

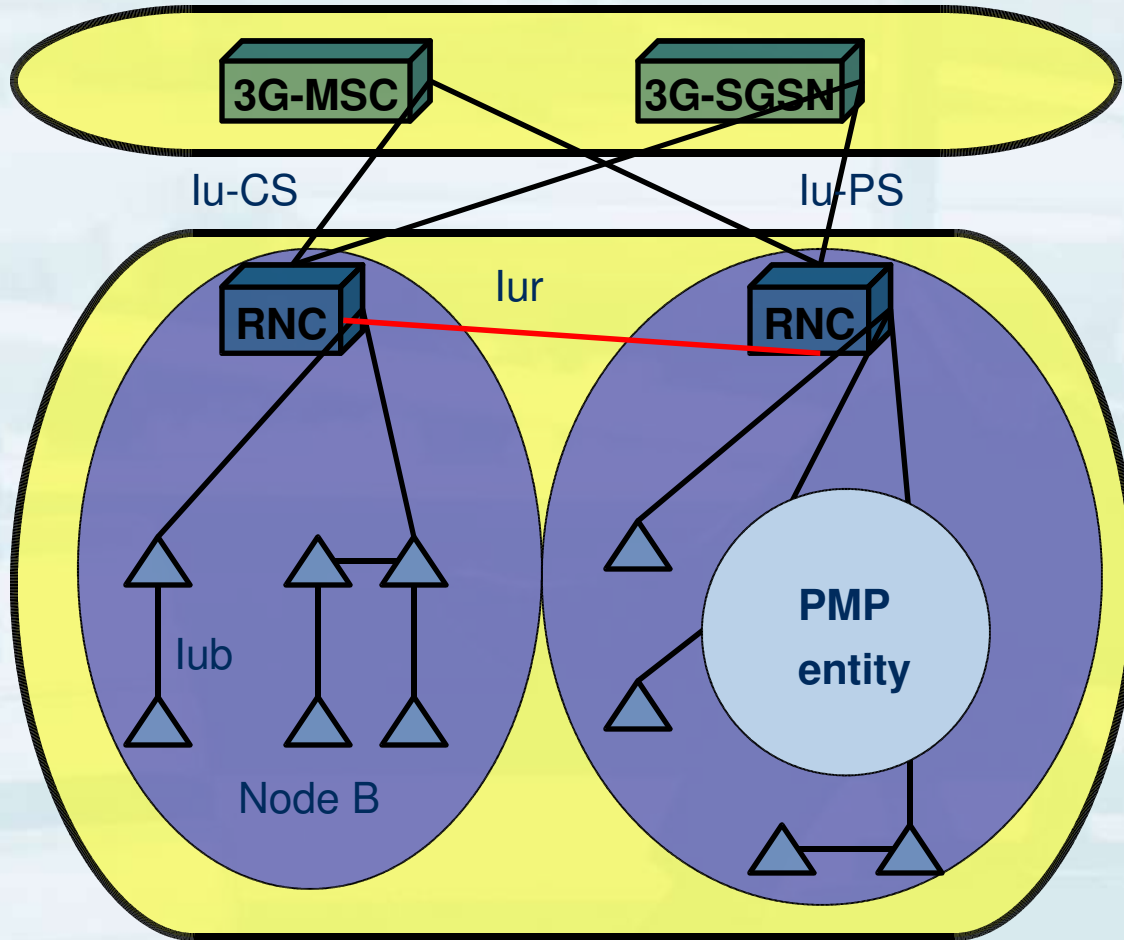


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Optimized UTRAN Topology Planning Including Point-to- Multipoint Equipment

J.Vossnacker, T.Winter, Siemens AG Berlin,
M.Gebala, M.Kutyłowski, B.Rozanski, M.Zawada,
Wrocław University of Technology

Network elements and logical topology in UTRAN



UMTS
radio access network
(UTRAN)

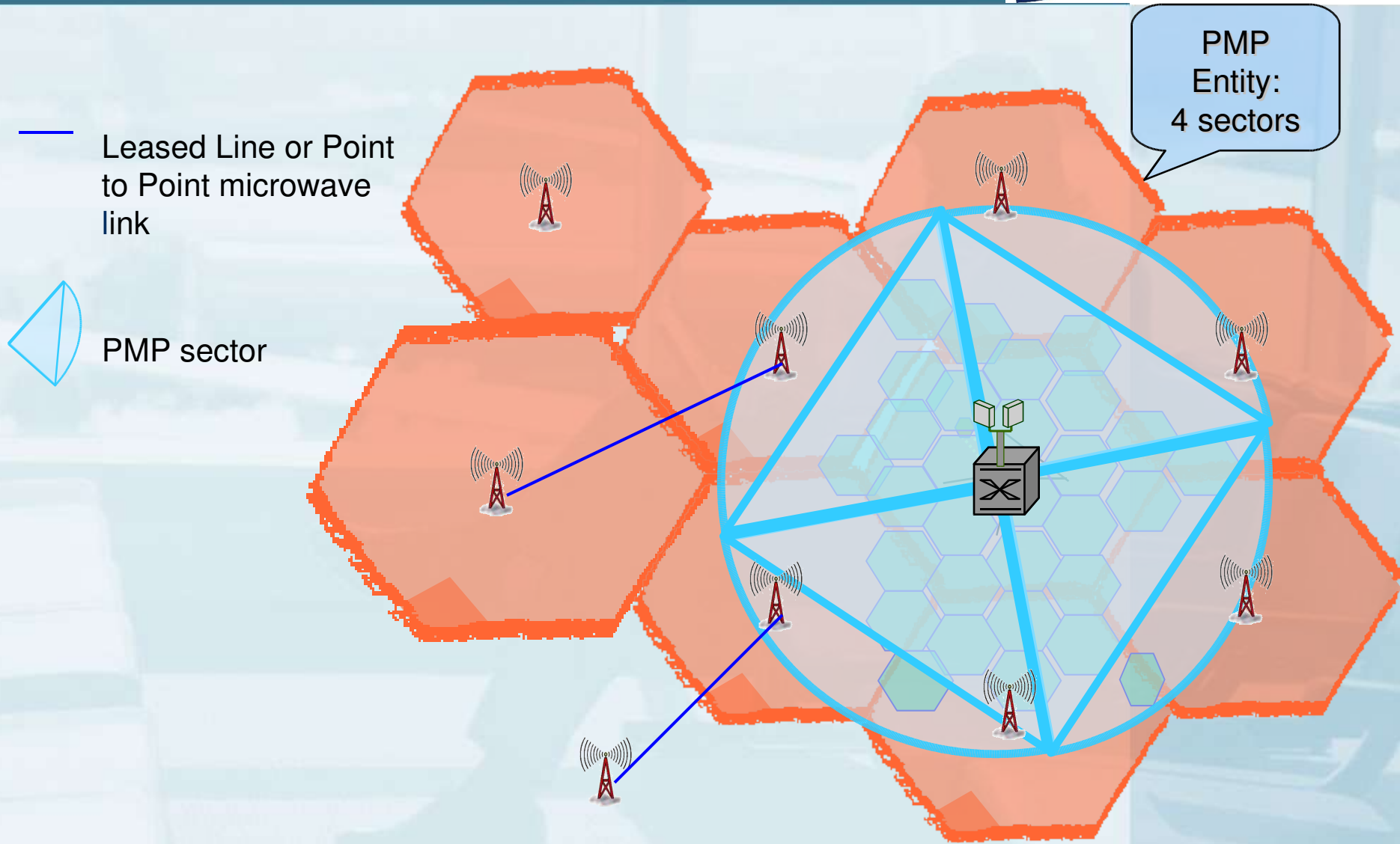
MSC =
Mobile Switching Center
(circuit oriented)

SGSN =
Serving GPRS Support Node
(packet oriented)

RNC =
Radio Network Controller

PMP entity =
Point to Multipoint Entity,
consisting of:
PMP Master Station,
Peripheral Stations and
connected Node Bs

Point to Multipoint Entity



■ Goal

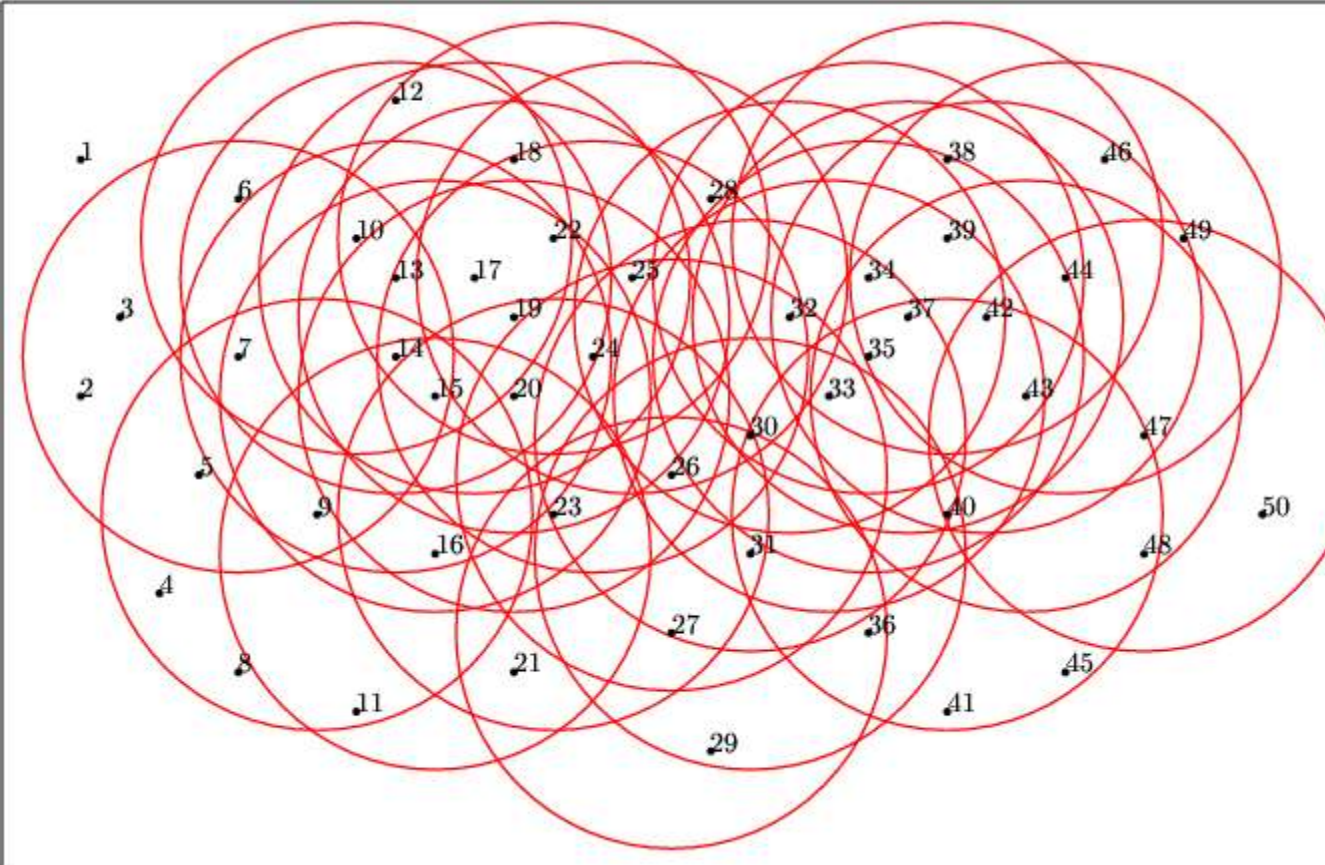
- Introduce PMP Equipment into UTRAN in order to reduce network costs

■ Algorithm Input

- UTRAN solution with pure leased lines and/or point-to-point microwave topology
- Set of optional PMP master station locations
- Costs (CAPEX and OPEX)
- Constraints (capacity, range, connectivity)

The Algorithm 2/4

Step 1: determine feasible PMP locations

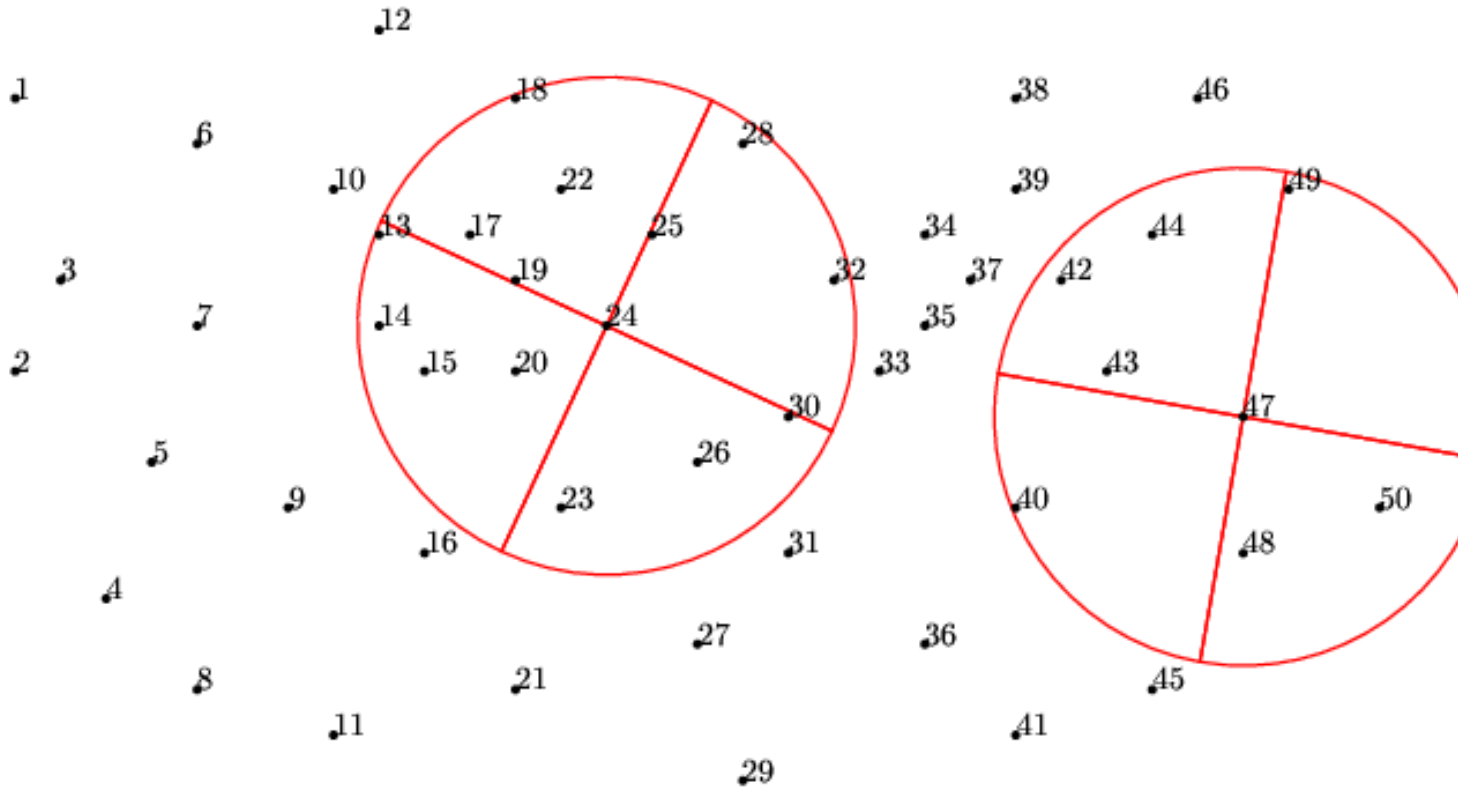


Result: Subset of PMP locations that:

- **satisfy constraints**
- **yield profit compared to point-to-point microwave and leased lines**
- **are partitioned into four sectors (not on the picture)**

The Algorithm 3/4

Step 2: Solve Weighted Independent Set Problem



Result: maximum non-overlapping collection of PMP entities

■ Step 3: build initial tree

- Connect PMP master stations to RNC
- Connect peripheral stations to PMP master stations

■ Step 4: add Node B to initial tree

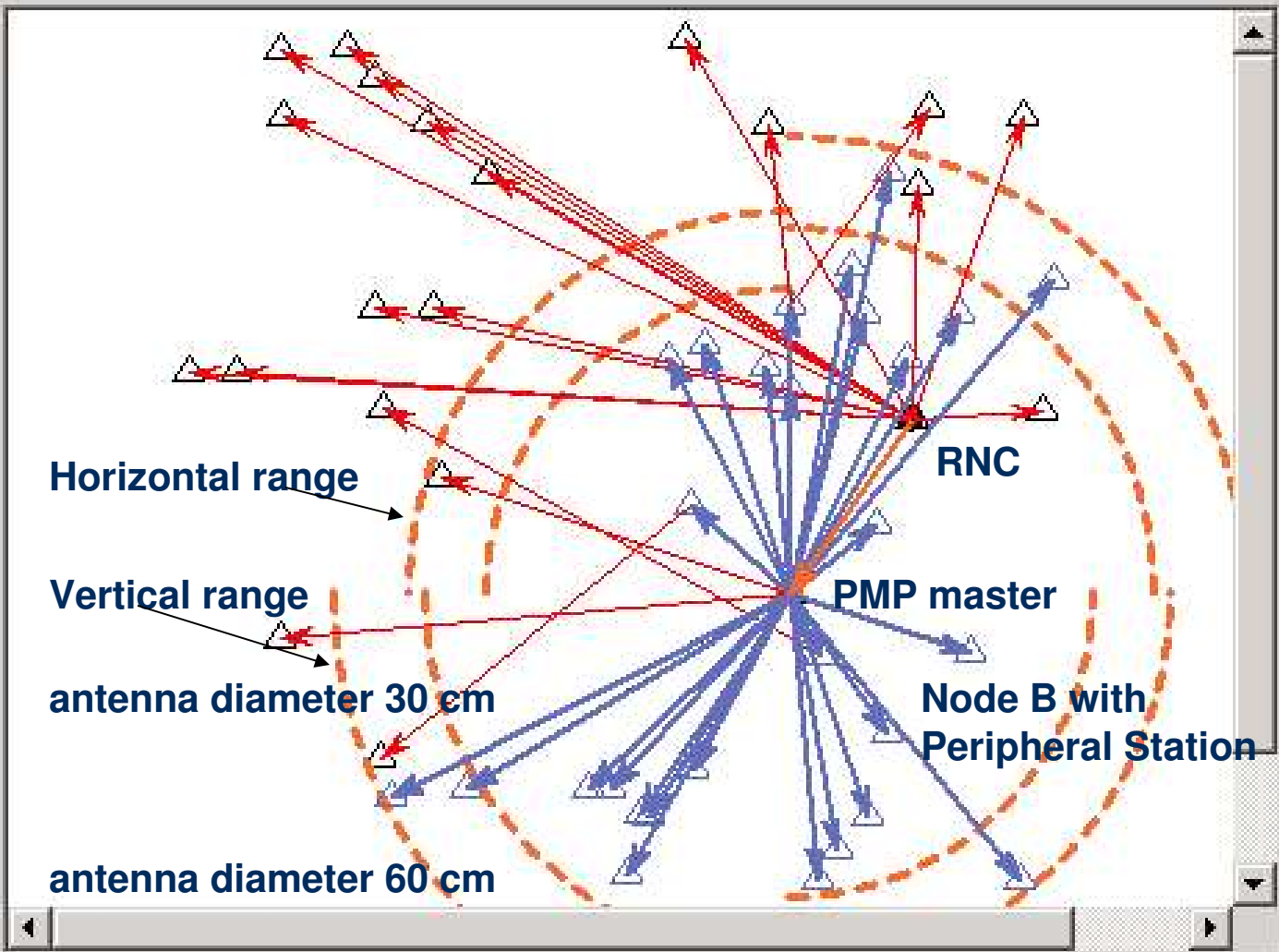
- Sort Node B by their distance to initial tree
- Repeatedly add Node B with minimal distance
- Improve solution by rearranging sub trees

■ Output

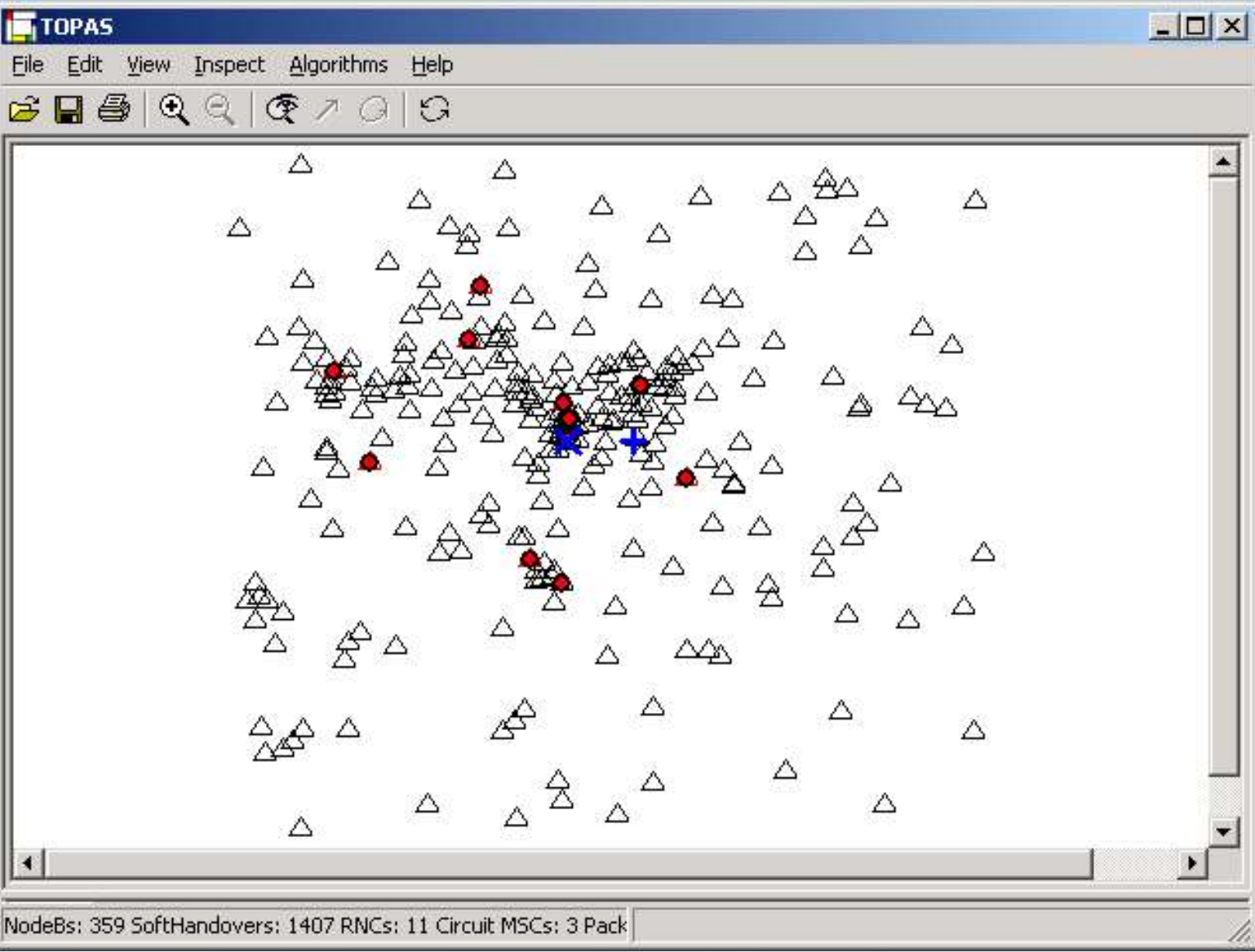
- UTRAN topology with PMP equipment
- Detailed description of introduced PMP entities



Name	Value
TS Id	NB_40_TS
Longitude	0.0803
Latitude	0.0237
TS type	TS_4E1
TS cost	4450
Link to	NB_13_PMP
Sector	3
Link traffic circuit	2000
Link traffic packet	2000
Link range	2161.27

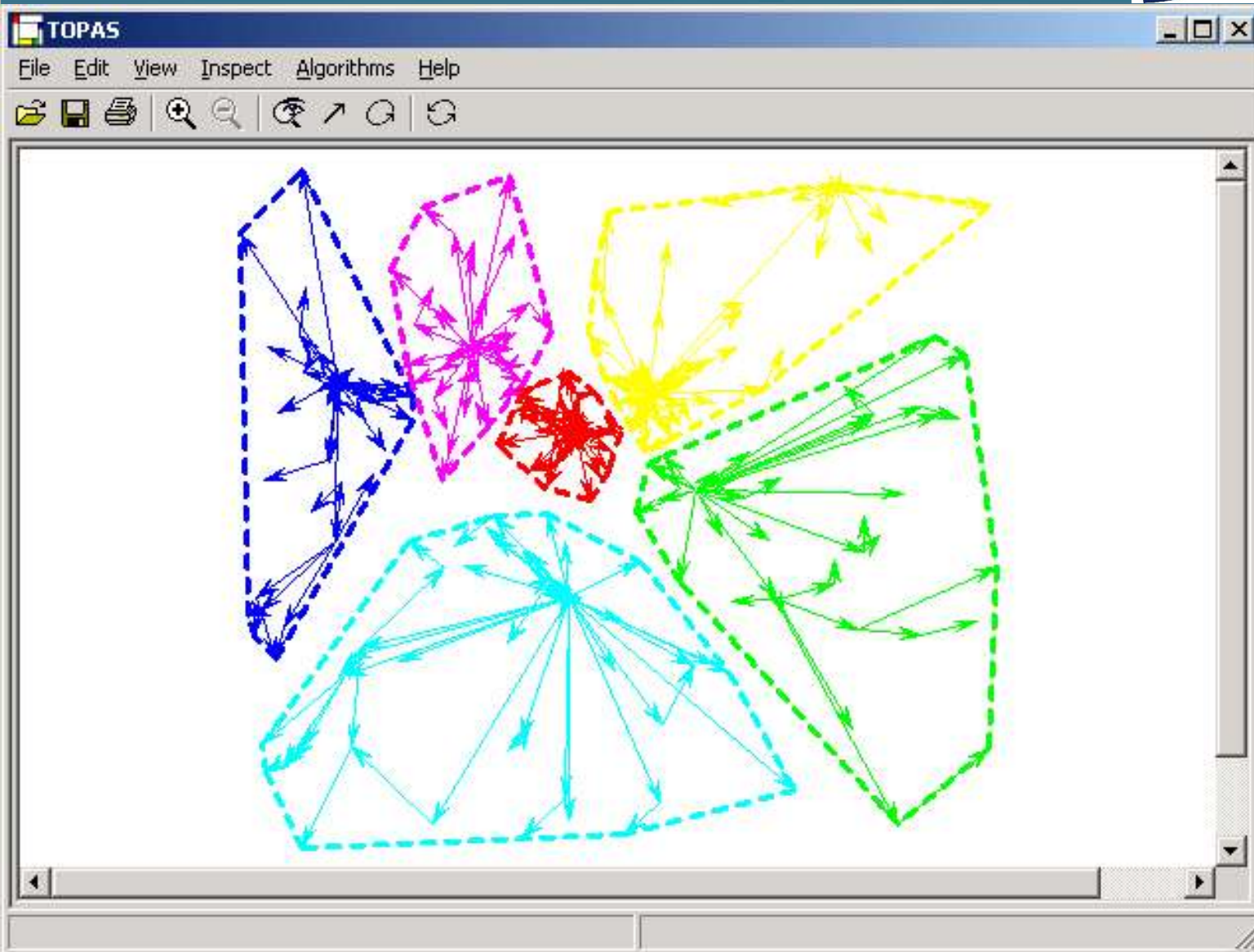


Example: UTRAN Network with 359 Node B



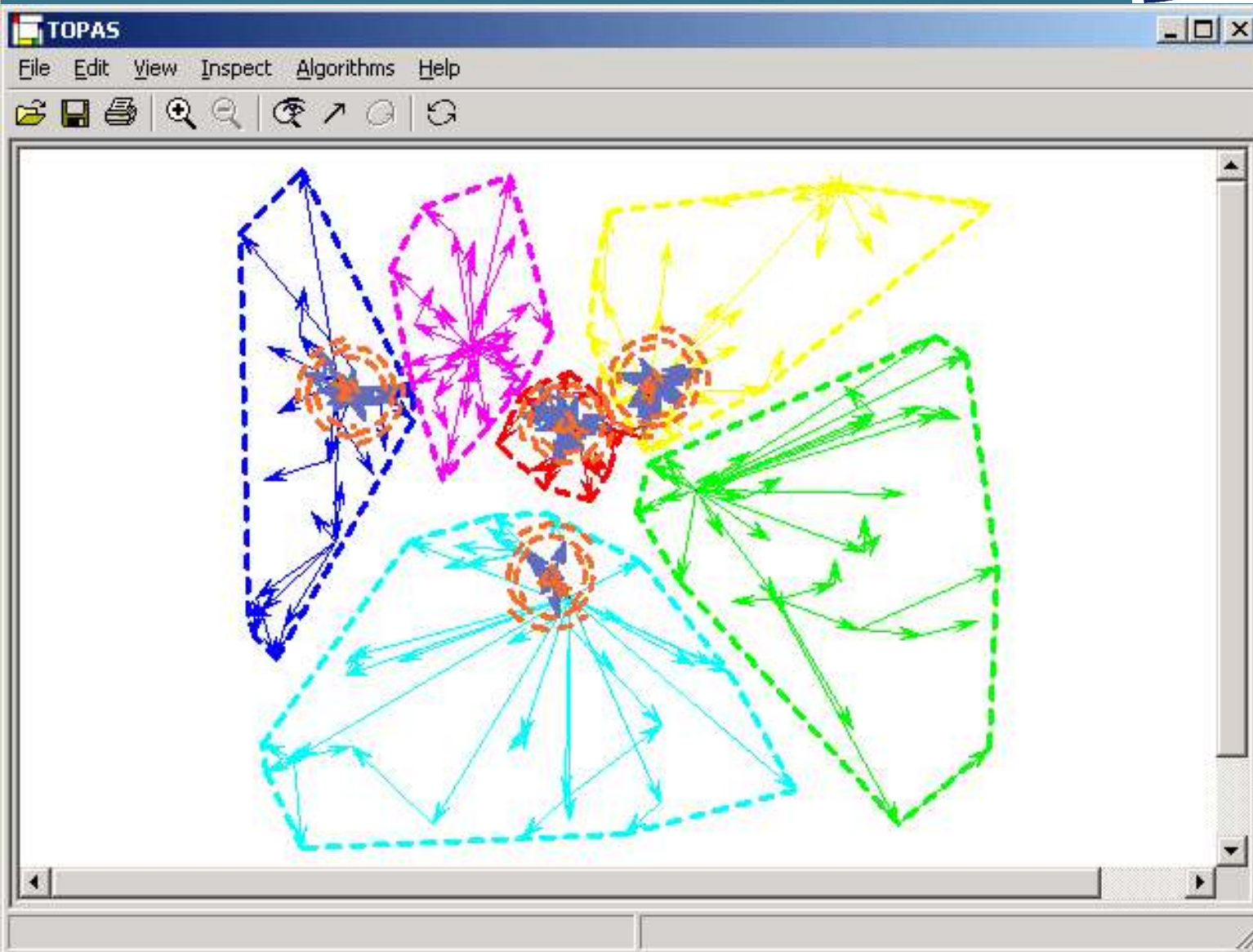
- △ NodeB
- RNC positions
- X MSC pos.
- + SGSN pos.

Solution using Leased Lines



Different colors indicate different RNC clusters

Solution including PMP Equipment



For four RNC clusters placing PMP entities reduces costs.

Profit in four years for the red cluster is nearly 10%.

- **The profit of PMP solutions increases with amortization period and traffic (high investment costs but low monthly costs, one PMP master station can serve a large number of Node B)**
- **An algorithmic approach for introducing PMP into UTRAN topology design has been presented**
- **Often the results of automatic optimization are different from the expectations based on viewing locations and density of Node B's.**
- **The PMP solutions generated by our tool can be used as a valuable decision support for network planners.**