Intel® Network Builders Solution Brief

ADI Engineering* RCC-VE Platform

Intel® Atom™ Processors

Lower Costs and Flexible Service Delivery with CPE Virtualization

ADI Engineering* brings NFV to the network edge with a low-cost, high-spec'd platform based on the Intel® Atom™ Processor C2000 Product Family tom Processor C2000 Product Family

EXECUTIVE SUMMARY

"Operators spend billions of dollars supplying, installing, configuring, and maintaining customer premises equipment (CPE) for both enterprise and residential customers," according to Simon Sherrington at Heavy Lifting.[1] One reason for these high costs is the use of inflexible, single-function CPE that leads to multiple devices per site, most of which are incapable of hosting new services. For example, a business may have a separate modem, router, firewall, and storage device that ultimately drive up an operator's hardware and support costs, and fail to provide a platform for new service deployment.

An alternative approach is to consolidate multiple services onto a single device using network functions virtualization (NFV) concepts that can help network operators and service providers lower costs and increase service delivery flexibility. "Virtualization techniques offer the opportunity to reduce the number of individual devices at locations; enable remote hosting, configuration, and management of functions traditionally resident at the customer premises; or even launch new services without replacing old equipment," says Sherrington.[1]

Virtualized CPE requires an economical yet high-spec'd device that can handle diverse networking and application requirements. As such, the RCC-VE platform from ADI Engineering* sets a new, low-cost standard in price-sensitive edge applications such as CPE, gateway, IoT, security appliance, and wireless access. The platform is based on the Intel® Atom™ processor C2000 product family, which delivers the necessary virtualization, packet processing, security, and computing capabilities in a compact, power-optimized form factor.

CPE VIRTUALIZATION

Digital services for residential and business markets are advancing at a rapid rate; while at the same time, evolving networking protocols and security requirements pose constant challenges. These trends, along with technological innovation, are reducing the useful lifespan of traditional CPE that is fixed-function or difficult to upgrade remotely. Devices that perform major network functions in hardware tend to be much less flexible than software-based devices.

Ushering in a generation of software-based devices, CPE virtualization can help network operators and service providers in a number of ways:

CapEX

- Lower cost CPE (hardware and support economies)
- Longer CPE lifetime

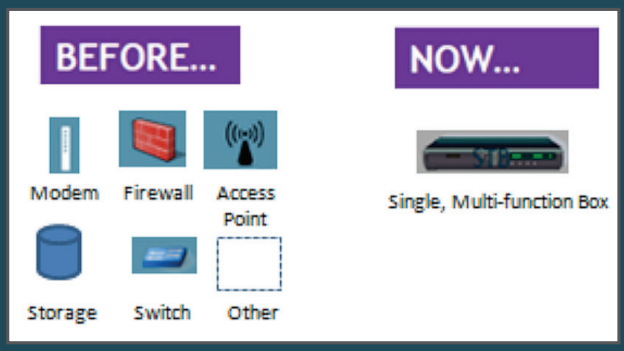


Figure 1. Moving to One Box per Site

OpEx

- Quick and transparent migrations (e.g., IPV4 to IPv6)
- One box per site versus a box per service (Figure 1)

Flexible Service Delivery

- New service deployment as easy as software download
- Always up-to-date services

GENERAL-PURPOSE HARDWARE

A key challenge for CPE virtualization is ensuring the new software-based processes can deliver the same level of performance on power-efficient, general-purpose hardware as on existing, proprietary CPE. For this reason, ADI engineering chose to base its RCC-VE and RCC-DFF platforms on the Intel Atom processor C2000 product family, which is a scalable, single-chip system-on-chip (SoC) with advanced virtualization, packet processing, security, and computing technologies. The key processor features are shown in Figure 2.

- **Virtualization Technology**
  The processor performs various virtualization tasks in hardware, like memory address translation, which reduces the overhead and footprint of virtualization software and improves its performance, security, and reliability. This hardware-assist technology is called Intel® Virtualization Technology (Intel® VT),[2] which helps reduce the virtualization overheads occurring in cache, I/O, and memory.

- **Packet Processing**
  When paired with the Data Plane Development Kit (DPDK), this two to eight core product family platform supports impressive packet processing speeds, delivering a 10:1 performance range from 2 to 20 gigabits per second (Gbps) of Layer 3 forwarding throughput.[3]
- **Security Functions**
  Select processor SKUs provide hardware acceleration to improve cryptographic performance when securing network traffic, while also making more processor cycles available for application processing. Called Intel® QuickAssist Technology, the capability supports over a dozen cryptography functions, including the highly-regarded[4] AES-GCM, that otherwise would consume a significant amount of processor cycles if computed in software.
- **Scalable Computing Performance**
  These SoCs offer a range of multi-core performance (from two cores up to eight cores), a thermal design power (TDP) range of 6W to 20W, and high levels of I/O and acceleration integration. They are ideal for thermally constrained solutions such as entry to mid-range branch office router, security appliances, wireless access, storage, or multi-function devices.

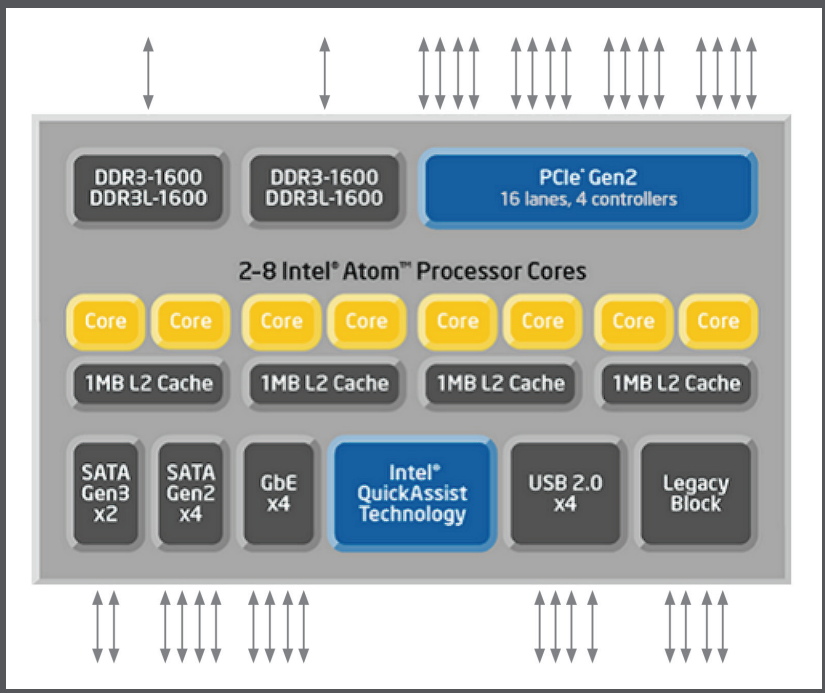


Figure 2. Intel® Atom™ Processor C2000 Product Family

ADI ENGINEERING* RCC-VE PLATFORM

The innovative RCC-VE platform (Figure 3) from ADI Engineering brings the performance of the Intel Atom processor C2000 product family to CPE, which previously had to settle for lesser processors and single-function devices. OEMs, carriers, and system integrators can deploy the platform to extend NFV from the data center to the network edge.

Figure 3. ADI Engineering* RCC-VE Platform

Design Methodology

In order to dramatically lower costs, ADI approached the design of the RCC-VE platform differently than the conventional way of building Intel® processor-based products. Instead of designing a "one-size-fits-all" board that supports the whole family of processors, ADI developed cost-optimized boards for several processor SKUs that support Intel QuickAssist Technology. This ensures the low-end board is not burdened with high-end components, such as a high-current voltage regulator that could be 75 percent more expensive than what is needed.

In addition, printed circuit board (PCB) layers are reduced, and system management and control components are a fraction of the cost. The savings are substantial, with absolutely no loss of performance or quality. The result is ADI can hit the price points required in cost-sensitive edge applications such as CPE, gateway, security appliance, and wireless access.

Product Family

The **RCC-VE** platform is based on a new paradigm – a family of compatible products designed from the ground up to serve different price/performance points with better scale up and down. Using two- and four-core processors from the Intel Atom processor C2000 product family exclusively, the RCC-VE platform supports 2 to 10 Gbps applications, delivering 5:1 scalability.

Other features include up to 32 GB of on-board eMMC Flash, so separate Flash modules are not needed, although expansion with mSATA SSDs is supported. The platform has on-board DDR3 capacity up to 16 GB (with or without ECC) and up to six gigabit Ethernet ports implemented with high-performance Intel® Ethernet Controllers. The RCC-VE board meets FCC and CE Class B emissions standards, even without an enclosure, and it is totally fanless for all dual-core processor boards and for some applications with quad-core processors.

Also based on the Intel Atom processor C2000 product family, ADI Engineering's **RCC-DFF** is a cost-optimized design serving virtualized network edge applications including small cell, wireless, virtual CPE, and security. This 120 x 120mm Nano-ITX platform brings NFV and the performance of the Intel Atom processor C2000 product family to edge applications requiring smaller form factors and lower price points.

The RCC-DFF platform is also supported by the Intel® Network Edge Virtualization SDK (Intel® NEV SDK), which is the first in the industry to provide a virtualized system out-of-the box based on the Intel Atom processor. The kit is a complete ready-to-run system, including the hardware, software, and tools equipment manufacturers need to create virtualized edge devices.

The Intel NEV SDK (Figure 4) includes RCC-DFF hardware bundled with:

- Intel® System Studio
- Wind River* Linux*
- KVM* Hypervisor with Wind River Open Virtualization Profile

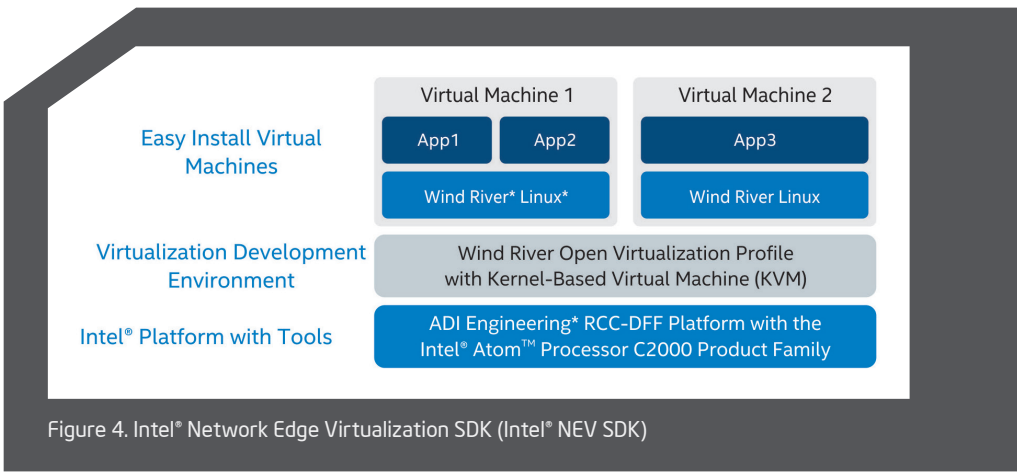


Figure 4. Intel® Network Edge Virtualization SDK (Intel® NEV SDK)

- Wind River Workbench* development tools
- DPDK accelerated drivers
- Intel QuickAssist Technology drivers
- Sample applications

Solution Development

ADI Engineering supplies RCC-VE and RCC-DFF development kits, boards, and pre-integrated systems with desktop or rackmount enclosures. Additionally, ADI can rapidly customize the RCC-VE platform to customer specifications (bill of materials changes or component-level redesign) and deliver private-labeled OEM product in volume. Under an Open IP supply chain model, ADI also offers design licensing of the RCC-VE and RCC-DFF platforms.

Solution Benefits

Network operators and service providers adopting CPE virtualization can take advantage of new opportunities to reduce CapEx and OpEx, and expedite the delivery of new services. This is made possible by ADI engineering's cost-optimized RCC-VE platform that makes the most of the highly-scalable performance of the Intel Atom processor C2000 product family. Bringing NFV to the network edge and CPE, this solution enables lower costs and flexible service delivery compared to today's stack of single-function devices in homes and businesses.

For more information about solutions from ADI Engineering, visit www.adiengineering.com.

For more information about Intel® solutions for communications infrastructure, visit www.intel.com/go/commsinfrastructure.

For more information about NFV- and SDN-based solutions, visit https://networkbuilders.intel.com.

1 Source: Heavy Lifting analyst Simon Sherrington, "Virtualization to Transform CPE," May 5, 2014, http://www.lightreading.com/carrier-sdn/nfv-%28network-functions-virtualization%29/virtualization-to-transform-cpe/a/d-id/708880.

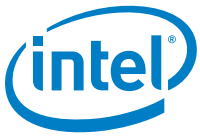
2 Intel® Virtualization Technology (Intel® VT) requires a computer system with an enabled Intel® processor, BIOS, and virtual machine monitor (VMM). Functionality, performance or other benefits will vary depending on hardware and software configurations. Software applications may not be compatible with all operating systems. Consult your PC manufacturer. For more information, visit http://www.intel.com/go/virtualization.

3 Source: ADI Engineering*.

4 Source: Cryptography Stack Exchange, http://crypto.stackexchange.com/questions/18860/choice-of-authenticated-encryption-mode-for-whole-messages.

For more information about solutions from ADI Engineering, visit **www.adiengineering.com**.

Solution Provided By:



Disclaimers

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at http://www.adiengineering.com.