International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

Review of Existing Remote Desktop Protocols

Aathmika N[1], Shanta Rangaswamy[2]

[1] *Dept. of Computer Science and Engineering, R V College of Engineering, Karnataka, India*
[2]*Associate Professor, Dept. of Computer Science and Engineering, R V College of Engineering, Karnataka, India*

Abstract - *Remote desktop access allows a user to access a remote / virtual desktop or a workstation securely over the Internet from any computer. Remote desktop access has gained a lot of importance, especially in the corporate sector, to assist employees in working-from-home or working remotely. Remote desktop access is built over a secure network communication protocol, like Microsoft RDP, designed for remote access to virtual desktops and applications. The protocols that assist remote desktop access vary in terms of security, compatibility and supported features, hence are used for different purposes. This paper presents an overview of the various proprietary and open source protocols available to achieve remote desktop access.*

Key Words: **Remote Desktop Access, Virtual Desktop, VDI, Desktop Virtualization, Remote Desktop Protocol**

1. INTRODUCTION

Traditionally, a client could access a desktop computer physically, which limited his/her productivity and accessibility to the computer. This led to the concept of remote desktop systems, where a host streams a desktop computer to the client's local system. The client can easily browse the remote desktop as if it were the local desktop. Remote desktop access is a common deployment scenario in corporate sector, which reduces the operational expenditures.

Desktop virtualization is a technology that allows a client to remotely or locally access the required desktop from a connected system [1]. It plays an integral role in digital workspaces like Citrix Workspace, VMWare Horizon etc. Based on the nature of the operating system instance of the required system, desktop virtualization can be classified into the following types -

(1) Local Desktop Virtualization: The operating system instance runs on the client device, hence uses the local system's resources for its operation. Though it does not require a network connection or dedicated resources, the required desktop cannot be shared across the network.

(2) Remote Desktop Virtualization: The operating system instance runs on a server inside a data center and the user interactions at the client device are recorded. As a result, there is a centralized control over the resources and desktops, which can be shared by multiple connected devices.

Virtual Desktop Infrastructure (VDI) is a popular type of desktop virtualization [2]. The required desktop images run on a central server and are delivered to the client system over the network. Since VDI is host-based, multiple users can access the required desktop simultaneously. Usually, VDI is used in digital workspace platforms, hence providing an excellent environment without compromising the security requirements.

Several open source and proprietary protocols are available to implement desktop virtualization. The paper describes some of the commonly used protocols.

2. REMOTE DESKTOP PROTOCOLS

Remote desktop access is achieved by a secure network communication protocol designed for remote management. Table 1 gives an overview of a few protocols. Some of the frequently used protocols are as given below-

(1) Remote Desktop Protocol (RDP)

RDP is a proprietary protocol developed by Microsoft that allows a client to communicate with a Windows server and run applications hosted on the server from the client's system [3]. Users are inclined towards RDP as it is free and easy to set up. It uses authentication and encryption to ensure security of the data being communicated. However, the earlier versions of RDP were prone to man-in-the-middle attack.

(2) Independent Computing Architecture (ICA)

ICA is a Citrix proprietary protocol developed in 1991 which provides specifications on how data is to be passed between the client and the server. The desktop/application runs on the cloud or network server and the changes made by the user is transferred to the server over the network [4].

The main advantage of ICA is its compatibility. ICA client software can be built into several thin client and mobile devices, where most of the work is done by the server. However, a network latency is observed when graphics intensive applications are used.

(3) PC-over-IP (PCoIP)

Overview of Remote Desktop Protocols			
Protocol	**Advantage**	**Disadvantage**	**Application**
RDP	Free of cost	Prone to man in the middle attack	Windows Remote Desktop Connection
ICA	Compatibility	Network latency	Citrix XenApp and XenDesktop
PCoIP	Compatibility with thin clients	Latency with graphics intensive applications	Teradici Workstation
SPICE	Supports audio output	One connection per VM	oVirt Cloud Management Software
ALP	Compatibility	Does not support USB traffic	Sun Ray Servers
RFB	Enhance-able with additional feature	Prone to network sniffing	Application Virtual Network Computing
ARD	Secure communication	Tunnel through VPN to avoid eavesdropping	Apple Remote Desktop
RGS	Good user experience	Expensive	HP Workstation
WSP	Easy feature enhancement	Expensive	Amazon WorkSpaces
Splashtop	Easy to implement feature	Limited features	Splashtop Enterprise

Table -1: Overview of Remote Desktop Protocols

PCoIP is a Teradici developed, UDP based proprietary protocol for remote desktop access. It was implemented in the blade server card, a product which was released by Teradici in 2007 [5]. The data from the required desktop is compressed and encrypted and transmitted to the client device, where it is decrypted to render the desktop view. PCoIP delivers bitmaps, which defines the position and color of every pixel on the desktop screen.

The primary benefit of PCoIP is compatibility i.e, thin clients or zero clients can be used as client devices. Thin clients are more secure than PCs as they are not dependent on a local operating system. However, PCoIP has a latency issue when graphics-intensive applications like videos are involved.

(4) Simple Protocol for Independent Computing Environment (SPICE)

SPICE is an open standard communication protocol for virtual environment released by Red Hat Inc. in 2010. It follows a client-server model where the virtualization server with installed SPICE server acts as the server and user system with installed SPICE client acts as the client [6].

Since it has a direct HDMI output, SPICE protocol allows even audio output to be transferred to the client with a lower latency. However, it supports only one connection per virtual machine at a time i.e on receiving a new connection to a VM, an older connection to the same VM will be terminated forcefully.

(5) Appliance Link Protocol (ALP)

ALP is a communication protocol developed and distributed by Sun Microsystems since 1999 as a part of the Sun Ray Software package. Sun Ray clients and Oracle virtual desktop clients use ALP to communicate with a Sun Ray server [7].

A major advantage of ALP is its compatibility. Once the client desktop is authenticated and connected to the Sun Ray server, the Sun Ray connector uses the required protocol to connect to the required desktop (RDP is used to connect to Windows desktop). However, ALP does not support encryption of USB traffic.

(6) Remote Frame Buffer (RFB)

RFB is an open source communication protocol developed by Olivetti and Oracle Research Lab used to remotely control another desktop. RFB is used in Virtual Network Computing (VNC) and its derivatives.

RFB is a simple protocol that can be easily enhanced with additional features like file transfer and advanced compression and security features. However, RFB is not a secure protocol as encryption key and encoded password can be sniffed from the network.

(7) Apple Remote Desktop Protocol (ARD)

ARD protocol is a proprietary protocol developed by Apple Inc. in 2002, used to remotely control computers or desktops built on MAC operating system [8]. This protocol plays an in- tegral role in the implementation of Apple Remote Desktop Software.

The latest version of ARD supports secure communication of plain and encrypted (with user credentials) data between the client and the remote desktop. However, it does not

encrypt file transfer and desktop graphics. Hence, ARD traffic should be tunneled through a VPN to avoid eavesdropping.

(8) Remote Graphics Software Protocol (RGS)

Remote Graphics Software is client-server model developed by Hewlett Packard Inc. in 2003 to enable remote access to complex 3D models and graphics intensive applications. The workstation/server is responsible for processing the graphics using OpenGL or DirectX and sending compressed bitmap images to the client.

The main advantage of RGS is its ability to provide a good user experience without latency and transmission loss. However, RGS is an expensive solution due to the high cost of workstation hardware. It does not support workstation access to Windows Vista as well.

(9) WorkSpaces Streaming Protocol (WSP)

WSP is a cloud-native streaming protocol developed by Amazon in 2019. It is used to build Amazon Workspaces, a secured Desktop-as-a-Service solution, which provides remote access to desktops hosted on the cloud. It offloads metric analysis and codec encoding to microservices that run natively on AWS cloud, hence adapting itself according to the user requirements [10].

Since it is a cloud-native protocol, feature and performance enhancements can be done without manual updates to WorkSpaces. However, Amazon WorkSpaces is expensive. Latency is observed when a large amount of information is to be retrieved from the required desktop.

(10) Splashtop Protocol

Splashtop, also called as Splashtop Remote uses a closed, proprietary protocol developed by Splashtop Inc. in 2010 for remote access via computers and mobile phones. As a prerequisite, Splashtop Streamer must be installed on the remote system and Splashtop Business must be installed on the client system [11].

The main advantages of Splashtop are its economical pricing and easy-to-understand and easy-to-implement security features. However, it has limited features and clunky visual design, which affects the user experience.

3. ADVANTAGES OF REMOTE DESKTOP ACCESS

The main advantages of remote desktop access are as listed below [12]-

(1) Easy Access: It allows a user to connect to the required desktop and access the required data from anywhere in the world.

(2) Working Remotely: An employee will be able to access the company resources through a connected system, thus ensuring his productivity.

(3) Low cost: A remote desktop service reduces the investment in physical desktop systems. It also allows an employee to work from his own device.

(4) Security: The server/workstation environment can be easily updated with security fixes. It backs up the required data that can be recovered in case of a server crash.

4. APPLICATIONS OF REMOTE DESKTOP ACCESS

Remote desktop access feature plays an important role in multiple industries and fields in resource accessibility, thus increasing the employee productivity [13]. This section gives a glimpse on how this feature is used in different industries-

(1) IT Industry: Employees can easily access the required company resources to complete their work from a connected computer system anywhere and anytime. Hence, employees can work-from-home or work remotely without any difficulties.

(2) Education and Training: Students can be allowed to access expensive training materials or applications from home at a time of their choice.

(3) Animation and Special Effects: Special effects including VFX and Motion Capture require expensive hardware devices like GPU, Beacon, Capsule etc. Remote access will enable animators to share the hardware and perform their work from home.

(4) Finance Trading: Finance trading deals with massive amounts of real-time data which must be stored in an organized manner. A workstation or a server is used to analyze the collected data and the findings are communicated to the concerned parties via remote desktop access.

5. CONCLUSION

The given paper gives an overview of the various communication protocols used for remote desktop access. Each protocol differs in its advantages and disadvantages. One has to choose a protocol based on his/her requirements and use case scenarios.

REFERENCES

[1] "What is Desktop Virtualization?", Citrix.com, https://www.citrix.com/en-in/glossary/what-is-desktop-virtualization.html (accessed Mar. 30, 2020)

[2] "Virtual Desktop Infrastructure", Citrix.com, https://www.citrix.com/en-in/digital-workspace/virtualization-vdi.html (accessed Mar 3, 2020)

[3] Cai Longzheng, Yu Shengsheng, Zhou Jing-Li, "Research and Implementation of Remote Desktop Protocol Service over SSL VPN", IEEE International Conference on Services Computing 2014, pp.45-49.

[4] "Citrix Independent Computing Architecture", extrahop.com, https://www.extrahop.com/resources/protocols/citrix-ica/ (accessed Apr. 1, 2020)

[5] T Richardson, K R Wood, "Virtual Network Computing", IEEE Internet Computing Vol. 2, 2016

[6] "Spice User Manual". [Online]. Available: https://www.spice-space.org/spice-user-manual.html (accessed Apr. 4, 2020)

[7] "Appliance Link Protocol (ALP)", docs.oracle.com, https://docs.oracle.com/cd/E35310_01/E25747/html/security-alp.html (accessed Apr. 1, 2020)

[8] "Apple Remote Desktop", apple.com, https://docs.oracle.com/cd/E35310_01/E25747/html/security-alp.html (accessed Apr. 9, 2020)

[9] "HP Remote Graphics Software – Overview". [Online]. Available: https://support.hp.com/in-en/document/c02163749 (accessed Apr. 9, 2020)

[10] Magana E Sesma, "Remote Access Protocols for Desktop-as-a-Service Solutions", PLoS ONE 14(1) 2019.

[11] "Splashtop Business Pro", pcmag.com, https://in.pcmag.com/software/116598/splashtop-business-pro (accessed Apr. 9, 2020)

[12] "Remote Desktop Service: The Advantages and Disadvantages", esoftload.info, https://www.esoftload.info/remote-desktop-service-advantages-disadvantages (accessed Apr. 1, 2020)

[13] "RDP Software", parallels.com, https://www.parallels.com/blogs/ras/rdp-software/ (accessed Apr. 1, 2020)