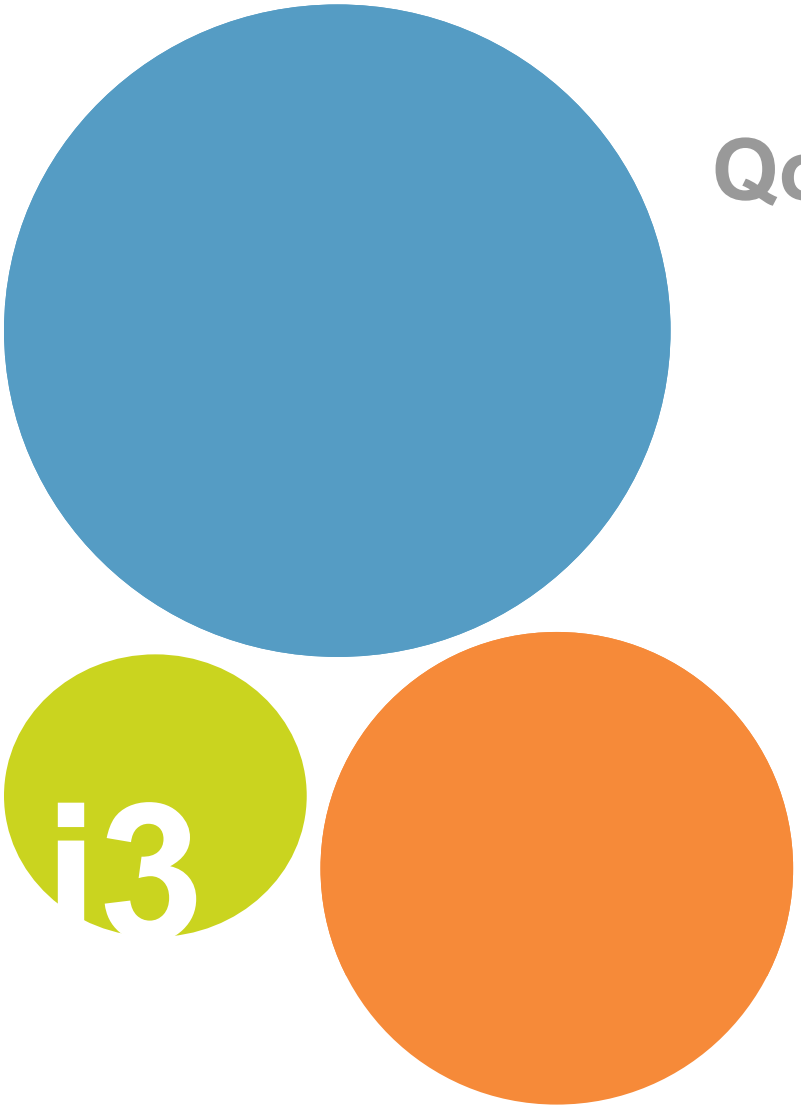

QoS Control & Monitoring

The i3 Forum approach for QoS Control for international voice services

presented by
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May 26, 2011

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Agenda

- QoS Business Drivers
- Use Cases
- Passive and Active Measurements
- Current i3 Forum approach (RTCP)
- i3 Solution Requirements
- Proposed Solution: QoS Aggregation
- Proposed Solution: Media Loopback
- Proposed Solution: SIP QoS reporting

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QoS Business Drivers

Current i3 Forum QoS Measurement Parameters

- Transport Parameters:
  - Round-Trip Delay
  - Jitter
  - Packet Loss

  } IP Quality
- Service Parameters:
  - MOS_{CQE} – Mean Opinion Score, Conversational Quality Estimated
  - **ALOC** – Average Length of Call (a.k.a. ACD)
  - **ASR** – Answer Seize Ratio
  - NER – Network Efficiency Ratio (corrects for user behavior)
  - PGRD – Post Gateway Ring Delay (delay to receiving alerting)

This presentation focuses on the measurement of MOS; transport parameters are also measured by the methods discussed.

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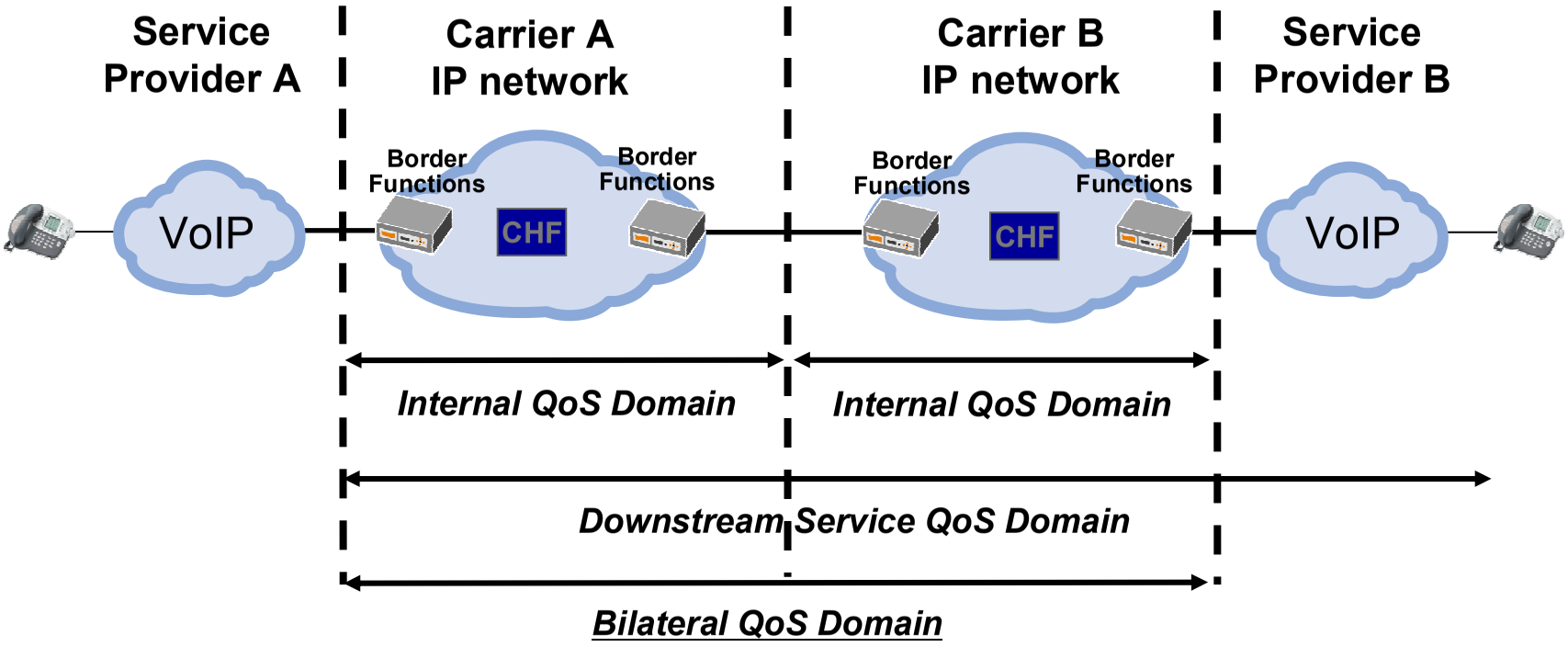
QoS Business Drivers

The importance of accurate MOS for international voice

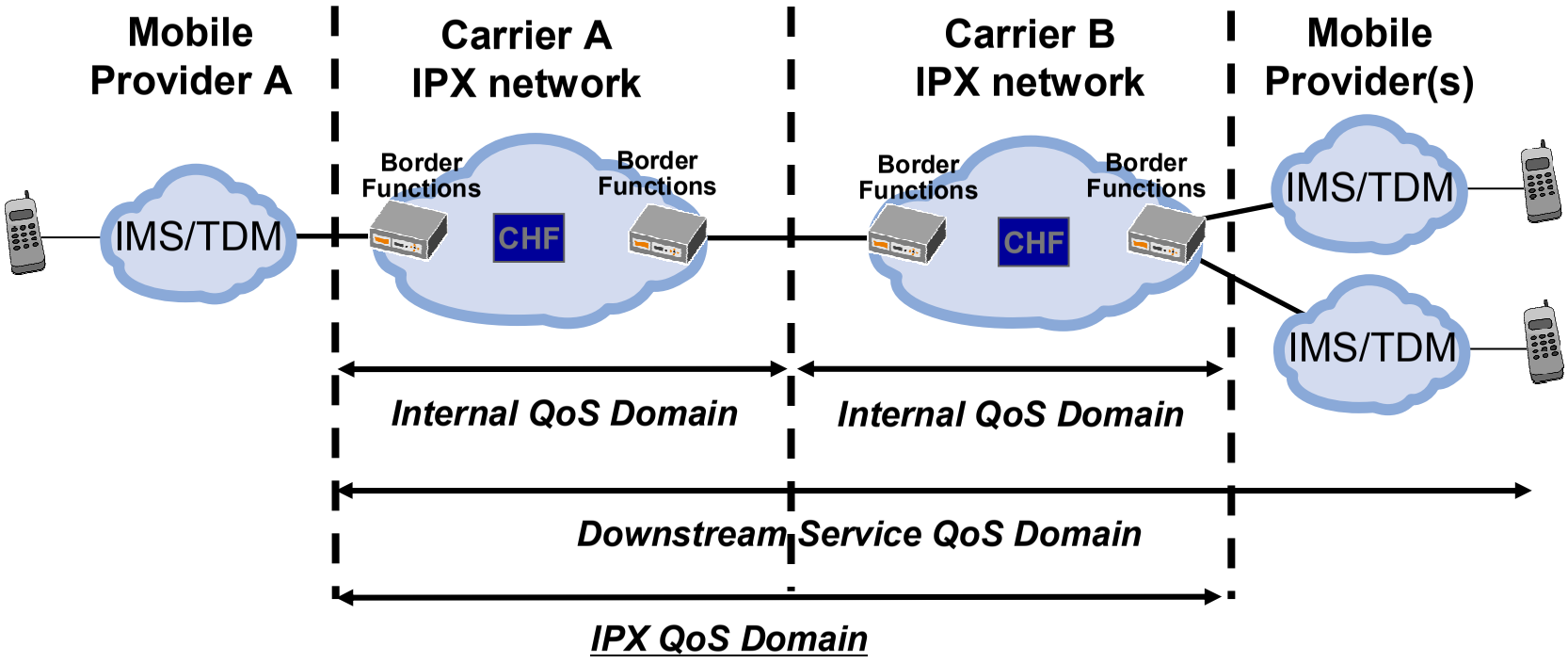
- SLA Enforcement
  - MOS an important KPI, particularly for GSMA IPX
  - Service provider customers now educated on MOS
- Routing Decisions
  - MOS an important complement to ASR/NER/ALOC
  - Quality plays an important part in LCR decisions
  - VoIP quality recognized as hard with only ASR/NER/ALOC
- Network Operations
  - Measurement of internal MOS essential
  - MOS information useful for diagnostics

QoS Use Case (1): Bilateral



- Carrier A knows quality across its Internal QoS Domain
- Carrier A wants to know quality across Bilateral QoS Domain
- Quality across Downstream Service QoS Domain to end user not needed

QoS Use Case (2): IPX



- Mobile Provider wants to ensure SLA compliance of Carrier IPX service
- Carrier A knows quality across its Internal QoS Domain
- Carrier A wants to know quality across IPX QoS Domain for SLA compliance
- Quality of Downstream Service QoS Domain not useful for SLA compliance

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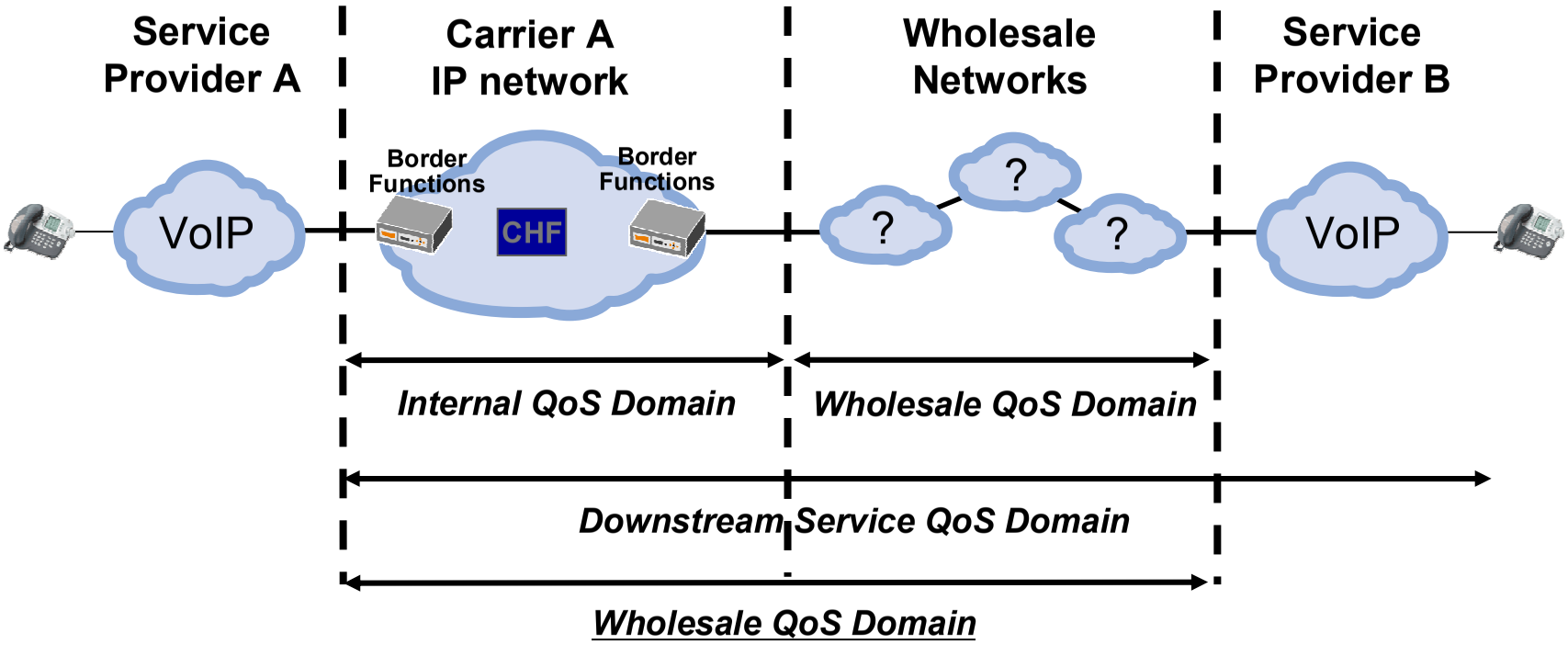
QoS Use Case (3): Global Wholesale



- Carrier A wants to know quality of wholesale route to downstream SP B
- Carrier A knows internal quality but not quality across wholesale cloud
- Quality across Downstream Service QoS Domain to end user may be useful

Active & Passive Measurement

Active

Methodology: Measurement by actively setting up test sessions across test domain

Pros:

- High resolution using MOS_{LQO}
- Also can provide MOS_{CQE}
- Control of measurement domain
- Other metrics available

Cons:

- Not always representative of real traffic path
- Large number of sessions may be required to provide full coverage e.g. N^2 problem

Passive

Methodology: Measurement by passively monitoring traffic sessions across the test domain

Pros:

- MOS_{CQE}
- Accurate representation of real performance
- Easy to configure
- Measurements easy to analyze

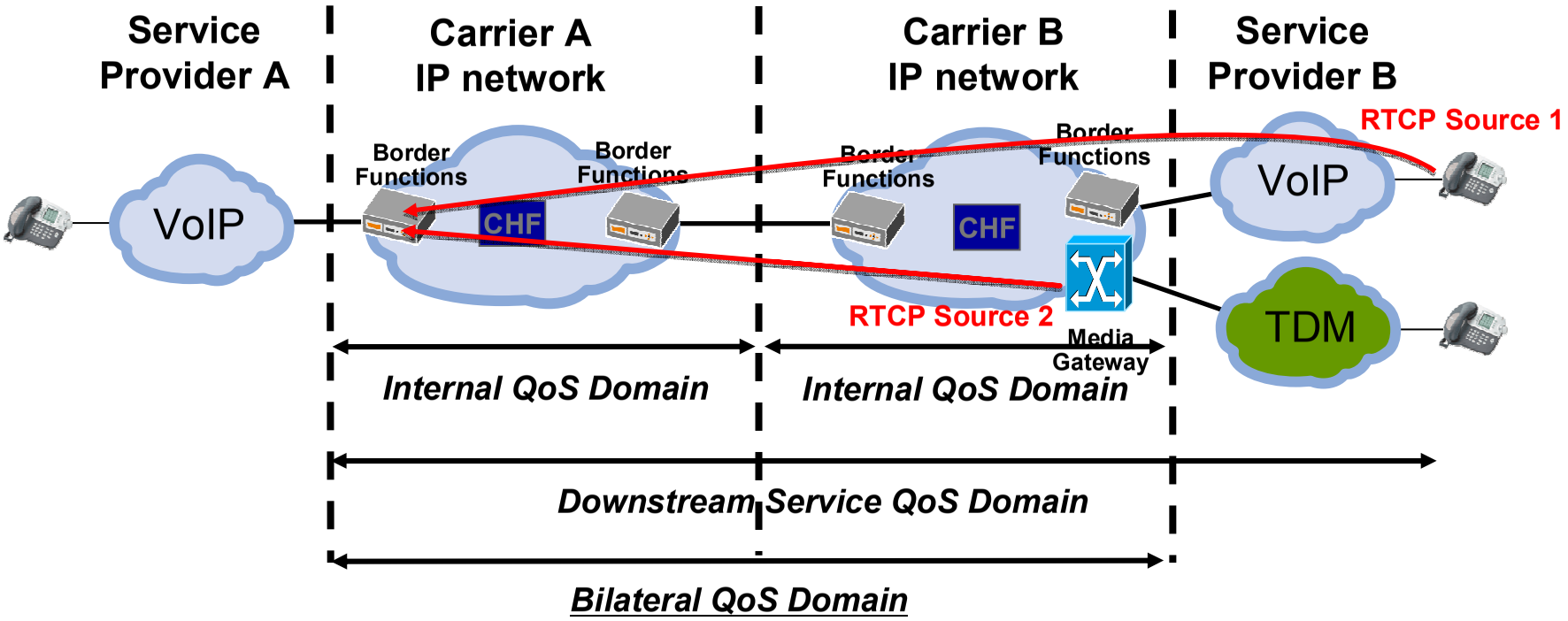
Cons:

- Uncertain control of measurement domain
- Limited diagnostic ability

Current i3 Approach (RTCP)

- Current i3 Forum Approach:
  - Specified in the Technical Interconnect Model document
  - Specifies MOS_{CQE} by passive measurement
  - Calculated from the R-Factor (ITU-T P.10/G.107)
  - R-Factor itself calculated using the E-model, using:
    - One-way delay
    - Jitter
    - Packet loss
    - Codec impairment (G.711 = 0 impairment)
  - Delay, jitter, loss from RTCP sender and receiver reports
  - RTCP measured from ingress SBC to downstream RTP end point

Current i3 Approach (Problem)



- Problem 1: RTCP report source ambiguity between RTCP Source 1 & 2
  - ⟶ Carrier border function does not know what it is measuring!
- Problem 2: RTCP measurement to end user device is not useful
  - ⟶ Quality across the carrier domains needed, end SP quality useful but not needed

Problems 1& 2 exists in all use cases, however depending on the relationship between carriers RTCP can be made to work, e.g. in a controlled Bilateral case

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I3 Solution Requirements

Ideal Requirements:

- Controllable or identifiable measurement domain(s)
- Active or Passive
- Provide MOS_{CQE} and optionally MOS_{LQO}
- Reasonable deployment overhead
- Preferably integrated into existing equipment
- Assist with SLA monitoring and troubleshooting
- Handle at least Bilateral and IPX use cases
- Not vendor proprietary / broad industry support
- Recognized standard i.e. IETF/ITU-T

Proposed Solution: QoS Aggregation

Aggregating Internal QoS Domain measurements

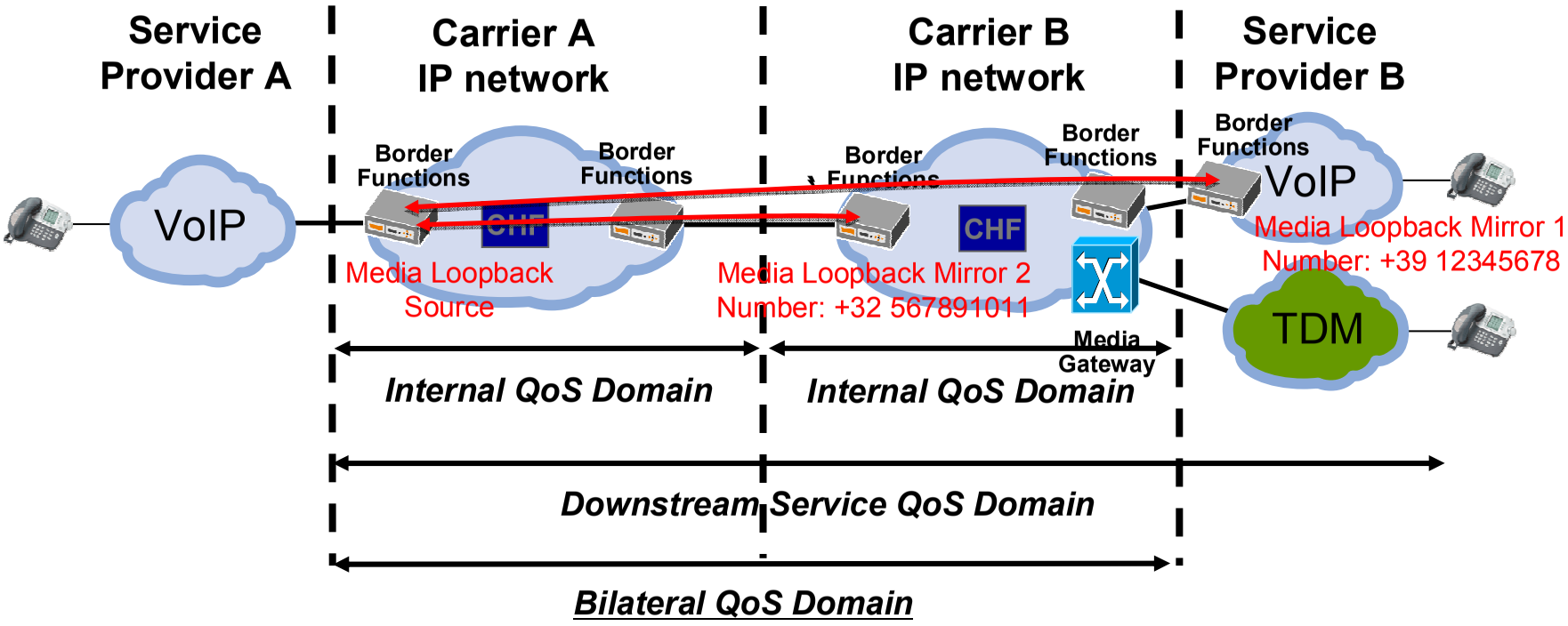
- Each carrier monitors quality across their internal QoS domain using their chosen mechanism e.g. probe servers or RTCP
- Carriers share information:
  - Directly with each other
  - Into a 3rd party maintained QoS database
- Some possible issues:
  - May not scale beyond the bilateral case
  - Who runs and administers central database if present?
  - Carriers may not wish to share information
  - Not suitable for troubleshooting operations in real time

Proposed Solution: Media Loopback (1)

IETF Draft: draft-ietf-mmusic-loopback-15

- "An Extension to the Session Description Protocol (SDP) for Media Loopback", March 2011
- Active mechanism which allows proposal of media path loopback with 3 modes:
  - Encapsulated source RTP sent back to sender
  - Direct loopback by copying inbound RTP back to sender
  - Media loopback by sending audio back to sender
- SDP to propose loopback session to destination 'mirror'
- Specifies use of RTCP/RTCP-XR for carrying of loss, delay, jitter and other information.
- Can generate MOS_{CQE} , maybe MOS_{LQO}
- Requires session to be created to a known test point, i.e. a test number

Proposed Solution: Media Loopback (2)



- To measure the quality across the Bilateral QoS Domain, Carrier A creates a loopback session to the Border Functions in Service Provider B

Proposed Solution: Media Loopback (3)

Some possible issues:

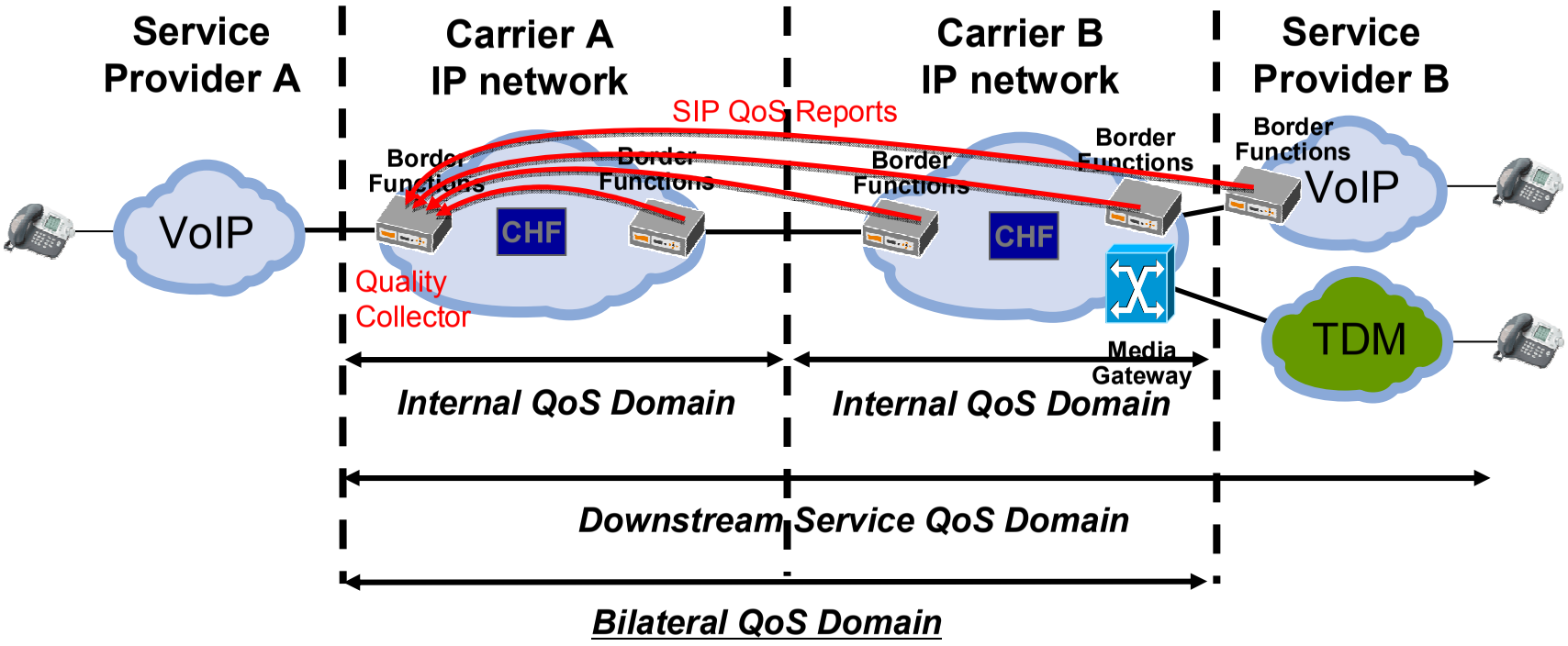
- Very large number of loopback sessions may be required:
  - Complete coverage could depend on network structure i.e. location and number of Border Function elements – N^2 problem?
  - Bilateral case probably workable, IPX case probably difficult, Global Wholesale case probably impossible!
- Loopback mirror (test point) locations will require to be shared:
  - Shared list needs to be established
  - Information on test number and system location important
  - Security concerns:
    - User security and access control
    - Partner only access in IPX
    - Internal network structure may need to be revealed
- Not measuring same path as actual traffic, possible fraud

Proposed Solution: SIP QoS Reporting (1)

Using SIP Signaling to carry QoS Reports

- Solution would use one of the available SIP message types:
  - PUBLISH
  - INFO
  - NOTIFY
- RTCP/RTCP-XR information provided i.e. loss, delay, jitter for MOS_{CQE} / R-Factor calculation
- Information could be sent after SIP BYE message
- Approach similar to IETF RFC6035 “Session Initiation Protocol Event Package for Voice Quality Reporting”, November 2010
- Reports would contain an identifier of the remote generator
- Reports could be sent from intermediate systems in call path
- Continues to work even if RTCP is broken by intermediate systems

Proposed Solution: SIP QoS Reporting (2)



- To measure the quality across the Bilateral QoS Domain, Carrier A uses received QoS reporting information from the SP B Border Function at the ingress Border Function

Proposed Solution: SIP QoS Reporting (3)

Some possible issues:

- Significant overhead may be created
  - Large number of additional SIP messages
  - Computing of quality information may be processor intensive
  - Deciding which QoS Reports to use may be complex
  - Overhead may be too much for Global Wholesale use case
- Source of QoS Reports could still be uncertain:
  - Is the source marked in report reliable?
  - Source identification would require rules
  - Networks would still have to reveal locations and topology
  - Source could be faked for fraud purposes

Summary

The i3 Forum is studying a solution for this problem

The industry will need to invest in solving it and should expect some return on investment for this.

We will work with members, standards bodies and vendors to identify solutions over the coming work cycles.

Proposed solutions and contributions are welcome.

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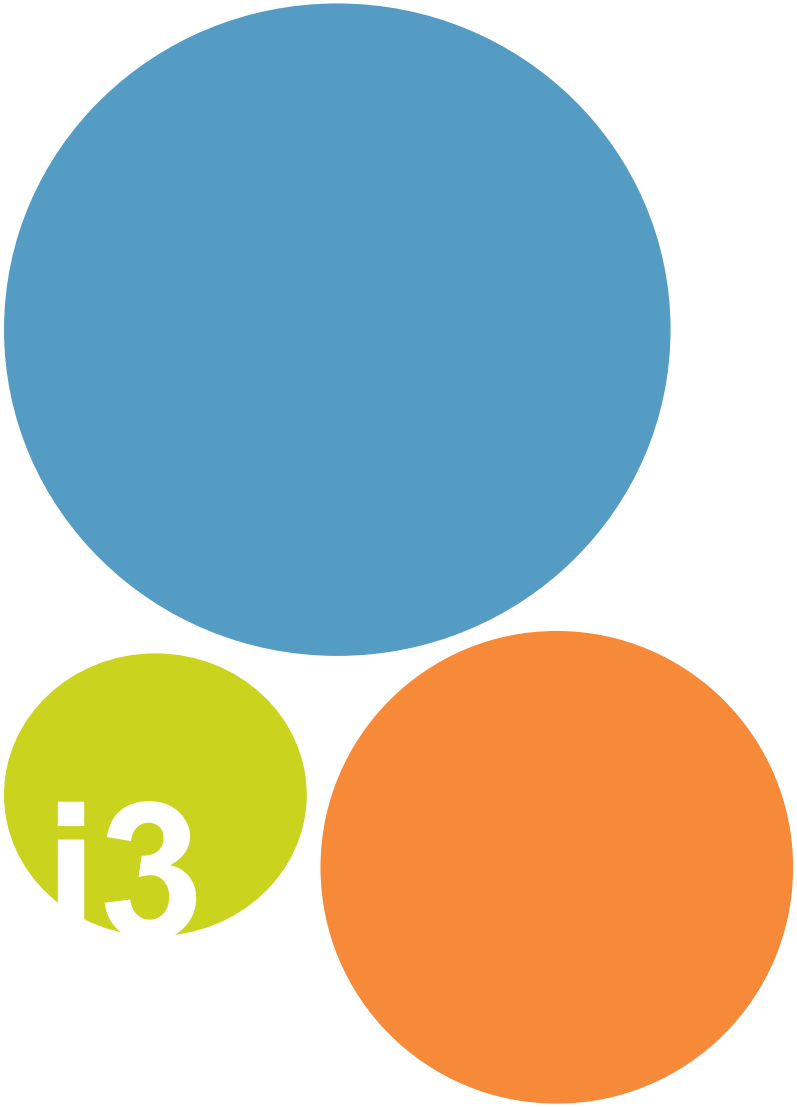

Thank You!