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ForTER - A ForCES Router Implementation

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Content

- **Overview**
- **Architecture**
- **Control Element**
- **Forwarding Element**
- **Implementation Status**



Overview - ForTER Project

- **Goal**

- Completion of the ForCES protocol
- Prototype implementation of a ForCES-inside router

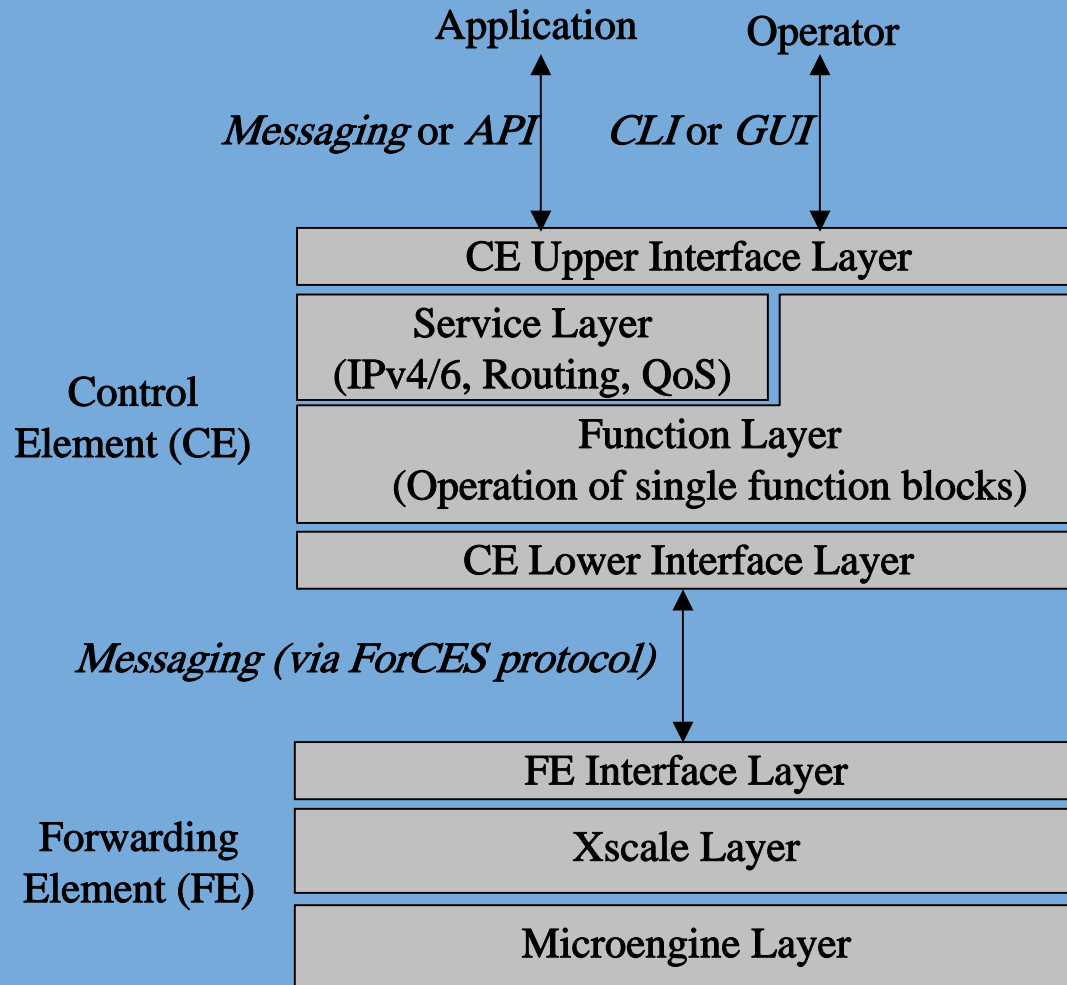
- **Funding**

- NSF China (60273061, 60573116)
- National Hi-Tech R&D Project (2005AA121310)
- ZJ NSF (RC02063), ZJ Sci&Tec Project (2005C21013)

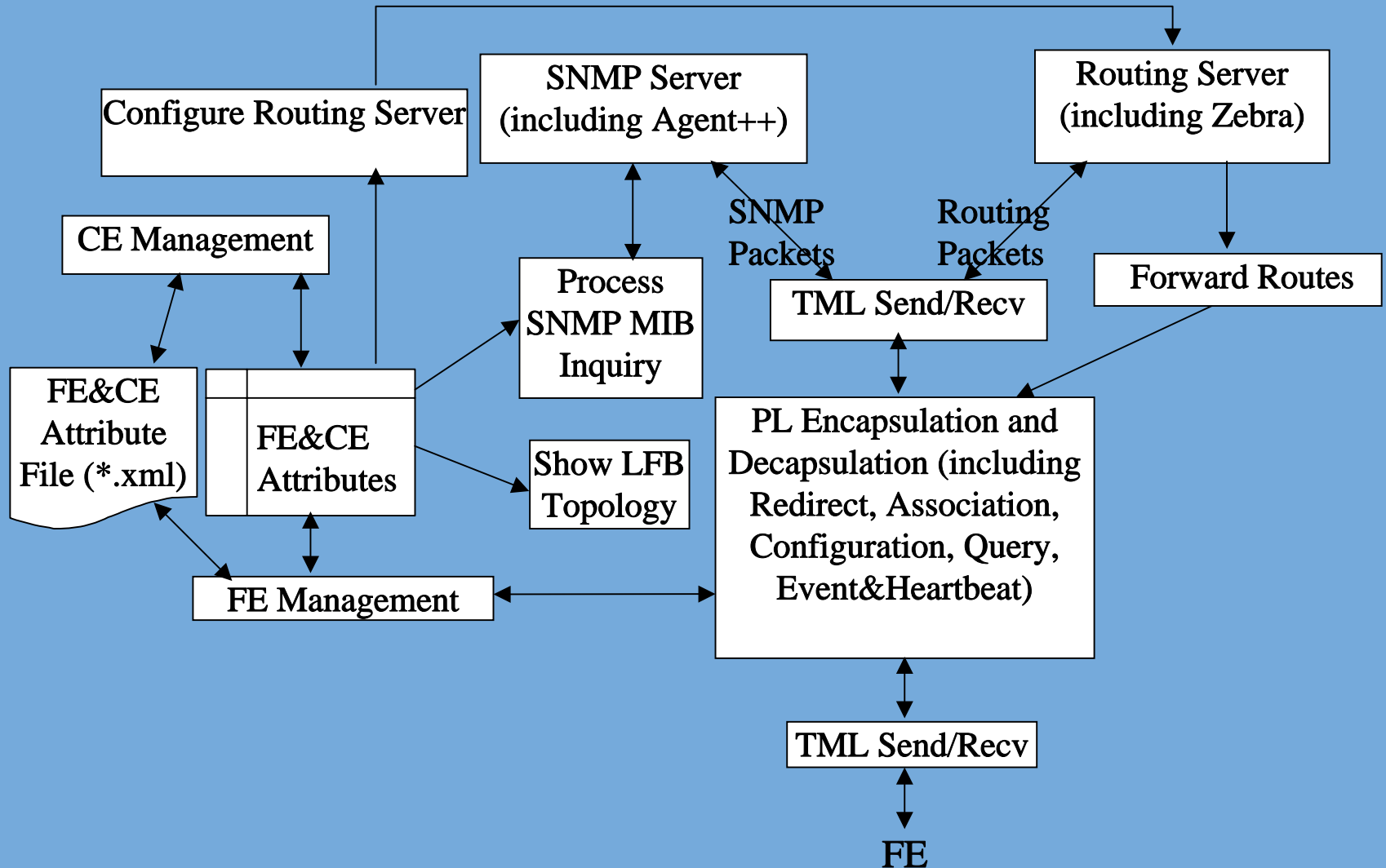
- **Team**

- Weiming Wang, Ligang Dong, Ming Gao, Fenggen Jia, Rong Jin, Gebin Zhu, Guangming Wang, Lei Shi, Ting Yue, Anzhen Zheng, Jin Yu, Shiping You, Xiaochun Wu

Architecture of ForTER



Control Element - Structure



Control Element - Parts

- CE Management and FE Management
- PL
 - Association - Receive Association Setup, Send Association Setup Response and Association Teardown
 - Configuration (including Event Subscription&Unsubscription) - Send Config, Receive Config Response
 - Query - Send Query, Receive Query Response
 - Event (including Heartbeat) - Receive Event and Heartbeat, Send Heartbeat
 - Redirect
- SNMP Server and related Communication (Inquire MIB Info. and Redirect SNMP packets)
- Routing Server and related Communication (Redirect Routing Packet and Forward Routes)
- TML - TMLOpen, TMLClose, TMLRecv, TMLSend, TMLConfig, TMLEvent

Control Element – User Interface

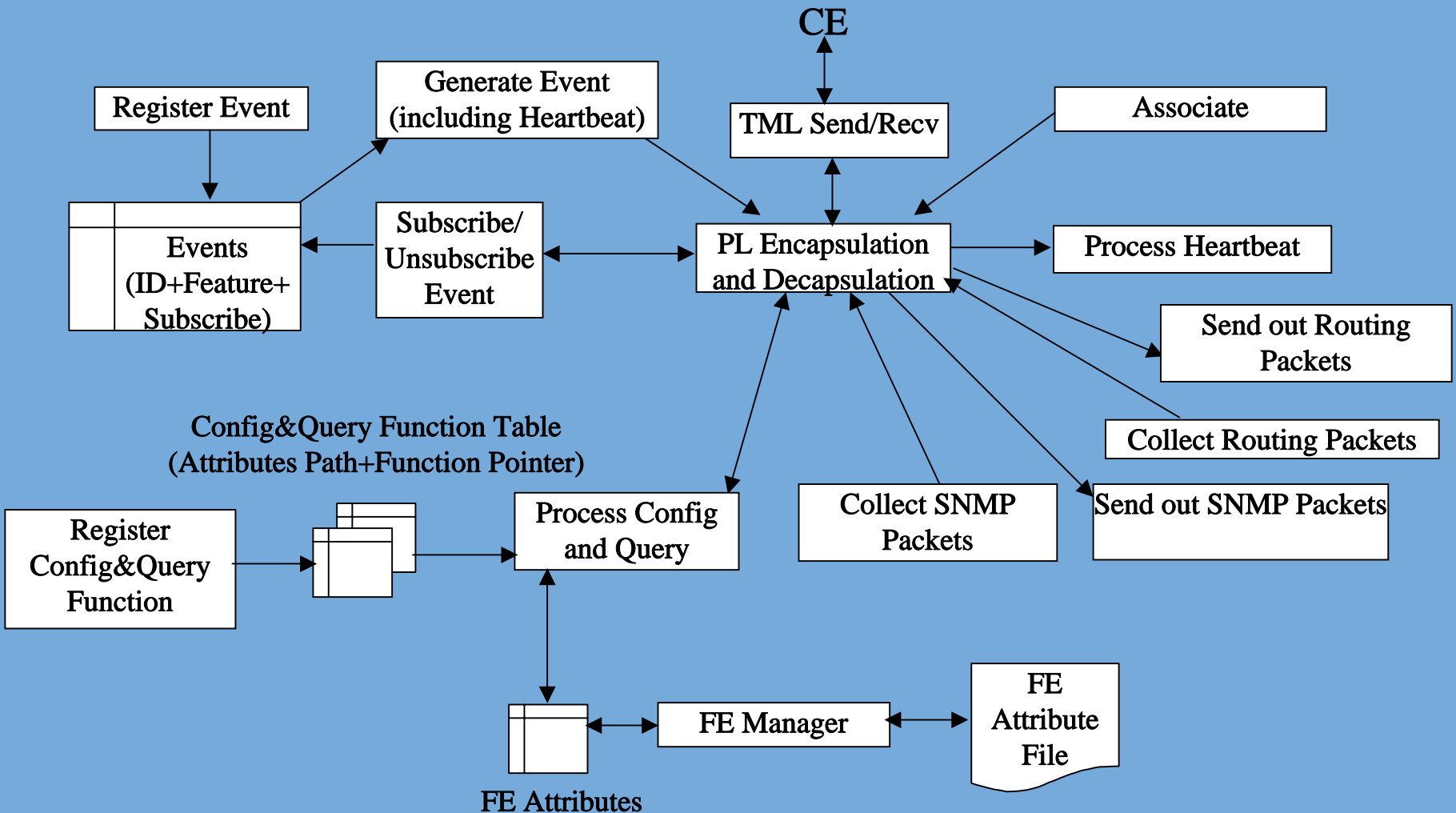
FE
Attribute
Tree

The screenshot displays the Control Element (CE) User Interface. On the left, the 'FEs' tree shows two FE instances. The first FE has ID:1, IP:10.1.82.11, and multiple LFBs. The second FE has ID:1, IP:10.1.82.53, and a port with ID:0, Type:2, Mac:020102030001, and IP:16.5.0.1. A context menu is open over the port, showing options like 'Show/Edit...', 'Add...', 'Remove', and 'Add Child...'. On the right, the 'LFB Topology Graph' shows a flow of data through LFBs (1-8) connected by datapaths. The graph includes a 'Receiver' (1) connected to 'eth0', a 'Classifier' (2), a 'Scheduler' (3), a 'Sender' (4), and 'eth1'. A second path starts from 'eth1' (5) through a 'Scheduler' (6), 'Scheduler' (7), and 'Sender' (8) to 'eth0'. A 'NOTE' section explains the symbols: a red circle for LFB, a blue number in brackets for PacketFlowID, and a black line for datapath. At the bottom, an 'Information List' shows log messages: 'Send config message', 'Send config message', 'associationSetupResponse send success', 'associationSetup message from IP 10.1.82.53 arrive Accepted!', and 'now wait for association from FEs'. The Windows taskbar at the bottom shows the '开始' button, several open applications, and the system tray with the time 21:02.

Information
List

LFB
Topology
Graph

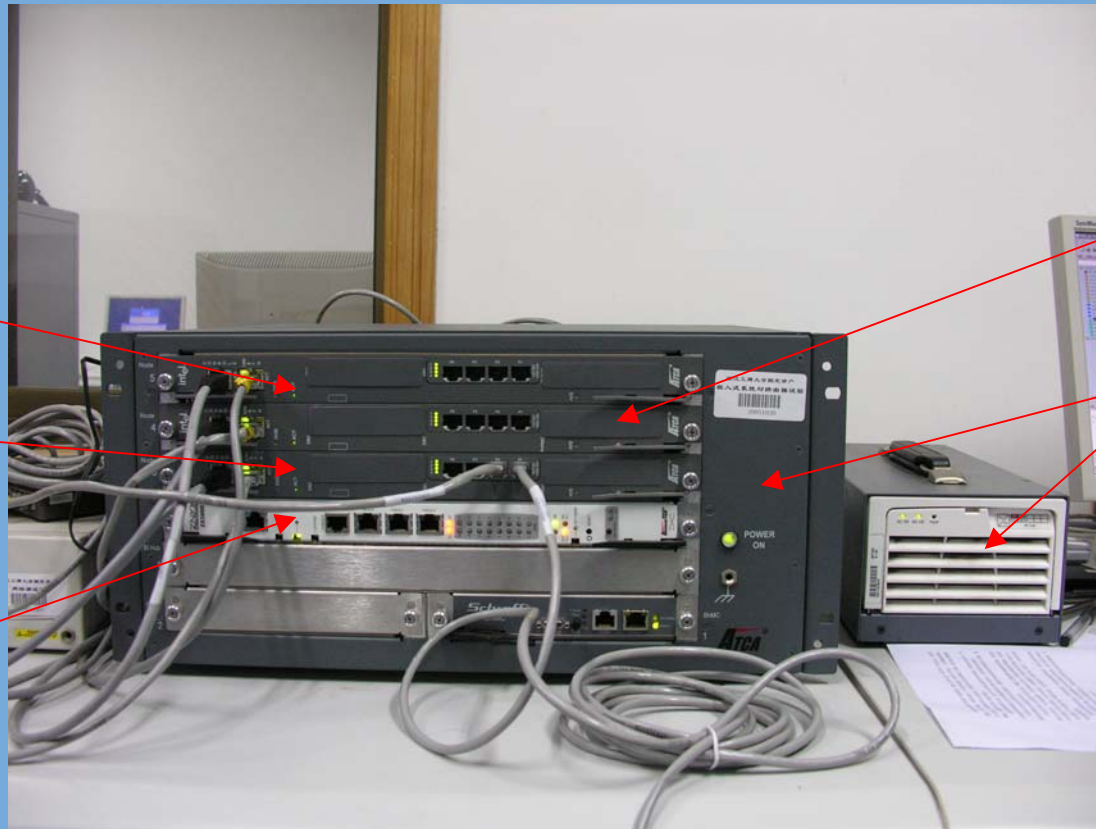
Forwarding Element – Structure



Forwarding Element – Parts

- FE Manager
- PL
 - Association - Send Association Setup, Receive Association Setup Response and Association Teardown
 - Configuration (including Event Subscription&Unsubscription) - Receive Config, Send Config Response
 - Query - Receive Query , Send Query Response
 - Event (including Heartbeat) - Send Event and Heartbeat, Receive Heartbeat
 - Redirect
- TML - TMLOpen, TMLClose, TMLRecv, TMLSend, TMLConfig, TMLEvent
- Callback for Events
- Attributes Path-Function Mapping for Query and Config

Forwarding Element – Surface



**IXMB2401
Single
Network
Processor
Base Card**

**ZX5000 Base
Fabric Switch**

**IXMB2801
Single
Network
Processor
Base Card**

KIXDP2851

Implementation Status

- **ForCES Protocol**

- **Completed:** Association, Configuration, Query, Event, Redirect for Routing
- **In Process:** Hearbeat, Redirect for SNMP

- **FE Model**

- **Primitively Completed:** FE Status, FE Events, FE Statistics, FE Ports, DSCP LFB, Forward LFB, Sender LFB, Receiver LFB, QM LFB
- **Most of works are in Process**

Implementation Status

- **CE**

- **Completed:**

- ForCES Protocol-based Communication with FE
- CE&FE Attributes Management
- Zebra-based Routing (architecture)

- **In Process:**

- Agent++-based SNMP
- More Interfaces with CE
- (Embedded) Linux Version of CE, Multi-CE,...

- **FE** – based on

IXA_SDK_4.1/ipv4_forwarder/quad_gbeth_2401

- **Completed:**

- ForCES Protocol-based Communication with CE

- **In Process:**

- Multi-FE
- On-Line Uploading of LFBs

The End



Routing

