



# Apache Kylin

## 深入Cube和查询调优

李栋 | Dong Li

技术合伙人 & 高级架构师

# 为什么需要优化？

---

Cube膨胀率变大

构建时间变长

查询时间变慢

.....



# 优化案例（1）

- 某金融企业，使用Apache Kylin作为报表分析引擎
- 硬件：高端PC服务器（每台40核、256GB内存，共20台的集群）
- 数据：事实表100w+记录；维表有“部门”，“人员”，“业务”等；度量是某些指标的平均值
- 优化：依据业务需求精简Cube设计（去除不必要维度，设置聚合组、联合维度等）
- 优化成果：

	优化前	优化后
构建时间	5小时	5分钟
膨胀率	1000+倍	10+%
查询性能	经常拖垮HBase	大部分1s内

# 优化案例（2）

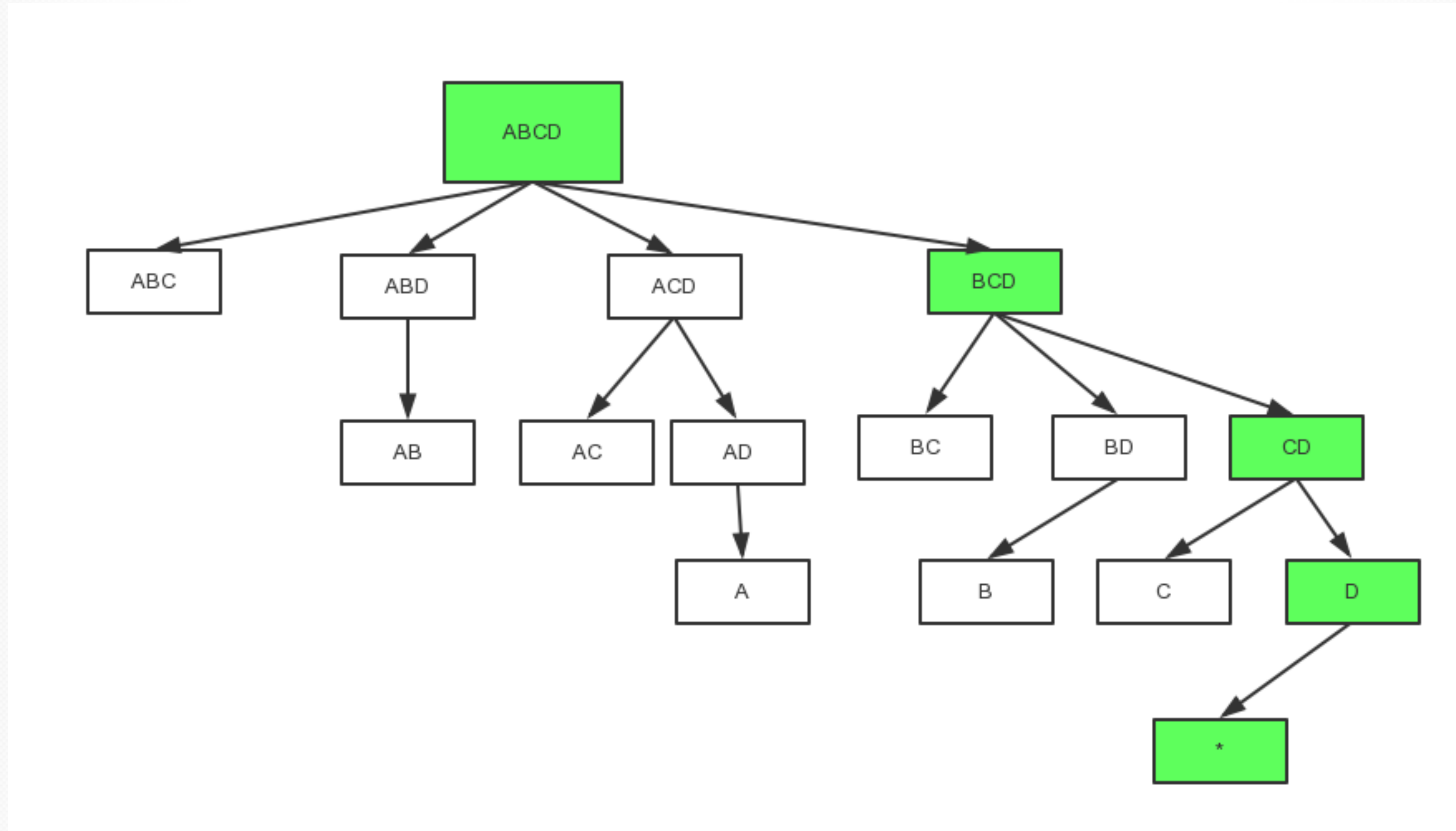
- 某智能硬件企业，使用Apache Kylin作为大数据平台引擎
- 数据：9个维度，其中1个基数千万级、1个基数百万级、其他基数10w以内；单月原始数据6亿条
- 优化：
  - 数据处理：对时间戳字段去除时分秒信息，实现降维
  - 设置聚合组，把超低基数维度设为必要维度；互斥条件分别包含在不同聚合组（如崩溃时间和上传时间）
- 优化成果：

	优化前	优化后
构建时间	100%	70%
Cube大小	1.9 TB	500 GB
查询性能	< 10s	< 2s



# Cube优化原理

# Cuboid 生成树





# Cube调优

## 数据特性

Cuboid – ABCD

行数：5

A1	B1	C1	D1
A2	B2	C2	D1
A3	B3	C3	D1
A4	B4	C4	D1
A5	B5	C5	D1

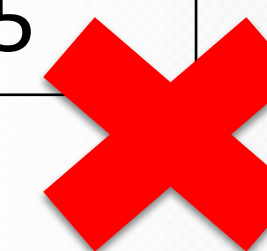
重合率 > 90%



Cuboid – ABC

行数：5

A1	B1	C1
A2	B2	C2
A3	B3	C3
A4	B4	C4
A5	B5	C5



## 业务逻辑

字段关联：Country、Province、City

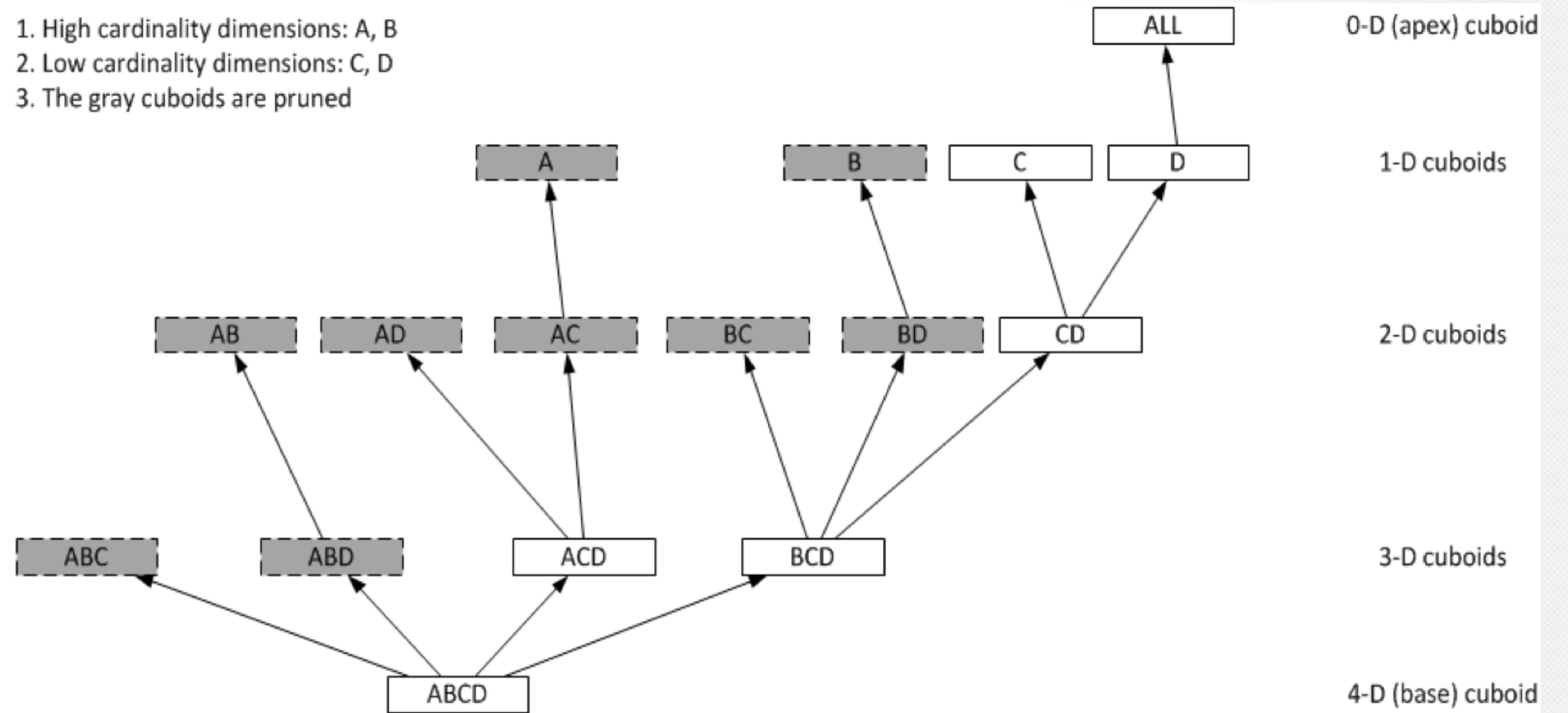
业务关联：Order\_Date、Deliver\_Date、Finish\_Date

# 高级设置

## 减少冗余Cuboid

- 聚合组
- 必要维度
- 层级维度
- 联合维度

1. High cardinality dimensions: A, B
2. Low cardinality dimensions: C, D
3. The gray cuboids are pruned

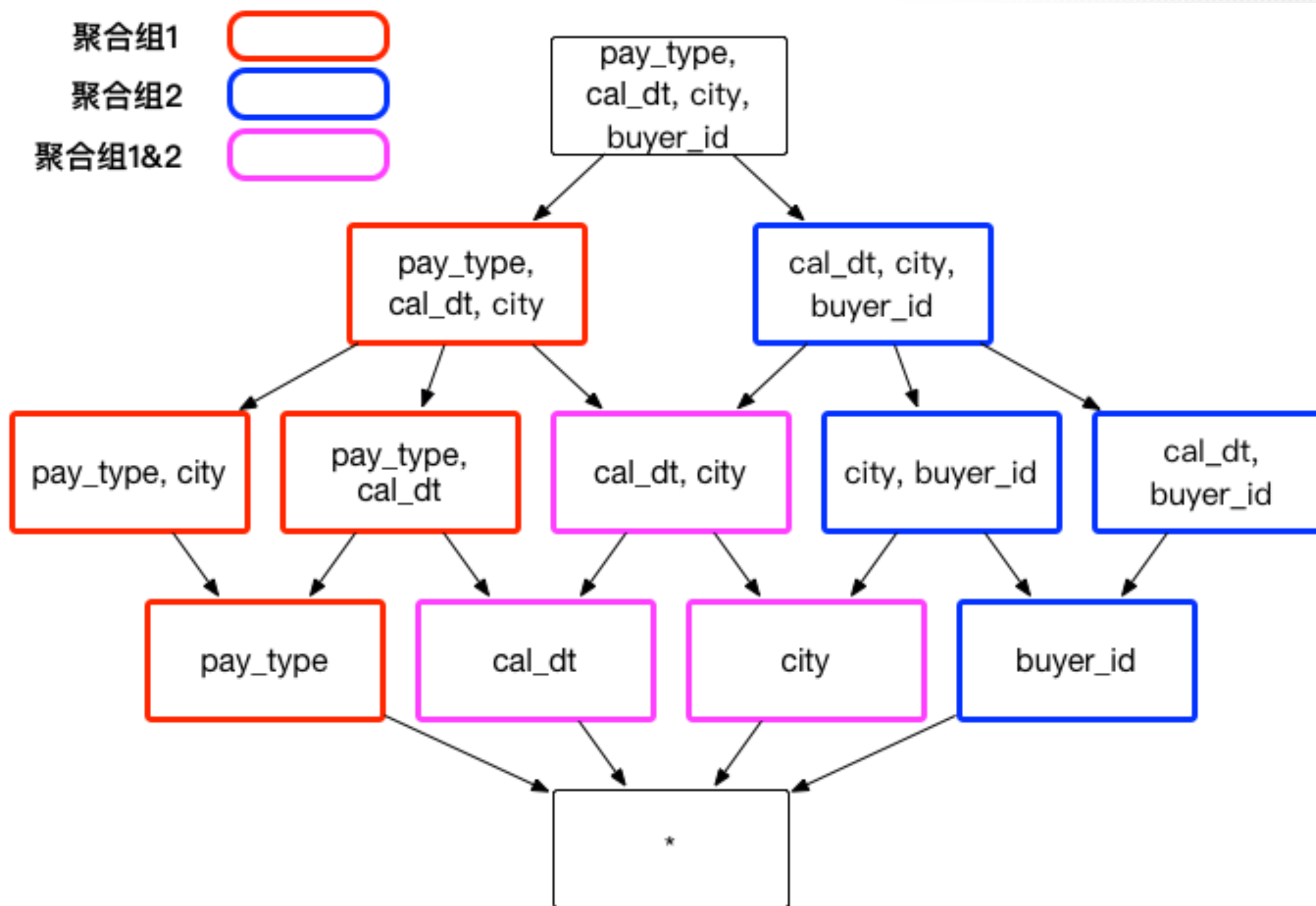




# 聚合组

对维度进行分组

- $2^{30} \rightarrow 2^{10} + 2^{10} + 2^{10}$



# 必须维度、联合维度、层级维度

A	B	C
A	B	-
-	B	C
A	-	C
A	-	-
-	B	-
-	-	C

设置 A 为  
必须维度

A	B	C
A	B	-
A	-	C
A	-	-

设置 A > B > C 为  
层级维度

A	B	C
A	B	-
A	-	-

设置 A,B 为  
联合维度

A	B	C
A	B	-
-	-	C





# KyBot

工欲善其事 必先利其器

# Why KyBot?

Cube构建慢？

SQL查询慢？

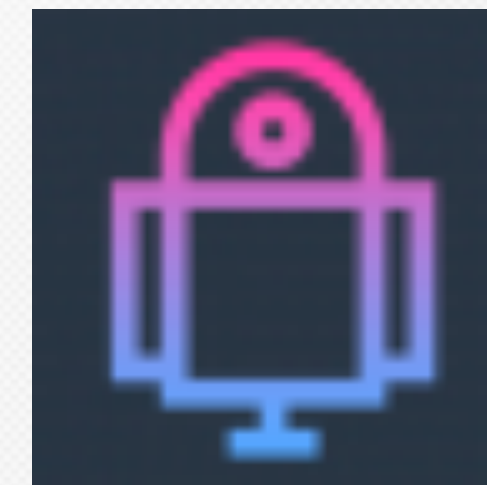
遇到Exception？

集群资源紧张？

*How to solve these problems? The KyBot was born!*



# What is KyBot?



**KyBot = Kylin+Robot**

<https://kybot.io>

Apache Kylin 在线诊断, 优化及服务平台



## 仪表盘

洞悉Kylin集群的健康情况



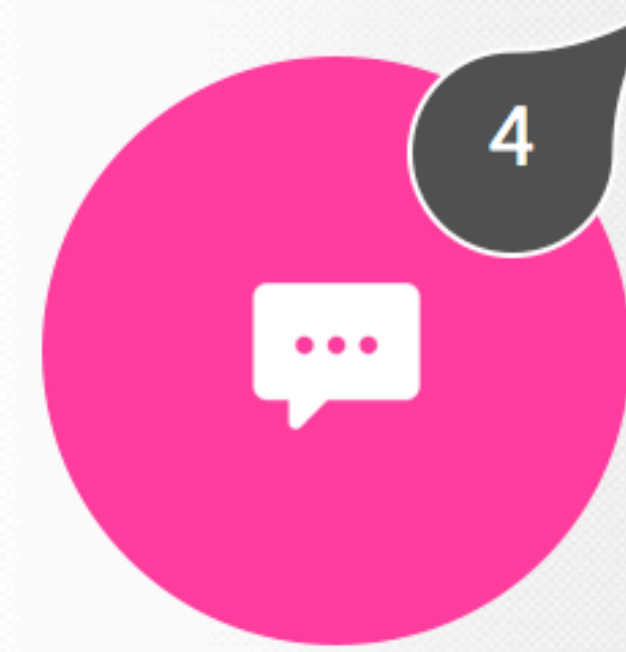
## 系统优化

寻求解决瓶颈问题的优化方案



## 故障排查

基于日志分析和索引技术快速定位和统计异常

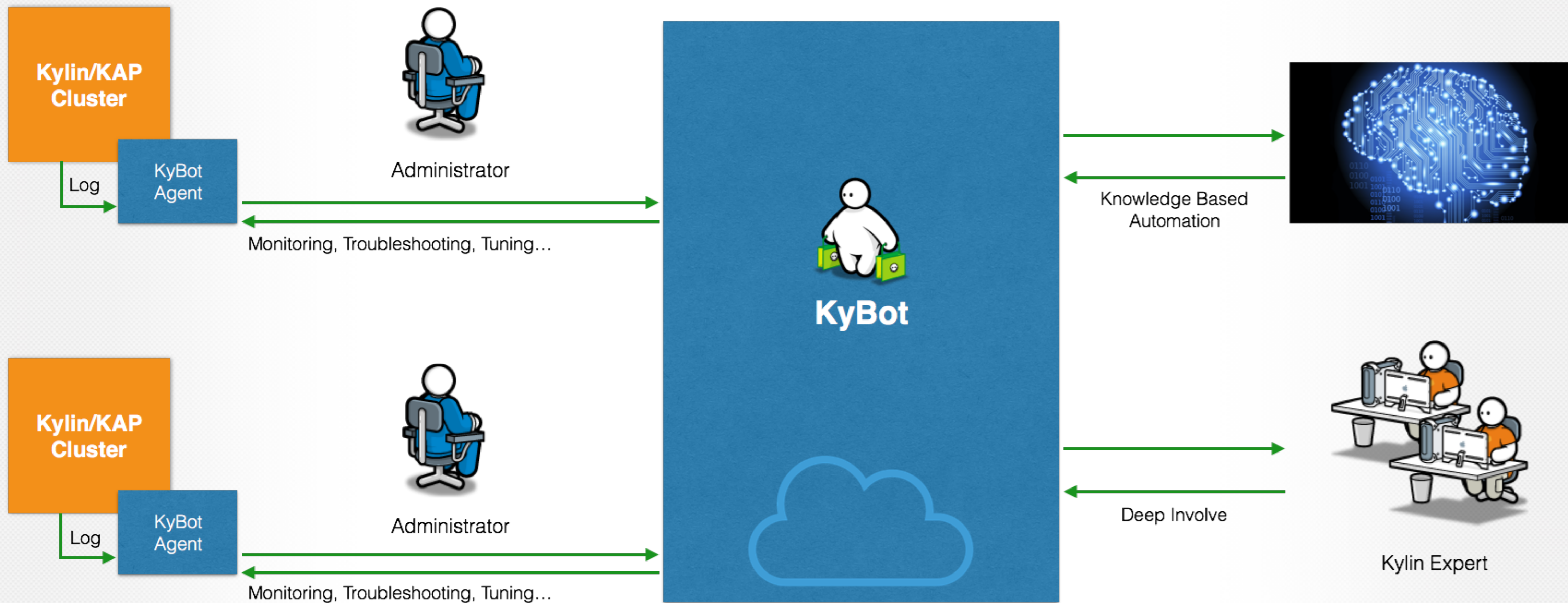


## 知识库

基于多年开发、实施经验和案例总结



# How does KyBot work?





# How to use KyBot?

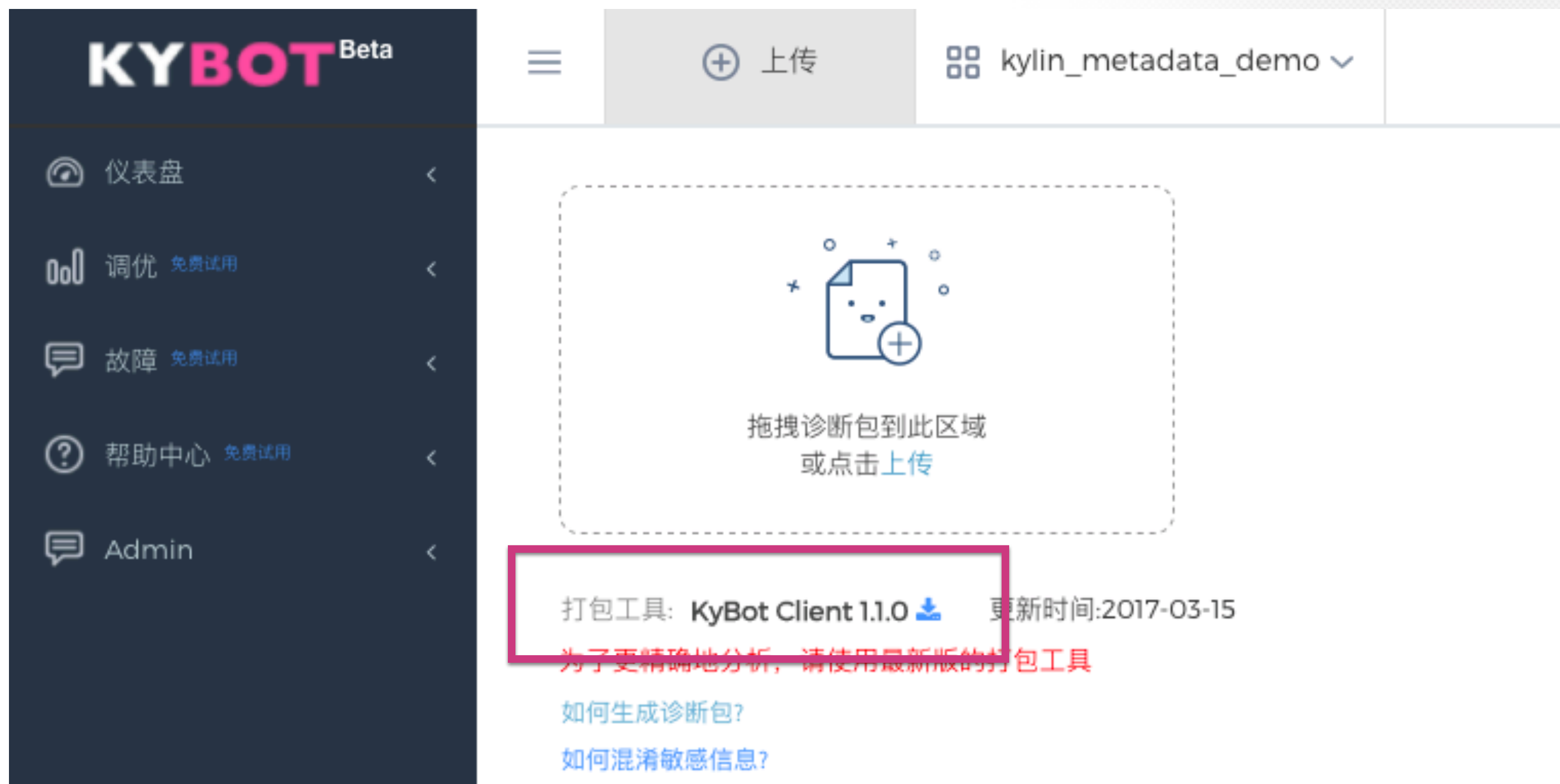
1. 注册KyBot账号
2. 下载KyBot Client
3. 生成诊断包
4. 上传诊断包

<https://kybot.io>



# How to use KyBot?

1. 注册KyBot账号
2. 下载KyBot Client
3. 生成诊断包
4. 上传诊断包





# How to use KyBot?

1. 注册KyBot账号
2. 下载KyBot Client
3. 生成诊断包
4. 上传诊断包

解压到\$KYLIN\_HOME目录下

```
[kylin@sandbox apache-kylin-2.0.0-SNAPSHOT-bin]$ ls kybot
agent          diag.sh        kybot-client-agent-runner-lib.jar  kybot-client.properties  kybot.sh
commit_SHA1    header.sh      kybot-client-lib.jar               kybot.mapping.2017-04-17  setup-agent.sh
```

执行kybot/kybot.sh打包

```
Package created at: /home/kylin/apache-kylin-2.0.0-SNAPSHOT-bin/kybot_dump/kybot_2017_04_20_04_38_46/kybot_2017_04_20_04_38_46_79C46B.zip
2017-04-20 04:39:41,205 INFO [main AbstractInfoExtractor:146]:
=====
Dump kybot package locates at:
/home/kylin/apache-kylin-2.0.0-SNAPSHOT-bin/kybot_dump/kybot_2017_04_20_04_38_46/kybot_2017_04_20_04_38_46_79C46B.zip
=====
2017-04-20 04:39:41,206 INFO [main KybotClientCLI:418]: Do not need to upload to server.
2017-04-20 04:39:41,207 INFO [Thread-7 ConnectionManager$HConnectionImplementation:2120]: Closing master protocol: MasterService
2017-04-20 04:39:41,238 INFO [Thread-7 ConnectionManager$HConnectionImplementation:1683]: Closing zookeeper sessionid=0x15b7ba388a500f2
2017-04-20 04:39:41,243 INFO [Thread-7 ZooKeeper:684]: Session: 0x15b7ba388a500f2 closed
2017-04-20 04:39:41,243 INFO [main-EventThread ClientCnxn:524]: EventThread shut down
[kylin@sandbox apache-kylin-2.0.0-SNAPSHOT-bin]$
```



# How to use KyBot?

1. 注册KyBot账号
2. 下载KyBot Client
3. 生成诊断包
4. 上传诊断包

The screenshot displays the KyBot web interface. At the top, there is a navigation bar with a menu icon, an '上传' (Upload) button, a project name 'kylin\_metadata\_demo', and user information 'English', '联系我们' (Contact Us), and '欢迎 dong' (Welcome dong). The main content area features a large dashed box for file upload with the text '拖拽诊断包到此区域 或点击上传' (Drag the diagnostic package to this area or click upload). Below this, there is a section for '打包工具: KyBot Client 1.1.0' (Packaging tool: KyBot Client 1.1.0) with a download icon and update date '更新时间:2017-03-15'. A red warning message states '为了更精确地分析, 请使用最新版的打包工具' (For more accurate analysis, please use the latest version of the packaging tool). There are also links for '如何生成诊断包?' (How to generate diagnostic packages?) and '如何混淆敏感信息?' (How to obfuscate sensitive information?). At the bottom, there is a table titled '上传记录' (Upload Record) with columns for '用户名' (Username), '文件名' (Filename), '实例' (Instance), '时间范围' (Time Range), '上传时间' (Upload Time), '分析' (Analysis), and 'Action'. The table contains one entry for 'dong@kyligence.io' with filename 'project\_2016\_08\_07\_07\_29\_38.zip', instance 'kylin\_metadata\_demo', upload time '2017-04-20 12:44:22', and a progress bar showing 54% analysis. The 'Action' column has a dropdown menu.

用户名	文件名	实例	时间范围	上传时间	分析	Action
dong@kyligence.io	project_2016_08_07_07_29_38.zip	kylin_metadata_demo		2017-04-20 12:44:22	54%	Action



# How to protect privacy?

- 混淆脱敏
  - 主机名
  - IP地址
  - 账户配置
  - 数据信息
  - 数值信息

```
# Configuration for sensitive information obfuscation
# There're 2 levels of obfuscation: RAW, OBF
# RAW - Disable obfuscation
# OBF - Enable obfuscation

# Whether to obfuscate column cardinality of tables
kybot.obf.cardinality=OBF

# Whether to obfuscate ip in text files, including logs.
kybot.obf.ip=RAW

# Whether to obfuscate hostname in text files, including logs.
# If set to OBF, you also need to set properties kybot.obf.hostname.pattern to define the wildcard pattern of hostname:
# For example: kybot.obf.hostname.pattern=*.kybot.io
kybot.obf.hostname=RAW

# Whether to mask constants(eg. filter values, case when etc.) in sql statements in log files.
kybot.obf.sql.const=RAW

# Whether to remove account information(such as email/ldap/saml account) in kylin.properties
kybot.obf.kylin.properties=OBF
```

# Cube评分

- 查询性能
- 构建性能
- 膨胀倍数
- 使用率
- 模型设计



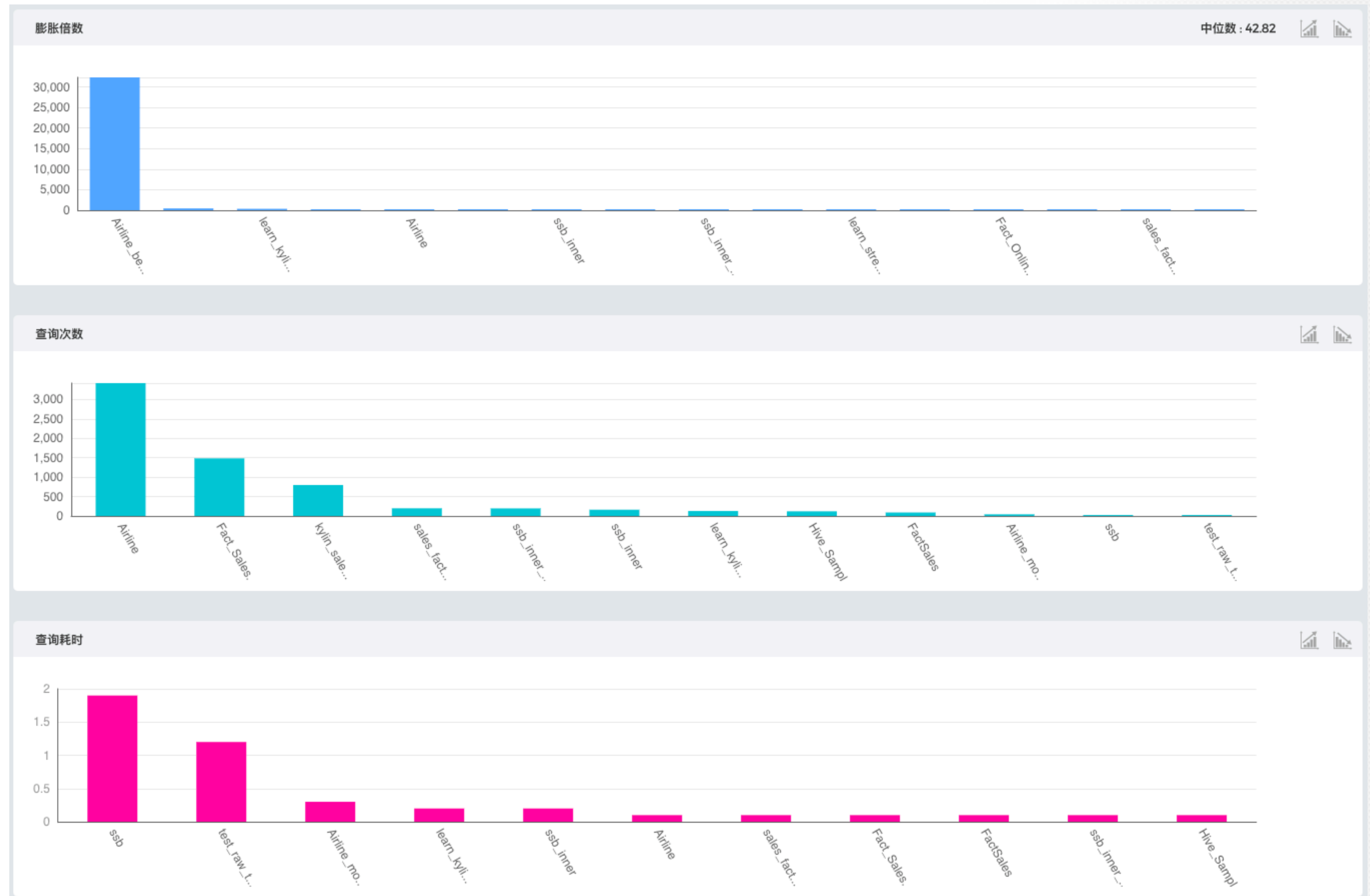
仪表盘 / Cube / ssb





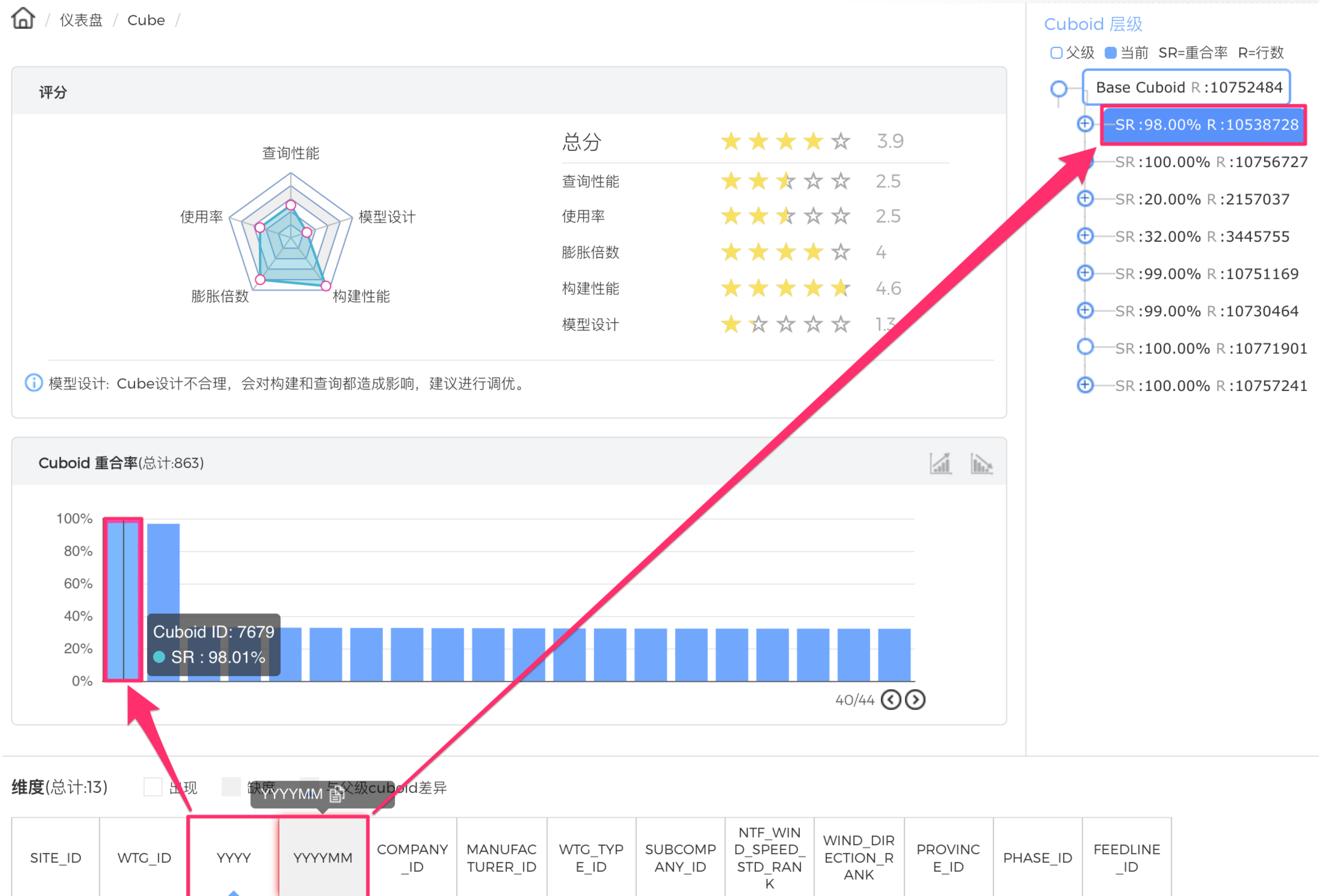
# Cube排行

- 按膨胀倍数
- 按查询次数
- 按查询耗时



# Cube调优

- 通过重合率寻找可以被剪枝的Cuboids





# Cube调优

- 和父级Cuboid差异  
字段基数很低
- 通过调整高级设置减少冗余Cuboid

维度(总计:13)  出现  缺席  与父级cuboid差异

S_ID	WORKER_ID	YYYY	YYYYMM	CATA1_ID	STAGE_ID	STEP_ID	CATA2_ID	A_LEVEL	B_LEVEL	LOCATION	TYPE	PIPE_ID
------	-----------	------	--------	----------	----------	---------	----------	---------	---------	----------	------	---------

基础信息				使用统计		
1 tiny 基数	varchar(256) 字段类型	dict 编码	no ShardBy	-- 过滤	-- group by	

聚合组

Hierarchy	YYYY 基数:1	YYYYMM 基数:3	
-----------	--------------	----------------	--

维度(总计:13)  出现  缺席  与父级cuboid差异

S_ID	WORKER_ID	YYYY	YYYYMM	CATA1_ID	STAGE_ID	STEP_ID	CATA2_ID	A_LEVEL	B_LEVEL	LOCATION	TYPE	PIPE_ID
------	-----------	------	--------	----------	----------	---------	----------	---------	---------	----------	------	---------

基础信息				使用统计		
1 tiny 基数	varchar(256) 字段类型	dict 编码	no ShardBy	-- 过滤	-- group by	

聚合组

Hierarchy	CATA1_ID 基数:1	CATA2_ID 基数:2	
-----------	------------------	------------------	--

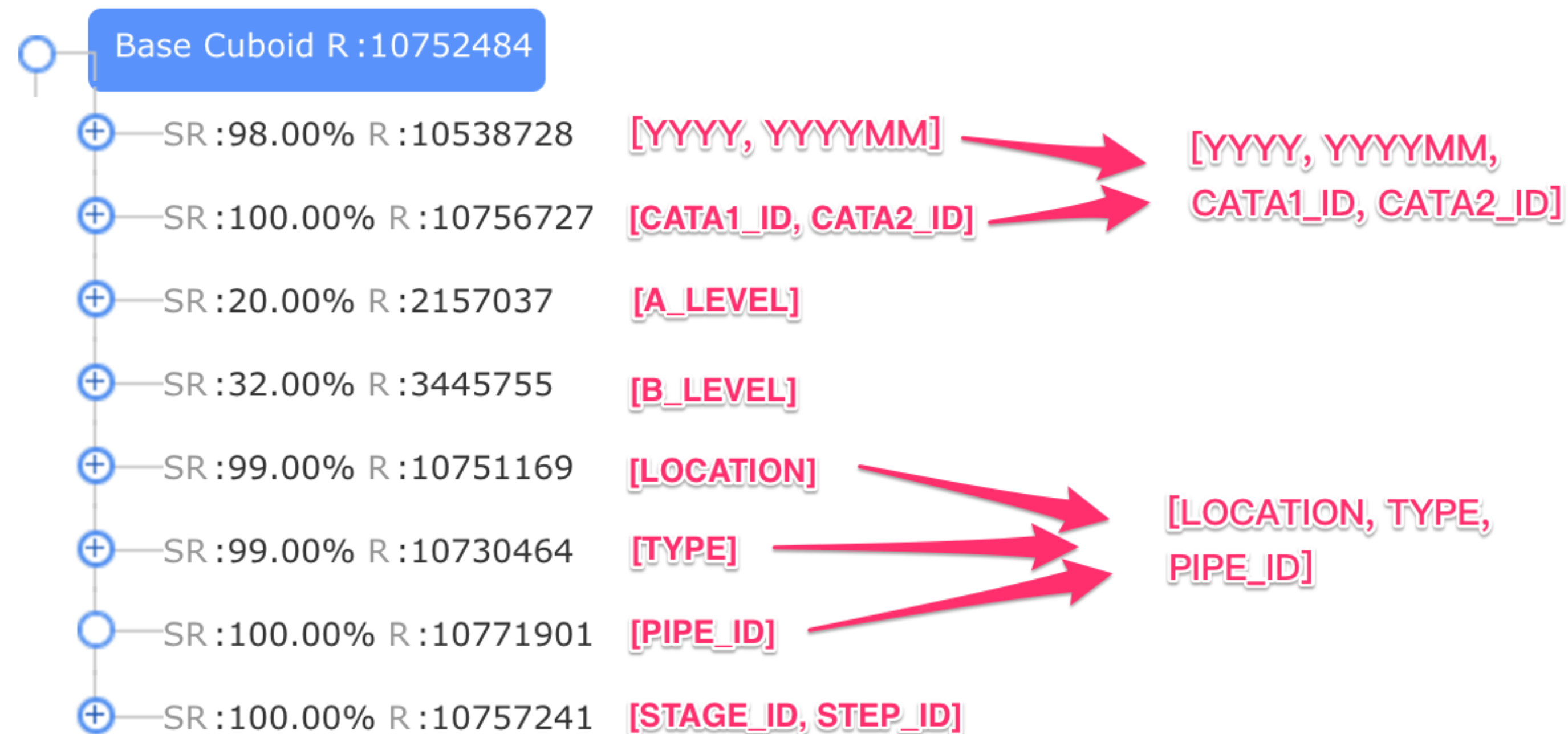


# Cube调优

- 通过减少冗余Cuboid，减少了Cube复杂度( $2^8 \Rightarrow 2^5$ )，从而降低膨胀率，节约存储，进而有效减小构建时间，同时保障查询效率

## Cuboid 层级

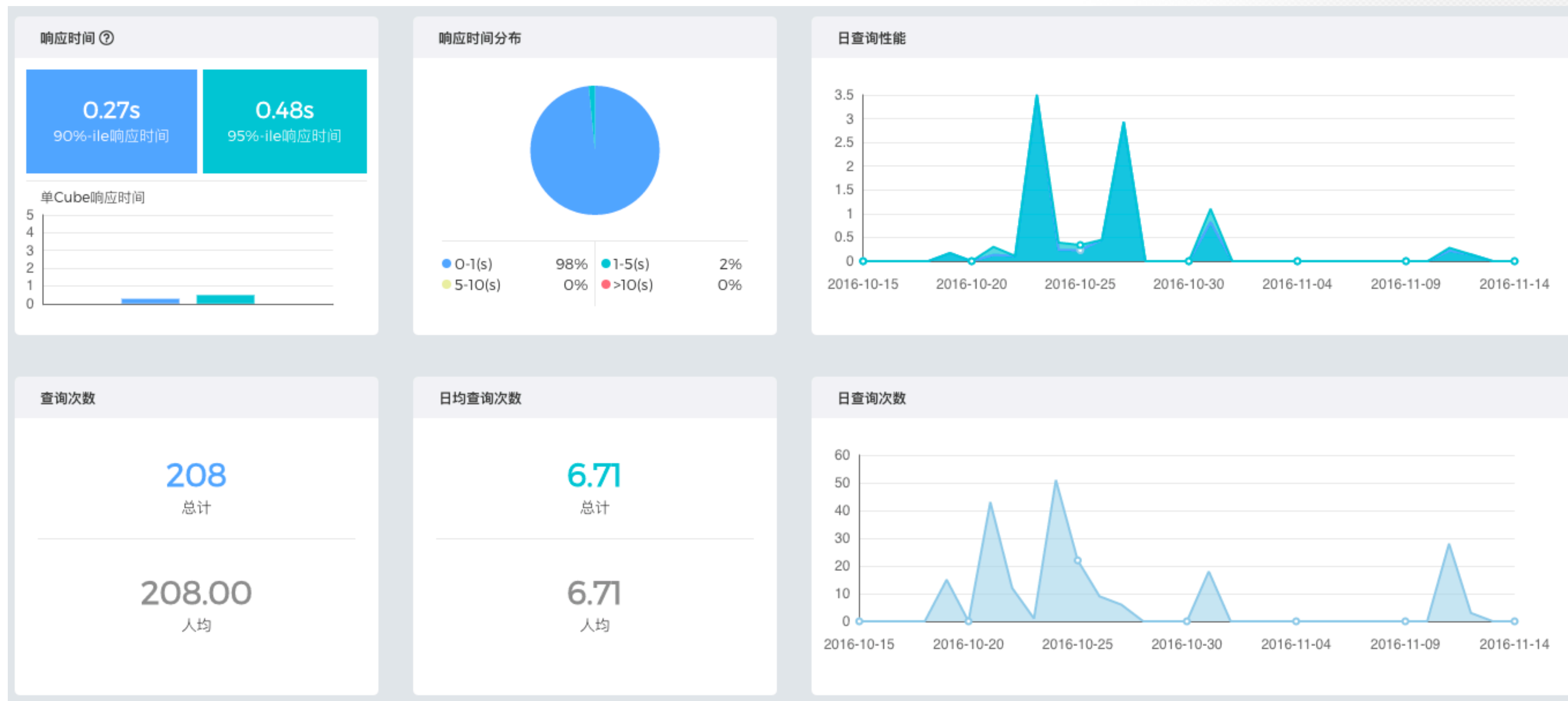
□ 父级 ● 当前 SR=重合率 R=行数





# 查询统计

- 响应时间
- 性能变化趋势
- 查询次数
- 负载变化趋势



# 定位查询

- 慢查询
- 失败查询

ID	项目	Cube	SQL	成功率	查询次数	响应时间(S)	调优
1	FactSales	Fact_Sales_1	select "DIMDATE"."CALENDARYEAR" as "c0","PRODUCT_PRODUCTSUBCATEGORY"."PR...	100%	1	9.98	→
2	FactSales	Fact_Sales_1	select "DIMDATE"."CALENDARYEAR" as "c0","STORE_GEGORAPHY"."CONTINENTNAME...	100%	2	9.95	→
3	FactSales	Fact_Sales_1	select "DIMCHANNEL"."CHANNELNAME" as "c0", "STORE_GEGORAPHY"."CONTINENTN...	100%	2	9.94	→
4	FactSales	Fact_Sales_1	select "DIMDATE"."CALENDARYEAR" as "c0", "PRODUCT_PRODUCTSUBCATEGORY"."P...	100%	3	9.92	→
5	FactSales	Fact_Sales_1	select "STORE_GEGORAPHY"."CONTINENTNAME" as "c0", "DIMDATE"."CALENDARYEA...	100%	4	9.78	→
6	FactSales	Fact_Sales_1	select "DIMDATE"."CALENDARYEAR" as "c0","STORE_GEGORAPHY"."CONTINENTNAME...	100%	1	9.76	→
7	ssb	ssb_inner	select count(*) from "SSB"."SUPPLIER"	100%	5	9.71	→
8	FactSales	Fact_Sales_1	select "DIMCHANNEL"."CHANNELNAME" as "c0", "PRODUCT_PRODUCTSUBCATEGOR...	100%	1	9.67	→
9	FactSales	Fact_Sales_1	select "DIMCHANNEL"."CHANNELNAME" as "c0", "DIMDATE"."CALENDARYEAR" as "c1", ...	100%	4	9.50	→
10	FactSales	Fact_Sales_1	select "DIMCHANNEL"."CHANNELNAME" as "c0", sum("FACTSALES"."SALESAMOUNT") ...	100%	6	9.46	→



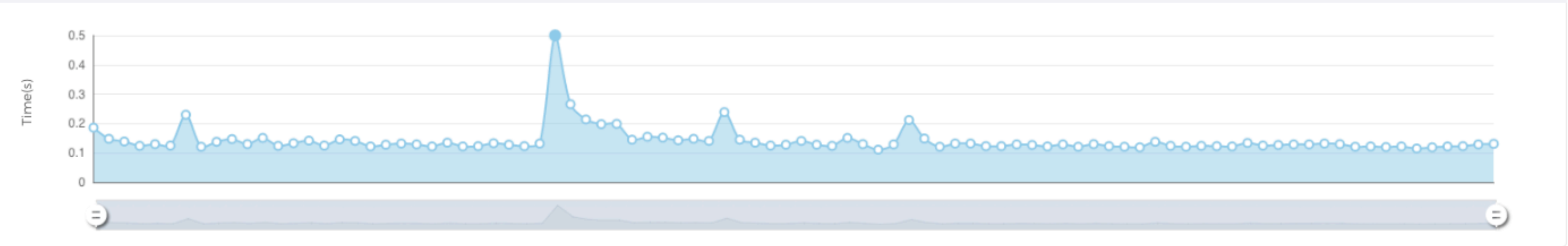
# 查询详情

- 执行历史
- Cuboid匹配
- 查询生命周期

仪表盘 / 查询 / 查询详情

```
select part_dt, sum(price) as total_sold, count(distinct seller_id) as sellers from kylin_sales group by part_dt order by part_dt
```

查询历史



learn_kylin 项目	kylin_sales_cube Cube	成功 状态	0.5s 响应时间	No 使用缓存	demo 提交者	2016-11-20 15:31:47 时间
-------------------	--------------------------	----------	--------------	------------	-------------	---------------------------

subQuery1

Cube: Kylin\_sales\_cube

过滤 Group by 过滤和Group By 出现 缺席

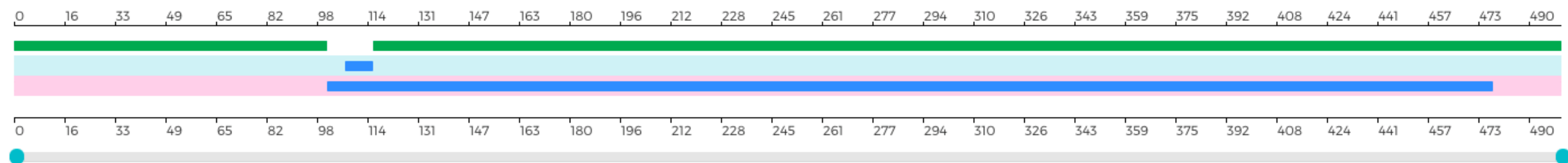
PART\_DT

PART_DT	LEAF_CATEG_I D	META_CATEG_ NAME	CATEG_LVL2_N AME	CATEG_LVL3_N AME	LSTG_FORMAT _NAME	LSTG_SITE_ID
---------	-------------------	---------------------	---------------------	---------------------	----------------------	--------------

365 基数  
date 字段类型  
dict 编码  
no ShardBy

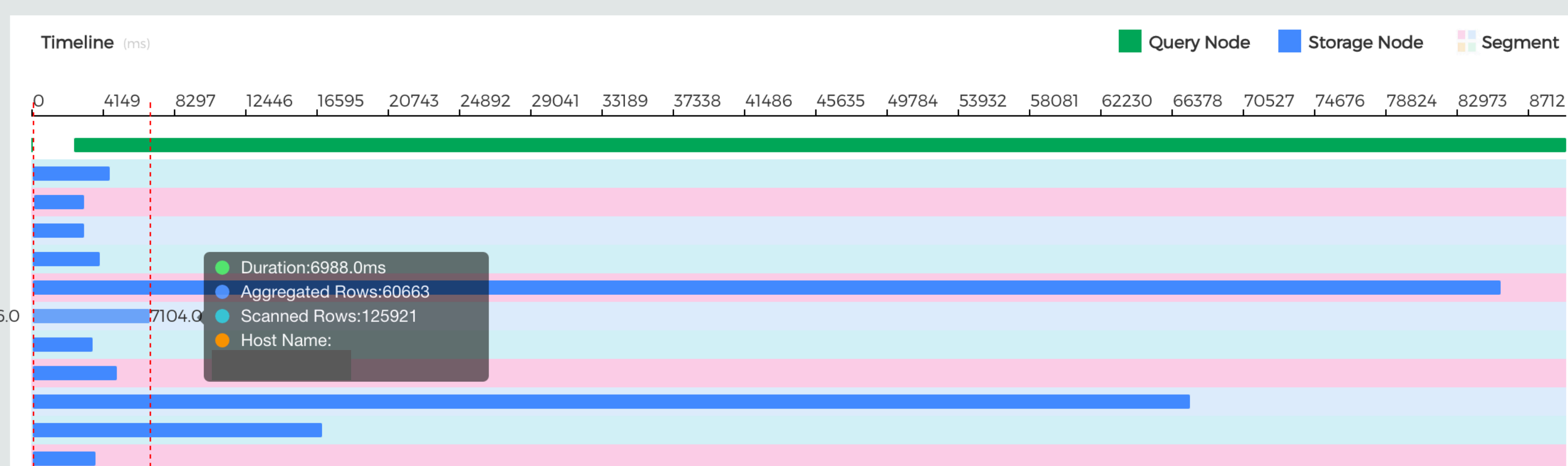
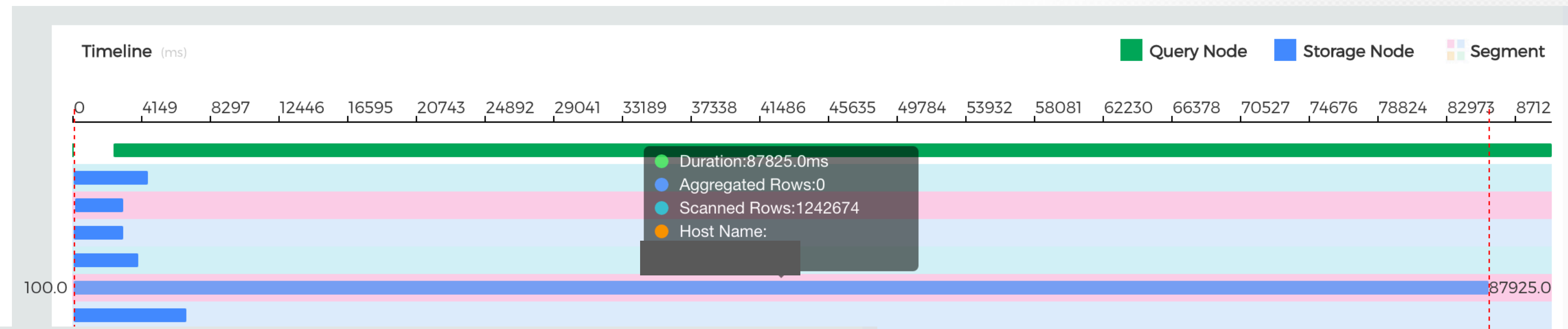
时间线 (ms)

查询节点 储存节点 Segment



# 查询调优 (1)

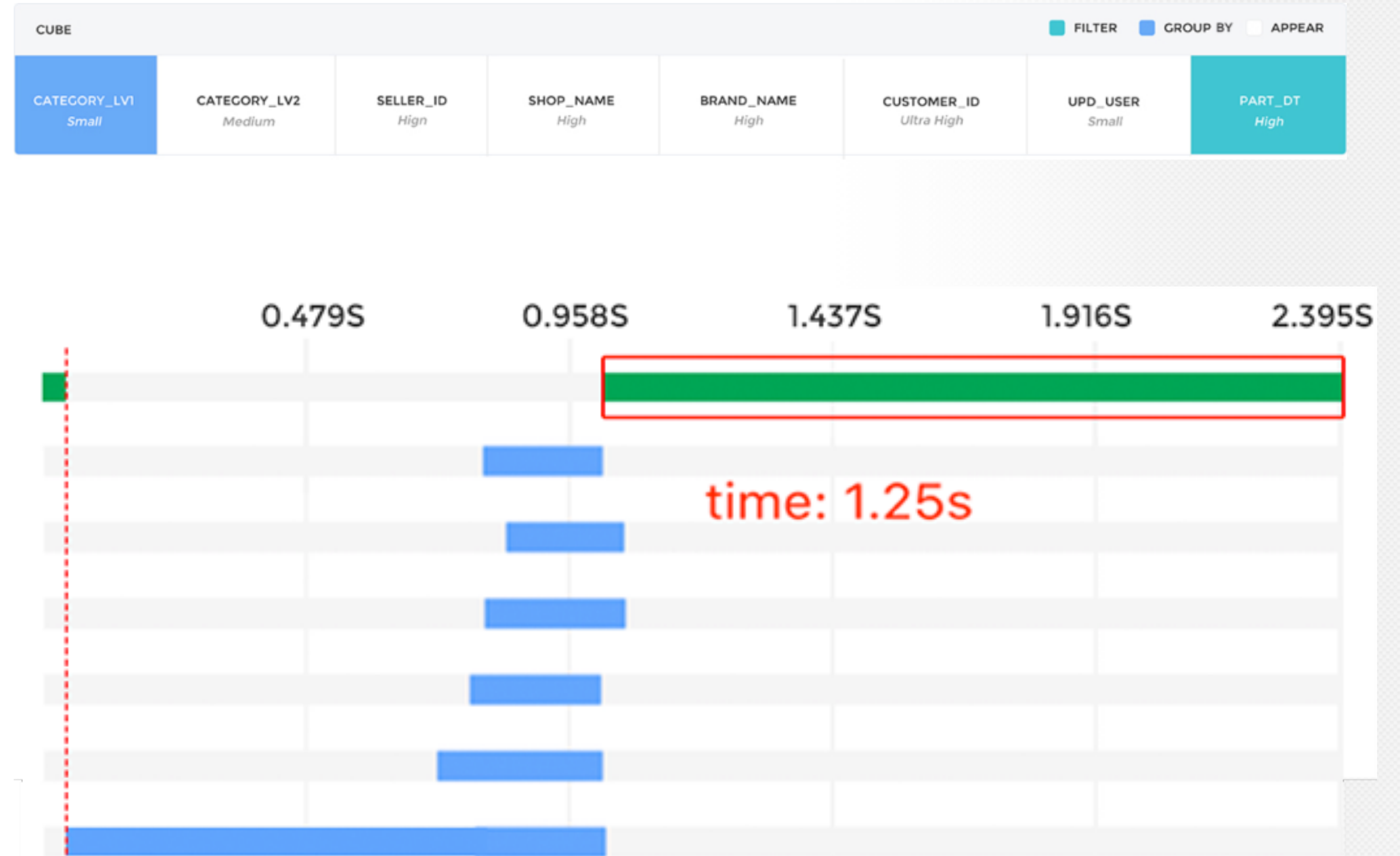
HBase Regions数据分布不均，导致Region Server负载不均，可以考虑设置UHC列为Shard By。





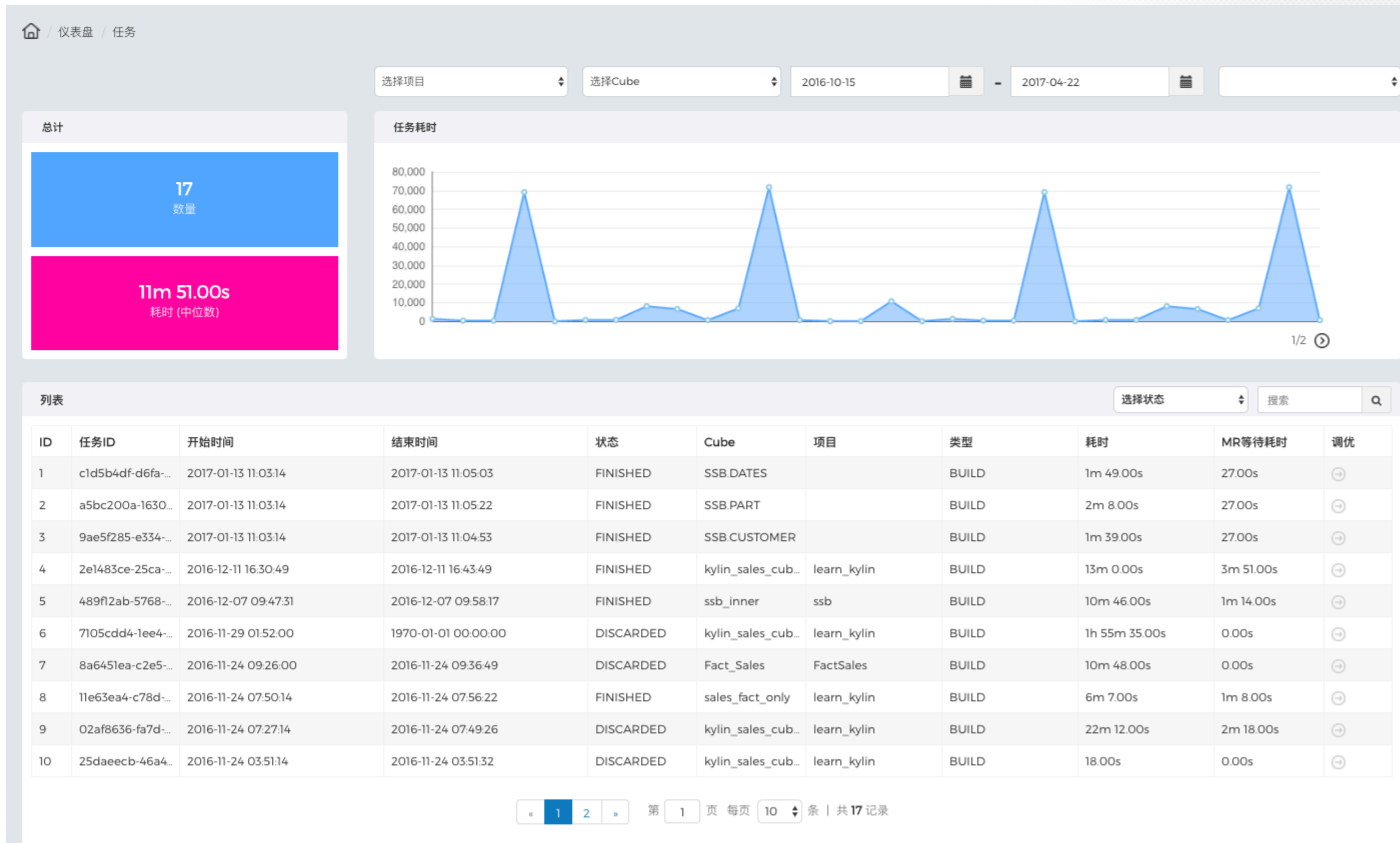
# 查询调优 (2)

- Cube上将多列高基数维度设置为必须维度，导致查询节点的聚合运算较多
- 可以考虑取消这些必须维度设置或改为联合维度



# 任务统计

- 任务统计
- 构建历史





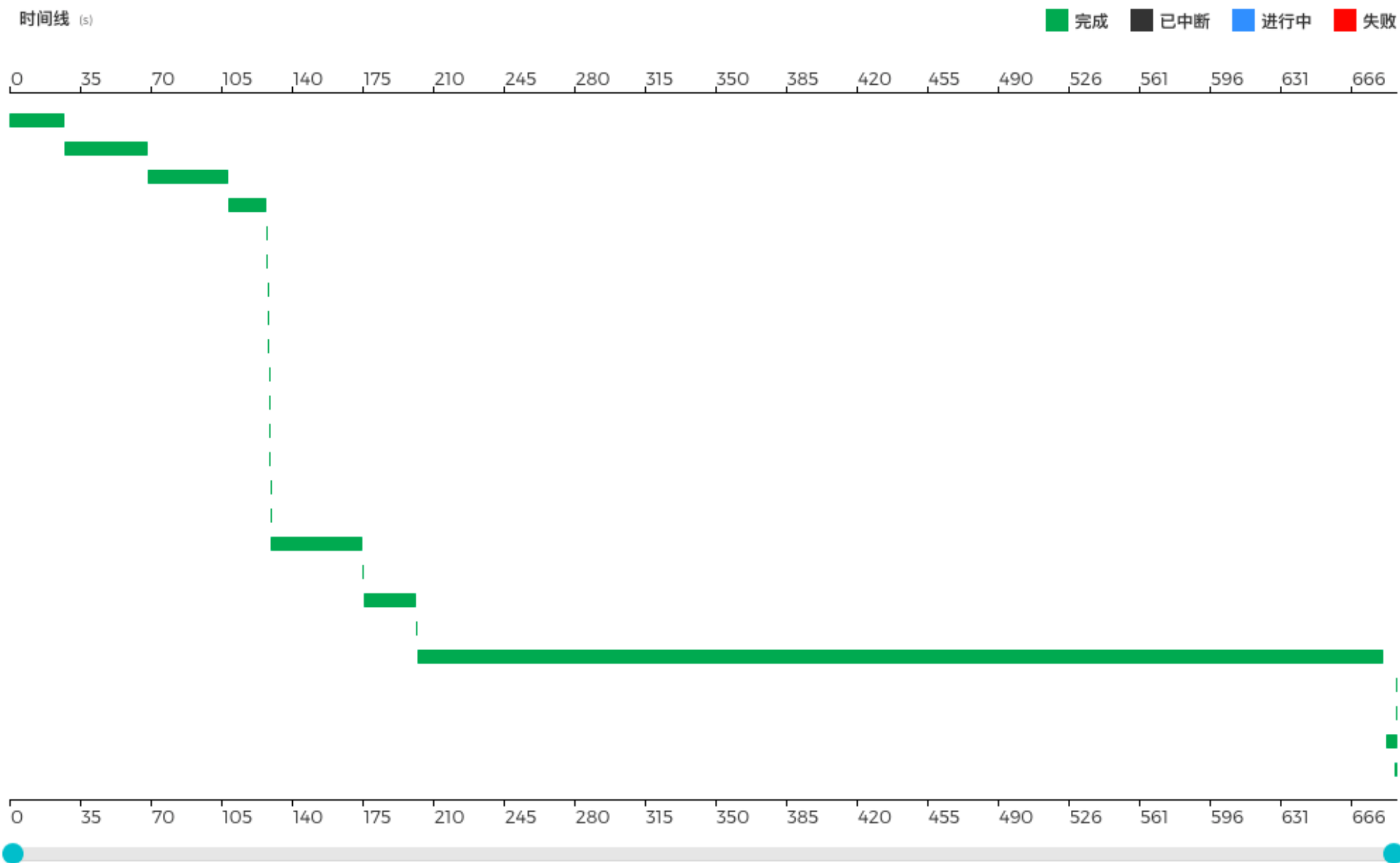
# 任务详情

- 查看生命周期
- 定位性能瓶颈

仪表盘 / 任务 / 任务详情

任务ID: [REDACTED]  
任务名称: [REDACTED] - 20170406000000\_20170408000000 - BUILD - GMT+08:00 2017-04-11 01:11:59  
状态: FINISHED  
时间: 2017-04-10 17:12:03 - 2017-04-10 17:27:49

[REDACTED] cube	15m 45.00s 持续时间	11m 12.00s MR等待时间	BUILD 类型
--------------------	--------------------	----------------------	-------------



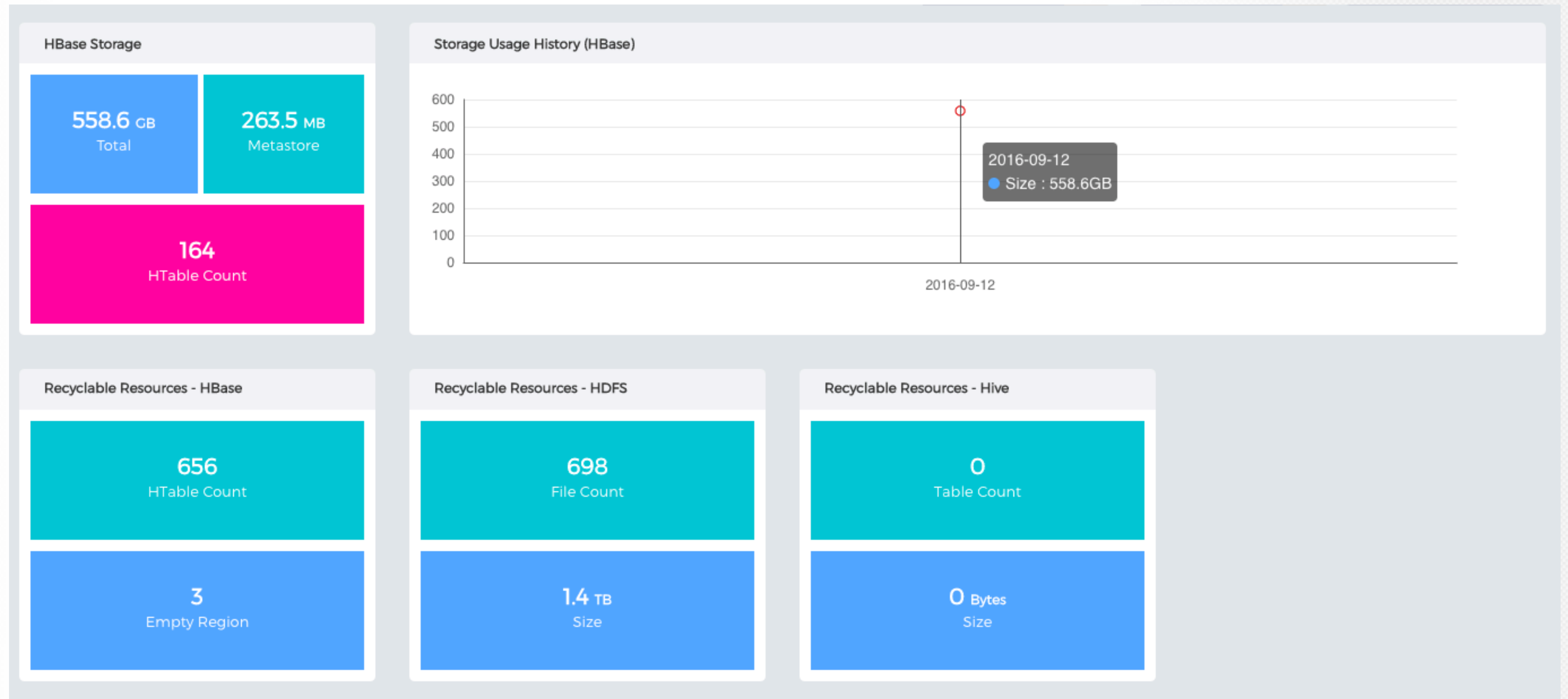
2017-04-10 17:12:03

- Create Intermediate Flat Hive ...
- Redistribute Flat Hive Table
- Extract Fact Table Distinct Col...
- Build Dimension Dictionary
- Save Cuboid Statistics
- Sizing Columnar Shards
- Build Base Cuboid Data
- Build N-Dimension Cuboid Da...
- Build N-Dimension Cuboid Da...
- Build N-Dimension Cuboid Da...
- Build N-Dimension Cuboid Da...
- Build N-Dimension Cuboid Da...
- Build N-Dimension Cuboid Da...
- Build N-Dimension Cuboid Da...
- Clean Cube Output
- Build Cube
- Clean Cube Output
- Build Columnar Page Index
- Clean Cube Index Output
- Tarball Columnar Files
- Clean Cube Tarball Output
- Update Cube Info
- Hive Cleanup
- Garbage Collection

2017-04-10 17:27:49

# 存储统计

- 存储分析
- 垃圾分析



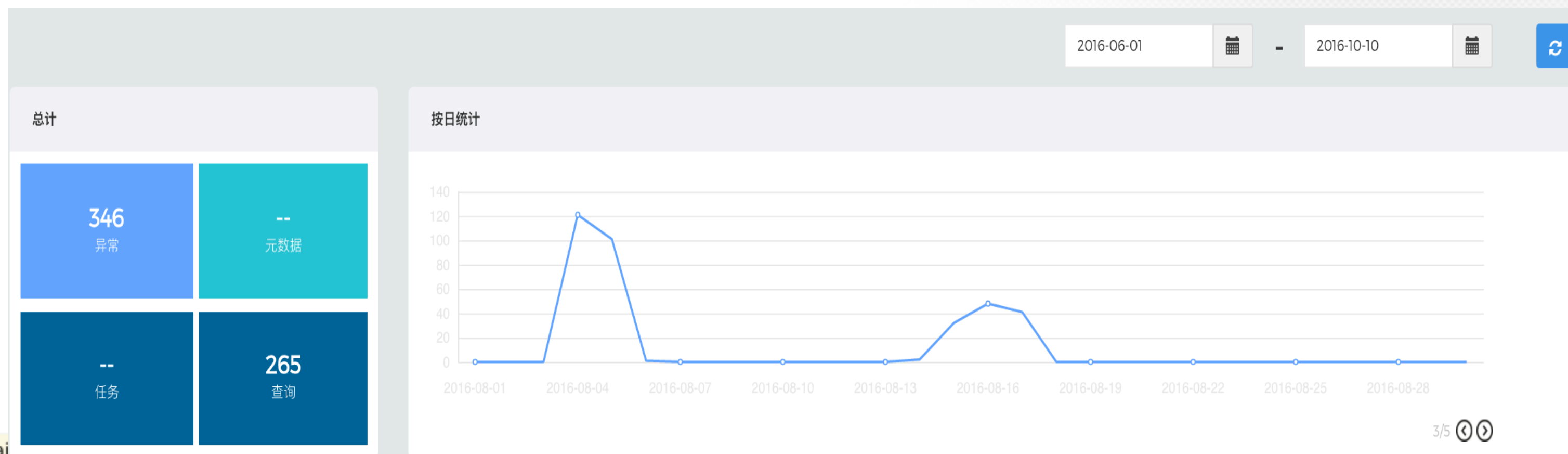


# 故障定位

- 异常统计
- 快速定位

kylin.log.2016-08-14

```
652 2016-08-14 10:50:13,784 ERROR [http-bio-7070-exec-8] security.KylinAuthenticationProvider:88 : Fai
653 org.springframework.security.authentication.BadCredentialsException: Bad credentials
654 at
org.springframework.security.ldap.authentication.LdapAuthenticationProvider.doAuthentication(LdapAut
655 at
org.springframework.security.ldap.authentication.AbstractLdapAuthenticationProvider.authenticate(Abst
656 at org.apache.kylin.rest.security.KylinAuthenticationProvider.authenticate(KylinAuthenticationPro
657 at org.springframework.security.authentication.ProviderManager.authenticate(ProviderManager.ja
658 at org.springframework.security.authentication.ProviderManager.authenticate(ProviderManager.ja
659 at org.springframework.security.web.authentication.www.BasicAuthenticationFilter.doFilter(BasicAuthenticationFilter.java:168)
660 at org.springframework.security.web.FilterChainProxy$VirtualFilterChain.doFilter(FilterChainProxy.java:342)
661 at
org.springframework.security.web.authentication.ui.DefaultLoginPageGeneratingFilter.doFilter(DefaultLoginPageGeneratingFilter.java:91)
662 at org.springframework.security.web.FilterChainProxy$VirtualFilterChain.doFilter(FilterChainProxy.java:342)
663 at
org.springframework.security.web.authentication.AbstractAuthenticationProcessingFilter.doFilter(AbstractAuthenticationProcessingFilter.java:116)
664 at org.springframework.security.web.FilterChainProxy$VirtualFilterChain.doFilter(FilterChainProxy.java:342)
665 at org.springframework.security.web.authentication.logout.LogoutFilter.doFilter(LogoutFilter.java:105)
666 at org.springframework.security.web.FilterChainProxy$VirtualFilterChain.doFilter(FilterChainProxy.java:342)
667 at org.springframework.security.web.context.SecurityContextPersistenceFilter.doFilter(SecurityContextPersistenceFilter.java:87)
668 at org.springframework.security.web.FilterChainProxy$VirtualFilterChain.doFilter(FilterChainProxy.java:342)
669 at org.springframework.security.web.FilterChainProxy.doFilterInternal(FilterChainProxy.java:192)
670 at org.springframework.security.web.FilterChainProxy.doFilter(FilterChainProxy.java:160)
```



异常

选择一个模块 搜索

ID	时间	模块	异常名称	信息	日志文件
1	2016-08-04 11:01:57	UNKNOWN	org.springframework.security.authentication.BadCredentialsException	Failed to auth user: ANALYST	kylin.log.2016-08-04
2	2016-08-04 11:04:53	QUERY	java.sql.SQLException	Exception when execute sql	kylin.log.2016-08-04



# 知识库

- 知识问答
- 最佳实践
- 实际案例
- .....

🏠 / 支持 / 知识库 / 问题

storage cleanup

搜索

创建工单

KyBot 为您搜索到5条与“storage cleanup”相关的信息

## How to clean up hive temporary tables

We provide a clean up tool in release packages. Customers could use this tool to clean up unused Hive tables. KAP & KAP Plus: `$(KYLIN_HOME)/bin/kylin.sh io.kyligence.kap.tool.storage.KapStorageCleanupCLI [--delete true] [--force t...`

## Uninstall KAP

From KAP Document:<https://kyligence.gitbooks.io/kap-manual/content/en/install/uninstall.en.html> KAP runs in non-invasive manner, so stop KAP instance processes stops all KAP cluster activities. To uninstall KAP completely and erase all data, please f...

## Clean Garbage

From KAP Document:[https://kyligence.gitbooks.io/kap-manual/content/en/operation/storage\\_cleanup.en.html](https://kyligence.gitbooks.io/kap-manual/content/en/operation/storage_cleanup.en.html) While KAP running for a period of time, there are tons of data becoming useless, yet they still occupied a lot of HDFS/HBase source, accumulation ...

## 垃圾清理

From KAP Document:[https://kyligence.gitbooks.io/kap-manual/content/zh-cn/operation/storage\\_cleanup.cn.html](https://kyligence.gitbooks.io/kap-manual/content/zh-cn/operation/storage_cleanup.cn.html) 在KAP运行一段时间之后，有很多数据因为不再使用而变成了垃圾数据，这些数据占据着大量HDFS、HBase等资源，当积累到一定规模会对集群性能产生影响。这些垃圾数据主要包括：Purge之后原Cube的..

## Create Cube

From KAP Document:[https://kyligence.gitbooks.io/kap-manual/content/en/molap/create\\_cube.en.html](https://kyligence.gitbooks.io/kap-manual/content/en/molap/create_cube.en.html) We need to define dimension combinations and measure types based on existed data model. This process is called Cube design and create. This chapter will i...

🏠 / 知识库 / 搜索

搜索问题或关键词...

搜索

创建工单

您是否遇到了这些问题？

- How to clean up hive temporary tables
- Kylin query node throw exception: "maybe another kylin process is still running?"
- What latency should I expect while streaming from Kafka?
- No partition column available during editing model.
- How to make KAP work with HDP sandbox?
- Query returns incorrect date via JDBC
- Does KAP support EMC Isilon as HDFS?
- OOM when using raw measure on high cardinality column

« 1 »

第

1

页

每页

10

条

| 共

5

记录

仍然没找到答案？ [创建工单](#)



# Future

---

More Automated

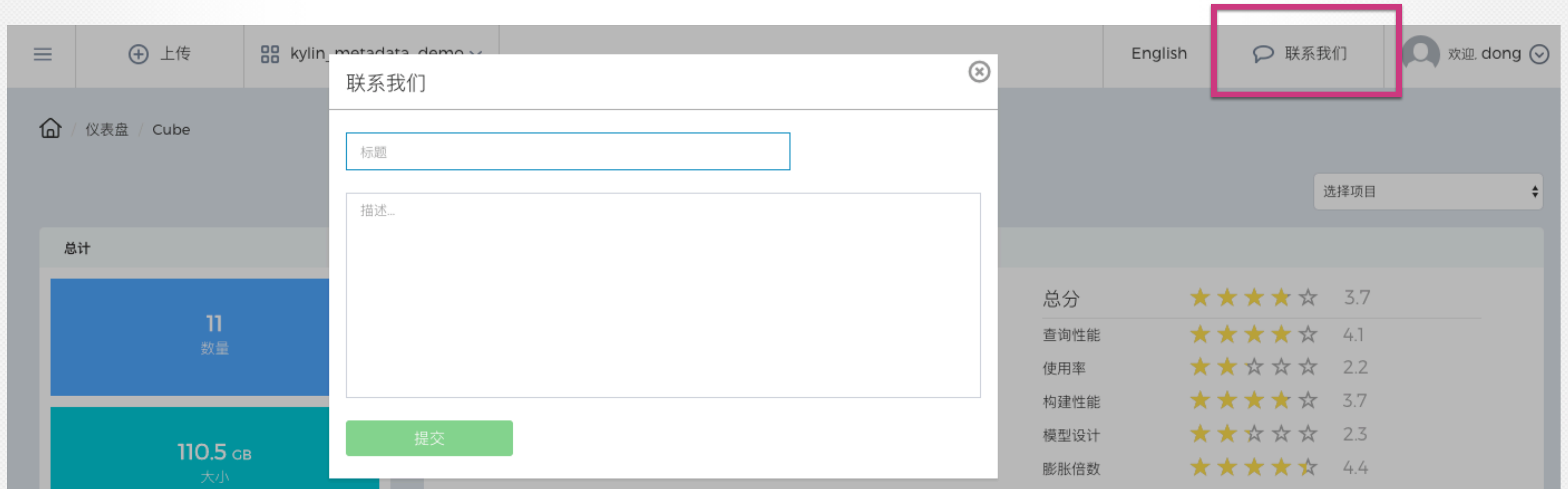
More Intelligent

More Efficient

.....

# 欢迎反馈

- 欢迎随时交流反馈！





# Q & A

<https://kybot.io>



WeChat: Kyligence



WeChat: ApacheKylin