

Navigation Hardware In the Loop Operating System Toolkit for C++ Testers

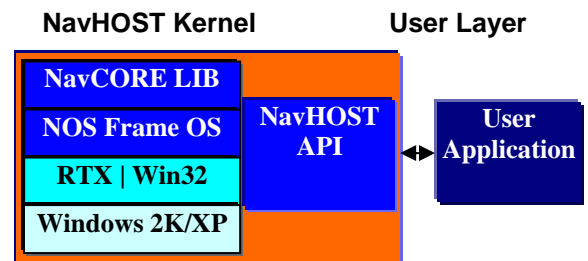
NavHOST is a comprehensive suite of software libraries that allows rapid development of real-time applications on Windows platforms for military and non-military users. NavHOST consists of three parts: The NavHOST Operating System (NOS) API, NavHOST API Toolkit and your application software.

The utility of NOS is augmented with the NavCore Library which collectively provides a comprehensive hardware in the loop test platform configurable for the user application.

The following top level components comprise the toolkit. Additional libraries are being added weekly.

- Math Library
- Digital I/O and Timer
- Ashtech Z/G12 GPS Receiver
- Crista IMU
- Piccolo Autopilot Serial Interface
- Piccolo Autopilot CAN Bus Interface
- Ideal-Aerosmith 1291BR rate table
- IGEMS Spread Spectrum Meter
- Weapon Telemetry
- Serial Interfaces
- TATE Jammer Synthesizer
- MilStd1553 Bus Controller and Monitor
- NavHost Library
- NavHost GUI Communication Pipe Commands – Interprocess Comm.
- NavHost Tool Kit Libraries.
- Core Ethernet Classes
- Navigation Algorithms
- NavHost Operating System
- VMIC Reflective Memory
- Satellite Constellation Simulator
- Inertial Simulation Library
- MIL-STD-1553 Avionics Support
- PCI IRIG Clock
- Real-Time Application Process

Each NavHOST library toolkit is access using API interfaces. The basic software structure of NavHOST is shown below.



Rapid

Development

Of

Hard Real-time

Simulation

Evaluation

Test

Applications

NavHOST is designed to make the process of creating real-time and deterministic hard real-time applications simpler and quicker. To achieve this goal, the highly C++ classed software architecture is divided into functional layers consisting of operating system interaction, interface device managers, device simulations, Kalman filters, instrumentation interfaces, client servers and much more.

The core NOS operating system layer is a frame based preemptive scheduler. NOS interfaces with the Ardence, formally VenturCom, RTX real-time extensions to Windows to achieve deterministic execution. RTX provides the deterministic task scheduling while NOS encapsulates the RTX functionality into a frame based process scheduler.

Frame based execution of real-time applications is essential to deterministic operation and stability as software evolves. NOS through simple API calls, relieves the developer from the tedious task of creating and managing multi rate process including data synchronization between differing rate processes. Multiple task rates from 1KHz to background rate at 65K priority levels are easily created.

For application requiring truly synchronous execution with external hardware, NOS accepts 1 pulse per second and 10MHz inputs to synchronize, align the multirate frames and compensate for clock drift. NOS is now available in three versions from deterministic execution to standard Windows performance with clock drift compensation. Win32 versions allow debugging and demonstration programs on standard PCs and laptops.

Control

Systems

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NavHOST Features:

Source Code

NavHOST is written in Microsoft C++ 7.0 with no use of MFC in the library. Due to NavHOST structure source code is available at selective levels for authorized users.

Hardware Platform

NavHOST executes on Pentium class PC platforms from laptops to multiprocessor systems allowing any PC to become a real-time HWIL processor.

Hardware Interfaces

NavHOST provides comprehensive support for the most commonly used interfaces. Each device driver is encapsulated by NavHOST to support multiple vendor hardware. Supported interfaces: RS232, SBS MILSTD 1553 BCBM, RS485 SDLC, RS422 Sync/Async, Digital I/O, VMIC Reflective Memory, Ethernet, CANbus, IRIG. Several interfaces implemented (ICD059, EGI, 150, 153)

Data Logging

Each NavHOST hardware interface or simulation interface contains a Data Logging class to manage storage of high rate synchronous data. Real-time and post processing utilities are provided to view and reduce the data.

Client Server Architecture

NavHOST is based on client server architecture to allow connectivity to distributed object. Several server types standard and specialized may be added or interfaced at the user layer. Servers supplied are EGI, SNU-84, generic inertial data frames and any attached data interface via ReDIRECT.

Data Interface and Engineering Unit Conversion Tool (DIRECT)

Data interfaces, either electrical or internal logical interfaces, are abstracted using Microsoft Access database to represent each message, word, bit on an interfaces. The Engineering Unit Conversion Engine (EUC) allows the operator to automatically perform unit conversions, word representation (endian, lsb, msb, float, caps, IEEE. etc) from any type. DIRECT operates over shared memory or UDP to allow clients to view, plot, log or just receive real-time or post test data.

Avionics Inertial Navigator & GPS RX Support

NavHOST contains support for the HG-764 Embedded GPS Inertial navigator for testing and GINS for laboratory interfacing. MAGR, 3A, PLGR, Ashtech G/Z12, HG423 and LTN92

avionics interface are included for authorized users.

Scaleable Six Degree of Freedom Model

A scalable medium fidelity 6DOF allow generation of inertial data for modelling, simulation, injection to hardware, inertial aiding and experimentation. Multiple instances of the 6DOF maybe created and distributed to the various hardware of simulation interfaces.

GPS RF Simulator Support

GPS constellation simulation interfaces to the L3-IEC SCS2450 RF generator is standard. Complete control with the scalable internal 6DOF or SCS native motion is possible. All data is logged and viewed via ReDIRECT. Other simulator support is available. Contact CSR for options.

GPS INS Navigation Simulation Library

The ability to simulate the interactions between GPS and Inertial sensors is essential to platform simulation and integration. Included in the GPS Simulation Library: Sensor error models, GPS constellation, simple GPS receiver, IMU models, Markov processes, Master / Slave transfer alignment models and more.

Math Library

NavHOST contains a comprehensive set of overloaded mathematical library classes and functions to process matrices, vectors, direction cosines, quaternions and transformations between coordinate systems (NED, NWU, ECEF, ENU..)

Real-time Applications Developed on NavHOST

- HWIL For GPS Inertial Testing
- Geolocation INS Generator
- EW RF Controller
- Standalone Weapon Telemetry System
- Rate Table Controller
- Mobile Aircraft Avionics Inertial and Stores Management Simulator for Weapon Integration Evaluation
- Mobile Aircraft to Weapon Core ICD Implementation
- Instrumentation controller – scopes, meters, etc.
- Distributed Trajectory Generator
- Remote data viewing telemetry stations

Support Tools

- Integrator test interactive development environment.
 - Test Editor
 - Real-time Event Builder
 - GuiBuilder – Display, Logs, Plots
- Data Interface Playback data reduction
- HTML Based Documentation

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