SIM7000 Series_CoAP _Application Note

LPWA Module

Document Title:	SIM7000 Series_ CoAP_Application Note
Version:	1.01
Date:	2019.07.28
Status:	Released

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About Document

Version History

Version	Date	Owner	What is new
V1.00	2019.05.03	Wei.zhang	First Release
V1.01	2020.07.28	Wenjie.Lai	All

Scope

This document applies to the following products

Name	Type	Size(mm)	Comments
SIM7000E/C/A/G	Cat-M1(/NB1/EGPRS)	24*24	
SIM7000E-N SIM7000C-N	NB1	24*24	

Contents

1 Introduction

1.1   Purpose of the document

Based on module AT command manual, this document will introduce CoAP application process.

Developers could understand and develop application quickly and efficiently based on this document.

1.2   Related documents

[1] SIM7000 Series_AT Command Manual

1.3   Conventions and abbreviations

In this document, the GSM engines are referred to as following term:
- ME (Mobile Equipment);
- MS (Mobile Station);
- TA (Terminal Adapter);
- DCE (Data Communication Equipment) or facsimile DCE (FAX modem, FAX board);

In application, controlling device controls the GSM engine by sending AT Command via its serial interface.
The controlling device at the other end of the serial line is referred to as following term:
- TE (Terminal Equipment);
- DTE (Data Terminal Equipment) or plainly "the application" which is running on an embedded system;

2 CoAP Introduction

In the IoT application, there is a network between the device and the device, and they need to communicate with each other. However, because IoT devices are usually resource-constrained, limited CPU capacity, limited RAM, limited flash, and limited network bandwidth, the CoAP (Constrained Application Protocol) protocol borrows the HTTP protocol mechanism and simplifies for such special scenarios. The protocol Packet format. The communication between IoT devices is succinctly realized.

2.1   CoAP protocol features

● Based on message model, four message types are defined, and the message is the data communication carrier, and the data communication between devices is realized by exchanging network messages.

● The operation of the CoAP Server cloud device resource is completed by the request and response mechanism. Similar to HTTP, the device can operate the server resource through four request methods (GET, PUT, POST, DELETE). The request and response packets are placed in the CoAP message for transmission.

● Message-based two-way communication (M2M), both the CoAP Client and the CoAP server can send requests to each other independently. Both parties can be in the client or server role.

● The protocol packet is lightweight and has a minimum length of only 4B.

● Support reliable transmission,data retransmission, block transmission. Ensure that data arrives reliably

● Support IP multicast, which can send requests to multiple devices at the same time (such as CoAP client search for CoAP Server)

● Non-long connection communication for low power IoT scenarios.

3 AT Commands for CoAP

AT Command	Description
AT+CCOAPINIT	Create CoAP object
AT+CCOAPURL	Configure CoAP URL
AT+CCOAPPARA	Assembling CoAP data Packet
AT+CCOAPACTION	Operate CoAP object
AT+CCOAPHEAD	Read head of CoAP packet
AT+CCOAPREAD	Read data of CoAP Packet
AT+CCOAPTERM	Delete CoAP object

3.1   AT+CCOAPINIT   Create CoAP Object

AT+CCOAPINIT Create CoAP Object	
Test Command AT+CCOAPINIT=?	Response **OK**
Execution Command AT+CCOAPINIT	Response **OK** or **ERROR**
Example	AT+CCOAPINIT OK

3.2   AT+CCOAPURL   Configure CoAP URL

AT+CCOAPURL Configure CoAP URL	
Test Command AT+CCOAPURL=?	Response **+CCOAPURL: <scheme>://<host>:<port>/<uri>** **OK**
Write Command	Response **OK**

AT+CCOAPURL=<scheme>://<host>[:<port>][/<uri>]	or **ERROR**
	Parameters **<scheme>** Current only CoAP **<host>** Server name or address of remote server **<port>** Server port of remote CoAP server **<uri>** Resource（Once effective）
Example	AT+CCOAPURL="coap://198.181.39.174" OK

3.3   AT+CCOAPPARA   Assembling CoAP Data Packet

AT+CCOAPPARA Assembling CoAP Data Packet	
Test Command **AT+CCOAPPARA=?**	Response **+CCOAPPARA: code,<hex_value>** **+CCOAPPARA: type,(("CON"),("NON"),("ACK"),("RST"))** **+CCOAPPARA: mid,<dec_value>** **+CCOAPPARA: token, ((0-ascii code),(1-hex code)),<value>** **+CCOAPPARA: content-format,<dec_value>** **+CCOAPPARA: accept,<dec_value>** **+CCOAPPARA: uri-path,((0-ascii code),(1-hex code)),<value>** **+CCOAPPARA: uri-query, ((0-ascii code),(1-hex code)),<value>** **+CCOAPPARA: etag, ((0-ascii code),(1-hex code)),<value>** **+CCOAPPARA: observe,<dec_value>** **+CCOAPPARA: max-age,<dec_value>** **+CCOAPPARA: size,<dec_value>** **+CCOAPPARA: payload, ((0-ascii code),(1-hex code)),<value>** **OK**
Write Command **AT+CCOAPPARA=<name1>[,<code1>],<value1>[,<name2>[,<code2>],<value2>][,...]**	Response **OK** or **ERROR**

	Parameters
	<namex> Various part of CoAP Packet
	<codex> Parameter encoding of input value
	       0 Ascii format
	       1 Hex format string
	<valuex> Value of <namex>

Example	AT+CCOAPPARA=code,1,uri-path,0,"home/query",uri-query,0,"address=1",payload,0,"hello world" OK

3.4   AT+CCOAPACTION   Operate CoAP Object

AT+CCOAPACTION	Operate CoAP Object
Test Command **AT+CCOAPACTION=?**	Response **+CCOAPACTION: <type>[,<value>]** **OK**
Write Command **AT+CCOAPACTION=<type>**	Response If <type>=4 **+CCOAPACTION: 4,<num>,<mid>** **OK** If <type>=5 **OK** or **ERROR**

	Parameters
	<type> Operation type
	    4 Query current receiving queue information
	    5 Clear the receive queue
	<num> Number of packets of the current receiving queue CoAP
	<mid> Receive the mid of the first CoAP packet in the queue
	
	Unsolicited Result Codes
	The receiving queue has enough space to store the unprocessed data packets of the protocol stack and will report it automatically.
	+CCOAPRCV: <mid>,<packet size>,<payload size>
	Parameters
	<mid> Message id of the received packet
	<packet size> The size of the received CoAP packet
	<payload size> Received CoAP packet payload size

Execution Command **AT+CCOAPACTION**	Response **+CCOAPACTION: 0,<mid>** **OK** or **ERROR** Parameters **<mid>** Message ID of the sent message Unsolicited Result Codes

	+CCOAPACTION: <type>[,<mid>]
	Parameters
	<type>
	1 Indicates that the receive queue is full
	2 Indicates that the mid CoAP response packet receives timeout
	3 CoAP socket error
	<mid> Message ID
	Receive the mid of the first CoAP packet in the queue(If <type>=1)
	Mid of Timeout packet(If <type>=2)
Example	AT+CCOAPACTION
	+CCOAPACTION: 0,1
	OK
	AT+CCOAPACTION=4
	+CCOAPACTION: 4,1,2
	OK

3.5   AT+CCOAPHEAD   Read Head of CoAP Packet

AT+CCOAPHEAD	Read Head of CoAP Packet
Test Command **AT+CCOAPHEAD=?**	Response **+CCOAPREAD: <mid>,((0-printconvert),(1-print raw))** **OK**
Write Command **AT+CCOAPHEAD=<mid>,<convert>**	Response If <convert>=1 **+CCOAPHEAD:** **<convert>,<ver>,<type>,<tkl>,<code>,<mid>,<token>,<content-format>,<max-age>,<etag>,<accept>,<if-match>,<if-none-match>,<uri-host>,<uri-port>,<uri-path>,<uri-query>,<location-path>,<location-query>,<proxy-uri>,<observe>,<block2>,<block1>,<size>** **OK** If <convert>=0 **+CCOAPHEAD: <convert>,<length>,<data>** **OK** or **ERROR**
	Parameters
	<mid> The message id of the CoAP packet will be read

	<convert>
	0 Print data in raw mode
	1 Print data after parsing
	<length> length of CoAP head
	<data> Data of CoAP head
Example	AT+CCOAPHEAD=1,1
	+CCOAPHEAD: 1,1,2,0,4.04,1,,,,,,,0,,,,,,,,
	OK

3.6   AT+CCOAPREAD   Read Data of CoAP Packet

AT+CCOAPREAD	Read Data of CoAP Packet
Test Command **AT+CCOAPREAD=?**	Response **+CCOAPHEAD: <mid>** **OK**
Write Command **AT+CCOAPREAD=<mid>**	Response **+CCOAPREAD: <length>,<data>** **OK** or **ERROR**
	Parameters **<length>** Length of packet **<data>** Data of packet
Example	

3.7   AT+CCOAPTERM   Delete CoAP Object

AT+CCOAPTERM	Delete CoAP Object
Test Command **AT+CCOAPTERM=?**	Response **OK**
Execution Command **AT+CCOAPTERM**	Response **OK** or **ERROR**

Example

4 Bearer Configuration

Usually module will register PS service automatically.

4.1   PDN Auto-activation

//**Example of PDN Auto-activation.**

AT+CPIN?   //Check SIM card status
+CPIN: READY

OK
AT+CGDCONT=1,"IP",""   //Configure APN for registration when needed
OK
AT+CSQ   //Check RF signal
+CSQ: 27,99

OK
AT+CGATT?   //Check PS service.
+CGATT: 1   //1 indicates PS has attached.

OK
AT+COPS?   //Query Network information, operator and network
+COPS: 0,0,"CHN-CT",9   mode 9, NB-IOT network

OK
AT+CGNAPN   //Query the APN delivered by the network after the
                                                                        CAT-M or NB-IOT network is successfully
                                                                        registered.
+CGNAPN: 1,"ctnb"   //"ctnb" is APN delivered by the CAT-M or NB-IOT
                                                                        network. APN is empty under the GSM network.

OK
AT+CNCFG=1,"ctnb","cdma","1234"   //Before activation please use AT+CNCFG to set
                                                                        APN\user name\password if needed.

OK
AT+CNACT=1   //Activate network
OK

+APP PDP: ACTIVE
AT+CNACT?   //Get local IP
+CNACT: 0,1,"10.94.36.44"

OK

4.2   APN Manual configuration

If not attached automatically, could configure correct APN setting.

//Example of APN Manual configuration.

AT+CFUN=0   //Disable RF
+CPIN: NOT READY

OK
AT+CGDCONT=1,"IP","ctnb"   //Set the APN manually
OK
AT+CFUN=1   //Enable RF
OK

+CPIN: READY
AT+CGATT?   //Check PS service.
+CGATT: 1   //1 indicates PS has attached.

OK
AT+CGNAPN   //Query the APN delivered by the network after the CAT-M or NB-IOT network is successfully registered.

+CGNAPN: 1,"ctnb"   //"ctnb" is APN delivered by the CAT-M or NB-IOT

OK   network. APN is empty under the GSM network.
AT+CNCFG=1,"ctnb","cdma","1234"   //Before activation please use AT+CNCFG to set APN\user name\password if needed.

OK
AT+CNACT=1   //Activate network
OK

+APP PDP: ACTIVE
AT+CNACT?   //Get local IP
+CNACT: 0,1,"10.94.36.44"

OK

5 CoAP Examples

//Example of CoAP	
AT+CNACT=1,"cmnet"	//Open data connection, the parameter "cmnet" is APN. This parameter needs to set different APN values according to different cards.
OK	
+APP PDP: ACTIVE	
AT+CCOAPINIT	//Create CoAP object
OK	
AT+CCOAPURL="coap://198.181.39.174"	//Configure CoAP URL
OK	
AT+CCOAPPARA=code,1,uri-path,0,"home/query",uri-query,0,"address=1",payload,0,"hello world"	//Assembling CoAP data packet
OK	
AT+CCOAPACTION	//Send data
+CCOAPACTION: 0,1	//Message id is 1
OK	
+CCOAPRECV: 1,14,9	//Received data, Message id is 1, data length is14 bytes, data payload is 9 bytes.
AT+CCOAPACTION=4	//Get receive queen.
+CCOAPACTION: 4,1,1	//The current receive queue has a total of 1 data packet, and the first packet id is 1.
OK	
AT+CCOAPHEAD=1,1	//Read the packet header with message id of 1 and print it parsed.
+CCOAPHEAD: 1,1,2,0,4.04,1,,,,,,,0,,,,,,,,,,,	
OK	
AT+CCOAPREAD=1	//Read the receive packet payload with message id of 1.
+CCOAPREAD: 9,Not Found	The total byte length is 9 and the content is Not Found.
OK	
AT+CCOAPTERM	//Delete CoAP Object
OK	
AT+CNACT=0	//Disconnect data connection

OK

+APP PDP: ACTIVE