# CAN and Tapestry

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CMSC 818

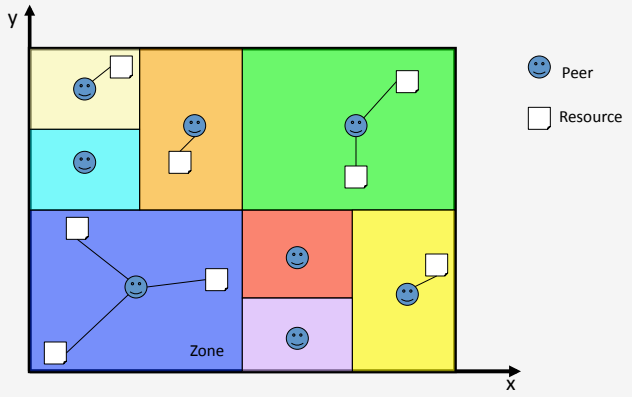
## CAN:
## CONTENT ADDRESSABLE NETWORK

**Scalable Indexing Mechanism**
large-scale decentralized storage applications

## Overview

- CAN is a distributed system that maps keys onto values
- Uses d-dimensional space for key hashing
- Interface:
  - insert(key, value)
  - retrieve(key)

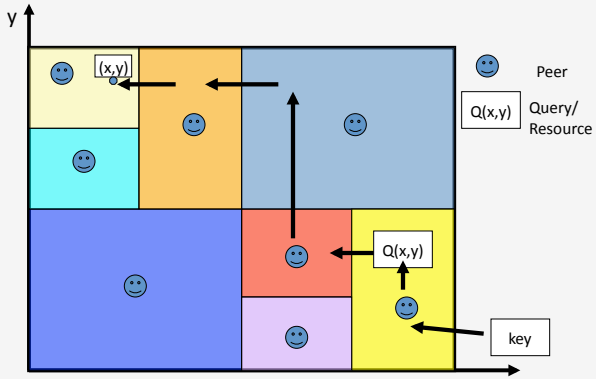
## Two dimensional case



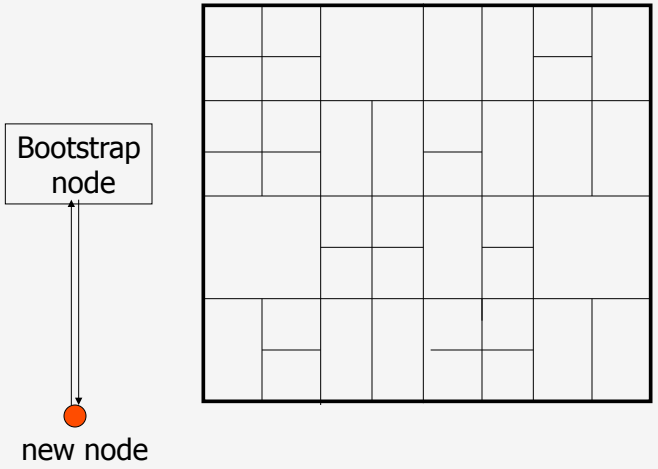

In this 2 dimensional space a key is mapped to a point (x,y)

# Routing

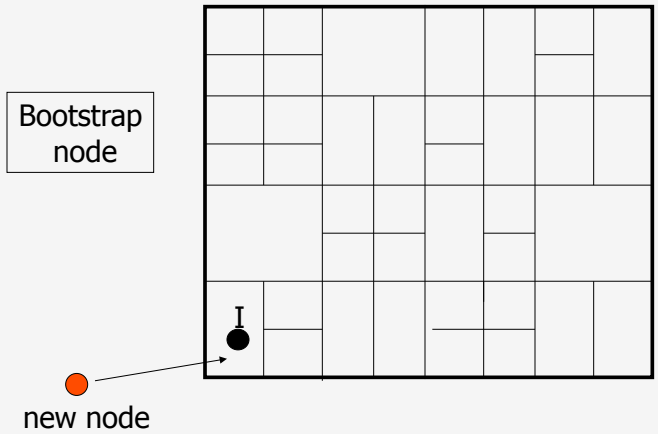
- d-dimensional space with n zones
- 2 zones are neighbor if d-1 dim overlap
- Algorithm:
  - Choose the neighbor nearest to the destination




# Construction

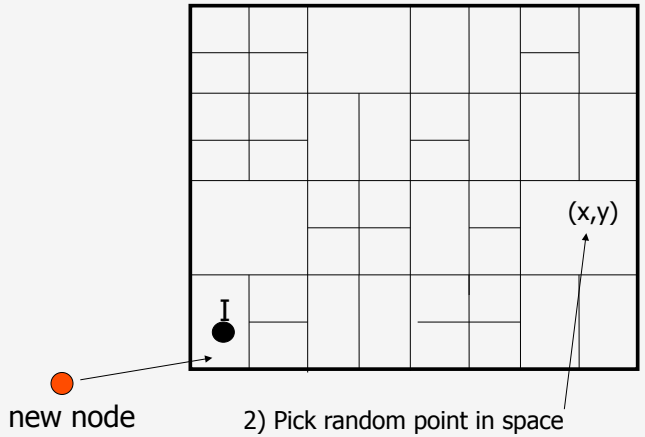



# Construction



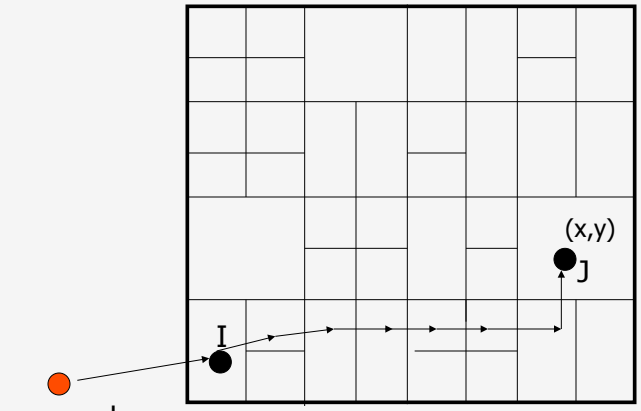

1) Discover some node "I" already in CAN

# Construction



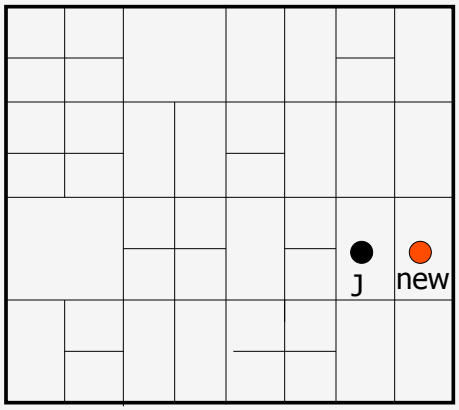

2) Pick random point in space

## Construction




3) I routes to (x,y), discovers node J

## Construction



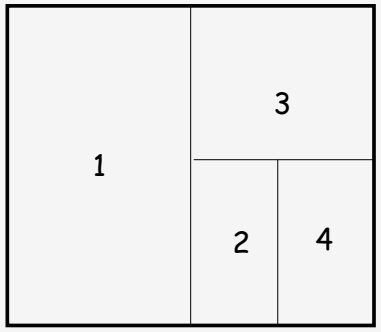

4) split J's zone in half… new owns one half

Insertion affects only O(d) other nodes

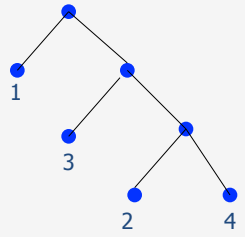
## Maintenance

- Use zone takeover in case of failure or leaving of a node
- Nodes send neighbors periodic update msg at discrete time interval *t*
  - *Along with its zone coordinate and neighbour list*
- If a node does not send alive msg in time *t*, its neighbour with the smallest zone size takes over its zone. The neighbours negotiate with TAKEOVER msg.

## Zone assignment

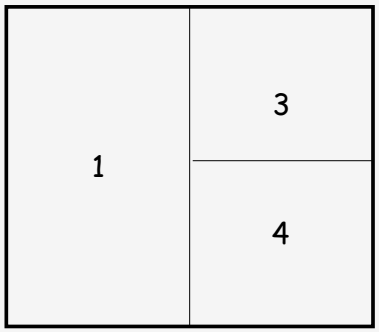



Zoning

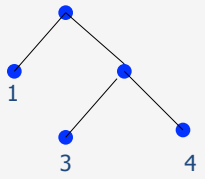



Partition tree

## Zone reassignment: node 2 leaves




Zoning




Partition tree

## Uniform Partitioning

- Instead of splitting directly splitting the node occupant node
  - Compare the volume of its zone with neighbors
  - The one to split is the one having biggest volume

## TAPESTRY

## TAPESTRY

- Structured p2p overlay
- CAN and CHORD do not exploit locality feature.
- DOLR: decentralized object location and routing
  - Route to node or object replicas.

# Mapping

Nodes are assigned NodeID.

Different application can coexist in a node. So msg also contains Application ID.

Application specific end-points have Globally Unique ID.

Objects have Object ID.

# DOLR API

- **Publish Object**: make an object available on the local node.
- **UnpublishObject**: remove its location mapping.
- **RouteToObject**: route a msg to a location of the object with given ID.
- **RouteToNode**: Route msg to the application (with given id ) running on the exact node.

# Basic Routing

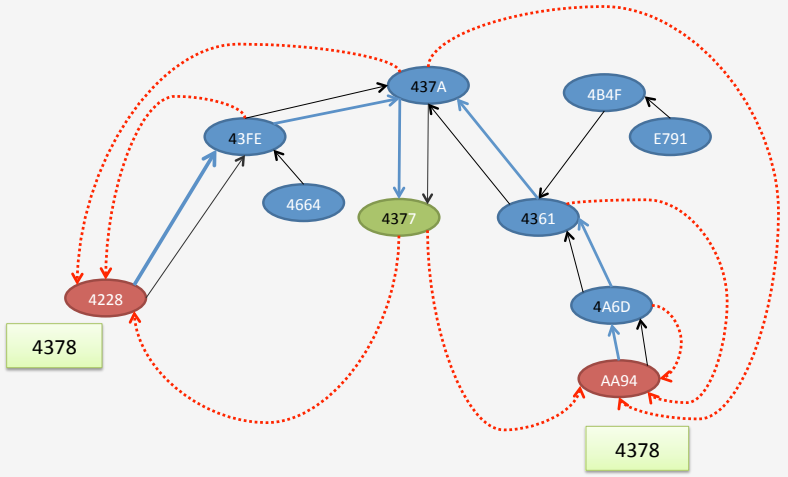
- Each Identifier has its ROOT.
- Node N is the root of Identifier G if its NodeID=Identifier G.
  - If exact match not found, use Surrogate [closest one in ID space]
- Routing table: contains list of <node ID, IP> . Of its neighbours.
- NodeIDs match larger prefixes with the Identifier as routing proceeds.

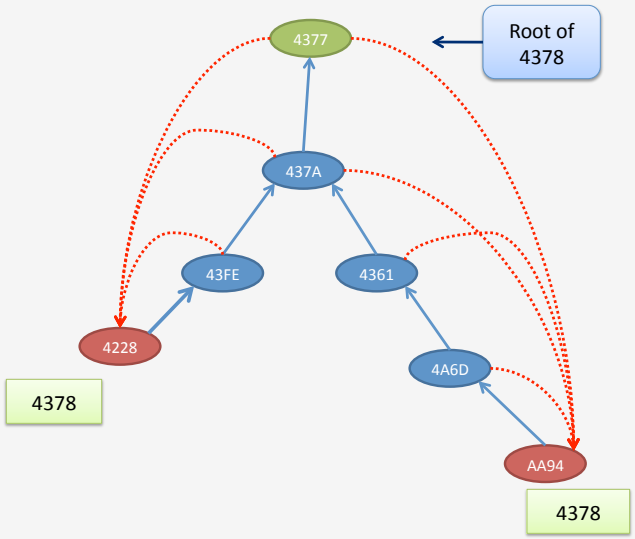
# Neighbor Map

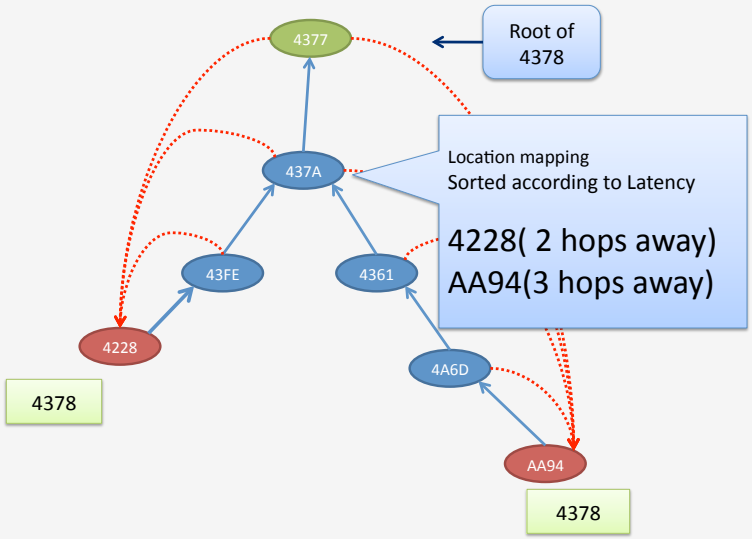
Node 325AE

| | 1 | 2 | … | 9 | … |
|---|---|---|---|---|---|
| Level 1 | 1**** | | | | |
| Level 2 | 31*** | | | | |
| Level 3 | 321** | 322** | | | |
| Level 4 | | | | 3259* | |

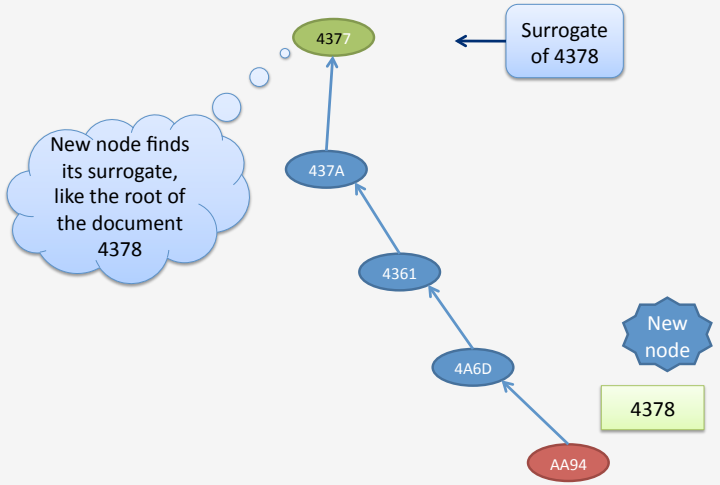
# Publish Object

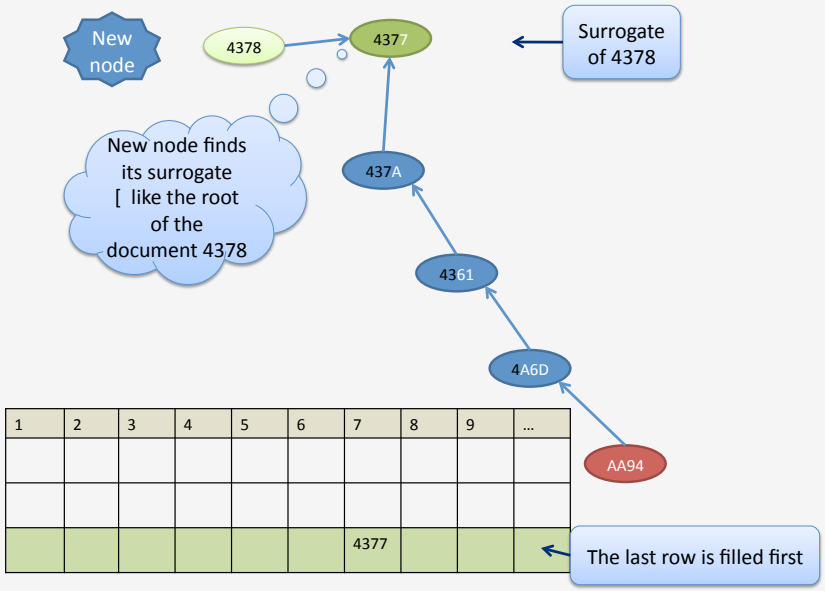


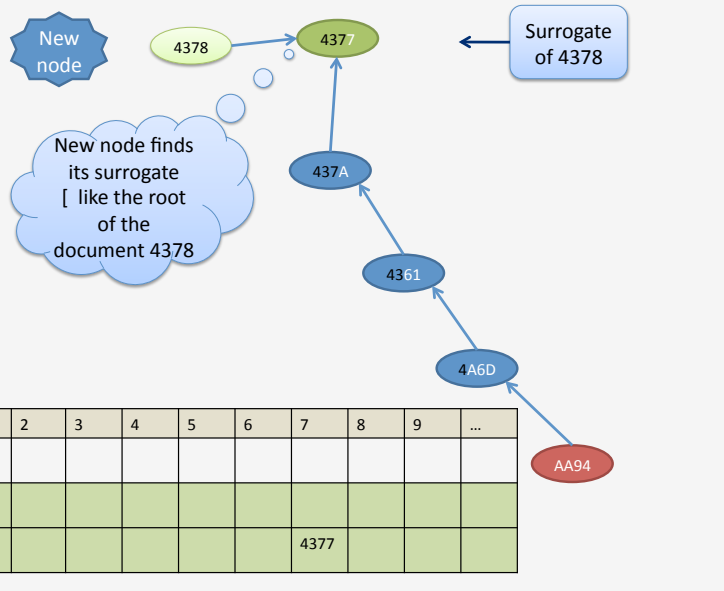



- Publishing object location pointers throughout the network facilitate efficient routing.



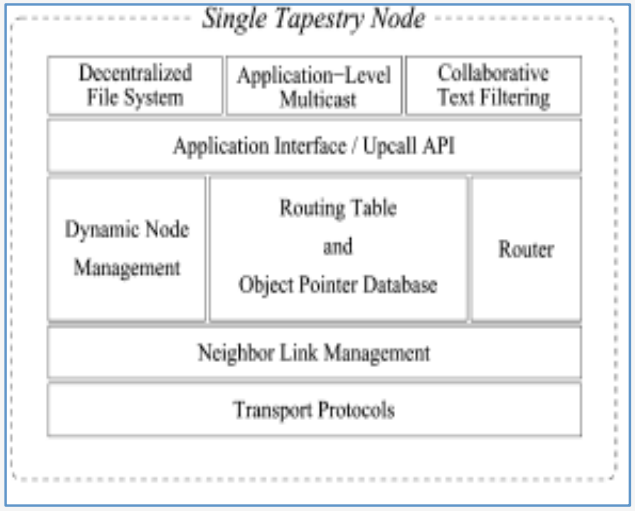



# Resiliency

- Soft state based republishing
- Fault tolerance: nodes keep secondary links, if the primary fails, make the secondary as primary and take another as secondary
- Nodes use periodic beacons:
  - Detect outgoing link failure
  - Detect node failure

# Component architecture

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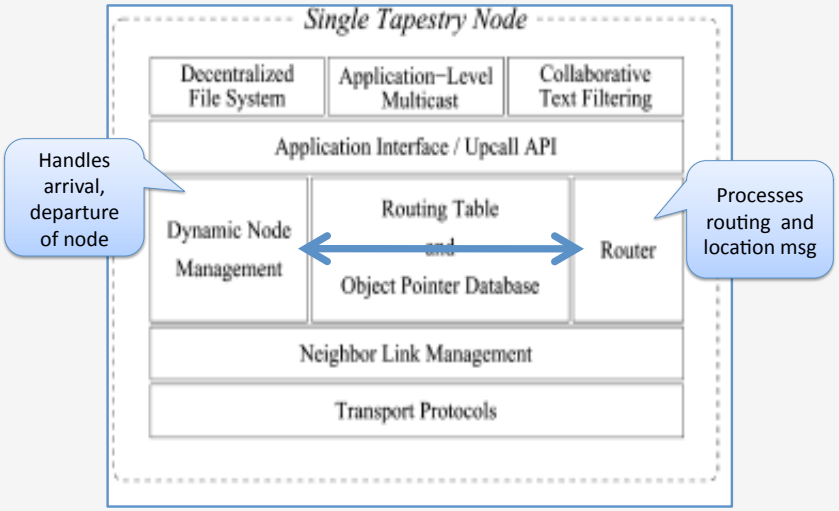


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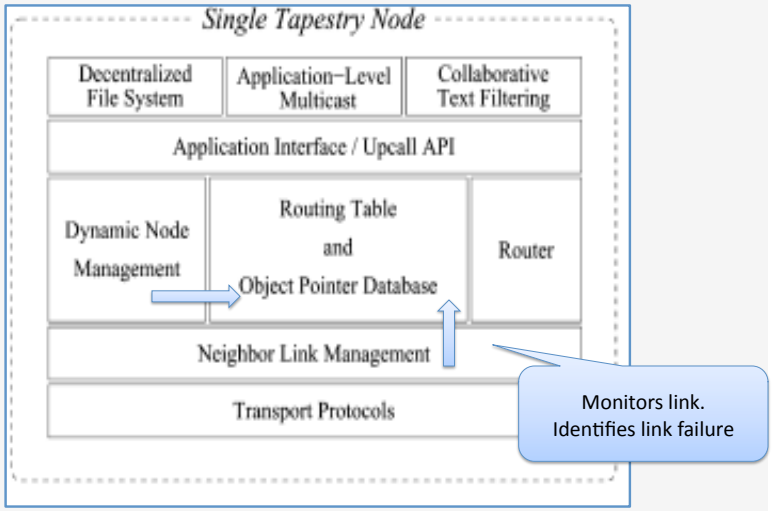

Thank you