ITU Regional Seminar on Costs and Tariffs for Member Countries of the Regional Group for Asia and Oceania (SG3RG-AO)

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The BU-LRIC model in Korea

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Agenda

- **Introduction**
- Overview of LRIC model development in Korea
- BU-LRIC model for Mobile Network
- BU-LRIC model for Fixed Network
- Sharing of BU-LRIC experiences
- Discussion

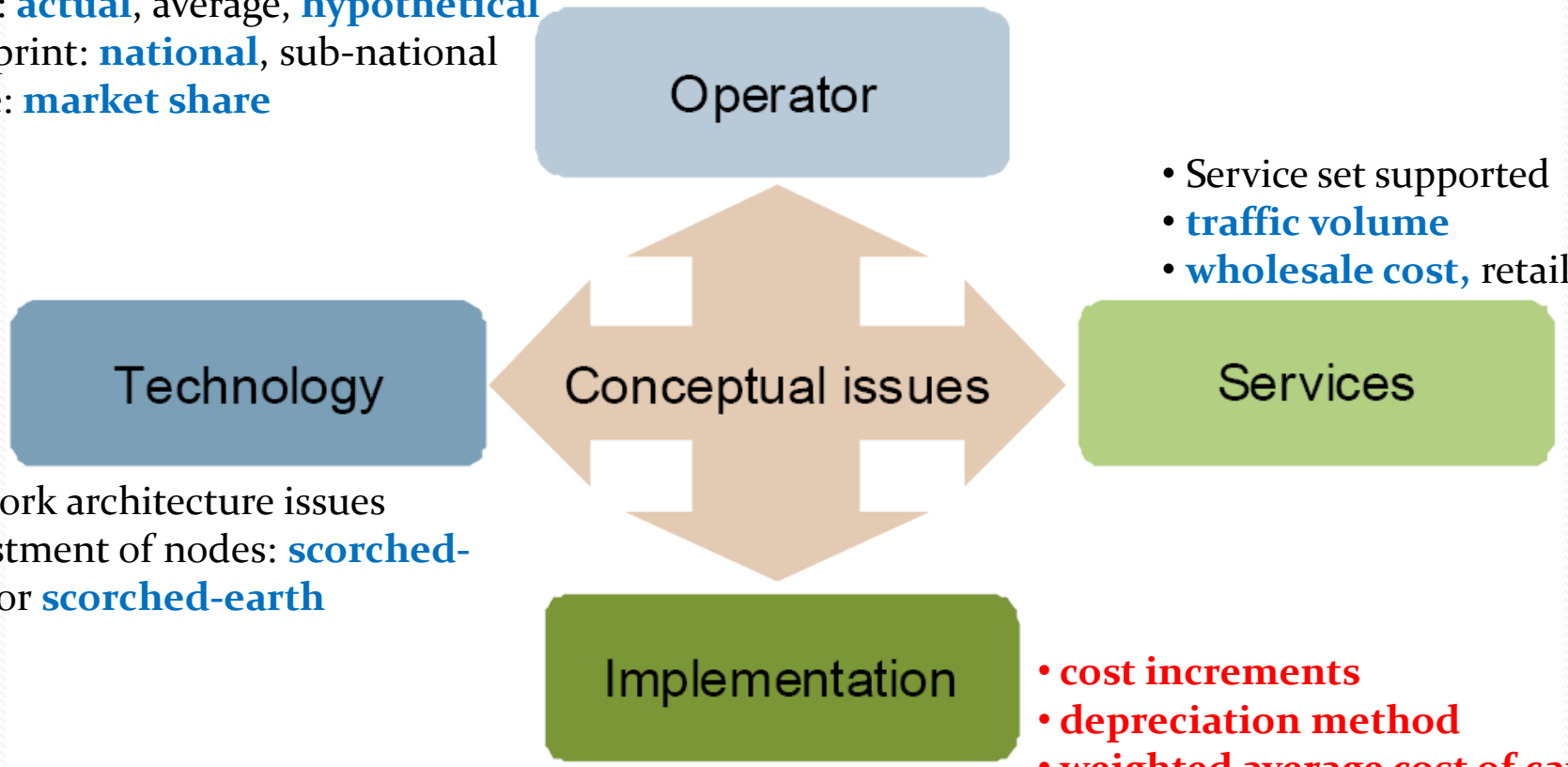
Principles of BU-LRIC

- **Competitive market**
- **Long-run costs**: include all the costs that will ever be incurred in supporting the relevant service demand
- **Incremental costs**: incurred in the support of the increment of demand; avoidable costs in case not supporting the increment
- **Efficiently incurred costs**
- **Costs of supply using modern technology**: choice of network technology (e.g. 2G, 3G); capacity of equipment; purchasing price and operating cost; maintenance cost

[Source: Analysys Mason]

Conceptual issues for BU-LRIC

- Type: **actual**, average, **hypothetical**
- Footprint: **national**, sub-national
- Scale: **market share**



- Service set supported
- **traffic volume**
- **wholesale cost,** retail cost

- network architecture issues
- adjustment of nodes: **scorched-node** or **scorched-earth**

- **cost increments**
- **depreciation method**
- **weighted average cost of capital**

[Source: Analysys Mason]

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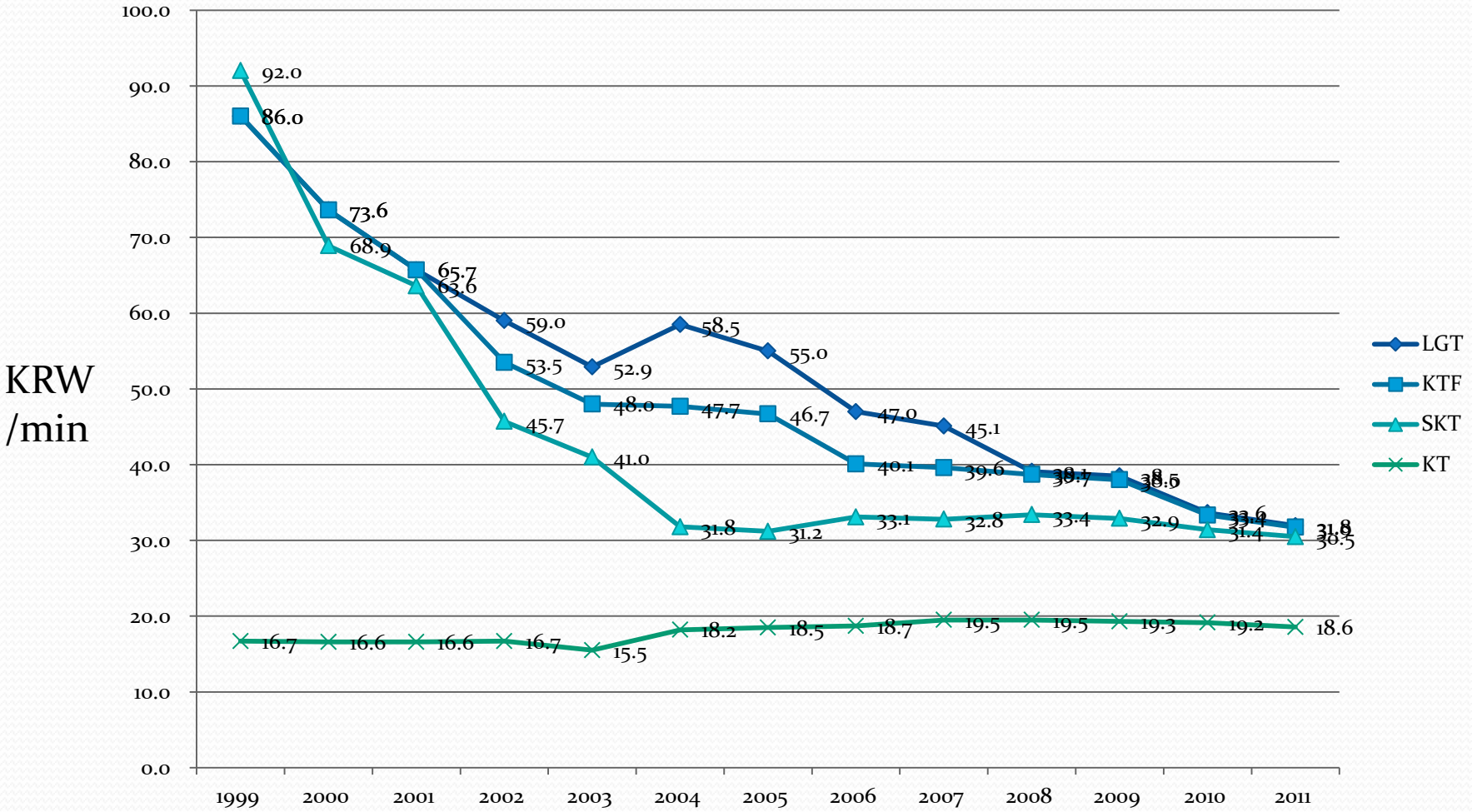
Interconnection regulation in Korea

- 1998~1999 (Revenue Sharing)
  - Zero-Payment Settlement between Mobile Operators
- 2000~2001 (Representative Cost System)
  - Introduction and Application of Cost-based Pricing
- 2002~2003 (Individual Rate System)
  - Fully Distributed Costs (FDC)
- 2004~present (Individual Rate System)
  - Introduction and Application of **LRIC**
  - Elaboration of both BU- and TD-LRIC models
  - Stepwise extension of models and applications

Changes of termination rates in Korea

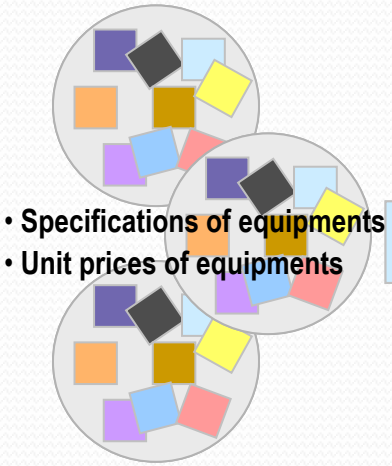


Note: Single MTR is to be applied from the year 2013

BU-LRIC system in Korea

Input Data

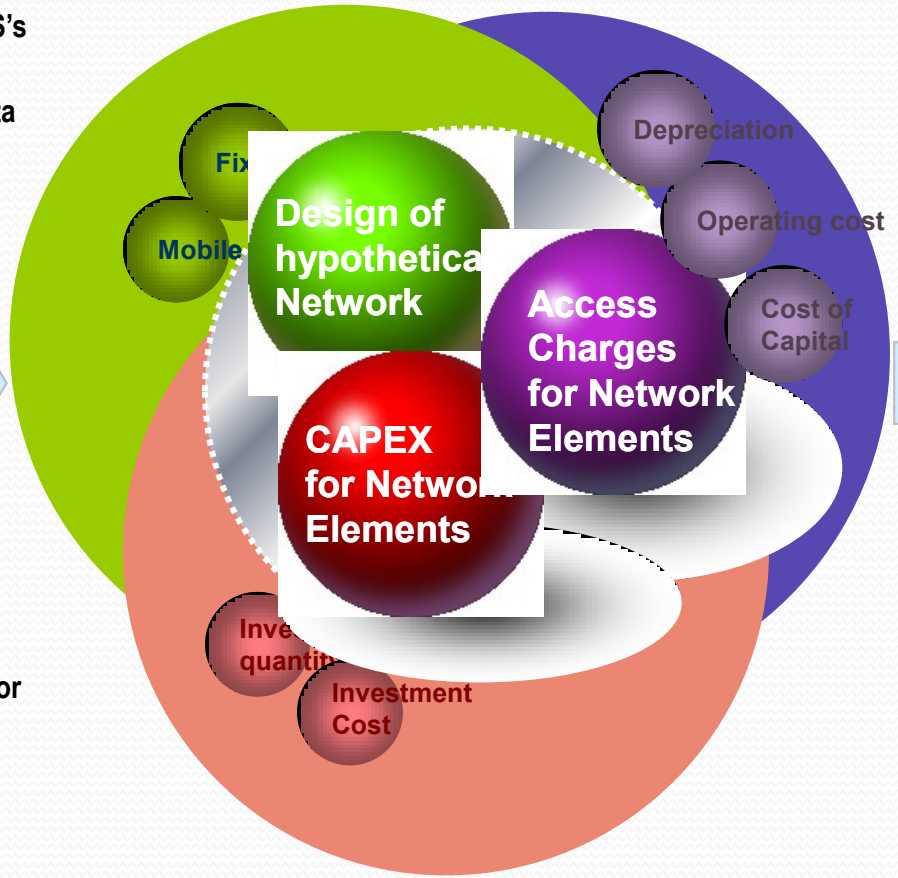
- Location and Traffic data of BTS's
- Location of switching stations
- Topography, roads, building data



- Specifications of equipments
- Unit prices of equipments

- Asset lifetime
- Operating cost Conversion factor
- Cost of capital

Components of BU process



Output

- Interconnection tariff for fixed and mobile operators
- Interconnection tariff for network elements

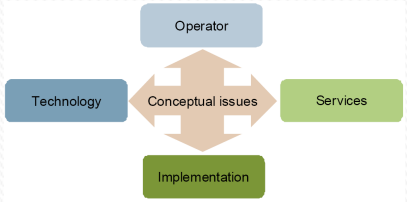
- KT: D. nodes, LE, TE; LL, LE-LE, LE-TE, TE-TE
- SKT/KTF/LGT: BTS, BTS Sites, BSC, MSC, CGS, HLR, BS-MSC, MSC-MSC

LL: Local loop
LE: local exchange
TE: toll exchange

Extension of BU-LRIC applications

- 2004-2005
  - Sample districts: Mobile 2, Fixed 12
  - Partial redesign of backbone network
  - Reflect operator's network topology
- 2006-2007
  - Sample districts : Mobile 8, Fixed 12
  - Full redesign of backbone network
  - Allow operator's existing point of interconnection
  - Forward-looking technology
- 2008-2009
  - Samples districts : Mobile 16 (including Seoul metro), Fixed 20
  - Elaboration of algorithms for optimizing mobile and fixed networks
  - Re-design of 3G network
- 2009-present
  - Migration into new BU-LRIC S/W system
  - Ready to simulate all districts (Mobile 164; Fixed 259)
  - Started to consider 4G network

BU-LRIC options applied in Korea



- Actual operator; Hypothetical existing operator
- National coverage for all operators
- Current market share; average of market share

- Mixed approach of scorched-node and scorched-earth
  - scorched-nodes: only MSC & Switching Stations
- 2G, 3G, and 4G;

	SKT	KTF	LGU+
800MHz	20MHz(2G)/10MHz(4G)	10MHz(4G)	20MHz(4G)
900MHz	-	20MHz(4G)	-
1.8GHz	20MHz(4G)	20MHz(2G)	20MHz(2G)
2.1GHz	60MHz(3G)	40MHz(3G)	20MHz(4G)

- Voice and SMS services
- Actual voice traffic volume data of each BTS is used
- Wholesale cost

Features of BU-LRIC model in Korea

- Practical and detailed approach
  - Actual traffic volumes of each BTS are collected from operators
  - Utilization of detailed geodata: topography, roads, buildings, etc.
- Phased approach
  - Preprocessing of Input data (Traffic volume & Geodata)
  - Network design and CAPEX calculation
  - Visual display network elements on electronic map: helps validating the efficiency of designed network
  - Calculation of BU-LRIC
- Flexible S/W systems
  - Various parameters are easily handled with data tables
  - Easy customization due to stepwise modularized S/W systems

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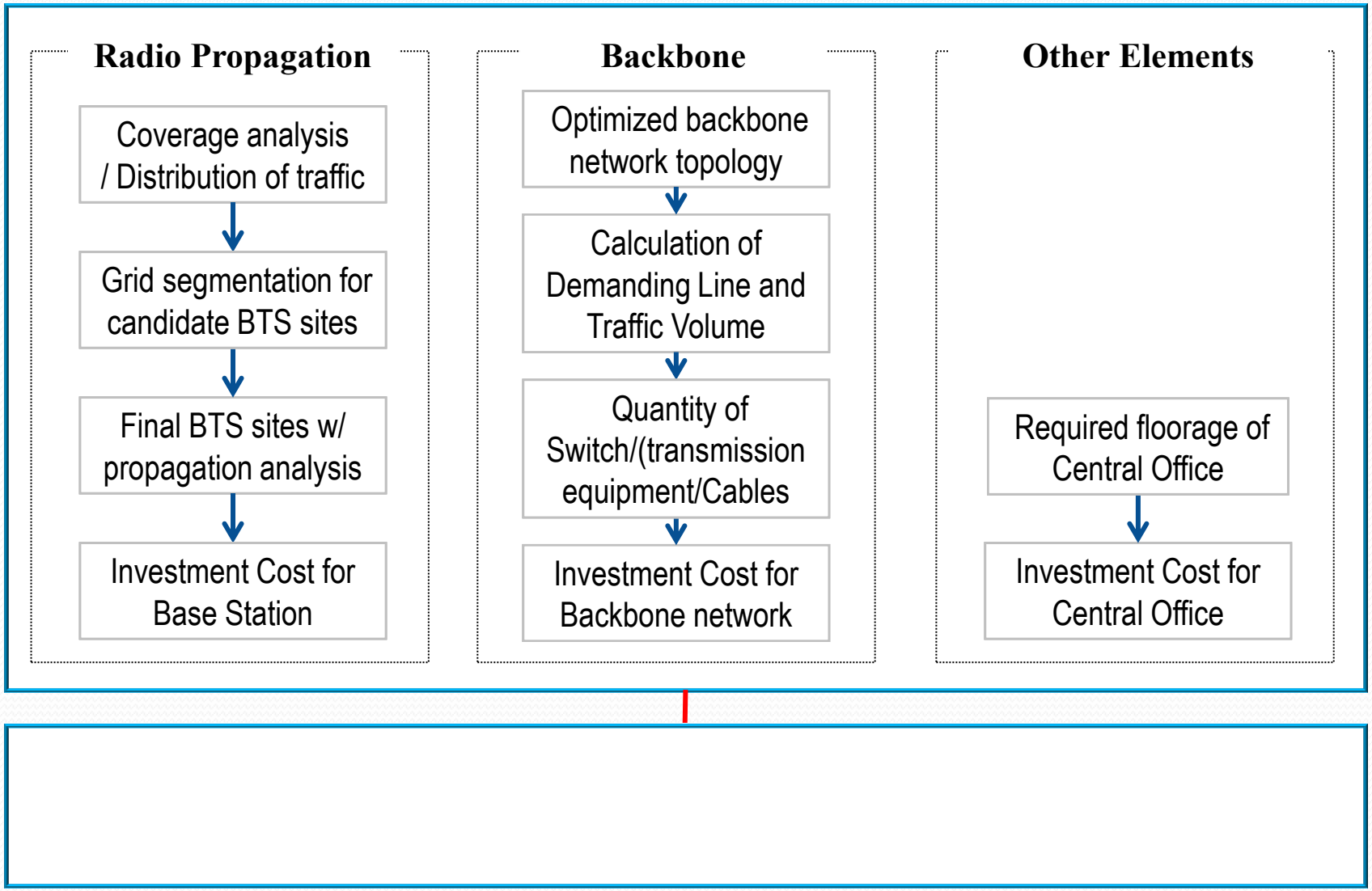
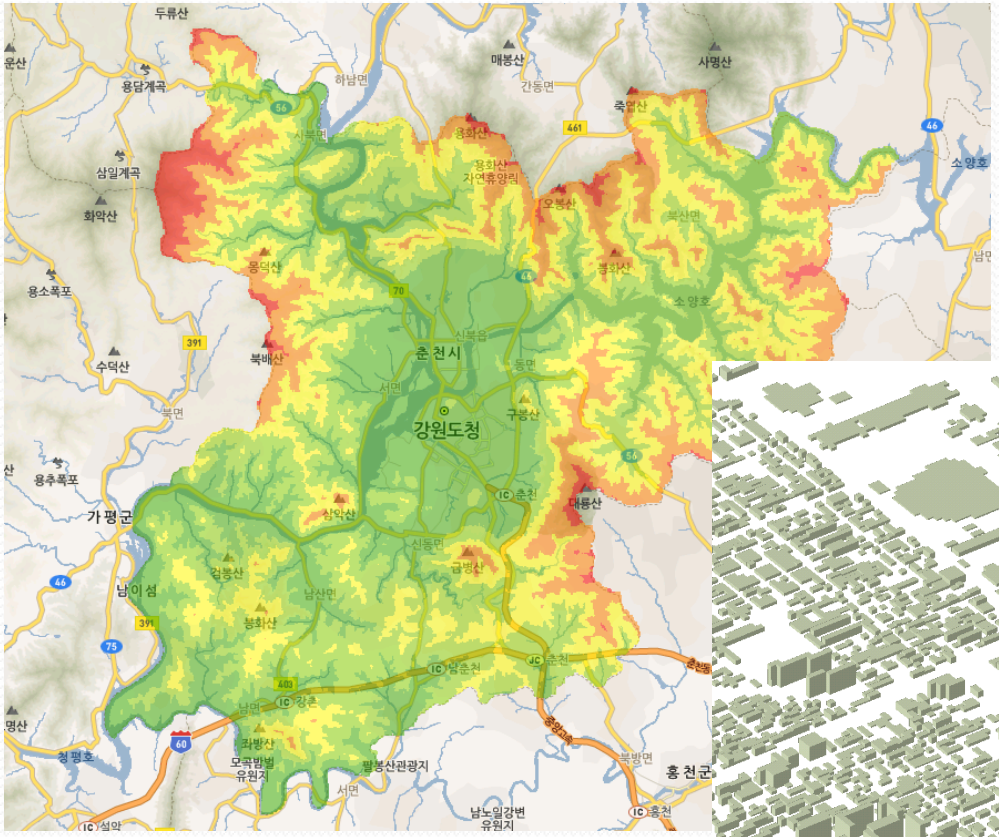
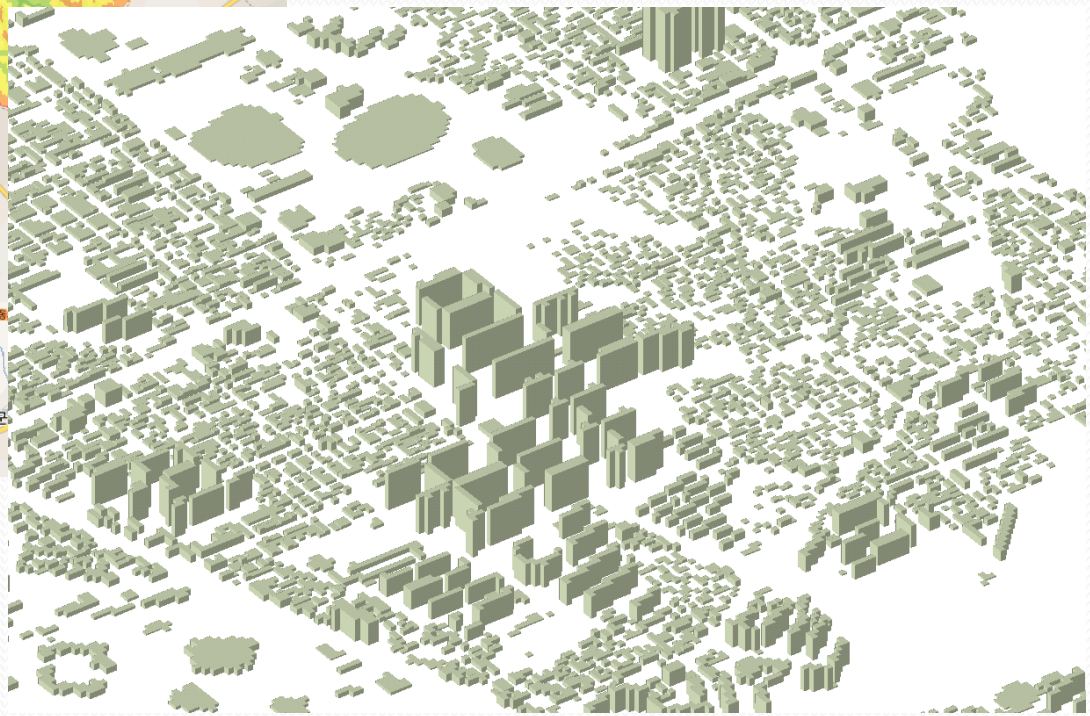
Steps for mobile network



Input geodata

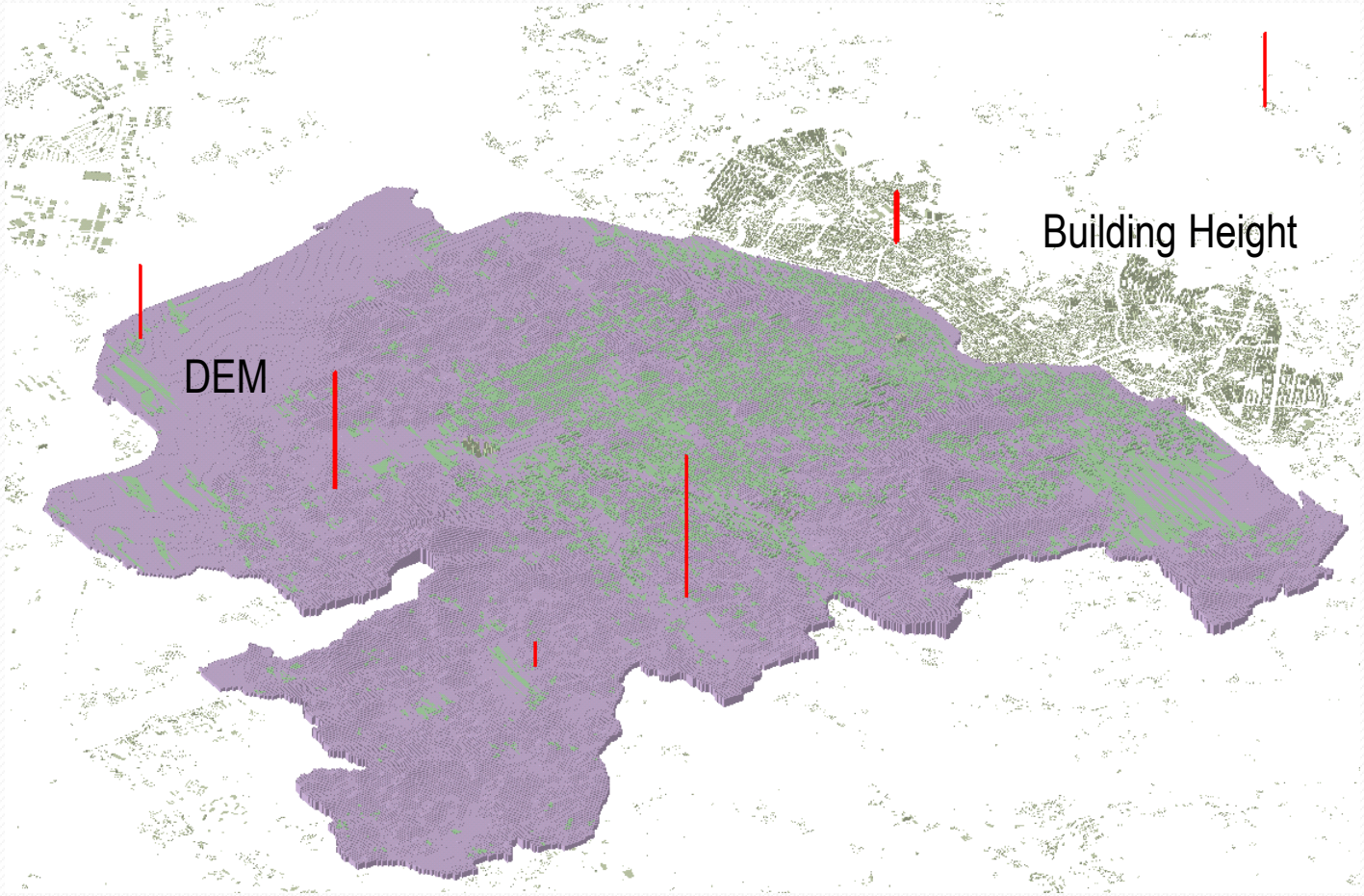


- DEM (Digital Elevation Model)
: Global DEM is available
: Scale used: 10 × 10 meters (*pixel*)



- Buildings (height & floorage by *pixel*): Not used, if n/a

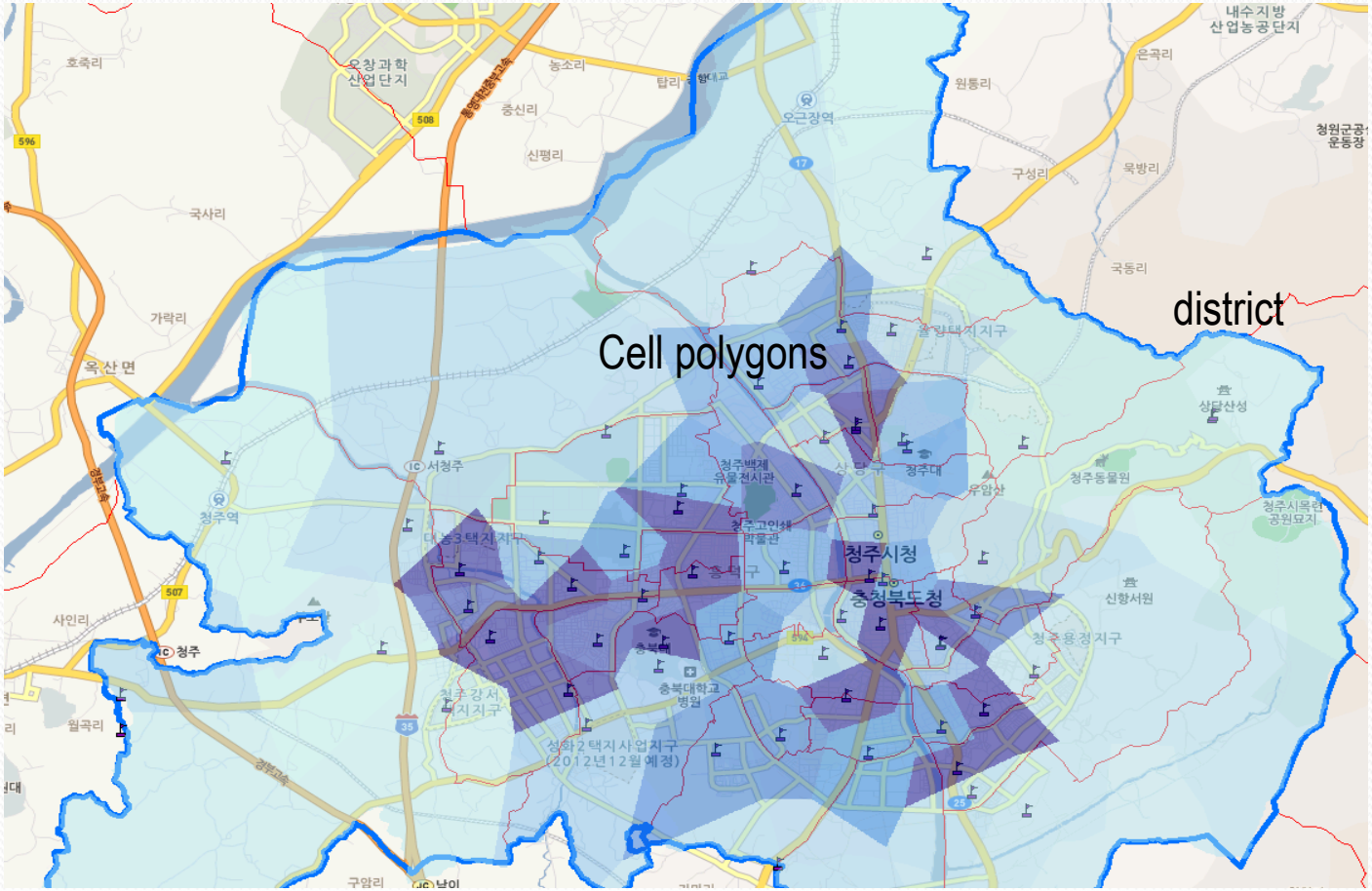
Rooftop elevation (by pixel)



Terminology used

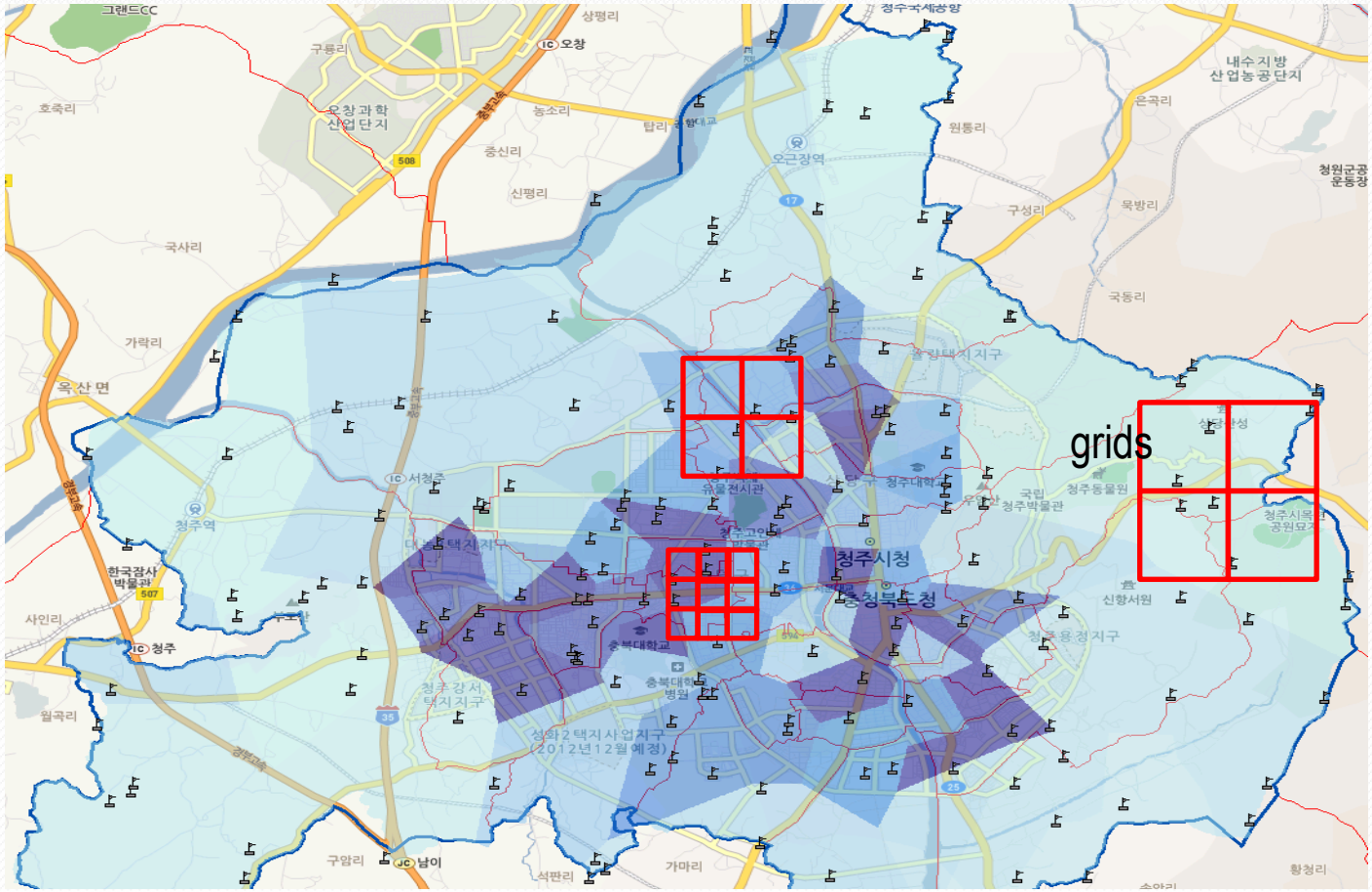
- District
  - Target area of simulation; same with administrative districts
- Cell
  - Area served by each (existing) BTS by coverage analysis
- Grid
  - Square area as a candidate BTS site (highest pixel in the grid)
  - Grid size varies depending on the traffic volume around
- Pixel
  - Square area: scale of 10 × 10 meters used
  - Most of analysis unit: coverage analysis, traffic volume distribution, capacity-based radio propagation analysis, etc

Coverage analysis & distribution of traffic (by pixel)



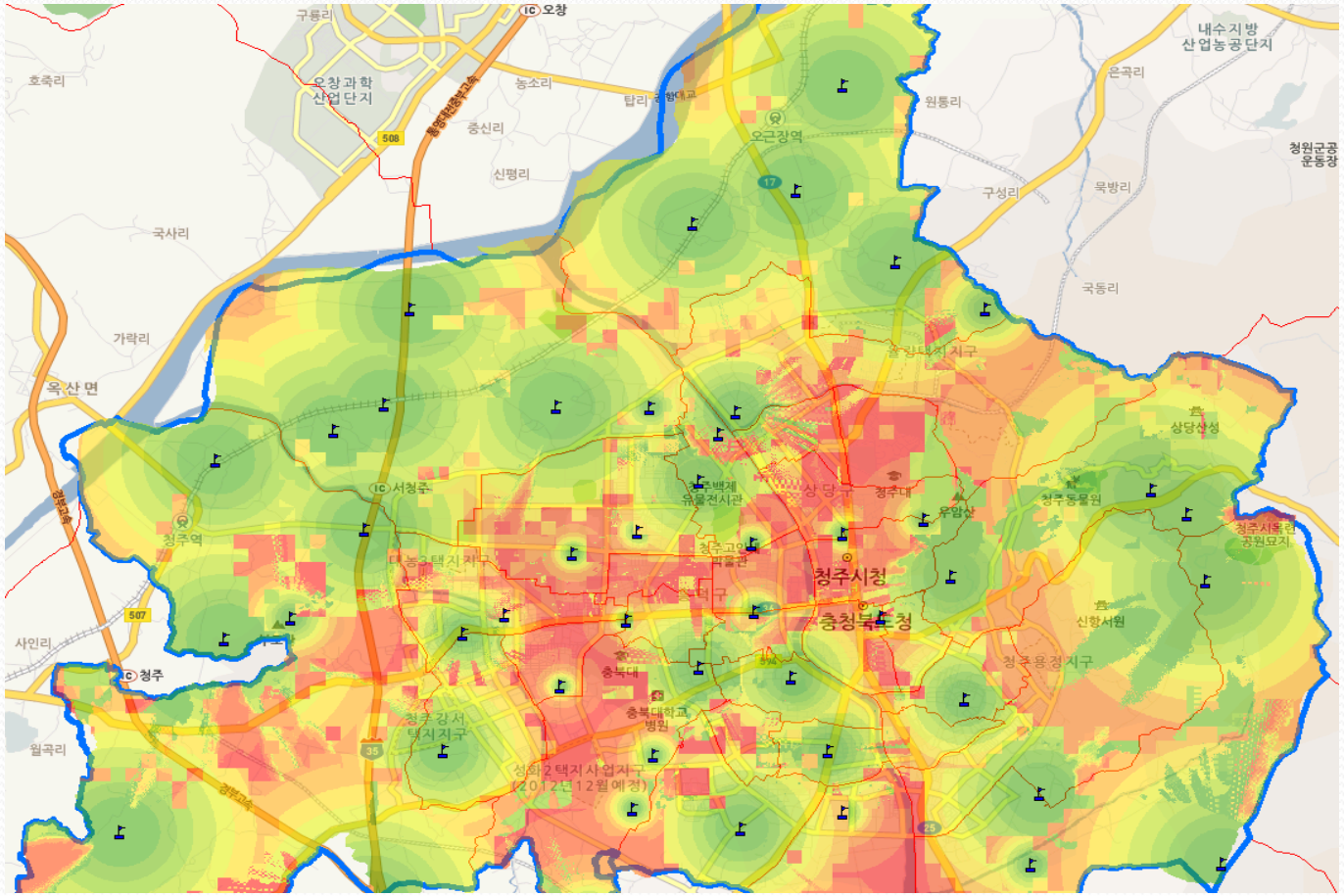
63 Existing BTS sites

Grid segmentation and candidates of BTS sites



127 Candidate BTS sites

Finally picked efficient BTS sites with capacity-based propagation analysis



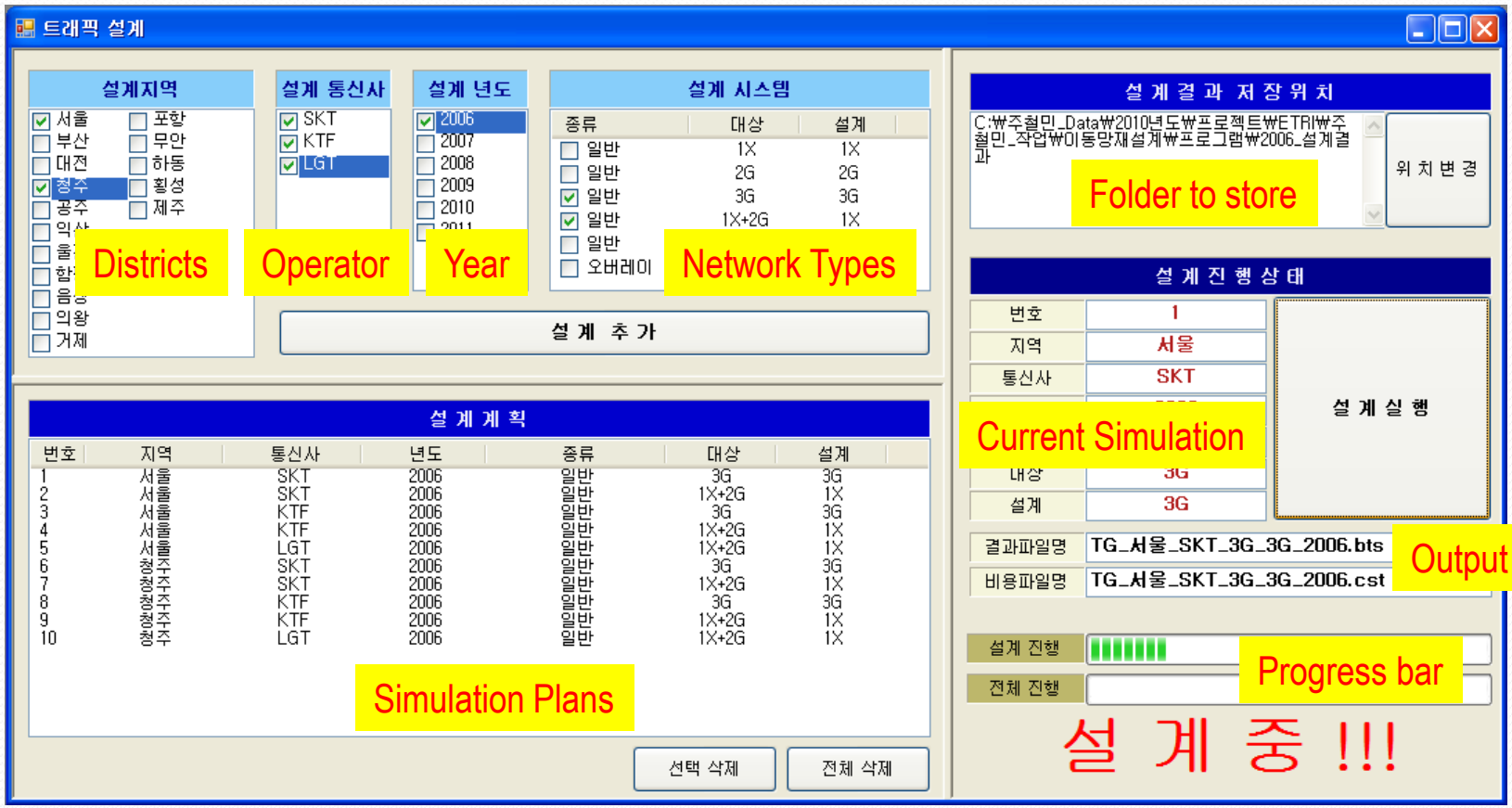
48 Efficiently designed BTS sites

Data tables of parameters

- All parameters for the network design and cost computation (e.g. unit cost) are managed as data tables
- Easy-to-use update of those parameters is supported

통신사	설계	서울	부산	대전	청주	공주	익산	홀진	함평	음성	의왕	거제	포항	무안	하동	횡성	제주
SKT	1X	1	8	3	1	3	2	1	1	1	1	1	5	1	1	1	1
	2G	1	8	3	1	3	2	1	1	1	1	1	5	1	1	1	1
	3G	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
KTF	1X	5	5	3	1	2	1	1	1	1	3	1	1	1	1	1	2
	2G	5	5	3	1	2	1	1	1	1	3	1	1	1	1	1	2
	3G	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LGT	1X	4	4	2	1	1	3	1	1	1	2	1	1	1	1	1	1
	2G	4	4	2	1	1	3	1	1	1	2	1	1	1	1	1	1
	3G	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

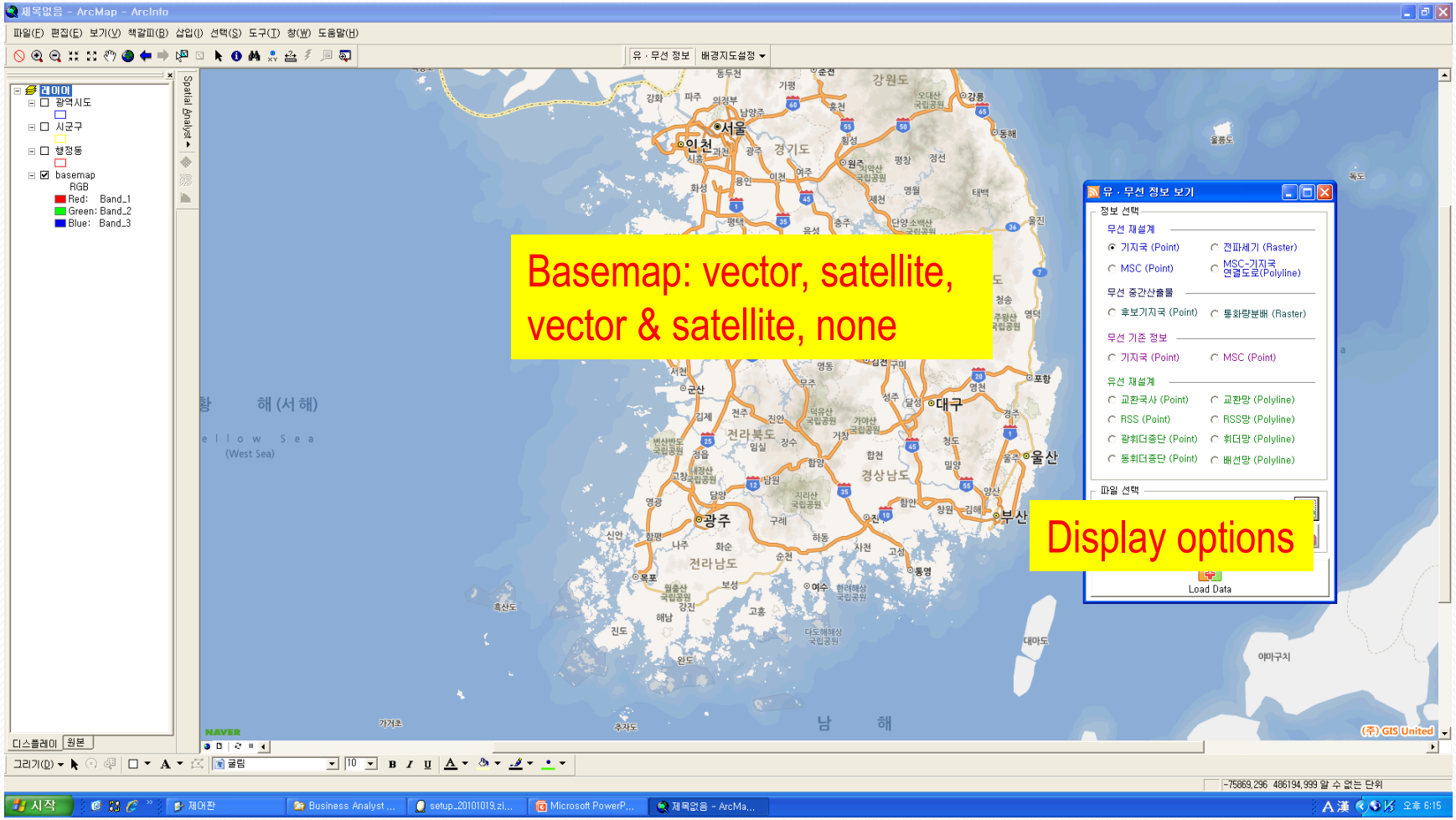
Simple execution of simulation runs



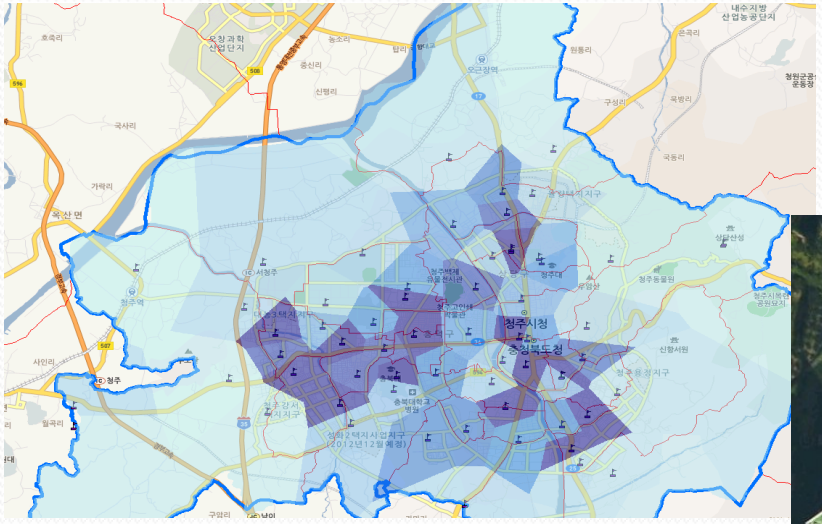
Spreadsheet output: volume and CAPEX of network elements

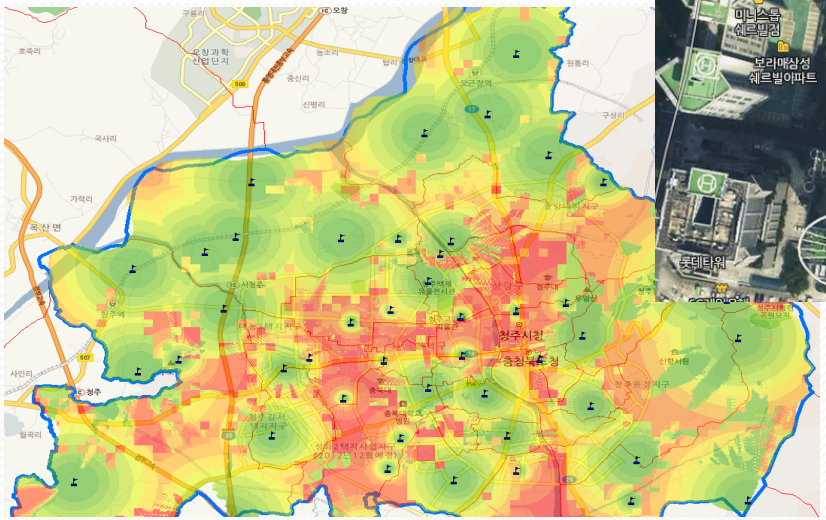
- Summary of simulation (for each simulation plan)
  - District, Operator, Traffic volume, Network type, Target Year
  - Total costs
- Categorized details (each subcategorized by network types)
  - BTS: FA, Threshold; # of BTS, unit cost (by # of sectors); sum of BTS costs
  - BTS site (default option: rent): # of site; Deposit, Rental fee (monthly)
  - BSC: Unit cost (min, max); # of BSC, # of BTS, CH; sum of BSC costs
  - BTS-BSC network (default option: rent): type of cable; distance; sum of BTS-BSC network costs
  - Ancillary equipment: Air-conditioning, fire extinguisher, QDF
  - Powersource equipment: Rectifier, Storage battery, Cabinet panel
  - Radio mast (6M or 40M): # of masts; unit cost; sum of mast costs

Display of network elements on e-map



User-driven display for validation





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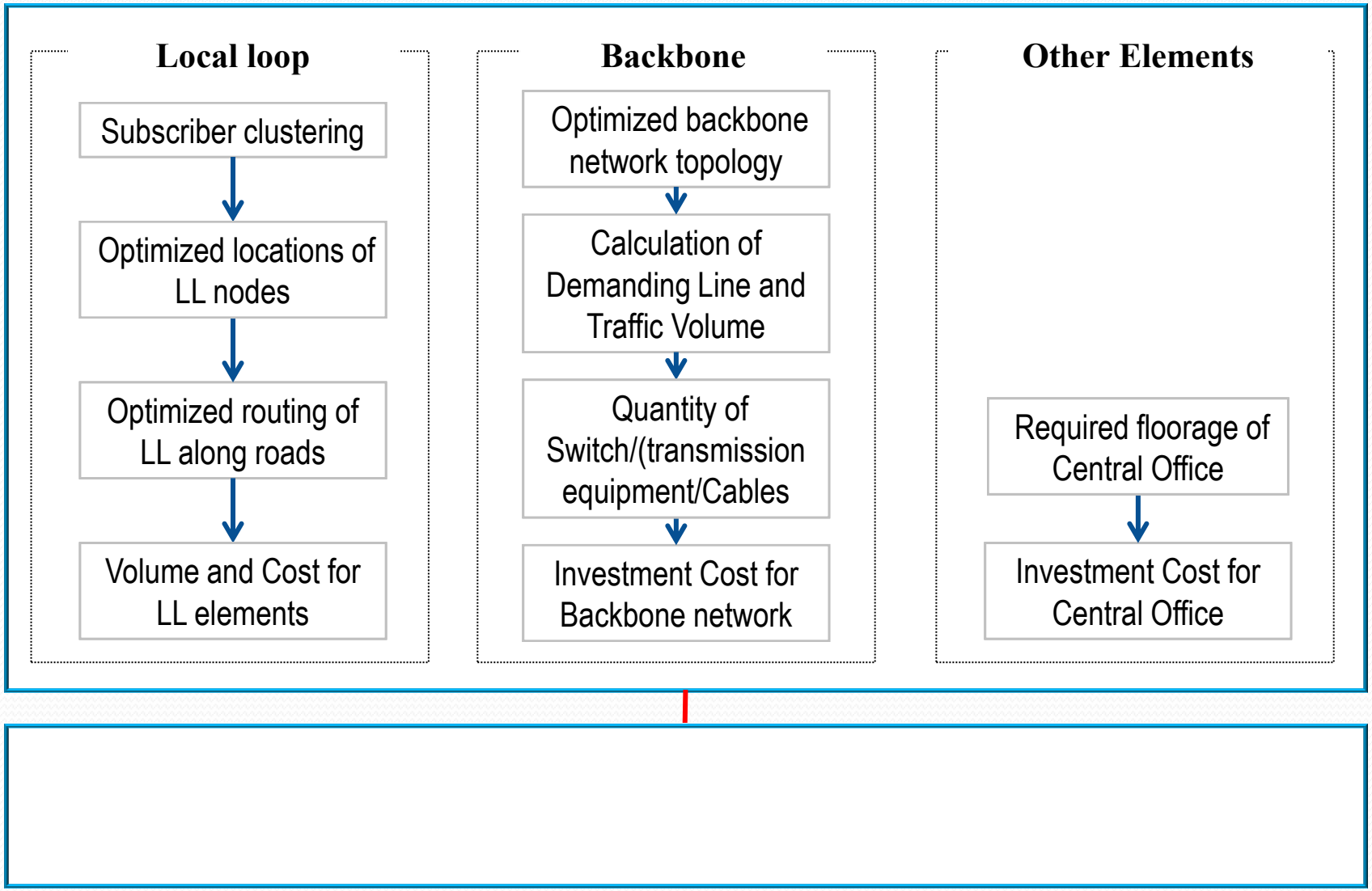
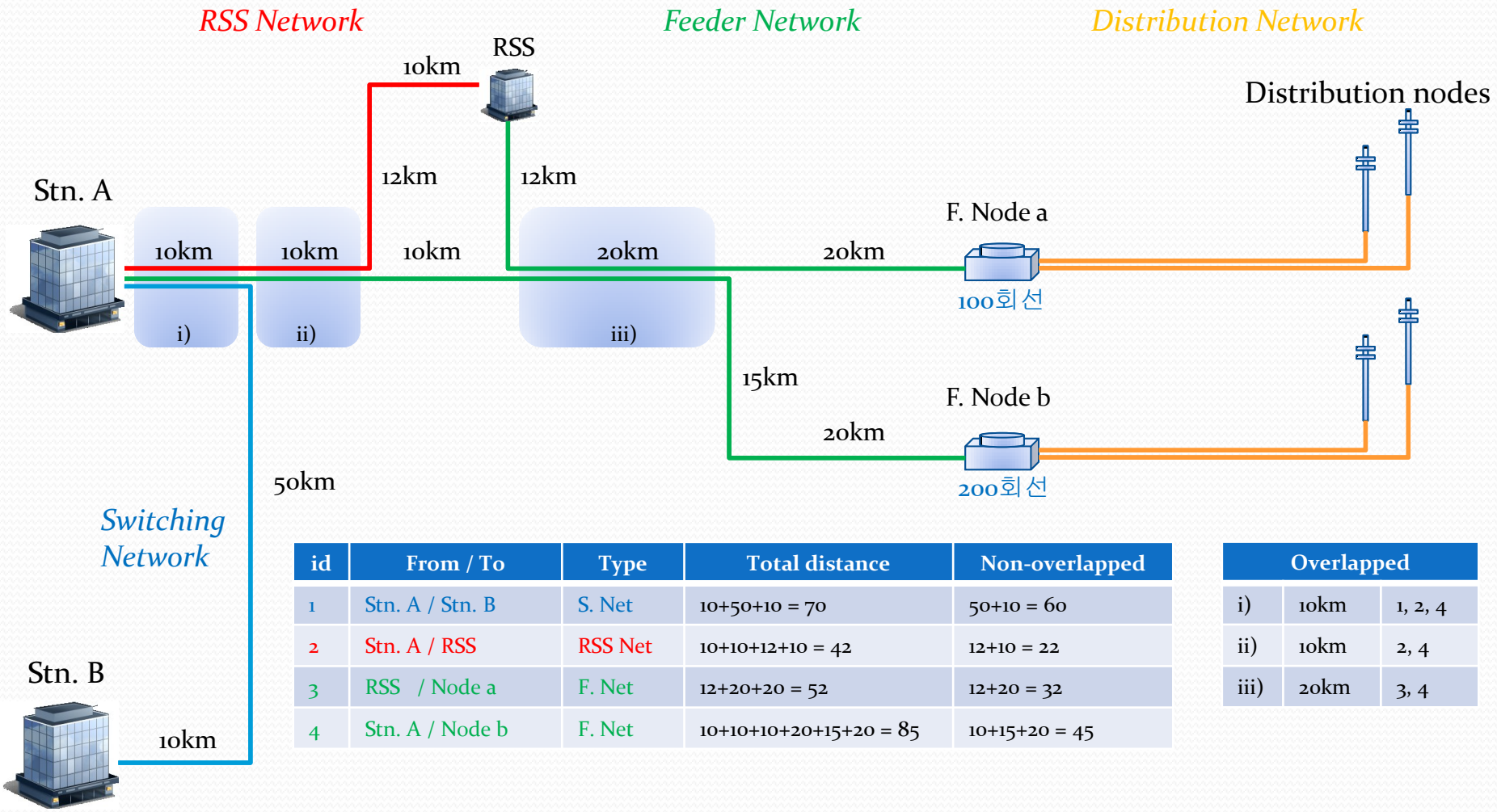
Steps for fixed network



Cost elements of fixed networks



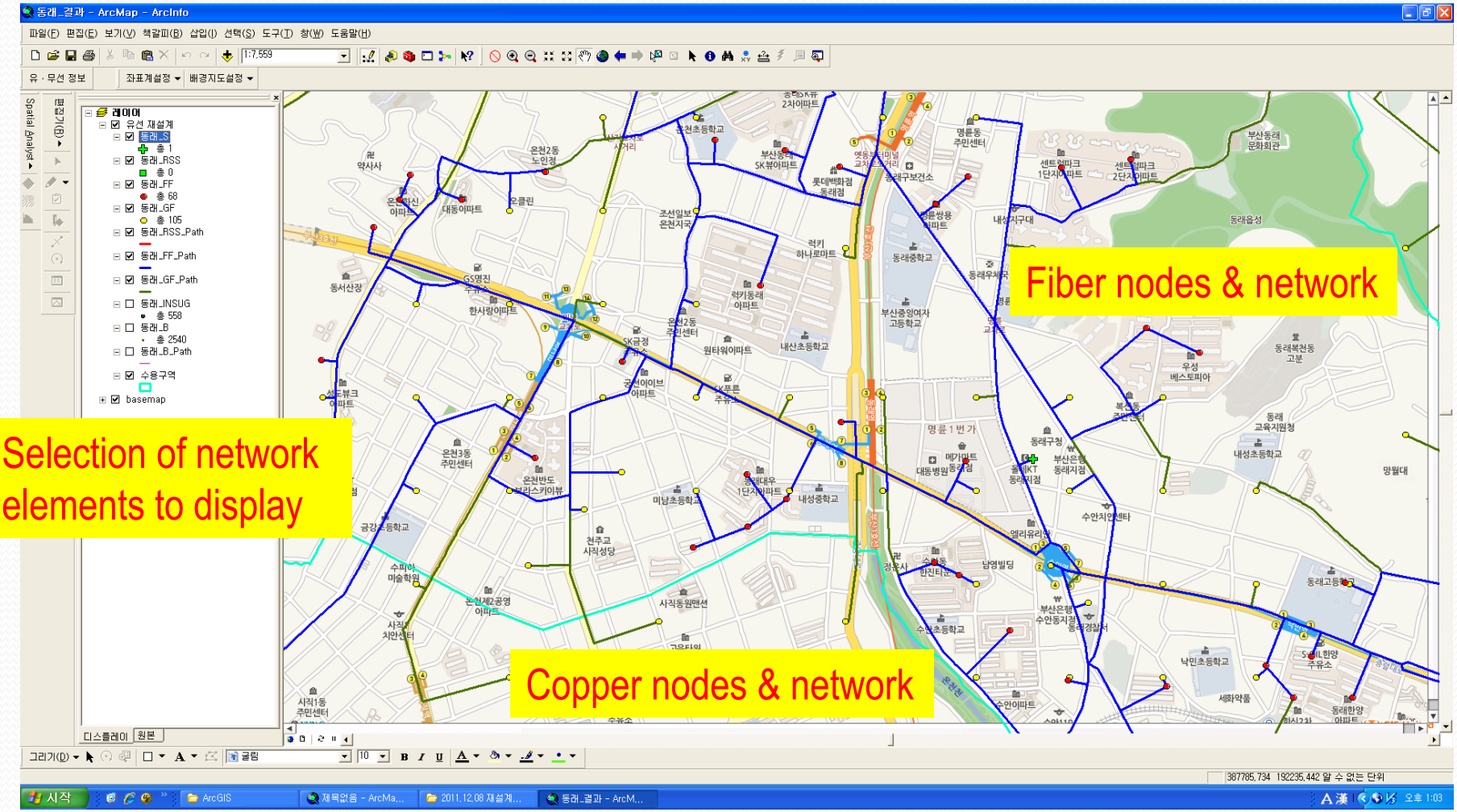
id	From / To	Type	Total distance	Non-overlapped
1	Stn. A / Stn. B	S. Net	10+50+10 = 70	50+10 = 60
2	Stn. A / RSS	RSS Net	10+10+12+10 = 42	12+10 = 22
3	RSS / Node a	F. Net	12+20+20 = 52	12+20 = 32
4	Stn. A / Node b	F. Net	10+10+10+20+15+20 = 85	10+15+20 = 45

Overlapped		
i)	10km	1, 2, 4
ii)	10km	2, 4
iii)	20km	3, 4

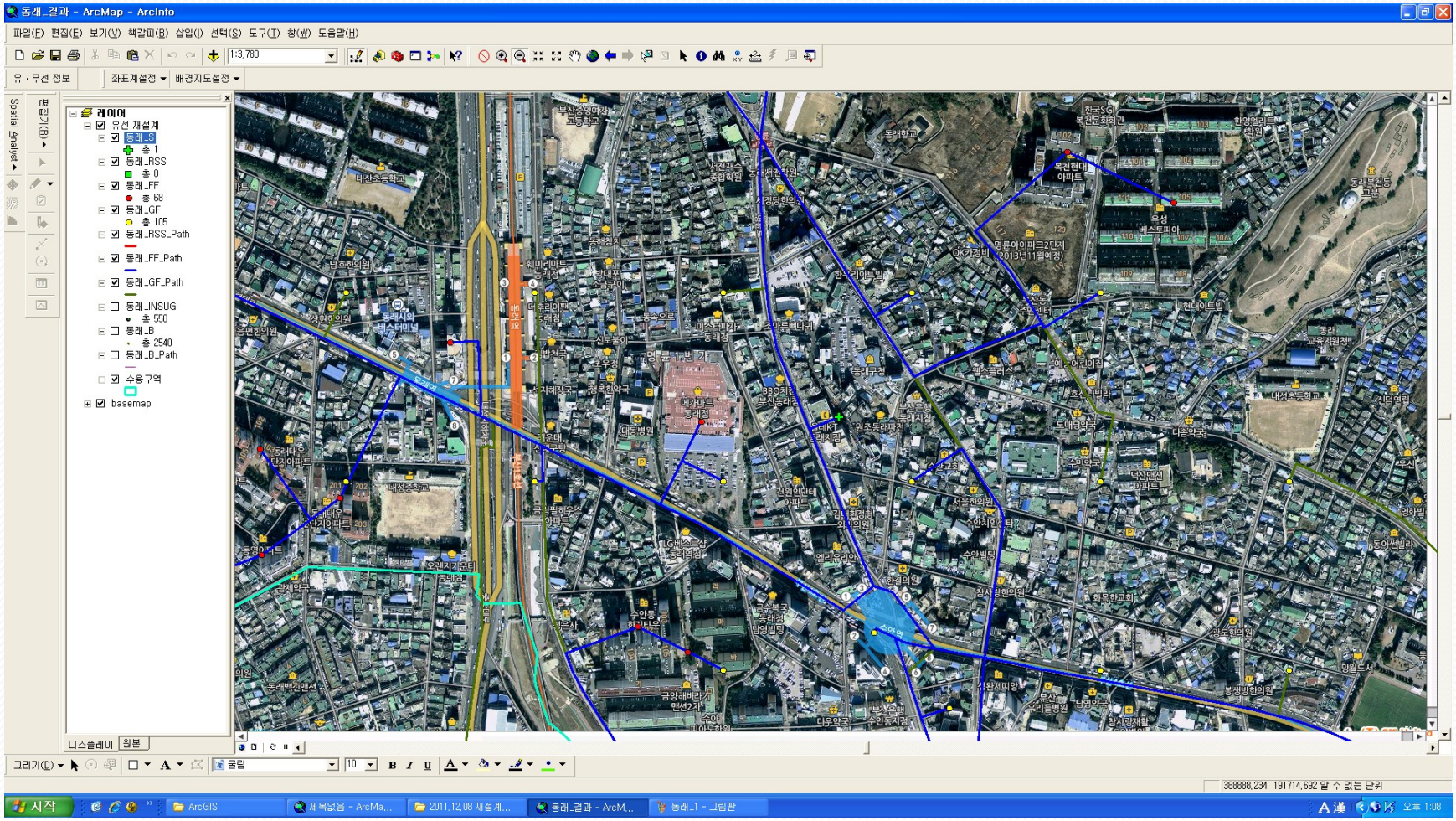
Spreadsheet output: Volume and CAPEX of network elements

- Summary of simulation (for each simulation plan)
  - District, Operator, Target Year, Total costs
- Categorized details (e.g., local loop case)
  - RSS network: # of RSS, length of duct, # of manholes, length of Fiber cable, # of equipments (Switching / Transmission); Costs
  - Feeder Network: # of Feeder nodes, length of Duct, # of Manhole, length of cable (each Cooper or Fiber); # of equipment (Switching / Transmission); Costs
  - Distribution Network: # of distribution nodes, length of Duct, # of Manhole, length of cable, # of poles; Costs
  - Additionally, details of overlapped sections are provided

Display of network elements on e-map



Zoomed-in view with vector & satellite basemap



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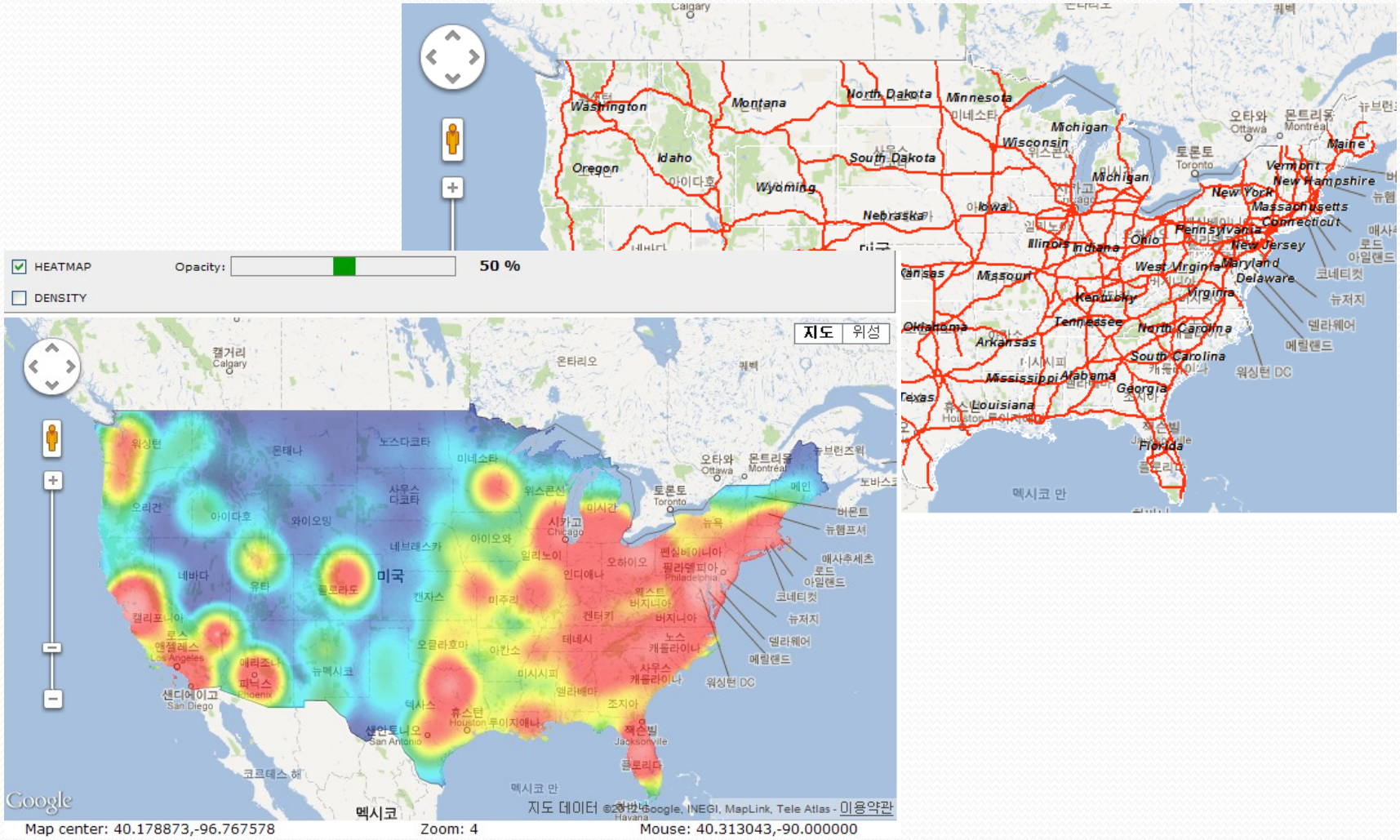
Proposal to share experiences

- Sharing of experiences in ITU-T SG3RG-AO will help better understanding and improvement of BU-LRIC models
- Survey of various options applied (or planned) in each member state could be proposed

Availability of GIS data

- There are some sources of GIS data, in case n/a
  - An example view of GIS data obtained from Google (Vietnam case)

Examples of overlay display on Google map



Willing to provide our experiences

- We are willing to provide our experiences and developed S/W systems non-commercially
  - Customization will be required due to diversity of options and differences of requirements granularity
  - Modularized systems will not ask much effort for customization
  - Member states can develop their own modules of BU-LRIC systems

Discussions…