Today

Internet scale Computing (Lesson 9)

✓ * giant scale services

⇒ * Map-reduce programming model

Friday

* CDN (Coral)

* Please watch videos before class *

Map-Reduce

Input & output to each of Map & Reduce

- <Key, Value> Pairs

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Example

- Emit # of occurrence of names in DOCs

- W = "Kishore"
- W = "Arun"
- W = "Drew"
- ⋮

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Key: filename Value: contents

<f1, contents> <f2, contents> <fn, contents>

- W = "Kishore"
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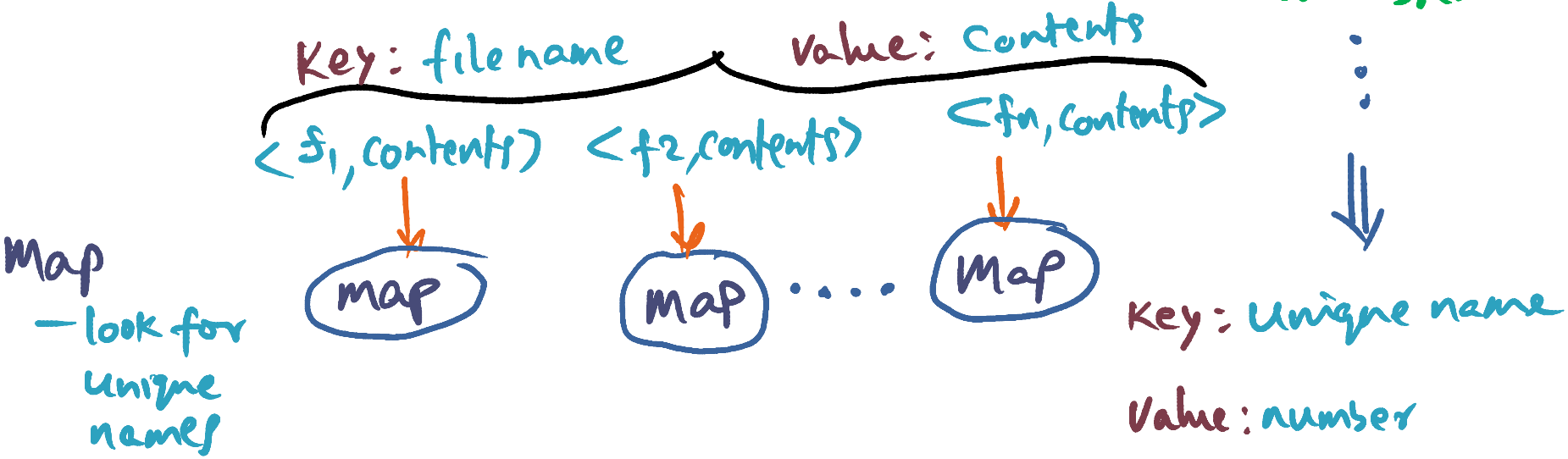

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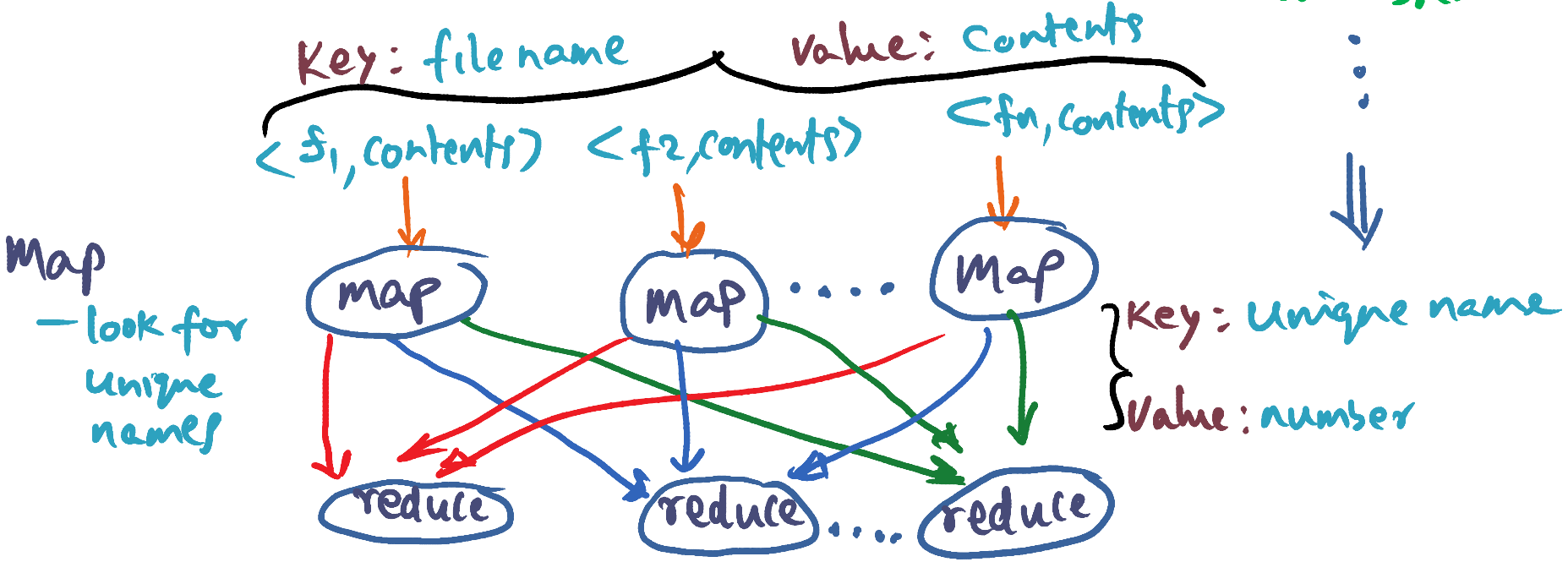

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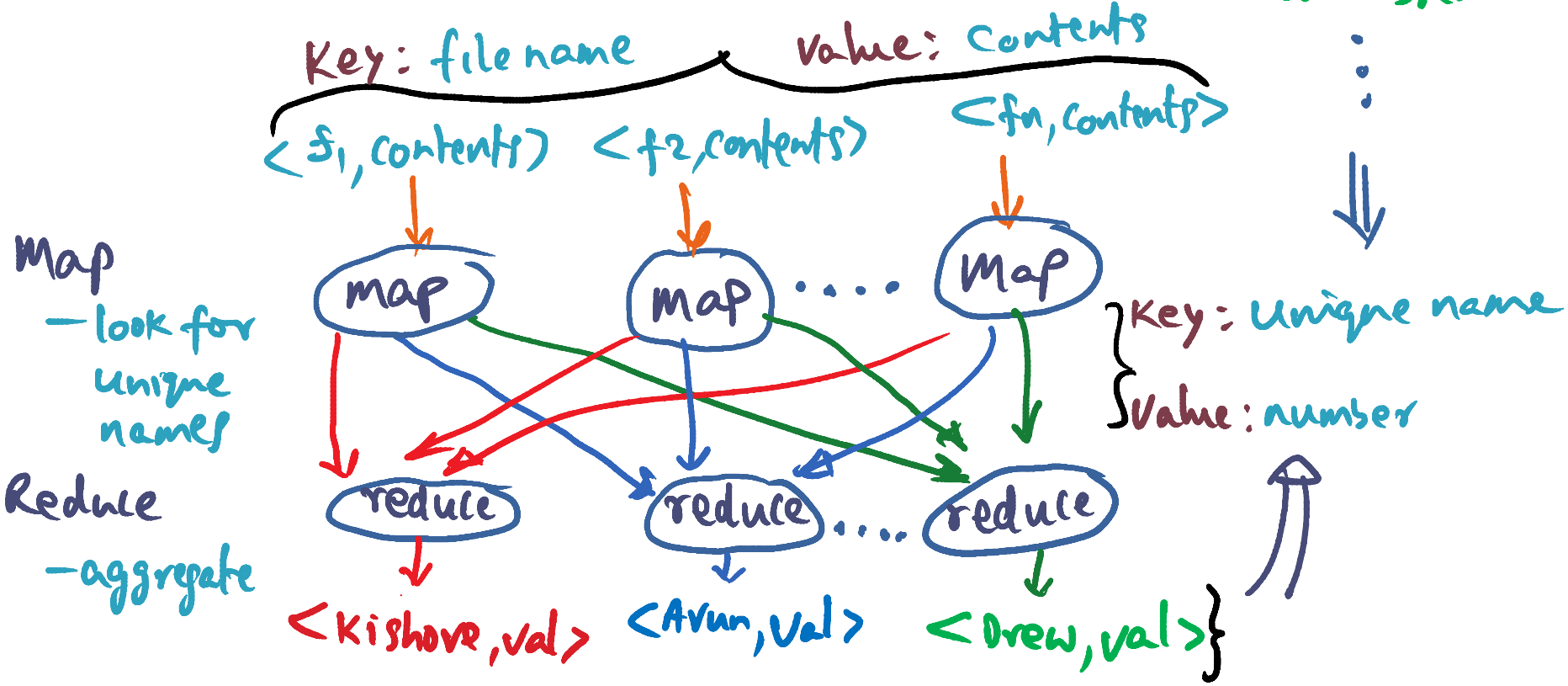

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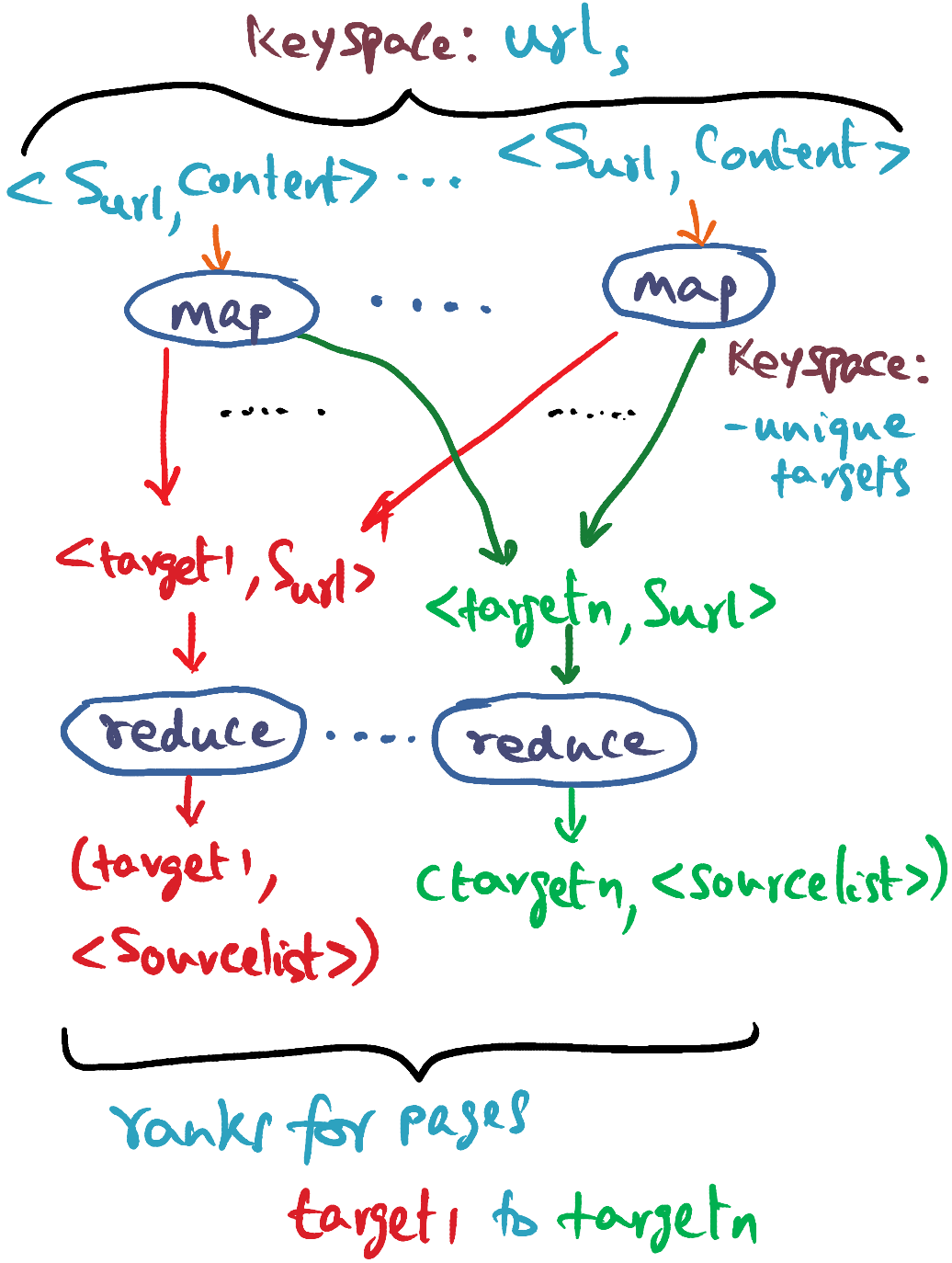
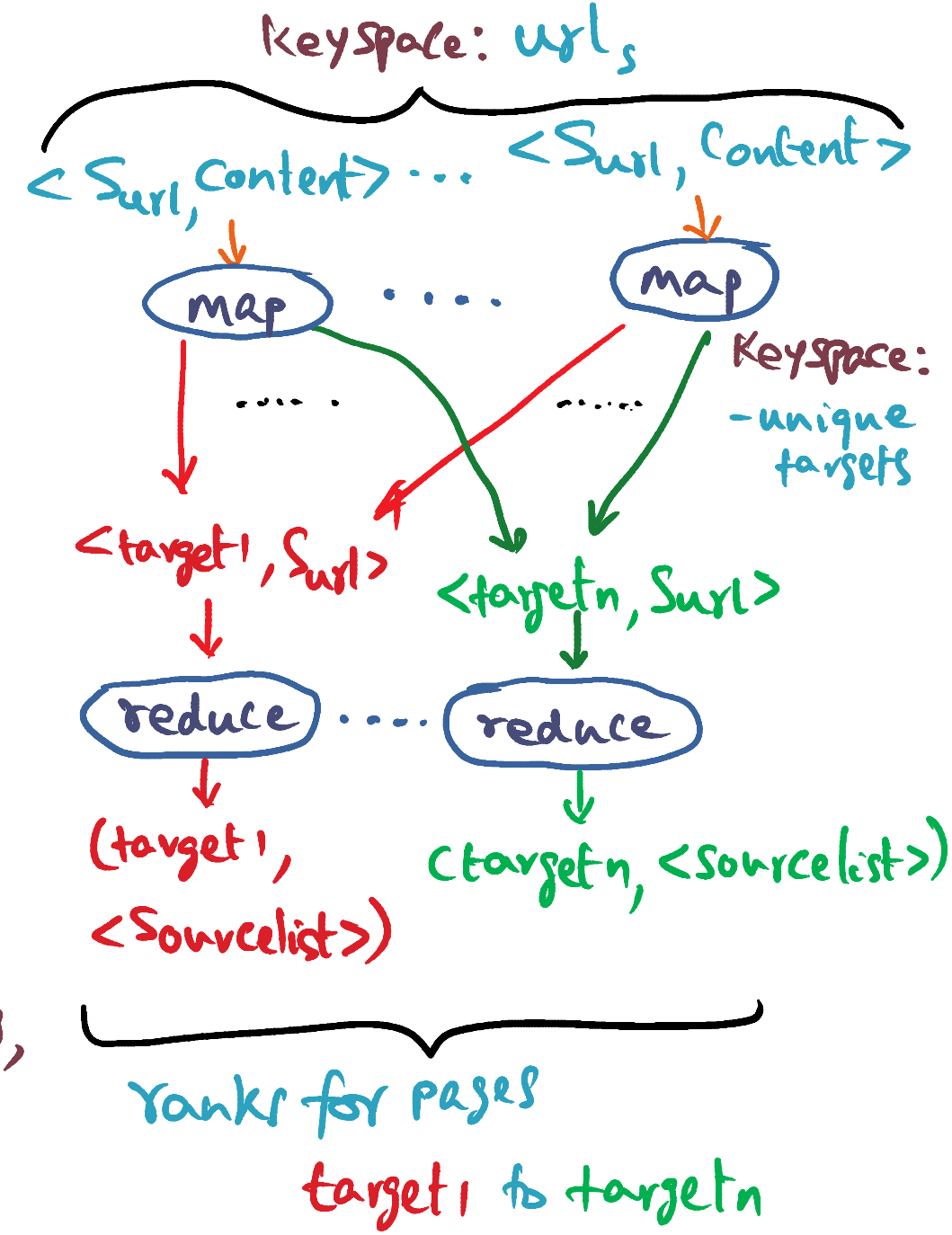
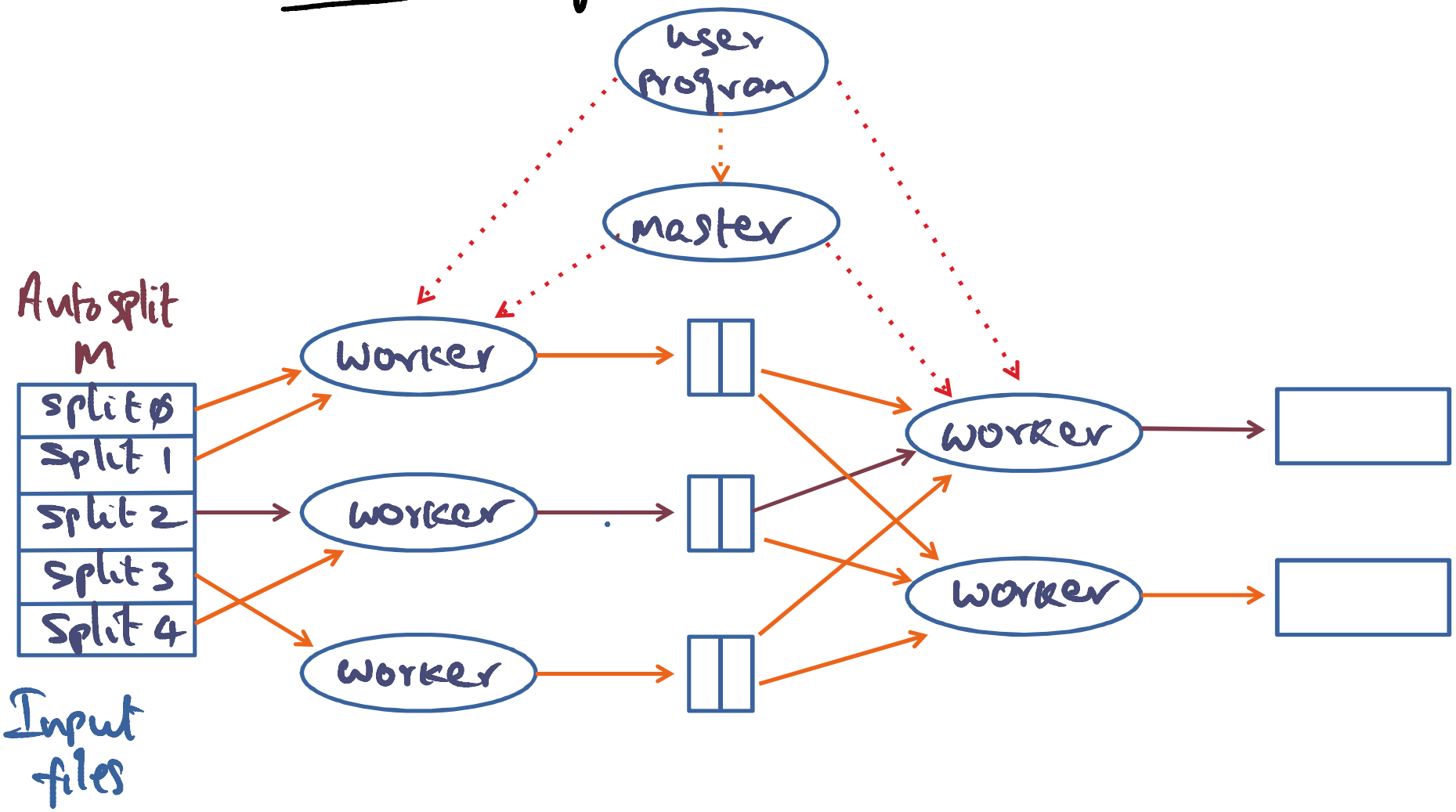


Why Map-Reduce?

- Several processing steps in giant-scale services expressible
- Domain expert writes
  - * Map
  - * reduce
- runtime does the rest
  - * instantiating number of mappers, reducers
  - * data movement



Heavy Lifting Done by the runtime



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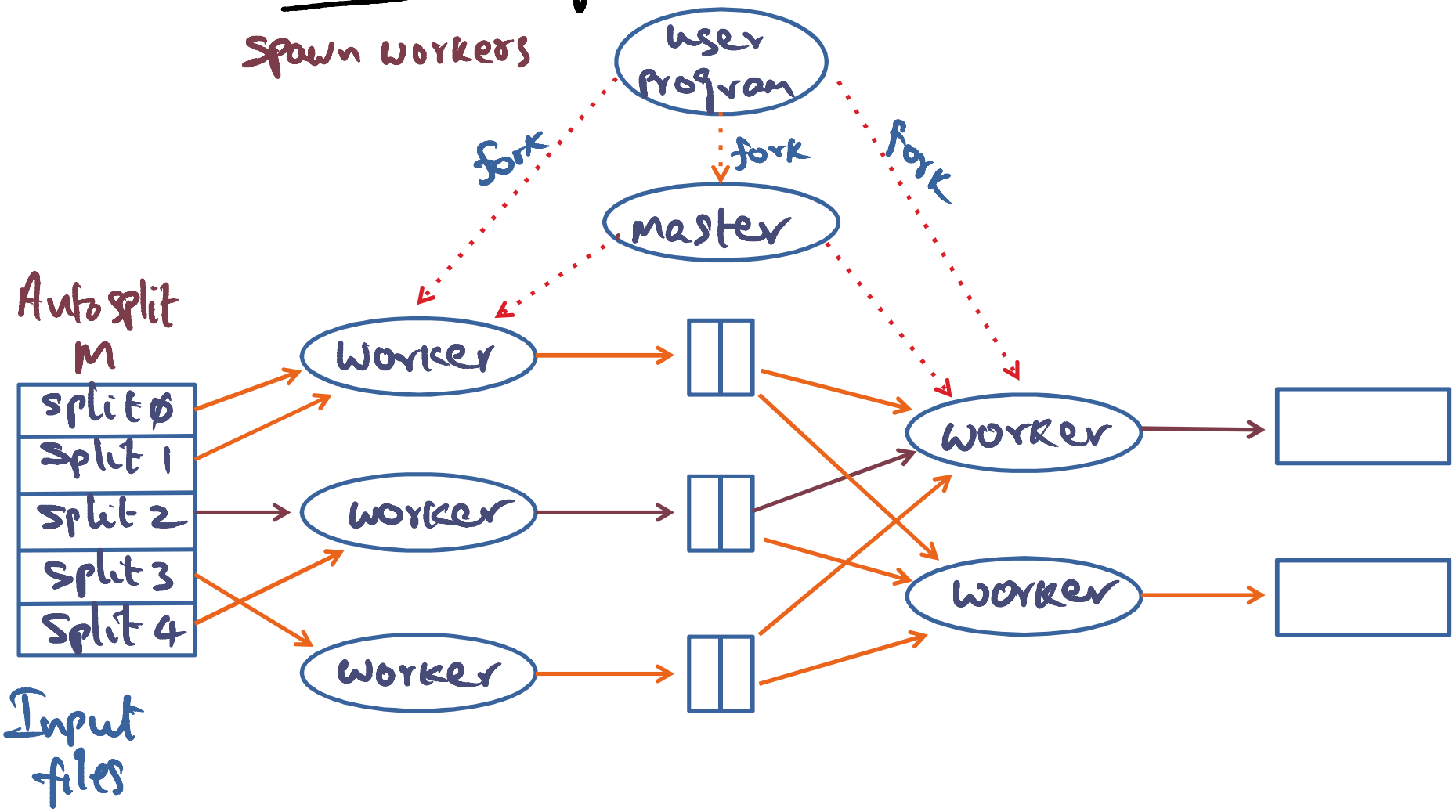

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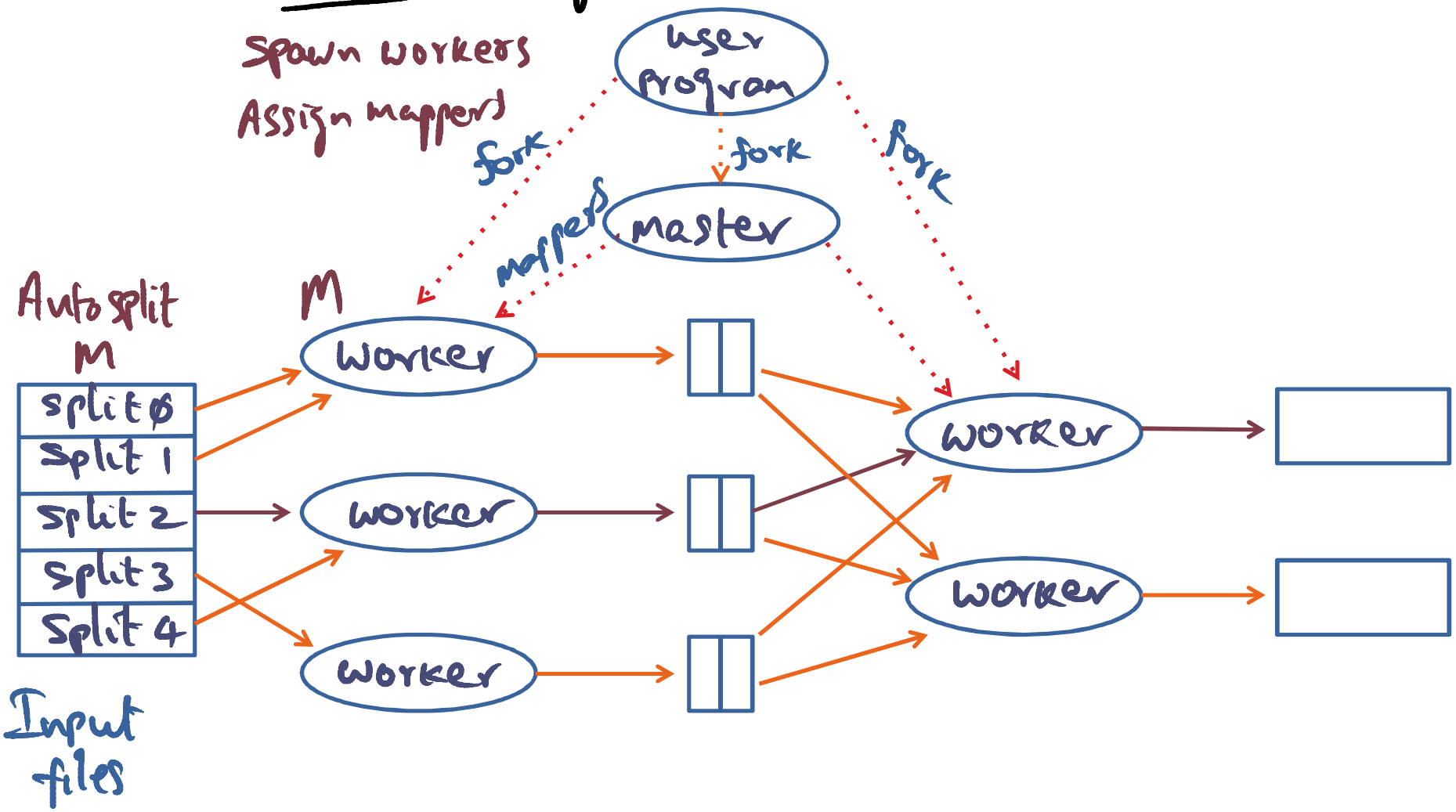

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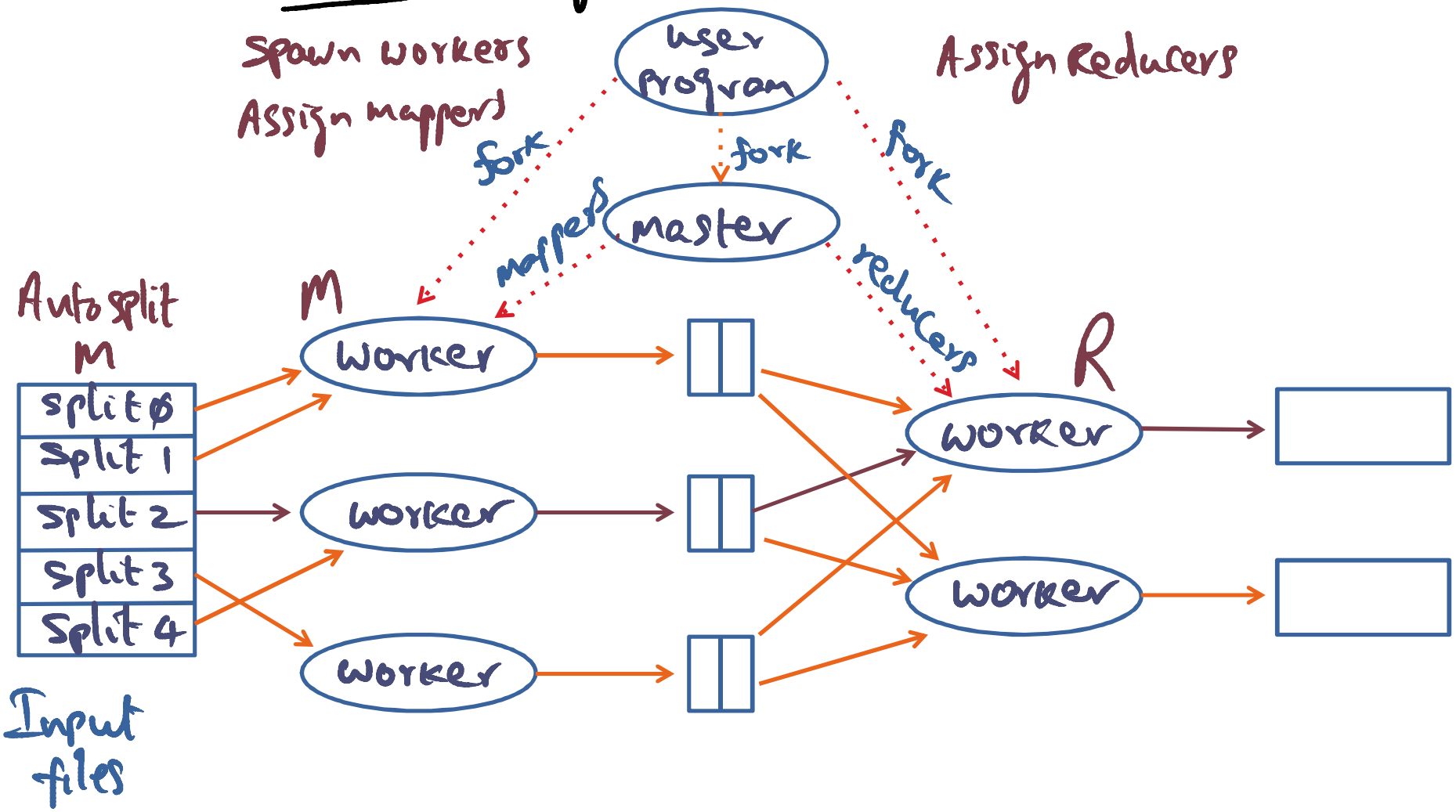

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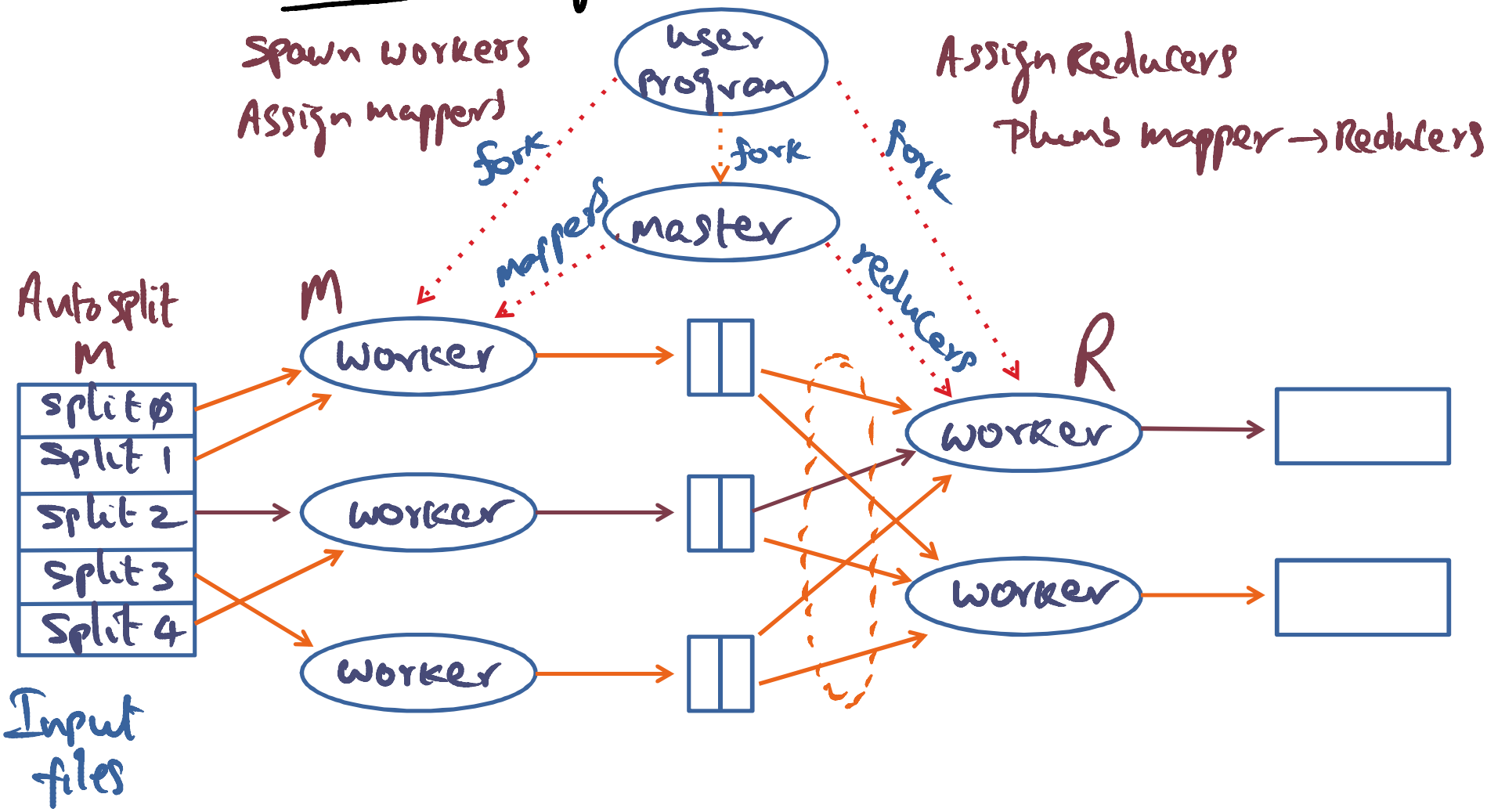

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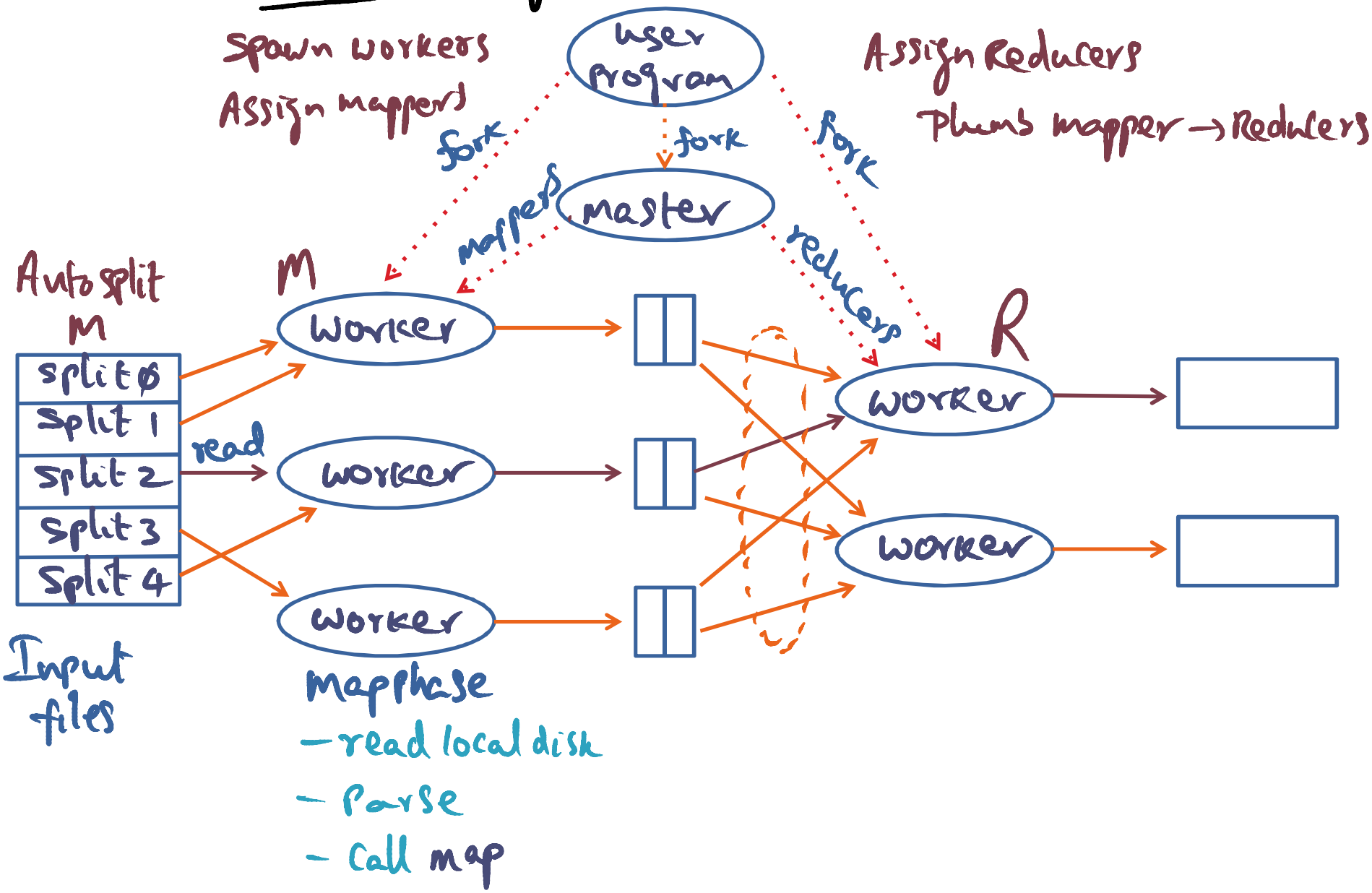

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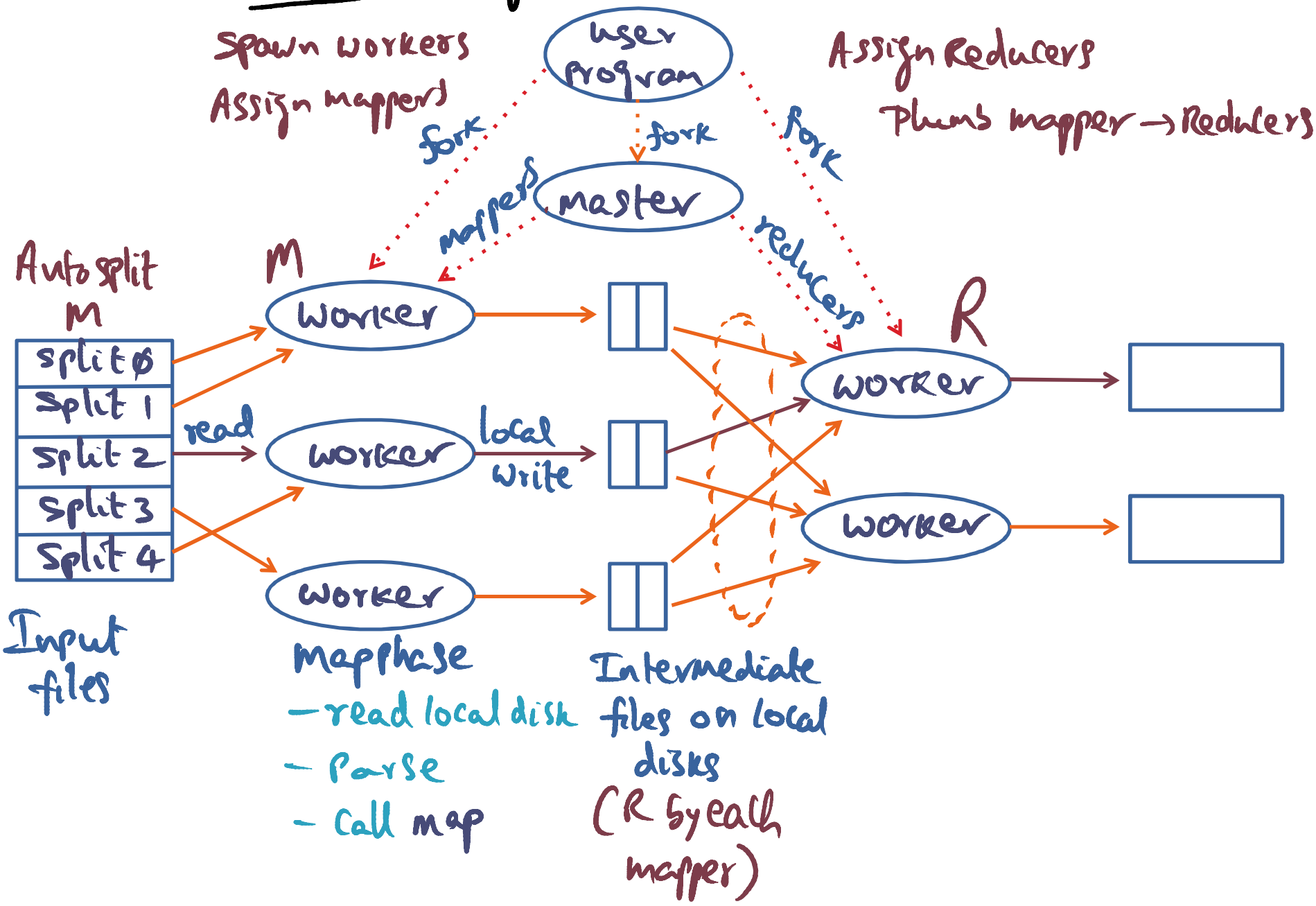

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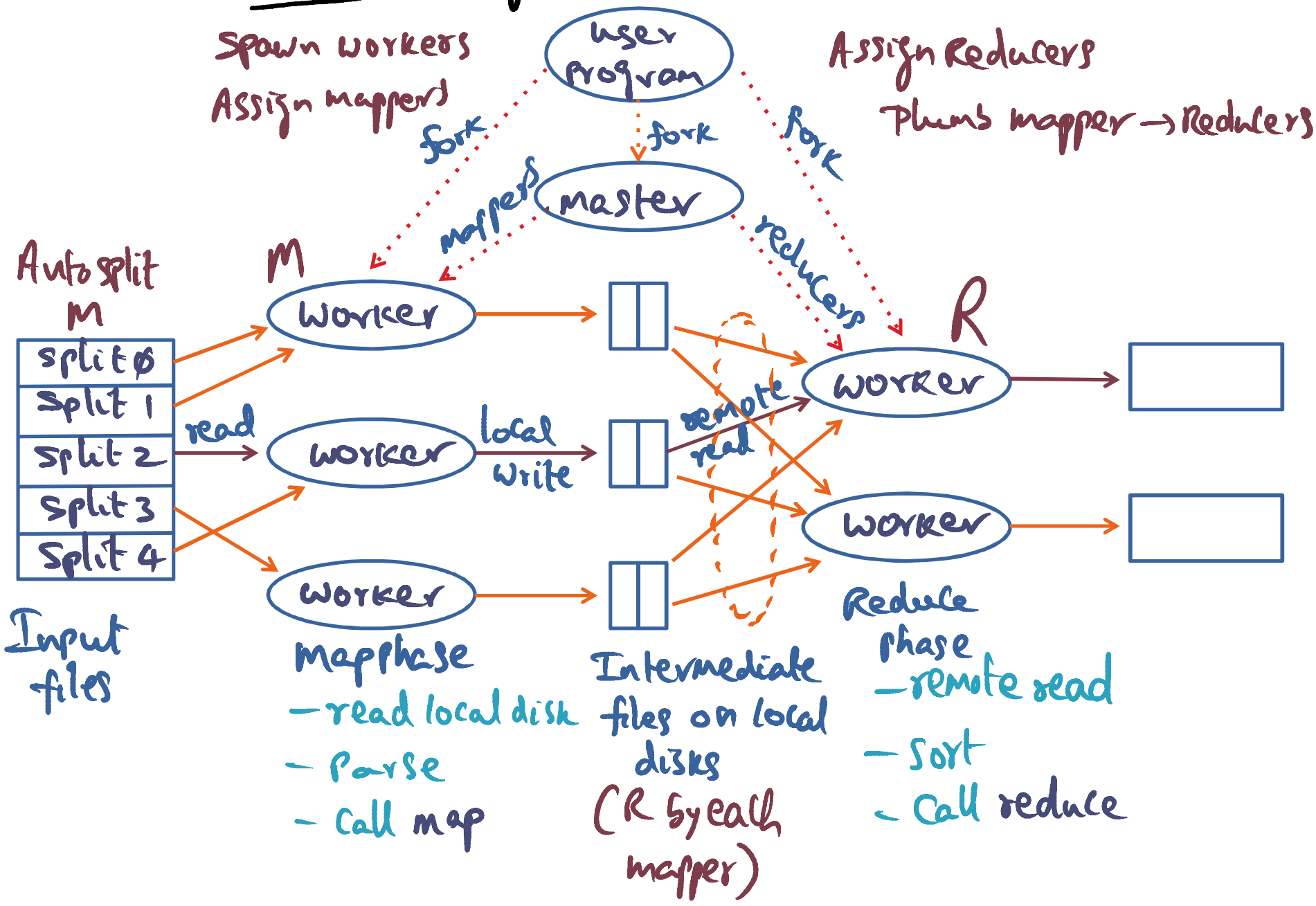

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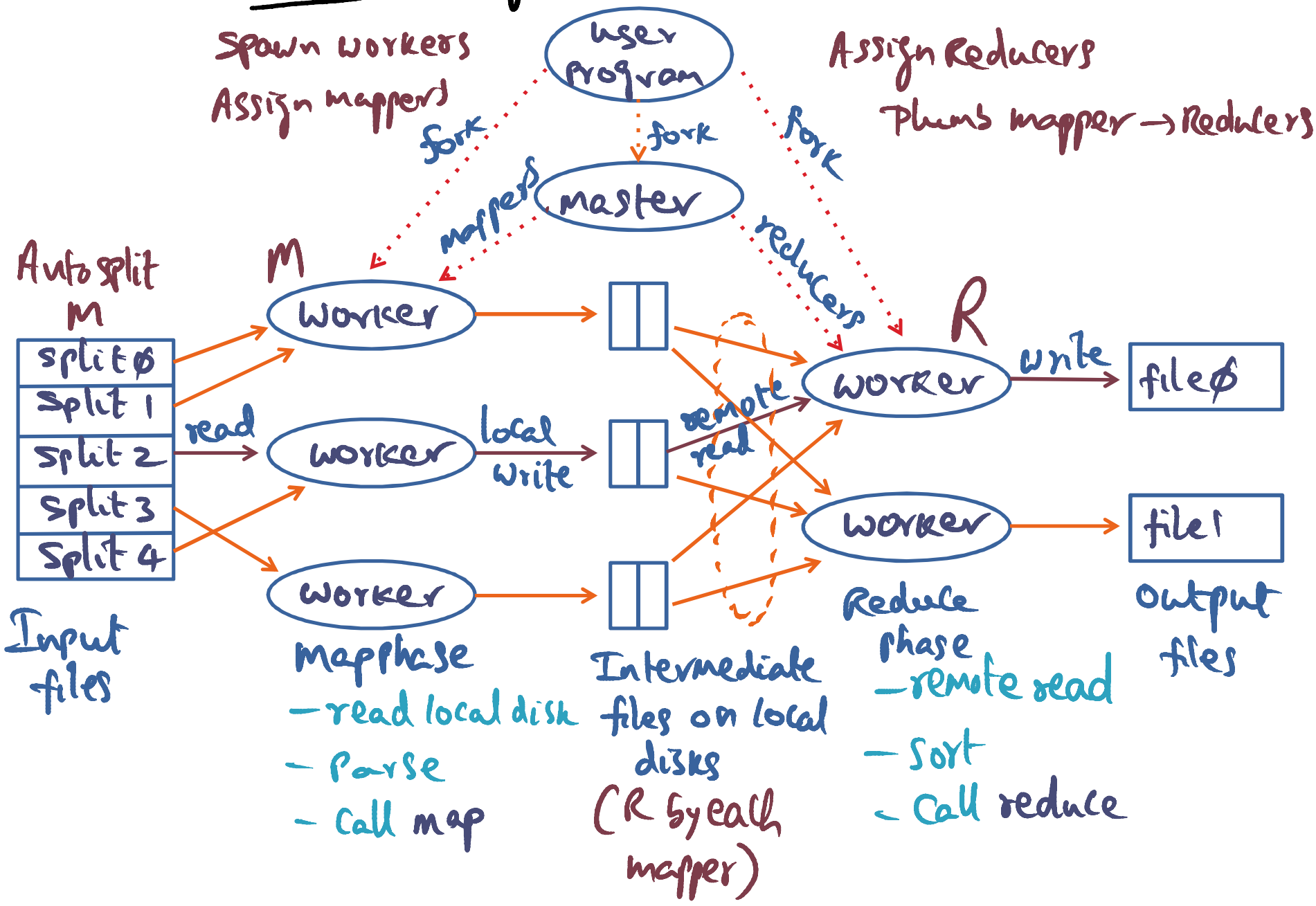

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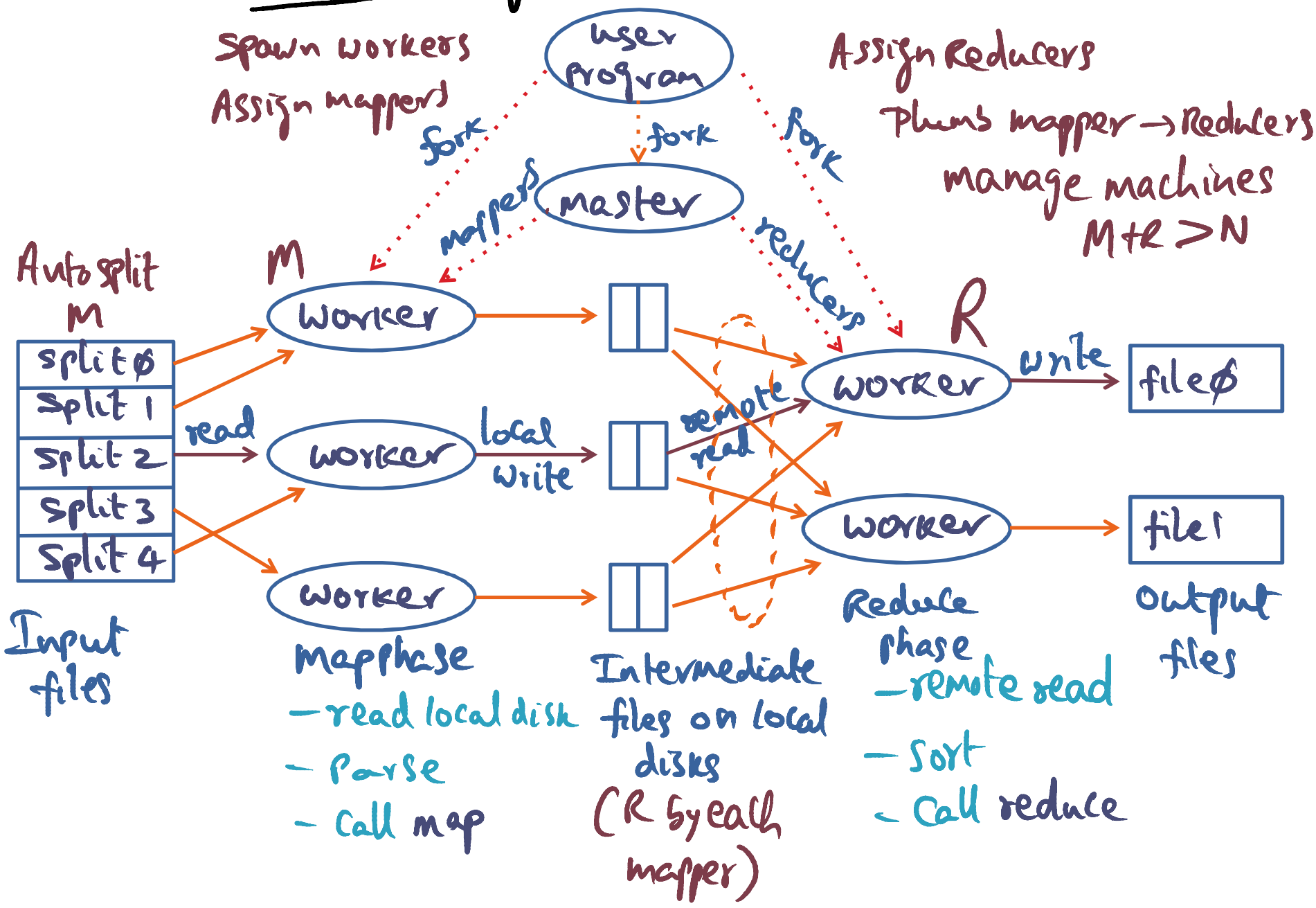

Issues to be handled by the runtime

Master data structures

- location of files created by completed mappers
- scoreboard of mapper/reducer assignment
- Fault tolerance
  - * start new instances if no timely response
  - * completion message from redundant stragglers
- Locality management
- Task granularity
- Backup tasks

Key takeaways

- map-reduce => simplicity
- domain expert's programming burden?
  - write "map" and "reduce" functions
- heavy lifting under the cover by the runtime system