Decreasing Media Breaks Through Content Sharing in Wireless Networks With Mobile Devices

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Abstract
This paper presents a unique media content sharing ecosystem based on seamlessly established communication sessions between a device such as cellular phone and a remote web-enabled device with a larger display.

Keywords
Mobile experience, media content sharing, communication session

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design, Experimentation

Introduction
Many modern handheld devices are equipped with audio-video playing capabilities and built-in camera sensors. Along with networking support for WiFi or 3G mobile devices have became a personal entertainment systems and sophisticated work tools. The amount of information that the smartphone is capable of storing

is increasing. Sharing this information may correspond to meeting emotional needs, maintaining social relationships, or enabling a business conversation [1]. For better multimedia sharing experiences, users often need to transfer media content to more powerful facilities such as desktop computers, wall projectors, or televisions. However, there is no easy way to share multimedia sessions across devices. Sophisticated configuration of the media sharing environment and preliminary set-up of the complex network system must be done to share photos from a mobile handset. Sometimes these operations cannot be done without using a number of cables and connectors. This cannot be called an interoperable and user-friendly experience. A typical scenario includes transferring media to a number of devices or consumer media sharing web sites, requiring additional commitment in synchronization, authorization and data storage. With this paper we propose a new way of sharing media content from mobile devices using seamlessly established communication sessions with a high degree of security. Federating media from the smartphone to larger display devices enables rich social experiences and sharing the content in more engaging manner.

Related Work

Previous studies have demonstrated the challenges in providing flexible media sharing systems among heterogeneous consumer electronic devices with in-home networks. Rigorous analysis was done by Yoon and Kim which resulted in a complex decentralized media sharing environment based on WiFi-Direct technology [2]. Oh, Lee et al. have designed an extended use case based on SIP protocol for media access on DLNA-enabled devices from public IP networks [5]. Liao, Huang and Hu presented UPnP based digital home environment in [4]. Some investigations [3,4] have carried on detailed research on technological and social issues around sharing media. We consider our solution unique, because the set of heterogeneous technologies that we exploit is an enabler to create a digital federated ecosystem for sharing consumers media in an intuitive way, avoiding complicated configuration of the media entities described in the literature.

Mobile Multimedia Sharing Mechanism

We have designed a system architecture, a software reference architecture, and a process of establishing a communication session between user mobile devices and remote devices via communication networks. The system architecture is present in the Figure 1.

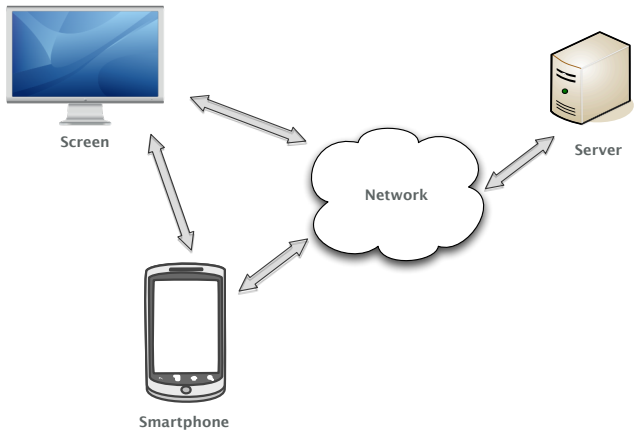

Figure 1. System architecture of the media sharing system

There are three main components of the system: a smartphone (with collection of media or information), a personal computer screen or web-enabled television

(for projection of the shared artifacts) and a server, with set of complex tasks such as

- session management
- transformation of the media stream (if necessary)
- user authentication and authorization

End-users do not worry about establishing communication sessions with the shared screen. All processing is done in secure manner transparently by our developed infrastructure.

The content owner establishes sessions by scanning visually projected data from the larger screen using a smartphone camera. The data encodes a randomly generated session ID. Shared information from the smartphone is not stored, but transferred directly from the handset. The web-enabled screen runs an application and can be accessed with its DNS name. The server consists of a number of RESTful web services, performing the tasks above.

A logical workflow diagram is presented in the Figure 2. It reflects the different data mode types. The data mode identifies an optimal path between the web-enabled screen and the smartphone: (a) within the same WiFi range (direct data mode) or (b) through cellular connection (indirect data mode), both communication channels established through secure tunnel on the server. Indirect data mode is used when the screen with projected media is in a different IP network then mobile phone. In some scenarios data may be located somewhere in the web but being referenced from the device, this use case is also considered by the implemented infrastructure.

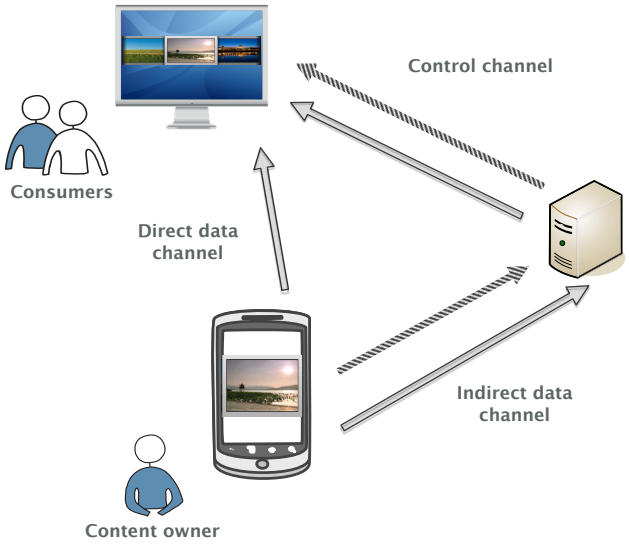

Figure 2. System workflow diagram

Media Types and Environments

Sharing photos, audio and video streams, web content and professional data (such as spreadsheets and presentations) provides for emotionally rich social interactions. Extended use cases for gaming or business transactions are considered as well.

Bandwidth efficiency and access latency are crucial indicators of system performance. In addition considerations of the mobile phone battery usage during the content transmission session require low-power mobile computations and possibly outsourcing some of the processing to the cloud facilities of the system. Examples include transformations of a video stream or fetching metadata information from images in order to provide additional value to consumers. This

proposed ecosystem can be applied to different environment including but not limited to

- digital homes driven by consumer electronics
- public places with digital signage facilities in cafés or airport kiosks
- workplaces

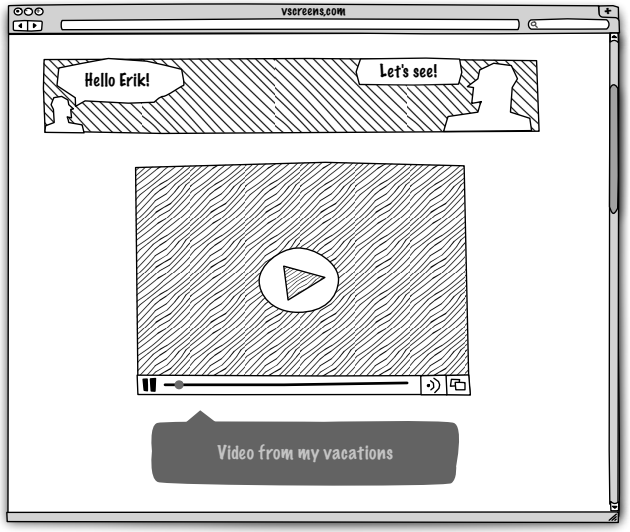

Figure 3. Front-end sketch of the media sharing system on the screen

All of these environments can support media sharing to help explore new applications and engage people with direct social interaction. Example of this media sharing is presented in the Figure 3. Sharing scenarios in the designed architecture are applicable for local and geographically-extended social circles.

Security, privacy and DRM issues are indeed unique challenges to deal with. Those can be addressed by new concepts and techniques developed specifically for operating in the environments with low degree of trust, for example including some control mechanism as white listing. Content owner are reassured that their media is protected from illegal distribution in our system implementation.

We are thrilled to present our prototyped architecture as a solid example of the mobile experiences of social user engagement and collaborative learning environment.

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