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NRC7292 Application Note

(Hostmode Firmware OTA)

Ultra-low power & Long-range Wi-Fi

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NEWRACOM, Inc.

NRC7292 Application Note (Hostmode Firmware OTA)
Ultra-low power & Long-range Wi-Fi

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1 Overview

This short user guide is a supplementary document for the sample Hostmode FOTA (Firmware Over-the-air) update application. The reference implementation will demonstrate the FOTA functionality using a HTTP server.

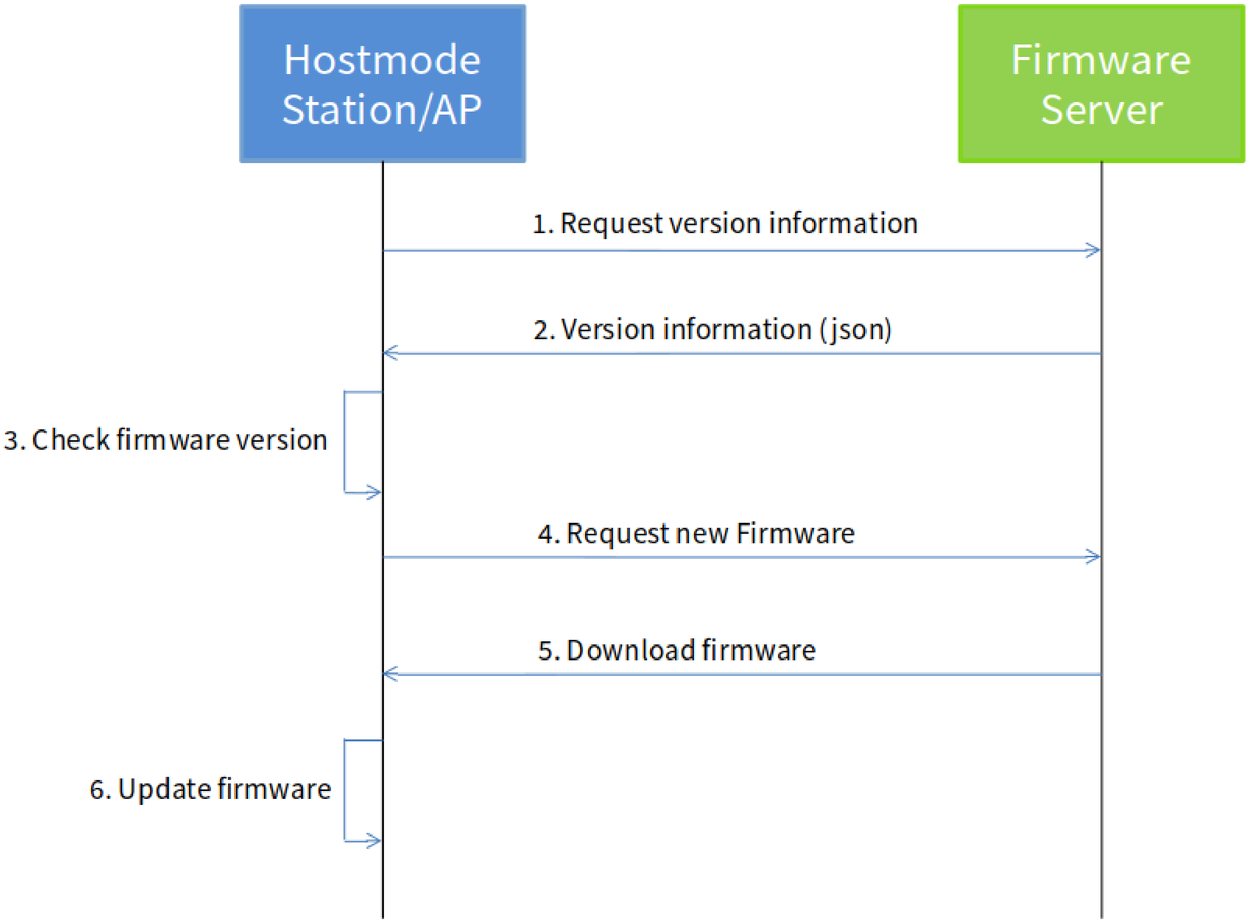


Figure 1.1 Hostmode FOTA procedure

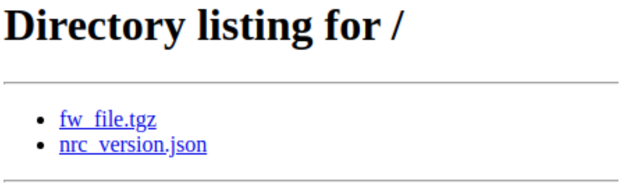
In the example implementation, the firmware update process fetches the firmware information daily at user configured time. If the downloaded firmware information indicates that the newer firmware version is available, it will download the new firmware, update the hostmode device, and restart the WIFI service. More detailed information about the procedure is outlined in later chapters.

2 HTTP(S) Server

The Python-based Simple HTTP Server will be used for the example application. The server will act as both a web server and a file server. The terminal command to start the server is a simple one-liner:

$python3 -m http.server <port number>

After running the script above, the server can be accessed remotely using a browser by typing the IP and the port number corresponding to the machine hosting the server. For example, if the IP of the host running the server is 192.168.1.11 and the port is set to 12345, typing “192.168.1.11:12345” in the search bar will redirect the browser to the index page. Upon accessing the server using a browser, the first page will display the list of files in the directory from which the server was started. More detailed information about setting up the server will be covered in a later chapter.



Directory listing for /

- fw_file.tgz
- nrc_version.json

Figure 2.1 Directory listing via a web browser

The directory contains 2 types of files:

***.tgz (*.tar.gz):**

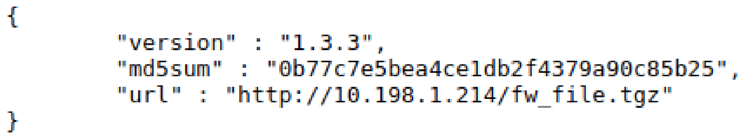
The files ending with the ‘.tgz (or .tar.gz)’ extension are firmware binaries. This contains

1. nrc.ko (Linux 802.11ah WIFI driver)
2. nrc_7292_cspi.bin (firmware to be uploaded to WIFI module)
3. nrc7292_bd.dat (WIFI board data)
4. cli_app (Client app used to control WIFI module)

nrc_version.json:

The json formatted version file consists following information:

1. the version identifier of the available firmware,
2. md5sum of firmware file. MD5 sum can be calculated by following instruction below.
   On MS Windows, do “certutil –hashfile <file> MD5”
   On Linux, do “md5sum <file>”
   On MAC OSX, “md5 <file>”
3. url where the firmware file is available.



```
{
        "version" : "1.3.3",
        "md5sum" : "0b77c7e5bea4ce1db2f4379a90c85b25",
        "url" : "http://10.198.1.214/fw_file.tgz"
}
```

Figure 2.2 An example JSON formatted firmware information file

3 FOTA Sample Procedure

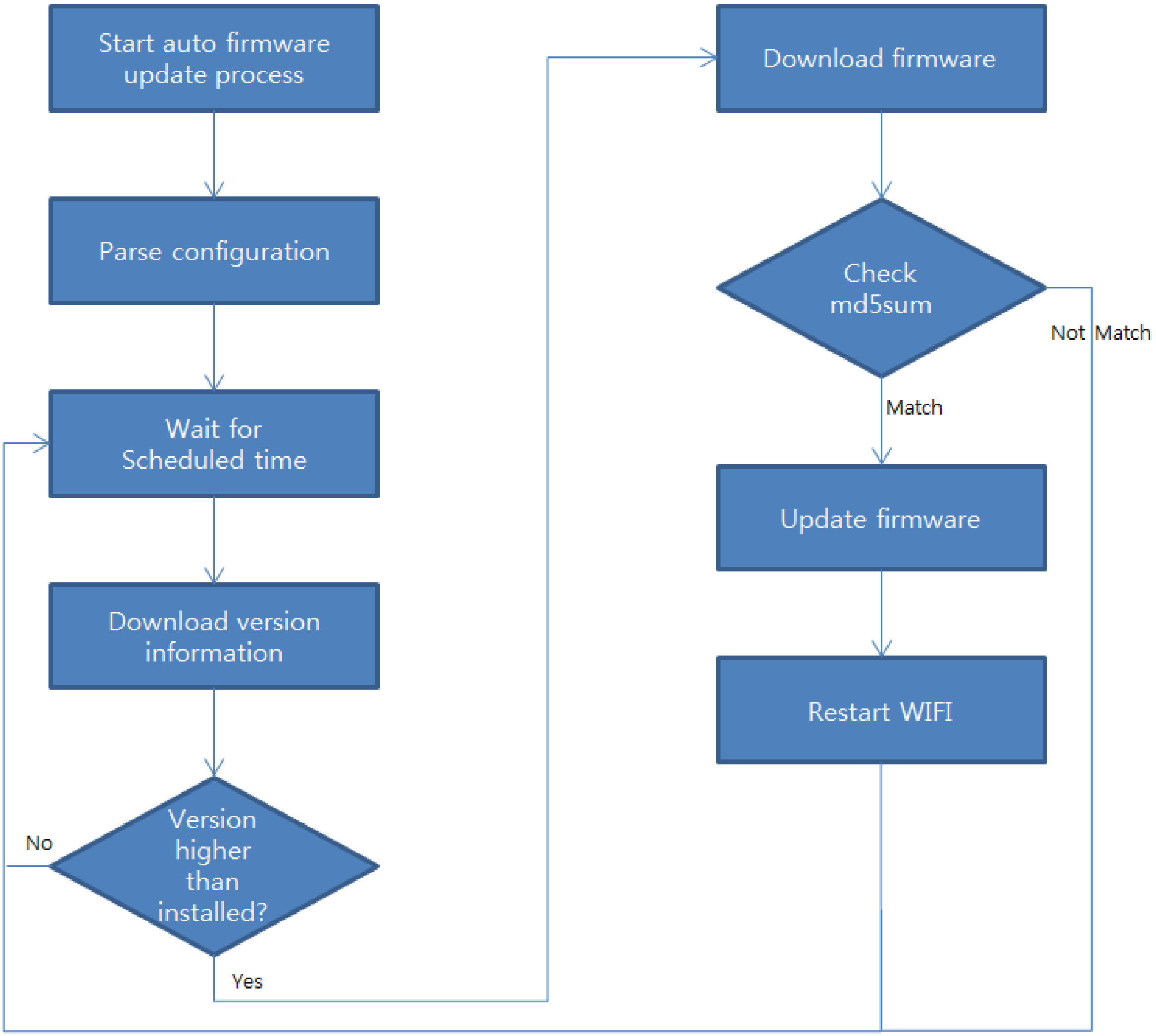


Figure 3.1 FOTA procedure in updater application

The diagram above shows the flowchart of the FOTA procedure. The module starts out by fetching the firmware version information from the HTTP server daily at user configured time. The firmware version information file contains information including the firmware version, the MD5 sum, and the URL where the firmware file is located. If the version extracted from the firmware server is higher than what is already installed on the device, it will start downloading new firmware package, then check the MD5 sum against the downloaded file and the "md5sum" value stored in the firmware information. When the firmware download completes without error, the newly downloaded firmware will be installed and restart WIFI service in the device.

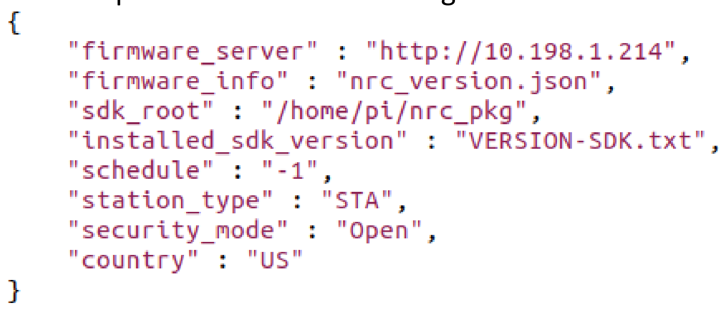
3.1 FOTA configuration

When starting FOTA service, it is required to prepare a configuration file. The configuration file is a JSON formatted with following information included.

Key	Value	Example
“firmware_server”	URL where the server is located	“http://10.198.1.214”
“firmware_info”	Firmware Version information file	“nrc_version.json”
“sdk_root”	Where the SDK is installed	“/home/pi/nrc_pkg”
“installed_sdk_version”	SDK version installed	“VERSION-SDK.txt”
“schedule”	Daily schedule 0.0 – 23.x. If “-1” is given, firmware updater will run once and exit.	“3.5” (indicates 3:30 AM)
“station_type”	Station or Access Point	“STA” or “AP”
“security_mode”	Security mode configured to start WIFI	“Open”, “WPA2-PSK”, “WPA3-OWE”, or “WPA3-SAE”
“country”	Country information	“US”, “KR”, “EU”, “JP”, TW”, or “CN”

Figure 3.2 FOTA Configuration

Below picture shows the example JSON formatted configuration file to start FOTA service.



```
{
    "firmware_server" : "http://10.198.1.214",
    "firmware_info" : "nrc_version.json",
    "sdk_root" : "/home/pi/nrc_pkg",
    "installed_sdk_version" : "VERSION-SDK.txt",
    "schedule" : "-1",
    "station_type" : "STA",
    "security_mode" : "Open",
    "country" : "US"
}
```

Figure 3.3 Example FOTA Configuration

3.2 Building nrc_fw_updater

Below are the steps required to build nrc_fw_updater.

Software dependencies

libcurl :

In order to install libcurl on Raspberry Pi

- sudo apt-get update
- sudo apt-get install libcurl4-openssl-dev

libcjson :

Since Raspbian OS doesn’t maintain cJSON library, it is necessary to build and install the library.

- Download cJSON source package from below link.
  wget https://github.com/DaveGamble/cJSON/archive/refs/tags/v1.7.15.tar.gz
- Extract the file
  tar –xzvf v1.7.15.tar.gz
- cd cJSON-1.7.15
- make all
- sudo make install (Note libcjson.so will be installed in /usr/local/lib directory)

Once above 2 software packages are install, follow below steps to build nrc_fw_updater.

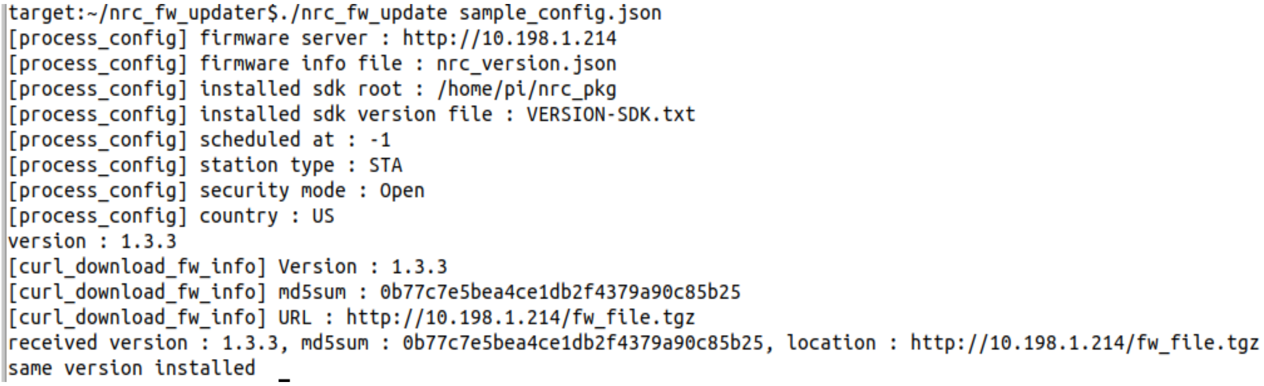
- cd nrc_fw_updater
- make

The application named “nrc_fw_updater” will be created at this point.

3.3 Starting nrc_fw_updater

One can start “nrc_fw_updater” by starting “nrc_fw_updater <config JSON file>.

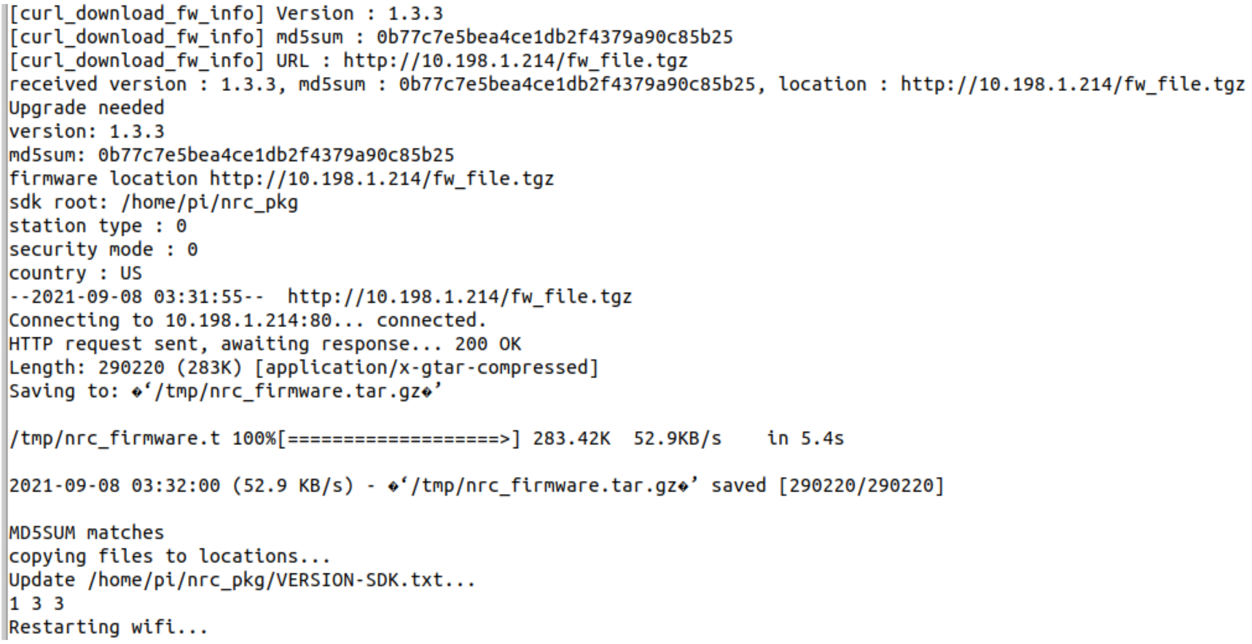
Below diagram shows example excution with scheduled time set to “-1” indicating that the updater needs to run once. Since the installed firmware version is the same as one available on the update server, the process exits without updating firmware.



```
target:~/nrc_fw_updater$./nrc_fw_update sample_config.json
[process_config] firmware server : http://10.198.1.214
[process_config] firmware info file : nrc_version.json
[process_config] installed sdk root : /home/pi/nrc_pkg
[process_config] installed sdk version file : VERSION-SDK.txt
[process_config] scheduled at : -1
[process_config] station type : STA
[process_config] security mode : Open
[process_config] country : US
version : 1.3.3
[curl_download_fw_info] Version : 1.3.3
[curl_download_fw_info] md5sum : 0b77c7e5bea4ce1db2f4379a90c85b25
[curl_download_fw_info] URL : http://10.198.1.214/fw_file.tgz
received version : 1.3.3, md5sum : 0b77c7e5bea4ce1db2f4379a90c85b25, location : http://10.198.1.214/fw_file.tgz
same version installed _
```

Figure 3.4 Example updater execution (no update)

If there is new firmware available, then it will download the firmware, update the device, and restart WIFI service. Below diagram shows that the update takes place.



```
[curl_download_fw_info] Version : 1.3.3
[curl_download_fw_info] md5sum : 0b77c7e5bea4ce1db2f4379a90c85b25
[curl_download_fw_info] URL : http://10.198.1.214/fw_file.tgz
received version : 1.3.3, md5sum : 0b77c7e5bea4ce1db2f4379a90c85b25, location : http://10.198.1.214/fw_file.tgz
Upgrade needed
version: 1.3.3
md5sum: 0b77c7e5bea4ce1db2f4379a90c85b25
firmware location http://10.198.1.214/fw_file.tgz
sdk root: /home/pi/nrc_pkg
station type : 0
security mode : 0
country : US
--2021-09-08 03:31:55--  http://10.198.1.214/fw_file.tgz
Connecting to 10.198.1.214:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 290220 (283K) [application/x-gtar-compressed]
Saving to: ◆‘/tmp/nrc_firmware.tar.gz◆’

/tmp/nrc_firmware.t 100%[===================>] 283.42K  52.9KB/s    in 5.4s

2021-09-08 03:32:00 (52.9 KB/s) - ◆‘/tmp/nrc_firmware.tar.gz◆’ saved [290220/290220]

MD5SUM matches
copying files to locations...
Update /home/pi/nrc_pkg/VERSION-SDK.txt...
1 3 3
Restarting wifi...
```

Figure 3.5 Example updater execution (update)

4 Revision history

Revision No	Date	Comments
Ver 1.0	09/07/2021	Initial version