QualNet®

QualNet 7.1
Distributed Reference Guide

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SCALABLE Network Technologies, Inc.

600 Corporate Pointe, Suite 1200
Culver City, CA 90230

+1.310.338.3318 TEL
+1.310.338.7213 FAX

SCALABLE NETWORK TECHNOLOGIES

SCALABLE-NETWORKS.COM

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600 Corporate Pointe, Suit 1200

Culver City, CA 90230

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SCALABLE-NETWORKS.COM

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Preface

Who Should Read this Guide

QualNet 7.1 Distributed Reference Guide describe the system requirements, installation process, compilation, and running QualNet on a distributed architecture.

QualNet Document List

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

Document	Description
QualNet API Reference Guide	This guide is a supplement to *QualNet Programmer's Guide* and provides detailed information on the QualNet API functions and parameters. This is available in both PDF and HTML formats.
QualNet Distributed Reference Guide	This guide provides instructions for running QualNet on a distributed architecture.
QualNet Documentation Portfolio	The documentation portfolio combines all QualNet documents in a single PDF file.
QualNet Installation Guide	This guide provides detailed steps for installing QualNet on Windows and Linux platforms.
QualNet Model Libraries	This set of documents contains detailed reference information on all QualNet models and includes the following protocol libraries. See *QualNet 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 Developer Federation Interfaces LTE Multimedia and Enterprise Sensor Networks UMTS Urban Propagation Wireless

Document	Description
QualNet Product Tour	This tour provides an introduction to QualNet by means of an example.
QualNet Programmer's Guide	This is a guide to the QualNet programming interface and functions, allowing users to develop and customize protocol models.
QualNet Release Notes	This document lists the changes (added and removed features, bug fixes, etc.) made in the current version of QualNet with respect to the previous version.
QualNet Statistics Database User's Guide	This is a guide to the statistics database generated by QualNet.
QualNet User's Guide	This is a detailed guide for using *QualNet* and works in combination with the *QualNet Model Libraries* set of documents.

Document Conventions

QualNet 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 QualNet source files used for illustration.
`Added Code`	Example of code that the user should add to existing QualNet functions and declarations to add a custom model to QualNet. 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 QualNet 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 QualNet, please contact QualNet Sales at info@scalable-networks.com or visit the QualNet website at www.qualnet.com.
- For technical help on QualNet or help on QualNet documentation, please contact QualNet Support at support@scalable-networks.com or visit our Support website at support.scalable-networks.com.

QualNet for Distributed Architectures

This document covers the system requirements, compiling, and running QualNet on distributed architectures.

Notes: **1.** Information contained in this document is supplemental to the information contained in *QualNet Installation Guide*. For help with installing and running QualNet on distributed architectures, users should also refer to *QualNet Installation Guide*.

2. In the rest of the document, we will use the term Distributed QualNet when referring to QualNet running on distributed architectures.

1 System Requirements

The requirements to run Distributed QualNet are listed in Table 1. (These requirements are in addition to the general requirements for running QualNet listed in *QualNet Installation Guide*.)

TABLE 1. Requirements for Distributed QualNet

Item	Requirements
Linux Distribution	CentOS 5.9, 64-bit version or Red Hat Enterprise Linux 5.9, 64-bit version **Note:** Other 64-bit Linux distributions with glibc 2.5 with gcc 4.1 may also work.
OFED	OpenFabrics Enterprise Distribution (OFED) 1.5 with Open MPI or MVAPICH
Network	Ethernet (with OpenMPI of OFED 1.5) or Infiniband interconnect (with OpenMPI or MVAPICH of OFED 1.5)
Expat Library	Expat library for the Linux distribution
C Compiler	gcc 4.1
C++ compiler	g++ (Gnu C++ compiler)

2 Installing Distributed QualNet

The capability to run on distributed architectures is inherent in standard QualNet. Refer to *QualNet Installation Guide* for instructions for installing QualNet on Linux platforms.

Note: If QualNet is already installed on your system, you do not need to reinstall QualNet to run it on distributed architectures. However, you must recompile QualNet to build the binary for distributed execution, as described in Section 5.

3 Installing Third-Party Software

Distributed QualNet requires the expat development library, a C/C++ compiler, and OpenFabrics Enterprise Distribution (OFED) to compile. This section describes how to install the required software.

3.1 Expat Development Library

The expat development library is needed to compile QualNet on Linux systems.

Install the expat development library from the Linux installation media or download site. Consult your system administrator for help with installing the expat development library.

3.2 C/C++ Compiler

To compile Distributed QualNet, gcc 4.1 and C++ compiler (g++) are required.

Install gcc 4.1 from the Linux installation media or download site. Consult your system administrator for help with installing gcc.

Most gcc installations include g++. If g++ is not included, then install the version of g++ compatible with gcc 4.1. Consult your system administrator for help with installing g++.

3.3 OpenFabrics Enterprise Distribution (OFED)

Distributed QualNet requires OFED 1.5 to be installed. OFED 1.5 has three MPI flavors: MVAPICH, MVAPICH2, and OpenMPI. QualNet supports only MVAPICH and OpenMPI.

Install the version of OFED 1.5 appropriate for your system from http://openfabrics.org.

- For clusters connected by Ethernet, only OFED 1.5 with OpenMPI can be used.
- For clusters connected by InfiniBand, OFED 1.5 with either MVAPICH or OpenMPI can be used.

4 Configuring OFED

OFED comes with multiple flavors of MPI. To configure OFED for Distributed QualNet, you must select an MPI flavor as the default MPI. OFED provides an application called mpi-selector to allow the user to select a default flavor. To use mpi-selector to set an MPI flavor as the default, do the following:

1. Determine which MPI flavors are installed by typing the following command:

   ```
   mpi-selector --list
   ```

   This displays the list of MPI flavors supported by the OFED distribution. For example, the following list is displayed for OFED 1.5:

   ```
   mvapich2_gcc-1.2p1
   mvapich_gcc-1.1.0
   openmpi_gcc-1.2.8
   ```

   QualNet only supports the last two MPI flavors (MVAPICH and OpenMPI).

2. Check which MPI flavor is set as the current default by typing the following command:

   ```
   mpi-selector --query
   ```

   This displays the default MPI flavor. For example, the following output is displayed if MVAPICH is the default MPI flavor with user level privileges:

   ```
   default mvapich_gcc-1.1.0
   level: user
   ```

3. To select an MPI flavor as the default or change the default flavor, do the following:

   To select MVAPICH as the default MPI flavor, type the following command:

   ```
   mpi-selector --set mvapich_gcc-1.1.0
   ```

   To select OpenMPI as the default MPI flavor, type the following command:

   ```
   mpi-selector --set openmpi_gcc-1.2.8
   ```

4. Start a new shell, or log out and log in again. (mpi-selector sets the default for future sessions but does not change the current shell.)

5 Compiling Distributed QualNet

To compile Distributed QualNet, perform the following steps:

1. Open a command window.
2. Select an MPI flavor as the default using mpi-selector, as described in Section 4.
3. Go to QUALNET_HOME/main directory.
4. QUALNET_HOME/main includes makefiles for different combinations of glibc and gcc versions and MPI flavors (see Table 3-1). Make a copy of the appropriate makefile.

   For example, for Red Hat Enterprise Linux 5.9 with OpenMPI, use the following command to make a copy of the makefile:

   ```
   cp Makefile-linux-x86_64-glibc-2.5-openmpi-ofed1.5 Makefile
   ```

   Notes: 1. To check the version of gcc installed on your system, type the following command in a command window: **`gcc -v`**.

   2. To check the version of glibc installed on your system, type one the following commands in a command window:

      - For Debian-based distributions (such as Ubuntu): **`dpkg -s libc6`**
      - For the other Linux distributions: **`rpm -q glibc`**

TABLE 3-1. Makefiles for Distributed QualNet

Linux Distribution	glibc Version	gcc Version	MPI Flavor	Makefile
CentOS 5.9, 64-bit version or Red Hat Enterprise Linux 5.9, 64-bit version	2.5	4.1	OpenMPI	Makefile-linux-x86_64-glibc-2.5-openmpi-ofed1.5
CentOS 5.9, 64-bit version or Red Hat Enterprise Linux 5.9, 64-bit version	2.5	4.1	MVAPICH	Makefile-linux-x86_64-glibc-2.5-mvapich-ofed1.5

5. Compile QualNet by using the following command (it takes several minutes for QualNet to compile):

   ```
   make
   ```

   This creates the QualNet executable in the QUALNET_HOME/bin directory. For Distributed QualNet, the executable is called qualnet.mpi.

To recompile QualNet, run **make** again. However, it is sometimes useful to delete all object files before recompiling. Use the following commands to remove all object (.o) files and recompile:

```
make clean
make
```

Note: Use the **make clean** and **make** commands when compiling Distributed QualNet for the first time.

6 Running Distributed QualNet

This section describes how to run Distributed QualNet from the command line and from QualNet GUI.

6.1 Running Distributed QualNet from the Command Line

To run Distributed QualNet, use the following command:

```
mpirun -np <N> -hostfile <host-file> qualnet.mpi <input-file>
```

where

`<N>`	Number of processors to run QualNet on
`<host-file>`	Name of the host file which lists the computers to be used. The format of this file is described below.
`<input-file>`	Name of the configuration file

Note: The same MPI flavor should be used as the default when compiling Distributed QualNet (see Section 5) and when running Distributed QualNet.

Format of the Host File

Create a host file that lists the hosts in your cluster or network. Each host name appears on a line by itself and is repeated as many times as the number of processors it has.

Note: The format of the basic host file for all MPI implementations is the same as described here. However, each MPI implementation may have advanced options for the host file. Refer to the OFED 1.5 documentation for a description of the advanced options.

Example

The following is an example host file that lists four hosts with two processors each:

```
host1
host2
host3
host4
host1
host2
host3
host4
```

6.2 Running Distributed QualNet from the GUI

To run Distributed QualNet from the QualNet GUI, perform the following steps:

1. Open the **Run Settings** dialog by pressing the **Run Settings** button (see Figure 1).

FIGURE 1. Run Settings Button

2. In the **Run Settings** dialog window that opens, set the parameters for distributed execution.
   - For running QualNet locally, do the following:
     a. Select the **Local Execution** radio button.
     b. Enter a value in the **Number of Processors** field.
     c. Check **Distributed Run Mode**.
     d. In the **Host File** field, specify the name of the host file that lists the computers to be used. See Section 6.1 for the format of the host file.

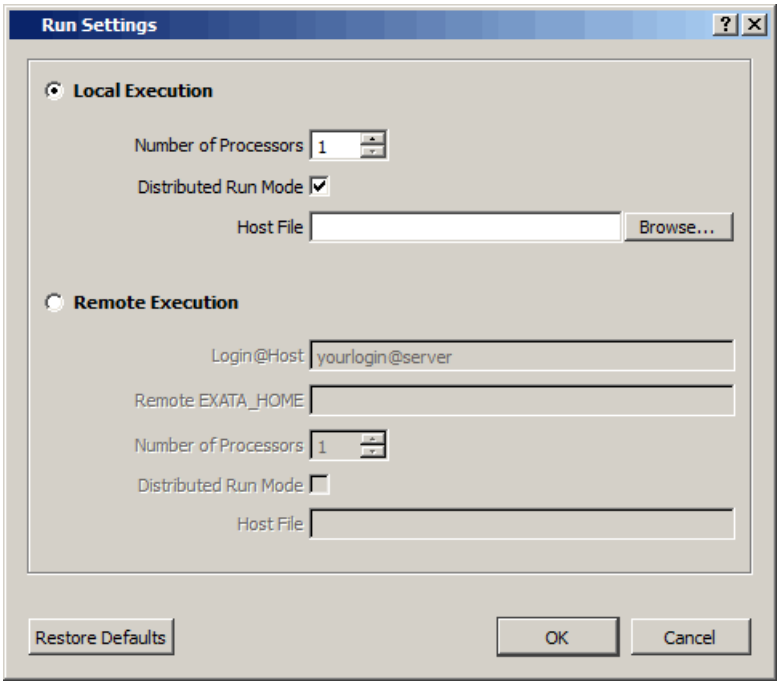

FIGURE 2. Run Settings Local Execution

   - For running QualNet remotely, do the following:
     a. Select the **Remote Execution** radio button.
     b. In the **Login@Host** field, enter the login name and the host machine.
     c. In the **Remote QUALNET_HOME** field, specify the directory where QualNet is installed on the host.
     d. Enter a value in the **Number of Processors** field.

e. Check **Distributed Run Mode**.

f. In the **Host File** field, specify the name of the host file that lists the computers to be used. See Section 6.1 for the format of the host file.

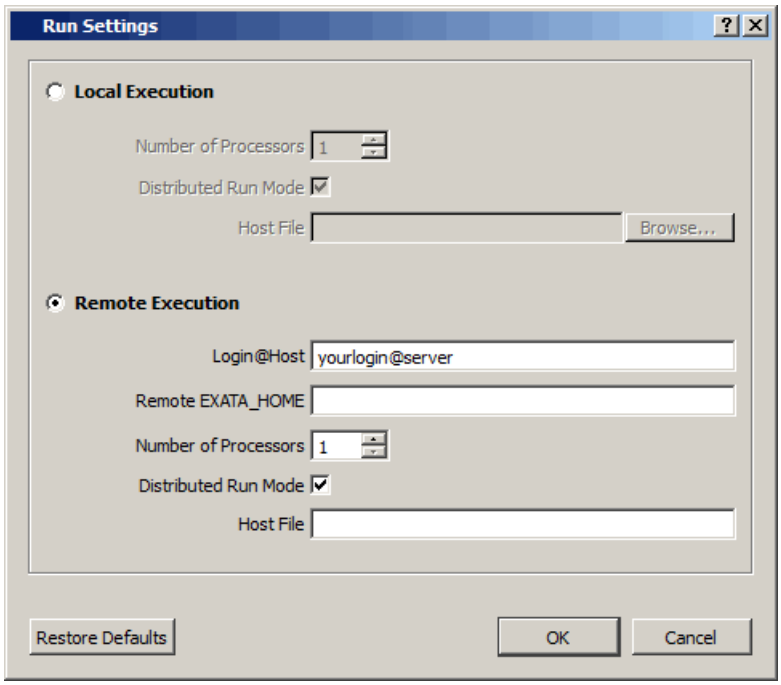

FIGURE 3. Run Settings for Remote Execution

7. Click **OK** to save the changes.
8. Run QualNet by clicking the **Run Simulation** button.

7 Helpful Links

- Helpful information on installation is available in the **Installation & Startup** section of **Community Forums**, which are accessible from the following URL:

  http://www.scalable-networks.com/boards

  Community Forums require a free registration for access.

- You can also get help with common installation and licensing issues at the FAQ page:

  http://www.scalable-networks.com/snt-support/index.php?_m=knowledgebase&_a=view