Efficient company:
Methodologies, modelling and application for tariff regulation

Tariff regulation: General

- Regulation is inevitably inefficient, and it is always preferable to encourage market competition.
- There are however “market failures” when the market is not perfectly efficient in allocating resources, leading to suboptimal distribution among the population.
- The aim of any market regulation should be to replicate what happens in a market under conditions of perfect competition.
- Regulation also has its failings, so market intervention is not always to be recommended, since it entails costs and application errors.

Tariff regulation: General

- Failings or inefficiencies may have several causes, mainly associated with the following:
  - Regulated prices may not reflect the costs of the service and may transfer rents to the wrong groups
  - Non-economic objectives may be important and costly
  - Regulation based on the cost of the service reduces incentives to enhance efficiency
  - Administrative overheads and indirect costs of regulation
  - Regulatory capture or regulators' own agendas.

Tariff regulation: General

- For a market to display conditions of perfect competition, two conditions of efficiency must be fulfilled together – productive and assignative:
  - Enterprises must minimize their production costs
  - Goods and/or services must be produced in a quantity and with a quality that people value and the units must be consumed by those who value them most.
- It is difficult to find examples where both conditions are fulfilled, and more often than not markets operate under conditions of imperfect competition or market failure, such as: monopoly, duopoly, market power or information problems.

Tariff regulation: General

- Notwithstanding this, there are various economic justifications for State regulation, the primary objective of which must always be geared to enhancing the allocation of resources.
- Ideally, regulation should be implemented only when the expected market benefits outweigh the costs of intervention.
- Regulation may serve to correct productive inefficiencies by setting prices or production quotas, or to correct assignative inefficiencies through subsidies.

Tariff regulation: General

- Tariff regulation may be exercised through various methods or methodologies, such as:
  - Price-cap
  - Rate of return (cost of capital)
  - Fully distributed costs
  - Benchmarking
  - Efficient company

Efficient company: Methodology

- The methodology consists in using a business model which sets tariffs for services on the basis of the costs that would be incurred by a company equipped with the most efficient technologies available on the commercial market at the time of the tariff-setting exercise and with optimum organization of operations, i.e. an entirely hypothetical situation.
- Regulated tariffs are derived from estimates of the investments required in order to meet demand for the projected service for a planning time-frame of four to five years and of all the relevant operating costs that would be incurred in order to provide the services in the most efficient manner possible.

Efficient company: Modelling

- In order to model the efficient company, the following features (modules and parameters) have to be determined:
  - Cost of capital
  - Estimated demand for the telecommunication services
  - Network design and investment in telecommunication infrastructure
  - Administrative investment
  - Human resources – wage bill
  - Operating costs
  - Depreciation – residual value
  - Attribution of costs between services provided
  - Self-financing equation

Efficient company: Cost of capital

- The cost of capital is a relevant parameter in setting tariffs for services, corresponding to the cost of capital invested or the rate of return on assets imposed on the company by the market, and is used as the discount rate applicable to cash flows generated by the efficient company.
- The most widespread method used in financial economics for determining the cost of capital is the Capital Asset Pricing Model (CAPM).

Efficient company: Cost of capital

- CAPM states that the rate is calculated from the following formula :

$$K_0 = R_F + \beta * PRM$$

where:

K_o : cost of capital

R_F : risk-free rate of return

β : company's systematic risk

PRM : market risk premium.

Efficient company: Estimating demand

- Analysis of the demand for telecommunication services is crucial in determining the required investment for an efficient company.
- Analysis of traffic demand and numbers of subscribers, and subsequent projections thereof, constitute key parameters for describing the industry with a view to proposing corrective measures in order to enhance operation or, alternatively, to adjust regulatory policy so as to achieve stated social objectives.

Efficient company: Estimating demand

- Demand analysis is complex, essentially on account of five factors:
  - Analysis of prices of the service.
  - Number of subscribers to the telecommunication system.
  - Types of traffic.
  - Substitution or complementarity.
  - Geographical breakdown of demand.

Efficient company: Network design and infrastructure investment

- On the basis of the subscriber and traffic demand, it is necessary to establish the network design for the efficient company, in order, once the required quantities of each network component or element have been determined, to establish the level of infrastructure investment and costs.
- The result must be a network that provides service to users with the required level of quality at the lowest possible cost, and within the prevailing technical and economic constraints such as, for example, spectrum availability or location of exchanges, and budgetary constraints in terms of available investment resources.

Efficient company: Network design and infrastructure investment

- The communications network shall include all infrastructure strictly necessary to provide the telecommunication services for which tariffs are to be regulated.
- It is necessary to establish the network design for the efficient company, in order, once the required quantities of each component have been determined, to establish the required level of infrastructure investment and costs in respect of access network, transmission, switching, management of operations and maintenance, and operating systems for ensuring optimum service provision with the defined quality and time-frames.

Efficient company: Network design and infrastructure investment

- Having regard to the various facets of the establishment of a telecommunication network, it must be possible to establish a methodology – based on engineering – for determining the costs of each of the network elements involved in the efficient company.
- Although this stage will depend a lot on the overall regulatory approach and the quantity and quality of available information, there are generic steps to be followed in the modelling process.

Efficient company: Administrative investment

- Once the infrastructure investment for the mobile network has been determined, it is necessary to determine the level of administrative investment associated with provision of the services.
- Such investment relates mainly to fitting out buildings to house the efficient company's commercial and administrative activities and all investment necessary for operation of the services provided, as well as personnel costs.
- These estimates will also include the working capital required for start-up and running of the company.

Efficient company: Human resources – wage bill

- Another relevant aspect for modelling of the efficient company is design and dimensioning of optimum staffing levels and functions within the human resources structure required to provide the telephone services.
- To this end, the current organigramme of the regulated company will be analysed and, on the basis of related efficiency parameters, functions will be identified in relation to the company's level of service, while preserving quality and timely service provision.

Efficient company: Human resources – wage bill

- Once work posts or duties have been specified within the structure, along with their functions and units within the organigramme, and the corresponding staffing levels for each, the remuneration level of every employee of the efficient company will be set.
- This calls for information on the local labour market, in order to gear salaries in the efficient company to the corresponding functions. Local market surveys are usually available with information on average national salaries, which will be relevant for analysing suitable rates to be incorporated in the model.

Efficient company: Human resources – wage bill

- From the costs of salaries and the staffing levels in the efficient company, an estimate of the company's operating costs for personnel will be derived.

Efficient company: Operating costs

- The costs of goods and services employed in the provision of regulated services have to be estimated on the basis of the various business activities that the telecommunication company in question undertakes.
- The most important items to be estimated are the following: office rental, network maintenance, leasing of vehicles, leasing of transmission media, termination charges, personnel costs, office supplies, publicity, marketing, commercial costs, etc.

Efficient company: Operating costs

- To model each of these various costs, it is important to have information on the regulated company so as to validate the associated costs and propose parameters and standards for dimensioning that will sustain them.

Efficient company: Depreciation – residual value

- To estimate depreciation on investment, it will be necessary to determine for each investment item the useful economic life of the asset and the depreciation method to be used (straight-line or accelerated).
- The residual values of investments made by the efficient company have to be determined on the basis of the useful lifetimes and cumulative straight-line depreciation of the asset.
- For both estimates, it will be useful to have an information base on the methods applied by telecommunication companies that are subject to regulation and parameters used to determine the useful lifetimes of assets.

Efficient company: Allocation of costs between services provided

- Once the levels of investment and operating costs entailed in providing the telecommunication services identified and planned according to demand have been determined, the different cost items will have to be allocated to the services provided.
- To this end, the proportion in which the different network elements and assets in general are used is incorporated in the efficient company model, in particular with respect to allocation for determining access or interconnection charges and prices charged to the public at large.

Efficient company: Self-financing equation

- The total cost of the company comprises the efficient company's investment and operating costs for the project, taking into account depreciation and residual value of assets, taxation and costs of capital.
- The total relevant cost for the purpose of setting tariffs will be calculated for the size of the company stemming from the average volume of provision of the various services during the period of validity of the tariffs and for the telecommunication infrastructure planning time-frame.

Efficient company: Self-financing equation

- The final tariffs will be those which, when applied to the projected demand of the regulated services of the efficient company for the tariff period, generate revenue which covers the total cost, thereby ensuring self-financing.

Efficient company: Methodology for calculating tariffs for services

- The main tasks to be carried out are the following:
  - Overall integration of models.
  - Sensitivity analysis of variables in the model.
  - Calculating the final level of tariffs to propose.
- This module serves to integrate all of the modules in order to produce total costs and expenditure associated with the efficient cost model and hence carry out the final calculations necessary to obtain the tariff levels derived from the model.

Efficient company: Methodology for calculating tariffs for services

- To calculate tariff levels, one determines either the incremental development cost and the total long-run cost, or the annuity, depending on the methodology it is decided to use, as well as the final tariffs to be proposed for the regulated services.
- To this end (if necessary and relevant), tariff areas may be defined, based on criteria of homogeneity of costs of providing service in the coverage areas considered, so as to minimize cross-subsidies between areas, while preserving tariff transparency for consumers.

Efficient company: Methodology for calculating tariffs for services

$$-\sum_{i=0}^{N}\frac{I_i}{(1+K_0)^i}+\sum_{i=1}^{N}\frac{(Y_i-C_i)*(1-t)+D_i*t}{(1+K_0)^i}+\frac{VR}{(1+K_0)^N}=0$$

where:

i : traffic year;

N : planning time-frame;

Ii : investment in the project in year "i";

Ko : cost of capital;

Yi : total long-run cost of the company in year "i";

Ci : annual operating cost of the company in year "i";

t : tax rate;

Di : depreciation in year "i", of fixed assets in the project;

VR : residual economic value of the company's assets in the fifth year.

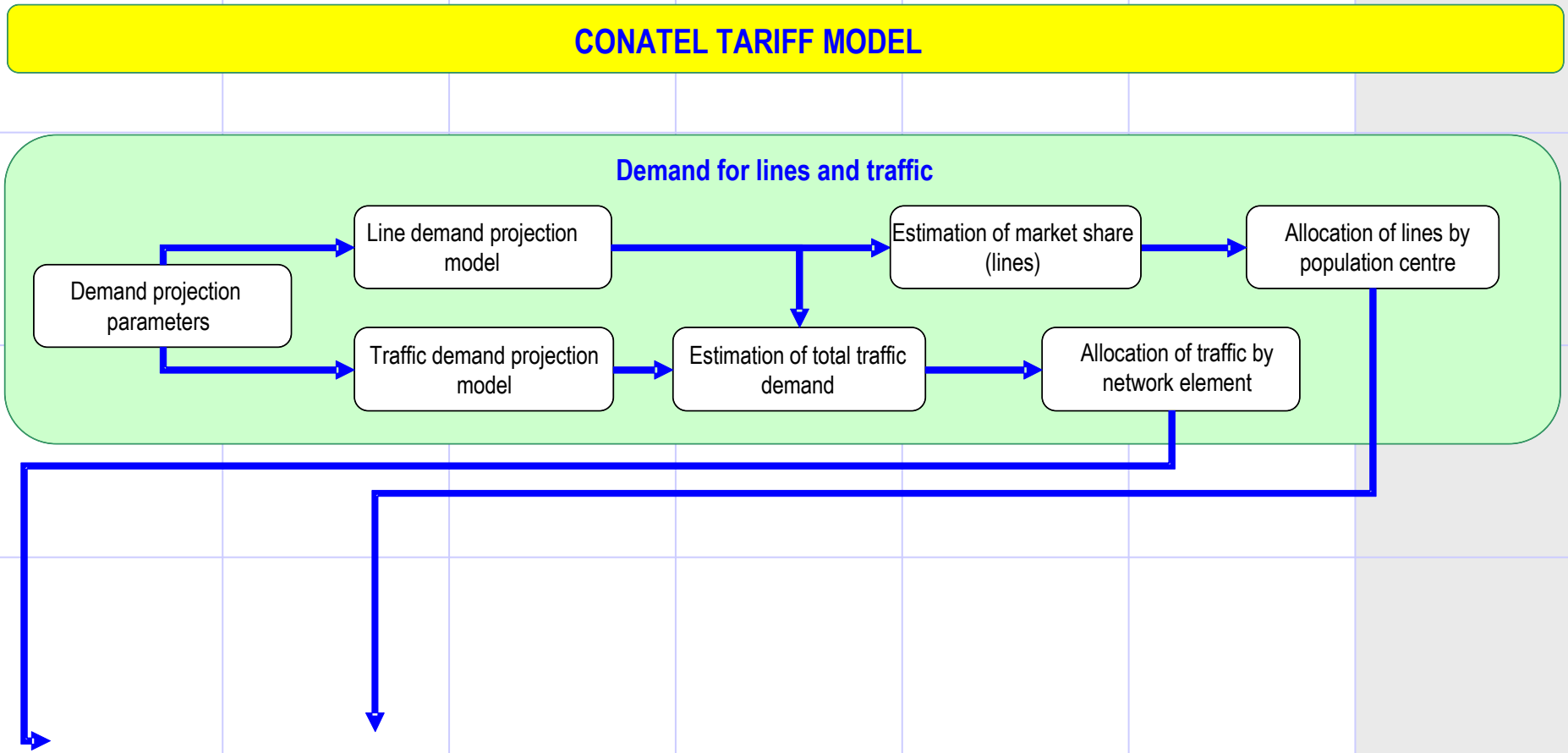
Efficient company: Applications and results

Cost of capital rate used for regulatory purposes

Companies	Country	Sector	Year	Cost of capital	Risk-free rate	Beta (β)	Risk premium
Entel PCS Entel Móvil Smartcom Telefónica Móvil Bellsouth	Chile	Mobile	2003	**10.92%**	0.35%	1.04	10.16%
Centennial Multikom	Chile	Trunking Digital	2004	**10.92%**	0.35%	1.04	10.16%
CTC GTD Telesat Manquehue CMET EntelPhone VTR Banda Ancha [1]	Chile	Fixed	2004	**9.9%**	0.35%	0.90	10.16%
TelSur TelCoy	Chile	Fixed	2004	**10.10%**	0.35%	0.96	10.16%
CTR RTC	Chile	Rural	200 3	**10.92%**	0.35%	0.90	10.16%
CANTV	Venezuela	Fixed	200 6	**13.52 %**	-	-	-
Movilnet Movistar Digitel.	Venezuela	Mobile	200 7	**12.15 %**	3.9 %	1.05	7.87

Tariff regulation model: Demand for lines and traffic

Case of Venezuela: long-run incremental cost model, consumer and interconnection tariffs



Demand for lines and traffic: Traffic demand projection model

Case of Venezuela: long-run incremental cost model, consumer and interconnection tariffs

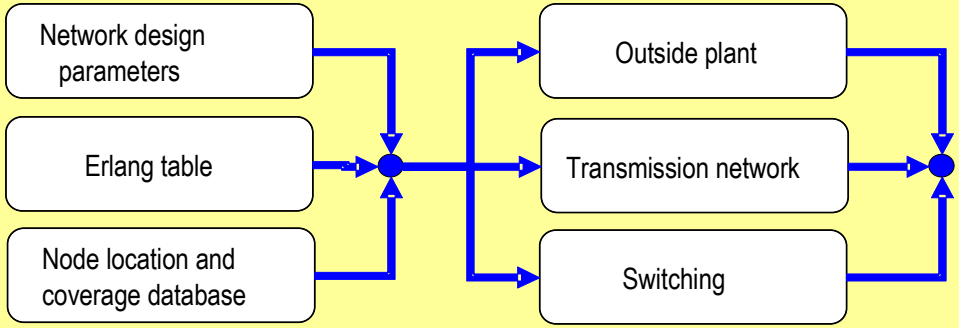
- The types of traffic studied are:
  - Local traffic within a network
  - Outgoing local traffic to another local network
  - Incoming local traffic from another local network
  - Outgoing national long-distance traffic
  - Incoming national long-distance traffic
  - Outgoing international long-distance traffic
  - Incoming international long-distance traffic
  - Fixed-mobile traffic
  - Mobile-fixed traffic

Tariff regulation model: Configuration and design of network elements

Case of Venezuela: long-run incremental cost model, consumer and interconnection tariffs

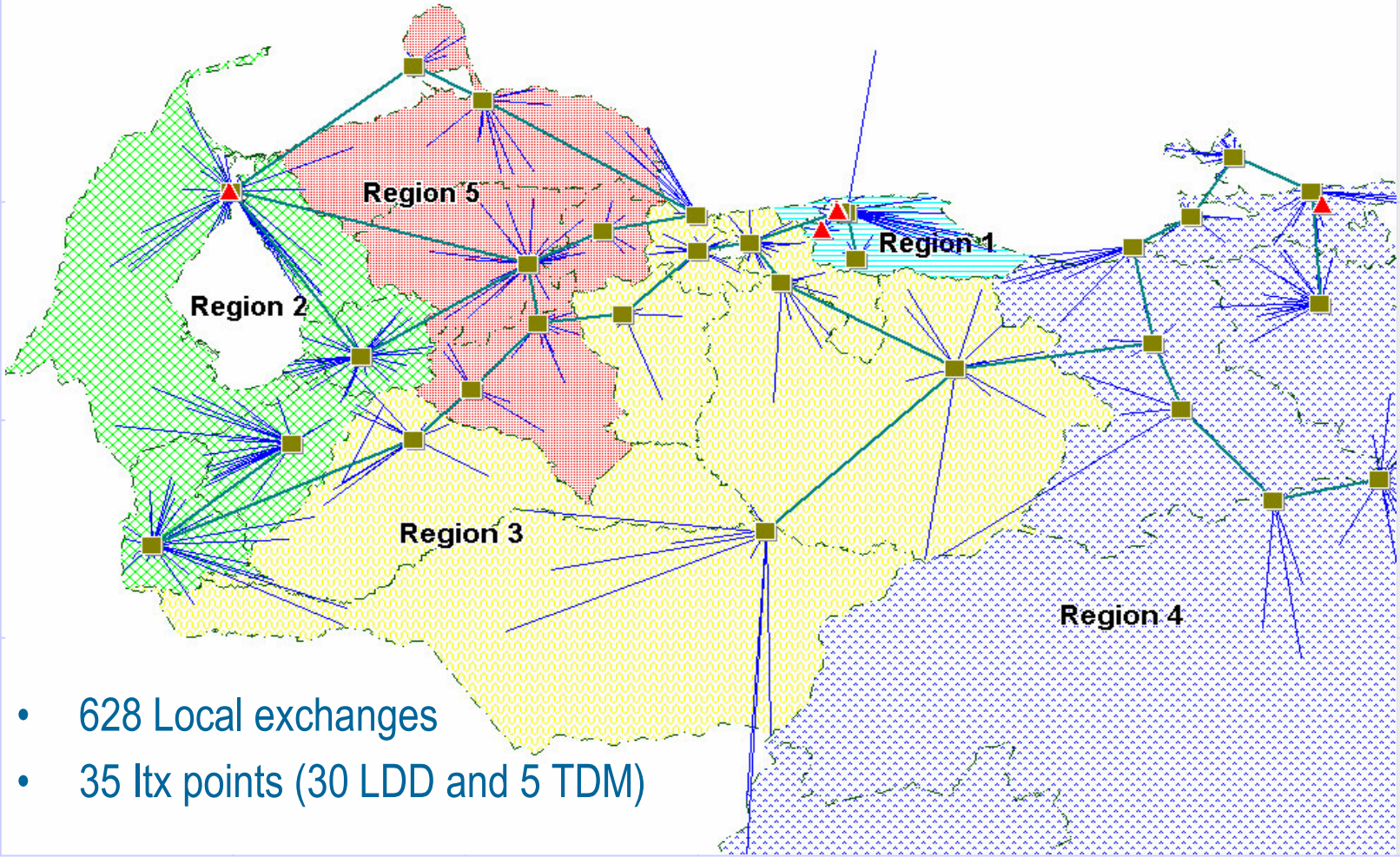
CONATEL TARIFF MODEL

Configuration and design of network elements



Geographical network structure: Technical network hierarchy

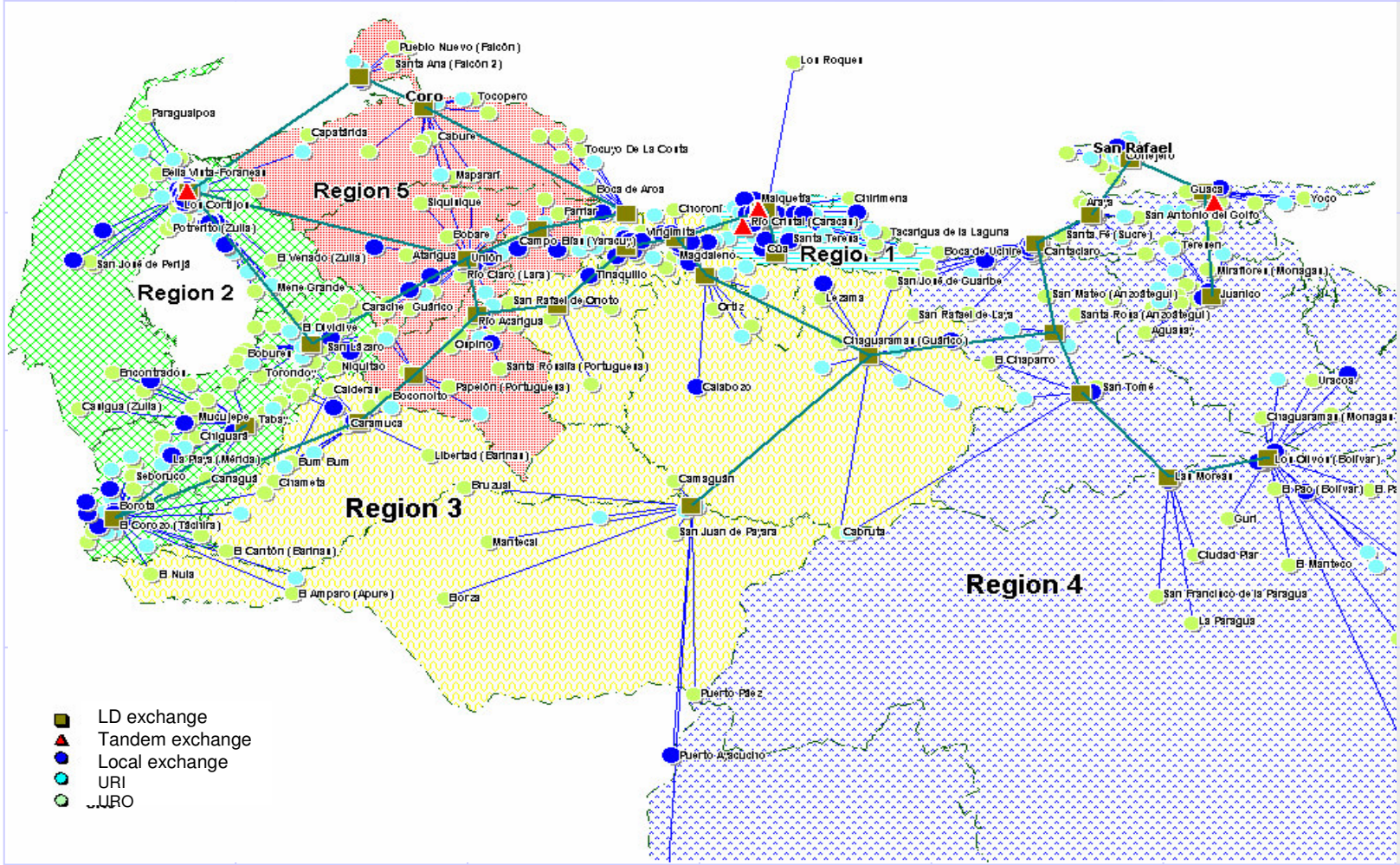
Case of Venezuela: long-run incremental cost model, consumer and interconnection tariffs



- 628 Local exchanges
- 35 Itx points (30 LDD and 5 TDM)

Geographical network structure: Network design

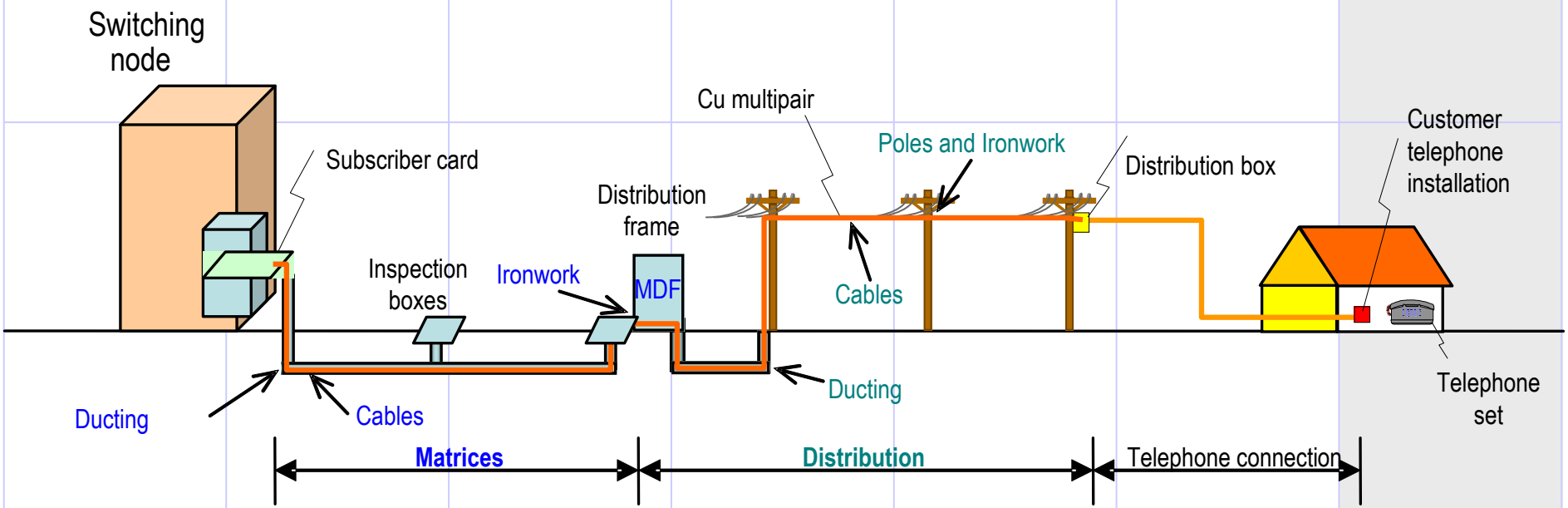
Case of Venezuela: long-run incremental cost model, consumer and interconnection tariffs



Configuration and network design: Outside plant

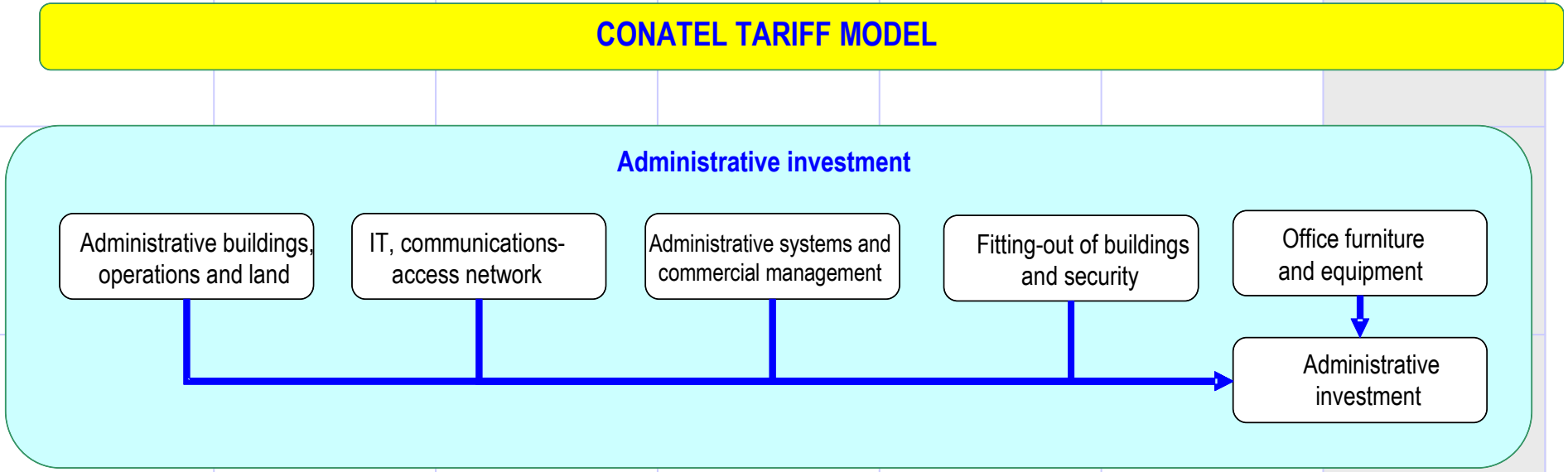
Case of Venezuela: long-run incremental cost model, consumer and interconnection tariffs

- External plant costs were determined on the basis of the following scheme:



Tariff regulation model: Administrative investment

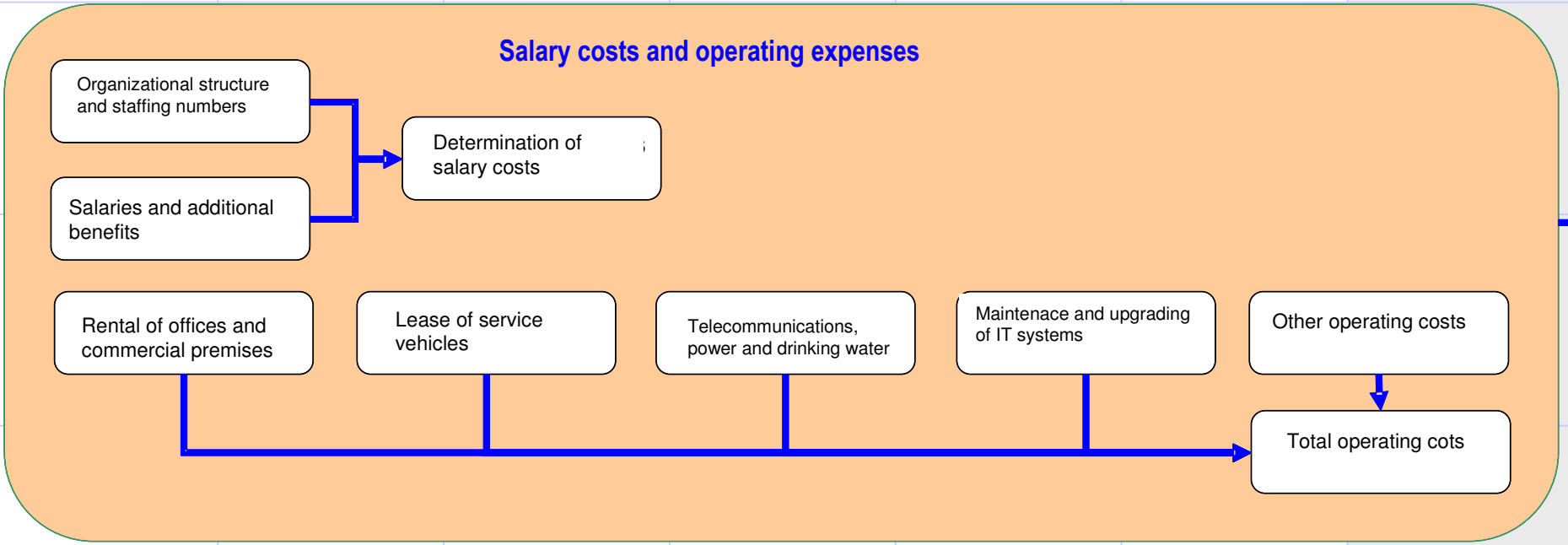
Case of Venezuela: long-run incremental cost model, consumer and interconnection tariffs



Tariff regulation model: Salary costs and operating expenses

Case of Venezuela: Long-run incremental cost model, consumer and interconnection tariffs

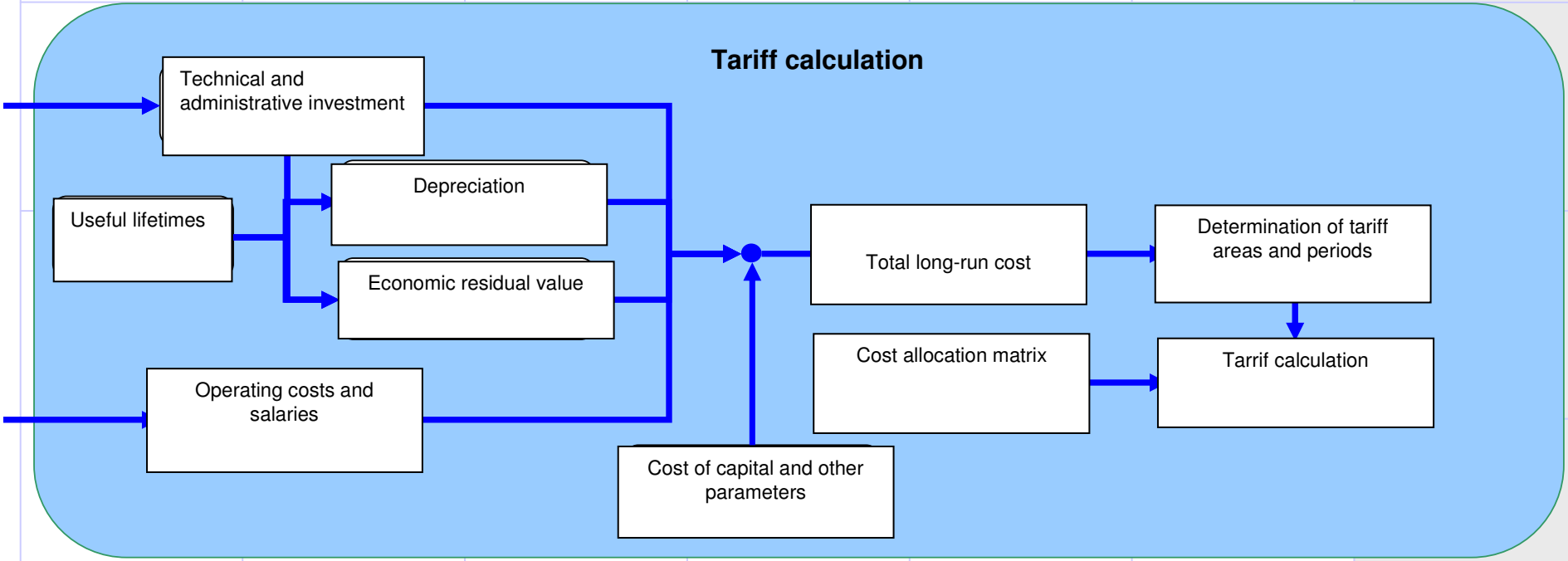
CONATEL TARIFF MODEL



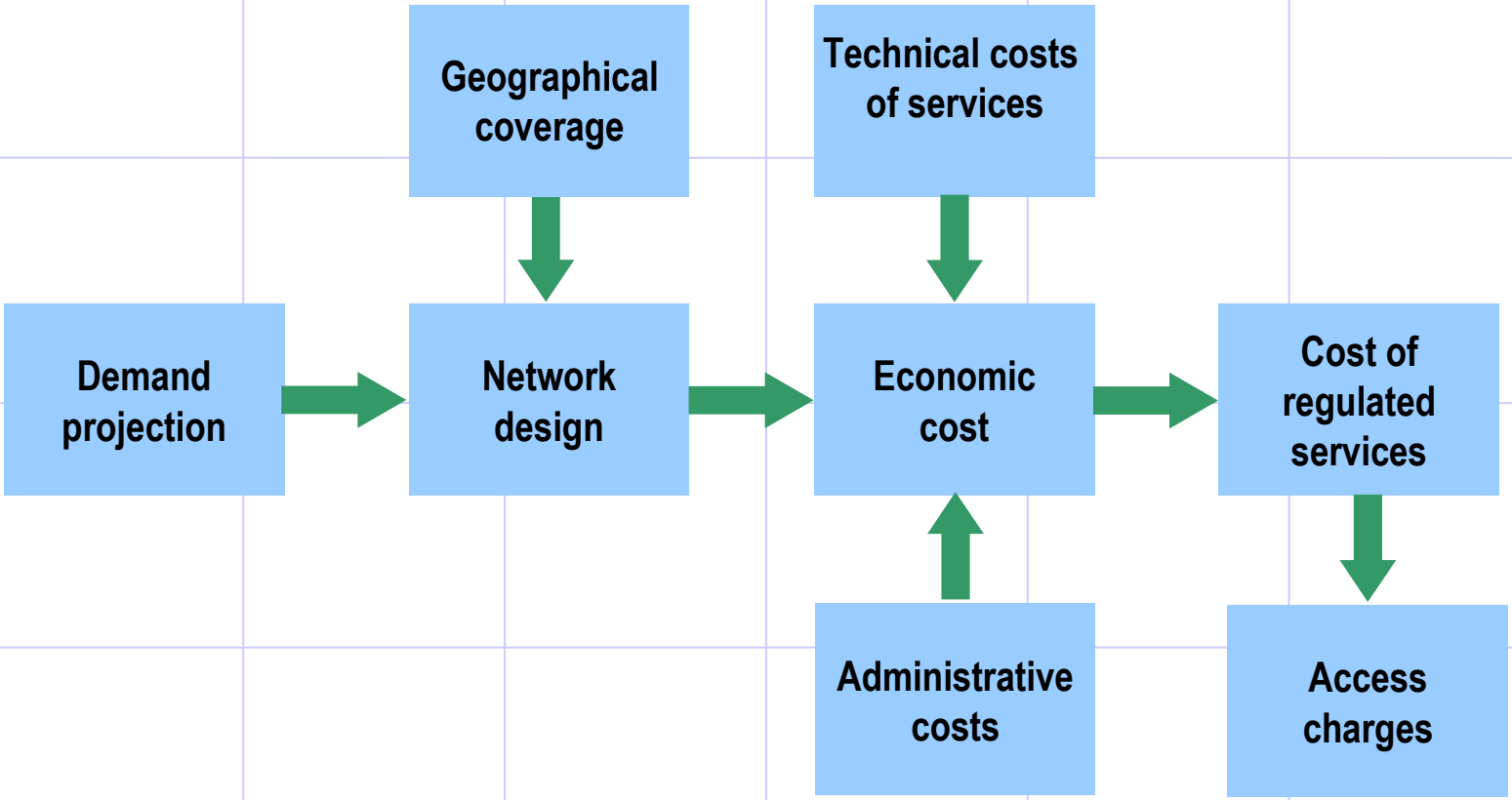
Tariff regulation model: Tariff calculation

Case of Venezuela: Long-run incremental cost model, consumer and interconnection tariffs

CONATEL TARIFF MODEL

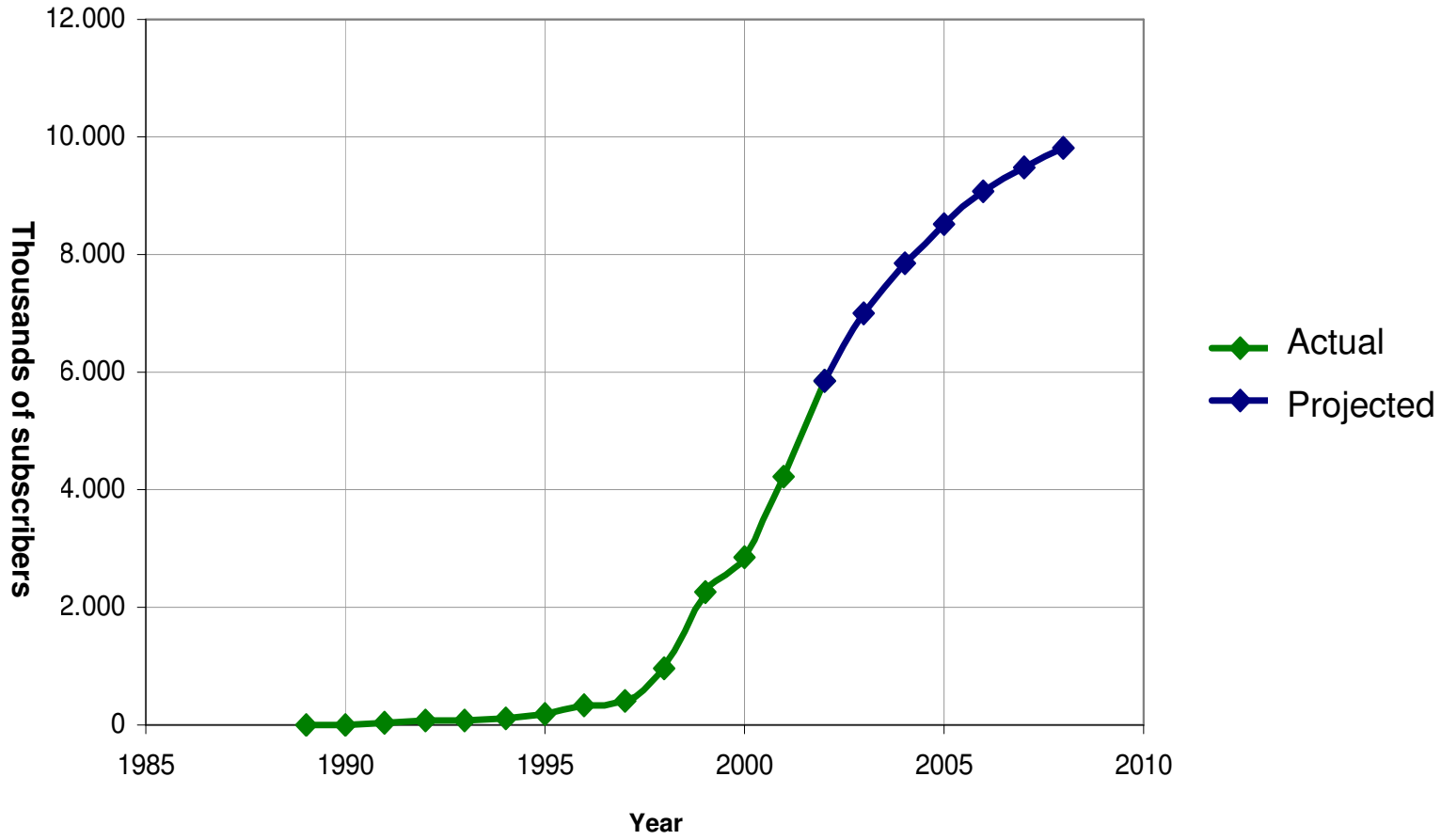


Overall outline



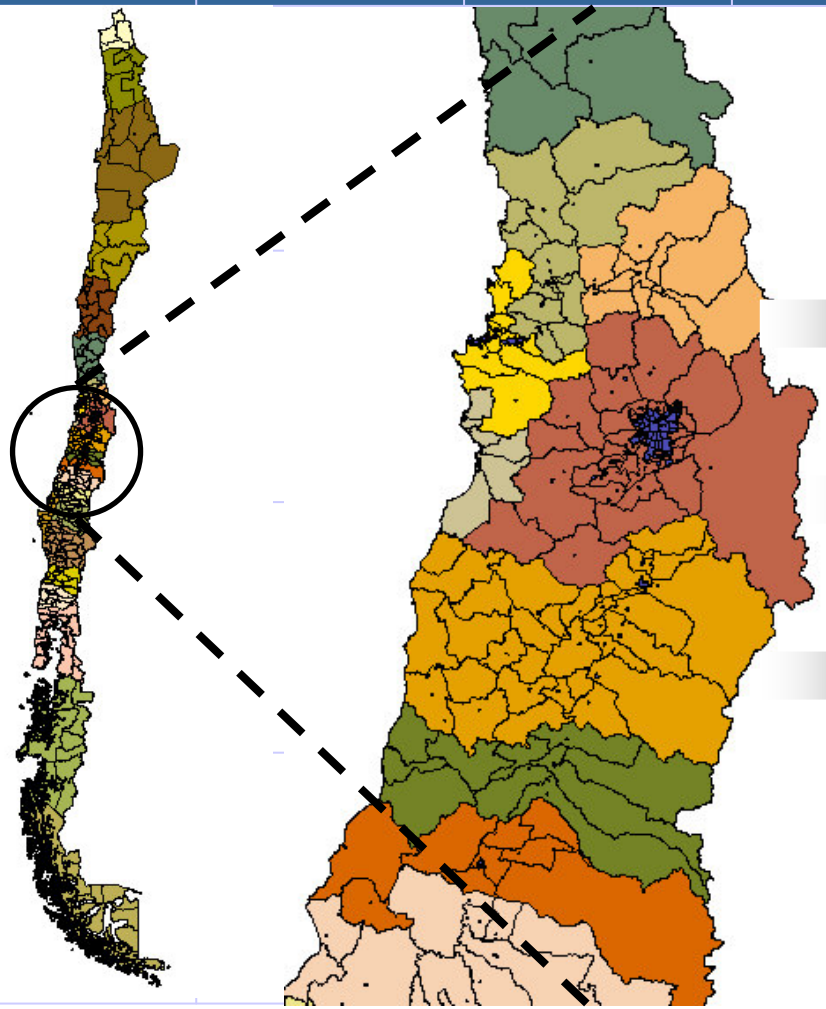
Demand projection: S curve

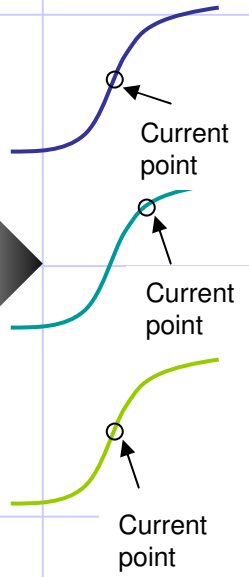
Case of Chile: Efficient mobile enterprise model, interconnection charges, Period 2003-2008



Geographical segmentation of demand

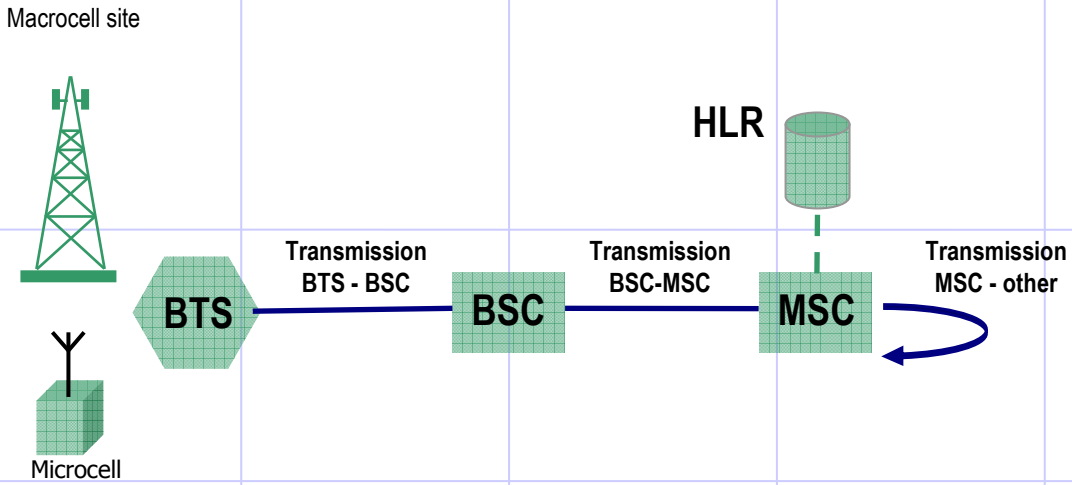
Case of Chile: Efficient mobile enterprise model, interconnection charges, Period 2003-2008





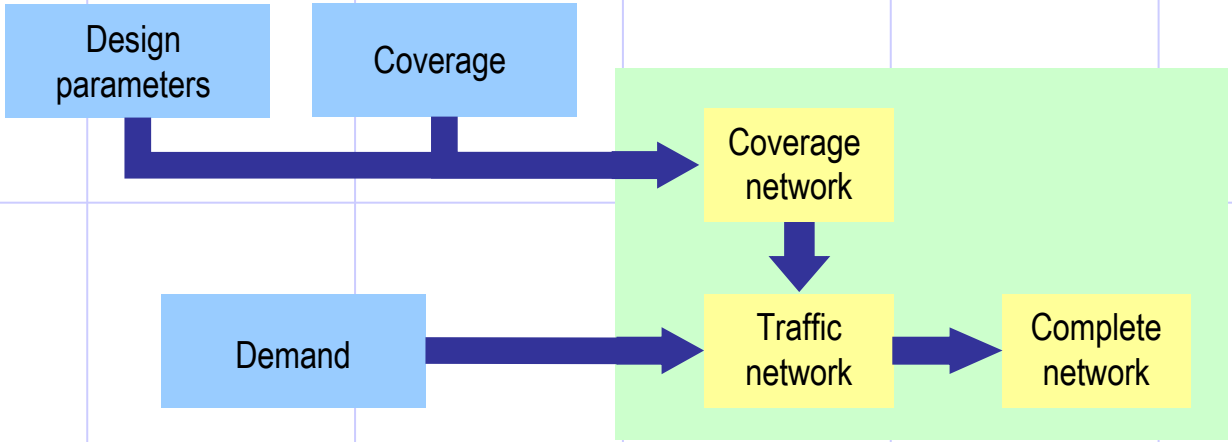
Network design

Network design: Coverage and capacity



Coverage and capacity as a function of: spectrum, HC traffic, bandwidth, re-use, Nº of sectors.

Subject to certain quality-of-service parameters.



Network design: Types of areas and cells

Case of Chile: Efficient mobile enterprise model, interconnection charges, Period 2003-2008

Four types of areas

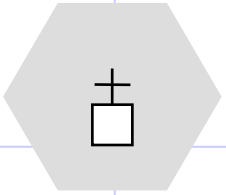
Dense urban

Urban

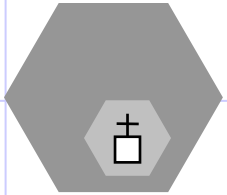
Rural

Road

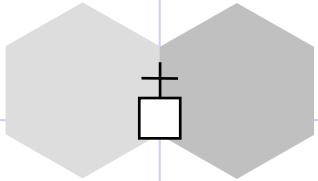
Four types of BTS



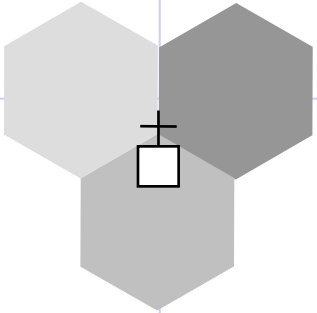
Omni-macrocell



Microcell



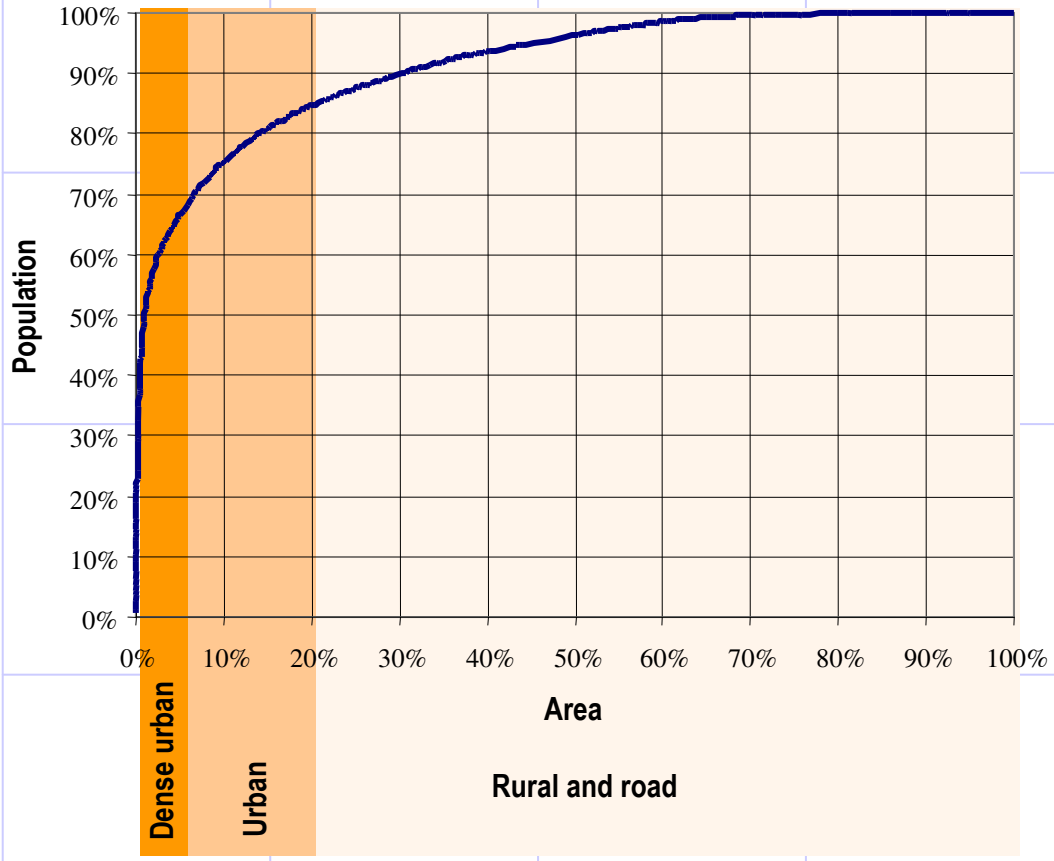
Macrocells - two sectors

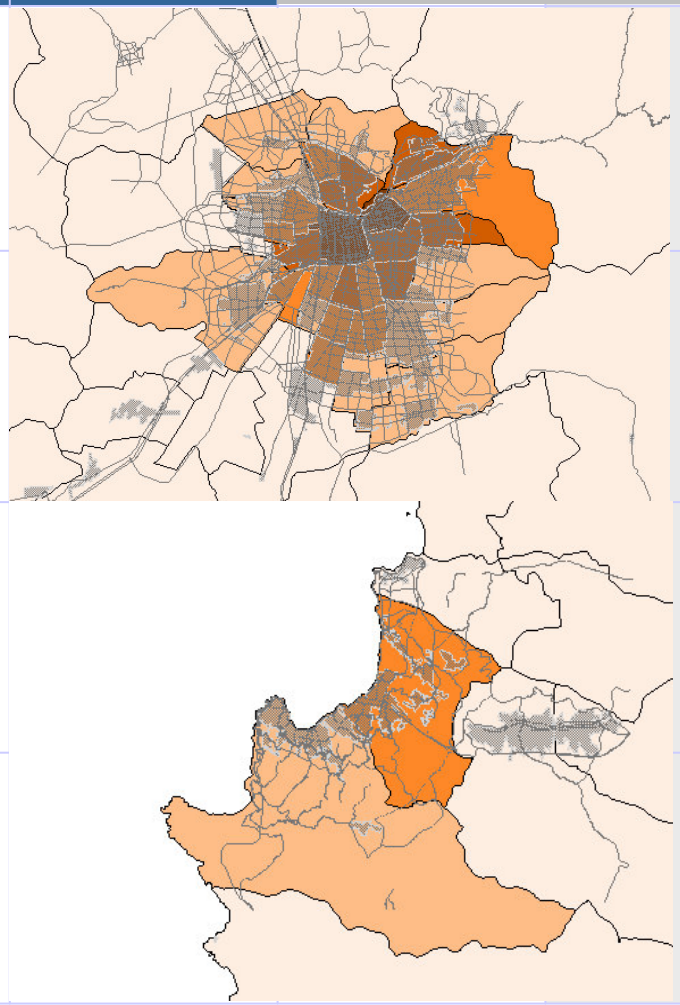


Macrocells – three sectors

Network design: Coverage requirements

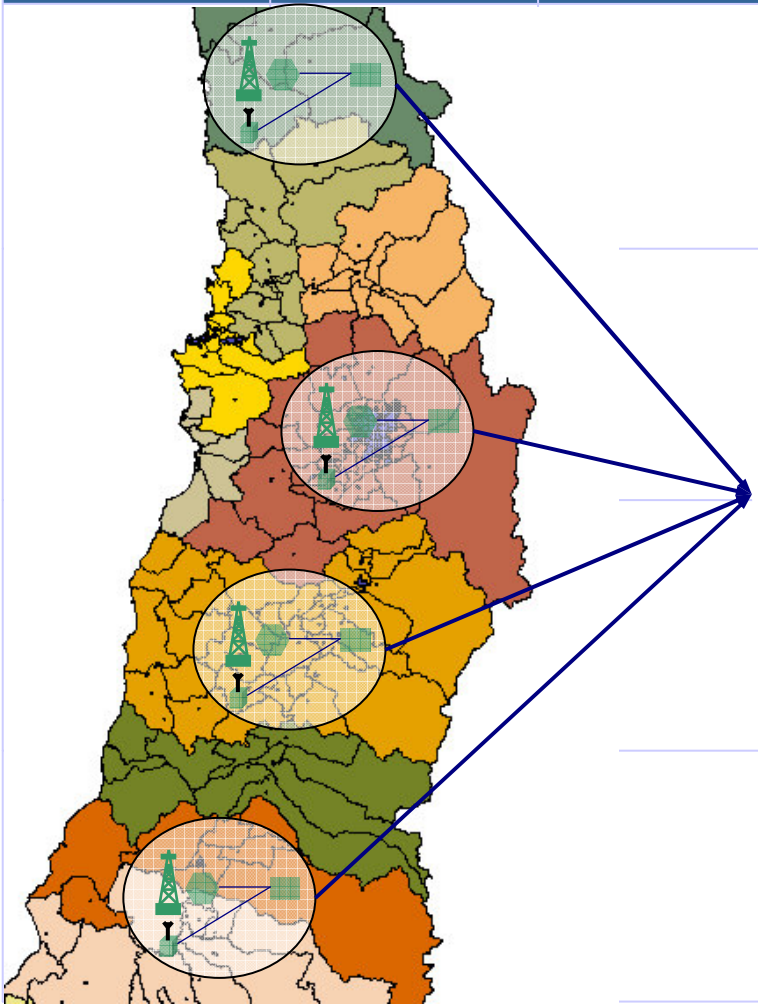
Case of Chile: Efficient mobile enterprise model, interconnection charges, Period 2003-2008





Network design: Optimization model

Case of Chile: Efficient mobile enterprise model, interconnection charges, Period 2003-2008



Number of BTS
Number of BSC
by primary area

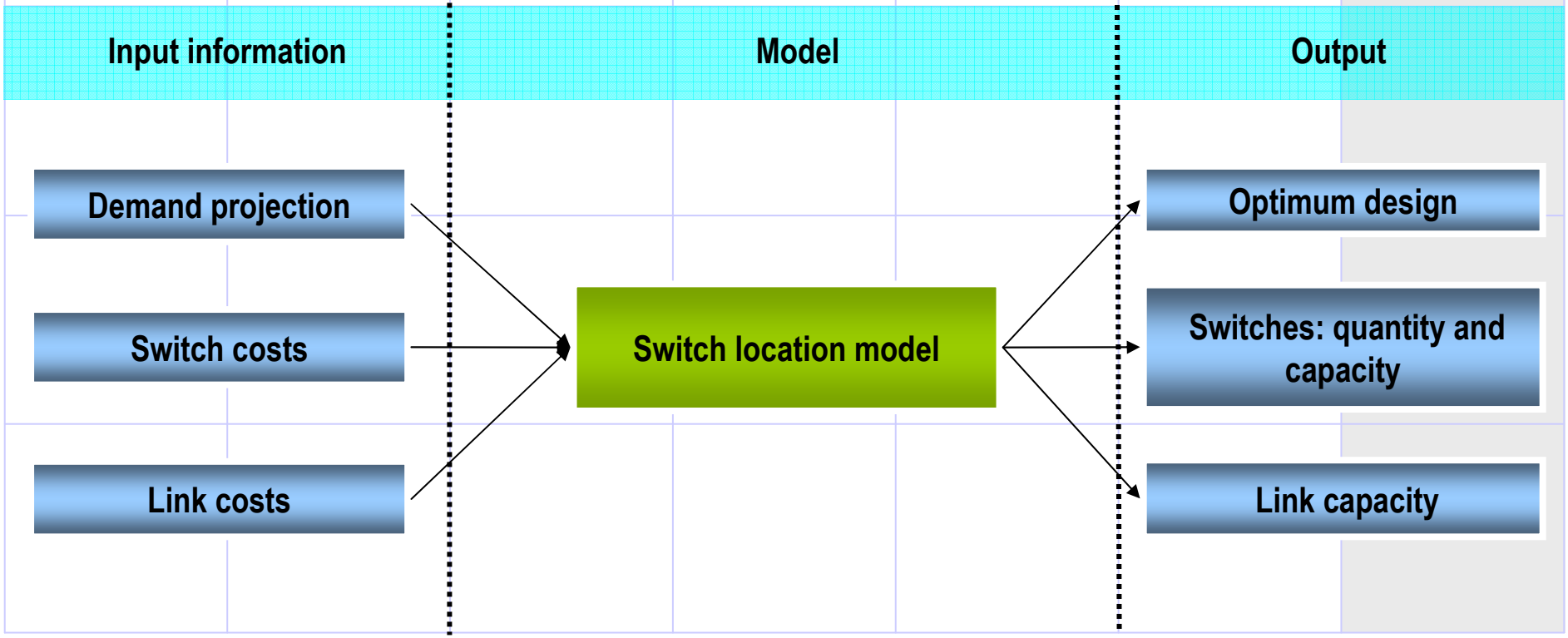
Optimization model

Number and location of MSCs

Network design: SW location model

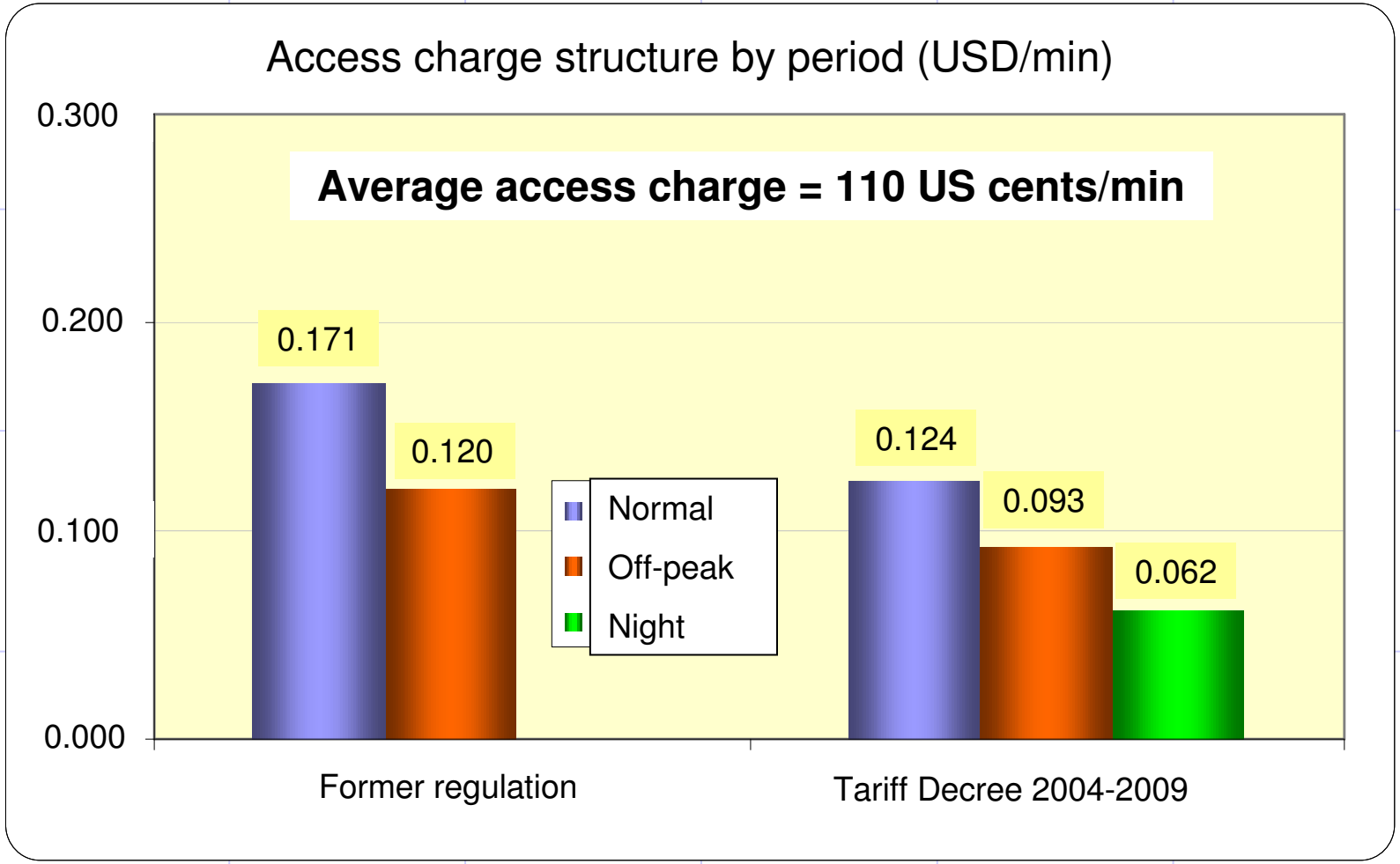
Case of Chile: Efficient mobile enterprise model, interconnection charges, Period 2003-2008

- Overall outline:



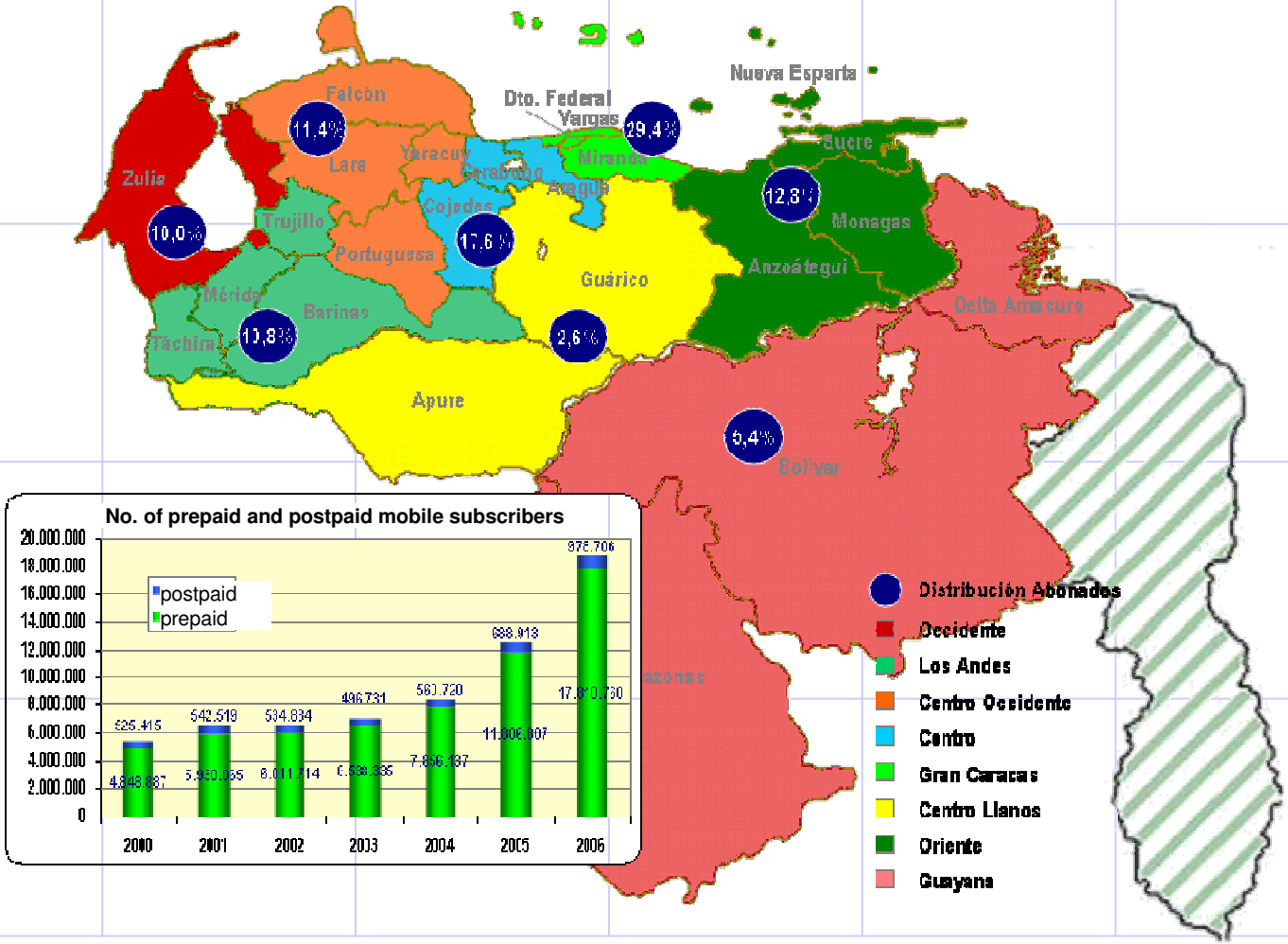
Mobile access charges: New prices

Case of Chile: Efficient mobile enterprise model, interconnection charges, Period 2003-2008



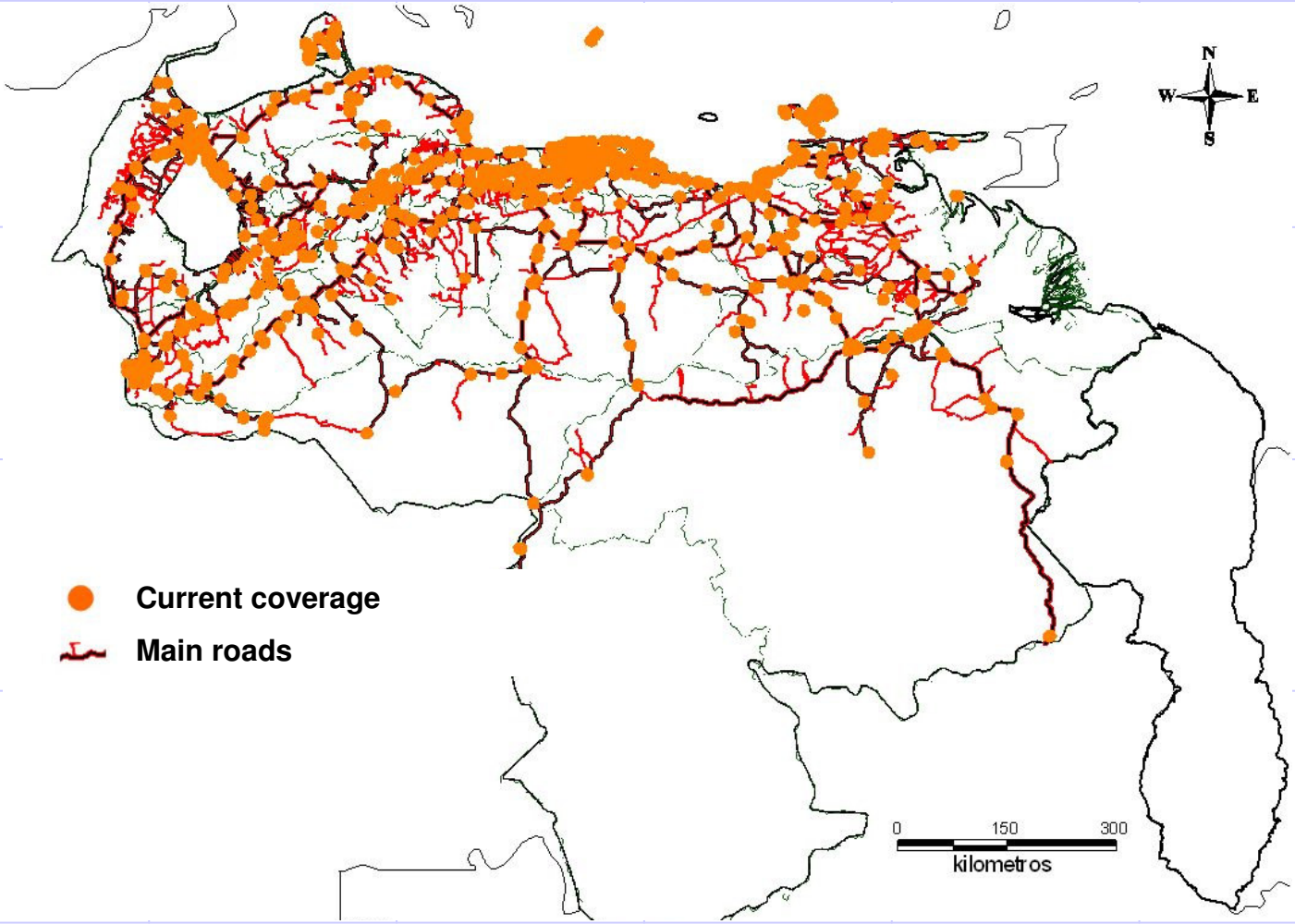
Evolution of market and subscriber distribution by region

Case of Venezuela: Long-run incremental cost model, consumer and interconnection tariffs



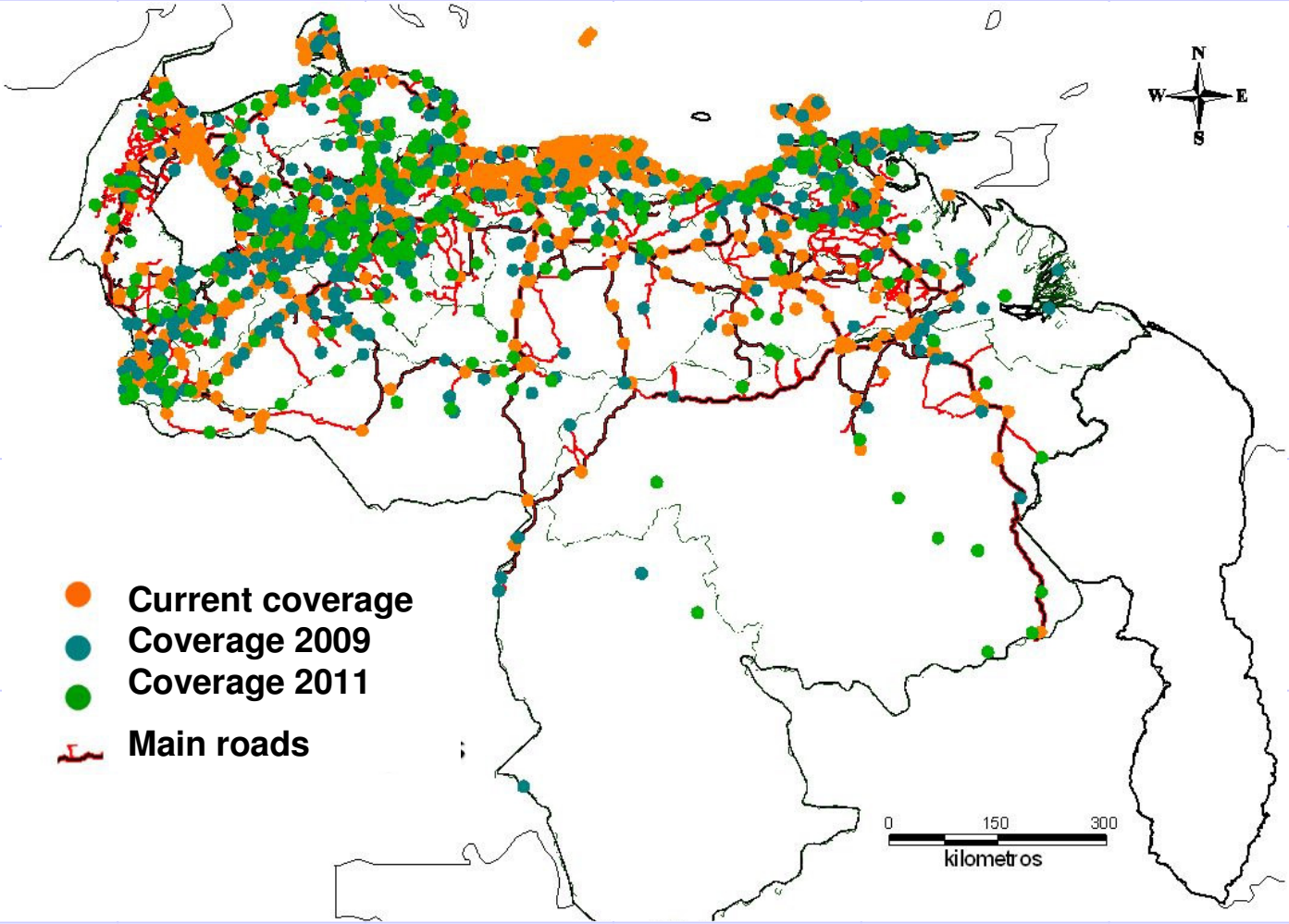
Mobile telephone network coverage during the first year

Case of Venezuela: Long-run incremental cost model, consumer and interconnection tariffs



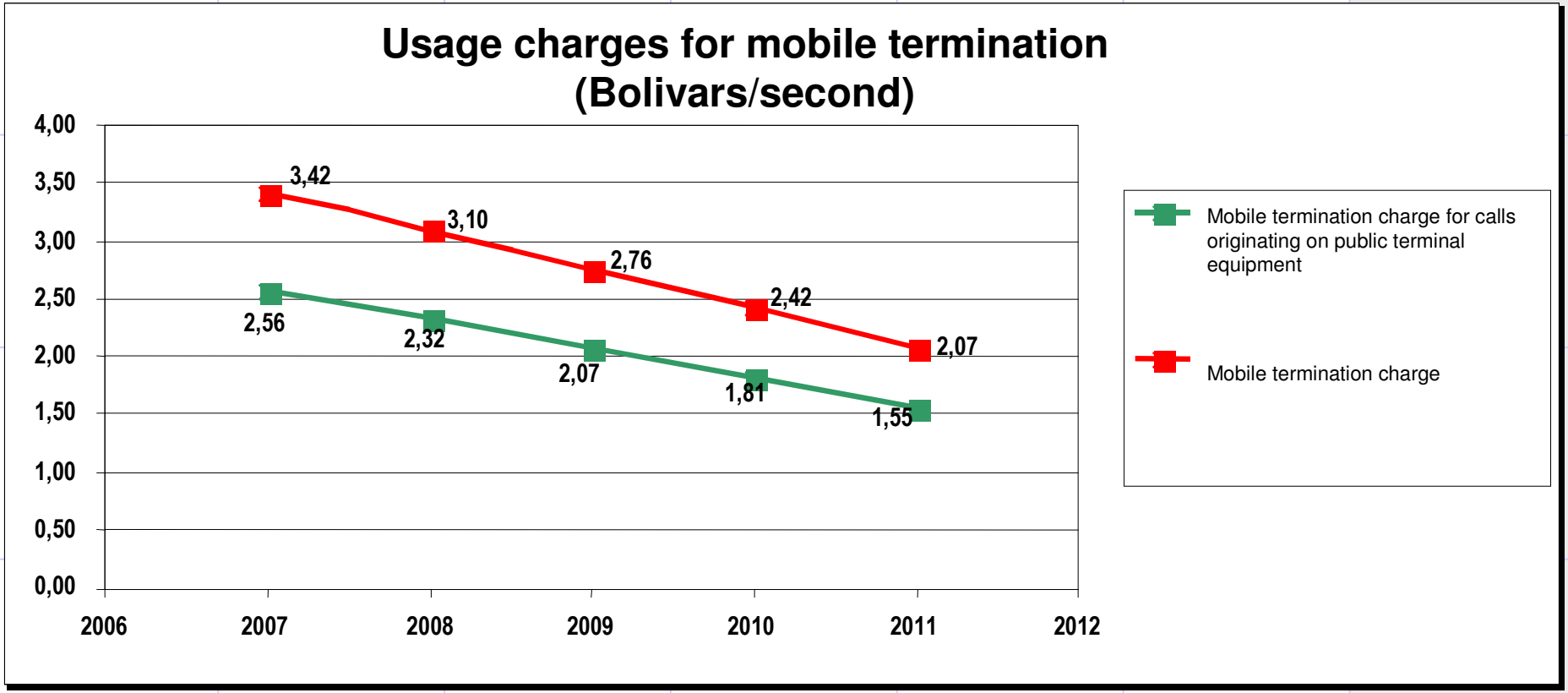
Mobile telephone network coverage for the years 2009 and 2011

Case of Venezuela:
Long-run incremental cost model, consumer and interconnection tariffs



Gradual adjustment of charges for use of mobile interconnection

Case of Venezuela: Long-run incremental cost model, consumer and interconnection tariffs



Thank you for your attention,

Efficient enterprise: Methodologies, modelling and application for tariff regulation

roberto@baltra.net