Distributed ≠ Decentralized
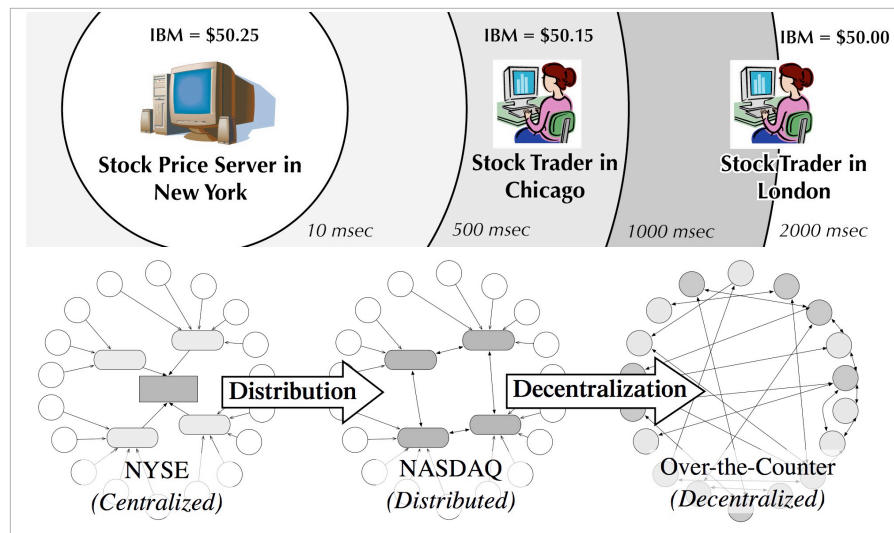
Deriving new architectural styles for the Web that cope with uncertainty.

Rohit Khare, Richard N. Taylor, *et al.* • Institute for Software Research • UC Irvine

IBM = $50.25 — Stock Price Server in New York — 10 msec

IBM = $50.15 — Stock Trader in Chicago — 500 msec

IBM = $50.00 — Stock Trader in London — 1000 msec — 2000 msec

Distribution → **Decentralization**

NYSE *(Centralized)* — NASDAQ *(Distributed)* — Over-the-Counter *(Decentralized)*

NEW IDEAS

- Consensus is expensive, if not impossible

  Latency: Network delays can make info 'stale'

  Agency: Participants can't always trust each other

- Instead, try coping *without* consensus:

  Today's client/server styles rely on ACID agreement
  <u>A</u>tomic, <u>C</u>onsistent, <u>I</u>solated, <u>D</u>urable transactions

  Manage the risk of disagreement w/BASE properties
  Best-effort networking, ***Approximate*** estimates
  Self-centered trust management, ***Efficient*** buffering

IMPACT

- Extend the Web to support ***real-time*** events

  REST architectural style only permits centralization

  - ARRESTED style adds **<u>A</u>synchronous** notification, message **<u>R</u>outing**, *precise* **<u>E</u>stimators** for remote values, & *accurate* assessments using **<u>D</u>ecision** rules.

- Support Internet-scale application integration

  Software running locally processes ***facts***; the output of *Services* run by *others* is only their ***opinion***.

  Such apps can tolerate slow, intermittent networks

SCHEDULE

- New open-source event router developed

  The `Mod_PubSub` project was created by ***KnowNow***, a startup spun off from our research at UC Irvine

  Available from `http://www.mod-pubsub.org/`

- New theoretical model published

  Doctoral dissertation, papers, and technical report:
  Extending the Representational State Transfer (REST) Architectural Style for Decentralized Systems, 2003
  Available as ISR-03-08 from `http://isr.uci.edu/`