

# Network Performance Score (NPS):

A method for initiating network improvement with a single QoE centric score



# 'Network Performance Score'

## Real-field network performance evaluation

- There are two basic questions:

*How good is my network or my service?*

→ *Integration*

*Where I can improve my network or service at most efficient?*

→ *Trouble shooting*

- At first I have to measure Quality of Experience (QoE) or 'performance'
  - **There are many, many technical measures, KPIs, QoS and QoE metrics**
- Real-field performance evaluation is large scale analysis. How to handle myriads of measurement results?
  - **Smart aggregation without losing drill-down capabilities**
  - **The Network Performance Score is the ideal entry point into a database**



# How to come to 'general' and valid QoE scores?

1. Transformation of technical measurements to an metric based on human perception
2. Rating and combining (perceptive) metrics to a QoE score for a service
3. Rating and combining of 'per service KPIs' to a overall QoE score describing performance of a network, an operator, an region,...

There are links to:

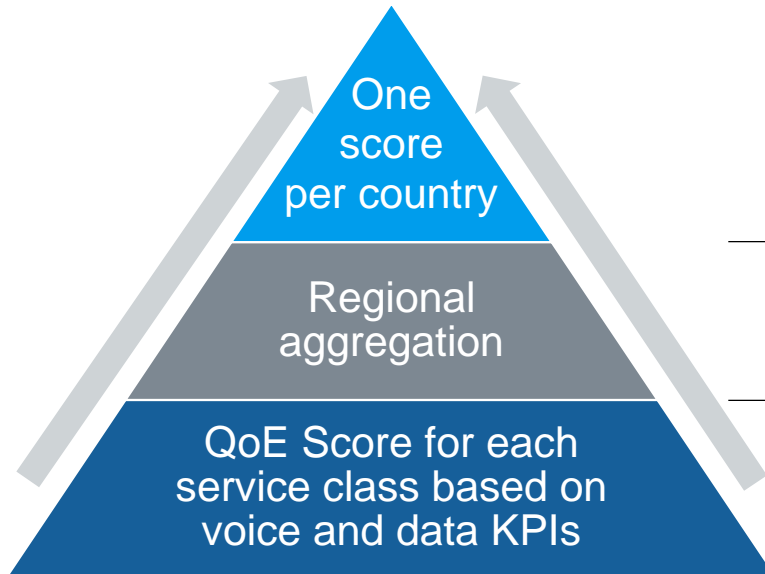
**ITU E.840** (former *E.NetPerfRank*)

**ETSI TR 103 559** (draft): *Best practices for robust network QoS benchmark testing and ranking*



# Network Performance Score

## Different levels of aggregation



Level 3: Weight and aggregate all regions to a countrywide score (*the “CxO level”*)

Level 2: Weight and aggregate QoE of all service classes per region

Level 1: Evaluate QoE for all service classes (different dimensions of a service class)

Methodology currently in standardization in ETSI STQ (*TR 103 559* draft available)

*“Best practices for robust network QoS benchmark testing and ranking”*



# A bit of history – where we are coming from?

- For decades telecommunication networks are focused on voice telephony, data communication started with modems and text based services
  - In mobile networks, GPRS, EDGE and UMTS were the first data technologies
    - Voice and Data are handled separately
    - Data bitrates are low and always the bottleneck in the transmission chain
- Improving data throughput on the last mile (or the mobile channel) had immediate positive effect on QoE



# A bit of history – ...and where we are today?

- Data transport capacity has improved by sizes in the last years.
- Voice services are using the same transport scheme and are ‘just a little part of data’
- Does it solve all problems of ‘perceived performance’?
  - *Networks are very heterogeneous, performance is influenced by actual technology, routing and resources*
  - *The data link is often not the limiting factor anymore, content providing infrastructure, interconnectivity and end-user devices can become the bottleneck*
  - *The peak capacity is not ‘standard everywhere’, in reality there is a very wide variability in what you get depending on technology, load, position, day-time, subscription,...*
  - *Services get smart, they adjust the data volume to varying channel capacities*

# What drives QoE of a service? What are dimensions of it?

## Use existing KPIs for QoE evaluation:

### ■ Service availability

- Do I have access to the service at all?
- Do I stop waiting because of too long waiting times?

### ■ Waiting for 'action' (task being started and/or completed)

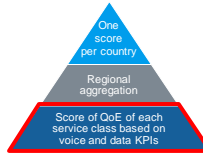
- How is the accepted duration (patience) for a normal 'web task', getting a call connected or seeing the video starting.

### ■ How is the quality of the media (e.g. video, voice, pictures,...)

- Is the quality how I expect it?



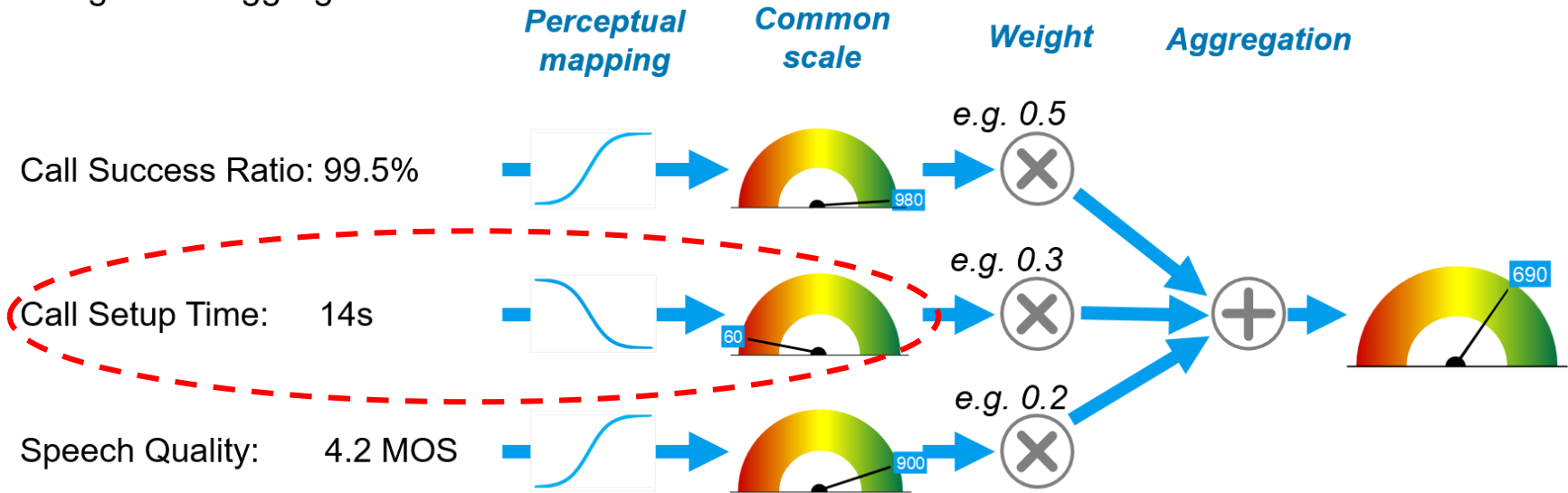
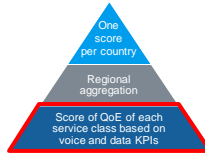
**QoE  
of a service**



# How to evaluate QoE of service classes? – Level 1

How to rate KPIs different dimensions to each other? Simple example for **telephony**

- (Only) what can be perceived, should have an impact on scoring
- Normalize to a common scale (0 ... 1000)
- Weight and Aggregation

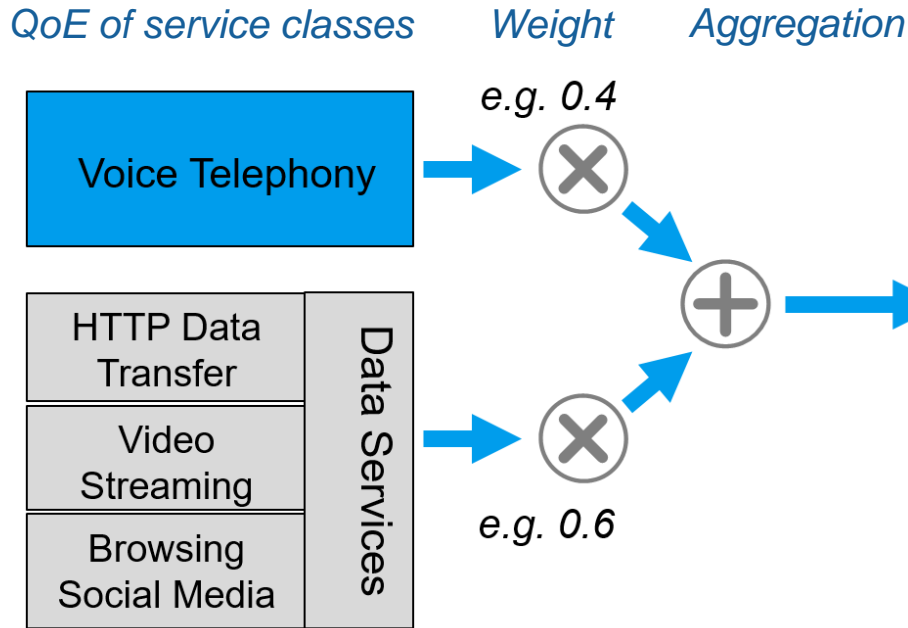


Critical dimension → target for improvements



# Network Performance Score – Level 2

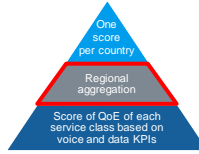
Weight and aggregate all service classes per region or category



*This score describes the performance in a certain location, time, situation...*

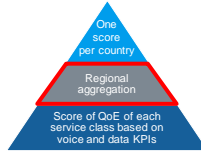
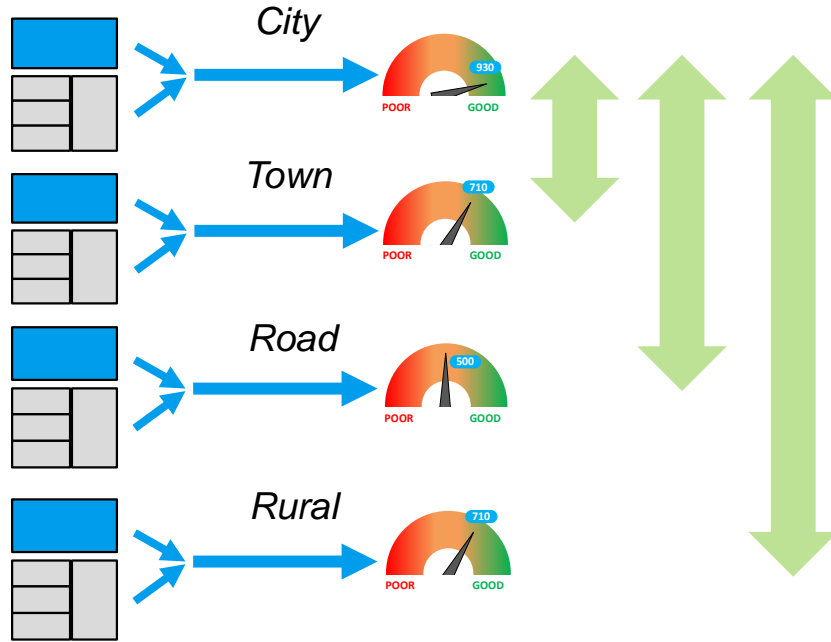


*...for further comparison with other regions etc.*



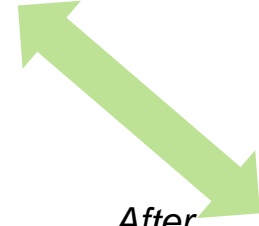
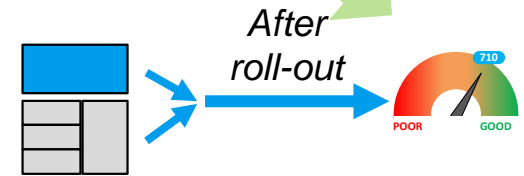
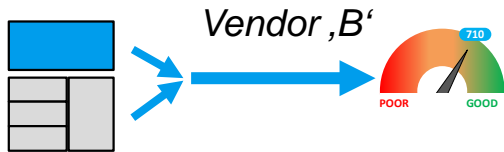
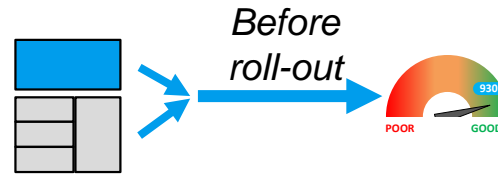
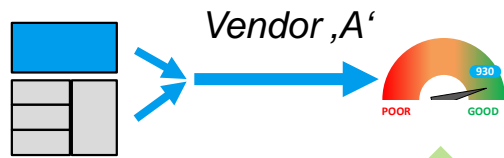
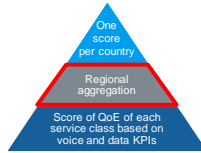
# Network Performance Score – Level 2

## Comparison of regions ('intra-market')



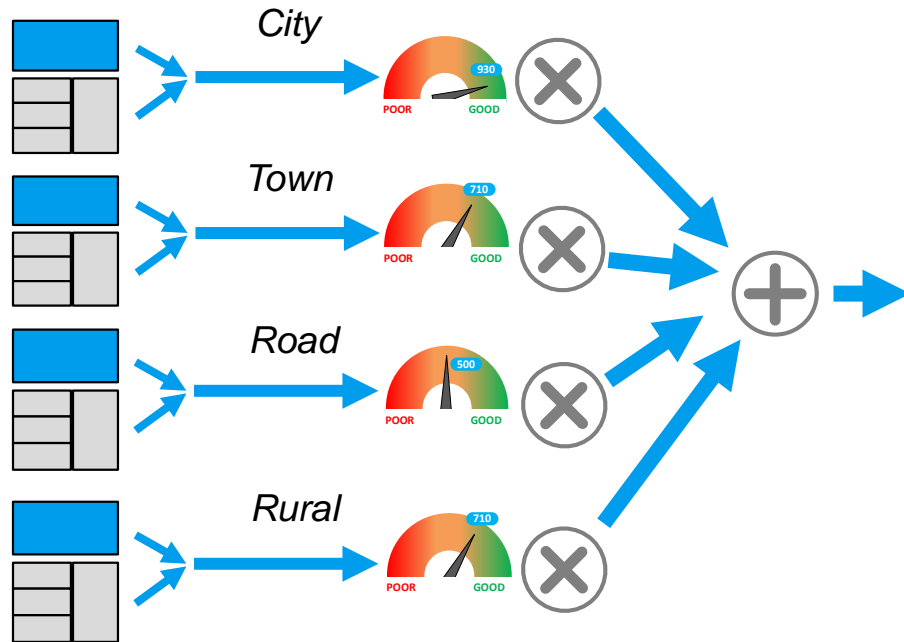
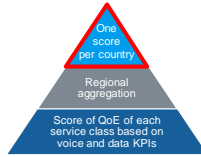
# Network Performance Score – Level 2

## Comparison of other categories ('intra-market')



# The Network Performance Score – Level 3

## The CxO level ('inter-market')

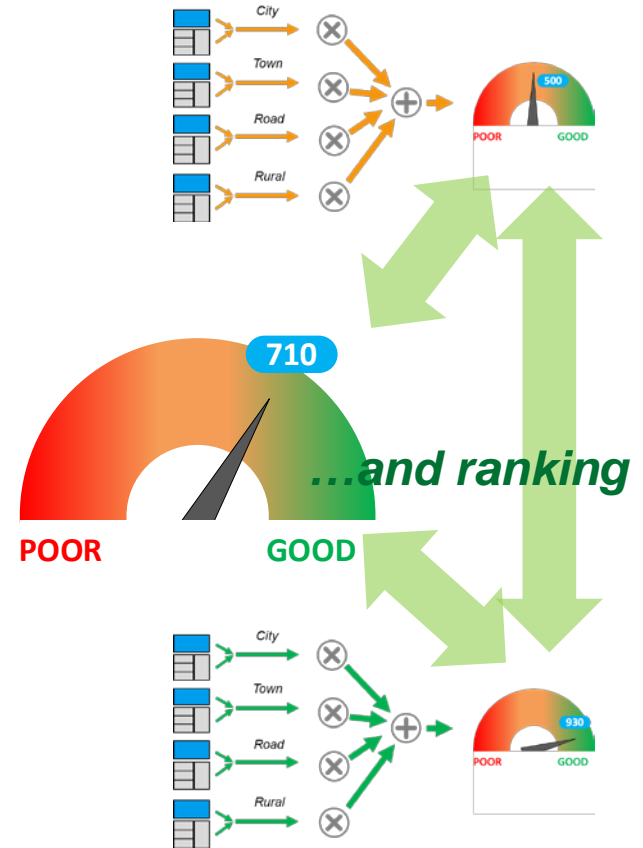
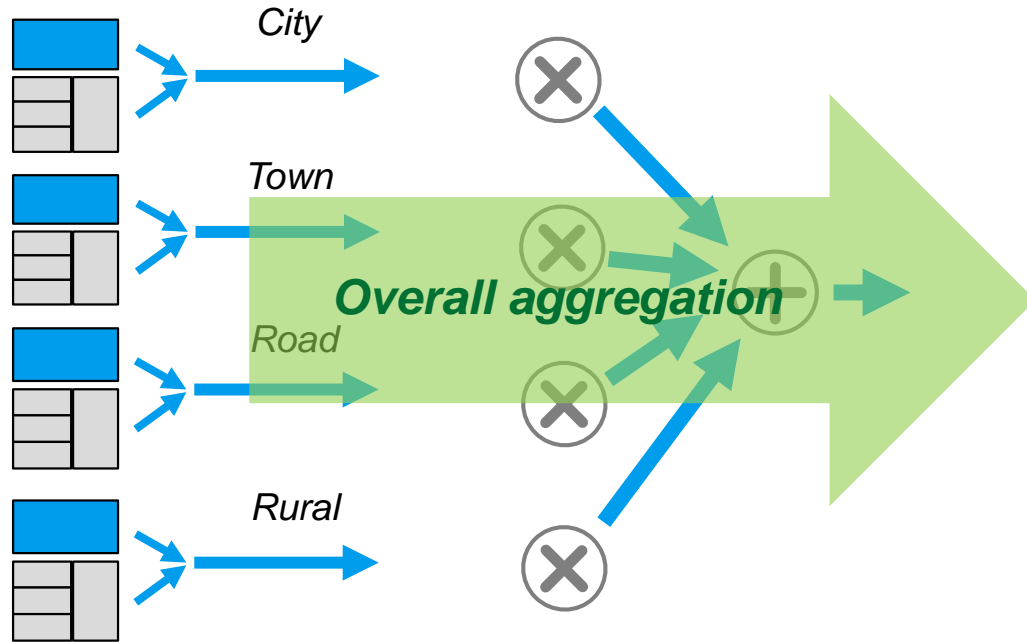


*This score describes the performance country-wide...*

*...for further comparison with competitors or other countries etc.*

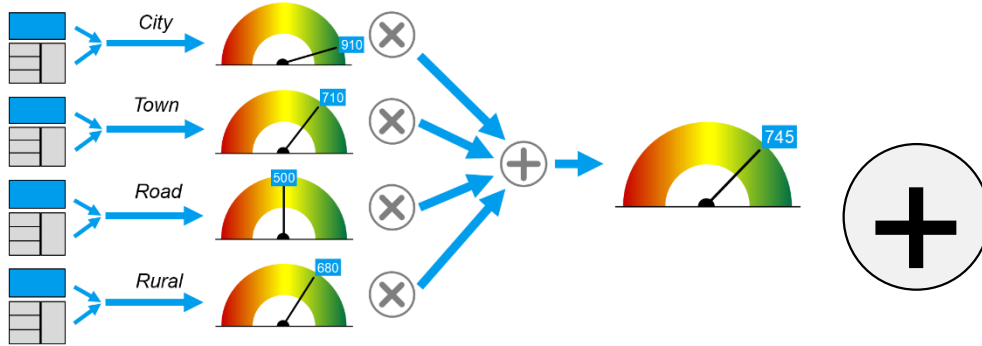
# The Network Performance Score – Level 3

## The CxO level ('inter-market')



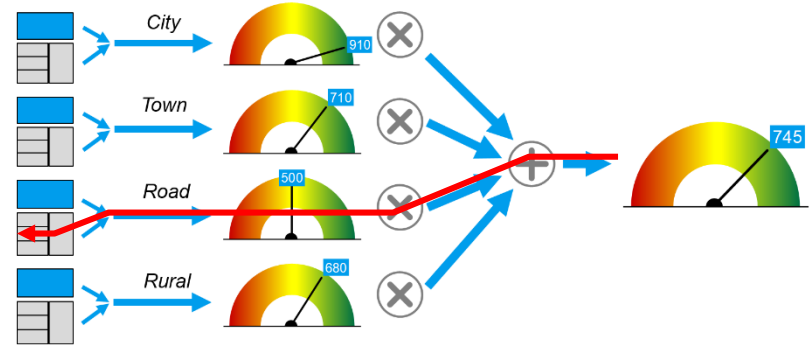
# The Network Performance Score

## Aggregation and drill down with the same tool



### Aggregation:

- Regional weighting (acc. to traffic, population, ...)
- Benchmarking different operators
- Comparison of technology and (infra) vendors
- Inter-market comparison (compare countries)

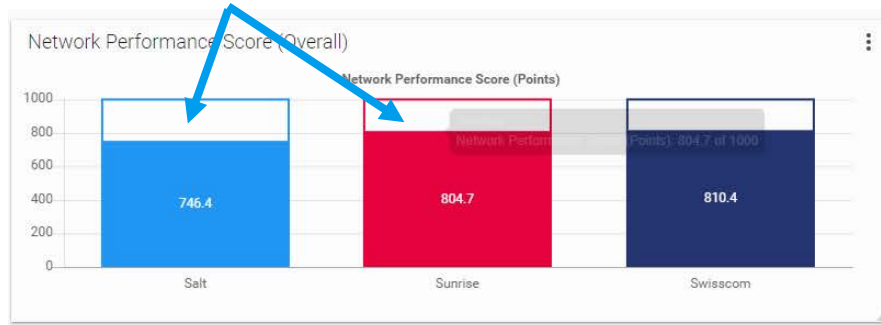


### Drill down:

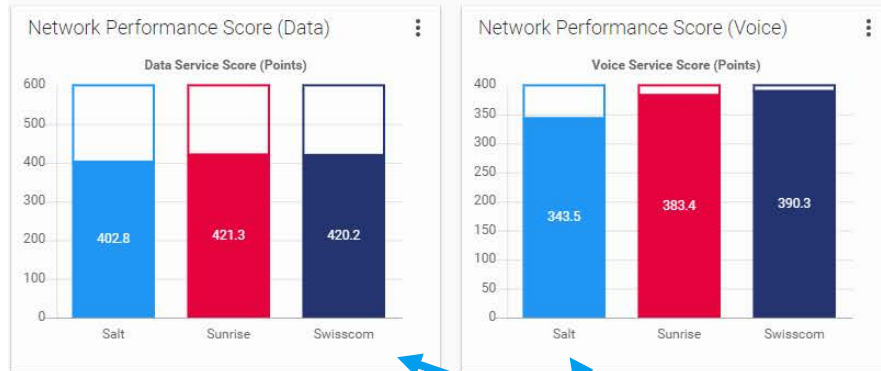
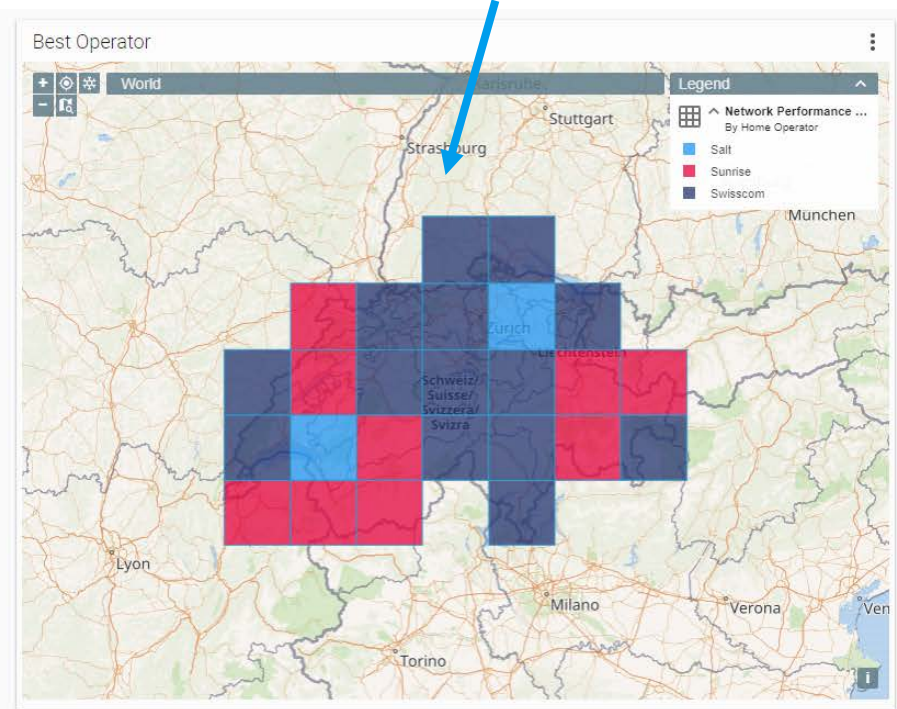
- Critical region
- Critical service class
- Critical dimension of service class
- Basis for network optimization

# ...some real-field data: overall view (three operators in CH)

*Improvement potential*



*Regional split on map*



*Split into voice and data*

# ...some real-field data: Category breakdown

Split on defined categories:

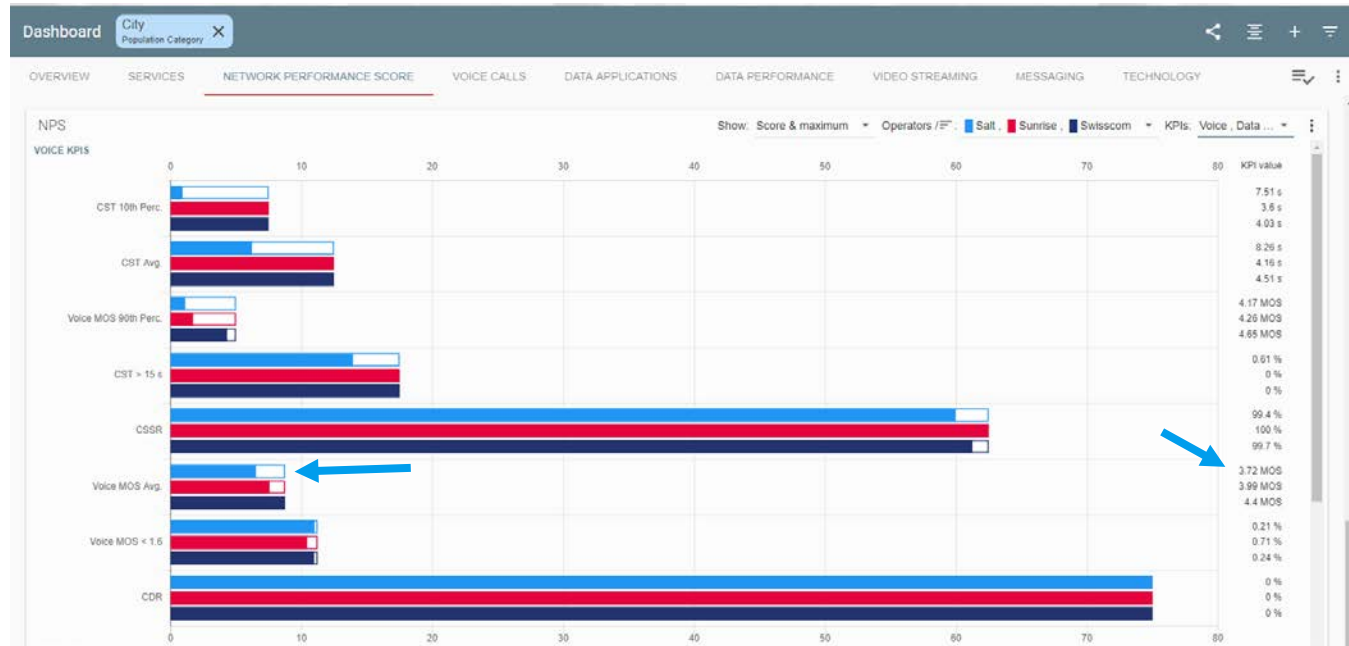
- City (50%)
- Town (30%)
- Road (20%)





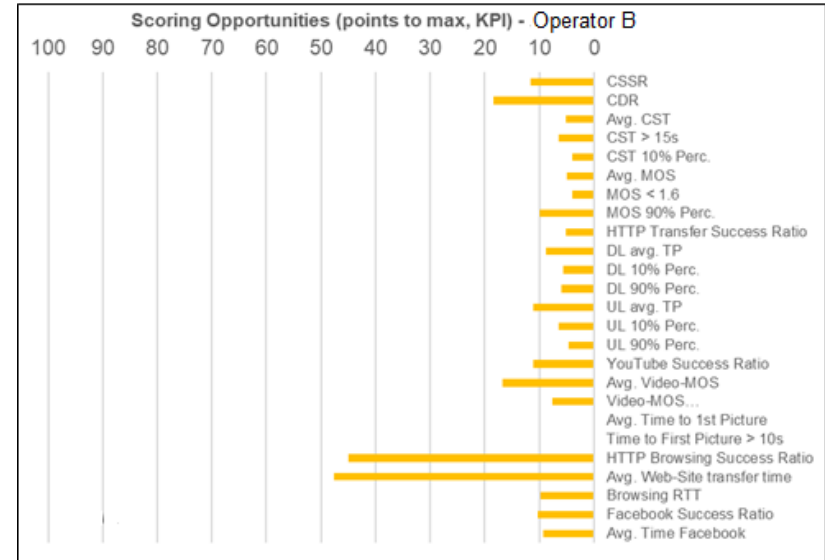
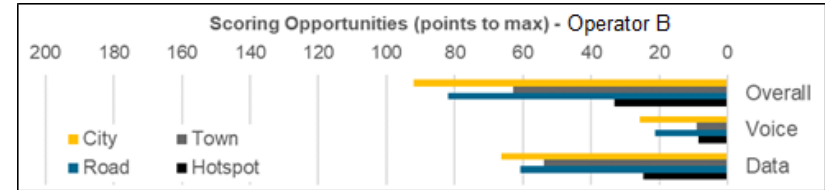
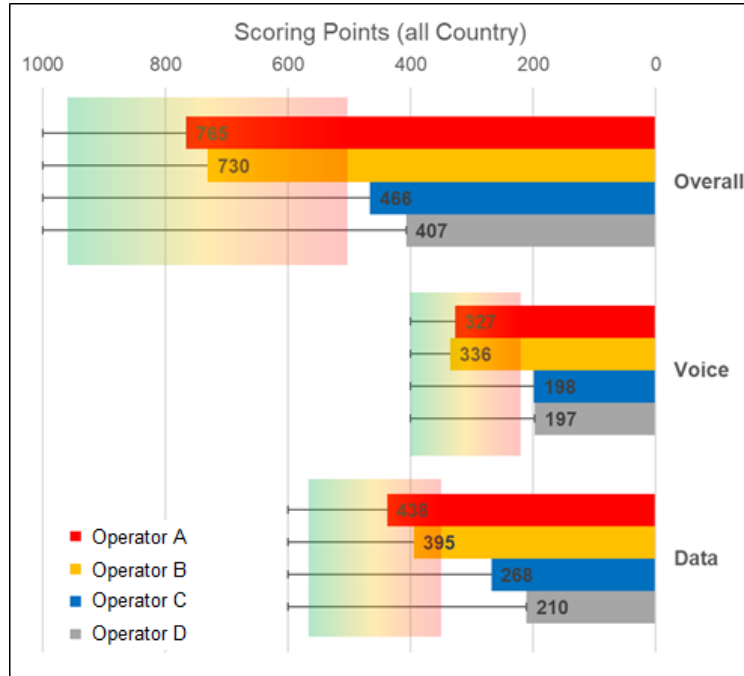
# ...some real-field data: Breakdown to individual KPI

## Improvement potential per individual category and KPI



# ...some real-field data: Reporting to Executive Management

## Operator comparison and Scoring Opportunities



# ...some real-field data: Scoring opportunity breakdown

Voice Telephony	Weight in Telephony	Weight in Overall	Max. Points	KPI			Improvement in points
				'bad' limit	'good' limit	Change KPI by	
Call Setup Success Ratio	0.3125	0.1250	125	85%	100%	0.1%	0.8
Call Drop Ratio	0.3750	0.1500	150	10%	0%	-0.1%	1.5
Avg. Call Setup Time	0.0625	0.0250	25	12 s	4.5 s	-1 s	3.3
Call Setup Time > 15s Ratio	0.0875	0.0350	35	3%	0%	-1%	11.7
10% Percentile CST	0.0375	0.0150	15	8 s	4 s	-1 s	3.8
Avg. Speech Quality P.863 'POLQA'	0.0438	0.0175	17.5	2	4.3	0.1 MOS	0.8
P.863 'POLQA' < 1.6 ratio	0.0562	0.0225	22.5	10%	0%	-1%	2.2
90% Percentile Speech Quality P.863	0.0250	0.0100	10	4	4.75	0.1 MOS	1.3

Data Services	Weight in Data	Weight in Overall	Max. Points	KPI			Improvement in points
				'bad' limit	'good' limit	Change KPI by	
FDPS Service Availability Service Accessibility	0.055	0.033	33	80%	100%	1.0%	1.1
FDTT DL Average MDR	0.035	0.021	21	2 Mbit/s	50 Mbit/s	1 Mbit/s	0.3
FDTT DL 10% Percentile MDR	0.045	0.027	27	2 Mbit/s	10 Mbit/s	1 Mbit/s	2.3
FDTT DL 90% Percentile MDR	0.0175	0.011	10.5	10 Mbit/s	120 Mbit/s	1 Mbit/s	0.1
FDTT UL Average MDR	0.035	0.021	21	0.5 Mbit/s	35 Mbit/s	1 Mbit/s	0.4
FDTT UL 10% Percentile MDR	0.045	0.027	27	0.5 Mbit/s	4 Mbit/s	1 Mbit/s	5.1
FDTT UL - 90% Percentile MDR	0.0175	0.011	10.5	5 Mbit/s	45 Mbit/s	1 Mbit/s	0.2
Video Test Success Ratio	0.1276	0.077	76.6	80%	100%	1.0%	2.6
Average Video-MOS J.343.1	0.0363	0.022	21.8	3	4.5	0.1 MOS	1.0
10% Percentile Video-MOS Value	0.0363	0.022	21.8	2	4	0.1 MOS	0.7
Average Time to 1st Picture	0.0099	0.006	5.9	7.0 s	2.0 s	-1s	0.8
Time to First Picture > 10s Ratio	0.0099	0.006	5.9	5%	0%	-1.0%	0.8
Web-site download Test Success Ratio	0.25333	0.152	152	80%	100%	1.0%	5.1
Average Web-site transfer Time	0.10857	0.065	65.1	6.0 s	1.0 s	-1s	8.7
Browsing RTT - Round Trip Time	0.0181	0.011	10.9	150 ms	30 ms	-10ms	0.6
Social Media Test Success Ratio	0.09375	0.056	56.3	80%	100%	1.0%	1.9
Average Media Transfer Time	0.05625	0.034	33.8	15	3	-1s	1.9

Thank you for your attention

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Mobile Network Testing

