AK-Systems IP-Plug multifunctional mini server

Customer

AK-Systems, a Russian developer, manufacturer and integrator of high-tech electronic devices.

Objective

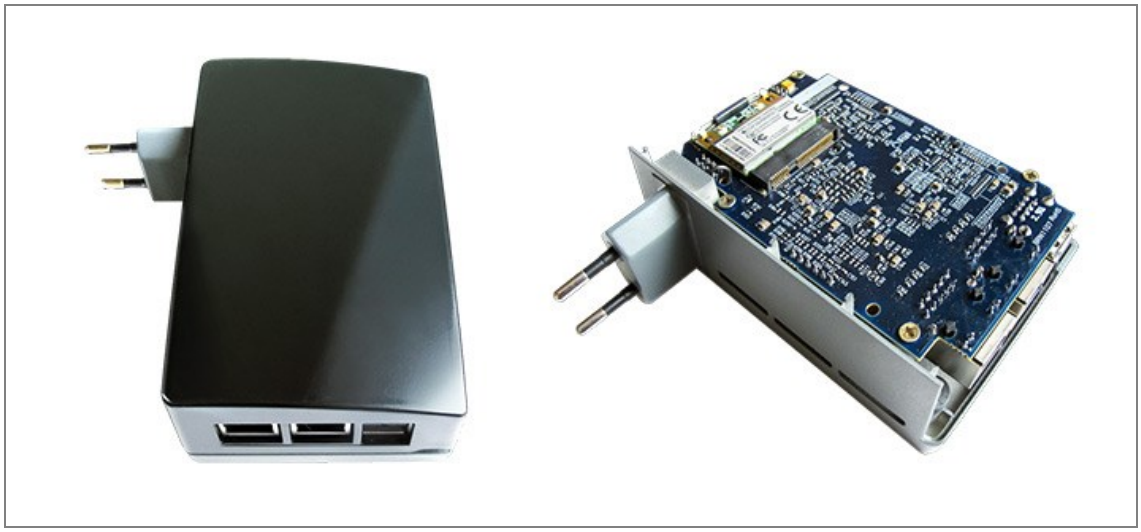
Develop a multifunctional network device (IP-Plug mini server) used for operation in SOHO networks and designed to solve a wide range of tasks, such as:

- Creating a Wi-Fi access point, as well as connecting to an existing WiFi network
- Creating an Internet access gateway, including the possibility of setting up a priority channel
- Creating a network printer and / or scanner
- Creating a backup server
- Implementing a file server with the possibility of access from both a local and a global network

The device should operate on a 220 V/50 Hz power supply in the 24x7 operation mode. It should be a small-sized low-power device.

Решение

Мини-сервер IP-Plug выполнен на базе процессора Marvell Kirkwood 88F6283 с частотой 1 ГГц. На компактной плате установлены два интерфейса Gigabit Ethernet и два USB 2.0. Опционально устанавливается Wi-Fi/BT-модуль 802.11 b/g/n + BT 2.1 EDR в форм-факторе ½ mini-PCIe. На процессорную плату могут устанавливаться ОЗУ и флеш-память различных объемов, от 512 МБ до 4 ГБ.



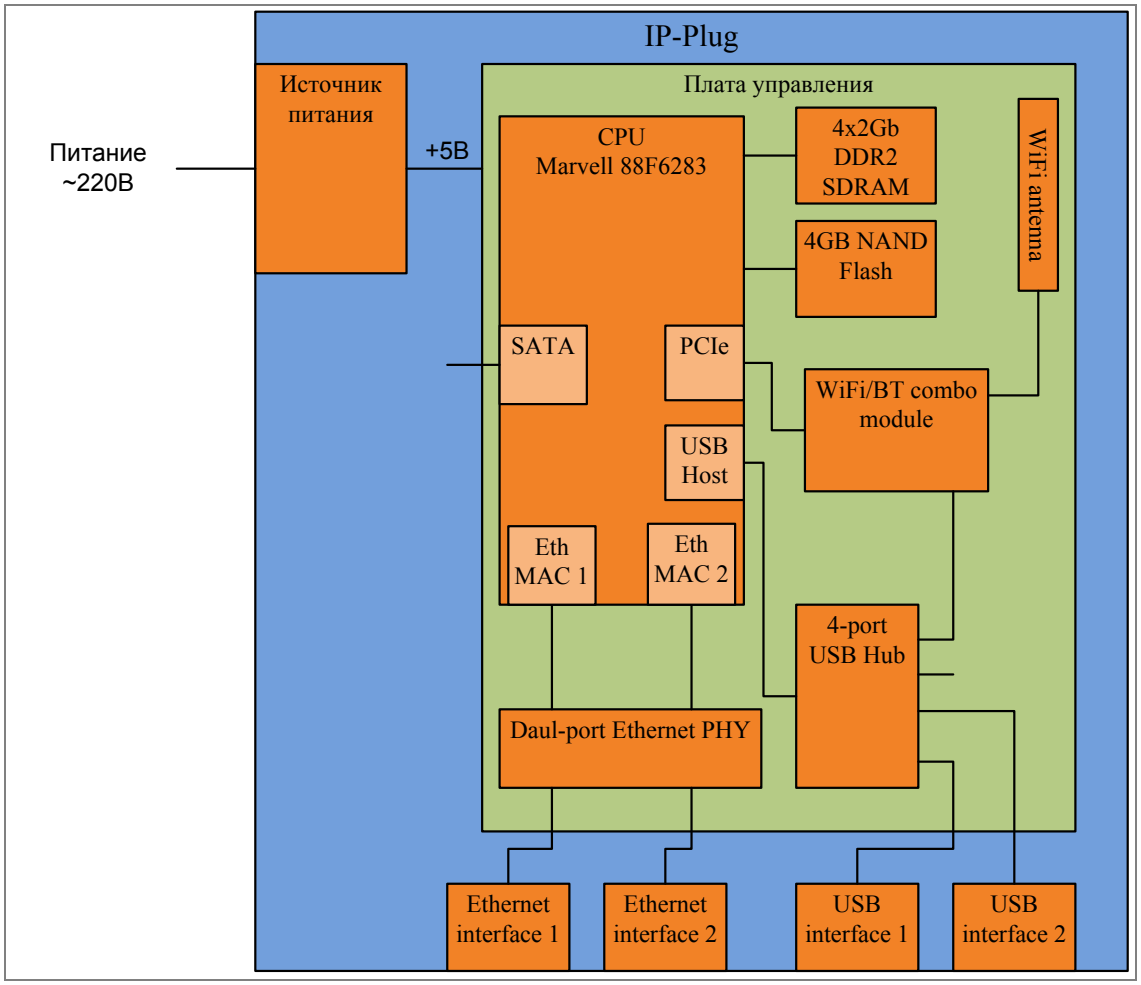


Figure. 1 Structural diagram of the device

The following program components were adapted for the operation of the device:

- U-Boot loader
- Linux kernel
- A Debian 6.0-based root file system

The boot loader performs basic initialization of the system (RAM, ROM, a network interface) and loads the operating system. It is also used for initial flashing and diagnosis of the device and its major components.

The Linux kernel contains drivers for all peripherals included in the mini server and provides program interfaces for applications and services. Support for major network protocols is implemented through Linux.

A FreeNAS-based graphic user interface was adapted to configure and manage the device.

Also, the specialized OpenWRT Service Asterisk distribution was installed on the mini server. This helps use the device as an IP telephony server.

One of the main tasks was studying temperature modes of the AK-Systems IP-Plug mini server. Thermal modeling was performed, taking into account heat consumption and dissipation for all the components. Based on the modeling results, the best option for the arrangement of modules inside the enclosure was selected and a board radiator was designed.

A number of enclosure design options were considered while developing the product's design. A 3D enclosure model was developed in accordance with the selected design option.

While launching the production of the device, the company's experts developed assembly design documentation for a number of the product's versions. In particular, documentation for manufacturing the enclosure allowed for different options of mounting interface connector holes. The experts also created a stand and specialized software for flashing and testing devices during mass production of large batches.

Advantages

- Use of a fully functional Linux distribution, the possibility of installing a large set of standard packages that help use the device in various applications
- Modern design
- Small size: 118 mm (long) x 76 mm (wide) x 43 mm (high)
- Low power consumption (average consumption in a typical application is less than 5 W, maximum power consumption during the operation of all peripherals is 15 W)
- Low production cost

Technologies	Linux Kernel, Plug-Computer, Debian, OpenWRT
Programming languages	C, Linux shell
Development tools	gcc, CAD tools
Project management tools	Redmine