Network Architecture Principles

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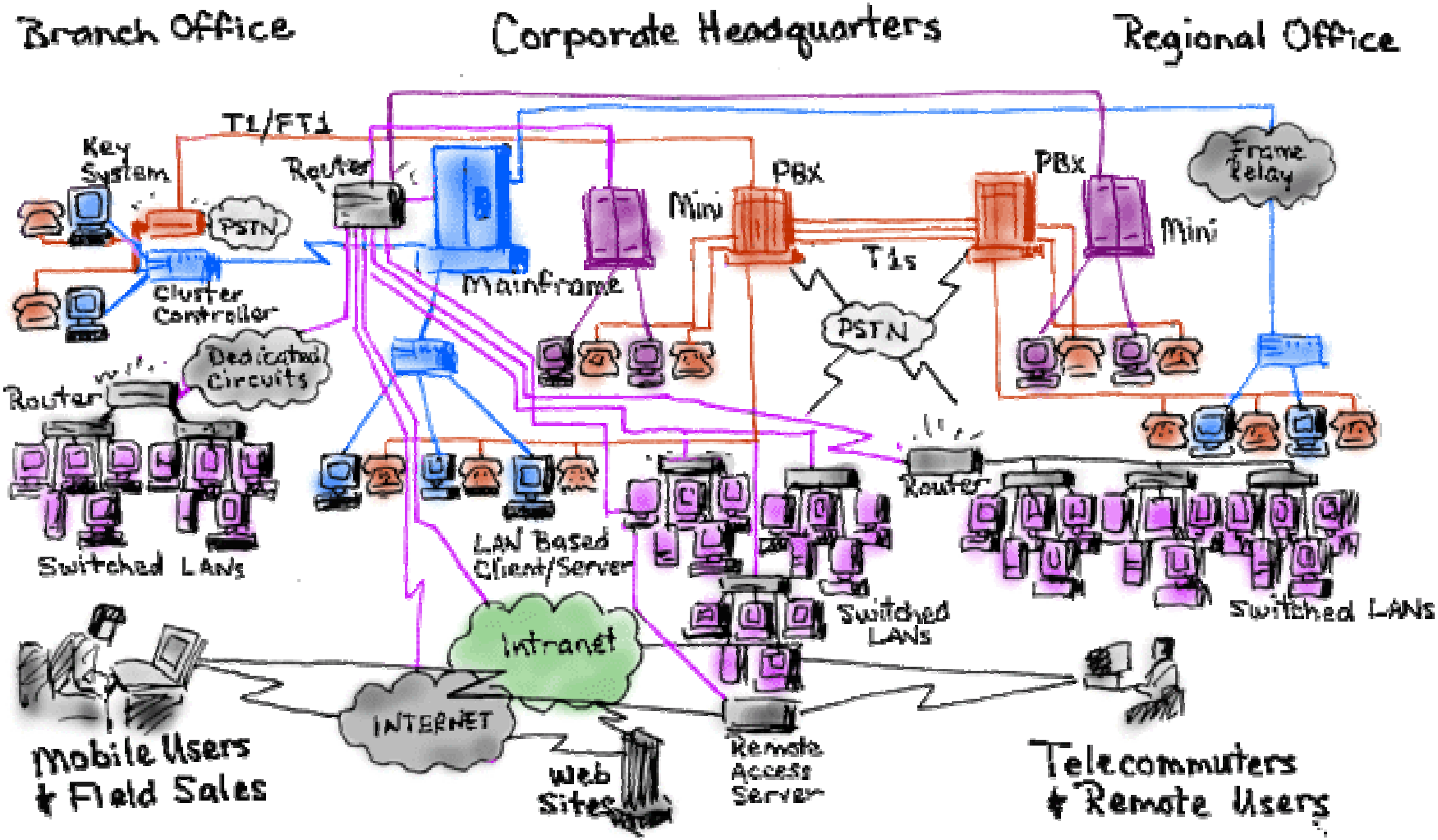
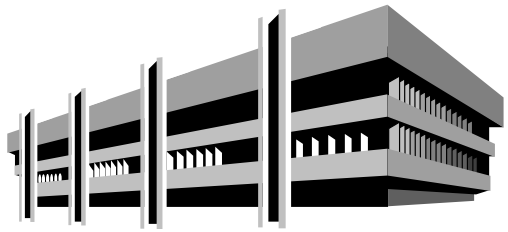
Look Familiar?

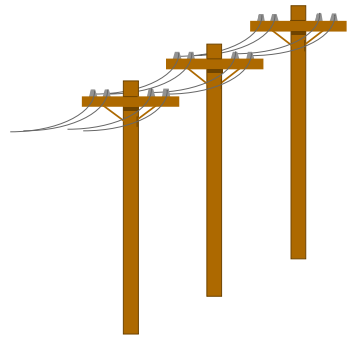


What's a Network Architecture?

- Definition of Network Architecture
  - The major components of a network and how they relate to each other
  - The desired state of an enterprise's network and telecommunications infrastructure
  - Strategic rather than tactical implementation timeframe (2-3 years)
- Differs from Network Design
  - Architecture does not specify exact sizing and placement of components
  - For example:
    - Network architecture would provide guidelines for where to utilize ATM, frame relay, ISDN, leased lines, etc.
    - Network design would require capacity planning effort to specify bandwidth (and CIR) and exact location of each link

Building Architecture Analogy





Building Architecture

- **Framing elements, plumbing, structural members, electrical circuits, foundations, heating and cooling systems, etc.**
- **Approved industry standards and practices, building codes**

Network Architecture

- **Hubs, switches, routers, transmission facilities, LANs, communications software, building wiring, etc,**
- **Standards and techniques for building networked computing systems**

Architecture Value Propositions

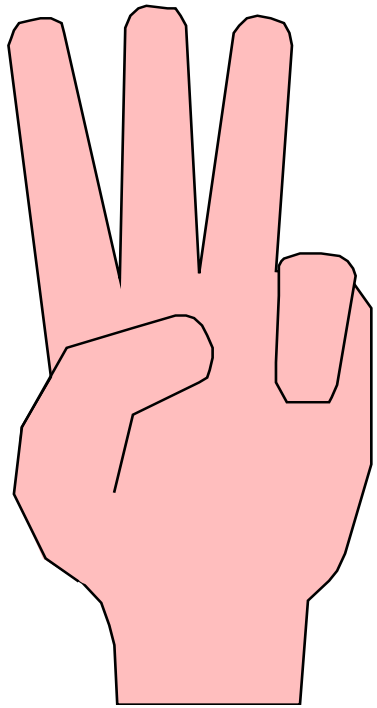
- **A way to evaluate applicability of new technologies, products, and services**
- **A framework for network technology decision-making**
- **A macro view of network systems and components**
- **A statement of direction for IT**
- **A way to reduce risk**
- **A way to facilitate compatibility and easier administration of systems**
- **A blueprint for future network growth**
- **A method of cost avoidance**
- **A way to create and document consensus**
- **A methodology to force consideration of all design factors**
- **A guide for the creation of an “enabling infrastructure” for unforeseen new applications**
- **A target for network migration**

Architecture Economics

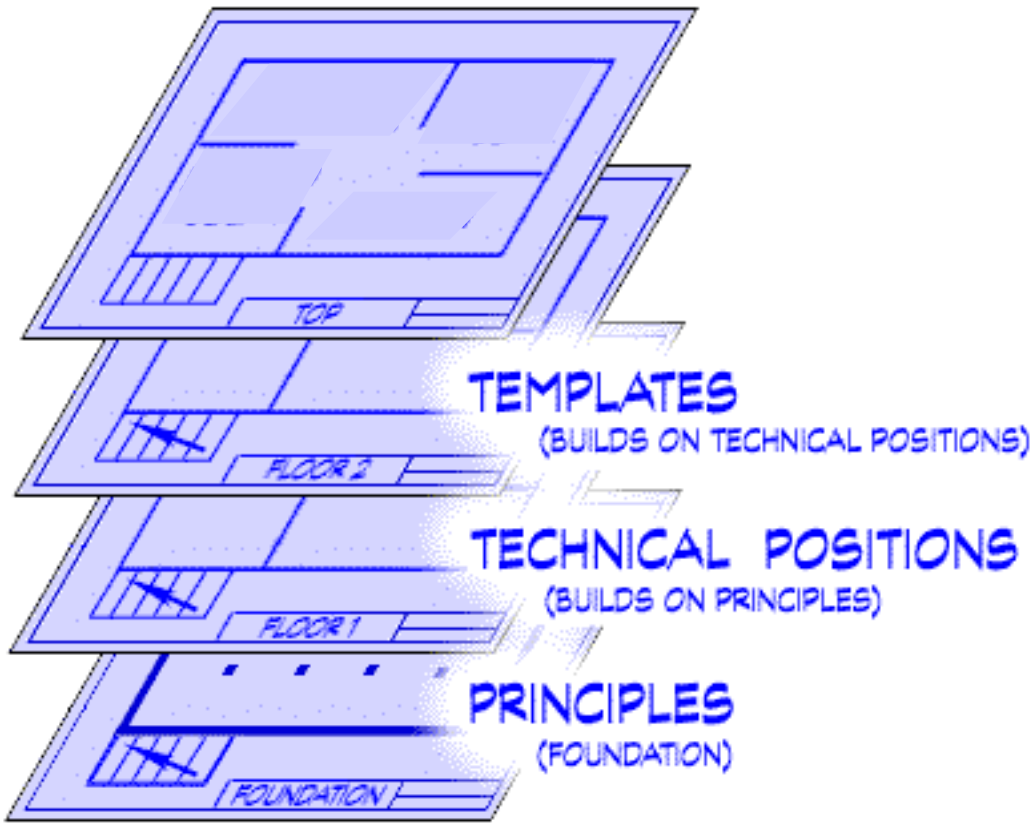
- Network Architecture Development
  - Often coincident with the decision to deploy a new network
  - Raises the issue of funding justification
- Funding Justification
  - Resistance to spending on infrastructure
    - Additional spending today to buy flexibility in coming years
    - Network spending analogous to “call” option in the stock market
  - Easier to understand lack of an appropriate network
    - Rapid offering of new products or services more difficult
    - Opportunity costs due to lack of competitiveness
  - Deployment of a new network as a long-term asset
    - Analogous to spending on R&D, education, or new building construction
- Spending on a new network is going to happen

Three Architecture Components

- "Technical Positions"
  - Statements that describe standards or specifications for use with each major architectural component or service
- "Templates"
  - Diagrams that address the distribution of systems functions and how they relate topologically
  - Models that show relationships between components specified by the Technical Positions
- "Principles"
  - High-level statements about the network that tie back to business goals
  - Incorporate values, organizational culture, and business goals
  - Drive Technical Positions (and Templates)



Architecture Component Relationships



- Building Architecture Analogy

Representative Principles

- “We will outsource all network services.”
- Cisco is our strategic vendor; wherever possible, we will purchase Cisco network products.”
- “All network decisions are made down at the individual department, business unit, or budgetary operating unit level.”
- “We will deploy any technology with the potential for competitive and market advantage, regardless of technical maturity."

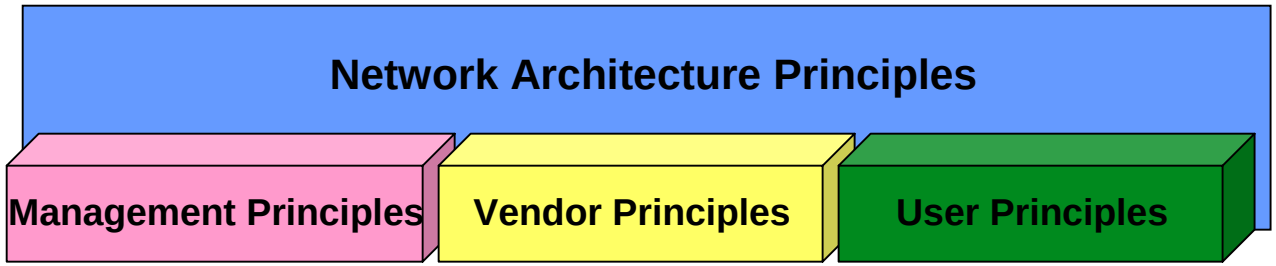
  - Each suggested principle must pass the “motherhood” test (i.e., could a person reasonably suggest and defend a contrary position?)

Principles in the Real World

Who Needs Principles?

- Principles Definition
  - Simple statements about an organization's beliefs and how how it wants to use networking over the long term
  - Derived from business goals and corporate values
  - The primary linkage between business strategies and network technology strategies
  - The highest level of guidance for network planning and decision-making
- Why?
  - Technical Positions and Templates cannot be made in a vacuum; they must be tied to type of business, organizational culture, and business goals
  - Without principles, an organization risks that its network will not be "in sync" with its business
- Principles represent the foundation for a network architecture

Principles Framework

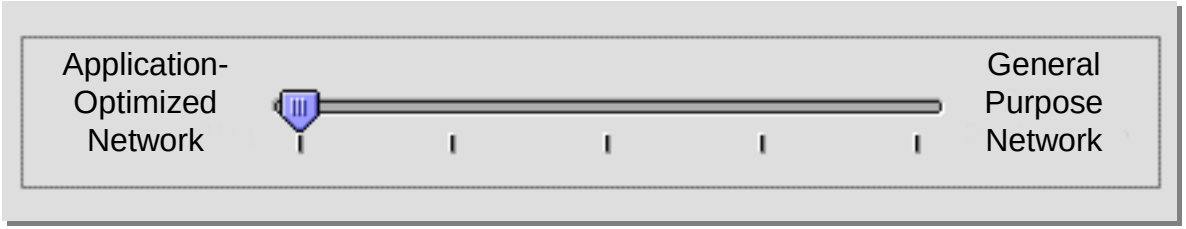


- Technology Risk Acceptance
- General vs. Optimal Solution
- Cost Center vs. Competitive Advantage
- Degree of Autonomy
- Network Service Justification

- Single Vendor vs. "Best of Breed"
- Second Sourcing
- Proprietary vs. Openness
- Vendor Risk
- Channel Relationships
- Outsourcing

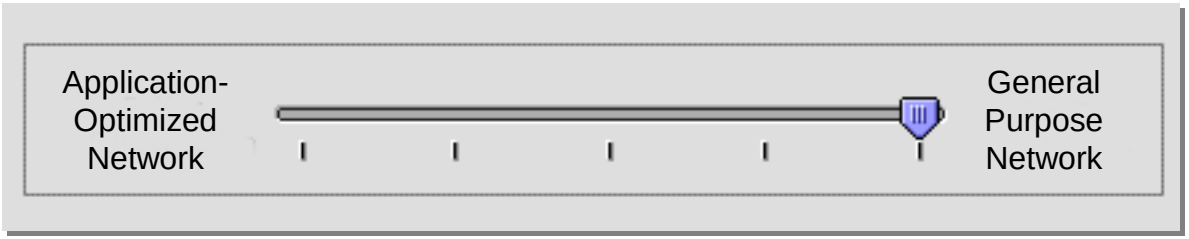
- Must Use
- Authorized Network Use
- Billing and Chargeback
- Universal Network Service

Developing a Principle



"The network will be optimized for known applications"

VS.



"The network will be an "enabling infrastructure" with the flexibility to support unforeseen future applications"

- Real-world principles may fall somewhere in-between:
  - "Network performance and capacity will be optimized only for SAP transactions; otherwise no application optimization will be provided"

Management Principles

Principle Area	Extreme Principle	Opposite Extreme Principle
Technology Risk Acceptance	We will deploy only those technologies and services that are mature and have been proven in our vertical industry	We will deploy any technology with the potential for competitive and market advantage, regardless of technical maturity
General vs. Optimal Solutions	The network will be optimized for specific known applications	The network will be an “enabling infrastructure” with the flexibility to support all current and unforeseen future applications
Cost Center vs. Competitive Advantage	The network will be managed with an emphasis on expense reduction	The network is a primary source and contributor to competitive advantage
Degree of Autonomy	Network decisions are all made at the enterprise level	Network decisions are made at the department, business unit, or budgetary operating unit level
Network Service Justification	Network services will be provided only on the basis of demonstrated need	Network services will be provisioned on the basis of perceived value or future needs

Vendor Principles

Principle Area	Extreme Principle	Opposite Extreme Principle
Single Vendor vs. "Best of Breed"	Vendor X is our strategic vendor, and where possible, we will buy from vendor X	We will select each individual type of service based on "best of breed"
Second Sourcing	We gain the best vendor leverage by purchasing as much as possible from the same source or supplier	Whenever possible, we will buy a significant percentage of each type of product or service from a second source or supplier
Proprietary vs. Openness	We will implement vendor-proprietary solutions without concern for standards or open systems	We will not implement single-vendor proprietary technologies that limit choice in the marketplace
Vendor Risk	We will only buy from well-established vendors with large marketshares	Our choice of vendor products will not be limited by vendor maturity, viability, or market share considerations
Channel Relationships	We will buy or obtain products and services only directly from the manufacturer or actual services provider	We will buy or obtain all products or services via resellers, VARs, or integrators
Outsourcing	We will install, operate, and maintain our own private network.	We will outsource all network services

User Principles

Principle Area	Extreme Principle	Opposite Extreme Principle
Must Use	All employees and applications must use the enterprise-provided network facilities	Employee groups and business units are free to obtain their own network services outside of enterprise-provided facilities
Authorized Network Use	Network administrators must approve all new applications and uses of the network	Users and applications are entitled to use the network without restrictions
Billing and Chargeback	All network usage charges will be flat-rate	Network chargeback will be tied to usage (volume, connect time, etc.)
Universal Network Service	The network will provide uniform service levels everywhere	Networks services may vary by geographic region

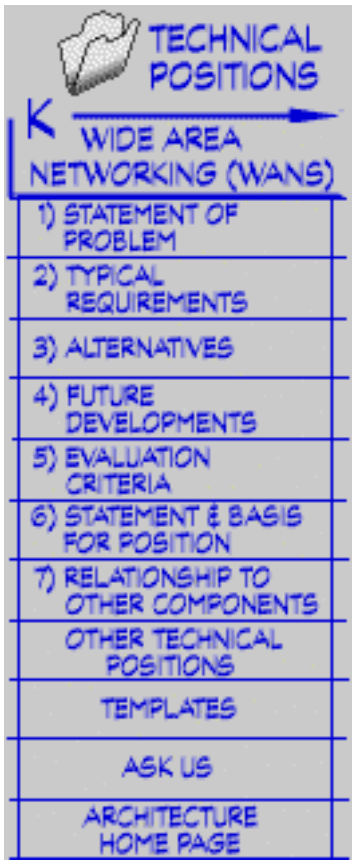
Final Thoughts on Principles

- Principles may apply to any area of information technology (IT) use
- Principles should be high level and technology-agnostic
  - Technology and standards guidance should be included in Technical Positions instead
  - Ensures that Principles have lasting value
- There are no “right” or “wrong” principles

Technical Position Areas

- Network/Transport Protocols
- SNA Networks
- Routing Protocols
- Quality of Service
- Addressing and Domains
- Multicast
- Switching and Routing
- Building Wiring
- Local Area Networks (LANs)
- Metropolitan Area Networks (MANs)
- Wide Area Networks (WANs)
- Remote Access
- Availability and Resiliency
- Phone Systems

Technical Position Components



- In an architecture document, *every* Technical Position should include:
  1. Statement of the Problem or Issue (a question)
  2. Typical Requirements
  3. Alternatives
  4. Future Developments
  5. Evaluation Criteria
  6. Statement and Basis for Position (MOST IMPORTANT)
  7. Relationship to Other Positions

Building Wiring Technical Position

- *What type of building wiring is needed to support network traffic?*
- Typical Requirements
  - "Horizontal" cabling between IDFs and outlets
    - Data wiring for desktop PCs and servers, voice to phones
    - Typical distances up to 100 meters
  - "Vertical" cabling in risers between IDFs and MDFs
    - For building/campus backbone network trunks, voice
    - Distances may extend to multiple kilometers
  - Sufficient bandwidth for 100+ Mbps data rates
  - Separate voice and data wiring infrastructures?
  - "Wiring is forever"

Building Wiring Tech Position (2)

- Alternatives
  - Copper twisted pair
    - Category 3, 4, 5, 5E, shielded, unshielded, screened
  - Coaxial cable
  - Fiber optic cable
    - Single mode
    - Multimode
  - Horizontal (desktop) vs. vertical (risers)
- Future Developments
  - Vendor FUD about Category 6, 7 cabling
  - Power for Ethernet phones

Building Wiring Tech Position (3)

- Evaluation Criteria
  - Fire and building codes
  - Application bandwidth requirements
  - Overall cost (cabling, connectors, installation)
  - Wiring closet and conduit space
  - Maintenance requirements
- Statement of Position

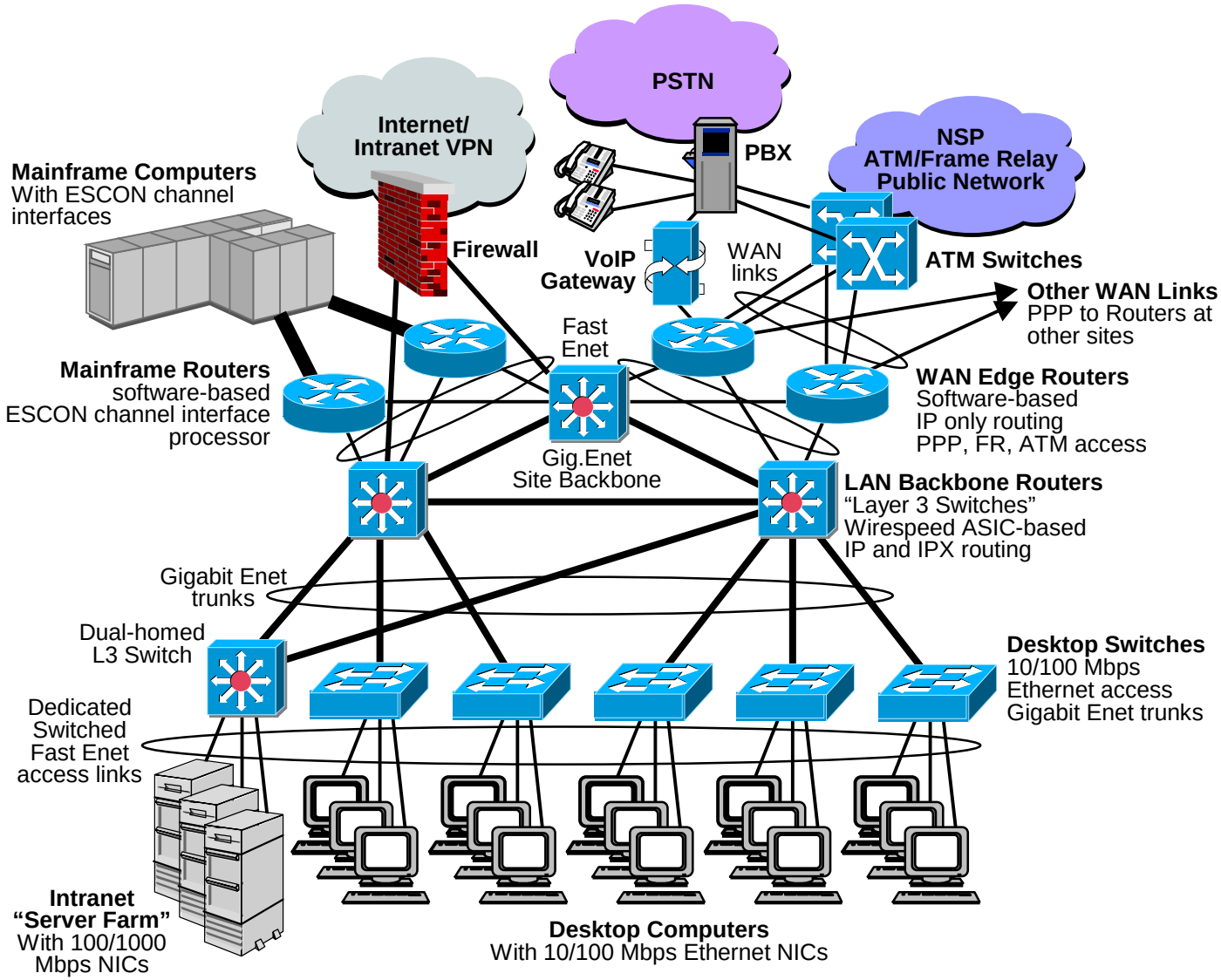
Horizontal Cabling

Use Enhanced Category 5 UTP (Cat5E) for horizontal wiring and patch cords between cable termination points and network electronics

Vertical Cabling

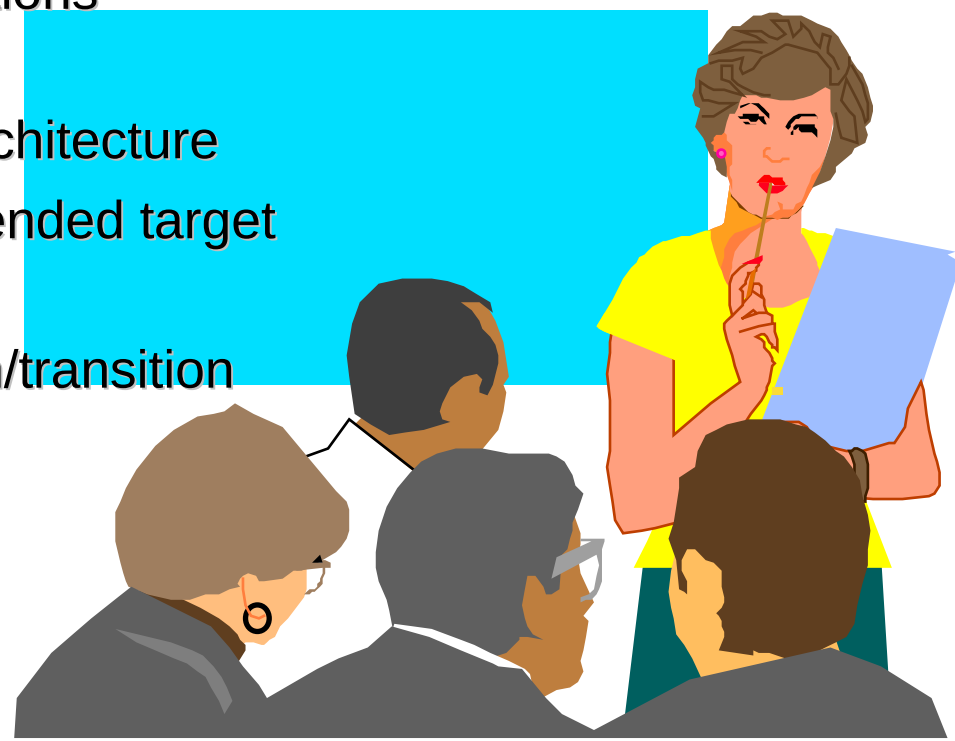
Use single-mode fiber optic cabling for vertical cabling (MDF-to-IDF, IDF-to-IDF) within a building or campus for data

PBX Large Site Template



Architecture Development Methodology

- Task 1: Collect information to determine baseline networks
- Task 2: Collect information on future business and communications directions
- Task 3: Assess current architecture
- Task 4: Develop recommended target architecture
- Task 5: Develop migration/transition strategies



Update at least once/yr.!

Key Points

- Every large enterprise and service provider needs an architecture for their network
- Use a proven framework
  - Principles
  - Technical Positions
  - Templates
- Principles can be used to guide implementation and explain your network to non-technical executives