An Information Management and Retrieval Method Considering Geographical Location on Ubiquitous Environment

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Background

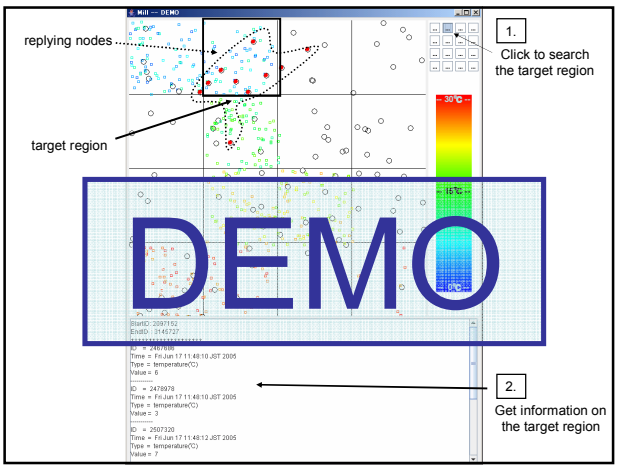
- Development of Wireless Technology & Positioning Devices
  - cars, PDAs, mobile phones…
  - easily connect to the Internet
  - get the actual position
- Demand for location related service
  - weather information (mobile phone)
  - traffic information (car navigation)

Goal

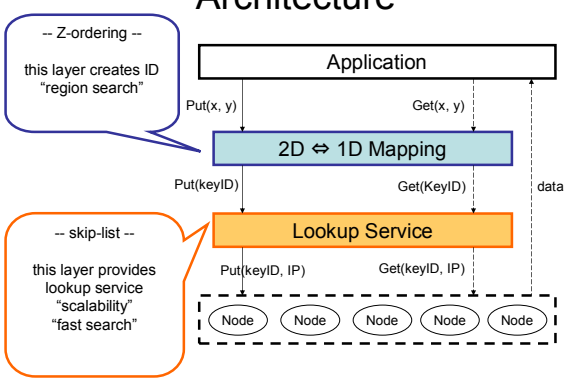
- collect data with geographical location
- share location-related data with each devices
- we can use location-related information of any place.
  - more detailed traffic and weather information
    - new geographical services
    - traffic and environmental problem

Requirements

- Scalability
  - manage a large number of devices
- Region search
  - weather and traffic information is deeply related with geographical position
- Fast Search
  - location-related information is easily affected by TIME (and location)

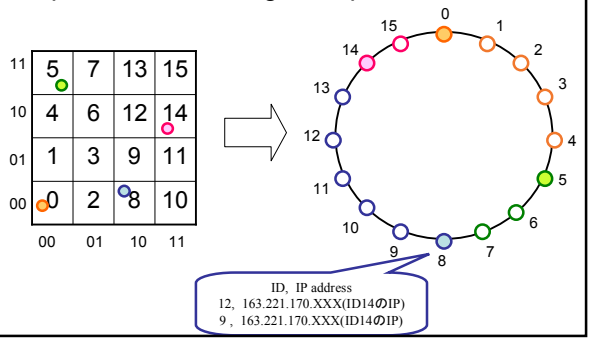


Architecture



Algorithm

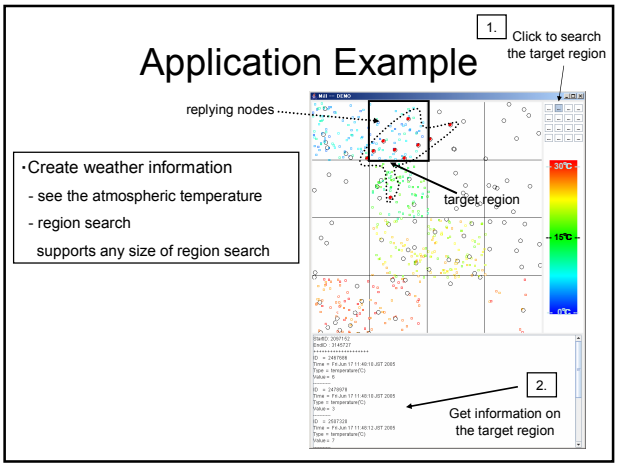
- optimize “Z-ordering”, “Skip-list” for P2P



Simulation environment

CPU	Pentium4 2.4GHz
Memory	1GB
Programming language	Java 2 SDK ver1.4.2-05
OS	WindowsXP-SP2
the number of nodes	10 → 2560
ID-space	2^{24} (4096 X 4096)
Transfer method	Random work

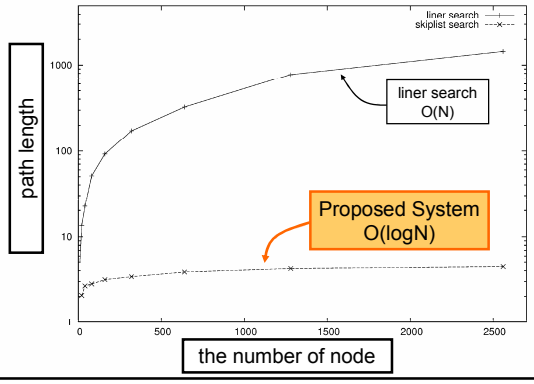
Application Example



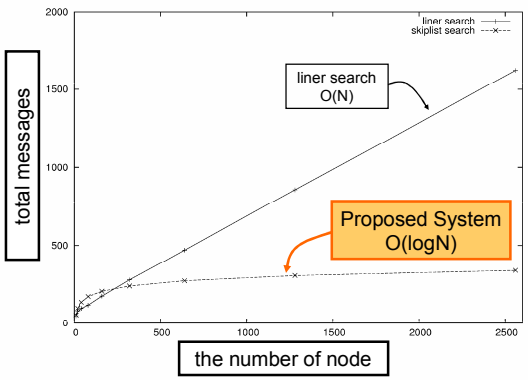
- Create weather information
  - see the atmospheric temperature
  - region search

  supports any size of region search

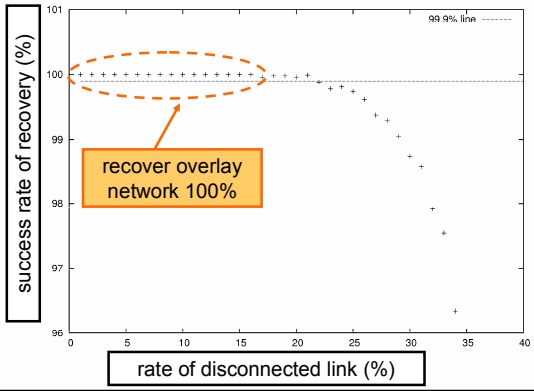
Routing Cost



Messaging Cost



Robustness



Related-work

- DHT-based P2P network
  - Chord, SkipNet, Tapestry, Pastory
  - routing cost: O(logN)
  - hashed ID is NOT match Geographical Info
    - so much queries are generated
- Geographical-based P2P network
  - CAN, LL-net
  - routing cost: O(sqrt(N))
  - complex area management
    - There are some kind of special nodes(Super nodes, etc)

Summary

- Scalability
  - message cost: O(logN)
- Region search
  - can search any size of square(few queries)
- Fast search
  - routing cost: O(logN)
- Other features
  - robustness
- Feature work
  - improve road-balance, support poor devices, etc…