Secure connections

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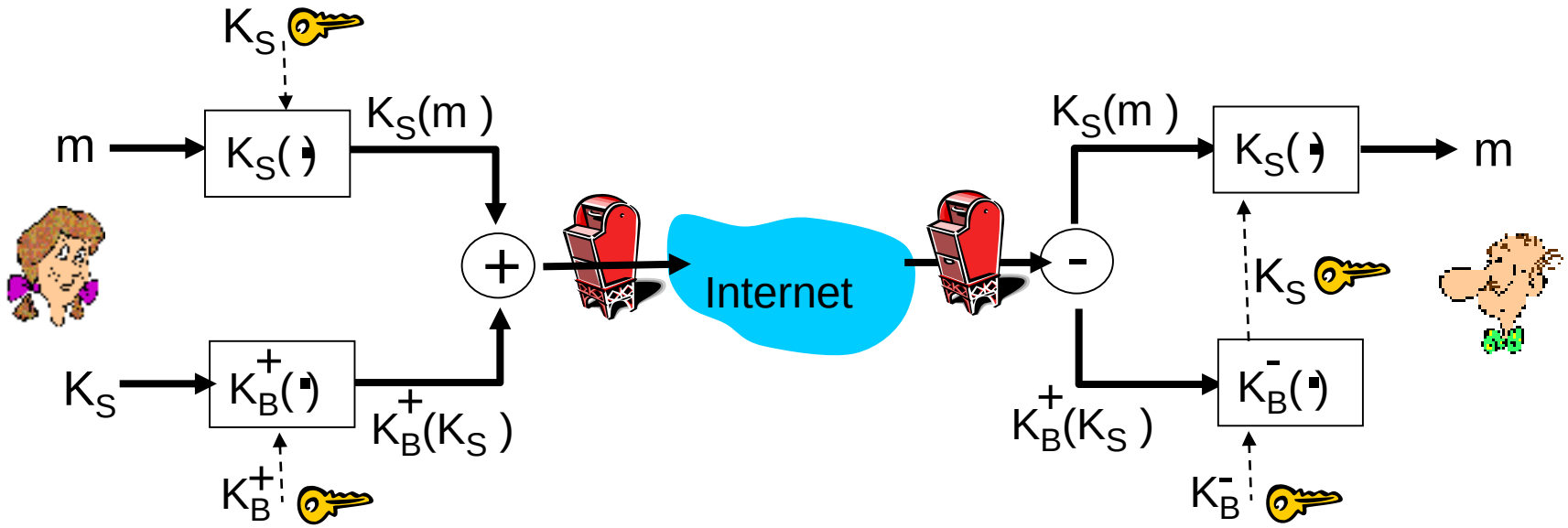
Secure connections examples

Application Layer	Email – Pretty Good Privacy
Transport Layer	Secure Socket Layer
Network Layer	Ipsec (VPN)
DataLink Layer	Wifi – WEP (not part of curriculum)
Physical Layer	N/A

Secure Application layer
email - PGP (Pretty Good Privacy)

Alice wants to

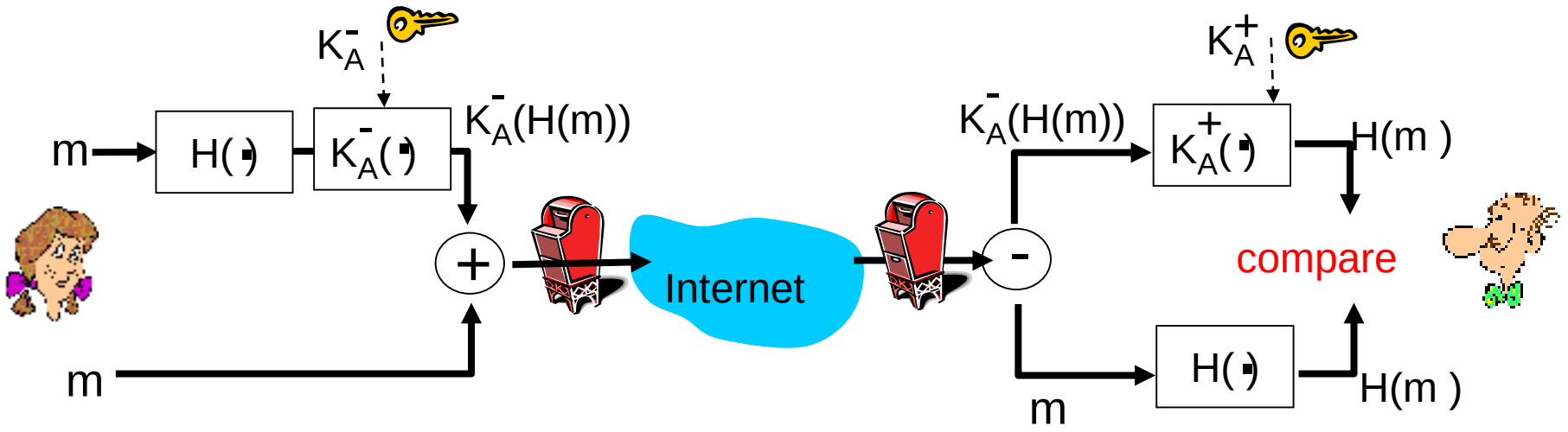
send confidential e-mail, m, to Bob



Secure Application layer
email - PGP (Pretty Good Privacy)

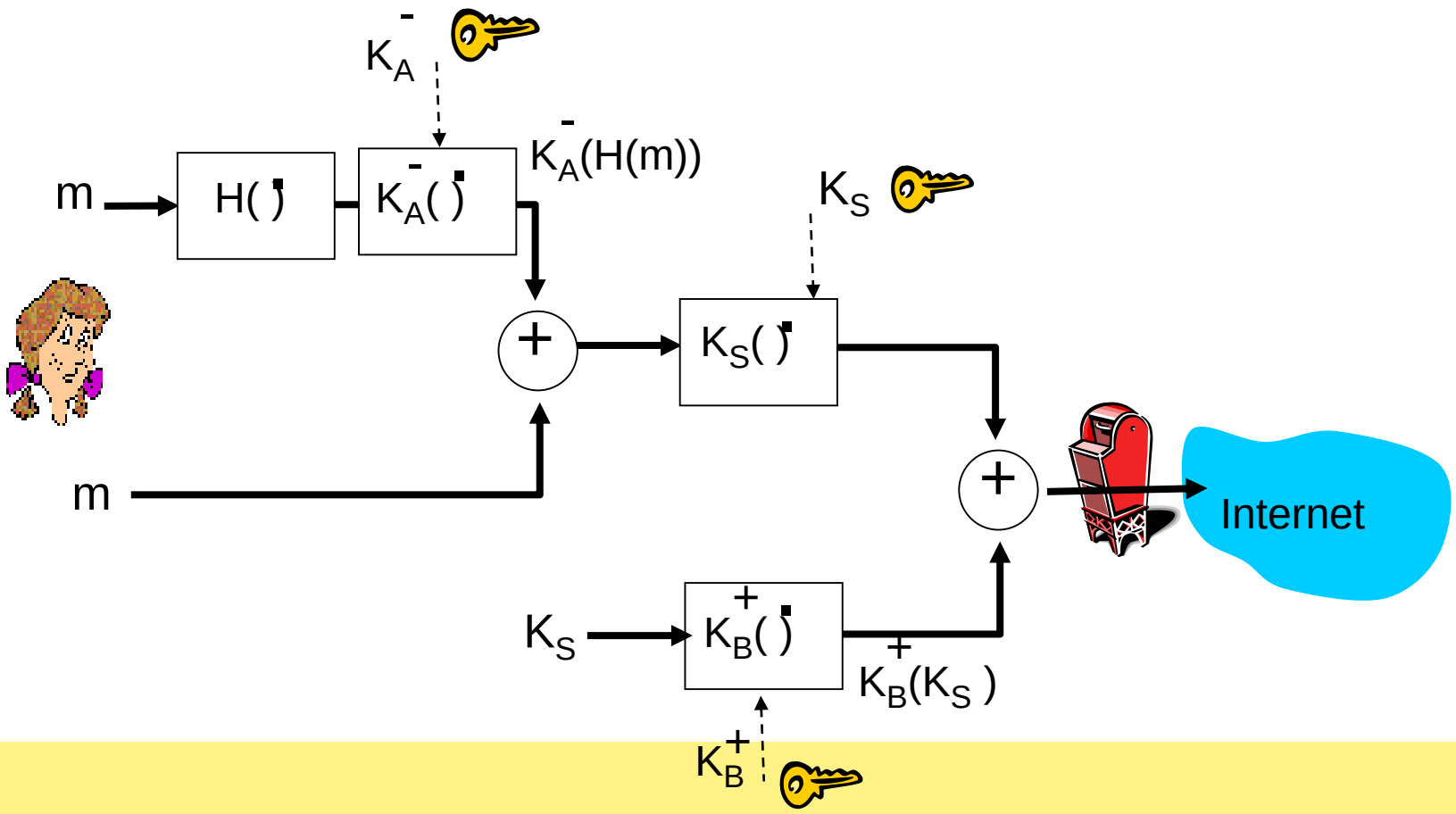
Alice wants to provide

sender authentication message integrity



Secure Application layer
email - PGP (Pretty Good Privacy)

Alice wants to provide sender authentication message integrity and a confidential email

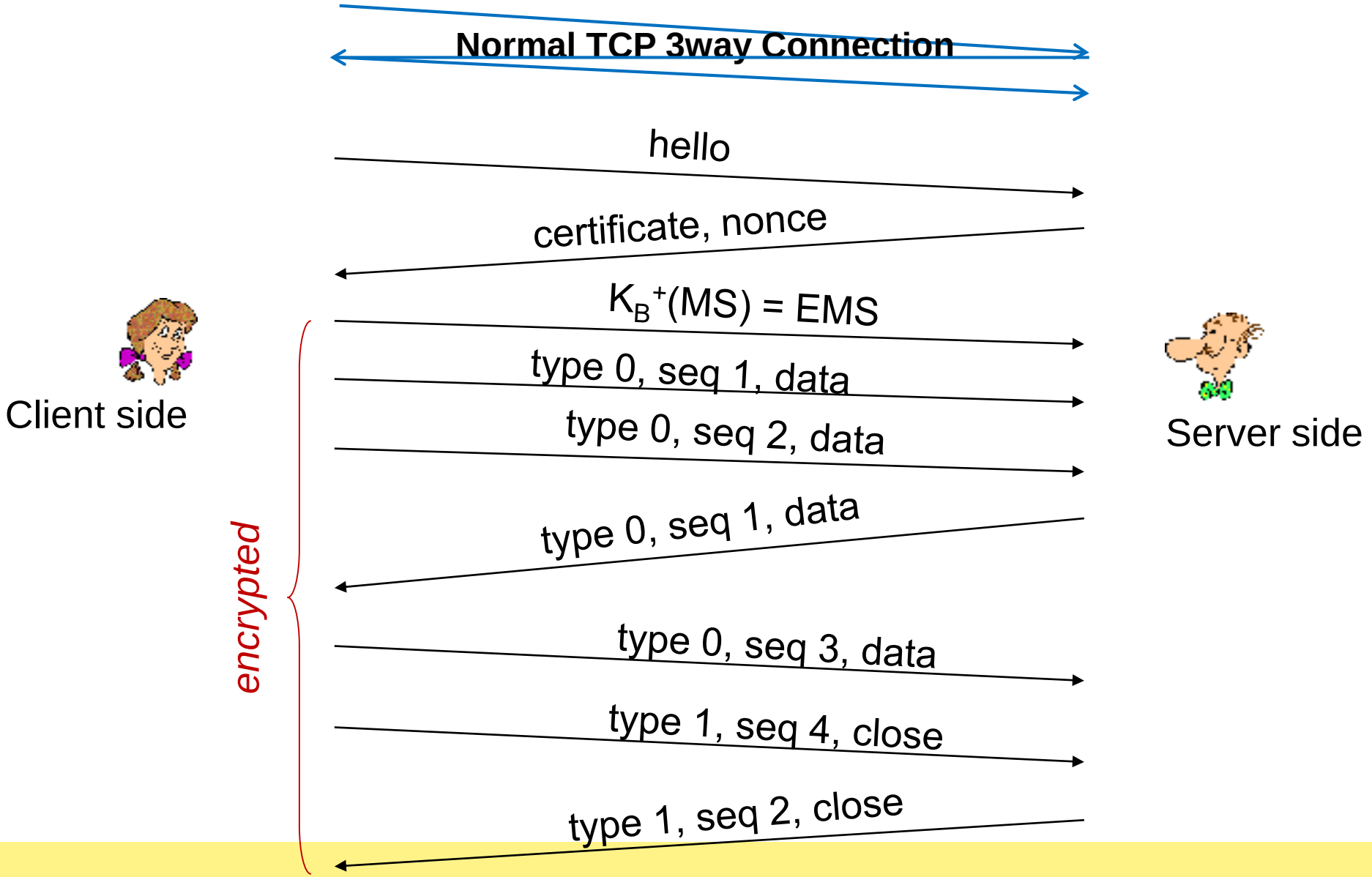


Secure Transport layer - Secure Socket Layer (SSL)

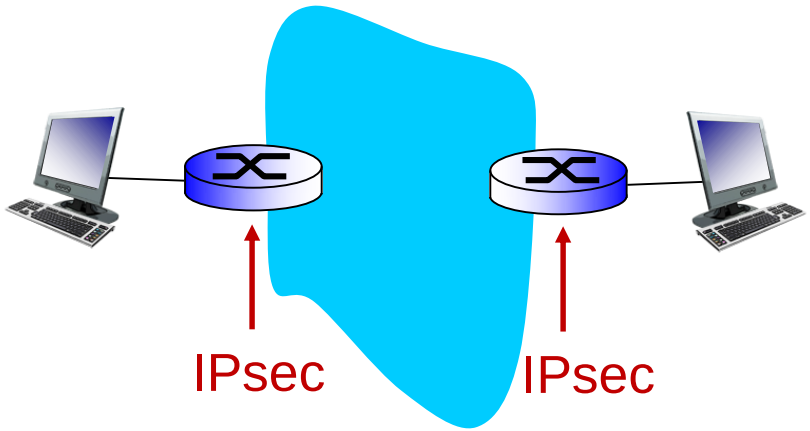
- SSL support Confidential (HTTP**S** is based on SSL)
- SSL ***can*** *support Integrity*

- Four keys (part of EMS – Encrypted Master Secret):
  - K_c = encryption key for data sent from client to server
  - M_c = MAC key for data sent from client to server
  - K_s = encryption key for data sent from server to client
  - M_s = MAC key for data sent from server to client

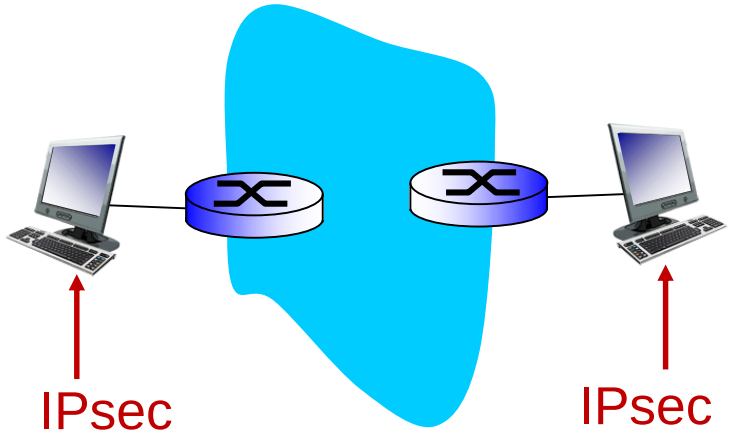
Secure Transport layer - Secure Socket Layer (SSL)



Secure Network layer
IPsec (Virtual Private Network - VPN)



- edge routers IPsec-aware (tunnel)



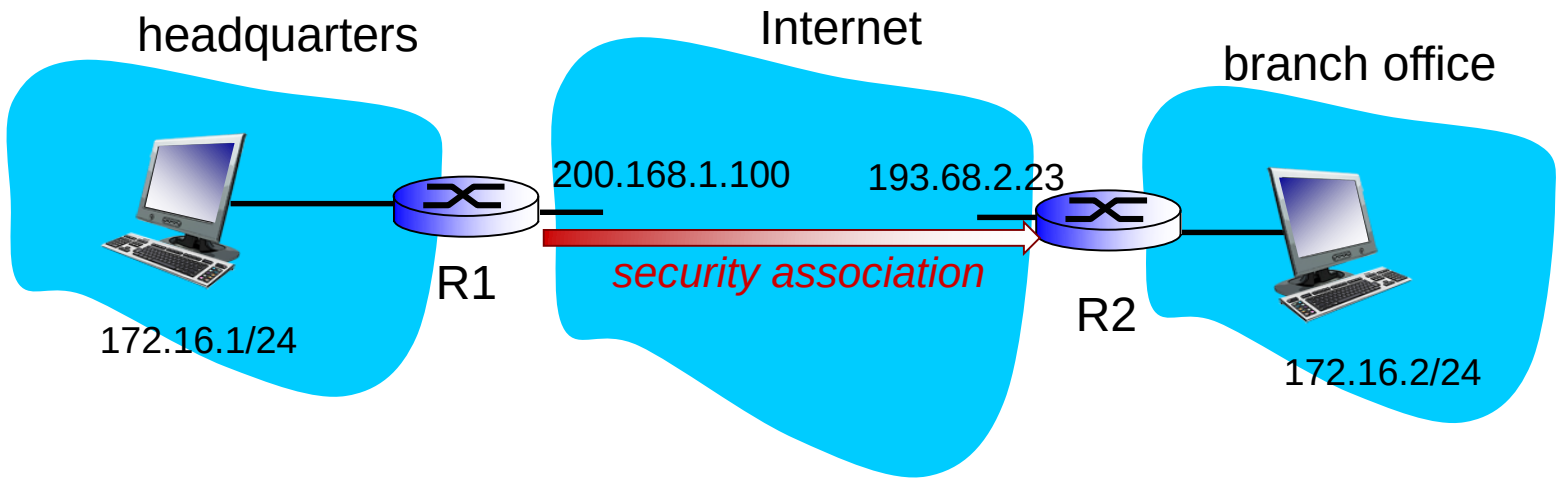
- hosts IPsec-aware

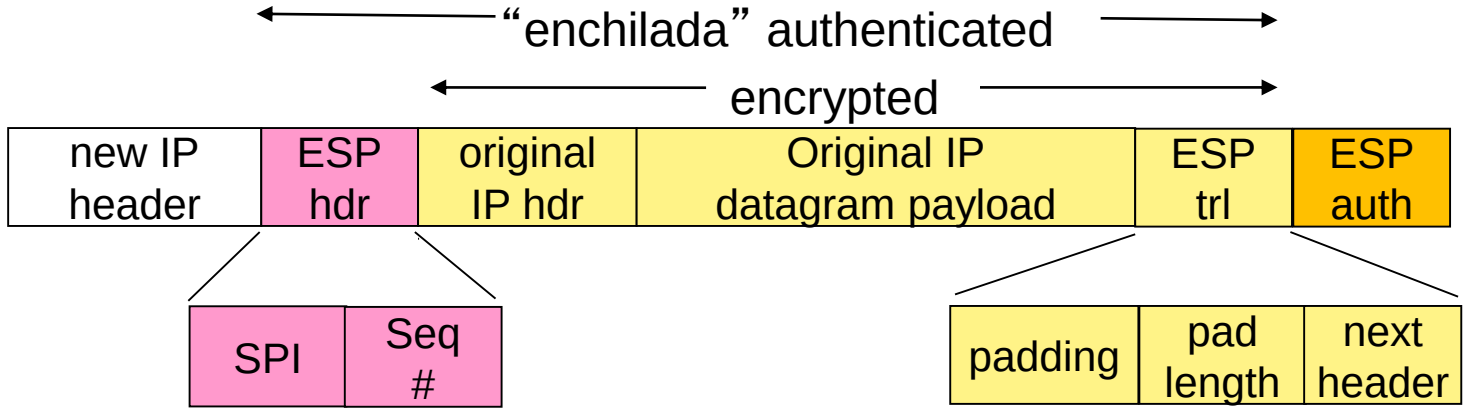
Secure Network layer
IPsec (Virtual Private Network - VPN)

- **Authentication Header (AH)** protocol
  - provides source authentication & data integrity but *not* confidentiality
- **Encapsulation Security Protocol (ESP)**
  - provides source authentication, data integrity, *and confidentiality*
  - more widely used than AH

IPsec (Virtual Private Network - VPN)

SA – or VPN as tunnel - the most often used security at Network layer





Secure DataLink layer
WEP - Wired Equivalent Privacy

authentication request

nonce (128 bytes)

nonce encrypted shared key

success if decrypted value equals nonce

Not very secure ! – use WPA/WPA2 -- Wifi Protected Access

Secure DataLink layer
EAP- Extensible Authentication Protocol