# CAP Theorem

In this lesson, you will learn about the CAP theorem.

**We'll cover the following**

- What is the CAP theorem?

# What is the CAP theorem?#

*CAP* stands for **consistency**, **availability**, **partition tolerance**. We've gone through consistency and availability in great detail. *Partition tolerance* means *fault tolerance*, how tolerant the system is of failures or partitions. It keeps working even if a few nodes go down.

You will find many definitions of the theorem online. The assert that amongst the three, *consistency*, *availability* and *partition tolerance*, we have to pick two. I find this a teeny tiny bit confusing, so I will try to explain the theorem more simply.

> *The CAP theorem* simply states that in case of a network failure, when a few of the nodes of the system are down, we have to make a choice between *availability* and *consistency*

If we pick *availability*, this means when a few nodes go down, the other nodes are available to the users for making updates. In this situation, the system is inconsistent because the nodes that are down don't get updated with the new data. When they come back online, if a user fetches the data from them, they'll return the old values they had when they went down

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If we pick *consistency*, in this scenario, we have to lock down all the nodes for further writes until the nodes that have gone down come back online. This ensures the *strong consistency* of the system because all the nodes will have the same entity values.

Picking between *availability* and *consistency* largely depends on our use case and the business requirements. We have been through this in great detail. Also, the design of the distributed systems forces us to choose one. We can't have both *availability* and *consistency* at the same time.

Nodes spread around the globe will take some time to reach a consensus. It's impossible to have zero-latency unless we transit data faster than or at the speed of time.

> P.S. It's the speed of time, not the speed of light. Speed of light does not have zero latency, and it does take some time to travel from one point to the other.

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Strong Consistency

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