ROBUST DISTRIBUTED DATA AGGREGATION

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Main Motivation

To the best of our knowledge, despite the considerable existing literature about distributed data aggregation, approaches that are at the same time accurate, fault-tolerant, and support dynamism, were found missing in the current state of the art.

...“We define aggregation as the ability to summarize information. In the area of sensor networks it is also referred to as data fusion. It is the basis for scalability for many, if not all, large networking services.”...

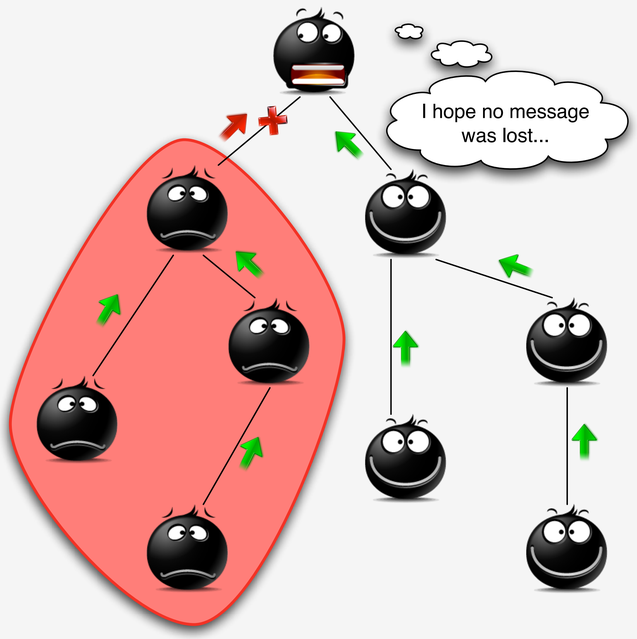
R.V. Renesse on The Importance of Aggregation (2003)

Main Publications

Fault-Tolerant Aggregation by Flow Updating. In 9th IFIP International Conference on Distributed Applications and interoperable Systems, pages 73–86, 2009.

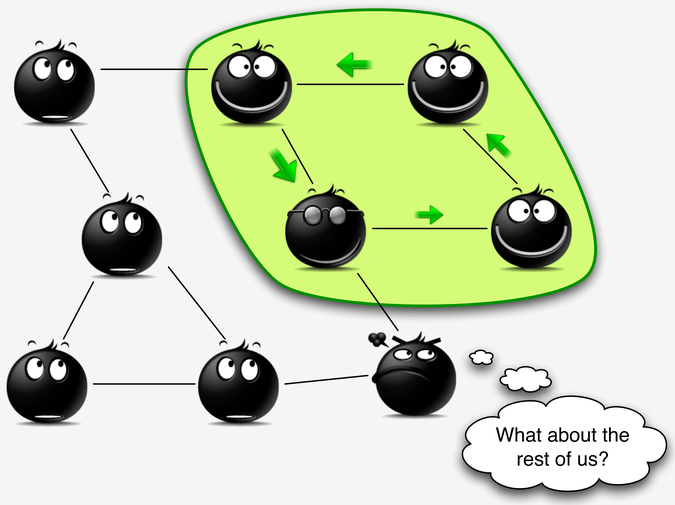
Fault-Tolerant Aggregation for Dynamic Networks. In 29th IEEE Symposium on Reliable Distributed Systems, pages 37–43, 2010.

Tree-based Approaches



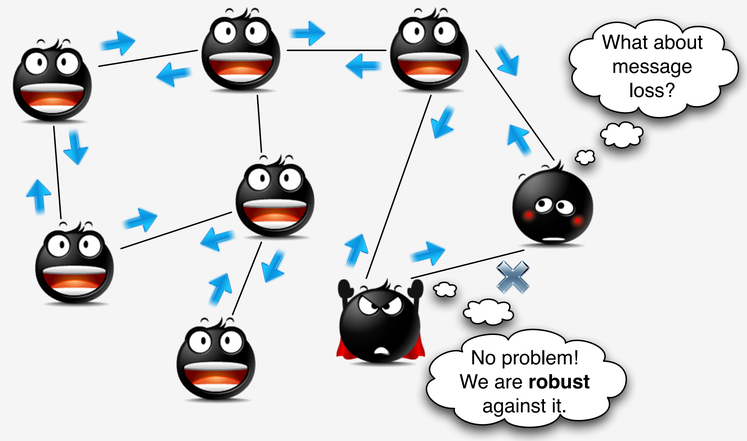
- Single point of failure;
- Centralized averaging scheme;
- Limited support for dynamic networks;

Probabilistic Approaches



- Dependent from the sampling quality;
- Not accurate (estimation error even without failures);
- Result determined at a single node;

Our Approach (Flow Updating)



- Idempotent Message exchange;
- Accurate averaging process (converge along time);
- Result determined by all nodes;
- Independent from the network topology;
- Supports message loss and node crash;
- Self-adapts to dynamic changes (network topology and input values);