Intellect Disclosure Support Based On Organizational Intellect Model

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Abstract

To establish the intellectual identity of the organization, it is important for every organization to revitalize creative activity inside and attract intellectual interest from outside the organization. This paper proposes a framework to support attraction of outside interest by disclosing the organizational intellect. We have developed models of organizational intellect and a support environment for creation and inheritance of organizational intellect based on the model. This paper proposes concepts to design attractive information for the outside in terms of intellectual activity, and a support system to disclose organizational intellect based on those concepts.

1   Introduction

The variety and growth of intellects in an organization are major sources of high competitive power for an organization [Nonaka 1995]. Regarding the growth of organizational intellect, it is important for each organization to exchange intellects not only internally, but also externally [Wenger 2002]. Lundkvist provides an example of importance of external exchange [Lundkvist 2004]. He analyzed the relation between a software company and the user group of the company's product. And then he reported that the users have played important role as innovators.

This study is intended to develop information systems to support both internal and external exchange. This paper specifically addresses the latter: it proposes a framework to support attracting intellectual interest from the outside by disclosing the organizational intellect effectively.

The next section will try to clarify our conception of the term "intellect" and then propose a model based on which computers support the creation and inheritance of organizational intellect. Section 3 presents an overview of intellect exchange support based on the model. Section 4 will discuss organizational intellect disclosure support further. In section 5 describes metadata for organizational intellect disclosure. Finally, section 6 present concluding remarks.

2   An Organizational Intellect Model

2.1   Intellect

The terms 'knowledge,' 'intellect,' and so on are used with various meanings, so there appear to be no definite meanings for them [Liebowitz, 1999]. Though it is difficult to define them strictly in a consistent manner, to show subjects of this study, we will take some exemplary definitions from the literature.

Brown and Duguid [Brown and Duguid, 2000] argue convincingly that knowledge is more than just information because it

- usually entails a 'knower',

- appears harder to detach than information, and

- is something what we digest rather than merely hold.

Tobin draws distinctions between data, information, knowledge, and wisdom [Tobin, 1996].

1. *Data*:

2. *Information*:= *Data*+ relevance + purpose

3. *Knowledge*: = *Information* + application

4. *Wisdom*: = *Knowledge* + intuition + experience

In this research, the term 'intellect' is used to express our idea similar to Brown and Duguid's argument about 'knowledge' and Tobin's 'wisdom'. Having an intellect means not only merely knowing something, but also digesting it through creation or practical use. It also means that the intellect cannot be separated from a person because it includes skill and competency. This is the major reason why we introduce the term "intellect." We aim to support creation and inheritance of organizational intellect by managing information concerned with intellect.

2.2 Dual loop model

Our goal is to present a framework of information systems that supports all the activities from the practical ones in an organization to ones oriented to knowledge creation and skill/competency development.

In this research, based on Dynamic Theory of Organizational Knowledge Creation [Nonaka 95], some activities related to the formation of organizational intellect are explained from both viewpoints of the 'individual' as the substantial actor in an organization and the 'organization' as the aggregation of the individuals.

The two viewpoints are modeled as two separated loops of activities with explicit interactions between them. The whole model called "Dual Loop Model [Hayashi et al., 2001]" is illustrated in figure 1. It works as the reference model for designing an intellect exchange support environment.

The dual loop model is constructed from formative process of an individual's intellect (figure 1 (A), personal loop) and formative process of organizational intellect (figure 1 (B), Organizational loop), and it represents the flow of intellects between them. Intellect creation activities in this dual loop model are explained in the following.

2.2.1 Personal loop

The personal loop is a loop of individual activities related to intellect. As shown in figure 1(A), it consists of four processes: *internalization*, *amplification*, *externalization* and *combination*.

This loop is considering two types of modes of individual activity; a learning mode, in which an individual acquires intellect from his/her surroundings, and a creative mode, in which he/she creates original intellect. A typical activity in the learning mode is one in which the members acquire intellect of which the significance is approved in an organization. Systems supporting the leaning and the creative modes can be considered the learning support and creative thinking support systems, respectively. A possible common basic requirement for supporting these two modes is:

- Easy access to useful intellect for intellect acquisition and creation activities.

This is closely equivalent to the considerations in the study of Ogata et al's knowledge awareness support [Ogata et al., 2000], kMedia [Takeda et al., 2000], and L-EVIDII [Ohira et al., 2001]. These researches aim to support individual activities in a community.

In our research, in addition, we aim to support making harmony between the individual activities and organizational activities which give direction to the individual activities based on a vision and strategy of the organization. We will describe the organizational activities in 2.2.2. We develop this idea in a framework that promotes the 'appropriate creation/distribution' of intellect in an organization based on knowledge management theory.

Basic requirements for each mode of the personal loop are:

- for the learning mode, preparing and implementing a rational learning process for an organization, and

- for the creative mode, supporting communication of intellect, e.g. acquiring knowledge and imparting it to others, as the basis of individual amplifying process.

In figure 1, nodes from 1 to 7 represent the events of the individual activities. Typical starting events for the learning and creative modes assumed in the dual loop model are nodes
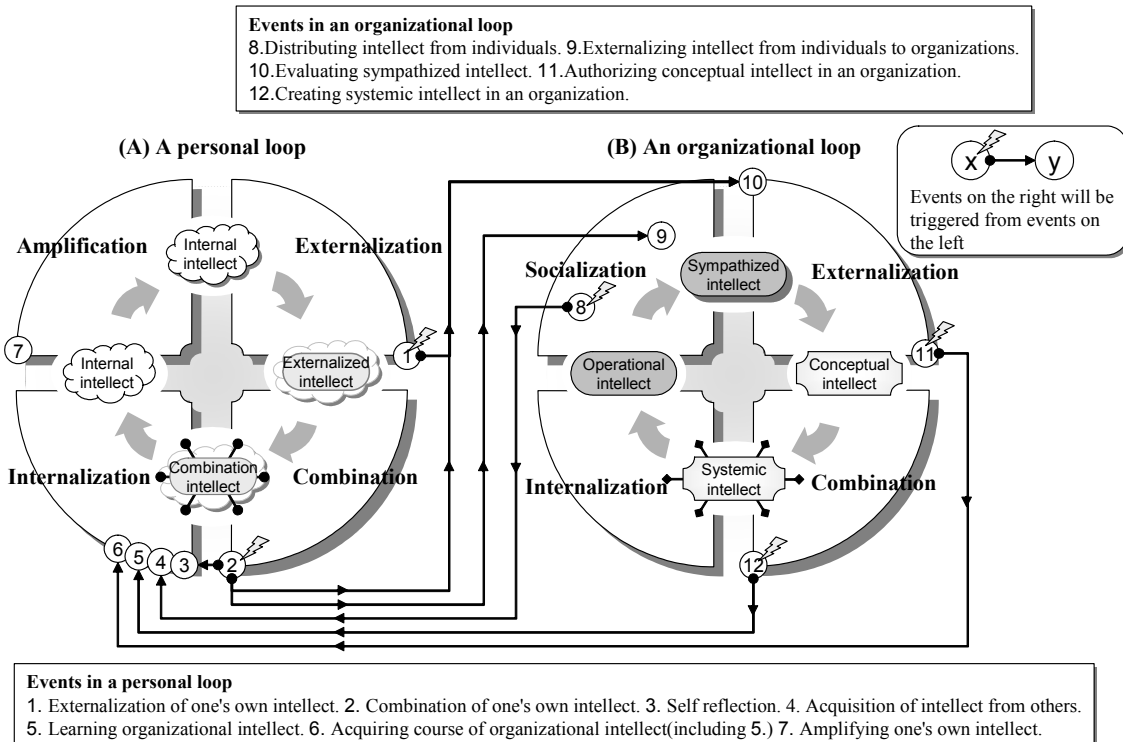
Events in an organizational loop
8.Distributing intellect from individuals. 9.Externalizing intellect from individuals to organizations.
10.Evaluating sympathized intellect. 11.Authorizing conceptual intellect in an organization.
12.Creating systemic intellect in an organization.

Events in a personal loop
1. Externalization of one's own intellect. 2. Combination of one's own intellect. 3. Self reflection. 4. Acquisition of intellect from others.
5. Learning organizational intellect. 6. Acquiring course of organizational intellect(including 5.) 7. Amplifying one's own intellect.

Figure 1 Dual loop model (partly simplified)

5 and 7, respectively in figure 1. Node 5 represents an event in which 'significant intellect in an organization' should be acquired, and node 7 is an externally-triggered event that represents a start of the creation of original intellect. These are defined in connection with a user's activity conditions and an organization's loop events.

2.2.2 Organizational loop

An Organizational loop is an abstract model, reflecting members' activities in personal loops in an organization as intellect inheriting and creating activities from an organizational viewpoint. The typical activities include acquisition and creation of intellect inside and outside an organization.

The loop consists of four processes: *internalization*, *socialization*, *externalization* and *combination*. In figure 1, nodes 8, 11 and 12 represent the events that trigger off individual activities performed in the personal loop process. For example, node 8 represents such an event as 'intellect distributed by individuals', node 4 represents 'obtaining intellect from others'. The arrow from node 8 to node 4 shows a causal link between the two events.

Furthermore, this dual loop model can explain conditions of creation and inheritance of the organizational intellect. For example, an organization that frequently has events in the socialization process (at the top left) and rarely has events in the combination process (at the bottom right) mean that even though an individual actively carries out intellect acquisition and creating activities, they are not likely to be recognized as 'organizational intellect'. Lack of relation between activities of individuals and ones of the organization can be identified as the causes. Further, when an organization has events only in the internalization process in the Organizational loop (at the bottom left), it can be seen that a tendency of the organization leans to knowledge acquisition activity in practice. Thus, the dual loop model is also useful as a reference for analyzing the proper process of intellect acquisition, passing down and creation in an organization.

3 Overview of Intellect Exchange Support

This study explores the following important issues that support information systems:

(A) Revitalization of activities for creation and inheritance of organizational intellect

- Supplying guidelines to direct organization members to the desired process of creation and inheritance of organizational intellect.

- Encouraging organization members to become aware of the relationships among people, intellects, and vehicles. Through that awareness, they can derive answers to questions such as: *Who knows the intellect well? Who should collaborate? Which medium is useful to obtain the intellect?*

(B) Disclosing organizational intellect to the outside

- Clarifying the intention of disclosure based on a deep understanding of the organizational intellect.

- Producing a presentation with the most suitable style for showing the intellect.

Figure 2 shows an overview of this project, focusing on (B). The dual loop model (DLM) and intellectual genealogy graph (IGG) form a foundation to provide awareness information on the organizational intellect for both organizational members and outsiders. That awareness will involve not only the meaning of the intellect itself but also its formative process.

As mentioned in the previous section, DLM represents a formative process of intellect in an organization, both from the viewpoint of the individual and the organization. This model serves the members as a guideline for organizational activity and the organization as a reference for analyzing its
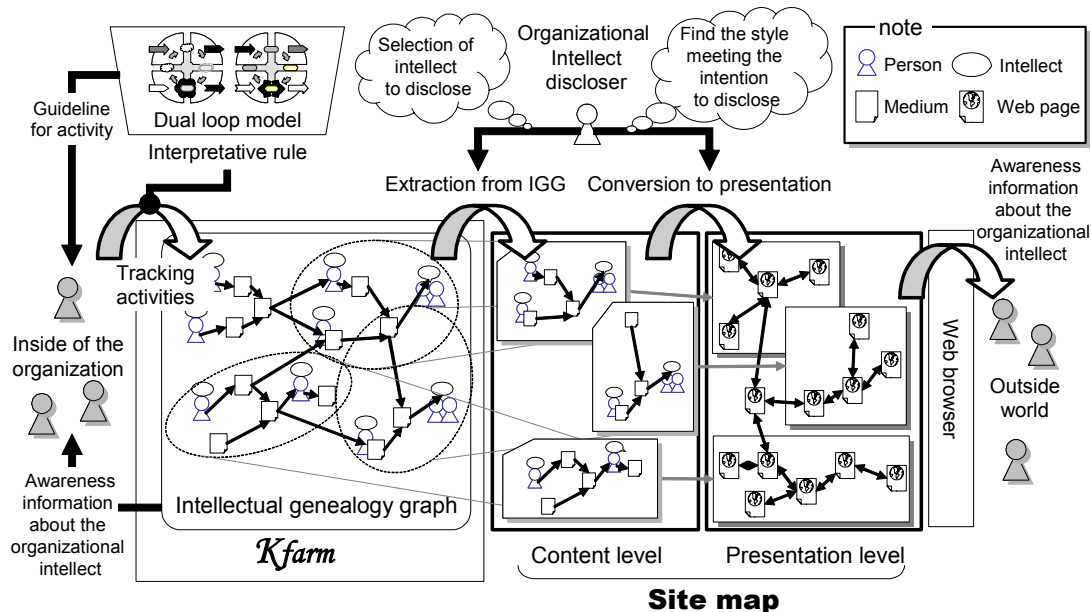

Figure 2. An overview of intellect exchange support

condition of creation and inheritance of the organizational intellect.

IGG represents chronological correlation among persons, activities, and intellect in an organization as an interpretation of the activities of organization members based on DLM [Hayashi et al., 2002]. IGG is generated from activities with vehicles. A vehicle is a representation of intellect that mediates intellect among people: text, figures, voice, and so on.

On the similar lines of research, ScnolOnto Project [Buckingham et al., 2000] aims to model the formative process of ideas in the academic community, paying attention to the *claims* described in vehicles (research literature). They propose a model for authors or readers to describe their interpretation of the *claims* on the vehicle and relationship among them. On the other hand, our study is interested in semi-automatic extraction of IGG by DLM-based interpretation of the observed activities, such as creating/revising/referring the vehicles.

A site-map is a model describing the structure of intellects to disclose. The model consists of a content level model and a presentation level one. The content level model is a subset of an IGG. That level model is extracted with the intention of disclosing the organizational intellect. The content level model is transformed into the presentation level model to allow its display on a WEB browser.

Based on these models, this project is intended to develop information systems to support both (A) and (B), as mentioned above. To support (A), it is crucial to prompt the members' spontaneous activity by providing organizational intellect awareness information based on IGG, as well as to direct their activity by presenting guideline on the activity along to DLM. On the other hand, to support (B), it is crucial to prompt the organization to grasp a comprehensive view of its own organizational intellect by also presenting IGG to enable the organization to prepare its best materials for disclosure. Moreover, it is important to prepare a mechanism for conversion from the content of disclosure to its presentation.

This brief paper is insufficient to allow comprehensive discussion on all the aspects presented in the previous section. This paper specifically addresses features of the framework focusing on Intellect disclosure support function. In the following, we will see the model and support functions for organizational intellect disclosure. Detailed explanation about DLM and IGG can be found in [Hayashi et al., 2001, 2002].

4 Organizational intellect disclosure support

The outline of tasks that designers carry out in the site-map design process is the following. During the content level model design process, designers select an organizational intellect that will be disclosed to the outside. And then, in the presentation level model design process, designers decide how to display the organizational intellect to the outside. This is similar to common tasks undertaken during website design.

This section presents concepts and support functions related to the design processes.

4.1 Concepts for organizational intellect disclosure

Site-map model consists of the presentation level model and the content level one. Table 1 summarizes concepts to describe the content level model and the presentation level one. The content level model describes meaning and intention of the disclosure information. The presentation level model is embodied as web pages displayed to the outsiders.

Most important of all, the relation between the presentation level model and the content level one describes the contextual information of intellect disclosure, that is, the relation between meaning and intention of the disclosure information and the embodiment of it as web pages. The base unit of mapping between the content level model and the presentation level model is a *Description* and a *Page*. The content level model plays a role of metadata for the corresponding presentation level model.

4.2 Support functions for organizational intellect disclosure

This study aims to design and develop an organizational intellect disclosure support environment. Here we will see necessary functions of the environment.

- *Lead designers into coordinating content and intention of disclosure*: The concepts mentioned in table 1 are provided as a basis of Site-map design for designers through the environment. Those concepts facilitate designers' recognition of the importance of coordinating disclosure content and intention.

Table 1. Site-map model concepts

Level	Concept		Explanation
Content level	*Description*		Description of a person, an intellect, a vehicles and an activity in IGG
	Attractive frame		A network of *descriptions* to be disclosed to the outside This is extracted from IGG with the organization's intention.
		Subject	A *description* of a person, an intellect, a vehicle or an activity that is presented as a subject of an *Attractive frame*
		Related items	*Descriptions* presented together with the *Subject*
	Theme		Description of intention of an *Attractive frame*.
		Subject	A person, an intellect, a vehicle or an activity that is a noteworthy item in the *Attractive frame*. It corresponds to the *subject* of the *attractive frame*.
		Purpose	Expectant effects of the *attractive frame* on the outside.
		Perspective	Necessary relations to display the *Subject* attractively according to the *purpose*.
	Site pattern		Pattern of extraction of an attractive frame from IGG.
Presentation level	*Page*		A web page that expresses a *description*.
	Cluster		A network of *pages* that corresponds to an *attractive frame*
	Cluster top page		A *page* that corresponds to the *subject* of an *attractive frame*.

(A) An Intellectual Genealogy Graph

The subject of the attractive frame

(C) A web page

The formative process of intellect represented in this paper

(B) An Attractive Frame

The formative process of the intellects related to preceding study

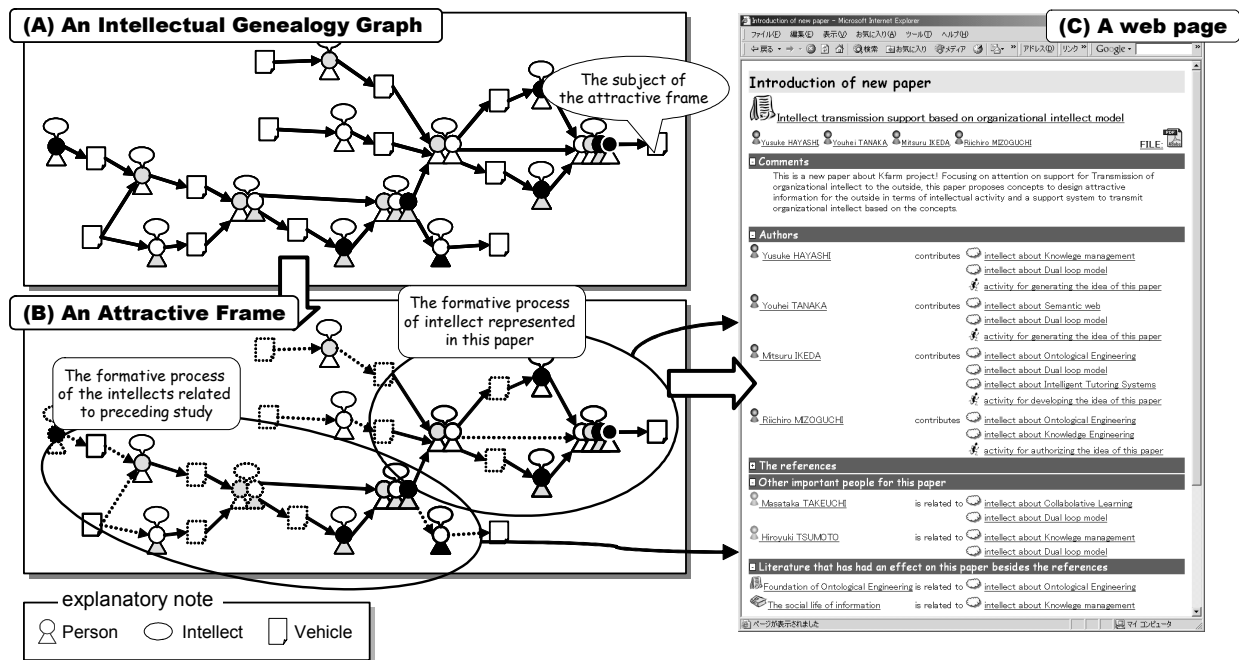explanatory note
⚇ Person ◯ Intellect ▢ Vehicle

Figure 3. The generation of a site-map model

- *Provide the lines of thought in Site-map design by Site pattern*: The site pattern describes noteworthy relations in IGG according to the intention of the disclosure. Based on the description, the environment provides for designers with the candidates for *Attractive frame*s as reference information.

- *Convert the content level model to the presentation level model*: The environment converts the content level model, which is represented by RDF, to the presentation level model, which includes web pages represented in HTML.

Figure 3 shows a site-map model generation image. Fig. 3 (C) shows an image of one of the web pages resulting from the generation. The web pages are included in the presentation level of the site-map model. Fig. 3 (C) displays a new paper just submitted to an international conference and the hyperlinks to those people, intellects, vehicles, and activities that are related to the intellect of the paper. The hyperlinks in this web page are set based on relations in the IGG (A).

Figure 3(A) shows an IGG, which has all nodes and links that are retrospectively accessible from the subject paper. Arrows indicate direct links among people, intellects, vehicles, and activities. A typical directed link means, for example, that a destination intellect is derived from a source one. The relations reflected in the hyperlinks are selected by the designer according to the intention of the disclosure. In this case, the intention specifically addresses the organization members' contribution to the subject paper. Tracing the links retrospectively from the subject in IGG, the designer prunes away confidential and irrelevant nodes to secure the disclosure infomation and render it to be easily understandable by outside entities.

Figure 3(B) shows an attractive frame extracted from IGG(A). The attractive frame has broken lines, which indicate that the links have been pruned away. The remaining nodes are important activities or intellects in the formative process of the subject. This extraction can reveal relations that are not described clearly in the vehicle. Finally, this model is converted to a web page as a presentation level model.

5. Metadata for organizational intellect disclosure

This paper defined the framework to describe contextual information of the organizational intellect. Contextual information includes people and vehicles that relate to the intellect, and the intellect's role. That contextual information is extracted from IGG. Metadata describing the contextual information are shown in Fig. 4.

These metadata show that a person made `medium#1`, named ontological engineering, with `intellect#1` through `intellectlevelactivity#1`. The meta data elements are defined in DLM ontology. A part of the ontology described with RDF schema is shown in Fig. 5.

6. Concluding remarks

This paper discusses organizational intellect disclosure support. That support is intended to activate intellect exchange and growth of mutual understanding among organizations. This study will also accumulate site patterns and develop a support environment using semantic web technologies.

```
<!DOCTYPE rdf:RDF [
 <!ENTITY rdf 'http://www.w3.org/1999/02/22-rdf-syntax-ns#'>
 <!ENTITY dc 'http://purl.org/dc/elements/1.1/'>
 <!ENTITY kfarm 'http://kfarm.mizlab.com/ns/example#'> ]>
<rdf:RDF xmlns:rdf="&rdf;" xmlns:dc="&rdfs;" xmlns:kfarm="&kfarm;">
    <rdf:Description rdf:about="uri:medium#1">
        <rdf:type rdf:resource="&kfarm;Medium"/>
        <dc:title>Ontology Engineering</dc:title>
        <dc:creator rdf:resource="uri:person#1"/>
        <kfarm:represent rdf:resource="uri:intellect#1"/>
    </rdf:Description>
    <rdf:Description rdf:about="uri:intellectlevelactivity#1">
        <rdf:type rdf:resource="&kfarm;IntellectLevelActivity"/>
        <kfarm:subject rdf:resource="uri:person#1"/>
        <kfarm:object rdf:resource="uri:intellect#1"/>
    </rdf:Description>
    <rdf:Description rdf:about="uri:intellect#1">
        <rdf:type rdf:resource="&kfarm;Intellect"/>
    </rdf:Description>
    <rdf:Description rdf:about="uri:person#1">
        <rdf:type rdf:resource="&kfarm;Person"/>
    </rdf:Description>
</rdf:RDF>
```
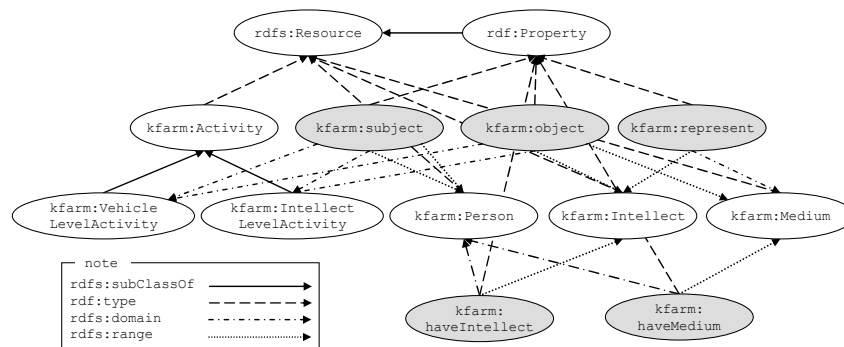
Figure 4. RDF description of the contextual information of an intellect

Figure 5. DLM ontology using RDF Schema

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