Quectel AG35-QuecOpen Solution

Presentation

Nov., 2017

Product Overview

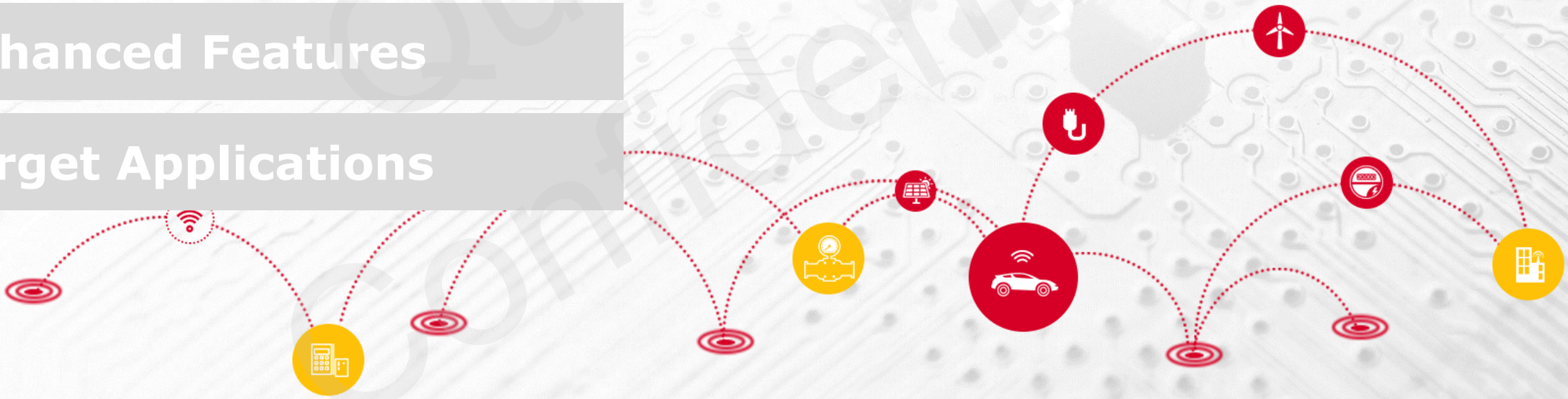
QuecOpen Introduction

Open Source

Development Guide

Enhanced Features

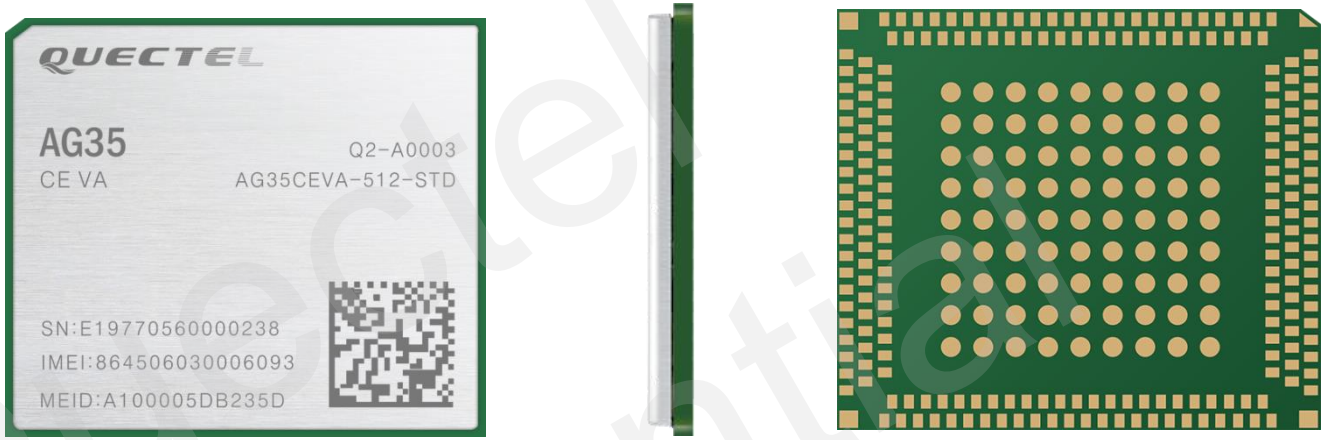
Target Applications



AG35 Highlights

Automotive LTE Module

33.0mm × 37.5mm × 3.0mm



- Qualcomm MDM9628 Chipset solution dedicated for automotive applications
- Ideal for automotive applications with IATF 16949 requirement
- Wide operation temperature range (-40℃ to +85℃)
- Automotive quality processes (PPAP, 8D, DFMEA, PFMEA…)
- Extremely high reliability testing standard
- Excellent EMC/ESD protection ensures great robustness even in harsh environments
- Compact SMT form factor ideal for integration in slim and size-constrained automotive solutions
- Multi-constellation GNSS receiver available for applications requiring fast and accurate fixes in any environment

AG35 Specifications

■ Multi-Mode LTE Cat 4 Module

33.0mm × 37.5mm × 3.0mm
LTE Cat 4, 150M DL/ 50M UL

Frequency		AG35-CE	AG35-E*
LTE	LTE-FDD	B1/B3/B5/B8	B1/B3/B5/B7/B8/B20
	LTE-TDD	B34/B38/B39/B40/B41	\
UMTS	WCDMA	B1/B8	B1/B5/B8
	TD-SCDMA	B34/B39	\
CDMA		BC0	\
GSM/EDGE		900/1800MHz	900/1800MHz
Embedded GNSS		GPS/GLONASS/BeiDou/GALILEO	GPS/GLONASS/BeiDou/GALILEO
Wi-Fi/BT Interface		Y	Y
Region		China	EMEA
Certification		TBD	TBD

1. "Y" means supported. *2. "*" under development.*

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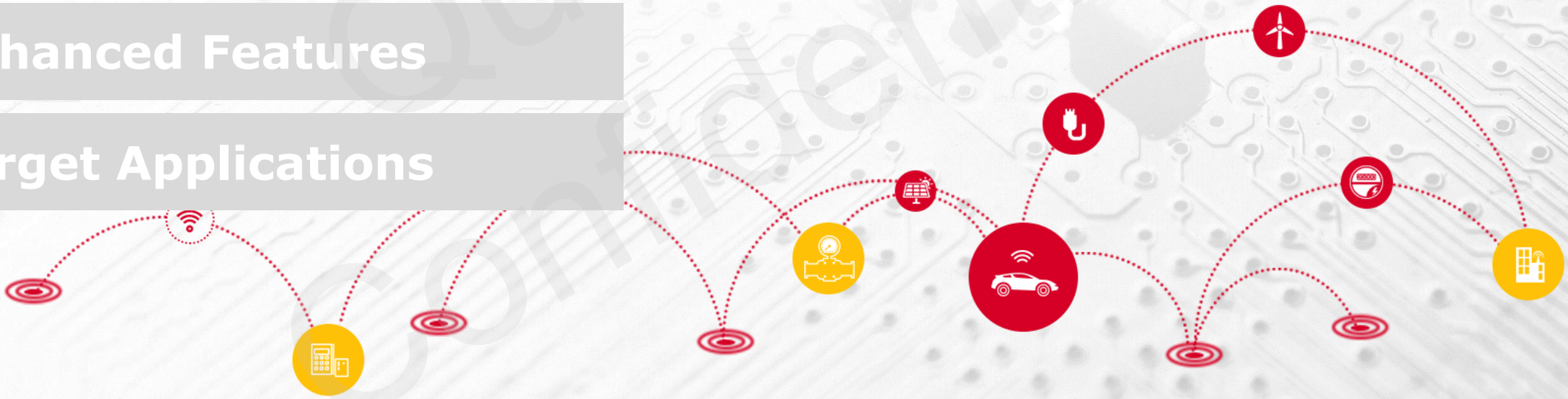


QuecOpen Introduction

QuecOpen™ is an open source embedded development platform based on Linux system, which is intended to simplify the design and development process for IoT applications.

High-powered Platform

With characteristics of high real-time, multithread and micro kernel, etc., QuecOpen transparently manages all LTE related activities to allow developers to natively execute C, C++ and shell script based program on the processor and in the memory of Quectel AG35 module.

Fast Development

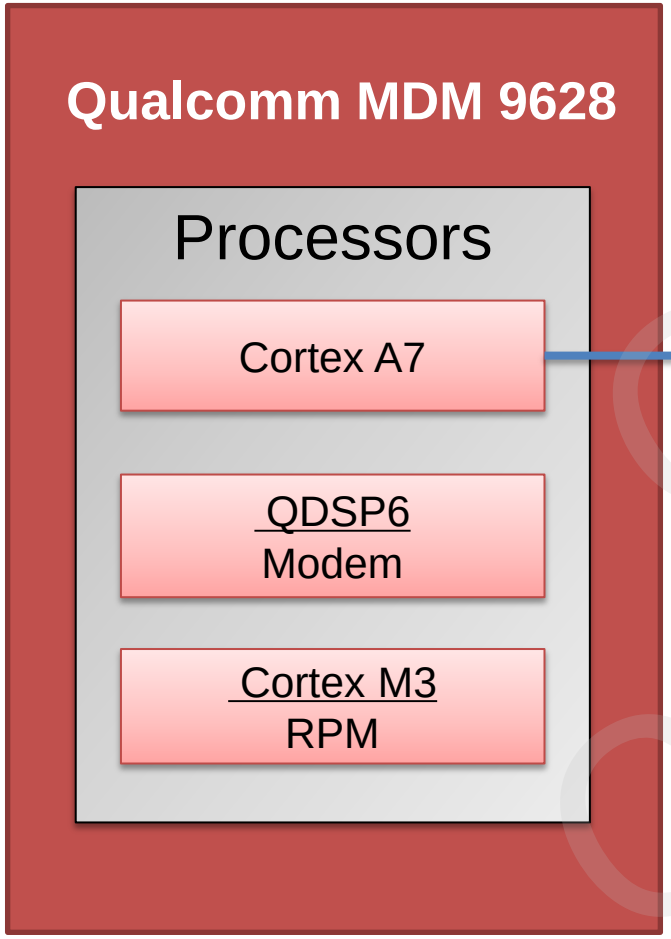
QuecOpen SDK provides rich small examples, which enables developers to realize fast development. Supporting C-based runtime libraries offers more flexibility for developers to design software and program.

More Competitive

By directly downloading the embedded applications to Quectel modules to run, it is now possible to remove the external host processor, memory, and a range of product specific ASICs such as IO expanders, audio DSPs, and many other analogue and digital devices.

QuecOpen Introduction

Qualcomm MDM 9628 Block Diagram



Processors	
Applications	ARM Cortex A7 up to 1.2GHz with 256KB L2 cache ARM Cortex A7 – primary boot processor
Modem system	QDSP6 processor at up to 691MHz (Turbo) Low-power audio post-processing supported in the modem system 768KB L2 caches
RPM system	Cortex M3 up to 100MHz The only master of the modem power manager (MPM) MPM coordinates shutdown/wakeup, clock rates, and VDDs Boot flow is RPM/applications processor-based

QuecOpen™ Framework

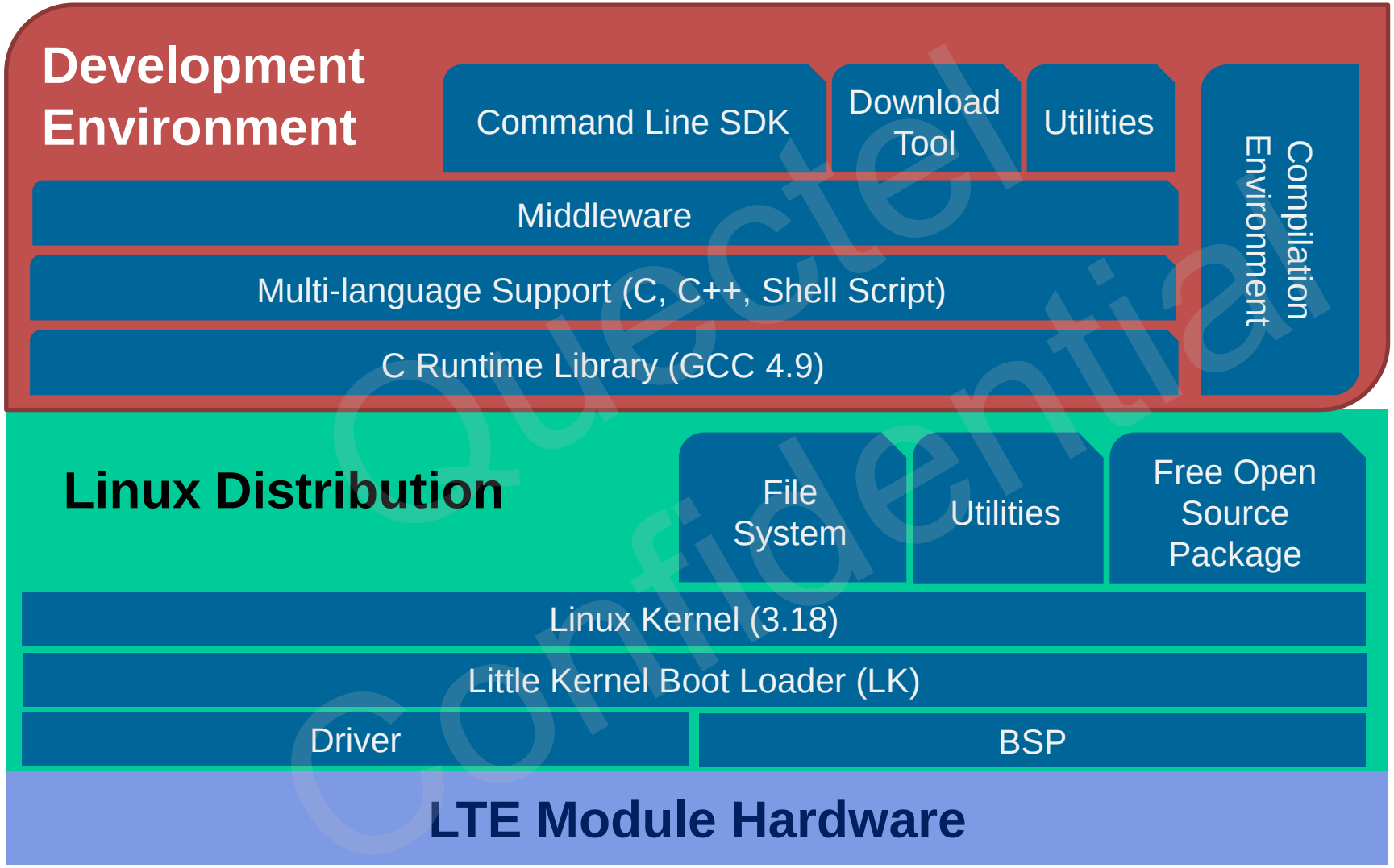
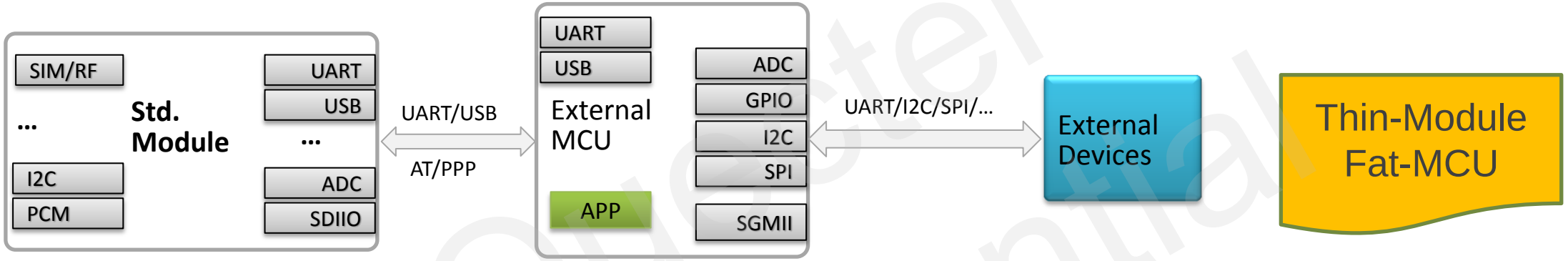


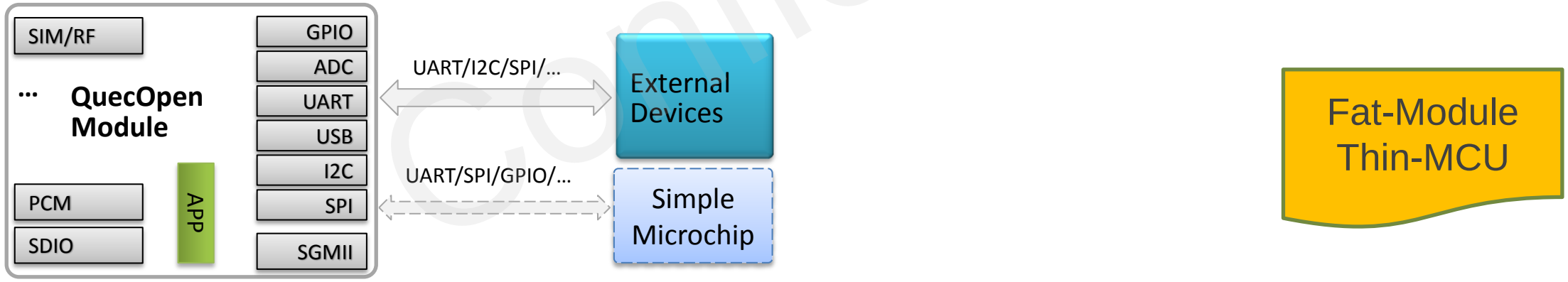
Figure: Framework of QuecOpen™ Solution

Advantages of QuecOpen™

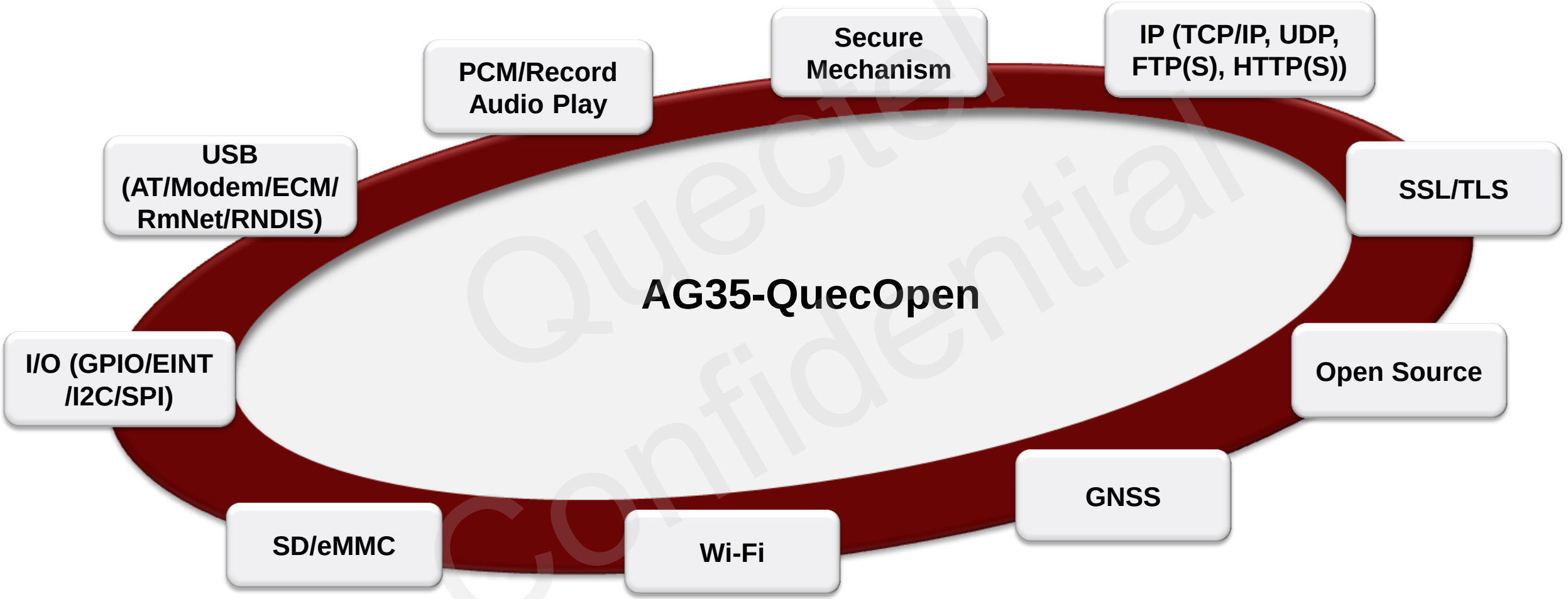
Standard Module Mode



QuecOpen™ Mode



Functionalities of QuecOpen™



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Target Applications

Open System Resources

CPU & OS

ARMv7 Cortex A7 up to 1.2GHz with 256KB L2 cache.
(Performance: 2280 DMIPS @1.2GHz, 1.9 DMIPS/MHz).
Linux distribution with kernel 3.18.

Flash Space

Filesystem	Type	Size	Used	Available	Use%	Mounted on
ubi0:rootfs	ubifs	60.4M	41.6M	18.8M	69%	/
ubi0:usrfs	ubifs	8.7M	184.0K	8.6M	2%	/data
/dev/ubi2_0	ubifs	99.9M	24.0K	99.9M	0%	/usrdata

Rootfs: about 18MB available. Customers may put read-only data, such as binary code bin and some configuration files and resource data.
usrfs: about 8MB available for customer application and important data.
usrdata: an R/W flash space, about **100MB** available for user code and data.

RAM

RAM available: 100MB

Open Hardware Resources (1)

- **UART**

  - Debug port (x1)
  - Application UART port (x3): all of them support hardware handshake option

- **GPIO** (more than 30)
- **I2C** (x2)
- **SPI** (x3)
- **PCM** (x1)
- **ADC** (x3)
- **SDIO** (x2): one for Wi-Fi, and the other for SD card or eMMC
- **SGMII** (x1)

Open Hardware Resources (2)

- **USB** (x1)

  Can be mapped into several different functional interfaces.

  - USB-AT port
  - USB-DM port
  - USB-NMEA port
  - USB-Modem port
  - USB-Network adapter

  In AG35-QuecOpen, the GNSS NMEA is outputted to applications through a virtual serial port *(/dev/smd7*).

  USB Design Suggestions:

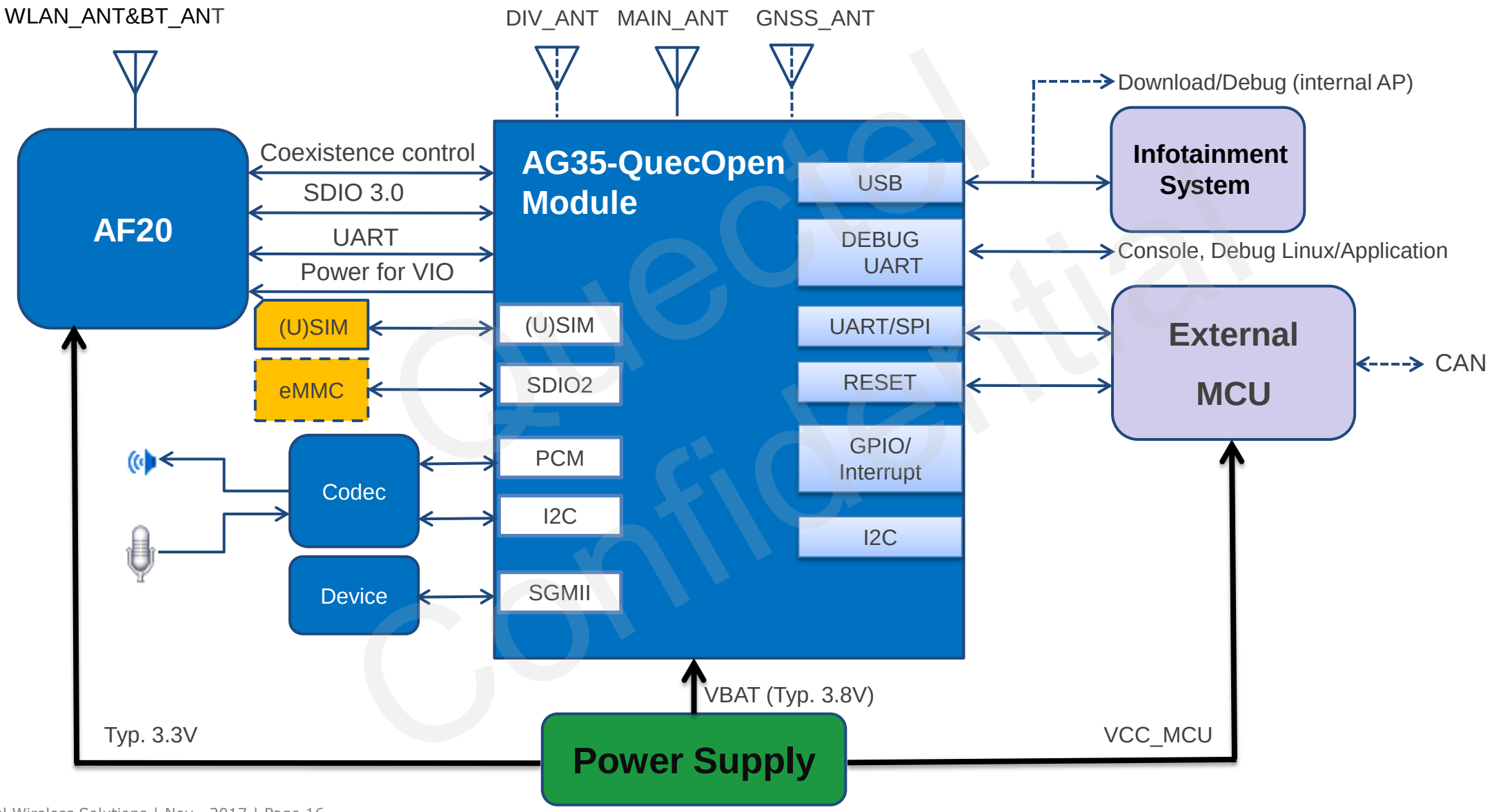
  - *For downloading → DM port*
  - *For capturing system log→ DM port*
  - *For debugging → ADB port*

Interfaces & Multiplexing Pins

Pin No.	Pin Name	Default Function Interface	Pin Multiplexing			Power Domain	Reset	Wake-up Interrupt	Remark
			Primary Function	Alternate Function 1	Alternate Function 2				
1	RESET_N	Reset	RESET_N	--	--	1.8V			
2	PWRKEY	Power Key	PWRKEY	--	--	1.8V			
32	USB_VBUS	USB	USB_VBUS	--	--	1.8V		--	Dedicated pin
33	USB_DM		USB_DM	--	--	1.8V		--	Dedicated pin
34	USB_DP		USB_DP	--	--	1.8V		--	Dedicated pin
36	USB_ID		USB_ID	--	--	1.8V		--	
143	OTG_PWR_EN		OTG_PWR_EN	GPIO_41	--	1.8V	B-PD,L	✗	
42	I2C1_SDA	I2C1 (Host Only)	I2C_SDA_BLSP4	GPIO_18	--	1.8V	B-PD,L	✓	
43	I2C1_SCL		I2C_SCL_BLSP4	GPIO_19	--	1.8V	B-PD,L	✓	
56	UART1_CTS	UART1	UART_CTS_BLSP3	GPIO_3	SPI_CLK_BLSP3	1.8V	B-PD,L	--	
57	UART1_RTS		UART_RTS_BLSP3	GPIO_2	SPI_CS_N_BLSP3	1.8V	B-PD,L	--	
58	UART1_RXD		UART_RXD_BLSP3	GPIO_1	SPI_MISO_BLSP3	1.8V	B-PD,L	--	
60	UART1_TXD		UART_TXD_BLSP3	GPIO_0	SPI_MOSI_BLSP3	1.8V	B-PD,L	--	
59	GPIO1	GPIO	GPIO_38	--	--	1.8V	B-PD,L	✓	BOOT_CONFIG_12
61	GPIO2	GPIO	GPIO_74	--	--	1.8V	B-PD,L	✓	
62	GPIO3	GPIO	GPIO_75	--	--	1.8V	B-PD,L	✓	

For more details, please refer to *Quectel_AG35-QuecOpen_GPIO_Assignment_Speadsheet*.

Application Model (AG35-QuecOpen Module)



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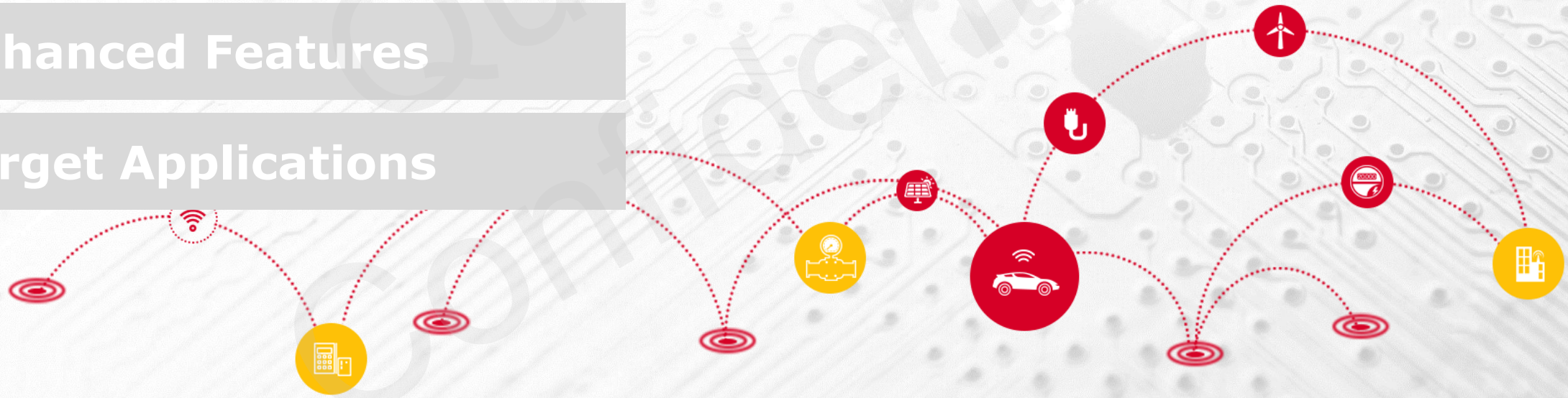


Dev-Host Requirements

- **Operating system**

  Ubuntu 64-bit OS, version 14.04.

- **Compiler**

  Specified compilation environment with GCC version 4.9

- **ADB (option for development stage)**

  Android Debug Bridge version 1.0.31.

- **Fastboot (option for development stage)**

Development Suites

- Development Documentation
- Compilation Environment
- SDK
- Drivers (USB, ADB)
- Download Tools:
  Quectel_Customer_FW_Download_Tool, ADB, Fastboot
- Utilities: serial tool “QCOM”, assistant tool for making rootfs/boot.img
- Open Kernel Source (optional)

Programming Capacities

- Shell script, C, C++
- GNU C Library
- main() entry procedure (application entry)
- Freely apply/free dynamic memory, malloc()/delete()
- Multithreading, dynamically threads creation
- Open-source APIs for I/O interfaces accessing
- APIs for network activation and management
- Standard Unix socket APIs for TCP/UDP connection establishment
- Standard 3GPP AT commands
- Quectel extended AT commands

How to Work with QuecOpen™ (1)

For more details about how to start working with QuecOpen™, please refer to ***Chapter 3*** of *Quectel_AG35-QuecOpen_Developer_Guide*.

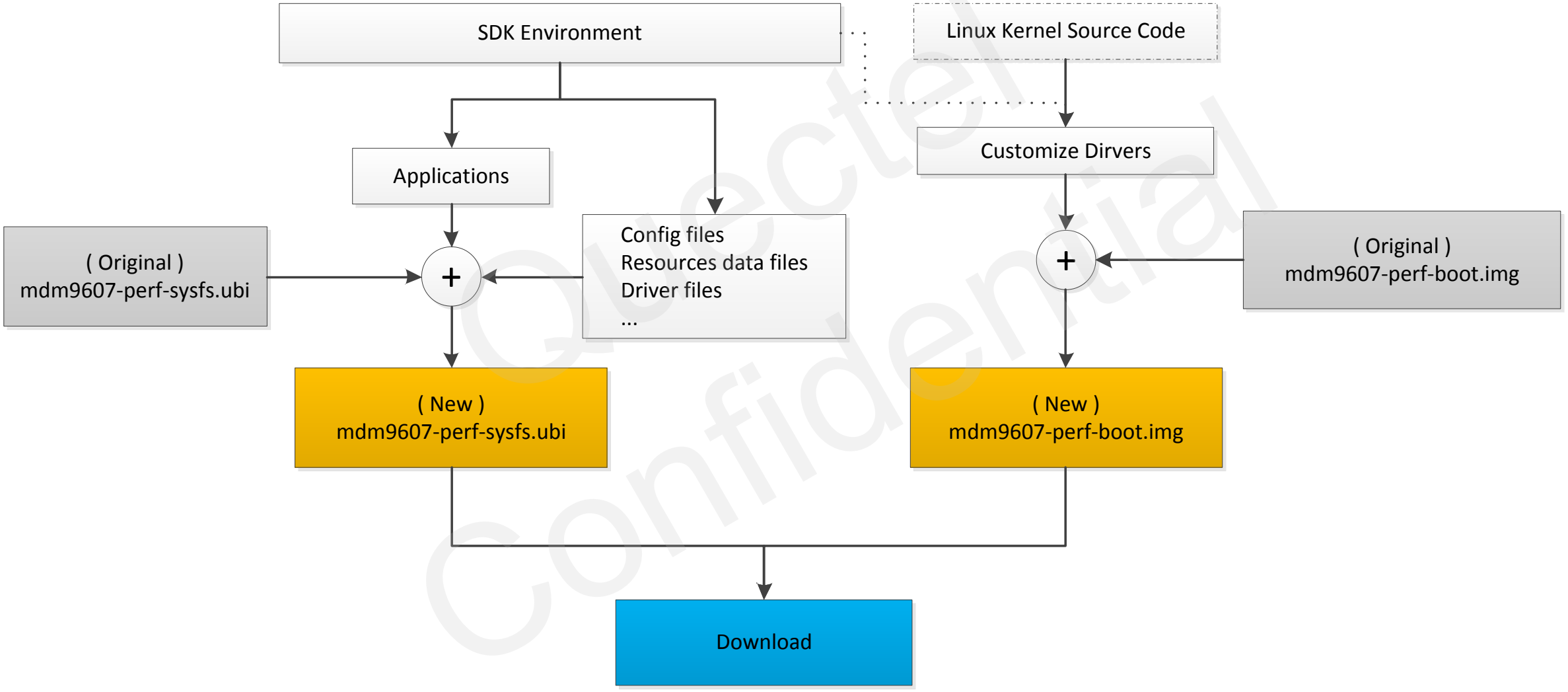
How to Work with QuecOpen™ (2)

More detailed information about AG35-QuecOpen development are provided in ***Chapter 2*** and ***Chapter 4*** of *Quectel_AG35-QuecOpen_Developer_Guide*.

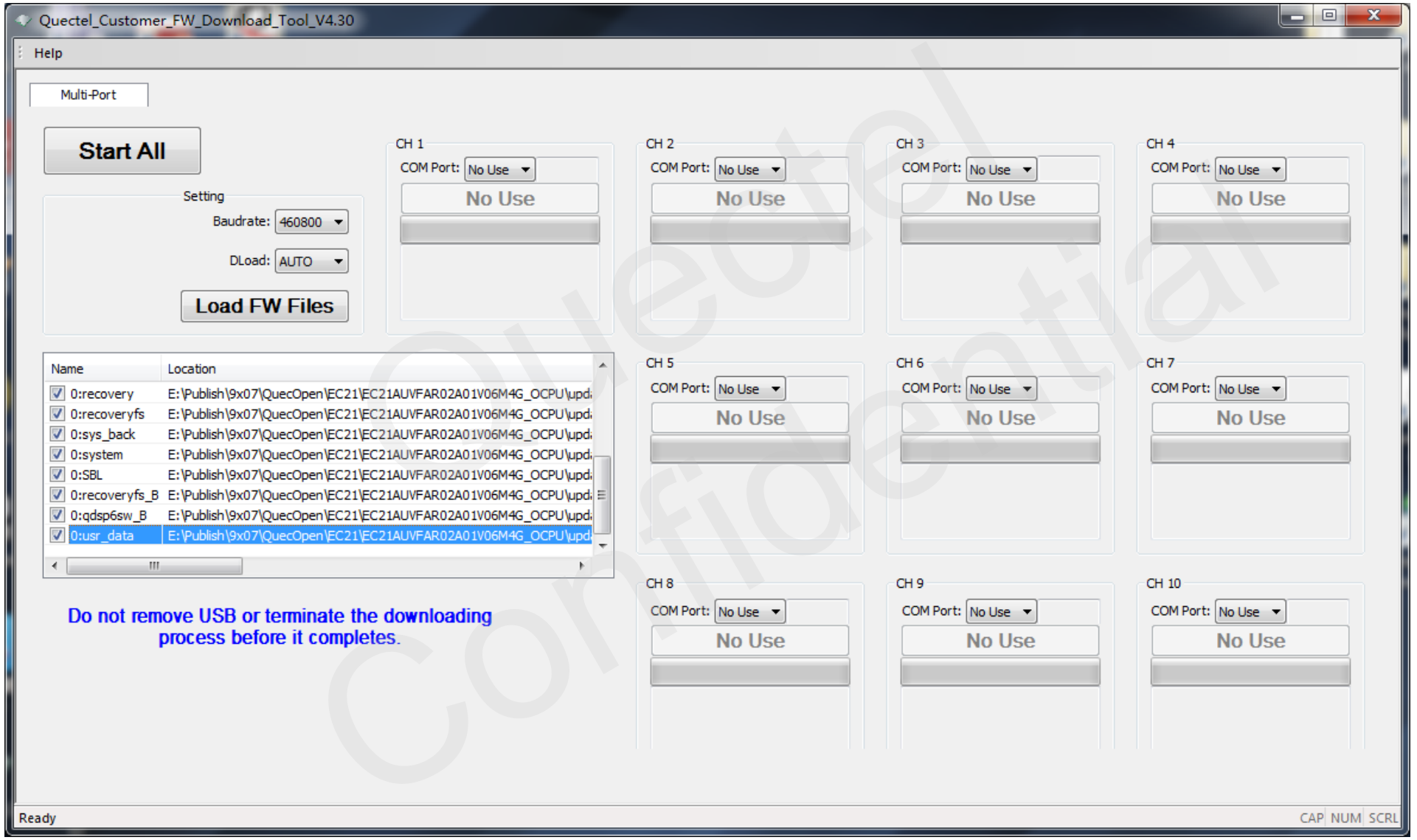
Dev./Download/Production (1)

appsboot.mbn	434 KB
ENPRG9x07.mbn	97 KB
mdm9607-boot.img	6,220 KB
mdm9607-recovery.ubi	9,984 KB
mdm9607-sysfs.ubi	50,048 KB
NON-HLOS.ubi	35,712 KB
NPRG9x07.mbn	97 KB
partition.mbn	1 KB
partition_nand.xml	7 KB
rpm.mbn	155 KB
sbl1.mbn	210 KB
tz.mbn	539 KB
usrdata.ubi	2,048 KB

Dev./Download/Production (2)



Dev./Download/Production (3)



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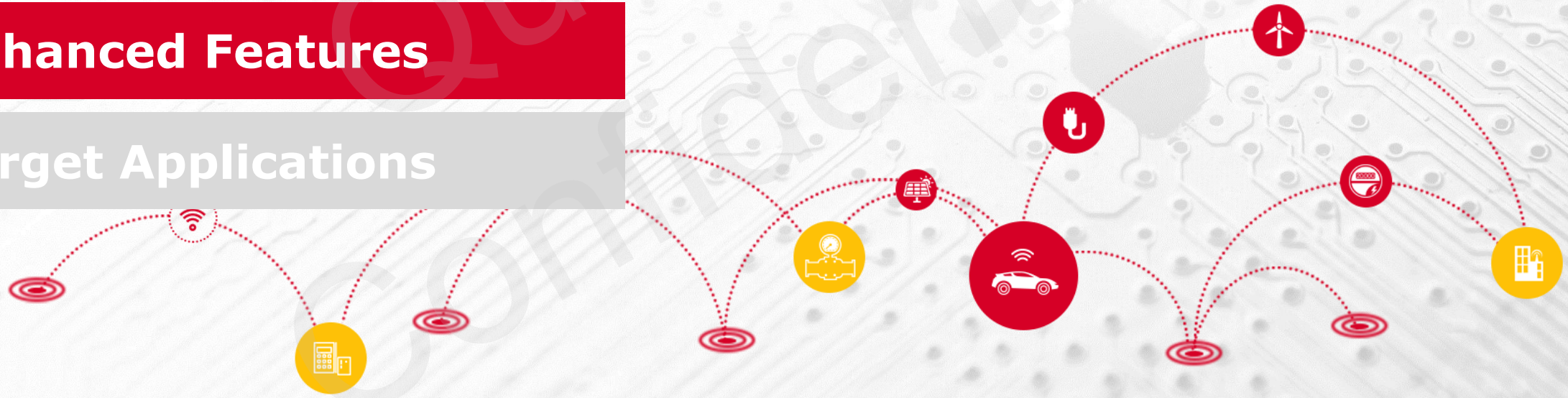


Key Features in Automotive

Wide Temperature Range
-40℃ ~ +85℃

eCall

Jamming Detection

Wi-Fi & BT

DFOTA

GNSS

ESD Protection

Embedded SIM

EMI Suppression

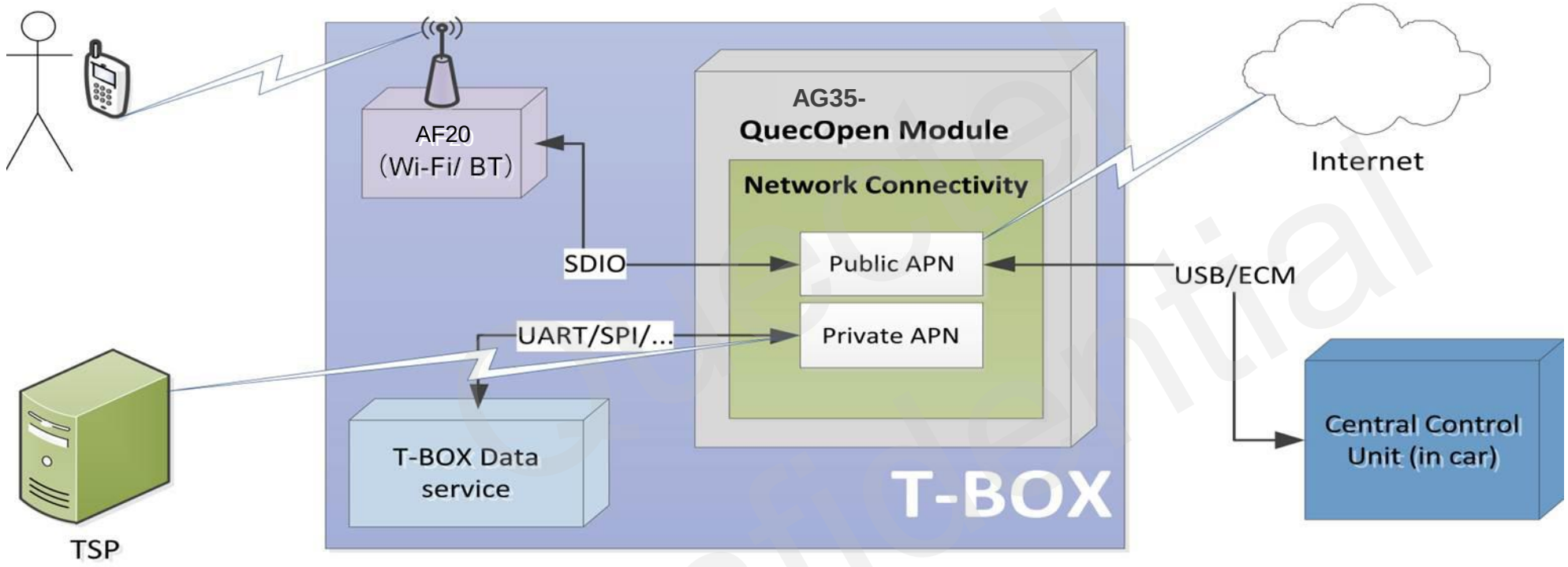
Low Target PPM Rates

Security

Long Life Cycle

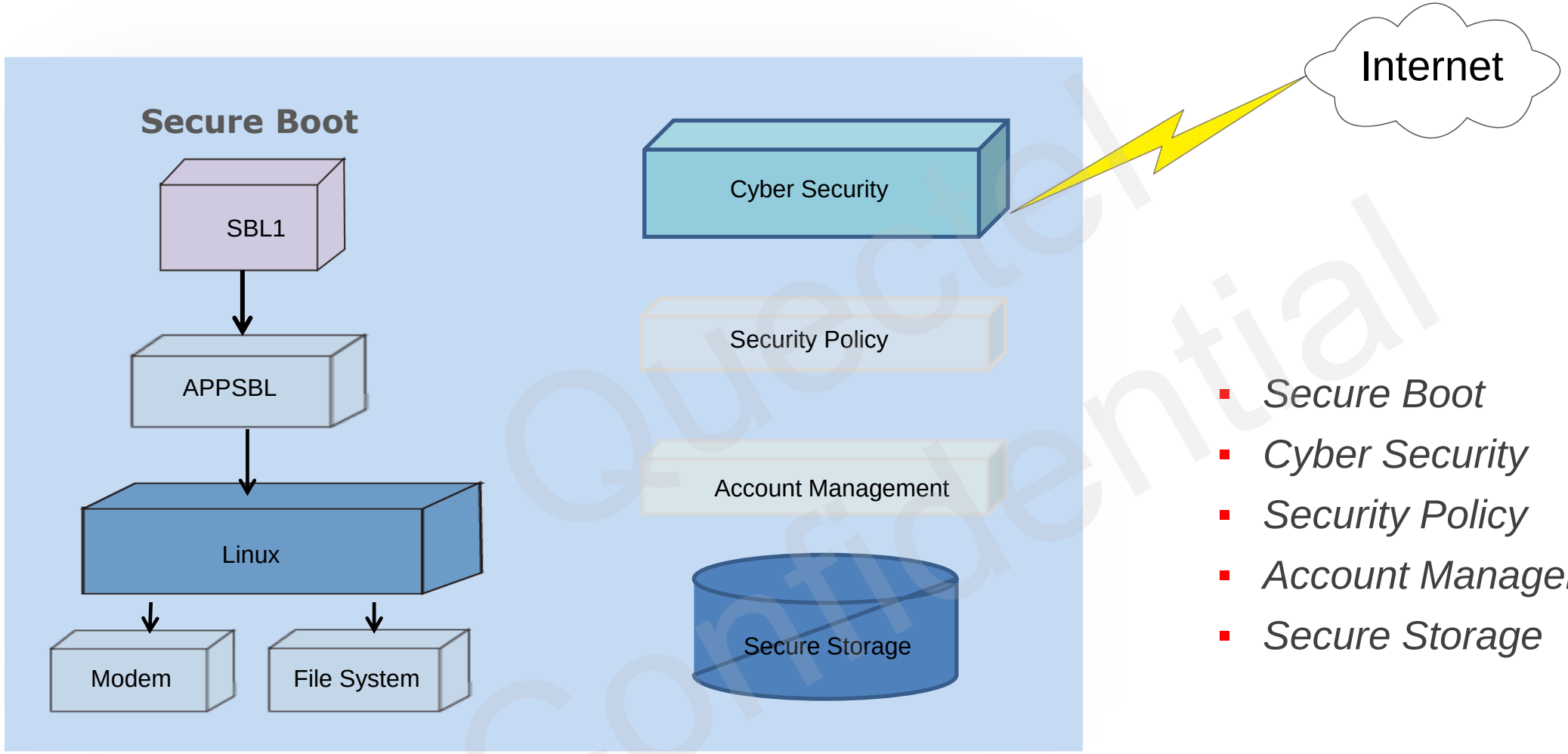
Antenna Diagnosis

Multi-APN Solution



- Users can get in-car infotainment and Wi-Fi access via the public APN.
- TSP is able to communicate with vehicles via the private APN, which can ensure the data that car OEM gets safer and more reliable.
- Maximally 8 APNs are supported now.

Security Solution



- *Secure Boot*
- *Cyber Security*
- *Security Policy*
- *Account Management*
- *Secure Storage*

eCall Function

A car will have an electronic safety system automatically call emergency services in case of a serious accident. Even if the driver is unconscious, the system will inform rescue workers of the crash site's exact whereabouts, and the rescues will be on its way within minutes. The system is named as "**eCall**".

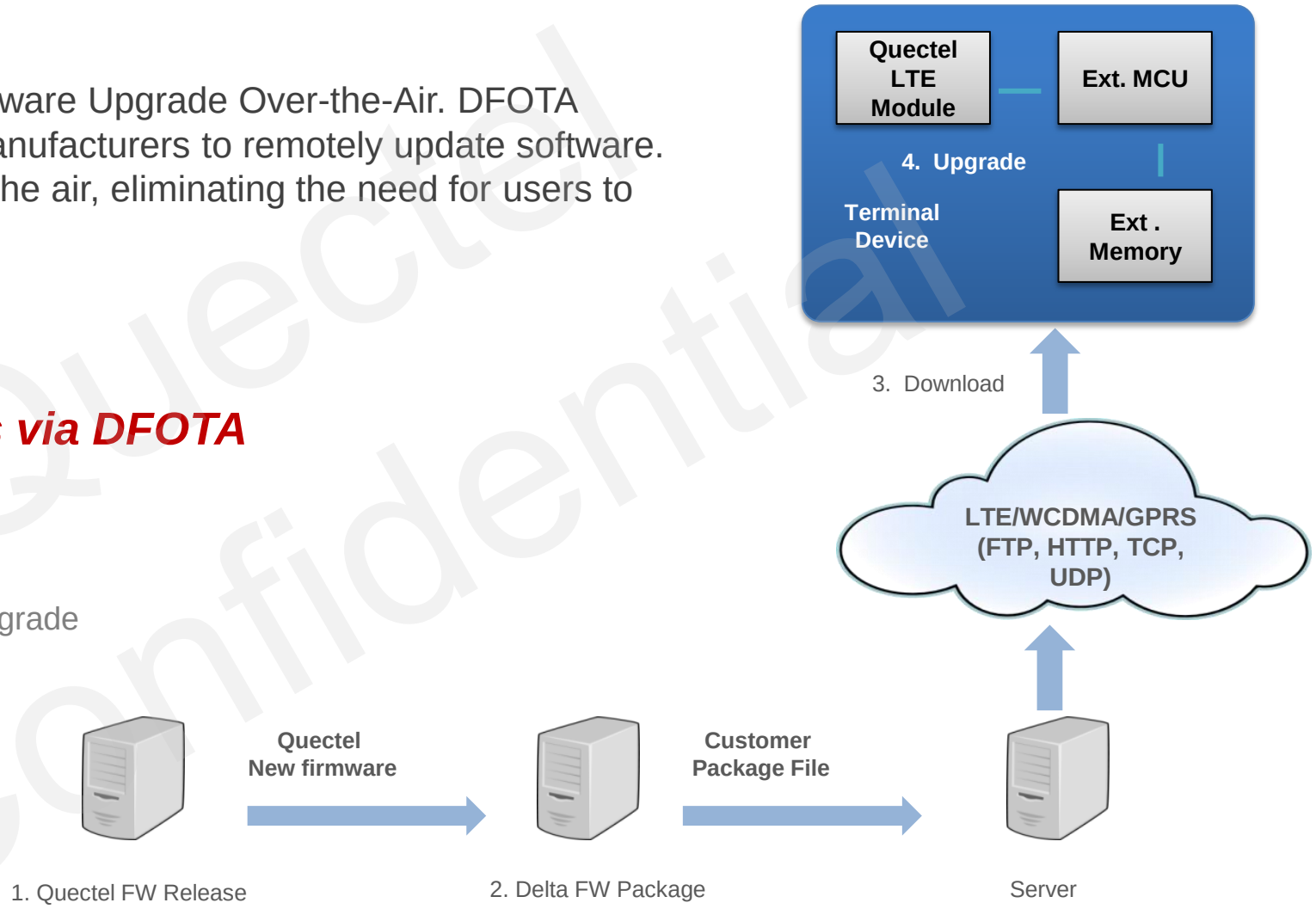
- *Quectel supports eCall in 2G/3G/4G/GNSS modules and has been working on eCall since late 2011.*
- *Quectel has enough development experience on eCall to support and assist customers with eCall application development.*

DFOTA

DFOTA is an acronym for Delta Firmware Upgrade Over-the-Air. DFOTA technology enables mobile device manufacturers to remotely update software. New software can be delivered over the air, eliminating the need for users to bring the device to a service facility.

Firmware Upgrade Process via DFOTA

- Get Delta Firmware Package
- Put Delta Package on Server
- Execute AT+QFOTADL Command
- Automatic Firmware Download and Upgrade

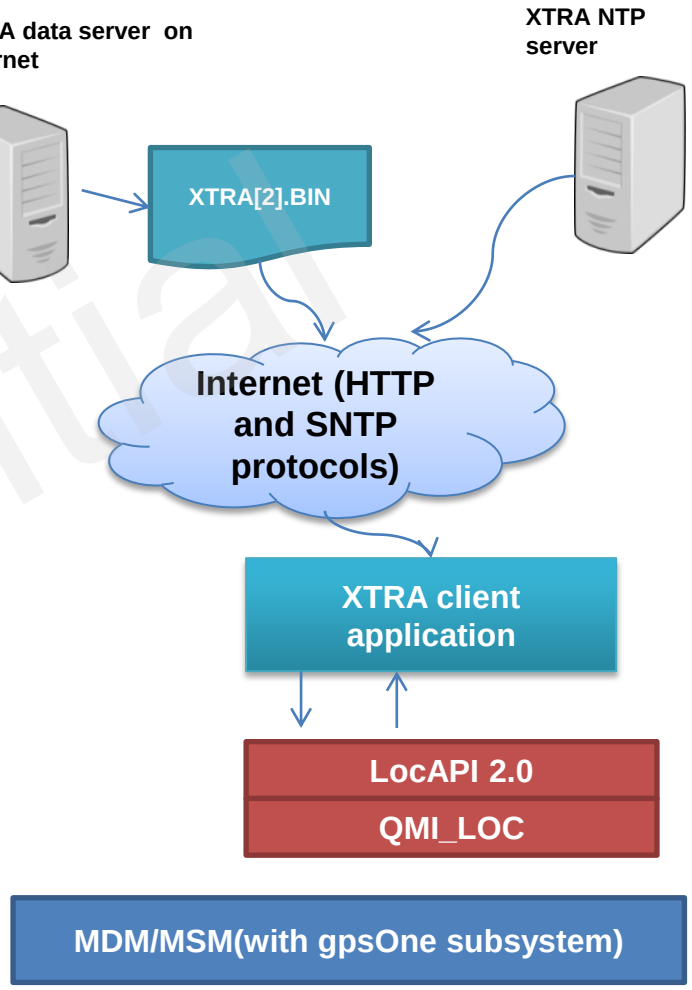


Qualcomm gpsOne Gen8C

XTRA Assistance Technology

Qualcomm's new GpsOne XTRA Assistance technology provides enhanced operation by enabling a user to download a small assistance data file through a brief Internet access session.

This technology delivers more accurate positioning with greater sensitivity than otherwise possible with standalone GPS receivers, especially in challenging areas such as indoors and in dense urban canyons.



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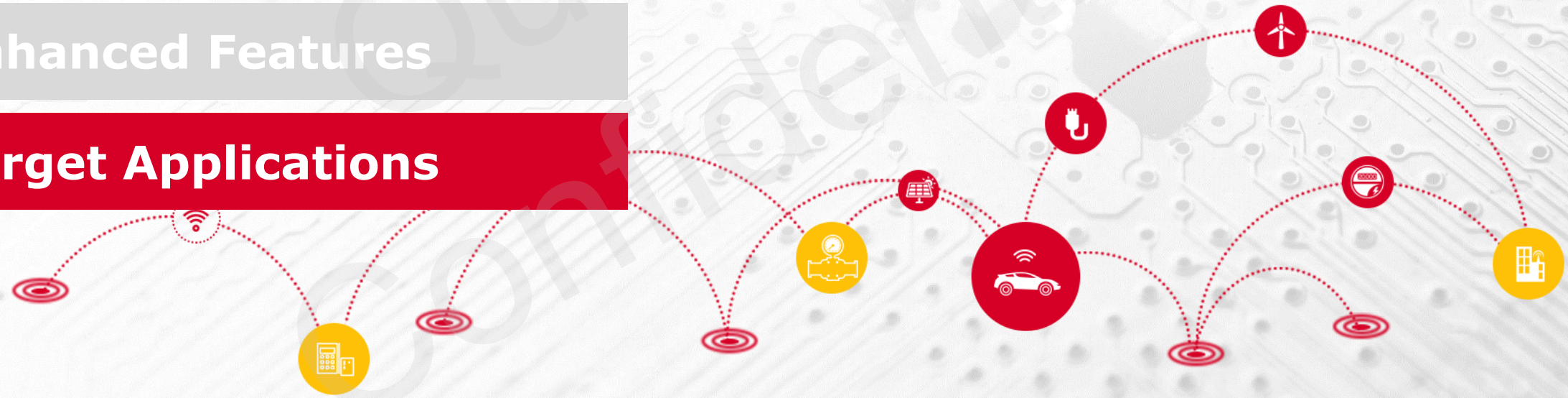


GPS-based Autonomous Navigation System

- GPS-based autonomous navigation system + monitoring center + wireless communication + Internet
- Based on M2M module, it combines geographical information system with automotive voice-assisted navigation technology to implement the perfect integration of the on-board wireless communication with autonomous navigation system.

- Real-time monitoring & tracking
- Mileage statistics
- Status feedback
- ……

Real-time Monitoring & Tracking

- On-screen navigation button
- Path planning
- Display setting
- ……

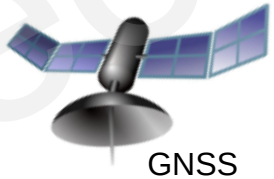
Navigation

- Hands-free call
- Message sending & receiving
- Automotive call
- Call center
- ……

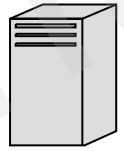
Telecommunication

- Internet access
- Text to speech
- DVD player
- ……

Multi-media Function



GNSS



Server

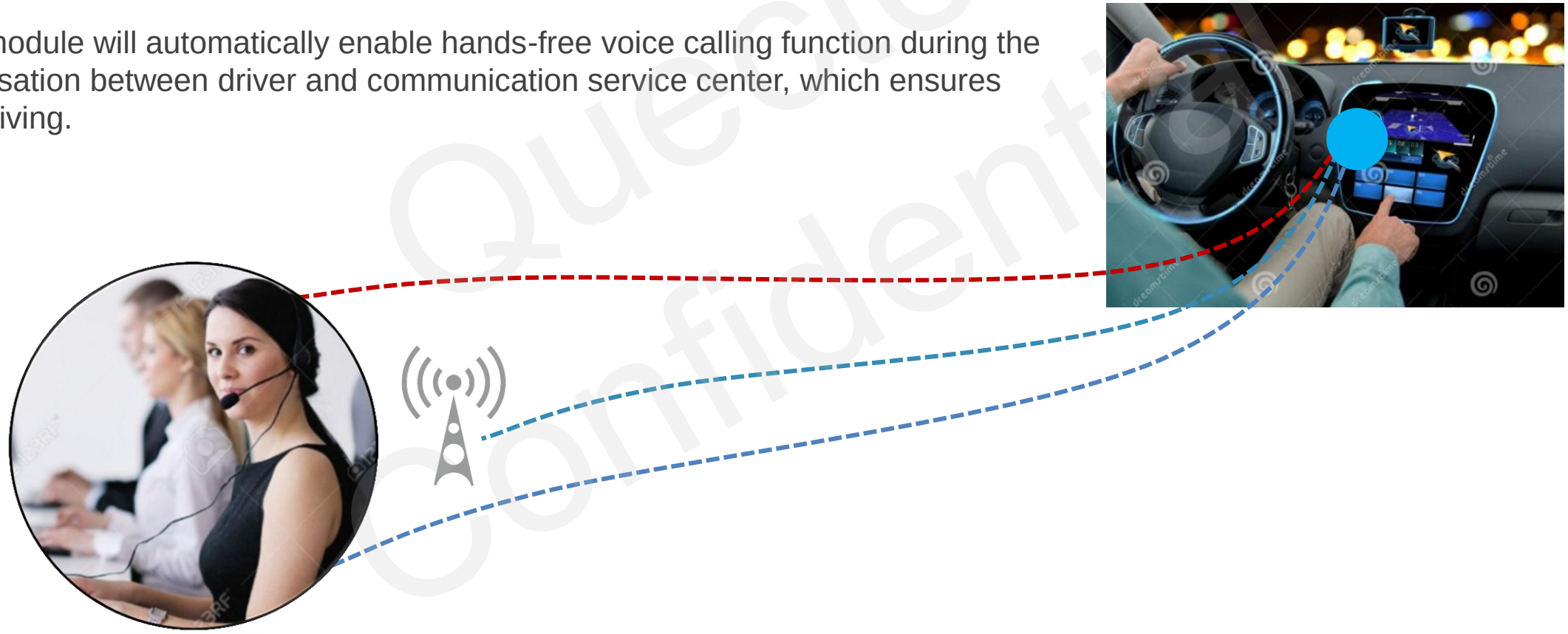
Automotive Module

Monitoring

On-screen Navigation Button

On-screen navigation button provides voice-assisted navigation information through interactive call between driver and communication service center. As soon as the call is received, communication service center will offer the turn-by-turn voice-guided driving directions. After the route is confirmed by the driver, communication service center will automatically generate the route and send it to the driver's phone.

M2M module will automatically enable hands-free voice calling function during the conversation between driver and communication service center, which ensures safe driving.



T-BOX

T-Box is a standard terminal for the connected car, providing diversified online applications like vehicle remote monitoring, remote control, safety monitoring and alarming, and remote diagnosis by means of 4G remote wireless communication, GPS satellite positioning, acceleration sensing and CAN communication functions.

T-BOX transmits the vehicle information and position information to the TSP Center via the built-in module. The TSP Center can track the status of vehicles and provide relevant services accordingly.

- Windows and air conditioner control
- Vehicle health alerts
- Unsafe driving alerts & reports
- Remote automatic vehicle diagnostic

TSP (Telematics Service Provider)

4G LTE In-car Wi-Fi

In-car Wi-Fi refers to Internet service provided in a car. Internet access can be provided by tethering a mobile phone, or with a mobile hotspot, whether portable or built into the car.

- Stay connected to everything while on the road
- Access your music, apps, social media – everything needed to keep in touch

Fast and reliable connection

Stream movies and TV on the go

4G LTE In-car Wi-Fi

Easy access to multi-media

Real-time data transmission

Thank you!

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