Service Level Agreement (SLA) and Global QoS index for 3G networks

Villy Iversen
Professor Technical University of Denmark, ITC Vice-Chairman

Manfred Schneps-Schneppe
Professor Dr, CEO AbavaNet, Moscow, Russia

ITU/ITC Regional Seminar on Network Evolution to Next Generation Networks and Fixed Mobile Convergence for CEE, CIS and Baltic States

Moscow (Russia), 27-30 April 2004

1

Outlook

1. UMTS QoS issues - a challenge for teletrafficers
2. Parlay for SLA control
3. Global QoS index
4. "Gold-silver-bronze" QoS standard
5. Best practice. New York experience
6. Best practice. LRAIC approach for penalties
7. Conclusion

2

1.1 Service Level Agreement

1)Service Level Agreement (SLA)- formal agreement between two or more entities with the scope to

- assess service characteristics,
- responsibilities and
- priorities of every part.

2)SLA may include the compensations for an unreached level of quality as a economic issue of the contract.

3

1.2 Introduction on QoS and SLA studies

1)ITU-T Rec.860 "Framework of a service level agreement" (2002) – a framework for NGN interconnection studies

2) ETSI Rec. ETR 138 (1997) – 9 QOS measures (incl. ISDN):

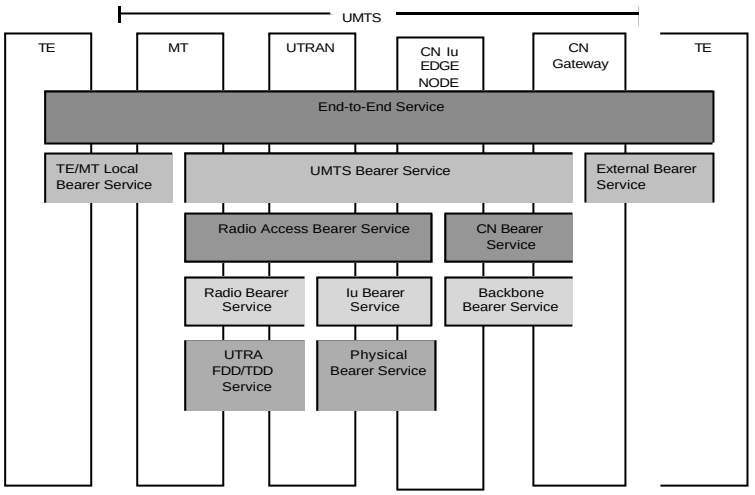
Fault report for access line per year,
Unsuccessful call ratio,
Call set up time,
Supply time for initial network connection,
Percentage of orders completed on or before the date confirmed or contracted with the customer,
Response time for operator service,
Availability of card or coin operated public pay phones,
Fault repair time,
Service restoration.

3) ETSI TIPHON project for IP telephony. **"Gold-silver-bronze" approach:**

voice packet loss: < .5% for class 1 = gold,
.5% to 1% for class 2 = silver,
1% to 2% for class 3 = bronze.

4

1.3 3GPP QoS Concept and Architecture (3GPP TS 23.107 V5.1.0)



5

1.4 Multimedia Services

- **Real Time Communications**
- **Voice**
- **Text**
- **Video**
- **Non-Real Time Communications**
- **audio download;**
- **video download;**
- **audio streaming;**
- **video streaming;**
- **general data files;**
- **text messaging (e.g. SMS);**
- **emails;**
- **general web browsing;**
- **multi-media messaging**

3GPP TR 22.941 V0.7.7
3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; IP Based Multimedia Services Framework; Stage 0 (Release 5)

6

1.5 Value ranges for UMTS Bearer Service Attributes

Traffic class	Conversational class	Streaming class	Interactive class	Background class
Maximum bitrate (kbps)	< 2 048	< 2 048	< 2 048	< 2 048
Delivery order	Yes/No	Yes/No	Yes/No	Yes/No
Maximum SDU size (octets)	<=1 500 or 1 502	<=1 500 or 1 502	<=1 500 or 1 502	<=1 500 or 1 502
SDU format information	RCP protocol	RCP protocol		
Delivery of erroneous SDUs	Yes/No	Yes/No,	Yes/No	Yes/No
Residual BER	$5*10^{-2}$, 10^{-2}, $5*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-6}	$5*10^{-2}$, 10^{-2}, $5*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}	$4*10^{-3}$, 10^{-5}, $6*10^{-8}$	$4*10^{-3}$, 10^{-5}, $6*10^{-8}$
SDU error ratio	10^{-2}, $7*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-5}	10^{-1}, 10^{-2}, $7*10^{-3}$, 10^{-3}, 10^{-4}, 10^{-5}	10^{-3}, 10^{-4}, 10^{-6}	10^{-3}, 10^{-4}, 10^{-6}
Transfer delay (ms)	100 – maximum value	250 – maximum valuc		
Guaranteed bit rate (kbps)	< 2 048	< 2 04		
Traffic handling priority			1,2,3	
Allocation/Retention priority	1,2,3	1,2,3	1,2,3	1,2,3

7

1.6 IETF activities and 3GPP

Quality of Service Enablers

IETF Integrated Services (IntServ) and Resource Reservation Protocol (RSVP)

Differentiated Services (DiffServ)

Multiprotocol Label Switching (MPLS)

QoS Management Enablers

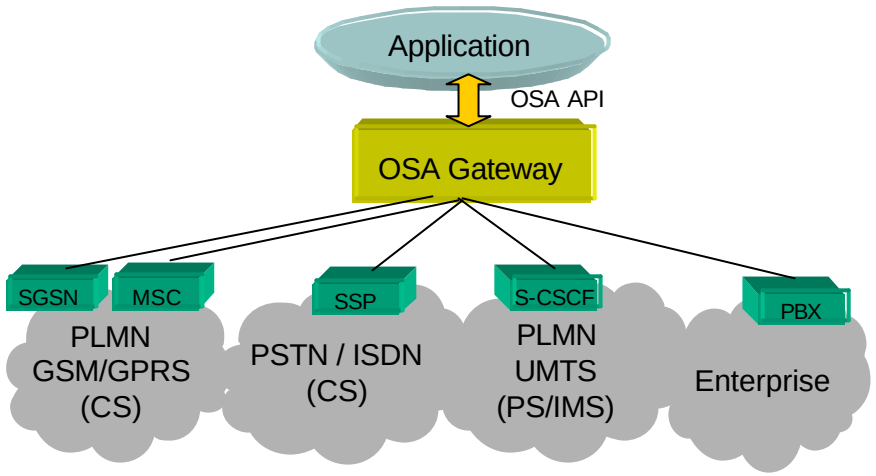
Service Level Agreements (SLAs)

Common Open Policy Service (COPS) protocol

Simple Network Management Protocol (SNMPv3)

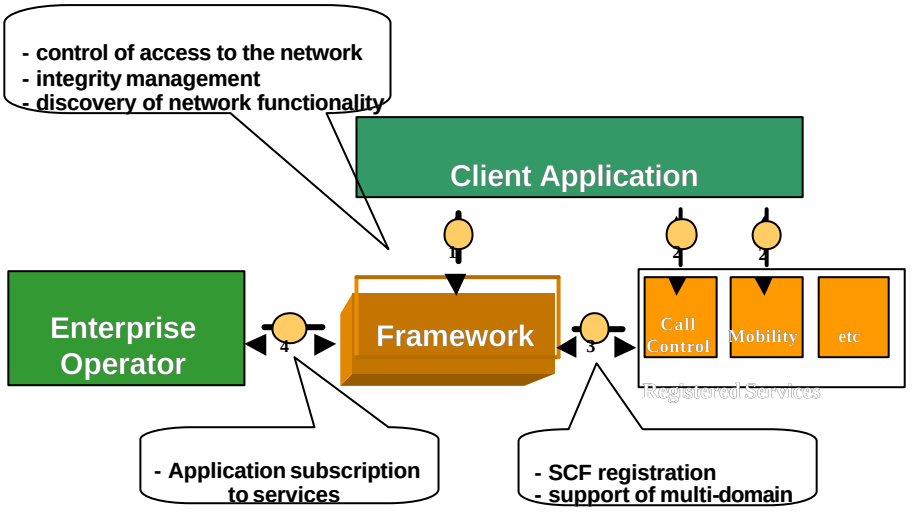
8

2.1 The Parlay/OSA API



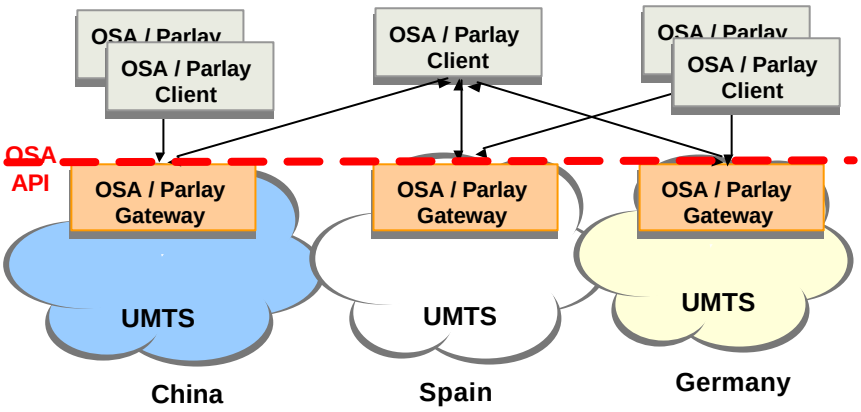
9

2.2 The Parlay/OSA Framework



10

2.3 OPIUM Project as UMTS QoS Testbed ?



11

3.1. How to built the global SLA index

1)We use a **linear discriminant function LDF**, in other words, a scalar product of vectors and :

$$Q = W1X1 + W2X2 + \ldots + WnXn$$

where *W1, …, Wn* are unknown constants, and choose some threshold value *a* that the decision rule is as follows

decision ***D1 if Q < a***

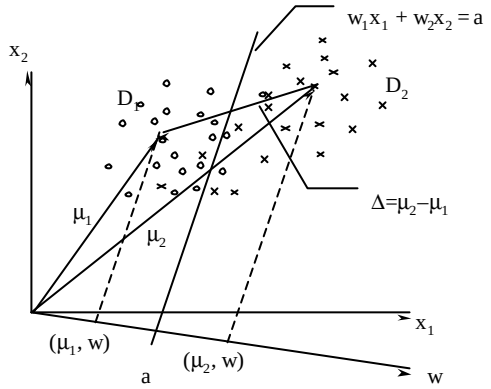
decision ***D2 if Q > a***

2)For **"gold-silver-bronze" standard** - any service/network provider can be correlated to one of three classes:

gold level ("Really Great" – expensive)	if Q < Q1,
silver level ("Darn Good" – not so expensive)	if Q1 < Q < Q2,
bronze level ("Best Effort" – inexpensive)	if Q2 < Q.

12

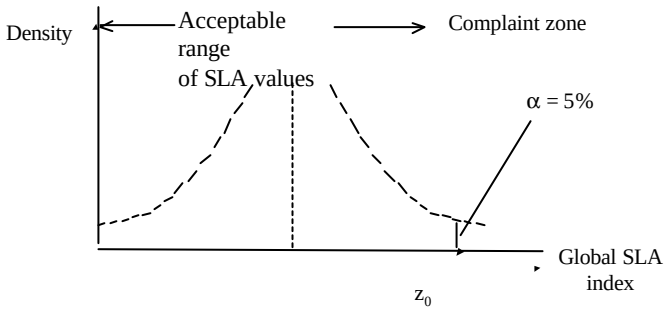
3.2 Geometrical interpretation of classification or two-dimensional case



Mahalanobis distance $M^2 = (m_2 - m_1)^T \sum (m_2 - m_1)$

13

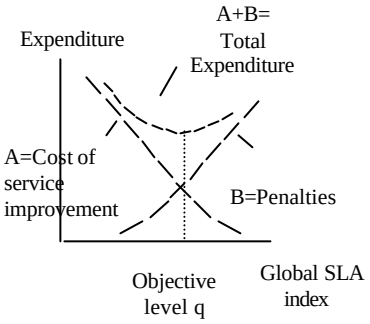
3.3 Scheme for SLA conflict resolution



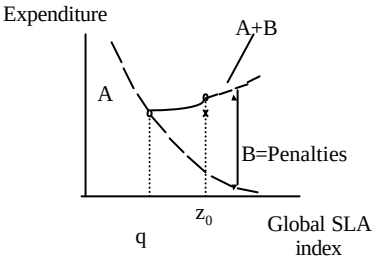
14

4.1 Quality optimisation scheme:

a) basic idea, b) penalty scheme



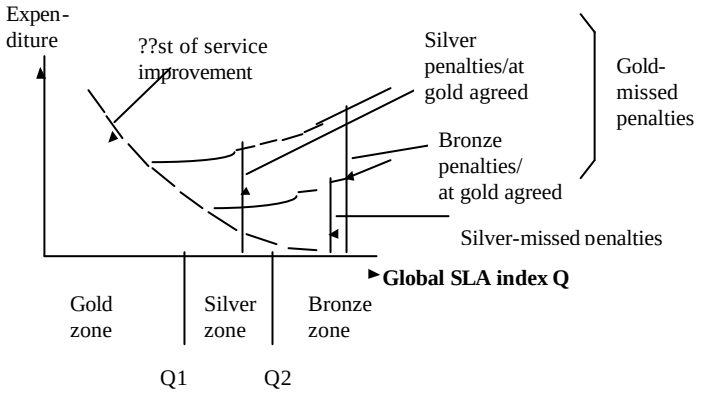
a)



b)

15

4.2 "Gold-silver-bronze" penalty scheme



16

5.1 Best Practice: "New York Telephone" Service Standards

The Telephone Service Standards of New York Telephone Company (Verizon NY now) were adopted by the New York State Public Service Commission in 1973 and revised in 1989 and 1991.

Measurement of service quality in four separate categories:

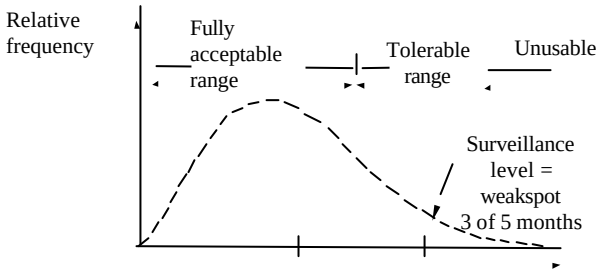
1) Maintenance Service,
2) Dial-Line Service,
3) Answer Time Performance, and
4) Installation Service.

These measurements are categorised into three levels:

1) **Objective levels** - the level of service that represents good quality service to consumers.
2) **Weakspot levels** to denote a level of service below which immediate analysis and corrective action may be required.
3) Three or more of five consecutive months of weakspot results are usually considered as **a surveillance level failure**

17

5.2 Illustration to customer trouble report rate CTRR



Objective level = 4.2 Weakspot = 7

18

5.3 NYT service standards

Service element	Objective level	Weakspot level
Maintenance service CTRR per 100 access lines Missed repair appointments (%) Out-of-service over 24 hours	 0.0 - 4.2 0.0 - 10.0 0.0 - 20.0	 Over 7 Over 15 Over 30
Installation performance Installations within 5 days (%) Installation appointments	 85 - 100 0.0 - 3.0	 Below 70 Over 10
Answering time performance (%) Business office - within 20 sec " ------- "- all positions busy Repair service - within 20 sec " ------- "- all positions busy	 90.0 - 100.0 0.0 - 10.0 90.0 100.0 12.0 - 16.0	 Below 85 Over 15 Below 85 Over 27

19

5.4 Rebates to all Manhattan customers relating CTRR

	Range of offices without penalties, %			
Target level	79%	81%	83%	85%
Rebate (Mill)	1995	1997	1999	2001
$5.0	78%	80	82	84%
$6.0	77	79	81	83
$7.0	76	78	80	82
$8.0	75	77	79	81
$10.0	74	76	78	80
$12.0	73	75	77	79
$15.0	72	74	76	78
$25.0	<72	<74	<76	<78

20

6 Best Practice: LRAIC approach for penalty scheme

Long Run Average Incremental Costs (LRAIC) approach:

1. The interconnection charges reflect the actual production costs (new entrant operators should not pay for inefficiency, mis-investments, etc.)
2. New entrant operators will be stimulated to invest in alternative networks.
3. To create consensus on the cost level among telecom operators.

The SLA as the common target for LRAIC analysis - the border point between bottom-up (new entrant estimate) and top-down (incumbent estimate): **the higher LRAIC estimates the higher penalties.**

21

7 Conclusion

1. UMTS QoS issues - a challenge for ITC
2. Parlay for SLA control
3. Revisited OPIUM Project as UMTS QoS and SLA Testbed
4. Global QoS index and "Gold-silver-bronze" standard
5. To develop LRAIC approach for penalties

22