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Advanced AnyConnect Deployment and Troubleshooting with ASA5500

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BRKSEC-3033

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What We Won't Cover

but may be covered in other Cisco Live sessions

- Clientless SSL VPN via Web Portal
- AnyConnect with IOS and IPSEC/IKEv2 : see BRKSEC-2881,BRKSEC-3054
- AnyConnect Web Security : see BRKSEC-2909
- AnyConnect NAM
- AnyConnect NVM: see BRKSEC-3014
- Roadmaps
- Licensing

see BRKSEC-90666: Deploying Cisco Licensing (CCIE Licensing) ☺

The Scenario : Labrats

- Pharmaceutical Research **Conglomerate** *
  run by Rats and Cats

*** Conglomerate**

two or more corporations engaged in entirely different businesses that fall under one corporate group

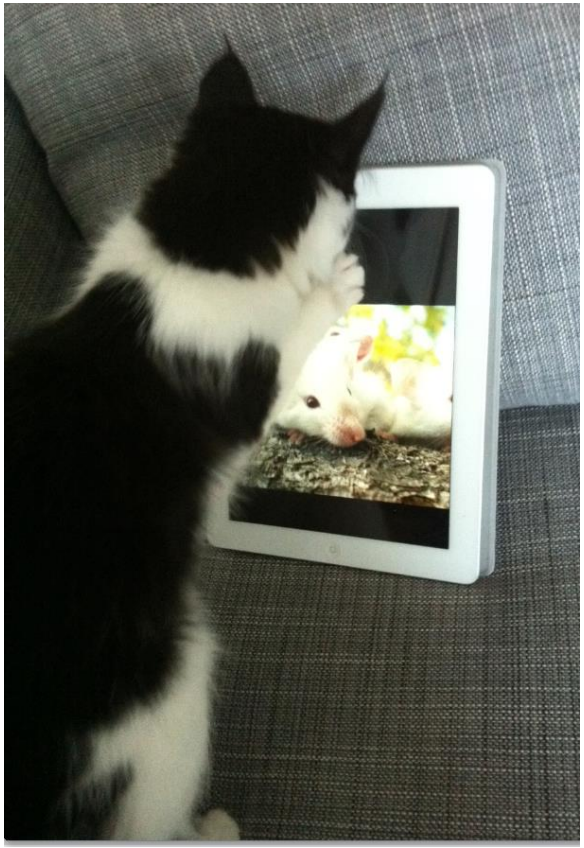
Wikipedia definition

Legal Disclaimer

Any similarities between Labrats and any other organization is (most likely) a coincidence

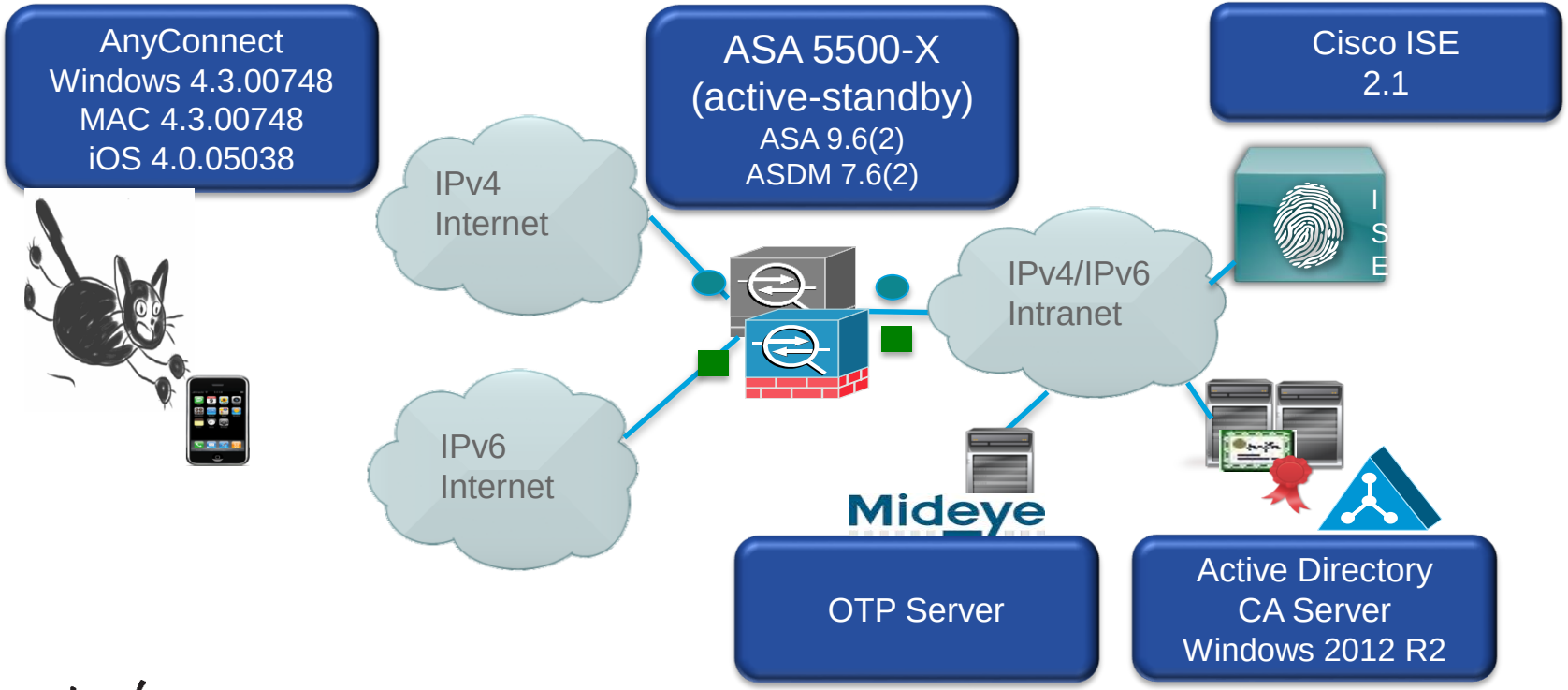
The Scenario : Labrats

- Using Corporate Devices
  - Windows, MACs, iPADs
- Embracing BYOD
- **Key Requirements :**
  - **Security**
  - **Easy to Use**
  - **IPv6**



The Scenario : Labrats

- Network Design and Versions Used



Agenda

Some Theory SSL and IPSEC

AnyConnect Fundamentals

AAA Deep Dive RADIUS & LDAP

AAA Deep Dive Client Certificates

Provisioning Client Certificates

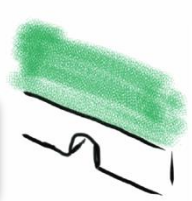
Posture Checking

Dynamic Access Policies (DAP)

ASA On the Rocks - adding ISE

Securing the Client

Customizing the User Experience

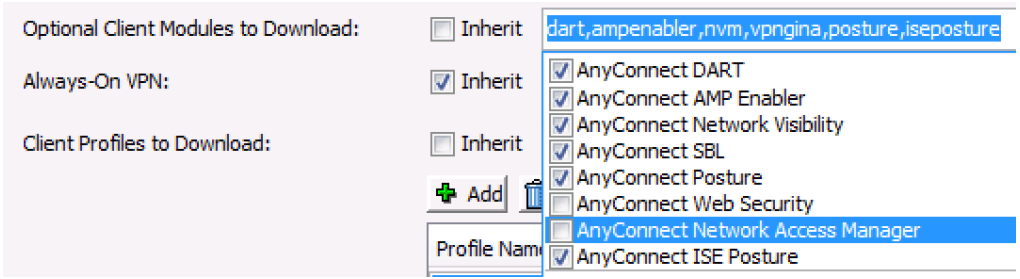


AnyConnect Windows Version Reminder!

- Versions older than 3.1MR13 or 4.2MR1 will no longer run on Windows from 2/14/2017
- Due to Microsoft code signing enforcement
  - http://social.technet.microsoft.com/wiki/contents/articles/32288.windows-enforcement-of-authenticode-code-signing-and-timestamping.aspx
  - http://www.cisco.com/c/en/us/td/docs/security/vpn_client/anyconnect/anyconnect43/release/notes/b_Release_Notes_AnyConnect_4_3.html#reference_AA75AD8674C4409DBA57F2EBD9CAE3BB

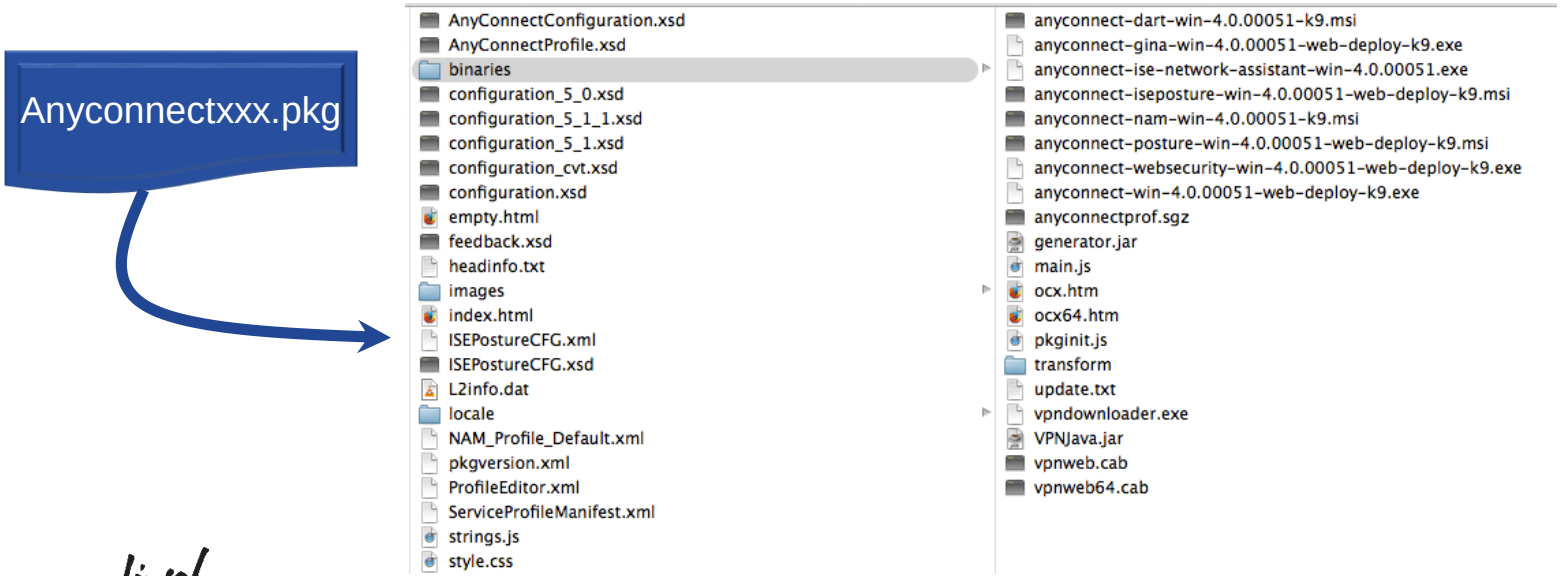
AnyConnect - Installation

- Installation Options
  - download from ASA or ISE (requires admin privileges)
  - **use Desktop Management System**
  - **Appstore, Google Play ... (mobile devices)**
- Optional modules to install
  - **DART**
  - **Posture**
  - **ISE Posture**
  - **Start-Before-Login**
  - AMP Enabler
  - Web security, Network Access Manager
  - Feedback Module
  - Network Visibility



At least one pkg file needed

- At least one pkg file must be uploaded to ASA, even if AnyConnect pre-deployed on clients (MSI, Appstore…)
- pkg file contains binaries… and more
- To check out, rename pkg file to zip and decompress



On the Client: AnyConnect Configuration Files

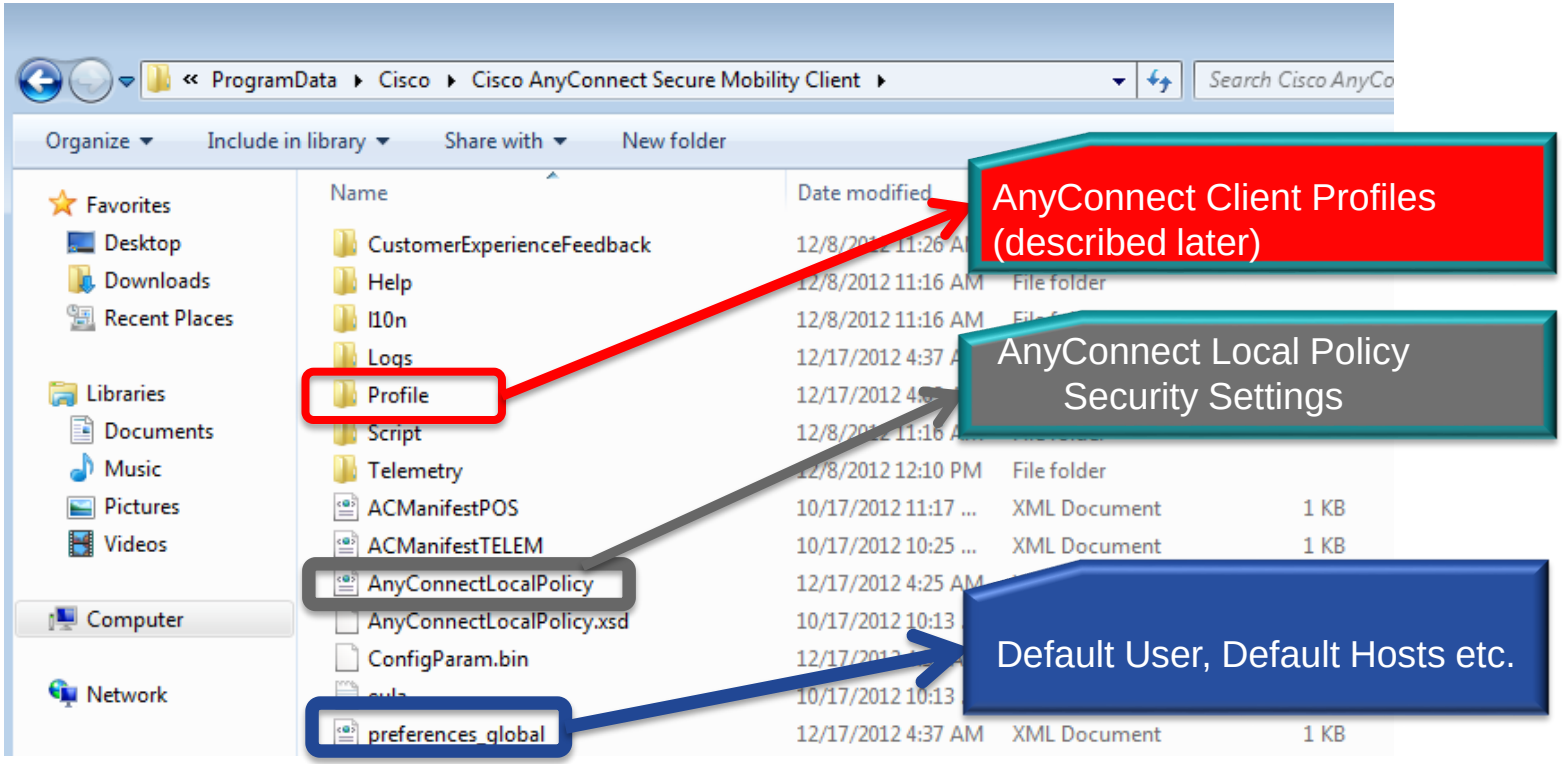
- AnyConnect Configuration Files are stored on the client in the following directories:

Windows 7 and Windows VISTA	C:\ProgramData\Cisco\Cisco AnyConnect Secure Mobility Client
Windows XP	C:\Documents and Settings\All Users\Application Data\Cisco\Cisco AnyConnect VPN Client
MAC OS X and Linux	/opt/cisco/anyconnect/

Windows 7 and Windows VISTA	C:\Users\username\AppData\Local\Cisco\ Cisco AnyConnect VPN Client\preferences.xml
Windows XP	C:\Documents and Settings\username\Local Settings\ApplicationData\ Cisco\Cisco AnyConnect VPN Client\preferences.xml
MAC OS X and Linux	/Users/username/.anyconnect

On the Client: AnyConnect Configuration Files

- Apply to all Users logged onto the machine



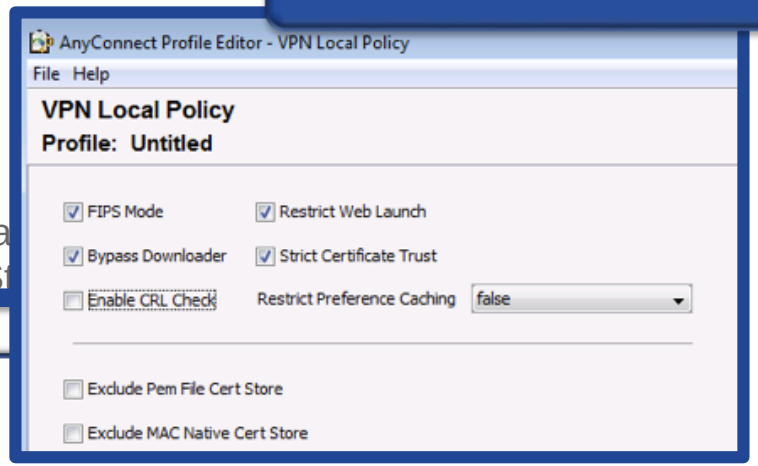
AnyConnect Local Policy File

AnyConnect Local Policy

- Not downloaded from ASA (use your favorite desktop management system)
- XML file defining important aspects of AnyConnect behavior
  - allowing user to accept untrusted ASA certificates
  - allowing client software updates from ASA (and from which ASAs)
  - allowing client profile updates from ASA (and from which ASAs)
  - certificate stores, credentials caching etc.

```
<FipsMode>true</FipsMode>
 <BypassDownloader>true</BypassDownloader>
 <RestrictWebLaunch>true</RestrictWebLaunch>
 <StrictCertificateTrust>true</StrictCertificateTrust>
 <EnableCRLCheck>false</EnableCRLCheck>
 <RestrictPreferenceCaching>false</RestrictPreferenceCa
 <ExcludePemFileCertStore>false</ExcludePemFileCertSt
```

Standalone Profile Editor

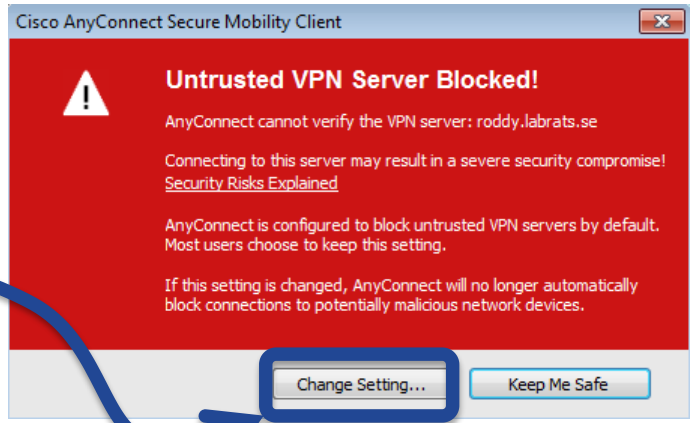


Local Policy File Example :

AnyConnect Local Policy

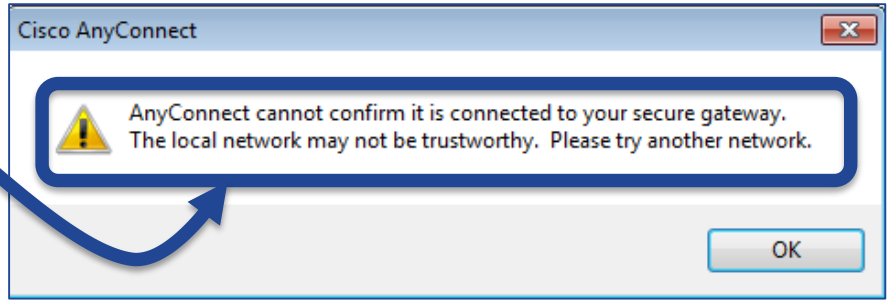
- If the server certificate is not trusted, do you want the user to be able to accept the certificate?

```
<StrictCertificateTrust>
false
</StrictCertificateTrust>
```

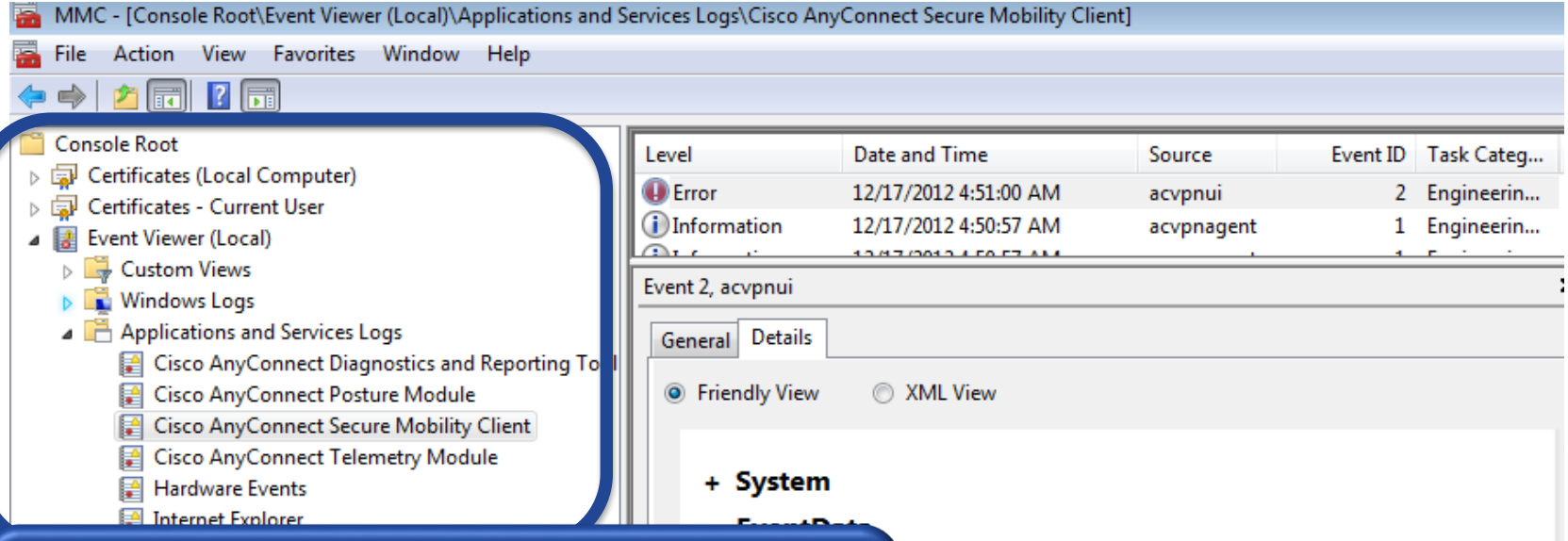


- .... or do you want AnyConnect to refuse to connect?

```
<StrictCertificateTrust>
true
</StrictCertificateTrust>
```



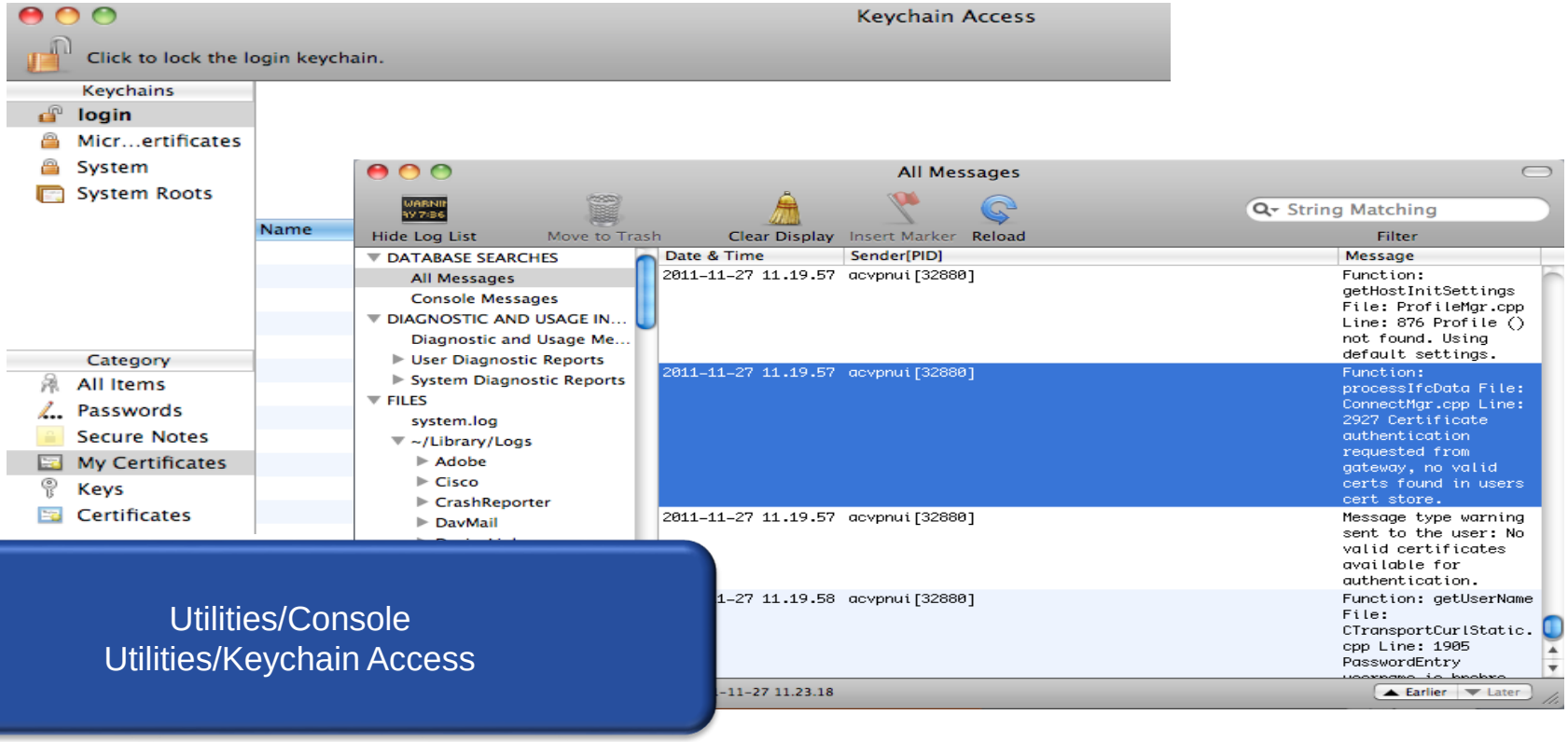
AnyConnect Troubleshooting Toolbox (Windows)



MMC console with snap-ins:
Event Viewer
Certificate (Current User)
Certificate (Local Computer)

Function: ConnectMgr::run File: .\ConnectMgr.cpp Line: 683 Invoked Function: ConnectMgr::initiateConnect Return Code: -29622263 (0xFE3C0009) Description: CONNECTMGR_ERROR_UNEXPECTED

AnyConnect Troubleshooting Toolbox (MAC)



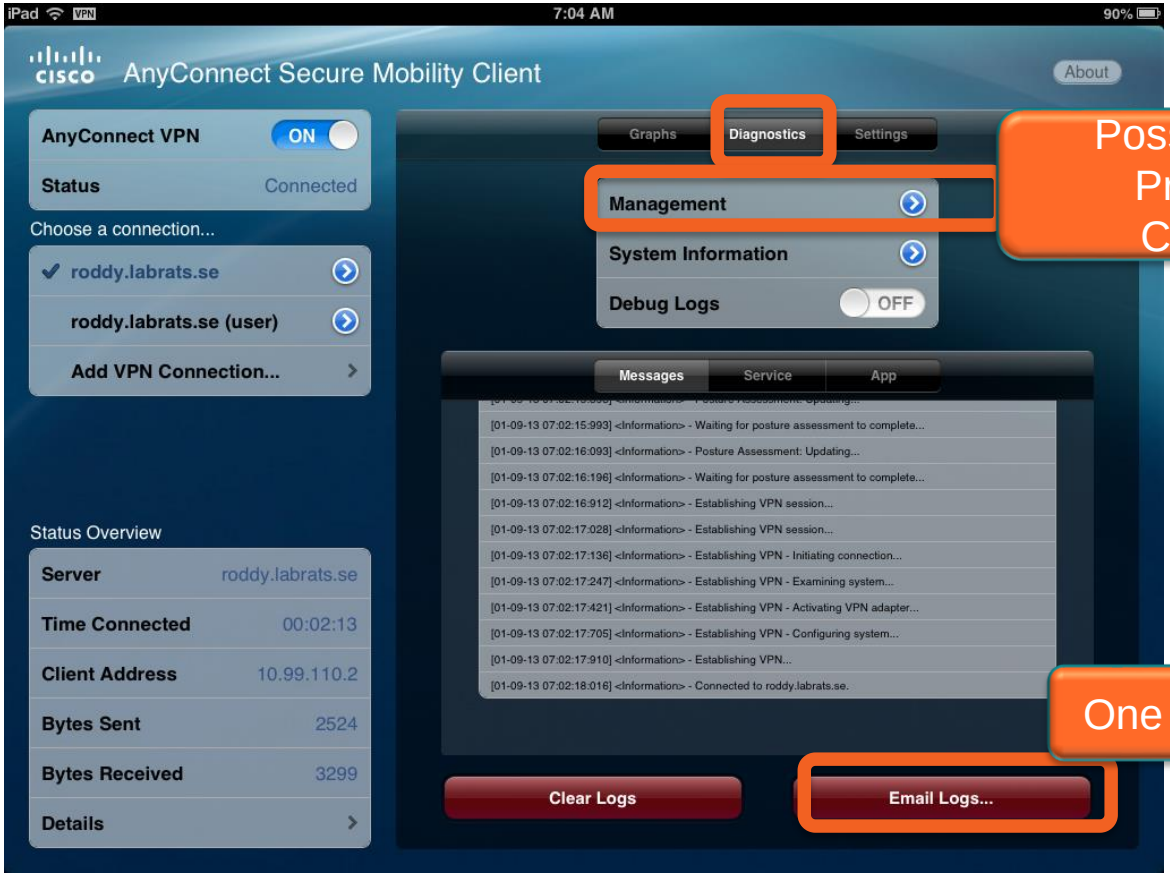
Utilities/Console
Utilities/Keychain Access

DART Tool (Windows and MAC)

- DART Tool can be installed with the client
- Similar to “show tech” on client
- Gathering of OS Data and log files in large zip file

GOT DART?

AnyConnect Troubleshooting Toolbox (iOS, Android)

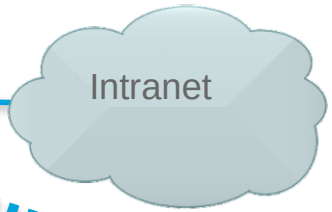


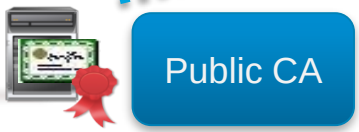
Possible to view Profiles and Certificates

One click email of logs

AnyConnect Fundamentals : ASA Server Certificate

- ASA certificate should be trusted by clients
  - Public (well-known) Certificate Authority (e.g. Verisign, Thawte)
  - Enterprise Certificate Authority, e.g. Microsoft Active Directory
  - Self-Signed (need to import certificate to all clients)
  - AnyConnect 4.1: check of CRL is configurable (Local Policy File)
- FQDN in Subject

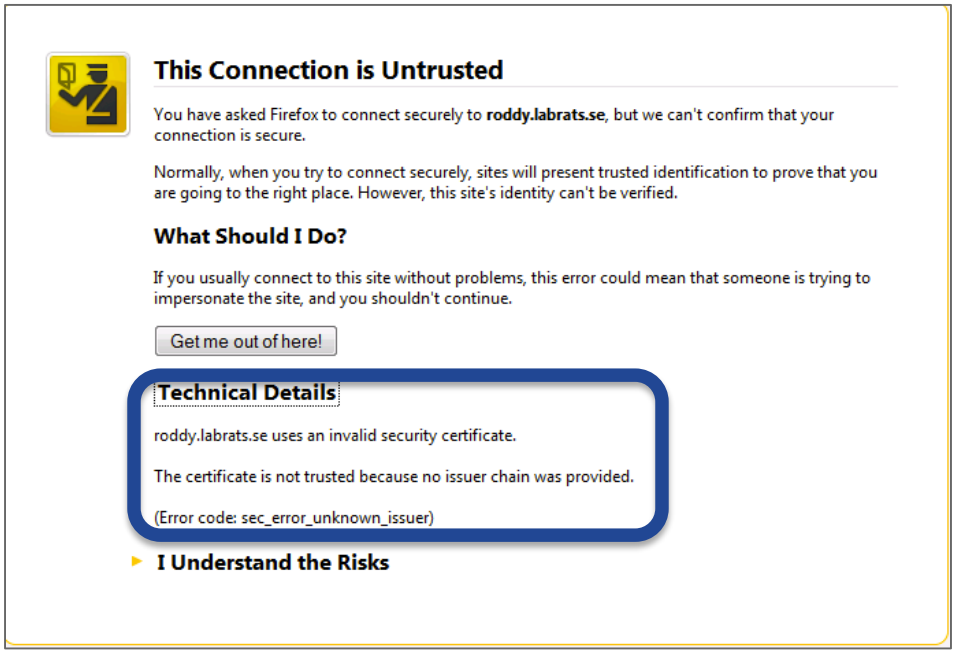




slide changed

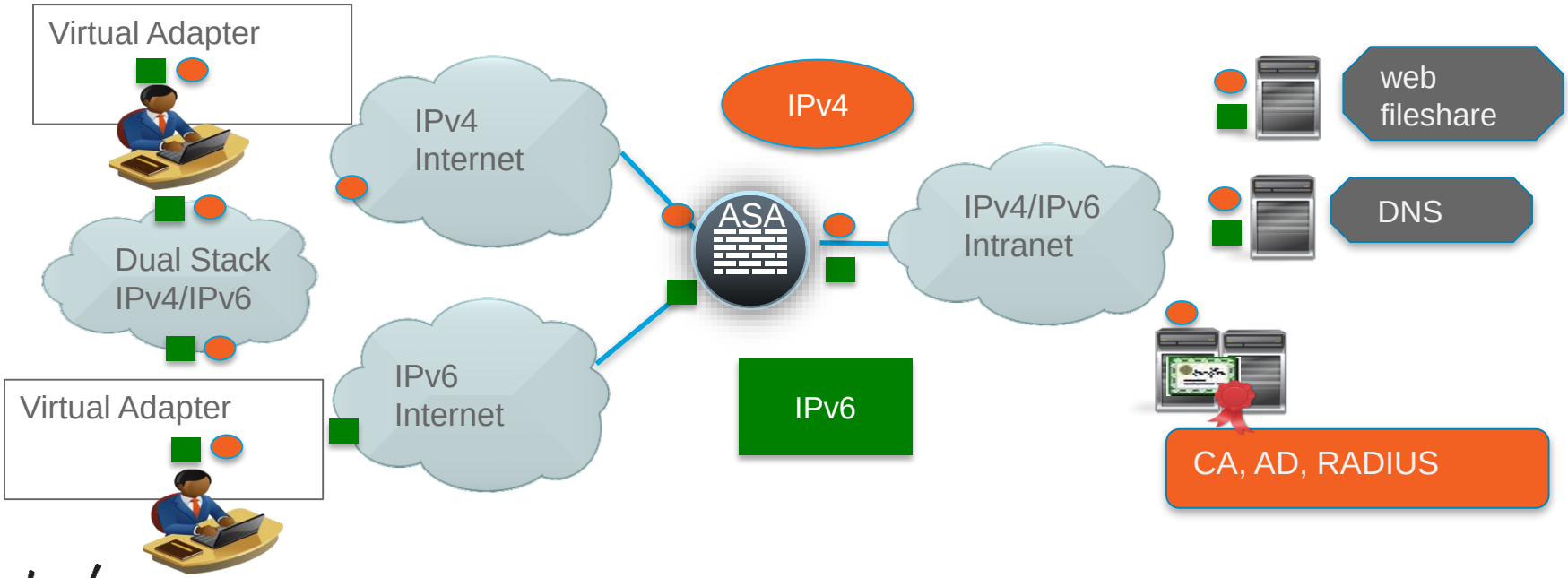
Ensure Clients Trust the ASA Certificate

- AnyConnect uses OS to validate certificate
  - Microsoft Windows: MS CAPI
  - MAC OS: Keychain
  - Linux: Varies with distribution
- Tip: Examine warnings with browser
  - Untrusted CA chain
  - Mismatch domain name
  - Validity time (GOT NTP?)



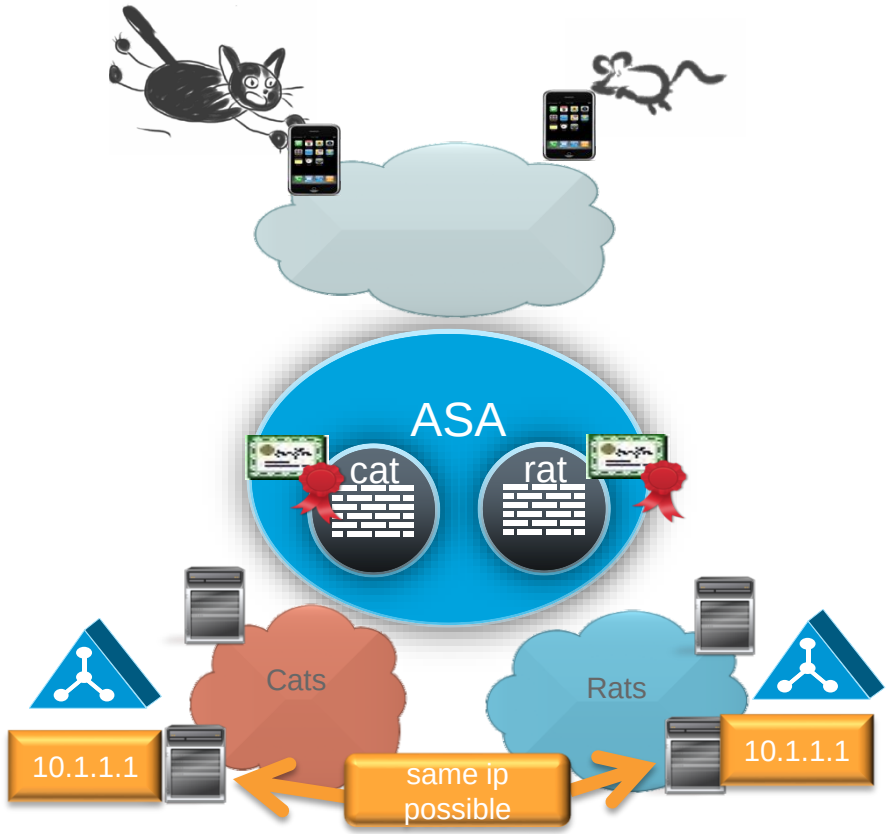
AnyConnect Fundamentals : IPv4 and IPv6

- AnyConnect 3.1 now supports **IPv6** tunneled inside **IPv4** or **IPv6**
  - management/control servers (CA, AD, RADIUS) IPv4 only

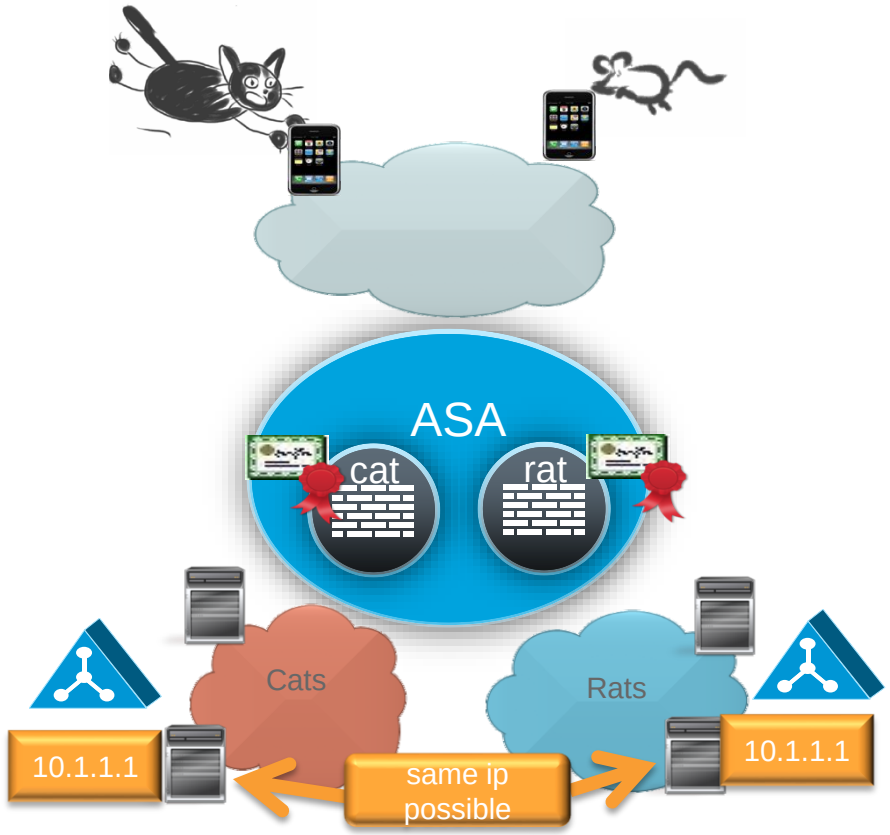


AnyConnect with Multiple Contexts

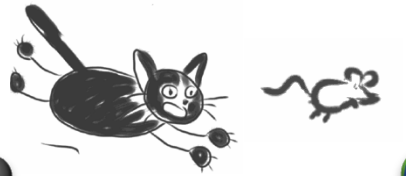
- ASA 9.5(1) and 9.6(2)
- One physical ASA with multiple contexts
- …with unique configurations
  - Certificates,
  - AnyConnect images
  - Policies
- …with separate management views
- …with separate ip address spaces



When Pigs Fly: AnyConnect with Multiple Contexts



Agenda



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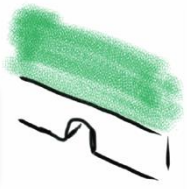
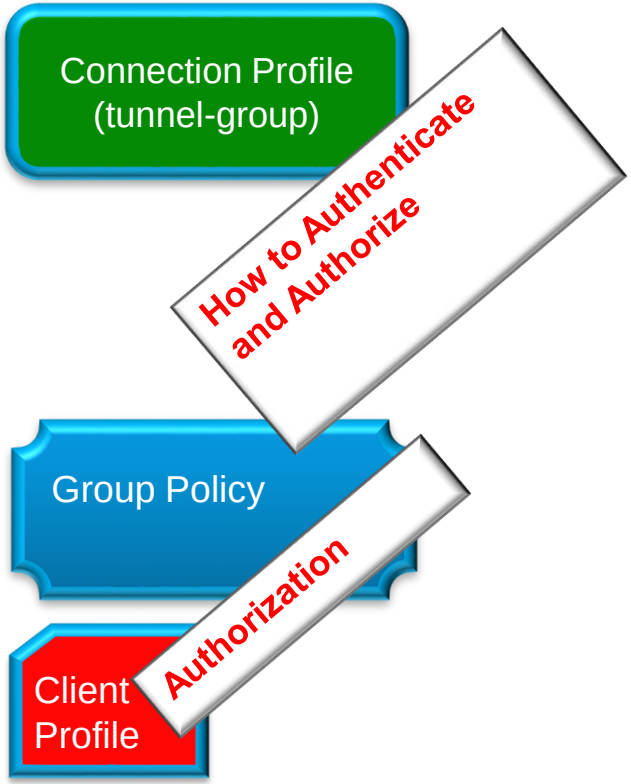


AAA in ASA : Some Important Concepts



Proving Who you are
Static Passwords (local to ASA, Active Directory, LDAP)
OTP (One-Time-Passwords), typically RADIUS
Certificates

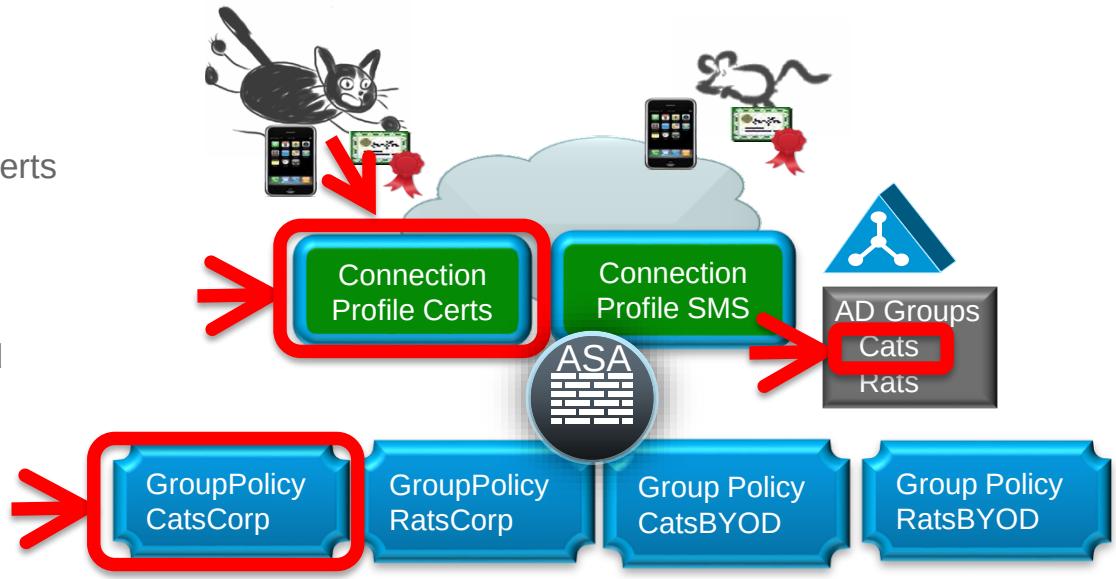
Determining What You are and What You can do
ACL, Split Tunnelling
Proxy settings, Timeouts
etc..

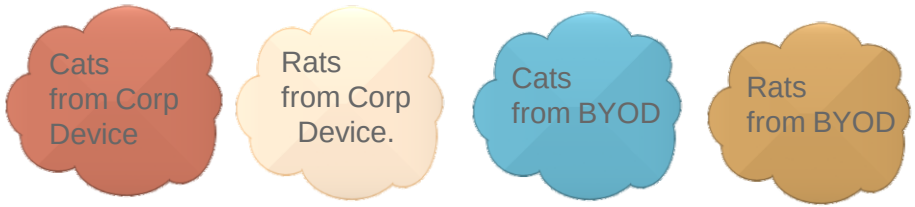
AnyConnect behaviour...
- Which ASA and Connection Profile to connect to
- "Always On"
- which certificate to use, etc...

Labrats Requirements

- Strong Authentication
  - Corporate devices (laptops, iPADs) use certs
  - BYOD use OTP sent as text to mobile
- Granular Authorization
  - Depending on Active Directory group **and** device (corporate vs. BYOD)
  - Access Rights differ with regards to

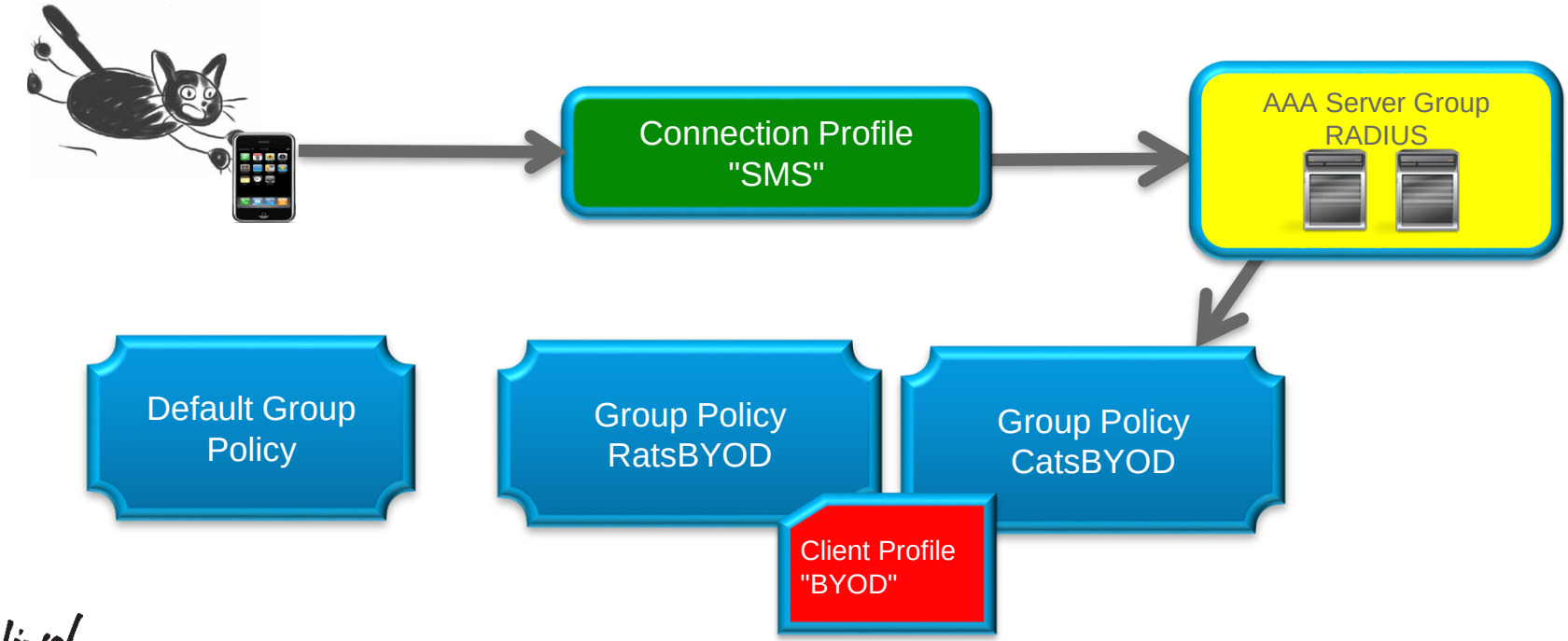
ACL (Filter)
IP address pool
Split Tunneling
Client Profile
Restrict to VLAN
...





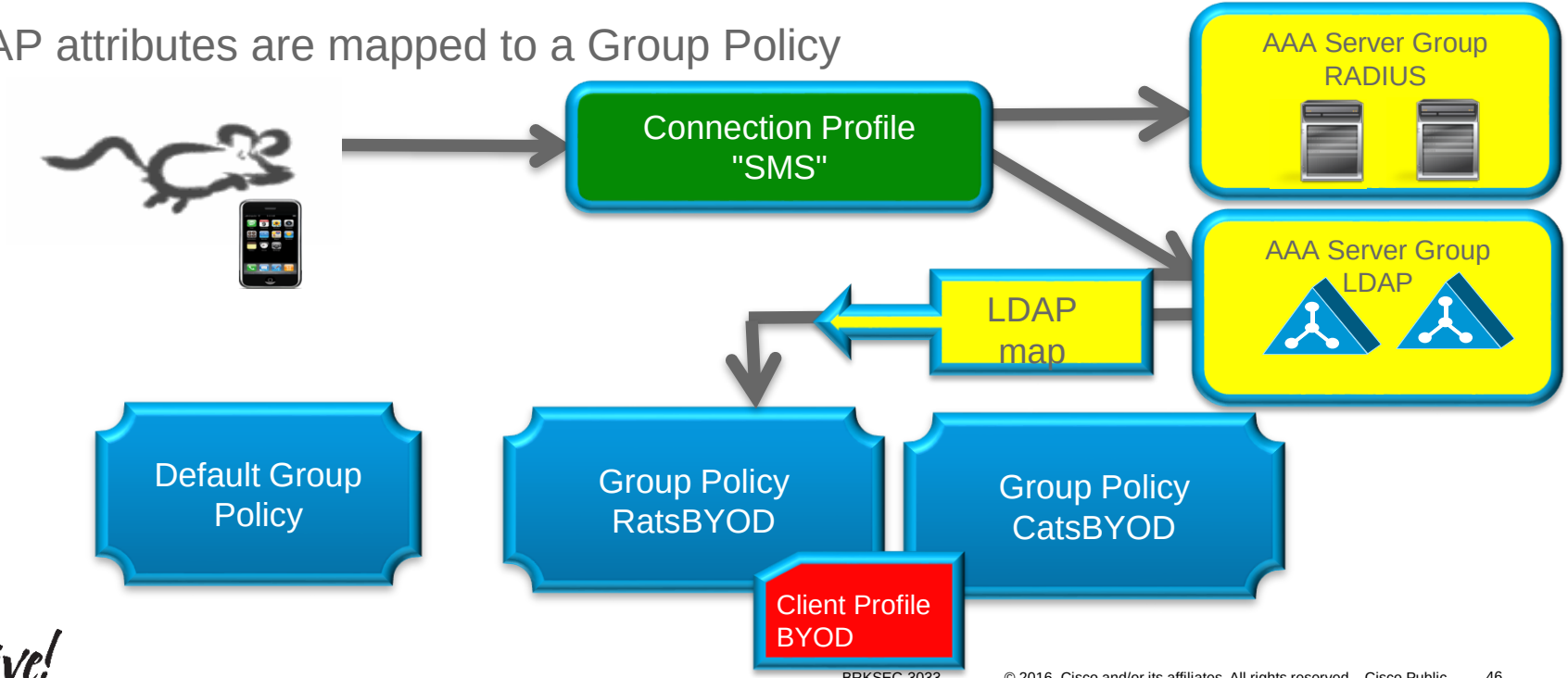
Authentication and Authorization by RADIUS

- User can be authenticated and authorized by RADIUS.
- RADIUS attribute IETF 25 (Class) is used to assign the group policy.



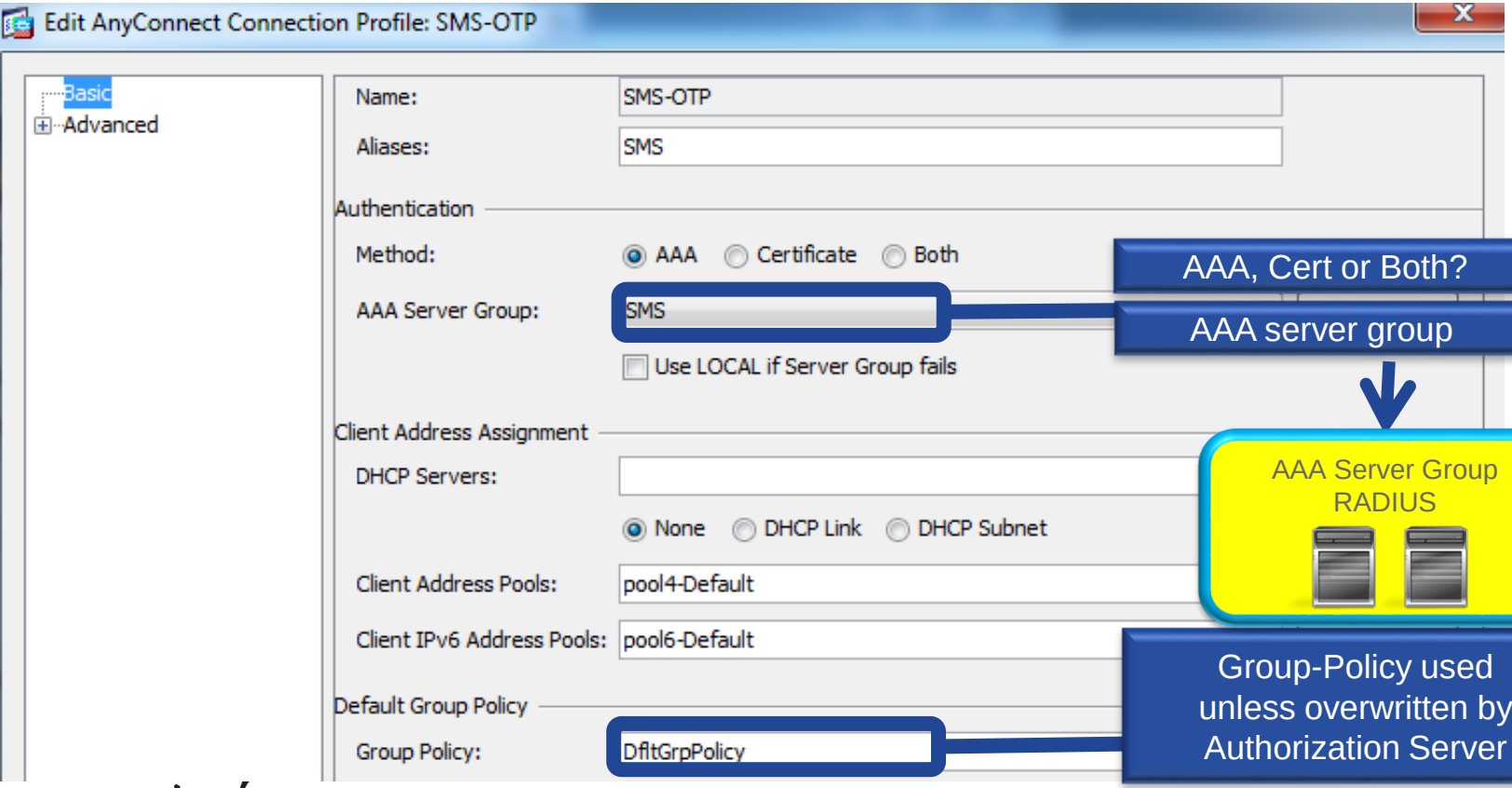
Authentication by RADIUS Authorization by LDAP

- User authenticated by RADIUS (typically strong authentication, OTP)
- Username used for LDAP lookup
- LDAP attributes are mapped to a Group Policy



Connection Profile : How to Authenticate

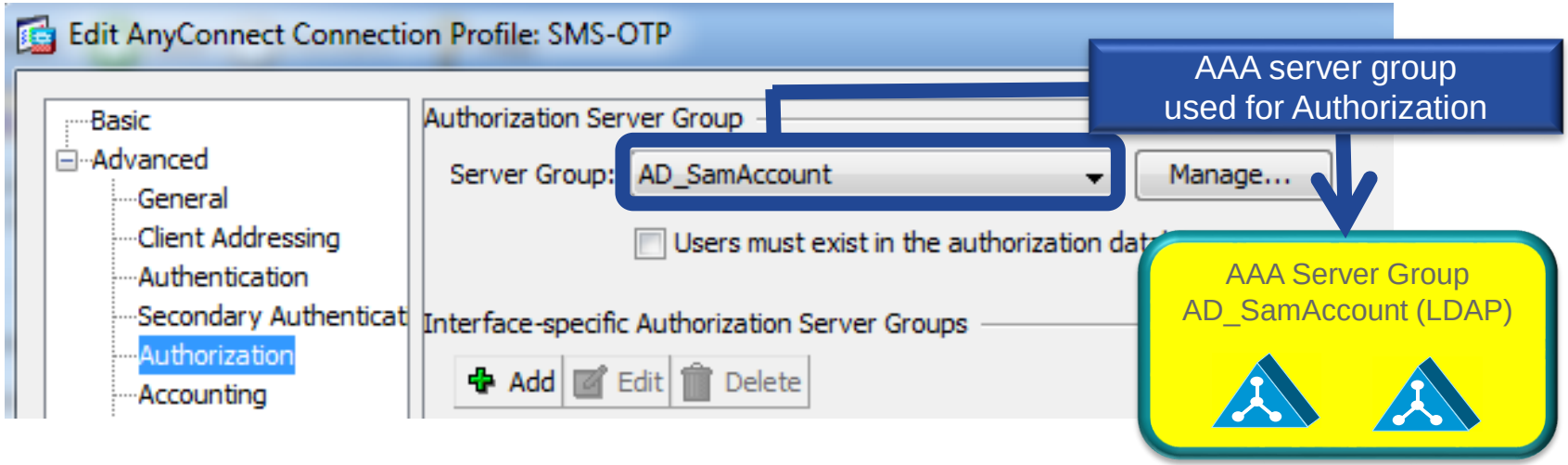
Connection Profile



Connection Profile : How to Authorize

Connection Profile

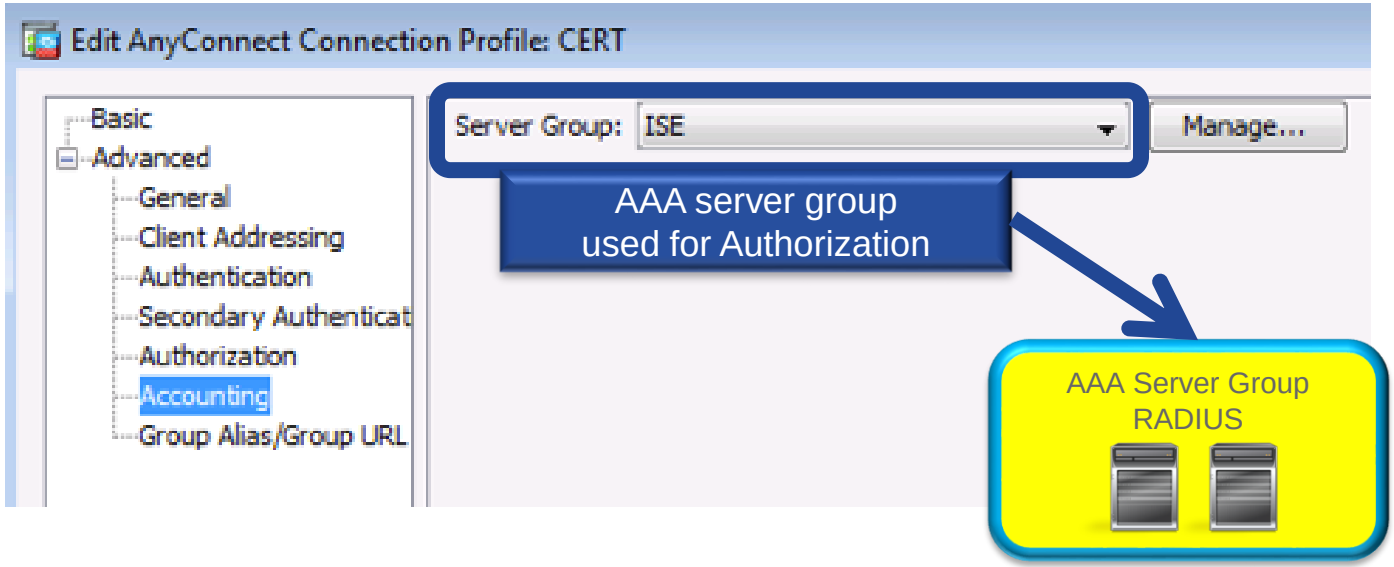
- Possible to define different AAA server group for authorization (if not specified, the same group is used for authentication and authorization).



Connection Profile: Where Send Accounting

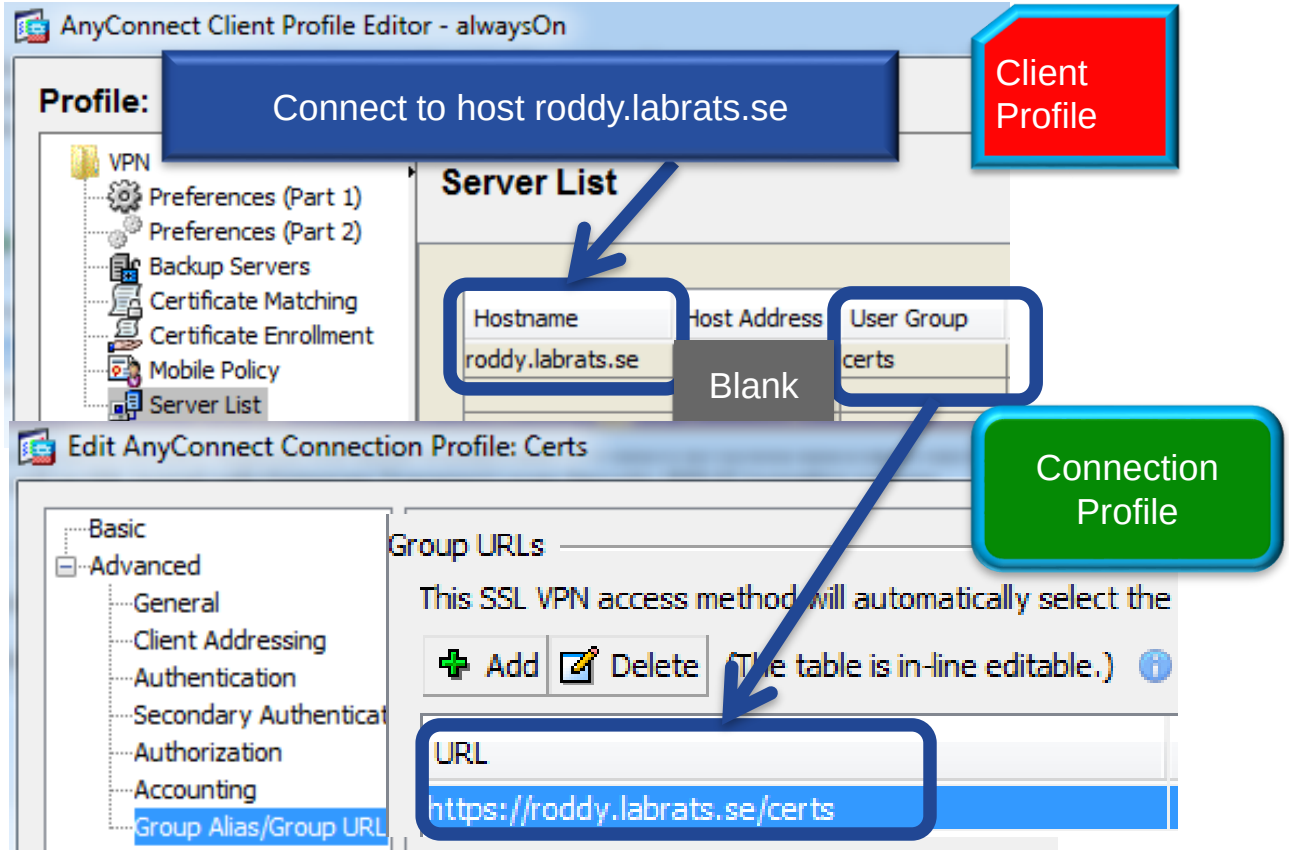
Connection Profile

- Possible to define AAA Server Group for RADIUS Accounting

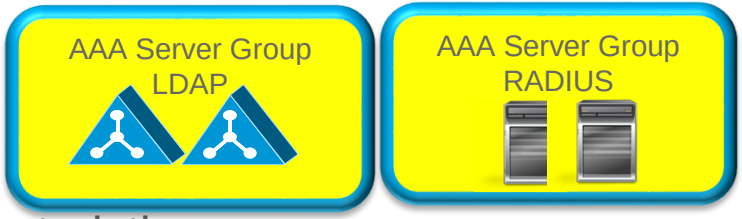


In the AnyConnect Client Profile : Server List

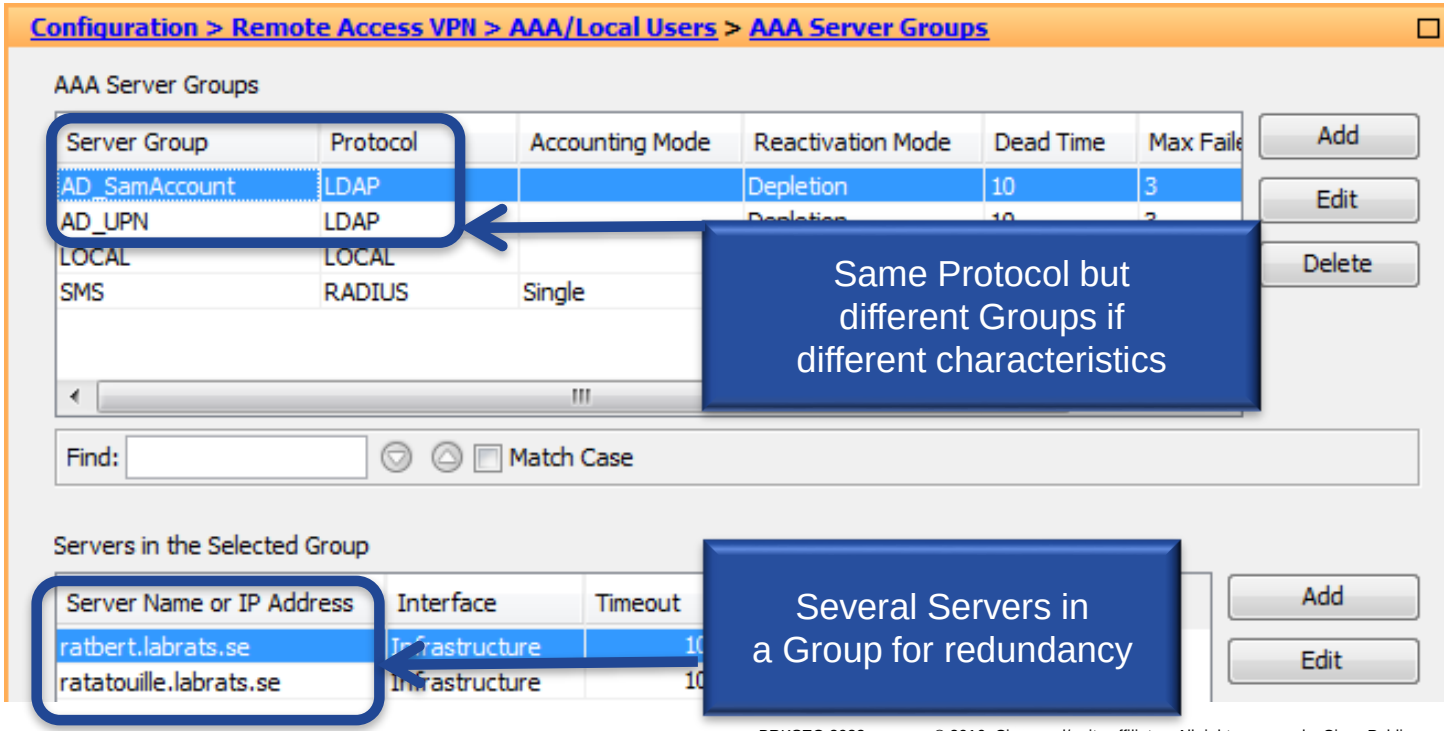
- Specify servers in the server list
- Do not specify Host Address
  - May cause cert warnings
- Don't have the user choose connection profile
  - Save mouse clicks



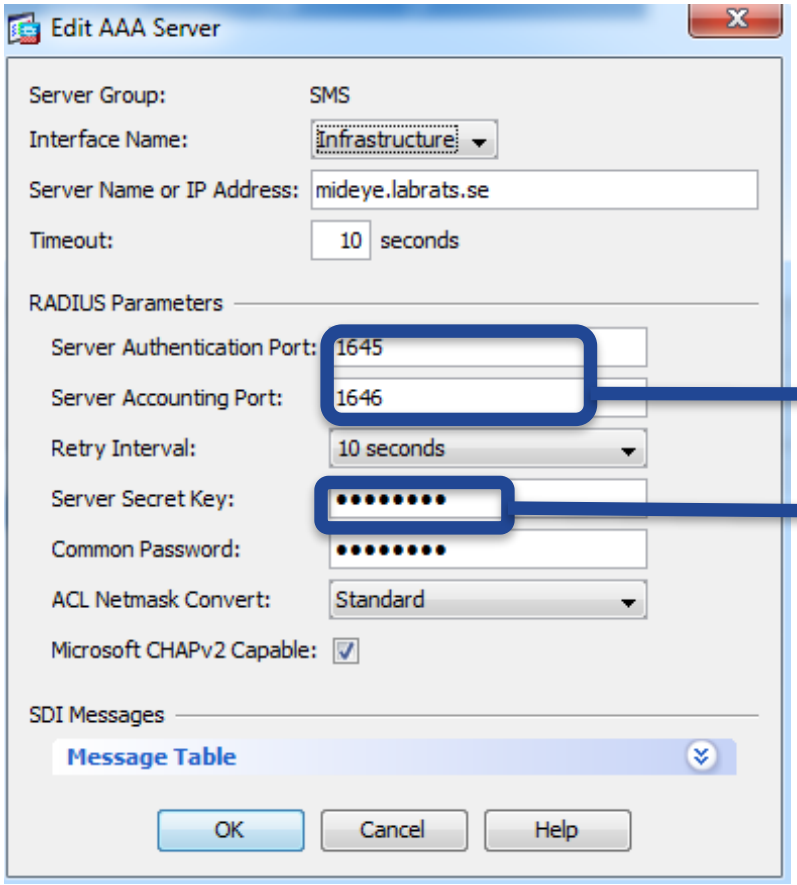
AAA Server Groups



- Using the same authentication protocol and characteristics



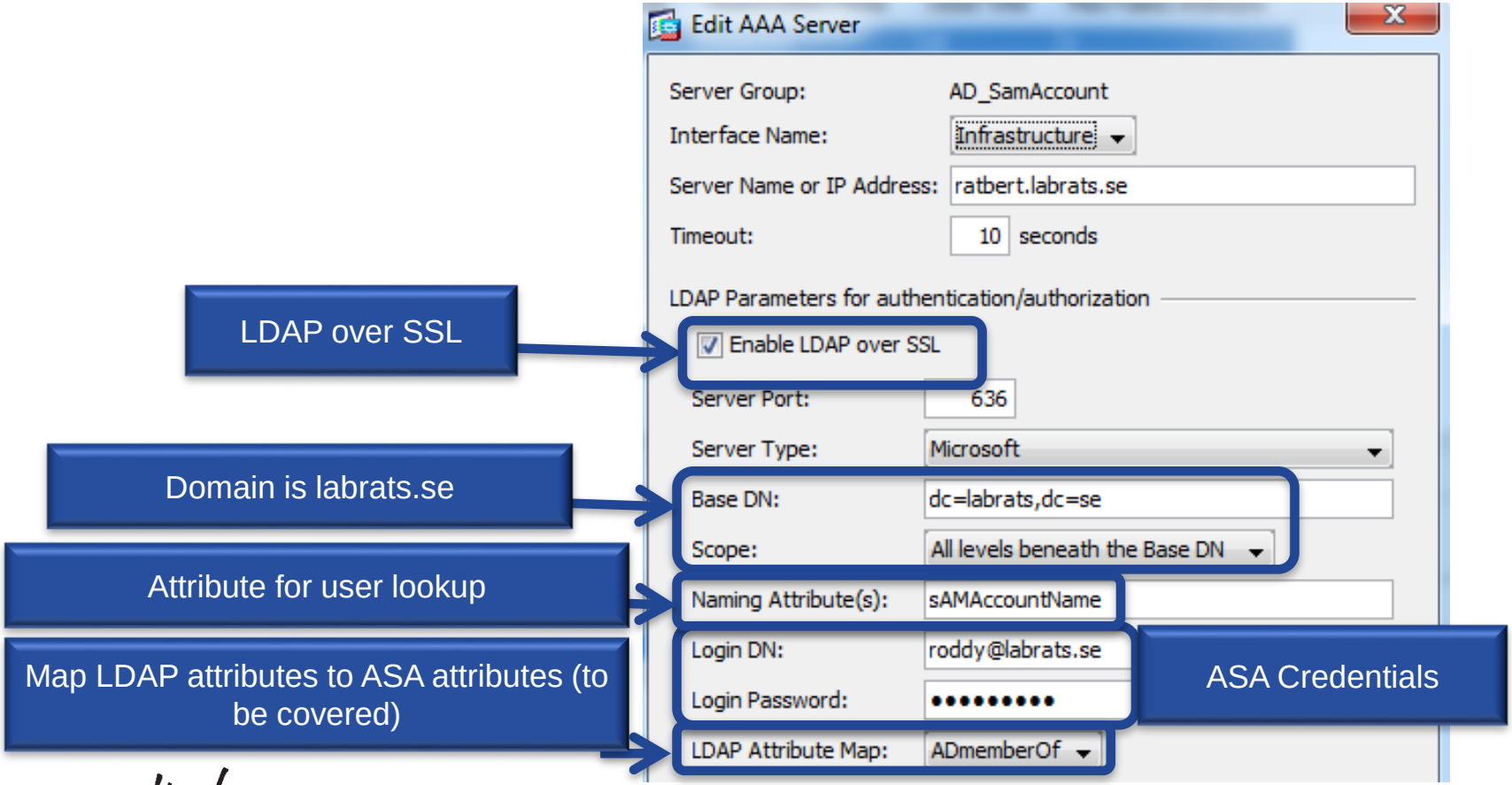
RADIUS Server Definition



Double check port numbers on RADIUS server

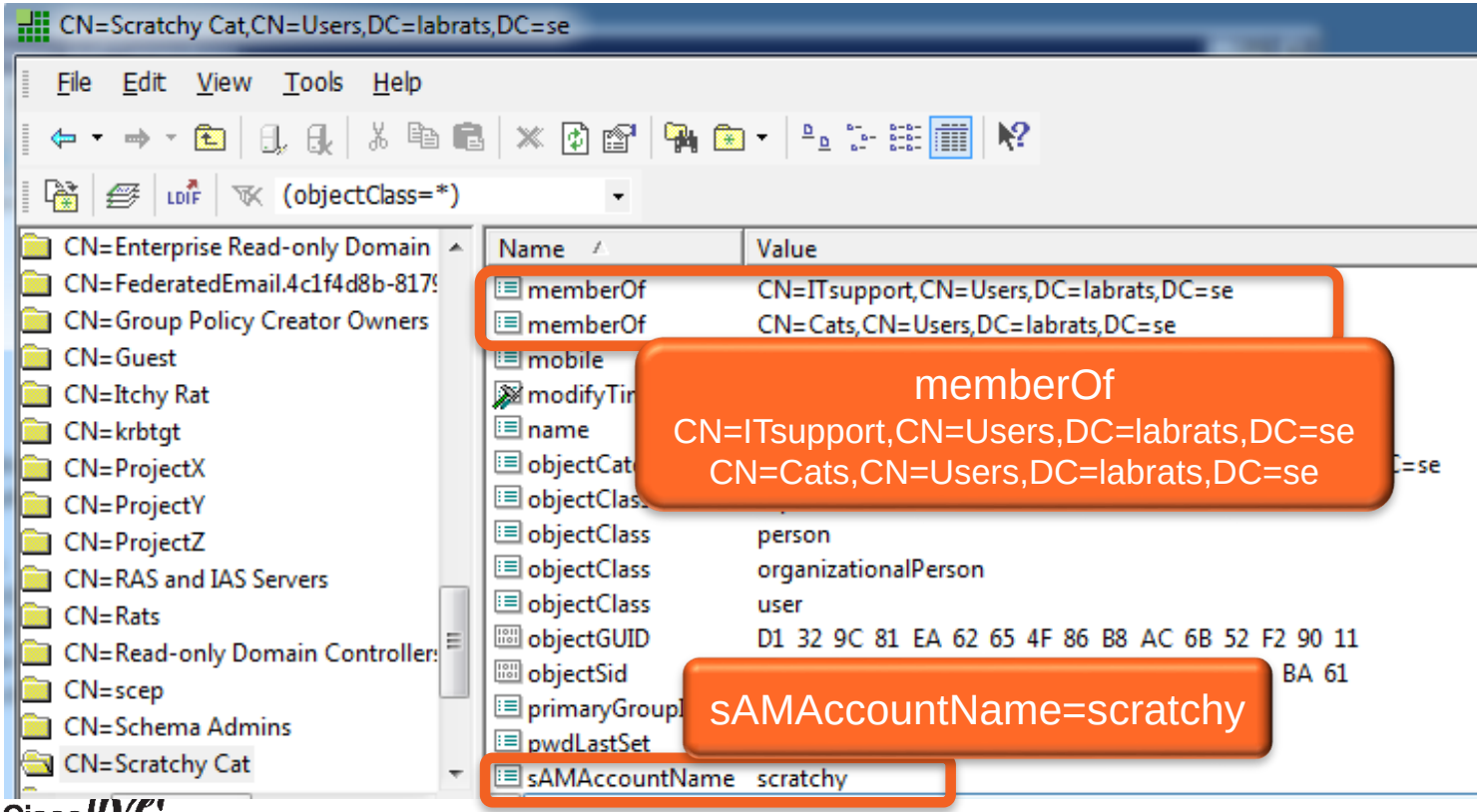
Shared Secret must match with RADIUS server

LDAP Server Definition (Active Directory)



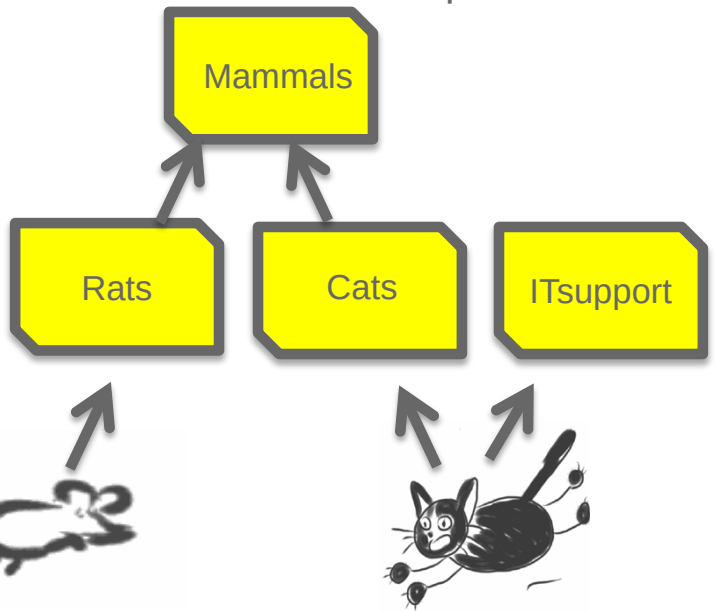
A Good LDAP Browser is Useful

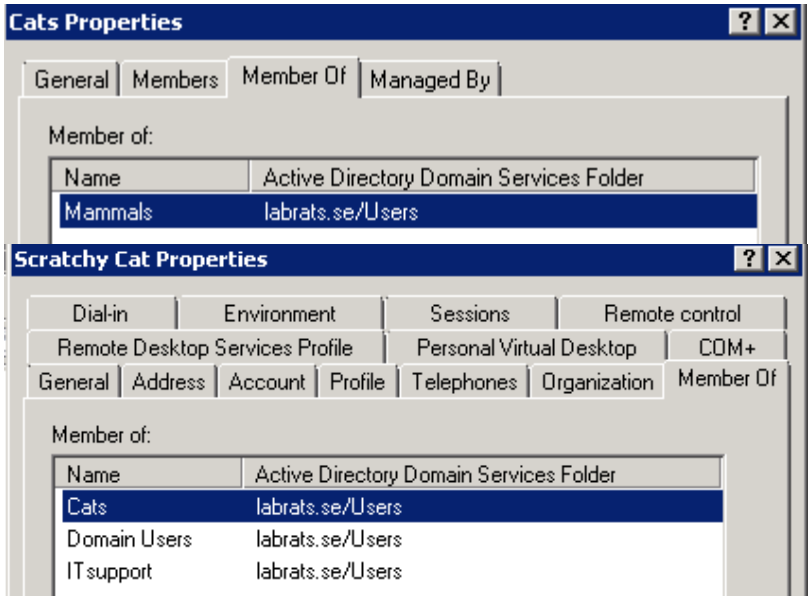
- To learn LDAP structure, and for troubleshooting : http://www.softerra.com



Using Active Directory “memberOf”

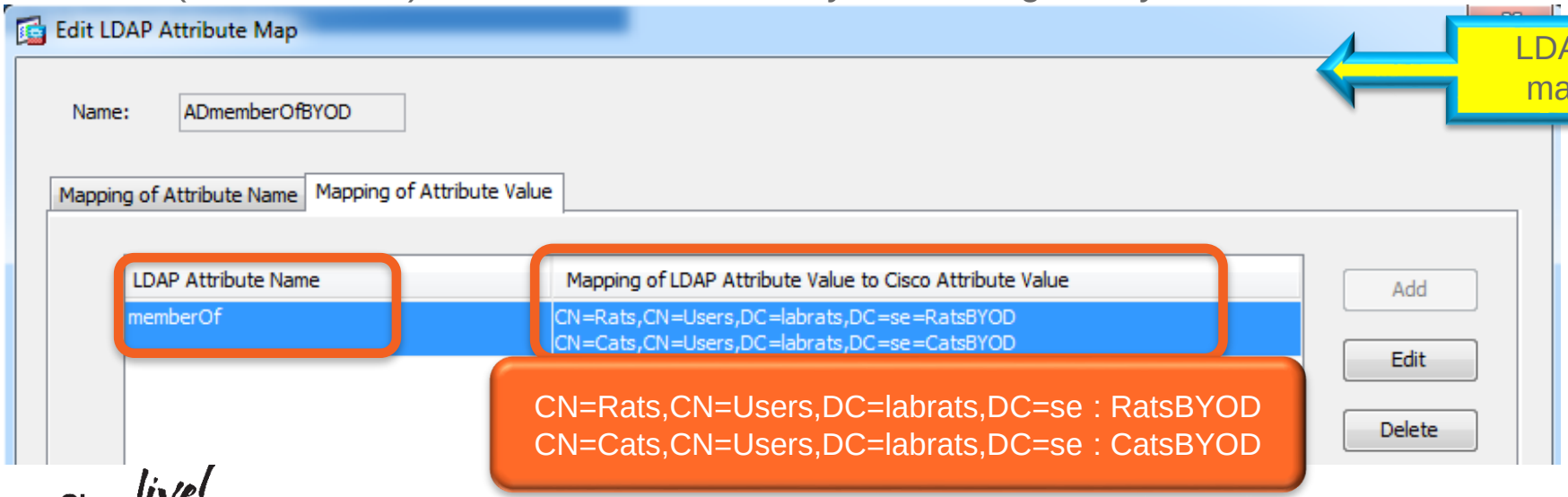
- A user in Active Directory can be a member of **many** groups
  - But can only belong **one** Group Policy in ASA
- A group may be a member of another group in AD
  - ASA will not do recursive lookup



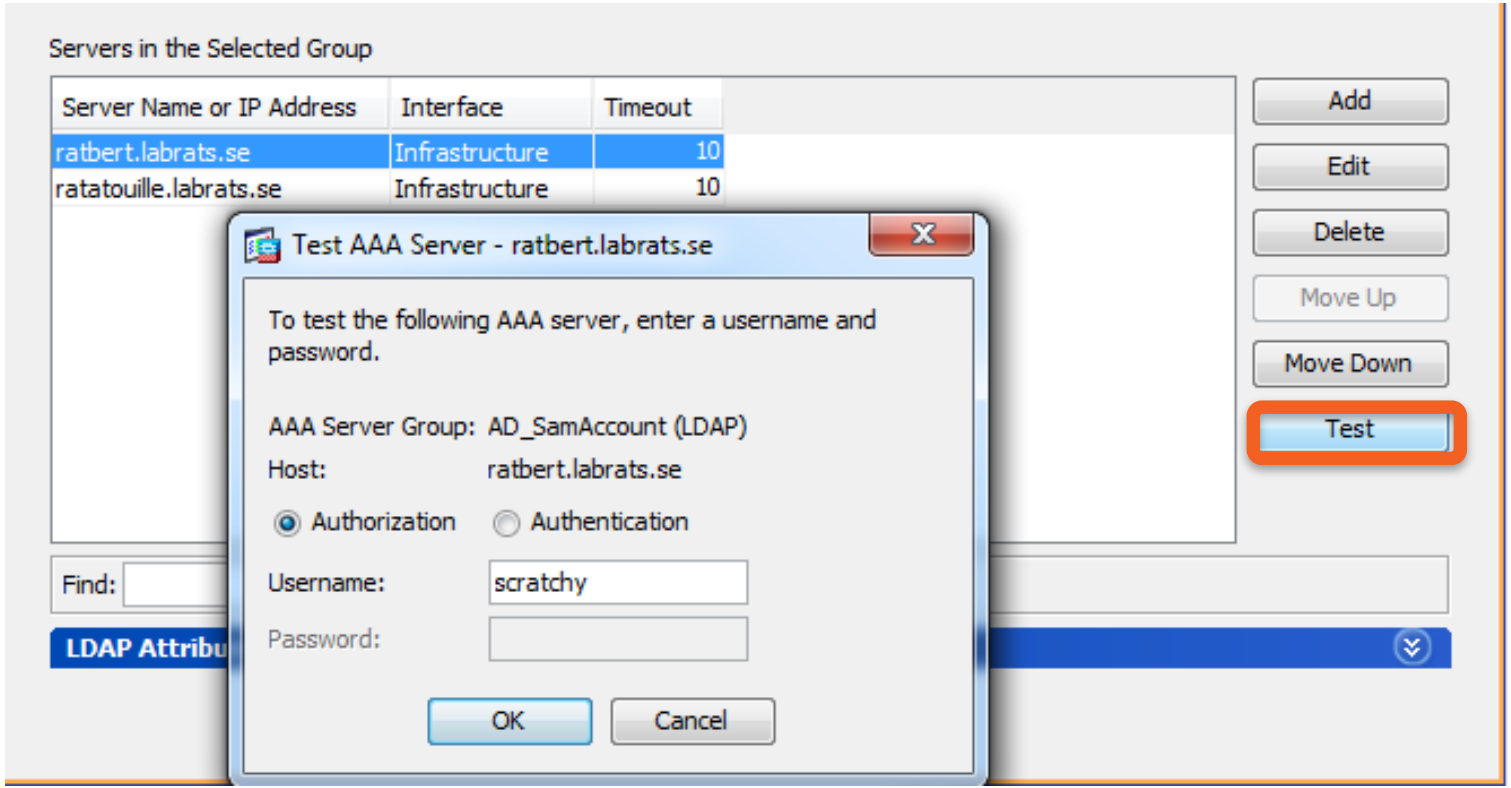


Mapping “memberOf” to Group Policy

- Map “memberOf” to ASA Group Policy with an LDAP attribute map
- **Beware:** First match will apply (many memberOf → one Group Policy)
- **Beware:** No support for lookup of nested groups (“group in group”)
- Using Cisco ISE (covered later) allows for better flexibility in assigning Group Policy
- DAP (covered later) allows for more flexibility in handling "many memberOf"

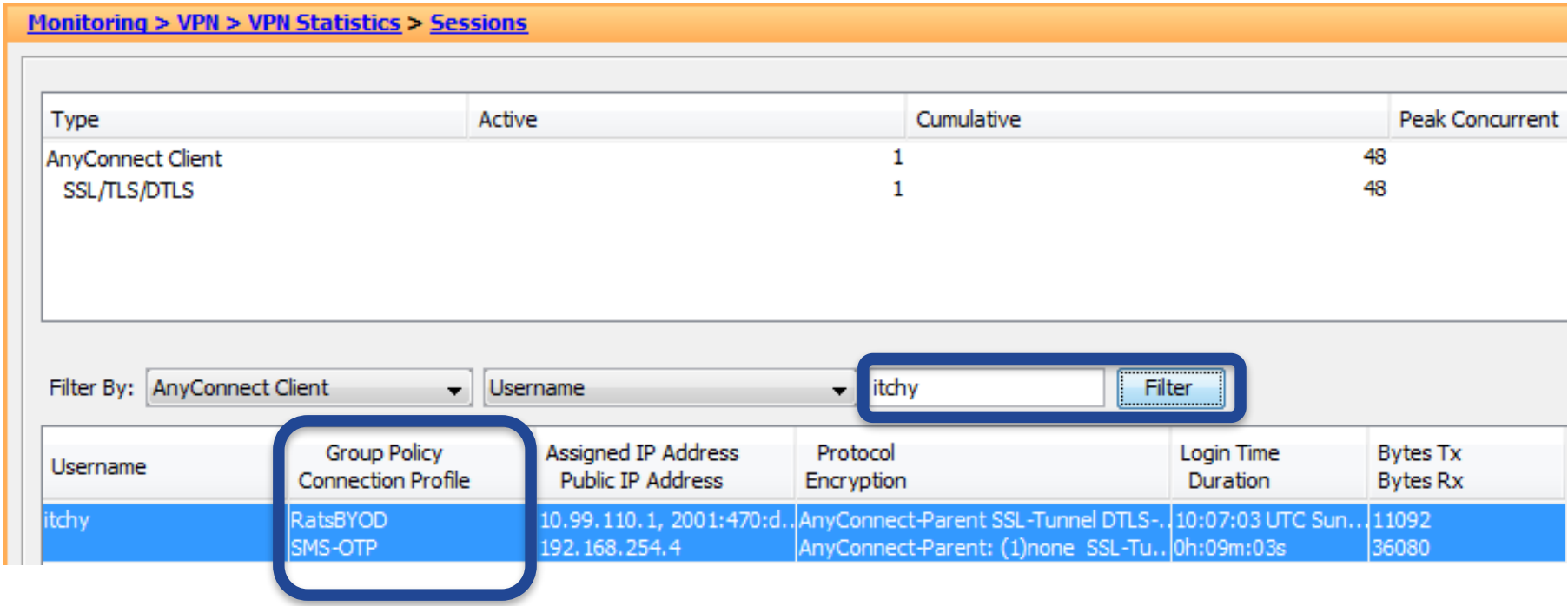


Troubleshooting AAA server



Troubleshooting AAA

- Checking that the right Group Policy has been assigned



Troubleshooting RADIUS : debug radius (1)

```
roddy(config)# sh debug
debug radius session
debug radius decode
roddy(config)# radius mkreq: 0xa1.....
got user 'scratchy'    got password
add_req 0xade2da48 session 0xa1 id 80
RADIUS_REQUEST
radius.c: rad_mkpkt
rad_mkpkt: ip:source-ip=192.168.254.4

RADIUS packet decode (authentication request)
--------------------------------------
Raw packet data (length = 172).....
01 50 00 ac 10 09 0e 2f 3c c5 1a 4b 28 41 e6 27   |  .P...../<..K(A.'
d4 7d 72 c3 01 0a 73 63 72 61 74 63 68 79 02 12   |  .}r...scratchy..
67 58 f2 72 53 db 00 ee 29 1a 49 b4 f1 c7 1a c7   |  gX.rS...).I.....
05 06 00 04 b0 00 1e 0f 31 39 32 2e 31 36 38 2e   |  ........192.168.
31 31 30 2e 31 1f 0f 31 39 32 2e 31 36 38 2e 32   |  110.1..192.168.2
35 34 2e 34 3d 06 00 00 00 05 42 0f 31 39 32 2e   |  54.4=.....B.192.
31 36 38 2e 32 35 34 2e 34 04 06 0a 01 29 6e 1a   |  168.254.4....)n.
22 00 00 00 09 01 1c 69 70 3a 73 6f 75 72 63 65   |  ".....ip:source
2d 69 70 3d 31 39 32 2e 31 36 38 2e 32 35 34 2e   |  -ip=192.168.254.
34 1a 0f 00 00 0c 04 92 09 53 4d 53 2d 4f 54 50   |  4........SMS-OTP
1a 0c 00 00 0c 04 96 06 00 00 00 02               |  ............
```

Access-Request from ASA to RADIUS Server

Troubleshooting RADIUS : debug radius (2)

```
Parsed packet data.....
.........
.........
Radius: Type = 26 (0x1A) Vendor-Specific
Radius: Length = 15 (0x0F)
Radius: Vendor ID = 3076 (0x00000C04)
Radius: Type = 146 (0x92) Tunnel-Group-Name
Radius: Length = 9 (0x09)
Radius: Value (String) =
53 4d 53 2d 4f 54 50                    | SMS-OTP
Radius: Type = 26 (0x1A) Vendor-Specific
Radius: Length = 12 (0x0C)
Radius: Vendor ID = 3076 (0x00000C04)
Radius: Type = 150 (0x96) Client-Type
Radius: Length = 6 (0x06)
Radius: Value (Integer) = 2 (0x0002)
send pkt 10.1.41.51/1645
```

ASA also sends Connection Profile (Tunnel-Group) and Client-Type (AnyConnect) to RADIUS Server in ACCESS-REQUEST

Troubleshooting RADIUS : debug radius (3)

```
RADIUS packet decode (response)
--------------------------------------
Raw packet data (length = 142).....
02 51 00 8e 13 94 12 5d 9c 56 84 ab bc 99 85 0d   |  .Q.....].V......
6a 71 7b 18 01 0a 73 63 72 61 74 63 68 79 18 28   |  jq{...scratchy.(
52 65 61 75 74 68 53 65 73 73 69 6f 6e 3a 30 61   |  ReauthSession:0a
30 31 32 39 33 33 30 30 30 30 33 35 31 45 35 30   |  0129330000351E50
44 42 33 31 35 42 19 0e 52 65 73 65 61 72 63 68   |  DB315B..Research
42 59 4f 44 19 34 43 41 43 53 3a 30 61 30 31 32   |  BYOD.4CACS:0a012
39 33 33 30 30 30 30 33 35 31 45 35 30 44 42 33   |  9330000351E50DB3
31 35 42 3a 69 73 65 31 2f 31 34 31 35 38 39 31   |  15B:ise1/1415891
37 31 2f 32 32 34 33 31 1d 06 00 00 00 01         |  71/22431......

Parsed packet data.....
.........
Radius: Type = 25 (0x19) Class
Radius: Length = 14 (0x0E)
Radius: Value (String) =
43 61 74 73 42 59 4f 44                           |  CatsBYOD
.......
Radius: Type = 29 (0x1D) Termination-Action
Radius: Length = 6 (0x06)
Radius: Value (Hex) = 0x1
rad_procpkt: ACCEPT
RADIUS_ACCESS_ACCEPT: normal termination
```

RADIUS server may assign Group Policy with the Class attribute

Troubleshooting RADIUS

Authentication logs from Cisco ISE

RADIUS Authentication Details

Showing Page 1 of 1 | First Prev Ne

Authentication Summary	
Logged At:	January 6,2013 9:58:31.372 AM
RADIUS Status:	Authentication succeeded
NAS Failure:	
Username:	scratchy
MAC/IP Address:	192.168.254.4
Network Device:	roddy : 10.1.41.110 :
Allowed Protocol:	Default Network Access
Identity Store:	SMS_Mideye
Authorization Profiles:	CatsBYOD
SGA Security Group:	
Authentication Protocol :	PAP_ASCII

Authentication Result

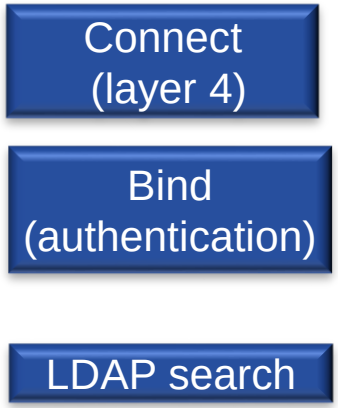
User-Name=scratchy
State=ReauthSession:0a0129330000366450E94A95
Class=CatsBYOD
Class=CACS:0a0129330000366450E94A95:ise1/141589171/24482
Termination-Action=RADIUS-Request

Troubleshooting LDAP

- debug ldap

```
roddy(config)# debug ldap 100
debug ldap  enabled at level 100
roddy(config)#
[42] Session Start
[42] New request Session, context 0xaddbaacc, reqType = Other
[42] Fiber started
[42] Creating LDAP context with uri=ldaps://10.1.41.10:636
[42] Connect to LDAP server: ldaps://10.1.41.10:636, status = Successful
[42] supportedLDAPVersion: value = 3
[42] supportedLDAPVersion: value = 2
[42] Binding as roddy@labrats.se
[42] Performing Simple authentication for roddy@labrats.se to 10.1.41.10

[42] LDAP Search:       Base DN = [dc=labrats,dc=se]       Filter  =
[sAMAccountName=scratchy]       Scope   = [SUBTREE]
[42] User DN = [CN=Scratchy Cat,CN=Users,DC=labrats,DC=se]
```



Troubleshooting LDAP (2)

- debug LDAP (2)

[42] Talking to Active Directory server 10.1.41.10
[42] Reading password policy for scratchy, dn:CN=Scratchy Cat,CN=Users,DC=labrats,DC=se
[42] Read bad password count 0
[42] LDAP Search: Base DN = [dc=labrats,dc=se] Filter = [sAMAccountName=scratchy]
Scope = [SUBTREE]
[42] Retrieved User Attributes:
……
[42] displayName: value = Scratchy Cat
[42] uSNCreated: value = 386330
[42] memberOf: value = CN=Cats,CN=Users,DC=labrats,DC=se
[42] mapped to Group-Policy: value = CatsBYOD
[42] mapped to LDAP-Class: value = CatsBYOD
[42] uSNChanged: value = 387490
[42] department: value = Cats
[42] name: value = Scratchy Cat
…….

Received Attributes and Group-Policy mapping

Agenda

Some Theory SSL and IPSEC

AnyConnect Fundamentals

AAA Deep Dive RADIUS & LDAP

AAA Deep Dive Client Certificates

Provisioning Client Certificates

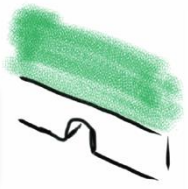
Posture Checking

Dynamic Access Policies (DAP)

ASA On the Rocks - adding ISE

Securing the Client

Customizing the User Experience

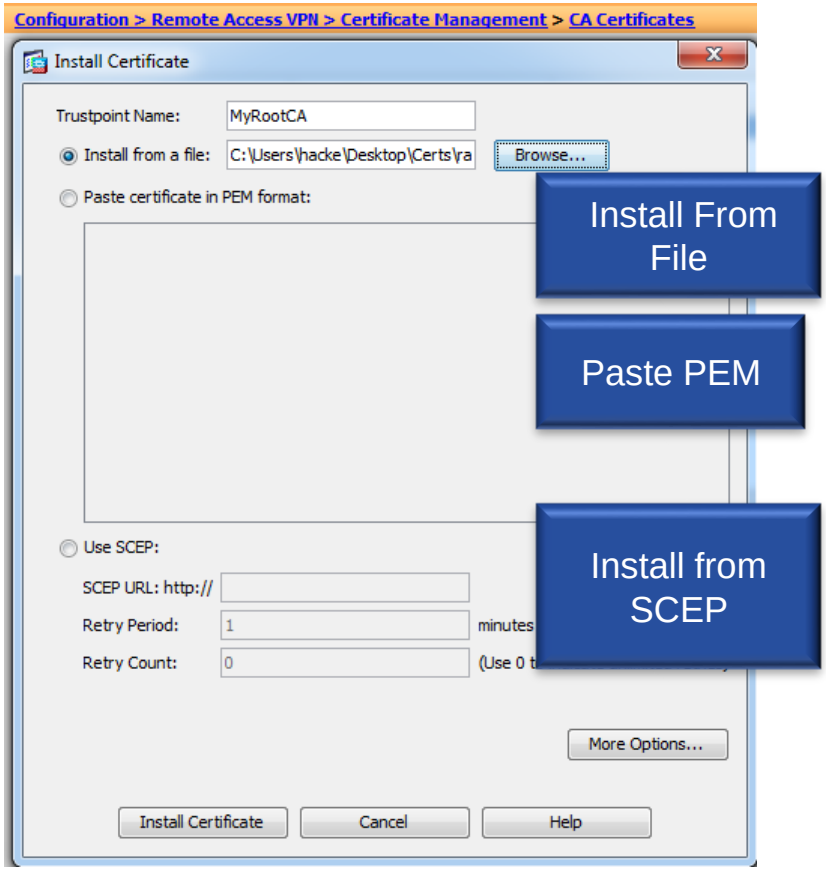


Authentication with Client Certificates

- Considered stronger authentication than passwords
- No need to manage passwords (password complexity, resetting passwords, expiring passwords...)
- Need to manage a PKI (Public Key Infrastructure) to enroll and revoke certificates
- Client Certificates may be tied to machine or user
- User certificates may be soft or hard (smart cards)
- We can make it difficult to move a certificate from one machine to another: Using client certificates allows us to **distinguish corporate devices from other devices (employee iPADs etc)**

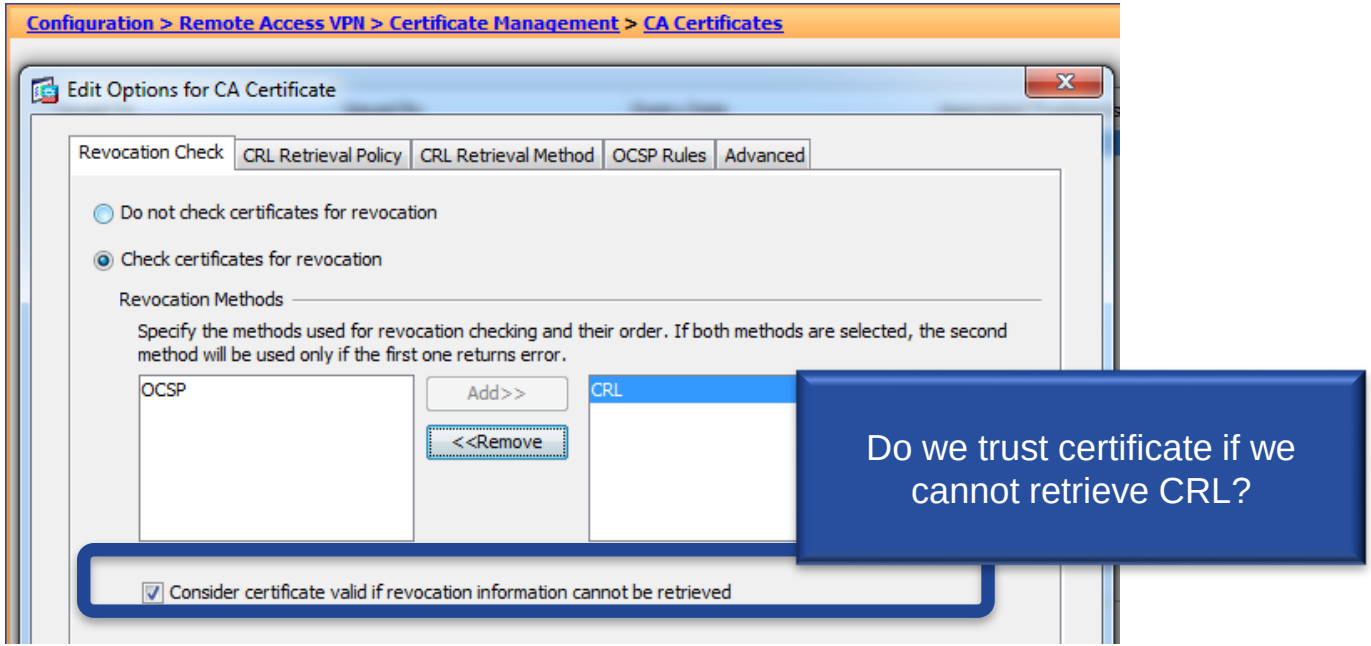
ASA must trust the Issuer of Client Certificates

- Install Issuer CA Certificate
  - from file
  - paste PEM file
  - SCEP
- Issuer of client certificates may be different to the issuer of the ASA certificate



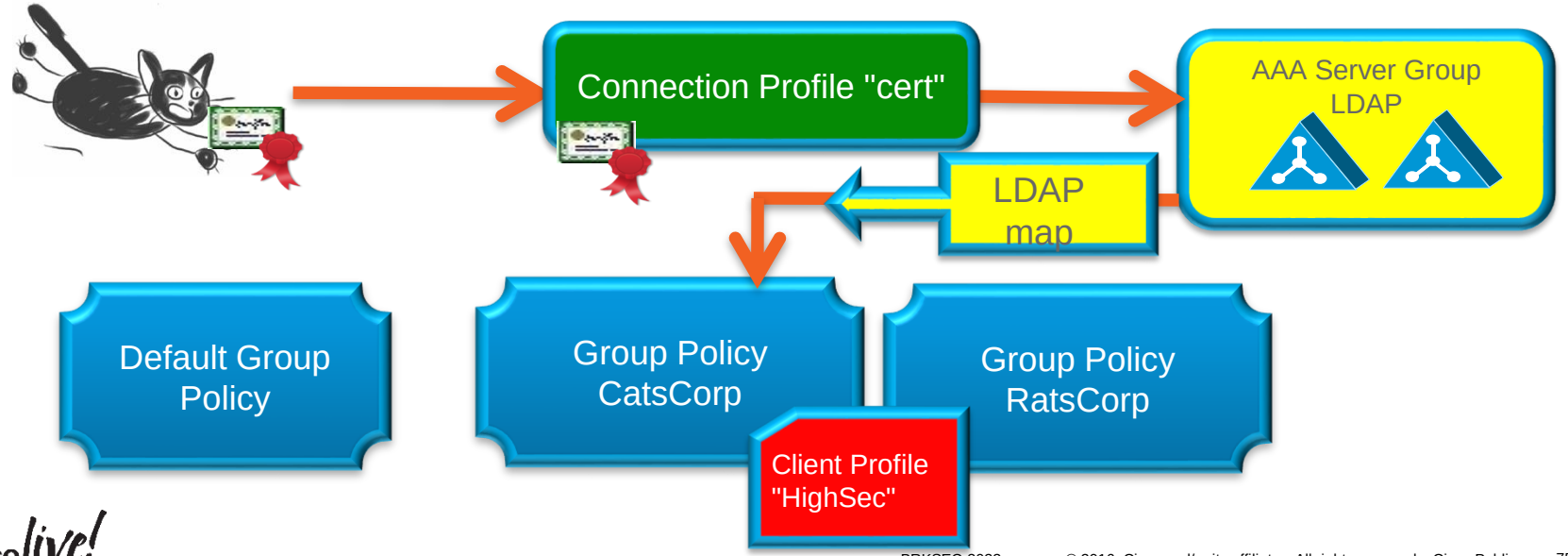
Checking for lost/stolen certificates

- CRL (Certificate Revocation List) downloads a list of revoked certificates (can be cached)
- OCSP (Online Certificate Status Protocol) checks status of individual certificates



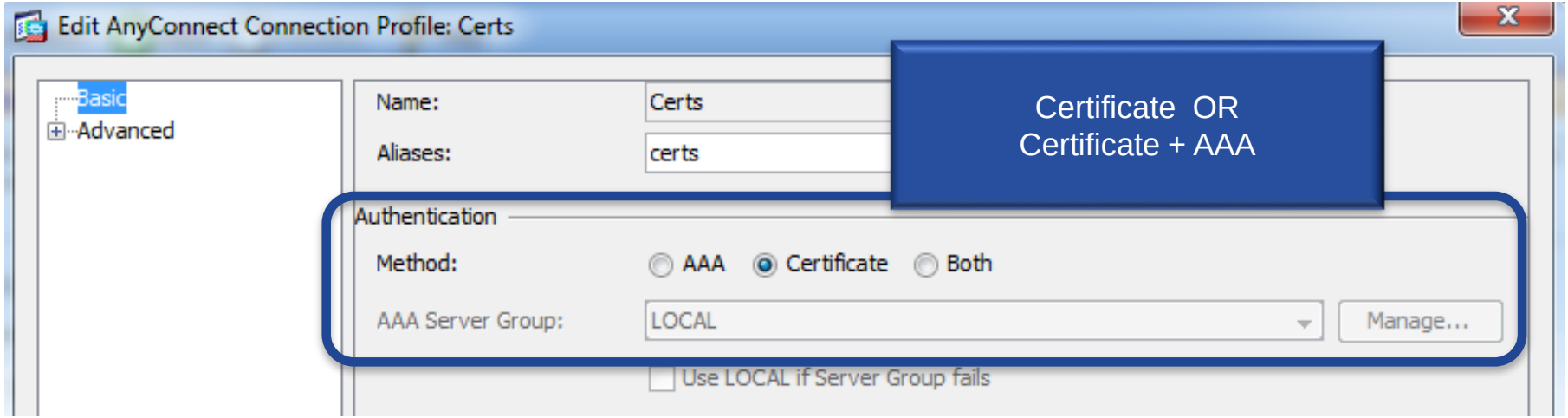
Authentication with Client Certificates Authorization with LDAP

- User authenticated with client certificate
- Username (some field) of certificate used for LDAP lookup
- LDAP attributes are mapped to a Group Policy



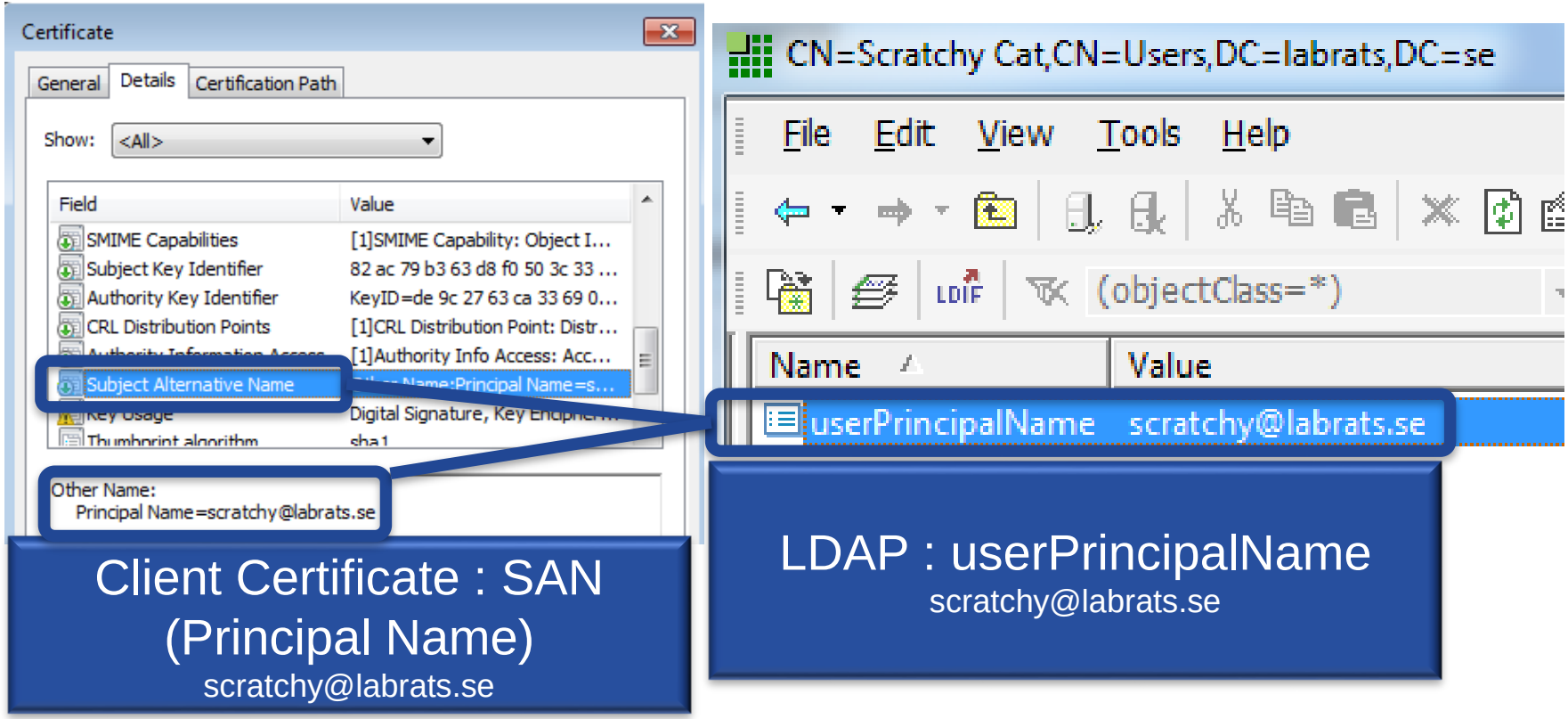
Authentication with Client Certificates

- Defined in Connection Profile
- Choosing "both" means that user first has to authenticate with certificate, then with username/password
  - Use case : Checking that user uses a corporate machine (with a soft certificate)

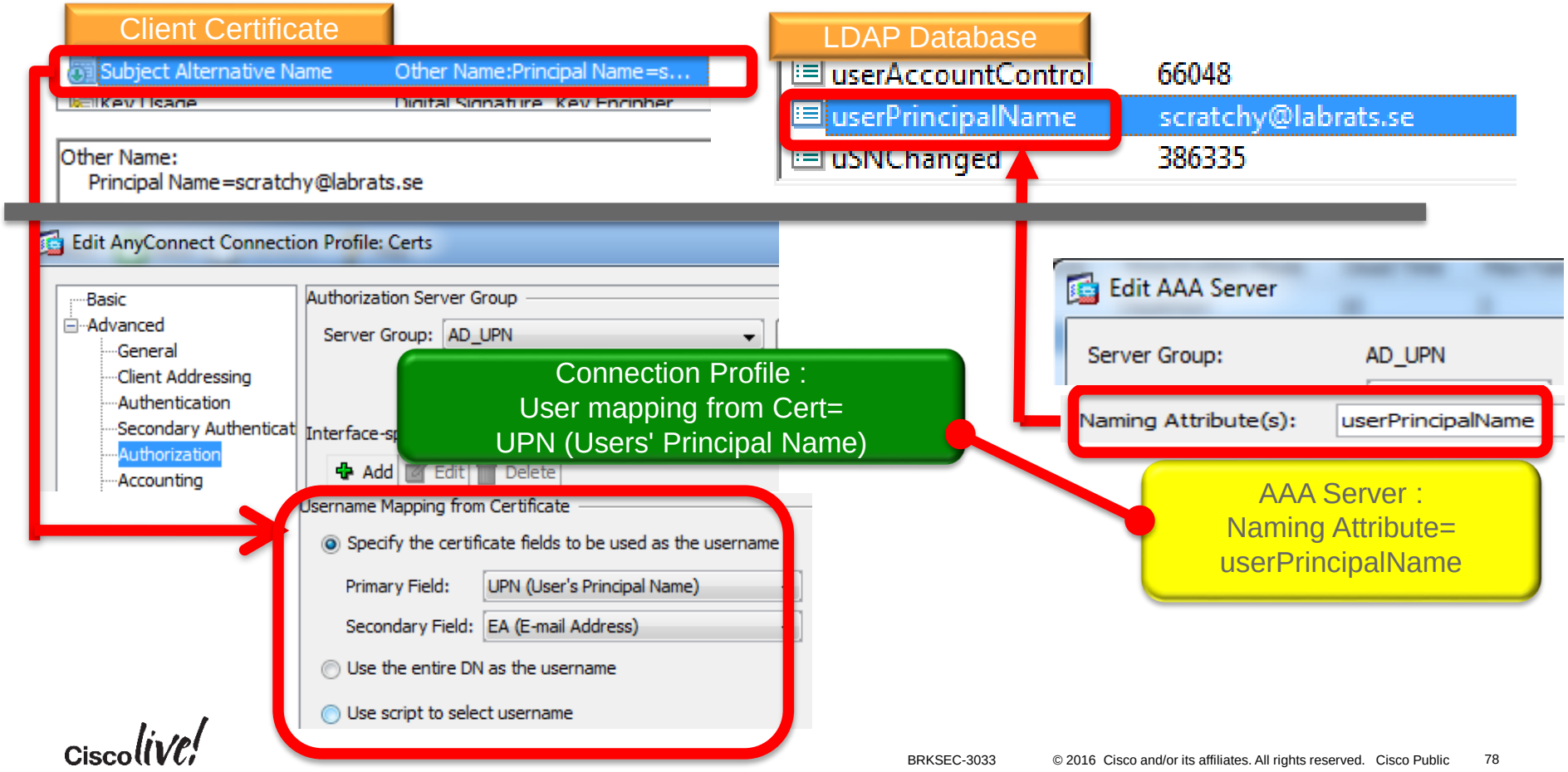


Authorization with Client Certificates

- Work out which fields in cert to use and how to map to LDAP

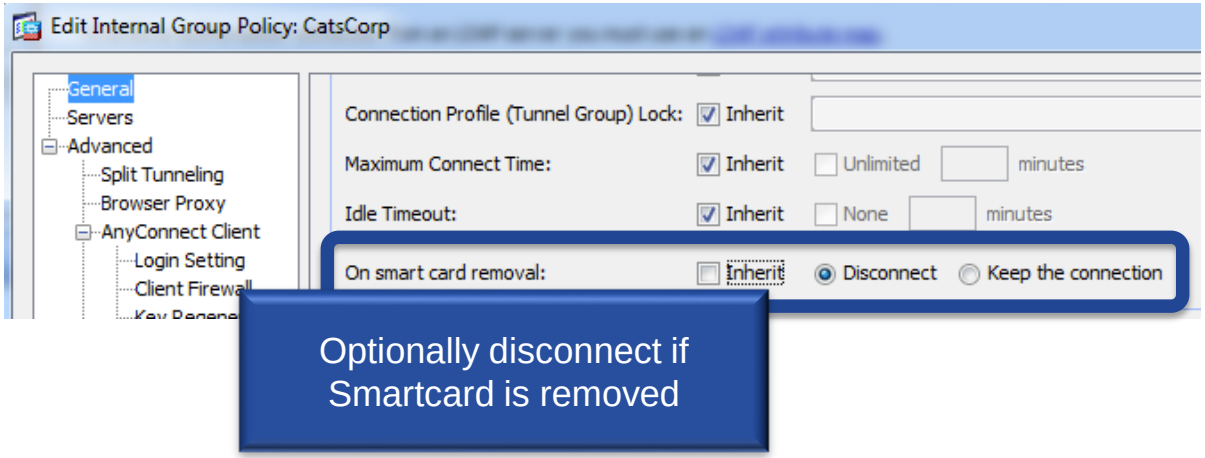


Authorization with Client Certificates

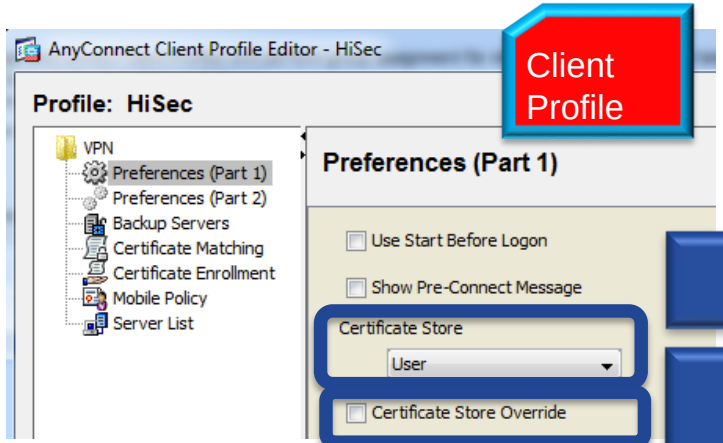


A smart card is just another client certificate

- Same principles and configuration as for soft client certificates
- …with the option of having AnyConnect disconnecting VPN when smart card is removed (configured under Group Policy/General)
- ASA/AnyConnect currently do not support “double” cert authentication
  - First with computer certificate, then with user certificate/smart card
  - Workaround : Use Posture checks to verify that it is corporate machine

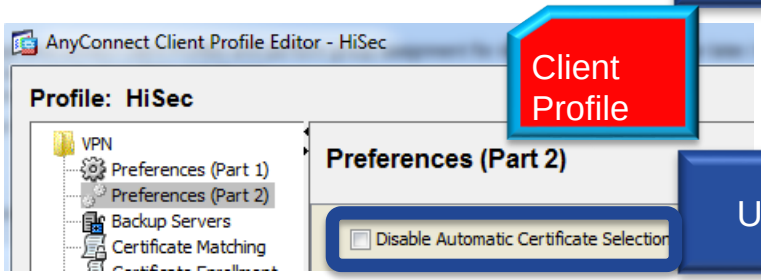


Client Profile Options to select the right certificate



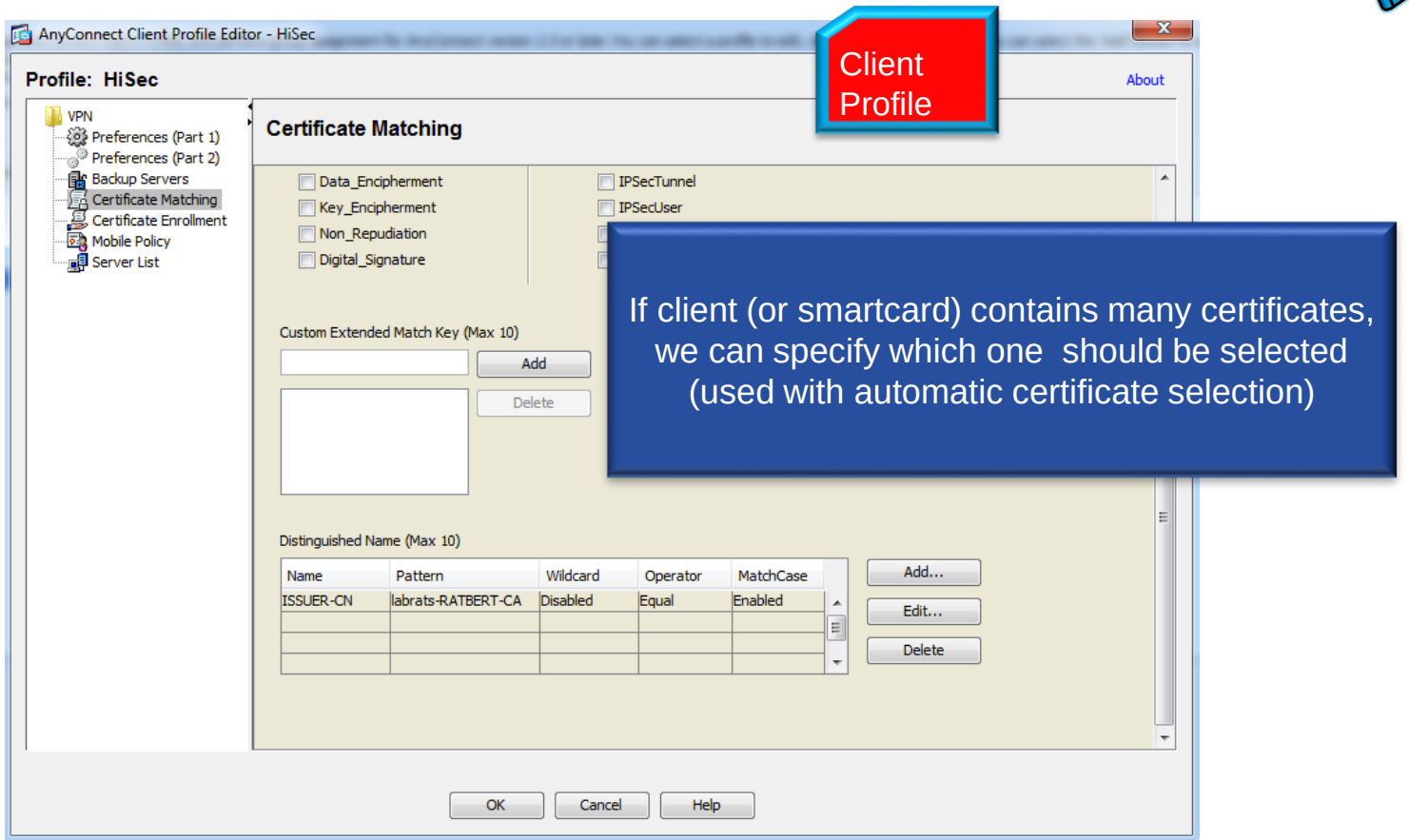
Certificate Store : User, Machine or All

Certificate Store Override :
Check if non administrator needs access to machine certificate

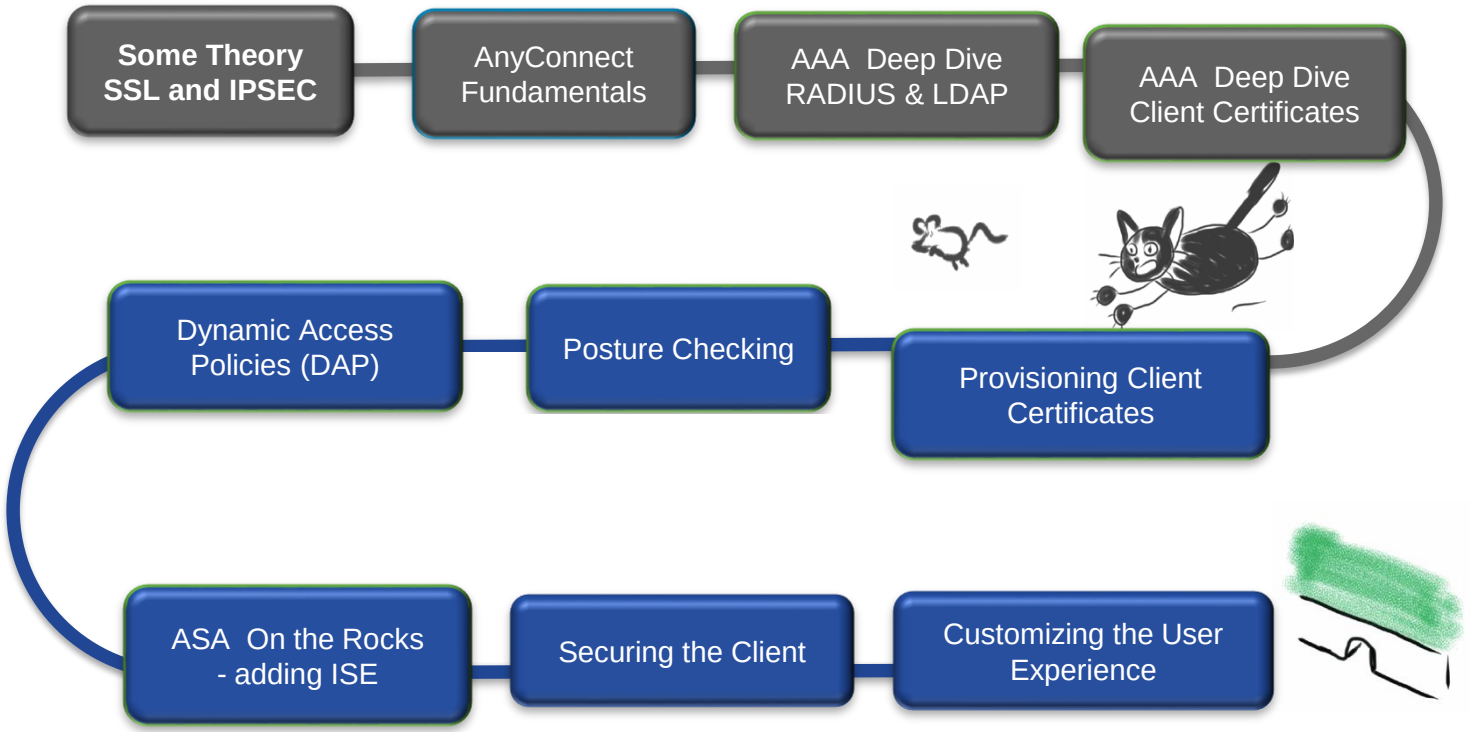


Uncheck for Automatic certificate Selection

Certificate Matching (for automatic cert selection)



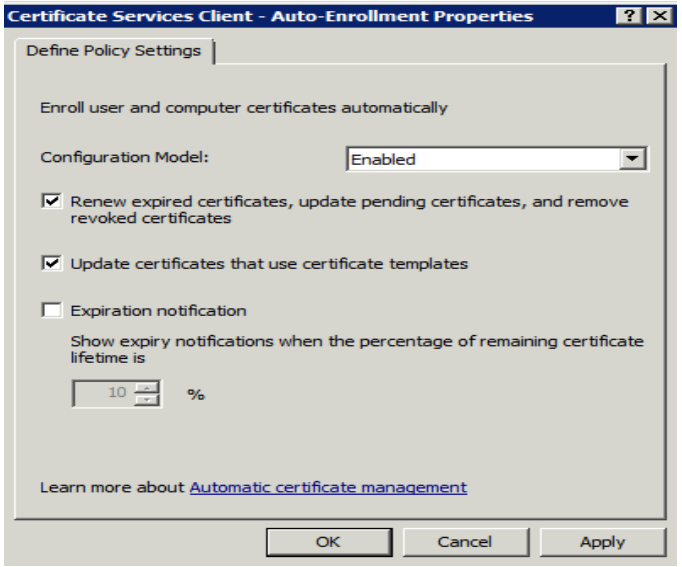
Agenda



Certificate Enrolment : Active Directory

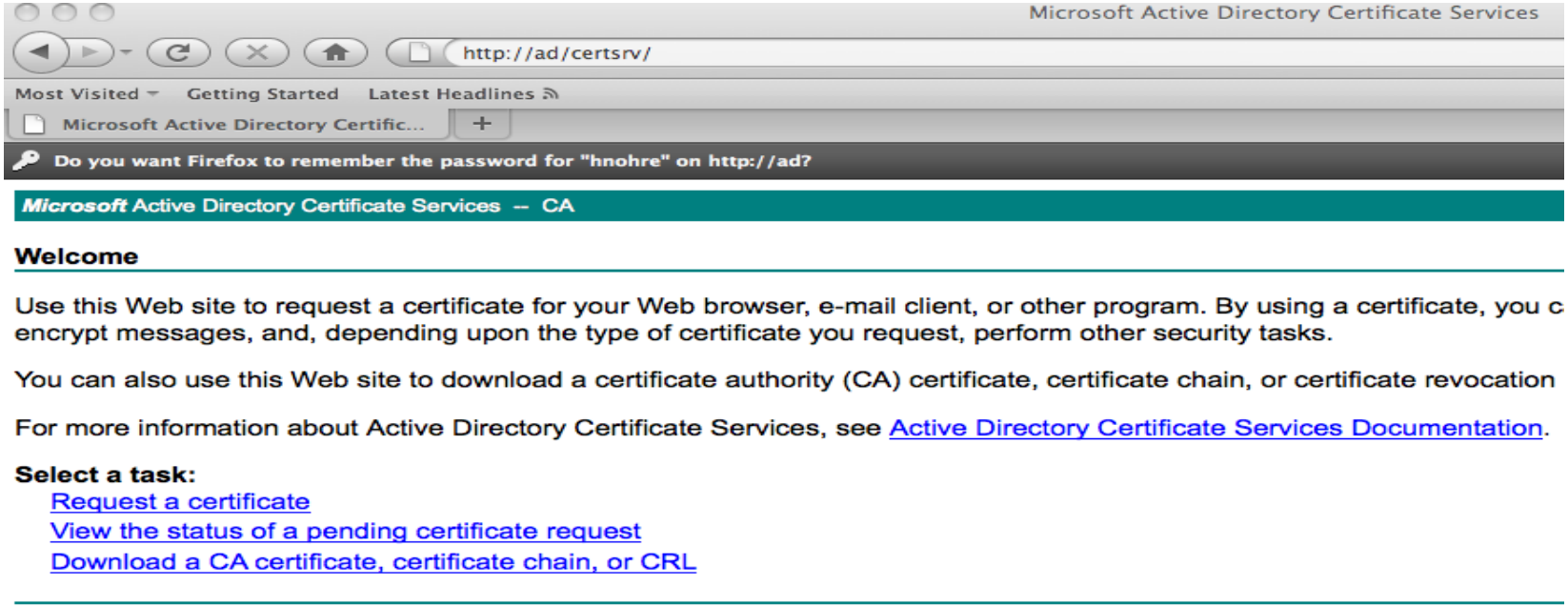
- Microsoft Active Directory supports automatic certificate enrolment for user and machine certificates
- User and machine are members of Active Directory Domain: Their certificates can be pushed by GPOs (Group Policy Objects)

http://technet.microsoft.com/en-us/library/cc770546.aspx



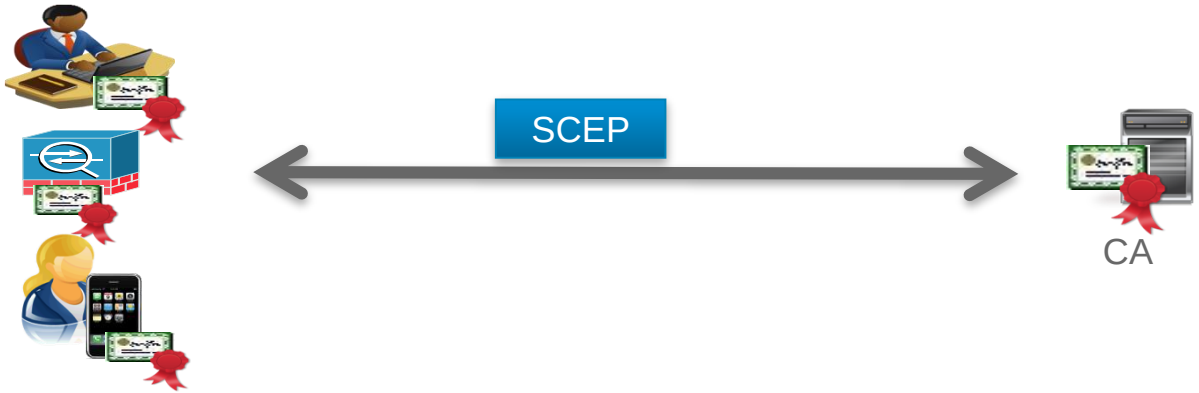
Certificate Enrolment : Active Directory (2)

- Microsoft CA also supports web enrolment
- Can be used by non-domain members, e.g. MACs



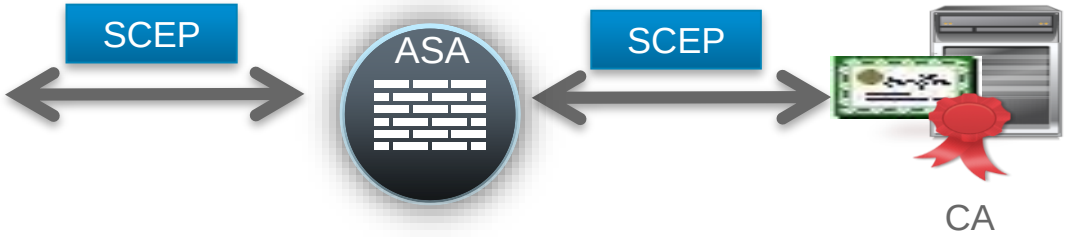
Simple Certificate Enrolment Protocol (SCEP)

- http://tools.ietf.org/id/draft-nourse-scep-23.txt
- Protocol for enrolling certificates over HTTP (basically encapsulating PKCS#10, PKCS#7 over HTTP)
- Originally developed by Verisign for Cisco
- **Widely** supported by network devices (including ASA and AnyConnect), clients and most Certificate Authorities (including Microsoft CA and Cisco ISE)



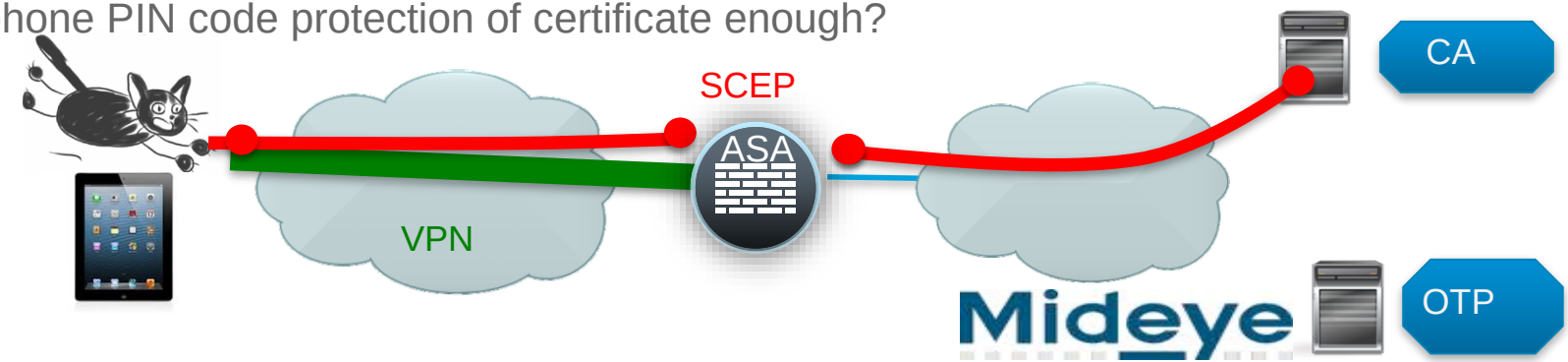
AnyConnect SCEP Proxy Support

- ASA can be an SCEP proxy, enabling AnyConnect on the outside to enroll to a CA on the inside of ASA without poking holes in Firewall
- Not to be confused with Legacy SCEP, where AnyConnect speaks directly to the CA over the VPN tunnel.
- SCEP proxy requires AnyConnect 3.0 or later :

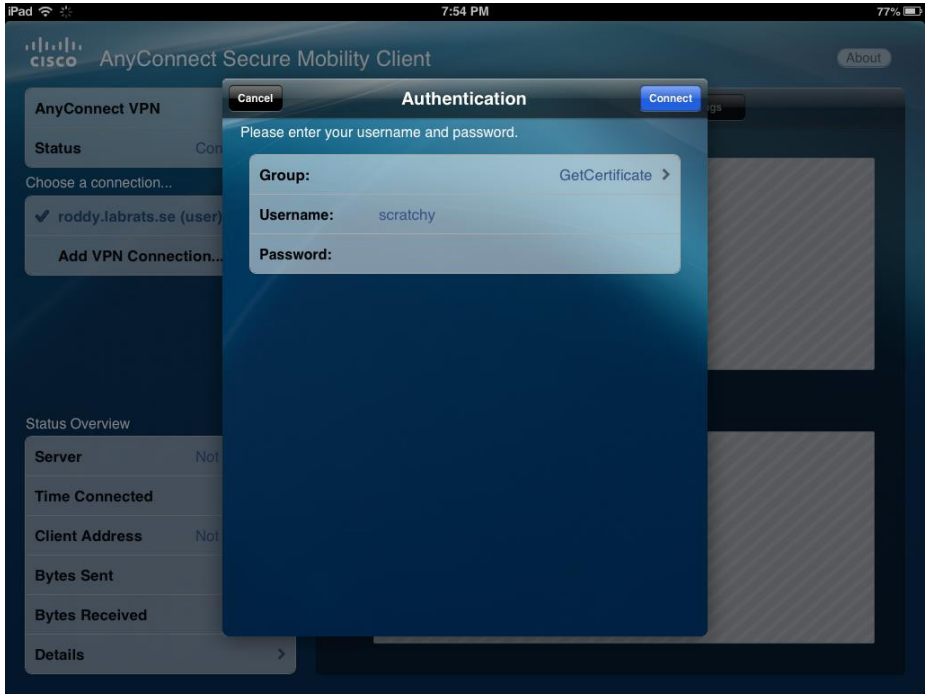


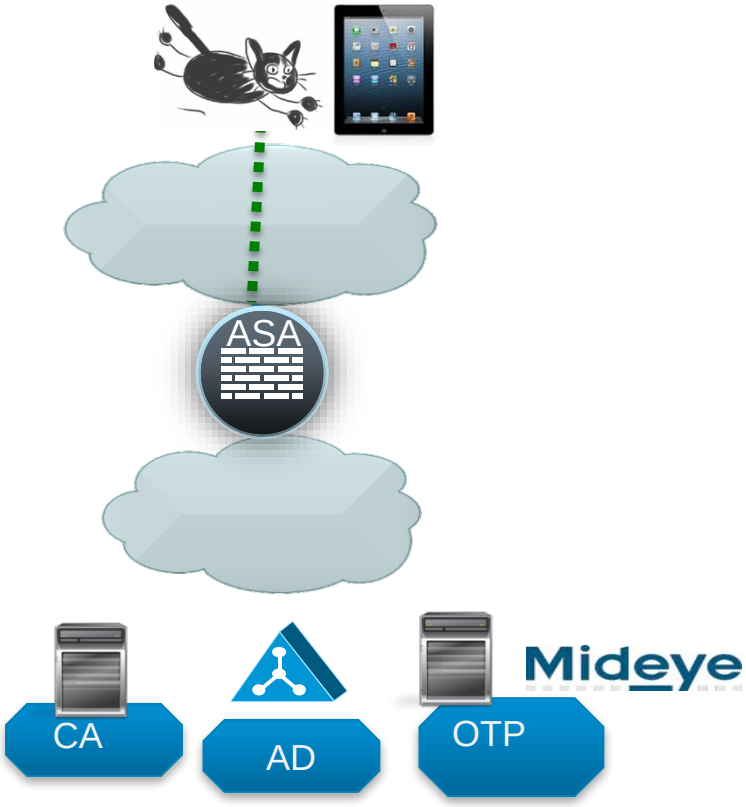
Case Study : Secure Enrolment of Certificates to Mobile Devices

- Mobile users (Windows, MAC, Phone, Android) logon from **anywhere** (over internet) to enroll
- Secure authentication via OTP sent by SMS to mobile
- Certificate automatically enrolled with correct subject name
- Note : to mitigate risk of stolen phones, use certs + AAA for authentication
  - is phone PIN code protection of certificate enough?

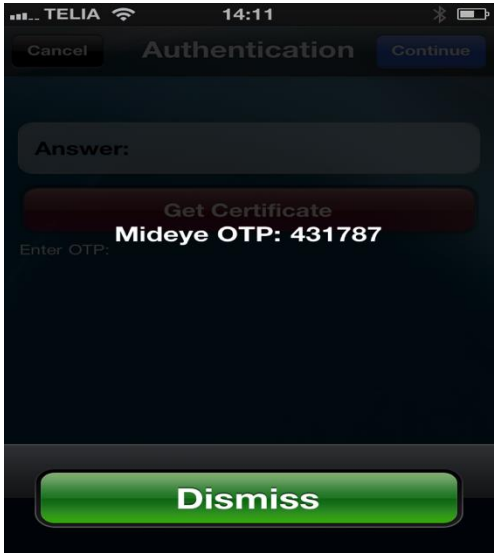


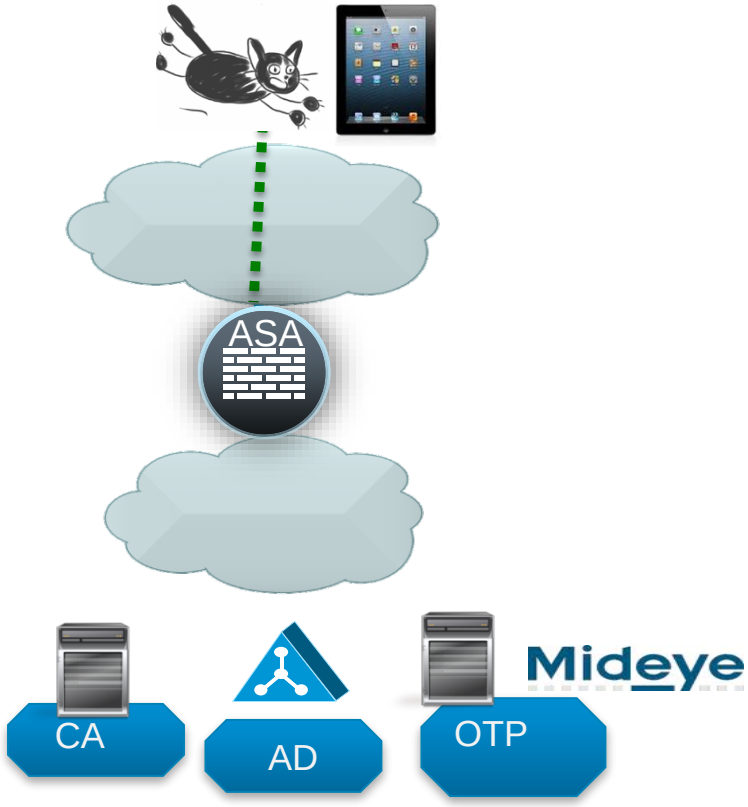
1. User Connects to ASA



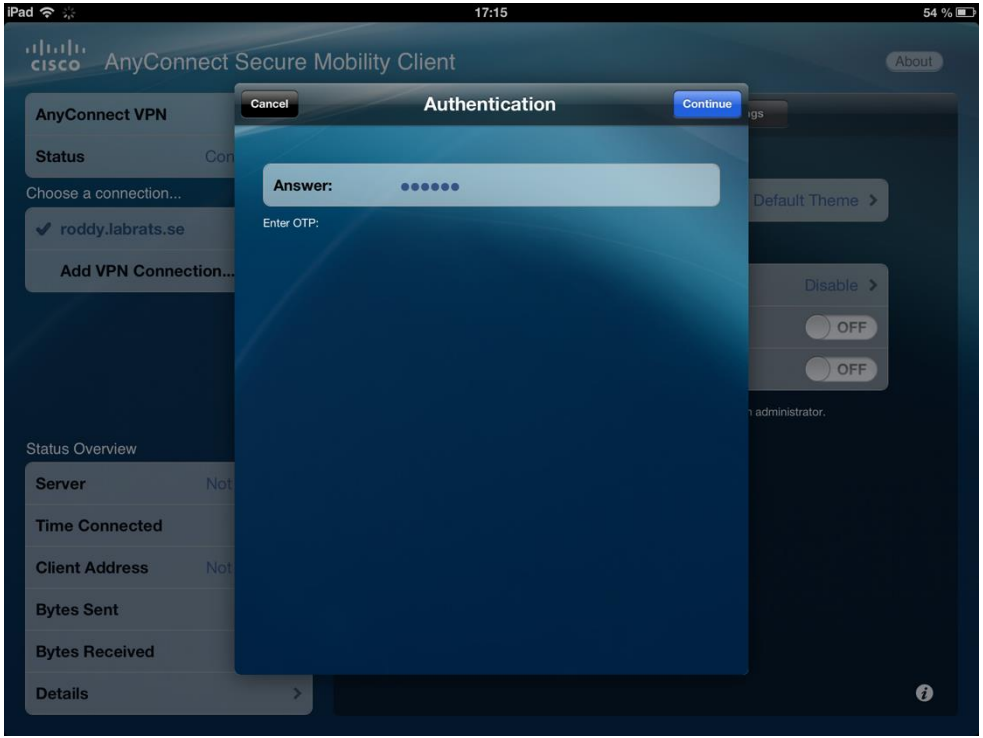


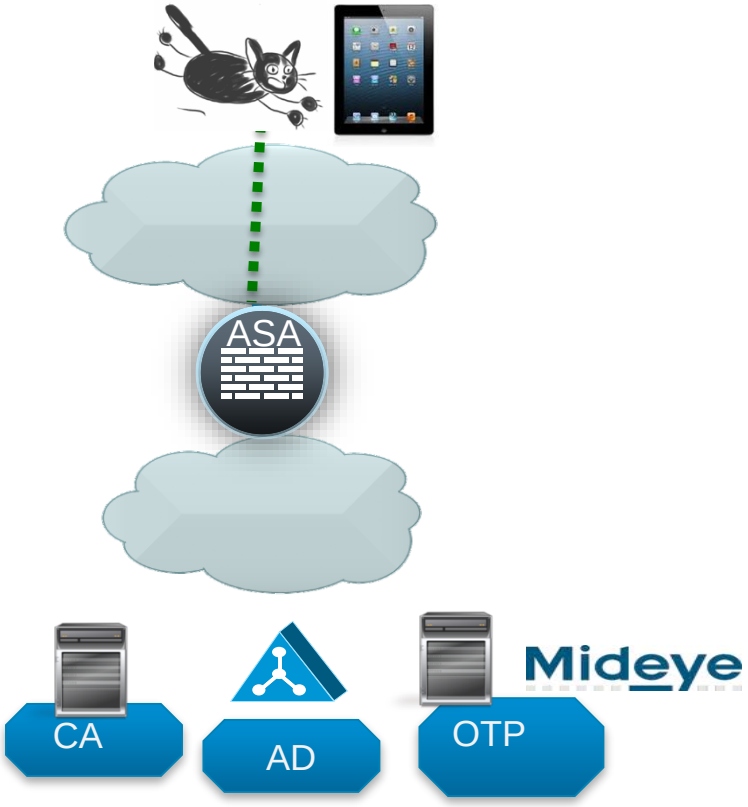
2. User Gets SMS with OTP





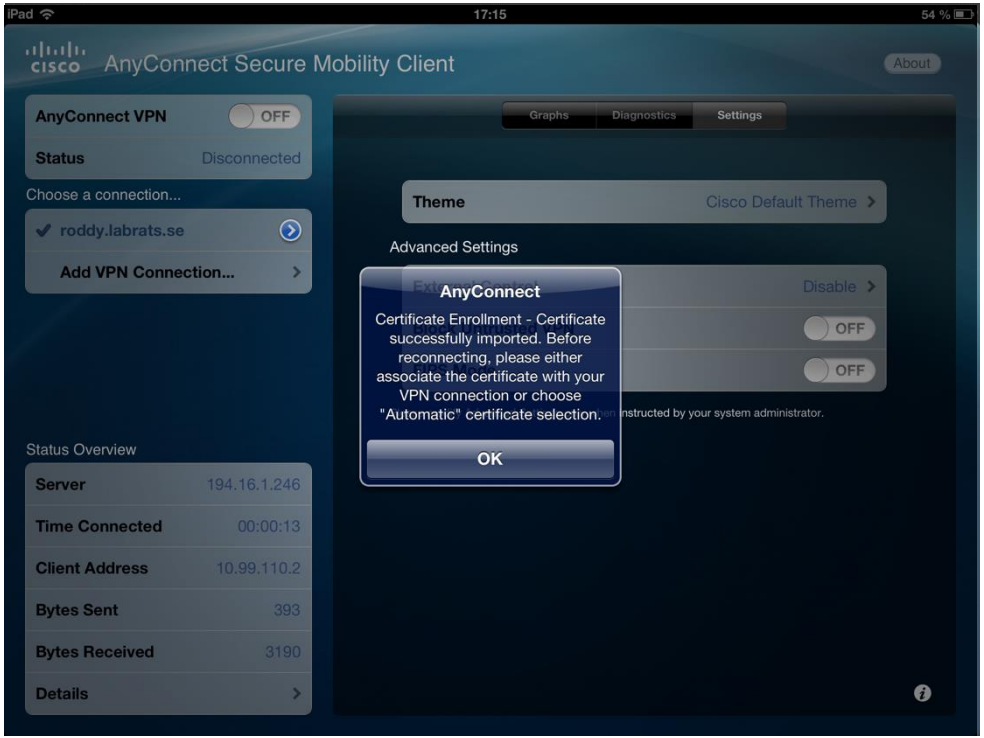
3. User logs on with OTP

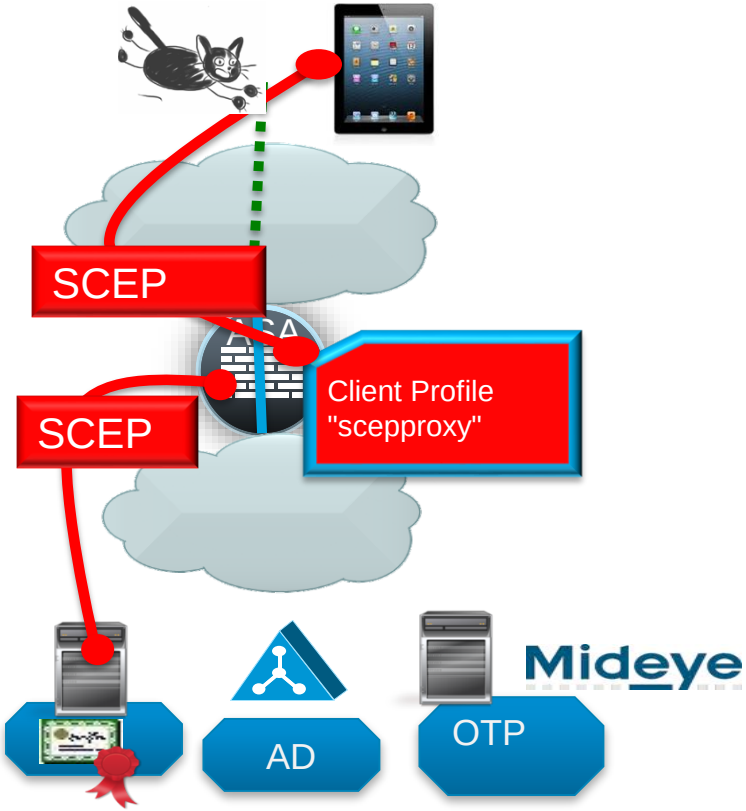




4. AnyConnect Gets Certificate from ASA (proxy to CA)

Cert can also be used for 802.1X*

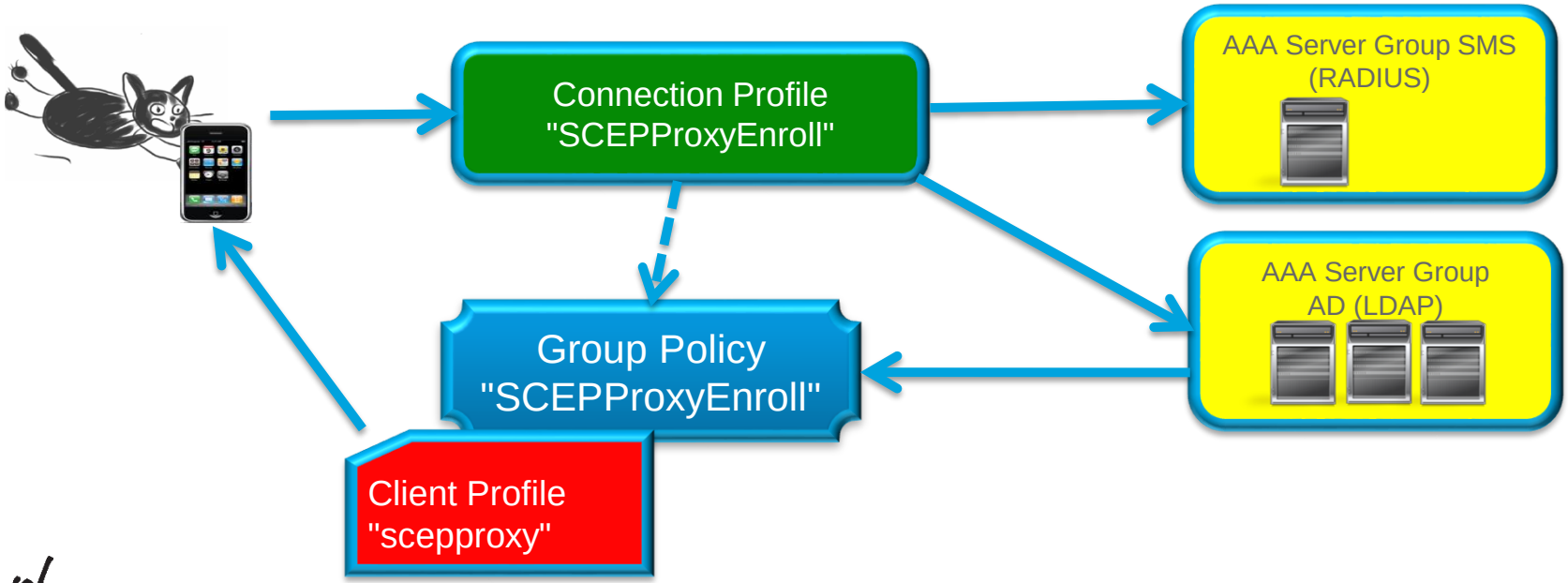




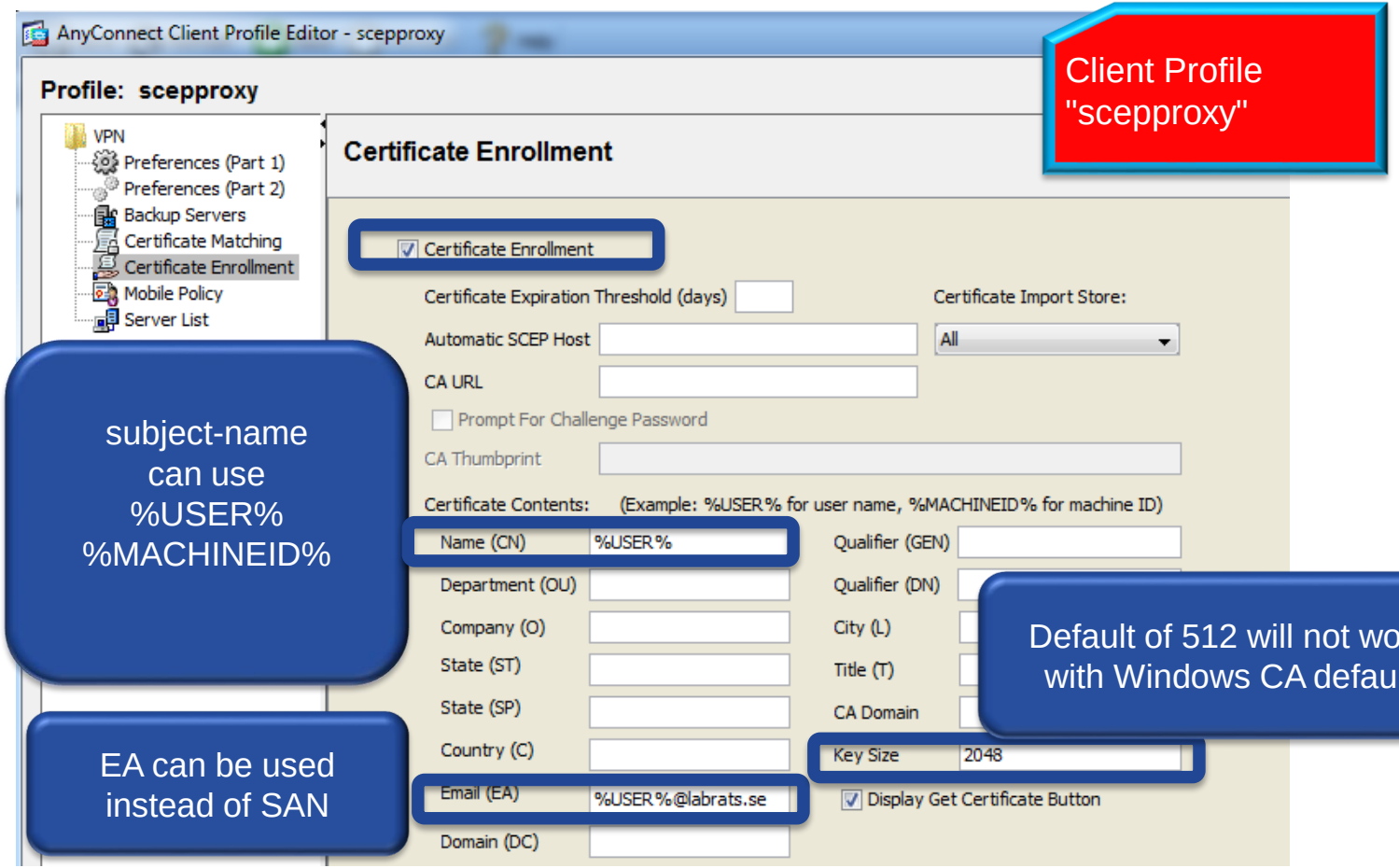
What to Configure on ASA

- Configuration example on

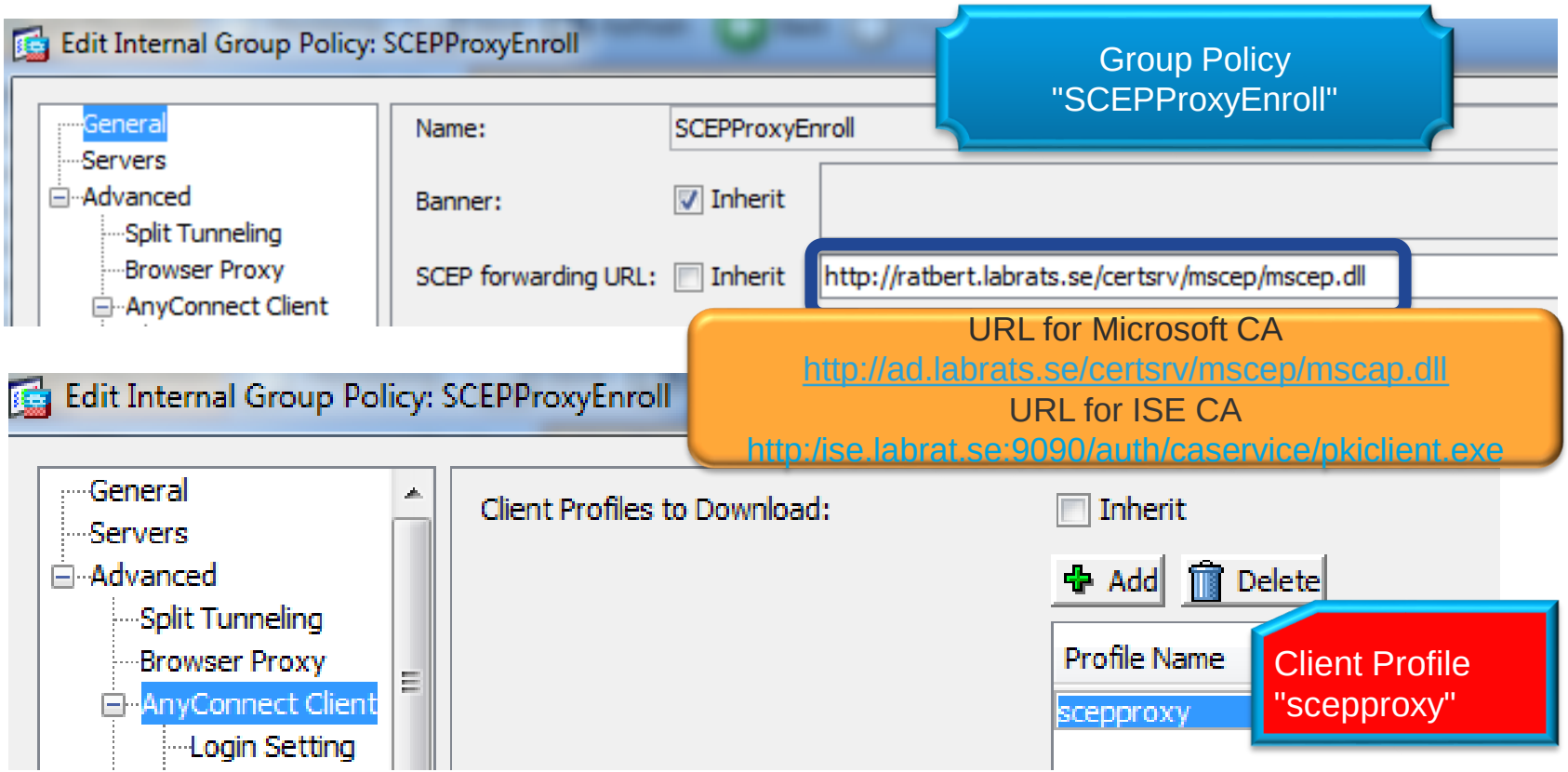
http://www.cisco.com/en/US/docs/security/vpn_client/anyconnect/anyconnect31/administration/guide/ac03vpn.html#wp1591160



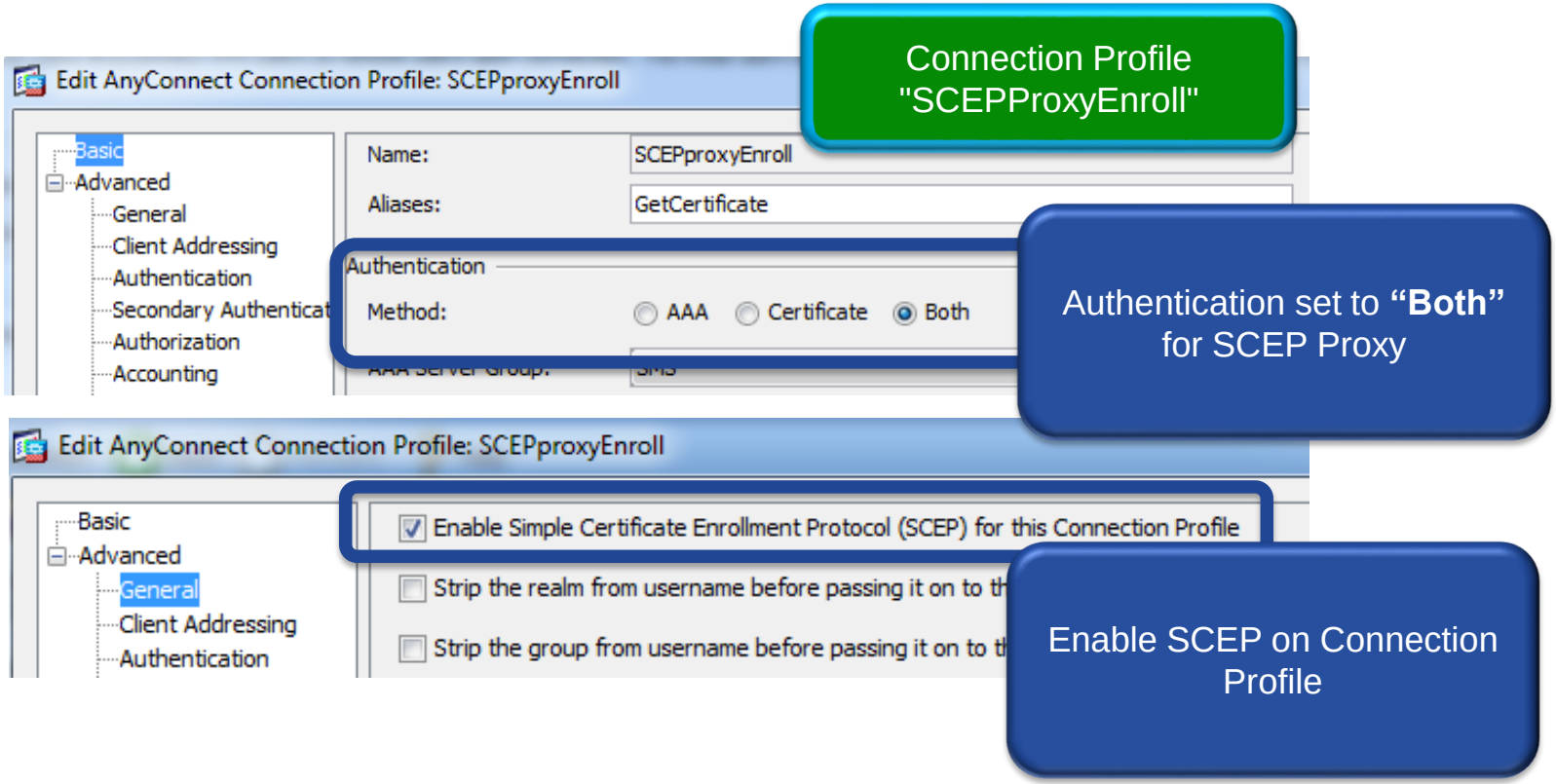
Client Profile For Certificate Enrollment



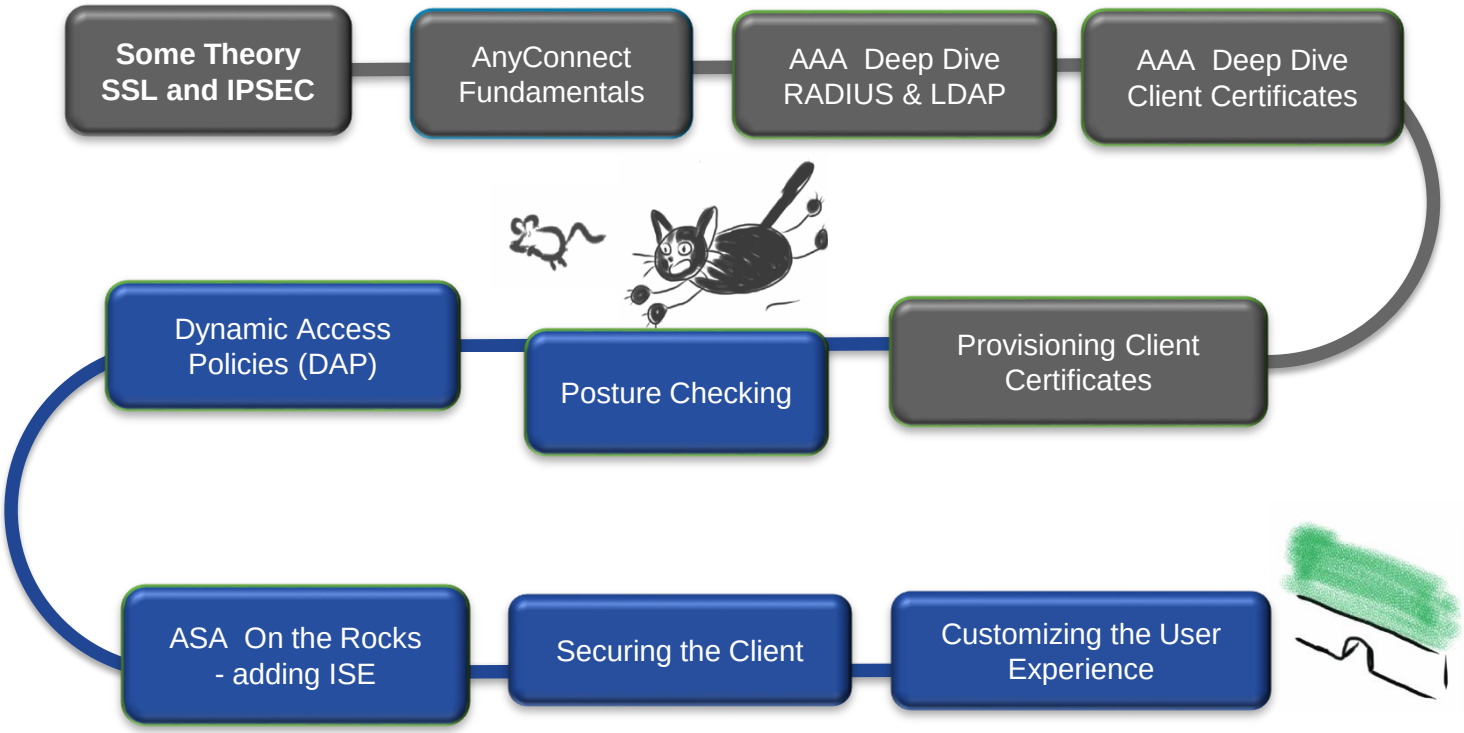
Group Policy for Certificate Enrollment



Connection Profile for Certificate Enrollment



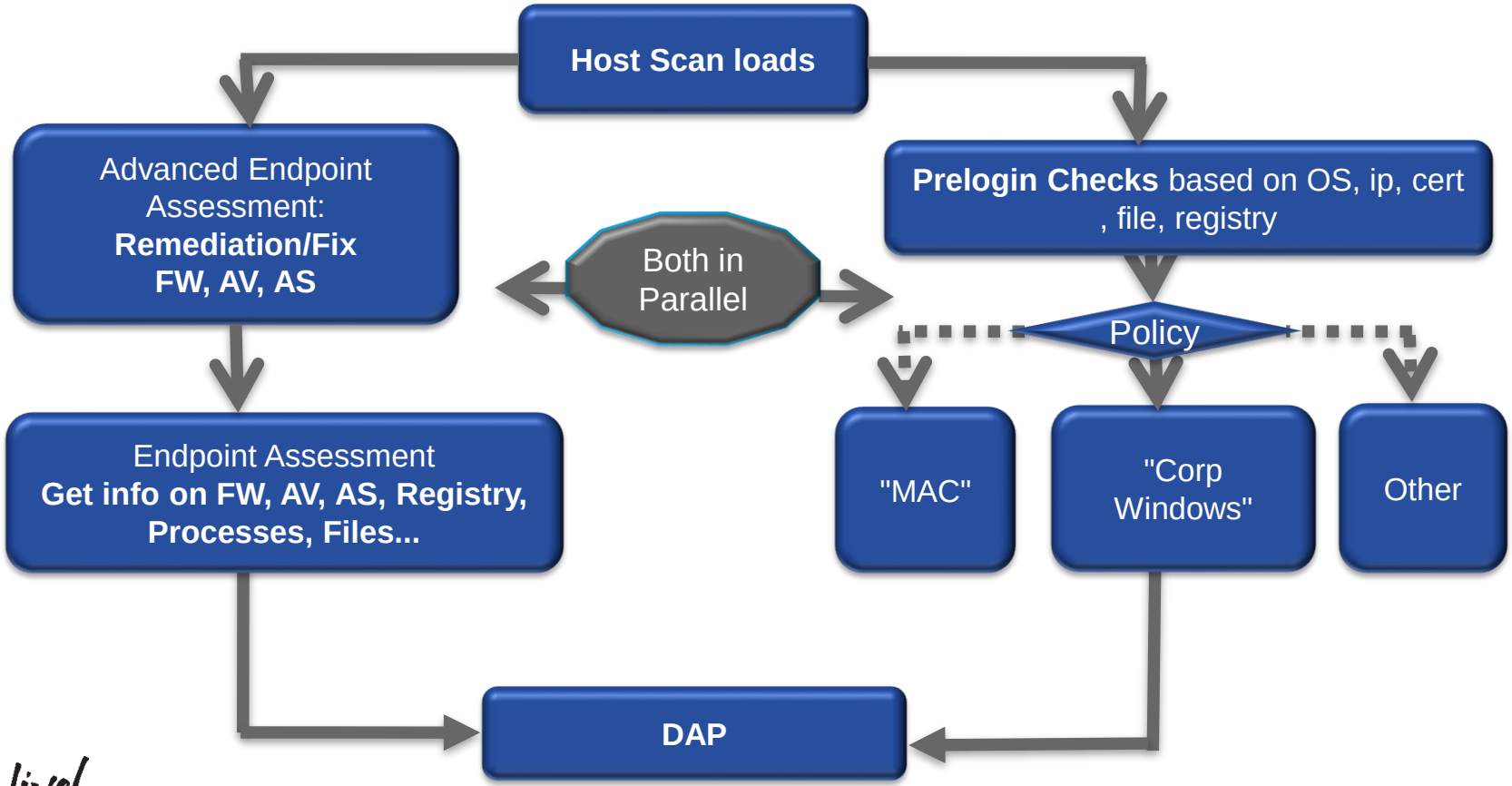
Agenda



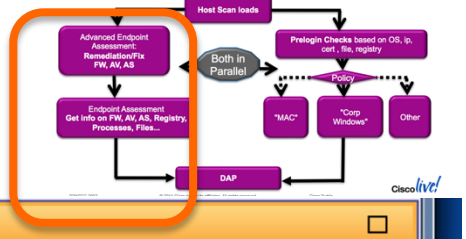
AnyConnect Posture : Do the Clients meet Requirements?

- Possible to check that client meets Posture Requirements : OS, Anti-Virus, Personal Firewall, Registry Keys, Open Ports etc
- Used in combination with Dynamic Access Policies (DAP) to grant access to clients depending on their posture status

The Host Scan Process



Configuring Host Scan



Configuration > Remote Access VPN > Secure Desktop Manager > Host Scan

Host Scan

Create entries to be scanned on the endpoint system. The scanned information ... ndpoint information can be configured under Dynamic Access Policies

Possible to create checks for Process, File and Registry keys that can be enforced by DAP

Basic Host Scan

ID	Info	Type
CorporateFile	C:\corporate.txt	File
CorporateKey	HKEY_CURRENT_USER\CorporateKey	Registry
CorporateProcess	notepad.exe	Process

Add ▾

- Registry Scan...
- File Scan...
- Process Scan...

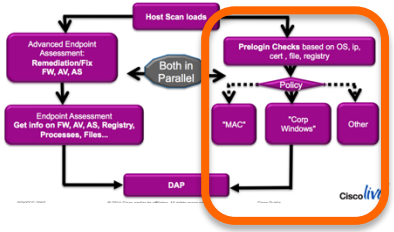
Host Scan Extensions

- ☑ Advanced Endpoint Assessment ver 3.6.4140.2
- ☑ Endpoint Assessment ver 3.6.4140.2

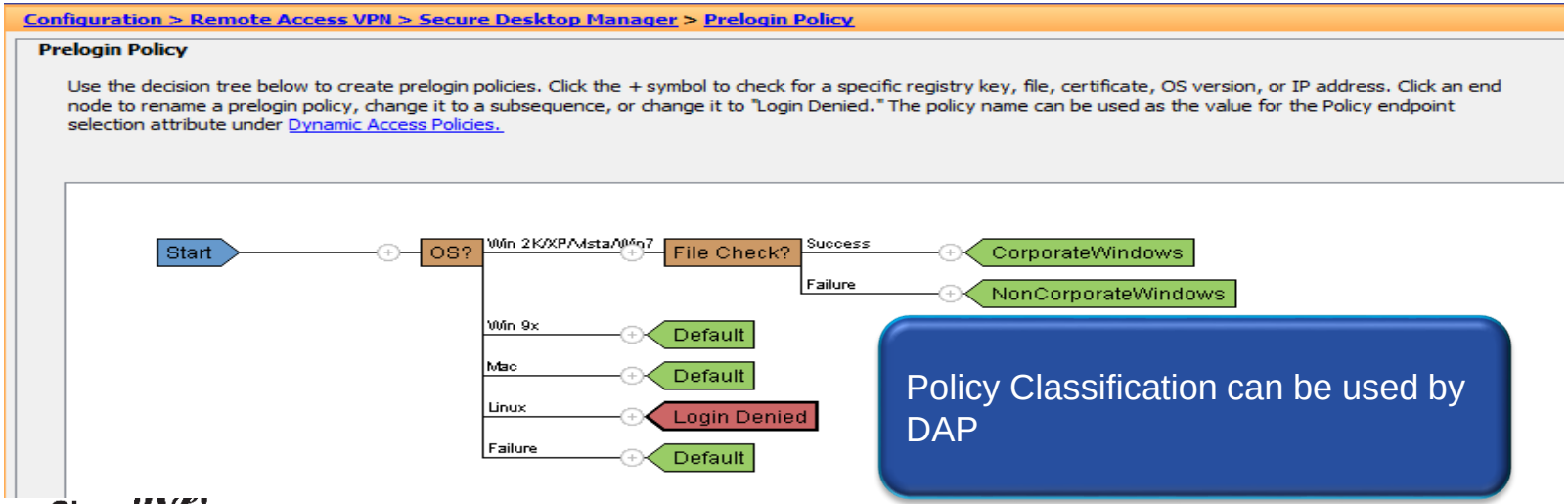
Configure

Endpoint Assessment must be checked to retrieve info on AV, AS, Firewall settings that can be enforced by DAP

Prelogin Policy

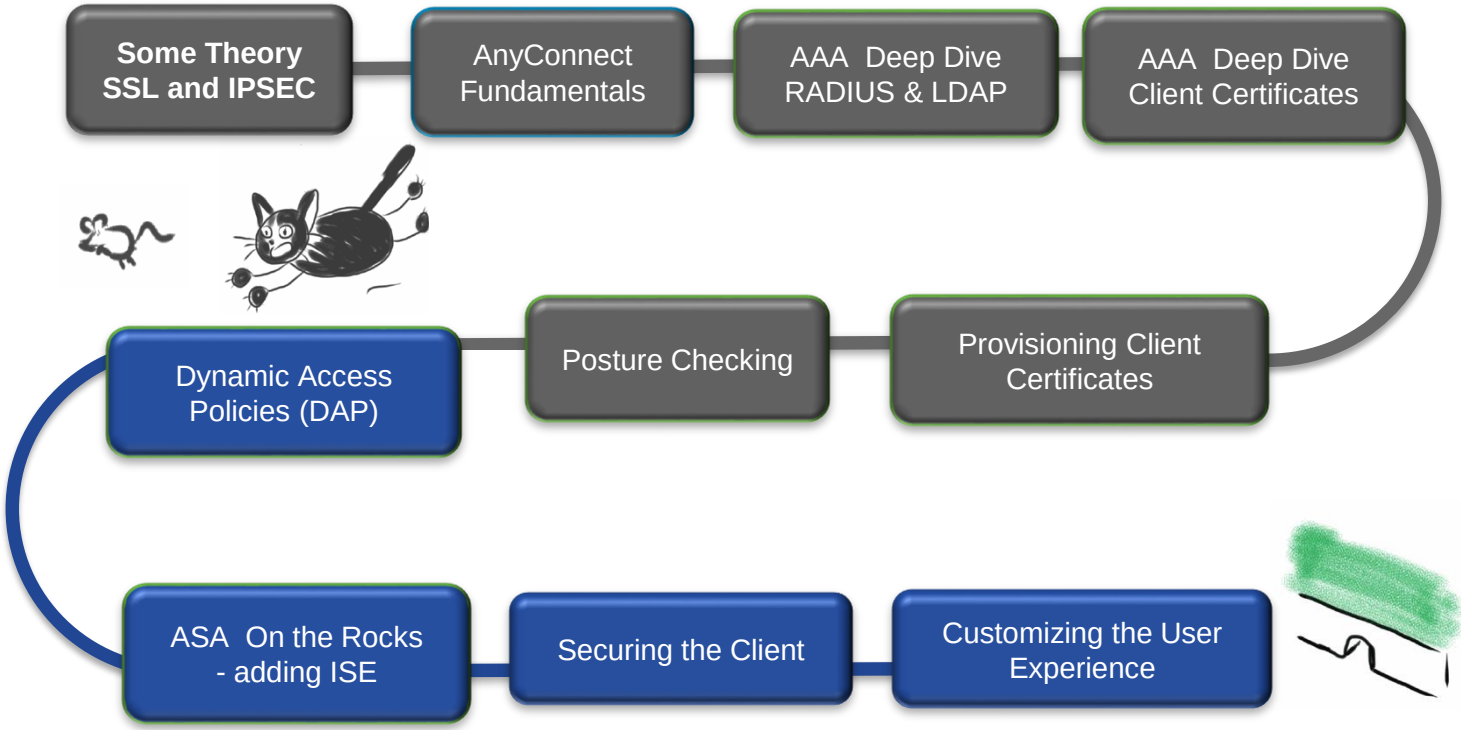


- Typical use case is to differentiate corporate devices
- Check client ip address, OS, that file exists, registry keys/values and certificate
  - client ip is the ip of network adapter (before any NAT…)
  - note : certificate check only checks if certificate exist, it does not cryptographically verify that the private key is there



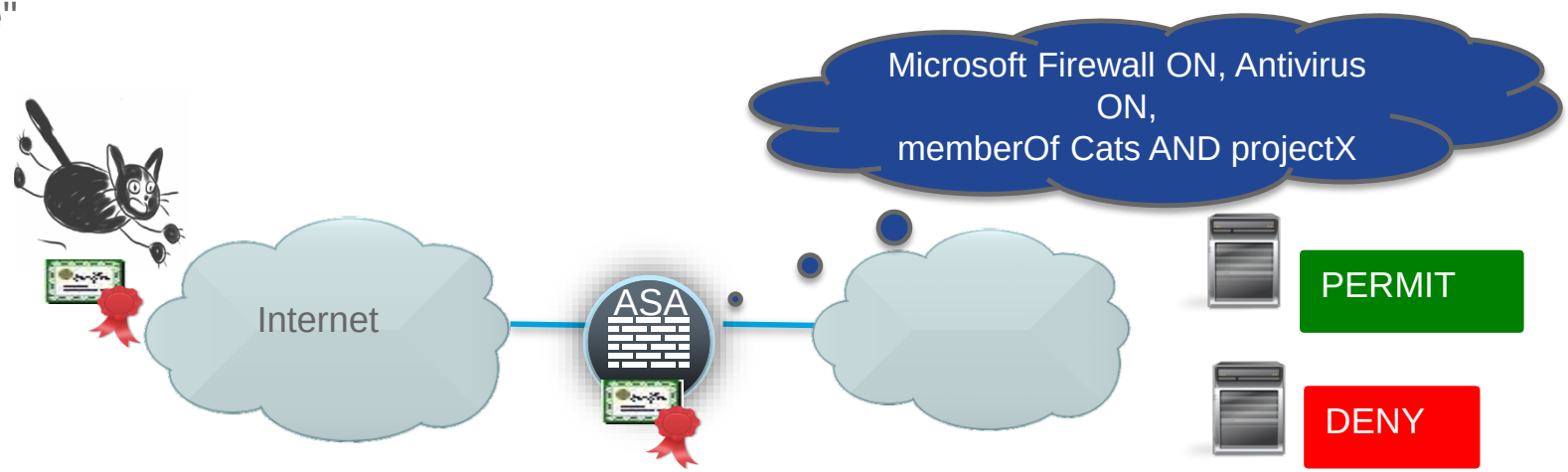
Policy Classification can be used by DAP

Agenda



Dynamic Access Policies (DAP)

- DAP allows **granular access control** to resources based on authentication method, AAA parameters and Posture
- Very flexible, allowing policies set by **Data Owners** access to Data :
  - "to access **my data** you must be member of AD groups Cats and ProjectX, you must be logged in with strong authentication and you must have Antivirus on a corporate machine"



How DAP relates to AAA

Posture: .....

Connection Profile SMS

AAA Server Group SMS (RADIUS)

AAA Server Group AD (LDAP)

LDAP map

Default Group Policy

Group Policy CatsBYOD

Group Policy RatsBYOD

memberOf Cats

memberOf ProjectX

DAP-1

DAP-2

+

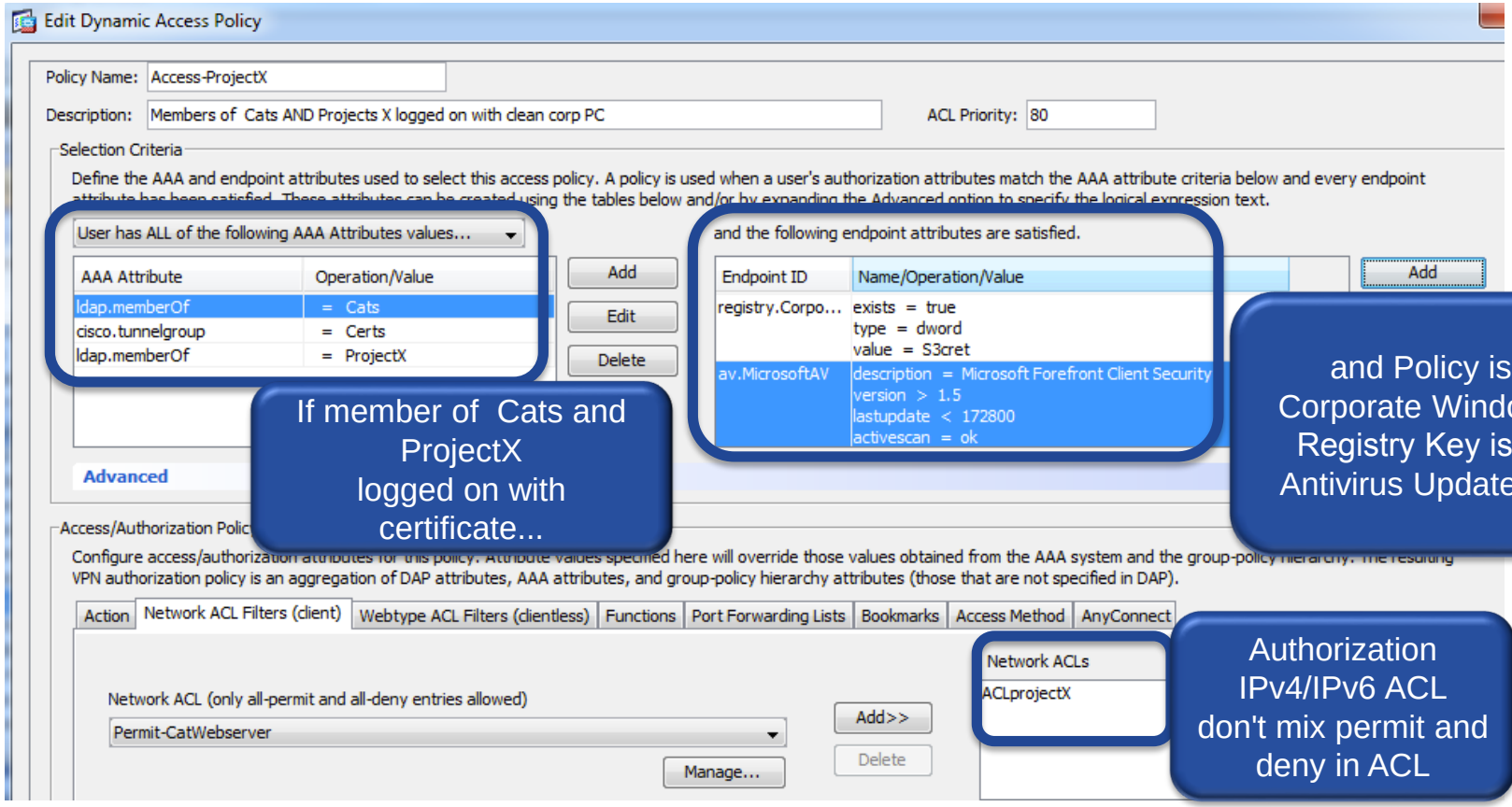
DAP-N

Dynamic Access Policies

override certain attributes from Group Policy

depending on AAA, Posture, Connection Profile...

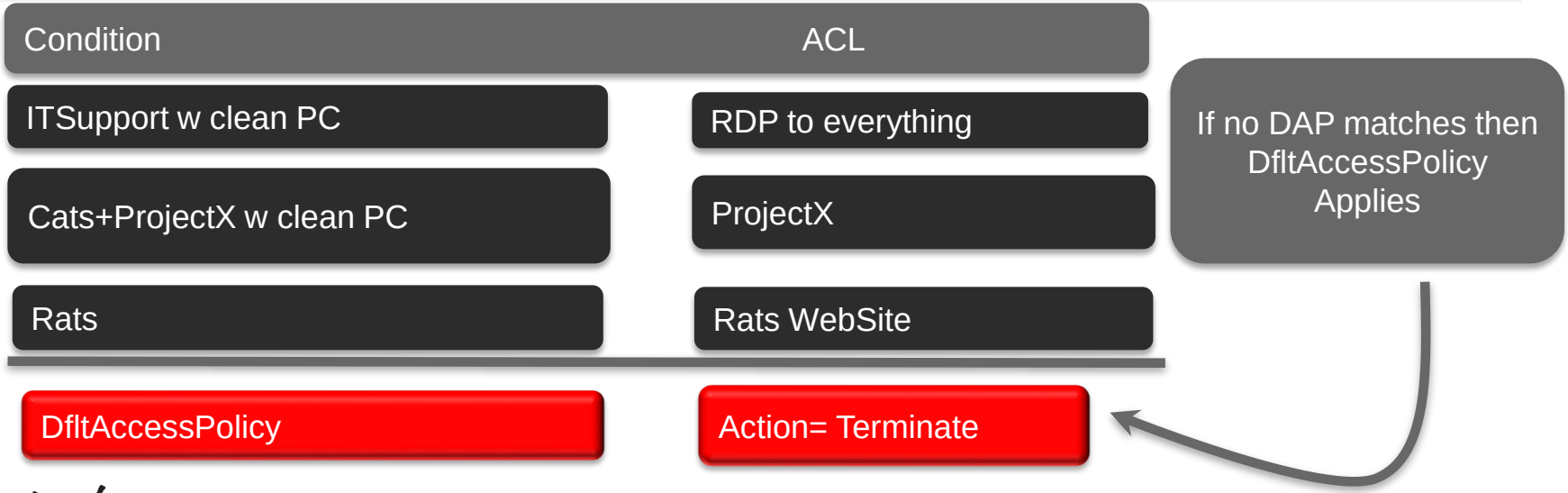
Configuring DAP



Default DAP (DfltAccessPolicy)

Configuration > Remote Access VPN > Network (Client) Access > Dynamic Access Policies

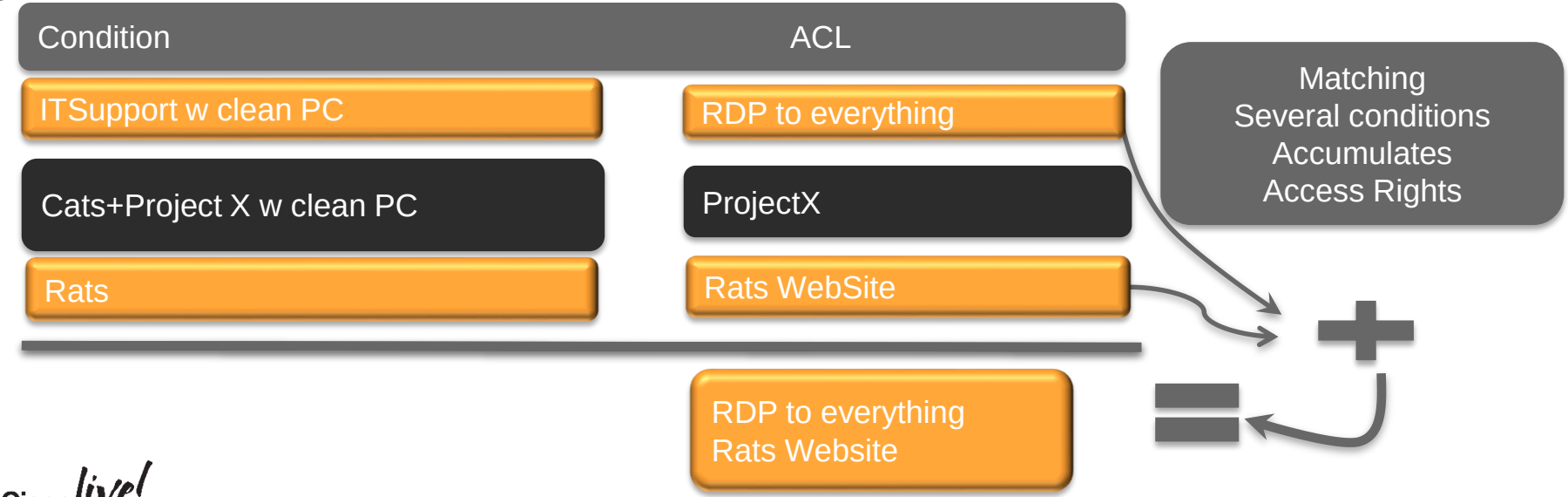
ACL Priority	Name	Network ACL List	Description
90	ITsupport Access	RDP-to-Everything	IT support Access with RDP
80	Access-ProjectX	ACLprojectX	Members of Cats AND Projects X logged on with cl...
70	Access to Rat Webserver	Permit-RatWebserver	Allow access to Rat Webserver to members of Rats...
-	DfltAccessPolicy		



DAP Grows On You! (DAP accumulates)

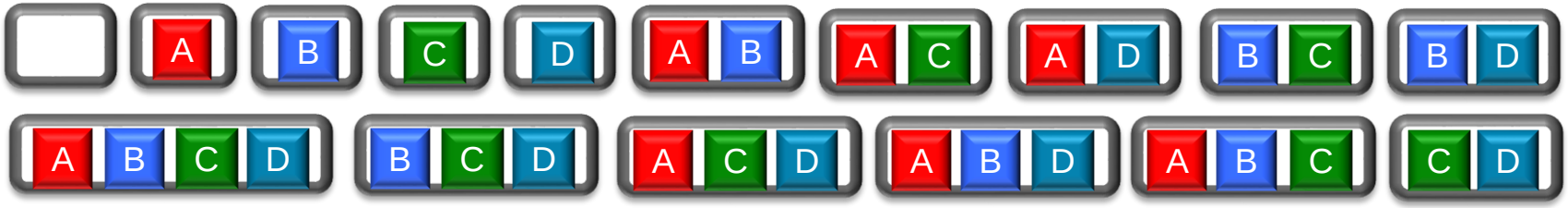
Configuration > Remote Access VPN > Network (Client) Access > Dynamic Access Policies

ACL Priority	Name	Network ACL List	Description
90	ITsupport Access	RDP-to-Everything	IT support Access with RDP
80	Access-ProjectX	ACLprojectX	Members of Cats AND Projects X logged on with cl…
70	Access to Rat Webserver	Permit-RatWebserver	Allow access to Rat Webserver to members of Rats…
-	DfltAccessPolicy		

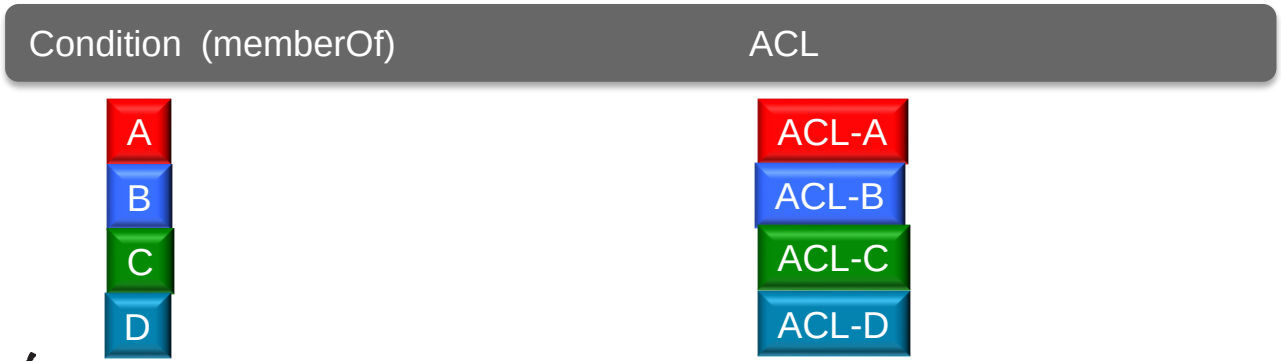


The Power of DAP

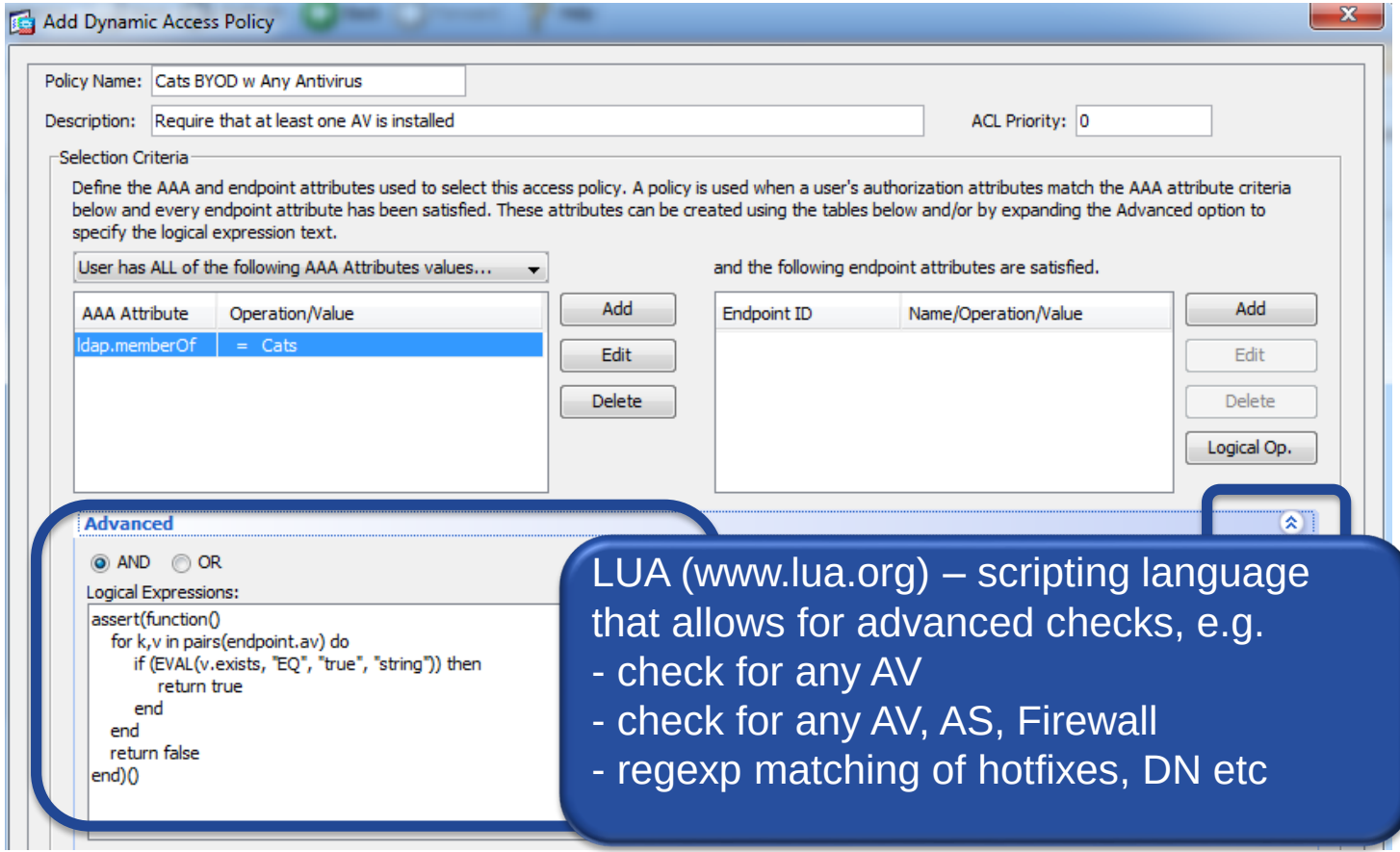
- Very flexible mapping to multiple "memberOf"
  - Example : 4 groups in Directory A B C D
  - A user may be a member of 0 to 4 groups : 16 combinations (2^n)



- **Quiz** : How many DAP policies do you need to cover the 16 combinations?



DAP with LUA



LUA examples

```
assert(function()
      function check(antix)
         if (type(antix) == "table") then
            for k,v in pairs(antix) do
               if (EVAL(v.exists, "EQ", "true", "string")) then
                  return true
               end
            end
         end
         return false
      end
      return (check(endpoint.av) or check(endpoint.fw) or check(endpoint.as))
   end)()
```

Check for Any Antivirus, Firewall or AntiSpyWare

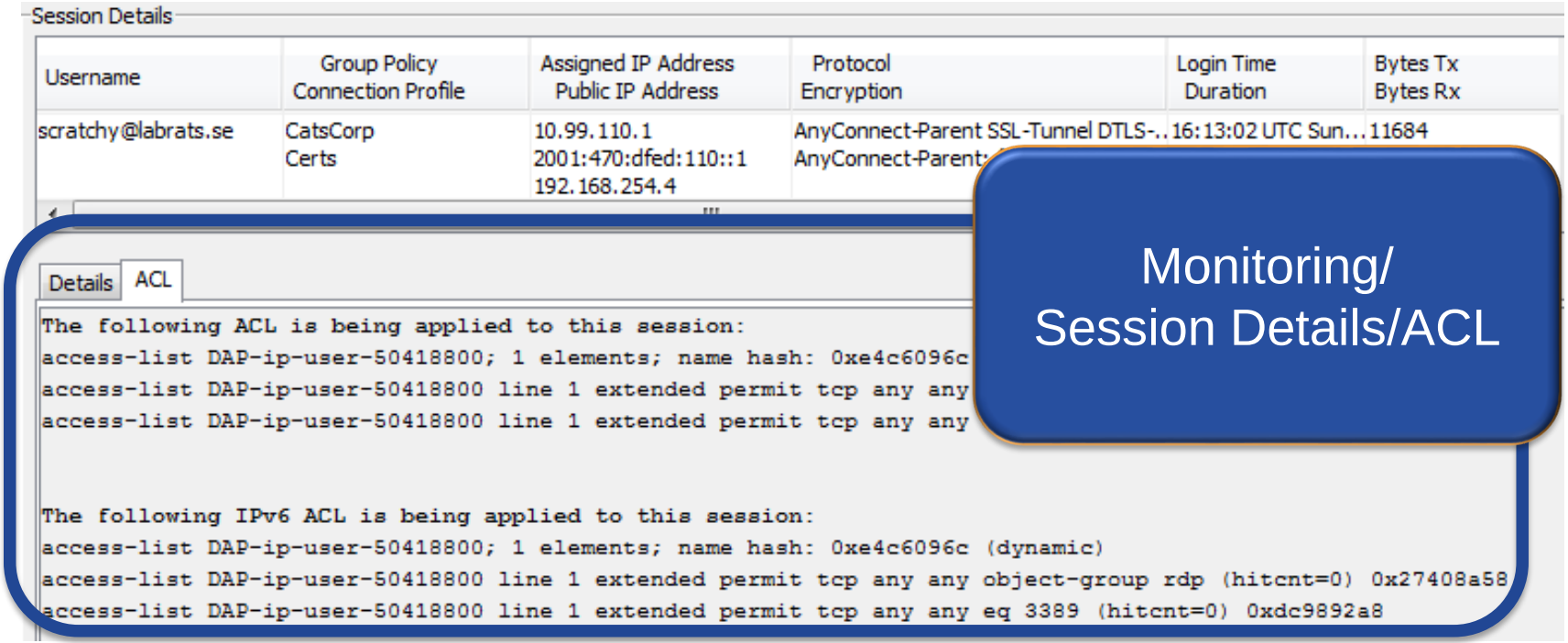
Troubleshooting DAP : debug dap trace

DAP_TRACE: DAP_open: B09086B0
DAP_TRACE: DAP_add_CSD: csd_token = [2441266B55C307BA5BEB70E5]
.....
DAP_TRACE: Username: scratchy@labrats.se, aaa.ldap.logonCount = 15
DAP_TRACE: Username: scratchy@labrats.se, aaa.ldap.sAMAccountName = scratchy
.....
DAP_TRACE:
dap_install_endpoint_data_to_lua:endpoint.as["MicrosoftAS"].description="Windows Defender"
DAP_TRACE: name = endpoint.as["MicrosoftAS"].description, value = "Windows Defender"
DAP_TRACE:dap_install_endpoint_data_to_lua:endpoint.as["MicrosoftAS"].version="6.1.76
DAP_TRACE: name = endpoint.as["MicrosoftAS"].version, value = "6.1.7600.16385"
.....
DAP_TRACE: name = endpoint.os.hotfix["KB2654428"], value = "true"
DAP_TRACE: dap_install_endpoint_data_to_lua:endpoint.os.hotfix["KB2656373"]="true"
DAP_TRACE: name = endpoint.os.hotfix["KB2656373"], value = "true"

LDAP info

Posture (Subset)

Troubleshooting DAP : Monitoring



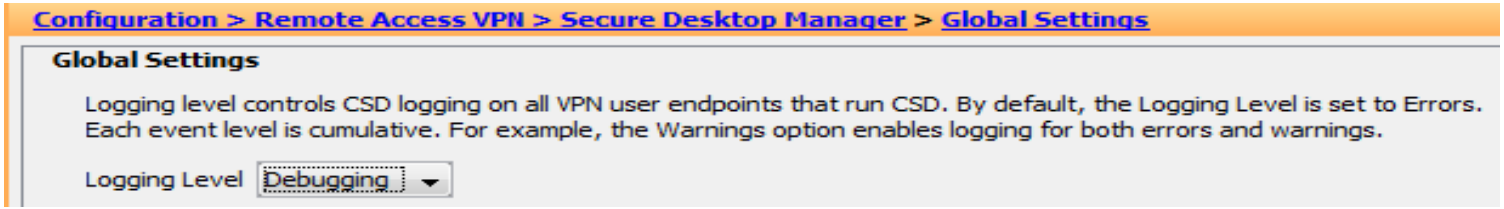
Troubleshooting DAP : Syslog

- Debug DAP trace not always practical in production
  - too much info
  - no filtering on username
- Syslog Message with good DAP info : **username** and **selected DAP records**

%ASA-6-734001: DAP: User **scratchy@labrats.se**, Addr 192.168.254.4, Connection AnyConnect: The following DAP records were selected for this connection: **ITsupport Access**

Troubleshooting Hostscan Component

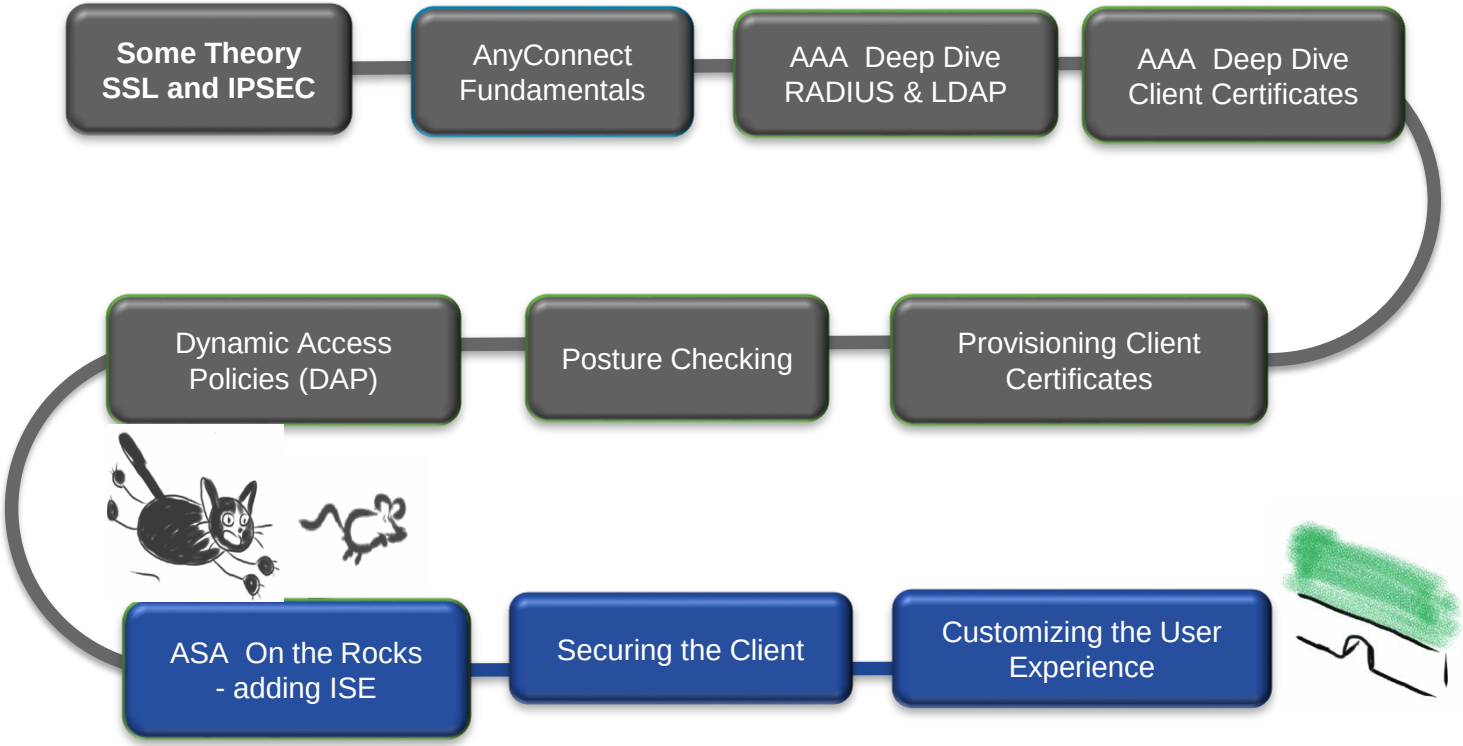
- Enable Debugging level at ASDM, then rerun test on problematic client



- Check Host Scan log files on problematic client
  - libcsd.log
  - cscan.log, detailed posture attributes
- These are located at
  - Windows %LOCALAPPDATA%\Cisco\Cisco HostScan\log
  - MAC/Linux : ~/.cisco/hostscan/log
- Examine Windows Event logs

GOT DART?

Agenda



Benefits of Secure Unified Access with ISE

Profiling & Device Inventory

Desktop Posture Checking and Remediation

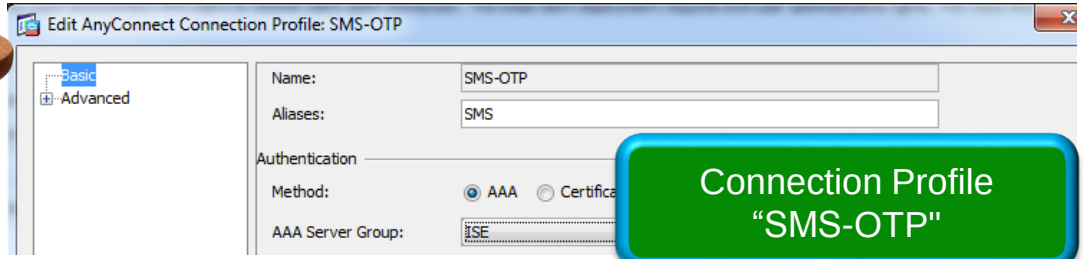
3rd Party Mobile Device Management

3rd Party Information Sharing

Unified Control of all Access

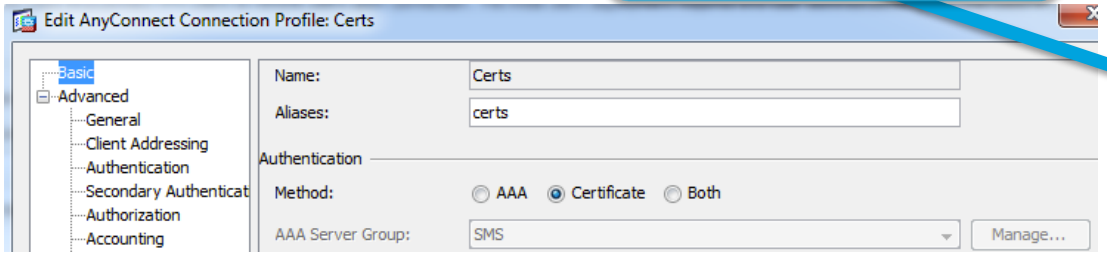
Flexible Directory Integration

Secure Unified Access : 2 minutes ASA Configuration

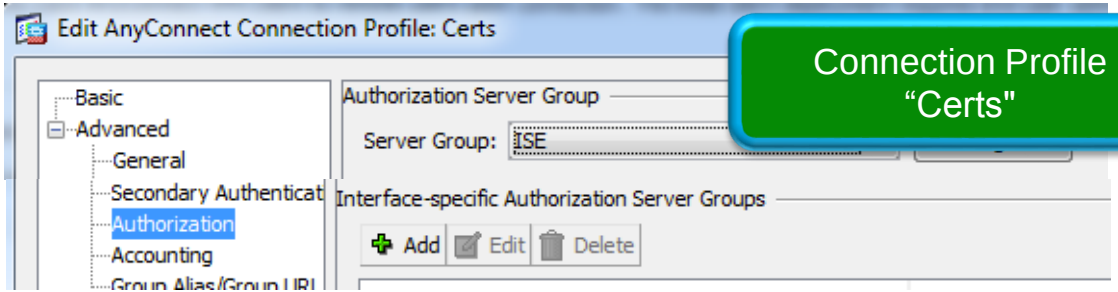


Connection Profile "SMS-OTP"

We no longer need to care about AD, LDAP or LDAP maps.. or OTP server

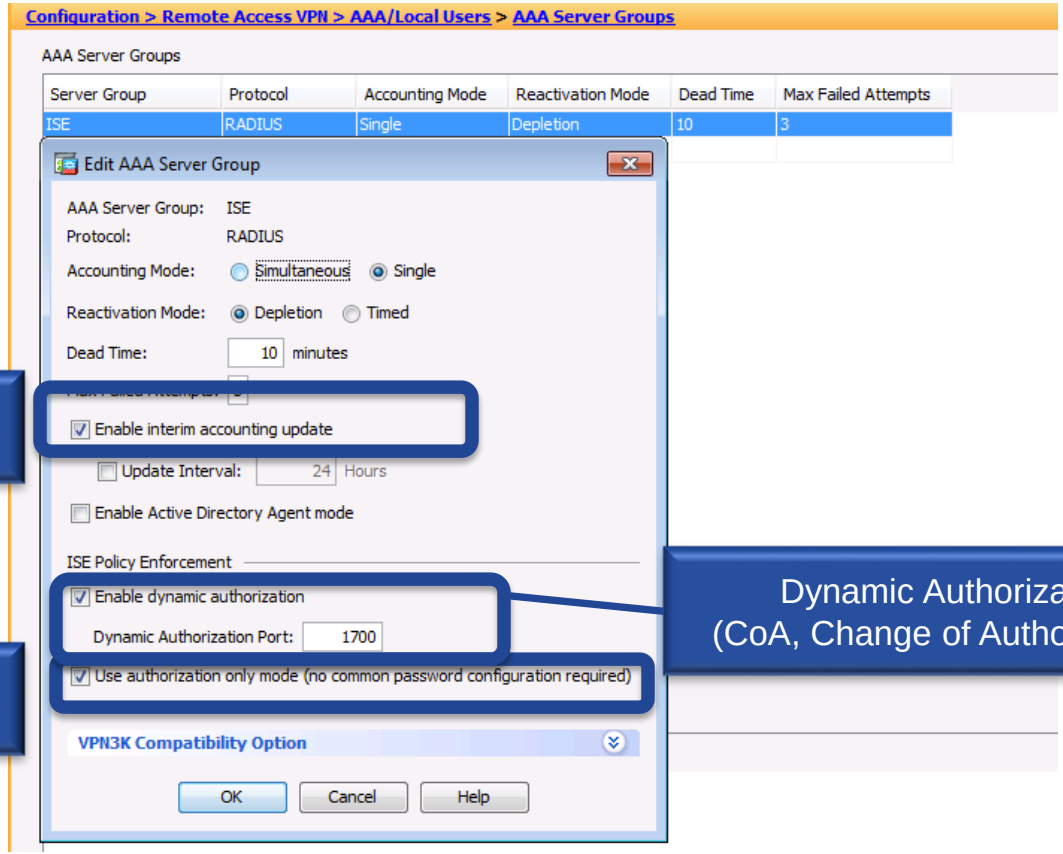


AAA Server Group RADIUS



Connection Profile "Certs"

ASA configuration of ISE AAA Server Group



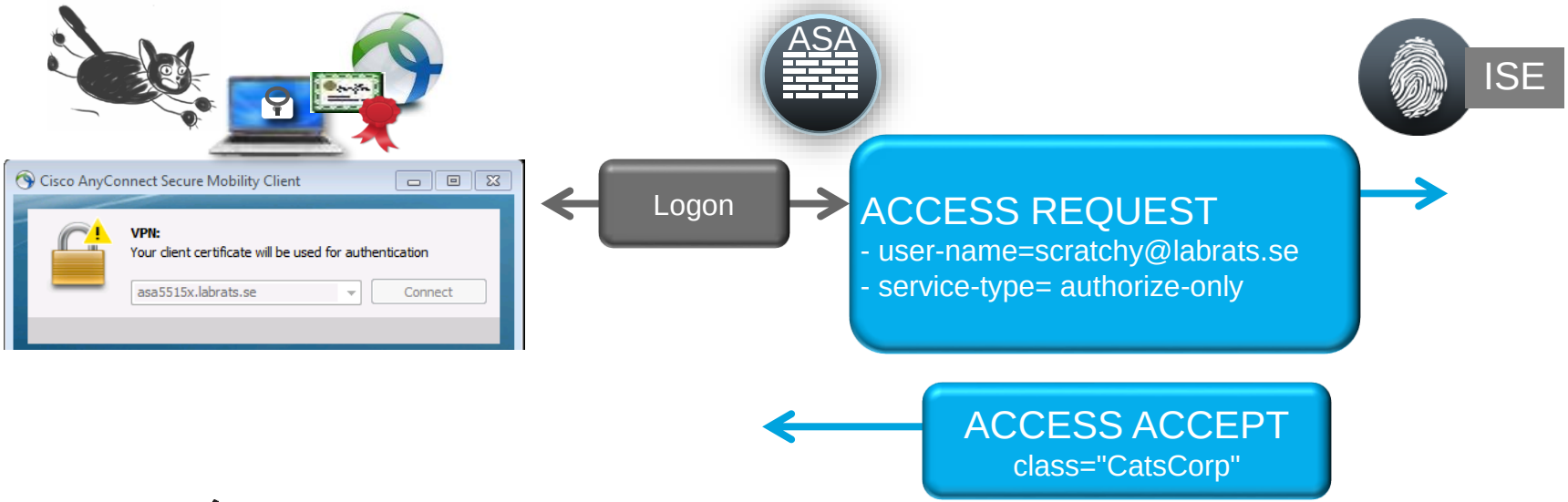
Interim Accounting

Authorization-Only

Dynamic Authorization
(CoA, Change of Authorization)

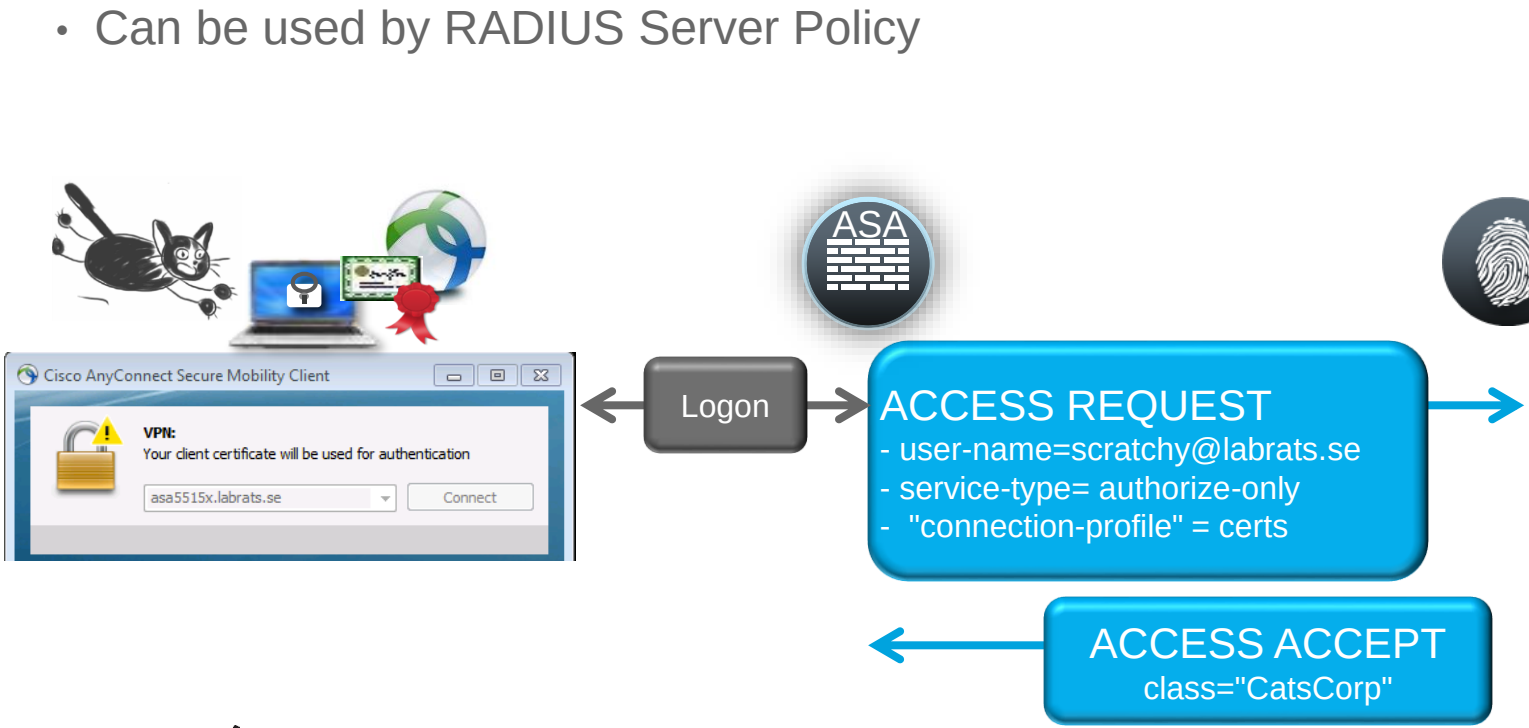
RADIUS Deep Dive: Client Certificate Authentication

- Authentication is between AnyConnect and ASA, ISE never sees or validates cert
- ASA does a authorize-only lookup (RFC 5176) with no password



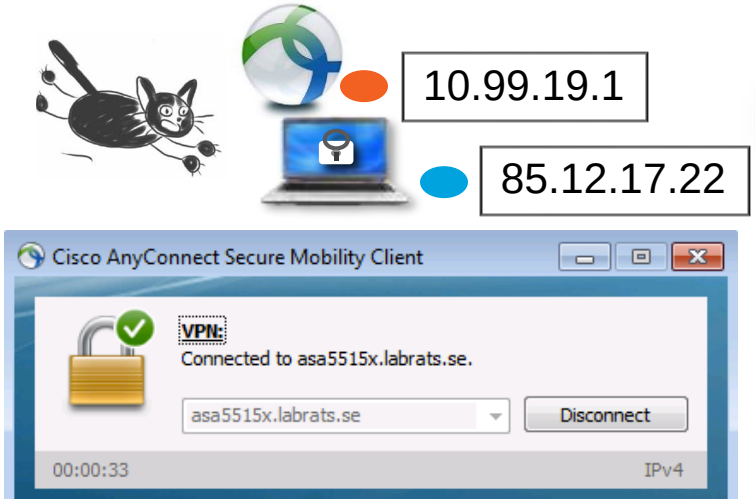
RADIUS Deep Dive: Connection Profile Name to ISE

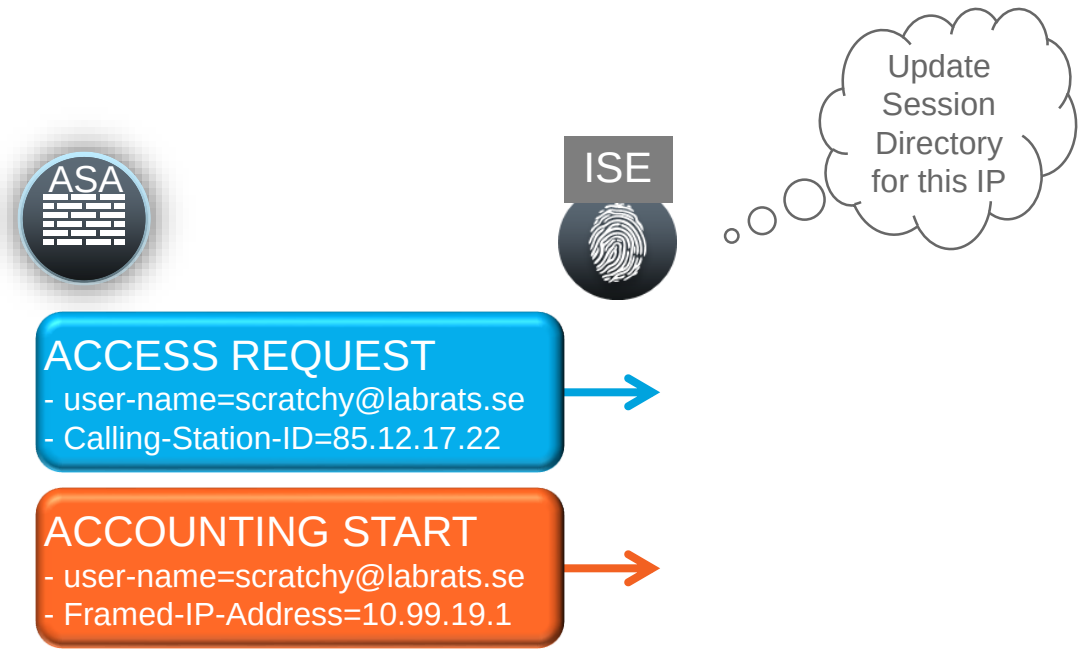
- ASA sends info about Connection Profile and Client Type to RADIUS server
- Can be used by RADIUS Server Policy



RADIUS: Keeping track of IP addresses

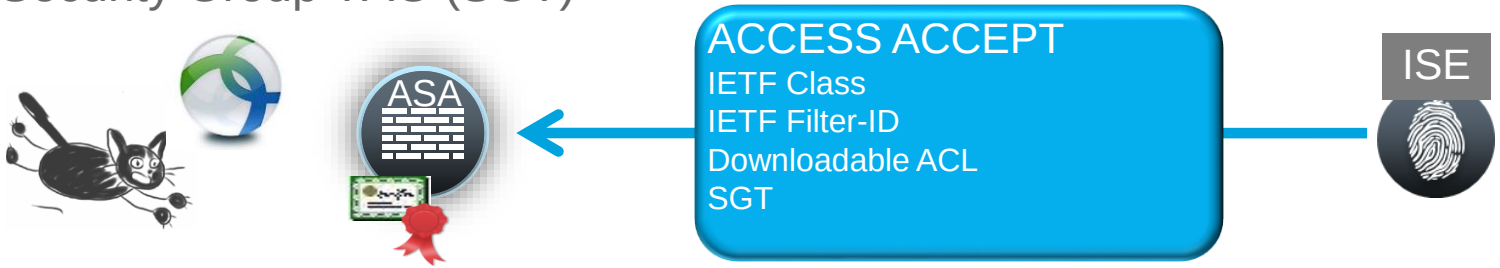
- Client physical ip address in RADIUS Calling-Station-ID
- Client virtual ip address in RADIUS Accounting Framed-IP-Address
  - turn on RADIUS accounting for visibility





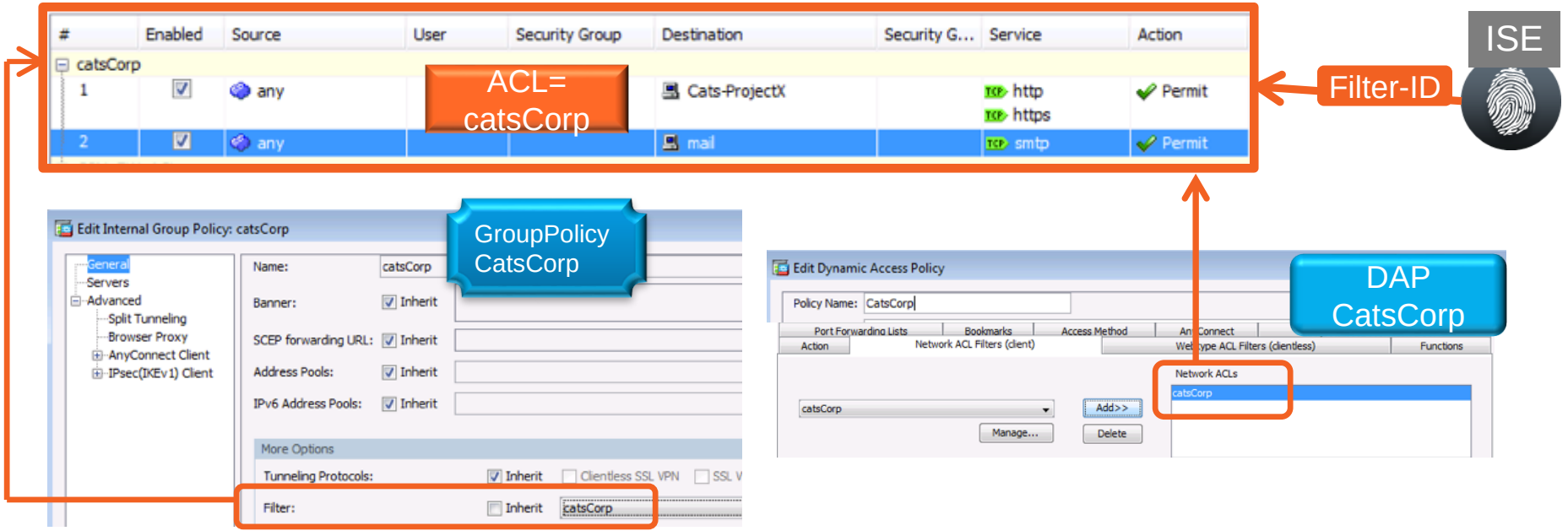
ASA Authorization Options

- IETF Class Attribute
  - map to Group Policy where Filter (ACL), VLAN restriction etc. defined
- IETF Filter ID Attribute:
  - map to ACL pre-defined on ASA
- DAP (Dynamic Access Policy) specifying ACL
- Downloadable ACL (dACL)
  - ACL defined on ISE and downloaded with RADIUS to ASA
- Security Group TAG (SGT)



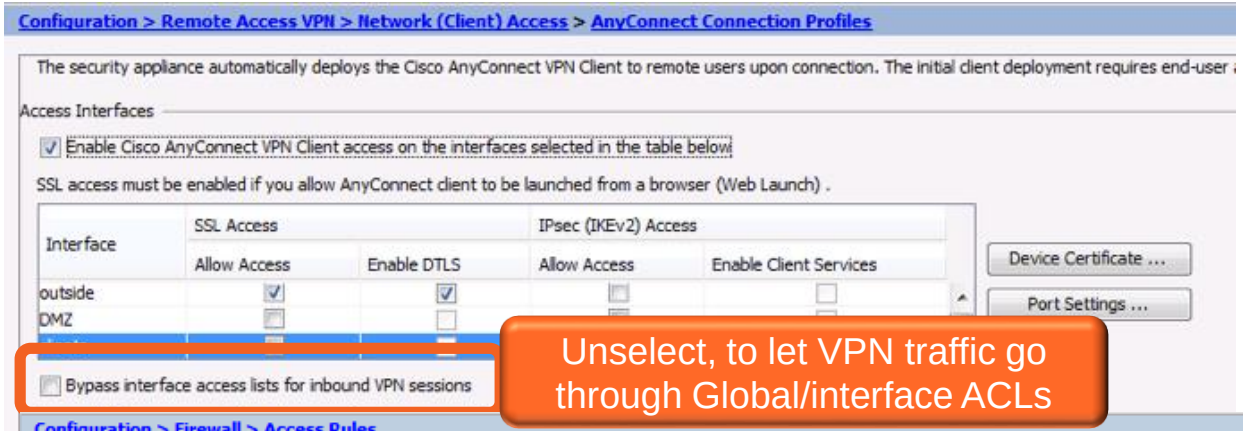
A Note on other (not **The** Firewall Rule table) ACLs

- Other ACL options: Group Policy, DAP, Filter-ID, dACL
  - applied from different places in GUI, separate from main Firewall Ruleset
  - applied from RADIUS (Filter-ID)

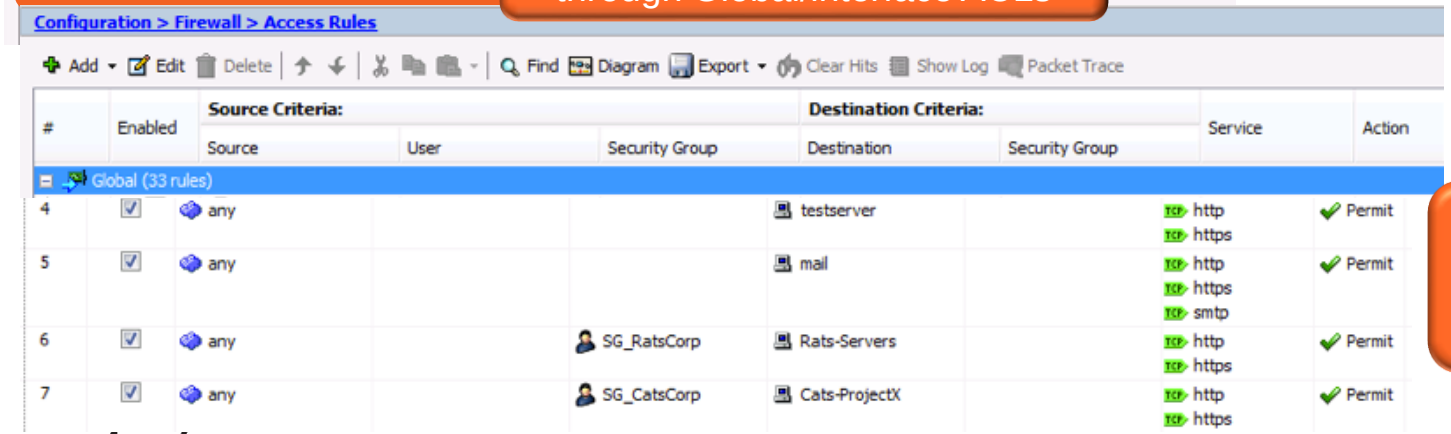


Consolidated Stateful Access Policy

Unified Control of all Access



Unselect, to let VPN traffic go through Global/interface ACLs

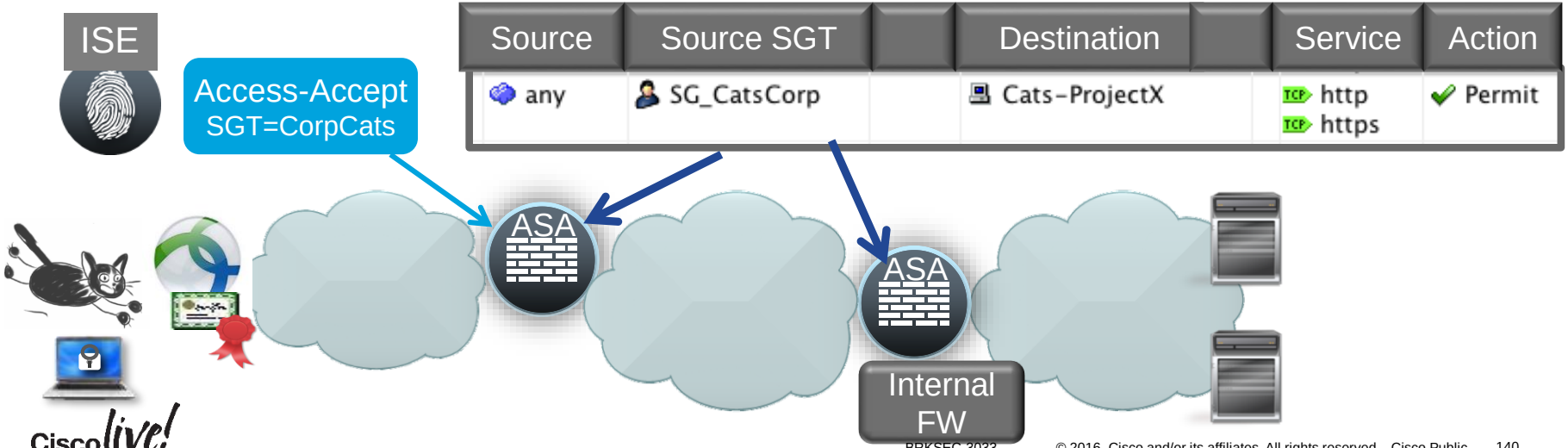


Mix and Match ACEs with and without SGTs

Authorization with Security Group Tags

Unified Control of all Access

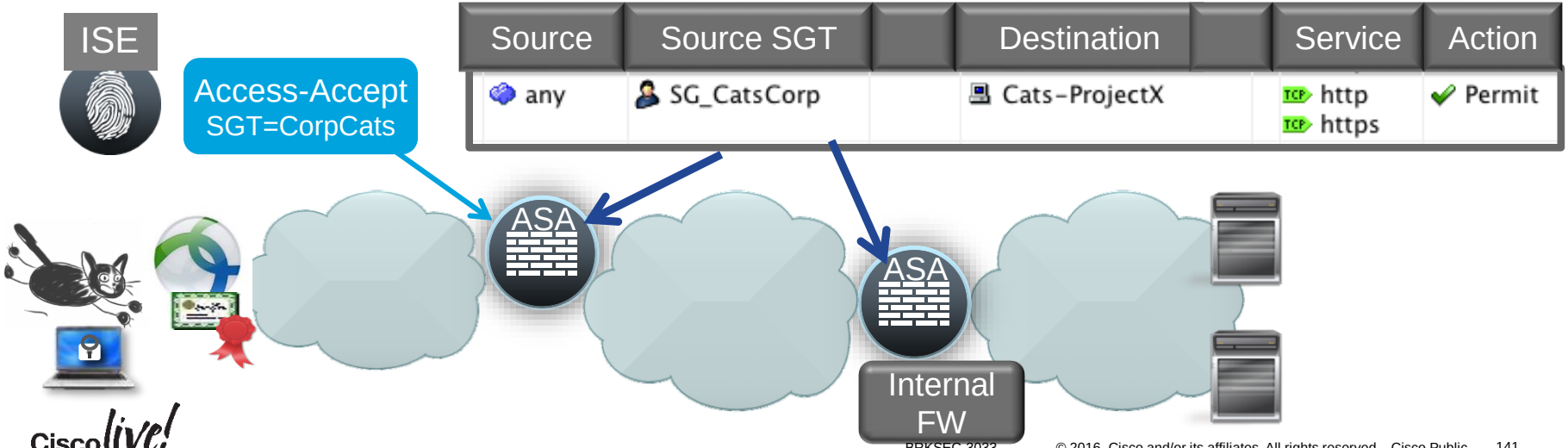
- ISE assigns SGTs to client session
- SGT used by ASA terminating Remote Access for policy enforcement
- ...and/or enforced by **downstream** device (e.g. ASA or Nexus in DC)
  - SGT info propagated by SXP or native SGT tagging (ASA 9.3.2)



This is Obviously **Cool**, but any Benefits?

Unified Control of all Access

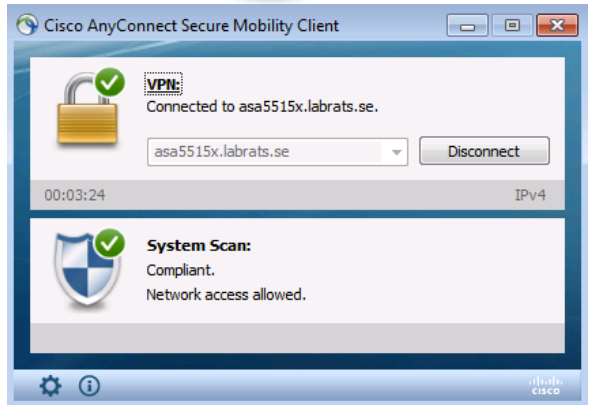
- De-coupling ip addressing from security
- Adding context (corporate device, AD group, posture status) to Firewall Rules
- Easy to configure same policy for VPN, Wired, Wireless
- ASA RA config: Consolidated, Statefull Security Policy.



AnyConnect ISE Posture Module

Desktop Posture Checking and Remediation

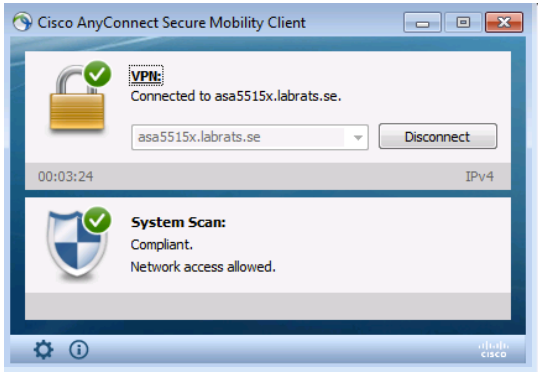
- Windows and MAC
- Checks and Remediates Posture
  - Works on campus (wired, wireless 802.1X)
  - Works with AnyConnect VPN
- Software and XML config file provisioned from
  - ASA
  - ISE or
  - **via Desktop Management System**
- Requires Compliance Module provisioned from
  - ISE or
  - via Desktop Management System

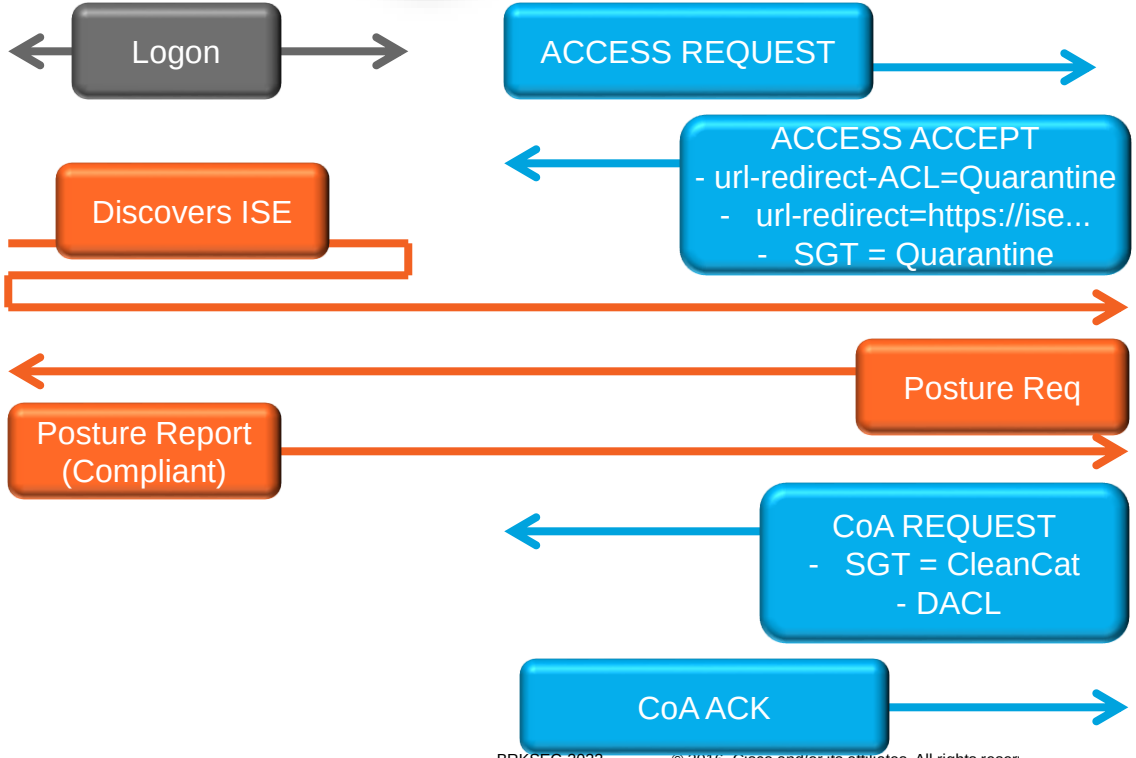


Desktop Posture Assessment

Agent Listing	Windows AnyConnect / NAC Agent	MAC OSX AnyConnect / NAC Agent
Client Provisioned by ISE		
Posture Assessment		
Microsoft Updates		Not Applicable
Service Packs		
Hotfixes		
OS / Browser Versions		
AntiVirus		
Installation / Signatures		
AntiSpyware		
Installation / Signatures		
File Data		Not Available
Services		
Application / Processes		
Registry Keys		
Posture Remediation		
Passive Re-Assessment (PRA)		

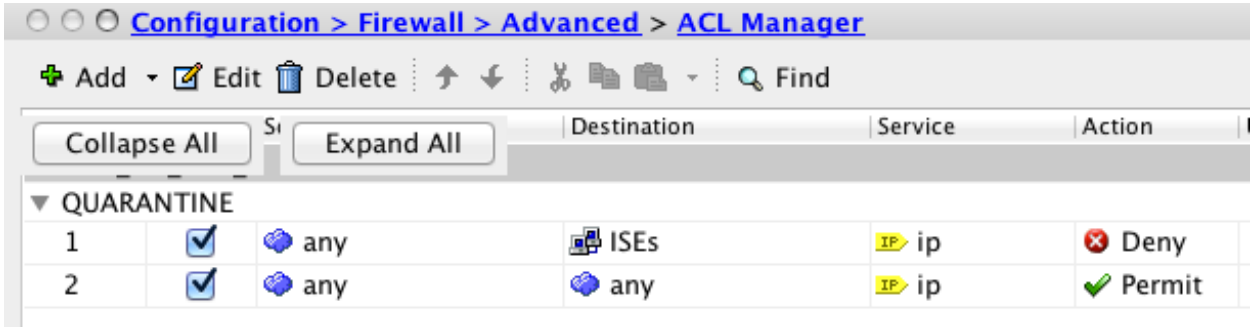
AnyConnect ISE Posture Flow





What to Configure on ASA for ISE Posture

- Configure a standalone ACL
  - permit means redirect traffic to ISE (default)
  - deny means do not redirect : this is traffic to ISE itself, traffic to remediation servers...
  - name of ACL must match RADIUS attribute **"url-redirect-acl"** signaled by ISE



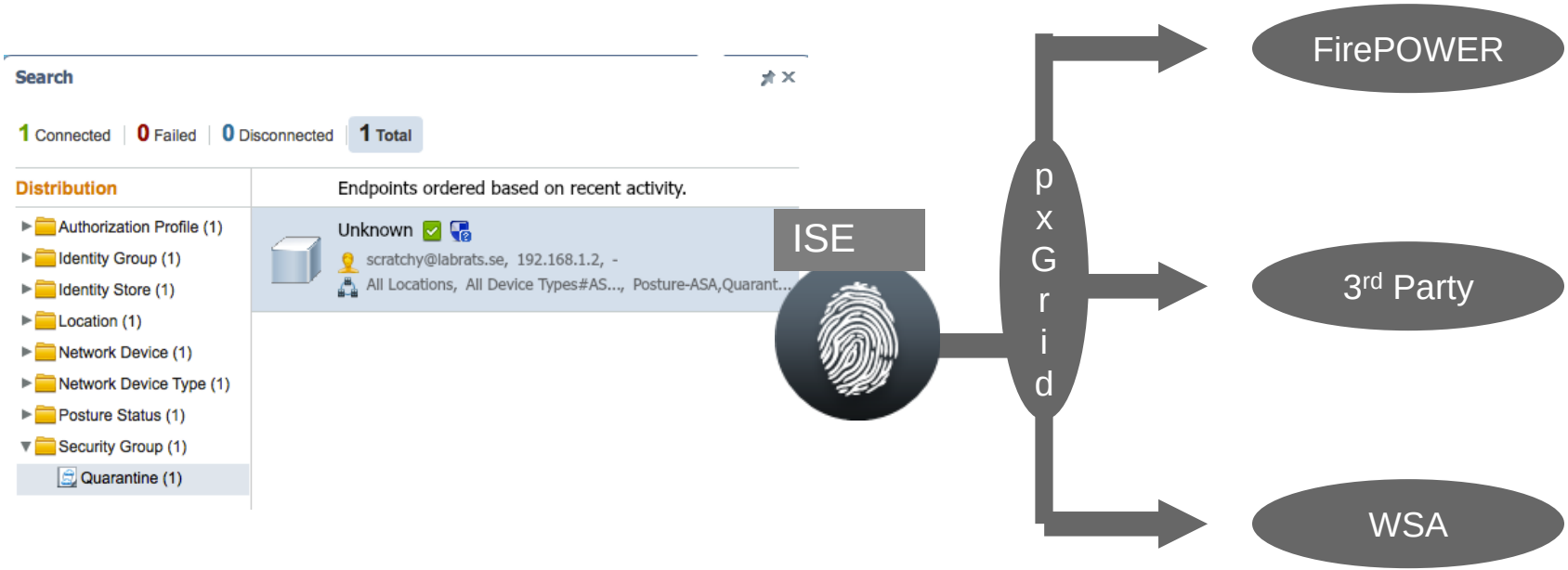
Deny means "Do not Redirect"

Permit means "Redirect to ISE"

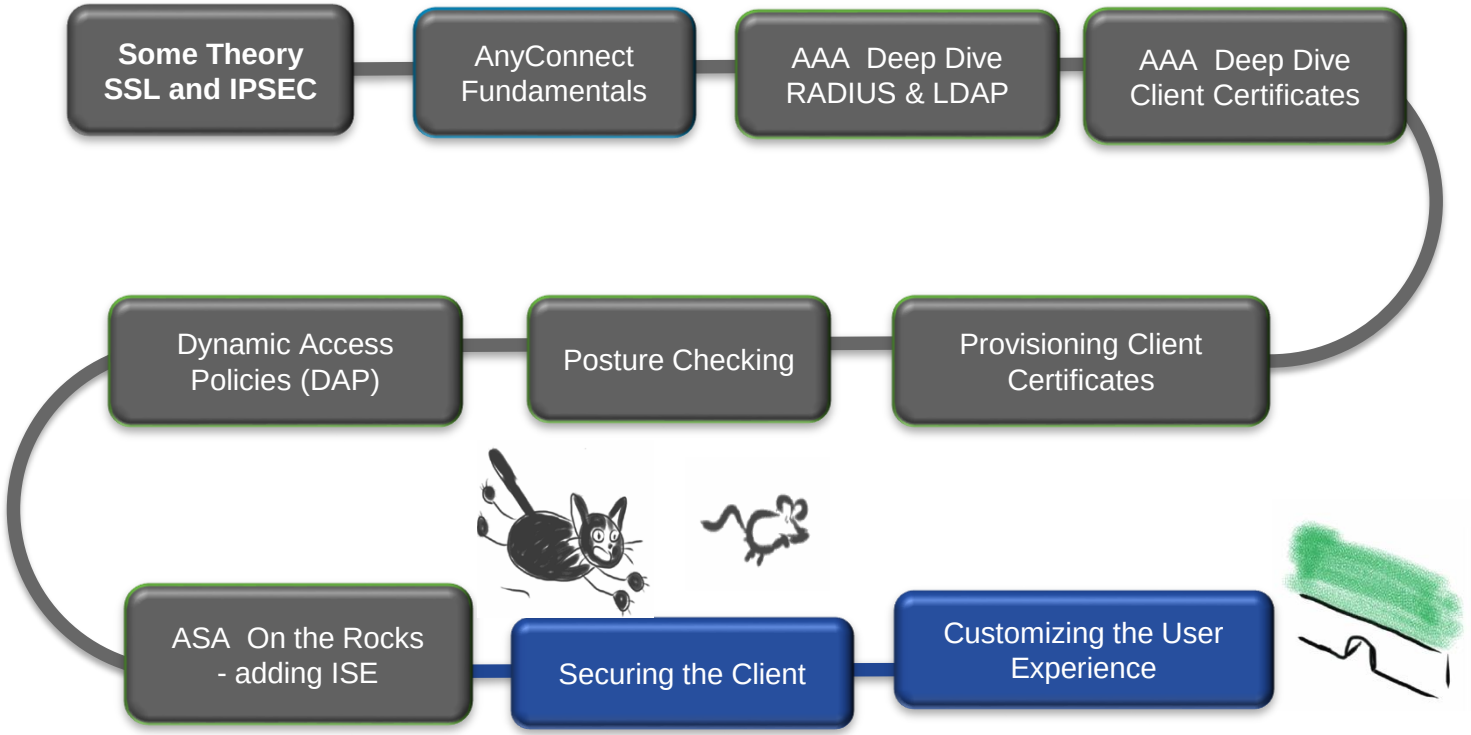
Information Sharing

3rd Party Information Sharing

- ISE knows identity, device, posture status, authentication method for everything
- ISE shares info via pxGrid

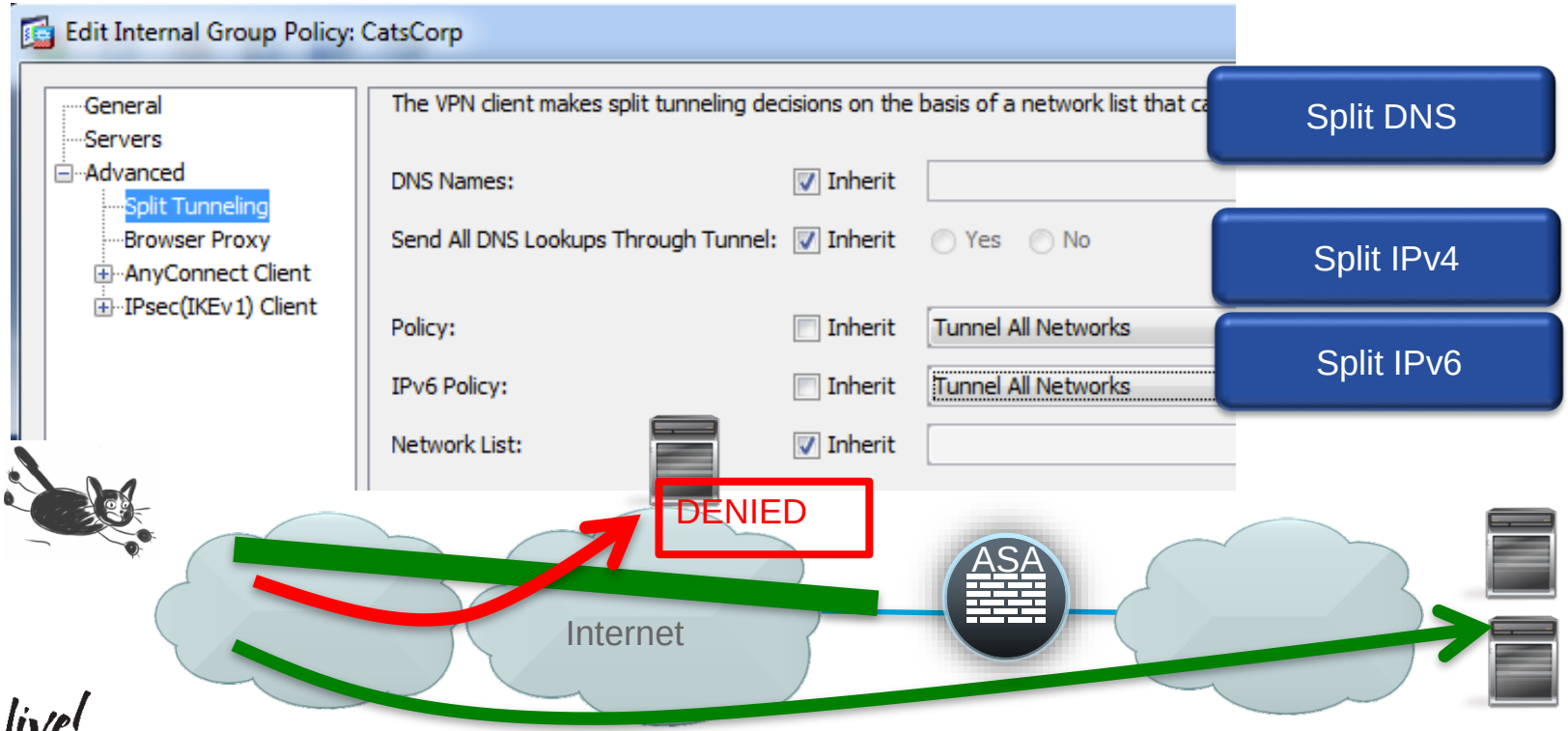


Agenda



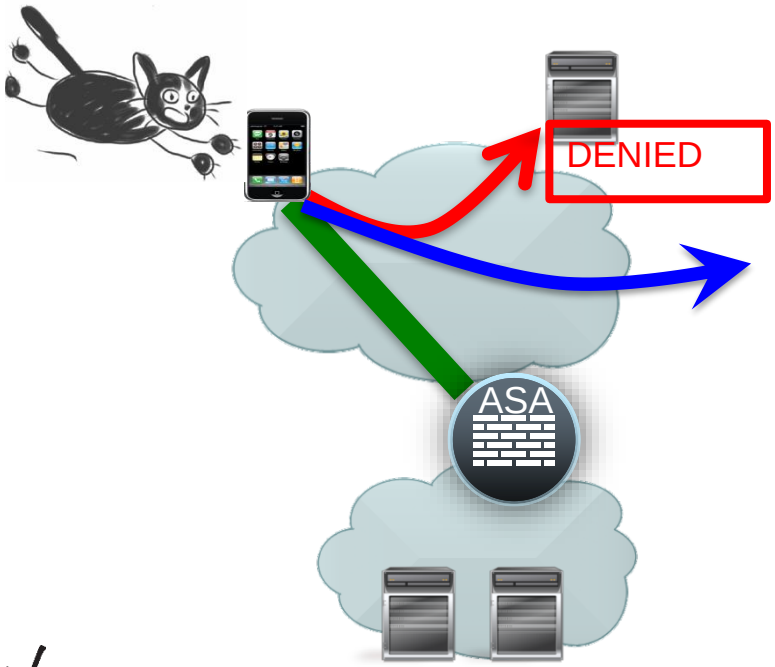
(No) Split Tunnelling Policy

- Defined in Group Policy : whether to allow traffic outside of the tunnel



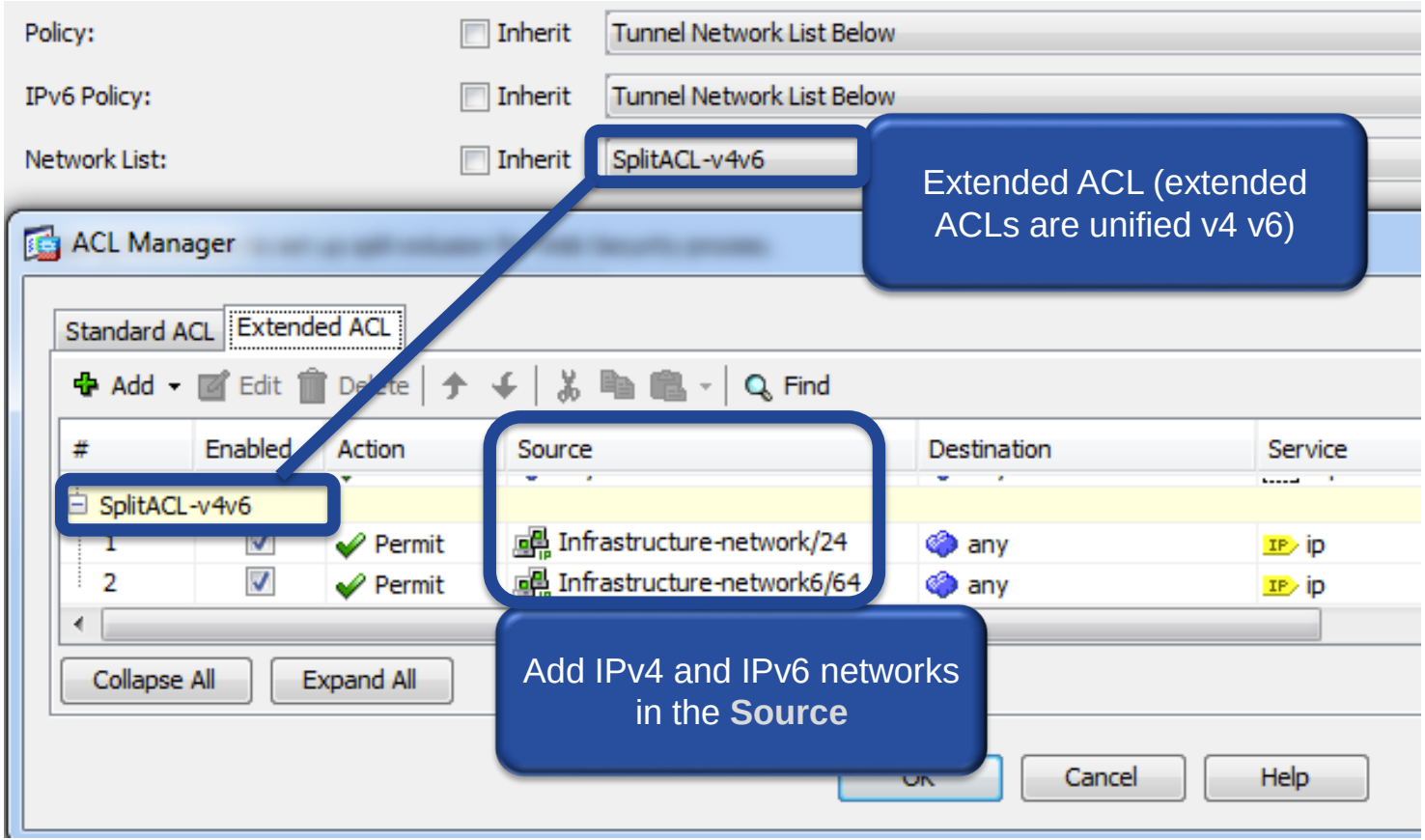
Note on Split Tunnelling Policy for mobile devices

- Even with no Split Tunneling (Tunnel All Networks), certain traffic from mobile devices (e.g. iTunes) goes outside the tunnel

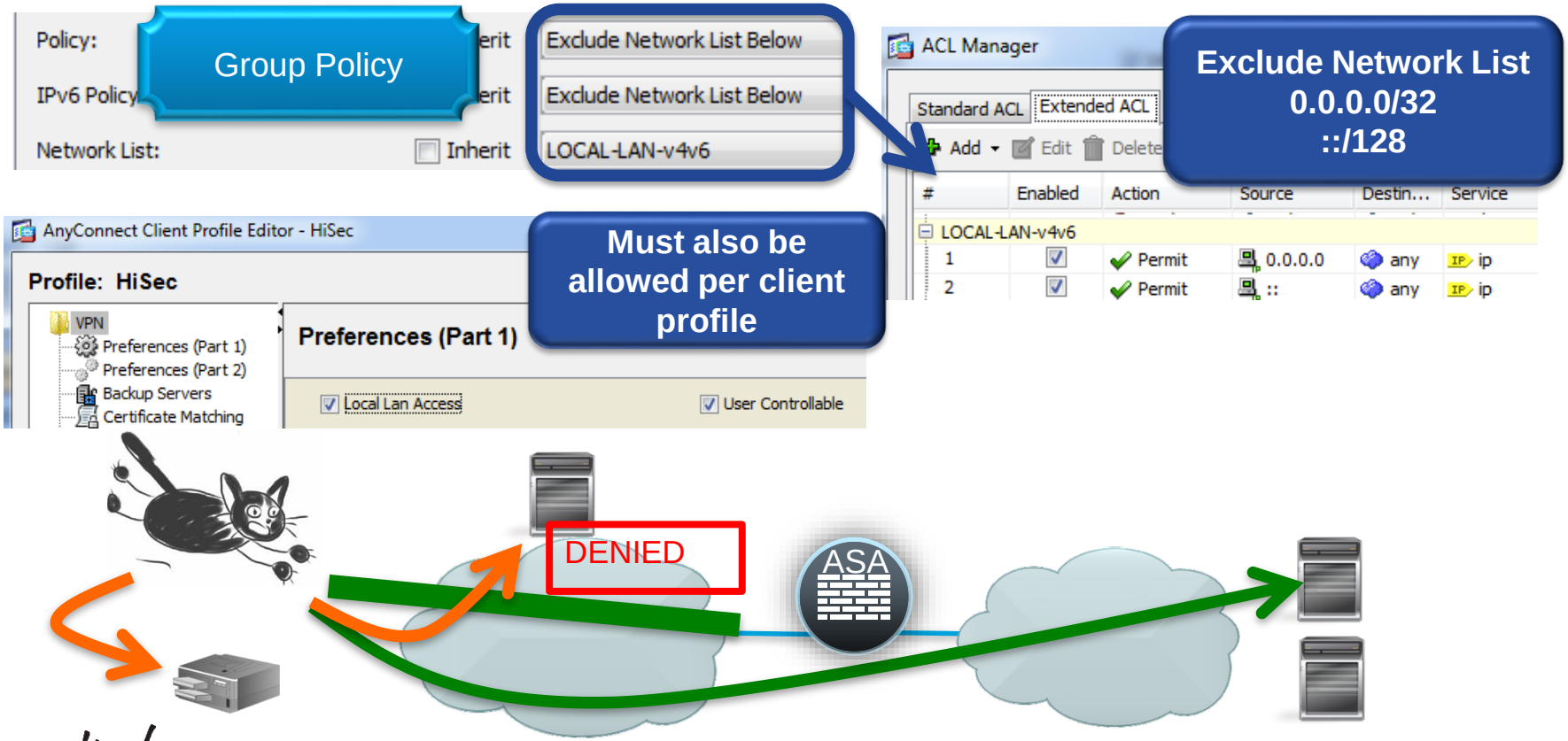


iTunes

Split Tunneling Example (IPv4 and IPv6)

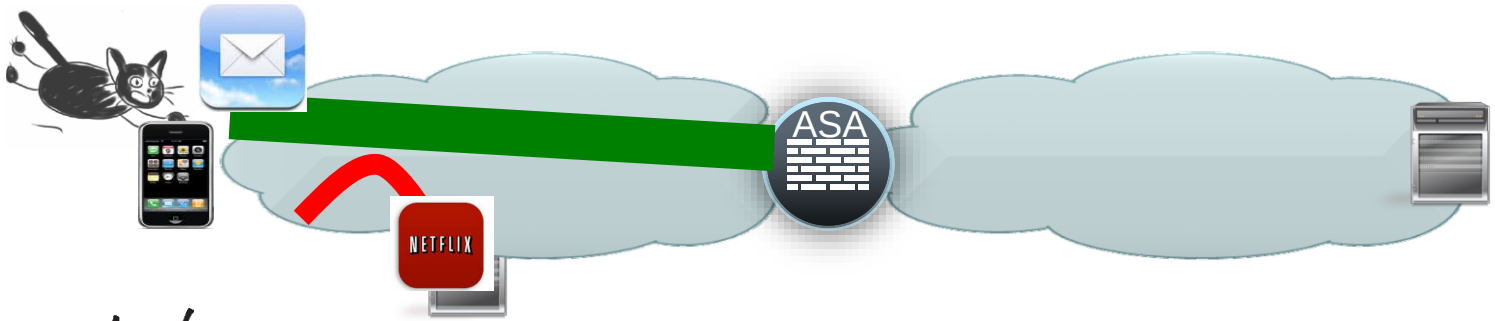


No Split Tunneling but Allow Local LAN Access



Per App VPN

- Available for iOS 7.0+, Samsung Knox, Generic Android 5.0+
- Allows for tunneling specified subset of apps through one AnyConnect tunnel
  - save resources : don't Netflix over VPN tunnel
  - security: don't allow non enterprise apps on enterprise network
- Configured via DAP
- Works with or without an Enterprise MDM

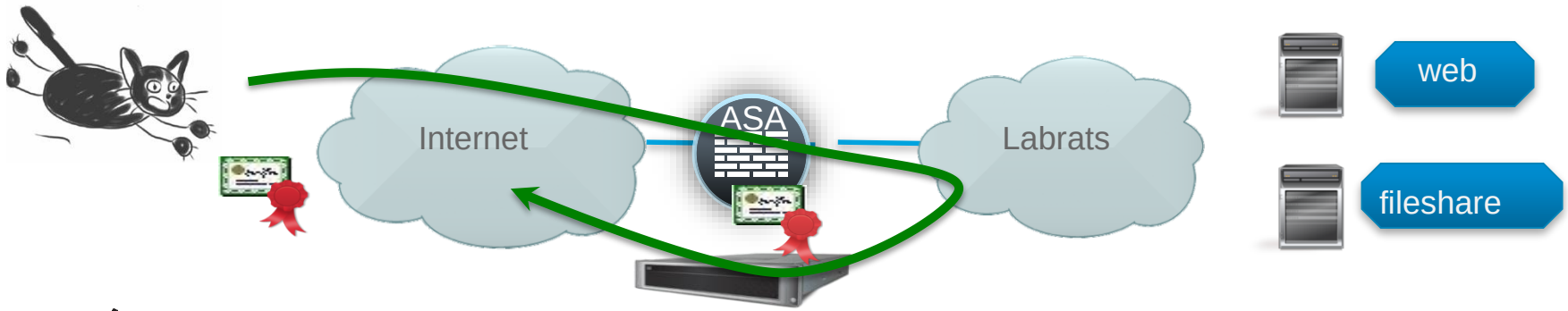


Seamless Security with Always-On

- Encourage/force (some) users to always be connected over VPN when off-premises
  - works on Windows, MAC
- Objective #1 : Seamless, simple user experience
  - Automatic Connection, "I am always at work" ☺
- Objective #2: Increased Security if surfing out via Enterprise Proxy or NGFW

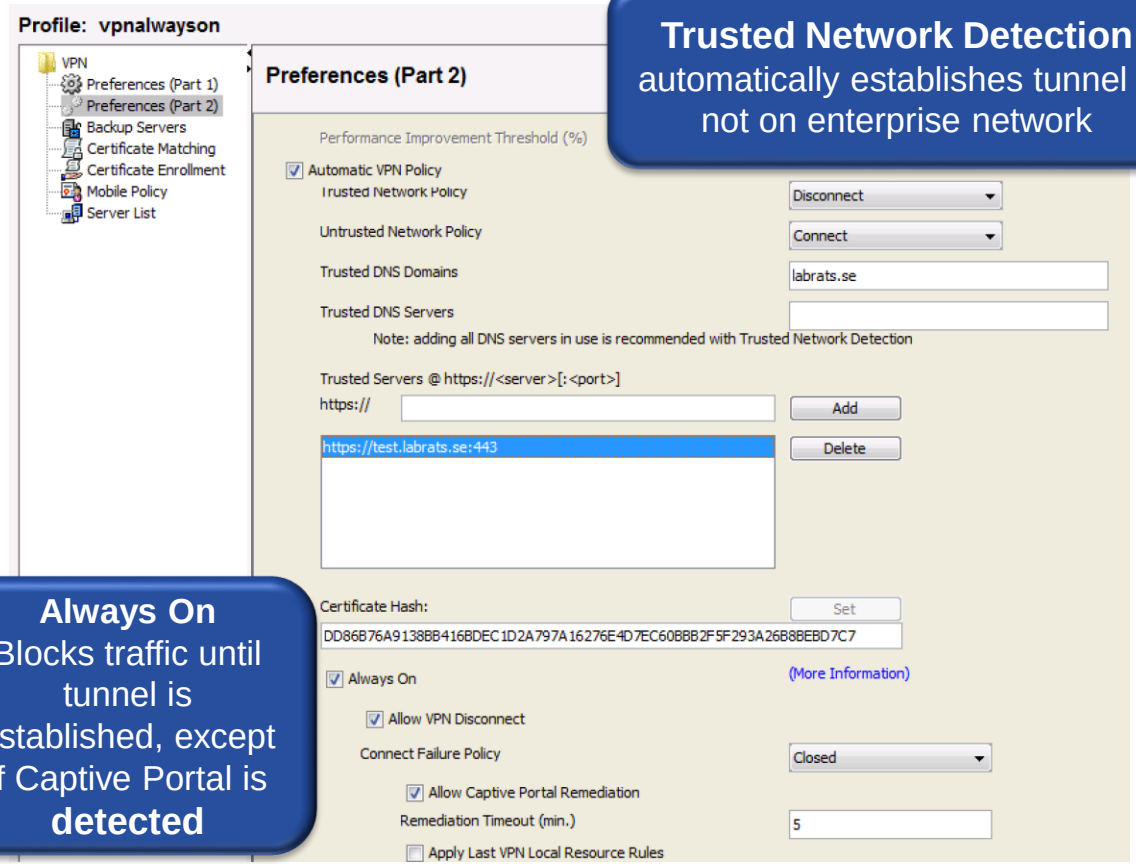
Trusted Network Detection
automatically establishes tunnel if not on enterprise network

Always On
Blocks traffic until tunnel is established,



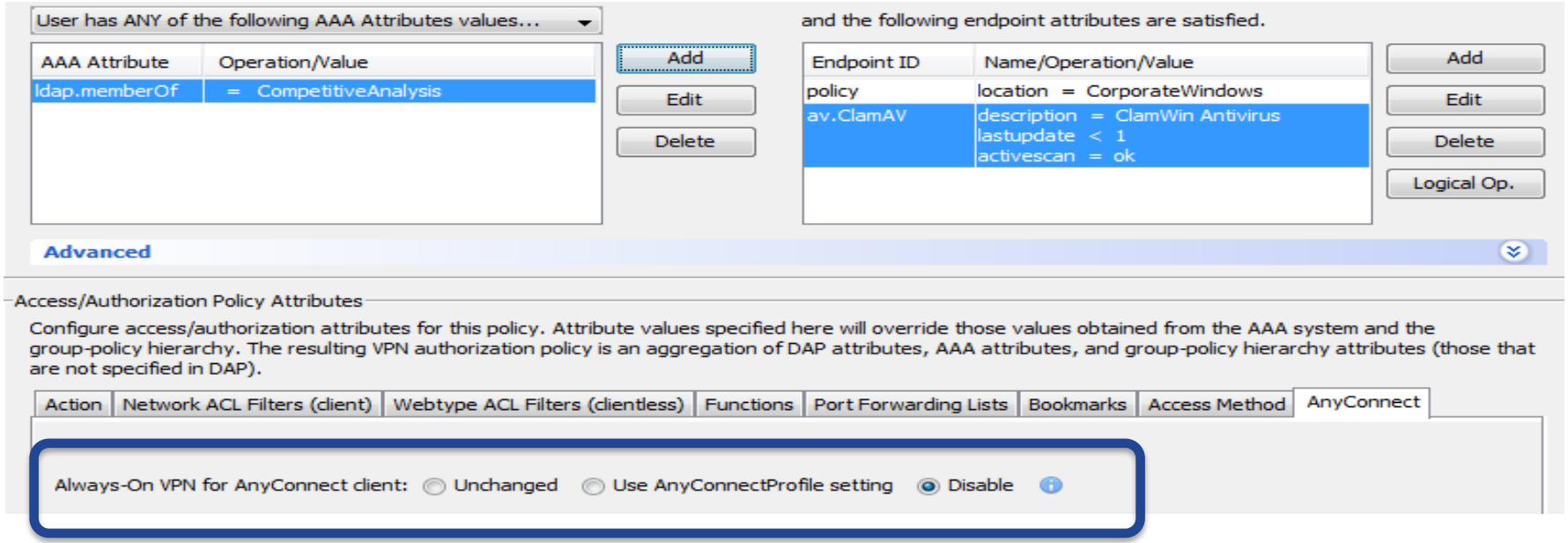
AnyConnect Client Profile with Always-On

- Define conditions for Trusted Network Detection
  - DNS Servers and Domain
  - **AC 4.2: https:// reachability**
- Define Always-On (must also define Server List)
- Connection Failure Policy : Open or Closed
  - Balance Security Requirements vs. Risk of No Network...
  - If Closed, specify if traffic will be allowed for X minutes if Captive Portal is **detected**
  - "Last VPN Local Resource Rules" : Last Client Firewall Rules



Disabling Always-On with DAP

- Always-On can be disabled by DAP
- AnyConnect will remember this setting when disconnected

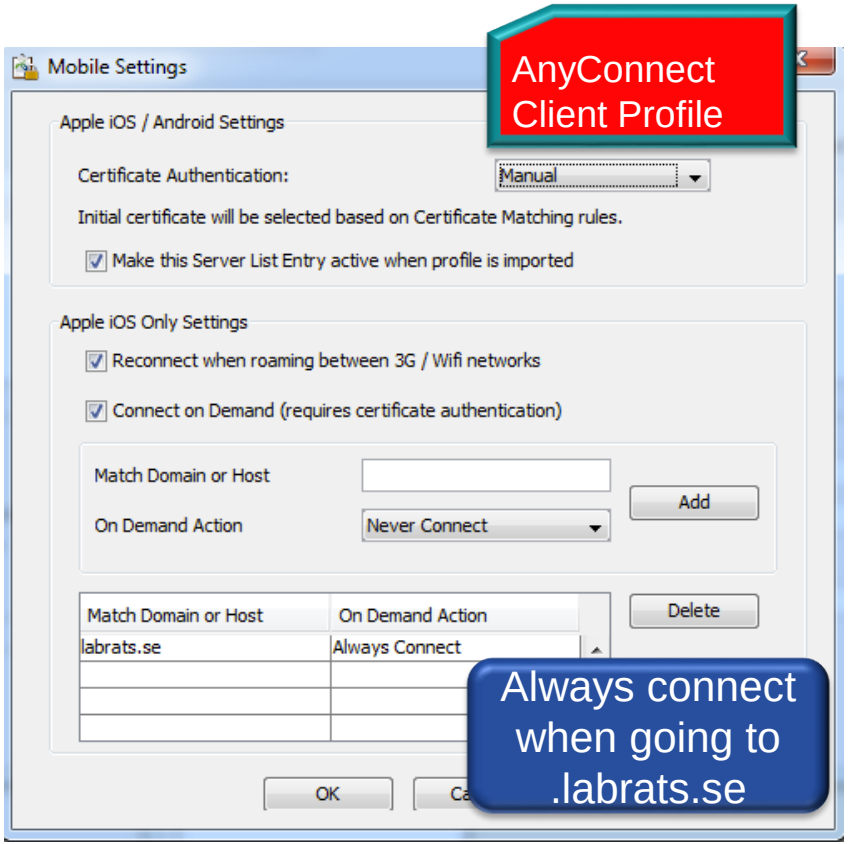


Always On does not work for Mobile Devices

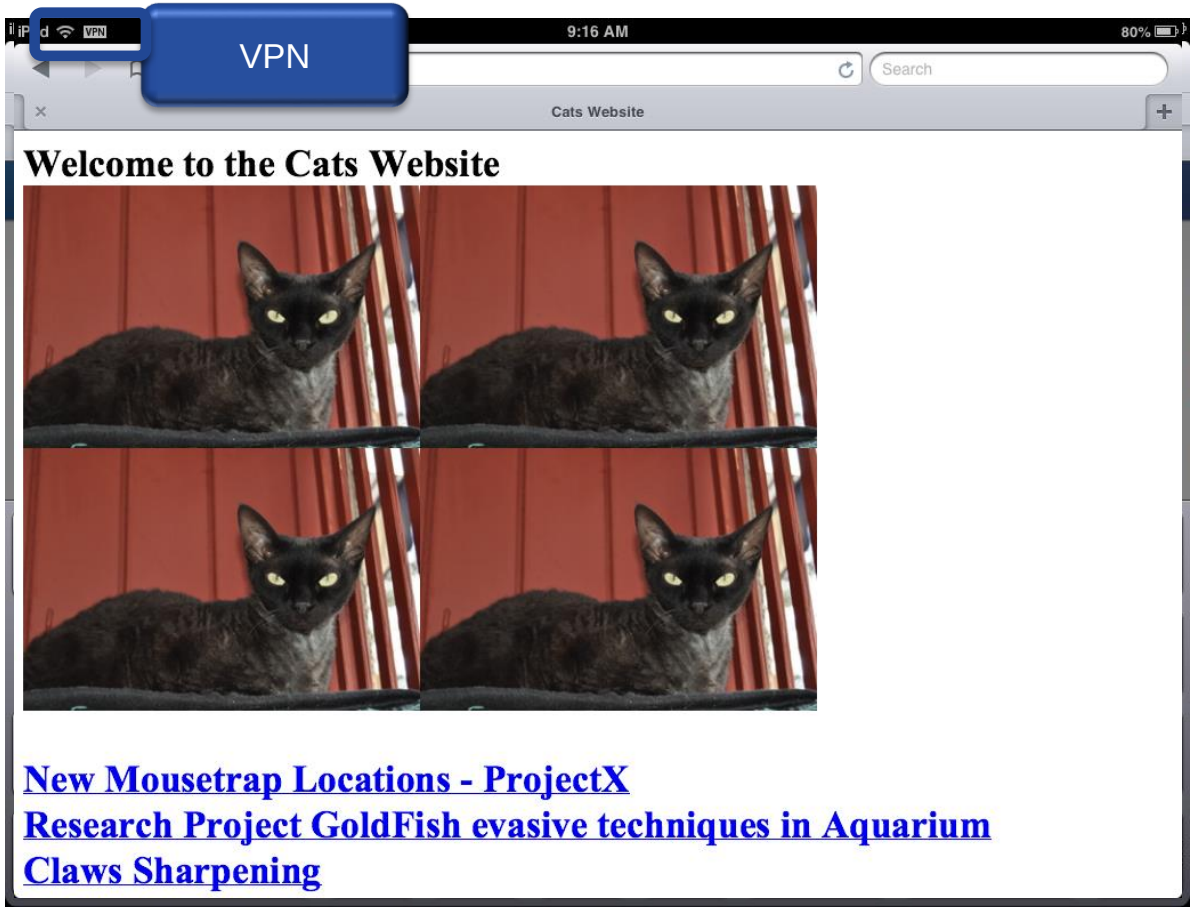
- Forcing Always-On not possible due to lack of OS APIs
  - ... vendor considerations for battery life, security
- Trusted Network Detection (TND) for Android
- On Demand VPN for iOS

On Demand VPN for iOS - Configuration

- VPN automatically connected when traffic directed to predefined domain
- Requires client certificate
- Configured in Client Profile/Server List/Additional Mobile Only Settings



On Demand VPN for iOS – User Experience



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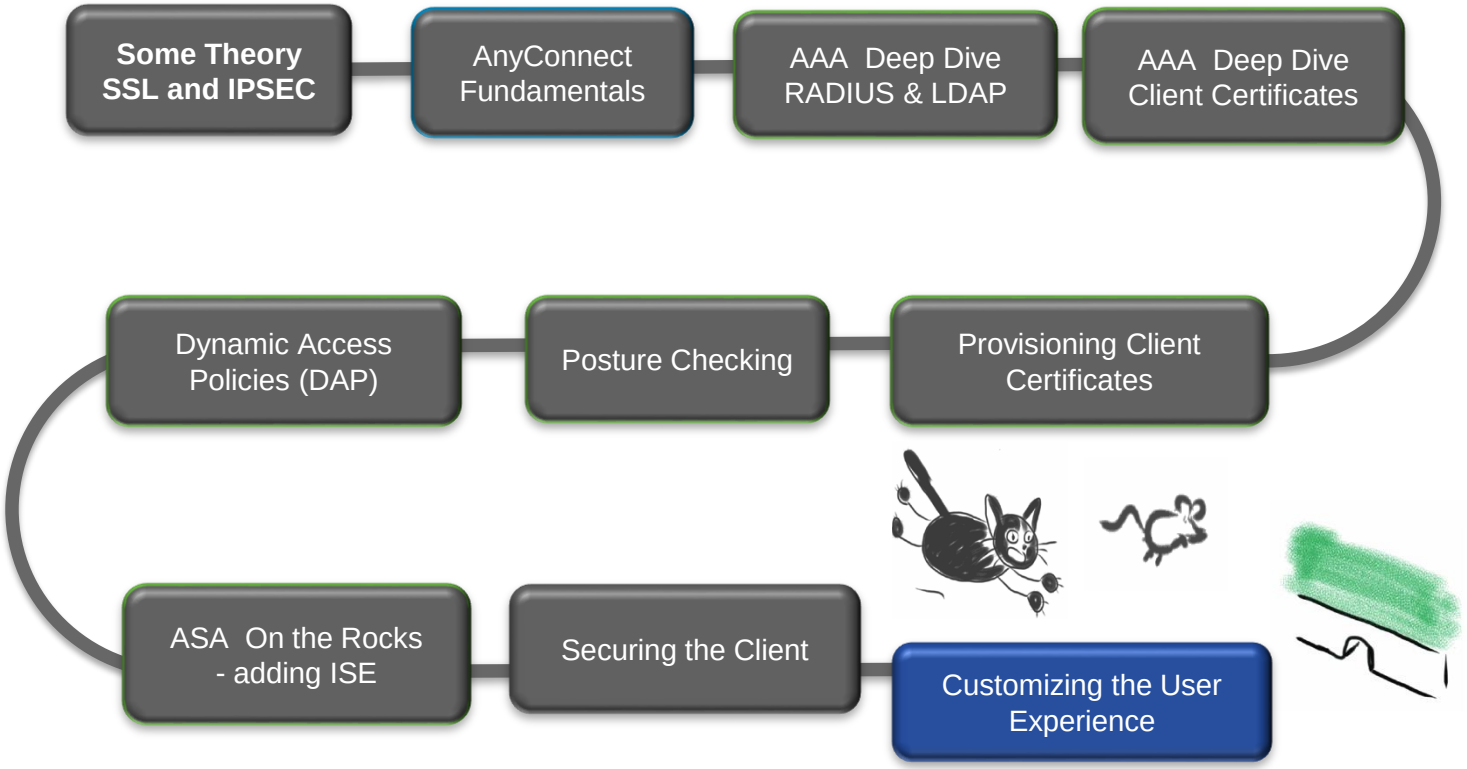
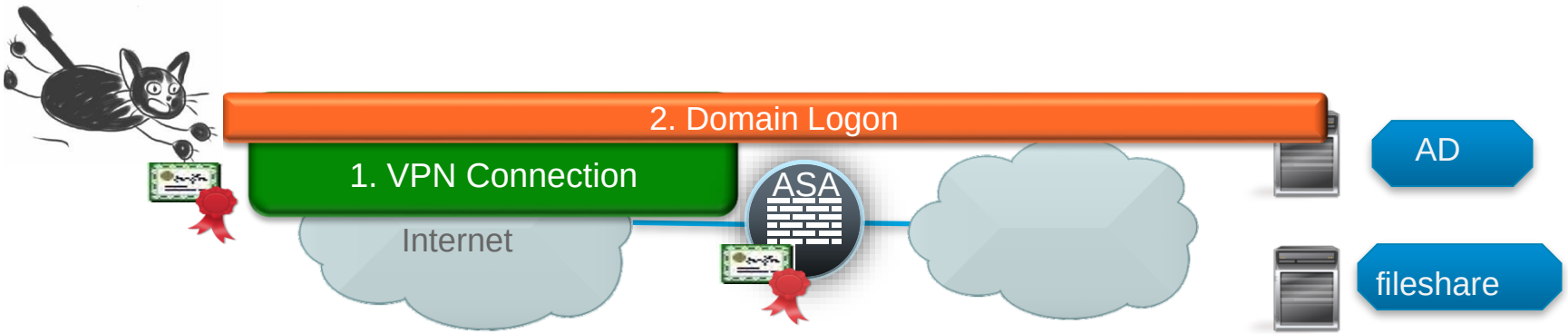


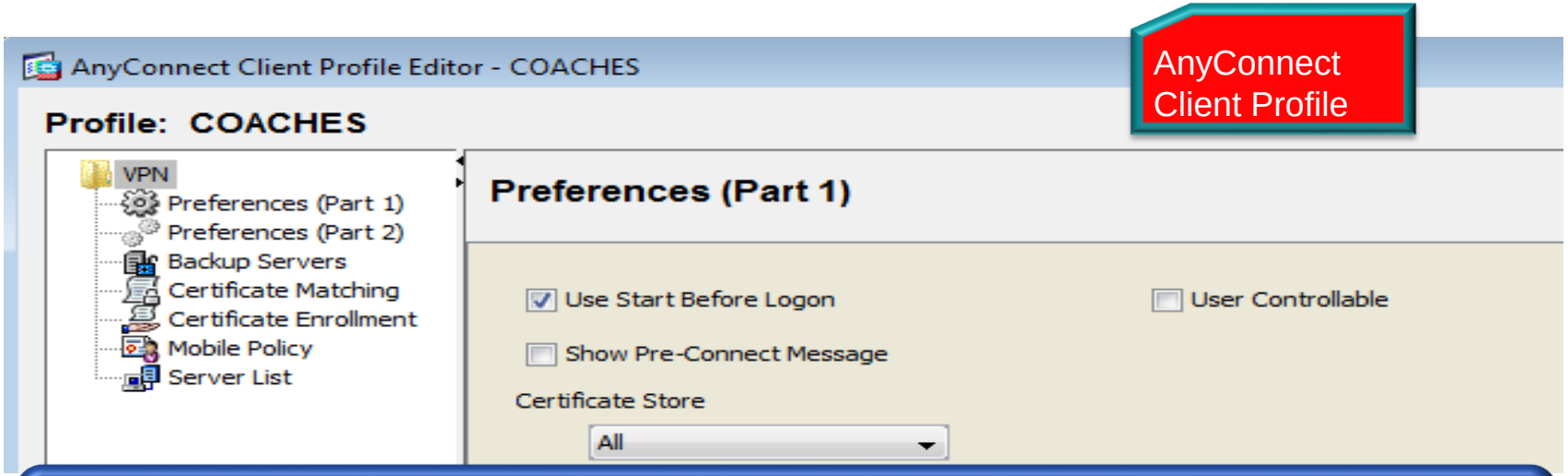
Seamless Office Experience by Start-Before-Logon

- Allows (some) Windows users to connect VPN before logging into computer
- Why? Allow domain-logon, GPOs, logon-scripts, change passwords, etc...
- Can be used with or without Always-On



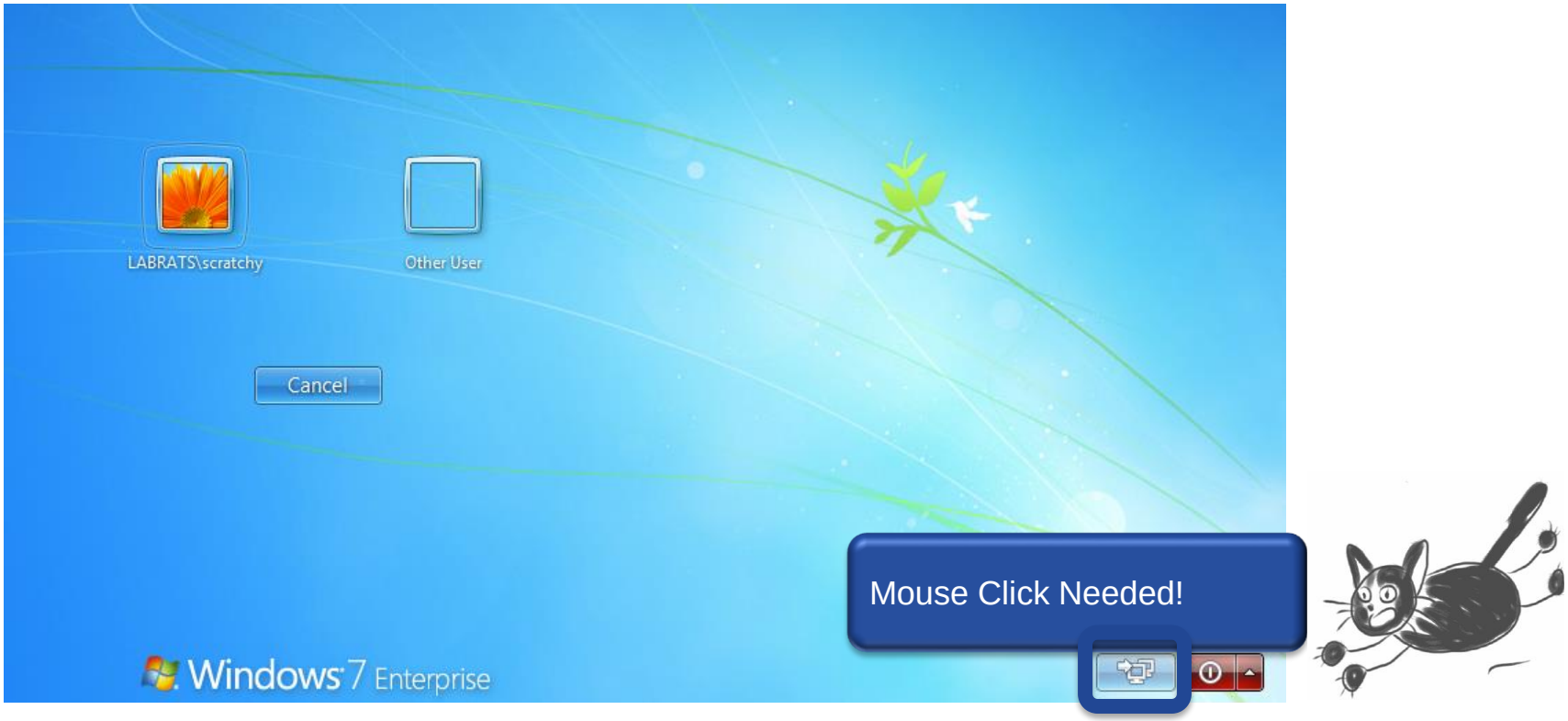
Configuring SBL in Client Profile

- May make it user controllable

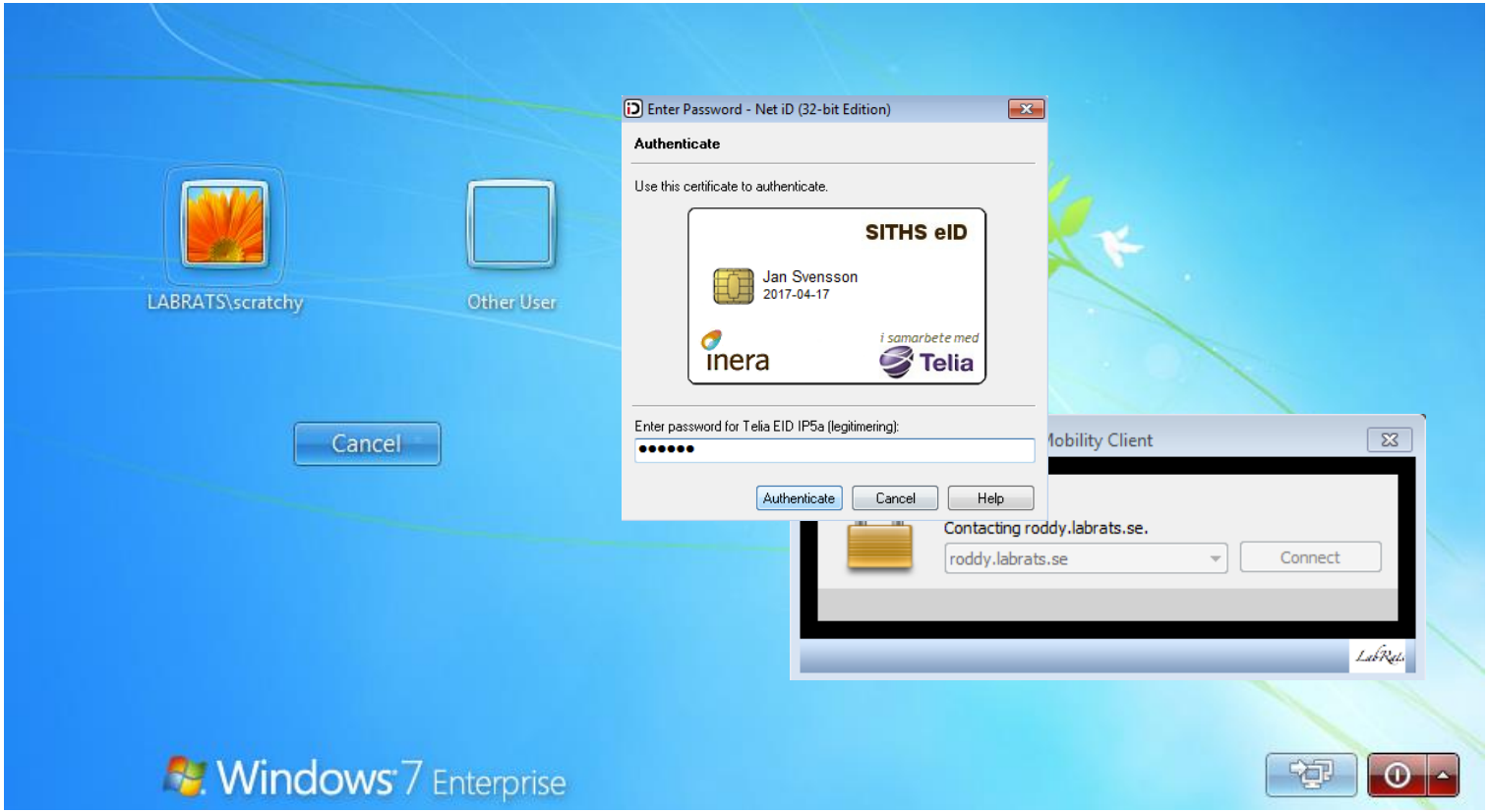


Note : Client certificates in User Store typically not accessible before logon (no knowledge of who the user is).
Client certificates on Smart Cards will work!

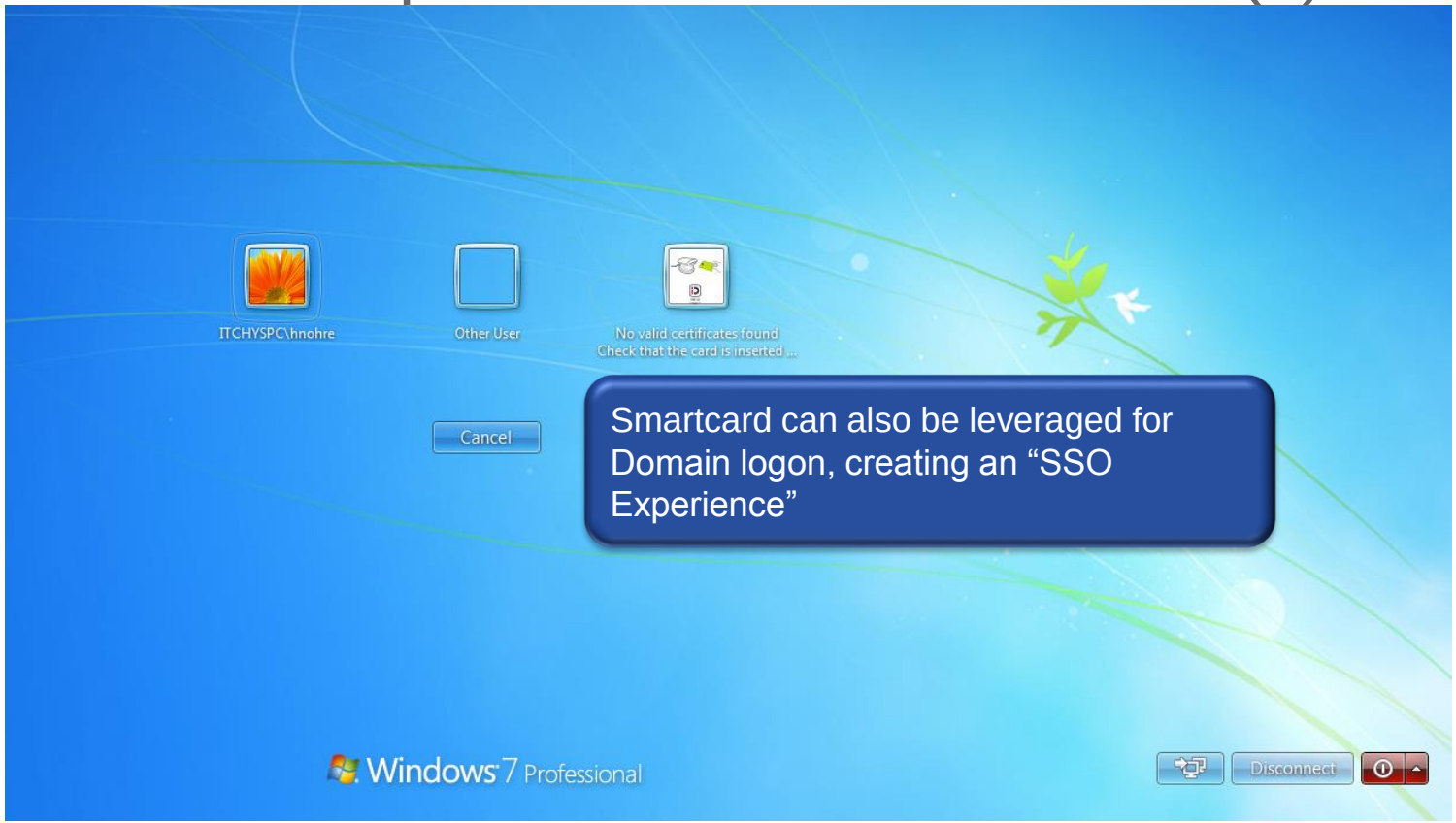
SBL User Experience



SBL User Experience with Smart Cards (2)



SBL User Experience with Smartcards (3)

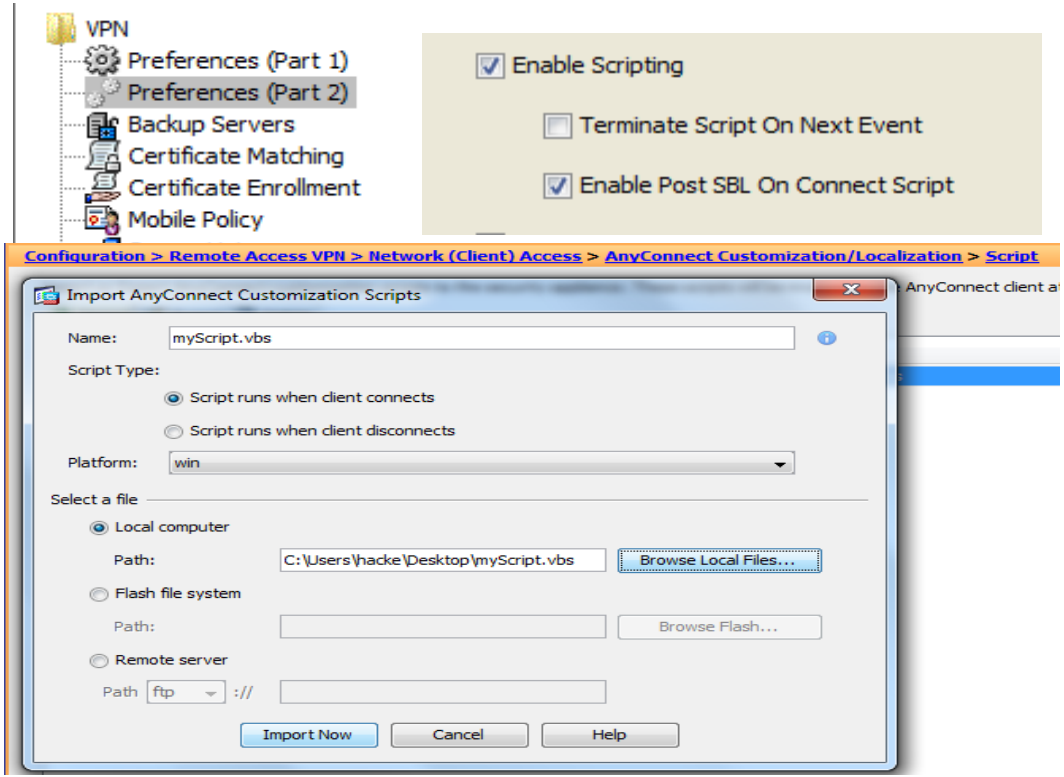


Running Scripts after Connect and Disconnect

- Runs a predefined script when (some) users connect to (or disconnect from VPN)
- Any native script language understood by client (*.vbs, *.sh etc)
- Script can be downloaded from ASA, or distributed by some other means
- Why?
  - Allow mapping of drives, GPO-update when SBL is not possible (e.g. behind a captive portal).
  - Also works on non domain members, including MAC, Linux

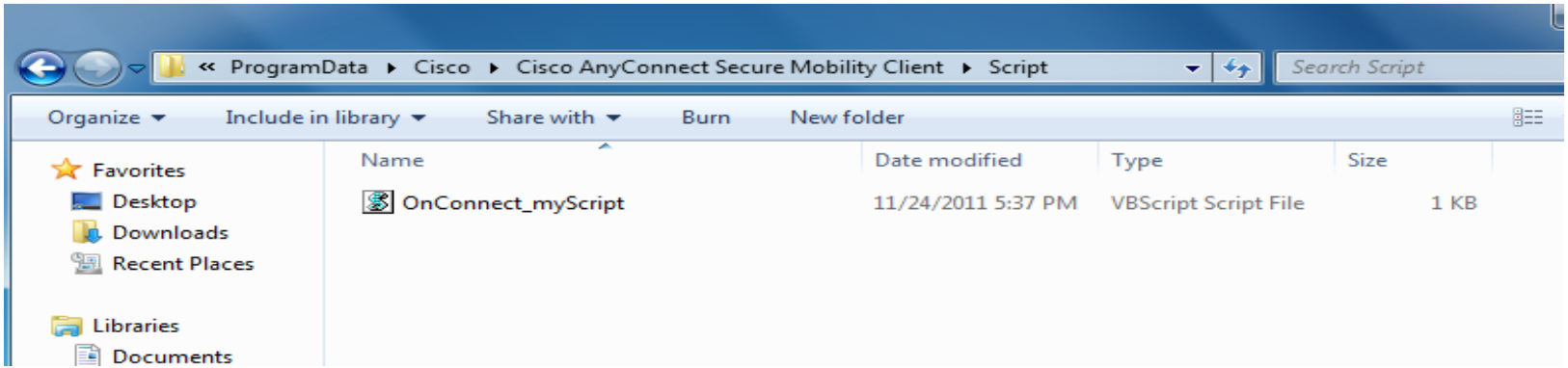
Configuring Scripting

- Enable Scripting in AnyConnect Client Profile
- Optionally : Import script to ASA for download to **all** clients
- Alternatively, use other means of putting the script in the script directory for desired clients



On the Client : The Scripts Folder

- AnyConnect executes the script in the folder that starts with "OnConnect"/"OnDisconnect" after VPN connection/disconnection
- Only one script is executed, but that script can launch other scripts
- Troubleshooting :
  - Check that script exists in folder and that AnyConnect Profile allows scripting.
  - Check that script executes ok when invoked from local machine (permissions etc).



Conclusion

- Secure Client with a Seamless User Experience
- Strong authentication and Granular Access Control with AAA and DAP
- Consider using ISE for Unified Access (VPN, Wired, Wireless)
- Find Balance between Requirements and Complexity (testing, maintenance)
- Good security and networking skills are essential, but also knowledge of adjacent technologies such as Active Directory, LDAP and PKI, ISE… as well as different client platforms

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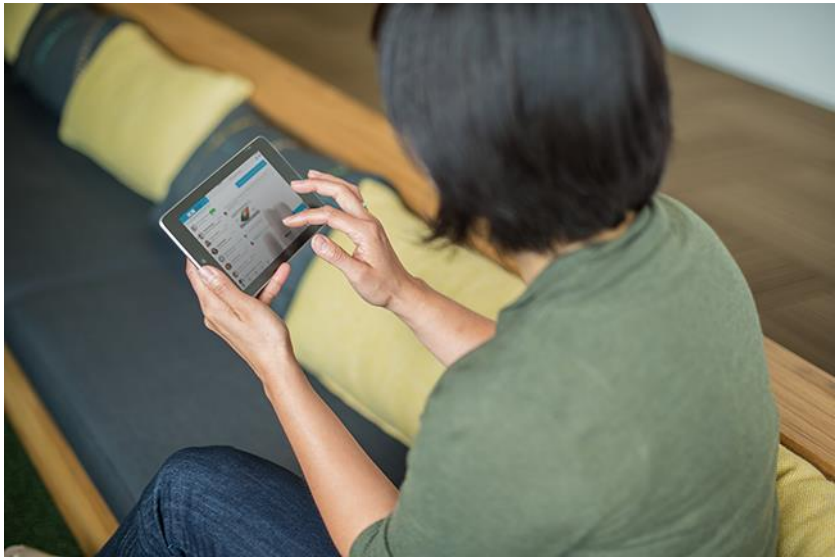

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- Meet the Engineer 1:1 meetings
- Related sessions

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- Walk-in Self-Paced Labs: LABCRS-1000, LTRRST-2016
- Lunch & Learn: Tuesday, Wednesday
- Meet the Engineer 1:1 meetings
- Related sessions: BRKRST-2667, BRKRST-2616, BRKSEC-2003, BRKSEC-3033, BRKSEC-3771, BRKRST-3304, BRKRST-2044, BRKRST-2312, BRKRST-3045, BRKSEC-3003, BRKRST-2022, BRKSPG-2300, BRKSEC-3200
- World of Solutions: ask about IPv6 support ;-)

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