GEC9 Demo : Network Coding in NetFPGA Routers
(Mobile Gigabit Wireless Access)

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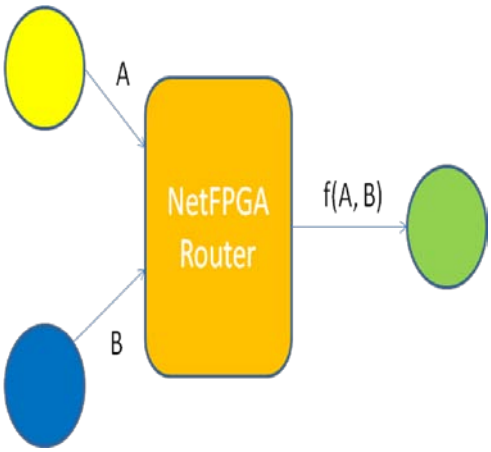
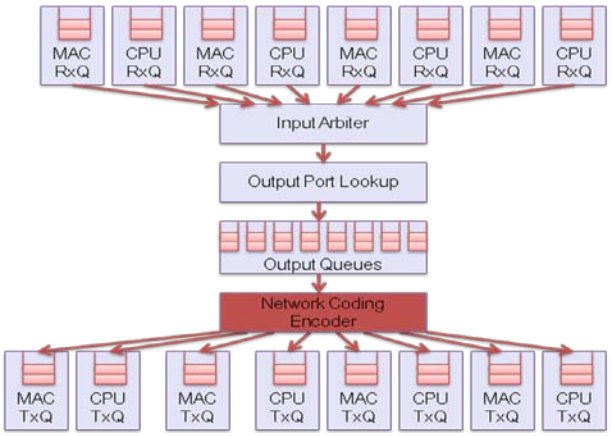
URL: http://www.ece.wisc.edu/~parmesh/geni.html

Abstract

Emerging gigabit wireless technologies will soon allow mobile devices to access broadband media on the move via gigabit wireless networks on the edge of the future Internet. However, gigabit wireless access does not easily result in gigabit end-to-end throughputs to mobile devices. The main goal of this project is to experiment with techniques needed to support end-to-end gigabit TCP and UDP throughputs from the Internet to the mobile devices. Specifically, the project proposes to leverage GENI's deeply programmable core and wireless edge networks, to experiment with techniques such as inter-flow and intra-flow network coding, multipath routing, and on-demand localized congestion control schemes in OpenFlow routers. Ongoing research shows that these components are key parts of the solution needed to deliver gigabit end-to-end throughputs to mobile users.



(a) Host configuration



(b) Block diagram of NetFPGA router

The demonstration here shows one of the first steps towards realizing the above experimental plan. In particular, it demonstrates inter-flow network coding in a NetFPGA router. As shown in the figure above, two hosts, namely Host 1 and Host 2, send a stream of UDP packets to a common receiver in Host 3 through a NetFPGA router. Instead of forwarding the packets as received, the NetFPGA router linearly combines a packet from Host 1 with a packet from Host 2 and forwards this network coded packet to Host 3. To perform this network coding in hardware, we have modified the design of a reference router distributed by the team at Stanford University. Specifically, as shown in the figure above, we added a new functional block called the *Network Coding Encoder* in the packet processing pipeline of the router.

In the demonstration, an observer can specify an 8-byte data payload to be included in each UDP/IP packet from Host 1. Similarly, one can also specify an 8-byte data payload to be included in each UDP/IP from Host 2. On the projected screen, one can observe the data payload in the Ethernet frames forwarded to Host 3 by the NetFPGA router. Since these Ethernet frames encapsulate the network coded UDP/IP packets, the data payload will contain a pre-determined linear combination of the observer specified 8-byte data payloads included in the UDP/IP packets from Host 1 and Host 2.