

The context analysis and the process of its formation

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Abstract. The development of the global economy and increased competition requires organizations to find new ways to enhance their competitive advantage. The most important and powerful source of important benefits organizations now have the knowledge and study of the subject – knowledge management processes. The efficiency of knowledge management depends on how these processes are interrelated infrastructure and processes of the organization to support the achievement of its objectives. To understand these relationships and present, not a simple list of elements and processes of the organization. Thus, we can conclude that requires an integrated structure in which all integrated dynamic coherent whole.

Key words: context, knowledge, type, processes, object, context models, control contexts.

INTRODUCTION

To date, the notion of context is used in linguistics, robotics, intellectual and mobile systems. At the same time, there is no common definition for the context for these industries [19]. Separate studies examine partial cases of the context or even their individual properties. This leads to a discrepancy in the interpretation and use of context-sensitive methods, the impossibility of reusing methods and models created for different industries and even for solving tasks in one industry.

Encyclopaedic and vocabulary sources give the following definition of the term “context”:

- The context is “interconnected conditions in which something exists or occurs” [3];
- “Situation in which something exists or occurs and which can be used to explain this”;
- “A set of conditions or facts that determine a particular event or situation”;
- “Conditions that form the environment for an event, sentence or idea, and they provide terms for their understanding”;
- In [20], the context is defined as “arbitrary information that can be used to characterize a particular entity.”

In this case, Context (lat. Contextus – close relationship plexus) – segment of the text written or oral language with a complete thought, which allows ascertain the meaning of a single word or phrase that part of it [1].

Conditionality context – a condition for meaningful use of a specific language units in speech (written or oral), taking into account its linguistic environment and situation of speech communication.

From a formal point of context is a system of reference namespace. Namespace called some set somehow related names or terms. Namespaces are an important part of the context of the use of names, since the name of the actual value may vary depending on whether the namespace is part of it [10].

Under artificial intelligence work related to knowledge bases and ontologies context is a part of the knowledge base, which is involved in the process of inference, solving some problems. Using context provides data and knowledge, current at the moment and meaningful for a particular task. Context narrows the field of databases or knowledge bases, forming a region with important information in this situation [2].

Knowledge – a form of existence and systematize the results of cognitive activity. Knowledge helps people efficiently organize their activities and to solve various problems encountered in its process. In a broad sense, knowledge – is a subjective image of reality in the form of concepts and ideas [3].

Examples of namespaces are IP addresses namespace Wikipedia, wildlife taxonomy, chemical nomenclature, UDC (Universal Decimal Classification) and others.

Objects context may make domain objects, tasks coming, methods in which context can manage knowledge domain. Given the development of information technologies and their focus on the user, the elements that make up the context expanded so that a user application and environment are also elements of context.

Context is any information that can be used to describe a situation in which there is currently an object, and information that can be obtained from the object, and the object as a user can be, environment, physical object and application. In respect of the application, the context provides information that affects decision making.

The above general definition clarifies the concept of situation. Characterized the situation arising from the interaction of objects. Thus, the context information

forms part of the space used by objects in their interaction [20].

Aspect application to use context allows, is not directly on the logical conclusion to limit it only important for the context of the rules or procedures. The context is a means to manage knowledge bases, thus avoiding redundancy and optimize knowledge extraction. Submission of context in a formalized allow interpretation based on user context to provide an explanation of the program, chosen solution, so the hypothesis. Thus, in terms of the application, the context makes better use of the resources of the environment in which the system operates. In terms of user context gives it valid, relevant and accessible for the solution of his task information [3].

TYPES AND PROPERTIES OF CONTEXT

Knowledge management is a systematic process by which knowledge needed for successful organizations are created, stored, distributed and used.

Today, knowledge – is the most important asset of modern organizations. Knowledge is information in context, able to conduct incentive to action understanding.

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Another way that knowledge is a question that arises in cognitive science (the science of thinking) in information technology and research in the field of artificial intelligence. In cognitive science it is related to the way people store and process information. In computer – with the selection of specific and generalized representation of knowledge, information and facts to collect and process information in a computer. The main problems in artificial intelligence is to learn to keep knowledge so that applications can intelligently handle them and achieve the same likeness of human intelligence

Researchers of artificial intelligence (AI) use the theory of knowledge of cognitive science. Techniques such as frames, inference rules and semantic networks came to AI theories of human information processing. Since knowledge is used to achieve intelligent behavior, the fundamental purpose of the theory of knowledge is to find ways of presentation that make possible the process of inference, ie the creation of knowledge with knowledge.

One of the problems in knowledge representation – how to store and process information systems knowledge in a formal way so that the machine could use them to achieve their objectives.

Expert systems, machine translation, and computerized maintenance system extraction and information retrieval (including database interfaces) need to formalize knowledge. Distribution of context on the species depends on respect of an object using a context or context for which it viewed properties.

Regarding the changes in the context that arise during interactions using context objects considered static and dynamic contexts. Static context includes the knowledge that no change in the interaction between

objects. They correspond to the knowledge of the subject area [4].

Dynamic context describes the changing of knowledge. The dynamic nature of context appears during use real context, for example, during the task.

Depending on the type of knowledge that have engaged in some situations, objects and knowledge used in this situation, there are three types of context:

1) The external context or contextual knowledge – part of the context of interest in this situation for the user. Contextual knowledge are the knowledge, implied or accumulated knowledge with which objects using the context encountered in the process of solving this or similar problems;

2) External knowledge – of the context, is not included in the contextual knowledge. The external context is not related to a specific problem to be solved, it is a knowledge further known to all installations using context;

3) Domestic or procedural context is part of contextual knowledge concretized according to the current target. That goal may be a solution to the current problem or performing certain actions. The amount of knowledge that make up the procedural context, should be sufficient to achieve the current goal [12].

In relation to the context-driven systems in the context of shared computing context, user context and physical context.

Computing context contains information about the connectivity of network nodes, bandwidth and immediate resources such as printers, monitors, workstations. The context describes the user profile of the user, the location and the current social situation. Physical context contains information about lighting, noise levels, traffic condition, temperature [5].

Regarding the proposed distribution of user context on the inside and the outside. Inside describes the state of the user. It can describe activities which involved customer personal information about him, his emotional state of others. External describes the environment in relation to the user, the location, the proximity of other facilities, time context. Also, this distribution may be called a physical rather than domestic context and instead external – virtual.

Another division of context with respect to the user includes:

- Physical context (the user's location and time);
- environmental context (weather, light, noise);
- user context (health, mood, planned activities);
- social context (group activity, the presence of the group);
- Context application (sent or received emails, visited web page).

In terms of man-machine interaction context consists of user context, the context of problem, context, context and application interaction [6].

In terms of representation obvious context for objects that use it produce explicit and hidden contexts. The interaction of objects context should include knowledge, known to all objects. Some of this knowledge can be described explicitly formalized or not, but it is assumed that all objects have this knowledge. These

include general knowledge (universal) knowledge or knowledge of each other object identified before, in previous stages of interaction. Said the knowledge is hidden (implicit) context. According clearly described knowledge are explicit context [19].

The basis of the separation of context on abstract and concrete is the same idea, which when divided by

explicit and hidden contexts. Abstract structure provides information that is potentially available items on the current situation. The concrete contains explicit description of the current situation. Sometimes called an abstract context outside.

There are several properties of the context given in Table.

Table. Properties context

Property	Consequence
1. Context arises at interaction of objects	Context makes sense to consider in the process of interaction between objects. In this case, the context describes a common, shared information known to all objects participating in the interaction.
2. General context that arises at interaction of objects includes context data objects	It is possible to perform inference under certain contexts within the overall context. Moreover, within the overall context of forms of inference (eg, non-monotonous logical conclusion, robotics, pattern designs) may be different. In case of contexts that make the general context distinguish the context of problem, and this problem can be decomposed into subtasks and context – context subtasks respectively, for each solution subtasks can use a mechanism opinion.
3. Background to the interaction of objects can be changed	The consequence of changes in the context caused by this change in contexts related relationships.
4. Context includes implicit knowledge and information	This property has two implications: 1) as much contextual information should be presented explicitly; 2) the use pattern of change and the context can display new context based on previously used contexts.
5. Context can describe a relationship between elements of abstract models and specific application data abstractions	This property is therefore the possibility of creating the current context used abstract context that in the future may be specified for other conditions. The process of creating an abstract context are called decontextualization.
6. The main purpose of context provide relevant and accurate information objects that are involved in cooperation to solve the current problem (achieving current goals)	Interpreting used object context, you can get relevant information to solve the current problem.

PRESENTATION CONTEXT MODELS

Task presentation context is a formal description of the subject matter of observation method of observation. Model based on the presentation context used formalism. Below are some model representation of the context used in different approaches and systems:

- Contextual logic – applied to the context, which is defined as a set of axioms.

This logic is an extension of first-order logic, where treated as axioms are true or not within a certain context. Context given formal object and attitude ist (c, p), where c – Context, p – an axiom.

The ratio ist (c, p) declares that the axiom is true in the context of p c. Management context by using the axioms that “move” which, in

turn axiom transferred from one context to another. Moved axiom in a new context should have the same truth-conditions that it had in its original context[7].

- Propozycyjni expression – above axioms expressed offerings are used to formalize contexts in bahatokontekstualniy Cyc knowledge base.

According to the related ist (c, p) context is defined as a set of agreed propozycyjniyh statements. Scope

context defined set of objects, conditions, etc., for which statements about them are true. Between contexts established hierarchical relationships that allow contexts generate different depth of detail. Management context by using procedures that perform logical conclusion statements described in the general context in specialized contexts.

- System Rules – used for context, describing the structure of knowledge.

Formalism rule system represents the knowledge structure package rules.

Use presentation at the rules and the level of knowledge base.

Presentation at filtering rules operated expressions.

Presentation at the level of knowledge bases divides knowledge base to set some small database driven directly to the rules, causing packets to the rules of the “then”, or the interaction between packages of rules for information exchange [8].

- Frames – framing an approach to represent the context used in the approach, based on models of knowledge representation system laid down in Protégé.

This approach is the context ontology data sources described by means of a global ontology.

- Context-sensitive graphs – context-dependent graph is a directed acyclic graph with a unique input and output and a series-parallel organization vertices connected oriented arcs.

The top can be used to represent actions, context-dependent concept recombination top or subgraph. Action meets executable method, context-dependent concept – a concept that is implementing in this context, the recombinant top – general concept (More abstract concepts), subgraph – a sequence of executable methods used in solving the problem. The ratio between the peaks show the sequence of actions. If there are several different options such sequences, these variants are closed recombination node that branches after passing sequence fixes that branch worked.

Management is in the context of dynamic conditions in the solution. It is based on fixing that which is context-dependent concept gained realization at the moment and, conversely, that the procedure has worked, freeing realization and turning them into abstract elements.

- Situational theory – in this model context is a set of attributes that describe the situation in general (abstract object in situational theory).

A set of attributes assigned values characterizing the specific situation (situation makes implementation of the abstract). Management context based on the ratio describing rules depending on contextual information. On the basis of these rules shall spread changes in related contexts. To promote the changes can be used by service messages sent message services concerned changes in contextual information (attribute values and a set of attributes) [9].

Other models include context: the context as some splitting semantic network context as part of the contextual system context as part of the tree of knowledge, and others.

As SIDS (system of intellectual decision support) designed to work with the knowledge of such systems for the most interesting presentation context model based on the model of knowledge representation. Modern and promising model used for knowledge representation and, consequently context is the ontological model. This model allows us to structure the accumulated information and provides semantic interoperability of objects involved in the interaction [13].

CONTEXT CONTROL

The main issue related to the research and application context – is to identify relationships between contexts and contexts of adaptation to current conditions and problems. Management collects context, interpretation, storage and distribution of contextual information in dynamic mode and the discovery of the relationship between contexts by which it becomes possible to effectively control contexts.

1) The collection of contextual information – the definition of what information should be included in a context, and that the best way of organizing.

Adding context to be considered relevant to the situation information includes descriptions of conditions and factors affecting that make this a unique situation and clear. The information included should contain directly

derived data pattern of the data and knowledge that currently known objects that interact. Adding all these types of data can detect hidden information out of context.

2) Interpretation of context – the problem of interpretation associated with the development of mechanisms that allow to use the collected information as appropriate for the specific conditions for specific purposes.

Because as sources of information can serve diverse distributed sources, the implementation of these mechanisms through raising the level of abstraction of context. By way of abstraction are dekontekstualizatsiya contextual information integration contexts, connections and contexts decomposition [15].

3) Decontextualization – a concept associated with obtaining permanent general context, derived from the specific terms and expressions that characterize a situation.

The idea is based on the context of interaction can include several private contexts. Thus, there is a general context that covers these private contexts. The resulting overall context of the future can be reused in other situations through its refinement..

4) Integration contexts – in the integration context is meant to connect multiple contexts into one. Integration of contexts used for:

- supplement the information contained in one context, information on the other; receiving context that can be used by application software to solve certain problems;

- improving the reliability of contextual information.

Can integrate both homogeneous and heterogeneous contexts (contexts received in accordance with the set of homogeneous or heterogeneous sources of information).

5) Decomposition – splitting into its component context – subkonteksty that can be crossed on the basis of certain characteristics (method of organization subkontekstu owner subkontekstu version subkontekstu, date and time of creation, etc.).

Decomposition allows only the portion of the database or knowledge that is relevant to the current task. It also allows you to copy pieces of context, re-assemble them for other purposes, etc.[18].

6) Storage and accumulation of contextual information.

Since the task of organizing the contextual information associated with the involvement of historically accumulated data and knowledge, the problem of storage of contextual information. Information should constantly accumulate, even if at the moment not interested in the business applications because over time you may receive an application, which will need to obtain specific history context. Thus, the accumulation and storage of contextual information is not associated with a particular application program and should be carried out independently. Having accumulated information allows re-use existing knowledge to identify hidden knowledge to predict the situation and intentions of the user [16].

7) The transfer of information from one context to another or exchange of contextual information.

This problem is a problem of an adequate understanding of the interaction contexts participants each

other, and the problem of abstraction context. In forming a general or abstract context covering several private contexts should correctly reflect the information described in the context of objects involved in the interaction. With the transfer of information related to the problem of context transfer content between different formats and languages and problem representation transfer rules inference from one context to another [17].

8) Modifying and updating context.

Although the problem of modifying and updating the context is clearly not part of the process of organizing content of information mention of it stems from the fact that the procedure modifications and updates are used to track dynamic changes in context. These changes include:

- expanding context for the addition of a supplementary information;
- change specific values contained in the local (particular, private) context;
- changes in the abstract context;
- changes in accounting contexts that are associated with varying ratios context (distribution changes).

History context consists of storing all performed on the data context changes.

There are types of relationships that may exist between contexts:

- inclusion – when one context whole or in part contains another;
- hierarchical mounted between contexts as specification (specification) with one other context;
- withdrawal when contextual information is determined logically deduced from known contextual information.

Based on the identified properties of context and context analysis models and problems solved in the management context, defines requirements for context management [14].

THE ONTOLOGICAL MODEL AS THE MOST CONVENIENT ALTERNATIVE PRESENTATION CONTEXT

The emergence of ontological knowledge representation model provided the opportunity to receive context-based structured knowledge domain.

In terms of method of presentation context, it should be described by standardized methods that provide independent way of presenting the platform. The model of knowledge representation must support operations to create a context and management. The most convenient way to represent context that meets modern requirements, ontological model is considered to represent information and knowledge. Context-dependent representations ontological model are:

- 1) Concepts representing objects involved in the situation;
- 2) Properties of concepts that represent the location of objects and time;
- 3) Restrictions on the fundamental situation.

In recent years the development of ontologies – explicit formal description of the terms of the domain and relationships between them – moves from the world of artificial intelligence labs for desktops experts from domains. The World Wide Web ontologies have become

commonplace. Ontologies network range from large taxonomies that categorized websites (eg, Yahoo!), to categorize products and their characteristics (eg, Amazon.com). The consortium WWW (W3C) develops RDF, speech coding knowledge on Web pages to make them understandable to electronic agents searching for information.

Office of Policy Research and Development US Department of Defense (The Defense Advanced Research Projects Agency, DARPA) in collaboration with the W3C develops markup language Agents DARPA (DARPA Agent Markup Language, DAML). In many disciplines developed standard ontologies that can be used by experts of the subject areas to share and annotate information in their field.

For example, in the medical field created great standard, structured vocabularies such as SNOMED and semantic network Unified Medical Language System (the Unified Medical Language System).

Ontology defines a common vocabulary for researchers who need to share information in the subject area. It includes machine-interpreted the wording of the basic concepts of the domain and the relationships between them [16]

CONCLUSIONS

Knowledge is an integral part of the life of mankind. Possession by certain knowledge enables you to feel the benefits of awareness, act according to the surrounding conditions and to develop, adapt and expand their horizons, and thus acquire qualities such as speed, flexibility, strength and reliability. This includes not only living systems, such as a human, but dead – namely, the various organizations that are created and exist through the production of human activities, and systems that are the result of scientific human activities, such as existing and emerging systems of artificial intelligence and context-driven systems of intellectual decision support.

Context plays an important role in the acquisition and use of knowledge. It considered the types and properties of context representation model context and the main task context management, including: collection, interpretation, storing and distributing context information in dynamic mode and identify relationships between contexts by which it becomes possible to effectively control contexts. Thus, the context is an effective way to manage knowledge bases, thus avoiding redundancy and streamline the process of obtaining knowledge.

REFERENCES

1. **Brezillon P. 1999** Context in Artificial Intelligence: I. A Survey of the Literature / Brezillon P. // Computer & Artificial Intelligence, No. 4, pp. 321–340.
2. **Burov Y. 2014** Business process modelling using ontological task models // Econtechmod : an international quarterly journal on economics in technology, new technologies and modelling processes. – Lublin; Rzeszow., – Vol. 3, No. 1. – pp. 11–22.

3. **Dey A. K. 2001** Understanding and Using Context / Dey A. K. // *Personal and Ubiquitous Computing*, No. 1, pp. 4–7.
4. **Fridman N. 1997** Hafner Ontology Design: A Survey and Comparative Review // *AI Magazine*, No. 18 (3), pp. 53 – 74.
5. **Gavrilova T. A. 2000** Bases of knowledge of intellectual systems / Gavrilova T. A. , Khoroshevsky V. F. – St. Petersburg: Peter. – 382 p.
6. **Gavrilov A. V. 2003** Hybrid Intelligent Systems / Gavrilov A. V. – N.: NSTU. – 164 p.
7. **Gruber T. R. 1993** A translation approach to portable ontology specifications / Gruber T. R. // *Knowledge Acquisition*, Vol 5, pp. 199–220.
8. **Hitzle P. 2005** What Is Ontology Merging? A Category- Theoretical Perspective Using Pushouts / Hitzle P., Krötzsch M., Ehrig M., Sure Y. // *Proc. First Intern. Workshop on Contexts and Ontologies: Theory, Practice and Applications (C & O)* held in conjunction with the 20th National Conference on Artificial Intelligence (AAAI-05), 2005, Pittsburgh, Pennsylvania: AAAI Press, pp. 104–107.
9. **Jackson P. 2001** Introduction to expert systems / Jackson P., M.: Williams, 624 p.
10. **Konev B. 2010** Decomposing description of logic ontologies / Konev B., Lutz C., Ponomaryov D., Wolter F. // In *Principles of Knowledge Representation and Reasoning: Proceedings of the Twelfth International Conference*, May 9-13,2010, Toronto , Ontario, Canada: AAAI Press, 2010.
11. **Kuzmin O. Ye. and Melnyk O. H. and Shpak N. O. and Mukan O. V. 2012.** The concept of creation and use of the polycriterial diagnostics systems of enterprise activity, *Econtechmod*. An international quarterly journal on economics in technology, new technologies and modelling processes, Vol. I, No. 4, pp. 23–28
12. **Lyons J. 2003** Linguistic Semantics: an Introduction / Lyons J, Cambridge University Press, 376 p.
13. **Natalya F. 2001** Ontology Development 101: A Guide to Creating Your First Ontology / Natalya F. Noy, Deborah L. McGuinness // *Stanford Knowledge Systems Laboratory Technical Report KSL-01-05 and Stanford Medical Informatics Technical Report SMI-2001-0880*, 23 p.
14. **Osuga S. 2001** The processing of knowledge / Osuga S., M.: Mir, 293 p.
15. **Pomerol J.-Ch. 2001** About Some Relationships between Knowledge and Context / Pomerol J.-Ch., Brézillon P. // *Modeling and Using Context (CONTEXT-01)*, Dundee, Scotland. *Lecture Notes in Computer Science*, Springer Verlag, pp. 461–464.
16. **Spitsyn V..G. 2001** Knowledge bases and expert systems / Spitsyn VG, T.: TPU, 88 p.
17. **Spitsyn V..G. 2007** Representation of knowledge in information systems: textbook / Spitsyn V. G., Tsoi Yu. R., T.: TPU, 160 p.
18. **Smirnov A. V. 2009** Models of context-driven decision support systems in dynamic structured domains / Smirnov A. V., Levashova T. V., Pashkin M. P. // *Proceedings of SPIIRAS*, No. 9, pp. 116–147.
19. **Smirnov A. V. 2004** Formation of the task context for intellectual support of decision-making. / Smirnov AV, Pashkin MP, Shilov NG, Levashova TV, Krizhanovskii AA // *Fundamental Foundations of Information Technologies and Systems. Proceedings of the Institute of System Analysis of the Russian Academy of Sciences*, No. 9, pp. 125–188.
20. **Winograd T. 2001** Architectures for Context / Winograd T. // *Human-Computer Interaction*, pp. 2–3.