EXata 5.1
Connection Manager User's Guide

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Preface

Who Should Read this Guide

EXata 5.1 Connection Manager User's Guide is intended for users familiar with the Windows or Linux operating systems. This guide describes the how to install and run EXata Connection Manager on operational hosts and use it with an emulation server running EXata.

For details of using EXata, refer to *EXata User's Guide.*

How this Guide is Organized

This guide contains the following information:

- Chapter 1 introduces EXata and describes its components.
- Chapter 2 describes how to install EXata Connection Manager on Windows and Linux systems.
- Chapter 3 describes how to use EXata Connection Manager to connect operational hosts to the emulation server and how to run real applications on operational hosts.

EXata Document List

The following table shows the EXata Documentation Set and offers a brief description of each document.

Document	Description
EXata API Reference Guide	This guide is a supplement to *EXata Programmer's Guide* and provides detailed information on the EXata API functions and parameters. This is available in both PDF and HTML formats.
EXata Connection Manager User's Guide	This guide provides information on installing and using EXata Connection Manager.
EXata Distributed Reference Guide	This guide provides instructions for running EXata on a distributed architecture.

Document	Description
EXata Documentation Portfolio	The documentation portfolio combines all EXata documents in a single PDF file.
EXata Installation Guide	This guide provides detailed steps for installing EXata on Windows and Linux platforms.
EXata Model Libraries	This set of documents contains detailed reference information on all EXata models and includes the following protocol libraries. See *EXata Model Library Index* for an alphabetical list of all our models and a reference to which library they can be found in. Advanced Wireless Cellular Cyber Developer Federation Interfaces LTE Multimedia and Enterprise Network Management Sensor Networks UMTS Urban Propagation Wireless
EXata Product Tour	This tour provides an introduction to EXata by means of an example.
EXata Programmer's Guide	This is a guide to the EXata programming interface and functions, allowing users to develop and customize protocol models.
EXata Release Notes	This document lists the changes (added and removed features, bug fixes, etc.) made in the current version of EXata with respect to the previous version.
EXata Statistics Database User's Guide	This is a guide to the statistics database generated by EXata.
EXata User's Guide	This is a detailed guide for using *EXata* and works in combination with the *EXata Model Libraries* set of documents.

Document Conventions

EXata documents use the following conventions:

Convention	Description
Book Title	Title of a document.
Command Input	A command name or qualified command phrase, daemon, file, or option name.
Command Output	Text displayed by the computer.
Note: or **Notes:**	Information of special interest.
[ ]	In syntax definitions, square brackets indicate items that are optional.
Code Segment	Segment of code from EXata source files used for illustration.
Added Code	Example of code that the user should add to existing EXata functions and declarations to add a custom model to EXata. A vertical margin in the left column indicates new lines of code that need to be added.
Ellipses (. . .)	Ellipses are used to indicate lines of code from EXata source files that have been omitted from an example for the sake of brevity.

More Information

- For general information about SCALABLE, visit the company website at www.scalable-networks.com.

- For more information on EXata, please contact EXata Sales at info@scalable-networks.com or visit the EXata website at www.exata.com.

- For technical help on EXata or help on EXata documentation, please contact EXata Support at support@scalable-networks.com or visit our Support website at support.scalable-networks.com.

1 Introduction to EXata

EXata is a network emulator that lets you evaluate on-the-move communication networks faster and with more realism than any other emulator. It uses a software virtual network (SVN) to digitally represent the entire network, the various protocol layers, antennas, and devices. EXata can interoperate, at one or more protocol layers, with real radios and devices to provide hardware-in-the-loop capabilities. EXata can also be connected to systems with real applications, which run on the SVN just as they would run on real networks.

Emulation and Simulation

A network emulator mimics the functions of a real network so that it appears, interacts, and behaves like the real network. The emulator provides an exact, high quality, reproduction of external behavior so that the emulated system is indistinguishable from the real system. An emulator provides a cost-effective method of evaluating new network technologies before actual systems or networks are built.

A network simulator duplicates the behavior of a real network, but cannot interact with real networks. A simulator uses lower quality reproduction or abstraction of the real system and focuses on simply replicating the real network's behavior. A network simulation is a very low cost method for developing the early stages of network centric systems. You can evaluate the basic behavior of a network and test combinations of network features that are likely to work.

Network emulation helps in developing a net-centric system by providing an environment in which design decisions can be easily changed and their impact evaluated. Customers of the net-centric system can use the emulated network and see how their applications (such as VoIP, situational awareness, sensor data, and streaming video) will perform when the real system is built. The emulated network can also be integrated with legacy systems to test interoperability and be used to train users on the next generation networks. By evaluating what works best early in the design cycle, the cost of modifying a system can be greatly reduced. This also sets realistic expectations of what the communications network will deliver, i.e., it provides predictability.
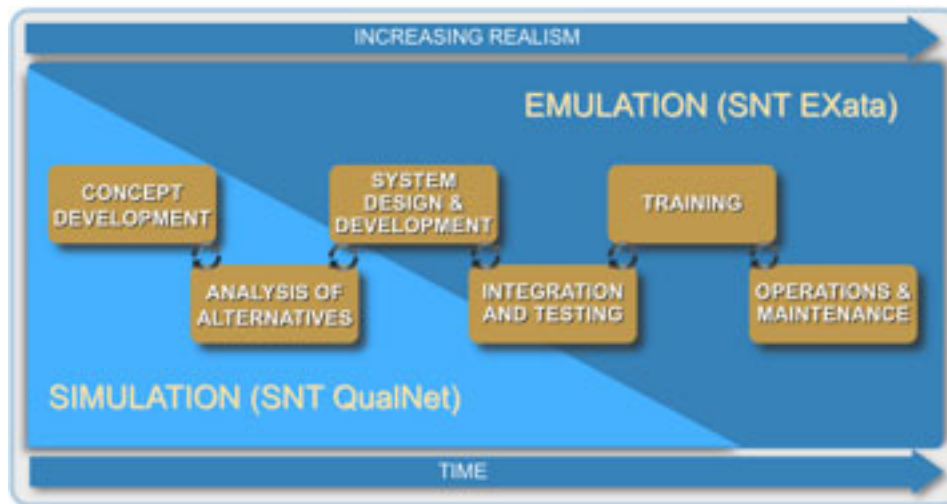
FIGURE 1-1.   Life-cycle of Developing a Net-Centric System

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1.1 EXata Features and Benefits

EXata is a comprehensive suite of tools for emulating large wired and wireless networks. It uses simulation and emulation to predict the behavior and performance of networks to improve their design, operation, and management. EXata SVN provides a cost-effective and easy-to-use alternative to physical testbeds that typically have high equipment costs, complex setup requirements and limited scalability.

EXata enables users to:

*   Develop emulation or simulation models for new networking technologies.
    *   Design new network technologies: Design new communications protocol models using the OSI-style architecture of EXata protocol stack.
    *   Design wireless networks of real world size: EXata can be run on multi-core processor computers to evaluate large wireless networks of 100s and 1000s of devices.
    *   Perform what-if analyses: Analyze the performance of networks and perform "what-if" analyses to optimize them. You can design a network, and then run batch experiments to test network performance when parameters, such as routing protocols, timers, and transmission power, are varied.
*   Connect real networks, applications, and devices with EXata emulated network.
    *   See real applications run on emulated networks: EXata can run real applications, such as VoIP, Internet browsers, and streaming video, on emulated networks as if they are running on real networks.
    *   Train with the network before it is ready to be deployed: EXata makes it possible to conduct training and operations with next-generation tactical networks and devices that are still being designed.
*   Analyze and manage EXata virtual networks with popular, industry-standard, tools.
    *   Snoop on packets: EXata has a packet sniffer interface that enables third-party tools like Wireshark and Microsoft Network Monitor to snoop/capture traffic from any device in EXata and analyze it. This lets you debug and troubleshoot network problems.

   – Manage an emulated network: EXata comes with a SNMP Agent, which enables you to use standard SNMP managers to view, monitor and control emulated networks in EXata just like managing real networks.

- Develop, test and evaluate, and train users on cyber warfare and network security technologies.

   – Research and develop new methods of attacks, counter measures, and intrusion detection.

   – Improve capabilities of existing network intrusion detection tools, such as Snort, against new types of attacks.

   – Study the effectiveness of counter-measures against new or existing cyber threats.

   – Train users on network security tools and procedures on isolated and quarantined environment modeled as software virtual networks.

   – Incorporate cyber warfare exercises into conventional wargaming exercises with other SAF/CGF simulations.

1.2 EXata Architecture

Figure 1-2 illustrates the EXata architecture. A high-level description of the various components is provided below. Refer to *EXata User's Guide* for details.
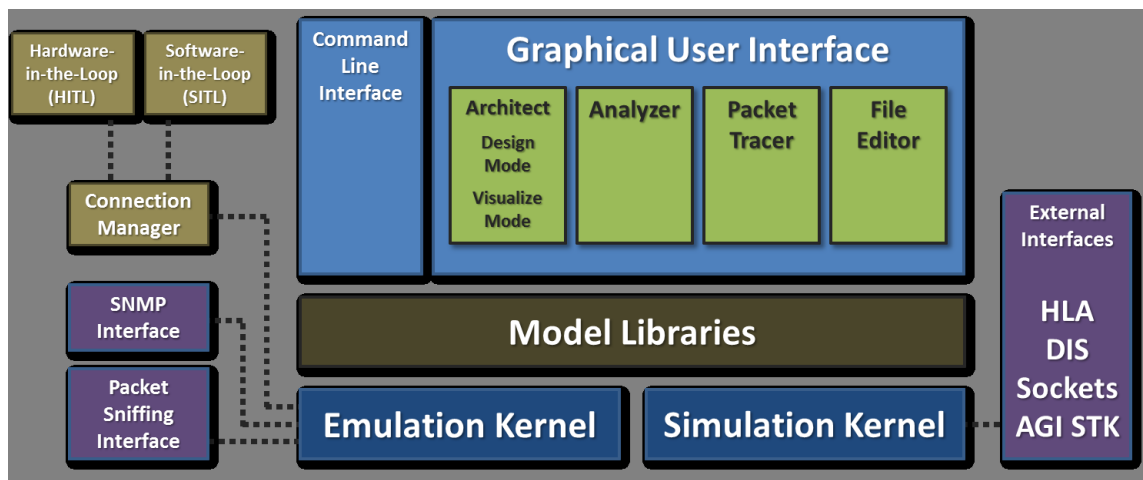

FIGURE 1-2. EXata Architecture

EXata Simulation Kernel

The simulation kernel of EXata is a parallel discrete-event scheduler. It provides the scalability and portability to run hundreds and thousands of nodes with high-fidelity models on a a variety of platforms, from laptops and desktops to high performance computing systems. Users do not directly interact with the kernel, but use the EXata API to develop their protocol models.

EXata Emulation Kernel

The emulation kernel of EXata is a high-fidelity, real-time interface to connect the modeled network with external real applications and hardware. The core of the emulation kernel is a real-time event scheduler that processes the internal EXata events, as well as the events from external sources, with real time

deadlines. It also provides a transparent interface to the real-world applications and hardware such that the latter can access any emulated network resource as if it exists physically. Users do not directly interact with the kernel, but use the Connection Manager or interfaces such as SNMP, Packet Sniffing interfaces to connect the real applications and hardware with the emulated network.

The EXata emulation kernel is enabled by default and it can be disabled to run EXata in simulation mode. In simulation mode, EXata runs as fast as possible (non-real time mode). Simulation mode is useful for creating and validating scenarios: both for network performance analyses and for potential subsequent use in emulation. In simulation mode, all emulation features (Connection Manager, SNMP and Packet Sniffing Interfaces, Hardware/Software in-the-loop) are disabled.

EXata Model Libraries

EXata supports a number of model libraries that enable you to design networks using various protocol models. EXata includes the Developer, Multimedia and Enterprise, and Wireless Model Libraries. Additional libraries to model network security and cyber attack and defense strategies, cellular networks, satellite networks, UMTS, WiMAX, sensor networks, military radio networks, and advanced propagation model libraries are also available. Refer to the *EXata Model Libraries* data sheet for more information or check the products page on our website.

EXata Graphical User Interface (GUI)

EXata GUI consists of Architect, Analyzer, and File Editor.

- **Architect** is a network design and visualization tool. It has two modes: Design mode and Visualize mode.

  In Design mode, you can set up terrain, network connections, subnets, mobility patterns of wireless users, and other functional parameters of network nodes. You can create network models by using intuitive, click and drag operations. You can also customize the protocol stack of any of the nodes. You can also specify the application layer traffic and services that run on the network.

  In Visualize mode, you can perform in-depth visualization and analysis of a network scenario designed in Design mode. As simulations are running, users can watch packets at various layers flow through the network and view dynamic graphs of critical performance metrics. Real-time statistics are also an option, where you can view dynamic graphs while a network scenario simulation is running.

  You can also assign jobs to run in batch mode on a faster server and view the animated data later. You can perform "what-if" analysis by setting a range of values for a particular protocol parameter and comparing the network performance results for each of them.

- **Analyzer** is a statistical graphing tool that displays hundreds of metrics collected during simulation of a network scenario. You can choose to see pre-designed reports or customize graphs with their own statistics. Multi-experiment reports are also available. All statistics are exportable to spreadsheets in CSV format.

- **Packet Tracer** provides a visual representation of packet trace files generated during the simulation of a network scenario. Trace files are text files in XML format that contain information about packets as they move up and down the protocol stack.

- **File Editor** is a text editing tool that displays the contents of the selected file in text format and allows the user to edit files.

EXata Command Line Interface

The EXata command line interface enables a user to run EXata from a DOS prompt (in Windows) or from a command window (in UNIX). When EXata is run from the command line, input to EXata is in the form of text files which can be created and modified using any text editor. Building and running scenarios with the

command line interface takes less memory and scenarios typically run faster than with the GUI. With the command line interface the users have the flexibility to interface with visualization and analysis tools of their choice.

EXata Connection Manager

EXata Connection Manager is the companion module of the main EXata emulation engine. The EXata emulation engine creates a digital replica of the target network, and EXata Connection Manager is used to run applications on the emulated network. The Connection Manager makes EXata advanced emulation technology easy and simple to use. Applications need no modification or customization to use the realistic emulated network in EXata.

Connection Manager supports a large variety of applications such as:

- Internet browsers
- Tactical communications
- Situational awareness information
- Sensor data
- Instant messaging
- VoIP
- Streaming video
- Multiplayer games

EXata SNMP and Packet Sniffing Interfaces

EXata supports a packet sniffer interface to enable capture and analysis of network traffic using standard packet sniffer/analyzer tools like Wireshark or Microsoft Network Monitor. Additionally, EXata can be managed using standard SNMP network managers like HP OpenView, IBM Tivoli, or SolarWinds Orion.

EXata HLA, DIS, Socket and STK Interfaces

EXata can also interact with a number of external tools in real-time.

- The EXata HLA and DIS modules, which are part of the Federation Interfaces Library, allows EXata to interact with other simulators and computer-generated force (CGF) tools, such as OTB, using High Level Architecture (HLA) or Distributed Interaction Simulation (DIS).
- The Socket Interface, which is a part of the Federation Interfaces Library, provides inter-process communication between EXata and an external program over a TCP socket, with EXata acting as the server and the external program as the client.
- The EXata Satellite Toolkit (STK) Interface, which is a part of the Developer Model Library, provides a way to interface EXata with the Satellite Toolkit developed by Analytical Graphics, Inc. (AGI) and function in a client-server environment.

2 Installing Connection Manager

This chapter describes how to install EXata Connection Manager on Windows (see) and Linux (see) systems.

2.1 Supported Platforms

Windows

EXata Connection Manager is supported on the following platforms:

- Windows 7 Home Premium and Professional 32-bit and 64-bit editions
- Windows 8 and Windows 8 Pro 32-bit editions

> **Note:** Although EXata Connection Manager has not been fully tested on other Windows platforms, it should also work on other editions of Windows 7 and Windows 8.

Linux

EXata Connection Manager is supported on 32-bit (x86 compatible) and 64-bit (x86-64 compatible) platforms running one of the following Linux distributions:

- CentOS 5.9
- Red Hat Enterprise Linux 5.9
- Ubuntu 12.04 LTS

> **Note:** If you need to run EXata Connection Manager on a Linux platform not listed above, contact support@scalable-networks.com.

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2.2 Installing Connection Manager on Windows

his section describes how to install Connection Manager on a Windows system.

Note: **1.** Connection Manager should be installed on an operational host, *not* the emulation server (i.e., the machine running EXata).

2. The Graphical User Interface (GUI) of Connection Manager is released under the GPL license. You must accept the GPL license agreement to install Connection Manager.

3. After installing Connection Manager, the installer will install a Microsoft patch for runtime components of Visual C++ libraries that is required to run Connection Manager.

4. For help with installation procedures or problems, contact support@scalable-networks.com.

To install Connection Manager on a Windows system, perform the following steps:.

1. Download the installation package (file exata-5.1-connection-manager-windows-installer.exe) from the EXata download page or load it from the installation CD.

2. Double-click on the installation package, and follow the installation prompts.

3. The installer will prompt you to install the WinPcap software.

a. If you choose to install WinPcap on Windows 8, the following Program Compatibility Assistant window is displayed. Select **Run the Program without getting help**.
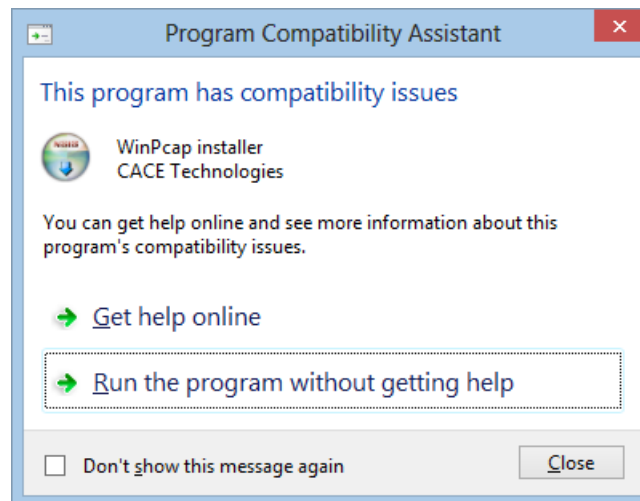
b. Follow the prompts to continue installing WinPcap. If the following warning message is displayed, click on **OK**.

c. Follow the prompts to complete WinPcap installation.

By default, Connection Manager is installed in C:\Program Files\Scalable\EXata\5.1 (on 32-bit platforms) and in C:\Program Files (x86)\Scalable\EXata\5.1 (for 64-bit platforms).

> **Note:** Some firewall programs may prevent Connection Manager from running. You may need to add it to the exception list of your firewall program. Check the documentation of your firewall program for details on adding a program to the exception list or contact your system administrator. If you are using Microsoft Windows firewall, visit the Microsoft website for details of adding a program to the exception list.

To test the Connection Manager installation, start Connection Manager as described in Section 3.1.1.

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2.3 Installing Connection Manager on Linux

This section describes how to install Connection Manager on a Linux system.

> **Note:** **1.** Connection Manager should be installed on an operational host, *not* the emulation server (i.e., the machine running EXata).
>
> **2.** Connection Manager is small enough that each user can install a separate copy of the software in their home directory. It need not be installed in /usr/local or other shared directories.
>
> **3.** For help with installation procedures or problems, contact support@scalable-networks.com.

To install Connection Manager on a Linux system, perform the following steps:

1. Download the installation package from the EXata download page or load it from the installation CD.

- The installation package for 32-bit platforms is exata-5.1-connection-manager-linux-installer-32bit.

- The installation package for 64-bit platforms is exata-5.1-connection-manager-linux-installer-64bit.

2. Double-click on the installation package and follow the prompts.

By default, Connection Manager is installed in /home/<user>/Scalable/EXata-Connection-Manager/5.1.

To test the Connection Manager installation, start Connection Manager as described in Section 3.1.2.

3 Using Connection Manager

This chapter describes how to use Connection Manager to prepare an emulation testbed and configure applications to run on it.

describes how to start Connection Manager on Windows and Linux systems.

describes how to connect Operational Hosts (the physical hardware running real applications) with the Emulation Server (the machine running EXata), using Connection Manager.

describes how to run real applications on an emulated network using Connection Manager.

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3.1 Starting Connection Manager

This section describes how to start Connection Manager on an operational host.

3.1.1 Starting Connection Manager in Windows

To start Connection Manager on Windows, do one of the following:

- Double-click the Connection Manager icon on the Windows desktop.
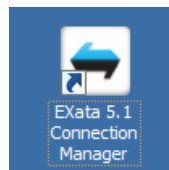
- Select **Start > All Programs > Scalable > EXata-Connection-Manager 5.1 > Connection Manager 5.1**.
- Navigate to the directory where Connection Manger is installed, right click on exata-connection-manager.exe and select **Run as administrator**.

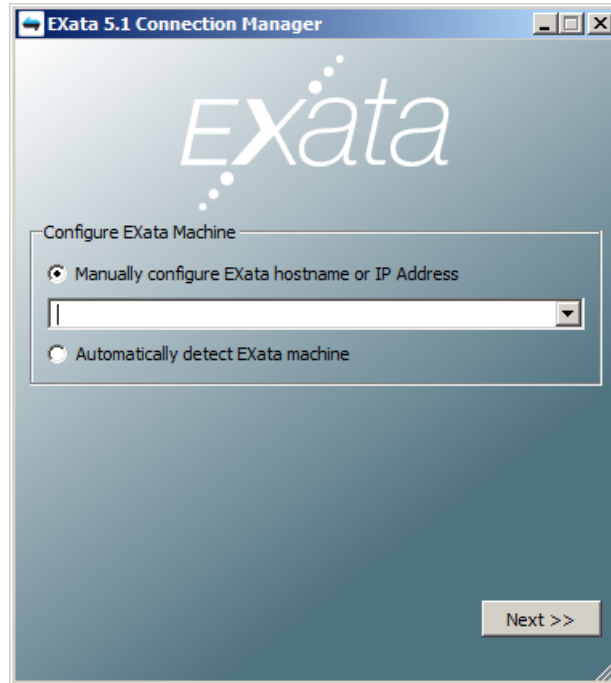The following startup screen is displayed when Connection Manager starts:

FIGURE 3-1.   Connection Manager Startup Screen

3.1.2 Starting Connection Manager in Linux

To start Connection Manager on Linux, do the following:

* Open a command-line window, and navigate to the directory where Connection Manger is installed.

* Type the following command:

    ```
    ./exata-connection-manager
    ```

  Note: You need root privileges to run Connection Manager.

  If you are logged in as a non-root account on Linux, you can launch Connection Manager by typing `sudo ./exata-connection-manager` and providing the root password.

The startup screen shown in Figure 3-1 is displayed when Connection Manager starts.

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3.2 Connecting Operational Hosts with the Emulation Server

To connect hardware-in-the-loop and to run applications on emulated nodes, including Internet-based applications and SNMP managers, it is required to connect the operational hosts with EXata running on the emulation server. This section describes the steps involved in establishing such a connection between the operational hosts and the emulation server using Connection Manager.

Connection Manager application runs on an operational host and is responsible for managing the operational host's networking configuration. Connection Manager is used to establish a connection

between the host and the emulation server. When a connection is established, Connection Manager displays the list of emulated network nodes. Connection Manager can also be used to run multiple applications on different emulated nodes from the same operational host (see Section 3.3.2).

After launching Connection Manager, a connection can be established between the operational host and the emulation server, either by manually providing the address of the emulation server (see Section 3.2.1), or by letting Connection Manager automatically detect the emulation server (see Section 3.2.2). Section 3.3 describes how to verify the connectivity between the operational host and the emulation server.

3.2.1 Manual Specification of Emulation Server

Before manually specifying the emulation server in Connection Manager, ensure the following:

- The operational host and the emulation server are connected with each other (you can use the `ping` command to verify this).
- On the emulation server, the EXata process is not blocked by the firewall.
- On the operational host, Connection Manager is not blocked by the firewall.

To specify the emulation server manually, provide the address of the emulation server to Connection Manager as follows:

1. Start Connection Manager and select **Manually configure EXata hostname or IP Address**.
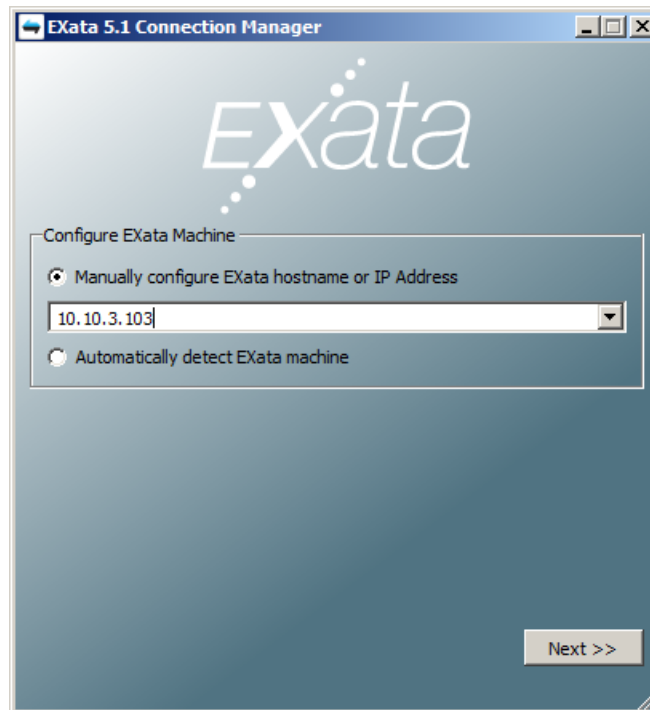
FIGURE 3-2.   Manual Specification of Emulation Server

2. Enter the IP address (e.g., 10.10.3.103 or fe80::216:35ff:fe64:3a5a) or host name (e.g., server01.mydomain) of the emulation server. You can also select from previously entered addresses from the pull down menu.

> **Note:** If you are providing a hostname, ensure that the operational host is reachable from the local DNS server.

3. Click **Next**.

Connection Manager will attempt to configure the network settings on the operational host to create an emulated link between this host and the emulation server. If Connection Manager is successful in creating a connection, the address configuration screen will be replaced with Network and Application configuration screen (see Figure 3-3). If this is the case, skip the remaining steps.

(If EXata is not running on the emulation server, the left screen in Figure 3-3 is displayed. If EXata is running on the emulation server, a screen similar to the right screen in Figure 3-3 is displayed.)
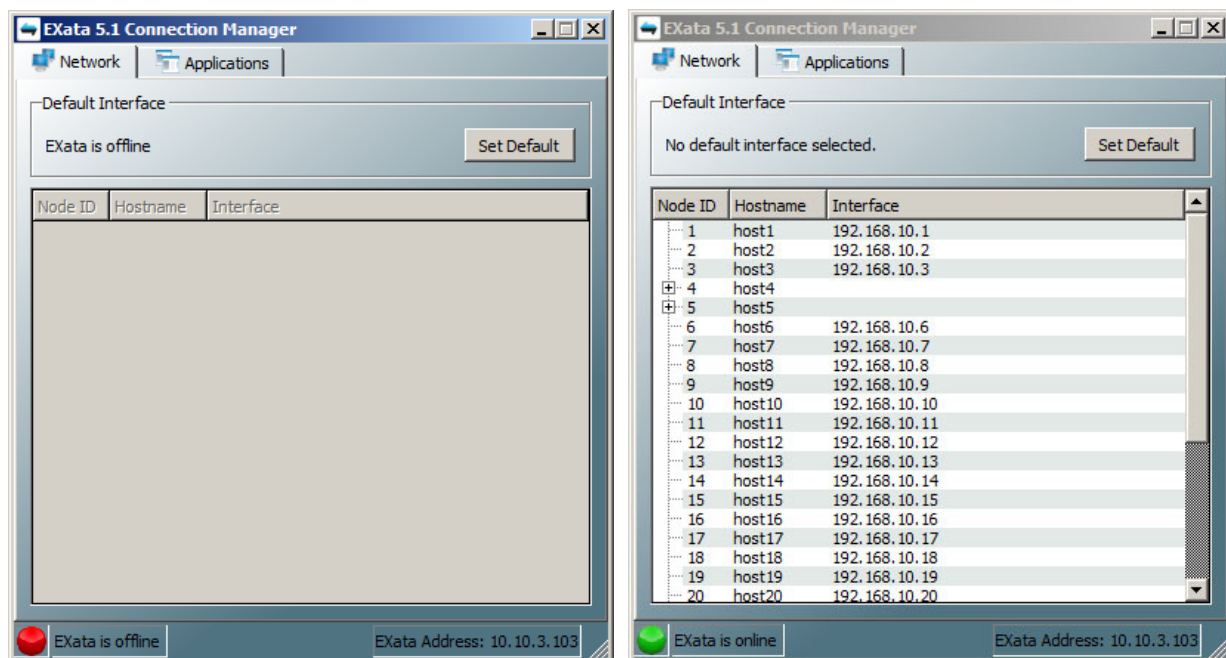
FIGURE 3-3.   Emulation Server Successfully Connected

If, however, Connection Manager is unable to create a connection, it will display a message (see Figure 3-4) asking for further network configuration information.
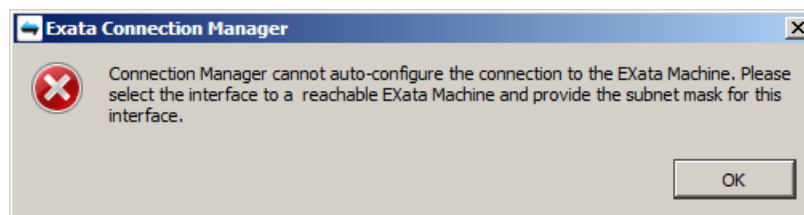
FIGURE 3-4.   Connection Manager Failed to Connect to Emulation Server

4. If Connection Manager is unsuccessful in creating a connection, click **OK** on the displayed message (see Figure 3-4). This changes the Connection Manager display (see Figure 3-5) to let you enter additional configuration information. (The left screen in Figure 3-5 is for IPv4 connections and the right screen is for IPv6 connections.)

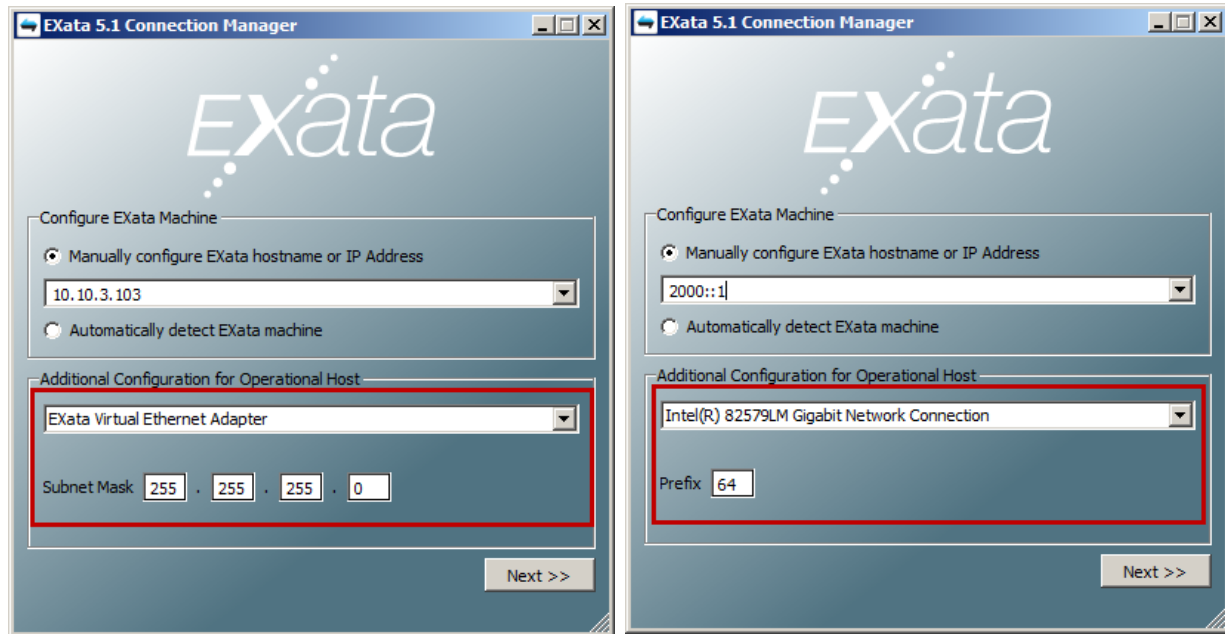**FIGURE 3-5. Advanced Configuration Options**

   a. Connection Manager lists the available network interfaces available on the operational host. From the pull-down menu, choose the interface that has been configured in the same subnet as the emulation server.

   b. Enter the subnet mask (for IPv4) or prefix (for IPv6) of the network interface device *on the emulation server* that is used to connect to this operational host.

   Note: To identify this subnet mask, open a command-line window and type `ipconfig`. Note the subnet mask for the appropriate network interface.

   c. Click **Next**.

   d. If Connection Manager is unable to generate a valid IP address in the same subnet as the emulation server, it will display a message (see Figure 3-6) asking to enter a valid IP address.
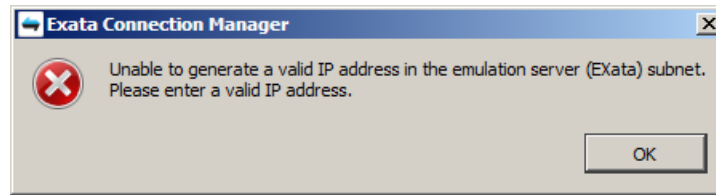
FIGURE 3-6.   Connection Manager Failed to Generate a Valid IP Address

If this happens, click **OK** on the displayed message. This changes the Connection Manager display to let you enter a valid IP address and subnet mask (for IPv4) or network prefix (for IPv6) to be assigned to the selected interface.
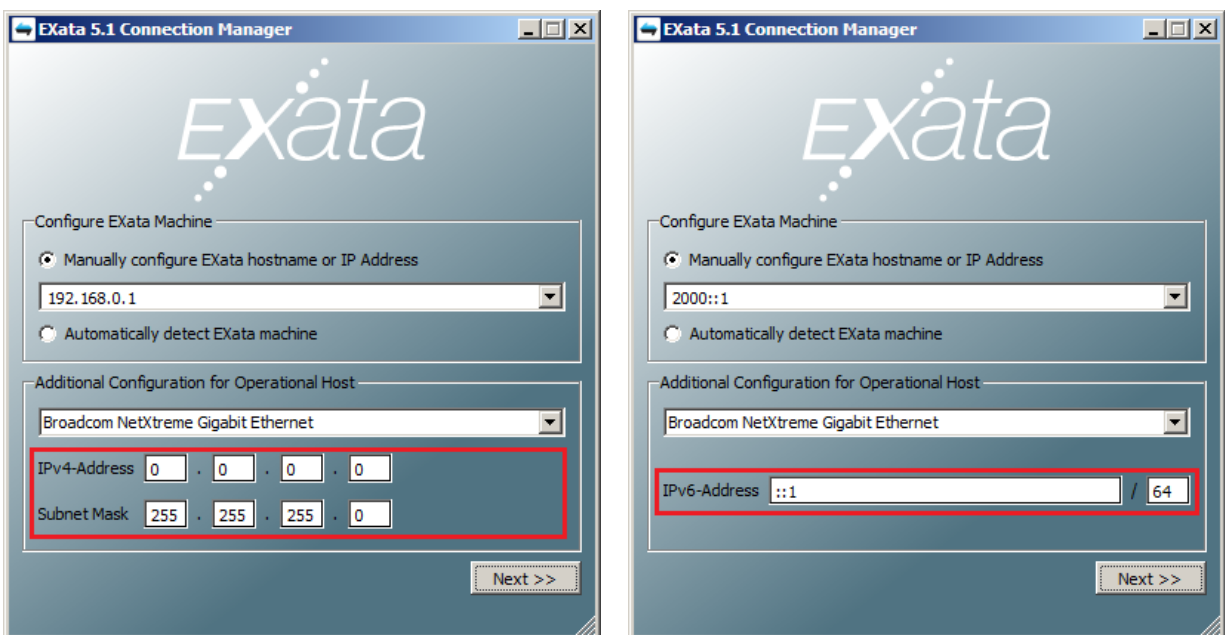

FIGURE 3-7.   Assign Valid IP Address

Note: If Connection Manager still cannot connect to the emulation server, it is likely, that the operational host and the emulation server are not connected with each other. Check the network cables for proper connectivity and consult your network administrator

3.2.2 Automatic Detection of Emulation Server

Connection Manager can also auto-detect emulation servers in the same subnet. For this mode to work, ensure the following:

- A scenario is running on EXata, either via GUI or command line.
- The operational host and the emulation server are connected with each other (you can use the `ping` command to verify this).
- On the emulation server, the EXata process is not blocked by the firewall.
- On the operational host, Connection Manager is not blocked by the firewall.

If all the above conditions are met, you can automatically configure the emulation server by doing the following:

1. Start Connection Manager and select **Automatically detect EXata machine**.
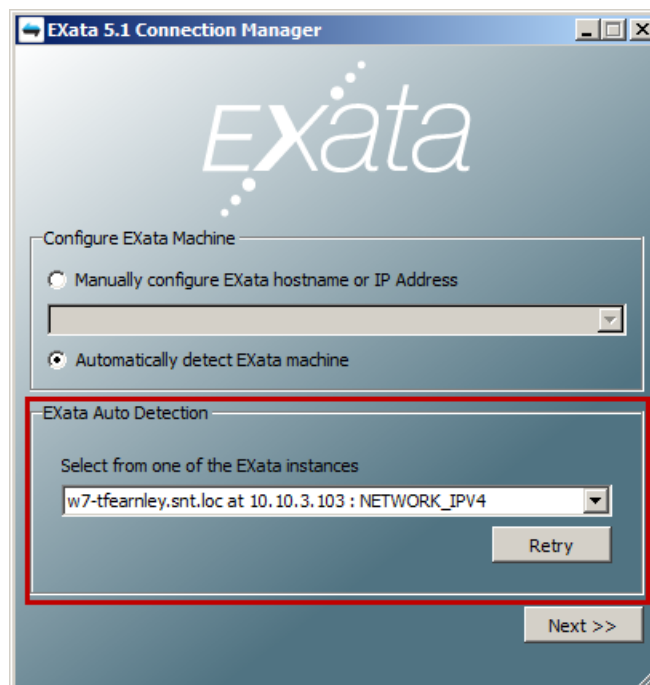
FIGURE 3-8.   Automatically Detecting Emulation Servers

2. If Connection Manager is able to detect any running EXata processes, it will display all the detected emulation servers in a pull down menu (see Figure 3-8). If an IPv4 scenario is running on an emulation server, then the label **NETWORK_IPV4** appears next to the interface address of the emulation server. If an IPv6 scenario is running on an emulation server, then the label **NETWORK_IPV6** appears next to the interface address of the emulation server. If a mixed IPv4/IPv6 scenario is running on an emulation server, then there are two entries for the server in the list: one for IPv4 and the other for IPv6. Select the emulation server that you wish to connect to.

3. Click **Next**.

3.2.3 Verifying the Connectivity

After Connection Manager has successfully connected to the emulation server, start the scenario in EXata in *Emulation mode* if you have not already done so.

Connection Manager will indicate in its status bar that it has detected an EXata process (see Figure 3-9) and display a list of the nodes in the scenario being executed by EXata.
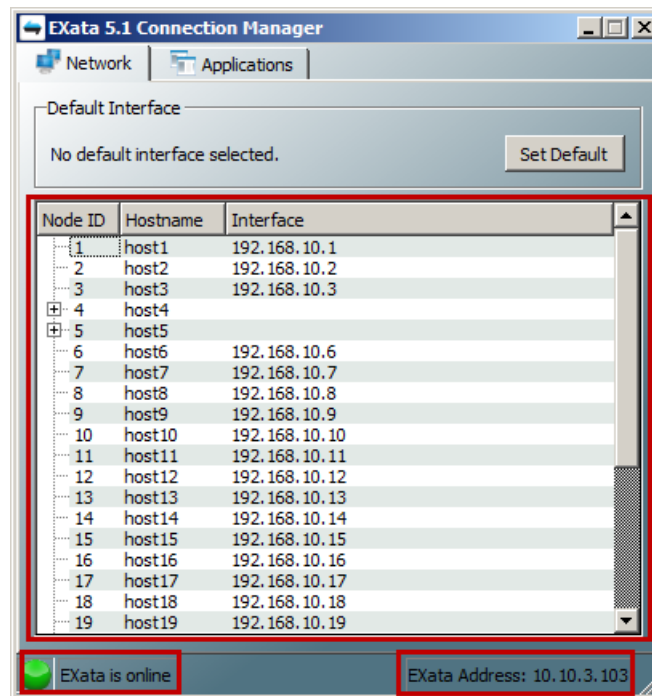

FIGURE 3-9.   List of Emulated Nodes in Network Tab

Note: If a node has only one interface, then its address is displayed in the same row as the ID of the node. If a node has multiple interfaces, then the list of interfaces and their addresses can be displayed by clicking on the '+' sign before the node ID.

Connection Manager lists all nodes and interfaces in the scenario. If you have connected the operational host to the emulation server using an IPv4 (IPv6) address, then only emulated interfaces with IPv4 (IPv6) addresses are enabled and can be selected as the default external node (see Section 3.3.1).

When Connection Manager forms a connection to an EXata process, a message is also displayed in the system tray icon (see Figure 3-10).
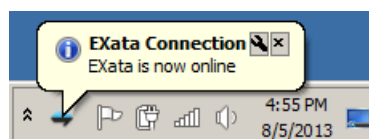

FIGURE 3-10.   Connection Manager System Tray Icon

When the EXata execution is terminated (by pressing the **Stop** button in the GUI toolbar, or terminating the EXata process on the command line interface), the list of nodes will disappear and Connection Manager will indicate that EXata is offline, both in the status bar and the system tray.

3.3 Running Applications

Connection Manager offers an easy mechanism to launch applications on the operational hosts that connect to the emulated nodes in EXata. This section describes how to set up applications at operational hosts to run on the emulated network using Connection Manager.

Connection Manager can be used to launch applications in two ways:

- Assign one emulated node in EXata to map to the operational host. All applications launched on the operational host will run on this emulated node (see Section 3.3.1).
- When launching an individual application, select the emulated node it should run on. In this way, different applications on the same operational host can connect to different emulated nodes (see Section 3.3.2).

3.3.1 Launching Applications on a Single Emulated Node

In this mode, the operational host can be a viewed as a physical counterpart of one of the emulated nodes: any application launched on this operational host will send and receive traffic to and from the protocol stack of that particular emulated node. To achieve this, it is required to configure the EXata emulator to create a one-to-one mapping between the emulated node and the operational host. This section describes how to create such a mapping using Connection Manager

Figure 3-11 provides the schematic diagram for this mode of operation. A mapping between the operational host and one node in the emulated network (henceforth referred to as the *External Node*) is created. Subsequently, any application launched on the operational host will use the emulated protocol stack of the External node for communications. Note that as many operational hosts are required as the desired number of External nodes, since there is a unique one-to-one mapping between the operational hosts and External nodes. Section 3.3.2 describes the EXata mode that removes this restriction.
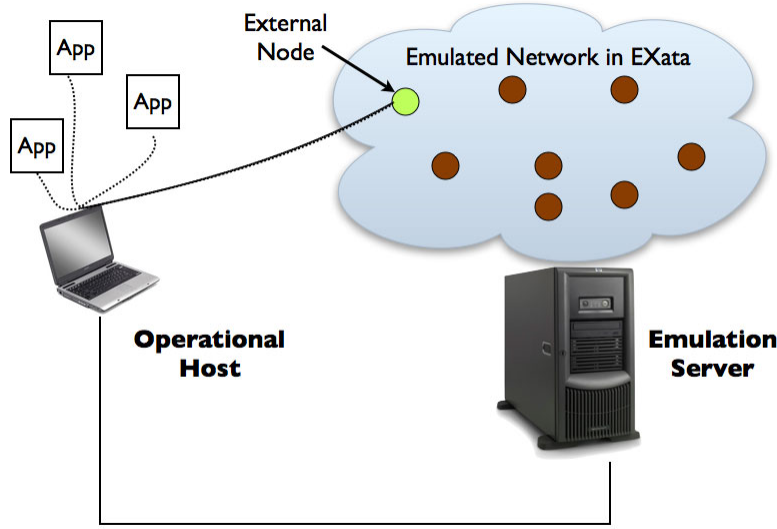
FIGURE 3-11.   Applications on Operational Host Connecting to Default External Node in EXata
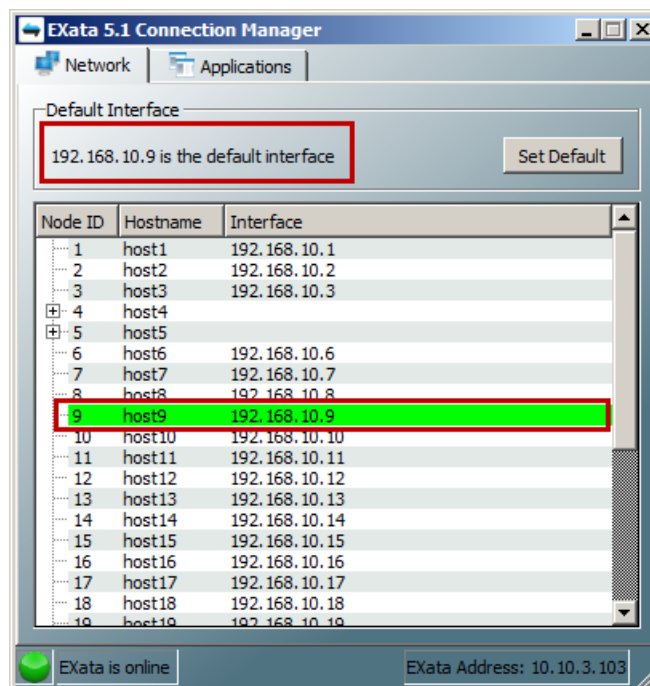
3.3.1.1 Setting a Default External Node

To create a one-to-one mapping between the operational host and an External Node in EXata, perform the following steps:

1. On the emulated server, run an EXata scenario in emulation mode, either from the GUI or command line interface. (In the rest of the section we assume that EXata was launched from GUI.)

Connect the operational host and the emulated server using Connection Manager, as described in Section 3.2.

2. Wait a few seconds until Connection Manager recognizes that EXata is running and displays a list of all the nodes in the **Network** tab.

3. Select one of the nodes in Connection Manager's display window by clicking on it, and click the **Set Default** button.

If an emulated node has multiple interfaces, then expand the display for the node and select one interface. Figure 3-12 shows an example where node 5 (host5) has two interfaces with addresses `192.168.10.5` and `192.0.1.1`.
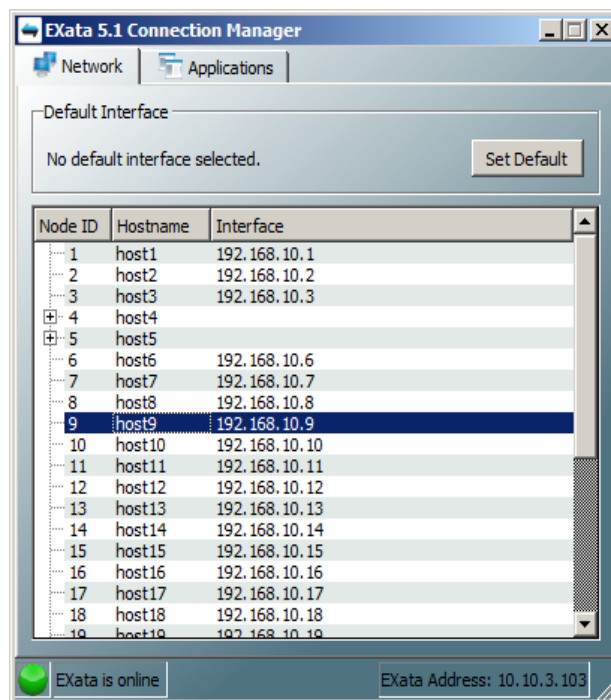
FIGURE 3-12.   Setting Default External Node

The selected interface is displayed in the **Default Interface** box and is highlighted in the node list.

FIGURE 3-13.   Default Node Configured

If EXata GUI is running, the selected node is highlighted on the canvas (see node 3 in Figure 3-14).
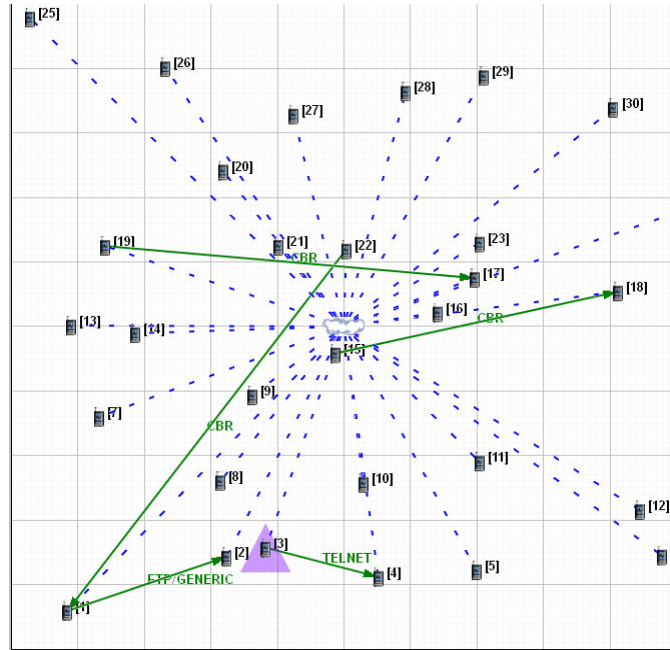

FIGURE 3-14.   EXata GUI Displaying the Default External Node

4. Verify by connecting to other nodes in the scenario by using one of the EXata emulated server applications (refer to *EXata User's Guide*).

An application run from the operational host will now also run on the default node.

3.3.1.2 Unsetting the Default EXata Node

To tear down an established connection between the operational host and the External node, you can unset the default node by following these steps:

1. Click on the interface that is currently configured as the default EXata External node.

2. The button text in the **Default Interface** text box will change to **Reset Default**. Click on the button.

    The **Default Interface** box displays that no default interface is set and the unset interface is no longer highlighted in the list.

    If EXata GUI is running, the node is no longer highlighted on the canvas.

3.3.1.3 Changing the Default EXata Node

While the scenario is running in EXata, you can change the operational host to connect to any other emulated node. This will enable the operational host to insert or receive traffic from different nodes in the scenario during the same execution run.

To change the default EXata node, do one of the following:

- Reset the current default EXata node and set a new one, as described above.
- Select the new node by clicking on it in the node list and click the **Set Default** button.

3.3.2 Launching Applications on Different Emulated Nodes

In this mode, when launching an application, the user can select on which emulated node in EXata the application should be executed. Thus, it is possible to run multiple applications on different emulated nodes, all from the same operational host. See Figure 3-15.

>   **Note:**   This feature is available only on operational hosts running Windows 32-bit editions.
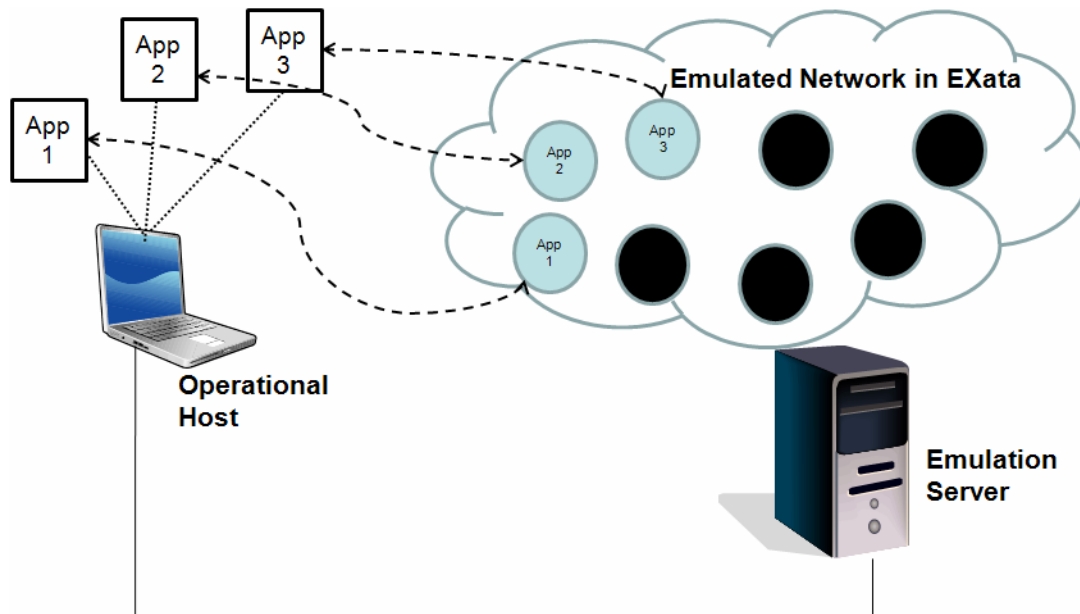

FIGURE 3-15.   Multiple Applications on a Single Operational Host Connecting to Different Emulated Nodes

3.3.2.1 Launching an Application on a Selected Emulated Node

To select an emulated node on which to run an application at the time of launching an application, perform the following steps:

1. Set up a connection between the operational host and the emulation server using Connection Manager, as described in Section 3.2. Ensure that the scenario is running in EXata in Emulation mode and Connection Manager displays the list of nodes in the **Network** tab.

2. To launch an application, right-click on the application icon on the desktop and click on **Run on EXata node**.
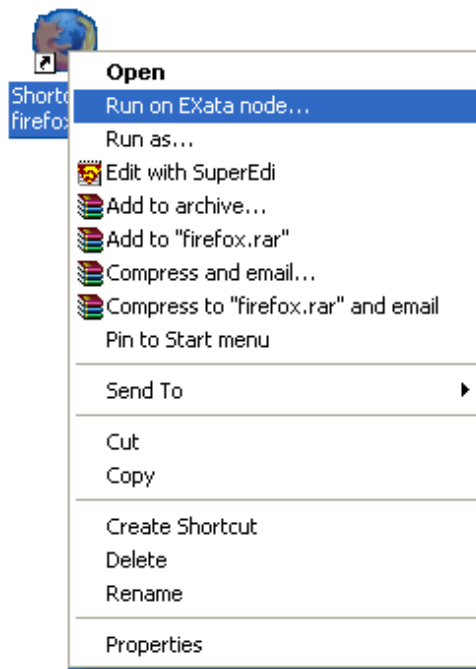
FIGURE 3-16.   Running Application on an EXata Node

3. A dialog box appears that lists all the nodes in the scenario. Enter a node ID or hostname or select a node from the pull-down list and click **OK**.
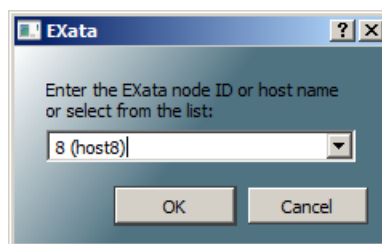

FIGURE 3-17.   Selecting an Emulated Node

Once the application has started, the **Application** tab of Connection Manager will display the application name and the emulated node (called an *External Application Node*) on which it is configured to run.
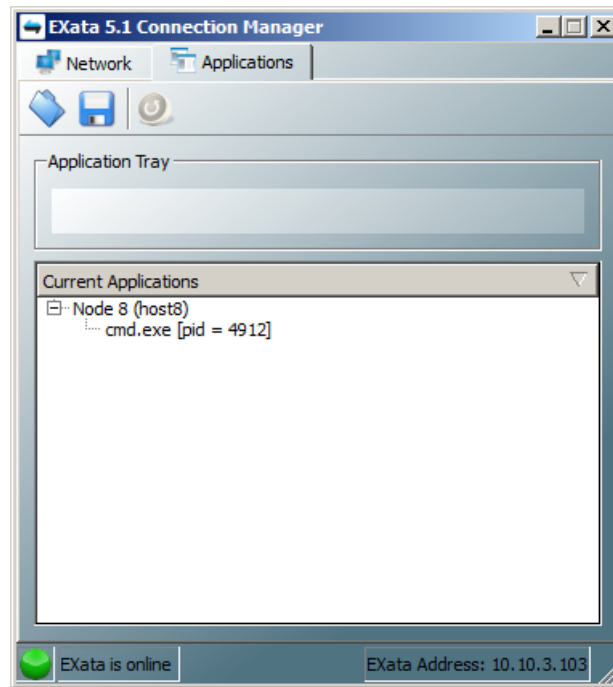

FIGURE 3-18.   Application Tab of Connection Manager

Tip: You can double-click the application in the **Application** tab of Connection Manager to bring the application window to the front.

Note: To run another application from command line, first launch the command window application (cmd.exe) to run on the emulated node via the steps outlined above. Then, run the application from this command window. This approach works because any child process launched by a process that was configured to use EXata, will also continue to use the same configuration.

If EXata GUI is running, the selected node is highlighted on the canvas by a green triangle (see node 8 in Figure 3-19).
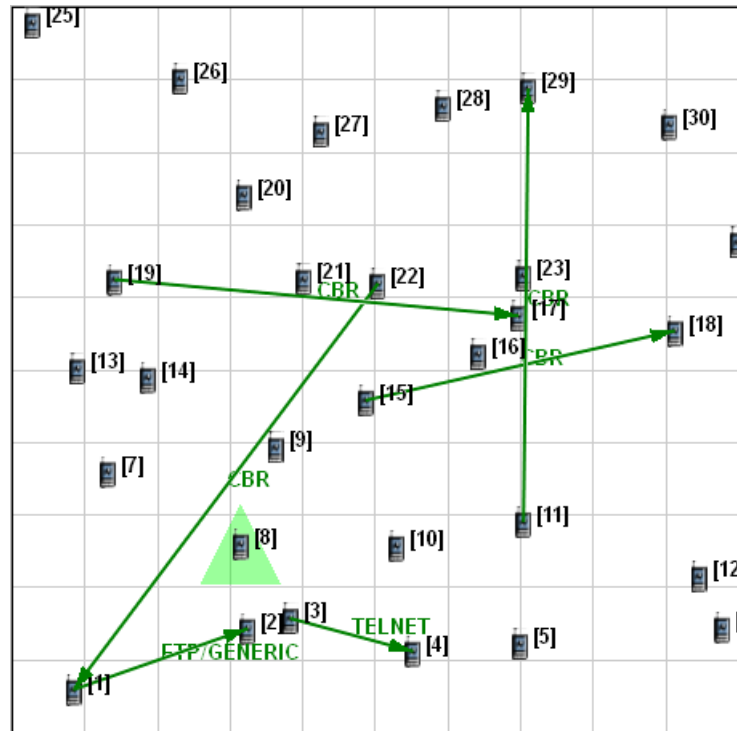

FIGURE 3-19.   EXata GUI Displaying an External Application Node

3.3.2.2 Restoring an Application Session

An application session is the record of information for all the currently running applications. The information includes the name of application, the path of the application executable binary, and the ID of the emulated node it is running on. Figure 3-20 shows an example of application session of four applications running over two emulated nodes.
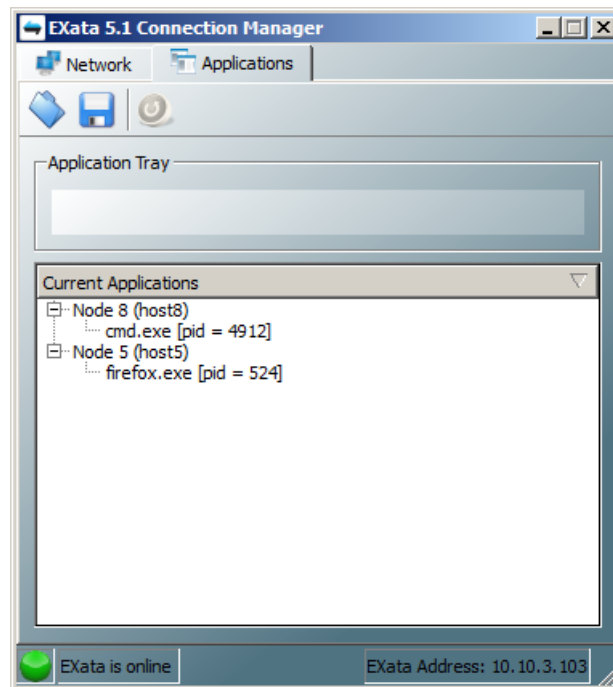

FIGURE 3-20. An Active Application Session

At the termination of the EXata process, either manually by the user or through the successful completion of the scenario, all applications running on the emulated nodes are terminated. However, before terminating the applications, Connection Manager saves the last application session. When the EXata process is restarted, Connection Manager provides the option to restore the last application session.

To restore the last application session from an EXata run, perform the following steps:

1. Restart the scenario in EXata in emulation mode from the GUI or the command line.

2. In the **Applications** window of Connection Manager, click on the **Restore** button in the toolbar.
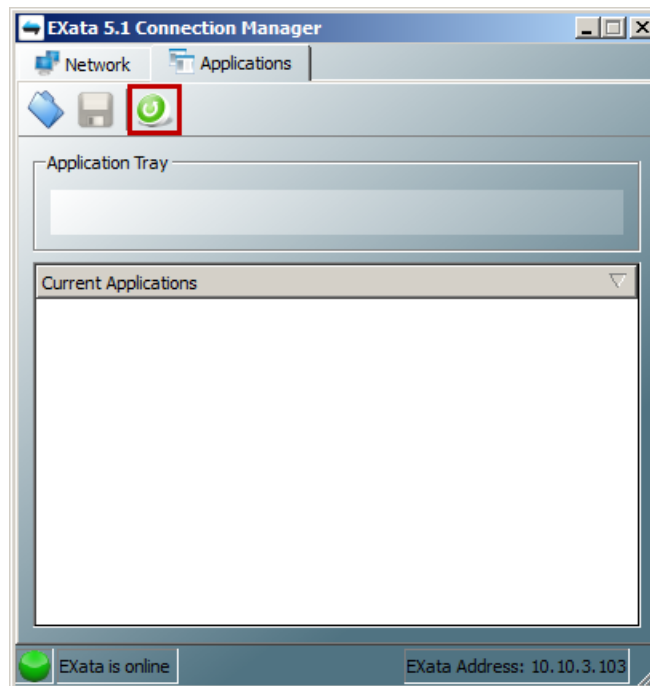

FIGURE 3-21.   Restore Application Session Button

3.3.2.3 Saving and Loading Application Sessions

You can also save an application session in a file while a scenario is running and load it at a later time.

To save an application session while a scenario is running, do the following:

1. In the **Applications** window of Connection Manager, click on the **Save** button in the toolbar.

2. Provide the filename and the directory path where to save the application session information.

To load a previously saved application session, do the following:

1. Ensure that the EXata is running in Emulation mode.

2. In the **Applications** window of Connection Manager, click on the **Load** button in the toolbar.

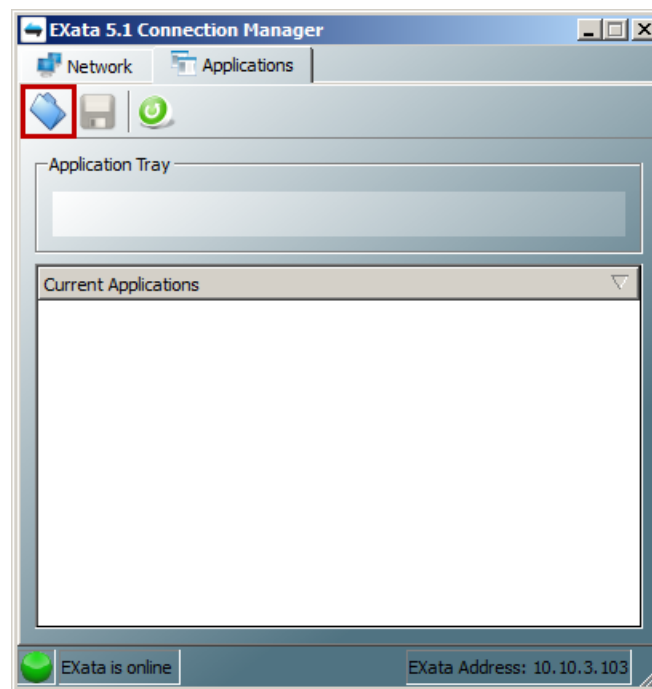3. In the file browser, select the name of the application session file to load.

FIGURE 3-22.   **Load Application Session Button**

3.3.2.4 Quick Launch Application Tray

The **Applications** tab in Connection Manager also features a quick launch application tray to quickly launch the frequently used applications.

To add an application to the quick launch tray, drag and drop the application icon from the desktop into the tray area. Figure 3-23 shows an example with applications loaded in the quick launch tray.

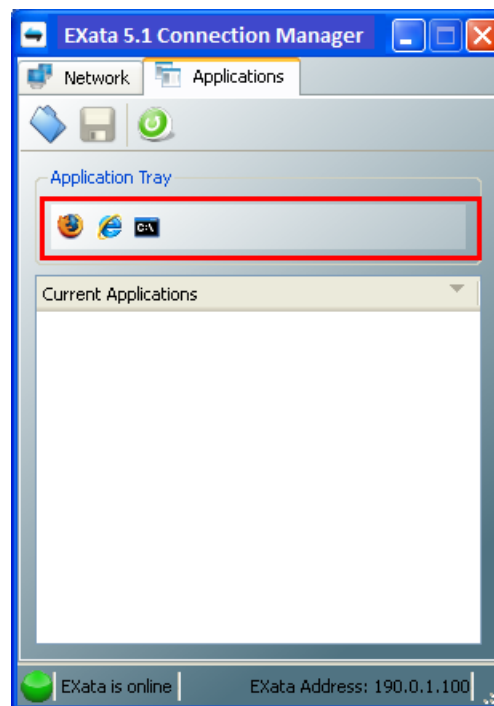To launch an application, click on the icon in the tray. This will open a dialog box (see Figure 3-17) to select an emulated node.

FIGURE 3-23.   Quick Launch Application Tray