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Lossless Digital Image Browser (LDIB)

What is an LDIB

A Lossless Digital Image Browser is a new multimedia application. It is an image browser which guarantees that the image quality is not degraded by compression or data loss. The *lossless* nature of the LDIB forbids it from decreasing the necessary bandwidth for the current viewing speed or to increase the browsing speed by dropping alternate frames or by increasing compression rates changing from lossless to lossy compression during different periods of time. Instead it uses a real-time channel with dynamic changes in the traffic characterization and performance requirements.

Motivation

Standard video and audio applications tolerate degradation in image quality to save bandwidth and to adjust speed. But degradation is not permissible in medical imaging (e.g. for remote surgery) and scientific visualization applications. However, these applications possess the characteristic of frequently changing playback rates. Thus, an LDIB requires real-time communication with changing traffic characterization and QoS.

In traditional real-time networks, the traffic specification and performance requirements for a real-time channel remain static over a channel's lifetime. This static behavior does not fit well with the variable traffic characterization and performance requirements of an LDIB. The Tenet Group at UCB and ICSI has developed real-time protocols with end-to-end performance guarantees. Recently, they have enriched the semantics of their real-time service by the Dynamic Connection Management (DCM) scheme. DCM provides the real-time service with the ability to modify the real-time traffic characterization and performance requirements with a modification contract. Any established real-time channel may request such modification at anytime. The LDIB is the first end-user test application for DCM.

Goal

Our goal was to design and implement an LDIB which
* provides exact timing of the displayed images,
* uses and tests the DCM scheme,
* provide measurement result, and
* works in a distributed environment

Design

The LDIB is composed of two Systems: an Image Selection System and an Image Browsing System. The Image Selection System finds and selects the images that the user wants to browse through, while the Image Browsing System controls the browsing of the selected image sequence.

The Image Browsing System consists of three applications that may run on different sites (Figure 1: "The Image Browsing System").

The user controls the browsing through the Control Panel (Figure 2: "Control Panel (CP)"), which presents the user with a VCR like Graphical User Interface (GUI). The user can choose the play direction, pause or stop the play, or he/she can determine the current image or the next image to be viewed,

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respectively, depending on the selected viewing speed.

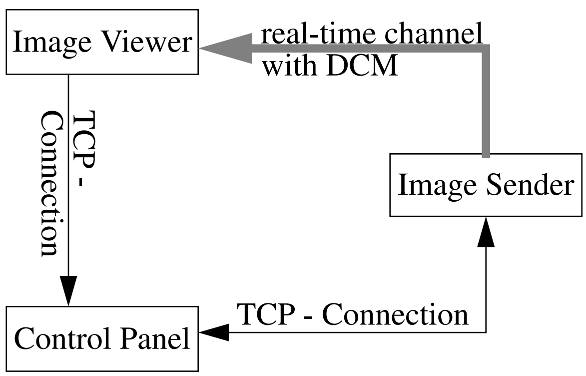

Figure 1:The Image Browsing System

The Image Sender sends the images of the image sequence according to the user's control instructions (such as SPEED <fps>, DIRECTION [FORWARD|BACKWARD], POSITION <int>, etc.) to the Image Viewer.

The Image Viewer displays the images arriving from the Image Viewer. It also calculates the current and average frames per second and sends it to the Control Panel.

Real-time Traffic Computation

The LDIB also provides the user with three alternative policies for determining the real-time traffic computation adjustment:

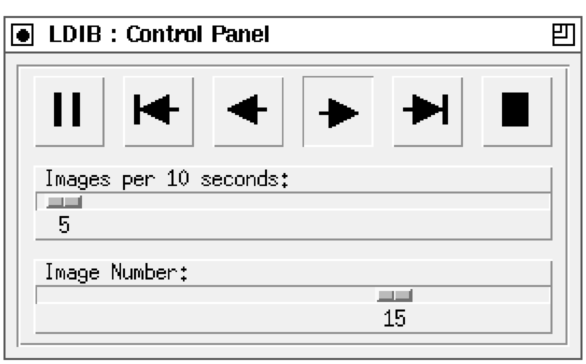

Figure 2:Control Panel (CP)

* immediate adjustment
* immediate adjustment with least resource reservation
* immediate adjustment for higher parameters, but smooth relaxation

The policies determine the modification to the traffic and performance parameters during browsing.

Measurements

The LDIB logs all measurements into appropriate log files. The logged information includes

* the failures/successes in fulfilling a modification contract depending on the modification policy,
* the distribution of fps,
* the average fps,
* the distribution of chosen viewing speeds, and
* the number of changes in position and viewing direction.

This information is logged per image sequence.

Outlook

The LDIB has been implemented using Tcl/Tk, Tcl-DP and C. The future plans include using the LDIB

* to measure DCM's performance,
* to derive further adjustment policies,
* to measure the user's behavior,
* to add new image decoders, and
* to integrate existing image databases.