

# SoNIC: Reliable Communication in High Assurance Clouds

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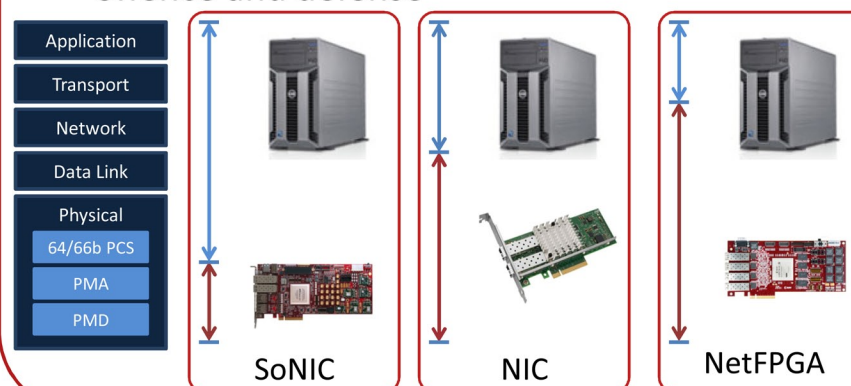
## Military depends on Network

- Challenges:
  - Availability: Packet loss
  - Security: Rogue routers and end-hosts
- Requires software access to entire network stack

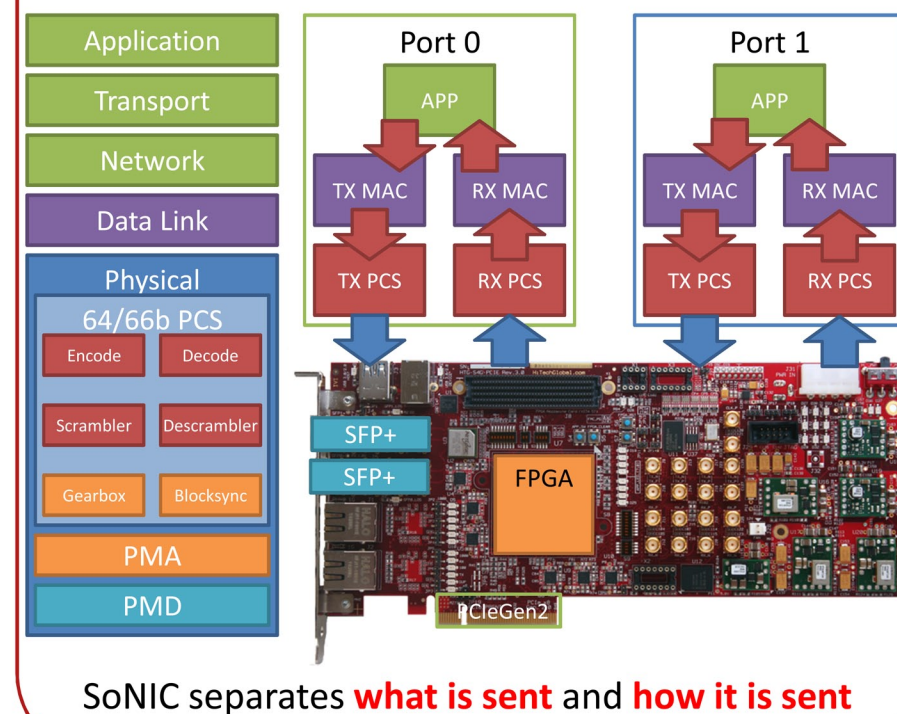


## SoNIC

- 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, enables unique network capabilities: offence and defense



## SoNIC Design

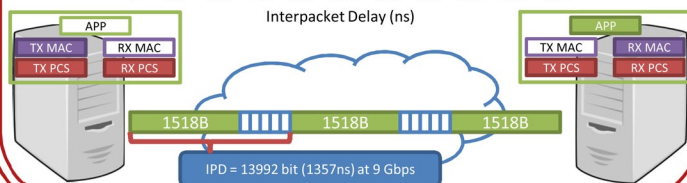
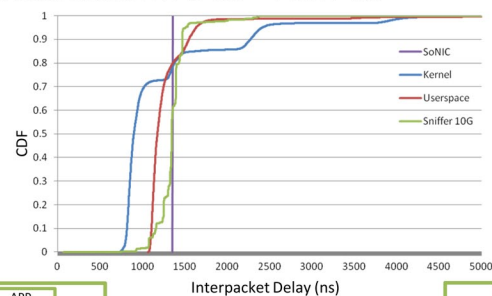


SoNIC separates **what is sent** and **how it is sent**

## Unique Network Capabilities

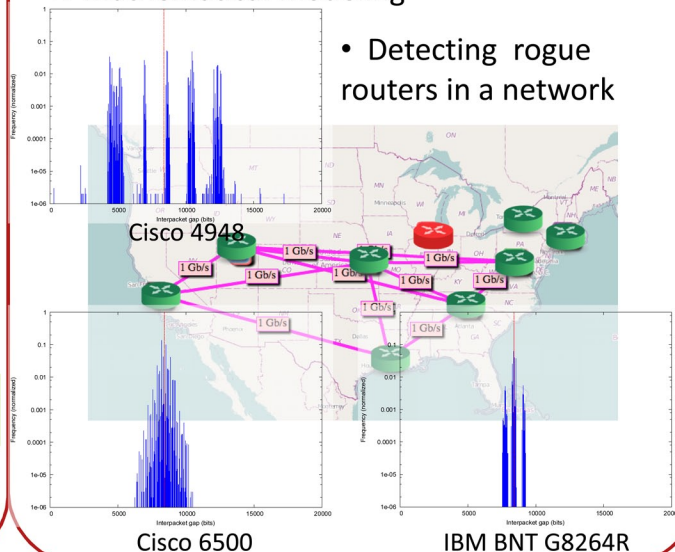
### Network Measurements

- Basics for network research
  - Generation: precise control of interpacket gaps
  - Capture: count # of bits between packets
- Generating/capturing 1518B packets at 9Gbps
  - With uniform IPDs = 1357 ns



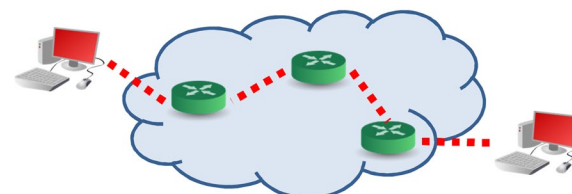
### Network Characterization

- Characterizing network components
- Routers perturb interpacket gaps differently => Mathematical modeling

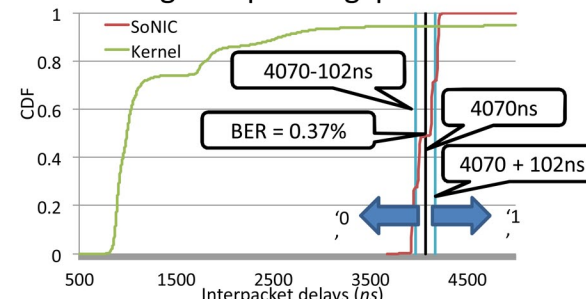


### Network Covert Channels

- Embedding signals into interpacket gaps.
  - Large gap: '1'
  - Small gap: '0'



- Modulating interpacket gaps at 100ns scale



## Contributions

- 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

## Status

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

<http://sonic.cs.cornell.edu>

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