WF121: 802.11 b/g/n module

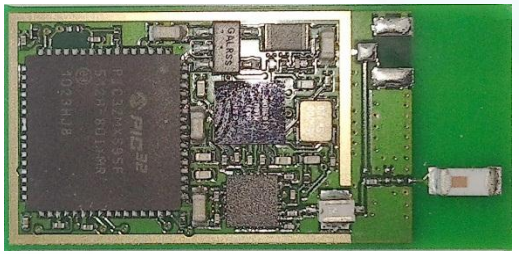
Product Presentation

Topics

- Key features
- Benefits
- WF121 overview
- The Wi-Fi software stack
- Evaluation tools
- Certifications
- Use cases

Key features

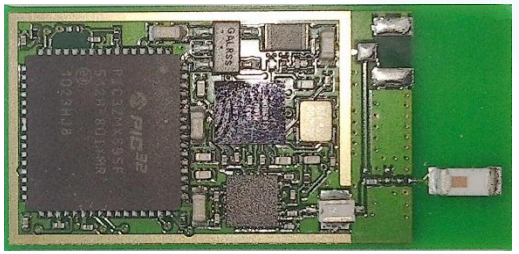
WF121: Key features



- **802.11 b/g/n compliant**
  - 2.4GHz single spatial stream
  - Physical rate up to 72.2Mbps
  - Client and soft AP modes
  - Wi-Fi direct support
- **Radio performance**
  - Transmit power: +18 dBm
  - Receiver sensitivity: - 88dBm
- **Integrated Wi-Fi drivers and TCP/IP stack**
  - IP, TCP, UDP
  - DHCP
- **Flexible host interfaces**
  - USB on-the-go, 20Mbps UART and 40Mbps SPI
- **Flexible development options**
  - BGLib™ binary based host API
  - BGScript™ scripting language support
  - Native applications development for the 32-bit processor
- **Wi-Fi, CE, FCC and IC and Telec qualified**

Benefits

WF121: Benefits



- **Fully integrated 802.11 solution with TCP/IP**
  - Lower cost
  - Faster time to market
- **Application hosting capabilities**
  - All application code can be executed on the WF121
  - Simple and fast implementation
  - Lower cost
- **Flash based**
  - Firmware is on-the-field upgradable
  - Application data can be stored on the flash
  - Settings can be stored on the flash
- **Good radio performance**
  - Long lange and robust connections
  - Programmable TX power
- **Fully qualified**
  - Proven interoperability
  - No qualification costs

WF121 overview

WF121: Radio

- **2.4GHz, 802.11 b/g/n Single spatial stream**

- **Operating freq. (ISM):**
  2402 – 2480 MHz

- **Data rates:**
  IEEE 802.11n : 72.2, 65, 58.5, 57.8, 52, 43.3, 39, 28.9, 26, 21.7, 19.5, 14.4, 13, 7.2, 6.5Mbps
  IEEE 802.11g : 54, 48, 36, 24, 18, 12, 9, 6Mbps
  IEEE 802.11b : 11, 5.5, 2, 1Mbps

- **Channels:**

North America:	11 channels
Europe:	13 channels
Japan:	14 channels CCK, 13 channels OFDM

- **Quality-of-Service:**
  WMM, WMM Power Save (WMM-PS)
  IEEE 802.11e (including Admission Control)
  Dynamic Power Saving

WF121: Radio

- **Operating freq. (ISM):** 2400 – 2497 MHz
- **TX power:** +18 dBm
- **RX sensitivity:** -88 dBm
- **Modulation methods:** CCK
  DSSS
  OFDM
  BPSK
  QPSK
  16-QAM
  64-QAM

WF121: Interfaces

Host interfaces

- 20 Mbps UART with flow contol or
- 40 Mbps SPI interface
- Full-speed USB on-the-go

Radio co-existence interfaces

- 3-wire Unity 3
- 3-wire Unity 3e+
- 4-wire Unity 4

Programming & Debug

- 802.11 debug SPI
- MCU debug and programming

WF121: Interfaces

Ethernet

- 10/100Mbps RMII interface

Peripheral interfaces

- Up to: 2 x I2C / SPI
- Up to: 2 x UART
- Up to:10 x AIO (10-bit ADC)
  1Msps

Configurable GPIO ports

- Configurable IO ports (wake-up, sleep etc.)

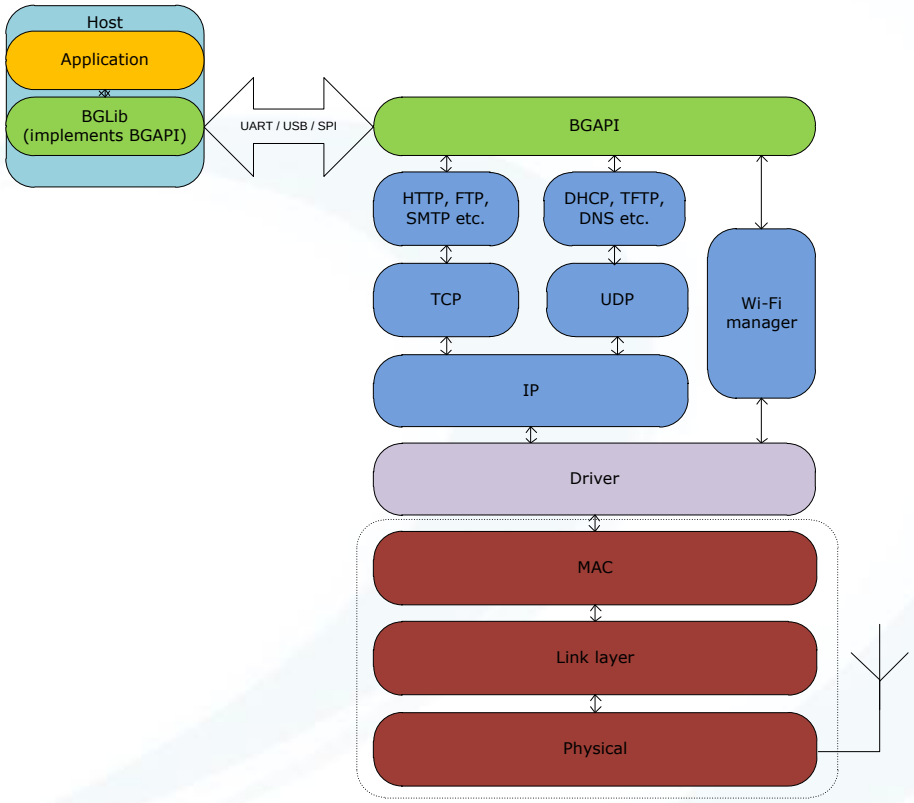
WF121: Microcontroller

- **Architecture:** PIC32
80MHz
1.56 DMIPS/MHz
- **SRAM:** 128kB
- **Flash:** 512kB

The Wi-Fi® software stack

The Wi-Fi software stack

- **Implements the following layers**
  - 802.11 interface driver
  - IPv4 compatible TCP/IP stack
  - TCP and UDP
  - DHCP
- **Implements the following clients and servers**
  - TCP client/server
  - UDP client/server
  - DHCP client
- **Security**
  - WEP
  - WPA
  - WPA2
- **Flexible host interface**
  - BGAPI: Binary protocol over UART, USB or SPI
  - BGLib: ANSI C library for host processors
- **On-module applications**
  - BGScript™ : simple scripting language
  - Object code availability for ANSI C development
  - **No host needed**



The Wi-Fi software stack

BGAPI
- A binary API between the host and the stack

DHCP, TFTP, DNS
- UDP based application protocols

HTTP, FTP, SMTP
- TCP based application protocols

Wi-Fi manager
- Connections, settings, security, scanning

UDP
- User Datagram Protocol
- A connection less data transmission protocol

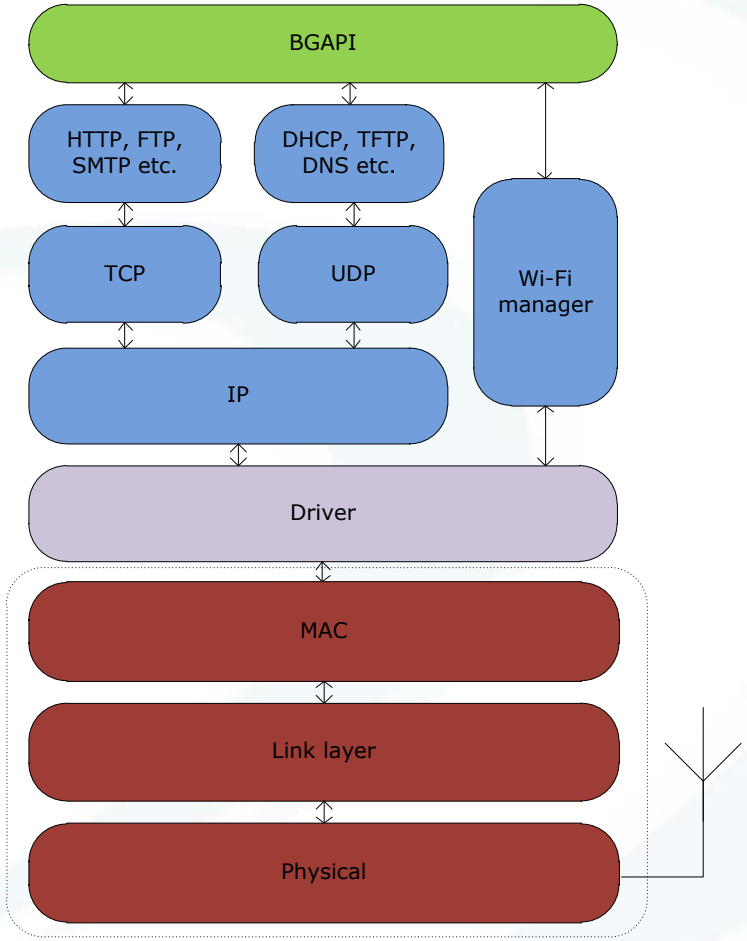
TCP
- Transmission Control Protocol
- Connection oriented data trasfer

IP
- Internet Protocol
- Transmission and reception of IP packets

MAC
- 802.11 Media Access Control

Link layer
- Packets and radio control

Physical layer
- Transmission/reception of bits

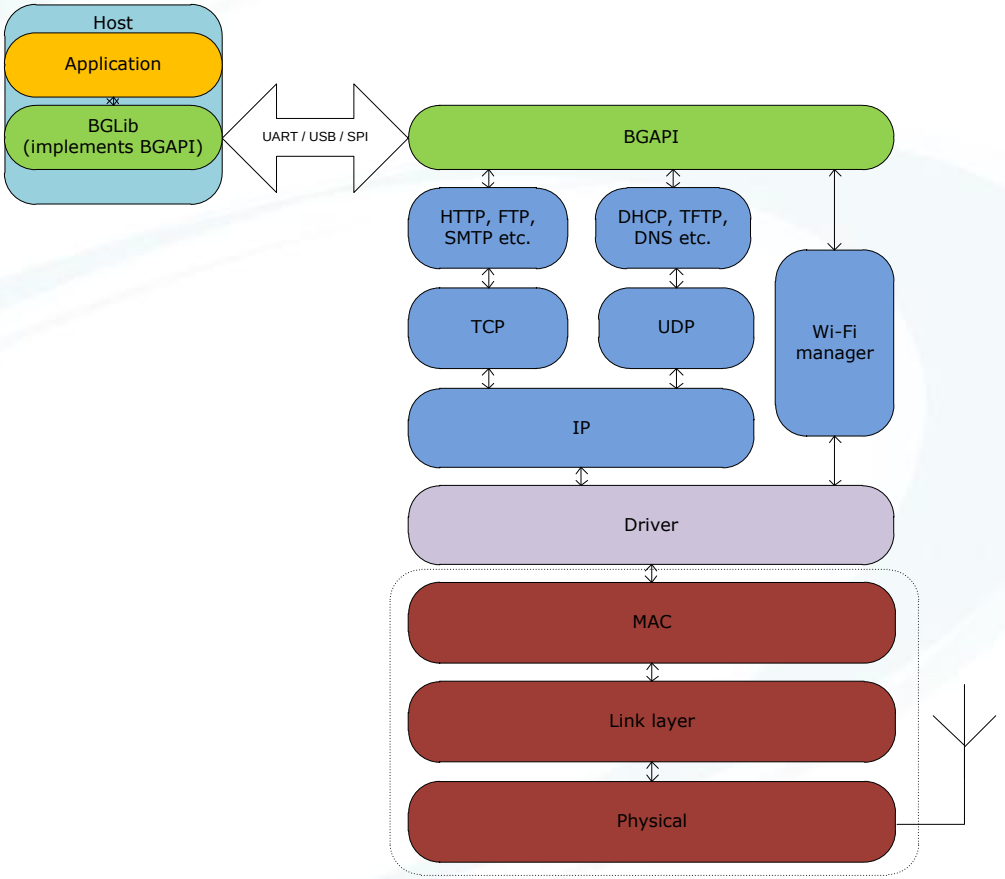


BGAPI protocol

- A binary command, response and event protocol between the host and the stack
- Small size requirement and low implementation overhead
- Good for application with a separate host
- A portable ANSI C host library (BGLib) available

Octet	Octet bits	Length	Description	Notes
octet 0	7	1 bit	**Message type (MT)**	*0: Command/response* *1: Event*
	6:3	4 bits	**Technology type (TT)**	*0100 : Wi-Fi*
	2:0	3 bits	**Length high (LH)**	*Payload length (high bits)*
octet 1	7:0	8 bits	**Length low (LL)**	*Payload length (low bits)*
octet 2	7:0	8 bits	**Class ID (CID)**	*Command class ID*
octet 3	7:0	8 bits	**Command ID (CMD)**	*Command ID*
octet 4-n		0-2048 bytes	**Payload (PL)**	*Up to 2048 bytes of payload*

BGAPI protocol



BGLib host library

APIs available for several host systems:

- Windows
- Linux
- Fully embedded implementation

Function and call back arhitecture

Benefits:

- Fast application development
- Proven / tested code
- Ready made example applications

BGScript : Application scripting interface

Basic style scripting API

- Fast development of simple applications
- Examples: Scanning, authentication, connecting, email

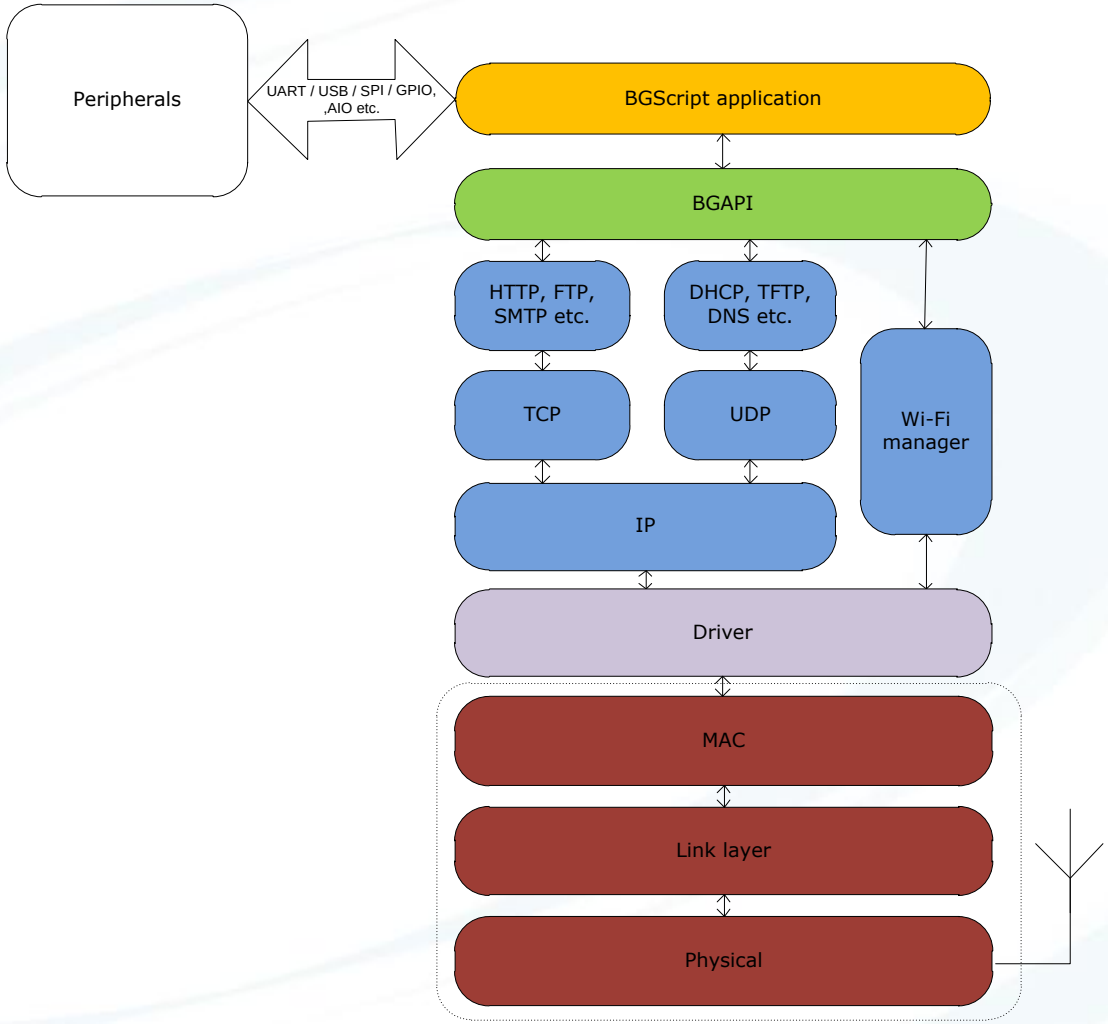
Software tools

- Code developed with any text or source code editor
- Code compiled with Bluegiga's compiler
- Binary application flashed to the hardware

Cuts out the need for external MCU:

- Reduced product cost
- Smaller footprint
- Faster time-to-market

BGScript


Peripherals
UART / USB / SPI / GPIO, ,AIO etc.
BGScript application
BGAPI
HTTP, FTP, SMTP etc.
DHCP, TFTP, DNS etc.
TCP
UDP
Wi-Fi manager
IP
Driver
MAC
Link layer
Physical

BGScript : Scan, connect and TCP server

```
/* System boot event listener */
sub system_started(status)
    system_set_passphrase("bgtwlan1bgtwlan!")          //Set pass word
    system_connect_ssid(1,"bgt3")                      //Connect to SSID ”BGT3”
    endpoint_send(0,"Connecting\n")                    //Send staus to UART
end


/* Disconnect event listener */
sub system_disconnected(reason)
    system_connect_ssid(1,"bgt3")                      //Connect to SSID ”BGT3”
end


/* Connection status listener */
sub system_link_status(status)                         //If status is connected
    if status=1 then system_tcp_start_server(1234,0)   //Start TCP server to port 1234
end

/* Connection status listener */                       //Route TCP stream to UART
sub endpoint_status(handle,type,streaming,destination,connected)
    if type=4 and connected=1 then endpoint_set_default_streaming_destination(0,handle)
end
```

WF121: Software Development Kit

Stack available as object code

A high-level C API

- Allows development of more complex applications into WF121
- Using the PIC32 processor

Software tools

- *Bluetooth* low energy stack provided as object code
- IDE: Microchip PIC32 based tools

Cuts out the need for external MCU:

- Reduced product cost
- Smaller footprint
- Faster time-to-market

Availability : Q1/2012

Evaluation tools

WF121: Interfaces

WF121 evaluation kit:

- WF121 module
- USB and serial host intefaces
- Ethernet
- Programming and debug cables

Certifications

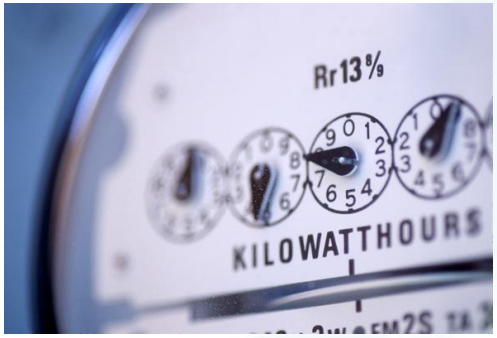
Certifications

- **Wi-Fi® certified**
- **CE**
  - EN300328
  - EMC330489
- **FCC**
  - Modular approval - 15.21,15.105(b)
- **Industry Canada (IC)**
- **Telec (Japan)**
- **Australia and New Zealand**

Use cases

Embedded Wi-Fi

- Point of sale terminals
- Portable scanners
- Metering
- M2M connectivity



Consumer electronics

- Internet radios

- Digital picture frames

- Medical devices

Security and surveilance

- Surveilance cameras

- Security cameras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