
Getting Started Guide for ATWINC3400 Wi-Fi using SAM D21 Xplained Pro

USER GUIDE

Introduction

This getting started guide describes the Atmel® ATWINC3400 Wi-Fi® Network Controller to build state-of-the-art Internet of Things (IoT) applications. The guide explains hardware information and how to install Atmel Studio (IDE), compile examples, and download ATWINC3400 firmware.

The following topics will be covered:

- How to get Atmel Studio (IDE) and install it
- Update new ASF package
- Target board information
- How to get time client example project
- How to get log message
- How to download firmware and certificate

Prerequisites

- Hardware Prerequisites
 - Atmel SAM D21 Xplained Pro Evaluation Kit
 - Atmel ATWINC3400-XPRO extension board
 - Atmel IO1 extension board
 - Micro-USB cable (Micro-A / Micro-B)
- Software Prerequisites
 - Atmel Studio 7.0
 - Time client example project source code



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1 Icon Key Identifiers



INFO Delivers contextual information about a specific topic.



TIP Highlights useful tips and techniques.



TO DO Highlights objectives to be completed.



RESULT Highlights the expected result of an assignment step.



WARNING Indicates important information.



EXECUTE Highlights actions to be executed out of the target.

2 Getting Started with Atmel Studio

2.1 Download and Install Atmel Studio 7.0

Atmel Studio is the integrated development platform (IDP) for developing and debugging Atmel ARM® Cortex®-M and Atmel AVR® microcontroller (MCU) based applications. The Atmel Studio 7.0 IDP gives you a seamless and easy-to-use environment to write, build, and debug your applications written in C/C++ or assembly code.

Atmel Studio 7.0 is now available, adding advanced debugging features such as Data and Interrupt Trace, improved RTOS integration, and better ability to debug code that has been optimized.

With the introduction of Atmel Gallery and Atmel Spaces, Atmel Studio 7.0 further simplifies embedded MCU designs to reduce development time and cost. Atmel Gallery is an online apps store for development tools and embedded software. Atmel Spaces is a cloud-based collaborative development workspace allowing you to host software and hardware projects targeting Atmel MCUs.

Download and install Atmel Studio 7.0 from <http://www.atmel.com/tools/ATMELSTUDIO.aspx>.



You can find the installed directory: C:\Program Files(x86)\Atmel\Atmel Studio 7.0.

2.2 Download and Install the Latest ASF

Atmel Studio 7.0 is free of charge and is integrated with the Atmel Software Framework (ASF) — a large library of free source code with 1,600 ARM and AVR project examples. ASF strengthens the IDP by providing, in the same environment, access to ready-to-use code that minimizes much of the low-level design required for projects. Use the IDP for our wide variety of AVR and ARM Cortex-M processor-based MCUs, including our broadened portfolio of Atmel SAM3 ARM Cortex-M3 and M4 Flash devices.

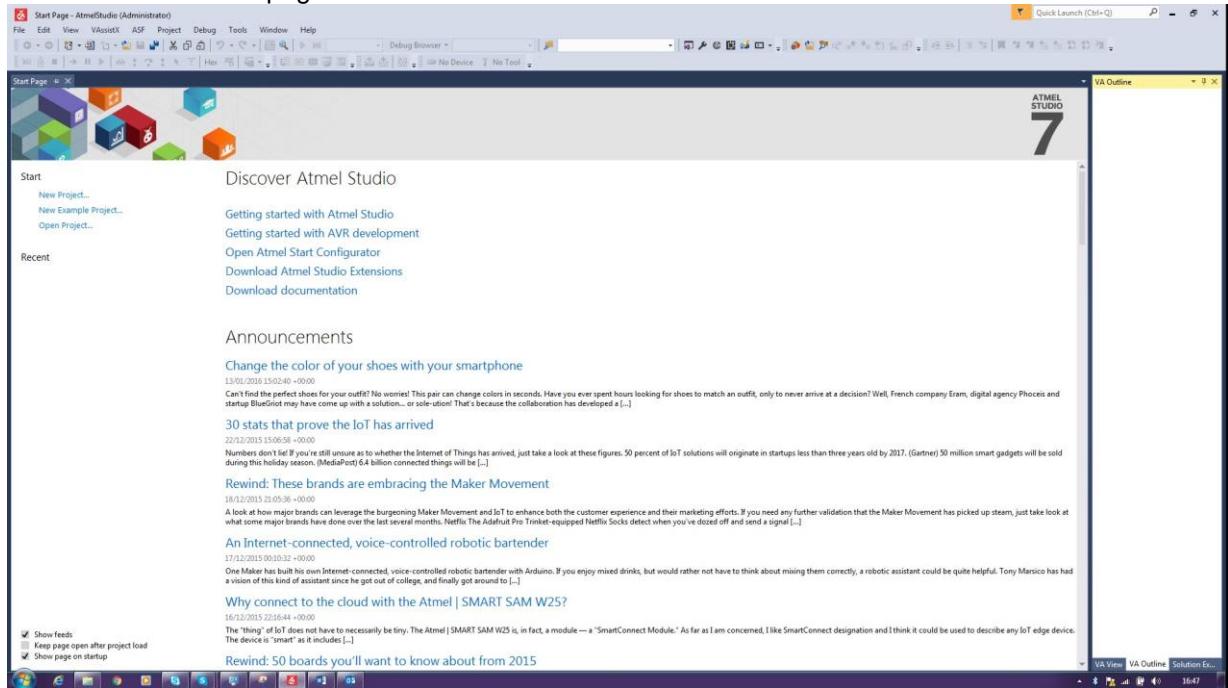
If the ASF version in your Atmel Studio is not the latest one you will be notified when Atmel Studio starts. The following procedure demonstrates how to update the ASF to the latest version. You can install other extensions in the list as well.

2.2.1 How to Update Atmel Studio to the Latest Version

1. Run Atmel Studio 7.0.

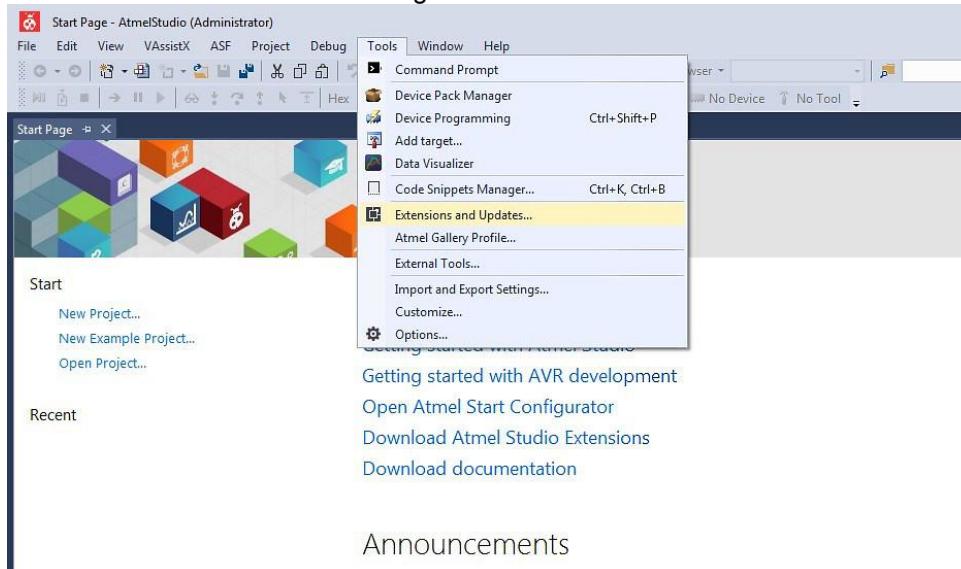


2. You can see the start page of Atmel Studio 7.0.



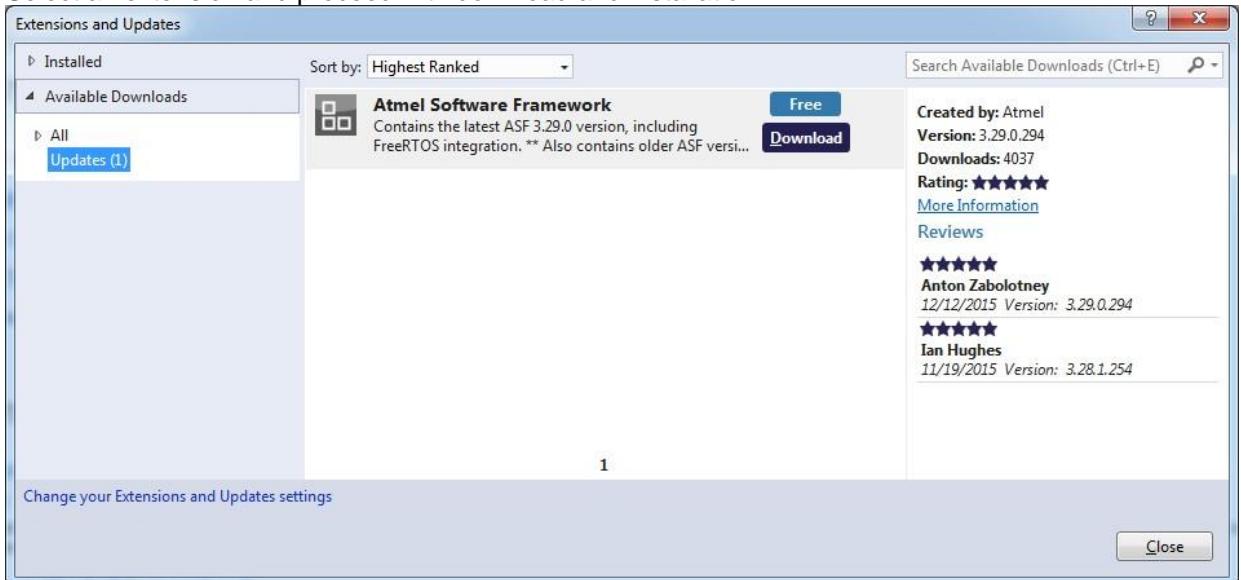
Update ASF to the latest version.

Menu → Tools → Extension Manager



Available Downloads → Updates → Atmel Software Framework

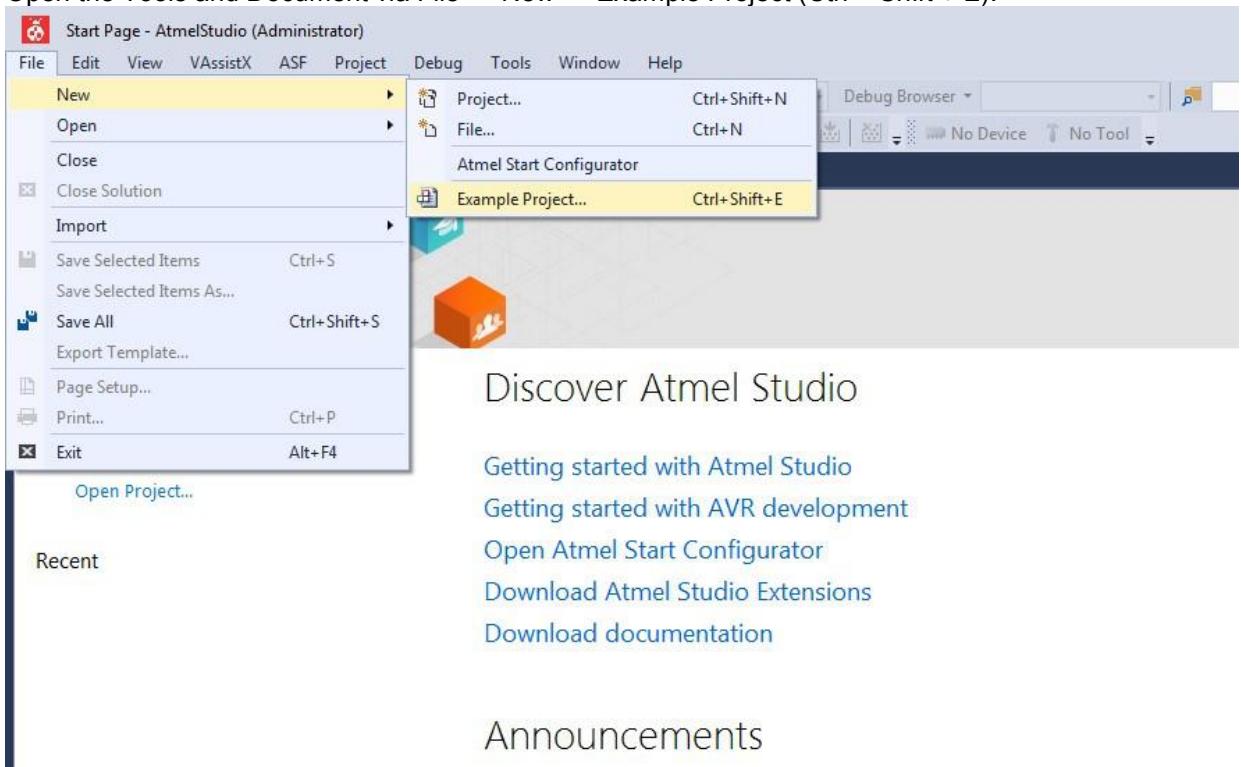
Select an extension and proceed with download and installation:



TIPS

Restart Atmel Studio to take effect of the newly installed extension.

3. Restart Atmel Studio.
4. Open the Tools and Document via File → New → Example Project (Ctrl + Shift + E).

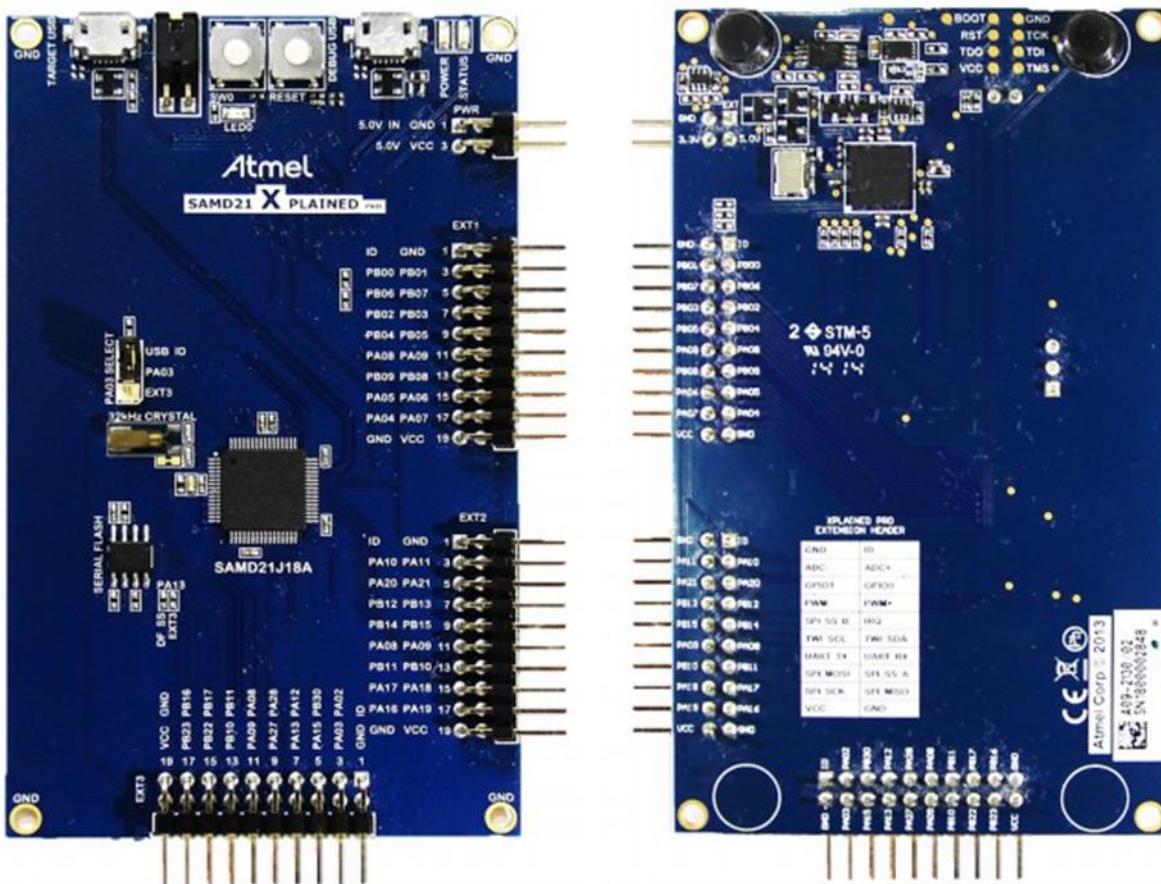


3 Getting Started with Atmel Hardware

This chapter introduces Atmel Evaluation Kits for testing IoT applications. The SAM D21 and the ATWINC3400 are essential but the IO1 and the OLED1 extension boards are optional.

3.1 Atmel SMART SAMD21-XPRO Evaluation Kit

The Atmel SAM D21 Xplained Pro evaluation kit is ideal for evaluating and prototyping with the Atmel SAM D21 ARM Cortex-M0+ based microcontrollers. Extension boards to the SAM D21 Xplained Pro can be purchased individually.



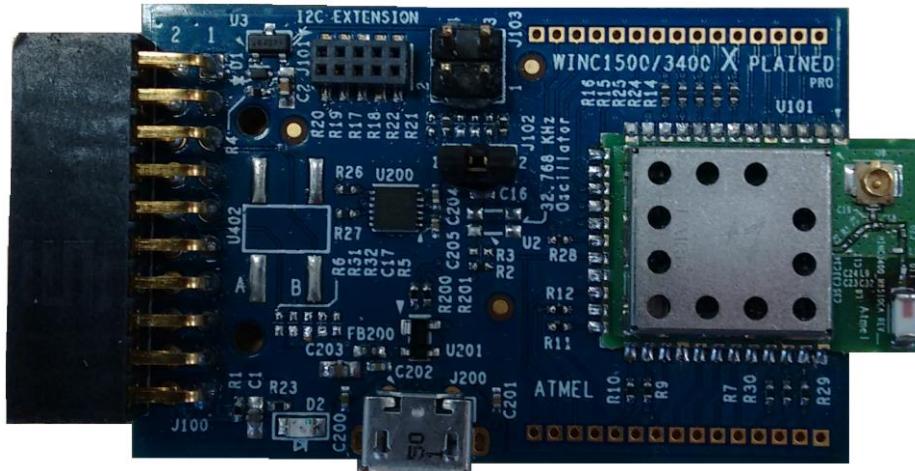
- SAMD21J18A microcontroller
- One mechanical reset button
- One mechanical user pushbutton (wake-up, bootloader entry, or general purpose)
- One yellow user LED
- 32.768kHz crystal
- USB interface, device and reduced host mode
- 8Mb Serial Flash
- Three Xplained Pro extension headers
- Embedded Debugger
 - Auto-ID for board identification in Atmel Studio 7.0
 - One yellow status LED

- One green board power LED
- Symbolic debug of complex data types including scope information
- Programming and debugging
- Data Gateway Interface: SPI, I²C, four GPIOs
- Virtual COM port (CDC)
- USB powered
- Supported with application examples in Atmel Software Framework

More detailed information about SAM D21: <http://www.atmel.com/tools/atsamd21-xpro.aspx>

3.2 Atmel SmartConnect ATWINC3400-XPRO Wi-Fi Extension Board

Atmel SmartConnect ATWINC3400 is an IEEE® 802.11 b/g/n IOT network controller SoC. It is the ideal add-on to existing MCU solutions bringing Wi-Fi and Network capabilities through SPI-to-Wi-Fi interface. The ATWINC3400 connects to any Atmel AVR or SMART MCU with minimal resource requirements. The ATWINC3400 most advanced mode is a single stream 1x1 802.11n mode providing up to 72Mbps PHY throughput. ATWINC3400 features fully integrated Power Amplifier, LNA, Switch, and Power Management. The ATWINC3400 provides internal Flash memory as well as multiple peripheral interfaces including UART, SPI, and I²C. The only external clock source needed for the ATWINC3400 is a high-speed crystal or oscillator with a wide variety of reference clock frequencies supported (between 12 – 32MHz). The ATWINC3400 is available in a QFN package.



- IEEE 802.11 b/g/n (1x1) for up to 72Mbps
- BLE Provisioning
- Integrated PA and T/R Switch
- Superior sensitivity and range via advanced PHY signal processing
- Wi-Fi Direct®, station mode, and Soft-AP support
- Supports IEEE 802.11 WEP, WPA2 Security Enterprise
- On-chip memory management engine to reduce host load
- 8Mb internal Flash memory with OTA firmware upgrade
- SPI as host interfaces
- TCP/IP protocol stack (client/server) sockets applications
- Network protocols (DHCP/DNS)

- Secure TLS stack
- WSC (wireless simple configuration WPS)
- On-Chip Network Stack to offload MCU
 - Integrated Network IP stack to minimize host MCU requirements
 - Network features: TCP, UDP, DHCP, ARP, HTTP, SSL, and DNS

More detailed information about ATWINC3400: <http://www.atmel.com/devices/ATWINC3400.aspx>

3.3 Atmel IO1-XPRO Sensor Extension Board

Atmel IO1 Xplained Pro extension board is a generic extension board for the Xplained Pro platform. It connects to any Xplained Pro standard extension header on any Xplained Pro MCU board. The extension board utilizes all functions on the standard Xplained Pro extension header to further enhance the feature set of Xplained Pro MCU boards.



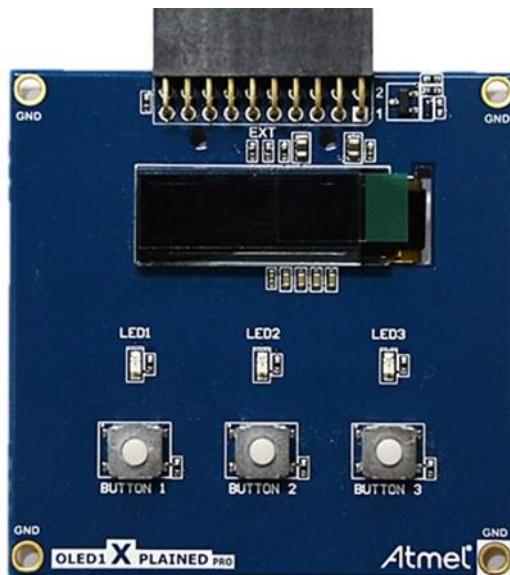
- microSD card connector
 - 2GB microSD card included
 - Accessed with SPI interface
- PWM
 - LED control
 - PWM → Low pass filter → ADC
- ADC
 - PWM → Low pass filter → ADC
 - Light sensor
- UART
 - Loopback interface via pin header
- TWI
 - AT30TSE758 Temperature sensor with EEPROM
- Xplained Pro hardware identification system

More detailed information about AT IO1:

http://www.atmel.com/images/atmel-42078-io1-xplained-pro_user-guide.pdf

3.4 Atmel OLED1-XPRO Display Extension Board

Atmel OLED1 Xplained Pro is an extension board to the Atmel Xplained Pro evaluation platform. The board enables the user to experiment with user interface applications with buttons, LEDs, and a display.

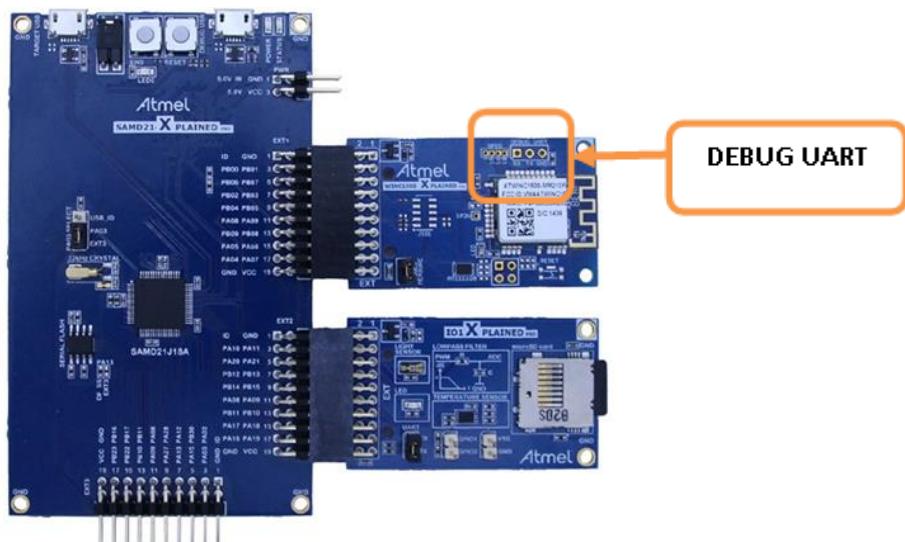


- UG-2832HSWEG04 monochrome OLED display
 - 128 x 32 pixels
 - Controlled by 4-wire SPI interface, up to 100MHz
- Three LEDs
- Three mechanical push buttons
- Xplained Pro hardware identification system

More detailed information about Atmel OLED1 Xplained Pro:

http://www.atmel.com/images/atmel-42077-oled1-xplained-pro_user-guide.pdf

4 How to Debug ATWINC3400 Wi-Fi Firmware



ATWINC3400 Xplained Pro board provides UART interface for debugging. You can connect the ATWINC3400 XPRO board to your PC using a USB-to-Serial device and a debug USB connector to get firmware debug information.

Open the ATWINC3400 DEBUG USB serial COM port, with the following settings:

- 460800 baud
- 8-bit data
- No parity
- One stop bit
- DTR/DSR flow control

Open a serial terminal tool to see the result. (ATWINC3400 Wi-Fi Firmware Debug information.)

5 How to Download New ATWINC3400 Firmware

5.1 Download Firmware

This section demonstrates the use of the ATWINC3400 with the SAM D21 Xplained Pro board to upgrade firmware of the ATWINC3400 Wi-Fi module. This is a basic operation to download firmware. It uses the following hardware:

- The SAM D21 Xplained Pro
- The ATWINC3400-XPRO on EXT1 header

Connect the SAM D21 (DEBUG USB PORT) to the USB port on your PC.



WARNING

Do not connect SAM D21 VIRTUAL COM PORT via terminal program.



STEP1: Build the Serial Bridge application on the SAM D21 Board.

1. Open “samd21_xplained_pro_serial_bridge” project located under src\Tools\ from the release package. This project supports serial bridge function on SAM D21.
2. Build the program.

STEP2: Firmware update to the ATWINC3400 Board.

1. Launch the following batch file from the release package.
 \src\download_all_sb_samd21_explained_pro.bat



RESULT

SUCCESS firmware download. The following information will be displayed on the command window.



RESULT

FAILED firmware download. The following information will be displayed on the command window.

```

SAMD21 flashing script: please connect edbg and power up the board.
Firmware check OK
Chiperase completed successfully
Firmware check OK
Programming completed successfully.
Mode UART
Can not find image_builder path...
Downloading Image...
*****
* >Programmer for WINC3400 SPI Flash<      *
*       Owner: Atmel Corporation           *
*****
2B0 Path ../../firmware/m2m_aio_2b0.bin
3A0 Path ../../firmware/m2m_aio_3a0.bin
3400 Path ../../firmware/m2m_aio_3400.bin
>>Init Programmer
Detecting ports...
EDBG Virtual COM Port (COM37)
(APP)(ERR)[nm_bus_port_detect][567]Failed to find any COM ports
0 of ports found
(Err)Failed To intilize programmer
Fail
#####
##          ######   ###   #####  ##
##          ##       ## ##  ##   ##
##          ##       ## ##  ##   ##
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##          #####   ##   ##  ##   ##
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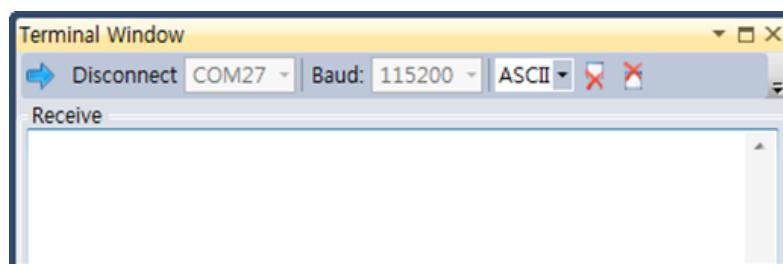
```

If you see a failed message, you must check if your device is assembled correctly.



WARNING

You must check the terminal program. Do not connect SAM D21 VIRTUAL COM PORT via terminal program.



Power cycle the board and retry firmware download again.

6 Getting Started with ATWINC3400 IoT Examples

This chapter introduces ATWINC3400 IoT examples and describes how to run an example on the SAM D21 board.

6.1 Organization of ATWINC3400 IoT Examples

All these examples are included in the ASF package and there are various IoT examples using Wi-Fi module.

6.1.1 Basic Examples

These examples describe basic Wi-Fi operation in ‘how-to’ manner:

- How to read chip ID (to identify ATWINC3400 H/W revision)
- How to set debug message level
- How to get MAC address of the Wi-Fi module
- How to start Wi-Fi in specific operation mode, such as:
 - STA Mode (Station Mode), and AP mode (Access Point mode)
- How to switch mode among STA, and AP modes during the runtime
- How to scan APs nearby
- How to set deep sleep mode
- How to connect to secure Wi-Fi with using WEP/WPA/WPA2 security
- How to connect to enterprise security network
- How to connect to security WPS
- How to get RF signal status by reading RSSI value
- How to set AP provision
- How to set HTTP provision

6.1.2 Protocol Examples

After basic code examples, the user may be interested in how to send and receive network packets. Here are protocol examples that can be extended for IoT application.

- UDP protocol example
- TCP protocol example
- NTP Time client – retrieve network time for IoT application
- MQTT protocol client example
- Send email – send an email from SMTP server
- Location client – get the current location of the network provider using HTTP

6.1.3 Advanced Examples

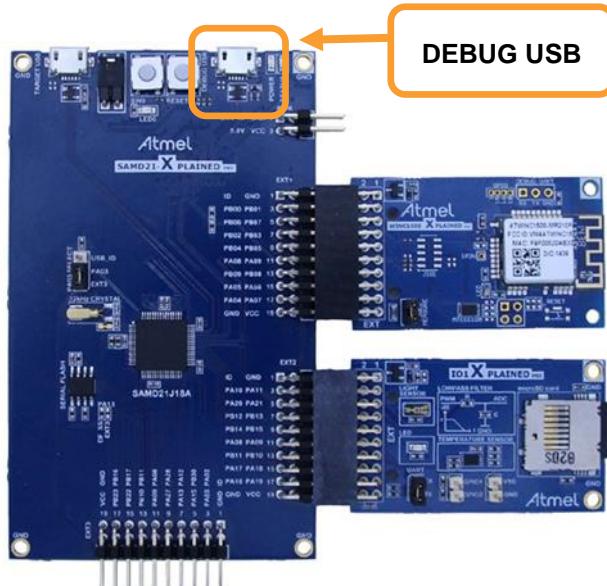
These examples demonstrate more complex functions like:

- Growl client – demonstrates using RESTful API over SSL (essential for IoT application)
- MQTT Chat client – demonstrate how to send and receive IoT information using MQTT protocol
- Time client – get the current time information of the network provider
- Wi-Fi serial - useful for chatting or controlling a remote device
- OTA Firmware Upgrade – ATWINC3400 Firmware upgrade via OTA server
- SSL connection - Set up an SSL connection

6.2 Connect the Board

Connect the ATWINC3400 Wi-Fi module to the SAM D21 as shown in the figure below.

The ATWINC3400 Wi-Fi module comes with a Wi-Fi software API. The purpose of this API is to provide an abstraction of the binary protocol used between the host processor and the ATWINC3400 Wi-Fi module while keeping an easy and reliable solution to add wireless capabilities to any user application. This software is based on the Atmel Software Framework (ASF) and is configured to use an ATWINC3400 Wi-Fi module on EXT1 by default. Note that switching to another extension port (EXT2 or EXT3) is possible by modifying a configuration file.

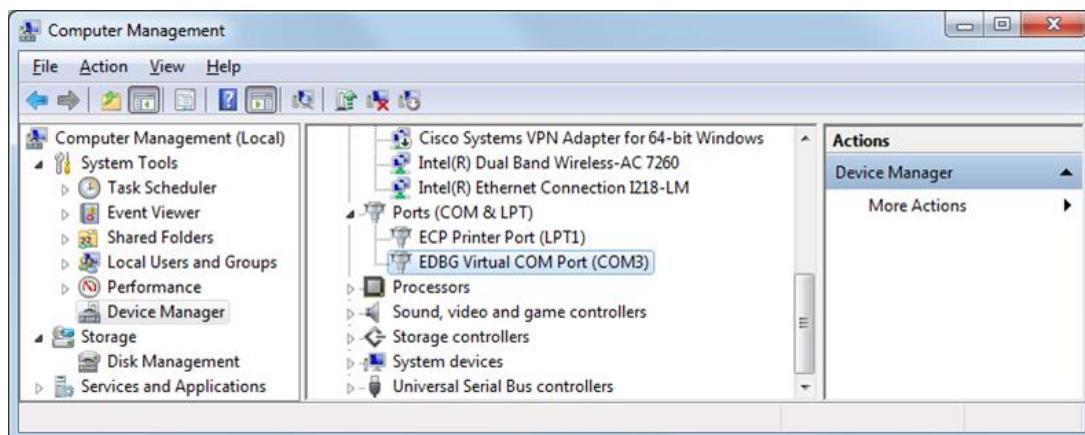


WARNING

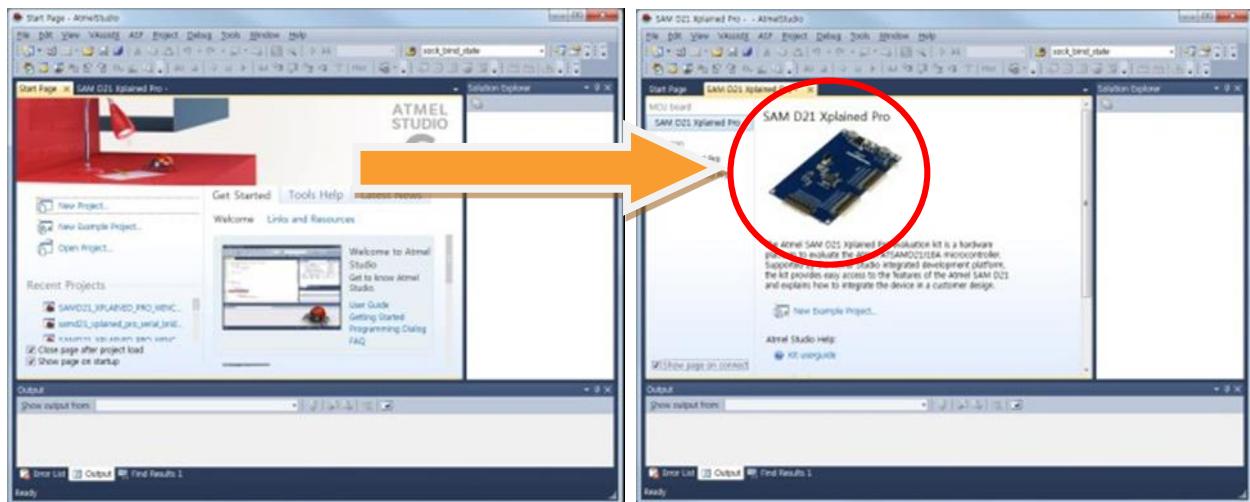
Connecting several ATWINC3400 Wi-Fi modules is possible but not supported by the provided Wi-Fi Software API.

For this getting start guide the ATWINC3400 Wi-Fi module will remain connected on EXT1.

Connect the DEBUG USB port on the SAM D21 to your PC using a Micro-USB cable. The SAM D21 will be visible in the Windows® Device Manager with its COM port.



Atmel Studio may detect your device automatically and show a proper page.



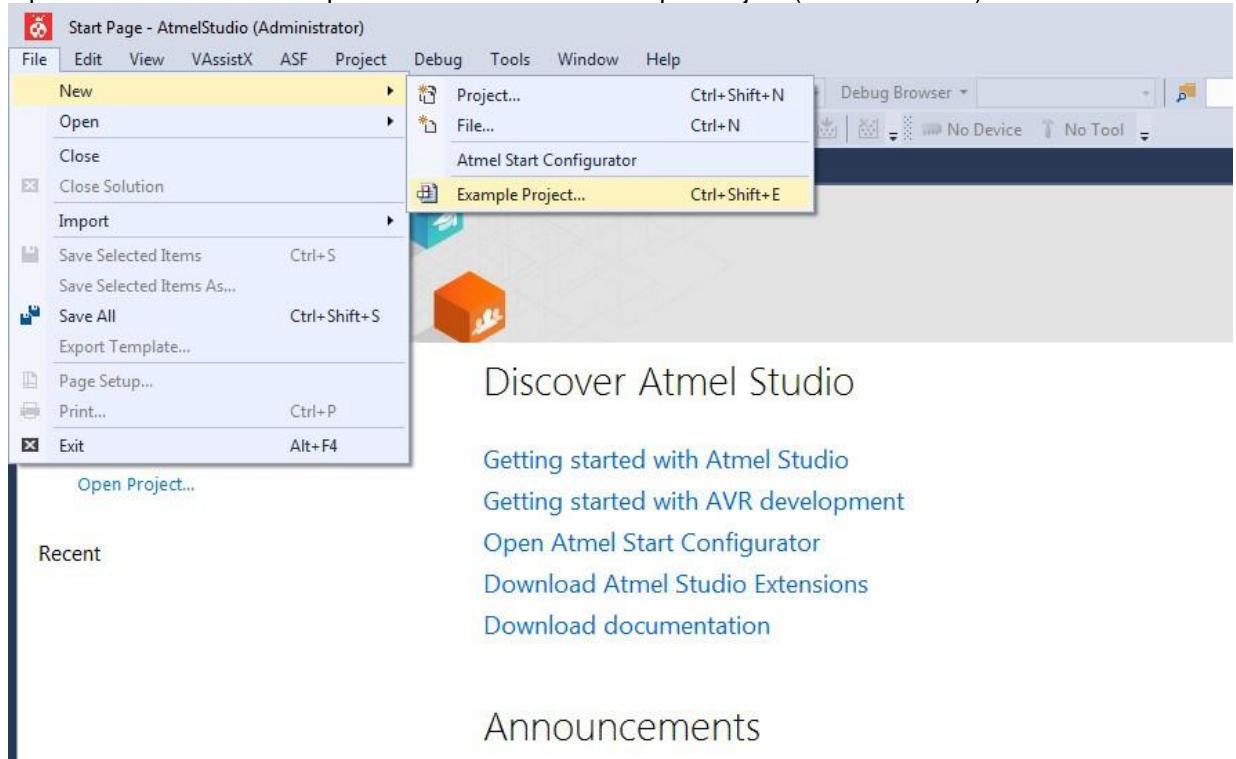
6.3 How to Get Time Client Example Project

This example demonstrates the use of the ATWINC3400 with the SAM D21 Xplained Pro board to receive time information from a time server. It uses the following hardware:

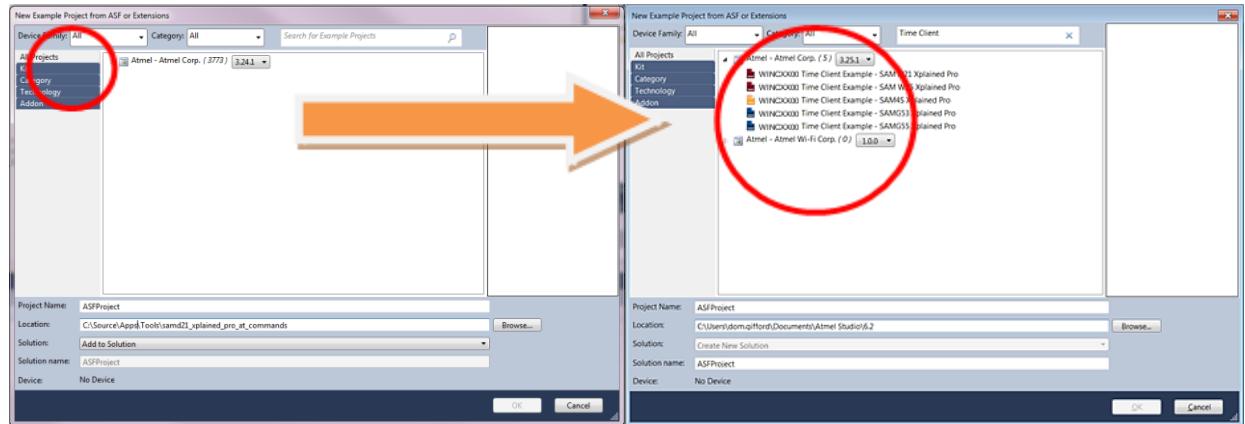
- The SAM D21 Xplained Pro
- The ATWINC3400 on EXT1 header
- The IO1 on EXT2 header
- A wireless access point
- A mobile device (for provisioning)



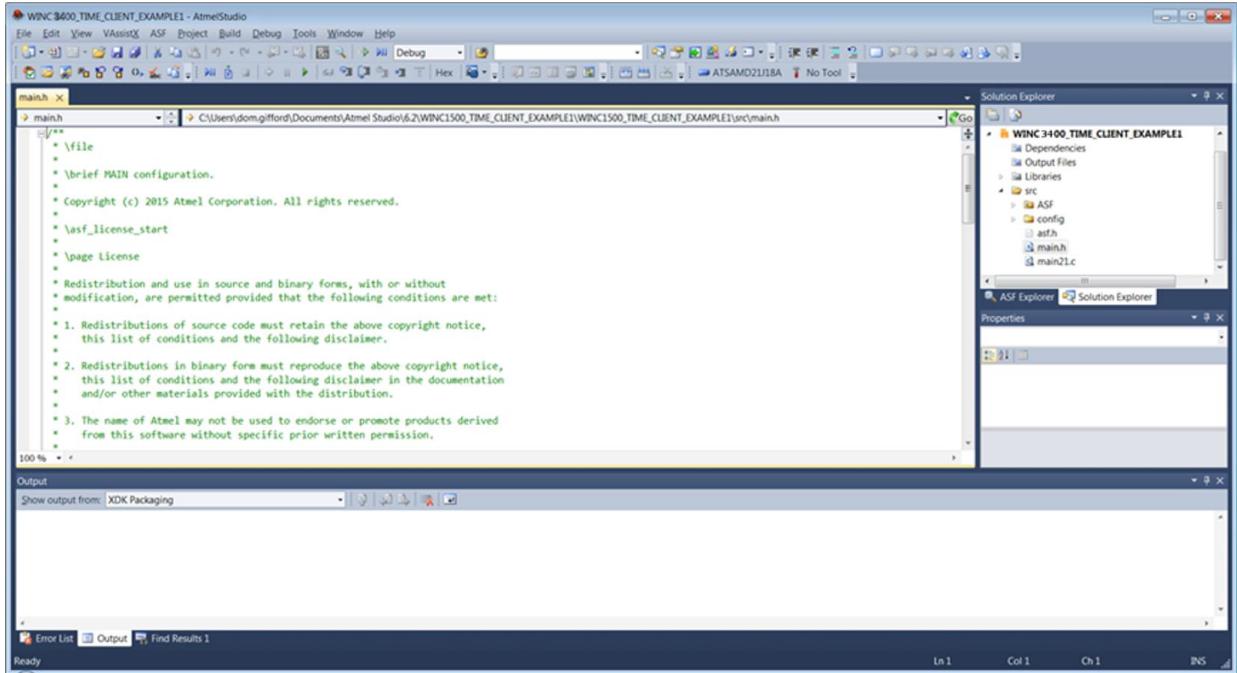
1. Open the Time client example via File → New → Example Project (Ctrl + Shift + E).



Input “Time Client” in the search window then you can find an example named like “WINC3400 Time Client Example – SAM D21 Xplained Pro”.



- Press the OK button then Atmel Studio will bring over the project source code of the example.



- Open the "main.h" file and edit the MAIN_WLAN_SSID, MAIN_WLAN_AUTH and MAIN_WLAN_PSK to reflect your own AP settings.

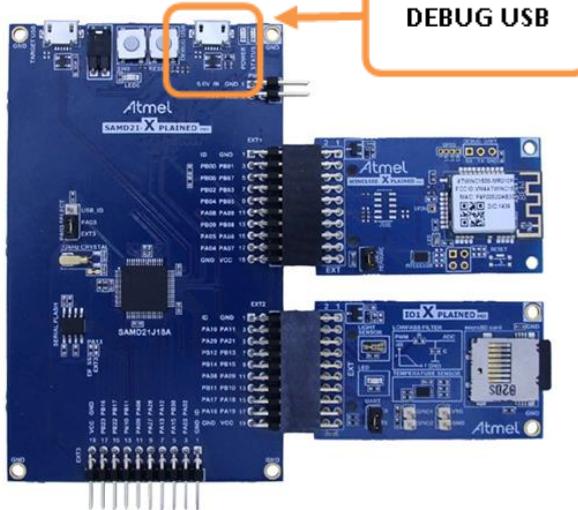
6.4 How to Build and Execute

This guide demonstrates how to build an example and execute it on the SAM D21 Xplained Pro.

- Build the solution (F7) and ensure you get no errors.



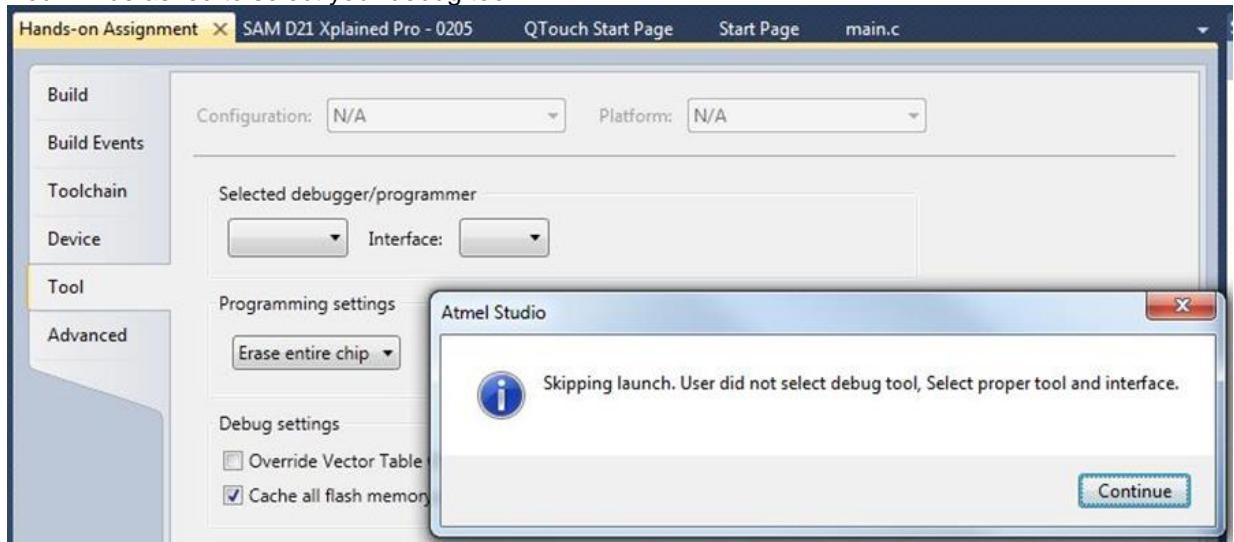
- Connect the ATWINC3400 Wi-Fi extension and the IO1 extension to the SAM D21 Xplained Pro as displayed below:



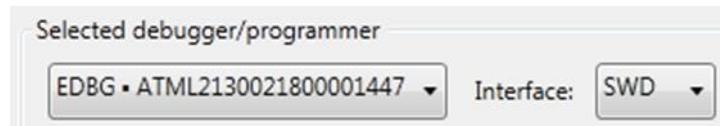
- Connect the SAM D21 Xplained Pro board to your PC using DEBUG USB connector.
- Program the application by clicking on the Start Debugging and Break icon.



5. You will be asked to select your debug tool:



6. Select EDBG and SWD (Serial Wire Debug) as Interface and increase the SWD clock frequency to 12MHz.



7. Click again on the Start Debugging and Break icon:

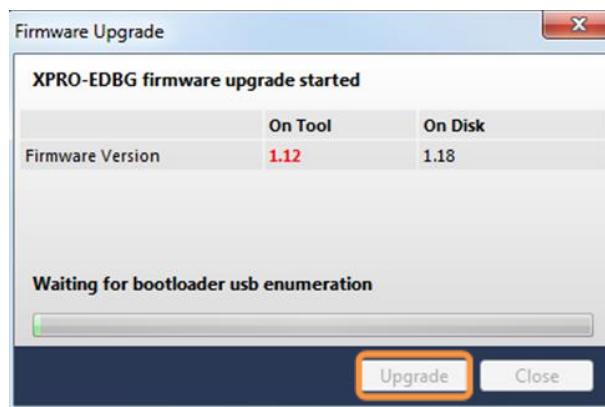


8. The application will be programmed in the SAM D21 embedded flash and breaks at main function. Click on continue to execute the application:



RESULT

You may be asked to upgrade your EDBG firmware. If so, click on Upgrade button:



WARNING

Upgrade operation may take a few minutes, wait for the operation to complete.



RESULT

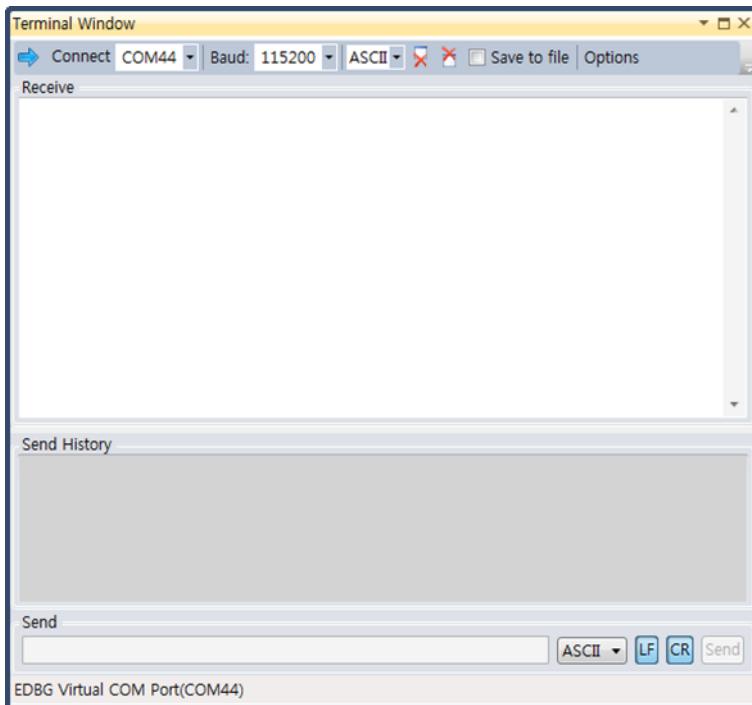
The example is now programmed and running.

Open the SAM D21 EDBG DEBUG USB serial COM port, with the following settings:

- 115200 bauds
- 8-bit data
- No parity
- One stop bit
- DTR/DSR flow control

Open a serial terminal tool to see the result. You can use your preferred serial terminal, such as PuTTY, TeraTerm, etc. You can also use terminal window plug-in in Atmel studio. You can install it through below menu. (Menu → Tools → Extension Manager.)

Connect to the device.



RESULT

The following information will be displayed on the terminal window.

```
-- WINC3400 time client example --
-- SAMD21_XPLAINED_PRO --
-- Compiled: XXX XX XXXX XX:XX:XX --
(APP)(INFO)Chip ID 3400d0
(APP)(INFO)Firmware ver    : X.X.X
wifi_cb: M2M_WIFI_RESP_CON_STATE_CHANGED: CONNECTED
wifi_cb: M2M_WIFI_REQ_DHCP_CONF: IP is XXX.XXX.XXX.XXX
(APP)(INFO)1 Socket 7 session ID = 1
resolve_cb: DomainName pool.ntp.org.
socket_cb: The GMT time is 11:34:50
```

7 Conclusion

This document explained essential parts of the evaluation kit and an example of use of the Atmel ATWINC3400 Wi-Fi module.

The following topics have been covered:

- How to get Atmel Studio (IDE) and install it
- Update new ASF package
- Target board information
- How to get time client example project
- How to update firmware and getting log message

You have seen how to use the ATWINC3400 Wi-Fi module and manage module software up-to-date. It is an essential part of utilizing the other ATWINC3400 resources.

8 Revision History

Doc Rev.	Date	Comments
42640A	02/2016	Initial document release.



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