

# E-Core – A Configurable IP Core for Application-specific NoC Performance Evaluation

## Idea/Motivation

A configurable Block emulating typ. IP Core Behavior

- No Need to code and implement the „real“ Functionality of the System
- Emulate IP Core Behavior @ NoC Ingress Boundaries

Is a NoC a good Platform for my Design?

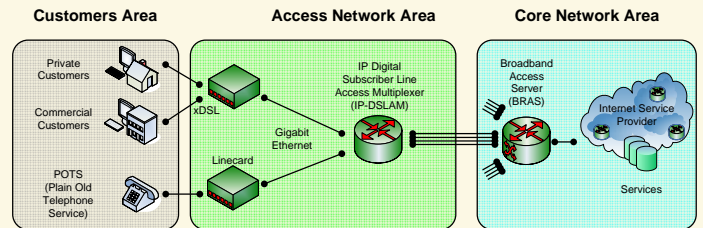
- E-Core is Feasible for preliminary Simulation Runs & Performance Evaluation
- Synthesizable (FPGA) for Online Simulation in Hardware

Virtex4 FX20(-10)	MHz	LUTs
Data Source	155	427
Data Sink	295	131
Transceiver	155	184



## Background/Own Research

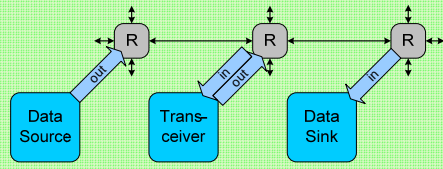
- Internet Packet Processing
- Hardware Design (FPGAs, ASICs)
- Networks-on-Chip (see URL below)
- Using Networks-on-Chip for our Designs as alternative Communication Architecture



## E-Core Configuration

### Configuration Types

- **Data Source** – Generation and Injection of NoC-Packets
- **Transceiver** – Reception, Modification, and Forwarding of NoC-Packets
- **Data Sink** – Reception of NoC-Packets
- Individual VHDL-Architectures for each Type



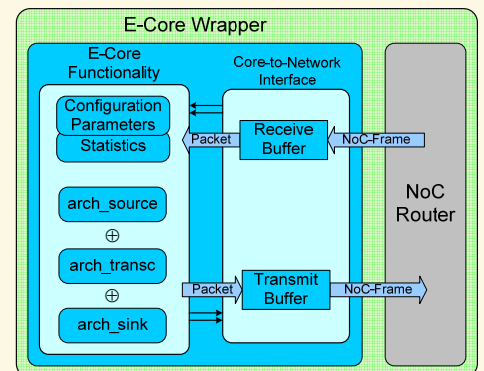
### Parameters

- Opcode (**Data Source**, **Transceiver**, **Data Sink**)
- Injection Rate (absolute, relative)
- Traffic Generation Options
- Acceptance Rate & Module Delay
- Packet Manipulation Options
- Source- & Destination Addresses
- NoC Flow Control Scheme

Minuted Statistics:

- # Packets/Bytes received
- # Packets/Bytes sent
- # Packets dropped
- # Control Packets sent
- Current Injection Rate

### Architecture



## ICMP for Online Injection Rate Adaptation

**Source Quenching** derived from Internet Control Message Protocol (ICMP)

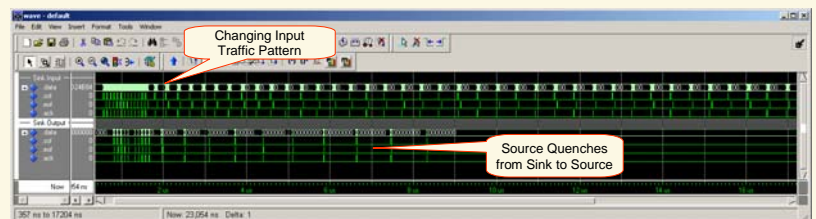
- Generated by Sink to throttle Source
- Triggered by Frame Drops @ the Sink's Input

**Source Boosting** Message added

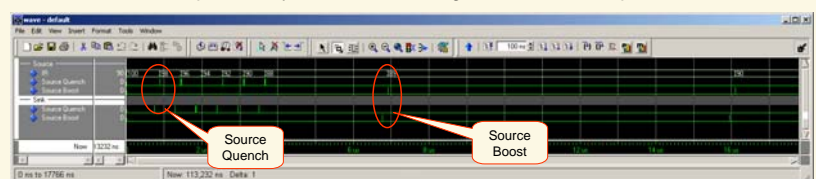
- Generated by Sink to accelerate Source
- Triggered by multiple successful Frame Receptions

Why Source Boosting?

- Source Quenching alone does not result in optimal Injection Rate (IR)
- Overshoots because of Buffer & Routing Delay
- Source Boosting slowly tunes & adapts IR
- `ir_quench_step > ir_boost_step`



Example 1: Only Source Quenching for Online IR Adaptation



Example 2: Source Quenching & Boosting for Online IR Adaptation



University of Rostock

S. Kubisch, H. Widiger, C. Cornelius, D. Timmermann, A. Strzeletz  
 Institute of Applied Microelectronics and Computer Engineering  
 {stephan.kubisch;claas.cornelius}@uni-rostock.de  
<http://www.networks-on-chip.com>

