IPsec

Protocols

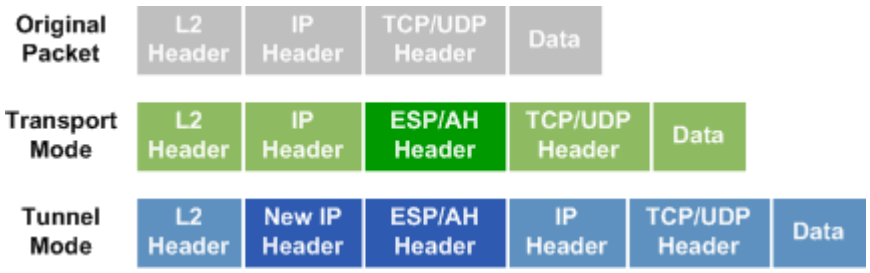
Internet Security Association and Key Management Protocol (ISAKMP) · A framework for the negotiation and management of security associations between peers; traverses UDP port 500

Internet Key Exchange (IKE) · Responsible for key agreement using public key cryptography

Encapsulating Security Payload (ESP) · Provides data encryption, data integrity, and peer authentication; IP protocol 50

Authentication Header (AH) · Provides data integrity and peer authentication, but not data encryption; IP protocol 51

IPsec Modes



Transport Mode · The ESP or AH header is inserted behind the IP header; the IP header can be authenticated but not encrypted

Tunnel Mode · A new IP header is created in place of the original; this allows for encryption of the entire original packet

Encryption Algorithms

	Type	Key	Strength
DES	Symmetric	56-bit	Weak
3DES	Symmetric	168-bit	Medium
AES	Symmetric	128, 192, or 256-bit	Strong
RSA	Asymmetric	1024-bit minimum	Strong

Hashing Algorithms

	Length	Strength
MD5	128-bit	Medium
SHA-1	160-bit	Strong

IKE Phases

Phase 1 · A bidirectional ISAKMP SA is established between peers to provide a secure management channel; IKE is performed in main mode or agressive mode

Phase 1.5 (optional) · Xauth can optionally be implemented to enforce user authentication

Phase 2 · Two unidirectional IPsec SAs are established for data transfer using separate keys; IKE quick mode is used

Configuration

ISAKMP Policy

```
crypto isakmp policy 10
 encryption aes 256
 hash sha
 authentication pre-share
 group 2
 lifetime 3600
```

ISAKMP Pre-Shared Secret Key

```
crypto isakmp key 0 MySecretKey address 10.0.0.2
```

IPsec Transform Set

```
crypto ipsec transform-set MyTS esp-aes 256 esp-sha-hmac
 mode tunnel
```

IPsec Profile

```
crypto ipsec profile MyProfile
 set transform-set MyTS
```

Virtual Tunnel Interface

```
interface Tunnel0
 ip address 172.16.0.1 255.255.255.252
 tunnel source 10.0.0.1
 tunnel destination 10.0.0.2
 tunnel mode ipsec ipv4
 tunnel protection ipsec profile MyProfile
```

Terminology

Data Integrity · Secure hashing (HMAC) is used to ensure data has not been altered in transit

Data Confidentiality · Encryption is used to ensure data cannot be intercepted by a third party

Data Origin Authentication · Peer authentication

Anti-replay · Sequence numbers are used to detect and block duplicate packets

Hash-based Message Authentication Code (HMAC) · A hash of the data and secret key used to provide message authenticity

Diffie-Hellman · A method of establishing a shared secret key over an insecure path using public and private keys

Troubleshooting

```
show crypto isakmp sa
show crypto isakmp policy
show crypto ipsec sa
show crypto ipsec transform-set
debug crypto isakmp
debug crypto ipsec
```