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

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
- 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
- E-Core Wrapper
- E-Core Functionality
- Core-to-Network Interface
- NoC Core
- NoC Frame
- Source Quench
- Source Boost

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