The strongSwan IPsec Solution with TNC Support

TCG Members Meeting June 2011 Munich

Prof. Dr. Andreas Steffen
Institute for Internet Technologies and Applications
HSR University of Applied Sciences Rapperswil
andreas.steffen@hsr.ch

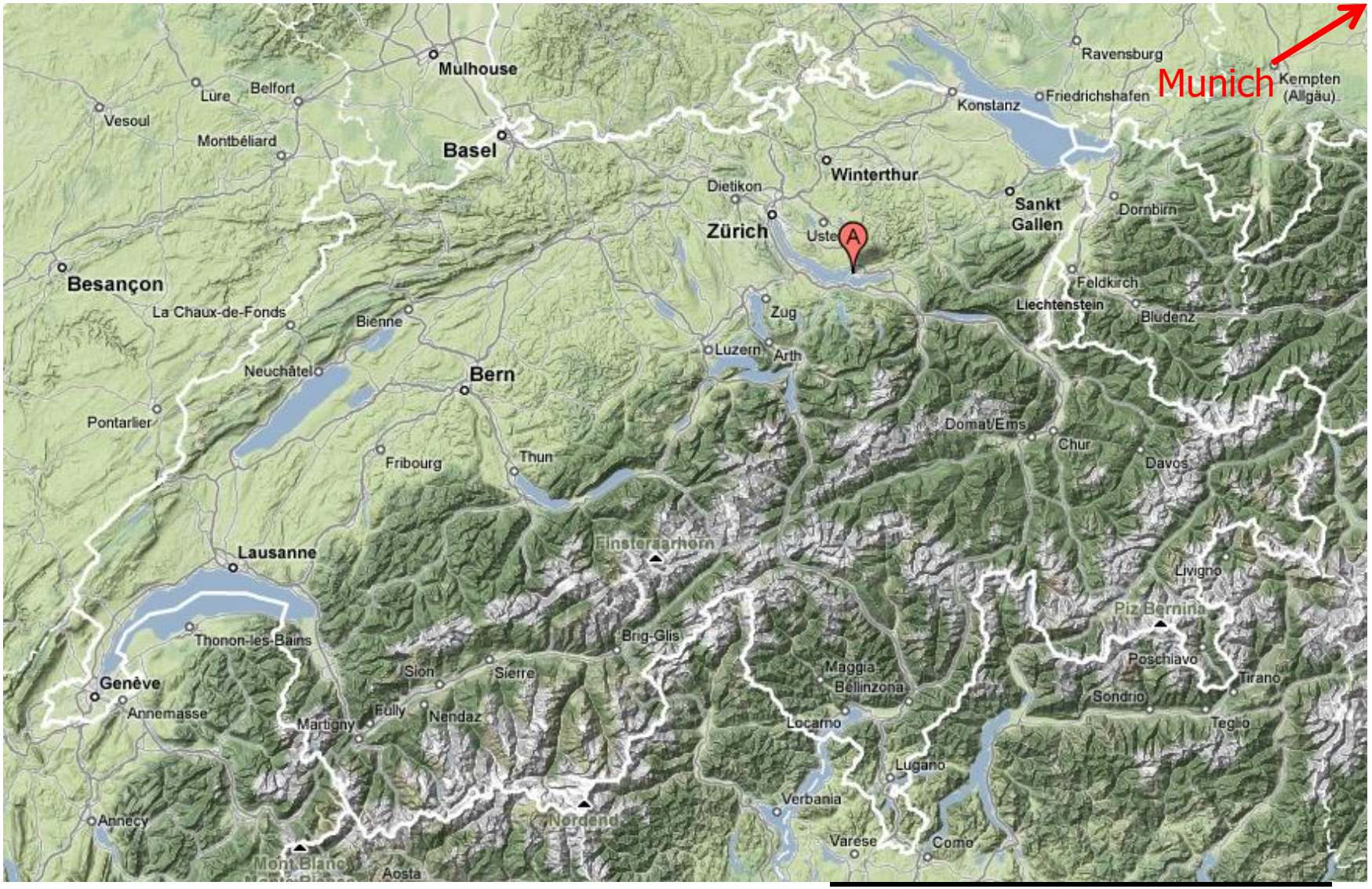
HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL
FHO Fachhochschule Ostschweiz

strongswan

Where the heck is Rapperswil?

HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL

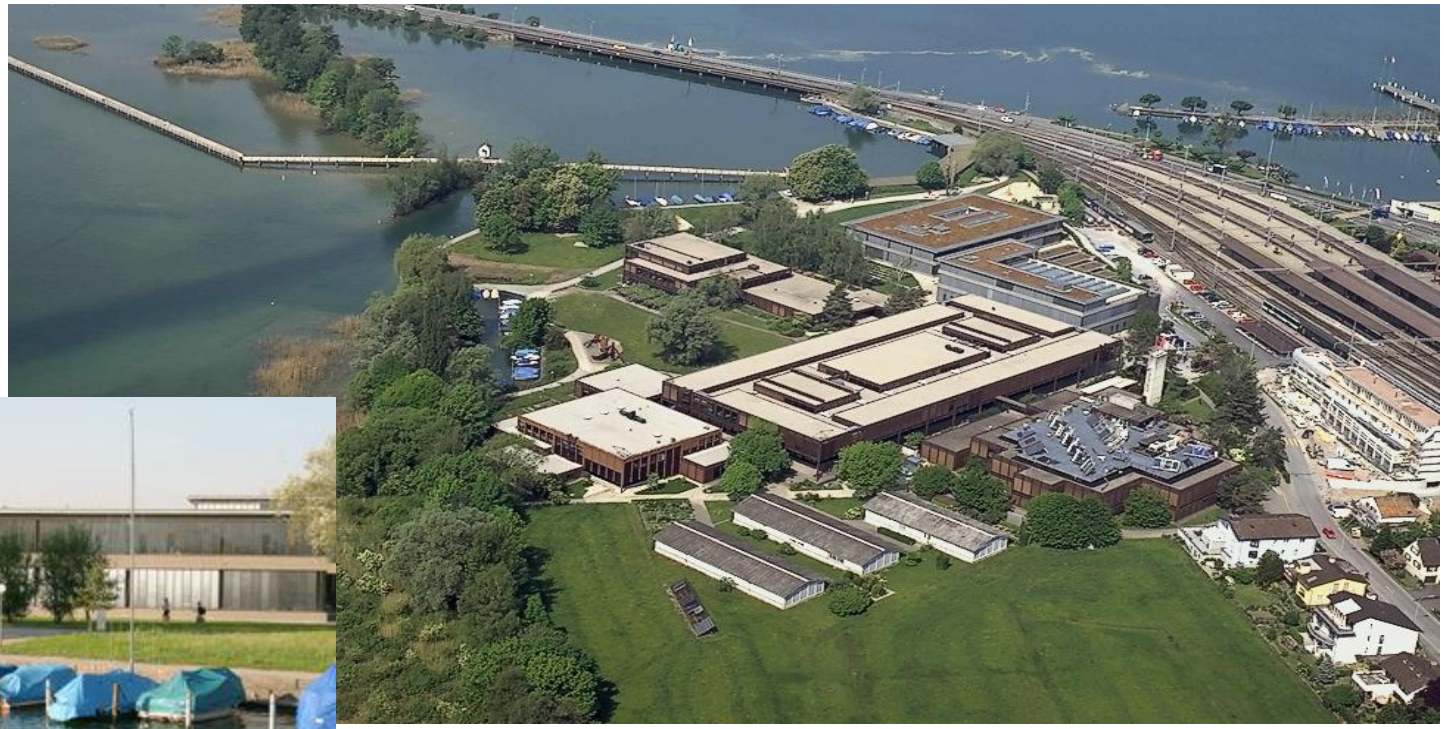
FHO Fachhochschule Ostschweiz



HSR - Hochschule für Technik Rapperswil

HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL
FHO Fachhochschule Ostschweiz

- University of Applied Sciences with about 1500 students
- Faculty of Information Technology (300-400 students)
- Bachelor Course (3 years), Master Course (+1.5 years)



The strongSwan IPsec Solution with TNC Support

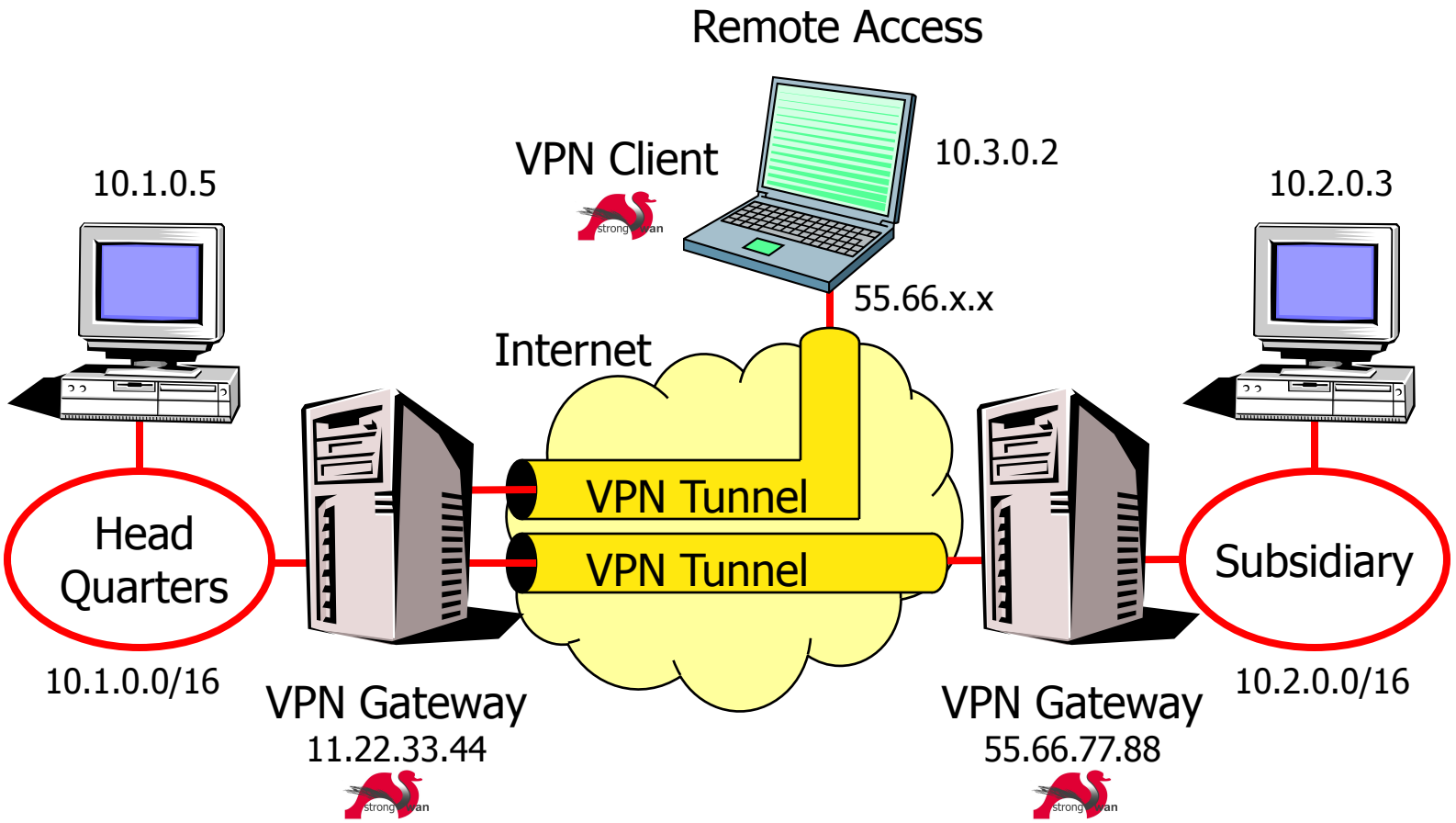
TCG Members Meeting June 2011 Munich

IKEv2 Open Source Implementation

HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL

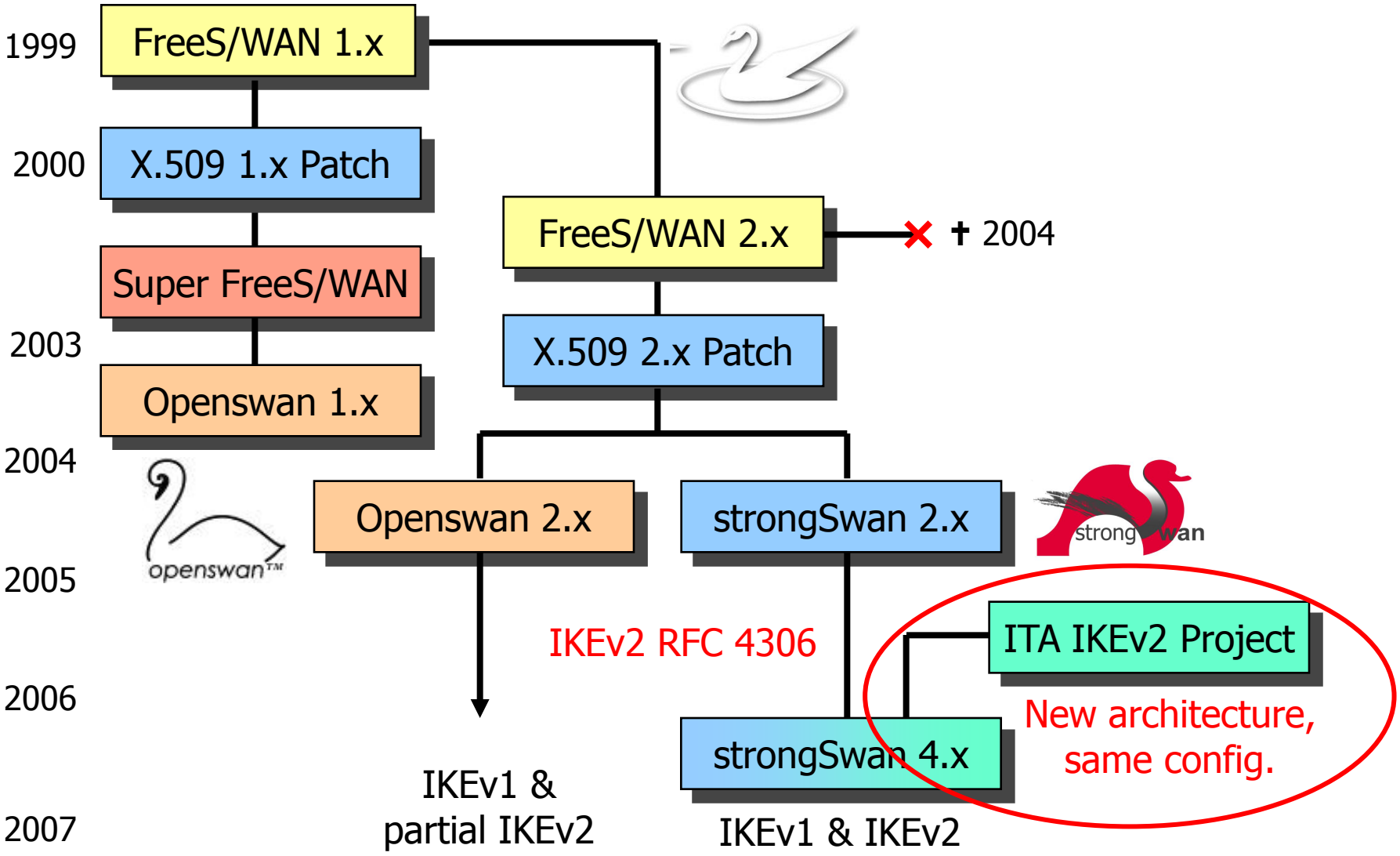
FHO Fachhochschule Ostschweiz

strongSwan Usage Scenarios



- strongSwan is an Internet Key Exchange Daemon responsible for automatically setting up IPsec-based VPN connections.

The FreeS/WAN Genealogy



IKEv2 Interoperability Workshops

Spring 2007 in Orlando, Florida
Spring 2008 in San Antonio, Texas

- strongSwan successfully interoperated with IKEv2 products from Alcatel-Lucent, Certicom, CheckPoint, Cisco, Furukawa, IBM, Ixia, Juniper, Microsoft, Nokia, SafeNet, Secure Computing, SonicWall, and the IPv6 TAHI Project.

strongSwan Key Customers

HSR HOCHSCHULE FÜR TECHNIK RAPPERSWIL
FHO Fachhochschule Ostschweiz

- Alcatel-Lucent, Clavister, Ericsson, Nokia Siemens Networks, Ubiquisys
  - Femtocells/Security Gateways for GSM/UMTS/LTE Mobile Networks
- Astaro
  - Astaro Security Gateway
- Secunet
  - SINA Box for High Security Applications (German Federal Government)
- U.S. Government
  - Open Source IKEv2/IPsec Reference and Test System for Suite B Elliptic Curve Cryptography

strongSwan Business Model

- Paid development of customer-specific add-ons
  - Features of general interest are released back into the main strongSwan distribution under the GPLv2 open source license
- Commercial licensing of the HSR-owned IKEv2 source code
  - Licensee is not obliged to disclose any proprietary modifications and add-ons to the IKEv2 strongSwan source code.

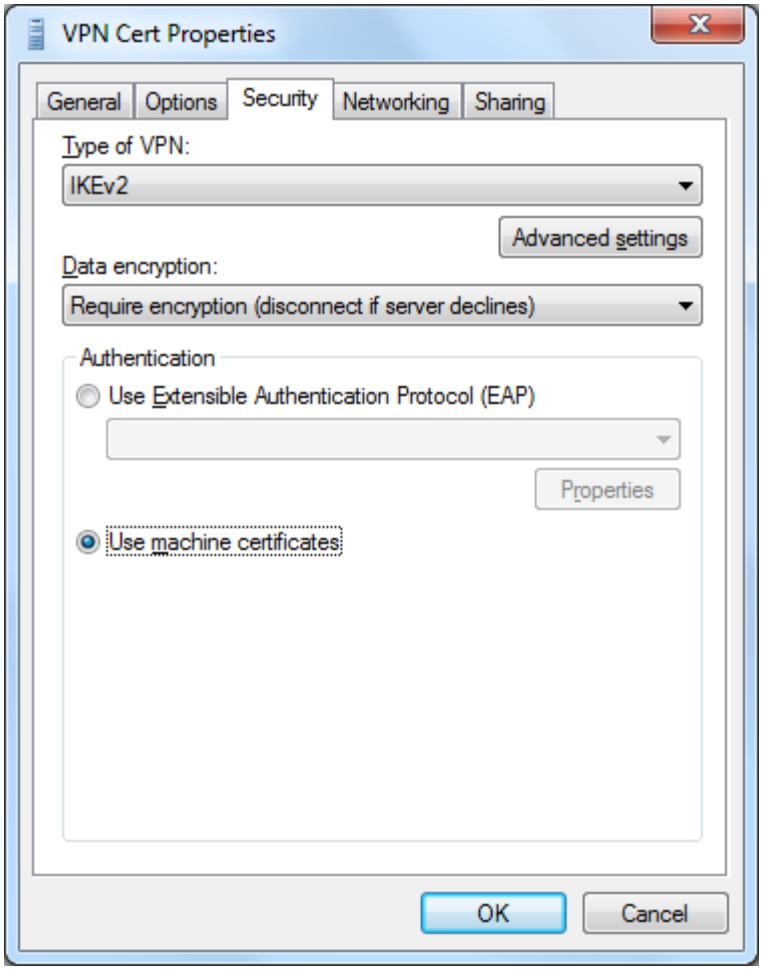
Supported Platforms

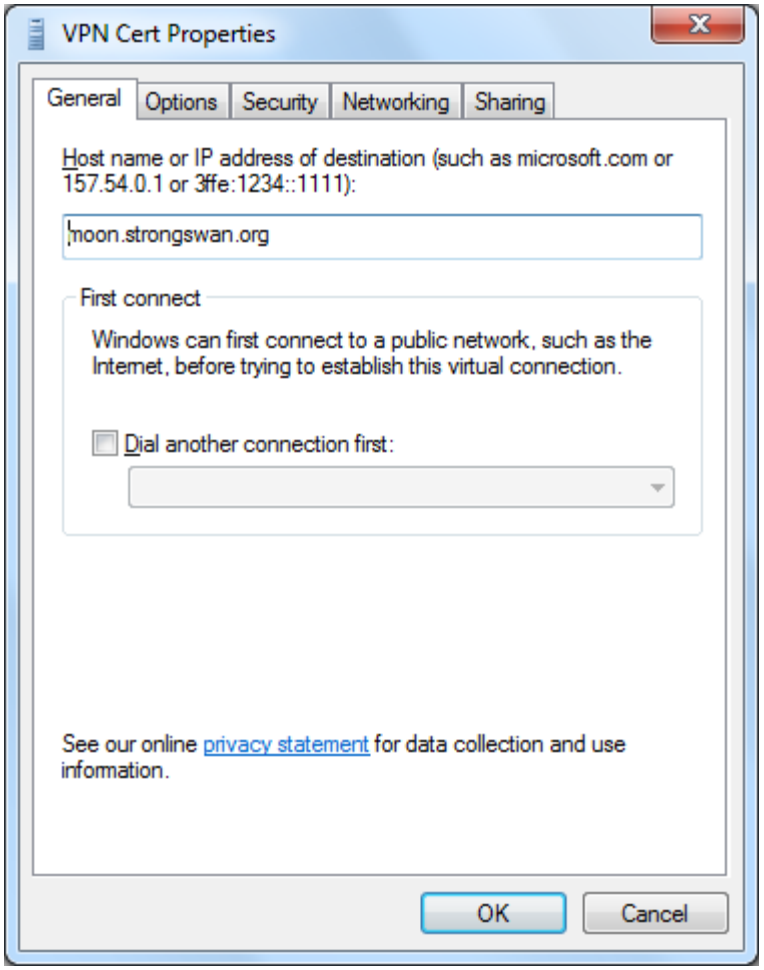
HSR HOCHSCHULE FÜR TECHNIK RAPPERSWIL
FHO Fachhochschule Ostschweiz

- Operating Systems
  - Linux
  - Android
  - FreeBSD
  - Mac OS X
- Hardware Platforms (32/64 bit)
  - Intel, Via, AMD
  - ARM, MIPS (e.g. Freescale, Marvell, 16-core Cavium Octeon)
  - PowerPC
- Networking Stack
  - IPv4
  - IPv6 (SuSE Linux Enterprise with strongSwan certified by DoD in 2008)
  - Mobile IPv4/IPv6
- Portable Source Code
  - 100% written in C but with an object-oriented modular approach
  - Performance scalability through extensive use of multi-threading

What about Windows?

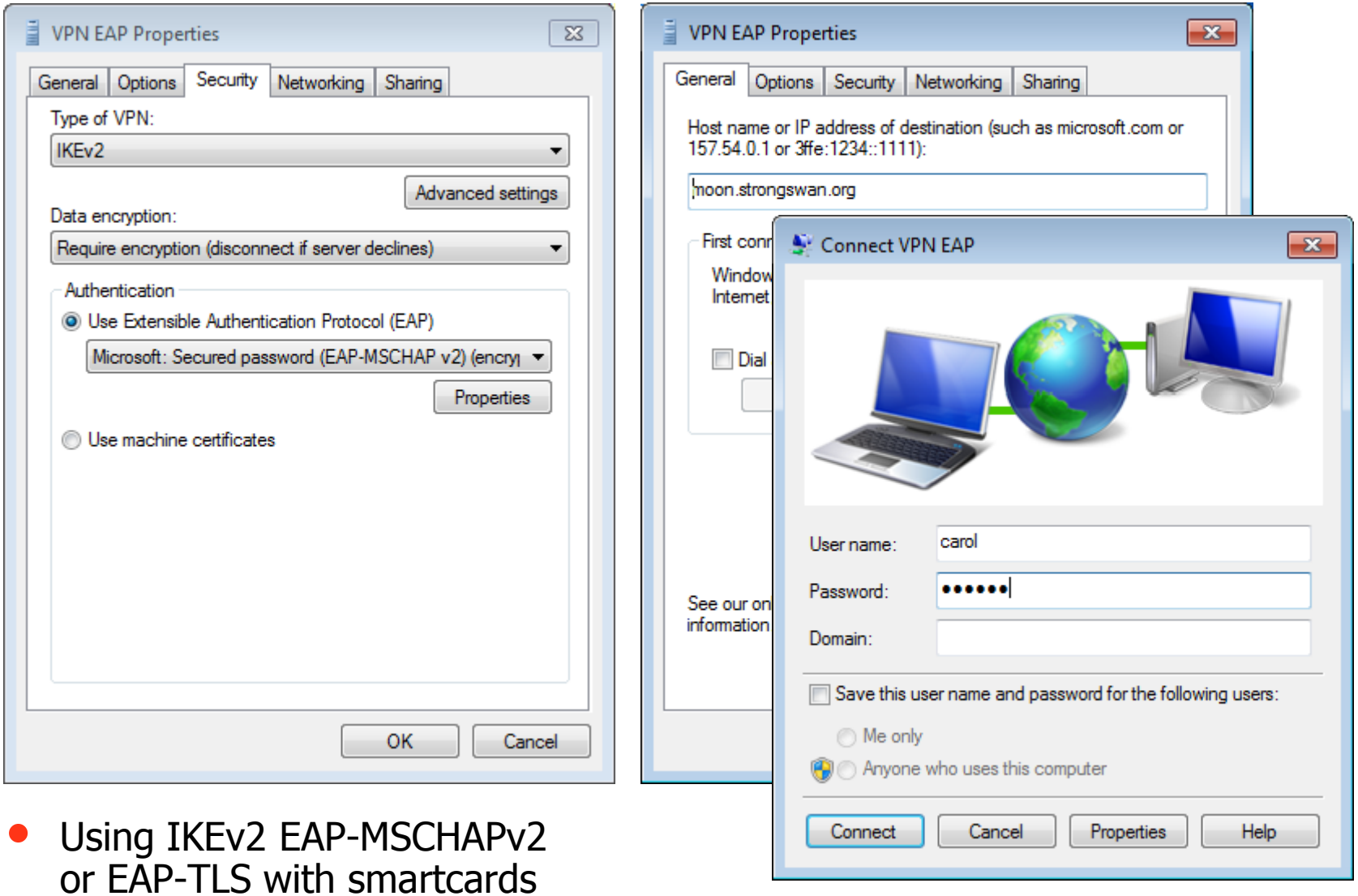
Windows 7 VPN with Machine Certificates





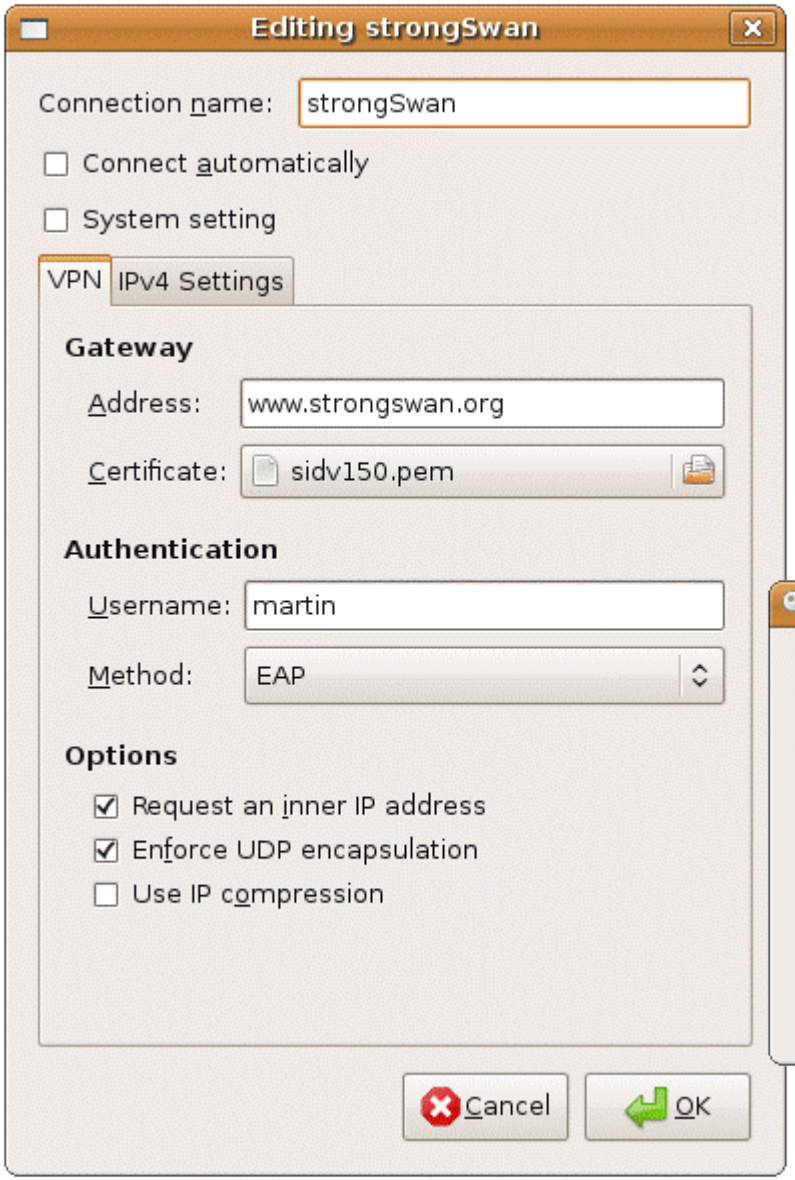
- Microsoft tested IKEv2 interoperability using strongSwan right up to the final Windows 7 release.

Windows 7 VPN with EAP Authentication



- Using IKEv2 EAP-MSCHAPv2 or EAP-TLS with smartcards

strongSwan Applet for the Linux Desktop



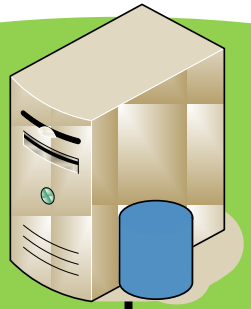
- D-Bus based communication.

strongSwan in a Mixed VPN Environment

HSR HOCHSCHULE FÜR TECHNIK RAPPERSWIL
FHO Fachhochschule Ostschweiz

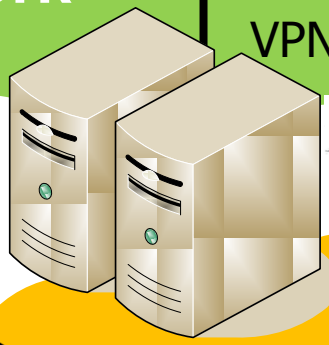
Windows Active Directory Server

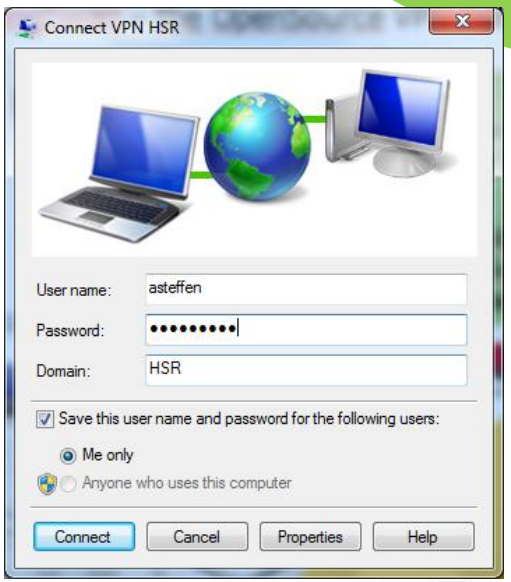
Linux FreeRadius Server



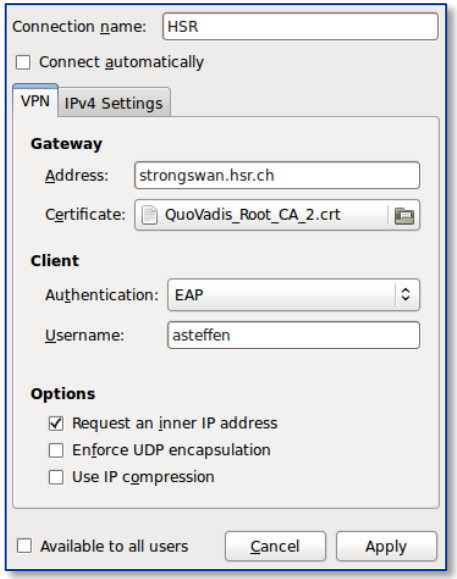
Corporate Network

High-Availability strongSwan VPN Gateway





Internet



Windows 7 Agile VPN Client

strongSwan Linux Client

IKEv2 Authentication Methods

HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL
FHO Fachhochschule Ostschweiz

- Based on Public Keys
  - X.509 certificates with RSA or ECDSA keys
  - PKCS#11 smartcard interface
  - CRLs via HTTP/LDAP, OCSP
- Based on Pre-Shared Keys (PSK)
  - Arbitrary PSK length, beware of weak secrets!
- Based on the Extended Authentication Protocol (EAP)
  - EAP-MD5, EAP-MSCHAPv2, EAP-GTC
  - EAP-SIM, EAP-AKA (GSM/UMTS/CDMA2000)
  - EAP-TLS, EAP-TTLS, EAP-PEAPv0
- Interface to AAA Server
  - EAP-RADIUS
- EAP and TNC Methods implemented as Plugins
  - strongSwan IKEv2 daemon loads plugins at run-time

The strongSwan IPsec Solution with TNC Support

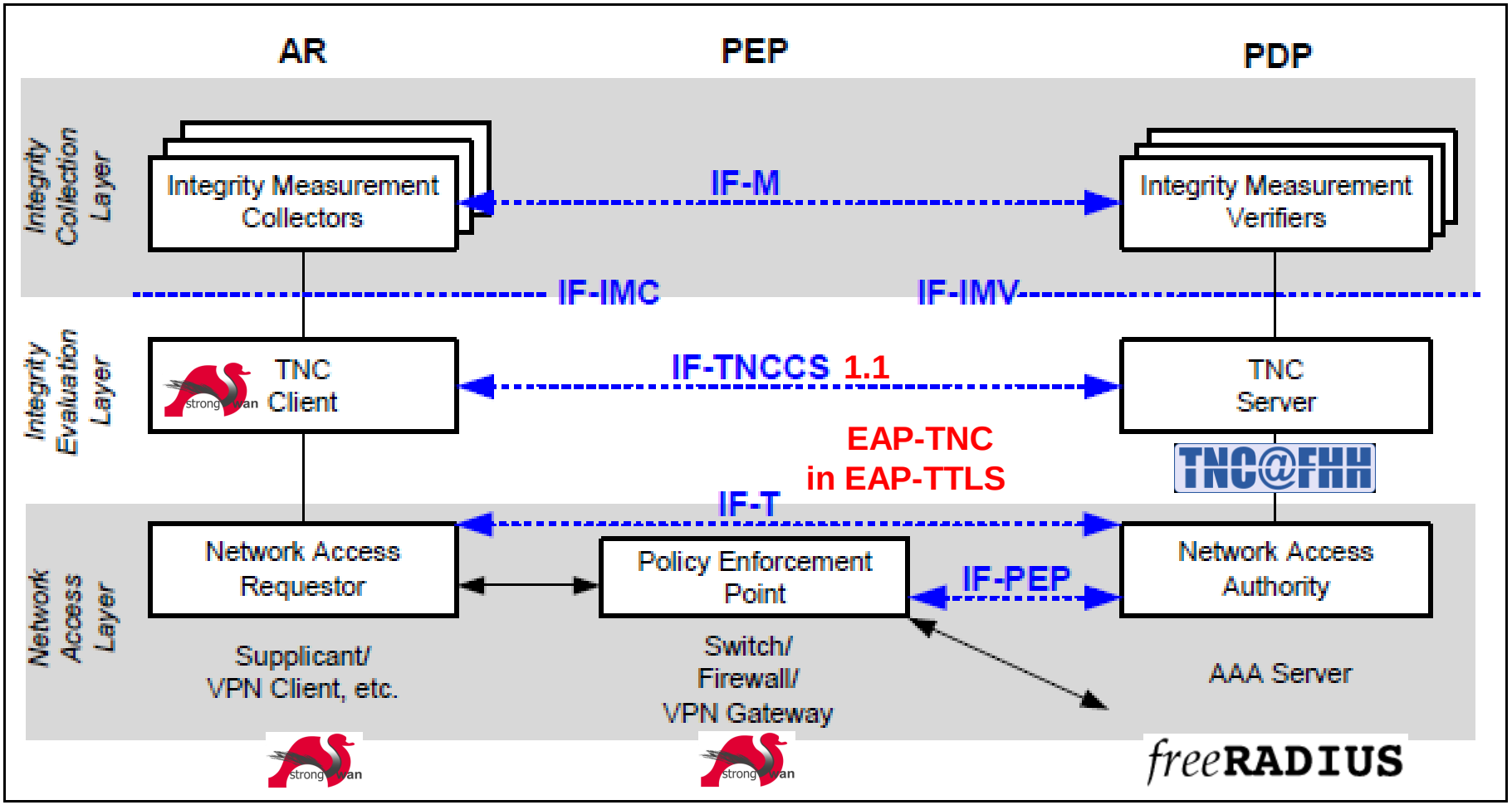
TCG Members Meeting June 2011 Munich

Trusted Network Connect Capabilities

HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL

FHO Fachhochschule Ostschweiz

strongSwan as a TNC client and PEP



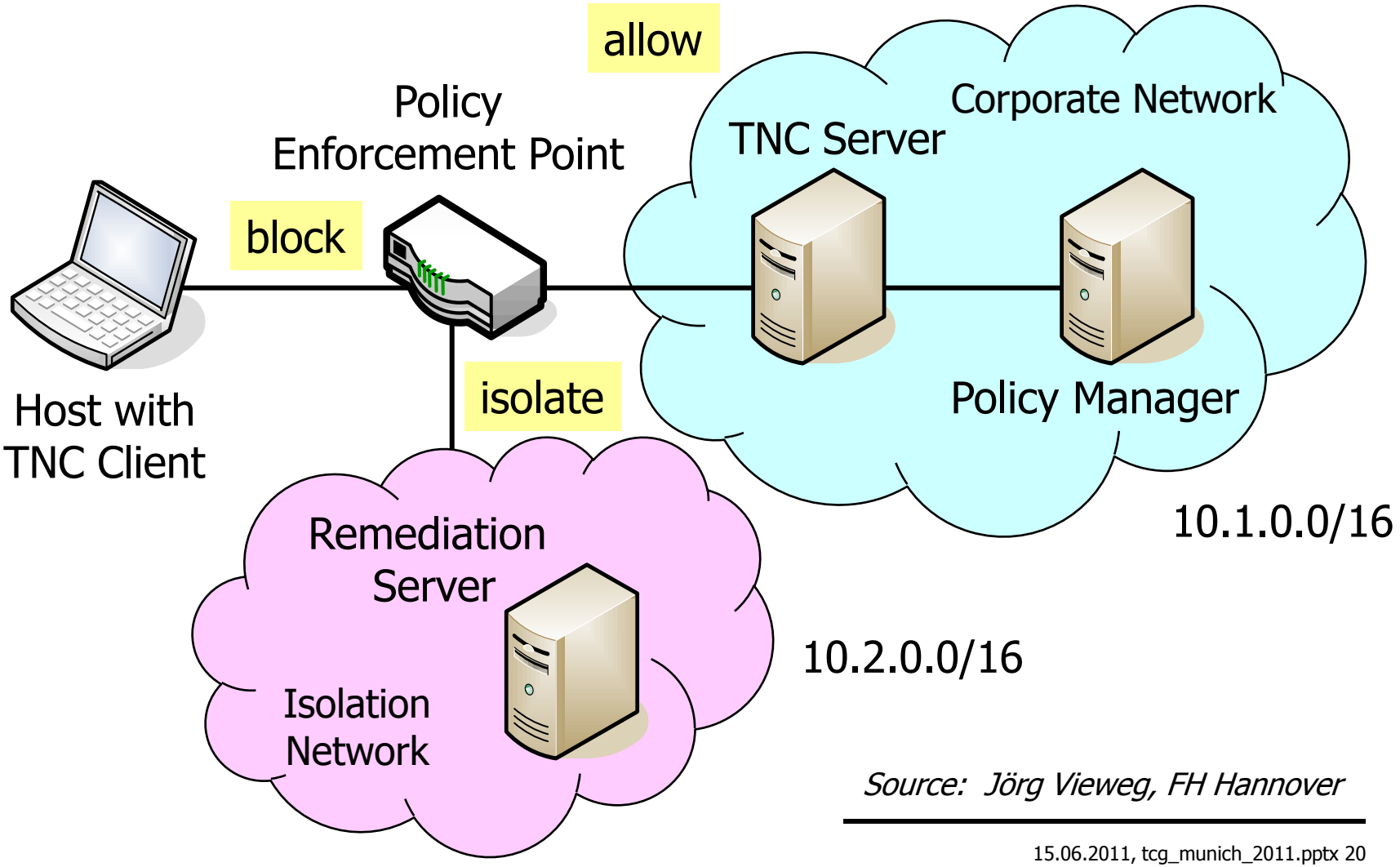
IF-TNCCS-1.1 Protocol on the TNC Client Side

HSR HOCHSCHULE FÜR TECHNIK RAPPERSWIL
FHO Fachhochschule Ostschweiz

```
13[TNC] sending TNCCS Batch (633 bytes) for Connection ID 1
13[TNC] <?xml version="1.0"?>
13[TNC] <TNCCS-Batch BatchId="1" Recipient="TNCS"...>
13[TNC] <TNCC-TNCS-Message>
13[TNC] <Type>00000003</Type>
13[TNC] <XML>
13[TNC] <TNCCS-PreferredLanguage>en</TNCCS-PreferredLanguage>
13[TNC] </XML>
13[TNC] </TNCC-TNCS-Message>
13[TNC] <IMC-IMV-Message>
13[TNC] <Type>0080ab31</Type>
13[TNC] <Base64>RHVtbXlJTUMgbWVzc2FnZSAwLCBhY3Rpb24gPSBhbGxvdw==</Base64>
13[TNC] </IMC-IMV-Message>
13[TNC] </TNCCS-Batch>
13[IKE] sending tunneled EAP-TTLS AVP [EAP/RES/TNC]
13[ENC] generating IKE_AUTH request 7 [ EAP/RES/TTLS ]
13[NET] sending packet: from 192.168.0.100[4500] to 192.168.0.1[4500]

15[NET] received packet: from 192.168.0.1[4500] to 192.168.0.100[4500]
15[ENC] parsed IKE_AUTH response 7 [ EAP/REQ/TTLS ]
15[IKE] received tunneled EAP-TTLS AVP [EAP/REQ/TNC]
15[TNC] received TNCCS Batch (473 bytes) for Connection ID 1
15[TNC] <?xml version="1.0"?>
15[TNC] <TNCCS-Batch BatchId="2" Recipient="TNCC„...>
15[TNC] <IMC-IMV-Message>
15[TNC] <Type>0080ab31</Type>
15[TNC] <Base64>RHVtbXlJTVYgdG8gRHVtbXlJTUMgbWVzc2FnZSAx</Base64>
15[TNC] </IMC-IMV-Message>
15[TNC] </TNCCS-Batch>
```

TNC Policy Enforcement



Source: Jörg Vieweg, FH Hannover

strongSwan Configuration on the PEP side

HSR HOCHSCHULE FÜR TECHNIK RAPPERSWIL
FHO Fachhochschule Ostschweiz

```
conn rw-allow
     rightgroups=allow
     leftsubnet=10.1.0.0/16
     also=rw-eap
     auto=add
```

```
conn rw-isolate
     rightgroups=isolate
     leftsubnet=10.2.0.0/16
     also=rw-eap
     auto=add
```

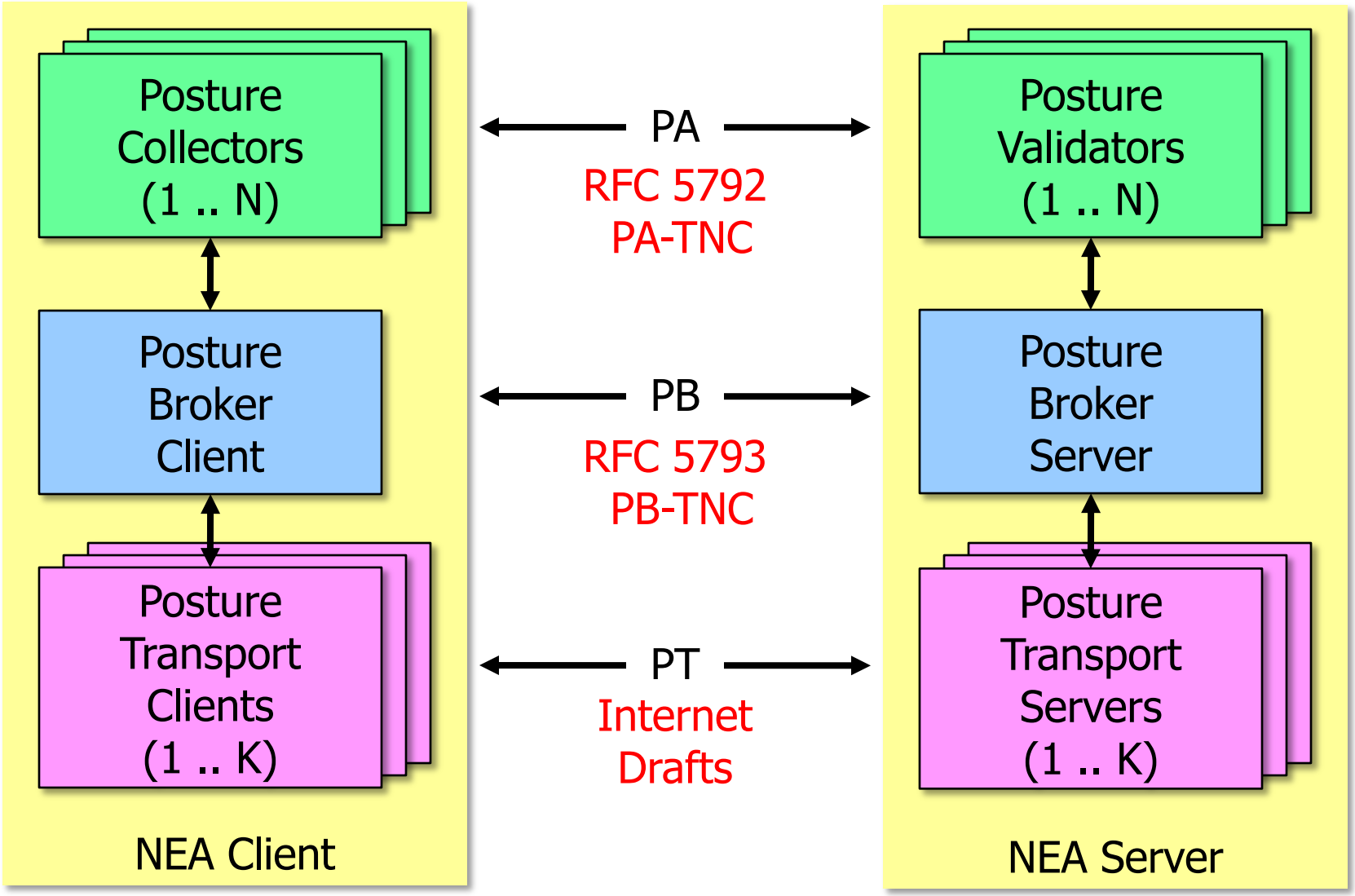
```
conn rw-eap
     left=192.168.0.1
     leftcert=moonCert.pem
     leftid=@moon.strongswan.org
     leftauth=eap-ttls
     leftfirewall=yes
     rightauth=eap-radius
     rightid=*@strongswan.org
     rightsendcert=never
     right=%any
```

IF-PEP Protocol on the strongSwan PEP

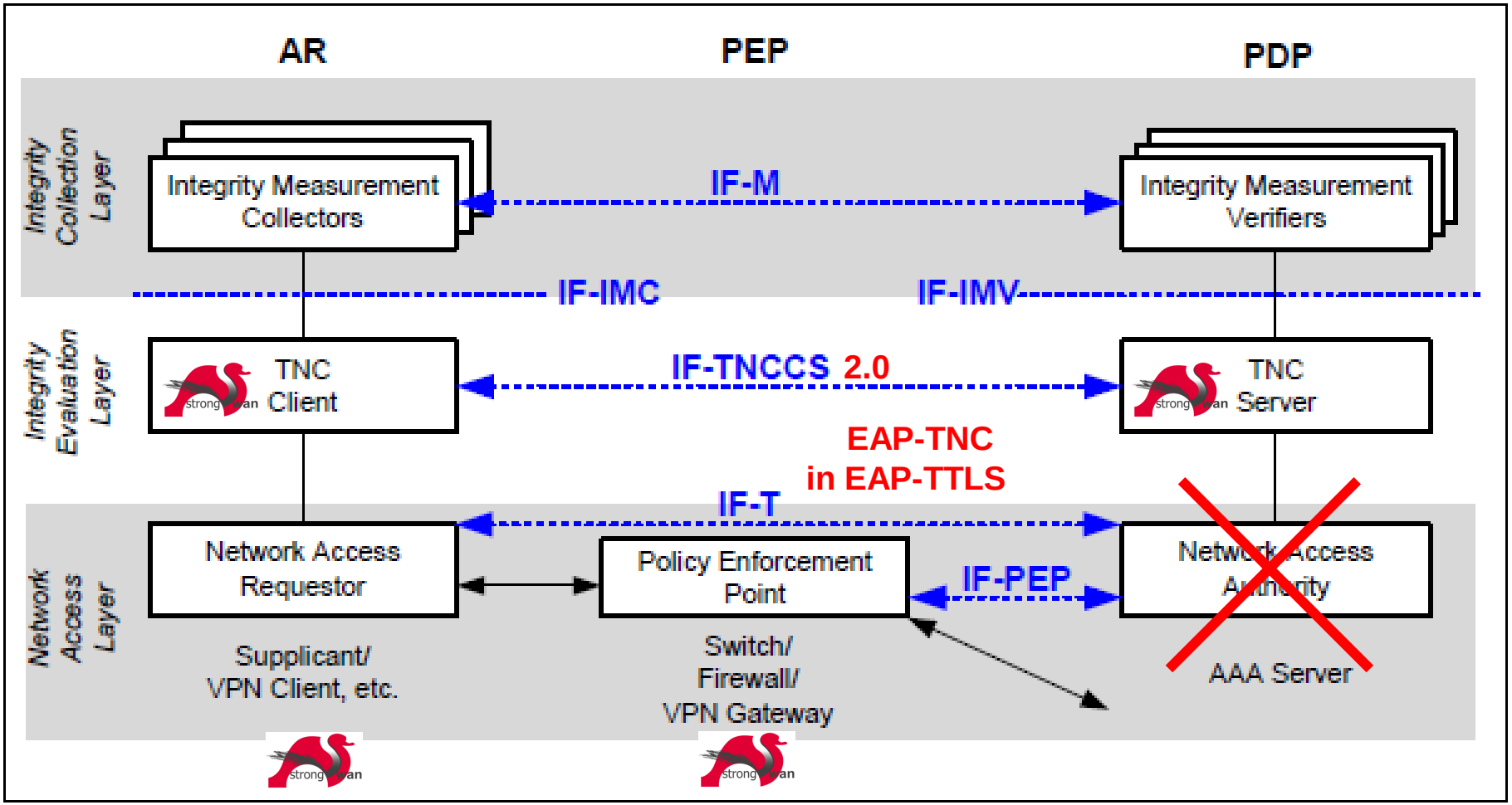
HSR HOCHSCHULE FÜR TECHNIK RAPPERSWIL
FHO Fachhochschule Ostschweiz

```
05[CFG] received RADIUS Access-Accept from server '10.1.0.10'
05[IKE] received RADIUS attribute Tunnel-Type: tag = 0, value = 9
05[IKE] received RADIUS attribute Filter-Id: 'allow'
05[IKE] RADIUS authentication of 'carol@strongswan.org' successful
05[IKE] EAP method EAP_TTLS succeeded, MSK established
05[ENC] generating IKE_AUTH response 11 [ EAP/SUCC ]
05[NET] sending packet: from 192.168.0.1[4500] to 192.168.0.100[4500]
04[NET] received packet: from 192.168.0.100[4500] to 192.168.0.1[4500]
04[ENC] parsed IKE_AUTH request 12 [ AUTH ]
04[IKE] authentication of 'carol@strongswan.org' with EAP successful
04[IKE] authentication of 'moon.strongswan.org' (myself) with EAP
04[IKE] IKE_SA rw-allow[1] established between
       192.168.0.1[moon.strongswan.org]...192.168.0.100[carol@strongswan.org]
02[CFG] received RADIUS Access-Accept from server '10.1.0.10'
02[IKE] received RADIUS attribute Tunnel-Type: tag = 0, value = 9
02[IKE] received RADIUS attribute Filter-Id: 'isolate'
02[IKE] RADIUS authentication of 'dave@strongswan.org' successful
02[IKE] EAP method EAP_TTLS succeeded, MSK established
02[ENC] generating IKE_AUTH response 11 [ EAP/SUCC ]
02[NET] sending packet: from 192.168.0.1[4500] to 192.168.0.200[4500]
01[NET] received packet: from 192.168.0.200[4500] to 192.168.0.1[4500]
01[ENC] parsed IKE_AUTH request 12 [ AUTH ]
01[IKE] authentication of 'dave@strongswan.org' with EAP successful
01[CFG] constraint check failed: group membership required
01[CFG] selected peer config 'rw-allow' inacceptable
01[CFG] switching to peer config 'rw-isolate,
01[IKE] authentication of 'moon.strongswan.org' (myself) with EAP
01[IKE] IKE_SA rw-isolate[2] established between
        192.168.0.1[moon.strongswan.org]...192.168.0.200[dave@strongswan.org]
```

Network Endpoint Assessment (RFC 5209)



strongSwan as a TNC client and TNC server



TNCCS-2.0 Protocol on the TNC Client Side

HSR HOCHSCHULE FÜR TECHNIK RAPPERSWIL
FHO Fachhochschule Ostschweiz

```
13[TNC] creating PB-PA message type 'ITA-HSR' 0x00902a/0x01
13[TNC] adding PB-PA message
13[TNC] PB-TNC state transition from 'Init' to 'Server Working'
13[TNC] sending PB-TNC CDATA batch (88 bytes) for Connection ID 1
13[TNC] => 88 bytes @ 0x8081044
13[TNC] 0: 02 00 00 01 00 00 00 58 00 00 00 00 00 00 00 06 .......X........
13[TNC] 16: 00 00 00 1F 41 63 63 65 70 74 2D 4C 61 6E 67 75 ....Accept-Langu
13[TNC] 32: 61 67 65 3A 20 65 6E 80 00 00 00 00 00 00 01 00 age: en.........
13[TNC] 48: 00 00 31 00 00 90 2A 00 00 00 01 00 01 FF FF 01 ..1...*......... J
13[TNC] 64: 00 00 00 C1 2E D6 2F 80 00 90 2A 00 00 00 01 00 ....../...*.....
13[TNC] 80: 00 00 11 61 6C 6C 6F 77 ...allow
13[IKE] sending tunneled EAP-TTLS AVP [EAP/RES/TNC]
13[ENC] generating IKE_AUTH request 7 [ EAP/RES/TTLS ]
13[NET] sending packet: from 192.168.0.100[4500] to 192.168.0.1[4500]

14[NET] received packet: from 192.168.0.1[4500] to 192.168.0.100[4500]
14[ENC] parsed IKE_AUTH response 7 [ EAP/REQ/TTLS ]
14[IKE] received tunneled EAP-TTLS AVP [EAP/REQ/TNC]
14[TNC] received TNCCS batch (58 bytes) for Connection ID 1
14[TNC] => 58 bytes @ 0x8080fee
14[TNC] 0: 02 80 00 02 00 00 00 3A 80 00 00 00 00 00 00 01 .......:........
14[TNC] 16: 00 00 00 32 00 00 90 2A 00 00 00 01 FF FF 00 01 ...2...*........ J
14[TNC] 32: 01 00 00 00 2C 40 A0 6C 00 00 90 2A 00 00 00 01 ....,@.l...*....
14[TNC] 48: 00 00 00 12 72 65 70 65 61 74 ....repeat
14[TNC] PB-TNC state transition from 'Server Working' to 'Client Working'
14[TNC] processing PB-TNC SDATA batch
14[TNC] processing PB-PA message (50 bytes)
14[TNC] handling PB-PA message type 'ITA-HSR' 0x00902a/0x01
```

Current Work

HSR HOCHSCHULE FÜR TECHNIK RAPPERSWIL
FHO Fachhochschule Ostschweiz

- TCG Certification of IF-IMC, IF-IMV, and IF-PEP Interfaces
  - Participation at the TNC 2011 Spring PlugFest in Chantilly, VA
  - Passed IF-IMC and IF-IMV compliance test suites
  - IF-PEP layer 2 VLAN test suite must first be adapted for layer 3 VPN
- IMC/IMV Test Pair with IF-M (RFC 5792 PA-TNC) Interface
  - Available now as strongSwan developers release
  - Stable strongSwan 4.5.3 release expected in July 2011 .

```
13[TNC] creating PA-TNC message with ID 0xc12ed62f
13[TNC] creating PA-TNC attribute type 'ITA-HSR' 0x00902a/0x00000001
13[TNC] => 5 bytes @ 0x808123c
13[TNC] 0: 61 6C 6C 6F 77 allow
13[TNC] creating PB-PA message type 'ITA-HSR' 0x00902a/0x01
```

```
14[TNC] handling PB-PA message type 'ITA-HSR' 0x00902a/0x01
14[TNC] processing PA-TNC message with ID 0x2c40a06c
14[TNC] processing PA-TNC attribute type 'ITA-HSR' 0x00902a/0x00000001
14[TNC] => 6 bytes @ 0x8080568
14[TNC] 0: 72 65 70 65 61 74 repeat
```

Future Work

HSR HOCHSCHULE FÜR TECHNIK RAPPERSWIL
FHO Fachhochschule Ostschweiz

- Implementation of PTS protocol binding to IF-M
  - HSR student Sansar Choinyambuu, implementor of the strongSwan IF-TNCCS 2.0 interface who is now working on TPM-based remote attestation is going to tackle the

    Platform Trust Service (PTS) protocol binding to IF-M

    as part of her Master Thesis.
- Ultimate Goal: Full support of PTS attestation
  - Stable strongSwan release with PTS attestation support expected in Q1 2012 .

Thank you for your attention!

Questions?

www.strongswan.org/tnc/