Introduction to NI Linux Real-Time

Publish Date: Mar 11, 2015

Overview

National Instruments has developed a Linux-based real-time OS (RTOS), called NI Linux Real-Time, through years of R&
development, collaboration with open-source community, and with contributions from partners. This RTOS is available or
hardware, described below. NI Linux Real-Time is fully supported in by the NI LabVIEW development environment with th
LabVIEW Real-Time Module.

In this article, learn about NI Linux Real-Time, key benefits of this technology, and the performance it offers. It's importan
that NI provides the same familiar LabVIEW software application development experience on hardware targets that supp
Linux Real-Time. For advanced low-level details, see Under the Hood of NI Linux Real-Time (
http://www.ni.com/white-paper/14626/en).

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1. Evolution of NI Linux Real-Time

Linux has long been used in embedded system design in large part because it is free, open sourced, and community gro
supported. With early use, embedded software developers concluded that Linux could not be an RTOS, and over the cou
time have developed a plethora of hybrid approaches that combine Linux with a dedicated RTOS for use in embedded
applications.

As the use of Linux in embedded system design matured, beyond pursuing hybrid solutions, developers also added featu
improve the determinism of the Linux kernel itself. More recently, the PREEMPT_RT patch set, an outgrowing of the effo
improvements to the Linux kernel, has increasingly become the recognized approach to viably achieving real-time perfor
with Linux. National Instruments has worked to use the PREEMPT_RT patch to create NI Linux Real-Time. To learn mor
the PREEMPT_RT patch set, read A Real-Time Preemption Overview (http://lwn.net/Articles/146861/).

2. Benefits of NI Linux Real-Time

Historically, real-time performance has come at the expense of usability. Luckily for NI Linux Real-Time, the usability ben
Linux offers carry over in large part because much of the benefit arises from the Linux kernel, which is largely intact. NI L
Real-Time thus offers compelling real-time performance on par with dedicated RTOSs but without sacrificing usability. An
of the increased usability the RTOS provides is the proven and stable network stack it offers, borrowed from generic Linu
the improved network stack, Real-time targets that support this RTOS can support true dual-DHCP network interface car
and do not require a reboot to apply changes to networking or time settings, and offer richer support for communication p
such as IPv6 and SNMP. Yet another compelling example is the display support for local HMIs that NI Linux Real-Time o
the new CompactRIO Performance Controller (http://www.ni.com/compactrio/performance-controller/).

Additionally, as Linux is far more ubiquitous than even the most popular of dedicated RTOSs in the marketplace, this new
offers a much richer ecosystem of IP and tools along with a significant base of experienced users capable of harnessing
potential of the RTOS. When using a real-time target that supports the NI Linux Real-Time OS, you have greater freedom
augment the functionality of your solution with the ecosystem that Linux provides and can take advantage of the vast bas
experienced Linux users if you lack the talent in-house. From more easily adding support for third-party peripheral hardw
as specialized sensors to much more easily integrating C/C++ code (http://www.ni.com/tutorial/52578/en/), NI Linux Real
empowers users.

Beyond usability and ecosystem, unlike many dedicated RTOSs, NI Linux Real-Time is a true dual-mode OS. As a dual-m
NI Linux Real-Time offers a significantly more resilient experience; should an application crash, the system continues to r
can recover from the application failure without significant disruption. NI Linux Real-Time also facilitates true multitasking
allowing you to run multiple programs in parallel. For example, you can run a database directly on the real-time target alo
your LabVIEW Real-Time application.

Lastly, drawing again from Linux, this RTOS offers a much improved ability to manage user account control and user file
permissions. User activity can be more easily logged on embedded devices, which support NI Linux Real-Time. Additiona
security features such as VPN and Firewall can be implemented, preventing the need for additional external hardware so
the sake of improved network security.

3. Performance

NI Linux Real-Time delivers real-time performance on par with the dedicated RTOSes offered on current-generation Com targets. The jitter of NI Linux Real-Time targets is on the same order of magnitude as the jitter on current real-time syster provided by NI. With respect to real-world control and streaming applications, NI Linux Real-Time-based CompactRIOs o significant increase in performance as control and streaming loops run at faster loop rates with lower processor utilizatior more insight into the performance offered by the Linux based RTOS, see NI cRIO-9068: Performance and Throughput Benchmarks (http://www.ni.com/white-paper/14613/en) and NI CompactRIO Performance Controller: Performance and Throughput Benchmarks (http://www.ni.com/white-paper/52250/en/).

4. Supported Hardware

NI Linux Real-Time is supported on the following NI Hardware:

- CompactRIO Controllers (http://www.ni.com/compactrio/)
- NI System on Module (http://www.ni.com/som/)
- Compact Vision Systems (http://sine.ni.com/nips/cds/view/p/lang/en/nid/210167)
- CompactDAQ Controllers (http://www.ni.com/data-acquisition/compactdaq/)
- NI myRIO (http://www.ni.com/myrio/)

5. More with NI Linux Real-Time

NI Linux Real-Time offers significant improvements while maintaining the ability to deliver the performance that critical re applications demand. As the performance benchmarks illustrate, the jitter of NI Linux Real-Time is on par with the jitter or real-time systems and the system-level performance is significantly improved over dedicated RTOSs.

It's also important to note that the abstraction, portability, and productivity offered by the LabVIEW reconfigurable I/O (RI architecture extend to targets that support NI Linux Real-Time. Despite the new RTOS, the LabVIEW software developm experience remains consistent across NI's embedded targets and you can seamlessly move code between targets base Linux Real-Time from other NI embedded hardware. Take advantage of the benefits this new technology offers by upgra NI Linux Real-Time capable target today.

Learn more about NI Linux Real-Time (http://www.ni.com/white-paper/14626/)