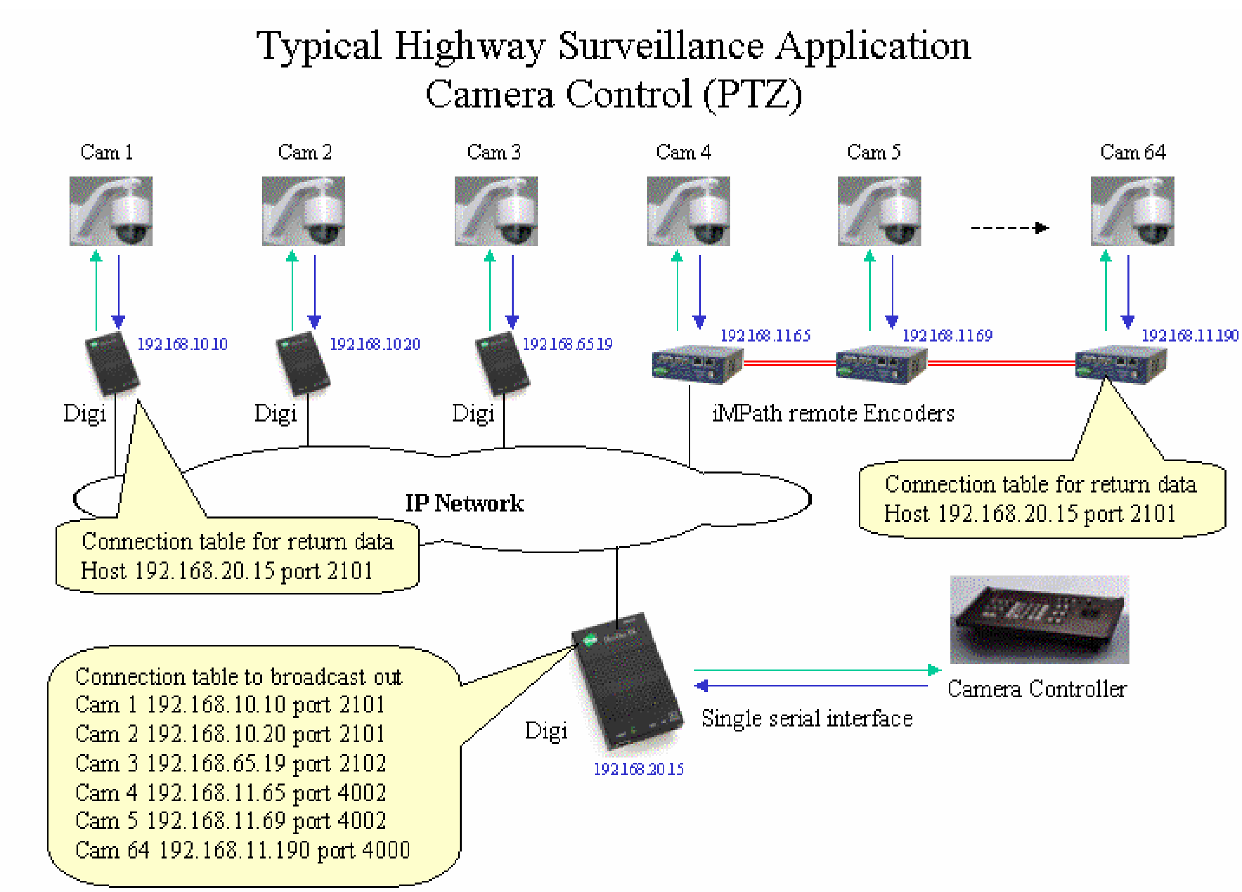

Figure 8

In this example, you will note that a similar configuration is used to return data traffic to the host controller. For the return traffic, a static return IP address is required to point to the host Terminal Server. See Figure 9 as an example for iMPath Encoder serial data port configuration in Multi-Unicast mode.

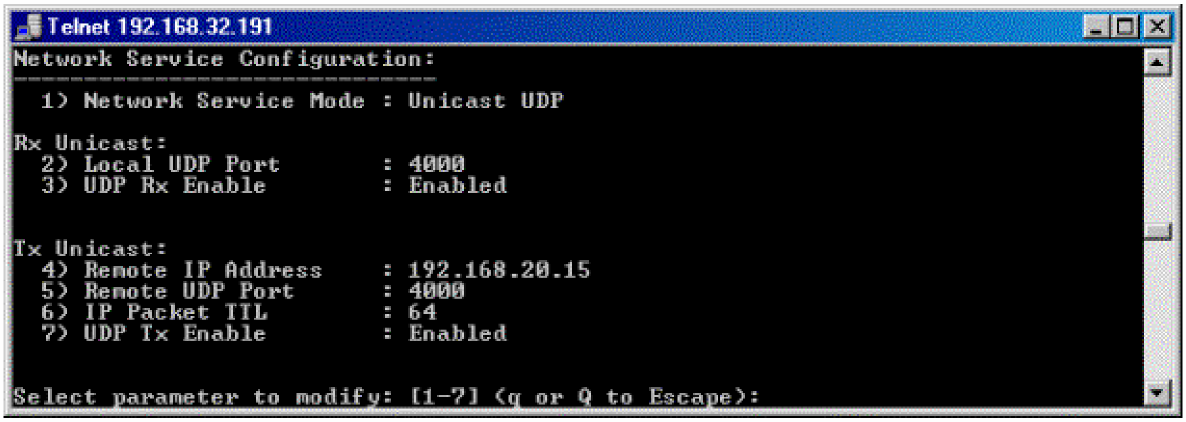

Figure 9

Multi-Unicast data is very efficient to distribute the data to multiple locations simultaneously, but it does have some limitations.

- Requires pre-knowledge of each remote destination IP address and Port address.
- Requires static configuration of each individual destination IP address in the host Terminal Server.
- Requires adding or removing address in the host terminal server every time a new remote site is added or removed.
- Every data sent to the remote sites generates individual packets for each site. This introduces some minimal network load but does introduce some network delays in large deployments.

The alternate solution is to use a standard protocol that is reliable, simplifies deployment and is widely used in the IP industry. IGMPv2 Multicast is another solution that addresses these application requirements.

2.3 Multicast Data Solution

The Multicast protocol is widely used for Video and Audio broadcasting. In addition to Video and Audio, iMPath i-Volution now offers Multicast for Serial Data applications.

With Multicast Data, there are only two configurations required. Set a fixed Multicast address on the host serial port and set each remote site to join that group. When adding other sites to the group, no changes are needed at the host end. Just set the remote unit to join the existing multicast group. This solution is much easier and has no restriction on the number of remote sites. In addition, with Multicast, the host forwards a single packet to all the remote sites. This is actually faster then the Multi-Unicast application.

Figure 10 illustrates a typical Multicast Data application.

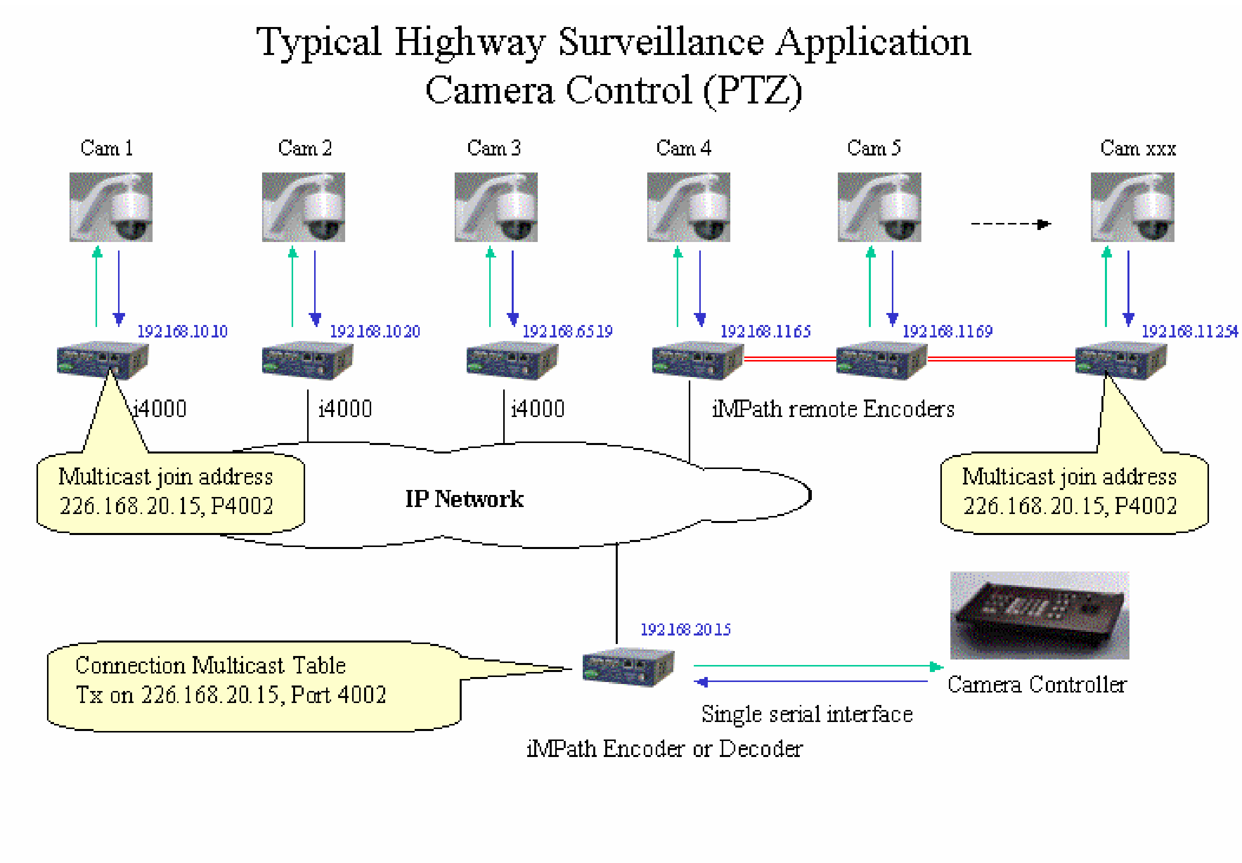

Figure 10

For return data, iMPath offers two-configuration modes. The first offers the ability to set the remote device to send all return traffic to a static pre-configured IP address. This was the case for the Multi-Unicast example and can be for the example of Figure 10. The second alternative is to set the unit auto detect where the last packet received originated from (sender IP address) and use this address for the return data to the host IP address. Once again, this simplifies the unit configuration as there is no need to keep track of host IP addressing.

With growing demand for redundant networks supported with multi-control rooms, iMPath's dynamic reply functionality offers a new and flexible solution to address this growing market. This function provides the ability to have multiple host controllers located at different locations to control the same remote devices. For camera controllers, the PTZ control command can be initiated from any location. Any of the host controllers can send traffic to any of the remote sites. For bi-directional traffic applications, the return traffic will be sent back to the last host that transmitted the multicast data on the network.

Figure 10 illustrates an application where two different users located at different facilities have control of any of the cameras from any of the controllers.

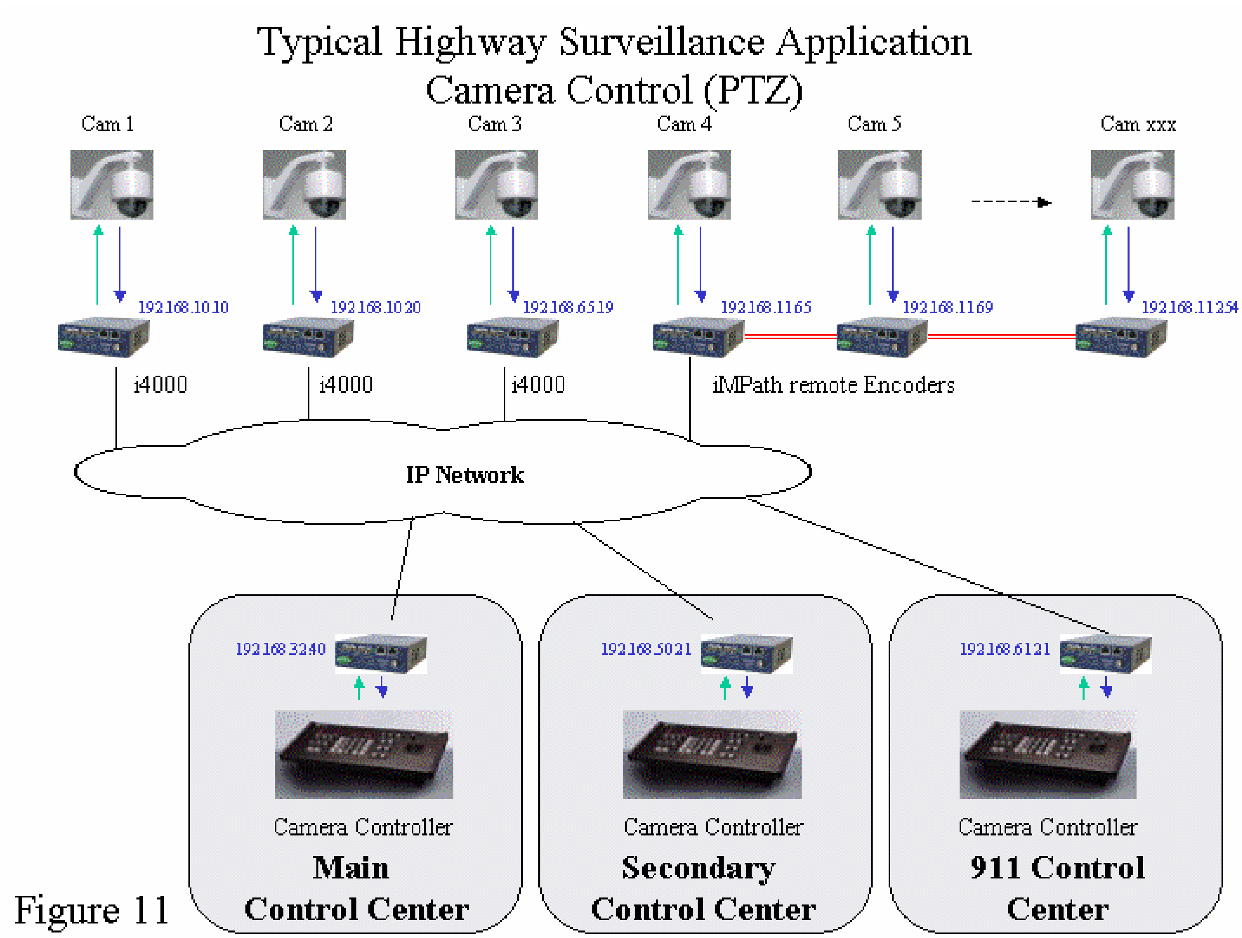

Figure 11

Figure 12 illustrates the configuration menus of the remote and host port configuration on iMPath products. Note the simplified configuration field for both sending and receiving ends.

Remote device configuration

```
Network Service Configuration:
------------------------------
  1) Network Service Mode : Multicast UDP Receiver

Rx Multicast:
  2) Multicast Group IP   : 225.168.10.13
  3) Local UDP Port       : 4000
     UDP Rx Enable        : Enabled [Not Configurable]


Tx Unicast:
     Remote IP Address    : auto [Not Configurable]
  4) Remote UDP Port      : 4000
  5) IP Packet TTL        : 64
  6) UDP Tx Enable        : Enabled
```

Host device configuration

```
Network Service Configuration:
------------------------------
  1) Network Service Mode : Multicast UDP Sender

Rx Unicast:
  2) Local UDP Port       : 4000
  3) UDP Rx Enable        : Enabled


Tx Multicast:
  4) Remote IP Address    : 225.168.10.13
  5) Remote UDP Port      : 4000
  6) IP Packet TTL        : 64
  7) UDP Tx Enable        : Enabled
```

Figure 12

2.4 Ethernet's Limitations of serial data

2.4.1 Latency

Serial Data communication is typically used between devices that are located in close proximity to each other via direct wires or using time division communication trunks such as modems or TDM technology for long distances. With this traditional approach, latency delays between end-to-end communications are very minimal if any. With the introduction of serial to IP communication, latency delays are expected, as the Ethernet network cannot guarantee time of delivery.

Most serial data applications do operate very well in Ethernet networks. Unfortunately, some applications are very time sensitive and do not function well in this environment. It is our recommendation that customers should verify with the application's manufacturer, that the application will work well over an IP network using Terminal Servers.

2.4.2 Network integrity

The traditional point-to-point connection on the Ethernet network utilizes TCP/IP protocol. TCP/IP offers packet verification to ensure all packets are error free. For Multi-Unicast and Multicast data, the data is transmitted using UDP and is sent blind onto the network. There is no error verification to ensure the message was received by the destination.

The lack of error correction on Ethernet networks using UDP could be a concern if your information was sent on saturated IP networks such as the public Intranet. These networks do not guaranty any bandwidth and are more suited for a TCP/IP application. In the case of private surveillance networks, customers have full control of the network components, users and traffic. Networks are designed for "zero" contention to ensure all the traffic can be on this network without any concern with bandwidth limitation. The use of UDP is very practical and secured in private networks that are engineered to meet all application bandwidth requirements.

2.5 Equipment list

All examples used in this document were tested using the following products.

Etherwan 9808S & 2224S Ethernet Switches
Linksys Ethernet Switch
Vicon Surveyor 2000 camera
Vicon Direct Control Application
iMPath i4000 version 1.0.41
DIGI TS 4H version: 82000747_M1 04/07/2004

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4 Conclusion

Historically, Serial Data broadcast applications were not well suited for Ethernet networks. With the introduction of Multi-Unicast and Multicast data support on Terminal Servers, these applications can now make full benefit of the flexibility of Ethernet communication networks. iMPath's i-Volution offers a complete solution that addresses the requirements of Serial Data Broadcast applications using both Multi-Unicast and Multicast data.

5 Product Support Contact List

5.1 iMPath Support

For additional information on iMPath products, feel free to contact any of the following representatives at :

Phone: 850-668-5293

Jim LaBatt	Blackhawk Enterprises Inc.		blhawk99@aol.com
	ITS Representative – North America		

Phone: 613-226-4000

Daniel Brisson	Sr. System Engineer	x297	dbrisson@impathnetworks.com
Gilles Lebel	Sr. System Engineer	x224	glebel@impathnetworks.com

5.2 DIGI Contact

For additional information on Digi solution, please contact Digi directly at:

Website : www.digi.com
Contact: Deb Smith Business Development Digi International
Telephone: 877-912-3444 ext 3283
Email: deb_smith@digi.com