NOS Benefits

The significance of the NOS architecture is that it allows developers, testers, systems engineers, QA, and IV&V to be more productive during all phases of the development lifecycle.

NOS offers a number of advantages over hardware-based testing, such as:

- Cost savings
- Quicker deployment (hours vs. months) time
- Increased efficiency
- Decreased configuration management resources

NOS offers benefits compared to other simulation environments, including:

- Works with unmodified binaries
- Supports multiple software systems
- Provides near-real time performance
- Ability to integrate external simulators

For more information

To explore how NASA's IV&V Program can provide dynamic analysis services to meet your specific needs, please contact Marcus Fisher at 304.367.8337 or ivv-dynamic-analysis@lists.nasa.gov, or visit us at www.nasa.gov/centers/ivv/dynamic_analysis.html for more information.

NOS Features/ Capabilities

Interception Technology: NOS provides an interception capability that allows users of the simulations to intercept, modify, or block data to or from various simulation components. The interception technology provides users the ability to inject faults during simulation without modifying software.

Reusable Simulation Architecture: The generic architecture enables rapid construction of software-only environments that simulate an interactive mission system, utilizes existing components when applicable.

High-Fidelity Simulator:

- No hardware dependencies
- Simulation of operational system
- Controlled execution of the simulation model and processor states
- Architecture supports dynamic addition of external custom components to the simulation environment
- Fault injection of hardware & measurements, software, and environmental variables to test software management responses
- Step-wise execution of software in a controlled, repeatable manner
- Execute mission scenarios and characterize timing behavior, memory usage, and CPU utilization

NASA's IV&V Program

Dynamic Analysis

What is it?

Who is it for?

What are the benefits?

What is it?

Traditionally, software IV&V concentrates on analyzing intermediate work products from the software development process. This static analysis considers the form and structure of a product without executing it, ignoring the software's behavior in response to dynamic conditions in an operational environment.

These deficiencies can be addressed using Dynamic Analysis – the execution or simulation of software to detect errors by analyzing the response of the product to sets of input data.

Dynamic Analysis can be used in conjunction with traditional static analysis techniques or as an alternative method for IV&V analysis to detect errors.

Who is it for?

Dynamic Analysis has potential application to many embedded software development projects across many different domains, such as:

- Aerospace
- Automotive
- Consumer Electronics
- Defense
- Industrial Automation
- Medical Devices
- Nuclear

Project staff that can benefit from Dynamic Analysis include:

- Program managers and decision makers
- Software and systems engineers
- Test and IV&V engineers
- Operations engineers
- Quality assurance

What are the benefits?

Using Dynamic Analysis reduces the risk of project failure and ensures the software does what it is supposed to do, does not do what it is not supposed to do, and tests how it reacts under adverse conditions. Benefits include:

- Aids in identifying software issues that cannot be found by other IV&V analyses.
- Verifies expected software behaviors, including responses to fault injections.
- Increases confidence that software will work as expected and properly handle adverse conditions.
- Increases the efficiency and effectiveness of IV&V by finding development errors early in the engineering and operational life cycle enhancing the likelihood of achieving project success within desired cost, schedule and performance goals.

Enabling Technology

One way that NASA IV&V enables Dynamic Analysis is via the NASA Operational Simulator (NOS) architecture. NOS provides an environment to analyze the actual execution of a binary image in a simulated target hardware environment, responding to simulated conditions in the operational environment. The reusable simulation architecture allows the IV&V Program to quickly develop, deploy, and perform V&V in a simulated environment. The approach taken within NOS provides the capability to test software without the presence of actual sensors, actuators, and instruments. The simulation environment runs the software in a CPU emulator alongside custom hardware models. This allows the simulation to run in real-time or even faster than real-time environments. Utilizing simulation reduces the cost of establishing a hardware-in-the-loop test environment by eliminating the need for specialized hardware.

The closed loop, end-to-end simulation environment is a robust, reliable, and flexible software system. It provides a platform for both analysis and operational usage of the system under test while maintaining complete system integrity.