

Chapter 1: Introduction

What is a Distributed System?

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- ▶ A *distributed system* is a collection of independent computers that appears to its users as a single coherent system.

Examples (1)

The image shows the Netflix logo, which consists of the word "NETFLIX" in a bold, white, sans-serif typeface. The letters are set against a solid red rectangular background. Each letter has a subtle 3D effect, with a dark shadow cast to its right and slightly downwards, giving it a sense of depth.

Examples (1)



<http://techblog.netflix.com/2012/06/netflix-operations-part-i-going.html>

The Internet is just a world passing around notes in a classroom. –Jon Stewart

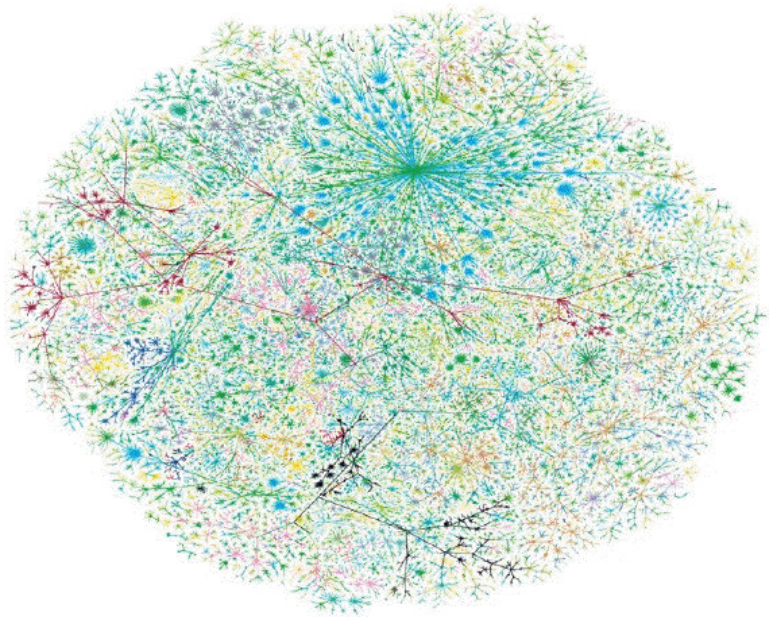
Examples (2)



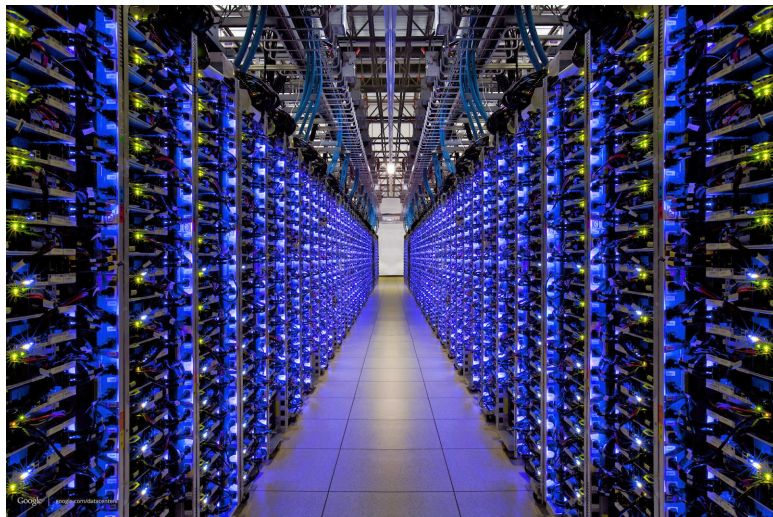
Google Search

I'm Feeling Lucky

Examples (2)



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Examples (3)

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- ▶ Virtually every substantial website!

In-class Exercise

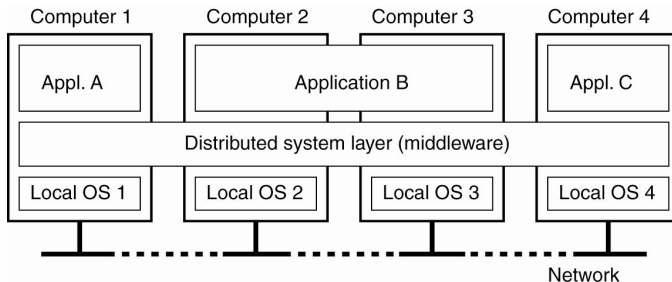
- ▶ Walk through architecture of various distributed systems ranging from: single server/client, multiple server/clients to point to point.

How to Implement a Distributed System?

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Making Resources Accessible

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 - ▶ Easier to collaborate and exchange information
 - ▶ Create virtual organizations where geographically dispersed people can work together using groupware
 - ▶ Enables electronic commerce
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- Eavesdropping or intrusion on communication
- Tracking of communication to build a profile

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Failure	Hide the failure and recovery of a resource

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- ▶ Signal transmission is limited by the speed of light as well as the speed of intermediate switches

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- ▶ Use of standard protocols.
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- ▶ Interoperability, Portability, Extensibility.
- ▶ Separating policy from mechanism. For example: *caching* in a web browser.

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- ▶ **Administrative**: be able to manage even if it spans independent administrative organizations

Centralized versus **distributed** implementations.

Centralized Solutions with Scalability Problems

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- ▶ There is no implicit assumption that a global clock exists.

In-class exercise. Simulate a centralized and a distributed algorithm for the same problem in class!

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- ▶ **Distribution:** Taking a component, splitting into smaller parts, and subsequently spreading them across the system. (E.g. Domain Name System)
- ▶ **Replication:** Replicating components increases availability, helps balance the load leading to better performance, helps hide latencies for geographically distributed systems. **Caching** is a special form of replication.

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“A distributed system is one in which the failure of a computer you didn't even know existed can render your own computer unusable.”
—Leslie Lamport

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In-class Exercise: Classify the examples we have seen so far into the three categories above.

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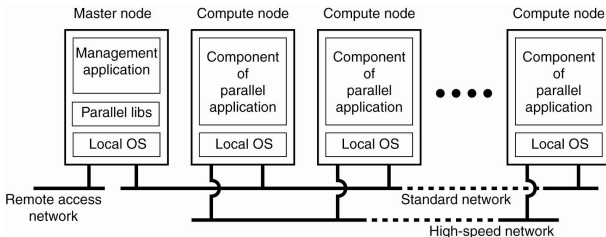
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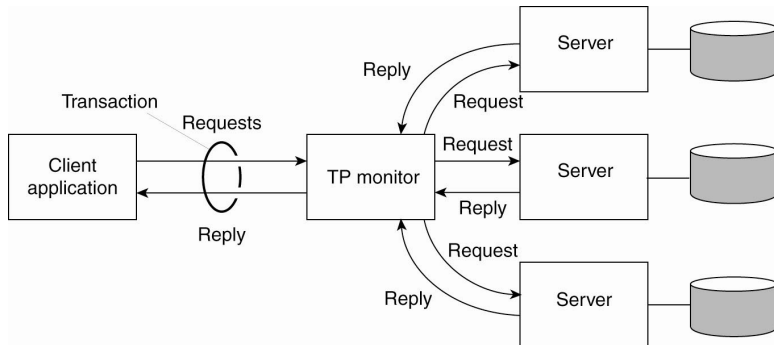
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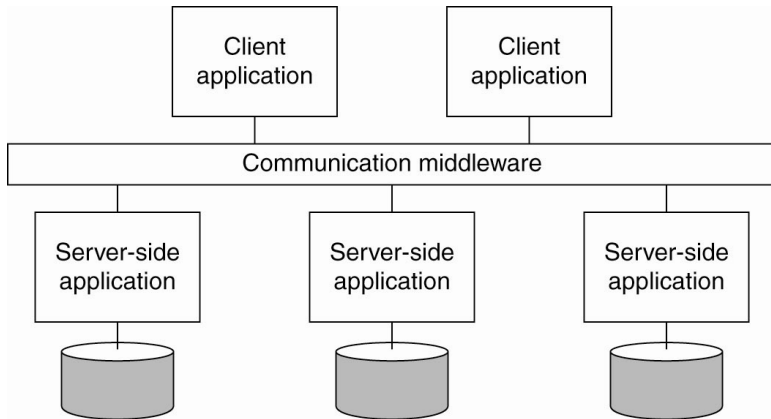
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Transactions can be **nested**. Durability applies to top-level transactions only. For example: an airline and a hotel database.

Transaction Processing Systems (2)



Enterprise Application Integration



Middleware as a communication facilitator for enterprise application integration.

Distributed Pervasive Systems

Requirements for pervasive systems:

- ▶ Embrace contextual changes.
- ▶ Encourage ad hoc composition.
- ▶ Recognize sharing as the default.

Examples: Home systems, Body Area Networks, Sensor Networks.

Chapter 1: Recommended Exercises

- ▶ **Problem 1.** What is the role of middleware in a distributed system?
- ▶ **Problem 2.** Explain what is meant by transparency, and give examples of different types of transparency.
- ▶ **Problem 3.** Scalability can be achieved by applying different techniques. What are these techniques?
- ▶ **Problem 4.** Give further examples of distributed pervasive systems.