IBN: A Communication Paradigm for Mobile Applications

http://www.cs.umd.edu/projects/ibn
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Basics

Content-Based Network (CBN)
- Network of endpoint entities “Contents”
  - Active Contents
    - communicate together by messages
    - perform a lookup for other contents
    - e.g. application service, network connection agent, ...
  - Passive Contents
    - stored in the network
    - e.g. document...
- Location-independent addressing
  - Extends P2P lookup services (e.g. Pastry, CAN, Chord, ...)
  - Maps a content to a specific node

IBN=CBN++
- Allows different instances of same content
- Instance Publishing
  - Self (active) / Free (passive)
  - Reliable
  - Leased
- Instance Routing
  - Decoupled from instance physical location
  - Routes to specific or “closest” destination instance
- Replicates contents for fault-tolerance

Features

Addressing
- Globally Unique Name
- n-tuple Instance Identifier
- Semantics assigned by applications
  - File Archiving System: (fileid:1,0,1) ➞ fileid v1.01
  - Multicast Group: (name:7,9) ➞ subgroup#7, member#9

Routing
- Instance-based routing
  - Messages routed to a published destination instance with “closest” ID (relative to the destination instance)
  - “Closest” semantics assigned by application
- Extends underlying P2P routing
- Route discovery service
  - Alleviates link failure
  - Routing efficiency
- Considering network locality

Applications

Interface
- Publish (ContentID, ContentData, NodeID)
  - Publishes a content in the IBN network at NodeID.
- Republish (ContentID, NodeID)
  - Changes content location in the IBN to NodeID.
- Unpublish (ContentID)
  - Removes a content previously published in the IBN.
- Send (Msg, DstContentID)
  - Sends a message to a content
- Retrieve (ContentID)
  - Retrieves a copy of a content data
- Deliver (Msg, SrcContentID, DstContentID)
  - Up call to the upper layer to deliver a message

Applications over IBN
- File Archiving
  - Different versions of same file
  - Files ➞ contents
  - Versions ➞ instances
- P2P Anycast
  - Select closest server to requesting node
  - Services ➞ contents
  - Servers ➞ instances
- Autonomous Transport Protocol (ATP)
  - Reliable communication between migrating applications through dynamic relocation
  - Application endpoints ➞ contents
    - migrate from node to node
    - Communication Agents ➞ instances
    - work on behalf of application

Ex. File Archiving System

Implementation

Prototype
- Directory Node for each content
  - responsible for maintaining the physical mapping to all instances of a particular content.
- Each message is routed first to the directory node, then redirected to the closest destination instance.
- Different contents mapped to different nodes
- Each node has 2 data structures
  - Published Contents
  - Contents currently residing on that node
- Routing Table
  - List of mapped contents and their current locations
- Implemented over Pastry

Routing Example

A message from content Z:1,5 destined to M:2,3 is routed to M:1,3