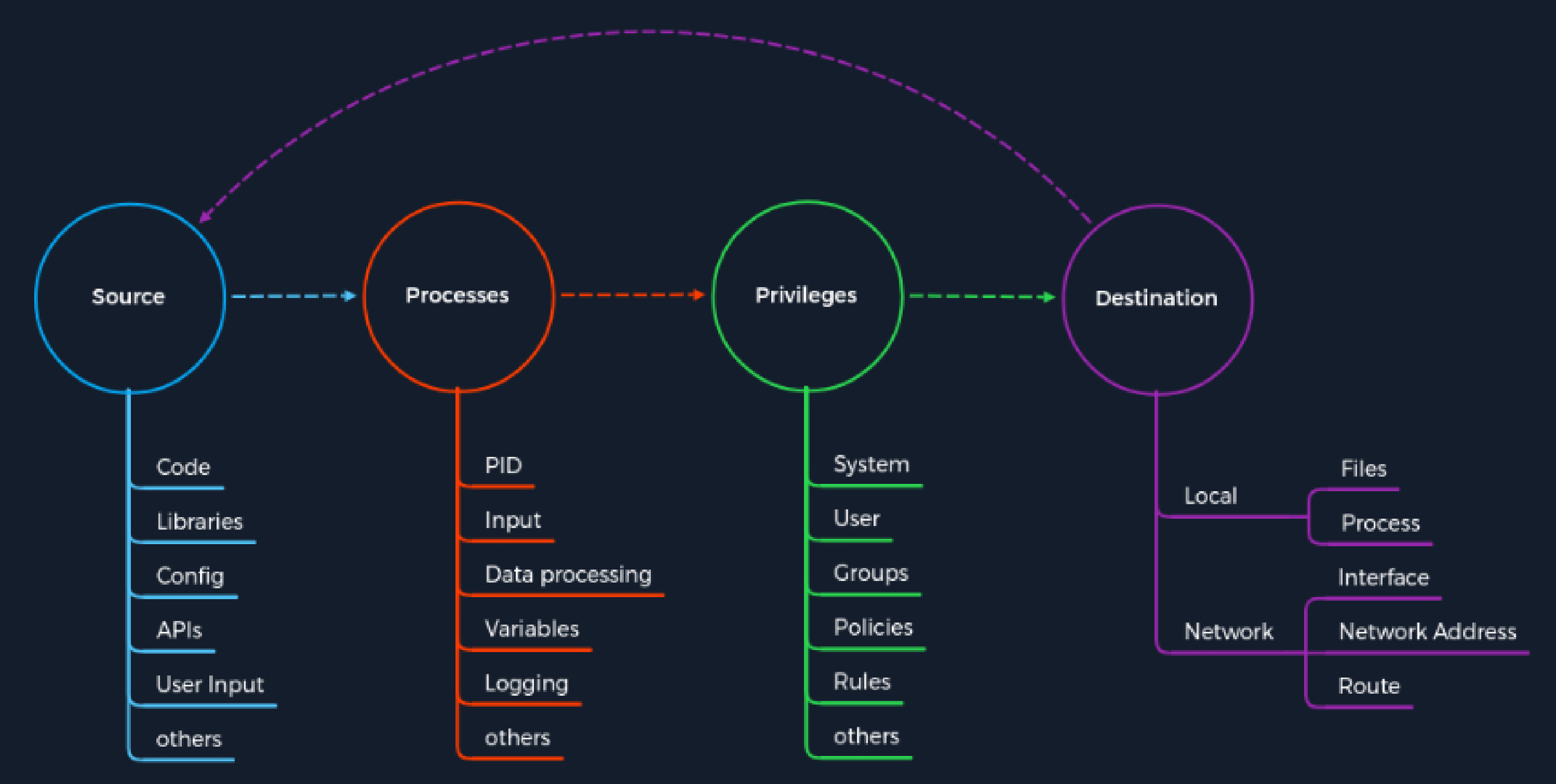
# Latest SQL Vulnerabilities

This time let's discuss a vulnerability that does not have a CVE and does not require a direct exploit. The previous section shows that we can get the `NTLMv2` hashes by interacting with the MSSQL server. However, we should mention again that this attack is possible through a direct connection to the MSSQL server and vulnerable web applications. However, we will only focus on the simpler variant for the time being, namely the direct interaction.

## The Concept of the Attack

We will focus on the undocumented MSSQL server function called `xp_dirtree` for this vulnerability. This function is used to view the contents of a specific folder (local or remote). Furthermore, this function provides some additional parameters that can be specified. These include the depth, how far the function should go in the folder, and the actual target folder.

### The Concept of Attacks



The interesting thing is that the MSSQL function `xp_dirtree` is not directly a vulnerability but takes advantage of the authentication mechanism of SMB. When we try to access a shared folder on the network with a Windows host, this Windows host automatically sends an `NTLMv2` hash for authentication.

This hash can be used in various ways against the MSSQL server and other hosts in the corporate network. This includes an SMB Relay attack where we "replay" the hash to log into other systems where the account has local admin privileges or `cracking` this hash on our local system. Successful cracking would allow us to see and use the password in cleartext. A successful SMB Relay attack would grant us admin rights on another host in the network, but not necessarily the host where the hash originated because Microsoft patched an older flaw that allowed an SMB Relay back to the originating host. We could, however, possibly gain local admin to another host and then steal credentials that could be re-used to gain local admin access to the original system where the NTLMv2 hash originated from.

### Initiation of the Attack

| Step | XP_DIRTREE | Concept of Attacks - Category |
|---|---|---|
| `1.` | The source here is the user input, which specifies the function and the folder shared in the network. | `Source` |
| `2.` | The process should ensure that all contents of the specified folder are displayed to the user. | `Process` |
| `3.` | The execution of system commands on the MSSQL server requires elevated privileges with which the service executes the commands. | `Privileges` |
| `4.` | The SMB service is used as the destination to which the specified information is forwarded. | `Destination` |

This is when the cycle starts all over again, but this time to obtain the NTLMv2 hash of the MSSQL service user.

### Steal The Hash

| Step | Stealing the Hash | Concept of Attacks - Category |
|---|---|---|
| `5.` | Here, the SMB service receives the information about the specified order through the previous process of the MSSQL service. | `Source` |
| `6.` | The data is then processed, and the specified folder is queried for the contents. | `Process` |
| `7.` | The associated authentication hash is used accordingly since the MSSQL running user queries the service. | `Privileges` |
| `8.` | In this case, the destination for the authentication and query is the host we control and the shared folder on the network. | `Destination` |

Finally, the hash is intercepted by tools like `Responder`, `WireShark`, or `TCPDump` and displayed to us, which we can try to use for our purposes. Apart from that, there are many different ways to execute commands in MSSQL. For example, another interesting method would be to execute Python code in a SQL query. We can find more about this in the documentation from Microsoft. However, this and other possibilities of what we can do with MSSQL will be discussed in another module.

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