Describing Next Generation Communication Services: A Usage Perspective

Emmanuel Bertin[1] and Noel Crespi[2]

[1] Orange Labs - France Télécom R&D - 42 rue des Coutures 14066 Caen, France
emmanuel.bertin@orange-ftgroup.com
[2] TELECOM SudParis - 9 Rue Charles Fourier, 91011, Evry Cedex, France
noel.crespi@it-sudparis.eu

Abstract. Telecom services are usually described from an applicative perspective. Service providers should yet describe formally what their services do for their users, in order to adapt them to user's needs and to compose them. We propose here a framework to describe communication services from a usage perspective, by describing formally the actions of the service users and of the service provider. This description is then used as a common library to compose new services and to check the consistence of these composed services.

1 Introduction

Telecom services evolve toward Next Generation Communication Services, also named user centric services, designed to fulfil user's needs instead of focusing on technologies and protocols. Similar evolutions are ongoing in multiple service area, like healthcare or education services. As user's needs are various and diverse, a single service can not be suitable for all communication needs: Different services must cooperate. How can this cooperation be achieved?

First, as learnt from software engineering, the various services should be kept separated with explicit boundaries, and not tightly integrated. This is usually referred as the loose coupling principle. Each service is responsible for a give task, and offers a public and well defined interface to other services. In addition, cooperation between services requires a common understanding of what each service do, i.e. a shared service description. Current service description languages like WSDL (Web Services Description Language) are focused on software aspects (API description) and not on what achieve the service for its user. This lack is especially underlined with communication services, where the value is not in data treatment, but in the quality of the user interaction and in the reliability of the executed tasks.

In this paper, we propose to describe communication services from the user point of view, by describing the actions from both the service users and the service provider. This paper is structured as follows. In section 2, we briefly survey the evolution toward user-centric services. We then study in section 3 the related work on the description of communication services. Next, we introduce in section 4 the notion of action to describe services and illustrate it step by step with the email example. The last section provides some conclusive remarks.

P. Mähönen, K. Pohl, and T. Priol (Eds.): ServiceWave 2008, LNCS 5377, pp. 86–97, 2008.

2 Toward User Centric Services

2.1 Trends and Motivations

Communication services are part of a broader story; their usage evolves in accordance with the transformations of the whole service sector. In addition to information and telecommunication, the service sector at large includes for example healthcare and social assistance, educational services, finance and insurance or public administration, as classified for instance in the North American Industry Classification System [1]. The current and future economic growth of the developed nations is mainly driven by the service sector, as reminded in Table 1.

Table 1. Sectoral shares in employment, Developed Economies and European Union [2]

	Employment in sector as share of total employment	
Year	1997	2007
Agriculture sector	6.1%	3.9%
Industry sector	28.3%	24.5%
Services sector	65.6%	71.5%

These rates witness our societal transformation from an industry society into a service society, as surveyed for example in [3], [4] or [5]. In an industry society, driven by mass market production, even services are considered as products, developed and marketed like products. In our service society, services are driven by individual and specific needs. As a single service entity is not able to meet alone the needs of users, a service is more and more considered as a composition of basic services. We observe this evolution in various social fields like healthcare services, education services or employment services: the trend everywhere is to enhance the "user experience" by making cooperating different entities to meet a unique user need [6]. The same trend can be noticed in IT.

According to this trend, service organizations are shifting from a product-centric paradigm to a customer/user-centric paradigm, as surveyed for example in 2006 by Shah [7], Day [8] or Kellogg [9]. Where the product-centric approach consists basically in selling products to whomever is ready to buy it, the customer/user-centric approach consists in serving customers/users by taking into account their needs. Rust [10] underlines even that "we witness the rise of “mass service,” driven by improved coordination and a greater availability of information. Whereas mass production focused on the product, the new philosophy is customer-centric."

2.2 User Versus Customer

We should draw here a distinction between users and customers. When considered with a product-oriented mindset, a service is seen as a delivery according to a client

order. When considered with a service-oriented mindset, a service is seen as a value co-creation process between the service consumer and the service provider, as established clearly by Tien [11] or Spohrer [12]. The more recent researches on services emphasize indeed that the user is directly implied in the value creation process of the service.

This is even more accurate with the rise of the audience economical models, where services are free and where service providers are remunerated by advertisers. The value of a service for a service provider is thus correlated with its capacity to drain advertising incomes. This capacity is itself correlated with the value of the service for users. In an audience model, the primary actor is thus no more the customer (the one who pays the bill), but the user (the one who sees the ads). Service providers should then consider the usefulness of their services for users. We have thus to investigate what is a service as seen by the user, and not only as designed or operated by the provider.

2.3 Services as Systems

Services at large are studied in marketing, in sociology and in organization management studies. Some of these studies are now merging with IT studies around a thematic named service science or SSME for Services Sciences, Management and Engineering [13].

Services are not standalone and tangible entities like products. A product does exist without clients, but a service does not exist without users. This is usually referred as the inseparability of production and consumption [14]: A service can not be considered independently of its consumption, of its usage. To reflect this, many authors envisage a service as a system [11, 12] composed from business actors (user and provider), from products and technologies (including hardware, software, protocols), and from a service logic (or service processes) linking the whole. This system is connected with other service systems.

Now, let us come back to communication services. First, communication services are evolving as presented above: they are more and more considered as a composition of basic services, they more and more follow a user-centricity paradigm, they are integrated in a whole service system. In addition, communication services are interactive services. Following [15], communication services can thus be classified as user-intensive. This means that the user provides significant inputs in the service logic.

We focus in this paper on the service logic that links the service user and the service provider, taking into account the interactive nature of communication services. We propose a high-level service description method to specify the interactions of users and providers. Let us review now the existing ways to describe communication services.

3 Existing Approaches to Describe Telecom Services

Describing telecom services is not a novel issue. As surveyed recently in [16], this has been a recurrent task in the telecom world, first inside the Intelligent Network paradigm, then through the TINA-C (Telecommunications Information Networking

Architecture consortium) initiative at the end of the 90ies, and more recently at ITU-T, ETSI or at the OMA (Open Mobile Alliance) [17]. At the same time, in the IT world, the service description issue has been mainly considered through the SOA (Service Oriented Architecture) paradigm, and the SOA approach is now percolating through to telecom services. Moreover, the semantic web community has also focused on this issue and its methods are now considered for describing telecom services, for example in European projects like Spice [18].

3.1 Telco Initiatives

Inside the telecom world, the first comprehensive initiative for modeling services has been the Intelligent Network, developed in the 80ies. A service is viewed from a user perspective as a collection of service features that complement a teleservice, where "a teleservice is a type of service that provides the complete capability, including terminal equipment functions, for communication between users" [19]. For example, the Call Forwarding feature complements the telephony service. Theoretically, this model enables to compose service feature to form new services, but, as acknowledged in [16], this possibility was never exploited. Norms mention service features nearly anecdotally, without defining structuring rules or composition rules. Service feature are defined as significant functions from the user point of view, but why and how these functions are significant is not clear. In summary, telecom operators and vendors have forged and have used the IN concepts with a product-oriented mindset, to sell nearly standardized services where users were interchangeable.

The TINA initiative tried to overtake the IN shortcomings, but did not specify a high-level service description language, focusing rather on a generic service session concept that should fit to every kind of services.

As surveyed in [20], ITU-T, ETSI and OMA have introduced more recently the concept of service building block. These service building blocks are called "Service Capabilities" by the 3GPP, "Service Support Capabilities" by the ITU-T and "Service Enablers" by the OMA. Service Support Capabilities studied at the ITU-T [21] typically include presence, location, group management, message handling, broadcast/multicast, push and session handling or device management. Service Enablers at the OMA [22] include for example data synchronization, device management, digital rights management, downloading, e-mail notification, instant messaging, presence and mobile location or multimedia messaging. Service capabilities defined at the 3GPP typically include presence [23] and messaging [24] or conferencing [25]. The functional implementation of these service building blocks is described in the according standards. But there is no high-level description method to specify the added value for the end-user and to position these building blocks one over the other.

3.2 IT Initiatives

Inside the IT world, innovation is mostly driven by the Information Systems (IS) evolutions. In order to adapt their IS to the service era, companies had to break the boundaries between their various applications [26]. The IT world has forged the Service Oriented Architecture (SOA) paradigm to overcome the lack of cooperation

between various software applications. Applications should no more be considered as standalone entities, but divided into services, i.e. discrete and independent units of business that perform a specific task and that are only accessible through an open and well-defined service interface.

Companies have discovered that the main challenge to apply this SOA paradigm was not a technical challenge. The main issue is indeed to identify and define the services, these discrete and independent units of business. Which part of the business should be considered as services? Should the services be fine grained (one function per service) or coarse grained (many functions per services)? How to ensure independence between services? How to ensure that the services suit to the enterprise business and strategy? How to identify the services that are necessary to meet a specific need? In the enterprise IT context, these questions may be answered by considering the enterprise business processes, as they describe the internal activity of the enterprise. Nevertheless, the services offered to end-users are usually not described through business processes, as indicated in [27]. With a product-oriented mindset, the main assets of a firm are indeed the efficiency of its internal processes, and not the service it offers to its users.

Moreover, when building and composing such IT services, most software engineers tend, in the end, to consider the user as a system component, providing inputs and requesting outputs like a software component (as surveyed for instance in [28]). This is not really a trouble for data services, which goal is to provide data that are treated to fulfill user needs. But concerning communication services, the complexity and the value of the service do not rely in the data treatment, but in the exchanges between the service users (e.g. caller and callee) though the service provider and in the way these exchanges are presented to the user, as detailed in [29]. As a consequence, communication services engineers are usually attaching great importance to protocols (like SIP, SMTP…) that describes the exchanges between parties.

3.3 Semantic Web Initiatives

The semantic web community has also widely studied mechanisms for service description, taking into account the added value of the service, as surveyed for instance by Zhixiong [30] or Arroyo [31]. Projects like Spice [18] aim to build a marketplace of services, where a user can request a service in (nearly) natural language. A service is then constructed according to his needs, by composing the existing services of the marketplace. The value is here more brought by the marketplace and its users, than by the service providers that become indeed interchangeable.

We saw above that the role of the user is shrunk when a service is considered with a product-oriented mindset. With this semantic marketplace, the role of the service provider is shrunk instead, the key actor being the marketplace provider that supplies a way to access to service resources. If this model seems effective for data services (e.g. with search engines like Google), it is not the case for communication services. Gmail is for example a "classical" email service provider and not something like an "emailing marketplace". Community and user experience are essential for communication services. As mentioned before, the value of communication services do not come from their data assets, but from the exchanges between three parties: the

service user, the service provider and other service users that communicates with the first one. This three-party model cannot be decomposed into 2 two-party models. In other words, the network effect is important for communication services, as illustrated for example recently with Skype or Facebook.

In addition, like in the IN approach of service features, there is no method to identify and to classify what do a service. One could argue that this classification can be done automatically through ontology mechanisms, as the features of a service are described using a semantic language. But as surveyed by Bedini in [32], such automated tools are indeed really pertinent when they build up on an existing classification.

Finally, the integration upon the existing services and platforms is definitively a tough issue, both technically and functionally. Technically, the introduction of new technologies and software tools is required (e.g. for ontology). Functionally, the web semantic paradigm follows an open world assumption, as described for instance in [33] that is not easily compatible with a component based architecture, where component are loosely-coupled (each component is a "closed world", a black box that offers services to other components).

4 Modeling Service Actions

Inside the SOA or semantic web paradigms, some studies attempt to link the offered services and the needs of the users, in order to achieve an automatic matching between users and services. However, these studies largely fail to model user needs because their variety and diversity. No framework can model in detail the needs of a human being and high level hierarchy like the Maslow pyramid (as proposed for instance in [34]) are not very useful to match precisely needs and services.

To take into account the previously mentioned shortcomings, we propose to describe a service through the exchange between the service user and the service provider. By representing formally such exchanges, we intend to describe in a formal way the added value of the service for its end-users (as mentioned, a service may imply several users, for example caller and callee for a telephony service). Our service description is based on the human language, which is a shared institution, rather than on human needs or goals.

4.1 User and Provider Actions

In our view, the concept of action is the most adapted tool to describe this exchange between service user and service provider. Service user and service providers interact by performing actions. For instance, a caller requests a phone call and the telephony provider then delivers the call to the callee. Both the call request (action of the user) and the call delivery (action of the provider) are seen by users as a part of the service.
By action of the user, we do not mean the concrete action done on the GUI (Graphical User Interface), but the immaterial activity, that the user is trying to perform. For example, the action of sending an email is not a matter of clicking on a send button (GUI), but of effectively sending an email. This accomplishment might be enabled by clicking on a button, but this GUI aspect is not considered here.

In summary, actions done by users and service providers within the course of a service are not a matter of GUIs. It is neither a question of service platforms or service infrastructure. So we have now shifted from the "how to describe what services do" question to the "how to describe the actions of users and provider within a service" question.

4.2 Describing Actions

We propose to establish these action descriptions on the language usage. As stated by John Searle (widely noted for his account of social reality) in [35]: "My dog has very good vision, indeed much better than mine. But I can still see things he cannot see. We can both see, for example, a man crossing a line carrying a ball. But I can see the man score a touchdown and the dog cannot (…). To see a touchdown scored he would have to be able to represent what is happening as the scoring of a touchdown, and without language he cannot do that." In our case, we can observe that actions are usually described with the same words within a given service, whatever the service provider. For example, the words "signing in" indicate the action of logging in into the provider's system, or the term "send" in a webmail context indicates the action of sending an email. We could observe the same in other European languages than English. This leads us to identify the actions that are common for communication services.

The description of the actions to consider for a given communication service are chosen according to the following criteria.

- First, their description should be a usual answer to the "what are you doing?" question or to the "what is the service provider doing" question. What are you doing? I'm writing an email. I'm checking my mailbox. I'm talking on the phone…
- Then, these actions should be known by the user as mandatory to perform the service. Delivering an email is for instance mandatory to the email service, but adding a smiley is not.

4.3 The Example of Email

Let us illustrate our approach with some services around email. Our first step consists in identifying actions and actors. The email service involves 3 parties: the email sender, the email service provider and the email receiver. All these 3 roles interact to perform the email service. We can identify the following actions:

- Contact selecting action (by email sender)
- Message composing action (by email sender)
- Message sending action (by email sender)
- Message delivering action (by email service provider)
- Mailbox checking action (by email receiver)
- Message reading (by email receiver)

Moreover, we observe that some actions require another action to be achieved before. For example, Message composing is required before Message sending. We

describe this fact with dependencies between actions. We can establish the following dependencies for any email service:

- The message composing action requires the selection of a contact to whom the email will be sent.
- The message sending action requires the composition of a message.
- The message reading action requires both the checking of the mailbox by the receiver and the delivery of the message by the email provider.
- The mailbox checking action requires the signing in of the receiver as a principal in the email provider system (the term principal is used here according to the Liberty Alliance vocabulary (http://www.projectliberty.org) and mean someone whose identity can be authenticated).
- The signing in action requires the subscription of an email account by a customer of the email provider (signing up action).
- The message delivering action requires the validity of the email address from the receiver, and so the subscription of an email account in the email provider system.

These actions and their dependencies are then manipulated with the semi-formal UML syntax, as represented on the figure 1. Actions are modeled as UML classes. These classes are tagged with the stereotype <<XXX>>, where XXX stands for the actor that performs the action (for example <<sender>> for an action performed by the party that sends an email). The dependencies are modeled with standard UML dependencies, graphically represented with a dotted arrow. We are using the

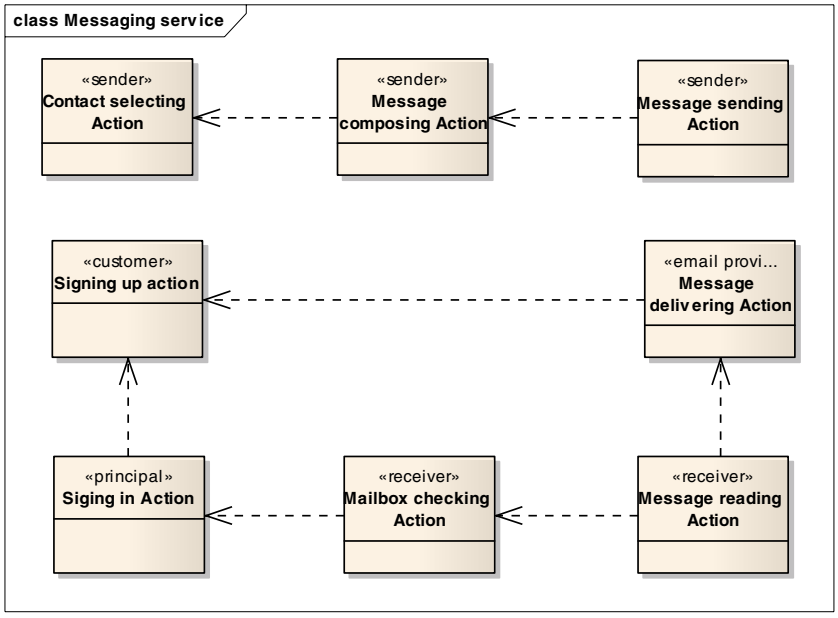

Fig. 1. Emailing actions

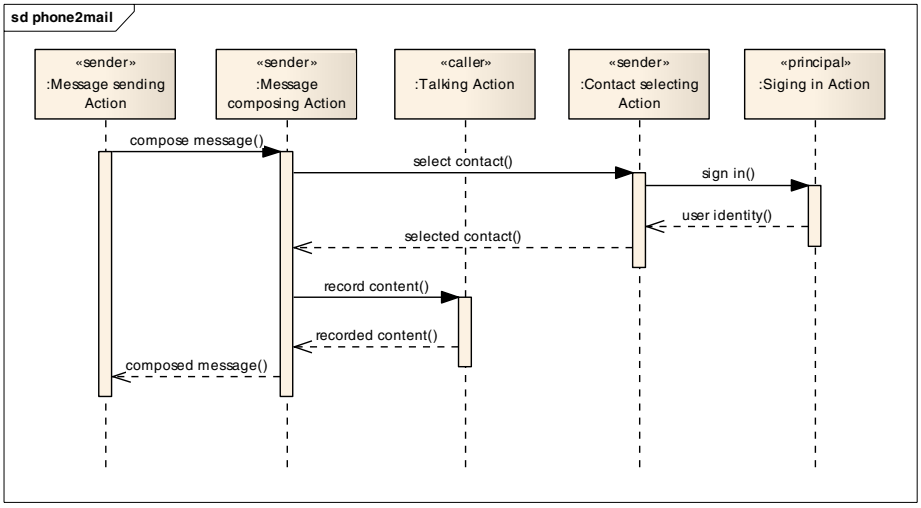

Fig. 2. Phone2mail actions

Enterprise Architect (from Sparx Systems) UML tool as a repository for our service descriptions. We have achieved these descriptions for the main communication services, like making and receiving calls, connecting to a communication network, sharing a personal context, signing in, signing up, watching video or hearing music, setting privacy parameters. We have identified so about forty different actions involved in the commonly used communication services.

Our second step consists in using these action descriptions as a library to describe new services. For instance, let us imagine a service to dictate emails. The service user selects a contact in his address book, triggers the service and then dictates its message, which is sent as an email to the aforementioned contact, through an attached audio file. Let us suppose that this service is marketed as the "phone2mail" service. The previous service description is rather clear but informal. It can not be shared within a formal service repository, nor interpreted by machines. With our communication action library, we can model it as an UML sequence diagram, as shown on figure 2.

The order of the sequence is not a temporal order, but a requirement order. The object at the left side of the sequence indicates the final purpose of the phone2mail service that is to send a message. The continuous arrows indicate a requirement and the dotted arrows indicate the information that is returned to fulfill the requirement. The temporal order is usually the opposite of the requirement order (the user first signs in, then selects a contact, then composes his message by talking and finally sends it).

With this formal description of service actions, we can verify the logical consistence of a service by checking if its particular chain of actions respects the general dependencies established above and represented on the figure 1 for email services. In the case of the phone2mail service, the sequence is coherent with these

dependencies. For example, the phone2mail service sequence is coherent with the dependency from the Message composing action toward the Contact selecting action.

Moreover, we can also deduce from this diagram the actors of our phone2mail service. The phone2mail user should also act as a principal for authentication, as an email sender and as a phone caller. In summary, we have here represented formally the phone2mail service with a UML sequence diagram that makes use of a common action library.

Within our UML repository, we have modeled several services provided by Orange, using this common action library. This enables us, in a third step, to compare objectively these services because they use the same description method and semantic. We are now working with the marketing business units in order to make use of this repository at the business level. This will enable marketers to describe formally their offers and to compare them with existing ones. This will also enable them to browse existing offers, especially in order to reuse existing services to build new ones.

5 Conclusion

User centricity is a key challenge for services in general and for next-generation communication services in particular. In order to adapt services to user's needs and to compose them, service providers should be able to describe formally what their services do for their users. We propose here to achieve this goal by describing formally the actions of service users and of service providers, using a common library of actions. This way to describe services is worked with marketers in order to build a conceptual tool that suit to their needs. They can in particular build new services by recomposing existing actions and check the consistence of this service according to existing logical dependencies between actions.

We plan to further investigate two topics. First, we are going to link these service descriptions with technologies like IMS (IP Multimedia Subsystem) or SDP (Service Delivery Platform) by considering the technical patterns (protocols, reference points…) behind them. Then, we will study how to compose automatically a service in a web environment, according to a sequence of actions.

References

1. North American Industry Classification System 2007 (Naics), US Dept. of Commerce (September 2007)
2. Global Employment Trends: January 2008, International Labour Office (2008)
3. Chesbrough, H., Spohrer, J.: A research manifesto for services science. Commun. ACM 49(7), 35–40 (2006)
4. Spohrer, J., Vargo, S.L., Caswell, N., Maglio, P.P.: The Service System Is the Basic Abstraction of Service Science. In: Proceedings of the 41st Annual Hawaii international Conference on System Sciences. HICSS, January 07 - 10, 2008, p. 104. IEEE Computer Society, Washington (2008)
5. Child, J., McGrath, R.G.: Organizations unfettered: Organizational form in an information-intensive economy. Aced. Manaement Journal 44(6), 1135–1148 (2001)

6. Zeithaml, V., Bitner, M., Gremler, D.: Services Marketing: Integrating Customer Focus Across the Firm, 4th edn. McGraw-Hill, New York (2006)
7. Shah, Denish, Rust, Roland, T., Parasuraman, A., Staelin, Richard, Day, G.S.: The Path to Customer Centricity. Journal of Service Research 9, 113–124 (2006)
8. Day, G.S.: Aligning the Organization with the Market. MIT Sloan Management Review 48(1), 41–49 (Fall, 2006)
9. Kellogg, K.C., Orlikowski, W.J., Yates, J.: Life in the Trading Zone: Structuring Coordination Across Boundaries in Postbureaucratic Organizations. Organization Science 17(1), 22–44 (2006)
10. Rust, R.T., Miu, C.: What academic research tells us about service. Commun. ACM 49(7), 49–54 (2006)
11. Tien, J.M., Berg, D.: A Case for Service Systems Engineering. J. Systems Science and Systems Eng., 113–128 (March 2003)
12. Spohrer, J., Maglio, P.P., Bailey, J., Gruhl, D.: Steps Toward a Science of Service Systems. Computer 40(1), 71–77 (2007)
13. http://www.research.ibm.com/ssme/
14. Gronroos, C.: In Search of a New Logic for Marketing: Foundations of Contemporary Theory. John Wiley & Sons Inc., Chichester (2007)
15. Pinhanez, C.: Service Systems as Customer-Intensive Systems and Its Implications for Service Science and Engineering. In: Proceedings of the 41st Annual Hawaii international Conference on System Sciences. HICSS, January 07 - 10, 2008, p. 117. IEEE Computer Society, Washington (2008)
16. Simoni, N.: Sous la direction de, Des réseaux intelligents à la nouvelle génération de services, Lavoisier (February 2007)
17. http://www.openmobilealliance.org/
18. http://www.ist-spice.org
19. Keck, D.O., Kuehn, P.J.: The Feature and Service Interaction Problem in Telecommunications Systems: A Survey. IEEE Transactions on Software Engineering 24(10), 779–796 (1998)
20. Bertin, E., Ben Yahia, I., Crespi, N.: Modeling IMS Services. Journal of Mobile Multimedia 3(2), 150–167 (2007)
21. Carugi, M., Hirschman, B., Narita, A.: Introduction to the ITU-T NGN focus group release 1: target environment, services, and capabilities. IEEE Communication Magazine 43(10), 42–48 (2005)
22. OMA, OMA Service Environment, Approved Version 1.0.4, 01, OMA-AD-Service-Environment-V1_0_4-20070201-A (February 2007)
23. 3GPP, Presence service using the IP Multimedia (IM) Core Network (CN) subsystem; TS 24.141, version 7.4.0 (September 2007)
24. 3GPP, Messaging using the IP Multimedia (IM) Core Network (CN) subsystem; TS 24.247, version 7.2.0 (June 2007)
25. 3GPP, Conferencing using the IP Multimedia (IM) Core Network (CN) subsystem, TS 24.147, version 7.6.0 (September 2007)
26. Rouse, W.B., Baba, M.L.: Enterprise transformation. Commun. ACM 49(7), 66–72 (2006)
27. Bertin, E., Fodil, I., Crespi, N.: A business view for NGN service usage. In: 2nd IEEE/IFIP International Workshop on Broadband Convergence Networks, 2007. BcN 2007, pp. 1–5, May 21 (2007)
28. Lamb, Kling: Reconceptualizing Users as Social Actors in Information Systems Research. Management Information Systems Quarterly 27(1), Article 2

29. Bertin, E., Lesieur, P.: Which architecture for integrated services? In: ICNS 2006. International conference on Networking and Services, p. 62 (2006)
30. Zhixiong, J., Leqiu, Q., Xin, P.: A Formal Framework for Description of Semantic Web Services. In: Proceedings of the 7th IEEE international Conference on Computer and information Technology. CIT, October 16 - 19, 2007, pp. 1065–1070. IEEE Computer Society, Washington (2007)
31. Arroyo, S., Lopez-Cobo, J.M.: Describing web services with semantic metadata. Int. J. Metadata Semant. Ontologies 1(1), 76–82 (2006)
32. Bedini, I., Gardarin, G., Nguyen, B.: Deriving Ontologies from XML Schema. In: Proceedings 4émes Journées francophones sur les Entrepôts de Données et l'Analyse en ligne (EDA 2008), Toulouse, France, June 5 - 6 (2008)
33. Patel-Schneider, P.F., Horrocks, I.: A comparison of two modelling paradigms in the Semantic Web. Web Semant. 5(4), 240–250 (2007)
34. Cai, H., Chung, J., Su, H.: Relooking at Services Science and Services Innovation. In: Proceedings of the IEEE international Conference on E-Business Engineering. ICEBE, October 24 - 26, 2007, pp. 427–432. IEEE Computer Society, Washington (2007)
35. Searle, J.R.: What is an institution? Journal of Institutional Economics 1(01), 1–22 (2005)