ModeX –
Multithreaded Module Execution Chains:
A Dynamically Configurable Network Stack
Architecture for Network Processors

Research work by ETH under progress
in the context of IST-FAIN

Lukas Ruf, ruf@tik.ee.ethz.ch
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(claudio|boris|jonas|marc)@topsy.net
Outline

• Motivation
• Requirements
• ModeX Approach
• Architecture of ModeX
• Discussion
Motivation

• IST-FAIN
• Active Networking for
  – Management, Control & Data Plane
  – High-performance
  – Network Processors

 ---> An architecture to support High-performance Active Networking is required.
Requirements for a Network Stack.

• At run-time composable (fine granular)
• Manageable & controllable (incl. resource consumption)
• Support of protection domains
• Architectural support for parallel execution
• "High-performance", i.e. comparable to "traditional" software-implementations
Model

• Module chain: graph of modules
• Network stack: graph of module chains
  – A module chain comparable to a layer
  – Explicit module chain-entry and -exit
    (Distributors)
  – Entry- and exit-points per network stack
• Module chains: freely inter-connectable
• Name of this model:
  Module Execution Chains -- ModeX
Model of ModeX
(Network Stack Configured as an OSI Implementation)
Architectural Functionality of ModeX

• Each module chain as a thread
  – can be instantiated several times

• Fast inter-module communication:
  – no table lookups for module "calls"

• Protection domain: per module chain

• Smart distributors per module chain entry
  – freely inter-connectable module chains
  – selection non-busy module chain
  – Allow the configuration of a layered configuration (several module chains connected together) as well as of a single layer (one module chain providing the full functionality)
ModeX-Instantiation with IPv4

TCP/UDP/ICMP UP

OSI 3 → 4

Forwarding

IPv4 UP

OSI 2 → 3

Ethernet UP

TCP/UDP/ICMP DOWN

OSI 4 → 3

IP Routing

ARP Management

IPv4 DOWN

OSI 3 → 2

Ethernet DOWN

INCOMING

OUTGOING

IN

OUT
Current Status

- ModeX for Topsy (www.topsy.net)
- ModeX-Implementations of IPv4 & IPv6 for Topsy
A Suitable Architecture for Network Processors?

- At run-time composable
- Manageable & controlable
- Protection domains
- Parallelism support
- "High-performance"
Future Work

• Specialized modules for network processors (like Intel IXP and IBM NP4GSx)
• Implementation of protection domains
• ModeX-implementation for Linux, PromethOS: To be used as the FAIN NodeOS
Thanks for your attention.

Questions after the introduction to the FAIN Active Node Demo