ITU / BDT- COE workshop

Nairobi, Kenya,

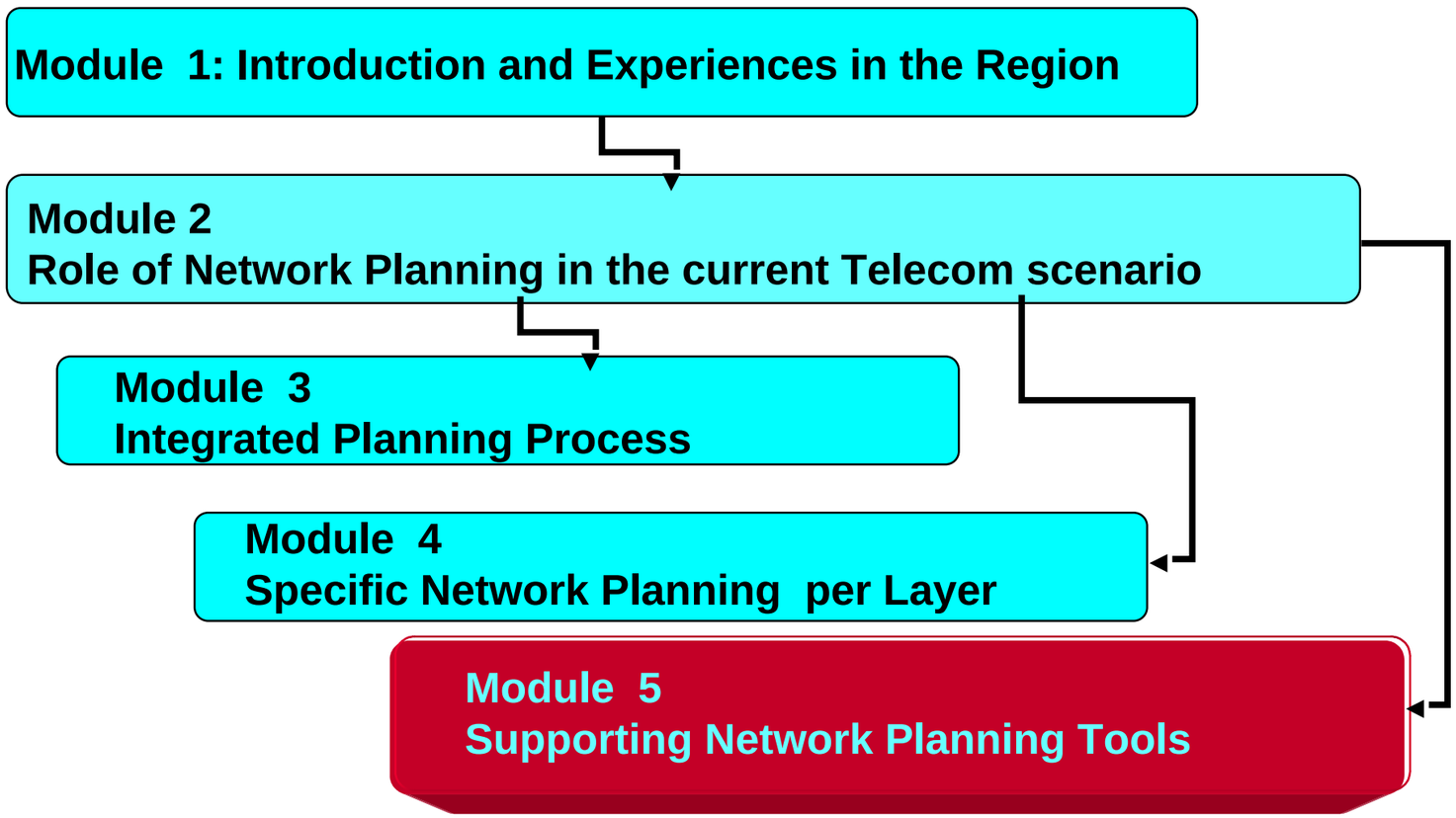
7 – 11 October 2002

Network Planning

Lecture NP- 5.1

Supporting Network Planning Tools

BDT - COE workshop on Network Planning



Content Module 5

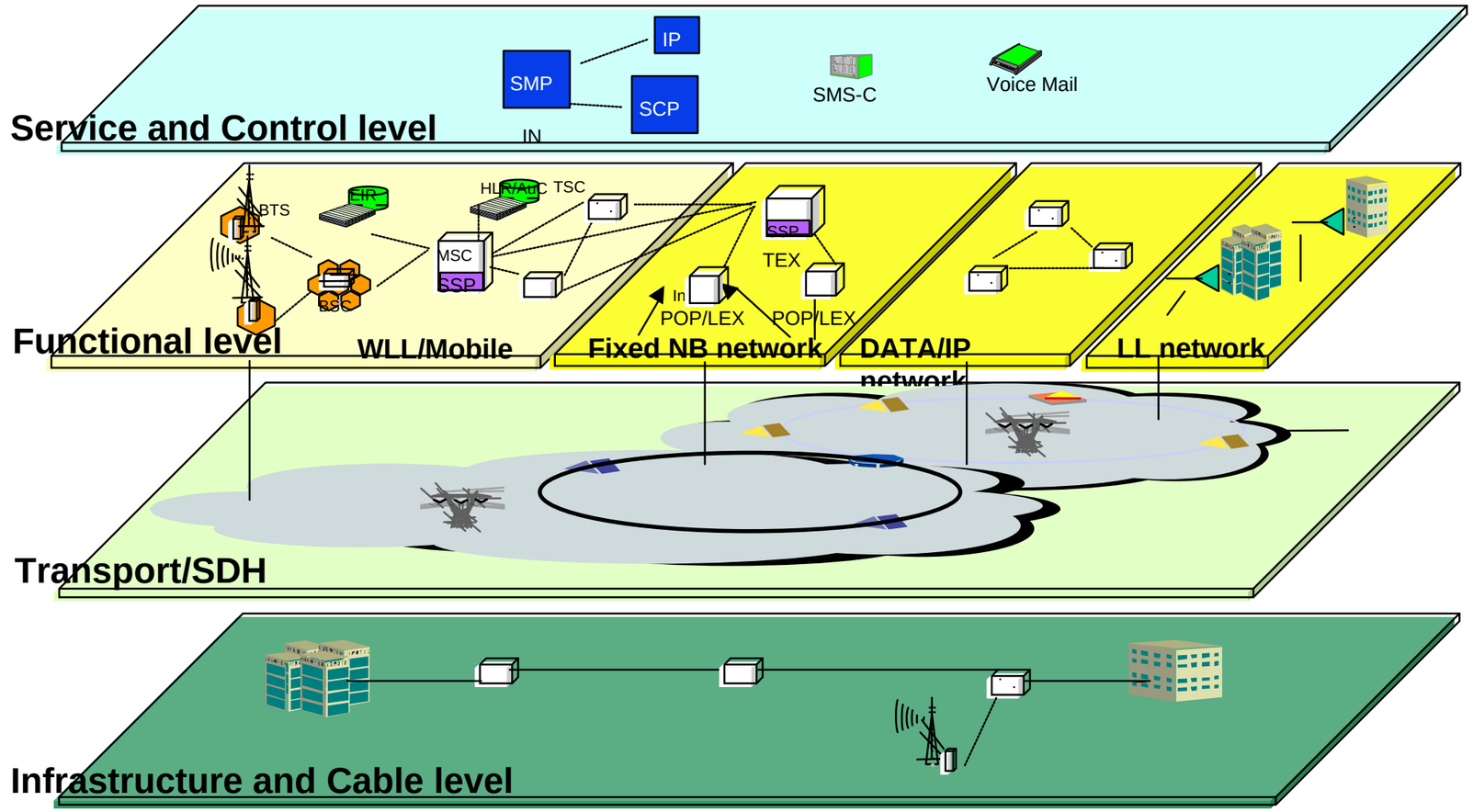
Describes tool categories and most frequent tools in use today

- **Objectives and tool categories by network coverage and degree of modeling detail**
- **Main functionalities for typical tools with inputs, outputs and results**
- **Case studies with tool results and benefits**

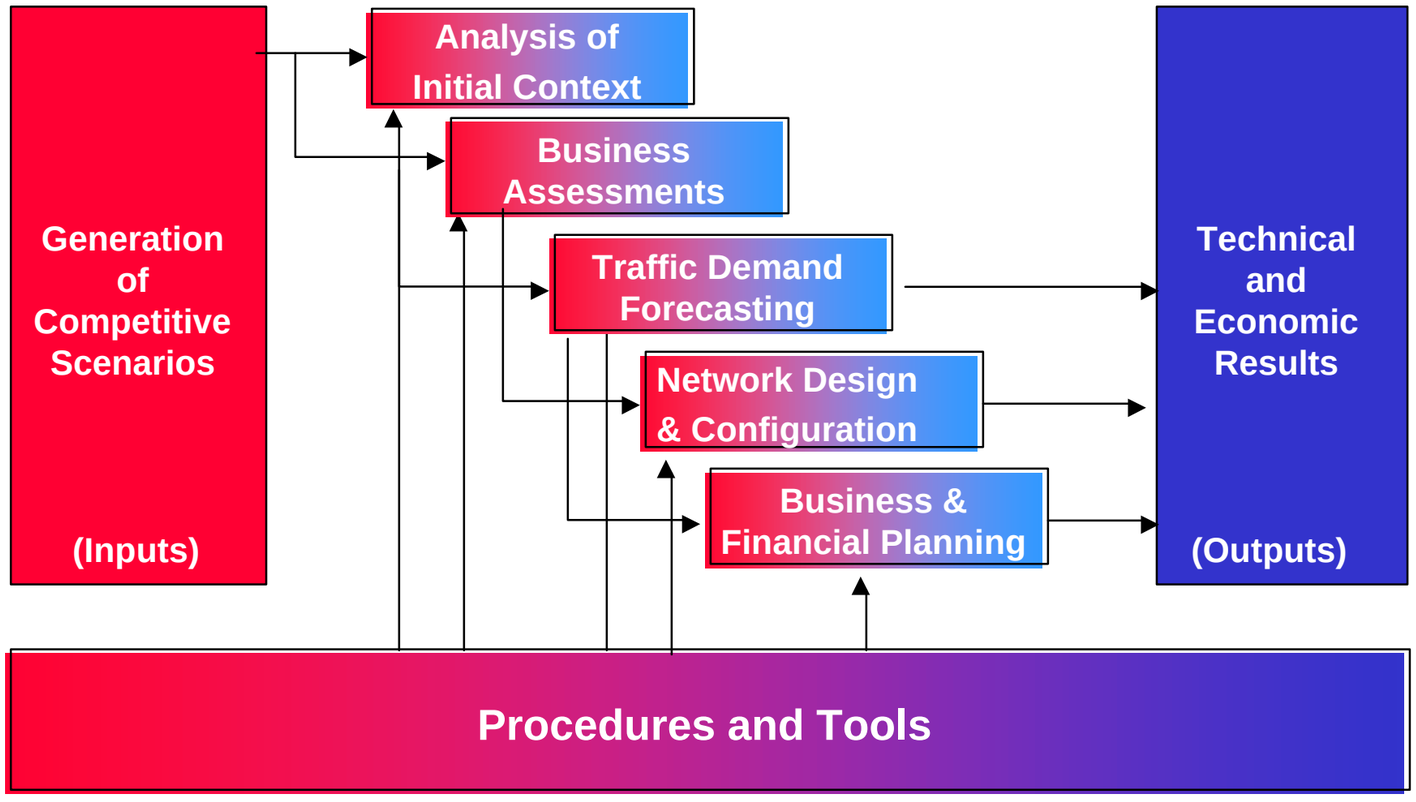
Content Chapter 5.1
Network Planning Tools

- Objectives and classification for the different tool types
  - Overall techno-economical evaluation
  - Network design and optimization
  - Network evaluation and simulation
  - Tool mapping per class

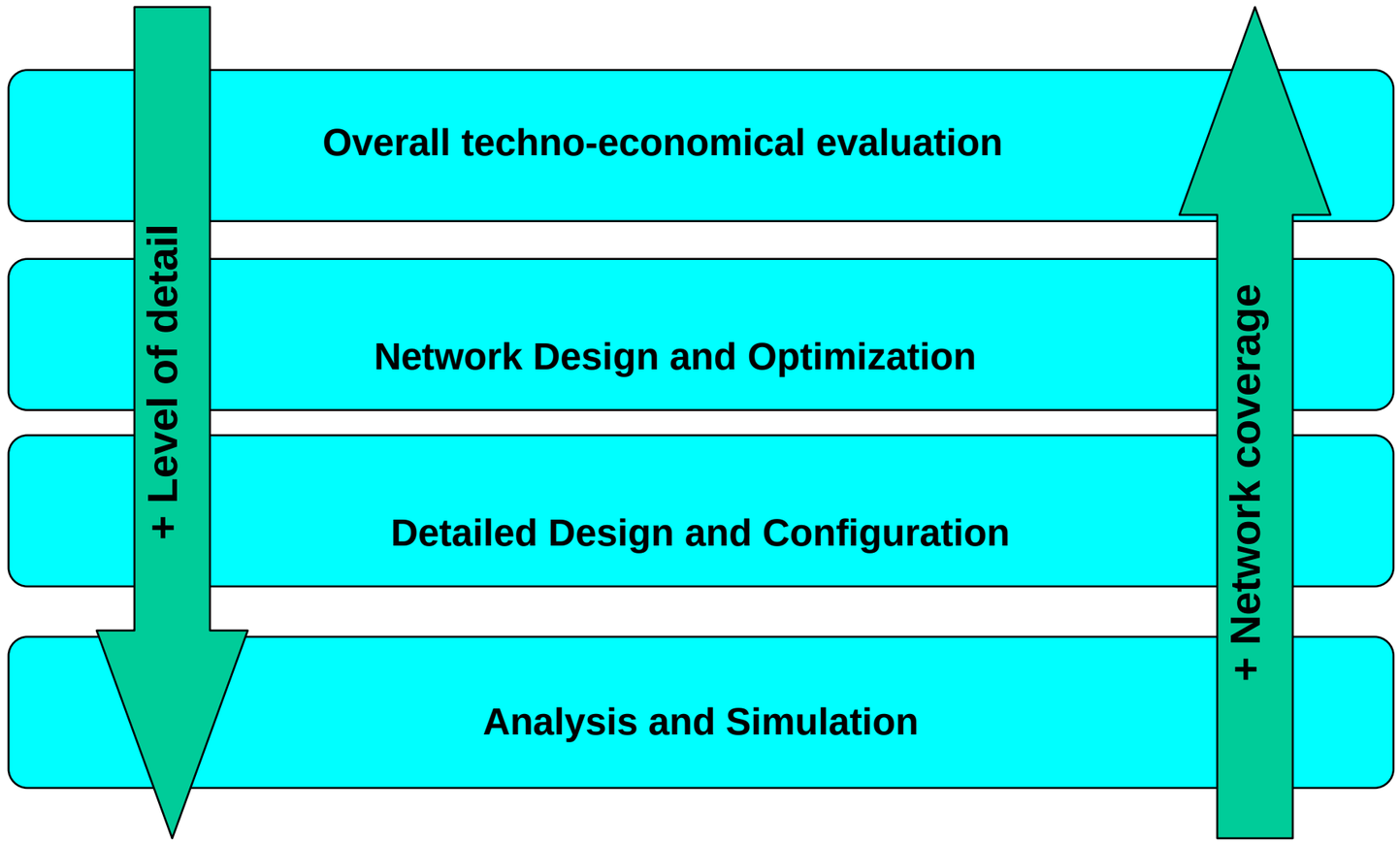
Network Planning
Strategic view: Network Layer Modeling



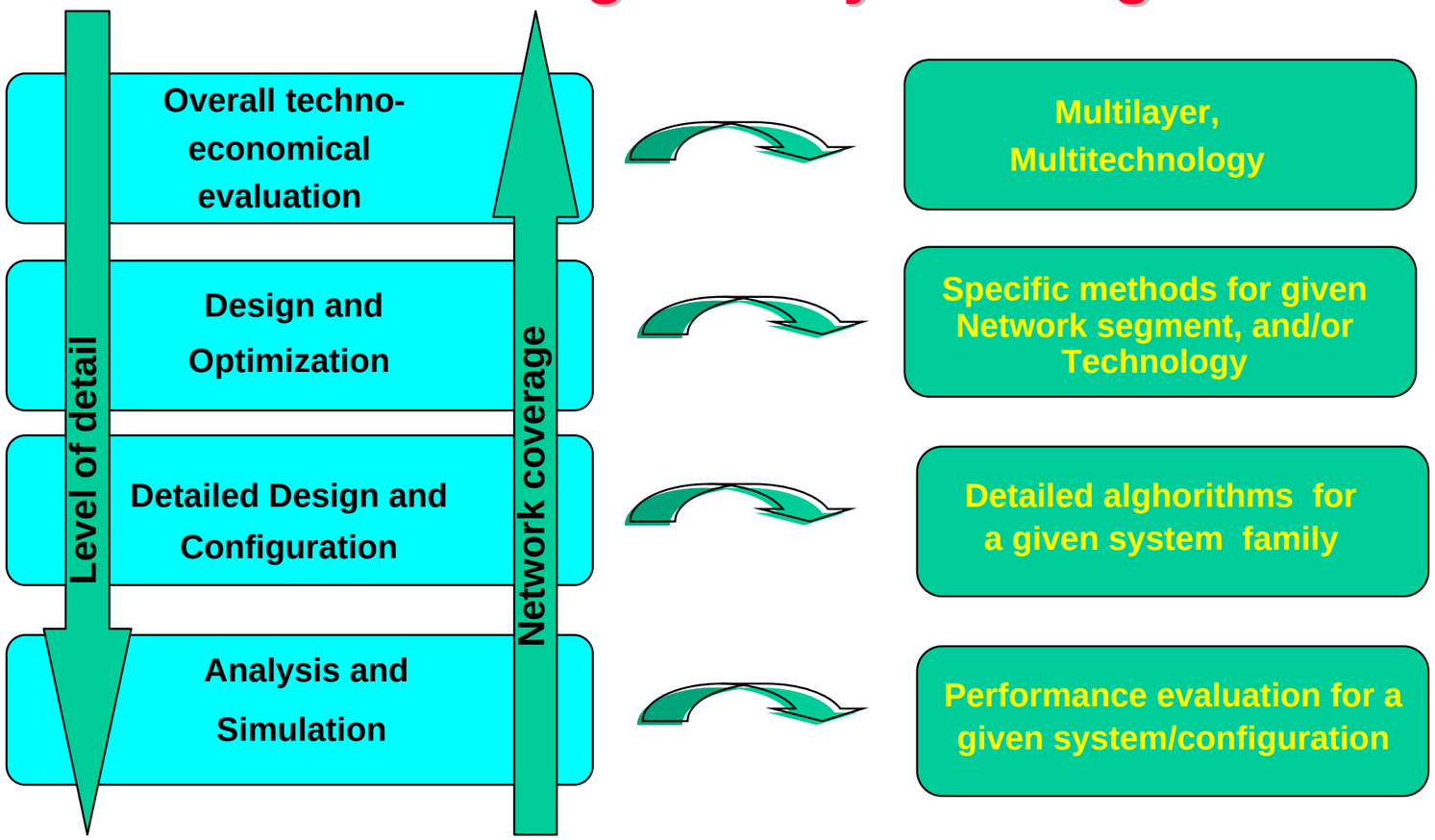
Planning Methodology:
Integrated Iterative Planning Process



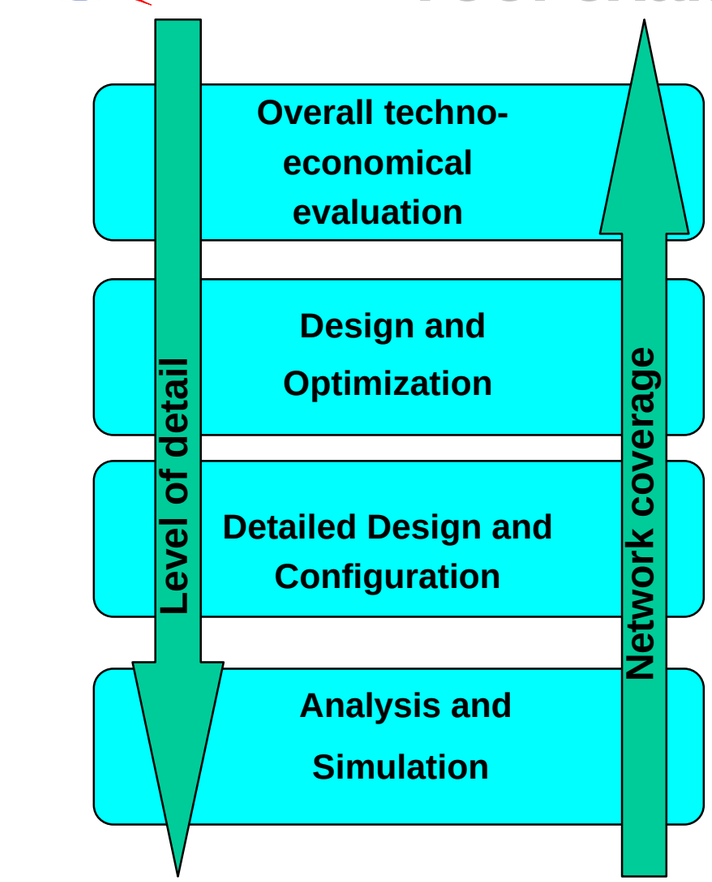
Network Planning Tools:
Tool categories by coverage and detail



Network Planning Tools:
Tool categories by coverage



Network Planning Tools:
Tool examples per category



STEM, Excel applications

PLANITU, NetWORKS, VPI, TSP, NetQUAD, RNP

NetWORKS - Pro, CIRCEE

OPNET,COMNET, SCOOP, RNO,

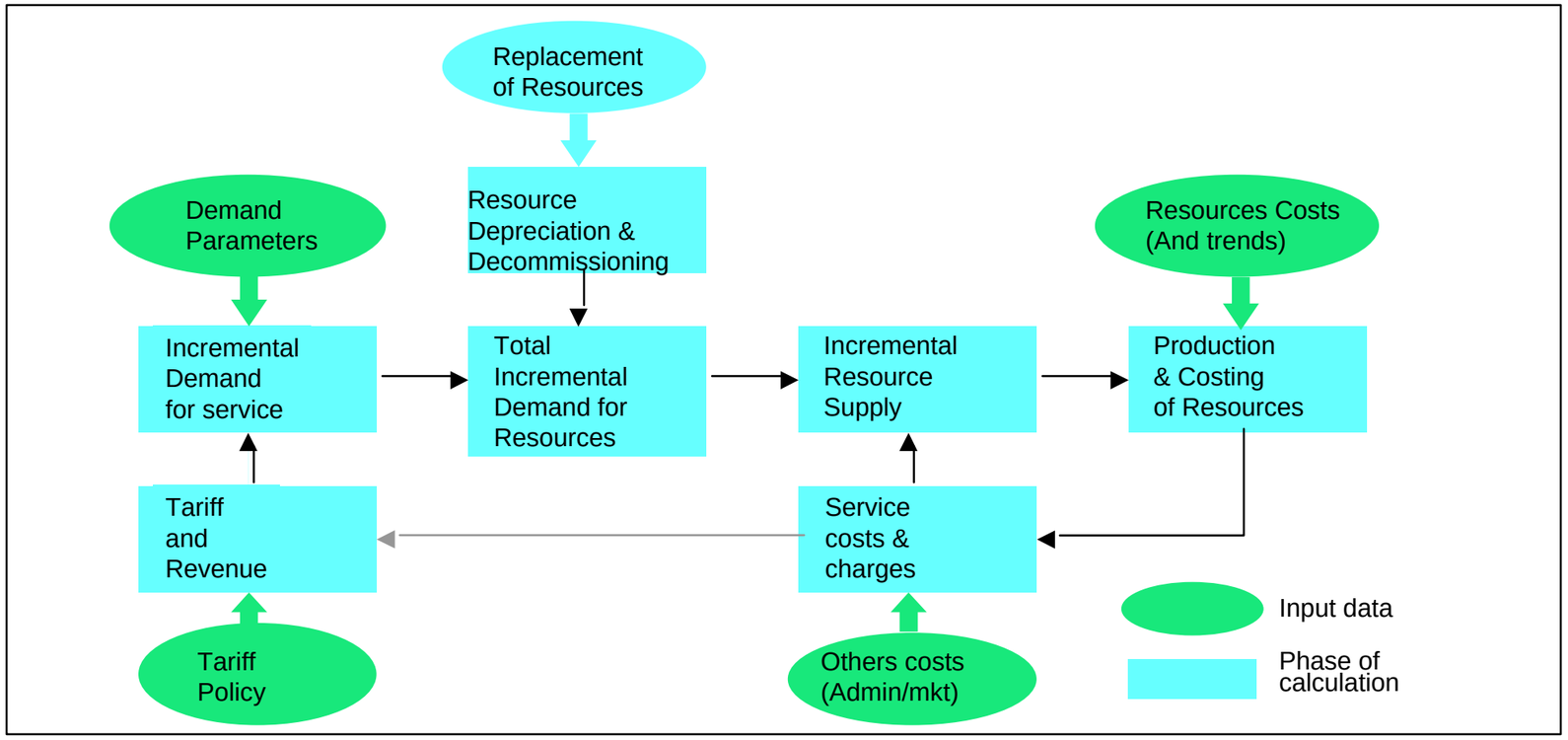
Network Planning Tools: STEM

Objective : **STEM is a business decision making support tool that enables the analysis of business models for Telecommunication Networks and services over a period of time.**

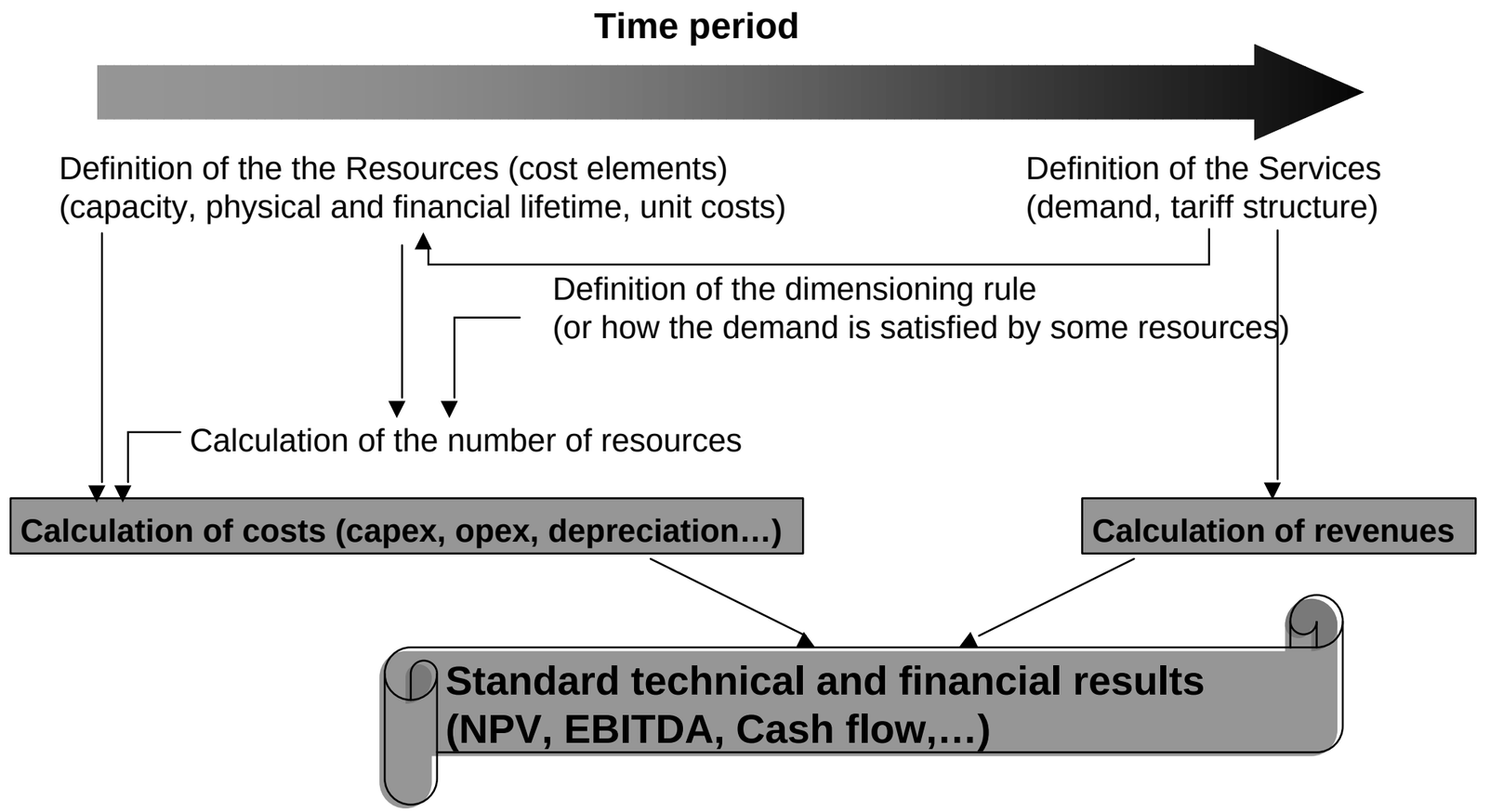
Business Planning

Business Planning Tools: STEM

Activity Flow:



How the STEM engine works



Business Planning Tools: STEM

Analysys

- **Coverage**
  - –Service Demand Projection
  - –Evaluation of network investment
  - –Evaluation of revenues for given tariffs and installation rate
  - –Interrelation between network growth and operational cost
  - –Pre-programmed for Standard Telecom and Finance calculations and for facilitating the rapid development of new models
  - –Produces the standard financial results like Cash Flow, Profit & Loss, Balance Sheet.
  - –Interfacing to other MS Windows applications like Excel, Word,....

Business Planning Tools: STEM

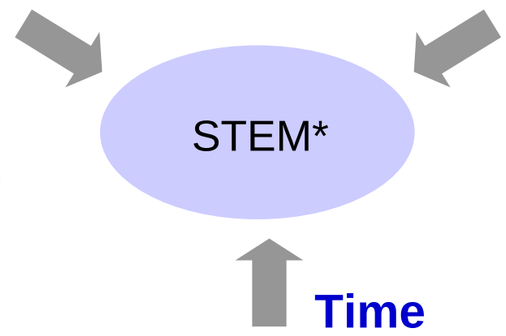
Analysys

Resources

- physical lifetime
- traffic-carrying capacity
- depreciation period
- economies of scale
- capital expenditure
- operating expenditure

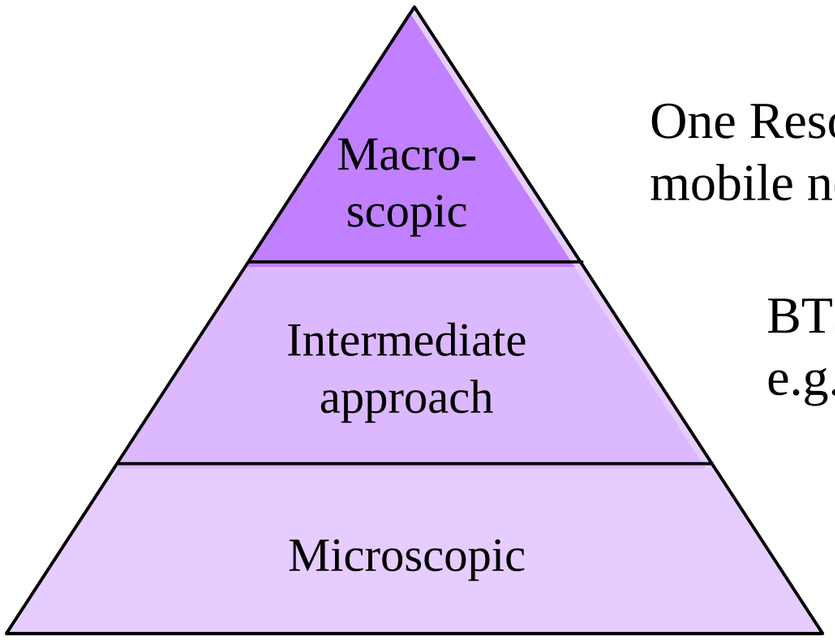
Services

- subscribers
- service rates
- annual and busy-hour traffic
- Erlang or BW demand
- resources required



- cost-related tariffs and demand elasticity
- age-based cost profiling
- non-linear resourcing

STEM allows both a macroscopic and microscopic approach to modelling



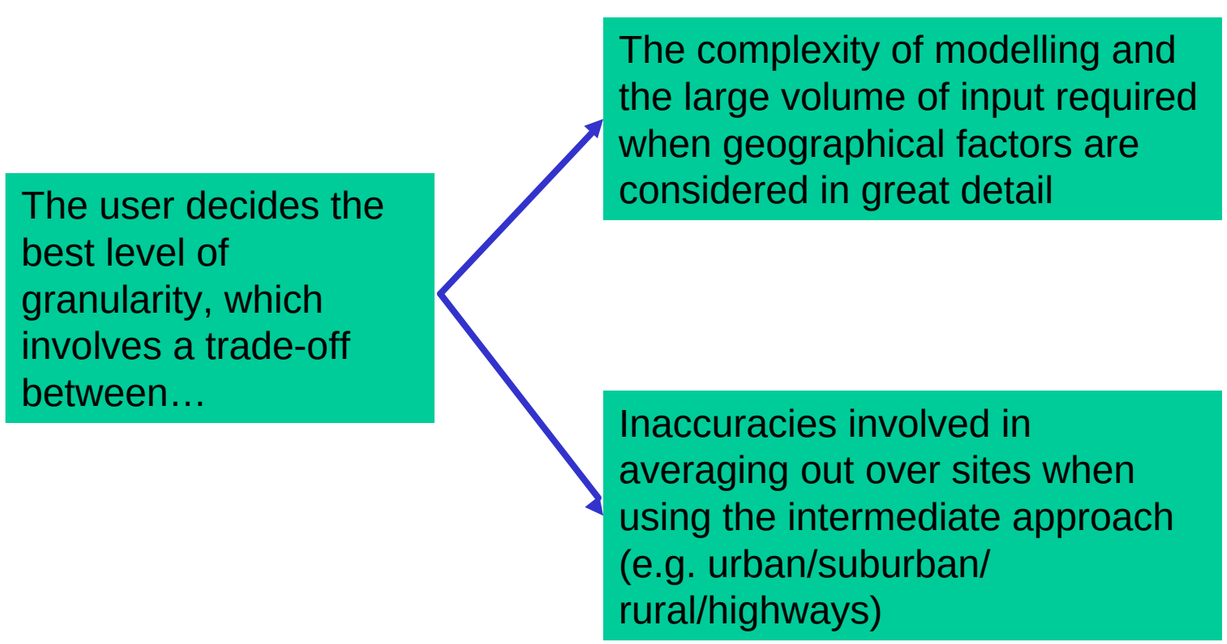
Examples:

One Resource used to model all BTSs in a mobile network

BTSs grouped by area type,
e.g. urban/suburban/rural/highways

BTSs modelled one by one

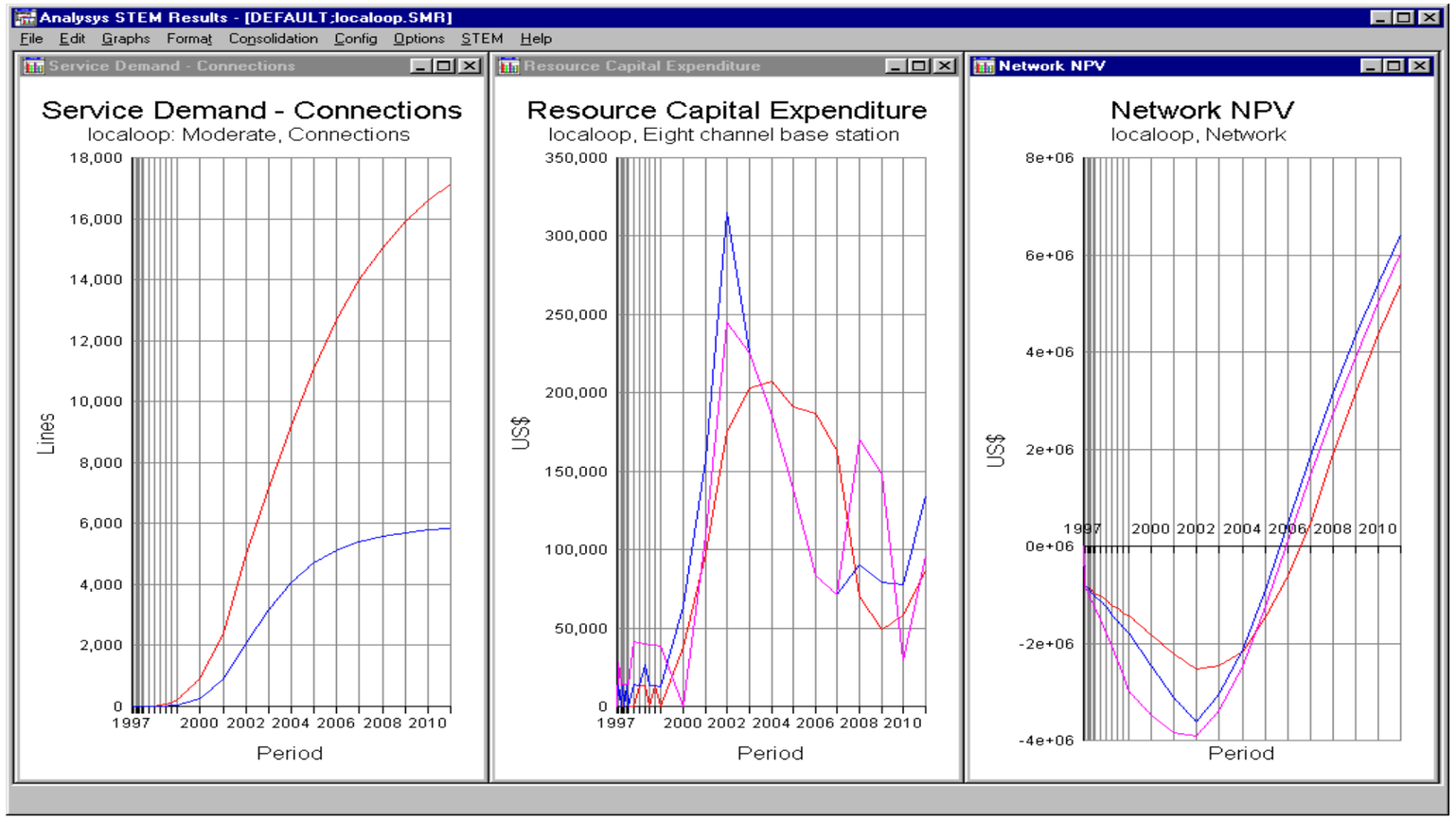
The user must choose the level of detail to be modelled



Business Planning Tools: STEM

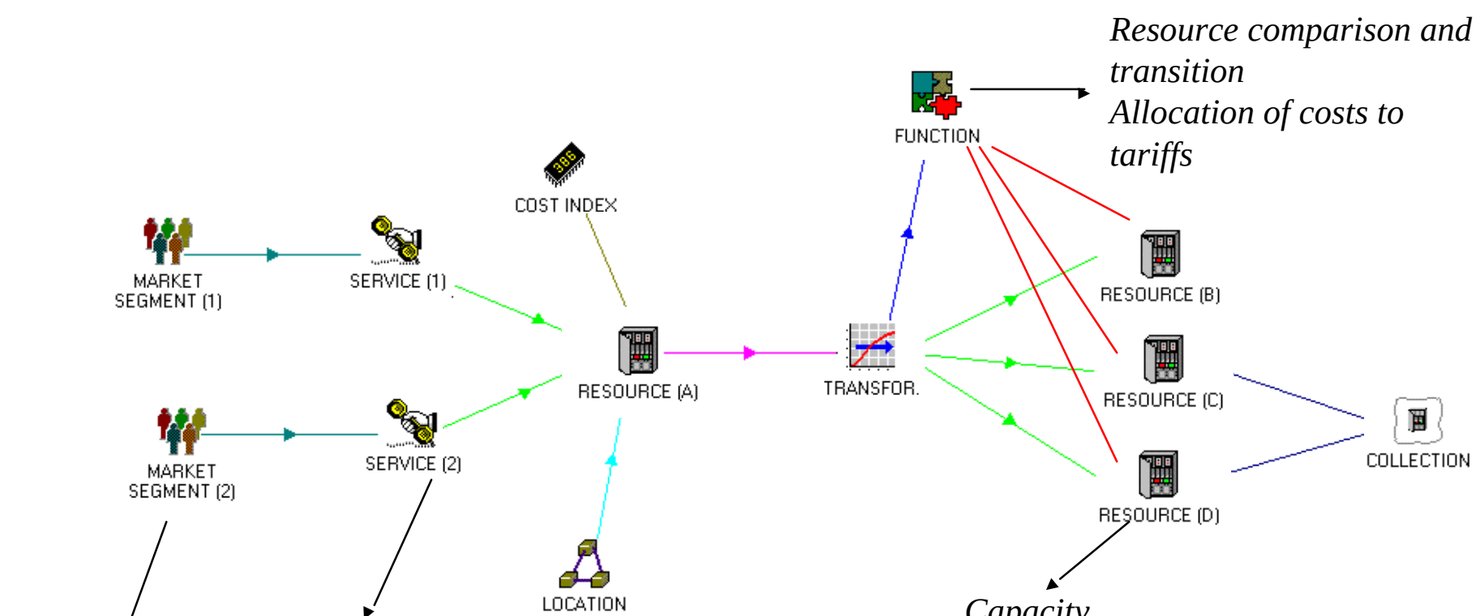
Example of results for business analysis

Analysys



* Under licence of Analysys

STEM focuses on telecoms objects



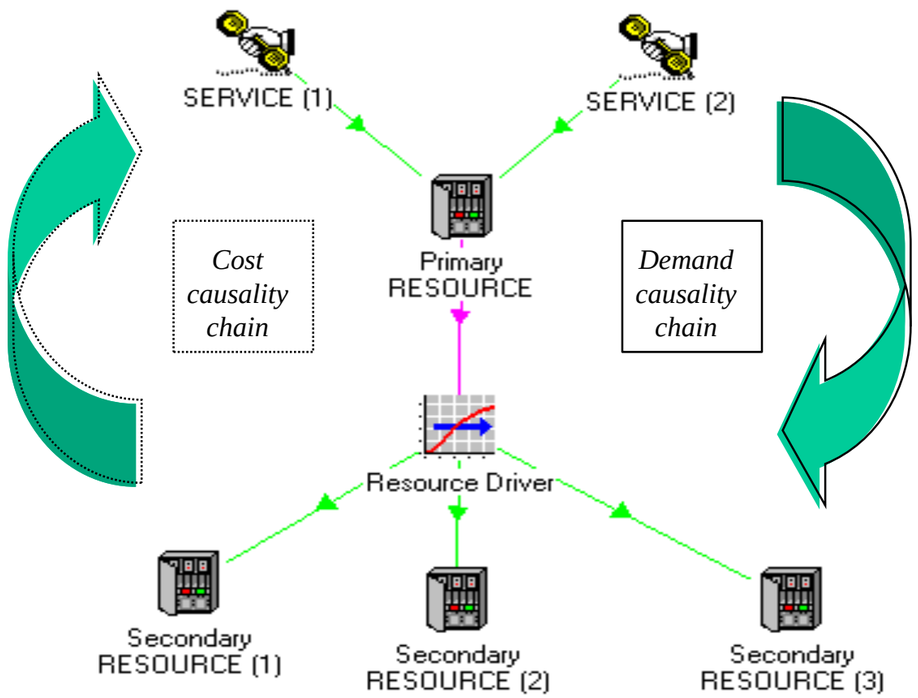
Resource comparison and transition
Allocation of costs to tariffs

Subscribers

Traffic
Tariffs
Resource requirement
Cost dependent tariffs
Price elasticity of demand

Capacity
Lifetime (physical and financial)
Costs (capex, opex)
Age profile
Economies of scale

STEM is demand driven and allocates costs to demand



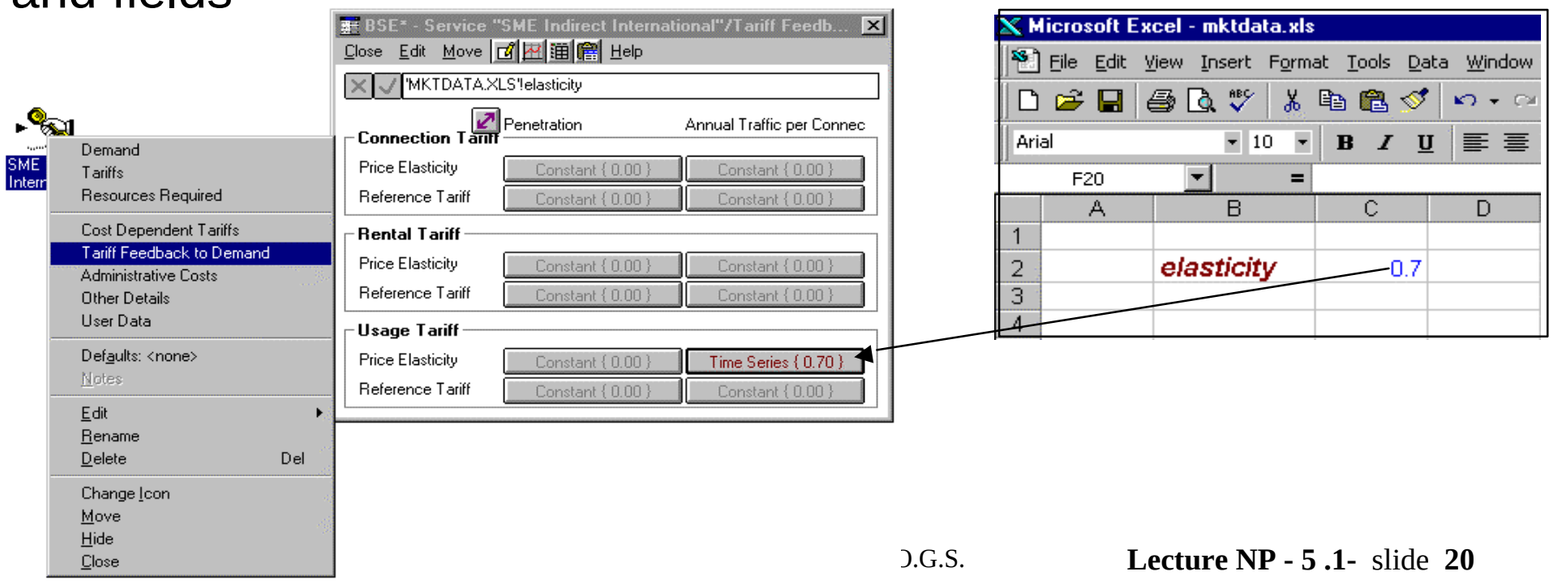
- Demand driven
- The STEM Editor emphasises the demand causality chain between services and resources
- The cost causality chain flows in the opposite direction

STEM accepts inputs from Excel and databases supporting ODBC drivers

In the Editor, inputs can :

either be entered manually, by clicking on the STEM elements and choosing the appropriate dialogs and fields

or imported from Excel using names and links to these names



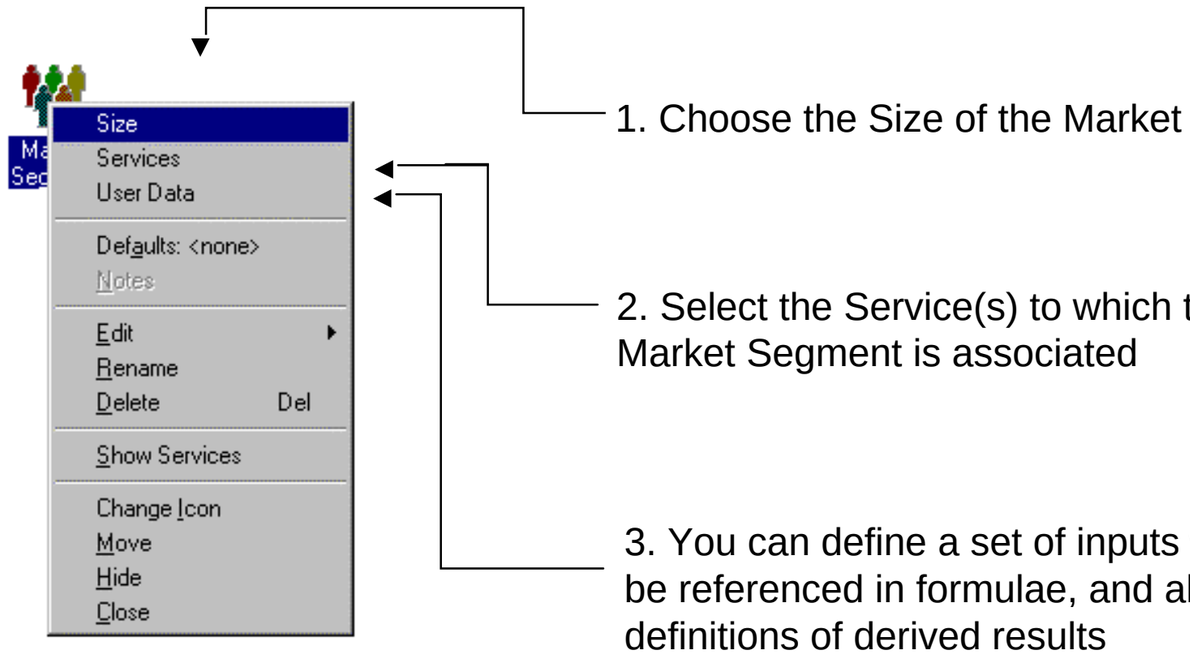
Business Planning Tools: STEM Modeling Elements

Analysys

The modelling basics

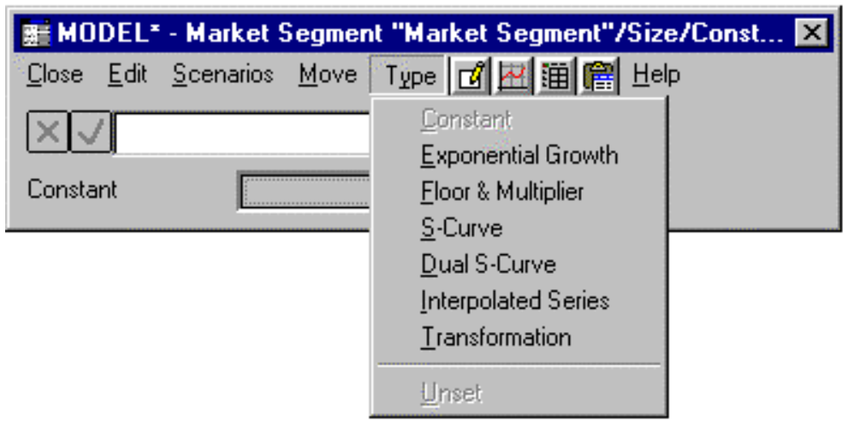
- Market Segment
- Services
- Resources
- Transformations
- Locations
- Financial model

Market Segment



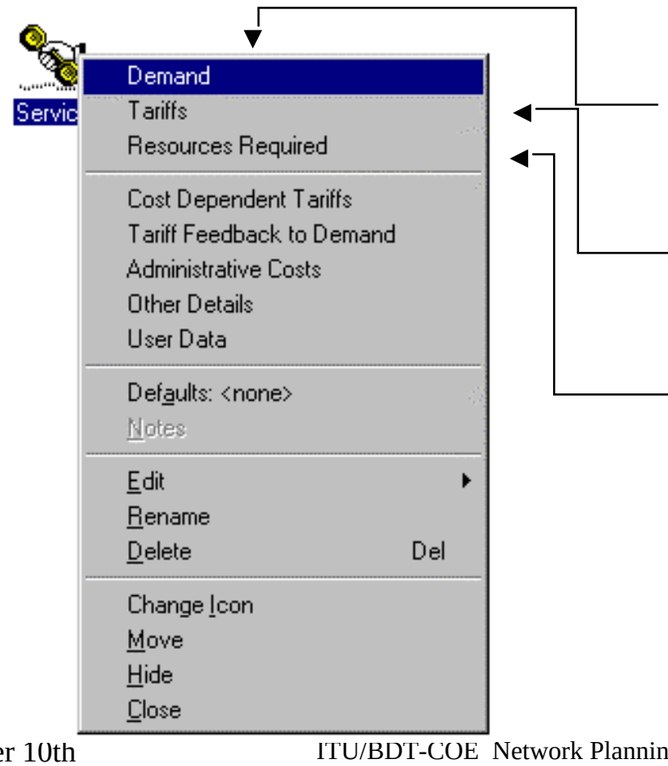
Understanding the Type menu [1]

- The Type menu is a commonly-used menu for inputting data:
  - Constant
  - Exponential Growth
  - Floor & Multiplier
  - S-Curve
  - Dual S-Curve
  - Interpolated Series
  - Transformation



Services

A Service is anything you can draw a revenue from, such as mobile telephony, X.25, house rentals…



1. Define the Demand for this service (customer base, traffic unit, penetration rate…)

2. Define the Tariff of this service (connection, rental usage tariff)

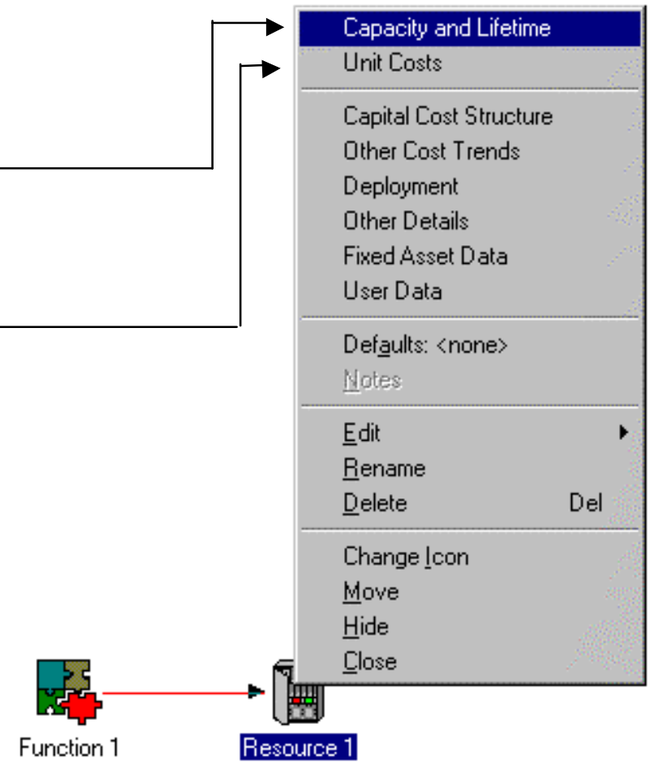
3. Select the Resources the operator must install to provide that service

Resources

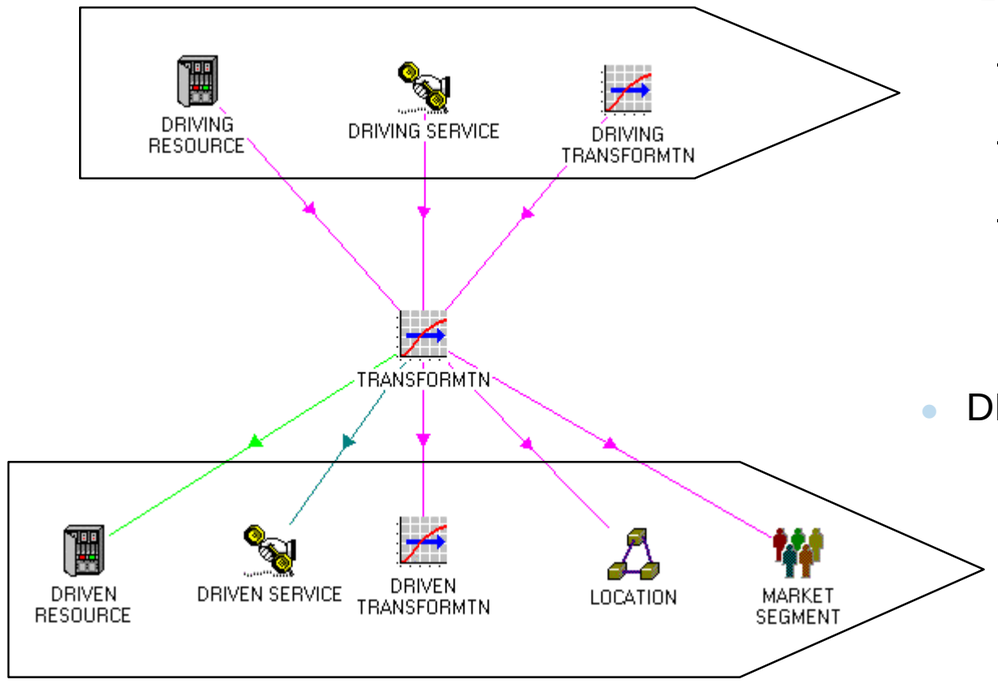
A Resource is anything that will cost you something, such as switches, leased lines, staff, a licence…

1. Define the capacity and the lifetime (physical, financial) of the Resource

2. Define the cost (capital cost, maintenance and operation costs…) of the Resource



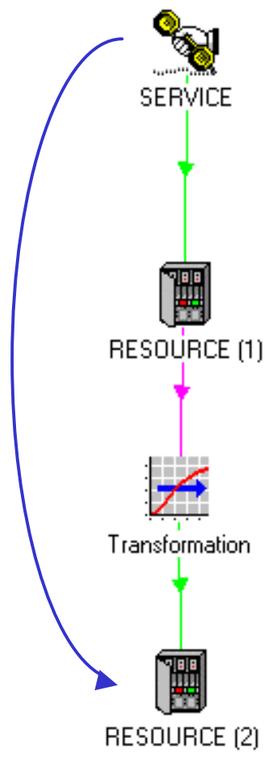
Transformations can use a variety of inputs and can drive several elements



- DRIVERS can be:
  - Resources
  - Services
  - Transformations

- DRIVEN elements can be:
  - Resources
  - Services
  - Transformations
  - Locations
  - Market Segments

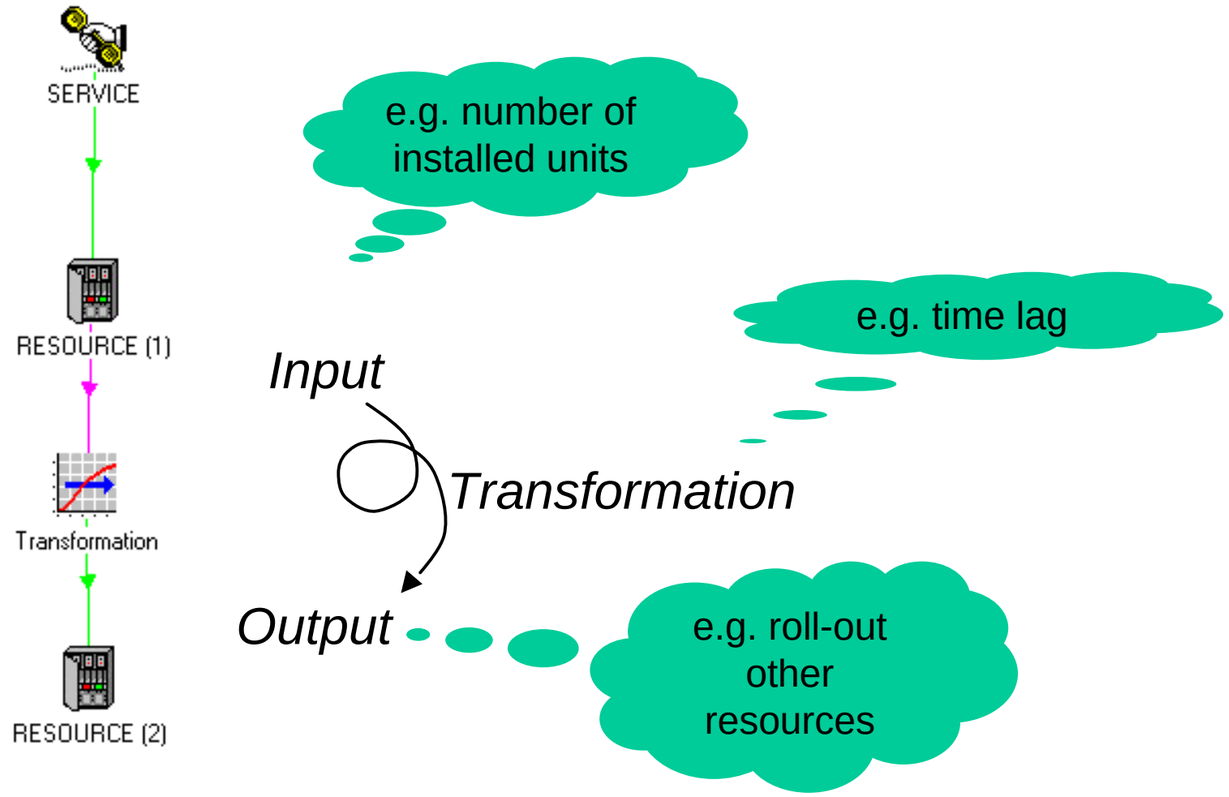
Transformations allow Resources to be driven by other Resources rather than by Services



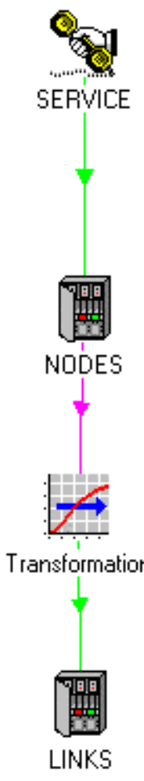
- This is particularly useful when:
  - there is a natural relationship between two Resources
    - e.g. towers are driven by base stations
  - Resources are distant from end customers and Services
    - e.g. in backbone networks
- However, all Resources in a STEM model are ultimately driven by Service demand

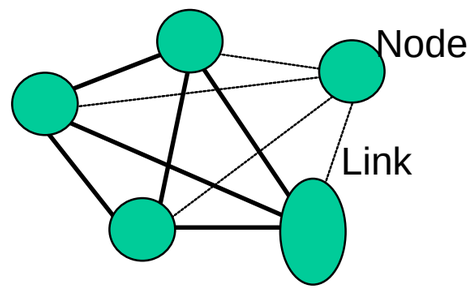
The rationale for Transformations is to act as secondary sources of demand

Analysys



Transformation: an example



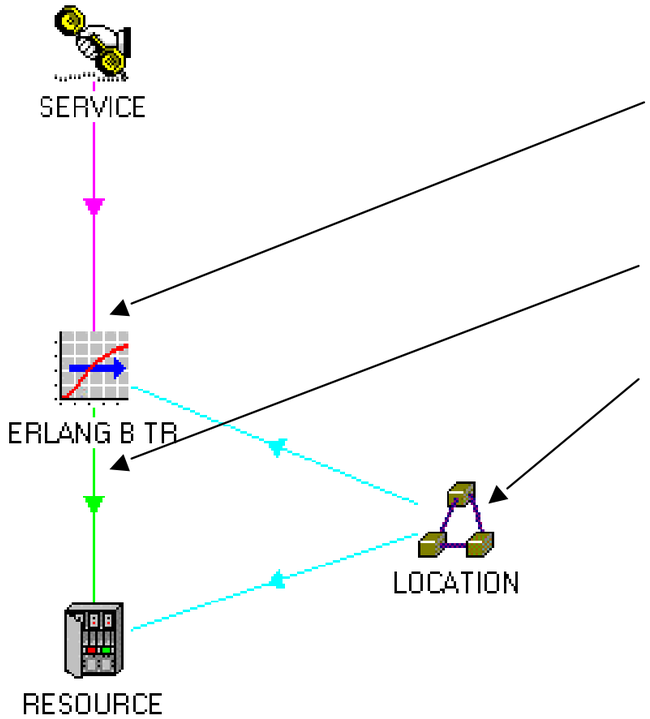


Input: *Number of Installed Units for NODES*

Transformation type: *Expression Transformation*
Expression=Input1(Input1-1)/2*

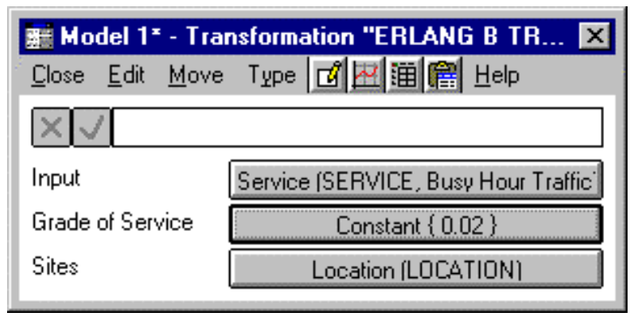
Output: *used to roll out LINKS*

Erlang B Transformations can be used to convert Erlangs into channels

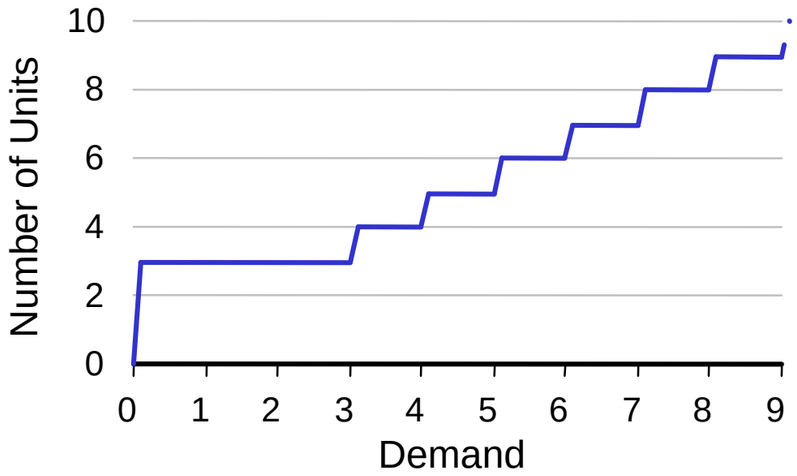


The input to the Transformation is the Service *busy hour traffic*

The Erlang B formula returns the *number of channels* required to meet that level of traffic (given the *GoS*) and the *number of sites* (because the formula is non-linear)



One for one distribution



Example assumptions:
Resource Unit Capacity = 1
Number of Sites = 3

This is used to impose a minimum number of units of Resource, equal to the number of sites. If demand requires a smaller number of units than the number of sites, the minimum will be installed anyway. If demand requires a greater number of units, additional units will be installed to meet demand

Business Planning Tools: STEM

Example of results for business analysis

Analysys