

Economic and Financial Terms of Interconnection

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Economic principles of interconnection

- When two telephone operators interconnect, new costs are created, both directly and indirectly.
- It is typically in the interest of both operators, and of society in general, to promote full interconnection of networks, to maximize traffic, communication, commerce.
- The costs of interconnection must be paid, ultimately, by the users of the networks. In economic terms, the most efficient result will be for users to pay the costs that they are responsible for “causing”.
- Costs of overall network development can be partly attributed to interconnection, but are mostly separate.

Costs of interconnection

- There is no single, simple, “correct” means of measuring the costs of interconnection, or of other aspects of telephone service
- Different methods of analyzing costs depend primarily upon the objective of the analysis
- The nature of the service and the available data also determine the most appropriate cost approach
- Different experts can disagree on cost results, even using the same data

Costs of interconnection

Categories of costs: Fixed vs. variable costs

- Fixed costs are costs that do not change in the short-run, regardless of network usage
- Also known as “non-traffic-sensitive” (NTS) costs
- Fixed costs include one-time Capital investment costs and recurring Operating expenses
- Capital costs are the investment costs of major facilities and equipment (switches, cables, etc.), including installation labor
- Capital costs are typically amortized as recurring expenses
- Fixed operating costs include recurring labor expenses and non-labor materials and services

Costs of interconnection

Categories of costs: Fixed vs. variable costs

- Variable costs are directly related to use of the telephone system in the short run. Also known as “traffic-sensitive” (TS) costs.
- These costs increase or decrease depending upon traffic volumes, circuits, or other measures of usage. In the case of interconnection, these are costs that vary with traffic between networks.
- May include capital investments in switching and circuit capacity, plus operating costs for administration, labor, power, special charges.
- In the economic “long run”, all costs are considered variable. In the short run, however, the majority of telephone network costs are fixed.

Costs of interconnection

Categories of costs: Fixed vs. variable costs

Summary:

Fixed (NTS) costs:

Capital investment (equipment + labor)

>> amortized as recurring expense

Operating costs

Recurring labor costs

Materials + services

Variable (TS) costs:

Vary with traffic and capacity

Circuits, switch capacity, administration

Most short run costs of telephone service are fixed. In the long run, all costs are variable.

Costs of interconnection

Categories of costs: Dedicated, shared, common

These categories are used for identifying the relationship of costs (input) to services (output)

- Dedicated costs are uniquely incurred to provide only a specific service (or group of services)
 - Includes most variable costs, some fixed costs
 - Interconnecting circuits, for example
- Shared costs are for facilities, labor, etc., that are used for a combination of services
 - Most fixed costs, such as switches, buildings, access lines, inter-office trunks
- Common costs are for administration and overhead, common to all operations of the telephone company

Costs of interconnection

Direct, fixed costs of interconnection

- When two networks are interconnected, certain new facilities, labor, administration, etc. are required as a direct result.
- These typically impose new fixed costs for dedicated facilities and labor.
- Examples: circuits between exchanges, termination, maintenance and operation labor.
- Unbundled network elements (UNEs): costs for specific network elements required for interconnection: loops, signaling, databases, administration, etc.
- Co-location: costs of building space, etc., when new network places facilities on existing network's premises.

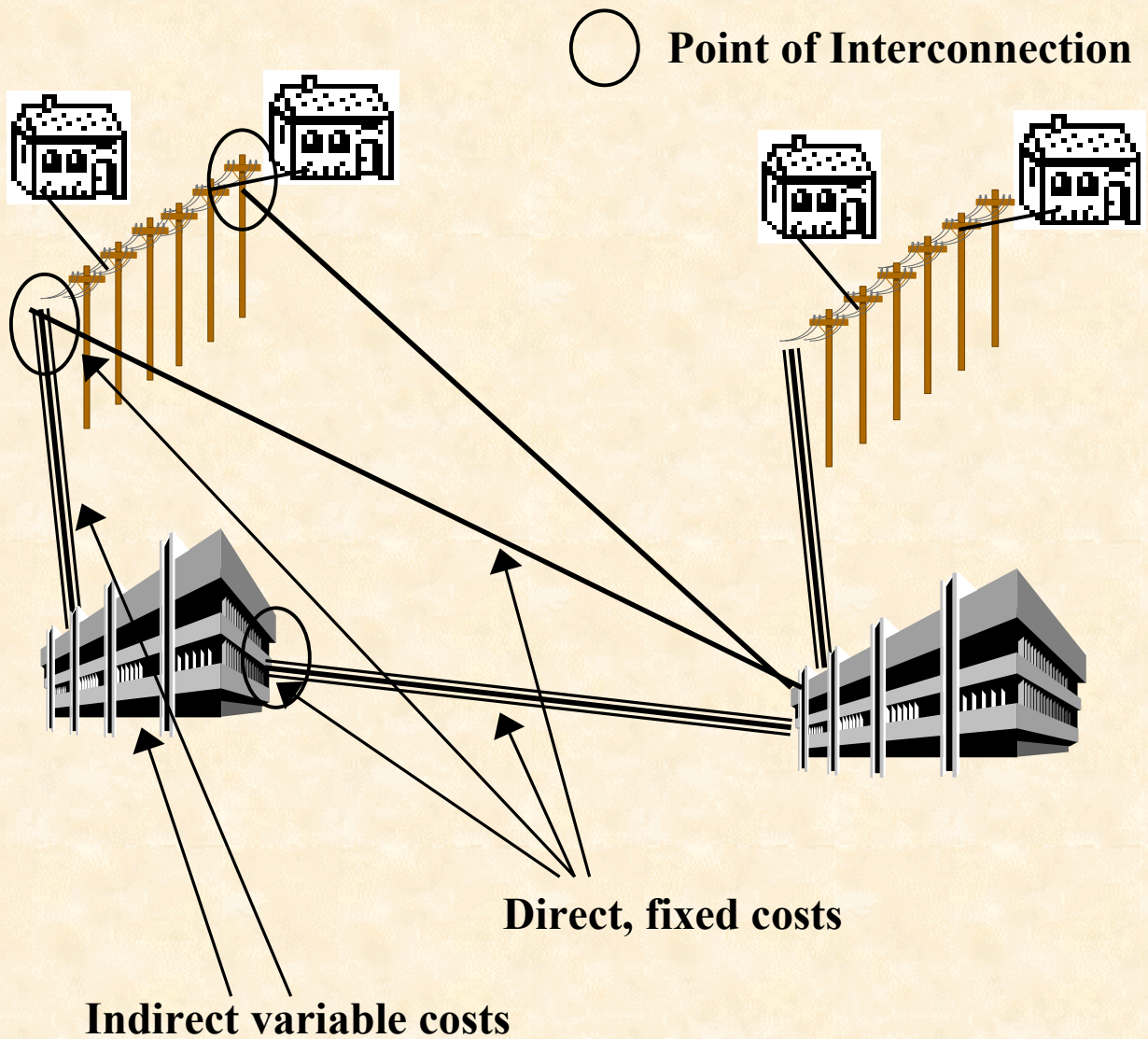
Costs of interconnection

Indirect, variable costs of interconnection

- Interconnection imposes variable costs on carriers in proportion to traffic that passes between networks.
- If total traffic increases due to interconnection, new switching and trunking capacity may be required.
- Re-routing, shifts in traffic patterns, origins, can also affect both carriers' costs.
- Operational and administrative costs for measuring, billing inter-network traffic.

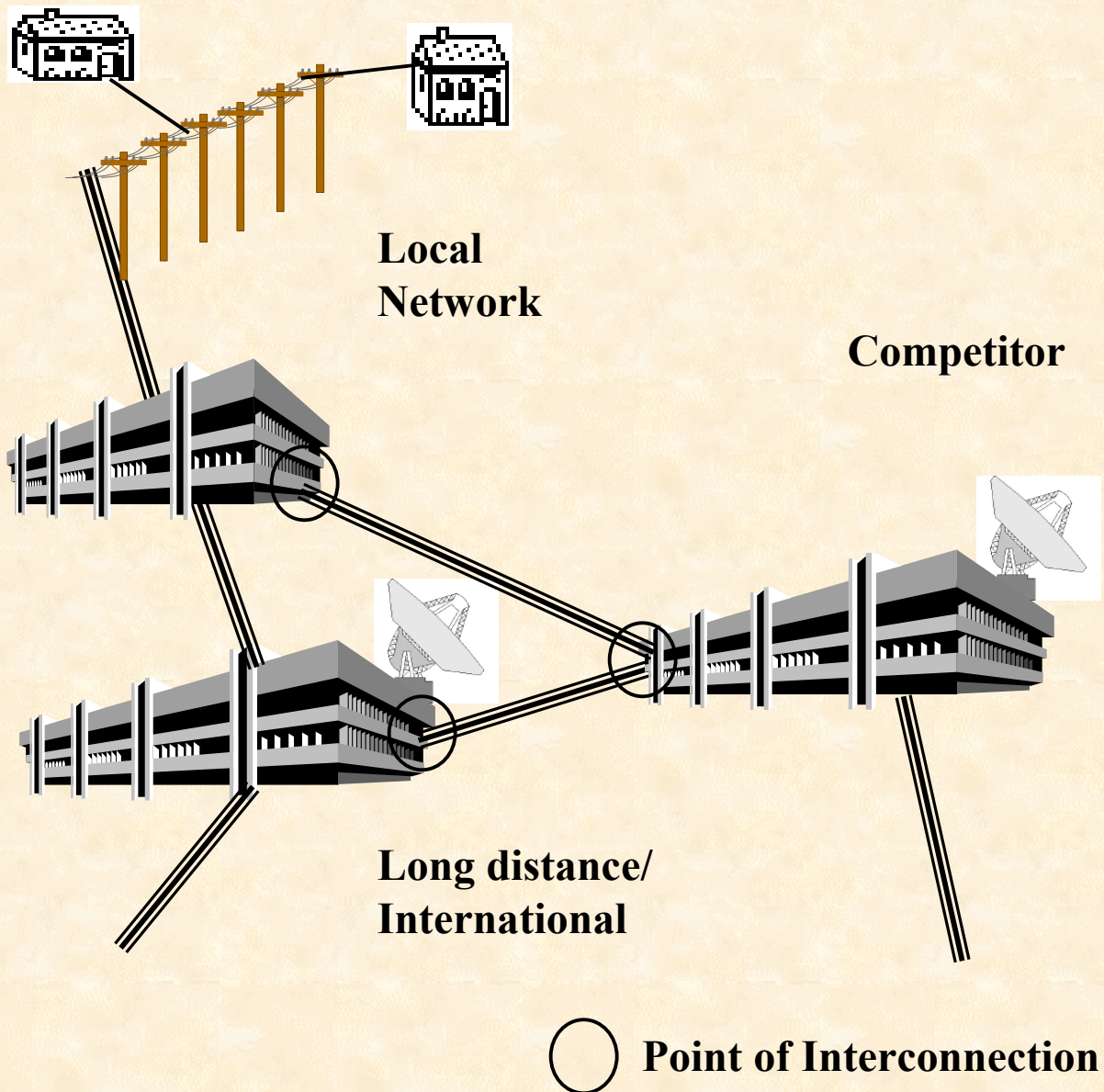
Costs of interconnection

Local network interconnection



Costs of interconnection

Long distance network interconnection



Cost study theories, methods

Historical, Fully Distributed Costs (FDC)

- Historical costs involved measuring actual costs incurred in the past to provide today's level of services.
- Historical cost amounts for purchase and installation of facilities, personnel, equipment, etc., should ideally be determined from accounting records.
- “Fully Distributed” cost studies involve assigning and allocating all of the operator's costs to its various services.
- Shared and common costs must therefore be allocated in some proportion to each of the services that incur those costs.
- Allocation factors can include: capacity, demand, dedicated costs, others

Cost study theories, methods

Historical, Fully Distributed Costs (FDC)

Advantages and drawbacks:

- Historical data are usually available and can be verified.
- FDC ensures all cost inputs are associated with outputs.
- However, historical data will not reflect changes in current and future costs
- Also, historical accounting data includes any inefficiencies in current management, which could be passed on to competitors
- FDC requires all services to pay part of common costs, which may not be required or appropriate for interconnection.

Cost study theories, methods

Forward-looking, incremental costs

- Forward looking cost studies attempt to anticipate actual future costs, not merely costs incurred in the past.
- Incremental costs are the extra costs caused by adding a single unit of service (minute, circuit, customer, etc.).
- Incremental costs only include direct costs, no allocation of overhead or shared costs that are unchanged by a new increment of service.
- In theory, incremental costs represent the price that firms would charge for services in a fully competitive market.

Cost study theories, methods

Forward-looking, incremental costs

- Long Run Incremental Cost (LRIC) studies are most common. The long run is a period over which all inputs are theoretically variable.
- Several different types of LRIC approaches have been proposed:
 - Total Service/Element LRIC (TSLRIC/TELRIC) - U.S.
 - FL-LRAIC- E.C.
- The main objective is to assess the theoretical increment in total service costs resulting from providing an incremental unit of service.
- The differences are more often technical, as incomplete data prevent fully implementing any approach.

Cost study theories, methods

Forward-looking, incremental costs

Advantages and disadvantages:

- LRIC provides a more efficient basis for promoting new competition.
- Competitors are not obligated to pay outdated or excessive costs, and dominant operators have incentives to reduce their own costs.
- However, data on future costs can be difficult to forecast, and subject to controversy and debate.
- Incremental cost methods can be especially complex, and competing studies can produce widely different results.

Cost recovery principles, options

Efficiency

- Ensure that the market produces the most cost-effective result possible, so that prices are low and production high.
- Base cost recovery on principle of “cost-causation”: whichever operator “causes” a cost to be incurred must pay for that cost entirely.
- Charges and payments should precisely reflect the nature of costs: fixed costs should yield fixed (monthly) charges, and variable costs should require per-minute variable charges.
- Can lead to different charges for different operators, based upon their different cost structures.

Cost recovery principles, options

Equity and competitive balance

- Emphasizes the goal of promoting effective competition by ensuring that new, smaller competitors are not penalized for their higher unit costs.
- May impose equal or proportionate cost recovery obligations on both dominant and small operators.
- All similar competitors pay similar charges, regardless of possible cost differences.
- In some cases, incumbents may be required to pay competitors' interconnection costs, to encourage competition.
- Result may be higher end user prices in the short run, but may spur eventual competition that would otherwise fail.

Cost recovery principles, options

Laissez Faire

- Seeks to avoid regulatory intervention, preferring negotiation between operators to determine cost recovery for interconnection.
- Minimizes the role of the regulator, including the need for expertise, time and expense for developing cost studies, legal disputes.
- Can work with operators of similar size, with market incentives to conclude agreements quickly.
- Unlikely to encourage dominant operators to negotiate fair and equitable cost sharing.

Cost recovery principles, options

Access deficits and network development

- Often interconnection charges paid to dominant operators have included elements for supporting network expansion (“access deficit charges”).
- Most of the cost of network development is not “caused” by the interconnection of other networks, including mobile or international services.
- Recent theory prefers isolating development costs and payments separately, through Universal Service Funds or similar mechanisms, to preserve efficiency of interconnection.
- However, some portion of network development costs can appropriately be attributed to interconnection and overall market expansion.

Interconnection charges

Cost-based charges

- Assuming reasonable cost study results are achieved, charges for interconnection can be set based directly upon those results.
- Choice of cost methodology, recovery principles, data, implementation, and means for updating/changing results will all influence charges.
- Where cost results are uncertain or incomplete, comparisons with “best practices” in other countries, or with other operators, can set benchmarks for charges.
- When introduced, charges and market performance should be reviewed regularly, in relation to revised cost results, to ensure appropriate charge levels.

Interconnection charges

Retail-based charges

- Some interconnection charges are based upon a percentage or discount of retail charges for similar services.
- For example, competitors might pay 80% of the full retail price for a circuit or for local exchange minutes.
- This system can simplify the process of establishing and accounting for charges, but it should be based upon a cost-orientation as much as possible.
- The discount level should closely reflect cost disparities between retail and wholesale services. Again, results should be monitored and revised regularly.

Interconnection charges

Price Caps

- As with other areas of tariff regulation, price caps can be an efficient, relatively simple option for setting and changing prices for interconnection.
- Initial prices are set based upon cost studies, to reflect appropriate costs as much as possible.
- Future price changes are allowed to be flexible, based upon a combined “basket” of service prices, with overall increases or decreases taking account of inflation and productivity changes.
- The initial price levels are critical in such as system, as are the formulas for allowing future changes.

Interconnection charges

Bill-and-Keep, Sender-Keeps-All

- These systems are appropriate for interconnection of networks with a relative balance of costs and traffic in each direction.
- No interconnection charges are paid between carriers. Instead, each operator charges its own users for services that originate on its network, and absorbs all incoming interconnecting traffic without payment from the other.
- If traffic is in balance, this saves the administration cost of interconnection charges.
- Standards for comparing traffic and costs must be applied, and revised as necessary.

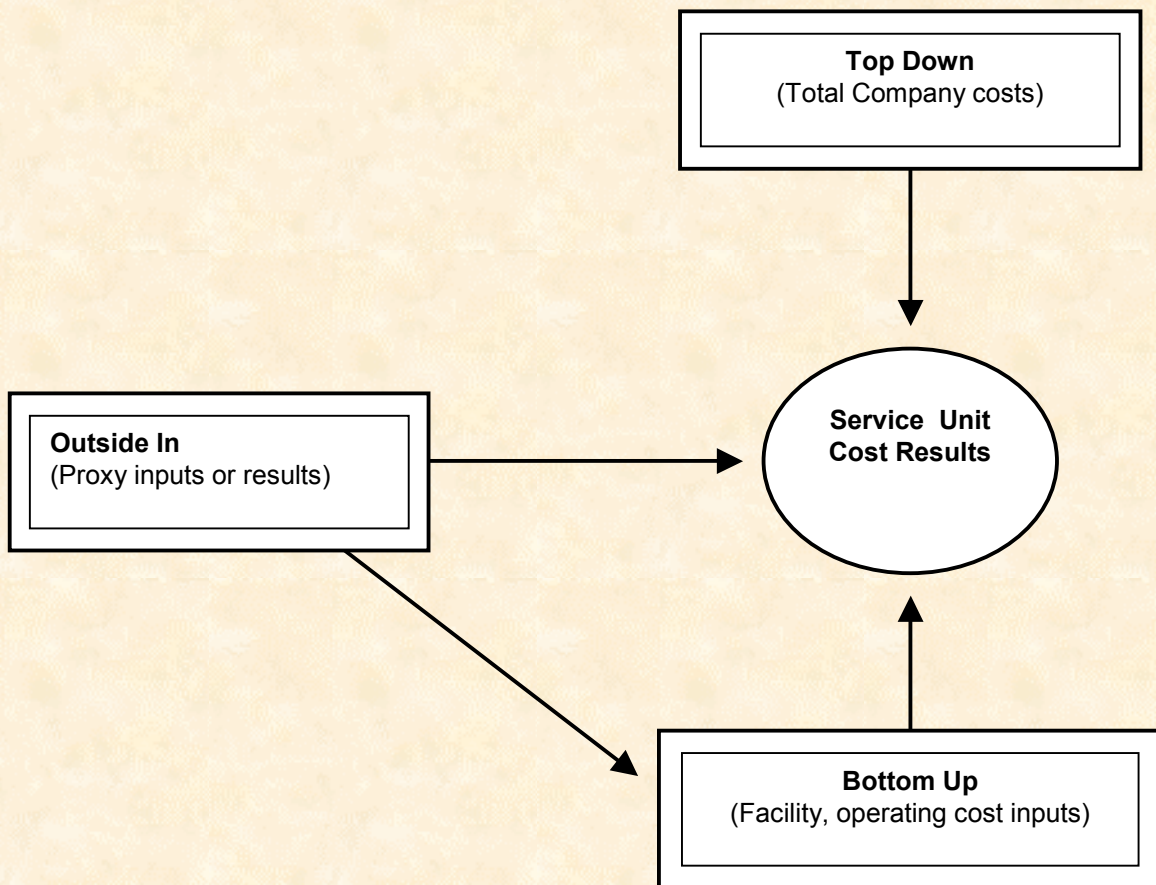
Interconnection charges

Revenue sharing

- This can be used where networks are not in direct competition, but provide complementary services.
- For example, interconnection between a local and long distance network, in which the long distance carrier pays a portion of its revenues to the local carrier as interconnection fee.
- The advantage is simplicity in accounting and administration.
- However, if the % of revenue shared is unrelated to the actual cost of the interconnection, this can result in inefficient markets.
- Therefore, cost-oriented analysis should still be the basis for such a system.

Cost study approaches

Converging cost methods



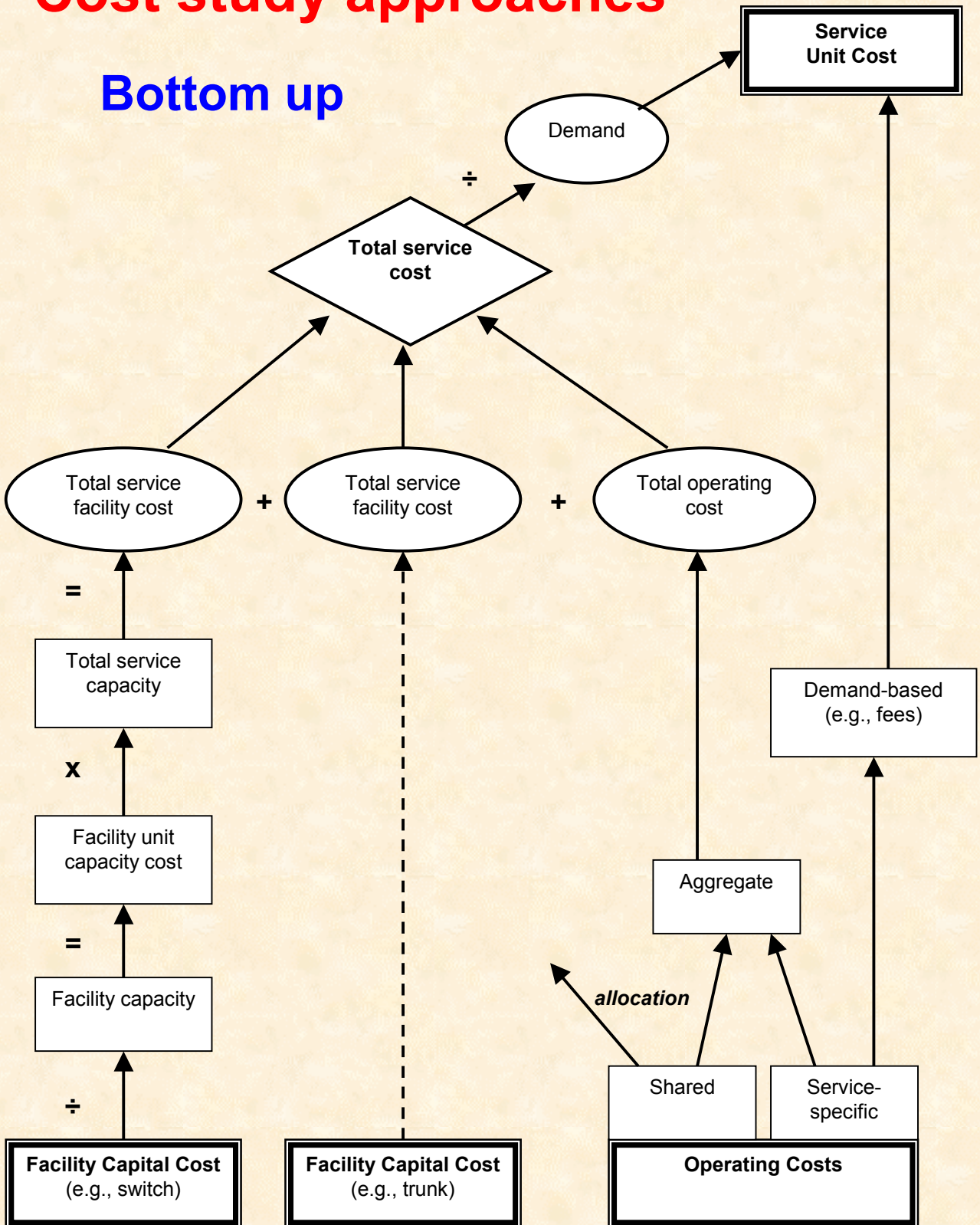
Cost study approaches

Converging cost methods

- Operators often have incomplete, conflicting, or unreliable accounting data to apply to cost studies
- Different theories and methods of evaluating costs can lead to different results
- The objective should be to conduct several separate analyses, and arrive at a “convergence” of results:
 - *Bottom-up* evaluates unit facility costs required to provide service, often using LRIC
 - *Top-down* allocates actual total company costs to each service, often FDC
 - *Outside-in* utilizes proxies of experience elsewhere to fill missing inputs and compare results

Cost study approaches

Bottom up

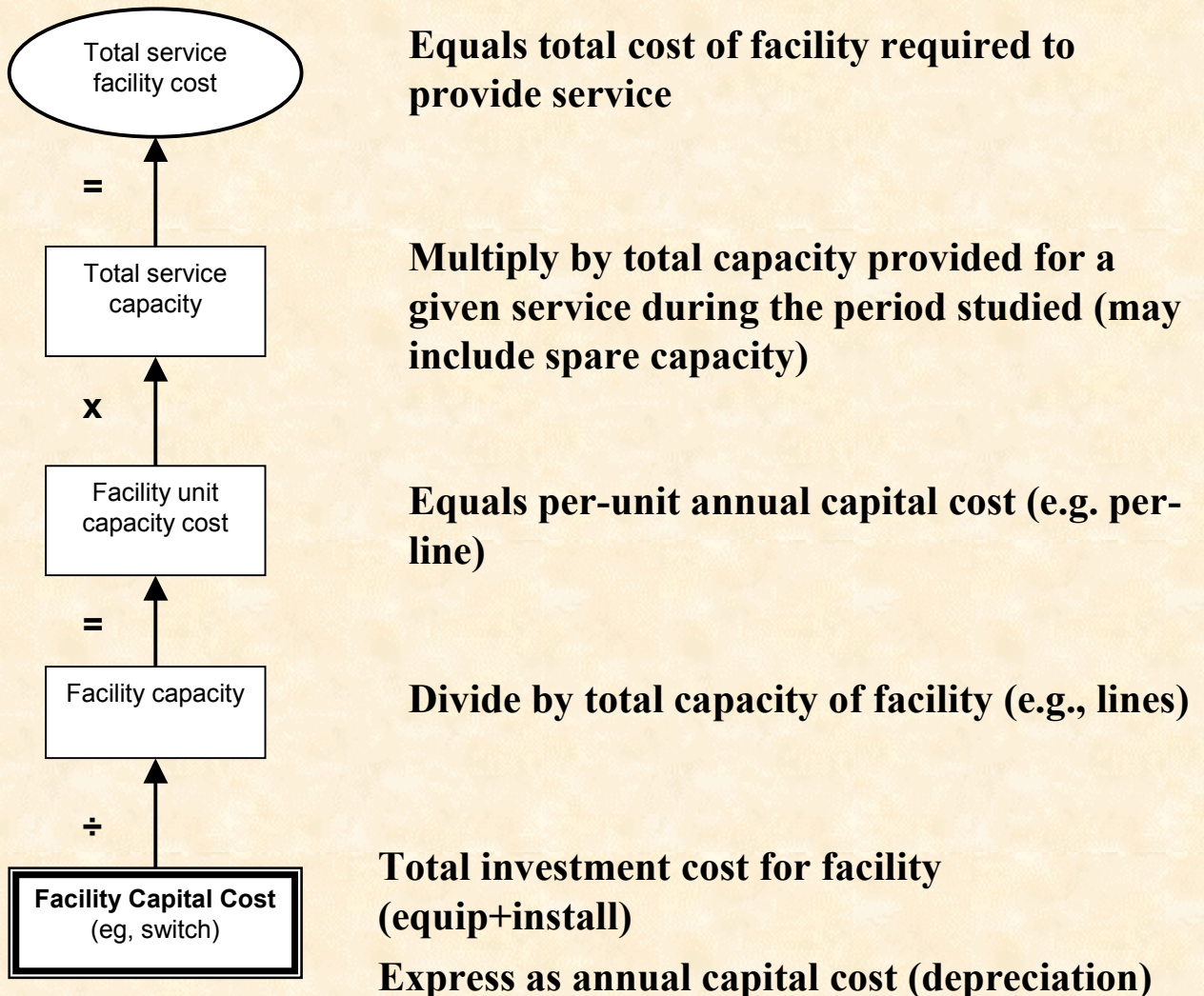


Cost study approaches

Bottom up

Facility cost analysis

Determines total annual cost of facilities required for each service



Cost study approaches

Bottom up

Operating cost analysis

Determines total annual operating cost required for each service

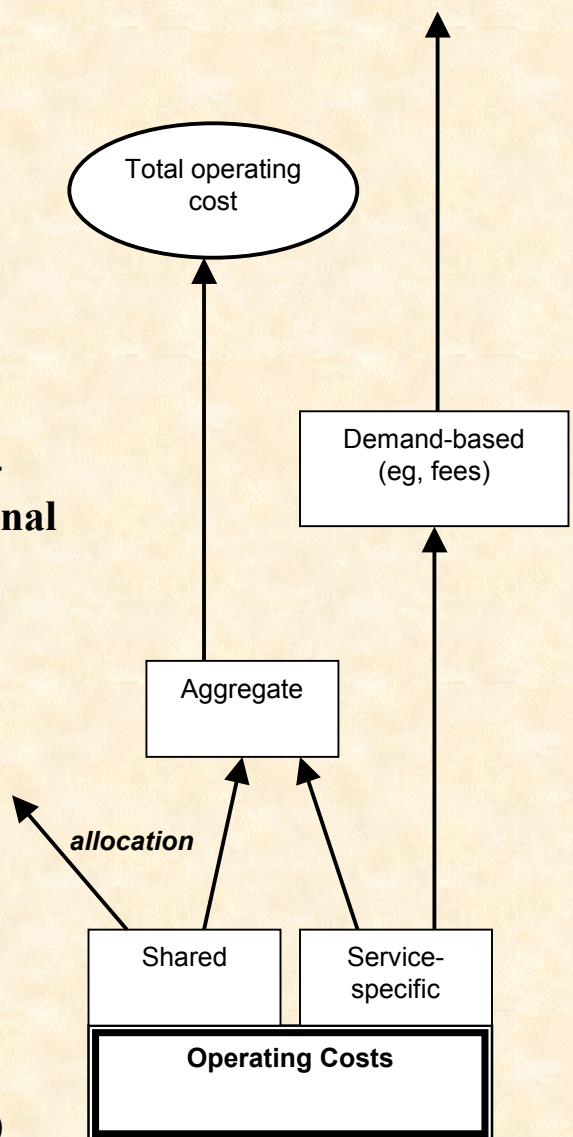
Combine shared and service-specific operating costs to obtain total service operating cost

Add demand-based (e.g., per-minute) fees and charges to final service cost

Allocate shared costs to services, by relative capacity or other measure

Identify which costs are shared, and which are required only for the service studied

Begin with estimate of required operating costs (admin., cust. service)



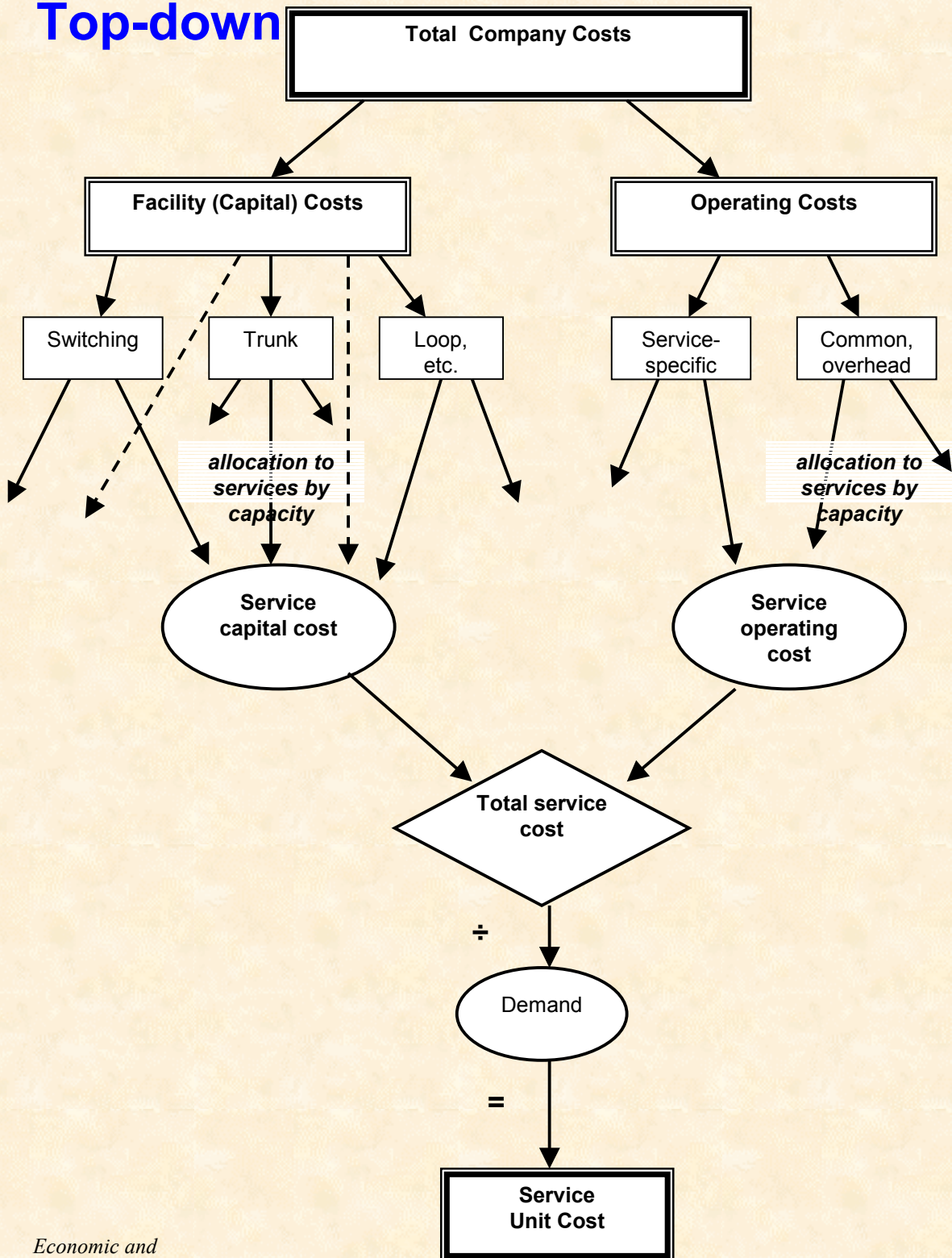
Cost study approaches

Bottom up

- Begins with actual investment cost for each type of facility, as well as gross operating costs for labor, etc.
- Determines capacity unit costs for facilities, and service facility cost from service capacity needs
- Determines service-specific and allocated operating costs for each service
- Combines facility and operating costs for each service, divides by demand to obtain service unit cost
- Issues:
 - Assumes current facility capital costs
 - Determination of appropriate gross operating cost amounts
 - Requires allocation mechanism for shared costs
 - Treatment of spare capacity

Cost study approaches

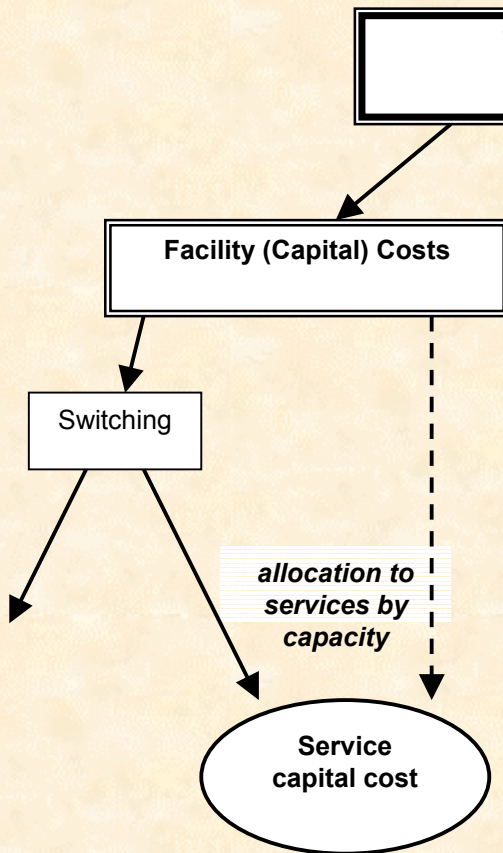
Top-down



Cost study approaches

Top-down

Facility cost analysis



From total company costs for year, identify capital costs (depreciation, interest, etc.)

Classify capital costs by type of facility; identify costs entirely dedicated to one service

Allocate costs of each facility according to relative capacity required for each service

Combine service-related costs of each facility to obtain total capital cost for service

Cost study approaches

Top-down

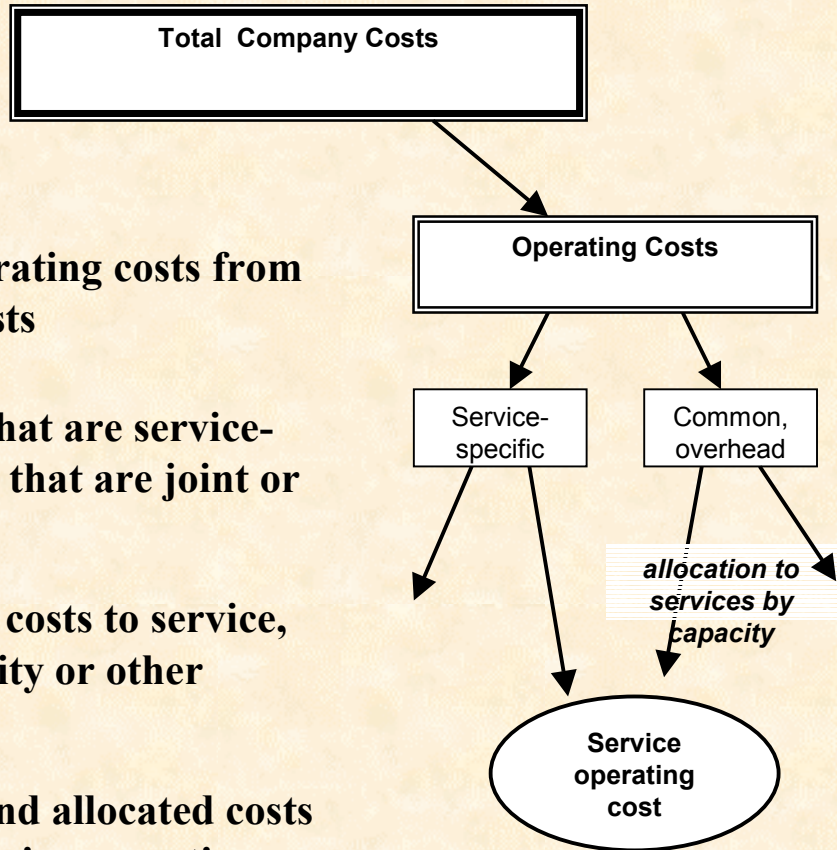
Operating cost analysis

Identify total operating costs from total company costs

Determine costs that are service-specific and those that are joint or common

Allocate common costs to service, by relative capacity or other measure

Combine direct and allocated costs to obtain total service operating cost



Cost study approaches

Top-down

- Begins with actual total company costs incurred for recent period
- Separates costs into facilities (capital) and operating
- Identifies service-specific costs, allocates shared costs to different services
- Combines facility and operating costs for each service, divides by demand to obtain service unit cost
- Issues:
 - Difficulty identifying source of book costs by type
 - Allocation mechanisms for shared costs
 - Requires allocation mechanism for shared costs
 - Tends to validate inefficiencies

Cost study data requirements

- Investment cost (current and historical) of each type of facility
- Total company capital costs, historic and projected
- Total operating costs required (actual and theoretical) to provide current services, by type of cost
- Capacity of different facilities (circuits, peak connections, equivalent minutes)
- Complete service demand data, past and projected
- Ability to separate and identify types of costs, including non-telecom activities

Cost study simplified example

Bottom-up

- Capacities must be expressed in equivalent minutes
- Labor costs for personnel needed to support interconnection services

Bottom Up (LRIC)				
<u>Facilities Capital Cost</u>				
	Interconnection	Long Distance	Interoffice	Local
	Trunk	Switch	Trunks	Switches
Long Run Investment cost	\$250,000	\$5,000,000	\$500,000	\$4,000,000
Useful life (years)	15	10	15	10
Monthly cost	\$1,389	\$41,667	\$2,778	\$33,333
Capacity (minutes)	500,000	5,000,000	1,000,000	3,000,000
Incremental cost/minute	\$0.0028	\$0.0083	\$0.0028	\$0.0111
<u>Operating Expenses</u>				
	Operation	Traffic Admin,	Customer	
	Maintenance	Billing	Support	
Labor costs/person/month	\$3,000	\$2,500	\$2,000	
Materials costs/person/month	\$500	\$800	\$300	
Equivalent persons assigned	20	15	5	
Total supported cost/month	\$70,000	\$49,500	\$11,500	
Minutes of service supported	800,000	800,000	800,000	
Incremental cost/minute	\$0.09	\$0.06	\$0.01	
Combined total cost/min				\$0.1638

Cost study simplified example

Top-down

- Allocation factors are the most essential and difficult element
- Amounts dedicated to interconnection based on contracts, for example

Top Down (Historical FDC)		Amount	Interconnection	
		Dedicated to	Allocation	Interconnection
	Total	Interconnection	Factor	Cost/Month
Total company costs for 2000	\$45,000,000			\$144,458
<u>Capital (depreciation)</u>				
Interoffice trunks	\$6,000,000	\$250,000	0.07	\$33,542
Long distance switching	\$5,000,000		0.08	\$33,333
Local switching	\$8,000,000		0.04	\$26,667
Loops, other	\$12,000,000		0	\$0
<u>Operating</u>				
Operation and maintenance	\$3,500,000		0.06	\$17,500
Traffic administration	\$2,000,000	\$150,000	0.06	\$9,250
Customer service	\$3,000,000		0.06	\$15,000
Management, marketing, etc.	\$4,500,000		0.02	\$7,500
Other	\$1,000,000		0.02	\$1,667
Interconnection minutes/month				800,000
Cost per minute				\$0.1806