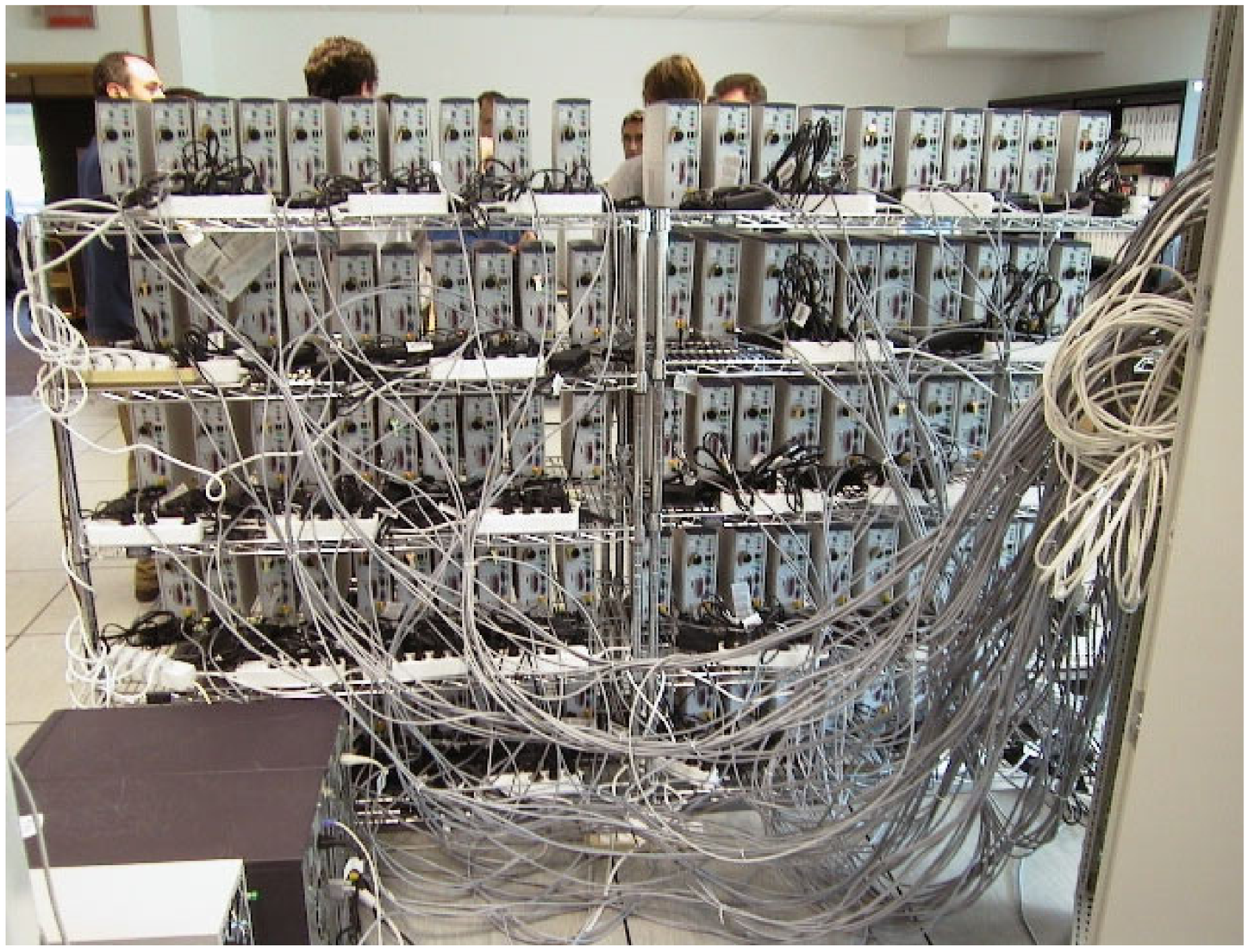
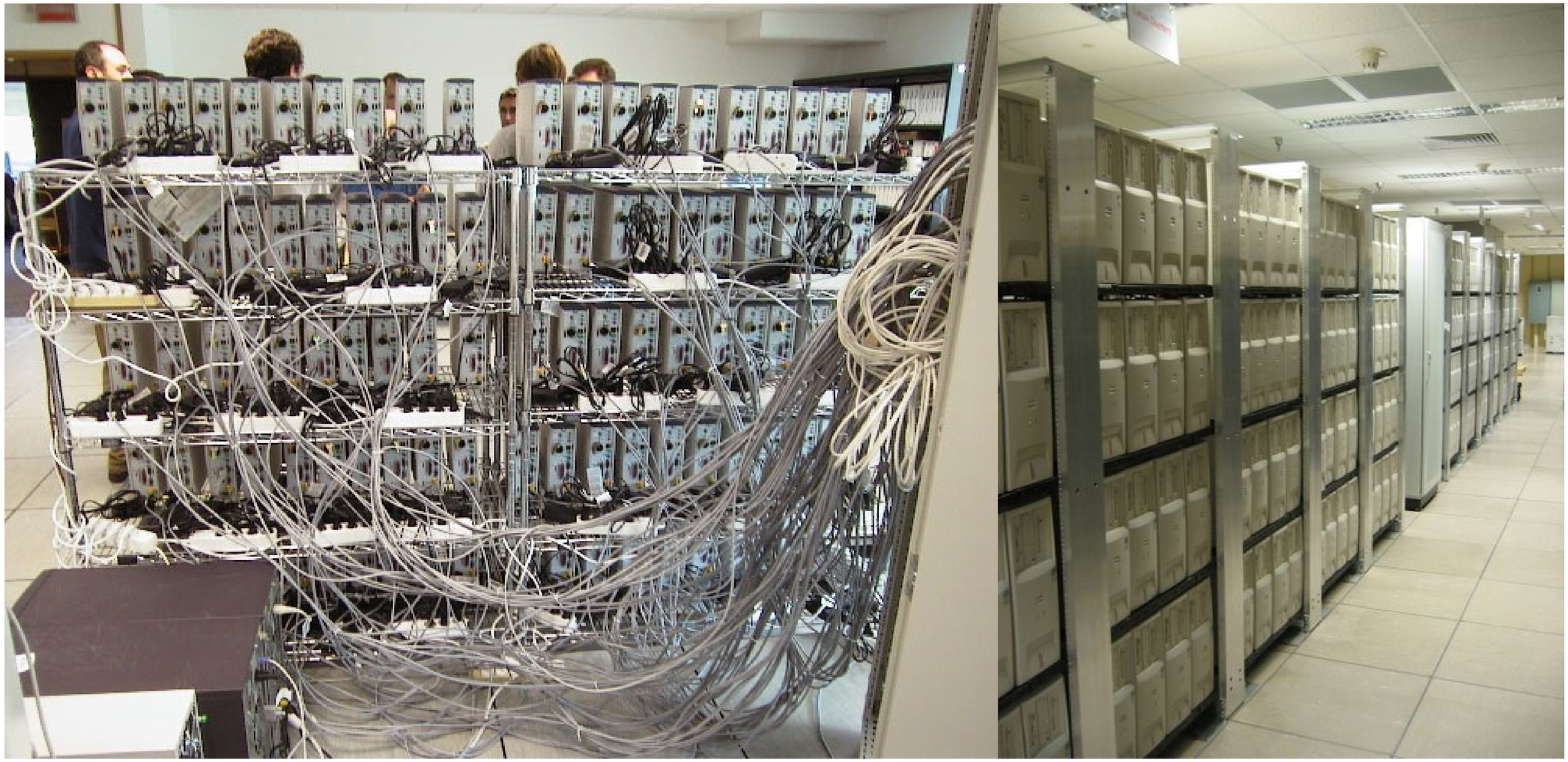
Yandex

Distributed Systems

Unreliable Components



https://www.codeproject.com/Articles/28788/Distributed-Computing-in-Small-and-Medium-Sized-Of?msg=2781776



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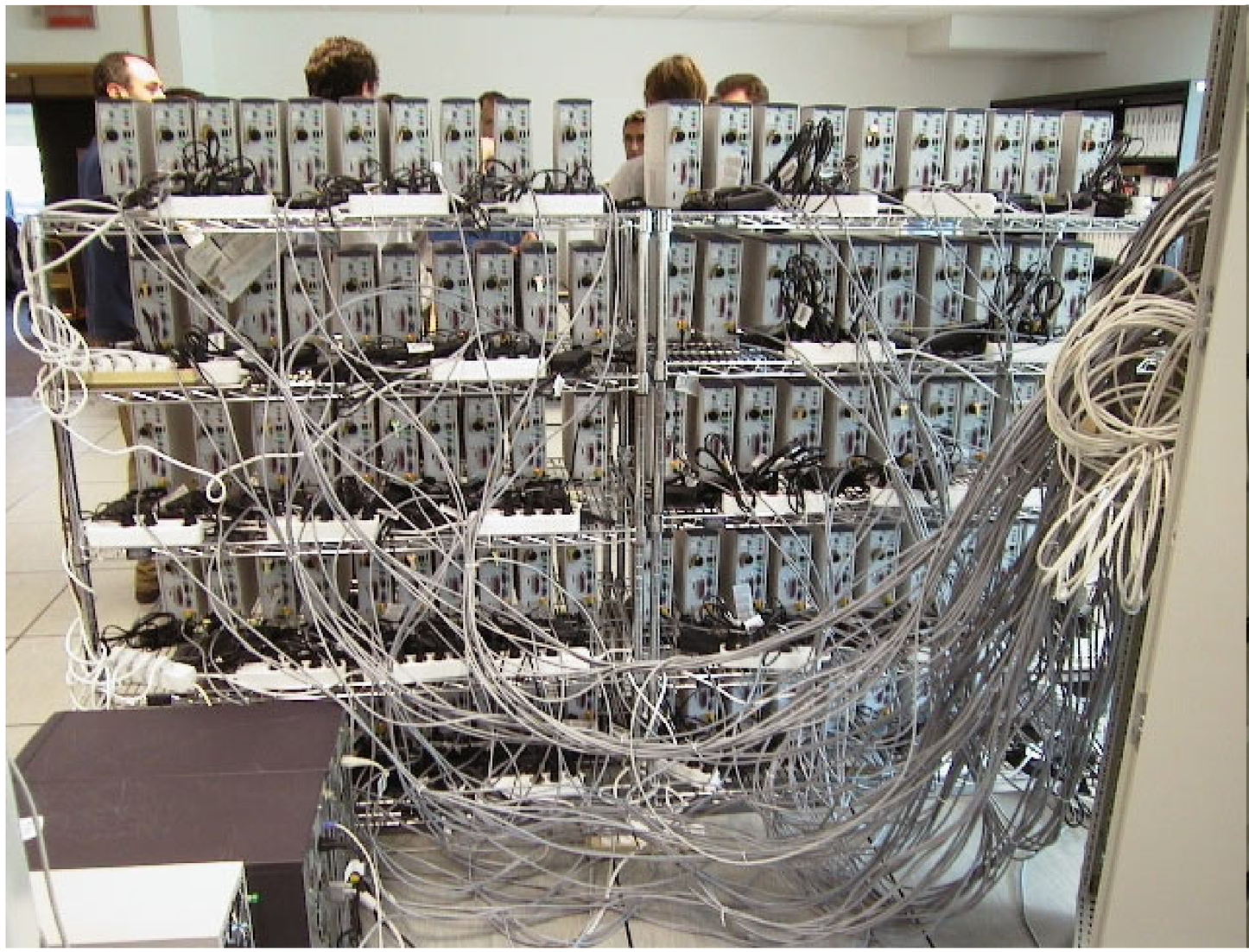

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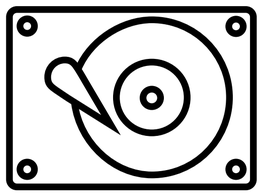
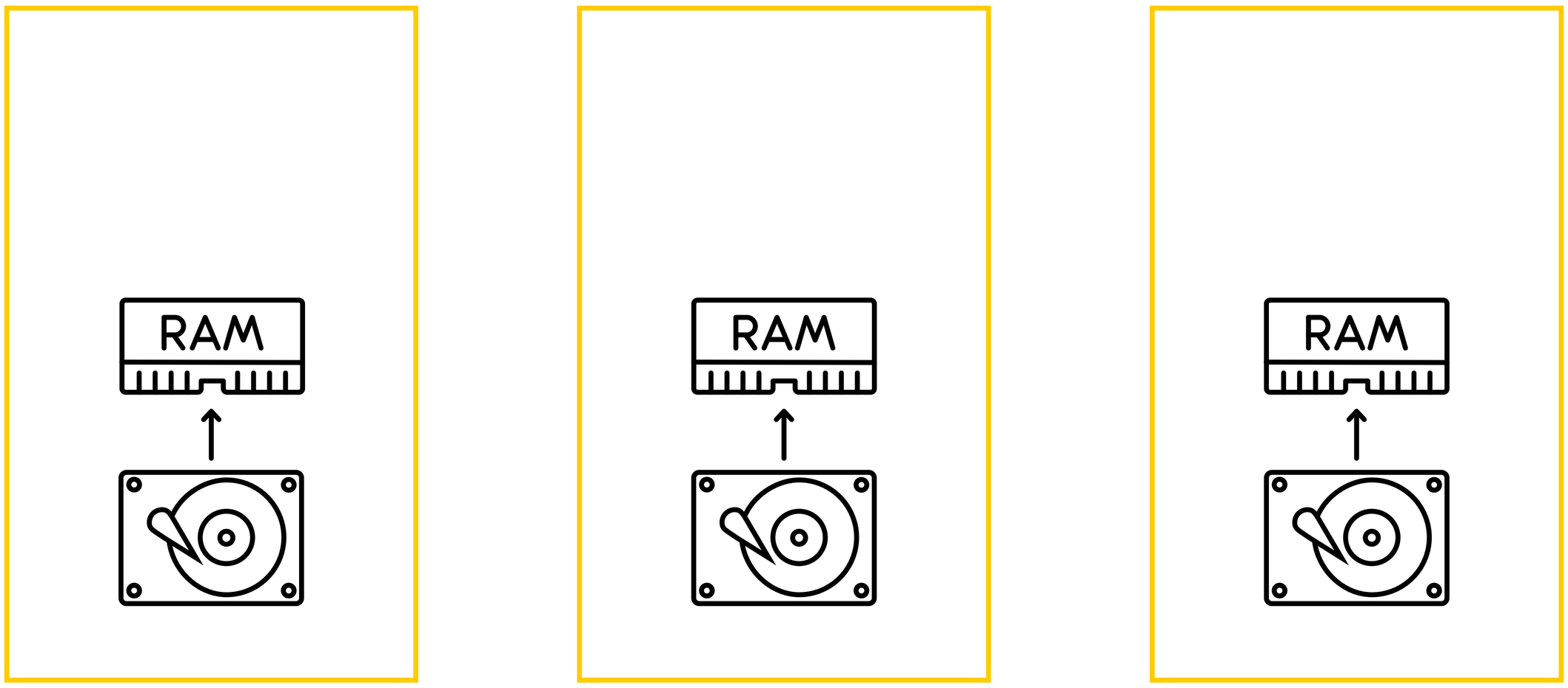
hadoop MapReduce

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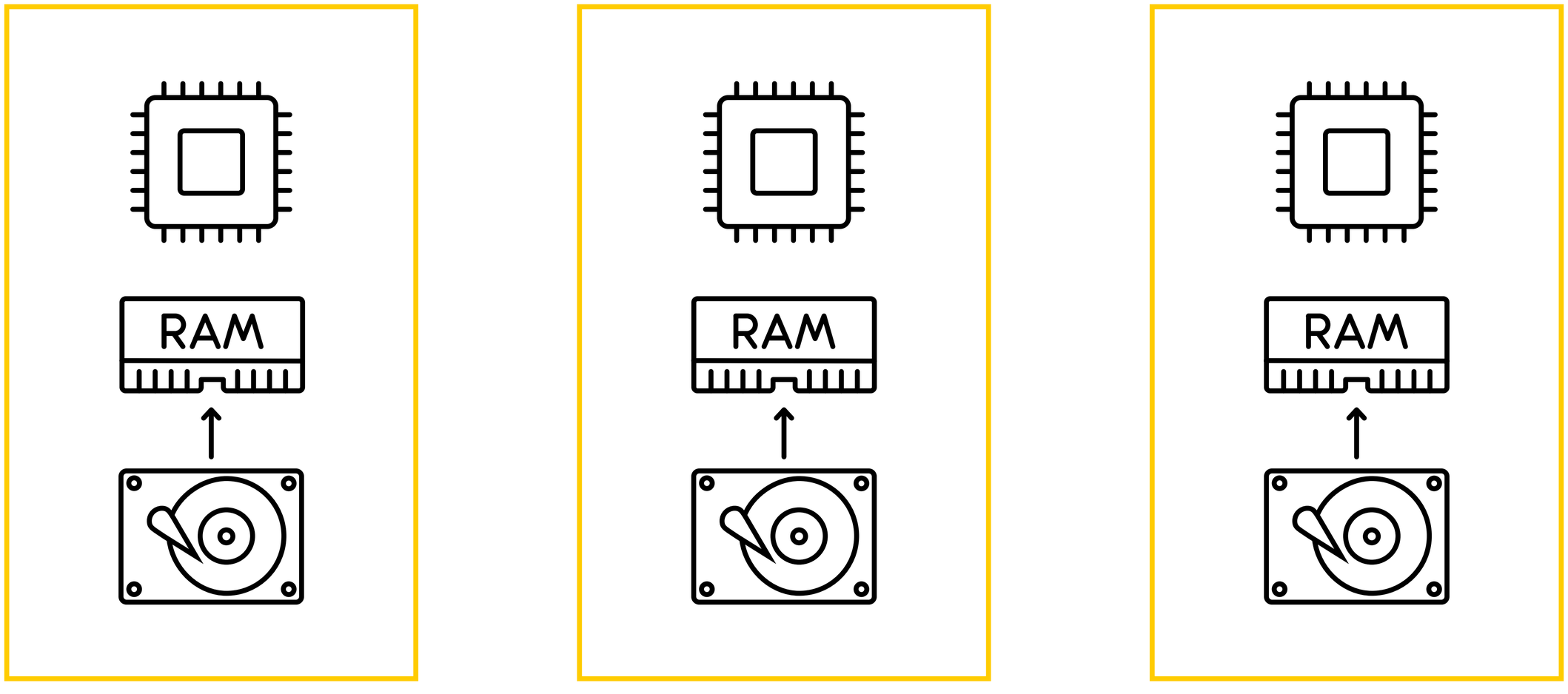
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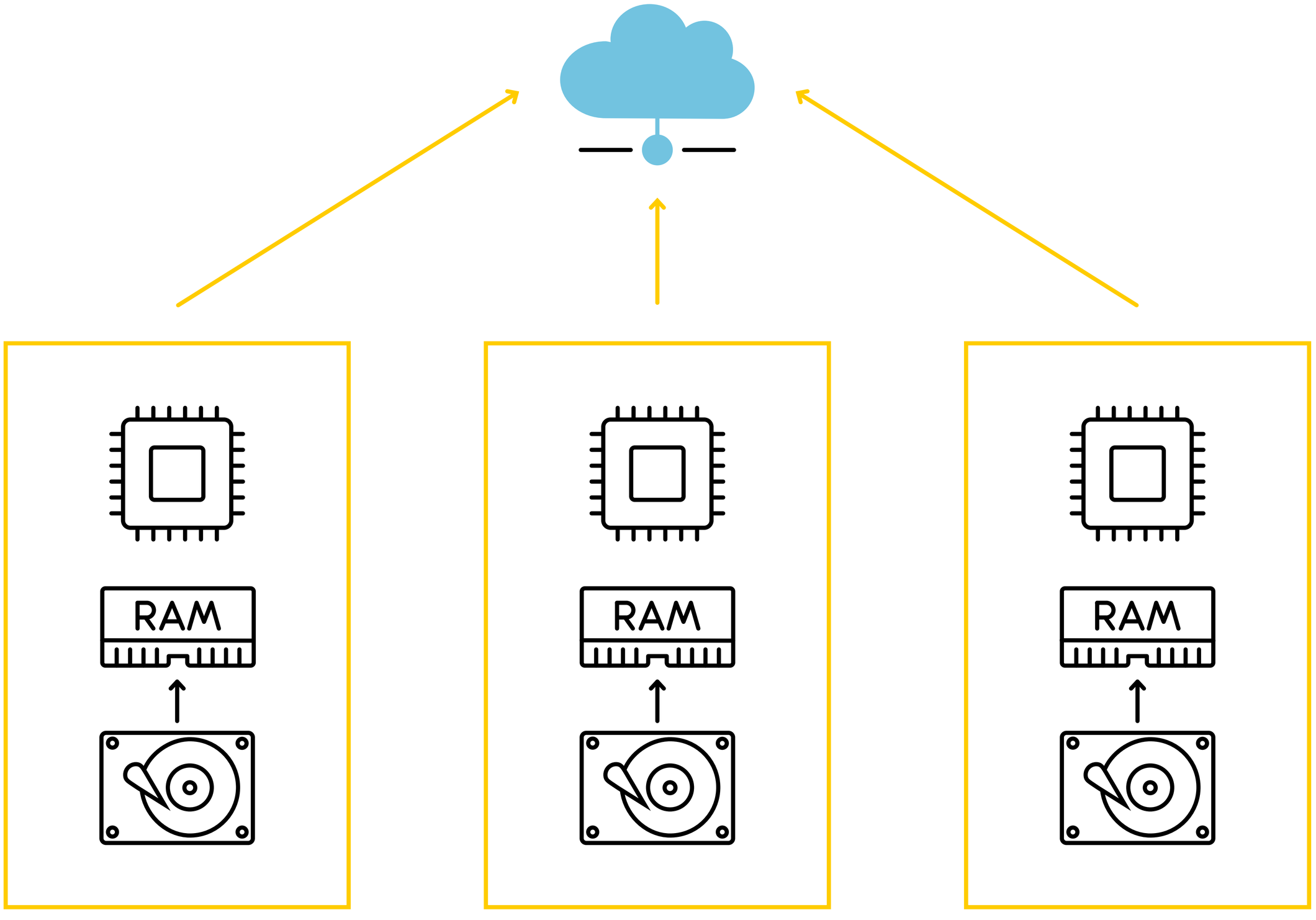
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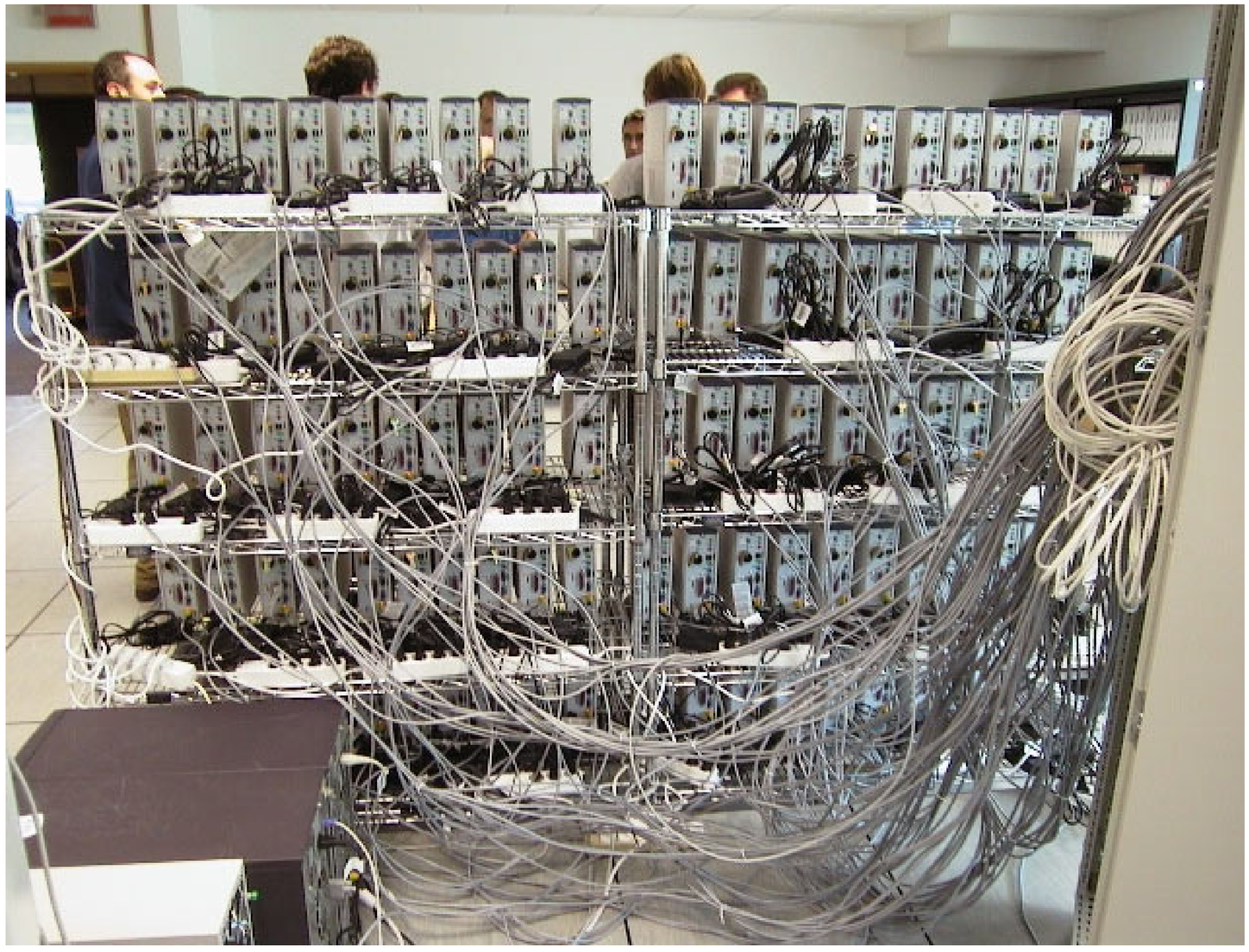
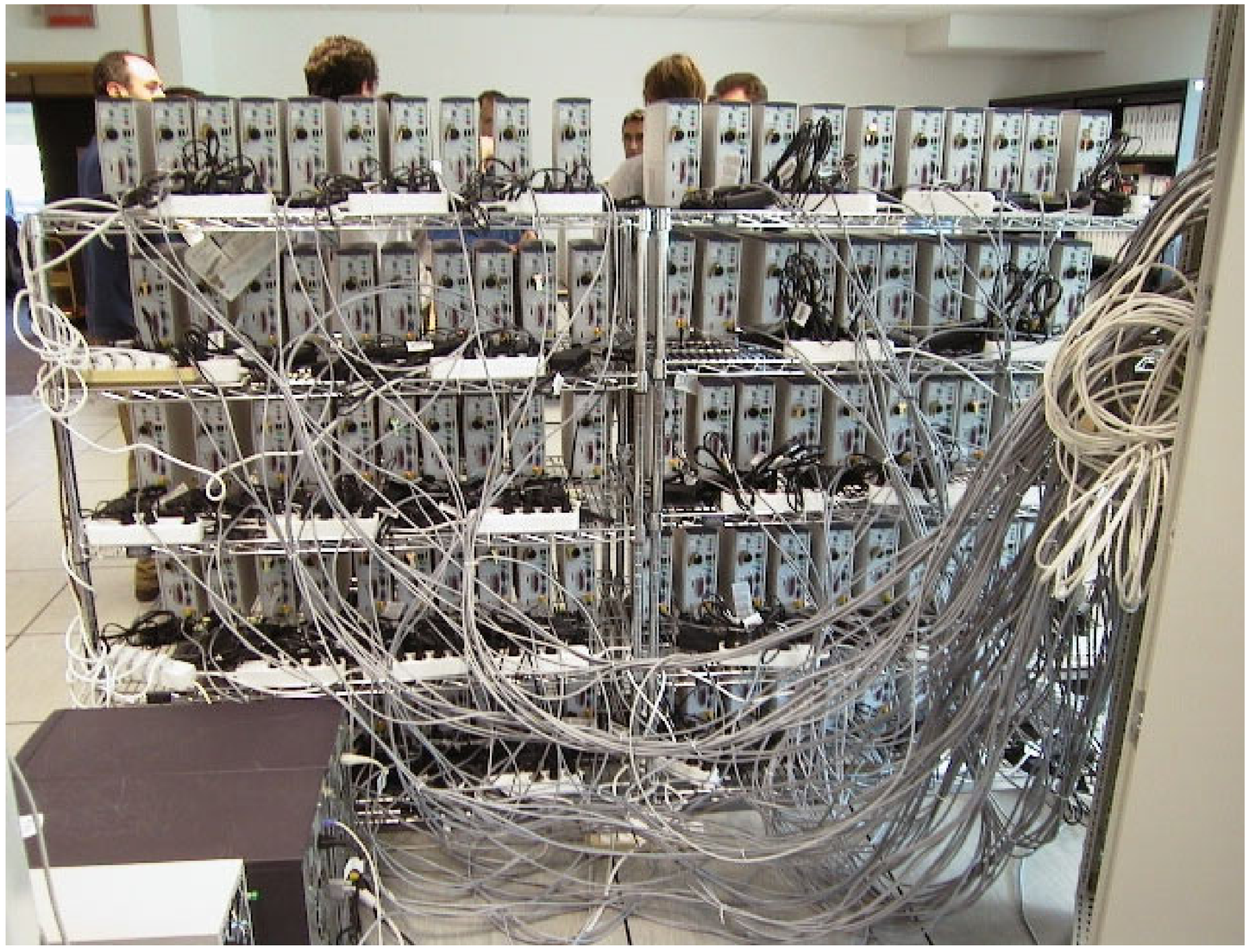
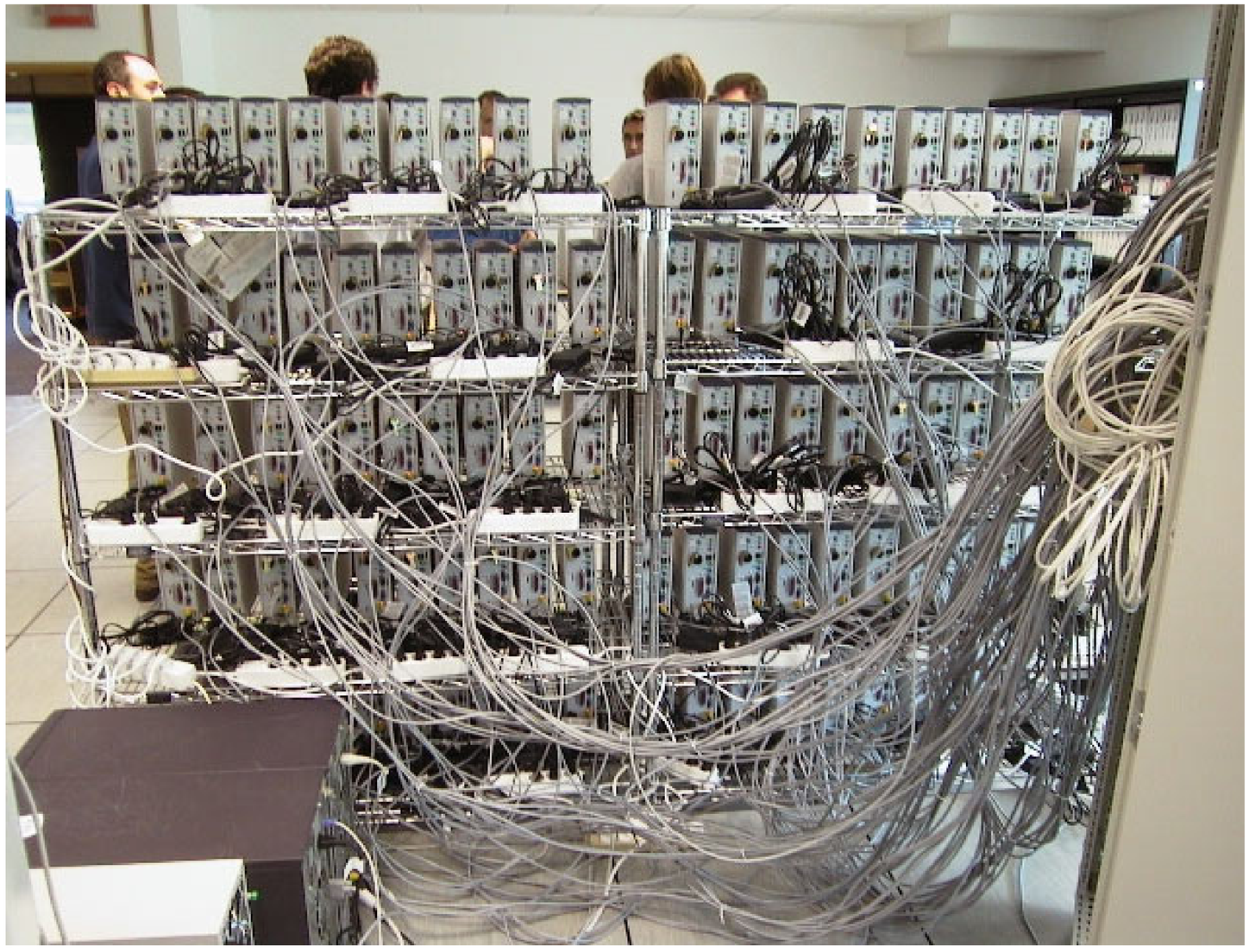


Node Failures:



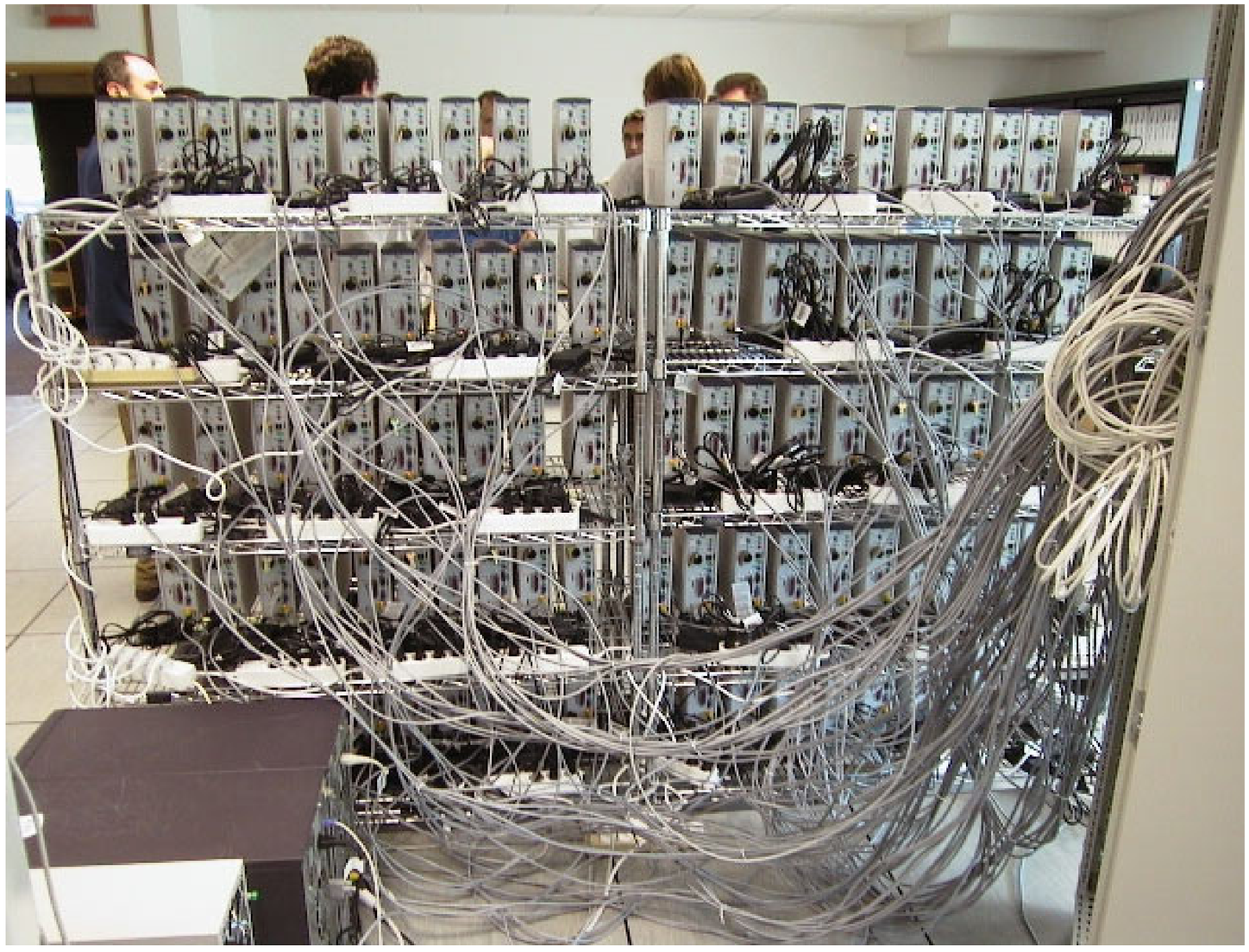
Node Failures:

- Fail-Stop



Node Failures:

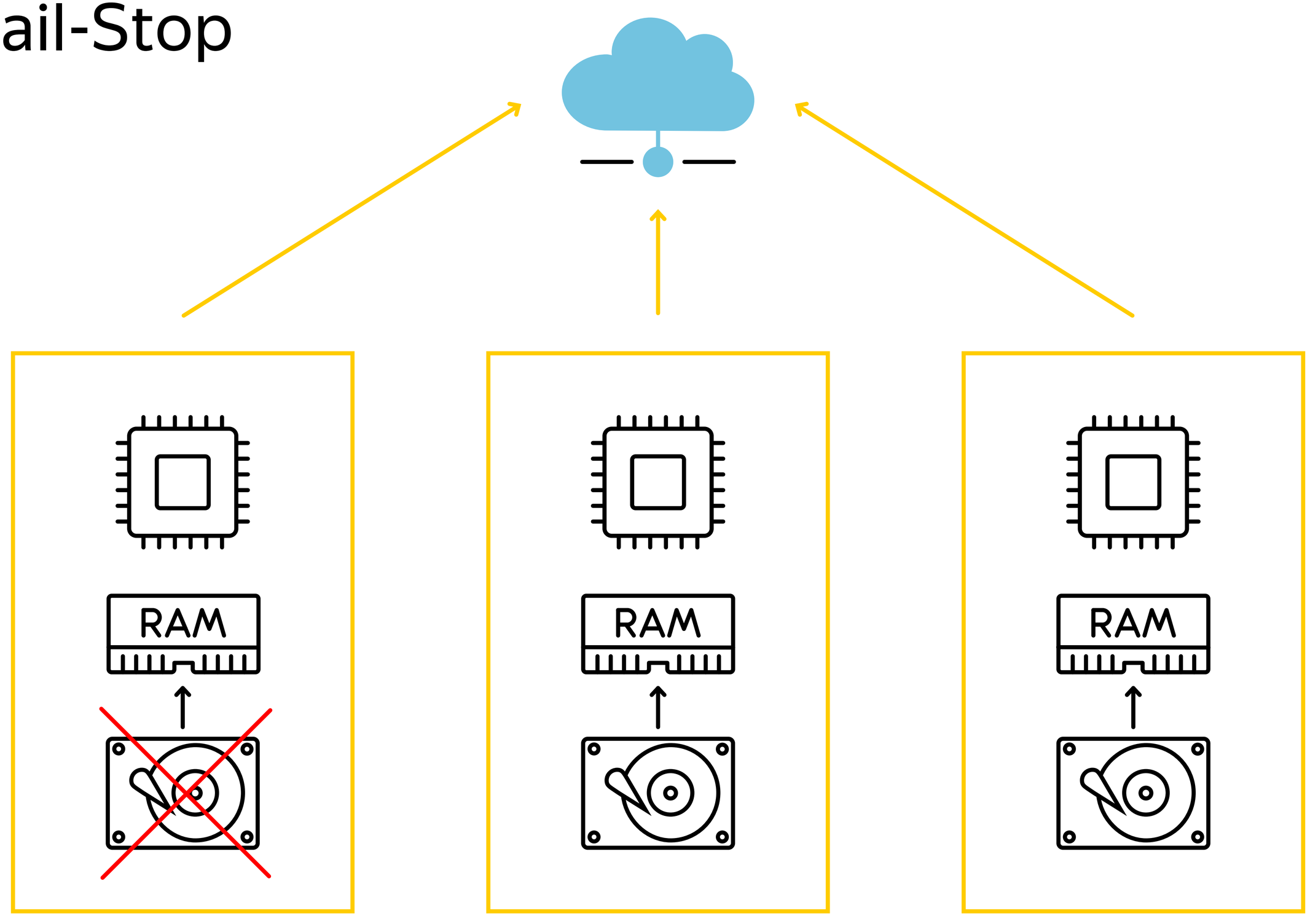
- Fail-Stop
- Fail-Recovery



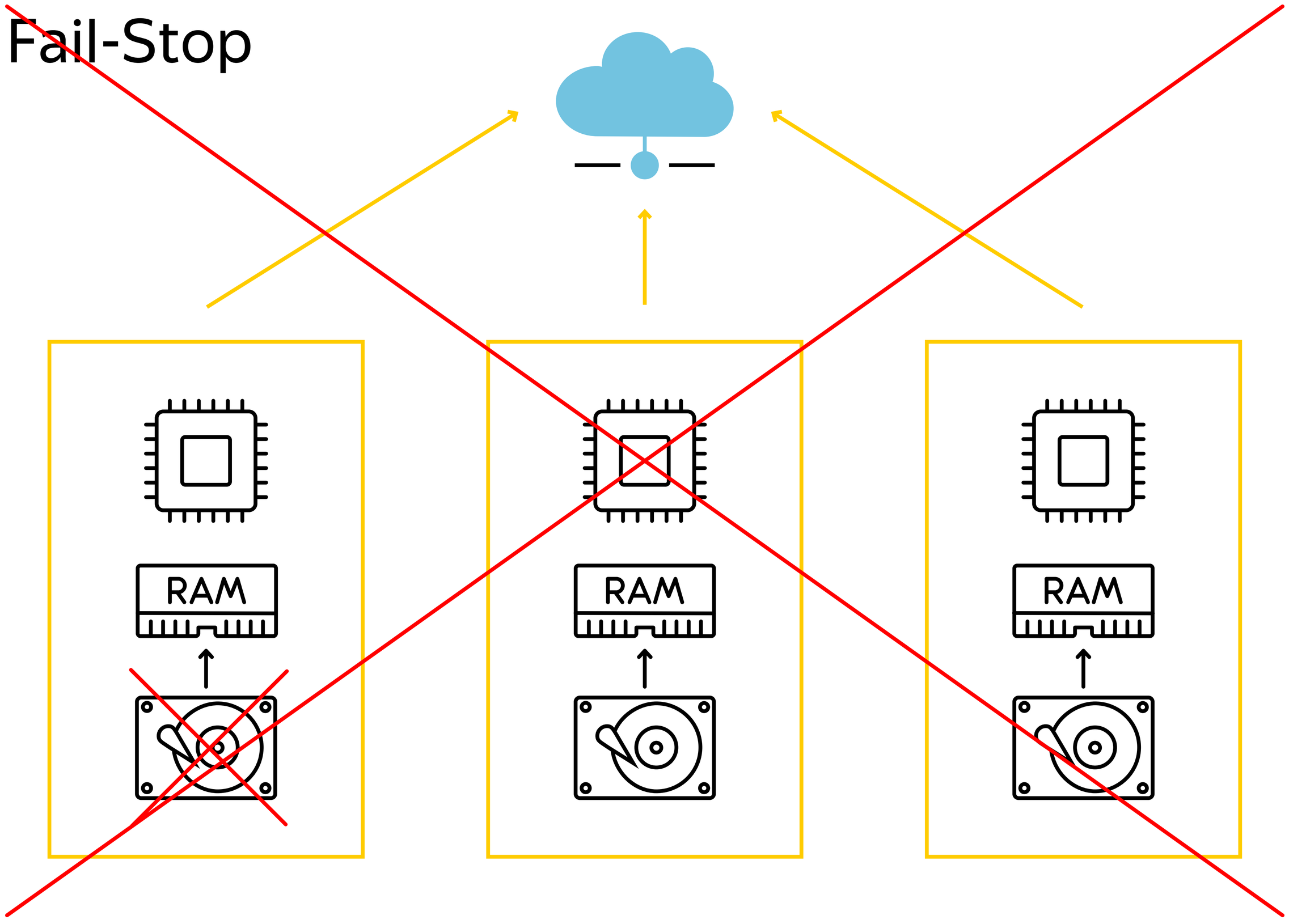
Node Failures:

- Fail-Stop
- Fail-Recovery
- Byzantine

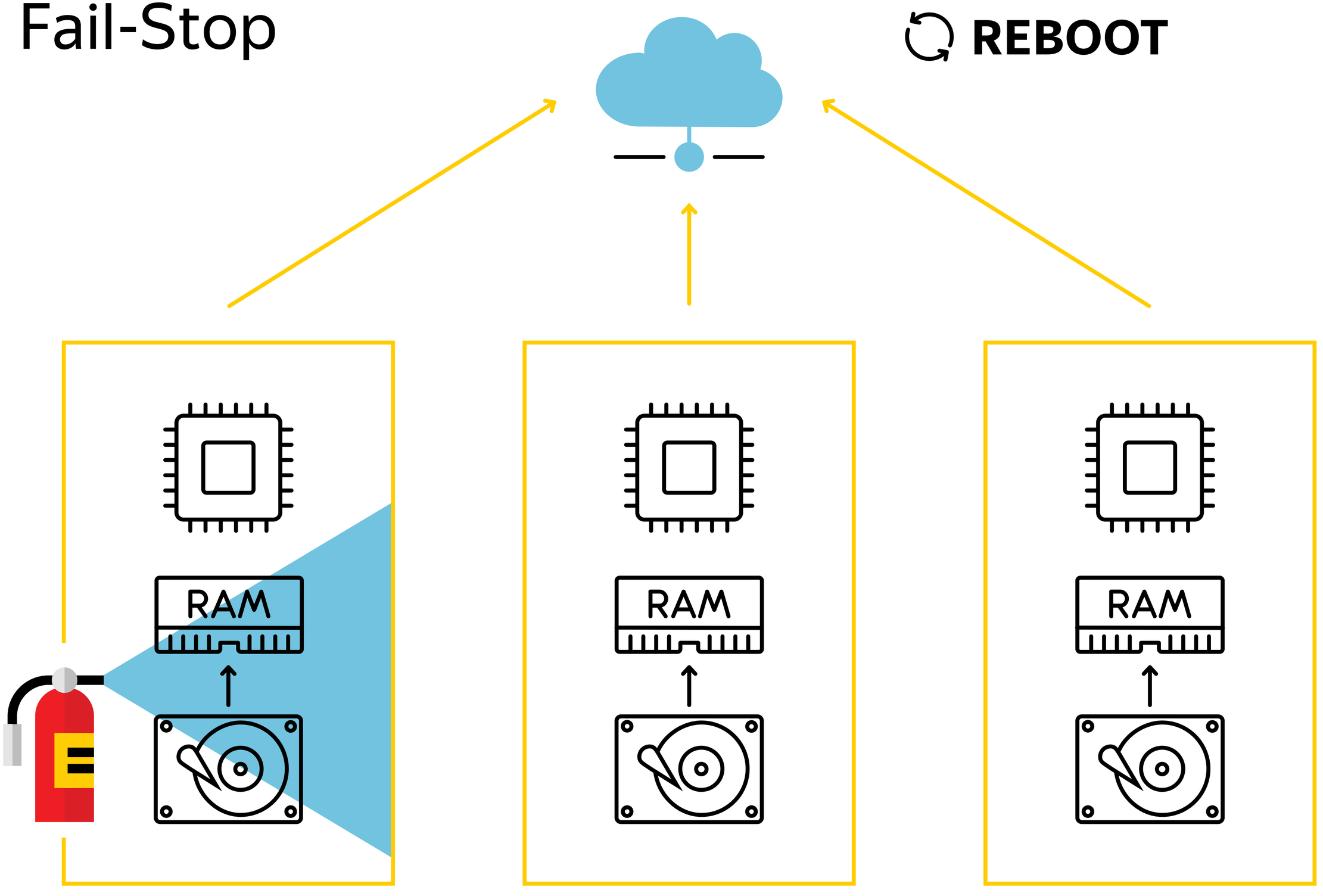
Fail-Stop



Fail-Stop

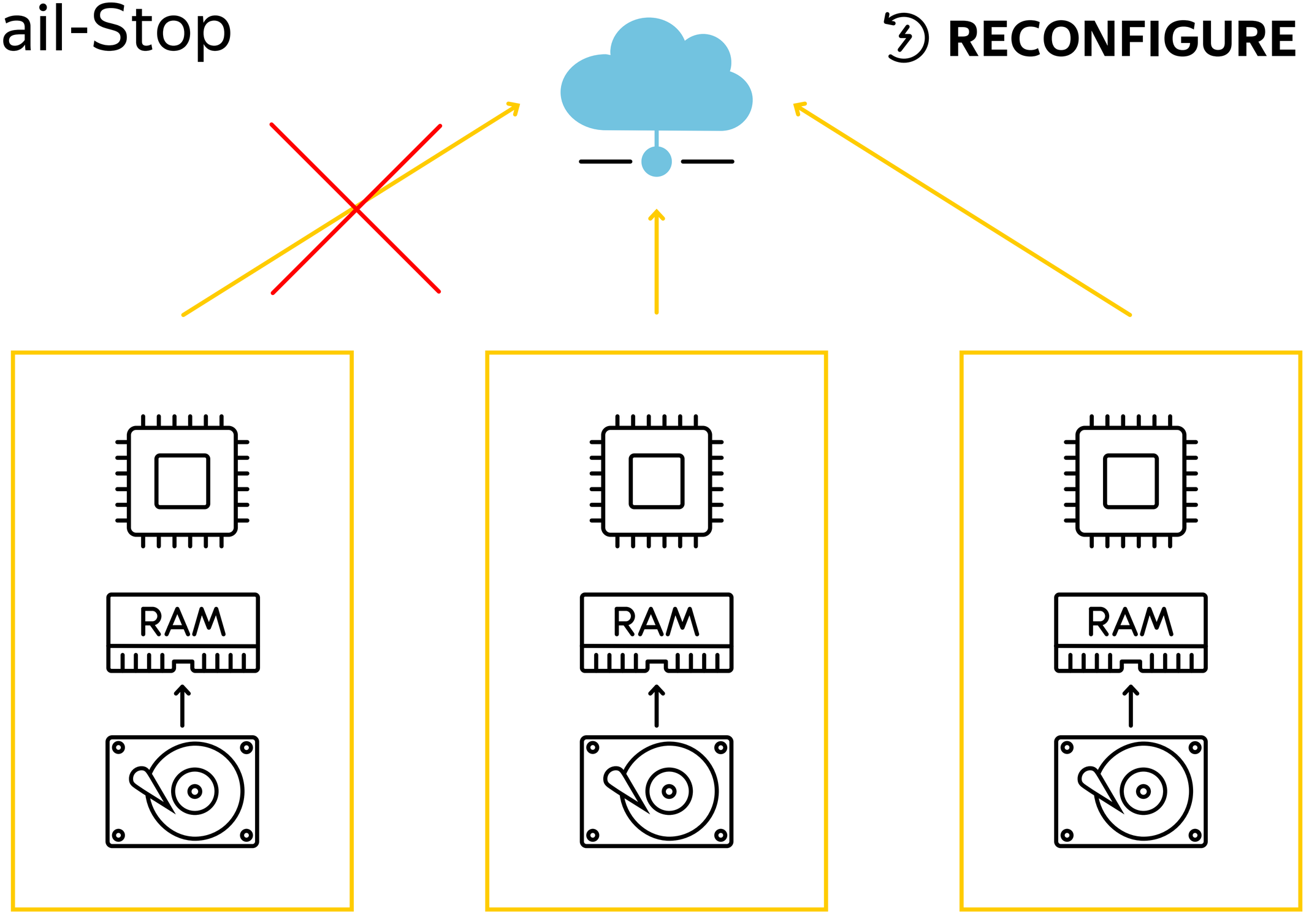


Fail-Stop

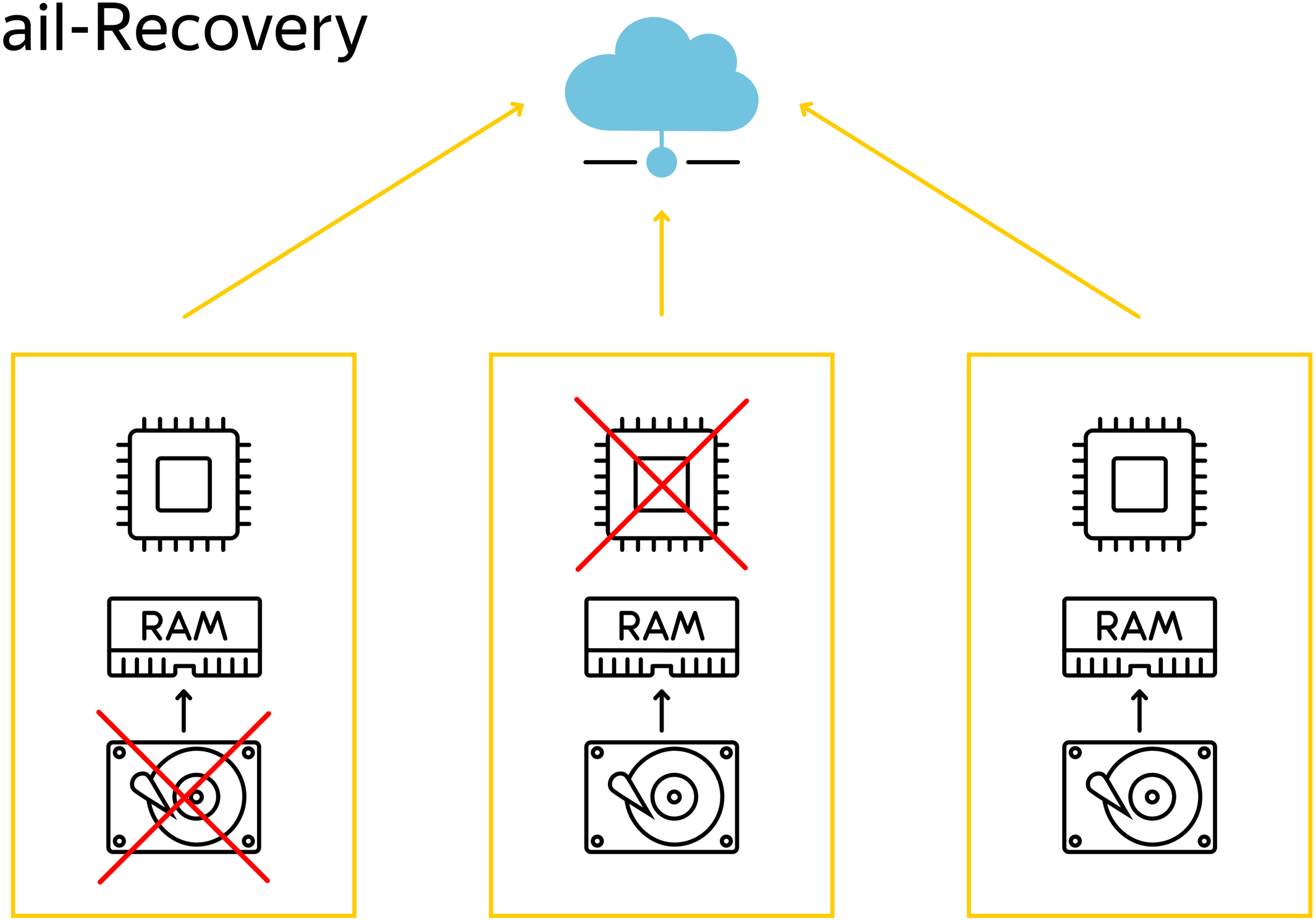


Fail-Stop

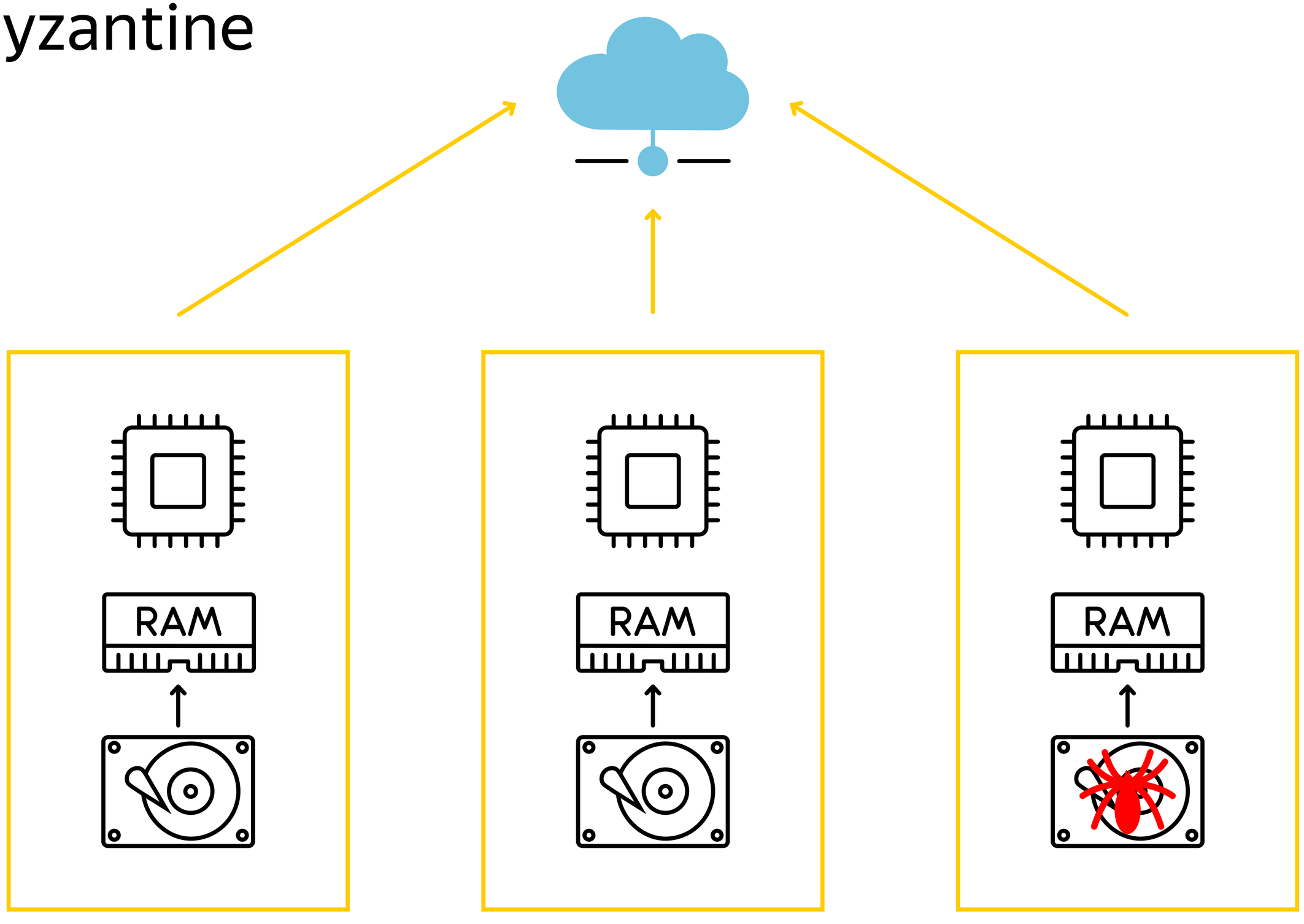
RECONFIGURE



Fail-Recovery



Byzantine



The Byzantine Generals Problem

LESLIE LAMPORT, ROBERT SHOSTAK, and MARSHALL PEASE
SRI International

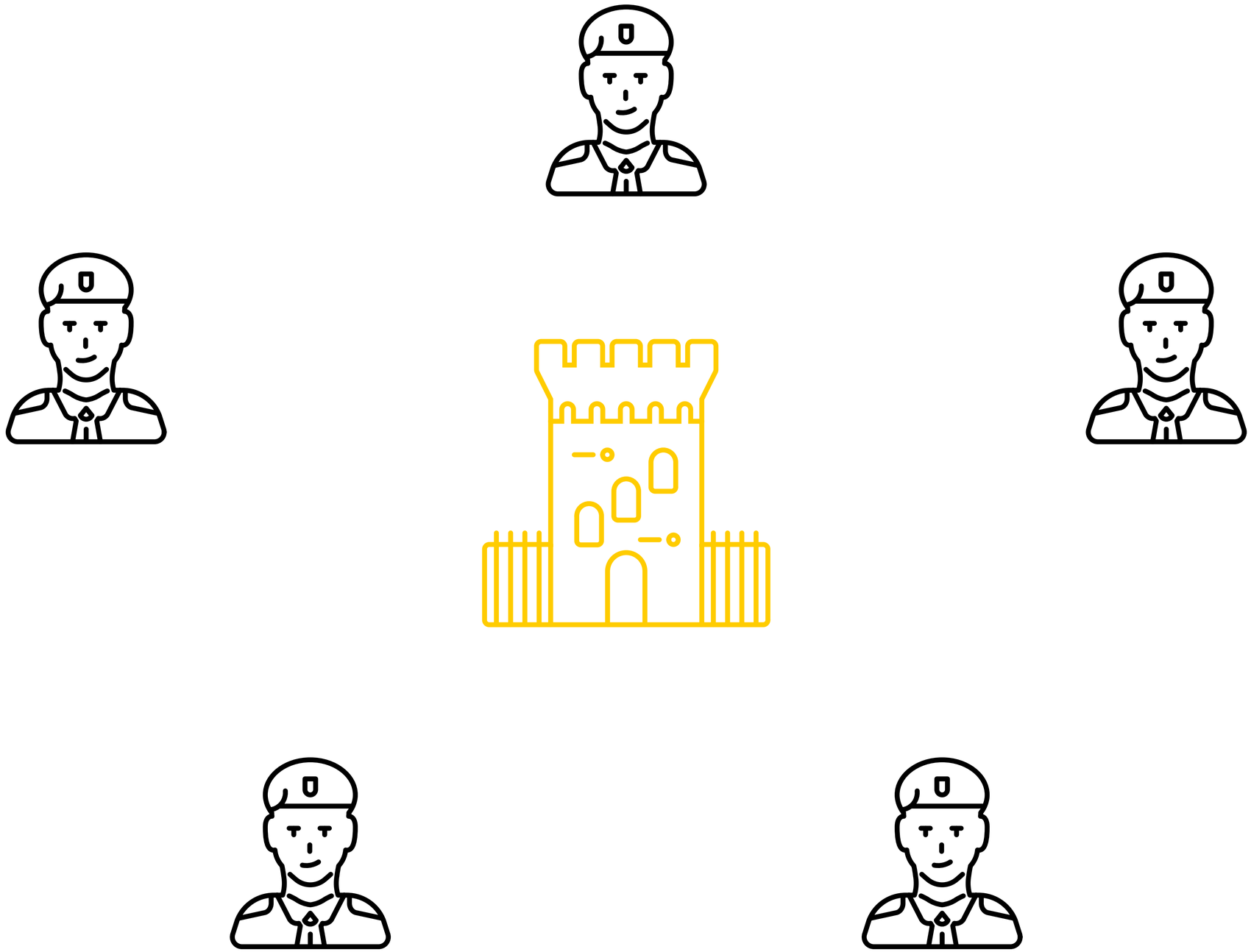
Reliable computer systems must handle malfunctioning components that give conflicting information to different parts of the system. This situation can be expressed abstractly in terms of a group of generals of the Byzantine army camped with their troops around an enemy city. Communicating only by messenger, the generals must agree upon a common battle plan. However, one or more of them may be traitors who will try to confuse the others. The problem is to find an algorithm to ensure that the loyal generals will reach agreement. It is shown that, using only oral messages, this problem is solvable if and only if more than two-thirds of the generals are loyal; so a single traitor can confound two loyal generals. With unforgeable written messages, the problem is solvable for any number of generals and possible traitors. Applications of the solutions to reliable computer systems are then discussed.

Categories and Subject Descriptors: C.2.4. [**Computer-Communication Networks**]: Distributed Systems—*network operating systems*; D.4.4 [**Operating Systems**]: Communications Management—*network communication*; D.4.5 [**Operating Systems**]: Reliability—*fault tolerance*

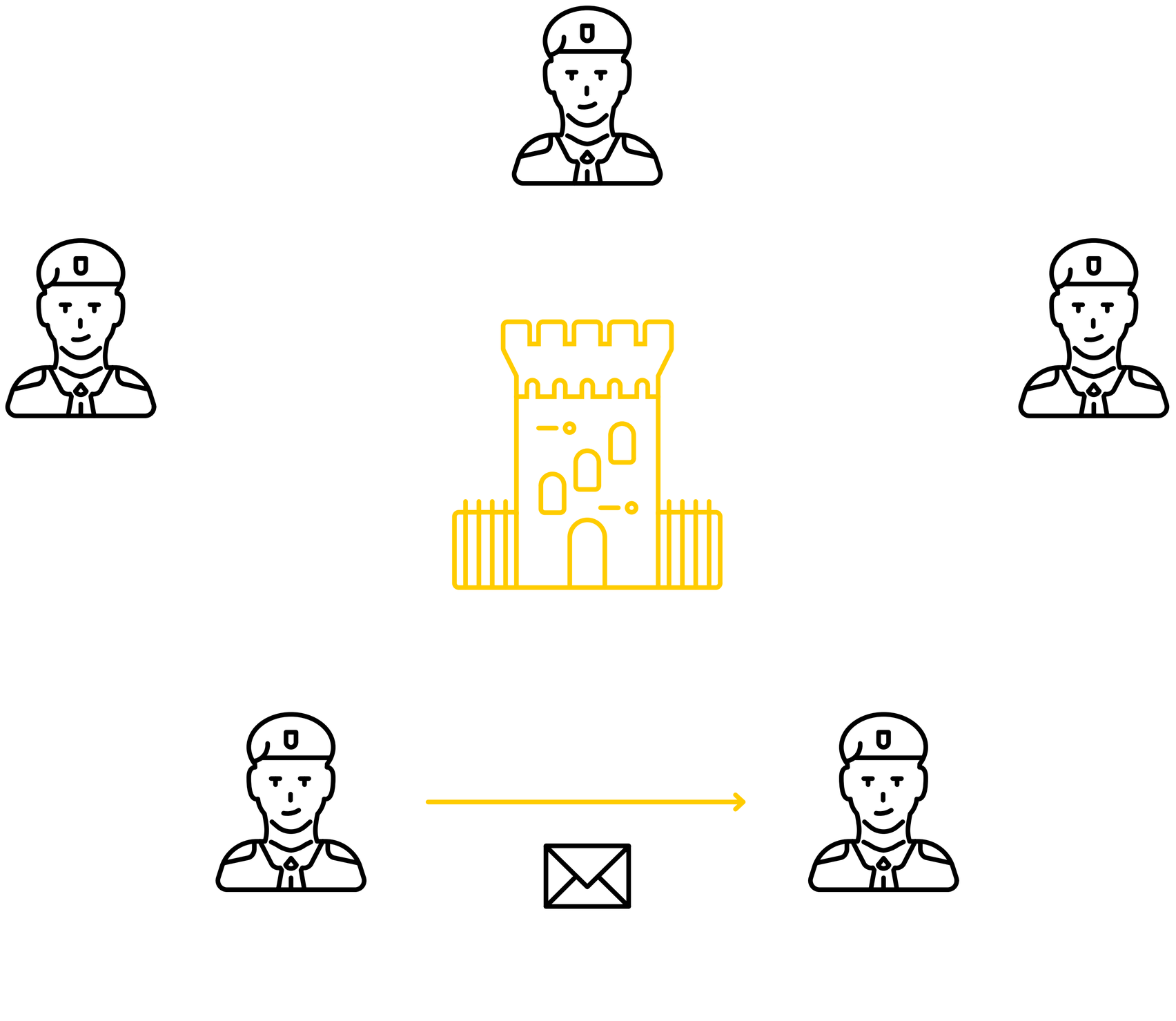
General Terms: Algorithms, Reliability

Additional Key Words and Phrases: Interactive consistency

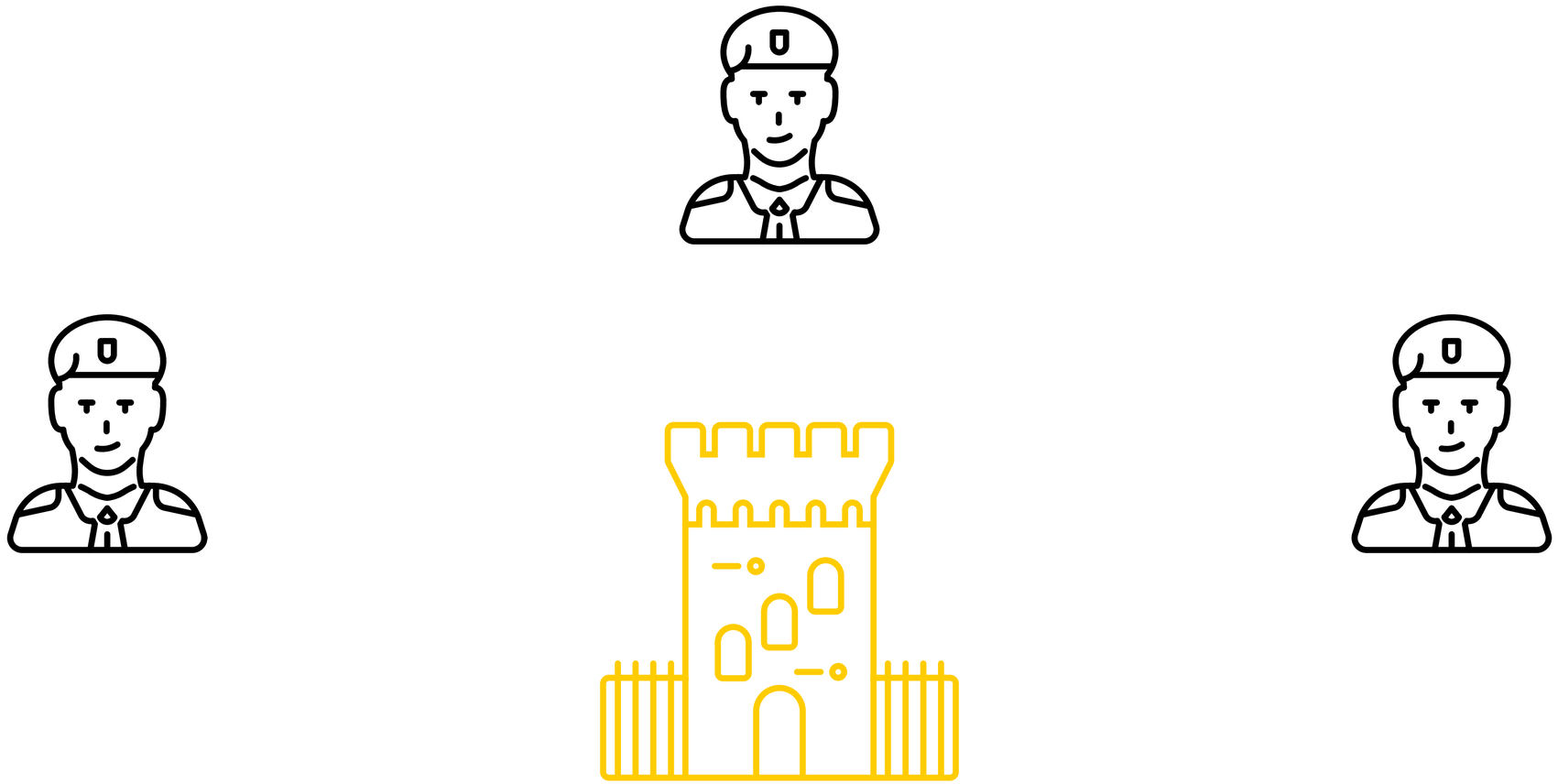
The Byzantine Generals Problem



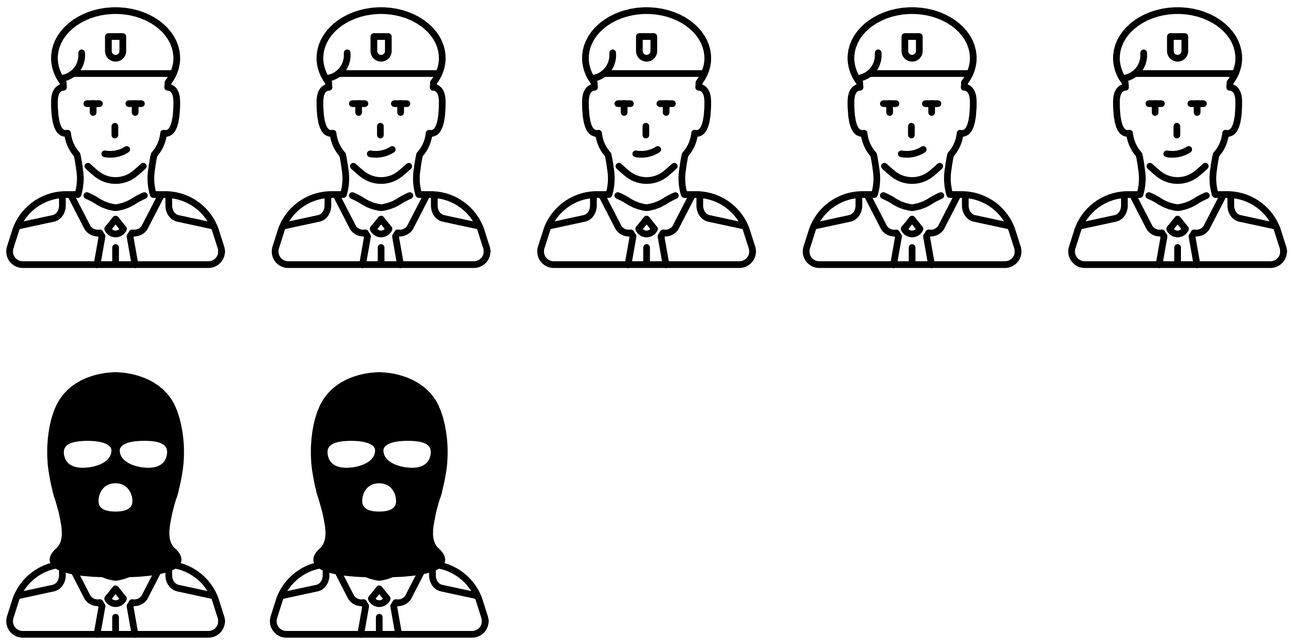
The Byzantine Generals Problem



The Byzantine Generals Problem



The Byzantine Generals Problem



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The Byzantine Generals Problem

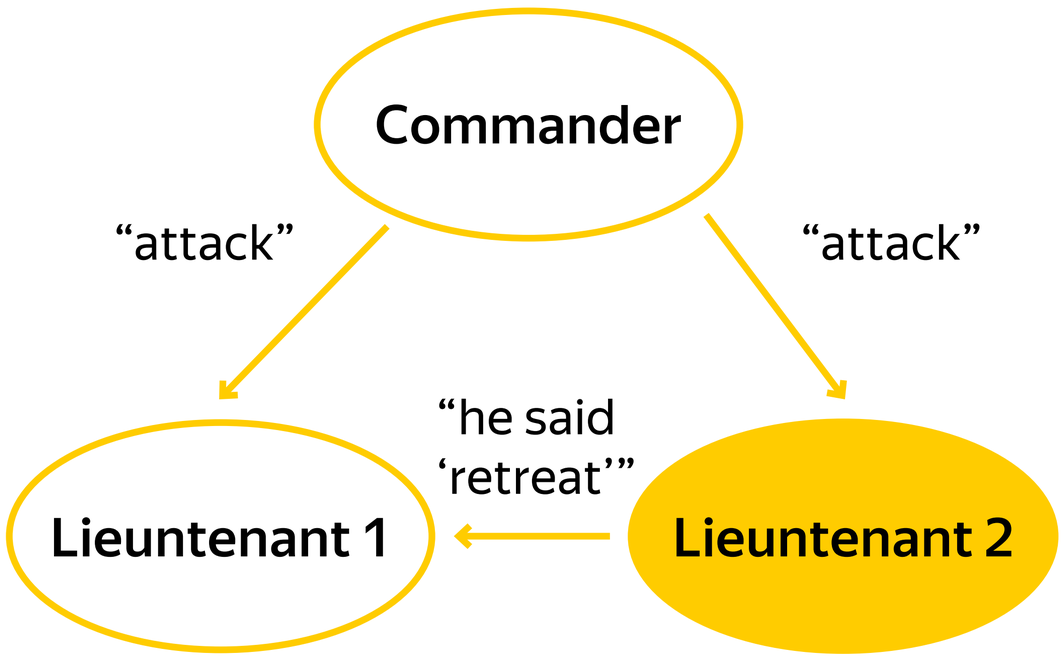


Fig. 1. Lieutenant 2 a traitor.

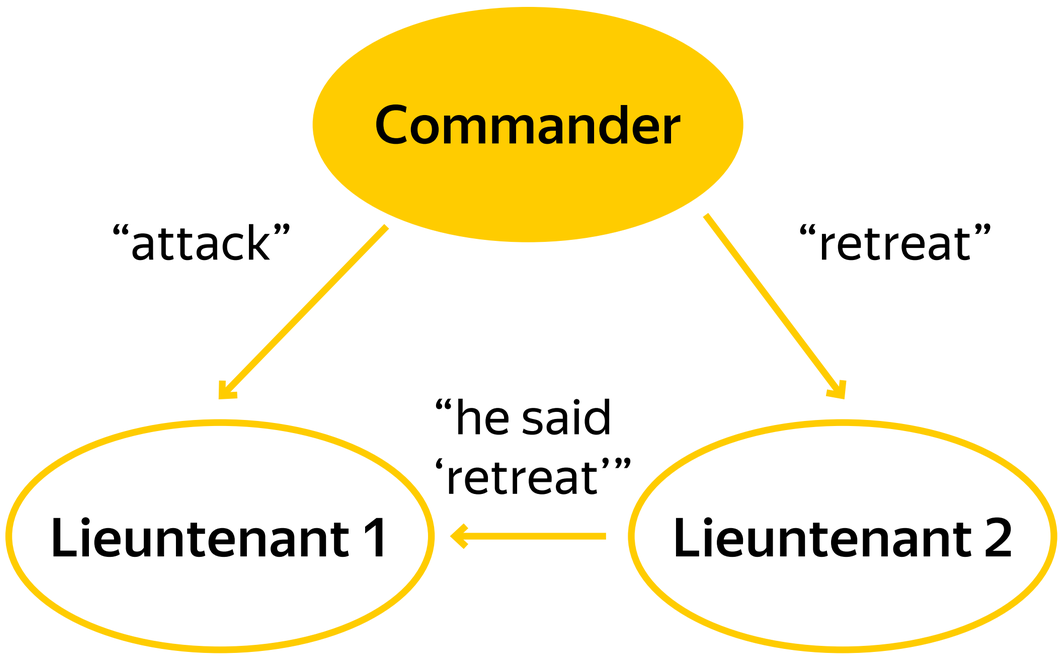
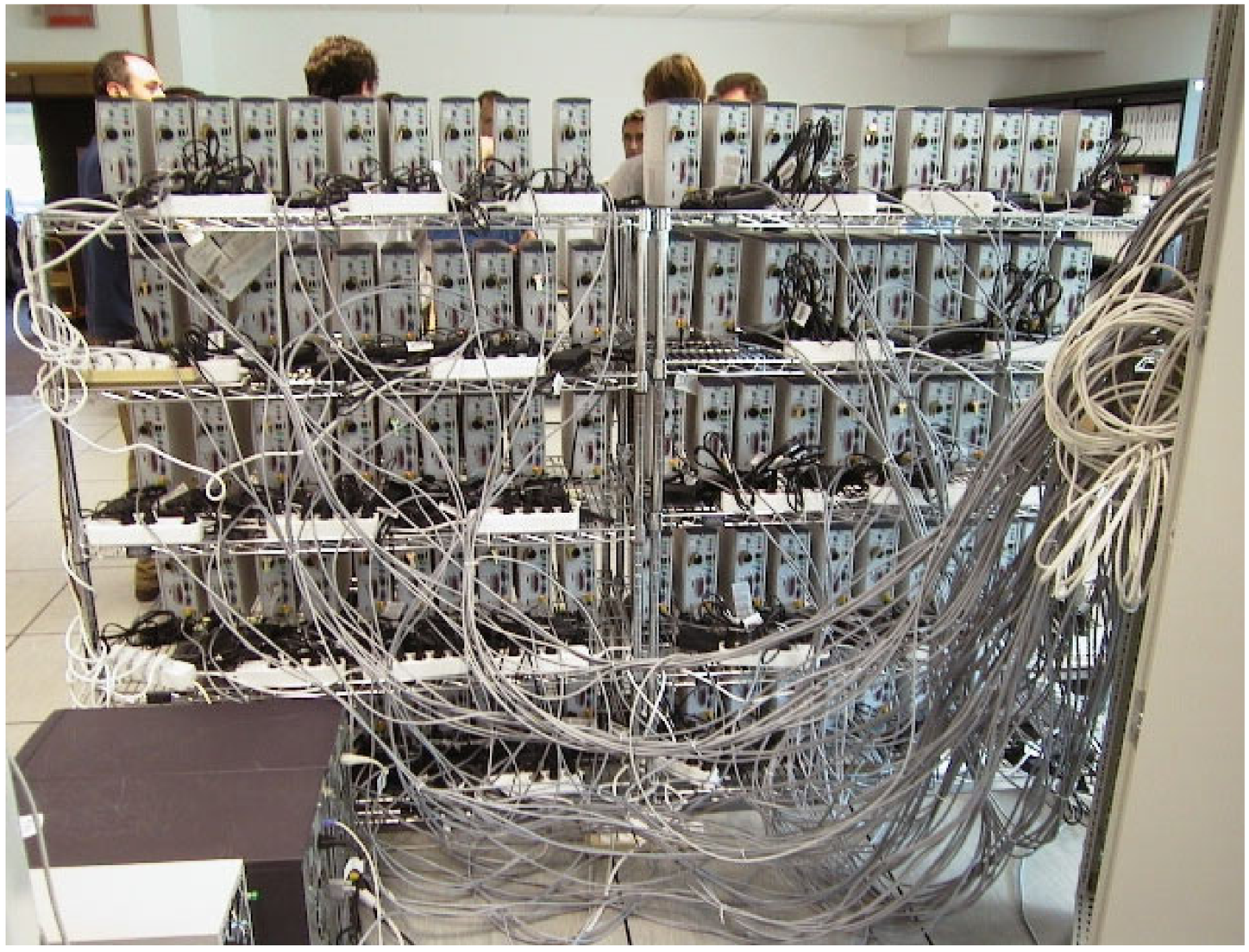


Fig. 2. The commander a traitor.



Node Failures:

- Fail-Stop
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BigDATAteam