A Model-Based Simulator for Content Delivery Network using SimEvents MATLAB-Simulink

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Abstract—Simulation methodology has become popular among network researchers due to the availability of various sophisticated and the flexibility of simulation packages in model construction and the result's validation. The objective of our research is to introduce a discrete simulator tools known as SimEvents toolbox that runs on MATLAB-Simulink with the advantages of graphical user interface (GUI) system and a total customized simulator design. In this paper, we design a model-based network simulator named as "CDNlink". CDNlink is designed based on a queuing model and functioned to study the content delivery networks (CDN). As a result, we have designed the simulator for Client, Router, DNS, and Server. Moreover, we simulate the CDN system for packet round trip time (RTT) and server's queue length.

Keywords—simulink, content delivery network, model-based simulation, simevents, cdnlink.

I. INTRODUCTION

Network simulation is generally used to verify models, analyses, generalize the results, evaluate the performance or to compare protocols. However, there is a possibility of inaccurate results when using simulation. In order to overcome this situation, it is important to use a credible simulation tool which is easy to use, more flexible in model development, modification and validation, and incorporates appropriate analysis of simulation output data, pseudo-random number generators, and statistical accuracy of the simulation results [1].

Simulation is one of an important method to simulate a model or mechanism that it can be studied for further research [2, 13]. A network simulation is a method of implementing the network with its parameters and properties. Through a simulation, the behavior of the network is studied either by network entities interconnection using mathematical formulas, or by capturing and playing back observations from a network data. Network simulator allows researchers to test the scenarios that are difficult or expensive to simulate in the real world. Particularly, the simulator is useful to evaluate new networking protocols or to test some changes to the existing protocols in a controlled and reproducible environment.

In this paper we design a network simulator named CDNlink as a content delivery network (CDN) simulator [3,

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4]. CDNlink is a model based simulator that designed based on a queuing principle, created by SimEvents toolbox and running on MATLAB Simulink platform [5].

SimEvents provides a discrete-event simulation engine and component library for analyzing event-driven system models and optimizing performance characteristics such as latency, throughput, and packet loss. SimEvents is a GUI system that provides queues, servers, switches, and other predefined blocks to model routing, processing delays, and prioritization for scheduling and communication. Using SimEvents we can study the effects of task timing and resource usage on the performance of distributed control systems, software and hardware architectures, and communication networks. Furthermore, it can also be conducted on operational research for making decisions related to forecasting, capacity planning, and supply-chain management.

The rest of the paper is organized as follows. Section 2 discuss the related works highlighting previous works and types of network simulators. In Section 3, we describe a queuing model for the simulation based on M/M/1 principle. Section 4 provides a proposed CDNlink design created on MATLAB-Simulink with the details network variables design. Section 5 discuss the implementation of the CDNlink on a simple mesh network with simulation results. Section 6 provides a conclusion with prospective future works.

II. RELATED WORK

Network simulator is a piece of software that predicts the behavior of a network, without an actual network being present. Network simulation is a method where a program models the behavior of a network either by calculating the interaction between the different network entities such as hosts, packets, signal, etc., using mathematical formula or actually capturing and playing back observations data from a particular network.

The client sent requests to the server through the Internet which consist many types of nodes, routers, redirectors, bridge, etc., based on a rule how the request come through that nodes. In order to more understanding on how the actual network works, a simulation becomes an important rule to represent the work of the actual network by implementing some of the mathematical methods i.e. queuing theory or calculus network. There are many software simulators that offered with its pros and cons. Based on our experiences, SimEvents [5] is one of simulator that based on queueing principle which relatively easy to use when we design a network system. In addition, and we can customize the network system by implementing some algorithms based on a mathematical model.

Previous research has investigated regarding the existing network simulators. NS2 is one of powerful network simulator and has been demonstrated for CDN simulation [6] where the