

ГАРМОНИЗАЦИЯ КИБЕР-ФИЗИЧЕСКОГО ОБЩЕСТВА

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Настоящая статья представляет новый тип облачных услуг, названный «Удовлетворение потребностей как сервис» (SNaaS), который включает в себя инновационный образовательный сервис, который мы назвали «Вездесущее руководство».

SNaaS гармонизирует деятельность людей в рамках иерархии социальных и личных потребностей, обрабатывает данные о текущей ситуации, генерирует и выполняет оптимальные сценарии поведения (или управляет их выполнением).

«Вездесущее руководство» обеспечивает пользователей всесторонними ответами на вопросы, недостающими компетентностями и пошагово инструктирует пользователя в ходе его деятельности.

Ключевые слова: облачный сервис; «Удовлетворение потребности как сервис»; «Вездесущее руководство»; обучение «сверху вниз»; теория потребностей и проблем.

This article highlights a new type of cloud service, named Satisfaction of Needs as a Service (SNaaS) that includes innovative educational approach, named Pervasive Guidance.

SNaaS harmonizes the human activities under hierarchy of social and private needs, processes current situation, generates and carries out optimal scenario of behavior (or guides its implementation).

Pervasive Guidance provides users with comprehensive answers to the questions, with missing competences, and step-by-step instructs users in the implementation of their activities.

Key words: cloud service; Satisfaction of a Need as a Service; Pervasive Guidance; Top-Down eLearning; Theory of Needs and Problems.

1. Introduction

According to the forecast of Cisco company 50 billion things and devices will be connected to the Internet till 2020 year.

The number of sensors and things, successfully applying in many fields, continually grows. For example, Libelium company (Spain), using their own hardware (Wastmote) provides application for Smart Cities, for Smart Environments, for Smart Water, for Security&Emergencies and others [13].

Nevertheless, by now there is no clear view how sensors and things will be represented and available.

EVERYTHING Company [14] thinks about a Facebook for Things™, where individual objects, just like people on social networks, have their own unique digital profiles that enable communications, apps and services (Fig. 1).

«The next step for the ‘Internet of Things’ is to bring physical objects on to the Web to become part of its application environment. In this Web of Things™, applications can be developed on top of the open and simple standards that made Web so successful (REST, XML, HTTP, Atom), physical objects can have the same attributes as other resources on the Web: linkable, discoverable, searchable, mashable and therefore usable» [14].

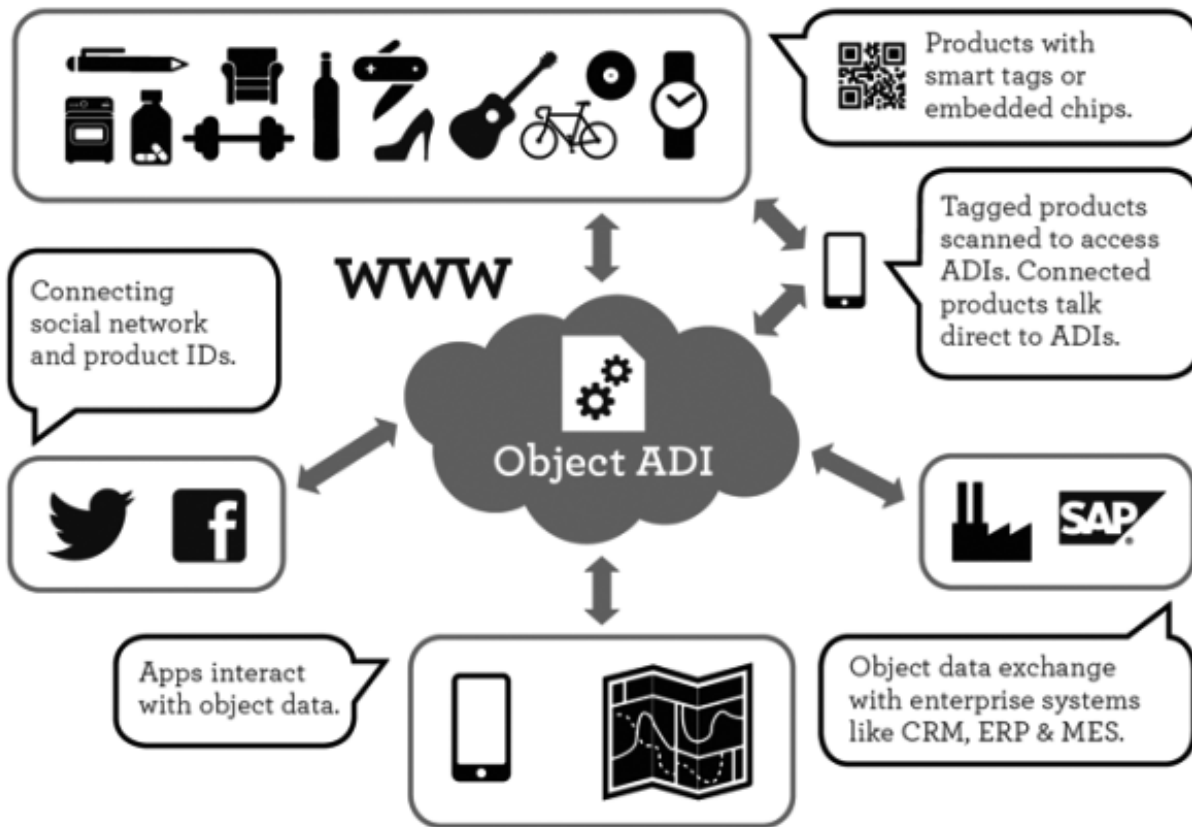


Fig. 1. How Web Object Technology Is Putting Every Physical Thing On The Web (EVERYTHING’s vision)

Similarly, SENSEI (an Integrated Project in the EU’s FP7) offers human Internet-like rendezvous service (directories, search engines, etc.), to allow a user to locate suitable resources based on desirable properties.

«A central entity in the SENSEI system model is the SENSEI resource. Conceptually resources in the SENSEI system provide unifying abstractions for real world information and interaction capabilities comparable to the web resources in the current Web architecture: in the same way as a web user interacts with a web resource (e.g. retrieve a web page), she can interact with real world resources (retrieve sensor data from a sensor resource)» [15].

Such human Web-like vision inevitably will lead to the need for development of semantic search engine in the space of «smart» devices and things. Given that until now Web semantic search engine doesn’t exist, there are not reasons to hope for the solving of same task for IoT.

To successfully find missing information, the keys of its representation and the search re-

quest must match. It means that the same engine should provide both representation and search.

Just such engine provides a functioning of SNaaS.

But Cyber-Physical Society’s (CPS for short) problems are not limited by the need in quick search of the adequate resources. A survival in CPS requires efficient procedure of an Activity Recognition on the one hand, and Guidance of Activity on the other hand.

A need in Activity Recognition is a need for a recognition of processes that runs in the given environment segment.

A need in a Guidance of Activity is a need in automatic processing of data, stemming from cyber-physical environment and user, in a generation of optimal scenario of its behavior, its support and in a processing of intermediate results.

Since cyber-physical ambience is continuously changed, both persons and enterprises more and more find themselves in a middle of obscurity. Soon a Human mind will no longer be able to master new and new competences.

Therefore a Guidance of Activity is CPS's top-priority task.

If a system provides Activity Recognition and Guidance of Activity, it is aware of the user's activities. Such system can coordinate and optimize people's activities to avoid resource squandering and unreasonable consumption of energy.

We represent SNaaS, as a system that satisfies above-mentioned needs of Cyber-Physical Society.

The rest of this article is structured as follows: Section 2 defines basic concepts of Theory of Needs and Problems, a significance of needs' hierarchy for Cyber-Physical Society and nominates SNaaS as Global Needs Satisfaction service of Cyber-Physical Society; Section 3 defines the basic principles of Cyber-Physical Society harmonization; Section 4 provides the conclusion.

2. Hierarchy of Needs

A central entity in the SNaaS system model is *a need*. Fig. 2. defines fundamental needs.

According to Theory of Needs and Problems [1] *a need* is a necessity to obtain something that is vital important for a person, for an enterprise, for a government, for a social group, or for the society as a whole, and *a problem* is a need for a renewal of a process of given need's satisfaction (*an activity*) in cases of its interruption or irregular intermediate results.

Vital to our life activity factors constitute a set of *Basic Needs*.

Social status stipulates certain standard of the well-being (i.e. a certain financial, cultural, family, and educational conditions).

A fundamental spiritual (as well as physical) need is *a need in internal and external harmony*.

In everyday life a person collects, systemizes, updates and puts into practice data, related to his needs.

In the Theory of Needs and Problems such information cluster is known as Need Satisfaction Domain (*NSD* for short). Any *NSD schemata* contain information of the need's origin, methods of the need's detection, available set of need's satisfactions (*workflows*) under different resources and also known possible problems that appear in the course of need's detection or during workflow.

Hierarchy of needs represents directed graph (Fig. 3).

Private NSDs are limited by personal experience, and as a rule, deal with narrow subset of real NSDs.

It is important to note that *individuality is expressed by a set of his needs and by features of these needs' satisfaction*.

Significance of needs' hierarchy for Cyber-Physical Society. An obsolescence of knowledge lasted 100 years in the XVIII and the XIX century. Now it takes about 3 years. In the CPS knowledge environment will be updated permanently.

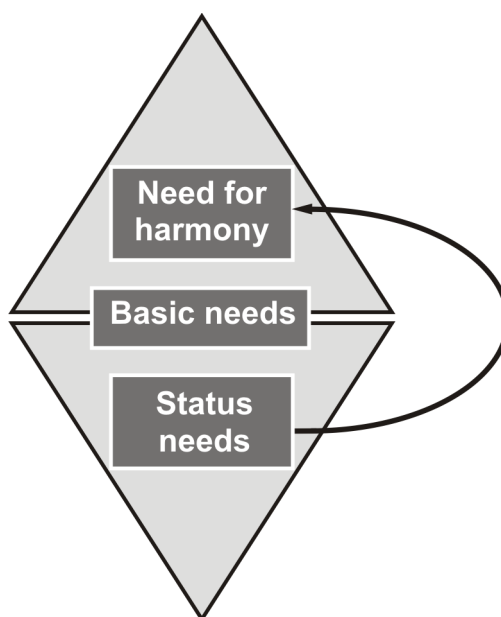


Fig. 2. Fundamental needs

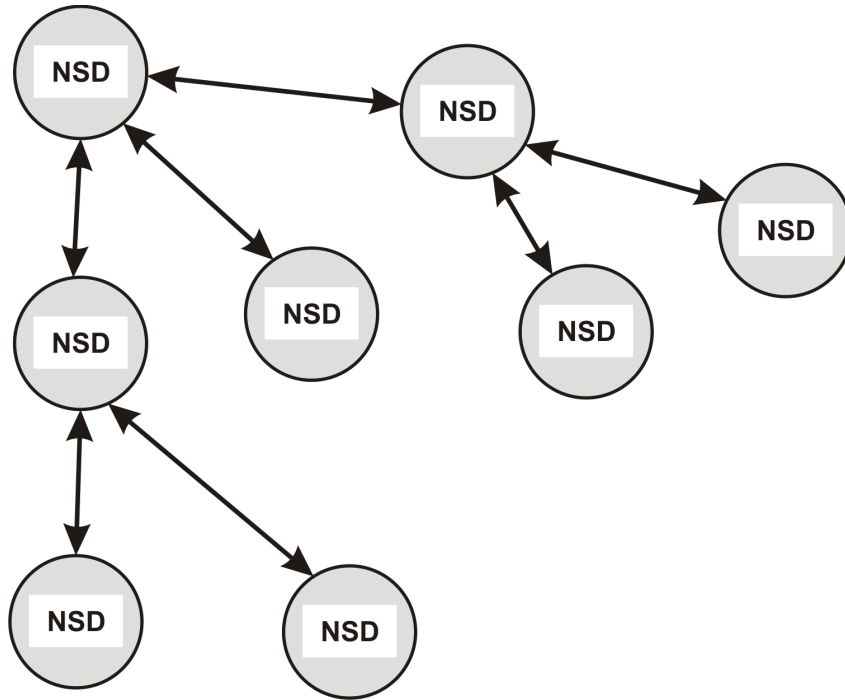


Fig. 3. Fragment of hierarchy of needs

How do people master knowledge?

Philosophers and psychologists from Immanuel Kant to these days [2-8] convincingly proved that knowledge is stored in our mind in form of schemata.

In Theory of Needs and Problems we consider knowledge as an instrument of reasoning, and reasoning as an instrument of a need's satisfaction.

Since any person (as well as any enterprise, a family, a community or a government) creates his own hierarchy of needs, he builds schemata of NSDs.

But resources (time, place, devices, equipment, finances, skills, actors, etc.) as well as workflows are changed continuously in Cyber-Physical Society. Hence, there is no sense to memorize temporary information, related to resources and activities.

It means that CPS's member shouldn't build detailed NSDs' schemata.

What remains?

Cyber-Physical Society's members will build and memorize only their own comprehensive hierarchy of needs.

What does comprehensive hierarchy of needs means?

It means that any CPS's member represents his own needs as causally-ordered composition

of related sub-needs, which are detailed as deep as possible.

Depending on nesting depth, the sub-need's composition means either preferable set of qualities/actions or generic framework of an activity.

A framework of professional activity should be continually updated and linked with Common Social Hierarchy of needs.

Every professional is obliged to insert into Common Social Hierarchy of needs both his activity in generic form of nested sub-needs and results of any socio-meaningful job, accompanied with a composition of needs that can be achieved by means of these results. Thereby, particularly, all resources and devices will be described in standard form.

What else?

CPS's members should know how to satisfy their needs in the optimal way under the circumstances.

To achieve this,

- any cyber-physical environment's object must be uniquely identified;

- any CPS's member should possess personal device that recognizes unique identifiers;

- CPS should possess *Global Needs Satisfaction service* that receives discovered unique identifiers, defines (or obtains from user) current need's name, processes relevant segment of

Common Social Hierarchy of needs, *recognizes current activities and generates optimal behavior scenario on the basis of known user's key resources (time, place, finances);*

— furthermore, Global Needs Satisfaction service provides user with comprehensive support of the optimal behavior's scenario (necessary training and explanations, a processing of intermediate results, etc.);

— Global Needs Satisfaction service, being aware of current activities of CPS's members, provides a coordination of their activities for an attainment of maximal efficiency under a minimization of resources and consumption of energy.

We define *SNaaS as Global Needs Satisfaction service for CPS.*

3. Self Regulation of Cyber-Physical Society

A society develops in the direction of a satisfaction of public and personal needs. Use of high technologies for the satisfaction of needs converts human habitat to heterogeneous and changeable cyber-physical environment.

Cyber-Physical environment embraces clouds, computers, communicating objects (including local area networks), sensors, smart devices and uniquely identifiable Things (IoT) (Fig. 4).

Human activity is serviced by objects of Cyber-Physical environment, which number has been increased recently. Soon it will grow a lot more. In the near future all equipment, tools, mechanisms and devices used by humans, will become smart devices and IoT objects.

Adapting an activity to circumstances (to the situation), a human changes a configuration of used tools and devices.

It becomes more and more difficult to make the optimal decision, in consideration of growth rate of cyber-physical environment, a complexity of modern technologies and a necessity of economy of resources and energy consumption.

In this connection a survival itself (both economical and physical) in the cyber-physical-informational space requires huge expenditure and efforts. Continuous assistance in form of pervasive guidance of human behaviour becomes actual need.

Thus a survival of society as a whole depends on its ability to self-regulation.

Society cannot intervene in the private life and in private business. But it can help people to

optimize and organize private life, private business and adjust it to social needs, social norms and requirements.

Any person, any enterprise, any community regulates life activity, on the basis of hierarchy of one's needs, and manages current activities, to satisfy the needs under optimally allocating resources (budget, time, place, skills, actors, tools, equipment) between activities.

We consider that self-regulation of society is possible to carry out similarly.

A. Cyber-Physical Society.

Hai Zhuge defined the Cyber-Physical Society as «*a multi-dimensional complex space that generates and evolves diverse subspaces to contain different types of individuals interacting with, reflecting or influencing each other directly or through the cyber, physical, socio and mental subspaces*» [11].

We define the Cyber-Physical Society as a *society, where people satisfy their needs using cyber-physical environment.*

We agree with Hai Zhuge that «Connecting various networks and machines with nature, society, and even human minds, we can create a new world...» [12].

We can use Cyber-Physical environment for monitoring of the social and private processes as well as for the harmonization of these processes.

SNaaS is destined for the achievement of this goal.

B. Correlators of the Cyber-Physical Society harmonization.

Likewise a regulation of the private life, a harmonization of CPS is a harmonization of actual activities under a hierarchy of needs and a minimization of resources. Theory of Needs and Problems provides unique framework for the accumulation of useful experience in the satisfaction of needs and in problem solving.

Interfaces with cyber-physical resources are inserted, as transactions, into the descriptions of available experience. Cyber-physical resources, used in runtime of any activity, make virtual network, which functionality is caused by current need. A specifics of new situation entails a new topology of cyber-physical resources that is a new virtual network.

Thus SNaaS administers cyber-physical environment and dynamically provides network

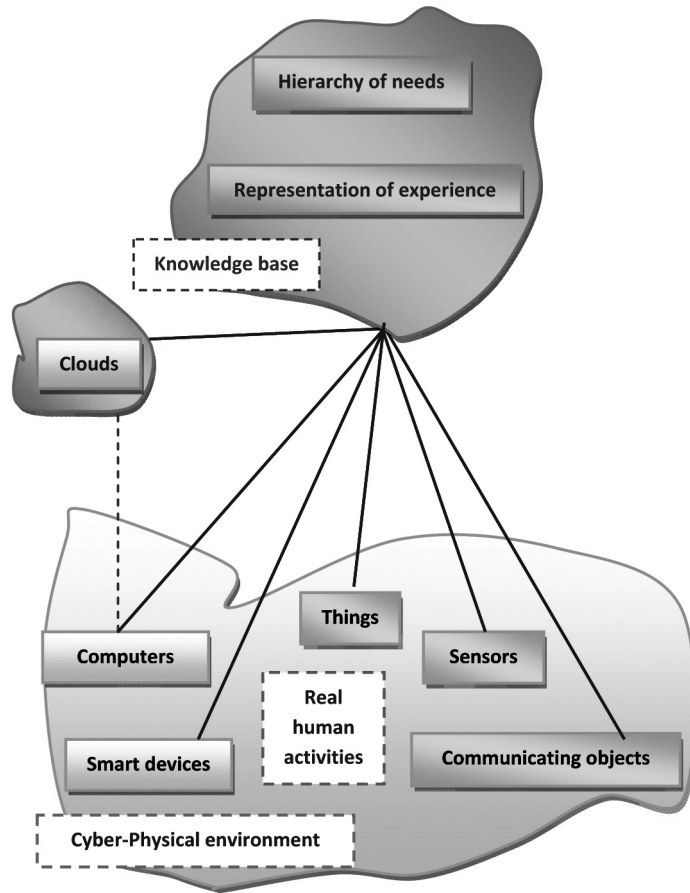


Fig. 4. Components of Cyber-Physical environment

virtualization, by means of which it serves activities, aimed to the satisfaction of needs.

SNaaS notation defines as *CPS correlation vectors* existing limits of resources (of raw material, of energy, of time, of place, of specialists, of human resources, of equipment, etc.) as well as limits of permissible level of radiation, permissible level of carbon dioxide and other ecological parameters.

A harmonization of CPS's state and CPS's processes by means of CPS correlation vectors becomes a key need of modern society that is continuously serviced by SNaaS through a monitoring of cyber-physical environment.

Processing data, stemming from cyber-physical environment, IoT and end-users, SNaaS builds complex services and big data's management by means of a multi-layered cloud service. SNaaS implements correspondent activities and operations, applying cloud services, hierarchically and semantically embedded one into another. Implementing, controlling and supporting end-user activities, SNaaS minimizes energy consumption and human resources.

Being aware of the end-user's needs and their actual activities, SNaaS impacts on socio-economic sphere, combining efforts of different social groups, communities, enterprises and persons in achieving their common or identical goals.

Thus SNaaS creates and supports dynamical social and economical networks, using experience of participants for the achieving their goals in minimal time and with minimal expenses.

4. Conclusion

SNaaS is a provider of innovative intelligent cloud services that satisfies user's needs and solves real-world problems, processing data that stem from end-users, IoT sensors, smart devices, communicating objects, business transactions, social networks, search engine logs, etc. as well as from an innovative knowledge base that accumulates generic and private human experience.

SNaaS is destined to serve a new society of 21 century, namely, Cyber-Physical Society.

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