Chapter 9

Data Transmission Oriented on the Object, Communication Media, Application, and State of Communication Systems

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ABSTRACT

The proposed communication system architecture is called TOMAS, which stands for data Transmission oriented on the Object, communication Media, Application, and state of communication Systems. TOMAS could be considered a Cross-Layer Interface (CLI) proposal, since it refers to multiple layers of the Open Systems Interconnection Basic Reference Model (OSI). Given particular scenarios of image transmission over a wireless LOS channel, the wireless TOMAS system demonstrates superior performance compared to a JPEG2000+OFDM system in restored image quality parameters over a wide range of wireless channel parameters. A wireless TOMAS system provides progressive lossless image transmission under influence of moderate fading without any kind of channel coding and estimation. The TOMAS system employs a patent pending fast analysis/synthesis algorithm, which does not use any multiplications, and it uses three times less real additions than the one of JPEG2000+OFDM.

INTRODUCTION

Development of new techniques for effective data transmission is very important now-a-days. Our proposed system architecture is called TOMAS which is data Transmission oriented on the Object, communication Media, Application, and state of communication Systems (Figure 1). Efficient data transmission could be provided if communication systems involved in data transmission would take into consideration and monitor constantly the following four aspects:

- **Object**: Its type, size, nature, etc. It can be one/two dimensional (1D/2D) signals, a three dimensional (3D) mesh, symbol data
alone, or any combination of them. For example, audio and video signals or an optical image of surface and its 3D map. Object properties impose certain requirements on processing techniques. For example, the image compression standard (International Organization for Standardization, 1994) does not support very large images, therefore it cannot be used directly for processing such data object;

- **Communication Media:** In case of a complex communication system, a data object might be transmitted over different communication media such as a wireless, coaxial, fiber optic link, or a waveguide (IEEE Standards Association, 1993). Hence, the total performance of one object transmission will depend on the performance of the weakest link. For example, LOS, fair channel conditions may not require from the system to employ a 256 subcarrier OFDM in order to provide required QoS;

- **Agent and/or Application:** A human user or some application imposes certain requirements on quality and rapidity of object transmission. For example, if the image Region Of Interest (ROI) access is required, JPEG2000 source coding might be preferable (International Organization for Standardization, 2000);

- **State of Communication Systems:** Time-varying characteristics of all systems involved in data exchange such as charge of batteries and status of all hardware, firmware and software components have to be monitored constantly. For example, it would not be useful to send a picture on some wireless terminal with a broken screen, or to employ some complex coding technique if the recipient side experiences a problem with decoder.

### WIRELESS TOMAS

Among all types of communication media mentioned above, we concentrate our attention on a radio link or wireless communications. Figure 3 proposes an architecture for wireless data Transmission oriented on the Object, communication Media, Application, and state of communication Systems (Wireless TOMAS).