SCALABLE NETWORK TECHNOLOGIES

DATASHEET

Make Networks Work

QualNet®

Network simulation software for:
Development
Analysis
Testing

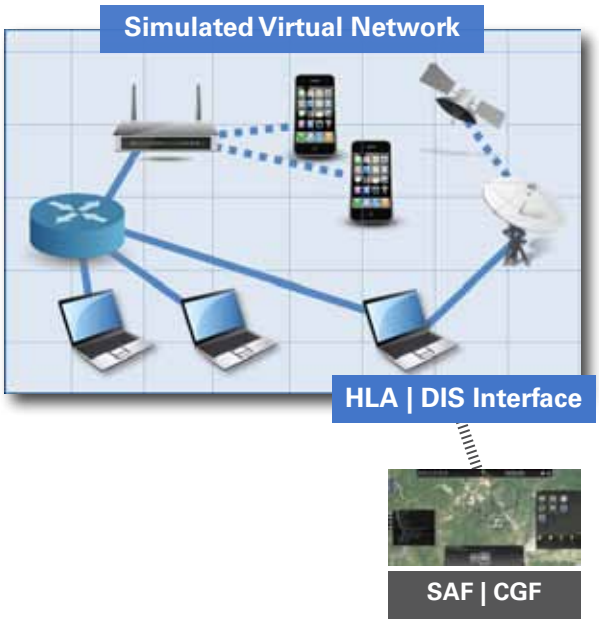
The QualNet® Simulation Platform

The QualNet software (QualNet) provides ultra high-fidelity simulated representations of large scale wireless, wired and mixed-platform network and networked device performance and behavior.

QualNet is the only modeling and simulation tool that can explore and analyze early-stage device designs and application code in closed, synthetic networks **at real-time speed or faster**.

Designed to take full advantage of the multi-threading capabilities of multi-core, multi-processor, cloud computing, cluster and 64-bit processor systems, QualNet supports models with thousands of network nodes.

QualNet is designed for engineers, planners and communications specialists who do research, testing, network design, capacity prediction, mission planning and hardware and software development and deployment.



NETWORK SIMULATION enables you to create a "virtual" model of your network – comprised of the routers, switches, servers, access points, radios, antennas, computers, and any other equipment – and then execute a wide range of "what if" operational scenarios:

- Will the network design provide the necessary performance and application response time ?
- What happens if key links get congested ?
- Why are the tablets intermittently losing connectivity in the warehouse ?
- Can this radio configuration provide sufficient coverage in the expected terrain ?

The Advantages of SCALABLE Simulation

Accuracy: QualNet delivers ultra-high fidelity simulations of network devices, transmitters, antennas, terrestrial characteristics, and human interactions, all at real-time speed. This makes abstraction for computational efficiency obsolete. You no longer need to be concerned about masking the very effects your simulations are meant to analyze.

Performance: QualNet's high-performance parallel processing power enables you to run simulations that find network problems in minutes that might take months to find in the field. Multiple analysis iterations in less time means you can solve more design and engineering problems faster than ever before.

Scalability: You get the same accurate simulations of wireless and wired networks for 50, 500, or 5,000 nodes.

QualNet Key Capabilities

- Faster-than-real-time evaluation of networks and network-centric systems
- Real network fidelity and accuracy
- Real world results using cost-effective "lab-based risk reduction" simulation technology

The QualNet® Product Family

The QualNet product family consists of the QualNet simulation platform plus add-on libraries of network element and other behavioral models. A number of libraries are included with the base platform, while others are available as options.

Element models are combined together to describe the overall communications environment. If necessary, QualNet allows users to develop custom models of unique elements and integrate them into the overall network model.

A feature-rich visual development environment lets users set up models quickly, efficiently code protocols, and then run scenarios that present real-time statistics and helpful packet-level debugging insight.

QualNet provides out-of-the-box support for multi-core processor systems. This means you can achieve faster simulation speeds, even real-time simulation, with the base QualNet product. For additional speedup and scalability through massively parallel execution, upgrade QualNet to run on additional processors.

QualNet runs on Windows and Linux operating systems, and is designed to link seamlessly with other modeling and simulation applications. It is supported on a variety of computing platforms, from sequential computers to shared memory multiprocessors, including workstation clusters and supercomputers.

Libraries of Elements

A communications network is a sophisticated combination of hardware, software, cables, circuits, protocols and applications, all architected to work together to provide effective information delivery. Each of the individual "elements," and the interactions between the elements, impact how the communications network operates and performs.

Consequently, in order to model an overall network, you need to first model the elements, and then link the elements together into the appropriate configuration.

Any network device, protocol, configuration, effect, or technology can be modeled in SCALABLE simulation, but starting from scratch can be an involved exercise. To dramatically speed up the process, SCALABLE has developed a family of "element" libraries containing models of the typical network building blocks. They have been engineered and verified to accurately represent specific behavior.

Each of the available libraries is also available in source code form (C/C++) in the SCALABLE Developer's Kit. They conform to a flexible OSI architecture, allowing engineers to easily build custom protocol stacks, waveforms, devices and interfaces.

The standard "classes" of elements which influence a network model (except for Images, which are for visual clarity) include:

- **Equipment:** the various hardware components
- **Human-in-the-Loop (HITL):** commands that control various elements during scenario execution
- **Images:** icons and other components that graphically depict elements and behavior
- **Interfaces:** protocols and mechanisms that enable interaction between a simulator and other simulators or external systems
- **Protocols:** the network protocols and waveforms that enable equipment to communicate
- **Terrain:** the physical terrain over which the communications takes place (DEM, DTED & Urban)
- **Weather:** descriptions of different weather behavior and its impact on communications

Examples of elements for protocols and waveforms in various libraries include Wi-Fi, sensor networks, cellular, MANET, WiMAX, and high-latency datalinks. Any of these elements can be included in your specific modeling exercise to quickly create detailed scenarios.

Standard and Optional Libraries

The QualNet platform has three libraries of elements included:

- Developer Library
- Wireless Library
- Multimedia and Enterprise Library

The libraries which are available as options include:

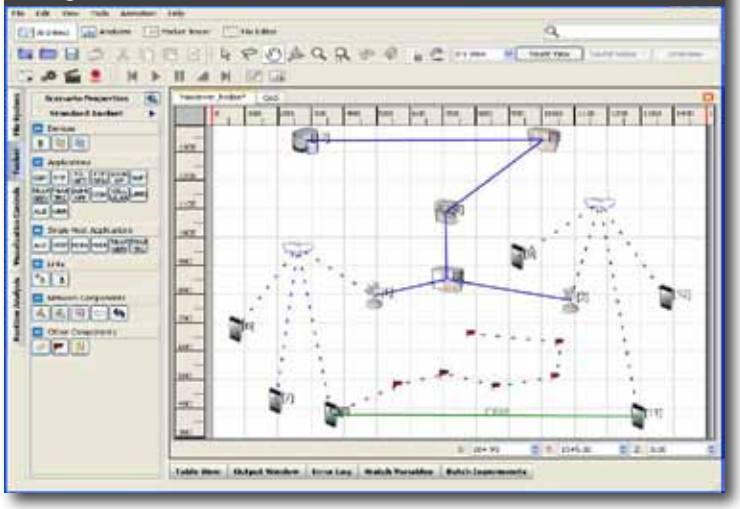
- Advanced Wireless Library
- Cellular Library
- Federation Interfaces Library
- LTE Library
- Military Radios Library [1]
- Propagation Library: Urban
- Sensor Networks Library
- UMTS Library

[1] These libraries are subject to export restriction under the International Traffic in Arms Regulations (ITAR) 22 CFR 120-130. International sales of these modules require authorization from the US Department of State.

Design Mode

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

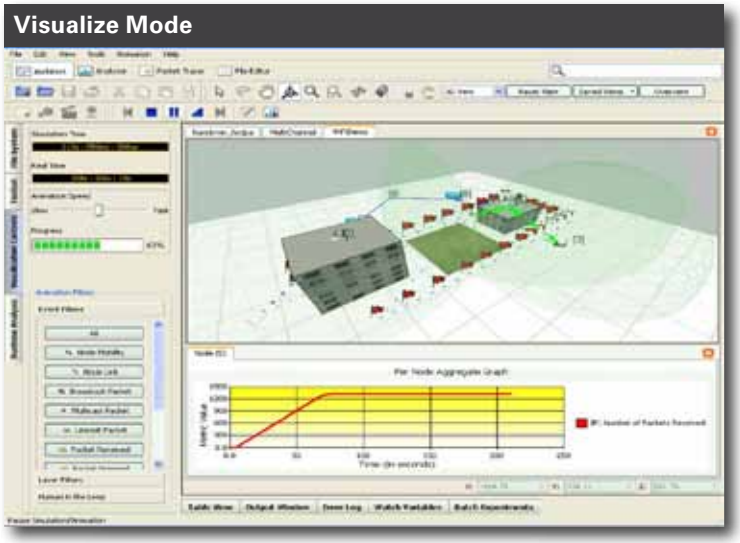
Design Mode



Visualize Mode

Visualize Mode gives the user opportunities to perform in-depth visualization and analysis of a network scenario created 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 users can view dynamic graphs while a network scenario simulation is running.

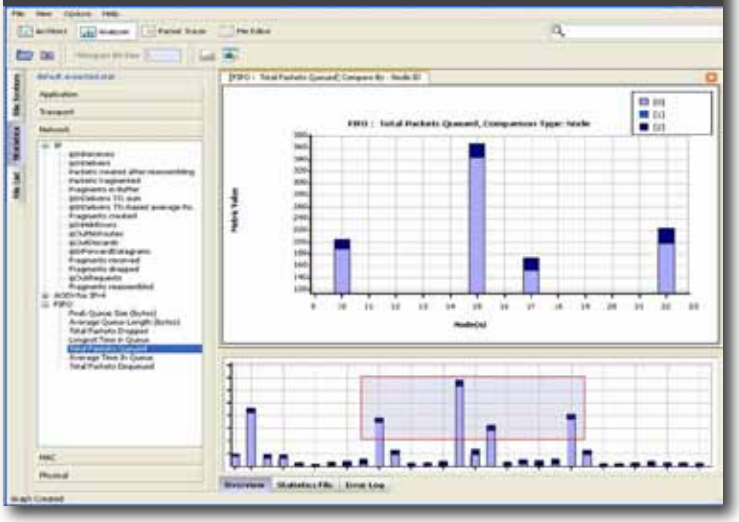
Visualize Mode



Analyzer

Analyzer is a statistical graphing tool that displays hundreds of metrics. You can customize the graph display. All statistics are exportable to spreadsheets in CSV format.

Analyzer



Scenario Player

Scenario configuration files created in QualNet are fully compatible with the optional Scenario Player application. Player provides very high quality visuals of the elements and their interactions during a scenario. The display is suitable for presentation to senior managers who need to quickly understand whether the network will work as expected.

Scenario Player

Statistics Database (Stats DB)

QualNet provides for the generation of several statistics tables in a statistics database. These tables contain information in much finer detail than in the standard statistics file. You can specify which tables are generated and can configure the information contained in each table. QualNet supports SQLite and MySQL 5.0 for the Stats DB.

Technical Partnerships

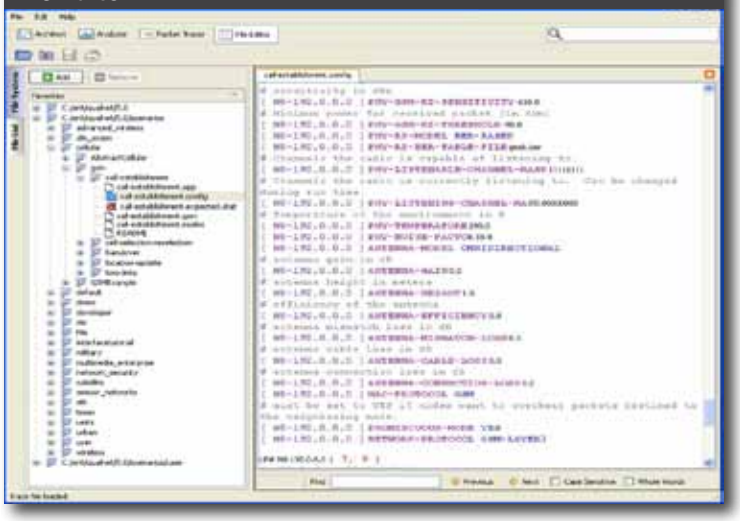
QualNet can be integrated with a wide range of third-party simulation and analysis tools, such as:

- Analytical Graphics, Inc. (AGI) System Toolkit (STK) for advanced mobility and satellite behavior models
- VT MAK VR-Forces for interaction with computer generated forces models
- Presagis STAGE for interaction with computer generated forces models

File Editor

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.

File Editor



Built for Speed

Real-time Simulation. Models can speed up and scale on parallel computing environments. One example: a cluster of 16 dual 2GHz Opteron systems connected by an Infiniband switch achieved real-time speed for 3,500 nodes*.

*** This scenario was designed for optimum performance in terms of traffic, mobility, and partitioning.**

System Requirements

CPU

- 32-bit (x86 compatible) processor
- 64-bit (x86-64 compatible) processor

OPERATING SYSTEMS

Windows

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

Linux

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

MEMORY

- 512 MB free for LAN-size simulations without GUI
- 2 GB free for LAN-size simulations with GUI
- 2 - 4 GB free for a large network (1000+ nodes)

DISK SPACE

- 1 GB free disk space (minimum)

VIDEO

- 128 MB graphics card with hardware 3D acceleration (minimum)
- 1024 x 768 or better screen resolution

COMPILERS

If you intend to develop custom protocol, equipment or other types of element models, you will need to compile the source code into the platform using a C++ compiler.

Windows

- Microsoft Visual Studio 2008 (VC9)
- Microsoft Visual C++ 2008 Express Edition (VC9 Exp)
- Microsoft Visual Studio 2010 (VC10)
- Microsoft Visual C++ 2010 Express Edition (VC10 Exp)

Linux

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.

Distribution	glibc Version	gcc Version
CentOS 5.9	2.5	4.1
Red Hat Enterprise Linux 5.9	2.5	4.1
Ubuntu 12.04 LTS	2.15	4.6