

# **COSC 301**

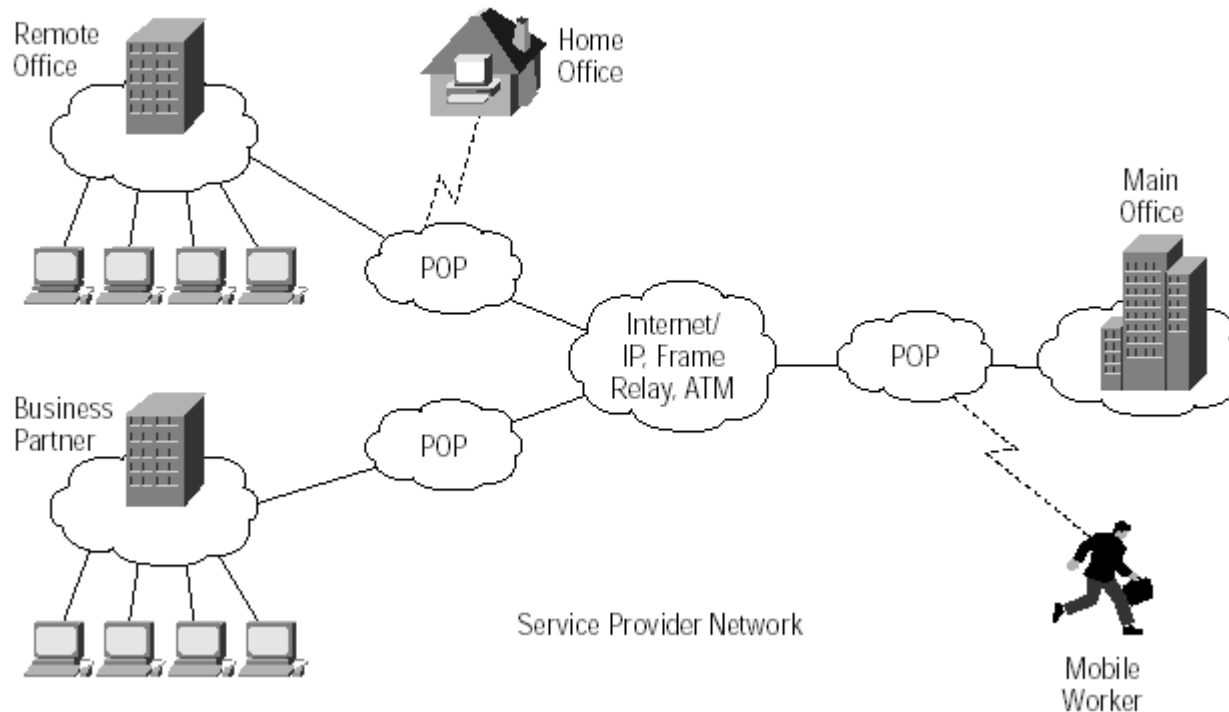
## **Network Management and Security**

### Lecture 20: Virtual Private Network

# Today's Focus

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VPN Defined



- What is VPN?
- How VPN works?

# Types of VPN

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- Remote access VPN
  - Allows individual users to set up secure connections with a remote network through a VPN router (network access server)
- Intranet VPN
  - Allows offices of the same company in different locations to set up secure connections with public networks like the Internet.
- Extranet VPN
  - Allows offices of different companies in different locations to set up secure connections with public networks like the Internet.

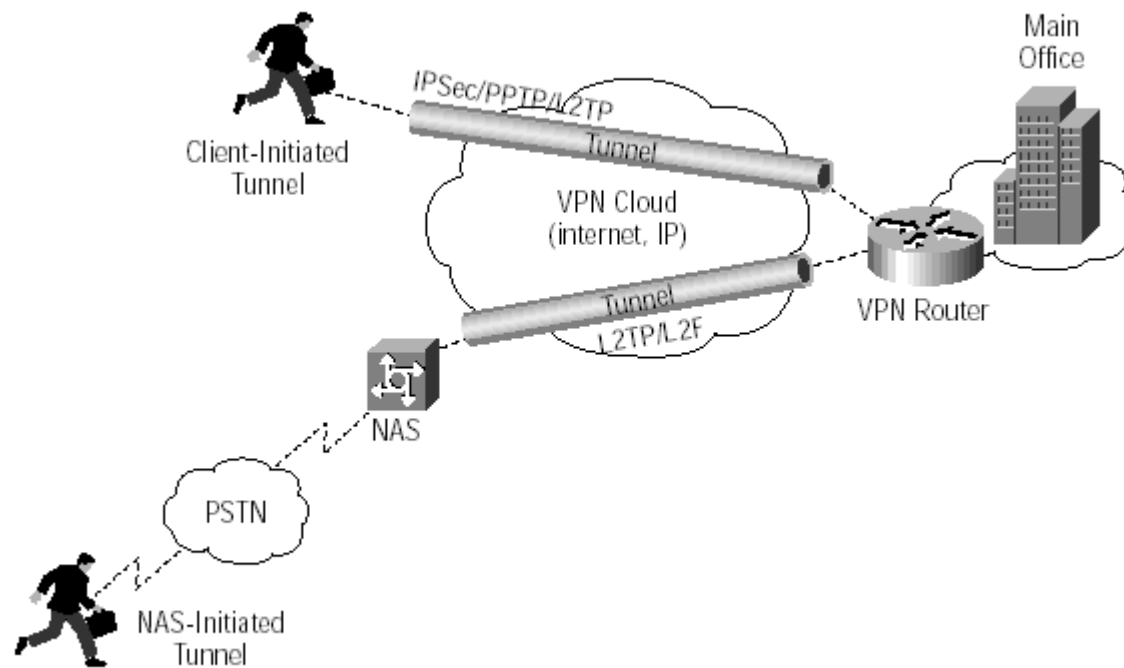
# Concepts

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- Point Of Presence (POP)
  - An artificial demarcation point or interface between networking entities
- Network Access Server (NAS)
  - A computer server that enables an independent service provider (ISP) to provide customers with internet access. NAS provides interface between telecommunication network and the internet backbone.

# Remote Access VPN

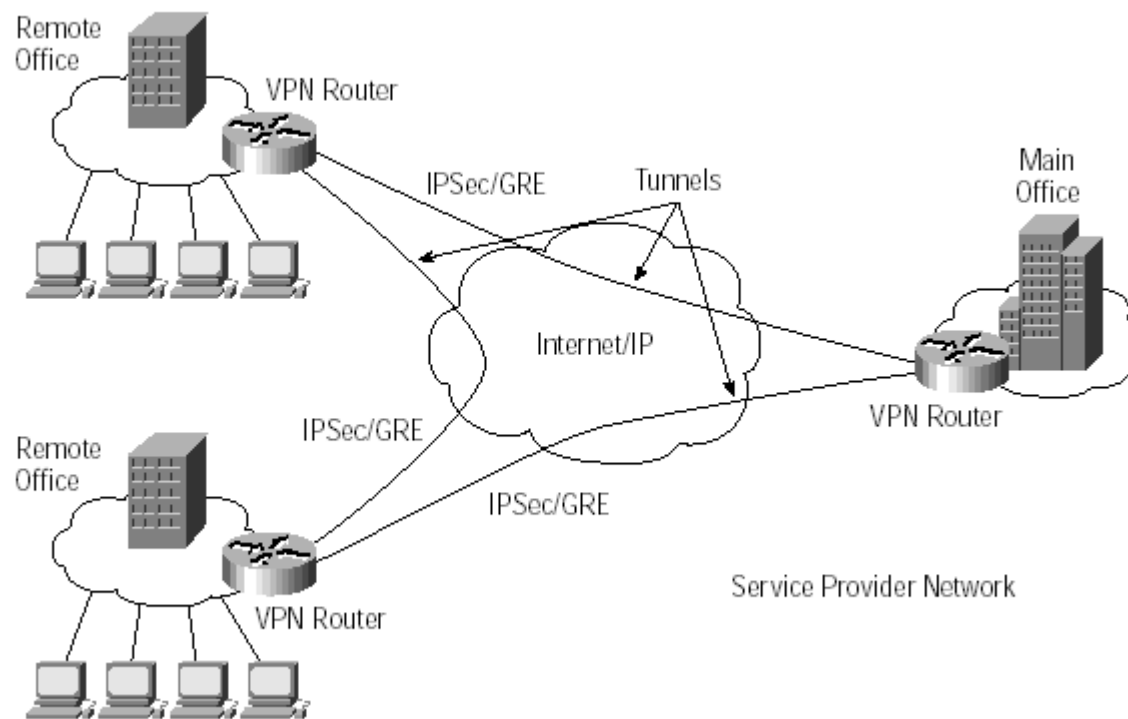
Client-Initiated Remote Access VPNs



# Intranet VPN

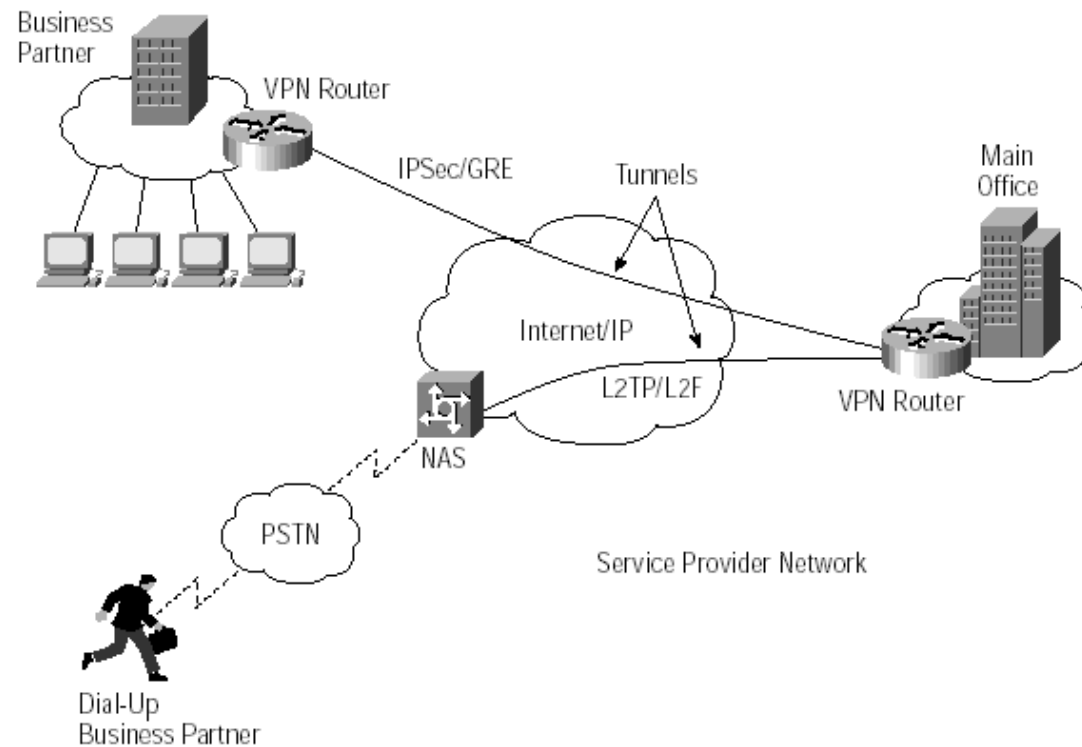
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Intranet VPN



# Extranet VPN

Extranet VPN



# Pros and Cons of VPN

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- Pros

- Easy to install
- Reduced cost compared with dedicated private network
- Flexibility and mobility
- Security

- Cons

- Unpredictable Internet traffic
- Compatibility issues due to various standards and vendors
- Understanding of security is harder due to complex protocol

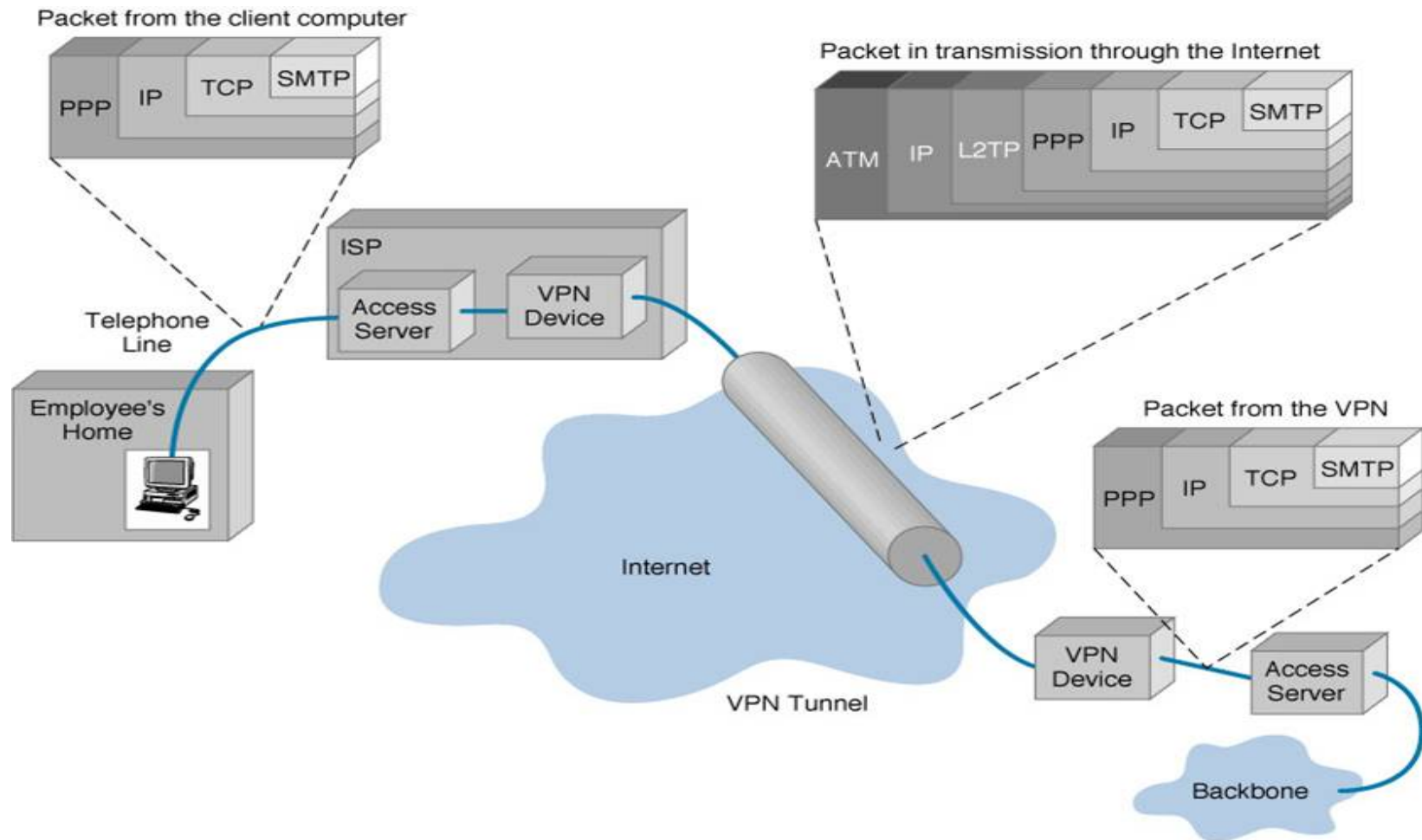


# How VPN works?

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- Operates at layer 3 of OSI model
  - IP layer of the TCP/IP model
- Tunneling
  - Encapsulate data in IP packets that encrypt their payload
  - Two VPN routers/switches exchange such IP packets directly but encode/decode before sending or after receiving the IP packets.

# Tunneling



# VPN Protocols

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- IPSec
  - A widely used protocol for securing traffic on IP networks. It can encrypt data between various devices, including router to router, firewall to router, desktop to router, and desktop to server.
  - It has two sub-protocols:
    - Encapsulated Security Payload (ESP) encrypts the payload with a symmetric key
    - Authentication Header (AH) ensures data integrity by using a hash function and a shared secret key.

# VPN Protocols (cont.)

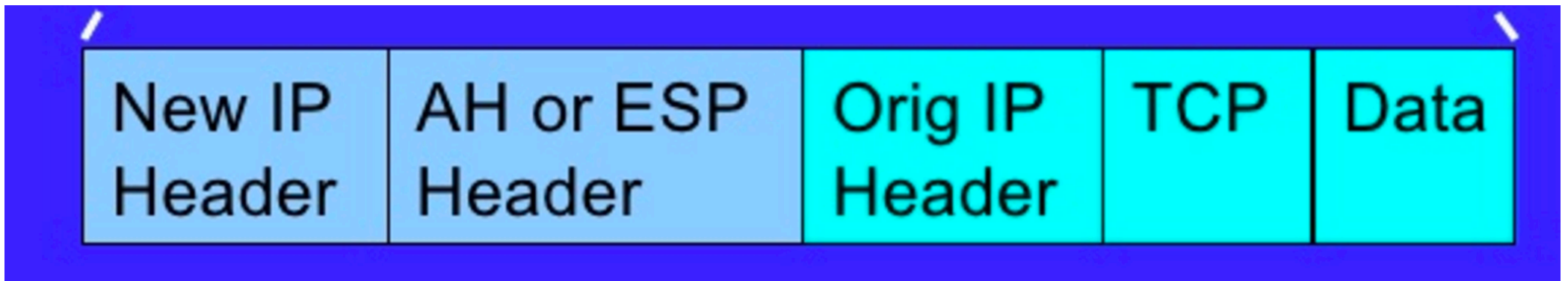
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- In remote access VPN, tunneling relies on Point-to-Point Protocol (PPP), on which the following three protocols are based.
- L2F (Layer 2 Forwarding)
  - Developed by Cisco; uses any authentication scheme supported by PPP
- PPTP (Point-to-Point Tunneling Protocol)
  - Supports 40-bit and 128-bit encryption and any authentication scheme supported by PPP.
- L2TP (Layer 2 Tunneling Protocol)
  - Combines features of PPTP and L2F and fully supports IPSec.

# IPSec details

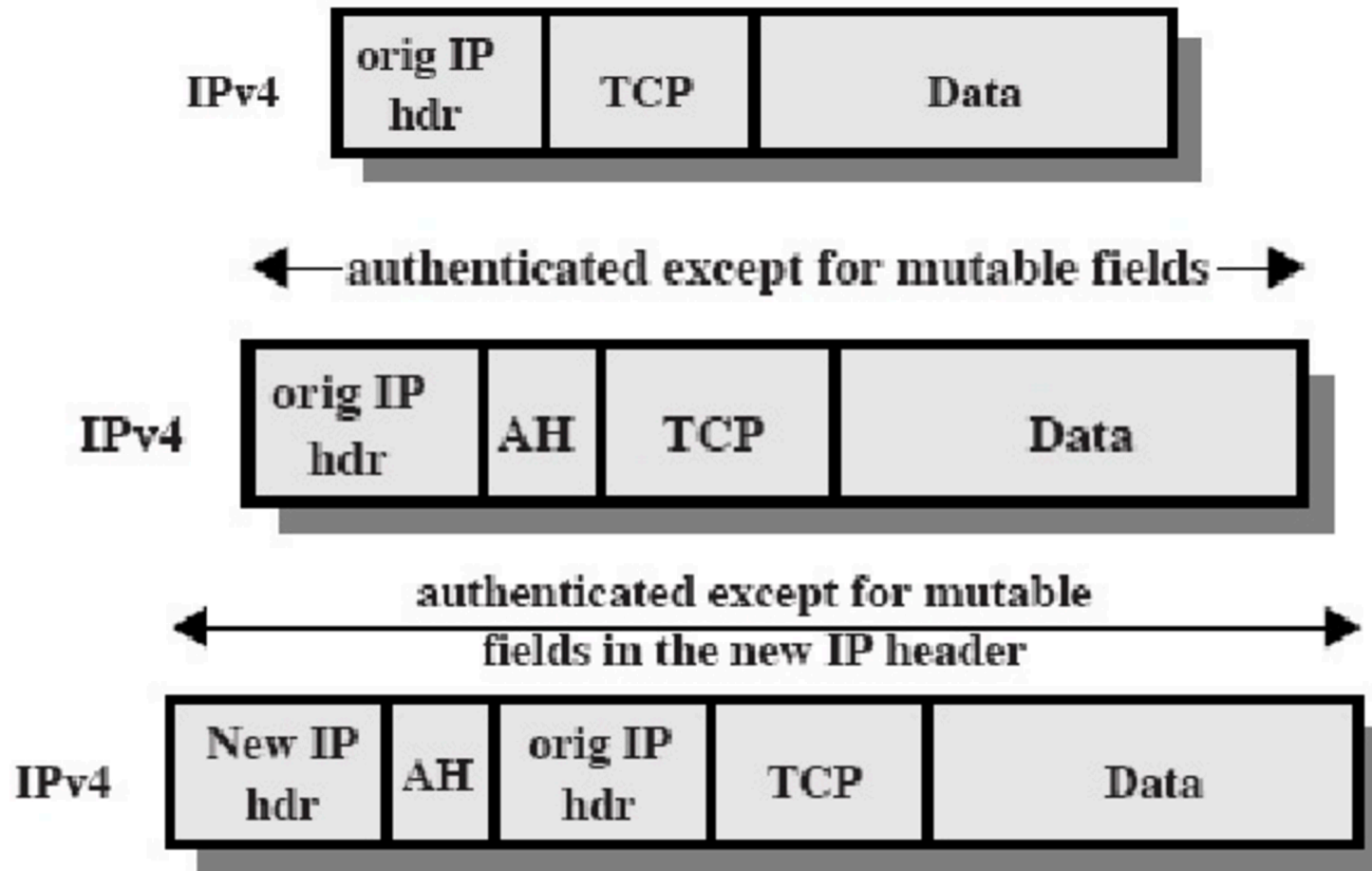
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- Provides two modes
  - Tunnel mode and transport mode



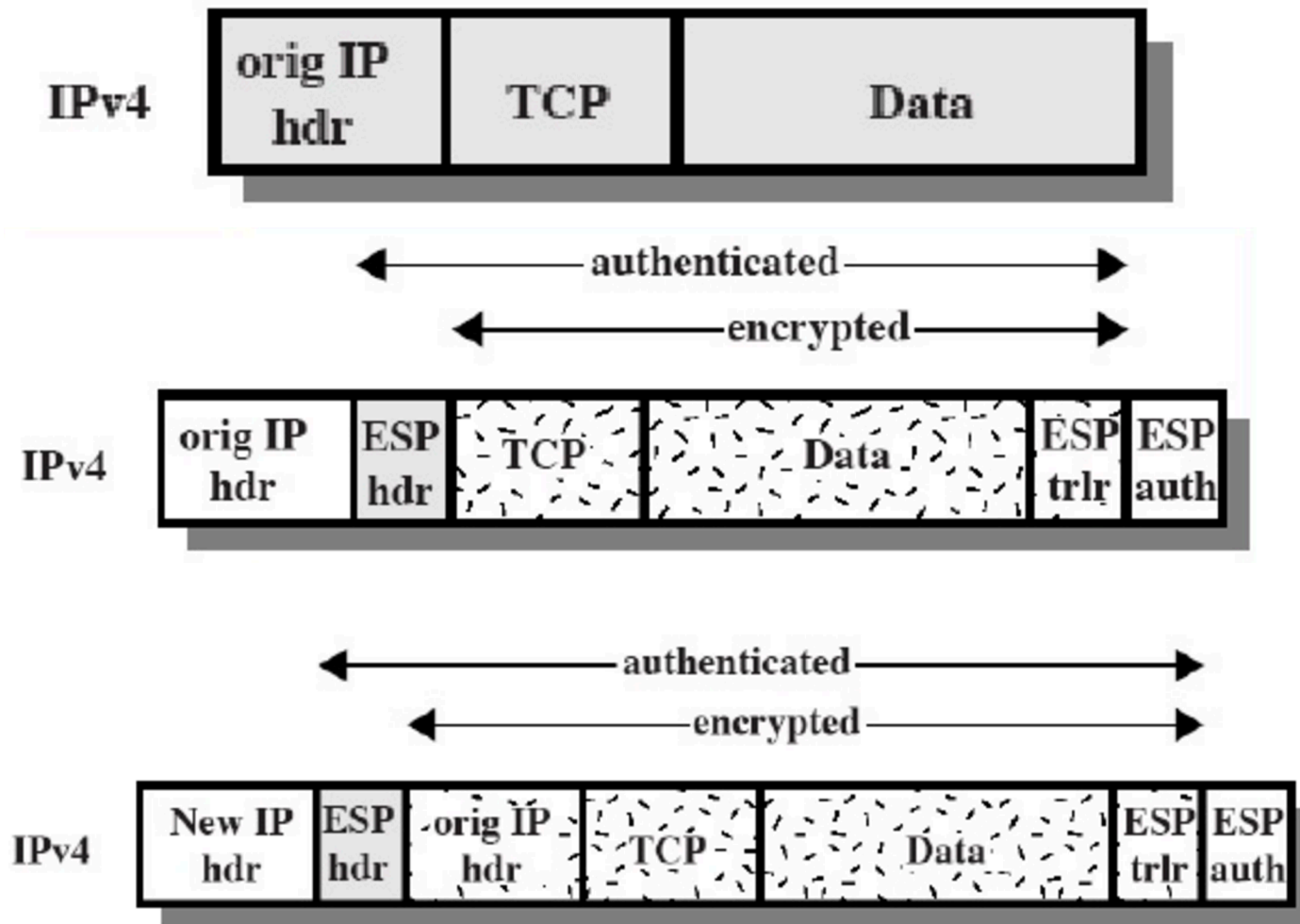
# IPSec details (cont.)

- Authentication Header in two modes

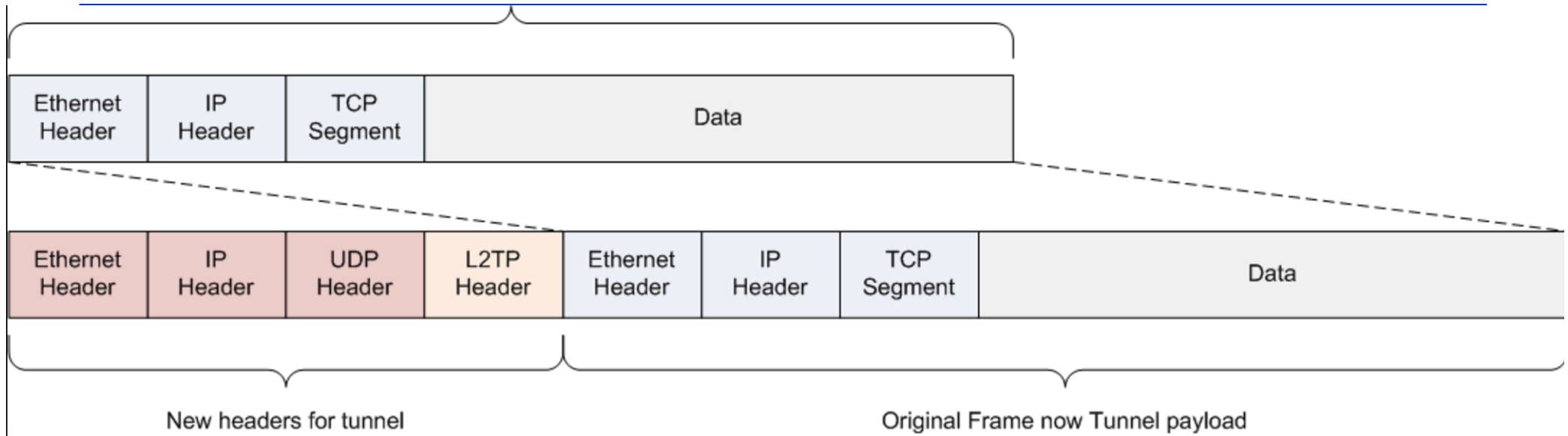


# IPSec details (cont.)

- ESP header in two modes



# L2TP details



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# Summary

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- Types of VPN
- VPN protocols: IPsec, L2TP/IPsec