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Developing Pig on Tez

Cheolsoo Park
VP, Apache Pig
Netflix

Mark Wagner
Committer, Apache Pig
LinkedIn

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What is Pig

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- Apache project since 2008
- Higher level language for Hadoop that provides a dataflow language with a MapReduce based execution engine

```
A = LOAD 'input.txt';
B = FOREACH A GENERATE flatten(TOKENIZE((chararray)$0))
    AS word;
C = GROUP B BY word;
D = FOREACH C GENERATE group, COUNT(B);
STORE D INTO './output.txt';
```

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Pig Concepts

- LOAD
- STORE
- FOREACH ___ GENERATE ___
- FILTER ___ BY ___

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Pig Concepts

GROUP ___ BY ___

- 'Blocking' operator
- Translates to a MapReduce shuffle

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Pig Concepts

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Joins:

- Hash Join
- Replicated Join
- Skewed Join

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Pig Latin

```
A = LOAD 'input.txt';
B = FOREACH A GENERATE
    flatten(TOKENIZE((chararray)$0))
    AS word;
C = GROUP B BY word;
D = FOREACH C GENERATE group, COUNT(B);
STORE D INTO './output.txt';
```

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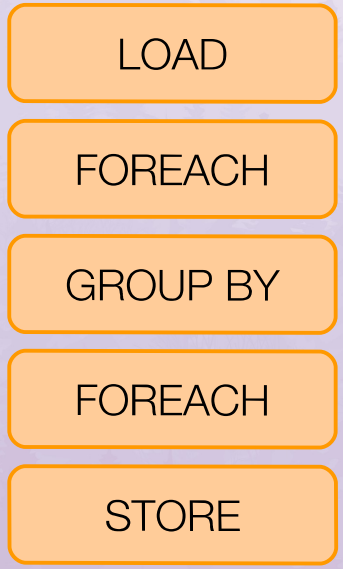
Logical Plan



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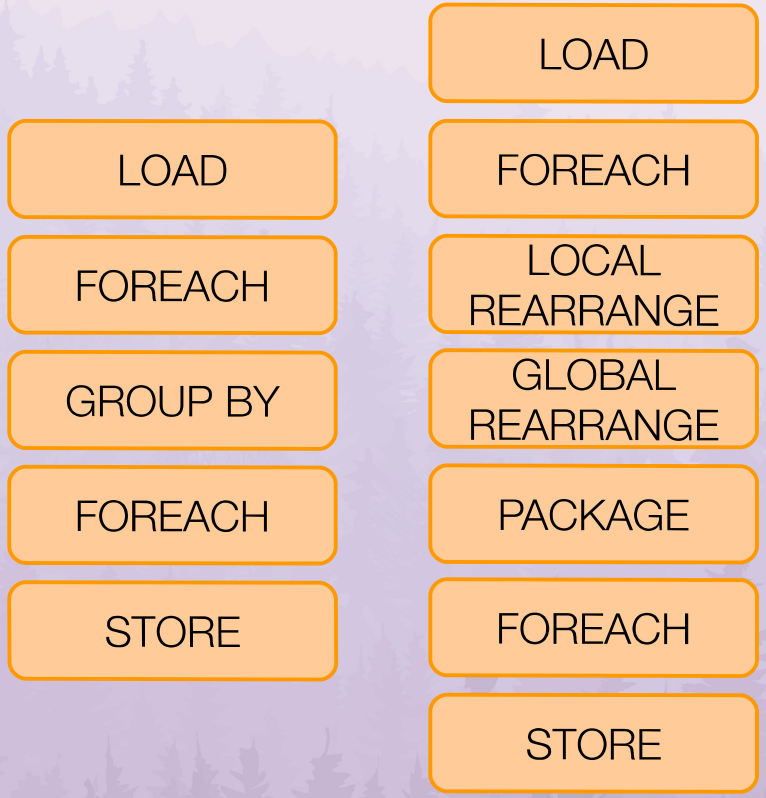
Physical Plan



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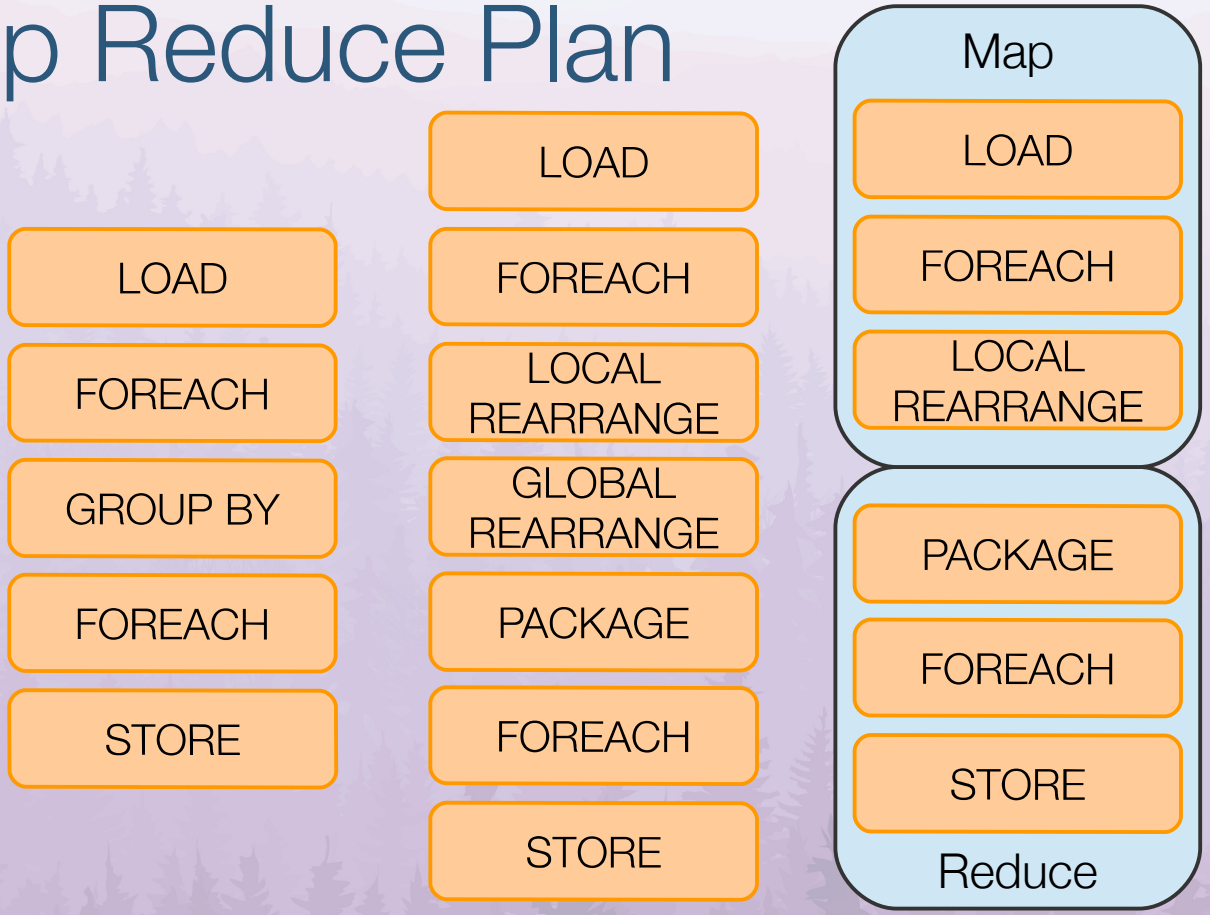
Map Reduce Plan



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What's the problem

- Extra intermediate output
- Artificial synchronization barriers
- Inefficient use of resources
- Multiquery Optimizer
  - Alleviates some problems
  - Has its own

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Apache Tez

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- Incubating project
- Express data processing as a directed acyclic graph
- Runs on YARN
- Aims for lower latency and higher throughput than Map Reduce

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Tez Concepts

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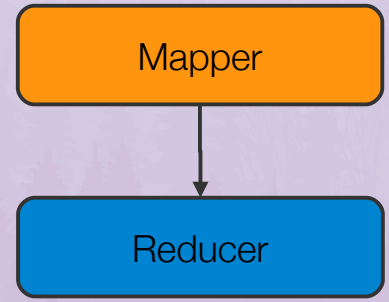
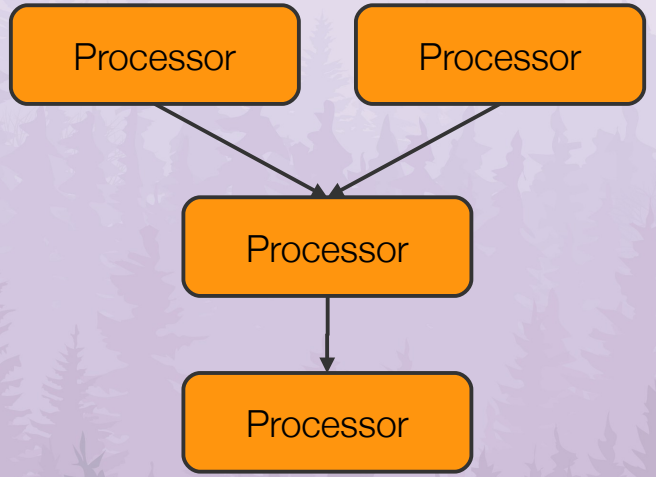
- Job expressed as directed acyclic graph (DAG)
- Processing done at vertices
- Data flows along edges





Benefits & Optimizations

- Fewer synchronization barriers
- Container Reuse
- Object caches at the vertices
- Dynamic parallelism estimation
- Custom data transfer between processors

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What we've done for Pig

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- New execution engine based on Tez
- Physical Plan translated to Tez Plan instead of Map Reduce Plan
- Same Physical Plan and operators
- Custom processors run the execution plan on Tez

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Along the way

- New pluggable execution backend
- Made operator set more generic
- Motivated Tez improvements

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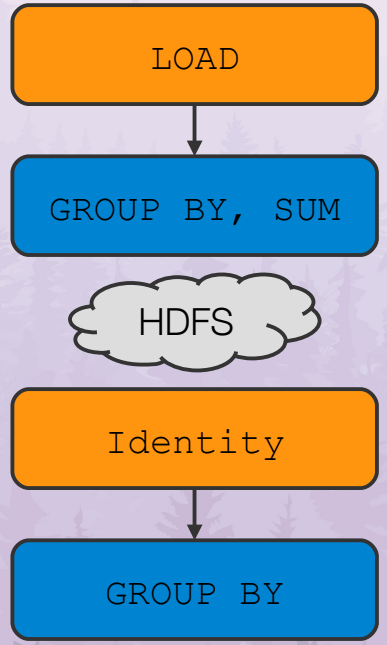
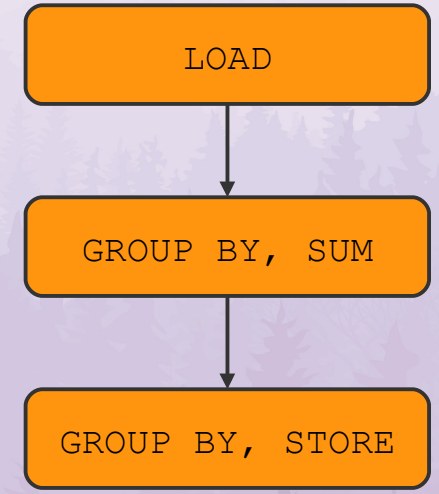
Group By

```
f = LOAD 'foo'
      AS (x:int, y:int);
g = GROUP f BY x;
h = FOREACH g GENERATE
      group AS r,
      SUM(f.y) as s;
i = GROUP h BY s;
```





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Join

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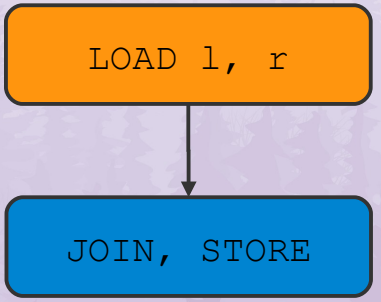
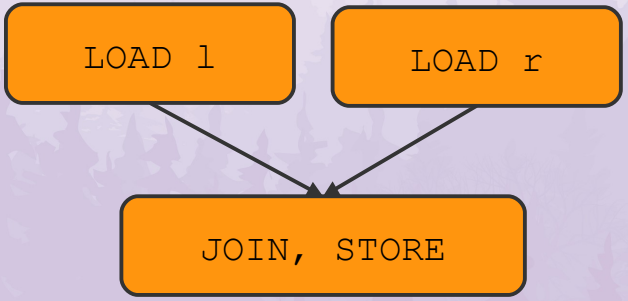
```
l = LOAD 'left' AS (x, y);
r = LOAD 'right' AS (x, z);
j = JOIN l BY x, r BY x;
```





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Group By

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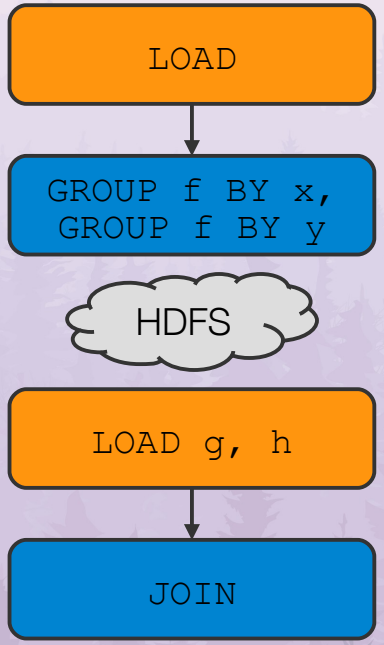
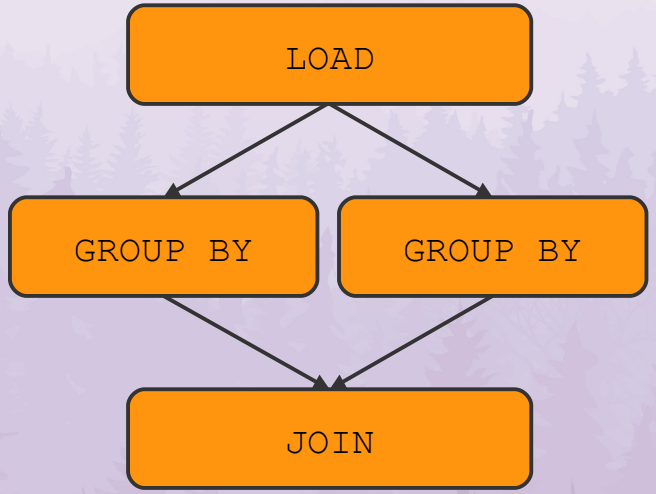
```
f = LOAD 'foo'
     AS (x:int, y:int);
g = GROUP f BY x;
h = GROUP f BY y;
i = JOIN g BY group,
         h BY group;
```





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Order By

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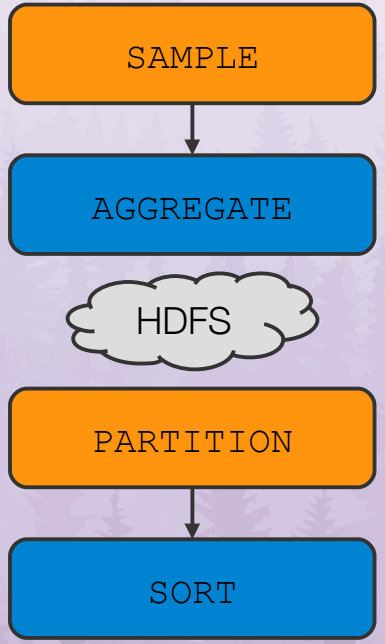
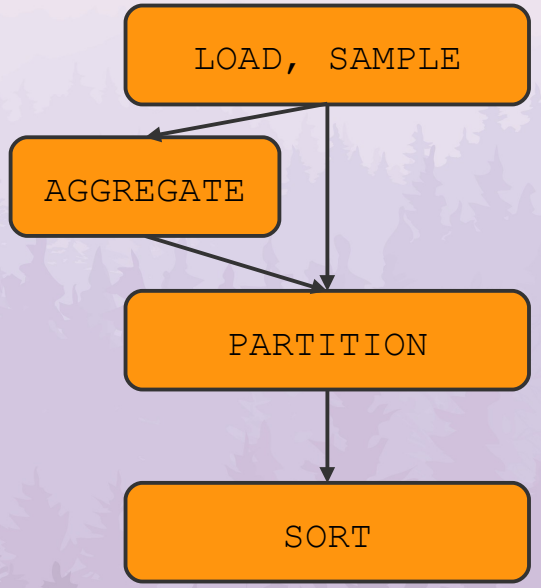
```
f = LOAD 'foo' AS (x, y);
o = ORDER f BY x;
```





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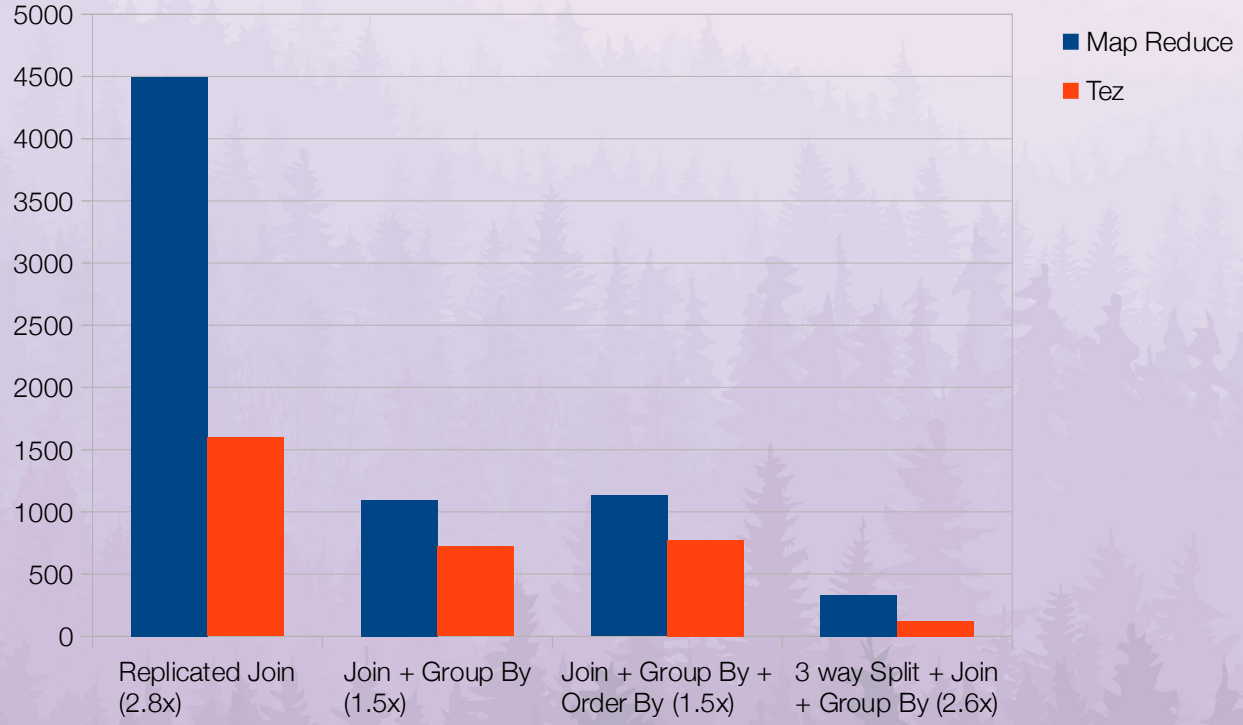
Performance Comparison



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How it started

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Shared interests across organizations

- Similar data platform architecture.
  - Pig for ETL jobs
  - Hive for ad-hoc queries

How it started

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Shared interests across organizations

- Hortonworks wants Tez to succeed.

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Organizing team

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Community meet-ups helped

- Twitter presented summer intern's POC work at Tez meet-up.
- Pig devs exchanged interests.

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Organizing team

Community meet-ups helped

- Tez team hosted tutorial sessions for Pig devs.
- Pig team got together to brainstorm implementation design.

Building trust

Companies showed commitment to the project

- Hortonworks: Daniel Dai
- LinkedIn: Alex Bain, Mark Wagner
- Netflix: Cheolsoo Park
- Yahoo: Olga Natkovich, Rohini Palaniswamy

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Setting goals

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Make Pig 2x faster within 6 months

- Hive-on-Tez showed 2x performance gain.
- Rewriting the Pig backend within 6 months seemed reasonable.

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Acting as team

Sprint

- Monthly planning meetings
- Twice-a-week stand-up conference calls

Issues / discussions

- PIG-3446 umbrella jira for Pig on Tez
- Whiteboard discussions at meetings

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Knowledge transfer

- Pig old timer Daniel Dai acted as mentor.
- Everyone got to work on core functionalities.
- Everyone became an expert on the Pig backend.

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Sharing credit

- Elected as a new committer and PMC chair.
- Gave talks at Hadoop User Group and Pig User Group meet-ups.
- Speaking at ApacheCon and upcoming Hadoop Summit.

Further collaborations

Looking for more collaborations

- Parquet Hive SerDe improvements.
- Sharing experiences with SQL-on-Hadoop solutions.

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Mind shift

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"If we can't hire all these good people, why don't we use them in a collaboration?"

- Collaboration instead of competition.

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Mind shift

“Why do we reinvent the wheel?”

- Share the same technologies while creating different services.

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Believe in the Apache way

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