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互联网人才 + 油站!

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www.geekband.com

系统设计中七剑客

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大纲

同步
网络
数据库
分布式
性能
估算
面向对象
案例
- 社交网站信息流
- 日志统计
- 网络爬虫
- 电商产品页面

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Introduction

System design:

1-3 rounds in interviews

For new-grad: not required/simple

For experienced: important to show your knowledge and thoughtful ideas

Knowledge, Design, Communication!

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Concurrency

Thread vs. Process

Consumer and Producer

Blockingqueue

Tracking:

Synchronized, Asynchronized

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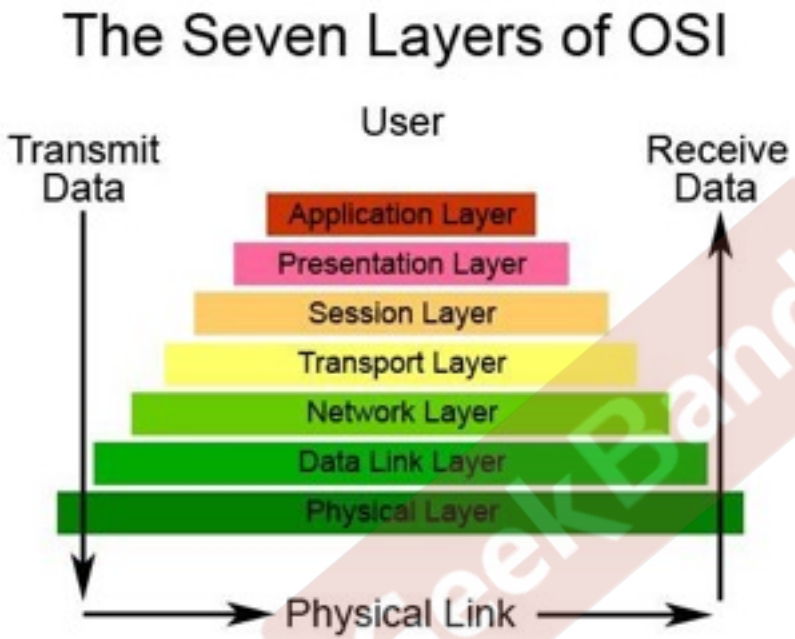
Network



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Visit URL

What happens after you typed a URL in your browser and pressed return key?

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Database

Relational DB vs. KV Store

Sharding vs. Clustering

TinyURL:

Store the mapping from shortlink code to full URL. The record/ document:

code: varchar(8)

url: varchar(1000)
created_at: timestamp

We also need to store the reverse mapping from URL back to code.

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Distribute System

How to scale Tiny URL service?

- Stateless frontend servers behind a load balancer
- Sharded/replicated database (on shortlink code)
- Memcached to scale read traffic
- Spread write load
- Locally buffered event tracking + async flush to high-throughput message queue
- Use a distributed unique ID generator (64-bit)

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Performance

Cache is KEY!

Numbers Everyone Should Know

L1 cache reference	0.5 ns
Branch mispredict	5 ns
L2 cache reference	7 ns
Mutex lock/unlock	25 ns
Main memory reference	100 ns
Compress 1K bytes with Zippy	3,000 ns
Send 2K bytes over 1 Gbps network	20,000 ns
Read 1 MB sequentially from memory	250,000 ns
Round trip within same datacenter	500,000 ns
Disk seek	10,000,000 ns
Read 1 MB sequentially from disk	20,000,000 ns
Send packet CA->Netherlands->CA	150,000,000 ns

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Estimation

How many piano tuners are there in the entire world?

Tiny URL: How much is total storage?

URL Length 10 - 1000 chars.

Total accumulated URL number 100 M

New URL registrations are on the order 100,000/day (1/sec)

Redirect requests are on the order of 100M/day (1000/sec)

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Design Pattern

23 patterns:
MVC
Singleton
Factory
Iterator
Decorator
Facade

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案例

News Feeds

Stats Server

Web Crawler

Amazon Product Page

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News feed

Define feed

Organize
- aggregate
- dedup
- sort

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Level 1.0

Database Schema:

- User
- Friendship
- News

Get Newsfeed:

merge news

Newsfeed vs News

UserId	*Name*	*Age*
1	*Jason*	*25*
2	*Michael*	*26*

FriendshipId	*SourceId*	*TargetId*
1	*1*	*2*
2	*2*	*1*

NewsId	*AuthorId*	*Content*
1	*2*	*“Hehe”*
2	*1*	*“Lala”*

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Why bad?

100+ friends

1 Query --> Get friends list

1 Query -->

```
SELECT news
WHERE timestamp>xxx
AND sourceid IN friend list
LIMIT 1000
```

IN is slow

Either Sequential scan or 100+ index queries

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Level 2.0

Pull vs Push

Pull: Get news from each friend, merge them together. (NewsFeed generated when user request)

Push: NewsFeed generated when news generated. (we have another table to store newsfeed, may cause duplicate news)

Push:

1 Query to select latest 1000 newsfeed.

100+ insert queries (Async)

Disadvantage: News Delay.

Level 3.0

- Popular star (Justin Bieber)
  - Flowers 13M +
  - Async Push may cause over 30 minutes (13M+ insertions, delay too long)
- Push + Pull
  - for popular star, don’t push news to flowers
  - for every newsfeed request, merge non-popular user newsfeed (push) and popular users newsfeed (pull)

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Level 4.0

Push disadvantage:

- Realtime
- Storage (Duplicate)
- Edit

Go back to PULL:

- Cache users' latest (14 days) news
- Broadcast multiple request to multiple servers (Shard by userId).
- Merge & sort newsfeed
- Cache newsfeeds for this user with timestamp

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Click Stats Server

How are click stats stored?

- A poor candidate will suggest write-back to a data store on every click
- A good candidate will suggest some form of aggregation tier that accepts clickstream data, aggregates it, and writes back a persistent data store periodically
- A great candidate will suggest a low-latency messaging system to buffer the click data and transfer it to the aggregation tier.
  - If daily, storing in hdfs and running map/reduce jobs to compute stats is a reasonable approach
  - If near real-time, the aggregation logic should compute stats

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Cache Requirement

[a] When a request comes look it up in the cache and if it hits then return the response from here and do not pass the request to the system
[b] If the request is not found in the cache then pass it on to the system
[c] Since cache can only store the last n requests, Insert the n+1th request in the cache and delete one of the older requests from the cache
[d]Design one cache such that all operations can be done in O(1) – lookup, delete and insert.

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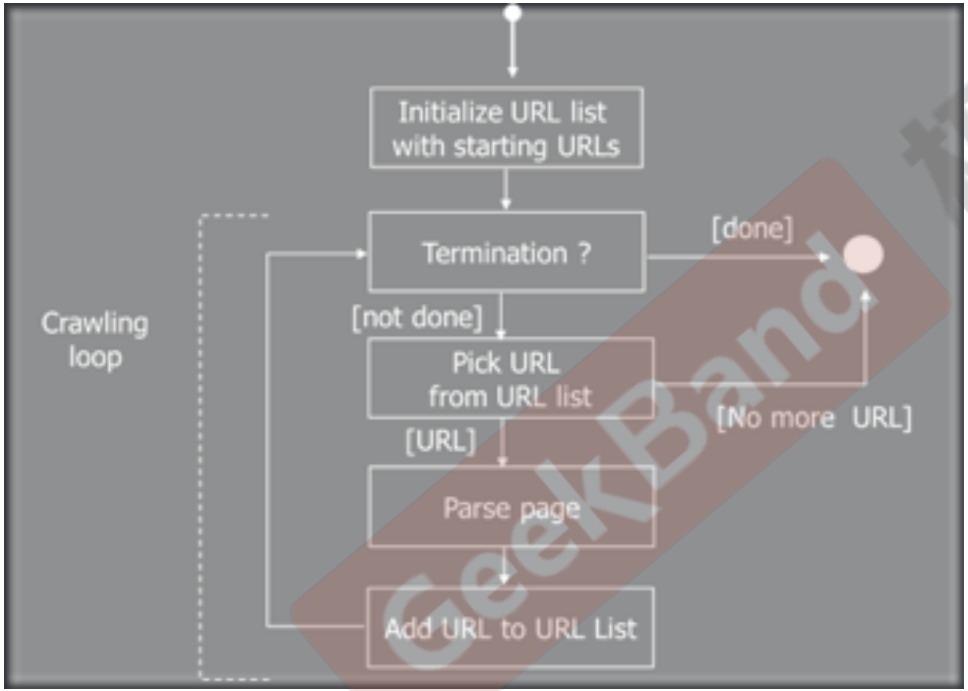
Web Crawler



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Amazon Product Page

The product page includes information such as

a) product information
b) user information
c) recommended products (what do other customers buy after viewing this item, recommendations for you like this product, etc)

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Reference

http://highscalability.com/

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Job Interviews: How should I prepare system design questions for Google/Facebook Interview?

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