The embedded Linux framework FirmUx is primarily designed for building networking devices. FirmUx is focused towards product usability and easy feature development. Due to the simplistic and clever architecture, writing new code and uploading it to a device is extremely simple. FirmUx is designed by putting forward consistency, predictability and simplicity. The framework is constructed to empower developers by providing new tools and explicit integration procedures.

Responsive GUI

User experience (UX) is often the best when it is unnoticed. Typically, embedded systems are less focused towards UX. Usually, those are built on a philosophy of function over overall design. The approach of FirmUx is completely opposite. The Graphical User Interface (GUI) of FirmUx is responsive, which means that graphic components can be easily changed and reorganized in order to meet user expectations of their embedded experience. GUI supports all screen sizes — from phones and tablets to standard desktop PCs.

Simple Architecture

FirmUx tries to keep things and complexity down to the minimum while still being generic enough and at the same time product tailored. For example, the UI of FirmUx works on a single configuration file only, it does not restart services, it just edits it. At the same time, the startup system is optimized so that startup is smart enough to restart/reload the reconfigured system components only.

Dual Boot

FirmUx powered boards utilize two — active and backup firmware images. During an upgrade only the backup partition is being updated. As an example if power goes off on a device during a firmware upgrade, active firmware image is not being affected. When the system starts up again, it will be running the last good firmware image from the "active" partition.

Easy Configuration

FirmUx follows the simple architectural rule: configuration file contains only the values that the end user is allowed to change. As a result, the configuration file is kept at a minimum, it is easy to overview and limits the number of options on the UI.

20 sec to Wireless Connectivity

FirmUx can be adjusted and modified in order to meet very specific product requirements. For example, the time frame from powering-on the device to running and connecting it to a wireless system is max 20 seconds. That is possible to achieve by constructing and maintaining a lean system — removing the unnecessary architectural components and focusing on the most important feature development.

Cloud-Agent

FirmUx utilizes a versatile and elegant agent that can securely connect to the cloud. It uses the TLSv1 protocol as transport. A reference implementation is using NATS technology. From the architectural standpoint, NATS can be replaced with MQTT protocol, yet FirmUx cloud agent is always using the same logic of how things are configured, data gathered and exchanged. Device communication is based on JSON encoded requests. Adding new action handlers or modifying the existing ones is a very smooth and simple process. Additionally it is possible to extend the reported statistics or add new functionality such as event reporting, etc.

	OpenWrt	FirmUx Basic	FirmUx Standard	FirmUx Premium
Recommended Device Count	Unlimited	Unlimited	Up to 5000	Unlimited
Functionality Overview	• The support of all our products is upstreamed in OpenWrt * • Single boot	• AP • Router • Bridge	• Dual boot • Firmux AP • Responsive UI • Easy configuration (Single JSON file)	• Dual boot • Firmux AP / Mesh • FirmUX cloud support • Responsive UI • Easy configuration (Single JSON file)
Driver/SDK	Open-Source Wireless Drivers (ath9k/10k/11k)	FirmUx - maintained QSDK wireless driver from Qualcomm	FirmUx-maintained QSDK wireless driver from Qualcomm	Source code for FirmUx Router Kit excluding vendor-restricted binaries (e.g. the QSDK driver)
Software Upgrades	Check OpenWrt release schedule. Latest stable release is 19.07.5	Latest software upgrade (currently 1.7.0)	Standard software upgrades	Standard software upgrades
Engineering Support	• Technical support charged on an hourly basis. Learn more on the support section (60 $/h)	• Technical support charged on an hourly basis. Learn more on the support section (60 $/h)	• Technical support charged on an hourly basis based on the service level agreement (60 $/h)	• 300 technical support hours per year • 2 business days response time
UI Rebranding	No	No	No	Yes
Annual Pricing	Free	Free	500+ devices - $5000 1000+ devices - $8000 2000+ devices - $12000 3000+ devices - $15000 4000+ devices - $16000 5000+ devices - $18000	$36000

Tailored Solution for Commercial Grade Product

Configuration

End-users can easily adjust the parameters of individual devices via FirmUx GUI. During boot or system reload, configuration data is used to setup network interfaces and network topology, as well as setup system files and start services with formatted service specific configuration. Configuration files are stored in JSON format. Additionally FirmUx allows you to take advantage of the custom Qualcomm wireless driver features and makes it possible to add those directly to the UI if desired.

VPN Applications

FirmUx will also serve as a helpful tool in building VPN applications. It has a built-in open-source WireGuard® solution that was initially released for Linux kernel but is now also widely deployable on macOS, Windows, BSD and Android operating systems.

Automatic Updates

With the automatic update functionality the FirmUx powered board is able to periodically check for the latest available firmware versions. When a new firmware is available on the server, a notification will appear on the FirmUx dashboard.

Management

FirmUx provides multiple management options including web GUI through HTTP(S) service and console management via SSH, Telnet or serial port. Management VLAN can be configured using either IPv4 or IPv6 addresses. Additionally FirmUx enables the use of SNMPv2 and SNMPv3 network management protocols. Cloud management is also available for FirmUx Premium devices.

Rebranding

Premium version of FirmUx allows clients to customize the look and feel of the GUI. This includes applying the company's logo & corporate colors so that your brand could be represented properly.
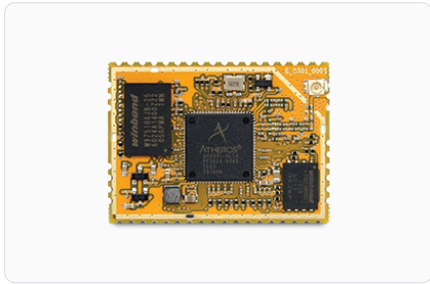
Statistics

JSON format files provide easy access to different types of statistics available on the FirmUx device -- system, internal Linux interfaces, Ethernet interfaces, wireless interfaces and internet throughput.
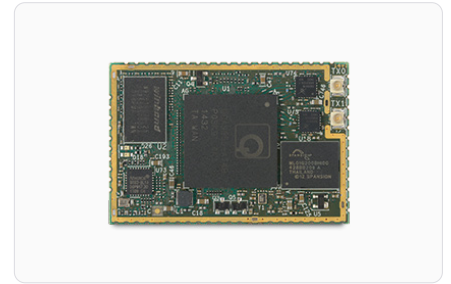
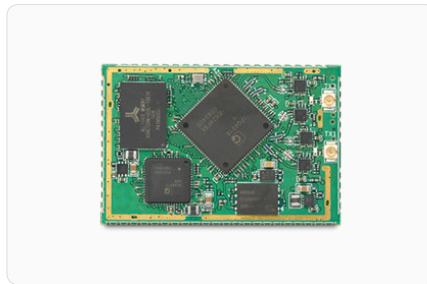# Device Compatibility

WiFi 4

Carambola 2

Lima

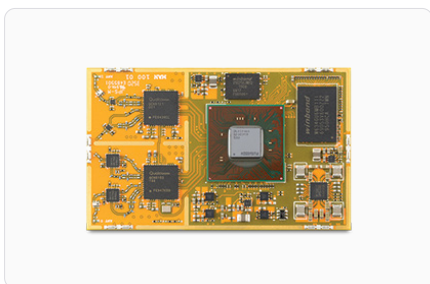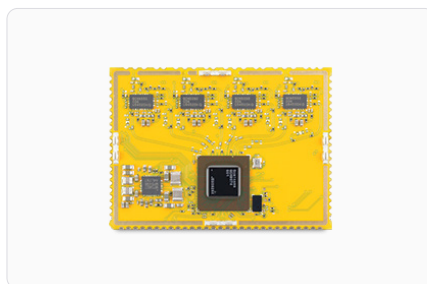Rambutan

WiFi 5

Habanero

Jalapeno

WiFi 6

Mango

Pineapple*

Functionality Overview

	FirmUx Basic	FirmUx Standard	FirmUx Premium
Configuration			
Instant reconfiguration based on changed config keys	✓	✓	✓
Configuration via Single JSON file	✓	✓	✓
Configuration backup and restore	✕	✓	✓
Configuration test	✕	✓	✓
Management			
SSH Management	✓	✓	✓
Telnet Management	✓	✓	✓
SNMP v2/v3 MIBs	✓	✓	✓
HTTP(S) Management	✓	✓	✓
Management VLAN with IPv4**	✕	✓	✓
SNMP Traps	✕	✓	✓
Troubleshooting			
Simple troubleshooting via FirmUx UI	✓	✓	✓
Wireless site survey	✓	✓	✓
Troubleshooting data download via FirmUx UI	✕	✓	✓
Remote system log	✕	✓	✓
Speedtest tool	✕	✓	✓
Spectral scan	✕	✓	✓
Security			
WPA2 (AES) Private/Enterprise encryption	✓	✓	✓
WPA3 encryption	✓	✓	✓
Wireless ACL	✕	✓	✓
Multiple user accounts	✕	✓	✓
Dual firmware images	✕	✓	✓

	FirmUx Basic	FirmUx Standard	FirmUx Premium
Networking			
AP & station modes	✓	✓	✓
Router mode	✓	✓	✓
Bridge mode	✓	✓	✓
Device discovery (LLDP, CDP, MNDP)	✓	✓	✓
Data VLAN access**	✗	✓	✓
Custom IP routes (IPv4 and/or IPv6 addresses)**	✗	✓	✓
Port forwarding configuration function (when NAT enabled)	✗	✓	✓
IPv6 Support	✗	✓	✓
Multiple WAN access	✗	✓	✓
Wireguard VPN	✗	✓	✓
Static IPv6 address configuration	✗	✓	✓
Customizable DHCP servers for each LAN	✗	✓	✓
LTE modem support	✗	✓	✓
User Interface and Diagnostics			
Responsive UI design	✓	✓	✓
Ping and traceroute tools in UI	✓	✓	✓
UI access over HTTPS	✓	✓	✓
Traffic graphs in UI	✓	✓	✓
Basic Interface and network stats in UI	✓	✓	✓
Real-time events and device log in UI	✗	✓	✓
Troubleshooting file download function in UI	✗	✓	✓
Advanced network status info	✗	✓	✓
Premium Only Features			
Rebranding	✗	✗	✓
Cloud Support	✗	✗	✓

**   IPv6 Support is available on FirmUx Standard and FirmUx Premium

*   OpenWrt/ath11k - Pineapple support is in progress