Instant Authoring with Application Output Recording: Taxonomy and Usage in DIANE

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Abstract

Application Output Recording (AOR) is the task to record the output of an application so that the reproduction of the recording is sufficiently similar to the original output performance. The paper proposes a taxonomy to structure the task and describes a generic architecture covering the complete range of possible complexities in a recorder. The usage of AOR is described in the context of the European Union funded ACTS-project DIANE (Design, Implementation and Operation of a Distributed Annotation Environment) which implements a generic distributed multimedia annotation environment running on broadband systems.

1 Application Output Recording

The aim of AOR is to record the output of a given application in such a way that the reproduction of this recording is sufficiently similar to the original output performance. This approach to AOR is entirely user oriented since it focuses on factors a user will immediately be concerned with and perceives technical and implementational aspects as dependent on these factors.

Our analysis of usage scenarios for AOR revealed that the process can be characterized by three groups of variables determining potential usability, technical consequences, and security (Figure 1). Restrictions to the possible variable values are propagated forward and backward along the lines. User requirements influence technical variables; technical requirements and limited resources pose restrictions to the usability potential.

The usability variable processing capabilities describes how the recorded data may be reused in addition to their basic presentation. It determines the structural and semantical content of the recorded data. The value of this variable is a description of intended post replay usages, e.g. copying of text from the presentation, identifying the application the recording was taken from, or even starting this application.

The technical variable requirement for recording awareness describes whether a recorded application is aware of the recording or not. Requiring awareness may simplify AOR since such an application is likely to provide highly suitable data. But it would also restrict the range of possible applications to record.

The technical variable recording data format describes the format of the raw data that is recorded. It represents all recorded information relevant to the application. Its value is the specification of a data structure. Almost all other aspects of the system affect the data format.

The technical variable point of data interception describes where the data to be recorded is acquired (Figure 2 left side). Its value describes for each media recorded where its respective media data will be accessed and how
this access is achieved.

The technical variable selection of recording source describes how the recording target is selected. This can be achieved by either providing a dedicated recording area where everything to record is dragged into or a direct selection mechanism, for example selecting the application with the mouse or identifying it by name. Selection with appropriate feedback is simple for screen output but much more difficult for other media like audio, robot control, or network communication.

The technical variable timing of recording describes whether "recording frames" are recorded continuously at a fixed rate, automatic whenever new output is available or manually on user demand.

The general variable security describes the security requirements for the recorded output. Generally, they are at least as high as they were for the original material and applications. It is very important that nothing is recorded which the user is not aware of [3]. Failing to provide this would pose a severe security risk since the user may accidentally record confidential material without noticing.

2 Generic Architecture for AOR

Figure 2 shows the data-flow diagram of a generic architecture for an application output recorder; replay is not shown. The application to be recorded with its runtime environment (virtual and physical devices) is shown on the left. The Data Acquisition Point determines the location where the data to be recorded can be acquired. Depending on the point of acquisition, the structuring of the data ranges from semantically very high level intercepted directly from the recorded application to semantically very low intercepted after physical devices (e.g. point a camera to the screen and put a microphone in front of the speaker).

The component Data Interception gathers all the raw data from one or more Data Acquisition points according to the currently selected scope. The scope is managed by the component Scope Selection which maintains a list of objects to be recorded. This list may dynamically change due to the dynamic structure of the recorded application (i.e. windows may be opened or closed) or due to user interaction. The component Change Detection may optionally reduce the amount of recorded data. Mainly, dependencies between recorded frames in the selected scope are being processed. The component Timing tells Data Interception when it's time to acquire data from the recorded application. It may be running in continuous mode with a determined frame rate, or it may be interactively controlled by a user (i.e. pressing a key to record). Finally, the component Format Conversion provides for transformation facilities to generate portable representations of the recorded data (e.g. MPEG).

3 Conclusion

Related approaches to AOR both from the scientific and the commercial sector have been classified using the taxonomy described in Section 1 (e.g. [1,2], Lotus ScreenCam, Microsoft Camcorder, HyperCam). Classification proved to be easy (where sufficient information is available) and sufficient for comparison. Due to space restrictions no details can be given here.

The generic architecture for AOR has been implemented in the ACTS project DIANE (Design, Implementation and Operation of a Distributed ANnotation Environment). The project is funded by the EU. The AOR implemented so far allows recording of generic applications intercepting data within various virtual devices.

DIANE is realized as a service allowing users to create, exchange and consume multimedia data easily. The basic concept to be supported by DIANE is that of a multimedia annotated document consisting of two distinct parts: recorded application output and annotations given by a user in various media.

4 References

