# Regulatory Issues for
# Next Generation Networks

**(Contribution to the 6th Würzburg Workshop on IP: "Joint EuroNGI and ITG Workshop on "Visions of Future Generation Networks")**

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# Contents

- **FL-LRAIC based rate regulation for PSTN/ ISDN unbundling and interconnection services**

- Current Regulatory issues of cost based rate regulation
  - Call termination in 2nd Generation Mobile Networks
  - Bitstream Access Service in Broadband Networks

- Regulatory challenges of introducing sustainable competition in the provision of broadband services

## FL-LRAIC based rate regulation

- Bottleneck facilities require regulatory measures in order to facilitate competition

- With regard to the liberalisation of telephony services introduction of cost based wholesale rates has been a core measure

- Cost based rate regulation has been implemented for
    - Interconnection of PTSN/ISDN (for call origination, termination, and transit)
    - Unbundling of the Subscriber Access Line (SAL)

- FL-LRAIC has been used as cost standard in order to set prices that support efficient build or buy decisions
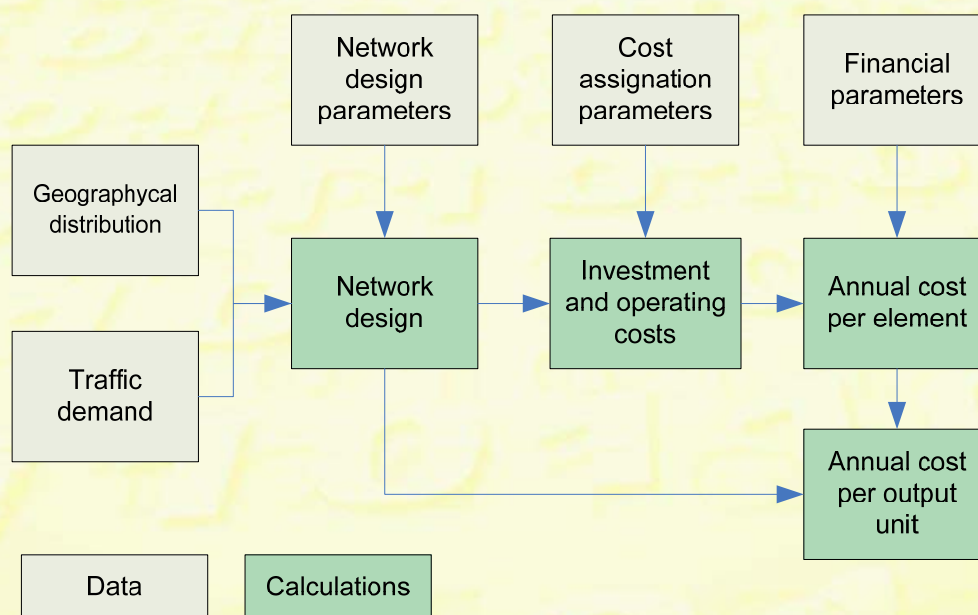
## FL-LRAIC based rate regulation

- In practice, regulatory means for determining the FL-LRAIC are cost models (bottom-up and top-down) and international benchmarks

- Regulatory interconnection regimes for the PSTN/ISDN were considered to be element based, and charged per minute

- Bottom-up cost modelling allows for a genuine determination of an efficient network design as required by the FL-LRAIC standard

- Top-down modelling and international benchmarks require additional sources of information in order to determine efficient cost of service provision

# FL-LRAIC bottom-up cost modelling

- takes into account a network configuration implemented by a new entrant operator under current technology
- can be developed either by a complete "Greenfield approach" or by a so called "Scorch Node approach"
- requires an estimation of the type of services integrated and the corresponding traffic for each of them (in order to capture economies of scale and scope)
- considers in PSTN/ISDN three cost drivers (line driven cost, call depending cost, traffic depending cost)
- calculates the cost per element by corresponding routing matrices for each service considering the traffic of all services integrated in the network
- hence the required network capacities adapts to the traffic required for the services
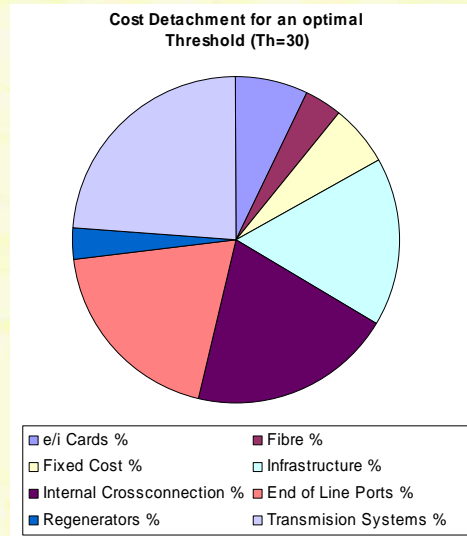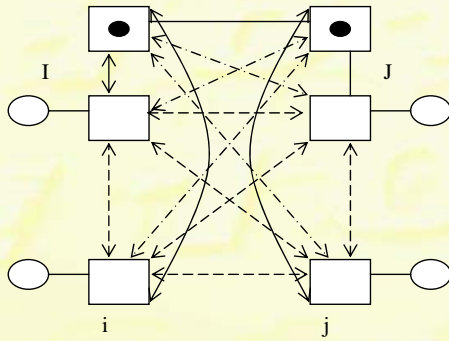
# Bottom Up Approach



from Hackbart/Kulenkapf ITS-Madrid 2002

## Application to legacy networks (PSTN/ISDN)

Leads for the PSTN/ISDN interconnection to three types with corresponding CTC

- Local termination
- Single transit termination
- Double transit termination



Cost Detachment for an optimal Threshold (Th=30)

- e/i Cards %
- Fibre %
- Fixed Cost %
- Infrastructure %
- Internal Crossconnection %
- End of Line Ports %
- Regenerators %
- Transmision Systems %

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# Overview

With regard to cost based rate regulation of wholesale services there are two main services

- Regulating the call termination cost for 2º Generation mobile networks

- Regulating the broadband internet access (bitstream access service)

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# CTC for Mobile networks

- The CTC for mobile networks are strongly related with the following parameter:
  - Market penetration
  - Degree of Indoor coverage
  - GoS degree
  - Type of frequency GSM900 or GSM1800
- Total cost are determined by more then 80% by the BSS
- Hence an optimal the cell deployment and the corresponding BTS distribution is the key factor for CTC under the FL-LRAIC Model
- Furthermore, regulatory problems arise from strong cost differences between different mobile operators mainly for GSM1800 with low market share against GSM900 with high market share
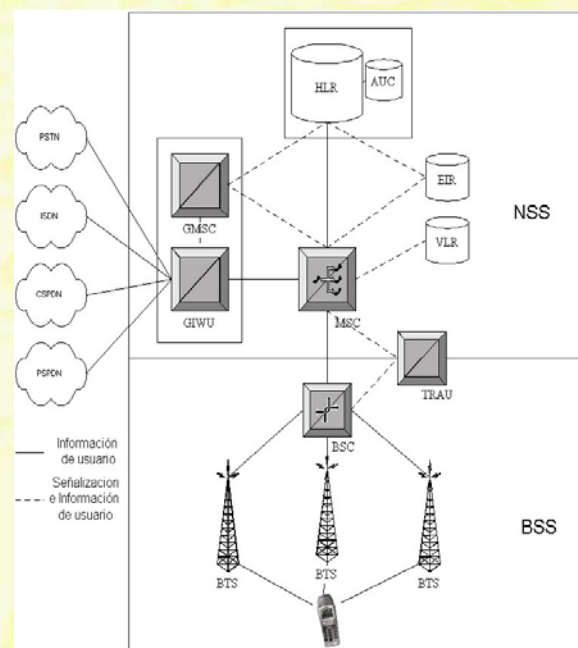
# Bitstream regulation for Broadband Internet Access via xDSL

**Bitstream Access Service (BAS):**

→ Wholesale transport service based on xDSL

→ Ranging from the end user up to the ISP PoP, over the following network sections:

      → Subscriber Access Network (SNA)

      → Broadband Access Network (BAN)

      → IP Network

→ Allows any ISP to offer broadband Internet Access on a national scale

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# Requirement from the ERG for BAS Regulation

The ERG determined the following requirements for BAS:

- high speed access link to the customers premises provided by the incumbent;

- transmission capacity for broadband data in both directions enabling new entrants to offer their own, value-added, services to end users;

- new entrants have the possibility to differentiate their services by altering (directly or indirectly) technical characteristics and/or the use of their own network using different points of access for the ISP

# ERG Reference Connection

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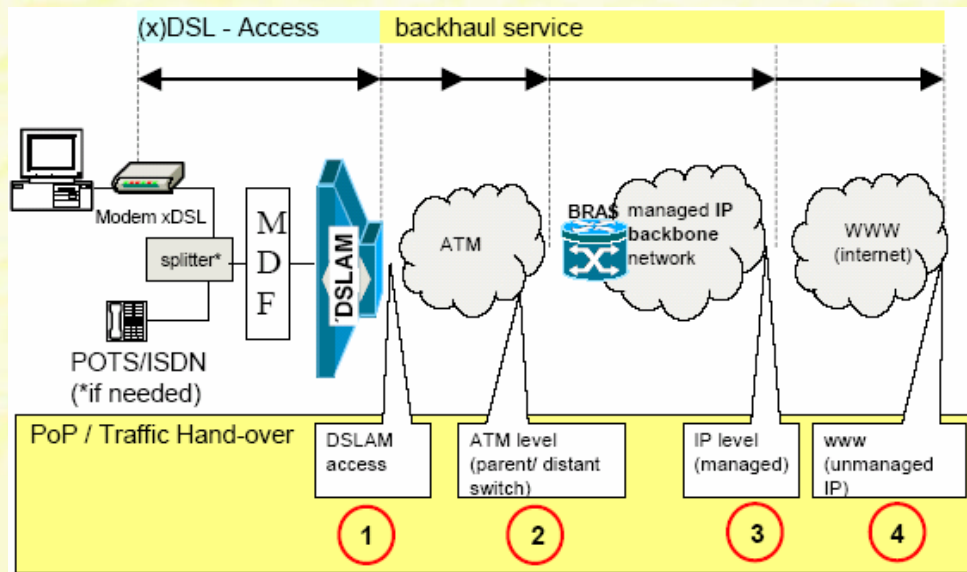
# Broadband Access Network

➜ Mostly implemented with ATM technology (Ethernet implementation has still low penetration)

➜ Provides infrastructure between the DSLAM and the PoP to the IP or ATM network

➜ Implemented in large networks by three / four levels with a hierarchical star topology

➜ The traffic is routed from the DSLAM up to the highest level using different VPs for each service class

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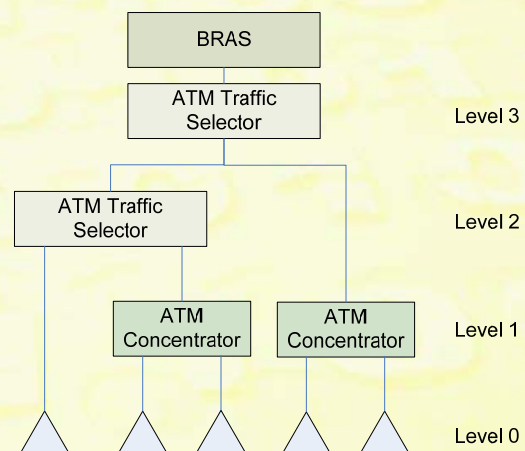
# Current BAN Design Model

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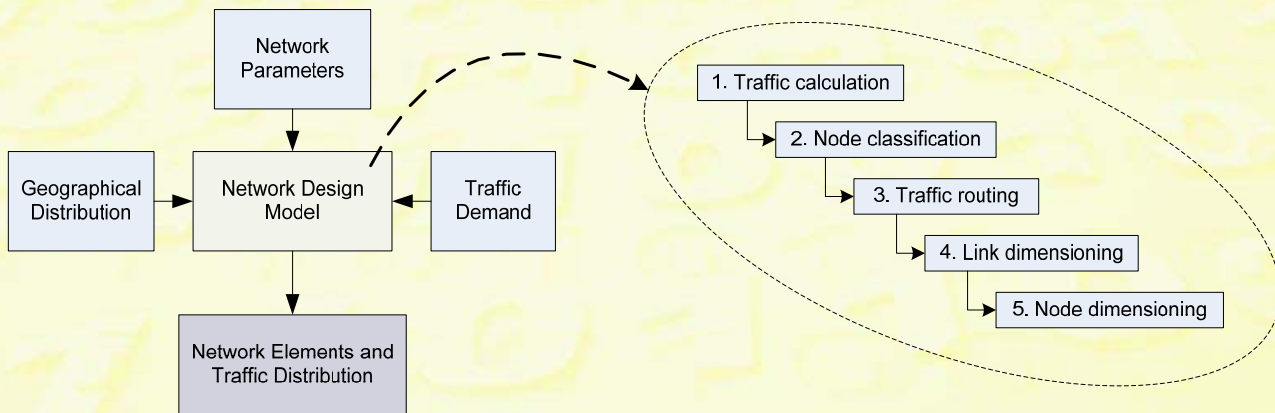
# Current IP Core Network architecture

➜ In case of regional ISPs IP core tunnelling will be required.

➜ Composed by a national Tier 2 Internet type

➜ Three level hierarchical network with access, edge and core routers.

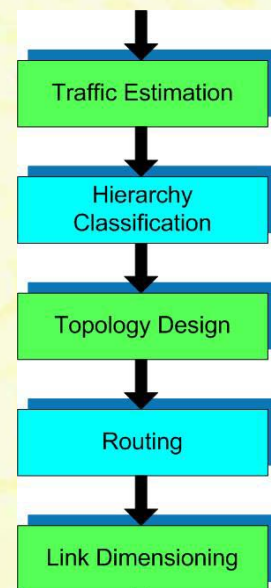➜ Star topology at lower level. Meshed (bi-connected) topology at higher level.
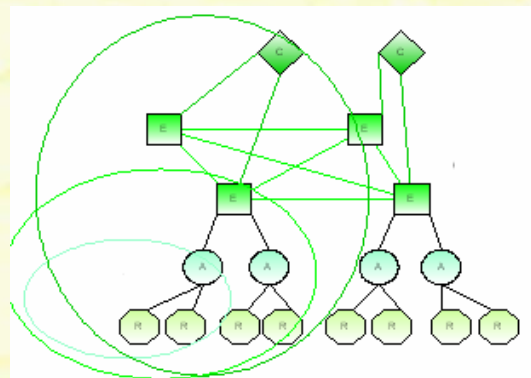
# Current IP Network design

→ Considers the total traffic resulting from all access networks

→ Classifies traffic in three transport classes: real time, streaming, best effort

→ Capacity dimensioning by multi-class traffic projection into one equivalent traffic:

$$C_t = [\lambda_1 \cdot C_{rt} + \lambda_2 \cdot C_{st} + \lambda_3 \cdot C_{be}]$$
$$\lambda_3 \approx 1; \lambda_1 > \lambda_2 > \lambda_3$$

Traffic Estimation

Hierarchy Classification

Topology Design

Routing

Link Dimensioning

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# Current service classes

Currently access service classes based on IP and one access class based on ATM are considered

Each service class is routed in a separated virtual path.

| Types of DSL products | Equivalent Bandwidth | Bandwidth guaranteed | Number of users |
|---|---|---|---|
| DSL private (mass market) | low | no | High |
| DSL business | middle | yes | Middle |
| IP-VPN for enterprises | high | yes | Limited |
| ATM access | high | yes | Strongly limited |

# Cost Modelling for BAS (I)

- → Bottom-up cost modelling primarily is CAPEX cost modelling
- → Network design under efficiency criteria considers all network elements in the transport tube between the client and the PoP site of the ISP.
- → Identifies the cost drivers for each network element and takes account of all services in order to capture economies of scale and scope
- → Calculation of unit cost requires regulatory specifications of
  - → Unit subject to cost allocation (e.g. cost per kBit/s or cost per capacity of interconnection line)
  - → Specification of cost allocation rules for
    - → different service classes (especially with regard to QoS)
    - → Infrastructure (cost sharing between PSTN/ISDN and broadband)

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# Cost Modelling for BAS (II)

- → Cost drivers of the network elements of the Broadband Access Network

|  | Bandwidth | Access Lines |
|---|---|---|
| **DSL Modem** |  | ✓ |
| **Splitter** |  | ✓ |
| **DSLAM** | ✓ | ✓ |
| **ATM Concentrator** | ✓ |  |
| **ATM Transit Switch** | ✓ |  |
| **BRAS** | ✓ |  |

# Cost Modelling for BAS (III)

➔ Identify for each BAS service the part of each network element used by corresponding cost routing factors.

$$C_{Serv\ i} = A_{Serv\_i} + BW_{Serv\ i} \cdot B_{unit}$$

$A_{Serv\_i}$ :      Cost driven by access line.

$BW_{Serv\ i}$ : bandwidth of the service

$B_{unit}$ :      Cost driven by the bandwidth (per unit)

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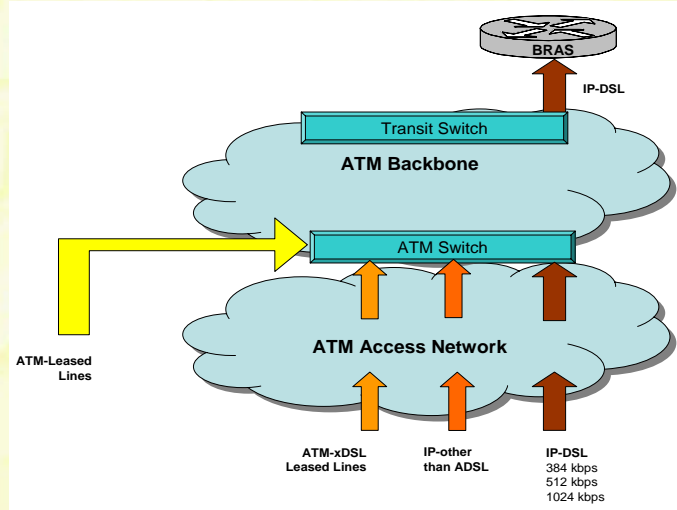
# Implementation  by GIT/UC-WIK

Two software network planning tools for the network design and cost study purposes:

➔ ATM-Access Network: Taroca-Ban *)

➔ National Tier 2 MPLS/IP network: Taroca-IP



Some problems to be studied:

➔ Optimal design of network structure and topology.

➔ Infrastructure sharing.

➔ Cost and interconnection pricing scheme determination.

➔ Migrations from a current to a future technology
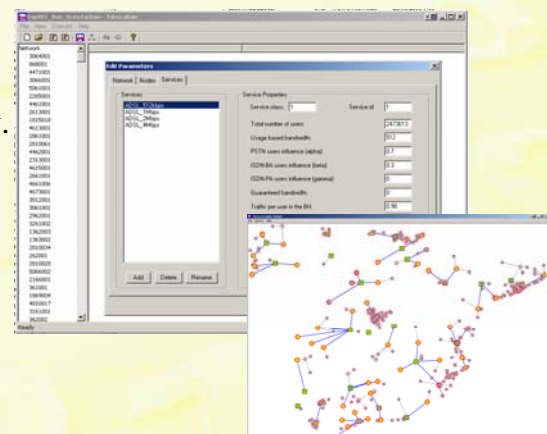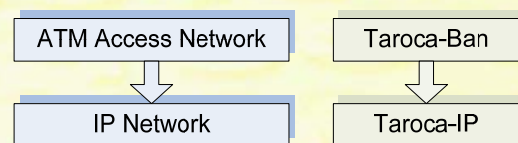
**\*) developed for the German NRA (Analytical cost model for the broadband network, 2005)**

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# Regulatory challenges

- Economies of scale and scope will become more important in broadband networks in contrast to the PSTN/ISDN

- Competitors will continue to rely on wholesale services

- Difficulties in cost allocation especially arise from service integration and QoS differentiation in broadband networks

=> ability of alternative operators to compete with the incumbent strongly depends on cost allocation rules with regard to wholesale services

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# Regulatory challenges

- Before deciding on cost allocation rules the design of the wholesale access services has to be defined
- Based on the FL-LRIC standard this requires a specification of an efficient network structure with corresponding service provision
- Due to service integration in broadband networks and the existing degree of freedom in network architecture implementation (NGN vs NGI) the regulatory decision making with regard to an interconnection regime has to be connected to the implementation in the incumbent network
- NGN network architecture as well as expected high traffic volumes tend to reduce the level playing field of alternative network operators

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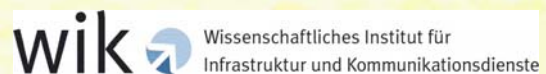
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