



# Nuum Solutions



## NVF : A simulated environment for IoT/Microkernel-based embedded systems

by the Nuum Engineering Team

### System Features

#### Industries:

Industrial, Medical Devices, Aerospace, Automobile

#### Technical Highlights:

- Linux Xenomai realtime framework over Linux Ubuntu
- Micrium Technology (uC/OS-3, uC/TCP-IP, uC/USB)
- IoT Telemetry
- Nuum Virtual Framework

#### Solution:

An virtual embedded development and test environment

#### Results:

- 33% reduction in design/test time
- Early verification enabled
- Significant improvement in project follow-up and technical decisions

### Introduction

Virtual Prototyping (VP) technology proposes emulation of embedded processors, peripherals, IO, and interaction with the real world. Systems created in VP fashion are fast and accurate enough to work on developing embedded software: from drivers to complex embedded firmware on single or multi-processors.

Combined with a well-defined design and verification process, VP becomes a powerful and productive **software development** and **test** methodology that significantly reduces the overall design and verification phases. Using VP, engineers can expect to connect their design to a wide range of simulation, verification, code coverage, analysis, and profiling tools. In addition, engineers can carry out hardware-in-the-loop and connect the VP with real/physical testing and measurement devices, and other equipment in the communication network using TCP/IP communication protocols which opens for the Internet of Things (IoT) world.

### Achieved using Nuum Virtual Framework (NVF)

The NVF is a VP technology built under Linux and is able to accurately reproduce the software programmer's view. As a result, engineers can develop functionality and testing, or can start working system validation of the system even before having access to all the physical hardware (target). It is like having a replica of the final system, without any hardware. This has tremendous advantages such as:

- Allowed to develop realtime embedded microkernel software with any target
- Allowed to connect to servers, web databases, or other machines (M2M) without any machines
- Allowed to reproduce realtime test environment without this environment being real.

## Emulation environment for Microkernel-based embedded systems and IoT

Nuum's methodology will foster further testing, or more advanced testing and validation at the coding stage, rather than waiting at the verification stage. Using this approach, the time spent at the testing and verification phases will be shorter, and the quality and productivity of the testing phase will be increased. Nuum's NVF is intended for replacing physical target development, deeply embedded nodes on a network, reducing the number of units on a distributed system to test, reproducing a IoT device communicating with a server, and so on. It provides a cheap and fast solution for reproducing an embedded environment and a network of devices. It promotes code consistency, accuracy, and integrity.

This methodology also creates the ability to undergo a code coverage phase before the target becomes available. This phase is not intended to replace the final code coverage phase on the real target, however it enables engineers to generate test cases/testbenches that will perform an early coverage to be reused later for the physical target. The methodology eliminates the need to develop such cases at the end of the cycle and provides better control of the hardware, software, and over time and human resources.

From a technical standpoint, the environment provides semi-hosting channels that bridge any data coming from the virtual world and leading to the real world (and vice versa), thereby creating a hardware-in-the-loop environment. This strategy allows us to connect to useful components such as test generation or measurement cards, USB and TCP/IP devices, and deported IoT devices.

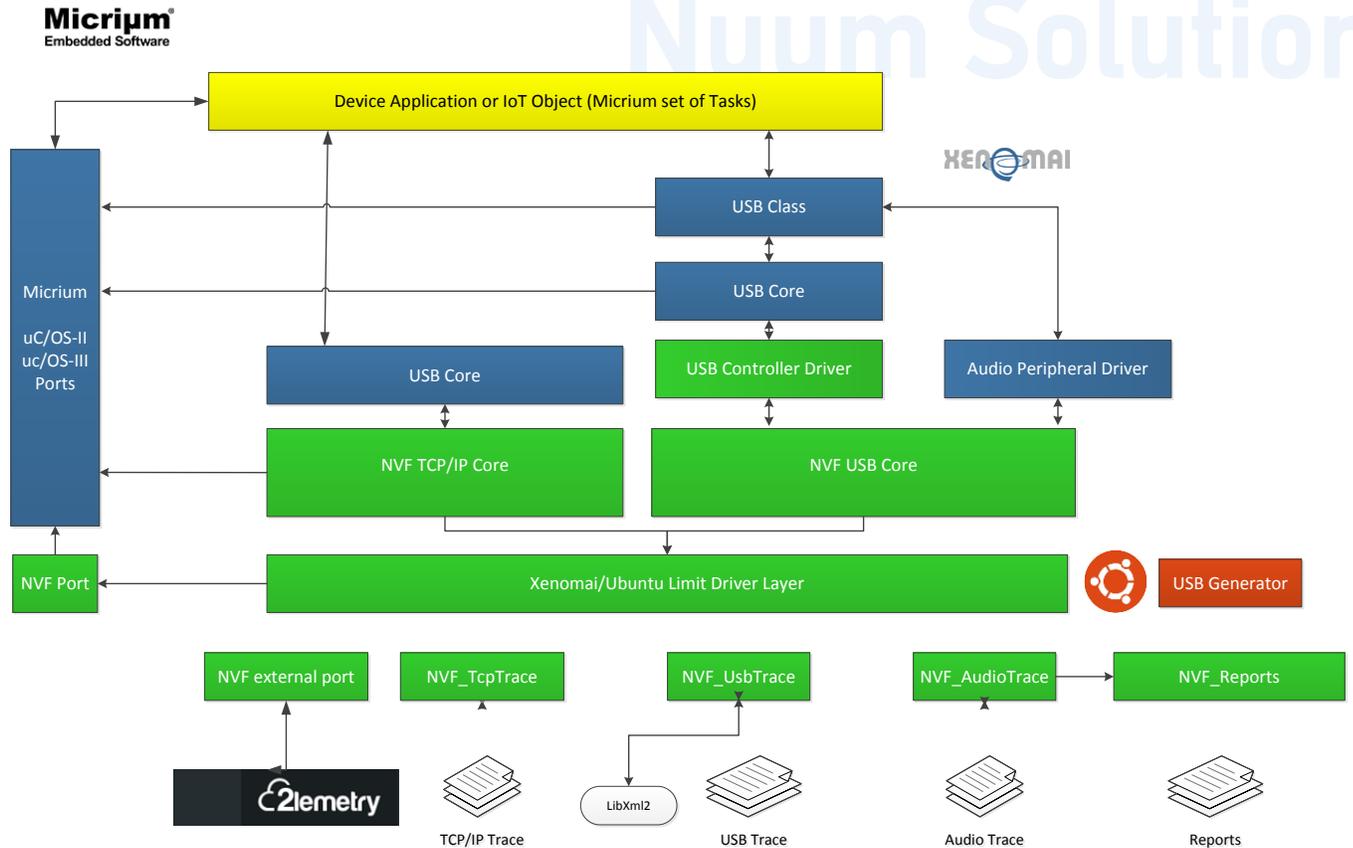
## Emulation environment for development, test

With respect to development and test, Nuum's methodology provides the required base, enabling programmers to develop and debug in the absence of any hardware/target. System architecture (multiprocessor), controllers and other peripherals can be emulated. Engineers can begin the coding stage very early in the global flow or work remotely from the main team/location.

Technically, a time-accurate architectural model representing the hardware portion (processor and drivers), including communication controllers (USB, TCP/IP) are linked to a Xenomai/Ubuntu realtime platform, which opens up software development and test. Engineers can develop component modules representing the system algorithms (for example, communication units, industrial devices under test and so on). Also, devices can be connected to the internet through TCP/IP requests.

The following figure illustrates the emulation environment:

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## Contact us for more information

This methodology intends to optimize and accelerate the design and validation phases by using virtual prototyping technologies. In addition, optimized design flow provides the enormous advantage of foreseeing hardware and human resources needs in the very early stages of the product cycle.

For more information on the NuUm Virtual Framework, please do not hesitate to contact our sales team.