TOWARDS NEW TRANSPORT SERVICES TO SUPPORT DISTRIBUTED MULTIMEDIA APPLICATIONS

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1. REQUIREMENTS FOR COMMUNICATIONS PROTOCOL SUPPORT

Lancaster University is involved in two related projects which together are working towards the design and implementation of a communications and distributed systems support architecture for multimedia applications. The Multimedia Network Interface (MNI) project has built a distributed multimedia workstation system which enables the development of experimental communications protocols and a distributed systems platform. The ESPRIT OSI 95 project aims to specify a new transport service and protocol to meet the needs of new applications in the high speed multiservice network environment.

1.1 State of the art in applications

An applications survey carried out within OSI 95 makes it clear that many new areas of application are made possible with the emergence of multimedia, including office automation, service industry applications, retail applications, domestic applications, science and engineering and cultural activities. The topic of Computer Supported Cooperative Work (CSCW) is also highlighted as an important development with implications for distributed multimedia technology.

1.2 Characteristics required of a new transport protocol

From the applications survey it is possible to identify a number of important issues which will have an impact on future work in transport services and protocols. The major requirements arising from these issues are outlined below:-

General

- support for a variety of services such as RPC and streams; profile selection; full consideration of end-to-end performance which implies tight coordination and QoS maintenance between communications sub-system and operating system.

Quality of Service (QoS)

- QoS parameterisation is required to support different media types; QoS negotiation and re-negotiation; real-time responsiveness for interactivity and control (RPC).

Orchestration

- Support for *continuous synchronisation* across a number of streams, e.g. lip-sync between audio and video. This introduces the notion of an *orchestrator* which oversees a number of stream connections.

Groups and multicast support

Multicast continuous media streams, and group RPC for CSCW support.

All of requirements points will have a significant impact on the OSI seven layer model, in general, and on transport services and protocols in particular. The issues presented above will be used in the next phase of OSI 95 to help identify precise requirements for a transport service and protocol called TPX that will support the new environment.

The work described in the paper is feeding useful practical information into the OSI 95 project. It is intended that TPX will be introduced into discussions on the ISO New Work Item on Enhanced Transport Mechanisms. It should be stressed that the experimental transport protocol at Lancaster is being used as a vehicle to test our ideas, particularly on QoS provision and orchestration, and is distinct from TPX itself.

2. EXPERIMENTAL DISTRIBUTED MULTIMEDIA ARCHITECTURE

The architecture of our experimental distributed multimedia system is as follows. Distributed multimedia applications view an object-based distributed application platform, known as the *base services platform*. The platform isolates applications from the complexities of multimedia devices and continuous media communications by providing high level run-time services which applications can dynamically bind to and access.

Below the platform are orchestration services and the experimental transport mechanisms. The purpose of the *orchestration services* is to provide synchronisation support for continuous media applications. Support is provided for *continuous synchronisation* as mentioned above, and also for the real-time association of actions with events such as the presentation of a particular frame in a video play-out. We apply the term *event-based synchronisation* to these sorts of situation. The orchestration services are visible in the application platform, but much of the mechanism of orchestration is carried out in close association with the transport protocol.

The transport protocol offers simplex connection-oriented services on the basis that the best way to support continuous media is by enforcing QoS guarantees not only end-to-end, but on a hop-by-hop basis (for example traversing across an internet). The service offers peer-to-peer, peer-to-multipeer, and multipeer-to-peer connection-oriented options. It also offers QoS negotiation and re-negotiation. It is designed around a rate-based flow control strategy which we believe is particularly appropriate for continuous media.

3. SUMMARY

The paper outlines the design of a continuous media (CM) transport service and an associated orchestration service which permits real-time co-ordination between distinct transport connections. Our transport service has simplex connections with flexible QoS configuration, including re-negotiation. Our work is notable for the close integration of CM transport concerns with those of the distributed application platform that we consider an essential part of future systems building.

An orchestration architecture is described that consists of three components: a high level orchestrator which makes HLO services available from our object-based application platform, HLO agents which control and monitor orchestrated connections, and low level orchestrators which sample and regulate the flow of CM information over intervals as directed by the HLO agent. The orchestration system is architecturally separate from the transport sub-system although the two components must be intimately related in implementation.

The context of our work is that it forms part of the ESPRIT OSI 95 project. Part of the aim of this project is to develop new transport services suited to the new environment of high-speed multiservice networks and distributed multimedia applications. The ESPRIT OSI 95 project is not the only international attempt to introduce a new high-speed transport protocol: in particular, ANSI X3S3.3 has recently issued draft descriptions of a new high speed transport service (HSTS) and protocol (HSTP), which are to be studied further within OSI 95.

4. ACKNOWLEDGEMENTS

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