3GPP LCLS (Local Call, Local Switch)

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Classic GSM User Plane

- user plane joins signaling plane at all times
- voice circuit between two phones in same BTS
  - goes from BTS to BSC (Abis) where a BSC-colocated TRAU is located
  - goes from BSC to MSC (A, typiclaly G.711))
  - returns from MSC to same BSC
  - returns from same BSC to same BTS
- this is of course far from optimal

Problems with classic approach

- works great with low-latency, land-based/wired TDM network
- works not well with remote sites connected via satellite (VSAT)
  - maritime sector
  - rural BTSs in areas where no other back-haul is available
- various vendors have implemented proprietary solutions
  - conveniently creating vendor lock-in

3GPP LCLS to the rescue

- official 3GPP standard appears to solve the problem in interoperable fashion
- underlying principle quite simple:
  - each call gets a *Global Call Reference* on A inerface
  - this allows BSC to identify two legs of same call
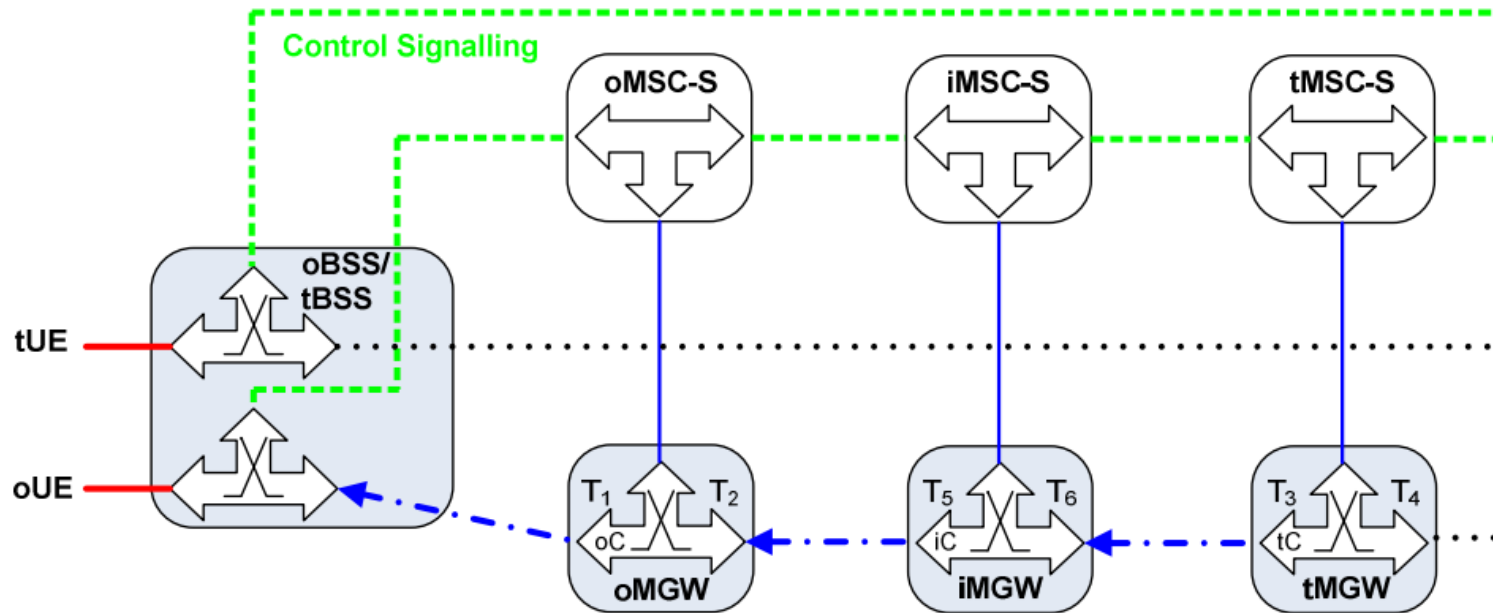 - this enables BSC to locally switch the user plane between such calls
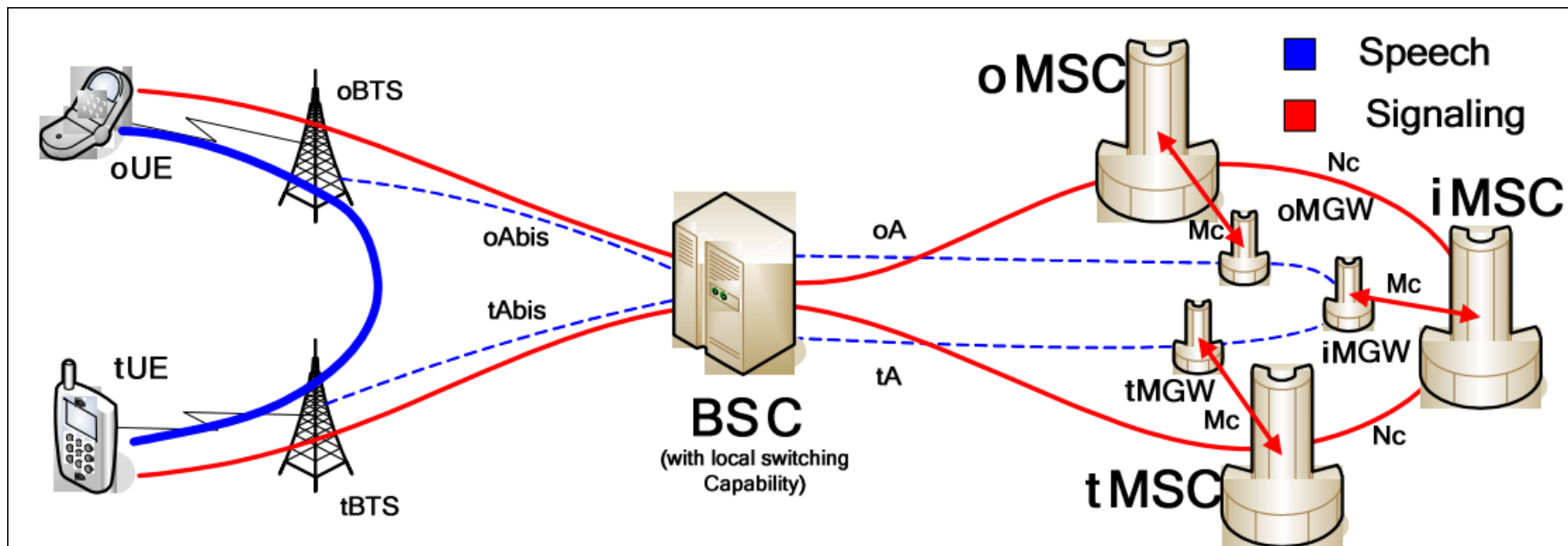
3GPP LCLS problem domains

- early media / alerting phase

- what about playback of voice announcements ("your prepaid account is low")?

- what about lawful interception?

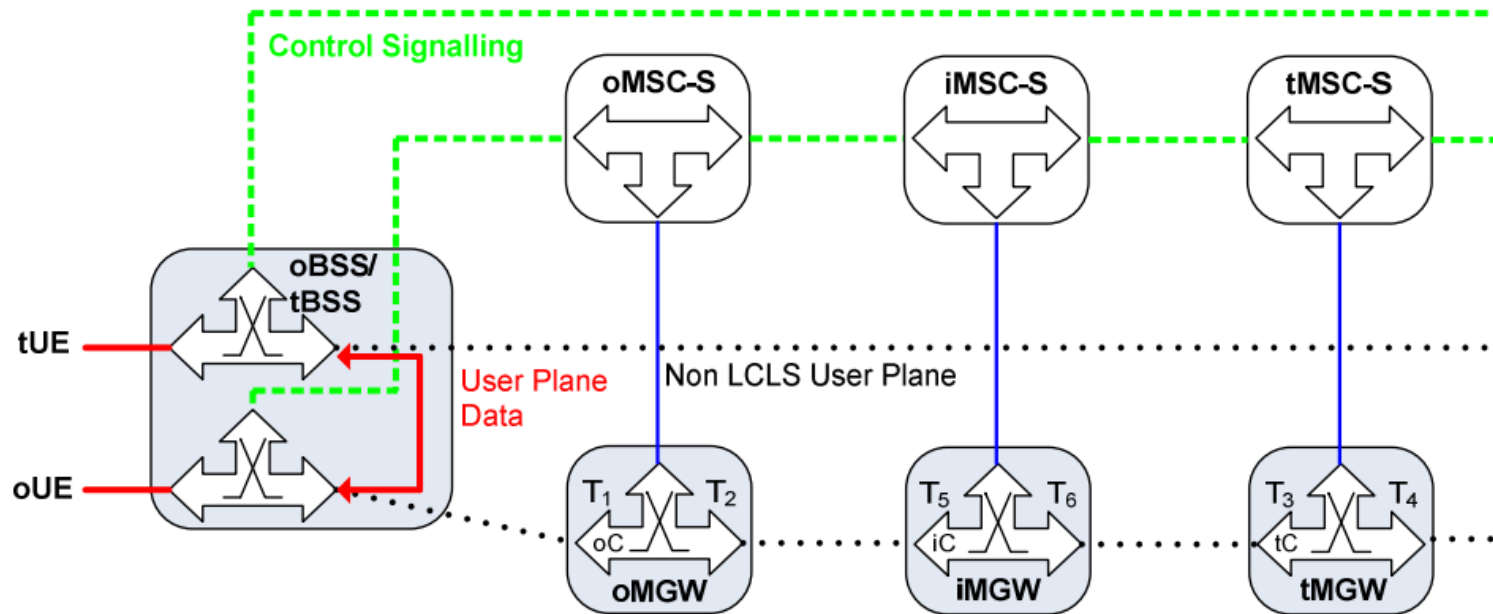- what about hand-over implications (intra-BSC, inter-BSC, inter-MSC, inter-RAT, …)?

3GPP LCLS early media

Connection Model 1: After Alerting, Backward Through Connection
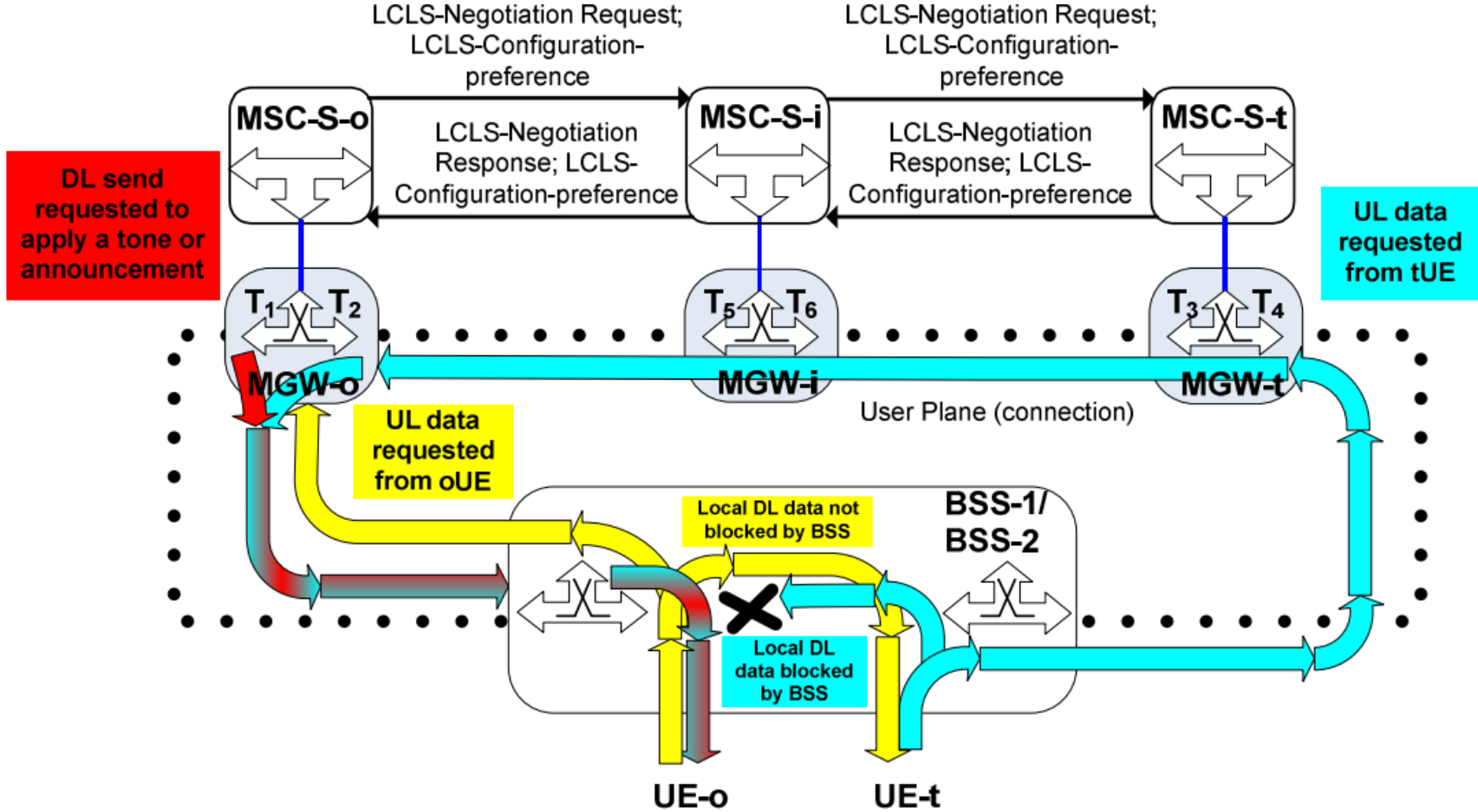
3GPP LCLS early media

Connection Model 2: After answer, Call is locally switched

Figure 6.3.1.1: Basic Call Establishment Connection Model for Local Call

3GPP LCLS tone / announcement

3GPP LCLS: Negotiation in CN

- don't blindly activate LCLS, but *negotiate* it
  - all calls start non-locally switched

- LCLS negotiation on Nc interface (ISUP, BICC, SIP-I) between MSCs
- LCLS negotiation only succeeds if all CN (MSC) support it
  - LCLS-Negotiation-Request IE
  - LCLS-Negotiation-Response IE
  - LCLS-Configuration-Preference IE

3GPP LCLS Negotiation results

- variety of different possible media configurations (examples)
  - classic non-local (non-LCLS)
  - connected both-way in BSS (basic LCLS)
  - connected both way in BSS *and* bi-casted UL to CN
  - connected both way in BSS *and* send access DL from CN
    - BSS may combine or replace local DL data with DL data from CN
  - connected both way in BSS *and* send access DL from CN, block local DL

3GPP LCLS: Implications on A / BSSMAP

- BSS is instructed about media configuration in BSSMAP
  - during call establishment
    - BSSMAP ASSIGNMENT REQ with GCR + LCLS-Config IEs
    - BSSMAP ASSIGNMENT COMPLETE with LCLS-BSS-Status IE
  - during handover
    - BSSMAP HANDOVER COMPLETE with LCLS-BSS-Status IE
  - at any other time
    - BSSMAP LCLS-NOTIFICATION from BSS → MSS
    - BSSMAP LCLS-CONNECT-CONTROL message MSS → BSS

3GPP LCLS: Osmocom Plans

1. Plan: support minimal sub-set without bi-casting

    a. in OsmoBSC

        i. requires us to add BSSMAP LCLS IEs/Messages

        ii. will use MGCP to re-configure the CN-side RTP connection on OsmoMGW

        iii. development will be test-driven (develop TTCN-3 tests first)

    b. in OsmoMSC (only among RANs connected to single MSC)

        i. requires us to permit/enable LCLS on AoIP

Further Reading

- 3GPP TS 23.284 http://www.3gpp.org/DynaReport/23284.htm
- 3GPP WI 430001 (LCLS-CN) http://www.3gpp.org/DynaReport/WiCr—440021.htm
- 3GPP WI 440021 http://www.3gpp.org/DynaReport/WiCr—440021.htm
- http://osmocom.org/projects/cellular-infrastructure/wiki/Local_Call_Local_Switch
- Osmocom tickets
  - http://osmocom.org/issues/1602
  - http://osmocom.org/issues/2487

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