VizPub: Visualizing the Performance of Overlay-Based Pub/Sub Systems

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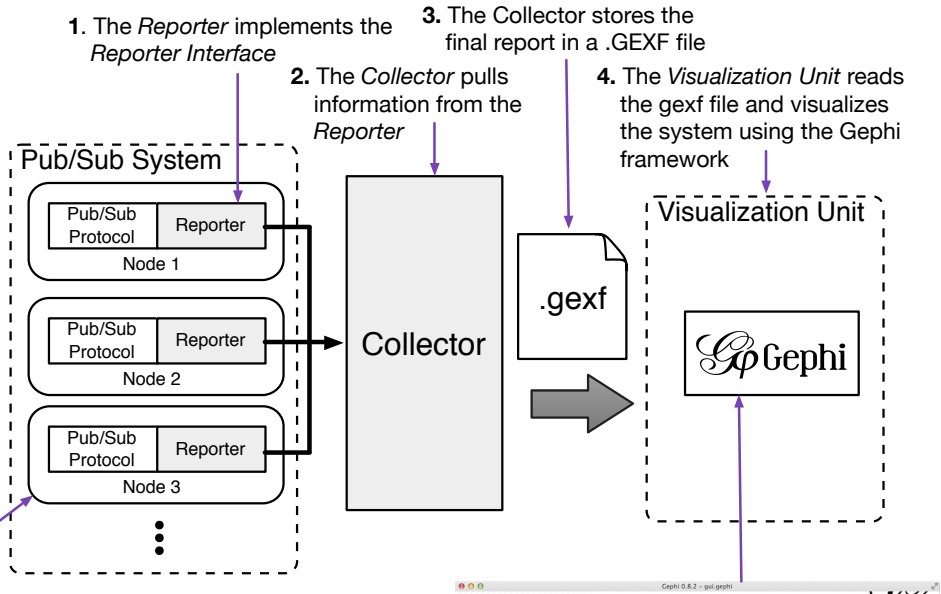
Objectives

- A tool for visualizing overlay-based pub/sub systems
- Gain insight into system performance
- Compare different pub/sub systems visually
- Visualize metrics such as node degree and hit-ratio

Architecture

Key Points

- Generic tool, apart from reporter interface implementation
- The amount of reportable data is configurable
- Metrics are derived and calculated based on the reported information
- Both aggregated and instantaneous metrics are supported
- Collection is done in online mode, but the computation and aggregation and derivation of various metrics can be done in offline mode

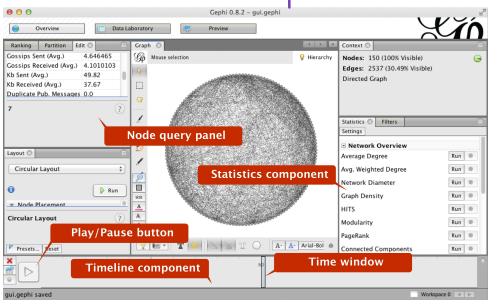


Each node reports:

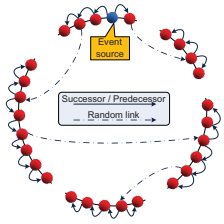
- The node id
- List of neighbor ids
- List of topic ids the node subscribes to
- Number of overlay control messages sent and received
- Number of overlay control message bytes sent and received
- List of publication messages sent and received

Gephi Framework [1]

- Playback system execution
- Calculate topology metrics such as degree
- Export data to .csv using the *Data Laboratory*



Examples of visualization for a specific system

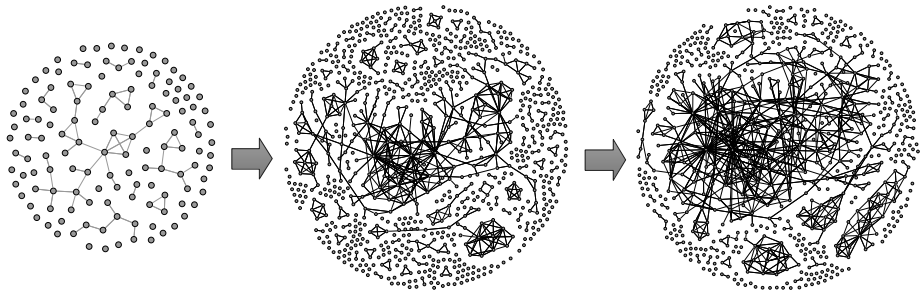


Background for the visualized system (PolderCast) [2]

- Topic-based P2P pub/sub system
- Organizes nodes in a ring structure
- Gossip-based overlay maintenance under churn
- Hybrid dissemination using ring and random links

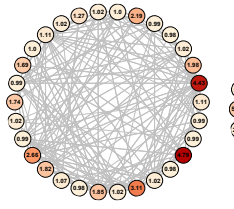
Data traces used in simulations

- Subscription traces from Facebook [cite?]
- Churn traces from the Skype super-peer network [cite?]
- Latencies using the King dataset [cite?]

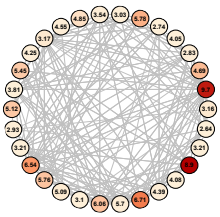


Visualization of overlay topology evolution during churn

- Playback system execution during churn
- Observe the evolution of the overlay topology incrementally
- Nodes appear and disappear due to churn



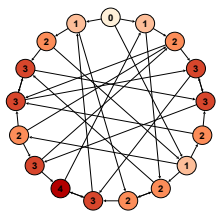
*Average number of gossip messages **sent** per node in PolderCast*



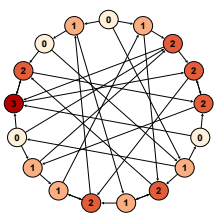
*Average Number of gossip messages **received** per node in PolderCast*

Structural Metrics

- Visualize structural properties of the overlay
- Use color to highlight overloaded nodes
- Labels update during playback of system execution



***Path lengths** in PolderCast*



***Duplicate message count** for PolderCast*

Dissemination Metrics

- Visualize dissemination of publications step-by-step
- Metrics represented as node labels
- Directed edges represent message paths
- Duplicate message count calculated by in-degree

[1] M. Bastian, S. Heymann, and M. Jacomy, "Gephi: An open source software for exploring and manipulating networks," in ICWSM, 2009.
[2] V. Setty, M. van Steen, R. Vitenberg, and S. Voulgaris, "Poldercast: Fast, robust, and scalable architecture for P2P topic-based pub/sub," in Middleware, 2012.

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