Implementing Secure Converged Wide Area Networks (ISCW)

Basic Teleworker Services

http://www.INE.com

Teleworker Services Goals

- Provide access into the network from SOHO locations while still ensuring
  - Centralized management
  - Security
  - Application response
    - e.g. VoIP
- Cisco's "Business Ready Teleworker"

Teleworker Components

- Access method
  - Cable, DSL, Fiber, etc.
- Security
  - IPSec, AAA, IPS, etc.
- QoS
- Management
  - SNMP, RMON, Syslog, etc.

Cable Access Overview

- Offers video, voice, and data over Hybrid Fiber-Coaxial (HFC) based network
- Uses Frequency Division Multiplexing (FDM) to deliver multiple RF signals over same wires
  - i.e. "broadband"

Cable Standards

- Data Over Cable Service Interface Specification (DOCSIS)
  - ITU-T standard developed by CableLabs
- Defines Layer 1 & Layer 2 specification
  - Layer 1
    - RF channels & modulation
  - Layer 2
    - Time Division Multiple Access (TDMA)
    - Synchronous Code Division Multiple Access (SCDMA)
    - Not contention based like Ethernet CSMA/CD
      - e.g. not prone to collisions
- Version defines throughput & features
  - 1.0/1.1/2.0/3.0
  - Region specific
    - i.e. DOCSIS vs EuroDOCSIS

Cable Equipment

- Cable Modem (CM)
  - CPE device to connect customer to distribution network via "tap" or "subscriber drop"
    - Essentially Ethernet to HFC bridge
  - e.g. HWIC-CABLE-D-2 or Linksys CM100
  - DOCSIS provisioning is plug-and-play
    - i.e. negotiate with CMTS, download config via TFTP
- Cable Modem Termination System (CMTS)
  - Located at cable network "headend"
  - Aggregates CM traffic into IP network
    - Essentially HFC to Ethernet bridge with lots of ports
  - e.g. Cisco uBR10000

For More Information on Cable

- Cable network architecture is outside the scope of this class
  - "PacketCable Implementation" (Cisco Press) ISBN 1-58705-181-8
  - http://www.cablelabs.com
- From our perspective, simply a WAN link into the IP network

xDSL Access Overview

- Digital Subscriber Line (DSL)
- Offers video, voice, and data over POTS
  - Analog voice only uses small frequency range
  - Data can use the remaining bandwidth over the same circuit
- Suffers from distance limitations more so than cable
  - i.e. attenuation over copper (POTS) worse than fiber + copper (HFC)

xDSL Standards

- Generic term for different ITU-T standards
  - Different bandwidth and features
- Two main categories
  - Asymmetrical
    - ADSL (Asymmetrical)
    - VDSL (Very-high-speed)
      - e.g. AT&T U-Verse
  - Symmetrical
    - SDSL (Symmetrical)
    - IDSL (ISDN)
    - HDSL (High rate)
      - i.e. T1/E1 substitute

DSL Equipment

- DSL Modem
  - CPE device connecting to local loop
  - Bridges/Routes Ethernet to ATM
  - e.g. WIC-1ADSL or Linksys AM300
- DSL Access Multiplexer (DSLAM)
  - Aggregates ATM PVCs from customer circuits and bridges to aggregation router
  - Basically an ATM switch with lots of DSL modems in single chassis
  - e.g. Cisco 6100 IP DSL Switch (EOL)
- DSL Aggregation Router
  - Accepts bridged ATM cells from DSLAM and routes to IP network
  - e.g. Cisco 6400 Carrier-Class Broadband Aggregator (EOL)

CPE to SP Communication

- DSLAM is a layer 2 device
  - Bridges from CPE to SP aggregation router
- Layer 3 session can exist between…
  - PC and SP aggregation router
    - RFC 1483/2684
    - AKA "IRB" or "RBE"
  - CPE and SP aggregation router
    - PPP over Ethernet (PPPoE)
      - AAL5SNAP encapsulation
    - PPP over ATM (PPPoA)
      - AAL5MUX encapsulation

RFC 1483/2684 (RBE) Config Example

```
CPE#
bridge irb
!
interface Ethernet0
 no ip address
 bridge-group 1
!
interface ATM0
 dsl operating-mode auto
 no ip address
 pvc 1/100
  encapsulation aal5snap
 !
 bridge-group 1
!
interface BVI1
 ip address dhcp
!
bridge 1 protocol ieee
 bridge 1 route ip
```

PPPoE Config Example

```
CPE#
vpdn enable
!
vpdn-group pppoe
  request-dialin
   protocol pppoe
!
interface FastEthernet0
 ip address 10.0.0.1 255.0.0.0
 ip nat inside
!
interface ATM0
 dsl operating-mode auto
 pvc 1/100
  encapsulation aal5snap
   pppoe-client dial-pool-number 1
!
interface Dialer1
 ip mtu 1492
 ip address negotiated
 ip nat outside
 encapsulation ppp
 dialer pool 1
 ppp chap hostname USERNAME
 ppp chap password PASSWORD
!
ip nat inside source list 1 interface Dialer1 overload
ip route 0.0.0.0 0.0.0.0 dialer1
!
access-list 1 permit 10.0.0.0 0.255.255.255
```

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PPPoA Config Example

```
CPE#
interface FastEthernet0
 ip address 10.0.0.1 255.0.0.0
 ip nat inside
!
interface ATM0
 dsl operating-mode auto
 pvc 1/100
  encapsulation aal5mux ppp dialer
   dialer pool-member 1
!
interface Dialer1
 ip address negotiated
 ip nat outside
 encapsulation ppp
 dialer pool 1
 dialer-group 1
 ppp chap hostname USERNAME
 ppp chap password PASSWORD
!
dialer-list 1 protocol ip permit
!
ip nat inside source list 1 interface Dialer1 overload
ip route 0.0.0.0 0.0.0.0 dialer1
!
access-list 1 permit 10.0.0.0 0.255.255.255
```

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For More Information on DSL

- Like cable, DSL design is outside our scope
  - Design and Implementation of DSL-Based Access Solutions (Cisco Press) ISBN 1-58705-021-8
  - End-to-End DSL Architectures (Cisco Press) ISBN 1-58705-087-0
- From our perspective, simply a WAN link into the IP network

Teleworker Services Q&A