The importance of infrastructure in the development of future proof telecommunication networks

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It is Raycap's distinct pleasure to participate and sponsor the 3rd Summit of Serbia and Montenegro.

As I am sure that some of you, especially the ones coming from the Telecommunications and Energy industries, know Raycap Corporation, there is a part of the audience who don't. Therefore, before focusing on the topic that I am going to analyze today, I will provide a brief introduction to our company. Raycap has been established in Athens, Greece in 1987 as a manufacturer, distributor and service provider of passive infrastructure systems and components utilized in telecommunication networks, power transmission and distribution grids, pipeline networks and defense applications. Its manufacturing plant is located in the Industrial Area of Drama in Northern Greece. Since its inception, 16 years ago, the company has experienced a significant growth and its products have been exported in more than 30 countries all over the world. Today, Raycap has corporate offices in Toronto, Canada, in Santiago, Chile and in Bucharest, Romania.

Due to the nature of our business, we have been actively involved in the development of the telecommunication network infrastructure in several countries in our region and thus, in the next few minutes I will try to present you some of the key issues associated with the construction, rehabilitation and optimization of telecommunication networks passive infrastructure. The term passive infrastructure describes all those systems, sub-systems and components of a telecommunication network, which enable and implement the physical interconnection between the active elements of the network, which collect, process, transmit and receive the various information signals.

During the last two decades, the waves of the digital revolution not only carried the global community toward the future, but washed away the boundaries between industries that used to be separate: communications, information systems and entertainment. Today we live in a world in which modern communications infrastructure is a prerequisite for economic growth whether you are a company, a nation or a region. Since this infrastructure is the technical core of restructuring, it has become central to the procedure of social and political change, globally. Especially for a country like Serbia & Montenegro, which has been sorely tried by the recent war, the reconstruction and upgrade of the infrastructure is a matter of paramount national importance. The convergence with the rest European States that are currently implementing their Information Society projects will be achieved through the creation of a high quality national core and access communications network. This network will provide the foundations for the implementation of not only essential voice-oriented applications like fixed and mobile telephony, but also broadband services. Furthermore, it will enable the transition of the telecommunications market of the country towards liberalization, as it will provide the key resources for the current and forthcoming operators to implement their business and service offering plans.

Networks of different technologies require different kinds of infrastructure. In general these can be classified in the following categories:

- Copper cable plants
- Fiber optic cable plants
- Coaxial cable plants
- Wireless infrastructure

Quite often people refer to this infrastructure as Outside Plant Network in the case of fixed networks or Radio Network in the case of wireless networks. For most people – even those in our industry – the subject of the passive network infrastructure doesn't generate much enthusiasm. Indeed, the network infrastructure is taken for granted by those not directly involved in its development. It is a rather complicated topic, not as glamorous as Video on Demand for example, or a hot marketing item like ISDN and ADSL. Some times speaking about the infrastructure is like trying to get students of military history excited about a seminar

on logistics – the science of getting supplies to your troops. However, even the most brilliant strategist in the world won't win any battles if his soldiers don't have ammunition or food. Well, it is exactly the same when it comes to the Information Superhighway and all of the other amazing stories in communications, that is: unless there is a copper or a glass wire or a pair of antennas going from "A" to "B", nothing else is going from "A" to "B" either.

It is not a coincidence, that the most advanced telecommunications markets in the world are those countries, which at a very early stage took a close look into this matter and allocated the necessary resources to build a future proof network. In most countries, the core network has been rebuilt using optical fiber cables and is capable of meeting the most sophisticated service demands. Today, as we know, fiber circles the globe. On the other hand, the problems of the copper access networks, the weakest link in the chain for any operating company, continue to be debated around the world. It is the most expensive element to maintain and repair; it is labor intensive, incurring high capital and expenditure. The cost of running an access network can be 60% of the total running costs of an entire network. This situation is to a large extent due to the lack of investment at the early stages of network deployment, inadequate maintenance and repair disciplines and absence of management focus.

About ten years ago there was a trend to replace copper based access networks with fiber networks. Massive investment programs were developed in the US, in Europe and in Japan, to bring the fiber to the home or as close as possible to it. However, operators were forced to consider quicker and cheaper solutions, which meant using the embedded copper network to its full potential. The copper asset has become extremely important and those networks, which were built-up over decades, represent an enormous financial investment with a replacement value of billions of dollars, in many cases, which simply cannot be written off. Meanwhile, due to the progress in signal processing techniques, new transmission capabilities of the copper twisted pair have been revealed. These capabilities enable installed copper networks to deliver high bit rate services generically known as xDSL with HDSL and ADSL being the most prominent so far. ADSL is regarded today as the most promising technique to deliver low cost broadband services to residential and small business customers.

While the use of the existing copper network to transmit broadband services looks attractive, it must be understood that not all parts of the copper plant will be immediately suitable. The delivery of high bit rate services through a particular telephone copper pair depends on its quality parameters and also on the type of services that are being delivered through neighboring pairs of the same cable. The necessary quality of the copper plant is safeguarded by appropriate sealing techniques at the terminal or joint locations and the use of sealed terminal blocks. The advancements in materials science have led to the commercial availability of gel-based products, which can easily guarantee that the quality parameters of the copper lines remain unaffected over a period of several decades.

Parts of the copper network which do not conform to the quality requirements of broadband services need to be upgraded, a process known as rehabilitation. Before rehabilitation all sections of the cables need to be tested for the presence of water, faulted pairs, bad splices and sheath faults. The physical application of rehabilitation to failed parts of the outside plant network is, like so many other things, easier said than done. It requires efficient management and scheduling as well as a high level of sophistication of the technical teams. Finally, the recording of the measured data and the use of the gained knowledge about the network quality are crucial for the future expansions and upgrades of the network.

Although copper is fighting back, it must be fully understood that the development of a fiber network is vitally important to the future of telecommunications. What has happened in the last 5 years is an attempt to strike the right balance between the exploitation of copper and the installation of fiber in the network. Fiber will continue to be installed where it is strategically, commercially and technically beneficial to do so.

The existence of well-deployed fiber infrastructure in a country greatly facilitates the provision of a true information highway, which will constitute the backbone of the Information Society. The introduction of new transmission technologies in fiber optic systems such as Dense Wavelength Division Multiplexing (DWDM), the exploitation of non-linear propagation phenomena and the deployment of fiber amplifiers, has boosted the capacity of these

networks. Today, the information transmission capability of each fiber can be easily increased by 16 to 128 times. However, as in the copper wire case the demand for premium transmission line quality has also been dramatically increased. Fibers have become much more sensitive to environmental disturbances and therefore, the implementation of a high quality management and protection framework in fiber optic networks is a prerequisite for the unleashing of the fibers' huge potential. In simple words each fiber pair of the network needs individual management – a concept known as Single Circuit Management. Single Circuit Management is essential in providing the quality of service demanded by customers and it allows network growth and churn to be catered for without interruption to customer service.

As with copper access networks, similar upgrade interventions are required in traditional coaxial cable plants used until recently only for the distribution of television programs to residential customers. The integration of cable plants with fiber optic networks has led to the Hybrid Fiber Coaxial or HFC network structure. Moreover, the network has also evolved from unidirectional to bi-directional, making it suitable for the accommodation of interactive telecommunication services like telephony and high speed Internet access. HFC networks are regarded today as one of the major candidate media for the delivery of broadband services provided that the necessary quality upgrade takes place. In this case the environmental sealing of the network as well as the elimination or in some cases the management of the radio frequency interference are key enablers to transform a relatively obsolete technology based system, to a fast growing broadband industry.

Finally, in order to fully cover the infrastructure deployment and upgrade challenges of modern telecommunication systems one needs to consider the wireless part of the network as well. The wireless medium has been traditionally used to cover the needs of long and short haul transmission requirements of fixed networks for several decades. In the last decade however, wireless is mostly used for the provision of cellular mobile telephony as well as for fixed wireless access. Especially in countries under development the use of wireless infrastructure is regarded as the fastest and the most economical way to provide access to customers, compared to the deployment of fixed line networks, which require much more capital expenditure and are more time consuming to implement. In the last few years fixed wireless access networks have also demonstrated their capability not only to deliver basic telephony access but also fiber-like broadband delivery capabilities. Serbia & Montenegro, being in the phase of development and reconstruction of its telecommunications infrastructure could be greatly benefited from the deployment of such systems, which unarguably did not prove very successful commercially in countries with mature telecommunication infrastructure, simply because they were regarded as complementary solutions to an already installed fiber network.

The evolution of second generation cellular systems towards third generation systems with Internet and multimedia bearing capabilities in combination with the advent of very high bit rate wireless local area networks will definitely create new business opportunities and will change the way that people communicate while on the move.

The wireless network infrastructure sector is being challenged by some rather peculiar problems compared to the fixed network sector. In an effort to reduce the deployment cost of the wireless network, which can account for more than 80% of the whole network deployment cost, operators are considering the collocation of their wireless transmission equipment in the same masts. They are even considering the use of the same antennas and cables given the shortage of space in the existing sites. However, collocation necessitates the existence of a carefully thought network roll out plan. Furthermore, the network components, which will be shared by two or more operators, like the antennas and the cables as well as their accessories need to be designed in such a way as to facilitate the propagation of multiple signals without interference and quality degradation. For environmental reasons it is also necessary to limit the number of antennas used to a bare minimum. This requirement imposes the use multi-band antennas, which are able to transmit and receive GSM as well as future-UMTS radio signals simultaneously. Finally, due to the different radio planning techniques used in 2nd and 3rd generation systems remote control of the shared resources of the network is also a crucial requirement.

I have attempted to provide a very brief overview of some of the most critical network infrastructure issues, as experienced by a company which specializes in the manufacturing

and service provision in this industry sector for several years. I have made every possible effort not to delve into the technical details of these matters and I apologize to the non-technical experts of this forum for some references in specific technologies and terms. The message I tried to convey is that although infrastructure is a part of the network that in most cases is either buried in the ground or found on hill and mountain tops so, most of us can hardly notice it, it constitutes the most vital and sensitive part of every telecommunication system. It requires meticulous planning during the phase of initial construction as well as the establishment of systematic maintenance procedures during operation.

Serbia & Montenegro, being in the phase of restructuring its telecommunications industry has all the opportunities to establish the appropriate framework, which will enable the development of a future proof network infrastructure, the availability of which will facilitate the liberalization of the market and will provide a healthy environment for growth and prosperity of its people.