Problems of CAP theorem proof and connection to PACELC taxonomy

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Abstract

Brewer's Conjecture, also known as *CAP theorem,* says that it is impossible for a web service to provide the following three guarantees: **C**onsistency, **A**vailability and **P**artition-Tolerance. A so called "*Strong CAP principle*" then says that only two out of the three properties of a distributed system (consistency, availability, partition-tolerance) can be achieved at the same time. Although there was given a proof of *Brewer's Conjecture,* it seems that this model is not complete and not as useful as was thought. Critics of the CAP theorem and of the strong CAP principle say that the proof is misunderstood and that problem of partition-tolerance is not addressed correctly. A *PACELC taxonomy,* on the other hand, brings more "real world" point of view on what is possible to achieve by using distributed systems when a *latency* is added to already mentioned guarantees (consistency, availability and partition-tolerance). Simultaneously it shows that the *strong CAP principle* could be misleading.

This work summarizes a knowledge about the CAP theorem and shows controversial parts of the Brewer's Conjecture's proof. It is pointed out that in terms of *strong CAP principle* combinations of consistency/partition-tolerance (CP) and consistency/availability (CA) result in systems with almost the same behavior in case of network partition appearance. This finally leads to an idea that the partition-tolerance is more important guarantee than the other two from CAP. The second part of the work deals with so called *PACELC taxonomy,* which is introduced and described. Finally the obscurity of the PC/EL (in terms of PACELC taxonomy) is reviewed.

The work gives some basic view on CAP theorem and PACELC taxonomy while showing the most discussed problems of these topics. Conclusion brings some questions about meaning of consistency and partition-tolerance.