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Data is cached everywhere, from the front end to the back end!

This diagram illustrates where we cache data in a typical architecture.

There are **multiple layers** along the flow.

🔷 1. Client apps: HTTP responses can be cached by the browser. We request data over HTTP for the first time, and it is returned with an expiry policy in the HTTP header; we request data again, and the client app tries to retrieve the data from the browser cache first.

🔷 2. CDN: CDN caches static web resources. The clients can retrieve data from a CDN node nearby.

🔷 3. Load Balancer: The load Balancer can cache resources as well.

🔷 4. Messaging infra: Message brokers store messages on disk first, and then consumers retrieve them at their own pace. Depending on the retention policy, the data is cached in Kafka clusters for a period of time.

🔷 5. Services: There are multiple layers of cache in a service. If the data is not cached in the CPU cache, the service will try to retrieve the data from memory. Sometimes the service has a second-level cache to store data on disk.

🔷 6. Distributed Cache: Distributed cache like Redis hold key-value pairs for multiple services in memory. It provides much better read/write performance than the database.

🔷 7. Full-text Search: we sometimes need to use full-text searches like Elastic Search for document search or log search. A copy of data is indexed in the search engine as well.

🔷 8. Database: Even in the database, we have different levels of caches:

- WAL(Write-ahead Log): data is written to WAL first before building the B tree index
- Bufferpool: A memory area allocated to cache query results
- Materialized View: Pre-compute query results and store them in the database tables for better query performance
- Transaction log: record all the transactions and database updates
- Replication Log: used to record the replication state in a database cluster

Over to you: With the data cached at so many levels, how can we guarantee the **sensitive user data** is completely erased from the systems?

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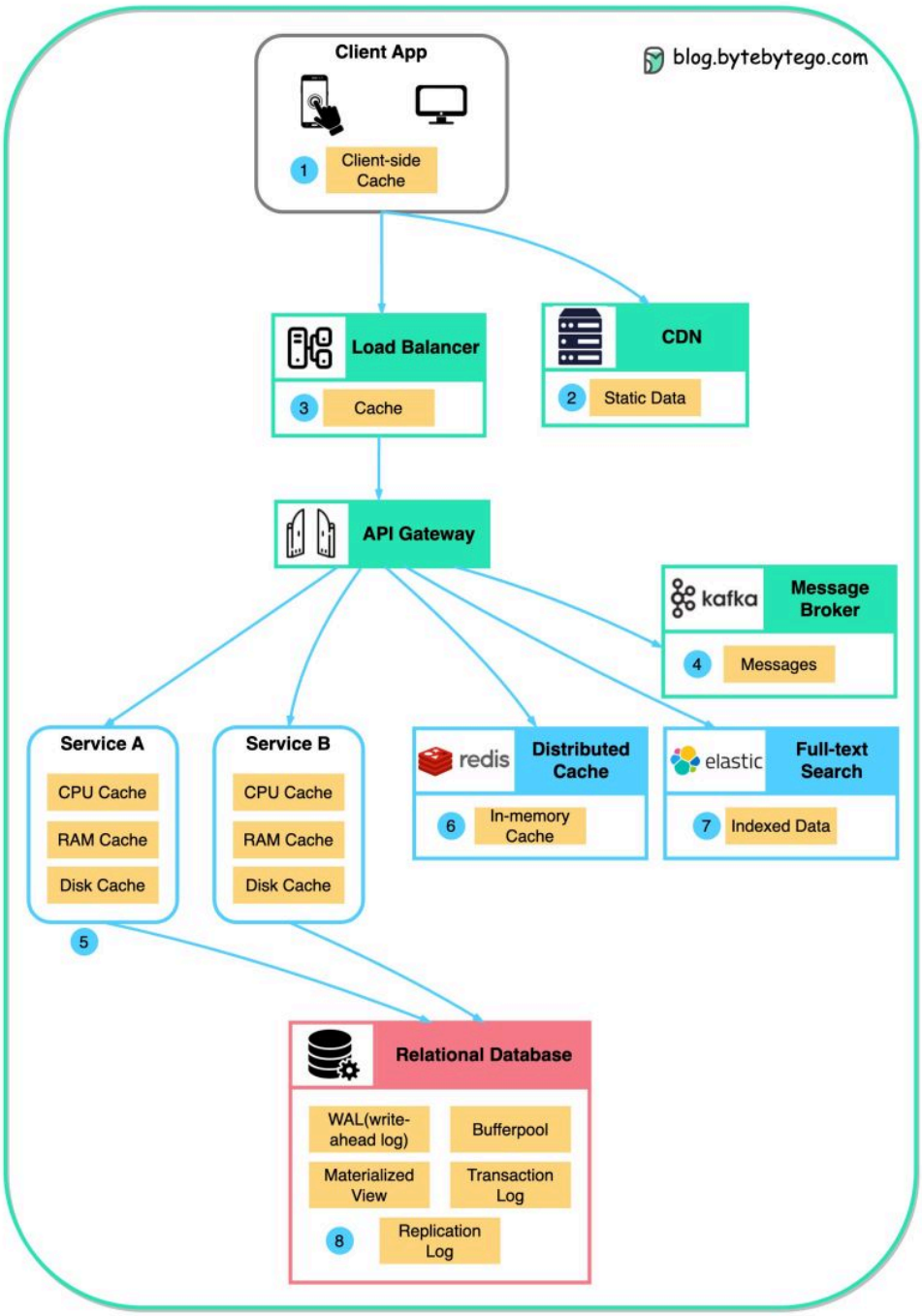
Cache Systems Every Developer Should Know



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