

系统设计第七课

小憩一下，马上开课



关注微信/微博，获取最新面试题及权威解答

微信: [ninechapter](#)

微博: <http://www.weibo.com/ninechapter>

官网: www.jiuzhang.com



System_Design_7

Typeahead and OOD

张无忌

2015-12-13

V 3.03

After class_7, you can answer

- Design typeahead/instant search
 - Facebook, Google, Factset, Expedia, Walmart, Alibaba
- Object oriented design: elevator, parking lot, blackjack
 - Facebook, Google, Twitter, Yelp, Amazon, FaceSet, Groupon, Alibaba, Tencent, Baidu, ...
- Achievement system
 - PocketGem

Part 1, Typeahead

[Read More](#)

Novice/Expert/Master, <http://url.cn/elvjyX>
Expert, <http://url.cn/g6cNdE>



b

Tweet

Barcelona Who to follow · Refresh · View all

Benzema Followed by Cetus Lee

Bernie Sanders Follow

Bristol City Follow

Bill Inman @billinman You follow each other

Bryan @luoboo You follow each other

Roberto Bayardo @roberto_bayardo Followed by Google Research

Dropbox for Business @Dropbox... Followed by Dropbox

BMW @BMW Followed by fafey

Bruce Wang @number5 Followed by yishuai

Search all people for b

ba

Tweet

Barcelona Who to follow · Refresh · View all

Barca Followed by Cetus Lee

bahubali Follow

baekhyun Follow

Balisage @Balisage Followed by Paul Ford

Roberto Bayardo @roberto_bayardo Followed by Google Research

Simon Baker @energizr Followed by Eerieelf

John Perry Barlow @JPBarlow Followed by Eerieelf and 3 others

Judy Barber @JudyBarber Followed by Mark Forster

Bart Hanson @BartHanson Followed by Eerieelf

Search all people for ba

Interviewer: design Typeahead

Necessaries

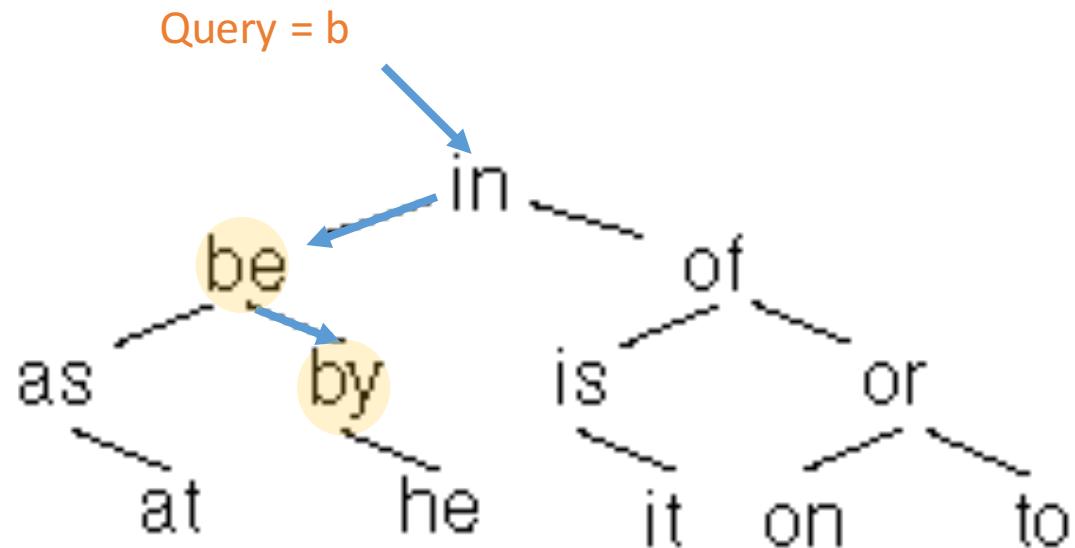
- Average latency < 100ms
- 95% < 50ms
- Challenge
 - Every millisecond counts

Interviewer: What is the algorithm?

Binary search tree



Words = { as, at, be, by, he, in, is, it, of, on, or, to}



m = average length of word
n = number of words

Time complexity of lookup: $O(\log(n)+k)$
Space complexity: $O(n * (m*\text{char} + 2*\text{pointer}))$

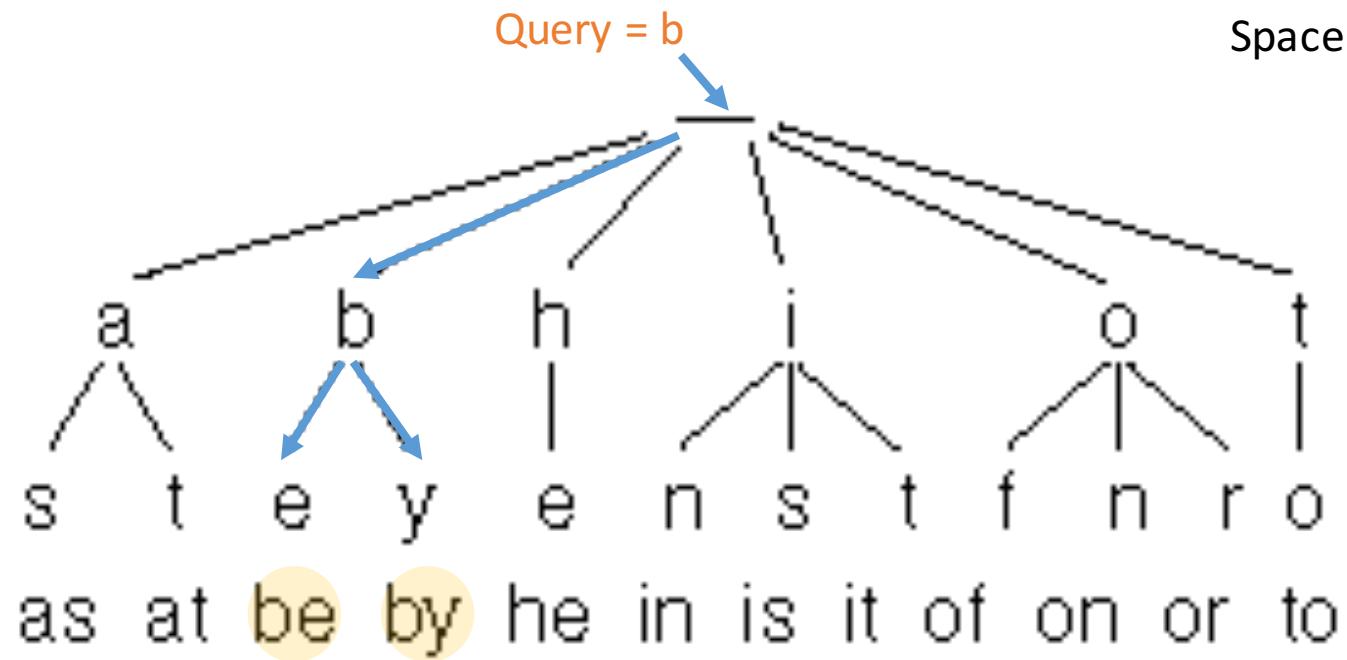
Trie tree



m = average length of word
 n = number of words

Time complexity of lookup: $O(\text{length(word)} + k)$

Space complexity (worst): $O(m * n * (26 * \text{pointer} + 1 * \text{char}))$



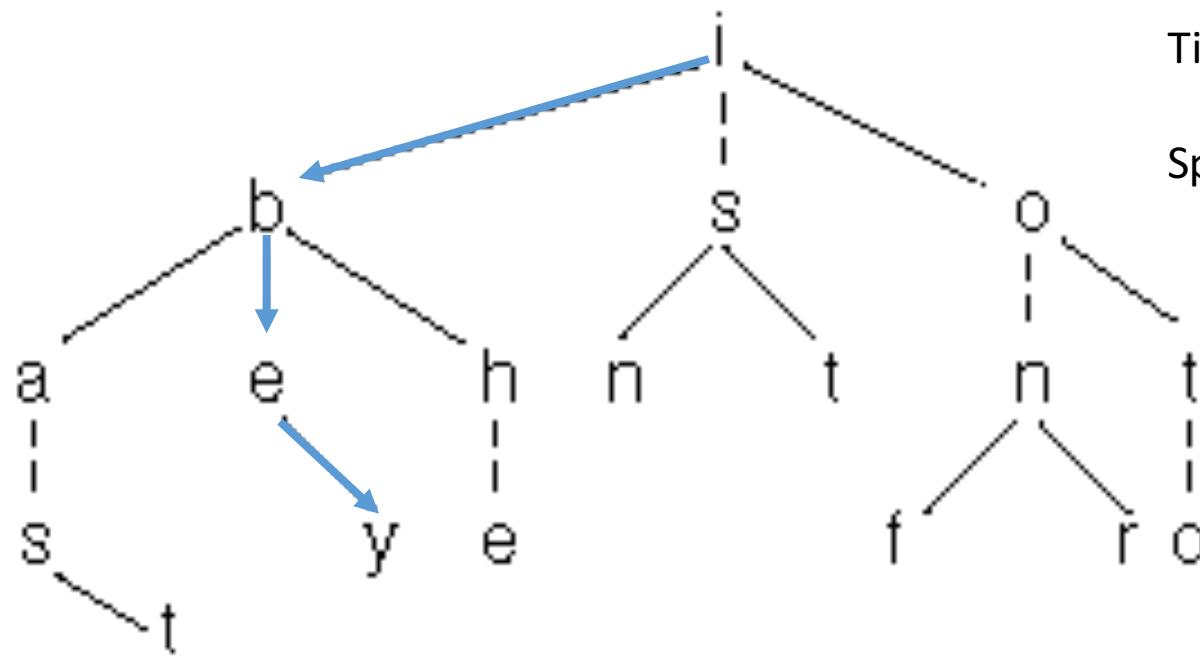
Read More

Novice, <http://url.cn/fNphWY>

Ternary search tree



Query = b



m = average length of word
n = number of words

Time complexity of lookup: $O(\log(n) + k)$

Space complexity (worst): $O(m * n * (3 * \text{pointer}))$

as at be by he in is it of on or to

Read More

Expert, <http://url.cn/bJJrY7>
Expert, <http://url.cn/Z2qavr>

Database with “like”



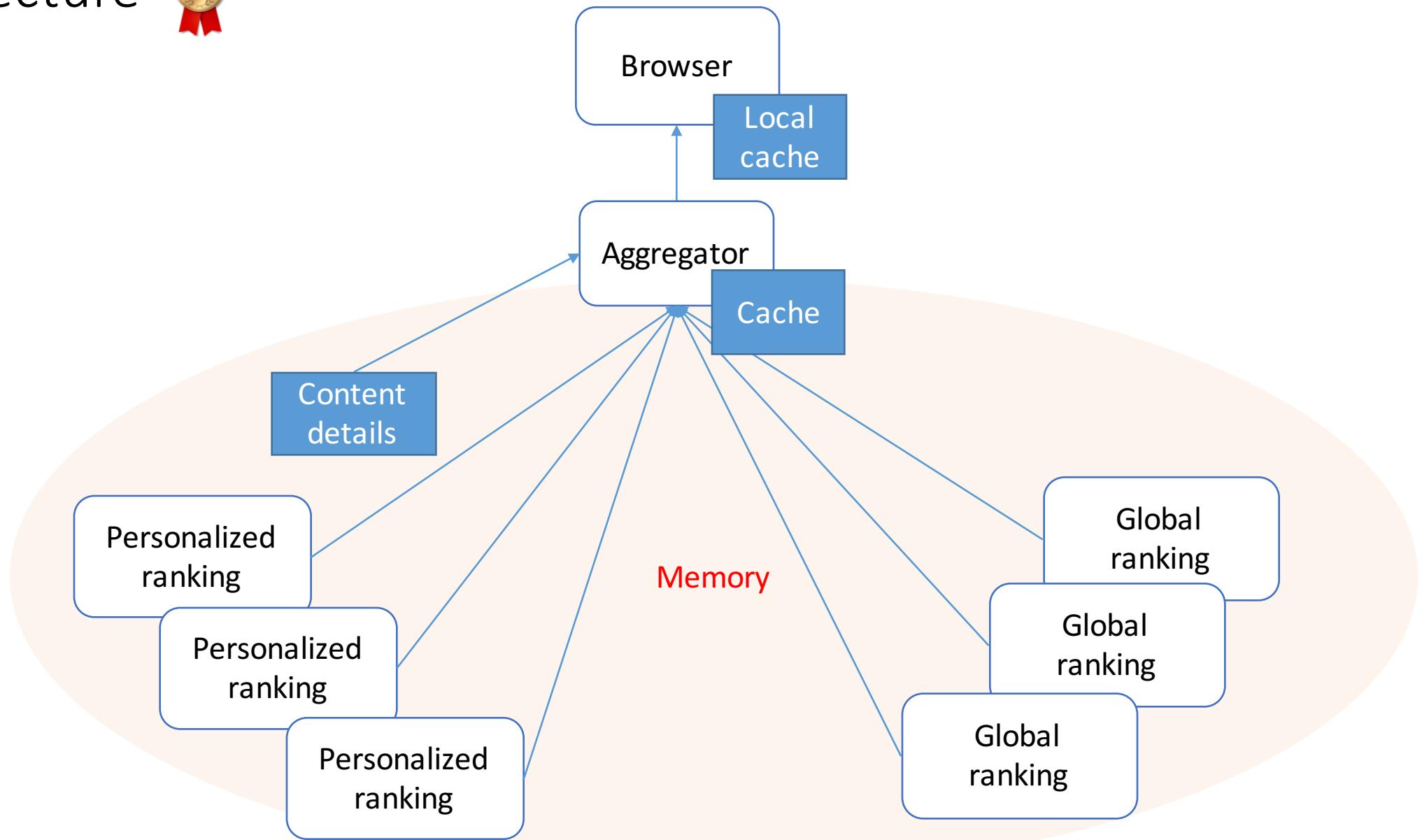
"SELECT * FROM table WHERE name **LIKE ".\$query."%**' ORDER BY name ASC"

Read More

Novice, <http://url.cn/a1BCDI>
Expert, <http://url.cn/g8oiql>
Master, <http://url.cn/crGbRt>

Interviewer: What is the architecture?

Architecture



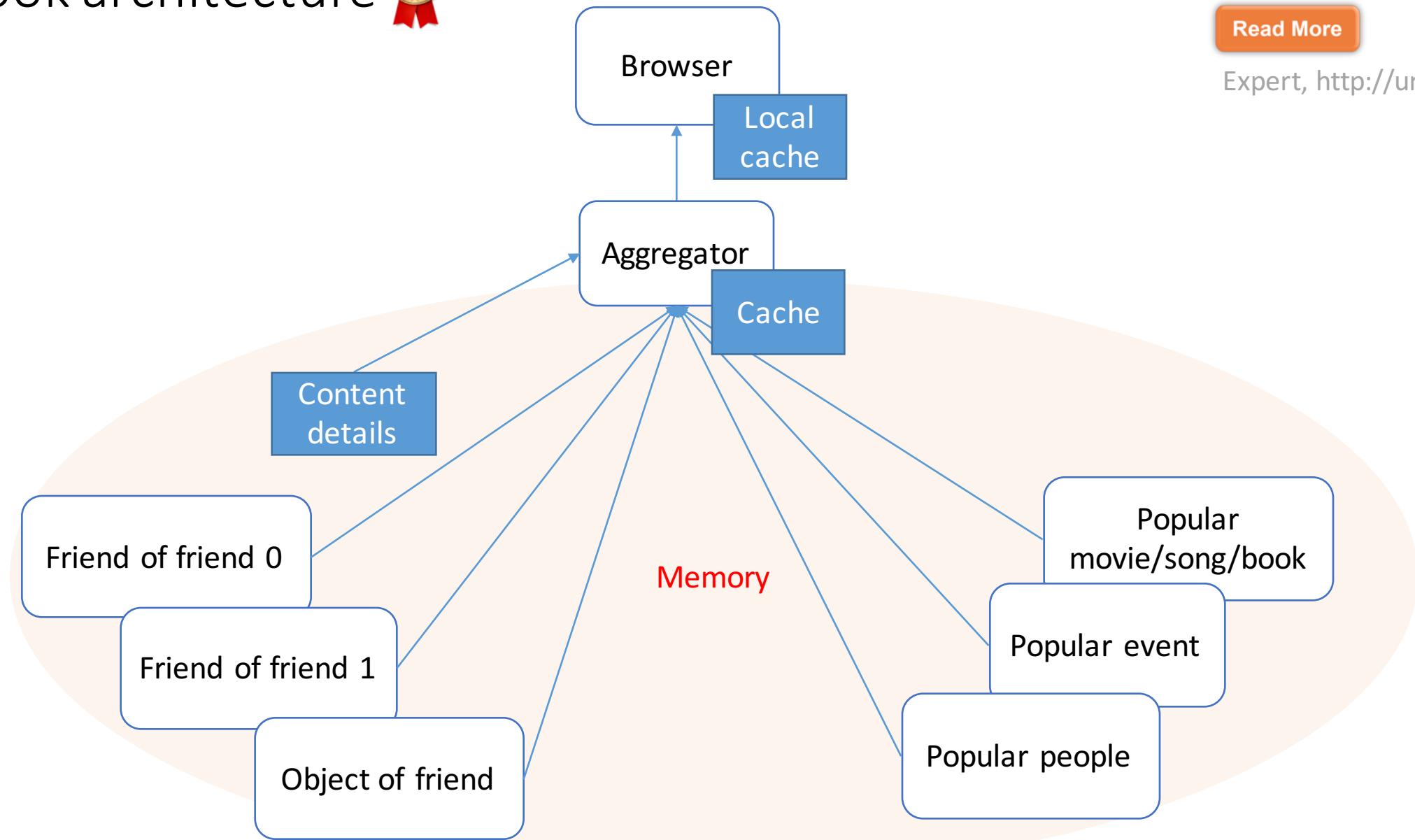
Interviewer: What is the case for
Facebook?

Facebook architecture

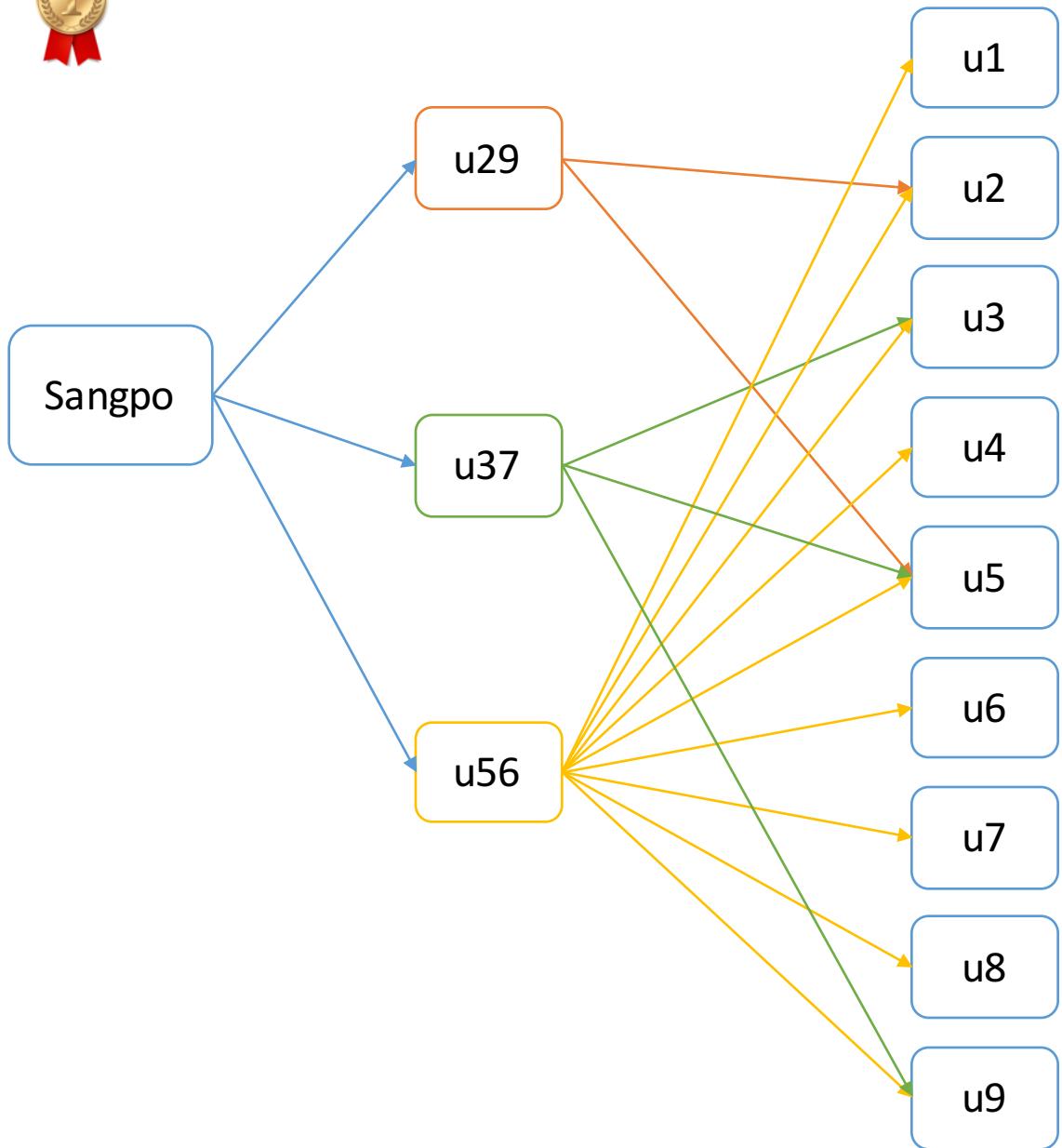


Read More

Expert, <http://url.cn/drQBKL>



Interviewer: How to calculate
friend of friend?



$$u_{29} = \{u_2, u_5\}$$

$$u_{38} = \{u_3, u_5, u_9\}$$

$$u_{56} = \{u_1, u_2, u_3, u_4, u_5, u_6, u_7, u_8, u_9\}$$

$$\text{FOF}(\text{Sangpo}) = \{u_1 = 1,$$

$$u_2 = 2,$$

$$u_3 = 2,$$

$$u_4 = 1,$$

$$u_5 = 3,$$

$$u_6 = 1,$$

$$u_7 = 1,$$

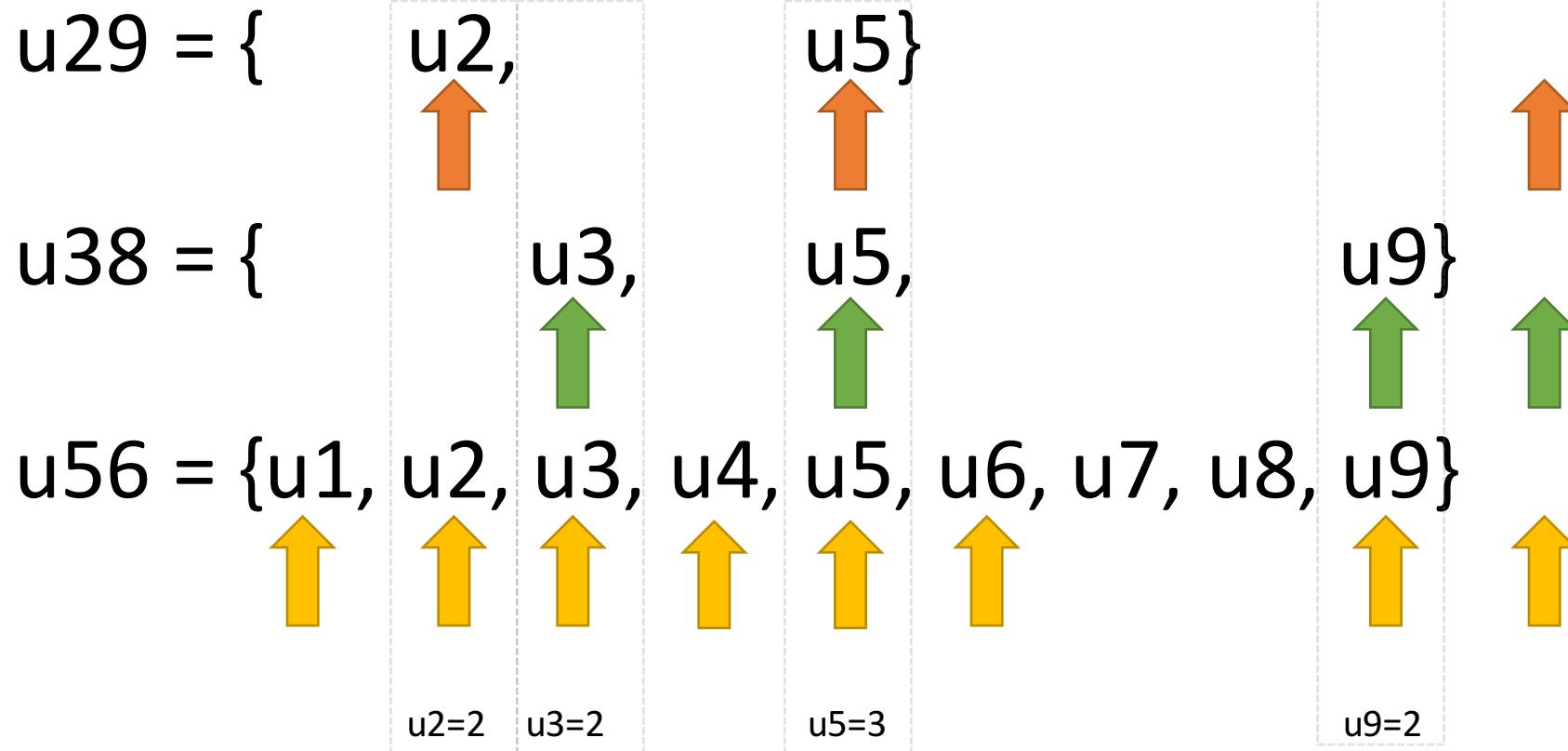
$$u_8 = 1,$$

$$u_9 = 2\}$$

Read More

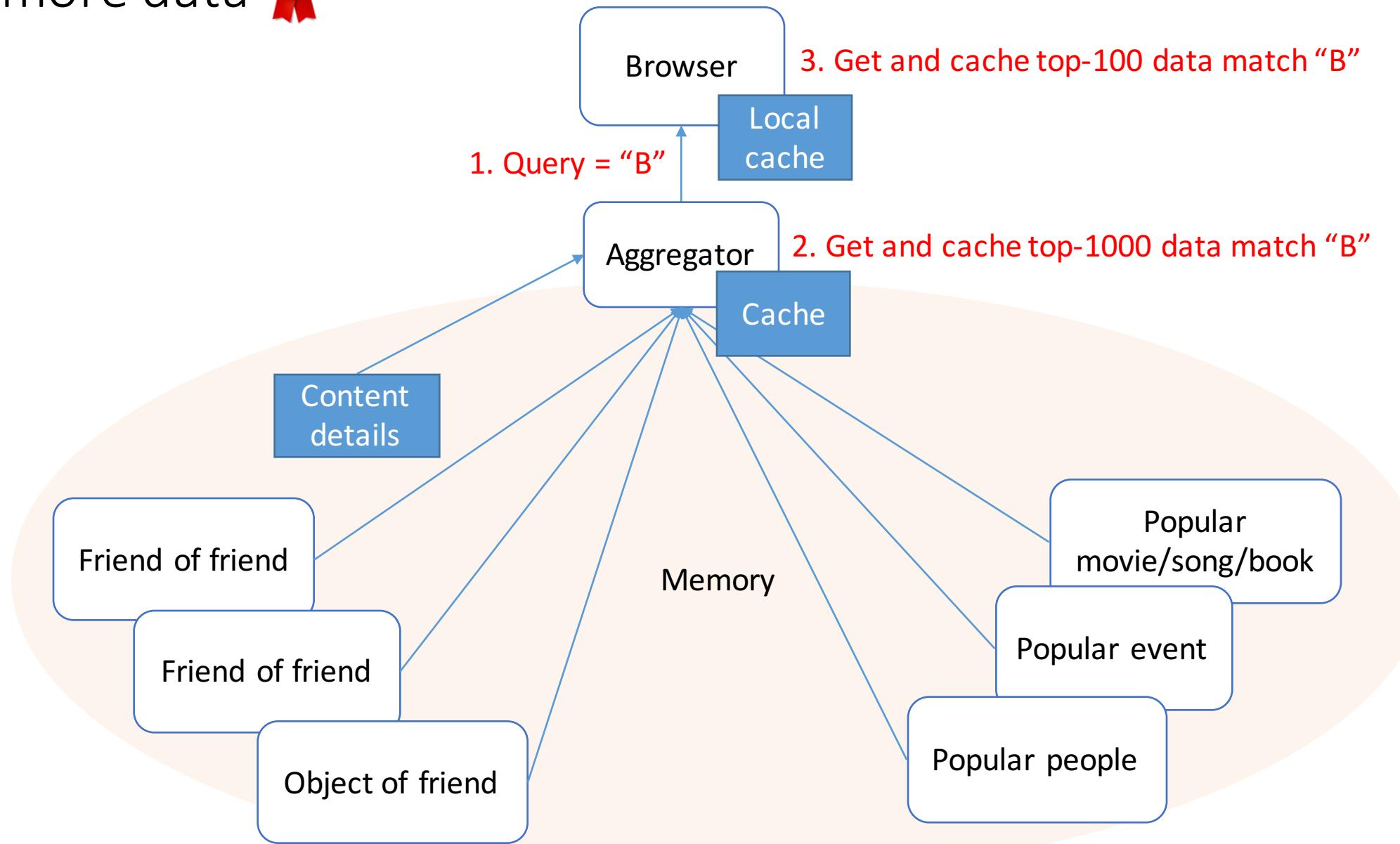
Novice, <http://url.cn/bJ2tAZ>

Expert, <http://url.cn/fFa37z>



Interviewer: How to speed up?

Cache more data



Interviewer: What is the case for
LinkedIn?

Typeahead in Linkedin

People ▾ j wein

Connections	Companies	Groups
 Jeff Weiner • 2 nd CEO at LinkedIn	 The Harry and Jeanette Weinber... Public Relations and Communications	 Schokolade & Pralinen, Champa... 7 members
 Jeff Weinberger • 2 nd Disruptive Marketing Executive and Thou	 Weinstein JCC Nonprofit Organization Management; 51-.	
 Jeremy Weinrib • 2 nd Director, Product Development at ESPN..	 Jana Weiner Consulting Public Relations and Communications	
 Joe Weinsteiger • 2 nd Owner Technical Ventures LLC, 30,000...		
 Joel Wein • 2 nd Fellow at Akamai		

Read More

Expert, <http://url.cn/bR2D3b>
Expert, <http://url.cn/ZdwOVg>



0. Query = "linked"



Searcher

Inverted index

...
link -> { doc3, doc5, doc19 }
linl -> { doc3, doc7 }
lioia -> { doc4, doc8, doc99 }
...

1. Check "link" with inverted index



2. Check bloomfilter with "linked"



Index of Doc3

Bloomfilter

Index of Doc5

Bloomfilter

Forward index

jump
links
win

Index of Doc19

Bloomfilter

Forward index

cat
linked
road

Bloomfilter

Bloomfilter

Forward index

jump
links
win

Bloomfilter

Forward index

cat
linked
road

Merger

4. Merge results from different sources

Ranker

4. Assign the docs with scores

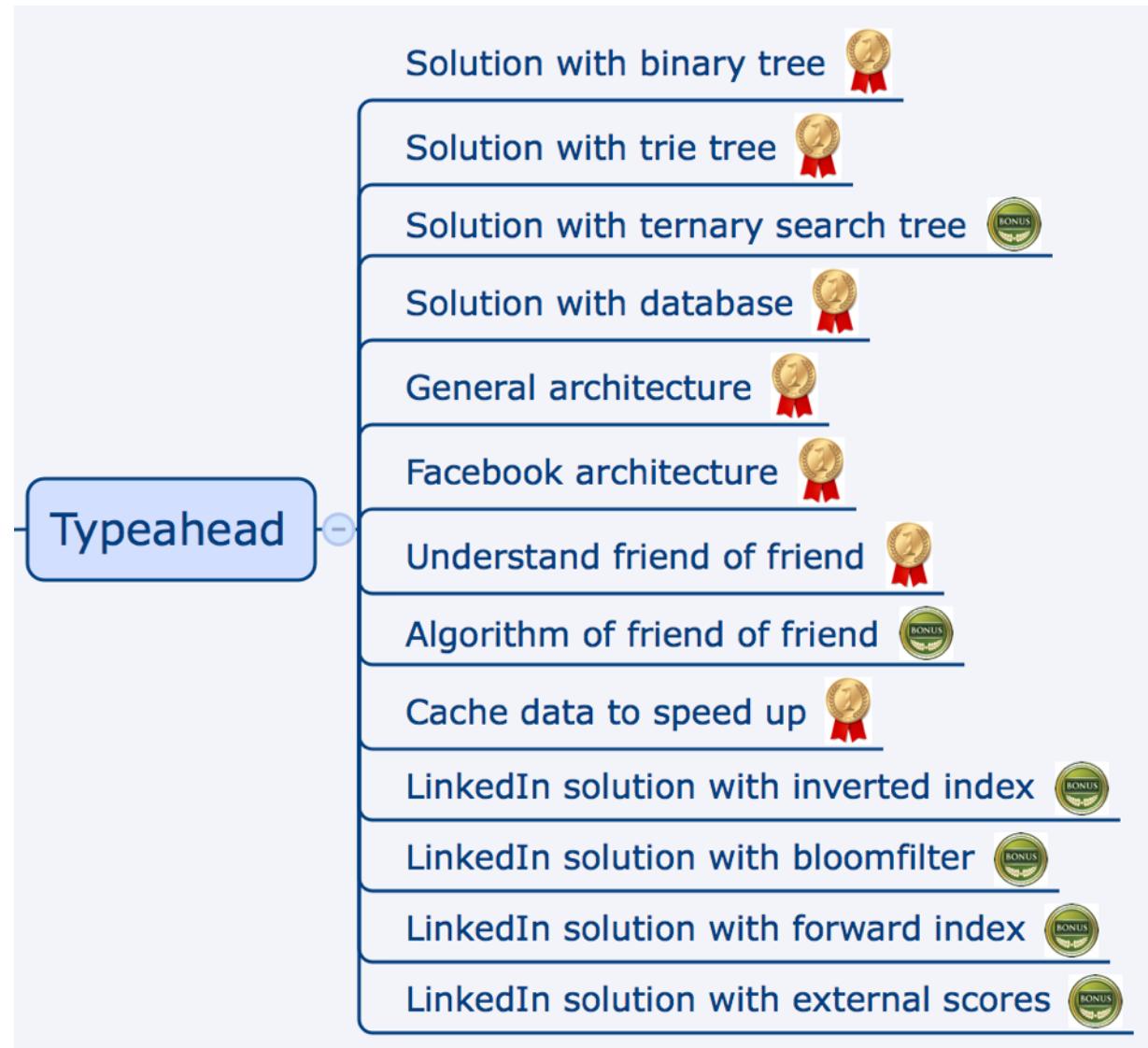


How to learn from open source?

<https://twitter.github.io/typeahead.js/examples/>



Summary of Part1 (7+6)





那威的森林

ノルウェイの森

《重金搖滾雙面人》 松山健一 / 《火線交錯》 菊地凜子 /

《重金搖滾雙面人》 松山健一 /

《火線交錯》 菊地凜子 /

《矚目新人》 水原希子

Part2 OOD

Read More

Novice/Expert, <http://url.cn/cZkv8D>

Novice/Expert/Master, <http://url.cn/eSlZ2V>

Expert/Master, <http://url.cn/Nqg8ny>

Interviewer: What is Singleton?

Singleton pattern

```
01. class CSingleton
02. {
03.     private:
04.         CSingleton() //构造函数是私有的
05.         {
06.         }
07.         static CSingleton *m_pInstance;
08.     public:
09.         static CSingleton *GetInstance()
10.         {
11.             if(m_pInstance == NULL) //判断是否第一次调用
12.                 m_pInstance = new CSingleton();
13.             return m_pInstance;
14.         }
15.     };
```

Read More

Novice, <http://url.cn/d3cuXX>

Novice/Expert, <http://url.cn/L6swwF>

Novice/Expert, <http://url.cn/TloHe6>

Interviewer: Design Parking Lot

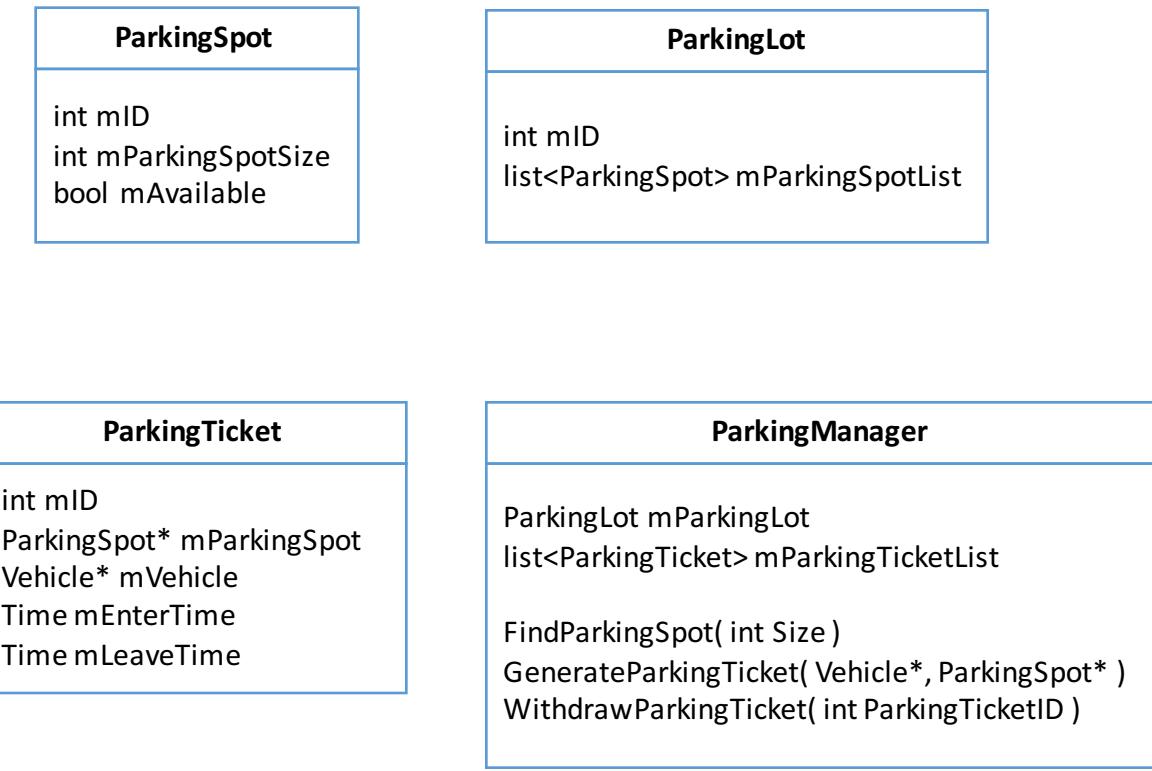
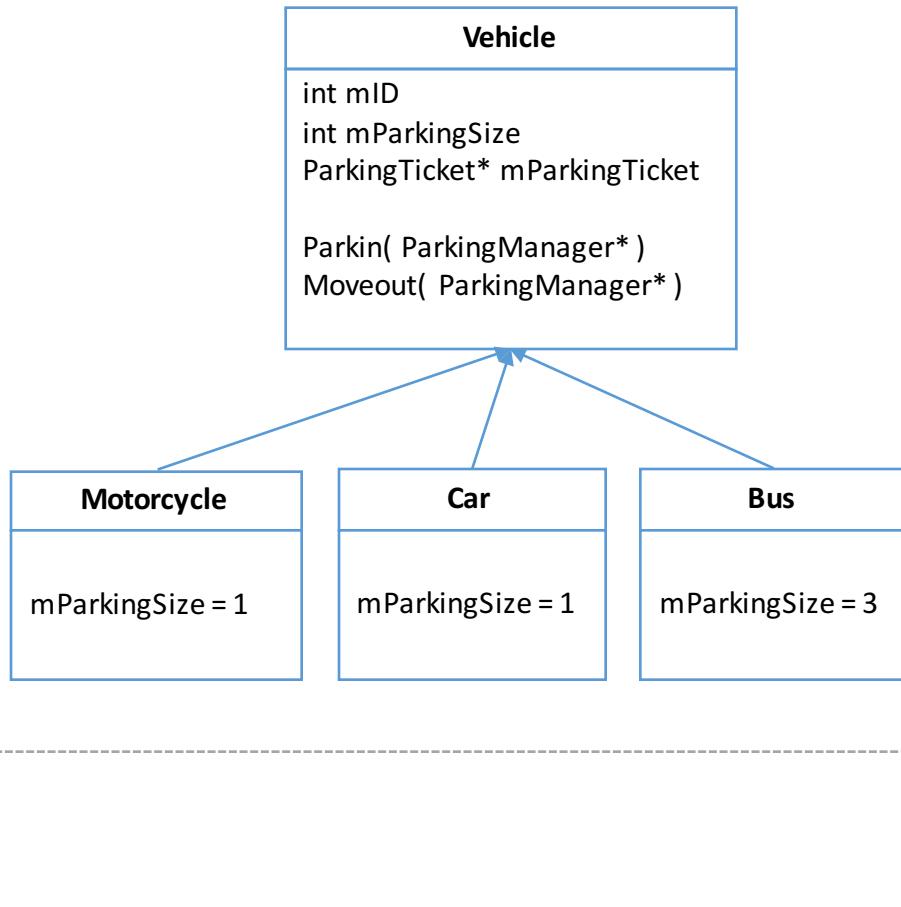
[Read More](#)

Novice/Expert, <http://url.cn/bym16l>

Expert, <http://url.cn/d63gIA>

Expert, <http://url.cn/fQWcqG>





Interviewer: Design Blackjack with AI

[Read More](#)

Novice/Expert, <http://url.cn/8VkNav>

Novice/Expert, <http://url.cn/fg7haN>

Novice/Expert, <http://url.cn/dOSORo>

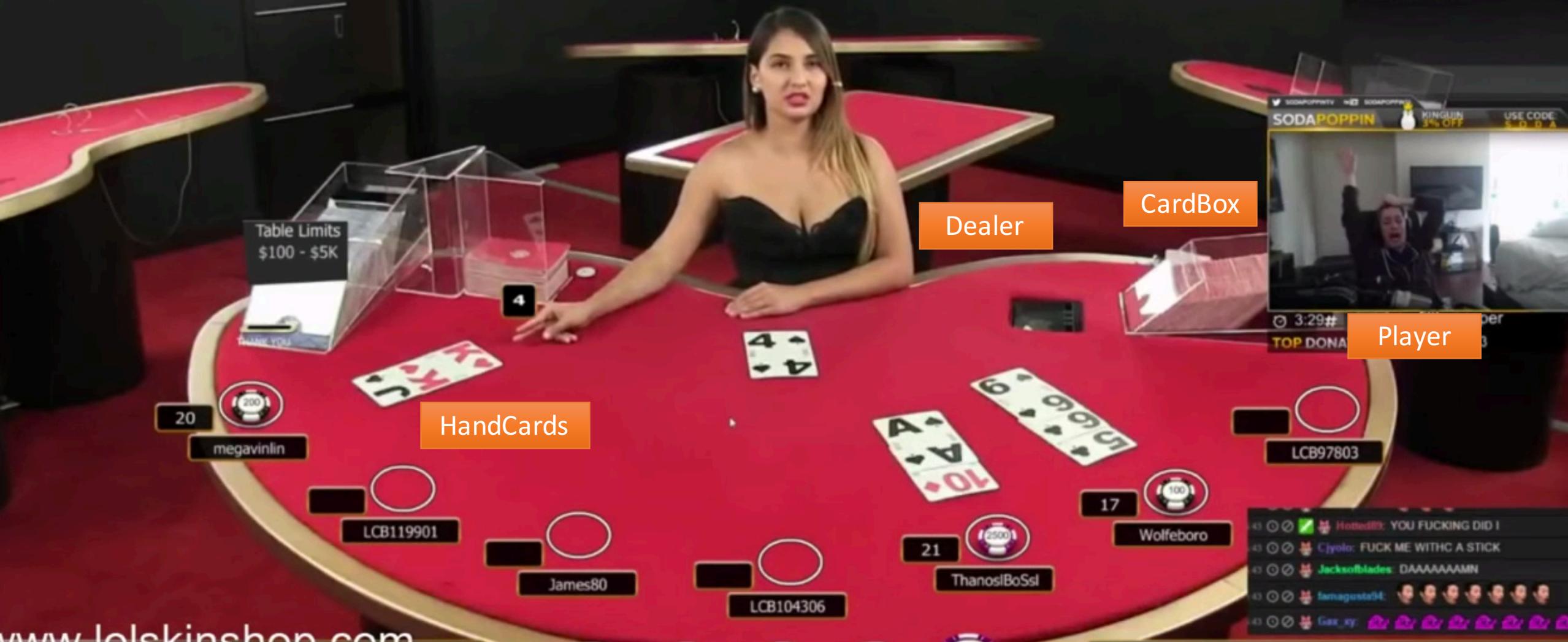
Expert, <http://url.cn/axr5UC>

Expert, <http://url.cn/bw69KI>

Expert/Master, <http://url.cn/XSrF8u>

Expert/Master, <http://url.cn/eKNY6v>





www.lolskinshop.com

Game ID: 10075308 Balance: \$ 4,050.75

Dealer: Sasha Bet Amount: 2.50K

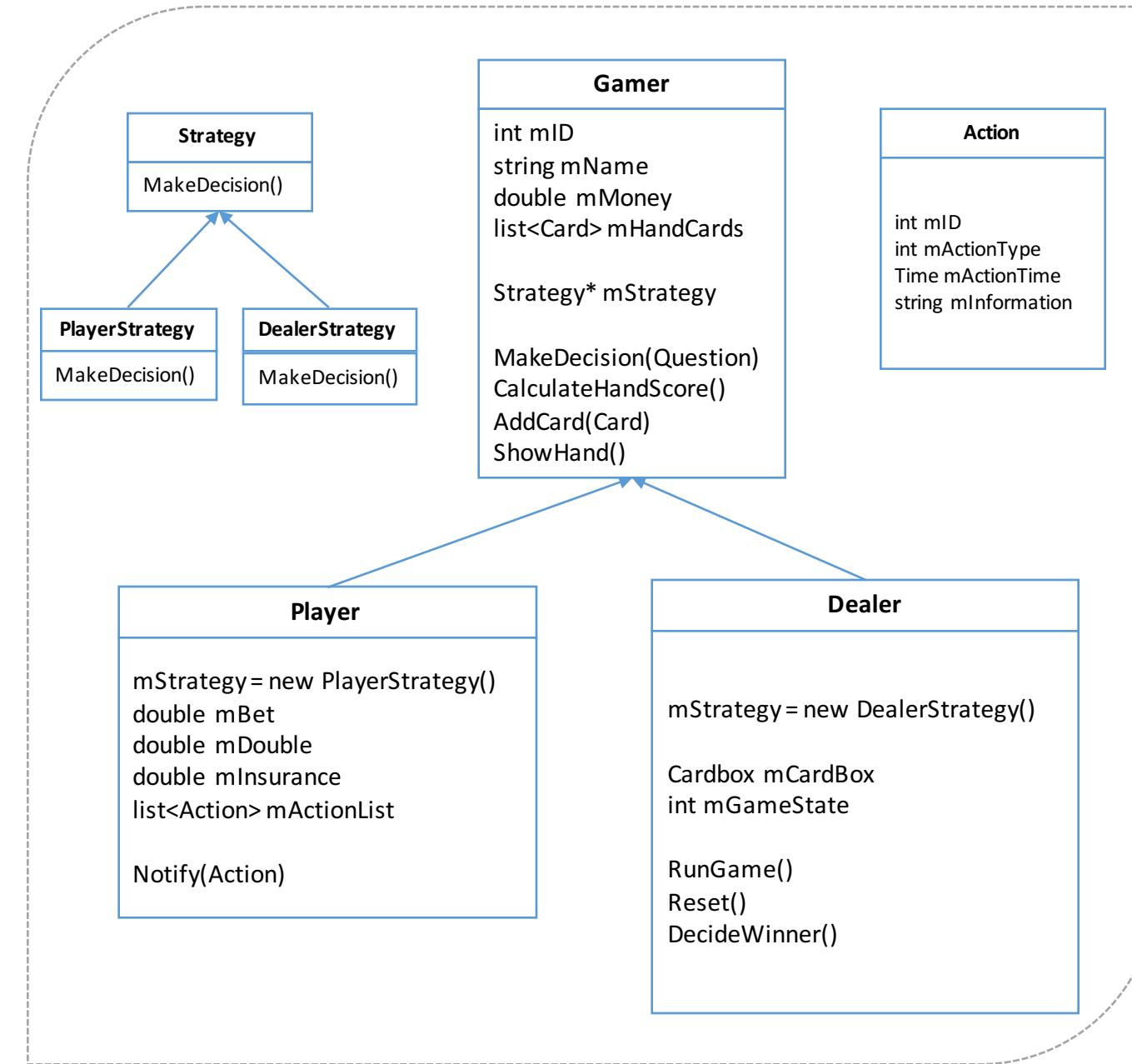
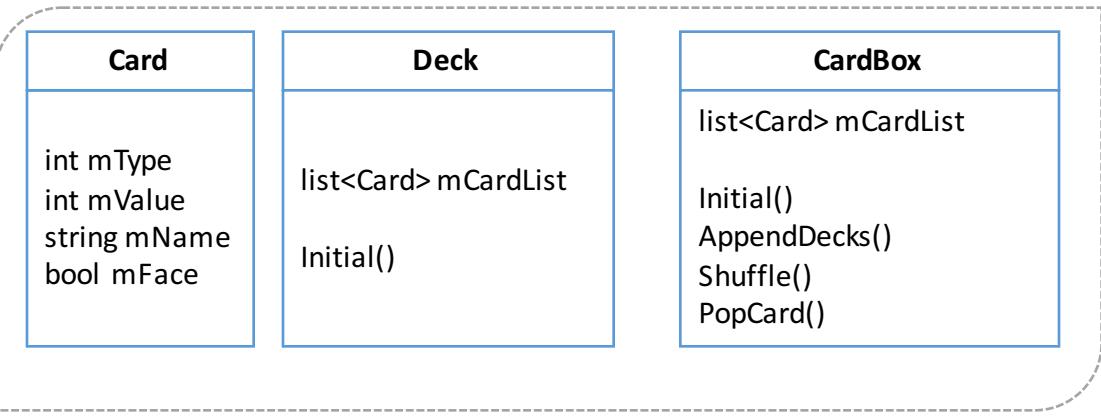


00

REBET

CLEAR

UNDO



Interviewer: Design Achievement system

[Read More](#)

Novice/Expert, <http://url.cn/eXrAWO>

Novice/Expert, <http://url.cn/c9VM97>

tapscape

35 499



1058



Attack!

Achievements

X

195 368

47 938

491



Sweet Victory!

Win 1250 trophies in Multiplayer battles

1114/1250

Rewards: 100x 450x



Empire Builder

Upgrade Clan Castle to level 4

2/4

Rewards: 100x 20x



Wall Buster

Destroy 2000 Walls in Multiplayer battles

496/2000

Rewards: 100x 20x



Humiliator

Destroy 100 Town Halls in Multiplayer battles

Completed:
25/45

Achievements also in Game Center

75/100

Rewards: 100x 10x

Challenge friends



SHOP

Three key points in object-oriented design

- A **class**

- **know** something
- **do** something
- **is** something

Player

- know AchieveTypeList
- know his AchieveList
- claim his Achieve

AchieveManager

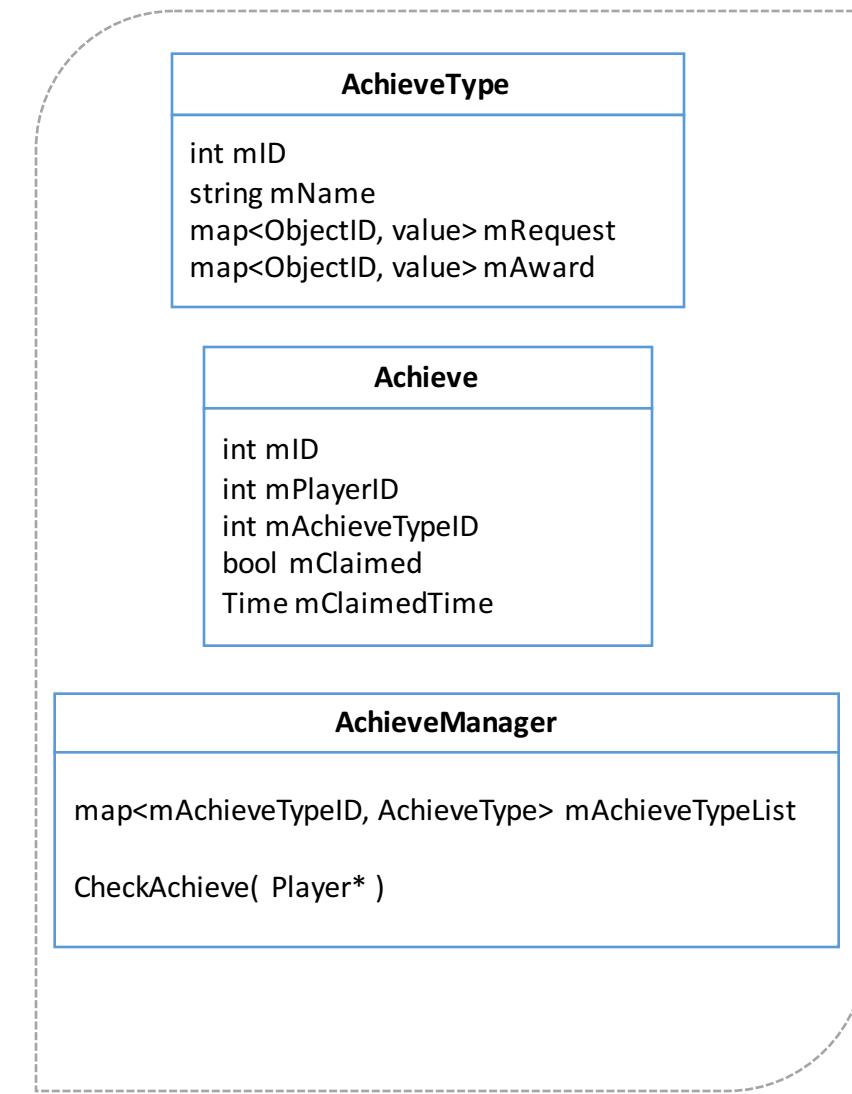
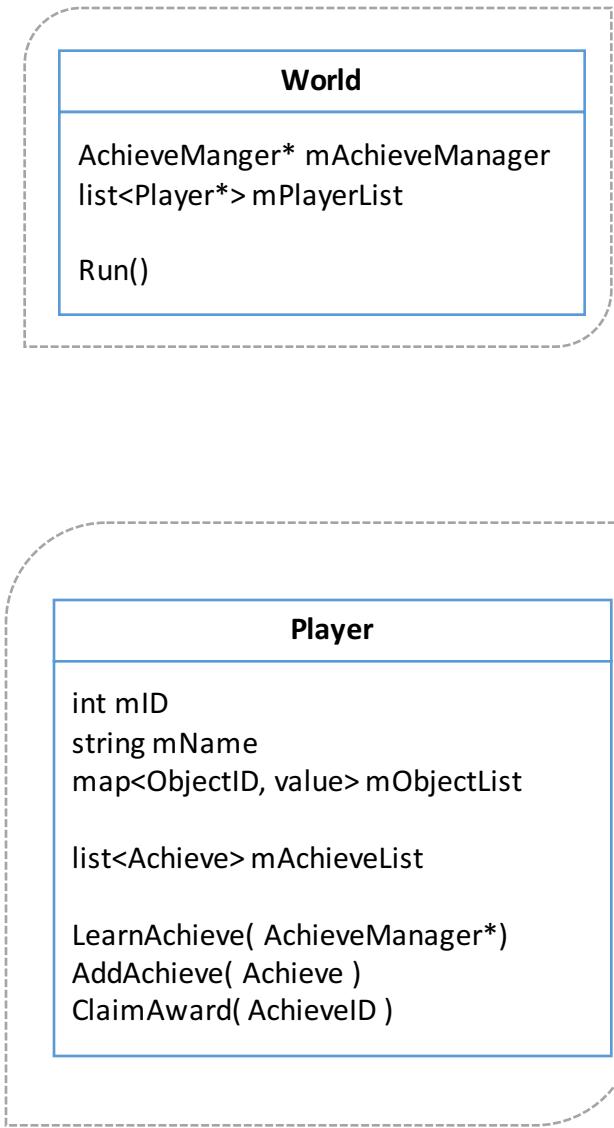
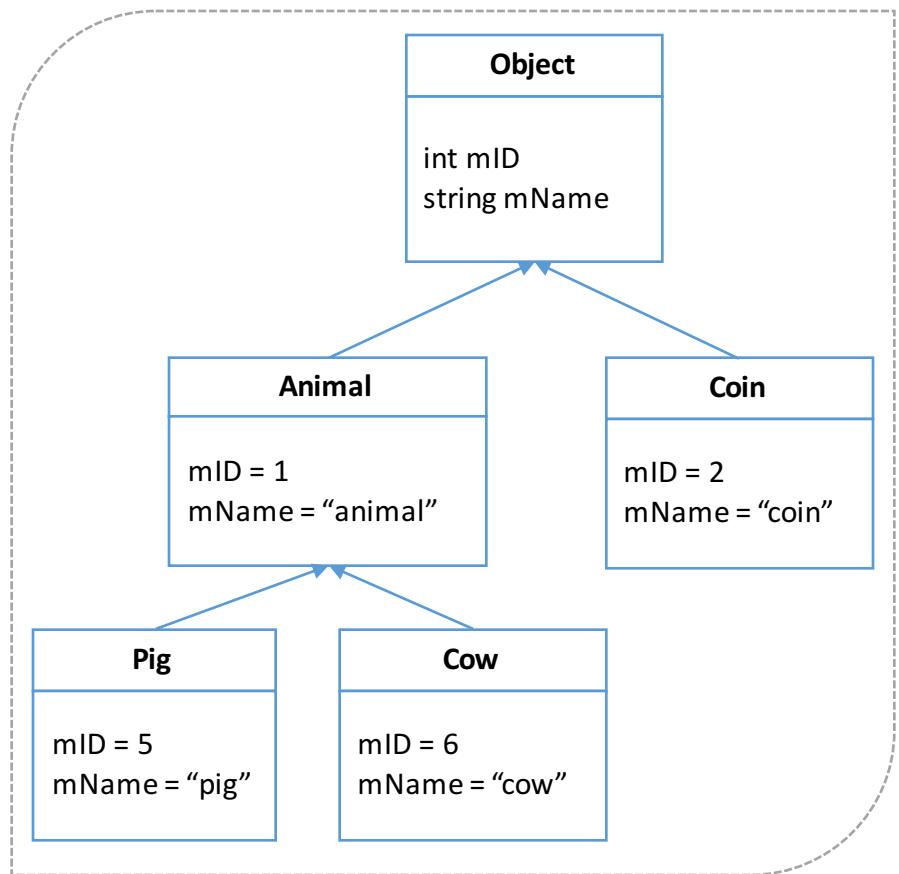
- know AchieveTypeList
- Add achieve to a player

World

- know Players
- know AchieveManger
- run the Game

Animal & Coin

- is an Object

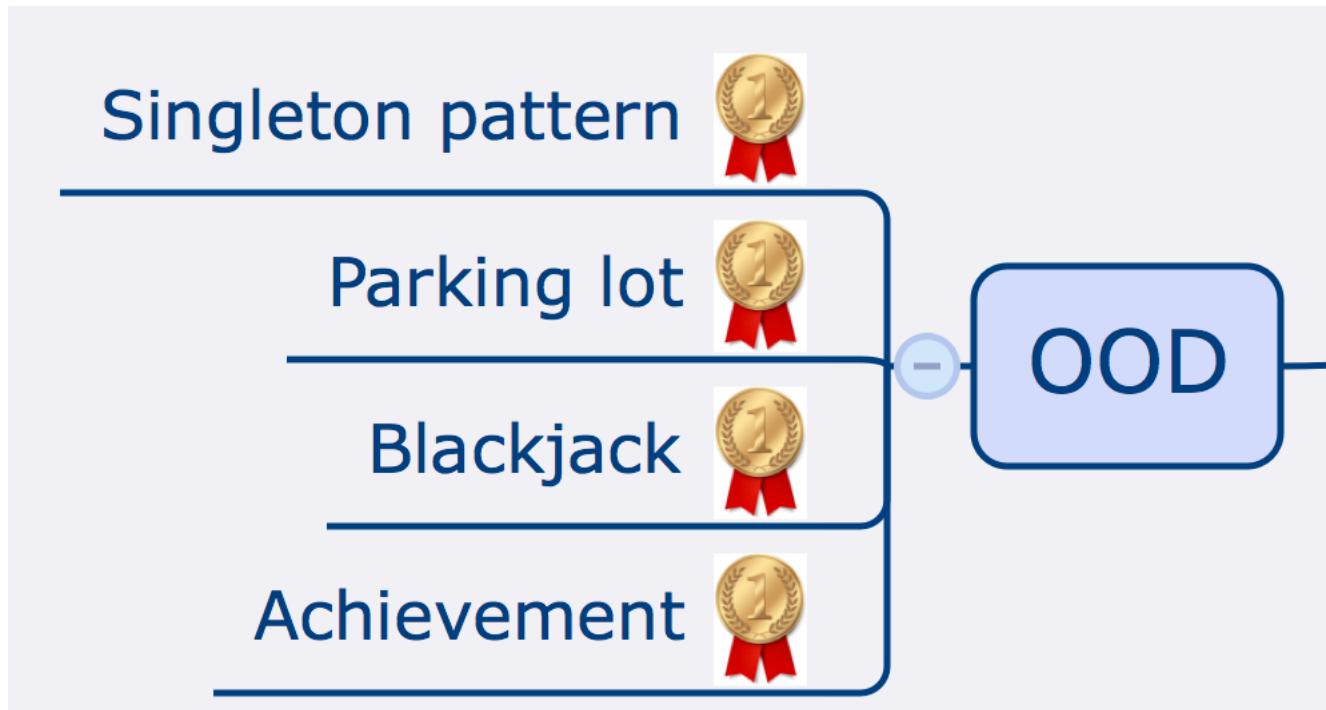


Homework

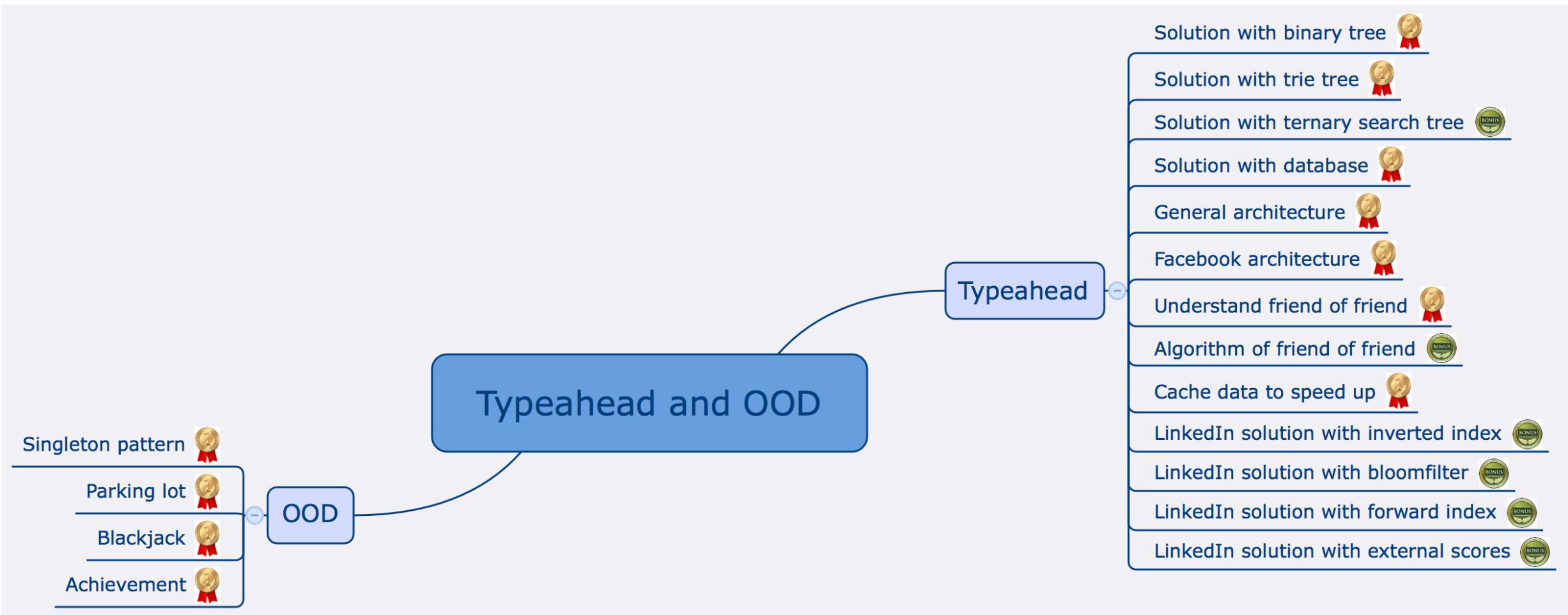
- Design elevator

<http://www.jiuzhang.com/qa/129/>

Summary of Part2



Summary



Keywords

- Typeahead
- Instant search
- Binary search tree
- Trie tree
- Ternary search tree
- Like
- Cache
- Friend of friend
- OOD
- Class
- Know/do/is
- Elevator
- Parking lot
- Blackjack
- Achievement

QA

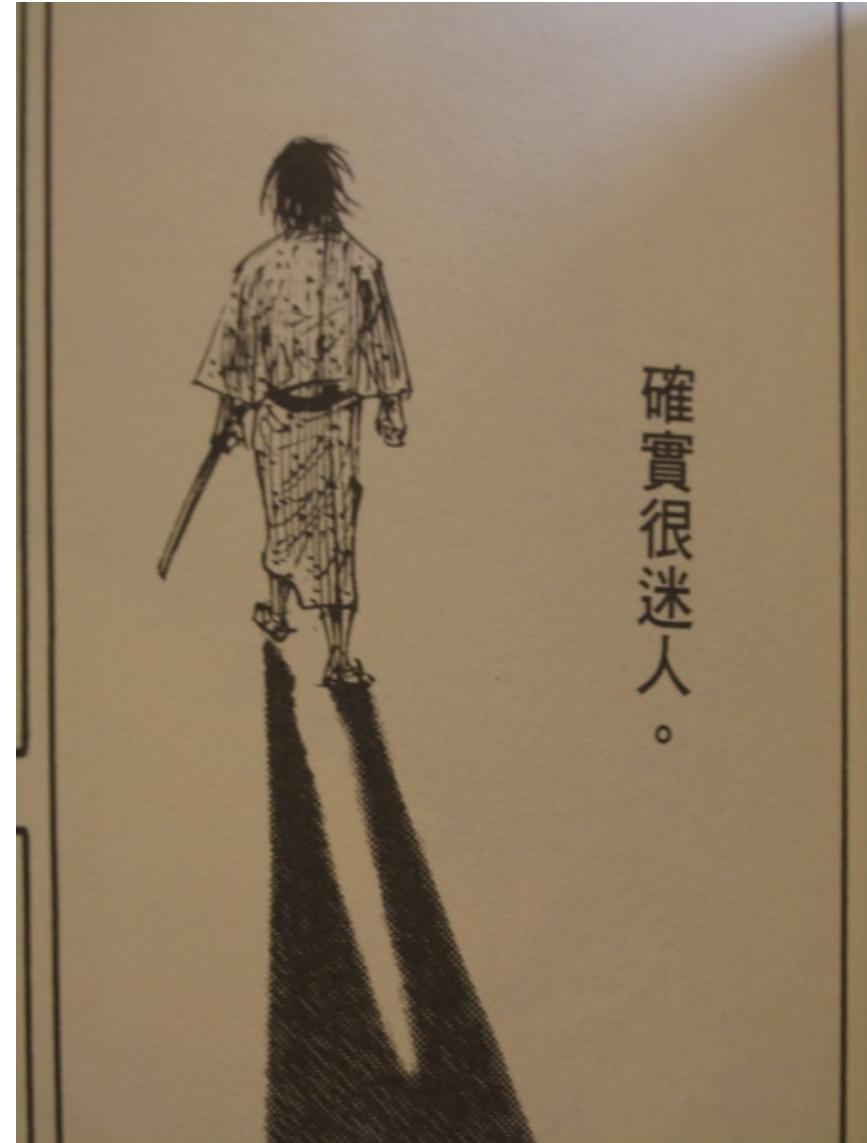
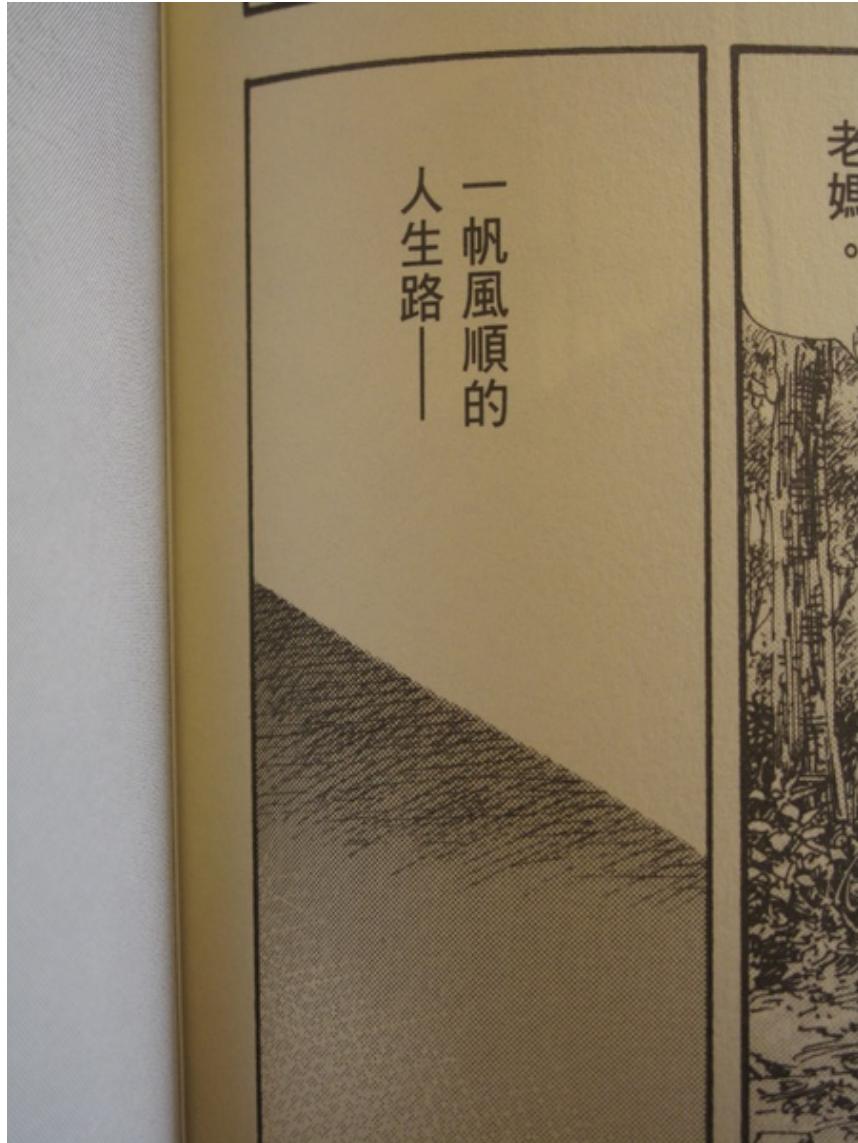


关注微信/微博，获取最新面试题及权威解答

微信: [ninechapter](#)

微博: <http://www.weibo.com/ninechapter>

官网: www.jiuzhang.com

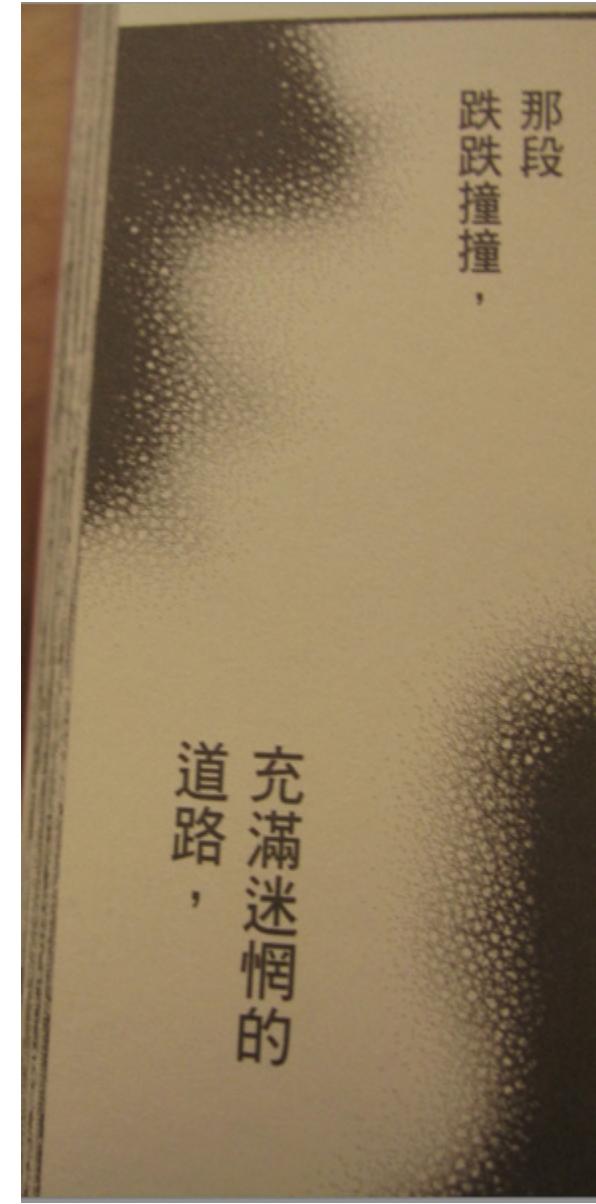




然而，事實上卻不可能那麼順利。



繞圈子。



一定會比任何人
都還要來得寬敞





系统设计第十期招生中

喜欢我们的课
就分享给一位好友吧

免费试听

正式开课

北京时间 2016-01-17 06:00
美西时间 2016-01-16 16:00

北京时间 2016-01-24 06:00
美西时间 2016-01-23 16:00

Read More

<http://www.jiuzhang.com>