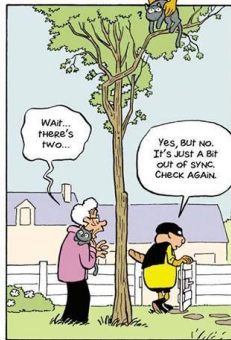
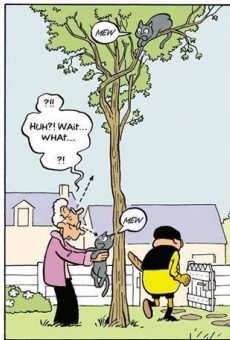


## Databases II: NoSQL, ACID, BASIC, CAP

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ACID: Atomicity, Consistency, Isolation, Durability [Jim Gray lata 70-te].

**Atomicity** all stages of a transaction have to complete, to finish a transaction

**Consistency** no constraint violation; all parties have the same data

**Isolation** independent transactions do not influence one another,

**Durability** a finished transaction is persistent, data is available for reading



- table/object locking
- I/O performance is decreased
- lags, waiting for locks

I. Wójcicki, DB2



AGH

## Distribution....

- Space scalability
- Performance scalability
- Single node vs multiple nodes

I. Wójcicki, DB2



Basically Available, Soft state, Eventual consistency [Eric Brewer 2000].

**basically available** it seems to be working, delivering data

**soft-state** database does not have to be consistent at all times

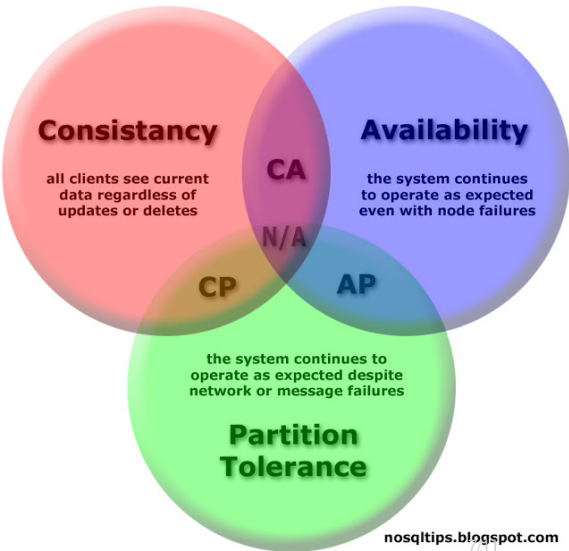
**eventually consistent** but will be at some time

BASE means that, consistency after every transaction is not required, as long as the database is eventually in a consistent state. Therefore, using stale data or providing approximate answers are tolerated. In essence, BASE is a best-effort design that gives up strong consistency for weak consistency.



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## CAP Theorem



DB2

- consistency: i.e., atomicity in ACID
- availability: i.e., responsiveness of the system
- partition tolerance: i.e., system works (amid partially) even with partial failure



- centralized database: no P, just: C, A,
- distributed database, distributed locking: no A, just: C, P,
- WWW cache/buffering, DNS: no C, just: A, P.





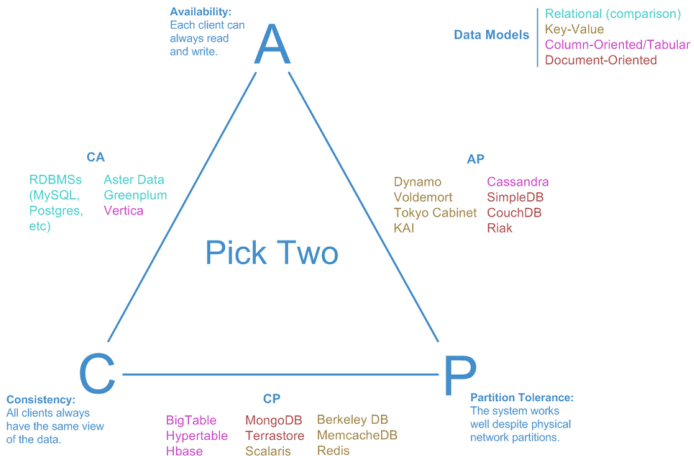
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## CAP, results

- No *partition tolerance*  
one node, no scalability.
- No *availability*  
With partial failure/disconnection, the database remains unavailable.
- No *consistency*  
temporary inconsistent.



## Visual Guide to NoSQL Systems





<http://nosql-database.org/>

**Column** Hadoop/HBase, Cassandra.

**Document** CouchDB, MongoDB.

**Key-value** Dynamo, Riak, Redis, Project Voldemort

**Graph** : Neo4J, AllegroGraph, Virtuoso

**Object**

**Multimodel**