Cooperative Web Browsing for Mobile Phones

By Group 838, 2007
Agenda

- Introduction
- Modules
- Integration
- Project Management
- Conclusion and Outlook
- Demonstration
Introduction

- Introduction
  - Project Concept
  - Project Approach
  - Project Steps

- Modules
- Integration
- Project Management
- Conclusion and Outlook
- Demonstration
Introduction

Prerequisites

Limited experience with

- Symbian C++
- Development for Mobile Phones
- Server scripting
- Web programming
Introduction

Project Concept
Introduction

Project Concept

Expected capacity gain

![Diagram showing individual and cooperative capacity gains.](image-url)
Introduction

Project Approach

Multiplexing:
- HTML index
- External links to resources
Introduction

Project Approach

Load Balancing

- Ensure maximum capacity gain
- Simple loadbalacing will be used
Introduction

Project Approach

- Stepwise approach

<table>
<thead>
<tr>
<th>External interfacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal application logic</td>
</tr>
<tr>
<td>Internal capabilities</td>
</tr>
</tbody>
</table>
Introduction

Project Steps

Relay Connection

Diagram showing a network of mobile terminals connected to a web server and proxy server through different protocols: TCP, Bluetooth, and GPRS.
Introduction

Project Steps

Relay capabilities:
- Bluetooth connectivity
- GPRS connectivity
- Remote GPRS interface over Bluetooth
Project Steps

Common Cooperation:
Common capabilities:

- List
- Control algorithm
Introduction

Project Steps

Dedicated Cooperation
Introduction

Project Steps

Dedicated Cooperation capabilities:

- Proxy server preparing for multiplexing
- Proxy interface on the MT
- Web Browser GUI
System requirements:

- Bluetooth connectivity
- GPRS connectivity
- Remote GPRS interface
- List
- Control algorithm
- Proxy Server
- Web Browser GUI
Introduction

Modules
- Bluetooth
- HTTP
- Web browser
- Proxy server

Integration
Project Management
Conclusion and Outlook
Demonstration
**Modules**

**Bluetooth:** Discover services & establish a connection, exchange data.

**HTTP:** GPRS Connection establishment, transmission and reception of data between phone and web server.

**Web browser:** Displays the contents of a HTML web page, loaded from Master MT.
Proxy Server: Retrieves information about a requested web page, and return a list of contents to the Master.
I want this (URL) Web Page

I need this index.html

The index is returned

TCP

GPRS

Master

Proxy server

Processing information

Links processing

Prelist

Balance

List1

List0

Information File
Modules

Load balancing

$preList

Temporary list

Ascendant order

$List 0/size: 21

$List 1/size: 24
Integration

- Introduction
- Modules
- Integration
  - Relay
  - Common cooperation
  - Dedicated cooperation
- Project Management
- Conclusion
- Outlook
- Demonstration
Overall structure of the MT application
Relay Scenario

- Prerequisite for successive scenarios.
- Implementation of HTTP and Bluetooth
- Bluetooth Control Protocol needed.
Bluetooth control protocol

- Enables remote HTTP GET requests.
- Handles retrieved web content properly.

**Packet types:**

<table>
<thead>
<tr>
<th>Packet Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EURLReq</td>
<td>HTTP GET request for a certain file</td>
</tr>
<tr>
<td>EURLReply</td>
<td>HTTP GET reply returning data</td>
</tr>
<tr>
<td>EURLEnd</td>
<td>HTTP GET complete</td>
</tr>
</tbody>
</table>
Integration

Receiving a Bluetooth packet

Data Received

- Is packet EURLReq
  - Yes: Issue HTTP GET With URI
  - No: Forward datachunk to CreateFile() With file id

- Is packet EURLEnd
  - Yes: Send message to framework with the file id
  - No: END
Fully functional integration of “Relay scenario”
Integration

Common cooperation

- Web Server
- Proxy Server
- Mobile Terminal 1 (Master)
- Mobile Terminal 2 (Slave)

Colors:
- Red: TCP
- Blue: Bluetooth
- Green: GPRS
Integration

Presenting the List

Master Array
Structure 1
Structure 2
...
Structure j

Slave Array
Structure 1
Structure 2
...
Structure i

STRUCTURE
- iFileId
- iConnectionId
- iFileFlag
- iFilePath
### Integration

**Presenting the structure**

- Identify which file to process
- Identify which mobile connection is used
- Identify the status download of a given file
- The file path returned by the ProxyServer

<table>
<thead>
<tr>
<th>STRUCTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• iFileId</td>
</tr>
<tr>
<td>• iConnectionId</td>
</tr>
<tr>
<td>• iFileFlag</td>
</tr>
<tr>
<td>• iFilePath</td>
</tr>
</tbody>
</table>
Integration

Sequence function diagram: Master array

- **Sequence Function**
  - \( i\text{HTTPCount}++ \)

- **Count**
  - \( \geq L(i\text{MasterArray}) \)
  - \( < L(i\text{MasterArray}) \)

- **Successful HTTP**
  - END

- **Issue HTTPGET**
  - HTTP Event
    - \( \text{EGOTResponse} \)
    - BodyData
  - \( ES\text{ucceeded} \)
  - \( C\text{create File} \)
Integration

Sequence function diagram: Slave array

Sequence Function

iBT Count

>=L(iSlaveArray)

Successful BT

END

SendBT Packet

Data Receive

Create File

<\L(iSlaveArray)

<iBTCount++

EURLEND

EURReply
Integration

Dedicated cooperation
Integration

Function Query List

?url =

?url = kom.aau.dk/group/07gr838/

http://192.38.55.43/gr838/

http://192.38.55.43/gr838/?url = kom.aau.dk/group/07gr838/
Integration

How we extract information from the list

- index.html
- img/coopWeb.jpg

- img/coopWeb1.jpg
- img/coopWeb2.jpg

- index.html
- img/coopWeb.jpg

- img/coopWeb1.jpg
- img/coopWeb2.jpg

- index.html
- img/coopWeb.jpg
Integration

- **STRUCTURE**
  - iFilePath

- **STRUCTURE**
  - iFilePath

- index.html
- img\coopWeb.jpg
Integration

Testing

37.82 seconds  20.09 seconds
Project Management

- Introduction
- Modules
- Integration
  - Project Management
    - Application
    - Handling problem areas
    - Avoiding problem areas
- Conclusion and Outlook
- Demonstration
Project Management Application

Project Management applied through:

- Weekly group meetings
- Dividing in sub-projects
- Supervisor meetings
Inadequate project management:

- Too many resources invested in the Cooperation application
- Halt development and focus on the report
Project Management

Avoiding problem areas

Avoiding same problems in future projects:

- Group meeting when allocating resources and timelines

- Seize premade projects/applications with deeper pre-investigation
Conclusion and Outlook

- Introduction
- Modules
- Integration
- Project Management
  - Conclusion and Outlook
    - Achievements
    - Improvements
- Demonstration
Achievements

Individual and project related achievements:

- Symbian, PHP and HTML insight/knowledge
- Good stepwise and modular project approach
- Finished proof of concept cooperative web browsing application
Conclusion and Outlook

Achievements

Most importantly:

- Significantly reduced download time using the cooperation application
- Supports the motivation for cooperating
Conclusion and Outlook

Improvements

Next steps:

- Extend the scope of devices in the setup
- Dynamically adjust to connecting and disconnecting devices
- Move load balancing to the phones
- Incorporate the web browser/GUI
Management system for sharing of the cellular links ("Think time" and "Processing time")

- Avoid redundant sharing
The main idea is that under a certain limitation of the cellular link data rates, cooperation will increase the virtual (what the user feels) data rate by bundling it with other users.