

Communications Networks

FOR THE

NEXT GENERATION

Broadband Internet Access

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InterNetworking Systems, Service
Provider Networks



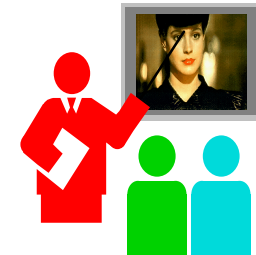
New Applications

**High-speed
business access
and next-generation
services QoS**



**Business
solutions**

integrated voice, video, data
and fax solutions



**DSL
Products and
Services**

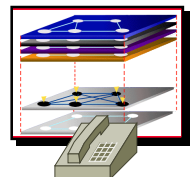
**Home
solutions**

video-on-demand, voice
and other applications



**Multi-Dwelling
Unit solutions**

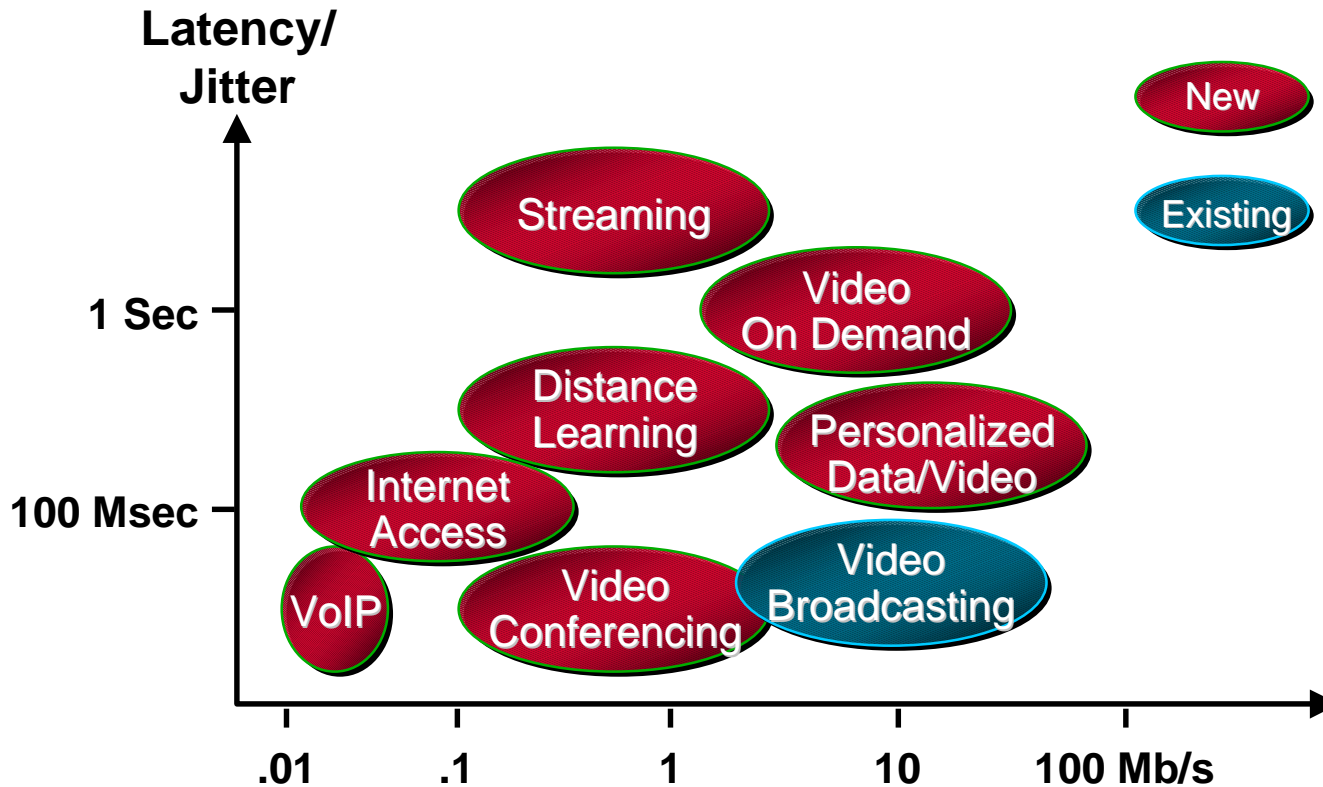
office buildings, apartment
buildings, hotel and
campus solutions



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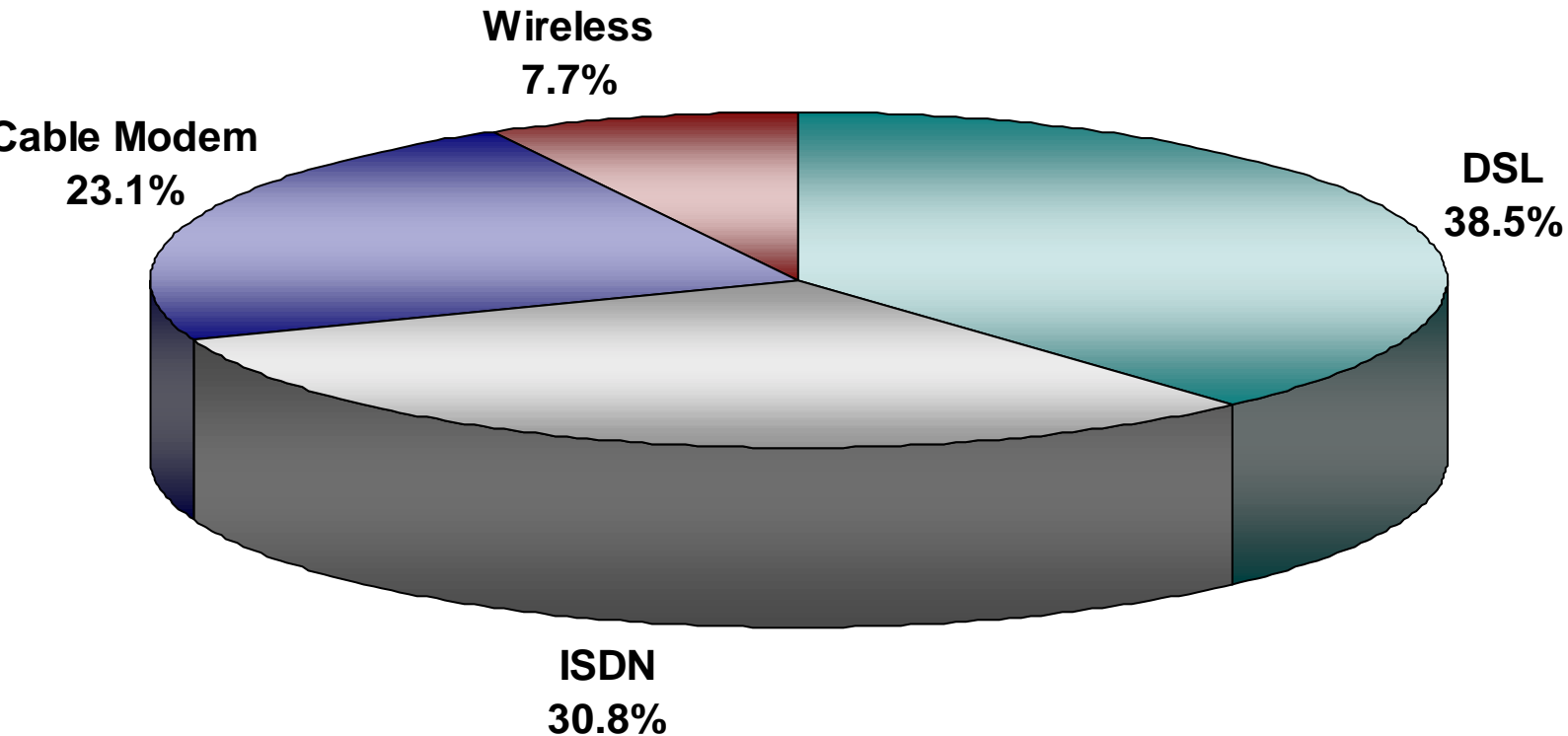
Application Opportunities

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Types Of High-Speed Access In Formal Programs

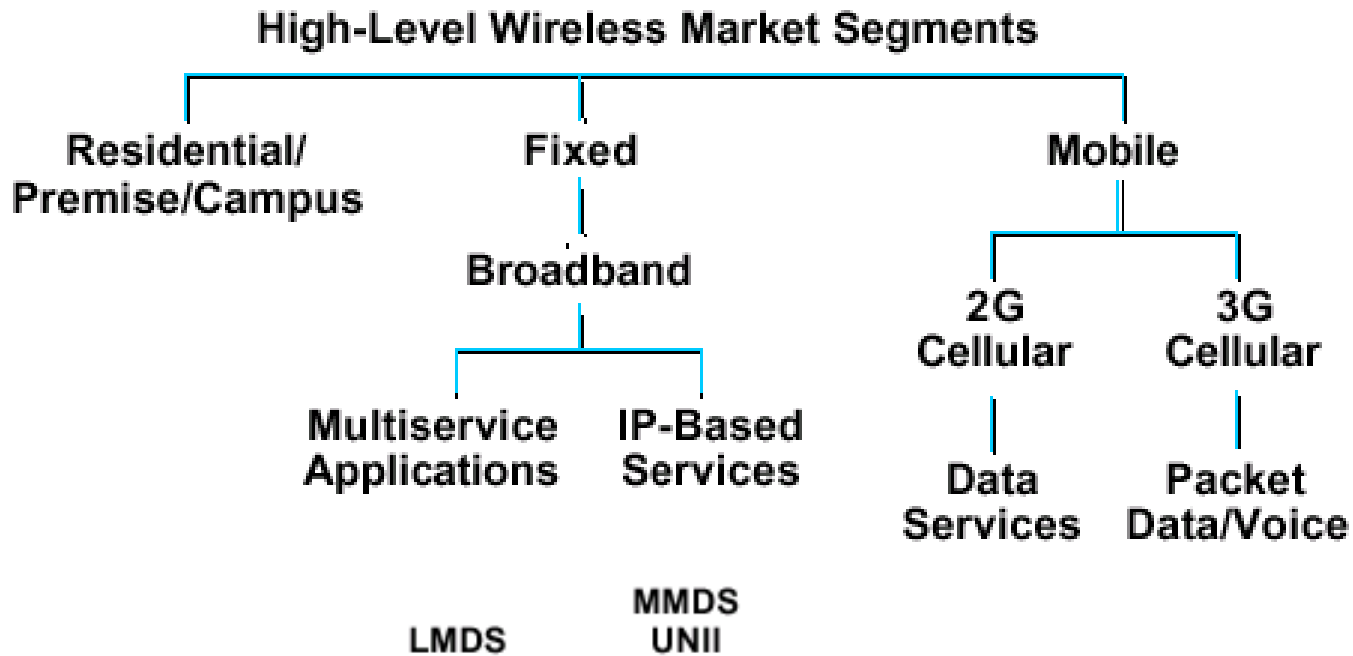
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DSL is closely followed by ISDN as the access technology of choice.

Wireless Technologies

Wireless Access



LMDS (Local Multipoint Distribution Service)

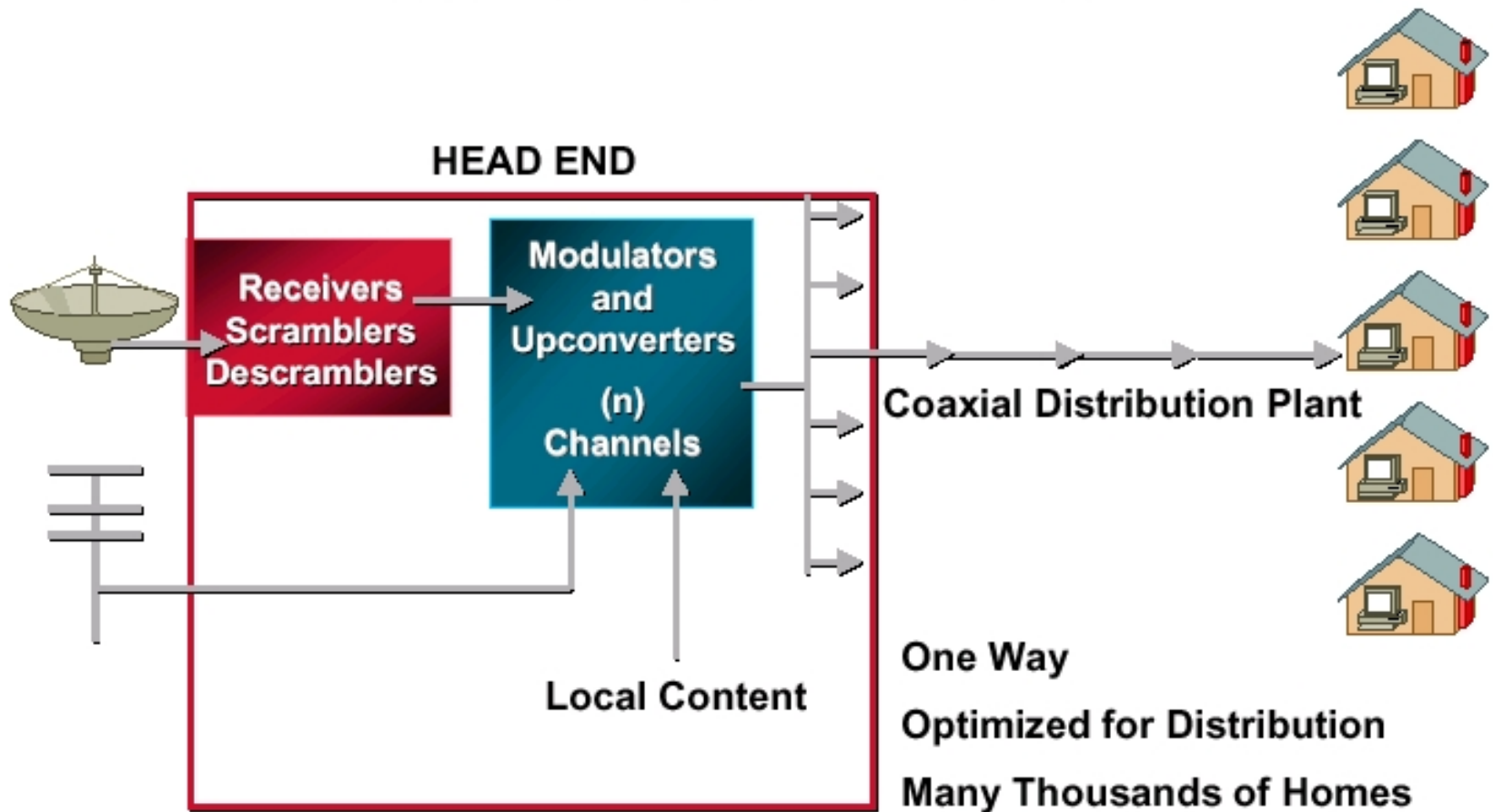
- **Two way broadband technology designed to integrate video, voice and high-speed data.**
 - High speed Internet Access
 - Real-Time multimedia file transfer
 - Remote access to corporate local area networks
 - Interactive video
 - Video-on-demand
 - Video-conferencing
 - Telephony
- **Fixed Wireless, initially envisioned as an entertainment video distribution technology competing with CATV system**
- **Low power, high frequency (25-31 GHz), 1300MHz**
- **short distance, 3-5 km coverage**
- **Up to 4,000 subscribers (voice/data) & 132 video channels**

LMDs issues...

- **March 1999, IEEE 802.11, 802.14 started initial study**
- **LOS (Line of Sight)**
- **Signal attenuated by water, path loss influenced by**
 - amount of local rainfall
 - tree deflection
 - host of other barriers
- **Overcome by reduce cell size or increase transmission power when it rains.**
- **Overlapping cells & high roof mounted antennas to avoid trees or barriers**
- **High Installation cost**

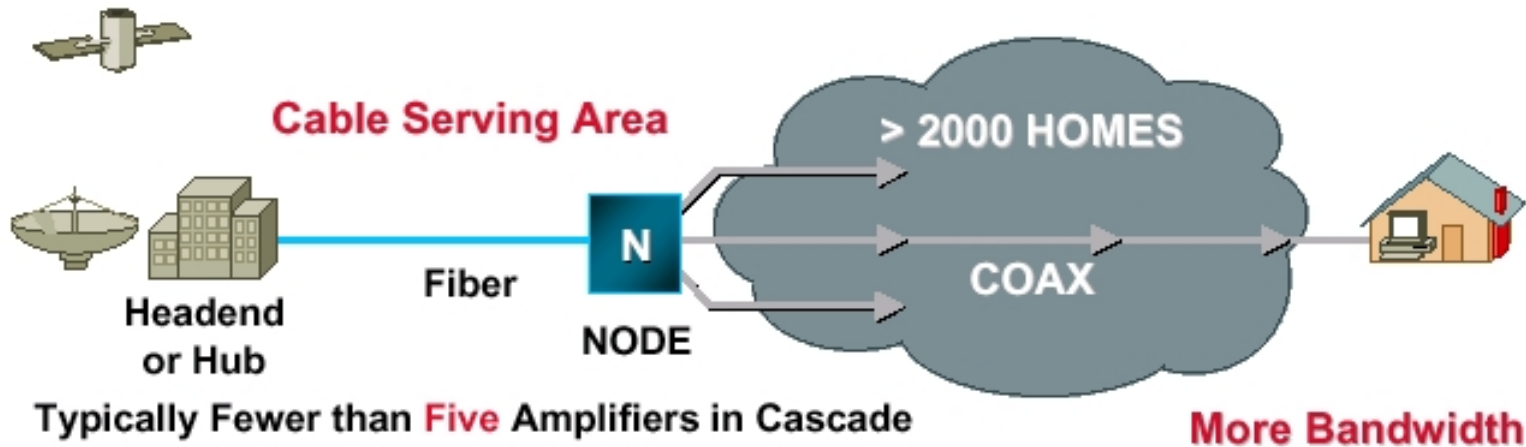
Cable Modem & HFC

Early Coax Feeder Network



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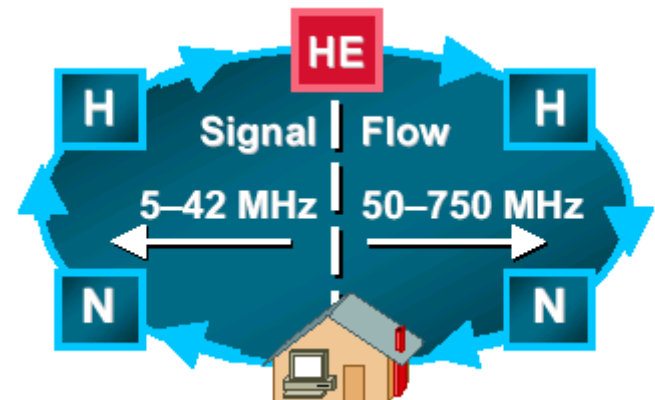
Hybrid Fiber Coax Infrastructure



- **Video** is transmitted over fiber to the node, where it is converted to an electrical signal and forwarded to the subscriber over existing coaxial cable
- Provision is made to support **return traffic** for future services

Benefits of HFC to Node level

- **High Reliability**
- **Increases RF bandwidth**
 - 750 MHz (or more)
 - Source brought closer to subscriber
 - Facilitates introduction of two way
- **Improves reliability and availability**
 - Fewer failure components
 - Improves noise characteristics



xDSL

Digital Subscriber Line

DSL (Digital Subscriber Line)

- **Digital Subscriber Line (DSL)** technology provides a cost-effective way to deliver **data, video, and voice** services over standard **twisted copper-pair local loop lines** to residential consumers, at-home workers, small businesses, medium-sized businesses, hotels, and multi-tenant buildings.
- DSL can be combined with **other access topologies**. For example, an operator can deploy fiber rings to a multiplexer in the basement of an office building and then use DSL over the in-building copper wiring. Another option is to use a broadband wireless connection with an antenna on a building roof, with voice and data traffic then carried over DSL using the copper wiring inside that building and adjacent buildings.

DSL Technologies

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		Type	Up/Down-stream Speeds	Distances
Business		IDSL	64kbps-144Kbps/144Kbps	1 pair up to 36,000ft Transparent to DLC
		SDSL	144k-2.3Mbps/144k-2.3Mbps	10,000 ft. (28,000 ft.)
		HDSL	1.5Mbps/1.5Mbps	12,000-15,000 ft.
		HDSL2	1.5Mbps/1.5Mbps	1 pair to 12,000 ft.
		VDSL	13-52Mbps/1.5-2.3Mbps	1,000-4,500 ft.
Consumer		ADSL	7.1Mbps/680Kbps	1 pair up to 18,000 ft. (12,000 ft. fastest speeds) Requires Splitter for Lifeline POTS
		RADSL	1.5-8Mbps/1.54Mbps	
		G.Lite	1Mbps/512Kbps	

DSL Benefits

Price/ Performance

- **Speed**
DSL is fast!
- **Cost-effective access**
DSL is far less than a T1 or E1
- **Flat fee**
DSL subscribers normally pay a flat monthly fee for Internet access. There are no usage charges.
- **Continuous Connection**
■ DSL users are **always connected**, so they get immediate Internet access. ISDN and dial-up modems must first establish a connection.

Dedicated Bandwidth

- **Dedicated bandwidth**
DSL provides a **dedicated last mile** connection, unlike shared bandwidth solutions (e.g., Ethernet and cable modems).

Uses Existing Wiring

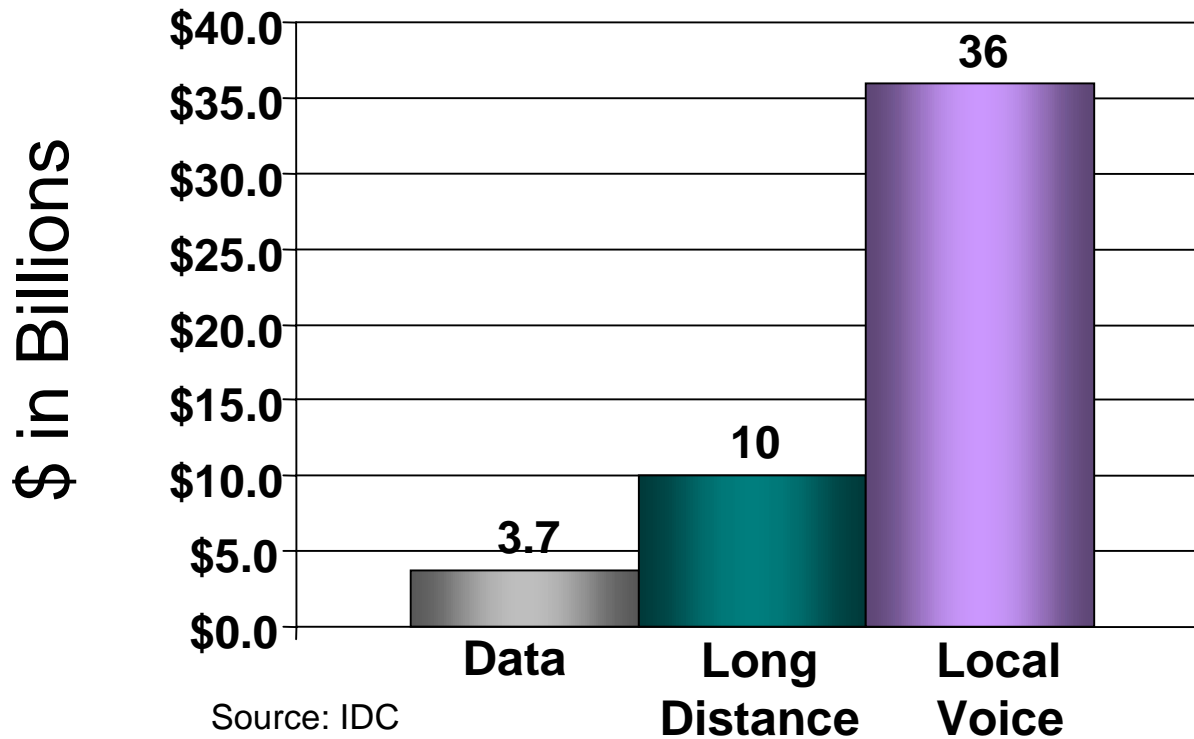
- **No special wiring**
 - DSL uses
 - the existing telephone wiring

Easy to Use

- **Upgrades**
DSL provides customers with a cost-effective upgrade path. Service Providers can upgrade a customer's service remotely when the customer needs a higher access speed.

Business Market

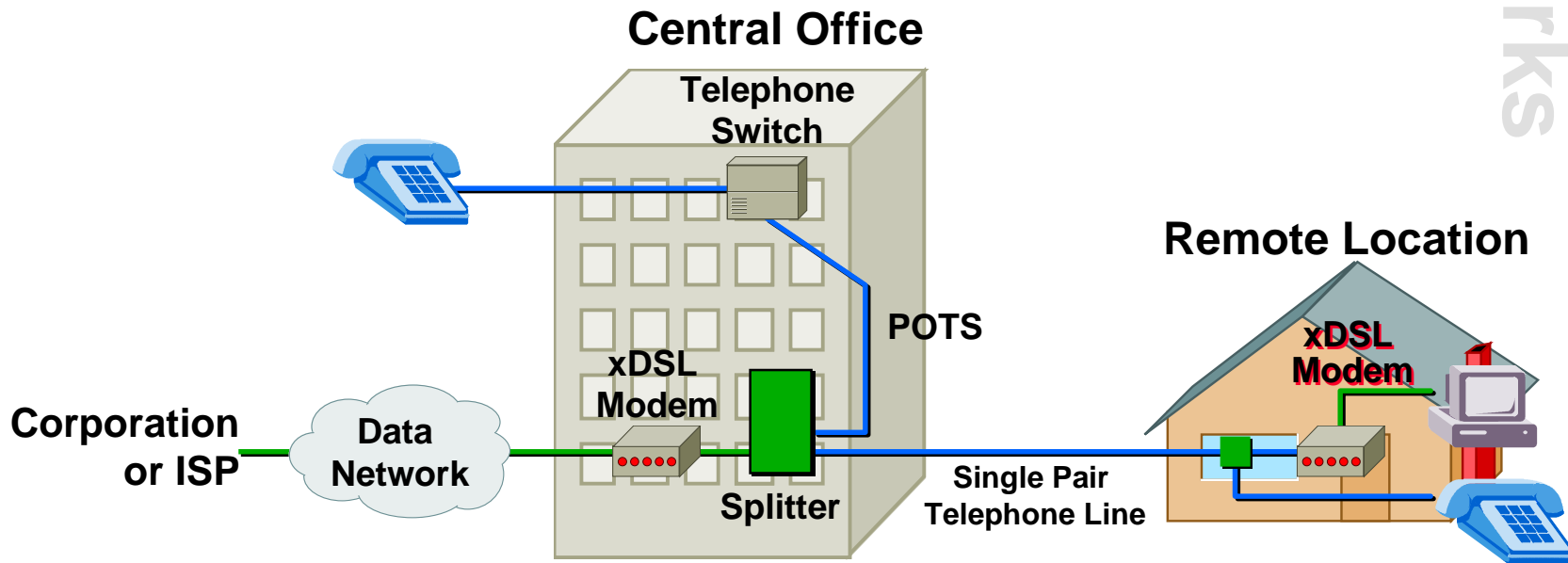
Small Business Annual Spending (Example from the U.S.)



Result: Integrated Voice/Data Can Be a Big Money Maker.

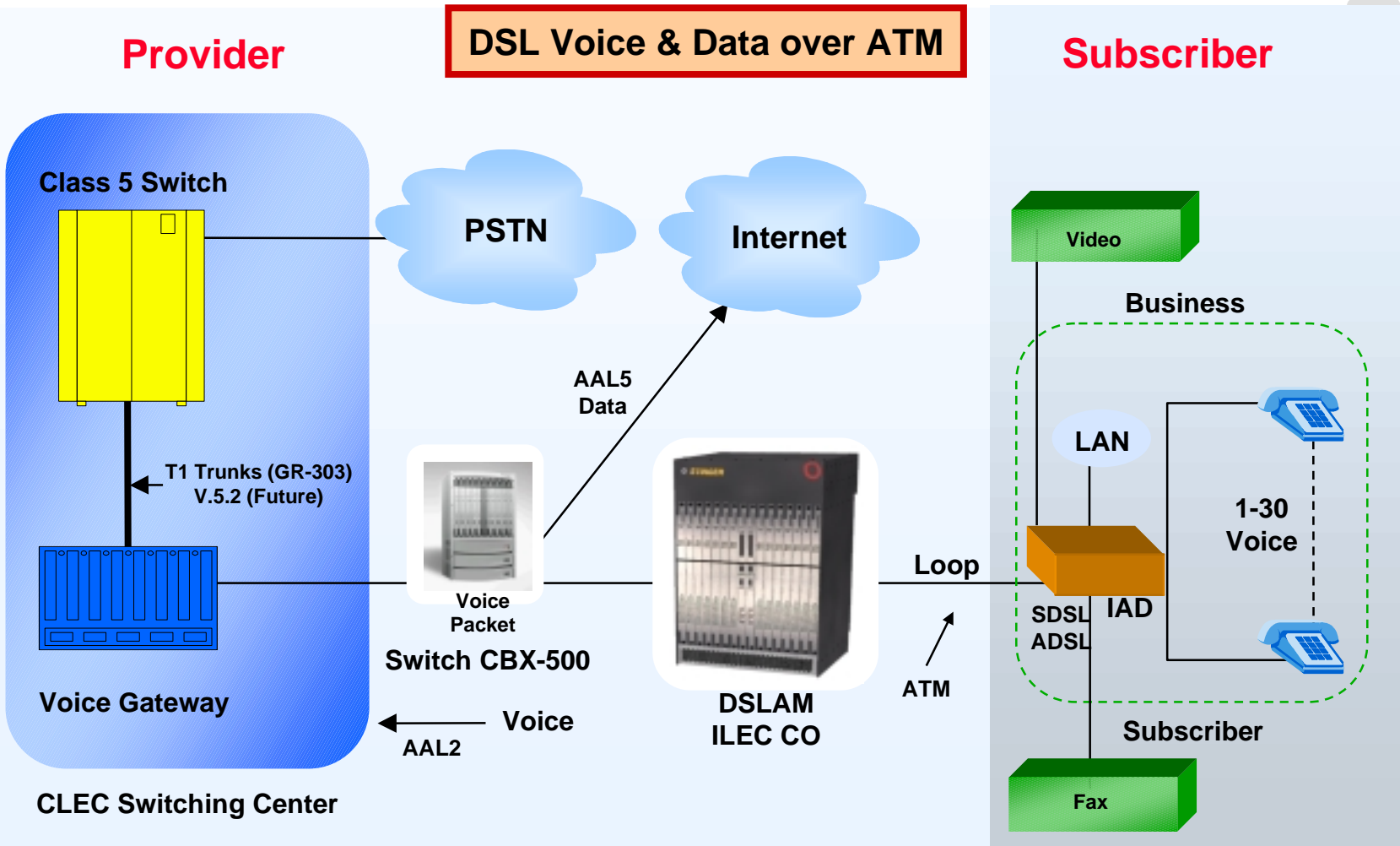
Generic xDSL Implementation

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DSL Voice/Data Solution

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DSL vs Cable

	DSL	Cable
Dedicated Vs. Shared	DSL Is a Dedicated Connection: <ul style="list-style-type: none">• No bandwidth contention• Secure	Cable Is a Shared Wire: <ul style="list-style-type: none">• Noticeable speed impairment during “rush hour”• Near-term security issues
Availability	Telephone Wires Are Universally Available to Nearly Every Business and Residence	Existing Cable Is Almost Exclusively Residential
Accessibility	Approx. 15% of Current Customers Are Inaccessible (Out-of-reach, Bad Copper, Etc.)	Cable Head-end Equipment Must Be Upgraded or Replaced for Two-way Communication
Impairment Susceptibility	Telephone Wires Are Susceptible to High-frequency Cross-talk and External Impairment	Cable Is Shielded—Signal Impairment Is Not a Problem
Customer Support	Established Customer Support Models and Systems for Data Services and Per Subscriber Outages	Data Service Is New and Operations Model Is Broadcast Oriented
Consumer Awareness	Telcos Are the Incumbent for Voice and Data	Cable Companies Are Moving Aggressively

Multi-Tenant and Multi-Dwelling Buildings

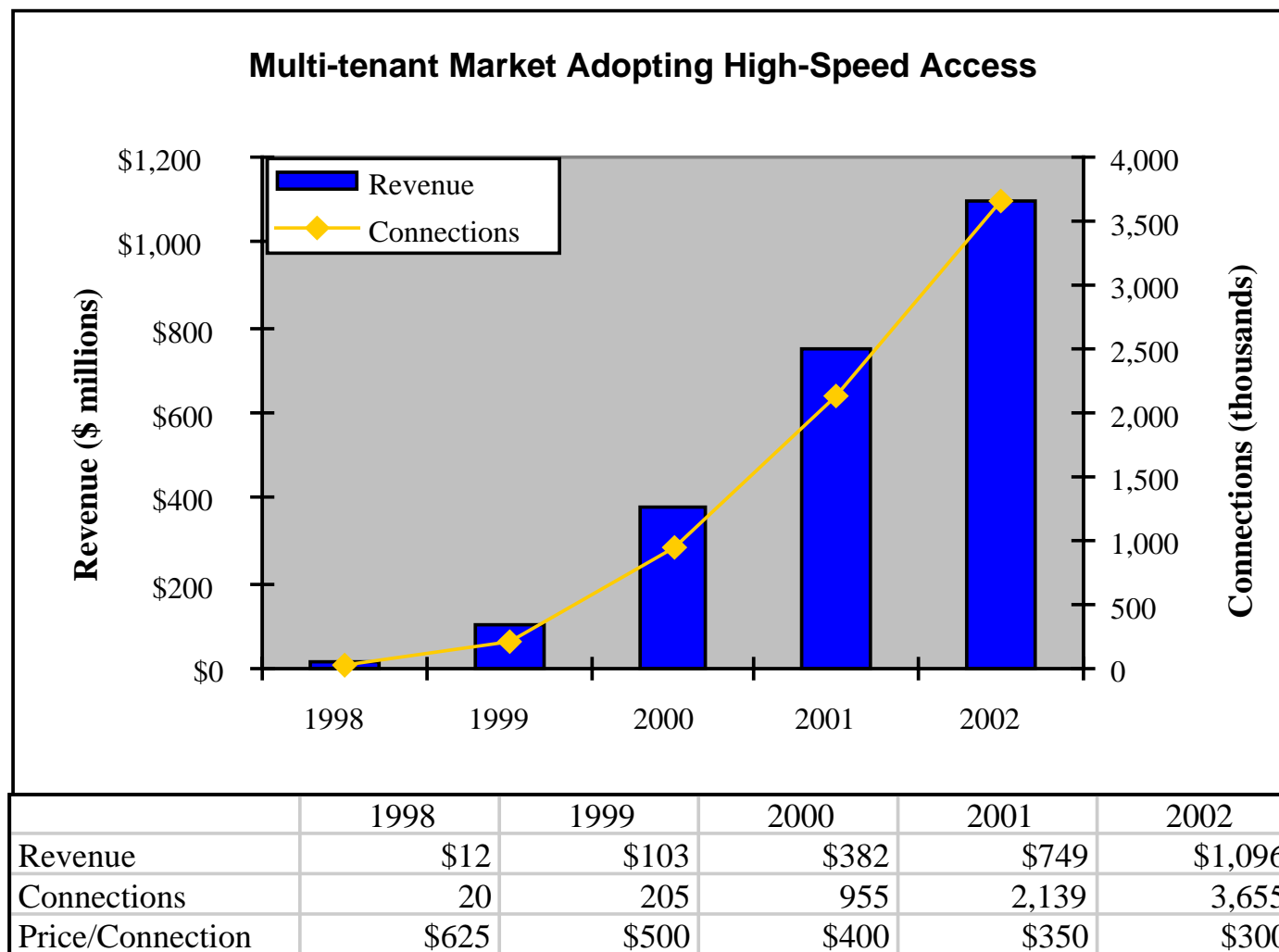
- **What are Multi-tenant Units/Multi-Dwelling Units (MTUs/MDUs)?** *Buildings with multiple tenants.*
 - **High-rise buildings or “garden-style” buildings**
 - Business
 - Residential
 - **Hotels**
 - **Campuses**
 - Corporations
 - Educational
- **Who are the potential customers for DSL services?** *End user customers (tenants).*
 - High-speed connections for business traveler guests.
 - Sophisticated home users
 - DSL can be used for corporations who have not yet invested in a LAN throughout their campus locations.
 - Small businesses needing T1/E1 speed, but lower cost.

Hotels In Broadband MTD Market

Hotel	Total # of Locations	Wired 9/99	Wired End of 99	Nightly charge	24-hour help
Marriott	684	20	100+	9.95	Yes
Hilton	275	25	50	9.95	Yes
Hyatt	111	16	20	9.95	Yes
Radisson	228	N/A	100	9.99	Yes
Westin	56	Up to 5	11	9.95	Yes
Sheraton	170	Up to 17	34	9.95	Yes

US MDU Market Size

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Source: Access Partners, Jan. 1999

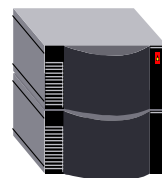
Lucent MultiDSL Portfolio

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**COE
Access Concentrator**



Stinger



DSL TNT



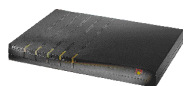
DSLMAX 20

**Circuit
Termination Device**



Terminator 100

**CPE
Frame and ATM**



**DSL
Pipe-IDSL
50, 75, and
85**



**DSL
Pipe-ADSL
-DMT
-CAP**



**DSL
Pipe-SDSL**



**CellPipe
50A
ATM-over-
ADSL router**



**CellPipe
50S
ATM-over-
SDSL router**

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Thank You!

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