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Network Security and Cryptography

Topic 11:
Remote Access

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Network Security and Cryptography

Topic 11 – Lecture 1:
Introduction to Remote Access & Web Applications

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Remote Access Topic 11 - 11.3

Scope and Coverage

This topic will cover:

- Alternative remote access technologies:
  - Web applications
  - Remote desktops

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Learning Outcomes

By the end of this topic students will be able to:

- Configure access control mechanisms
- Select an appropriate remote access solution

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What is Remote Access?

- Accessing a computer where the user does not have physical access to it
  - Remote control of a computer
  - Using another device
  - Over a network, e.g. the Internet

- A common example is the remote troubleshooting services offered by computer manufacturers

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Why Have Remote Access?

- Allows staff to work from any location – they are no longer required to be physically in the office
  - Home working
  - Out of hours working
  - Mobile staff

- Has become a critical part of many modern businesses

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Uses of Remote Access

- Comes under two categories:
  - Accessing files remotely
  - Accessing applications remotely

- By accessing files a remote user can transfer any individual files they need whilst working remotely

- By accessing applications the remote user can use software on the network and therefore also process files and data in the same way as if they were in the workplace

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Remote Application Architecture

- In order to create remote access facilities an understanding of the application architecture is necessary

- Three general models:
  - Client/Database
  - Client/Server
  - Web-based

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Client/Database Architecture

- Complete applications are installed on the client computer
  - Fat clients

- Client connects to a database via a network

- Data for applications is held on the database

- Usually used where there is only a small number of clients

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Client/Server Architecture

- Typically has a stripped down version of applications installed on the client
  - Sufficient to connect to the server application

- A full version of the software is installed on the server

- Business logic rules are applied at the server and a connection created to the database

- Example is mail client such as MS Outlook

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Web-based Architecture

- Web browser is used as the client
- Requires minimal software on the client computer
- Interacts with web server
- Provides web-based user interface
- Server may communicate with other application servers to provide functionality
  - These are usually on other hardware
- Results are displayed in the web browser
- E.g. webmail

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Remote Access Technologies

- A number of means of gaining remote access, for example:
  - Virtual Private Network (VPN)
  - Remote Desktop Connection (RDC)
  - Application Hosting
  - Web-based applications
- There are implications to consider:
  - Security
  - Bandwidth requirements

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Virtual Private Network (VPN)

- Secure tunnel between remote user and internal network
- Once session is created user can pass data in/out of network
- Limits due to available bandwidth
  - User or network end
- Works well with web-based applications

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Remote Desktop Connection (RDC)

- Applications are hosted on a remote server
- Appears as though screenshots have been sent to the client
- Keyboard and mouse inputs are forwarded to the server
- Results are shown in the screenshots that are returned to the client
- Uses a constant and relatively small amount of bandwidth

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Application Hosting

- Application hosting involves using an external partner to host applications on their servers
- Removes the need for internal IT departments to manage the architecture, servers and applications
- Use of software and hosting management is via the external partner who charges for this service
- The remote access is to this external partner's servers, whether from inside the office or from a remote location

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Web-based Applications

- Clients do not require any dedicated software other than a standard web browser

- Data passes over the Internet

- Data transfer is encrypted

- Can be provided as Software-as-a-Service (SaaS)
  - Software vendors provide access to the software via the Internet

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General Security Considerations

- Security best practice should be followed:

  - Firewalls
  - Anti-virus software
  - Updates and patches
  - Security policies and procedures
  - Staff training
  - IDS
  - Vulnerability scanning
  - Separating web server, database server, etc.

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*Topic 11 – Lecture 2:
Remote Desktops*

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Remote Desktop

- Allows applications to be run on a remote server but displayed locally
- Can be achieved via software installed on the client or via a feature provided by the OS
- May be command line applications
- May be applications with a graphical user interface (GUI)
- There are many OS that provide this functionality

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Display Data Remotely

- The controlling computer displays the image received from the controlled computer
- This image is updated:
  - At regular intervals
  - Or when a change on screen is noted by the software
- The controlling computer transmits input from its own keyboard or mouse to the controlled computer
- The software implements these actions on the controlled computer

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Display Data Remotely

- The controlled computer acts as though these input actions were operated directly on itself
- Any changes to the display as a result of these actions are transmitted back to the controlling computer
- The controlling computer then displays this new display image on its screen
- Input devices and screen on the controlled computer may be disabled

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A Warning!!

- Attackers have used remote access software to gain control of many computers

- A typical scenario involves the user receiving a telephone call from someone pretending to be a legitimate corporation

- They offer to fix your computer remotely

- Once the remote access is allowed they use the computer for other purposes

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Remote Desktop Protocols

- There are a number of protocols that may be used for remote desktop applications, including:
  - Virtual Network Computing (VNC)
  - Remote Desktop Protocol (RDP)
  - Apple Remote Desktop (ARD)
  - Independent Computing Architecture (ICA)
  - Appliance Link Protocol (ALP)

- We will look at the first two in a little detail

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Virtual Network Computing (VNC)

- A graphical desktop sharing application

- Provides remote access to a GUI

- Transmits keyboard and mouse actions in one direction

- Transmits graphical screen updates in the other direction

- Original source code and many derivative packages are open source

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Platform Independence

- VNC is platform independent

- A VNC viewer can connect to a VNC server using a different operating system

- Multiple clients can connect to the same VNC server at the same time

- VNC clients and servers are available for most GUI based operating systems

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VNC Components

- VNC server is the program on the server that allows the client to take control of it

- VNC client (also known as the viewer) is the program that controls the server

- The remote framebuffer (RFB) protocol sends simple graphic messages to the client and input actions to the server

- The machine with the VNC server does not have to have a physical display

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Framebuffer

- A memory buffer

- Drives video output display

- Stores information on the colour value of every pixel in a display

- Used in all systems that use windows

- Information can be transmitted storing the colour and position of each pixel in a rectangle

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The RFB Protocol

- RFB sends information regarding rectangles of screen display

- The colour information of rectangles for display are transmitted as a framebuffer

- Includes compression techniques and security features

- Client uses port 5900 for server access

- Server may connect in listening mode on port 5500

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VNC Security

- VNC does not use plaintext passwords

- But it is not very secure

- Open to sniffing attacks

- Can be tunnelled over SSH or VPN connection for enhanced security

- There are SSH clients for most platforms

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Remote Desktop Protocol (RDP)

- Microsoft protocol
- Provides a GUI to another computer
  - Remote display
  - Remote input
- Supports a number of technologies
- Supports a number of LAN protocols
- An extension of the ITU T.120 family of protocols
- Clients exist for most operating systems

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RDP Operation

- RDP uses its own video driver to convert rendering information into packets
- Sends them to the client via the network
- RDP receives rendering data at client and converts into Windows graphics device interface (GDI) calls
- Mouse/keyboard events are sent from client to server
- RDP uses its own on-screen events driver to receive these events

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RDP Features

- RDP offers many features:
  - Encryption
  - Bandwidth reduction
  - Roaming disconnect
  - Clipboard mapping
  - Print redirection
  - Sound redirection
  - Support for 24 bit colour
  - Smart Card authentication

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