An Investigation into Distributed Channel Mobility Support for Communicating Process Architectures

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Breakdown

Background

Limitations and Definitions

Potential Models of Distributed Channel Mobility

Analysis and Summary
Breakdown

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Last Year

A Critique of JCSP Networking

Problems found
1. Performance
2. Resource usage
3. Interoperability

Implementations coming
- PyCSP (delayed – sorry John)
- occam-π (closer)
Protocol for CPA Networking

Simple low level messages to support distributed channel (and barrier) communications

\{
SEND 45 34\} \{24 [24]BYTE\}
\{ACK 34 0\}

All message headers are triples \{\}

Some messages require a data load \{\}
Aim

Protocol support for mobility (as far as possible)

Process mobility not relevant
- JCSP Networking now a communication layer
- Platform specific issues

Channel mobility support
- Core to networking functionality
- Supports process mobility
Local Mobile Channels – occam-π

CHAN TYPE my.mobile
   MOBILE RECORD
      CHAN INT chan?:
   :

PROC my.proc(CHAN my.mobile? chan!)
   my.mobile? in:
   my.mobile! out:
   SEQ
      in, out := MOBILE my.mobile
      chan ! in
   :
public class my_proc
{
    ChannelOutput chan;
    public my_proc(ChannelOutput chan)
    {
        this.chan = chan;
    }

    public void run()
    {
        One2OneChannel c = Channel.one2one();
        chan.write(c.in());
public class my_proc
{
    NetChannelOutput chan;
    public my_proc(NetChannelOutput chan)
    {
        this.chan = chan;
    }

    public void run()
    {
        NetChannelInput in = NetChannel.net2one();
        chan.write(in);
    }
}
Why do I want this?

Distributed mobile channels would be nice
  – Cross machine mobility
  – Interoperable mobility

Distributed mobile processes would be nicer
  – Mobile agents (with code mobility)
  – Connected mobiles
    • Mobile agents have difficulty here
Mobile Architecture

Code mobility specifies mobility of code element only

CPA takes a connector first approach
Mobility of Components

Code Mobility Mobile

Code

State

Passive

Active
Breakdown

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Analysis and Summary
Defining a Distributed Mobile Channel

A mobile channel end resides on a node
– A node is part of a distributed application that resides on a device

We send messages (connect) to a input channel end via its address
– A channel input can therefore be defined by its location

A channel output uses this location to send messages
– To migrate a channel, we send a copy of the input location

Input end mobility is generally the problem!
Addressability and Connectivity

Addressability
– The ability to connect to a device from its address

Connectivity
– The ability to be connected to a device
Simplified model of network domains

Internet

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TU/e

Local Network (192.168.x.x)

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Analysis and Summary
One-to-One Networked Channel
Problem with One-to-One
Name Server

Diagram showing the flow of data between a producer, a name server, and a consumer. The arrows indicate the direction of data flow:
- From the producer to the name server, labeled "Request".
- From the name server to the consumer, labeled "Resolve".
- From the consumer to the name server, labeled "Register".
Message Box
Message Box Server
Chain
Reconfiguring Chain
Mobile IP
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Analysis and Summary
Properties of Interest

Transmission time
- The amount of time taken to transfer a message from a sender to receiver

Reconfiguration time
- The amount of time taken to reconfigure architecture to migrate a (input) channel

Reachability
- The set of domains that can reach the input end

Robustness
- The overall reliance on connections and devices to provide the mobile infrastructure
## Analysis Results

<table>
<thead>
<tr>
<th>Transmission Time</th>
<th>Reconfiguration Time</th>
<th>Reachability</th>
<th>Robustness</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-to-One</td>
<td>One-to-One</td>
<td>Chain</td>
<td>One-to-One</td>
</tr>
<tr>
<td>Name Server</td>
<td>Message box server</td>
<td>Reconfiguring chain</td>
<td>Message box server</td>
</tr>
<tr>
<td>Message box</td>
<td>Message box</td>
<td>Mobile IP</td>
<td>Name server</td>
</tr>
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Analysis Results

One-to-One is great
  – If you don’t require server like communication

Name server is good
  – For cluster computing (local domain)

Mobile IP is good
  – For global connectivity

Which is best?
  – Unsure. What do we want to use our mobility for?
Future Work

Simulation, implementation and verification of selected model(s)

Determine the required protocol messages

Implement protocol in different languages / platforms
  – occam-π
  – PyCSP
  – CHP
  – etc…
Summary

We have a better model for mobile agents
  – Component mobility, not code mobility

Distributed mobility of channels is a key problem
  – We have done it before!
  – We need a good model
  – Some problems to overcome

Number of potential models
  – I still don’t know which one to choose

Networking protocol for CPA still ongoing
Questions