Spidergon STNoC Overview, and Low-Power Specific Features

Michaël Soulié – STMicroelectronics Grenoble
June 24th 2010

Outline

- Spidergon STNoC technology
  - Spidergon STNoC overview
  - Spidergon STNoC building blocks
  - Spidergon STNoC EDA

- Spidergon STNoC low-power specific features
SPIDERGON STNOC TECHNOLOGY

Overview

- Initiated by STMicroelectronics Grenoble AST lab in 2004 as a research project
- Major achievement of the Catrene supported LoMoSA project
- Currently in deployment phase among STMicroelectronics/STEricsson product division
- Still evolving in the Catrene supported COMCAS project
  - special emphasis on Low Power features
Overview

Spidergon STNoC IPU is set of *Communication Primitives* and *Platform Services* implemented on top of a distributed on-chip network (NoC backbone) which connects several components.

Building Blocks

Building blocks are:
- Network Interface (NI), Router, Link
- Derived modules from the building are:
  - Network Plug Switch (NPS), Adaptive Link (AL)
**Link**

- Same link connects all Spidergon STNoC building blocks.
- Link organized as US/DS interfaces, part of the Spidergon STNoC modules.
- Interface composed of:
  - flit, with parametric size
  - per-flit sideband signals, with parametric content
  - per-flit handshake signals credit based
- Spidergon STNoC link supports virtual channel

**Network Interface**

- Master NI connects master IP to Spidergon STNoC
- Slave NI connects slave IP to Spidergon STNoC
- Master/Slave NI expose to SW the service registers
- Master/Slave NI responsible for:
  - IP protocol management
  - Services and SW view
  - (de)packetization
  - Size/frequency adaptation
- NI widely parametric:
  - traffic type
  - Store&forward mechanism
  - number of retiming stages
  - FIFO sizes
  - services…
Router

- Support 2 different routing algorithms
  - Spidergon routing
  - Source routing
- Transport protocol agnostic
  - Deals with network packets, not with request/response
- Support all the Spidergon STNoC topologies
- Support virtual networks
- Implement the FBA QoS Scheme

Network Plug Switch

- used to (de)aggregate traffic
- provided with loopback capability
Adaptive Link / Relay Station

- Derived from the Link
- used to “cut” long links
- allows for flit size conversion
- allows for frequency conversion
- Support for virtual channels
- provided with store&forward mechanism
- in relay station configuration, no additional FIFO inside.

Adaptive Link / Relay Station

Different module configurations for different purposes

RelayStation: configuration used to break long link (backend oriented)

Alink with freq. conv: used to cross frequency domain

Alink with size conv: used to adapt flit size

Alink with volt. conv: used to support multiple voltage domain (under development)
Spidergon STNoC and its EDA flow

STNoC GUI
configuration, integration, validation and analysis

STNoC Compiler

Pre-verified RTL, EDA and sim scripts, NoC Services

Software Device Driver

Documentation

STNoC Verification Platform

Software Device Driver

Pre-verified RTL, EDA and sim scripts, NoC Services

SPIDERGON STNoC LOW-POWER SPECIFIC FEATURES
Network Interface Shut-down capability

- Spidergon STNoC network can be organized as part of multiple power domains
- Spidergon STNoC enables partial interconnect switch-off
  - Distributed architecture
  - Path redundancy
  - Routing re-programmability

Despite Power island 2 is OFF all alive Masters keep the same connectivity to all alive slaves
Example of a physical implementation

- GALS
- Multiple Voltage domains

Asynchronous Relay Station

Relay Station with level shifters and isolation cells

THANK YOU!