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The Identity Security Company™

PAM Administration

PAM Self-Hosted Architecture

Agenda

In this session, we will look at:

- The **PAM Self-Hosted** system architecture
- How to locate and manage the local services, configuration files, and logs for the various **PAM Self-Hosted** components
- How to locate and manage the built-in **Safes** and users for the various **PAM Self-Hosted** components
- The internal integration and communication between the various **PAM Self-Hosted** components and the **Vault**

System Architecture Review

What is PAM Self-Hosted?

PAM Self-Hosted

PAM solution when all of its components are owned and operated by the customer

An entirely on-premises installation of the **Vault** and all the different components

An entirely cloud-based deployment where the **Vault** and components are deployed to one of the supported Cloud platforms


A hybrid deployment in which some components are in the Cloud and others, very often the **Vault**, are installed on-premises.

CyberArk Privilege Cloud – PAM as SaaS

The **Privileged Access Manager** is delivered as Software as a Service

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PAM Self-Hosted Components

Secure Digital Vault	• A secure server used to store privileged account information. • Based on a hardened Windows server platform.
Password Vault Web Access (PVWA)	• The web interface for users to gain access to privileged account information. • Used by Vault administrators to configure policies.
Central Policy Manager (CPM)	• Performs the password changes on devices. • Scans the network for privileged accounts.
Privileged Session Manager (PSM)	• Isolates and monitors privileged account activity. • Records privileged account sessions.
Privilege Threat Analytics (PTA)	• Monitors and detects malicious privileged account behavior.

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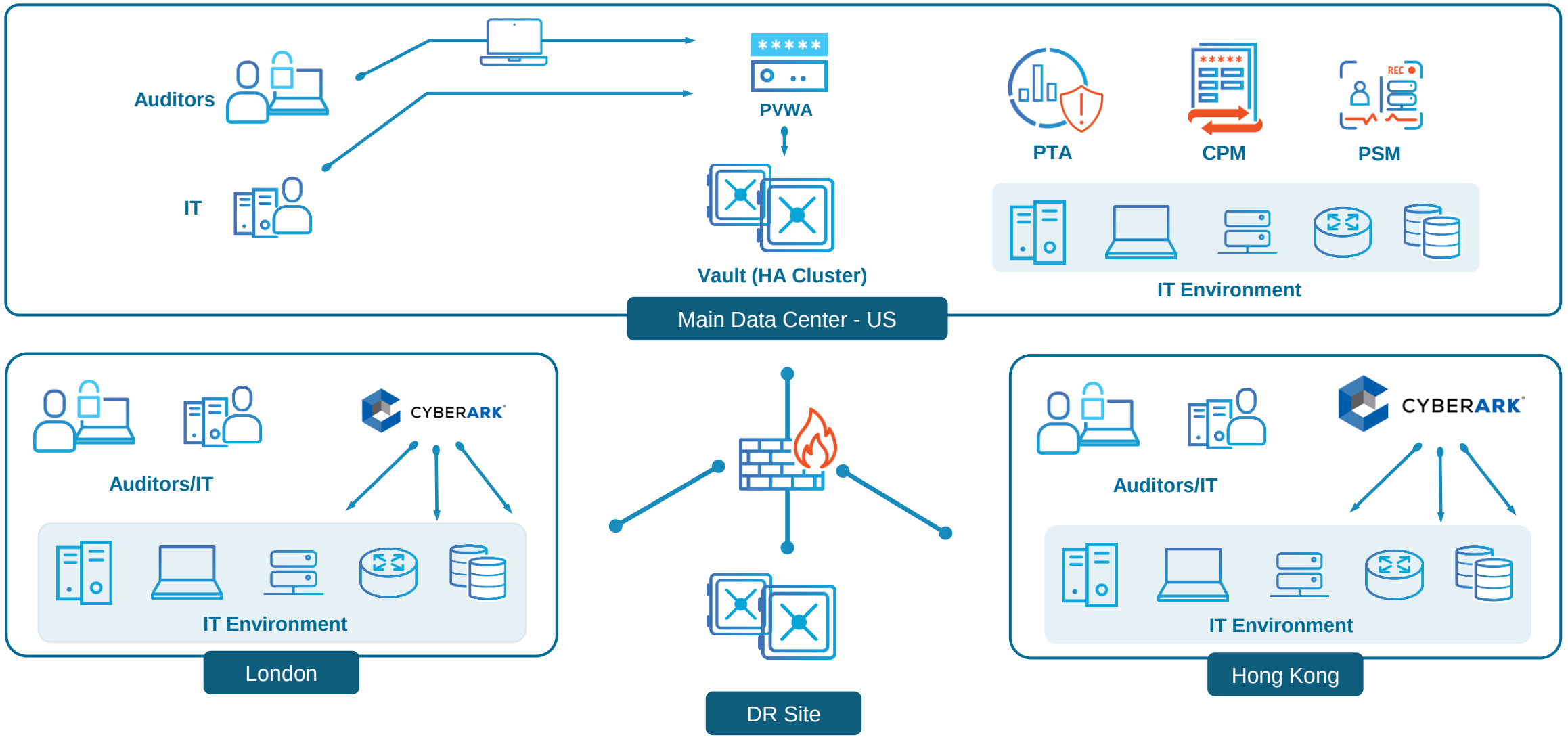
CyberArk's Scalable Architecture



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Component Local Environment

In this section we will look at the main services, configuration files, and logs for each of the following components:

- Vault
- CPM
- PVWA
- PSM

Inside the Vault

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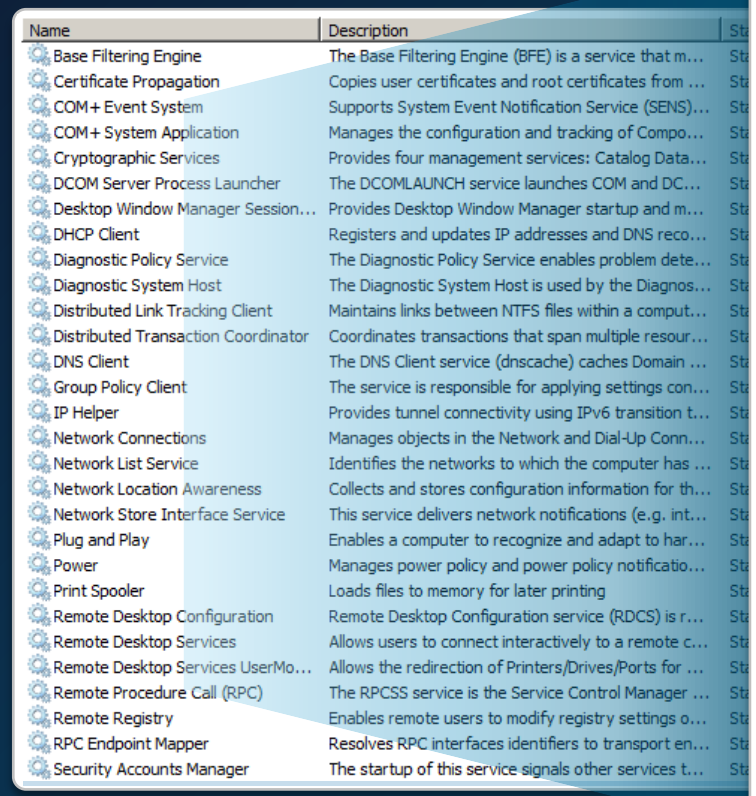
Vault Services

Services before Vault installation



Name	Description
Base Filtering Engine	The Base Filtering Engine (BFE) is a service that m...
Certificate Propagation	Copies user certificates and root certificates from ...
COM+ Event System	Supports System Event Notification Service (SENS)...
COM+ System Application	Manages the configuration and tracking of Compo...
Cryptographic Services	Provides four management services: Catalog Data...
DCOM Server Process Launcher	The DCOMLAUNCH service launches COM and DC...
Desktop Window Manager Session...	Provides Desktop Window Manager startup and m...
DHCP Client	Registers and updates IP addresses and DNS reco...
Diagnostic Policy Service	The Diagnostic Policy Service enables problem dete...
Diagnostic System Host	The Diagnostic System Host is used by the Diagnos...
Distributed Link Tracking Client	Maintains links between NTFS files within a comput...
Distributed Transaction Coordinator	Coordinates transactions that span multiple resour...
DNS Client	The DNS Client service (dnscache) caches Domain ...
Group Policy Client	The service is responsible for applying settings con...
IP Helper	Provides tunnel connectivity using IPv6 transition t...
Network Connections	Manages objects in the Network and Dial-Up Conn...
Network List Service	Identifies the networks to which the computer has ...
Network Location Awareness	Collects and stores configuration information for th...
Network Store Interface Service	This service delivers network notifications (e.g. int...
Plug and Play	Enables a computer to recognize and adapt to har...
Power	Manages power policy and power policy notificatio...
Print Spooler	Loads files to memory for later printing
Remote Desktop Configuration	Remote Desktop Configuration service (RDCS) is r...
Remote Desktop Services	Allows users to connect interactively to a remote c...
Remote Desktop Services UserMo...	Allows the redirection of Printers/Drives/Ports for ...
Remote Procedure Call (RPC)	The RPCSS service is the Service Control Manager ...
Remote Registry	Enables remote users to modify registry settings o...
RPC Endpoint Mapper	Resolves RPC interfaces identifiers to transport en...
Security Accounts Manager	The startup of this service signals other services t...

Services Post Installation and Hardening

Name	Description	Status
Cyber-Ark Event Notification Engine		Started
Cyber-Ark Hardened Windows Firewall	Windows Firewall helps prot...	Started
CyberArk Logic Container		Started
DCOM Server Process Launcher	The DCOMLAUNCH service l...	Started
DHCP Client	Registers and updates IP a...	Started
DNS Client	The DNS Client service (dns...	Started
Group Policy Client	The service is responsible f...	Started
Net.Pipe Listener Adapter	Receives activation request...	Started
Net.Tcp Listener Adapter	Receives activation request...	Started
Net.Tcp Port Sharing Service	Provides ability to share TC...	Started
Network Connections	Manages objects in the Net...	Started
Network List Service	Identifies the networks to ...	Started
Network Location Awareness	Collects and stores configur...	Started
Network Store Interface Service	This service delivers networ...	Started
Plug and Play	Enables a computer to reco...	Started
Power	Manages power policy and ...	Started
PrivateArk Database		Started
PrivateArk Remote Control Agent		Started
PrivateArk Server		Started
Remote Desktop Services	Allows users to connect inte...	Started
Remote Procedure Call (RPC)	The RPCSS service is the Se...	Started
RPC Endpoint Mapper	Resolves RPC interfaces ide...	Started

- Total number of previously running services has been reduced as part of the hardening process
- Vault installation has added 6 new services

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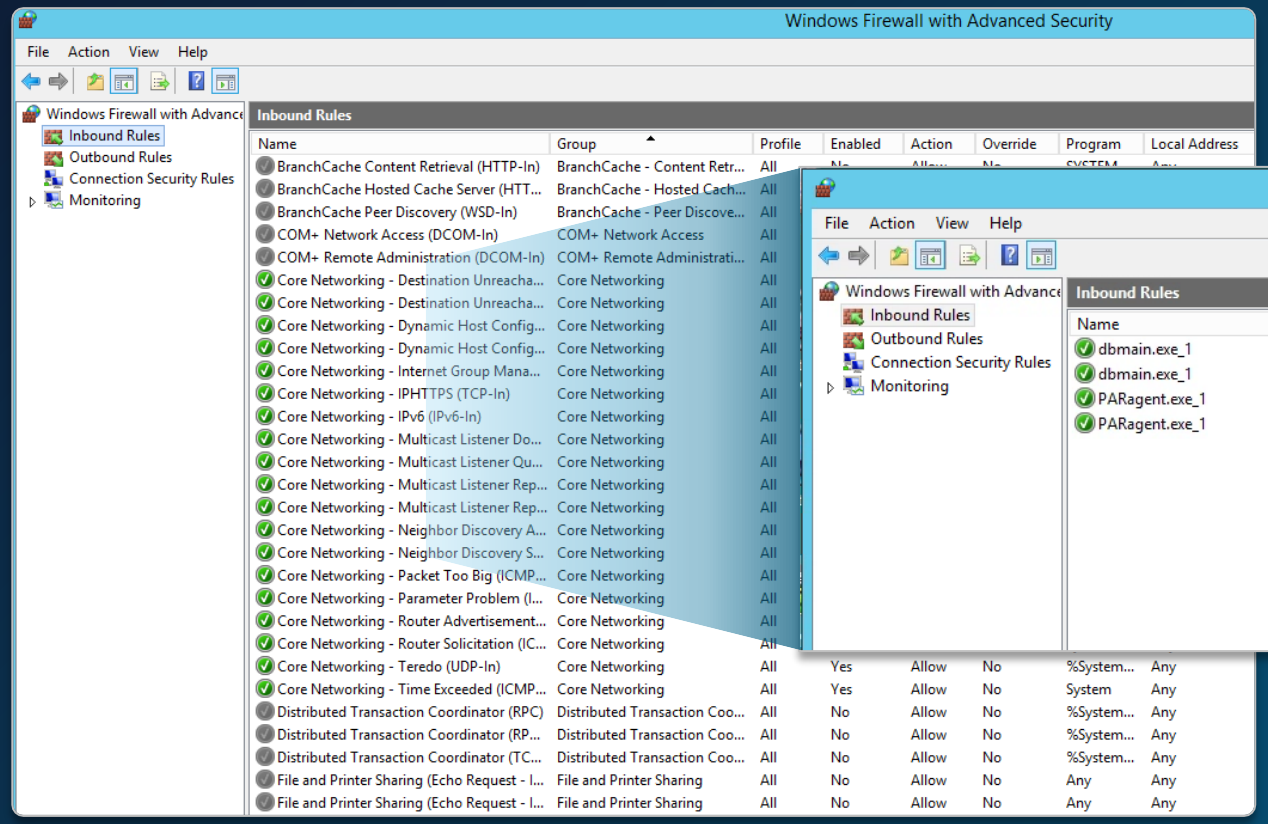
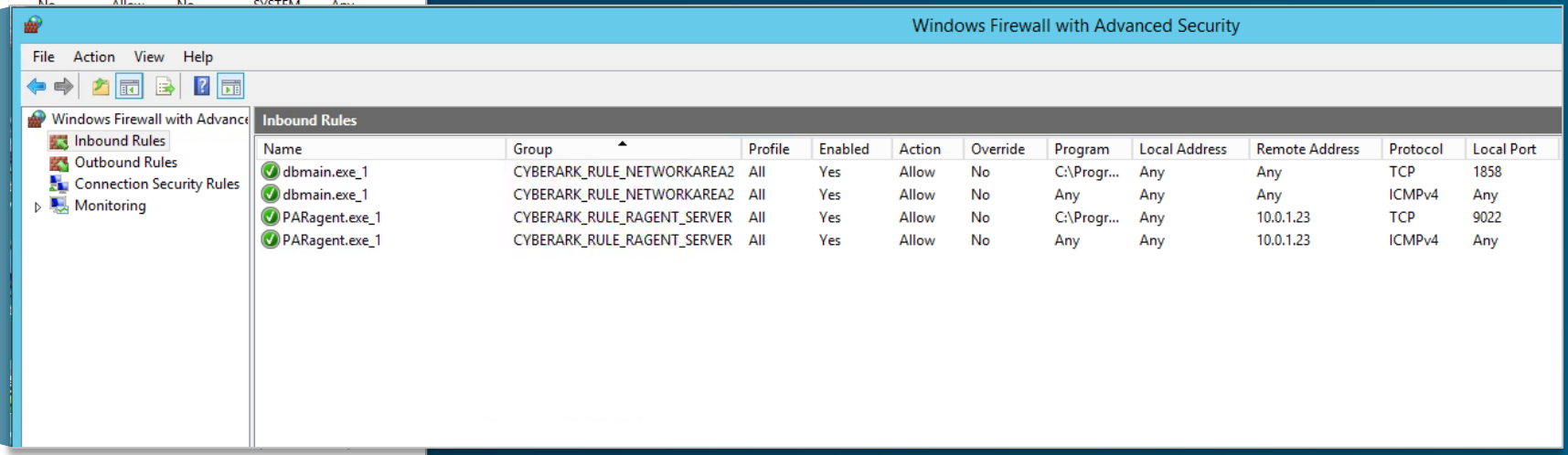
Vault Firewall

Firewall before Vault installation



Firewall Post Hardening



All Firewall Rules that do not relate to CyberArk have been deleted, both inbound and outbound.

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Vault Main Configuration Files

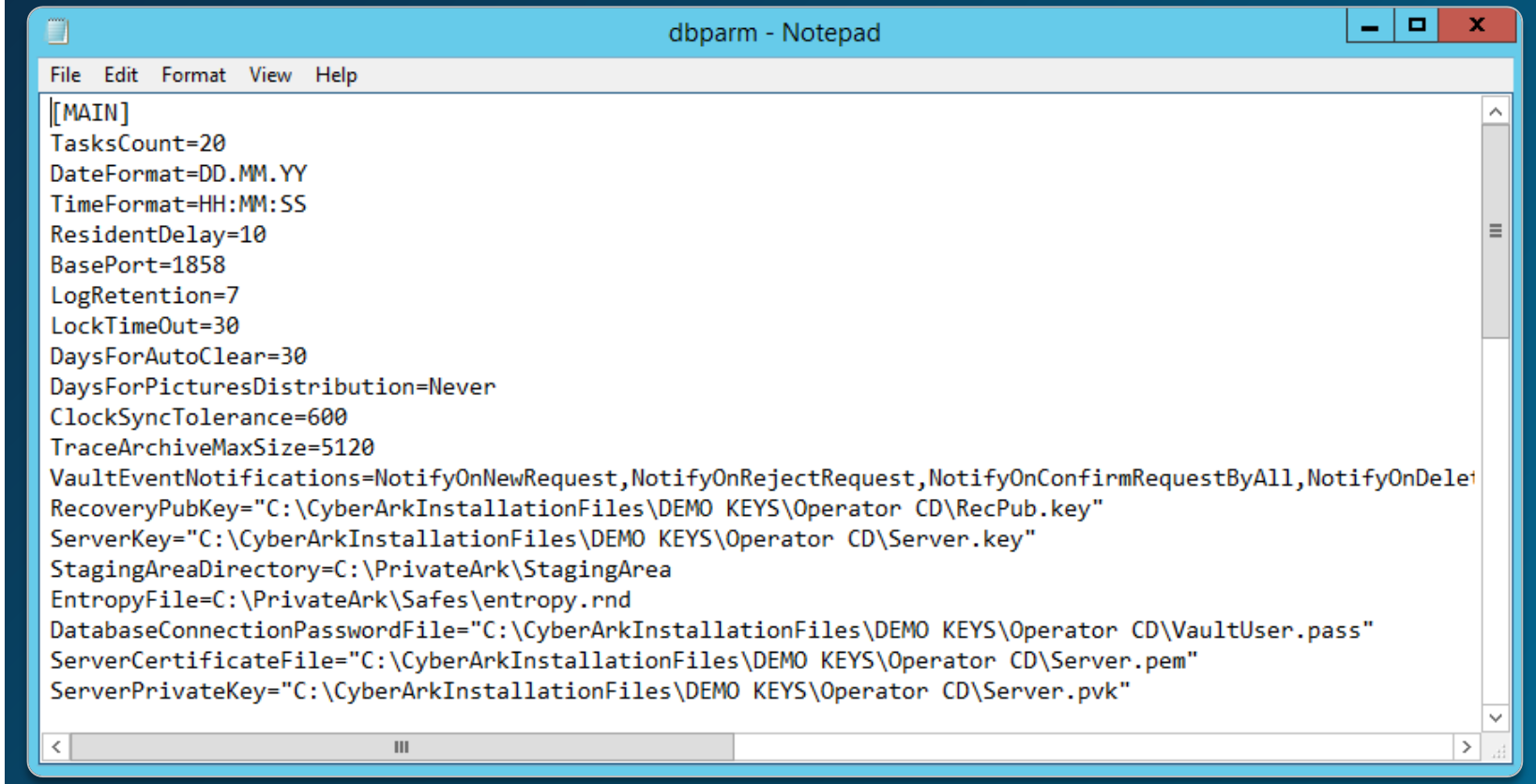
dbparm.ini	• Main configuration file of the Vault • Any change requires a restart of the Vault service
passparm.ini	• Configure password policy for users of the Vault
PARagent.ini	• Configure Remote Control Agent in the Vault • SNMP Configuration
tsparm.ini	• Configure the physical disks used to store Vault data

dbparm.ini

dbparm.ini:
Current Vault configuration file, contains parameters for Log Level, Server Key, Syslog, Timeouts, Recovery Key, etc.

DBPARM.sample.ini:
Contains all the possible configuration options. Full info on these parameters is contained in the PAM documentation.

dbparm.ini.good:
Contains the last known working configuration of the dbparm.ini file. Created automatically when the Vault server starts up.



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Vault Log Files

Italog.log	• Main log file of the Vault server.
Trace.d0	• Trace file of the Vault. • It is detailed according to the debug level configured in the dbparm.ini.

Inside the PVWA

PVWA Service
IIS Services

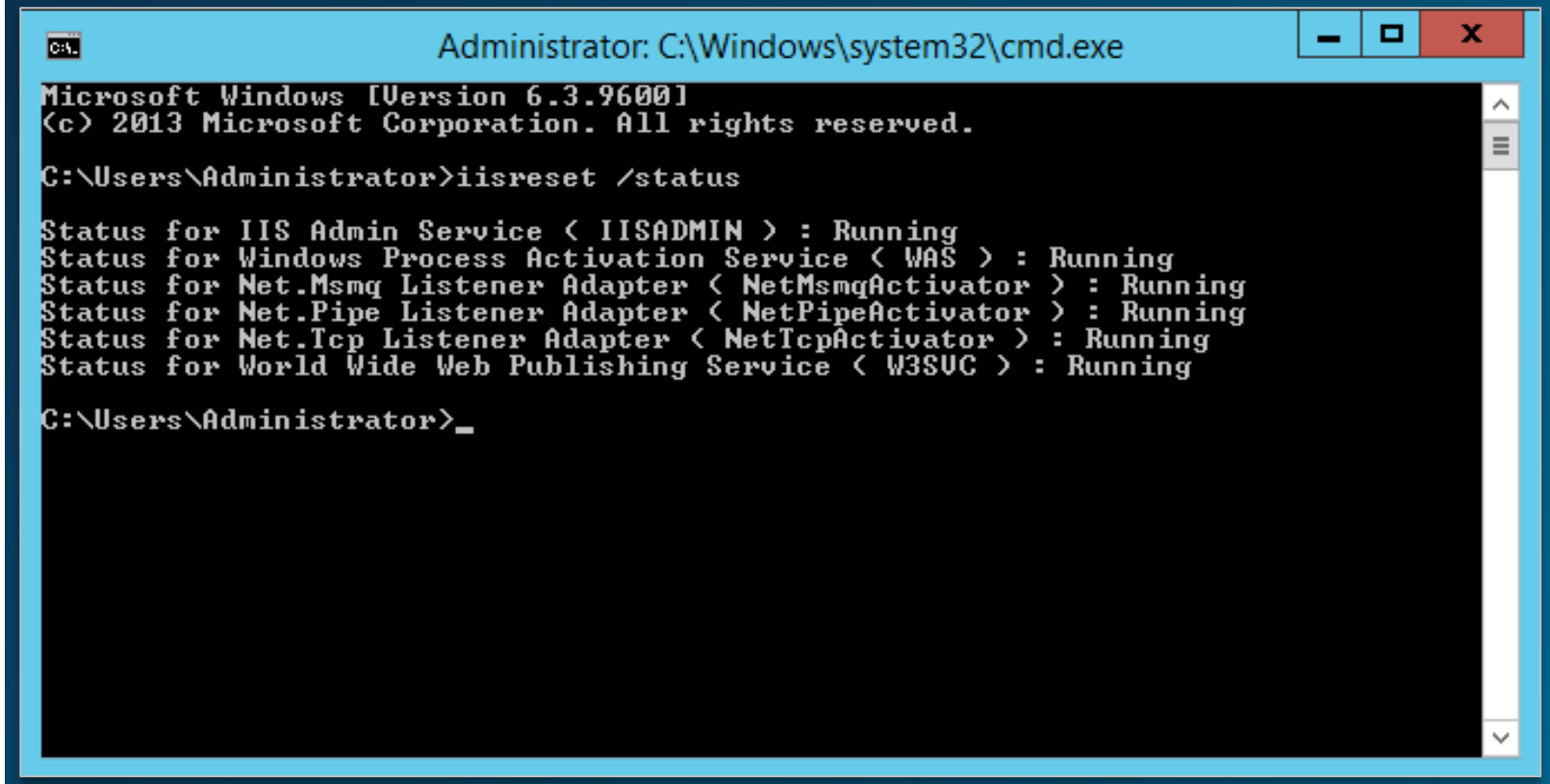
As the **PVWA** is a web application running on **IIS**, you can control it through the IIS Manager interface or use the command line by running:

iisreset /restart

or

iisreset /status

to check status of website



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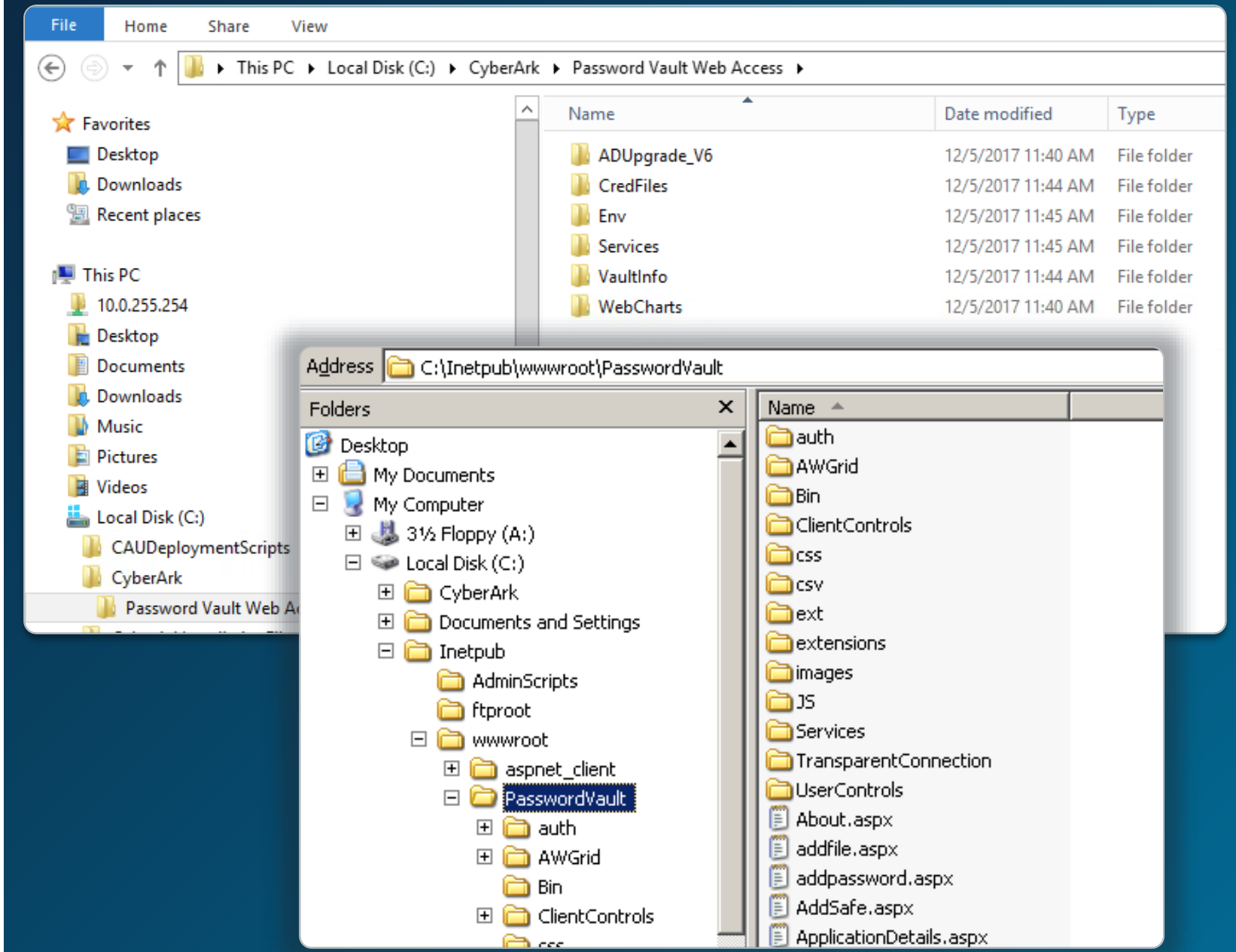
PVWA Directories
IIS Folder

- **PVWA** application files are located at:

  C:\Cyberark\Password Vault Web Access

- Web page: IIS Virtual Folder - ***PasswordVault***



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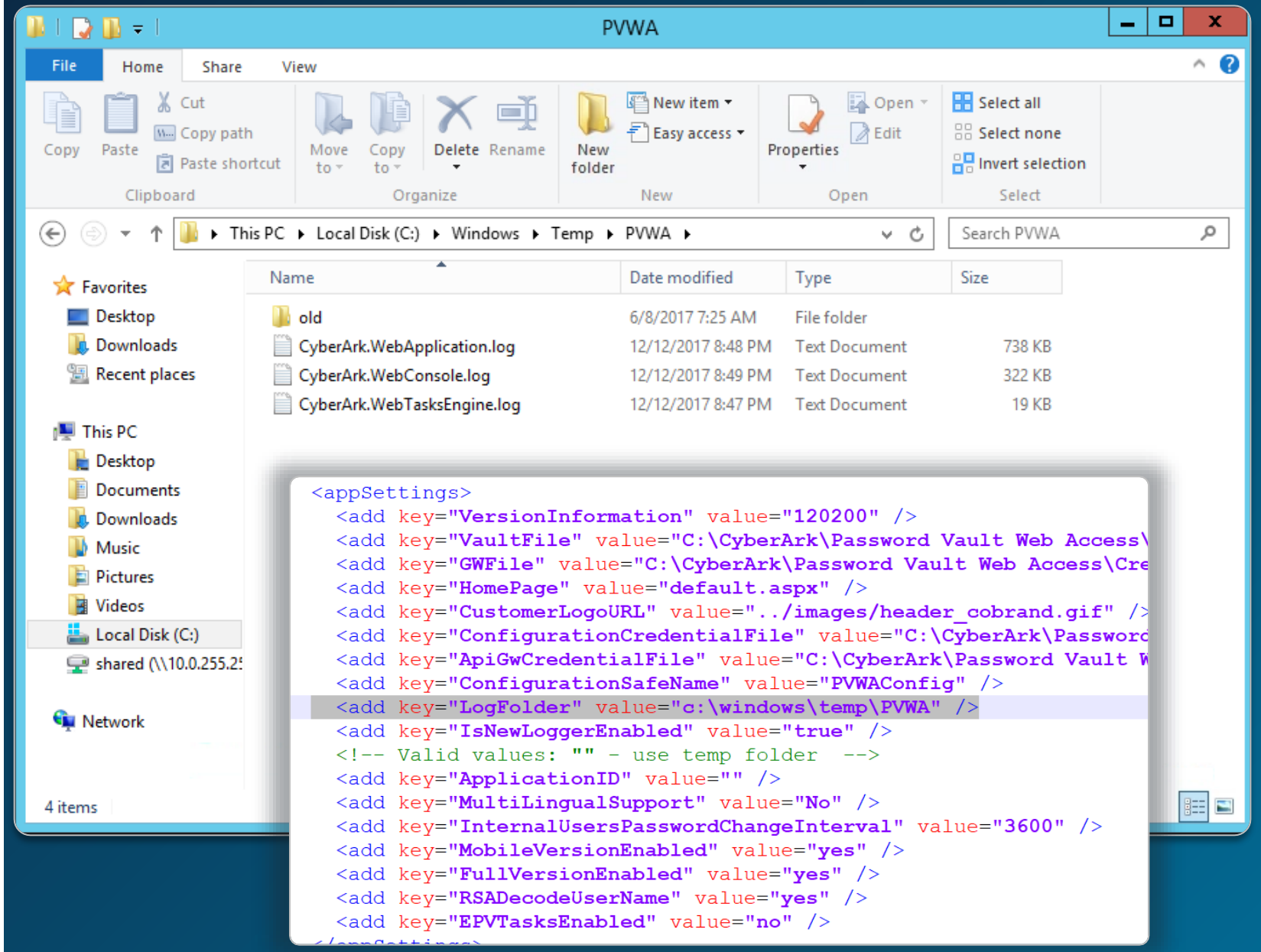
PVWA Log Location

- Default log file location:

  %windir%\temp\PVWA\.

- Can be changed by going to the ***PasswordVault*** folder under IIS, opening the file ***web.config***, and modifying the "LogFolder" parameter



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Inside the CPM

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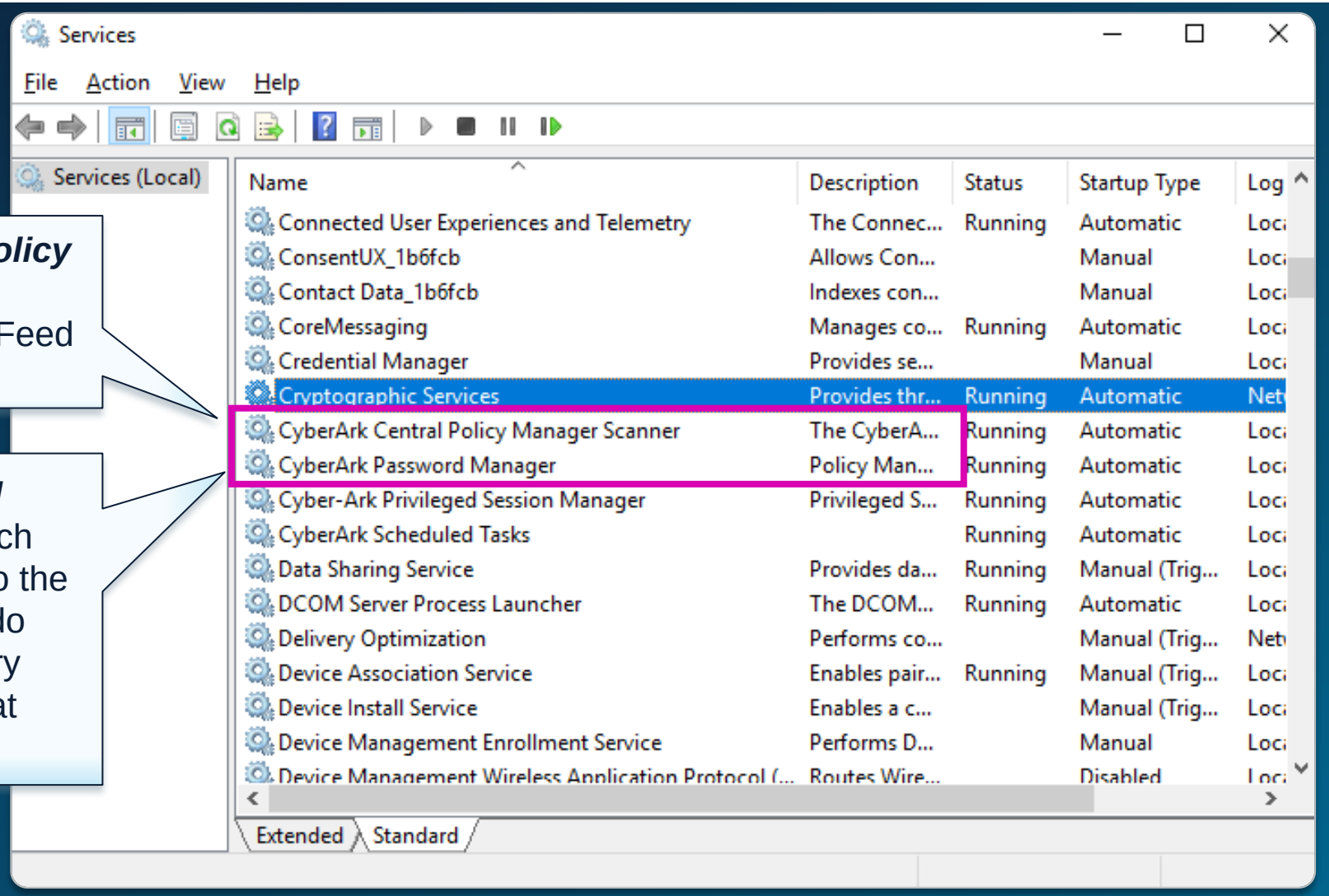
CPM Services

The **CPM** server has two main services:

The CyberArk Central Policy Manager Scanner is the scanner for the Accounts Feed workflow.

The CyberArk Password Manager service is a batch processor that connects to the **Vault** looking for work to do and kicks off the necessary processes to complete that work.



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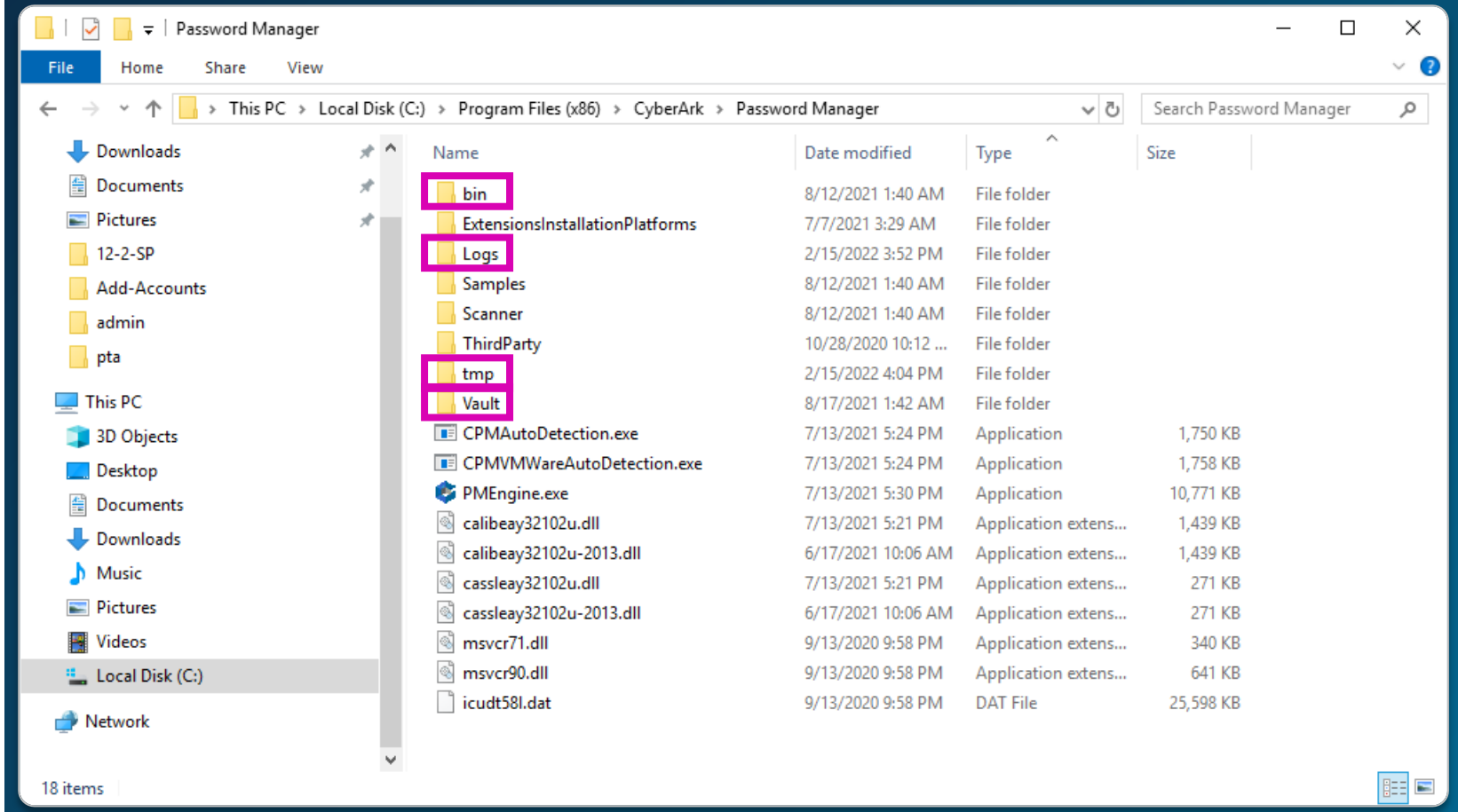
CPM Directories

bin –
Contains all the files required to run the CPM and the change password processes on target machines

Logs –
Contains CPM activity log files

tmp –
Contains files that are used by the CPM for internal processing

Vault –
Contains the configuration that tells the CPM where to find the vault and how to connect



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Log Files

Activity Logs
(Logs folder)

- ***pm.log*** – contains all the log messages, including general and informative messages, errors, and warnings.
- ***pm_error.log*** – contains only warning and error messages.

Third-party Log Files
(Logs\ThirdParty folder)

- Generated by the **CPM**'s password generation plug-ins when an error occurs
- Name of the log file:
  <type of password>-<Safe>-<folder>-<name of password object>.log
  E.g., ***Operating System-UnixSSH-1.1.1.250-Root.log***

History Log Files
(Logs\History folder)

- After a log file has been uploaded into the **Safe**, it is renamed and moved into the History subfolder.
- The file is marked with a time stamp and renamed as follows:
  <filename> (<date>-<time>).log

Inside the PSM

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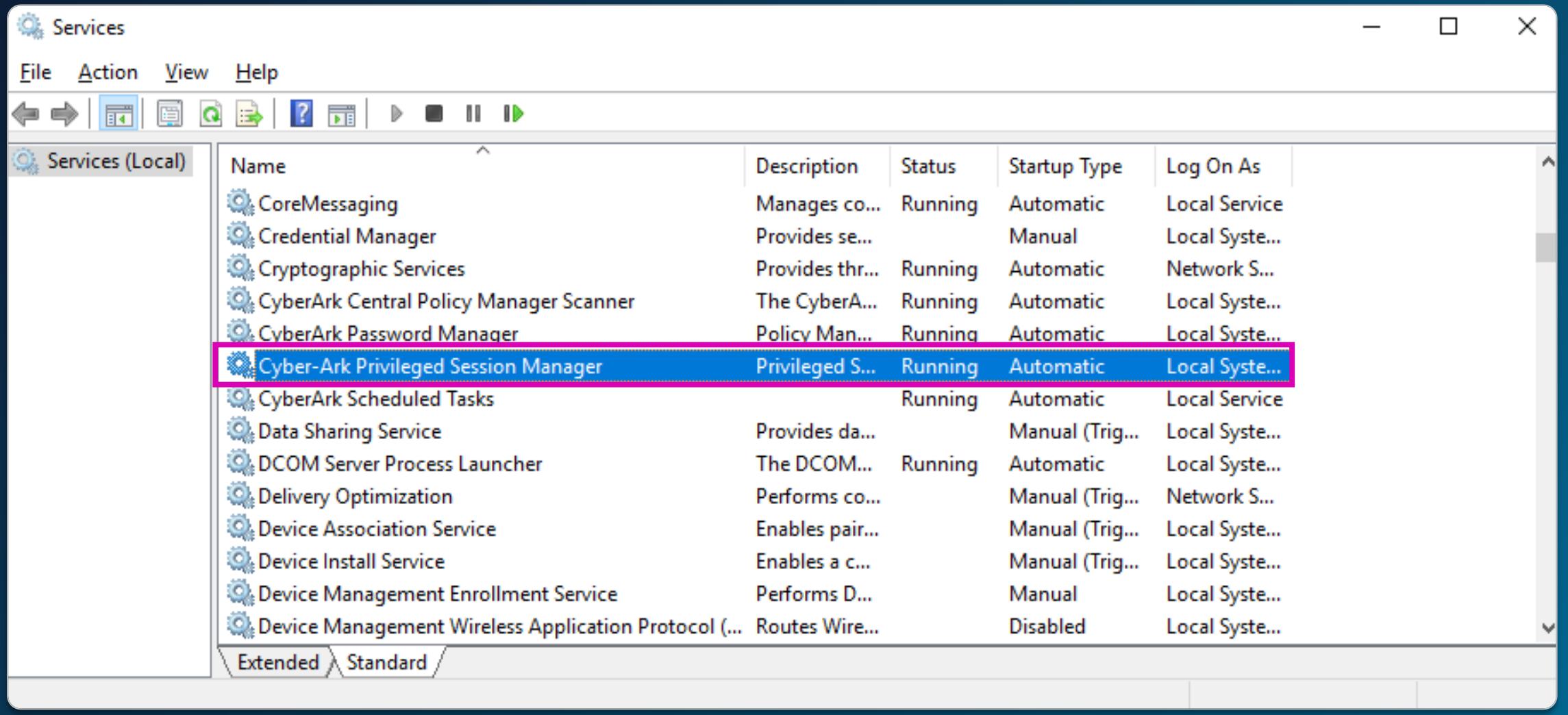
The PSM Service



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PSM Directories

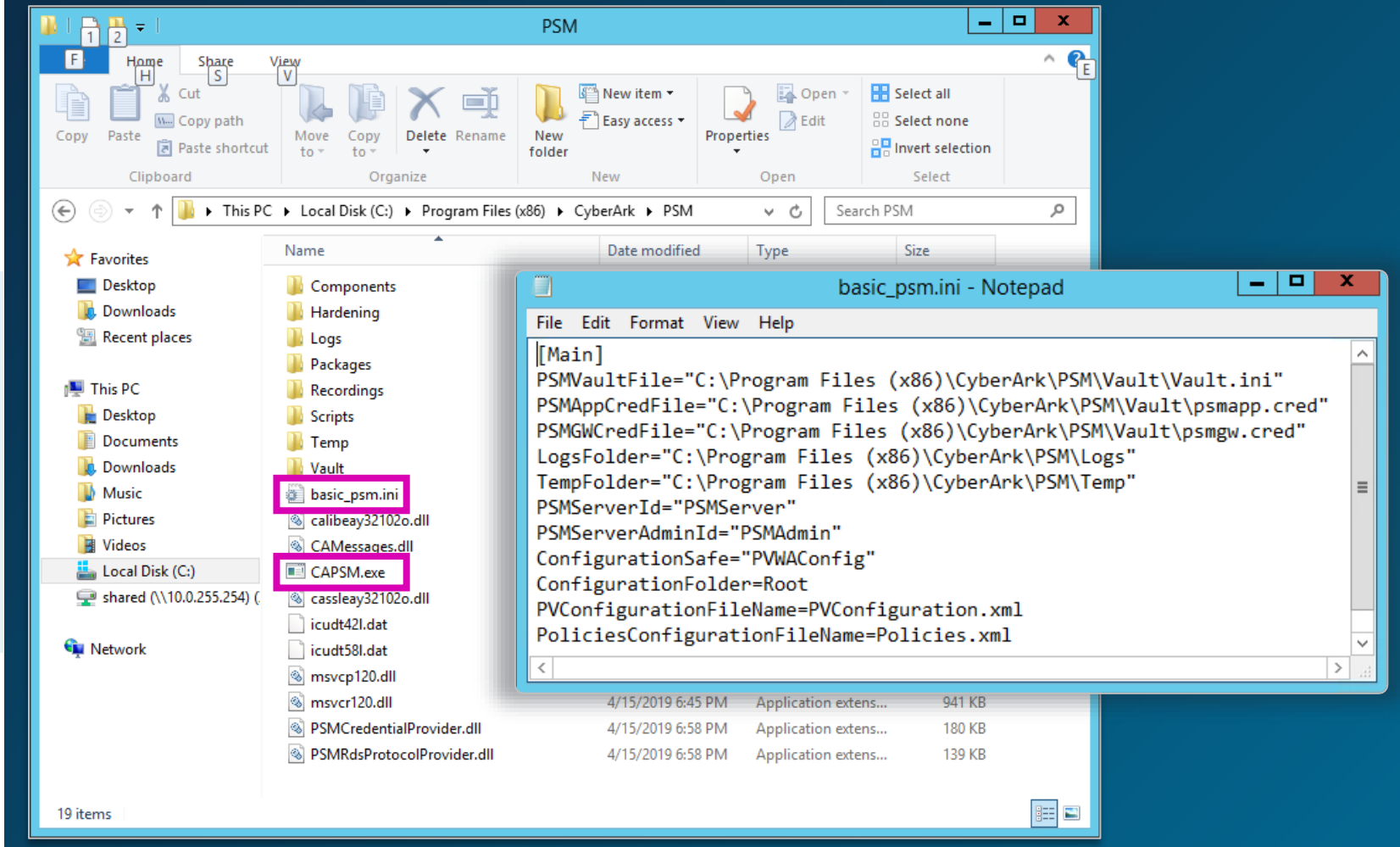
In the **PSM** directory you'll find all the configuration files, logs, and connectors that allow end users to connect to target systems.

Vault

Provides the PSM with the information required to log into the Vault

service user is given write permissions on this folder.

required to start the **PSM** (cred file locations, **Safe** names).



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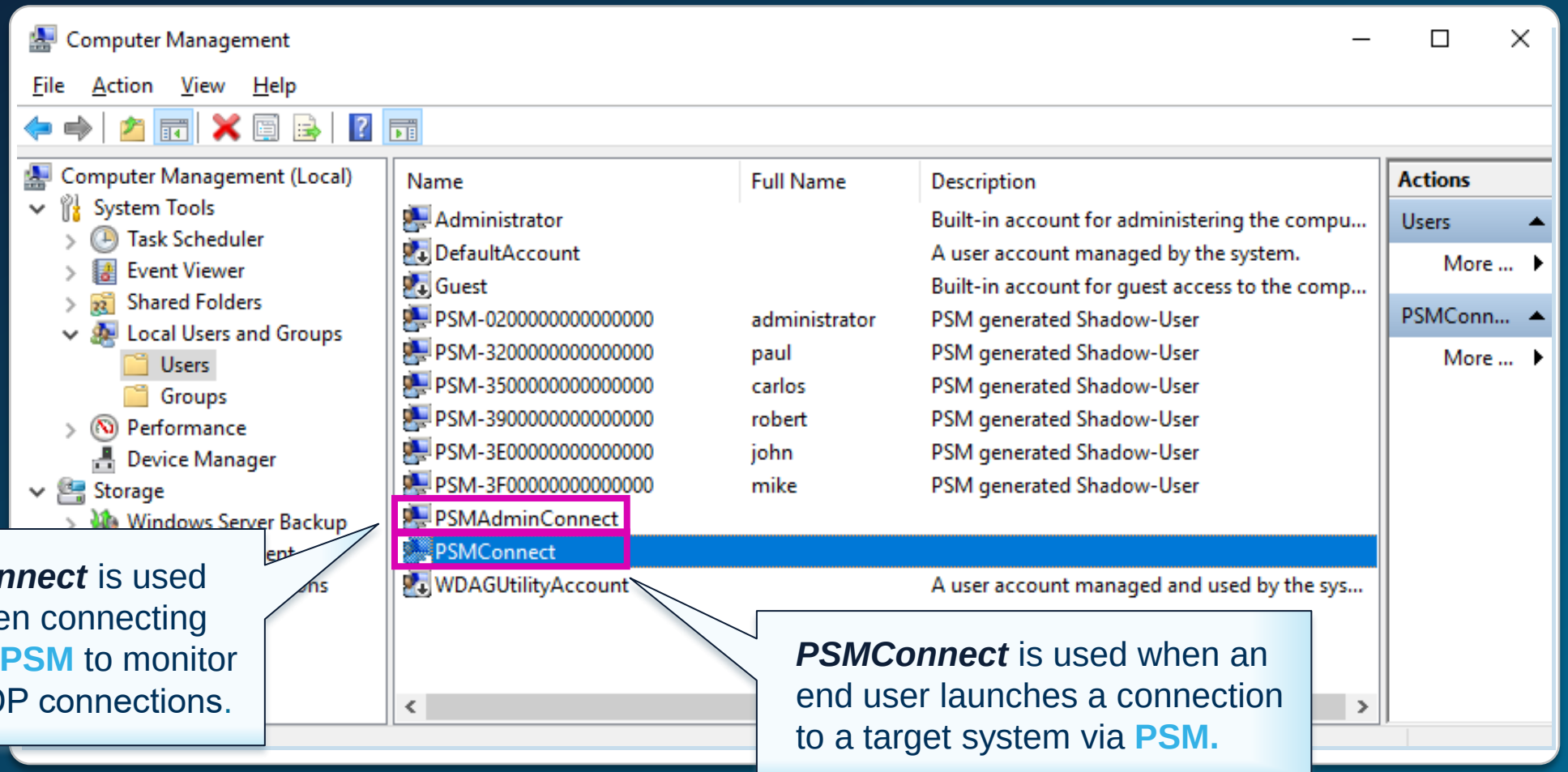
PSM Logs

All activities that are carried out by the **PSM** are written to log files and stored in the ***Log*** subfolder of the **PSM** installation folder

PSMConsole.log	• Contains informational messages and errors that refer to **PSM** function.
<SessionID>.Recorder.log	• Contains errors and trace messages related to the **PSM** Recorder that can be used for troubleshooting with session video recordings. The types of messages that are included depend on the debug levels specified in the **Recorder** settings of the **PSM** configuration.
<SessionID>.<connection client >.log	• Contains errors and trace messages related to the connection client that can be used for troubleshooting.

PSMConnect and PSMAdminConnect Users

PSMConnect and ***PSMAdminConnect***t are local users on the **PSM** server.



PSMAdminConnect is used by Auditors when connecting via RDP to the **PSM** to monitor other users' RDP connections.

PSMConnect is used when an end user launches a connection to a target system via **PSM.**

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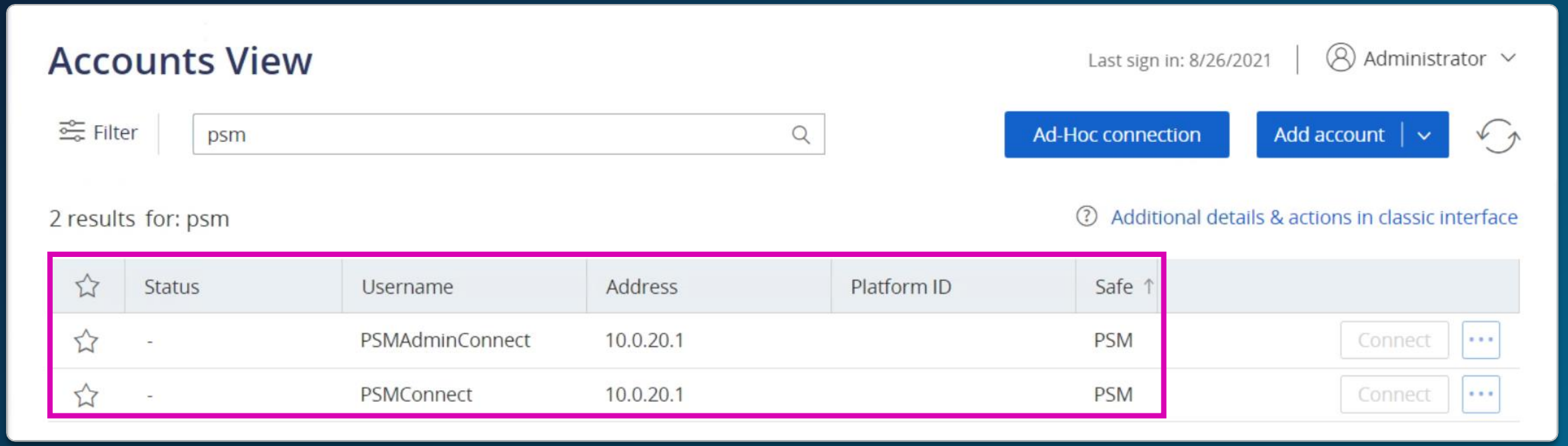
PSMConnect and PSMAdminConnect

The credentials for the ***PSMConnect*** and ***PSMAdminConnect*** users are stored as accounts in the **Vault** and should be managed in the same way any other account.



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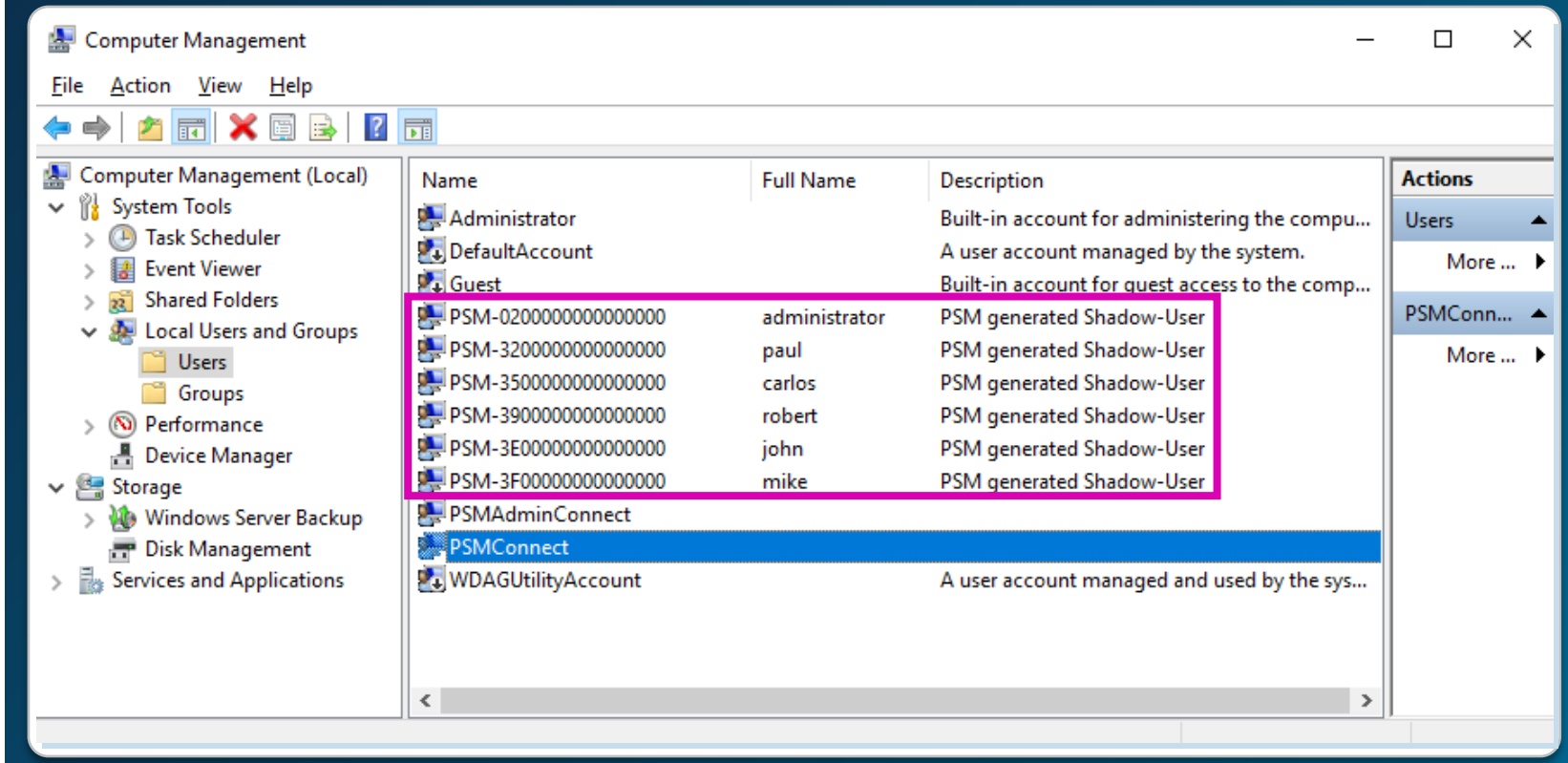
PSM
Shadow Users

- When a **Vault** user launches a session via the **PSM** for a **non-RDP** connection (e.g., **SSH**) for the first time, a shadow user is created for the user on the **PSM** server.
- This shadow user launches the application needed for the connection (**Putty** in the case of an SSH connection).
- The credentials for these users are reset with every connection.



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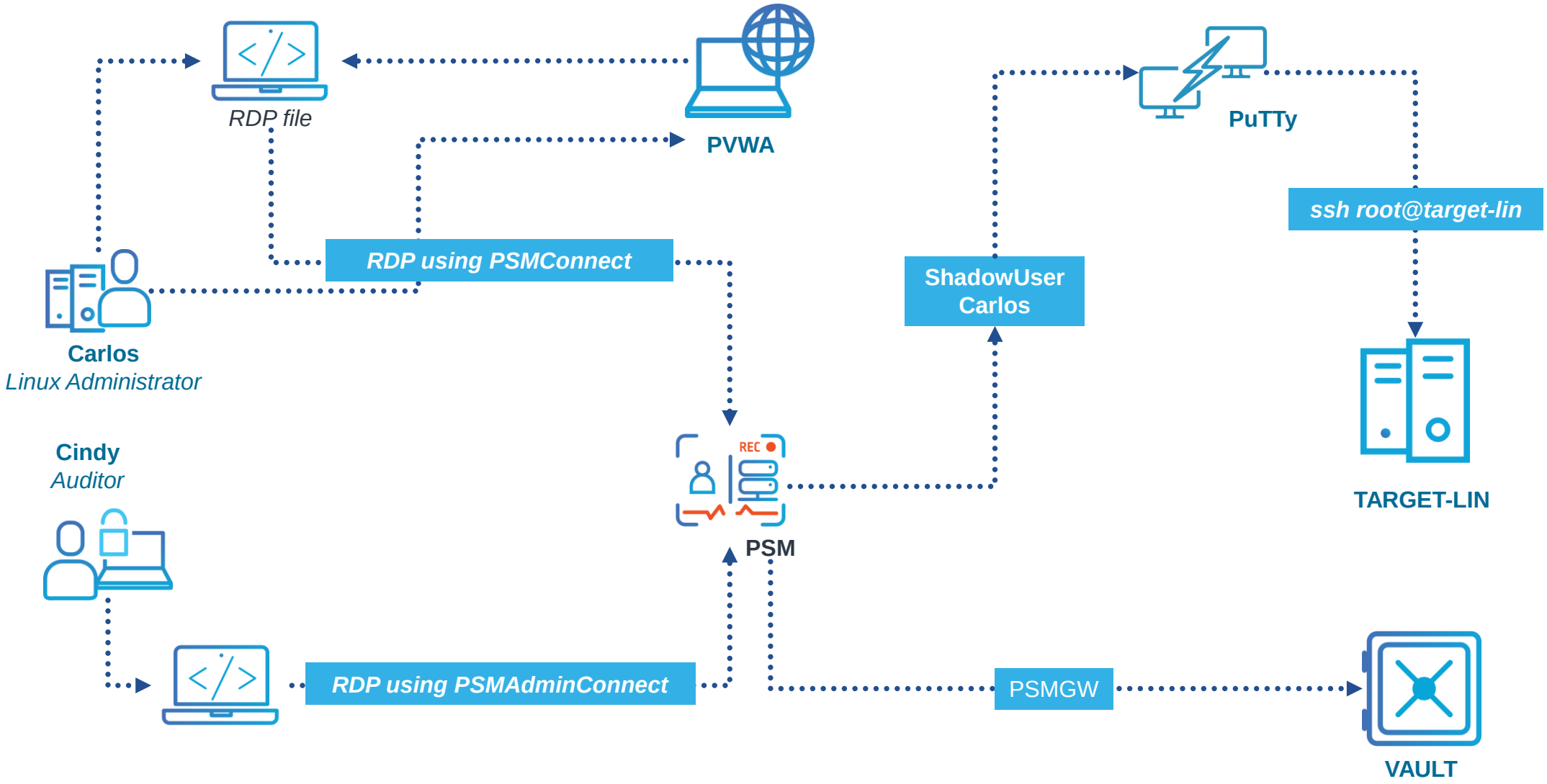
PSM Users Summary



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Internal Safes and Users

In this section we will look at the Internal safes and users created in the **Vault** for each component:

- **Vault**
- **CPM**
- **PVWA**
- **PSM**

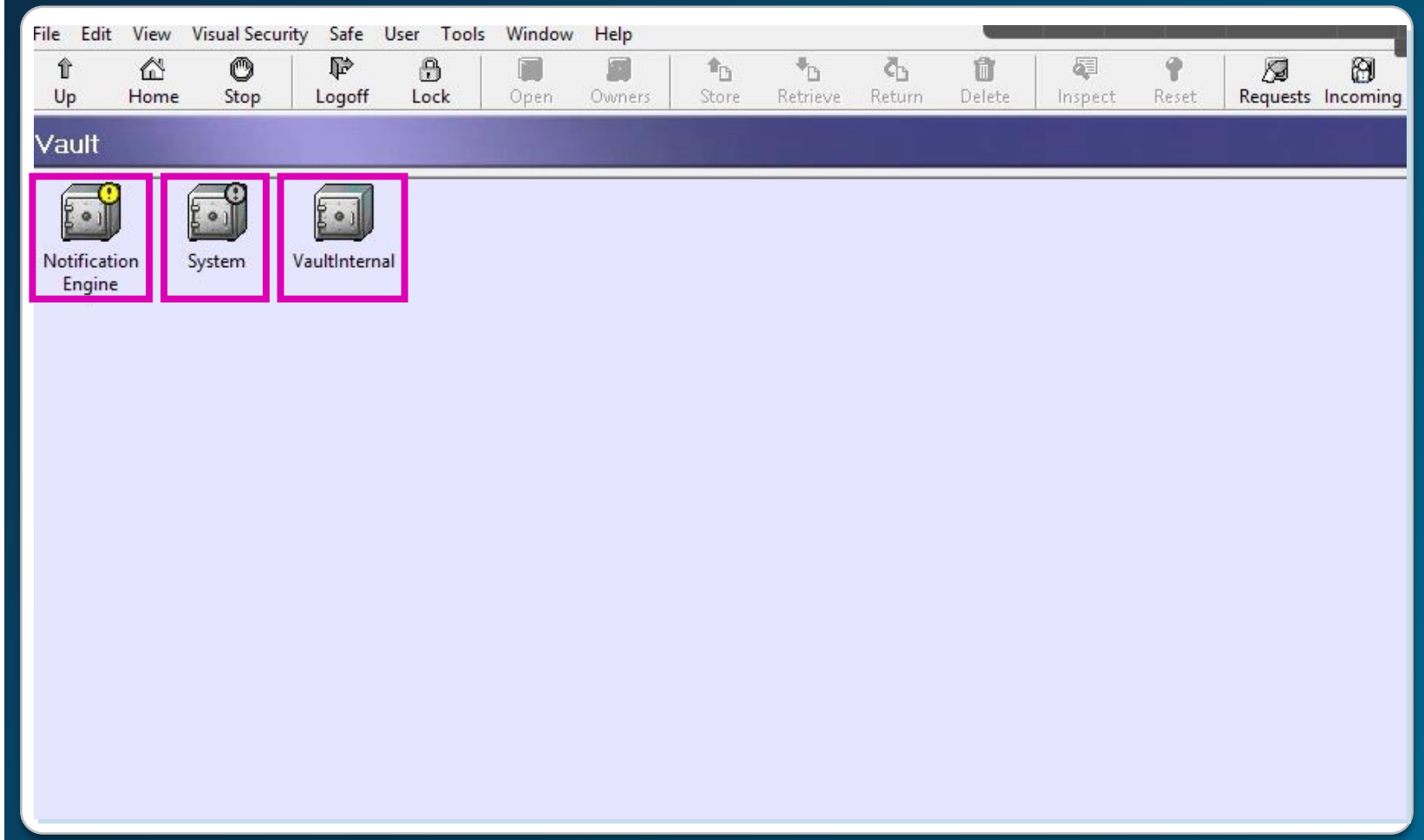
Vault Internal Safes

The three internal safes created during the **Vault** installation are:

- **Notification Engine:**
  used by the ENE service

- **System:**
  contains the file links for ***dbparm.ini***, etc.

- **VaultInternal:**
  contains configuration data for **CyberArk** LDAP integration



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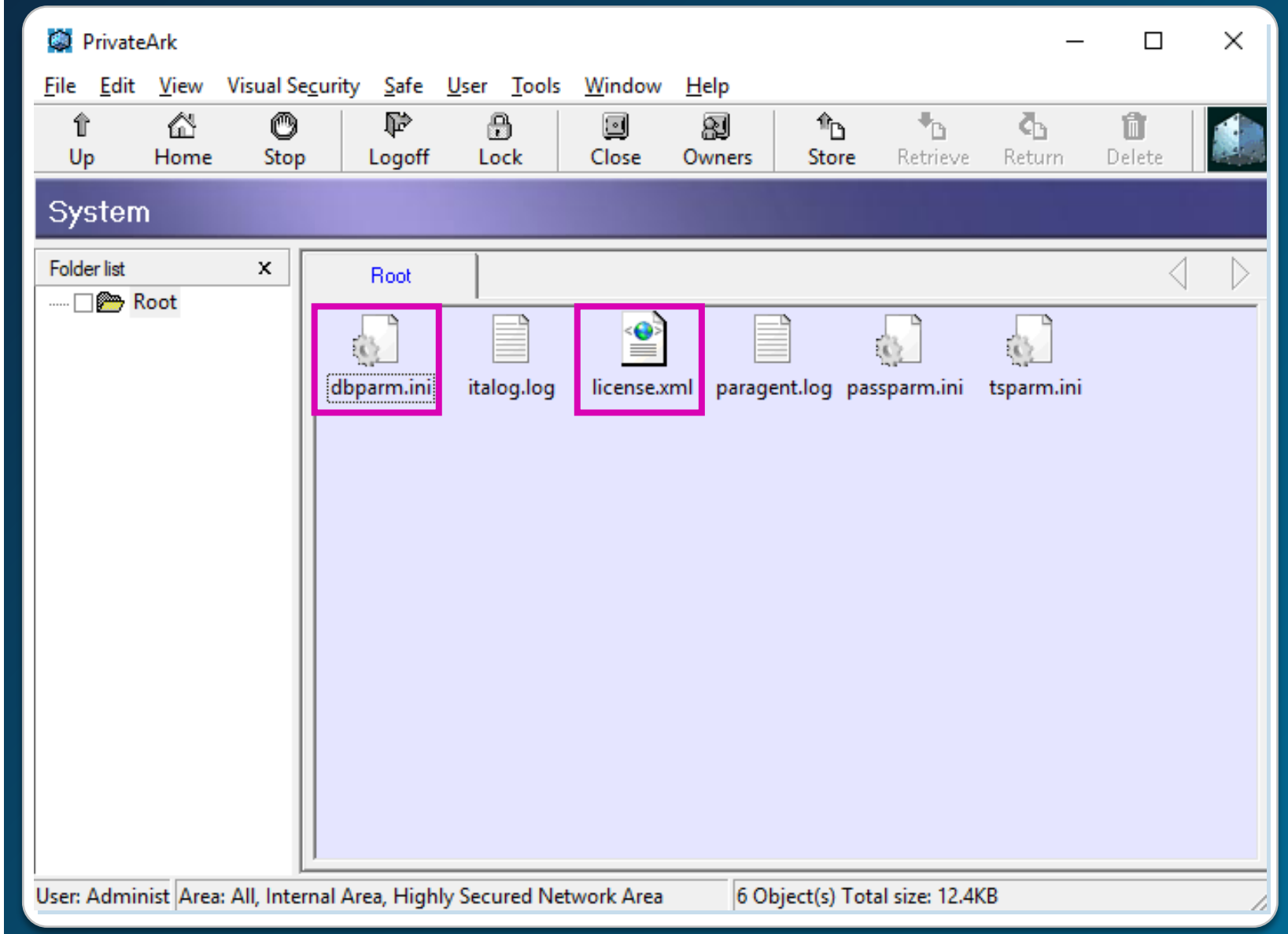
The System Safe

- The Vault's main configuration files and logs can be accessed in the **System** Safe from remote stations using the **PrivateArk Client**
- A new ***License.xml*** file can be copied into this Safe to update the license without the need to restart the Vault service



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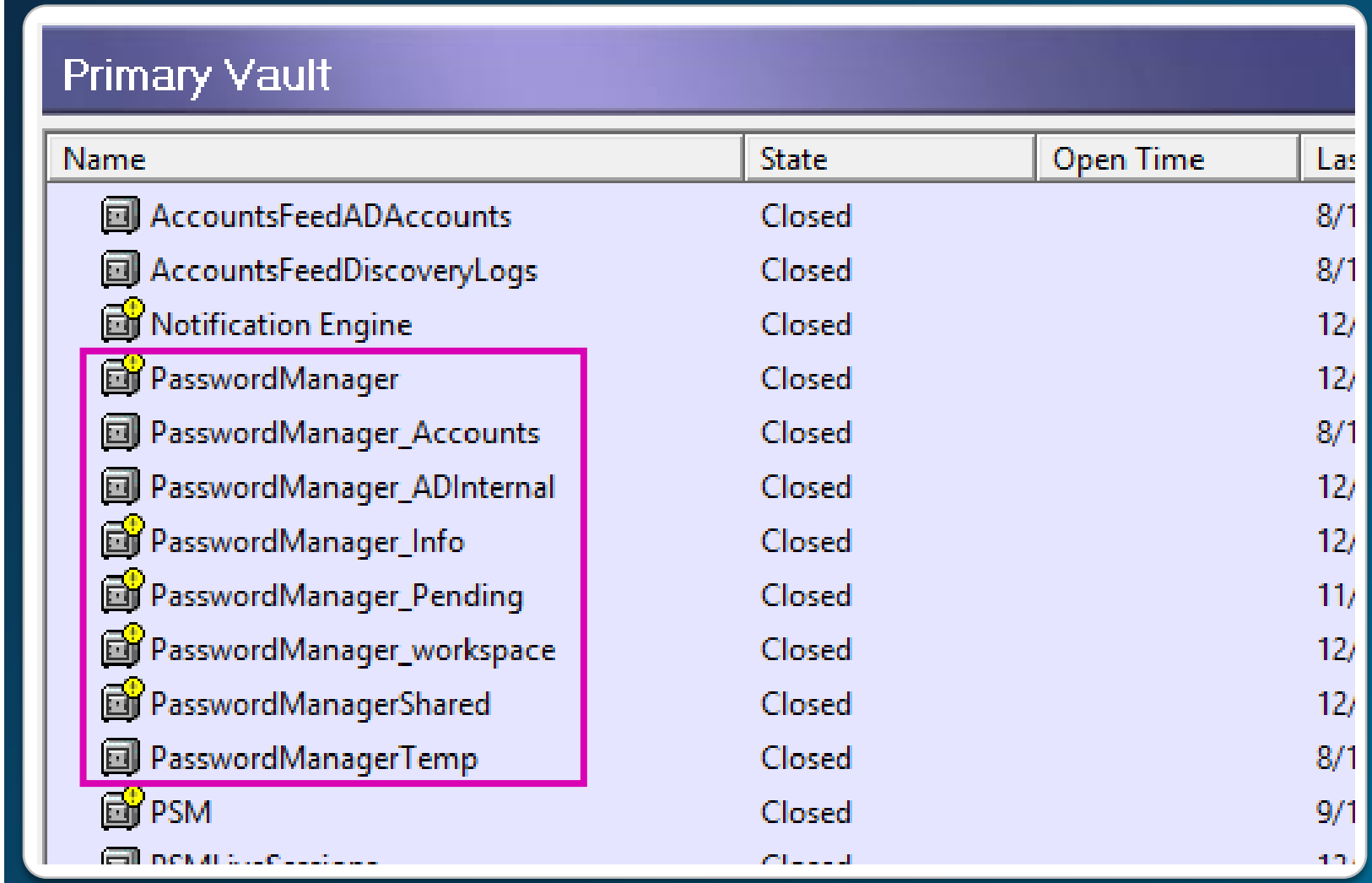
CPM Internal Safes

The installation of the first CPM will create 8 Safes:

- *PasswordManager*
- *PasswordManager_Accounts*
- *PasswordManager_ADInternal*
- *PasswordManager_info*
- *PasswordManager_Pending*
- *PasswordManager_workspace*
- *PasswordManagerShared*
- *PasswordManagerTemp*

Additional CPMs will share some Safes and create some additional new ones.



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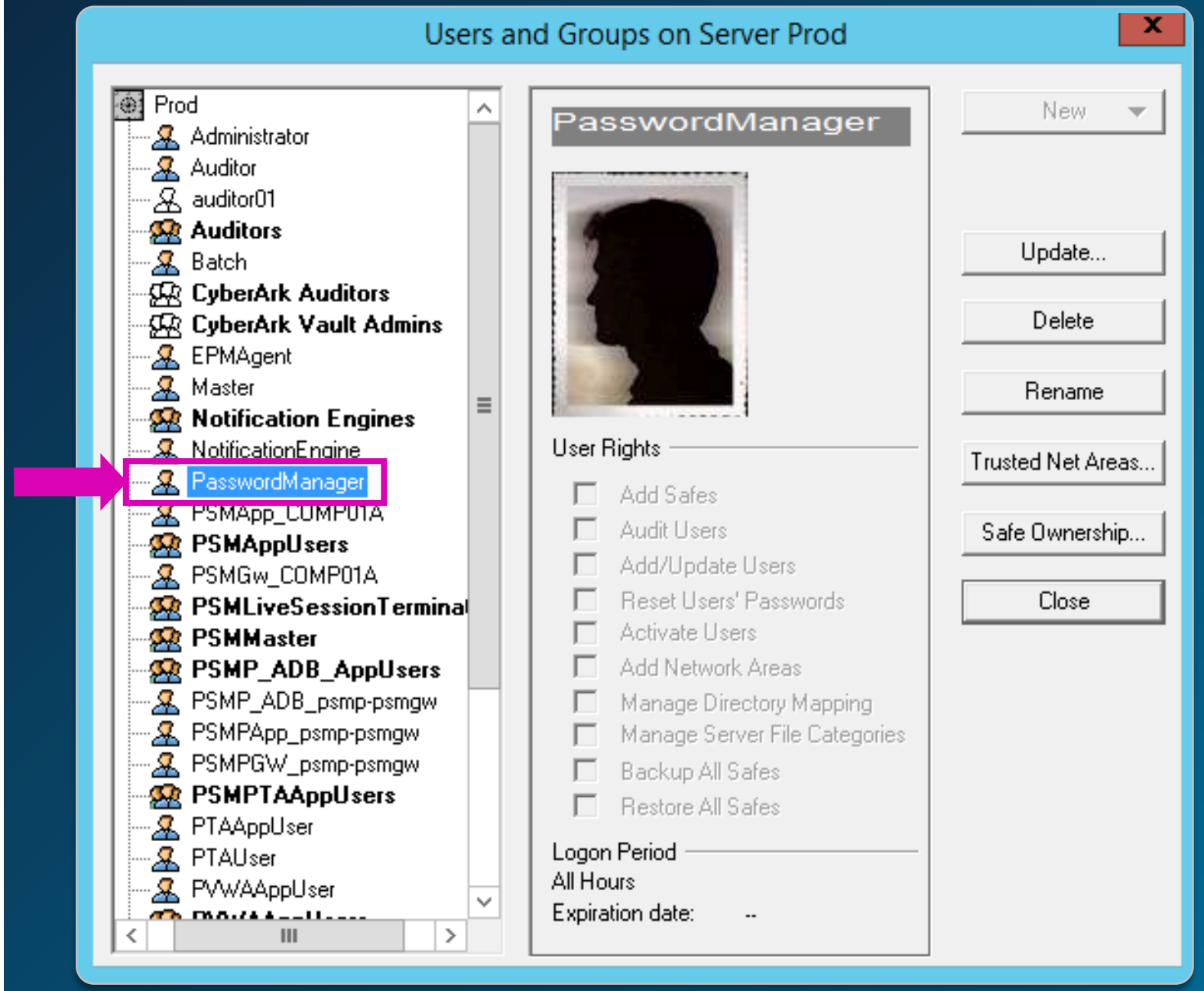
CPM Vault User

Tools > Administrative Tools > Users and Groups

- By default, the first **CPM** user's name is ***PasswordManager***
- When creating a new Safe through the **PVWA**, the **CPM** user is automatically added to the **Safe**



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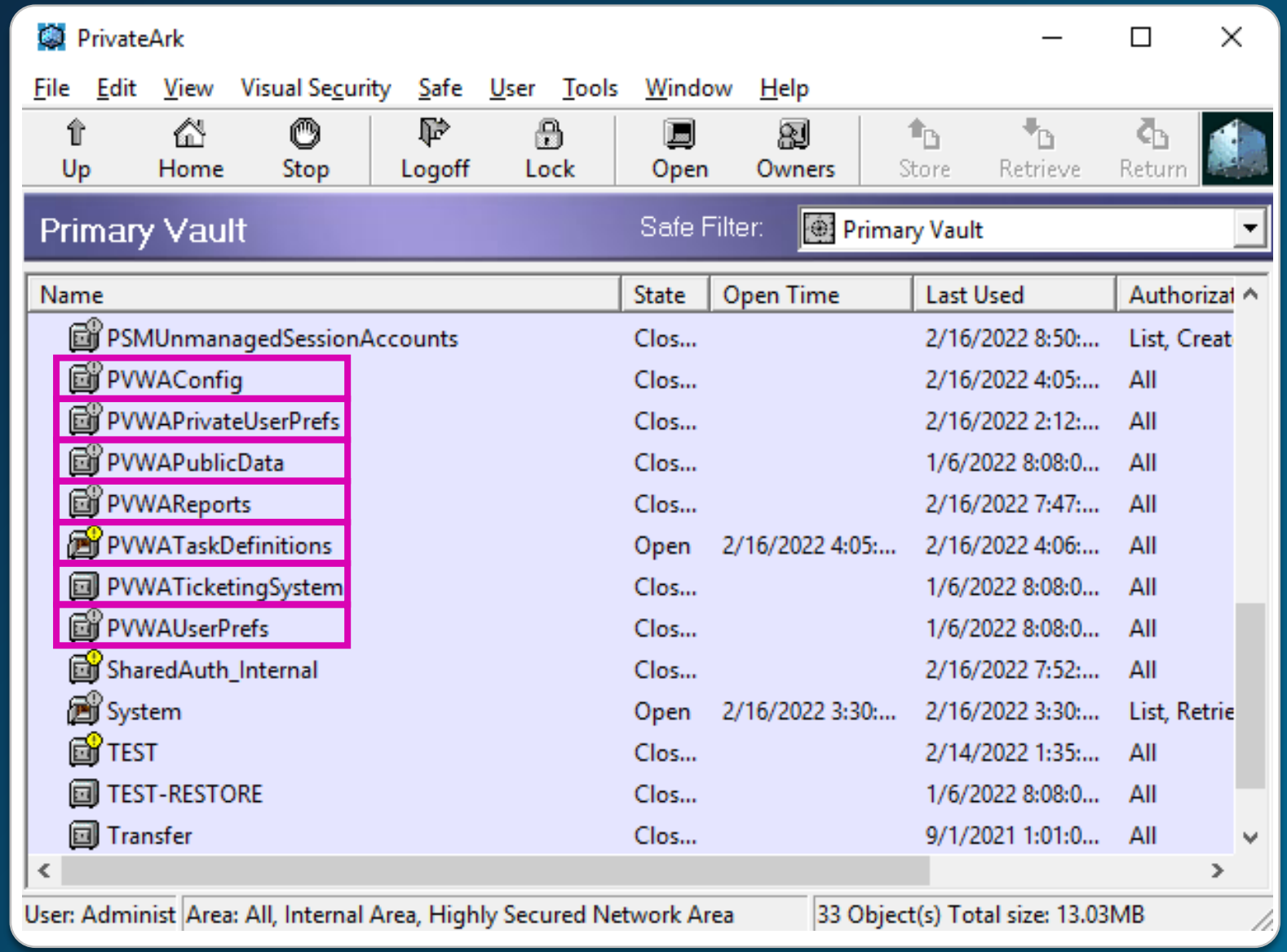
PVWA Safes

- **PVWAConfig** – configuration settings for **PVWA**
- **PVWAPrivateUserPrefs** – user preference settings

  ***Note**: The above two safes should not be accessed directly*
- **PVWAPublicDat**a – contains the help documents that can be accessed in the **PVWA**
- **PVWAReports** – completed reports
- **PVWATaskDefinitions** – report definitions
- **PVWATicketingSystem** – information on integrations with third-party ticketing systems
- **PVWAUserPrefs** – Changes to individual user preferences



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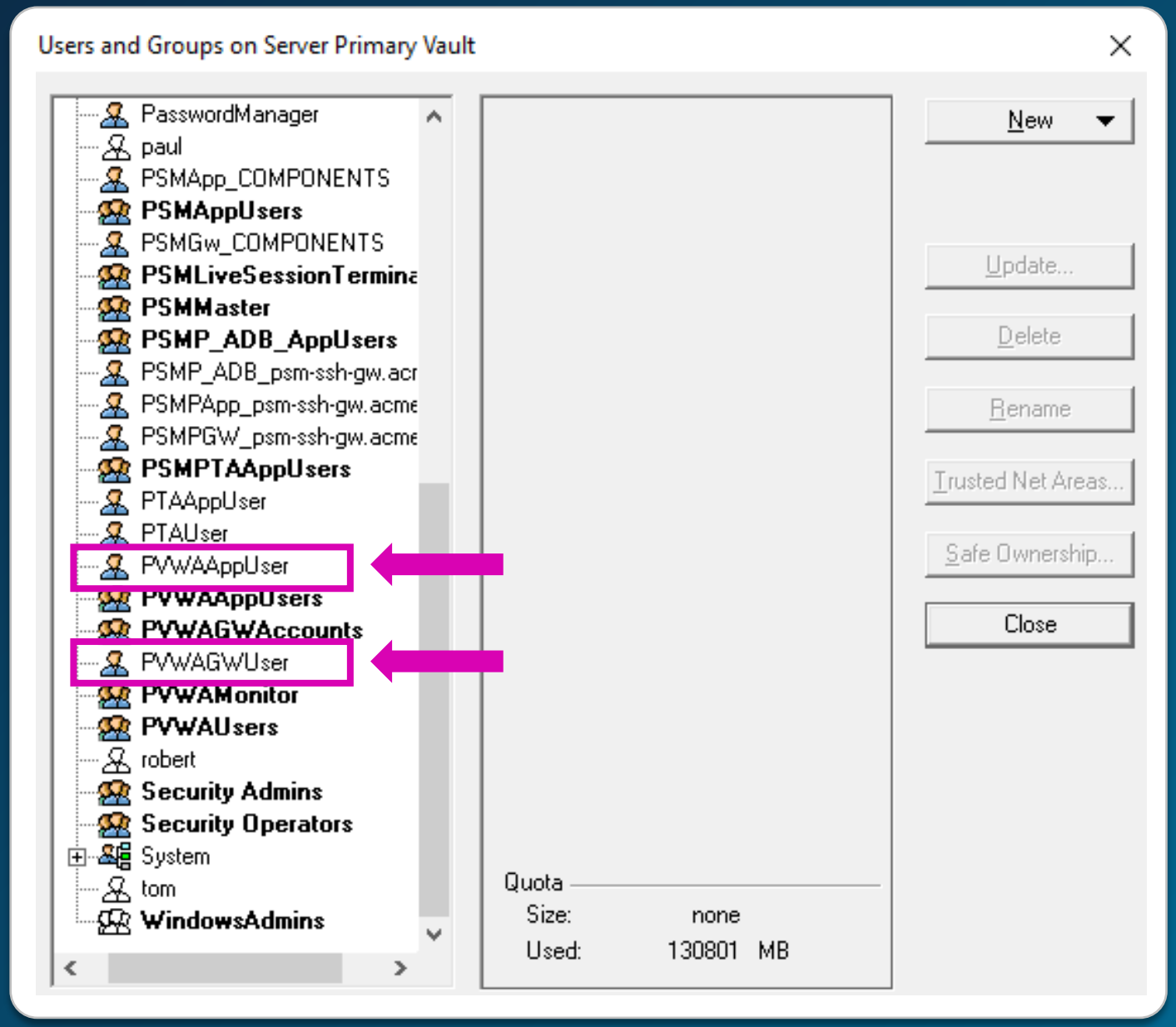
PVWA Vault Users and Groups

Tools->Administrative Tools->Users and Groups

- ***PVWAAppUser*** is used by the **Password Vault Web Access** for internal processing
- ***PVWAGWUser*** is the gateway user through which other users will access the **Vault**



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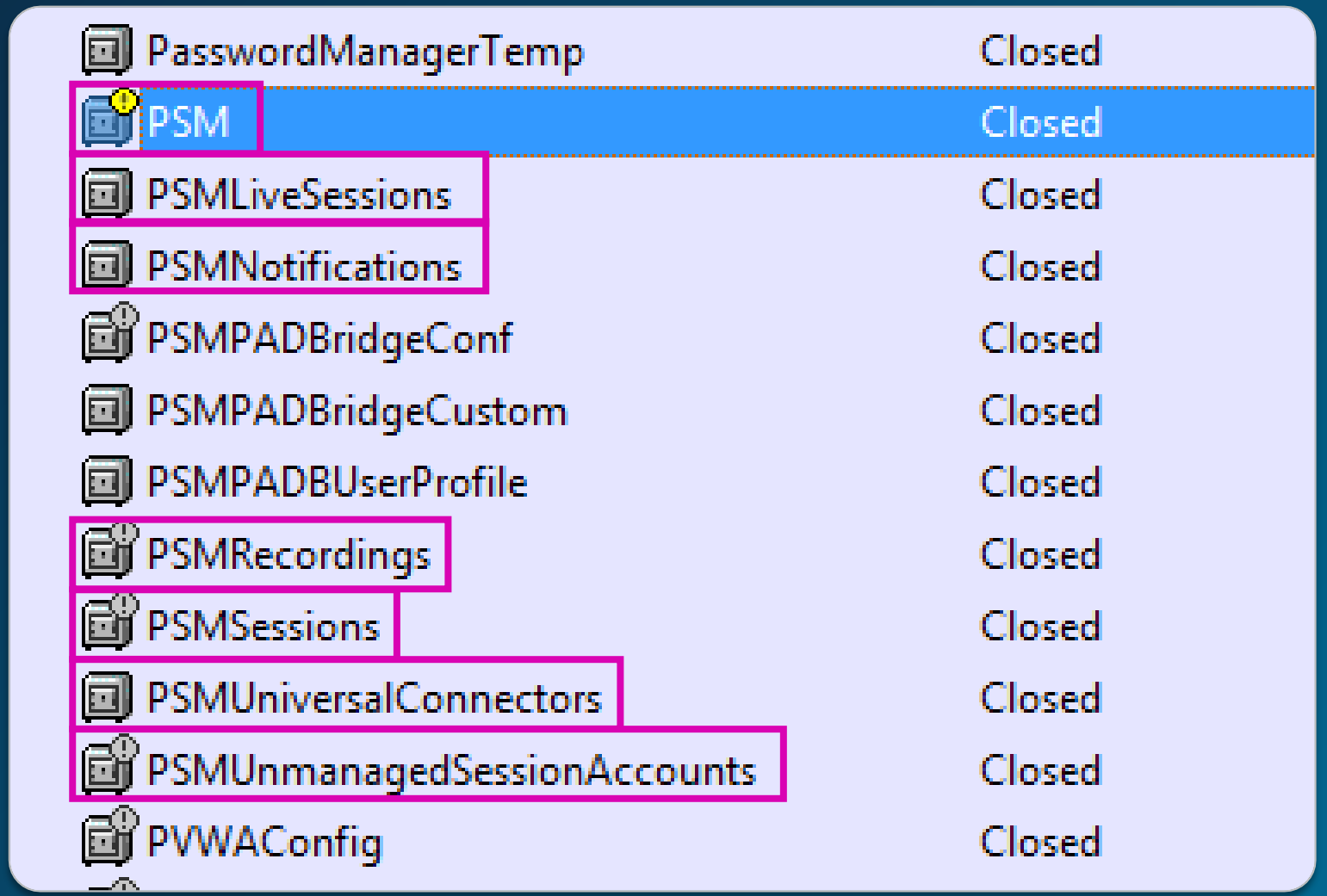
PSM Safes

- **PSM** – contains the password objects for PSMConnect and PSMAdminConnect.
- **PSMLiveSessions** – allows users to monitor live sessions
- **PSMNotifications** – allows users to terminate, suspend, or resume sessions.
- **PSMRecordings** – default safe for storing recordings.
- **PSM Sessions** – allows users to launch sessions via PSM
- **PSMUniversalConnectors** – used in auto deployment for PSM connectors to multiple PSMs.
- **PSMUnmanagedSessions** – allows users to monitor live Ad-hoc sessions



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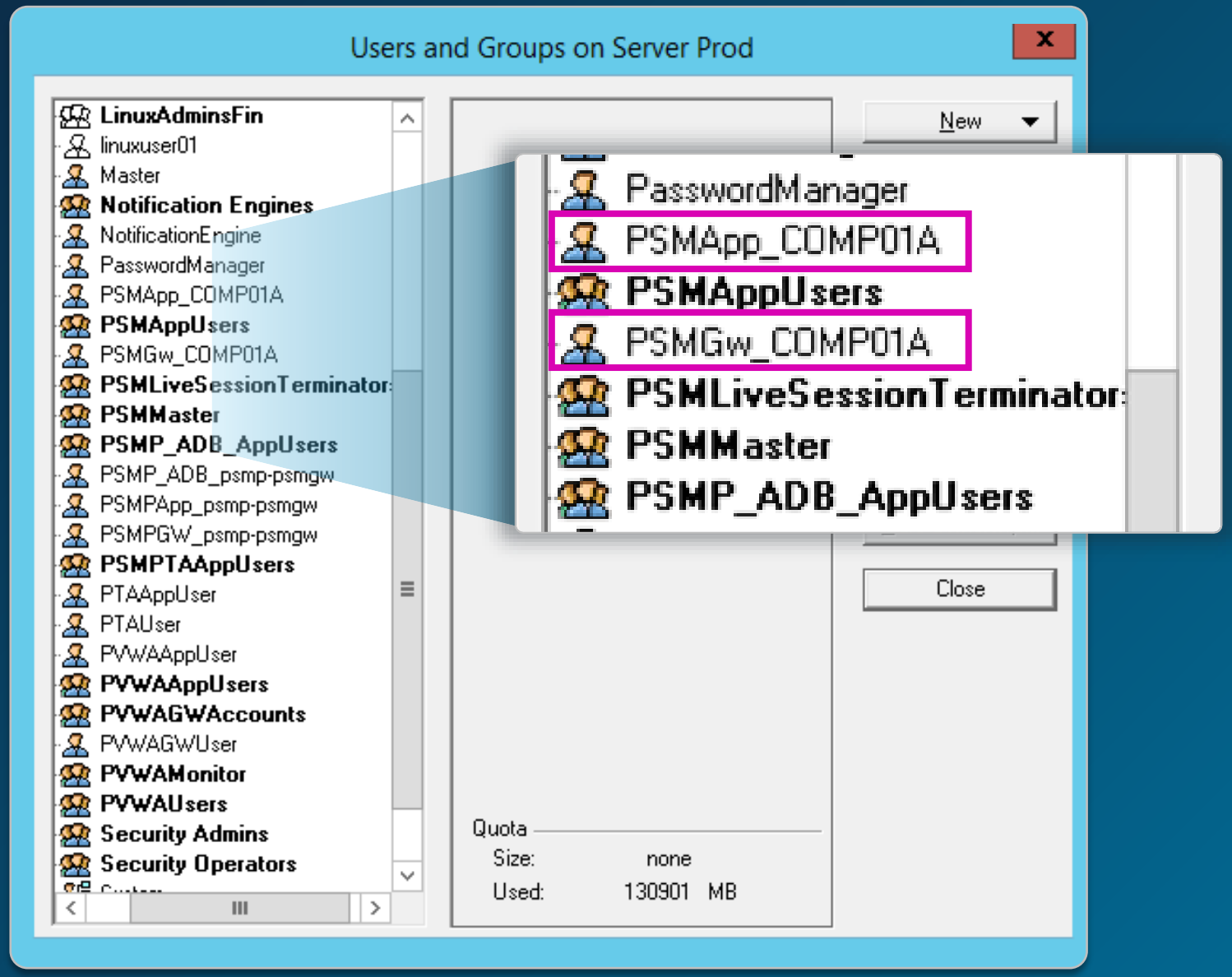
PSM Vault Users

PSMApp_<MachineName>

- Used by the **PSM** for internal processing
- The credential file for this user is stored on the **PSM** server in a file named psmapp.cred
- This user is added automatically to the PSMAppUsers group

PSMGW_<MachineName>

- This is the Gateway user through which the **PSM** will access the **Vault** to retrieve the target machine password
- The credential file for this user is stored on the **PSM** server in a file named ***psmgw.cred***
- This user is added automatically to ***PVWAGWAccounts*** group. Being a member of this group enables this user to access all password Safes



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PSM Vault Groups

PSMAppUsers

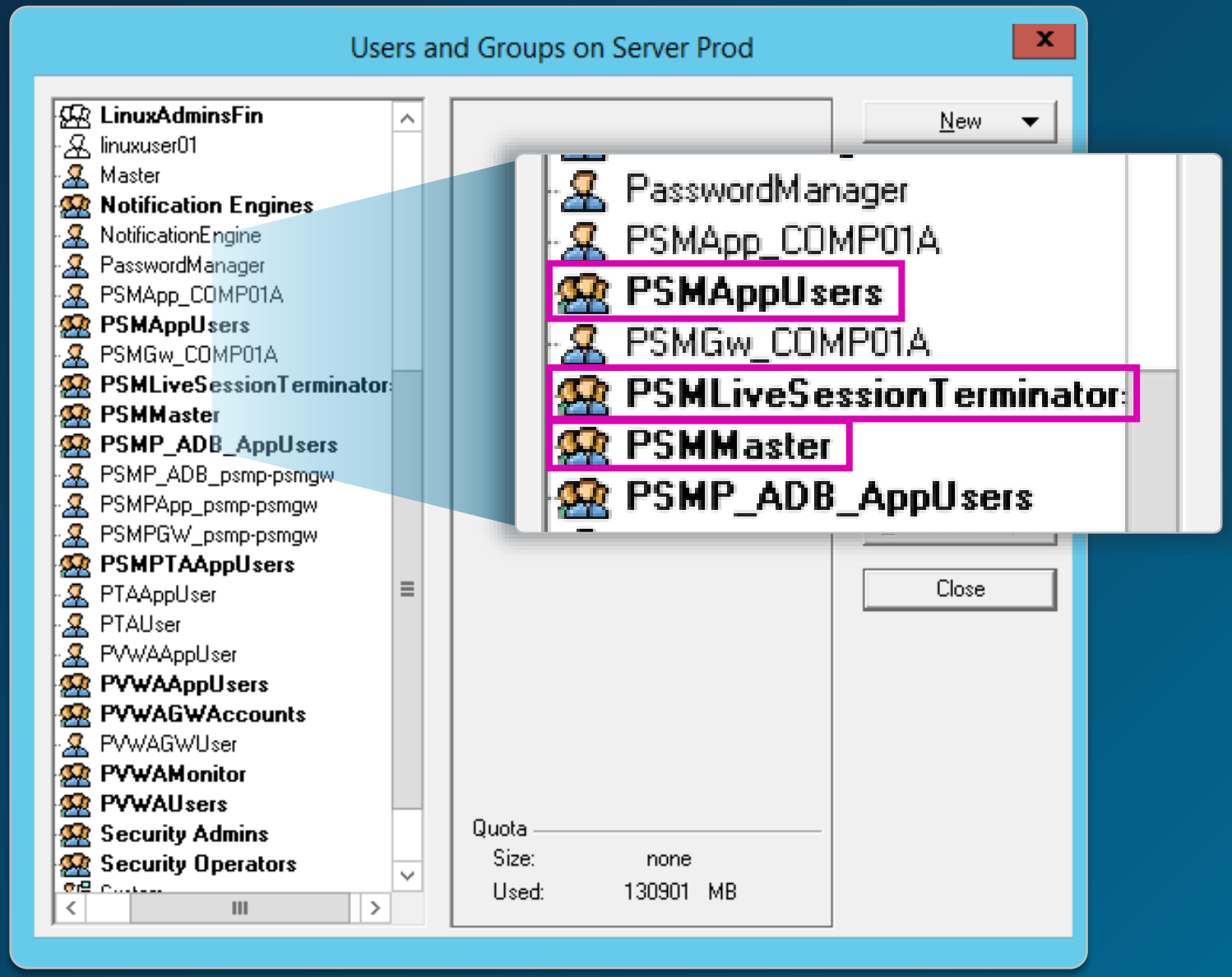
- This group is used to retrieve configuration data from the **Vault**, create Recording Safes, upload recordings, and perform other **PSM** activities

PSMLiveSession Terminators

- Members of this group can terminate, suspend, and resume live sessions

PSMMaster

- This group manages the Safes where recordings are stored.
- It is added to the Recordings Safes with all authorizations



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Internal Communication

In this section we will look at how **Components** communicate with the **Vault** and each other:

- Direct communication with the **Vault**
- Communication with the **Vault** using **REST/API**

Direct Communication With the Vault

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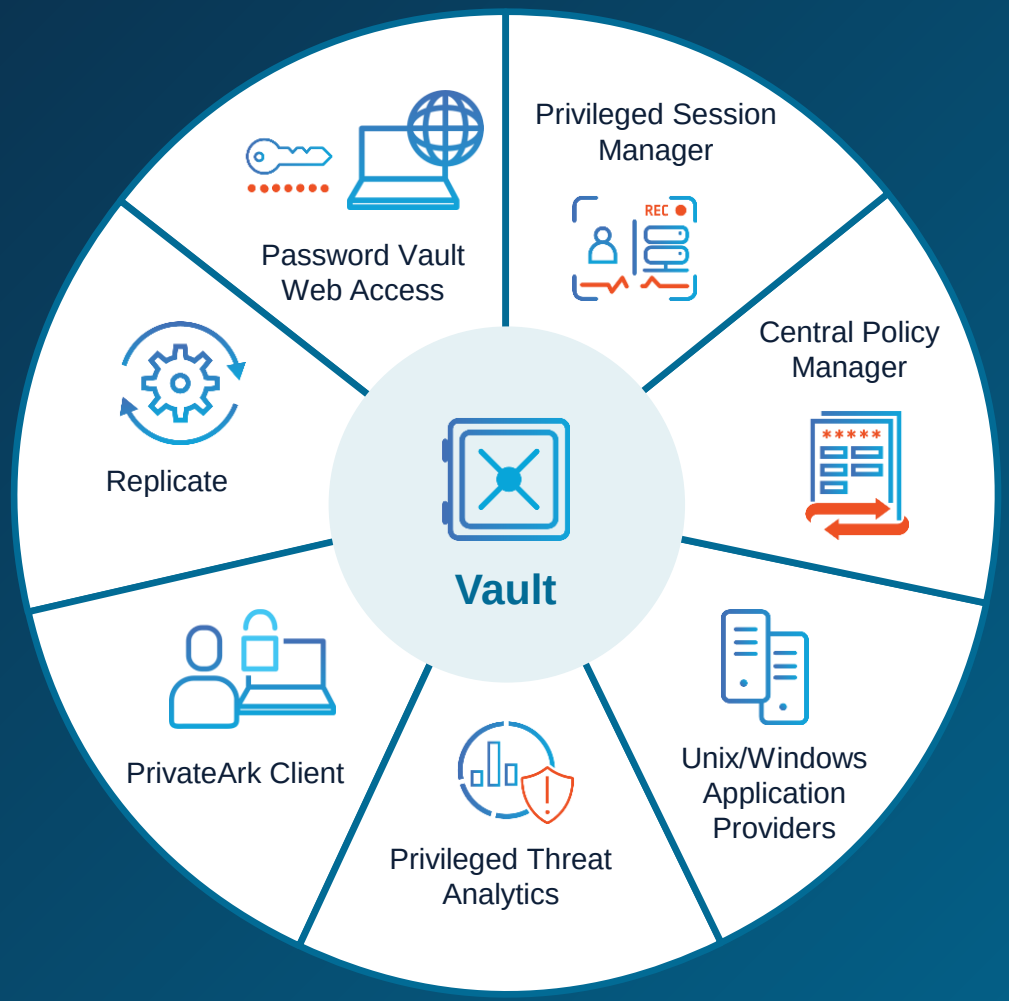
Connecting to the Vault

- Components communicate with the **Vault** using the **CyberArk** proprietary protocol on port **1858**
- Components must first authenticate to the **Vault** each time they are started
- Each Component has a User ID and password stored in a *“credential file”*



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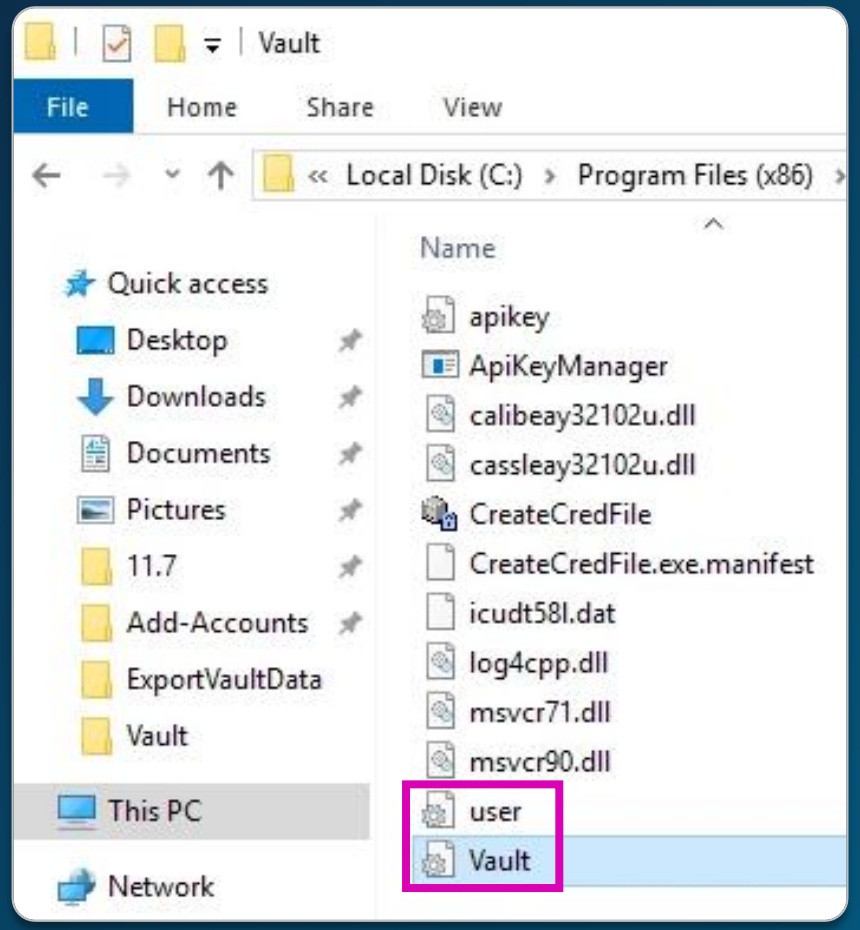
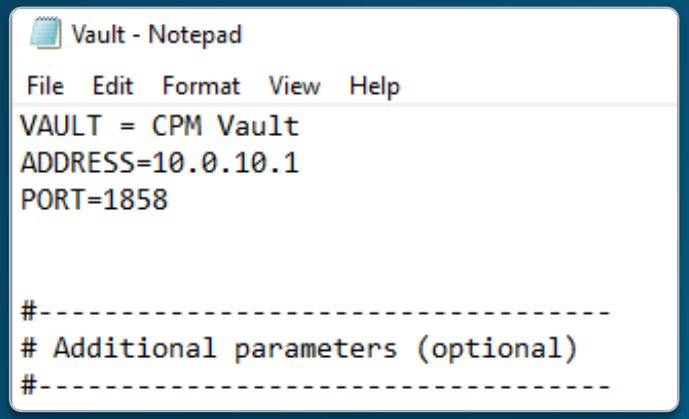
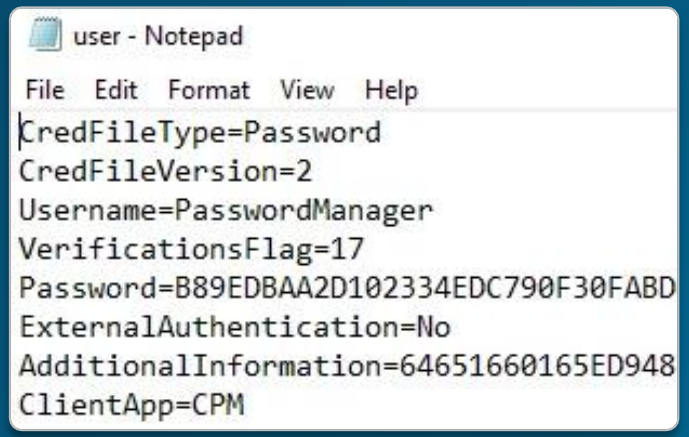
CPM Example
Vault Address and Credentials

- Components communicate with the **Vault** using the following configuration files:
  - *Vault.ini*
  - *Cred File*
- The **Vault.ini** file contains the **Vault** address and port
- The cred file contains the user name and a hash of the password used to authenticate to the **Vault**







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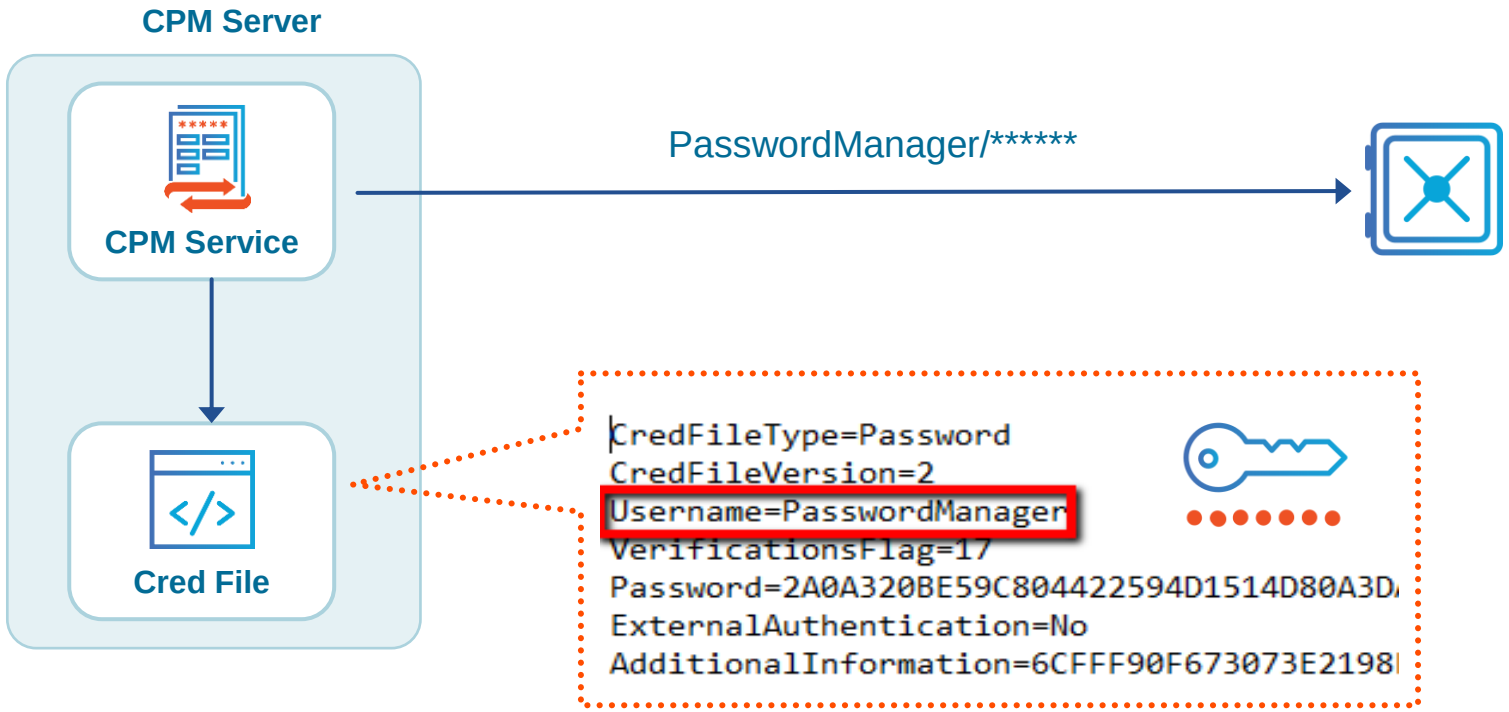
CPM Example
Vault Credential Files

- When the **CPM** authenticates to the **Vault**, it uses the credentials stored in the file ***user.ini*** (the cred file):
  - *The CPM username*
  - *A hash of the password*
- After the **CPM** successfully authenticates, the password in the **Vault** and cred file are rotated



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Communicating With the Vault Via REST

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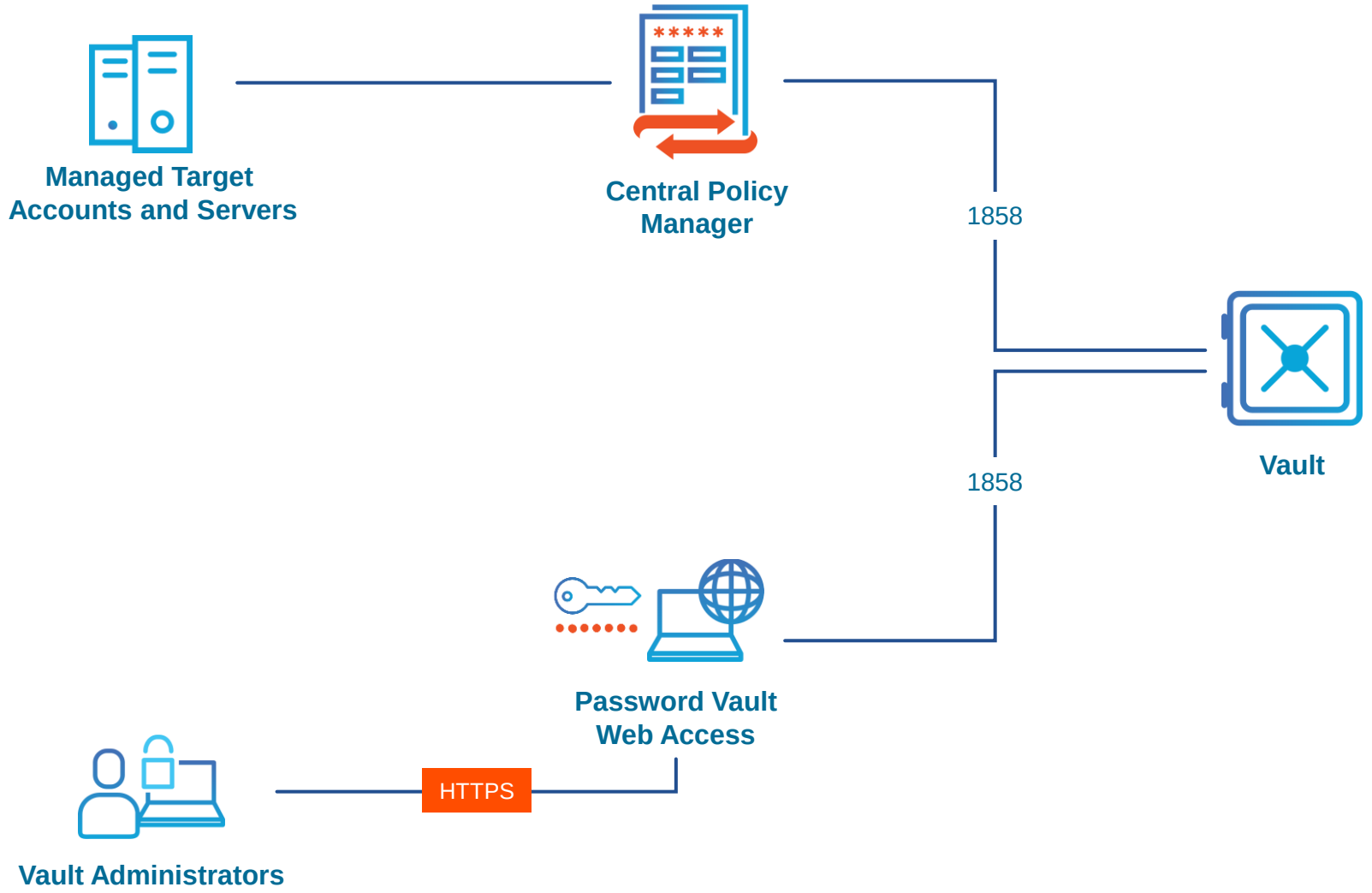
Component Internal Communication

Historically, components communicated directly with the **Vault** using the **CyberArk** proprietary protocol (over port 1858).



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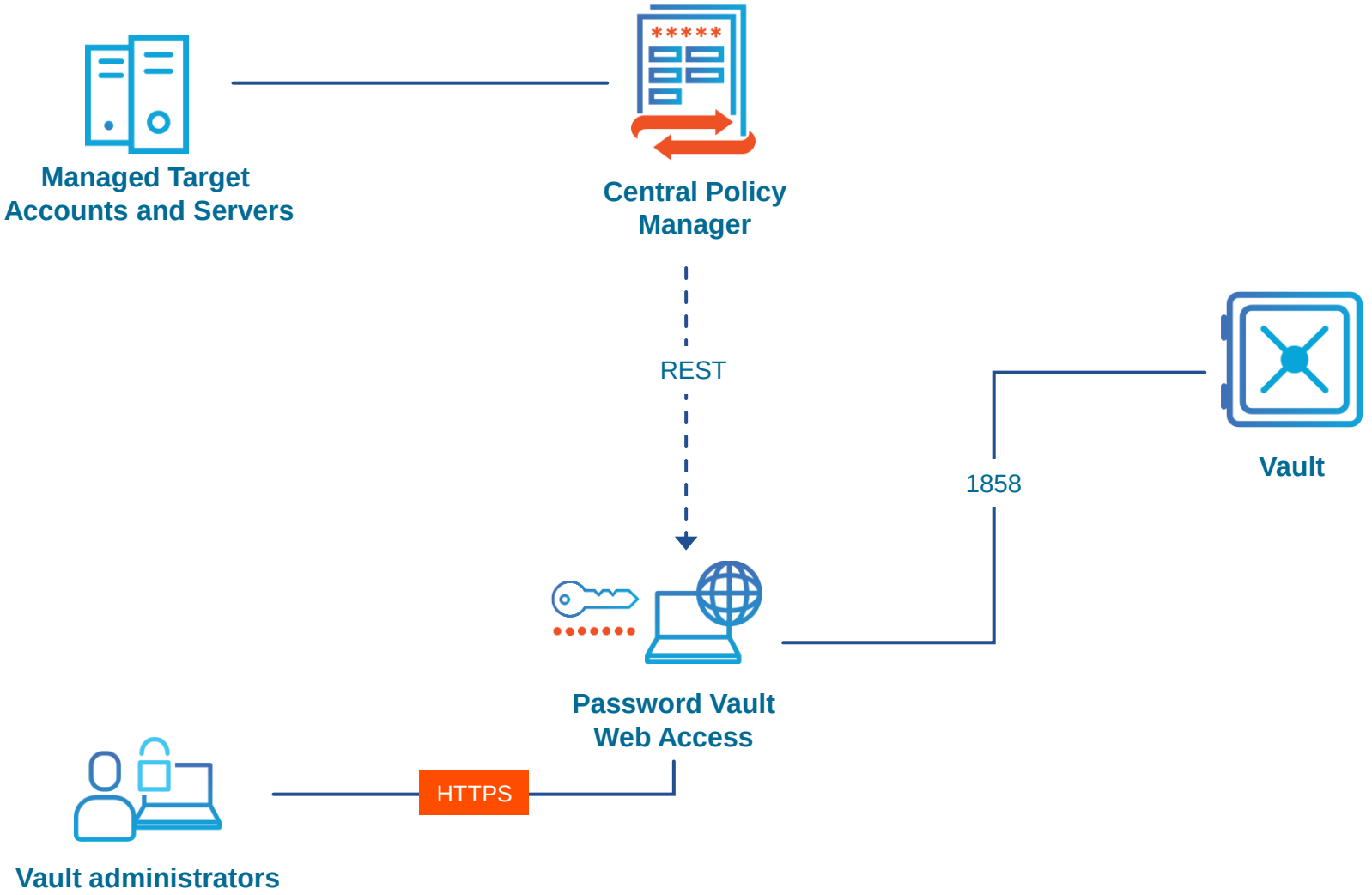
Component Communication – REST First

- As we move towards “REST first”, new functionalities use REST instead of the **CyberArk** proprietary protocol.
- Components communicate with the **PVWA** over REST, and the **PVWA** performs the actions on the **Vault**.



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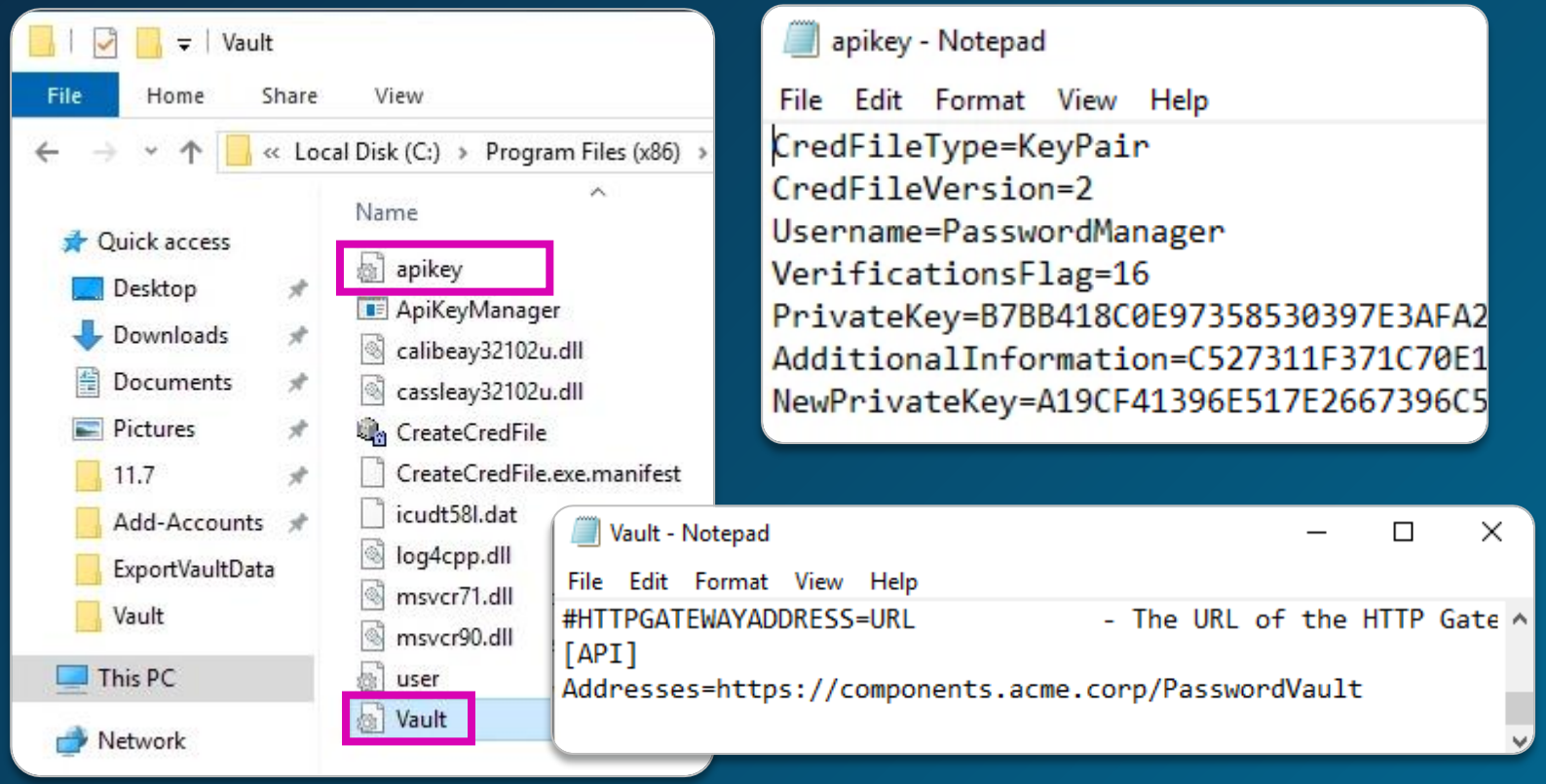
API Address and Keys

- When using REST to communicate with the **Vault**, components use the following configuration files:
  - ***Vault.ini***
  - ***ApiKey*** file
- The ***Vault.ini*** file contains the API address (**PVWA**)
- The ***ApiKey*** file contains the private key used to authenticate to the **Vault** via REST



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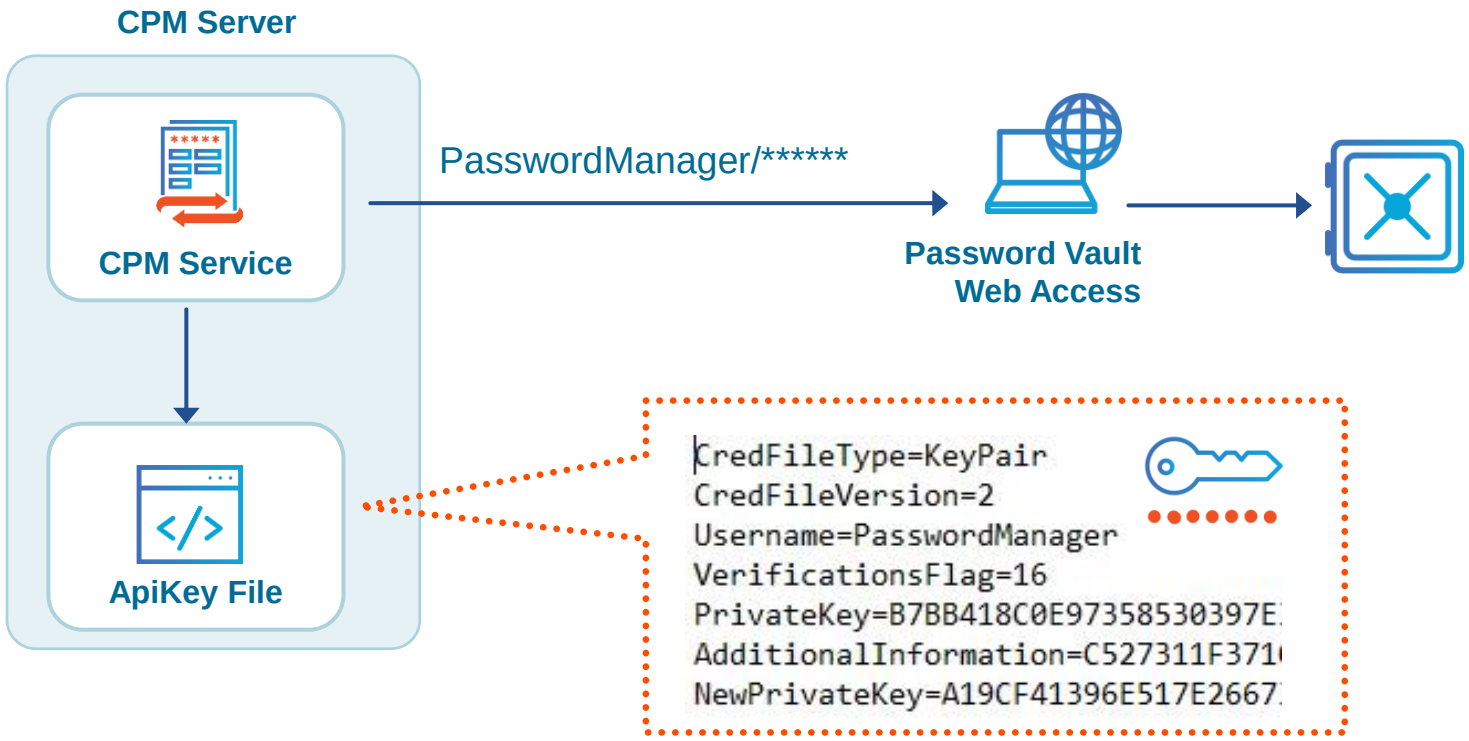
CPM Example
API Keys

- An asymmetric key pair is used to provide a secure way for automated API calls and scripts, as well as **CyberArk** clients, to communicate with the **Vault**.
- The private key is stored locally for use by the script or **CyberArk** client, while the public key is stored in the **Vault**.
- Both keys are associated with a username that was previously created in the **Vault** and used for API authentication.



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Summary

Summary

In this session we discussed:

- The system architecture
- The local services, configuration files, and logs for the PAM Self-Hosted components
- The built-in Safes and users of the various components
- The internal integration and information flow among the PAM Self-Hosted components

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Additional Resources

Documentation

CyberArk Digital Vault Security Standards

Security Fundamentals for PAM