



Network modeling software for:

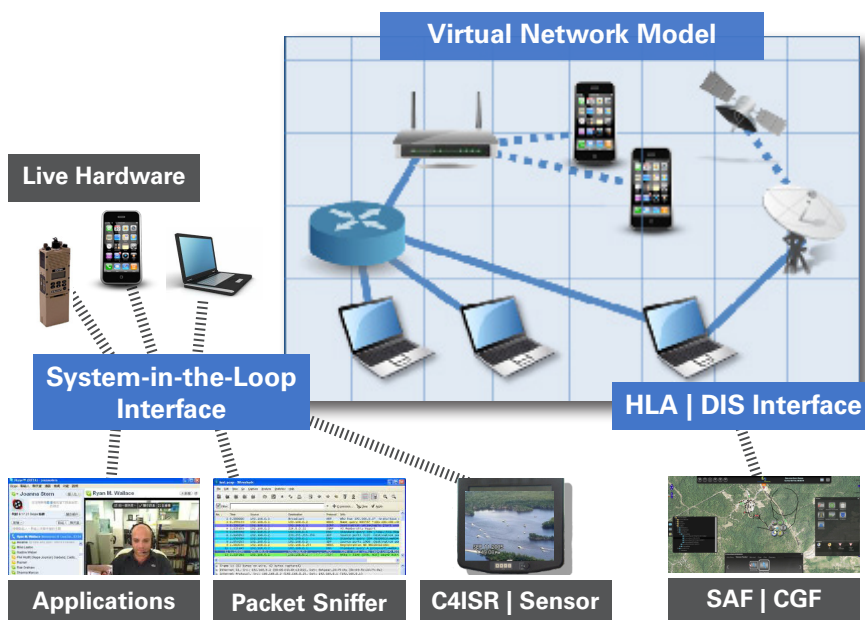
Development
Analysis
Testing
Cyber Assessment

EXata® software (EXata) is a tool for scientists, engineers, IT technicians and communications specialists to create virtual models of all types of data, voice and video networks. The models are comprised of nodes representing the network elements and endpoints (routers, switches, access points, ground stations, satellites, mobile phones, radios, sensors, PCs, servers, firewalls and other security equipment) and the links that interconnect the nodes (LAN segments, internet circuits, radio transmissions, Wi-Fi signals, LTE connections, etc.).

The virtual network models are used by EXata to simulate the behavior of the network under a wide variety of user-defined operating scenarios and application traffic patterns at real-time speeds and with real-world fidelity, accuracy and precision.

EXata enables virtual network models to integrate seamlessly with live hardware and applications via a system-in-the-loop emulation interface.

Using the optional Cyber Library for EXata, virtual network models can include cyber defense and cyber vulnerability components, and scenarios can incorporate a wide range of cyber attacks.



The EXata® Network Modeling Platform is used for:

- Research on protocols and waveforms
- Network design and architecture optimization
- Capacity prediction
- RF interference and propagation modeling
- Mission planning
- Early-stage device design comparisons
- **Live applications performance analysis**
- Disaster response preparation
- Hardware and software development
- Communications problem identification
- **Live hardware testing and certification**
- **Equipment scalability evaluation**
- **Cyber resiliency assessment**

Highly-realistic “virtual” models of all types of data, voice and video networks are utilized by the high-performance simulator to answer a wide range of “what if” operational planning and problem solving scenarios, such as:

- Will the network design provide the necessary performance and application response time?
- What happens if key links get congested?
- Why are mobile systems losing connectivity in the rear of the warehouse?
- How can I leverage five live radios, interoperating with 500 virtual radios, into an effective mission rehearsal?
- How resilient is my information flow to cyber attacks like denial of service?

EXata supports engineers and planners who need to Make Networks Work.

EXata® Overview

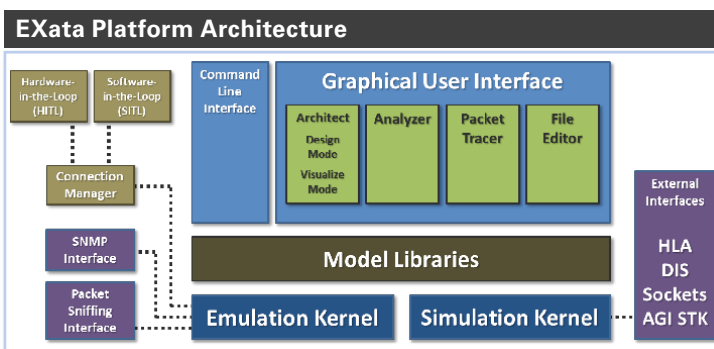
EXata® software (EXata) is a platform used to design and analyze networks, networked systems and distributed applications behavior. Virtual models of all types of network architectures and information flows are built on the platform using libraries of pre-defined and user-developed component models.

EXata Developer

- **Design Mode:** Create virtual network models (and create new protocol and waveform component models)
- **Visualize Mode:** Define and execute operational scenarios in simulation
- **Analyzer:** Process results and generate reports
- **System-in-the-Loop:** Emulation interface to integrate live hardware and applications with virtual network models

Virtual network models created by network engineers with the EXata Developer platform can be leveraged by users of the Run-Time platform for ongoing analysis and experimentation.

Virtual network models and simulation scenarios are created and executed primarily via a feature-rich visual development environment lets users quickly set up models, code protocols if necessary, and then run scenarios that present real-time statistics and helpful packet-level debugging insight. There is also a command line interface for multi-run experimentation control.



EXata can be federated (i.e. integrated) seamlessly with other simulation systems (such as kinetic battlefield simulators) via an optional Federation Interfaces library.

EXata takes full advantage of the multi-threading capabilities of multi-core, multi-processor, cluster and 64-bit processor systems, **supporting models with thousands of network nodes**. The software runs on both MS Windows and Linux operating systems with single-user and server-based licensing options.

Any network device, protocol, configuration, effect, or technology can be modeled in SCALABLE simulation,

EXata Key Capabilities

- Scalability to thousands of nodes enables more sophisticated design and analysis
- Real-time simulation optimizes productivity
- High-fidelity models deliver more accurate results
- Cost-effective “lab-based risk reduction” network simulation technology provides solutions to mission-critical, business-critical problems
- System-in-the-Loop emulation interface allows efficient equipment and applications testing
- Cyber library enables cyber assessment for risk management and response planning

What Makes the EXata Platform Unique ?

Integration with live equipment: EXata virtual network models can be seamlessly integrated with physical equipment such as servers, computers, radios and sensors (as well as a full network environment) to test and validate interoperability, scalability and performance.

Integration with live applications: Live applications (such as VoIP, chat, video feeds, file transfers and database queries) can be run across the simulated virtual network to accurately analyze behavior under different network conditions.

Interaction with packet sniffers: EXata supports a packet sniffer interface to enable capture and analysis of network traffic using standard packet sniffer/analysis tools like Wireshark.

Interaction with SNMP managers: EXata virtual network models can be monitored using standard SNMP network managers from companies such as Hewlett-Packard, IBM and SolarWinds.

Cyber Library: EXata scenarios can be enhanced to include cyber defenses and cyber vulnerabilities, and then evaluated for response to cyber attacks from the optional Cyber Library.

but starting from scratch can be an involved exercise. To dramatically speed up the process, SCALABLE has developed a family of libraries containing models of the typical network component building blocks. They have been engineered and verified to accurately represent specific behavior.

Libraries

EXata platforms come with a default set of libraries of component models. Licenses for optional model libraries may be added.

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 components which influence a network model (except for Images, which are for visual clarity) include:

- **Cyber Threats:** models of cyber attacks, defenses and vulnerabilities
- **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.

The EXata platform has three libraries of component models included:

- Developer
- Wireless
- Multimedia and Enterprise

The libraries which are available as options include:

Standard and Optional Libraries

- Advanced Wireless
- Cellular
- **Cyber**
- Federation Interfaces
- LTE
- Military Radios [1]
- Sensor Networks
- TIREM Propagation Interface [2]
- UMTS (3G Cellular)
- Urban Propagation

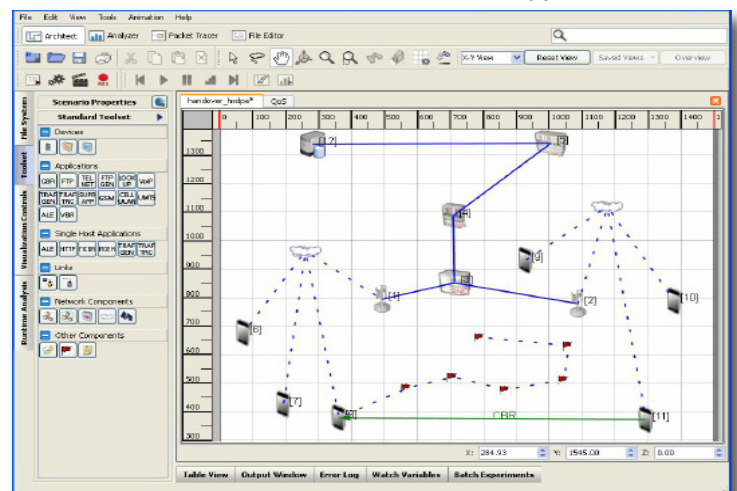
[1] These libraries are subject to export restriction under the International Traffic in Arms Regulations (ITAR) 22 CFR 120-130. International sales of these modules require authorization from the US Department of State.
 [2] Requires the licensing of additional software from Alion Science and Technology Corporation.

Design Mode

Design Mode is used to **create virtual network models** via an intuitive point-and-click drag-and-drop graphical user interface.

Nodes representing various types of network elements and endpoints are placed on a canvas. Each node is configured with wired or wireless network interfaces and communications characteristics. Nodes are then interconnected with the appropriate network links.

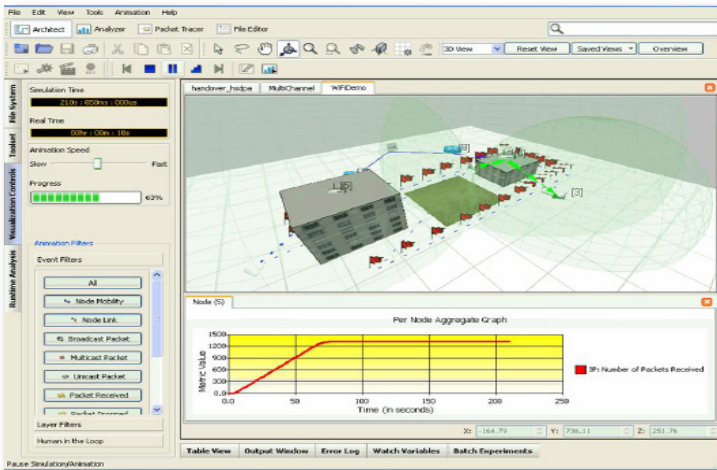
Virtual network models can include subnets, mobility patterns of wireless users, other functional parameters of network nodes, and physical characteristics such as terrain and structures. A wide array of different application layer traffic and services that run on the network can be applied.





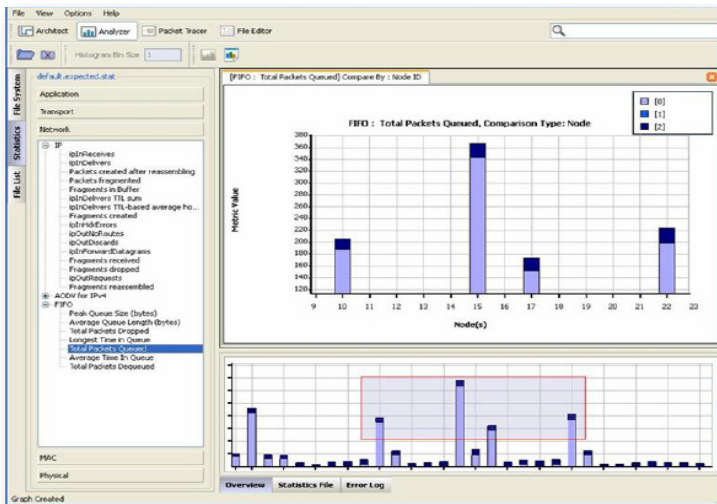
Visualize Mode

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.



Analyzer

Analyzer is a statistical graphing tool that displays hundreds of metrics. You can customize the graph display.



Statistics Database (Stats DB)

EXata provides for the generation of numerous 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. EXata supports SQLite and MySQL 5.0 for the Stats DB.

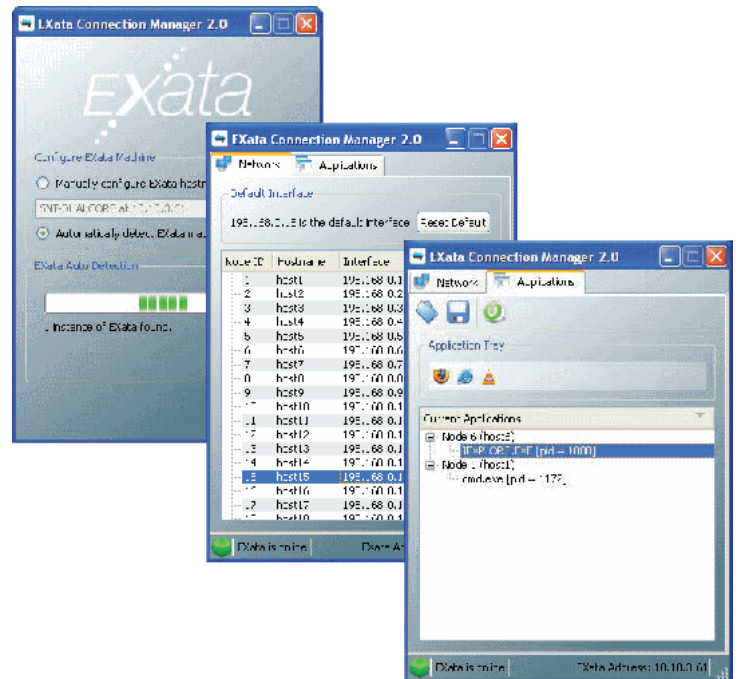
Connection Manager

The Connection Manager makes the EXata advanced emulation technology easy to use. Applications need no modification or customization to use the realistic emulated network.

Connection Manager runs on your live operational systems. Applications use the Connection Manager to run their network traffic over the EXata simulated virtual network.

Connection Manager supports a large variety of applications such as:

- Internet browsers
- Tactical communications
- Situational awareness information
- Sensor data
- Instant messengers
- VoIP
- Streaming video
- Multi-player games



Affiliations



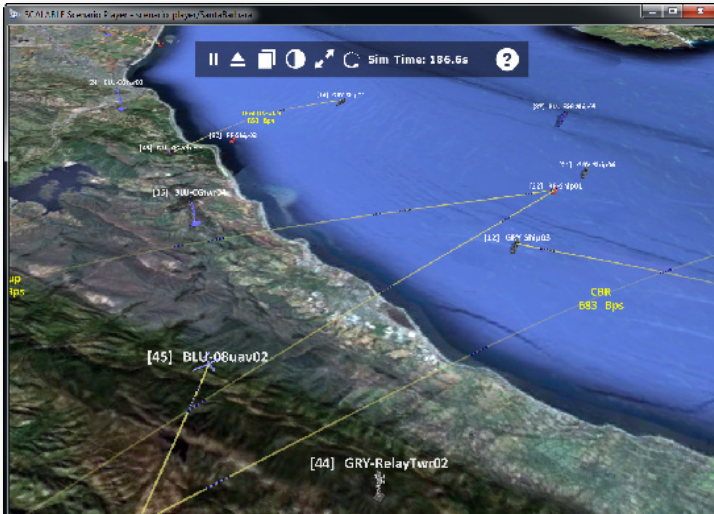
Technical Partnerships

EXata 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

Scenario Player

Scenario configuration files created in EXata are fully compatible with the included Scenario Player application. Player provides very high quality 3D visuals of the network elements and their interactions during a scenario. The display is suitable for presentation to senior managers who need to quickly understand scenario behavior.



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

- 64-bit (x86-64 compatible) processor

OPERATING SYSTEMS

Windows

- Windows 10 Pro and Windows 10 Pro 64-bit editions

Linux

- CentOS 7.6
- Red Hat Enterprise Linux 6.7
- Ubuntu 16.04 and 18.0 LTS

MEMORY

- 2 GB free for LAN-size simulations with GUI
- 4 GB free for a large network (1000+ nodes)

DISK SPACE

- 2 GB free disk space (minimum)

VIDEO

- 128 MB graphics card with hardware 3D acceleration (minimum)
- 1680 x 1050 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 2017
- Microsoft Visual Studio Community 2017 for Windows Desktop

Linux

The expat development library is needed to compile EXata on Linux systems. Install the expat development library from the Linux installation media or download site.

| Distribution | glibc Version | gcc Version |
|------------------------------|---------------|-------------|
| CentOS 7.6 | 2.17 | 4.8 |
| Red Hat Enterprise Linux 7.6 | 2.17 | 4.8 |
| Ubuntu 16.04 LTS | 2.23 | 5 |
| Ubuntu 18.04 LTS | 2.27 | 7 |