

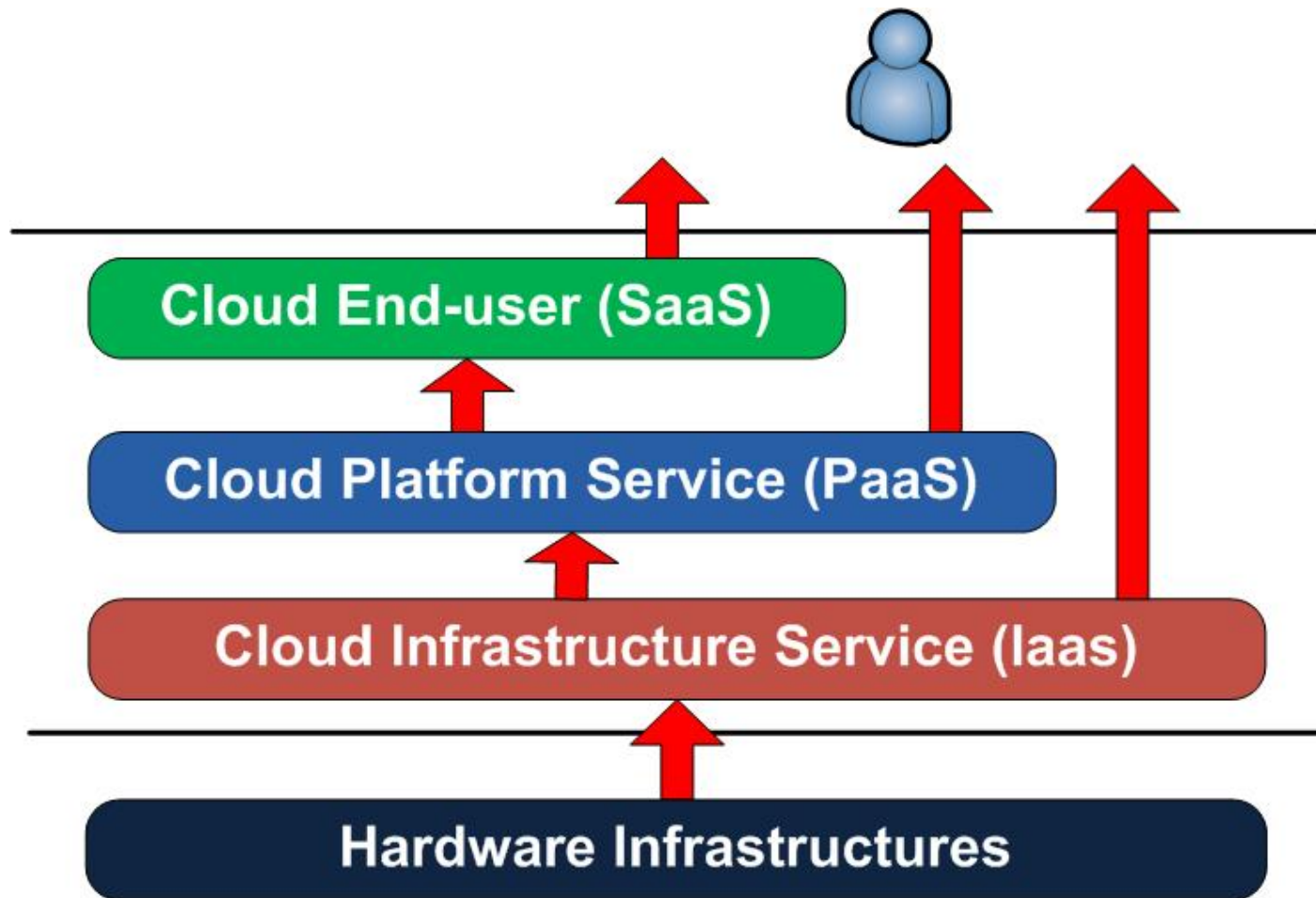
Pre-mature Cloud & Its Key Technologies

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Outline

- Cloud Service Model
- Why Cloud?
- Different Voices
- Underlying Technologies
- References

Cloud Service Model



Key Players

- ✧ **Amazon:** EC2, S3
- ✧ **Apache:** Hadoop
- ✧ **Microsoft:** Azure
- ✧ **IBM:** Blue Cloud (Nov, 15, 2007)
- ✧ **Google:** AppEngine
- ✧ **Salesforce.com:** AppExchange



Why Cloud?

- Pay-per-use
- Elastic & Scalable
- Virtualization
- Ubiquitous

Different Voices

- Is Migrating easy or practical?

✓ A different architecture is not necessarily worse than the current one.

✓ Standardization

Different Voices

- Is data secure?

- ✓ Not cloud-specific
- ✓ Cloud may be more secure.
- ✓ Risk evaluation mechanism

Different Voices

- Can SLAs (Service-Level Agreements) be supported?

- ✓ Yes but inadequate
- ✓ More like a refund while not quality-assured
- ✓ Still helpful
- ✓ Larger companies are more robust (e.g., earthquake)

Different Voices

- Is cloud really cheap?

- ✓ How to compute the cost of internal data centers?

- ✓ Application-specific

- ✓ A hybrid architecture rules?

Underlying Technologies

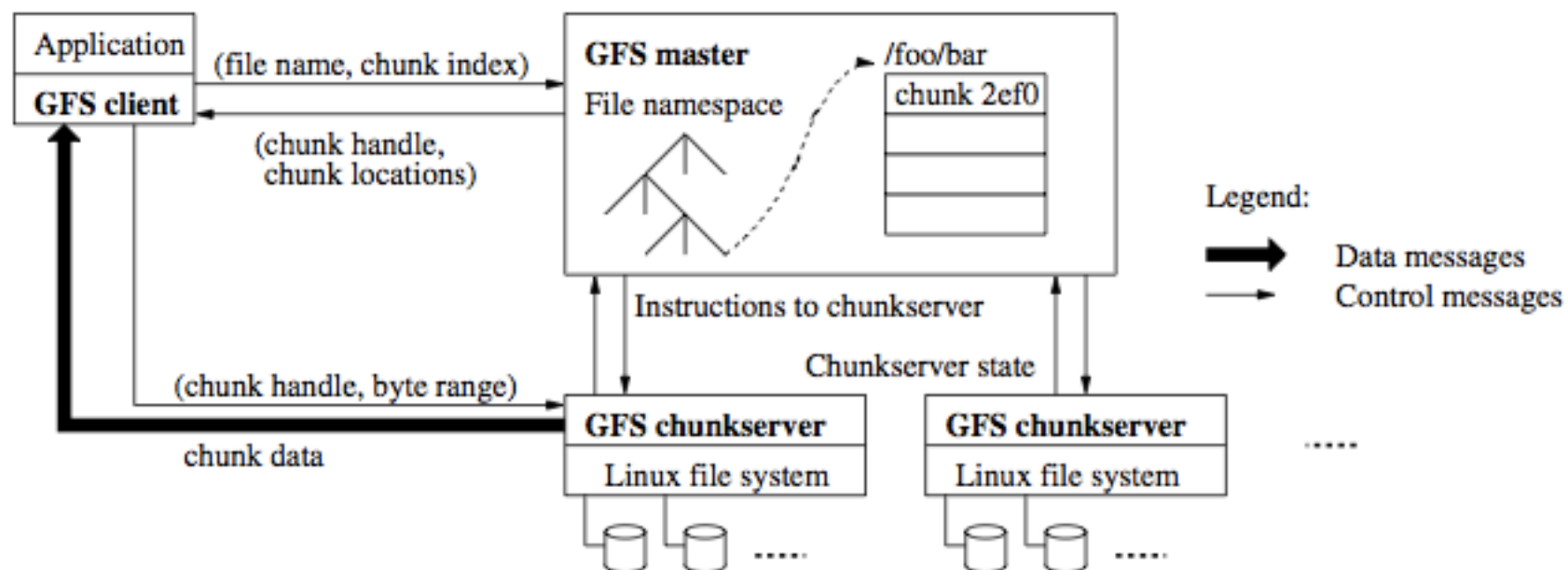
- GFS
- MapReduce
- BigTable
- Hadoop

Underlying Technologies

- Challenges
 - Unreliability of hardware
 - Commodity components
 - Redundancy
 - Software Reliability

Underlying Technologies

- GFS
 - Monitors, Error detect, fault tolerance, auto-recovery
 - Size of file. Redesign IO operation, block size
 - Access mode. Rarely modify but append. Side effect, locality?
 - Consistency relaxation
 - Throughput oriented, user latency is not so important. Most batch mode.

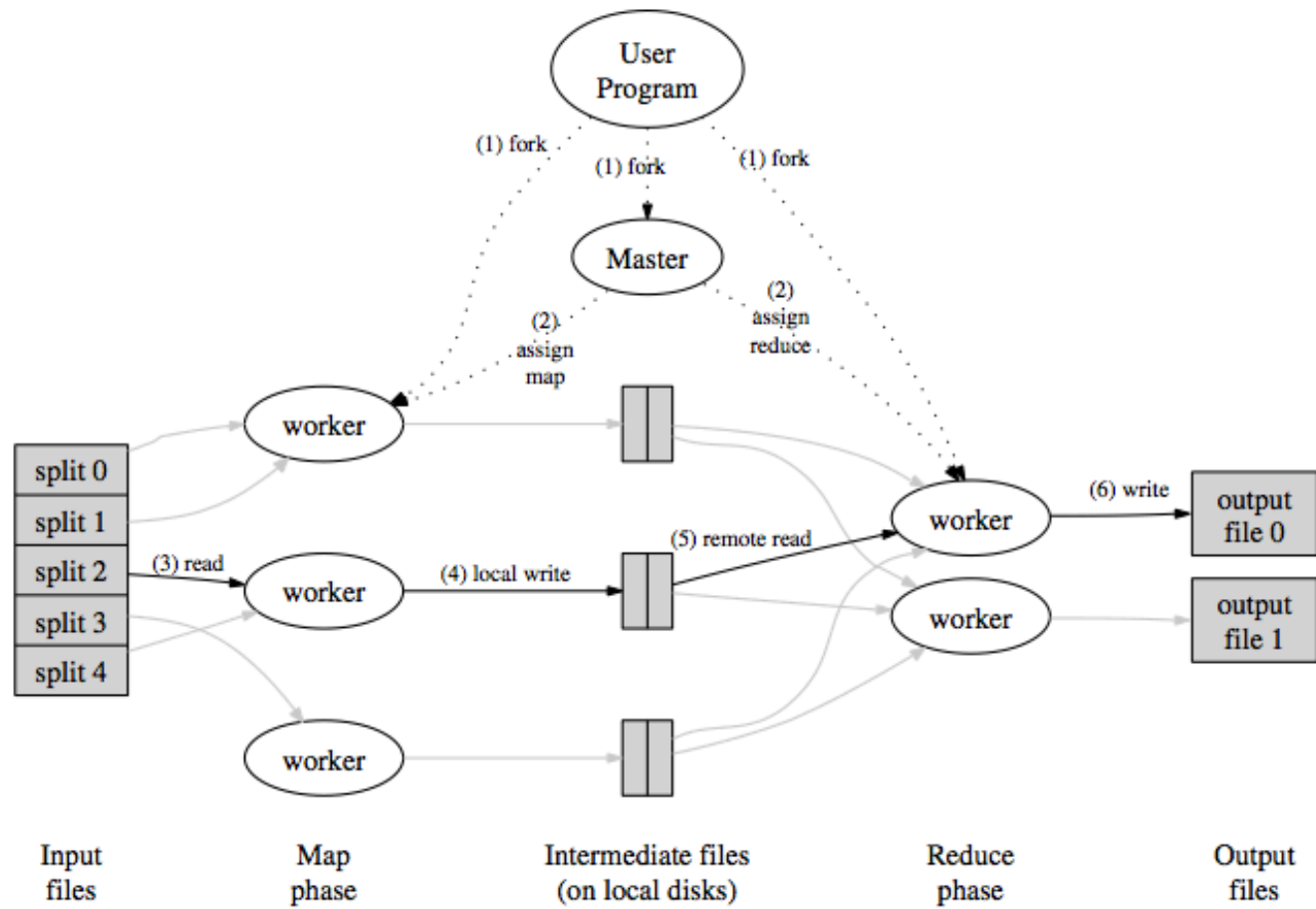


Underlying Technologies

Map: The master node takes the input, chops it up into smaller sub problems, and distributes those to worker nodes. A worker node may do this again...After processing the sub problem, the worker node will return the result to the master node

Support distributed
S
down to two
-and-Conquer)

Reduce: The master node collects all the answer to all the sub problems and combines them

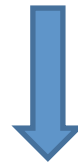


Underlying Technologies

- BigTable
 - A fast and extremely scalable DBMS on top of GFS
 - Flexible Column design
 - Separated into tablets
 - Compressed as needed

Underlying Technologies

Row Key	Time stamp	"contents"	"anchor"		"mime"
"com.cnn.www"	t9		"anchor.cnnsi.com"	"CNN"	
	t8		"anchor.my.look.ca"	"CNN.com"	
	t6	"<html>..."			"text/html"
	t5	"<html>..."			
	t3	"<html>..."			



Row Key	Time stamp	"contents"
"com.cnn.www"	t6	"<html>..."
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Underlying Technologies

- Hadoop
 - Inspired by Google
 - HDFS -> GFS
 - MapReduce -> Google MapReduce
 - Hbase -> BigTable
 - New members: Pig, Hive...

References

- Sanjay Ghemawat, Howard Gobioff, and Shun-Tak Leung, **The Google File System** , SOSP'03
- Jeffrey Dean and Sanjay Ghemawat, **MapReduce: Simplified Data Processing on Large Clusters** , OSDI'04
- Fay Chang , Jeffrey Dean , Sanjay Ghemawat , Wilson C. Hsieh , Deborah A. Wallach , Mike Burrows , Tushar Chandra , Andrew Fikes , Robert E. Gruber, **igtable: A distributed storage system for structured data**, OSDI'06