

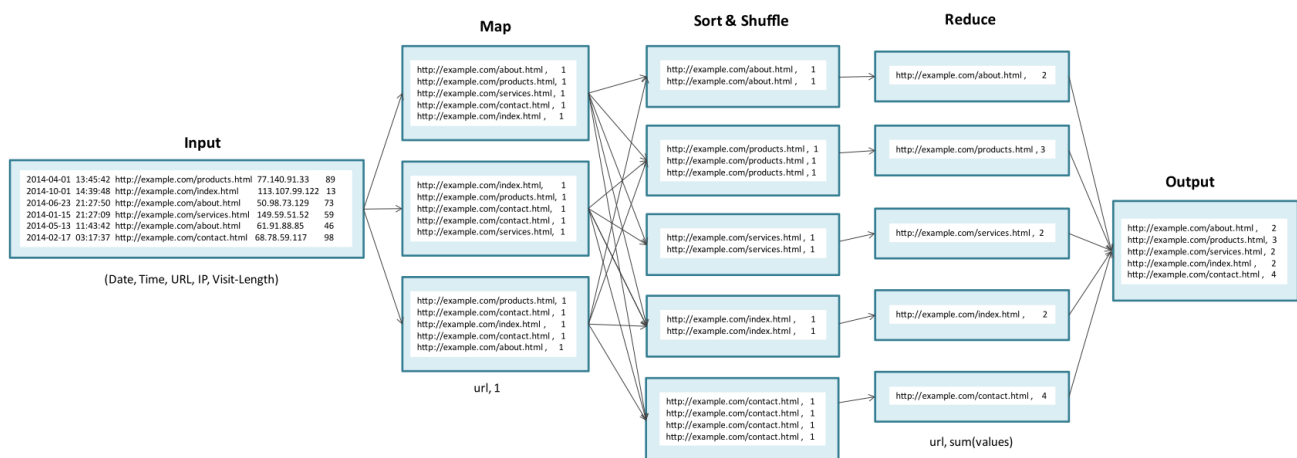
MapReduce Examples

Example 1: Counting

The map step parses the provided text string into individual words and emits a set of key/value pairs of the form

<word, 1 >.

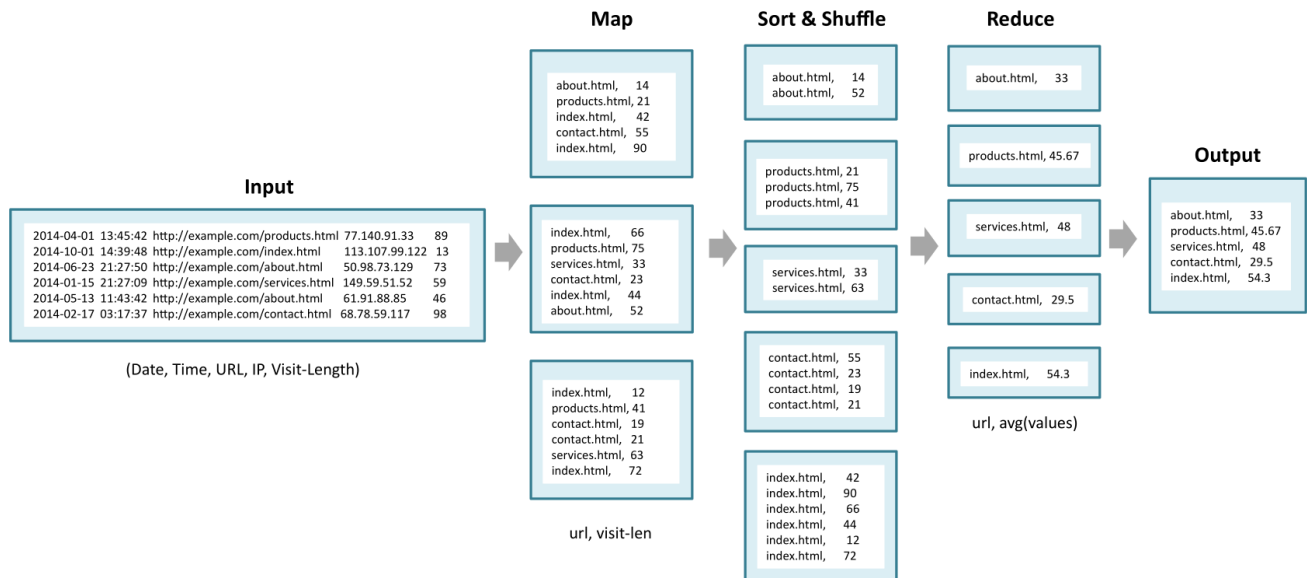
For each unique key-in this example, word-the reduce step sums the 1 values and outputs the <word, count> key/value pairs.



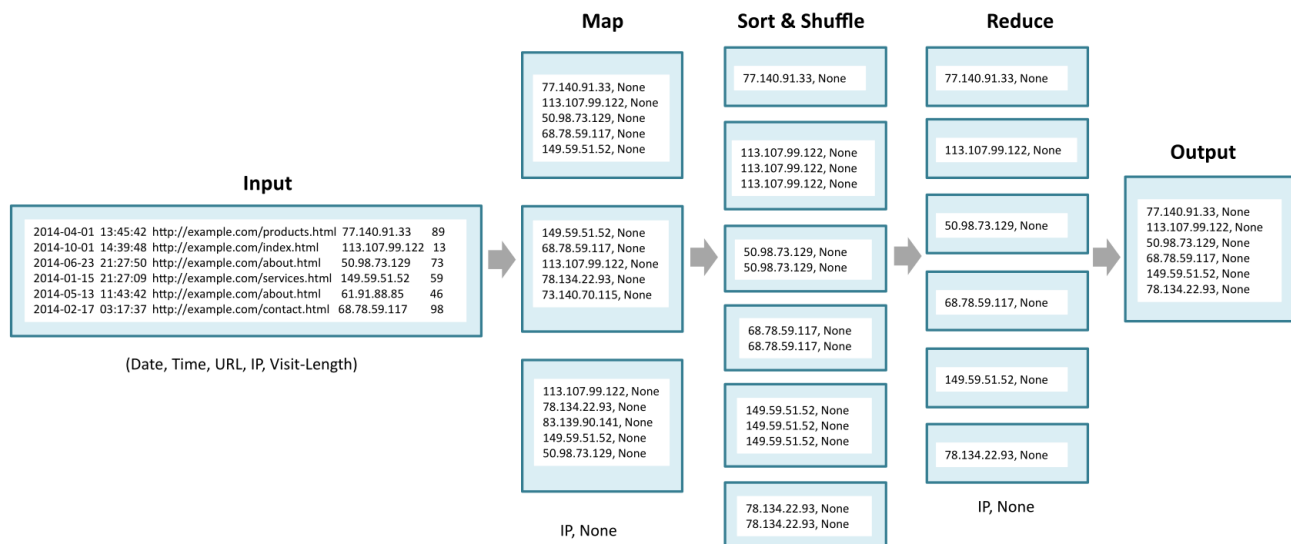
[More examples on next page]

Identify the tasks in these examples:

Example 2



Example 3



Additional Map-Reduce Algorithms

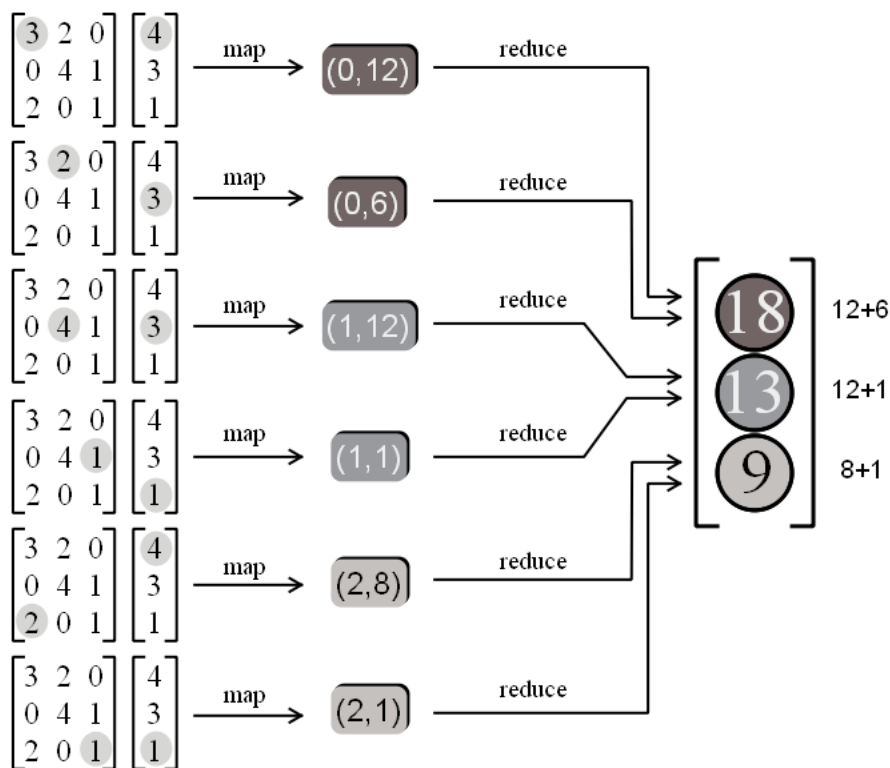
MapReduce is suitable for problems that involve numerous elements.

1. Matrix-Vector Multiplication

Map: For each element in each input emit $((i,k), M[i,j])$ and $((i,k), V[j,k])$

Reduce1: First multiply $M[i,j]$ with $V[j,k]$

Reduce2: Sum values for key (i,k)



2. Relational Operations

Selection	Map	Emit row (r,r) if r satisfied the test condition.
	Reduce	Identity function. Pass input to the output.
Projection	Map	Emit (r _s , r _s) where r _s contains only the attributes that are in s for the row r.
	Reduce	Reduce [r _s , r _s , r _s , ...] into single r _s .
Union/ Intersection	Map	Emit each row as (r, r).
	Reduce	Union: Reduce each [r] or [r,r] values to r. Intersection: Reduce [r] to \emptyset and [r,r] to r.
Natural Join	Map	For (r, k) in T1 emit (k, (T1, r)). For (k, c) in T2 emit(k, (T2, c)).
	Reduce	Reduce [(T1,r), (T2,c)] to (r, k, c).
Grouping/ Aggregation	Map	See examples 2 and 3 above in “MapReduce Examples” section.
	Reduce	