WebCatPlus Hardware Architecture

WebCatPlus is an embedded web server that runs on BiPOM's MINI-MAX/ARM-E microcontroller board. WebCatPlus can be easily expanded using a wide variety of BiPOM Peripheral boards.

WebCatPlus uses the following memory resources of MINI-MAX/ARM-E to function as a web server that allows multiple simultaneous connections:

- 512K Program Flash on ARM7 Microcontroller contains the web server firmware.

- 32K RAM on ARM7 Microcontroller serves as variable and stack space for web server and also contains information about TCP/IP connections.

- 1 Megabyte Data Flash on MINI-MAX/ARM-E contains the web content, including configuration, any HTML pages, graphics, scripts such as Java Script, Java Applet byte code and other client side languages that can be embedded in HTML.

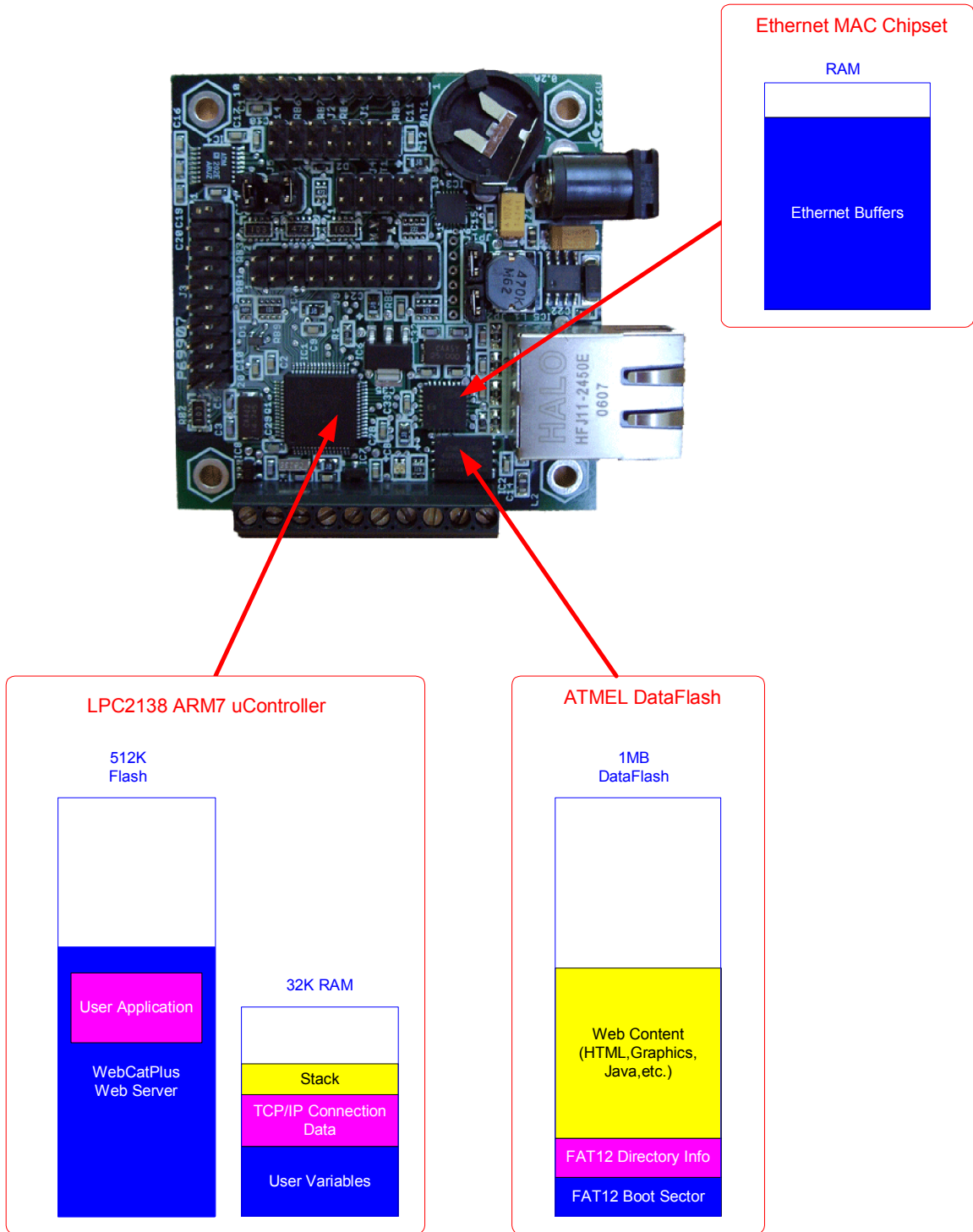Figure 1 shows these memory resources in more detail.

Ethernet MAC Chipset

RAM

Ethernet Buffers

LPC2138 ARM7 uController

512K
Flash

User Application

WebCatPlus
Web Server

32K RAM

Stack

TCP/IP Connection
Data

User Variables

ATMEL DataFlash

1MB
DataFlash

Web Content
(HTML,Graphics,
Java,etc.)

FAT12 Directory Info

FAT12 Boot Sector

Figure 1

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Software Architecture

WebCatPlus Consists of the following software components:

- UIP TCP/IP Stack: Open source/GNU
- FreeDOS FAT File System: Open Source/GNU
- HTTP Server: Open source, supplied by BiPOM Electronics
- Tag Support: Open source, supplied by BiPOM Electronics

Theory of Operation

When WebCatPlus is powered, the web server firmware starts running. As first step, it initializes the hardware and looks for a valid boot sector and FAT12 file system on DataFlash. If a valid file system is found, the firmware looks for Configuration files (config.txt and config2.txt). These configuration files contain information about the web server, for example, IP address, Gateway address and other TCP/IP parameters. When the firmware reads a valid configuration, it starts listening for TCP/IP connections.

When the firmware detects an incoming Ethernet packet, the firmware checks the type of the packet. If the type is ICMP (ping) request, this means that a computer on the local area network (or Internet) is pinging the WebCatPlus. The firmware sends an ICMP reply to the pinging computer.

If the packet type is Telnet, a Telnet session is started and Telnet data is exchanged.

If the packet type is HTTP, it is most likely coming from a web browser from a computer on the local area network (or Internet). In this case, HTTP request contains the URL of the HTML page that the browser wants to display. The firmware accesses the FAT12 file system directory on DataFlash and looks for the requested HTML. If found, the HTML contents are sent back to the requesting PC as part of an HTTP reply.

The browser on the remote computer may send additional HTTP requests to get further web content such as embedded graphics, other HTML's, JAVA byte code, etc. All these HTTP requests are services by WebCatPlus and the results sent to the remote computer.

If there are embedded tags inside the HTML, these tags are substituted with appropriate values and the resulting values are sent back to the remote computer as part of HTML. Some of the embedded tags are used for accessing actual hardware such as I/O ports, analog inputs, etc.

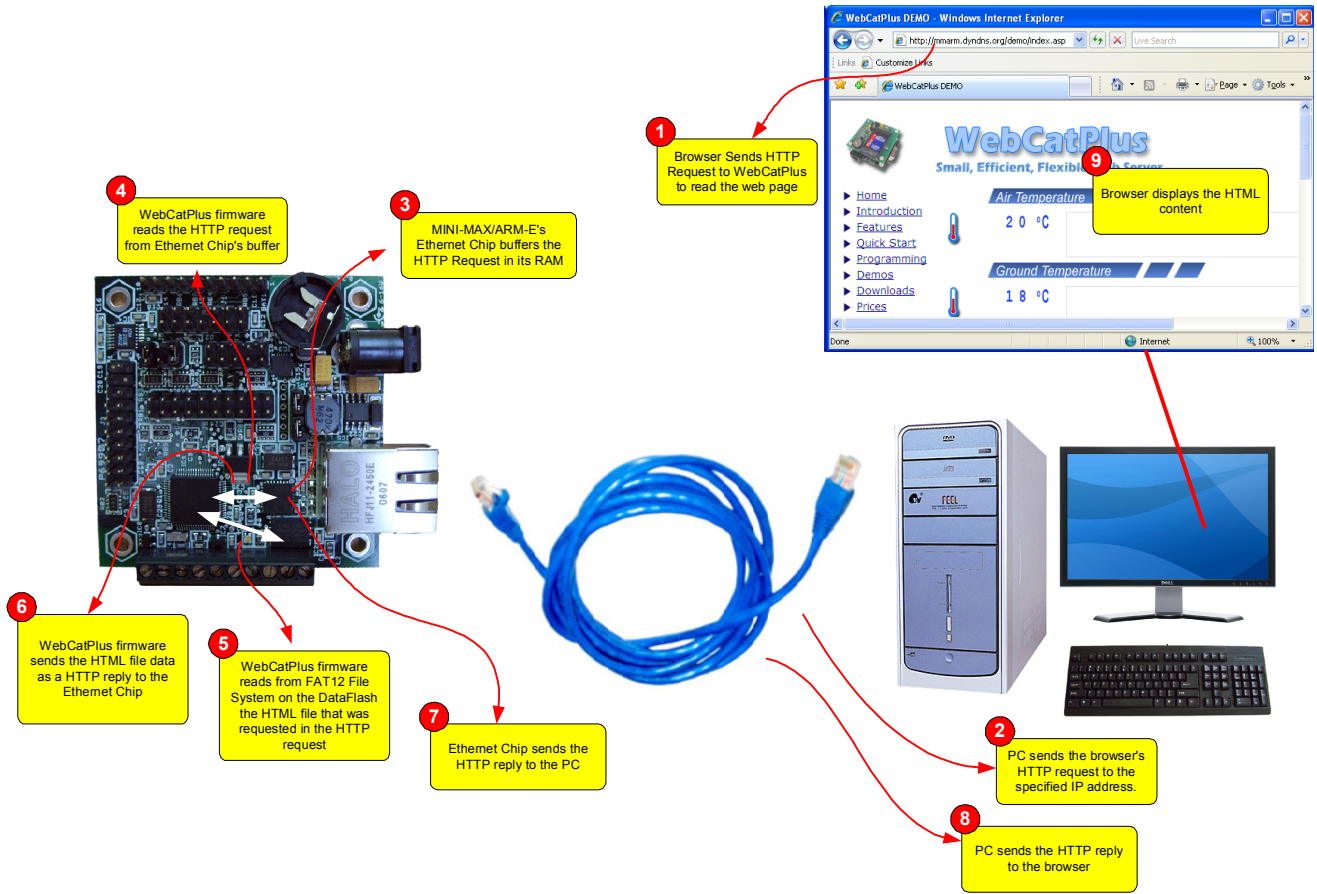Figure 2 shows the path of data flow.

1 Browser Sends HTTP Request to WebCatPlus to read the web page

9 Browser displays the HTML content

4 WebCatPlus firmware reads the HTTP request from Ethernet Chip's buffer

3 MINI-MAX/ARM-E's Ethernet Chip buffers the HTTP Request in its RAM

6 WebCatPlus firmware sends the HTML file data as a HTTP reply to the Ethernet Chip

5 WebCatPlus firmware reads from FAT12 File System on the DataFlash the HTML file that was requested in the HTTP request

7 Ethernet Chip sends the HTTP reply to the PC

2 PC sends the browser's HTTP request to the specified IP address.
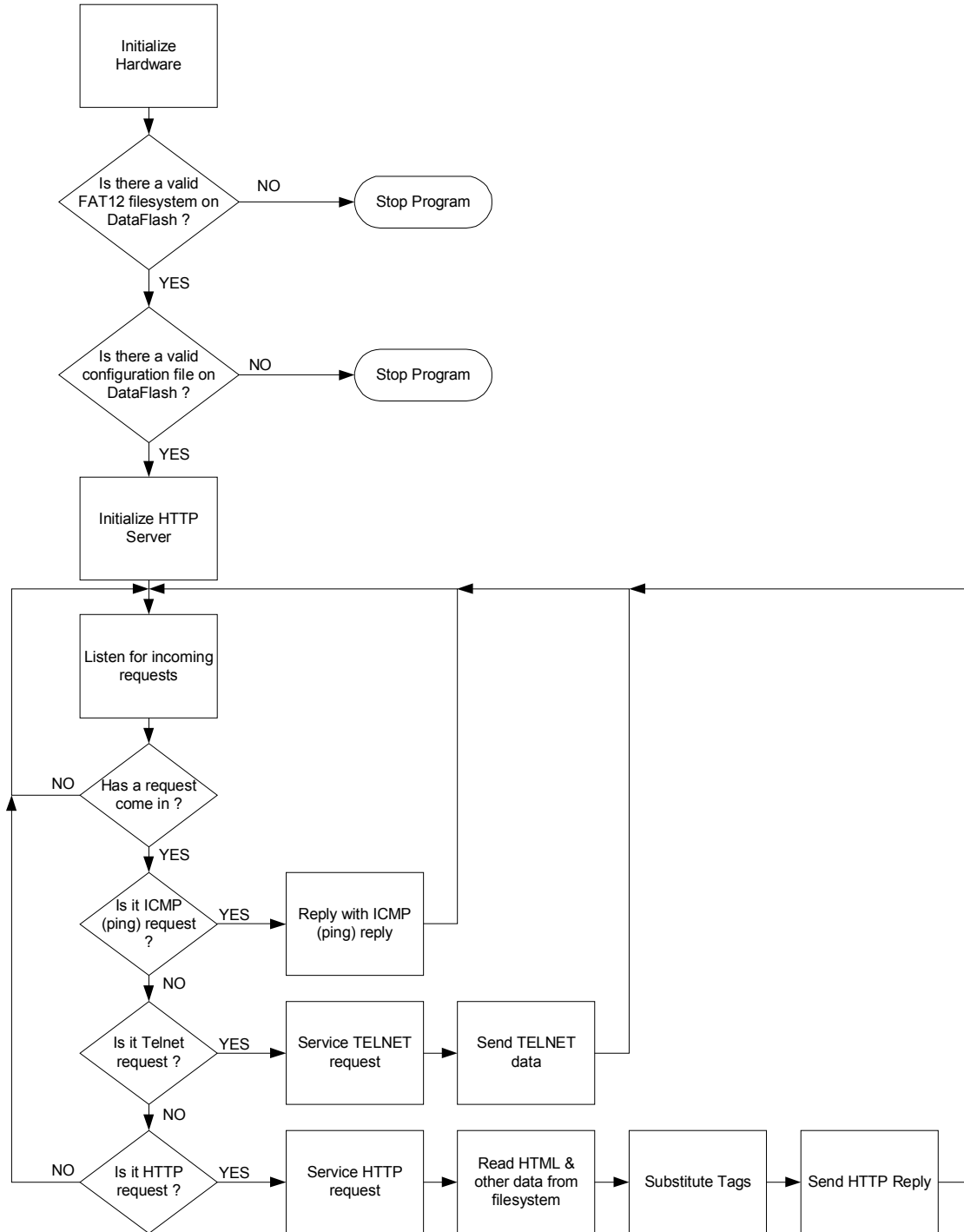
8 PC sends the HTTP reply to the browser

Figure 2: Path of data flow

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Figure 3: WebCatPlus Web Server Flowchart