Last updated: May 21, 2019

System Design Template

(1) FEATURE EXPECTATIONS [5 min]

(1) Use cases
(2) Scenarios that will not be covered
(3) Who will use
(4) How many will use
(5) Usage patterns

(2) ESTIMATIONS [5 min]

(1) Throughput (QPS for read and write queries)
(2) Latency expected from the system (for read and write queries)
(3) Read/Write ratio
(4) Traffic estimates
    - Write (QPS, Volume of data)
    - Read (QPS, Volume of data)
(5) Storage estimates
(6) Memory estimates
    - If we are using a cache, what is the kind of data we want to store in cache
    - How much RAM and how many machines do we need for us to achieve this ?
    - Amount of data you want to store in disk/ssd

(3) DESIGN GOALS [5 min]

(1) Latency and Throughput requirements
(2) Consistency vs Availability [Weak/strong/eventual => consistency | Failover/replication => availability]

(4) HIGH LEVEL DESIGN [5-10 min]

(1) APIs for Read/Write scenarios for crucial components
(2) Database schema
(3) Basic algorithm
(4) High level design for Read/Write scenario

(5) DEEP DIVE [15-20 min]

(1) Scaling the algorithm
(2) Scaling individual components:
    -> Availability, Consistency and Scale story for each component
    -> Consistency and availability patterns
(3) Think about the following components, how they would fit in and how it would help
a) DNS
b) CDN [Push vs Pull]
c) Load Balancers [Active-Passive, Active-Active, Layer 4, Layer 7]
d) Reverse Proxy

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            >> Master-slave, Master-master, Federation, Sharding, Denormalization, SQL
            Tuning
      > NoSQL
            >> Key-Value, Wide-Column, Graph, Document
            Fast-lookups:
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            >>> RAM [Bounded size] => Redis, Memcached
            >>> AP [Unbounded size] => Cassandra, RIAK, Voldemort
            >>> CP [Unbounded size] => HBase, MongoDB, Couchbase, DynamoDB
g) Caches
      > Client caching, CDN caching, Webserver caching, Database caching, Application
      caching, Cache @Query level, Cache @Object level
      > Eviction policies:
            >> Cache aside
            >> Write through
            >> Write behind
            >> Refresh ahead
h) Asynchronism
      > Message queues
      > Task queues
      > Back pressure
i) Communication
      > TCP
      > UDP
      > REST
      > RPC
```

(6) JUSTIFY [5 min]

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(1) Throughput of each layer
(2) Latency caused between each layer
(3) Overall latency justification
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https://www.gbmb.org/kb-to-mb

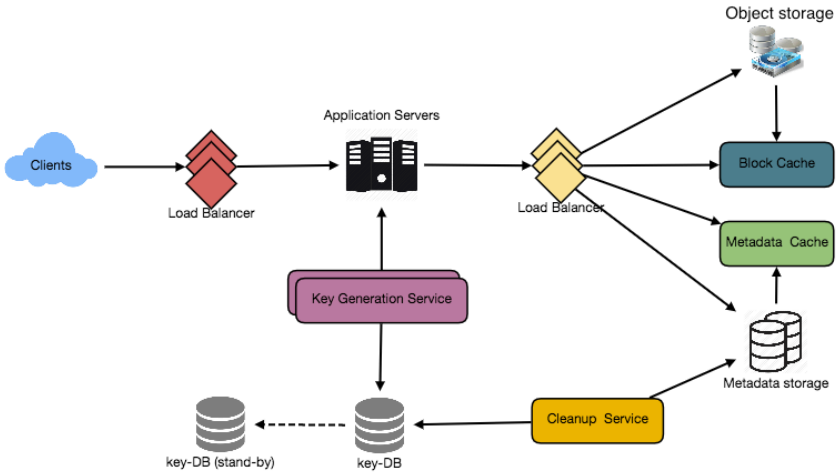
KB	MB	GB	TB	PB
10^3	10^6	10^9	10^12	10^15
2^10	2^20	2^30	2^40	2^50

1 Million = 10^6

b. Datastore layer

We can divide our datastore layer into two:

1. Metadata database: We can use a relational database like MySQL or a Distributed Key-Value store like Dynamo or Cassandra.
2. Object storage: We can store our contents in an Object Storage like Amazon's S3. Whenever we feel like hitting our full capacity on content storage, we can easily increase it by adding more servers.



Detailed component design for Pastebin