

A Generalized Net Model of University Electronic Archives

Anthony Shannon¹, Daniela Langova-Orozova², Evdokia Sotirova³,
Krassimir Atanassov⁴, Pedro Melo-Pinto⁵, Taekyun Kim⁶, Lee-Chae Jang⁷, Dong-Jin Kang⁸

¹ Warrane College, the University of New South Wales, 1465, &
KvB Institute of Technology, North Sydney, NSW, 2060, Australia

² Free University of Bourgas, Bourgas-8000, Bulgaria

³ “Prof. Asen Zlatarov” University, Bourgas-8000, Bulgaria

⁴ CLBME - Bulgarian Academy of Sciences,

Acad. G. Bonchev Str., Bl. 105, Sofia-1113, Bulgaria

⁵ CETAV - University of Tras-os-Montes e Alto Douro, Ap. 1014,
5001-911 Vila Real, Portugal

⁶ Institute of Science Education, Kongju National

University, Kongju 314-701, S. Korea, tkim@kongju.ac.kr

⁷ Department of Mathematics and Computer Science, KoKuk
University, Choongju 314-701, S. Korea, leechae.jang@kku.ac.kr

⁸ Information Technology Service Kyungpook National University

Abstract

Using the theory of Generalized Nets we have modelled the information exchange within the electronic archives of an idealized university Intranet.

Key words : Idealized university, Generalized Net, Model

1. Introduction

There are two kinds of information in an electronic archive: generally accessible information (regulations, procedures, messages) and information for authorized access only (personal archives of the main subjects in the university structure: rector, deputy rectors, deans, heads of department, students). From their local computer, every user has access to the generally accessible information, where documents can be searched, retrieved and visualized. The archive of authorized access enables access to specific information only after the respective username and password have been input. Hence, different users work with different data, depending on their level of access. Users are given rights to search and visualize a document, add new documents in the archive, and edit or delete documents.

A GN-model

The Generalized Net (GN; see [1, 2, 3, 4, 5]) which can describe an electronic archive management is represented in Figure 1.

The generalized net contains the following tokens: ε -tokens, which stand for the users;

β -tokens that interpret the electronic archive, and γ -tokens, which represent the administrators.

Initially, places L_1, L_2, \dots, L_m hold ε -tokens ($\varepsilon_1, \varepsilon_2, \dots, \varepsilon_m$) with initial characteristic “client_i”, $i = 1, \dots, m$. In a certain moment of time an ε_i -token may split into two tokens. One of them – let it be the original ε_i -token, will remain in the respective place L_i , and the new

ε_i^1 -token, which will pass via transition Z_1 .

Also initially, places B_0 and B_p contain one β_0 -token and β_p -token with respective initial characteristics of “generally accessible electronic archive” and “electronic archive with authorized access”. In a certain moment of time these tokens may also split into several new ones.

The original tokens will remain in their respective places, and the new ones will transfer to transitions Z_2 and Z_8 , passing via transition Z_7 . The transitions are represented as follows:

$$Z_1 = \langle \{L_1, L_2, \dots, L_m\}, \{S\}, R_1, \vee (L_1, L_2, \dots, L_m) \rangle,$$

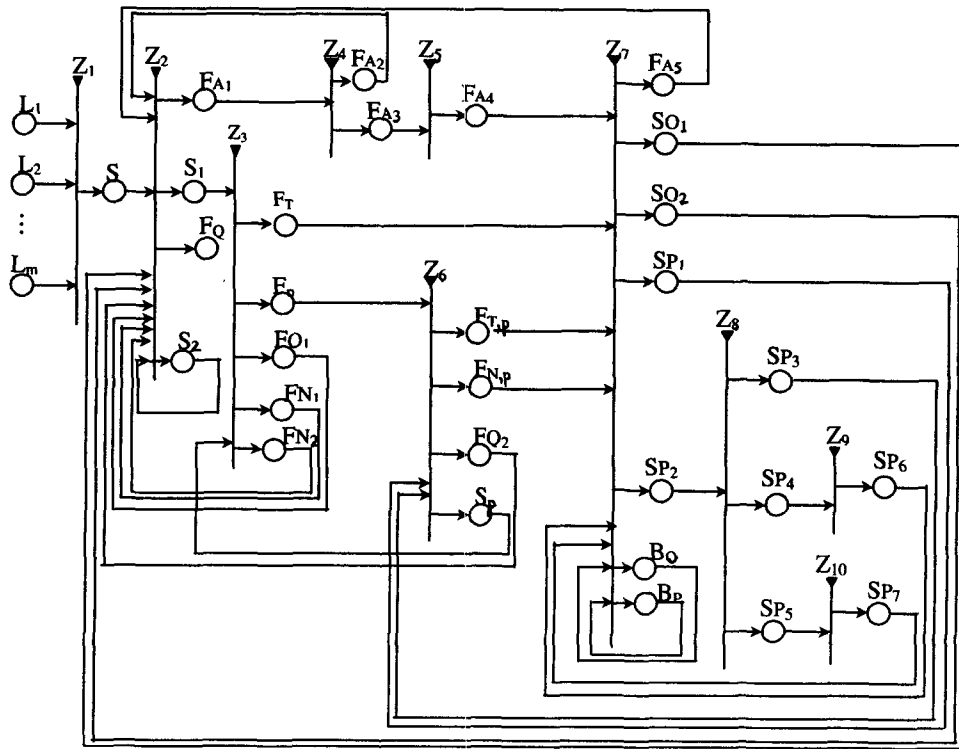


Figure 1. Model of the university electronic archive

where:

$$R_1 = \begin{array}{c|c} & S \\ \hline L_1 & W_1 \\ L_2 & W_2 \\ \dots & \dots \\ L_m & W_m \end{array}$$

in which:

$W_i =$ "There has been input consisting of the address of the main page of the university electronic archive", ($i = 1, \dots, m$).

The tokens which enter place S take on the characteristic "client, main page of the university electronic archive".

$Z_2 = \langle \{S, S_2, FQ_1, FQ_2, FN_1, FN_2, SO_1, SO_2, FA_2, FA_5, SP_1, SP_3\}, \{S_1, S_2, FA_1, FQ\}, R_2, \vee (\wedge(S_2), S, FQ_1, FQ_2, FN_1, FN_2, SO_1, SO_2, FA_2, FA_5, SP_1, SP_3) \rangle$,

where:

$$R_2 = \begin{array}{c|cccc} & S_1 & S_2 & FA_1 & FQ \\ \hline S & false & WS_2 & false & false \\ S_2 & W_{2,1} & false & WA_1 & W_{2,Q} \\ FQ_1 & false & WQ_1 & false & \\ FQ_2 & & false & & \\ FN_1 & false & WQ_2 & false & false \\ FN_2 & false & WN_1 & false & false \\ SO_1 & false & WN_2 & false & false \\ SO_2 & false & WO_1 & false & false \\ FA_2 & false & WO_2 & false & false \\ FA_5 & false & WA_{2,2} & false & false \\ SP_1 & false & WA_{5,2} & false & false \\ SP_3 & false & WP_1 & false & false \\ & false & WP_2 & false & false \end{array}$$

in which:

$WS_2 =$ "There is a new client",

$W_{1,2} =$ "Function Loading the main menu",

$WA_1 =$ "Function Administration of the electronic archive",

$W_{2,Q} =$ "Function Exit from the electronic archive",

$WQ_1 =$ "Function Exit from the main menu",

$WQ_2 =$ "Function Back to the main page",

$WN_1 =$ "Message has been read" & WQ_2 ,

$WN_2 =$ "Message has been input" & WQ_2 ,

$WO_1 =$ "Information has been found in the generally accessible electronic archive",

$WO_2 =$ "Information has not been found in the generally accessible electronic archive",

$WA_{2,2} =$ "The administrator has input wrong information",

$WA_{5,2} =$ "The administrator has activated function Back to the main page",

$WP_1 =$ "Information has been found in the electronic archive with authorized access",

$WP_2 =$ "Information has not been found in the electronic archive with authorized access".

The tokens which enter place S have the characteristic "client, main menu of the electronic archive". The tokens entering place FA_1 are given the characteristic "client: administrator's password", ($i = 1, \dots, m$), while the tokens entering place FQ obtain the characteristic "client: exit from the electronic archive", ($i = 1, \dots, m$).

$Z_3 = \langle \{S_1, S_p\}, \{F_T, F_p, FN_1, FN_2, FQ_1\}, R_3, \vee (S_1, S_p) \rangle$,

where:

	F_T	F_p	FN_1	FN_2	FQ_1	
$R_3 =$	S_1	$W_{S,T}$	$W_{S,p}$	WS,N_1	WS,N_2	$W1,Q_1$
	S_p	False	W_p	false	false	W_{p,Q_1}

in which:

$W_{S,T}$ = "Function *Search* for information in the generally accessible partition of the electronic archive",

$W_{S,p}$ = "Function *Password input* for the electronic archive partition with authorized access",

WS,N_1 = "Function *View messages*",

WS,N_2 = "Function *Compose new message*",

$W1,Q_1$ = "Function *Exit* from the main menu"

W_p = "New password will be input to access the electronic archive partition with authorized access",

W_{p,Q_1} = "Function *Back to the main page*".

In places F_T , F_p , FN_1 , FN_2 and FQ_1 the tokens have the respective characteristics: "client: search criteria", for $i = 1, \dots, m$; "client: password", for $i = 1, \dots, m$; "client: message", for $i = 1, \dots, m$ and "client: new message", for $i = 1, \dots, m$.

$$Z_4 = \langle \{ FA_1 \}, \{ FA_2, FA_3 \}, R_4, \wedge (FA_1) \rangle,$$

where:

	FA_2	FA_3	
$R_4 =$	FA_1	WA_{1,A_2}	WA_{1,A_3}

in which:

WA_{1,A_2} = "Administrator's password has been input",

WA_{1,A_3} = "Wrong password has been input".

The tokens that enter places FA_2 and FA_3 have the characteristics "password: administrator" and "wrong password", respectively.

$$Z_5 = \langle \{ FA_3 \}, \{ FA_4 \}, R_5, \wedge (FA_3) \rangle$$

where:

	FA_4	
$R_5 =$	FA_3	WA_{3,A_4}

WA_{3,A_4} = "Function *Serving the electronic archive*".

The tokens entering place FA_4 obtain the characteristic "administrator: activities".

$$Z_6 = \langle \{ F_p, SP_1, SP_3 \}, \{ F_{T,p}, F_{N,p}, F_{Q,p}, S_p \}, R_6, \vee (F_p, SP_1, SP_3) \rangle,$$

where:

	$F_{T,p}$	$F_{N,p}$	FQ_2	S_p	
$R_6 =$	F_p	$W_{T,p}$	$W_{N,p}$	WP,Q_2	$W_{p,p}$

in which:

$W_{T,p}$ = "Function *Search* of information in the electronic archive partition with authorized access",

$W_{N,p}$ = "Function *Add document* in the electronic archive partition with authorized access",

WP,Q_2 = "Function *Back to the main page*",

$W_{p,p}$ = "Wrong password for the archive partition with authorized access has been input".

$$Z_7 = \langle \{ FA_4, F_T, F_{T,p}, F_{N,p}, SP_6, SP_7, B_O, B_p \}, \{ FA_5, SO_1, SO_2, SP_1, SP_2, B_O, B_p \}, R_7, \vee (FA_4, F_T, F_{T,p}, F_{N,p}, SP_6, SP_7, B_O, B_p) \rangle$$

where:

	FA_5	SO_1	SO_2	SP_1	SP_2	B_O	B_p
FA_4	False	false	false	false	false	$WA_{4,O}$	$WA_{4,p}$
F_T	False	false	false	false	false	$W_{T,O}$	false
$F_{T,p}$	False	false	false	false	false	false	$W_{T,Bp}$
$F_{N,p}$	False	false	false	false	false	false	$W_{T,Np}$
SP_6	False	false	false	false	false	false	$WP_{6,p}$
SP_7	False	false	false	false	false	false	$WP_{7,p}$
B_O	$W_{O,A}$	$W_{O,1}$	$W_{O,2}$	false	false	true	false
B_p	$W_{p,A}$	false	false	$W_{p,1}$	$W_{p,2}$	false	true

in which:

$WA_{4,O}$ = "The administrator has operated within the generally accessible electronic archive",

$W_{A,p,1}$ = "The administrator has operated within the electronic archive with authorized access",

$W_{T,O}$ = "There is a search inquiry for information in the generally accessible electronic archive",

$W_{T,Bp}$ = "There is a search inquiry for information in the electronic archive with authorized access",

$W_{T,Np}$ = "There are new documents for adding in the electronic archive with authorized access",

$WP_{6,p}$ = "Edited documents in the electronic archive with authorized access shall be saved",

$WP_{7,p}$ = "Documents in the electronic archive with authorized access shall be deleted",

$W_{O,A}$ = "The administrator has made changes in the generally accessible electronic archive",

$W_{p,A}$ = "The administrator has made changes in the electronic archive with authorized access",

$W_{O,1}$ = "There is retrieved information from the generally accessible electronic archive",

$W_{O,2}$ = "There is no retrieved information from the generally accessible electronic archive",

$W_{p,1}$ = "There is retrieved information from the electronic archive with authorized access",

$W_{p,2}$ = "There is retrieved information from the electronic archive with authorized access".

The tokens which enter places SO_1 and SO_2 have, respectively, the characteristics "client: information from the generally accessible electronic archive", for $i = 1, \dots, m$, and "client: message for unfulfilled inquiry for search in the generally accessible electronic archive", for $i = 1, \dots, m$. The tokens that enter places SP_1 and SP_2 have the respective characteristics "client: message for unfulfilled inquiry for search in the electronic archive with authorized access", for $i =$

1, ..., m, and "client i: information from the electronic archive with authorized access", for $i = 1, \dots, m$.

$$Z_8 = \langle \{SP_2\}, \{SP_3, SP_4, SP_5\}, R_8, \wedge (SP_2) \rangle,$$

where:

$$R_8 = \begin{array}{c|ccc} & SP_3 & SP_4 & SP_5 \\ \hline SP_2 & WP_{2,P_3} & WP_{2,P_4} & WP_{2,P_5} \end{array}$$

in which:

$$WP_{2,P_3} = W_{p,2},$$

WP_{2,P_4} = "Function *Editing a document* from the electronic archive with authorized access",

WP_{2,P_5} = "Function *Deleting a document* from the electronic archive with authorized access".

The tokens entering place SP_3 do not have any new characteristics. In places SP_4 and SP_5 the tokens are given the characteristics "client: a document for edition", for $i = 1, \dots, m$ and "client: a document for deletion", for $i = 1, \dots, m$, respectively.

$$Z_9 = \langle \{SP_4\}, \{SP_6\}, R_9, \wedge (SP_4) \rangle$$

where:

$$R_9 = \begin{array}{c|c} & SP_6 \\ \hline SP_4 & WP_{4,P_6} \end{array}$$

in which:

$$WA_{3,A_4} = \text{"A document has been edited"}$$

The tokens which enter place SP_6 have the characteristic "client_i: edited document", for $i = 1, \dots, m$.

$$Z_{10} = \langle \{SP_5\}, \{SP_7\}, R_{10}, \wedge (SP_5) \rangle$$

where:

$$R_9 = \begin{array}{c|c} & SP_7 \\ \hline SP_5 & WP_{5,P_7} \end{array}$$

in which:

$$WP_{5,P_7} = \text{"A document has been deleted"}$$

Finally, the tokens that enter place SP_7 take on the characteristic "client: deleted document", for $i = 1, \dots, m$.

Conclusion

The generalized net model constructed in the manner outlined above can be used for the simulation of the processes which occur within the electronic archives of an idealized university. The information exchanged within the system can be then evaluated by means of intuitionistic fuzzy estimations.

Reference

- [1] K. ATANASSOV, *Generalized Nets*. World Scientific, Singapore, 1991.
- [2] A. Shannon, E. Szmidt, E. Sotirova, I. Petrounias, J. Kacprzyk, K. Atanassov, M. Krawczak, P. Melo-Pinto, S. Melliani, T. Kim, Intuitionistic fuzzy estimation and generalized net model of e-learning within a university local network, *Advan. Stud. Contemp. Math.* 9 no. 1(2004) 41-46.
- [3] A. Shannon, D. Langova-Orozova,, E. Sotirova, I. Petrounias, K. Atanassov, M. Krawczak, P. Melo-Pinto, S. Melliani, T. Kim, Generalized net model of intranet in an abstract university, *Proc. Jangjeon Math. Soc.* 7 no. 1(2004), 81-88.
- [4] A. Shannon, D. Langova-Orozova,, E. Sotirova, I. Petrounias, K. Atanassov, P. Melo-Pinto, T. Kim, Generalized net model of information flows in intranet in an abstract university, *Advan. Stud. Contemp. Math.* 8 no. 2(2004), 183-192.
- [5] A. Shannon, D. Langova-Orozova,, E. Sotirova, I. Petrounias, P. Melo-Pinto, K. Atanassov, T. Kim, Generalized net model of university classes schedule, *Advan. Stud. Contemp. Math.* 8 no. 1(2004), 23-34.

Anthony Shannon(Australia)

Daniela Langova-Orozova(Bulgaria)

Evdokia Sotirova(Bulgaria)

Krassimir Atanassov(Bulgaria)

Pedro Melo-Pinto(Portugal)

Taekyun Kim(South Korea)

tkim@kongju.ac.kr

Lee-Chae Jang(South Korea)

leechae.jang@kku.ac.kr

Dong-Jin Kang(South Korea)