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Generalized net model of the dynamic host configuration protocol

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Introduction

In a series of papers the process of functioning, and work of different types of nets [6, 7, 8, 9, 10] and wireless nets [2, 3, 4, 5] have been described by Generalized Nets (GNs) [1]. The paper describes modelling of the dynamic host configuration protocol. GNs are used for modelling of the power supply of independent object. GNs allow modelling of parallel, real-time flowing processes, their simulation, management and optimization.

The Dynamic Host Configuration Protocol (DHCP) automates the assignment of IP addresses, subnet masks, default gateway, and other IP parameters. The assignment occurs when the DHCP-configured machine boots up or regains connectivity to a network. The DHCP client sends out a query requesting a response from a DHCP server on the locally attached network. The query is typically initiated immediately after booting up and before the client initiates any IP based communication with other hosts. The DHCP server then replies to the client with its assigned IP address, subnet mask, DNS server and default gateway information.

The assignment of the IP address generally expires after a predetermined period of time, before which the DHCP client and server renegotiate a new IP address from the server's predefined pool of addresses. Typical intervals range from one hour to several months, and can, if desired, be set to *infinite* (never expire). The length of time the address is available to the device it was assigned to is called a *lease*, and is determined by the server.

DHCP operations fall into four basic phases. These phases are IP lease request, IP lease offer, IP lease selection, and IP lease acknowledgement.

- DHCP discovery

The client broadcasts on the local physical subnet to find available servers.

- DHCP offers

When a DHCP server receives an IP lease request from a client, it extends an IP lease offer.

- DHCP requests

When the client PC receives an IP lease offer, it must tell all the other DHCP servers that it has accepted an offer.

- DHCP acknowledgement

When the DHCP server receives the DHCPREQUEST message from the client, it initiates the final phase of the configuration process.

GN-model

Figure 1 shows the generalized net model, describing dynamic host configuration protocol.

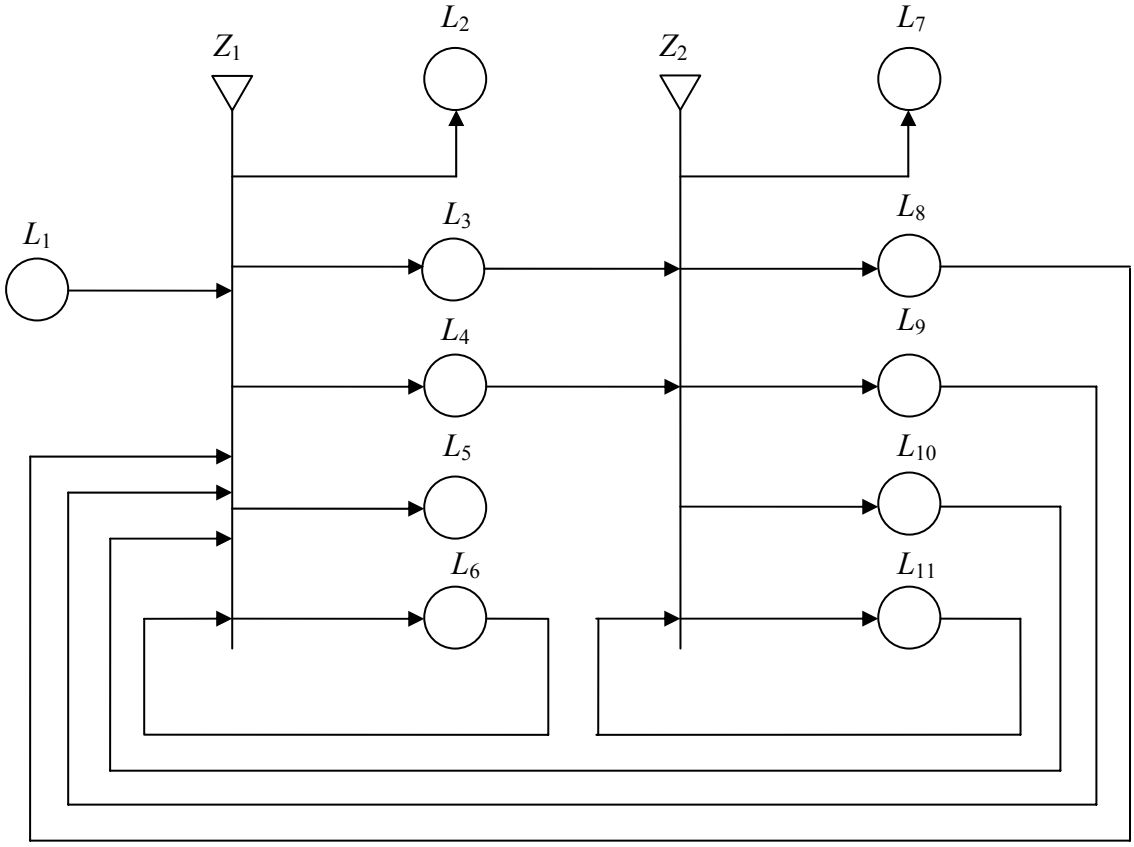

Figure 1

The generalized net contains the following set of transitions:

$$A = \{Z_1, Z_2\},$$

where transitions describe:
Z_1 – Work of client;
Z_2 – Work of server.

Prom place L_1 enter α-token with characteristic "new client".

$$Z_1 = <\{L_1, L_6, L_8, L_9, L_{10}\}, \{L_2, L_3, L_4, L_5, L_6\}, R_1>,$$

where

R_1=

	L_2	L_3	L_4	L_5	L_6
L_1	*False*	*False*	*False*	*False*	*True*
L_6	$W_{6,2}$	$W_{6,3}$	$W_{6,4}$	$W_{6,5}$	*True*
L_8	*False*	*False*	*False*	*False*	*True*
L_9	*False*	*False*	*False*	*False*	*True*
L_{10}	*False*	*False*	*False*	*False*	*True*

,

and:
$W_{6,2}$ = "Can't connect to the server",
$W_{6,3}$ = "IP lease request from a client",
$W_{6,4}$ = "The client receives an IP lease offer",
$W_{6,5}$ = "The client receives an IP".

Tokens entering places L_2, L_3, L_4, and L_5 obtain characteristics respectively:

"no connection with the server";
"client I, MAC address";
"client I, MAC address; request for offered IP address";
"client I, IP address".

$$Z_2=<\{L_3,L_4,L_{11}\},\ \{L_7,L_8,L_9,L_{10},L_{11}\},\ R_2>,$$

where

R_2=

	L_7	L_8	L_9	L_{10}	L_{11}
L_3	*False*	*False*	*False*	*False*	*True*
L_4	*False*	*False*	*False*	*False*	*True*
L_{11}	$W_{11,7}$	$W_{11,8}$	$W_{11,9}$	$W_{11,10}$	*True*

and:
$W_{11,7}$ = "Can't connect with client",
$W_{11,8}$ = "The server has offered the client with an IP",
$W_{11,9}$ = "The server acknowledges the request and sends the acknowledgement to the client",
$W_{11,10}$ = "The server can't send an IP".

Tokens entering places L_7, L_8, L_9, and L_{10} obtain characteristics respectively:

"no connection with the client";
"client I, MAC address; offer for an IP address";
"client I, MAC address; IP address" and
"client I, IP address; reject for sending an IP address".

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