# Smart Monitoring System for Anomaly Detection on Business Trends in Alibaba

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# About me



- Senior Specialist of GOC(Global Operation Center) Team in Alibaba Group
  - Business trend monitoring
  - Business fault diagnosis and root cause analysis
  - Data warehouse for infrastructure and operation data



- Before I joined Alibaba
  - Senior Engineer of SRE Team in Baidu



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# Introduction to Alibaba Group




淘宝 Taobao

天猫 TMALL.COM

AliExpress™
Smarter Shopping, Better Living!

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支付宝 ALIPAY

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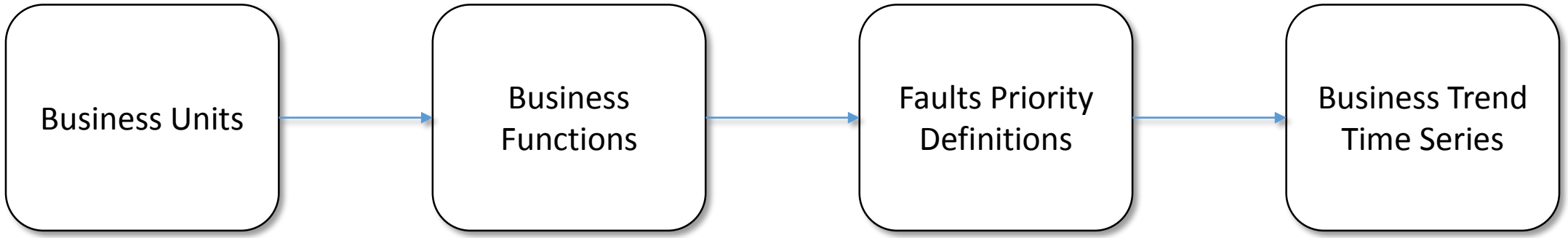
# About business trends monitoring in Alibaba




- Business faults management
  - Mapping business functions to business trends
- Faults Priority Definitions
  - Orders per minute on Taobao decreased by XX% or above => P1 Fault
  - Transactions per minute on Alipay decreased by X% to XX% => P2 Fault
- Business trends monitoring
  - Business faults can be found by anomaly detection on business trends



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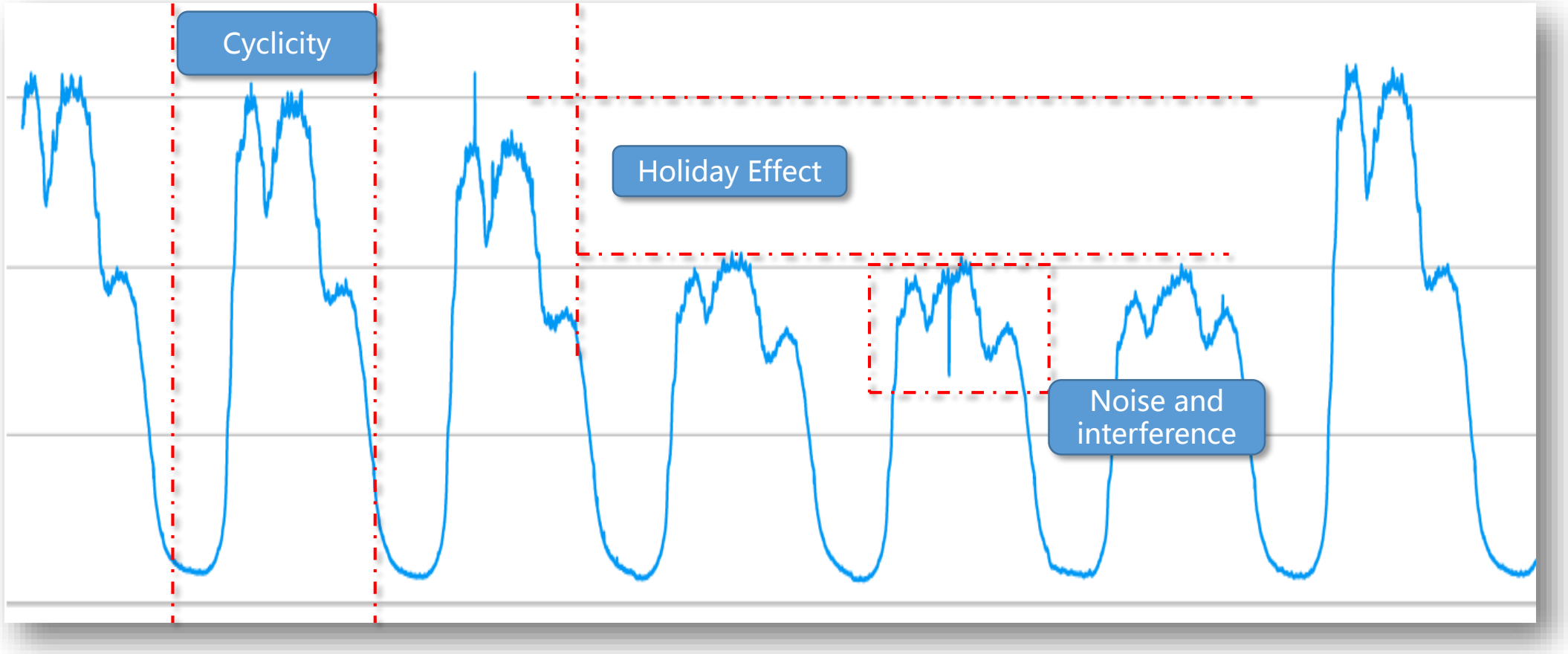
# Features of businesses trends



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# Challenges of anomaly detection on business trends



- How to adopt the characteristics of different business trends?



- How to meet the artificial standards of faults?



- How to get all the configurations in automation?



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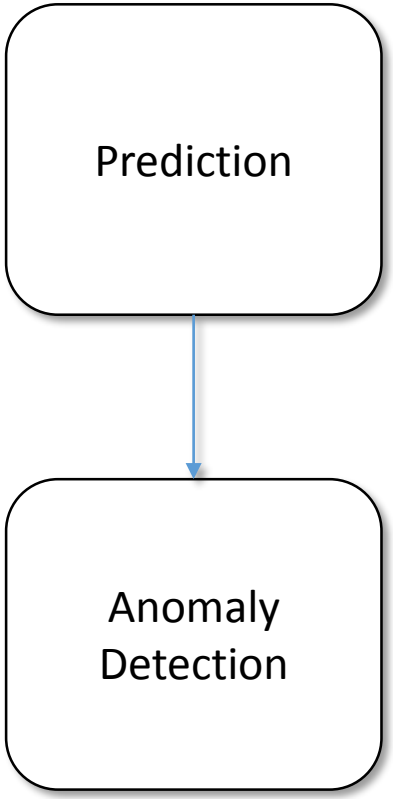
# Summary of anomaly detection approaches



- Local trend based
  - Static threshold
  - Dynamic threshold
  - Local regression



- Historical trend based
  - Trend prediction
    - Segment average of historical data
    - Time series decomposition
      - Holt-winters
      - STL (Seasonal Trend LOESS)
    - Machine Learning
      - Deep Learning(LSTM)



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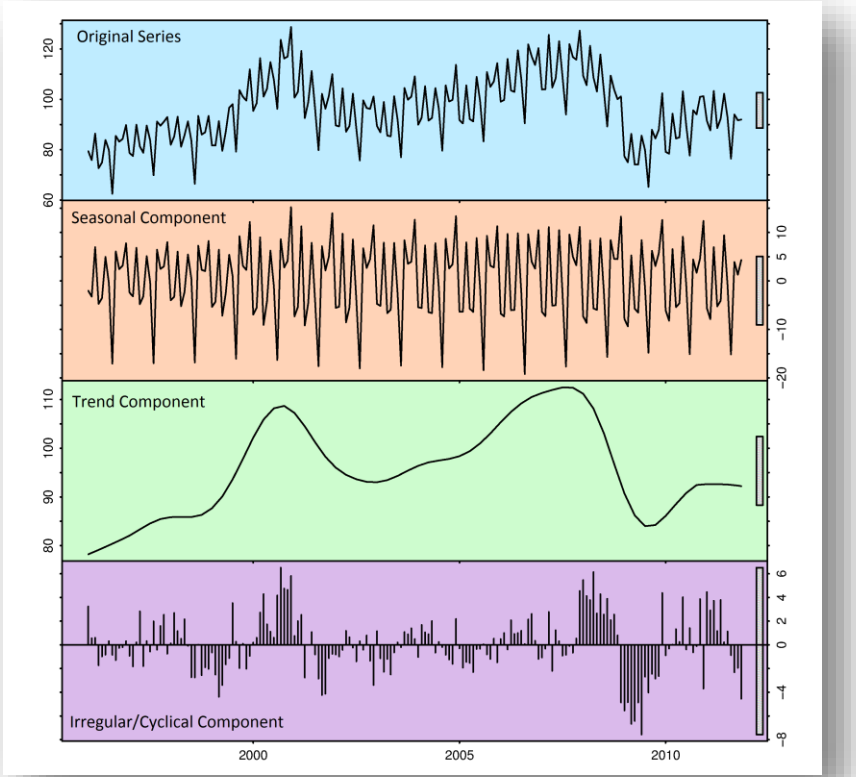
# Our choice

- Our choice
  - STL (Seasonal Trend on LOESS)

- Advantages of STL on business trends time series
  - Suitable for cyclical data
  - Suitable for data with drifting trend
  - Robust to local noises and interference




https://quantdare.com/wp-content/uploads/2014/09/decomp-example.png



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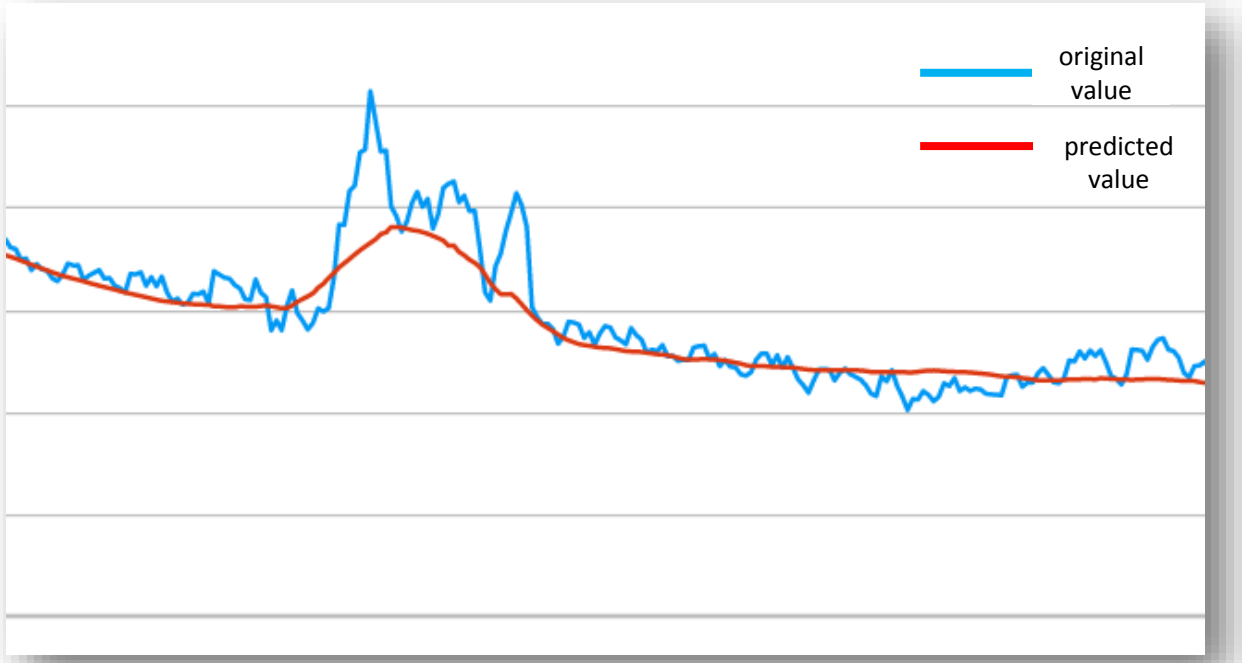
# How to get a good “prediction”

- A good “prediction”
  - Accurately fits business trends
  - Smooth and stable



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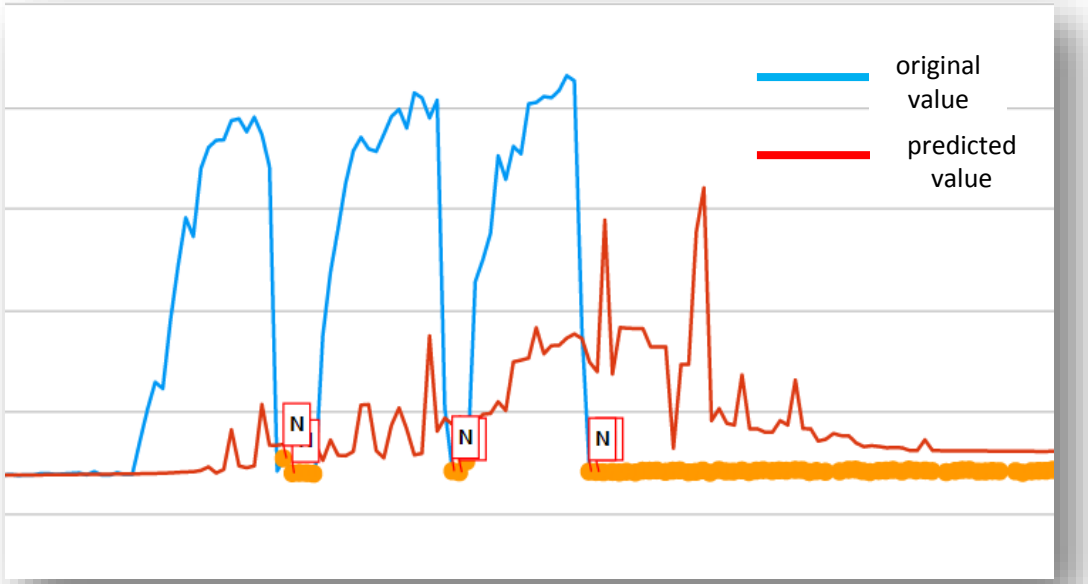
# Using STL directly on original data…

- Drawbacks
  - Effected by noise
  - Not smooth or stable
  - Not enough sensitive to recent trends
- Solutions
  - Customized data preprocessing



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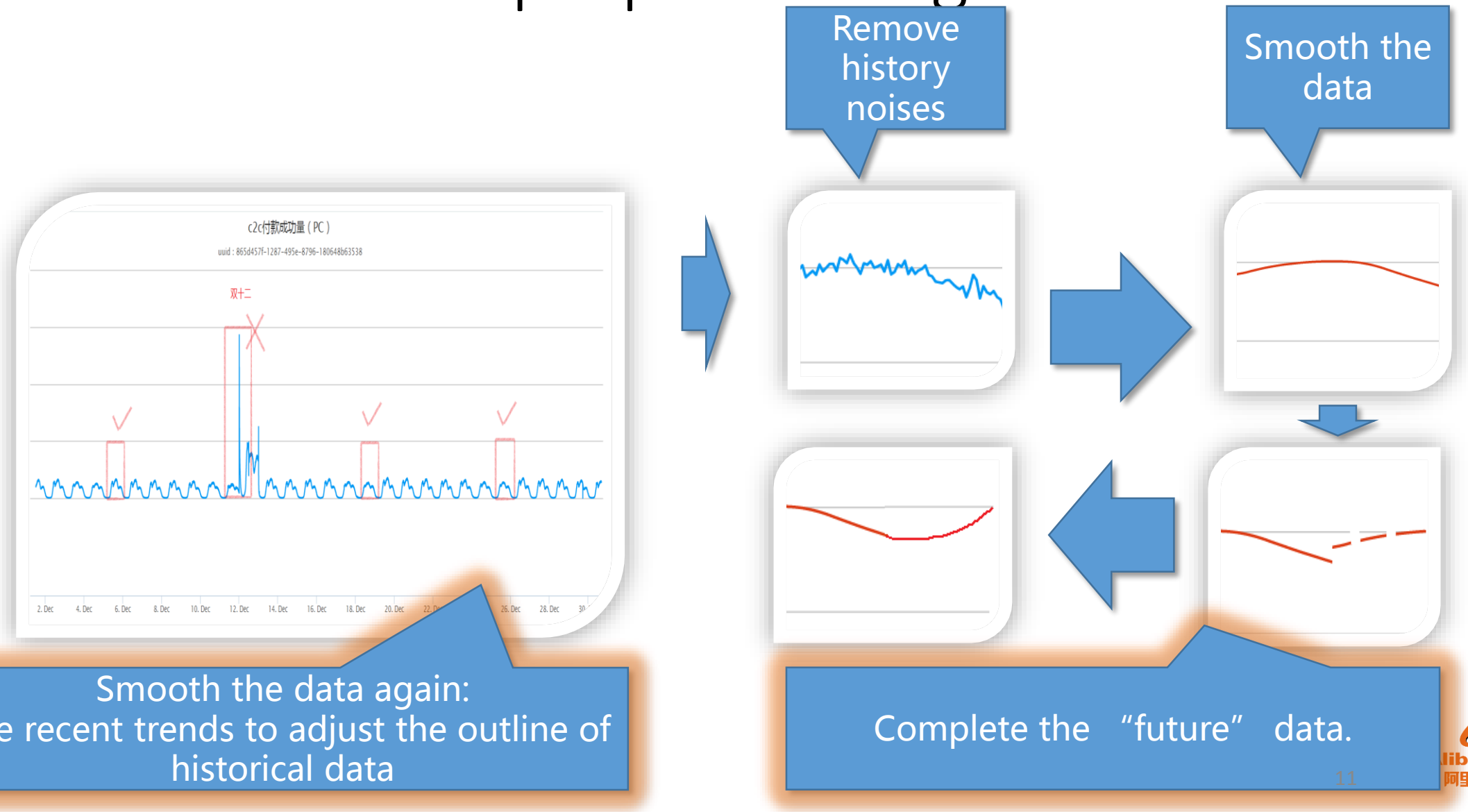
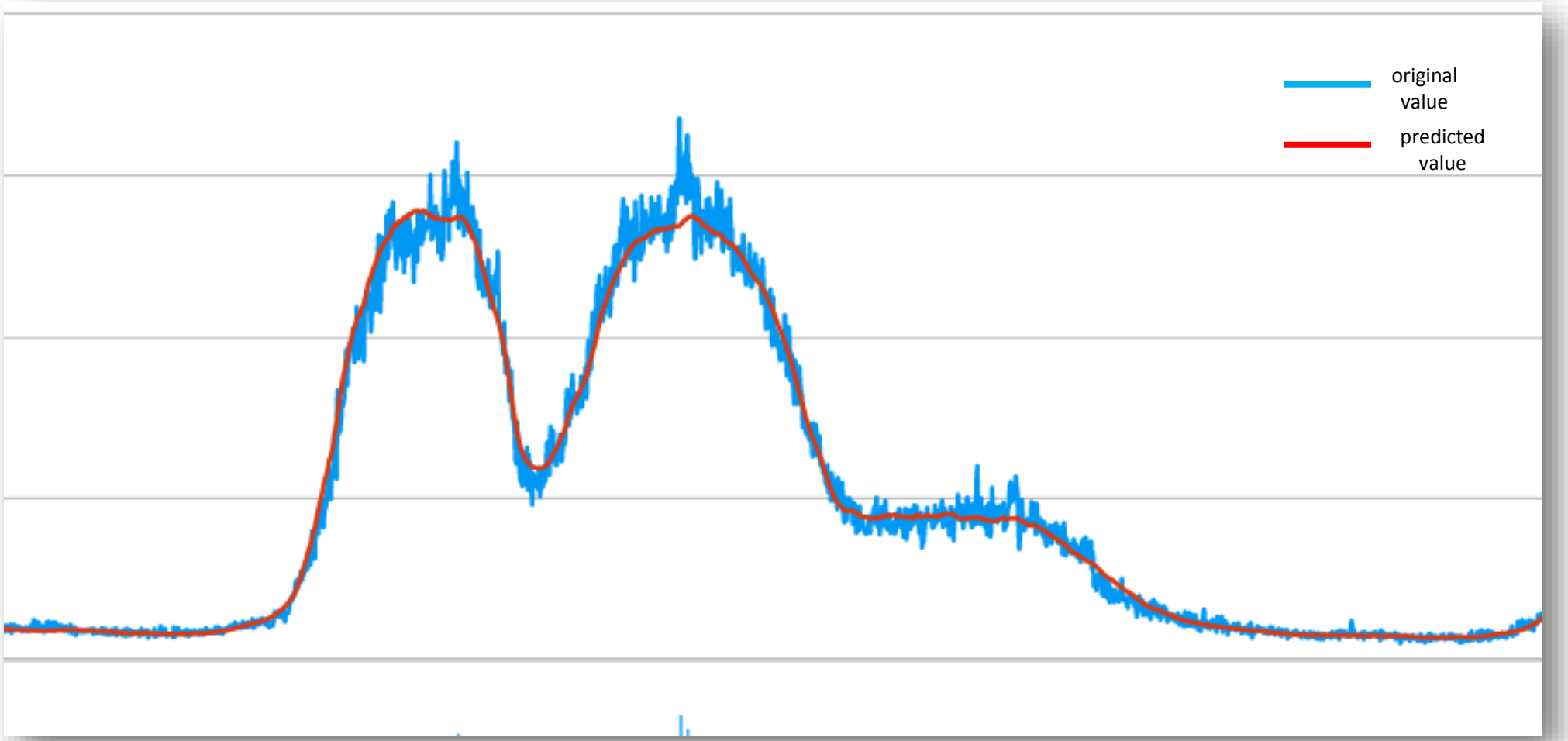
# Customized data preprocessing



# A better “prediction” is born



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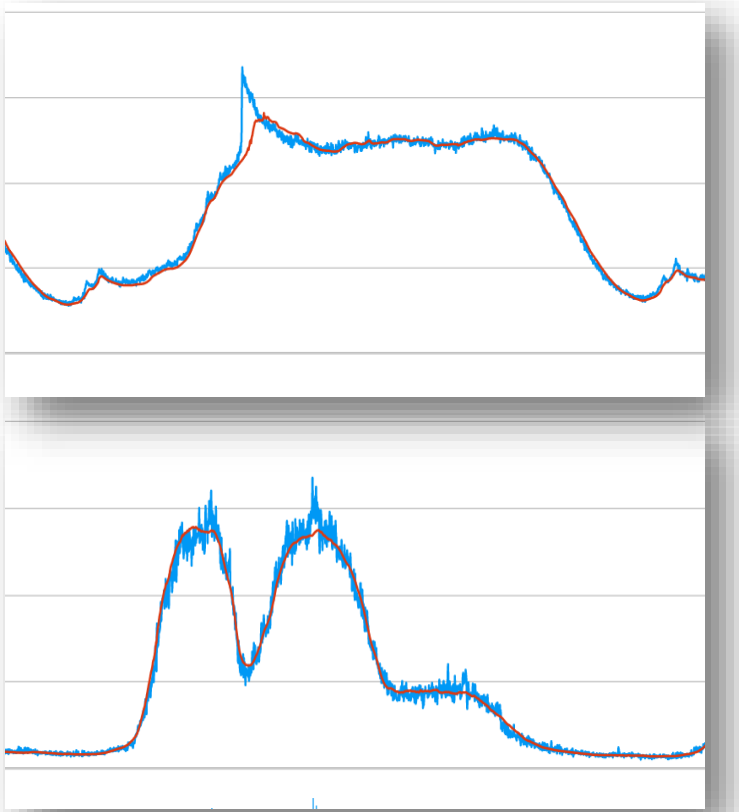
# Anomaly detection based on predicted curve

- The traditional N-sigma law
  - Anomaly point : residence > N * sigma
- N == 3?
  - Sigma varies with the time segment
  - Sigma varies with the business trend
- We need
  - Different N for each time segment and each business trend





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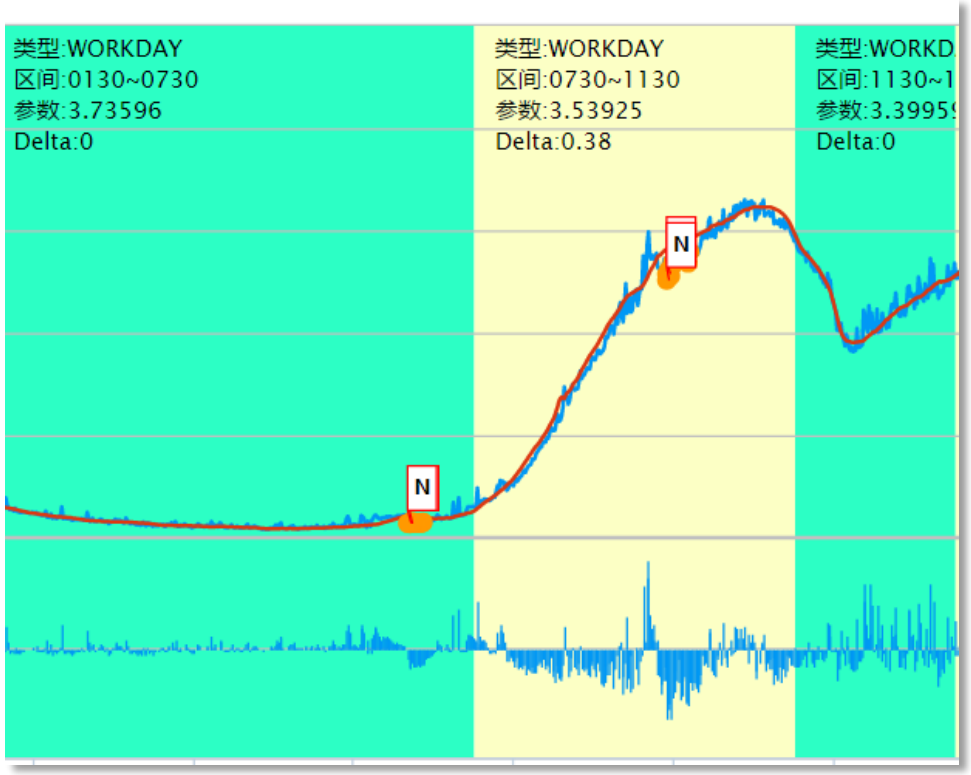
# How to determine the “N”s




- Divide the time segments by residence for each business trend
- Initialize the N for each time segment
- Adjust the N according to manual feedback



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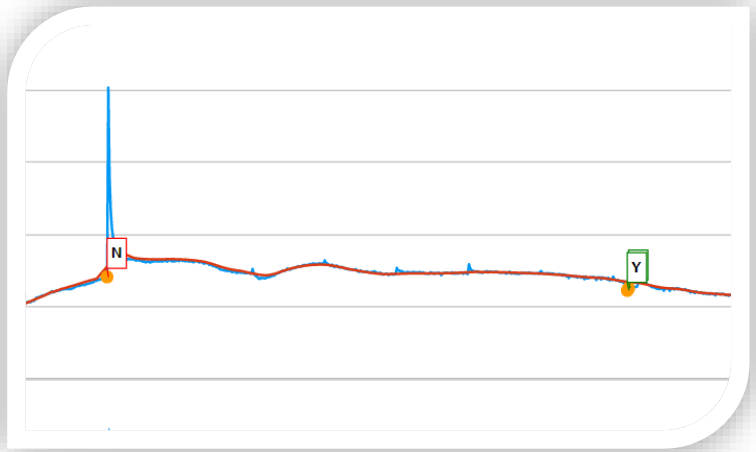
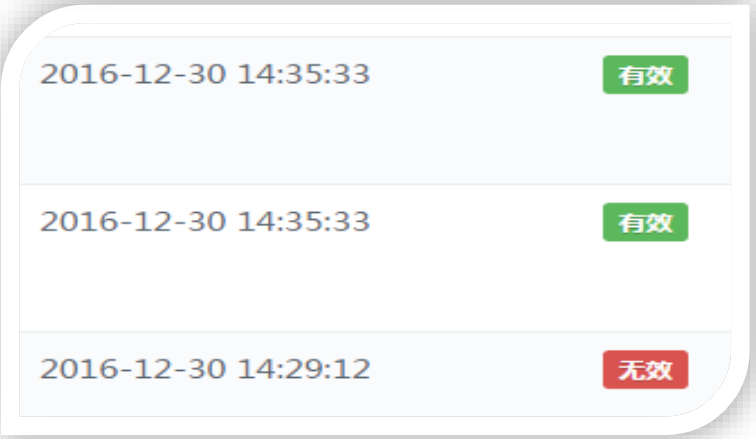
# Manual feedback loop

- About the label data
  - Label data from the operators' team
    - Effectiveness of the anomaly points
  - Quantity of the label data
- How to utilize the label data
  - Adjust the N parameter according to the label data
  - Tolerant the errors in the label data



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# Evaluation

- Anomaly detection
  - Precision: 80%
  - Recall: 80%

- Configuration cost
  - Auto parameter initialization
  - Auto parameter adjustment
    - When the business trend changes






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# Future work



- Lightweight anomaly detection for system metrics



- Early warning for business faults



- Fault diagnosis and root cause analysis



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# Q & A



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