A Multicast service for Mobile Computing

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Multicasting service with host mobility

"A service paradigm to allow messages to be sent to a group of mobile hosts whose physical location changes with time"

- addressing mechanism has to be considered to minimize the number of messages transmitted
- disconnection is presumed to be voluntary, to reduce power consumption of mobile hosts
- wireless medium has broadcast and asymmetric communication with bandwidth constraints
- many applications do not require a firm reply, e.g. mail, news
Network latency and host mobility

(MSS )

\( mh_1 \)

(MSS \( \mu \))

\( mh_{1,1} \)

\( mh_{1,2} \)

\( mh_{1,3} \)

(MSS \( \lambda \))

(MSS \( \rho \))

received twice

want it later

not received

not received

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The Setup

- location information = mobile host address + its MSS address
- MSS (Mobile Support Station) has responsibilities
  - to execute most of the service
  - to maintain mobile host related states
  - to deliver messages to the local hosts
- the members of the group can send to the group

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Approach

- addressing: forwarding + tunneling
- service interface: reply count, timeout
- message sequence number (M_id)
- message log (msg_log)
- group view: maintain message delivery history and local member’s status

Host moving procedure

- MSS
- message forwarding
- leave
- hand-off address propagation
- MSS
- check hand-off authorization
- detect
Service interface

mobile_multicast(group_name,
message text,
reply count,
timeout for message lifetime)
⇒ set of reply

Multicasting service

All reply

Subset reply

Early reply

No reply

(reply count, timeout)

(#,0)

(0,#)

(0,#)
Message sequence number (M_id)

- MSS name + sequence number
- sender (MSS) generates it for each service invocation
- destination MSS uses it to resolve an exactly once semantic for message delivery with mobility

msg_log
- build on receiving message
- erase with all reply, or time out

Group view

[group_name]

MSSs:

<table>
<thead>
<tr>
<th>MSS4</th>
<th>MSS8</th>
<th>MSS45</th>
<th>MSS2</th>
<th>MSS7</th>
</tr>
</thead>
</table>

local hosts:

- mh3
- mh4
- mh5
- mh8
- mh2

last replied M-id

msg_log : list of (M_id, message text, timeout, set of not-acked hosts)

host_status:

- stay_in
- stay_out
- stay_alone
- stay_visitor

forwarding address
On receiving message

<table>
<thead>
<tr>
<th></th>
<th>stay_in (stay_visitor)</th>
<th>stay_out</th>
<th>stay_alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>all_reply</td>
<td>broadcast</td>
<td>forward to visiting MSS and wait reply</td>
<td>wait to change the host status</td>
</tr>
<tr>
<td></td>
<td>reply to sender (reply to home MSS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>subset_reply</td>
<td>&quot;</td>
<td>&quot;</td>
<td>reply to sender with the host status</td>
</tr>
<tr>
<td>early_reply</td>
<td>reply to sender broadcast (reply to home MSS)</td>
<td>&quot;</td>
<td>wait to change the host status</td>
</tr>
<tr>
<td>no_reply</td>
<td>broadcast</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>(reply to home MSS)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Hand off procedure

<table>
<thead>
<tr>
<th></th>
<th>Initiator</th>
<th>Responder</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>stay_in</strong></td>
<td>build up an out_view with stay_visitor</td>
<td>if responder has an out_view stem from the same home_view</td>
</tr>
<tr>
<td></td>
<td>set the home_view with stay_out hand over the out_view to new MSS</td>
<td>resolve the msg_log</td>
</tr>
<tr>
<td></td>
<td></td>
<td>else, if any msg_log not-replied from the host, <em>broadcast</em> reply to the home MSS</td>
</tr>
<tr>
<td><strong>stay_visitor</strong></td>
<td>if return back to the home MSS, set an out_view with stay_in hand over the out_view else, hand over the out_view to new MSS</td>
<td>resolve the msg_log</td>
</tr>
<tr>
<td></td>
<td></td>
<td>if responder has an out_view stem from the same home_view</td>
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<td></td>
<td>resolve the msg_log</td>
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<td>else, if any msg_log not-replied from the host, <em>broadcast</em> reply to the home MSS</td>
</tr>
</tbody>
</table>

### Acknowledgement

- **sender**
  - sending
  - forwarding
  - reply, if need
- **visiting MSS**
  - reply
- **home MSS**
  - reply, if need

- **sender**
  - tunneling
  - reply, if need
- **visiting MSS**
  - reply
- **home MSS**
  - reply, if need
On receiving re-connection request

*case* (local host) : set the host status with stay_in
    if any msg_log not-replied from the host
        broadcast

*case* (visiting host) : request a hand off to home MSS

Summary

- provides multicasting service paradigms for host mobility environment
- deals with some features at the level of service interface
- jointly supports forwarding and tunneling addressing scheme
- resolves the message delivery problem using group view with host status