The Opportunity: Expected Market Acceleration for IOT

>30B Connected devices by 2020
- ABI Research, 2015

~100 Expected # of connected devices per household
- Atmel Estimate

4.5B # of smart phone Subscriptions by 2018
- Ericsson Mobility Report, 2015

42% of World Wide Households will have Wi-Fi by 2016
- Strategy Analytics

50% of IoT Solutions will be provided by startups which are less than 3 years old by 2019
- Gartner
An MCU at the Heart of Every IoT Edge Node

Power Train
Safety
BUS Controller

Transportation

Patient Monitoring
Elderly Care
Smart Health
Telecare

Healthcare

Energy

Smart Meters
Data Collectors
Thermostats
Security

Industrial

Industrial Control
Building Automation
HMI Panels
Retail

Industrial

Residential

White Goods
Smart Lighting
Home Automation
Alarm Systems
Automated Chores

Residential

Lifestyle

Fitness & Wellness
Wearable
Gaming
Connected TV/STB

Lifestyle
Scalable Family of Atmel | SmartConnect

- **SAM W**
  - Wi-Fi MCU Solutions
  - Wi-Fi 802.11a/b/g/n
  - 72Mb/s
  - Up to 200m range

- **SAM B**
  - BLE MCU Solutions
  - Bluetooth Dual Mode
  - 3Mb/s
  - Up to 30m range

- **SAM R**
  - Wireless MCU Solutions
  - Narrowband FSK 2.4GHz & Sub GHz
  - ~ 2-5Kb/s
  - Up to 2Km range

- **SAM W**
  - Bluetooth Low Energy
  - 1Mb/s
  - Up to 10m range

- **802.15.4**
  - ZigBee 6LoWPAN
  - 250kb/s
  - Up to 300m range

- **Wi-Fi**
  - 802.11a/b/g/n
  - 72Mb/s
  - Up to 200m range

- **Bluetooth**
  - 802.11a/b/g/n
  - 72Mb/s
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- **Bluetooth Low Energy**
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- **Narrowband FSK 2.4GHz & Sub GHz**
  - ~ 2-5Kb/s
  - Up to 2Km range

- **2.4GHz**
  - ZigBee 6LoWPAN
  - 250kb/s
  - Up to 300m range

- **250kb/s**
  - 6LoWPAN
  - 250kb/s
  - Up to 300m range
What Does it Take to Make IoT a Reality?
Bridging the Gap Between Two Worlds

SmartConnect
Adds Connectivity To Cloud Out of the Box

Cloud API
Network Services
TLS Security
Comm. Stacks

Ultra Low Power
HW Integration
Production-ready Modules

Motor Control
Real time processing
Sensors Management
Metrology Algorithms
Fail-proof User Interface
Battery powered

Embedded Developers

Backend Services Developers

Identity & Access Governance
Data Routing & Analysis
Datacenter Management
Business Intelligence
Complex Event Processing
Enterprise Service
RDBMS NoSQL
Atmel Value Added System Level Smart Connect Solution

- Atmel Security Solutions
- Customer Application
- Atmel Software Solutions
- IoT Comm. Stacks + 3rd Party Cloud APIs
- Ultra Low Power Hardware Integration

Security

Wireless (Comms)

MCU (Application)

Security (Crypto Authentication)

15mm

33mm

Creating a System Solution for Easy Adoption
# Broad Customer Reach and Social Footprint

<table>
<thead>
<tr>
<th>Atmel Studio Development Platform</th>
<th>Atmel Gallery App Store</th>
<th>Arduino Partnership</th>
<th>AVR Freaks Community</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Atmel Studio" /></td>
<td><img src="image" alt="Atmel Gallery" /></td>
<td><img src="image" alt="Arduino" /></td>
<td><img src="image" alt="AVR Freaks" /></td>
</tr>
<tr>
<td>66,000 Active Developers</td>
<td>95,000 Users</td>
<td>1,200,000 Development Boards</td>
<td>&gt;200,000 Members</td>
</tr>
<tr>
<td>2,000 Embedded SW Apps</td>
<td>425,000 Downloads</td>
<td>218,000 Forum Members</td>
<td>Very Large Vendor Specific</td>
</tr>
<tr>
<td>High Customer Satisfaction Rating</td>
<td>First Embedded Developer App Store</td>
<td>Platform of Maker Community</td>
<td>User Community</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Facebook</th>
<th>Twitter</th>
<th>YouTube</th>
<th>LinkedIn</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Facebook" /></td>
<td><img src="image" alt="Twitter" /></td>
<td><img src="image" alt="YouTube" /></td>
<td><img src="image" alt="LinkedIn" /></td>
</tr>
<tr>
<td>224,700 Likes</td>
<td>22,700+ Followers</td>
<td>1,600,000 Views</td>
<td>23,000 Followers</td>
</tr>
<tr>
<td>73% YoY Growth</td>
<td>140% YoY Growth</td>
<td>31% YoY Growth</td>
<td>63% YoY Growth</td>
</tr>
<tr>
<td>97,000+ Monthly Clicks</td>
<td>1.5M+ Monthly Impressions</td>
<td>5.4K Subscribers</td>
<td></td>
</tr>
</tbody>
</table>
Atmel SmartConnect Value Proposition

World Class MCU Portfolio & Ecosystem
- Atmel |SMART MCU/MPUs, Atmel AVR MCUs
- Industry leading PicoPower innovation
- Atmel Studio, Arduino Platform

State of the Art Low Power Wireless SoCs
- Low Power Wi-Fi 802.11 a/b/g/n + BT 4.0 Combo SoCs
- Bluetooth 4.1 Low Energy SoC
- ZigBee/6LoWPAN 802.15.4 Transceivers

Best in Class Layered Security solutions
- Highest industry standard for link security (WPA2 Enterprise)
- Hardware accelerated IP Transport Layer security (TLS)
- Crypto solutions for anticloning & ecosystem management

SmartConnect IoT Solutions
- Ready to MP Certified Modules with integrated IoT SW stack
- MCU-like integration in Atmel Development Ecosystem
- Years of battery life on batteries
Internet Of Things (IoT) Hype & Challenges

• Everywhere – “by 2016, about 800 million households worldwide will have WiFi access at home. That’s a global penetration of about 42%.”
  
Strategy Analytics

• Everything – “by 2020, we expect to see 50 billion devices connected to the Internet.”
  
J.Chambers, Cisco

• Embedded – “By 2018, 40% of IoT-created data will be stored, processed, analyzed and acted upon close to, or at the edge, of the network.”
  
Gartner

• Disruptive – “by 2018, 50% of the internet of things solutions will be provided by startups which are less than 3 years old.”
  
Gartner

What Is IoT, and where does the real value come from?

What will it take to make it a reality?
Once Upon A Time…

Things

Cellular

Application/Action

Cloud

Data Analytics
Today & Tomorrow…

- **Things**
- **Gateways**
- **Satellite**
- **Cellular**
- **Fiber, DSL**
- **Local Networks**
- **New Generation Of WAN Technologies; Sig Fox, Weightless, etc.**
- **Cloud**
- **Data Analytics**
- **Choose Best Available Link**
- **Application/Action**

**Data Analytics Application/Action**

**Choose Best Available Link**

**New Generation Of WAN Technologies; Sig Fox, Weightless, etc.**

**Satellite**

**Cellular**

**Fiber, DSL**

**Local Networks**

**Short Range Connectivity**

**Long Range Connectivity**

**Things**
Infrastructure of the IoT For Service Delivery

IoT Value Is Created Via New Differentiating Services In A Variety of End Segments
Infrastructure of IoT

Edge / Sensing Nodes

Secure Service Delivery Infrastructure

Edge nodes may include:
- An MCU/MPU (85%/15%)
- Sensors (and actuators)
- Integrated connectivity
- Energy source
- Security

Edge nodes need to be:
- Secure
- Low cost
- Low power
- Low complexity
- Low footprint
- Industrial-grade and robust

15 © 2015 Atmel Corporation
Infrastructure of IoT
Different Edge /Sensing Nodes For Different Applications

Secure Service Delivery Infrastructure

Edge / Sensing Nodes

MCUs / MPUs
Security
Sensing
Connectivity

Tags, Key fob, Beacon, etc.

Wireless Connectivity
Security
Sensor(s) / Sensing Platform
Battery

Fitness band, Activity Tracker, Temp Sensor, etc.

Wireless Connectivity
Security
Sensor(s) / Sensing Platform
Battery

Thermostat, Door Lock, Appliances, etc.

MCU
Security
Sensor(s) / Sensing Platform
Battery

Smart City Infrastructures, Smart Metering, etc.

MCU / MPU
Security
Sensor(s) / Sensing Platform
Energy Source

Application / Action

Data Analytics
Edge/Sensing Nodes Under Microscope

Secure Service Delivery Infrastructure

MCUs/MPUs
Energy
Security
Sensing
Connectivity

Applications/Action
Data Analytics

Ocean of Software

MCU / MPU
Analog
NVM
I/Os
Low-power Core

Narrow Band & Wide-band RF
Sensors (MEMS)
Energy Source/Batteries
PMIC/PMU
Antenna(s)

Security
Services, the real value of the IoT
Ex: The Smart Home of the Future

Traditional Service Providers

Internet
Landline Phone
Cable/Satellite
Mobile Phone
Security
Electric
Water
Gas

Future Smart Home
Host of New Generations Of Services

Future Smart Home:
Digitally Controlled via Local Automation and Remote Cloud Processing

New Generation Of Service Providers

Home Health
Elderly Monitoring & Care
Home Automation Services
Home Landscape & Maintenance
New Types of Infotainment

Home Meal Services
Remote Education
Remote Maintenance
Many Other Services

Quad Play
Triple Play
Infrastructure of IoT

- Edge / Sensing Nodes
- MCUs/MPUs
- Energy
- Security
- Connectivity
- Short Range Connectivity (BAN, PAN, LAN, HAN)
- Hierarchical IoT Gateways
- Long Range Connectivity (WAN)
- Secure Service Delivery Infrastructure
- Applicatio n/ Action
- Data Analytics
- Cloud
Edge / Sensing Nodes Are Getting Integrated Into Everyone’s Life

Automotive
- Car Access
- Power Train
- Safety
- BUS Controller

Healthcare
- Patient Monitoring
- Elderly Care
- Smart Health
- Telecare

Lifestyle
- Fitness & Wellness
- Wearable
- Gaming
- Connected TV/STB

Industrial
- White Goods
- Smart Lighting
- Home Automation
- Alarm Systems
- Automated Chores

Residential
- Smart Meters
- Data Collectors
- Thermostats
- Security

Energy
- MCU / MPU
- Wired / Wireless Connectivity
- Security
- Sensor(s) / Sensing Platform
- Energy Source

Security
- Car Access
- Power Train
- Safety
- BUS Controller
Rolling out the largest control data network in the world

Solving the Interoperability paradigm
Service Delivery Infrastructure

Services
- Smart City
- Smart Roads
- Smart Farm
- Factory Automation
- Home Automation
- Tele-Health

LOTS OF OTHER SERVICES

BIG Data Analytics

IoT Services

Operations Management

Access & Core Networks

WSN (Edge Nodes)

Billing & Operations Support System (BOSS)

Billing & Operations Analysis

Service Platforms 1…N

QoS Monitoring & Service Management

Network Management

Value add/other Service Provider

Telecomm/Network Providers, MVNOs, Other

End User or Service provider Owned

End Users, Private Business, Municipalities, etc.

Services

Connectivity

Sensing

Embedded Processing

Ethernet Fiber

SigFox, Weightless, etc.

Dedicated Line

Cellular

Other

Satellite

Billings & Operations Analysis

Service Platforms 1…N

QoS Monitoring & Service Management

Network Management

Connectivity

Sensing

Embedded Processing

Billings & Operations Support System (BOSS)

Billing & Operations Analysis

Service Platforms 1…N

QoS Monitoring & Service Management

Network Management

Connectivity

Sensing

Embedded Processing

Direct to End User or Service provider Owned

Direct to End Users, Private Business, Municipalities, etc.

Direct to Value add/other Service Provider

Direct to Telecomm/Network Providers, MVNOs, Other

Direct to IoT Services

Direct to Operations Management

Direct to Access & Core Networks

Direct to WSN (Edge Nodes)

Direct to Services

Direct to Connectivity

Direct to Sensing

Direct to Embedded Processing

Short range low-bandwidth connectivity (BLE, 802.15.4, 802.11n, etc.)

Bridge

Transportation

Building

Farm

Emergency Services

Factory
Hierarchical Gateways
Connecting the Cloud to the Tiniest Sensing/Edge nodes

Bluetooth
Zigbee, 802.15.4
WiFi, DASH7, ISA100
Wireless HART, EnOcean
Wireless MBus
Ethernet, EtherCAT, Profinet, Modbus, HPGP
Etc.

Ethernet / Fiber
Weightless/ Sig Fox
802.11ah
Cellular
Sub Gig
Satellite
PLM/PLC (G3, Prime, etc.)
Etc.

BAN/PAN/LAN/HAN

Display
Switching & Routing
Protocol Conversion
Firewall & VPN
Security
Storage
Fast Data Analytics
Hierarchical Gateways

NAN/WAN

UART, SPI, I2C, USB, X10, GPIO, RS-485, RS-422, RS-232, etc.
The Role of the Gateway
Moving the Interoperability paradigm up the stack

TCP/IP Protocol Stack
- HTTP
- RTP
- TCP
- UDP
- ICMP
- IP
- IEEE 802.11 MAC
- IEEE 802.11 PHY

6LoWPAN Protocol Stack
- Applications
- UDP
- ICMP
- IPv6 with 6LoWPAN
- IEEE 802.15.4 MAC
- IEEE 802.15.4 PHY
Communication Topologies Across Hierarchies

Scalability based on use case, dictating processing and communications support

Edge/Sensing Nodes  Gateway
Service Delivery & Connectivity Frameworks

Why?
Because devices need to interconnect across OSs, platforms and Vendors no matter which network topology or Transport technology they operate on, across multiple vertical markets.

Profiles
- Consumer
- Enterprise
- Industrial
- Automotive
- Education
- Health

Framework APIs
Common Resource-Based Object Model

Framework
- Discovery
- Data Transmission
- Data Management
- Device Management

Transports
- Bluetooth
- WiFi Direct
- WiFi
- ZigBee
- LTE

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Rolling out the largest control data network in the world

Security and privacy issues
Internet as a Top Security Concern

Intelligence Chiefs Warn that Cyber Attacks are Nation’s Top Security Threat
By Jordy Yager and Carlo Munoz

Shodan: The Scariest Search Engine on the Internet
By David Goldman, @DavidGoldmanCNN

Shodan navigates the Internet’s back channels. It runs 24/7 and collects information on about 500 million connected devices and services each month. It's stunning what can be found with a simple search on Shodan. Countless traffic lights, security cameras, home automation devices & heating systems, connected to the Internet & easy to spot.

Shodan searchers have found control systems for a water park, a gas station, a hotel wine cooler and a crematorium. Cybersecurity researchers have even located command and control systems for nuclear power plants and a particle-accelerating cyclotron by using Shodan.
Does Privacy Still Exist?

Whether we admit it to ourselves or not, and whether we like it or not, we’re being tracked all the time:

- **Google** tracks us, both on its pages and on other pages it has access to.
- **Facebook** does the same; it even tracks non-Facebook users. It correlates your online behavior with your purchasing habits offline.
- **Apple** tracks us on our iPhones and iPads.

One reporter used a tool called Collusion to track who was tracking him; **105 companies tracked his Internet use during one 36-hour period**

Today there are over 150 commercial entities in the U.S. tracking your online and offline behavior
SmartConnect IoT Layered Security Solutions

Offering best in Class Security for IoT Edge Nodes

SmartConnect Wi-Fi

Layer 1: Physical

Layer 2: Link

Layer 3: Network

Layer 4: Transport

Layer 5: Session

Layer 6: Presentation

Layer 7: Application

APPLICATION

HTTP, FTP, SMTP, SNMP,

TLS/SSL
TCP/UDP

IP, ARP, DHCP

802.11b/g/n

Security Level

CryptoAuthentication
ATECC108A bundled with WINC1500

-> Authentication used for Anti-cloning, Ecosystem Management, Storage of Keys/Certificates

On-Chip (WINC1500)
TLS 1.0 (SSL)

-> Ensures Data Encryption “Coming out” of the LAN, also Known as Internet Security

On-Chip (WINC1500)
WEP, WPS, WPA2 Personal WPA2 Enterprise

-> Ensures Data Encryption within the LAN to avoid intrusion
The Semiconductor Building Blocks
What does it take?
Solving today’s IoT System Integration Challenge

No Supplier has a System level solution
- Decentralized Development environment
- Increases risks of system security holes.
- Multiple SW stack suppliers & Silicon Vendors
- RF antenna and coexistence issues
- Low BOM efficiency: Cost, Space
- Power Consumption

SMARTCONNECT System Solution
- MCU / Wireless SoC Chipsets
- Ready to MP Certified Modules
- Layered Security
- MP ready integrated SW stacks
- System-In-Package Integration
- Lowest Power Consumption
- Shortest Time to Market
• Standalone Edge Node Module

The SAMW25 is a certified module used as a turn key Add-On module adding Wi-Fi Connectivity to an existing system.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wi-Fi SoC</td>
<td>WINC1500A</td>
<td>WINC1500A</td>
</tr>
<tr>
<td>Embedded Host MCU</td>
<td>SAMD21</td>
<td>SAMD21</td>
</tr>
<tr>
<td>Single Band 802.11n</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>WPS, WPA/WPA2 Supplicant</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>TCP/UDP, DNS, HTTP/HTTPS, TLS</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CryptoAuthentication (ECC108)</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>Antenna Design</td>
<td>PCB</td>
<td>PCB</td>
</tr>
<tr>
<td>OTA Upgrade</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dimensions</td>
<td>33.8mm x 14.9mm</td>
<td></td>
</tr>
<tr>
<td>Pin out</td>
<td>51 castellations</td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>FCC, IC, ETSI, TELEC</td>
<td></td>
</tr>
</tbody>
</table>
50% of IoT Solutions will be provided by startups which are less than 3 years old by 2019 - Gartner

What will you make?...
At the heart of the heart of the Maker Community
Atmel powers 90+% of all 3D printers...

Facilitates Makers:
• Rapid prototyping
• Reduced costs
• Accelerated time to market
Did you know that?

Quote from CEO of Kickstarter

“There were over 160 AVR based [read: Atmel] Projects on Kickstarter of which 103 successful, collecting 7 M USD in funding"

That's a potential of 103 companies founded on Atmel
Arduino WiFi-Shield
Enabling Smart, Connected IoT Devices

• Another joint Atmel/Ardueino project
  • Based on WINC1500 802.11b/g/n network controller
  • Supports 3.3v & 5v operation, works with all Arduino platforms.
  • Stackable, connects using long wire-wrap headers.
  • Includes Atmel Crypto Authentication device, allowing hardware authentication capabilities.
  • WINC1500 features integrated TCP/IP stack, TLS security and SoftAP support.

• Provides connectivity for Zero/UNO/DUE and more.
  • Enables using Arduino as IoT rapid prototyping platform

  → Thousands of Project examples

• Introduced at Maker Faire NY Sept 19th.
Re-Cap

• The IoT will open up a whole new world of services, by establishing the largest control data network in the world

• A balanced approach with a full secure service delivery framework is needed to establish IoT services

• Security and privacy issues must be addressed

• Standards harmonization is not the answer to everything, but a pruning will happen, in the mean time co-existence is the name of the game

• Semiconductor products need to be built from the grounds up for new generation of battery operated devices
Wireless Solutions - IoT References
ATMEL | SMARTConnect
Scalable Family of Atmel | SmartConnect

SAM W
- Wi-Fi MCU Solutions
  - Wi-Fi: 802.11a/b/g/n
    - 72Mb/s
    - Up to 200m range

SAM B
- BLE MCU Solutions
  - Bluetooth Dual Mode
    - 3Mb/s
    - Up to 30m range

SAM R
- Wireless MCU Solutions
  - Narrowband FSK
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ZigBee 6LoWPAN
- 250kb/s
- Up to 300m range

Wireless MCU Solutions
- SAM R

BLE MCU Solutions
- SAM B

Powered by Visual Studio

© 2015 Atmel Corporation
SmartConnect – Wi-Fi Solutions

**Standalone IoT Solution – SAMR Series**
- Standalone, SAM MCU-based integration w/ Wireless SoC
- Available as a module or exceptionally as a SiP

**Network Controller – WINC Series**
- Add-On solution integrating IoT Stacks on a WiFi SoC
- Connects to any Atmel AVR or SMART MCU with minimal resource requirements for the MCU
- Available as Module for Channel or Chipset

**Link Controller – WILC Series**
- Add-On Wireless SoC to an Atmel SMART MCU/MPU
- Network Services, Profiles run on the eMPU
- Available as Module for Channel or Chipset
WINC1500 combines Performance and Ubiquity
Out of the box IP Connectivity with Higher data rate requirements

Incremental Applications demand IP-based wireless connectivity to the Cloud

- Connectivity to Access Points
- Cloud-ready platform with multiple Cloud partners
- MP-ready Certified modules
- Best in the industry Security

Best-in-Class specification

- Rx: 60mA @ -90dBm, Tx: 172mA @ +18dBm
- WLCSP: 3.2mm x 3.2mm
WINC1500 Network Controller Series

WINC is a State of The Art Wi-Fi single-chip Network Controller

• Targeting IoT use cases with best SISO20 data rate and extended range

• True Single Chip Internet Network Controller solution

• System in Package with 4Mb/8Mb stacked flash

• SW Distribution package & full collateral available

### Network Controller

<table>
<thead>
<tr>
<th>Standards</th>
<th>802.11 b/g/n 1x1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max PHY rate</td>
<td>72Mbps</td>
</tr>
<tr>
<td>Frequency</td>
<td>2.4GHz</td>
</tr>
<tr>
<td>Interfaces</td>
<td>SPI, UART</td>
</tr>
<tr>
<td>Tx peak (mA)*</td>
<td>172mA @3.3V (18dBm) 149mA @2.5V (14dBm) 117mA @2.0V (10dBm)</td>
</tr>
<tr>
<td>Rx peak (mA)</td>
<td>60mA @3.3V (-90dBm) 55mA @3.3V (-87dBm)</td>
</tr>
<tr>
<td>Rx PS mode (DTIM1**)</td>
<td>1mA</td>
</tr>
<tr>
<td>Rx sleep</td>
<td>280uA</td>
</tr>
<tr>
<td>Package</td>
<td>5x5mm QFN</td>
</tr>
<tr>
<td>Temp Range</td>
<td>-40 to +85°C</td>
</tr>
</tbody>
</table>

† Numbers are based on WINC1500B
*For 6-24Mbps rates
** DTIM1 = 102ms with 1ms RX active
**WINC1500 Network Controller Series**

**Module Offer**

- **Network Controller Module**

  The Network Controller is a certified module used as a turn key Add-On module adding Wi-Fi Connectivity to an existing system.

<table>
<thead>
<tr>
<th>Feature</th>
<th>WINC1500 -MR210P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wi-Fi SoC</strong></td>
<td>WINC1500</td>
</tr>
<tr>
<td><strong>External Host Type</strong></td>
<td>MCU</td>
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<tr>
<td><strong>External Host Interface</strong></td>
<td>UART, SPI</td>
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<tr>
<td><strong>Single Band 802.11n</strong></td>
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<tr>
<td><strong>OTA Upgrade</strong></td>
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<tr>
<td><strong>Dimensions</strong></td>
<td>22 x 15 mm</td>
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<td><strong>Pin out</strong></td>
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SAMW25 Series – Secure Edge Node Module

Module Offer

• Standalone Edge Node Module

The SAMW25 is a certified module used as a turn key Add-On module adding Wi-Fi Connectivity to an existing system.

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<td>SAMD21</td>
<td>SAMD21</td>
</tr>
<tr>
<td>Single Band 802.11n</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>WPS, WPA/WPA2 Supplicant</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>TCP/UDP, DNS, HTTP/HTTPS, TLS</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CryptoAuthentication (ECC508)</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>Antenna Design</td>
<td>PCB</td>
<td>PCB</td>
</tr>
<tr>
<td>OTA Upgrade</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dimensions</td>
<td>33.8mm x 14.9mm</td>
<td></td>
</tr>
<tr>
<td>Pin out</td>
<td>51 castellations</td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>FCC, IC, ETSI, TELEC</td>
<td></td>
</tr>
<tr>
<td>Sampling</td>
<td>Apr’2015</td>
<td>Apr’2015</td>
</tr>
<tr>
<td>Availability (MP)</td>
<td>Jun’2015</td>
<td>Jun’2015</td>
</tr>
</tbody>
</table>
WILC1000 Link Controller Series

WILC1000 Module Offer

- Link Controller Module

The Link Controller is a certified module used as a turn key Add-On module adding Wi-Fi Connectivity to an existing system.

<table>
<thead>
<tr>
<th></th>
<th>WILC1000-MR1100</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wi-Fi SoC</strong></td>
<td>WILC1000/1</td>
</tr>
<tr>
<td><strong>Host Type</strong></td>
<td>MPU</td>
</tr>
<tr>
<td><strong>Host Interface</strong></td>
<td>SDIO</td>
</tr>
<tr>
<td><strong>WPS, WPA/WPA2 Supplicant</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>TCP/UDP, DNS, HTTP/HTTPS, TLS</strong></td>
<td>Host MPU</td>
</tr>
<tr>
<td><strong>Antenna Design</strong></td>
<td>–</td>
</tr>
<tr>
<td><strong>OTA Upgrade</strong></td>
<td>–</td>
</tr>
<tr>
<td><strong>Dimensions (mm)</strong></td>
<td>15 x 14</td>
</tr>
<tr>
<td><strong>Pin out</strong></td>
<td>31 (LGA)</td>
</tr>
<tr>
<td><strong>Certification</strong></td>
<td>FCC, IC, ETSI</td>
</tr>
</tbody>
</table>
**WINC3400 combines Wi-Fi and Bluetooth**

Migration to simultaneous Wi-Fi / Bluetooth links

**WILC3000**
**WINC3400**
Wi-Fi b/g/n
BT 4.0

**Sampling June’15**

Incremental Applications demand multi-mode wireless connectivity

- Connectivity to Access Points & Smartphone connectivity
- Easy Wi-Fi provisioning option over Bluetooth
- Cloud-ready platform with multiple Cloud partners
- MP-ready Certified modules
- Best in the industry Security

**Best-in-Class specification**

- Adaptive BLE/Wi-Fi coexistence engine
- Die Size: 4.2mm x 4.2mm
Wi-Fi Link Controller Series

802.11b/g/n and Combo BT4.0 Low Power SoCs

- Best in the industry link budget for **Extended range** IoT use cases
- **Lowest peak current** during Tx and Rx for power constrained applications
- State of the Art **WiFi/BLE combo** with advanced co-existence engine
- **WLCSP package offer** for small form factor integration
  - 802.11bgn SoC: **3x3mm**
  - 802.11bgn/BT4.0: **4.1x4.1mm**

- Available as System in Package with **4Mb Serial Flash**
  - Allows to run TCP/IP and/or BLE stacks on-chip
  - Support for **On-Chip OTA firmware upgrade**
  - Lowers requirements on Host MCU to a 4KB Flash and 1KB RAM API

**Availability:** Sampling Now.

<table>
<thead>
<tr>
<th>Link Controller</th>
<th>WILC1000 WINC1500</th>
<th>WILC3000 WINC3400</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU core</td>
<td>APS3 @ 40MHz</td>
<td>APS3 @ 40MHz</td>
</tr>
<tr>
<td>Standards</td>
<td>802.11 b/g/n 1x1</td>
<td>802.11 b/g/n 1x1, BT 4.0 (HS, LE)</td>
</tr>
<tr>
<td>Max PHY rate</td>
<td>72Mbps</td>
<td>72Mbps</td>
</tr>
<tr>
<td>Frequency</td>
<td>2.4GHz</td>
<td>2.4GHz</td>
</tr>
<tr>
<td>Stacks</td>
<td>WEP, WPS, WPA2 Wi-Fi STA/AP/Direct</td>
<td>WEP, WPS, WPA2 Wi-Fi STA/AP/Direct BT 4.0 HCI</td>
</tr>
<tr>
<td>Crypto. Acceleration</td>
<td>-</td>
<td>AES-128, SHA-256, RSA</td>
</tr>
<tr>
<td>Applications</td>
<td>IoT, Audio/Video</td>
<td>IoT, Audio/Video</td>
</tr>
<tr>
<td>Interfaces</td>
<td>SPI, UART, I2C</td>
<td>SPI, UART, I2C</td>
</tr>
<tr>
<td>Tx/Rx (dBm)</td>
<td>+20dBm/-91dBm</td>
<td>+18.5dBm/-91dBm (WiFi) +10dBm/-95.5dBm (BT)</td>
</tr>
<tr>
<td>Tx/Rx peak (mA)</td>
<td>172mA/55mA</td>
<td>172mA/55mA (WiFi) 52mA (BT)</td>
</tr>
<tr>
<td>Package</td>
<td>5x5mm QFN 3x3mm 56WLCSP</td>
<td>6x6mm QFN 4.2x4.2 92WLCSP</td>
</tr>
<tr>
<td>Temp Range</td>
<td>-40 to +85°C</td>
<td>-40 to +85°C</td>
</tr>
</tbody>
</table>

802.11b/g/n and Combo BT4.0 Low Power SoCs

• Best in the industry link budget for **Extended range** IoT use cases
• **Lowest peak current** during Tx and Rx for power constrained applications
• State of the Art **WiFi/BLE combo** with advanced co-existence engine
• **WLCSP package offer** for small form factor integration
  - 802.11bgn SoC: **3x3mm**
  - 802.11bgn/BT4.0: **4.1x4.1mm**

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  • Allows to run TCP/IP and/or BLE stacks on-chip
  • Support for **On-Chip OTA firmware upgrade**
  • Lowers requirements on Host MCU to a 4KB Flash and 1KB RAM API

• **Availability:** Sampling Now.
SmartConnect – Enabling BT SMART Solutions

**BT SMART Network Controller**
- Added 256 KB SPI Stacked Flash
- Available as a Module
- Leverages the Atmel SMART peripherals and Ecosystem

**BT SMART Link Controller**
- Ultra low power BLE SoC
- Best in class Power Consumption
- ARM Cortex M0 32 bit processor
BTLC1000 – BT SMART Link Controller
The world’s smallest and lowest power BLE SoC

Incremental Applications demand wireless connectivity using the Smartphone as the gateway

- Provides 2-3x the battery life of the best BLE solutions available today.
- Package enables up to 3x smaller designs vs. current solutions.

Best-in-Class specification
- Rx: <5mA @3.0V, Tx: <4mA @3.0V, Sleep: <1uA
- Average Current in Advertising: 7uA  (Dialog:14uA, Noridc:31uA)
- Die Size: 2.1mm x 2.2mm
BLE 4.1 SoC Link Controller and MCU

- Ultra low power BLE SoC
  - Cortex-M0 based Standalone MCU (SAMB01) or Companion Link Controller (BTLC1000) to a Host MCU
  - Dual mode Slave/Master (up to 8 slaves)
  - Integrated Transceiver, Modem, MAC, PA, TR Switch, and PMU

- Power Consumption:
  - Rx: <5mA @ 3.0V
  - Tx: <4mA @ 3V
  - Sleep: <1uA (RTC + 8KB dedicated RAM Retention)

- ARM Cortex M0 32 bit processor
  - 128kB embedded islanded RAM (3x32KB, 2x16KB)
    - 96KB available for application
  - 128kB embedded ROM
  - 256KB Stack Flash option (SAMB01 6x6 QFN48 only)
  - Multiple low power sleep modes

- Peripherals
  - Low power comparator, ADC, and PWM analog I/Os
  - RTC, single XO, and optional fully integrated sleep oscillator

- Security: AES-128 & SHA-256 HW encryption
  (Secure OTA, Link Encryption on top of BLE)

- BTLC1000 Ultra small form factor:
  2.1x2.1mm WLCSP and 4x4 QFN 32L

- Samples March 2015:
  4x4 QFN32 BTLC1000 and 6x6 QFN48 SAMB01

- Production Samples August 2015: WLCSP, QFN

---

### BLE SoC

<table>
<thead>
<tr>
<th>Feature</th>
<th>BTLC1000</th>
<th>SAMB11</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU Core</td>
<td>Cortex-M0 @ 26MHz</td>
<td>Cortex-M0 w/256KB stacked Flash</td>
</tr>
<tr>
<td>Max PHY rate</td>
<td>1Mbps</td>
<td>1Mbps</td>
</tr>
<tr>
<td>Frequency</td>
<td>2.4GHz</td>
<td>2.4GHz</td>
</tr>
<tr>
<td>Stacks</td>
<td>Self Contained GATT and GATT-based profiles BLE 4.1</td>
<td>Self Contained GATT and GATT-based profiles BLE 4.1</td>
</tr>
<tr>
<td>Applications</td>
<td>Wearable, IoT</td>
<td>Wearable, IoT</td>
</tr>
<tr>
<td>Interfaces</td>
<td>SPI, UART, I2C 12-15 GPIO</td>
<td>SPI, UART, I2C 30 GPIO</td>
</tr>
<tr>
<td>Tx/Rx peak (mA)</td>
<td>&lt;4/5mA @ 3.0V</td>
<td>&lt;4/5mA @ 3.0V</td>
</tr>
<tr>
<td>Tx Pout</td>
<td>-30dBm to +4dBm</td>
<td>-30dBm to +4dBm</td>
</tr>
<tr>
<td>Rx Sensitivity</td>
<td>&lt;-95dBm</td>
<td>&lt;-95dBm</td>
</tr>
<tr>
<td>Sleep Mode</td>
<td>&lt;1uA</td>
<td>(**)&lt;1uA</td>
</tr>
<tr>
<td>Package</td>
<td>4x4mm QFN 32L 2.1x2.1mm WLCSP</td>
<td>6x6mm QFN 48L</td>
</tr>
<tr>
<td>Power Supply</td>
<td>(†)1.8V – 4.3V</td>
<td>(*)2.3V – 3.6V</td>
</tr>
<tr>
<td>Temp Range</td>
<td>-40 to +85°C</td>
<td>-40 to +85°C</td>
</tr>
</tbody>
</table>

(†) 1.5V under investigation
(*) limited by stacked Flash voltage range
(**) Stacked Flash Supply switched off
Block Diagram BTLC1000

BTLC1000
Cortex-M0 + BLE

- ARM Cortex M0 26 MHz MCU
- Always ON Logic
- 2xSPI, 2xI2C, 2xUART
- 128 KB IRAM/DRAM
- AES-128 Engine
- 128 KB ROM
- SHA-256 Engine
- 6x128 bit eFuse

Ultra Low Power BLE Frontend
BLE 4.1 PHY
BLE 4.1 MAC
ADC/DAC Temp Sens.

PLL
ADC
Sleep Osc
LDO
DC-DC
RTC

Ultra Low Power BLE Frontend
BLE 4.1 PHY
BLE 4.1 MAC
ADC/DAC Temp Sens.

Powers
LDO
Sleep Osc
DC-DC
RTC

Always ON Logic
2xSPI, 2xI2C, 2xUART
128 KB IRAM/DRAM
AES-128 Engine
6x128 bit eFuse
SHA-256 Engine

ADC
PLL
Ultra Low Power BLE Frontend
BLE 4.1 PHY
BLE 4.1 MAC
ADC/DAC Temp Sens.
Block Diagram SAMB11

SAMB11
Cortex-M0 + BLE

- Ultra Low Power BLE Frontend
- BLE 4.1 PHY
- BLE 4.1 MAC
- ADC/DAC Temp Sens.
- ARM Cortex M0 26 MHz MCU
- 128 KB IRAM/DRAM
- 128 KB ROM
- 256 KB 26MHz SPI Stacked Flash
- AES-128 Engine
- SHA-256 Engine
- 2xSPI, 2xI2C, 2xUART
- Always ON Logic
- 6x128 bit eFuse

- PLL
- ADC
- LDO
- Sleep Osc
- DC-DC
- RTC
- Osc
- PLL
- Sleep Osc
SmartConnect – Enabling Embedded 15.4 Solutions

802.15.4 Microcontroller – SAM Rx Series
- Standalone 802.15.4 MCU System In Package
- Leverages the Atmel SMART peripherals and Ecosystem
- Available as a Module or a SiP

802.15.4 Transceivers – RFx Series
- True SPI-to-antenna solution providing a complete radio transceiver interface between the antenna and the microcontroller.
Atmel's 802.15.4 Position

**Worlds #1 in Power Consumption**
- Reduces power consumption and extend battery lifetime

**Strong ZigBee Participation**
- Golden Unit on ZigBee PRO R20
- Golden Unit on ZigBee LightLink
- Golden Unit on ZigBee IP
- Golden Unit on ZigBee RF4CE
- ZigBee Home Automation
- ZigBee Green Power

**Worlds #1 Supplier to the US Smart Energy Market**
- 30% market share for 802.15.4 compliant chipsets

**Founding member of the IPSO Alliance**
- Board member
- 6LoWPAN solutions together with Sensinode (ARM)

**Associate Member of the Connected Lighting Alliance (TCLA)**
- Initiative to stimulate Open Standard wireless lighting solutions
- Largest consortium of Connected Lighting Players
Atmel Wireless 802.15.4 Platform

- **Hardware:**
  - SAMR21 System-in-Package
  - ATmegaRFR2 System-on-Chip
  - RF transceivers: 2.4 GHz and Sub-GHz
  - Modules
  - Development boards

- **Firmware:**
  - Protocol stacks:
    - lwMesh
    - 802.15.4 MAC
    - ZigBee PRO (BitCloud™)
    - ZigBee RF4CE
    - 6lowPAN
  - Reference applications

- **Development tools:**
  - IAR and GCC compilers and IDEs
  - RF performance application
  - Wireless composer
  - Packet sniffers
Atmel 802.15.4 Transceivers - AT86RFxx Family

- 2.4 GHz and Sub-GHz
- Full flexibility in RF/MCU selection
- Also available as modules

<table>
<thead>
<tr>
<th>Device</th>
<th>ISM Band</th>
<th>Max bitrate, Mbps</th>
<th>Min Rx sensitivity, dBm</th>
<th>Max Tx power, dBm</th>
<th>Sleep current, uA</th>
<th>Active Rx current, mA</th>
<th>Listen Rx current, mA</th>
<th>Tx current, mA @ Ranging</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT86RF233</td>
<td>2.4 GHz</td>
<td>2</td>
<td>-101</td>
<td>+3.5</td>
<td>0.02</td>
<td>11.8</td>
<td>6</td>
<td>13.8 @ 3.5dBm</td>
</tr>
<tr>
<td>AT86RF212B</td>
<td>700 MHz 800 MHz 900 MHz</td>
<td>1</td>
<td>-110</td>
<td>+10</td>
<td>0.2</td>
<td>9.2</td>
<td>9.2</td>
<td>17 @ 5dBm</td>
</tr>
</tbody>
</table>

- **Common characteristics:**
  - Supply Voltage: 1.8 – 3.6V
  - Package: QFN32, 5x5mm
  - Temp ranges: -40 to +85°C / +125°C

- **Common features:**
  - HW MAC acceleration
  - HW AES
  - Automatic FEM control
  - True random number generation
  - Antenna diversity
SAM R21 – ZigBee/6LoWPAN MCU
A versatile 802.15.4 MCU with advanced IoT peripherals

Incremental Applications demand self configurable mesh networking and IP addressability

- Robust and self healing/self reconfigurable network
- IP addressability in deeply embedded low power devices

Best-in-Class specification

- RF Performance
  - Tx Power +4dBm/Receiver Sensitivity -101dBm
  - TX On: 18mA@ 4dBm/RX On: 9.2mA
- Sleep Power Consumption
  - <150μA/MHz active (CoreMark®)
  - <4μA with RTC and Full RAM retention
- Package Options
  - 32pin 5x5mm, 48pin 7x7mm
ATSAMR21
Cortex M0+ MCU with 2.4Ghz 802.15.4 Transceiver

Key peripherals (QFN48)
- 5x SERCOM (I²C, SPI, or USART)
- 4x 16-bit timers
- 15x IRQ
- 8x ADC
- 2x AC
- 1x USB

SAMR21 System-in-Package

| Memory options | Flash: 64 / 128 / 256 KB  
<table>
<thead>
<tr>
<th></th>
<th>SRAM: 8 / 16 / 32 KB</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCU frequency</td>
<td>Upto 48MHz</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>1.8V – 3.6V</td>
</tr>
</tbody>
</table>
| RF Performance | Max Tx Power: +4 dBm     
|                | Min Rx Sensitivity: -99 dBm |
| Power consumption | Active MCU: <140µA/MHz (CoreMark®) |
|                | Tx: 13.8mA(@4dBm), 11.8mA(@0dBm) (excl. MCU) |
|                | Active Rx: 11.8 mA (excl. MCU) |
|                | Rx Listen: 6 mA (excl. MCU) |
|                | Sleep: 4 µA with RTC     |
| Packages       | 32 pin 5x5mm            
|                | 48 pin 7x7mm             |
| Temp Ranges    | -40 to +85 °C / -40 to +125°C |
| Other features | HW AES                   |
|                | Automatic external FEM control |
|                | Antenna Diversity        |
|                | Capacitive Touch HW engine (PTC) |
|                | High Data Rates (upto 2Mbps) |
|                | Integrated 32KHz crystal |
|                | Ranging engine           |
Any Questions?