



ITU / BDT- COE workshop

Nairobi, Kenya,

7 – 11 October 2002

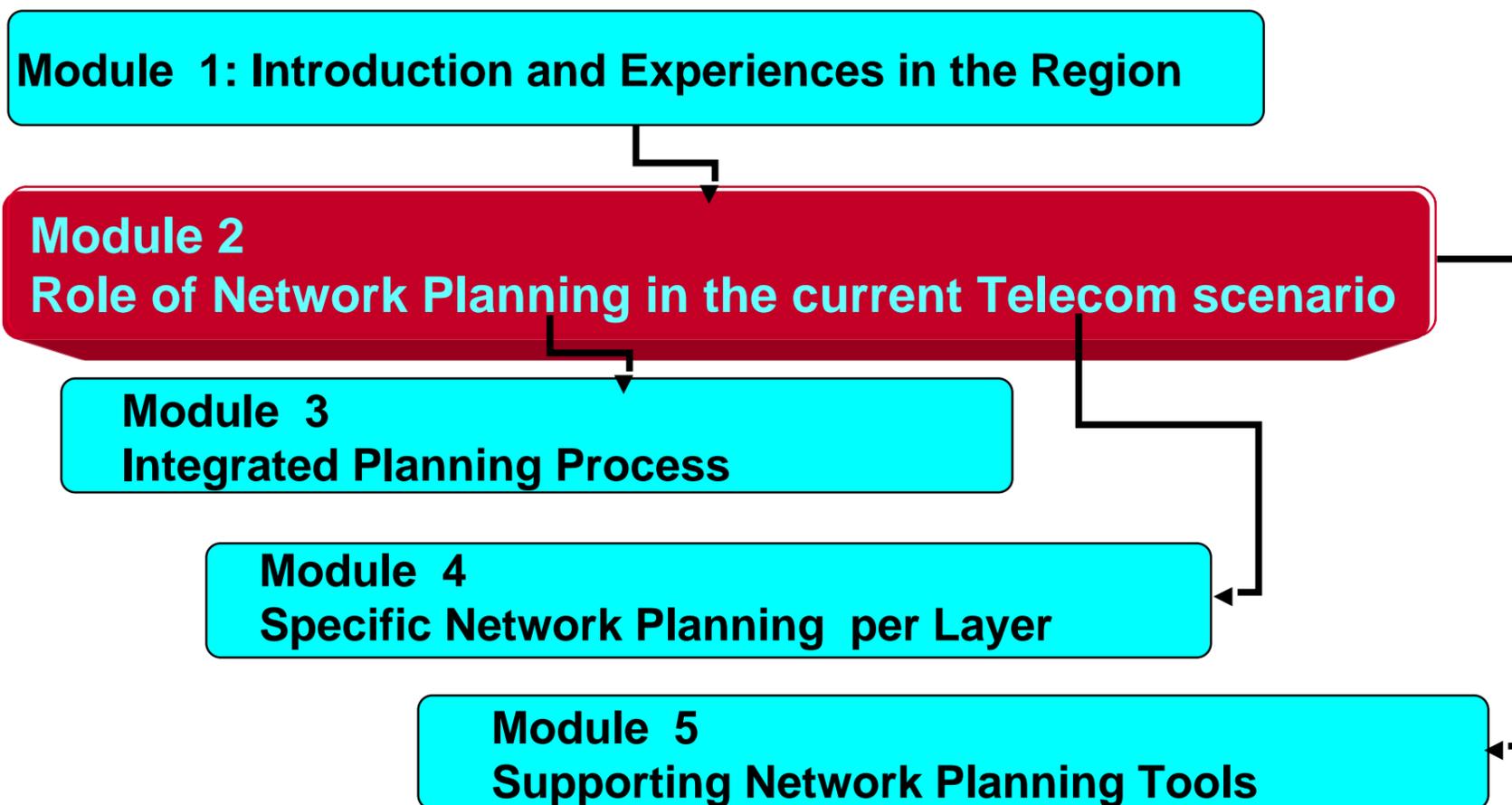
Network Planning

Lecture NP-2.2

Role of Network Planning in the current Telecom scenario



BDT - COE workshop on Network Planning





Content Module 2

Define main characteristics of the network planning with today's technologies and uncertainties

- **What requirements are frequent to analyse and define Network evolution**
- **What are the main objectives of the network planning activity**
- **Impact of the competition and importance of strategic planning and business plans**
- **How to better map solutions to each geo scenario**
- **What main solutions and architectures are available and/or in development**
- **Different time scales and missions for the plans**



Content Chapter 2.2

- **Requirements to the Network Planner**
- **Scope and activities within the network planning area**
- **Strategic Planning and new Technologies.**
- **Solution mapping per scenario**



Network Planning

Key requirements in competition

- **Business Oriented Needs**
 - **What are the best customer segments to address ?**
 - **Which services have to be introduced through time ?**
 - **What is the best service bundling per customer type ?**
 - **How to maximize revenues ?**
 - **How to reduce capital expenditure ?**
 - **How to reduce operational expenditure ?**



Network Planning

Key requirements in competition

- **Network Oriented Needs**
 - **How to forecast services and traffic demands?**
 - **How many nodes to install ?**
 - **What is best location for systems and related communication media ?**
 - **What is the best network architecture and routing ?**
 - **Best balance between built and lease ?**
 - **How to plan capacity evolution and solutions migration ?**
 - **How to ensure SLA and protection level ?**



Network Planning

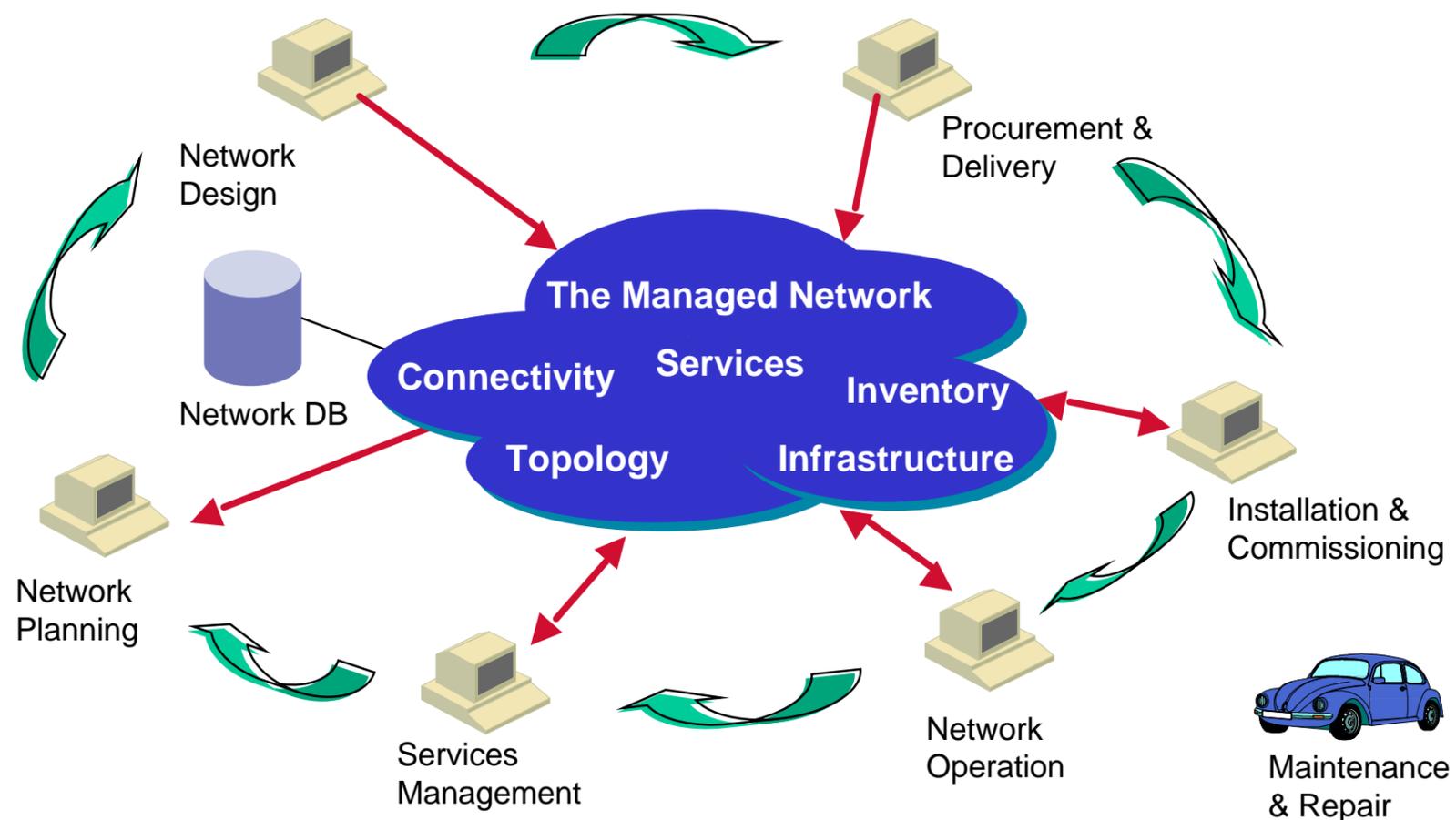
Key requirements in competition

- **Operation Support Needs**
 - **How to evaluate alternatives for direct operation and outsourcing ?**
 - **How to organize the operation processes ?**
 - **Which IT applications ensure an efficient support to operation ?**
 - **How to train labor force on the operational activities ?**



Network Planning

Role within the network lifecycle





Network Planning Scope: Mission

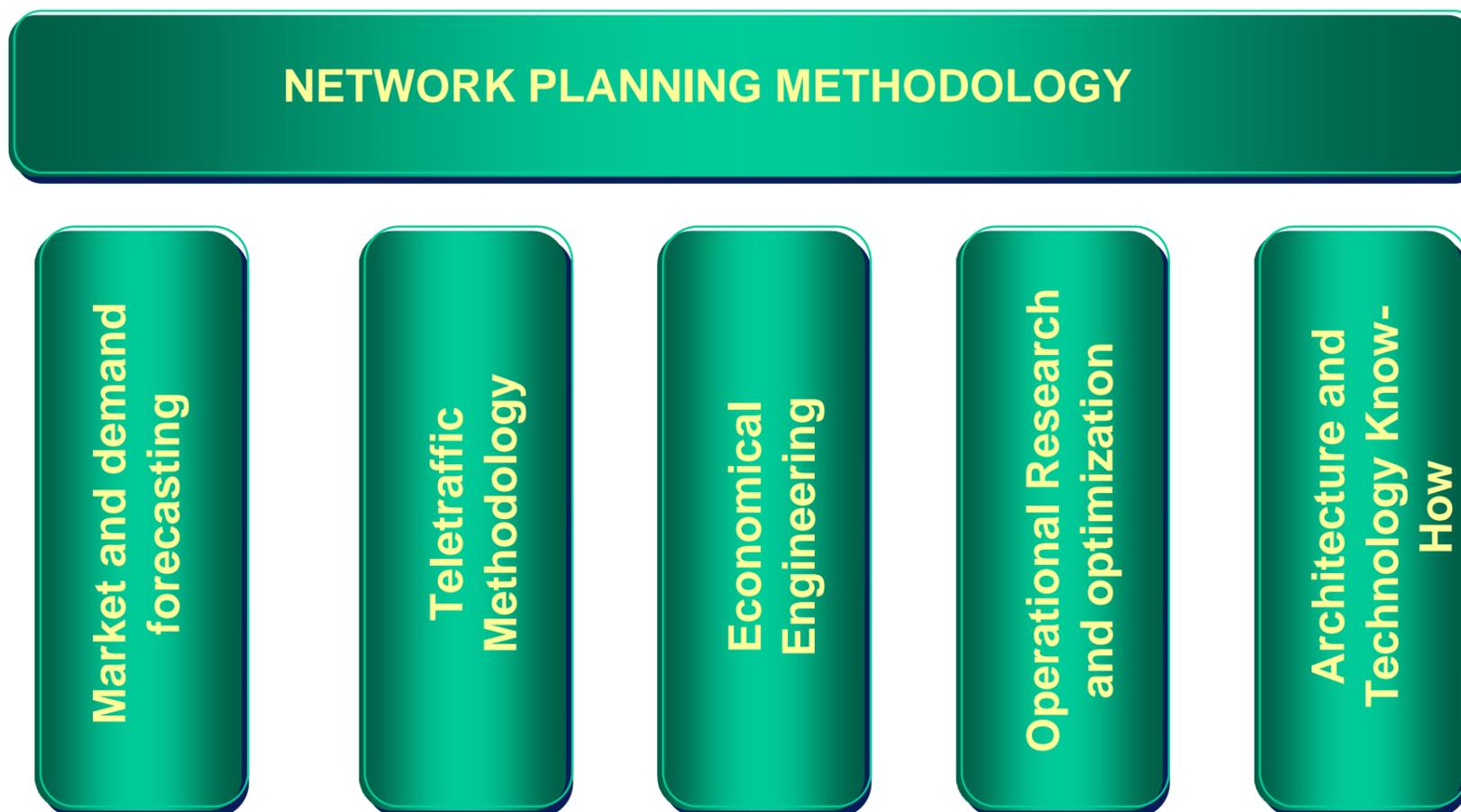
“Decision making on the network deployment to Optimize Business based on quantitative evaluation”

- Considering geo-marketing scenarios and traffic demand
- Overall vision on the network layers
- Deciding network topology, interconnection and routing
- Optimizing balance between performance/SLA and cost (CAPEX + OPEX)
- Considering regulatory constraints
- Anticipating business evaluation and feasibility



Network Planning

Scope: Main supporting pillars





Network Planning

Scope: Main supporting pillars

NETWORK PLANNING METHODOLOGY

Market and demand forecasting

- Historical projection: ARMA, ARIMA, etc.
- Analogy with other demands
- Evolutionary (grow lifecycle)
- Causal on originating factors
- Scenarios (alternatives and feasibility)
- Visionary (imagination)



Network Planning

Scope: Main supporting pillars

NETWORK PLANNING METHODOLOGY

Teletraffic Methodology

- Statistical flow modeling for arrival rates and holding times
- Capacity models based on stochastic processes: Analytical and Simulation
- Dimensioning based on efficiency and QoS
- Good founding on the multiple contributions from the International community (ITC)



Network Planning

Scope: Main supporting pillars

NETWORK PLANNING METHODOLOGY

Operational Research and optimization

- Linear programming → method of “simplex”
- Non linear modeling → procedures based on gradients
- Flow Optimization → critical path, maximum flow, etc.
- Combinatorial processes → “branch and bound”
- Iterative processes → decisión by succesive comparisons
- Heuristic procedures → hybrid with emphasis on constraints and equipment characteristics



Network Planning Scope: Typical activities (1)

- 1) Problem and Network Partitioning to reduce complexity
- 2) Data Gathering to match real needs
 - Geo- scenarios
 - Existing Network & carried services
 - Current Performance and waiting lists
- 3) Demand Forecasting and traffic characterization
- 4) Definition of Solution Alternatives



Network Planning

Scope: Typical activities (2)

- **5) Mapping best alternatives to requirements in coverage and technologies**
- **6) Nodes/Links Design, Location and Dimensioning**
- **7) Network Costing in CAPEX and OPEX**
- **8) Optimization for routing and deployment**
- 9) Sensitivity Analysis to demand level, QOS, etc.
- 10) Documentation of Network Plan and deployment



Network Planning Scope: Dimensions

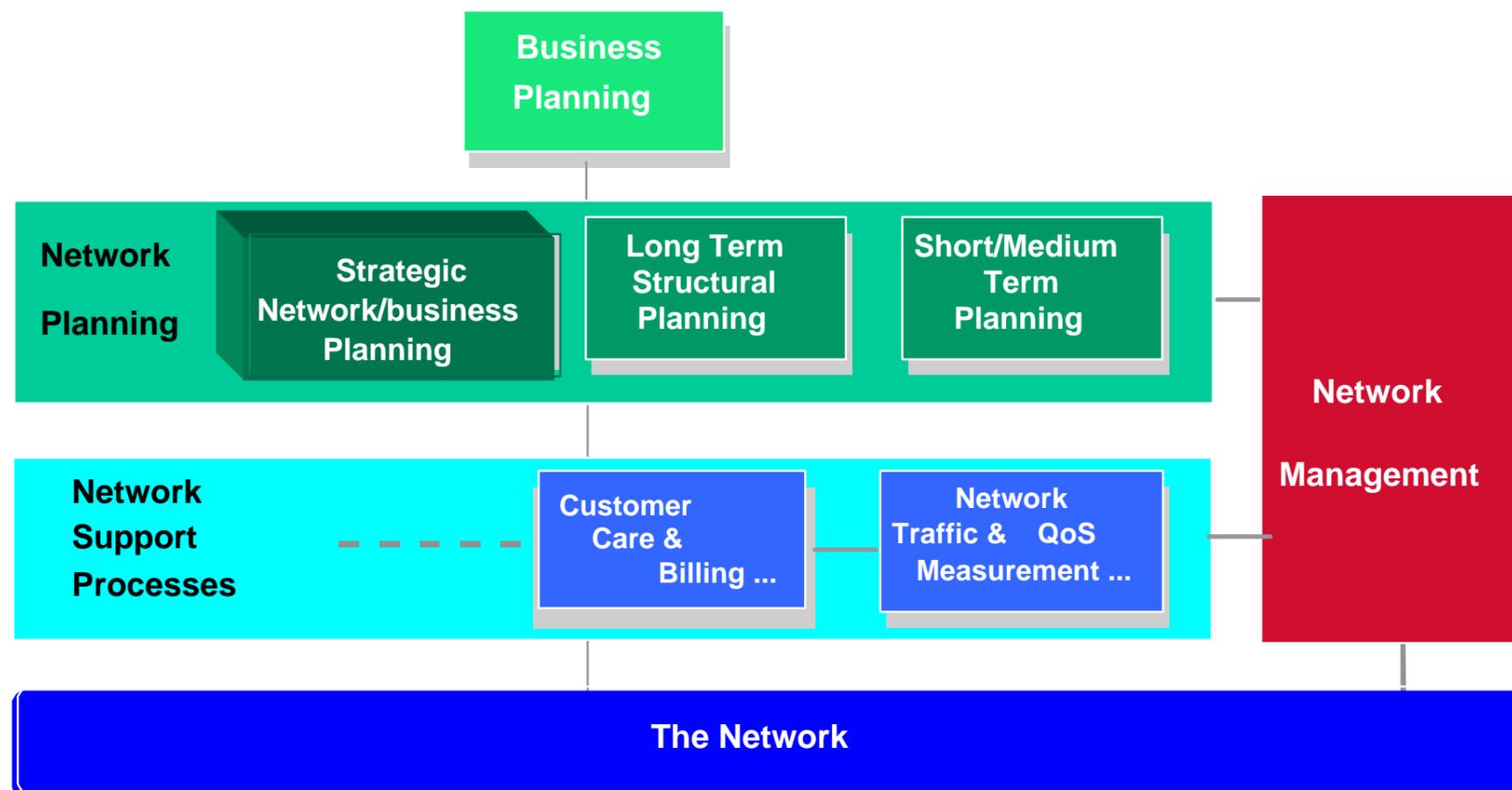
- **By Time** → Short, Medium, Long term
- **By Level of Detail** → Strategic/Business/Network/NE
- **By Network Layer** → Service layer up to Infrastructure
- **By Network Segment** → Access, Metro, Core, end-to-end
- **By Technology** → PSTN, SDH, Radio, ATM, IP, etc
- **By Service** → POTS, Data, LL, Video, etc





Network Planning

Scope: Related Processes





Network Planning Strategic view

Key decisions to guide the overall network structure, services and technologies:

- **Role and market segments within competition**
- **Main evolution for technologies and architectures. NGN**
- **Solution mapping per scenario**



Network Planning Strategic Planning: Role in competition

- **Selection of market segments: economy of scale**
- **Make versus outsource decision**
- **Policy on revenues and financing**
- **Partnership selection**
- **Priorities definition**



Strategic Planning: Evolution on Technology and architecture

Technological alternatives: Which, When and Where

- **Architecture at core and access segments**
- **Operation support applications**
- **Planned evolution steps**

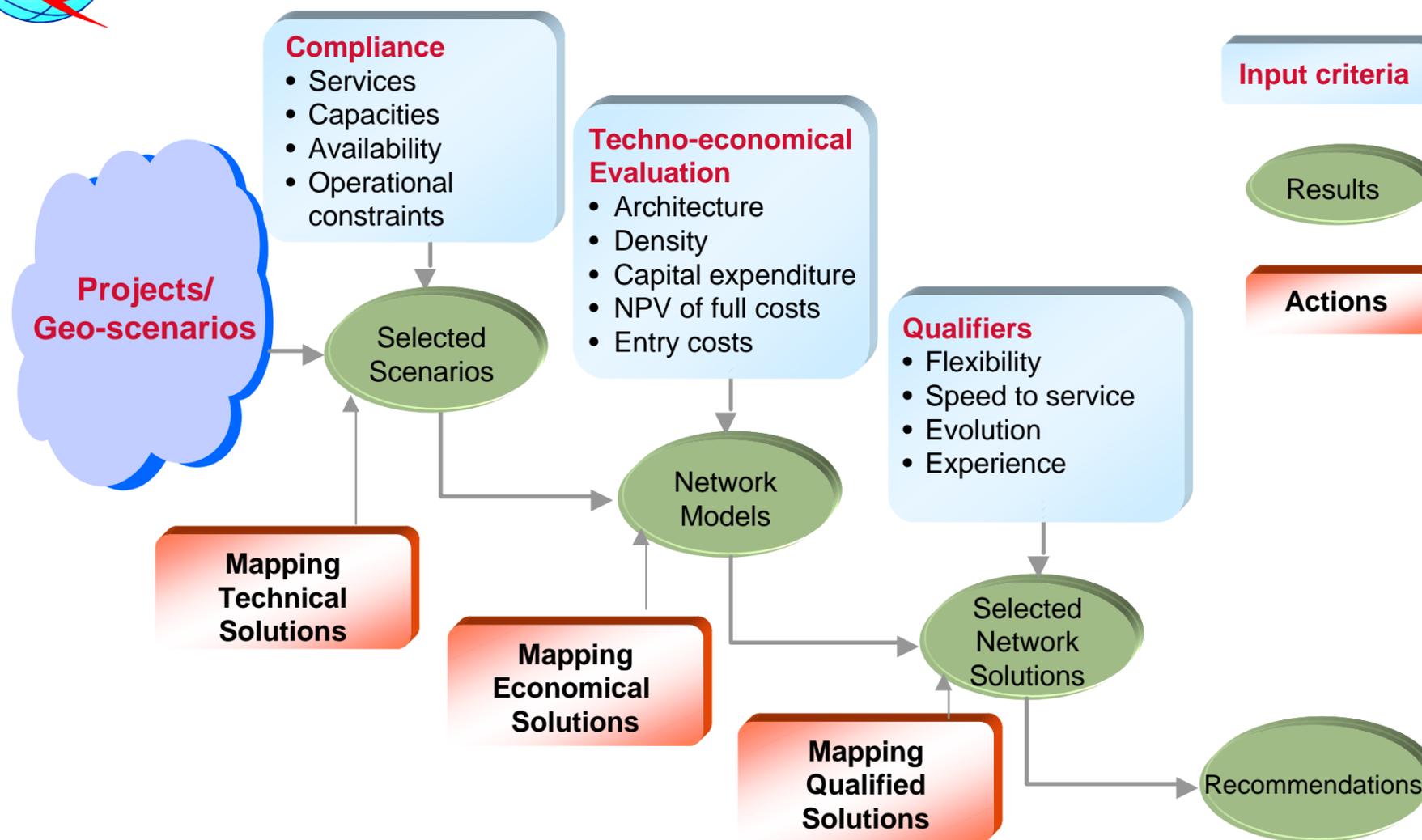


Solution Mapping

- **Variety of geo-scenarios within the country**
- **Characterize parameters for scenario and solutions**
- **Techno-economical evaluation to select best COOP**

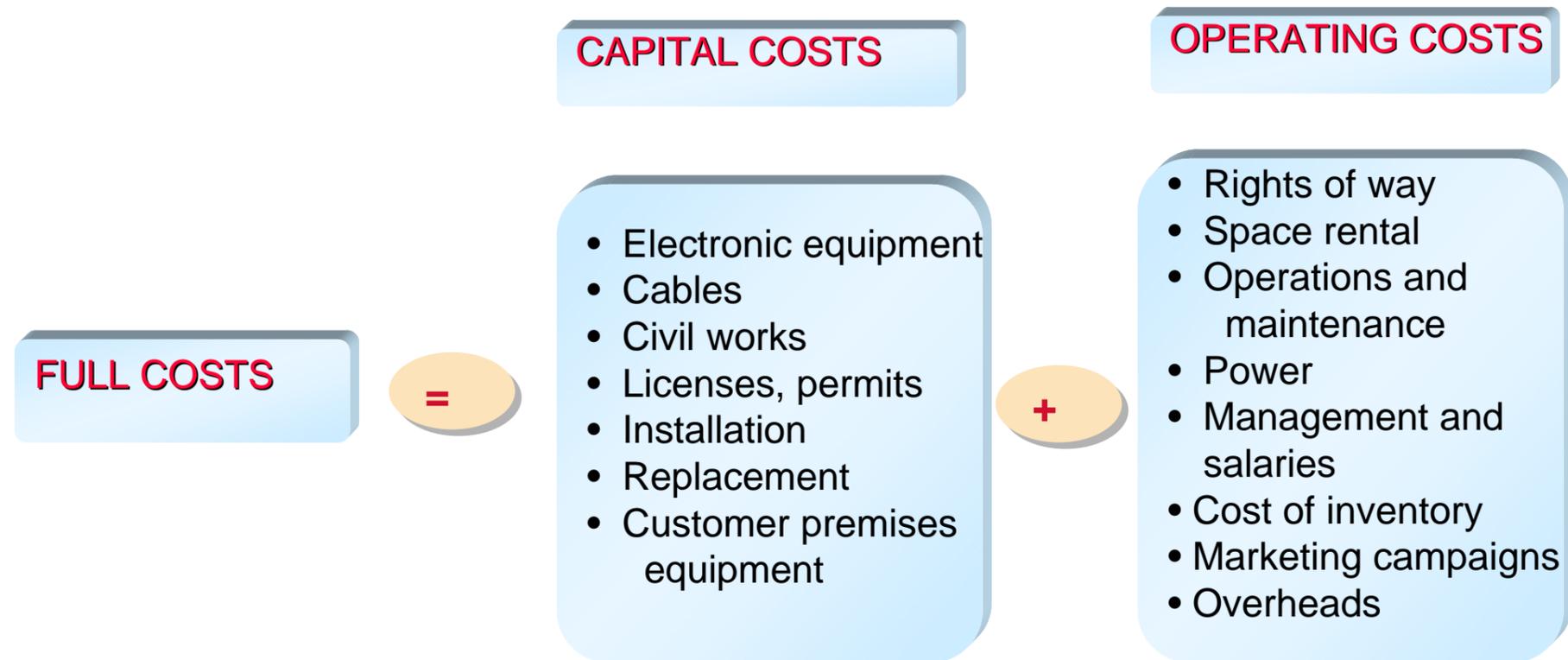


Solution Mapping: Methodology



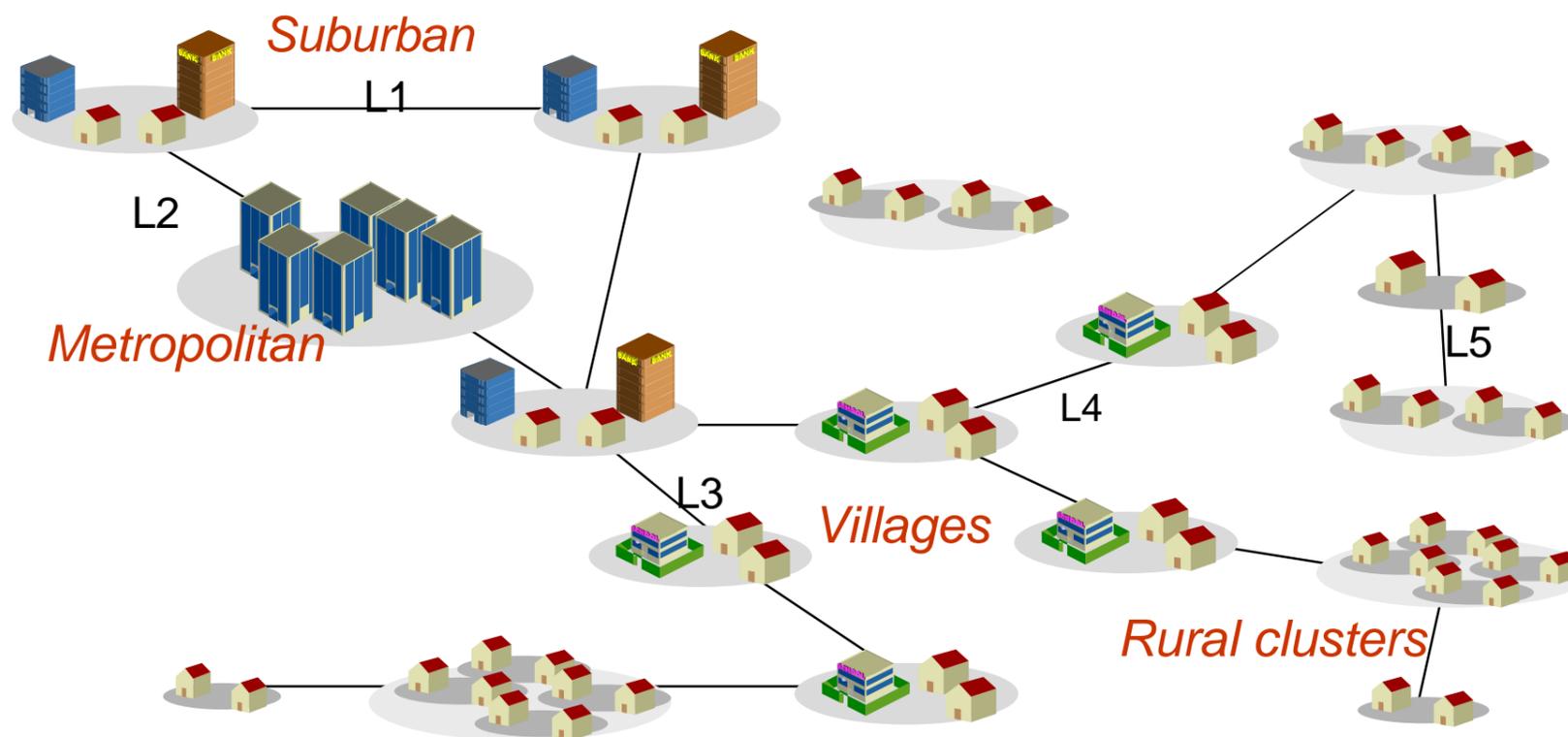


Solution Mapping: Cost Modeling





Solution Mapping: Example of Geo Scenarios

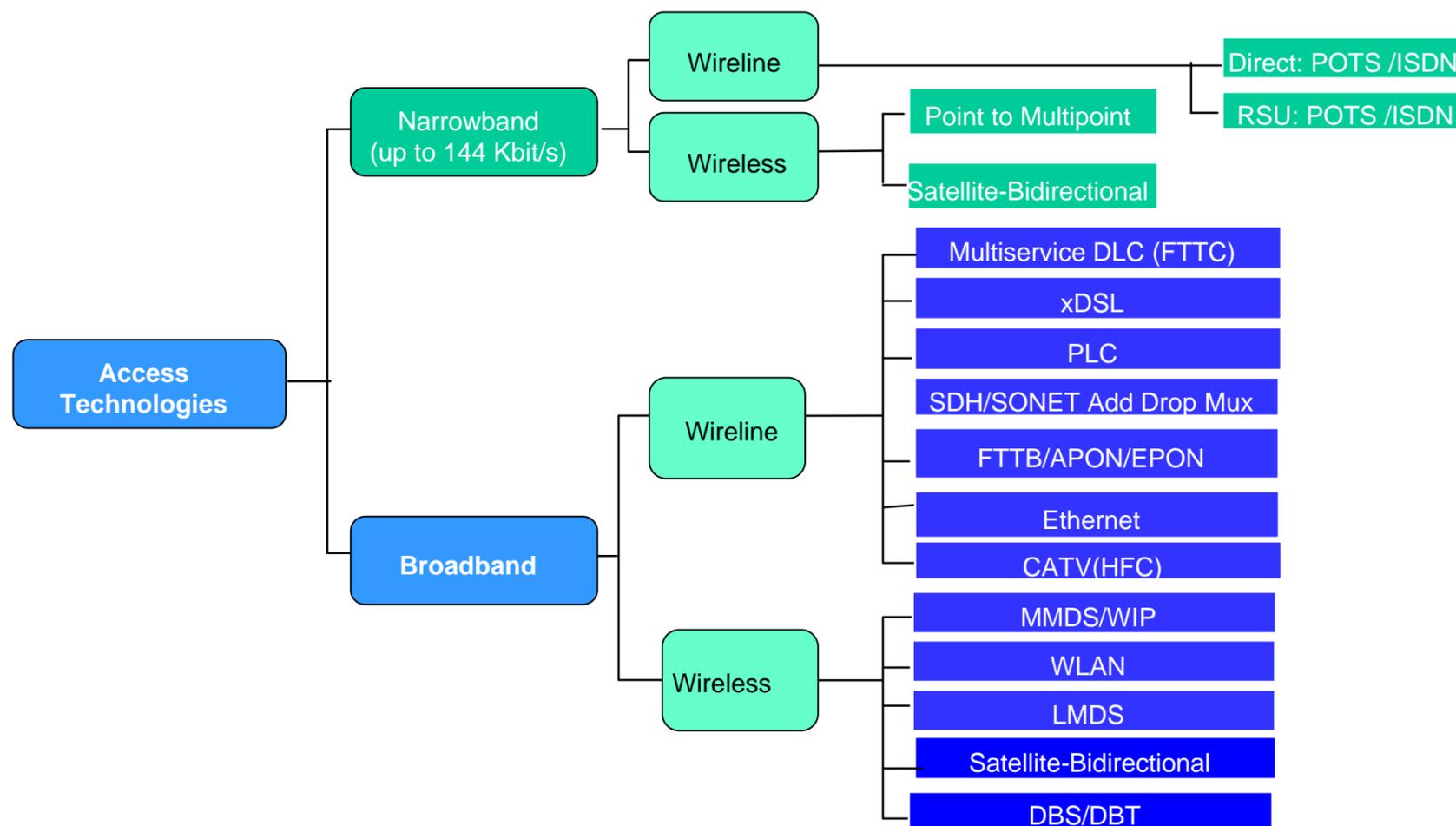


L1: Distance between suburban
L2: Suburban - metropolitan distance
L3: Suburban - village distance

L4: Distance between villages
L5: Distance between rural

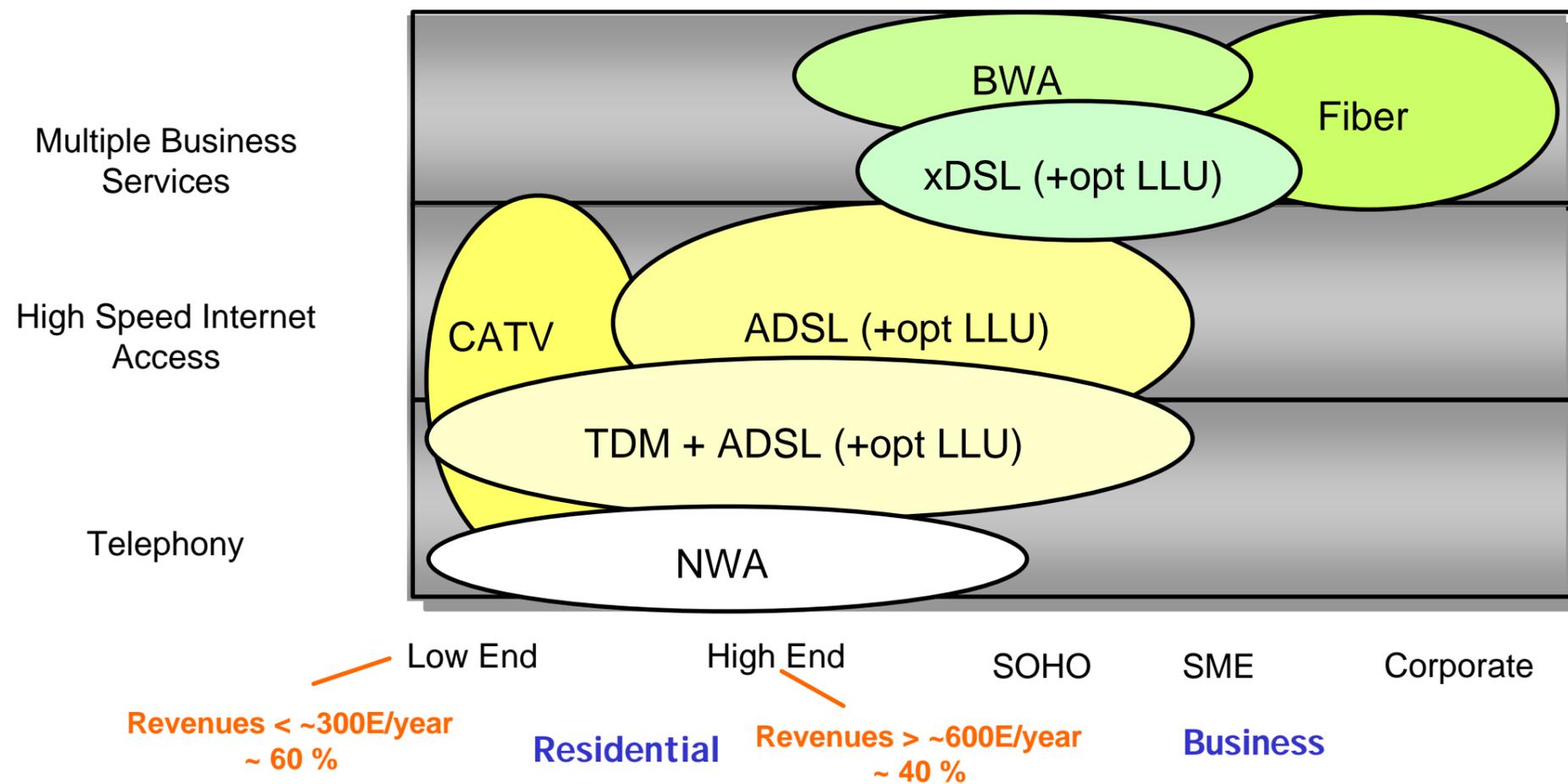


Solution Mapping: Technological alternatives at access (Fixed)





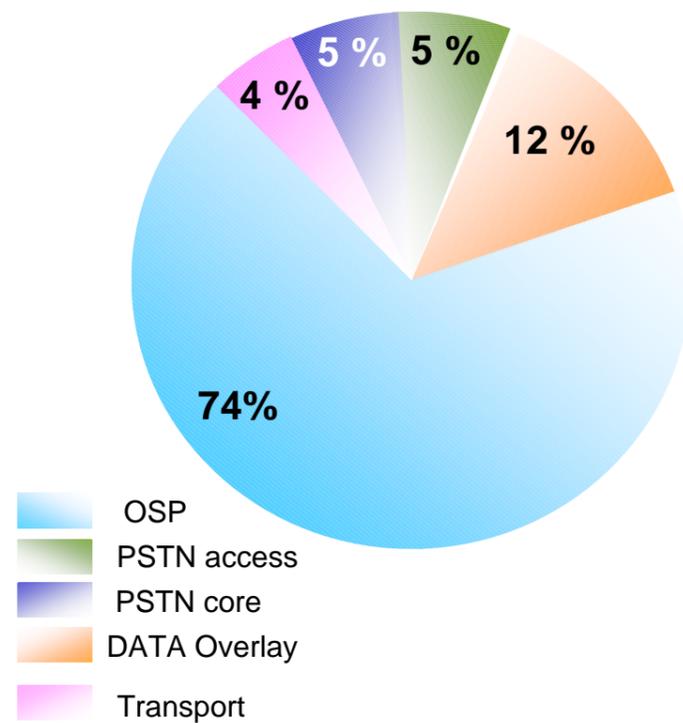
Solution Mapping: Technical Alternatives at access



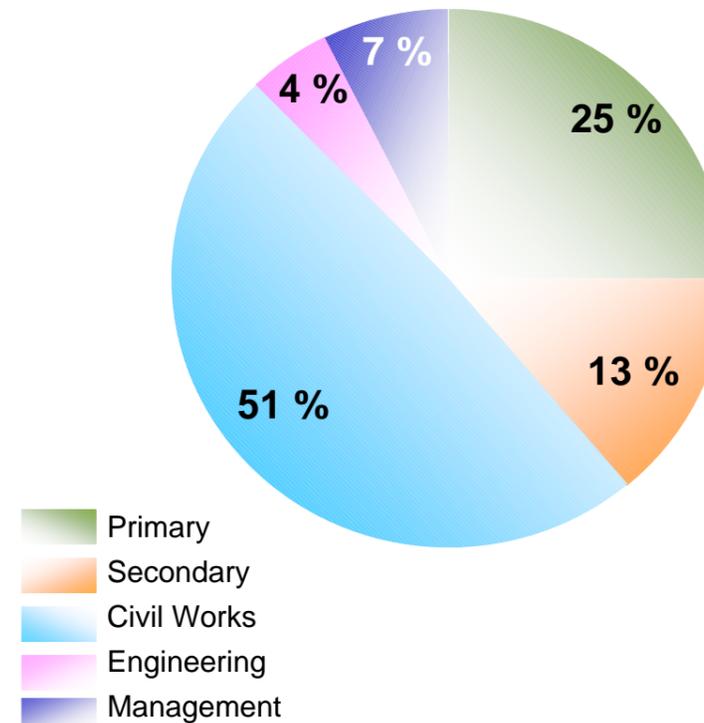


Solution Mapping: Investment Splitting in Greenfield Access

**Network Cost Composition
for overlay PSTN and Data**
(Metropolitan 1 node Ducts+ Aerial)



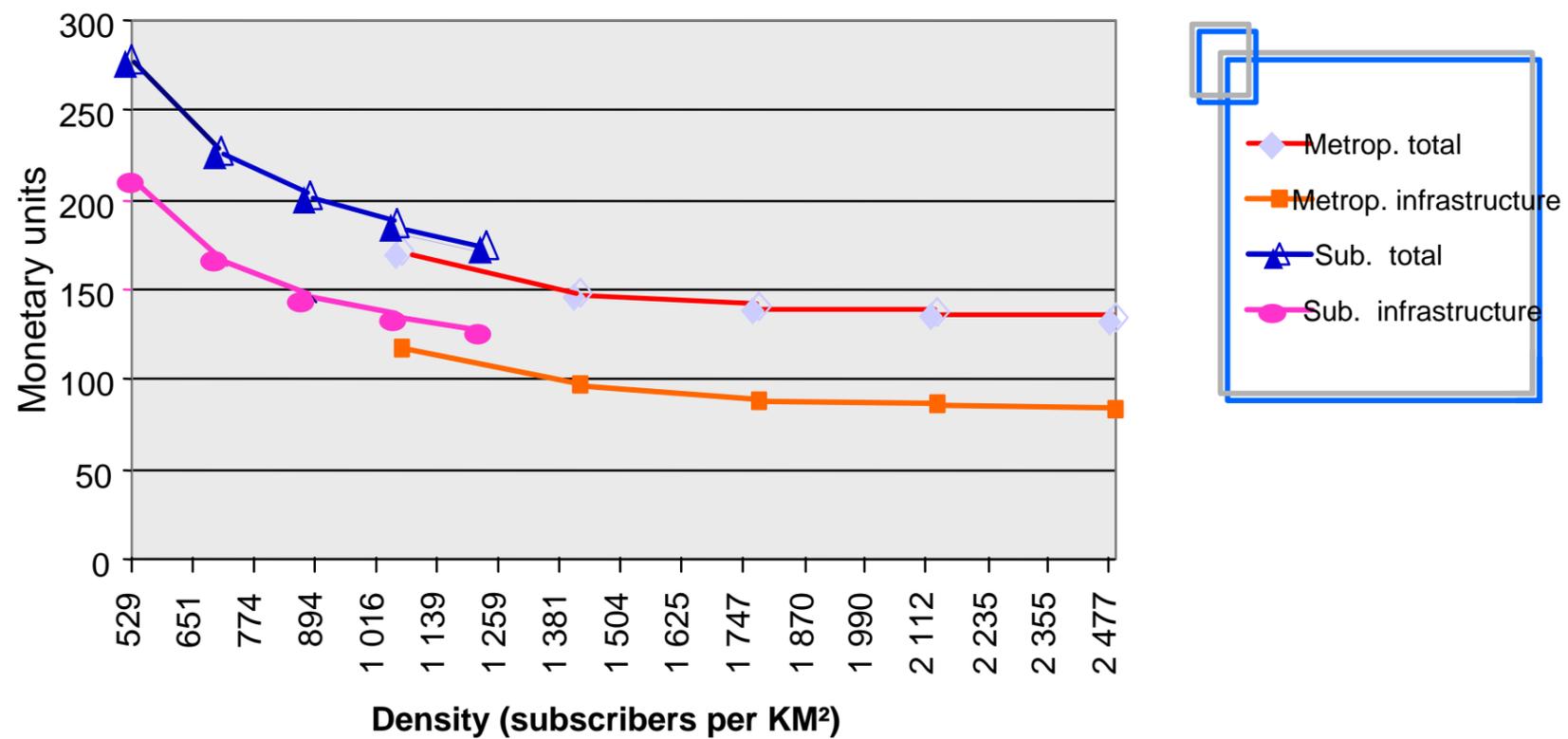
**Infrastructure (OSP) Cost
Composition**
(Metropolitan 1 node Ducts+Aerial)





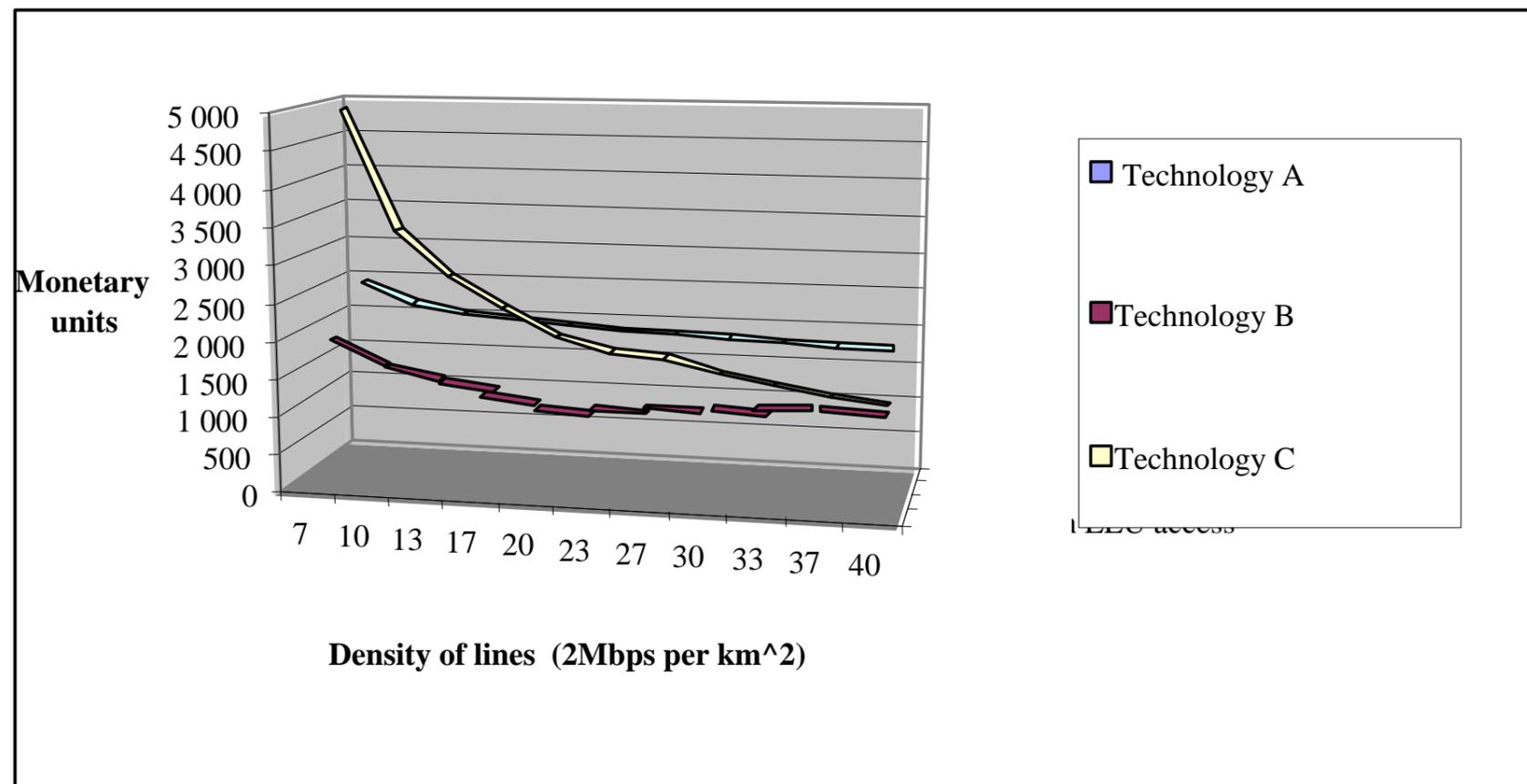
Solution Mapping: Investment sensitivity to density in WL Access

High density areas



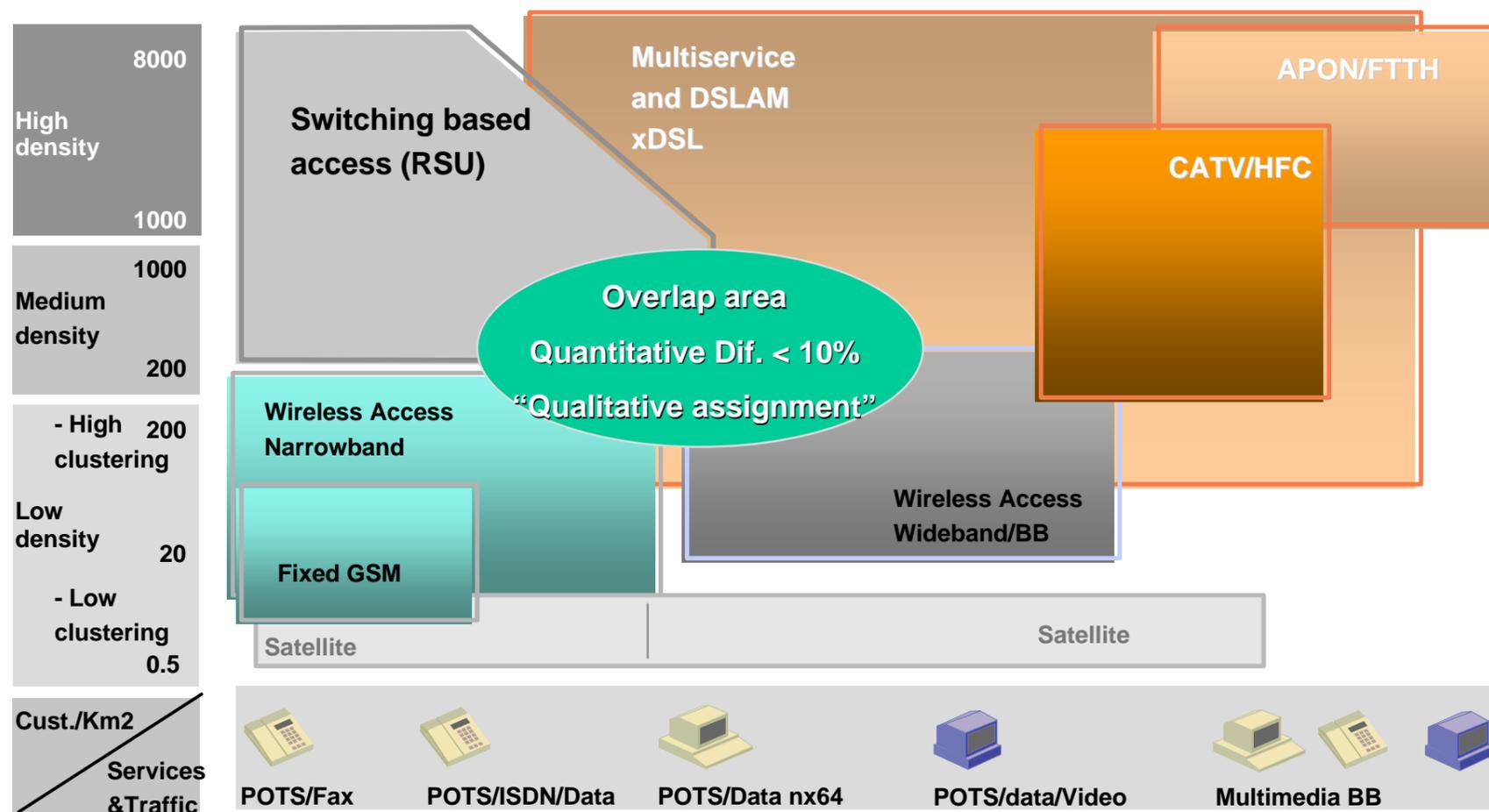


Solution Mapping: Solution selection per customer density





Solution Mapping: Techno-economical Recommendation





Network Planning Reference benefits

- **Adequate definition of customer segments, services and business to ensure efficient operation in competition**
- **Anticipation of 2 to 3 years in the positive IRR**
- **Saving factors of 20 to 200 % by adequate solution/technology mapping in the access segment**
- **Additional gains between 20 to 40 % by topology/routing optimization**