

3GPP LCLS (Local Call, Local Switch)

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Classic GSM User Plane

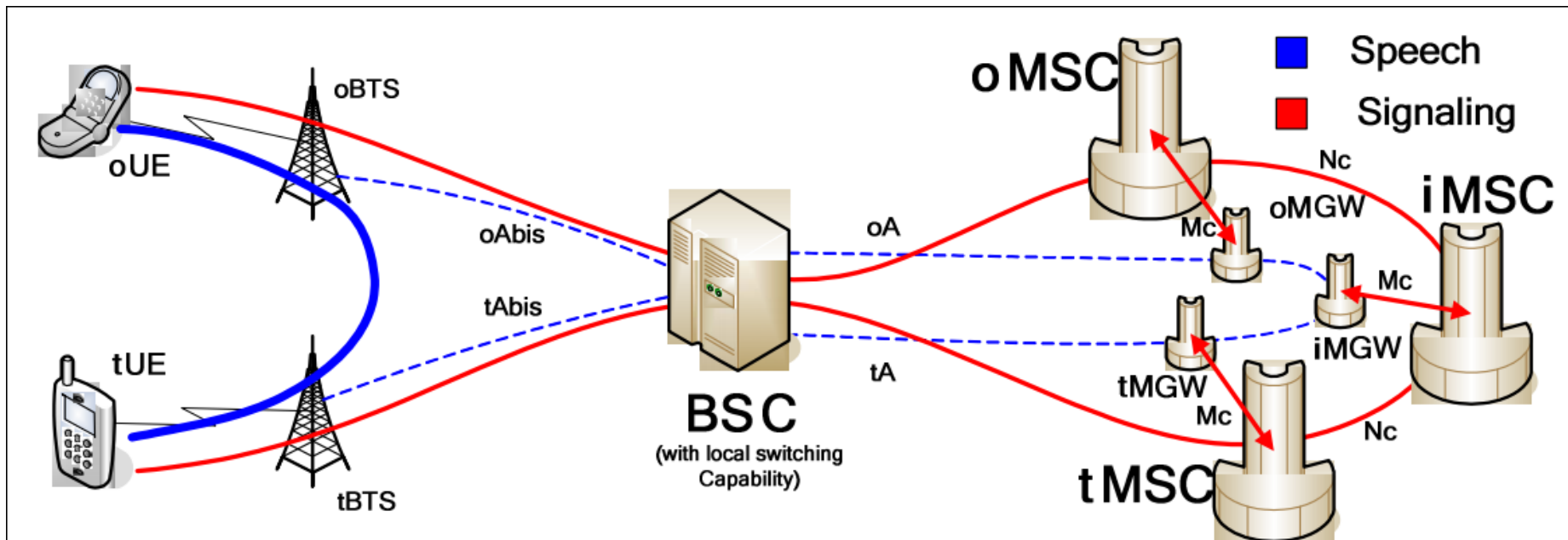
- user plane joins signaling plane at all times
- voice circuit between two phones in same BTS
 - goes from BTS to BSC (Abis) where a BSC-located TRAU is located
 - goes from BSC to MSC (A, typically G.711)
 - returns from MSC to same BSC
 - returns from same BSC to same BTS
- this is of course far from 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 interface
 - this allows BSC to identify two legs of same call
 - this enables BSC to locally switch the user plane between such calls

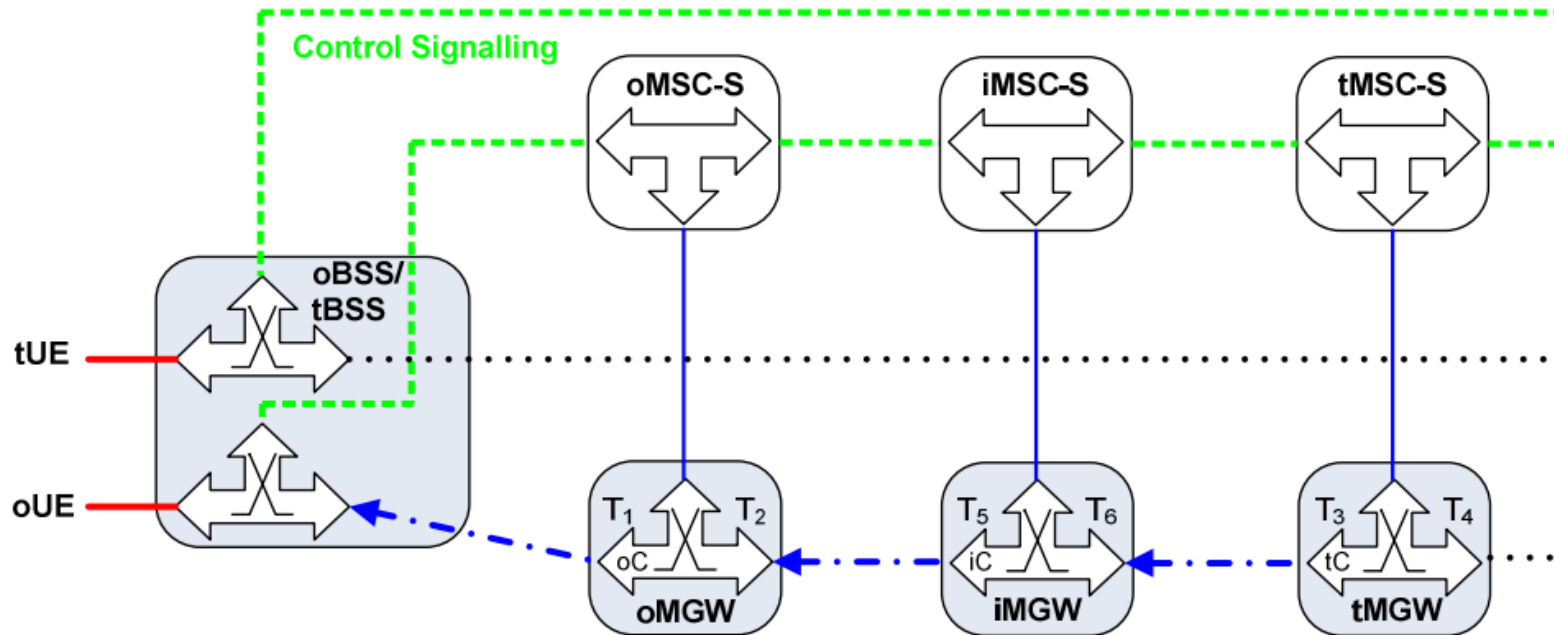


3GPP LCLS problem domains

- 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-MS, inter-RAT, ...)?

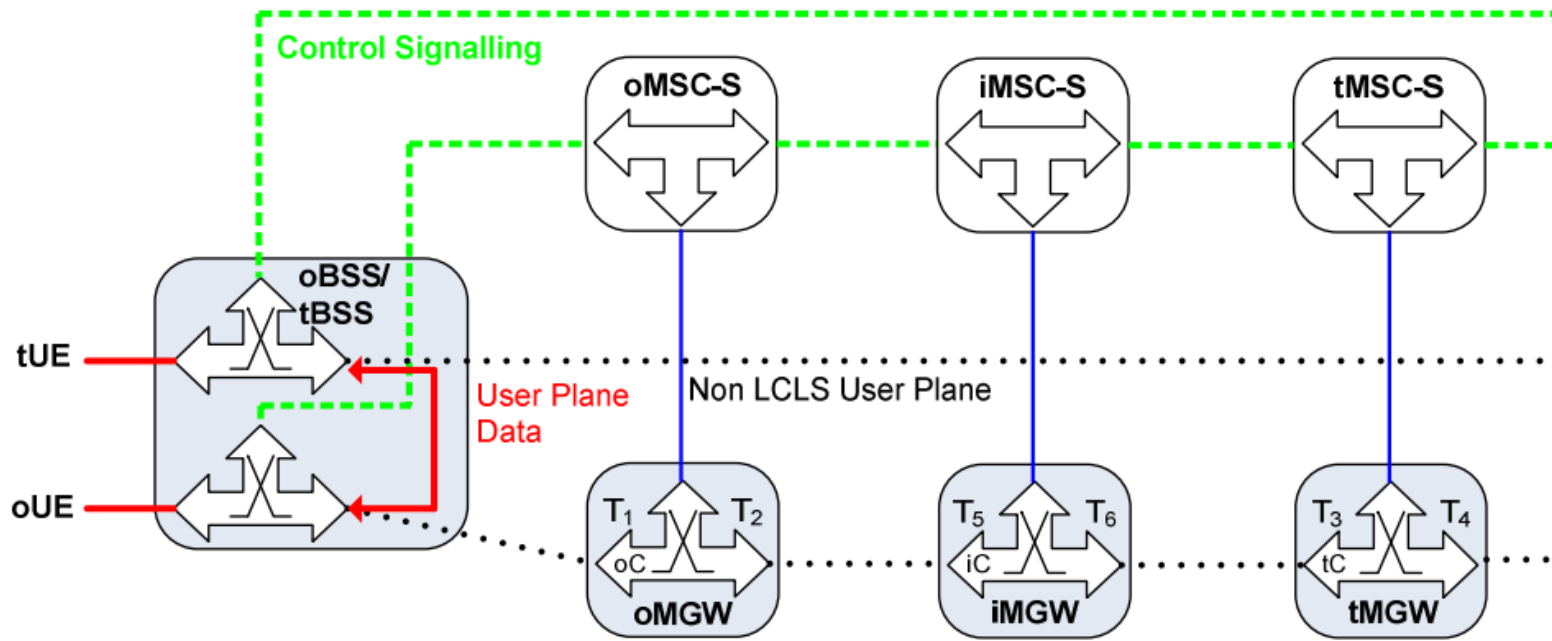
3GPP LCLS early media

- Control plane link which transmits signalling
- User plane link path through CN, connected or disconnected
- User plane link which transmits real user plane data within BSS and UEs
- User plane link which transmits real user plane data in backward direction from the CN towards oUE (e.g. network provided ring-back tone)



Connection Model 1: After Alerting, Backward Through Connection

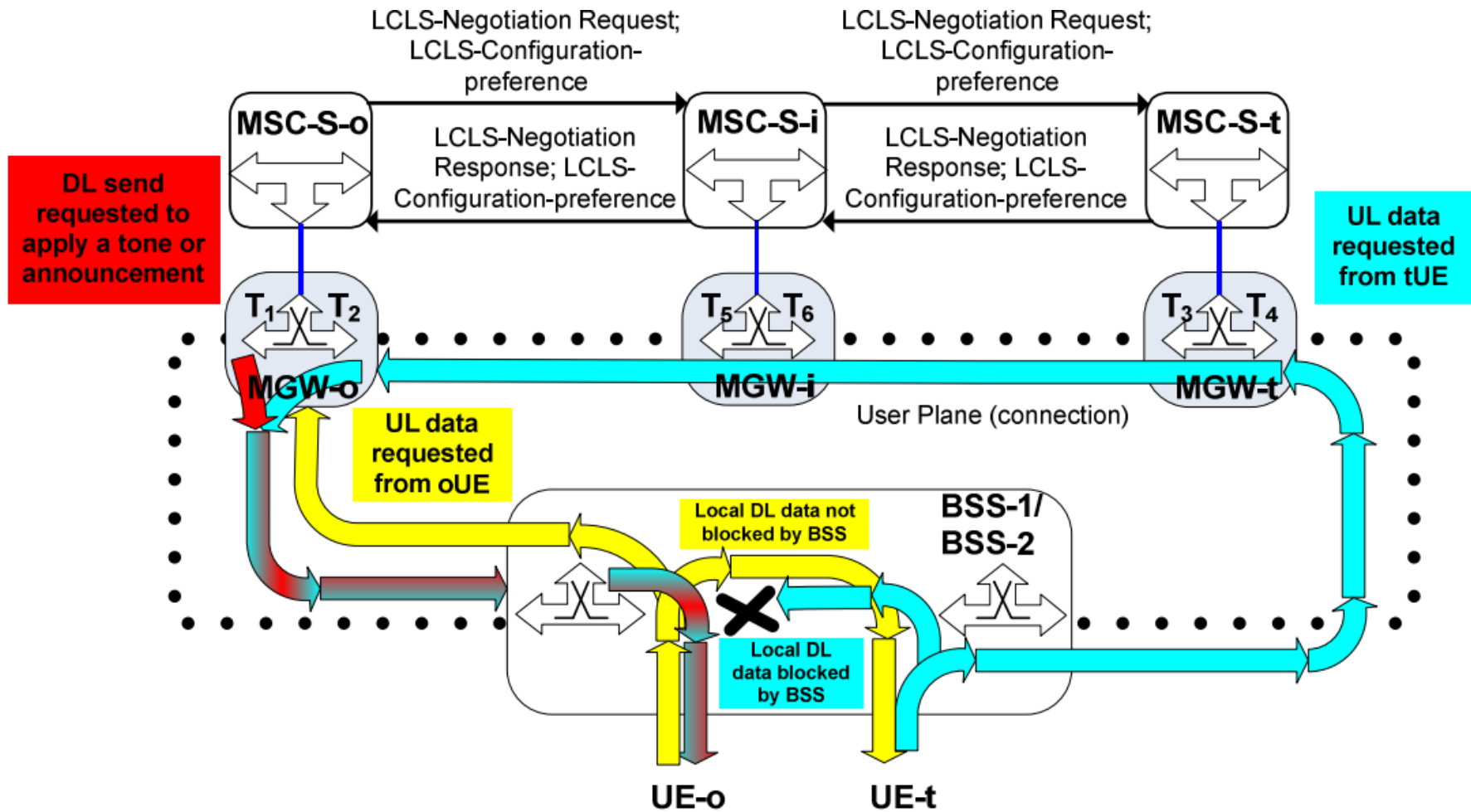
3GPP LCLS early media



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 Support

1. minimal sub-set without bi-casting
 - a. in OsmoBSC
 - i. added BSSMAP LCLS IEs/Messages
 - ii. use MGCP to re-configure the CN-side RTP connection on OsmoMGW
 - iii. development was test-driven (TTCN-3 tests written first)
 - b. in OsmoMSC
 - i. currently not implemented yet

3GPP LCLS: Osmocom Restrictions

1. RTP audio looping is done in BSC-located MGW
 - a. saves RTP on A interface between BSC and MSC
 - b. doesn't save RTP round-trip on Abis between BTS and BSC
2. In deployments with a centralized BSC, that's insufficient
 - a. you want true RTP loop-back between the BTSs involved in locally switched call
3. implementation pending, should happen rather soon

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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