Simulation Model of the Intelligent Network's Node

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Abstract

The method for calculating delays which occur during the call establishment process for Intelligent Network (IN) services provides estimates of message-processing times in IN nodes. This study contains a simulation model of message-processing in IN nodes in the form of an open queuing network with exponential service time distribution in the nodes.

INDEX TERMS: INTELLIGENT NETWORK, IN NODES, END-TO-END DELAYS.

I. INTRODUCTION

One of the main parameters for Quality of Service in an IN is end-to-end delay, which occurs during the call establishment process. In a previous work by the author of this paper [1], a method was presented for calculating delays for the basic services which are provided in Russia's Intelligent Network. This method states that in order to calculate delays during the IN service provisioning it is necessary to be able to calculate the time taken to process signaling messages in IN nodes. In this work, IN node model has been constructed which consists of a software-controlled database accessed with the help of the upper layer protocols of Signaling system #7 (SS7), such as TCAP (Transaction Capabilities Applications Part) and INAP (Intelligent Network Application Part). This research examines an IN node model with distributed architecture.

II. MAIN PART

The distributed architecture of the IN node (fig.1) consists of one central module with a central processor for servicing the operational processes of the TCAP and INAP subsystems and several connected peripheral modules. Inside each peripheral module the operational processes of the MTP2 (Message Transfer Part) subsystem are serviced by one processor and the MTP3 and SCCP (Signaling Connection Control Part) subsystems by another.

The processing procedure for signaling messages takes the following form. The signaling message enters one of the peripheral nodes via the signaling link and is then processed in accordance with MTP2 subsystem procedures, and then in accordance with MTP3 and SCCP subsystem procedures. After this, messages from all peripheral modules across the internal communication network enter the central module where they are placed in one queue to be processed by the TCAP and INAP subsystems. After being processed by the central processor, the message goes back to the appropriate peripheral node where it is then processed for transfer to its destination point.

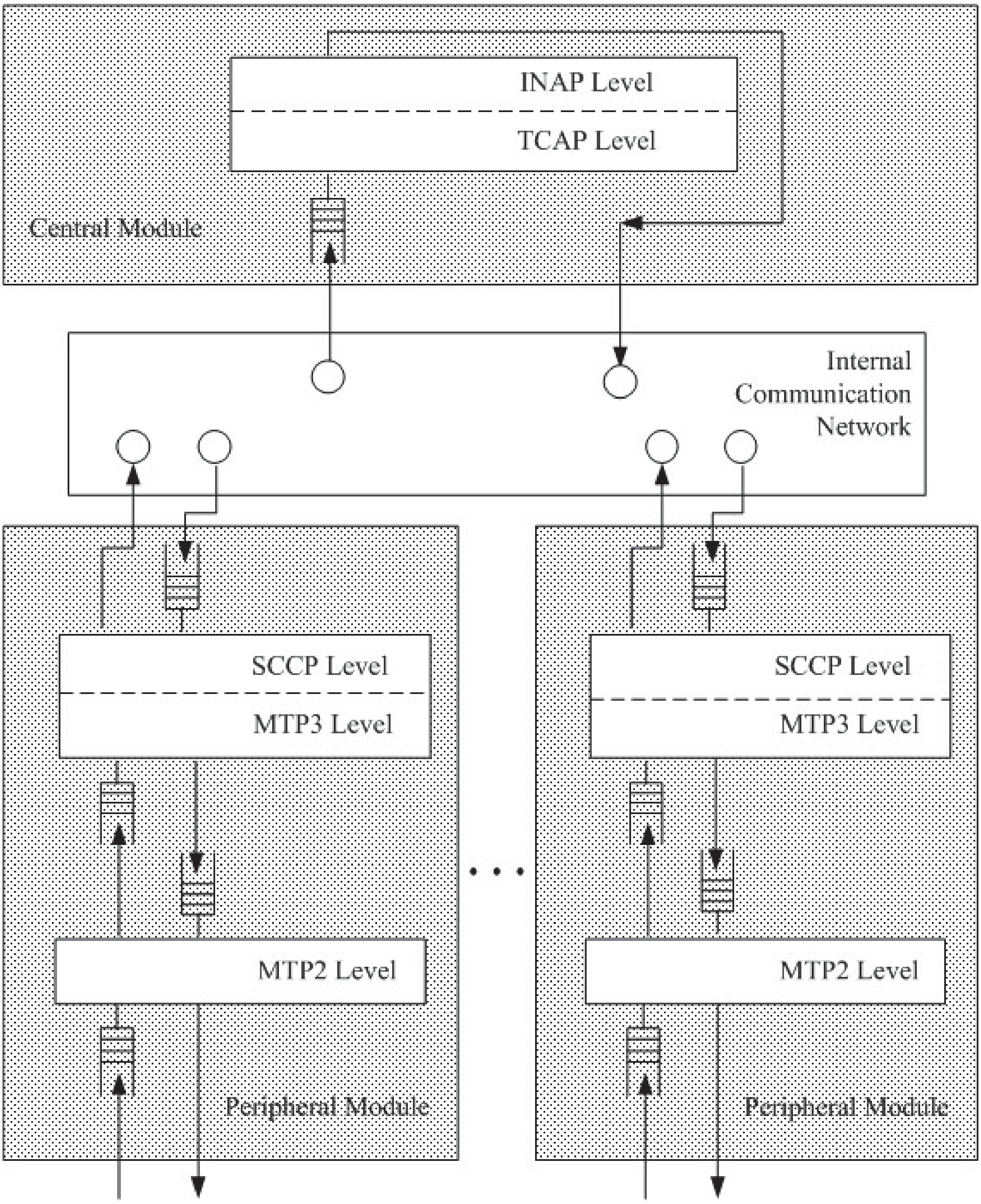

Fig. 1. Functional model of IN node with distributed architecture

For simulation purposes SCP (Signaling Control Point) node was taken as example of IN node, as an example of IN Service Universal Access Number (UAN) service was considered. The simulation model presented in this work was created with the help of the GPSS World Student Version (General Purpose Simulation System). This model makes it possible to calculate the average time in an open queuing network and compare this value with results for an analytical model. During modeling, source data is used – namely, the call arrival rate of flows entering the queuing network from outside and the service time distribution for each node of queuing network. The call arrival rate of the incoming flow corresponds to the intensity of the flow of signaling messages entering the IN node during busy hour. Call service durations in open queuing network nodes represent the length of time taken to process signaling messages using the corresponding processors in the IN node.

Calculations were conducted for call arrival rate λ from 0 to 130 calls/s. Such a scale for λ values was chosen so as to meet the conditions for the existence of a steady-state conditions for separate nodes in the queuing network.

In figure 2 there is a graph showing the dependence of the mean time taken for processing of a signaling message in SCP node on the incoming call arrival rate received from analytical and simulation modeling.

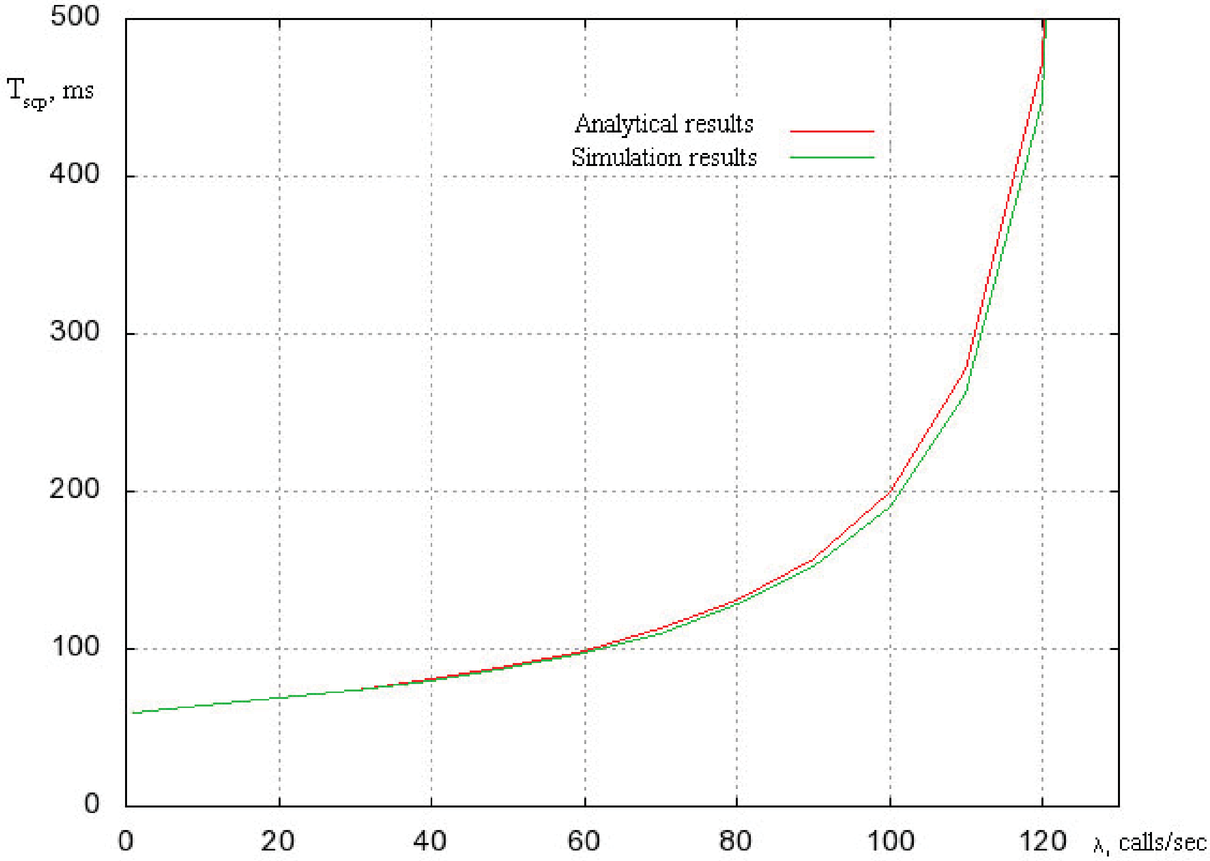

Fig. 2. Mean time for processing of signaling message in SCP node

From the graph it is clear that the time taken to process a signaling message in the SCP node (received using analytical methods) represents the upper threshold for signaling message processing time in the SCP node when using simulation modeling. Analysis can be made on the accuracy of these values by looking at values for absolute and relative errors. According to the results received, with call intensity values of up to 100 calls/s relative errors do not exceed 5%, which is acceptable for engineering calculations.

III. Conclusion

The simulation results make it possible to estimate delays of messages in the IN node. With call arrival rate of up to 100 calls/s, the mean delay value in the SCP node is from 60ms to 200ms. For busy hour of UAN services when the call arrival rate is 5 calls/s, the mean call-processing time in the node is 64ms.

Acknowledgment

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References

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