Working principle, attacks and defenses of SSL/TLS

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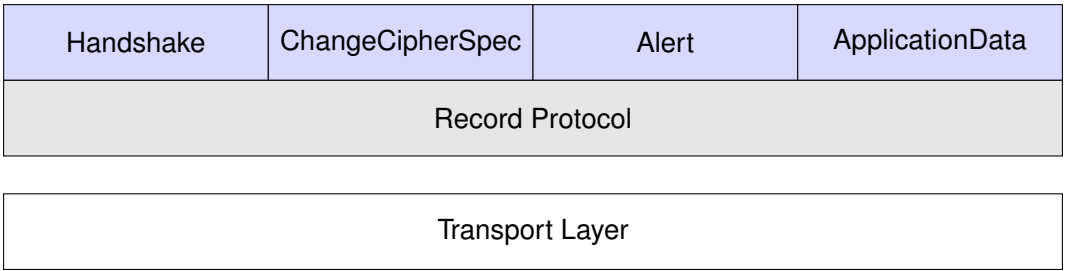
DER FORSCHUNG | DER LEHRE | DER BILDUNG

Motivation TLS

- security protocol above the transport layer of the OSI model
- provides authentication of communication partners, encryption and integrity check of sent messages
- used by many higher layer protocols and applications
- SSL/TLS is the most used security protocol today. [1]

[1] [Jörg Schwenk. Sicherheit und Kryptographie im Internet. 4. Auflage Springer Vieweg, 2014.

Protocol hierarchie



Fundamental ideas

long-lasting principles, which are applicable or observable in multiple contexts.

Andreas Schwill. Computer Science Education based on Fundamental Ideas. *http://ddi.uni-muenster.de/didaktik/Forschung/Israel97.pdf* (Retrieved 07.1.2016)

Examples:

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- hybrid cryptosystems

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- hybrid cryptosystems
- authenticated key exchange

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- side-channel attacks

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Examples:

- hybrid cryptosystems
- authenticated key exchange
- side-channel attacks
- cryptographic principles, e.g. unpredictable IVs

Discovery learning with simulations

Discovery learning (also **exploratory learning**)

learning by interacting with the world by exploring and manipulating objects and performing experiments.

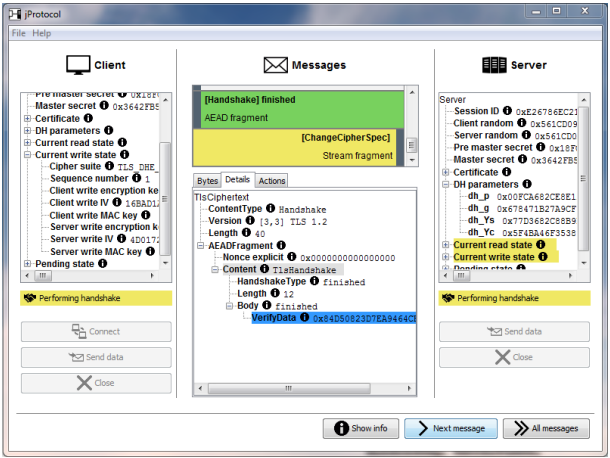
J. S. Bruner. On Knowing: Essays for the left hand. Harvard University press, 1979.

Simulations

interactive computer programs modelling activities, which enable us to observe normally hidden processes.

Helmut M. Niegemann et al. Kompendium multimediales Lernen. Springer, 2008.

Live demo


jProtocol
File Help
Client
Messages
Server
[Handshake] finished
AEAD fragment
[ChangeCipherSpec]
Stream fragment
Bytes Details Actions
TlsCiphertext
ContentType Handshake
Version [3,3] TLS 1.2
Length 40
AEADFragment
Nonce explicit 0x0000000000000000
Content TlsHandshake
HandshakeType finished
Length 12
Body finished
VerifyData 0x84D50823D7EA9464C
Server
Session ID 0xE26786EC21
Client random 0x561CD09
Server random 0x561CD0
Pre master secret 0x18F
Master secret 0x3642FB5
Certificate
DH parameters
dh_p 0x00FCA682CE8E1
dh_g 0x678471B27A9CF
dh_Ys 0x77D3682C88B9
dh_Yc 0x5F4BA46F3538
Current read state
Current write state
Performing handshake
Connect
Send data
Close
Show info
Next message
All messages

Possible next steps

- Unimplemented in TLS plugin
  - certificate validation
  - session resumption
  - client authentication
  - TLS extensions
- Implement other protocols

Thank you!