From QoS to QoE: Integration to E2E Service Delivery

Prepared for TOT Academy

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Speaker Profile

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Executive summary

- 16 years of experiences in telecom/ICT and management consulting
- Have worked with Thai policy makers and regulators in charge of technology and ICT
- Speaker and thought leader in ICT/telecom since 2008. Have been quoted in various print and broadcast media
- Member of International Association of Innovation Professionals (IAOIP)

Education

- Ph.D., Telecommunications major, Temple University, Philadelphia, PA. USA.

Publications

- "Development of Telecommunications Infrastructure and Policy in Thailand" (English). Author: Monsinee Keeratikrainon, Ph.D., Lambert Publishing House, released in 2010 Available in Amazon, Barns & Noble, and most international bookstores.
- "Cutting-edge Strategy Cook Book" (Thai). Author: Monsinee Keeratikrainon, Ph.D., published by McKansys (Thailand), 2013.

Work Experiences

Sofrecom (Part of Orange Group)

Regional Commercial Director

- Leading commercial activities by initiating solutions and best-practices to help regulators and telecom operators in this region achieve their goals

Deloitte

Partner, Commercial Advisory and Diligence

- Led Commercial and Technology Due Diligence advisory service unit, in supporting clients' new investment and M&A initiatives as well as go-to-market and technology deployment strategies.

Frost and Sullivan

Country Director, Thailand and Myanmar

- Led market research and growth strategy consulting service in Thailand and Myanmar while being the firm's spokesperson and thought leaders in ICT, and also leading key events of the firm, such as, Global Innovation and Leadership (GIL), MegaTrend and Techvision 2020.

Wipro Technologies

Delivery Head

Key Projects :

- dTAC BSCS transformation program, working on site with dTAC commercial and operation team for
- K-bank transformation (KT) project , reported to Kbank's CIO.

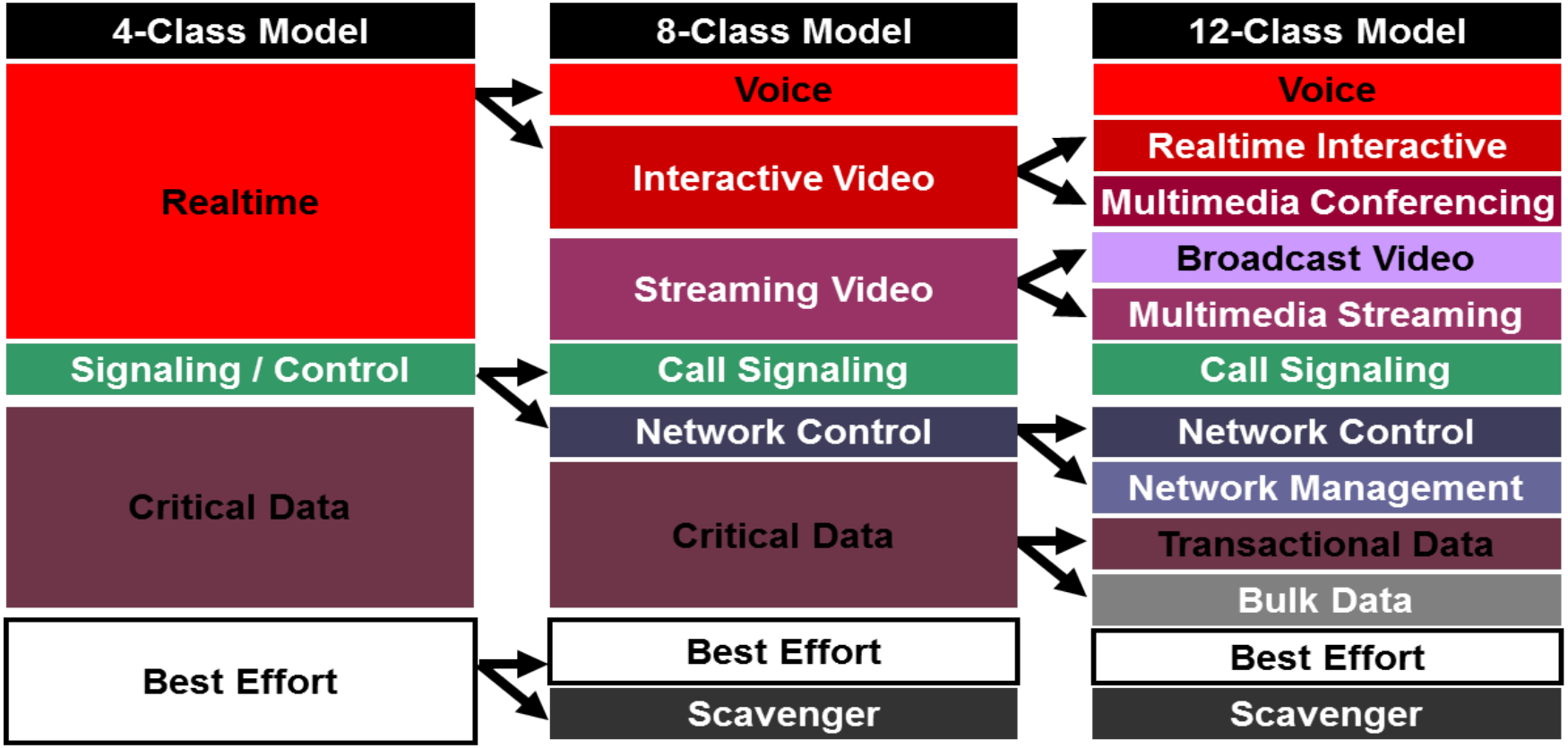
TRUE Corporation

Senior Manager – Broadband & Data Service

- Supervised and managed strategic initiatives related to new products and services for B2B and datacom users

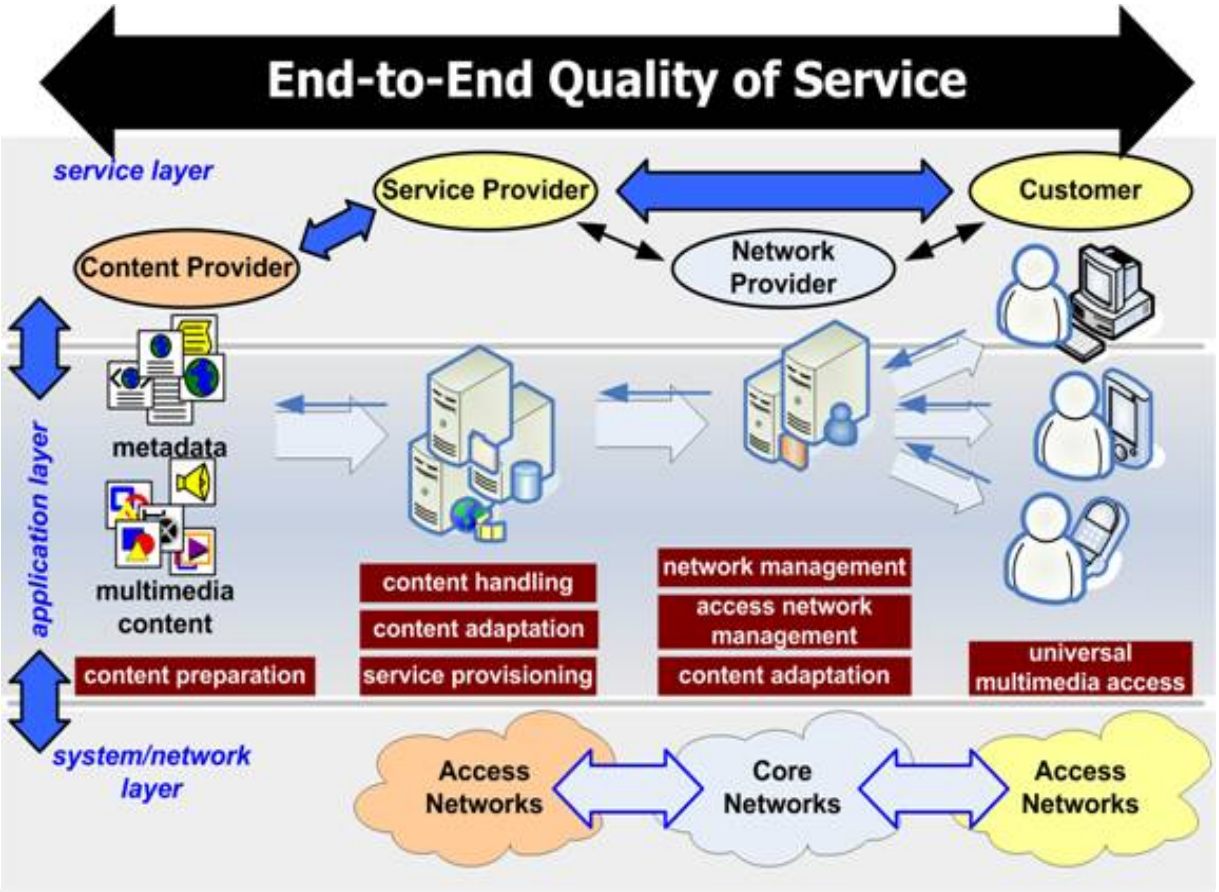
QoS Class-of-Service Model Evolution

Evolving business needs are causing complex QoS model. Therefore, network administrators need to well plan ahead to deploy QoS in a phased approach, in order to address all the needs.



RFC 4594 (Source: "End-to-End QoS Network Design: Quality of Service for Rich-Media & Cloud Networks", Cisco 2013)

Applying E2E QoS in multi-play environment



3rd generation UMA: end-to-end QoS by MPEG-21-enabled cross-layer Digital Item Adaptation (Source: UNI Klagenfurt)

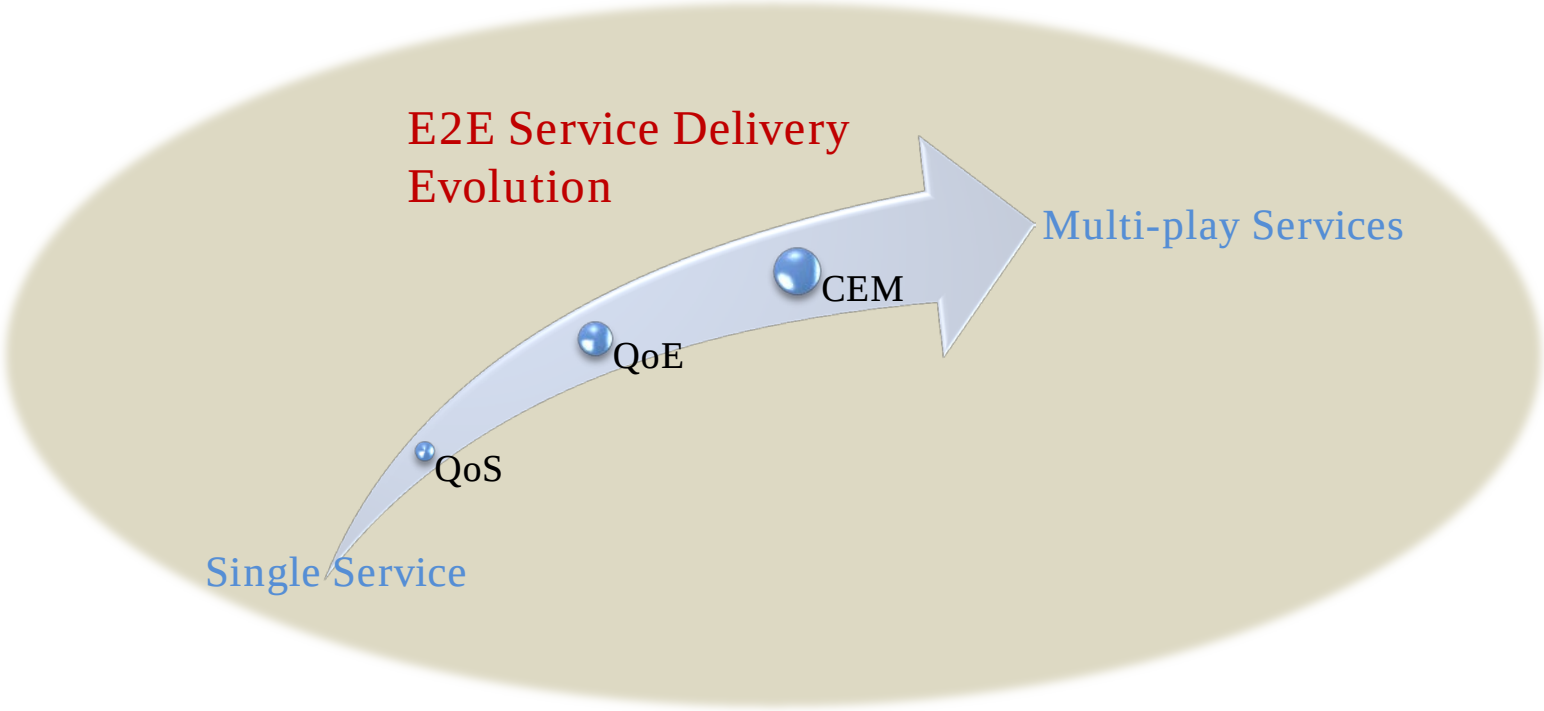
The *Content Provider* prepares the actual multimedia content as Digital Items

The *Service Provider* enriches the multimedia content with additional metadata SLAs taking into account constraints imposed by access networks for service provisioning towards the customer

The *Network Provider* offers QoS-based connectivity services providing reachability between network hosts: Management of the core and access networks

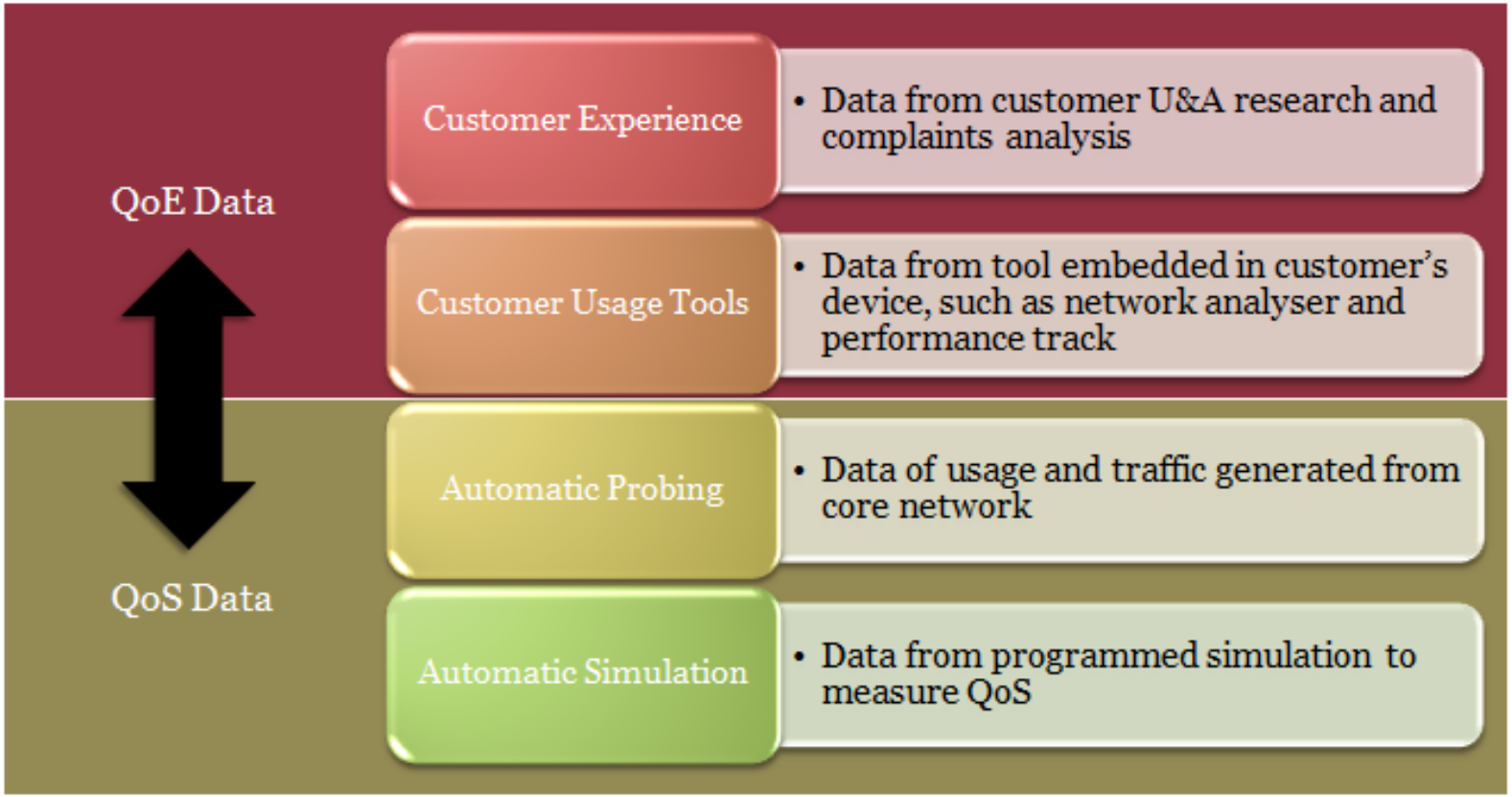
The *Customer* is having a worthwhile, informative experience anytime and anywhere while interacting with the services provided by the Service Provider, with smooth rendering of scalable content while enforcing digital rights imposed by individual participants in the delivery chain

Emerging of QoE in E2E Service Delivery



- The term quality of experience (QoE) has been used interchangeably with CEM.
- Both QoE and CEM are linked to the similarly striking quality of service (QoS) label.
- Implementing QoS policies can enhance QoE.
- CEM is a broader concept of QoE, which covers all enhancements to service, customer journey, touch points, online accessibility and much more.

Challenges and Options in Reconciling QoS and QoE



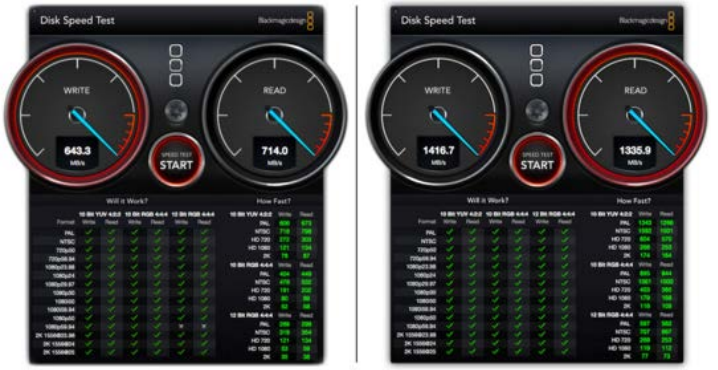
Steps in enhancing QoS and QoE

QoE Measurement through Simulating

Case Study of Mobile Broadband

Test Protocol

- Differ from technical speed test that requires many technical testing devices and resulted in technical and jargon data, the test protocol in simulation test is assumed to run as an end-user dummy (subscriber /user-side) who is using mobile data services from selective mobile operator in the market.
- The service mimics “regular usage behavior” like it is a “real user”. It is going to access to that mobile network to utilize its bandwidth for browsing the Internet, watching clips, downloading photos, or wanted to experience actual speed at specific sites.
- Objective is to adopt feedbacks from end-users to cross-check technical test and to assume performance of service providers based on the real use cases.



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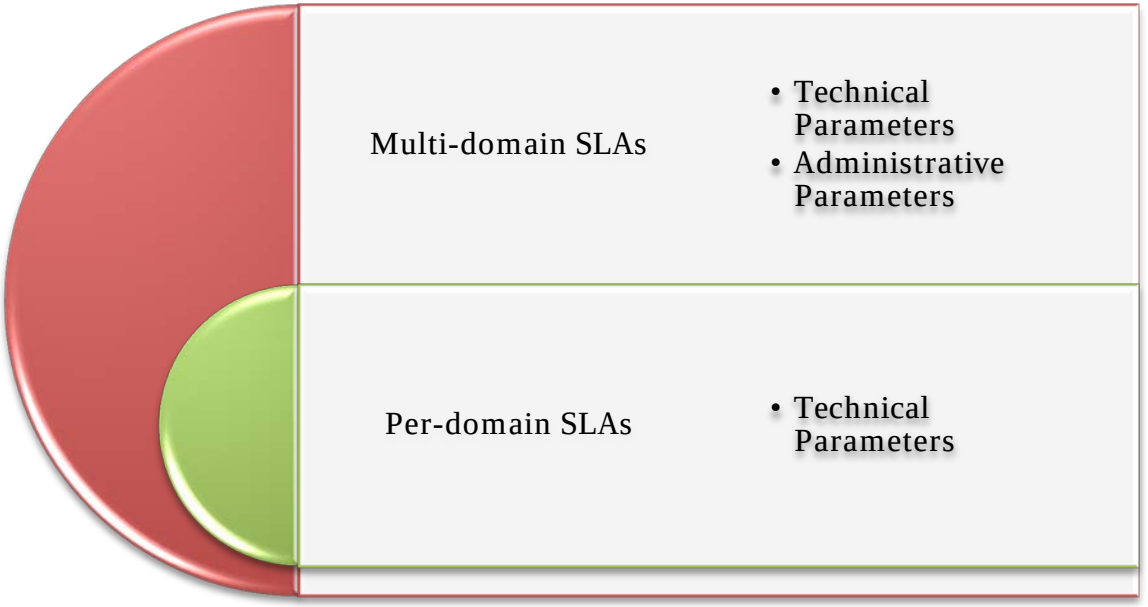
Common Test Categories

MKS MCKANSYS Market Knowledge Strategy

Download speed – raw&avg (Mbps)	Upload speed- raw&avg (Mbps)	Hotspot radius (BTS/Node-B), Sq.KM	Location (District / GPS Loc)	Period (Time span -24hrs)
Density of population	Type of network (G/E/H/H+/4G)	Latency (ms)	Access time to www (sec)	Mobile apps speed validation

1. **Average mobile network bandwidth per selective site**
   - An average of mobile network bandwidth speed at testing site (unit test: Mbps)
   - Area of testing site would be around district area (Landmark: District / Amphor / or Municipality
   - Testing site is about r=1KM of landmark
   - Latitude : Longitude
2. **Duration of the day (min =3 / max = 5 spans)**
   - In this category, MAX 5 spans of the day are collected to mimic real usage activities and behaviors.
   - 7-8am / 9-10am / 12-1pm / 5-7pm / and after 9pm
3. **Access time of the most favorite websites**
   - At least 3 –most favorite websites will be selected for testing
   - Use a browser to access those websites(unit test: sec)
   - Determine the acceptable threshold –approx. 12sec
4. **Type of network services and network latency**
   - GPRS / G / EDGE
   - 3G / H / H+ / 4G
   - Average latency (ms)
5. **Lifestyle activity: Streaming quality on selective applications (For example: Youtube)**
   - The network must support streaming services at 480p
   - Must be aligned with mobile network bandwidth speed
   - For example: Speed at 1.5 Mbps should support streaming at 480p

Needs for E2E Network SLAs



SLAs in multi-domain context cover
- Maintenance
- Monitoring
- Troubleshooting

ALO (Administrative-Level Object)

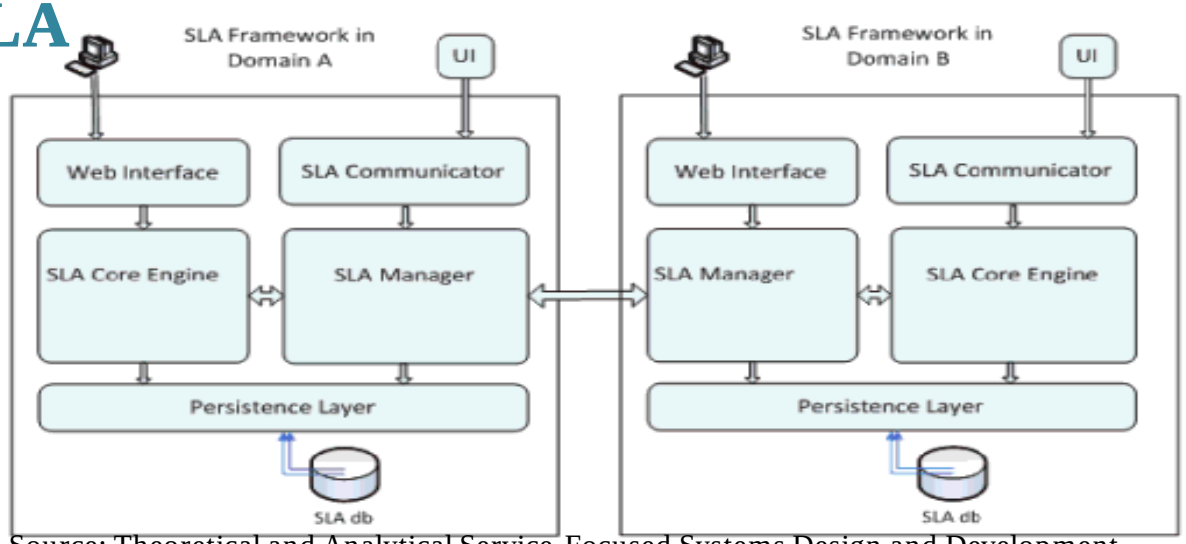
Administrative parameters
- Contracts
- Duration
- Availability
- Response times
- Fault handling procedures

SLO (Service-Level Object)

Technical parameters
- Service instance
- Performance guarantee
- Flow description
- Monitoring infrastructure
- Availability/Reliability (Max Downtime, MTTR)

Merging Rules for E2E SLA

- As we are moving towards multi-domain context where QoS provisioning is each domain's responsibility, the E2E SLA will be achieved by merging of each domain's SLA.
- The merging rules applied to each SLS parameter of the per-domain SLAs in order to provide E2E SLA



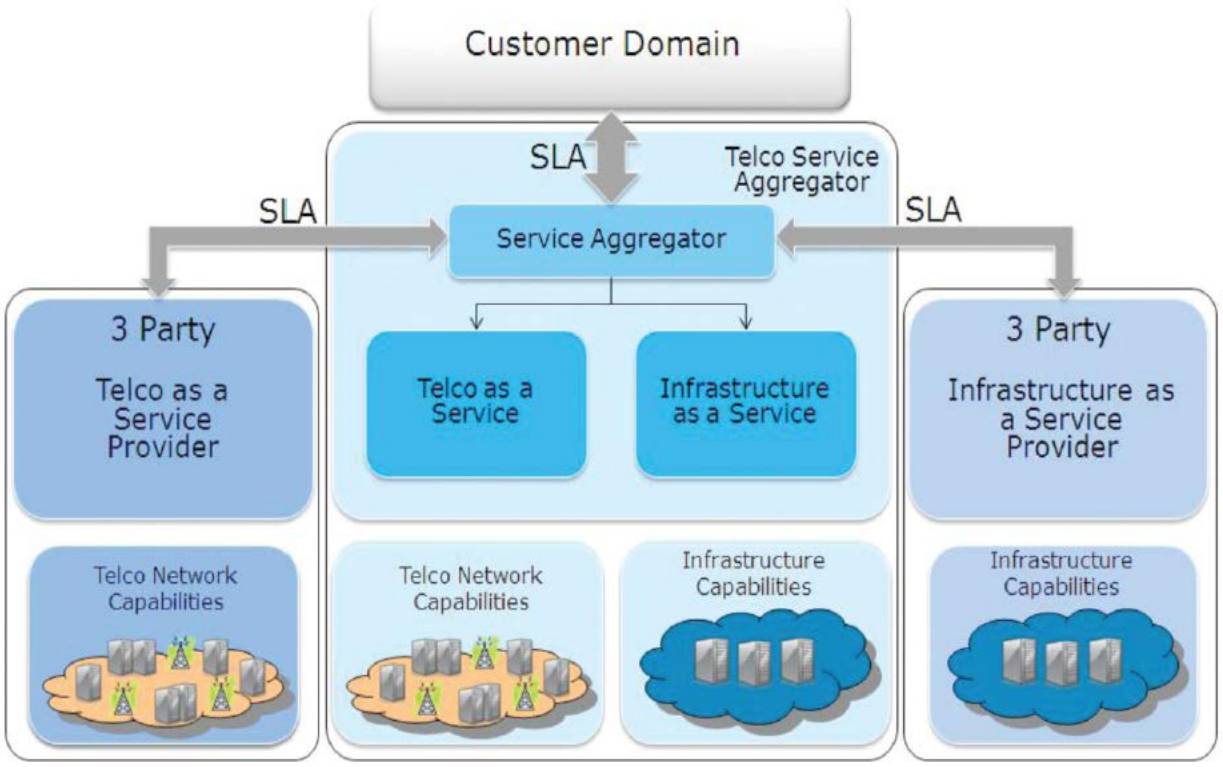
Source: Theoretical and Analytical Service-Focused Systems Design and Development, edited by Chiu, Dickson K. W. 2012

E2E Service Level Specifications (SLS)

Parameters	Description
Service Instance Scope	A list with technical information of the ingress interface and the egress interface of the domains involved in the path
Flow Description	A list of DSCP values , the IP source-destination address pair along with the protocol and the application's targeted ports
End-to-End Performance Guarantee	• Service duration: intersection of per-domain service duration values • Service availability: min{ServiceAvailabiltyi } • Capacitye2e <= min{Ci} • MTUe2e ≤ min{MTUi} • OWDe2e ≥ ∑{OWDi} • IPDVe2e : we treat IPDV as an RMS value and use its square as an additive parameter • Packet losse2e ≥ ∑{PLi} • The rest fields in the e2e SLA are the union of the per-domain fields.
Monitoring Infrastructure	Information on the monitoring capabilities of each domain in the path in terms of which parameters are monitored, the points where measurements are possible, the availability of measurements
Reliability	Allowed mean downtime per unit of time for the service provision and maximum allowed time-to-repair (TTR) incase of breakdown for the provision of the service.

Business Scenario

SLAs Aggregation



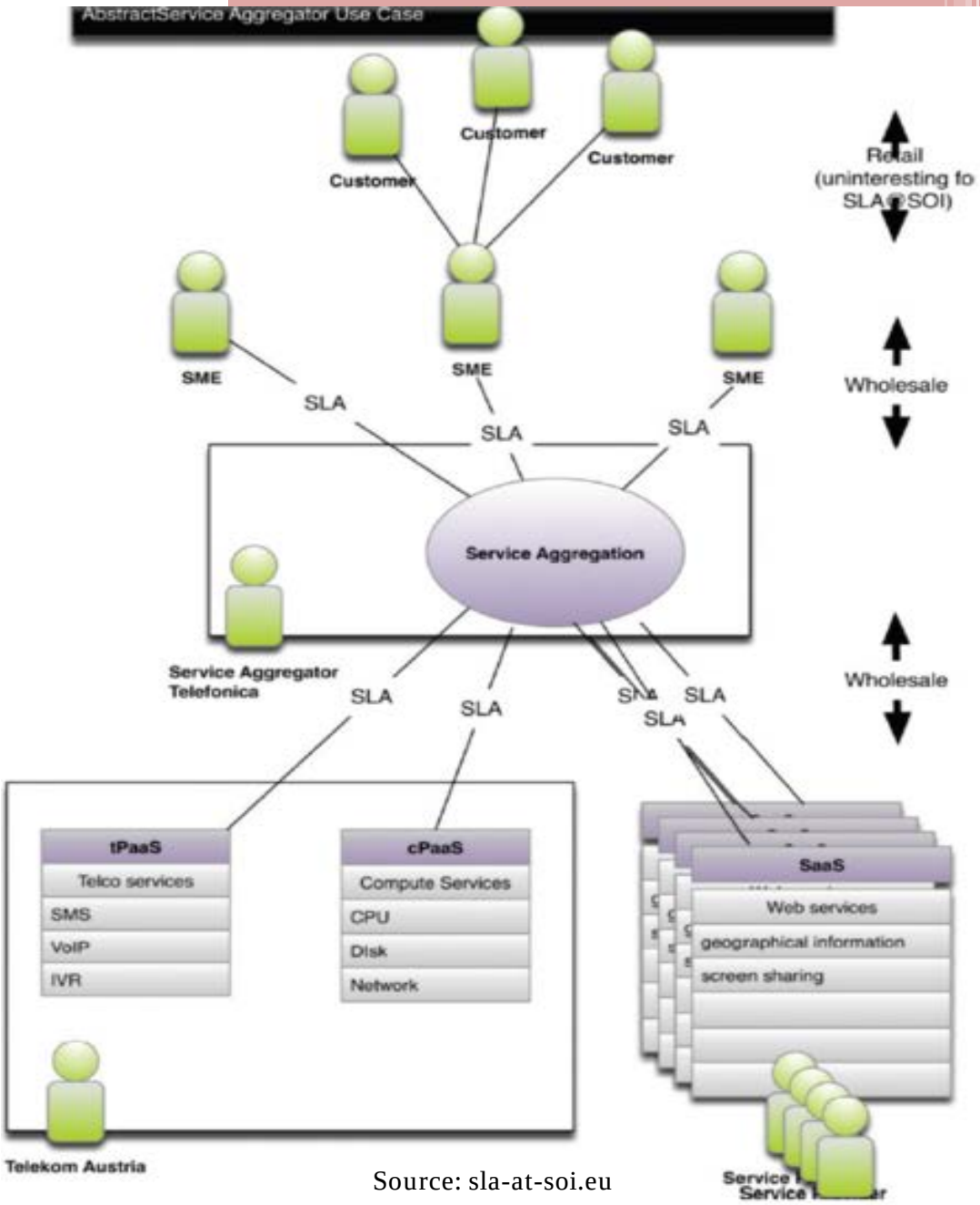
Source: sla-at-soi.eu

- The Service Aggregation use case is demonstrating the aggregation of SLA-aware telecommunication services, including third party web-based services.
- A common model is being used to define and manage all SLAs, and customer relationship management systems are being enhanced to personalise the business aspects of the SLA lifecycle.
- SLA customisation is allowed whereas Customer Negotiation of Quality of Service is also implemented.

Business Scenario

Case: Telefonica

- Telefonica is moving towards “Telecom Platform as a Service”
- The structure focuses on how multi-party, multi-domain SLAs for aggregated services can best be managed.
- The scope includes Telecoms Platform as a Service, Compute Platform as a Service and Software as a Service.
- The end goal is a dynamic new ‘Telecoms as a Service’ capability that offers customers personalised and dependable service.



Source: sla-at-soi.eu

Business Scenario

Case: Telecom as a Service (Prototype)

- Due to the aggregation of telco services with digital web services from external third parties, the result is a Service Delivery Platform considered to be Telecom as a Service.
- First step to facilitate this aggregation to SLAs of existing telco services. Once SLA-enabled, automated negotiation of customised service instances will be possible.
- If a provider cannot satisfy an entire service request, they may automatically subcontract to third parties that can help them meet the request.

CATEGORY	SERVICE	DESCRIPTION
Voice	*VoIP*	Voice communications over internet protocol
	Fixed-line	Voice communications over traditional analog fixed line connections
	Mobile	Voice communication over radio based networks such as GSM or UTMS
Messaging	*SMS*	Short messaging text messages originally intended for GSM based networks
	MMS	Multi-media messages incorporating text, images, movies, and possibly sound originally intended for GSM networks
	Email	A standard for messaging layered on internet protocol networks
Applications	*Multi-party voice calls*	The aggregation of voice calls with more than two endpoints (i.e. conference bridge)
	Voice mail	A service that answers a voice call, recording an audio message for subsequent playback
	Interactive Voice Response	The use of DTMF message tones to guide a voice call through a series of messages or possible conference calls

Source: sla-at-soi.eu

Business Scenario

Use Cases Evaluation:

Key value dials and metrics being evaluated in this use case.

VALUE DIAL	METRIC
Customer satisfaction	Rate of claims per customer % reduction (elimination to zero) of undetected SLA violations
Dependability	Availability (% of the time the service is available, ej. 99,99%) Mean time to recover from an SLA breach (in seconds)
End2End manageability	rate of monitored atomic services per total number of atomic services
Fast decision making	% of automatic penalties adjusted
Agility	average time to provision a service average time to modify a service
Operational Efficiency	Opex associated to platform management
Energy Efficiency	Energy Consumption kW/hr Energy Savings

VALUE DIAL	METRIC
Reliability of Aggregate Service	Availability expressed a percentage of time service is available Average time for service restoration of failure
Service Efficiency	Percentage utilization of compute infrastructure
Infrastructure Utilization	Volume of phone calls made per wholesale
Multi-party Monitoring	Person months (PMs) it takes to establish a multi-party monitoring solution
Agility	Average time to provision a service Average time to modify a service

Source: sla-at-soi.eu

Best-Practices in SQM Framework

Consulting
DETECON

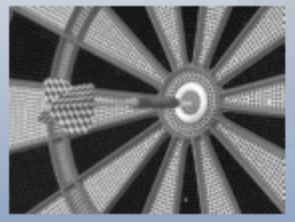
Service Quality Management is a central lever of effectively implementing marketing strategies. The key is to deliver the quality promised to the customer.

Service Quality Management – Context and Motivation

Service Quality Management should support the provider to operate its services making conscious decisions. Therefore precise and transparent information about customer perceived service quality is needed.

Excellent Product Quality

- Find levers to technically improve service delivery



- Detect deviation from target as early as possible

Premium Customer Experience

- Think customer service perception

- Customer satisfaction is a key lever for low churn

Quality Management Economics

- Efficient and precise problem detection

- Lever for operational efficiency, e.g. due to swift problem rectification

Best-Practices in SQM Framework

Consulting
DETECON

Detecon's customer-centric SQM approach fulfills Marketing and Service Management requirements while enabling detailed problem analysis.

End-to-end Service Performance Framework

The Service Quality Management implementation is used for managing, tracking, monitoring, analyzing, improving and reporting on distinct Key Quality Indicators which reflect the service quality from a customer viewpoint.

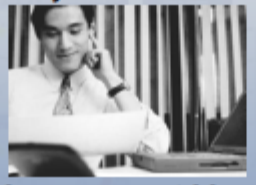
Quality Indicators

- Media quality

- Metadata service components
- Device related indicators

Stakeholders

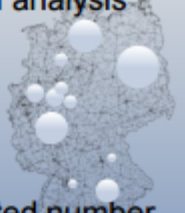
- Service Manager
- Analyst



- Measurement Manager
- Change Manager
- Problem Manager

Drill Down Views

- Geographic distribution
- Trend analysis



- Affected number of customers
- Quality and business target correlation

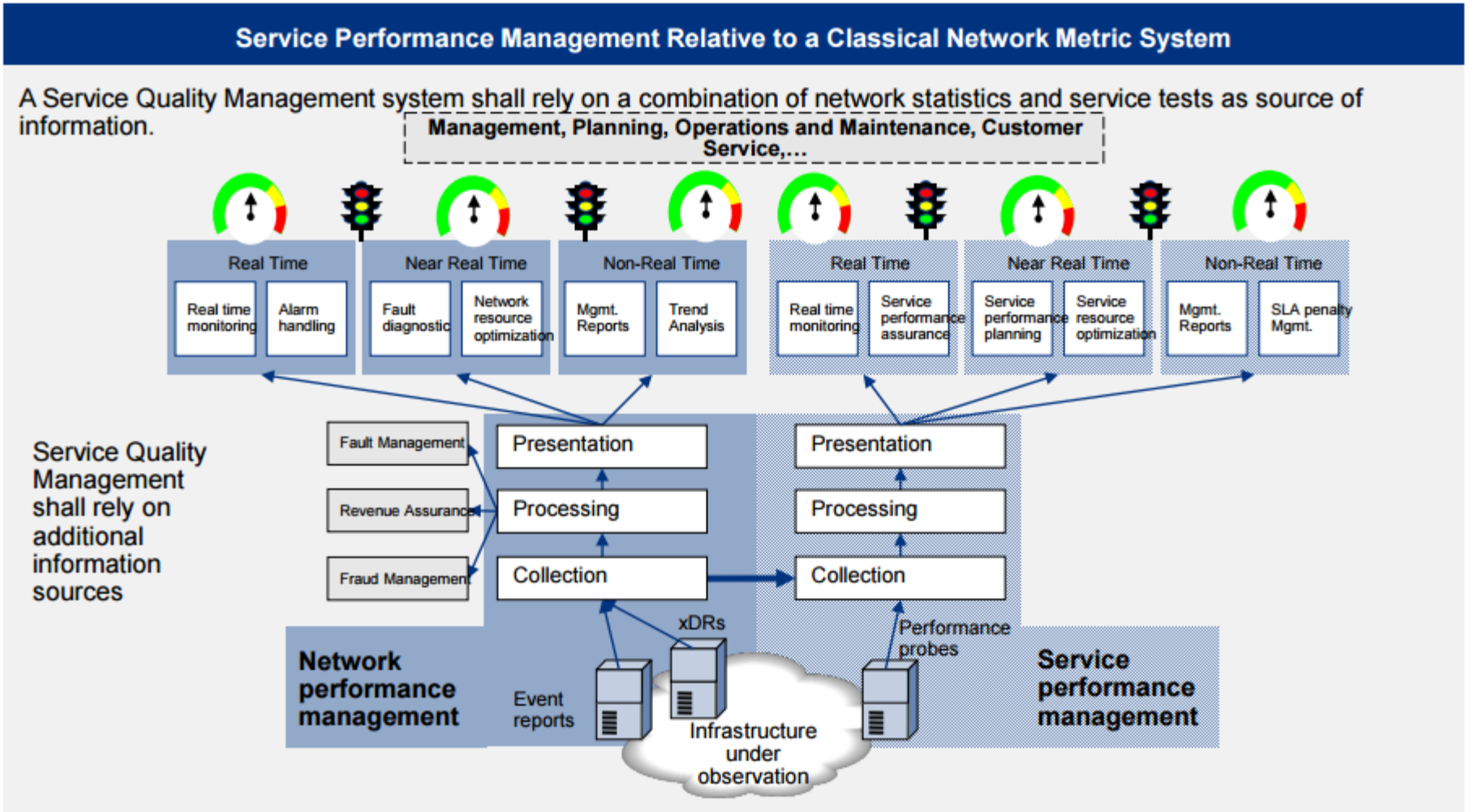
Best-Practices in SQM Framework

Consulting
DETECON

Service Quality Management is based on a system supporting fact based planning, improvement, evaluation and communication of service quality.

Service Performance Management Relative to a Classical Network Metric System

A Service Quality Management system shall rely on a combination of network statistics and service tests as source of information.



Best-Practices in SQM Framework

Consulting
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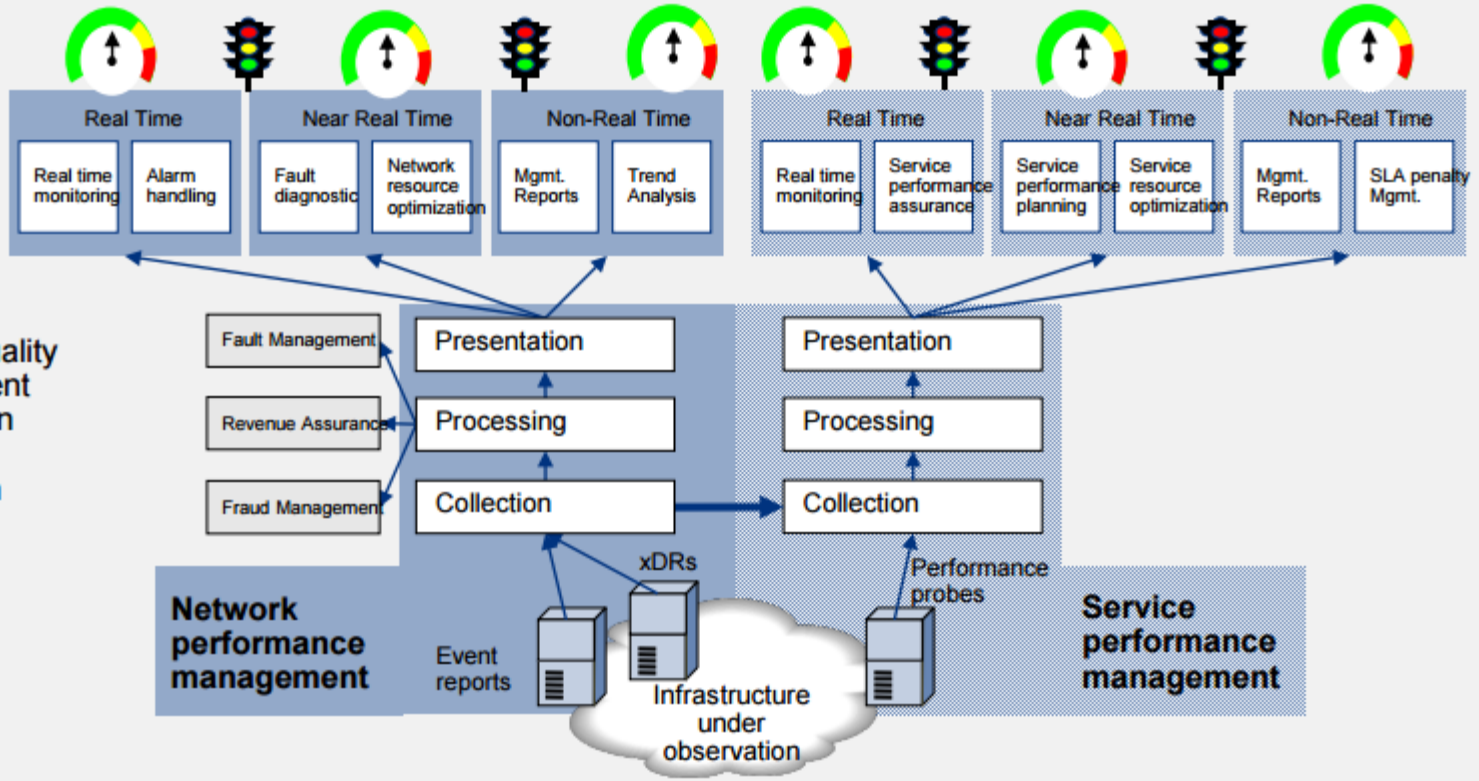
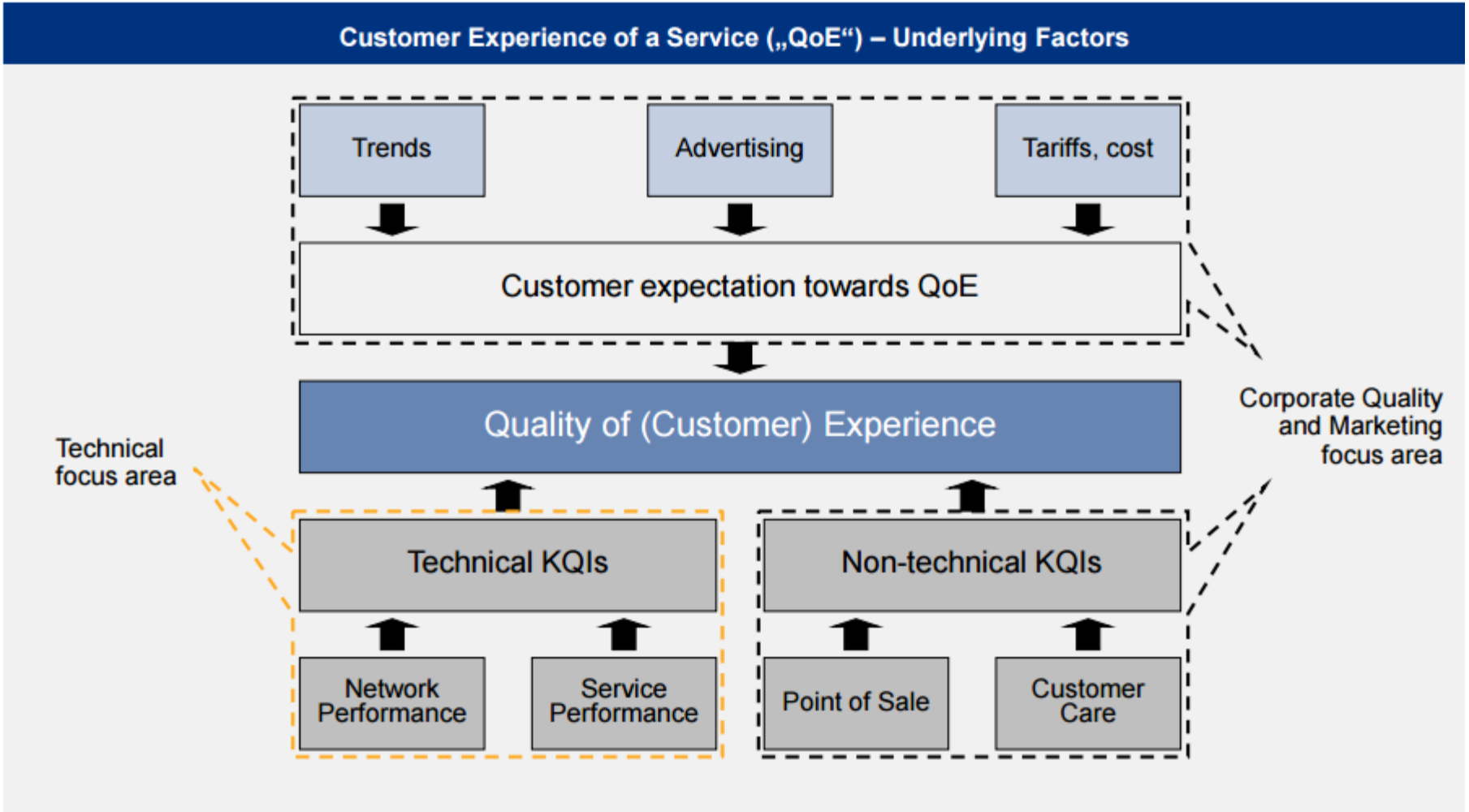


SQM Approach and Methodology

Consulting DETECON

A premium quality service meets or exceeds expectations in all relevant areas of customer experience.

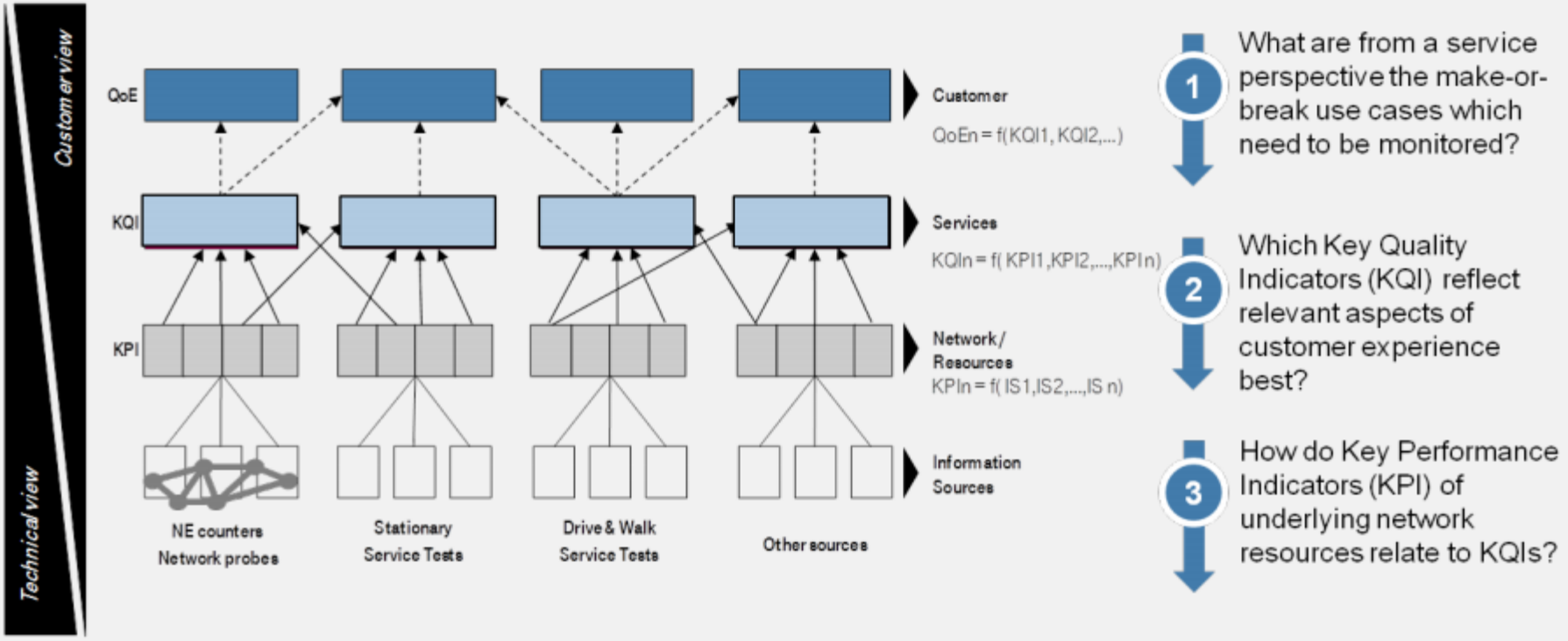


SQM Approach and Methodology

Consulting
DETECON

For the end-to-end Service Performance Framework, distinct service use cases need to be analyzed and their implementation broken down into performance indicators.

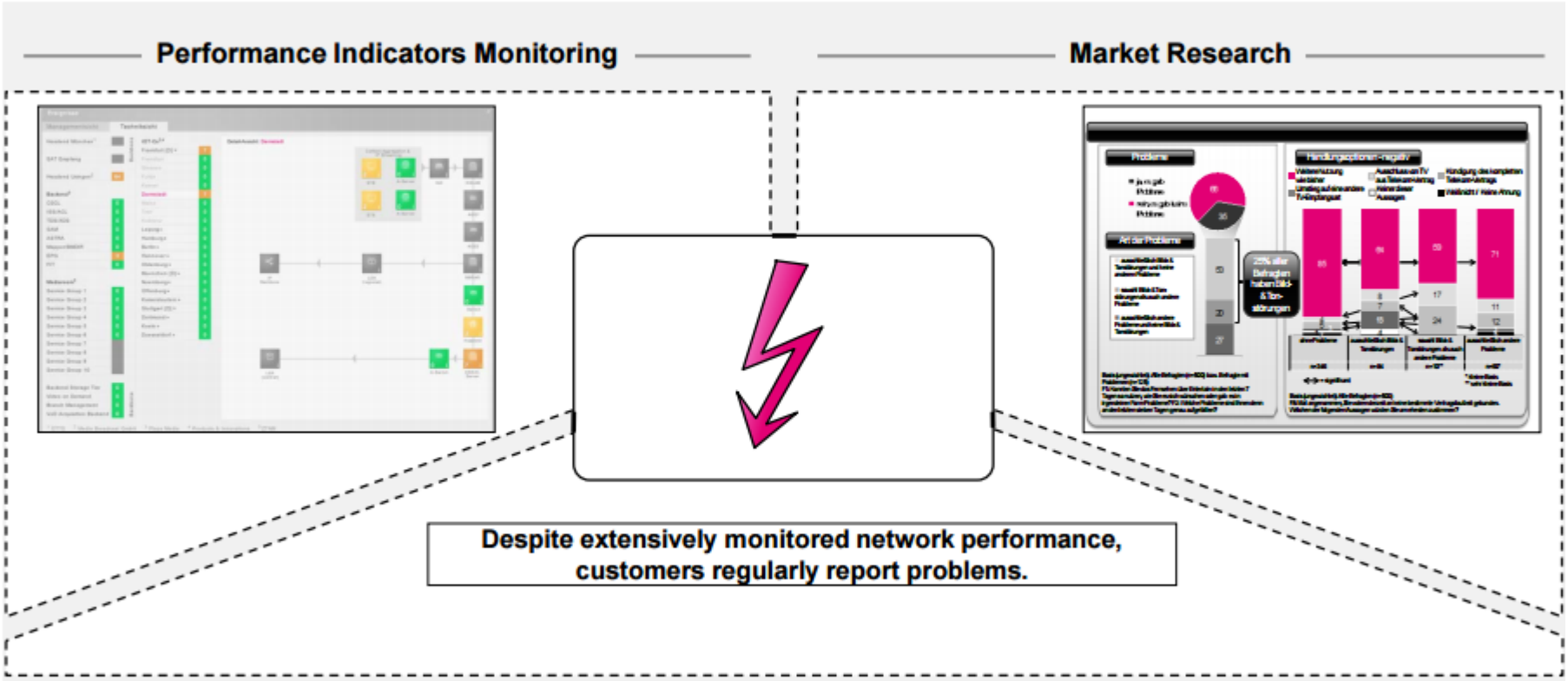
Service Performance Framework Hierarchy applied to Entertain to Go services



SQM Approach and Methodology

Consulting
DETECON

With the Service Performance Framework Detecon aims to correlate network performance and customer experience measurably and transparently.



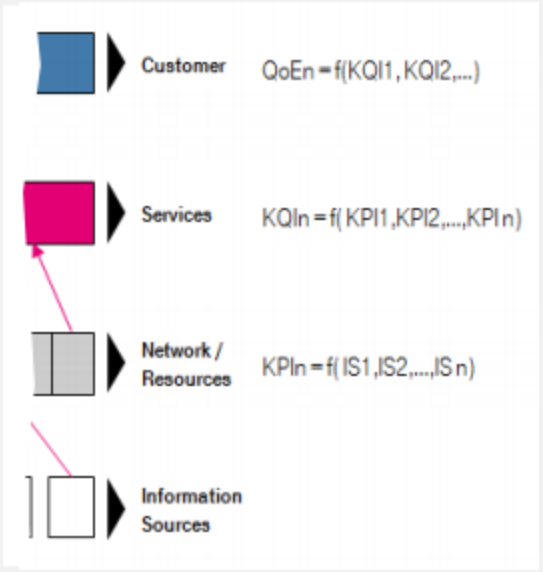
Key Quality Indicators (KQI) describe service quality from the customer perspective.
Key Performance Indicators (KPI) measure network performance.
The objective is to derive KQIs from KPIs.

SQM Approach and Methodology

Consulting DETECON

A Top-Down SQM Approach requires to identify, correlate and map KxIs for key services. The correlation mechanism must be jointly agreed with the customer.

KxI Identification



KxI Correlation and Mapping

- QoE to KQI Mapping
- Modeling of KQI to related KPIs
- KQI to KPI Mapping

KxI framework "logic"

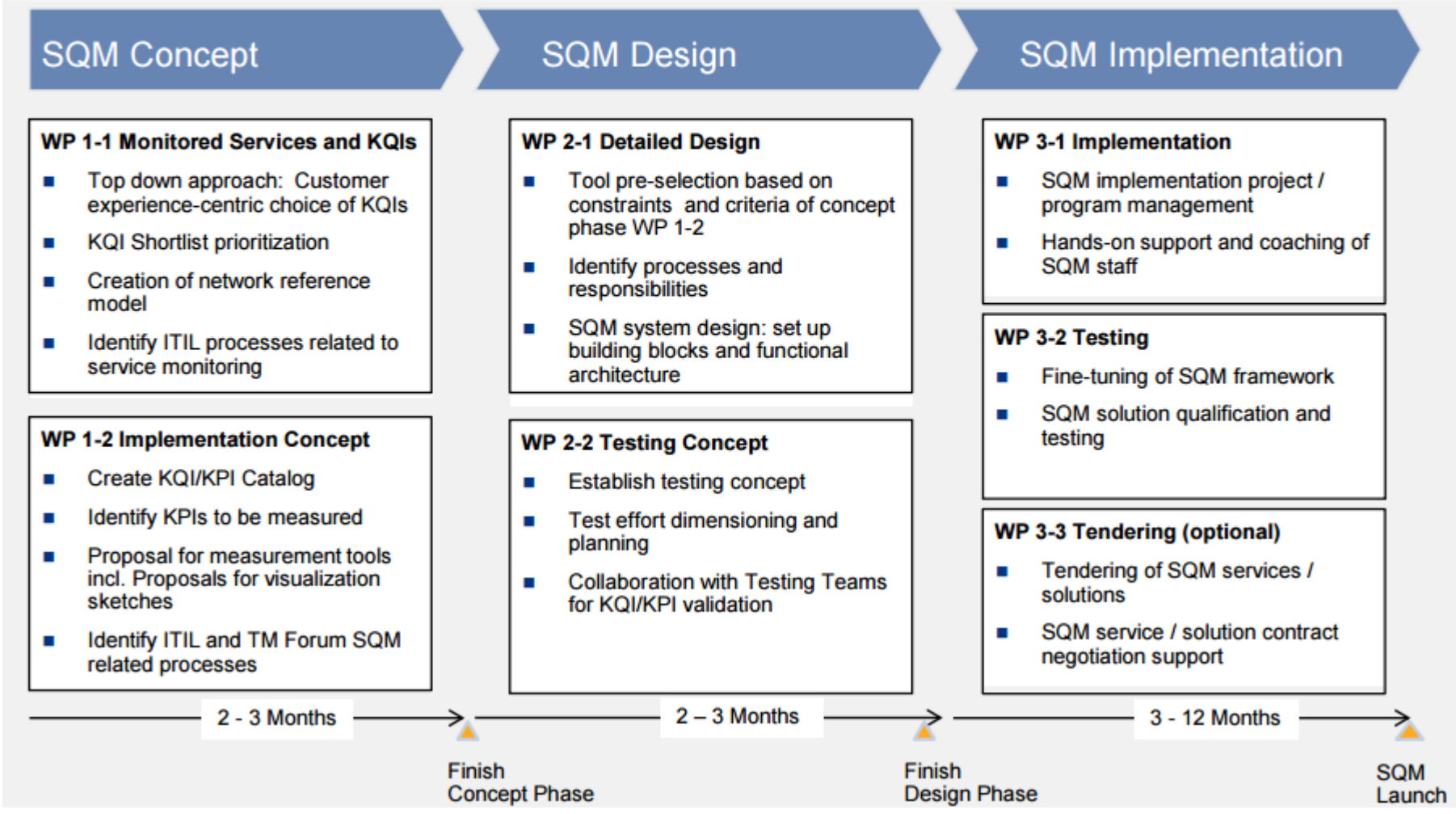
Category	KQI name	Mapping: KQI value	Mapping: QoE score	Weight
Accessibility	first page loading success ratio	≥ 99%	5	40%
		95%~99%	4	
		80% ~ 95%	3	
		70% ~ 80%	2	
		< 70%	1	
	average first page loading speed	≥ 512kbps	5	10%
		256~512kbps	4	
		128~256kbps	3	
		64~128kbps	2	
		< 64kbps	1	
Retainability	web browsing data transfer cut-off ratio	≤ 0.1%	5	10%
		0.1% ~ 0.5%	4	
		0.5% ~ 1%	3	
		1% ~ 2%	2	
		> 2%	1	
Integrity	web page refreshing success ratio	≥ 99%	5	25%
		95%~99%	4	
		80% ~ 95%	3	
		70% ~ 80%	2	
		< 70%	1	
	average page refreshing speed	≥ 512kbps	5	15%
		256~512kbps	4	
		128~256kbps	3	
		64~128kbps	2	
		< 64kbps	1	

QoE to KQI mapping will be done based on Customer's "lessons learned" and Detecon assessment. KPI to KQI mapping will be done according to the particular service architecture.

SQM Approach and Methodology

Consulting DETECON

SQM from concept to realization: Key activities per phase with indicative duration. Exemplary work packages geared to SQM requirements of a DTAG IPTV service.



Thank you

Question?

Contact: monsinee.kee@icloud.com