University of Toronto

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Networks - Speeds

WAN (Wide Area Network)

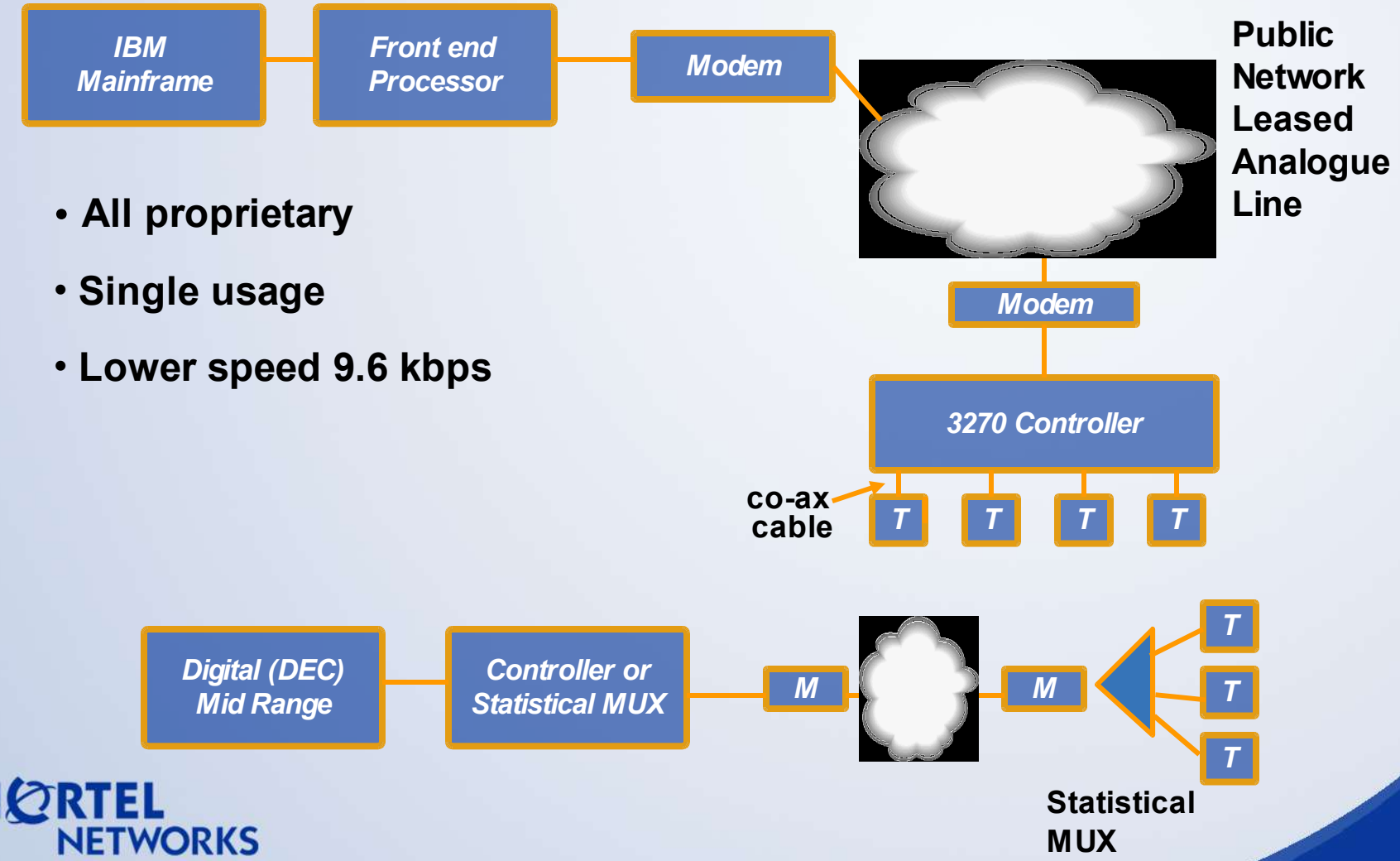
80's	Dial	2.4 kbps
80's	Leased Line	9.6 kbps
80's	Leased Line	19.2 kbps
90's	Digital Access	56.0 kbps
90's	Backbone WAN	128.0 kbps
2000	T-1 Access/Backbone	1,544.0 kbps
2000	Cable	1,000 (1M)
2000	DSL	6,000 (6M)
2000	T-3 Metro/ATM	45,000 (45M)

LAN (Local Area Network)

Ethernet

80's	Hub	10,000 (10M)
90's	Switch	100,000 (100M)
2000's	Switch	1,000,000 (1 Gig)
2004	Switch	10,000,000 (10 Gig)

Networks – The 80's
Computing Model – Centralized CPU, 'Dumb Terminals'



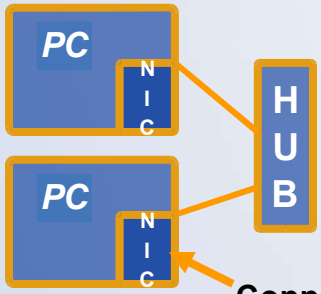
- All proprietary
- Single usage
- Lower speed 9.6 kbps

Local Area Networks (LAN) Computing Model, Distributed CPUs (PC or Departmental system)

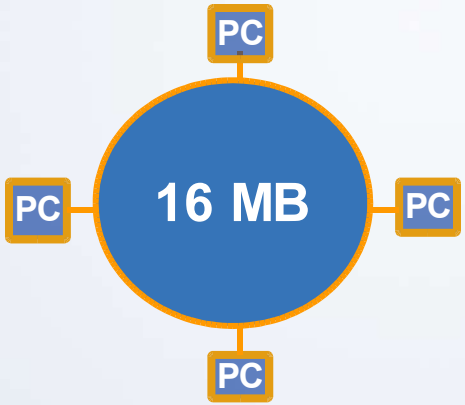
- Share Resources - Printers

IBM Token Ring

Physical

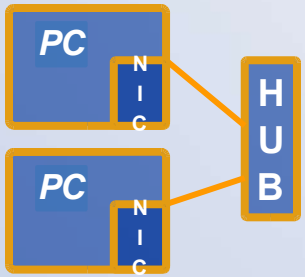


Logical



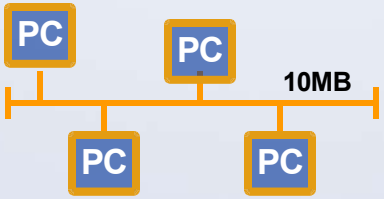
Copper typically Category 3 STP
(Shielded twisted pair)

DEC, HP, etc. Physical



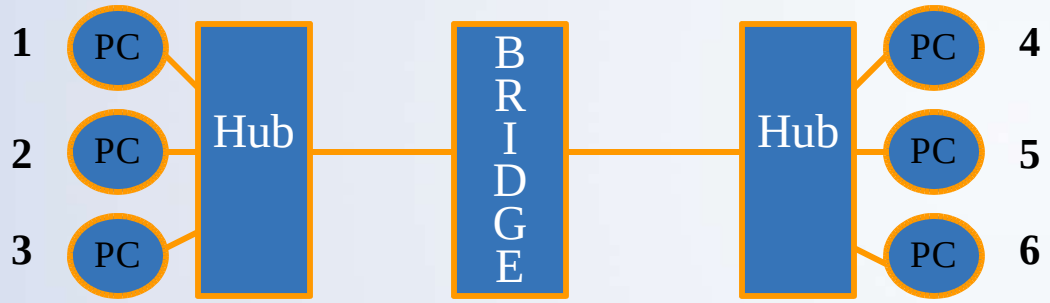
Logical

Ethernet

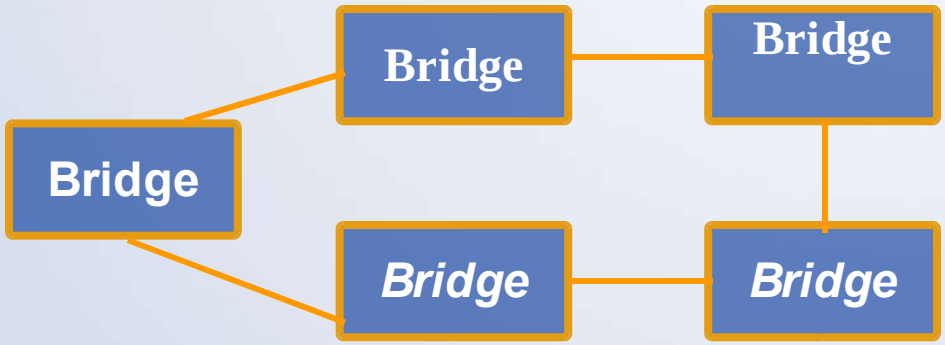


NORTEL NETWORKS
BUSINESS WITHOUT BOUNDARIES

LAN to LAN
Computing Model Centralized and Distributed (including Client-Server)
Bridge – "here or there"



Knows what is on <u>local</u> port



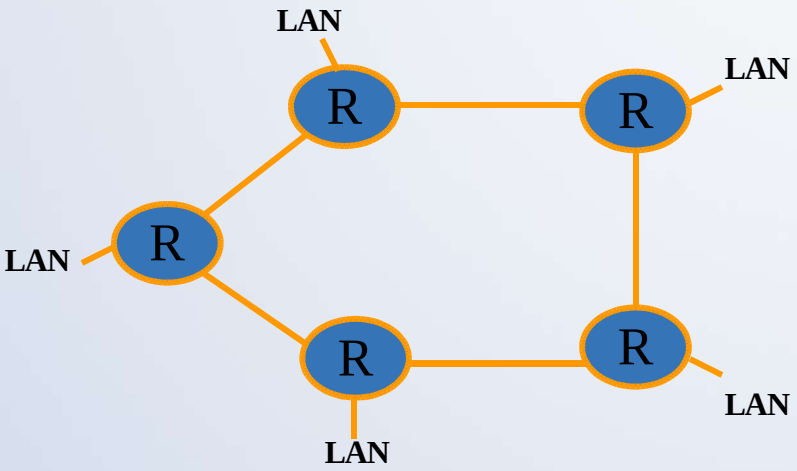
Forward all 'unknown' packets/frames

LAN to LAN

Bridge Issues

- Scale
- Broadcast storms

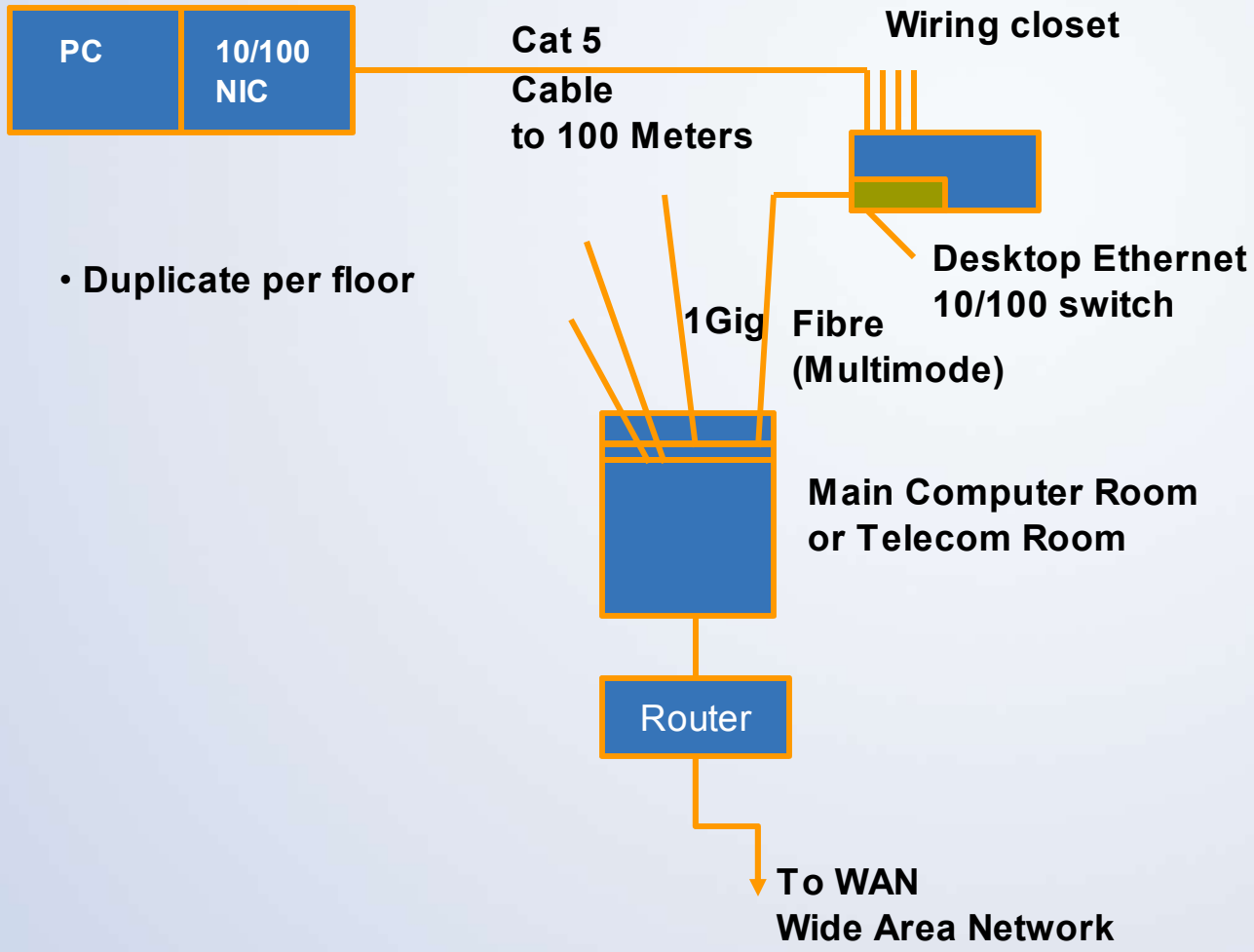
Solution → L3 routing



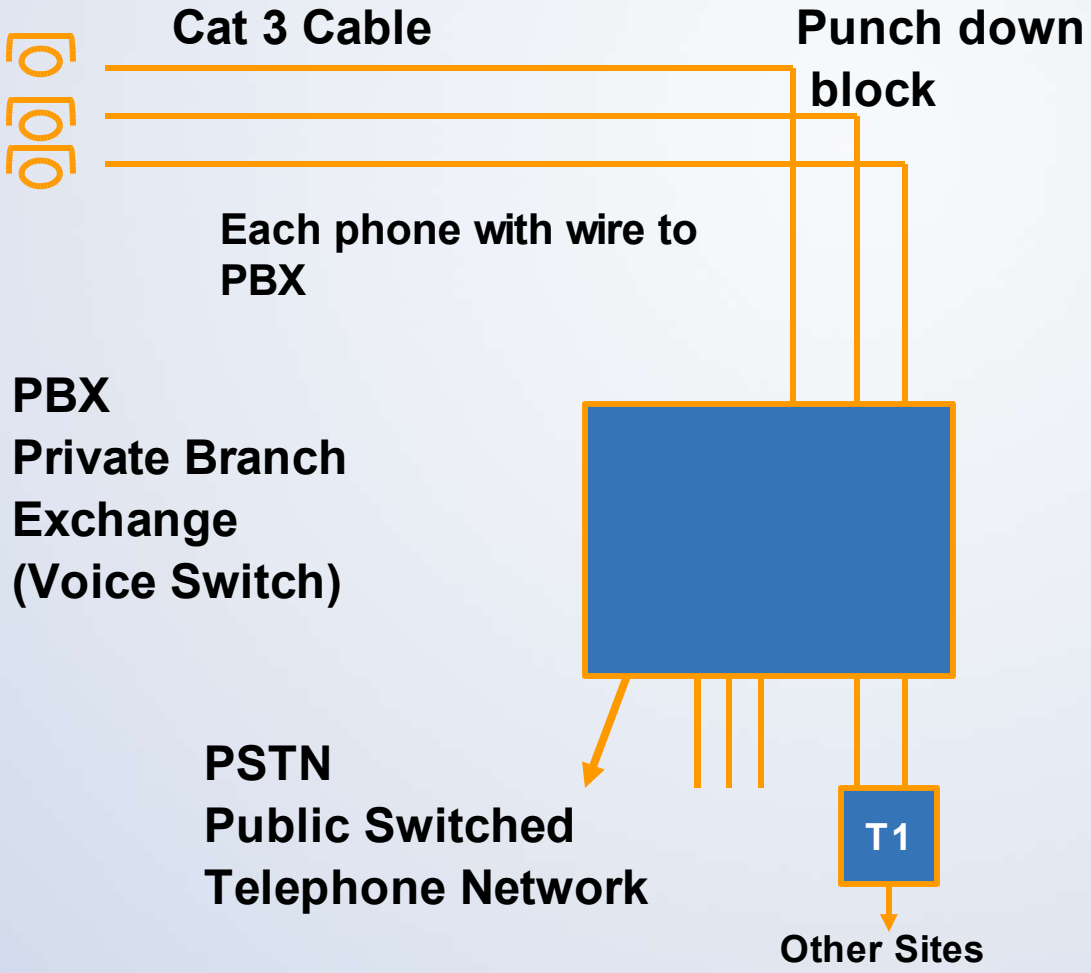
- IP
- IPX (decline)
- OSI (dead)
- Vines (dead)
- DecNet (almost dead)

Forward to 'connect' site only!

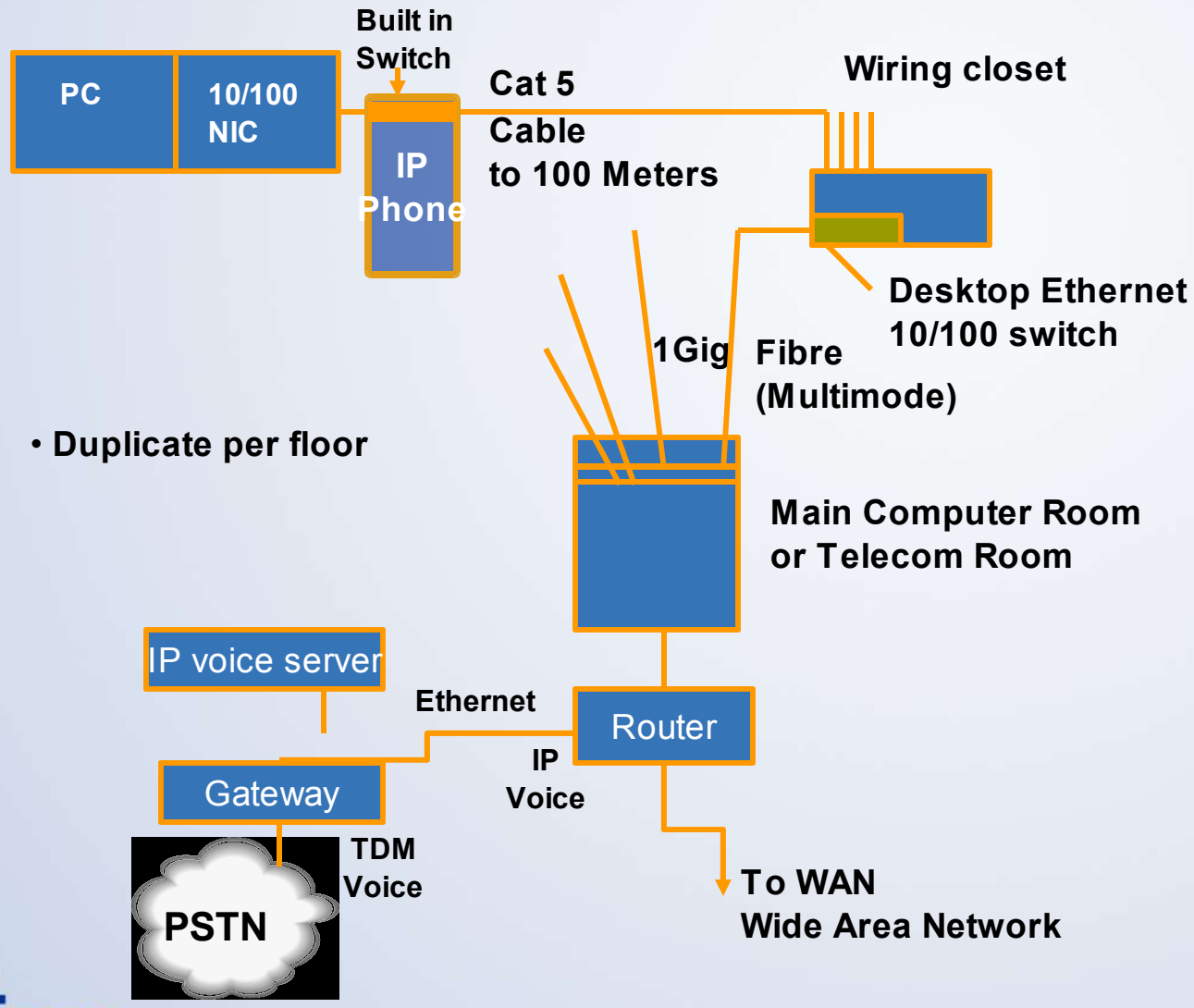
Typical Building – Today - DATA



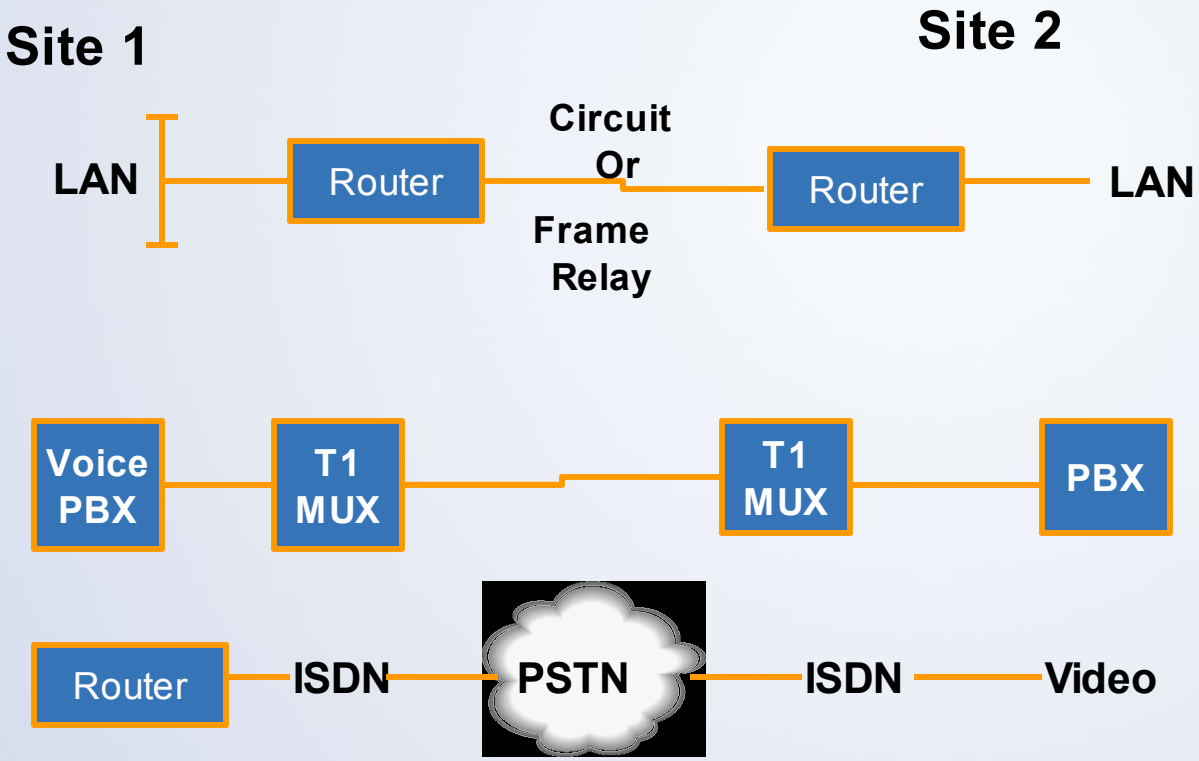
Typical Building – Today - VOICE



Campus – After VOIP Convergence



WAN – Before Convergence

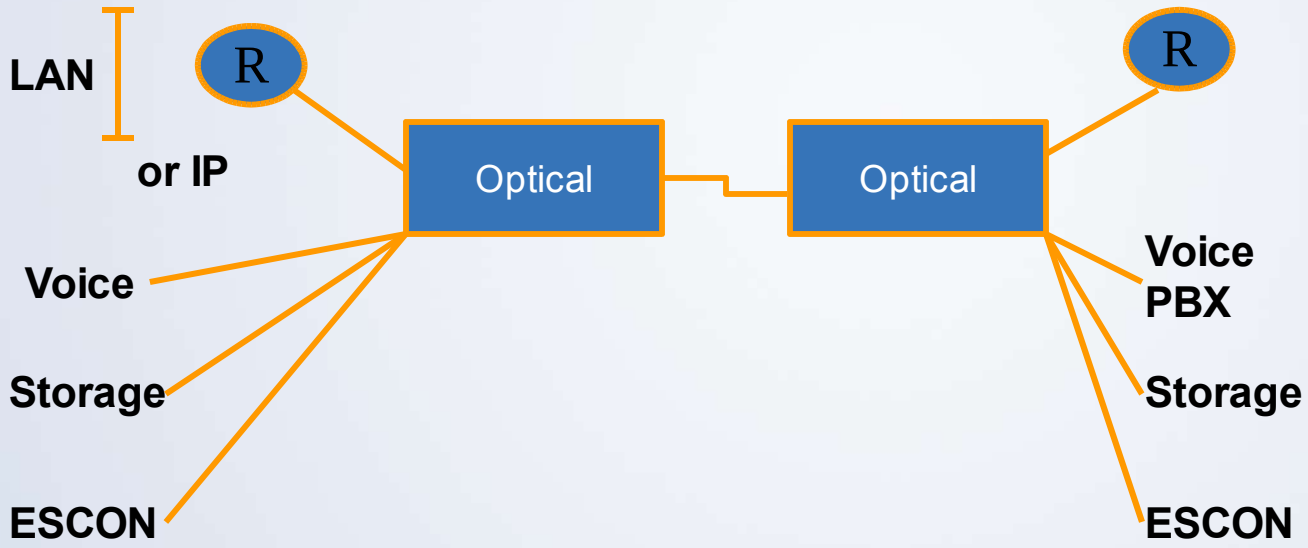


Special

- Storage Protocols
- IBM Channel Extension
  - ESCON

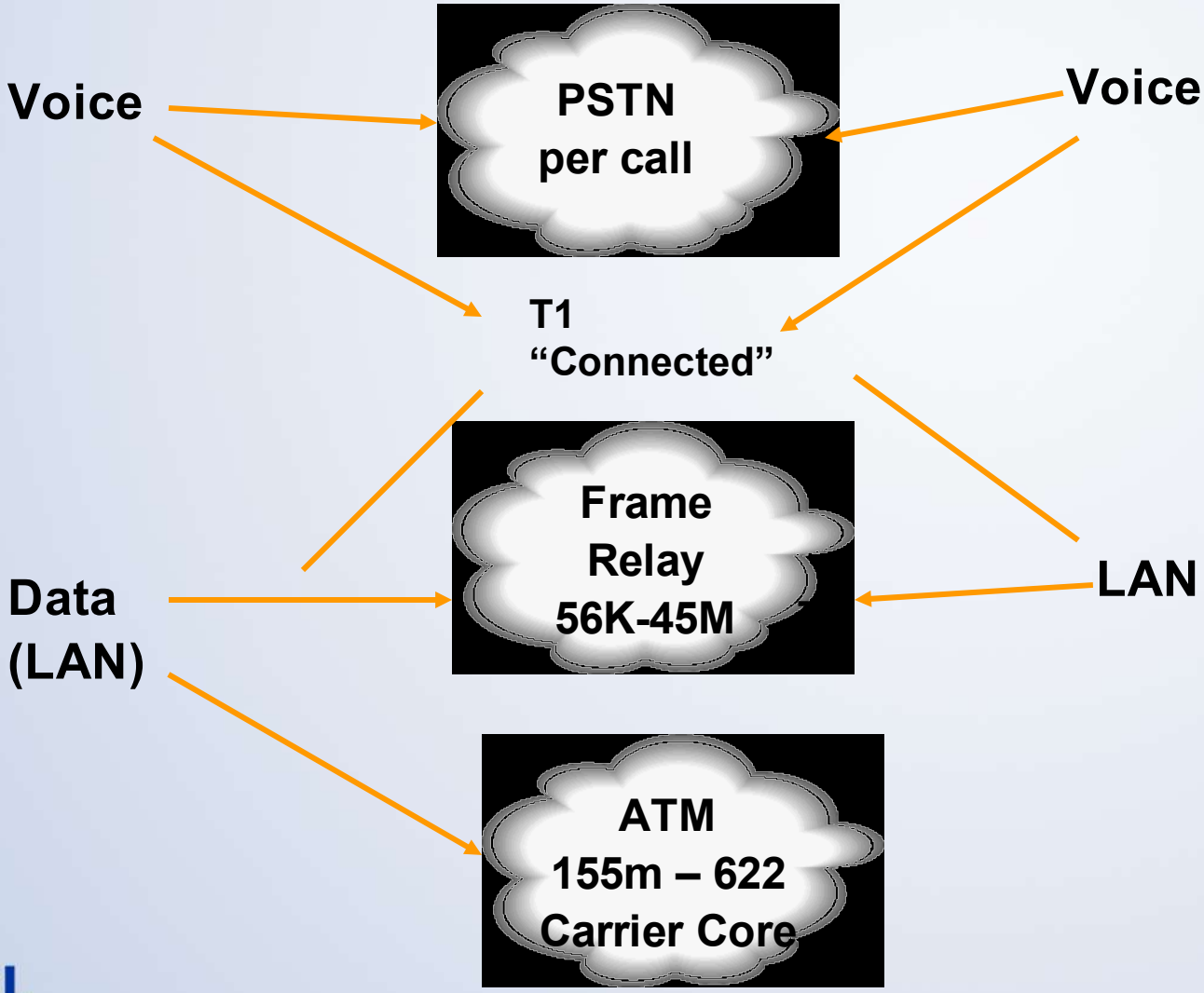
Customer may have 3 – 5 separate networks

WAN – After Convergence



- Collapse on high speed
- Optical core

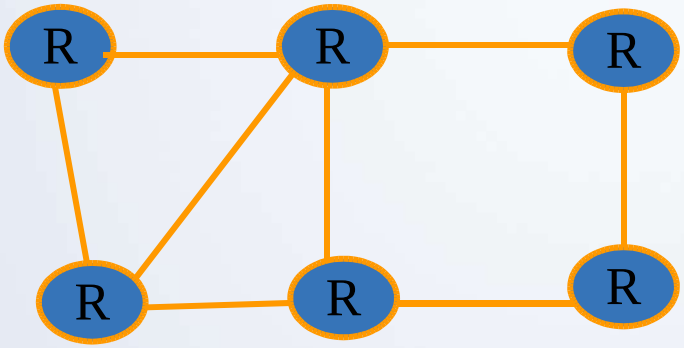
Public or Carrier Networks



Public Networks – Collapse on IP

The Internet – All IP All Routed

Shared



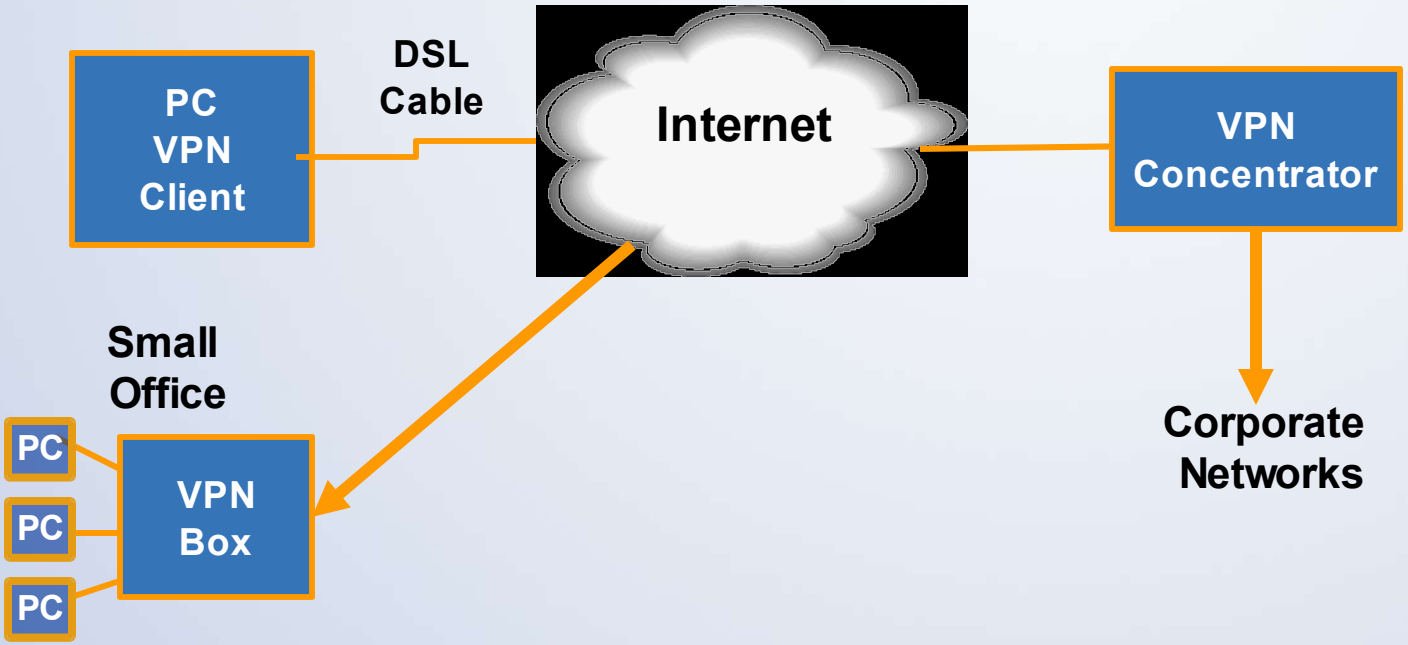
Issues

- Security
- Reliability
- Predictability
- Transaction vs. file transfer

Advantage ↓ **Cost vs. Private**

Internet Solutions

- VPN
  - Create secure 'tunnel'
  - Work at home
  - Site to site



Network Issues

- Cost
  - Reduce but add bandwidth
- Security
  - Firewalls
  - Intrusion Detection – IDS
  - Content Filtering
- Availability
  - Before 5/12
  - Now 7/24
  - Mission Critical
- Complexity
  - Cost to run/support
  - Troubleshooting
  - Transition to Web applications

Trends

- Convergence
  - IP/Optical
- Outsourcing
  - Sell assets
  - Manage to lower costs
    - Scale
- Wireless
  - LAN mobility
  - Reduced wiring
  - Slower speeds
- Data Resiliency/Backup
  - Disaster Recovery
  - Audit

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