CS5412: USING GOSSIP TO BUILD OVERLAY NETWORKS

Lecture XX

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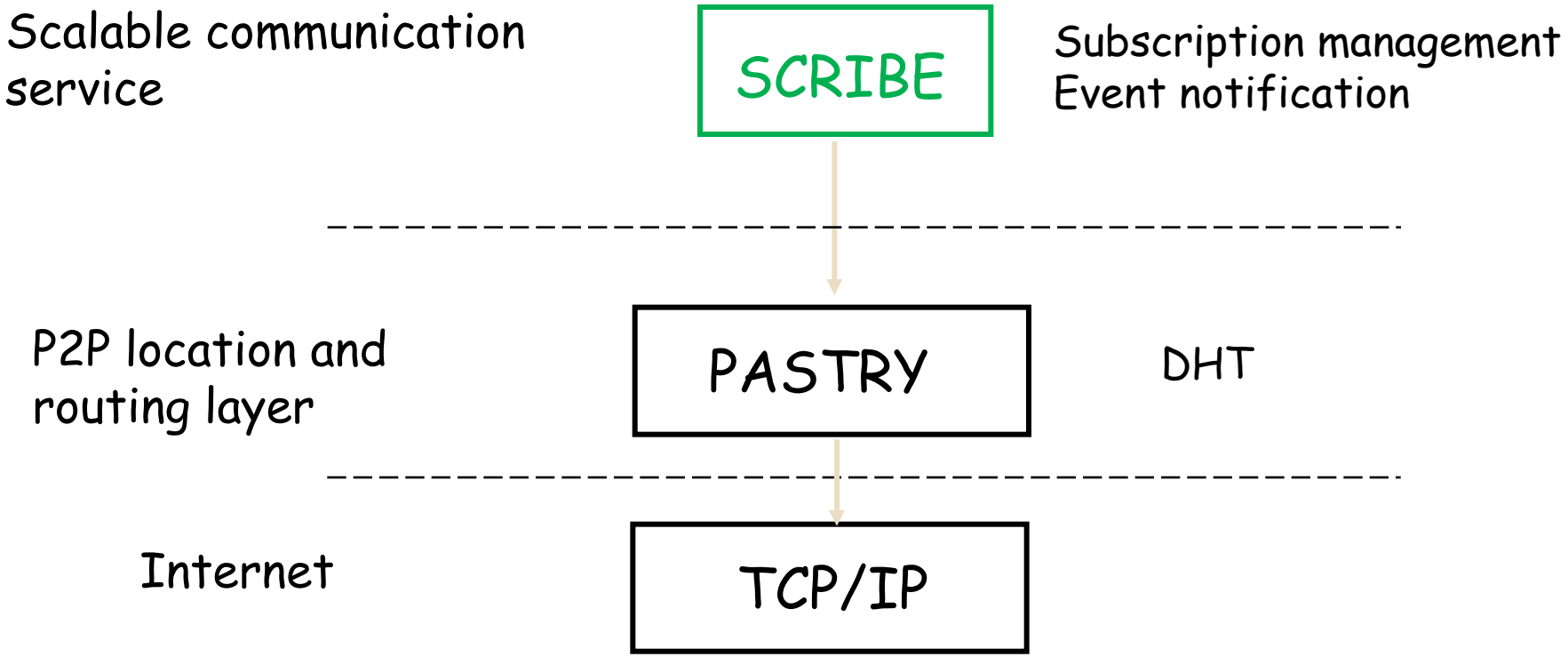
Gossip and Network Overlays

- A topic that has received a lot of recent attention
- Today we'll look at three representative approaches
  - Scribe, a topic-based pub-sub system that runs on the Pastry DHT (slides by Anne-Marie Kermarrec)
  - Sienna, a content-subscription overlay system (slides by Antonio Carzaniga)
  - T-Man, a general purpose system for building complex network overlays (slides by Ozalp Babaoglu)

Scribe

- Research done by the Pastry team, at MSR lab in Cambridge England
- Basic idea is simple
  - Topic-based publish/subscribe
  - Use topic as a key into a DHT
    - Subscriber registers with the "key owner"
    - Publisher routes messages through the DHT owner
  - Optimization to share load
    - If a subscriber is asked to forward a subscription, it doesn't do so and instead makes note of the subscription. Later, it will forward copies to its children

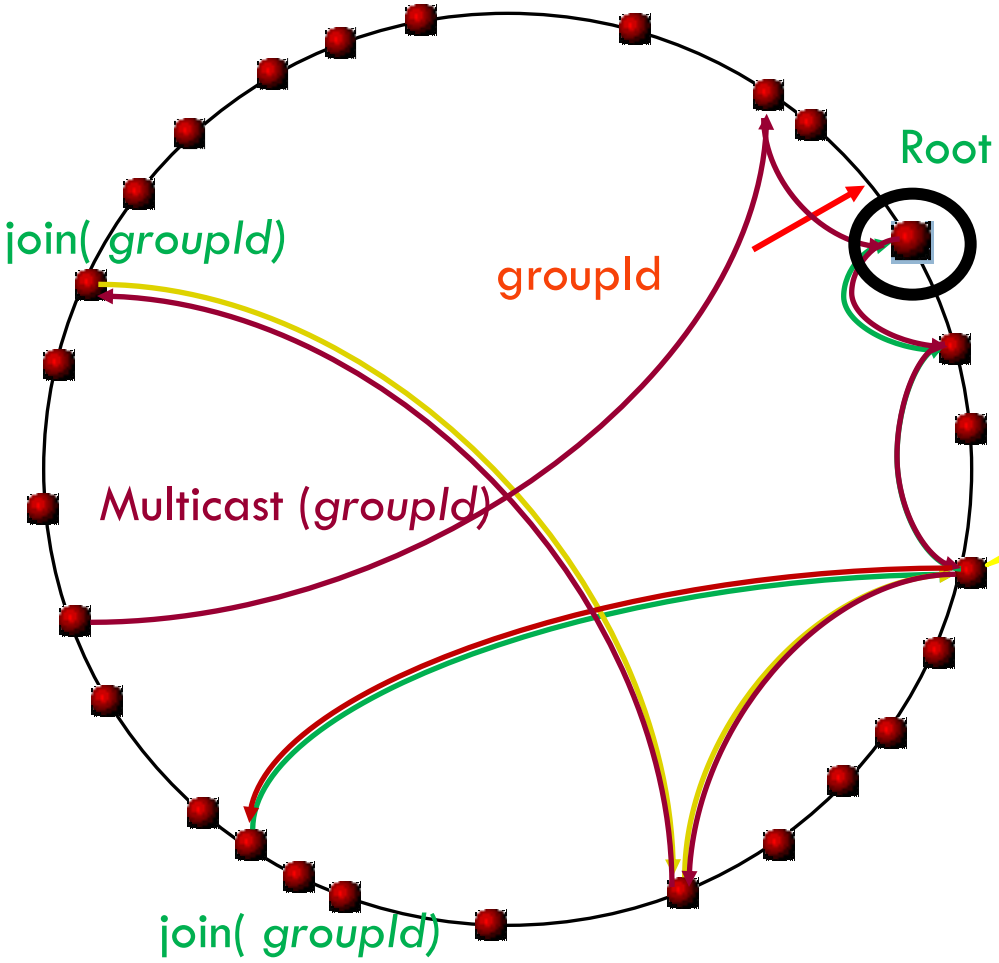
Architecture



Design

- Construction of a multicast tree based on the Pastry network
  - Reverse path forwarding
  - Tree used to disseminate events
- Use of Pastry route to create and join groups

SCRIBE: Tree Management



- Create: route to groupId

Forwards two copies

upId

stry

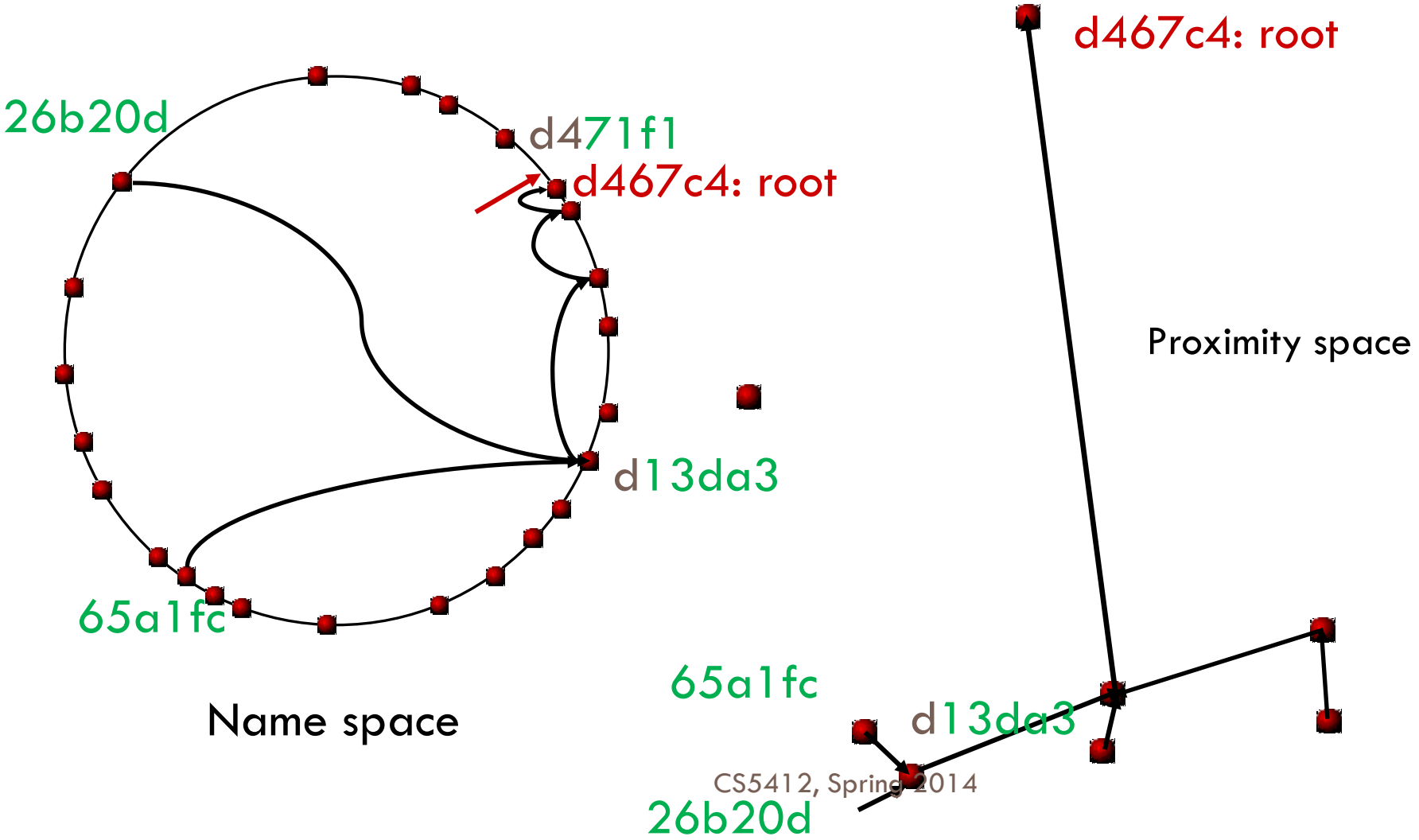
bers to the root.

- Multicast: from the root down to the leaves

Low link stress

Low delay

SCRIBE: Tree Management



Concerns?

- Pastry tries to exploit locality but could these links send a message from Ithaca… to Kenya… to Japan…
- What if a relay node fails? Subscribers it serves will be cut off
  - They refresh subscriptions, but unclear how often this has to happen to ensure that the quality will be good
  - (Treat subscriptions as "leases" so that they evaporate if not refreshed… no need to unsubscribe…)

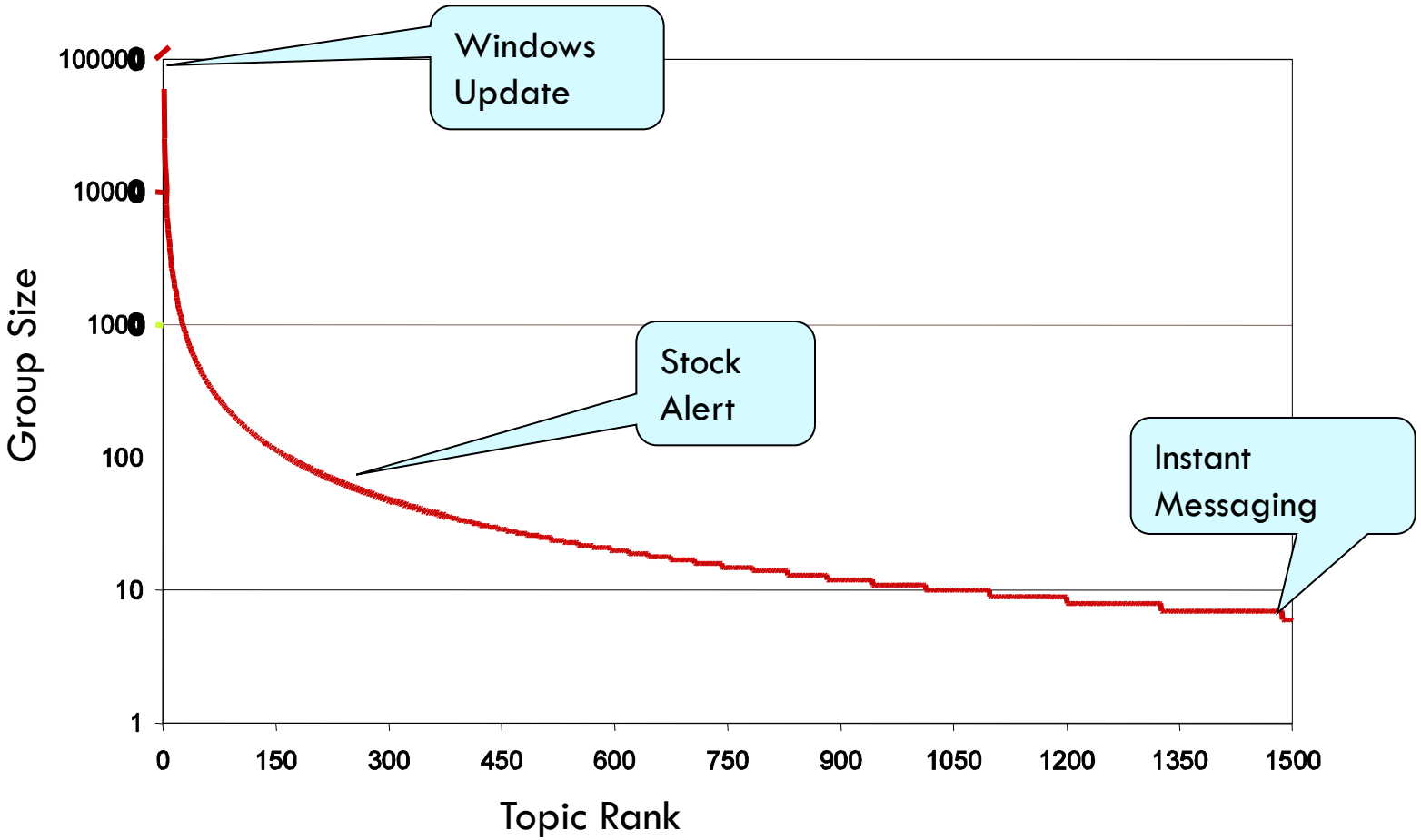
SCRIBE: Failure Management

- Reactive fault tolerance
- Tolerate root and nodes failure
- Tree repair: local impact
  - Fault detection: heartbeat messages
  - Local repair

Scribe: performance

- 1500 groups, 100,000 nodes, 1msg/group
- Low delay penalty
- Good partitioning and load balancing
  - Number of groups hosted per node : 2.4 (mean) 2 (median)
- Reasonable link stress:
  - Mean msg/link : 2.4 (0.7 for IP)
  - Maximum link stress: 4*IP

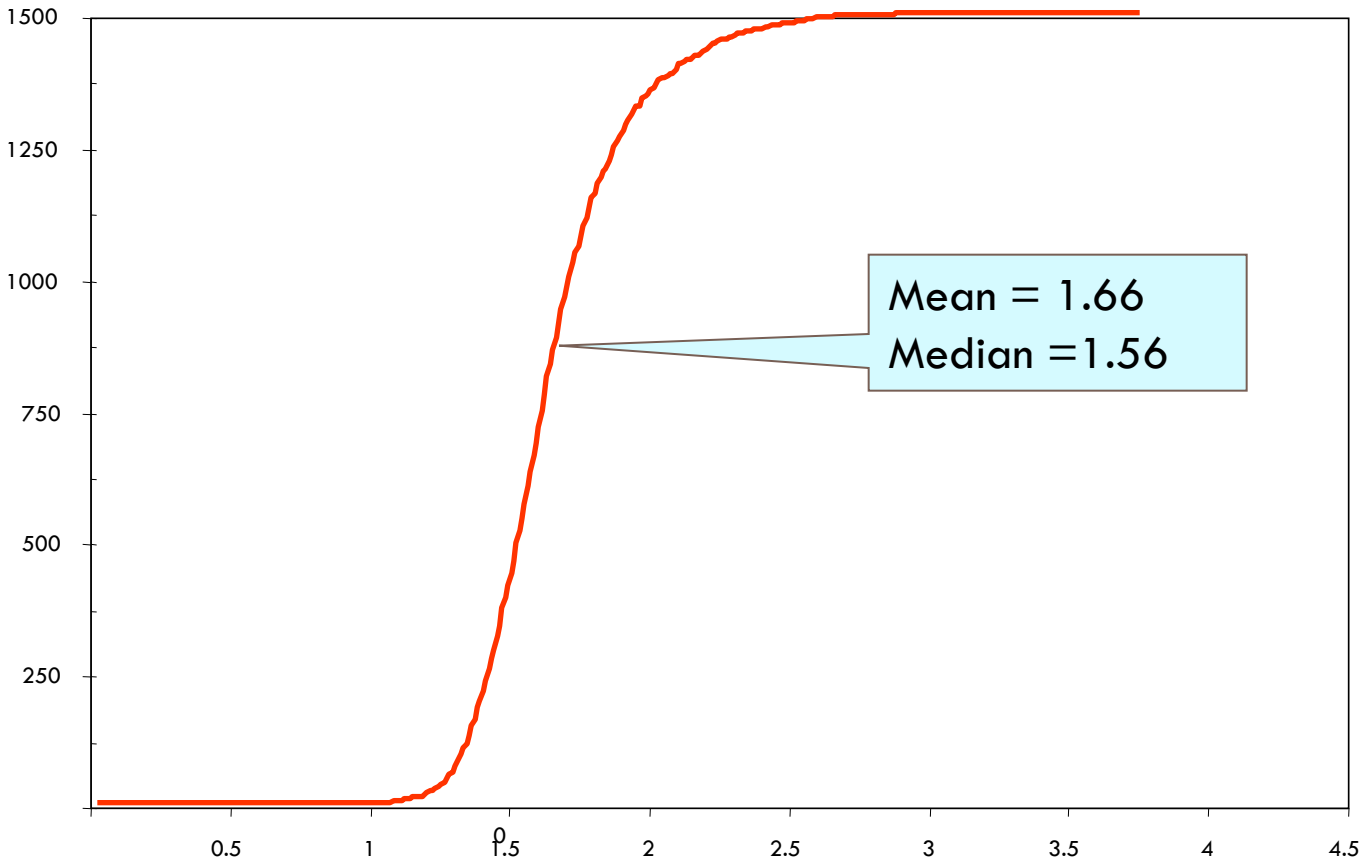
Topic distribution



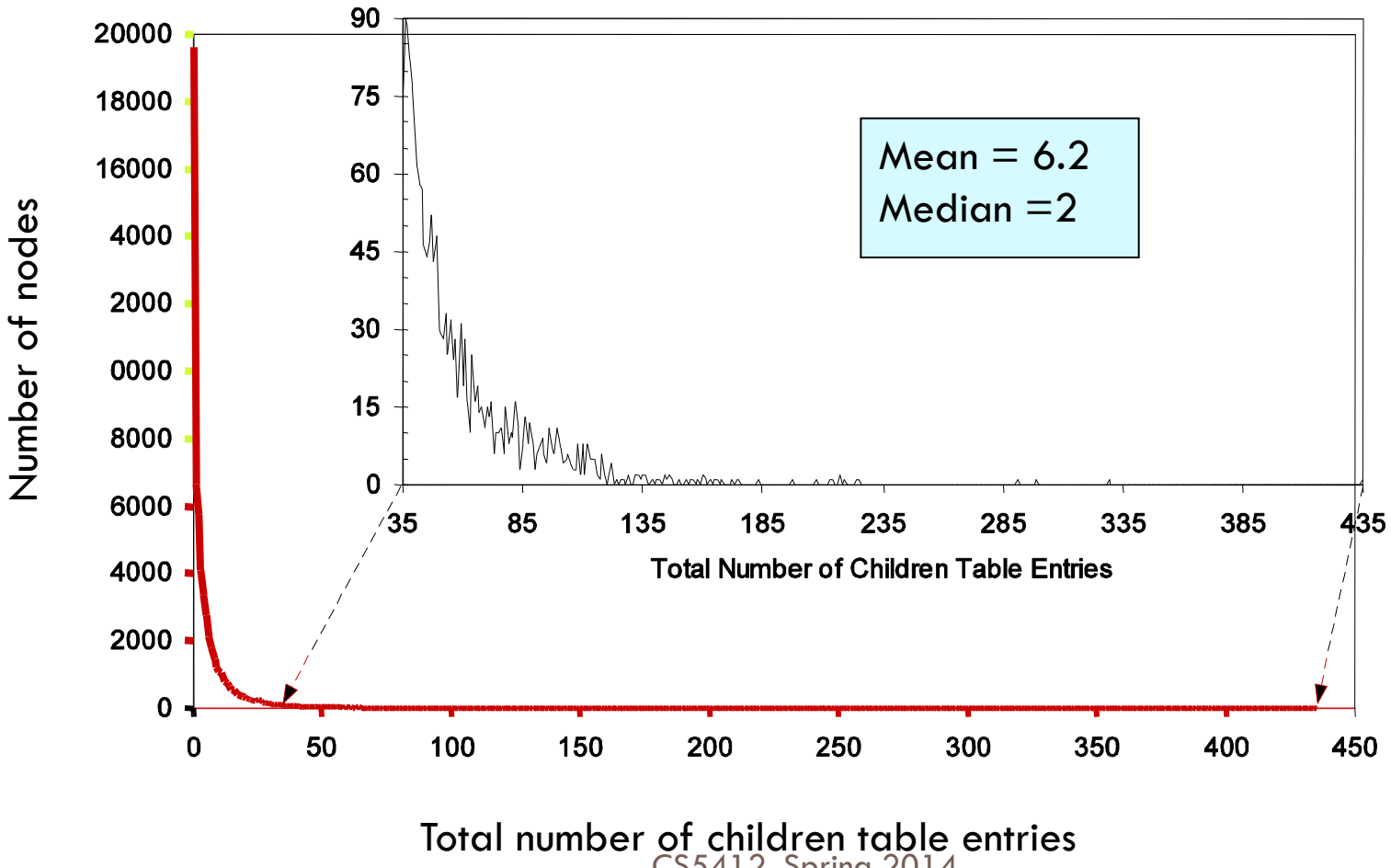
Concern about this data set

- Synthetic, may not be terribly realistic
  - In fact we know that subscription patterns are usually power-law distributions, so that's reasonable
  - But unlikely that the explanation corresponds to a clean Zipf-like distribution of this nature (indeed, totally implausible)
  - Unfortunately, this sort of issue is common when evaluating very big systems using simulations
  - Alternative is to deploy and evaluate them in use… but only feasible if you own Google-scale resources!

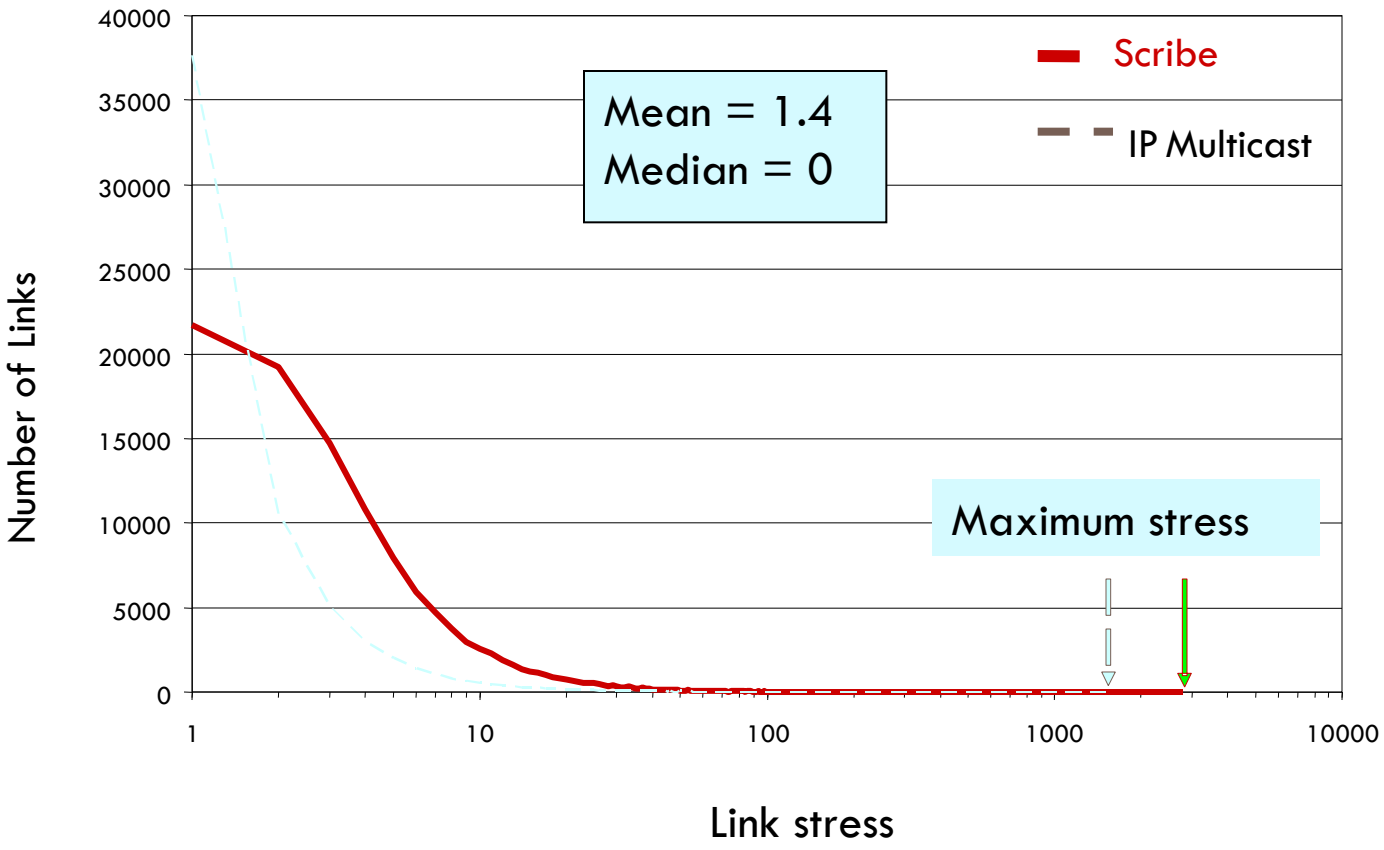
Delay penalty



Node stress: 1500 topics



Link stress


40000
35000
30000
25000
20000
15000
10000
5000
0
Number of Links
1
10
100
1000
10000
Link stress
Scribe
IP Multicast
Mean = 1.4
Median = 0
Maximum stress

T-Man

T-Man