



Deutsche Telekom Group



Consulting  
**DETECON**

**Enhanced Mobile Capacity Management – how to monitor, control, and steer your service quality**

**Superphones and tablets show a significantly higher data service usage. Consequently, they will load the networks. Significant capacity expansions are required.**

Personal Smartphone usage...

Monthly Data Usage per Subscriber in MByte\*

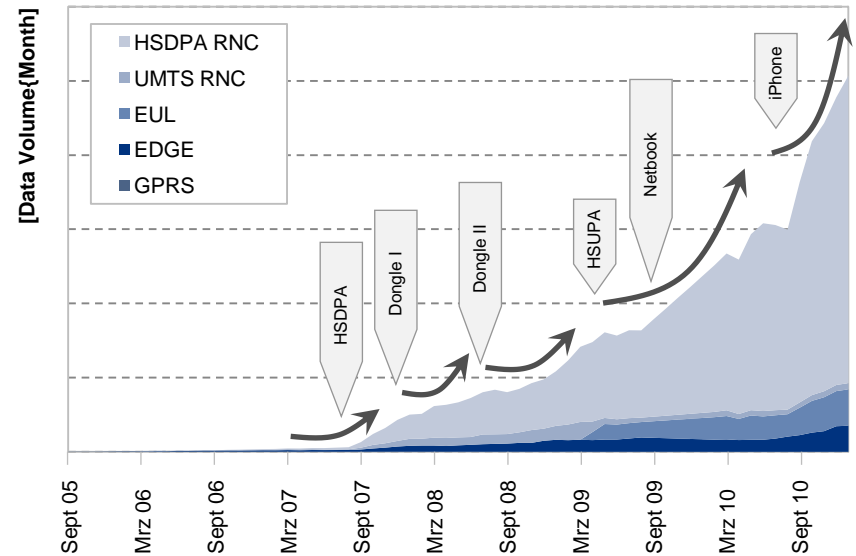
Smartphone      Superphones      Tablet Computers



Autonomous micro traffic caused by APPs contributes significantly to the monthly usage

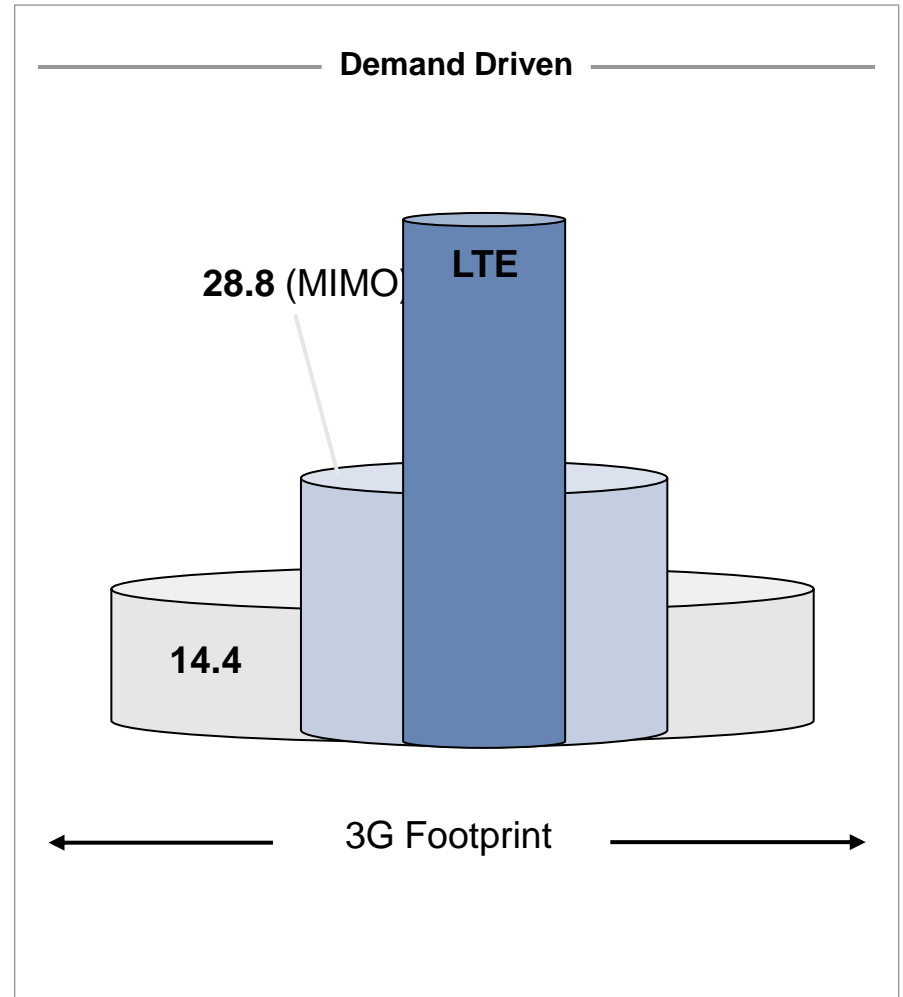
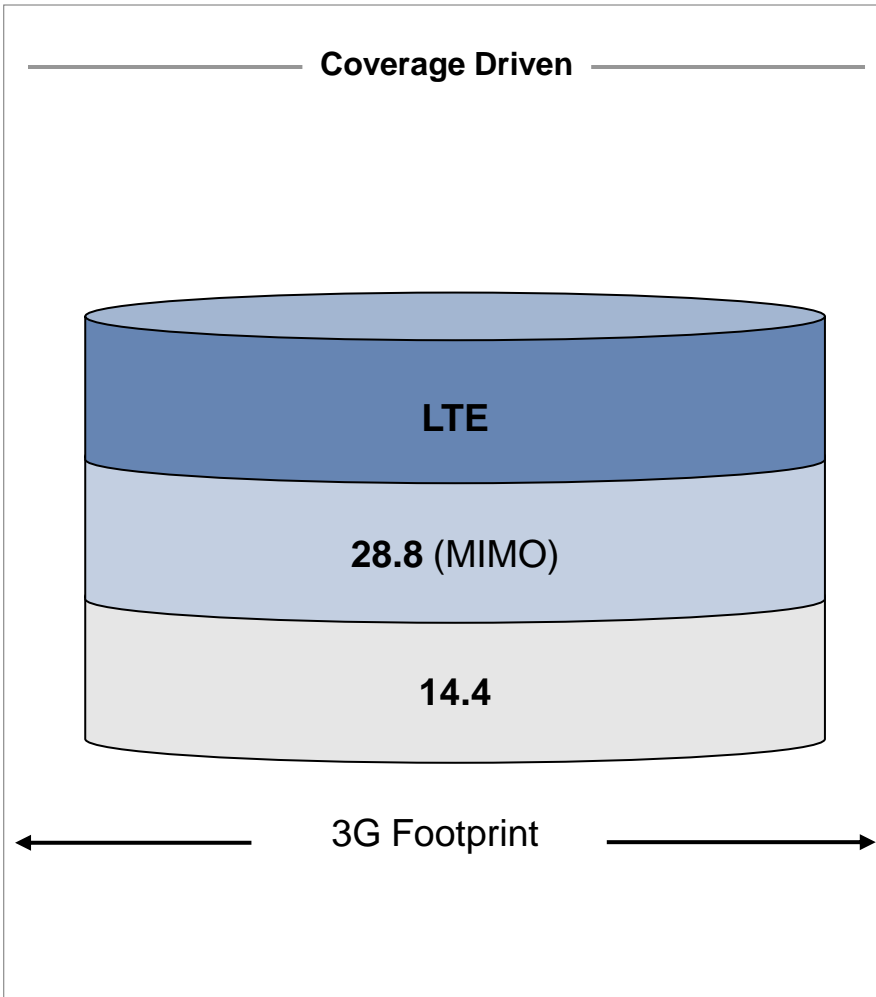
\*Source: Bloomberg, Business Week

...and network impact



- Exponential traffic growth cannot be stimulated in existing customers & service base only
- Either capture of new customers or introduction of new technology and/or new handhels can stimulate an exponential traffic growth
- Linear traffic growth means customer saturation or capacity limitation already

Capacity expansions do cost a lot of money – money operators nowadays don't have. A targeted expansion therefore helps to reduce this dilemma.

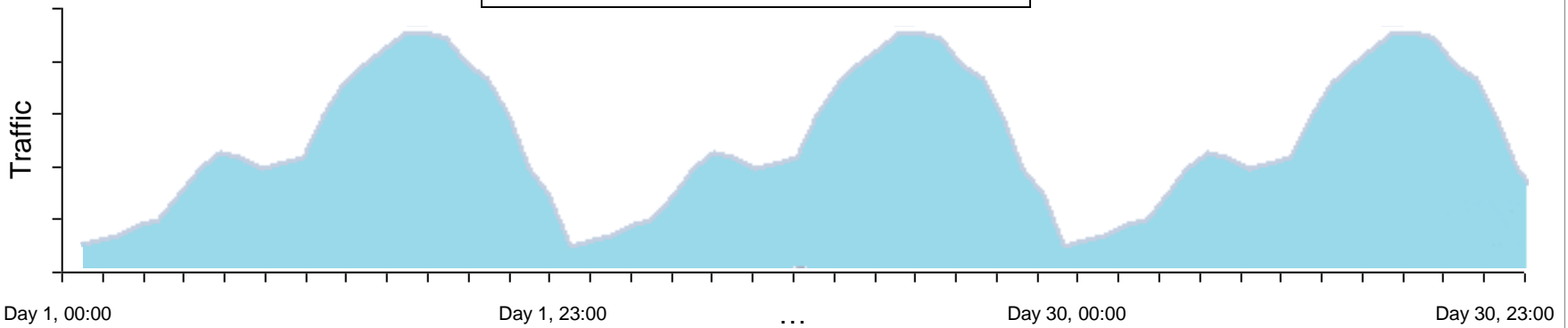


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Client's logo

**Budget relevant "capacity" always refers to busy hour resource utilization.**

$$\text{capacity} = \frac{\text{volume}}{\text{time}}$$



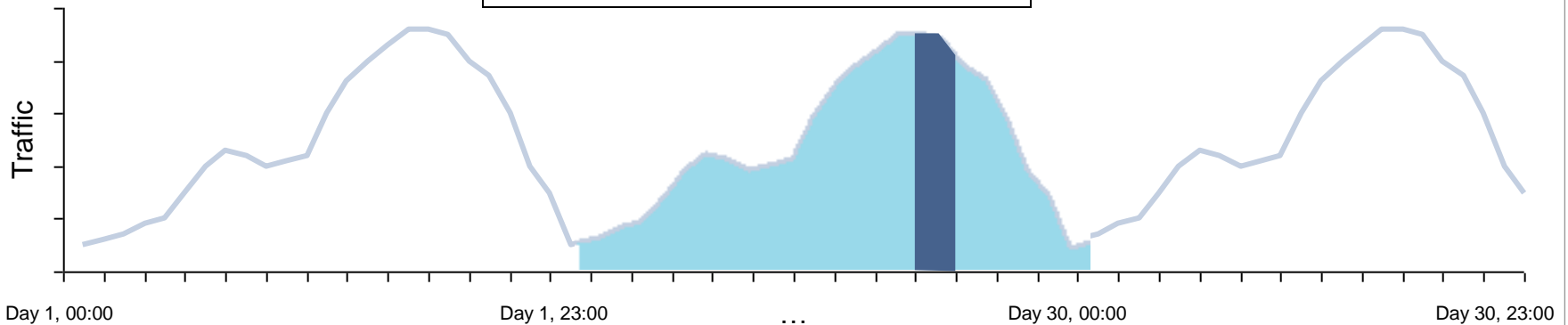
**Aggregation period: 1 month**

- Gives the total traffic volume consumed
- Can be directly translated to billable revenues
- Does not reflect daily and hourly fluctuations

➔ Is typically used by marketing

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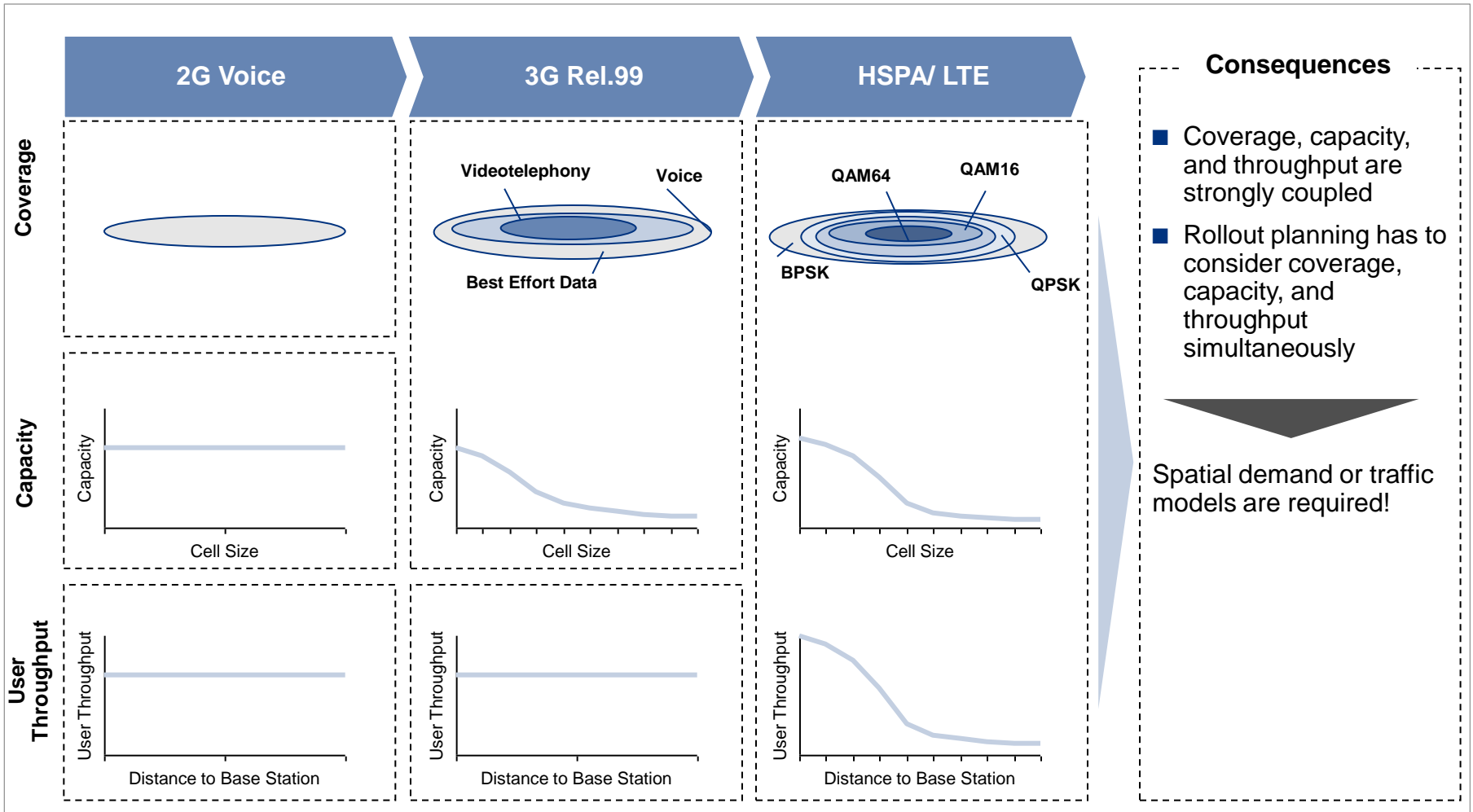
➡ Is typically used by marketing

**Aggregation period: 1 hour**

- Reflects daily and hourly fluctuations
- No correlation between monthly volumes (marketing) and daily busy hour (technology)

➡ Is typically used by technology

With the introduction of HSPA and LTE spatial market models are implicitly required in order to capture the complex interrelation of coverage, capacity, and throughput.



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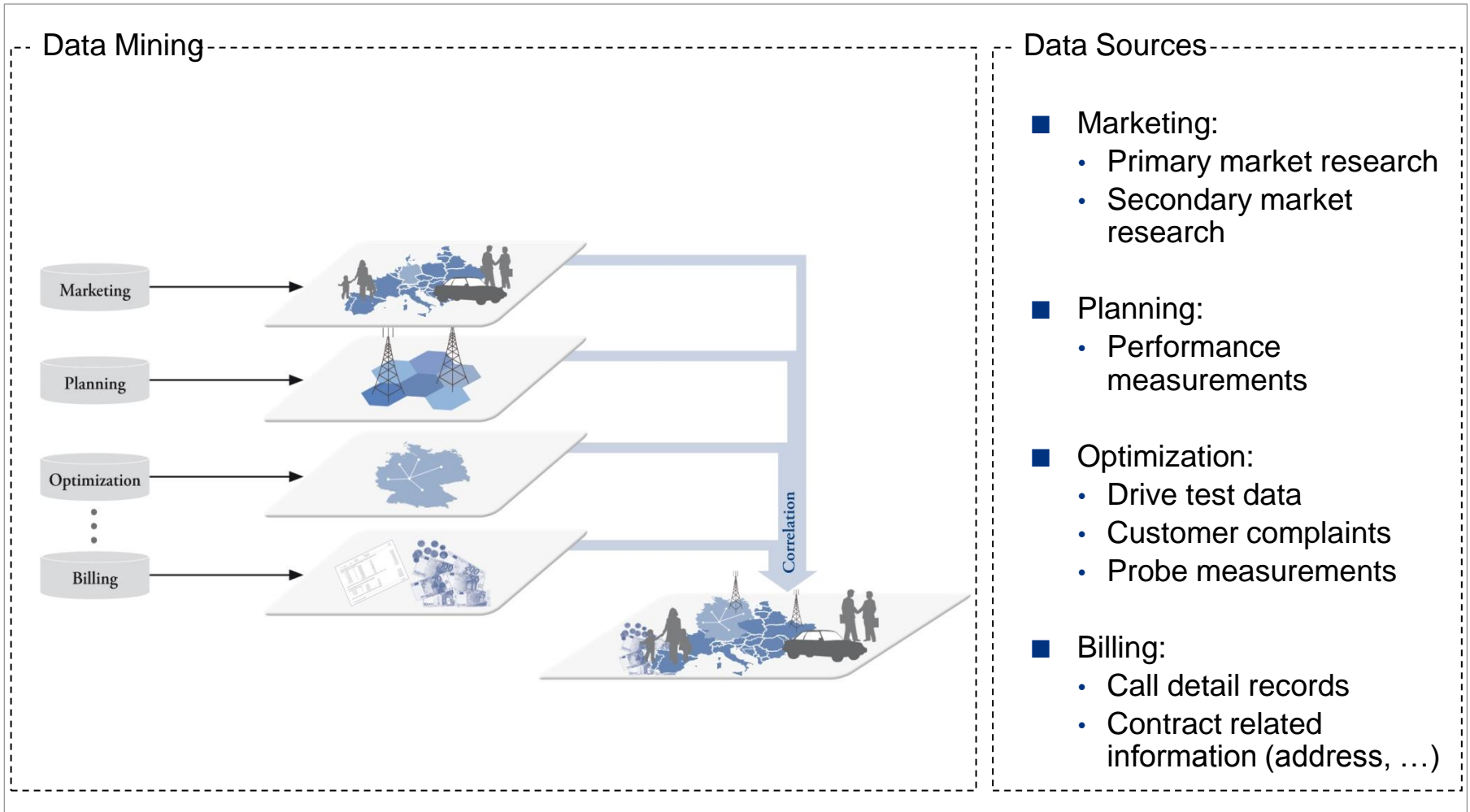
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**The expansion dilemma can only be solved by using spatial and temporal demand models that give answers to central questions characterising the demand.**

1. Who has the demand?
2. What types of services are demanded?
3. Where is the demand located?
4. Which quality users expect?
5. How much of the services are requested?
6. When does the demand occur?

Spatial and Temporal Demand Model

Data mining is the mean to develop a spatial demand model that correlates information of various data sources.

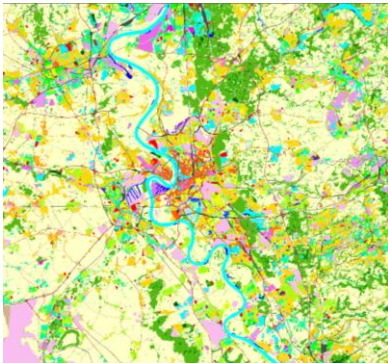




# Network usage measurements in combination with geodata allow to spatially analyse the traffic distribution as well as the traffic growth distribution.

## Geodata

Clutter data



Best server data

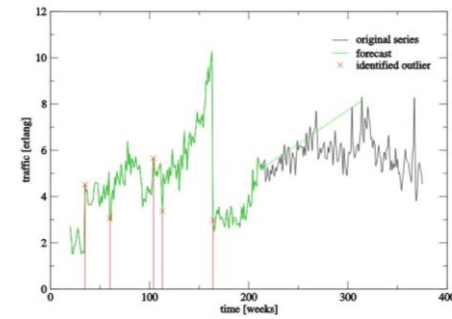


## Measurements

1	A	B	C	D	E	F	G
Date	CellID	Voice (Eff)	Video (Eff)	Data (Eff)	Data Volume (Mbyte)	Code Tree Utilization	
2	2010-09-01 1A	0.2111	0	0.1056	0.1623096	4.955	
3	2010-09-01 1B	0.1603	0	0.1028	0.0548621	6.264	
4	2010-09-01 1A	0.3912	0	0.3333	1.0452377	7.328	
5	2010-09-01 2B	0.4596	0	0.3667	0.4517072	5.833	
6	2010-09-01 1C	0.2661	0	0.1364	0.00206439	7.105	
7	2010-09-01 3A	0.4486	0	0.2764	0.13522761	5.58	
8	2010-09-01 3B	0.5776	0	0.5736	2.2327461	7.436	
9	2010-09-01 1C	0.1039	0	0.0911	0.1410102	4.756	
10	2010-09-02 4A	0.3623	0	0.1633	0.4458823	5.467	
11	2010-09-02 4B	0.2567	0	0.1675	0.2671744	5.476	
12	2010-09-02 5A	0.1847	0	0.2297	0.5246225	5.927	
13	2010-09-02 5B	0.6083	0	0.2596	1.25683272	5.983	
14	2010-09-02 6A	0.4639	0	0.2375	0.7416932	6.304	
15	2010-09-02 6B	0.1925	0	0	0	4.244	
16	2010-09-02 6C	1.2284	0	0.2222	1.62072339	7.283	
17	2010-09-02 7A	0.4667	0	0.463	1.0263495	6.32	
18	2010-09-03 7B	0.3468	0.0542	0.4222	0.5260724	6.333	
19	2010-09-03 7C	0.1037	0.0014	0.2317	0.5883774	5.559	
20	2010-09-03 8A	0.35	0	0.1653	0.4189424	5.32	
21	2010-09-03 8B	0.0753	0	0.1097	2.0501177	10.823	
22	2010-09-03 8C	0.1663	0	0.5389	1.0135693	7.673	
23	2010-09-03 9A	0.0486	0	0.0794	0.07043429	4.028	
24	2010-09-03 9B	0.4667	0	0.3917	2.3692691	9.261	
25	2010-09-03 9C	0.4056	0	0.1603	0.45837285	5.763	
26	2010-09-04 10A	0.2639	0	0.5969	0.0388493	7.017	
27	2010-09-04 10B	0.1906	0	0.4534	0.1475225	6.924	
28	2010-09-04 10C	0.1306	0	0.1038	0.11633271	5.466	
29	2010-09-04 11A	0.2119	0	0.2625	0.3354361	5.649	
30	2010-09-04 11B	0.1897	0	0.1861	0.3250463	6.087	
31	2010-09-04 11C	0.4437	0.0069	0.4056	3.143406	7.533	
32	2010-09-04 12A	0.0937	0	1.0694	7.3643933	15.766	
33	2010-09-04 12B	0.5333	0	0.1034	0.14131173	4.175	
34	2010-09-05 12C	0.5042	0.0014	0.563	1.0432022	6.017	
35	2010-09-05 13A	0.1663	0	0.3711	0.52941793	6.872	
36	2010-09-05 13B	0.1194	0	0.2264	0.4662826	5.66	
37	2010-09-05 13C	0.1663	0	0.3417	0.44494516	6.077	
38	2010-09-05 14A	0.0969	0	0.1021	0.0943407	4.616	
39	2010-09-05 14B	0.0969	0	0.1021	0.0943407	4.616	

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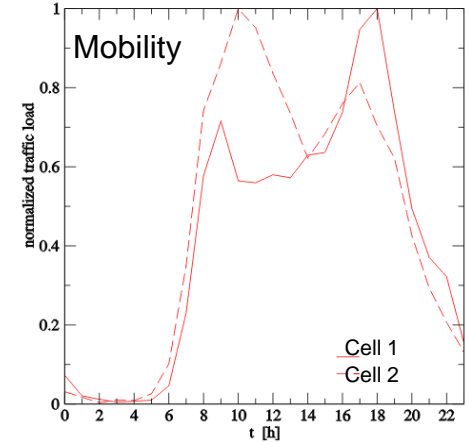
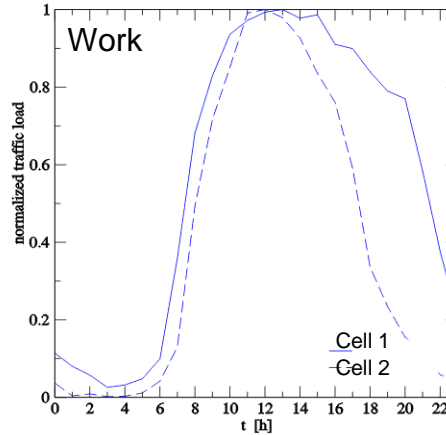
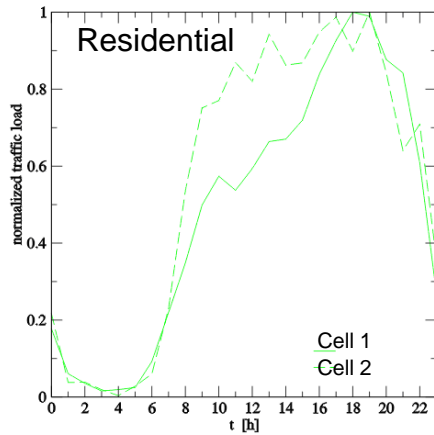
## Traffic Distribution



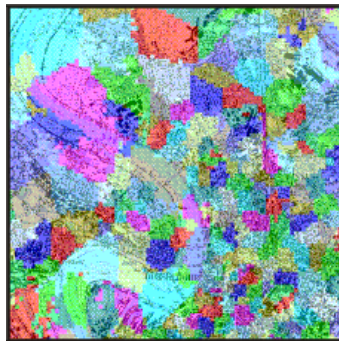
- Spatial traffic distribution layer per service category
- Spatial traffic growth distribution layer per service category
- Seasonal effects

# Learn from your network: simple statistics help to characterize the current customer base – even on a spatial level.

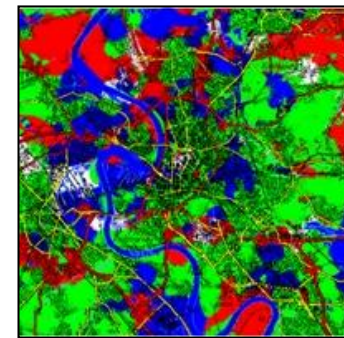
## Cell Characteristics



Best Server Plot

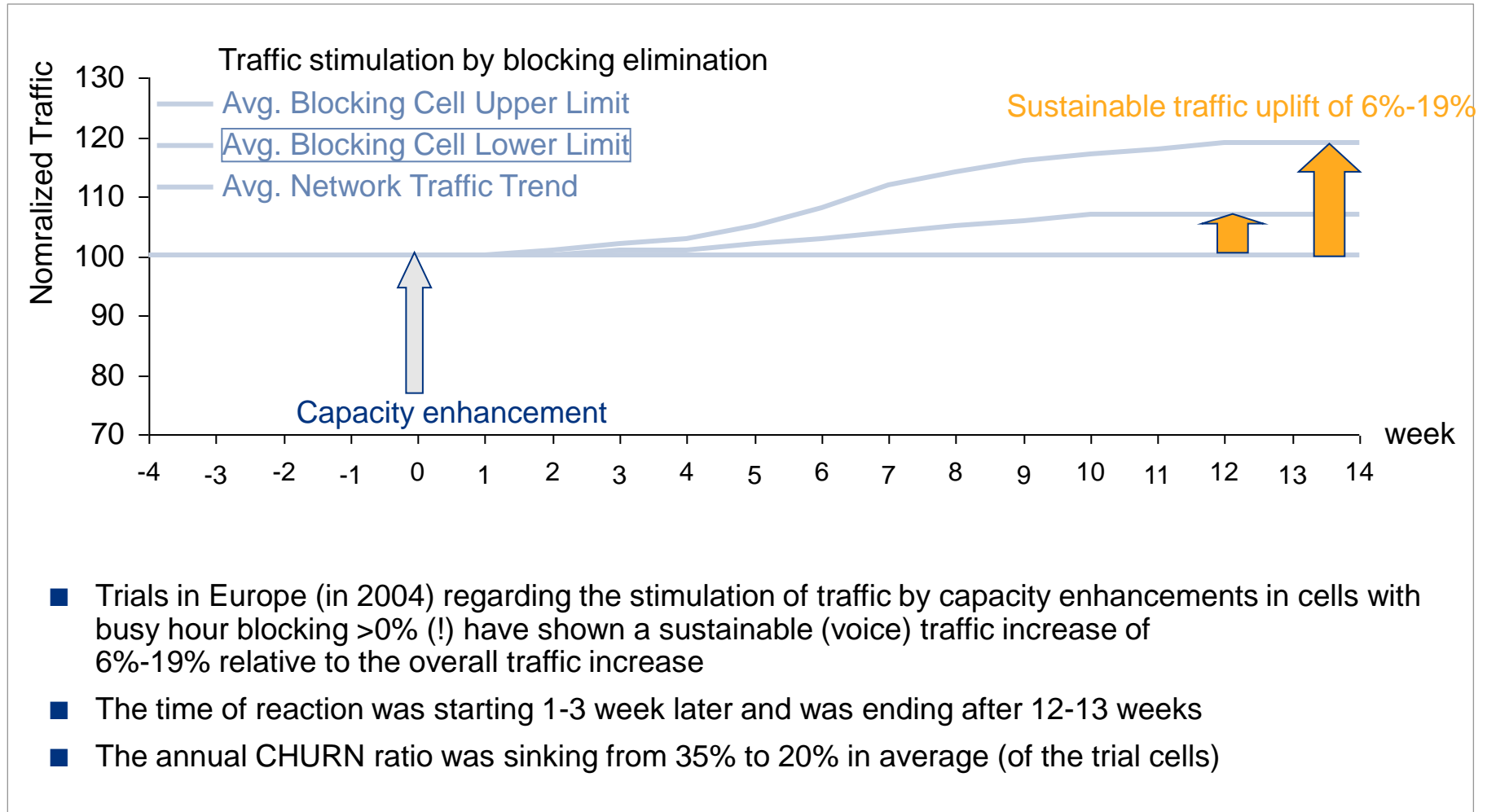


- Work
- Residential
- Mobility



Cell classification according to dominant traffic behavior

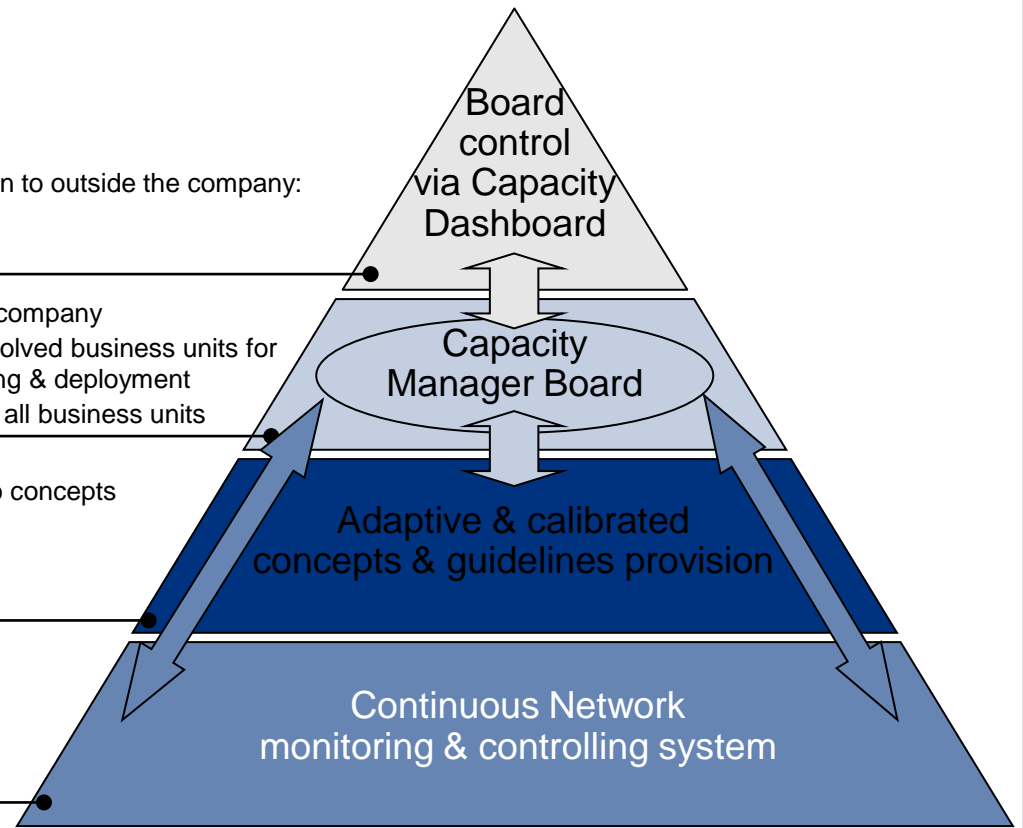
**Sustainable elimination of primary blocking but also secondary HR-ratio stimulates the customer's traffic and reduces the CHURN rate obviously.**



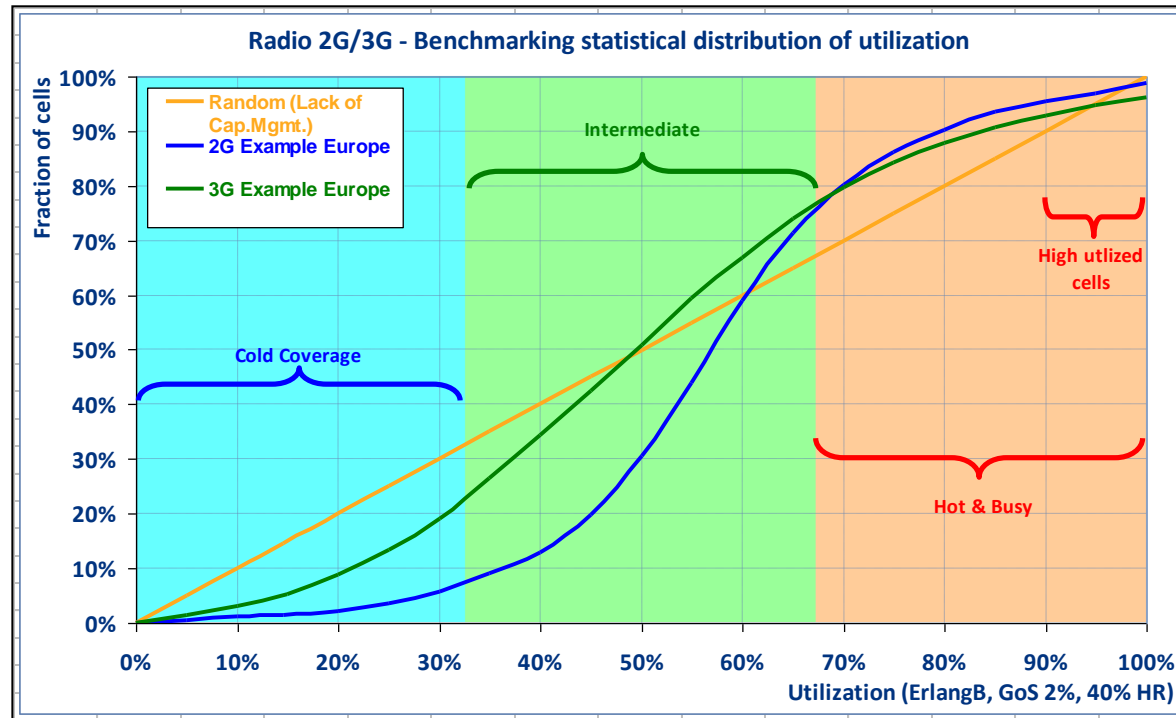
## Enhanced mobile capacity management learns from the network!

### Hierarchical organization of responsibilities and information flow:

- Control of capacity and utilization information
  - Communicating coherent & authoritative capacitive information to outside the company: Shareholders, investment bankers and competitors
  - Assures their own responsibility for investment efficiency
- 
- Single provider of any capacity related information inside the company
  - Assures the usage of consistent capacity information in all involved business units for forecasting, budgeting, strategy development, network planning & deployment
  - Coordination of the interaction of and information flux through all business units
- 
- Provision of a consistent set of the translation from strategy to concepts
  - Enabling of adaptive & continuously converging guidelines
  - Iterative calibration of deployed guidelines
  - Assures the most efficient usage of CAPEX
- 
- Primary base for all capacity related information
  - Derived from ongoing interaction between operation optimization, planning & engineering
  - Ensures crosschecking with network reality permanently



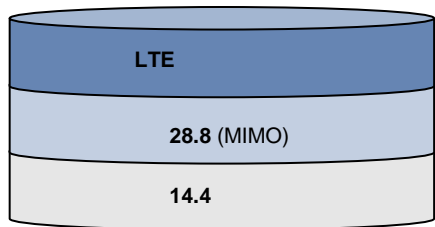
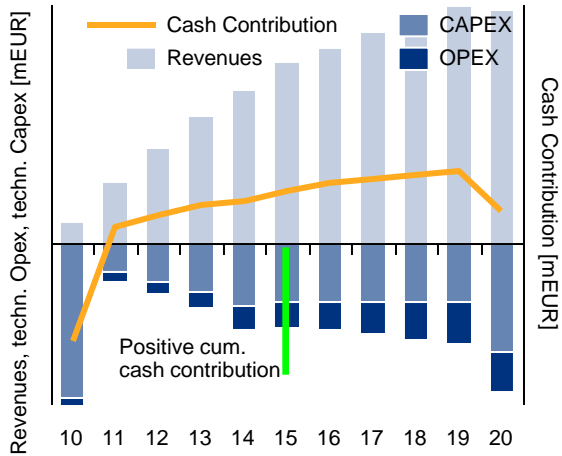
In a perfect world utilization is distributed according to a step-function. In reality, however, the distribution often is close to random...



- Capacity management avoids over- or under provisioning of resources
- Superior network quality is ensured in hot and busy spots while pure coverage sites are equipped with minimal capacity only
- An efficient expansion strategy will release CAPEX compared to a random strategy

# Demand driven network deployment significantly reduces the budget requirements.

## “Traditional Rollout”

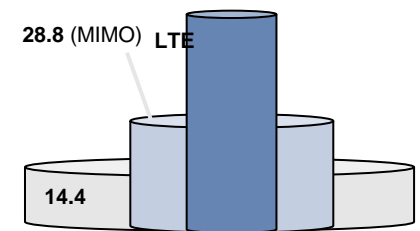
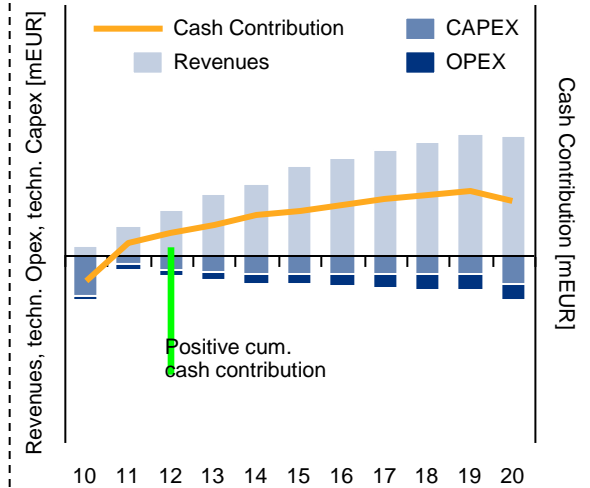


3G Footprint

## Consequences

- CAPEX savings:
  - Only 1/3 of CAPEX required
- Increased profitability:
  - Break-even reached 3 years earlier
  - NPV increased by 20%
- Focus on network quality improvement and high-selective performance improvement:
  - Demand driven deployment of HSPA+ releases and LTE

## Demand Driven Rollout



3G Footprint



Client's logo



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