Elasticsearch 和 Kibana 在 Hulu视频的应用实践

倪顺 @ Hulu

关于我

2016年加入Hulu，围绕提高用户播放视频体验，从事QoS（Quality of Service）数据相关工作。

主要内容包括数据集成、分析、可视化、自动监控等。

hulu

Hulu

- 高质量视频内容
- 丰富客户端支持
  - 网站
  - 手机
  - 电视盒子
  - Roku，Xbox

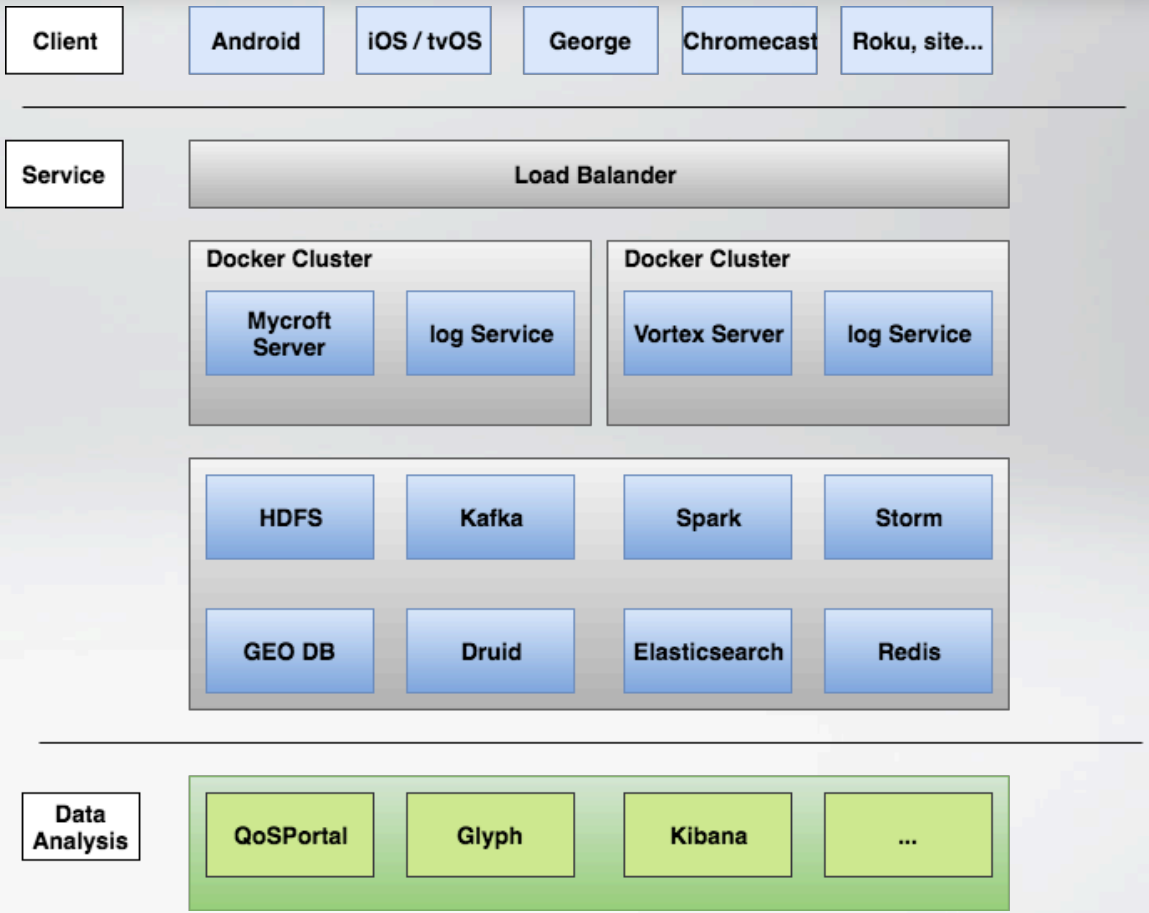
“吉祥物”

主要内容

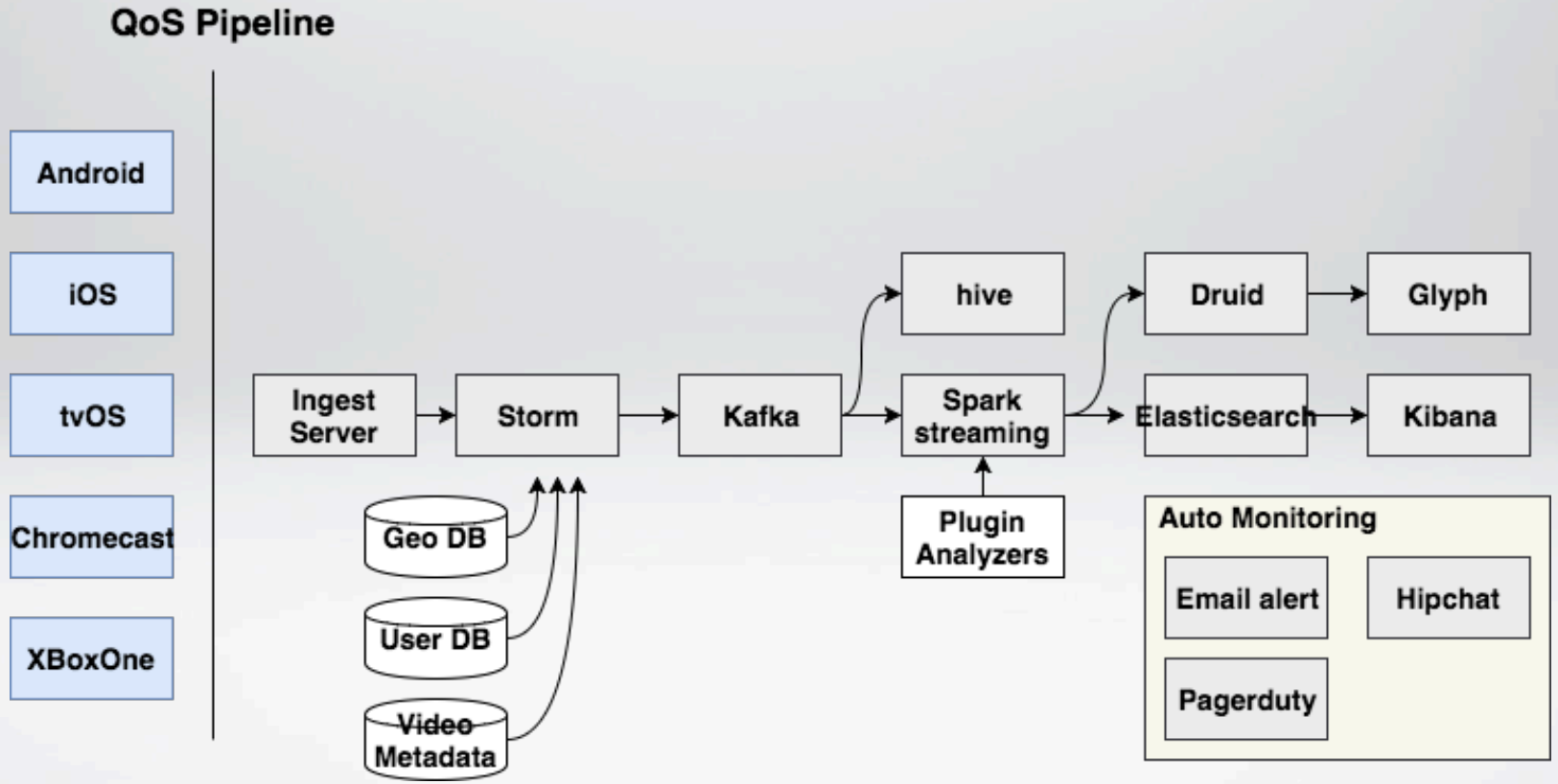
- 技术架构
- 应用实践
  - 视频播放质量报表
  - AB test 支持
  - Kibana可视化定制
- 经验心得
- Q & A

技术架构

- 用户播放数据收集
  - Start, End
  - Pause, Resume
  - Rebuffer
  - Seek
  - Bitrate
  - …
- 数据预处理
- 数据分析可视化



技术架构 – QoS Pipeline



主要内容

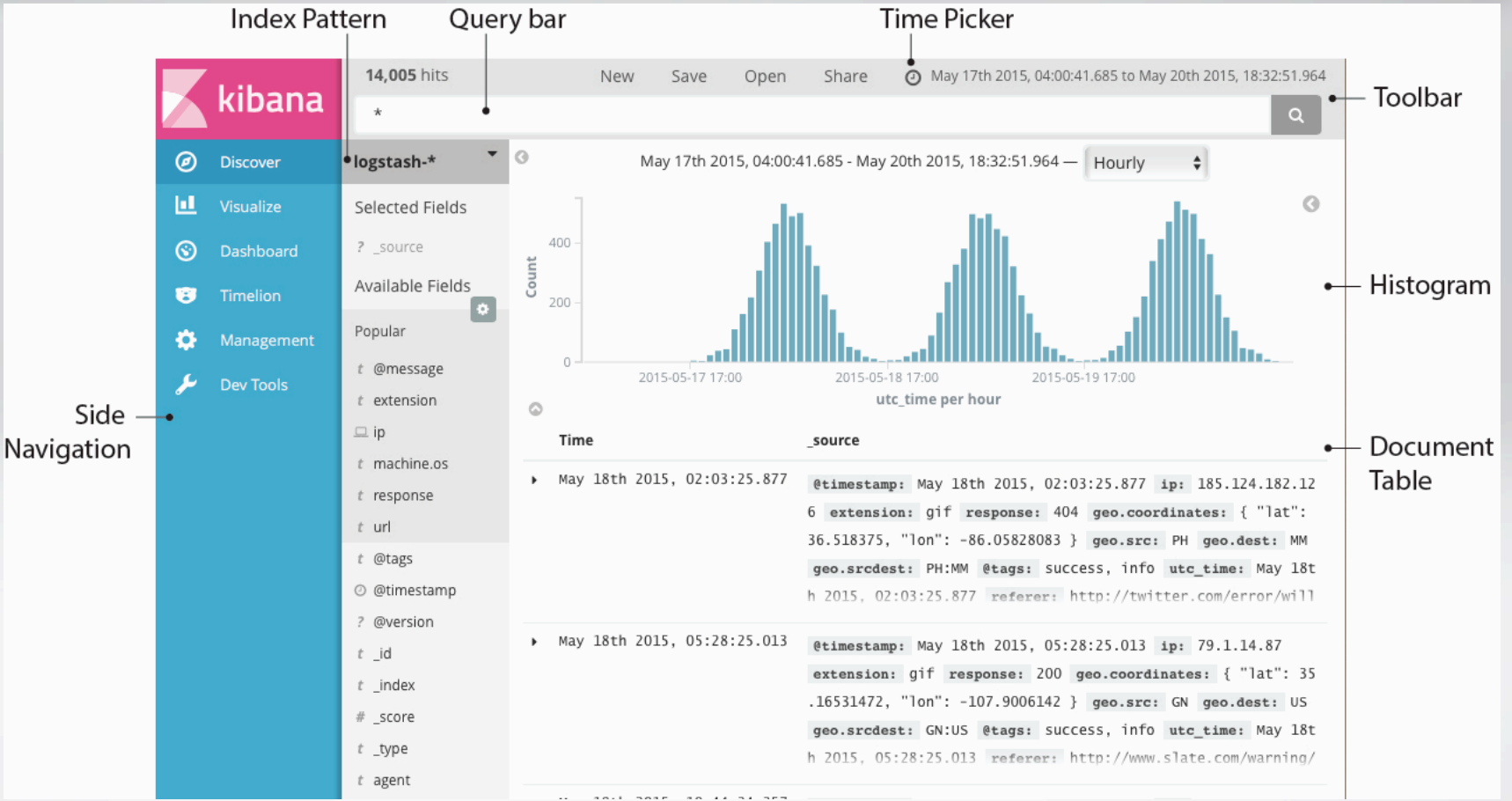
- 技术架构
- 应用实践
  - 视频播放质量报表
  - AB test 支持
  - Kibana可视化定制
- 经验心得
- Q & A

应用实践－视频播放质量报表

- Kibana basic features warm up
  - 支持明细查询
  - 支持 Visualization：Pie chart, Line chart, histogram, tile map, etc.
  - 支持 Dashboard：多个 visualization 的集合

应用实践－视频播放质量报表

Discover



应用实践－视频播放质量报表

elastic 中文社区 | IT大咖说 知识分享平台

Visualization

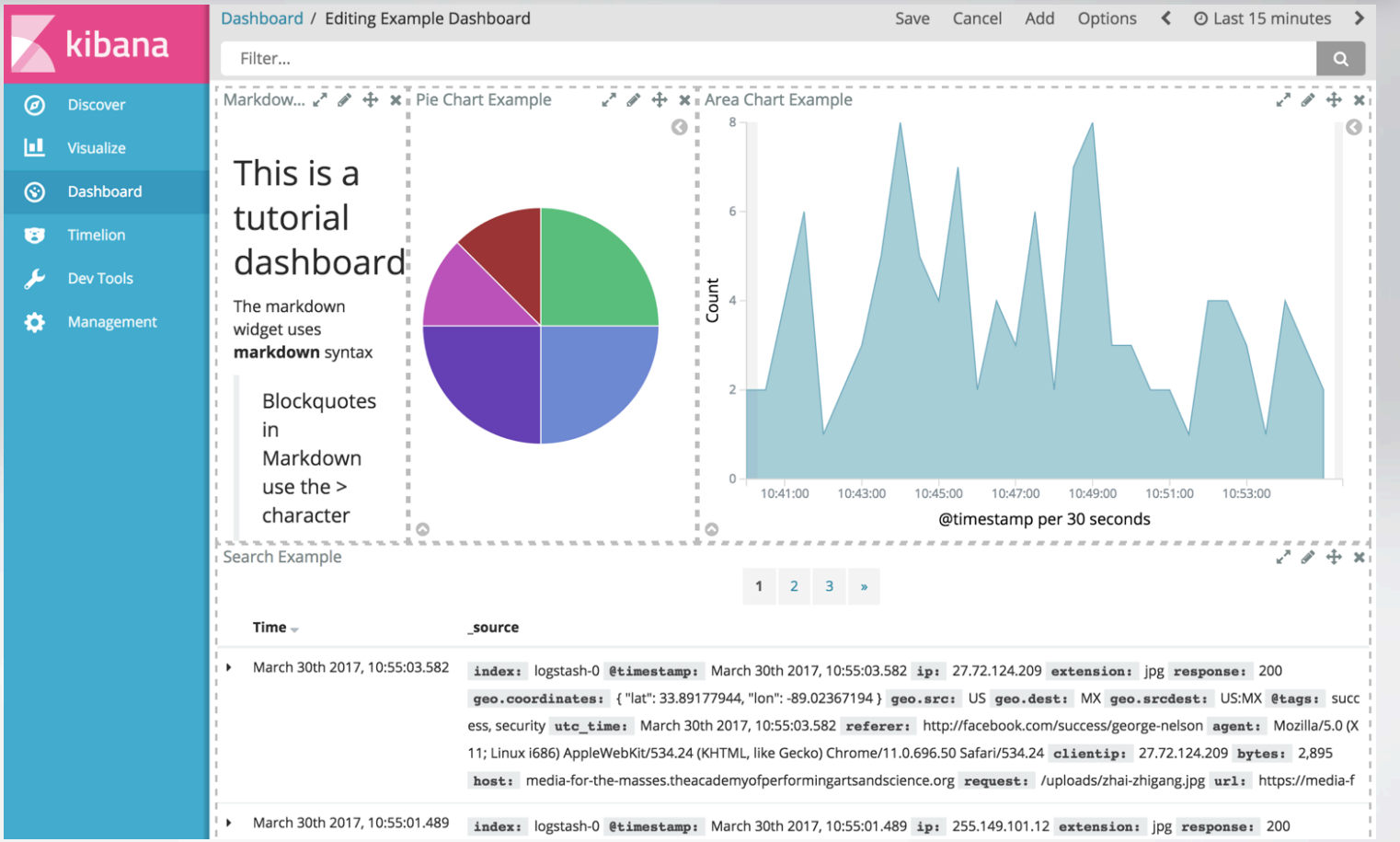
Create a new visualization

Step 1

Area chart	Great for stacked timelines in which the total of all series is more important than comparing any two or more series. Less useful for assessing the relative change of unrelated data points as changes in a series lower down the stack will have a difficult to gauge effect on the series above it.
Data table	The data table provides a detailed breakdown, in tabular format, of the results of a composed aggregation. Tip, a data table is available from many other charts by clicking grey bar at the bottom of the chart.
Line chart	Often the best chart for high density time series. Great for comparing one series to another. Be careful with sparse sets as the connection between points can be misleading.
Markdown widget	Useful for displaying explanations or instructions for dashboards.
Metric	One big number for all of your one big number needs. Perfect for showing a count of hits, or the exact average a numeric field.
Percent View	Percent metric visualization
Pie chart	Pie charts are ideal for displaying the parts of some whole. For example, sales percentages by department.Pro Tip: Pie charts are best used sparingly, and with no more than 7 slices per pie.
Tile map	Your source for geographic maps. Requires an elasticsearch geo_point field. More specifically, a field that is mapped as type:geo_point with latitude and longitude coordinates.
Timeseries	Create timeseries charts using the timelion expression language. Perfect for computing and combining timeseries set with functions suchs as derivatives and moving averages
Vertical bar chart	The goto chart for oh-so-many needs. Great for time and non-time data. Stacked or grouped, exact numbers or percentages. If you are not sure which chart you need, you could do worse than to start here.

应用实践－视频播放质量报表

Dashboard



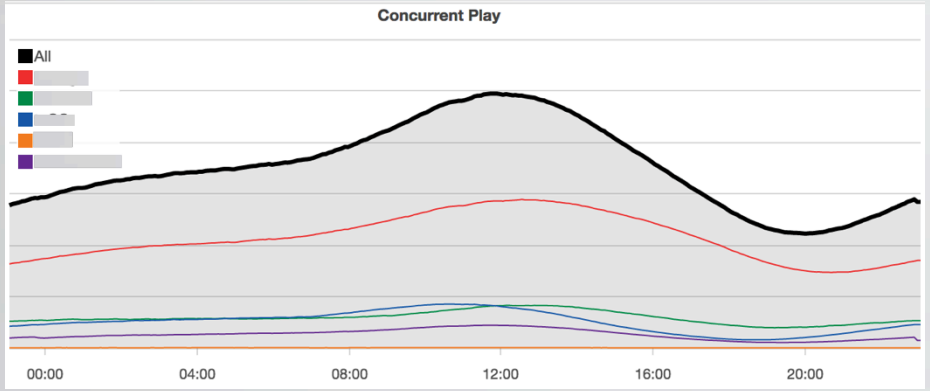
应用实践－视频播放质量报表

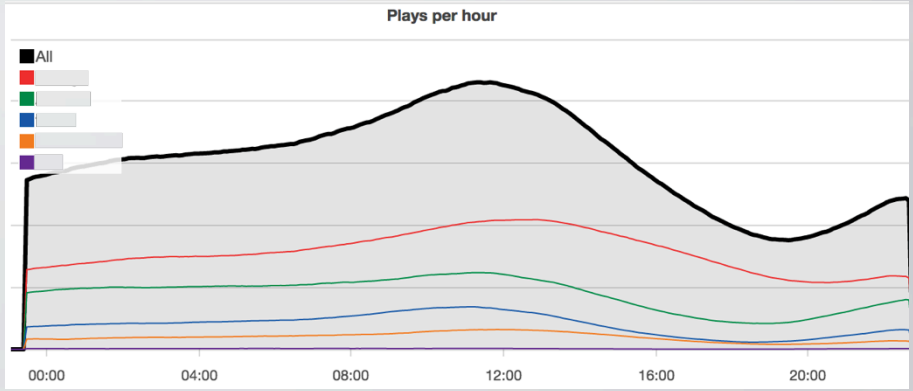
- 问题：播放日志有了，我们怎么利用?
  - Each record with 100 ～ 200 fields

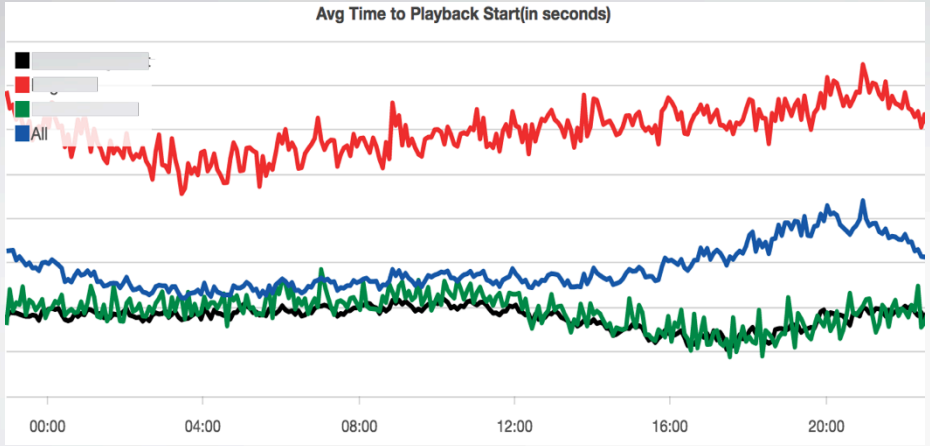

```
{
  "app": "hulu",
  "bitrate": 3200,
  "bitrate_switch_count": 2,
  "content_id": "1043295",
  "client": "xboxone",
  "time_to_playback_start": 2312,
  "geo": [0.4073030090332031E2, -0.814533462524414E2],
  "timestamp": "May 18th 2017, 17:33:57.963"
}
```

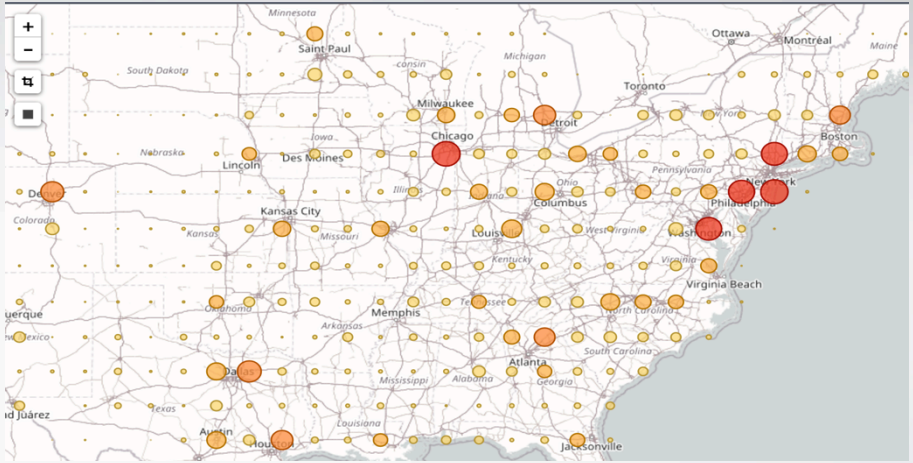

- 比较关心的指标
  - 播放量
  - 播放启动时间
  - 视频卡顿率
  - 播放码率
- 形成 QoS dashboard

应用实践－视频播放质量报表



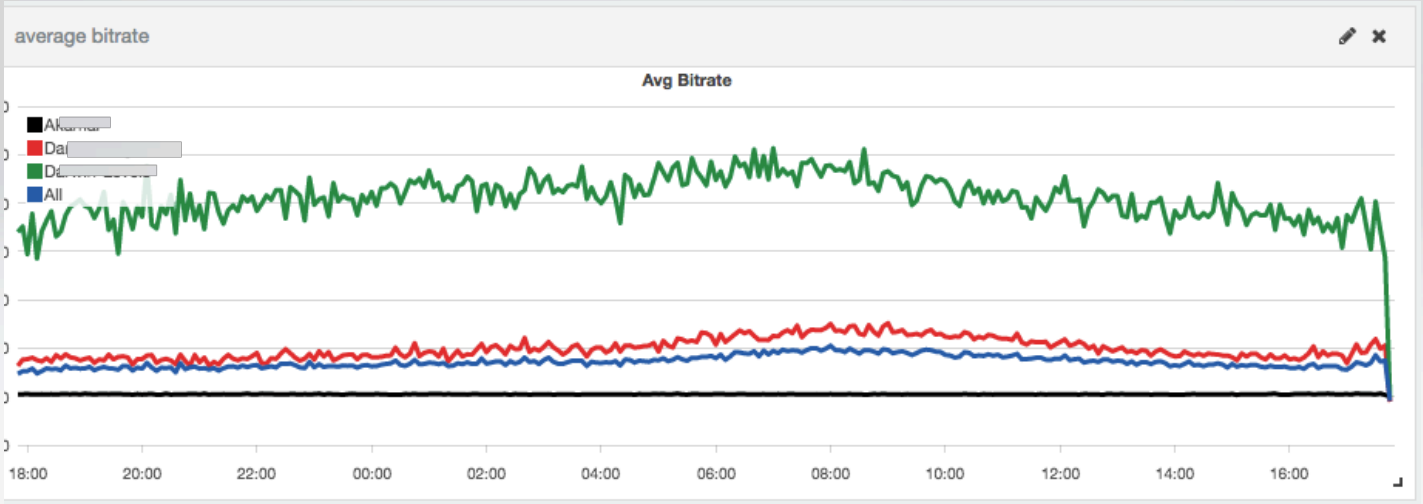






应用实践－视频播放质量报表

- 除此之外，支持Ad hoc的 query & dashboard
  - Drill down by CDN, ISP, Content, etc.
  - 即时地比较各个CDN provider的质量



主要内容

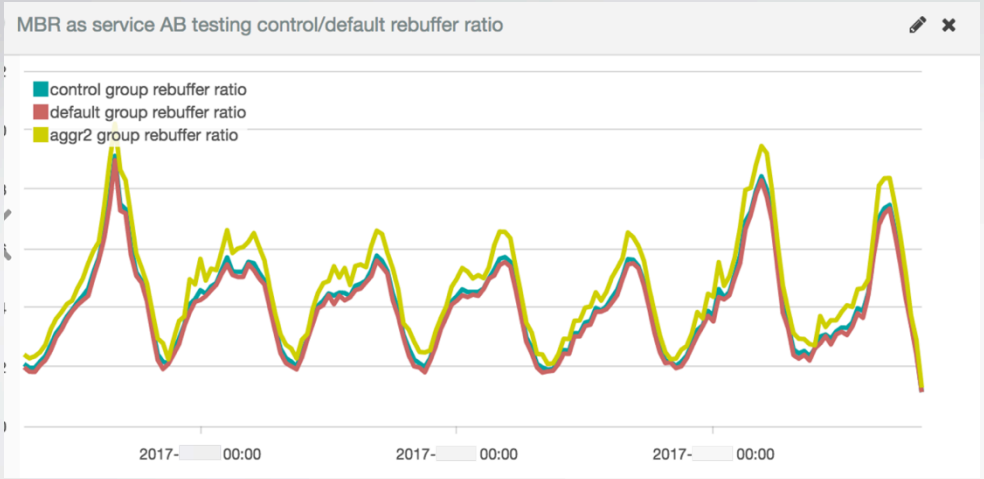
- 技术架构
- 应用实践
  - 视频播放质量报表
  - AB test 支持
  - Kibana可视化定制
- 经验心得
- Q & A

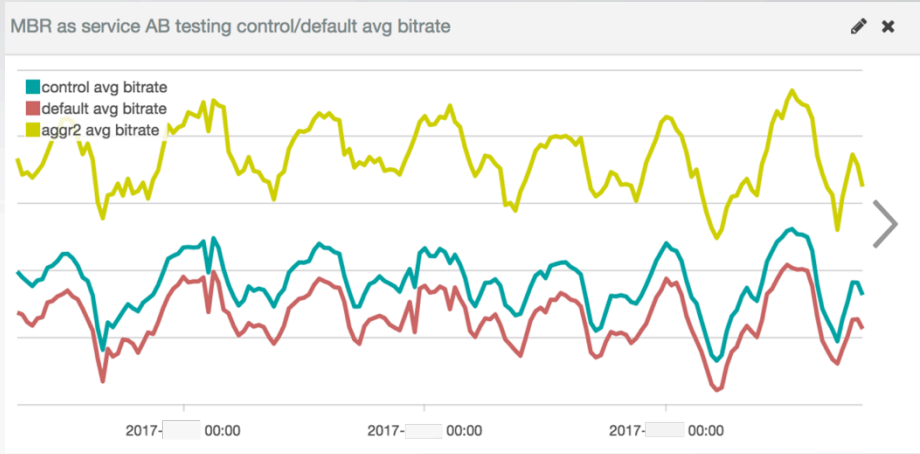
应用实践－AB Test 支持

- 问题：如何验证新的播放策略，以减少卡顿，并且提高码率？
- Elasticsearch＋Kibana对数据灵活支持
  - 设置对照组和实验组
  - 收集目标数据
  - 可视化对比实验结果
- 优势
  - 开发人员完全掌握原始数据，可自由可视化数据，减少对数据团队的依赖

应用实践－AB Test 支持

- 具体场景：观看高清视频是否可以提高用户留存率?
- 实验组设置
  - 对照组
  - 实验组：激进地使用高码率的片源





主要内容

- 技术架构
- 应用实践
  - 视频播放质量报表
  - AB test 支持
  - Kibana可视化定制
- 经验心得
- Q & A

应用实践－kibana可视化定制

- Kibana可视化：饼图，线图，柱状图，...
- 然而美中不足：
  - 无法对多个查询进行数学运算后再可视化
  - 在一张图中显示多个的查询结果
  - 操作简洁，可是不够灵活，如支持moving average平滑化

应用实践－kibana可视化定制 - Timelion

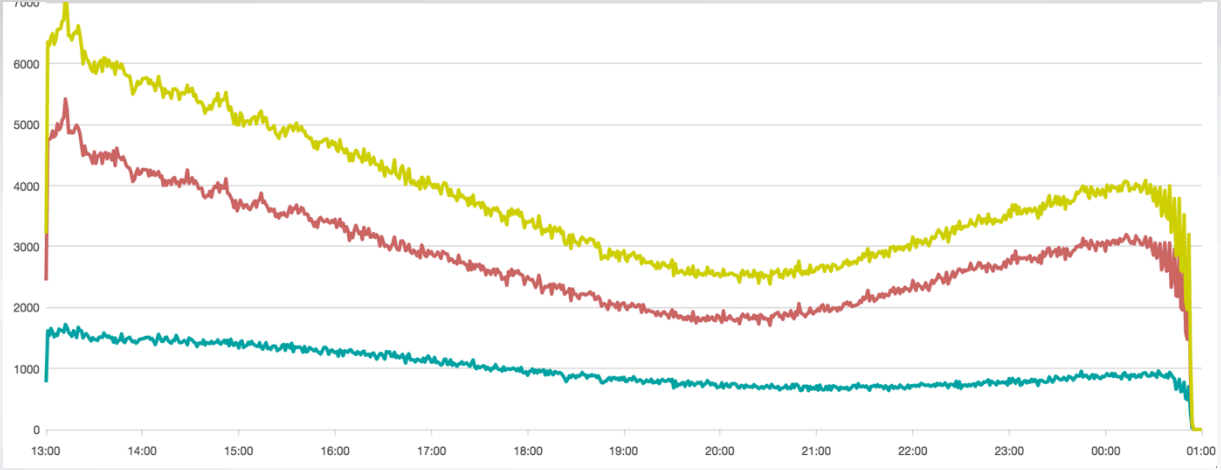
- Open source kibana plugin: timelion
- 功能：
  - 支持数学运算：加、减、乘、除、abs、movaverage、min、max...
  - 定制画图：控制线粗、颜色、填充
  - 基于 jQuery flot，易于自主开发定制新功能

应用实践－kibana可视化定制 - Timelion

Timelion add

add two data series
两个数列对应点相加

.es(q='query1'),
.es(q='query2'),
.es(q='query1').add(.es(q='query2'))



应用实践－kibana可视化定制 - Timelion

Timelion divide

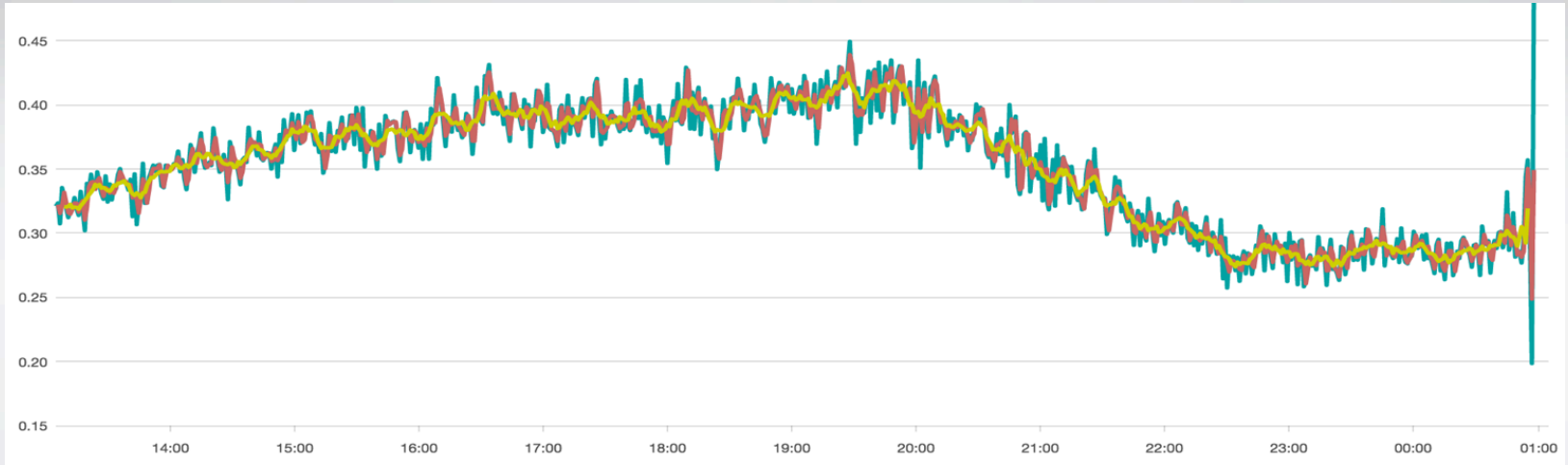
divide two data series of the same length. 两个数列对应点相除

.es(q='query1'),
.es(q='query2'),
.es(q='query1').divide(.es(q='query2'))

应用实践－kibana可视化定制 - Timelion

Timelion movingaverage

平滑线图，多点均线图
.es(q='query1'),
.es(q='query2'),
.es(q='query1').divide(.es(q='query2')) (blue)
.es(q='query1').divide(.es(q='query2')).movingaverage(window=2) (red)
.es(q='query1').divide(.es(q='query2')).movingaverage(window=8) (yellow)



应用实践－kibana可视化定制 - Customize

- 定制Kibana
  - 使用OpenStreetMap & 高德地图替代默认地图，支持18级别放大

应用实践－kibana可视化定制 - Customize

- 定制Timelion
  - 支持 divideseries：多个数列对应除以多个数列
  - 支持柱状图显示
  - 支持Percentile查询

应用实践－kibana可视化定制 - Customize

- Divideseries

```
{
  "app": "hulu",
  "bitrate": 3200,
  "bitrate_switch_count": 2,
  "content_id": "1043295",
  "client": "xboxone",
  "rebuffer_count": 1,
  "time_to_playback_start": 2312,
  "geo": [0.4073030090332031E2, -0.8145334625244l4E2],
  "timestamp": "May 18th 2017, 17:33:57.963"
}
```

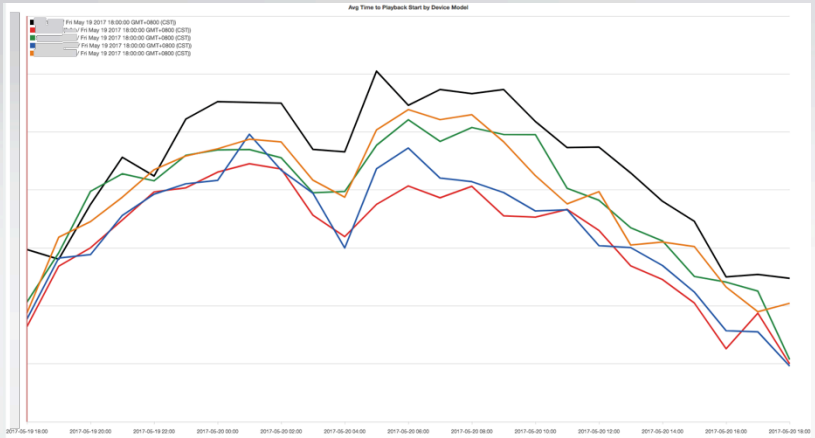
- 查询所有client上的rebuffer ratio
  - .es(q='rebuffer_count:>0').divide(.es(q='*'))
- 查询 xboxone 平台上的 rebuffer_ratio
  - .es(q='rebuffer_count:>0 AND client:xboxbox').divide(.es(q='client:xboxone'))
- 查询 Android、iOS、tvOS、XboxOne、Chromecast上的rebuffer_ratio
  - .es(q='rebuffer_count:>0 AND client:Android').divide(.es(q='client:Android'))
  - .es(q='rebuffer_count:>0 AND client:iOS').divide(.es(q='client:iOS'))
  - ...

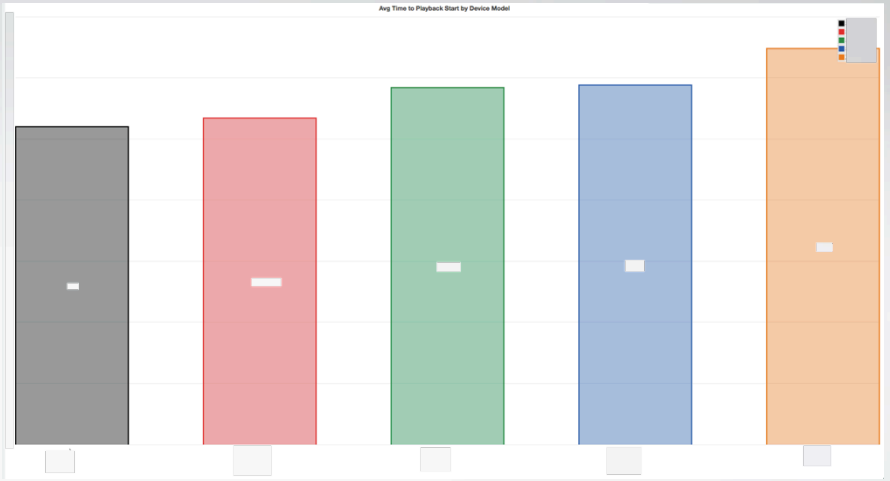
Try divideseries, 一行解决

- 查询 Android、iOS、tvOS、XboxOne、Chromecast上的rebuffer_ratio
  - .es(q='rebuffer_count:>0', split='cilent:5').divideseries(.es(q='*', split='client:5'))

应用实践－kibana可视化定制 - Customize

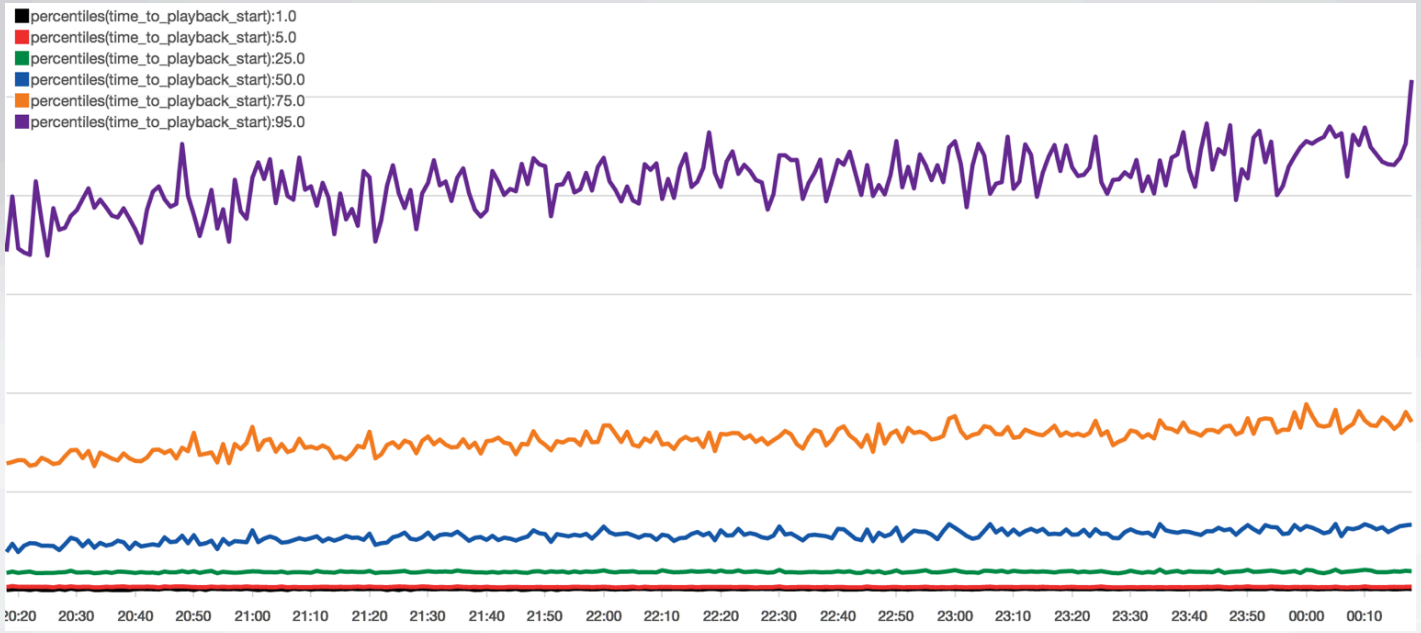
- Timelion柱状图显示
  - Timelion是基于jQuery flot画图
  - 支持柱状图显示
  - 线图到柱状图的值域映射：avg, sum, etc.





应用实践－kibana可视化定制 - Customize

- Timelion percentile
  - 查询百分位图：1,5,25,50,75,95
  - .es(q='*', split='client:6', metric='percentiles:time_to_playback_start:1,5,25,50,75,99')



主要内容

- 技术架构
- 应用实践
  - 视频播放质量报表
  - AB test 支持
  - Kibana可视化定制
- 经验心得
- Q & A

经验心得

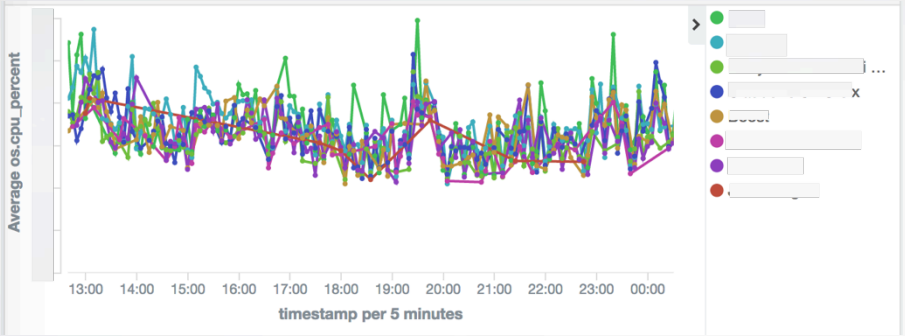
- 应用 Elasticsearch 和 Kibana 遇到的坑和经验
  - 针对时间序列类的数据：Index命名实例
    - [domain]_[team]_[app]_[version]_[date]
    - Hulu_player_qos_**v01**_2017-03-03, Hulu_player_qos_**v02**_2017-03-03
    - 解决问题：日内更改index mapping，业务需求改变频繁
      - 对所有 text 字段，增加 field_name.raw 字段 (not analyzed text field)
  - 某字段类型常变化
    - 为避免与现有mapping冲突，采用备用字段
    - Myfieldname + myfieldname_v01
    - 解决问题：已存文档的content_id字段映射为int，新文档的content_id是

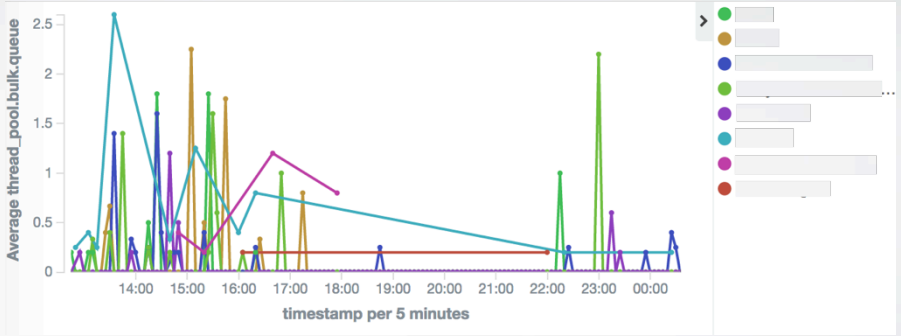
经验心得

- 应用 Elasticsearch 和 Kibana 遇到的坑和经验
  - Shard数量
    - fixed
    - 1 ~ 3 shards per datanode per index
    - Replication shard
  - 控制数据存入速度
    - Google guava rate limiter

经验心得

- 应用 Elasticsearc 和 Kibana 遇到的坑和经验
  - 自己动手监控Elasticsearch cluster的状态
    - 定期查询 /_nodes/stats
    - CPU、内存、插入队列等待长度、文档总数、shard总数、relocate的shard数
    - ES cluster历史状态全知道





未来计划

- 未来计划
  - 扩展Timelion
    - 整合更多数据源
    - 支持用户编写自定义计算逻辑
  - 增强Kibana
    - 扩展Kibana本身的Visualization，支持灵活计算
    - 导出Dashboard数据
  - Smart Alert

Q & A

Thanks