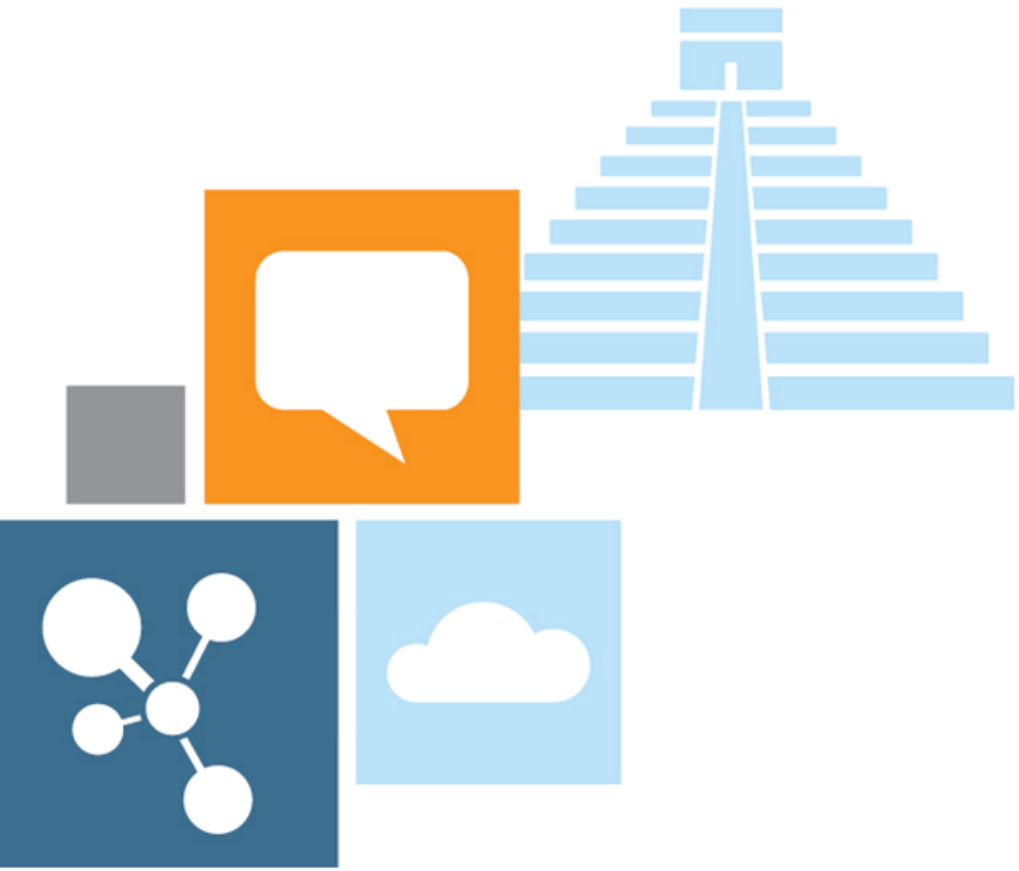
Microsoft



Microsoft® Research

Faculty Summit 2012

Riviera Maya, Mexico | May 23-25 | In partnership with CONACYT

Big Data and the Cloud Phenomenon

Pedro Celis
Distinguished Engineer,
Microsoft, United States

Date
Thursday, May 24, 2012

How much information is there?

- Almost everything is recorded digitally.
- Most bytes are never seen by humans.
- Data summarization,
  trend detection
  anomaly detection
  are key technologies

See Mike Lesk:

How much information is there: http://www.lesk.com/mlesk/ksg97/ksg.html

See Lyman & Varian:

How much information

http://www.sims.berkeley.edu/research/projects/how-much-info/

Patterns

- AMBIENT DATA -> SHOEBOX PATTERN

BIG DATA IS A DISRUPTIVE SHIFT

- DRIVES NEW OPPORTUNITIES AND NEW DESIGN PATTERNS
- AMBIENT DATA -> SHOEBOX PATTERN

TECHNOLOGIES

“A SPREADSHEET WITH 300 BILLION ROWS?”

ONE YEAR OF ADSENSE CLICKSTREAM DATA:
COOKED DOWN WITH MAP-REDUCE, 50X:20 TB
VERTIPAQ SERVER SCALE-OUT, 33X: 600 GB
VERTIPAQ IN-MEMORY STORE, 40X: 15 GB
PROCESS IN EXCEL: 300 B ROWS

SINGLE-DIGIT HOURS

LESS, + QUICK RELOAD
0.3 S OPERATIONS

GARTNER: “WAIT, WHAT? WHAT DID WE JUST SEE?”

THE COST OF 1 PB

COST OF DATA ENTRY FOR 1 PB:

MANUAL DATA ENTRY: $1/kB

1 PB = $1 TRILLION

COST OF SERVERS FOR 1 PB:

33 COMMODITY SERVERS @ $3,00

1 PB = $100,000

$1 TRILLION : $100,000 = 10^7

BING

FOR EACH SEARCH THEY SEND OUT DATA
THEY ALSO COLLECT DATA ABOUT THE SEARCH AND THE USER
THEY SAVE MORE DATA THAN THEY SEND BACK

BING IS AN INFORMATION MACHINE,
CREATING DATA FOR THEIR CUSTOMERS –
THE ADVERTISERS
CREATING DATA FOR THEIR USERS –
BETTER RELEVANCE AND RANKING ANSWERS
PETABYTES PER DAY

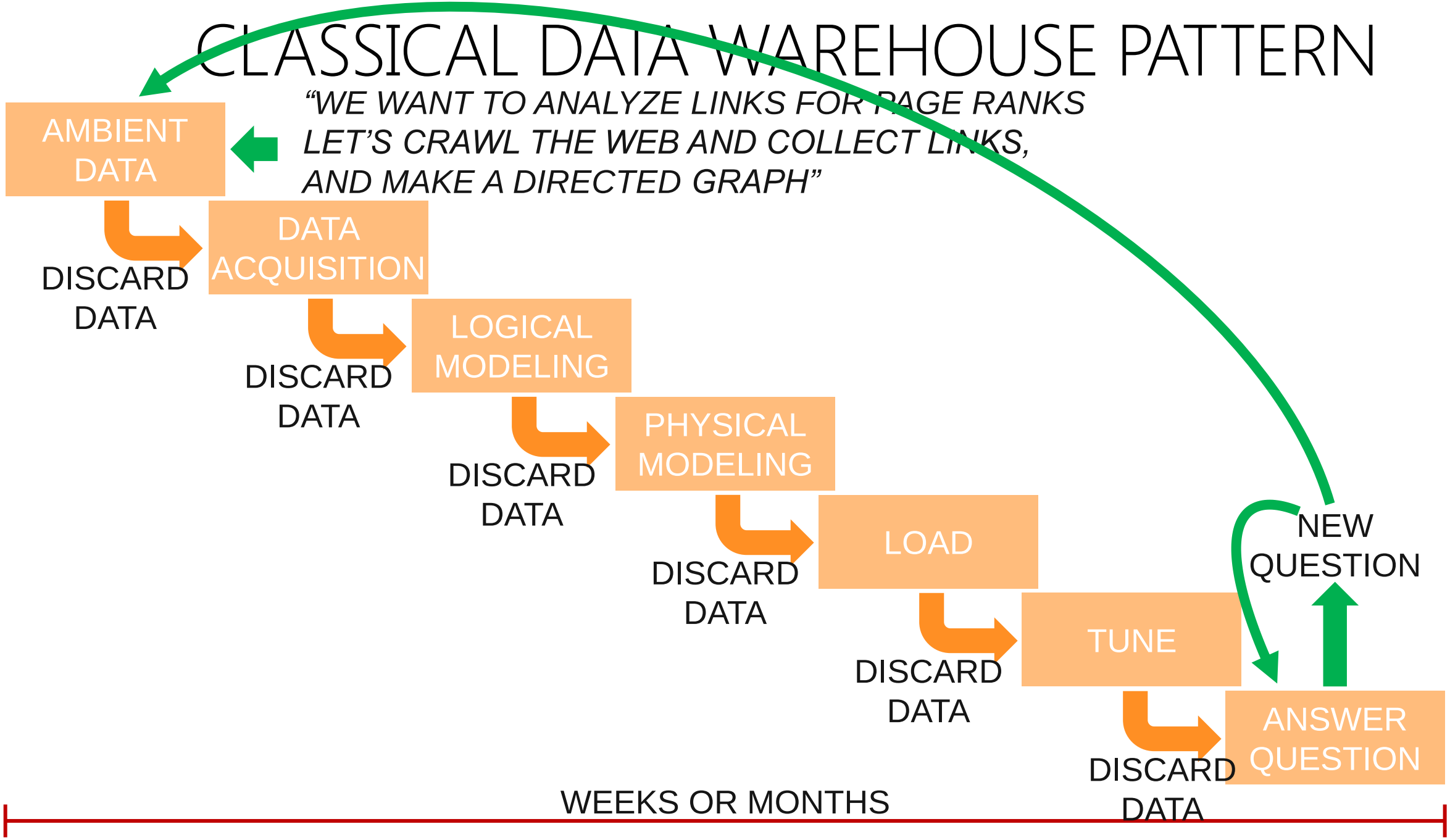
BIG DATA IS A DISRUPTIVE SHIFT

- DRIVES NEW OPPORTUNITIES AND NEW DESIGN PATTERNS
- AMBIENT DATA -> SHOEBOX PATTERN

EXAMPLE: THE DIGITAL SHOEBOX PATTERN

"RETAIN ALL
POTENTIALLY VALUABLE
AMBIENT DATA
FOR SUBSEQUENT ANALYSIS"

CLASSICAL DATA WAREHOUSE PATTERN

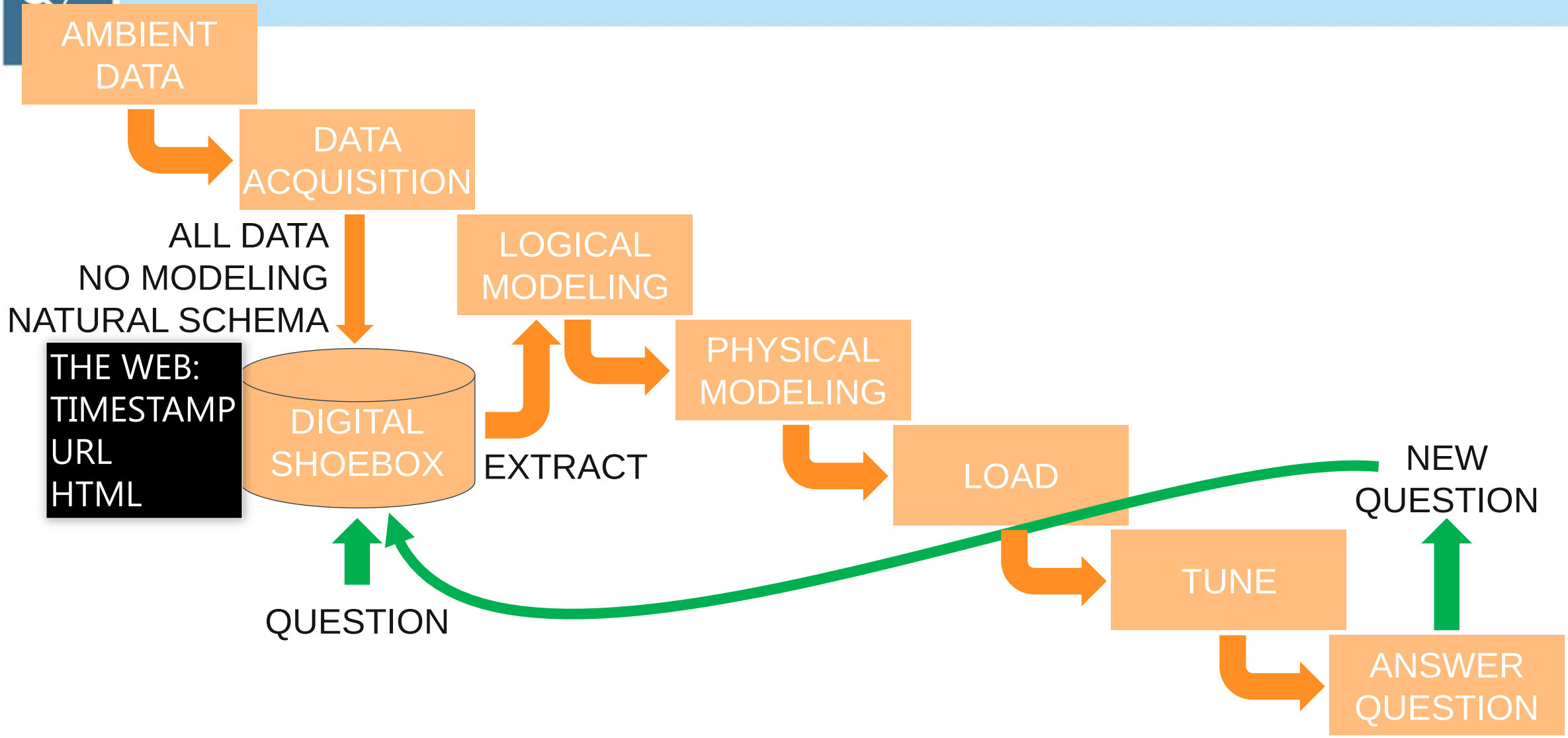


CLASSICAL DATA WAREHOUSE PATTERN

A CULTURE OF SCARCITY

A CULTURE OF ABUNDANCE

DIGITAL SHOEBOX PATTERN



DIGITAL SHOEBOX PATTERN

WHEN IS THIS PATTERN APPROPRIATE?

$$\left(\frac{perceivedLatentValue}{time}\right) > \left(\frac{cost(dataAquisition) + cost(dataStorage)}{time}\right)$$

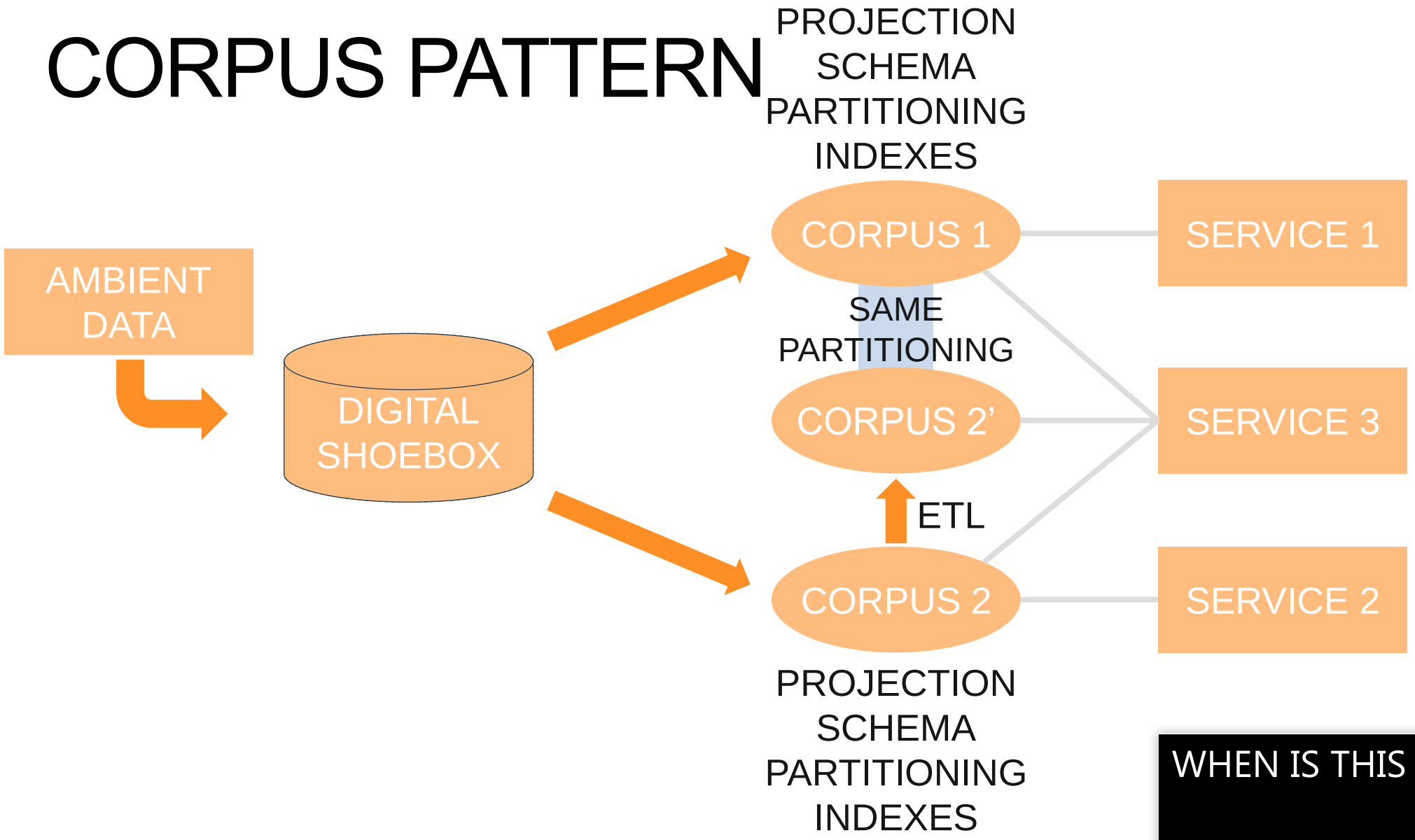
BIG DATA IS A DISRUPTIVE SHIFT

- DRIVES NEW OPPORTUNITIES AND NEW DESIGN PATTERNS
- AMBIENT DATA -> SHOEBOX PATTERN
- CONSTRUCTING DATA FROM DATA -> CORPUS PATTERN

WHEN IS THIS APPROPRIATE?

1. PERF IS CRITICAL
2. STORAGE COST IS OK
3. STALE DATA IS OK

CORPUS PATTERN

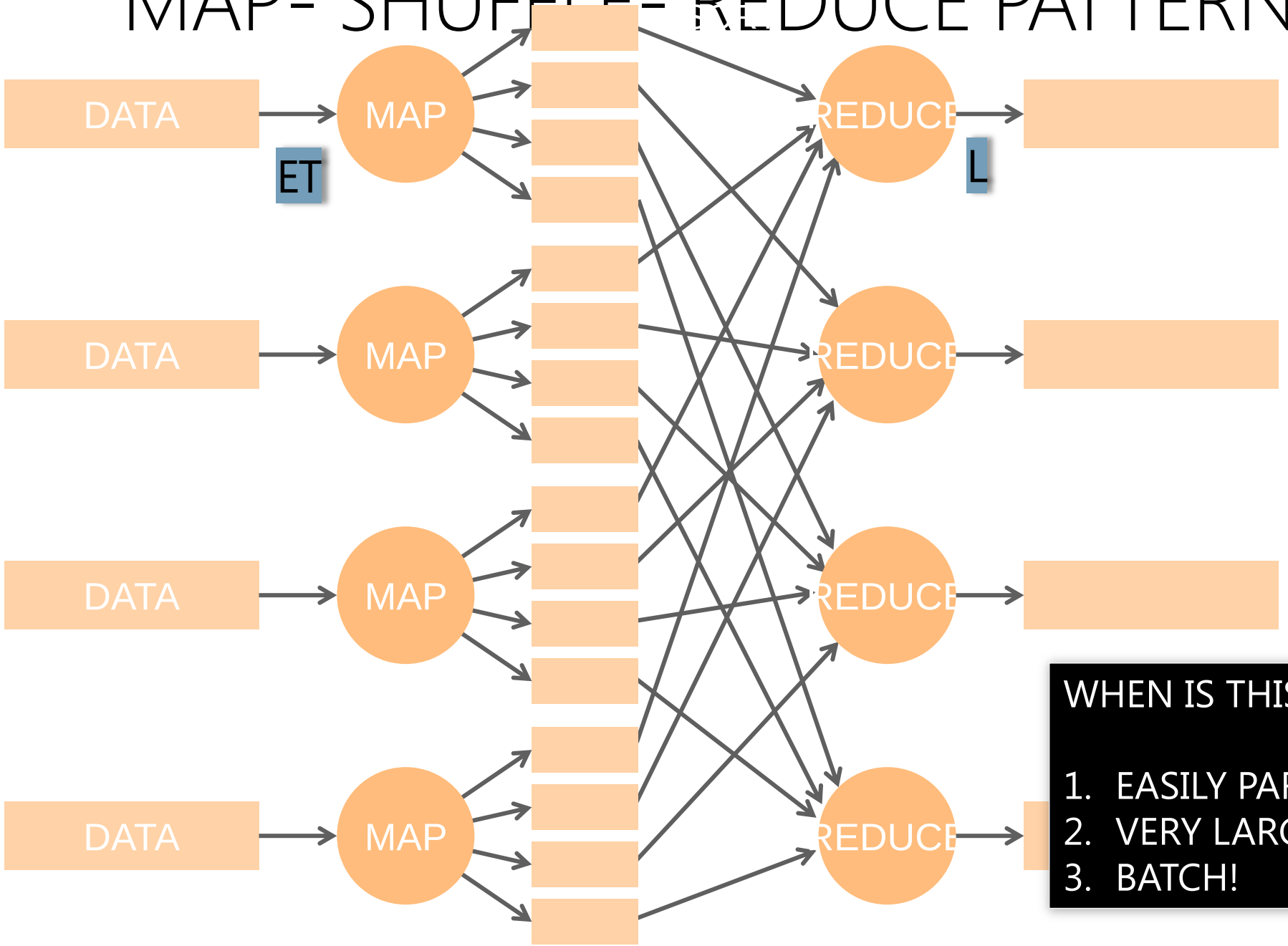


"WE'LL OPTIMIZE THE DATABASE FOR THIS DUAL USE"

WHEN IS THIS APPROPRIATE?

1. PERF IS CRITICAL
2. STORAGE COST IS OK
3. STALE DATA IS OK

MAP- SHUFFLE- REDUCE PATTERN



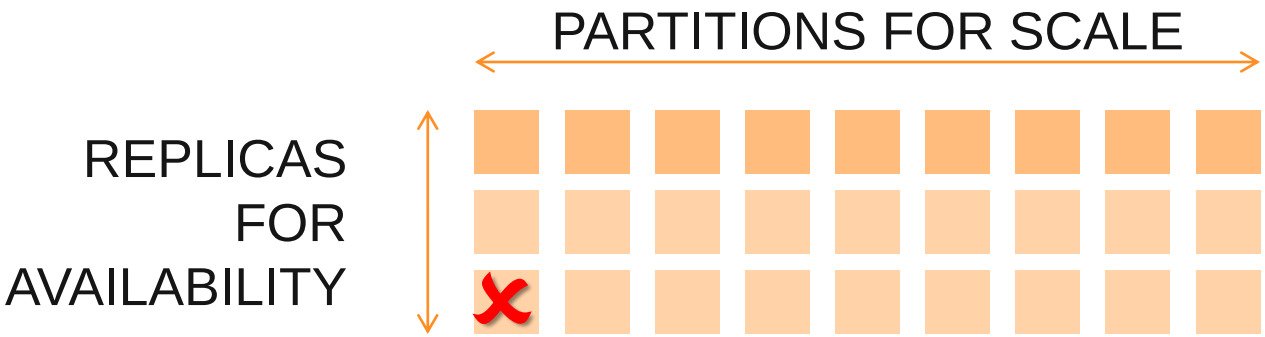
WHEN IS THIS APPROPRIATE?

1. EASILY PARALLELIZABLE
2. VERY LARGE SCALE
3. BATCH!

BIG DATA IS A DISRUPTIVE SHIFT

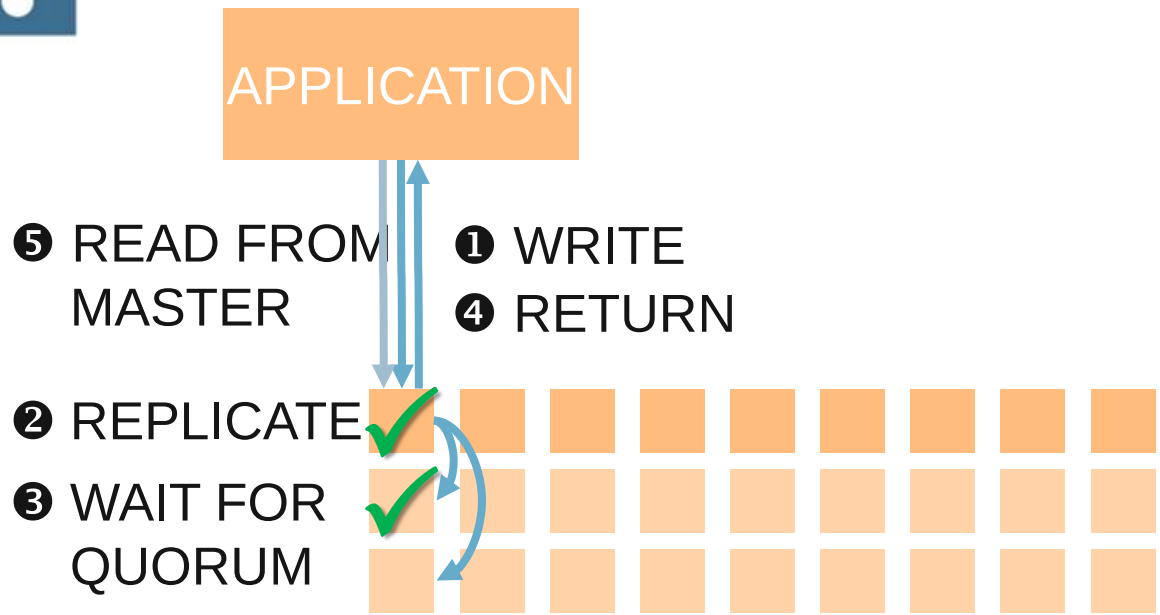
- DRIVES NEW OPPORTUNITIES AND NEW DESIGN PATTERNS
- AMBIENT DATA
  -> SHOEBOX PATTERN
- CONSTRUCTING DATA FROM DATA
  -> CORPUS PATTERN
- MANY COPIES OF THE SAME DATA
  -> REPLICATION PATTERN

SQL AZURE REPLICATION PATTERN



1. NO TRANSACTIONS ACROSS PARTITIONS
2. AUTOMATIC RECOVERY ON NODE FAILUR

SQL AZURE REPLICATION PATTERN



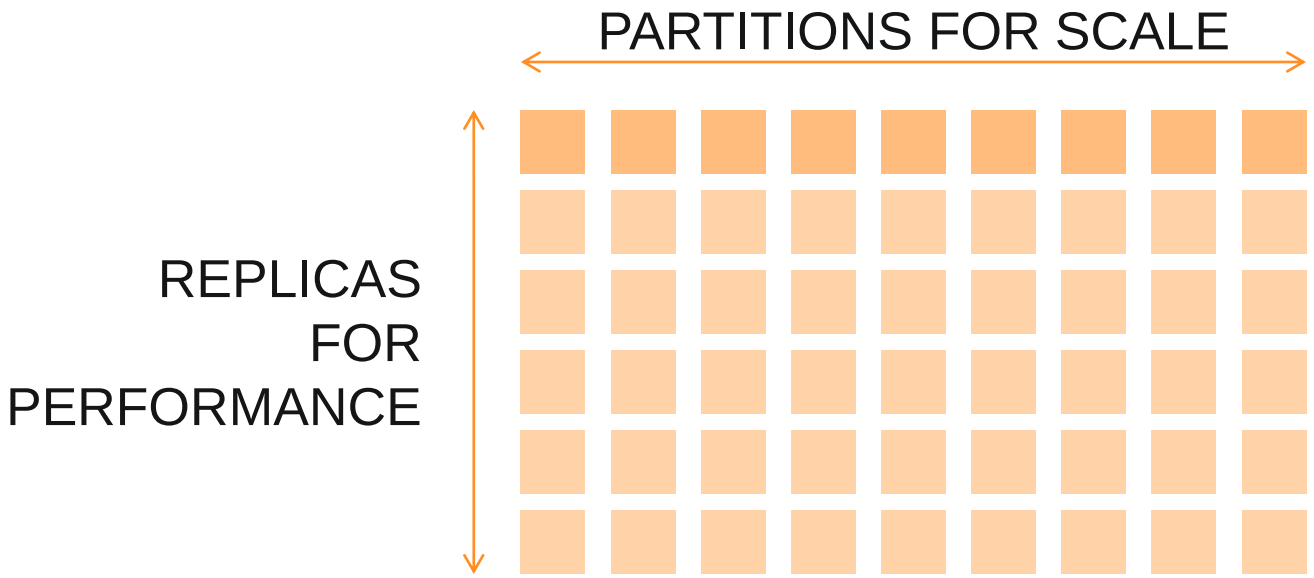
1. NO TRANSACTIONS ACROSS PARTITIONS
2. AUTOMATIC RECOVERY ON NODE FAILUR
3. ACID TRANSACTIONS WITHIN A PARTITION
4. CONSISTENCY
5. READ PERFORMANCE LIMITED BY MASTE

WHEN IS THIS APPROPRIATE?

1. APP NEEDS CONSISTENCY
2. READ AND WRITE LOADS SIMILAR

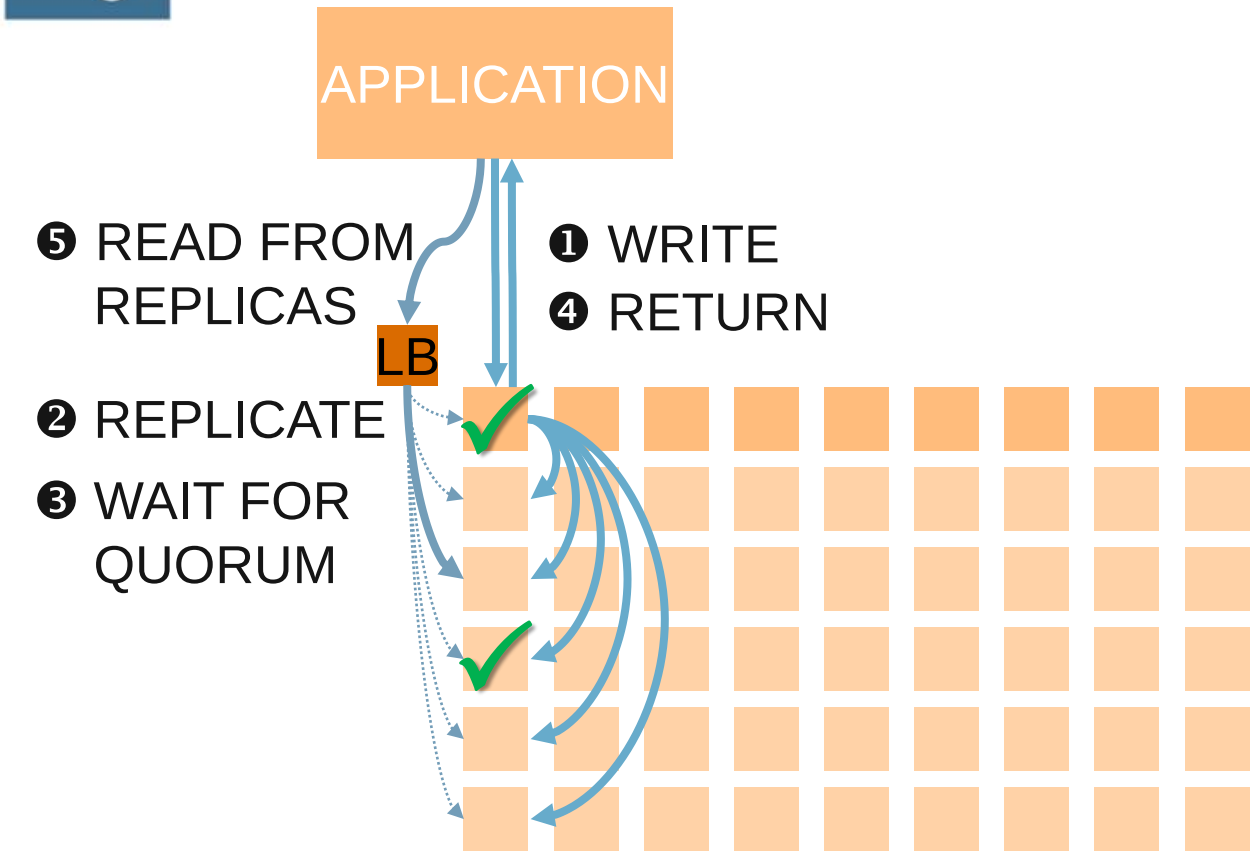
Consistency.
The applications sees all the effect of its transactions as they occurred in chronological order

BING REPLICATION PATTERN



1. NO TRANSACTIONS ACROSS PARTITIONS

BING REPLICATION PATTERN



SQL Always ON (HADRON) with Readable Secondaries

1. NO TRANSACTIONS ACROSS PARTITIONS
2. ATOMIC TRANSACTIONS WITHIN A PARTIT
3. NO READ CONSISTENCY ACROSS PARTIT
4. EVENTUAL CONSISTENCY

WHEN IS THIS APPROPRIATE?

1. READ FOCUSED LOAD
2. PERF IS CRITICAL
3. WEAK CONSISTENCY OK

BING REPLICATION PATTERN

ALLOWS TUNING READ PERF BY ALLOCATING RESOURCES TO HOT PARTITIONS

CHOOSE DESIGN PATTERN

- READ/WRITE LOADS
- SCALE REQUIREMENTS
- PERF REQUIREMENTS
- TOLERANCE FOR WEAK CONSISTENCY
- TOLERANCE FOR STALENESS
- BATCH OR LIVE
- AD HOC OR PRODUCTION

“WE HAVE BEEN SUCCESSFUL AS A DATABASE COMPANY FOR SO LONG, PEOPLE DON’T RECOGNIZE THIS IS A NEW ERA.”

WE HAVE THE TECHNOLOGY
WE HAVE THE DATA

DO WE HAVE THE IMAGINATION?

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