



VCOM Virtual Matrix User Guide

Patent Pending: U.S. Serial # 11/970,871; International Serial # PCT/US08/50481

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VCOM Virtual Matrix - IntraCom
Licensed to IntraCom for 1000 clients
06/28/08 07:45:56 - Server using configuration file: "C:\Program Files\IntraCom\VCOM\SystemConfiguration.bcf" ... # of Configured Users: 16, System Audio Sample Rate: 16 KHz
06/28/08 07:45:56 - Server ready to accept connections... Version: 2.1.0.101 [Pre-Release], IP Address: 192.168.0.4:1000
06/28/08 07:47:30 - [systemdml] Administrator login ... Version: 2.1.0.35 [Pre-Release], IP Address: 192.168.0.4:49298
06/28/08 07:47:57 - [Stephen] Client login rejected due to invalid login name and password.
06/28/08 07:48:11 - [Station #1] Client login ... Version: 2.1.0.51 [Pre-Release], IP Address: 192.168.0.4:49296, Client Audio Sample Rate: 16 KHz
06/28/08 07:48:13 - [Station #1] Talk activated for All Page
06/28/08 07:48:14 - [Station #1] Listen activated for Party Line 6
06/28/08 07:48:14 - [Station #1] Talk activated for Party Line 6
06/28/08 07:48:14 - [Station #1] Talk deactivated for Party Line 6
06/28/08 07:48:15 - [Station #1] Talk activated for Party Line 2
06/28/08 07:48:15 - [Station #1] Listen activated for Party Line 3
06/28/08 07:48:15 - [Station #1] Talk activated for Party Line 3
06/28/08 07:48:15 - [Station #1] Talk activated for Party Line 4
06/28/08 07:48:16 - [Station #1] Listen activated for Party Line 5
06/28/08 07:48:16 - [Station #1] Talk activated for Party Line 5
06/28/08 07:48:16 - [Station #1] Talk deactivated for Party Line 2
06/28/08 07:48:21 - [Station #1] Client logout
06/28/08 07:48:26 - [Station #5] Client login ... Version: 2.1.0.51 [Pre-Release], IP Address: 192.168.0.4:49298, Client Audio Sample Rate: 16 KHz
06/28/08 07:48:27 - [Station #5] Listen activated for Party Line 1
06/28/08 07:48:27 - [Station #5] Talk activated for Party Line 1
06/28/08 07:48:27 - [Station #5] Listen deactivated for Party Line 1
06/28/08 07:48:28 - [Station #5] Talk activated for All Page
06/28/08 07:48:28 - [Station #5] Listen activated for Party Line 6
06/28/08 07:48:28 - [Station #5] Talk activated for Party Line 6
06/28/08 07:48:29 - [Station #5] Client logout
06/28/08 07:48:33 - [Station #5] Client login ... Version: 2.1.0.51 [Pre-Release], IP Address: 192.168.0.4:49305, Client Audio Sample Rate: 16 KHz
06/28/08 07:48:43 - [Station #2] Talk activated for Party Line 2
06/28/08 07:48:43 - [Station #2] Talk activated for Party Line 3
06/28/08 07:48:43 - [Station #2] Listen activated for Party Line 4
06/28/08 07:48:43 - [Station #2] Talk activated for Party Line 4
06/28/08 07:48:44 - [Station #2] Listen activated for Party Line 1
06/28/08 07:48:44 - [Station #2] Talk activated for Party Line 1
06/28/08 07:48:45 - [Station #2] Talk activated for All Page
06/28/08 07:48:46 - [Station #2] Listen activated for Party Line 6
06/28/08 07:48:46 - [Station #2] Listen deactivated for Party Line 6
06/28/08 07:48:46 - [Station #2] Talk activated for Party Line 6
06/28/08 07:48:47 - [Station #2] Talk deactivated for Party Line 6
06/28/08 07:48:47 - [Station #2] Talk activated for Party Line 6
06/28/08 07:48:47 - [Station #2] Talk deactivated for Party Line 6
06/28/08 07:48:47 - [Station #2] Talk activated for Party Line 6
06/28/08 07:48:51 - [Station #2] Client logout
06/28/08 07:48:54 - [Station #2] Client login ... Version: 2.1.0.51 [Pre-Release], IP Address: 192.168.0.4:49307, Client Audio Sample Rate: 16 KHz
06/28/08 07:48:54 - [Station #2] Client login ...
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1. INTRODUCTION

1.1 VCOM

VCOM is a non-blocking, all software multi-channel/multi-access Intercom over Internet Protocol based on a dedicated server, multiple client architecture. VCOM is engineered for professional, mission critical communications in broadcast, production, military, aerospace, and government applications.

This short document provides information on how to install, configure, and use the VCOM Virtual Matrix server software.

1.2 SYSTEM REQUIREMENTS

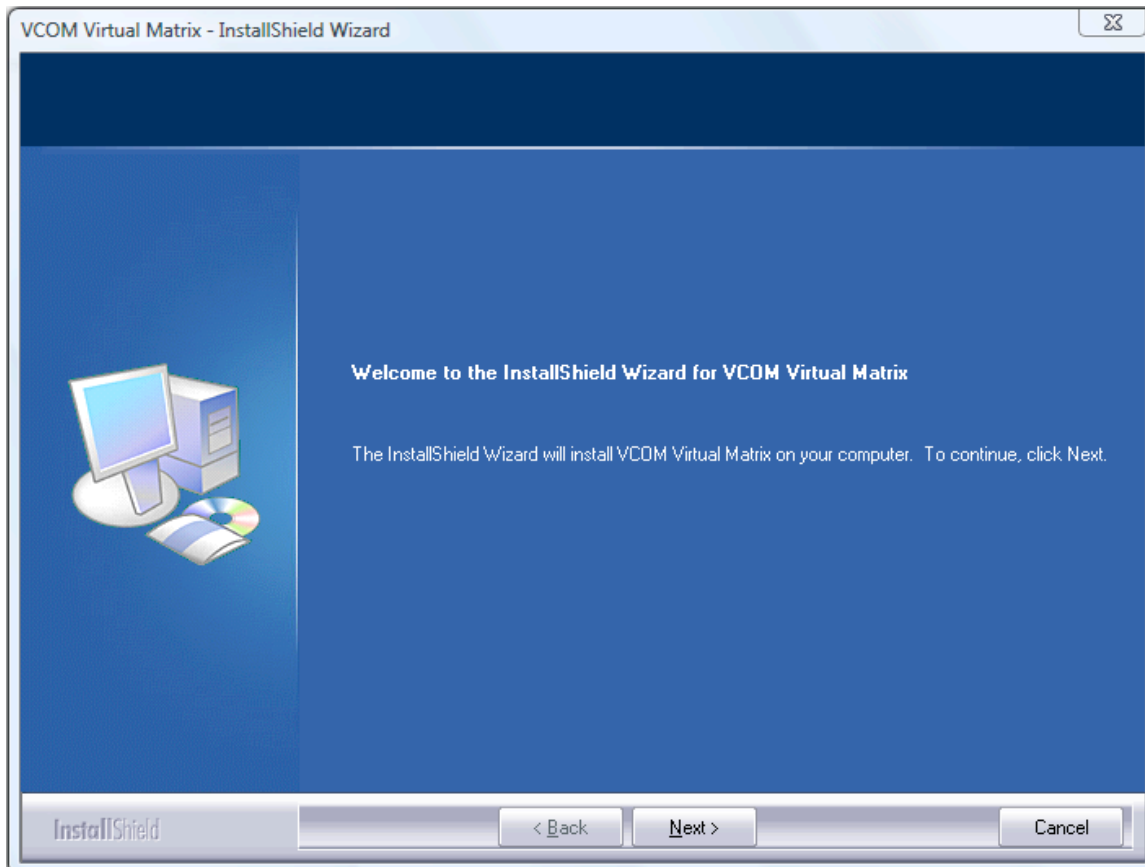
- Hardware Requirements
 - Pentium 4, 2 GHz Processor, 1Gb RAM

Requirements may be greater depending on system size
- Software Requirements
 - Windows Server 2008 (preferred), Windows Server 2003, Windows XP, Windows Vista, Windows 7
- Network Requirements
 - 100BaseT connection
 - See Appendix: Network Bandwidth Requirements Guide
- Firewall Requirements
 - Outbound: Allow TCP connection for data on port 1000 and UDP connection for audio on port 1000
 - Inbound: Port forwarding TCP and UDP on port 1000 to IP address of server

2. INSTALLATION

Locate the VCOM Virtual Matrix setup application, typically named 'VCOM_Virtual_Matrix_Setup.exe,' that was provided either electronically or on CD.

Run the installer and follow the prompts.

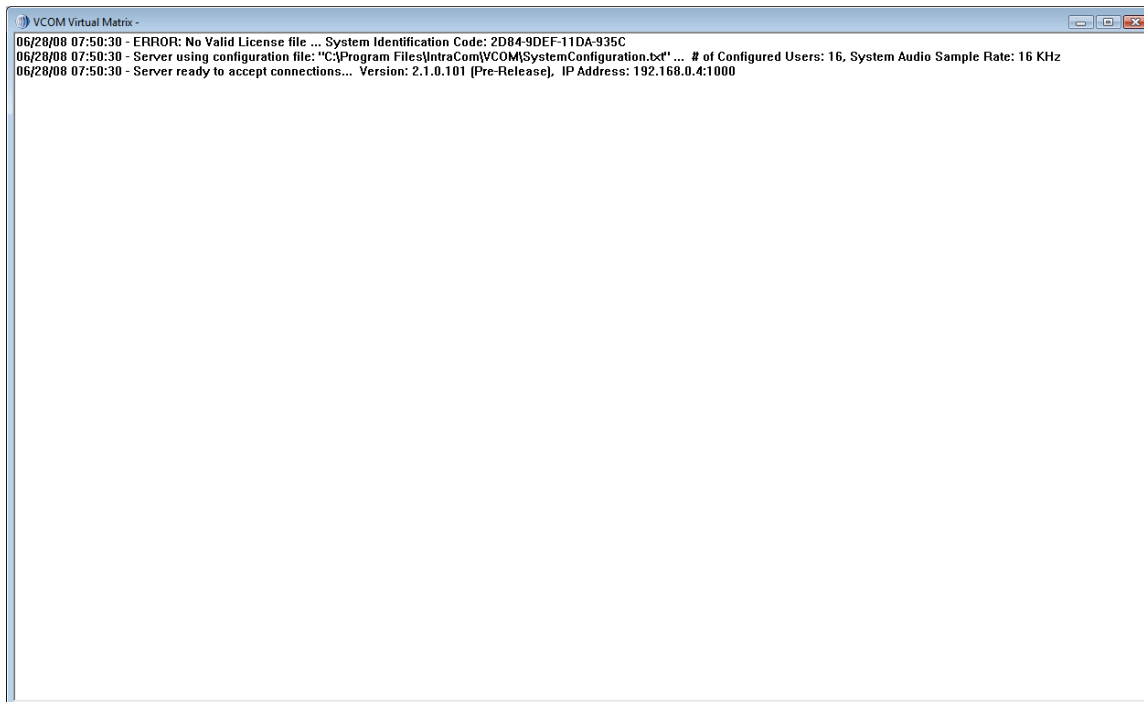


You will need to accept IntraCom Systems' License Agreement to install the software.

During the installation process you will be asked if you want to install the VCOM Virtual Matrix to run as a service or application.

To open the VCOM Virtual Matrix once installed click on your 'VCOM Virtual Matrix' shortcut icon on your desktop or click on your start menu and select 'All Programs.' Find 'IntraCom' and select 'VCOM Virtual Matrix.'

Note, you can run the VCOM Virtual Matrix before licensing but will not be able to connect Control Panels or Device Interfaces.



3. LICENSING

To license your VCOM System you need to acquire a valid license file from IntraCom Systems, LLC. To do so you must provide IntraCom with your unique 'System Identification Code' generated automatically when you install the VCOM Virtual Matrix. The 'System Identification Code' is a unique value specific to the computer on which the Virtual Matrix was installed and is not transferable to any other computer. If the server you are running the VCOM Virtual Matrix on has dual network cards make sure the correct one is chosen before sending the system identification code as it is dependant on the network card being used. You can obtain the 'System Identification Code' either by:

- 1) Log into the VCOM System Administration Application and in the upper left side of the main window click the '...' icon next to 'System Information.' Note, the VCOM System Administration downloads and installs automatically with the VCOM Virtual Matrix ready to connect with the default login name and no password required. *Refer to the VCOM System Administration User Guide for detailed instructions on its use; or*

2) Observing the error message displayed in the VCOM Virtual Matrix main window ('ERROR: No Valid License file ... System Identification Code:') which is followed by your 16 digit system identification code

Once you locate your system identification code email, fax, or call it into your VCOM sales representative so a license file can be provided. When you receive your license file do one of the following:

1) Log into the VCOM System Administration Application and in the upper left side of the main window click the '...' icon next to 'System Information.' Then click the 'Upload License File' button. *Refer to the VCOM System Administration User Guide for detailed instructions on its use;* or

2) Copy the file to the same directory of the VCOM Virtual Matrix executable, typically C:\Program Files\IntraCom\VCOM.

Note, if the server is being installed for failover purposes no license is required.

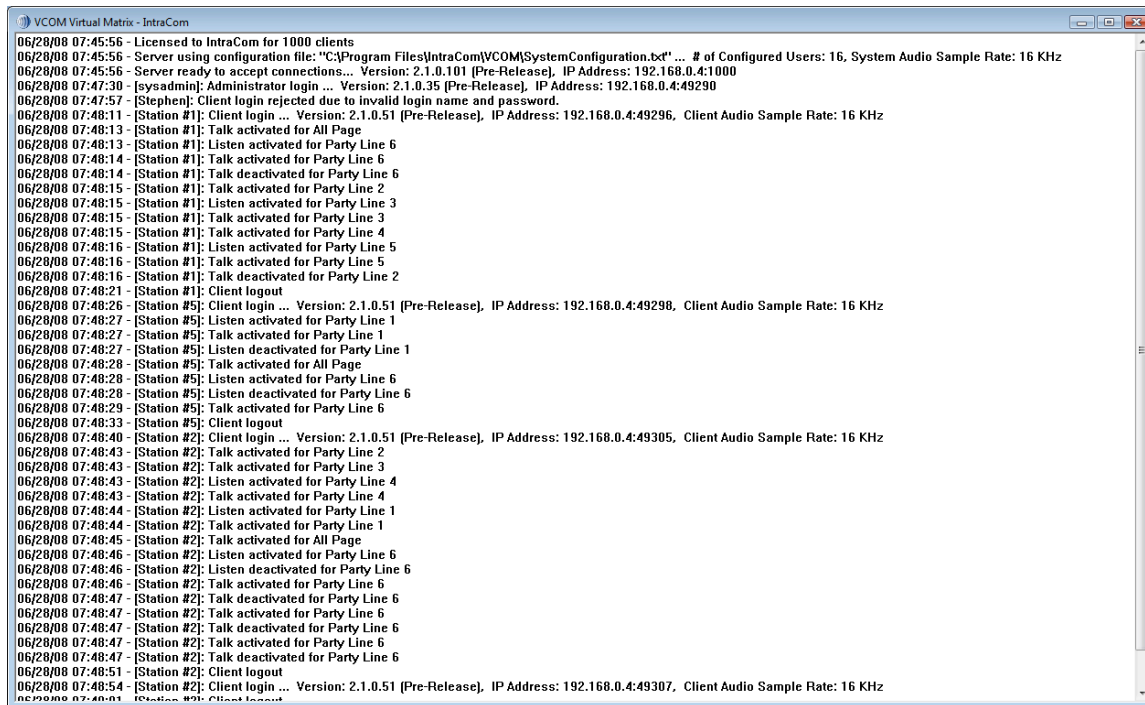
Once the license file is installed, the VCOM Virtual Matrix will be ready to accept connections under the default configuration for 20 users consisting of 11 Point-to-Point channels, 9 Input/Output channels for device interfacing, 8 Party Lines, and 1 Fixed Group set as an All Page. Default Login Names for VCOM Control Panels are set to 'station1 - 11' and 'io1 - 9' for Device Interfaces, all using no password.



4. OPERATION

The VCOM Virtual Matrix requires no user interaction during operation.

During operation the logging feature in the main window displays a time stamped entry for many system events include client connections/disconnections and selector activations.



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VCOM Virtual Matrix - IntraCom
06/28/08 07:45:56 - Licensed to IntraCom for 1000 clients
06/28/08 07:45:56 - Server using configuration file: "C:\Program Files\IntraCom\VCOM\SystemConfiguration.txt" ... # of Configured Users: 16, System Audio Sample Rate: 16 KHz
06/28/08 07:45:56 - Server ready to accept connections... Version: 2.1.0.101 [Pre-Release], IP Address: 192.168.0.4:1000
06/28/08 07:47:30 - [sysadmin]: Administrator login ... Version: 2.1.0.35 [Pre-Release], IP Address: 192.168.0.4:49290
06/28/08 07:47:57 - [Stephen]: Client login rejected due to invalid login name and password.
06/28/08 07:48:11 - [Station #1]: Client login ... Version: 2.1.0.51 [Pre-Release], IP Address: 192.168.0.4:49296, Client Audio Sample Rate: 16 KHz
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06/28/08 07:48:27 - [Station #5]: Listen deactivated for Party Line 1
06/28/08 07:48:28 - [Station #5]: Talk activated for All Page
06/28/08 07:48:28 - [Station #5]: Listen activated for Party Line 6
06/28/08 07:48:28 - [Station #5]: Listen deactivated for Party Line 6
06/28/08 07:48:29 - [Station #5]: Talk activated for Party Line 6
06/28/08 07:48:33 - [Station #5]: Client logout
06/28/08 07:48:40 - [Station #2]: Client login ... Version: 2.1.0.51 [Pre-Release], IP Address: 192.168.0.4:49305, Client Audio Sample Rate: 16 KHz
06/28/08 07:48:43 - [Station #2]: Talk activated for Party Line 2
06/28/08 07:48:43 - [Station #2]: Talk activated for Party Line 3
06/28/08 07:48:43 - [Station #2]: Listen activated for Party Line 4
06/28/08 07:48:43 - [Station #2]: Talk activated for Party Line 4
06/28/08 07:48:44 - [Station #2]: Listen activated for Party Line 1
06/28/08 07:48:44 - [Station #2]: Talk activated for Party Line 1
06/28/08 07:48:45 - [Station #2]: Talk activated for All Page
06/28/08 07:48:46 - [Station #2]: Listen activated for Party Line 6
06/28/08 07:48:46 - [Station #2]: Listen deactivated for Party Line 6
06/28/08 07:48:46 - [Station #2]: Talk activated for Party Line 6
06/28/08 07:48:47 - [Station #2]: Talk deactivated for Party Line 6
06/28/08 07:48:47 - [Station #2]: Talk activated for Party Line 6
06/28/08 07:48:47 - [Station #2]: Talk deactivated for Party Line 6
06/28/08 07:48:47 - [Station #2]: Talk activated for Party Line 6
06/28/08 07:48:47 - [Station #2]: Talk deactivated for Party Line 6
06/28/08 07:48:51 - [Station #2]: Client logout
06/28/08 07:48:54 - [Station #2]: Client login ... Version: 2.1.0.51 [Pre-Release], IP Address: 192.168.0.4:49307, Client Audio Sample Rate: 16 KHz
06/28/08 07:48:54 - [Station #2]: Client logout
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VCOM is configured dynamically using the VCOM System Administration application which is installed with the VCOM Virtual Matrix. It can also be installed and run on any client-side work station. To open the VCOM System Administration application, click on your 'VCOM System Administration' shortcut icon on your desktop or click on your start menu and select 'All Programs.' Find 'IntraCom' and select 'VCOM System Administration.' The default master login name is 'admin' and there is no password configured. Once logged in, this can be changed.

Refer to the VCOM System Administration User Guide for detailed instructions on how to configure VCOM.

5. OPERATING AS A SERVICE

The VCOM Virtual Matrix is provided both as an 'application' and as a 'service'. An application is run in the foreground and is visible to the user. A service is run in the background and is invisible to the user. While running the application is advantageous to use during initial setup and configuration, running as a service is preferable as it can never be inadvertently closed and the service will automatically restart in the case of an environmental power failure.

To install the Virtual Matrix as a service, open a Command prompt and navigate to the installation directory of the Virtual Matrix (typically C:\Program Files\IntraCom\VCOM). From this directory type 'VirtualMatrixService install'. The Virtual Matrix server will automatically be started. To view the operating status of the Virtual Matrix service, open the Services application from the Windows Control Panel.

6. FAILOVER CAPABILITY

Overview

In any mission critical communications system it is imperative to have built in-redundancy. VCOM supports this function with a Failover capability. Failover by definition is the ability to automatically switch over from a primary working server to a secondary backup server should there be any catastrophic failure in operation of the primary server or its associated network.

Implementation

In the primary server, the IP address of the secondary server is configured. When the primary server starts, a connection to the secondary server is immediately established. Through this connection the primary server shares its licensing information to the secondary server so that individual licensing for the secondary server is not required. Additionally, the primary server conveys any operational changes to the system configuration to secondary server in real time so that the system configurations remain synchronized. This connection will remain active as long as both servers are running. If this connection is lost, the secondary server will immediately assume it is an active server allowing VCOM clients to connect. However in some cases even if the connection is not lost, the complexities of some network failures may still warrant the secondary server becoming the active server.

When any VCOM client logs into the primary server, the secondary server IP address is automatically provided to it. In the event that communications with the primary server is lost, the client will automatically attempt to connect to the secondary server. If the secondary server is available and active, the VCOM client will log into the secondary server. Once the secondary server becomes the active server, switching back to the primary server **generally** will require a manual authorization as the condition that caused the failover would need to be properly evaluated to ensure there is no possibility for re-occurrence of that event which would unnecessarily disrupt active communications. The manual switchover can be controlled through the System Administration application.

Failover Criteria

In normal operations, the primary server is always the active server. In general as long as the communications link between the primary and secondary server is connected, the primary server will remain as the active server. When a server is not the active server, logins will not be allowed. There are many different scenarios that can result in a failover event. The most common are as follows:

- Communication link between primary and secondary servers lost due to primary server failure.

In this simplest scenario, the secondary server would recognize the loss of the primary server and immediately become the active server. All clients would also recognize the loss of the primary server and would immediately reconnect to the secondary server.

- Communication link between primary and secondary servers lost due to failure of network infrastructure.

In this scenario, the secondary server would recognize the loss of the primary server and immediately become the active server. Since the primary server is still running, it too would also still consider itself to be the active server. However, if the network failure also resulted in the simultaneous loss of the majority of connected VCOM clients the primary server will deactivate itself forcing all remaining clients to connect to the secondary server.

- Communication link between primary and secondary servers is not lost but partial failure of network infrastructure.

In this scenario, the partial network failure may result in the loss of a large portion of the VCOM clients. In this case the primary server will

inform the secondary server to activate allowing connections to be made. If the secondary server reports the client connection were established the primary server will deactivate itself forcing all remaining clients to connect to the secondary server.

Other Considerations

Many SIP clients also support a failover server however the IP address of the secondary server often must be manually configured.

The primary and secondary servers should never be co-located so as eliminate the risk of simultaneous server failure due to environmental issues.

Summary

The VCOM Failover support is an integral part of any mission critical communications solution. While its operation will never be visible to the end user, its availability in the case of an unforeseen catastrophic primary server failure will quickly restore communications capability.

7. SUPPORT

Visit our web site at www.intracomsystem.com for general information.

Email us at support@intracomsystem.com for questions not addressed in the sections above or call our technical support hotline at 818-357-2347.

APPENDIX: Network Bandwidth Requirements Guide

The network bandwidth requirements must be carefully analyzed to ensure proper bandwidth is available at any point where multiple clients will share the same physical connection point. The most obvious connection point where this is critical is at the server where bandwidth requirements will be the sum of the requirements of every possible client. The least obvious connection point where this is also important occurs when multiple remote clients in one physical location need to access the server in another physical location as the bandwidth requirements for the connection between these two points will be the sum of the requirements for all remote clients.

To determine the bandwidth requirements it is necessary first to determine the network bandwidth utilization per client connection, which is indicated below for the various audio sample rates that can be configured.

Audio Sample Rate	Data Rate (Kbps) [ATS=20ms*]	Data Rate (Kbps) [ATS=40ms*]	Data Rate (Kbps) [ATS=60ms*]	Data Rate (Kbps) [ATS=80ms*]	Data Rate (Kbps) [ATS=100ms*]
8 KHz	32	23.6	20.8	19.4	18.56
16 KHz	44.8	36.4	33.6	32.2	31.36
32 KHz	46.8	38.4	35.6	34.2	33.36

* ATS = Audio Time Slice per packet which controls how many 20ms audio frames are transmitted within a single UDP packet. As each UDP packet requires a fixed amount of overhead, the more frames sent at the same time, the less the UDP overhead which conserves network bandwidth. Conversely, the more audio frames sent per transmission, the greater the system latency and the potential audible consequence of a lost packet. The default is 20ms.

To determine server bandwidth requirements, first determine maximum potential bandwidth utilization by multiplying the number of clients (users and devices interfaced) by the Data Rate associated with appropriate Audio Sample Rate for the configured Audio Time Slice per packet. The product is the bandwidth required if every client were to receive audio simultaneously (maximum download bandwidth requirement) and also the bandwidth required if every client were to send audio simultaneously (maximum upload bandwidth requirement). In a typical system, the maximum download bandwidth requirement must be allocated for, as several system functions can require simultaneous audio transmission to all clients. The maximum upload bandwidth requirement however will realistically never be achieved as it is not feasible that all audio sources in a system would be active simultaneously since the result would be inaudible. As such the upload bandwidth to be allocated must be made based on the estimation of the

number of simultaneous active audio sources noting that inactive audio sources will have no bandwidth requirements.

GLOSSARY

Audio Sampling Rate: How many times per second an analog audio waveform is digitally sampled, i.e. takes a “digital snap shot” to create a digital representation. The more samples taken, the higher the fidelity.

Automatic Gain Control (AGC): An adaptive system where the average signal level is used to adjust the gain to an appropriate level for a range of input signal levels. AGC effectively reduces the volume if the signal is strong and raises it when it is weaker.

Client: A VCOM specific term to refer collectively to either a Control Panel or Device Interface.

Control Panel: VCOM’s client-side GUI enabling users to conduct communications using color coded selectors which represent audio/voice channels.

Device Interface: VCOM’s client-side software application that bridges VCOM with multiple external communications systems.

IFB: An abbreviation of Interrupt Foldback or Interrupt Feedback. It is sometimes referred to as PI (Program Interrupt). In radio and television broadcasting IFB serves as a voice cueing mechanism for on-air talent. The talent listens to a program audio signal which can be interrupted by the voice of a production person (such as a director or producer) for the purpose of giving instructions to the talent regarding the show in progress. This is seen by a television viewer as the earpiece that a news announcer wears in the ear.

ISO: A high level intercom function by which a temporary and private communications link is established between an operator who is located at an intercom control panel and another operator. The derivation of the term ISO is from the word isolate. The function is valuable wherever a short term private exchange is required between two operators who are normally sharing the conversation required to accomplish a group activity. When any two people need to talk together without interfering with or being heard by anyone else, ISO is the function required. The most common application is that of a video control operator and a television camera operator.

System Administration: VCOM’s client-side system administration application which allows for dynamic configuration from any workstation or the server hosting the Virtual Matrix.

Server: Used interchangeably with "Virtual Matrix," VCOM's server-side audio summing/mixing engine.

SIP: Session Initiation Protocol (SIP) is a widely adopted signaling protocol for Internet conferencing, telephony, presence, events notification and instant messaging. By supporting SIP, VCOM can readily interface with many commonly used IP phones, IP phone systems, and other SIP-compliant devices.

VCOM: A non-blocking, all software multi-channel/multi-access Intercom over Internet Protocol (IoIP) based on a dedicated server, multiple client architecture. VCOM is engineered for professional, mission critical communications in broadcast, production, military, aerospace, and government applications.