Core Group Based Tree: A Hierarchical Multicast Routing Protocol

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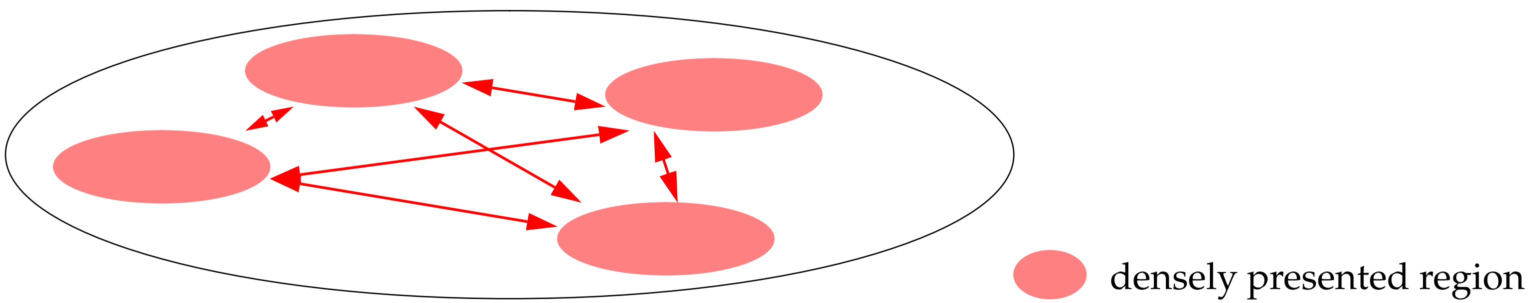
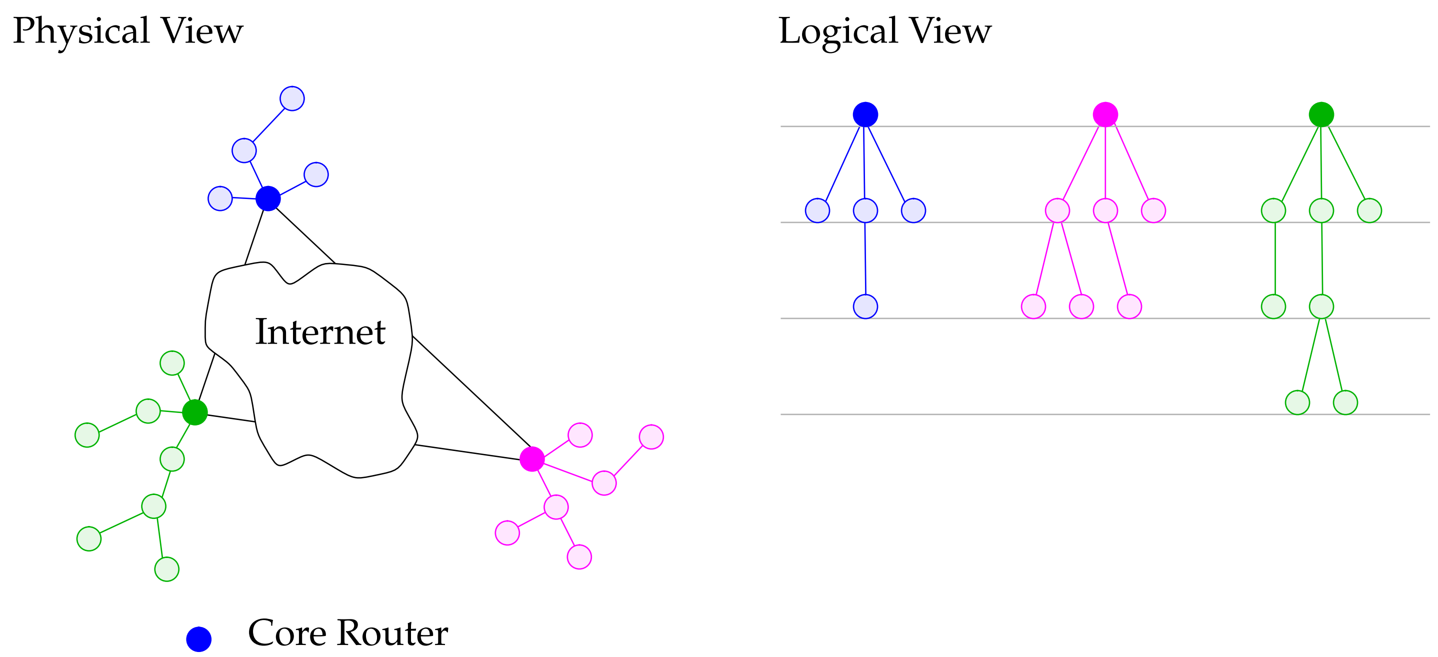
Motivation

- **Create a multicast routing protocol that has**
  - good scalability
  - simple protocol design
  - configurable delay performance
  - support for dense subgroups across a wide area
- **Uniformly providing the best delay performance to all videoconferencing scenarios is not the optimal solution**
- **The protocol should provide efficient routing support for the multicast group that has members densely presented in several regions which are spread across a wide area.**



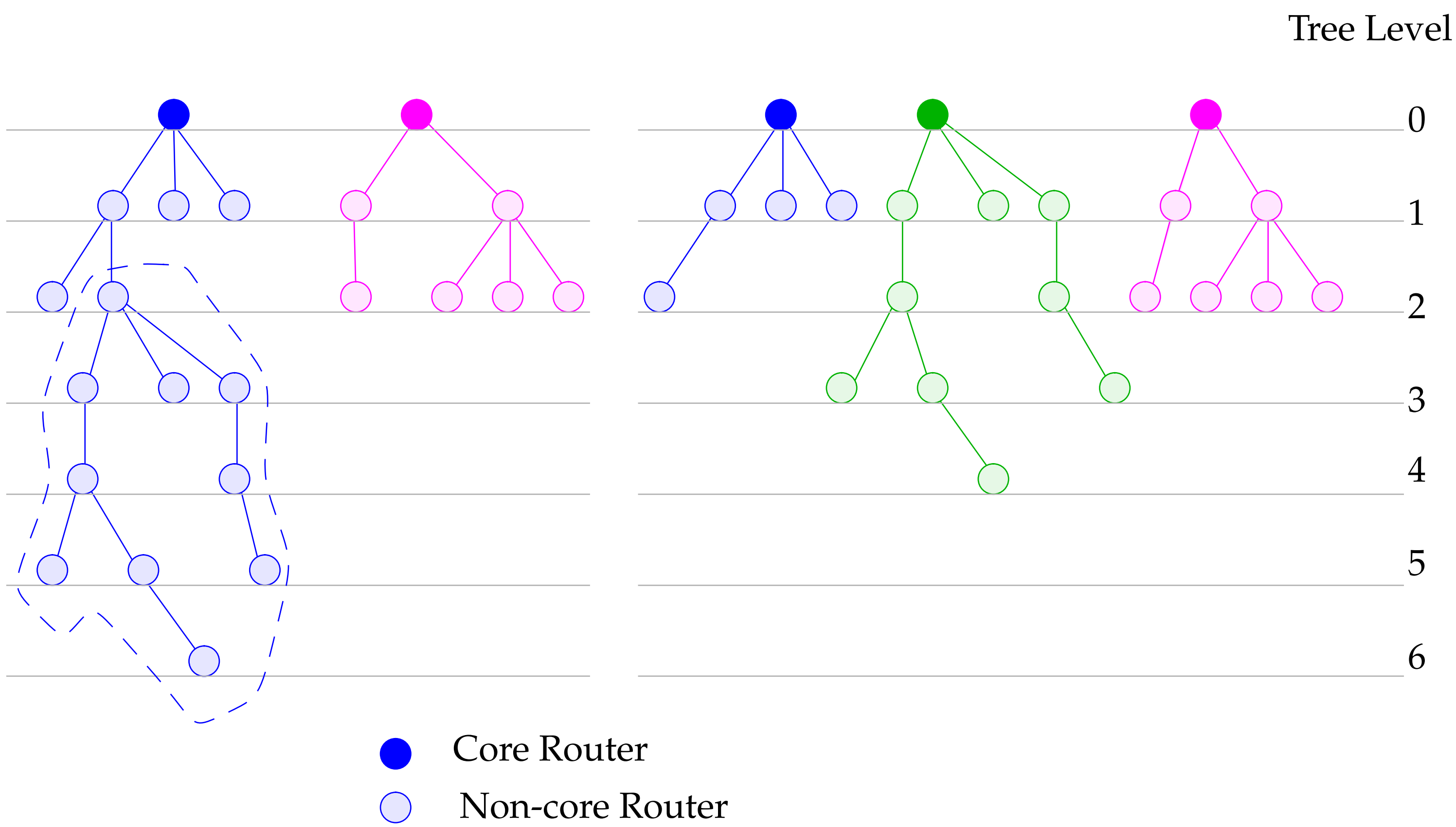
Our Solution: Core Group Based Tree

- **Core Group Based Tree (CGBT)**
  - routing topology composed of multiple CBTs with their cores interconnected by multicast or unicast
  - dynamic core formation and placement
  - application delay-requirement dependent core formation
  - hierarchical routing
  - good scalability and simple system design



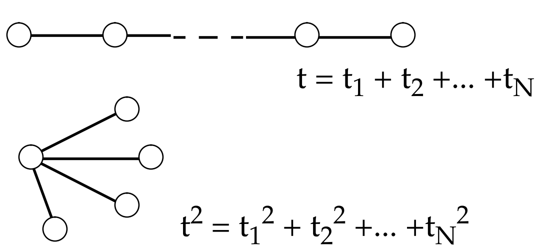
CGBT - Dynamic Core Formation

- **Tree splitting**
  - A new core is formed when the size of its downstream distribution tree exceeds a certain tree metric
  - tree metric table: application delay requirement dependent

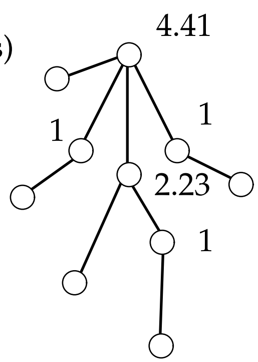


Tree Metric and Tree Metric Table

- **The tree metric measures the topological distribution of links in a tree.**
- **The tree metric table records the minimum tree metric required for a non-core router to form a new tree.**
- **The computing of a tree metric involves two operations:**
  - The concatenation of links
  - The merge of links
- **The tree metric table is determined by the delay requirement of multicast applications and the network topology information, including the average node degree.**

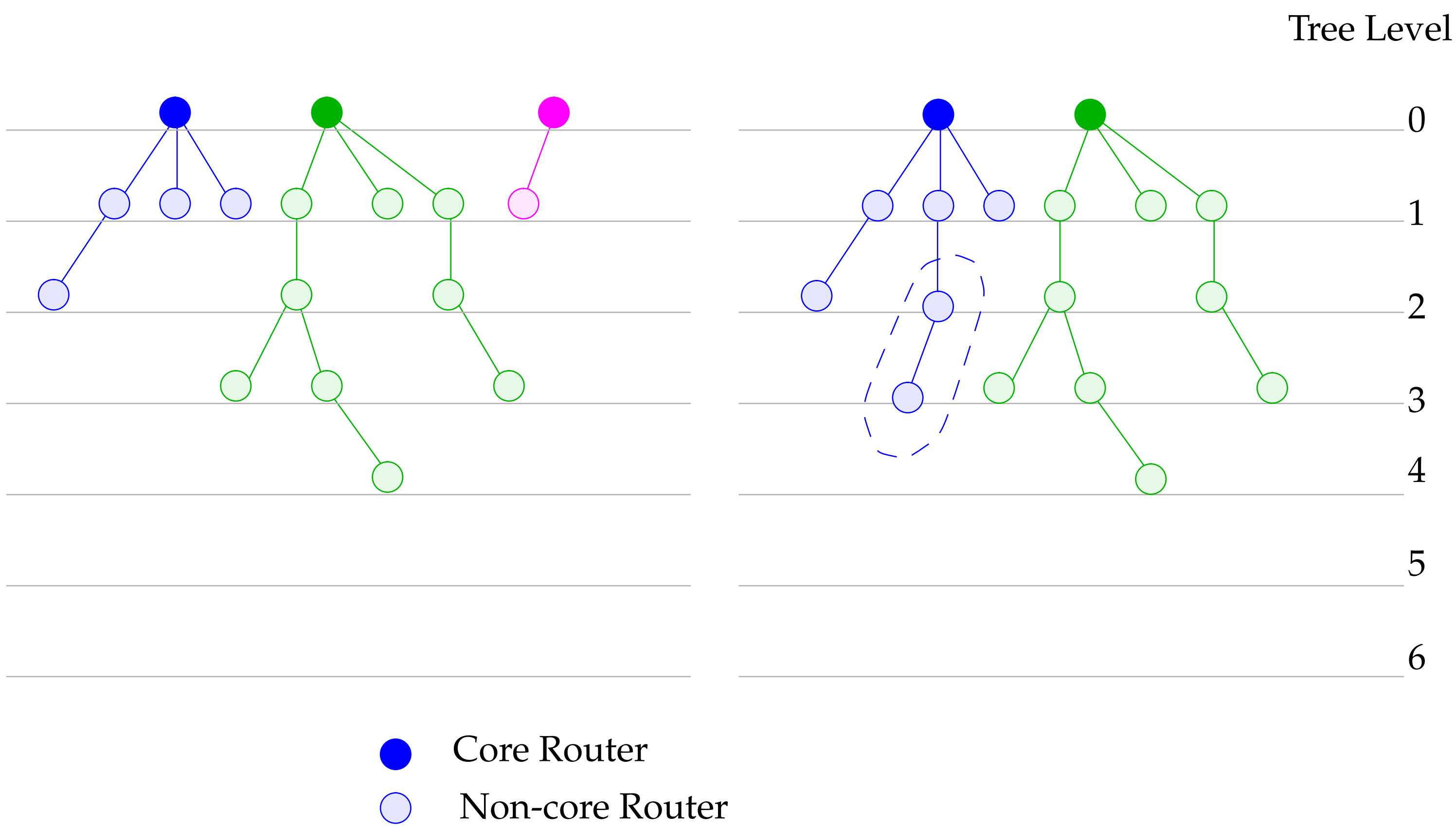


Tree Metric Table (Hops)
Level 1: Infinity
Level 2: Infinity
Level 3: 7.18
Level 4: 4.26
Level 5: 2.59
...



CGBT - Dynamic Core Formation

- **Tree merging**
  - A core and its downstream distribution tree is merged back when its tree metric is below a certain number, CGBT-Merge-Metric.

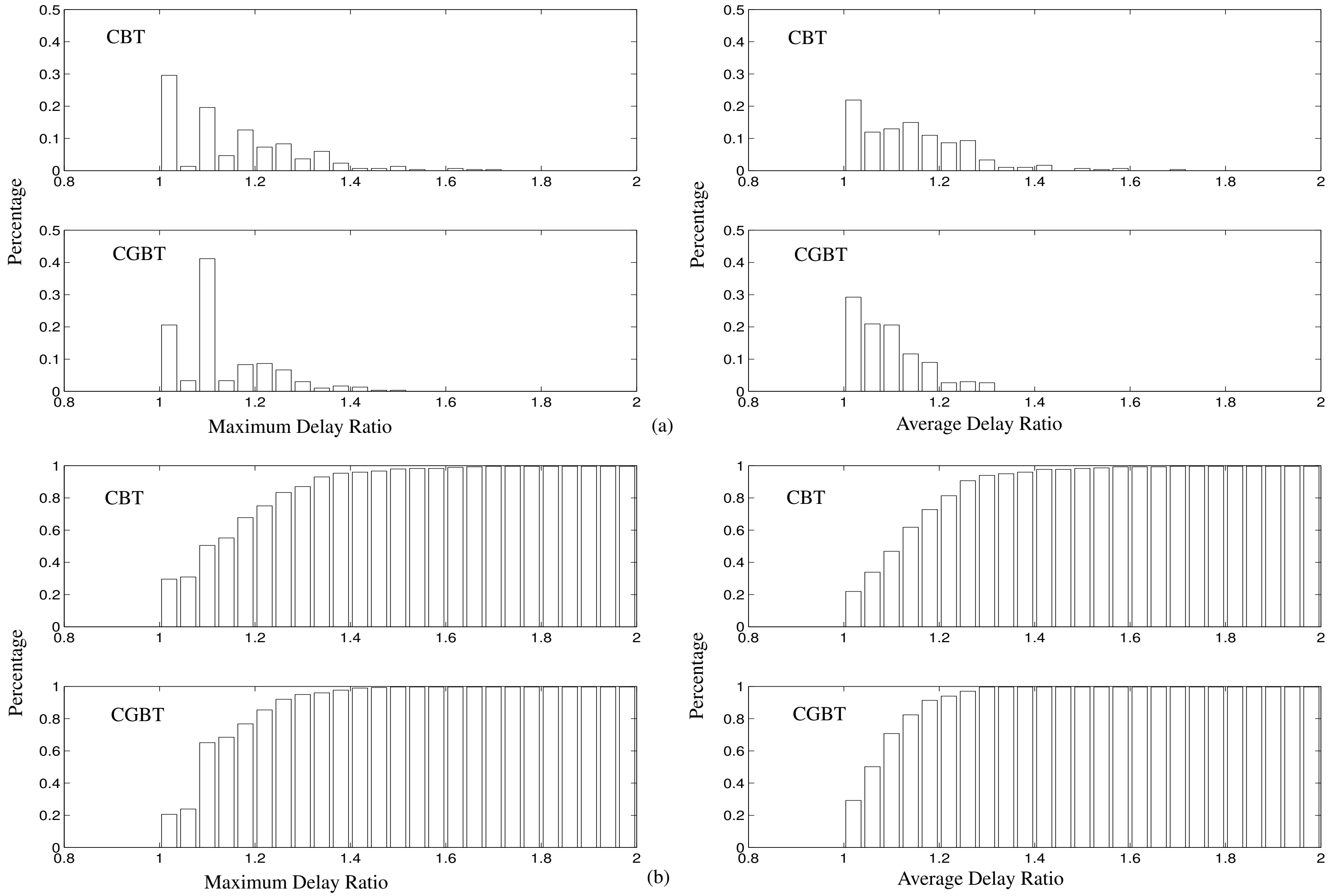


Performance Evaluation

- **Random network simulations evaluate**
  - the delay performance of the CGBT protocol
  - the effectiveness of the tree splitting and merging algorithms
- **Simulation constructions**
  - backbone network modeled after the NSFNET(ANSNET)
  - local routers randomly placed on the graph
  - multicast participants randomly placed in clusters on the graph
  - hop metric as the delay measure

Simulation Results

- **Histograms of delays for CBT and CGBT trees with network size of 100 and multicast group size of 30; 300 simulation runs**



Summary

- **Problems in applying existing IP multicast protocols to multiparty videoconferencing**
  - design trade-offs: scalability, delay performance, and protocol complexity
  - lack of variable delay support for different applications
- **Our solution: Core Group Based Tree**
  - improved delay performance over CBT, good scalability and simple protocol design
  - variable delay support for different applications
- **Performance evaluation of CGBT**
  - showed improvements in delay performance
  - demonstrated the effectiveness of CGBT's dynamic core formation scheme

`the content of this talk can be found at`

`http://www.eecs.berkeley.edu/~yuanchi`