

## TIM 50 - Business Information Systems

### Lecture 17

Instructor: Terry Allen  
UC Santa Cruz  
11/21/2011

## Outline

- Announcements
- Databases (cont'd)
- Algorithms and Protocols
- Student Presentations
- Akamai

## Announcements I

- Database Assignment due 12/2 (submit electronically)
- Business paper - due 12/2 (last day of instruction)

## Announcements II

- Student Presentations next week?
  - ??
- Reading:
  - Chapter 10 of Messerschmitt (Reader 1)
  - American Airline Case Study (Reader 2)
  - Chapter 1 on Networking
- 2<sup>nd</sup> Database tutorial
  - Friday, Dec. 2, 3:00 p.m., BE109

## Student Presentations

- Rachel Karagianes - Artificial Skin
- Eleonor Concepción - Galaxy Hotel System

## The Relational Model

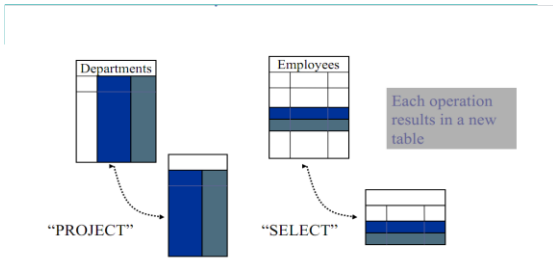
EMPLOYERS			
EMPL_ID	EMPL_NAME	EMPL_POSITION	DEPT_ID
100	Alice	Manager	1
101	Bob	Programmer	1
102	Chris	Manager	2
103	David	Accountant	2

DEPARTMENTS		
DEPT. ID	DEPARTMENT	DEPT. ADDRESS
1	IT	San Jose
2	Finance	New York

Primary Keys: EMPL\_ID, DEPT. ID

Secondary Key: DEPT\_ID (in EMPLOYERS)



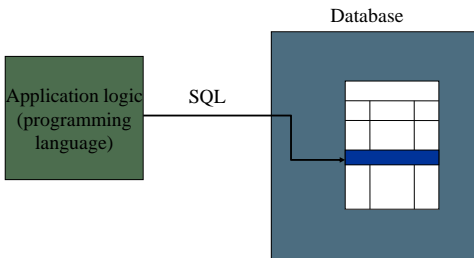
## Database Operations

EMPLOYERS				DEPARTMENTS		
EMPL_ID	EMPL_NAME	EMPL_POSITION	DEPT_ID	DEPT_ID	DEPARTMENT	DEPT_ADDRESS
100	Alice	Manager	1	1	IT	San Jose
101	Bob	Programmer	1	2	Finance	New York
102	Chris	Manager	2			
103	David	Accountant	2			

JOIN EMPL_DEPT					
EMPL_ID	EMPL_NAME	EMPL_POSITION	DEPT	ADDRESS	
100	Alice	Manager	IT	San Jose	
101	Bob	Programmer	IT	San Jose	
102	Chris	Manager	Finance	New York	
103	David	Accountant	Finance	New York	

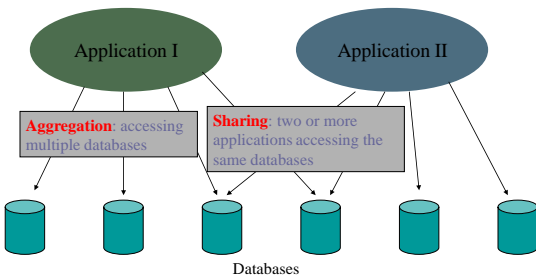
## Application Logic and Tables



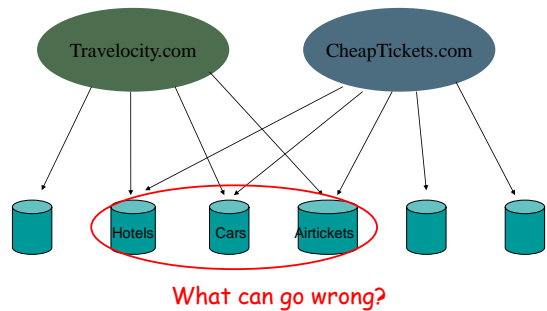
## Databases & OLTP

Click to add text

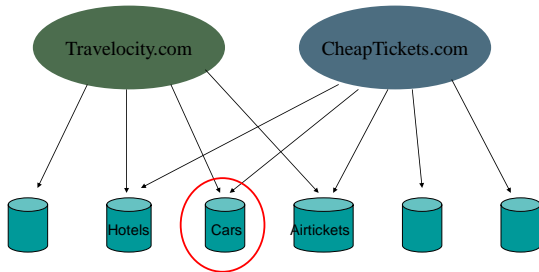
## Recall - Two capabilities



## Example - Travel Agency

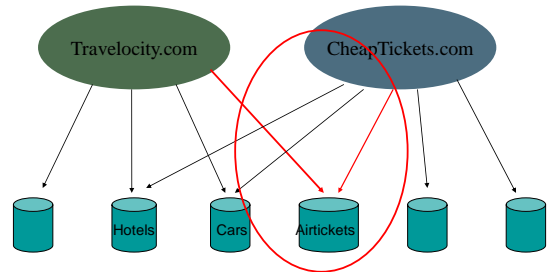


## Example - Travel Agency



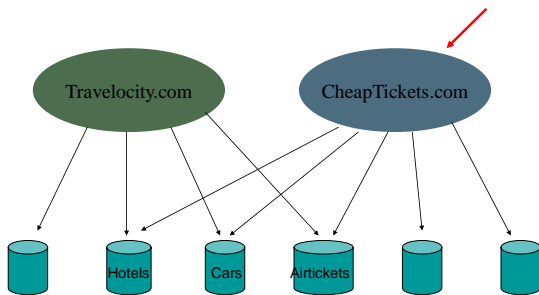
A resource might be unavailable

## Example - Travel Agency



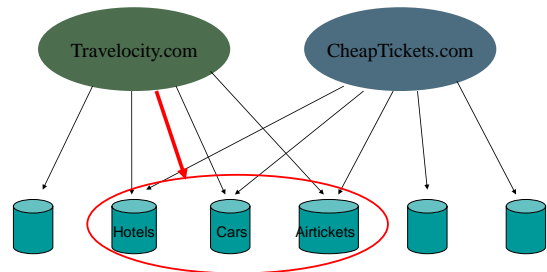
Two applications might try to access & update the same resource concurrently

## Example - Travel Agency



An application or a host might crash before the completion of the transaction

## Example - Travel Agency



A customer's transaction should be completed in its entirety, or aborted

## Transaction Processing

- "The coordination of multiple resources and the shared access to common resources in a systematic and consistent way"
- **Examples?**
  - Financial applications (stock market, ATMs)
  - Reservations (travel, theatre)
  - Manufacturing (inventory, purchasing, billing)
  - Etc...

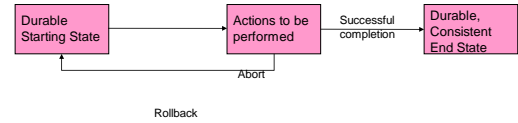
## Online Transaction Processing (OLTP)

- Transaction Processing for networked applications
- **4 Important Properties of transactions: ACID**
  - **A**tomicity
  - **C**onsistency
  - **I**solation
  - **D**urability

## The ACID properties

- **Atomicity**
  - All transaction components should either complete together (commit) or abort
  - E.g. All reservations (airline, hotel, car) should be grouped as a single transaction that either commits, or aborts
- **Consistency**
  - A transaction must leave the system in a consistent state at the end of the transaction, or else abort
  - E.g. Either a consistent set of reservations has been made, or none
- **Isolation**
  - Concurrent transactions are allowed only if they don't interfere with each other
  - Two travel agents can concurrently access the same database if the reservations are for different dates/places
- **Durability**
  - A transaction leaves the resources in a permanent state after it commits

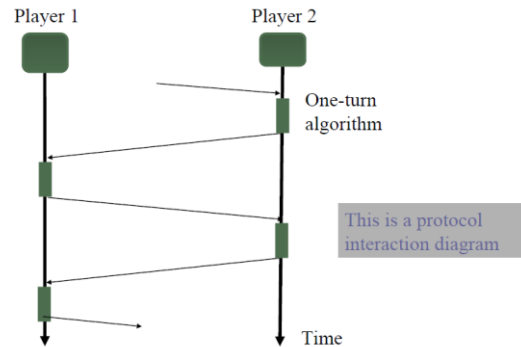
## Structure of a Transaction



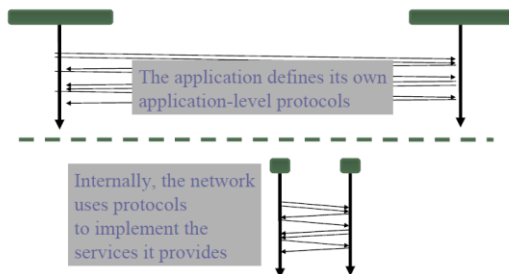
## OLTP

- **Simplifies application development**
- **Enables protection and integrity of mission-critical data in a transparent way**
  - for the end user
  - for the application developer

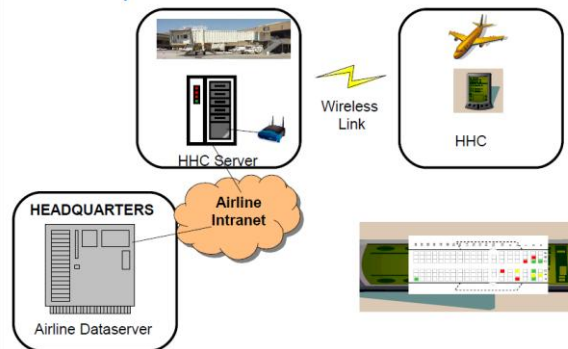
## Monopoly players protocol



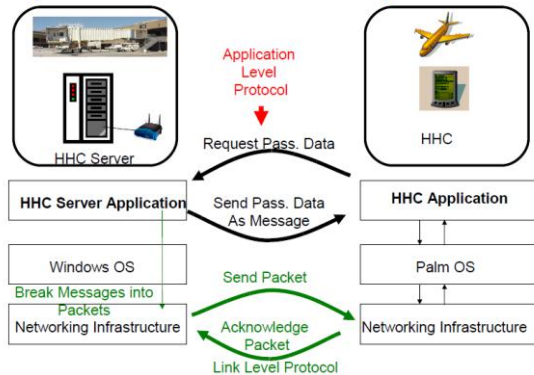
## Application and infrastructure



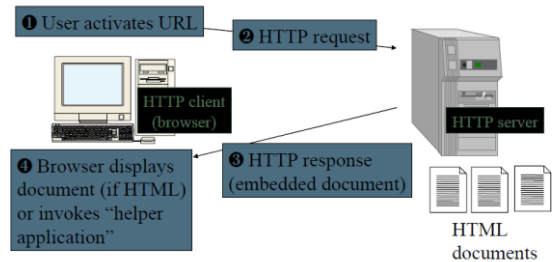
## Example:



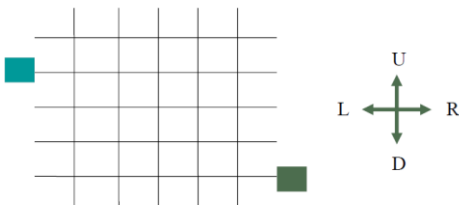
## Layered Protocols Example



## Example: HTTP (Hyper Text Transfer Protocol)



## Example

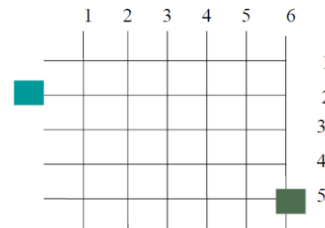


Path from ■ to ■ is (R,D,D,D,R,R,R,R)

Is (R,D,D,D,R,R,R,R) an address?

No! -- not an address, because it depends on starting point

## Example



Address of ■ is (6,5)

Route from ■ can be inferred

## Program

### Program

- Precise description of an algorithm in a formal language that is called programming language
- Actions are applied to data

## Formulation in a language

- Natural language
  - No strict syntactic rules
  - Great density and semantic capability
- Formal language
  - Strict syntax and semantics
- Programming language
  - Formal language in which computations can be described
  - Executable by an electronic computer

## Can we solve all problems?

Collatz Conjecture (Ulam):

**while  $x \neq 1$  do**  
**if (x is even) then  $x = x/2$**   
**else  $x = 3 * x + 1$**

Example:

7 → 22 → 11 → 34 → 17 → 52 → 26 → 13 → 40 → 20 → 10 → 5 →  
 16 → 8 → 4 → 2 → 1

Given *any* arbitrary number  $x$ , will the program terminate?

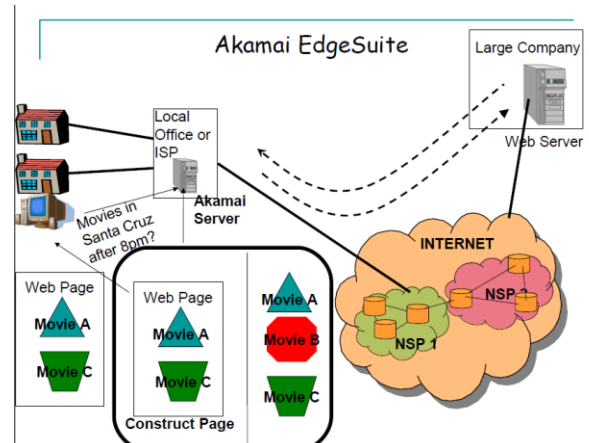
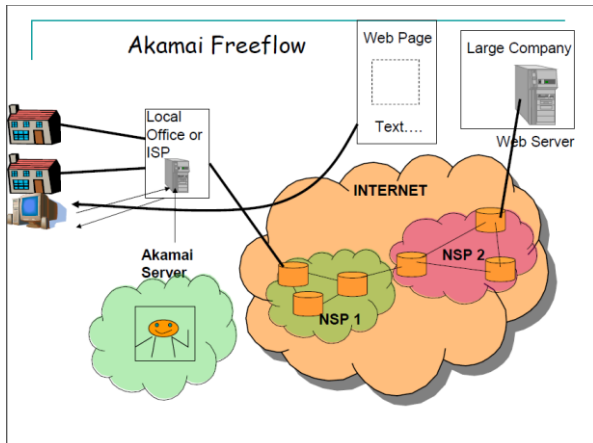
Open problem!

## Translation of programs

Source Code  
 (in a programming language)

↓  
**Compiler**

↓  
**Input** → Executable program → **Output**  
 (machine language)



## Quiz 4 (total 10 pts)

- ▣ What is SQL?
- ▣ How long (in bits) is an IP address?
- ▣ Akamai is famous for what?