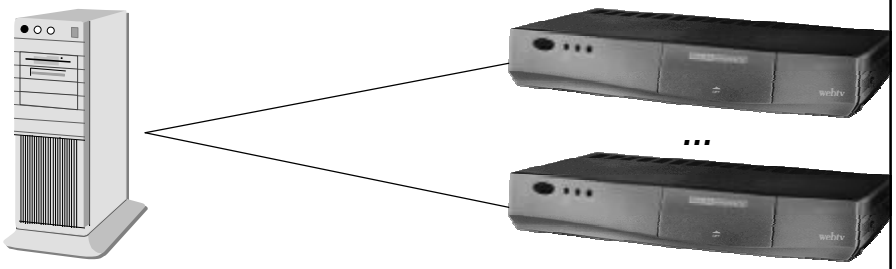
Distributed System Case Studies

Motivation

- ***Case Studies***
  - ***Hongkong Telecom's Video-on-demand***
  - ***UBS IT Services Infrastructure***
  - ***Boeing's Aircraft Configuration Management***
  - ***Managing of Football Association***
- ***Used the principles and techniques presented in this course.***
- ***Will provide a motivation for this course.***
- ***Will provide illustrative examples throughout this course...***

Hongkong Telecom Video on demand



- *Aim: provide subscribers with facilities to download videos from HK TK servers to low-cost Web-TVs.*
- *currently 90,000 users.*
- *Built using distributed object-technology.*

Requirements

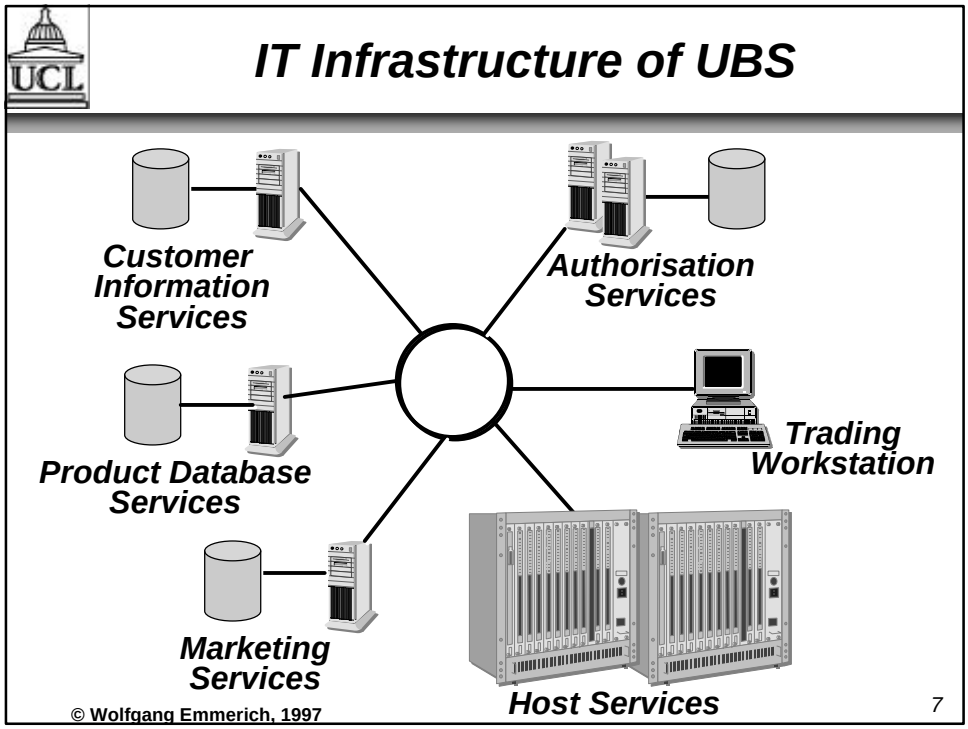
- *Hardware:*
  - *Clients: Web-TV*
  - *Servers: RISC processor*
- *Operating System Heterogeneity :*
  - *Clients: Java OS*
  - *Servers: UNIX*
- *Programming Language Heterogeneity:*
  - *Clients: Java*
  - *Servers: C++*

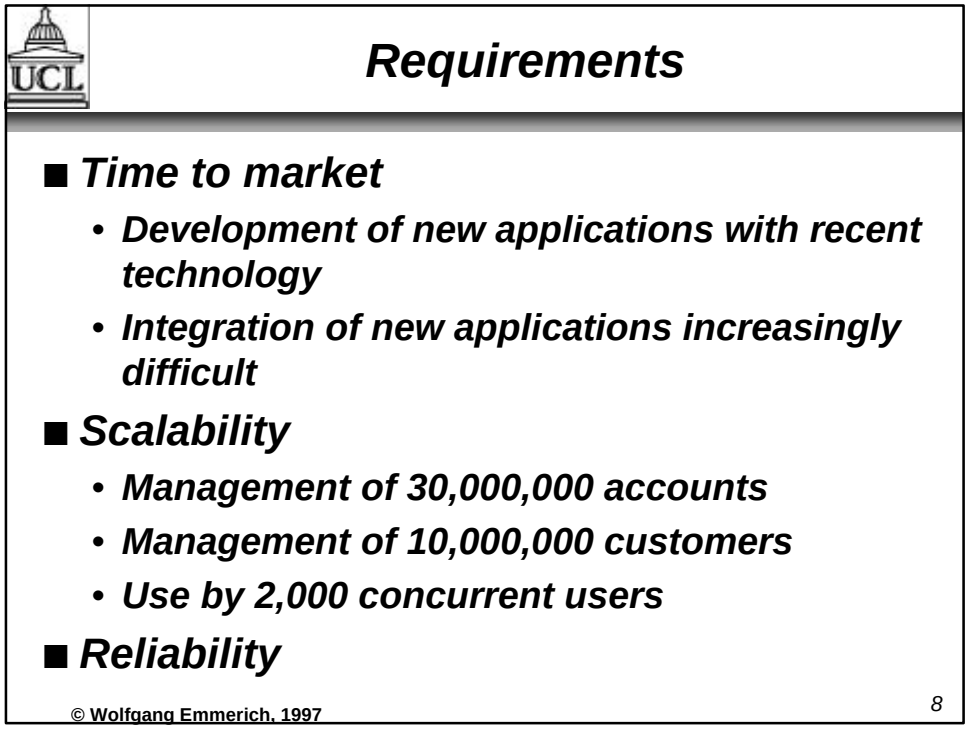
Requirements (cont'd)

- **Communication across Network**
  - How to transmit complex data structures across the Internet?
- **Scale**
  - Scaling from initially several hundred to currently 90,000 users
- **Security**
  - Secure Payment
  - Authentication

Why distributed object technology?

- **Distributed:**
  - Video clients need to download/show video on customer's Web-TV
  - Multiple servers needs to be operated by Hongkong Telecom:
- **Object Technology:**
  - Video clients are written in Java:
    - Web-TV has Java Virtual Machine
    - portability to e.g. Sony Playstation, Sega-Console...
  - Video servers are written in C++:
    - high performance


IT Infrastructure of UBS
Customer Information Services
Authorisation Services
Product Database Services
Trading Workstation
Marketing Services
Host Services
© Wolfgang Emmerich, 1997
7


Requirements
■ Time to market
• Development of new applications with recent technology
• Integration of new applications increasingly difficult
■ Scalability
• Management of 30,000,000 accounts
• Management of 10,000,000 customers
• Use by 2,000 concurrent users
■ Reliability
© Wolfgang Emmerich, 1997
8

Requirements (cont'd)

- *Hardware Heterogeneity*
  - *Unisys Mainframes*
  - *IBM Mainframes*
  - *SPARC Servers*
  - *PC Workstations*
- *Operating System Heterogeneity*
  - *MVS*
  - *UNIX*
  - *Win-NT*
- *Programming Language Heterogeneity*
  - *Cobol*
  - *C/C++*
  - *Visual Basic*

Why distributed object technology?

- *Uniform view of all banking services*
- *Appropriate level of abstraction*
- *Preserving investment by wrapping legacy applications*
- *Exploiting advantages of object technology for new development*
- *Resolving*
  - *distribution*
  - *heterogeneity*

Boeing 777 Configuration Mgmnt.

Problems to be solved

- ***Scale***
  - ***3,000,000 parts per aircraft***
  - ***Configuration of every aircraft is different***
  - ***CAA regulations demand that records are kept for every single part of aircraft***
  - ***Aircraft evolve during maintenance***
  - ***Boeing produce 500 aircraft per year***
  - ***Configuration database grows by 1.5 billion parts each year***
  - ***Projected life of each aircraft 30 years***
  - ***45,000 engineers need on-line access to engineering data***

Problems to be solved (cont'd)

- **COTS Integration**
  - Existing IT infrastructure was no longer appropriate
  - Boeing could not afford to build required IT infrastructure from scratch
  - Components were purchased from several different specialized vendors
    - relational database technology
    - enterprise resource planning
    - computer aided project planning
  - Components needed to be integrated

Problems to be solved (cont'd)

- **Heterogeneity**
  - 20 Sequent database machines as servers for the engineering data
  - 200 UNIX application servers
  - NT and UNIX workstations for engineers

Why distributed object technology

- *Object wrapping of COTS*
- *Resolution of distribution at high level of abstraction*
- *Resolution of heterogeneity*
- *Scalability*

Management of Football Association

- *Managing soccer leagues, national team, clubs, player transfer*
- *Imaginary system*
- *Common example that can be twisted for didactic purposes*

Requirements

- *Autonomy of clubs*
  - *Every club operates its own administration, training/game scheduling.*
- *Need for integration in order to*
  - *register players with the football association.*
  - *book players for national team games.*
  - *agree to schedule of league games.*
- *Heterogeneity*
  - *different machines*
  - *different programming languages*

Commonalities

- *Integration of new, legacy and components off-the-shelf*
  - *Legacy components might not need to be re-engineered*
  - *COTS cannot be modified*
- *Heterogeneity of*
  - *hardware platforms*
  - *operating systems*
  - *networks*
  - *programming languages*
- *Construction of distributed systems*