Module 10
IPSec

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IPSec

- Before two machines send the messages using their IP addresses, they have to establish an IPSec SA (Security Association)
- IPSec SA
  - The two hosts A and B exchange their public-key certificates (that has their IP address and public-key certified).
  - All further communication are encrypted with the public key of the receiver (so that it can be decrypted only by the receiver with its private key)
  - The two hosts A and B negotiate on the encryption and keyed-hashing algorithms to use for confidentiality and integrity + authentication respectively.
  - The two hosts establish a session key (for integrity and authentication) using the public-key encryption based Diffie-Hellman key exchange mechanism.
  - Using the session key, the two hosts can then establish a secret key for confidentiality in communication.
  - IPSec SA is unidirectional: If machines A and B want to send messages back and forth, they have to establish an IPSec SA in each direction.
  - An IPSec SA from A to B is said to be outbound at A and inbound at B.
  - An IPSec SA from A to B is identified by the tuple <SPI, IPaddress of A> where SPI is the Security Parameter Index value, locally unique at A. The combination of the SPI with the IP address of the host makes the tuple globally unique.

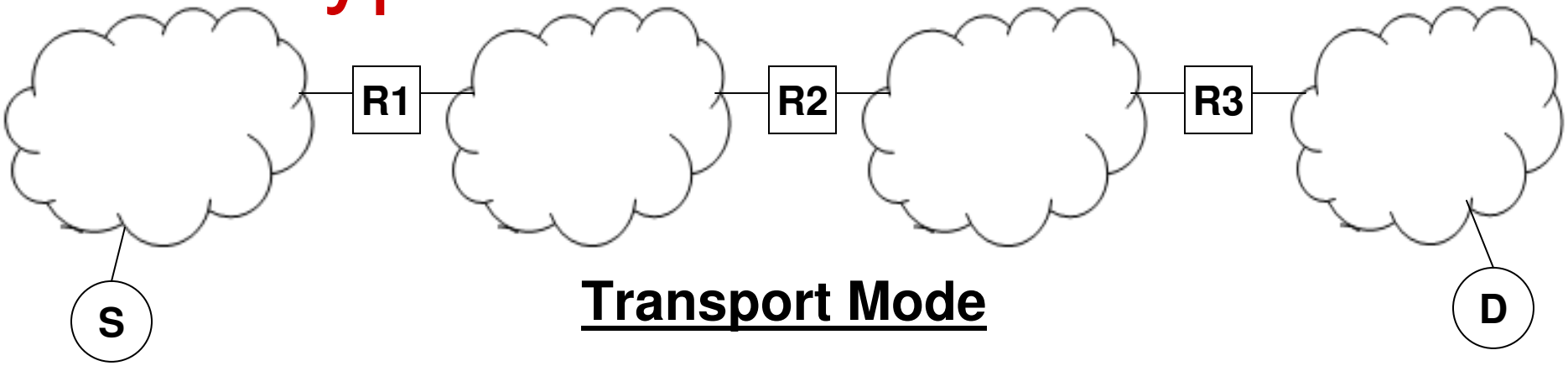
IPSec

- The IPSec header is inserted in between the IP header and transport layer header. There is no need for support from any higher layers.

IP Header	IPSec Header	TCP/ UDP Header	Data

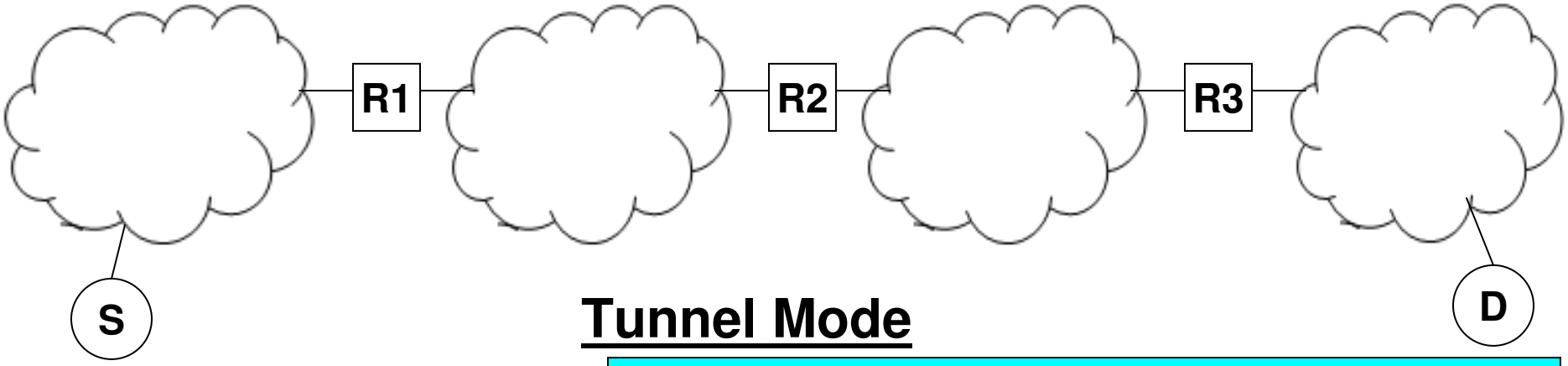
- IPSec headers:
  - Authentication Header (AH): used for integrity + authentication
  - Encapsulated Security Payload Header (ESP): used for confidentiality, integrity + authentication.
- IPSec Modes:
  - Transport Mode: When IPSec SA is directly established between the two end hosts. Message is secure all the way from the source host to the destination host
  - Tunnel Mode: When IPSec SA is established between the gateway routers of the two end hosts. Message is not secure in the source and destination networks. Need to use IP-in-IP encapsulation to encapsulate the IP datagram with the IP addresses of the two ultimate end hosts.

Typical IPSec Scenarios



Transport Mode

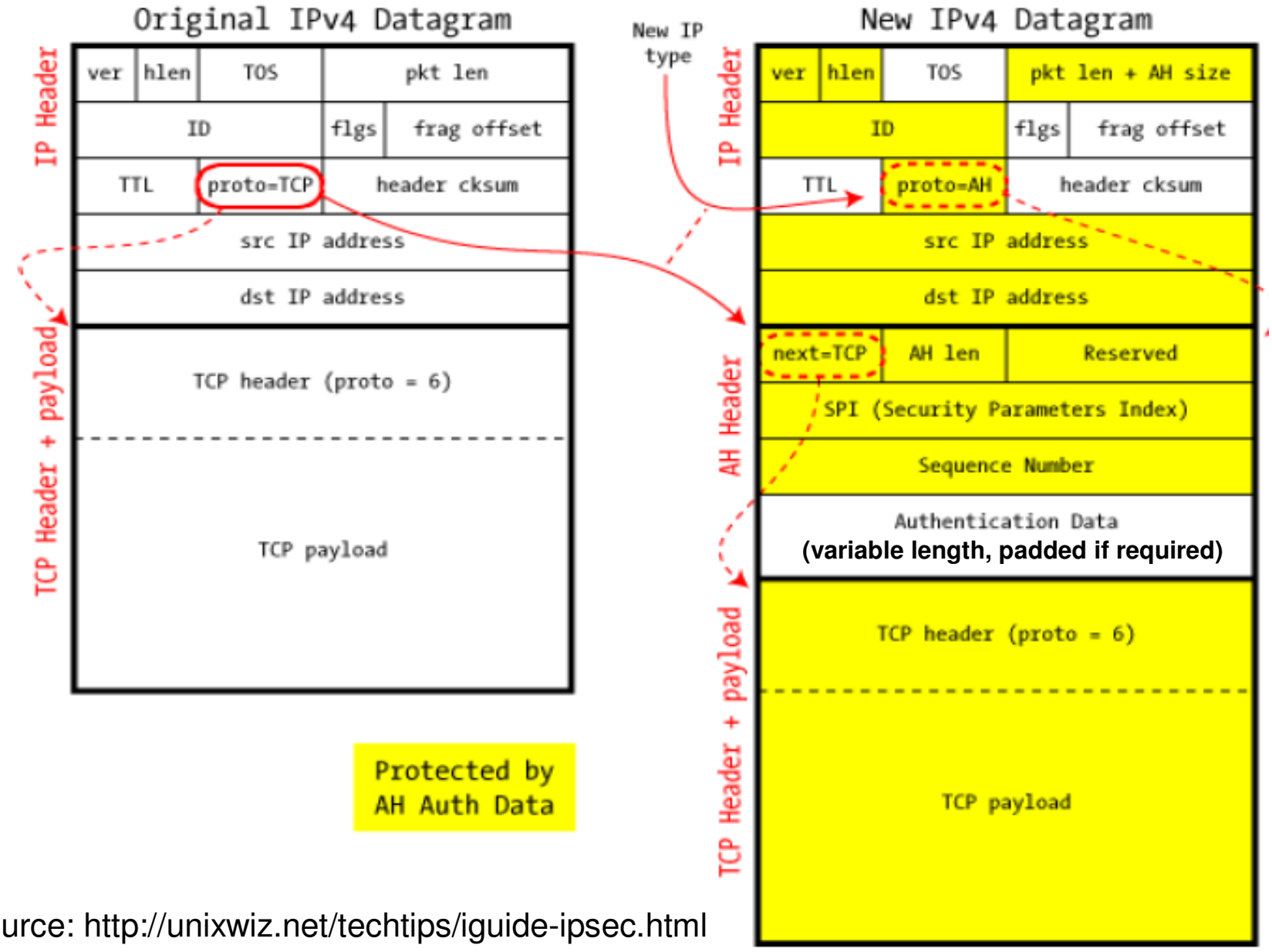
IP Header IP_S IP_D	IPSec Header SA: S -- D	TCP Header	Data



Tunnel Mode

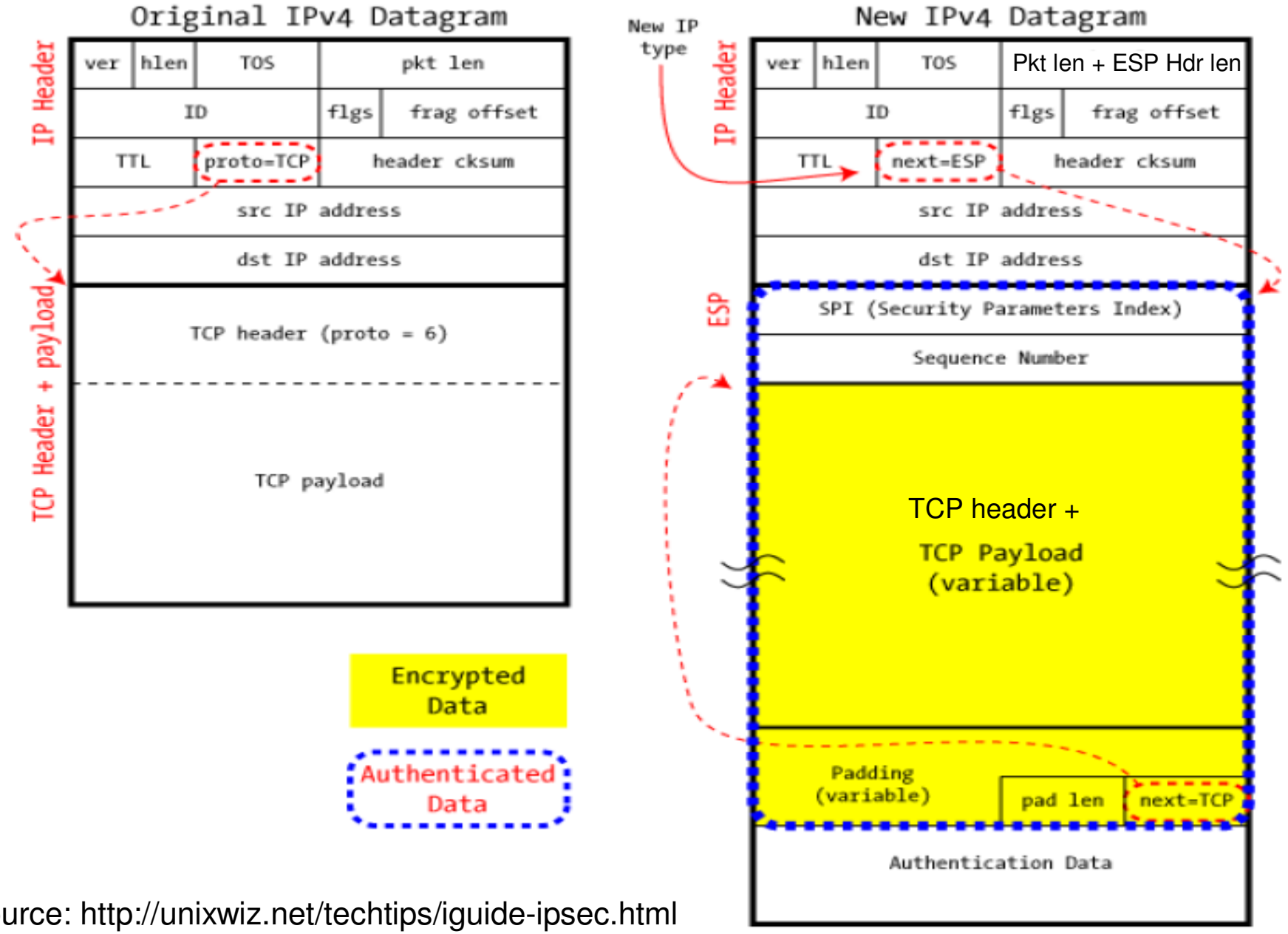
IP Header IP_{R1} IP_{R3}	IPSec Header SA: R1 – R3	IP Header IP_S IP_D	TCP Header	Data

IP4 Datagram with Authentication Header



Source: http://unixwiz.net/techtips/iguide-ipsec.html

IP4 Datagram with ESP Header



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