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# TIM 50 - Business Information Systems

## Lecture 17

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Instructor: Terry Allen

UC Santa Cruz

11/21/2011

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# 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

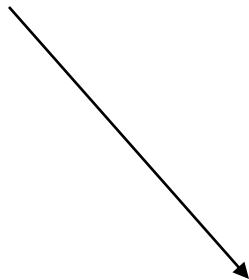
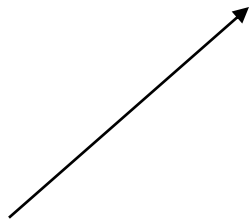
Secondary Key



## 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

Primary Keys



## DEPARTMENTS

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



# Database Operations

## 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
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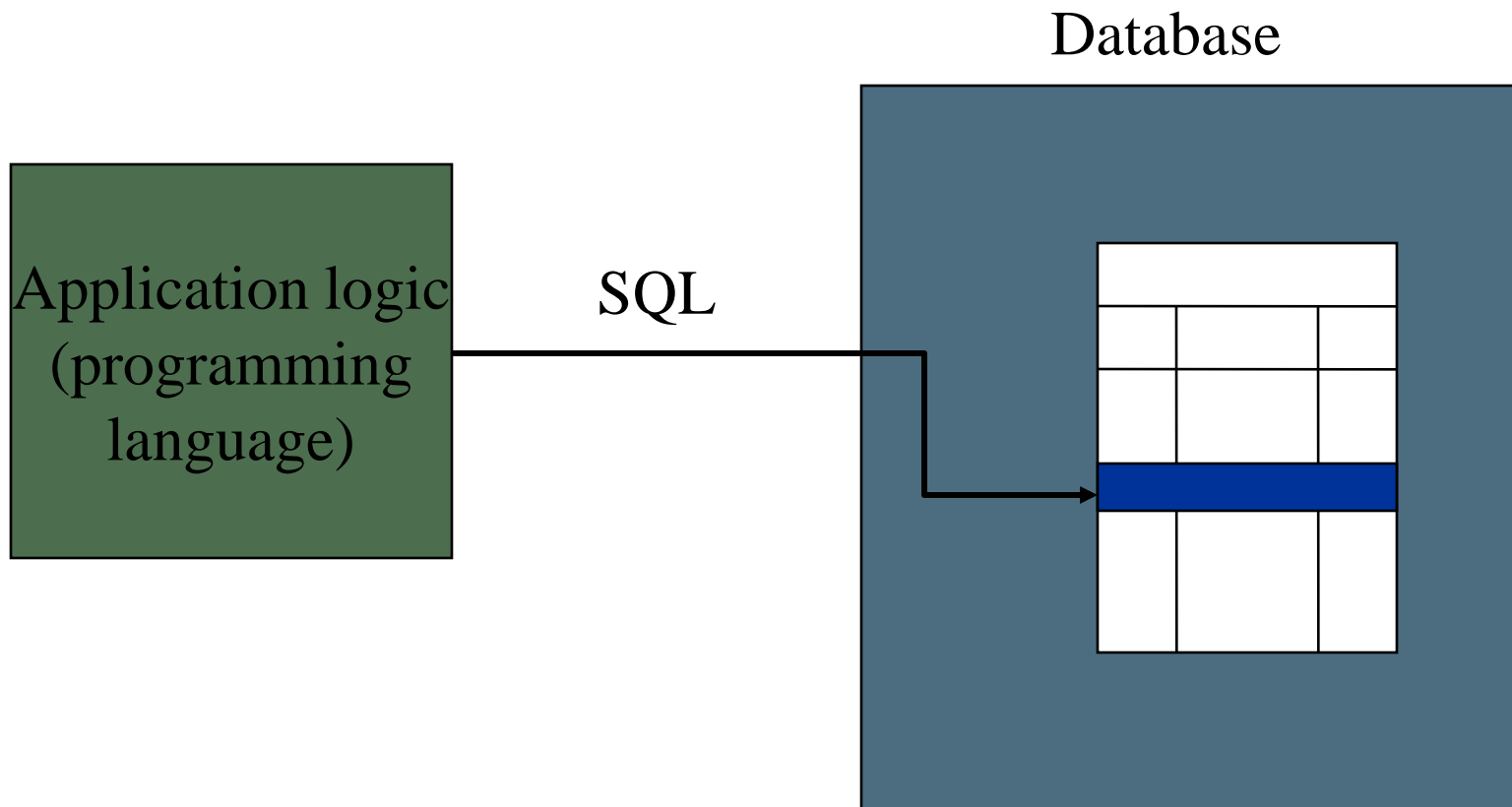
## JOIN EMPL\_DEPT



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

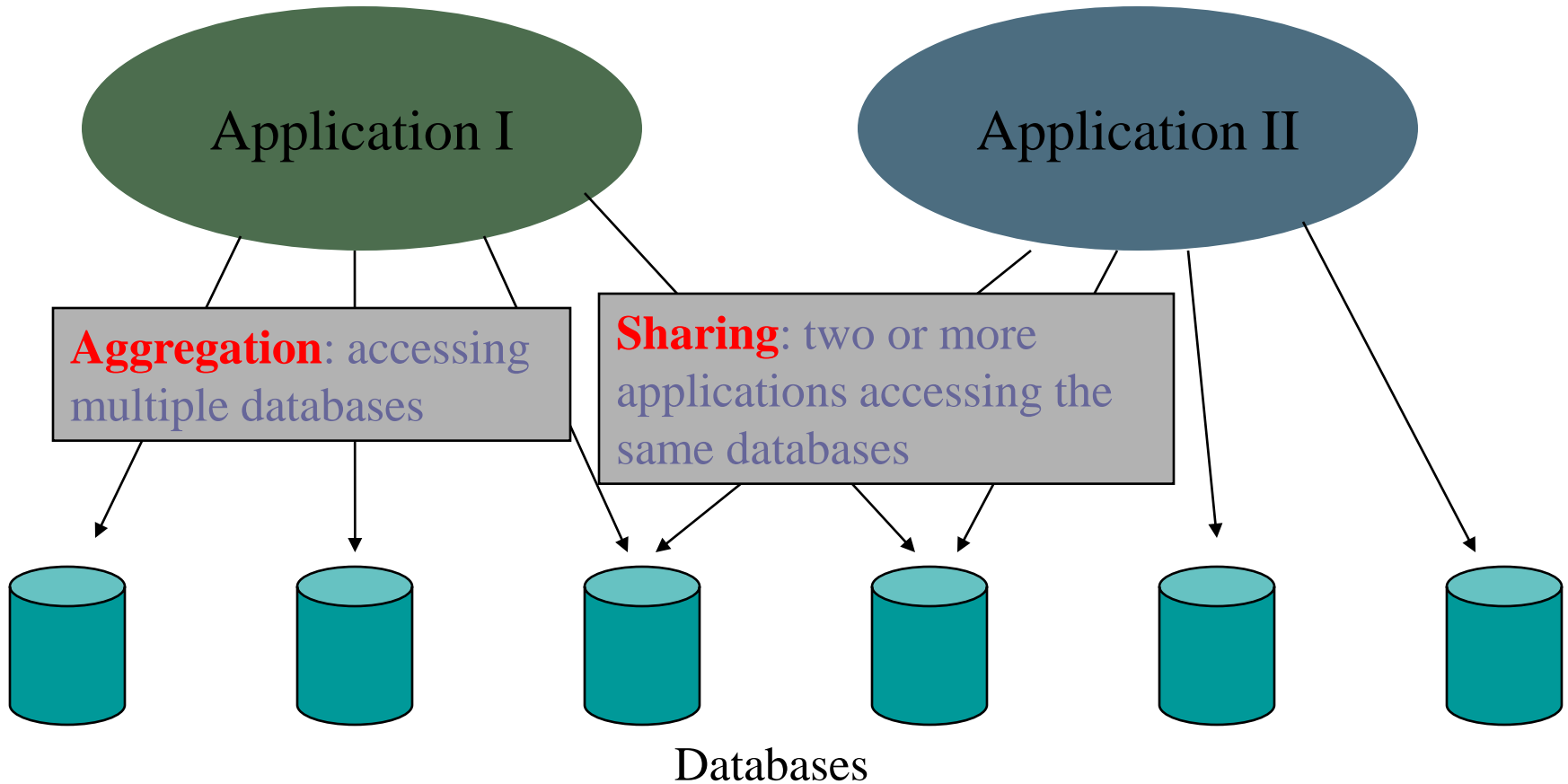


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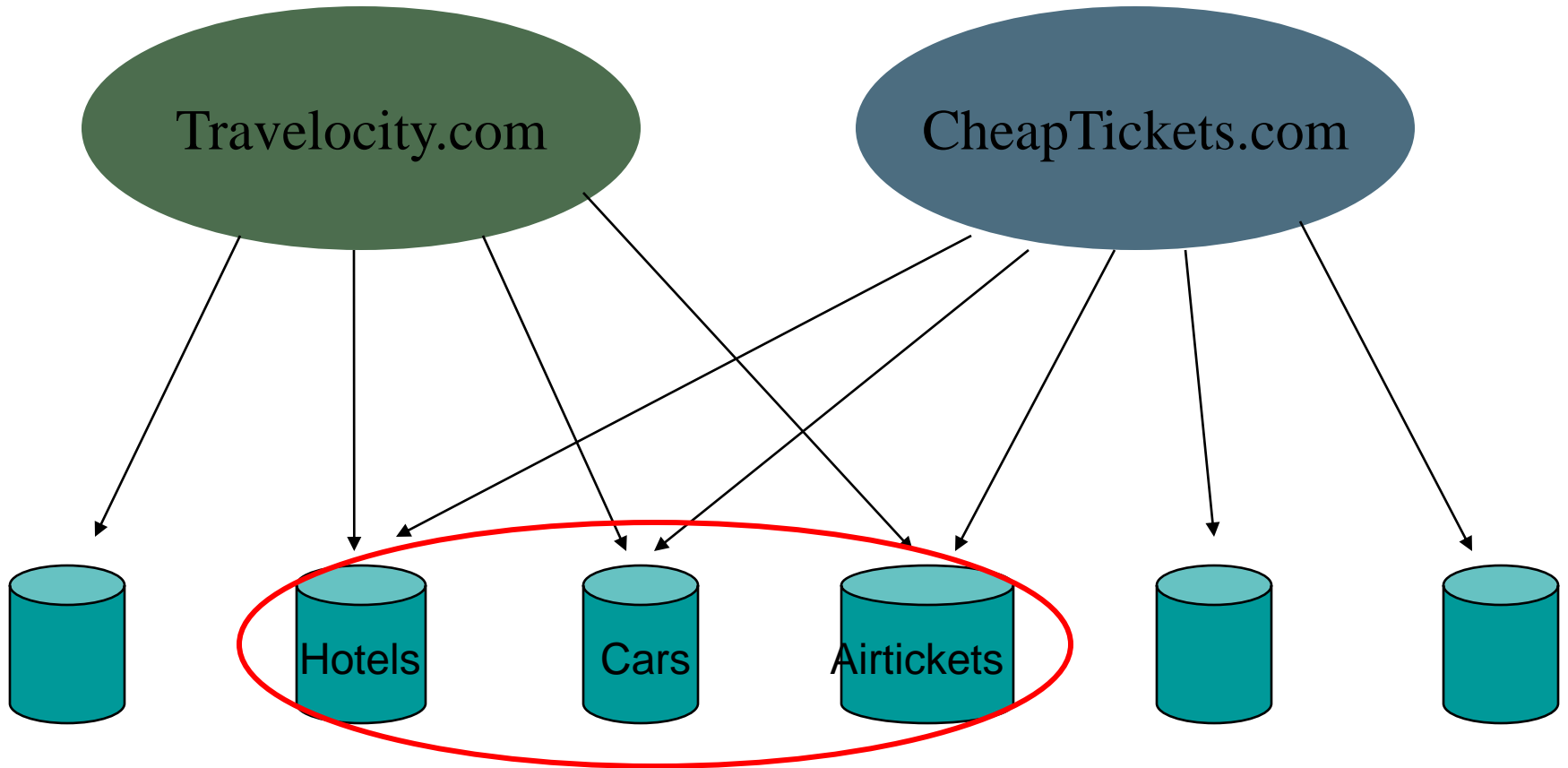
# Databases & OLTP

□ Click to add text

# Recall - Two capabilities

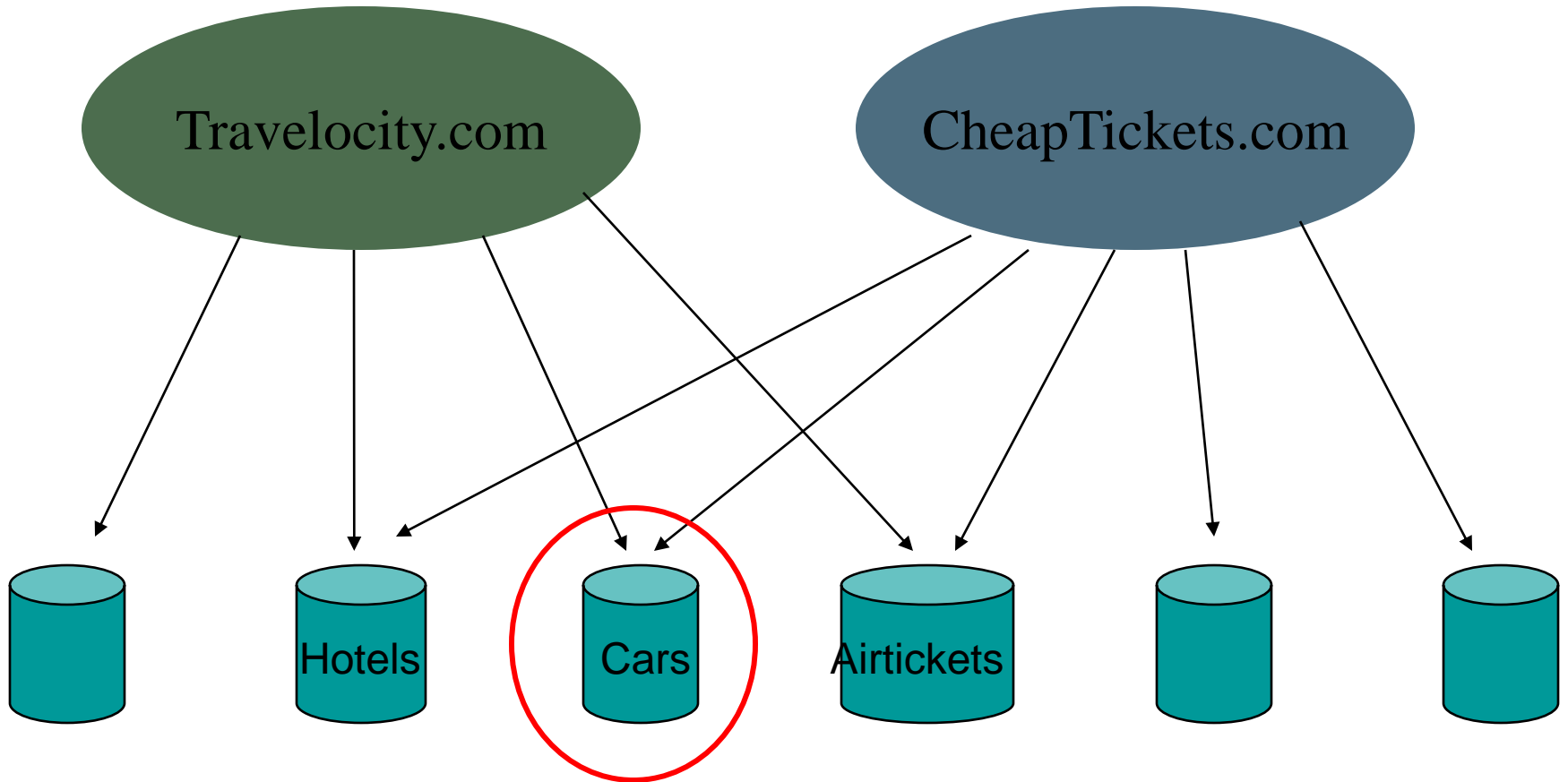


# Example - Travel Agency



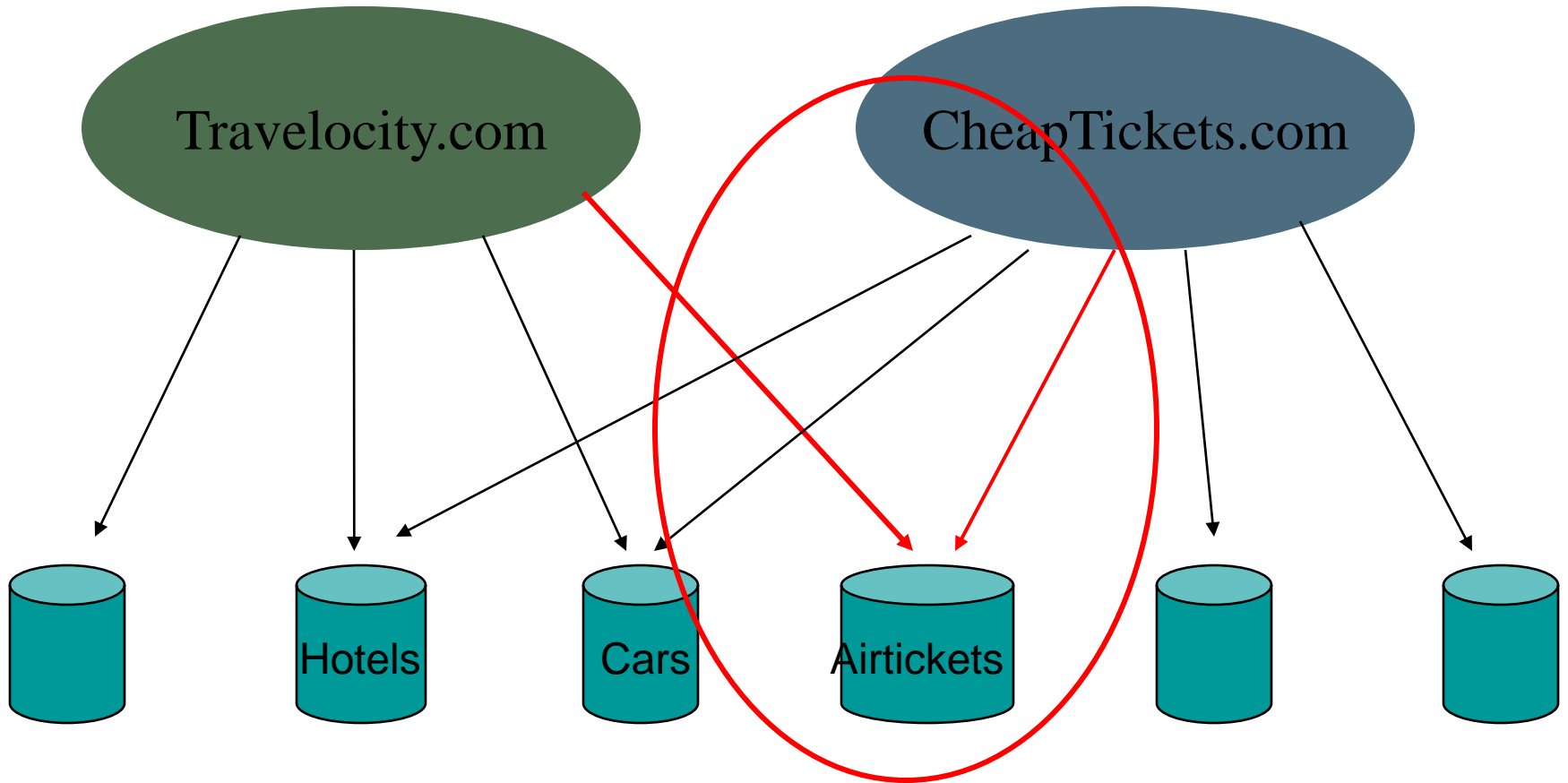
What can go wrong?

# Example - Travel Agency



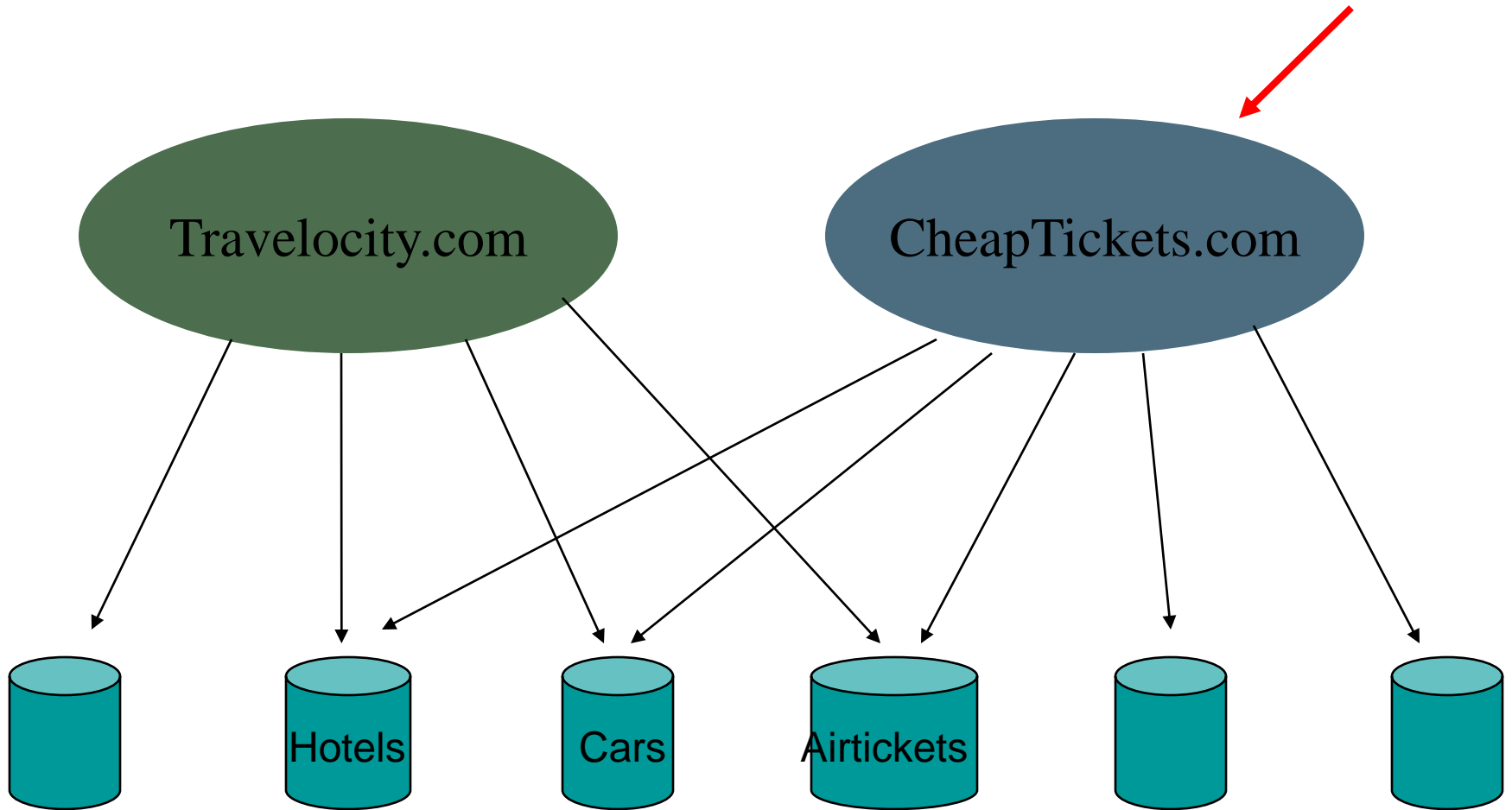
**A resource might be unavailable**

# Example - Travel Agency



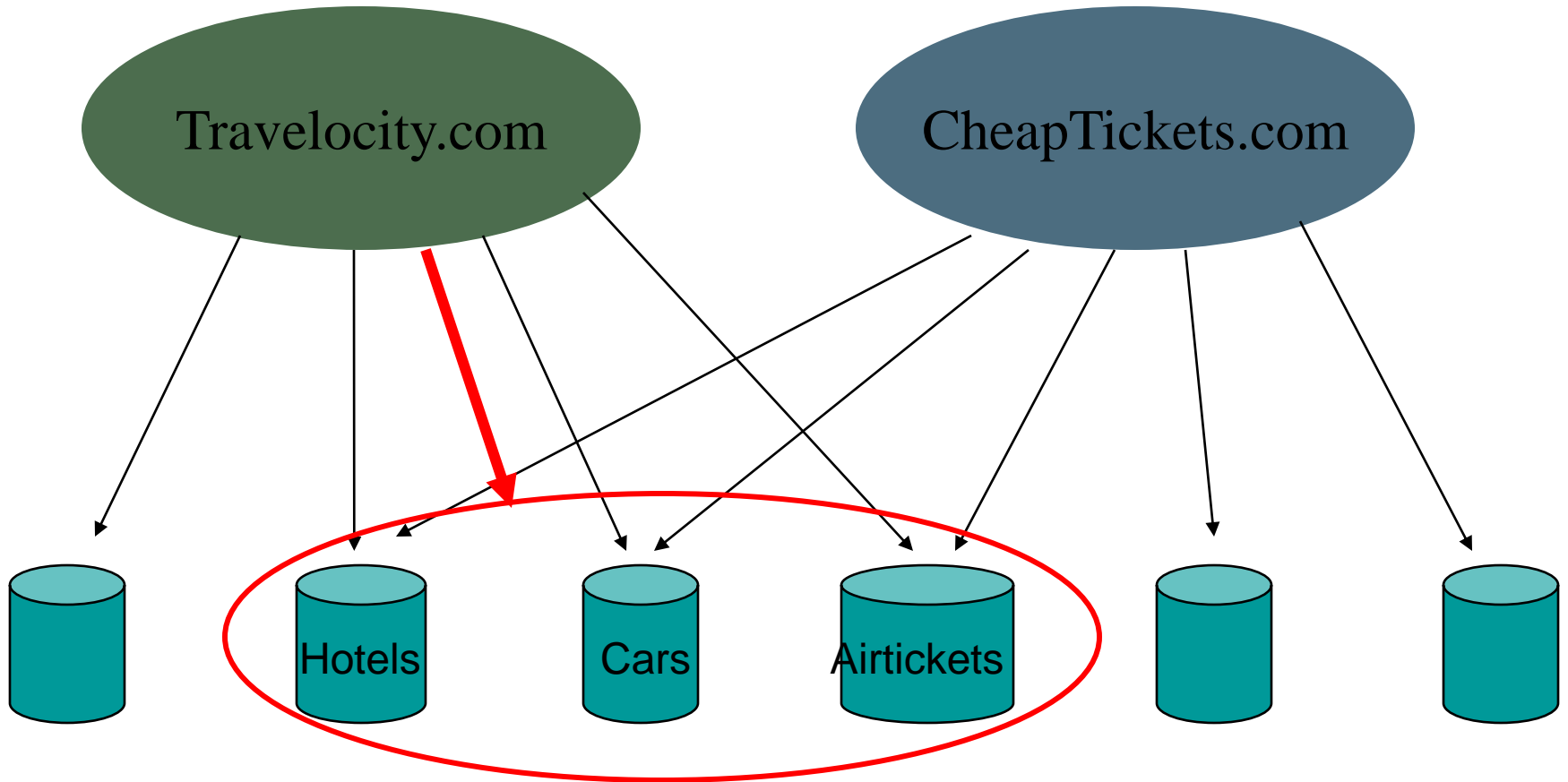
Two applications might try to access & update the same resource concurrently

# 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**
  - Atomicity
  - Consistency
  - Isolation
  - Durability

# 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

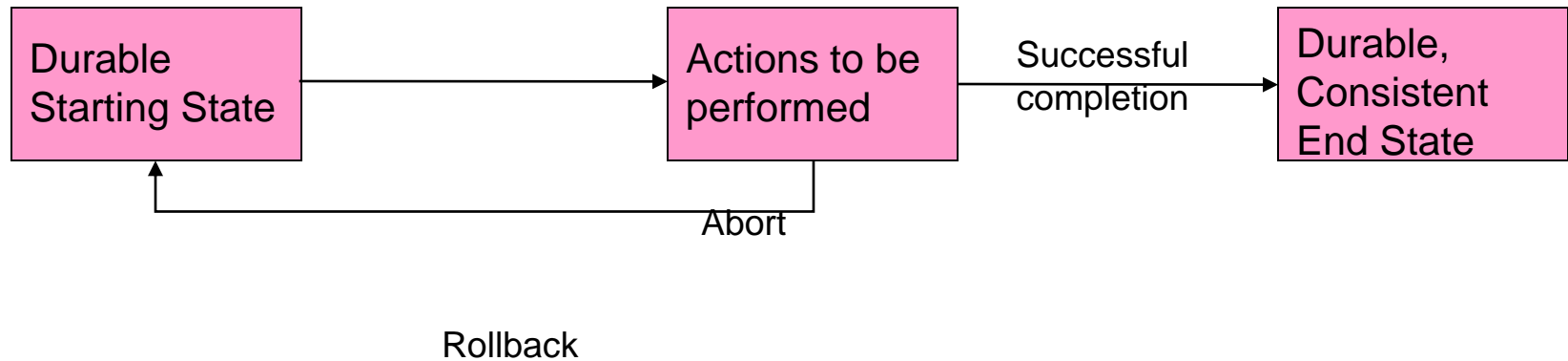
## ■ Isolation

- 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

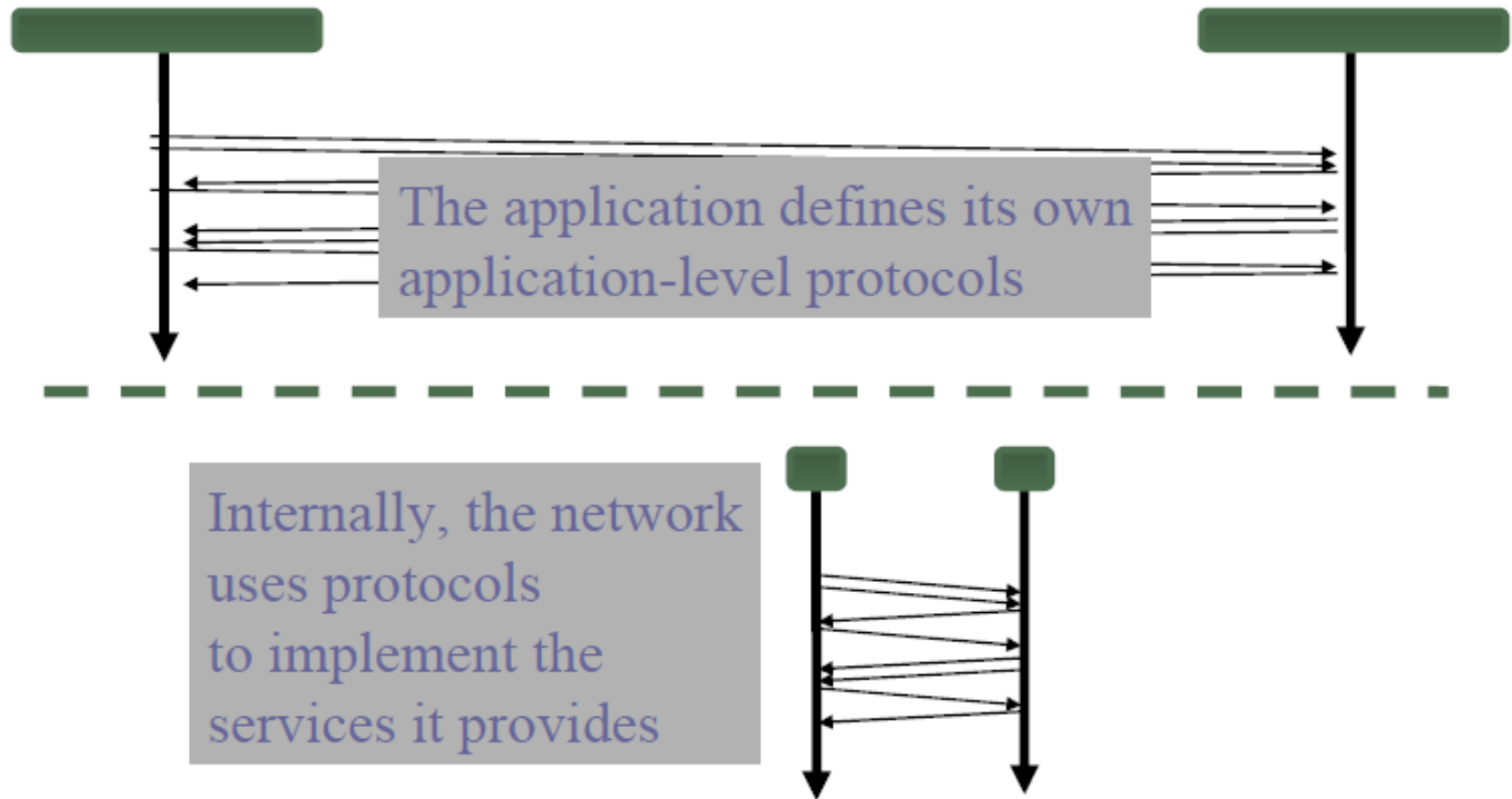


# OLTP

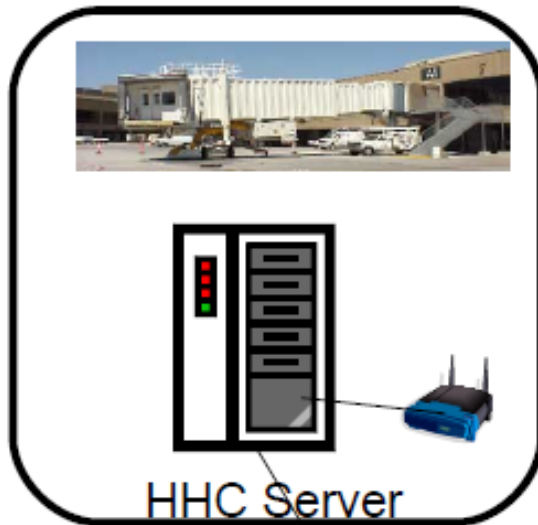
- Simplifies application development
- Enables protection and integrity of mission-critical data in a transparent way
  - for the end user
  - for the application developer



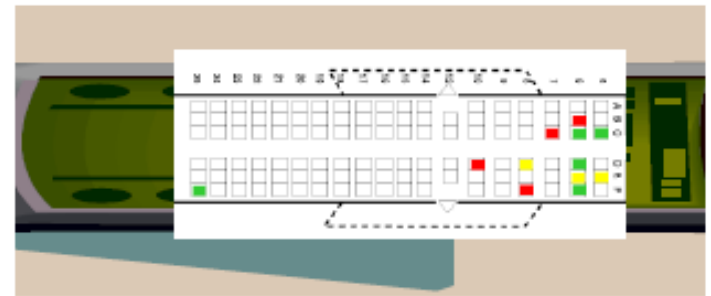
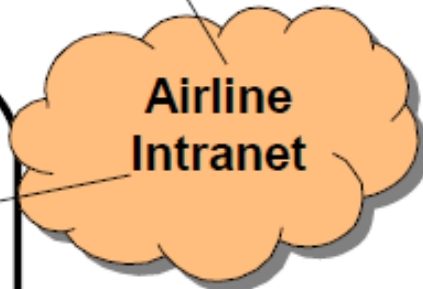
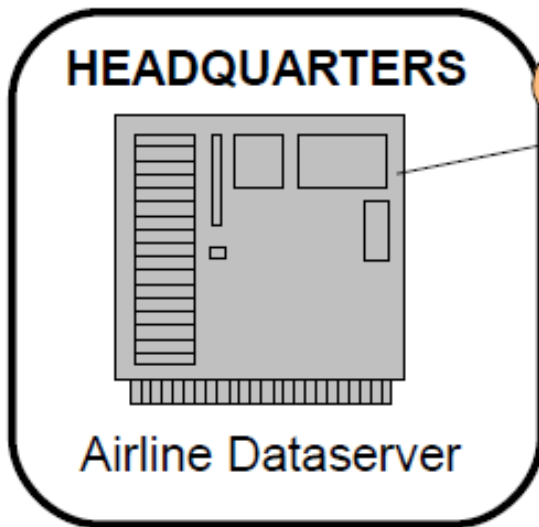
# Application and infrastructure



# Example:

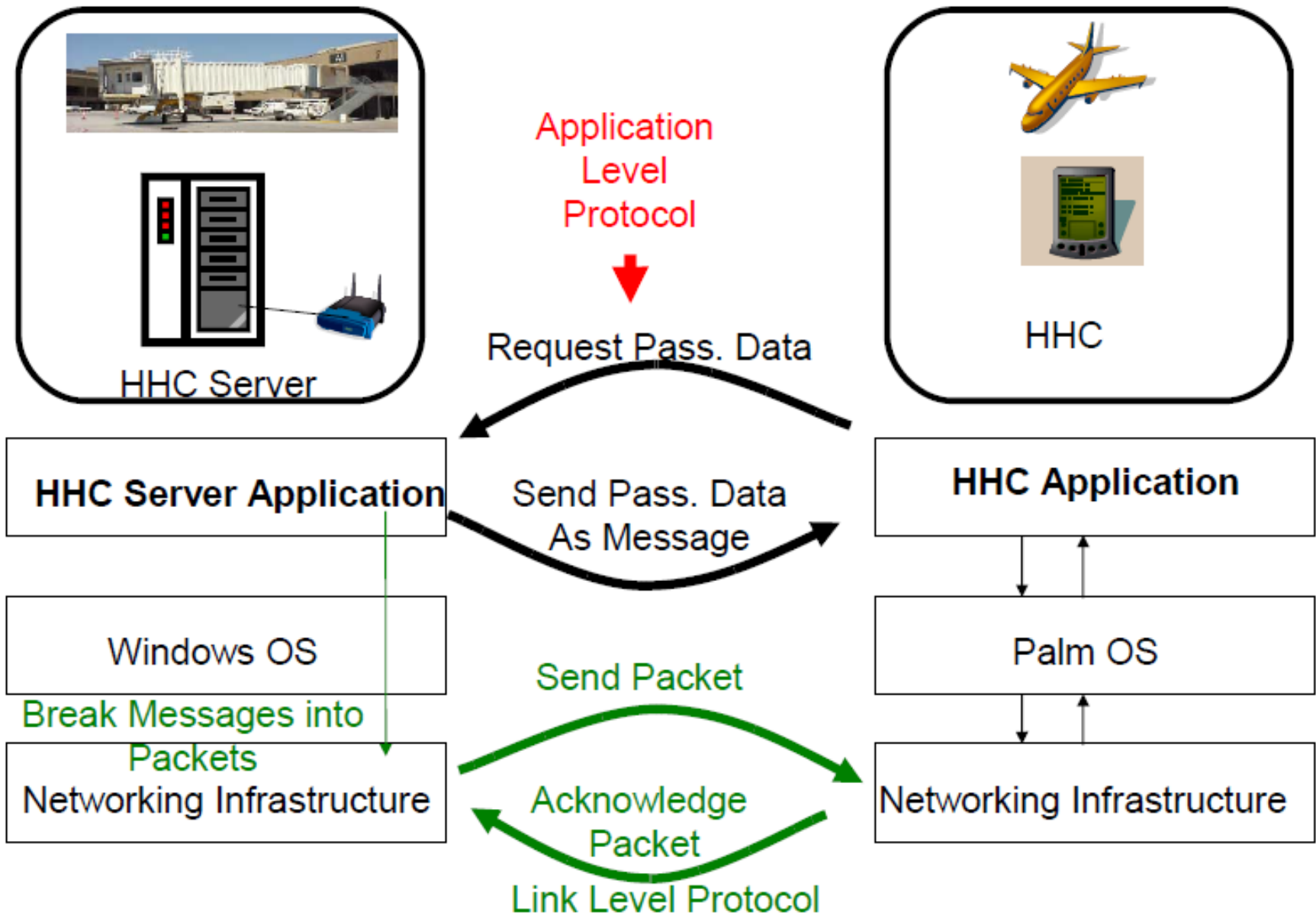


Wireless Link

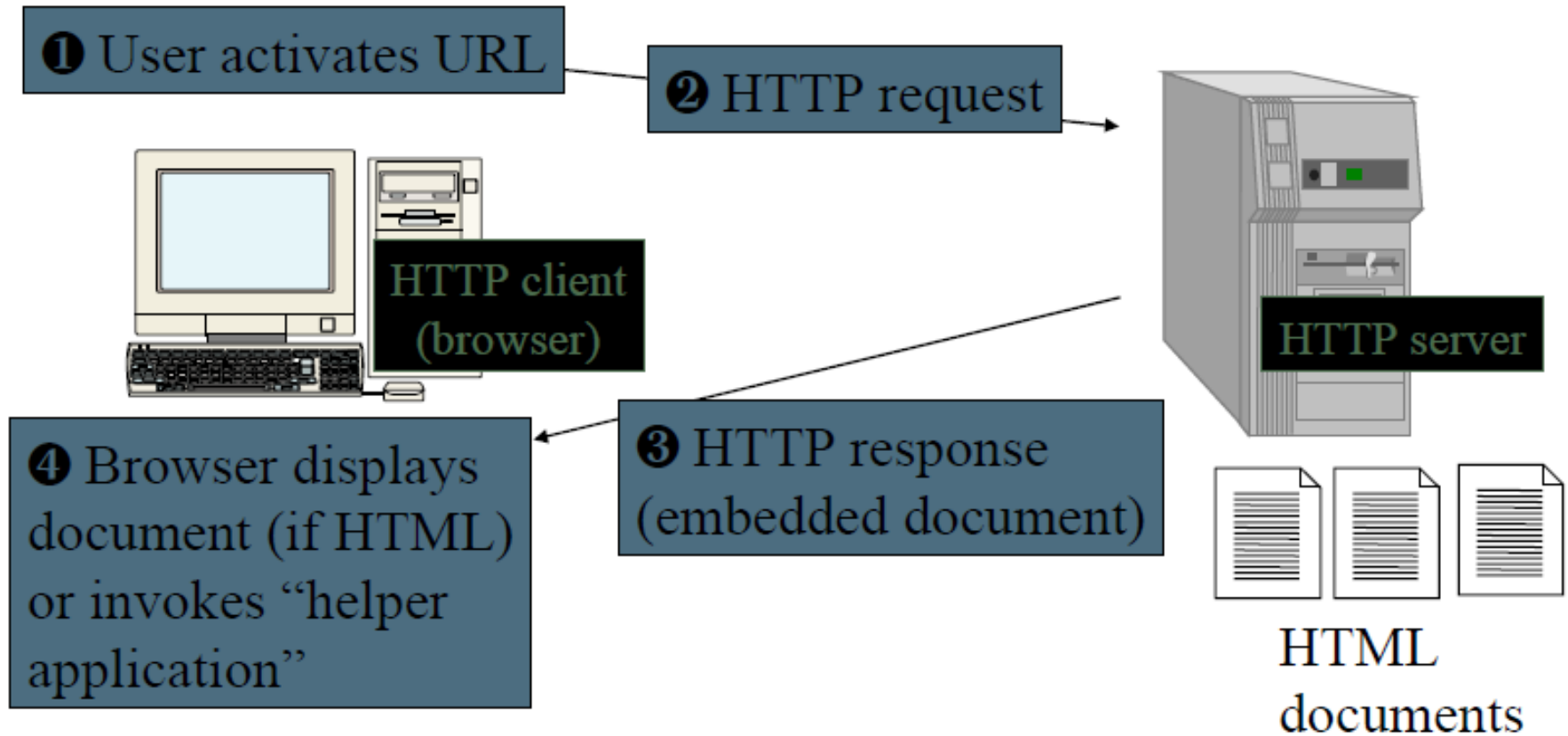




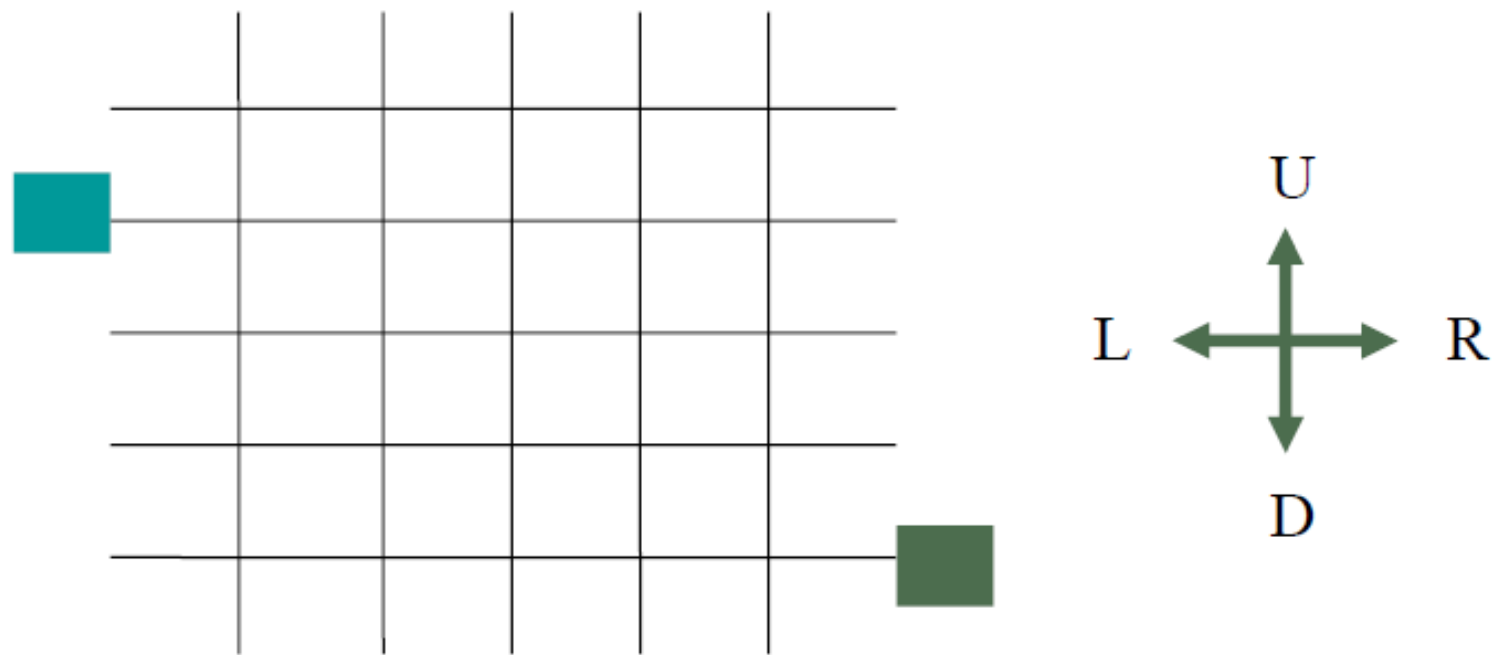
# Layered Protocols Example



# Example: HTTP (Hyper Text Transfer Protocol)



# Example

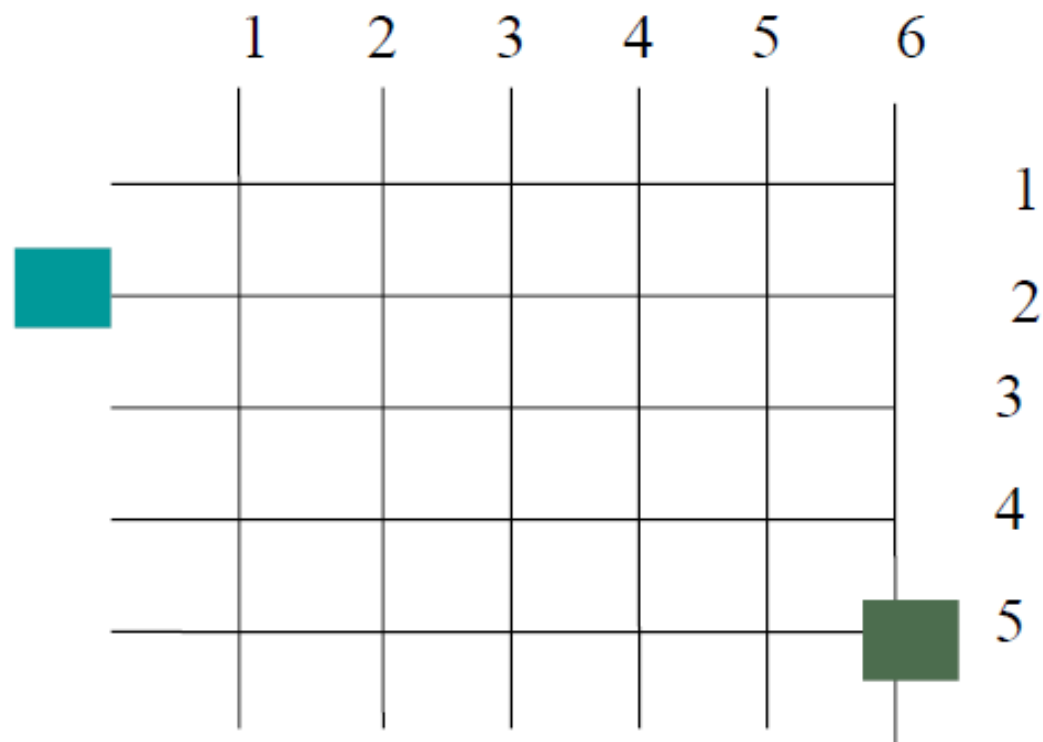


Path from  to  is (R,D,D,D,R,R,R,R)

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)*



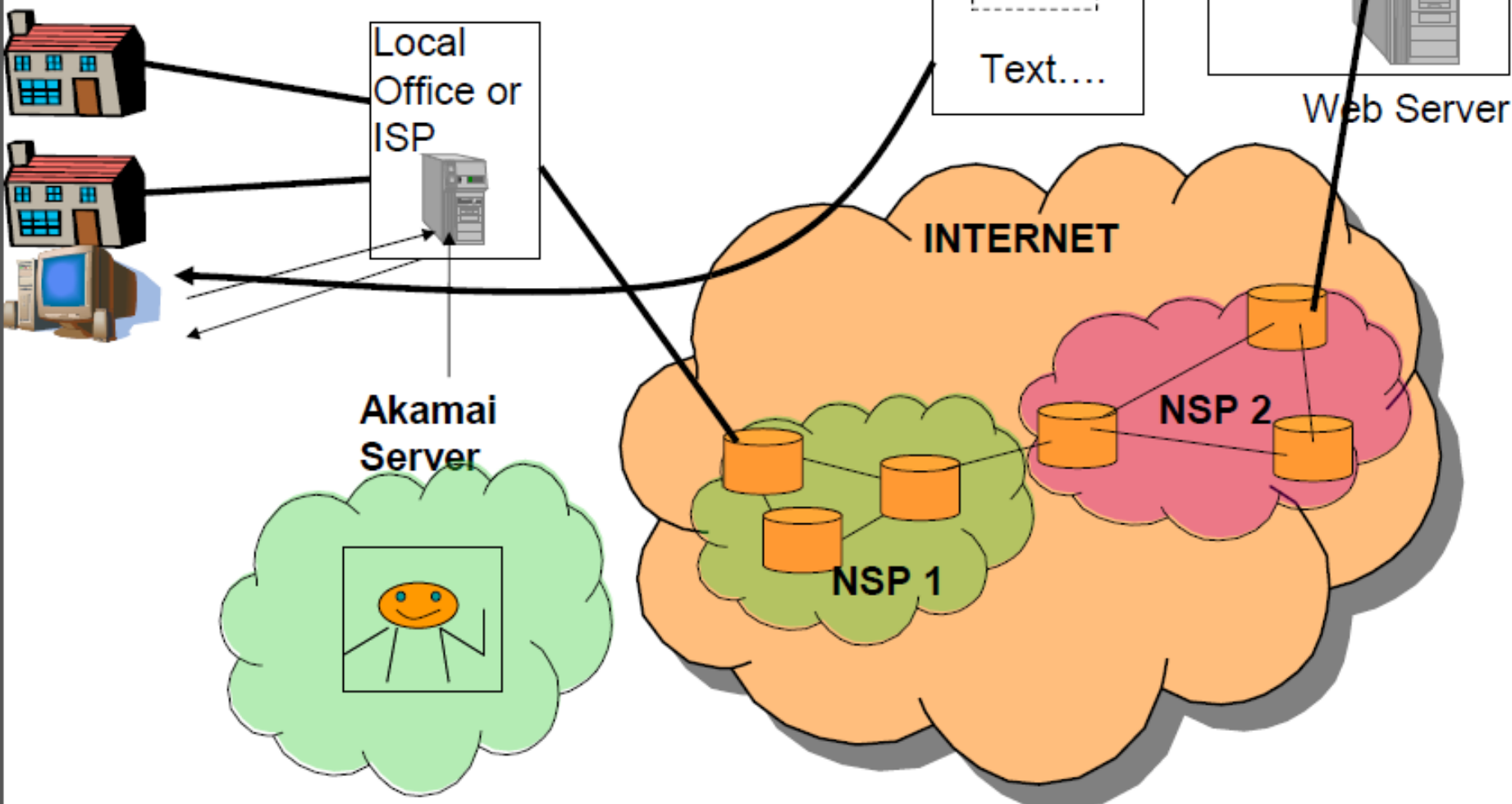
**Compiler**



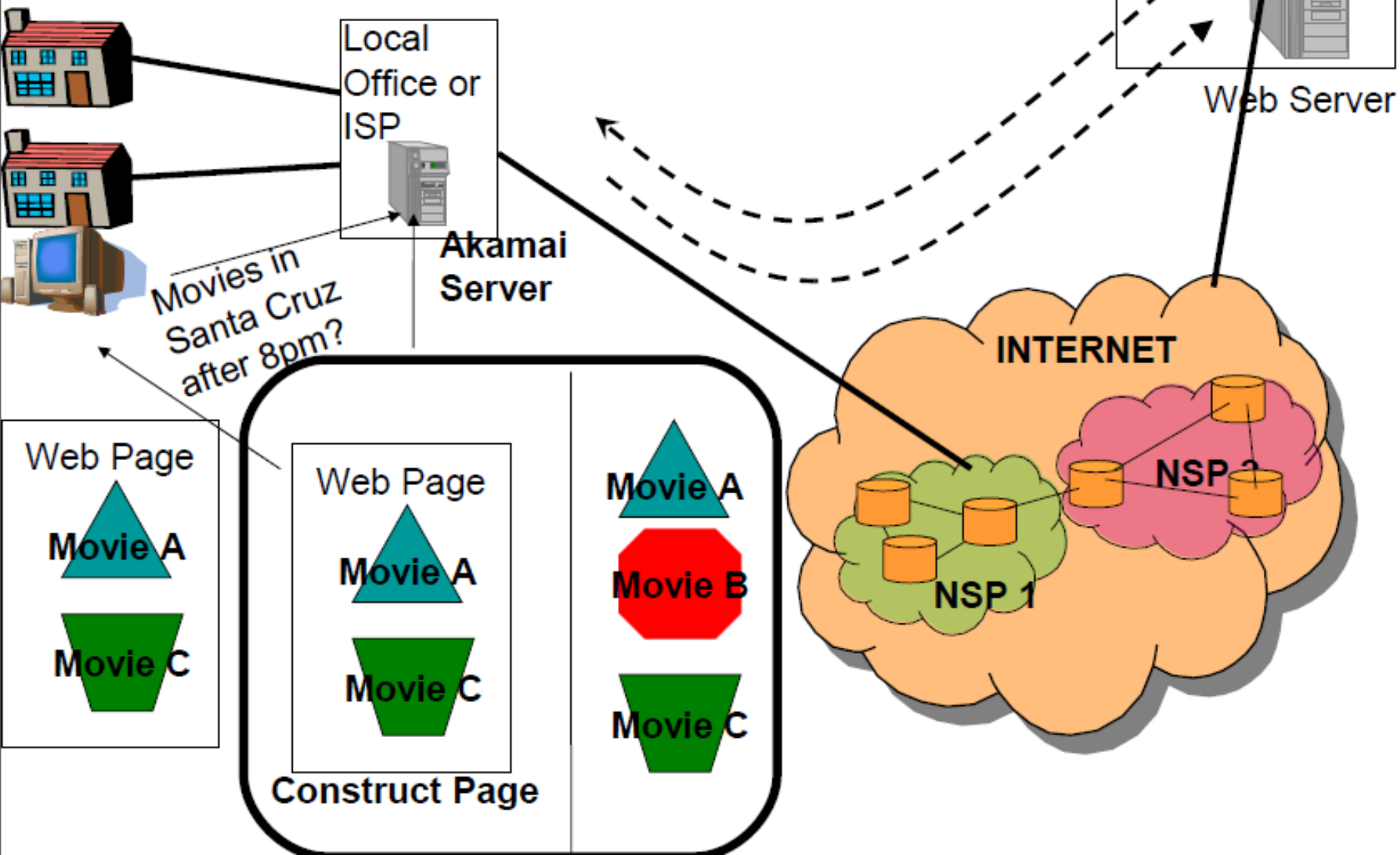
**Input** → Executable program → **Output**  
*(machine language)*



# Akamai Freeflow



# Akamai EdgeSuite



## Quiz 4 *(total 10 pts)*

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