A Study Of Openness in 3G

Mehdi Khorasani†, Dr. Lionel Sacks‡

† Lucent Technologies, ‡ UCL, Departement of E&EE

Abstract: Openness in telecommunication networks is a major challenge the telecom industry is experiencing. Layered architectures, the introduction of Intelligent Networks both in fixed and mobile networks, standardisation of protocols for interfaces, programmable networks, open network APIs are some approaches in this direction.

This paper takes a look at openness in telecommunication systems from three different angles, i.e. commercial, architectural and engineering and reviews issues related to the subject in each area.

1. Introduction

Service delivery models in data communication systems and telecommunication systems are rather different. In the former systems, the core network is purely a routing network and data services are defined at the periphery (edge services). In the latter systems, telephony services were originally defined in the core networks (core services).

Since 1980's, telecommunication services are moving ever outside from the core networks. Due to regulatory demands, market needs, time to market, cost reduction and technical benefits, telecom network systems have been gradually moved towards that of a more open and modular architecture.

In telephony, historical assumptions about the terminal capability limitations have led to a two-tier architecture, consisting of a user domain and a network domain. In this model, there is a little distinction between a network provider and a service provider [1]. Introduction of Intelligent Network services was the first radical step towards separation of the service domain from the network domain. Although there is a clear separation between these two domains in the IN architecture, but this separation has only afforded network operators valued added services. This modularisation has remained within the core network. In this sense, it has not had a commercial extension. Only very recently, Open Network APIs' initiative (Parlay/OSA) is commercially dividing the market into different segments, allowing application and service domain to act as a separate market.

As more advanced terminals with new capabilities became available, new mechanisms for having intelligence at periphery were defined. Computer Telephony Interface, CTI, and Computer Supported Telecommunication Applications, CSTA, are examples of this approach.

As seen, the service delivery model has a big impact on system architectures and business models. In that sense, the telecom industry is learning from the IT industry and adopting ideas from the data communication world. Some communities or people express it as "convergence between telephony and IT". With regards to a likely business model for 3G and beyond, [2] suggests "the current market, which is mainly vertically separated between operators, may change. Operators may no longer be classified as either fixed or mobile, but may offer a variety of different access technologies. The market may not be defined in terms of whole networks, but in terms of access operators, switching operators, transit operators, service operators and data management operators". Figure 1 depicts the above discussion. Each box in the figure represents a market segment.

In the subsequent sections, we will study three different aspects of the above open modelling, namely commercial, architectural, and engineering.

2. Commercial Aspect of Openness

There are numerous cases where standards have been developed but not widely adopted [3]. The acceptance and the deployment of a new developed standard or technology is mainly dependent on whether there is, at least, a satisfactory business case for it. A business case is successful if it can offer new useful services to the society (in which case some cultural changes may be needed) and/or it will respond to a specific need.

When standardising and designing 2nd Generation Mobile Networks such as Global Systems for Mobile Communications, GSM, the industry had a very strong and clear business case in mind, i.e. offering "mobile telephony" service to the society. This was defined as a "core service" explained above. This service was realised in terms of a number of bearer services, tele-services and supplementary services.

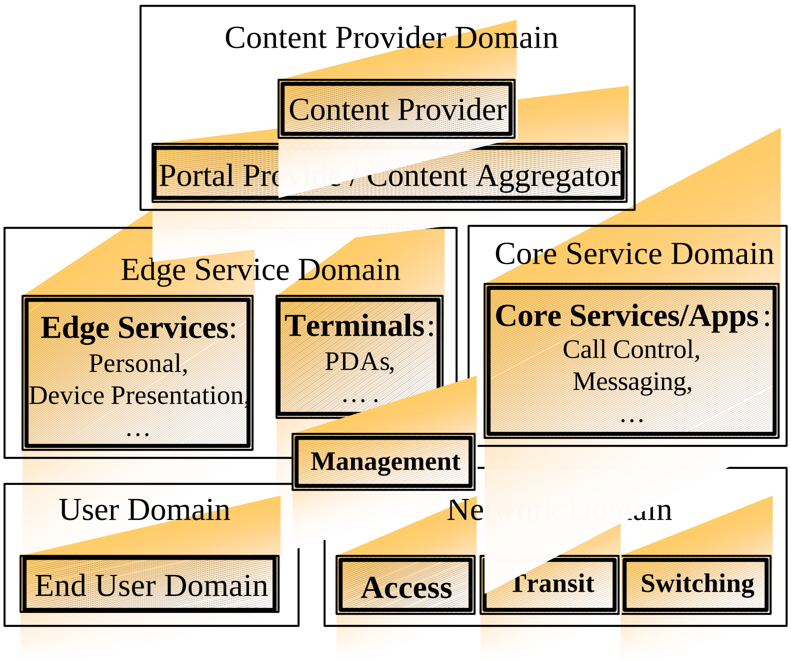

Figure 1 – New Service Delivery Model and Market Segments

When Short Message Service, SMS, was introduced, nobody could imagine that this service would hit such a huge success. All figures in SMS business case show that the designer of SMS never imagined that the use of this service would reach 1 billion a day.

On the other hand, regulatory bodies are asking network operators to open up their network capabilities to third party service and application providers. Regulation is causing re-examination of current service delivery models, and is having a big impact on architectural and commercial decisions.

In next generation network architectures such as 3rd Generation Mobile Systems, it is frequently stated that services will no longer be standardised but it is service capabilities available as tool kits that will be standardised [3]. This is a revolutionary step towards openness in telecommunication system architectures, segregating market segments from each other. But there is a danger here: the lack of business case for 3G networks and services. To fulfil this gap, standardisation bodies, such as 3rd Generation Partnership Project, have broken this promise and have defined a number of "core services". Examples are *Location Services* in UMTS Release 99, *Multimedia Messaging Service* in UMTS Release 4 and *Presence Service* possibly in either later versions of Release 5 or Release 6. One can imagine that the industry is defining a number of "service examples", but in authors' view the main reason is the lack of business case for 3G initiatives. Nobody can convince or expect a network operator to spend £5b to acquire a 3G spectrum licence and an additional of ~£3-5b to implement a UMTS network (R'99, R'4 or R'5) with no clear 3G services in place but only some imaginative services in mind and a number of service capabilities.

So far our discussion has only be focused on the "core services" although in an open manner. An addition to this discussion is to include "edge services" as shortly explained in Section 1, Introduction. There is mainly no way to standardise *edge services* such as fleet management, etc, but there are some serious approaches to implement *Intelligence in the handsets*. Marc Rouanne, President of Alcatel's mobile network division said: "We are fighting people who want to make network dumb pipes. To avoid this happening, you have to keep intelligence in the network [4]. Or Jean-Louis Hurel, marketing director of Alcatel's mobile network division said: " Alcatel's position is that if data on subscriber usage patterns is maintain in the network, handsets need not be as complicated as some manufacturers – such as Nokia – want to make them"[4]. He added "If the intelligence is in the handset, the network is just a dumb pipe. Then operators can only drive down price to differentiate themselves" [4].

Telecommunication industry is facing a new challenge to find the right balance between the "edge services" and the "core services" and in the case of "core services" to define a minimum number of core service examples in order to enrich the business case for the next generation mobile systems.

The new way of thinking is also influencing the working methods in standardisation bodies. 3GPP is an example, which combines the best practices of traditional standards bodies and those of fora. It has a very flat organisation, empowers the technical groups to approve their own deliverables and produces standards through Partnership [5].

Based on the assumption that the life cycle for each mobile generation is about one decade and the fact that the preparation of 3G works began in late 80's, the industry and research communities have started to brainstorm 4th Generation scope and to initiate early day research works, prior to complete roll out of 3G systems. ITU is preparing to set a frame for 4th Generation work. ITU-R WP8F is already analysing 4G Radio demands. The idea is to decide about "IMT-2000 & Beyond" in WRC-2006. The talks are about having around 100Mbit/s on mobility and about 1Gbit/s on stationary. All preliminary work on 4Th generation suggests that the industry is moving towards lacking a business case but more open segmented market.

3. Architectural Aspect of Openness

The idea began with modularisation of network architectures. Operators will benefit from an open architecture, as it will enable them to play a multi-vendor game. At the same time, they are under regulatory pressure to open up their revenue channels to competing industries. The ideas of *Open Programmable Networks* and *Open Switches* were very welcomed by operators.

In a layered approach, an entire system consists of a number of stand-alone components (layers) interconnected through well-defined ***interfaces***. In its commercial extended form, each layer represents a market. An *interface* is "a boundary across which two systems communicate. An interface might be a hardware connector used to link to other devices, or it might be a convention used to allow communication between two software systems" (FOLDOC - http://wombat.doc.ic.ac.uk/foldoc/). Interfaces should be *open* and *standard*. An ideal theoretical open architecture applies the idea of modularisation recursively to its components until reaching the basic atomic units. Each component should be replaceable as the interfaces between components are open and standard. Each instance of a component (i.e. manufacturers' products) should comply with *open standard interface specifications.* An interface can be a hardware interface or a software interface.

At a macro level, a future network can be divided into three big domains: User Domain, Network Domain and Service Domain. Users lie at one edge of the network and access core network services through User-Network Interface, **UNI**. Service and application providers lie at the other end of the network and access network capabilities through Service-Network Interface, **SNI**, to control traditional network services or to offer new enhanced core services. Within the network domain, interconnection is achieved through Network-Network Interface, **NNI**. Note that the User Domain can include "edge services". Figure 2 illustrates the three-domain architecture.

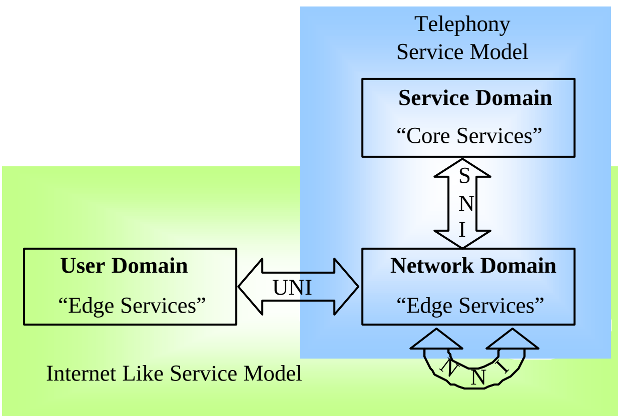

Figure 2 – Future Network Architecture At Macro Level

Standardisation of interfaces especially on hardware began in very early days. Many standardisation bodies focused on *interface standardisation*. Examples are Telecom Industry Association, TIA (www.tiaonline.org) that, amongst other things, sets standards for communication cabling; Committee T1 (www.t1.org), which develops standards and implementation agreements related to interfaces, as they apply to various applications, for communication networks; the Telecommunication Technology Committee, TTC (www.ttc.or.jp/e); and ITU (www.itu.org), which has defined a number of interface specifications e.g. G.703, G.704, I.431, etc.

On software components, an open interface means an *open, standard* ***Application Programmer Interface, API***. The industry has paid huge attention to standardise open APIs. A very recent approach is Open Network APIs, Parlay (www.parlay.org) and 3GPP Open Service Architecture, OSA (www.3gpp.org). The beauty of Parlay/OSA is that they expose operators' network capabilities (trusted domain, seen from operators' view) to third party service and application providers (i.e. un-trusted domain).

The power of an open API as an interface is that it provides the higher layer with an abstraction of functionality, which resides within the lower layer. The trend at architectural level is to define the application and service APIs in an implementation and platform independent manner to make them as generic as possible. Parlay APIs are example of such an approach.

One application of the layered approach in UMTS is the development of MSC server. The idea is to separate pure switch/routing functionality from the switch control mechanism within the MSC. This will enable operators to grow the service delivery and control parts of their networks in relative isolation to the growth of the user traffic parts of the network. This also enables packet switched and circuit switched networks to share a common IP based infrastructure [6].

Distributed computing; Common Object Request Broker Architecture, CORBA; JAIN, TINA-C, IEEE P1520, IN Forum, Open Mobile Architecture; Service Creation Environment, SCE; and Web Services technologies are other examples of architectural approaches towards openness.

4. Engineering Aspect of Openness

Implementation aspect of open network architectures is subject to a separate deep study. In this paper, we only highlight two major thoughts to complete our three-angle approach.

1- At architecture level, the idea is to design interfaces and APIs as generic, implementation and platform independent as possible. It cannot be purely achieved. As an example, Parlay APIs have been defined at a very high level to make them purely implementation independent. At the same time, the Parlay group has defined the APIs for two middleware platforms, i.e. COM and CORBA. All interface specifications are available in IDL and MIDL. Another example is the birth of Parlay X. In authors' view Parlay X was born due to long discussions around engineering Parlay 2.1, 3.0 and 3.1 specifications. The main reasons the industry decides to defined Parlay X as a subset of Parlay APIs are: 1- Parlay APIs are too complex (very similar to what happened to CORBA, i.e. Minimum CORBA or to DAP, i.e. Lightweight DAP), 2- Some operators prefer Web Services technologies rather than CORBA based interfaces.

2- The more generic interfaces and APIs have been defined, the more functionality should be included in it to make it implementable. To clarify this, we give an examples. Some middleware and platform technologies have very reach functions, like CORBA security (a middleware function) or exceptions (a powerful platform feature). If an interface or API architecture will not use these middleware/platform dependent features, it has to define these functions at a higher level by other means.

References

[1] Programming Telecommunication Networks, *Aurel A. Lazar*, IEEE Network, Page 8-18, Sept/Oct 1997.

[2] Middleware in Telecommunications, *Mehdi Khorasani*, London Communications Symposium 2000, Sept 2000.

[3] Standardised Service Capabilities: The need for standardisation illustrated by the development of the Presence Service, *P.M. Carpenter, M.L.F. Grech*, IEE 3G2002 Conference, May 2002.

[4] Industry at odds over 'Intelligence' of 3G, *3G Mobile, Volume* 4, *Number 11*, Page 2, June 12, 2002.

[5] An Introduction to 3rd Generation Mobile Systems, *Adrain Scrase*, IEE 3G2002 Conference, Tutorial 1, May 2002.

[6] IP Multimedia over 3G, N. Lobley, A. Harmand, IEE . 3G2002 Conference, May 2002.