SDN: Experimenting with the control to forwarding plane interface

EWSDN'12 – Darmstadt

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Intro

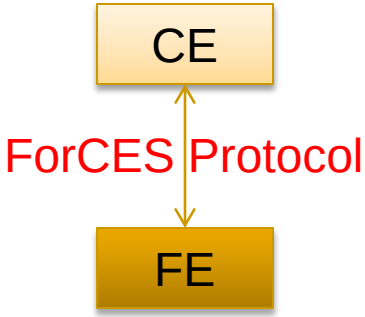
- SDN
  - A culmination of effort from the era of A&P Networks.
  - Requirement: Separate Forwarding & Control Plane.
    - Abstractions
    - API
- Two protocols:
  - ForCES
  - OpenFlow

Motivation

- Coexistence, Convergence, Assimilation?
  - Need for two?
- Unleash programmability for network service architectures.
  - How does OpenFlow & ForCES cope with new requirements?

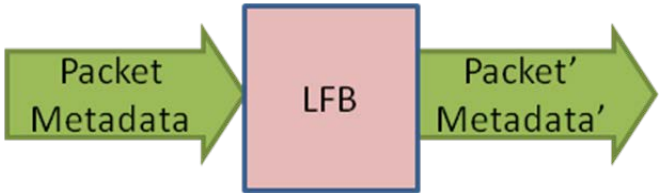
ForCES

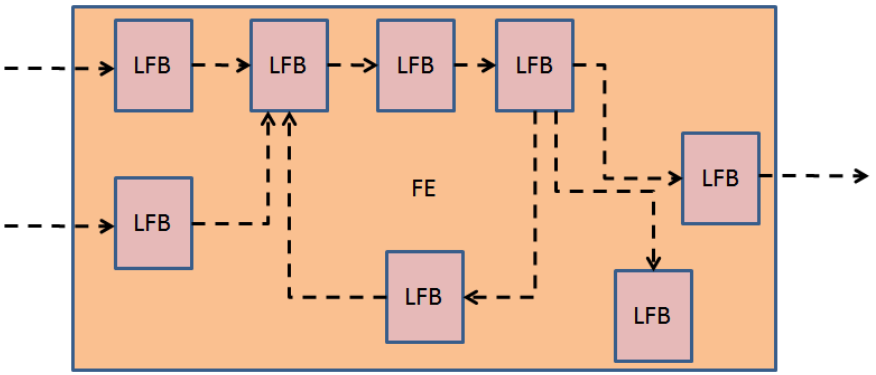
- FORwarding & Control Element Separation.
  - IETF
  - Suit of protocols
    - Protocol (RFC 5810)
    - SCTP-TML (RFC 5811)
    - Model (RFC 5812)
  - Abstraction of the Forwarding plane.
  - API to control and manage modeled devices.



ForCES Model

- Models FEs using LFBs.
- LFB
  - Model building block
  - Fine-grained* operations of the Forwarding Plane
  - LFB Topology creates FE.





ForCES Protocol

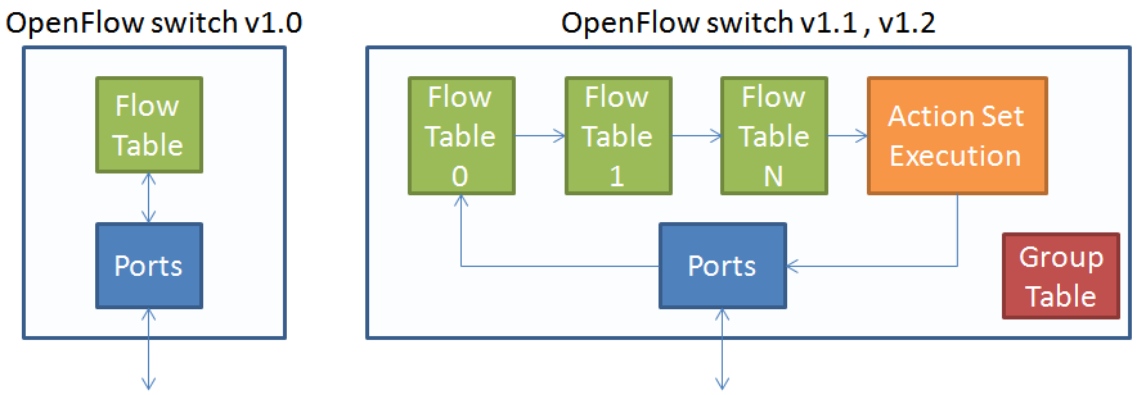
- **Model agnostic.**
- A CE can:
  - Associate with an FE
  - Configure one or more LFBs of an FE
  - Query one or more LFBs of an FE
  - Redirect in/out.
  - Subscribe to events to any LFB.

ForCES Protocol (2)

- Mechanisms:
  - Capability discovery
  - Transactions
  - Two phase commits
  - Batching/parallelization
  - High Availability and Failover
  - Command Pipelines
  - Heartbeat mechanism

OpenFlow

- Models in detail an OpenFlow switch.
- Protocol is tightly coupled with model
  - Model change => Protocol change
- Consists:
  - One or more Flow Tables.
  - Group Table
  - Action Set
  - Ports



Forwarding Engine Comparison

OpenFlow	ForCES
Match Fields / Counters.	LFB Components.
Instructions / Action Set / Action List	Special Values of Components / Implementation Specific.
Actions	LFBs
Pipeline.	LFB connectivity.
Static Model of switch.	No limitation.
Static Capability list.	No limitation.

Protocol Similarities

OpenFlow protocol	ForCES protocol
Secure channel – TLS	ForCES runs over IPSec
Feature discovery	LFB Capability discovery
Configuration / Modify-State / Read-State	Configuration / Query
Packet Out / Packet In.	Packet Redirect
Barrier.	Transaction.
Flow-Removed / Port-Status / Error	Event Notification messages
Hello	Association messages
Echo	Heartbeat messages
Xid (Transcation id)	Correlator

Protocol Differences

OpenFlow protocol	ForCES protocol
Experimenter	Not required.
Only error reporting	Acknowledge request mechanism
Not available	Message Batching
Static Events provided by protocol	Dynamic Event Subscription
Echo messages	Controlled heartbeat mechanism
Not available	Execution Mode Selection
Not available	Command pipelining

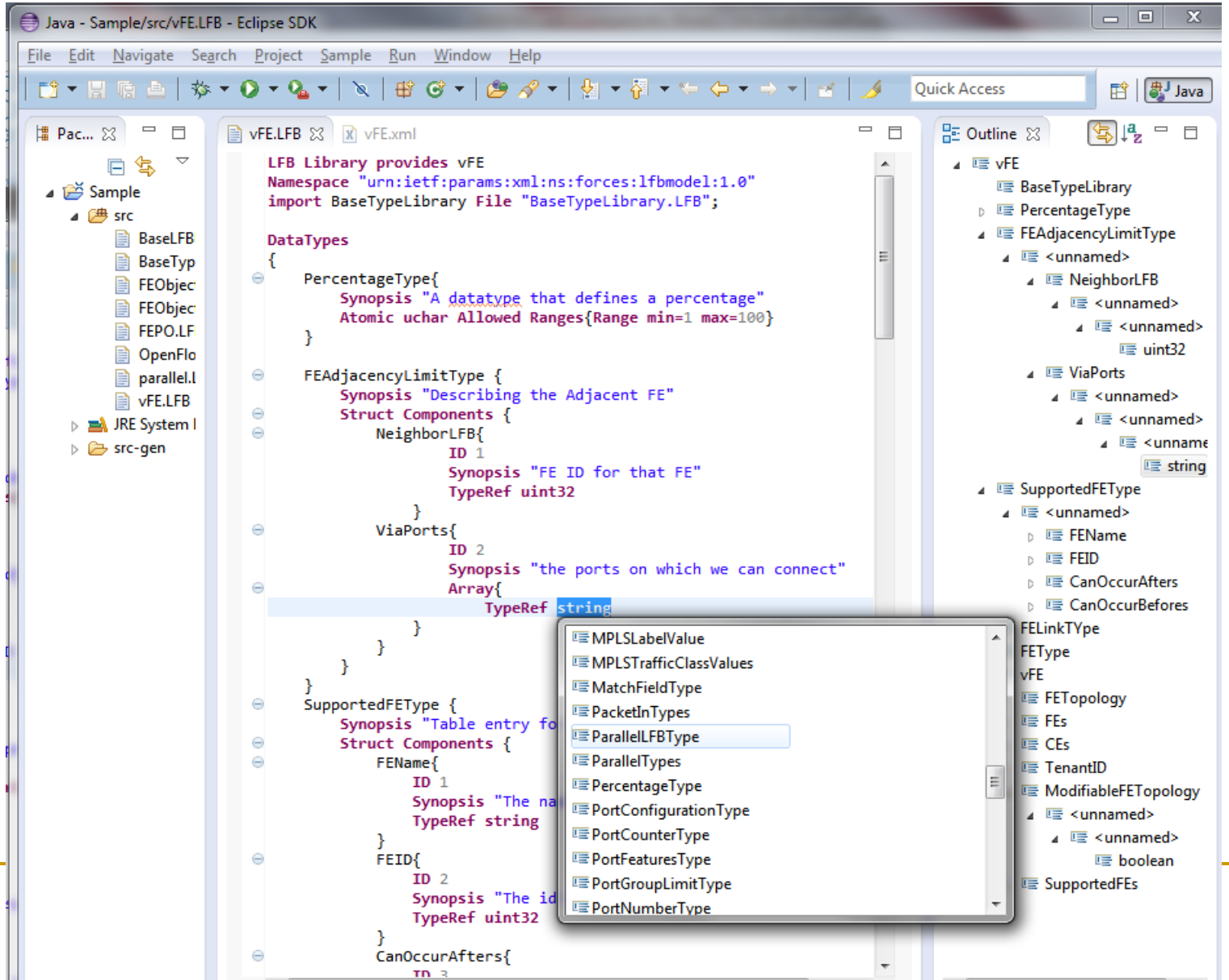
All well and good… but!

- Whither ForCES?
  - Industry (little adoption)
    - Disruptive business model.
    - Current known:
      - NTT Japan Implementation
      - Mojatatu's Network OS
      - Verizon (recently published two drafts).
      - Ericsson
      - Huawei
  - Academia (few implementations)
    - No open source availability (YET!)
      - Zhejiang Gongshang University
      - University of Quebec (Montreal)
      - University of Patras

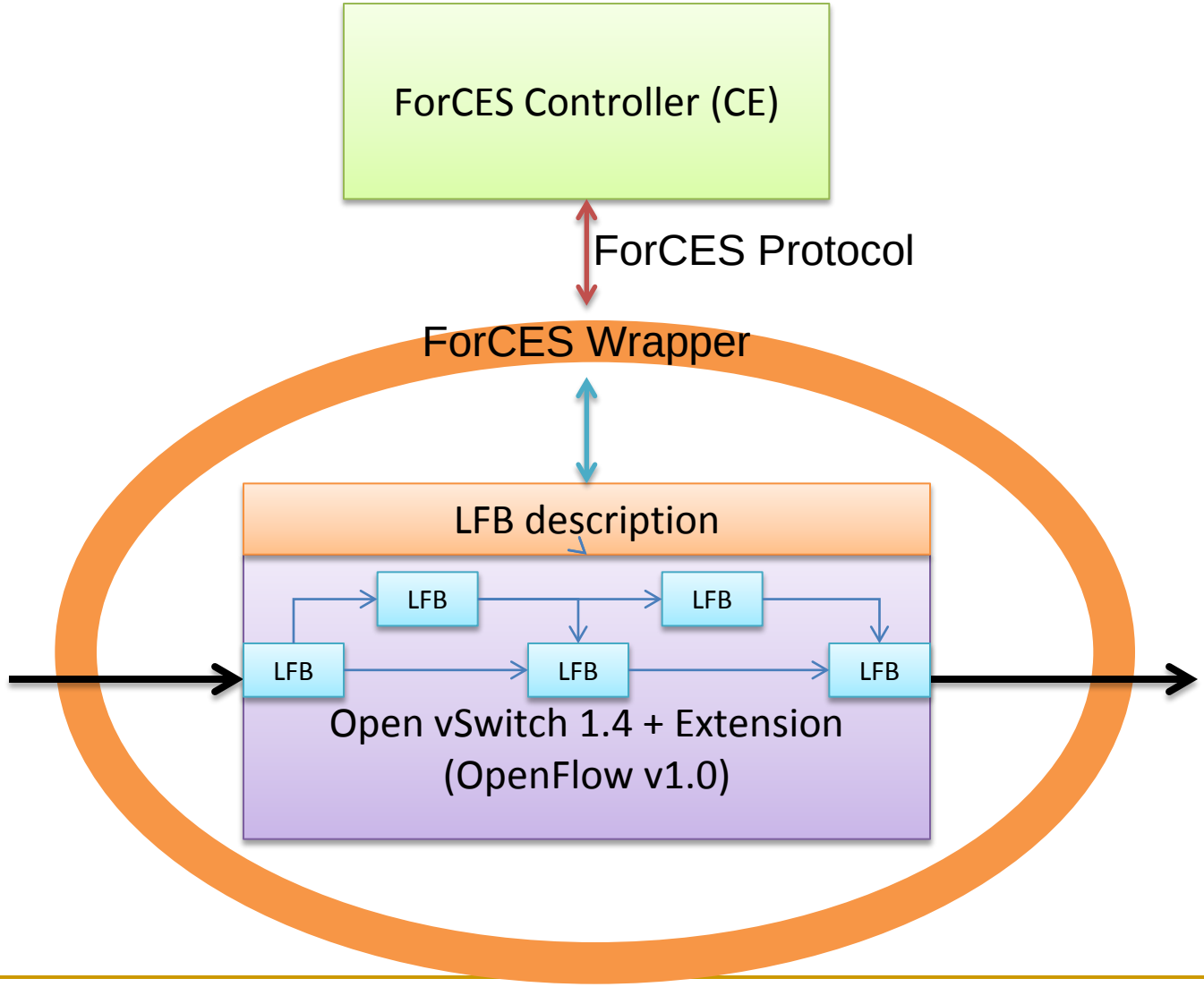
Good news everyone!

- ForCES-based Network Operating System SDK availability
  - Implemented by Mojatatu Networks (Jamal Hadi Salim - ForCES wg chair).
  - Mojatatu NetOS© SDK –write control applications and incorporate FE hardware.
  - Will be available this year.
  - Inquiries to sdk@mojatatu.com
- ForCES open source code availability. (internally announced – no link/date yet!)
  - Zhejiang Gongshang University

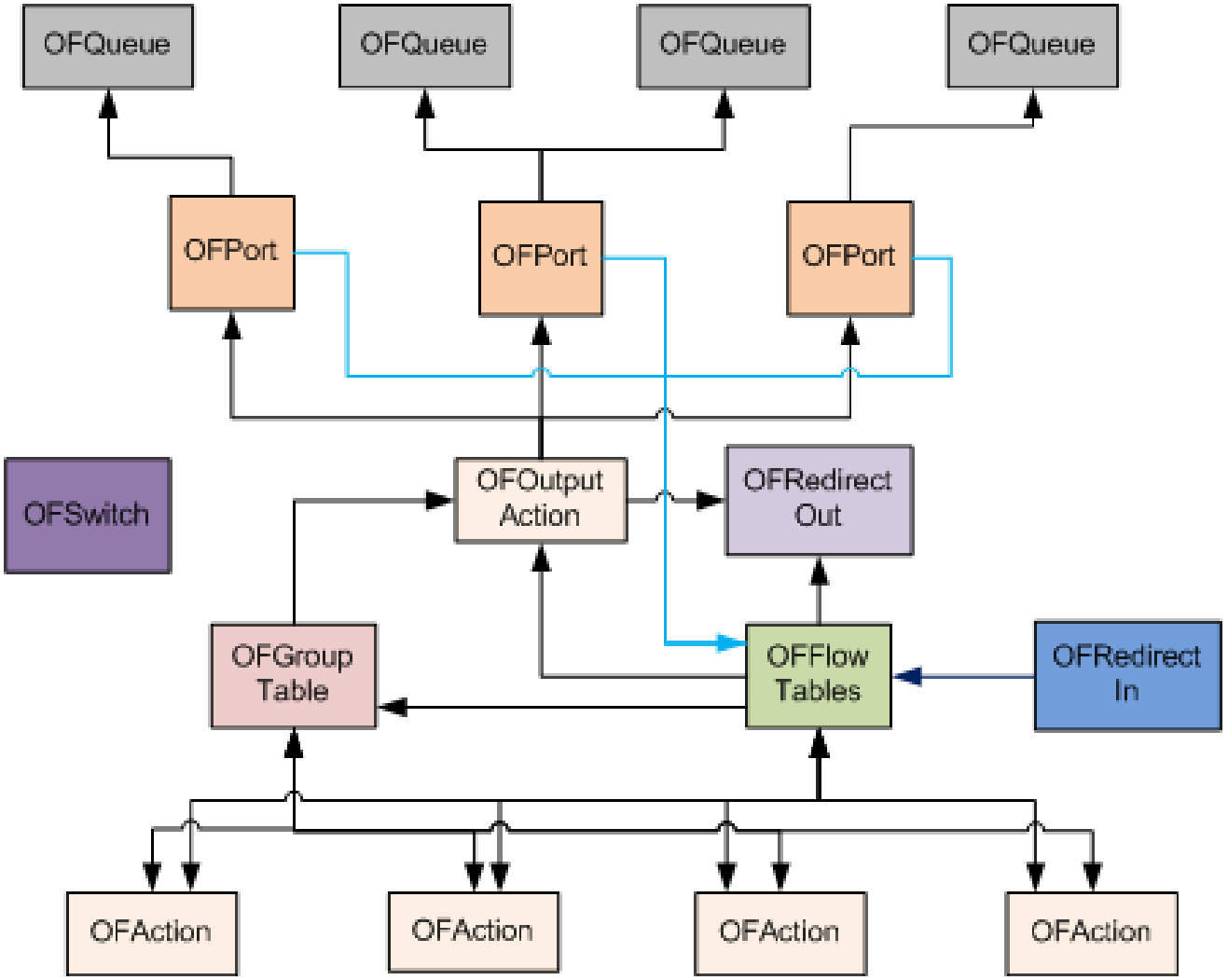
More good news - Tools!



Ah, yes the motivations!



Motivations – Current work



Use Case

- New services for Home Gateways.
- Split the Home Gateway
  - Forwarding in customer
  - Services in provider.
- Current issue: NAT
  - OpenFlow currently lacks TCP-flags matches.

Conclusions

- ForCES vs OpenFlow
- Defined a middleware for proof-of-concept of convergence.
- ForCES has solved issues that OpenFlow now tries to tackle.
- OpenFlow can take into advantage ForCES expertise and experience.

Backup Slide #1