Welcome to INF1343!

Database Modeling and Database Design

Yuri Takhteyev
University of Toronto
January 3, 2011

What is a “Database”?

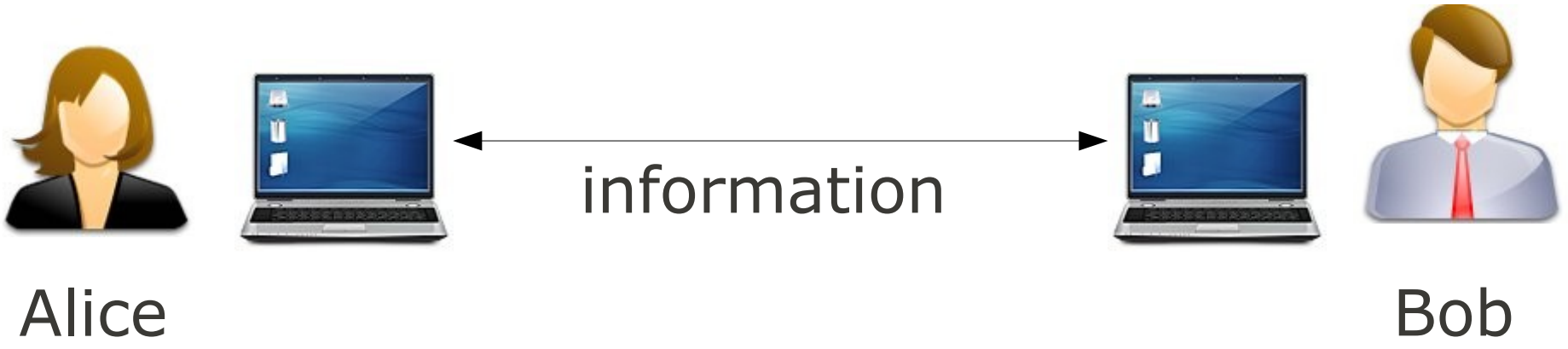
“an organized collection of data”
(digital, managed with software)

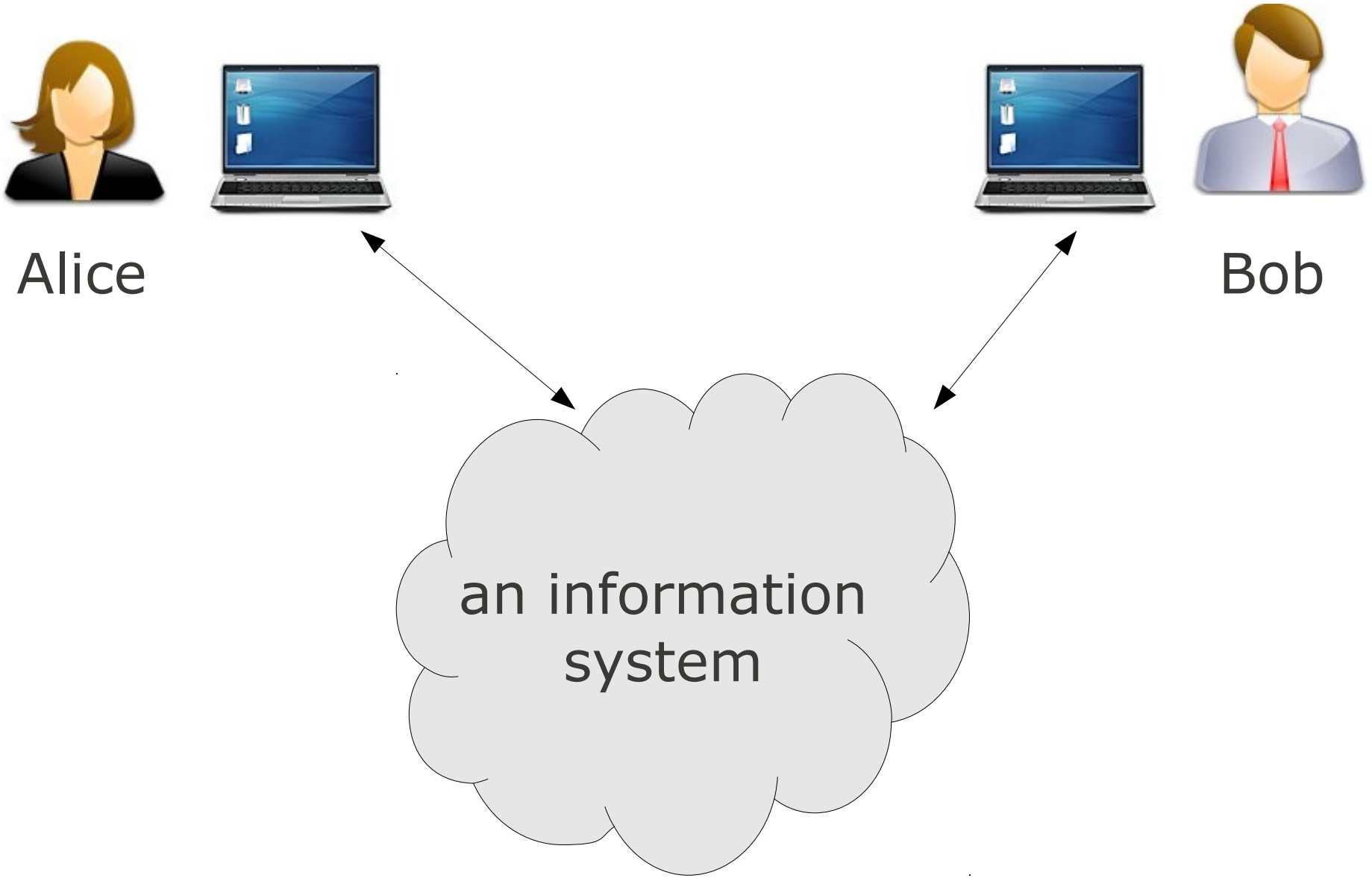
“DBMS”

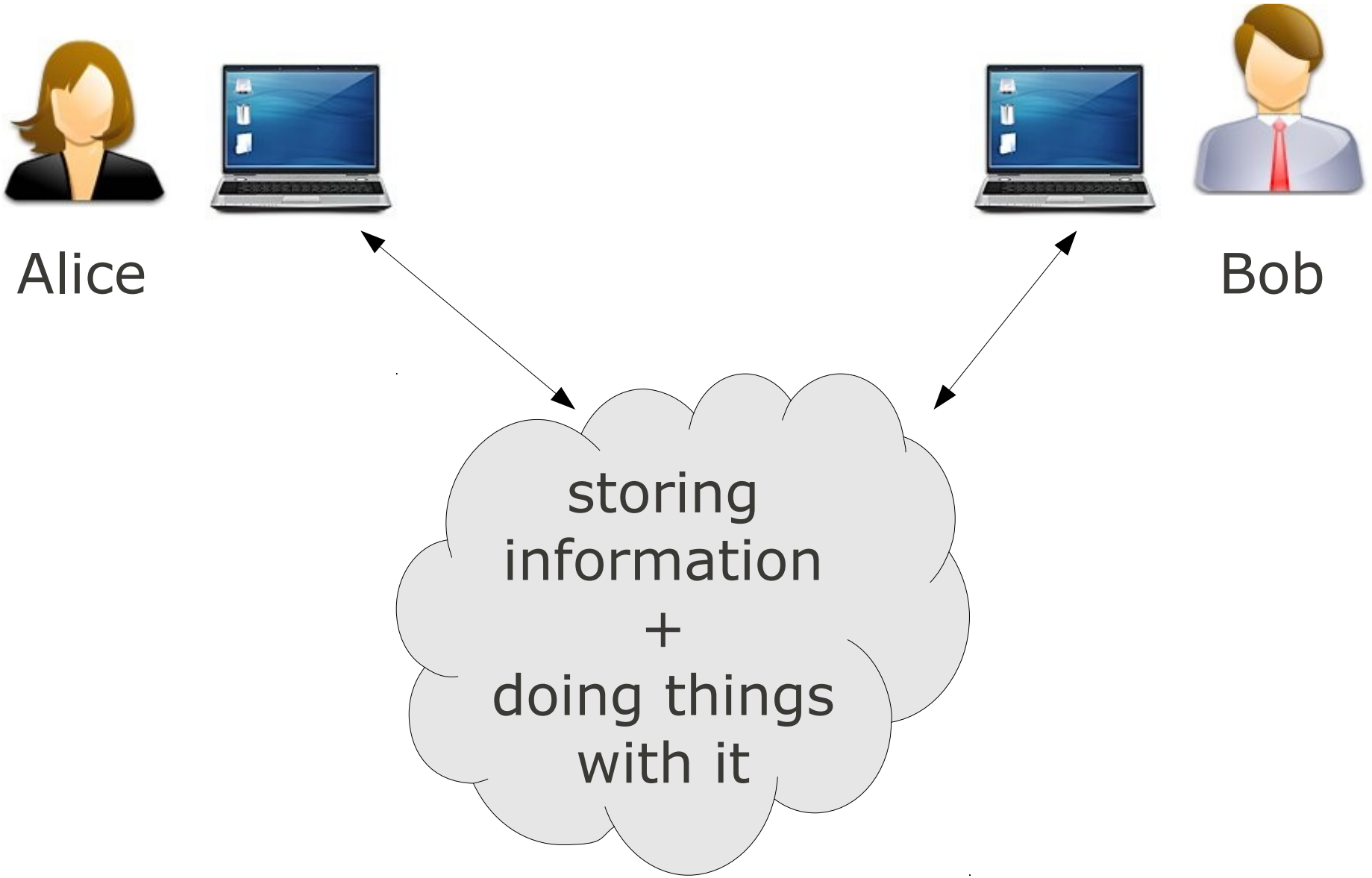
information

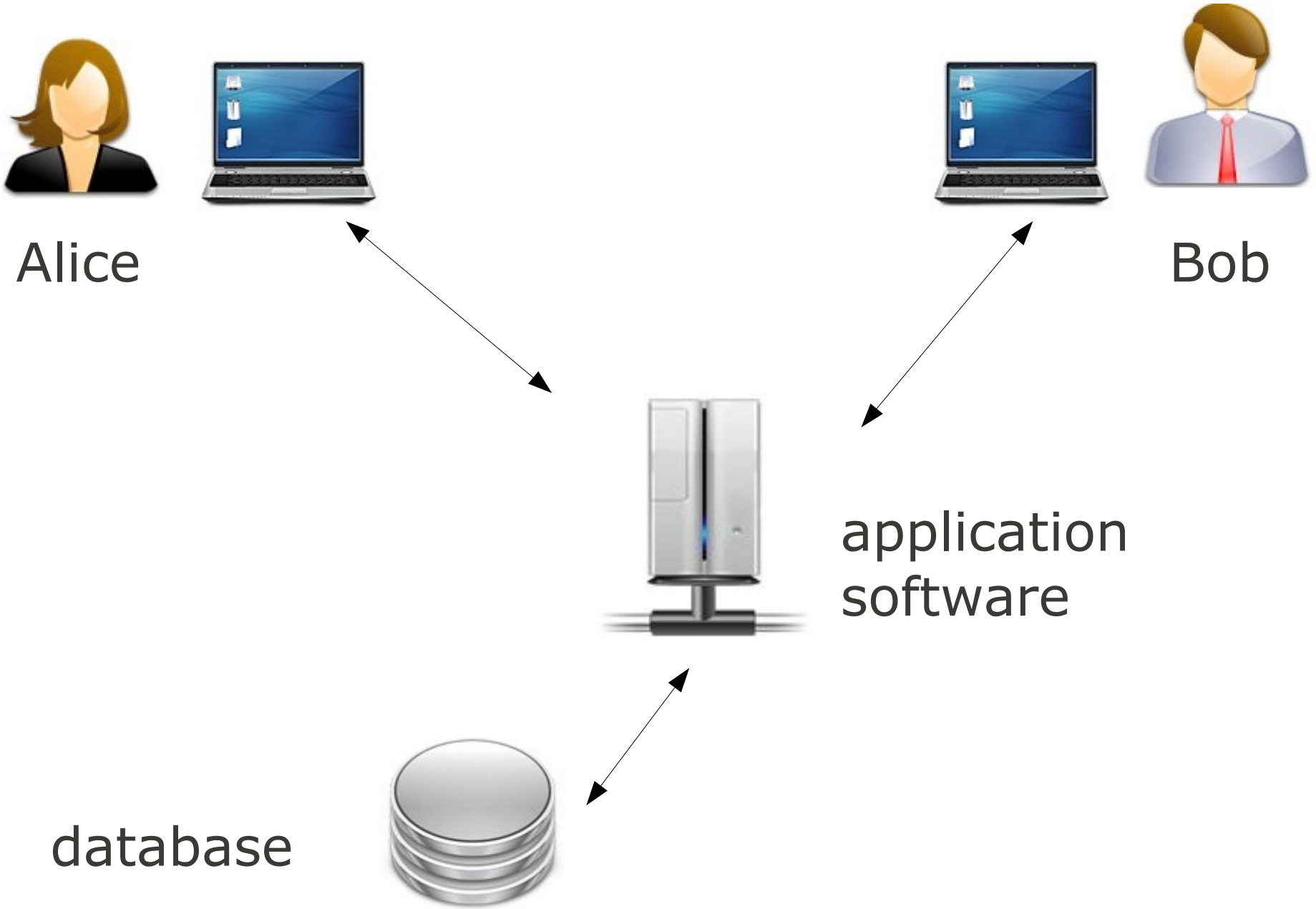
Alice

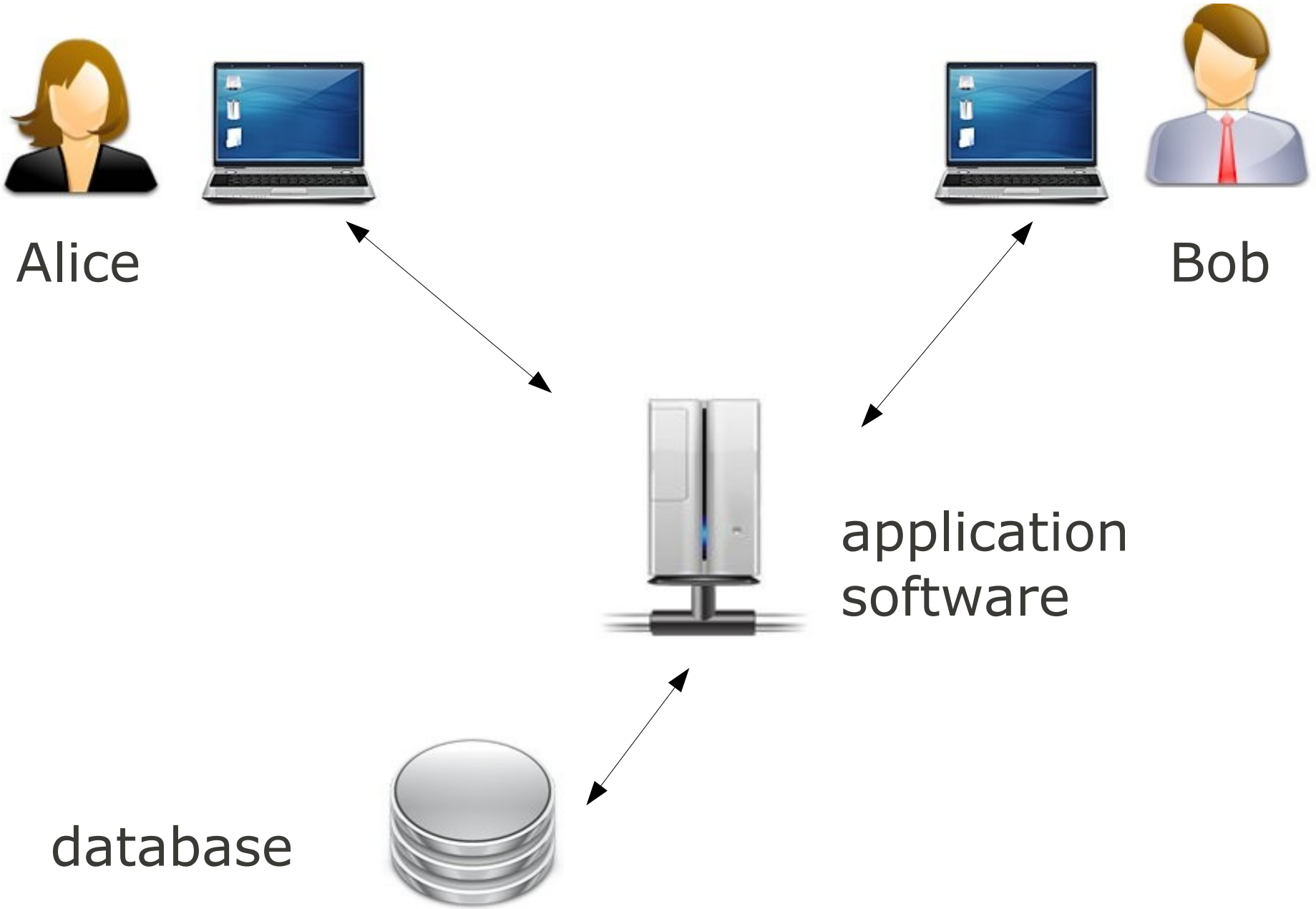
Bob

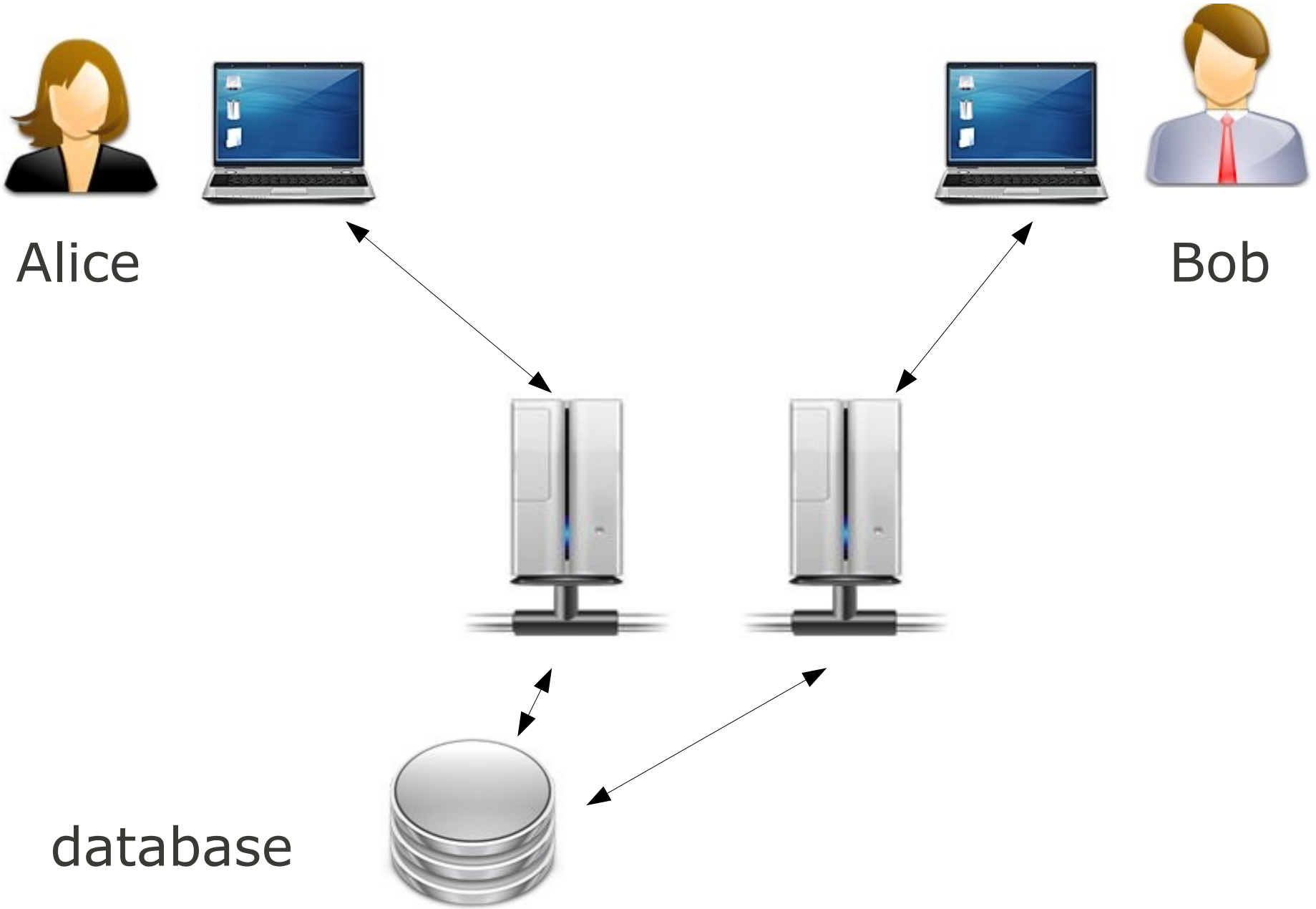

information
Alice
Bob


Alice
Bob
an information system

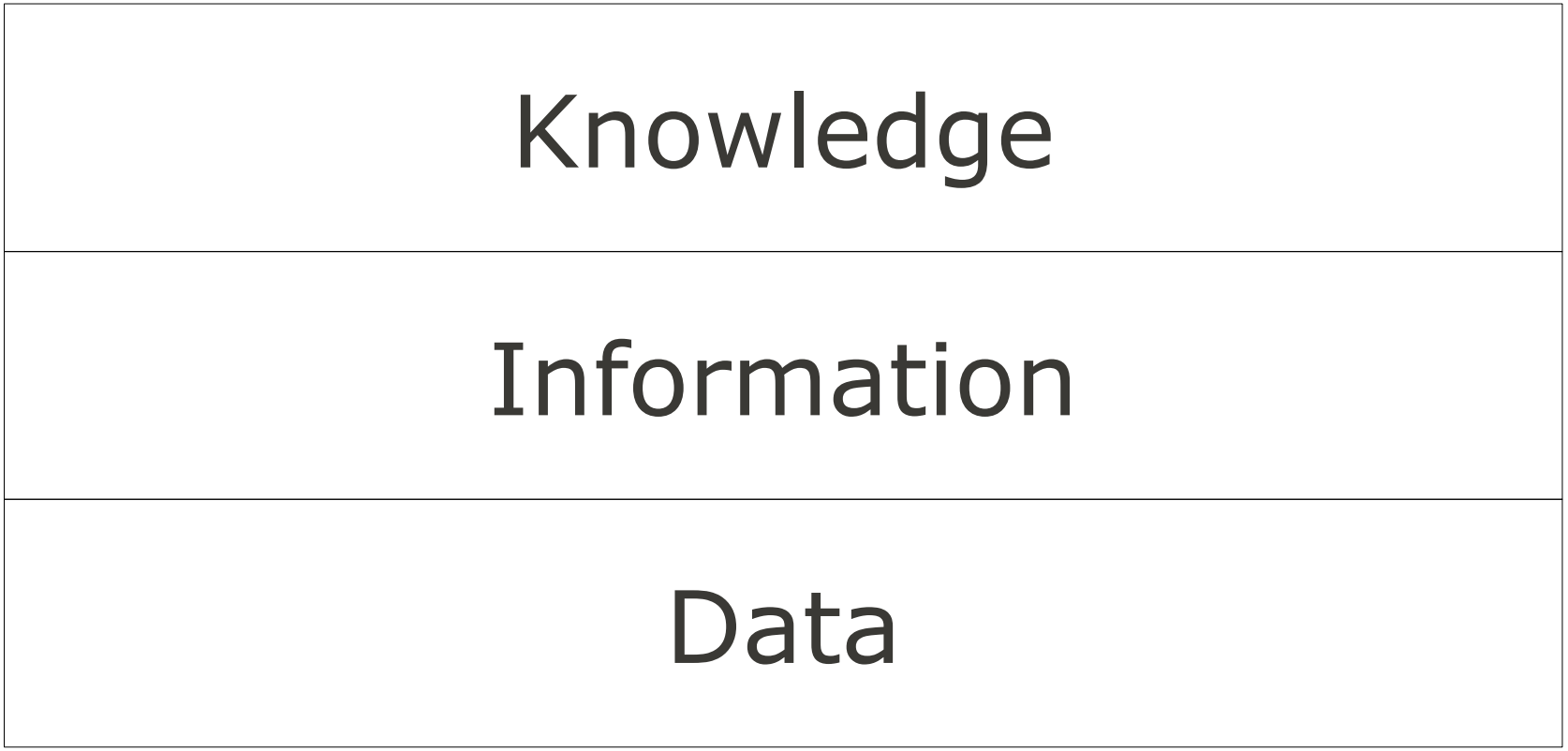

Alice
Bob
storing
information
+
doing things
with it


Alice
Bob
application
software
database

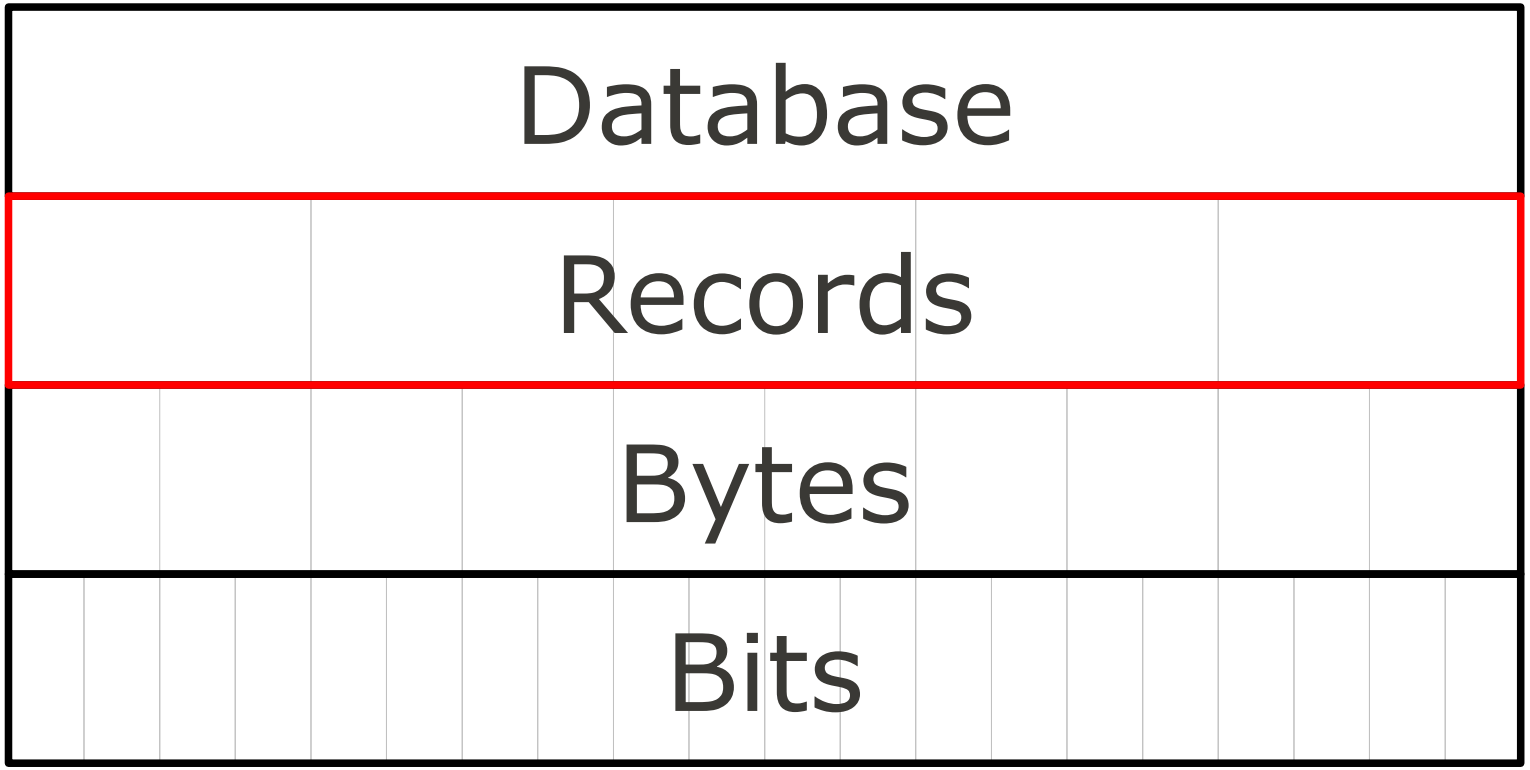

Alice
Bob
application
software
database
“persistent storage”


Alice
Bob
database
“persistent storage”

What is Data?



What is Data?



require a way of *finding* the record

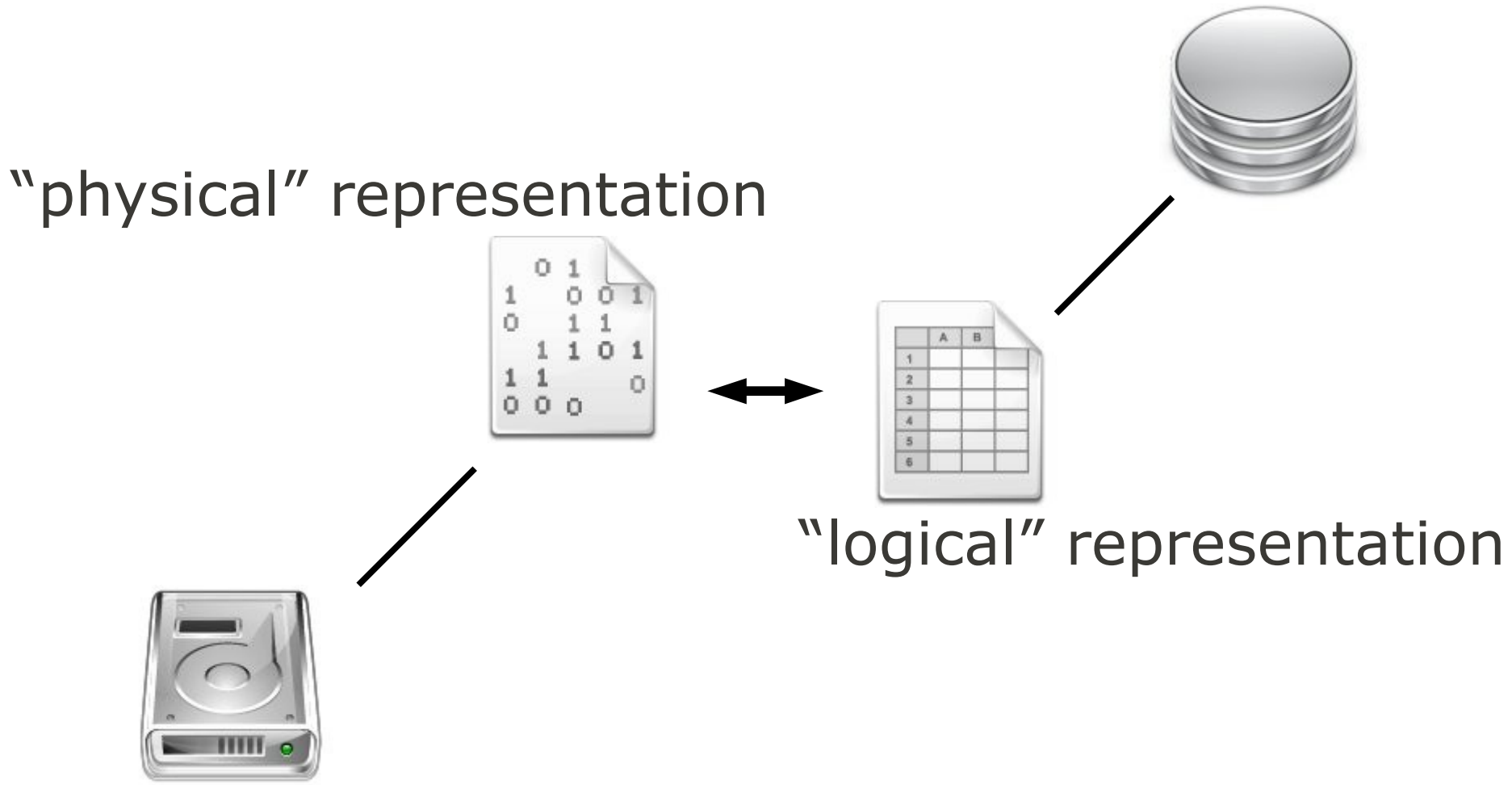
Create

Read

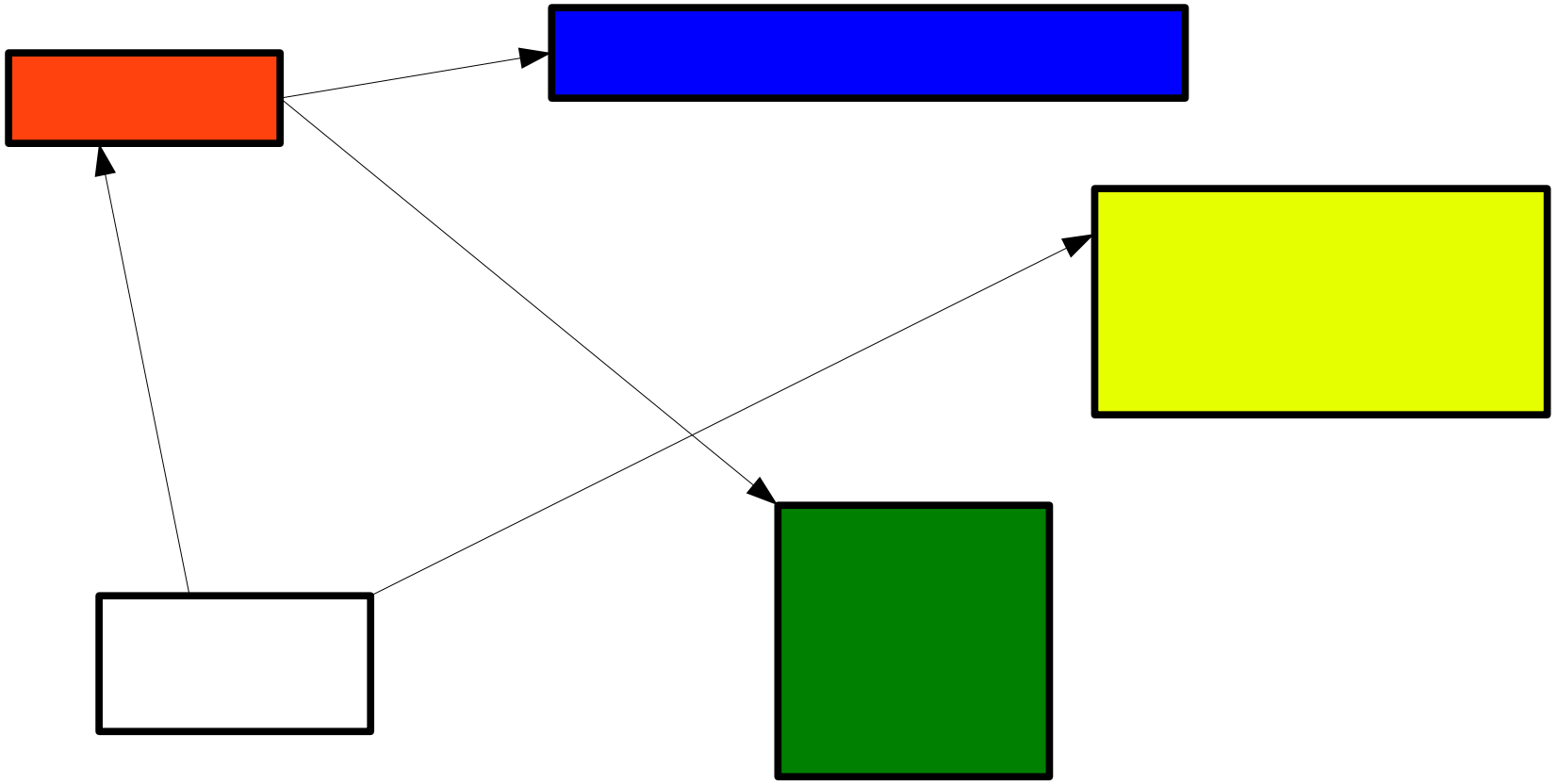
Update

Delete

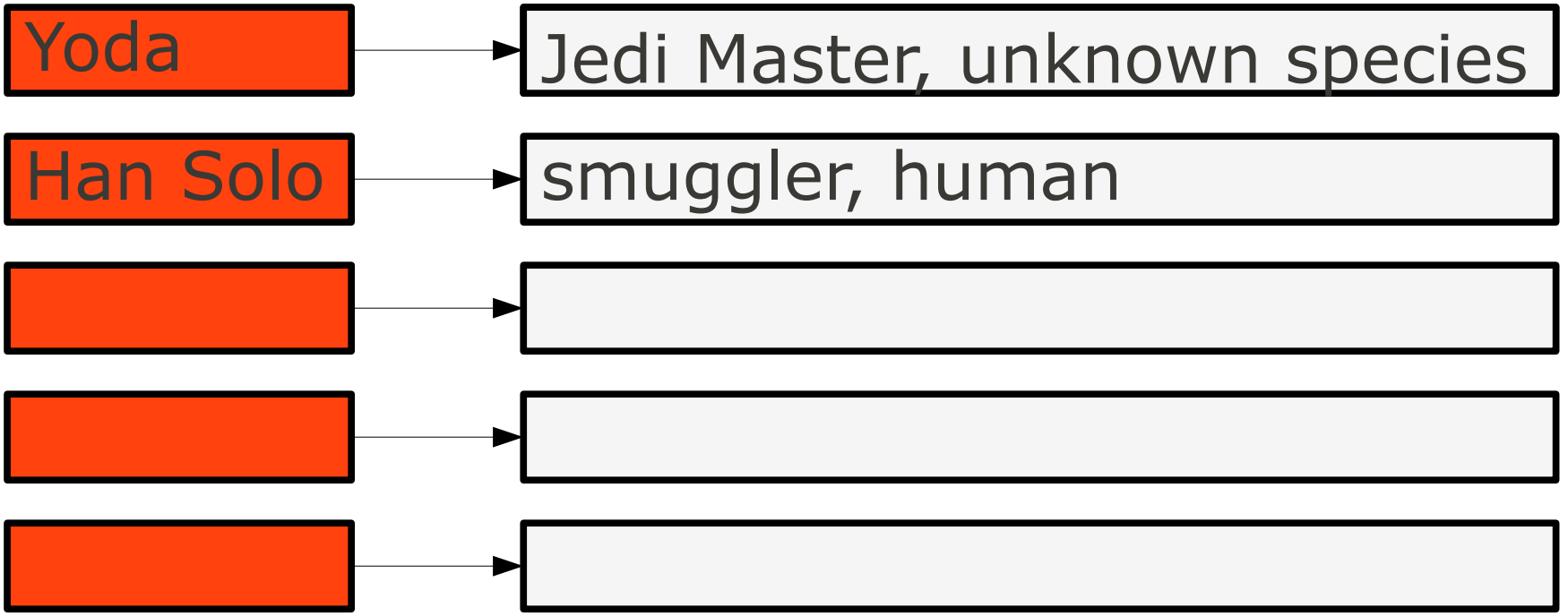
Database Elements



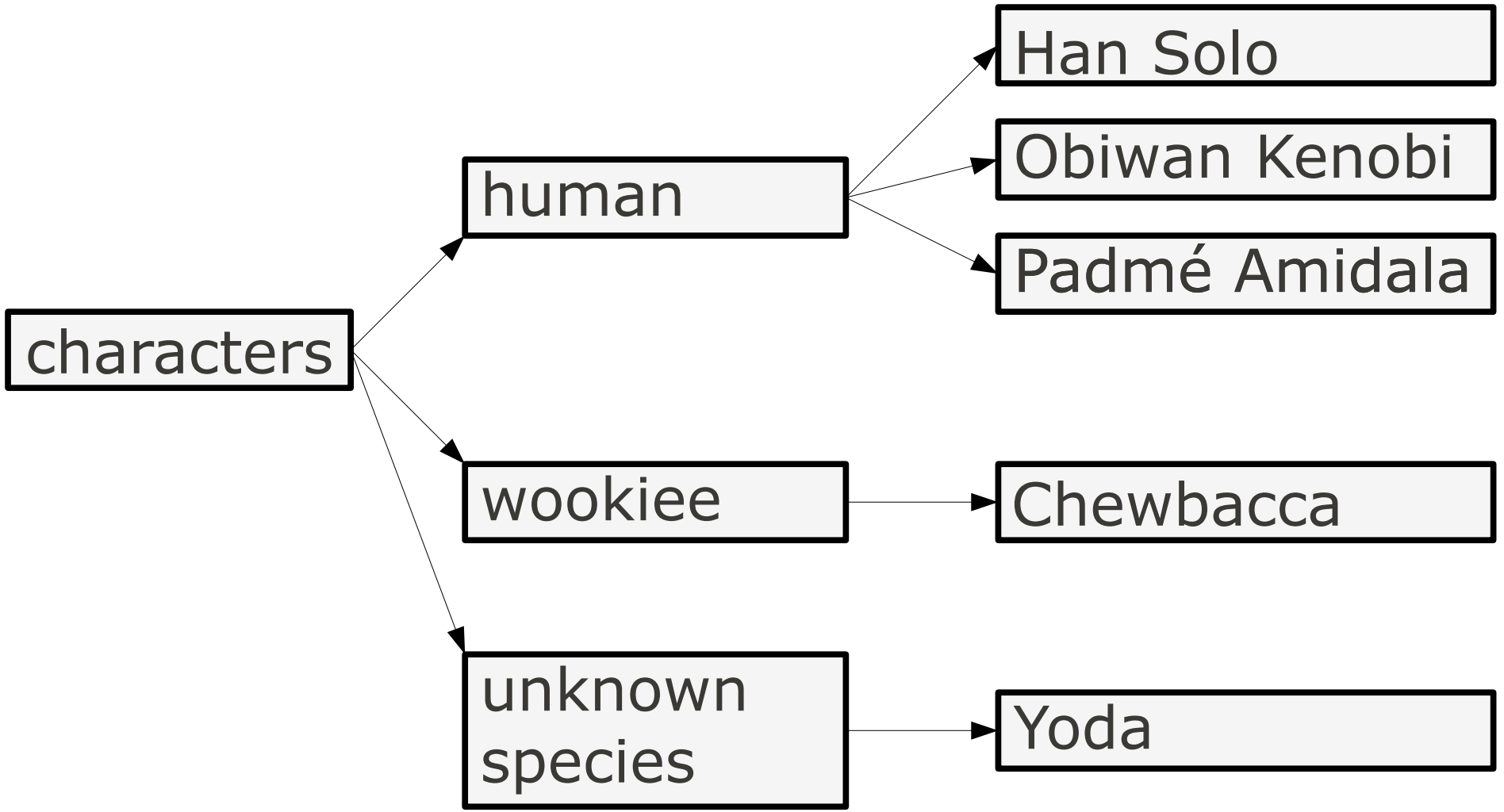
Databases Models



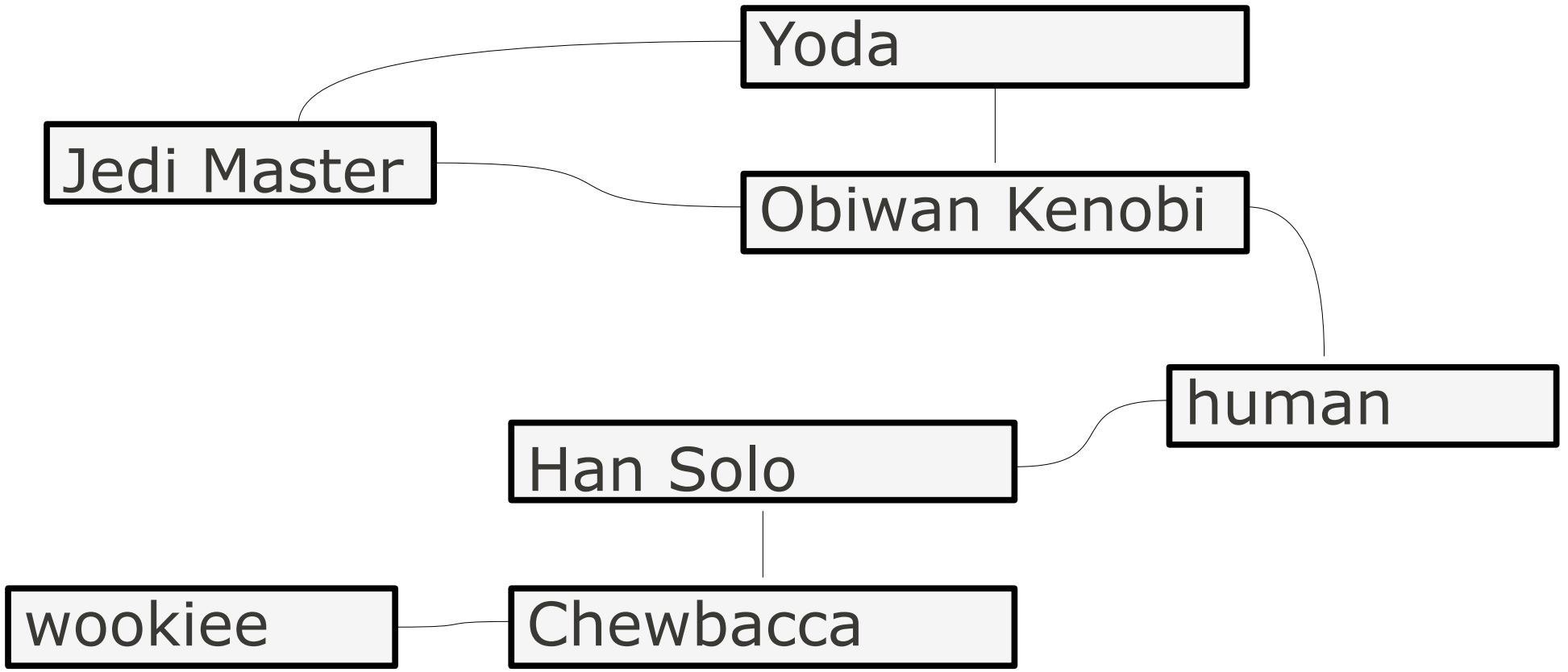
Key-Value



Hierarchical



Network


Yoda
Jedi Master
Obiwan Kenobi
human
Han Solo
wookiee
Chewbacca

Relational

A notion of a “relation”

not to be
confused with
a “relationship”

A Relation

(Yoda, Jedi Master)

A Relation

(Yoda, Jedi Master, unknown species)

A Relation

(Yoda, Jedi Master, unknown species)

(San Solo, smuggler, Human)

(Padmé Amidala, queen, Human)

(Jabba, crime lord, Hutt)

(Jar Jar Binks, senator, Gungan)

Another Relation

(Human, humanoid, 1.7 m)

(Gungan, humanoid, 1.89 m)

(Hutt, gastropod, 3.5 m)

(Ewok, furry biped, 0.9 m)

And Another

(humanoid, 2 legs)

(gastropod, 0 legs)

Tabular Form

species

Human	humanoid	1.7
Hutt	gastropod	3.5

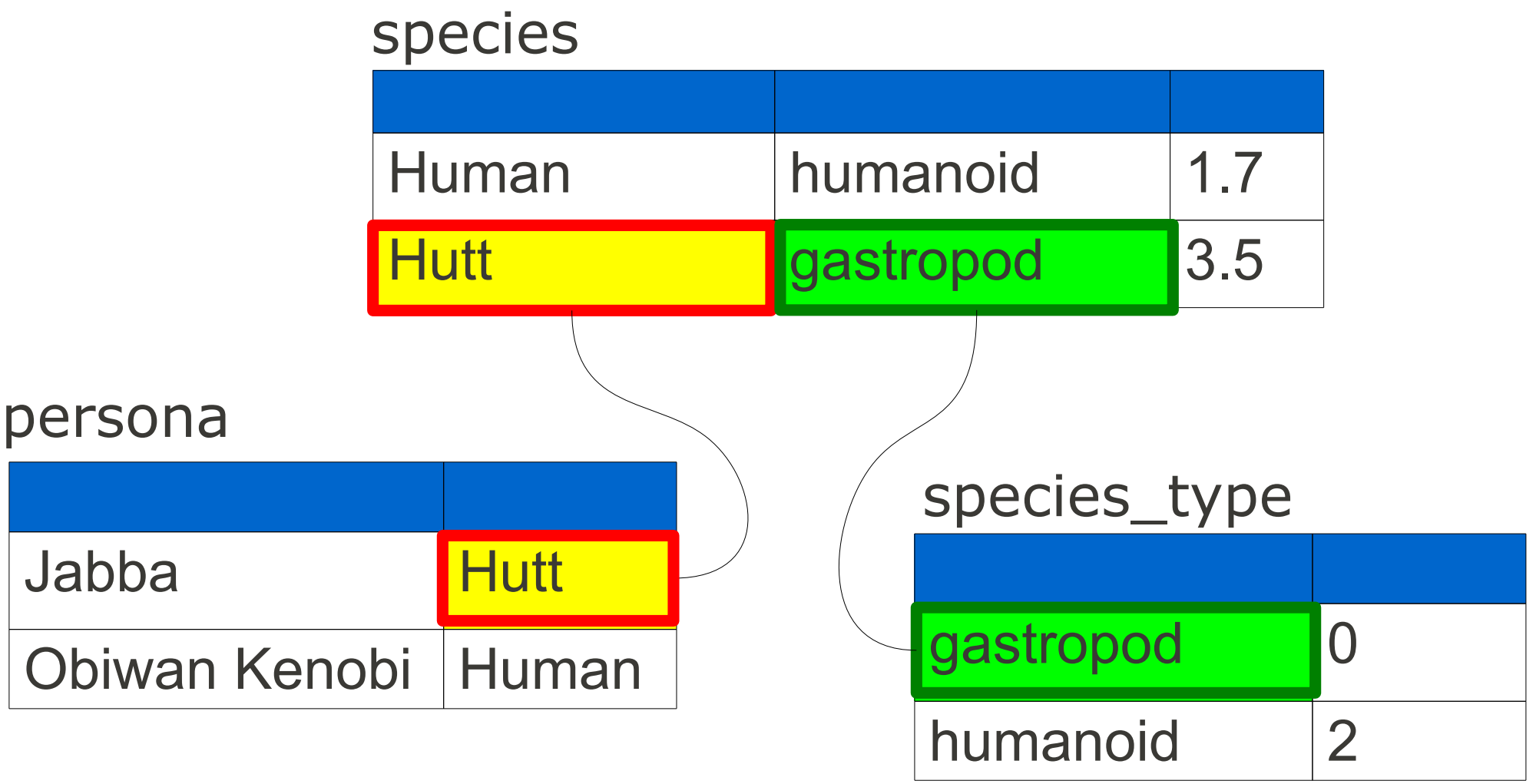
persona

Jabba	Hutt
Obiwan Kenobi	Human

species_type

gastropod	0
humanoid	2

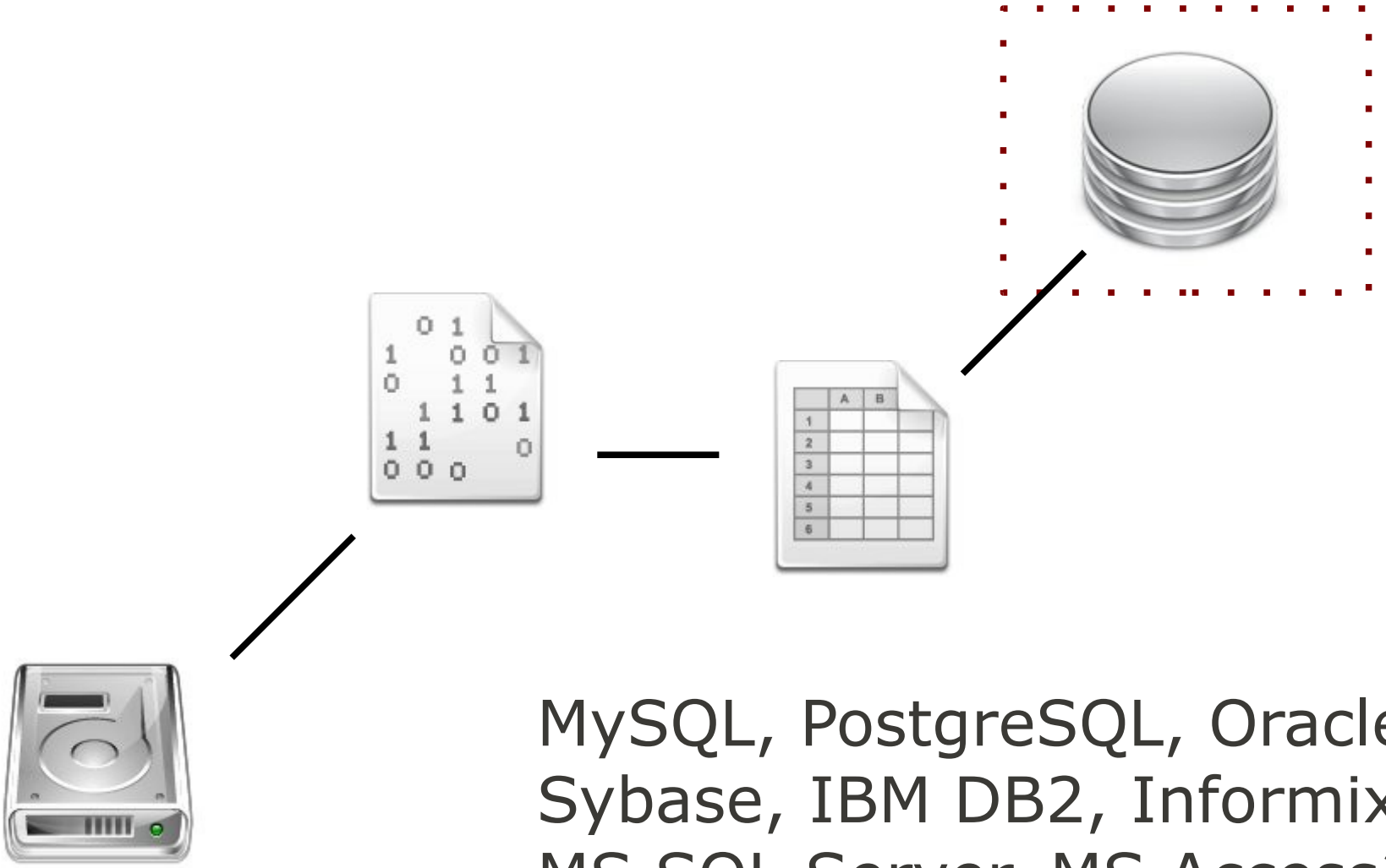
Tabular Form



Relational Data Modeling

Finding a proper relational representation for data

RDBMS

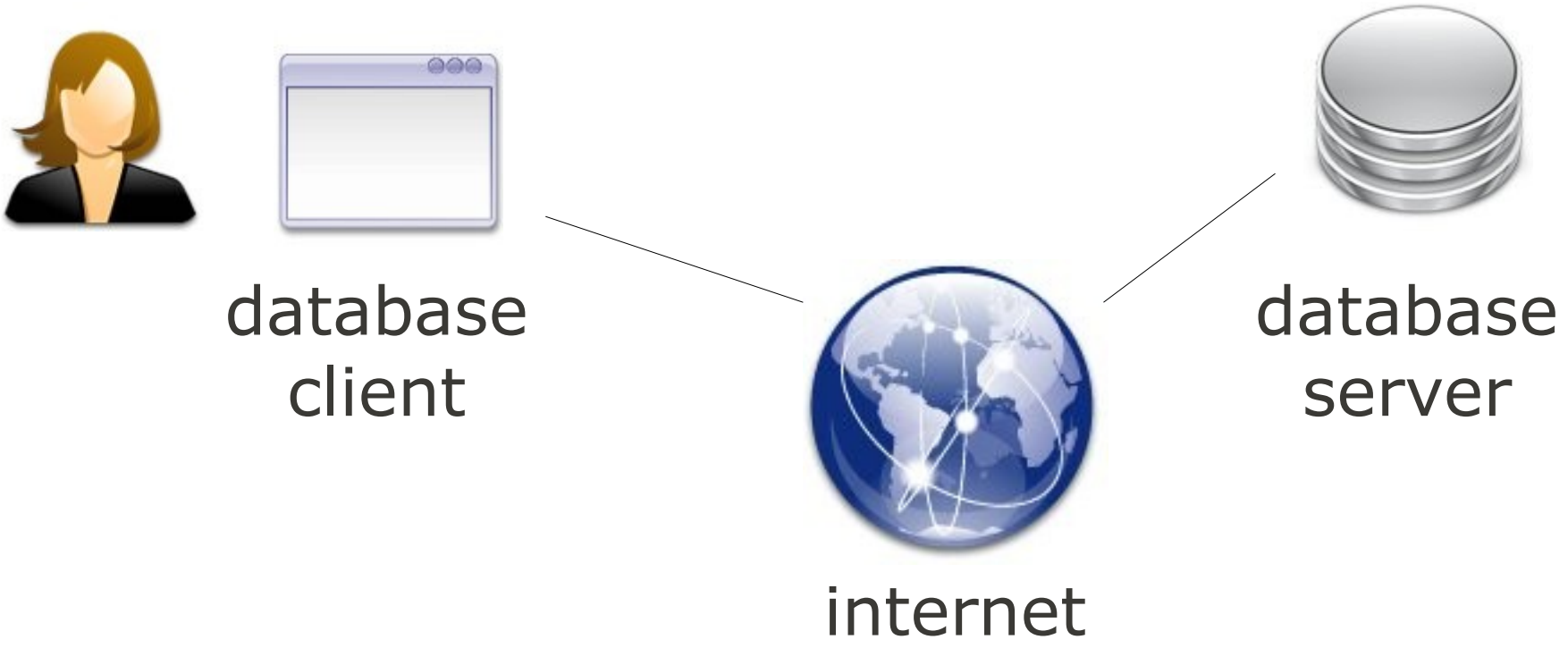


MySQL, PostgreSQL, Oracle,
Sybase, IBM DB2, Informix,
MS SQL Server, MS Access*

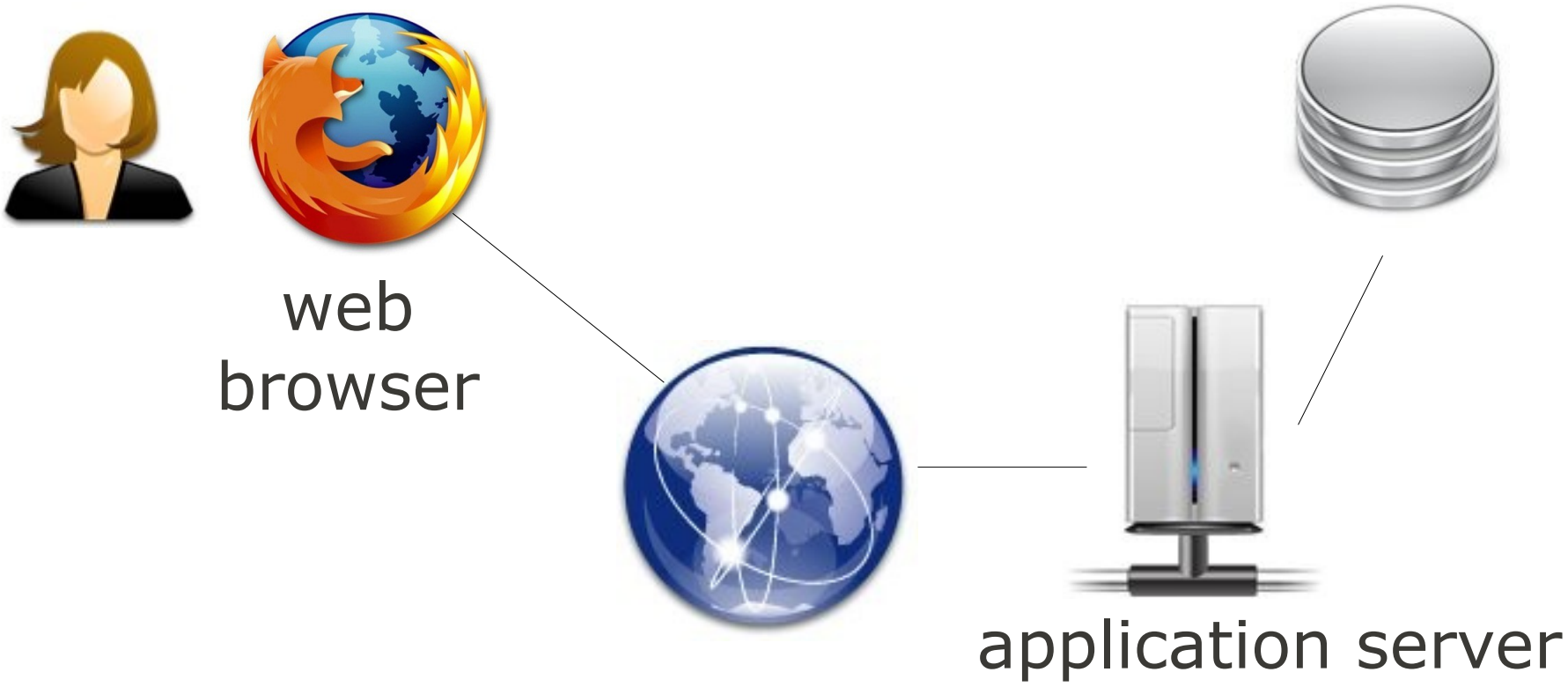
Accessing a Database

Built-in GUI

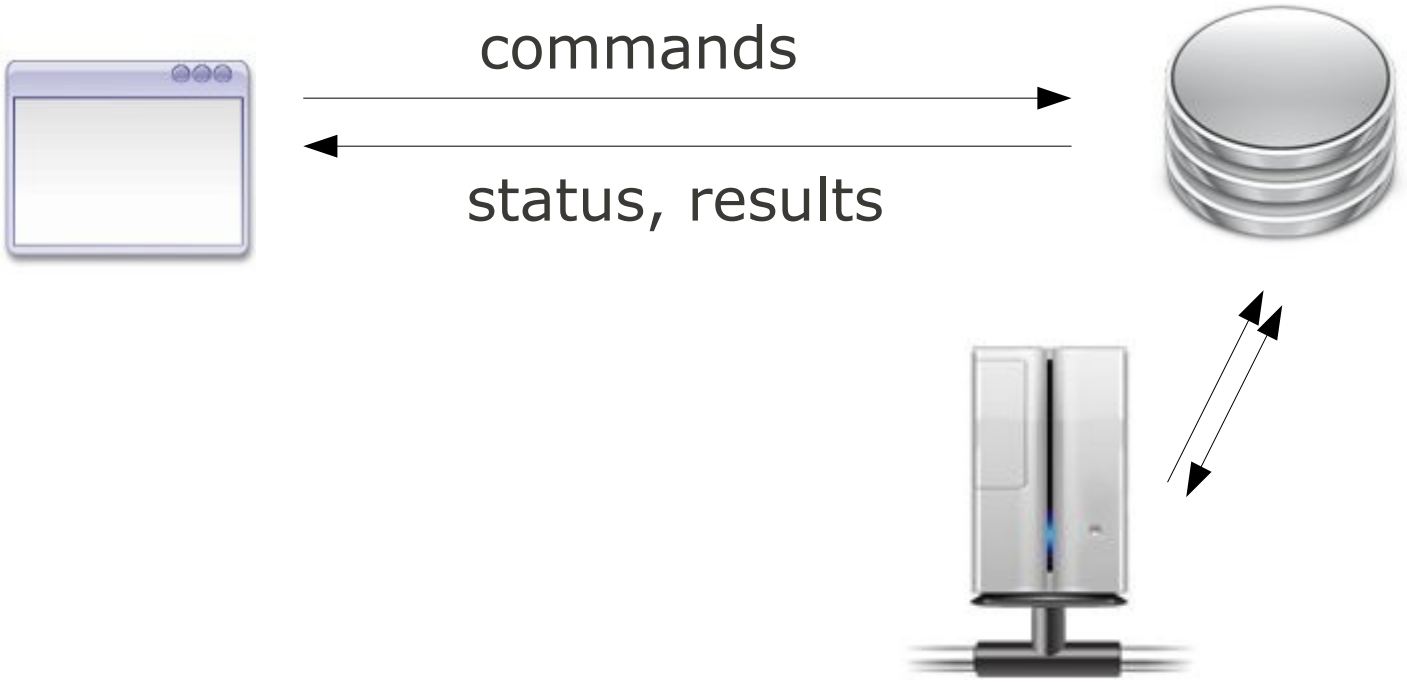
GUI Client for a Remote Database



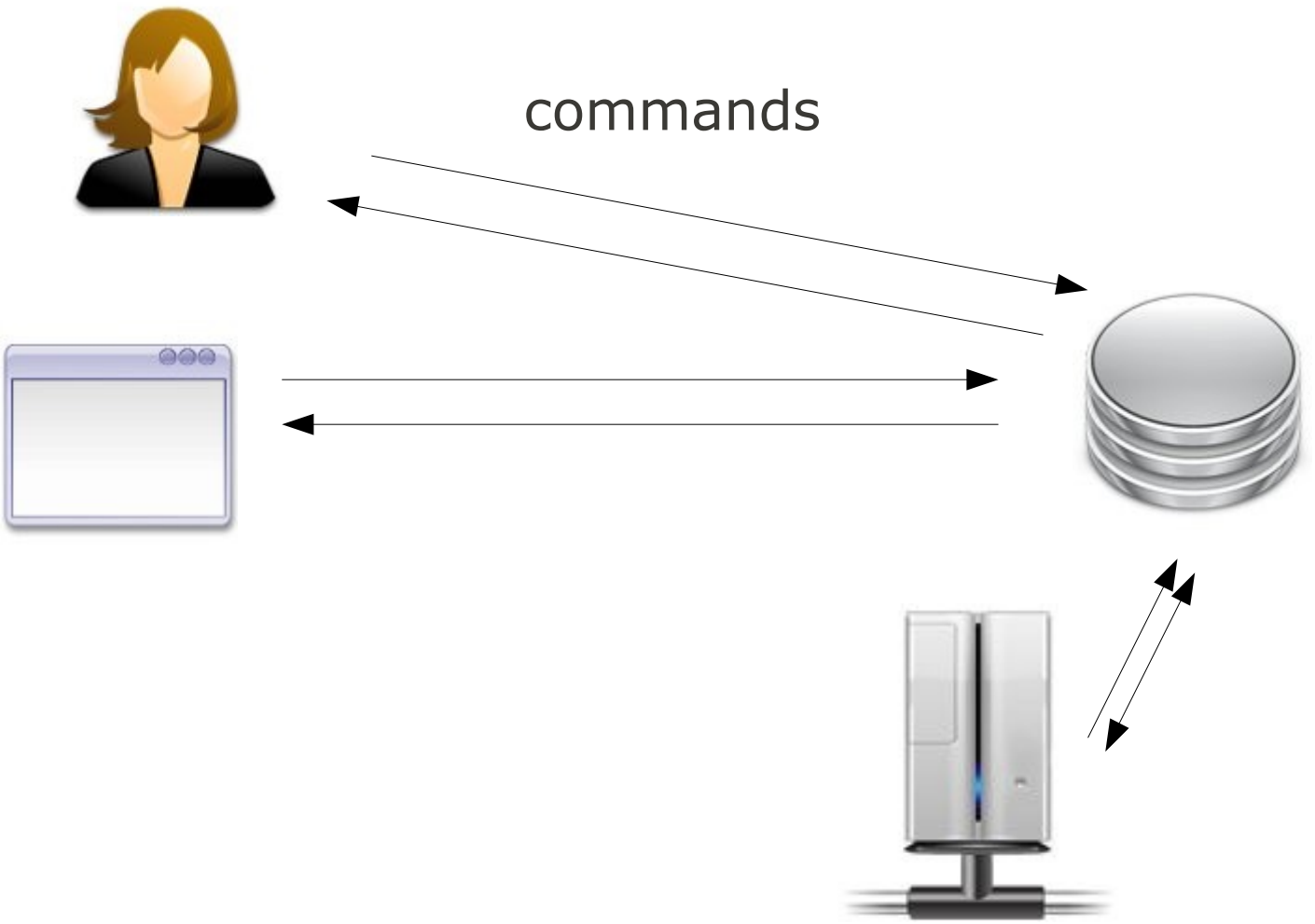
A 3-Tier System



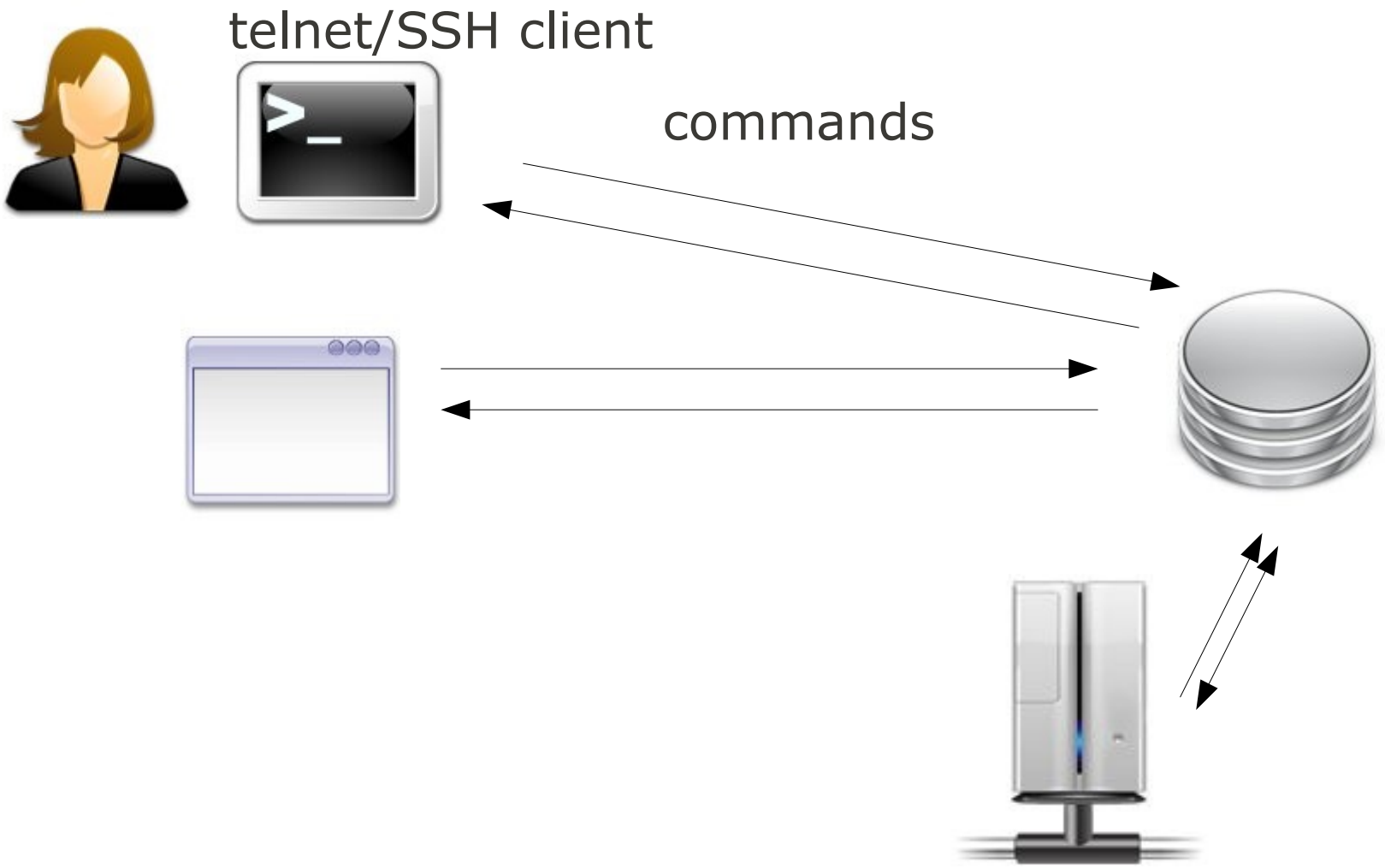
A Query Language



A Query Language



A Query Language



Structured
Query
Language

An SQL Statement

```
select name, occupation
from persona
where species=”Wookiee”;
```

An SQL Statement

```
select name, occupation
from persona
where species=”Wookiee”;
```

- SQL keywords are not case-sensitive (de facto)
- text strings nearly always are
- names or tables and fields usually are

An SQL Statement

so:

select = SELECT* = seLecT**

from = FROM* = From**

* some people prefer this

** ugly, don't do this

but:

persona != PERSONA != Persona

”Wookiee” != ”wookiee”

Types of Statements

Data Manipulation

select, insert, update, delete

Data Definition

create, alter, drop

Data Control

grant, revoke

Transaction Control

commit, rollback

This Course

http://bit.ly/inf1343

a shortcut for
http://takhteyev.org/courses/11W/inf1343/

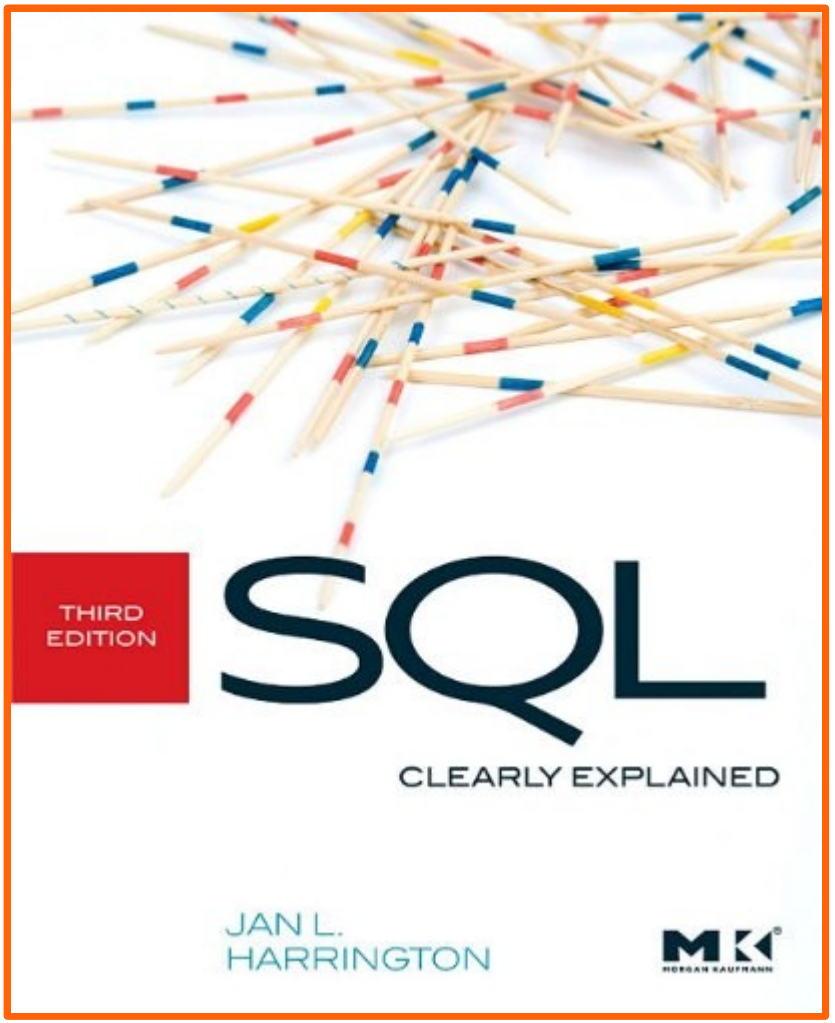
Contact Information

Office hours:

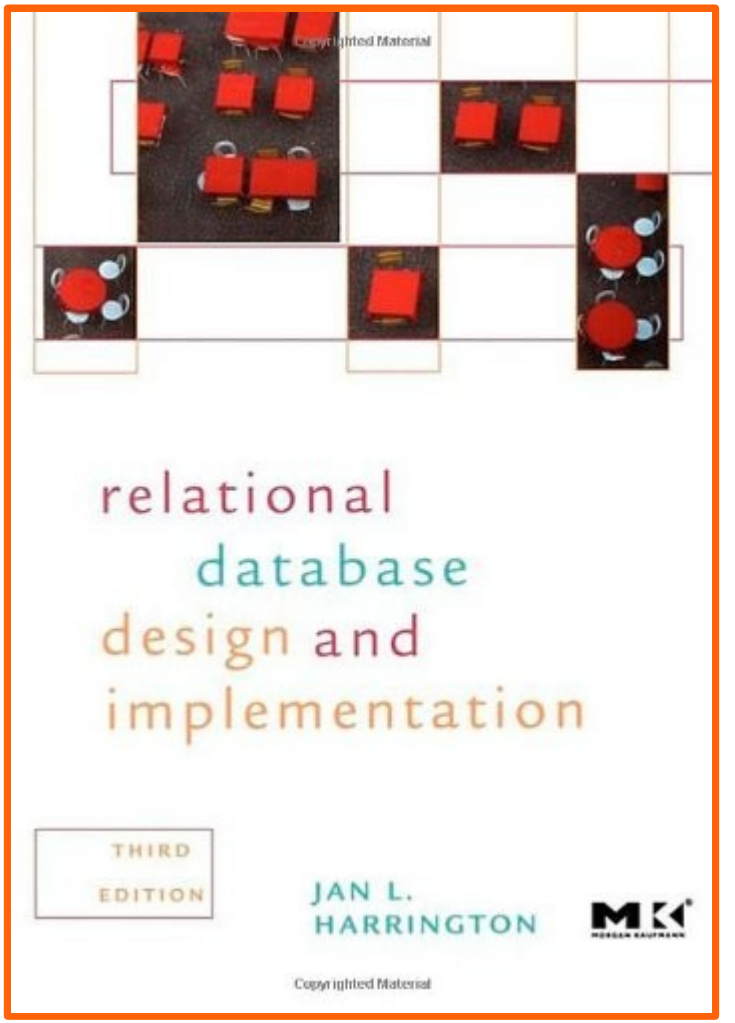
- Mon, 2-3pm, iSouth rm. 328

Email:

- use UToronto mail
- put “inf1343” in the subject line
- expect 2 day turn-around

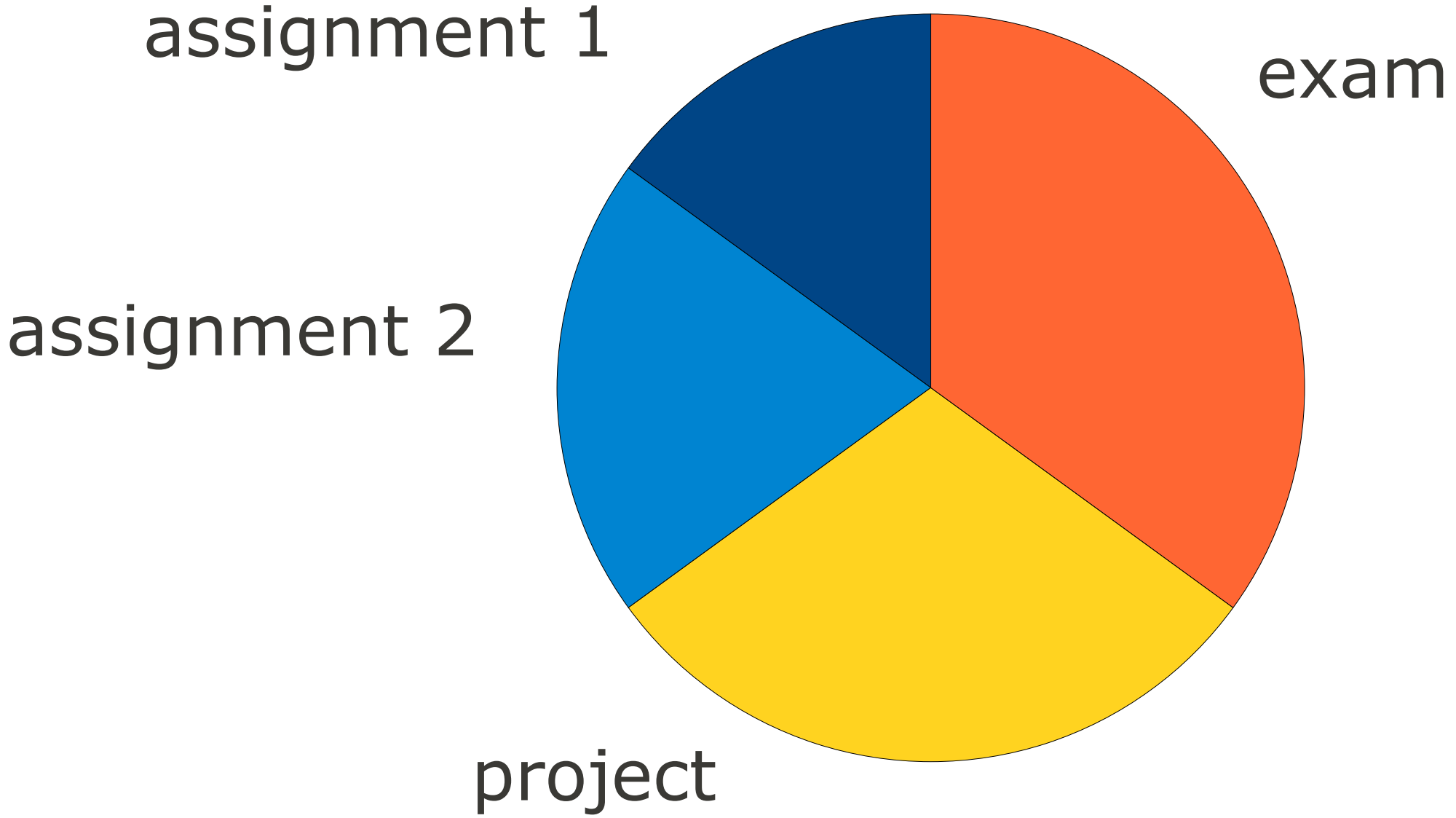

THIRD
EDITION
SQL
CLEARLY EXPLAINED
JAN L.
HARRINGTON

"SQL"

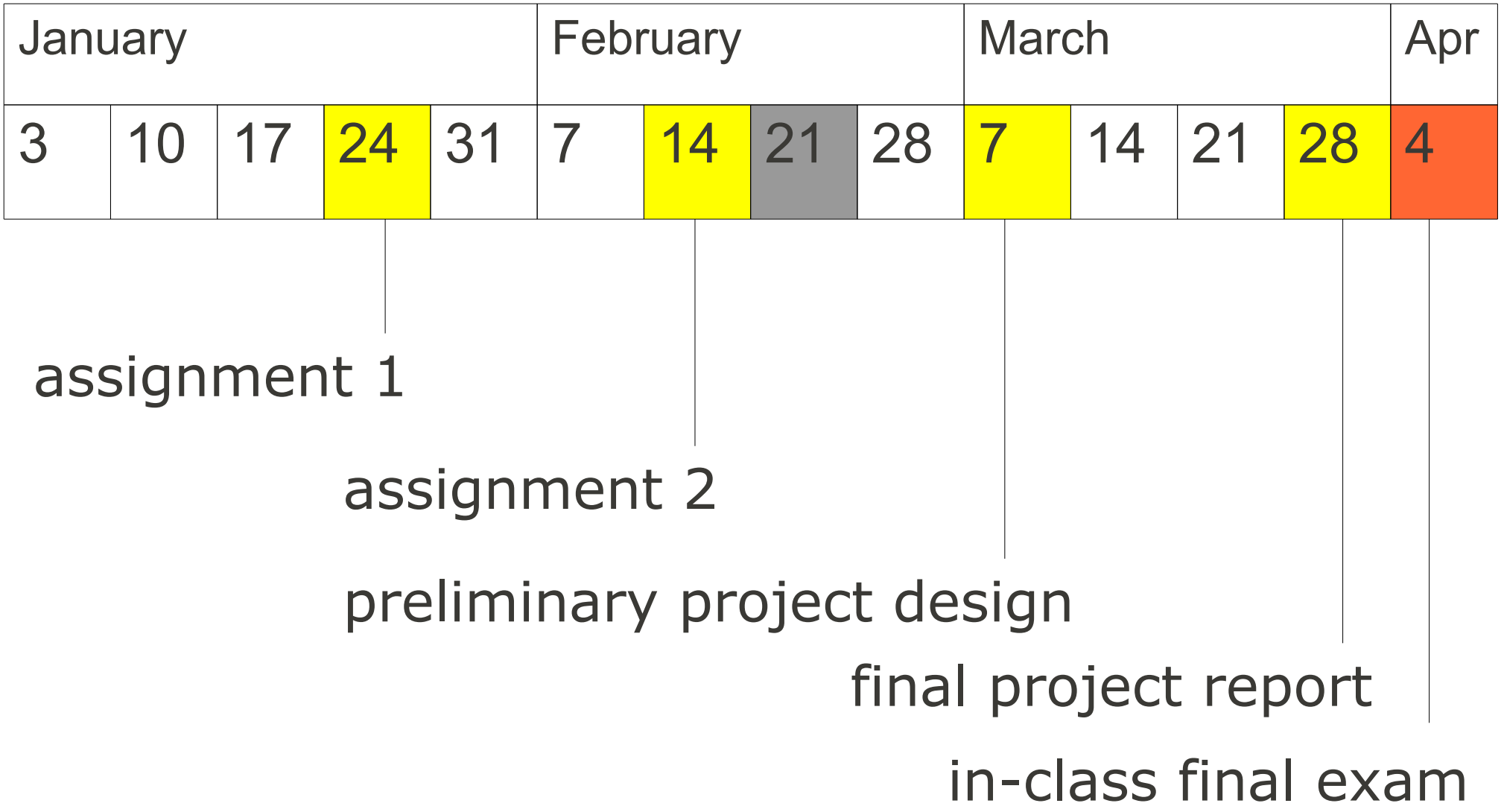

relational
database
design and
implementation
THIRD
EDITION
JAN L.
HARRINGTON
Copyrighted Material

"RDD"

Grading



Due Dates

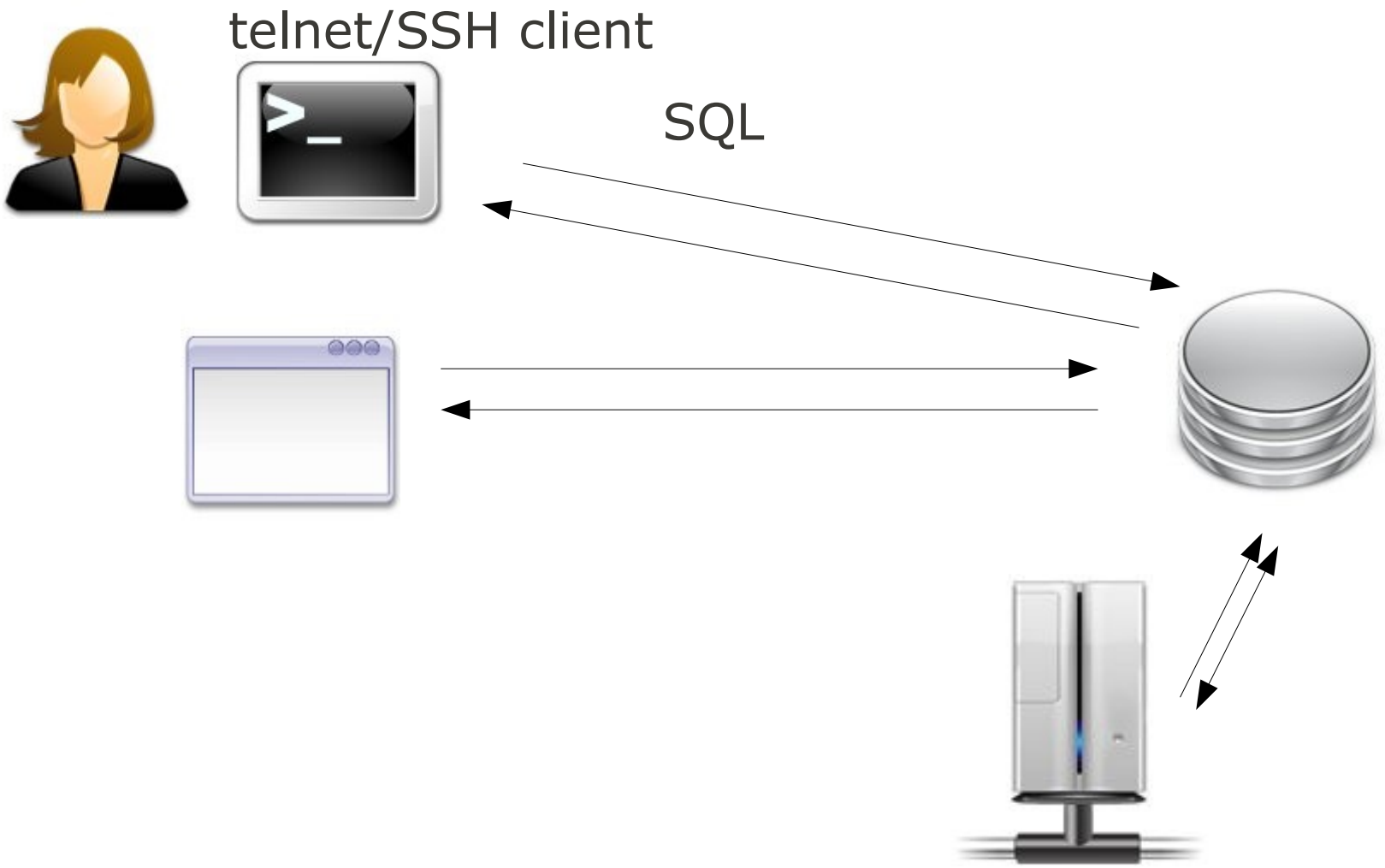

January
February
March
Apr
3
10
17
24
31
7
14
21
28
7
14
21
28
4
assignment 1
assignment 2
preliminary project design
final project report
in-class final exam

Lecture Schedule

(See the syllabus)

Questions?

A Query Language



Unix via SSH

1. Using a local bash* terminal
2. Using remote bash via SSH**
3. Running mysql remotely via SSH
4. Moving files back and forth

* Bash = "**B**ourne **a**gain **sh**ell"
  (a somewhat updated version of the 1971 Thompson shell)

** SSH = "**S**ecure **sh**ell"
  (a secure version of the 1969 telnet)

Local v Remote

Local:

Your laptop / desktop

Remote:

Another computer you are using (via your "local" machine)

Hint: Check the name in the prompt, e.g.: yuri@**chai**:~$

A Terminal App / Bash

OSX:

"Terminal" (pre-installed)

Linux:

"gnome-terminal" (pre-installed)

Windows:

"git-bash" from Git

http://code.google.com/p/msysgit/

(you can use PuTTY if you prefer)

SSH

ssh **kenobio7**@yoda.ischool.utoronto.ca

- your username is your UtorID
- your password is your UtorID too
- you will need to change your password

You will need to re-enter your **original** password before entering the new one. That is, the sequence is:

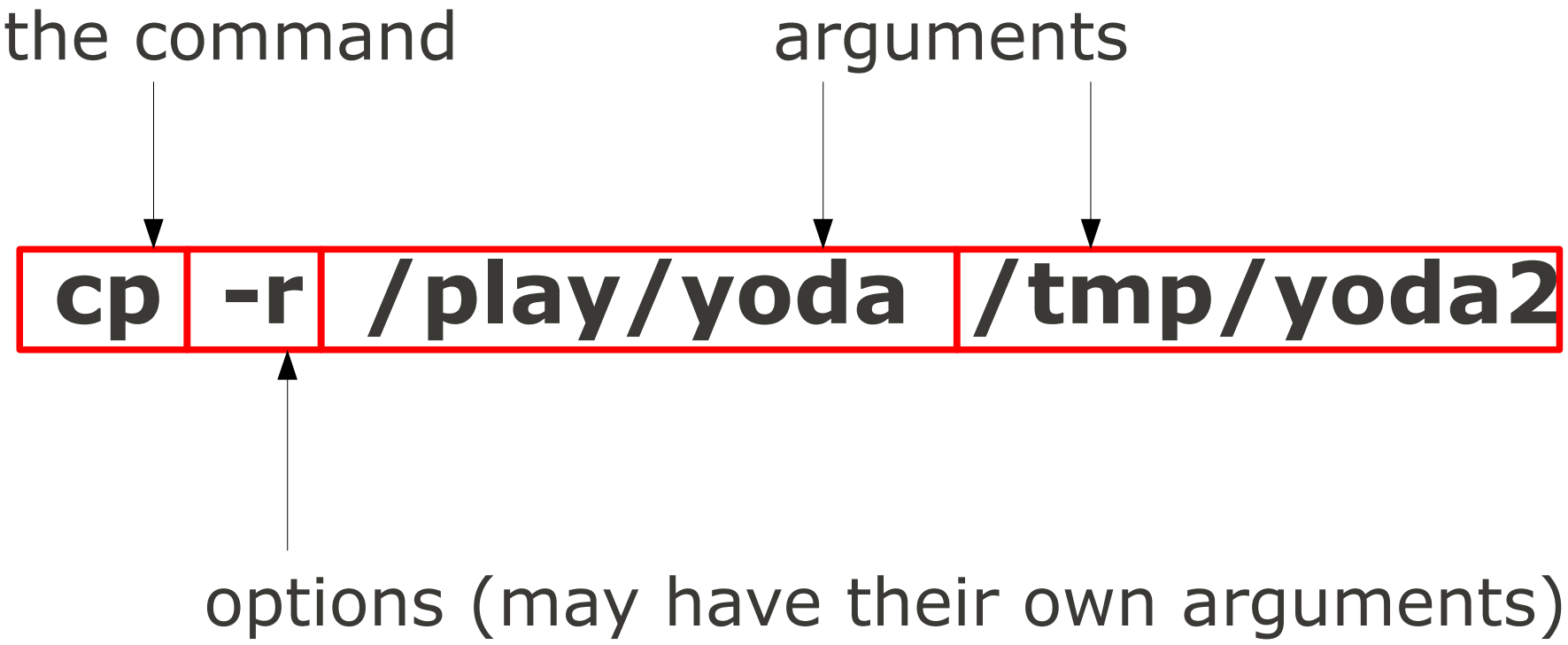
original, original again, new, new again.

More Unix Commands

ls – **l**i**s**t files in a directory
cd – **c**hange **d**irectory
mkdir – create (**m**a**k**e) a **dir**ectory
rm – delete ("**r**e**m**ove") a file or directory
cp – **c**o**p**y a file or directory
less – view a text file
nano – edit a text file
mysql – start mysql client

some of those commands are available both in your local and remote bash, some just on the server

Anatomy of the Unix Command



Some Examples

cd /play

go to directory “/play”

Hint: press [Tab] after typing “/pl”

ls

list the files in the current directory

cd yoda

go to directory “yoda”

Hint: press [Tab] after typing “y”

ls

Hint: use [↑] for earlier commands

Some Examples

less force.txt

Hint: press [Tab] after typing “f”

Hint: press “q” to exit less

cd ..

go to up one level

ls

cd locked

go to directory “sandbox”

Hint: you don't have the permissions

Some Examples

cd sandbox

mkdir obiwan

create a directory “obiwan”
(use your own name)

ls

we should see everyone's directory

cd obiwan

go to your directory

Some Examples

ls /play/yoda/

What was that file called again?

less /play/yoda/force.txt

Let's look at it again.

cp /play/yoda/force.txt .

copy “force.txt” to the local directory

nano force.txt

edit force.txt

Hint: **^** means [Control]

Options

ls -sh

list files with file sizes

cp -r /play/yoda .

copy “recursively”

less -N force.txt .

show the file with line numbers

Getting Help

man ls

user **man**ual for the **ls** command

Directories

/home/kenobio7
user's “home” directory

~
alias for user's home directory
e.g. “ls ~”

.
current directory

..
parent of the current directory

Redirection

command > file.txt

write the output to file

command < file.txt

feed the content of file to the command

command1 | comman2

send the output of command1 to command2

(We'll see examples in a second.)

MySQL

mysql
connect to mysql
mysql -u *username* -p
connect to mysql as a *kenobio7*, with a password

MySQL Prompt

mysql>

do not confuse with the bash prompt!

Hint: type “exit” or ^C to exit.

What do we enter at the mysql prompt?

A Bit of SQL

```
use starwars;

select name, occupation
from persona
where species=”Wookiee”;
```

A Bit of SQL

```
mysql> use starwars;
Database changed
mysql> select name, occupation from
persona where species="Wookiee";

+------------+-------------+
| name       | occupation  |
+------------+-------------+
| Chewbacca  | co-pilot    |
+------------+-------------+
1 row in set (0.00 sec)
```

SQL From a File

cd ~

cp /play/yoda/humans.sql .

mysql < humans.sql

run mysql client feeding it the contents of “non-humans.sql”

mysql < humans.sql > h.txt

save the output into “h.txt”

Exercise: create a file “ewoks.sql” that would give us a list of **Ewoks**.

Using SCP

scp = secure **c**o**p**y (or **s**sh + **cp**)
copy files over an ssh connection

Hint: You will usually be running this in your **local** bash session (i.e. on your laptop/desktop).

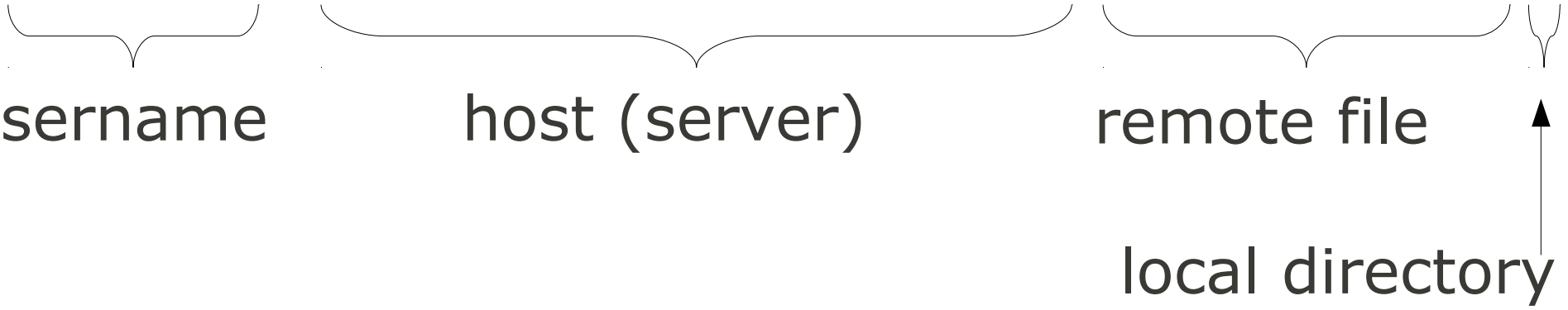
Hint: Windows users can use WinSCP instead.

Remove to Local

scp user@host:/remote/file /local/dir

e.g.:

scp kenobio7@yoda.ischool.utoronto.ca:~/humans.txt .



Local to Remote

scp /local/file user@host:/remote/dir

e.g.:

scp ewoks.sql kenobio7@yoda.ischool.utoronto.ca:~/

Editing Files Locally

Windows: **Notepad++**
Mac: **TextWrangler**
Linux: **gedit** (or emacs, vi)

Key feature: syntax highlighting

Home Exercises

1. Connect to the server.
2. Connect to mysql database “starwars.”
3. Find the droids (the species is “droid”).
4. Write an SQL file for finding the droids.
5. Scp the file to the server.
6. Find the droids, saving the results to a file (“droids.txt”).
7. Scp droids.txt back to your laptop/desktop.