Bottleneck Analysis of a Port Simulation

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1. INTRODUCTION

The purpose of the work is to develop a new output analysis capability in support of the Configurable Port Simulation (CPortS) developed at VMASC by Old Dominion University.

General Scope of Work:

To identify and capture appropriate measures for analysis of internal port operations and to perform Queue Statistics, Port area input/output rates, cargo idle time (both internal to a port area and externally for resources to leave a port area), perform peak throughput analysis, and design and generate GUI based output display using graphs to visualize A formal process is to be defined to utilize the data in assisting analysts to identify potential bottlenecks.

2. BACKGROUND

The Configurable Port Simulation (CPortS) is a discrete-event simulation that facilitates the analysis of movements of military unit equipment through worldwide seaports and allows for detailed infrastructure analysis. CPortS was developed in support of the PORTSIM project to simulate Ports Of Debarkation (POD). CportS assists planners in comparing and selecting ports and it determines port throughput capability and utilization of critical resources. The simulation works at the entity level, tracking individual cargo, transporters and port resources. [1 – 3]

Current output analysis techniques with CPortS are not suited for studying very large operations. The current techniques involve capturing the lifecycle of each individual piece of cargo, and providing cargo reports and graphs at the entity level. Utilizing current database and spread sheets as the development environment limits the number of data points and generates a very large processing time (orders of magnitude greater than the current simulation time). By identifying the requirements of Military Traffic Management Command Transportation Engineering Agency (MTMCTEA) in utilizing CPortS, it appears that a cargo entity level analysis is inappropriate. It is part of this project to develop a formal bottleneck analysis method to better capture and utilize the required data from the simulation.

3. CURRENT WORK

To get started, I had to get acquainted with the current work and data .In order to do that I collected papers which addressed modeling and simulation issues and concepts similar to CPortS and details about the current system's process model. I used the current system to learn how it works, how the data is used in the simulation and how the system generates scenarios and produces outputs. Then I moved on to create some sample input data for the system to understand its input requirements and the effects of different types of data on the system.

The CPortS simulation model is coded in a discrete-event simulation language called as MODSIM III (MODular SIMulation Language). I collected details about the language in order to understand the code of CPortS.

MODSIM III

MODSIM III is a general-purpose, modular, block structured language which provides support for Object-Oriented Programming, discrete-event simulation and animated graphics. It is intended to be used for building large process-based discrete-event simulation models through modular and Object-Oriented development techniques.[4]

I am currently working on the code to understand the methods and data structures used in the code and to identify the points where the model extracts output data.

4. WORK PLAN FOR SUMMER 2004

a. To rewrite parts of the code to collect required data :

The first part of the summer will be used to perform the following tasks:

- To exactly understand the output data required to develop the new output analysis capability,
- identify the points at which data has to be extracted from the simulation code,
- determine appropriate data structures which help to collect data and rewrite those parts of code to use the determined data structures to collect the required data
- to identify and capture appropriate measures for analysis of internal port operations and performing sensitivity and bottle neck analysis.

The anticipated data to be captured (but not necessarily sufficient data) are:

A . Queue Statistics

B. Port area input/output rates

C. Cargo Idle time

1. internal to the port area
2. externally waiting for resources to leave the port area

b. To design and develop an appropriate Graphical User Interface (GUI) for display of data:

The tasks here are to design and develop GUI based output displays to provide the output data in graphical format .The current system displays the output as graphs at the

entity level based on each individual cargo item, this has to be modified into a more comprehensive output by using a time line instead of individual cargo items as the scale. To achieve this proper processing methods have to be determined and the developed.

5. WORK PLAN FOR FALL 2004

To perform Bottleneck Analysis

As the data for bottleneck analysis will have been captured, a formal analysis process has to be defined to utilize the data to identify potential bottlenecks.

6. REFERENCES

[1] Leathrum, J. and T. Frith. 2000 "A Reconfigurable Object Model for Port Operations", Proceedings of Summer Computer Simulation Conference, SCSC 2000, (Vancouver, BC, july).

[2] Leathrum, J., R.Mielke and T. Frith. 2000 "An Integrated Spreadsheet Approach to Simulation Interfaces", Proceedings of Summer Computer Simulation Conference, SCSC 2000, (Vancouver, BC, july).

[3] Leathrum, J. and Lars Karlberg. "Analyzing the Sensitivity of Simulation Parameters" Virginia Modeling, Analysis and Simulation Center, Old Dominion University.

[4] Advanced Simulation - Discrete Event Simulation, Department of computing University of Surrey http://www.computing.surrey.ac.uk/courses/cs366/MSTUT.PDF