RESEARCH ARTICLE OPEN ACCESS

Remote Control of Android Phones Using VNC

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ABSTRACT
Virtual Network Computing (VNC) is a graphical desktop sharing system to remotely control another computer. It makes use of Remote Frame Buffer protocol which is a simple protocol for remote access to Graphical User Interface. VNC allows users to access graphical displays quickly and easily. This paper proposes a new architecture for remote control of android mobile devices which allows sharing of displays between android mobile phone and PCs. This process must be carried out within Wi-Fi range irrespective of various platforms like Windows, Mac or Linux. The image of the desktop should be compressed before transmission. A modified region algorithm is used to reduce the encoding time of screen image and increase the screen update rate. A number of video encoders are integrated into a prototype system.
Keywords **–** Android, Mobile Device, Remote Control, Virtual Network Computing, Wi-Fi.

I. INTRODUCTION

Phones used to be all about making calls, but introduction of smart phones has the capability of performing much more functionalities. The range of new touch screen smart phones allows user to access the internet, use social media, get live news updates, play music and video, and much more. These features are same as the one which were previously provided by computer system architecture. This system will be implemented on android software system. VNC [1-4] is platform independent. It consists of VNC client and server for many GUI based operating system. It is based on thin client architecture.VNC server can handle multiple client at the same time.

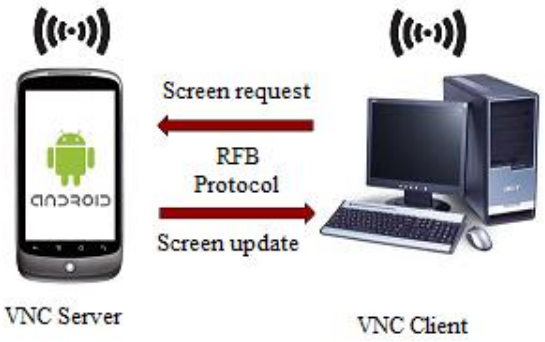

Fig. 1 Mobile VNC system

It uses Remote Frame Buffer (RFB) [6] protocol for sharing a screen between distinct devices as shown in Fig. 1. This should be done within Wi-Fi network.

There are many applications available for sharing the desktop between two or more PCs. This paper focuses on accessing mobile device on remote PC and control of android platform. It can be used for file transfer between client and server. It can also contribute to customer care services and any software company. Some features of this application are downloading and uploading files, installing applications and starting applications etc.

Proposed architecture is provided in section 2. Section 3 describes about design of proposed system. In section 4 different encoding techniques are described. Section 5 focuses on system implementation which gives information about RFB protocol and region detection algorithm. Various applications are given in section 6. Finally, section 7 concludes the paper.

II. PROPOSED ARCHITECTURE

With the development of android phones, there is drastic improvement in the functionalities of mobile phones. Many applications like Java games, browsing web pages, read and write emails etc. can now be easily performed on mobile phones. This functionality has made us to propose the use of mobile phones to remotely control computers.

Virtual Network Computing is a graphical desktop sharing system that uses RFB protocol to remotely control the display of another device. This can be done via network. It is used to capture a mouse and keyword events [5] of the remote device for controlling functionality. It relays the graphical screen updates back to the connected device. A VNC system consists of a client, a server and a communication protocol. The mobile device is used as server that accepts the connections from different clients. The client layer is used to interact between the controlling equipment and monitored device.

III. DESIGN OF PROPOSED SYSTEM

3.1 Remote visualization service

VNC server is responsible to share the graphic information with the client layer. The VNC service should be configured to make use of Tight encoding. Because of this, the display will be smooth even if the network is slow. The client makes request to the server with connection parameters and establishes a connection. The client layer requests the server to show the device's display. If the server does not support the VNC system, a raw display can be used as alternative.

3.2 Application management service

Application Management service is used for centralized management of applications. The client layer can access the information regarding the applications and also modify it. This would make it possible to perform software updates on all monitored devices. For Example, the client can make request to the server to install an application and the server is responsible to install the application sent by the client.

3.3 Service and process management service

At any instance of time the device may have set of processes running. This task could make a bad use of resources to complete its task. The server is used to give information about these processes and services. The client layer is responsible to manage these processes and services.

3.4 File system management service

In computing, a file system is used to store and retrieve the information. Most of the devices require the exchange of files between different systems. File system management service provides a central location for sharing files between both systems. Further the client can add files into the device, for example to make some data available to users or update the files. The server will allow the client to update, add, perform any operations on file or remove file.

3.5 Device status service

Device status service is used to check the status of a device by providing the general information of the device to the clients. This would help the control user to determine the device that requires immediate attention. For example, server could notify a client about a problem.

IV. ENCODING STUDY

RFB is a simple protocol for remote access to Graphical User Interface. It is applicable to all windowing systems and applications as it works at frame buffer level. The RFB protocol can operate over any reliable transport, either byte stream or message based. The RFB protocol works by responding to the request from client about specific onscreen rectangle and then server responds in the form of the update consisting of an encoding or the difference between the moment of the request and the last time the client requested data about this rectangle [7]. There is high consumption of bandwidth and consequent delay in the process for sending information. In order to overcome this problem, different encoding techniques have been developed. The data will be sent in the form of rectangle of pixels. Every rectangle of pixel data is prefixed by a header which provides the position of rectangle on the screen, the width and height of the rectangle and type of encoding used. This encoding type gives detail about the encoding of pixel data. The data then follows using specified encoding. These encoding techniques specify the way to transfer the graphical information. When the client wants to communicate with server, both sides must agree upon the encoding type to be used. If the client requires an encoding which is non-existent, the server will appropriate the next encoding available.

There are five basic types of VNC encoding techniques used such as RAW, RRE, Hextile, Zlib and Tight.

4.1 RAW

The simplest encoding type is RAW encoding. In this encoding, the data consist of width and height pixel value. The server sends all graphical pixel to the client in the form of width*height pixel values (where width and height are the width and height of rectangle). The values represent each pixel in left-to-right scan line order. All RFB clients must support this encoding method. The process time used is minimal and the performance is very high when the server and the client are on the same machine. The performance is reduced if the client is hosted in a remote device due to the transfer of large amount of data.

4.2 RRE

RRE stands for Rise and Run-length encoding. It consists of grouping consecutive identical pixel in order to send only the information of one pixel and the number of replications of that pixel. RRE encoded rectangles arrive at client in a form which can be rendered immediately and effectively by the simplest of graphics engine. The main idea behind RRE is the partitioning of rectangle of pixel data into rectangular sub-regions each of which consists of pixel of single value and the union of which compromises the original rectangular region. It is used when large blocks of same color exists.

4.3 Hextile

Hextile is a variation of RRE. Hextile divides the rectangle into 16*16 tiles. It allows the dimensions of the sub-rectangles to be specified in 4 bits each, 16 bits in total. The rectangle is split into tiles starting at the top left going in left to right, top to bottom order. The width of last tile in each row will be correspondingly smaller if the width of the whole rectangle is not an exact multiple of 16. Similarly, if the height of the whole rectangle is not an exact multiple of 16 then the height of each tile in the final row will also be smaller.

4.4 Zlib

Zlib is an encoding technique which is used to compress the information in order to reduce the size of the package as much as possible. The main disadvantage of this is that it requires more amount of CPU processing. This method is used when the VNC server does not work with the Tight encoding.

4.5 Tight

Tight encoding is a combination of the JPEG and Zlib compression mechanisms. It preprocesses the data to maximize the compression ratio and minimize CPU consumption. This method is also effective for slow network.

V. SYSTEM IMPLEMENTATION

The prototype system is built on mobile operating system platform. This has been popularly used for mobile devices like smart phones, tablet PC's. It consist of VNC server and VNC clients. The server and client are connected using TCP/IP connection over Wi-Fi network.

5.1 RFB Protocol Procedure

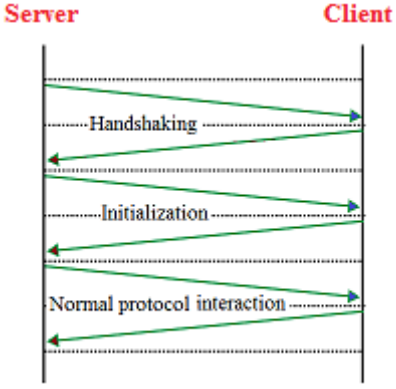

Fig. 2 The RFB protocol procedures of VNC system

RFB [6] is used to remotely access graphical user interface. The RFB protocol is divided into 3 phases as illustrated in Fig. 2. When the server and client establish the connection, the server sends the protocol version message to the client. This is called handshaking phase. They agree upon security types by exchanging security message. The next phase is initialization phase. When server receives the clientInit message from client it sends the serverInit message. This message informs the client about the width and height of the server's frame buffer. It also gives information about its pixel format and device name. The last phase is normal protocol interaction. The client sends the server messages such as SetPixelFormat and SetEncoding messages. Various encoding methods are used which comprise of RAW, RRE, Hextile, Zlib, and Tight. After agreeing upon encoding methods the client sends FramebufferUpdateRequset message to the server. The server sends its screen to the client only when it receives update message from the client.

5.2 Region detection algorithm

To detect the modified regions the precise prediction of modified pixel location is very important in order to reduce the time. For this, we hierarchically determine the pixel location for comparison. This can be achieved using the algorithm as described below

5.2.1 Hierarchical region detection algorithm

In this algorithm, the unit rectangle is down-sampled by a factor of 4 in both horizontal and vertical direction. Then pixel comparison is done in a raster scan order. If a modified pixel is detected then the corresponding unit block is a code block, otherwise the unit rectangle is down-sampled by a factor of 2 and again the pixels are compared. If a modified pixel is detected then the unit rectangle is a code block. Otherwise the remaining pixels are compared in the same way as mentioned above. If no modified pixel is determined, the corresponding unit rectangle is determined as a skip block.

VI. APPLICATIONS

VNC is reliable software for remote assistance, administration, remote desktop sharing and IT help desk. It can also be used in distance education from any place in the world. VNC connected users can chat with other users connected at the same time, or with a host computer user. It also enables connected users to transfer files in either direction or also share with other users connected at the same time. VNC also finds its applications in customer care service.

VII. CONCLUSION

This application is developed to perform remote control of android device. It is used to enhance remote desktop in terms of screen sharing and file transfer. This is done using RFB protocol. The region detection algorithm is used to consequently increase screen updates at client. With

the increase in the use of android, this system will be developed for tablets and other handheld devices.

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