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QUALCOMM CDMA Technologies

REDEFINING MOBILITY

QMI IDL/QCCI/QCSI Overview

80-N4863-1 C

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Revision History

Version	Date	Description
A	Mar 2011	Initial release
B	Jun 2011	Updated to Qualcomm standards
C	Oct 2011	Added slides 28-33

Contents

- Introduction
- IDL QMI
- QCCI
- QCSI
- Backward Compatible with Legacy Services
- QMI Core Server Framework APIs
- References
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Introduction

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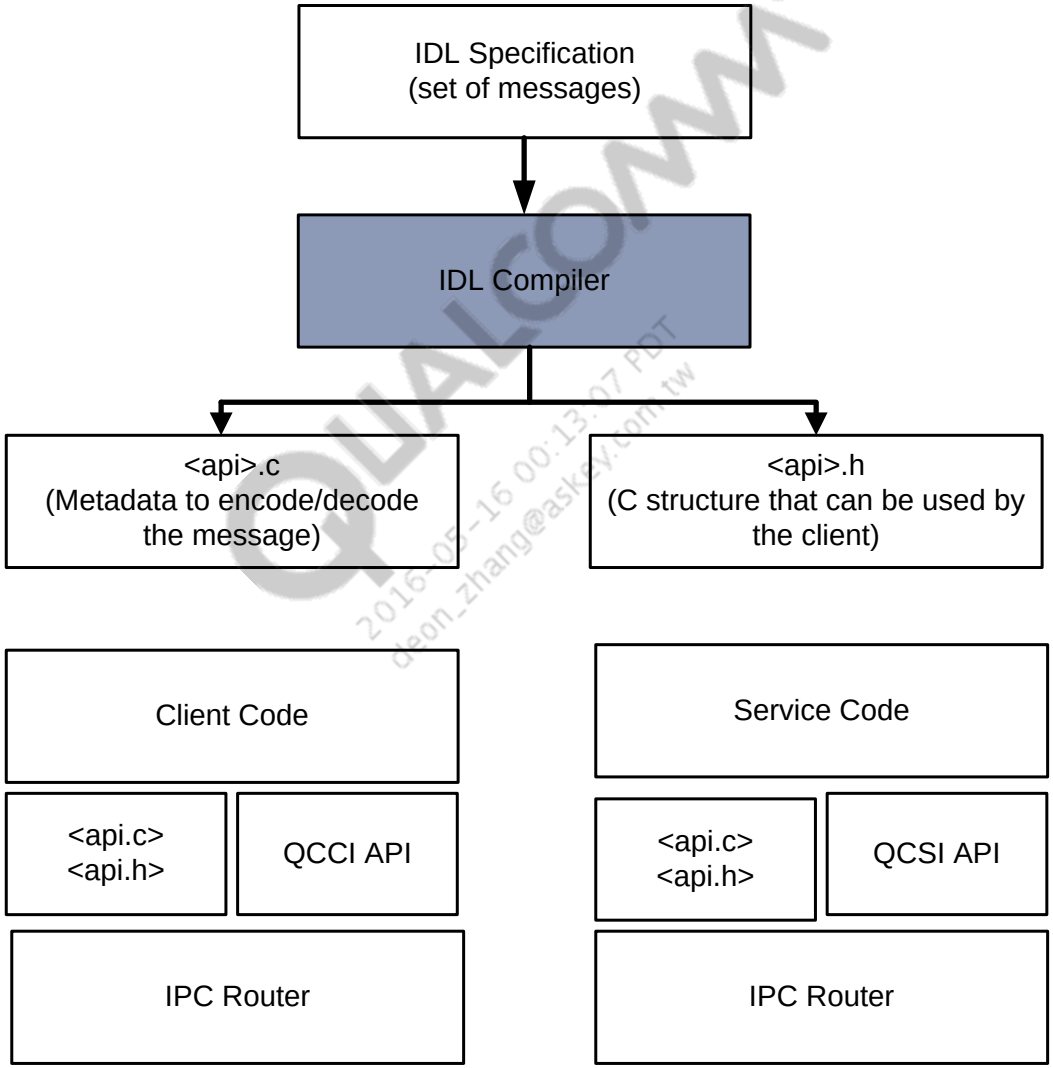
Introduction of IDL/QCCI/QCSI



Note: This picture is for new services developed using the new tools.

Introduction of IDL/QCCI/QCSI (cont.)

- IDL language and IDL Compiler
  - The syntax of QCT IDL is similar to the C programming language; the IDL Compiler generates the source file and header file
- The QMI Common Client Interface (QCCI)
  - C library that includes interfaces for all QMI services autogenerated from IDL
  - Registers clients with a service
  - Performs encoding/decoding of QMI messages
  - Exchanges messages
    - Synchronous and asynchronous command/response
    - Asynchronous indications
  - Registers clients with a service
  - IPC Router used for new services

QMI Common Service Interface (QCSI)

- QCSI wraps the QMI framework and provides service interface analogous to QCCI
- Performs encoding/decoding of QMI messages
- Includes autogenerated files for all QMI service interfaces
- C language library with functions to:
  - Register a service
  - Inform the service of client registration/deregistration
  - Deliver a request from a client and send a response
  - Send asynchronous indications
- Pairs up the service response with the request transaction

IDL QMI

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IDL

- QMI interfaces are written in an Interface Definition Language (IDL)
- Autogenerated files
  - IDL Compiler generates the <api>.c and <api>.h
    - Header file containing data types for all QMI messages
    - Source file containing meta-data needed by the encode/decode library
  - Interface documentation
- Encode/decode library
  - C routines translate between the C data structures and the wire message format
  - Library is independent and decoupled from autogenerated files
  - Meta information to encode/decode the messages would be generated in <api>.c as Service_Object
  - During Service/Client initiation, the meta information would be registered to QCSI/QCCI for message encode/decode
  - Clients/Service can send/receive messages by using QCCI/QCSI API

IDL Example

Message definition

```
revision 1
```
← Revision Statement

```
//! @MSG      QMI_PING_REQ
//! @TYPE     Request
//! @SENDER   Control point
//-------------------------------------------
------------------------------
message {
            //! Ping
            mandatory char ping[4];
} ping_req_msg;

//! @MSG      QMI_PING_DATA_RESP
//! @TYPE     Response
//! @SENDER   Service
//-------------------------------------------
------------------------------

message {
  //! Response Data
  mandatory uint8 data<PING_MAX_DATA_SIZE>;
  //! Result Code
  mandatory qmi_response_type resp;
//!< Standard response type.
} ping_data_resp_msg;
```

Service definition

```
service ping {
            //! @ID QMI_PING
            ping_req_msg
QMI_PING_REQ,
            ping_resp_msg
QMI_PING_RESP,
            ping_ind_msg
QMI_PING_IND;
            //! @ID QMI_PING_DATA
            ping_data_req_msg
QMI_PING_DATA_REQ,
            ping_data_resp_msg
QMI_PING_DATA_RESP;
            //! @QMI_PING_DATA_IND_REG
            ping_data_ind_reg_req_msg
QMI_PING_DATA_IND_REG_REQ,
            ping_data_ind_reg_resp_msg
QMI_PING_DATA_IND_REG_RESP;
            //! @QMI_PING_DATA_INDICATION
            ping_data_ind_msg
QMI_PING_DATA_IND;
} = 0x55;
```
← Service ID

.h Example

- Message definition

```
typedef struct {

  /* Mandatory */
  /*  Ping */
  char ping[4];
}ping_req_msg_v01;  /* Message */

typedef struct {

  /* Mandatory */
  /*  Pong */
  char pong[4];

  /* Mandatory */
  /*  Result Code */
  qmi_response_type_v01 resp;  /*  Standard
response type.  */
}ping_resp_msg_v01;  /* Message */
```

- Service definition

```
/*Service Message Definition*/
#define QMI_PING_REQ_V01 0x0001
#define QMI_PING_RESP_V01 0x0001
#define QMI_PING_IND_V01 0x0001
#define QMI_PING_DATA_REQ_V01 0x0002
#define QMI_PING_DATA_RESP_V01 0x0002
#define QMI_PING_DATA_IND_REG_REQ_V01 0x0003
#define QMI_PING_DATA_IND_REG_RESP_V01 0x0003
#define QMI_PING_DATA_IND_V01 0x0004

/* Service Object Accessor */
qmi_idl_service_object_type
ping_get_service_object_internal_v01
 ( int32_t idl_maj_version, int32_t
idl_min_version, int32_t library_version );

#define ping_get_service_object_v01( ) \
         ping_get_service_object_internal_v01(
\
            PING_V01_IDL_MAJOR_VERS,
PING_V01_IDL_MINOR_VERS, \
            PING_V01_IDL_TOOL_VERS )
```

← Message ID

← Service Object

.c Example

- Message meta information

```
/*Type Definitions*/
/*Message Definitions*/
static const uint8_t ping_req_msg_data_v01[] =
{
  QMI_IDL_TLV_FLAGS_LAST_TLV | 0x01,
  QMI_IDL_FLAGS_IS_ARRAY |
QMI_IDL_GENERIC_1_BYTE,
  QMI_IDL_OFFSET8(ping_req_msg_v01, ping),
  4
};

static const uint8_t ping_resp_msg_data_v01[] =
{
  0x01,
  QMI_IDL_FLAGS_IS_ARRAY |
QMI_IDL_GENERIC_1_BYTE,
  QMI_IDL_OFFSET8(ping_resp_msg_v01, pong),
  4,

  QMI_IDL_TLV_FLAGS_LAST_TLV | 0x02,
  QMI_IDL_AGGREGATE,
  QMI_IDL_OFFSET8(ping_resp_msg_v01, resp),
  0, 1
};
```

- Service object

```
/* Service Object Accessor */
qmi_idl_service_object_type
ping_get_service_object_internal_v01
 ( int32_t idl_maj_version, int32_t
idl_min_version, int32_t library_version ){
  if ( PING_V01_IDL_MAJOR_VERS !=
idl_maj_version || PING_V01_IDL_MINOR_VERS !=
idl_min_version
       || PING_V01_IDL_TOOL_VERS !=
library_version)
  {
    return NULL;
  }
  return
(qmi_idl_service_object_type)&ping_qmi_idl_serv
ice_object_v01;
}
```

← Service Object

QCCI

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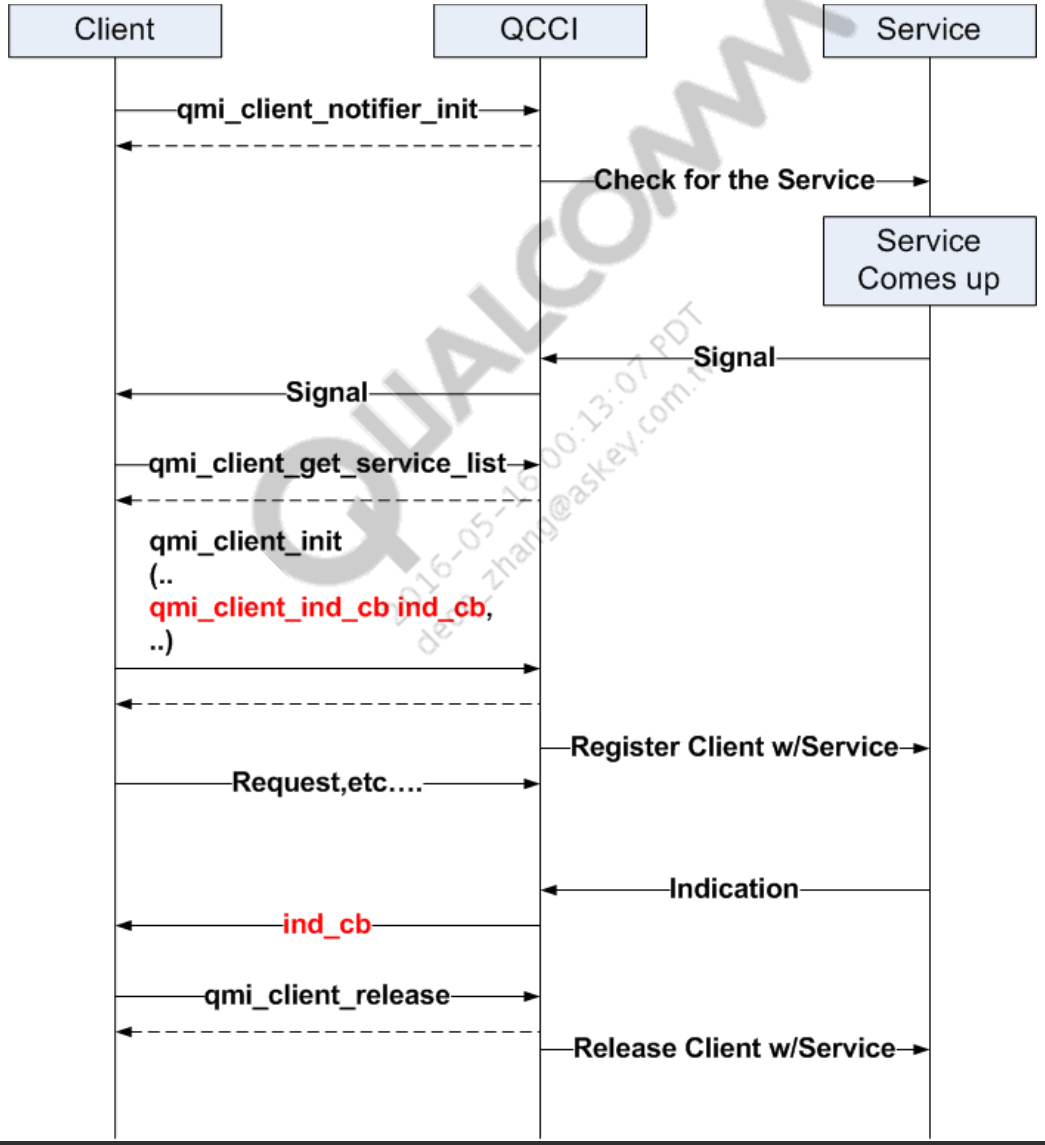
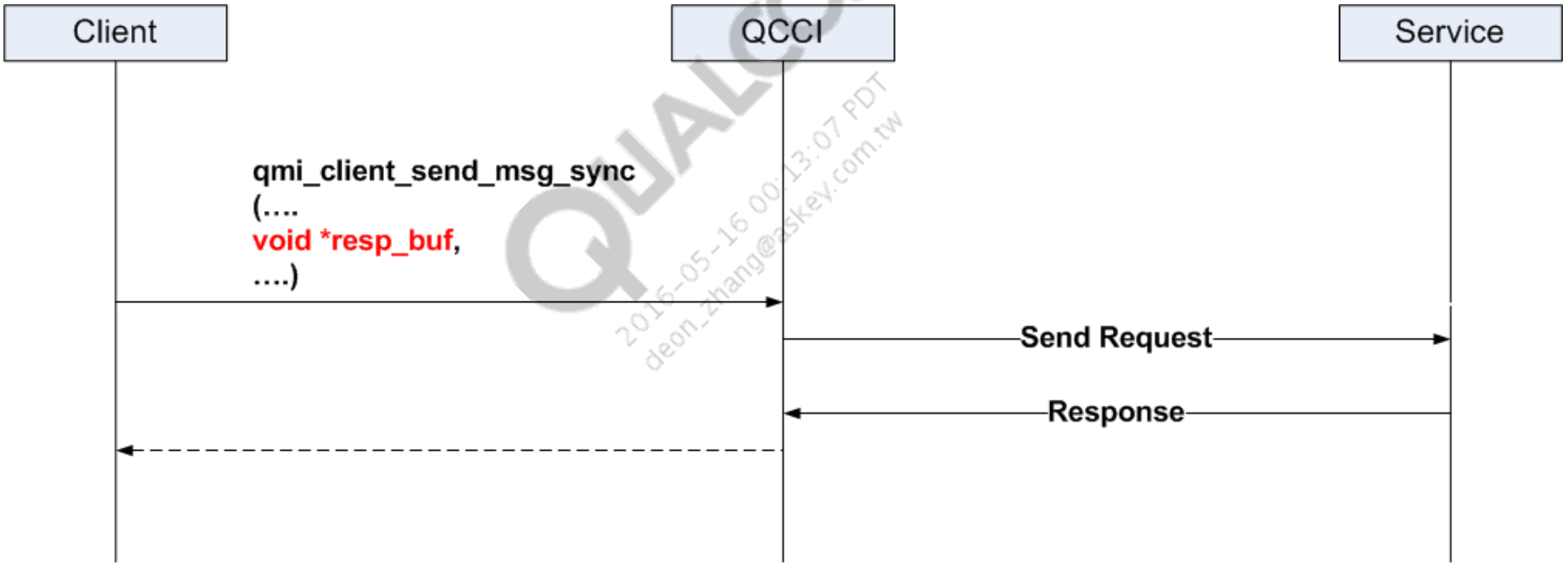
QCCI

- QCCI is a set of APIs that allow the client to send and receive QMI messages to and from the server.
- QCCI APIs
  - Callback function prototypes
    - qmi_client_recv_raw_msg_async_cb
    - qmi_client_recv_msg_async_cb
    - qmi_client_ind_cb
  - Connection APIs
    - qmi_client_notifier_init
    - qmi_client_init
    - qmi_client_get_service_list
  - Message sending APIs
    - qmi_client_send_raw_msg_async/qmi_client_send_raw_msg_sync
    - qmi_client_send_msg_async/ qmi_client_send_msg_sync
    - qmi_client_delete_async_txn
  - Release connection APIs
    - qmi_client_release
  - Encode and decode APIs
    - qmi_client_message_encode
    - qmi_client_message_decode

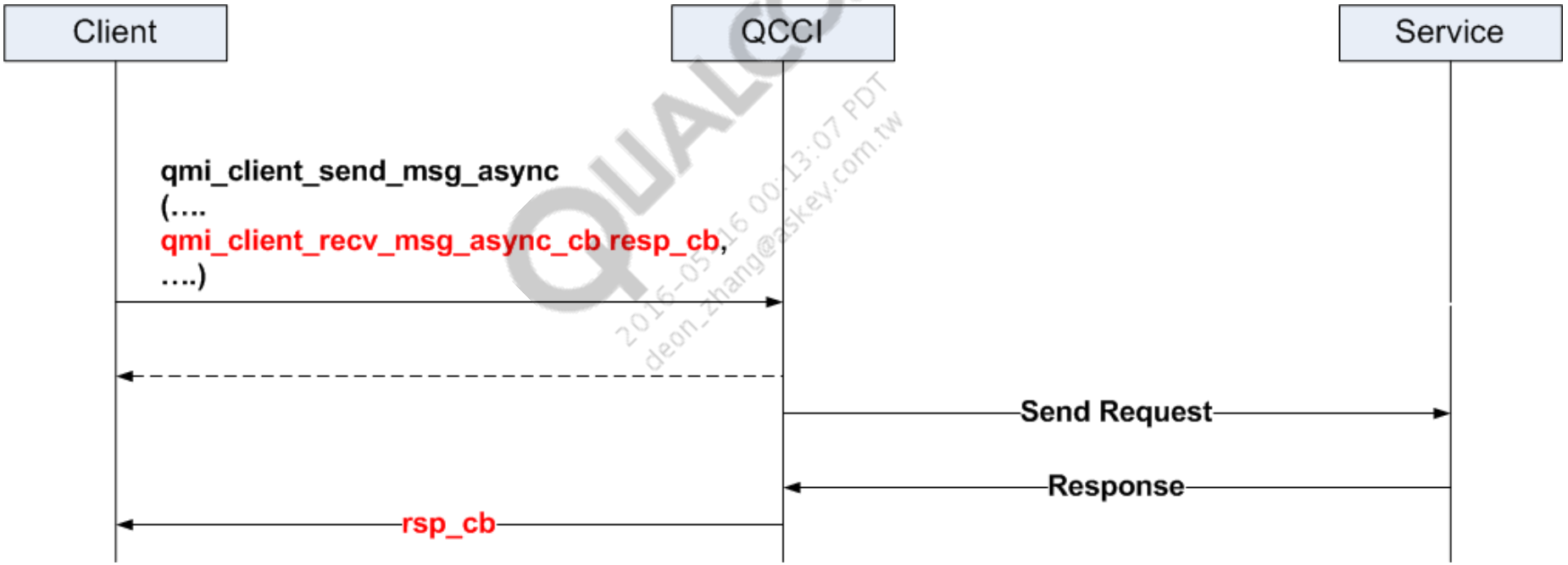
QCCI – Initializing a Client



QCCI – Sending a Message Synchronous



QCCI – Sending a Message Asynchronous



QCSI

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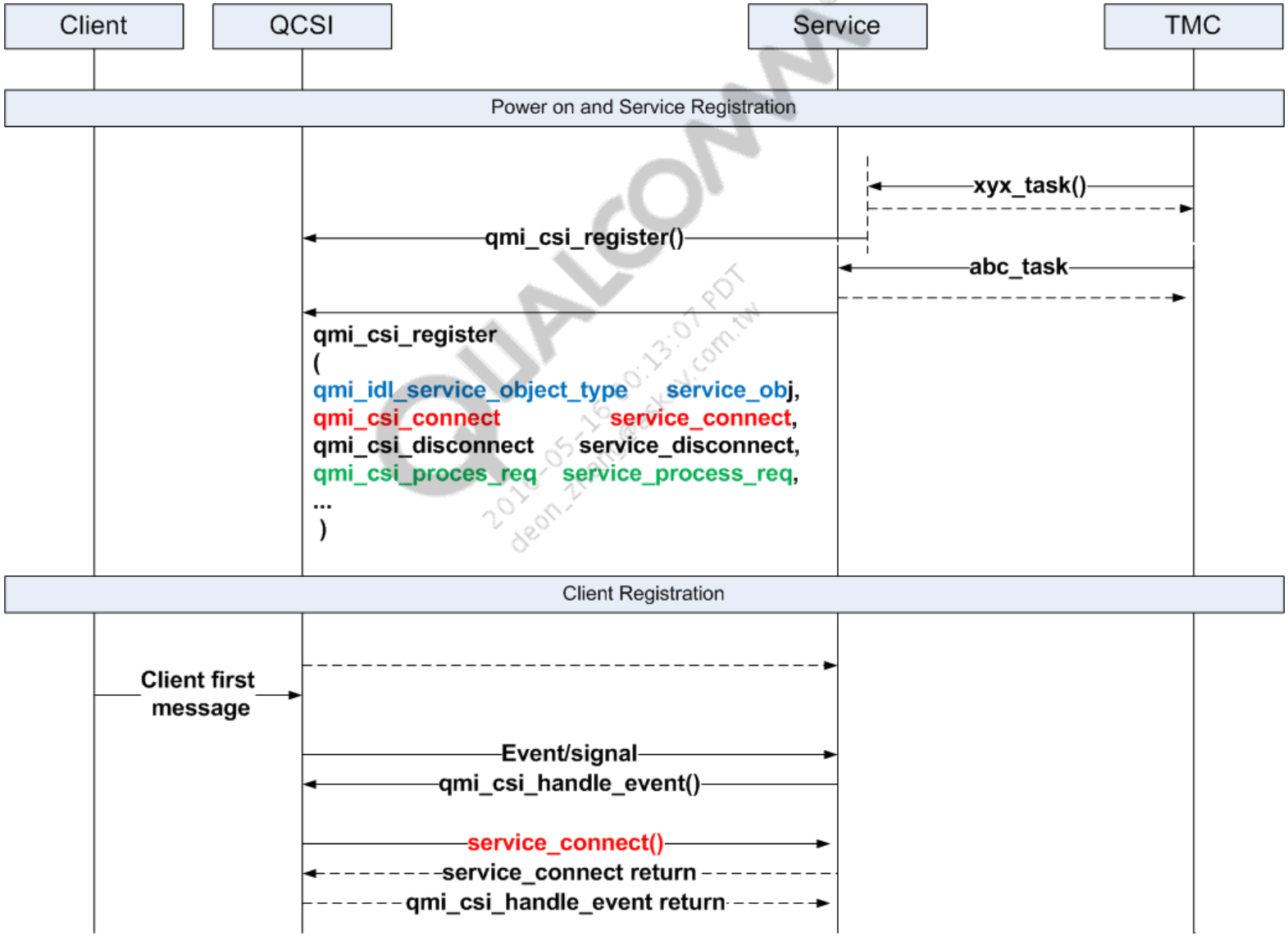
QCSI – QMI Common Service Interface

- Used with the autogenerated files from the QMI IDL compiler to write a service that can receive and respond to messages from a client, as well as send indication
- Simplifies the process of writing a QMI service by a set of APIs and callbacks for:
  - Handling requests
  - Sending responses and indications
  - Handling client connect and disconnect event
  - Encoding and decoding of messages

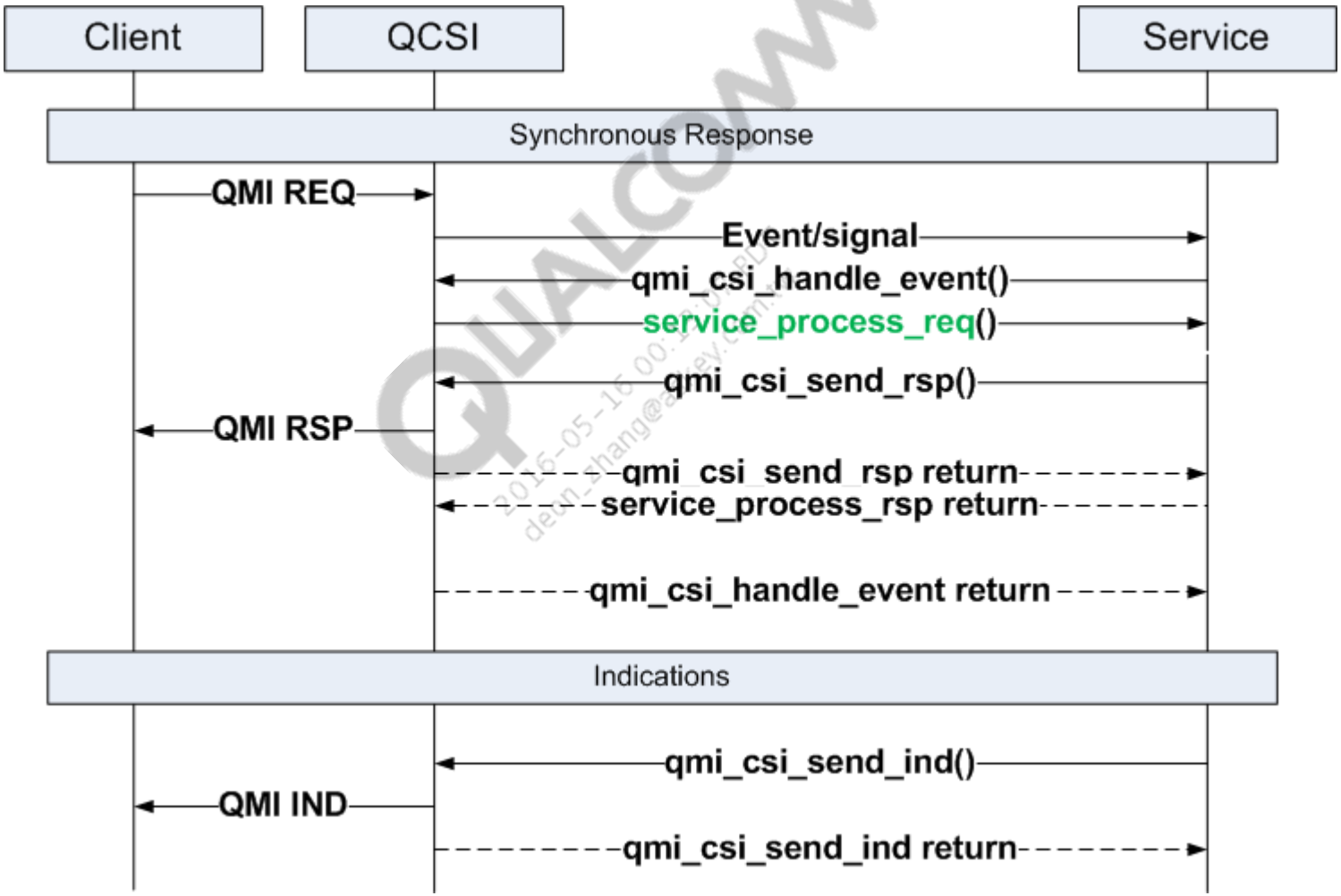
QCSI APIs

- Callback function prototypes
  - qmi_csi_connect
  - qmi_csi_disconnect
  - qmi_csi_process_req
- Registration APIs
  - qmi_csi_register
  - qmi_csi_unregister
- Message sending APIs
  - qmi_csi_send_resp
  - qmi_csi_send_ind
  - qmi_csi_send_broadcast_ind
- Event handling APIs
  - qmi_csi_handle_event

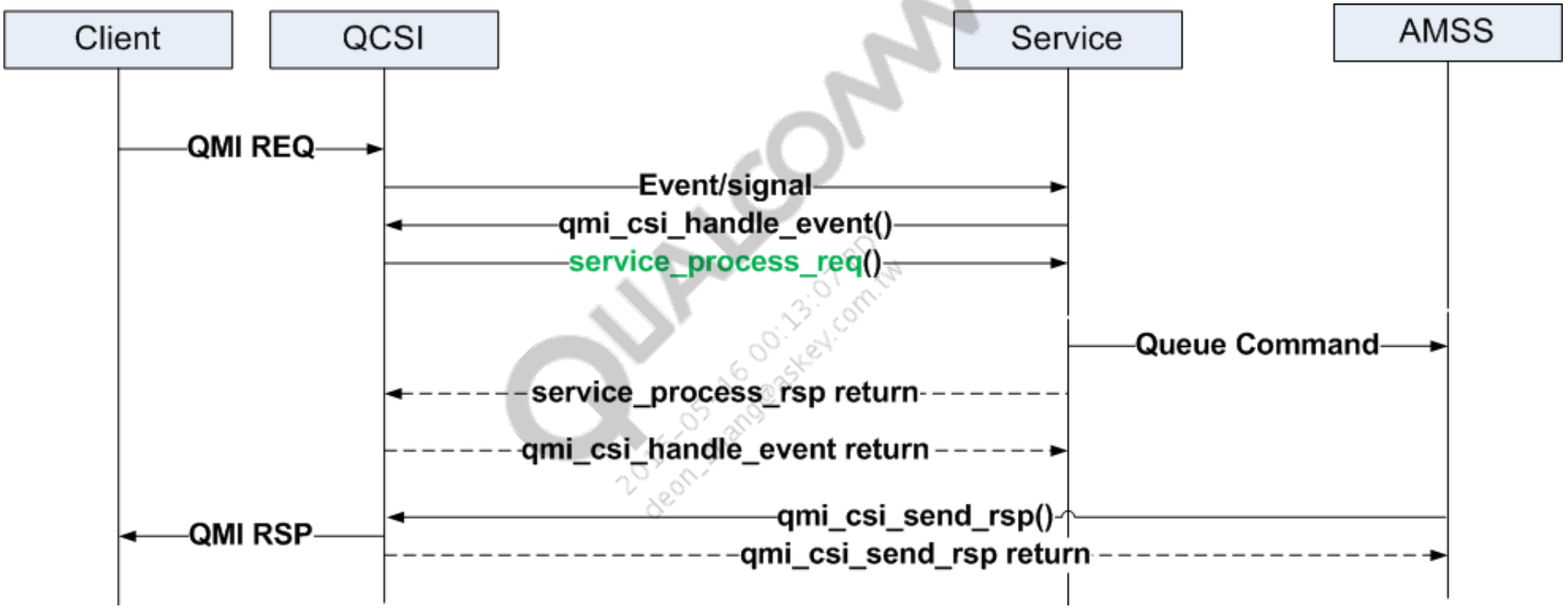
QCSI – Service Registration and Client Registration



QCCI – Synchronous Response and Indication



QCCI – Asynchronous Response



Backward Compatible with Legacy Services

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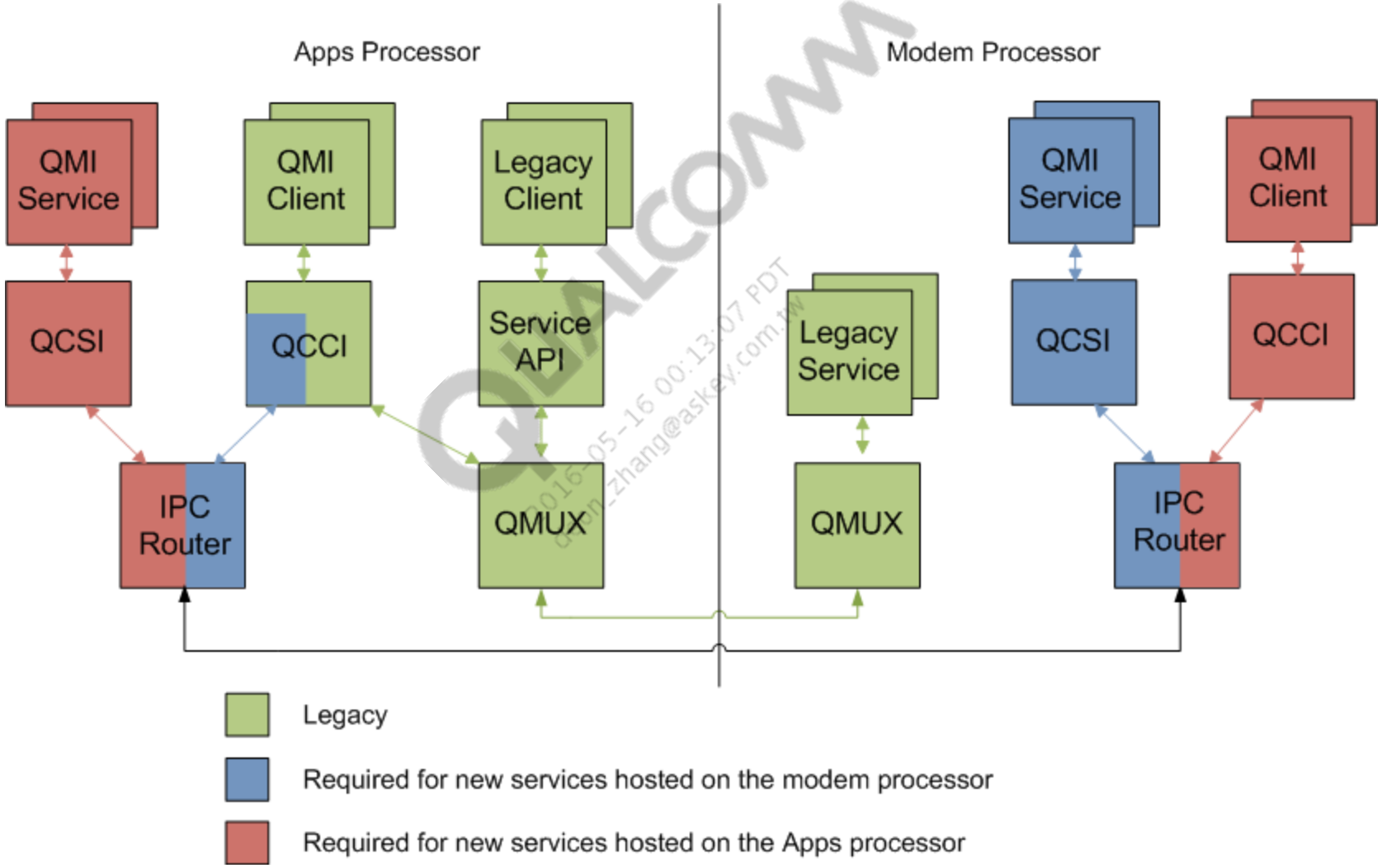
Backward Compatible with Legacy Services



Backward Compatible with Legacy Services (cont.)

- QMI Link Layer
  - QCCI/QCSI decides to use Qmux or IPC Router, based on Service ID
  - IPC Router used for new services
  - QCCI/QCSI interface is the same even though Qmux and IPC Router interfaces are different
- New QCSI/QCCI exists in both the modem side and app side.
  - Services located in the modem side use the QCSI in the modem side, e.g., Universal Location Provider (ULP) Service
  - Services located in the app side use the QCSI in the apps side, e.g., EFS Service

QMI Core Server Framework APIs

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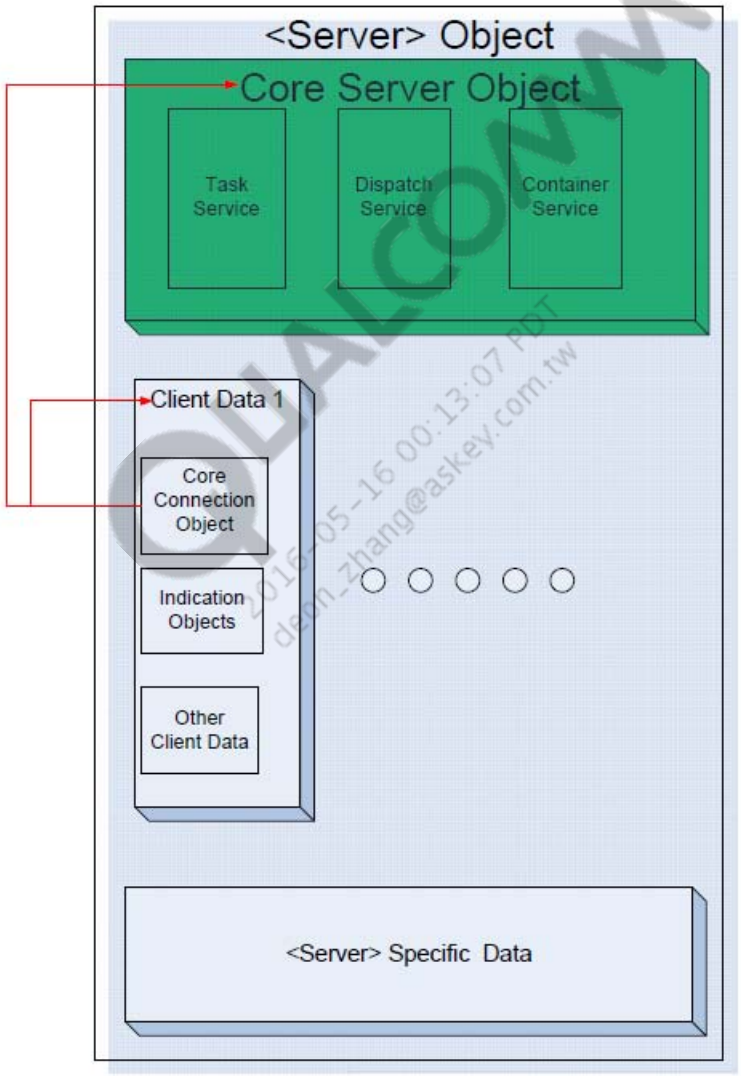
QMI Core Server Framework APIs

- These APIs are built on top of the QCSI framework
- The primary purpose is to facilitate the clients to implement a server with less effort
- The framework allows the users to write an object-based server that extends the core server object. The core server object provides generic functionality that every service needs

QMI Core Server Framework APIs

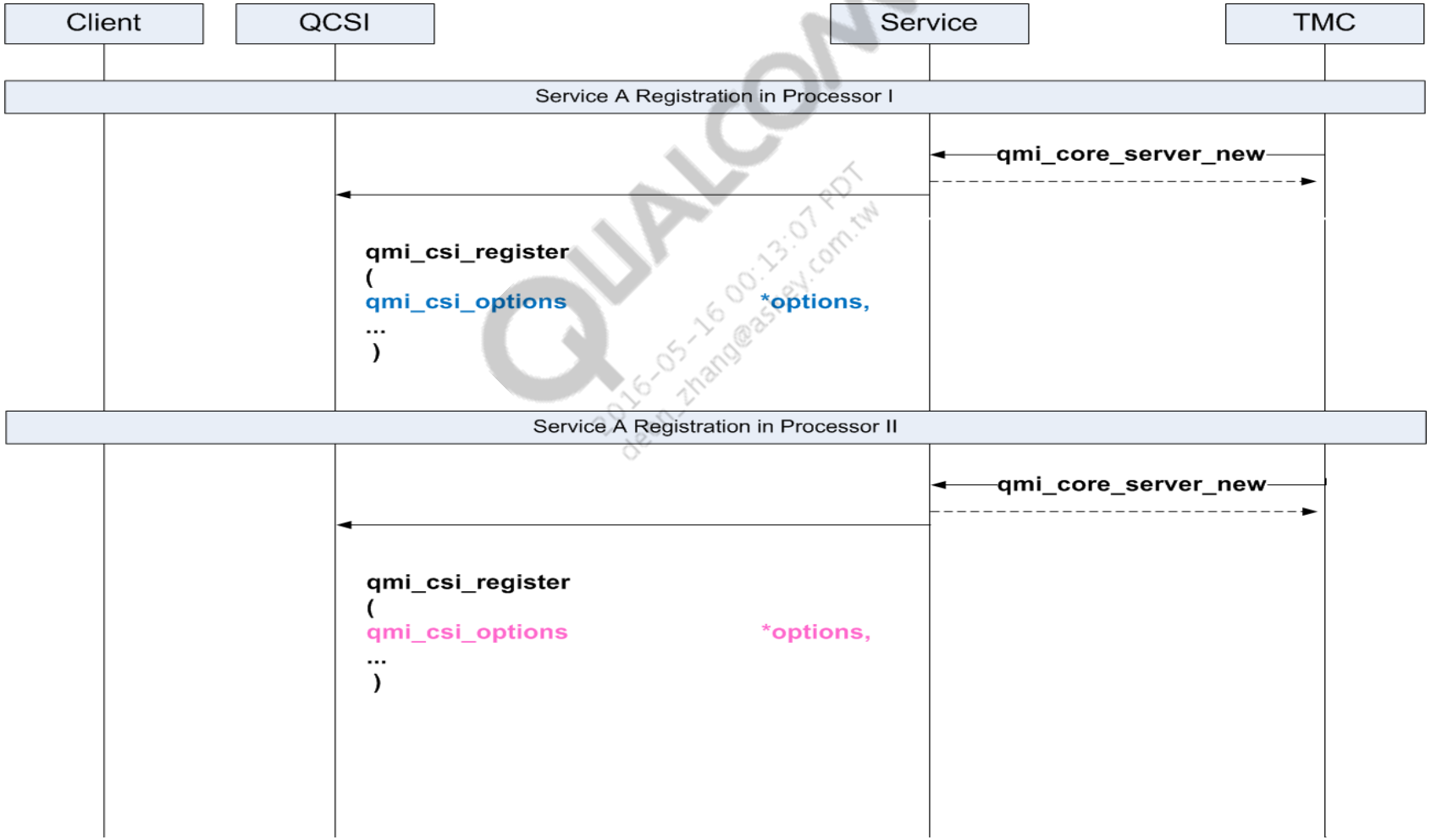
- Callback Function Prototypes
  - qmi_csi_connect
  - qmi_csi_disconnect
  - qmi_csi_process_req
- Constructor/Destructor APIs
  - qmi_core_server_new
  - qmi_core_server_delete
- Registration APIs
  - qmi_core_server_register
  - qmi_core_server_unregister
  - qmi_core_server_register_client
  - qmi_core_server_unregister_client
- Message Dispatch APIs
  - qmi_core_server_dispatch_msg
  - qmi_core_server_send_ind
  - qmi_core_server_send_resp
- Event Handling APIs
  - qmi_core_server_handle_event
- Utility APIs
  - qmi_core_server_start_server
  - qmi_core_server_check_valid_object
  - qmi_core_server_get_client_data
  - qmi_core_server_get_os_params

QMI Core Server Framework APIs – Service Object

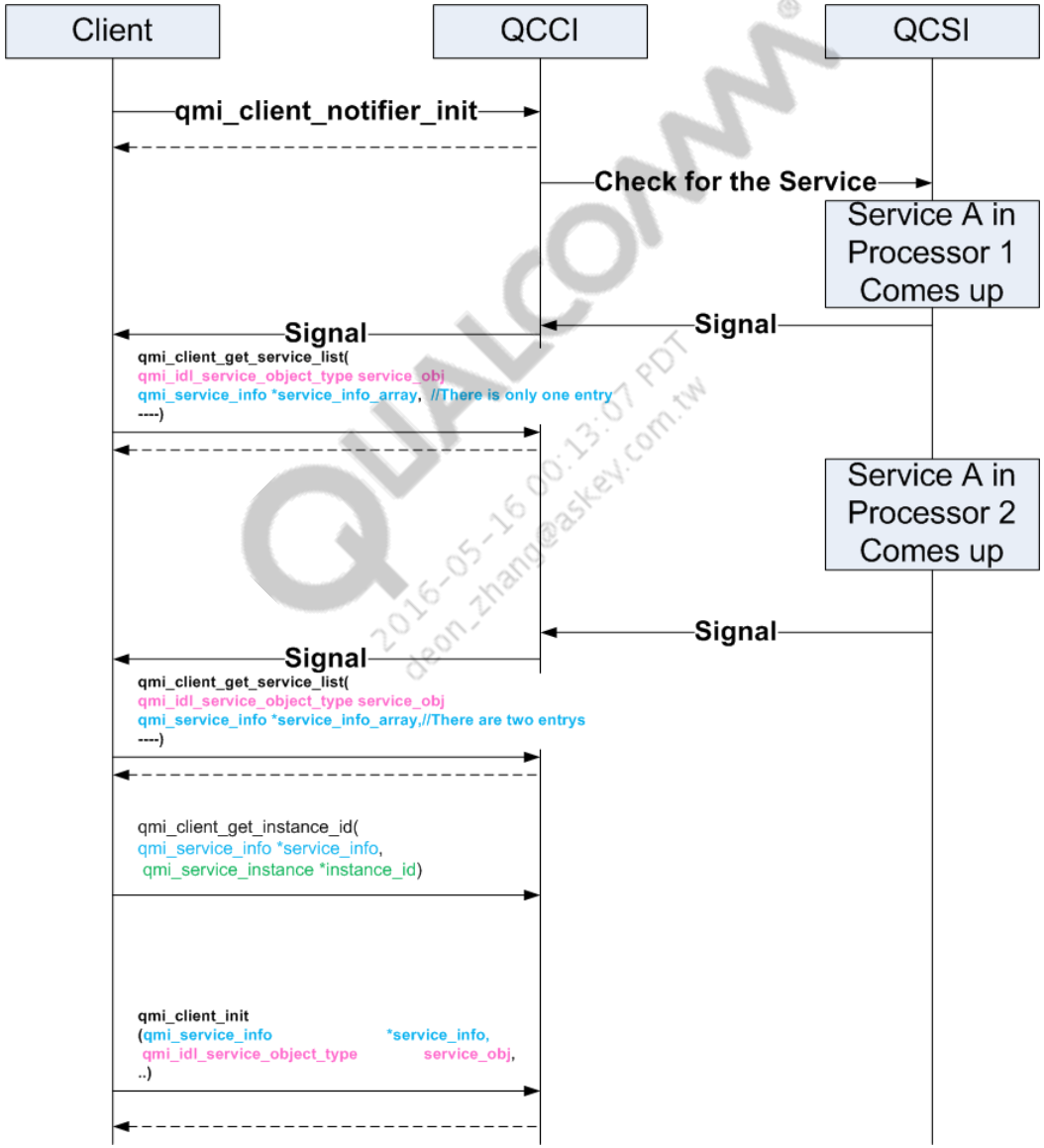


Example – Service A Running in Two Processors

- There is instance_id in qmi_csi_options
- <service id> : <version> : <instance> should be unique



Example – Client Initialization with Service A Running in Processors 1 and 2



References

Ref.	Document	
Qualcomm		
Q1	*Application Note: Software Glossary for Customers*	CL93-V3077-1
Q2	*QMI Client API Reference Guide*	80-N1123-1
Q3	*QMI Common Service APIs Reference Guide*	80-N1123-2
Q4	*QCT API Guidelines and Tools*	80-N0846-1

Questions?

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