

# Even More Metrics ...

## Performance Evaluation of Computer Systems

Vojtěch Horký   Peter Libič   Petr Tůma

Department of Distributed and Dependable Systems  
Faculty of Mathematics and Physics  
Charles University

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# Outline

- 1 Network Traffic
- 2 Reliability and Availability
- 3 Computing Infrastructure Capacity
- 4 Information Retrieval Functionality
- 5 More ...

# Network Metrics

## Network Communication

- Throughput – with networks called bandwidth.
- Latency.
- Jitter.
- Packet loss.

## Network Services

- Connections per second.
- Transactions per second.
- Maximum concurrent connections.

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# Reliability and Availability Metrics

## Reliability

- Probability of errors
- Mean time between errors – *error-free seconds*

## Availability

- $availability = \frac{uptime}{totaltime}$
- Mean uptime – *Mean Time To Failure (MTTF)*
- Mean downtime – *Mean Time To Repair (MTTR)*
- MTTF is often better indicator than availability (think short uptimes and extremely short downtimes)

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# Cloud Metrics

## Scalability

The ability to adjust available resources.

### Expressing scalability

- Maximum resource allocation limits
  - ▶ Easy in private cloud
  - ▶ But how about public cloud ?
- Resource allocation granularity
- Acquisition and release time
  - ▶ Technical
  - ▶ Accounting

# Cloud Metrics

## Elasticity

The ability to use scalability to address changing resource demands.

### Expressing elasticity

- Average or total time to move from under or over provisioned
- Average or total amount of under or over provisioned resources
- In reaction to various workload fluctuation patterns
  - ▶ Gradual up or down
  - ▶ Regular fluctuations
  - ▶ You have been slashdotted !
- Converting to money ?
  - ▶ Cost of under vs over provisioning
  - ▶ Bunch of estimates
    - ★ Apple 2015 App Store 10-12 hours down estimated 25M USD
    - ★ Amazon 2017 S3 Service 3-4 hours down estimated 150M USD
    - ★ Amazon 2018 Store 12-15 minutes down estimated 3M USD



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# Information Retrieval Metrics

## Precision

Share of correct results in total results delivered.

$$\textit{precision} = \frac{\textit{truepositive}}{\textit{truepositive} + \textit{falsepositive}}$$

## Recall

Share of correct results delivered in total correct results.

$$\textit{recall} = \frac{\textit{truepositive}}{\textit{truepositive} + \textit{falsenegative}}$$

## Accuracy

Share of correctly classified results.

$$\textit{accuracy} = \frac{\textit{truepositive} + \textit{truenegative}}{\textit{all}}$$

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## ... Think About More

- Test coverage metrics ?
- Energy efficiency metrics ?
- Interface usability metrics ?
- Artificial intelligence metrics ?
  - ▶ Speed of learning
  - ▶ Quality of decision
- ...