Performance Analysis of Mobile Communication Systems

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Main topics

- PA & CP concept and methodology
- General issues on communication mobility
- Performance model at link layer (WLAN). IEEE 802.11 family
- Performance model at transport layer. How does TCP behave with wireless links
- Mobile QoS architectures

Performance Evaluation and Capacity Planning

Basic concepts

PE & CP. Main textbooks

- R. Jain, The Art of Computer Systems Performance Analysis
- D. A. Menasce et al., Capacity Planning and Performance Modeling. From Mainframes to Client-Server Systems
- W. Feller, An Introduction to Probability Theory and Its Applications Vol. 1 and 2
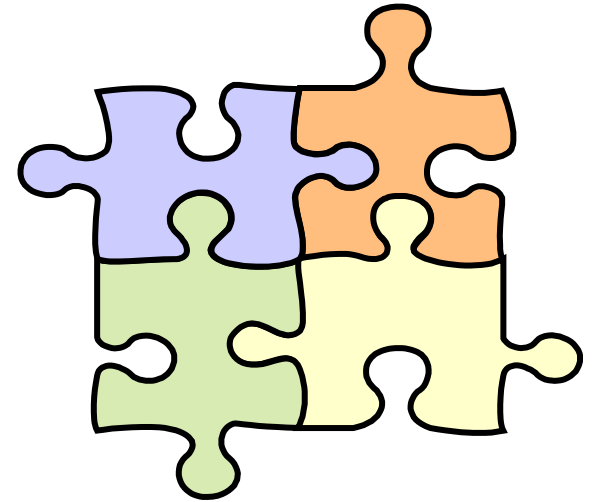
The Capacity Planning Problem

The Capacity Planning Problem

- Reengineer the corporation!
- Predict the performance level under new situation
- Should I by a new disk or add more memory to my workstation?
- Will the file server support an additional 15 workstation?

The Capacity Planning Problem

- Uncle John told me that getting more memory is better than adding new disk

- The manufacturer recommends that we move to a multiprocessor file server

- Rules of Thumb

- Capacity planning questions can be answered in a scientific manner

- Predict performance under different scenarios

The Capacity Planning Problem

- Exercise 1:

  Give the example of the capacity planning problem from your personal experience

The Capacity Planning Problem

The bank problem.

- A local bank has three fully automated branch offices and 10 ATMs are available at 10 locations around the city

- The central IS consists of two mainframe computers that share a disk farm

The Capacity Planning Problem

The questions of the **board of directors**

- Will the current IS facility allow for the expected growth of the bank?

- If not when it will be necessary to upgrade the current IS environment?

- Of several possible upgrades which represent the best cost-performance trade off?

The Capacity Planning Problem

Typical situations

- Increasing the number of BTM terminals

- Increasing in transaction volumes (queries vs. updates)

- New applications (new growth vs. new implementation)

The Capacity Planning Concept

- Capacity planning is the determination of the predicted time in future when system saturation is going to occur, and the most cost-effective way of delaying system saturation as long as possible.

- Why is saturation occurring?

- Which are the best alternatives

- What is bottleneck (Utilization 100%, Longest delay)

The Capacity Planning Concept

Why Capacity planning is important?

- User dissatisfaction
- External Image of the company
- Productivity decrease
- Budgetary constrains
- Risk of financial losses
- IS environment control
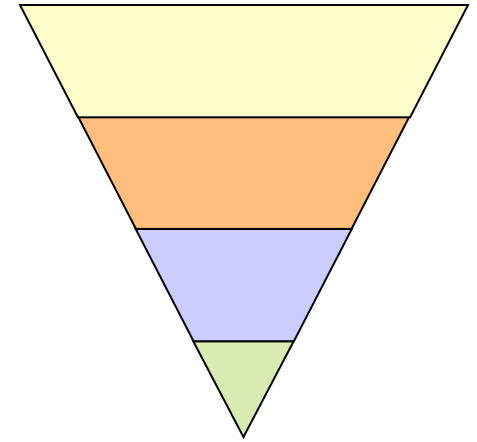
Capacity Planning Methodology

Capacity Planning Methodology

- What is the current installed capacity?

- What services should be provided in the future?

- What quality goals are planned for the services?

- What is the most cost-effective system configuration to handle current and future services and meet the planned quality goals?

Capacity Planning Methodology

Methodology overview

- Understanding the current environment
- Characterizing the workload
- Validating and calibrating the model
- Forecasting the future workload
- Predicting future system performance

Capacity Planning Methodology

- The theoretical capacity is the maximum rate at which it can perform work. The rate at which requests are served is known as throughput.

- Thus capacity is upper limit of throughput

- Response time for the customer

- Throughput for the manager

Time Windows

- Business experiences cycles.
- Christmas (peak and dormant, holidays, weekends, working ours, etc.
  More examples?)
- Time interval during which the system, the workload and the performance indexes are observed represents the time window.

Service Levels

- The service level is provided at a given cost. Service level rule the relationship.

- User expects: response time (satisfactory), availability (`uptime` expressed in %), reliability (as much as possible or...?), cost.

- Quantifiers: average, variation, quintiles.

Service Levels

- Throughput of 30 tps, with at least 90% of the transactions responding in less than 2 sec.

- Average response time 1 sec for trivial transaction.

- File server availability of 98% during each one-month period.

- Average response time 0.5 sec for local commands and 1.5 for remote ones.

- MTTF the disk subsystem should > 10,000 h

Service Levels

- Exercise 3:

  Give the example of the service level requirements.
  What do you expect as a customer from a telephone
  company, BTM machine, ticket service system (or any other
  enterprise)?
  Express your expectations through service level metrics and
  choose the quantifiers.