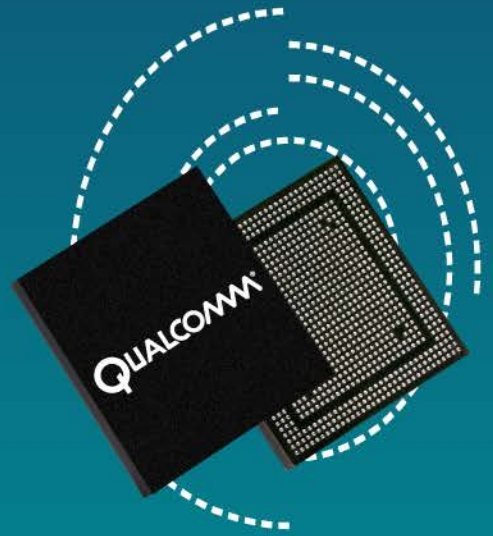
Qualcomm
TECHNOLOGIES, INC



SGLTE Data Services Overview

80-NJ017-4 C

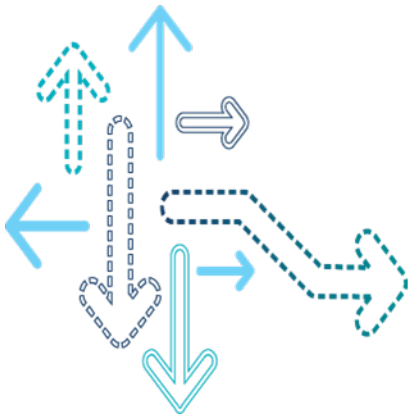
Qualcomm Technologies, Inc.
5775 Morehouse Drive
San Diego, CA 92121
U.S.A.

Revision History

Revision	Date	Description
A	Jul 2013	Initial release
B	Oct 2013	Updated slides 13 and 14
C	Jan 2014	Added applicable Introduction and Scope slides

Contents

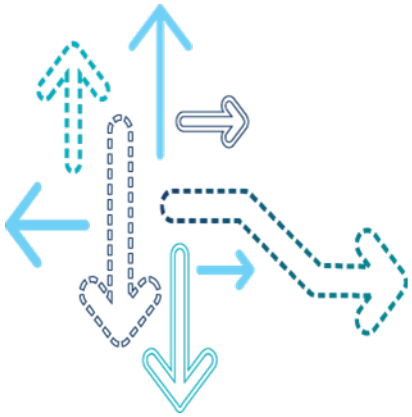
Introduction



Scope

- Applicable for product lines from Dime 2.0 onwards

SGLTE System Architecture

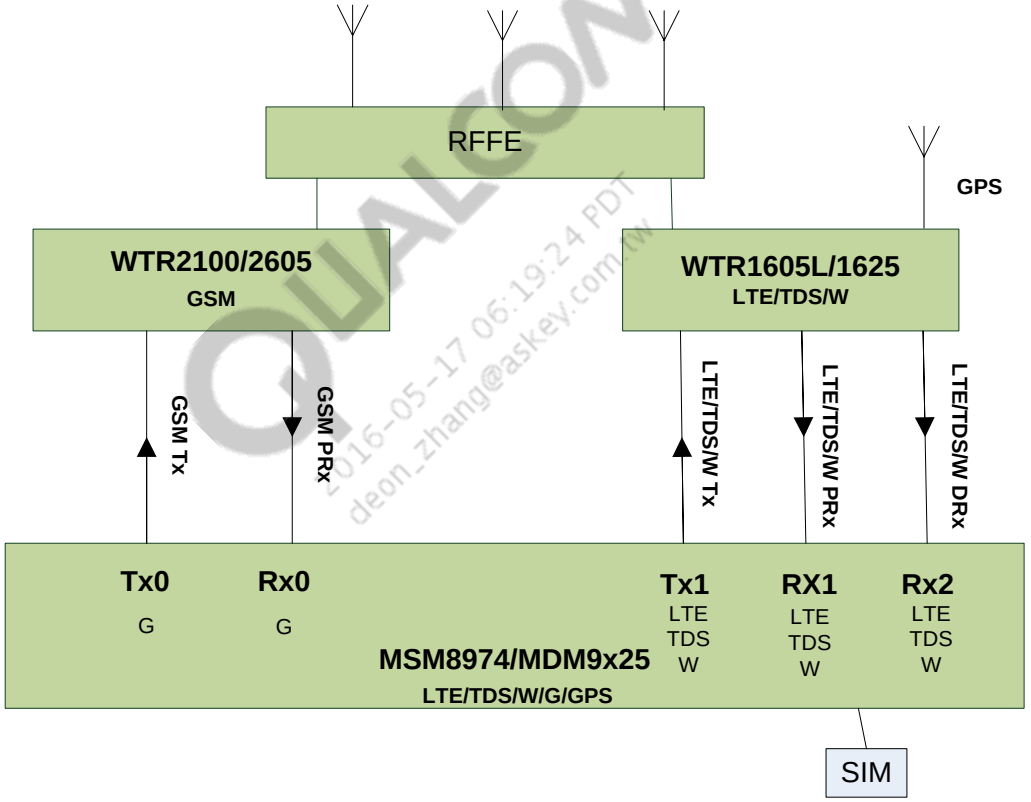


Concept Overview

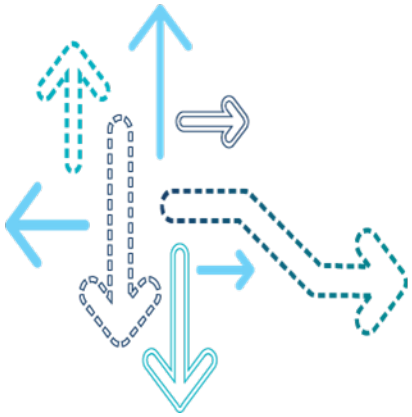
- An LTE-capable, voice-centric UE requires support of a voice transport over the LTE network for normal voice operation. The network is expected to support either CSFB or VoLTE so that the UE may be operational on the LTE RAT for voice in addition to data. It is possible that certain networks do not support voice transport over LTE. At the same time, it may be desirable that the UE remain on LTE RAT to access data services.
- The SGLTE UE essentially decouples LTE operation from voice service availability on the serving LTE network. This UE is capable of operating on LTE for data services while simultaneously offering voice service on GSM over a separate modem and transceiver.
- The UE allows for simultaneously accessing two networks using two modems (L+G) and the associated transmitter and receiver.

Example High-Level System Diagram for SGLTE Platform

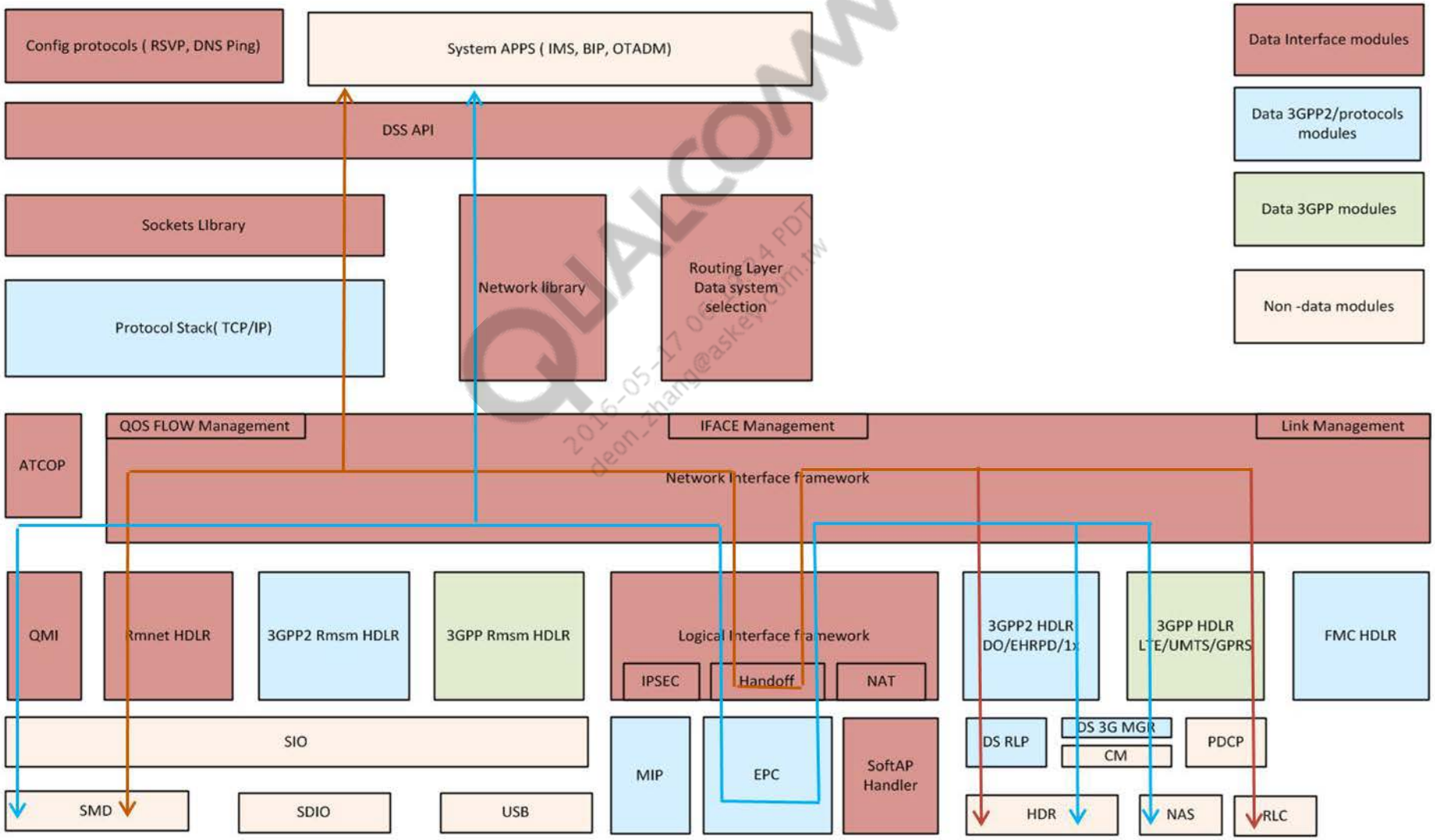
- This example uses the MSM8974/MDM9x25 chipsets.



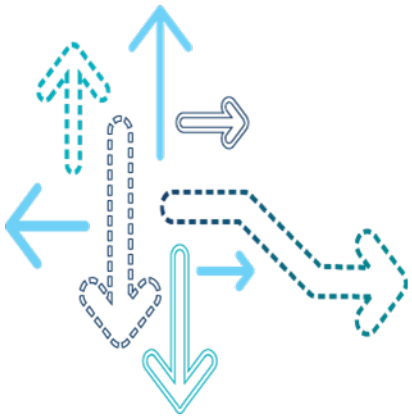
Data Services Architecture and High-Level Design



Modem Data Architecture



SGLTE Data Services Requirement



Data Services Requirement

- Simultaneous voice and data
  - Simultaneous TD-LTE data + GSM voice
  - Simultaneous TD-SCDMA data + GSM voice
  - GSM voice or EDGE data standalone when TD-LTE and TD-SCDMA are unavailable
  - LTE→UMTS/GSM CSFB when roaming
- CS and PS domain mode can be different

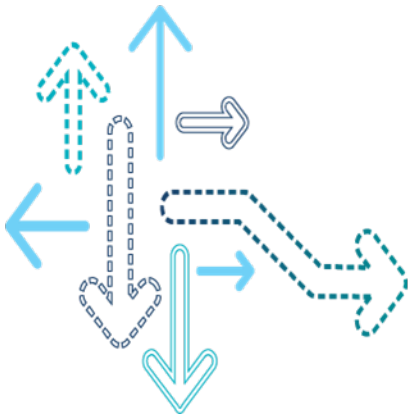
Data Services Requirement (cont.)

- Tethered mode connectivity
  - Support in either EDGE or TD-SCDMA/TD-LTE
  - Remote Network Driver Interface Specification (RNDIS)-based tethering via Android OS
  - QMI/RmNet-based and Dial-Up Network (DUN) Tethered mode connectivity for testing and compliance test purposes, over separate ports to individual modems
  - Tethered mode AT command support for compliance test purposes, over separate ports to individual modems
- Data continuity
  - Supported between TD-LTE and TD-SCDMA
  - Supported between GPRS and TD-LTE/TD-SCDMA, between GERAN and TD-LTE/TD-SCDMA
- Supports a maximum of seven embedded and one tethered APN connectivity simultaneously on LTE, WCDMA, TD-SCDMA, and GERAN
- Supports IPv4, IPv6, and IPv4v6 type data call

Data Services Requirement (cont.)

- AT Command requirements
  - The UE shall support manual PLMN selection using the primary stack when operating in non-SGLTE mode.
  - When operating in SGLTE mode, the UE shall support manual system selection using both the primary and secondary stacks.
  - While operating in SGLTE configuration, if the user selects a PLMN with MCC that is not in the SGLTE PLMN list during manual system selection, the UE shall switch to operating in non-SGLTE mode.
  - While operating in non-SGLTE mode, if the user selects a PLMN with MCC in SGLTE PLMN during manual system selection, the UE shall switch to SGLTE configuration and set the mode on the primary and secondary stacks based on the user mode setting.
  - For Airplane mode, the UE shall configure both the primary and secondary stacks to Airplane mode.

Preferred Data System



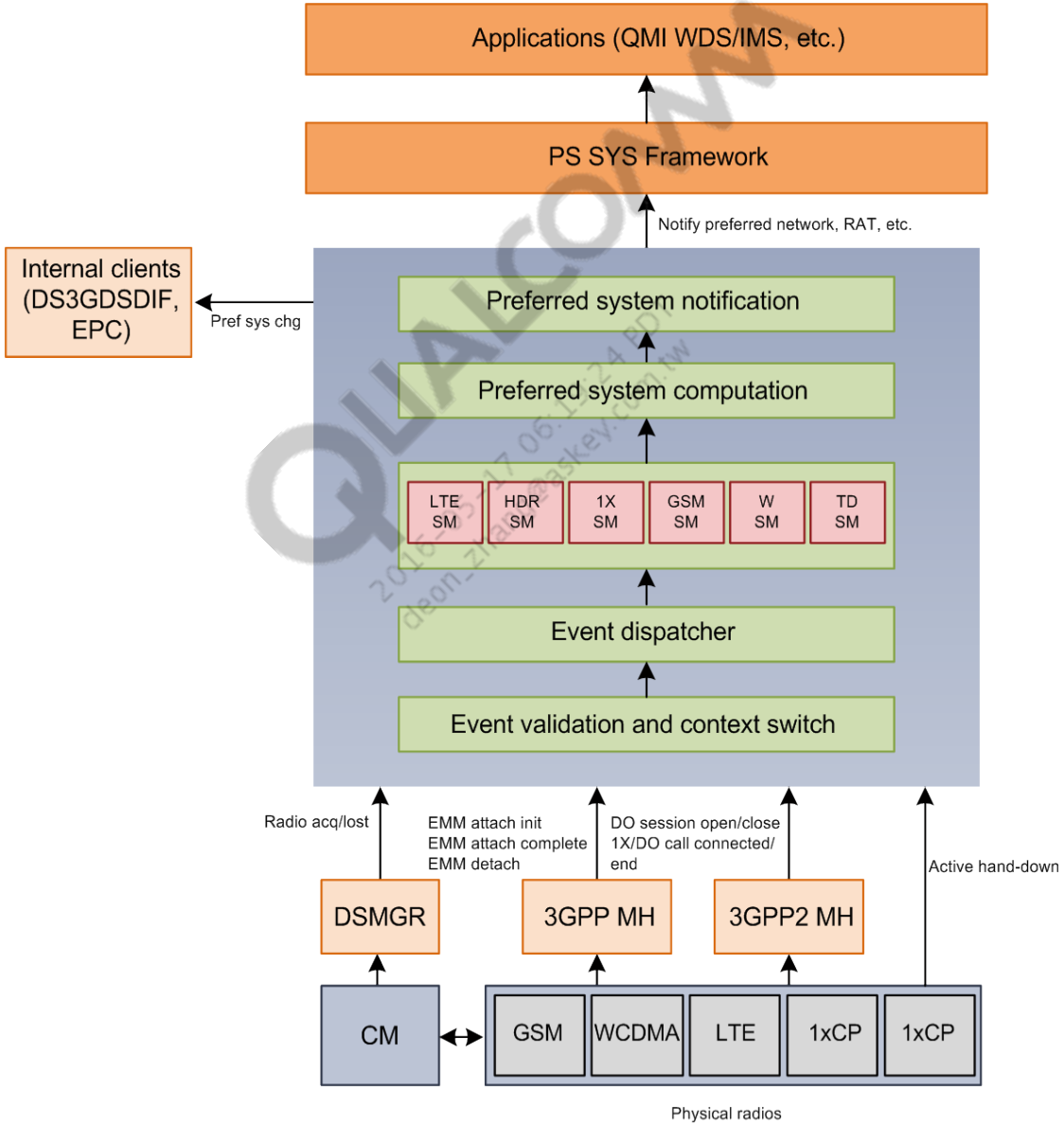
Data Service Determination (DSD)

- DSD module determines the preferred data system
  - If data services are available over multiple systems, e.g., LTE/TD-SCDMA/GSM/GPRS/EDGE, the preferred system is determined by DSD.
    - Provides an API to clients to query the preferred data system
    - Indication is provided to notify clients of the preferred data system change
- DSD uses CM serving system change events to determine system availability
  - This implements system algorithms to determine the preferred data system based on configured policy and hysteresis considerations.
- DSD design is changed in SGLTE to handle PS domain and CS domain for 3GPP separately
  - Previous DSD assumed that PS and CS domain in 3GPP would always be on the same RAT, but this is no longer the case with SGLTE where LTE can be PS registered and GSM is CS registered.

SGLTE Device Mode of Operations Handled by DSD

Scenario	PLMN mode	Main stack	Hybrid stack
1	SGLTE	TD-LTE (PS)	GSM (CS)
2	SGLTE	TD-SCDMA (PS)	GSM (CS)
3	SGLTE	GSM/EDGE (CS + PS)	—
4	Non-SGLTE	L, W, T, G (PS + CS)	—

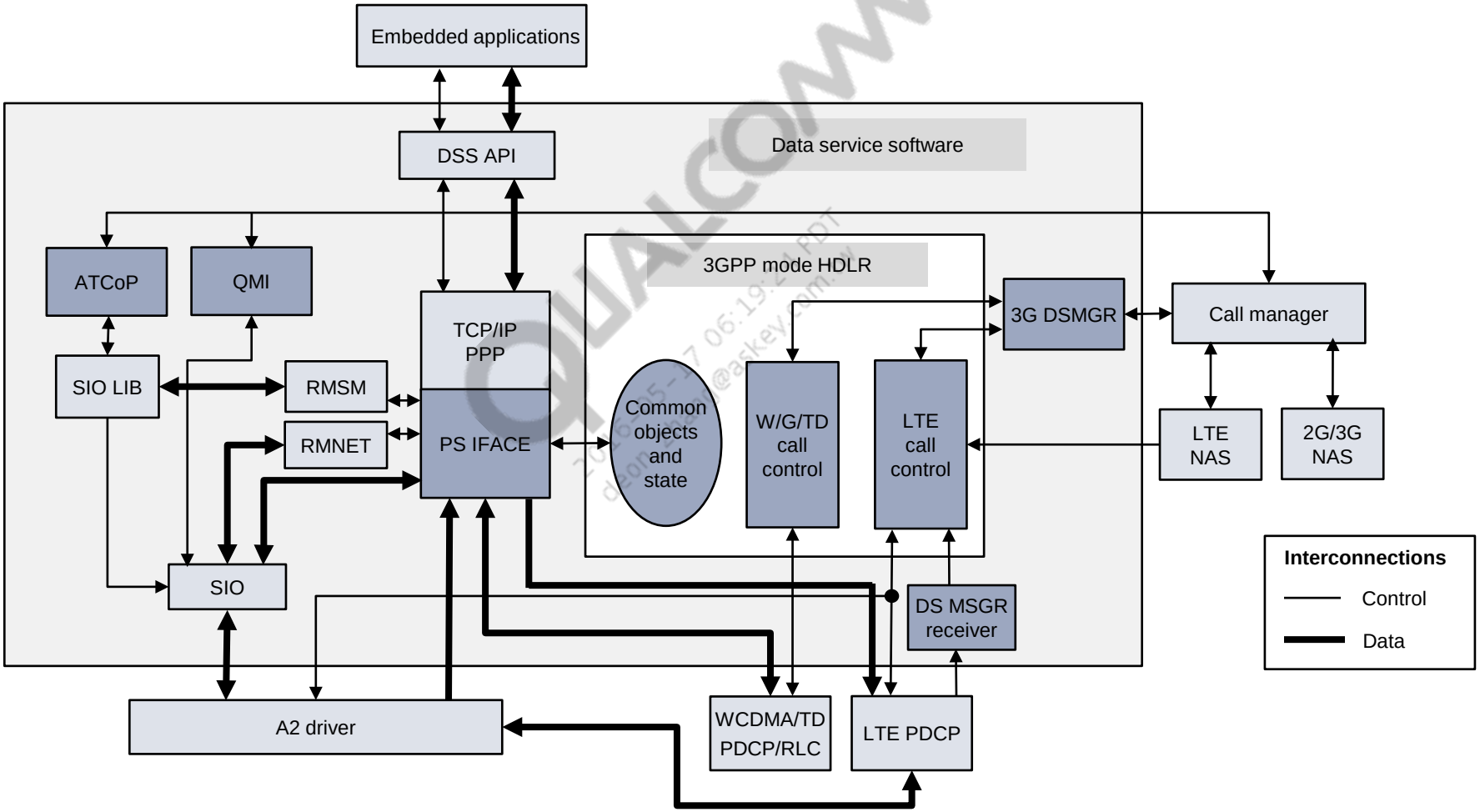
DSD Design Architecture



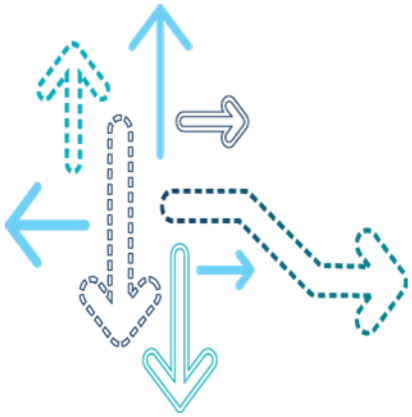
Data Path

- Unlike the previous QMC SGLTE solution that was a fused solution having a dual chip, MSM8974 is a single-chip solution and there are *no* changes in the data path.
- DSD indicates the preferred RAT over which the data call needs to be placed.
- Once AP/DS provides the preferred system in the call origination request, lower layers take care of establishing the data call using the appropriate WTR chip.

Data Services Modem Processor



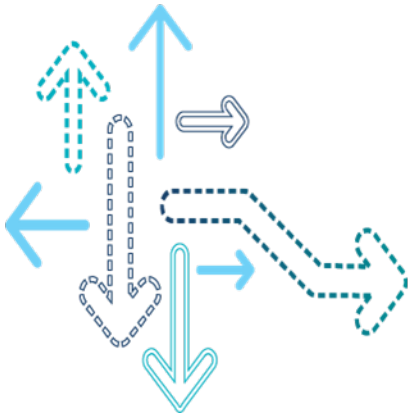
Embedded Data Call Scenario



System Selection for Embedded Call

- Interface selection on apps processor – Embedded calls
  - QCRIL layer is notified of the current preferred data system from the DSD module on the modem via QMI WDS
  - Android telephony receives notification of the preferred data system from RIL
  - Android telephony provides the APN to Data RIL to bring up the call on the current preferred system
  - Android data RIL sends a QMI WDS route lookup message to the modem to perform a global route lookup across all technologies
  - Route lookup will go through all supported IFACEs (data interface) and return the IFACE with the highest priority level to the Android Data RIL

Tethered Data Call Scenario



RNDIS Tethered Call

- The RNDIS tethered call shares the interface used by the Android-embedded data call.
  - RNDIS enables both embedded and tethered calls to happen simultaneously via the same interface toward the modem.
  - Android implements a standard RNDIS interface, which uses NAT for assigning IPv4 addresses to the tethered device.
  - Neighbor discovery proxy implementation is used on Android to enable RNDIS tethering for IPv6.
  - Since RNDIS shares the embedded data call, the system selection for the RNDIS tethered call is exactly the same as that for the embedded data call.
  - RNDIS tethering eliminates the need for data call arbitration between embedded and tethered data calls.

System Selection for RmNet and DUN Tethered Calls

- Since RmNet and DUN calls are for compliance purposes only, system selection for such calls assumes that when testing a certain modem, that modem is PS registered over the desired RAT to be tested.
  - The tester will need to ensure that the modem being tested is set up with the right environment.
- Interface selection on the modem – Upon receiving a tethered call request from the TE, the mode handler on the modem will do route lookup to determine which IFACE should be selected with highest priority.
  - In the route lookup, the mode handler will go through each IFACE available for the RATs supported on that modem and execute the Access Control List (ACL) function on each IFACE.
  - The ACL function will tell whether a particular IFACE is supported and return the priority for that IFACE if supported.
  - The mode handler will choose the highest priority IFACE to set up the tethered call.

References

Ref.	Document	
Qualcomm Technologies		
Q1	*Application Note: Software Glossary for Customers*	CL93-V3077-1

Questions?

https://support.cdmatech.com