Determining the Costs of Interconnection

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Presentation overview

- Definition and purposes of interconnection
- Alternative definitions of “cost”
  - Historical/accounting
  - Forward-looking/economic
- Network components of interconnection
- Identifying and calculating the individual components of total cost
  - Investments
  - Capital and operations expenses
  - Overheads

Definition of interconnection

- Interconnection allows a carrier to use facilities and/or services provided by another carrier to permit its customers to:
  - Communicate with customers of the other carrier
    - terminate calls using the other carrier's call completion services
    - originate, transport or terminate calls using leased portions of the other carrier's network
  - Access services that are available only from the other carrier, *e.g.*:
    - numbering and directory service databases
    - emergency call handling (E911) services

Value of interconnection

- Interconnection is essential to realizing efficiencies in telecommunications
  - Allows valuable network externalities to be captured
  - Allows carriers to avoid the deployment of duplicative or inefficiently-sized networks
  - Helps to promote the development of a more competitive telecommunications industry
    - interconnection aids rapid and ubiquitous market entry -- even in rural areas where the market may not support multiple facilities-based carriers
    - interconnection allows new carriers to enter the market on an efficient staged basis

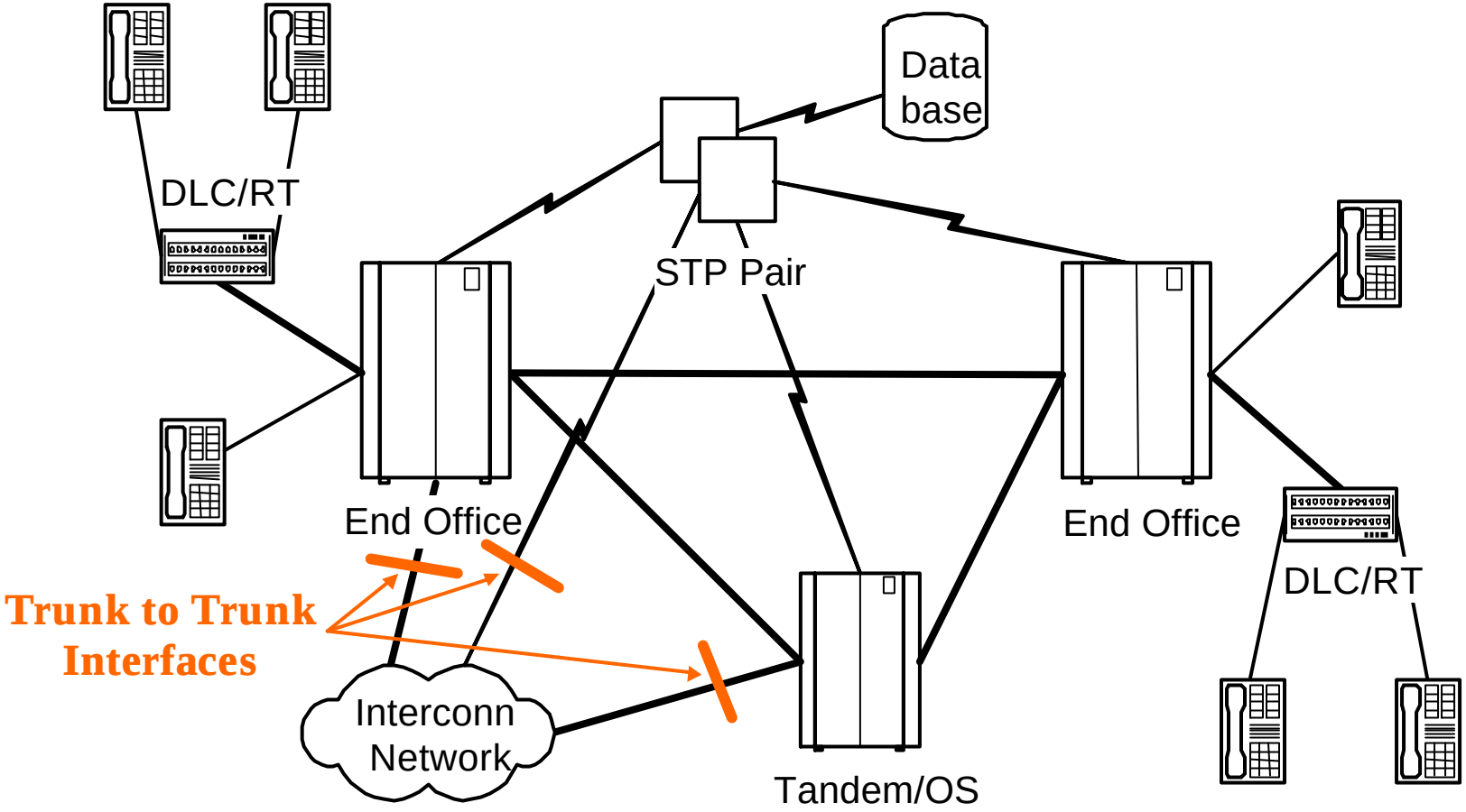
Uses for interconnection

- Different carriers need different types of interconnection
  - International and Domestic Long Distance (ILD and DLD) carriers need to interconnect to local exchange carriers (LECs) to terminate calls
  - Mobile carriers need to interconnect to LECs to lease transport facilities and to terminate calls
  - Competitive local exchange carriers (CLECs) need to interconnect to LECs to lease loops, switching and transport facilities and to terminate calls
  - Internet service providers (ISPs) need collocation facilities

Points of interconnection

- Interconnection can take place at different points within a carrier's network
  - *Trunk* level interconnection used for:
    - ILD/LD to LEC
    - Mobile to LEC
    - LEC to LEC (noncompeting)
    - CLEC to LEC (competing)
  - *Element* level interconnection used for:
    - LEC to LEC (noncompeting)
    - CLEC to LEC (competing)
    - ISP to LEC

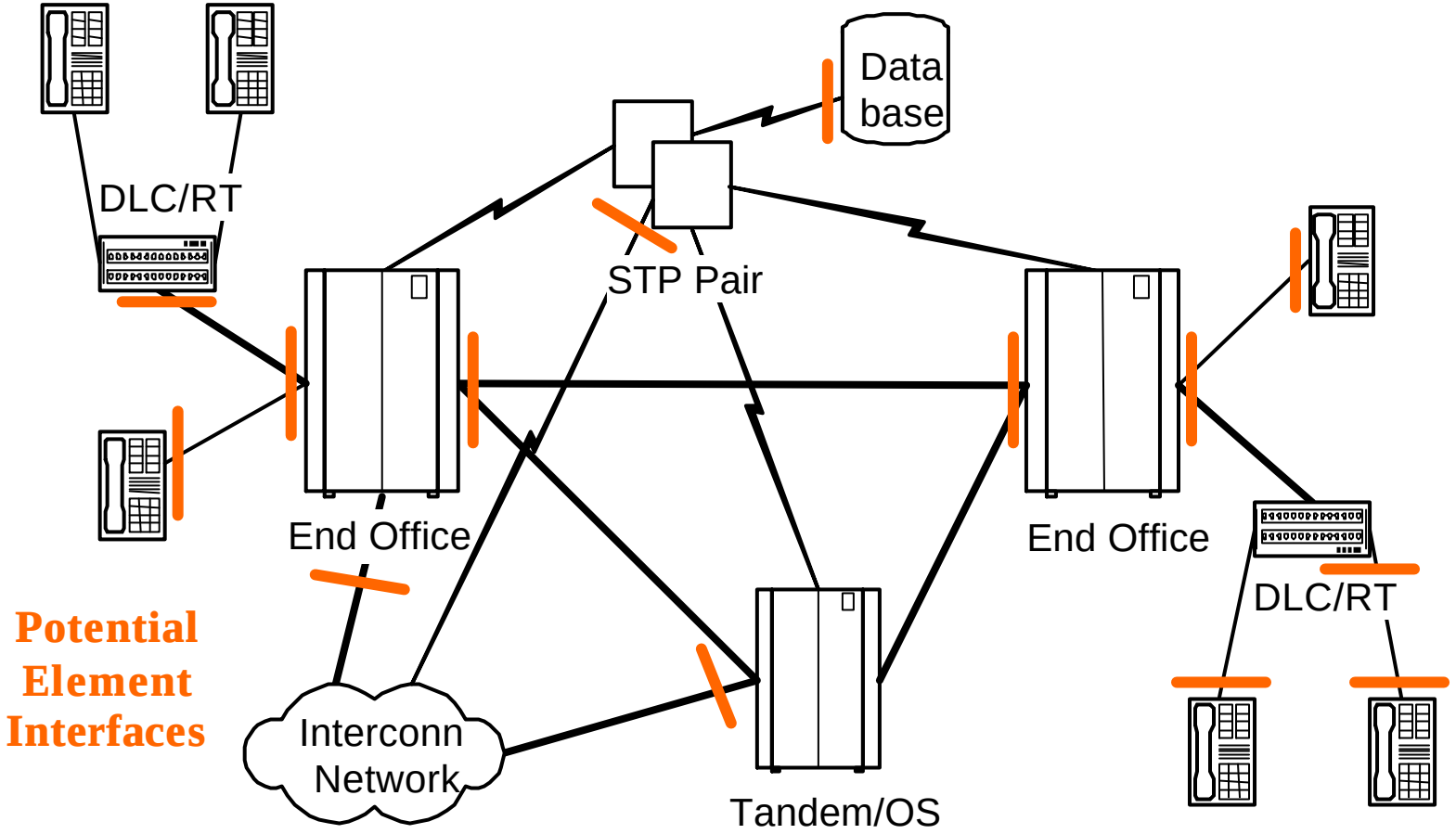
Trunk level interconnection



Trunk level interconnection

- Trunk level interconnection may occur:
  - In the middle of a transmission span (*e.g.*, international “half circuit”); or
  - At the termination of a transmission circuit at a:
    - tandem or local switch
    - cross-connect system
    - other network node
- Trunk level interconnection is straightforward
  - Its use is extremely common
  - Standards are available and well-known
  - It requires relatively little technical and administrative integration between networks

Element level interconnection



Element level interconnection

- Element level interconnection can occur through the lease of unbundled:
  - Loops
  - Switching
  - Transport
  - Signaling
  - Databases
  - Combinations of any or all of the above

Element level interconnection

- Element level interconnection can be complex
  - Its variety is limited only by the imagination of interconnecting carriers to create particular:
    - customer services
    - provisioning designs
  - It requires substantial technical and administrative integration between networks
    - collocation may be required (*e.g.*, central office space, power)
    - physical interfaces vary in complexity
    - it is essential to develop efficient, integrated Operations Support Systems (OSS)

Costing methodologies

- Historical embedded costs (HEC)
  - Calculates costs using historical books of account
  - Typically is based on an accounting system that may have been specified by the:
    - regulator
    - tax authority
    - securities authority
  - Embodies the profile of network designs, efficiency levels, costs, quantities and qualities that exist today (or that existed at some point in the past)

Costing methodologies

- Forward-looking “actual” costs (FLAC)
  - Adjusts historical books and network design to assess what the current network might cost if it was purchased today
  - Current network may not even be available for purchase today
  - Resulting profile of network designs, efficiency levels, costs and qualities will be inconsistent

Costing methodologies

- Forward-looking economic cost (FLEC)
  - Cost concept designed to represent the long run cost level that would be experienced by a competitive new entrant to the market with newly constructed facilities if it:
    - operates efficiently using “best” currently-available technologies
    - serves the total demand for the costed item
    - earns a “normal” (competitive) return

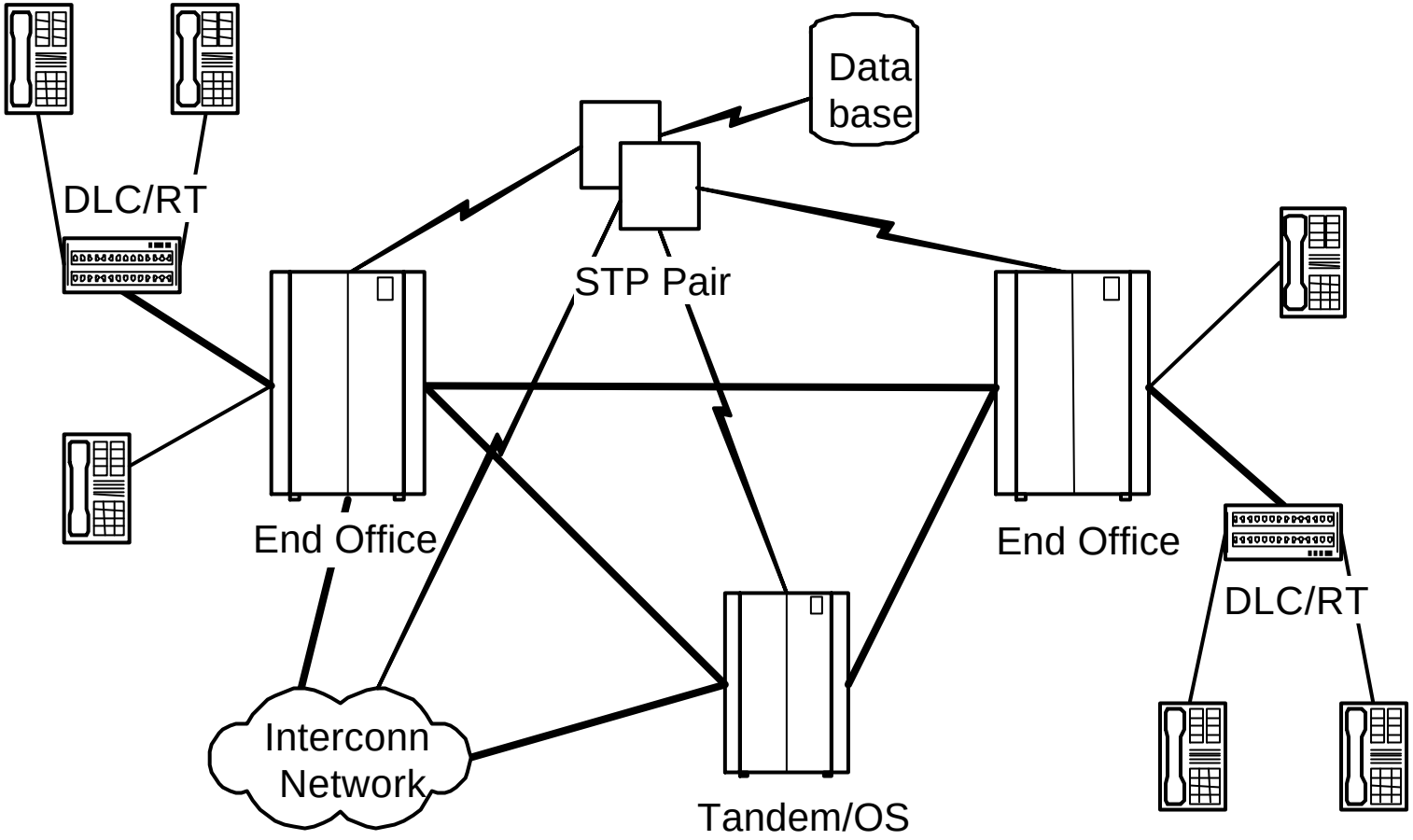
Interconnection services costed

- Many interconnection services must be costed
  - Trunk interconnection/call completion at:
    - mid-spans
    - tandem switches
    - end office switches
  - Unbundled network elements
    - individually
    - in combinations
- Retail services can be costed, too
  - Basic local exchange service
  - Toll long distance services

Building blocks

- The basic building block of interconnection and/or retail services is the network element
  - Interconnection services and retail services are collections of network elements
  - These services can differ by their use of:
    - different combinations of network elements in different quantities
    - different amounts of marketing or other “service creation” expenses
- But first, the cost of each element in the total network must be established

Network elements



Cost development stages

- Input data development
  - Counting, locating and clustering customers
  - Determining quantities of each element demanded
  - Determining costs of network equipment items and their placement
- Designating appropriate:
  - Quantity of each element to be provided
  - Quality of each element to be provided

Cost development stages

- Determine design and engineering of each element of the network:
  - Loop plant
    - routes, distances, technology, bandwidth/throughput
  - End office switching
    - technology (digital/circuit/packet)
    - level of blocking and features
  - Interoffice transport (level of blocking)
  - Tandem switching
  - Signaling
- Multiply calculated quantities of capital inputs by their purchase prices to compute investments

Cost development stages

- Carrying cost of capital investments
  - Minimum expense stream that must be recovered to justify the acquisition and use of capital assets
  - What would have to be paid to a capital owner to rent use of the equipment
- Components
  - Depreciation - loss of productive capacity
  - Expected price and utilization changes - change in market value of equipment
  - Return - payment of investors' opportunity costs
  - Taxes

Depreciation

- As capital equipment ages, its productive capacity may decline due to:
  - "Wear and tear"
    - *e.g.*, cable jacketing and insulation deteriorating, terminal connections oxidizing/corroding
    - increased maintenance and repair requirements
  - Obsolescence
    - development of new technologies/equipment that perform the required tasks more cheaply
    - shift in customer preferences away from the products produced by the capital equipment

Depreciation

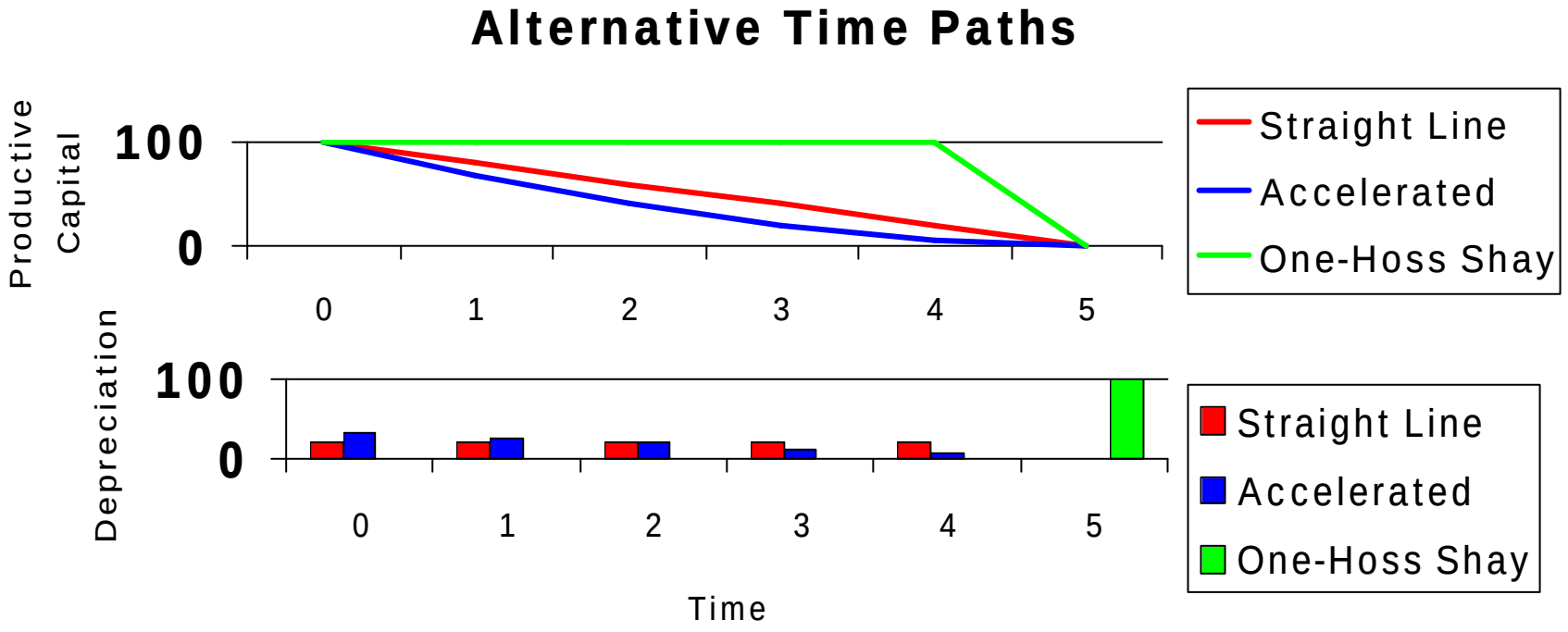
- Equipment possibly could become more productive
  - Equipment requiring a “break-in” period
  - Conduit that can now carry more traffic as fiber optic cables displace copper cables
- Much telephone plant is like a “one-hoss shay”
  - Runs pretty much indefinitely without loss of its initial productivity until replaced due to obsolescence

Have you heard of the wonderful one-hoss shay,
That was built in such a logical way,
It ran a hundred years to a day?

Oliver Wendell Holmes

Depreciation

- Time pattern of productivity change/loss is important



Depreciation

- Depreciation charges should match the actual amounts of economic productivity loss experienced on a period-by-period basis
- There exist many accounting prototypes
  - Straight line
  - Accelerated: sum-of-the-year's digits, declining balance
  - Equal life groups
- Proper use of these methodologies depends on whether individual vintages or collections of capital vintages are being modeled

Expected price changes

- The replacement price of capital goods may be expected to change due to:
  - Obsolescence
    - technological progress
    - customer demand for final goods
  - Scarcity
- Because one possible use for capital equipment is to sell it to another user, any expected change in offer price for the capital must also be incorporated into its carrying cost

Gross return

- Payment to investors for advancing the funds used to purchase the capital
- Debt investors: interest rate
- Equity investors: return to equity
  - Discounted cash flow (DCF)
  - Capital Asset Pricing Model (CAPM)
  - “Comparable” firms
- All of the above calculations must reflect the risks associated with the investment

Net return

- Overall return is a weighted average cost of capital based on relative fractions of debt and equity percents
- Reduced by tax payments that must be made to the tax authorities

Other expenses

- Support expenses (often expressed as a fraction of relevant investment costs)
  - Network operations
  - Network maintenance
- Corporate overhead expenses
  - Top management
  - Financing
  - Legal
  - Other corporate overheads

Overall cost of interconnection

- Sum of costs of network elements used, plus
- Interconnection service creation expenses
  - Assembling the elements together
  - Marketing
  - Customer support
  - Billing
- Universal service or other subsidies are not part of the “cost” of interconnection
  - Any such support should be funded explicitly and broadly to distort as little as possible telecom usage

Summary

- Interconnection takes many different forms and is needed by all carriers
- Opinions differ on appropriate definition of “cost”
  - Historical/accounting
  - Forward-looking/economic
- Interconnection costs are built up from the costs of the individual network components used to construct an interconnection service
- These costs have many components that must be calculated and combined