1 CheatSheet: System Design For Job Interview INTERVIEW

- PDF Link: cheatsheet-systemdesign-A4.pdf, Category: interview
- Blog URL: `https://cheatsheet.dennyzhang.com/cheatsheet-systemdesign-A4`
- Related posts: CheatSheet: Leetcode For Code Interview, CheatSheet: Well-Known Papers For IT Industry, #denny-cheatsheets

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1.1 Reference

Name	Summary
Papers	CheatSheet: Well-Known Papers For IT Industry, Github: papers-we-love
Github	Github: system-design-primer
Cheatsheet	CheatSheet: Behavior Questions For Coder Interview
Cheatsheet	CheatSheet: Leetcode For Code Interview, CheatSheet: Common Code Problems & Follow-ups
Coding	Code problems for #oodesign, CheatSheet: Leetcode For Code Interview
YouTube	YouTube: Intro to Architecture and Systems Design Interviews
YouTube	YouTube Channel: Success in Tech, YouTube: Scalability Harvard Web Development
YouTube	YouTube: System Design Interview

1.2 Process Of System Design

Num	Name	Summary
1	Outline use cases: List major and focus on some	Show good sense. The questions you asked define your level
2	Estimate scale: **Data** + **Traffic**	Back-of-the-envelope estimation
3	Defining data model	It helps to clarify how data will flow among different components
4	Abstract design	Sketch main components, explain workflow, avoid too deep for details
5	Detailed design + discussion with interviewers	Explain trade-off of your proposal + on-demand deep dive
6	Identify and resolve Bottlenecks	**Key challenges** + **Trade-Offs**. Usuaully no optimal solution(s)
7	Scale your design	Availability, Resiliency, Scalability, Security, Serviceability, etc

1.3 Top 20 Design Problems For Technical Modules

Num	Name
1	Design a distributed counter
2	Delayed task scheduling
3	Design a thread-safe Hashmap
4	Design An API Rate Limiter
5	Delayed queue
6	Design a distributed UUID generator
7	Design a distributed Hashmap
8	Design data sync for a distributed system
9	Design A big file transfer feature
10	Design a distributed transactions
11	Design: A Parking Lot Service
12	Design a distributed transaction
13	Design: A URL Redirecting Feature
14	Top URL hits
15	Unique url hits
16	Design a load balancer
17	Design a client-server API to build a rich document editor
18	Design online/offline status system
19	Design a circuit breaker
20	Design a service auto-discovery feature
21	Design a secrets management system

1.4 Top 20 Design Problems For A Complex Product

Num	Name
1	Design: TinyURL - A URL Shorterner Service
2	Design Twitter News Feed
3	Design K/V DB
4	Design: Flight booking service
5	Design: Uber Backend
6	Design an API gateway
7	Design: An Elevator Service
8	Design web crawler
9	Design amazon shopping cart
10	Design: Google Suggestion Service
11	Design a payment processor
12	Design google doc
13	Design gmail
14	Design instagram, a photo sharing app
15	Design Yelp, a location-based system
16	Design Pastebin.com
17	Design amazon book recommendation system
18	Google autocomplete
19	Design Google PageRank
20	Design messaging/notification system
21	Design search post system
22	Design memcache/redis
23	Design typeahead
24	Design Google Adsense fraud detection
25	Design a voice conference system
26	Design slack

1.5 Top 30 Concepts For Feature/System Design

Num	Name	Summary
1	Caching	Stores data so that future requests of data retrieval can be faster
2	Message Queue	Provides an asynchronous communications protocol,
3	Data Partition & Sharding	Break up a big data volume into many smaller parts
4	DB Indexing	Create indexes on multiple columns to speed up table look up
5	DB replication	Duplicate data to increase service availability
6	CAP: Consistency/Availability/Partition	A distributed database system can only have 2 of the 3
7	DB: SQL & NoSQL	Relational databases and non-relational databases
8	Concurrency & Communication	
9	Pessimistic And Optimistic Locking	
10	Consistency Module	weak consistency, eventual consistency, strong consistency
11	Conflict resolution	Quorum, vector lock, reconcile on read/write, CRDT
12	B+ Tree	
13	Networking: HTTP	
14	Pull vs Push model	
15	Garbage Collection	
16	Memory Management	
17	Heartbeats	
18	Self Protection	API Rate limit, Circuit breaker, bulkhead, throttling
19	Filesystem	
20	API: gRPC vs REST	
21	Load balancer	
22	Scale up vs Scale out	Vertical scaling and Horizontal scaling
23	API Design	
24	Session management	
25	Networking: TCP vs UDP	
26	Consistency patterns	Weak consistency, Eventual consistency, Strong consistency
27	Availability patterns	Fail-over vs Replication
28	CDN - Content Delivery Network	Edge caching
29	Monitoring	
30	Security	
31	Networking: DNS	
32	Linux signals	

1.6 Top 15 Advanced Data Structure & Algorithms

Num	Name	Summary
1	Consistent Hash	
3	Bloom filter	A space-effcient query returns either "possibly in set" or "definitely not"
4	CRDT(Conflict-Free Replicated Data Types)	
5	SSTable (Sorted Strings Table)	
6	LSM (Log Structured Merge Trees)	
7	Gossip	Propagate cluster status
8	Two-phase commit/Three-phase commit	
10	Vector Clocks/Version Vectors	
11	Paxos and raft protocol	
12	Merkle Tree	

https://raw.githubusercontent.com/dennyzhang/cheatsheet.dennyzhang.com/master/cheatsheet-featuredesign-A4/dynamo-summary.png

1.7 Explain workflow: What happens when XXX?

Num	Name	Summary
1	When happens when I search in google?	
2	How loadbalancer works	
3	Explain three phase commit model	
4	Explain HTTP return code	
5	Explain Mysql DB replication model	
6	Explain gossip protocol	
7	Explain CAP	
8	Explain Hadoop file system	
9	[Linux] Explain OS booting process	
10	[Linux] What happens, when running "ls -l *"	
11	[Linux] What happens, when pressing "Ctrl + c"	

1.8 Explain tools: how XXX supports XXX?

Num	Name	Summary
1	How JDK implement hashmap?	
2	Explain java garbage collection model	
3	Explain raft/etcd	
4	How OS supports XXX?	

1.9 Cloud Design Principles

Num	Name	Summary
1	Fail fast	
2	Design for failure	
3	Immutable infrastructure	
4	Cats vs Cattle	Avoid snowflake servers
5	Auto healing	
6	Async programming	
7	GitOps operational model	
8	Event-Driven Architectures	

1.10 Cloud Design Patterns

Num	Name	Summary
1	Ambassador pattern	Create helper service to send network requests, besides the main sevice
2	Cache-Aside pattern	Load data on demand into a cache from a data store
3	Circuit Breaker pattern	If a request takes too many reousrce, abort it
4	Bulkhead pattern	Isolate elements into pools, so that one fire won't burn all
5	Gateway Aggregation pattern	Aggregate multiple individual requests into a single request
6	Priority Queue pattern	Support different SLAs for different individual clients
7	Strangler pattern	Incrementally migrate a legacy system piece by piece

1.11 Engineering Of Well-Known Products

Name	Summary
Google	Link: Google Architecture
Facebook	Link: Facebook Live Streams
Twitter	Link: Twitter Image Service, YouTube: Timelines at Scale
Uber	Link: Lessons Learned From Scaling Uber
Tumblr	Link: Tumblr Architecture
StackOverflow	Link: Stack Overflow Architecture

1.12 Grow Design Expertise In Daily Work

Num	Name	Summary
1	Keep the curiosity	Thinking about interesting/weird questions helps
2	Deep dive into your daily work	Unify and normalize problems from daily work
3	Learn the work of your coleagues	Indirect working experience also help
4	Popular products under the hood	Once you notice an interesting feature, think about how it's supported?
5	Read engineering blogs	Especially for big companies
6	Tools under the hood	Common tools/frameworks
7	Try tools	Use cases; Alternatives; Pros and Cons
8	Read papers	Best practices in papers
9	Try new things	Gain hands-on experience; evaluate alternatives
10	Datastore & OS	Learn how databases and operating systems work
11	Language implementation	Deep dive into one programming language. Java, Python, Golang, etc

1.13 Engineering Blogs/Websites

Name	Summary
Compnay Tech Blog	Website: Facebook Engineering, Website: Google Developers
Compnay Tech Blog	Medium: Netflix Blog, Medium: Airbnb Engineering & Data Science
Compnay Tech Blog	Shopify Engineering, Github Engineering
Website	Website: hiredintech - System Design
Website	Website: interviewing.io, Website: interviewbit.com
Reference	Link: Preparing for your Software Engineering Interview at Facebook
Reference	Link: The System Design Process
Individual Tech Blog	Blog: All Things Distributed - Amazon CTO, Blog: highscalability

1.14 Typical Trade-Off

Num	Name	Summary
1	Performance vs Scalability	
2	Latency vs Throughput	
3	Availability vs Consistency	Brewer's CAP theorem

1.15 Misc

Num	Name	Summary
1	How to store 2TB data into 3 disks of 1TB. And be tolerant for one disk failure	A, B, C. And C = A XOR B
2	Find out the difference between two files. Majority of these two are the same	#lcs - Longest Common Subsequence
3	How to support feature of "diff 1.txt 2. txt"	
4	Avoid double payment in a distributed payment system	link

1.16 More Resources

`https://github.com/binhnguyennus/awesome-scalability`
`https://github.com/donnemartin/system-design-primer`
`https://github.com/checkcheckzz/system-design-interview`
`https://github.com/binhnguyennus/awesome-scalability`
`https://docs.microsoft.com/en-us/azure/architecture/patterns/`