Graph Parallel Abstraction

- **Vertex-Program** associated with each vertex
- **Graph** constrains the interaction along edges
  - **Pregel**: Programs interact through messages
  - **GraphLab 1**: Programs can read each others state

**Example:** *PageRank*

- **Iterate:**
  \[
  R[i] = 0.15 + 0.85 \sum_{j \in E} \frac{R[j]}{\text{Degree}(j)}
  \]

**Natural Graphs**

*Graphs Encode Relationships between Entities*

- **Small** neighborhoods
- **Similar** degree vertices
- **Easy to partition**
- **Large** Neighborhoods
- **Power-Law Degree**
- **Difficult to partition**

**Power-Law Graphs**

- Most vertices have relatively few neighbors while a few vertices have many neighbors
- Probability of having degree \( d \): \( P(d) \propto d^{-\alpha} \)

**Results**

*PageRank (per Iteration):*

- 40M Webpages, 1.4B Links

*Triangle Counting:*

- Twitter Graph: 40 Million Vertices
- 1.4 Billion Edges
- 34.8 Billion Triangles

*Available Now!*

http://GraphLab.org