SoNIC: Precise Realtime Software Access and Control of Wired Networks

Ki Suh Lee, Han Wang, Hakim Weatherspoon
Computer Science, Cornell University

Access to the physical layer

- Valuable Information: Idle Characters
  - Each bit is ~97ps wide
- Allows Control / Capture of Interpacket Gaps
- Enlightens network research

SoNIC

- Software-defined Network Interface Card
- Goal: Control every bit in software in realtime
- Implements the PHY in software
  - Enabling control / access to every bit in realtime
  - With commodity components
  - Thus, enabling novel network research

Network Measurements

- Basics for network research
  - Generation: SoNIC controls IPGs in # of I/s
  - Capture: SoNIC captures IPGs in # of bits
- Generating/capturing 1518B packets at 9Gbps
  - With uniform IPDs = 1357 ns

Network Research Applications

- Combining Packet generation / capture
  - Characterizing network components
- Cut-through vs. store-and-forward switches

Network Characterization

- Embedding signals into IPGs.
  - Large gap: ‘1’
  - Small gap: ‘0’
- Overt data rate: 3 Gbps, Covert data rate: 250kbps
- Modulating IPGs at 100 ns scale: < 1% BER

Network Steganography

- Unprecedented access to the PHY
- Cross-network-layer research
- Precise control of IPGs
- Design and implementation of the PHY in software
- Novel scalable hardware design
- Optimizations / Parallelism

Contributions

- Measurements in large scale
  - Mini DCN with 16 boards
  - GENI testbeds
  - 40 GbE SoNIC

Status

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http://sonic.cs.cornell.edu