MODEL OF ARRIVAL / DEPARTURE AND CHARGE / DISCHARGE MANAGEMENT IN PROT ZONE USING PETRI NET.

[1]Ahmed Salem Al-eraqi and [1]Assoc.Prof Ahamad Tajudin,
[1]School of Computer Sciences, Universiti Sains Malaysia,
[2]Dr.Adli Mustaffa
[2]School of Mathematical Sciences, Universiti Sains Malaysia,
11800 USM, Pulau Pinnang
E-mail:[1] aleraqi@cs.usm.my,[1] tajudin@cs.usm.my,[2] adli@cs.usm.my

Abstract:

In view of the economic importance of port for the countries, and due to the unique nature of this activities for the international navigation, the tasks that its management should perform optimally have been multiple. Therefore, the movement of ship and steamboats, and the affairs of shipping and unshipping should be handled by the method of mathematical modeling, using simulation methods and the precise and rapid uses of computer. This paper deals with a basic study to the performance of these objectives. The movement of steamboats, ship, and goods in a port of diverse and multiple tasks is subject to the concept of modeling a large sets of events which occur concurrently and simultaneously in the occurrence and correlation, like the movement of steamboats in the anchorage, unloading of their goods, and performance of their desired services .We will try to model all those events using Petri-net model.

Introduction

The pressures of global competition and need for extensive inter-organizational collaboration are forcing governments and companies to streamline their handling in the port and make it very efficient. Consequently, load/unload handling in the port must be able to give the satisfaction to the customers in terms of time and cost operation. The importance of trade grows as transport over sea increases spurred by advances in technology to build large terminals and ships. Moreover, frequency of transport also augments, with the increasing volume of trade due to economic growth (Imai. Et al. [5]), Lai and Shih [1]). According to Imai et al. [2] berth allocation has a primary impact on the efficiency of operations, especially in a "Multi-User Container Terminal". The events of the operations in terminal start with the arrival of the ship to harbor, after that it is piloted by the tug to a destination quay. In the quay there are a number of berths, which are places to moor the ships (Pierre Hansen). Once the ship moors at the quay to the allocated berths, the manipulations of Unload from the ship to the vehicles is carried out using the cranes. The vehicles transport the goods to the stock port or to their destination out of port. The above operations can be performed in inverse to load the ship from the terminal. After ending the load/unload operations the ship starts to departure from the berth. Managers in many container terminals are trying to attract carriers by automating handling equipment, providing and speeding up various services, and furnishing the most current information on the flow of containers. At the same time, however, they are trying to reduce costs by utilizing resources efficiently, including human resources, berths, container yards, quay cranes, and various yard equipments [2].

Classical Petri Nets (PN)

There are two principal models in (PN): first is mathematical, and the second is graphical, better understanding the concept of the simultaneous Programming, can be study as a special structure which generates a simulation language or logical presentation, or description, analysis and constructed of different kinds of real s systems[3]. This section briefly present the classical Petri Nets following the notation of Petterson . A Petri Net C is a tuple C=<P,T,I,O> where P is a set of places, and O is a set of transition, I is a set of transition inputs, and O is denoted by transition outputs. A marking of Petri Net C is denoted by μ and a marked Petri Net is referred to as M=<P,T,I,O, μ>. A marking is an n-vector of natural numbers where n is the number of places ($n=|p|$)[4]. Arrived in the harbor the circle arrive represent the places of ships arrived at the harbor as input. There is a single transition T={t} (shown as a thick horizontal black line) will be firing will a new ship arrive and put it in the queue as represent by a circle queue as a output place, if no ship arrives no transition event wait for new arrival. Accordingly I={<t , arrive>} and O={<t , queue>}. Sets I and O are show graphically as arcs between the places and the transition. As mentioned above a marking assigns tokens to the places. In Figure 1 tokens is one, e.g each arc leading from a place to a transition requires a presence of one token in originating place. Arriving ship a transition removes all the enabling tokens from the corresponding enabling places and adds tokens to the queue place. A Petri Net marking represents snapshot of a system being modeled by the net. This example models process of entering ships arrived in the queue.

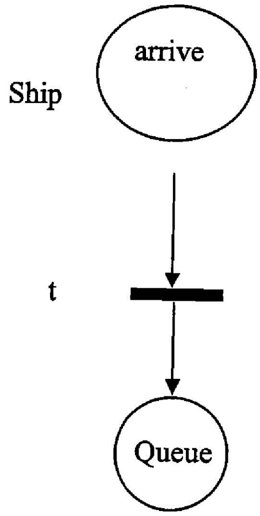


Figure 1 Classical PN

While being conceptually simple, Petri Nets can be used to model a wide spectrum of systems (e.g. multi-agent systems sharing resources, operating systems, etc)[4].

Petri Nets Useful

Petri Nets considered as a satisfied model and erasable to represent the parallel systems in software and hardware, Petri Nets is modeling of events systems where there an appearance simultaneously in the occurrence and correlation as shown in Figure 1. The importance of Petri Nets in computing the model with no synchronizations for following reasons :

1- The powerful properties in the graphic representation for no synchronizations computing.

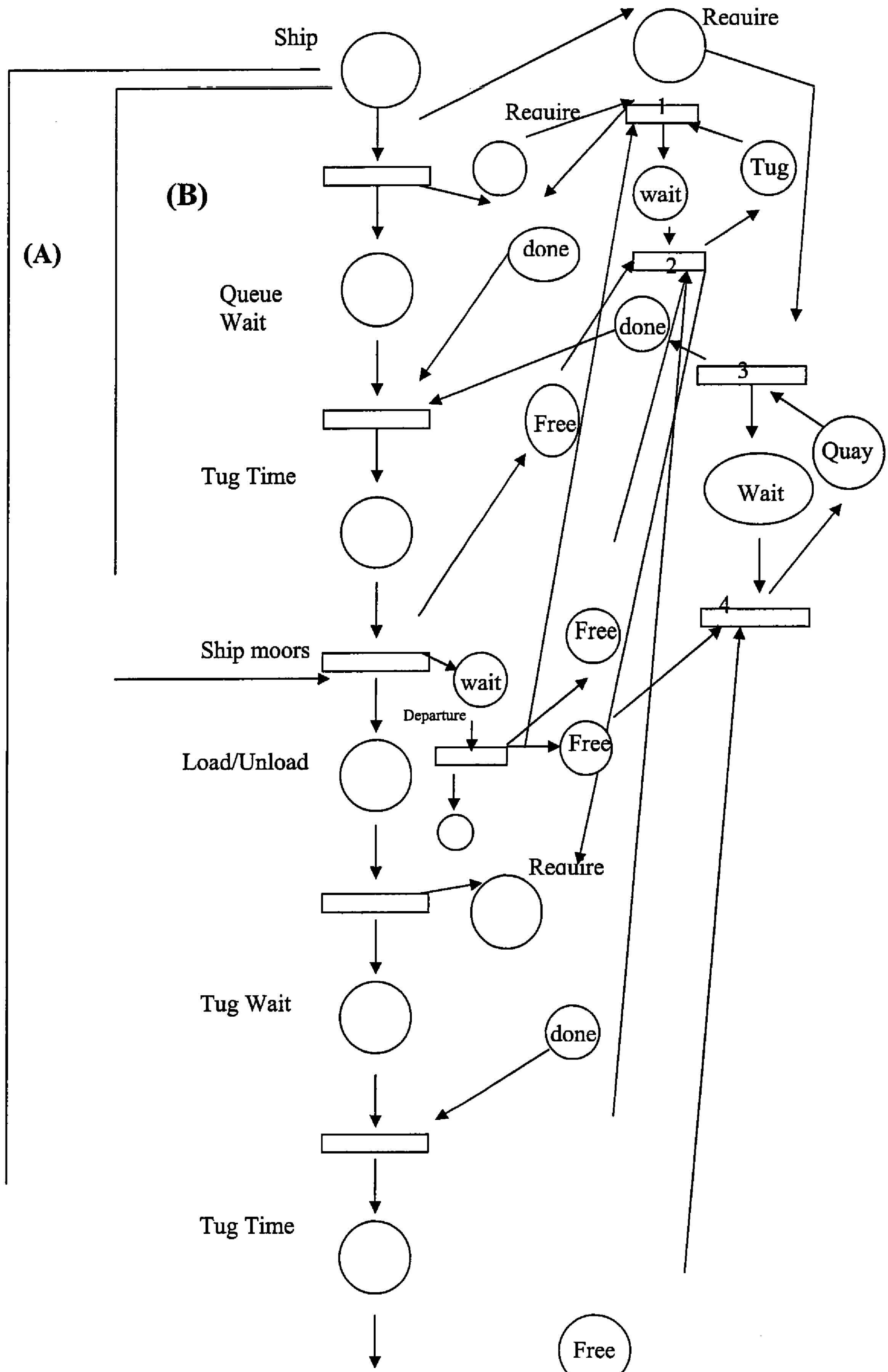
2- Computing the sequential and concurrently events for the real-time system.

3- Petri Nets applications allowed discover the weak points in any system especially Dead Lock points[1].

Modeling Ships Arrival and Departure

In this model, there are many events that occur in sequence and parallel. Following the model Figure 2, we will describe each event in detail, starting form the arrival time ending by departure of the ship. Even the model is classic but we can always extract some critical states that can be discuss in detail in the future, Until now ports transport operations are not all defiantly disbandment in time, resources and management planning. The description of each level in this model will appear all effective sides that must be taken in consideration regarding this type of operation. The underlying aim of the research to increase quay terminal performance without physical expansion by utilizing the available resources more efficiently [6]. As shown in Figure 2 there are two types of arrival ships, First (A) comes for load/unload, these kind of ships take time to processing in port in general, the second type (B) comes only for supplying fuel, food and take less time in the port cause the short processing in this case. Starting by case (B) the arrival to the harbor, if there is a queue, the ship will enter the queue otherwise it will be tugged to destination berth. In this case there are two conditions that must be available for ship moors 1) the destination berth must be free, because the number of berths to be allocated to a quay is one of the decision problems at the strategic level, 2) the availability for the free tugs to piloting the ship to destination berth, otherwise ship must be wait until these two conditions executed at same time. Once the ship moors in berth allocated, if only for supplying ship will be for waiting time, time necessary depending on the quantity required by the ship and the resources using to achieve this job (e.g flow of fuel pump and water ..etc). After finishing the task the Capitan asks for tugs to leave the berth to harbor in this case if no tug is available, the ship will wait until the availability of tugs this waiting regarding the congestion in the harbor or the driving channel from/to harbor/quay is limited to one channel. When this condition effected, the system is informed with the new state of berth and tugs (new state is free berth and tugs for next request). In the case (A) model effect all the events in section (B) and start to prepare for new operation more heavy and complicated, in time and resources called load/unload the ship by using cranes and vehicles to/from the stocks or to the final destination out of port.

The spent time of the vessel at this level is more important for the owner because for him it costs money, the resources along the operation must be efficient and have high performance in terms of materials or humans. The study of simulations and modeling with retrieved data can forecast for good manager and planning of the quay. Figure 3 show the operation of charges handling in detail [1]. Estimation of time load/unload depend on, a dynamic estimator which model the time of the global traffic for different companies and ships, and estimator of the container flow occurring in the terminal since some weeks before the ship's arrival[7].Once the ship ending load/unload the quit procedure start to prepare for final departure from the berth, as explain in the section (B).


Ship
Require
Require
1
Tug
wait
(B)
(A)
done
2
Queue
Wait
done
3
Free
Quay
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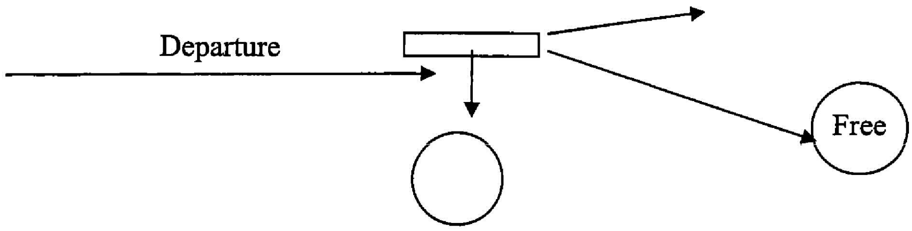

Figure 2 Model of Ship Arrival and Departure

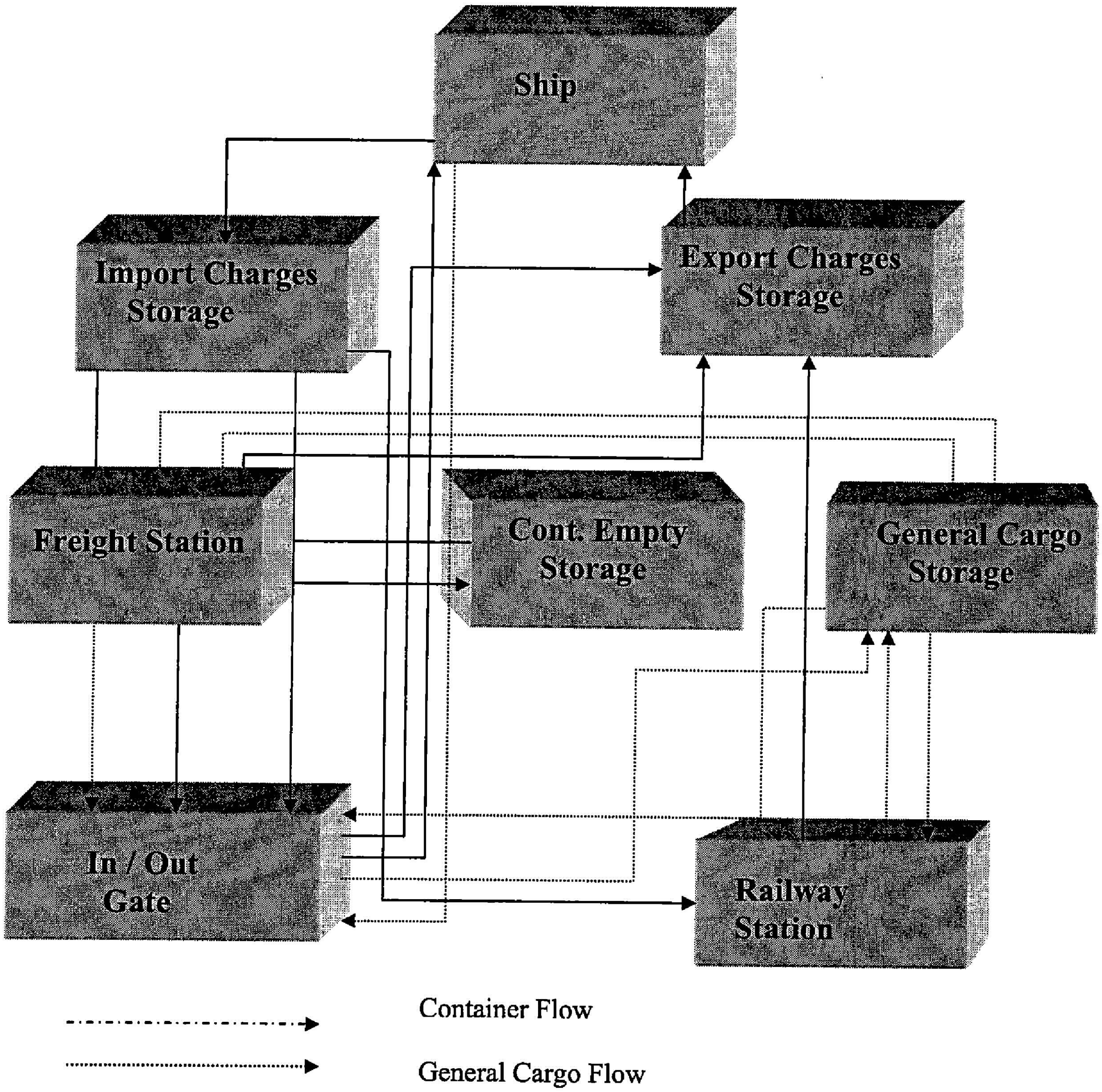

Figure 3 General Structure of the flows of Charges in quay Terminal

Conclusin

The intent in this objective is to develop an approach for modeling events in arrival and departure of ships through Petri Nets. In each place there is a phenomenon active after taking the decision in the transition action which allows passing from event to other with synchronized harmony, formulated by complex procedures. By adjusting time intervals associated with transitions and other parameter values (e.g resources), it is possible to extract various types of scenario analyses to evaluated time wait and the performance efficiently in terminal. The major problem in ship spent time are, 1) Berth allocation, 2) resources performance, 3) easy network in the terminal to stack, 4), scheduling ships arrival and resources on the terminal. There are various directions in which future research must be concentrated and placing the above points in our future studies, certainly the ports that have limited capacity in terminal and resources.

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