# ITU / BDT- COE workshop

**Bangkok, Thailand,**

**11 – 15 November 2002**

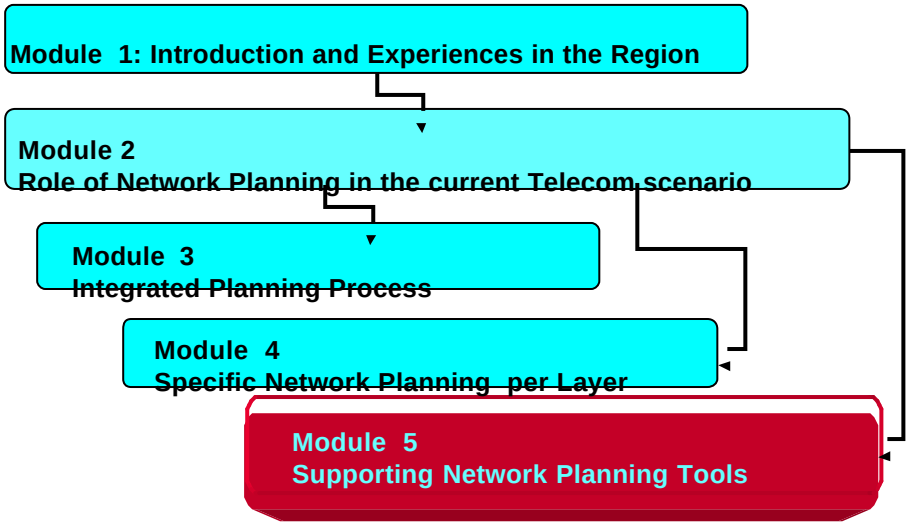
# Network Planning

## Lecture NP- 5.3

## Supporting Network Planning Tools



# BDT - COE workshop on Network Planning

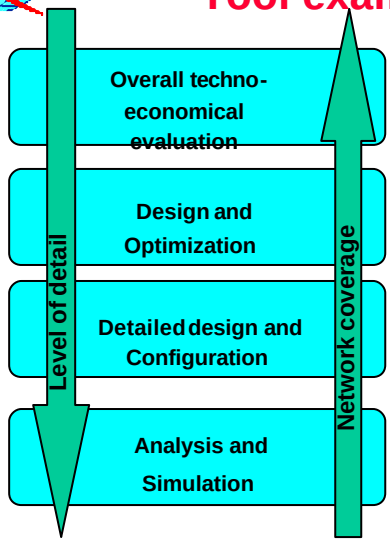


# Content Chapter 5.3
# Network Planning Tools

- 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




STEM, Excel applications

Planitu, NetWORKS-Trans, NetWORKS-Switch, VPI-Maker, NetQUAD, CHIRplus

VPI-Configurator, NetWORKS - Pro, CIRCEE

OPNET,COMNET, SPECTRA

# Network Planning Tools: NetWORKS

Telecom Network Planning

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

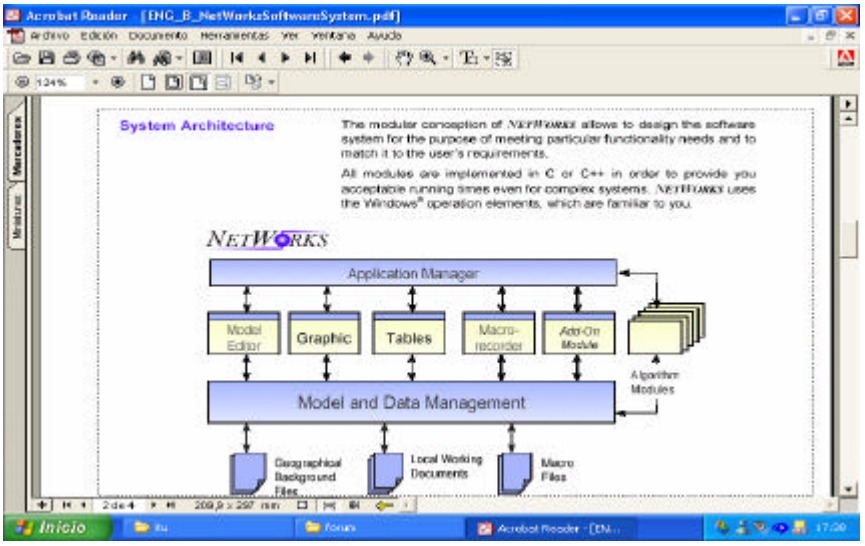


# Network Planning Tools: NetWORKS

Telecom Network Planning

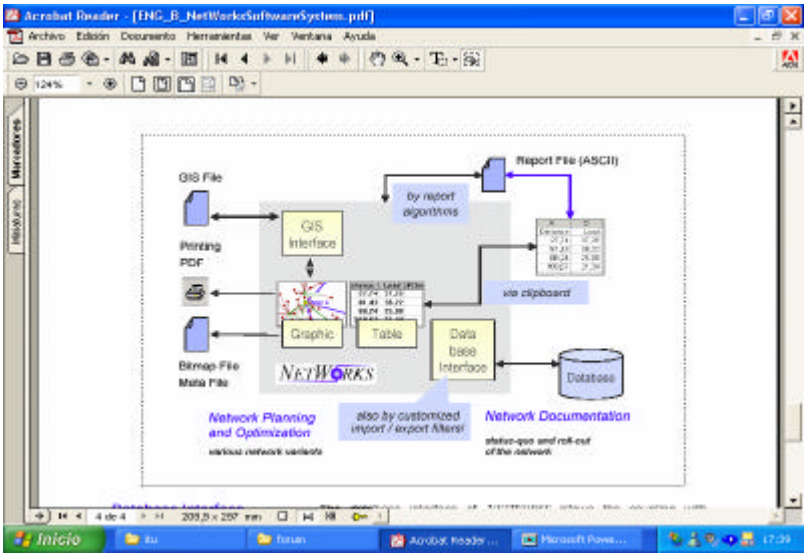
**Objective : NetWORKS is a Telecom network planning tool to design, optimize and dimension several network layers as: Switching, Transmission, Cable, Mobile, etc.**

# Network Planning Tools: NetWORKS

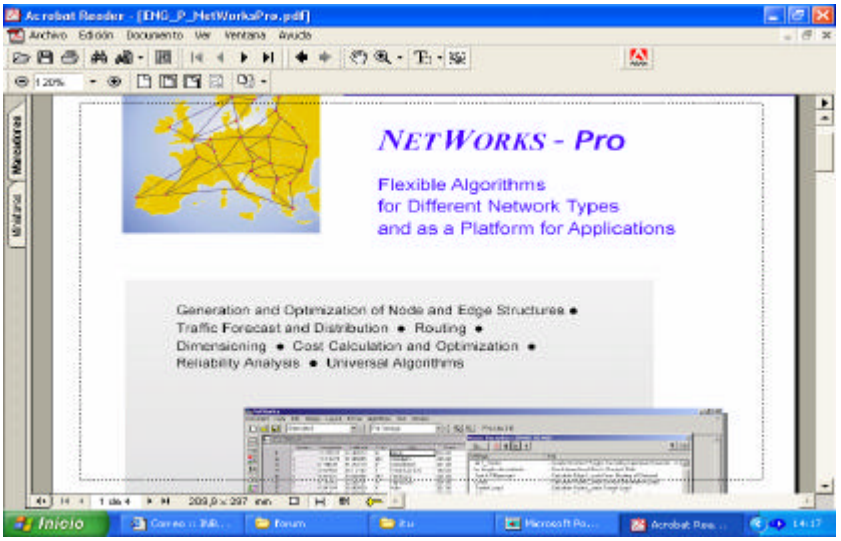





# Network Planning Tools: NetWORKS

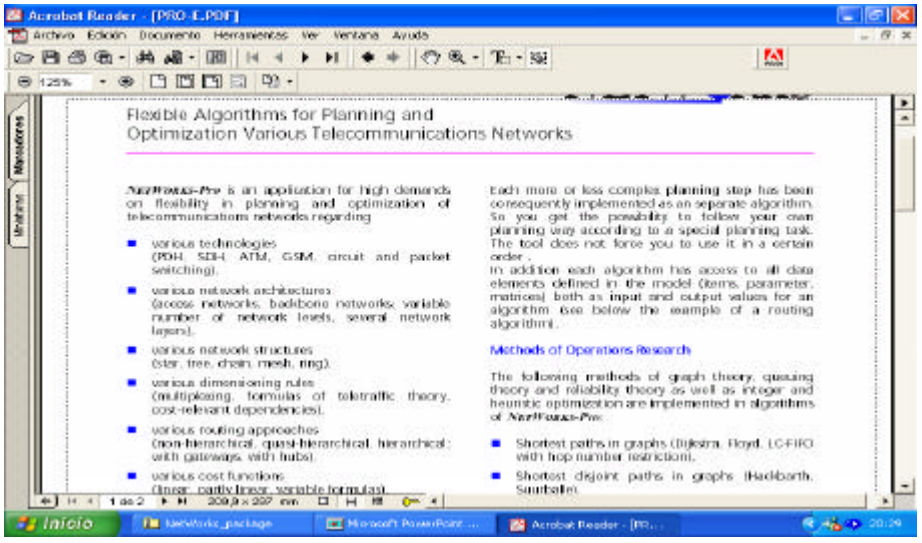


# Network Planning Tools: NetWORKS

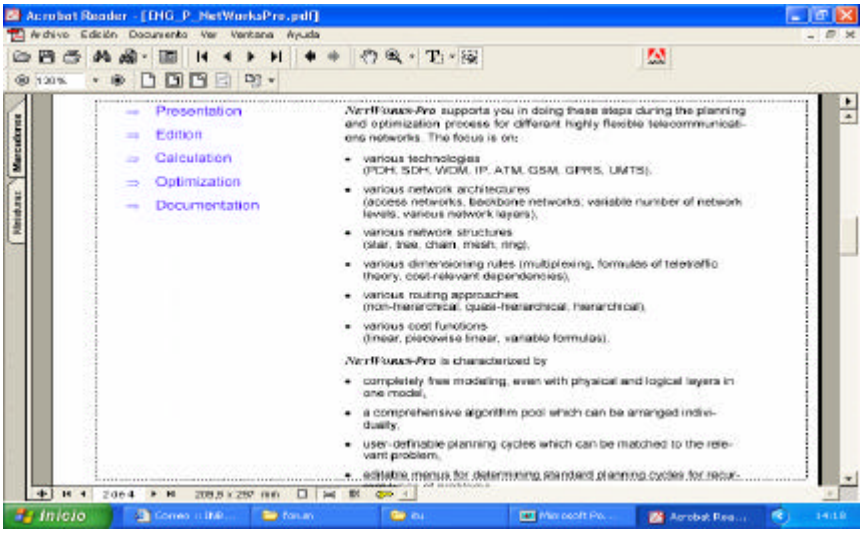





# Network Planning Tools: NetWORKS

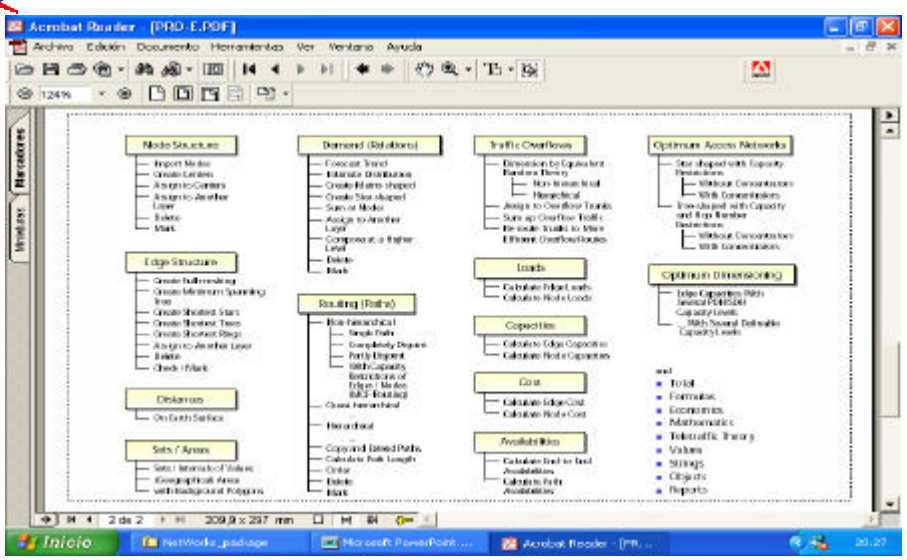


# Network Planning Tools: NetWORKS

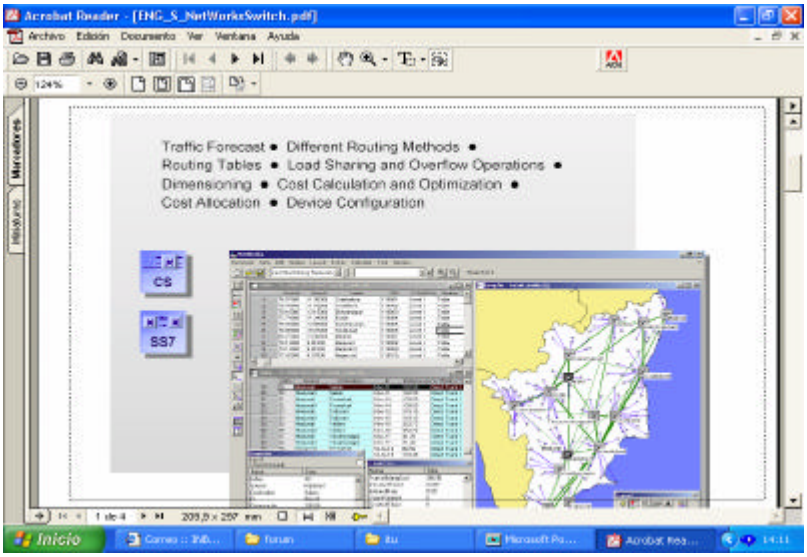





# Network Planning Tools: NetWORKS

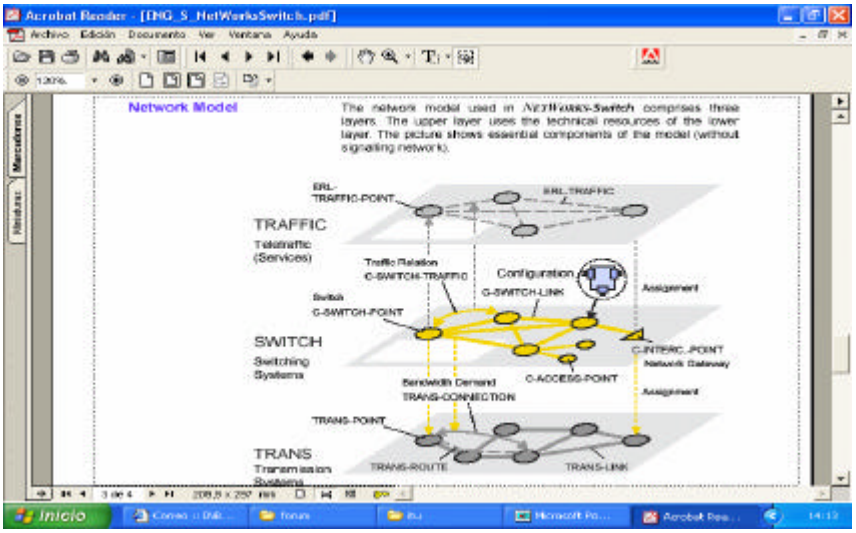


# Network Planning Tools: NetWORKS

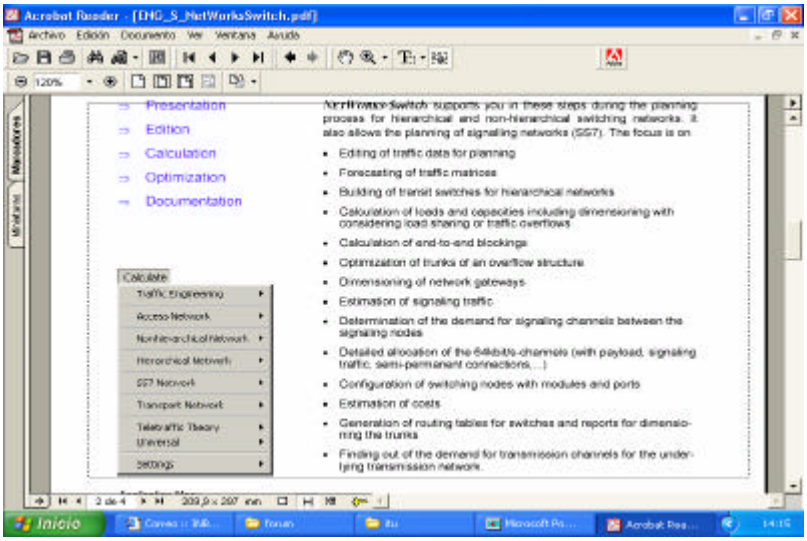





# Network Planning Tools: NetWORKS

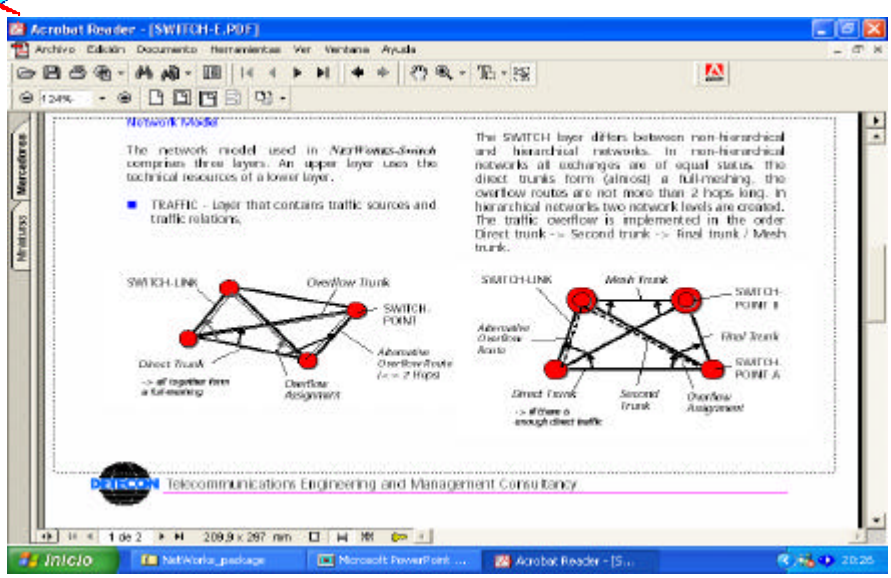


# Network Planning Tools: NetWORKS

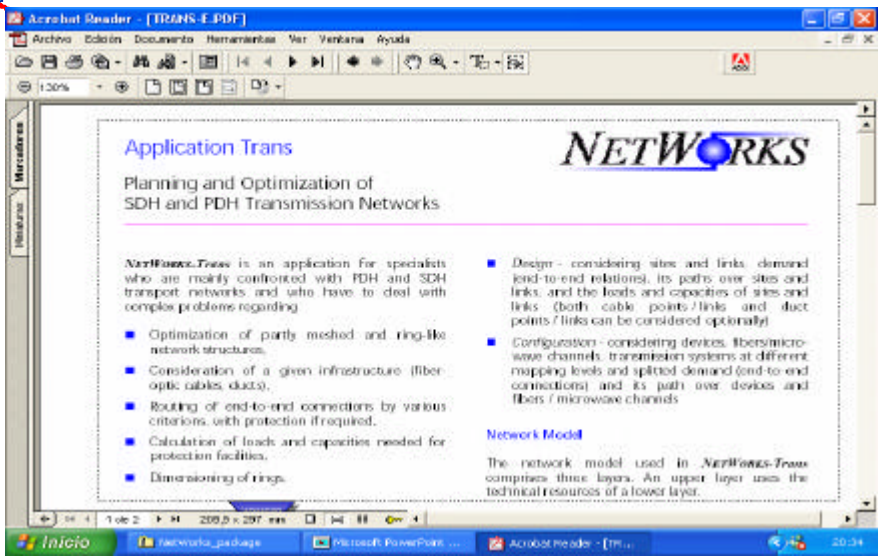





# Network Planning Tools: NetWORKS

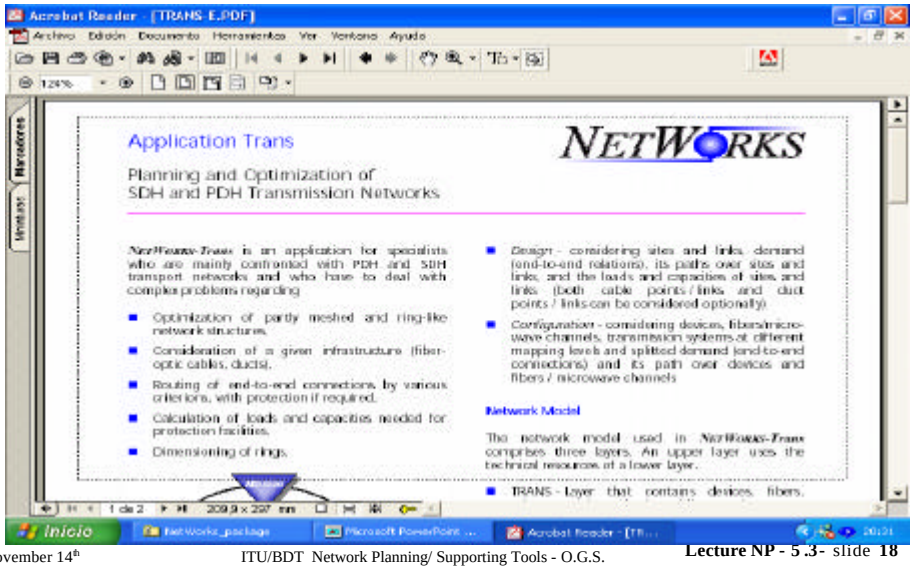


# Network Planning Tools: NetWORKS

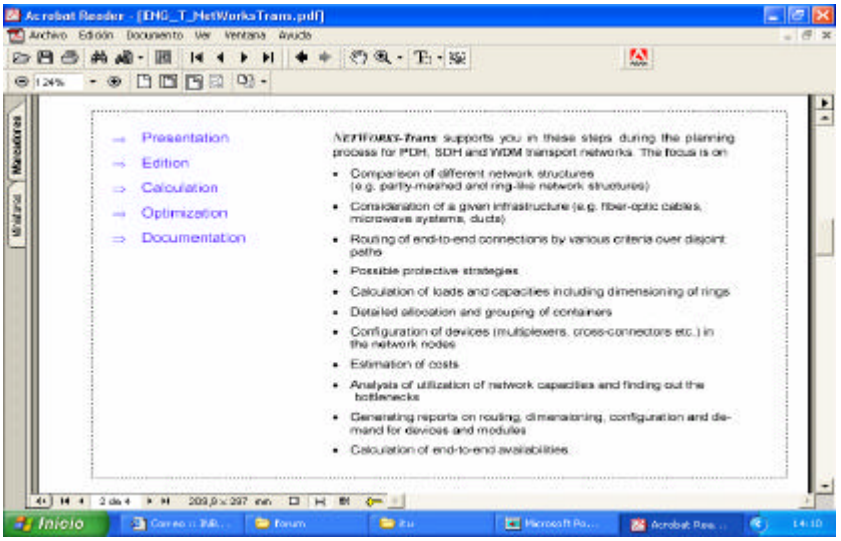





# Network Planning Tools: NetWORKS

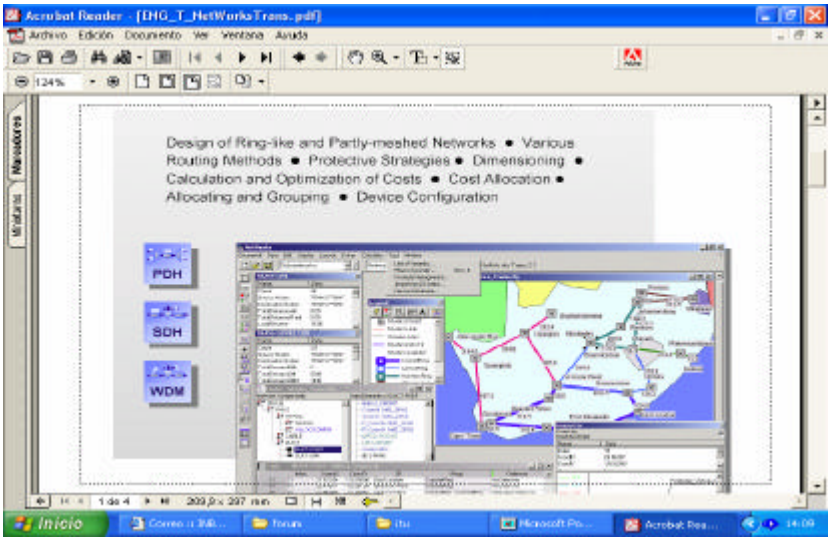


# Network Planning Tools: NetWORKS

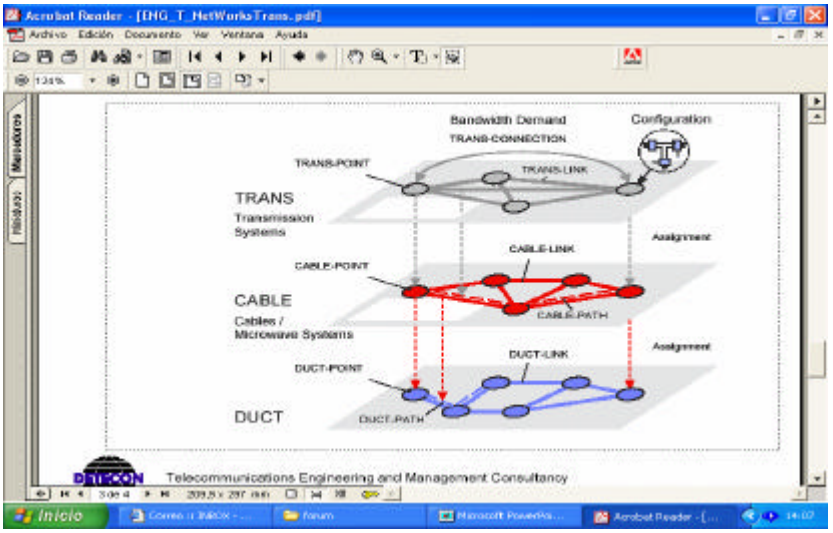





# Network Planning Tools: NetWORKS

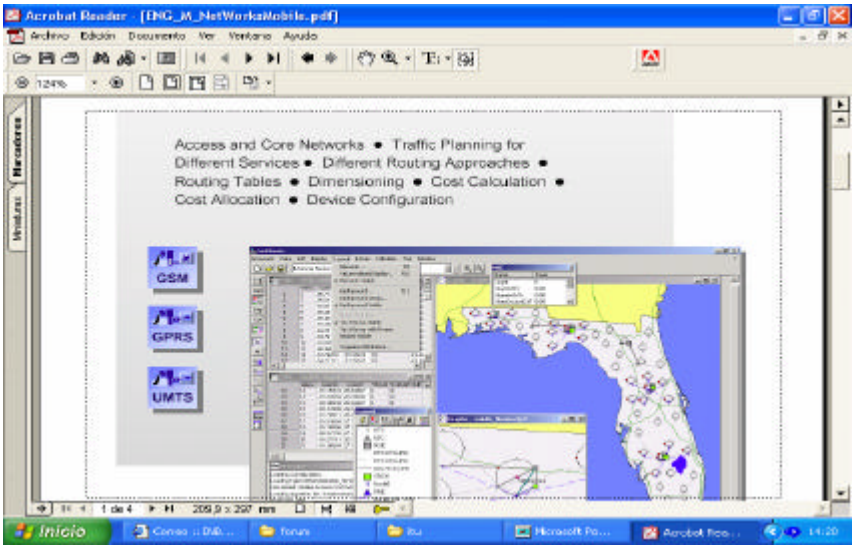


# Network Planning Tools: NetWORKS

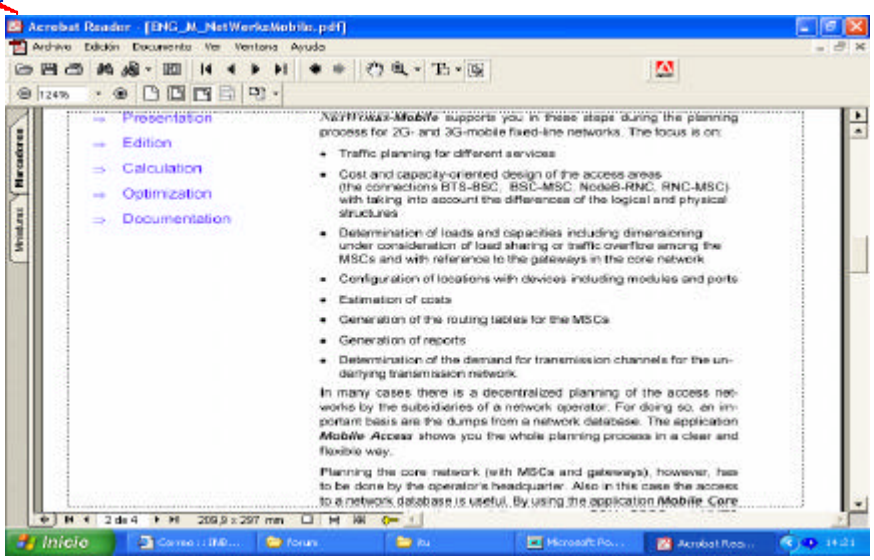





# Network Planning Tools: NetWORKS

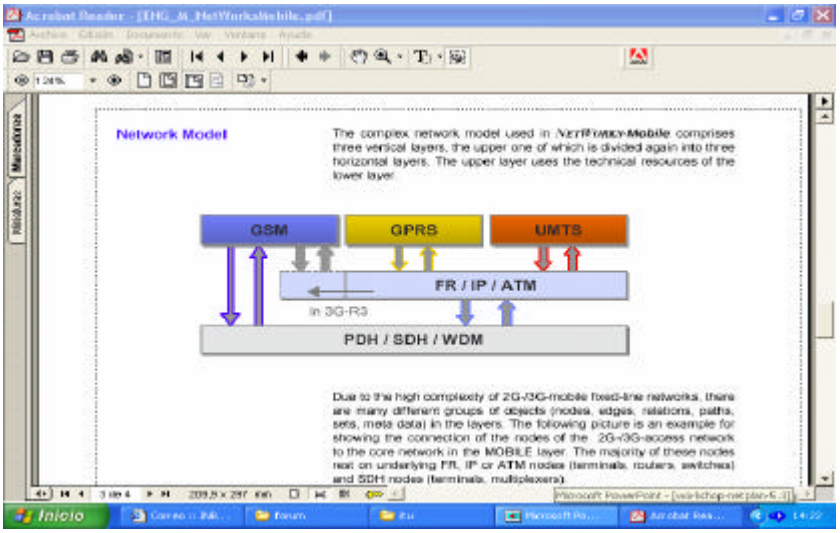


# Network Planning Tools: NetWORKS

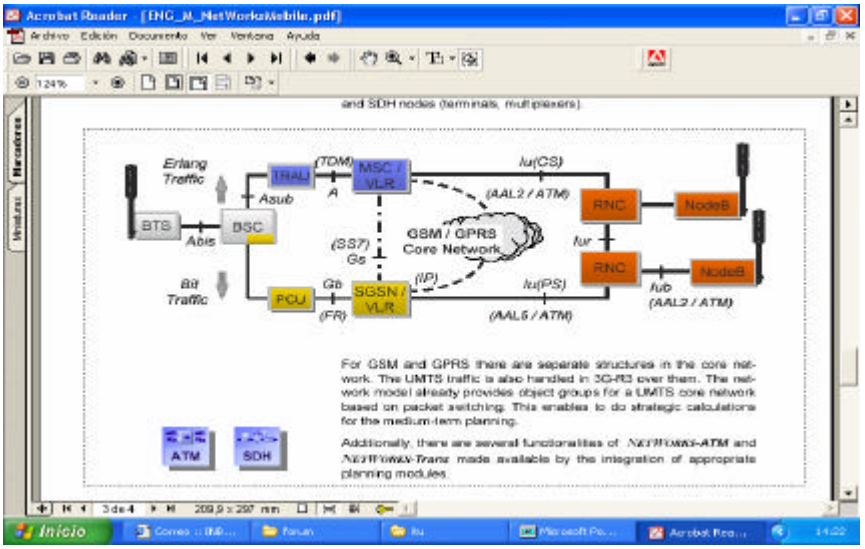





# Network Planning Tools: NetWORKS

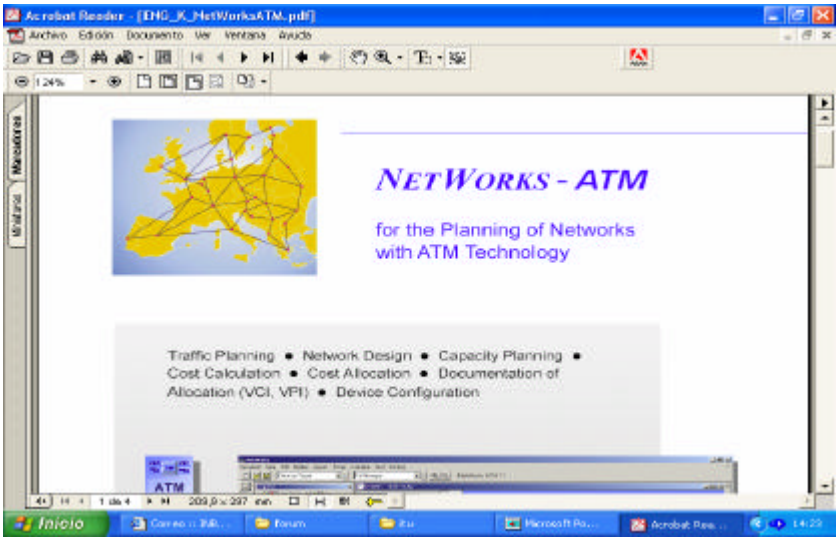


# Network Planning Tools: NetWORKS

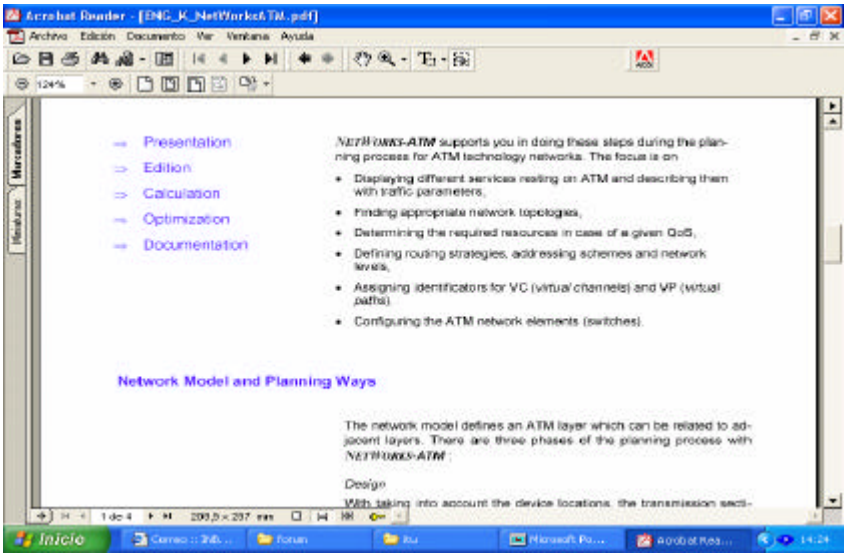





# Network Planning Tools: NetWORKS

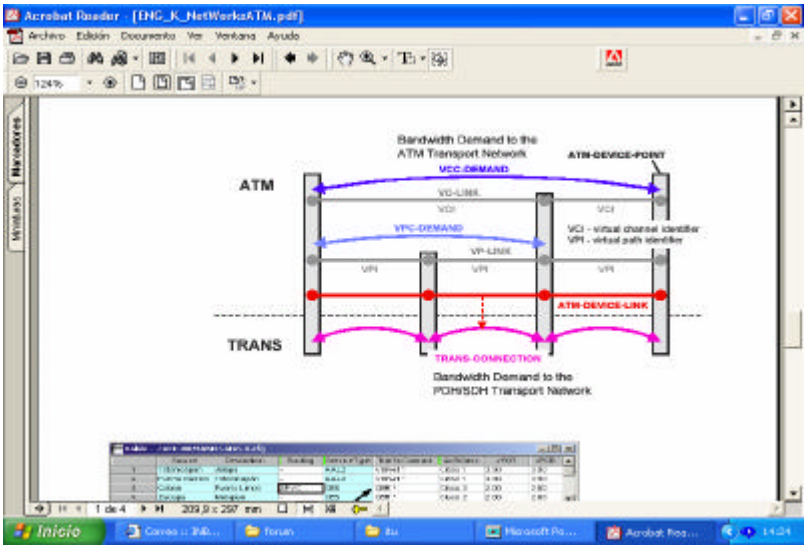


# Network Planning Tools: NetWORKS

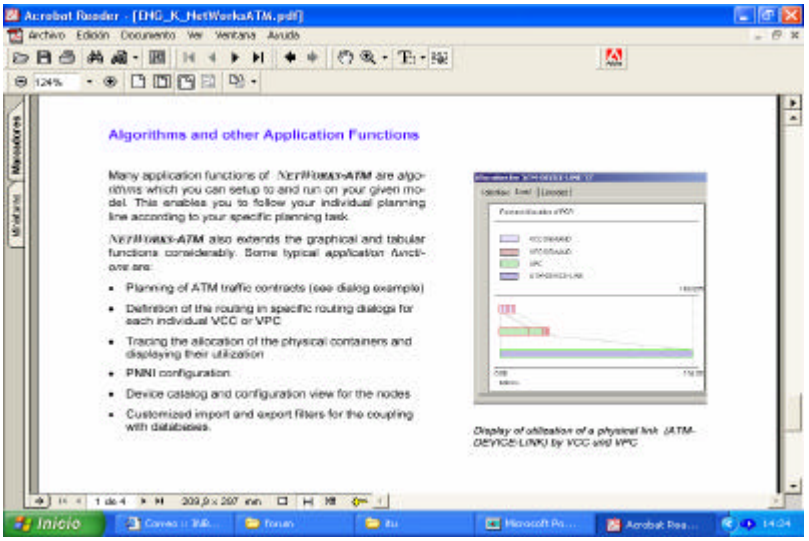





# Network Planning Tools: NetWORKS



# Network Planning Tools: NetWORKS





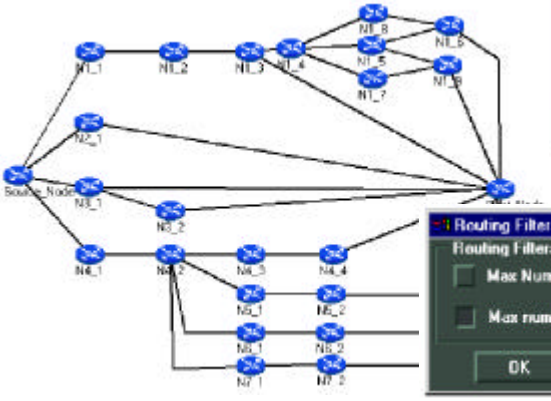

# Network Planning Tools: NetQuad

**Telecom Network Planning**

**Objective : NetQuad is a Telecom network planning tool to design, optimize and dimension several network layers as: PSTN, Transmission, ATM, IP**

# Network Planning Tools: NetQuad Telephony

- Local/transit exchanges
- Traffic point to point (import for more complex affinity method)
- Routing can be computed or forced








# Network Planning Tools: NetQuad Telephony Results

**Routing Table**

| Node Name | Traffic Source | Traffic Destination | Route Number | Traffic Type | Next Node Name | Share | Next Node Name | Share | Next Node Name | Share |
|---|---|---|---|---|---|---|---|---|---|---|
| Source_Node | Source_Node | Dest_Node | T1 | 1 | N2_1 | 0.50 | N3_1 | 0.50 | | |
| Source_Node | Source_Node | Dest_Node | T1 | 2 | N1_1 | 1.00 | | | | |
| N1_1 | Source_Node | Dest_Node | T1 | 1 | N1_2 | 1.00 | | | | |
| N1_2 | Source_Node | Dest_Node | T1 | 1 | N1_3 | 1.00 | | | | |
| N2_1 | Dest_Node | Source_Node | T1 | 1 | Source_Node | 1.00 | | | | |
| N2_1 | Source_Node | Dest_Node | T1 | 1 | Dest_Node | 1.00 | | | | |
| N3_1 | Dest_Node | Source_Node | T1 | 1 | Source_Node | 1.00 | | | | |
| N3_1 | Source_Node | Dest_Node | T1 | 1 | Dest_Node | 1.00 | | | | |
| N3_1 | Source_Node | Dest_Node | T1 | 2 | N3_2 | 1.00 | | | | |
| N3_2 | Dest_Node | Source_Node | T1 | 1 | N3_1 | 1.00 | | | | |
| N3_2 | Source_Node | Dest_Node | T1 | 1 | Dest_Node | 1.00 | | | | |
| N1_3 | Source_Node | Dest_Node | T1 | 1 | Dest_Node | 1.00 | | | | |
| N1_3 | Source_Node | Dest_Node | T1 | 2 | N1_4 | 1.00 | | | | |
| N1_4 | Source_Node | Dest_Node | T1 | 1 | N1_3 | 1.00 | | | | |
| N1_4 | Source_Node | Dest_Node | T1 | 2 | N1_5 | 0.33 | N1_8 | 0.33 | N1_7 | 0.33 |
| N1_8 | Source_Node | Dest_Node | T1 | 1 | N1_8 | 1.00 | | | | |
| N1_5 | Source_Node | Dest_Node | T1 | 1 | N1_8 | 0.50 | N1_9 | 0.50 | | |
| N1_7 | Source_Node | Dest_Node | T1 | 1 | N1_9 | 1.00 | | | | |
| N1_6 | Source_Node | Dest_Node | T1 | 1 | Dest_Node | 1.00 | | | | |

- Lists for routes
  - Load-sharing
  - Overflow...

# Network Planning Tools: NetQuad Telephony Results

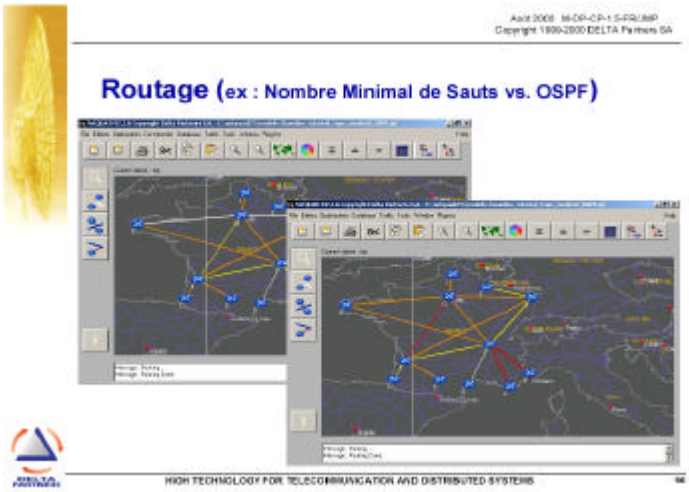
- PCM can be 24,30 or 31 circuits size
- Cartographic view with colours
- End to end loss as a result
- No failure simulation available

**Trunk's sizing report**

| Source.Site | Source.Node | Dest.Site | Dest.Node | Trunk | Min.Number.of.Circuits | Number.of.Circuits |
|---|---|---|---|---|---|---|
| top | Source_Node | top | N1_1 | Source_Node_N1_1 | 0 | 0 |
| top | Source_Node | top | N2_1 | Source_Node_N2_1 | 42 | 62 |
| top | Source_Node | top | N3_1 | Source_Node_N3_1 | 42 | 62 |
| top | Source_Node | top | N4_1 | Source_Node_N4_1 | 0 | 0 |
| top | N1_1 | top | N1_2 | N1_1_N1_2 | 0 | 0 |
| top | N1_2 | top | N1_3 | N1_2_N1_3 | 0 | 0 |
| top | N2_1 | top | Dest_Node | N2_1_Dest_Node | 42 | 62 |
| top | N3_1 | top | N3_2 | N3_1_N3_2 | 0 | 0 |
| top | N3_1 | top | Dest_Node | N3_1_Dest_Node | 42 | 62 |
| top | N4_1 | top | N4_2 | N4_1_N4_2 | 0 | 0 |



# Network Planning Tools: NetQuad IP



# Network Planning Tools: NetQuad IP



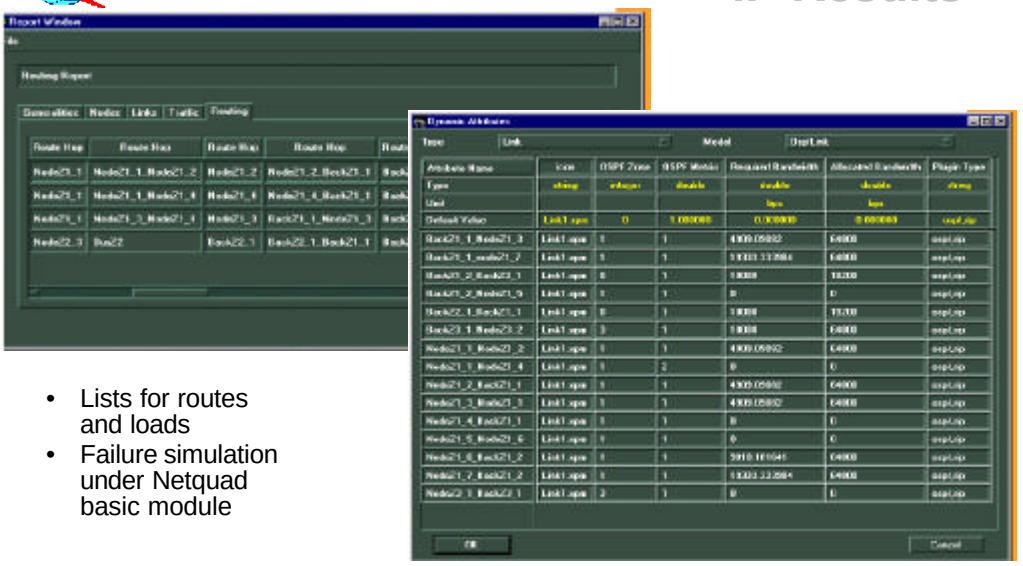
- Nodes types and links can be declared as fixed or can be changed on bandwidth needs
- Equipment library to be done



# Network Planning Tools: NetQuad IP


- Traffic input
  - Only one data can be introduced and generalised
  - Imply high memory capacity for storage and computing

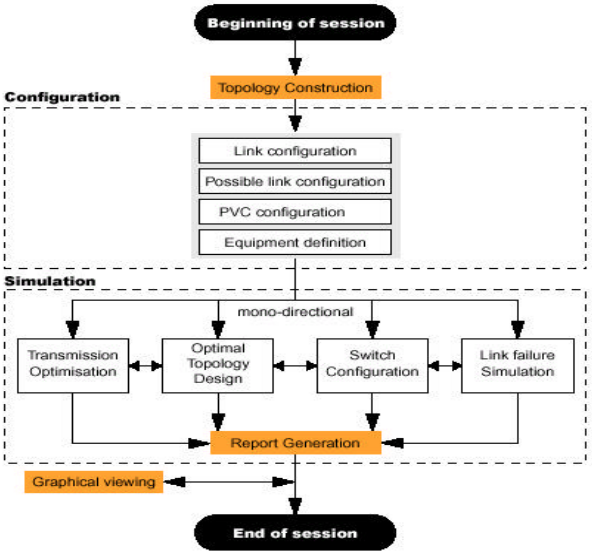
# Network Planning Tools: NetQuad IP Results



- Lists for routes and loads
- Failure simulation under Netquad basic module

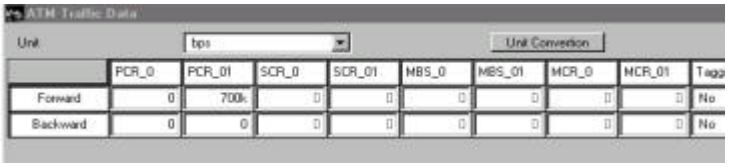


# Network Planning Tools: NetQuad ATM



# Network Planning Tools: NetQuad ATM

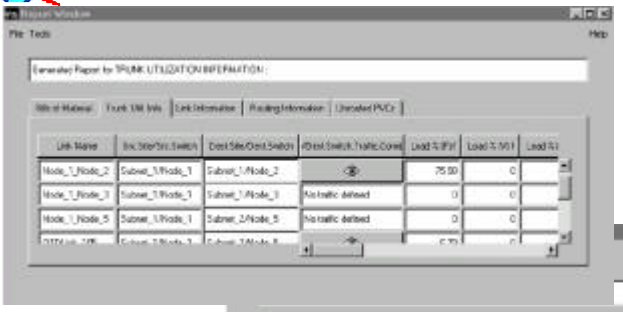
- Traffic per PVC basis can include PCR, SCR, UBR types…
- Equipment library to be done

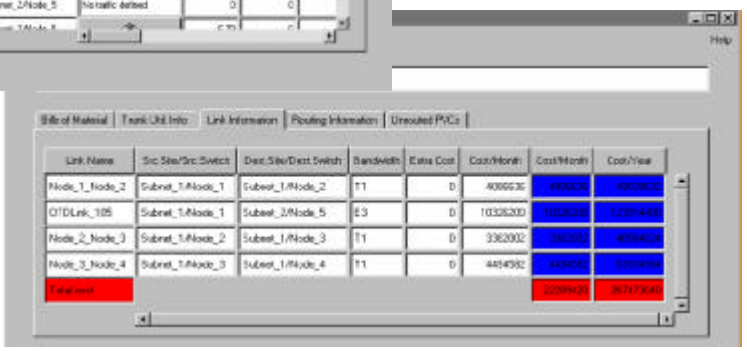




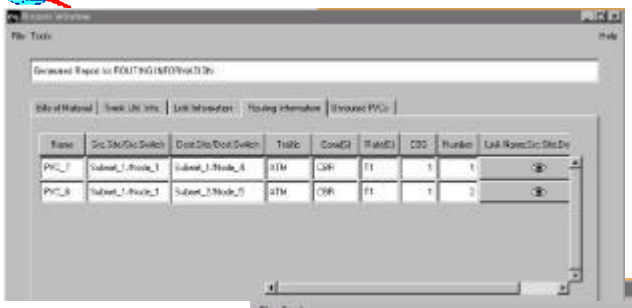

# Network Planning Tools: NetQuad ATM Results

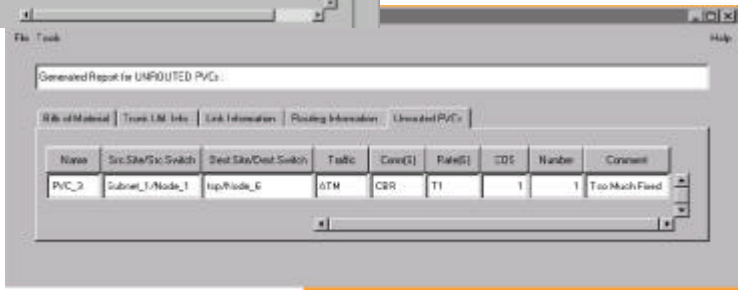
- Trunk utilisation and price





# Network Planning Tools: NetQuad ATM Results

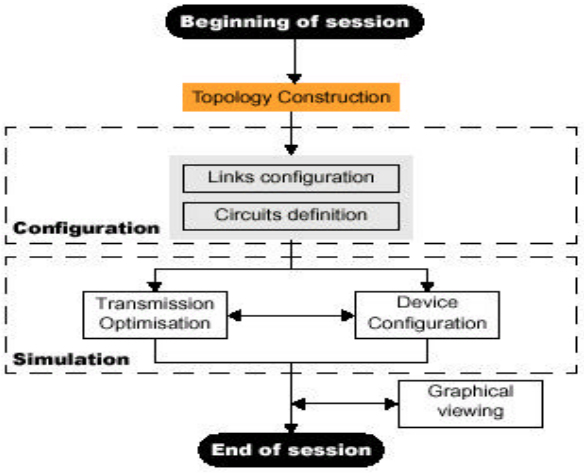




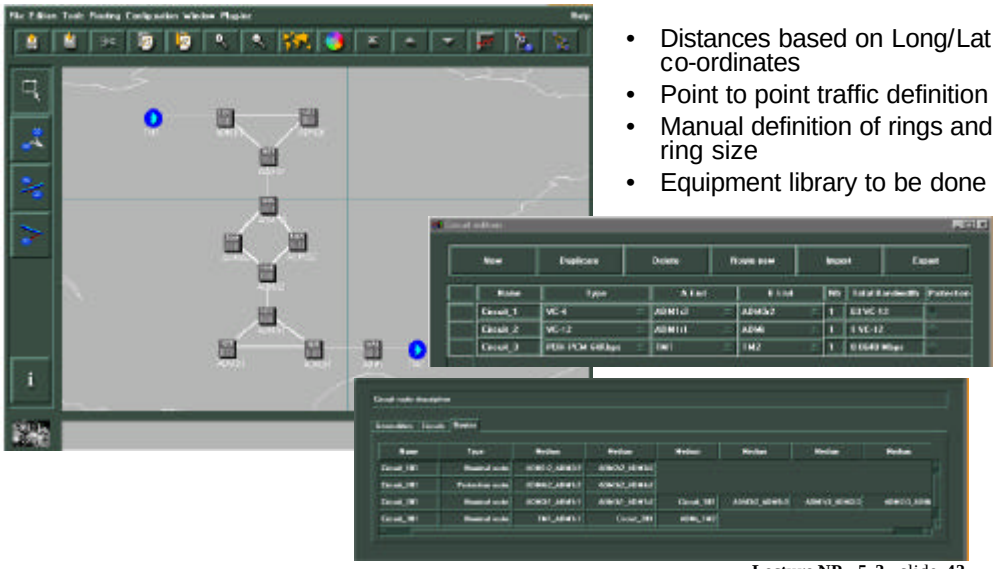

- Detailed routing or unrouted PVCs
  - New routing to be applied by the user or less constraint on the link size and node load
- Failure simulation available



# Network Planning Tools: NetQuad SDH



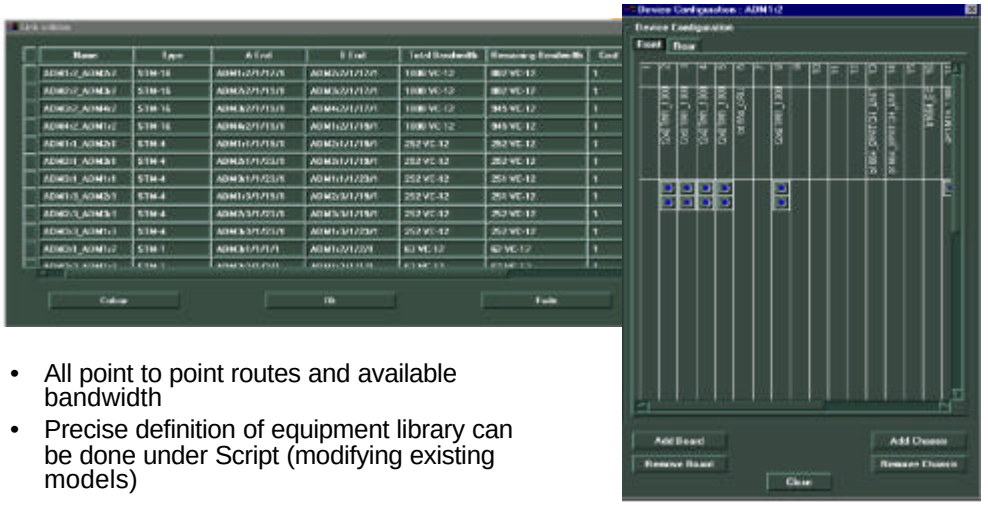
# Network Planning Tools: NetQuad SDH



- Distances based on Long/Lat co-ordinates
- Point to point traffic definition
- Manual definition of rings and ring size
- Equipment library to be done

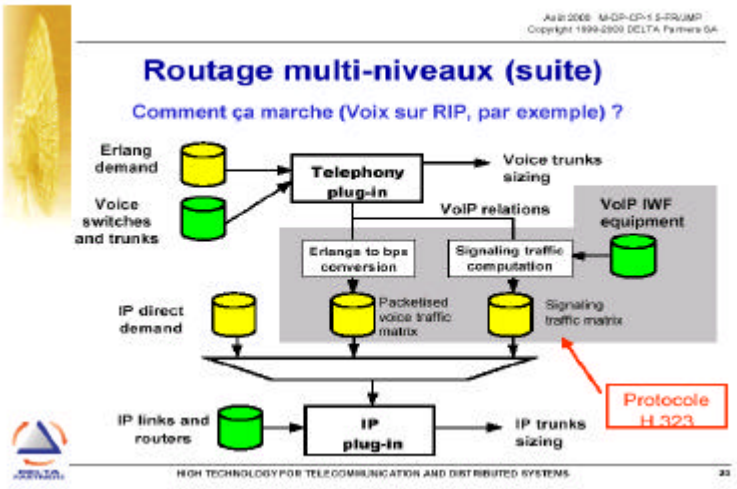


# Network Planning Tools: NetQuad SDH Results



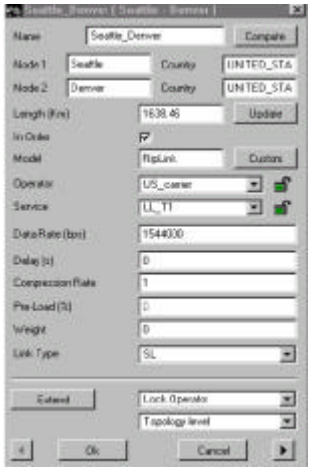
- All point to point routes and available bandwidth
- Precise definition of equipment library can be done under Script (modifying existing models)

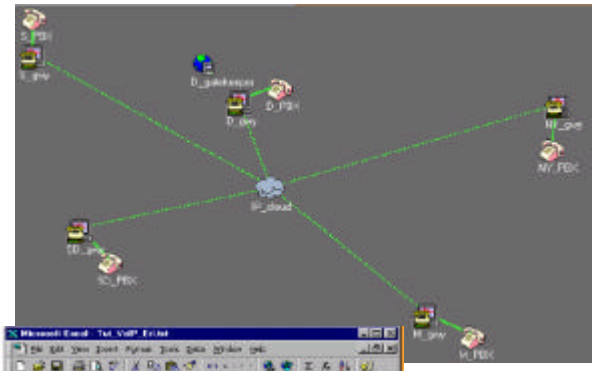
# Network Planning Tools: NetQuad VoIP

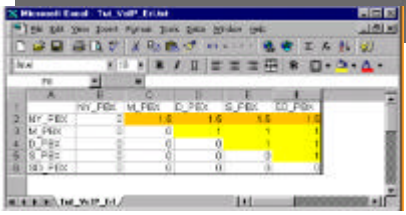





# Network Planning Tools: NetQuad VoIP



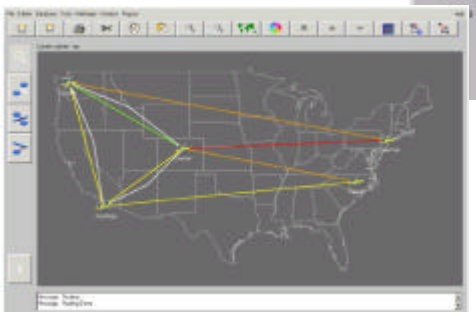


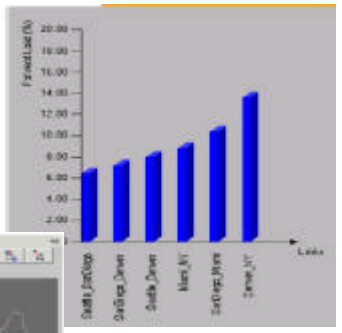


- Mixed of telephony and IP input

# Network Planning Tools: NetQuad VoIP


- Mixed of results using IP routing laws







# Network Planning Tools: NetQuad Script

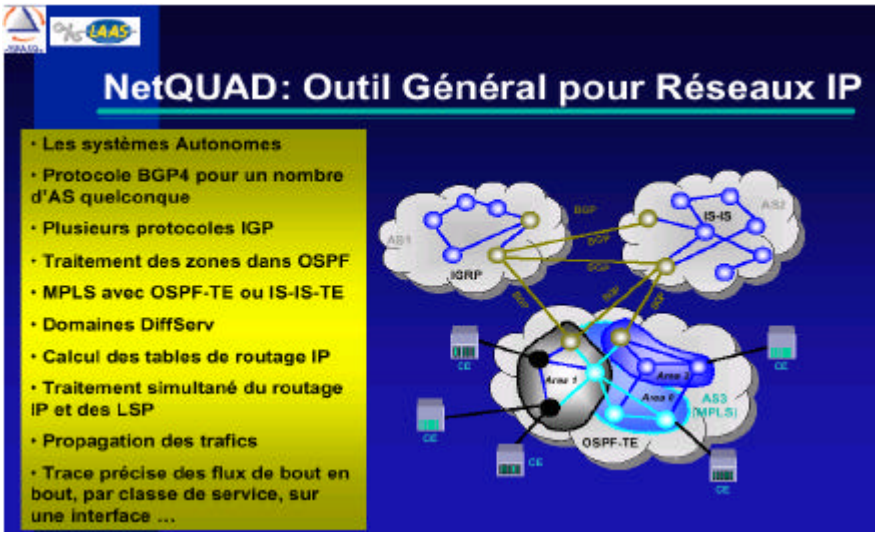
## Exemple de script
## Positionnement de routeurs OSPF

```
{
int i, void, NodeNumber;
string model;
string site[10];
double X_Pos[10], Y_Pos[10];

NQ_Topology France_Net;
NQ_Node NewNode;
NQ_GeoSubnet Hl_Dad;

NodeNumber = 11;

Hl_Dad = NQ_SearchGeoSubnetByName("top");

model = "ospfNode";

for (i=0; i<=NodeNumber; i = i+1)
{
NewNode = NQ_NewNode ( France_Net, Hl_Dad , site[i] , model , X_Pos[i] , Y_Pos[i]);
NewNode.country = "FRANCE";
NewNode.site = site[i];
}

void = NQ_RefreshTopology ();
```

HIGH TECHNOLOGY FOR TELECOMMUNICATION AND DISTRIBUTED SYSTEMS

- Based on C language
- Includes all attributes of the objects that can be found and enhanced in Netquad

# Dimensioning tool
# Netquad MPLS Phase 1






# Dimensioning tool
# Netquad MPLS Phase 2