

COMP3027J

Software Architecture

Performance and its Tactics

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Outline

1. The Meaning of Performance

2. Tactics to Improve Performance



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1. The Meaning of Performance

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The Meaning of Performance

Concerns

- Speed of system response to events
- Related to the number and arrival pattern of events

Sources of Events

- User requests, inside the system, outside the system



The Meaning of Performance

Arrival Patterns of Events

- Random
- Regular at specific time scales (day, month, semester, year)



The Meaning of Performance

Arrival Patterns of Events



全国大学英语四、六级
考试成绩查询

快捷查询 免准考证查询

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姓名 姓名

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The Meaning of Performance - Scenarios

Source of Stimulus

- May come from inside or outside the system

Stimulus

- Event arrival (requires response)



The Meaning of Performance - Scenarios

Artifacts

- Services provided by the system

Environment

- System may be in different modes
(normal / emergency / overload)



The Meaning of Performance - Scenarios

Response

- System processes incoming events, which may lead to state changes

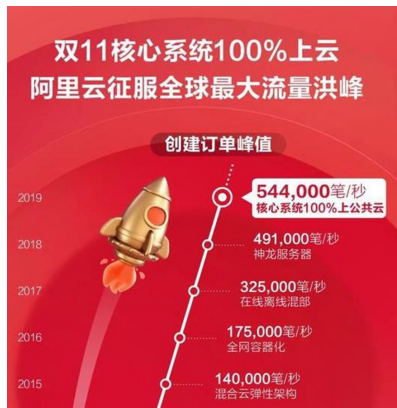


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The Meaning of Performance - Scenarios

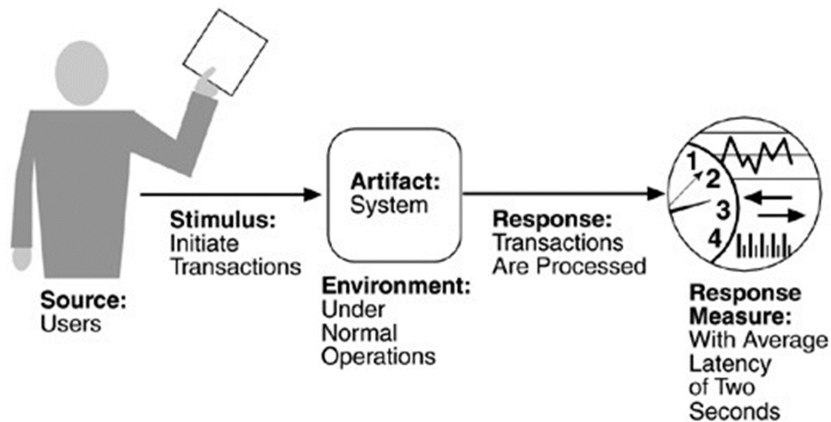
Response Measure

- Time taken to process events
- Number of events processed per unit of time
- Error rate/loss rate of processing



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Performance Scenario Example



Outline

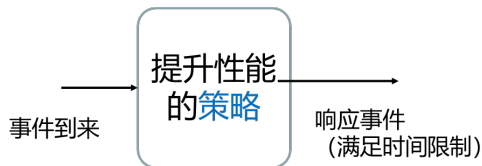
1. The Meaning of modifiability

2. Tactics to Improve Performance



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Tactics to Improve Performance-Overview



Objective

- Respond to events within a limited time
- Acquire resources + Use resources

Direction 1: Resource requirements

Direction 2: Resource management

Direction 3: Resource arbitration



Tactics to Improve Performance

-Resource Requirements

Improve computational efficiency without changing the amount of data to be processed

- Use more efficient algorithms
- Reduce resource occupation when processing events

排序方法	平均时间	最好情况	最坏情况	辅助存储	稳定性
选择排序	$O(n^2)$	$O(n^2)$	$O(n^2)$	$O(1)$	不稳定
插入排序	$O(n^2)$	$O(n)$	$O(n^2)$	$O(1)$	稳定
冒泡排序	$O(n^2)$	$O(n^2)$	$O(n^2)$	$O(1)$	稳定
希尔排序	$O(n^{1.25})$	--	--	$O(1)$	不稳定
快速排序	$O(n \log n)$	$O(n \log n)$	$O(n^2)$	$O(n \log n)$	不稳定
堆排序	$O(n \log n)$	$O(n \log n)$	$O(n \log n)$	$O(1)$	稳定
归并排序	$O(n \log n)$	$O(n \log n)$	$O(n \log n)$	$O(n)$	稳定
基数排序	$O(d(n+rd))$	$O(d(n+rd))$	$O(d(n+rd))$	$O(rd)$	稳定



Tactics to Improve Performance

-Resource Requirements

Reduce the total amount of data to be processed

- Control the rate of event arrival
- Process only a subset of requests



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Tactics to Improve Performance

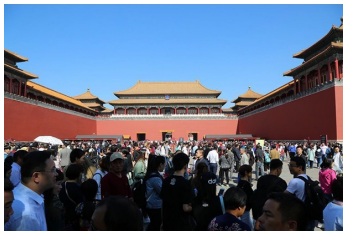
-Resource Requirements

Limit execution time

- Obtain approximate solutions within a specified time

Limit the length of the event queue to be processed

- Directly abandon processing some events



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Tactics to Improve Performance

-Resource Management

Utilize concurrency mechanisms

- Multithreading, multiprocessing, multicore, multi-machine...

业界首款旗舰5G SoC芯片
融合5G和AI的革命性飞跃



CPU 8-Core	NPU 2+1 Core	GPU 16-Core
2G / 3G / 4G / 5G Modem		
ISP 5.0		LPDDR 4X
UFS 3.0 / 2.1		HiFi Audio
4K HDR Video		Security Engine

103亿晶体管

业界首款 7nm + EUV 5G SoC
业界首款 旗舰5G NSA & SA SoC
业界首款 16核Mali-G76 GPU
业界首款 大-微核架构NPU



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Tactics to Improve Performance

-Resource Management

Increase available resources

- Computational resources, storage resources, bandwidth resources...

弹性计算	存储服务	数据库	云通信
云服务器	云存储	关系型数据库	短信服务 HOT
云服务器 ECS HOT	对象存储 OSS	云数据库 POLARDB	语音服务
弹性裸金属服务器（神龙）	块存储	云数据库 RDS MySQL 版 HOT	流量服务
轻量应用服务器	文件存储 NAS	云数据库 RDS MariaDB TX 版	物联网无线连接服务
FPGA 云服务器	文件存储 CPFS	云数据库 RDS SQL Server 版	号码隐私保护
GPU 云服务器	文件存储 HDFS（公测中）	云数据库 RDS PostgreSQL 版	号码认证服务（公测中）
专有宿主机	归档存储	云数据库 RDS PPAS 版	云通信网络加速（公测中）



Tactics to Improve Performance

-Resource Arbitration

First-come, first-served

Fixed priority scheduling

- Military express lanes at airports and stations



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Tactics to Improve Performance

-Resource Arbitration

Dynamic priority

- No starvation
- Earliest deadline first



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Concerns of Performance

- Speed of response processing

Tactics to Improve Performance

- Resource requirements
- Resource management
- Resource arbitration



Thank you!