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Securing RDP deep dive

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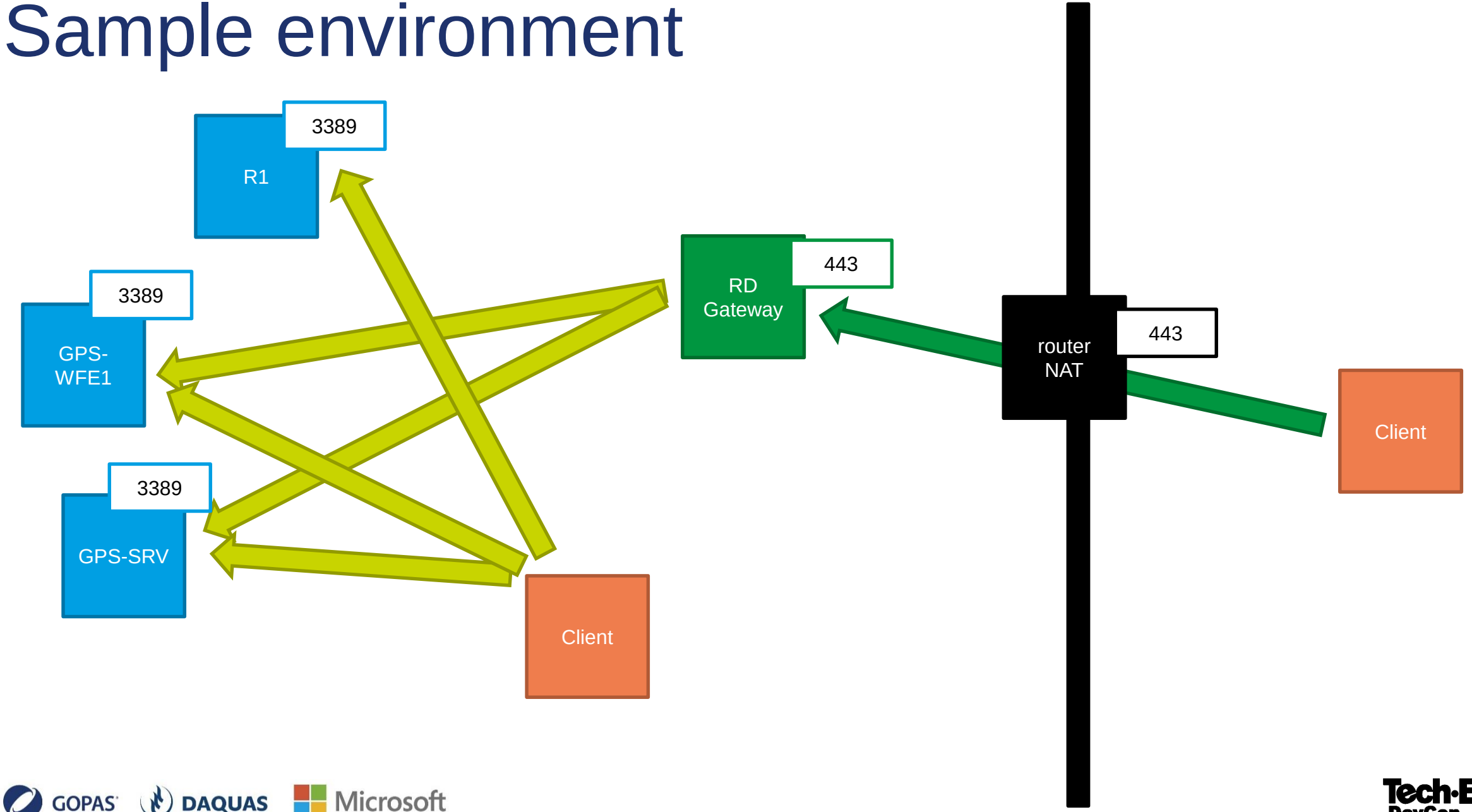
Tech·Ed DevCon

Agenda

- RDP transport security history
- TLS for RDP over TCP 3389
- NLA authentication with Kerberos and NTLM
- RDP single-sign-on (SSO)
- TLS for RDP over RD Gateway
  - TCP 3389 tunneled in HTTPS
- Limiting pass-the-password and pass-the-hash
- RestrictedAdmin mode

Sample environment



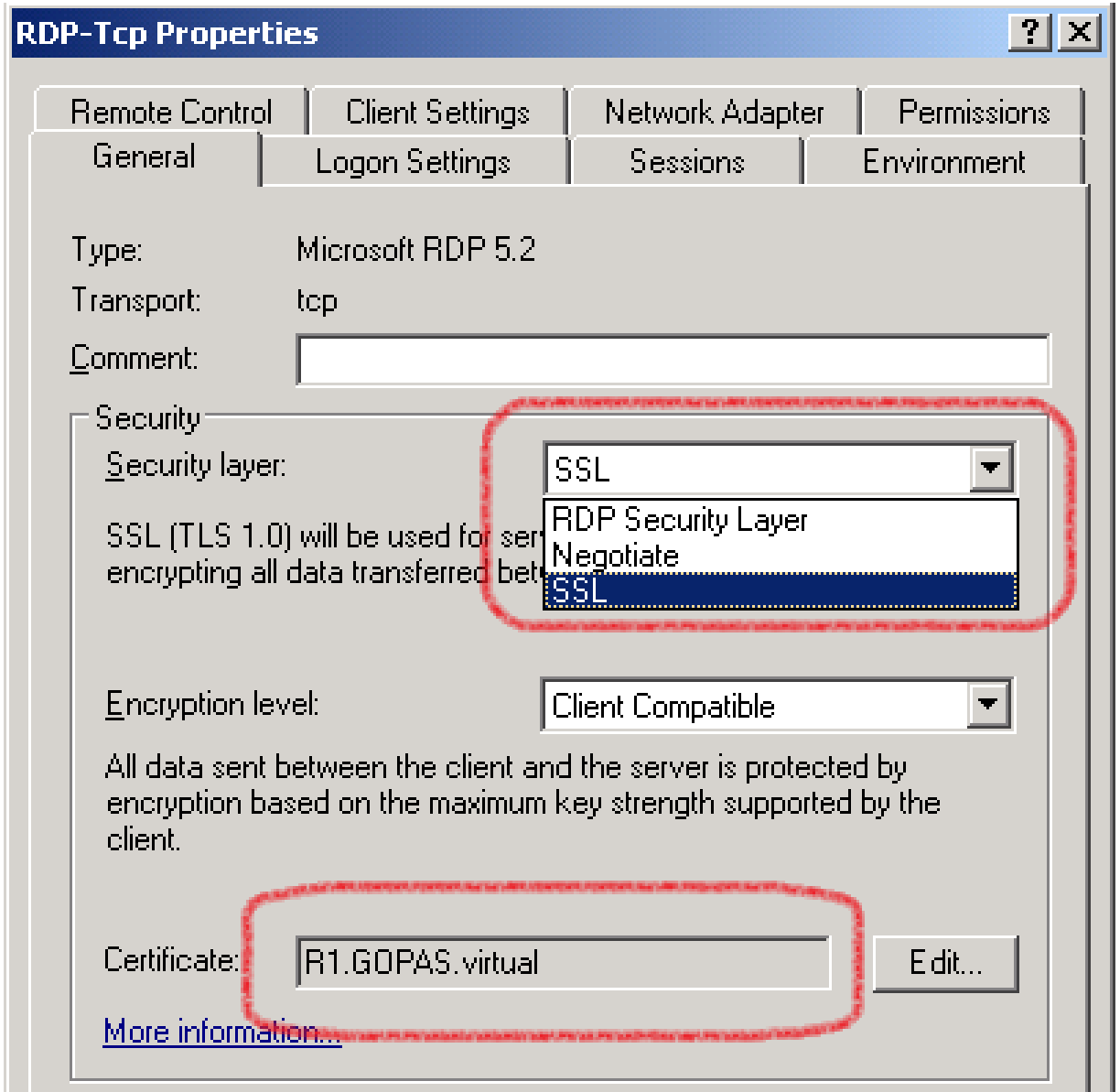
Windows 2003 and older

- RDP security layer
  - DH key exchange (unauthenticated)
  - safe against passive eavesdropping
  - prone to MITM attacks
  - no server authentication
- Windows 2003 SP1
  - TLS 1.0 support
  - manual certificate selection

Windows 2003 TLS certificate requirements

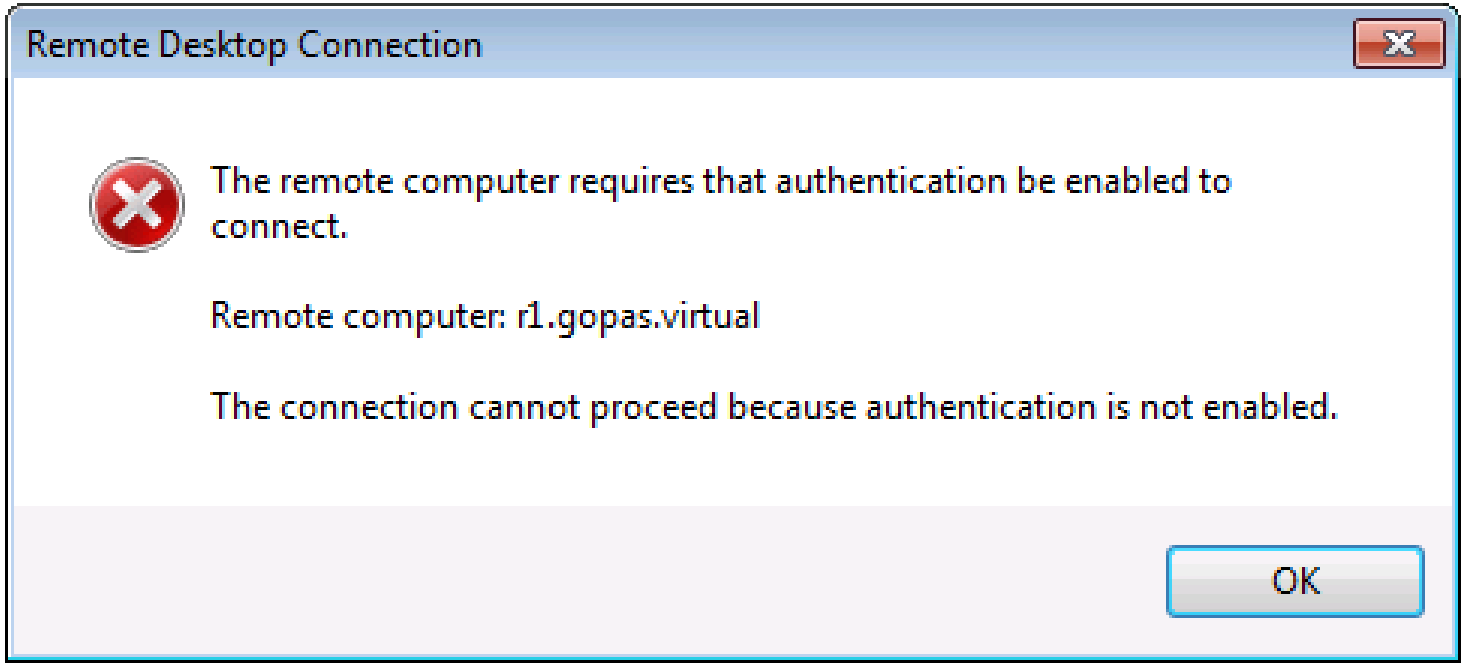
- Subject or SAN
  - CN or DNS name of the RDP server used by client
- Enhanced Key Usage (EKU)
  - Server Authentication (OID 1.3.6.1.5.5.7.3.1)
- Key Usage
  - Key encipherment
  - TLS 1.0 only supported by Windows 2003
  - TLS 1.0 does not have ECDH/RSA suites
- CSP
  - Microsoft RSA SChannel Cryptographic Provider
- Signature
  - might be signed by SHA2 (SHA256) if updates installed (KB938397, KB968730)

Windows 2003 RDP TLS configuration



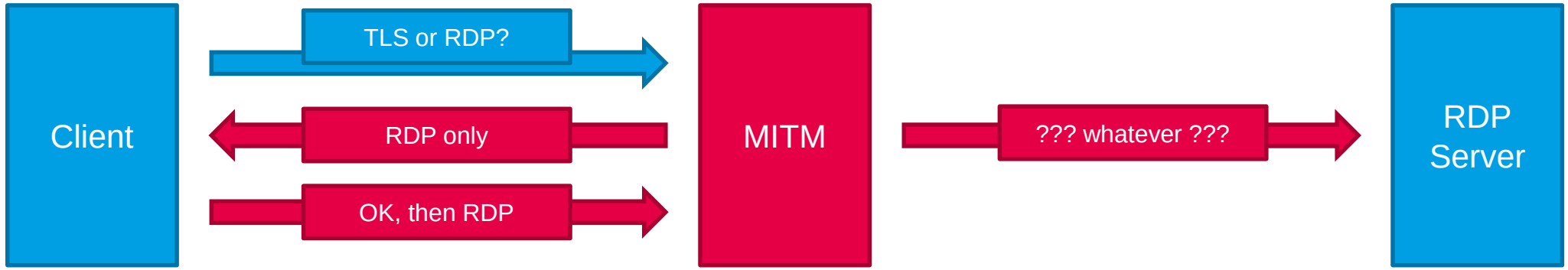
Incorrect or no certificate on the server

- The remote computer requires that authentication be enabled to connect. The connection cannot proceed because authentication is not enabled.



Negotiate or explicit TLS?

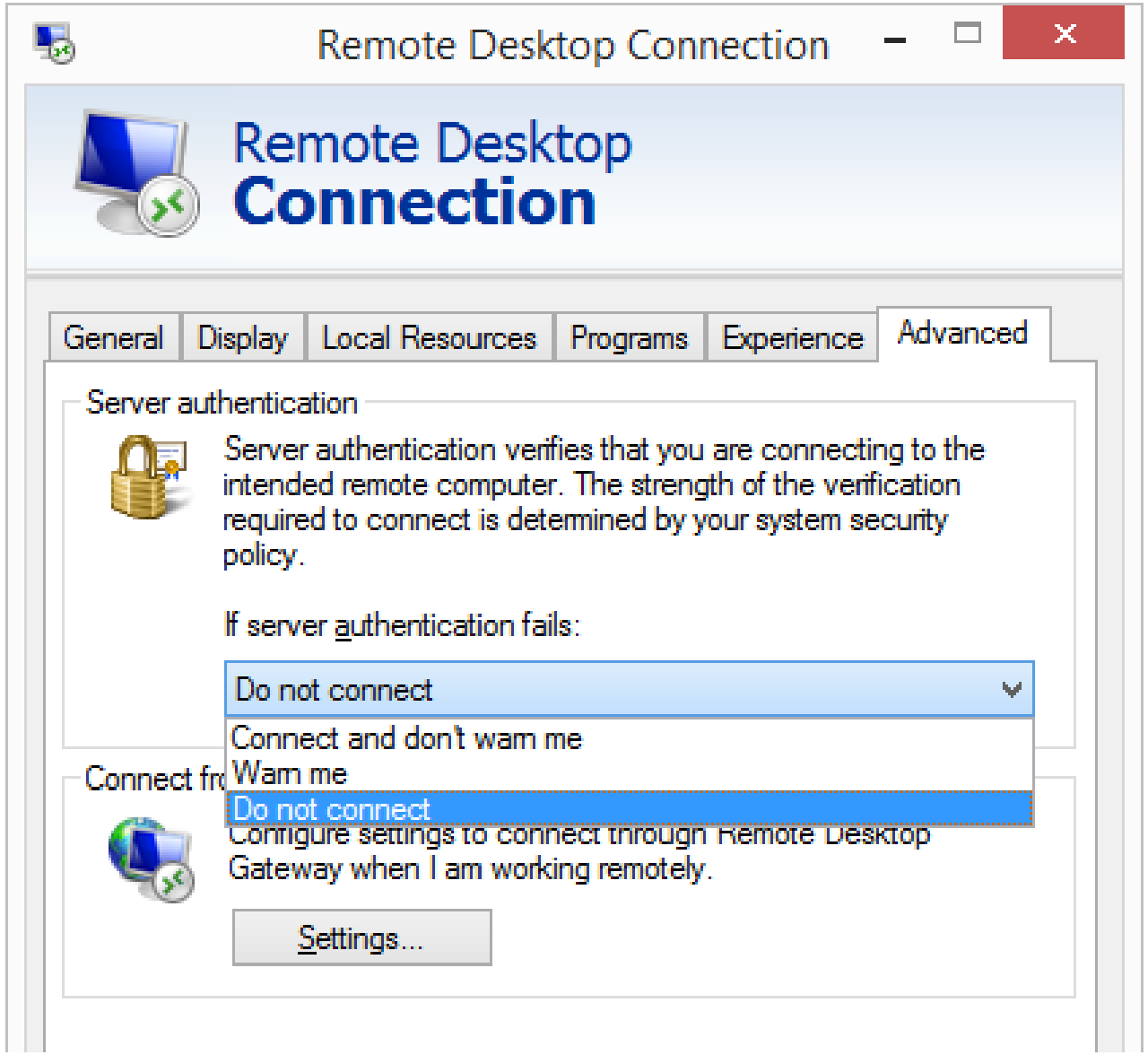
- Client compatibility (TLS requires MSTSC 5.2)
- Active MITM downgrade possible with Negotiate
- Must enforce TLS on client



Enforce server authentication on client (KB895433)

- .RDP file setting
  authentication level:1
- HKLM\Software\Microsoft\
  Terminal Server Client
  AuthenticationLevelOverride
  DWORD = 1

- No authentication = 0
- Attempt authentication = 2



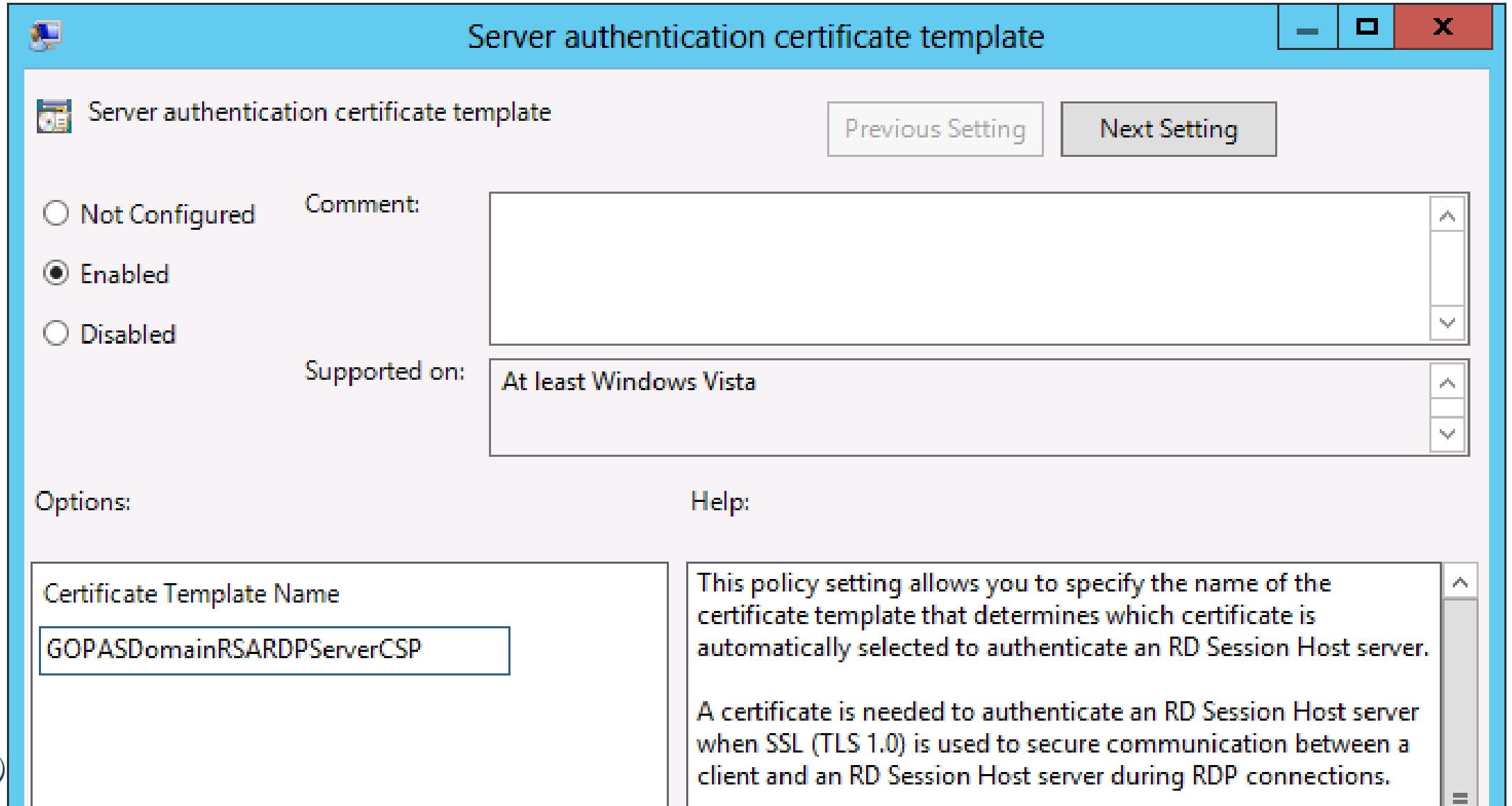
Windows 2008 RDP TLS certificate

- Remote Desktop Configuration service
- Self-signed auto-generated TLS server certificate
  - changed with primary DNS suffix or computer name change
  - untrusted
- Manually selected TLS server certificate
  - manual configuration
- GPO based automatically enrolled TLS server certificate
  - automatically enrolled from enterprise online AD CS

Windows Vista/2008+ TLS certificate requirements

- Subject or SAN
  - CN or DNS name of the RDP server used by client
- Enhanced Key Usage (EKU)
  - Remote Desktop Authentication (OID 1.3.6.1.4.1.311.54.1.2)
  - Server Authentication (OID 1.3.6.1.5.5.7.3.1)
- Key Usage
  - Key encipherment
  - Windows 7/2008 R2 still uses only TLS 1.0, does not have ECDH/RSA suites
  - Digital signature
  - Windows 8/2012 supports TLS 1.1+ with ECDH/RSA suites
- CSP or CNG/KSP
  - any
- Signature
  - might be signed by SHA2 (SHA256)

GPO certificate template selection



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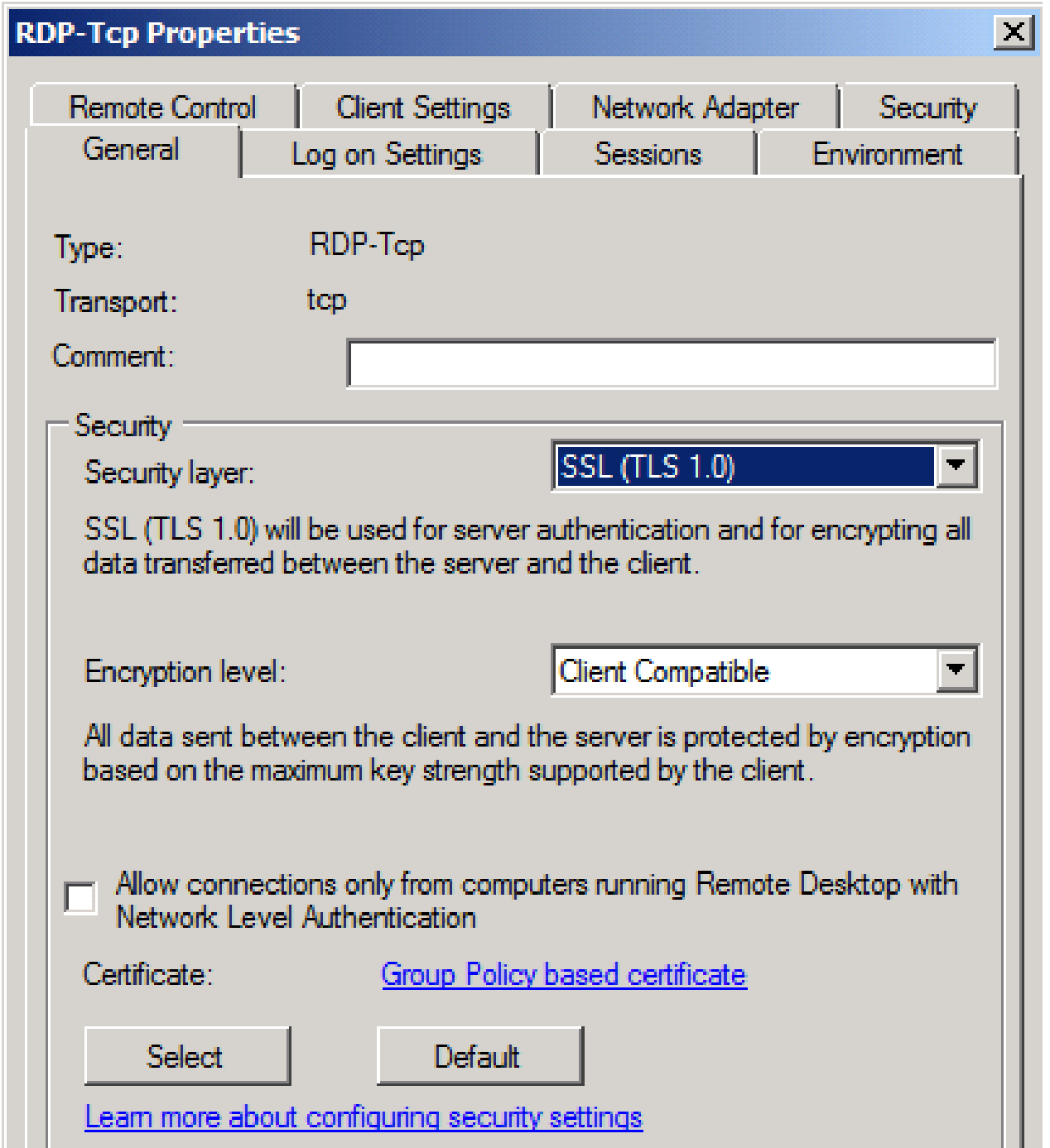
GPO certificate template selection

- certificate enrollment performed by Remote Desktop Configuration service



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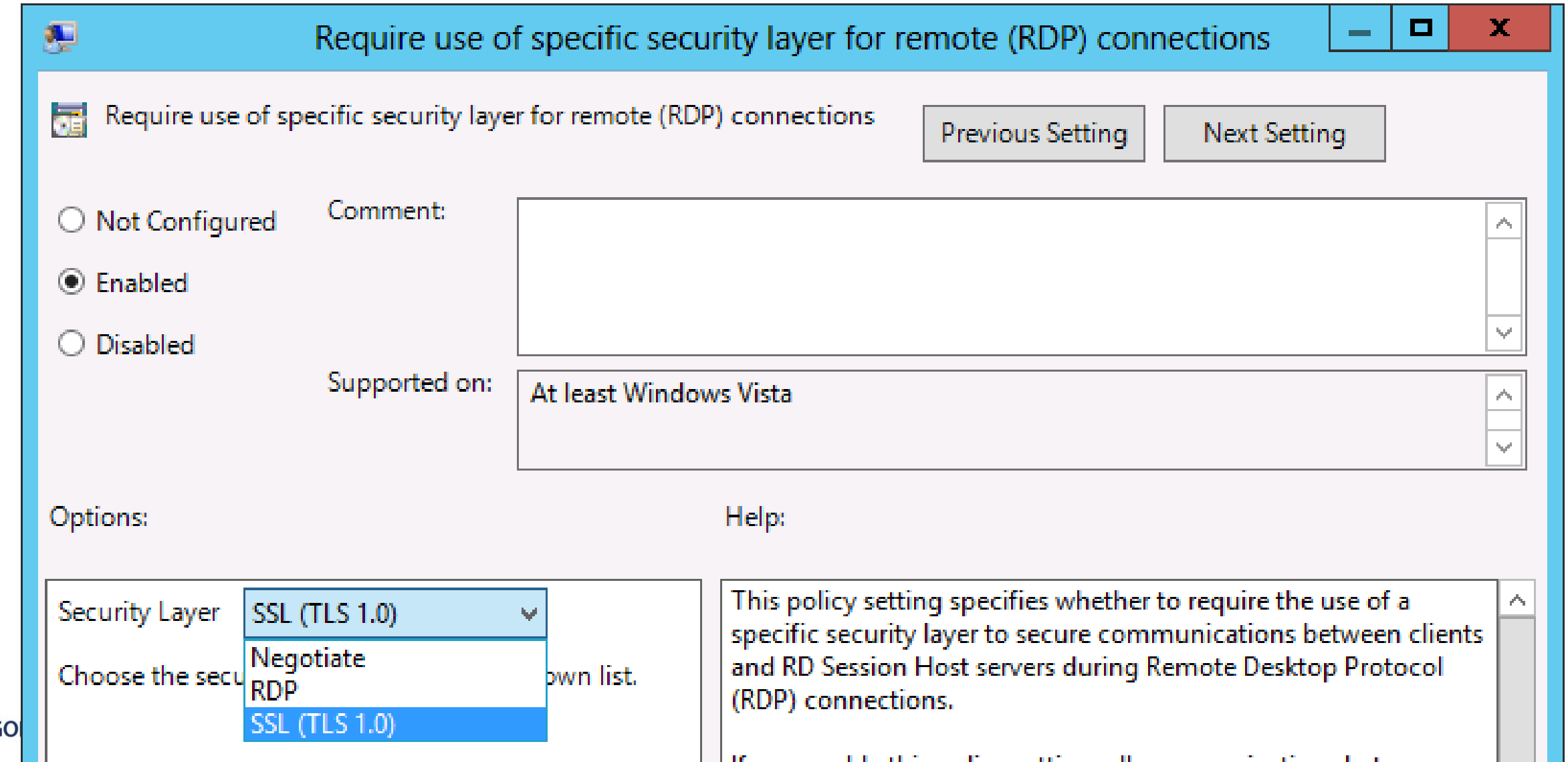
GPO configuration for TLS on server

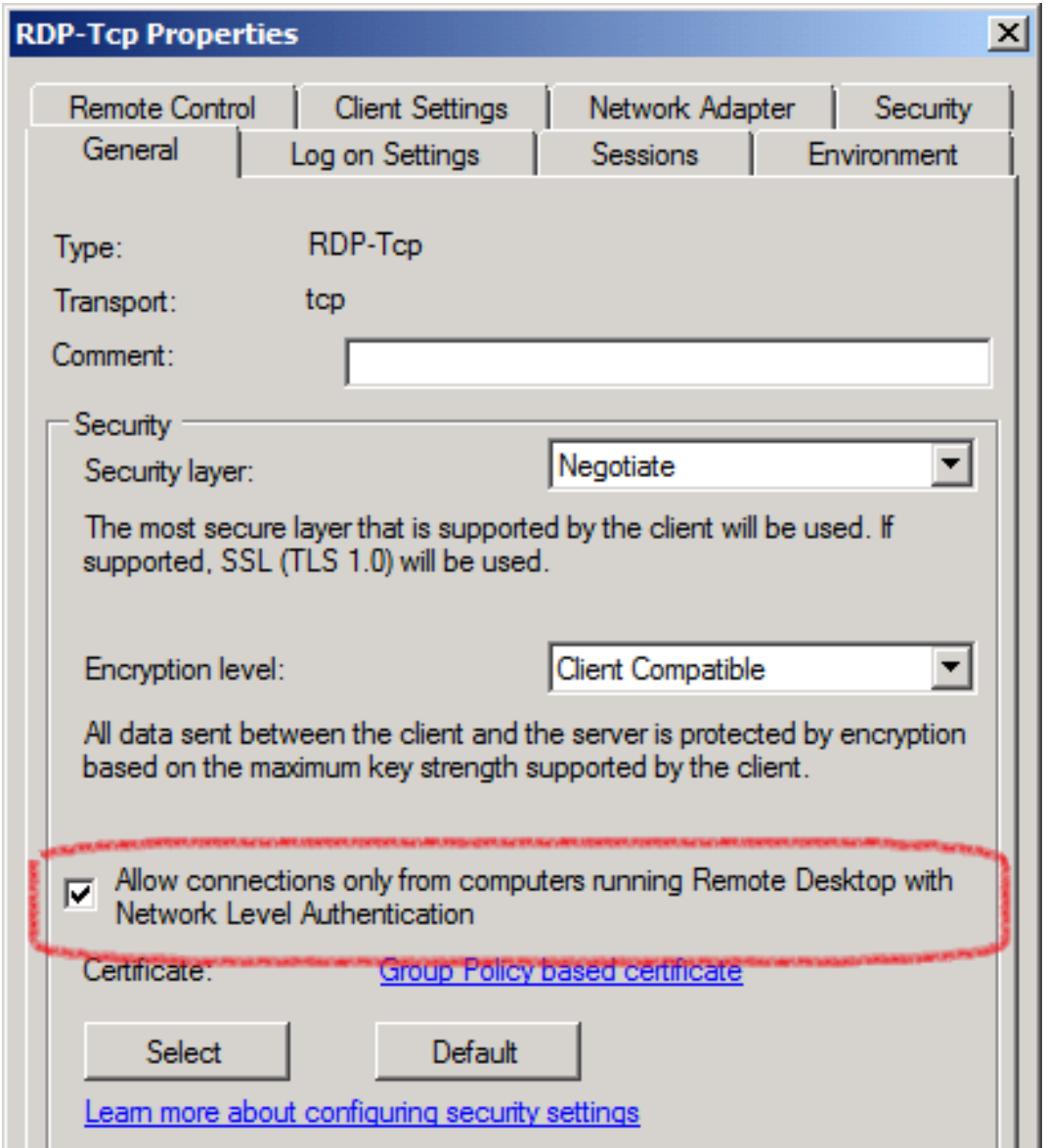


Network Level Authentication (NLA)

- Additional authentication during channel establishment
  - Kerberos or NTLM
- Requires TLS
- Removes the TLS certificate quality requirement
- With Kerberos provides mutual authentication of the channel
- Supported with MSTSC 6.0+

NLA requirement on the server

- With Kerberos the authentication is mutual and as such does not require enforcement on client

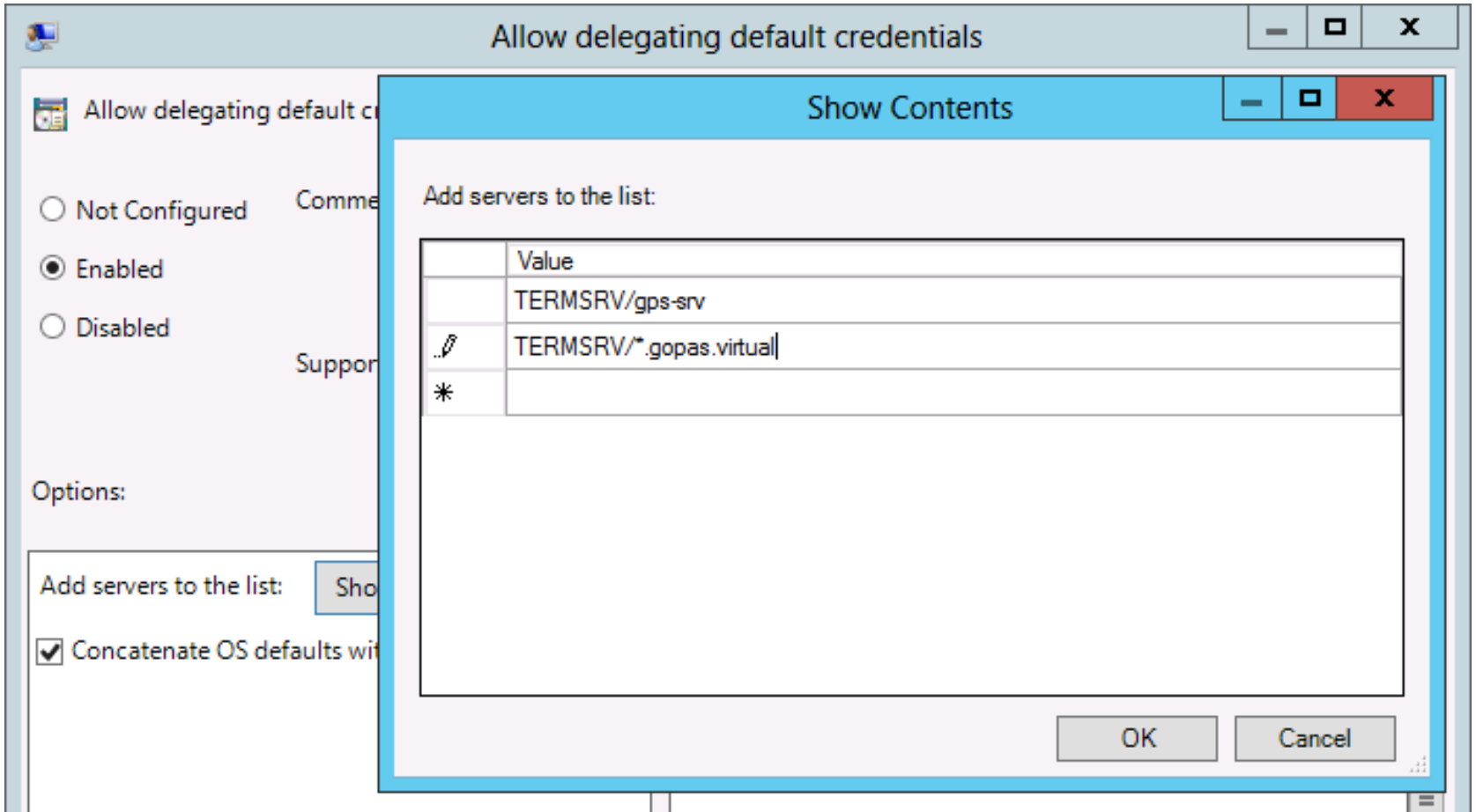


RDP is basic authentication

- Password transported in "full" or "plaintext" form
- Client LSASS does not supply plaintext password to client applications
  - always typed or stored locally

RDP single-sign-on (SSO)

- With TLS and NLA with Kerberos
  - requires server authentication with Kerberos
- Client LSASS passes plaintext password to the remote server encrypted by TGS key



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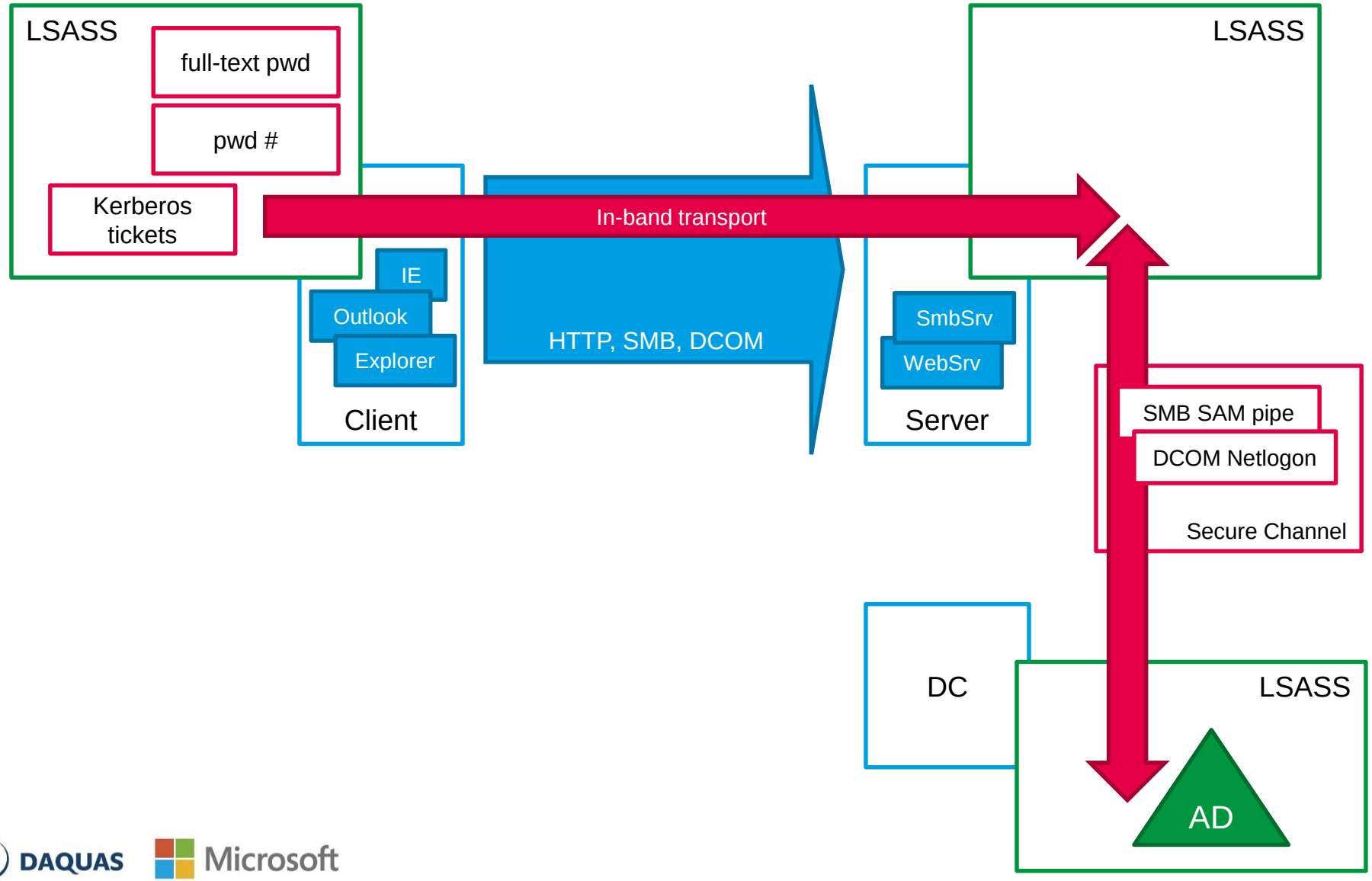
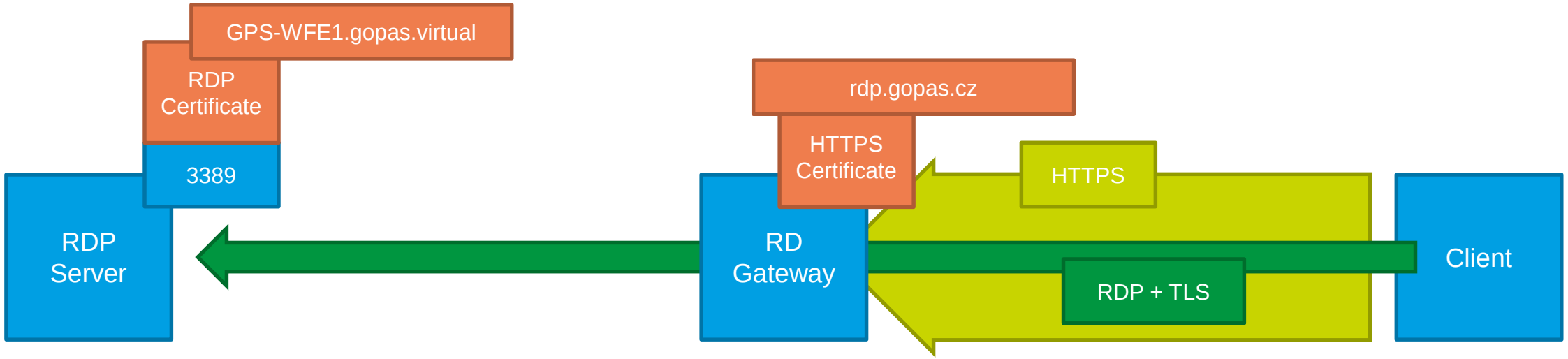
LSAS (local security authority sub system)



Stealing user password from LSASS memory

- Local administrator on the RDP server
  - just read it from LSASS memory
- Windows 10 can store LSASS private data in Hyper-V Virtual Secure Mode (VSM) outside of the OS
  - just like a smart card

RD Gateway


GPS-WFE1.gopas.virtual
RDP Certificate
3389
RDP Server
rdp.gopas.cz
HTTPS Certificate
RD Gateway
HTTPS
RDP + TLS
Client

RD Gateway certificate requirements

- Subject or SAN
  - CN or DNS name of the RD Gateway server used by client
- Enhanced Key Usage (EKU)
  - Server Authentication (OID 1.3.6.1.5.5.7.3.1)
- Key Usage
  - Key encipherment
  - Windows Vista/2008 still uses only TLS 1.0, does not have ECDH/RSA suites
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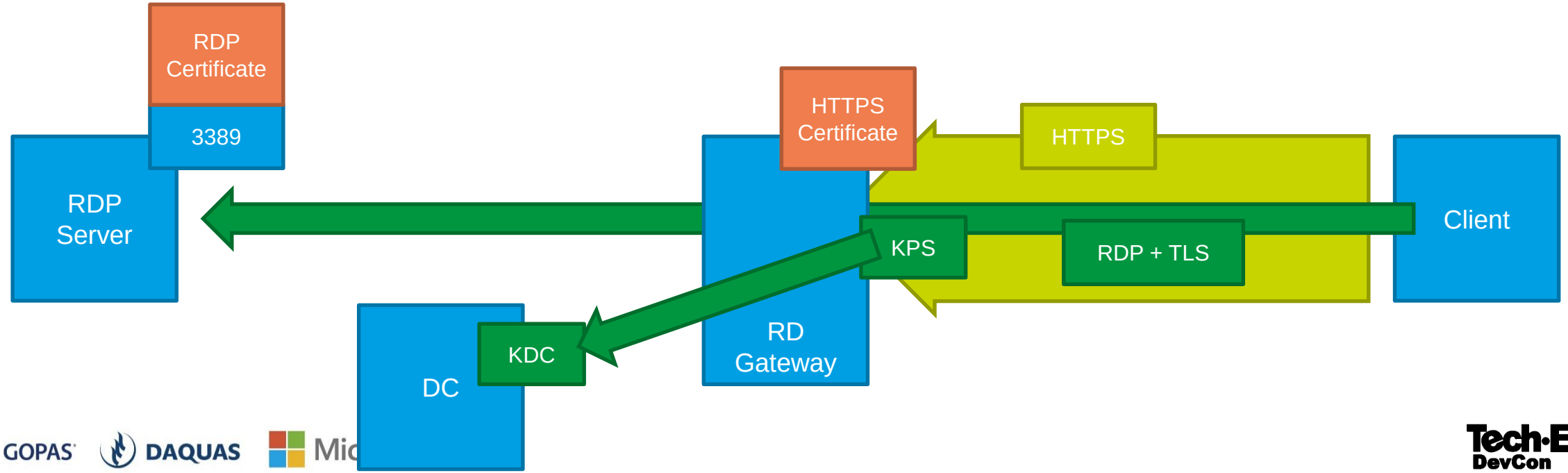
- CSP or CNG/KSP
  - any
- Signature
  - might be signed by SHA2 (SHA256)

Trust over RD Gateway

- Client would have to trust both the internal certificate and the RD Gateway public certificate
- Windows 2012 offers KDC Proxy Service (KPS)
  - requires Windows 8 client



MSTSC and KDC proxy

- To enable KDC proxy on client, set the RDP file property
  - rdgiskdcproxy:i:1
- To set the property centrally
  - Set-RDSessionCollectionConfiguration -CustomRdpProperty "rdgiskdcproxy:i:1"

Limit pass-the-hash attacks

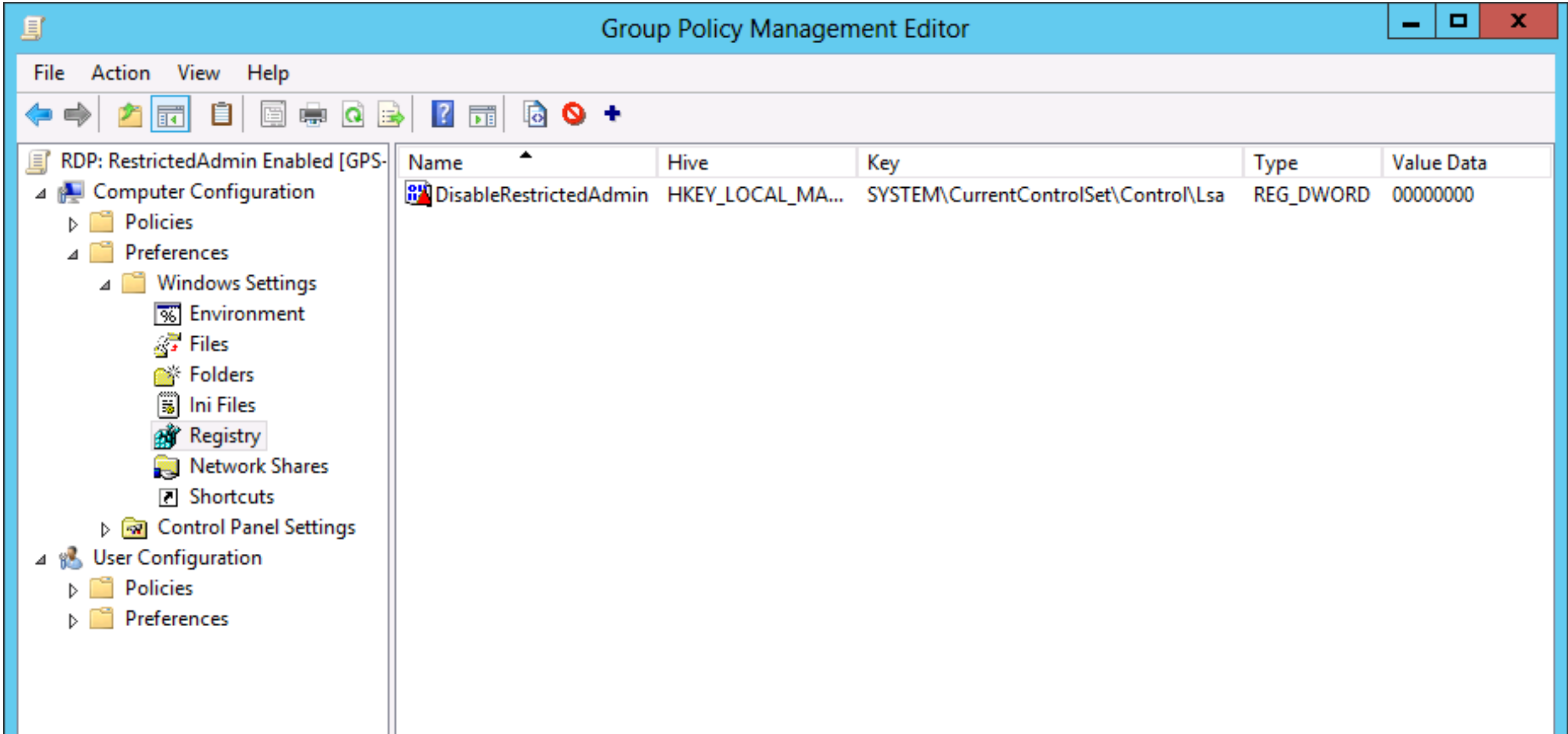
- Use smart-cards with Kerberos PKINIT
  - no password
  - cannot be copied
- Limit TGT lifetime (1 hour)
  - 1 hour ~ session duration
- Disable NTLM
  - since Windows 7/2008 R2

- or use Restricted Admin mode
  - since Windows 8/2012 RDP server

RestrictedAdmin mode

- mstsc /restrictedAdmin
- Does NOT send plaintext password
  - authenticates only with the NLA Kerberos
- Cannot access network resource
  - by default receives RDP computer's credentials
- Must be configured
  - HKLM\System\CurrentControlSet\Control\LSA
    DisableRestrictedAdmin = DWORD = 0
    DisableRestrictedAdminOutboundCreds = DWORD = 1/0

RestrictedAdmin with GPO preferences



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Děkuji za pozornost!

GOC172 - Enterprise PKI
GOC175 - Advanced Windows security

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