# DATACOMM

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## Telephony

- Public Switched Network
- AT&T Divestiture
- Intra-LATA Routing
- Inter-LATA Routing
- Regulation
- Voice Communications Services
- Office Phone System Features
- Wireless Communications
- Homework assignment

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### **Public Switched Network**

Star topology vs mesh

- Cannot link everyone to everyone else
  - Pairwise linkages grow as n(n-1)/2 which is approx. n<sup>2</sup>/2 for large n
    - Thus for 1000 people would need about
    - 500,000 connections
  - Therefore move to star network where connections are proportional to n
- Link phones to central office
  - AKA end office or local exchange
  - choose circuits using central office switch

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## **Public Switched Network**

#### Signalling

- off-hook
- dialtone
- ringing
- ring-back
- busy
- call-waiting
- flash
- howler

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### **Public Switched Network**

#### Signalling

- Touch-tone or DTMF (Dual-Tone Multifrequency Dialling)
  - Each row and column contributes a known frequency
  - Therefore each key generates unique pair of tones
  - DTMF register converts tones into digit
  - Also used by Touch-Tone Interfaces to
- computers
- Rotary dialing
  - opening and closing at fixed frequency

– now on way out DC 2 - 5

### **AT&T Divestiture**

#### • U.S. Govt vs AT&T (1974-1984)

- viewed huge Bell System as monopoly
- AT&T referred to as "Ma Bell"
- Modified Final Judgment (MFJ) forced
- divestiture of components
- led to changes in organization and terminology
- AT&T one of many IECs (inter-exchange carriers)
- Bell Communications Research (Bellcore)
  - research
  - administrative services
  - serves all BOCs (Bell Operating Companies)

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### **AT&T Divestiture**

- Local phone companies supply specific regions only
- These Local Exchange Carriers (LECs) include both
  - Bell Operating Companies (BOCs)
  - AKA "Baby Bells"
  - also Independent Telephone Companies (ITCs)
- Groups of BOCs formed Regional Bell Operating Companies (RBOCs)
  - AKA Regional Holding Companies (RHCs)

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## AT&T Divestiture

- BOCs defined several Local Access and Transport Areas (LATAs)
  - carry all calls within LATA
  - bring long-distance calls to Point of Presence (POP) for IECs
- Most LATAs centered on metropolitan areas
- LATA can include several area codes
- Structures in Canada are similar to U.S. pattern
  - Bell Quebec, Bell Canada, AGT…
  - e.g., Quebec LATA includes 514, 819, 450 & 418

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### Intra-LATA Routing

- Local loop used for calls within 3-digit prefix or groups of several prefixes
- Interoffice trunk carries signal between central offices within LATA
- Area codes do not determine if call is local or long-distance
- Several LECs can share a LATA
- Data exchange among LECs ensures proper billing to customer through one LEC

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## Inter-LATA Routing

- Inter-LATA = long-distance
- Requires intervention of IECs
- Default carrier reached using 1- prefix
- In US can reach alternate carriers using 5digit access codes of form 10xxx
- All LECs and IECs share standard signals
- Billing options also sent through lines as special audible tones
- Specific route of call varies from one call to another; hence switched network

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### Regulation

• USA

- State Public Utility Commissions (PUCs)
- Federal Communications Commission (FCC)
- Open Network Architecture (ONA)
- Basic Service Elements (BSEs)
- Canada
  - Canadian Radio-Television and
  - Telecommunications Commission (CRTC) – Similar to U.S. situation
  - Similar to 0.5. Situation
- Other countries usually have Postal, Telephone & Telegraph Administrations (PTT)

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### Voice Communications Services

- Wide-area telecommunications services (WATS)
- Inward-WATS = toll-free (800, 888 etc) service
- Revenue-generating = 900 numbers
- Foreign exchange (local number in another city)
- Leased lines
  - lower cost if used fully
  - no switching: always open
  - guaranteed line quality
  - can pay for high-quality conditioned line
  - risks of outage greater than for switched calls

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### Office Phone System Features

Centrex

- central office handles all calls into office including intra-client calls
- usually need code (e.g., 9) to place outside call
- Customer-Premises Equipment (CPE) can replace Centrex; e.g., Key Systems, PBX

#### Key systems

- multiline phones
- wiring for intercom function
- can handle up to about 150 users

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### Office Phone System Features

Private Branch Exchange (PBX)

- AKA Computerized Branch Exchange (CBX)
- similar to a central office
- can handle thousands of phones
- can link PBXs together for huge companies
- multiple lines from PBX to LEC central office
- usually offer many service features
  - call detail [account] recording (CDR or CDAR)
  - direct inward system access (DISA): very dangerous (see later)

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### **Wireless Communications**

#### Cordless phone

- a few channels available
- low-power = short distance
- susceptible to eavesdropping and theft of dial tone
- Microcellular phone system
  - base stations within building or campus
  - computer-operated switching of call as end-points move throughout area

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## **Wireless Communications**

Public cellular phone system

- Problems of confidentiality and noise
- Analog systems will be replaced by digital cellular
- New systems of personal cellular services

   will permit phone number to be changed to personal number
  - thus calls will follow person
  - will use whichever channel is cheapest
  - e.g., phone on nearest desk if possible; else personal cellular phone

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### Homework

- Read Chapters 1 & 2 of your textbook in detail, adding to your workbook notes as appropriate.
- Review and be prepared to define or expand all the terms listed at the end of Chapter 2 of your textbook (no hand-in required)
- Answer all the exercises on page 30 of the textbook using a computer word-processing program or absolutely legible handwriting (hand in after quiz tomorrow morning)

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