**Thesis Structure**

Work-Title Performance Modeling of Control Plane Based Real-Time Packet Communication for the Future Internet

Structure:

Front Page

Abstract English and German

Acknowledgements

Table of Content

List of Figures and Tables

List of Acronymous

List of Mathematical Symbols

1. Introduction (5-6 pages)
   1. Background Knowledge
2. Briefly introduce the subject area: Future Internet, Queueing System, distribution function, other related research.
3. The concepts will be involved in thesis: Future Internet, Real-Time requirement, Cloud Support, MPLS, Virtualization Techniques, Optical/Electrical Communication buffer scheme.
   1. Motivation
4. Due to the agile deployment of centralization, the future internet will benefit from SDN scenario, which will introduce a different signaling process comparing to nowadays’ network system
5. Because of the requirement of real-time communication (<50ms), the delay of the packet forwarding process should be optimized, (for instance the waiting time in 3-shake-hand).
6. Current researches are more likely to measure a lots of packets transmission time to get a mean delay time under different situations, while we would like to numerically derivate the distribution function of the delay time, which can be a general expression and can be applied to most situations with different parameters.
   1. Main Structure

Overview of chapter content

1. Future Internet
   1. Software Defined Network
      1. Architecture of SDN
2. Short history and current state.
3. General scheme, the decouple of Control and Data Plane, the concept of centralization.
4. Briefly introduce communication scheme between different planes and the protocols (OpenFlow, Northbound and Southbound, etc.)
   * 1. Future application of SDN
5. Advantages compared to the traditional network structure
6. Problem faced before widely deployed
   1. Efficient packet forwarding
      1. Packet Flow Path
7. Introduce Packet Flow forwarding scheme
8. The reason to set up Packet Flow Path (real-time, Optical communication without buffer)
   * 1. Network Function Virtualization

Introduce the NFV concept and MPLS, which is used to establish the virtual channel for flow.

* + 1. Latency in Packet Communication Protocol

1. Briefly talk about the waiting latency happened in “Send-and-Wait” Protocol with “Timeout Recovery”
2. The packet flow path can reduce the need of “send-and-wait” situation which is likely to happen between different plane communication. And the distribution function of total delay can be used to optimize the timeout value.
   1. Cloud support

Mainly about the DB support for controller. Abstract the database of storing network information from controller to cloud end, to implement data restoration for distributed system.

1. Modeling
   1. Signal Processing of Packet Flow Path Establishment
      1. Network Architecture of the Modeling Object
2. Simplest: one Controller—one DB—2 Switches (Serial Processing)
3. Medium: one Controller—one DB—multiple Switches (partial parallel processing)
4. Final: Multiple Controllers—Individual DB for each Controller—multiple Switches
   * 1. Signal processing in the System

Figure out the Signaling Time Diagram for different

* + 1. Modeling by Queuing Theory

Use M/G/1 system as sub-system to modelize the structure above

* 1. Modeling by Task Graphs
     1. Tasks Representation

Abstract each sub-system as a task phase with general distribution described by 1st and 2nd moment.

* + 1. Task Graph Reduction

1. Reduction Rules, (four basic operation)
2. Reduction based on mix phase-type model
   1. Modeling Parameter

Explain the parameter assumption for tasks(E and Coeffient) and task input(lambda), may combined with QoS, server utilization etc.

1. Performance Analysis
   1. Mathematical performance analysis
      1. Performance Evaluation of Sub-System

Mainly about the mathematical derivation of 1st and 2nd moment of task’s sub

model (M/G/1)

* + 1. Implementation of Task Graph Reduction

1. Derivation of Task Graph Reduction applied on the general model to get the final virtual task node.
2. Briefly explain the code implement
   1. Simulation Techniques
      1. Introduction of Simulation Enviroment

Briefly introduce the SimLib

* + 1. Set Up Simulation of Target Model

Explain how the model been map into Simulation system and the code implement.

1. Results Verification

Compare the results from analytical implement and simulation.

1. Conclusions and Future work

Summary the result, discuss the positive and negative part.

Appendix

References

Reference summary

1. NFV introductory white paper:

Benefits, enablers and challenges for NFV

NFV highly complementary to SDN but not dependent on each other. To launch a new network service often require new hardware.

Definition: NFV aims to transform the way that network operators architect network by evolving standard IT virtualization technology to consolidate many network equipment types onto industry standard high volume servers, switches and storage

Benefits, but not limited to:

1. Reduce cost and power consumption

2. Increase speed of Time to Market

3. Multi-tenancy share resource

Challenges:

1. Portable

Interest, including but not restricted to:

Software-based DPI advanced traffic analysis

CDN

For communication-oriented functions, high-performance packet processing is available through high-speed multi-core CPUs with high I/O bandwidth,

Cloud infrastructures provide methods to enhance resource availability and usage by assigning

The Cloud support in thesis scope is just storage and inquire

2. NFV Update White Paper

NFV will accelerate networks and services innovation

It is not intended to be exhaustive:

Virtualization eliminates the dependency between a network function and its hardware by creating a standardized execution environment and management interfaces for the Virtualised Network Functions.

CDN Load based resource allocation Fault avoidance and recovery

Resource remain under-utilized for most of their lifetime as peak load is a temporal phenomenon.

The VNF is the software implementation of a network function.

For example in the mobile network, like Base Station (BS) functions, e.g. PHY/MAC/Network stacks that handle different wireless standards (e.g. 2G, 3G,, LTE, WiMax,etc.) can share the hardware resources in a pooled and centralized environment and achieve dynamic resource allocation as well as reduced power consumption.

To transform today’s static and stove-piped network infrastructure into a more agile, programmable infrastructure.

3. SDN: A Comprehensive Survey

Difficult to configure, vertically integrated, centralization of network control introducing the ability to program the network.