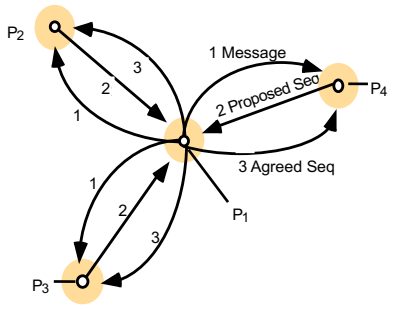
ISIS algorithm for total ordering

- No central sequencer
  - Achieves decentralization
  - *Distributed* doesn't mean *decentralized*.
- Every sender acts as a sequencer.
- Since there is no single sequencer that determines a number, it requires *agreement* on sequence numbers.
  - Agreement is very important for decentralization.
- Thus, each sender does not pick a sequence number alone.
  - Otherwise, two different senders can pick the same number.
- Each sender receives proposals for a sequence number every time.
  - Among the proposals, the sender picks a number.

ISIS algorithm for total ordering



ISIS algorithm for total ordering

- How to propose a number?
  - Need a way to guarantee that a higher number is picked among all numbers assigned as sequence numbers already or potentially assigned as sequence numbers
  - Each message receiver pick a number that is the highest among all the numbers that it has ever seen, i.e., all previous proposals and actual message sequence numbers.
- How to pick a sequence number out of all proposals?
  - Among all proposals, pick the highest number

ISIS algorithm for total ordering

- Sender multicasts message to everyone
- Reply with proposed priority (sequence no.)
  - Larger than all observed *agreed* priorities
  - Larger than any previously proposed (by self) priority
- Store message in priority queue
  - Ordered by priority (proposed or agreed)
  - Mark message as undeliverable
- Sender chooses agreed priority, re-multicasts message with agreed priority
  - Maximum of all proposed priorities
- Upon receiving agreed (final) priority
  - Mark message as deliverable
  - Reorder the delivery queue based on the priorities
  - Deliver any deliverable messages at the front of priority queue
- Notice any (small) issue?

CSE 486/586 Administrivia

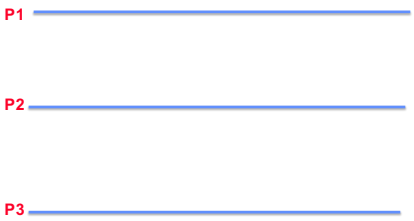
- PA2-B is due on 3/15.
  - Right before Spring break
- Midterm is on 3/13.
- Come up with a schedule that works.

Problematic Scenario

- Two processes P1 & P2 at their initial state.
- P1 sends M1 & P2 sends M2.
- P1 receives M1 (its own) and proposes 1. P2 does the same for M2.
- P2 receives M1 (P1's message) and proposes 2. P1 does the same for M2.
- P1 picks 2 for M1 & P2 also picks 2 for M2.
- Same sequence number for two different msgs.
- How do you want to solve this?
  - Use process numbers as a tie-breaker.
  - For a proposal, always use the following format: X.Y
    - » X is the proposed number and Y is the process id.
  - P1 has proposed 2 for M1 → The proposal for M1 is now 2.1.

Example: ISIS algorithm

We don't dictate when events are happening



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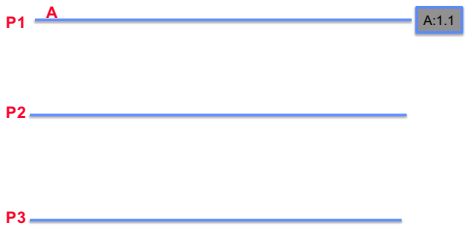

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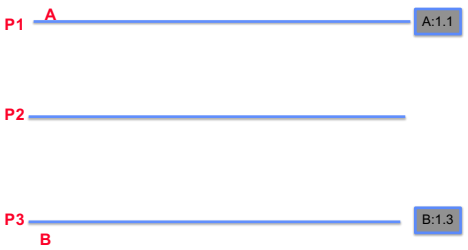

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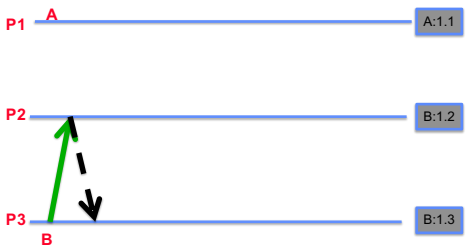

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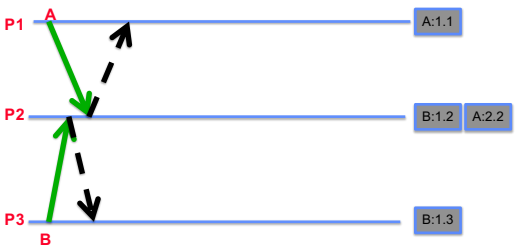

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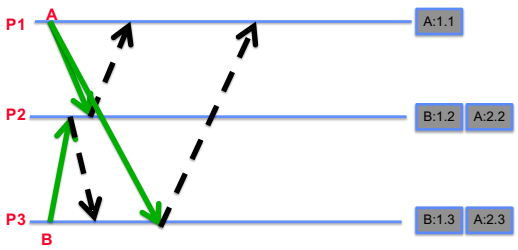

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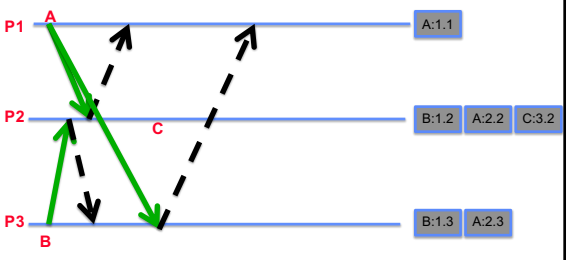

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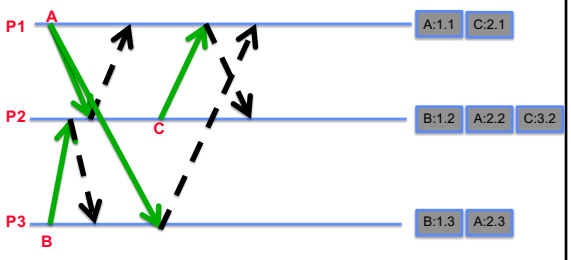

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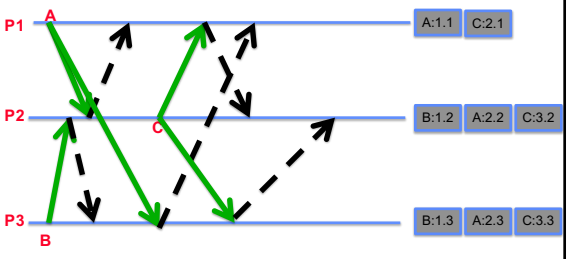

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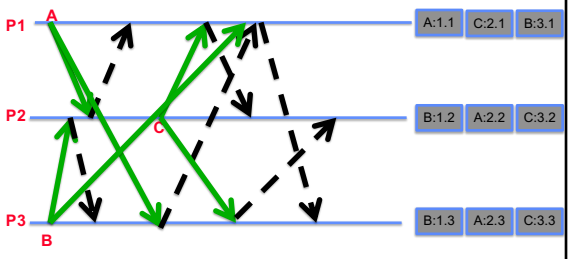

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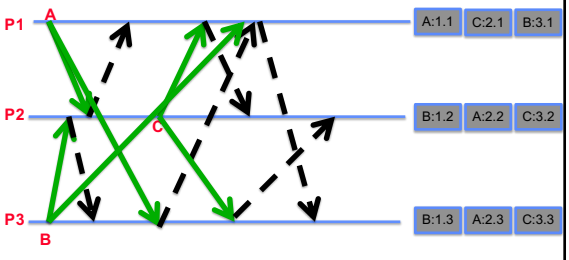

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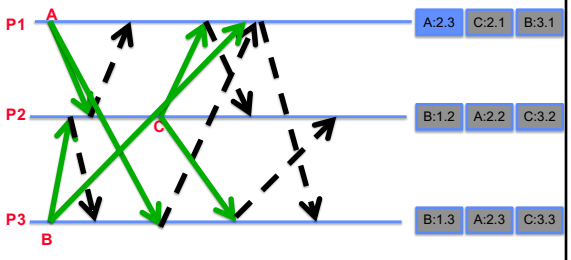

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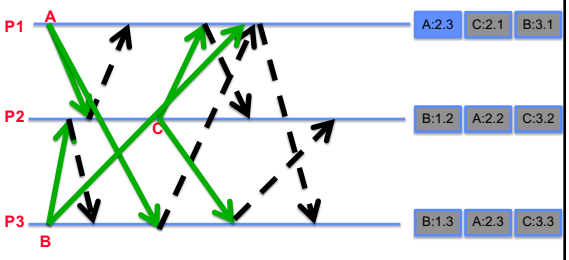

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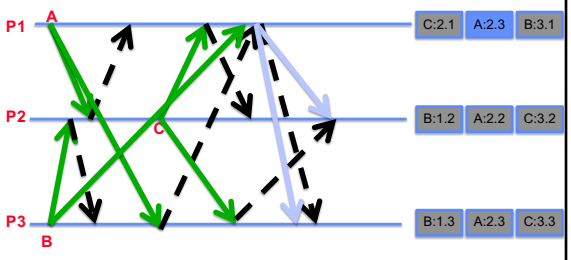

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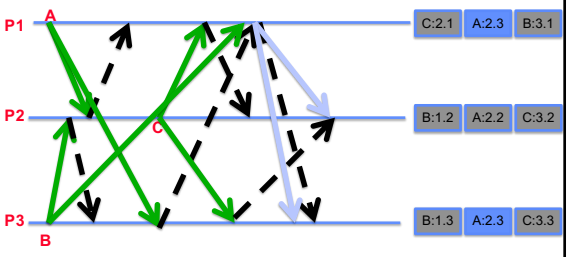

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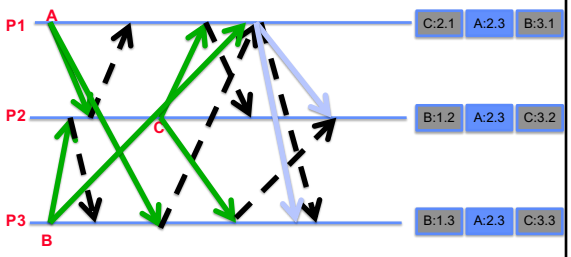

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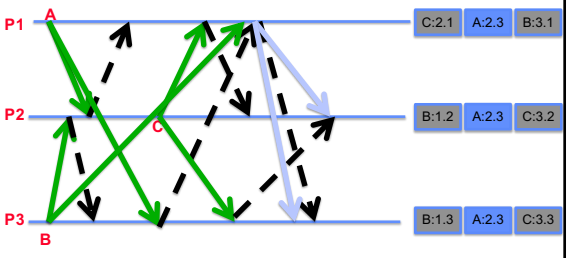

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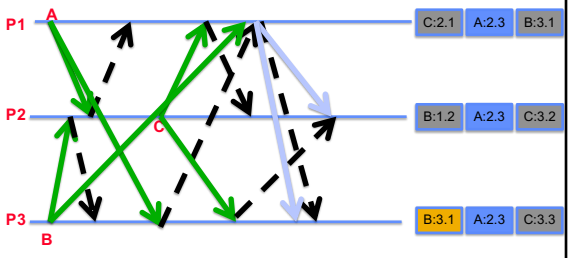

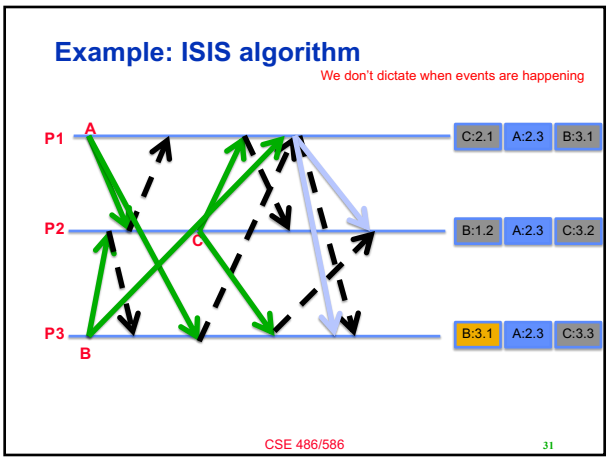
Example: ISIS algorithm
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P1
P2
P3
A
B
C
C:2.1
A:2.3
B:3.1
B:1.2
A:2.3
C:3.2
B:3.1
A:2.3
C:3.3
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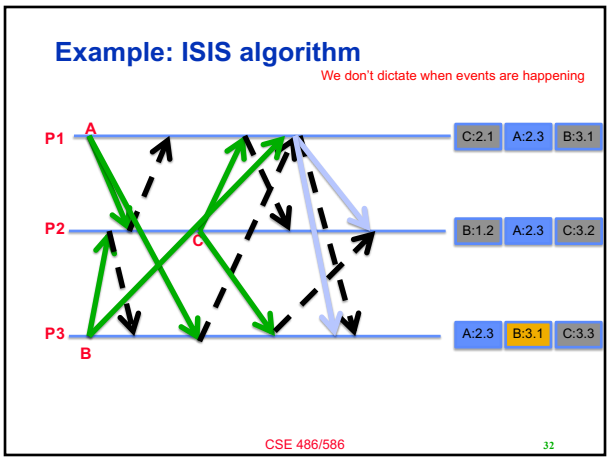
31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A:2.3
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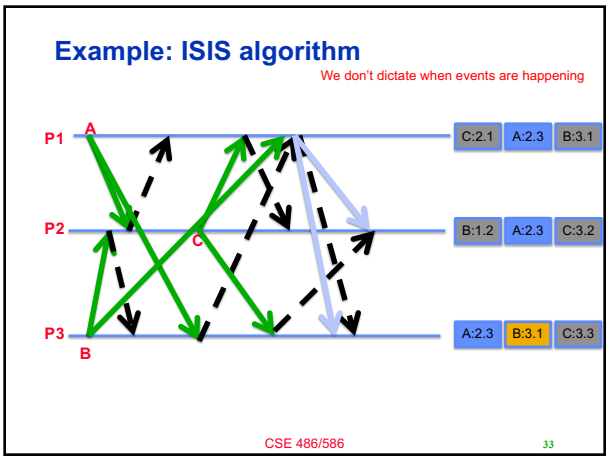
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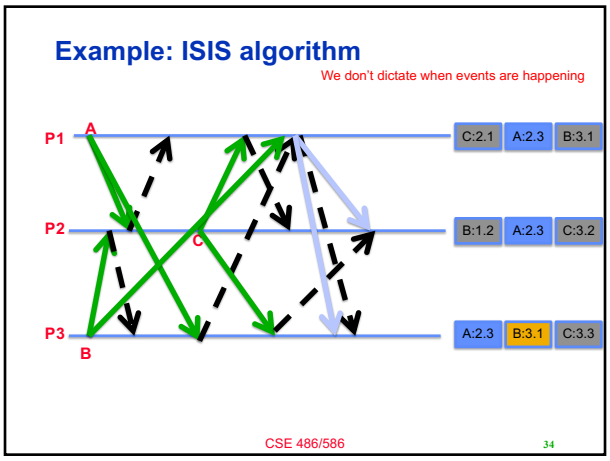
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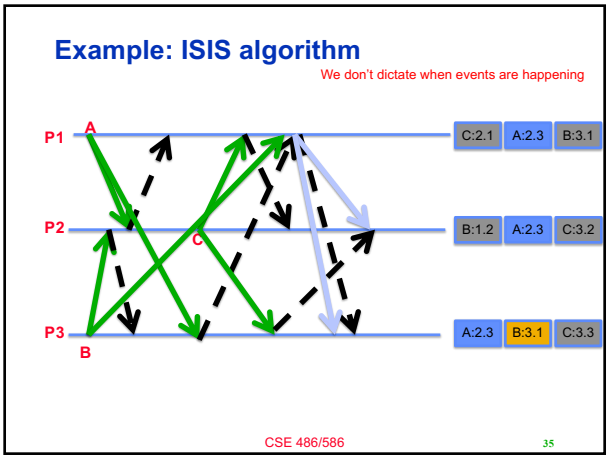
34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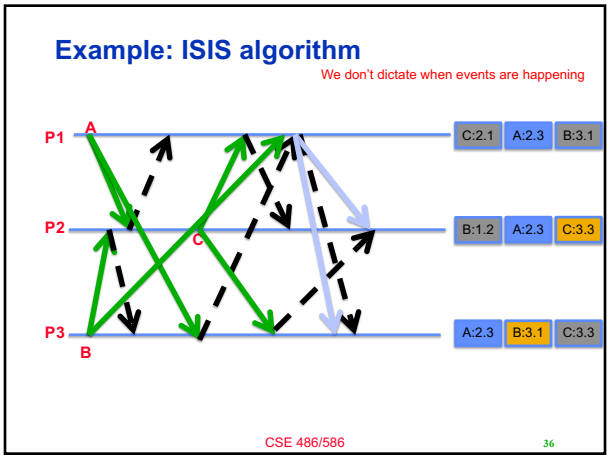
35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36

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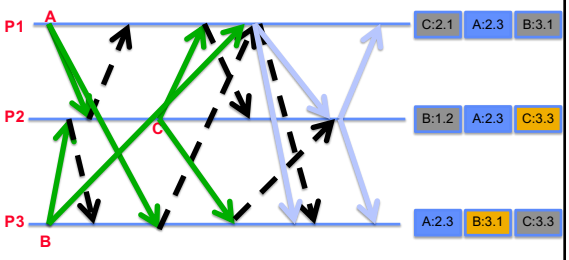

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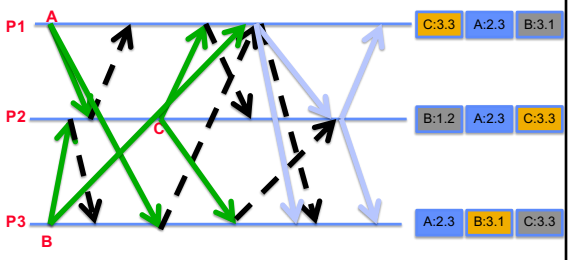

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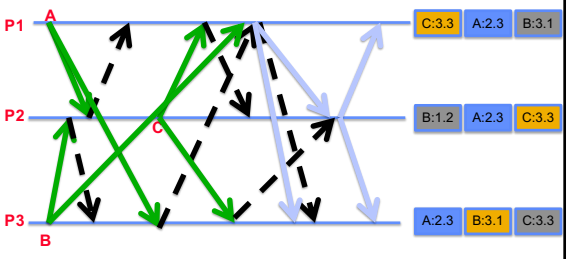

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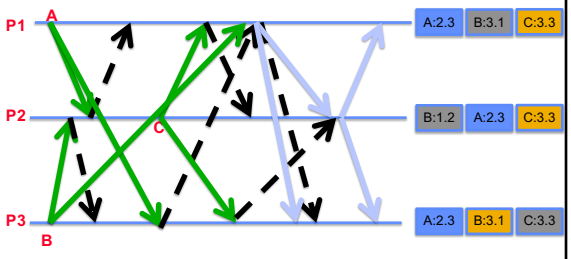

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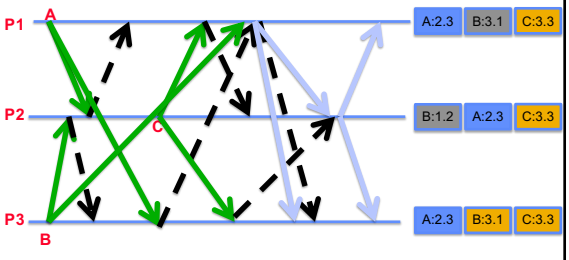

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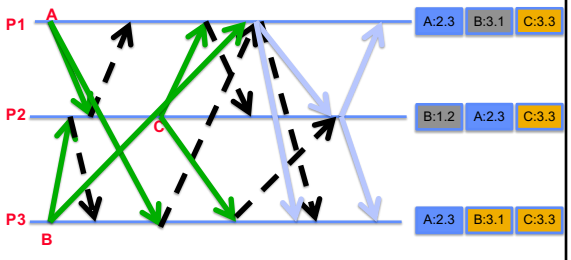

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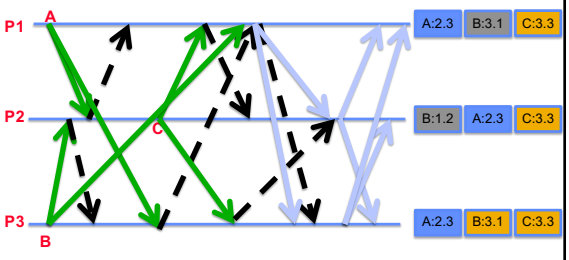

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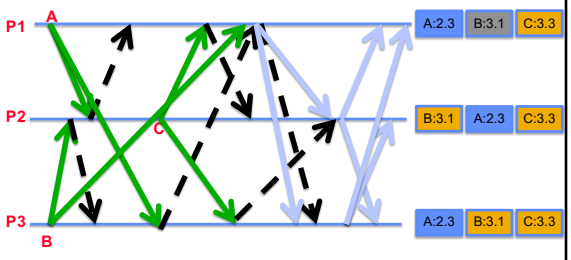

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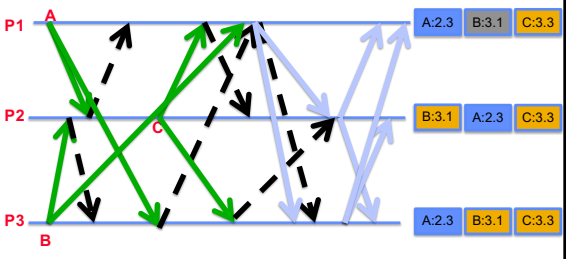

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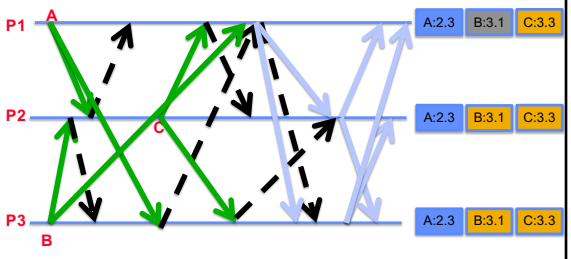

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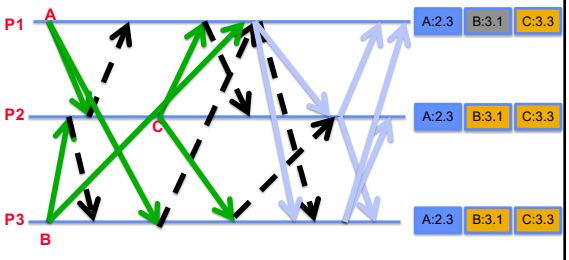

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