Telecommunications Reinvented

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***Abstract*— The paper addresses evolution of telecommunication services during last few decades with the focus on return of some old concepts from ISDN, IN, B-ISDN, in a new form, and on emerging ideas like Web 2.0. It is also a pretext to come back to the roots of the concept of communication in order to take a fresh look at and to evaluate whether and to what extent we are witnessing reinvention of telecommunications as communication in a broad sense that includes the social aspect in the virtual dimension.**

***Index Terms*— telecommunications, services, communication, convergence, NGN, IMS, ISDN, IN, Internet, Web 2.0.**

I. Introduction

DURING the last few decades path of development of telecommunications revealed recurring of some already well known ideas. It is a good starting point for consideration of current trends of evolution of electronic communication in the context of return of some of these old ideas in a modified form and also new concepts and solutions. Convergence of telecommunications, Internet, IT and media and liberalization of the market opened new opportunities for operators, service providers (including non-ICT companies without own network infrastructure such as MVNO) and made possible that the same or similar services could be offered by players traditionally present in other markets. It leads to increased competition stimulating innovation and resulting in broader and more attractive offer of services for the customers. Even a layman notices dynamics of change when compares his or her new mobile phone with the previous one bought just two or three years ago. These observations inspired the paper and encouraged the author to come back to the roots of meaning of the communication concept and to take a fresh look at current telecommunications, e.g. Next Generation Networks (NGN) to analyze to what extent it has been "reinvented" both in technical and pragmatic – user viewpoint terms.

Communication in its broad meaning is one of the most important aspects of our life, civilization and economy. Everyday life and activities of societies could hardly be imagined without communications. Colloquially speaking communications is a process of exchange of information among its participants. According to Charles Cooley society consists of a network of communication between component actors and subgroups. Therefore, the process of communication, more particularly its embodiment in public opinions, cements social bonds and insures consensus. In other words, public opinion does not emerge from prior agreement but from reciprocal action of individual opinions upon each other - from the clash of ideas in the process of communication.

In Cooley's view [7] communication is "*the mechanism through which human relations exist and develop—all the symbols of the mind, together with the means of conveying them through space and preserving them in time. It includes the expression of the face, attitude and gesture, the tones of the voice, words, writing, printing, railways, telegraphs, telephones, and whatever else may be the latest achievement in the conquest of space and time*".

Etymologically the concept of "*communications*" origins from a Latin verb - *communico*, *communicare*, denoting: *make common*, *join*, *convey somebody a message*, *deliberate* and a noun - *communio*, denoting community, sense of communion. Until the sixteenth century it has denoted *participation*, *sharing* and later on new meaning was introduced – *transmission*, *transfer*, *order* (e.g. postal) due to development of roads and postal services.

The term communication has been defined in many ways for many purposes. Klaus Marten has conducted an analysis of some 160 definitions proposed by many researchers and concluded the concept can be interpreted in the following ways:

1) Communication as transmission.
2) Communication as understanding. Communication is a process evoking understanding and meaning. Effective communication requires meeting of the following conditions:
   - there exists a sender,
   - transmission follows,
   - a channel for communication is available,
   - there exists a receiver (paying attention to the process),
   - a common language was agreed,
   - a process was scheduled,
   - there exists a goal or goals of communication.
3) Communication as stimulus-response act.
4) Communication as relationship.
5) Communication as interaction.
6) Communication as exchange.
7) Communication as a social behavior.

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When considering communication a model of information flow should be also taken into consideration. Typically the following types of information flow are distinguished:

1) Allocution. Mainly unidirectional transfer with a limited feedback (e.g. a lecture, sermon, speech).
2) Conversation.
3) Consultation.
4) Registration.

II. MIGRATION TO NGN

The reported analysis of many interpretations and meanings of the "communication" constitutes a basis for consideration of the "telecommunications" concept today. It should be emphasized that a traditional concept of telecommunications has been replaced by the term "electronic communication" to reflect ongoing process of convergence with Internet and media. In the following we will still use the term "telecommunications" which both covers legacy domain as well as new domains.

According to a narrow basic definition telecommunications is a domain of science and technology dealing with transmission of all types of information over distances. It is also a legal term defined by the telecommunication or electronic communication law. According to the latter definition telecommunication is sending, receiving or transmission of different type of information, by means of conduits, radio or optics, or other means using electromagnetic energy.

Referring to the earlier discussion of the communication term we will define telecommunications as communication over distances in a broad sense. Due to this approach new definition includes social, semantic and context aspects which emerged because of convergence of Web 2.0/3.0 with telecommunication services. It also covers significance of an intuitive user interface (e.g. touch screens) and integration of distributed content from many remote sources in a single application (mash-up). It can be argued that new ideas related to evolution to NGN and development of Internet actually implement the idea of returning to the roots of communication in its original old meaning with one addendum – broadening the concept to a virtual domain. This observation can be used as a valuable hint and inspire development of new innovative services.

When analyzing a vision of versatile NGN based on Common IMS one can notice that a conceptual framework was elaborated in the 70s, 80s and 90s. The key enablers establishing basis for future networks and services were:

1) Full digitalization of networks
2) Mobility
3) Broadband
4) Integration of networks and services
5) Flexibility of service scenarios
6) Step by step opening of networks and service delivery platforms to third parties
7) Evolution of Internet
8) Liberalization of the telecom market.

The idea of service integration in a fully digital network with convergence of the circuit and packet switching was embodied by the ISDN concept which was developed in the early 80s. It was the first successful technology attempt to integrate voice and data. Lack or limited competition slowed down its development at that time. The acronym was ironically interpreted as „Integration Subscribers Don't Need" or „It Still Does Nothing". Later in the 90s the number of ISDN subscribers started to increase due to its support to dial-up Internet access, especially in Europe.

ISDN was a case of evolution of telecommunications stimulated mostly by progress in technology. Signaling, service model and many technical solutions were inherited by GSM which could be treated in a sense as "mobile ISDN" (e.g. SMS service was based on one of the ISDN supplementary services - UUS).

According to the ITU-T definition, NGN is "A packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service related functions are independent from underlying transport-related technologies. It enables unfettered access for users to networks and to competing service providers and/or services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users."

The NGN architecture is characterized as follows:

1) Packet-based transfers.
2) Separation between control functions, call/session, and application/service., which constitutes the next step beyond IN/CAMEL SDPs and Parlay APIs.
3) Support for a wide variety of multimedia services and applications based on service building blocks.
4) Broadband capabilities with end-to-end QoS (Quality of Service).
5) Interworking with legacy networks using open interfaces.
6) Unrestricted access of users to different service providers.
7) Converged services between fixed and mobile telephony.
8) Full independence of services from the underlying transport technologies.

NGN shall provide the necessary capabilities (infrastructure, protocols, etc.) to allow the creation, deployment and management of services through standardized APIs (Application Programming Interfaces).

III. NGN, IMS, SDPS AND INTERNET

IMS has been defined as a part of the UMTS Release 5 (and subsequent releases) standard by the 3rd Generation Partnership Project (3GPP). It is a SIP protocol based generic architectural framework for delivering voice, multimedia and data communication services to mobile and fixed users. IMS breaks the traditional isolated, dedicated, per-service

architecture stove-pipe vertical model, and introduces an open application-oriented horizontal solution. It is a catalyst for convergence of services and adds security, charging and billing and Quality of Service to the IP and Internet world.

However it was originally elaborated as an evolution of the UMTS mobile networks, currently, IMS has been playing since Release 8 a role of the common, core network architecture framework for both mobile, fixed and cable networks, the so called Common IMS. It represents now a reference architecture implementation of the Next Generation Networks (NGN).

The 3GPP IP Multimedia Subsystem (IMS) provides the interfaces for interaction and underlying communication control infrastructure. The IP Multimedia Subsystem has been defined and evolved from 3GPP Release 5 specifications on as overlay architecture on top of the 3GPP Packet Switched (PS) Core Network for the provision of real time multi-media services.

The service delivery entity in IMS is the IP-based application server (AS), which hosts and executes services, and interfaces with the network using the Session Initiation Protocol (SIP). The goal of the AS is to allow third party providers an easy integration and deployment of their value added services into the IMS infrastructure. IMS defines three types of AS, each with a specific role:

1) SIP AS: This is the native IMS application server, hosting value added services and triggered by the S-CSCF. The SIP AS utilizes resources such as the Home Subscriber Server (HSS) or User Profile Server Function (UPSF) to store and lookup the identities and information used in calls and sessions made by subscribers.
2) OSA-SCS: an Open Service Access - Service Capability Server interfaces with application servers using OSA/Parlay API. As such, SCS is more not a gateway than a regular application server. However, from the S-CSCF point of view, applications reside at the SCS. SCSs allow application servers to view and get access to IMS and legacy wireline and mobile networks. SCS provide a level of network abstraction by exposing the network capabilities via OSA/Parlay APIs. The SCS allows current service subscribers, which are on legacy fixed and mobile networks, to access the new IMS service features. This conversion function is critical to ensure the business cases for IMS remain viable by allowing coexistence of IMS and legacy fixed and mobile infrastructure.
3) IM-SSF: The IM-SSF is another gateway server. It provides interworking between IMS and a CAMEL service environment by bridging SIP and CAP protocols in ISC interface. From the S-CSCF point of view, it is treated as an application server with access to an IN network (CAMEL platform).

Due to the fact that the IMS overlay architecture is widely abstracted from their interfaces, the IMS can be used for any mobile access network technology as well as for fixed line access technology as currently promoted by ETSI TISPAN within the NGN reference architecture definitions (Releases 1 to 3).

The term Service Delivery Platform (SDP) denotes a system architecture or environment that enables the efficient creation, deployment, execution, orchestration and management of one or more categories of services. As such, the SDP is the key component of the telecom Service Layer.

The SDP has emerged as a result of telecom network architecture evolution. Evolution towards a unified convergent network with a horizontal service architecture replacing separate specialized vertical legacy networks and platforms represents a stable trend in telecommunications. This enables efficient service delivery across multiple types of networks, as well as for the creation of Web and IT applications that utilize operators' network capabilities.

Currently SDP is typically built using the Service Oriented Architecture (SOA) paradigm which enables efficient service integration, orchestration and lifecycle management. SDP is instrumental in service migration from legacy networks to all-IP networks and the standard NGN/IMS architecture.

The most important standards that affected evolution of SDP space are: SIP (Session Initiation Protocol), SIP Servlets, IMS, OSA/Parlay and Parlay X APIs, JAIN SLEE, OMA PEEM (Policy Evaluation, Enforcement and Management), and OMA Telecom Web Services.

IV. Conclusion

A perspective of development and deployment of NGN services is based on blending of experience legacy telecommunications with web applications representing emerging new ideas, of which the most important is context awareness in a broad sense. The context may include: presence, availability, willingness to interact, location, social aspect (group communications, user generated content, content sharing, folksonomies). Important part of it is opening networks to the third party developers and service providers. A trend towards mobile, ubiquitous, seamless, access agnostic, convergent model of using services – "triple A": Any device, Anytime, Anywhere, can be also identified. It includes also ad hoc and Machine to Machine communications - M2M.

To more and more extent communications becomes only a catalyst or even maybe a kind of utility which might be seamlessly embedded in any application or a device which are used for collaboration, dissemination of information, providing security, advice and guidance, entertainment exposing its original social context.

New vision of networks and services gives incentive to go to the origins of the "communications" concept by returning to its roots and again emphasizing its social aspect. In a sense we have been witnessing now reinventing of telecommunications as the communications in a broad sense and a virtual dimension. A taxonomy of telecommunications based on the discussion in the paper is depicted in Figure 1.

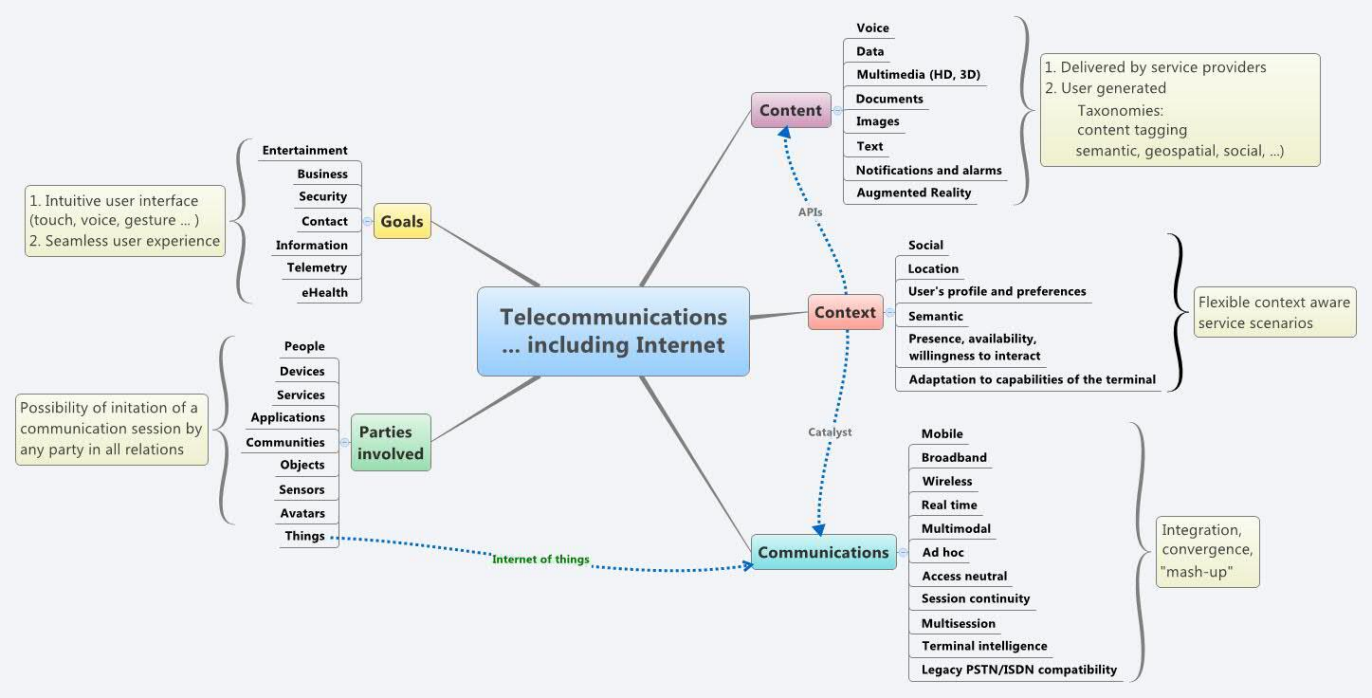

Fig.1 Telecommunications – a taxonomy

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