



# ITU / BDT workshop

Warsaw, Poland,

6-10 October 2003

## Network Planning

Lecture NP- 5.3

### Supporting Network Planning Tools

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## BDT workshop on Network Planning

Module 1: Introduction and Experiences in the Region

Module 2  
Role of Network Planning in the current Telecom scenario

Module 3  
Integrated Planning Process

Module 4  
Specific Network Planning per Layer

Module 5  
Supporting Network Planning Tools

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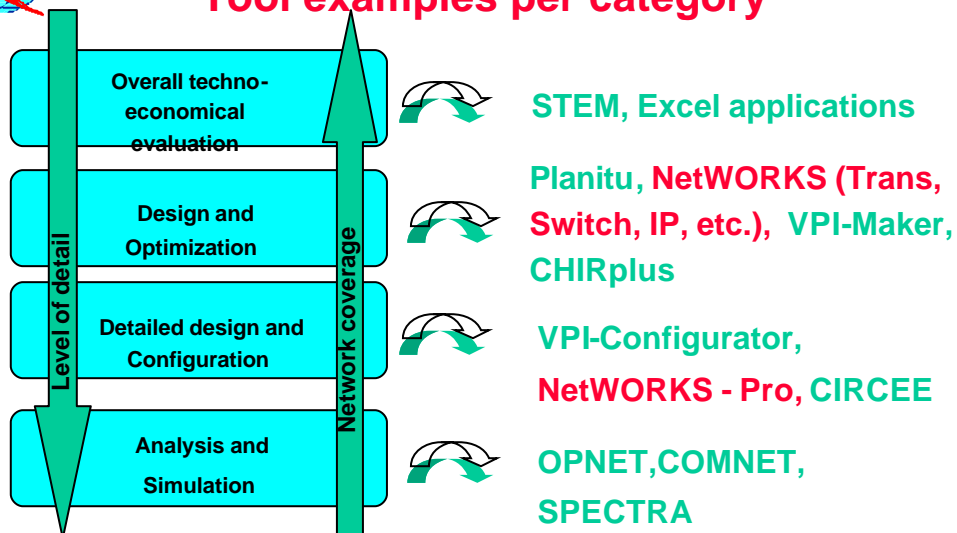


## Content Chapter 5.3 Network Planning Tools

- 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 Tools: Tool examples per category





## Network Planning Tools: NetWORKS

Telecom  
Network  
Planning

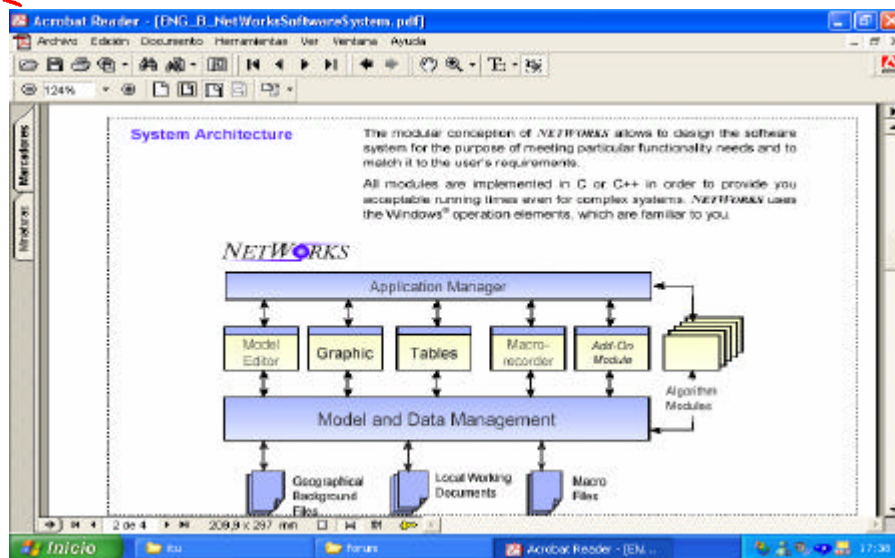


**Objective :** NetWORKS by Detecom (Germany) is a Telecom network planning tool to design, optimize, dimension and document several network layers and technologies as: Switching, Transmission, Cable, Mobile, IP, Signalling, etc.

[networks.info@detecom.com](mailto:networks.info@detecom.com)

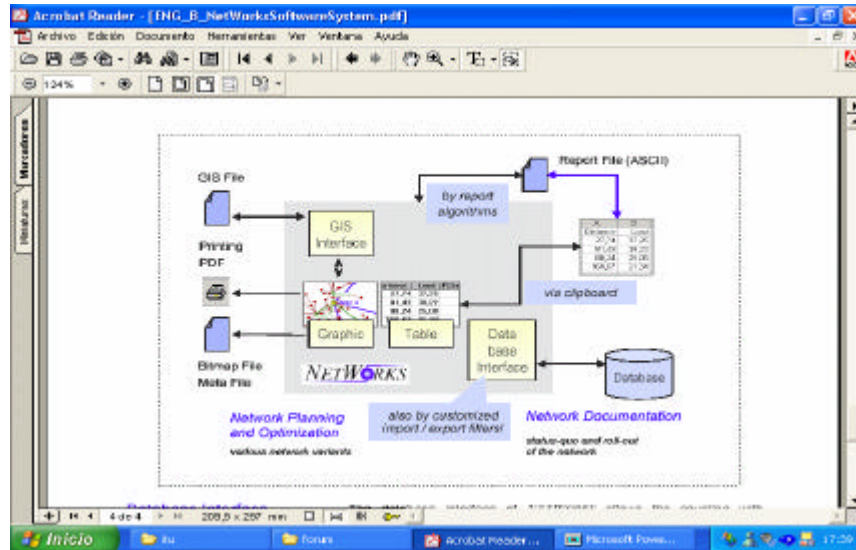


## Network Planning Tools: NetWORKS





## Network Planning Tools: NetWORKS



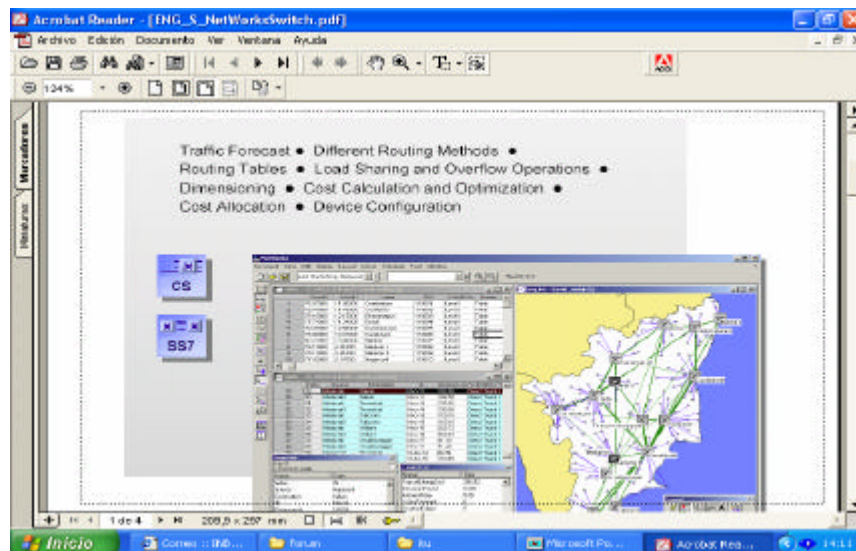
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## Network Planning Tools: NetWORKS



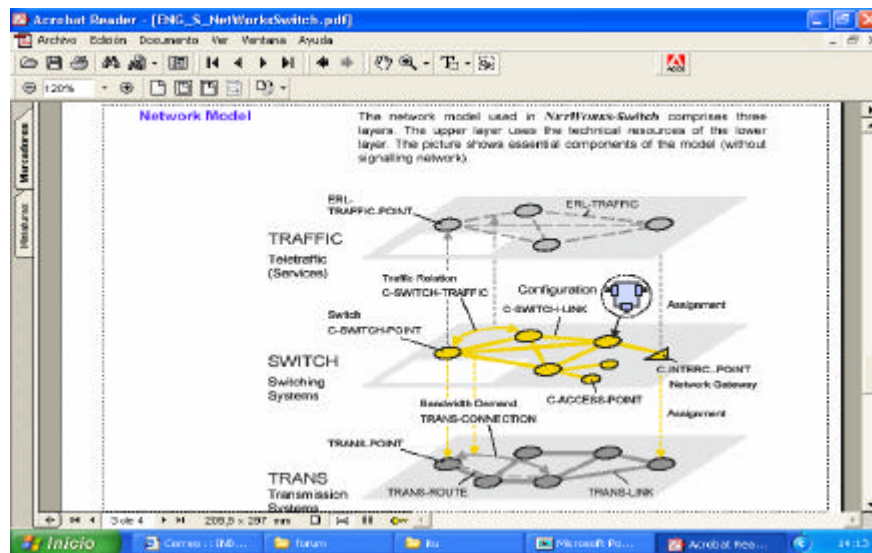
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## Network Planning Tools: NetWORKS



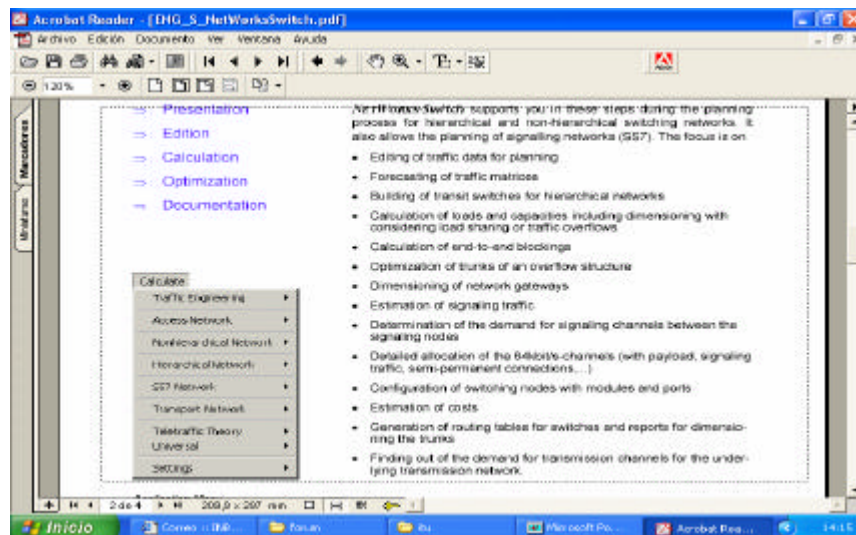
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## Network Planning Tools: NetWORKS

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### Network Model

The network model used in *NetWORKS-Switch* comprises three layers. An upper layer uses the technical resources of a lower layer.

- TRAFFIC - Layer that contains traffic sources and traffic relations.

The SWITCH layer differs between non-hierarchical and hierarchical networks. In non-hierarchical networks all exchanges are of equal status. The direct trunks form (almost) a full-meshing, the overflow routes are not more than 2 hops long. In hierarchical networks two network levels are created. The traffic overflow is implemented in the order Direct trunk -> Second trunk -> Final trunk / Mesh trunk.

Telecommunications Engineering and Management Consultancy

Inicio | NetWORKS\_package | Microsoft PowerPoint ... | Acrobat Reader - [S...

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## Network Planning Tools: NetWORKS

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### Application Trans

# NETWORKS

#### Planning and Optimization of SDH and PDH Transmission Networks

*NetWORKS-Trans* is an application for specialists who are mainly confronted with PDH and SDH transport networks and who have to deal with complex problems regarding

- Optimization of partly meshed and ring-like network structures.
- Consideration of a given infrastructure (fiber-optic cables, ducts).
- Routing of end-to-end connections by various criterions, with protection if required.
- Calculation of loads and capacities needed for protection facilities.
- Dimensioning of rings.

- Design - considering sites and links, demand (end-to-end relations), its paths over sites and links, and the loads and capacities of sites and links (both cable points / links and duct points / links can be considered optionally)
- Configuration - considering devices, fiber/micro-wave channels, transmission systems at different mapping levels and splitted demand (end-to-end connections) and its path over devices and fibers / microwave channels

### Network Model

The network model used in *NetWORKS-Trans* comprises three layers. An upper layer uses the technical resources of a lower layer.

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## Network Planning Tools: NetWORKS

**Application Trans**

**NETWORKS**

Planning and Optimization of SDH and PDH Transmission Networks

*NETWORKS-Trans* is an application for specialists who are mainly confronted with PDH and SDH transport networks and who have to deal with complex problems regarding:

- Optimization of partly meshed and ring-like network structures.
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- **Design** - considering sites and links, demand (end-to-end relations), its paths over sites and links, and the loads and capacities of sites and links (both cable points / links and duct points / links can be considered optionally).
- **Configuration** - considering devices, fiber/microwave channels, transmission systems at different mapping levels and splitted demand (end-to-end connections) and its path over devices and fibers / microwave channels.

**Network Model**

The network model used in *NETWORKS-Trans* comprises three layers. An upper layer uses the technical resources of a lower layer.

- **TRANS** - layer that contains devices, fibers, ...

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## Network Planning Tools: NetWORKS

→ **Presentation**

→ **Edition**

→ **Calculation**

→ **Optimization**

→ **Documentation**

*NETWORKS-Trans* supports you in these steps during the planning process for PDH, SDH and WDM transport networks. The focus is on:

- Comparison of different network structures (e.g. partly-meshed and ring-like network structures)
- Consideration of a given infrastructure (e.g. fiber-optic cables, microwave systems, ducts)
- Routing of end-to-end connections by various criteria over disjoint paths
- Possible protective strategies
- Calculation of loads and capacities including dimensioning of rings
- Detailed allocation and grouping of containers
- Configuration of devices (multiplexers, cross-connectors etc.) in the network nodes
- Estimation of costs
- Analysis of utilization of network capacities and finding out the bottlenecks
- Generating reports on routing, dimensioning, configuration and demand for devices and modules
- Calculation of end-to-end availabilities

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## Network Planning Tools: NetWORKS

Design of Ring-like and Partly-meshed Networks • Various Routing Methods • Protective Strategies • Dimensioning • Calculation and Optimization of Costs • Cost Allocation • Allocating and Grouping • Device Configuration

PDH  
SDH  
WDM

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## Network Planning Tools: NetWORKS

Bandwidth Demand TRANS-CONNECTION  
TRANS-POINT  
TRANS-LINK  
Configuration

TRANS Transmission Systems

CABLE-POINT  
CABLE-LINK  
CABLE-PATH  
Assignment

DUCT-POINT  
DUCT-LINK  
DUCT-PATH  
Assignment

DTICOM Telecommunications Engineering and Management Consultancy

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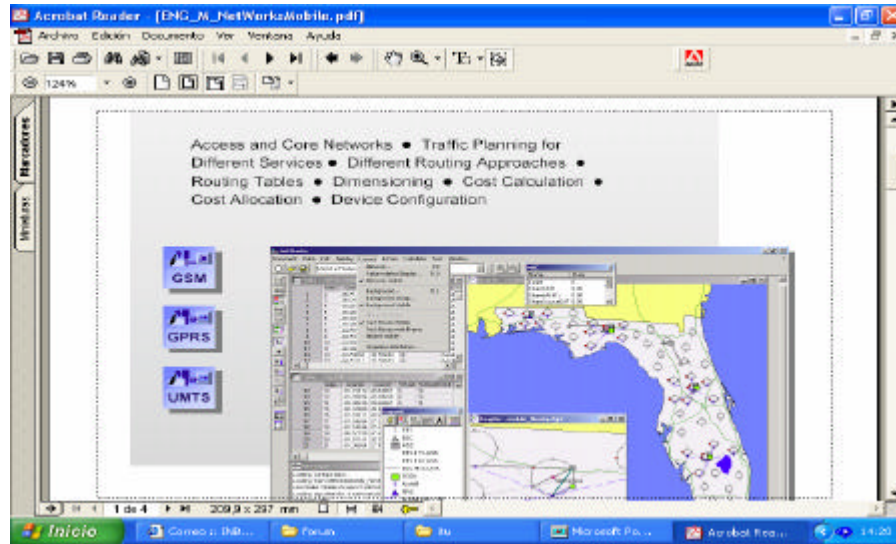
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## Network Planning Tools: NetWORKS



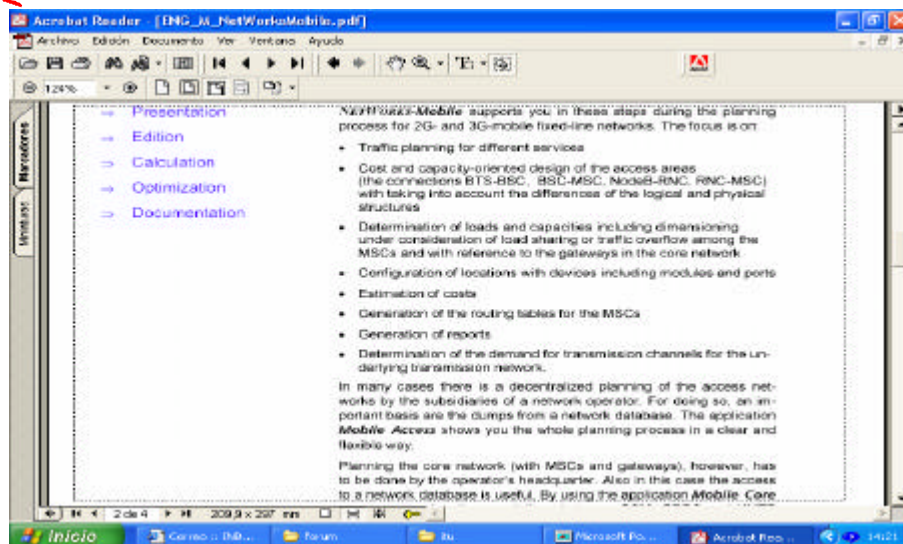
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## Network Planning Tools: NetWORKS



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## Network Planning Tools: NetWORKS

Network Model

The complex network model used in NetWORKS-Mobile comprises three vertical layers, the upper one of which is divided again into three horizontal layers. The upper layer uses the technical resources of the lower layer.

The diagram illustrates a three-layer network model. The top layer consists of three boxes labeled GSM, GPRS, and UMTS. Below these is a box labeled FR / IP / ATM, with a note 'in 3G-R3' below it. The bottom layer is a box labeled PDH / SDH / WDM. Bidirectional arrows connect GSM to FR/IP/ATM, and GPRS to FR/IP/ATM. Unidirectional arrows point from FR/IP/ATM to PDH/SDH/WDM. Bidirectional arrows also connect UMTS to FR/IP/ATM.

Due to the high complexity of 2G/3G-mobile fixed-line networks, there are many different groups of objects (nodes, edges, relations, paths, sets, meta-data) in the layers. The following picture is an example for showing the connection of the nodes of the 2G/3G-access network to the core network in the MOBILE layer. The majority of these nodes rest on underlying FR, IP or ATM nodes (terminals, routers, switches) and SDH nodes (terminals, multiplexers).

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## Network Planning Tools: NetWORKS

and SDH nodes (terminals, multiplexers).

The diagram shows a detailed network architecture. On the left, 'Erlang Traffic' enters through a 'BTS' (Base Transceiver Station) connected to a 'BSC' (Base Station Controller). The BSC is connected to a 'MSC/VLR' (Mobile Switching Center / Visitor Location Register) via an 'A' interface. The MSC/VLR is connected to a 'GSM / GPRS Core Network' via an '(SST) Gs' interface. The Core Network is connected to an 'RNC' (Radio Network Controller) via an 'Iu(CS)' interface. The RNC is connected to 'NodeB' (Base Station) via an 'Iur' interface. The Core Network is also connected to an 'SGSN/VLR' (Serving GPRS Support Network / Visitor Location Register) via an '(IP) Gb' interface. The SGSN/VLR is connected to the RNC via an '(AAL5 / ATM) Iu(PS)' interface. The RNC is also connected to another 'NodeB' via an '(AAL2 / ATM) Iub' interface. There are also connections from the Core Network to the RNC via '(AAL2 / ATM) Iu(CS)' and '(AAL5 / ATM) Iu(PS)' interfaces. Below the diagram are icons for 'ATM' and 'SDH'.

For GSM and GPRS there are separate structures in the core network. The UMTS traffic is also handled in 3G-R3 over them. The network model already provides object groups for a UMTS core network based on packet switching. This enables to do strategic calculations for the medium-term planning.

Additionally, there are several functionalities of NetWORKS-ATM and NetWORKS-trans made available by the integration of appropriate planning modules.

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## Network Planning Tools: NetWORKS

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**NETWORKS - ATM**

for the Planning of Networks with ATM Technology

Traffic Planning • Network Design • Capacity Planning • Cost Calculation • Cost Allocation • Documentation of Allocation (VCI, VPI) • Device Configuration

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→ Presentation

→ Edition

→ Calculation

→ Optimization

→ Documentation

**NETWORKS-ATM** supports you in doing these steps during the planning process for ATM technology networks. The focus is on

- Displaying different services relying on ATM and describing them with traffic parameters.
- Finding appropriate network topologies.
- Determining the required resources in case of a given QoS.
- Defining routing strategies, addressing schemes and network levels.
- Assigning identifiers for VC (virtual channels) and VP (virtual paths).
- Configuring the ATM network elements (switches).

**Network Model and Planning Ways**

The network model defines an ATM layer which can be related to adjacent layers. There are three phases of the planning process with NETWORKS-ATM

Design

With taking into account the device locations, the transmission secti-

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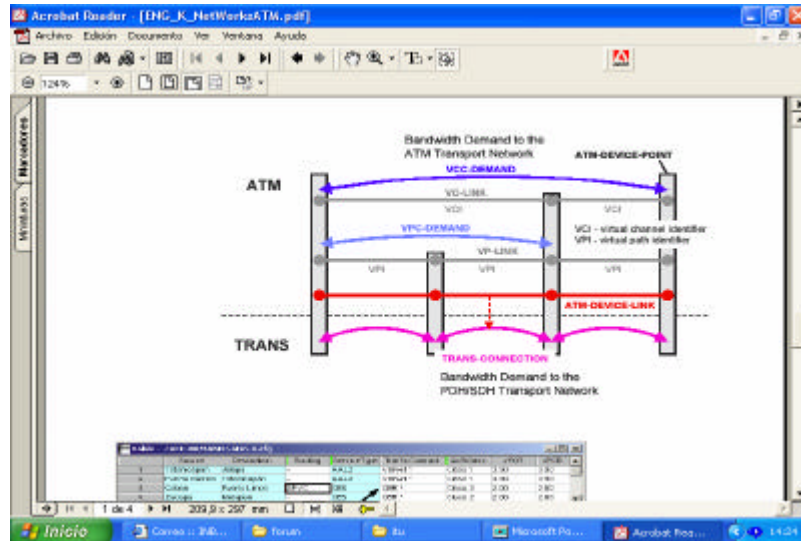
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## Network Planning Tools: NetWORKS

**Algorithms and other Application Functions**

Many application functions of NetWORKS-ATM are algorithms which you can setup to and run on your given model. This enables you to follow your individual planning line according to your specific planning task.

NetWORKS-ATM also extends the graphical and tabular functions considerably. Some typical application functions are:

- Planning of ATM traffic contracts (see dialog example)
- Definition of the routing in specific routing dialogs for each individual VCC or VPC
- Tracing the allocation of the physical containers and displaying their utilization
- PNMI configuration
- Device catalog and configuration view for the nodes
- Customized import and export filters for the coupling with databases.

Display of utilization of a physical link (ATM-DEVICE-LINK) by VCC and VPC

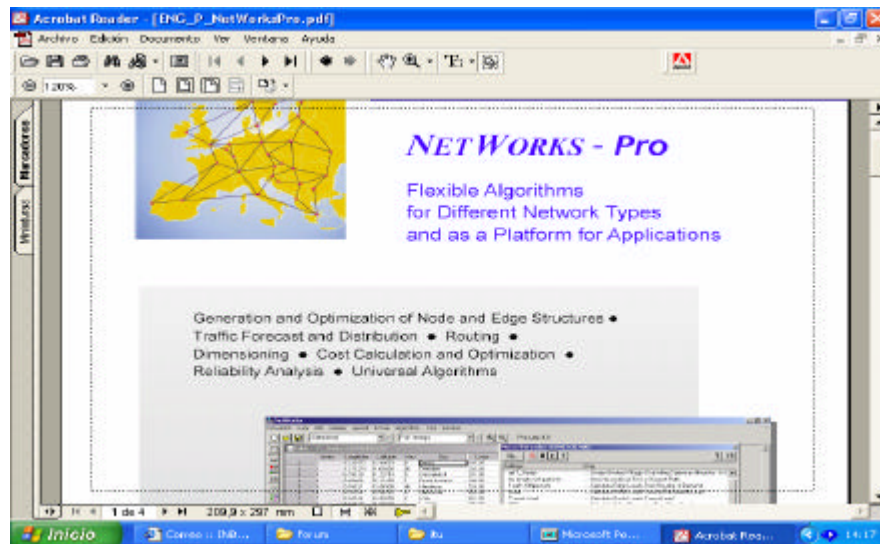
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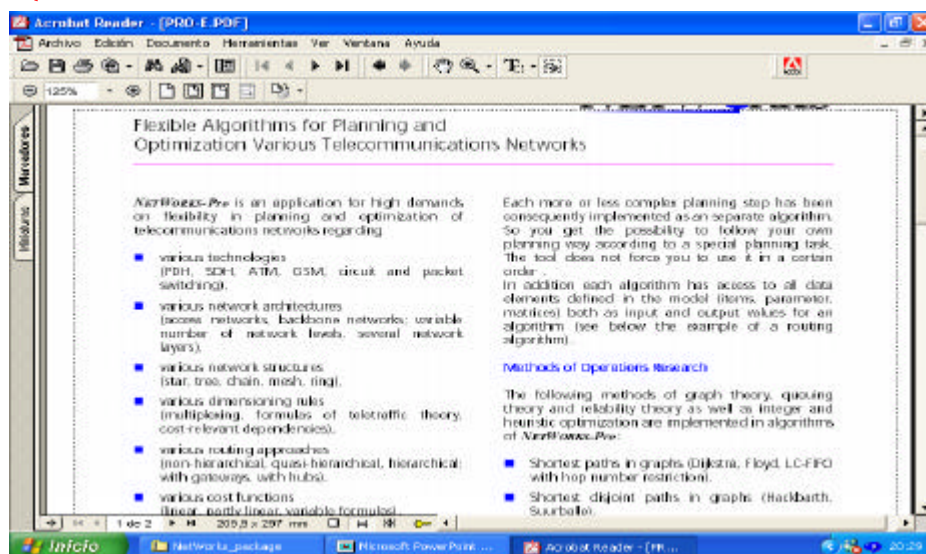
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## Network Planning Tools: NetWORKS



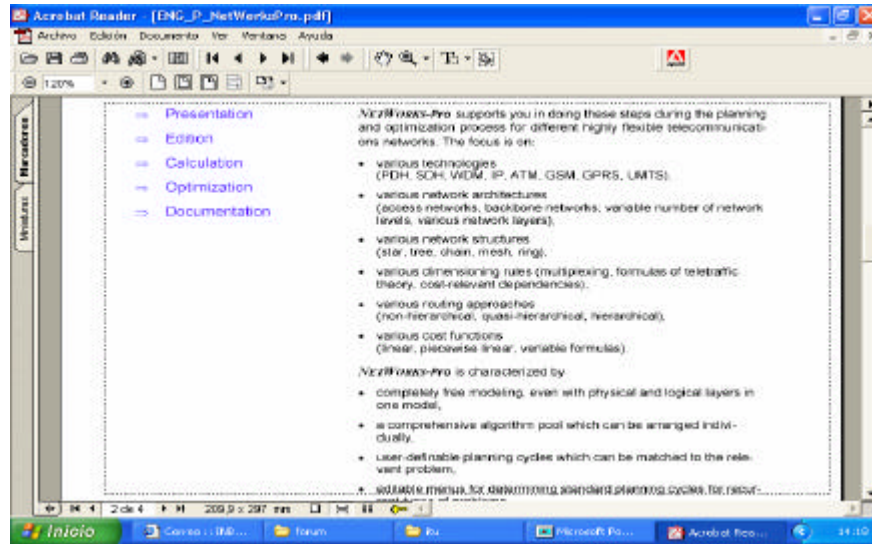
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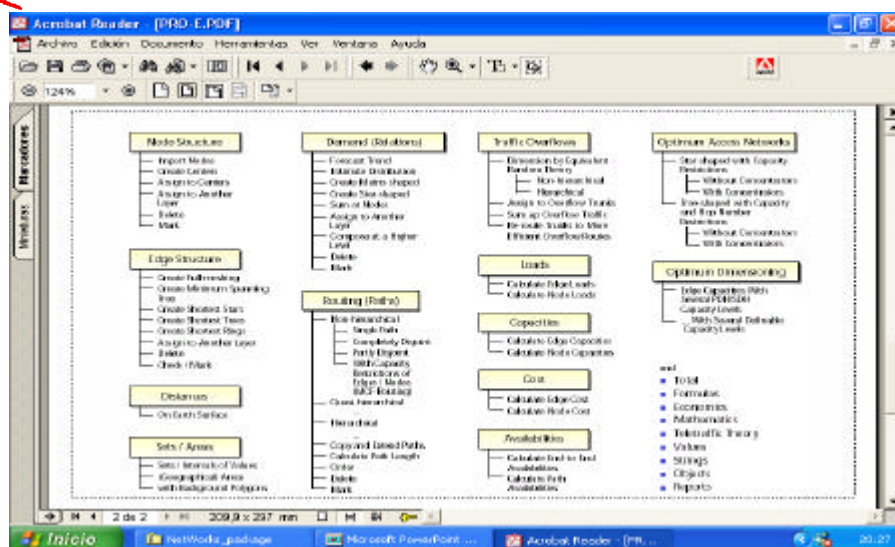
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# Network Planning Tools: NetWORKS



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## Network Planning Tools: NetWORKS

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