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SUBJECT - NETWORK SECURITY NA DCRYPTOLOGY

TITLE – IP SECURITY

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IP Security



IP Security

- have considered some application specific security mechanisms
 - eg. S/MIME, PGP, Kerberos, SSL/HTTPS
- however there are security concerns that cut across protocol layers
- would like security implemented by the network for all applications

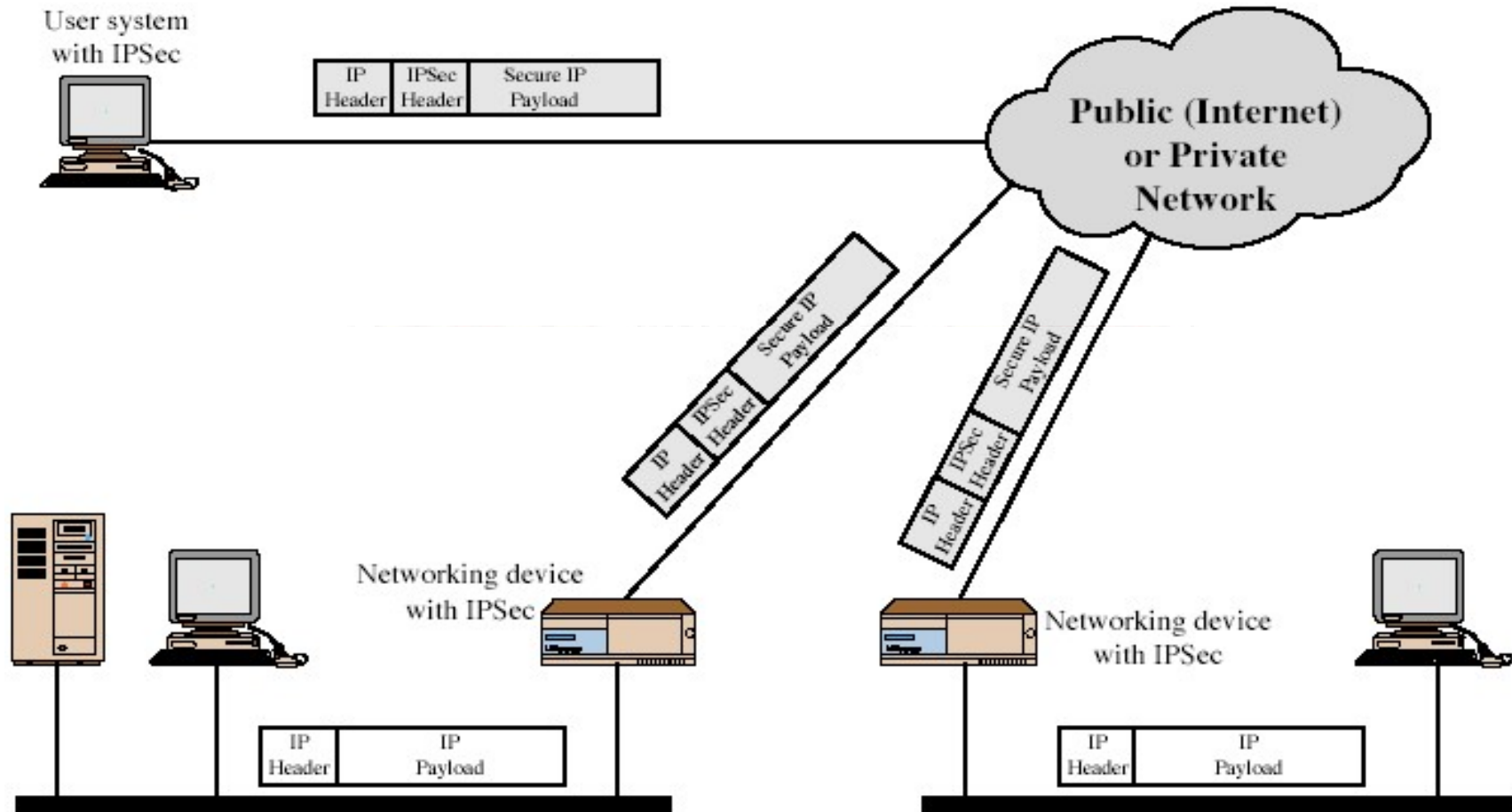


IPSec

- general IP Security mechanisms
- provides
 - authentication
 - confidentiality
 - key management
- applicable to use over LANs, across public & private WANs, & for the Internet



IPSec Uses





Benefits of IPSec

- in a firewall/router provides strong security to all traffic crossing the perimeter
- is resistant to bypass
- is below transport layer, hence transparent to applications
- can be transparent to end users
- can provide security for individual users if desired



IP Security Architecture

- specification is quite complex
- defined in numerous RFC's
 - incl. RFC 2401/2402/2406/2408
 - many others, grouped by category
- mandatory in IPv6, optional in IPv4



IPSec Services

- Access control
- Connectionless integrity
- Data origin authentication
- Rejection of replayed packets
 - a form of partial sequence integrity
- Confidentiality (encryption)
- Limited traffic flow confidentiality



Security Associations

- a one-way relationship between sender & receiver that affords security for traffic flow
- defined by 3 parameters:
 - Security Parameters Index (SPI)
 - IP Destination Address
 - Security Protocol Identifier
- has a number of other parameters
 - seq no, AH & EH info, lifetime etc
- have a database of Security Associations

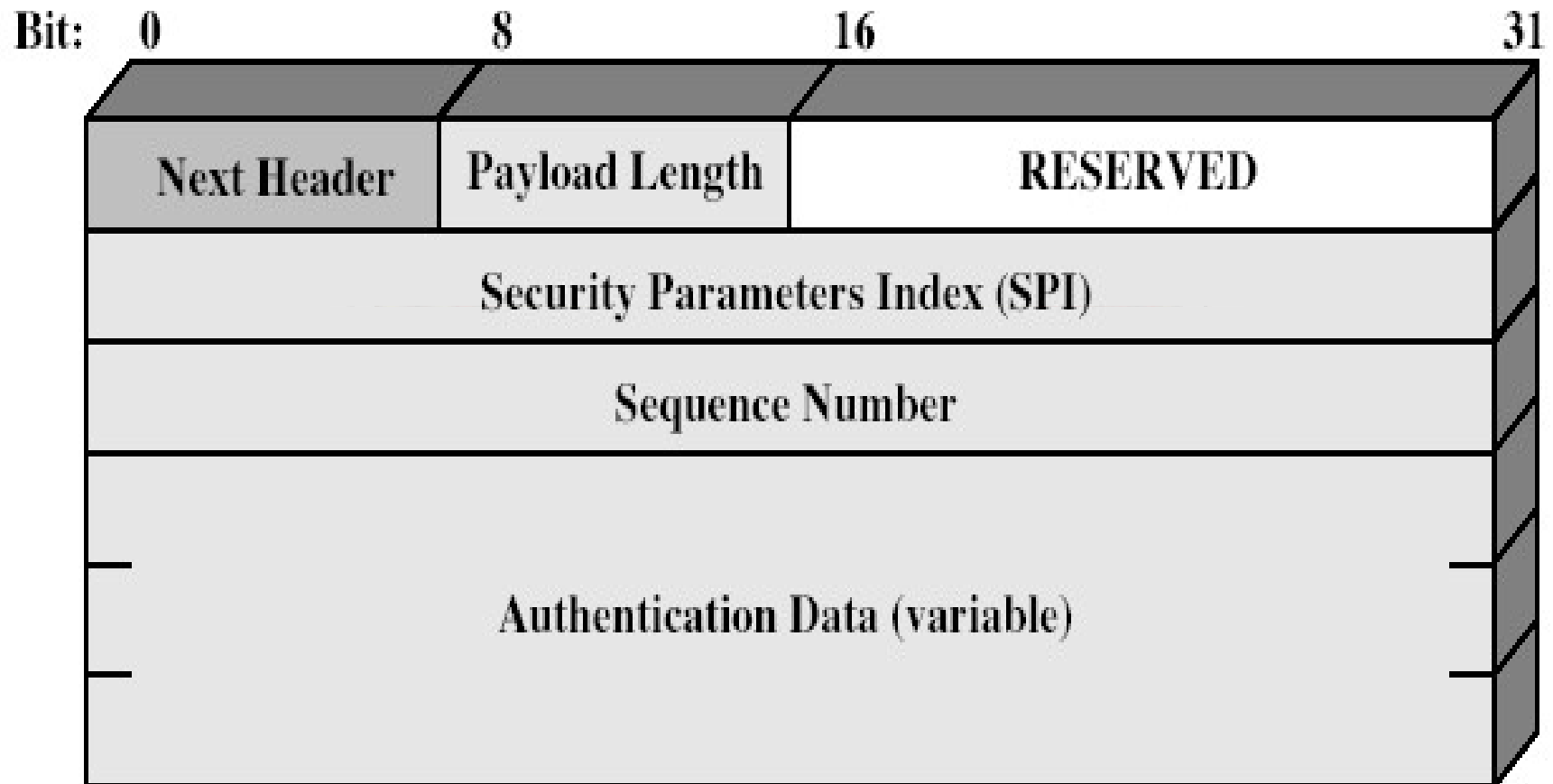


Authentication Header (AH)

- provides support for data integrity & authentication of IP packets
 - end system/router can authenticate user/app
 - prevents address spoofing attacks by tracking sequence numbers
- based on use of a MAC
 - HMAC-MD5-96 or HMAC-SHA-1-96
- parties must share a secret key

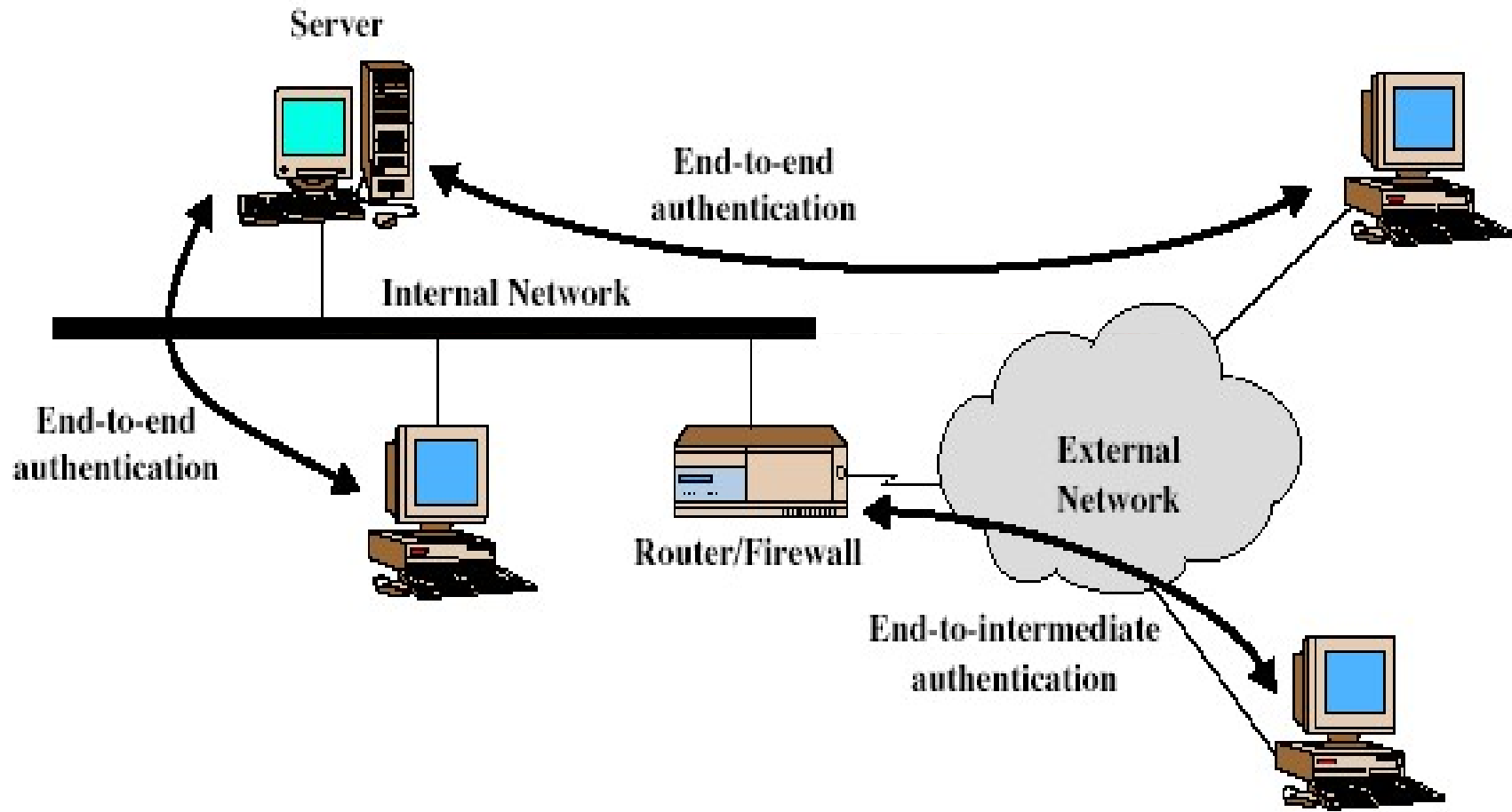


Authentication Header





Transport & Tunnel Modes



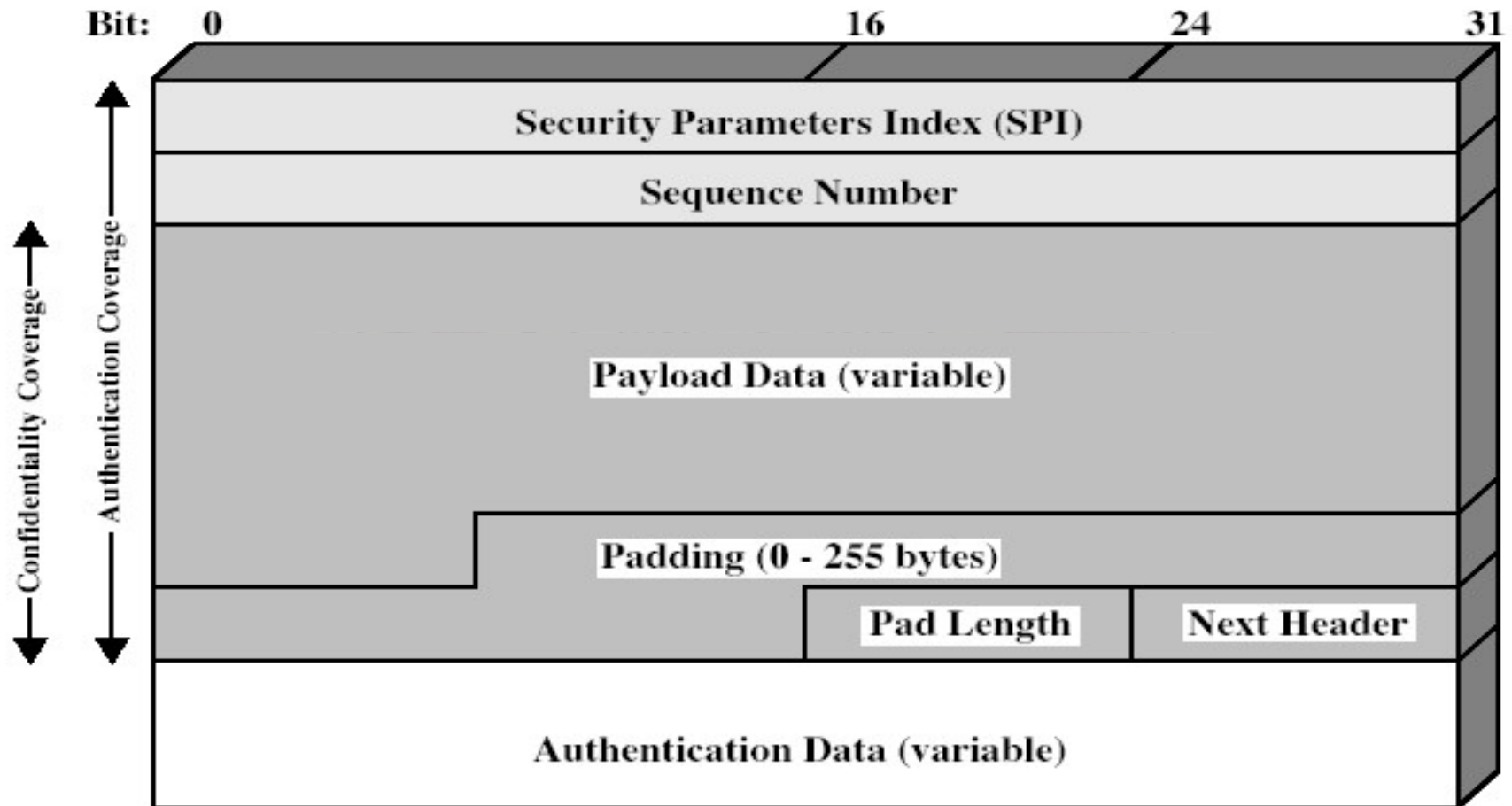


Encapsulating Security Payload (ESP)

- provides message content confidentiality & limited traffic flow confidentiality
- can optionally provide the same authentication services as AH
- supports range of ciphers, modes, padding
 - incl. DES, Triple-DES, RC5, IDEA, CAST etc
 - CBC most common
 - pad to meet blocksize, for traffic flow



Encapsulating Security Payload





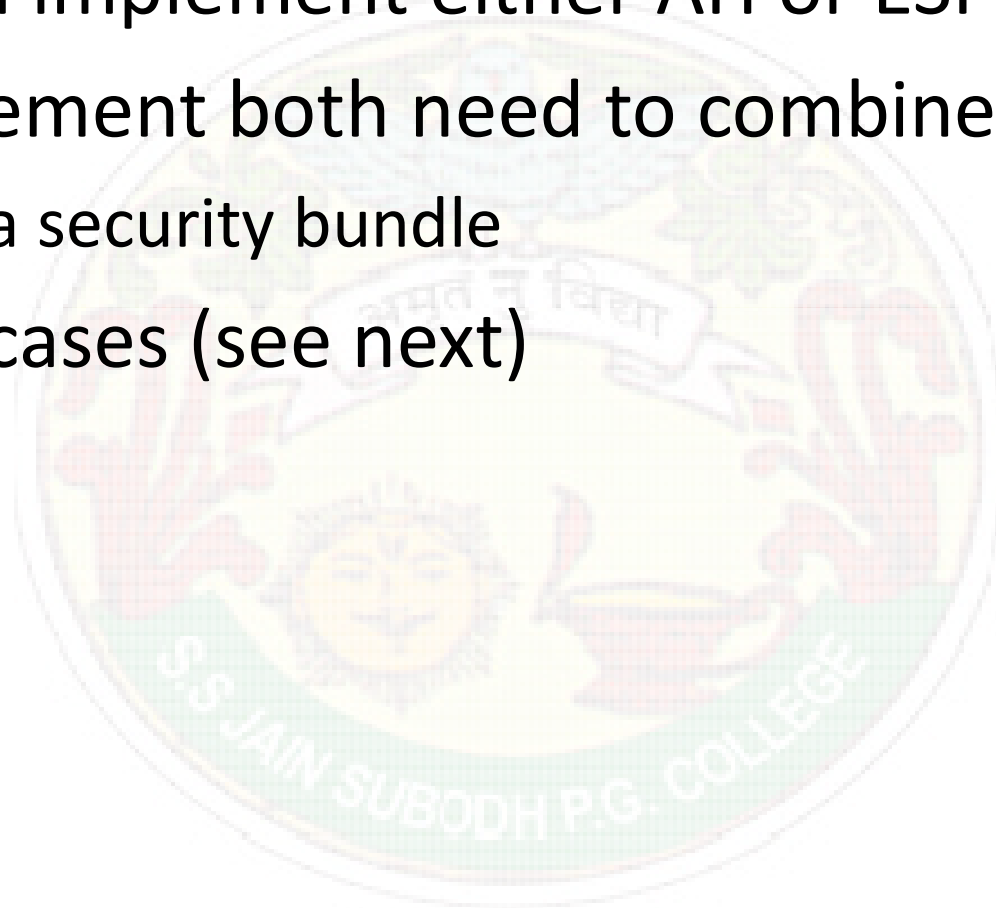
Transport vs Tunnel Mode ESP

- transport mode is used to encrypt & optionally authenticate IP data
 - data protected but header left in clear
 - can do traffic analysis but is efficient
 - good for ESP host to host traffic
- tunnel mode encrypts entire IP packet
 - add new header for next hop
 - good for VPNs, gateway to gateway security



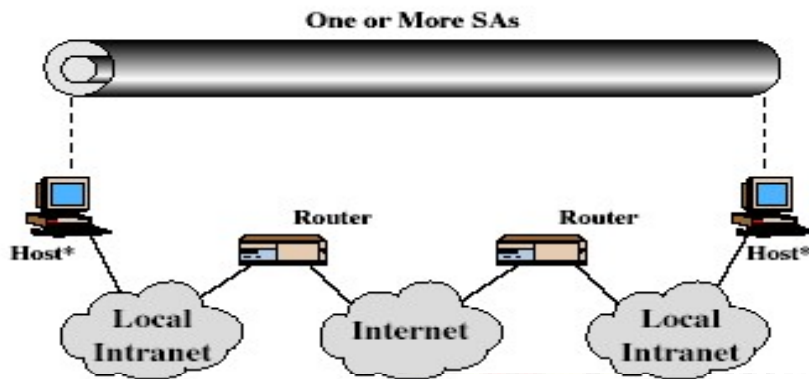
Combining Security Associations

- SA's can implement either AH or ESP
- to implement both need to combine SA's
 - form a security bundle
- have 4 cases (see next)

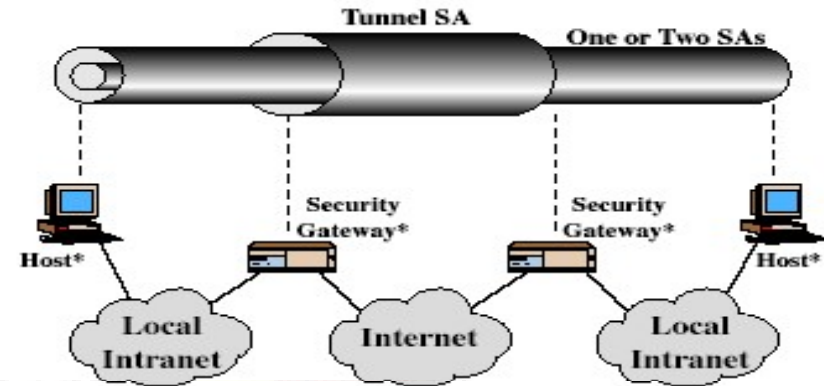




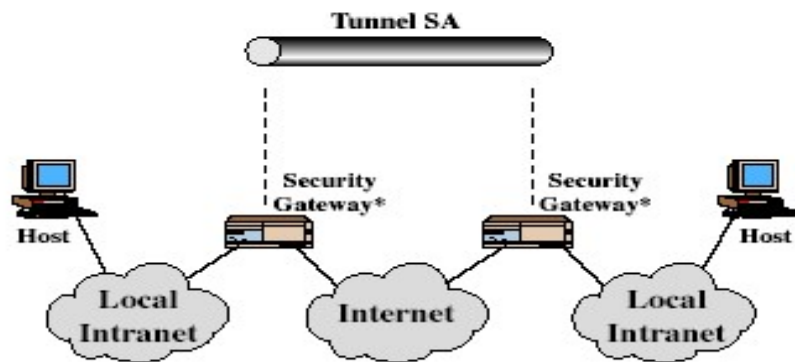
Combining Security Associations



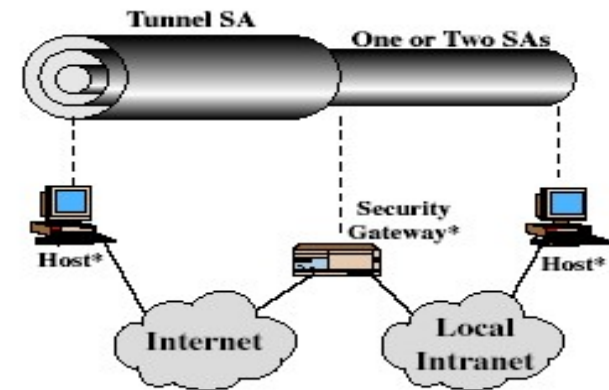
(a) Case 1



(c) Case 3



(b) Case 2



(d) Case 4



References

- William Stallings, *Cryptography and Network Security*, 1999.

