PowerGraph
Distributed Graph-Parallel Computation on Natural Graphs
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Graph Abstractions

Typical graph abstractions assume each vertex has few neighbors. They partition the graph for parallel work based on vertices so they used edge cuts.
Natural Graphs

Natural graphs are those found in the real world such as social networks. They typically have highly skewed power-law degree distributions. This means that a few vertices have many edges while some have few.
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PowerGraph

Begin the program by activating a vertex.
The program then runs until no vertices are activated.
Vertices can activate themselves and neighboring vertices.
The order of activated vertex execution is not defined but all activated vertices are guaranteed to eventually execute.
Async or synchronous executions are available.
Vertex Cut

A vertex cut permits a single vertex program to span multiple machines.
This allows evenly assigning edges.
A random vertex cut can be used.
A greedy vertex cut can improve performance.
  It places edges to minimize conditional expected replication factor.
  It requires machine coordination which increases initial overhead.
  Reduction in communication needs makes it faster in practice.
Performance Comparison

(a) Power-law Fan-In Runtime  (b) Power-law Fan-Out Runtime

Figure 10: Synthetic Experiments Runtime. (a, b) Per iteration runtime of each abstraction on synthetic power-law graphs.
Recent Work
GraphChi

GraphChi is designed for use on a single machine.
PowerGraph is designed for a distributed system.
PowerGraph outperforms but not proportional to the resources available.
GraphX

GraphX is a distributed graph system like PowerGraph and is built on Apache Spark, a distributed dataflow system.

GraphX has similar performance but scales better.
Ligra

Ligra is designed for a single machine.
Ligra is slightly faster per iteration than PowerGraph on PageRank on the Twitter graph.
X-Stream

Like PowerGraph, X-Stream maintains state in the vertices and exposes a scatter-gather model.

X-Stream is designed for a single shared-memory machine.

X-Stream uses an edge centric iteration method where the different phases iterate over edges rather than vertices.

X-Stream outperforms GraphChi and Ligra (when taking into account pre-processing time).