Design and Application of Multimedia Communication Networks: Emerging Technologies, Future Trends and Beyond Horizons

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Extended Abstract

"It is very difficult to predict especially the future"

Fundamental aspects of optimal design and control of multimedia communication networks are considered in this keynote address. Ubiquitous future telecommunication will require innovative protocols embedded into information assurance algorithms.

Nowadays and future network designers are confronted with the following major sources of complexity: *non-determinism* of input parameters and performance of network elements; *non-linearity* of qualitative relations for performance evaluation and hardware/software related cost functions; *multi-dimensionality*, i.e., to analyze/control/design a multimedia network it is necessary to consider a multitude of control variables and constraints on performance, reliability, security etc; *real-time-control requirements* when flows on the network are changing very fast; *non-homogeneity* of traffic components (voice/data); *combinatorial complexity* that stems from a multitude of choices of end-to-end paths.

Among future applications are communications

A1. with deep space autonomous and/or man-controlled spacecrafts,

A2. with submarines, under-water aircraft carriers and transatlantic under-water hyper-speed trains (there are such projects).

Now there is no real-time communication for A2, since electro-magnetic waves do not propagate in the water.

For A1 real-time communication is currently impossible since propagation time takes at least several hours within Solar system and will take many years for traveling to the nearest solar systems with planets.

A3. The communication will become even more problematic if there will be an attempt to use an autonomous spacecraft to explore a Jupiter satellite, which as scientists believe might have an underwater life. To control such an apparatus it will necessary to overcome at least two technological obstacles: how to communicate in a real-time regime plus how to propagate signals underwater.

Fortunately there is an emerging technology that might be helpful in solution of these problems. A theoretical possibility was predicted by A. Einstein almost 70 years ago, however a serious research started only two decades ago.

Current and emerging applications require both innovative technologies and new protocols of operation.

B1. There are serious research activities over the world on Transhumanism (for more details visit website www.easinus.us). In the International Transhumanism Society, which has more than 80,000 members, hundreds of scientists, engineers, sociologists, economists, lawyers, politicians and other professionals analyze technological feasibility and other aspects of how to substantially expand human life and eventually make humans live several thousand years or even more. That will require man-machine interactions,

and ubiquitous telecommunication systems will play a crucial role. Yet, the Transhumanism is only the first stage.

B2. The second stage is Posthumanism (see the website www.easinus.us). On an advanced stage of the Transhumanism humans will have choices: to retain their biological form of existence, or to select e-Life, or adopt a combination of both. Each form of existence has its own advantages and disadvantages. The e-Life will become technologically feasible if there will exist efficient and highly-powerful systems of telecommunication.

In the keynote address I will list and briefly discuss a current state of research in physics, telecommunication engineering and computer science that will eventually lead to innovative applications and even new forms of existence.

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