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Experimental Study on  
Locality-aware  
Application Layer Multicast

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# Outline



- ⌘ Introduction
- ⌘ Related Work
- ⌘ System Description
- ⌘ Experiments
- ⌘ Conclusion

# Introduction



- ⌘ Nodes self-organize into an overlay network in application layer multicast.

- ⌘ Nodes locate in clusters in Internet.

  - ☑ Distance

  - ☑ Bandwidth

- ⌘ Considering the location of nodes during the overlay construction is important.

# Related Work

## ⌘ Chainsaw

- ☑ Random overlay

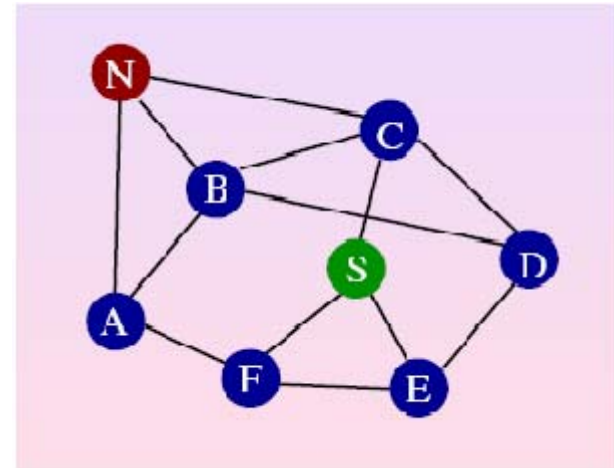
- ☑ Merit

  - ☑ Simple

  - ☑ Easy to construct

- ☑ Problem

  - ☑ Without considering the nodes' location



# Related Work



## ⌘ Binning

- ☑ Topologically-aware overlay

- ☑ Merit

  - ☑ Optimize the overlay

  - ☑ Simple and practical

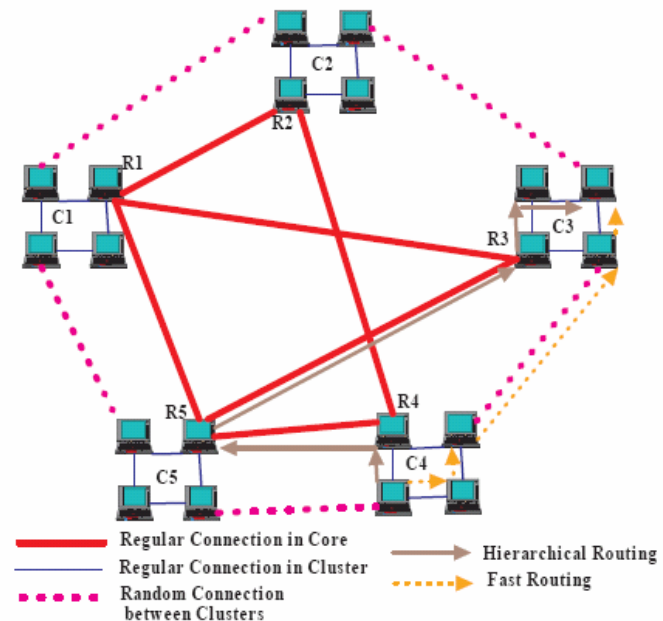
- ☑ Problem

  - ☑ Clustering based on relative distance between two nodes: not accurate

# Related Work

## ⌘ HONet

- ⊞ Hybrid locality-aware overlay
- ⊞ Based on network coordinate
- ⊞ Merit
  - ⊞ More accurate clustering scheme
- ⊞ Problem
  - ⊞ Structured clusters: more bandwidth cost to maintain



# System Description



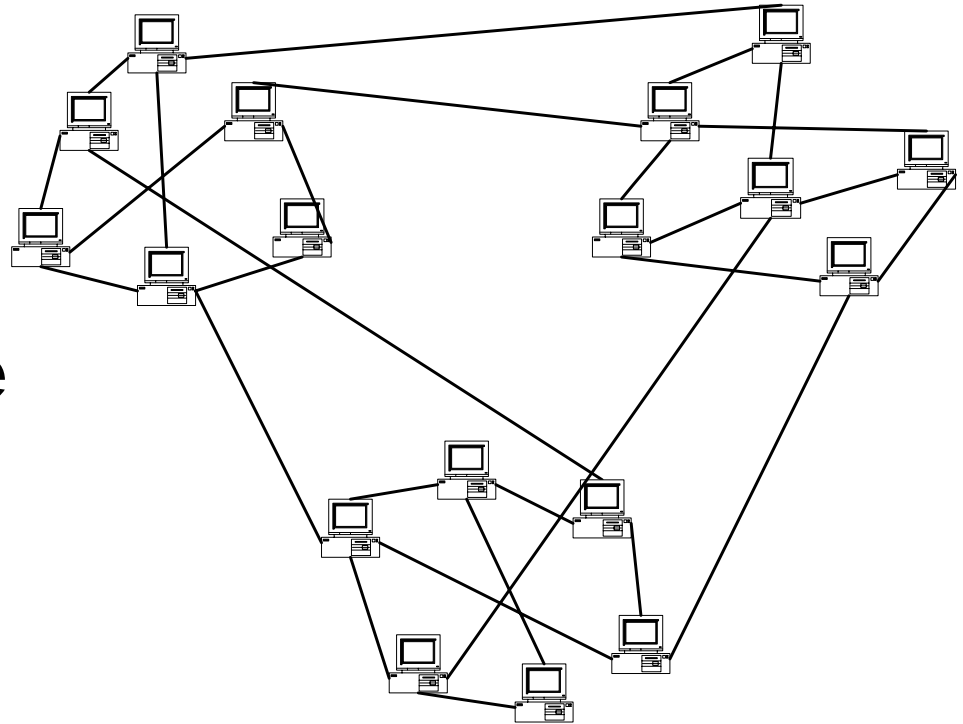
## ⌘ Design Consideration

- ☑ Consider the participating nodes' location
- ☑ Use network coordinate
- ☑ Unstructured overlay

# System Description

## ⌘ Canicula

☑ Locality-aware overlay based on network coordinate



# System Description



- ⌘ Choose a set of landmark nodes
- ⌘ Measure a set of network latencies
  - ☑ A peer's network coordinate
- ⌘ Estimate the distance between two peers
  - ☑ triangulated heuristic

# System Description



- ⌘ Cluster radius

- ⌘ Two peers in a cluster

  - ☑ If two peers' distance is less than cluster radius

- ⌘ Choose more neighbors in one's cluster than in other clusters

  - ☑ Use bandwidth sufficiently

  - ☑ Assure the connectivity of the overlay

# System Description



## ⌘ Pull-based system

- ☑ Maintain a window of available packets
- ☑ Inform neighbors about new packets
- ☑ Receive message about new packets from one or more neighbors
- ☑ Choose one neighbor to send request to obtain new packets

# Experiments

## ⌘ PlanetLab

- ☒ An open platform for developing, deploying and accessing planetary-scale services



# Experiments



## ⌘ Our experiments

- ☑ Over 300 nodes on PlanetLab

- ☑ Evaluate the performance

  - ☒ RDP (Relative Delay Penalty)

  - ☒ Packets loss rate

- ☑ Compare Canicula to Chainsaw and Binning

# Experiments



## ⌘ Parameters configuration

- ☑ Average node degree: 6

  - ☑ Assure the three overlays have the same average node degree

- ☑ Cluster radius: 40ms

# Experiments



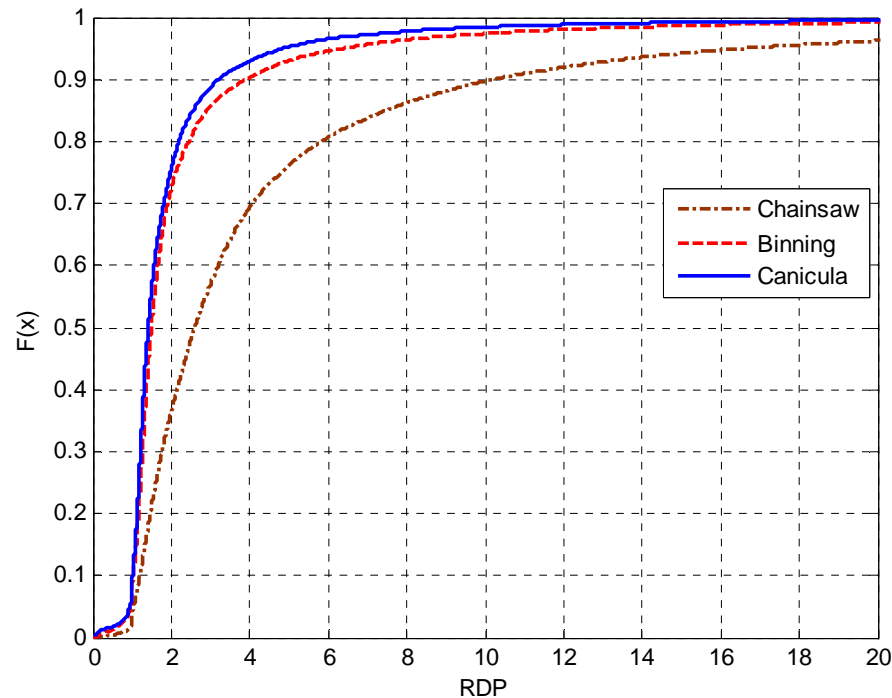
## ⌘ RDP (Relative Delay Penalty)

- ☑ The ratio of two peers' network delay in overlay and their end-to-end delay
- ☑ The smaller RDP is, the better the overlay fits the real network topology.

# Experiments

⌘ The CDF of the three overlays' RDP

☒ Canicula < Binning < Chainsaw



# Experiments



## ⌘ Packets loss rate

- ☑ One of the most direct parameters to show the performance of multicast
- ☑ Data source rate: 530kb/s

# Experiments

⌘ Average packets loss rate:

☑ Canicula < Binning < Chainsaw

Overlay <sup>Ⓟ</sup>	Chainsaw <sup>Ⓟ</sup>	Binning <sup>Ⓟ</sup>	Canicula <sup>Ⓟ</sup>
Average packets loss rate <sup>Ⓟ</sup>	2.57168 <sup>Ⓟ</sup>	1.99128 <sup>Ⓟ</sup>	1.84039 <sup>Ⓟ</sup>
Ratio of nodes whose packets loss rate is less than 1% <sup>Ⓟ</sup>	0.94961 <sup>Ⓟ</sup>	0.95970 <sup>Ⓟ</sup>	0.96478 <sup>Ⓟ</sup>

# Conclusion



⌘ Canicula has better performance

☑ Locality-aware overlay is better than random overlay

☑ Clustering based on network coordinate is more accurate

# Conclusion



⌘ Considering the nodes' locality in Internet during the overlay construction can improve the performance of the application layer multicast



Thanks!