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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

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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)

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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 { }

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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

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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
:
```

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Local Mobile Channels – JCSP

```
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());
```

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Net Mobile Channels – JCSP (sort of)

```
public class my_proc
{
  NetChannelOutput chan;
  public my_proc(NetChannelOutput chan)
  {
    this.chan = chan;
  }

  public void run()
  {
    NetChannelInput in = NetChannel.net2one();
    chan.write(in);
```

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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

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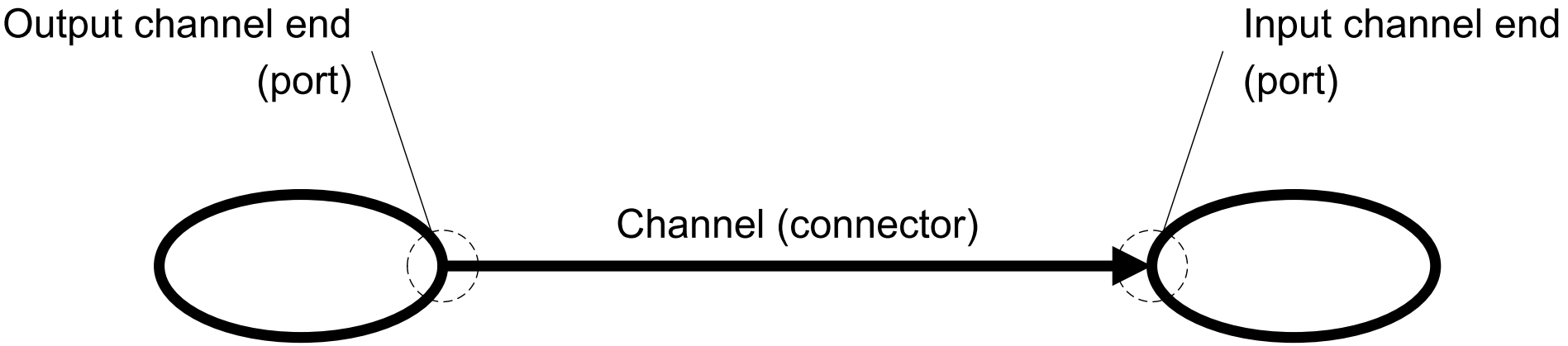
Mobile Architecture

Code mobility specifies mobility of code element only

CPA takes a connector first approach



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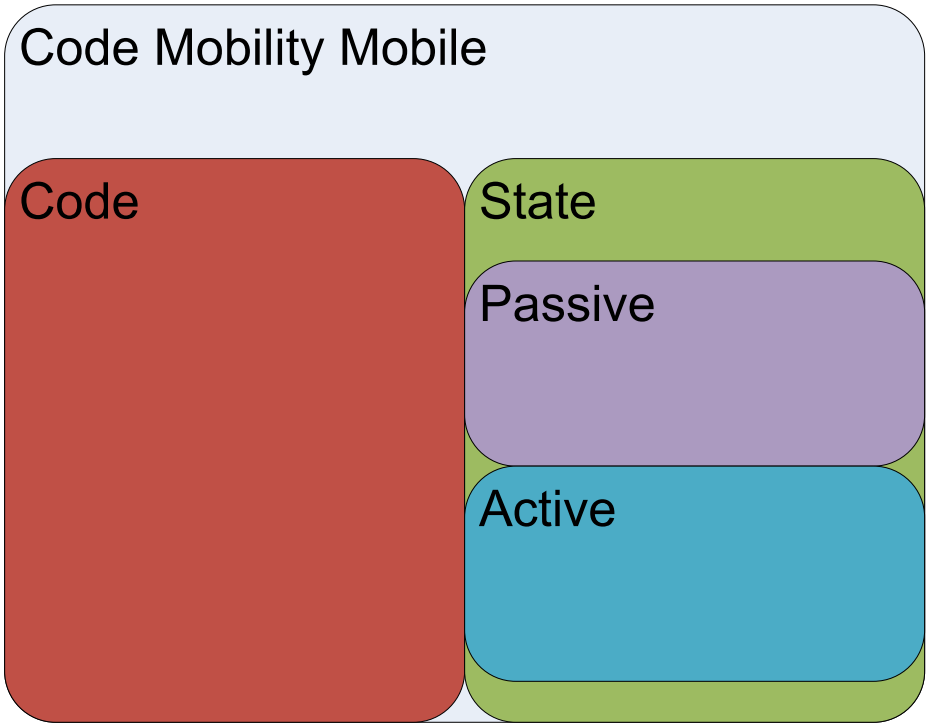
Mobility of Components



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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!

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Addressability and Connectivity

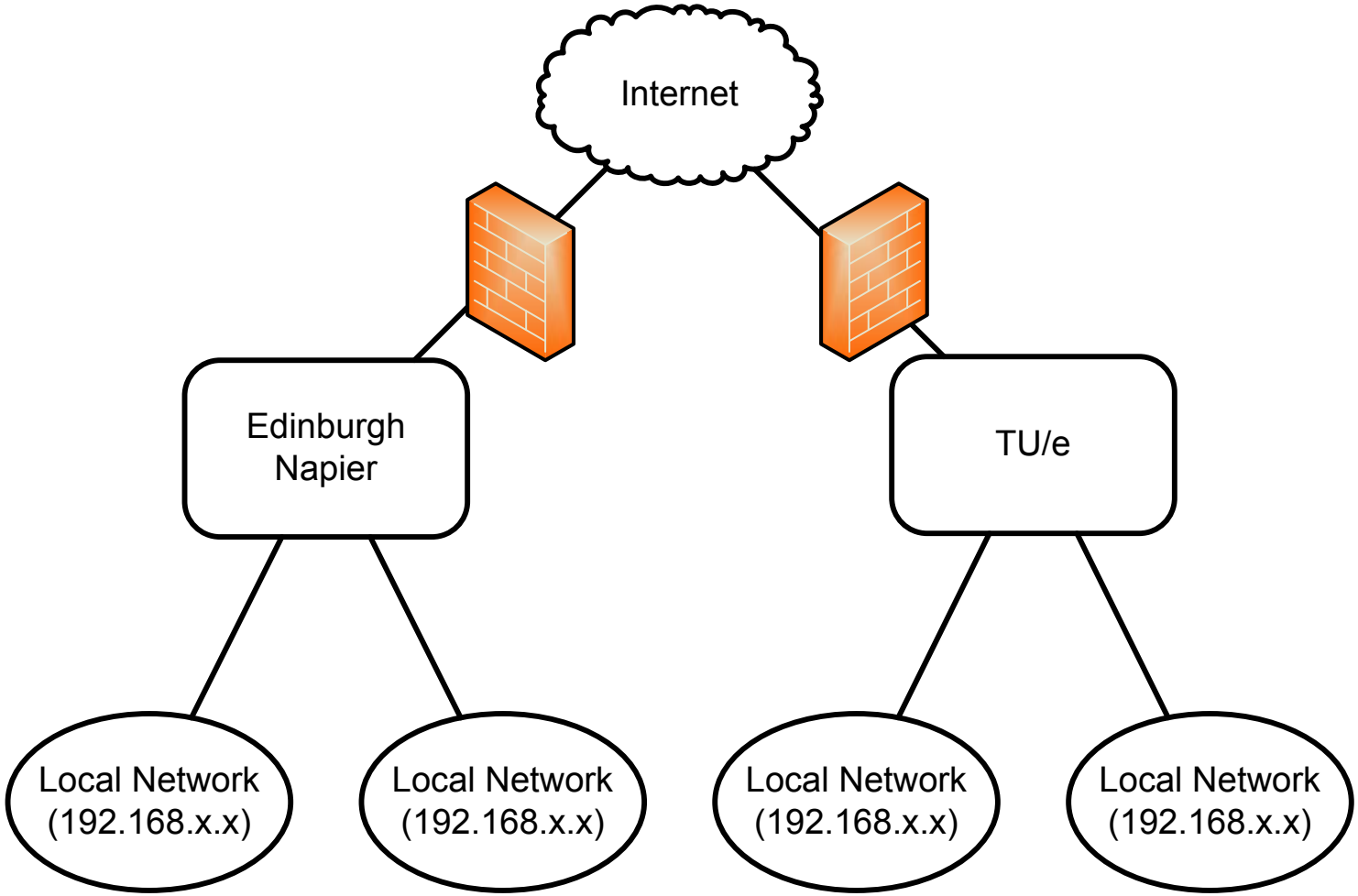
Addressability

- The ability to connect to a device from its address

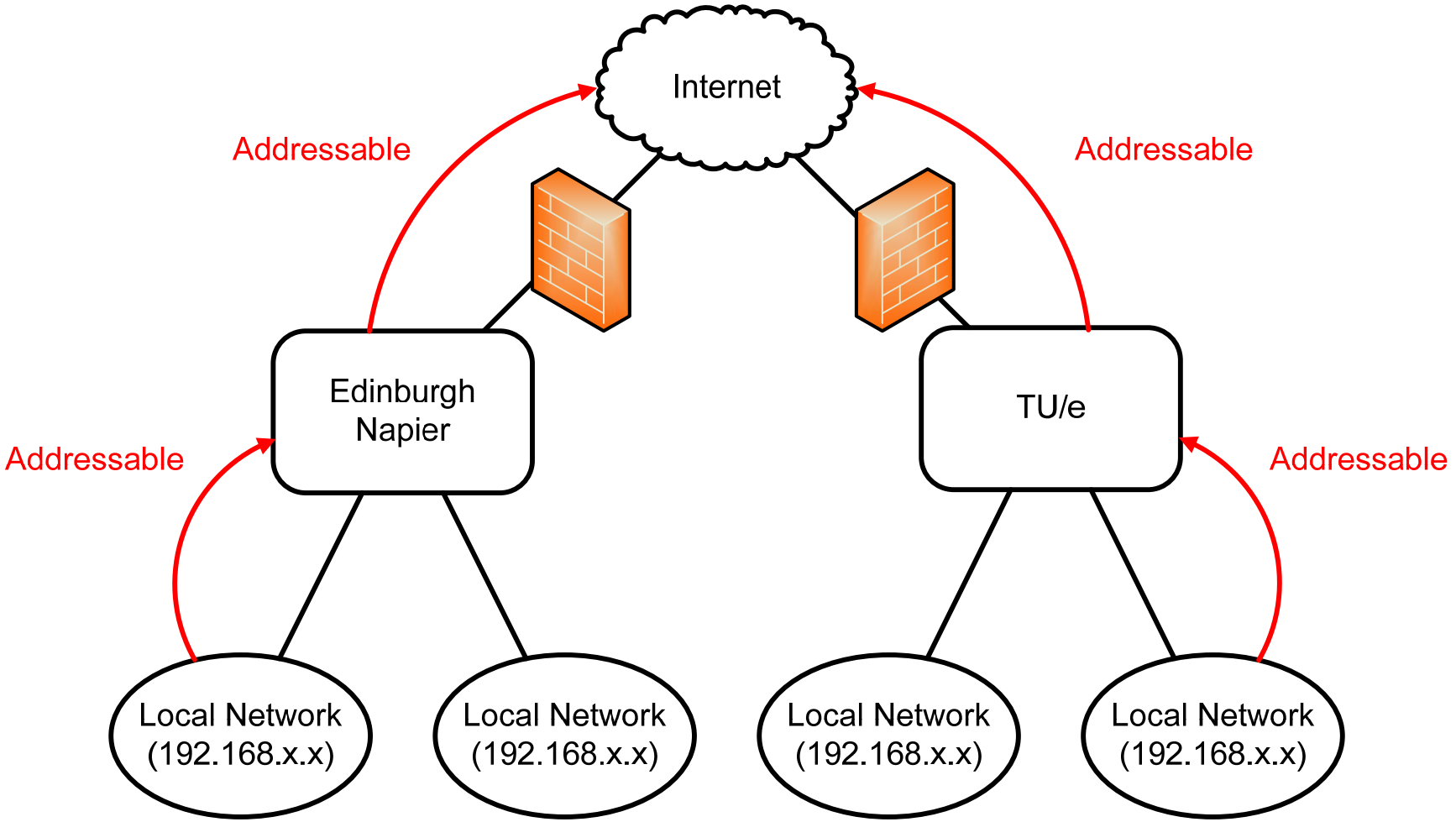
Connectivity

- The ability to be connected to a device

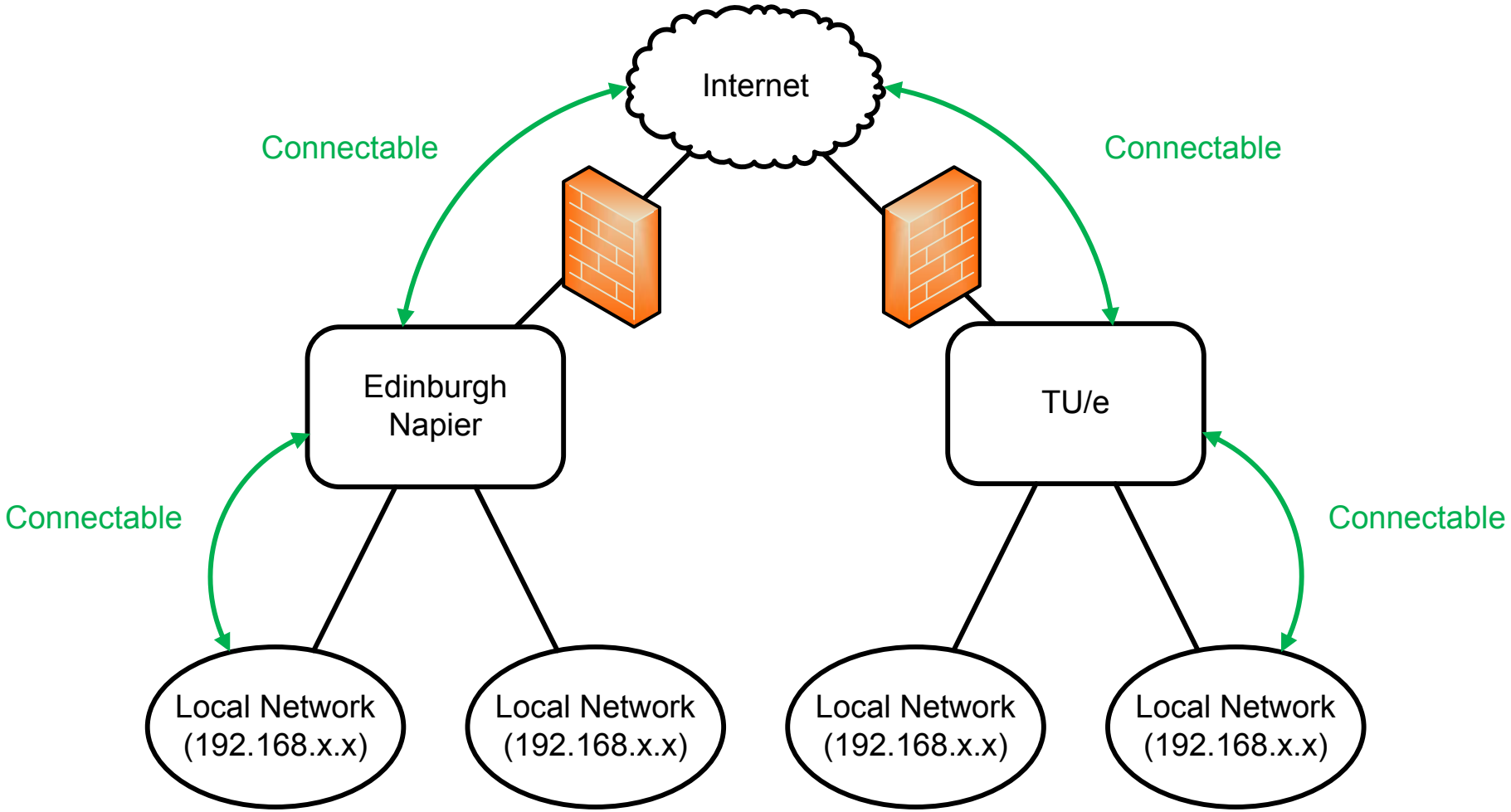
Simplified model of network domains



Simplified model of network domains



Simplified model of network domains



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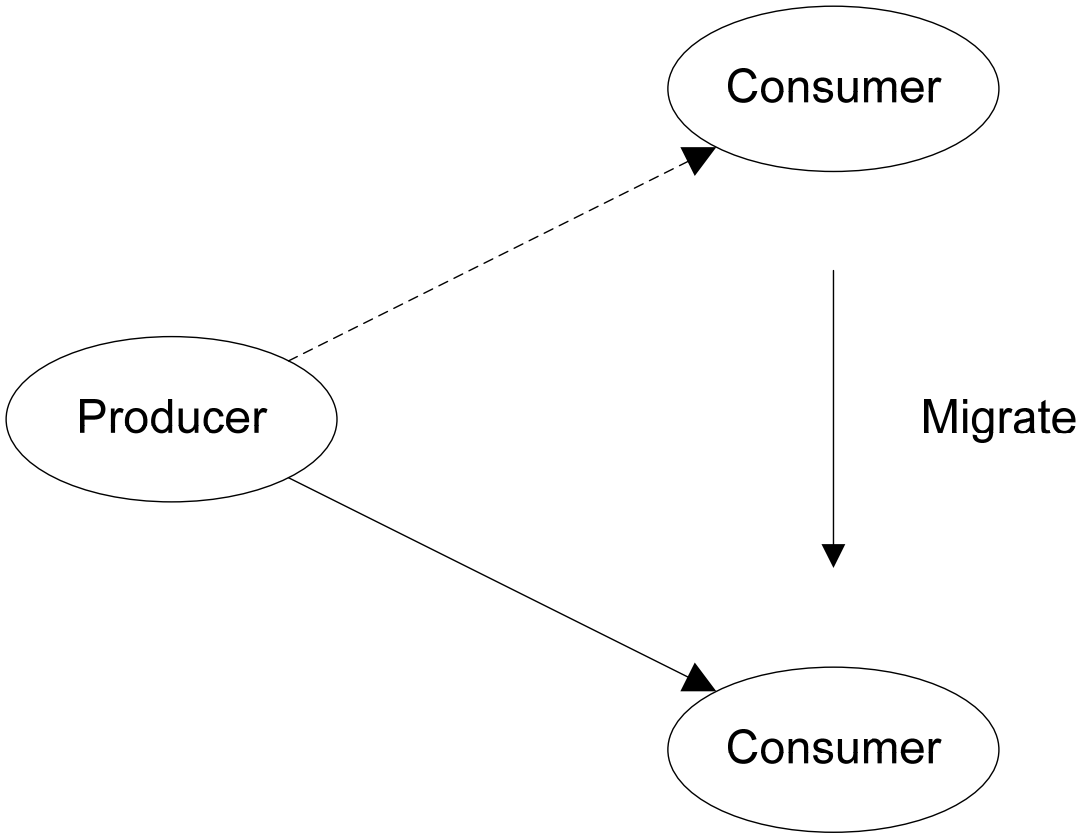
One-to-One Networked Channel



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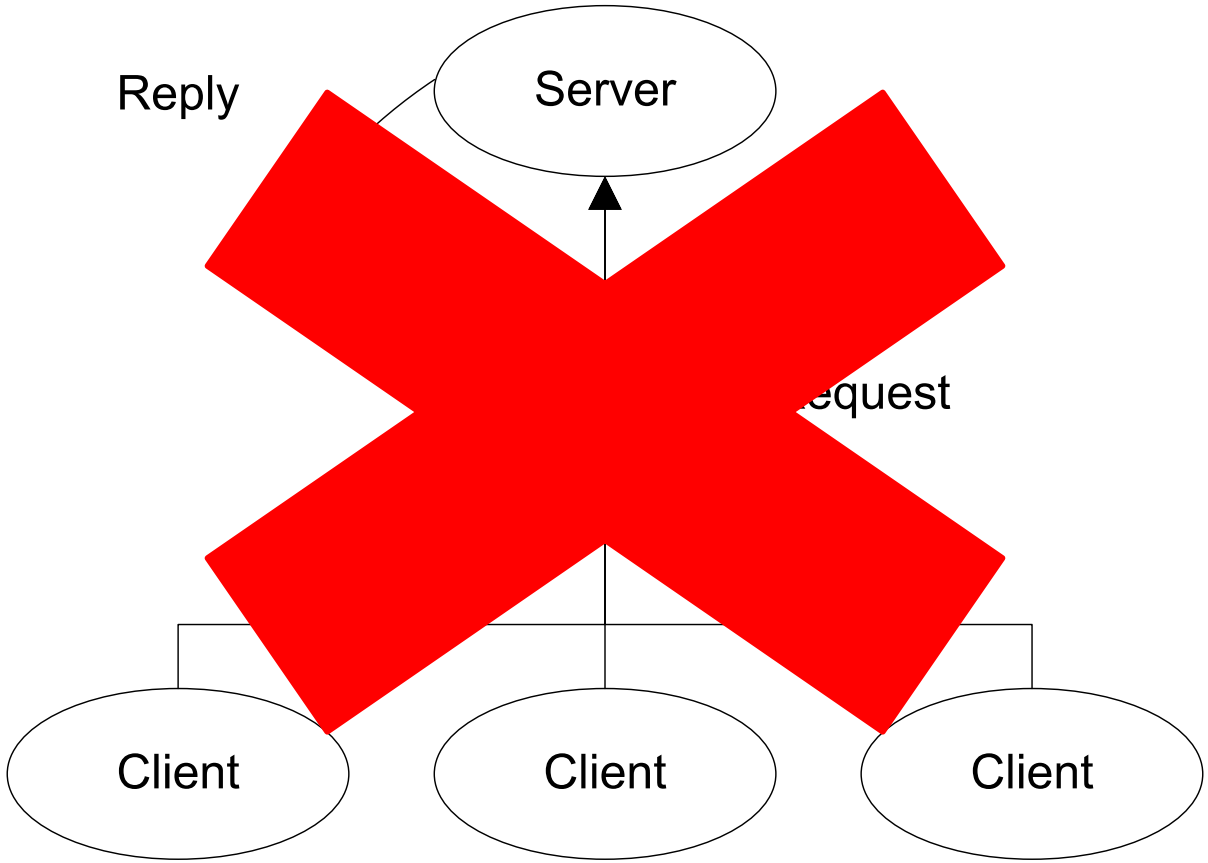
Problem with One-to-One



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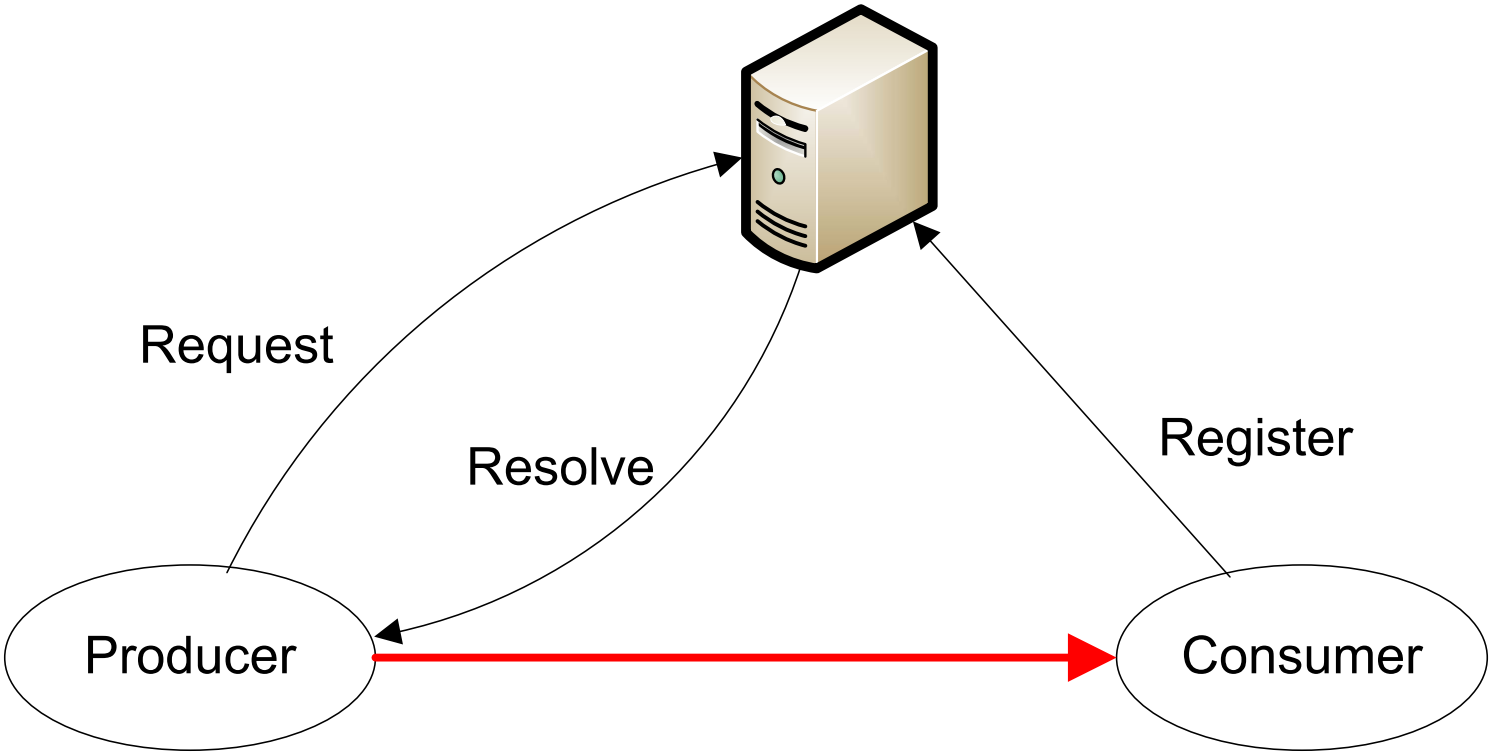
Name Server



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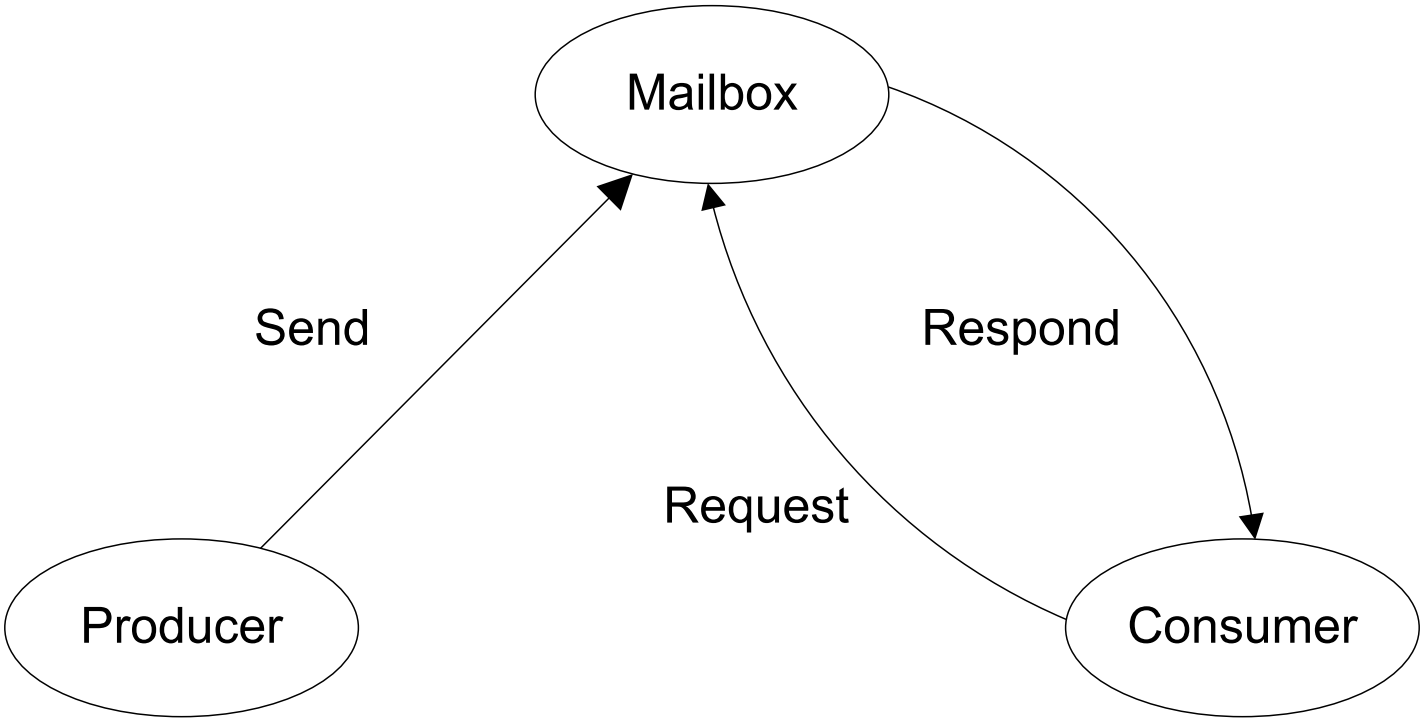
Message Box



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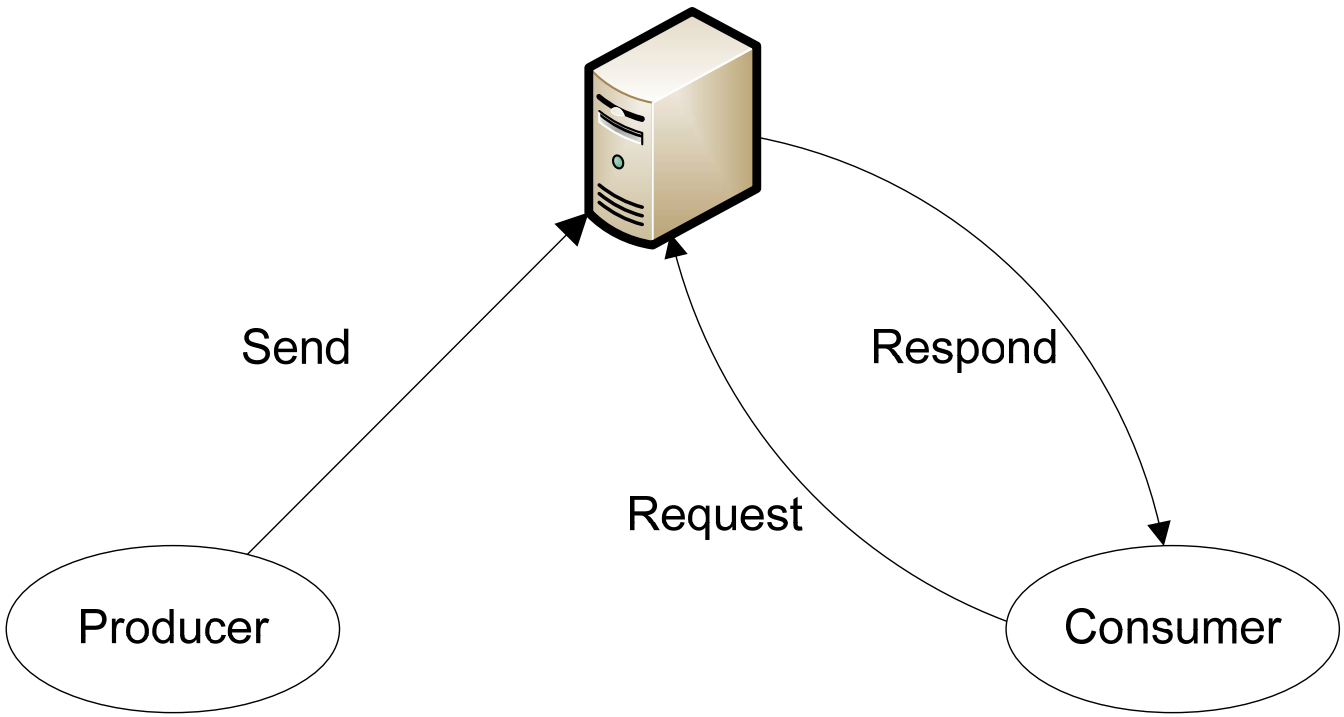
Message Box Server



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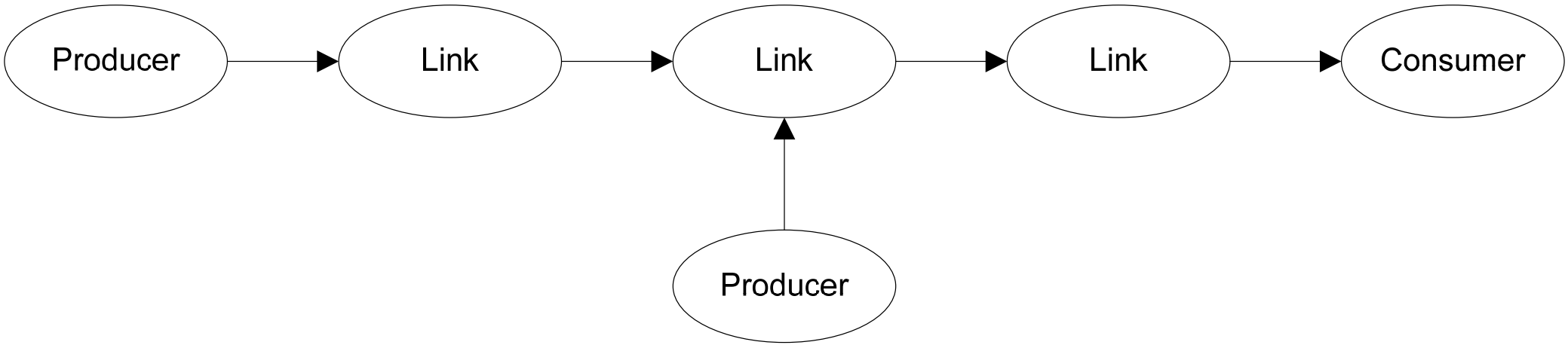
Chain



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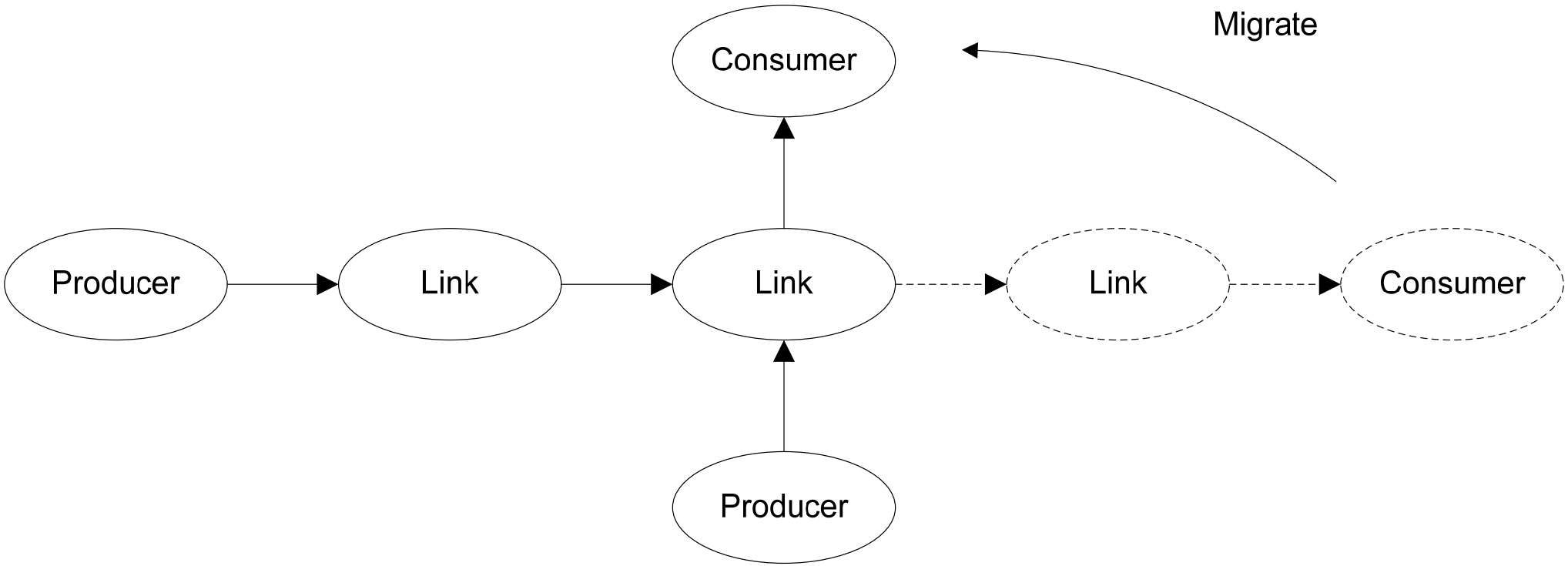
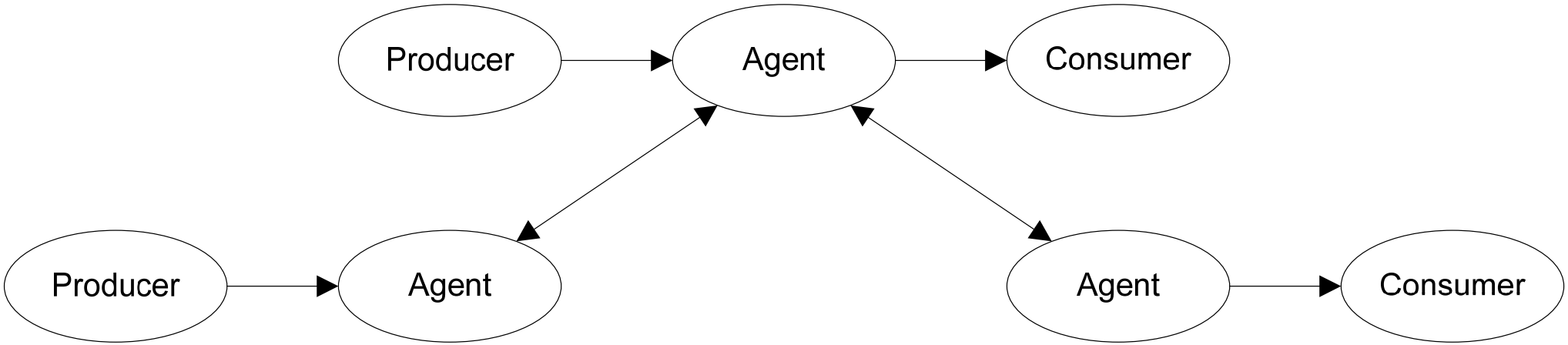
Reconfiguring Chain



Mobile IP



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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

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Analysis Results

Transmission Time	Reconfiguration Time	Reachability	Robustness
One-to-One	One-to-One	Chain	One-to-One
Name Server	Message box server	Reconfiguring chain	Message box server
Message box	Message box	Mobile IP	Name server
Message box server	Chain	Message box	Mobile IP
Reconfiguring chain	Name server	Message box server	Message box
Mobile IP	Mobile IP	One-to-One	Reconfiguring chain
Chain	Reconfiguring chain	Name server	Chain

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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?

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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…

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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

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Questions