MPEG－4

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Introduction

In the last couple of years, it has become apparent that there is a class of problems which cannot be served by existing standards such as the MPEG and H.320 families. For example, the conventional telephone network will continue to exist for over twenty years in rural locations, and conventional modem technology will reach a limit with the V.34 standard at 28.8Kbits/s. Also, wireless communication is poised to be a critical technology, and will always be limited in bandwidth. Considering also the problems of channel noise, and low power consumption implementation, it is clear that a new approach is needed.

The requirements of the problem dictate at least an order on magnitude improvement in coding efficiency. This strongly suggests that algorithms will be required which go beyond the scope of sample-based, signal processing techniques. The challenge for MPEG4 is to fuse techniques from such diverse areas as machine vision, computer animation, speech recognition, music synthesis, and more.

The past experience of H.261 and MPEG video has been that algorithms originally intended for restricted transmission bitrates are in practice useful at a wide range of bitrates. In fact bitrate has not been a useful classification of compression algorithms. It is expected that this will be true for MPEG4 also, and i fact some participants are interested in problems which will require very high compression ratios, because the initial volume of data will be extremely high. As a result, MPEG4 will be an extensible standard.

Nevertheless, in the short-term, MPEG4 is focused on the immediate, real problem of very-low bitrate coding, and particularly the wireless communication environment.

Collaboration

MPEG4 activities are being conducted in close collaboration with very-low-bitrate coding efforts within ITU-T SGXV. The current ITU program is short-term, and focused on standardizing a terminal for a PSTN videophone. The constraints virtually mandate an extension of existing standard practice, e.g., extensions of H.261. The ITU also has a long-term program with the same focus, but having higher performance goals. This latter program will be pursued in collaboration with MPEG4, and it is hoped that the ITU program will benefit from the generic audio and video coding algorithms of MPEG4, while MPEG4 will benefit by being compatible with the complete terminal interface standards of the ITU.

Applications

As noted, there is an immediate focus on very low bitrate coding for wireless applications. MPEG4 has identified three major classes of application, within which several sub-classes are defined:

1. Real-time audiovisual communication
    - 1.1 Point-to-point videotelephony
    - 1.2 Multipoint videotelephony
    - 1.3 Remote expert
2. Multimedia
    - 2.1 Interactive editing of audiovisual material
    - 2.2 Interactive playback of audiovisual material
    - 2.3 Non-interactive playback of audiovisual material
3. Remote Sensing
    - 3.1 Building and property monitoring
    - 3.2 Transportation system monitoring
    - 3.3 Information gathering by mobile human
    - 3.4 Mobile (vehicles, robots; piloted and pilotless)

End-user applications include robotic environmental clean-up of toxic waste spills, security and surveillance systems, audiovisual communication with emergency crews, educational networks to rural communities, digital cordless videophone, and highway traffic management.

Requirements

There are two classes of requirements: i) Application-driven, i.e., top-down requirements, and ii) Channel-Characteristics-driven, i.e., bottom-up requirements.

MPEG4 is concerned with a wide diversity of applications, and despite a current, pragmatic focus on very-low bitrate applications, must be extensible to future applications such as Ultra High Definition Television or networked virtual reality video games. MPEG4 acknowledges the heterogeneous nature of future communication networks, and is dedicated to providing "end-to-end" coding. This means no intermediate transcoding in communications that may include a diversity of intermediate links that are wired and wireless, narrowband and wideband, noisy and clean, and have bursty and uniform noise characteristics.

MPEG4 is currently conducting an exhaustive requirements gathering and analysis process in the belief that this is an essential prelude to successful definition of the standard.

Workplan

The following steps have been agreed to work toward a successful standard:

1. Invitation to all relevant researchers and implementers to participate in MPEG4; compilation of an extensive bibliography. (1993-1994)
2. Definition of Applications, Channel Characteristics, and Requirements.

(1993-1994)

3. Sponsorship of technical approaches via an internal seminar mechanism. (1993-1994)
4. Initial research of extensible syntactic descriptions. (1994)
5. Definition of test procedures for evaluating algorithms. (1994)
6. Competitive phase in two stages, for algorithm selection. (1994-1996)
7. Collaborative phase for convergence of algorithms, and definition (1995-1997)
8. Committee Draft standard (1997)
9 International Standard (1998)

Vision

The diversity of applications and operational environments make it improbable that a single algorithm for either audio or video will meet all requirements. In addition, there is a clear trend toward cost-effective hardware that is flexible or even fully programmable. This means it is unacceptably restrictive but also unnecessary to define a single algorithm or a rigid syntax. Instead, standards are maturing to a new level in which the syntax itself comprises the standard, and constitutes a communication language that both conveys and describes the data being transmitted.