

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
SLOAN SCHOOL OF MANAGEMENT

15.565 Integrating Information Systems:

Technology, Strategy, and Organizational Factors

15.578 Global Information Systems:

Communications & Connectivity Among Information Systems

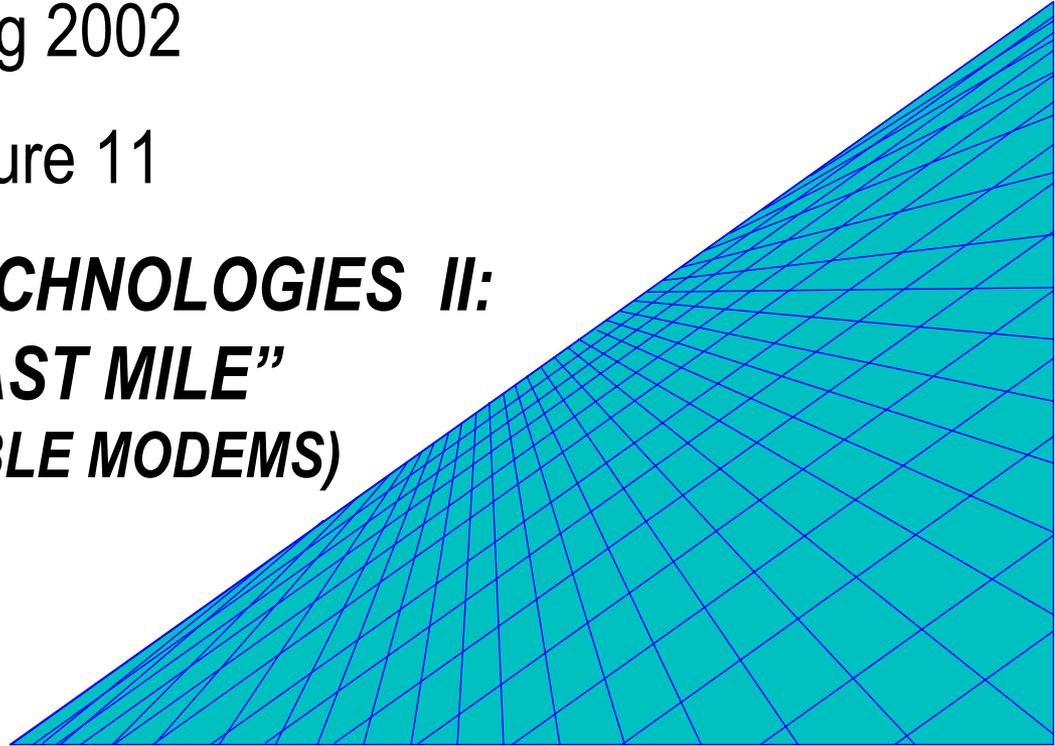
Spring 2002

Lecture 11

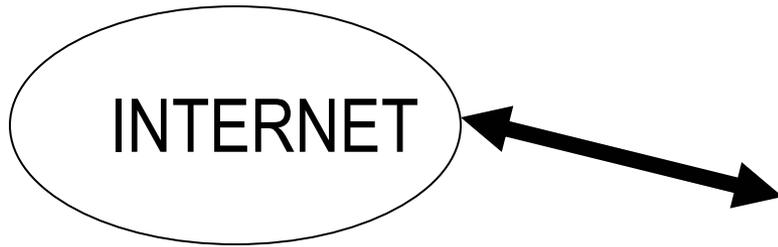
EMERGING TECHNOLOGIES II:

“THE LAST MILE”

(xDSL / CABLE MODEMS)



THE DIGITAL “LAST MILE”



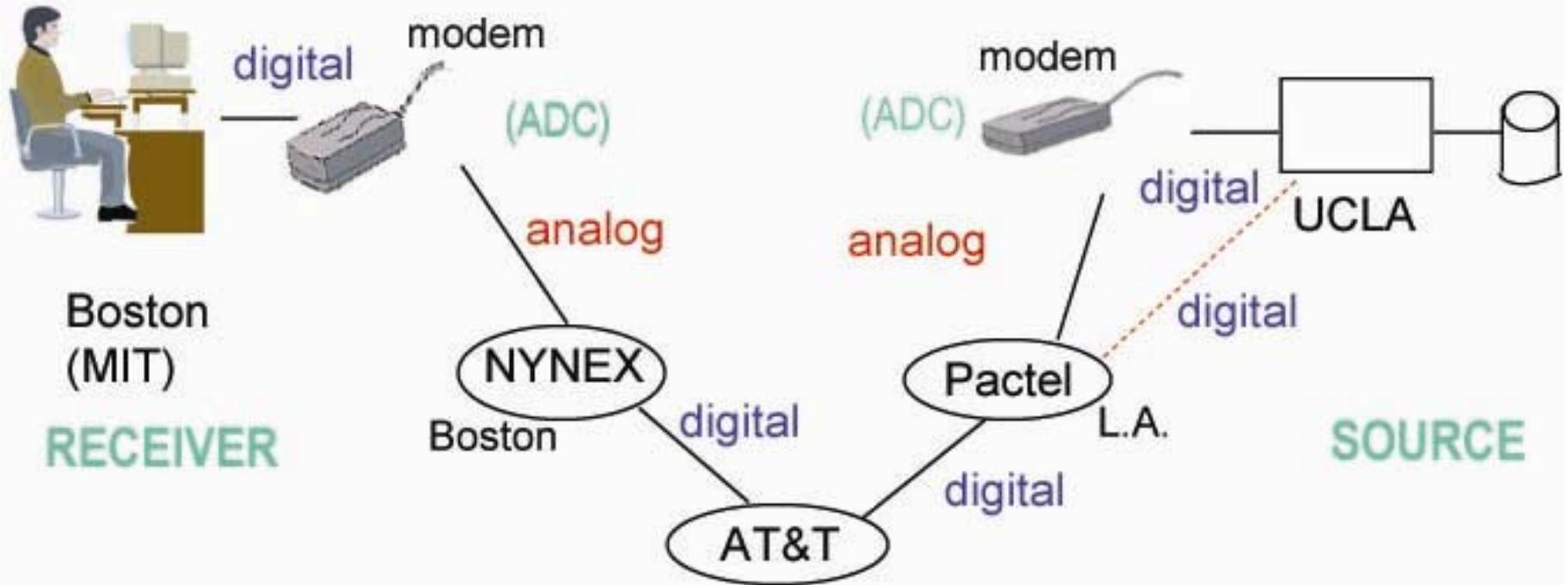
- CHALLENGES

- EXPENSIVE
- DISRUPTIVE

- APPROACHES

- “JUST DO IT” (FIBER TO THE HOME)
- **“USE EXISTING” (TELEPHONE, CABLE)**
- “BYPASS” (RADIO, SATELLITE)

56K MODEMS



- ONLY ONE ANALOG-TO-DIGITAL CONVERSION (ADC)
- **ASYMMETRIC** (56K "downstream", 33.3K or less "upstream")
- NOT GUARANTEED 56K SPEED (OFTEN 40-60% LESS)

EMERGING REMOTE ACCESS TECHNOLOGIES

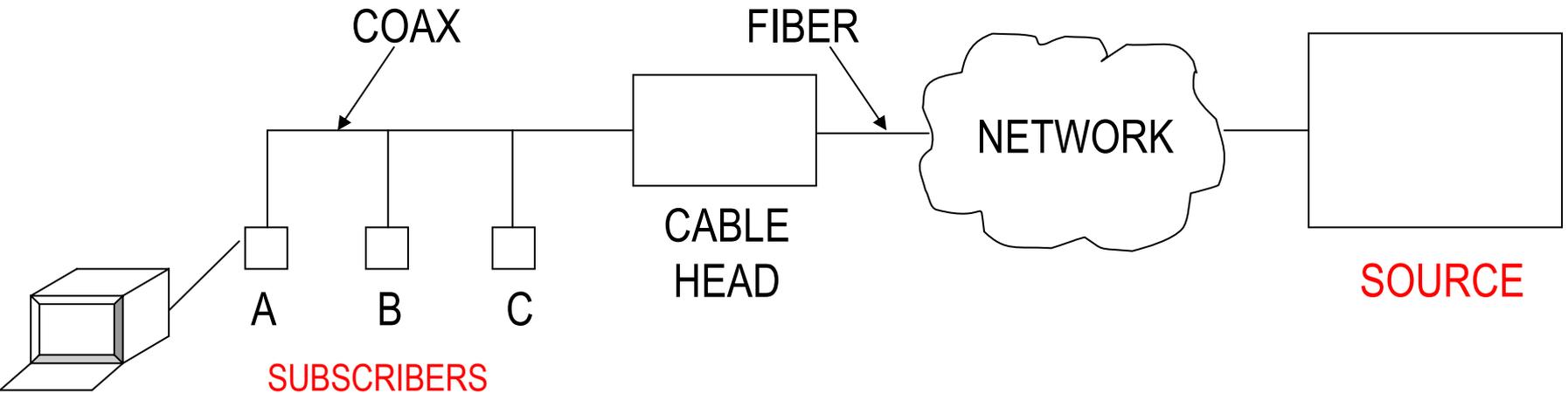
	Voice/ Data	Media	Speed	Traffic Flow	Connection	Availability	Distance limitation ¹	Equipment
ADSL	Data	Copper pair	T1 to 9 Mbit/s downstream, 16- to 640 Kbit/s upstream	Asymmetric	Point-to-point	Limited	18,000 feet	DSL modem
Cable modem	Data	Coaxial cable	500 Kbit/s to 30 Mbits downstream, 640 Kbit/s to 15 Mbit/s upstream	Both	Point-to-point	Limited	None ²	Cable, modem, Ethernet card
HDSL	Data	Copper pair	384 Kbit/s to T1	Symmetric	Point-to-point	Limited	12,000 feet	DSL modem
ISDN	Both	Copper pair	128 kbit/s	Symmetric	Switched	Nationwide (though not everywhere)	18,000 feet	Terminal adapter

¹ From central office or head-end

² Customer must have cable service

ADSL = Asymmetric digital subscriber line, HDSL = High-speed digital subscriber line, T1 = 1.544 M

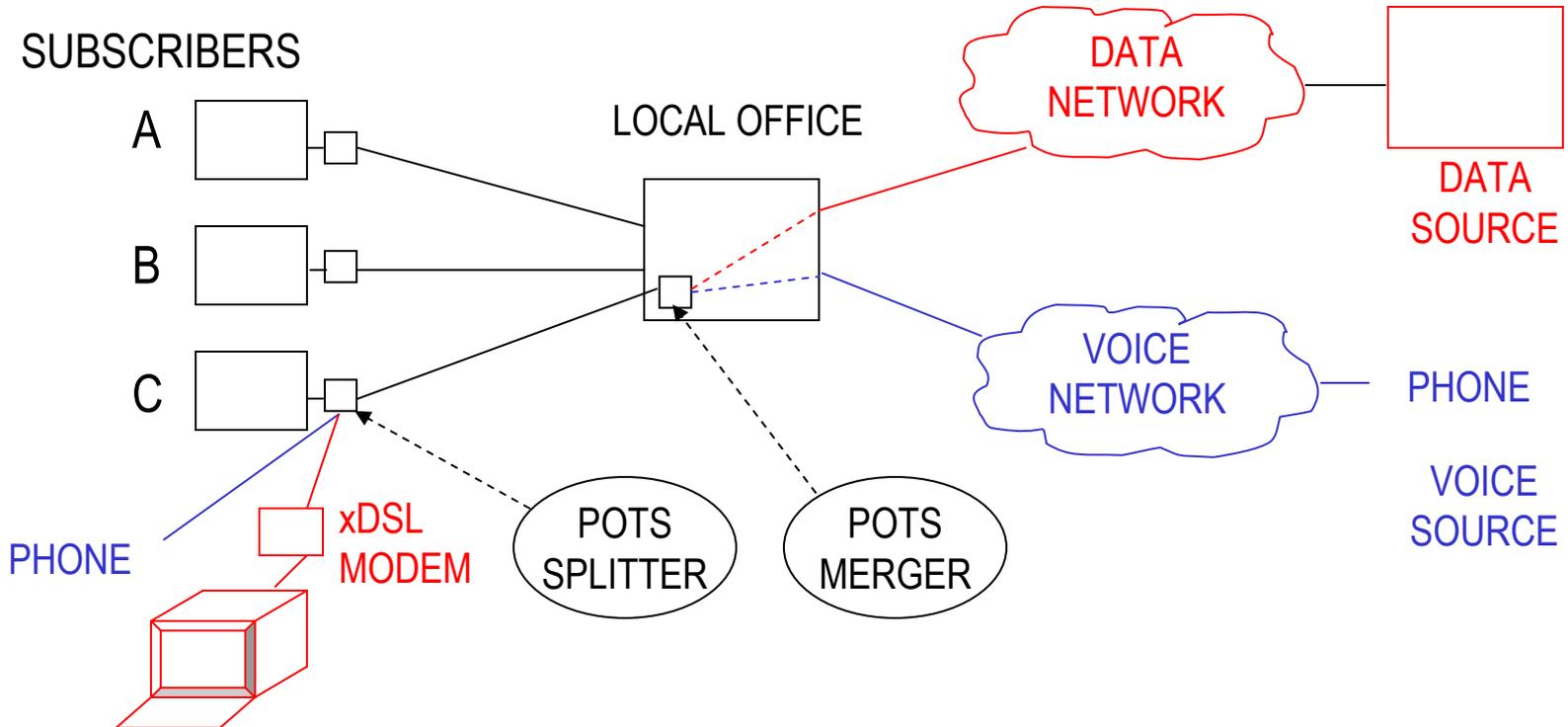
CABLE MODEMS



- HOW SIMILAR TO AND DIFFER FROM ETHERNET
 - IMPACT ON PERFORMANCE / PRIVACY
- WHY ASYMMETRIC (NORMALLY)
- DIRECTION OPTIONS:
 - NO UPSTREAM (UNI-DIRECTION)
 - LIMITED UPSTREAM (ASYMMETRIC)
 - SYMMETRIC
- ROLE OF SATELLITE TV AND TELCO'S

xDSL MODEMS

- DSL = DIGITAL SUBSCRIBER LINE



- USES UNUSED PHONE LINE CAPACITY -- VARIOUS ENCODING TECHNIQUES
- DISTANCE KEPT SHORT -- TRADE-OFF: DISTANCE VS. SPEED
- CAN BE SYMMETRIC OR ASYMMETRIC (e.g., ADSL)
- WHAT ARE REASONS FOR DELAY IN DEPLOYMENT?

TYPES OF DSL TECHNOLOGIES

- **ADSL:** ASYMMETRIC DSL
- **R-ADSL:** RATE ADAPTIVE DSL
 - ADJUSTS DYNAMICALLY TO LINE LENGTH AND QUALITY
- **ADSL LITE** (Bell Atlantic, Microsoft)
 - SLOWER SPEED AND WITHOUT POTS SPLITTER
 - LARGER DISTANCES AND SIMPLIFY INSTALLATION
- **HDSL:** HIGH BIT RATE DSL
 - SYMMETRIC AND HIGH SPEED (T1)
 - SHORTER DISTANCES AND MULTIPLE WIRE PAIRS
- **SDSL:** SINGLE LINE DSL
 - USES SINGLE WIRE PAIR AND SHORTER DISTANCES
- **VDSL :** VERY HIGH BIT-RATE DSL
 - ASYMMETRIC AND FASTEST (13-52M DOWN, 1.5-2.3M UP)
 - SHORTEST DISTANCE (1000-4500 FEET)

APPLICATIONS (with differing needs)

- Internet / Intranet Access
- Web browsing vs hosting
- E-mail
- Remote LAN
- Video conferencing
- Transaction processing
- IP telephony
- Call center services
- Video telephony (video conference)
- High-definition TV
- Video-on-demand
- Leased line backup