Hidden CAP present in your E-Wallets that FinTech companies don't tell you

Have you ever tried using your e-wallet at a coffee shop, only to find that it suddenly doesn't work due to a network issue? This often forces you to use a card or cash instead. But did you know that this inconvenience is actually related to maintaining the consistency of your account, the security of the system, and the trust you place in your e-wallet? This can be explained by the CAP theorem, a principle in distributed systems that highlights the trade-offs between three key elements: Consistency (C), Availability (A), and Partition Tolerance (P)[1].

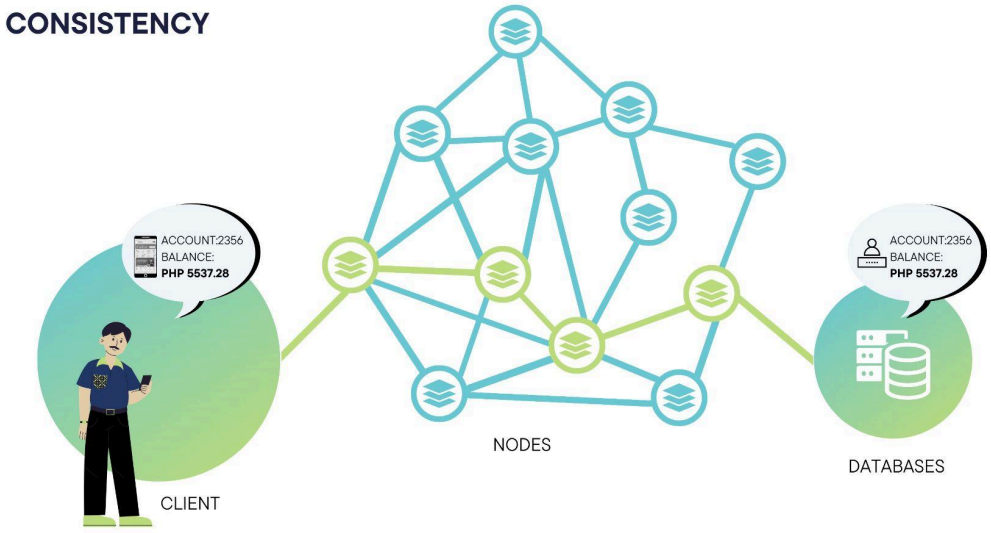

Figure 1. *Sample distributing system highlighting Consistency in CAP Theorem*

Consistency means that all parts of the system reflect the same data at the same time. For instance, when you check your e-wallet, it should show the most recent transaction details [2]. Figure 1 illustrates how consistency ensures that your transaction data is synchronized across all parts of the e-wallet system.

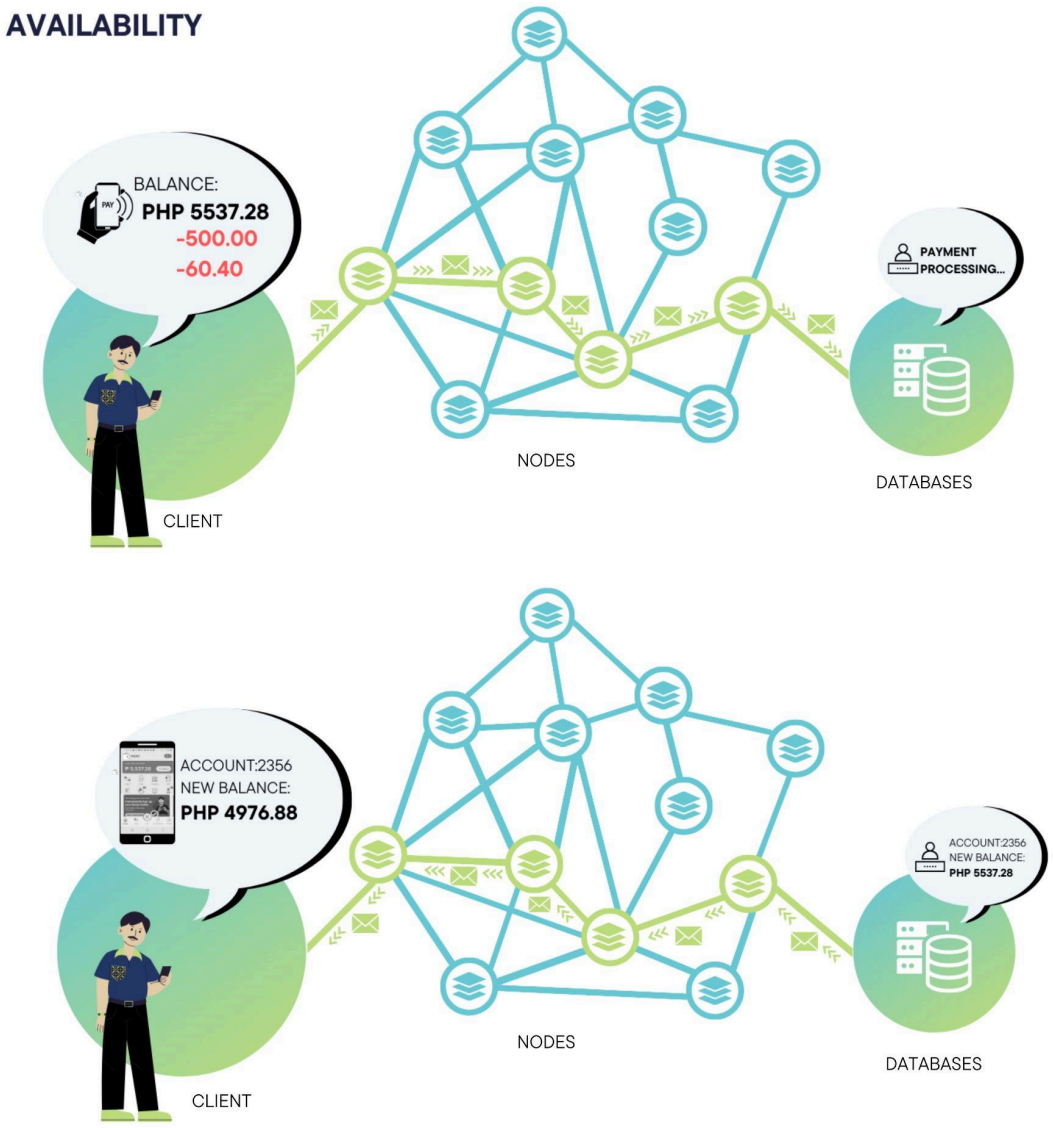

Figure 2. *Sample distributing system highlighting Availability in CAP Theorem*

Availability ensures that the system responds to your requests, such as balance updates or transaction processing, even if there are delays [2]. Figure 2 shows how the system processes your requests and provides a response, even under stress or delays.

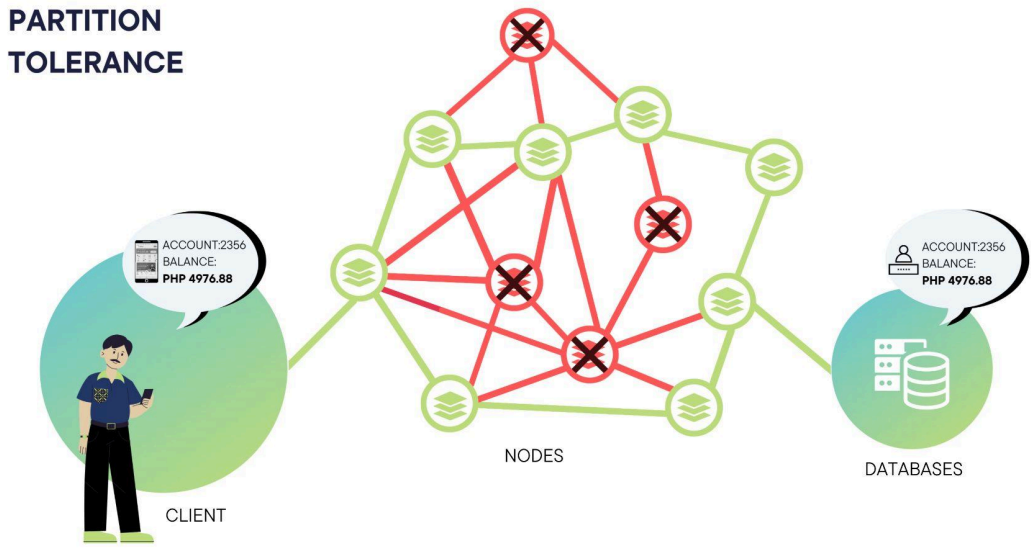

Figure 3. *Sample distributing system highlighting Partition Tolerance in CAP Theorem*

Partition Tolerance means the system continues to operate despite network issues [2]. Figure 3 demonstrates how the e-wallet maintains connectivity with the main server and keeps functioning even during network problems.

According to the CAP theorem, during network partitions, a system must choose between consistency and availability [3]. If a system prioritizes availability, it might display your balance but prevent transactions like withdrawals or transfers until the network issue is resolved. This approach helps maintain data integrity and prevent errors. As the network recovers, the system ensures that discrepancies between your wallet and the database are minimized.

E-wallets often prioritize consistency to ensure transaction integrity and prevent financial losses. By focusing on consistency, every transaction is accurately reflected, which helps avoid issues like duplicate transactions or errors that could lead to financial discrepancies. This emphasis on consistency ensures that your transaction history remains reliable and up-to-date, preventing potential losses or disputes.

On the other hand, banks prioritize keeping services like ATMs and online banking operational at all times. Their goal is to ensure these services are always accessible, even if there are delays in processing transactions. To achieve this, banks commonly use batch processing, which groups transactions and processes them at scheduled times. This approach

ensures that user requests are handled and services remain available, even with system delays. Transactions are processed promptly, with account consistency updated afterward, reducing service interruptions and maintaining user trust.

In summary, the aspect of the CAP theorem a distribution system prioritizes depends on factors such as user experience, data consistency, and regulatory requirements. Solutions include adaptive systems that adjust to current needs, eventual consistency models that allow delays in data synchronization, and multi-region deployment to reduce failure risks and improve redundancy. Ultimately, the system's focus determines which CAP aspect is prioritized.

For those interested in a deeper dive into the CAP theorem and its applications, you can explore the links and references to technical papers, articles, and books provided below for further reading. Additionally, consider examining how the CAP theorem relates to recent distributed system issues, such as the Microsoft outage in July 2024, or META’s server issues from May 2024. These real-world examples can offer valuable insights into how different systems manage the trade-offs between consistency, availability, and partition tolerance.

REFERENCES:

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