



Dataflow Simulation

Rifki Sadikin

Research Center for Informatics, Indonesian Institute of
Sciences

O2 Asian Workshop 2014 @ Pusan, December 16, 2014

Table of contents

LIPI Contributes to O2

Backgrounds

Network Simulation

Network Simulation Design

Simulation Experiments (Small Scale)

Memory Simulation

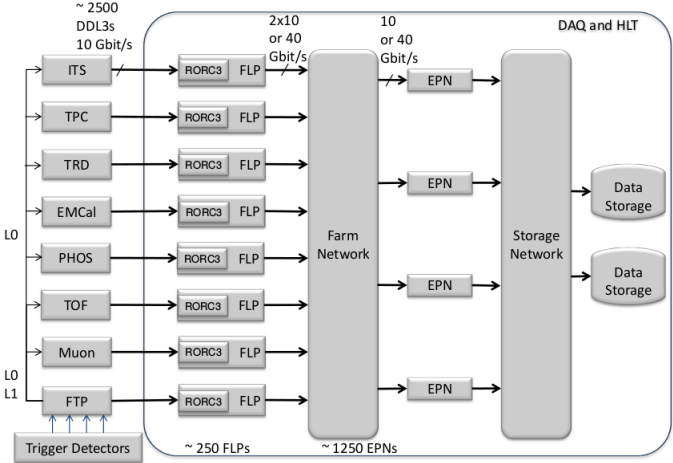
Summary



LIPI Personels Contribs to O2

- ▶ Network Simulations for ALICE Data Acquisition
 - ▶ (Rifki Sadikin, Taufiq Wirahman, Furqon Hensan).
- ▶ Software Development for TPC Reconstruction
 - ▶ (Suharyo, Rifki Sadikin, Taufiq Wirahman, Nova Hadi Lestriandoko, Nurhayati)
- ▶ Testing Method on Software Life Cycle (DR)
 - ▶ (Didi Rosiyadi, Iftitah)

From Detectors to Storages



From: Upgrade of the ALICE Experiment Letter Of Intent, Alice Collaborator, 2012

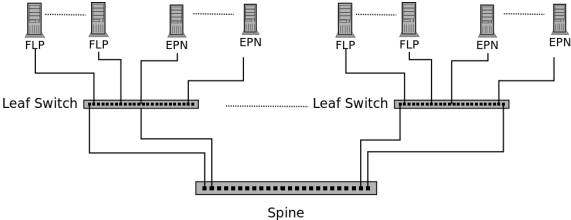
Network and Storage Simulation with OMNET++



▶ Network Simulation

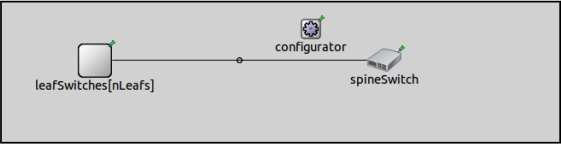
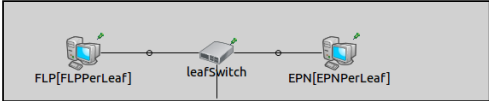
- ▶ The model consists of read-out and processing hosts and routers/switches for networking.
- ▶ Simulate storage and network behavior in discrete event simulations (with INET library)
- ▶ Network measurements (such as: latency, throughput, queuing behaviour and utilization).

▶ Storage Simulation

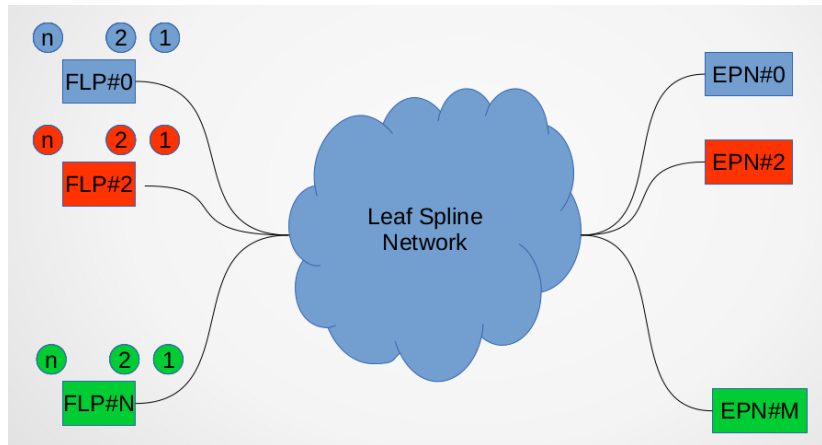
Network Design



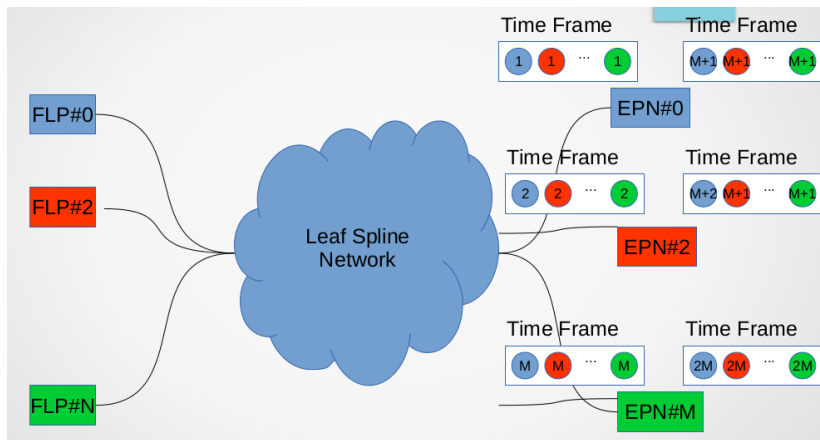
- 
 FLPEPNSpineLeaf
 - cable
 - cableFLPEPNI eaf
 - cablel eafSpine
 - cableEPNGrid
- 
 LeafSwitches



Simulation Start State



Simulation End State



Simulation Hardwares



Cibinong site



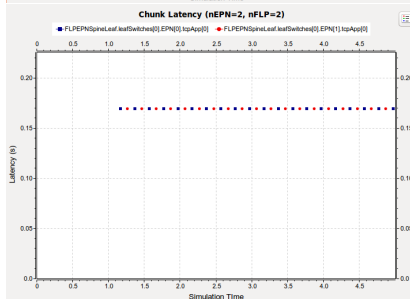
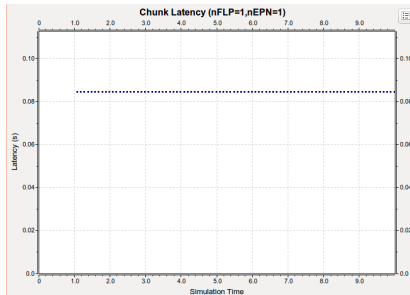
Bandung site

- ▶ Fujitsu RX350 S7 → (**For Simulation**)
 - ▶ 2 x Intel Xeon E-5 2650 8C/16T 2 GHz 20 MB
 - ▶ 8GB DDR3-1600 R-ECC (Total 128 GB)
 - ▶ HD SATA 6G 3 TB 7.2K 3.5" BC (Total 24 TB)
- ▶ Fujitsu RX200 S7 → (**For Development**)
 - ▶ 2x Intel Xeon E-5 2609 4C/4T 2.4 GHz 10 MB
 - ▶ 4GB DDR3-1600 R ECC (Total 8 GB)
 - ▶ HD SATA 6G 500 GB 7.2K HOT PL 2.5"

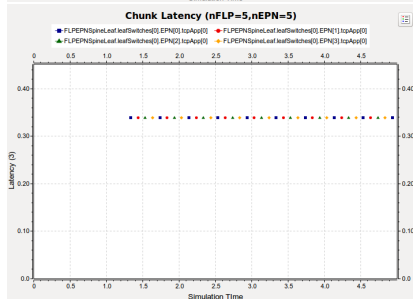
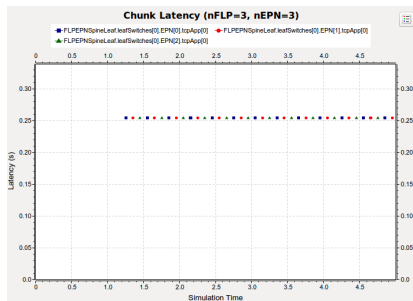
General Parameters and Cable's Datarate

- ▶ General
 - ▶ ARP = true, IPForward = true, queueType = DropTailQueue
 - ▶ MTU = 9000B, MSS = 18912B
 - ▶ Advertised Window = 512000
 - ▶ Frame Capacity = {12000}
- ▶ Cables
 - ▶ From Hosts \leftrightarrow Leaf = 10 Gbps
 - ▶ From Leaf \leftrightarrow Spine = 40 Gbps
- ▶ Simulation
 - ▶ Number of chunk send simultaneously = 1
 - ▶ Number of chunk to send = 250
 - ▶ Chunk size = 100 MB
 - ▶ Send interval time = 0.1 s
 - ▶ Number of $\{(FLP, EPN)\} = \{(1, 1), (2, 2), (3, 3), (4, 4)\}$

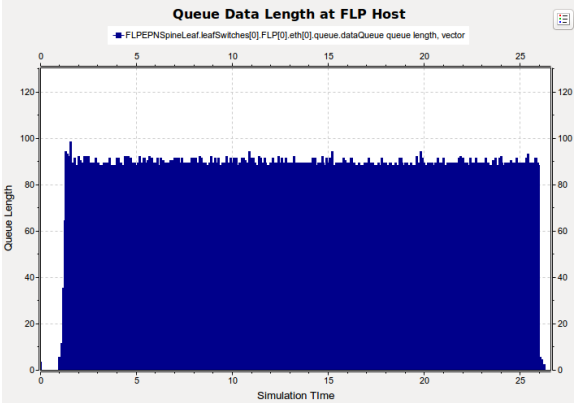
Chunk Latency



Chunk Latency (2)



Queue Length



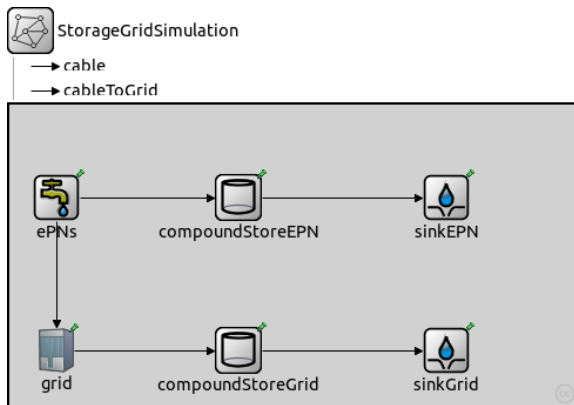
Network Simulation (TODO)

- ▶ Simulation takes time.
 - ▶ (1,1) 16m 44s
 - ▶ (2,2) 32m 01s
 - ▶ (3,3) 48m 03s
 - ▶ (4,4) More than 1h
- ▶ Simulation results takes space.
- ▶ Carefully deciding which parameters to be watched (and stored).

Storage Simulation

- ▶ Improve Charles's Code
- ▶ Now possible to edit what computation units and compression rate for each computation step in a host (EPN or GRID).
- ▶ The simulation setting is done in the omnet.ini
- ▶ Introduce GRID modul to represent GRID outside of FLPs and EPNs
- ▶ The simulation assume 20% jobs are done in the GRID

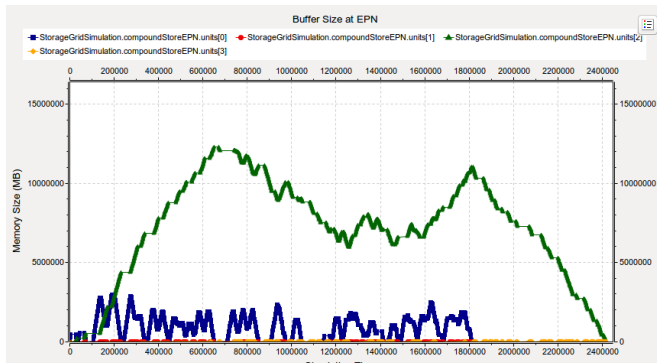
Storage Network



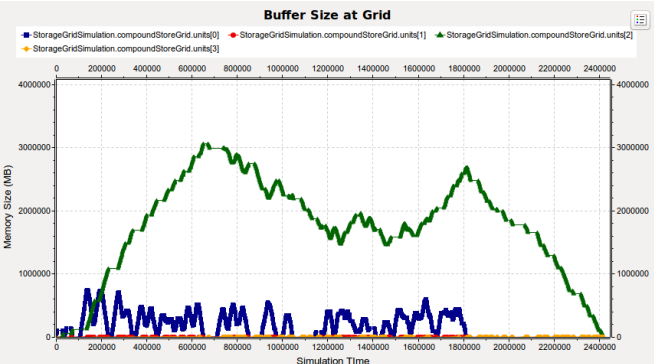
omnet.ini at Storage Network

```
StorageGridSimulation.compoundStoreEPN.units[0].name = "waitCalib"  
StorageGridSimulation.compoundStoreEPN.units[0].procTime = 8h  
StorageGridSimulation.compoundStoreEPN.units[0].compression = 1  
StorageGridSimulation.compoundStoreEPN.units[1].name = "reduce"  
StorageGridSimulation.compoundStoreEPN.units[1].procTime = 60s  
StorageGridSimulation.compoundStoreEPN.units[1].compression = 2  
StorageGridSimulation.compoundStoreEPN.units[2].name = "waitMore"  
StorageGridSimulation.compoundStoreEPN.units[2].procTime = 7d  
StorageGridSimulation.compoundStoreEPN.units[2].compression = 1  
StorageGridSimulation.compoundStoreEPN.units[3].name = "add"  
StorageGridSimulation.compoundStoreEPN.units[3].procTime = 60s  
StorageGridSimulation.compoundStoreEPN.units[3].compression = 1/1.3
```

Storage Simulation Result



Storage Simulation Result



Summary

- ▶ We are preparing to run network simulation.
- ▶ Need to specify what statistics to be collected.
 - ▶ Consider statistics size
 - ▶ OR Save each signal in different files
- ▶ Storage simulation need to be verified.

Futher works:

- ▶ More refine network and storage simulation design (statistics included).
- ▶ Run the network and storage simulation to collect the results.
- ▶ Configure simulation parameters accordingly.

Thank You

