

# E4-E5 (CM)

## Quality Of Service of Mobile Network

# WELCOME

- This is a presentation for the E4-E5 CM Technical Module for the Topic: Quality Of Service For Mobile Network.
- Eligibility: Those who have got the Up gradation to from E3 to E4.
- This presentation is last updated on 12-3-2011.
- You can also visit the Digital library of BSNL to see this topic.

# AGENDA

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- Overview of QoS
- QoS Monitoring Methods
- QoS Regulations in India
- Network Parameter for QoS
- Problems in the Network
- Summery

# Service quality

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“Quality in a service or product is not what you put into it. It is what the client or customer gets out of it.”

-Peter Drucker

# QoS Definitions

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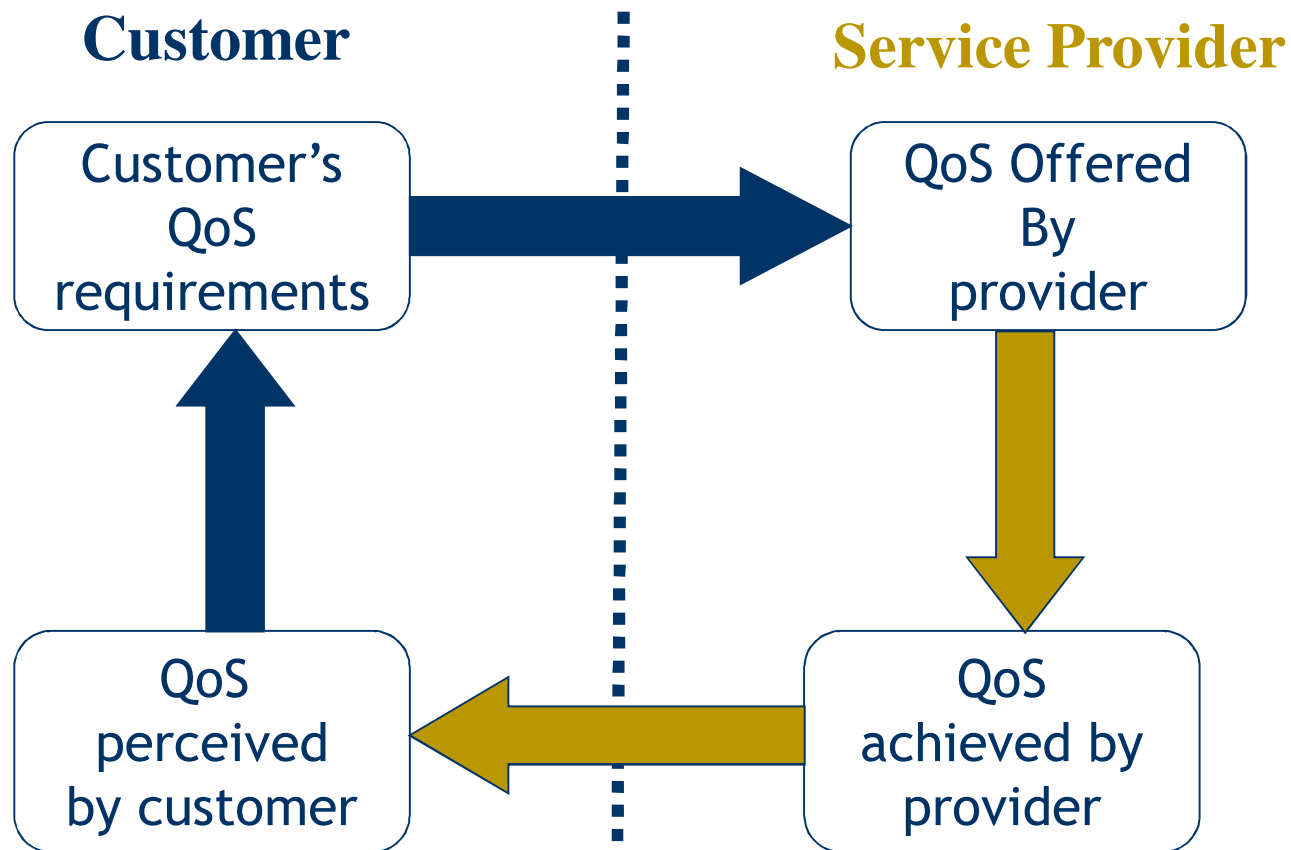
The term “Quality of Services” (QoS) is defined as “the collective effect of service performance which determines the degree of satisfaction of a user of the service”.

ITU-T Rec. E. 800

Customer Satisfaction: Customer’s Perception of the degree to which the customer’s requirements have been fulfilled

# Quality Criteria Perspective

QoS to be truly useful and practical enough, it must be meaningful from following 4 viewpoints:



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# QoS Monitoring

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## Objective Assessment

- AUDIT OF QOS PARAMETER AT OPERATOR SITE
- COMPARISON OF DATA WITH PMR DATA SUBMITTED TO TRAI

## Subjective Assessment

CARRY OUT PERSONAL AS WELL AS TELEPHONIC INTERVIEW TO ASSESS CUSTOMER PERCEPTION

# QoS Regulations in India



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## Regulations on Quality of Service (QoS):

- Basic Service (Wire line)
- Cellular Mobile Telephone Services (Basic wireless + Cellular Mobile)
- Broadband Service
- Code of Practice for Metering & Billing Accuracy
- Internet Services
- VoIP based International Long Distance Service

**TRAI Website [www.trai.gov.in](http://www.trai.gov.in)**

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# QoS Regulation Parameters: Benchmarks for Basic Services (Wireless) & Cellular Mobile Services



| Sl | QoS Parameter   | (Benchmark) |
|----|---|-------------|
| 1  | % of Billing Complaints resolved within 4 weeks         | (100%)      |
| 2  | Call set-up Success Rate (within licensees own network) | (>95%       |
| 3  | Service Access Delay                                    | (< 15 sec)  |
| 4  | Blocked Call Rate                                       |             |
|    | ➤SDCCH/Paging Channel Congestion                        | ( <1%)      |
|    | ➤TCH Congestion   | (< 2%)      |
| 5  | Call Drop Rate  | (< 3%)      |
| 6  | Percentage of connections with good voice quality       | (>95%)      |

# QoS Regulation Parameters: Benchmarks for Basic Services (Wireless) & Cellular Mobile Services



| Sl | Parameter  | (Benchmark)  |
|----|--|--------------|
| 7  | Service Coverage (Indoor > -75 dBm, In Vehicle > -85 dBm, Outdoor > -95 dBm)           |              |
| 8  | Point of Interconnect (POI) Congestion   | ( < 0.5%)    |
| 9  | Response Time to Customer for Assistance<br>( within 60 Sec= 80%, within 90 Sec = 95%) |              |
| 10 | Billing complaints per 100 bills issued  | ( < 0.1%)    |
| 11 | % of Billing Complaints resolved within 4 weeks  | (100%)       |
| 12 | Period of all refunds due to customers from the date of resolution of complaints       | ( < 4 Weeks) |

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# Network Parameter

- Call Set-up Success Rate(within licensees own network) -- >95%
  - As per TRAI guidelines, it should be implemented in such a way so as to take care of following three steps:
    - Attempt to establish a call is made
    - The TCH is allocated &
    - The call is routed to the outwards path of the concerned MSC.
- Service Access delay – 9 to 20 sec  
(Average of 100 calls=<15 sec)

# Network Parameter

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- **Blocked Call Rate –SDCCH Congestion** --  $< 1\%$ 
    - 100 x Ratio of blocked attempts of SDCCH & total SDCCH seizure attempts (Sum of all Cells data) will be taken as SDCCH Congestion percentage.
  - **Blocked Call Rate –TCH Congestion** --  $< 2\%$ 
    - It is equal to 100 x Ratio of Blocked Attempts to Total TCH assignment requests
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# Network Parameter

- Call Drop Rate --  $< 3\%$ 
  - It is equal to  $100 \times$  Ratio of TCH dropped after assignment to Total TCH successfully assigned
- % of connections with good voice quality --  $>95\%$
- POI Congestion --  $< 0.5\%$ 
  - It is equal to  $100 \times$  Ratio of number of attempts facing all circuits busy condition and total number of attempts on that POI

# Why Customer is not Happy?

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- Network related parameters include call drop and also network congestion
- customer care/helpline services and customer perception of service
- Billing

# Problems in the Network

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- Low network availability
  - Low network stability
  - RF Issues
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# Low Network Availability

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- Large Number of BTS remains down
  - which causes
    - Coverage problem
    - Hand over problem
    - Large amount of radio capacity unavailable
  - Which is due to
    - Power Failure and Low battery back up
    - Non functioning of DG at the time of Power failure
    - Transmission media failure



# Low network stability

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- Large number of BTS interruptions (Blinks)
    - Which causes
      - BCCH Failure very frequently
      - Call drops
      - Muting during conversation
    - Which is due to
      - Errors in PCM
        - **Observation**-Very high BER
      - High Temperature – Non functioning of A/C
        - TRU,s become non functional and faulty also.
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# RF Issues

- Overloaded BTS requires load balancing with adjacent BTS by tilting/lowering down/raising up BTS antennas.
  - Riggers are not available for getting done above work.
- Radio Capacity loading in DHQ,s & big Towns is around 90% or more but in rural area many of the BTS,s are under loaded because of not having required coverage. Such BTS needs immediate action to make them -----.
  - Riggers are not available for getting done above work.

# Main causes of Call Drop

- Call drops in GSM network can be caused by the following:
  - i) **Equipment:** GSM radios/Combiners can be a cause of this, solution to this is replacement of the unit. A Mobile Station (phone) can also be a cause.
  - ii) **VSWR (voltage wave standing ratio):** VSWR caused by poor connections on feeders, water penetration, fault on antenna etc
  - iii) **Transmission problem:** If transmission is not perfect, high B.E.R (Bit error ratio) or other factors causing inaccuracy of transmission.

# Main causes of Call Drop

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- **Interference:** when there's frequency interfere (either co-channel or adjacent interference).  
**Hand-over:** if hand-over between two sectors is not well defined
  - **Antenna down-tilts wrong** (coverage shortfalls or interference)
  - **Antenna on one sector pointing in different directions** (Bad site performance and dropped calls)
  - **Antenna support structure not rigid** (dropped calls)
  - **Antenna obstructed** (poor performance and dropped calls)
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# Reasons for call drop

- **Handover** : The MS monitors the power level and signal quality, determined by BER for non receiver bit sequences (synchronization sequence), from both its current BTS and upto 6 surrounding BTSs. This data is received on the downlink broadcast control channel (BCCH). The MS determines and sends to the current BTS a list of the 6 best received BTS signals. The measurement results from the MS on downlink quality and surrounding BTS signal level are sent to BSC and processed within the BSC. The system then uses the list for best cell handover decisions.

# Reasons for call drop

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- In case a traffic channel (TCH) is not available in the selected BTS then the conversation shall continue with the existing BTS with deteriorated voice quality and ultimately it may result in call drop.

# Performance affecting – Voice quality



- Poor Quality-
  - » Poor UL Quality -Due to frequency interference .
  - » Hardware problem –TRX, Card failure etc .
  - » Faulty Repeaters –Introduce interference in the GSM band once faulty .
  - » At the Boundary cells- unavailability of neighboring cells for handover and poor signal strength and timing advance
  - » Fading

# Summary

- Quality of Services” (QoS) is the collective effect of service performance and the degree of satisfaction of a user of the service
- **Objective & subjective Assessment** are the methods to calculate the QoS.
  - Low network availability, Low network stability, RF related problems are main problems in mobile network.
  - There are various QoS bench marks for mobile, landline, broadband services.



