

# Casual Mobile Screen Sharing

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## Abstract

The concept of casual screen sharing is that multiple users can cast screen images from their personal hand-held devices on to a large shared local screen. It has applications in personal and business domains where documents or images need to be discussed in a shared environment. The ‘casual’ qualifier implies that the overheads of this sharing should be minimal. Implementation of casual screen sharing poses two general problems: sending content from multiple devices with minimal or no authentication/authorisation, and displaying this content on the larger screen. This paper proposes a solution and describes the development of a prototype, CasualShare.

*Keywords:* screen-sharing, public display, casual sharing

## 1 Introduction

Screen sharing is an effective method to share what one person sees on their device’s screen with the screen of another device. The technique typically involves a host sharing its screen to a client’s screen through an appropriate communication channel. The potential of this technique for a mobile device is significant, as it enables viewing on a larger screen which is more convenient for an audience. There are some particular problems that arise with existing screen sharing techniques:

The first problem is how the host and client will connect to each other. This can be a connection via cord, Bluetooth, wireless local network (*wifi*) or through the internet. Many existing techniques require long-winded authentication or synchronisation between the devices; this affects the usability of these techniques and can be frustrating to the users.

The second problem is that of providing for multiple connections. Many existing techniques allow only a single screen sharing session, because when more than one device is sharing their screen to a single server a variety of new problems occur. These include (i) the need to handle more connections which can cause delays, and (ii) the allocation of the real-estate on the large screen.

## 2 CasualShare

This paper describes a MAC OS X program called CasualShare which runs as a server and receives content from client(s) within a local area network (LAN), through Airplay™ (Apple, a) and a VNC connection (Fleishman, 2010). Both VNC and Airplay are used because they support wireless transfer, and require minimal authentication. The VNC connection is used for mirroring the whole of a client’s screen, while Airplay is used only

for sending images and videos. Once this content is sent to the server, it is subject to manipulation by CasualShare to be displayed on a large screen. This overcomes both problems stated earlier: by allowing clients to share content with no authentication once connected to the same local area network (LAN) – it assumes whoever is connected to the network is trustworthy – and displaying content appropriately on a large screen.

## 3 Airplay

Airplay comprises a mix of protocols created by Apple, to view media from an iOS device or from a computer, using iTunes™ (Apple, b), to an Airplay receiver. Airplay supports images, videos, audio and also screen mirroring which requires special encoding hardware that does not use too much CPU power. iPhone 4S, iPad2 and Macs with Sandy Bridge CPU’s include this hardware. Airplay locates compatible devices automatically by using Apple’s Bonjour software (Apple, c), without requiring any configuration. This is achieved by using a DNS-based service discovery (Krochmal & Cheshire, 2011), and allows an Airplay server to be found from an iOS device simply by clicking the Airplay icon (see Figure 1).

With CasualShare, to send an image via Airplay once connected is simple; whatever image is displayed on the device is automatically sent to the server. A slideshow session is started by going to the first image of the slideshow then pressing the play button, located on the bottom of the image. Then every three seconds a new image is sent to the server. The duration can be changed in the device’s settings, and the slideshow can be stopped at any time by pressing the pause button.

Videos are sent to the server in the same manner as slideshows. Pressing the play button while displaying a video will send that video at the current play position to the server; the device keeps control over the video so it can still pause and scrub. The video is shown with a custom controller, placed in the centre bottom; this controller has four controls: play/pause, scrubbing scroll bar, full screen button and a volume scroll bar, so the server also has control over the video. These buttons are transparent and fade out when the mouse is inactive; this

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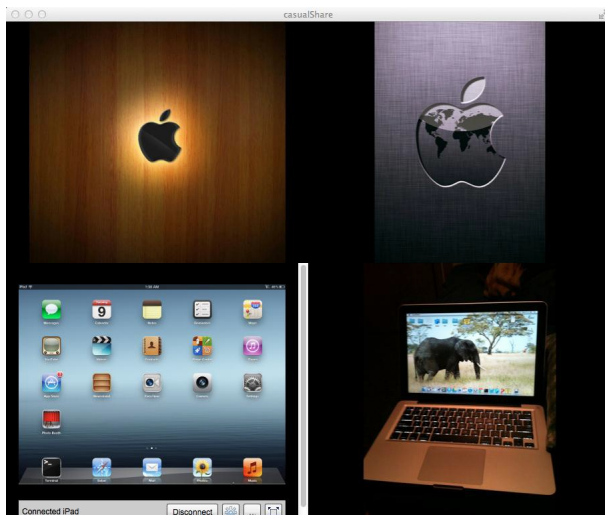
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makes it more aesthetically pleasing and less distracting for the user(s) to view the images and videos.

#### 4 VNC Connection

CasualShare uses FlashLight-VNC (Fucci, 2010), a lightweight open source VNC Client written in Adobe Flash. It is used to connect to a VNC Server (Richardson, *et al*, 1998) like Veency (Simon, 2008) which will be running on the mobile device to mirror its screen and also allow control from a mouse and keyboard.

To locate VNC Servers running on the network this project uses Nmap (Lyon, n.d.) ("Network Mapper") which is a free and open source utility for network discovery and security auditing enabling fast port scanning within an IP range. This allows the software to scan all addresses on the network to see which addresses have the VNC port open, allowing a user to easily connect to a VNC server without manually entering an IP address.



**Figure 1:** Multiple devices connected (images top and bottom right, mirroring session on bottom left)

#### 5 Display Content

This server is also capable of displaying media simultaneously with multiple devices. This means several devices can send images, videos or mirror their screens to the server at the same time. The server partitions the screen appropriately so that each device receives the same proportion of the screen (see Figures 1).

There is currently no limitation on how many devices can connect. When a new device connects, the server simply checks to see if the screen needs splitting to create a new space, and if it does, it will be split vertically before horizontally, as screens are typically wider.

#### 6 Preliminary Results

While extensive user testing has not been done, we have conducted a usability study on CasualShare with five participants. The goal of this study was to gather and analyse findings about the perceived strengths and weaknesses of CasualShare.

The results obtained through this study show that using Airplay to send images and videos to CasualShare

is the favoured feature, as it is straight forward and easy for users to control. The mirroring feature proved to be the hardest and most undesirable feature of CasualShare, as it required the user to navigate to the mirroring tab, scan and connect to a specific IP address.

The study revealed that CasualShare was overall effective and easy to use, and that all participants found the software useful and would use the system again for personal and/or business use.

#### 7 Conclusion and Further work

The aim of this project was to produce a casual but efficient technique for screen sharing from a mobile device to a larger screen. This has been achieved by utilising existing techniques and addressing their weaknesses. CasualShare, the screen sharing software created by this project runs on a Macintosh computer and displays images, videos and a mirroring session, sent wirelessly from a mobile device. The improvements achieved by CasualShare regarding screen sharing include: wireless transfer of media through a local area network (LAN); casual approach with no authentication (once connected to LAN); multiple connections from clients to the server; the display of media from multiple devices with appropriate partitioning; caching media to reduce latency; and full control of media from server and client side;

CasualShare is freely available through the website [www.joris.co.nz](http://www.joris.co.nz). At the time of writing there had been some 1500 downloads over the 10 months it had been available.

CasualShare could be taken along several different paths to further improve its functionality. Screen mirroring is a capability of the latest Airplay protocol. This is achieved through an encoded video stream which is packetized holding a 128-byte header. One improvement for future work would be to include screen mirroring by decoding the video bit stream. This would allow mirroring without the need of a VNC connection.

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