A Generalized Net Model of University Electronic Archives

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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 \( L_1, L_2, \ldots, L_m \) hold ε-tokens \( (\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_m) \) with initial characteristic "client", \( i = 1, \ldots, m \). In a certain moment of time an ε-token may split into two tokens. One of them – let it be the original \( \varepsilon_i \)-token, will remain in the respective place \( L_i \) and the new ε-token, which will pass via transition \( Z_i \).

Also initially, places \( B_0 \) and \( B_p \) contain one β0-token and βp-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 \( Z_0 \) and \( Z_p \), passing via transition \( Z_i \). The transitions are represented as follows:

\[ Z_1 = \langle \{ L_1, L_2, \ldots, L_m \}, \{ S \}, R_i, \lor \{ L_1, L_2, \ldots, L_m \} \rangle, \]

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where:

\[
R_1 = \begin{array}{c|c}
& S \\
L_1 & W_1 \\
L_2 & W_2 \\
\vdots & \vdots \\
L_m & W_m
\end{array}
\]

in which:

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

The tokens which enter place \(S\) take on the characteristic

\(Z_3 = \langle \{S_1, S_2, FQ_1, FQ_2, FN_1, FN_2, SO_1, SO_2, FA_2, FA_5, SP_1, SP_3\}, \{S_1, S_2, FA_1, FQ_0\}, R_3, \vee (\land (S_2), S, FQ_1, FQ_2, FN_1, FN_2, SO_1, SO_2, FA_2, FA_5, SP_1, SP_3)\rangle,\)

where:

\[
R_3 = \begin{array}{c|c|c|c|c}
S & S_2 & FA_1 & FQ_1 \\
S_2 & W_2 & FA_1 & FQ_1 \\
FQ_1 & false & true & false \\
FQ_2 & false & false & false \\
FN_1 & false & false & false \\
FN_2 & false & false & false \\
SO_1 & false & false & false \\
SO_2 & false & false & false \\
FA_2 & false & false & false \\
FA_5 & false & false & false \\
SP_1 & false & false & false \\
SP_2 & false & false & false
\end{array}
\]

in which:

\(W_{S_2} = \text{"There is a new client"},\)

\(W_{1,2} = \text{"Function Loading the main menu"},\)

\(W_A = \text{"Function Administration of the electronic archive"},\)

\(W_{3,0} = \text{"Function Exit from the electronic archive"},\)

\(W_{Q_2} = \text{"Function Exit from the main menu"},\)

\(W_{Q_2} = \text{"Function Back to the main page"},\)

\(W_{N_1} = \text{"Message has been read"} \& W_{Q_2},\)

\(W_{N_2} = \text{"Message has been input"} \& W_{Q_2},\)

\(W_{O} = \text{"Information has been found in the generally accessible electronic archive"},\)

\(W_{O_2} = \text{"Information has not been found in the generally accessible electronic archive"},\)

\(W_{A_2} = \text{"The administrator has input wrong information"},\)

\(W_{A_2} = \text{"The administrator has activated function Back to the main page"},\)

\(W_{P_1} = \text{"Information has been found in the electronic archive with authorized access"},\)

\(W_{P_2} = \text{"Information has not been found in the electronic archive with authorized access"}.\)

The tokens which enter place \(S_1\) have the characteristic

\(\text{"client, main menu of the electronic archive"}.\) The tokens entering place \(FA_1\) are given the characteristic "client: administrator's password", \((i = 1, \ldots, m),\) while the tokens entering place \(FQ_0\) obtain the characteristic "client: exit from the electronic archive", \((i = 1, \ldots, m).\)

\(Z_3 = \langle \{S_1, S_p\}, \{F_1, F_2, FN_1, FN_2, FQ_0\}, R_3, \vee (S_1, S_p)\rangle,\)
where:

\[
R_3 = \begin{bmatrix}
F_T & F_T & F_T & F_T & F_T \\
S_1 & W_{ST} & W_{SP} & W_{SN1} & W_{SN2} & W_{IQ1} \\
S_p & False & False & False & False & W_{PO1}
\end{bmatrix}
\]

in which:
- \(W_{ST} = \text{"Function Search for information in the generally accessible partition of the electronic archive"},\)
- \(W_{SP} = \text{"Function Password input for the electronic archive partition with authorized access"},\)
- \(W_{SN1} = \text{"Function View messages"},\)
- \(W_{SN2} = \text{"Function Compose new message"},\)
- \(W_{IQ1} = \text{"Function Exit from the main menu"},\)
- \(W_p = \text{"New password will be input to access the electronic archive partition with authorized access"},\)
- \(W_{PO1} = \text{"Function Back to the main page"}.\)

In places \(F_T, F_T, FN_1, FN_2\) and \(FO_1\) the tokens have the respective characteristics: "client: search criteria", for \(i = 1, \ldots, m\); "client: password", for \(i = 1, \ldots, m\); "client: message", for \(i = 1, \ldots, m\) and "client: new message", for \(i = 1, \ldots, m\).

\[
Z_1 = \langle\{FA_1\}, \{FA_2, FA_3\}, R_{NO} \land (FA_1)\rangle,
\]

where:

\[
R_4 = \begin{bmatrix}
FA_1 & FA_2 & FA_3 \\
T_{A1/A2} & WA_{1/A2} & WA_{1/A3}
\end{bmatrix}
\]

in which:
- \(WA_{1/A2} = \text{"Administrator’s password has been input"},\)
- \(WA_{1/A3} = \text{"Wrong password has been input"}.\)

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

\[
Z_2 = \langle\{FA_4\}, \{FA_4\}, R_{NO} \land (FA_3)\rangle,
\]

where:

\[
R_5 = \begin{bmatrix}
FA_4 \\
T_{A3/A4}
\end{bmatrix}
\]

in which:
- \(WA_{A3/A4} = \text{"Function Serving the electronic archive"}.\)

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

\[
Z_2 = \langle\{FP, SP_1, SP_1\}, \{FP, FN_2, FN_2, FP_2, SP_1\}, R_{NO} \land (FP, SP_1, SP_1)\rangle,
\]

where:

\[
R_6 = \begin{bmatrix}
F_T & FN_2 & FO_2 & S_p \\
F_p & W_{TP} & W_{NP} & W_{PO2} & W_{PO}
\end{bmatrix}
\]

in which:
- \(W_{TP} = \text{"Function Search of information in the electronic archive partition with authorized access"},\)
- \(W_{NP} = \text{"Function Add document in the electronic archive partition with authorized access"},\)
- \(W_{PO2} = \text{"Function Back to the main page"},\)
- \(W_{PO} = \text{"Wrong password for the archive partition with authorized access has been input"}.\)

\[
Z_3 = \langle\{FA_4, F_T, FN_2, SP_1, B_O, B_p\}, \{FA_2, SO_1, SO_2, SP_1, SP_2, B_O, B_p\}, R_{NO} \lor (FA_4, F_T, FN_2, SP_1, SP_2, B_O, B_p)\rangle,
\]

where:

\[
<table>
<thead>
<tr>
<th>FA_4</th>
<th>SO_1</th>
<th>SO_2</th>
<th>SP_1</th>
<th>SP_2</th>
<th>B_O</th>
<th>B_p</th>
</tr>
</thead>
<tbody>
<tr>
<td>False</td>
<td>True</td>
<td>True</td>
<td>False</td>
<td>False</td>
<td>True</td>
<td>False</td>
</tr>
<tr>
<td>FA_2</td>
<td>SO_1</td>
<td>SO_2</td>
<td>SP_1</td>
<td>SP_2</td>
<td>B_O</td>
<td>B_p</td>
</tr>
<tr>
<td>False</td>
<td>True</td>
<td>False</td>
<td>False</td>
<td>False</td>
<td>True</td>
<td>False</td>
</tr>
<tr>
<td>FA_3</td>
<td>SO_1</td>
<td>SO_2</td>
<td>SP_1</td>
<td>SP_2</td>
<td>B_O</td>
<td>B_p</td>
</tr>
<tr>
<td>False</td>
<td>True</td>
<td>False</td>
<td>False</td>
<td>False</td>
<td>True</td>
<td>False</td>
</tr>
<tr>
<td>SP_1</td>
<td>SO_1</td>
<td>SO_2</td>
<td>SP_1</td>
<td>SP_2</td>
<td>B_O</td>
<td>B_p</td>
</tr>
<tr>
<td>False</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>False</td>
<td>False</td>
<td>False</td>
</tr>
<tr>
<td>SP_2</td>
<td>SO_1</td>
<td>SO_2</td>
<td>SP_1</td>
<td>SP_2</td>
<td>B_O</td>
<td>B_p</td>
</tr>
<tr>
<td>False</td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>False</td>
<td>False</td>
<td>False</td>
</tr>
</tbody>
</table>

in which:
- \(WA_{A4/0} = \text{"The administrator has operated within the generally accessible electronic archive"}.\)
- \(WA_{A3-A4} = \text{"The administrator has operated within the electronic archive with authorized access"}.\)
- \(WA_{T_0} = \text{"There is a search inquiry for information in the generally accessible electronic archive"}.\)
- \(WA_{T_0} = \text{"There is a search inquiry for information in the electronic archive with authorized access"}.\)
- \(WA_{T_3} = \text{"There are new documents for adding in the electronic archive with authorized access"}.\)
- \(WA_{F_4} = \text{"Edited documents in the electronic archive with authorized access shall be saved"}.\)
- \(WA_{T_0} = \text{"Documents in the electronic archive with authorized access shall be deleted"}.\)
- \(WA_{O_1} = \text{"The administrator has made changes in the generally accessible electronic archive"}.\)
- \(WA_{O_2} = \text{"The administrator has made changes in the electronic archive with authorized access"}.\)
- \(WA_{O_3} = \text{"There is retrieved information from the generally accessible electronic archive"}.\)
- \(WA_{O_4} = \text{"There is no retrieved information from the generally accessible electronic archive"}.\)
- \(WA_{O_5} = \text{"There is retrieved information from the electronic archive with authorized access"}.\)
- \(WA_{O_6} = \text{"There is retrieved information from the electronic archive with authorized access"}.\)

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

\[ Z_9 = \langle \{ SP_3 \}, \{ SP_4, SP_5 \}, R_9 \wedge (SP_5) \rangle \]

where:

\[ R_9 = \begin{array}{ccc}
SP_3 & SP_4 & SP_5 \\
WP_2P_3 & WP_2P_4 & WP_2P_5 \\
\end{array} \]

in which:

\[ WP_2P_3 = W_{P2}, \]

\[ WP_2P_4 = "Function\ Editing\ a\ document\ from\ the\ electronic\ archive\ with\ authorized\ access". \]

\[ WP_2P_5 = "Function\ Deleting\ a\ document\ from\ the\ electronic\ archive\ with\ authorized\ access". \]

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, ..., m and "client: a document for deletion", for i = 1, ..., m, respectively.

\[ Z_9 = \langle \{ SP_5 \}, \{ SP_6 \}, R_9 \wedge (SP_3) \rangle \]

where:

\[ R_9 = \begin{array}{c}
SP_5 \\
SP_4 \\
WP_4P_5 \\
\end{array} \]

in which:

\[ WA_3A_5 = "A\ document\ has\ been\ edited". \]

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

\[ Z_{10} = \langle \{ SP_i \}, \{ SP_1 \}, R_{10} \wedge (SP_5) \rangle \]

where:

\[ R_9 = \begin{array}{c}
SP_5 \\
SP_4 \\
WP_5P_6 \\
\end{array} \]

in which:

\[ WP_5P_6 = "A\ document\ has\ been\ deleted". \]

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

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**Reference**


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