CISPA
HELMHOLTZ CENTER FOR INFORMATION SECURITY

Consensus in the presence of Overlapping Faults and Total Omission Setting

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Funded by
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Byzantine Agreement

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Inputs

- Validity
- Consistency
- Termination

Outputs

Byzantine Agreement

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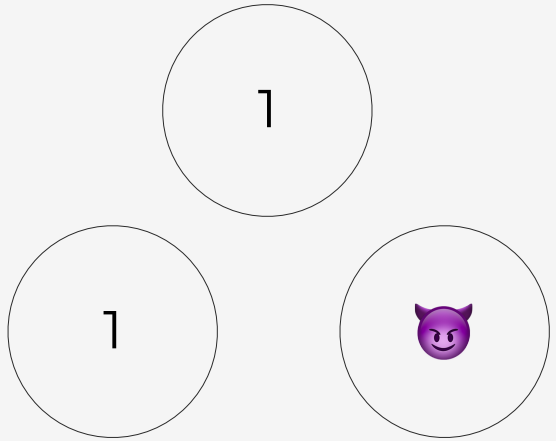

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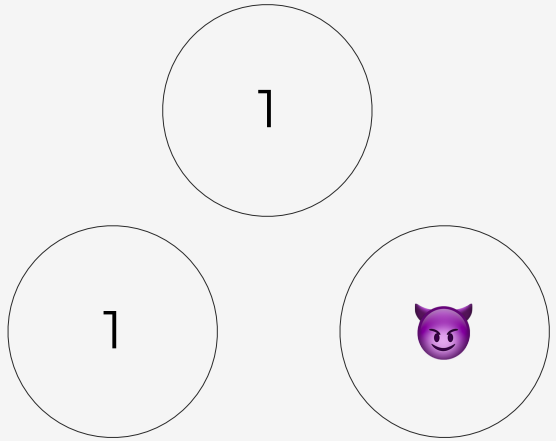

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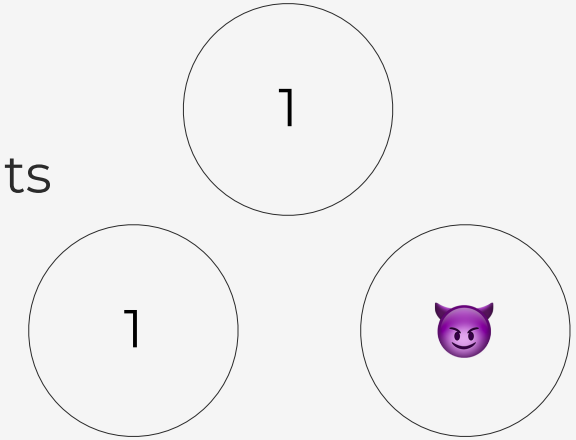

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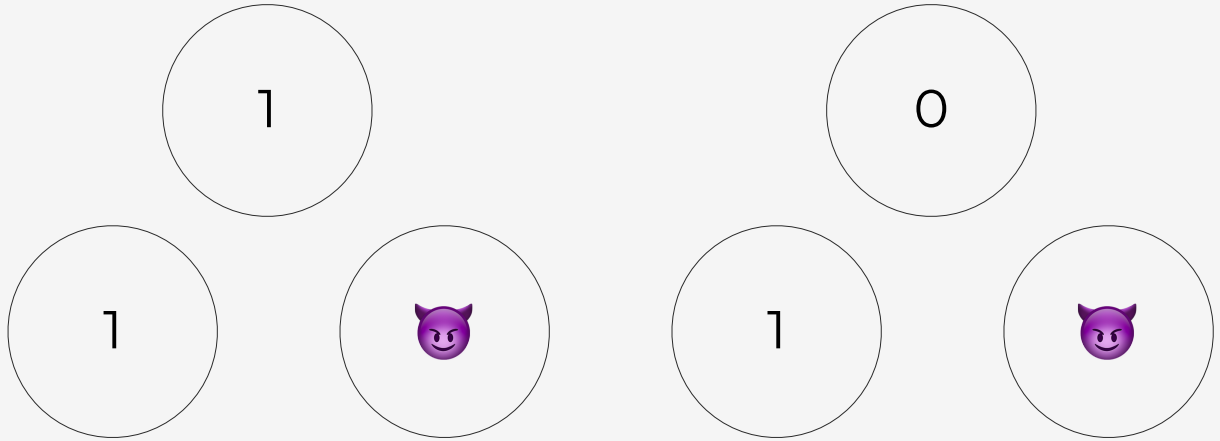

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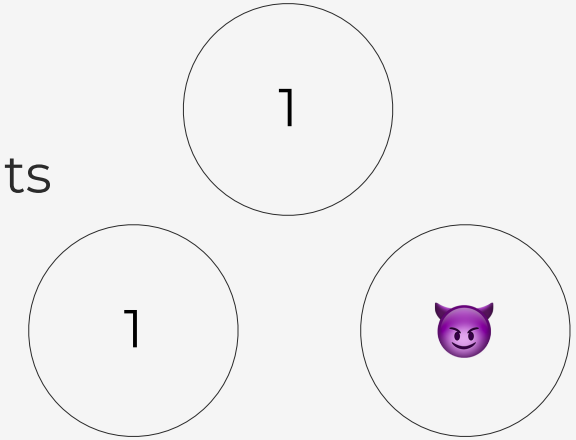

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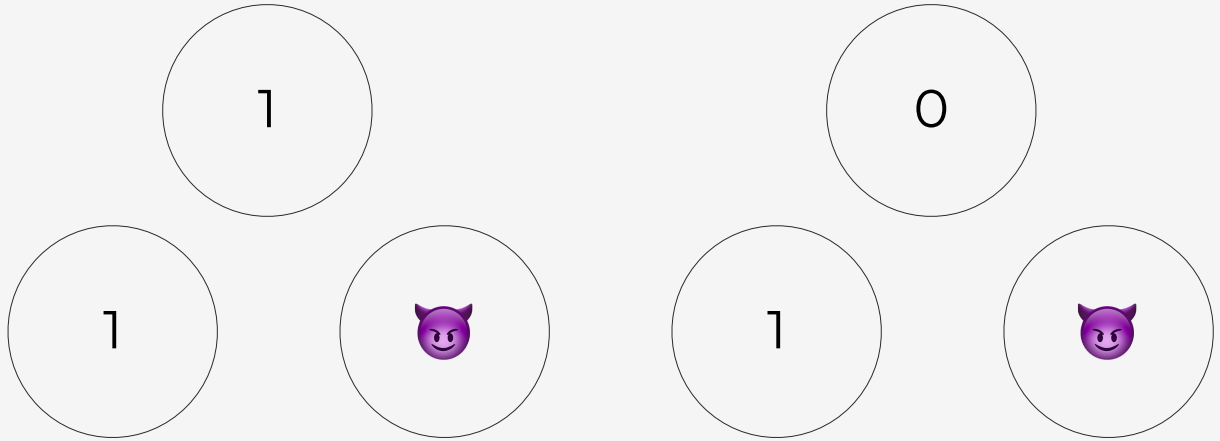

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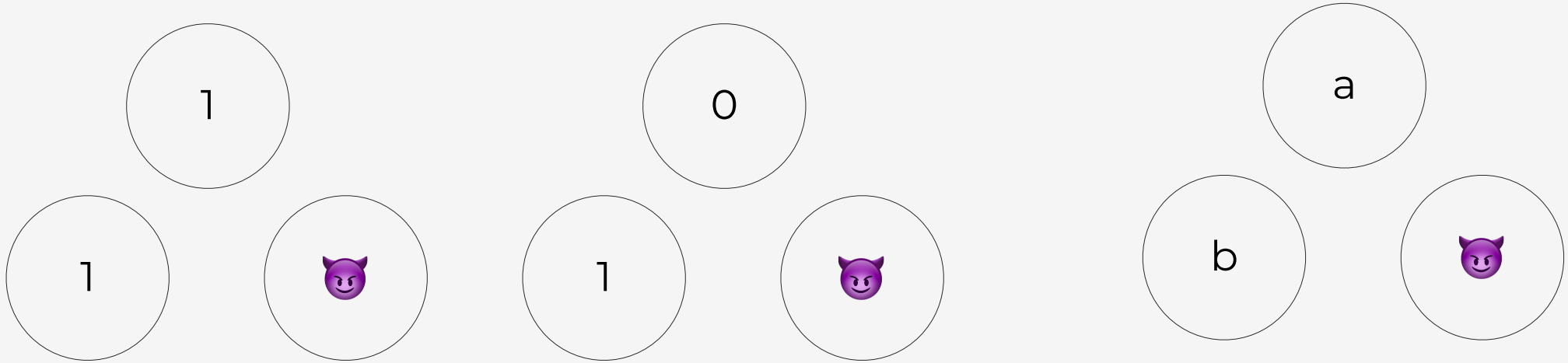

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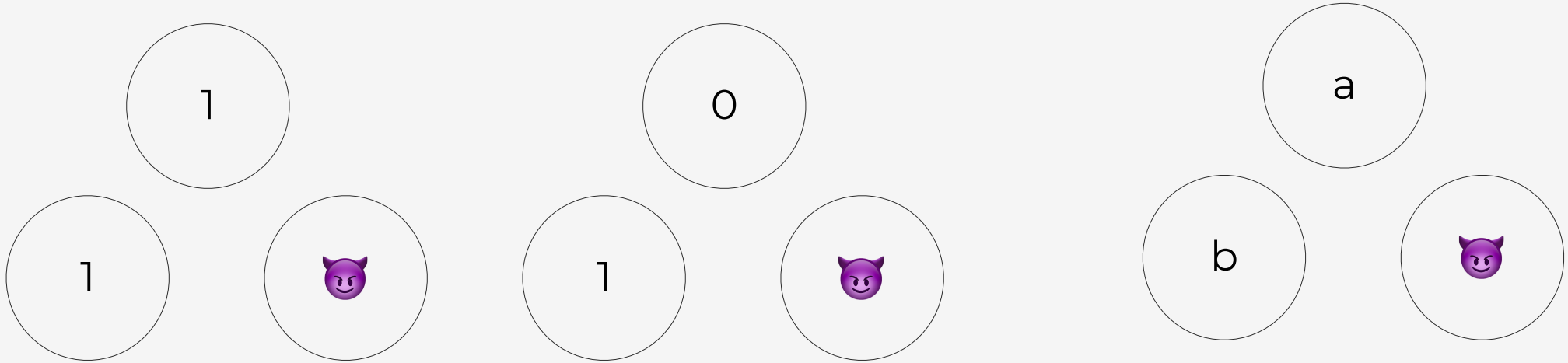

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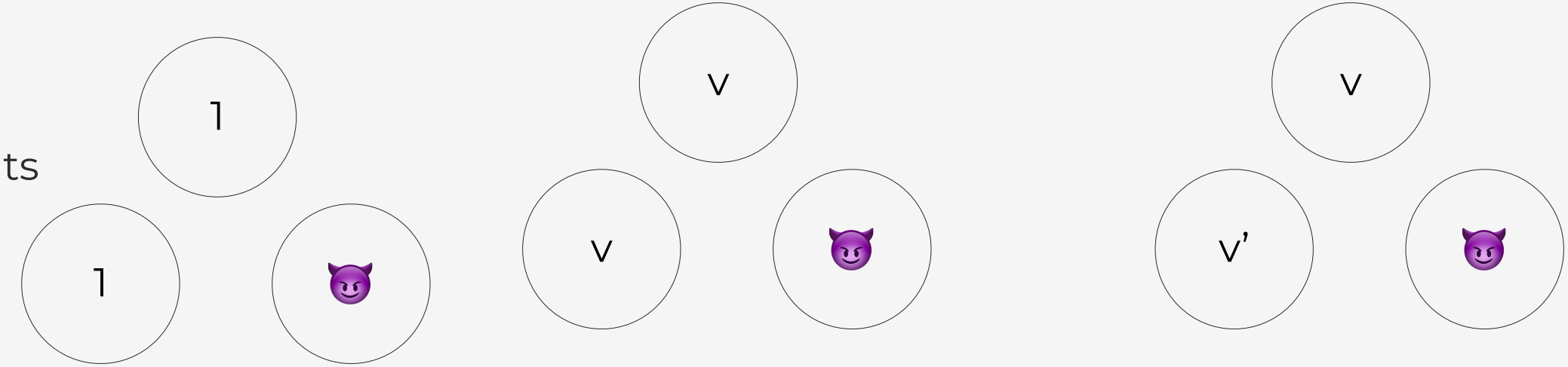

Mixed Fault Model

Mixed Fault Model

- Send Omission(Ghost👻)
- Receive Omission(Zombie🧟)
- Byzantine Corruption
- Full-Omission(Overlapping Faults)

Omissions

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- Send Omission 👻

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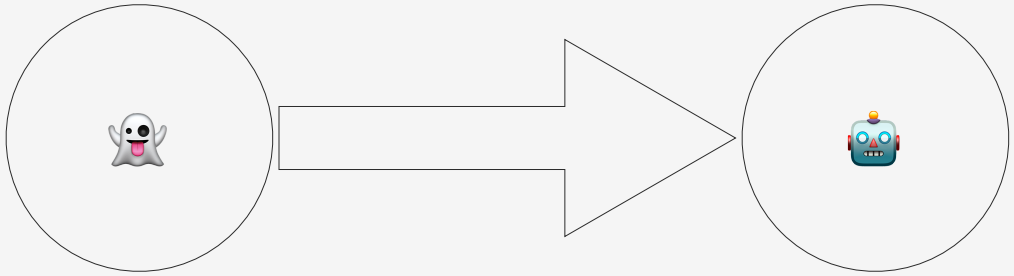

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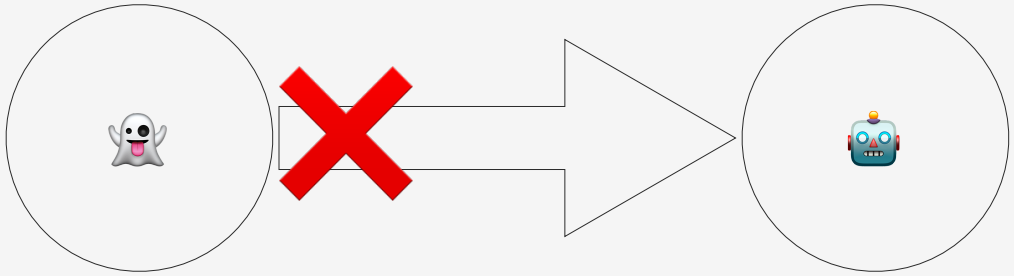

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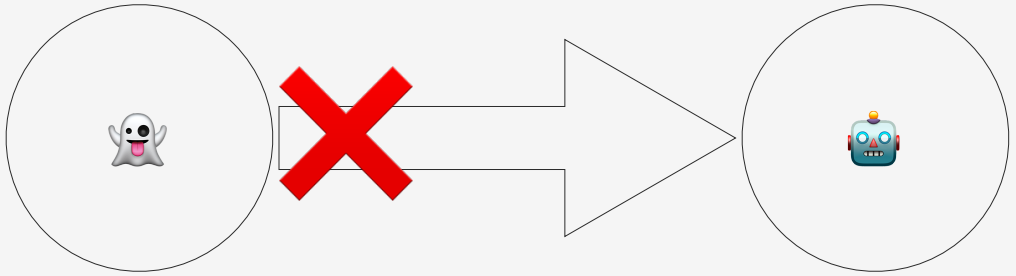

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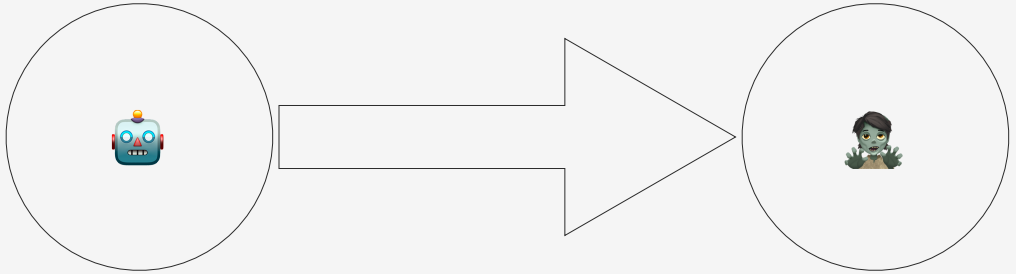

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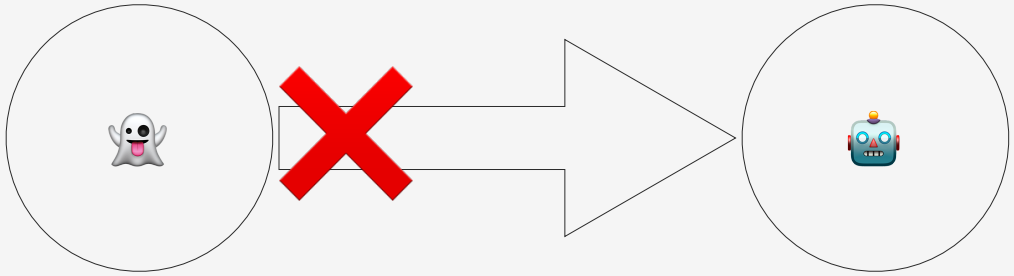

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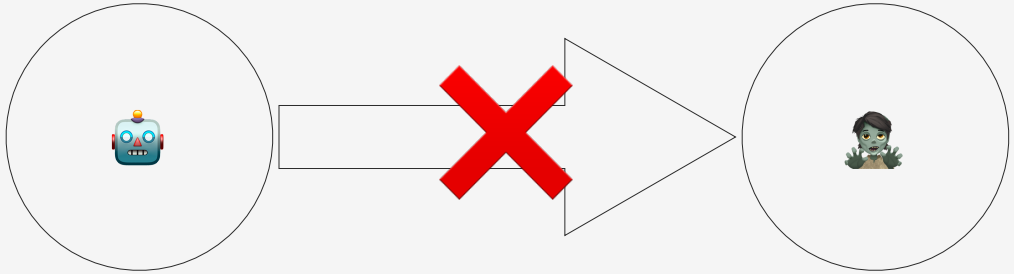

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  It is allowed to output a flag Z=True to indicate it is actually receive omission.

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  When it sets itself as Send Omission, it must be the case it is send omission.

  It must output the “correct” value if it is not receive omission.

Basic Idea: Self-Detection

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If a party receives number of messages less than it expected, at least one message has been dropped on its side, so it can detect itself as receive omission.

- **Send Omission Detection**

If a party knows at least one nonfaulty party has not received the message it is expected to send, it can detect itself as send omission.

Our Starting Point: Zombies and Ghosts[LS2022]

Undead Weak Multicast

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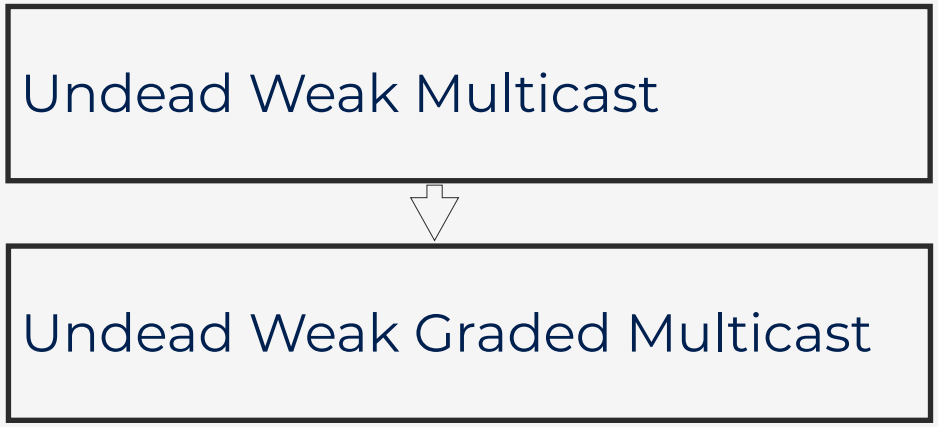

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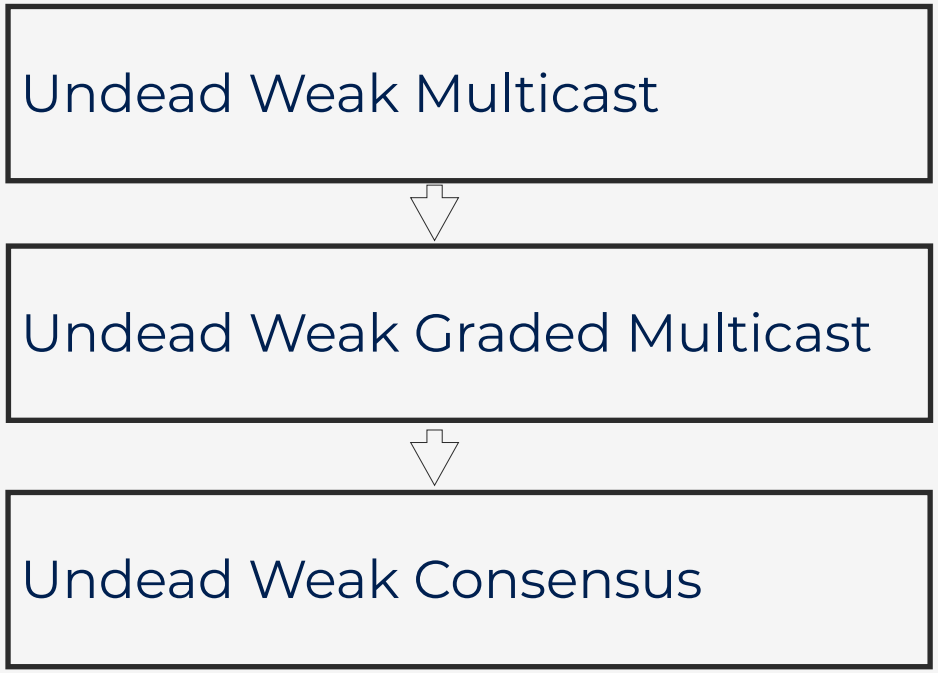

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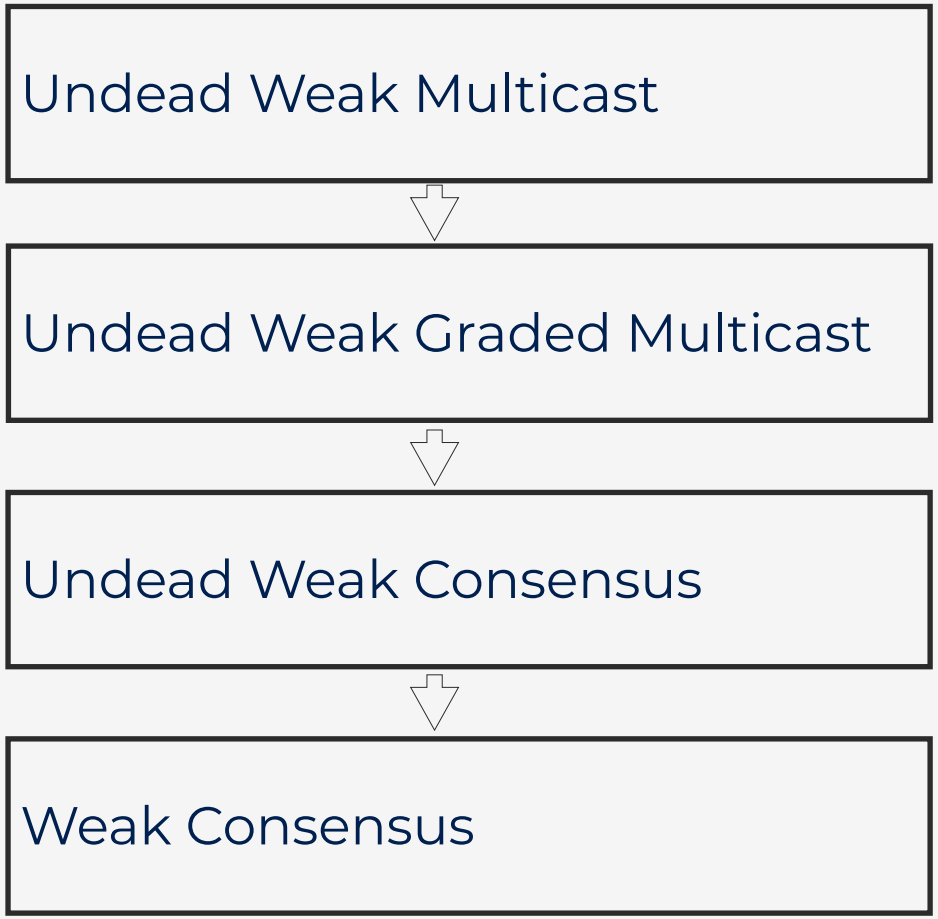

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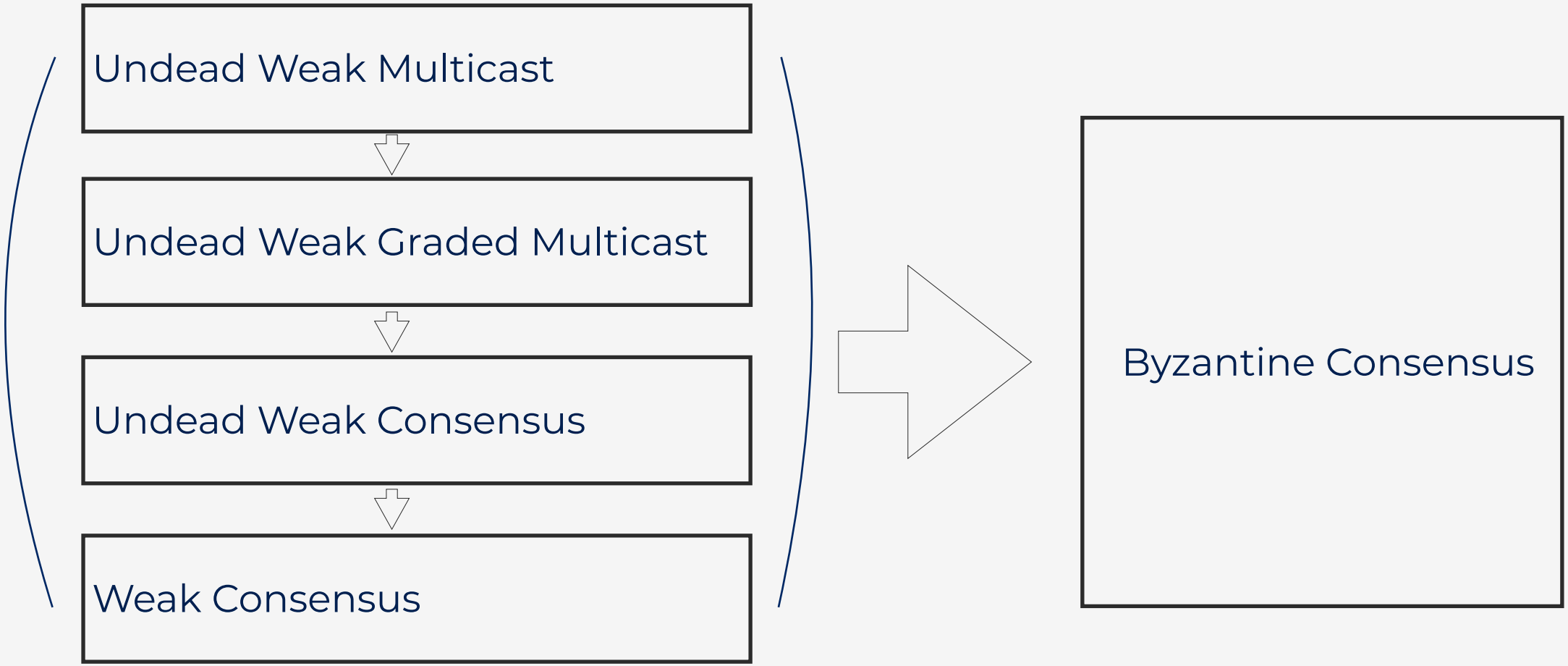
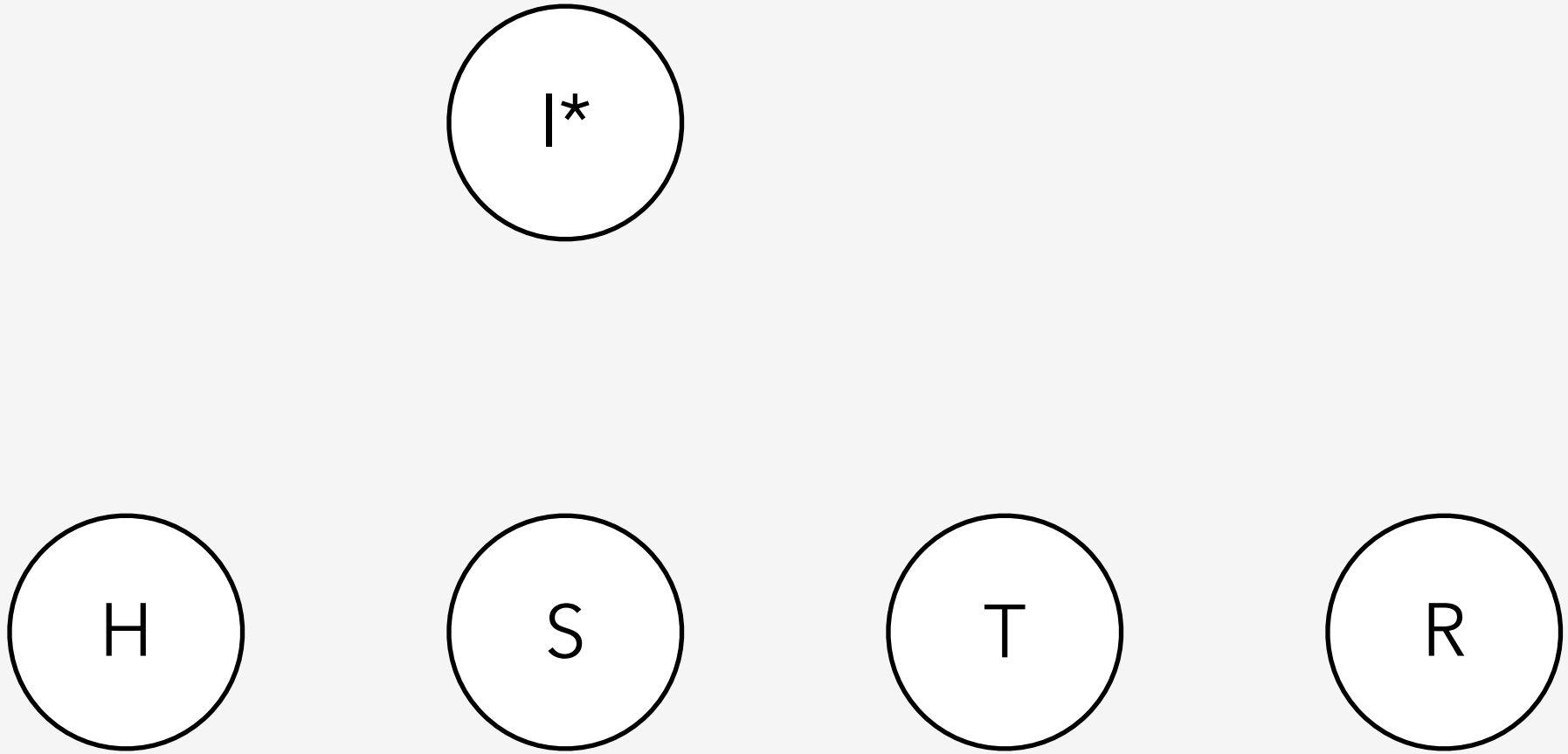


Undead Weak Multicast[LS23]



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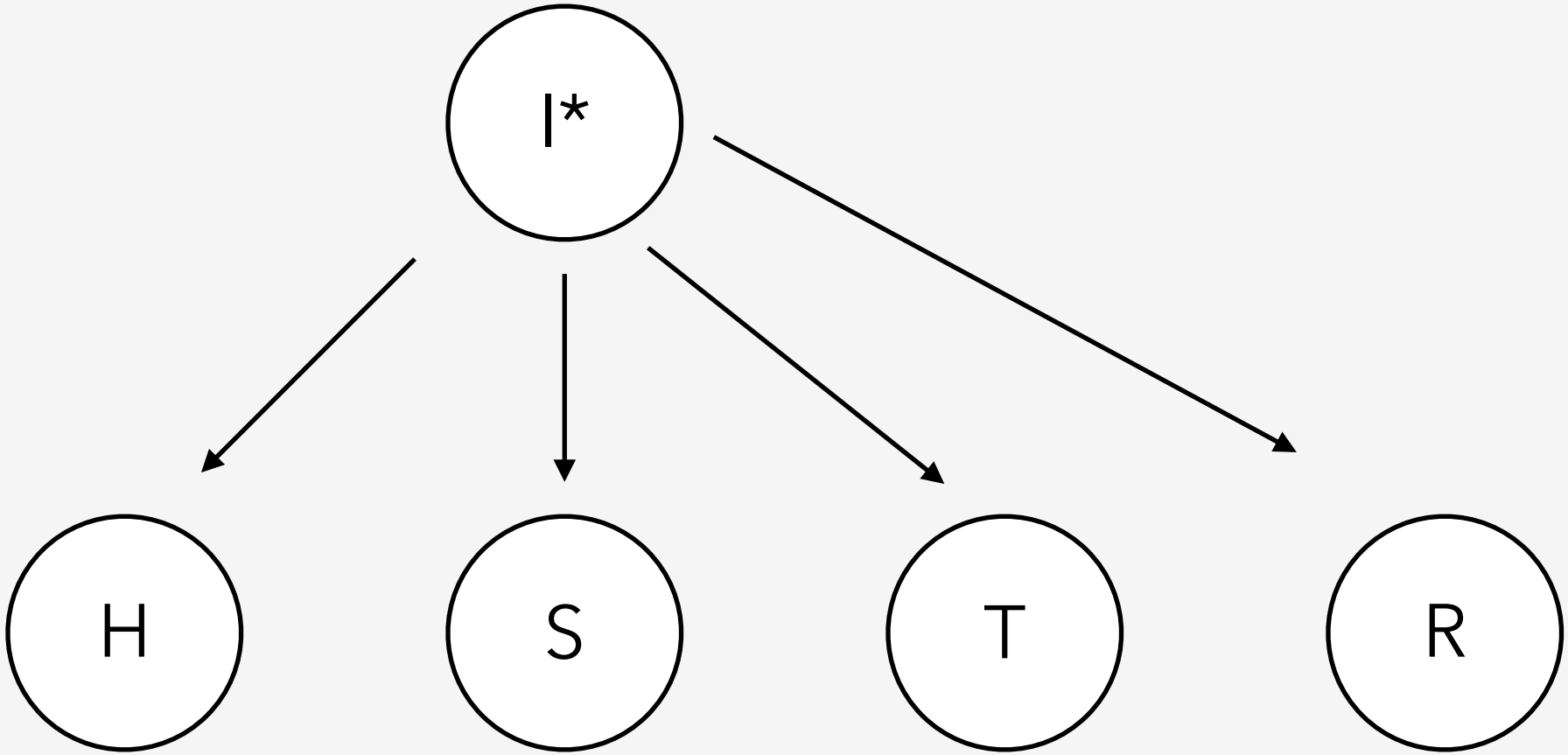

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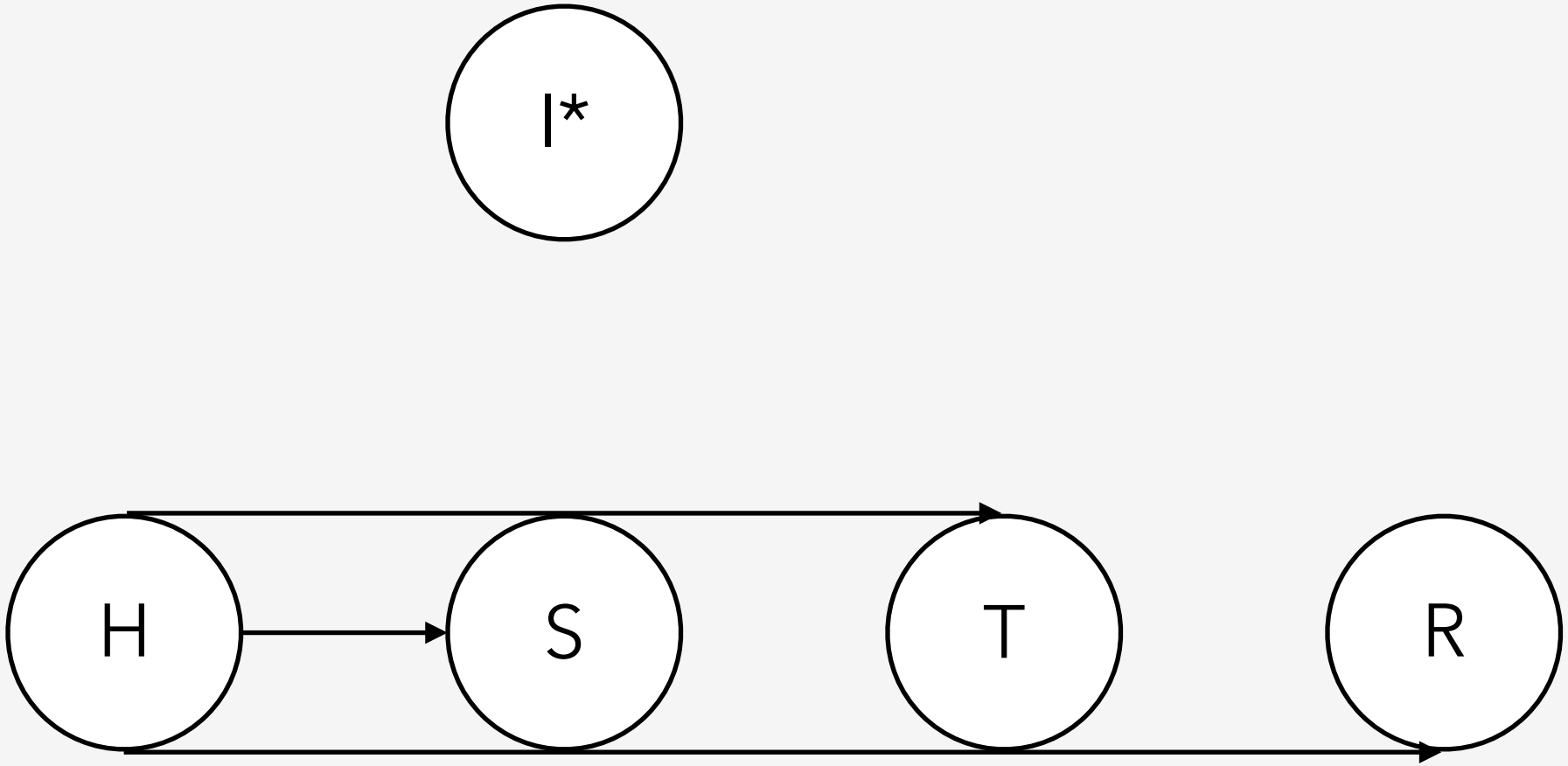

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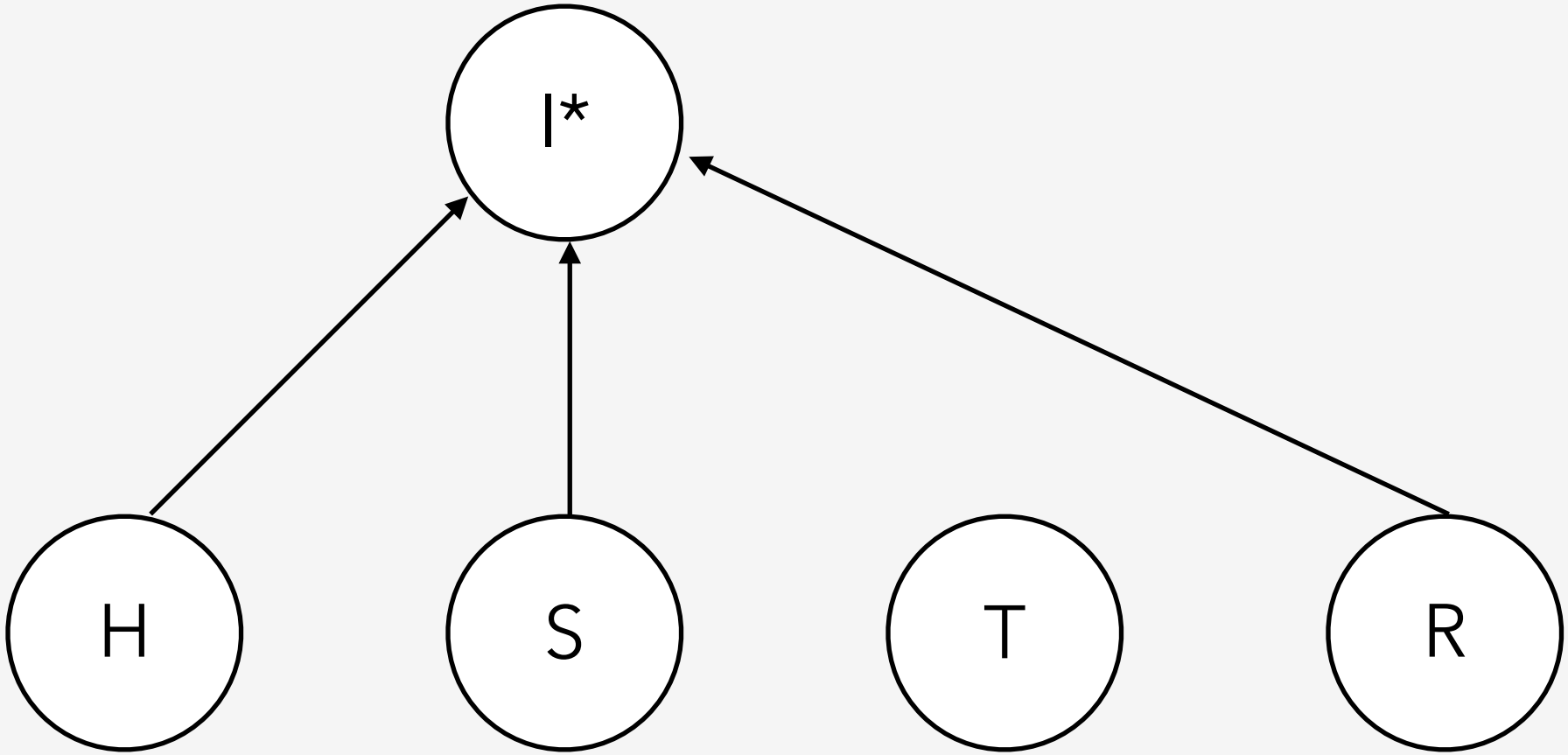
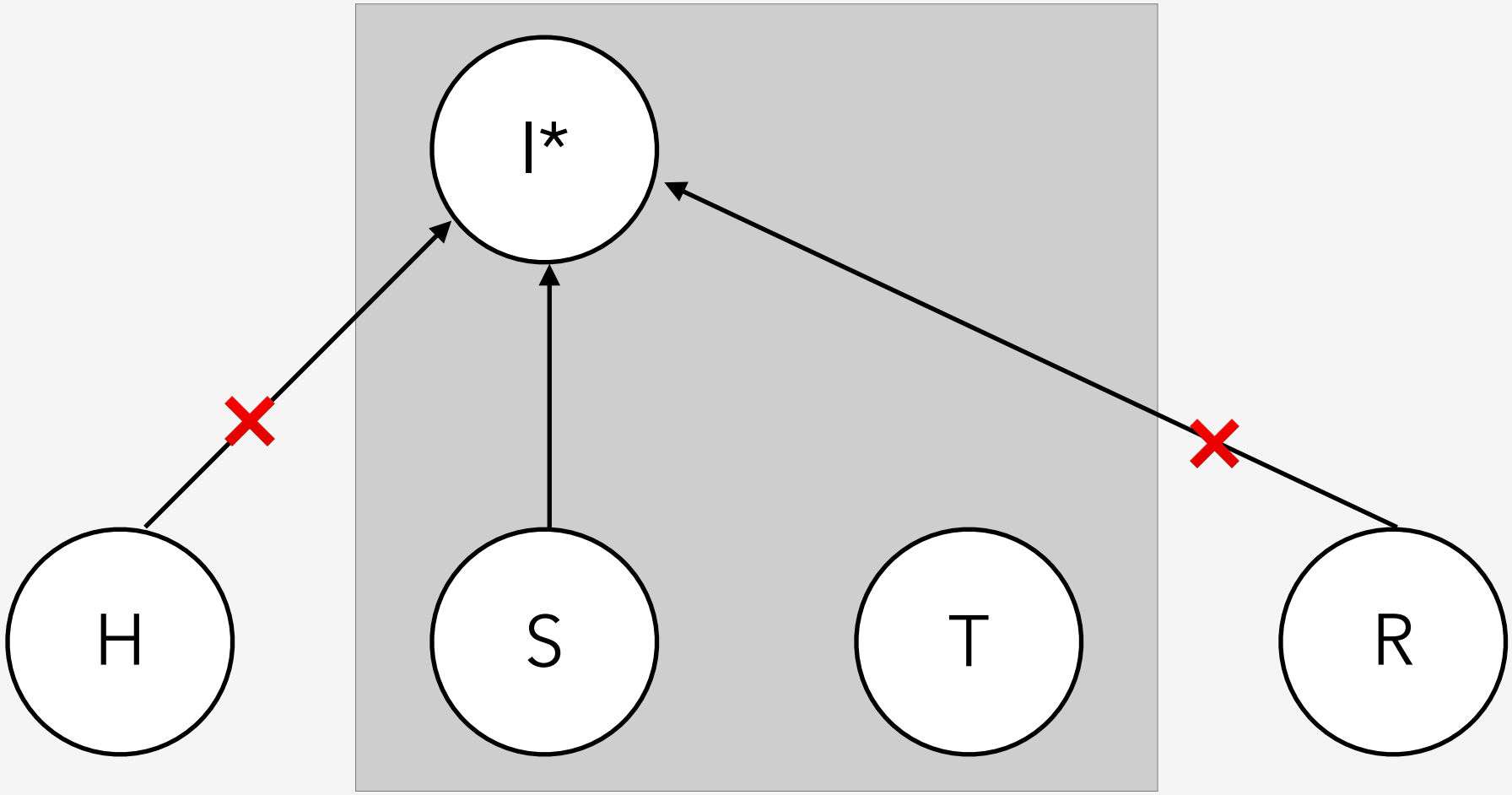
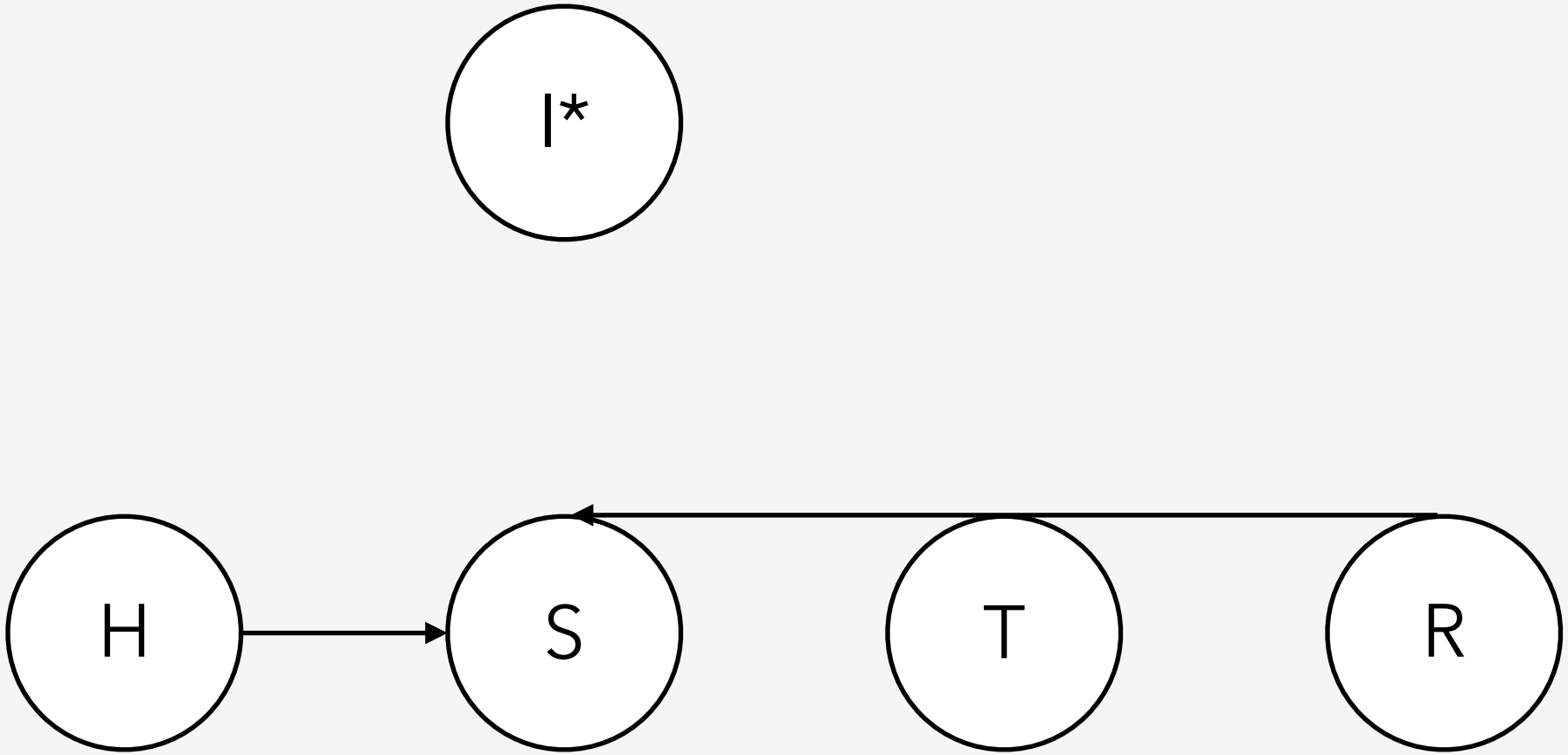


Failed to detect a Full-Omission Sender



Our Solution Against Overlapping Faults



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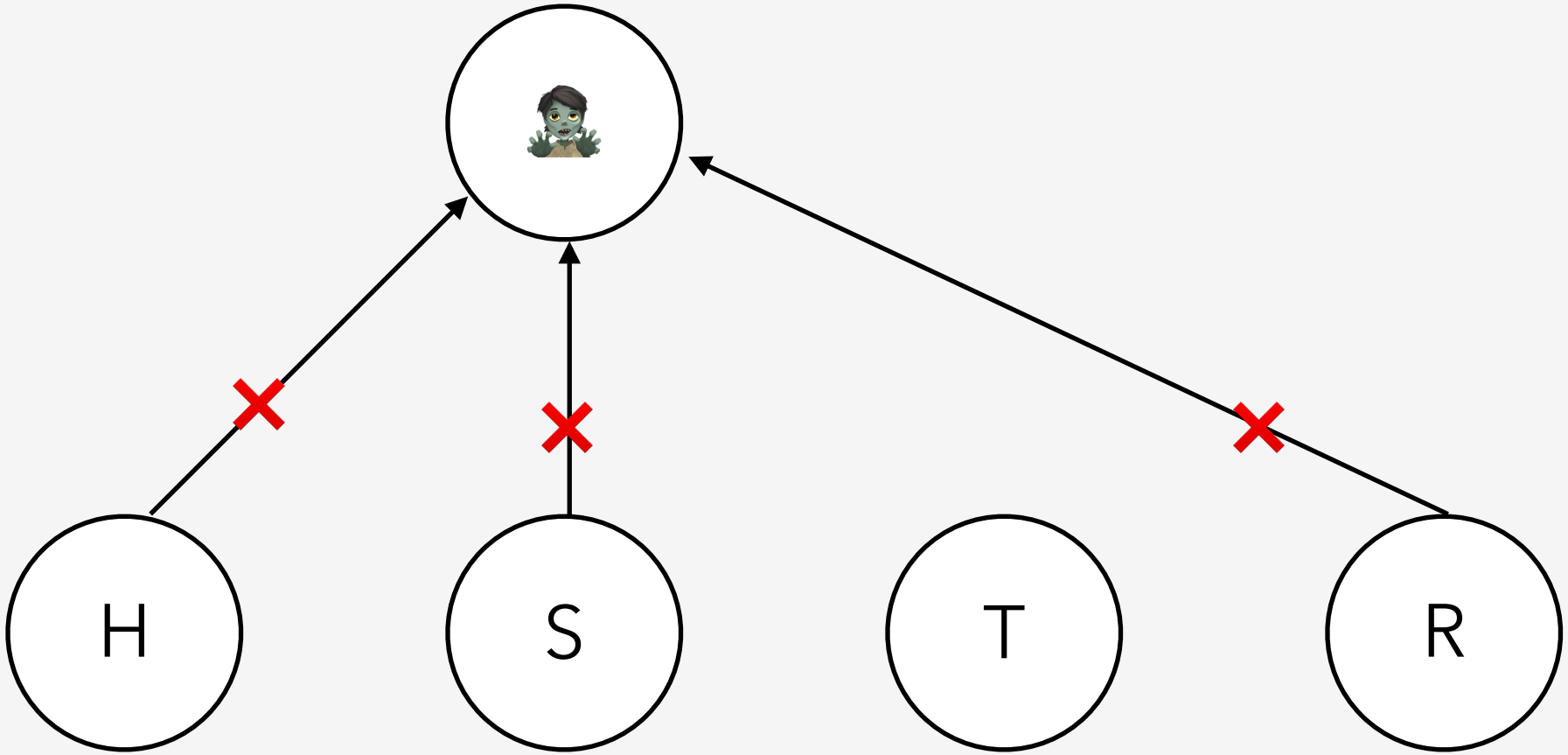

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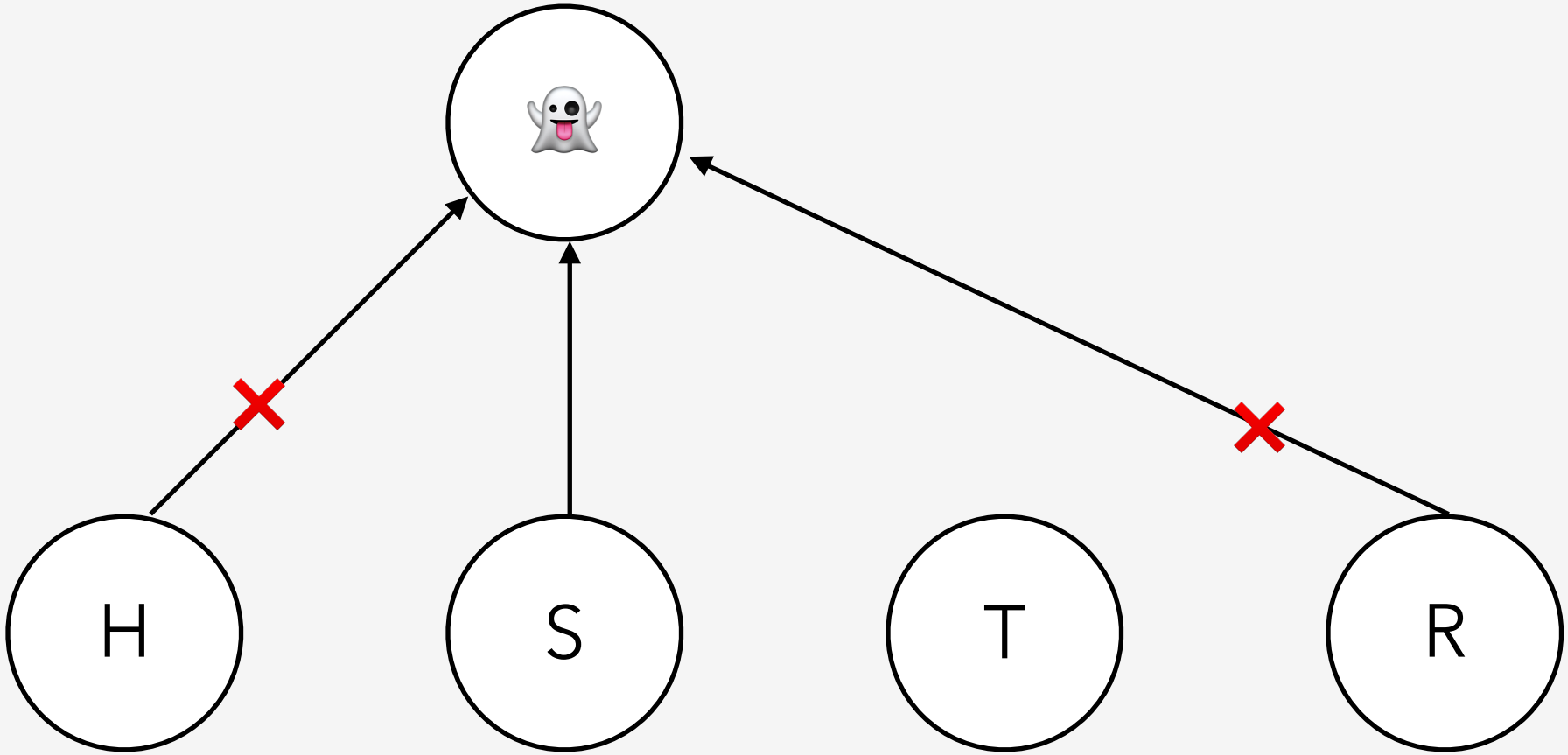

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Closes the Door, Leaves a Window

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Our Result: There is a Byzantine Agreement Protocol with $s + r = n$.

A Consensus Protocol with s+r=n(s<n)

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Undead Very Weak Multicast

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For s+1 Different Leaders

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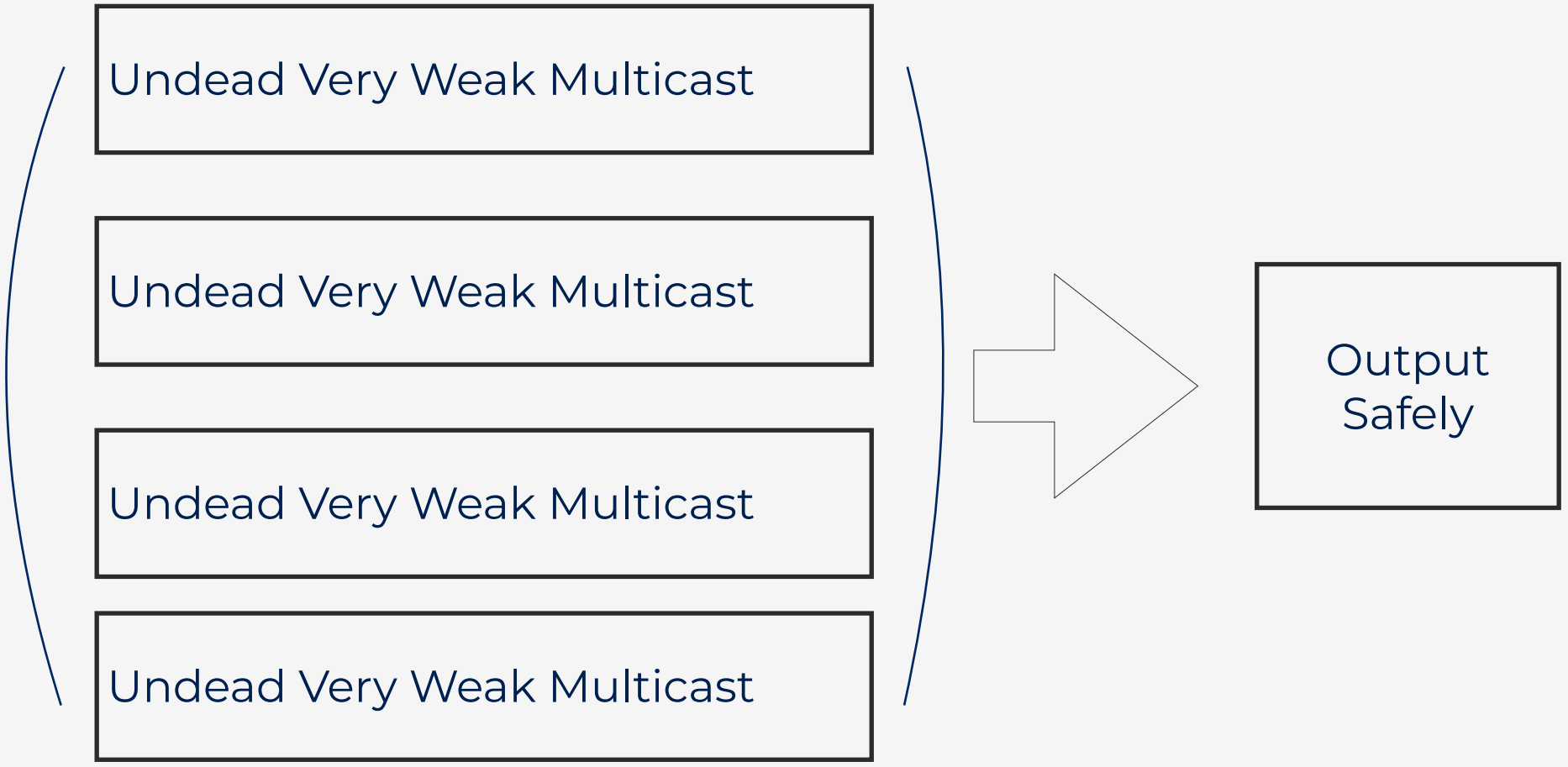

For s+1 Different Leaders

Total Omission Setting (s+r=n)

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- **Complete Characterization**

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- **Optimal Resilience**

  Impossibility proof for Agreement with $s + r > n$ (with overlapping).

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Thank you!