Embedded Web Server for Equipments

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Introduction

Server:
- Computer Program
- Physical computer
- Software/Hardware System

Web Server:
Software/Hardware system having a dedicated functionality

What is an Embedded Web Server?
Embedded Web Server

- Embedded systems are generally located remotely
- Monitoring operation, Checking performance, collecting data, or upgrading the application software can be a costly and time-consuming process
- EWS can host web site on your embedded devices
- Benefits: Remotely report status, Get remote data to process, or even send remote messages to have their administrator informed about some incidents.

Tiny Embedded Web Server, the OMEGA iServer
EMBEDDED INTERNET

• Many applications require huge memory and processing power
• Embedded systems: Limited resources
• Solution: Provide internet-connectivity Embedded systems
• EI solves TCP/IP and browser
• Adoption rate in market is High: Solves Disparity of Networking Standards and Inconsistency of User Interfaces.
• Software :Making Standard(TCP/IP)
• Hardware: Ethernet or Bluetooth
Structure of EI model

Mini Embedded Web Server : “Webit”
Hardware Platform

• How the platform is different?
  - Focus on application
• Why to choose 8-bit and limited resource chip?
  - Size
  - Cost
  - Power consumption
• What they chose?
  - 3k-byte Flash Rom for kernel code and 512 bytes SRAM.
  - 8MHz
  - 32 Kbyte EEPROM
TCP/IP PROTOCOL SUITE

TCP/IP defines a set of rules to enable computers to communicate over a network. specifying how data should be packaged, addressed, shipped, routed and delivered to the right destination.
TCP/IP PROTOCOL SUITE REDUCTION

Connecting in the network:
• RS232, RS485, CAN etc.
• Can we do Remote Monitoring?

How to connect embedded system with Internet?
• Connect it with PC
• Realize N/W protocols in the chip

EWS: A microcontroller with an embedded TCP/IP stack is called as an Embedded web server
TCP/IP PROTOCOL SUITE (Contd..)

- Not all protocols are necessary for EI
- HTTP, TCP, ARP, RARP, ICMP: Basic need
- UDP: may prefer
- Seldom used: SNMP and FTP
TCP/IP PROTOCOL SUITE REDUCTION (Contd..)

• UDP and TCP: What is the Difference?
• Connection establishment and disconnection
  - Three handshake protocol
• Connection Maintenance and data transfer
  - Reduction method and Stop-and-wait Protocol
• For simplicity, one client and one server taken
• In case of multiple clients and servers, multiple connections must be supported in kernel
  - For maintenance, multiple connections states have to be recorded in the web server.
  - TCB is designed to handle this task.
TCP/IP PROTOCOL SUITE REDUCTION (Contd..)

- Several timers maintained for reliability. For example Time-out timer
- Time-out timer:
  - Once the data is sent, Timer is started
  - If ACK does not come back within the time frame, data is sent again
  - Finally six seconds timer selected to utilize SRAM resource fully
- Keep-alive timer:
  - For idle connections which waste resources
  - Timer too long; Limited resources of MCU, Can’t Implement
  - Timer reduced at kernel level
USER DEVELOPING PLATFORM

• Kernel: Internet Interface only, Usage determined by user
• Includes Debugger, binary utilities and other tools
• Data Received: Headers removed layer by layer
• Based on Socket and port number: UNS Function called
• Data Transmit: Headers added layer by layer
• UDP/TCP_SEND function used
CASE STUDY

The Mini Web Server applied to Air condition:
CASE STUDY (Contd..)

- Webit Connection
  - AC with I2C bus
  - Internet with RJ45 Interface
- Homepage Size: 28KByte that includes HTML, Pictures, other files
- Button press on homepage: Command sent to Webit
- Commands: Decrease/Increase the temperature
- Take appropriate action via I2C
- After completion of action, Webit sends back response.
CASE STUDY (Contd..)

Evaluation of Performance:
- Three kinds of Web pages: txt, HTML, HTML+Java Applet
- Through Data from the table: Speed is acceptable.
- Stability: When more than one user access Webit!!

<table>
<thead>
<tr>
<th>File category</th>
<th>File size</th>
<th>File number</th>
<th>Time</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>TXT</td>
<td>30</td>
<td>1</td>
<td>18.29</td>
<td>13.12</td>
</tr>
<tr>
<td>HTML&amp;jpg</td>
<td>28.4</td>
<td>6</td>
<td>17.91</td>
<td>12.64</td>
</tr>
<tr>
<td>HTML&amp;Java Applet</td>
<td>28</td>
<td>4</td>
<td>25.45</td>
<td>8.8</td>
</tr>
</tbody>
</table>

Table 2 REALIBILITY PERFORMANCE OF Webit

<table>
<thead>
<tr>
<th>ICMP</th>
<th>TCP</th>
<th>ICMP LOST</th>
<th>TCP LOST</th>
</tr>
</thead>
<tbody>
<tr>
<td>86400</td>
<td>207360</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>
CONCLUSION

• Introduced general design concept of EWS

• Introduced policy of TCP/IP reduction whose goal is to allow easy access to and exploitation of remote equipment

• The mini EWS provides common devices an internet interface and gains a good performance
Thank Y’ll For Your Cooperation!!!

Queries?