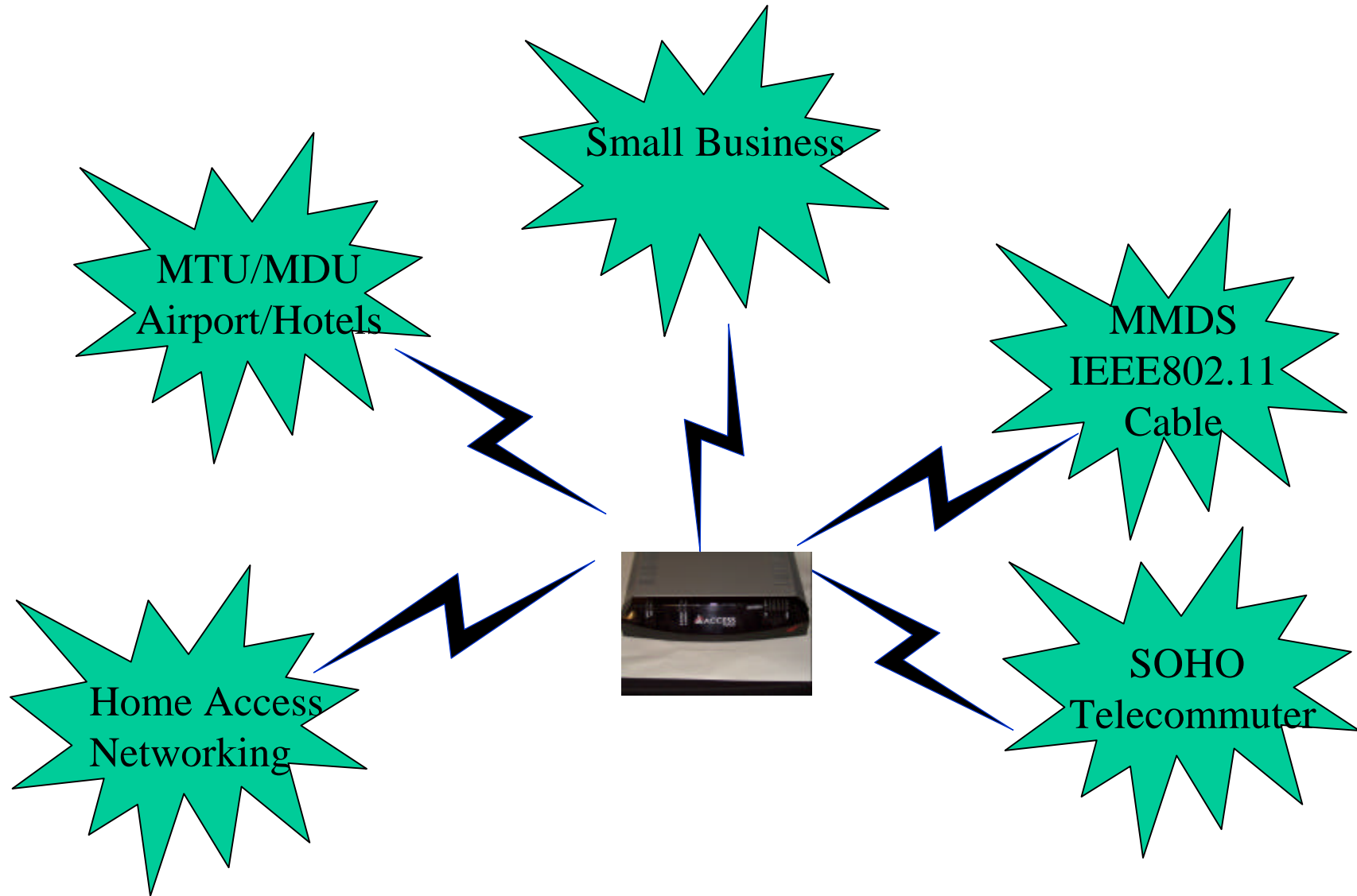


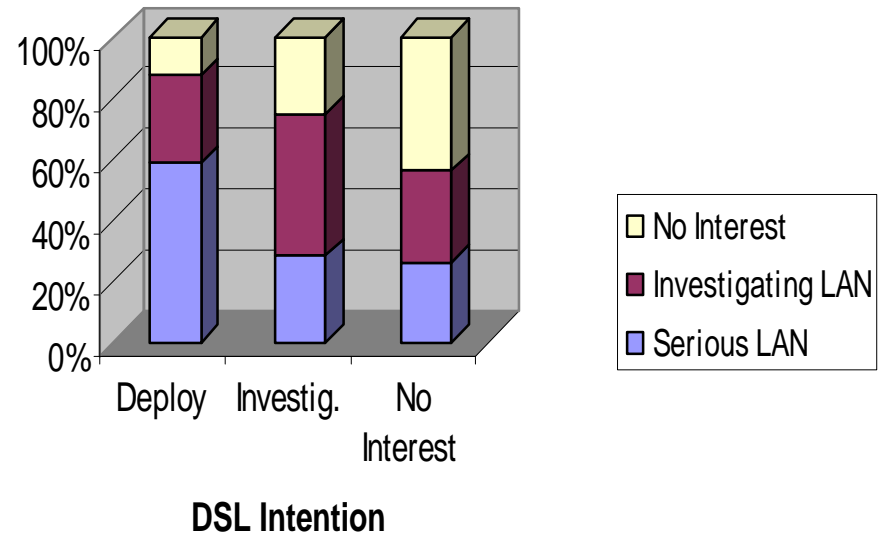
Integrated Access Device



IAD Market Drivers

- 37% of broadband subscribers interested in residential Nets*
- DSL customers:
 - One of the 12 most frequently asked questions” How do I connect my multiple PC’s to DSL.”
- Industry Data:
 - 20% of broadband subscribers opt for multi-user options (HPNA, wireless, Ethernet, voice) with willingness to pay.

Relationship Between DSL and Home Networking



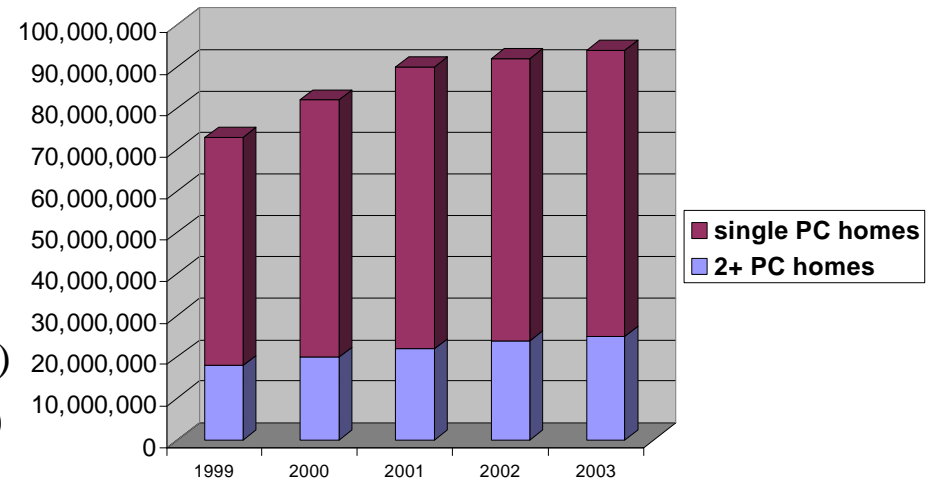
* Source: Yankee group compilation of DSL and home networking markets.

Integrated Access Device

Market Drivers cont.

- Rapid Deployment of DSL
- Small business users
 - Traditionally under-served segment
 - Desire self install systems (4-8 lines)
- Growth of Home Offices*
 - No resident MIS professional
 - 2002 - 8 Million home offices w/LANs
 - 2-4 phone lines (varying call privileges)
 - No rewiring (HPNA/Wireless/pwr line)
 - 15.7M Telecommuters 1998
 - 13M small business households
- In Home Entertainment
 - Multiple TV households with video
 - DVD/MP3/Playstation II

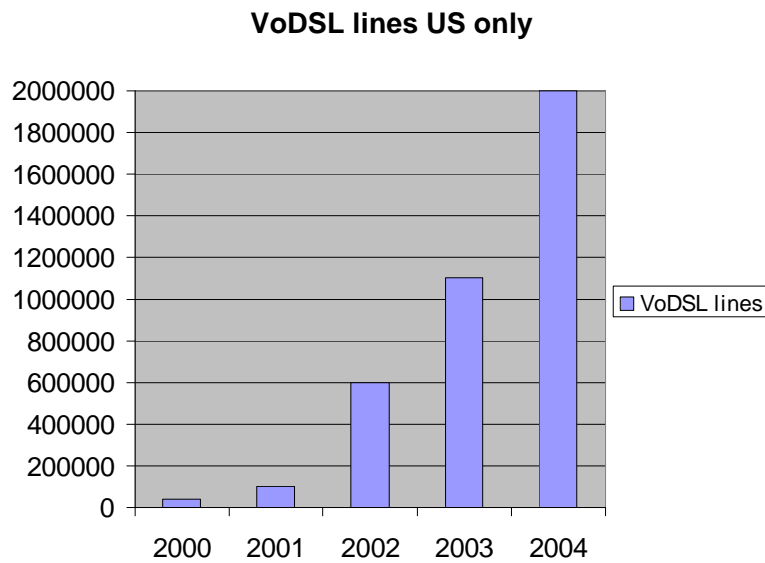
Proliferation of Multiple PC Households



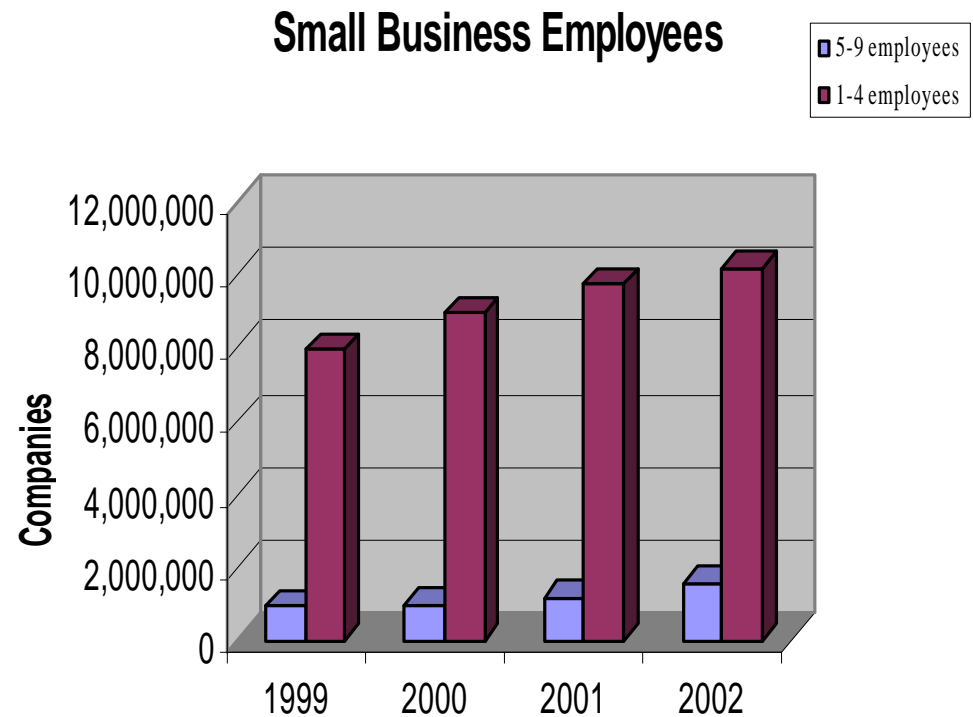
Source: IDC 1999
Dataquest 1998

* Source: ZDNET Survey 5/99:

VoDSL and Small Business Statistics

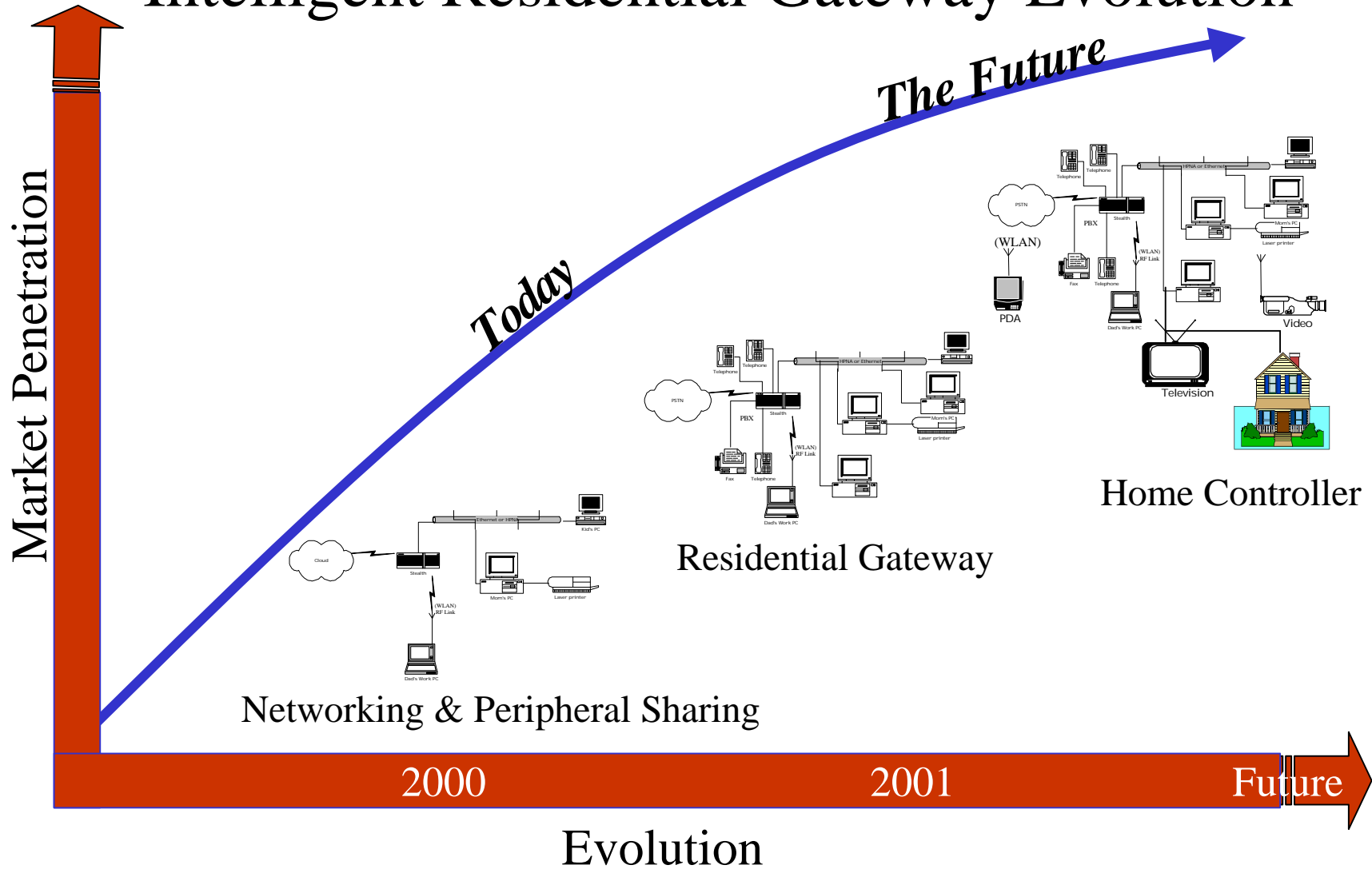


Source Telechoice 14% of total U.S. DSL lines will also carry VoDSL



Source: InStat Oct 1998

Intelligent Residential Gateway Evolution

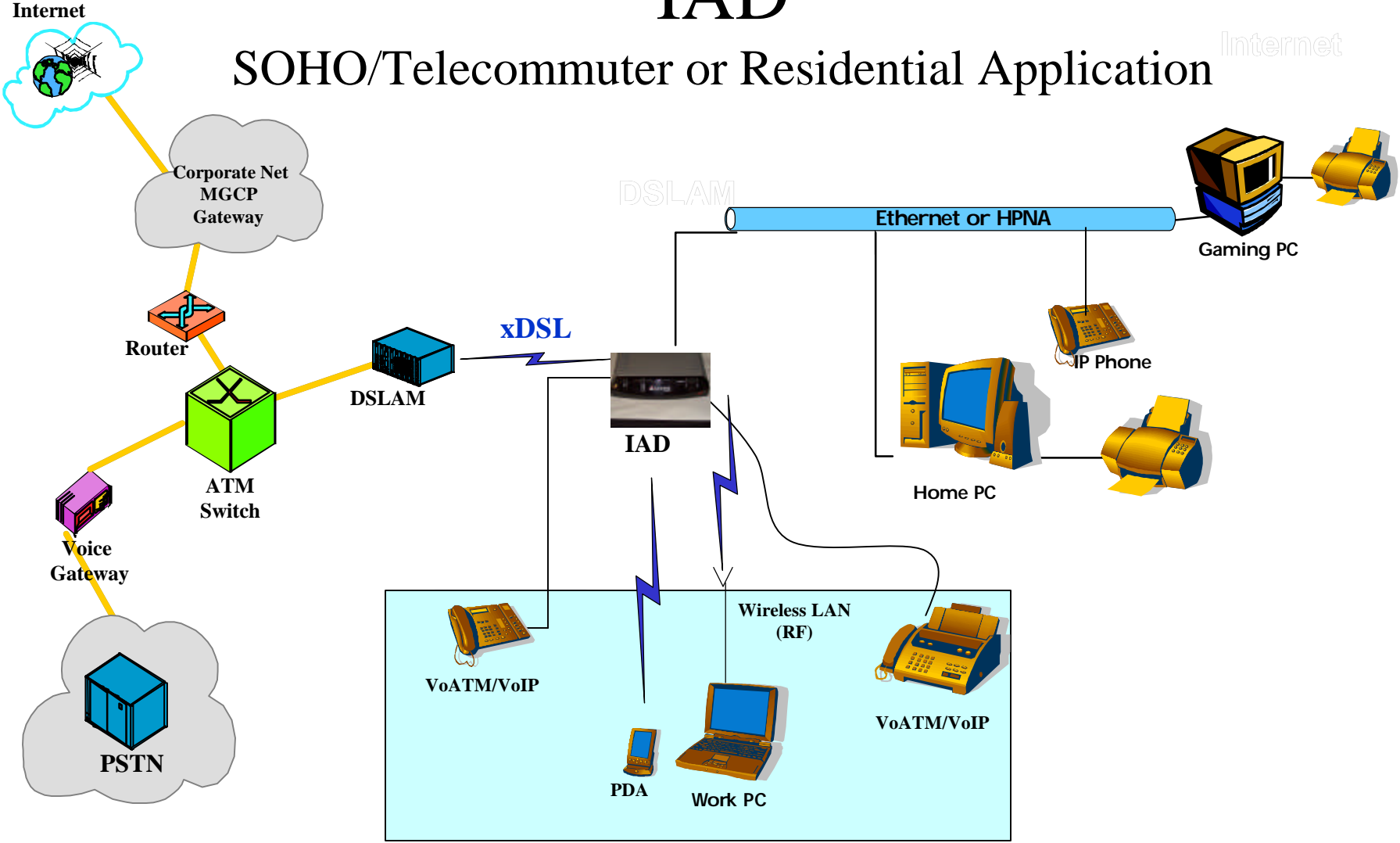


IAD Wish List

- Intelligent Residential Gateway
 - Broadband Access-DSL, Cable, MMDS, other
 - P.C. Networking
 - Peripheral Sharing
 - Ethernet, HPNA, Power Line, Wireless
 - Security/Encryption
 - Video Transport, Playback, TiVo, teleconferencing
 - Internet Appliances
 - HPC/PDA Integration
 - Voice - VoIP, VoATM
 - MP3 downloads
 - Home control and automation
 - Web server/mail server
 - Open services gateway initiative support (SUN, Cisco, others)

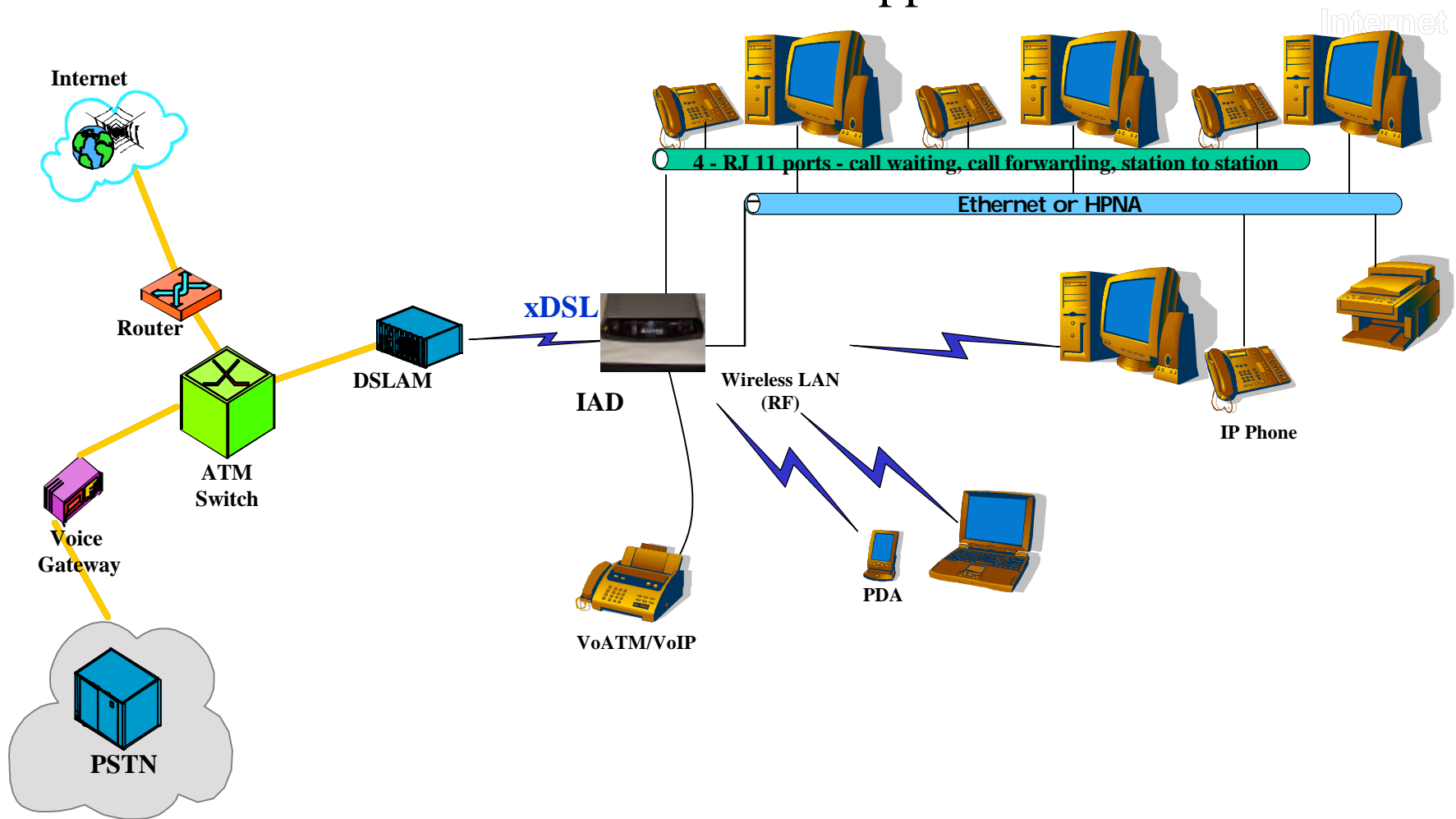
IAD

SOHO/Telecommuter or Residential Application



IAD

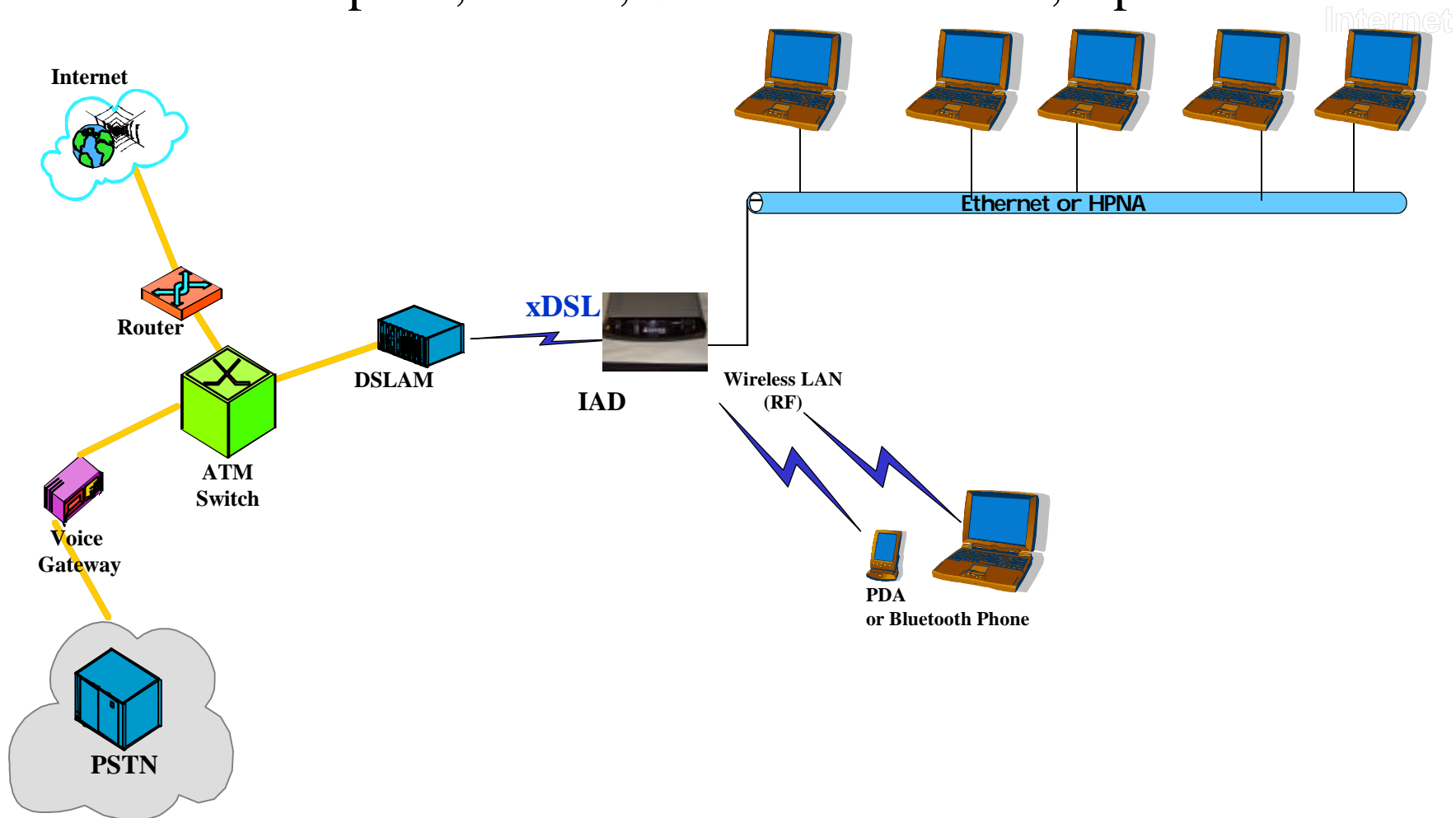
Small Business Application



IAD

MTU/MDU Application

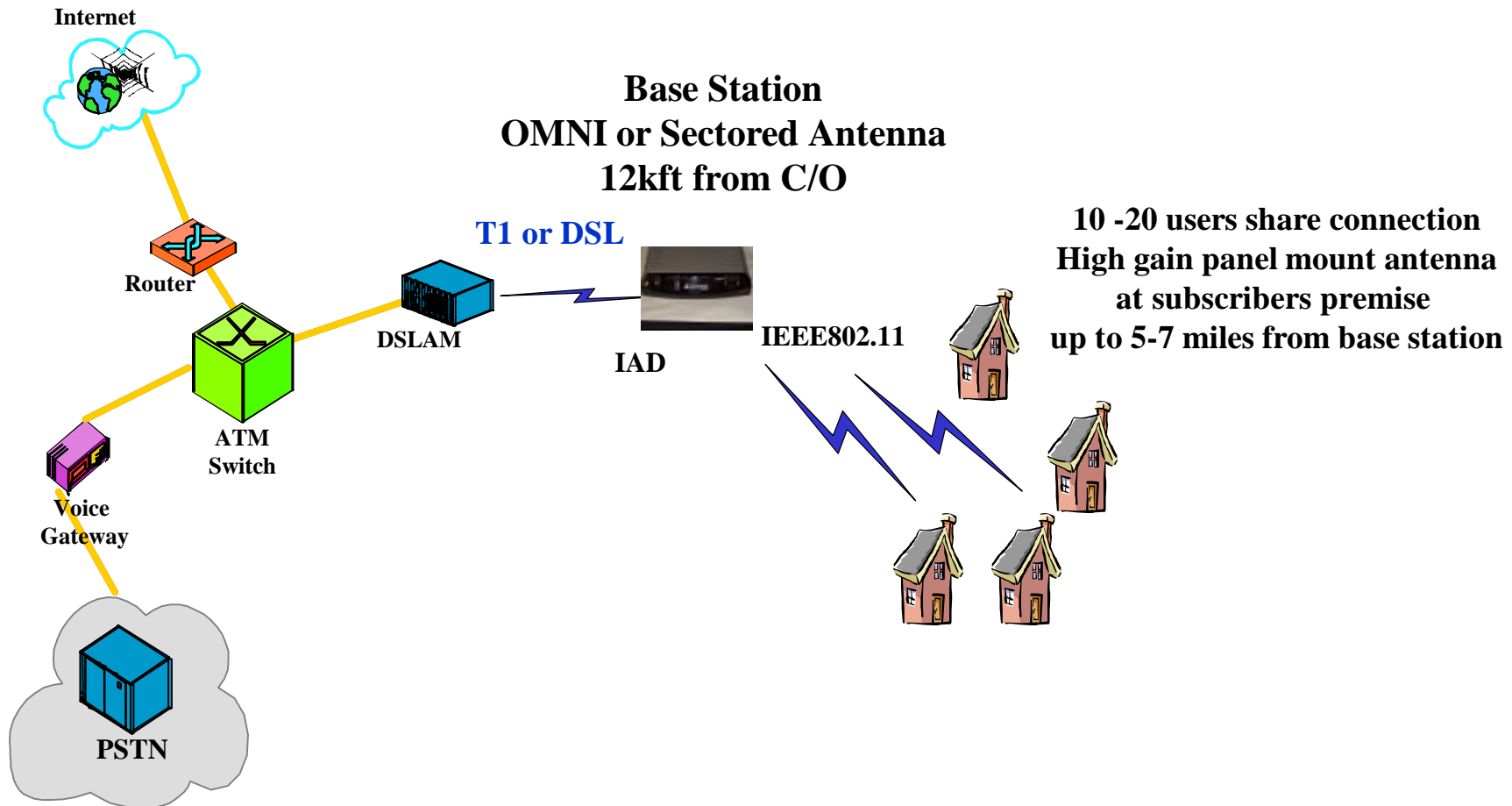
Airports, Hotels, Conference centers, Apartments



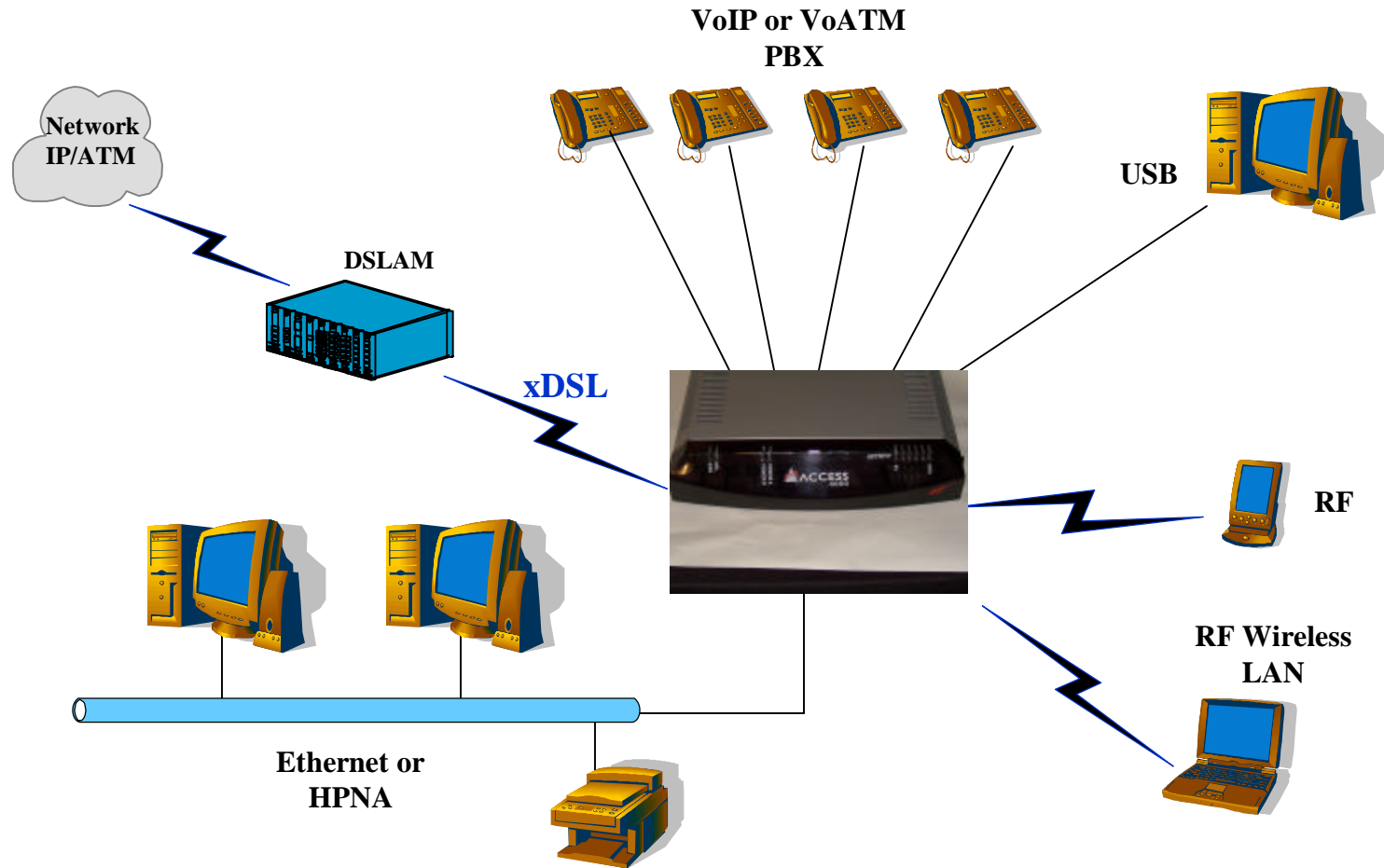
IAD

Wireless Application

Internet



Integrated Access Device Solution



LAN Networking Alternatives + Video

- Wired
 - Ethernet
 - USB
 - HPNA 2.0 - Uses existing in building wiring 10 Mbps
 - HomePlug 10 Mbps
- Wireless
 - Bluetooth - 2.4 GHz F.H.S.S, voice and data short range
 - HomeRF - data/voice F.H.S.S
 - IEEE 802.11b - data/voice D.S.S.S
 - IEEE802.11a - 54 Mbps voice/data/video OFDM/DMT
 - Hyperlan -Europe OFDM/DMT
- Video
 - MPEG2/MPEG4, streaming

Wireless LAN Standards Chaos

- 2400-2483.5 ISM band US and Europe
- 2471-2497 Japan
- 5.1-5.3 GHz UNII
- 5.7 GHz ISM Band
- Bluetooth - 2.4 GHz F.H.S.S, voice and 721 kbps data
- HomeRF - FHSS
 - 1.6 Mbps, Approved NPRM - 10 Mbps
- IEEE 802.11a/b - FH, DS-SS (2 Mbps/11 Mbps/54 Mbps)

Westell Solution

Westell's IAD -Access 4000

- Positioning - Best of breed flexible technology
 - Simultaneous Operation: RF, HPNA, Ethernet and USB LAN
 - Base Configuration (ADSL, 4 Ethernet Ports, expansion ports)
 - Home Networking - Ethernet, HPNA 2.0, USB, HomeRF, IEEE802.11(future), Bluetooth (future)
 - Voice - IP or ATM with intelligent mini PBX call options
 - Support for up to 4 RJ11 phone set connections
 - Video Distribution and playback (future)
 - Security/telemetry features

Westell Access 4000 IAD



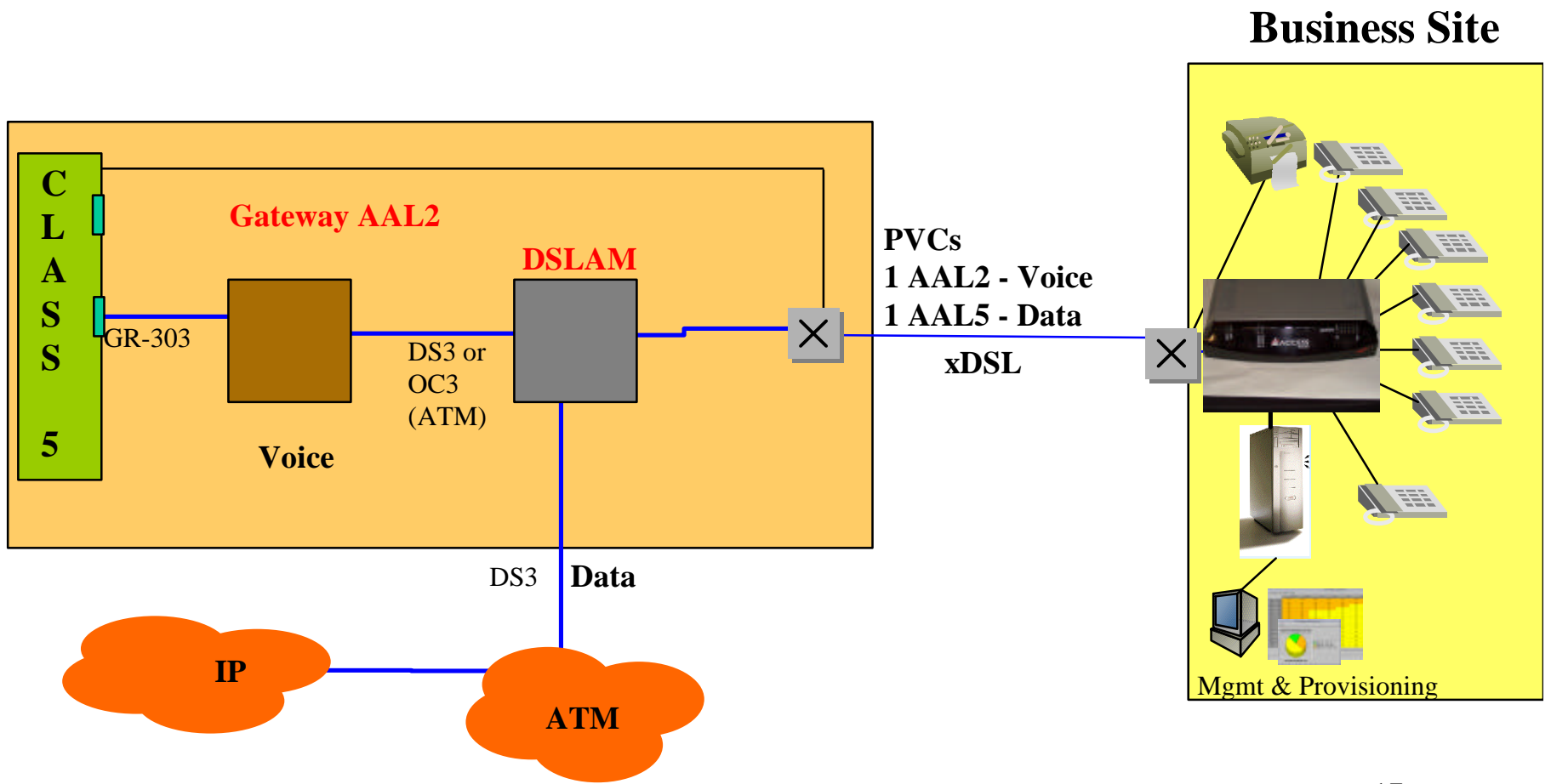
- 4 Port Ethernet hub
- 4 channel voice card
- USB
- HPNA 2.0 card
- ADSL port
- Desk top or wall mount
- Voice expansion slot + 2 PCMCIA slots

Typical IAD Voice Features

- Enhanced Voice Features
 - Automatic Call Back
 - Call Screening
 - Call Forwarding
 - Number Mobility
 - Station to Station Calling
 - Web Based Directory
 - VPN Support
 - Conference calling
- Support for Derived voice lines (RJ-11, HPNA, Cordless)
- Multiple CODEC options G.711, G.723.1, G.726, G.728, G.729A
- Multiple signaling options IP or ATM: MGCP, H.248/Megaco, SIP, Net2Phone, others

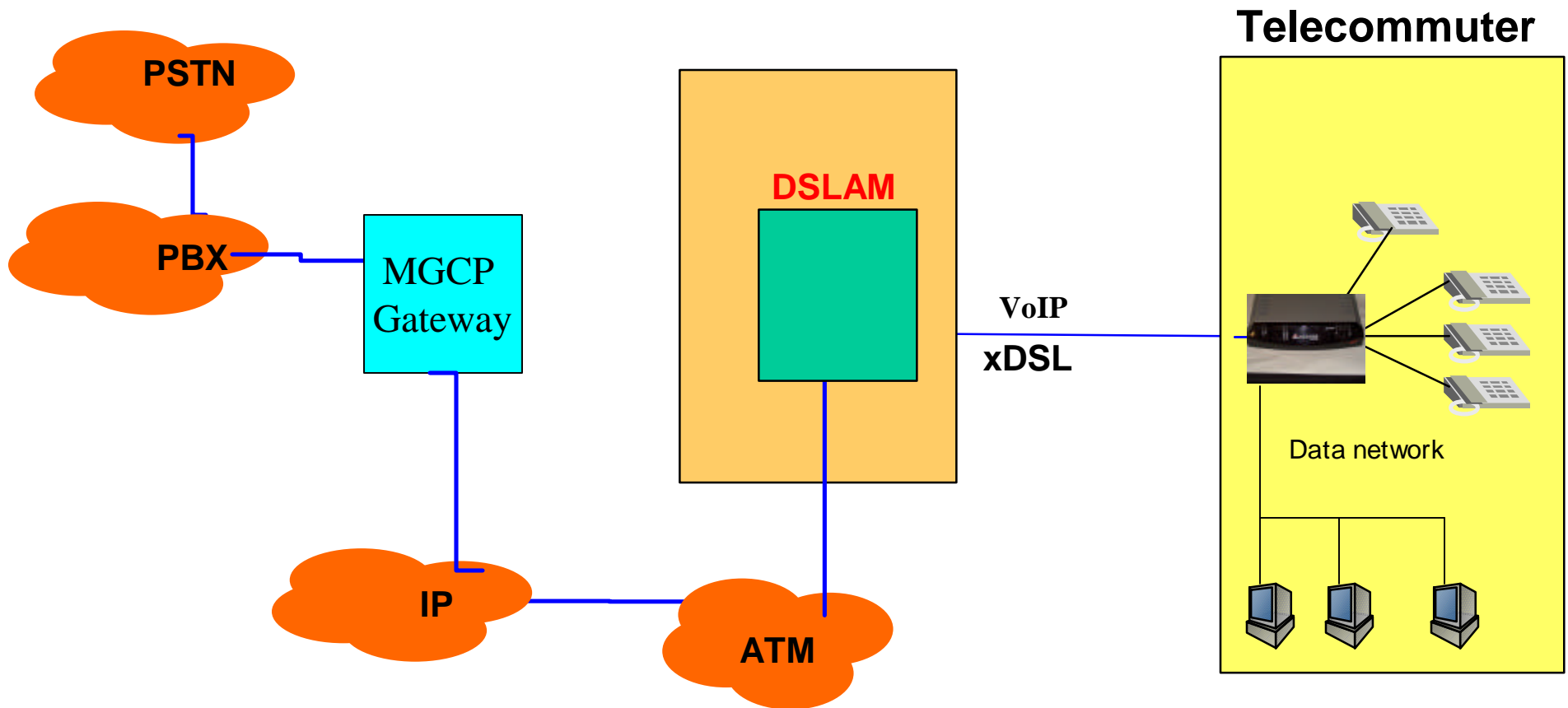
VoATM Application

-Class 5 switch termination



Telecommuter

Corporate PBX Extension



Preliminary Data Features

- PPPOA- RFC 2364/PPPOE- RFC 2516
- NAT/DHCP server
- RFC 1483 bridged and routed
- Firewall Support
- Password/peer group protection
- Transparent routing support- Net Meeting, IPSEC, L2TP, PPTP, games
- Multiple PVC's
- SVC support and auto provisioning
- Router support RIP1, RIP2, OSPF

Integrated Voice Services

- Voice Service Highlights
 - Multiple Virtual Connections Instead of Physical Loops
 - High Speed Data Shares Same Loop As Derived Voice lines
 - Each Derived Line Supports Fax and V.90 Modems
 - CO Powered Lifeline Service Available with ADSL
- Transport Options
 - Voice Over ATM (AAL2)
 - VOIP (MGCP) , H.323/H.248 Megaco, SIP, Net2Phone
 - Data Over ATM (AAL5)

IAD WAN Interfaces

- ADSL
 - T1.413, G.992.1, G.992.1
 - 32K-8Mbps Downstream
 - 32K-800 kbps Upstream
 - Adjustable in 32K Increments
 - Encapsulated in ATM AAL2 or AAL5
 - QoS (CBR, VBR-rt, VBR-nrt, UBR and GFR)
- g.SHDSL
- MMDS
- T1
- HDSL
- Cable

Standards Groups

- bluetooth.org -SIG
- atmforum.com
- homeplug.org
- homerf.org
- wifi.org
- osgi.org
- homepna.org
- dslforum.org
- ietf.org
- atmforum.org

IAD Challenges/Summary

- Convergence of IAD and residential gateway
- Self install solution- residential/SOHO/teleworker
- Distribution of voice services via wireless/HPNA
- Integration with existing OSS systems is difficult
- Standards activity must play a key role
- Migration of CTI will drive service revenue
- Teleworker, small business and residential= \$\$\$\$\$\$\$\$\$
- Traditional IAD (Ethernet, RJ-11 Voice) is limited
- IAD must be scaleable and able to evolve with services