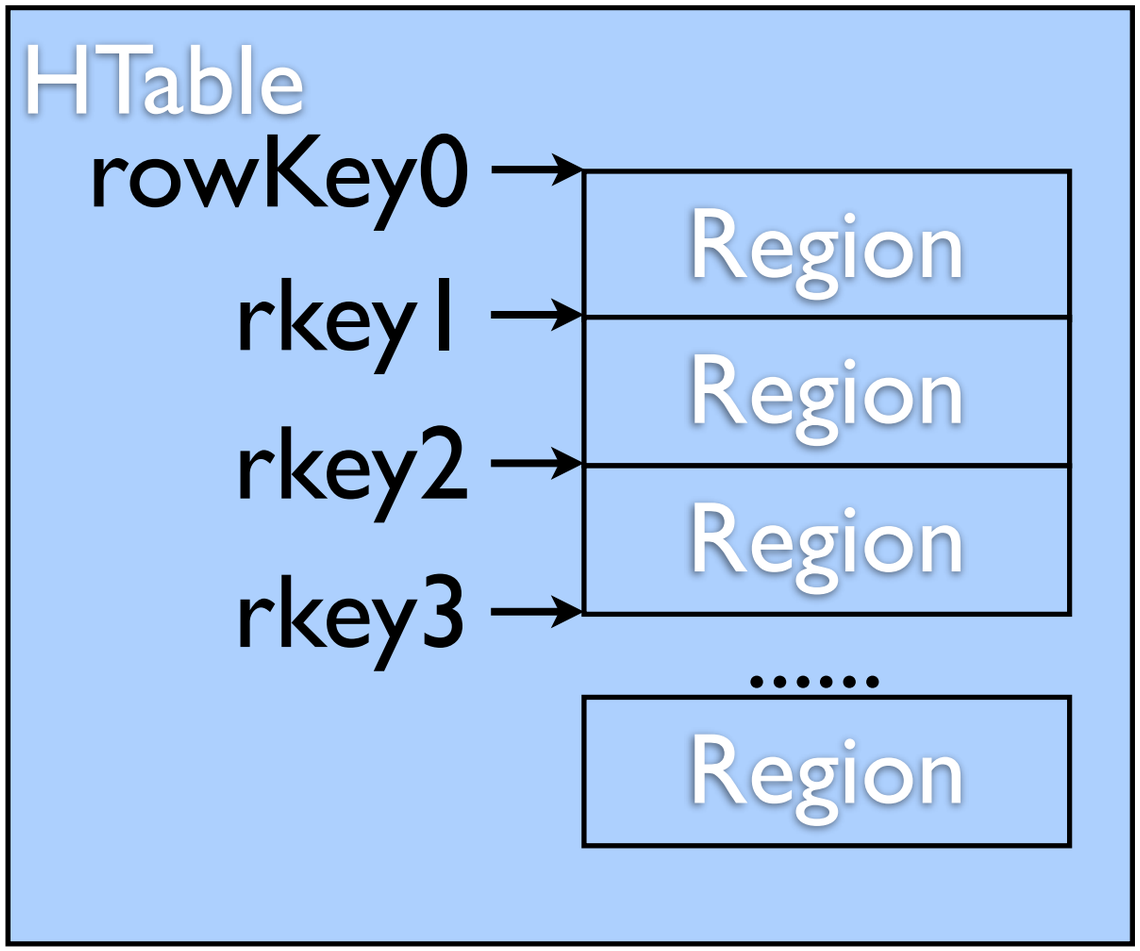
Project Mitosis

Second dimension for HBase Table: PartitionKey

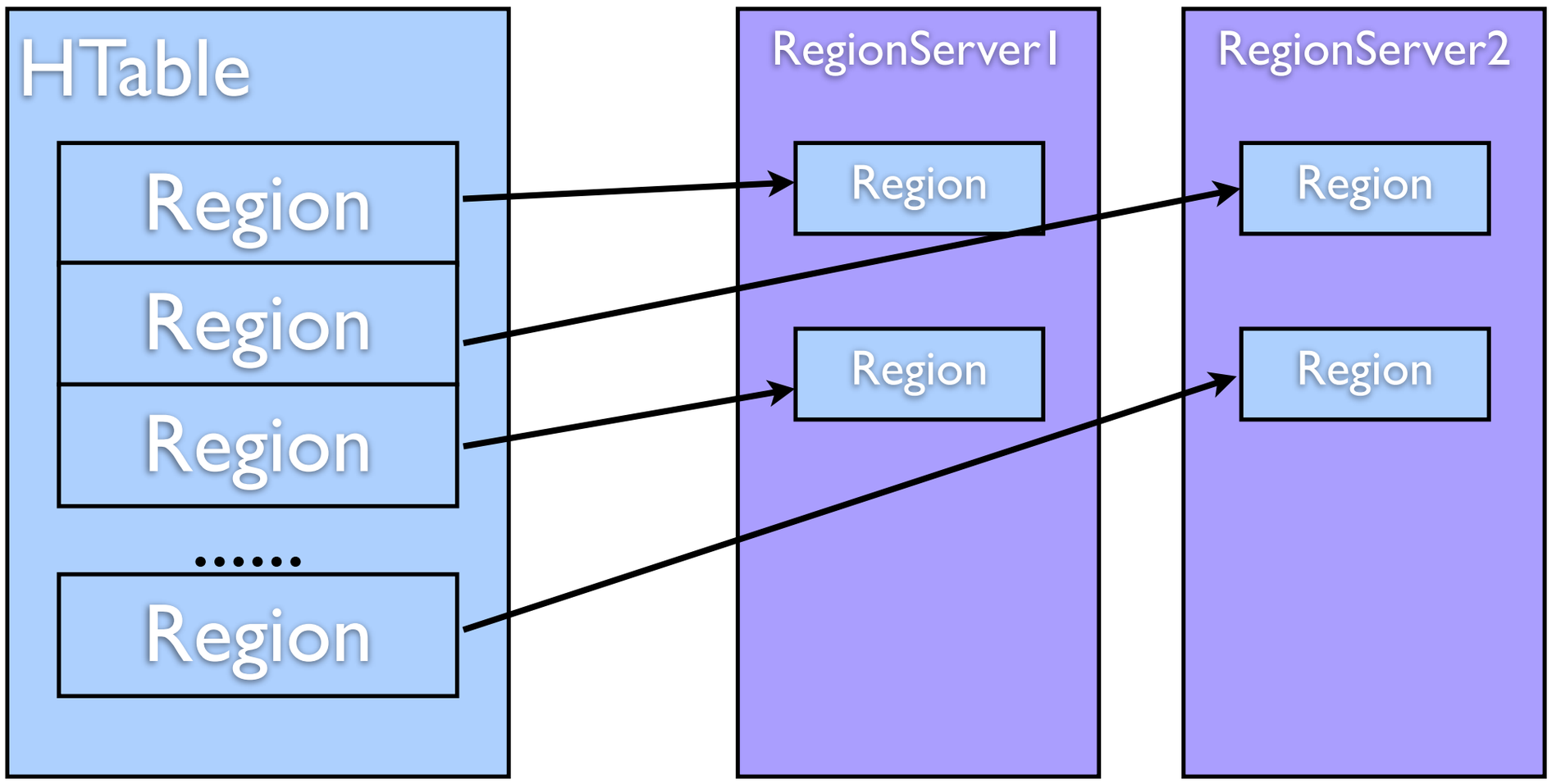
Current Region Layout

- HTable
  - ={Regions}
- Region
  - =[rkey0, rkey1)



Current Region Layout

- RegionServer
  - = *



Current Region Layout

- Benefits
  - do not worry about data distribution
    - ease of system admin
- Drawbacks
  - have no control over data distribution
    - hard to reduce query cost (join)

Current Region Layout

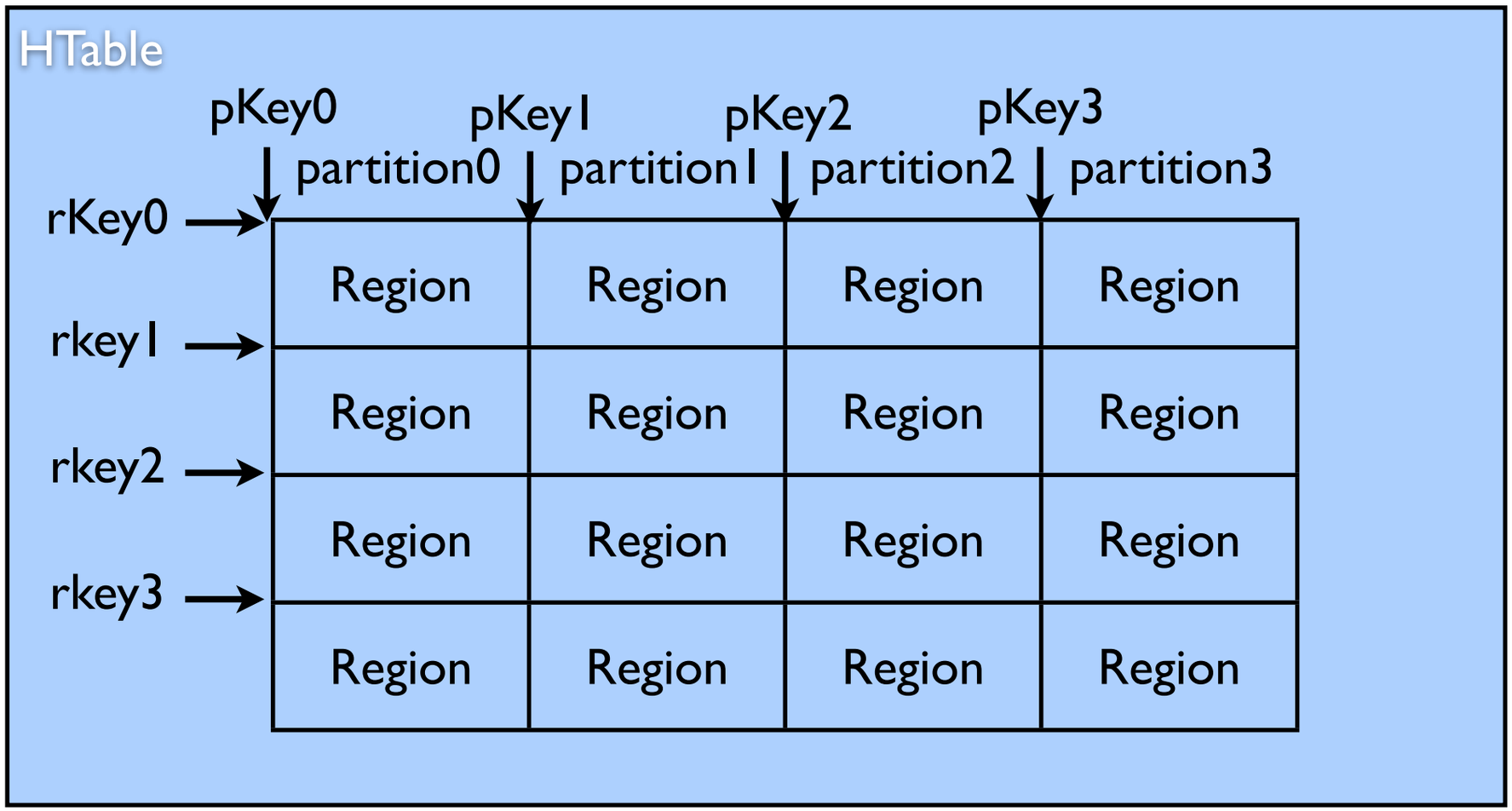
- Drawbacks because
  - rowKey is used for
    - BOTH the key of the most performant query
    - AND the key of definition of Region, thus the definition of data partitioning

Redifinition of Region

- Introduce: **PartitionKey**
  - HTable = {Regions}
  - Region = ([rKey0, rKey1), [pKey0, pKey1))
  - Partition: [pKey0, pKey1)
  - RegionServer = {Partitions}

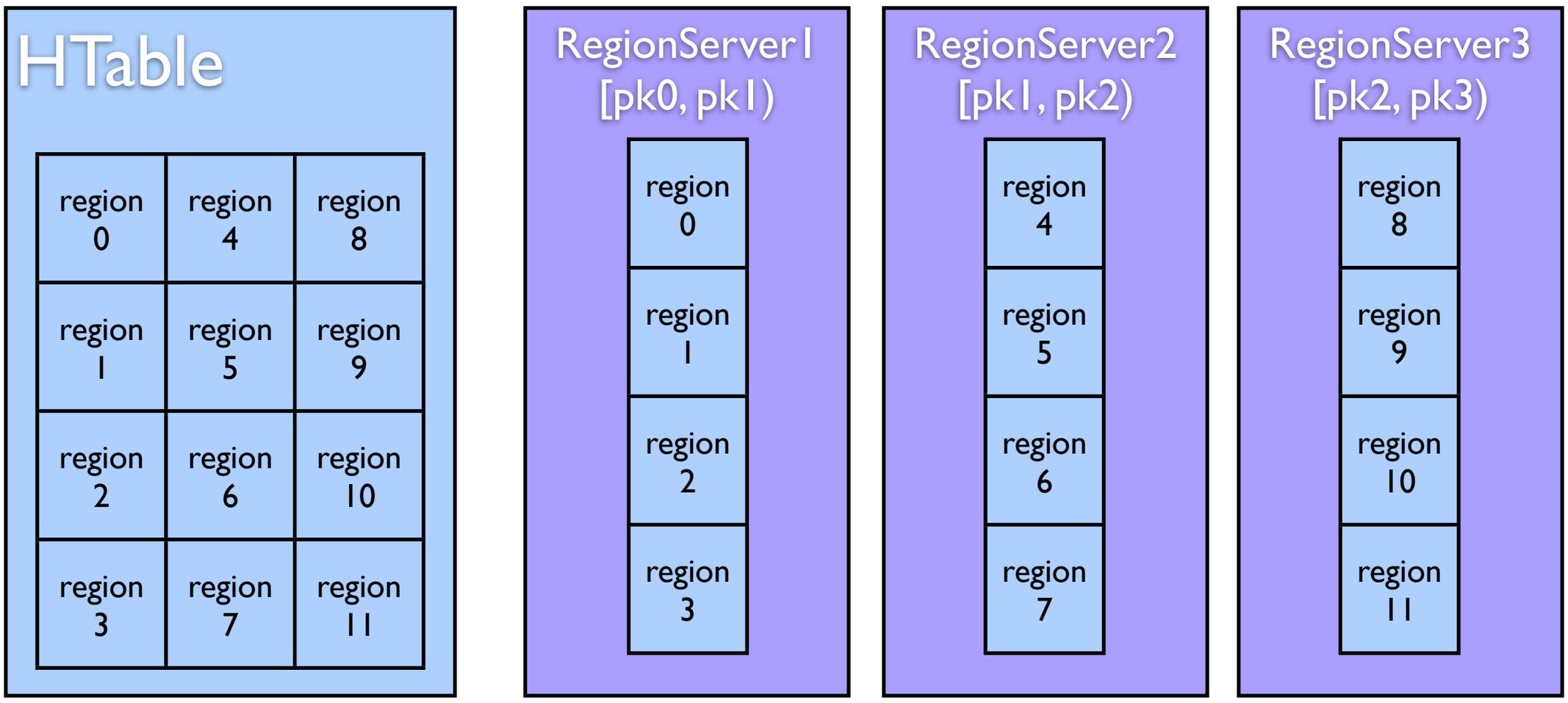
The New Region

- 2 dimensional data space of HTable



The New Region

- RegionServer example
  - 3 RegionServers with 1 partition each



The New Region

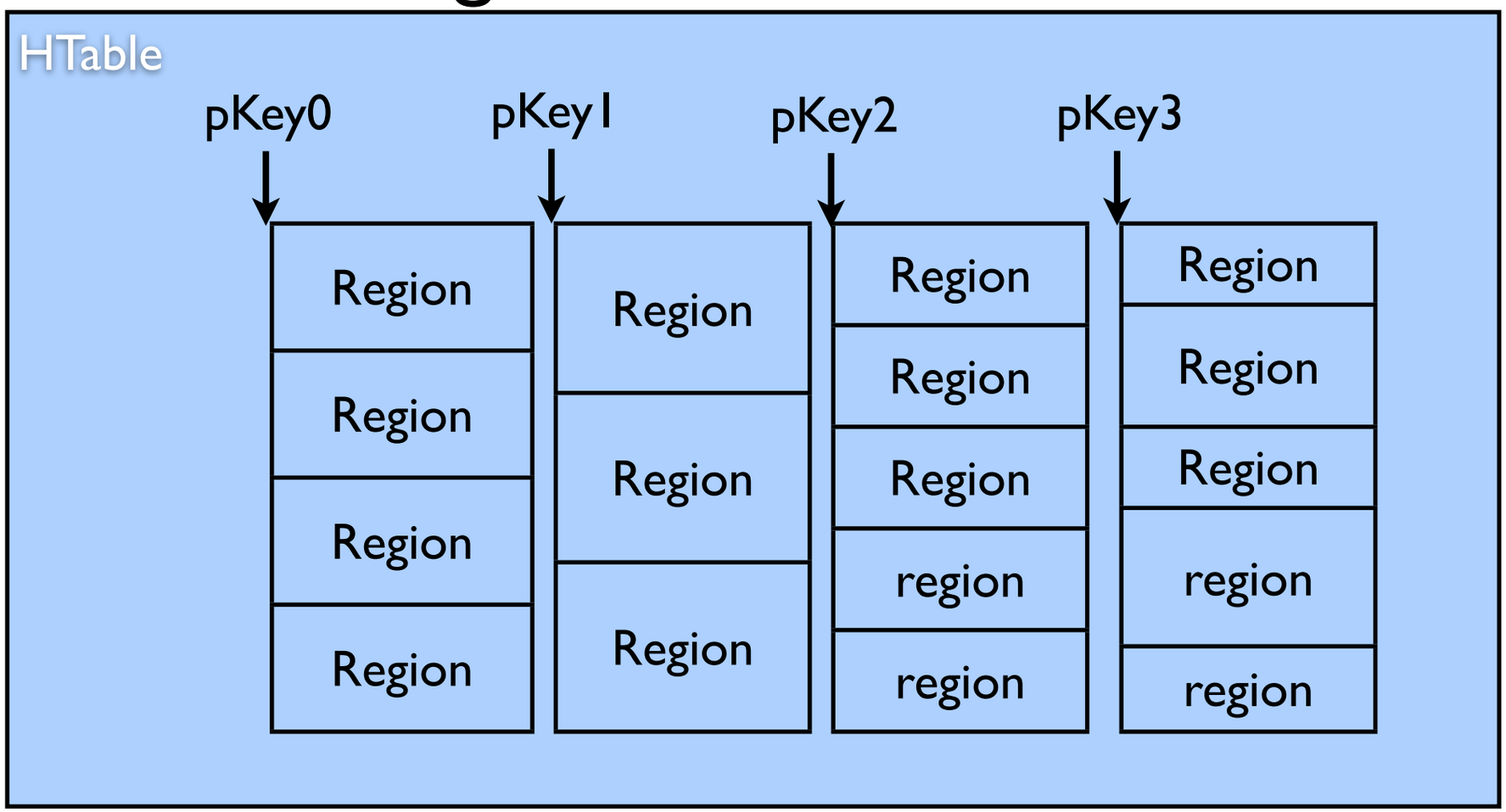
- All regions within a partition belong to the same RegionServer.
- partitions of a RegionServer do not overlay with partitions of another RS.

The New Region: P.S.

- In fact, we care more about data distribution across RegionServers.
- we don't really care about data distribution within a RegionServer.
- So...

The New Region: P.S.

- rowKey boundaries of different partitions do not align.



TODO list: changes

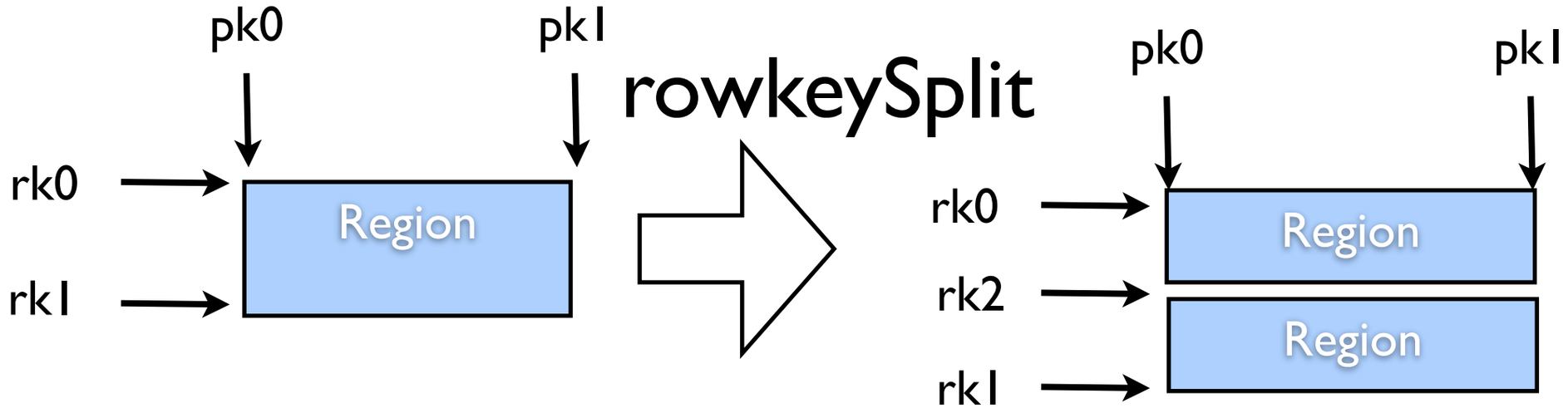
- Region
  - additional meta about pKey
- RegionServer
  - additional meta about pKey
- HMaster
  - pKey-aware of Region-RS assignment
- new procedure: **PartitionSplit**
- changes in read/write op of HBase

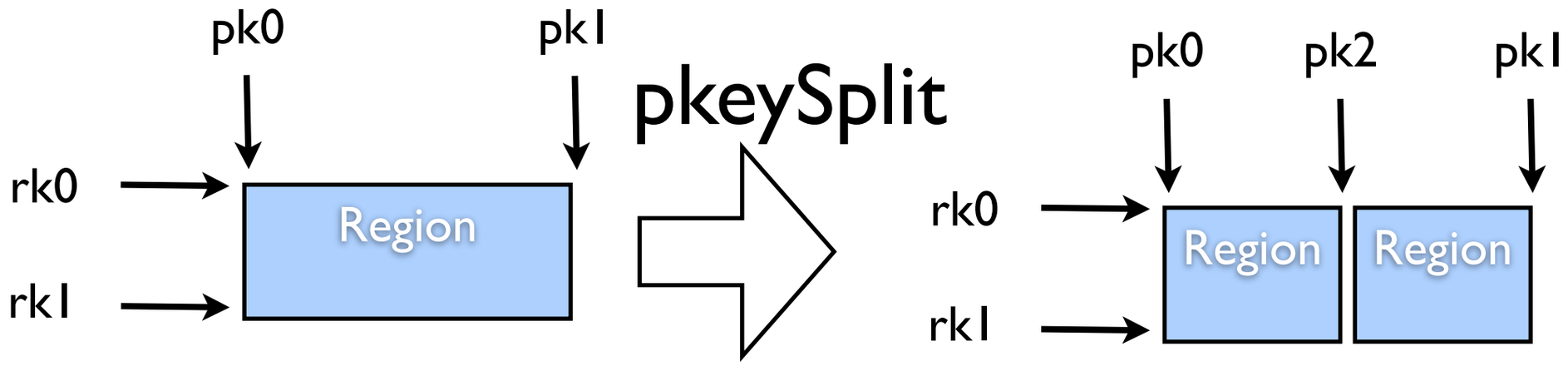
Partition Split

- Why a region splits? mainly 2 reasons:
  - (a) we need smaller region for faster op.
  - (b) we need to distribute data to more node .
- with PartitionKey, there are 2 types of split:
  - a region split along rowKey (for (a))
  - a region split along pKey (for (b))

Partition Split

- rowKey Split vs pKey Split



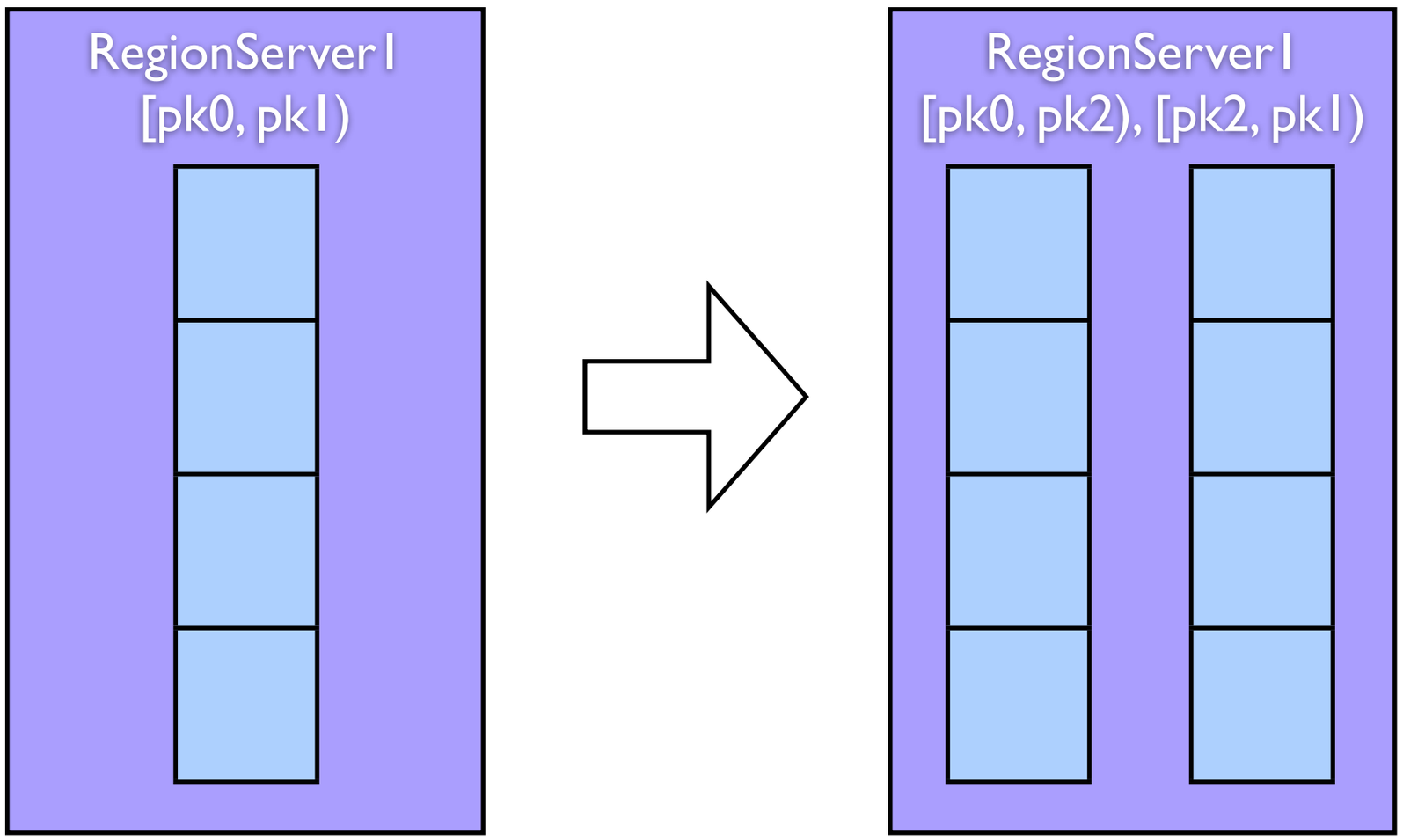


Partition Split

- Definition: a partition splits into 2
  - [pK0, pK1) -> [pk0, pk2), [pk2, pk1)
- every Region in the partition split into 2 along pKey

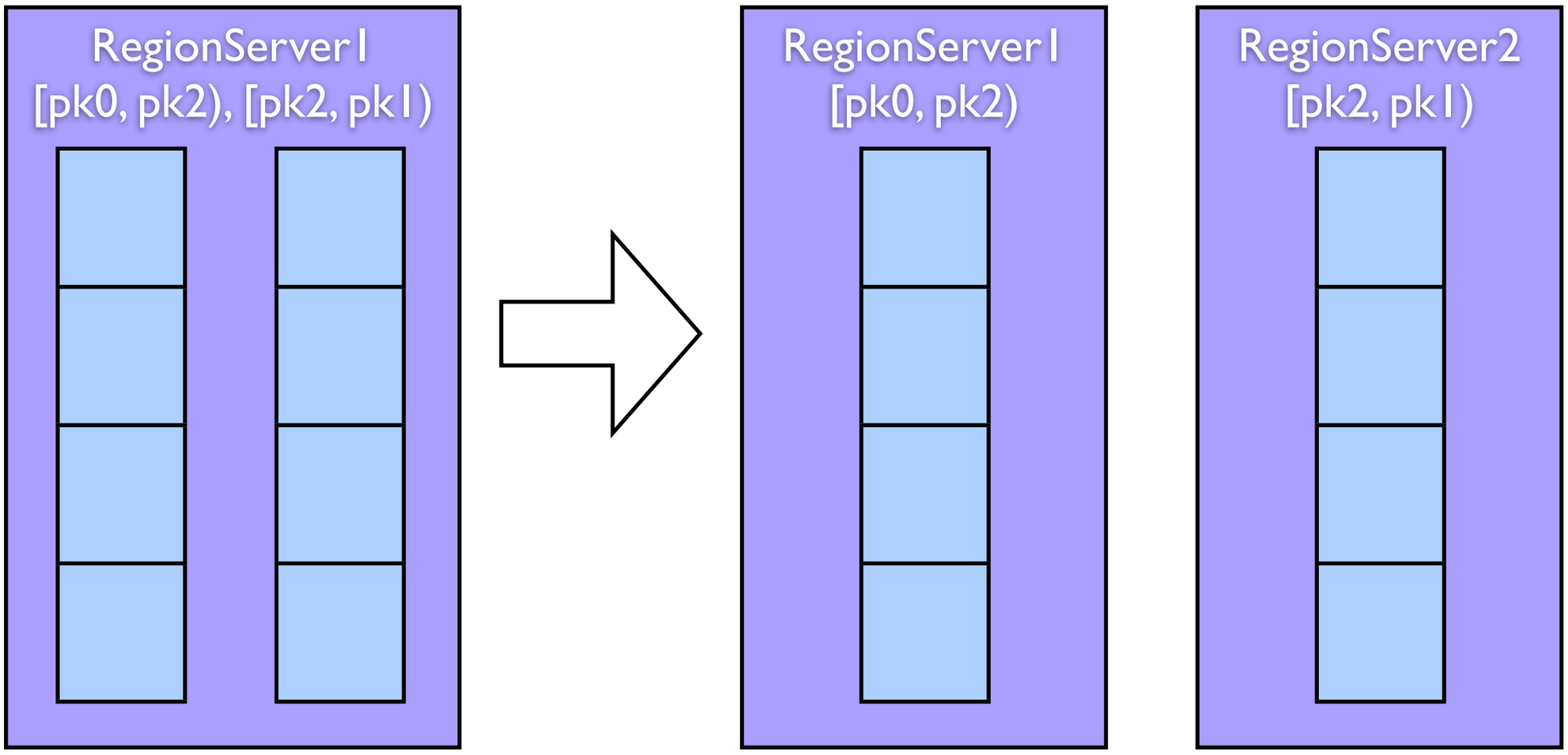
Partition Split

- every Region in the partition split into 2



Partition Split

- Why partition split? because we need more node



Partition Split

- More questions
  - when ordinary split? when partition split?
  - what happend when adding node?

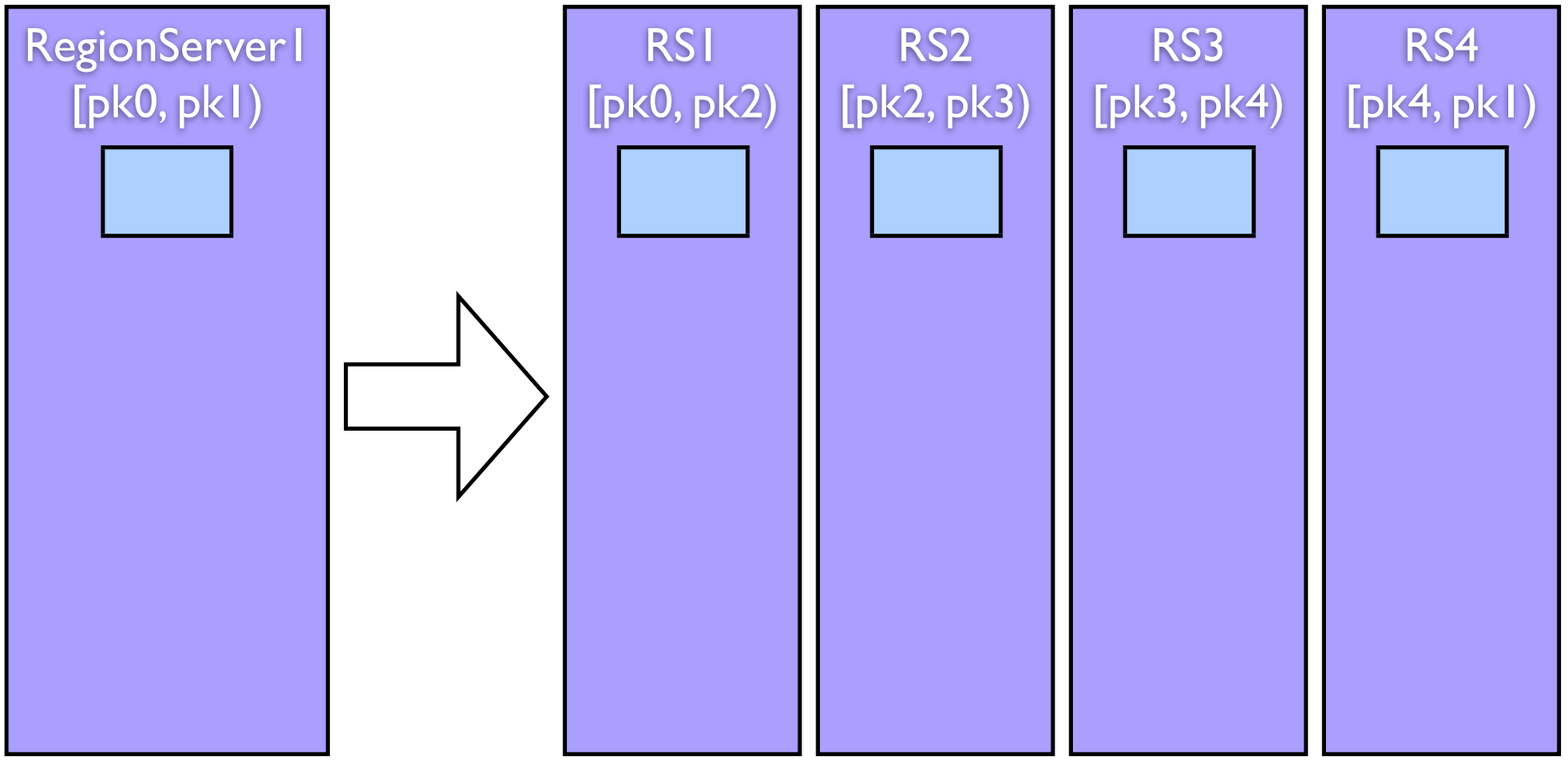
Split Policy

- rowKey split: same as now
- partition split: means we need more node for this HTable
- regions size
- query load

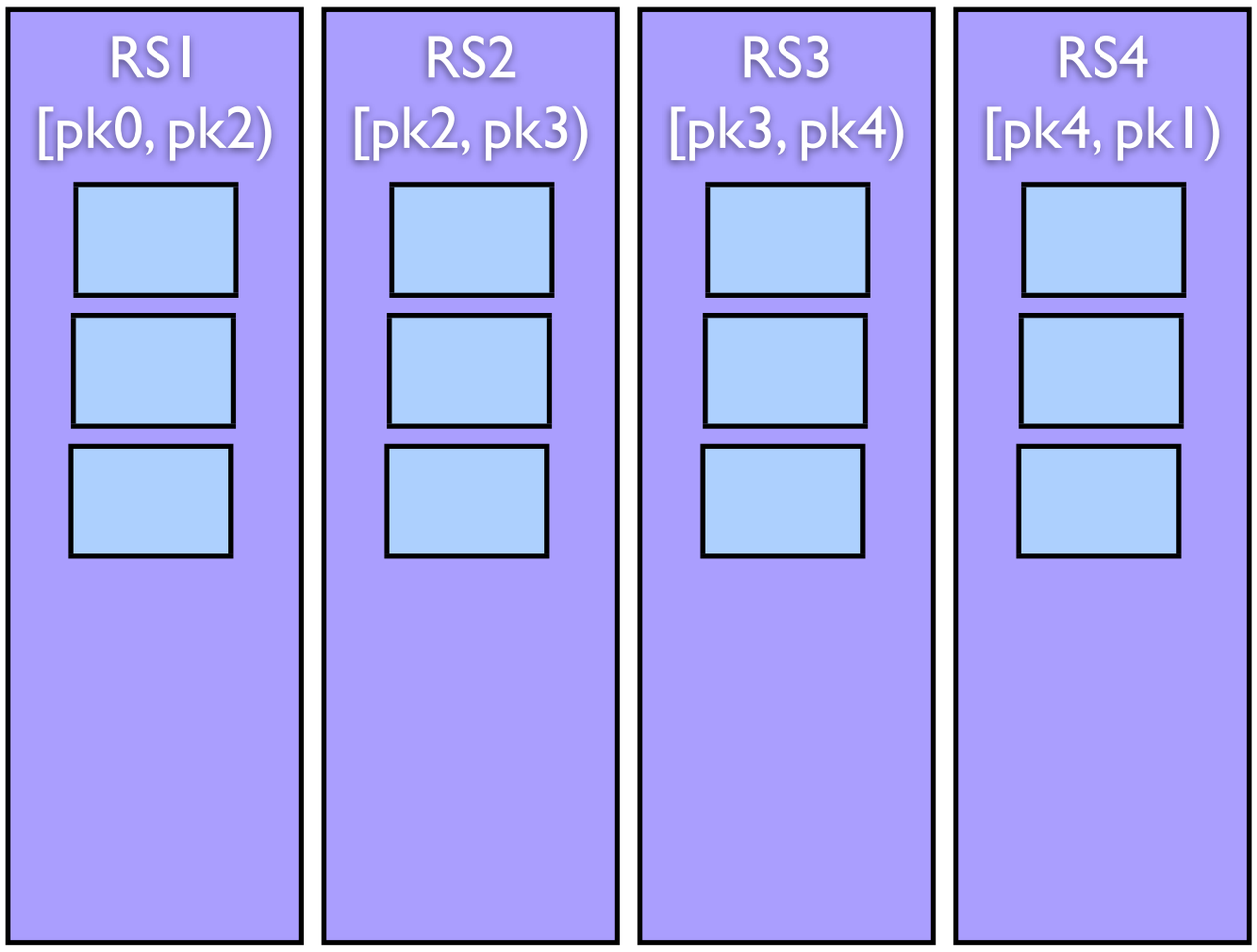
Split Policy Proposal

- partition split first
- with per table maxinum partition limit
  - region would first pKey split to Pmax partitions, then rowKey split within each partition

Split Policy Proposal



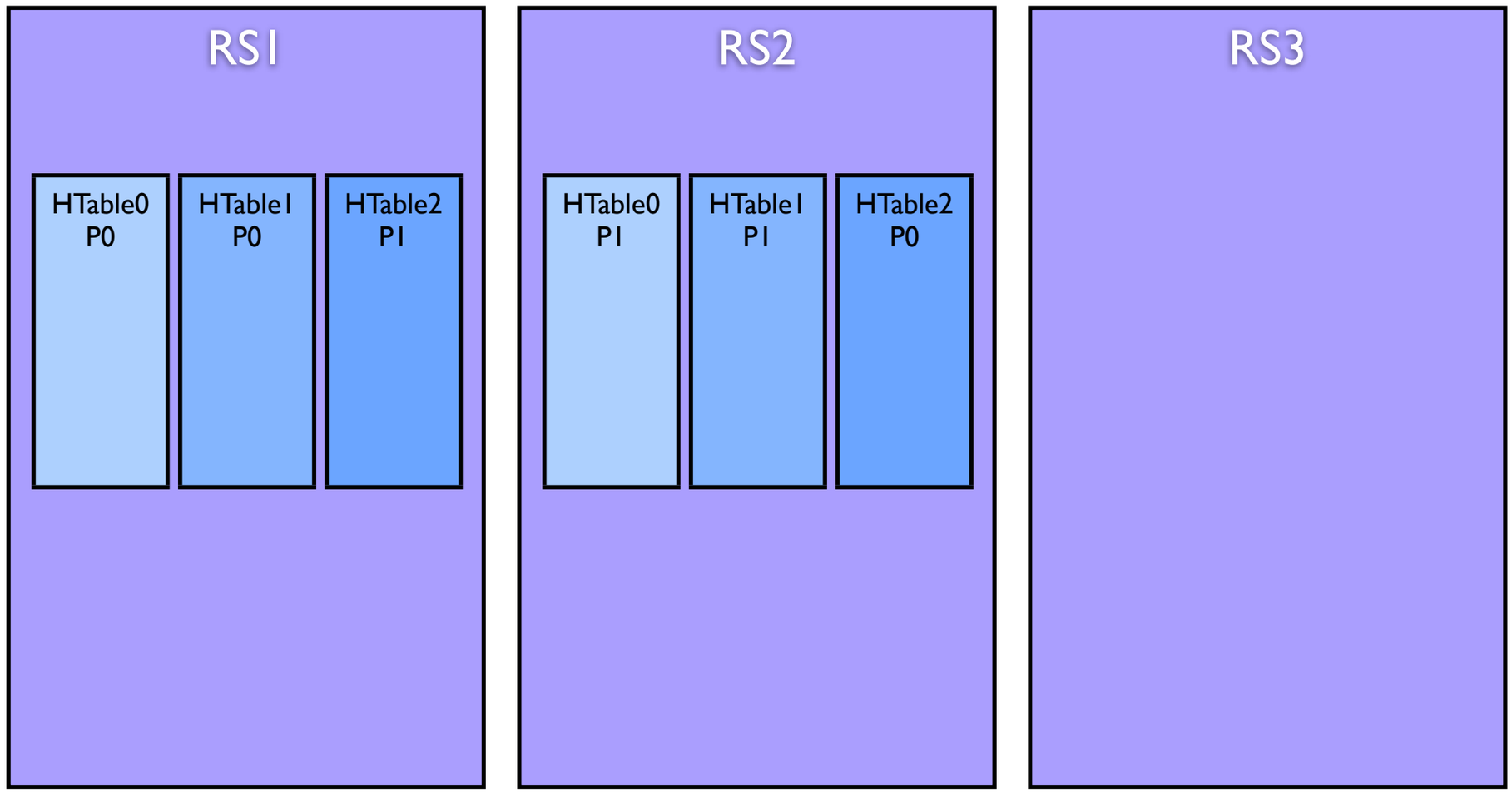
Split Policy Proposal



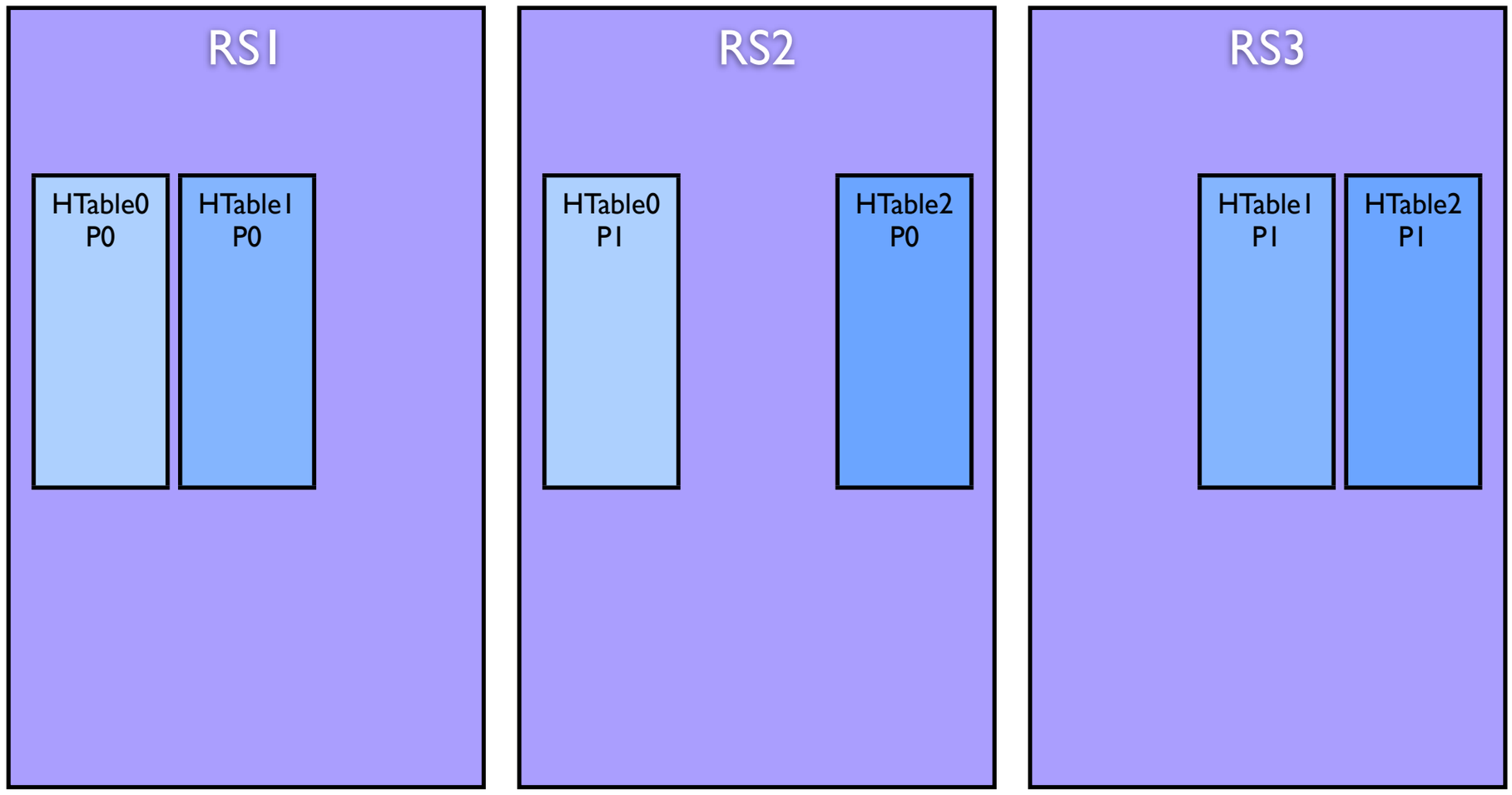
Adding Node Proposal

- Same as HBase
  - do not trigger split;
  - reassign partitions, like HBase reassign regions

Adding Node Proposal



Adding Node Proposal



Adding Node Proposal

- If a partition need to plit, but not enough node, adding node would trigger partition split.

Questions

- proper way of describing partitionkey?
  - part of rowkey? a column? a CF?
- write into HBase?
- scan from HBase?
- split along partition key?
- split while writing?
- split while reading?
- split failover?
- Phase 2?

Phase 2: TableGroup

- Define 2 HTable with same Partition Def
  - 2 HTable with same partition info
  - 2 HTable partition-split simultaneously