

stc

reference interconnection offer (RIO)

Annex C Attachment 6

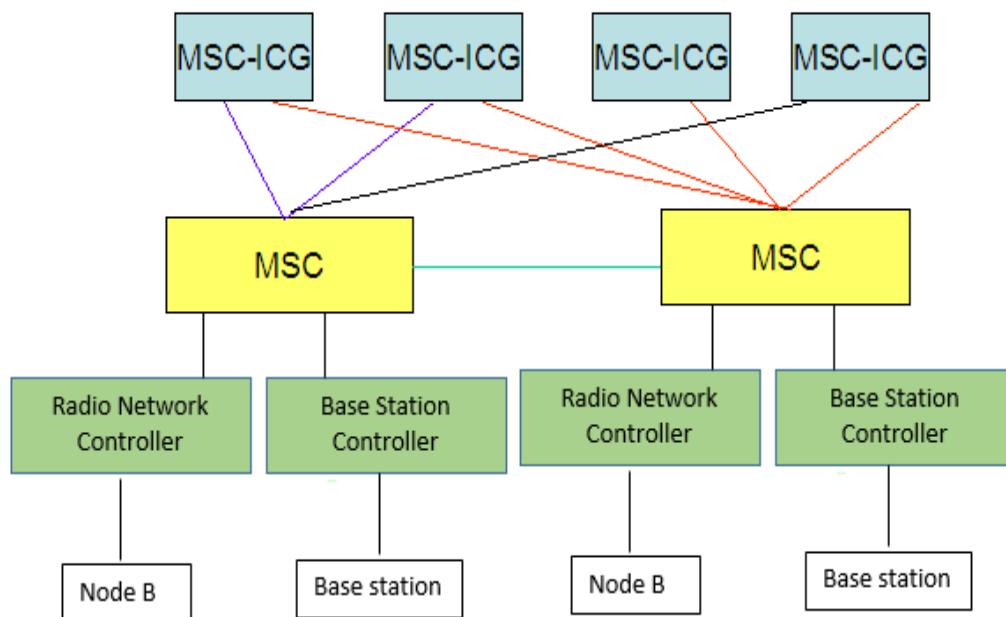
Mobile Network Technical Information

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1 mobile network

1.1 The topology of **stc**'s Mobile Network is very similar to that of **stc**'s main core network in that it has the hierarchical structure shown in Figure 1 below. The network comprises of eight (8) Transit Mobile Switching Centres designated as Interconnection Gateways (MSC-ICG), two (2) in Riyadh, two (2) in Jeddah, two (2) in Makkah and two (2) in Dammam and 20 Mobile Switching Centres (MSC), once the 4G5 project is fully implemented. The cellular base stations are parented on base station controllers which provide the mobile connectivity within the individual cells.



MSC-ICG : Mobile Switching Centre Interconnection Gateway

1.2 Mobile voice network description

stc mobile voice network consists of MSC-S and MGW used to provide service for **stc** customers and for national and international roamers:

- **stc** is using UDC architecture for its subscriber's databases.
- Mobile voice network is highly redundant and scalable to ensure excellent user experience.
- Mobile voice network is divided into five pools interconnected between them using TSC layer which consist of 8 T-MSC nodes.
- **stc** is providing VoLTE service for some of its LTE customers using IMS network as voice engine.
- The IMS platform is used for both fixed and mobile voice services.
- Mobile voice network support 2G, 3G and 4G access.
- It's planned to extend VoLTE services to the WiFi coverage.
- **stc** is planning to have 5G access.

1.3 Mobile packet network description

stc mobile packet network consist of 13 MME-SGSN, offering triple LTE/3G/2G access and 24 GGSN-SPGW gateways:

- **stc**'s mobile packet core is used to provide MBB data service for **stc** customers and for national and international roamers.
- There is 3 SGSN/MME Pools to offer higher resiliency.
- All gateways work in load sharing, while local access is preferred.
- Mobile packet core network is highly redundant and scalable to ensure world-class user experience.
- **stc** is planning to have 5G access. Thus the packet core will evolve to support 5G access.

2 TRAFFIC INTERCONNECTION TO THE MOBILE NETWORK

- 2.1 **stc** provides Interconnection to Other Licensed Operators to its Mobile Network at the MSC-ICG level. The Interconnection shall be provided at the POIs specified in Table 1 and in accordance with the technical standards/specifications as provided in this document i.e. Attachment 6 of Annex C (*Technical Information*).

3 LOCATION OF POINTS OF INTERCONNECTION

- 3.1 The locations of the MSC-ICGs where Interconnection is available are listed in **Table 1**.

Site No	JV Code	Exchange Name	City	Exchange Location / Address	Exchange Location / Address	Switch Type	Vendor	Signaling Point Code
304-00	TSD1	Khobar TMSC-1	Dammam	Al Khobar, Dammam	شارع لمظوران صف برئد لمخير لمركزى	IC Gateway	Huawie	3019
302-00	TSD2	Lasilki TMSC-2	Dammam	Lasilki, Dmmam	شارع الاتصالات شرق تجيع الاتصالات	IC Gateway	Huawie	3030
202-00	TSJ1	Rowais TMSC-1	Jeddah	Rowais, Jeddah	تقاطع طريق لمندهُؤ نع شارع لمسطن بجىار نكتب لى زئر لمدا لمهُؤ	IC Gateway	Huawie	2039
214-00	TSJ2	Mujamma Jeddah TMSC-2	Jeddah	Mujammah, Jeddah	حى لمبلد، شارع لمكى لمهُؤ نع شارع لمسطن سابتكى	IC Gateway	Huawie	2041
224-00	TSK2	Mansour TMSC-2	Makkah	Mansour, Makkah	حى لمهُؤ صر، شارع لمهُؤ صر	IC Gateway	Huawie	4019
223-00	TSK1	Aziziyeh TMSC-1	Makkah	Aziziyah, Makkah	شارع لمعز زئؤ لمعان صف نسجد لمشئخ عبد لمعز زئؤ بن باز	IC Gateway	Huawie	4018
108-00	TSR1	Mather TMSC-1	Riyadh	Mather, Riyadh	حى ان لمدان، شارع ان لمدان	IC Gateway	Huawie	1116
101-00	TSR2	Murabba TMSC-2	Riyadh	Murabba, Riaydh	حى لمُربع، شارع لمك لمُصم	IC Gateway	Huawie	1117

Table 1 - Location of Points of Interconnection in Mobile Network

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- 3.2 The list of MSC-ICGs provided in Table 1 will be updated periodically. Additional POIs will be determined by agreement between **stc** and the Other Licensed Operator as part of the Network Plan and will be consistent with Clause 4.2 of Annex C (*Technical Information*).
- 3.3 In order for the Other Licensed Operator to interconnect with the **stc** mobile Network it shall:
- a) Establish Interconnection with **stc** at Points of Interconnection offered by **stc** at the MSC-ICG exchanges.
 - b) For Interconnection with a Kingdom wide Other Licensed Operator public Network, the initial requirement is to establish Interconnection at a minimum of two (2) of the Points of Interconnection to ensure diversity and resilience. (The details of the initial Interconnection arrangement will be agreed during the initial network planning process.)

4 INTERCONNECT LINKS AND ROUTING

- 4.1 Interconnect Links will be used as necessary to provide Interconnection routes for the conveyance of the Other Licensed Operator's traffic into the **stc** Mobile Network. Routes will be established in accordance with the Other Licensed Operator's agreed Network Plan and capacity forecasts as stipulated in Annex E (*Forecasting*).

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- 4.2 As the planned decommissioning of the **stc** Fixed Network Service Nodes continues in the future, in the case of new requests from the OLOs for Interconnection with the **stc** Fixed and Mobile Network, the OLOs will have to consider the PoI options that are available at that time based on the prevailing technology trends, whereas currently the **stc** POIs are based on Service nodes and Transit Switching Centres (TSCs).
- 4.3 Until routes are mature and traffic volumes become stable, interconnect routes will be uni-directional. At a later stage, bi-directional operation of these routes will be considered.
- 4.4 The Other Licensed Operator shall deliver only traffic which will terminate on the **stc** or hosted MVNO mobile number ranges at the Points of Interconnection at the MSC-ICG exchanges. Also, traffic to subscribers who have ported their numbers to **stc**, which will be preceded by the routing number prefix 1545, can be delivered to Points of Interconnection at the **stc** MSC-ICG exchanges.
- 4.5 The Other Licensed Operators shall be responsible for querying, routing and termination of the Calls to the numbers that have been ported out of the **stc** Network.
- 4.6 The Other Licensed Operator will be responsible for those routes on which it sends traffic to the **stc** Network and will dimension the routes to meet the target Unsuccessful Call Termination Ratio measures stated in Annex I (*Quality of Service Measures*).

5 SIGNALLING NETWORK

5.1 The **stc** mobile Network utilises Signalling System No.7 (SS7) and Diameter in accordance with ITU-T Q.7xx and ITU-T Q.7xx series standards with options as adapted to the Kingdom of Saudi Arabia, as described in Attachment 3 (*Saudi Arabia SS7 Signalling Standard*) of this Annex C (*Technical Information*), which provides the standard specifications for Layers 1, 2 and 3 of the Message Transfer Part (MTP). This Attachment 3 also provides the standard specifications for the ISDN User Part (SA-ISUP). The signalling point codes (SPCs) for the POI Service Nodes are provided in Table 1 of this Attachment.

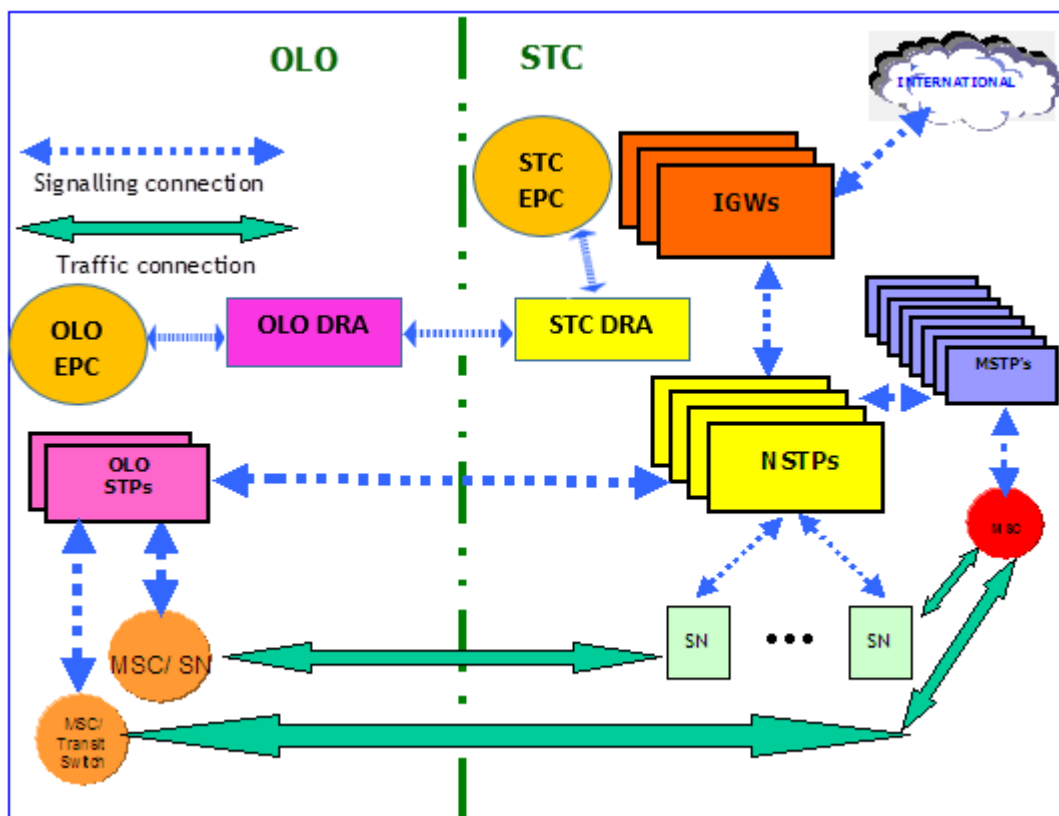


Figure 3 : Signalling Interconnection

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- 5.2 The utilisation of SS7 links shall be maintained within the guidelines of ITU-T Q.706 Recommendations of 0.2 erlang under normal load and 0.4 erlang under high load (e.g. changeover of a parallel link). However, higher loads such as e.g. 0.3/0.6 normal/high may be permitted as appropriate.
- 5.3 As a part of the Network Plan, referred to in Annex H (*Operations and Maintenance Manual*), a set of SS7 signalling tests will be performed in order to insure the compatibility and interoperability between **stc** and the Other Licensed Operator Networks at the 3 MTP levels as well as ISUP & Supplementary Services levels. These tests are extracted from the ITU-T Q.780, Q.781, Q.782, Q.784 and Q.785 Recommendations.
- 5.4 Figure 3 above, shows an architectural schematic diagram of the **stc** signalling network, which supports the **stc** Network. In addition, the necessary connections of the Other Licensed Operator signal transfer points (OLO STPs) and International Gateways (IGWs) to the **stc** national STPs (NSTPs) are shown. The SPCs for the NSTP's are 1000, 1001, 2000, 2001. In addition, the list of M-STPs and their locations along with their SPCs are provided in Table 2 below which will be updated periodically depending on the nodes modernization requirements:



Site Number	Node Name	Exchange Name	Switch Type	Switch Sub-Type	C7 Point Codes
121	STG1	Deerah	Ericsson	STP	1002
121	STG2	Deerah	Ericsson	STP	1003
119	STG3	Nasiriyah	Ericsson	STP	1004
119	STG4	Nasiriyah	Ericsson	STP	1005
202	STG5	Rouwais	Ericsson	STP	2002
204	STG6	Nazlah	Ericsson	STP	2003
211	STG7	Saheefah	Ericsson	STP	2004
212	STG8	Sharafiyah	Ericsson	STP	2005
103	STG9	Shimeisy	Ericsson	STP	1008
105	SG10	Makkah Road	Ericsson	STP	1009
303	STP1	Mutlaq	Ericsson	STP	3002
308	STP2	Dahran	Ericsson	STP	9201
121	STP3	Deerah	Ericsson	STP	1606
105	STP4	MakkahRd	Ericsson	STP	1607
204	STP5	Nuzlah	Ericsson	STP	2905
209	STP6	Mushrifa	Ericsson	STP	2906

Table 2: List of STGs, their Locations and Signalling Point Codes

6 synchronisation

- 6.1 The **stc** Network synchronisation is generally in line with relevant ITU-T recommendations. In order to establish Interconnection, the Other Licensed Operator will fulfil the timing performance requirements of ITU-T recommendation G.811. This can be achieved for Plesiochronous Mode by deriving reference timing from OLO's own Stratum 1 clock or the OLO will receive the master timing signal from **stc**.
- 6.2 The specification of the timing system that is required in order to ensure proper operation of the interconnected Networks is given in Annex C, Attachment 5 (**stc Synchronisation Scheme**).
- 6.3 Licensed operators are responsible for the management of synchronisation on their respective networks.

7 INTERFACE STANDARDS

7.1 Electrical STM-1 Interfaces.

7.1.1 If an electrical STM-1 interface is provide it shall be to the following ITU-T G.703 specification:

- Bit rate 155,520 kbit/s \pm 20 ppm
- Nominal value of pulse amplitude 1 V
- Attenuation 12 dB at 77,760 kHz
- Impedance (coaxial connectors) 75 Ohms
- Reflection attenuation (8 MHz to 240 MHz) 15 dB

7.2 Optical STM-1 Interfaces

7.2.1 If an optical STM-1 interface is provide it shall be to the following ITU-T G.957 specification:

(i) 155 Mbit/s STM-1 Interface (Application Class S-1.1 for Short Hauls)

- Bit rate 155,520 kbit/s \pm 20 ppm
- Code binary (NRZ)
- Wavelength range 1261 nm to 1360 nm
- Attenuation 10 dB to 28 dB

(ii) 155 Mbit/s STM-1 Interface (Application Class L-1.1 for Long Hauls)

- Bit rate 155,520 kbit/s \pm 20 ppm
- Code binary (NRZ)
- Wavelength range 1285 nm to 1330 nm
- Attenuation 10 dB to 28 dB

(iii) 155 Mbit/s STM-1 Interface (Application Class L-1.2 for Long Hauls)

- Bit rate 155,520 kbit/s \pm 20 ppm
- Code binary (NRZ)
- Wavelength range 1480 nm to 1580 nm
- Attenuation 10 dB to 28 dB

7.2.2 Optical STM-4 interface will be specified by ITU-T G.957

(i) 662 Mbit/s STM-4 interface (Application Class S-4.1 for short haul)

- Bit rate 622,080 Kbit/s
- Code Binary
- Wavelength rage 1293 - 1334 / 1274 – 1356 nm
- Attenuation 0 – 12 dB

(ii) 622 Mbit/s STM-4 interface (Application Class L.4.1 for long haul)

- Bit rate 622,080 Kbit/s
- Code Binary
- Wavelength range 1300 - 1325 / 1296 – 1330 nm
- Attenuation 10 - 24 dB

(iii) 622 Mbit/s STM-4 interface (Application Class L.4.2 for long haul)

- Bit rate 622,080 Kbit/s
- Code Binary
- Wavelength range 1480 – 1580 nm
- Attenuation 10 – 24 dB

8 NUMBERING

8.1 Number Ranges

8.1.1 Only traffic to mobile number ranges allocated to **stc** and those allocated to **stc** hosted MVNOs can be delivered to Points of Interconnection at the **stc** MSC-ICG exchanges with the exclusion of the ranges reserved for other purposes including Global Title (GT) and (Mobile Roaming Station Number) MRSN. Also, traffic to subscribers who have ported numbers to **stc**, which will be preceded by the routing number prefix 1545 can be delivered to Points of Interconnection at the **stc** MSC-ICG exchanges. For the avoidance of doubt, such routes cannot be used for the delivery of traffic to **stc** geographic national number ranges, **stc** non-geographic number ranges, international number ranges or any other number ranges even as an overflow route. **stc** will not onward route any calls to such number ranges, which are delivered, to the POI on the MSC-ICG.