SSL VPN
Virtual Private Networks based on Secure Socket Layer

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SSL VPN: What is that?

SSL as the central mechanism on which to base secure access

- Site-to-site VPN
- Remote access VPN
- Secure service access
- Loose interpretation of VPN
- SSL (pseudo)VPN
- Tunneling based on TCP or UDP
Why Not IPsec VPN?

- IPsec too difficult and/or too expensive to use securely
  - Too many options to be configured and administered
- Operates in kernel space
  - Failures potentially catastrophic
- Installation difficult and risky
- Concerns fade with maturity
Why SSL VPN

- Lower complexity
- Installation
- Configuration
- Management
- Non-interference with kernel
- Most widely used
- Higher, more robust security
Compared to IPsec VPN

- No problem with NAT traversal
- No authentication of IP header
- No encryption of ports as with IPsec ESP (encapsulation security payload)
- Packets dropped at a higher layer
- Critical with DOS attacks
Compared to PPTP

- Initially proprietary (Microsoft)
- Initially weak security
  - Fixed later
- Poor interoperability with non-Microsoft platforms
- GRE (generic routing encapsulation) tunneling
  - Possibly blocked by routers
SSL (pseudo)VPN

- IPsec VPNs connect networks
- Or hosts to networks
- SSL VPNs connect
- Users to services
- Application clients to application servers
Why SSL (pseudo)VPN

- No client code is to be installed
- Usable anywhere (kyosk)
- Applications available through web browser
- Deploying HTTPS
- Not a general security solution
- Specific solutions suitable to selected applications
In Summary

SSL VPNs have a good chance of working in any network scenario

- TCP or UDP tunneling enable
- NAT traversal
- Firewall traversal
- Router traversal
- SSL (pseudo)VPN enable universal client (web browser)
SSL VPN Flavors

- Application translation
- Port forwarding
- SSL’ed protocols
- Web proxying
- Application proxying
- Network extension
- Site-to-site connectivity

Pseudo VPN
Application Translation

- Native protocol between VPN server and application server
  - E.g., FTP, STMP, POP
- Application user interface as a web page
- HTTP(S) between VPN server and client
- Not suitable for all applications
  - Look&feel might be lost
Application Translation

HTTPS

SSL-VPN

POP3

Mail server
Port Forwarding

- Port forwarder on client
- Additional software
- Platform dependent
  - Unless Java or ActiveX
- Application points to localhost
  - To port X
- Usual application port
  - E.g., TCP port 110 (POP3)
Port Forwarding

SSL/HTTPS

POP3

Port Forwarder

TCP port 443

HTTPS

POP3 (TCP port 110)
Port Forwarding

- Port forwarder sends data stream to SSL connection to VPN gateway
  - To port Y
  - Usually port 443 (HTTPS)
- VPN gateway forwards data stream to application server
  - To port X
  - E.g., TCP port 110 (POP3)
Port Forwarding

SSL/HTTPS
TCP port 443

HTTPS
TCP port 110

POP3

SSL-VPN - 17
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Port Forwarding

- Works only with fixed port protocols
- Problems with address and port in application layer protocol
- SSL-VPN gateway must know application protocol to translate
- Application layer gateway (ALG)
SSL’ed Protocols

- Secure application protocols
- Protocol-over-SSL
  - E.g., POP-over-SSL, IMAP-over-SSL, SMTP-over-SSL
- Client and server support required

POP-over-SSL

TCP port 995
Proxying

- VPN Gateway downloads web pages through HTTP
- Ship them through HTTPS
Application Proxying

- Compatibility with older servers
- Client points at SSL-VPN gateway

TCP port 995

TCP port 110

POP-o-SSL

POP3

SSL-VPN - 21
Network Extension

Tunnel over SSL

POP3

FTP

Tunnel over SSL

POP3

FTP
Performance Pitfalls

- IP over TCP
  - No delivery of packets after a lost one
  - Loss leads to throttling of tunnel
    - TCP congestion control
- TCP over TCP: unpredictable
- Large transmitter buffers in gateways
Products and Vendors

- Open VPN (openvpn.net)
- AEP
- F5 Networks
- NetScreen Technologies
- Netilla
- Nokia
- Symantec
- Whale Communications
Main Issues

- Interoperability
- Product specific features
- Implementation weaknesses
- Availability of client on specific platforms
