# Intelligent Anomaly Detection in Heterogeneous Internet Services

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# Agenda

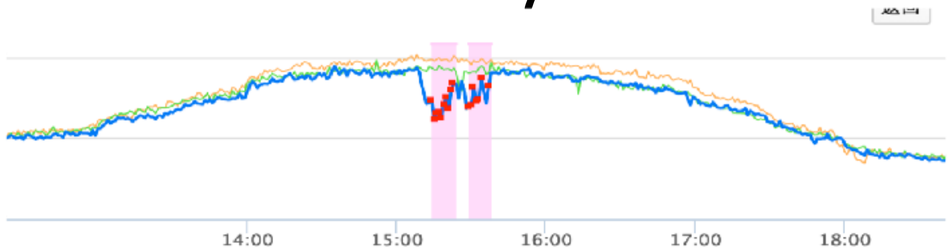
- Brief introduction to Baidu
- Heterogenous services and their challenges to our SREs
- Anomaly detection in typical services
- ARK : A generalized intelligent operation platform for Baidu services

# Introduction to Baidu

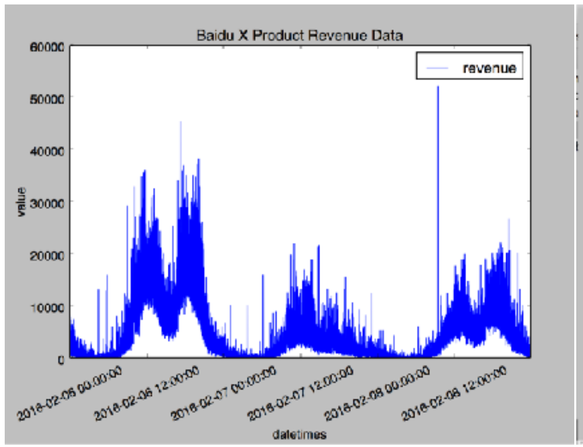
- One the largest search engines in the world
  - ✓ Web/Image/Video/News/…
- Besides search, we also have
  - ✓ Location Based Service - Maps
  - ✓ Social/Knowledge - Tieba/Zhidao
  - ✓ Online to Offline - Nuomi/Waimai
  - ✓ Finance/Payment - Wallet
  - ✓ Cloud computing - Cloud
- Covers more than 1 Billion users in total

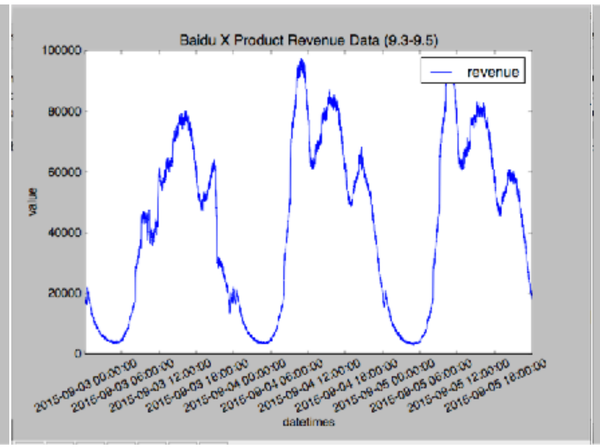
# Anomaly Detection in Heterogenous Services

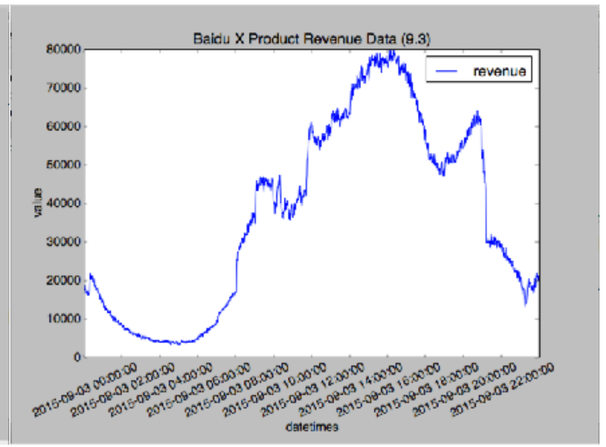
- Anomaly Detection in theory




- However, here are some realities



# Divide and Conquer

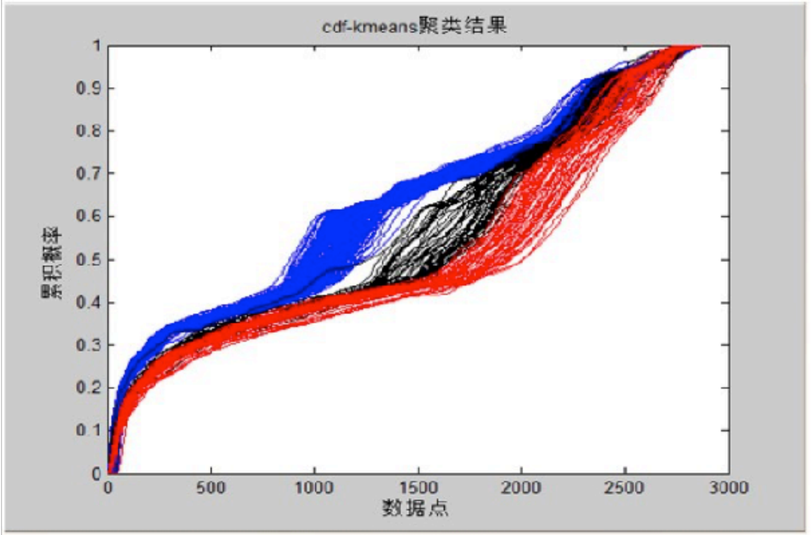
- Several typical categories we manually touch on
  - ✓ Holiday sensitive
  - ✓ Very unstable
  - ✓ Requiring fully automatic configuration

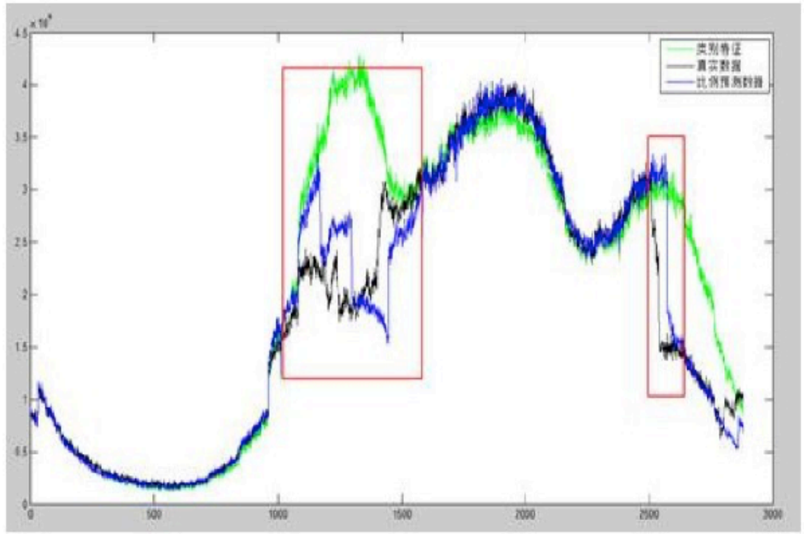
# Holiday Sensitive Curves

- Holidays in Chinese Calendar have no fixed dates
  - ✓ 2016 - Spring Festival (Feb., 8th) - Dragon Boat festival (Jun., 9th)
  - ✓ 2017 - Spring Festival (Jan., 28th) - Dragon Boat festival (May, 30th)
- There is no common pattern among different holidays
- It's hard to know the baselines!
  - ✓ The training data are pretty sparse

# Basic idea and the result

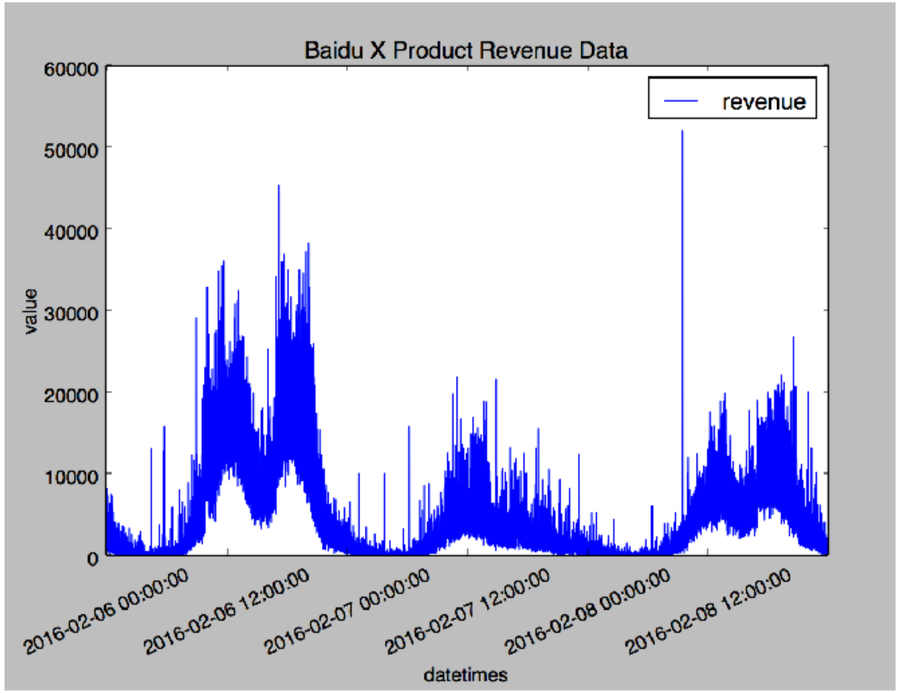
- Clustering on daily CDF of curves
- Classification on dates (features include weekend, holiday, etc.)
- LR based estimated algorithm



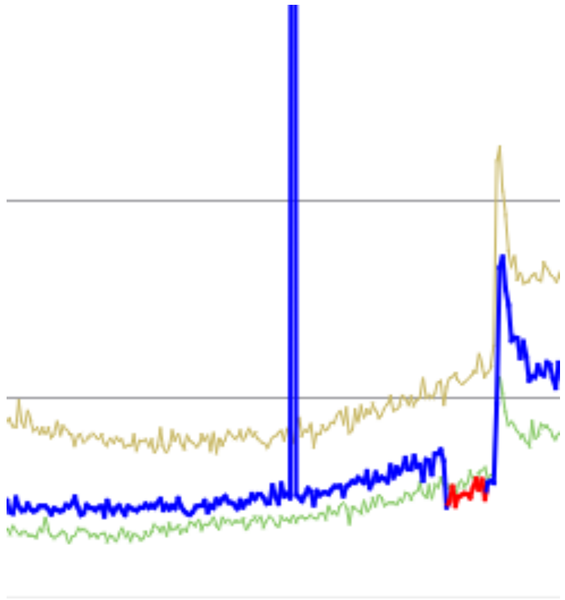
# Very Unstable Curves

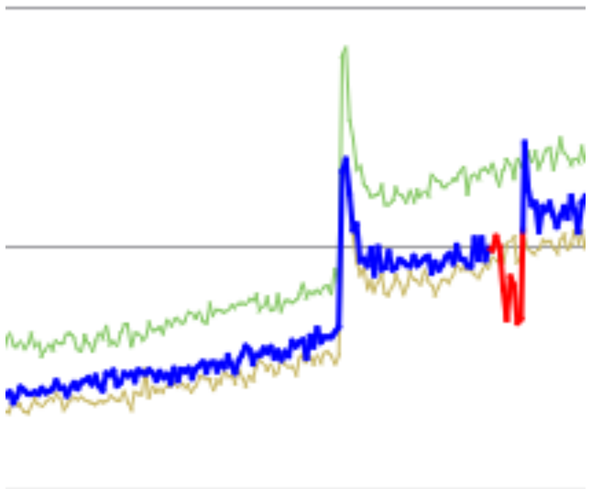
- Very unstable but not anomaly, caused by
  - ✓ Revenue with significantly different price goods
  - ✓ Revenue under some promotions
- The curve's variance is huge, traditional method cannot guarantee the precision/ recall



# Basic Idea and Result

- A compound solution, including
  - ✓ smoothing by sliding window
  - ✓ Reduce the impact from huge absolute values by using logarithm
  - ✓ Considering the increasing/decreasing rate
- The results





# Curves requiring automatic configuration

- Two many curves to monitor, but
  - ✓ No enough bandwidth to do manual configuration from SRE side
  - ✓ Hard to select algorithms
  - ✓ Even harder to setup/adjust parameters
- The examples of such metrics
  - ✓ RPC numbers between two modules
  - ✓ Network transmission amount on some switch devices

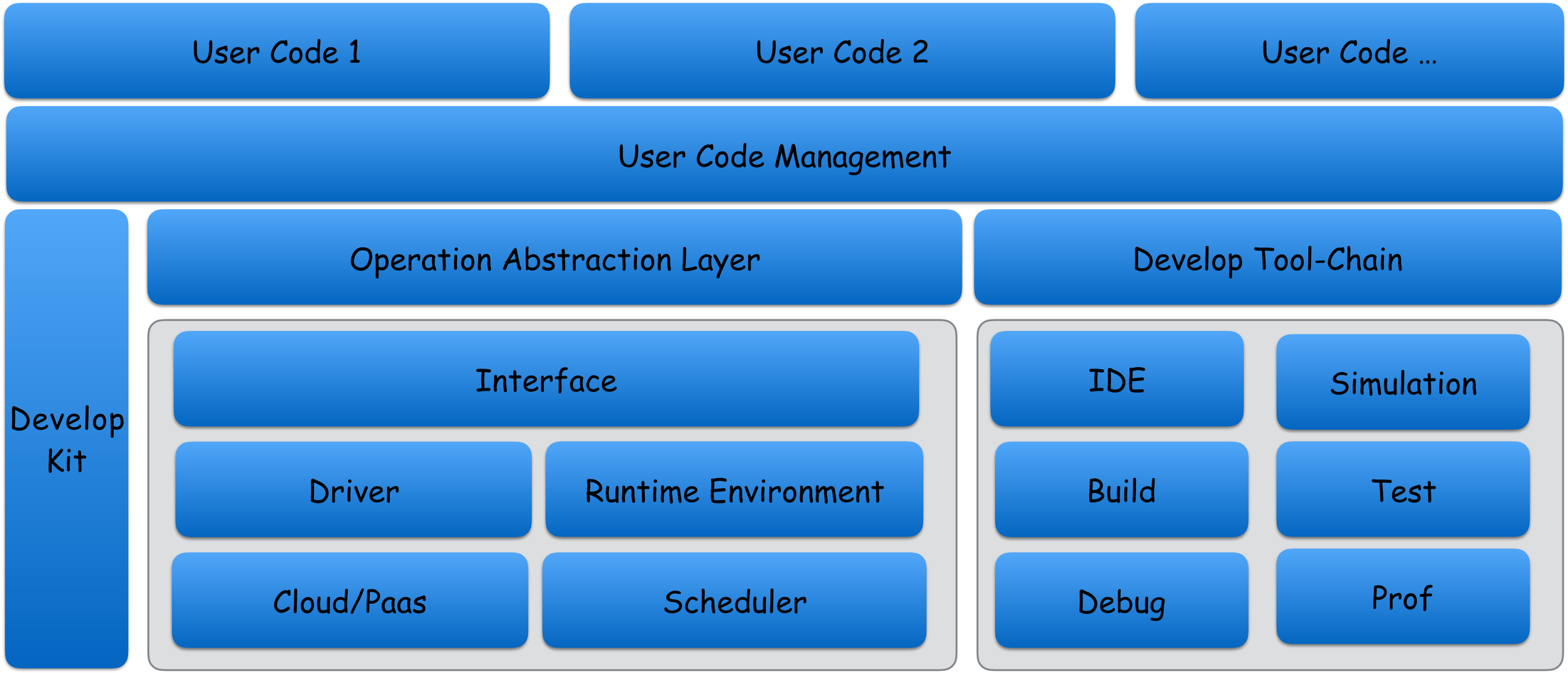
# Basic Idea and Results

- Using machine learning to select algorithm
  - ✓ Whether or not the curve is periodical
  - ✓ How the curve's stability look like
  - ✓ The difference between maximum and minimum
- The default parameters configuration, plus auto-adjustment based on user feedback (marked by on-call)
- The sampling results so far
  - ✓ Precision is about 84%

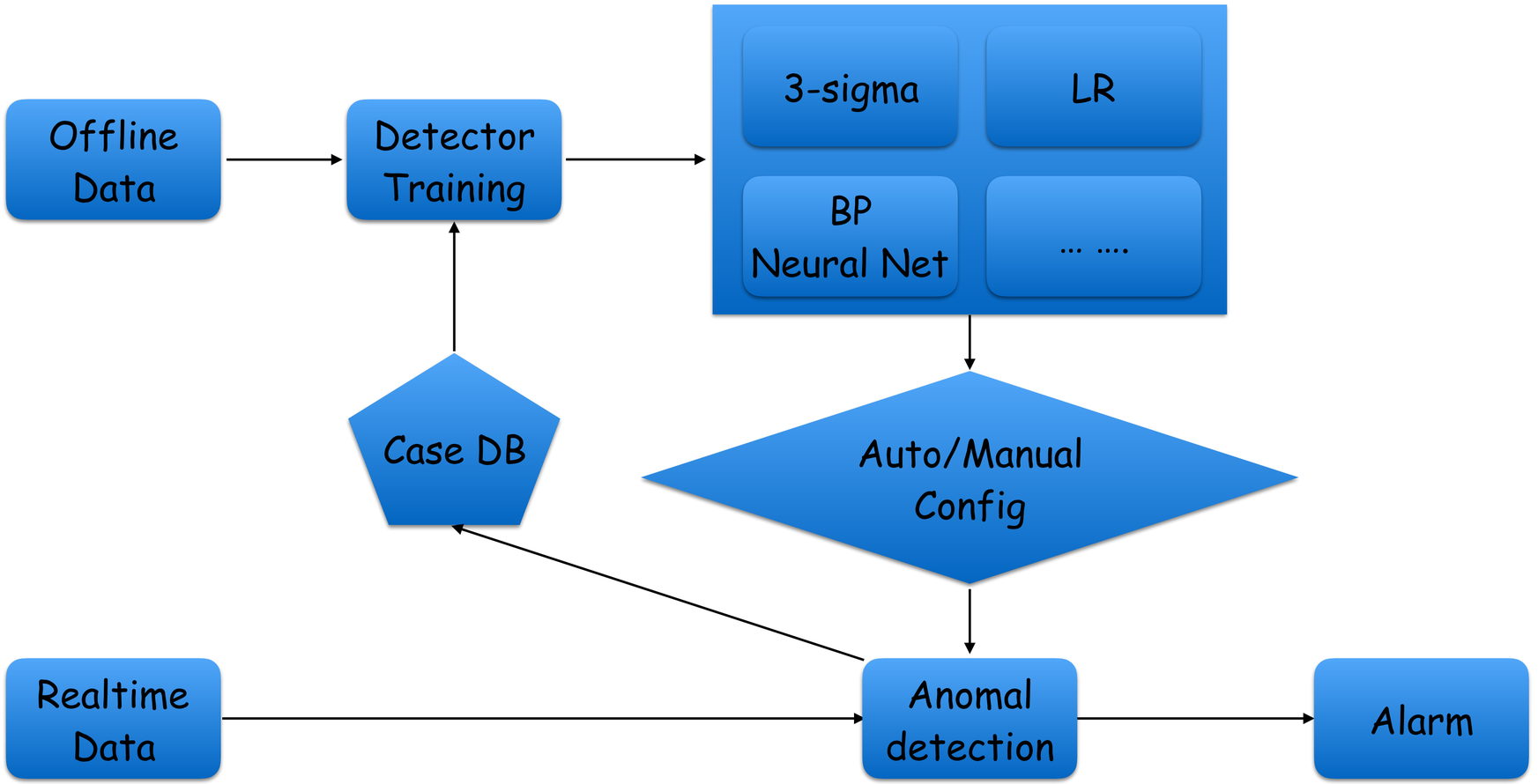
# More Pain Points

- Other SREs have needs to customize the existed algorithms
- Codes are hard to reuse
  - ✓ Different execution environments (programing languages)
  - ✓ Different data sources with different formats
  - ✓ Different teams/projects

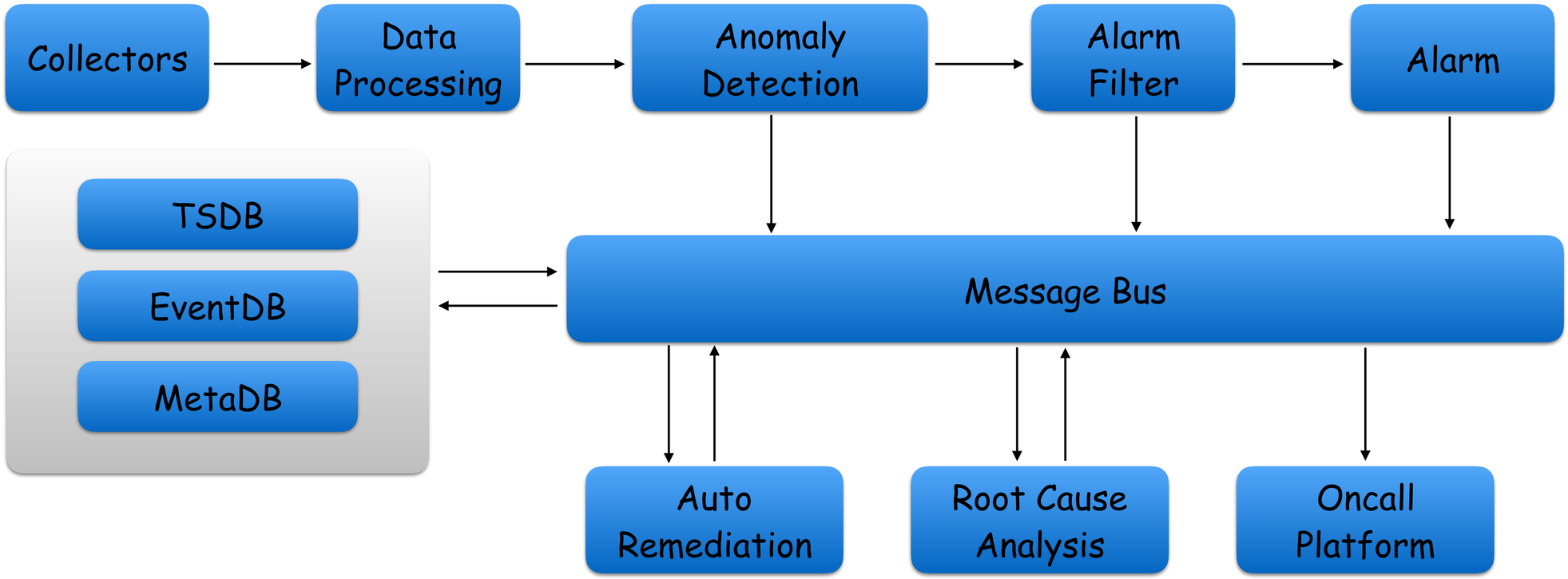
# ARK - A Generalized OP Platform



# Unified Algorithms and deployment



# Unified Monitoring DB and Platform




智能OnCall
百度地图十一出行高峰保障直播间
地图活动直播间10.1
活动状态
12点开抢猴子
最高QPS:
累计PV
12点抢猴子
最高QPS:
累计PV
十一狂欢节-AR活动
最高QPS
累计PV
玩游戏，赢汽车！
最高QPS
止损历史
异常指标已恢复正常，止损...
异常指标已恢复正常，止损...
决策多个特征异常，无法自...
核心 决策多个特征异常，无...
直播内容
输入命令
发送
止损信息
常指标已恢复正常，止损成功
止损信息 18:42:26
预案执行成功，等待止损效果检测
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状态通知 8:00:00
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相关操作以及信息
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止损通知 开启 关闭
定位通知 开启 关闭
状态通知 开启 关闭
活动通知 开启 关闭
作战部
智能机器人（@vi）
快捷链接
能监控
预案平台
服务可用性
外网监控

Thanks Very Much

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Welcome Questions!