

Foundations of Telecommunications Technology

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Purpose

- Consider the types of traditional networks
- Explore the technology trends
- Examine the implications of these technology trends

Understanding the T/C Industry

Understanding the T/C Industry

- Major Segments of the Industry (now blurred)
 - Telephone Companies (Local and Long Haul)
 - Data Communications Providers
 - Cable Television Companies
 - Commercial Mobile Radio Service Providers
 - Internet (and Enhanced) Service Providers
 - “Over-the-Air” Broadcasters
 - Equipment Manufacturers
 - Content Providers

Understanding the T/C Industry

- Characteristics of Different Types of Signals

	<u>VOICE</u>	<u>DATA</u>	<u>VIDEO</u>
Basic Signal Type:	Analog	Digital	Analog
Bandwidth:	Few KHz	Variable	MHz
Holding Times:	Minutes	Varies Widely	Minutes/hours
Activity:	“Continuous”	Bursty	Continuous
Delay Tolerance:	Very Little	Seconds	Seconds +
Symmetry:	Symmetrical	Asymmetrical	Asymmetrical

Traditional Network Architectures

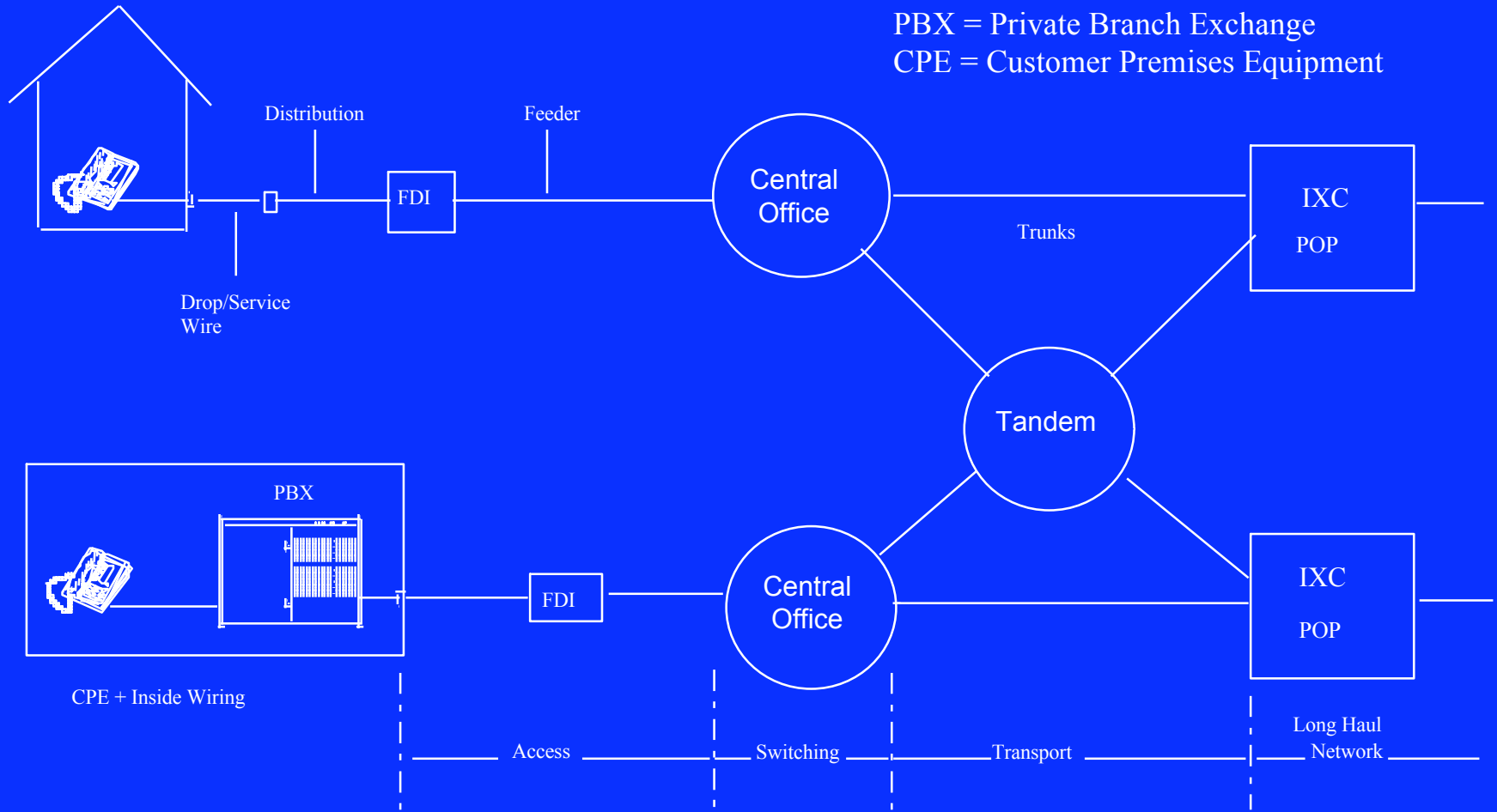
Understanding the T/C Industry

- Traditional Network Architectures (the “Silos”)
 - Traditional Public Switched Telephone Network (PSTN)
 - Traditional Cable Television Network
 - Traditional Wireless Network
- Evolution of Traditional Networks (Convergence)
- Public Policy Implications (Illustrative)

The Traditional PSTN

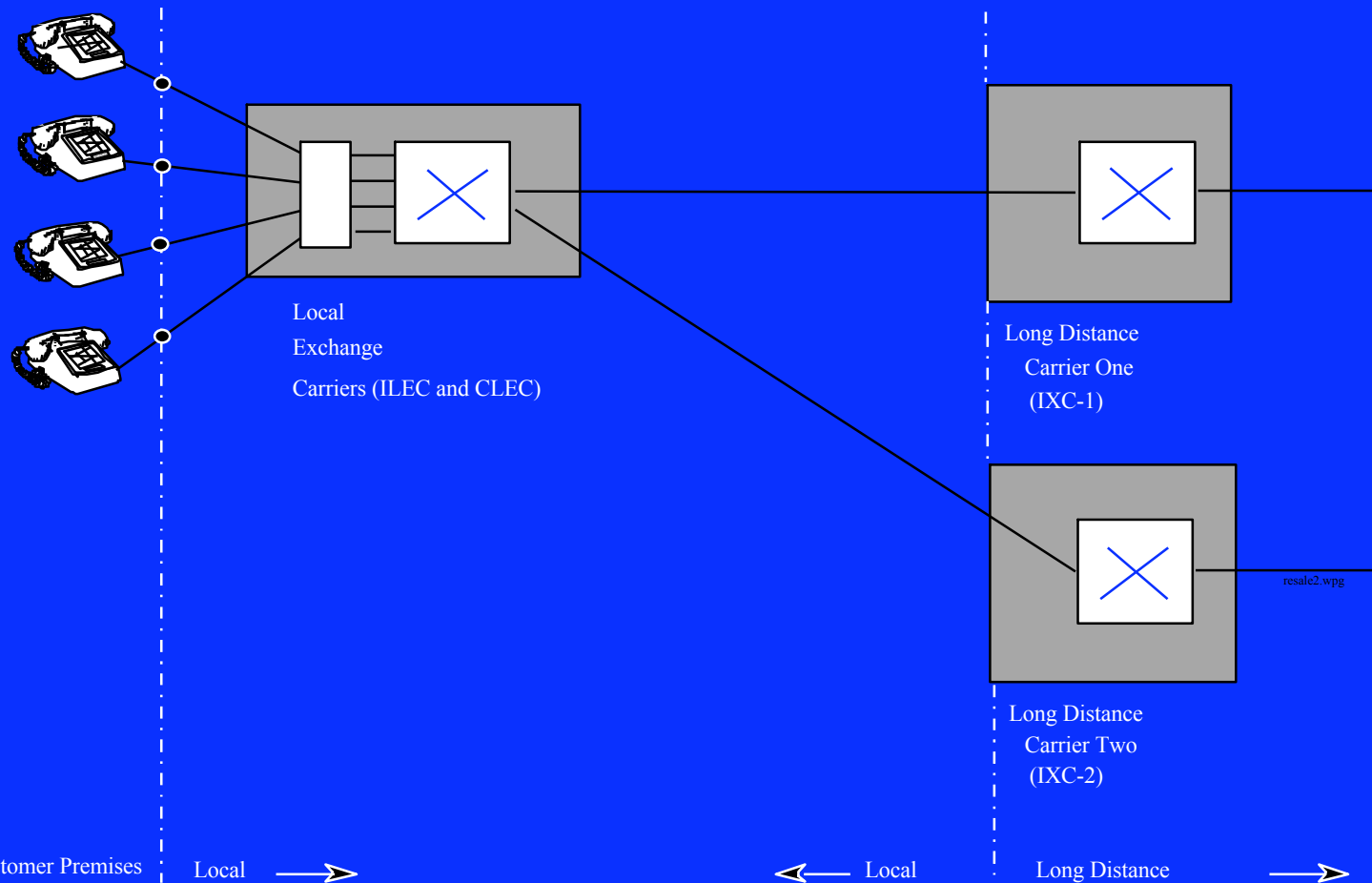
- Access Perspective

IXC = Interexchange Carrier
POP = Point of Presence
FDI = Feeder-Distribution Interface
PBX = Private Branch Exchange
CPE = Customer Premises Equipment



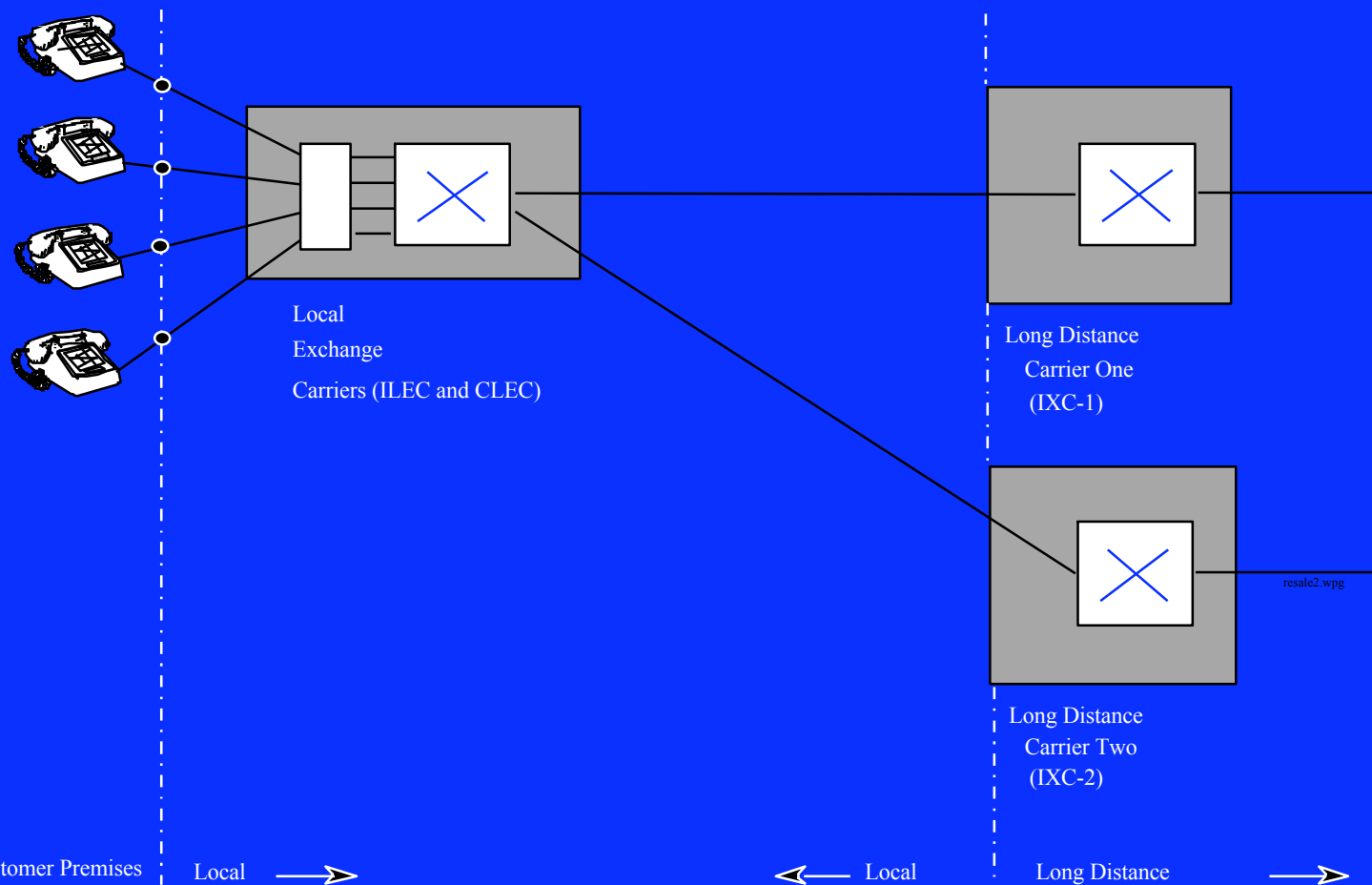
The Traditional PSTN

- Local Exchange Network from a Long Distance Access Perspective



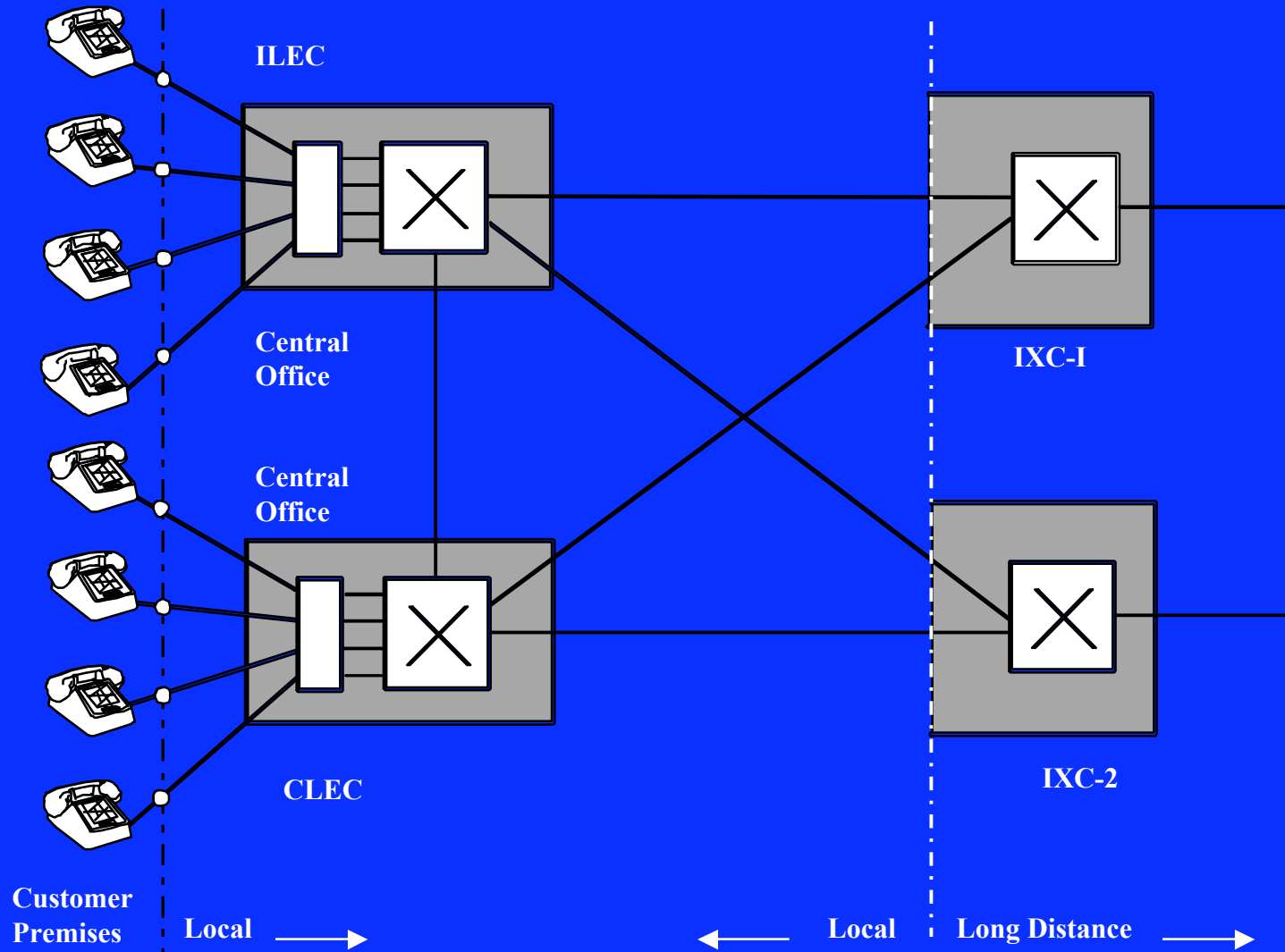
The Traditional PSTN

- Resale-Based Local Exchange Competition



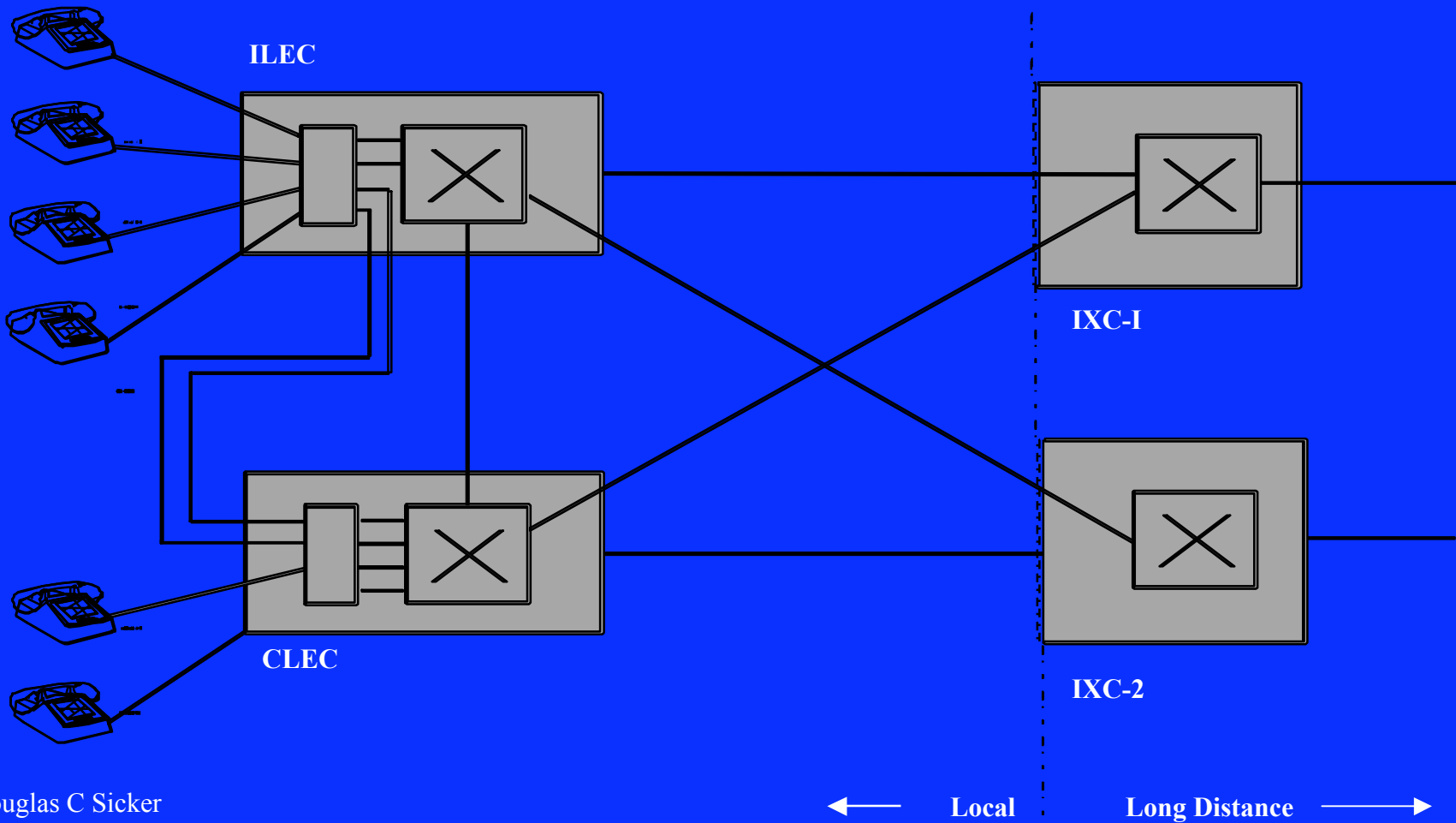
The Traditional PSTN

- Facilities-Based Local Exchange Competition



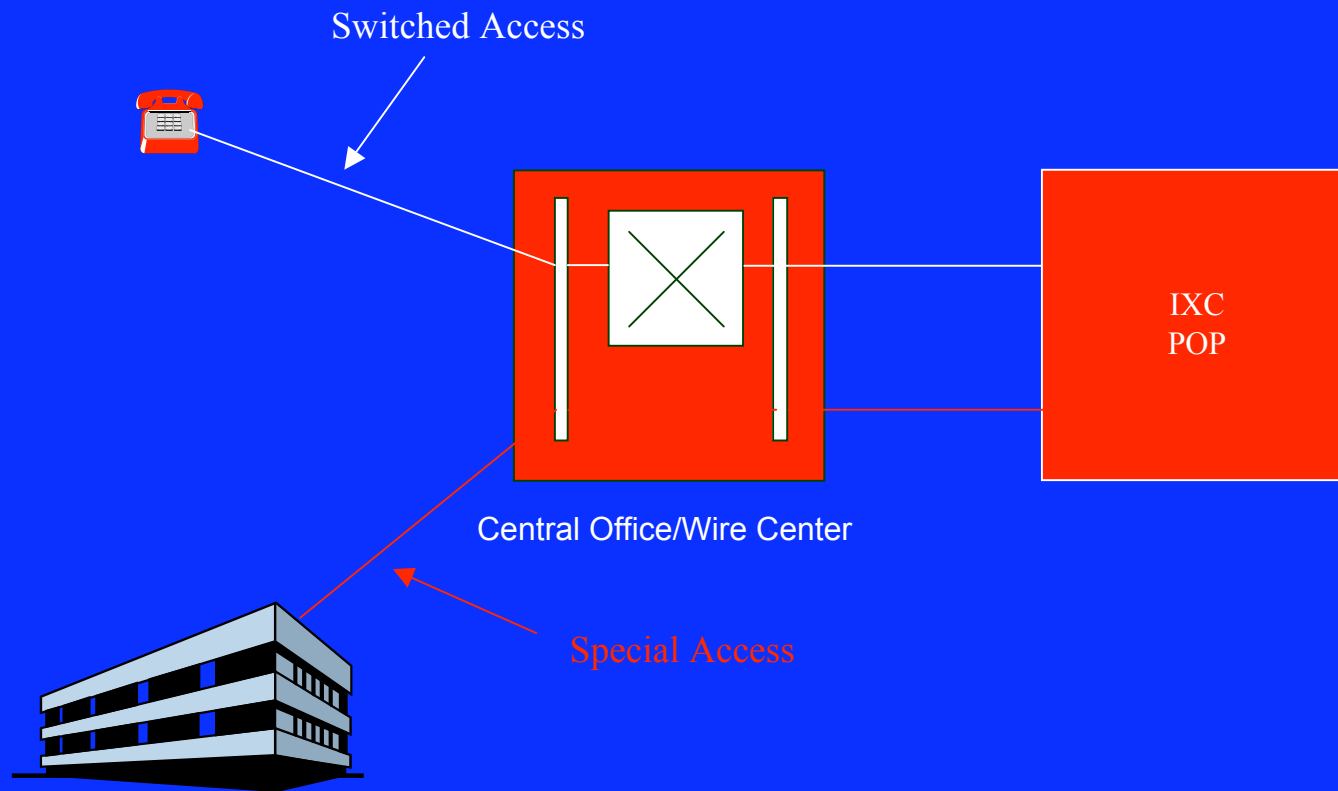
The Traditional PSTN

- Unbundled Network Element-Based Local Exchange Competition (Unbundled Loops)



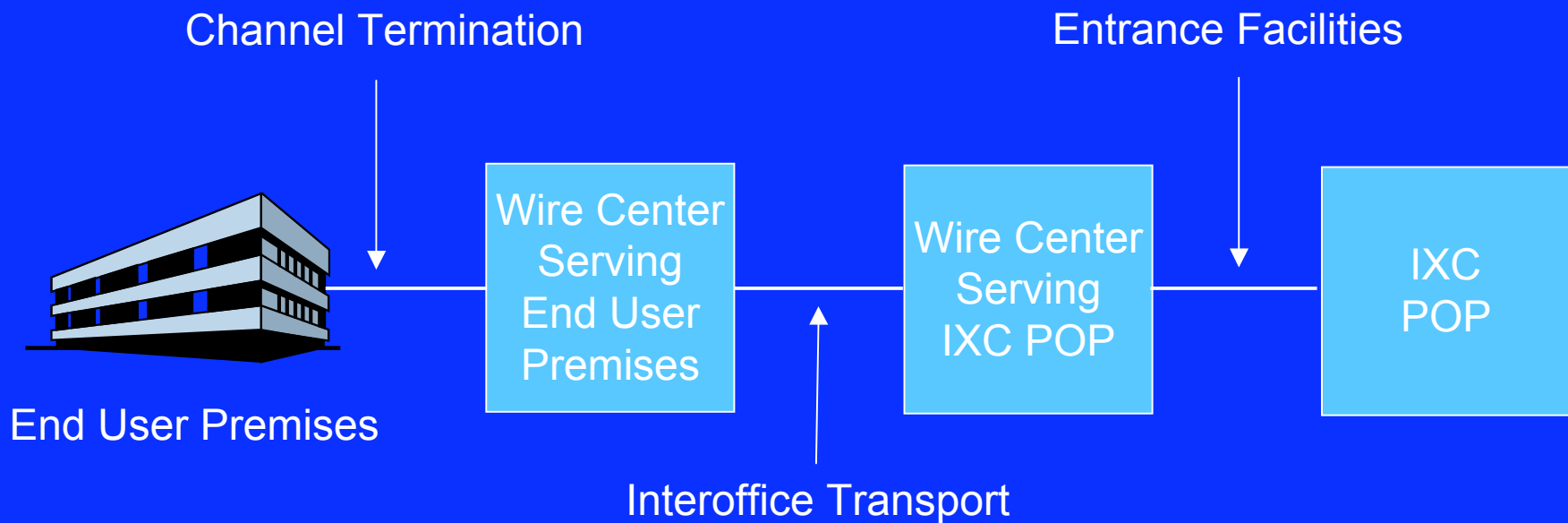
The Traditional PSTN

- Switched Versus Special Access

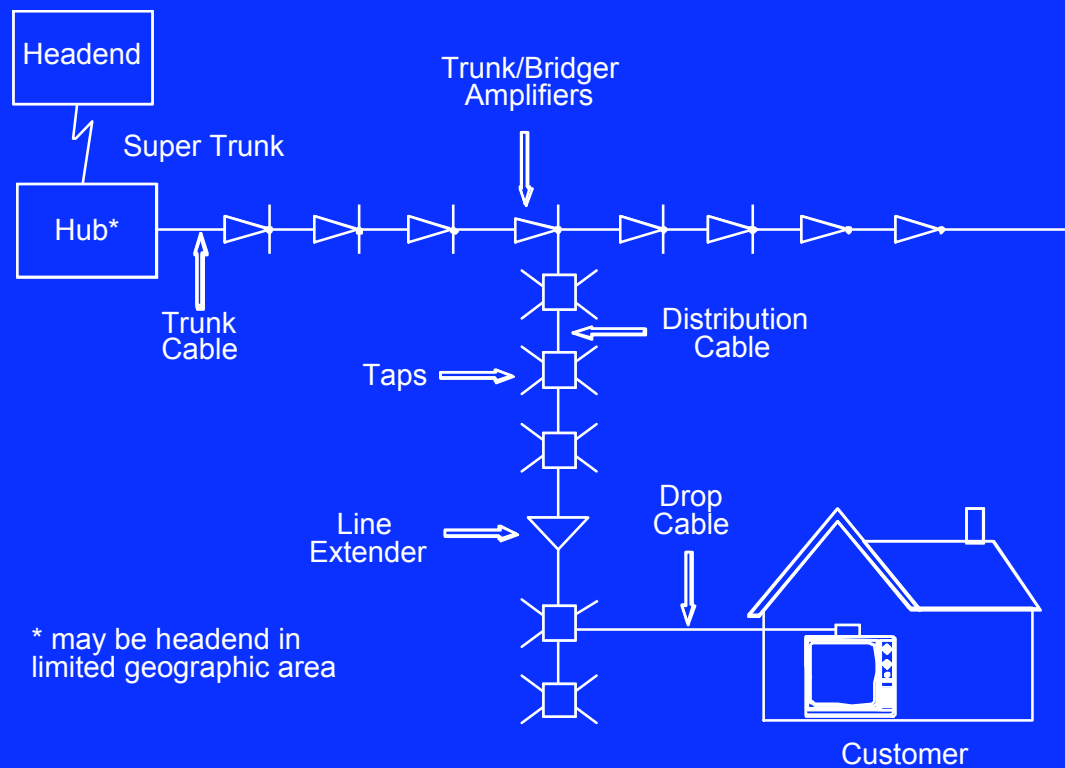


The Traditional PSTN

- Special Access -- Details

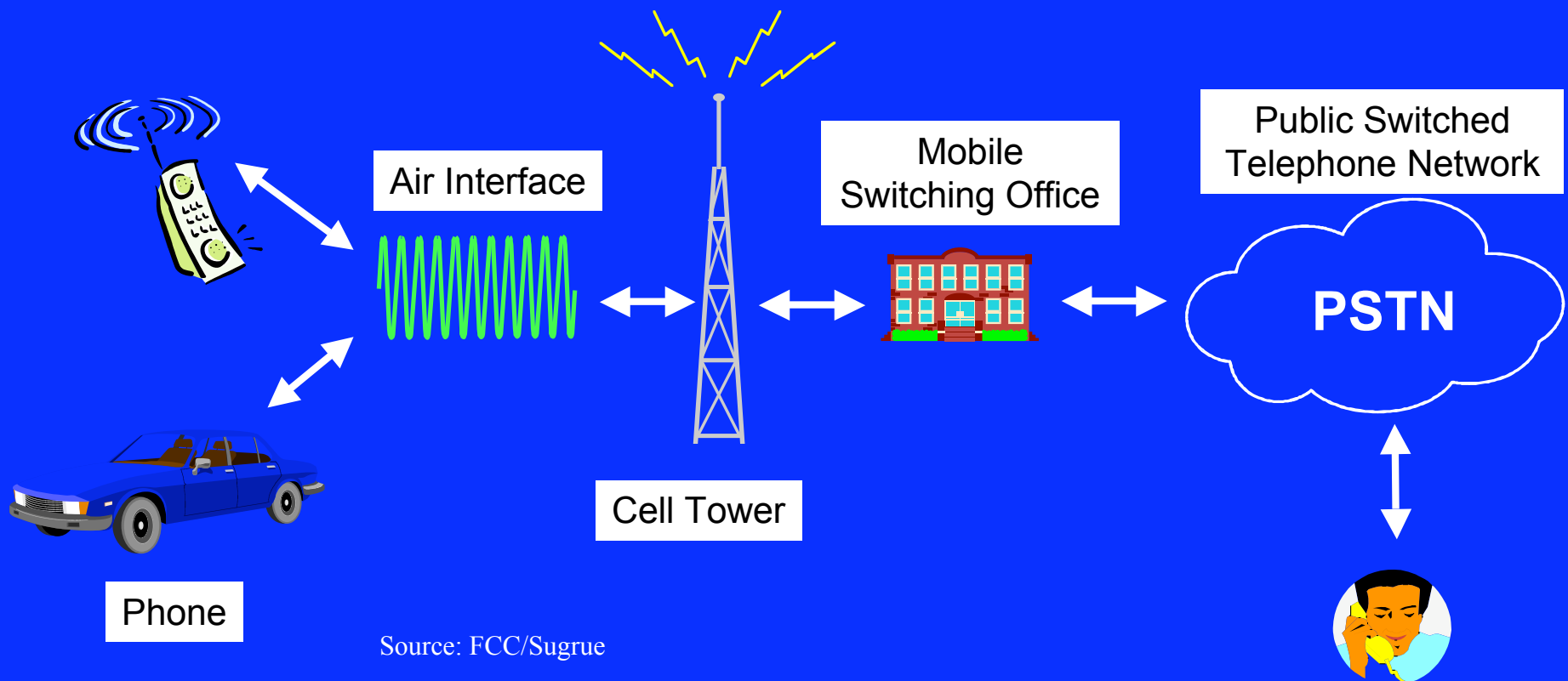


Traditional Cable Television Network



Traditional Wireless Network

- Traditional Cellular Network



Evolution of the Traditional Networks

Evolution of the Traditional Networks

- Observations Regarding Traditional Voice, Data, Cable and Wireless (Cellular) Networks
 - Individually architected to match the characteristics of the three types of signals (voice, data, entertainment video)
 - A result of the tight coupling between the architecture/network design and the applications was technological “stovepipes”

Evolution of the Traditional Networks

- Observations (Continued)
 - These specialized networks or technological stovepipes were “unconverged” as opposed to being general purpose or converged platforms capable of handling voice, data, still image and video – multimedia
 - The regulatory structure (both the governing law and the organization of the regulatory agency) reflected (and still reflect) these technological “stovepipes”

Evolution of Traditional Networks

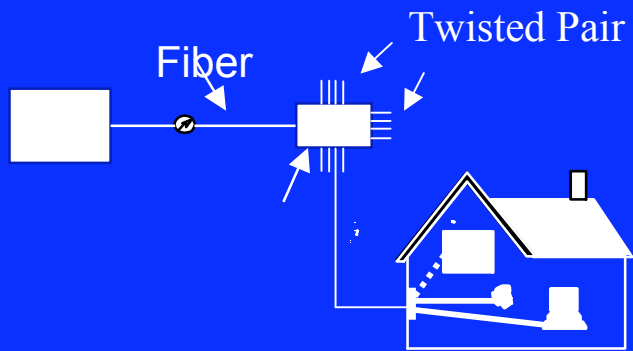
- Traditional “Silos” of Service/Regulation



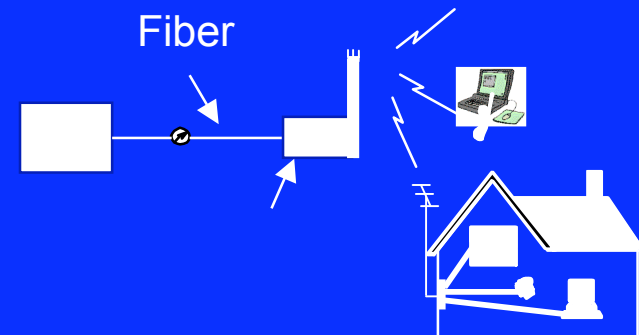
Evolution of the Traditional Networks

- Observations (Continued)
 - All of the traditional networks are developing in a similar direction from a network architecture standpoint:
 - Evolving from analog to end-to-end digital transmission and switching (largely completed except in the “last mile”)
 - Extending broadband facilities deeper into the network either directly to customers or closer to them

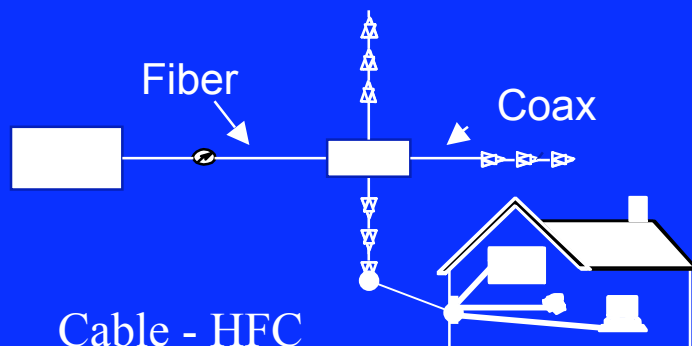
Evolution of the Traditional Networks



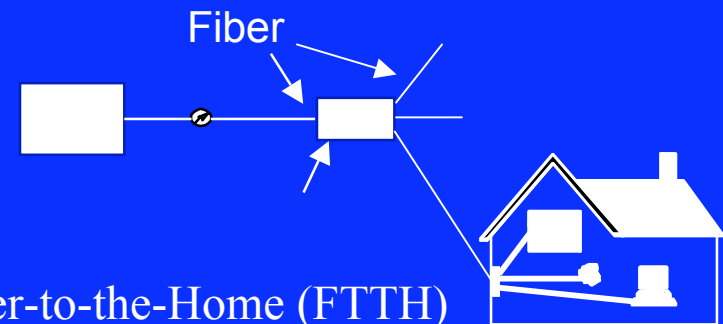
Wireline - DSL



Wireless – Various



Cable - HFC



Fiber-to-the-Home (FTTH)

Evolution of the Traditional Networks

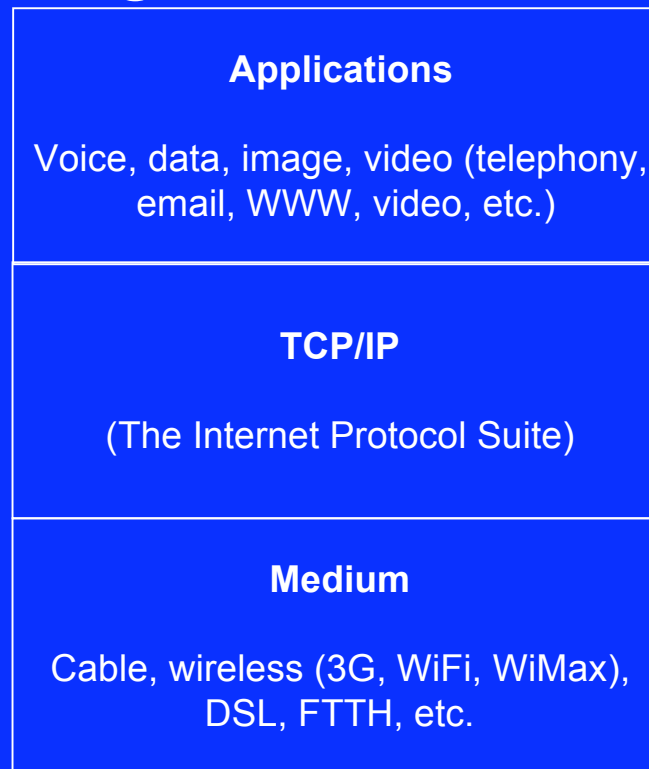
- Observations (Continued)
 - Evolving from circuit switching to packet switching with more “intelligence” at the edge of the network rather than the interior
 - Logical separation of the signaling and transport portions of networks – i.e., separation of control information from user content – and the development of more powerful signaling/control systems accessible to end users and third party providers
 - The above two steps rely heavily upon the Internet Protocol Suite (TCP/IP)

Evolution of the Traditional Networks

- The Result of the Trends:
 - “Technological convergence” and the creation of a powerful all digital, packet-switched, broadband, low latency platform supporting all applications – voice, data, image and multimedia
 - A “network of networks” platform that uses common, open, non-proprietary standards and protocols (i.e., the Internet Protocol -- IP)
 - Extension of this platform using wireless technology to allow users to communicate anyplace, anytime, in any mode or combination of modes

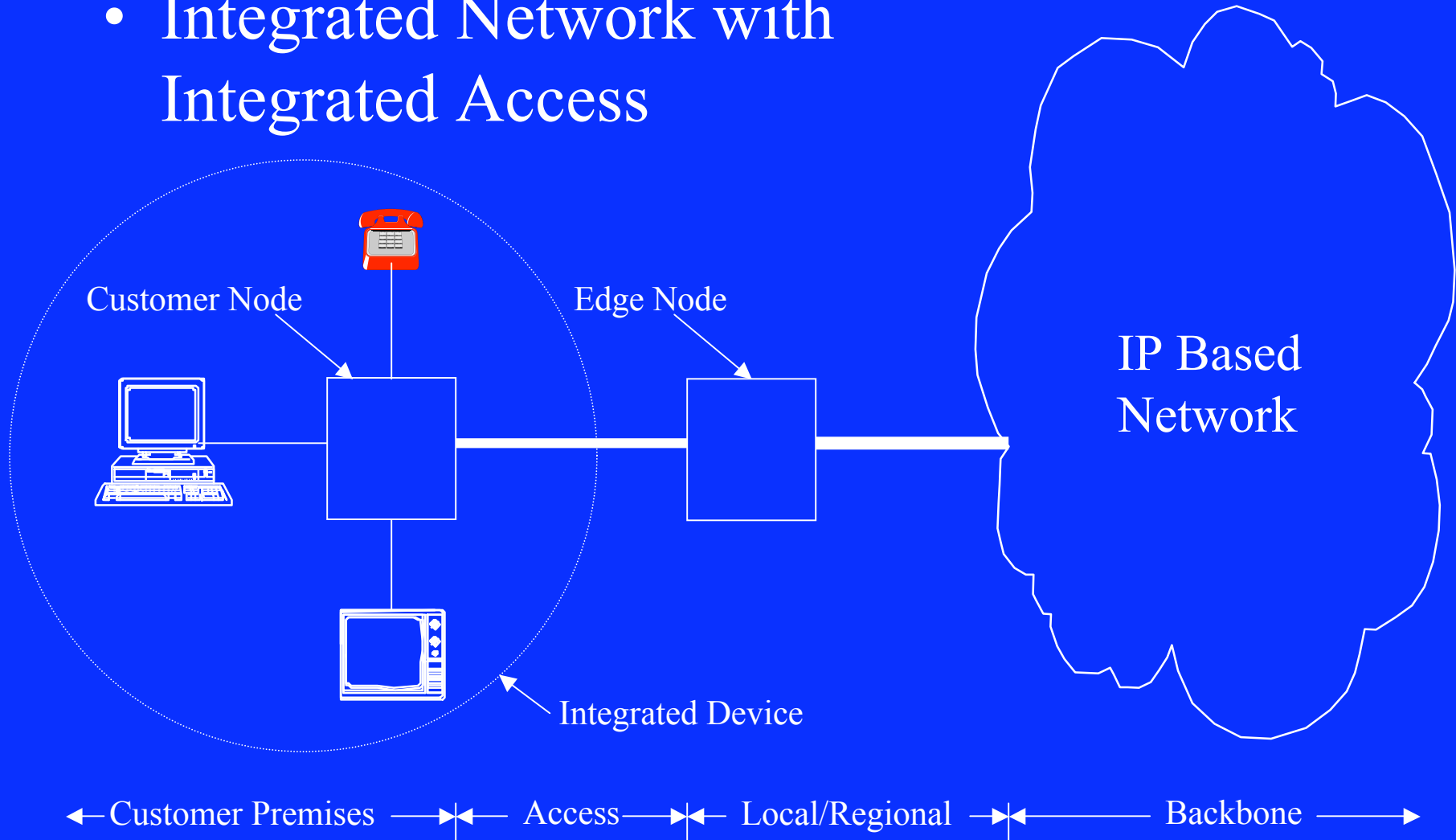
Evolution of the Traditional Networks

- Future Converged Services



Evolution of the Traditional Networks

- Integrated Network with Integrated Access



Public Policy Implications (Illustrative)

Source: Sicker/Hatfield

Public Policy Implications (Illustrative)

- Administration/control/regulation of functions that should be centralized
- Definition of what qualifies for universal service support
- Definition of what services should contribute to the universal service fund

Source: Sicker/Hatfield

Public Policy Implications (Illustrative)

- Boundary between telecommunications and information services
- Boundary between cable and broadcast and telecommunications services
- Structure of regulatory agencies
- Access charges and intercarrier compensation

Public Policy Implications (Illustrative)

- Jurisdictional Issues
 - Definition of telephone service when it is just an application residing in computers at the edge of the network
 - What should be regulated?
 - Who should be the regulator?
 - How is it to be regulated?
 - How do we ensure social goals?
 - Who should be responsible for consumer issues?

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