

Welcome to INF1343!

Database Modeling and Database Design

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University of Toronto

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What is a “Database”?

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

↑
“DBMS”



Alice



information



Bob



Alice



information



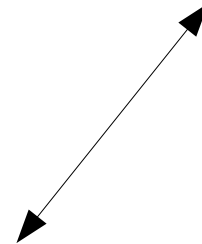
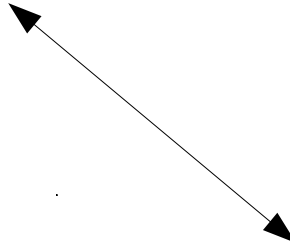
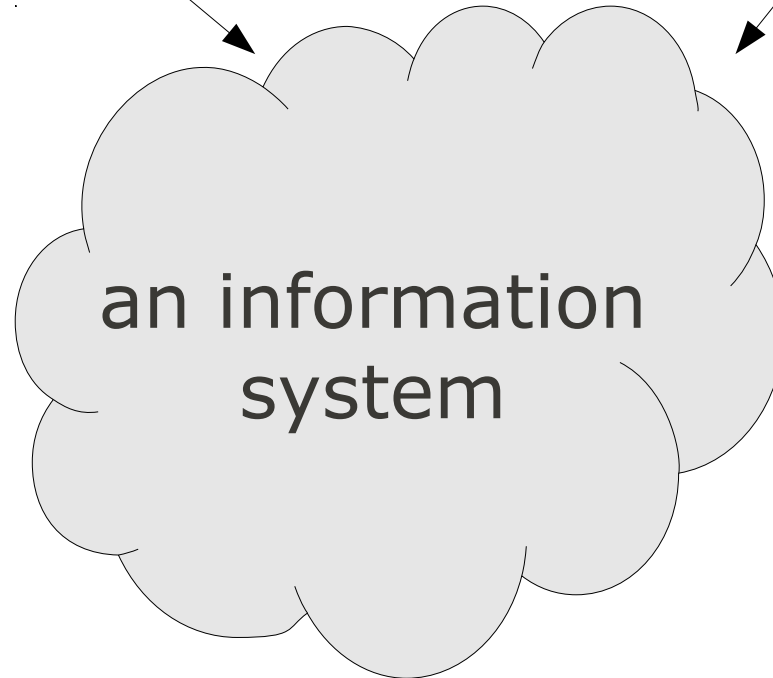
Bob



Alice



Bob

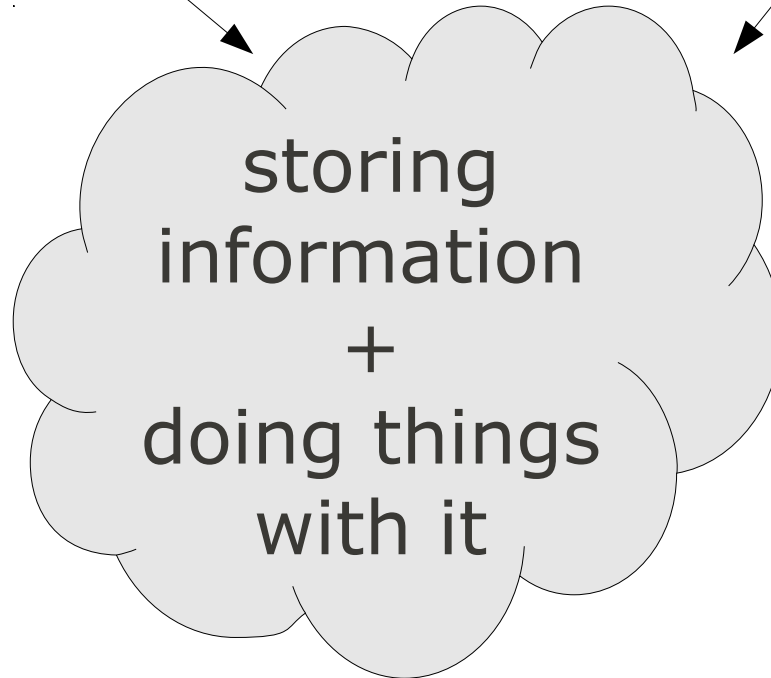
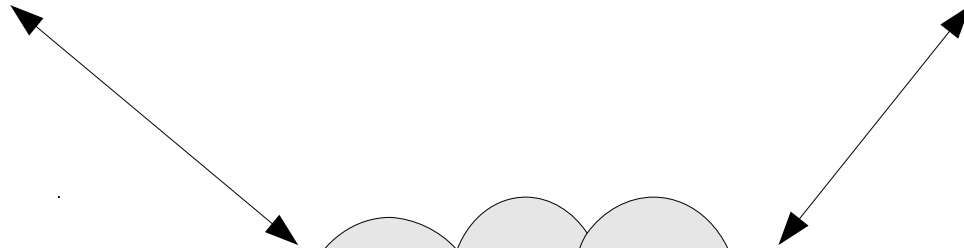




Alice

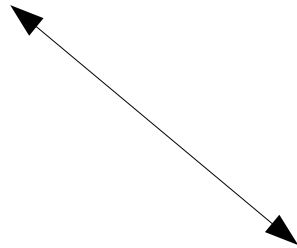


Bob

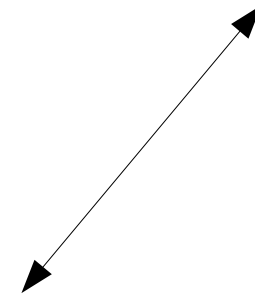




Alice

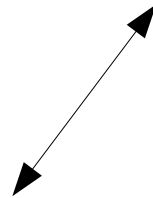


Bob



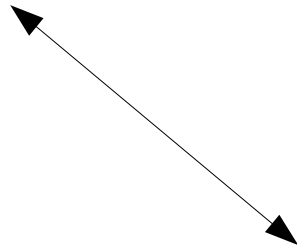
application software

database

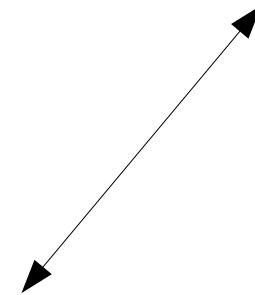




Alice



Bob

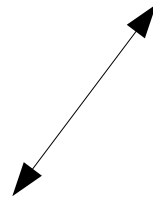


application software



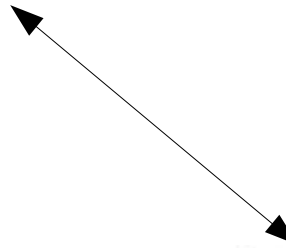
database

"persistent storage"

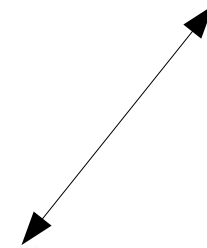




Alice

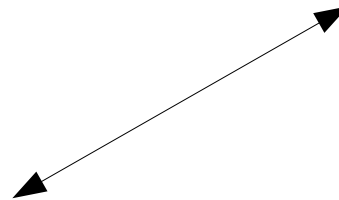


Bob



database

"persistent storage"



What is Data?

Knowledge

Information

Data



require a way
of *finding* the
record

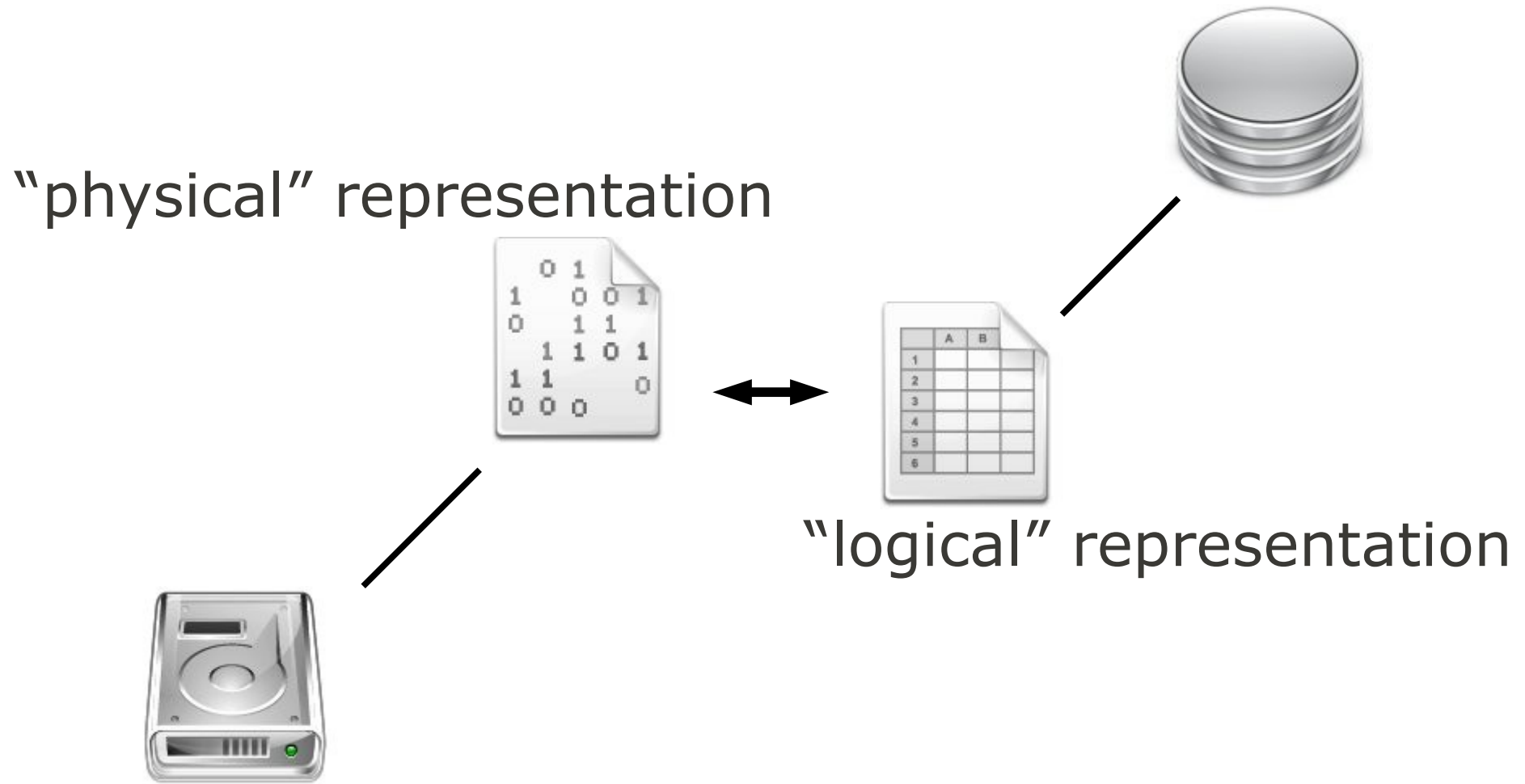
Create

Read

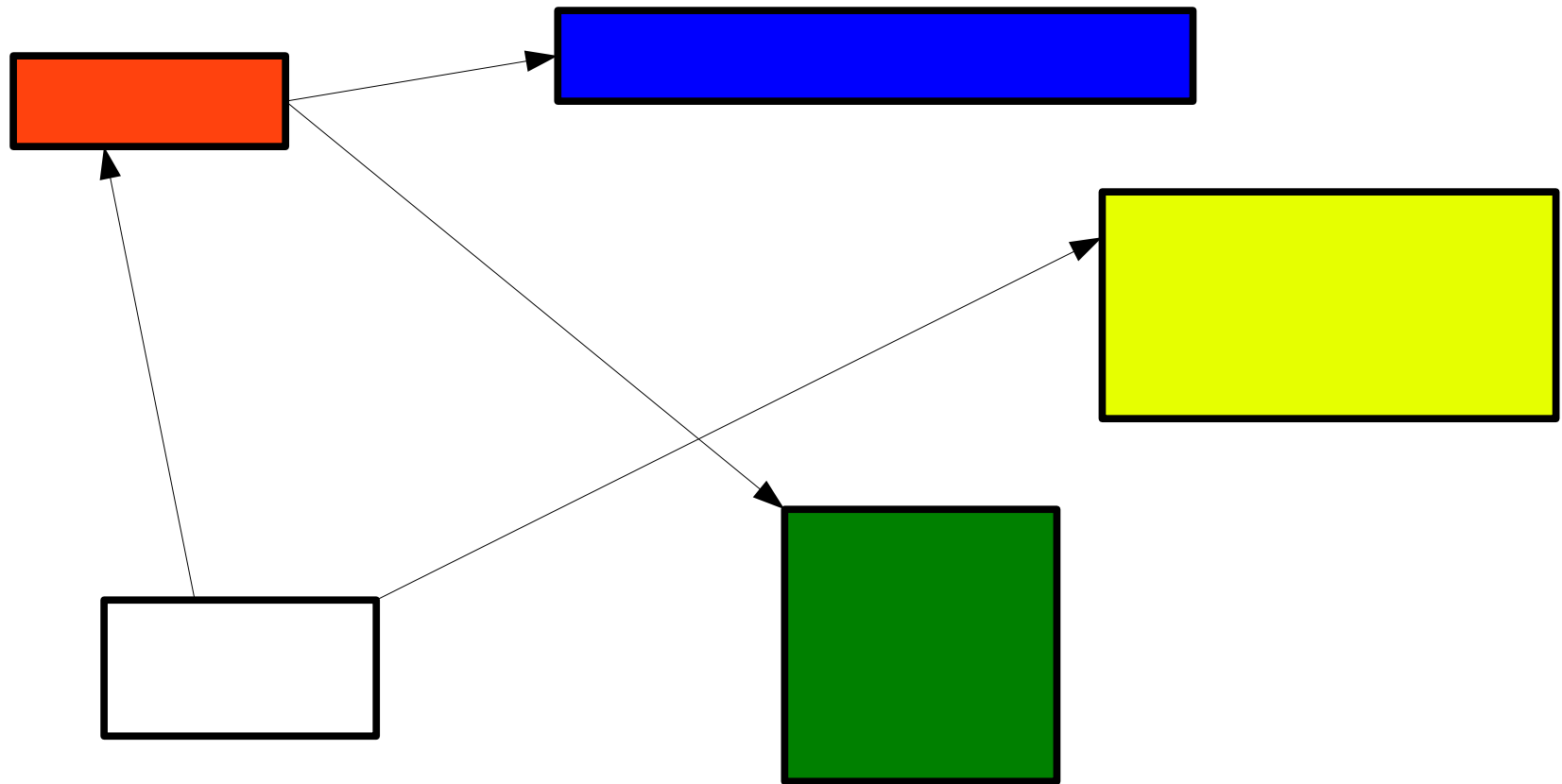
Update

Delete

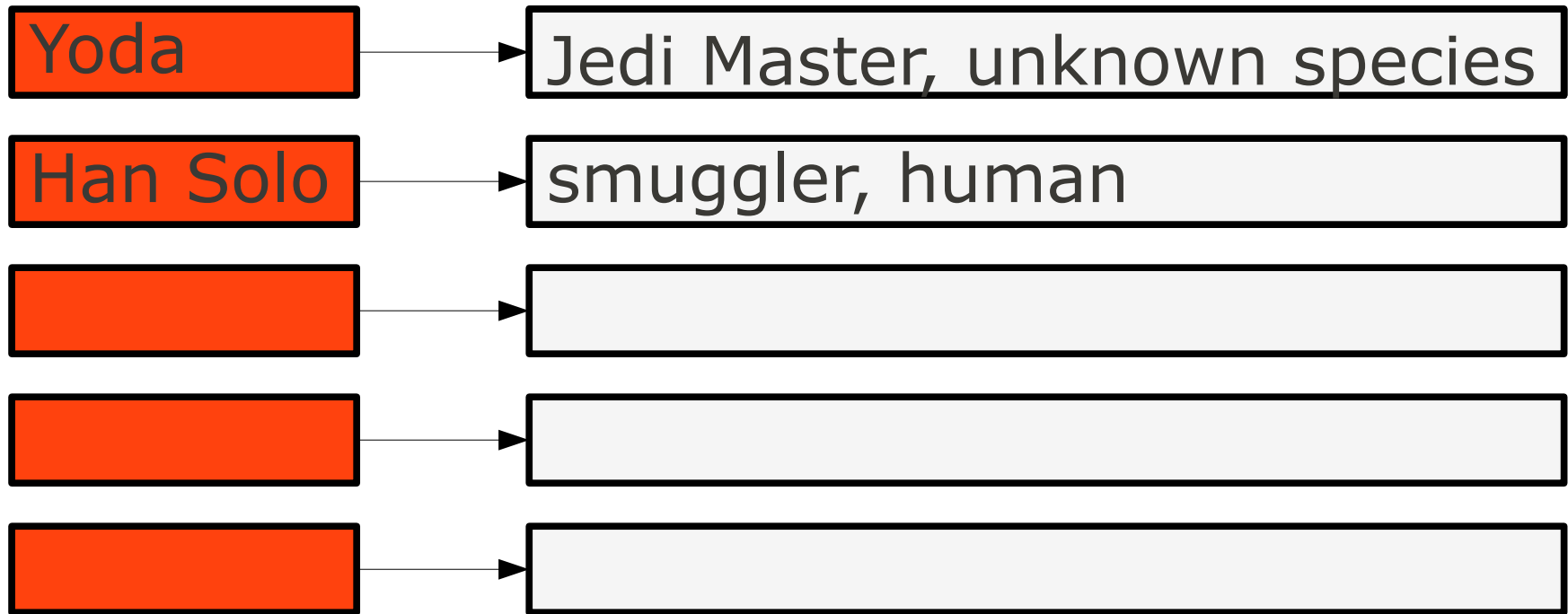
Database Elements



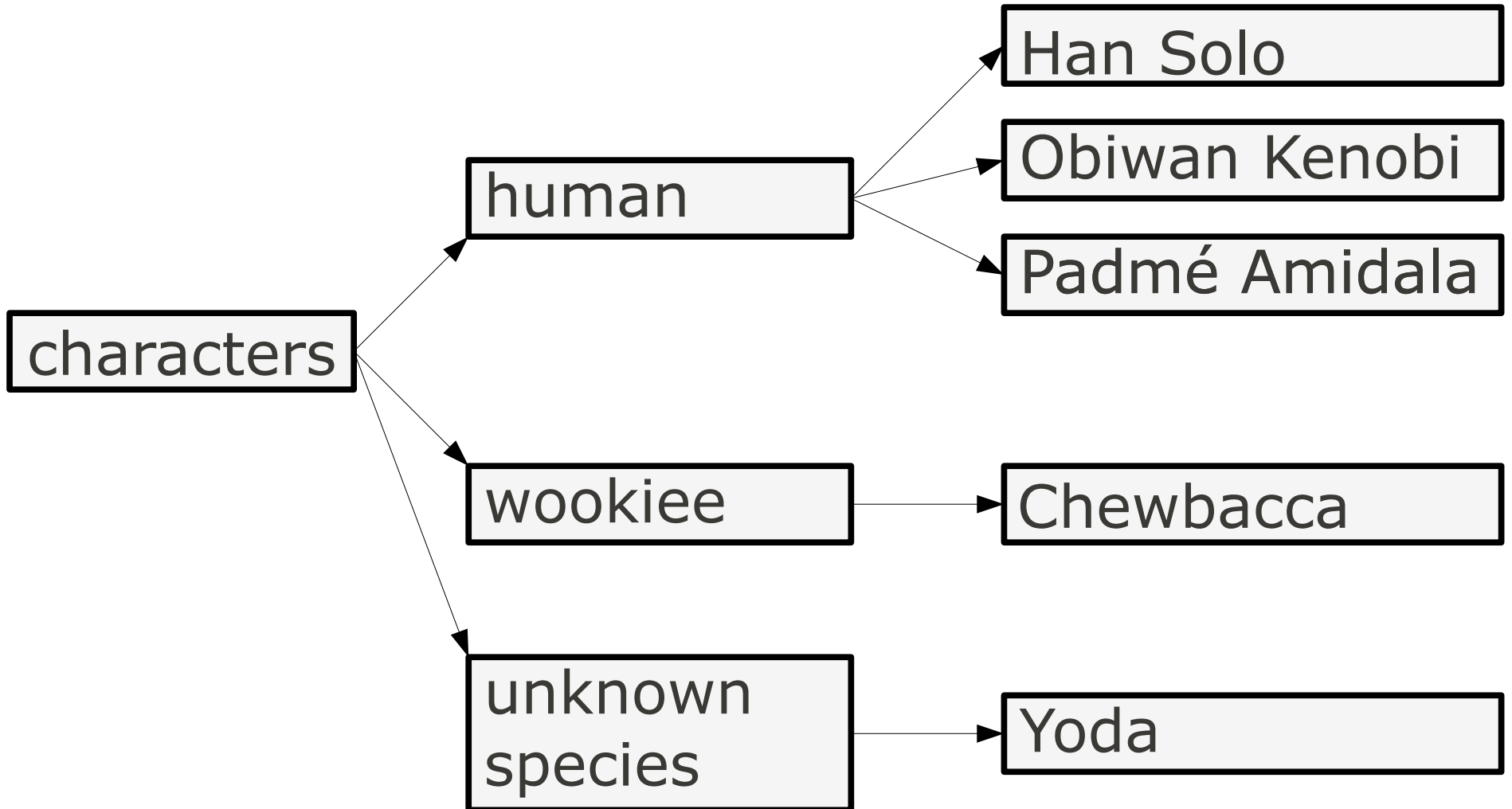
Databases Models



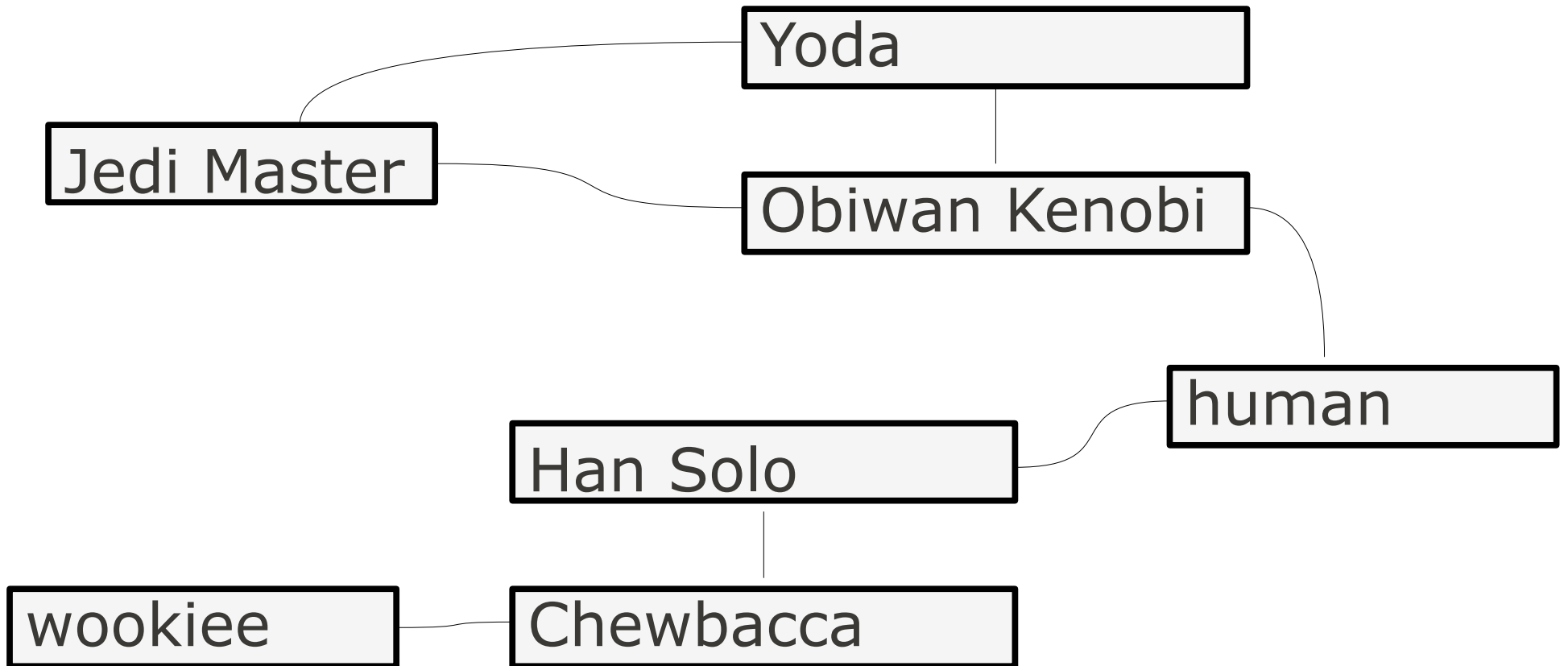
Key-Value



Hierarchical



Network



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

species

Human	humanoid	1.7
Hutt	gastropod	3.5

persona

Jabba	Hutt
Obiwan Kenobi	Human

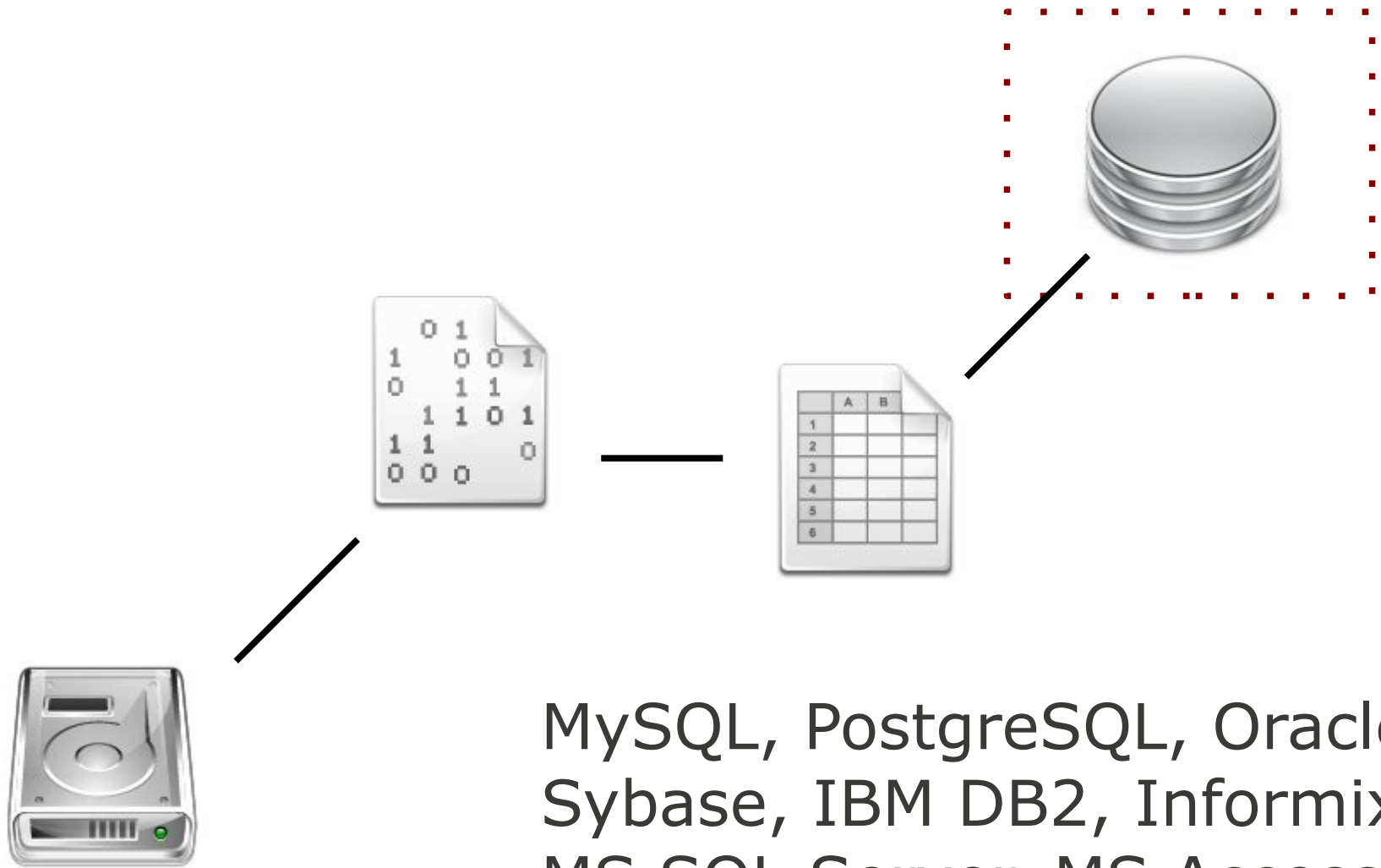
species_type

gastropod	0
humanoid	2

Relational Data Modeling

Finding a proper relational
representation for data

RDBMS



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

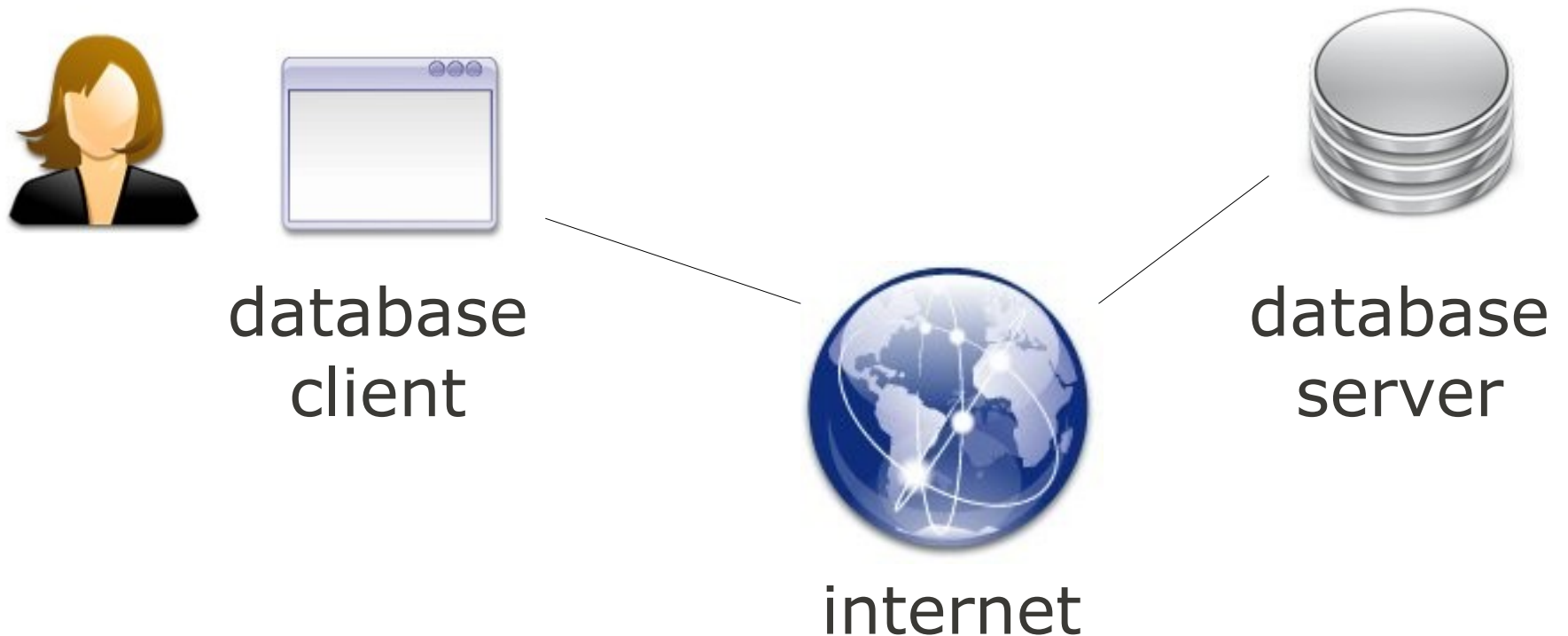
Accessing a Database



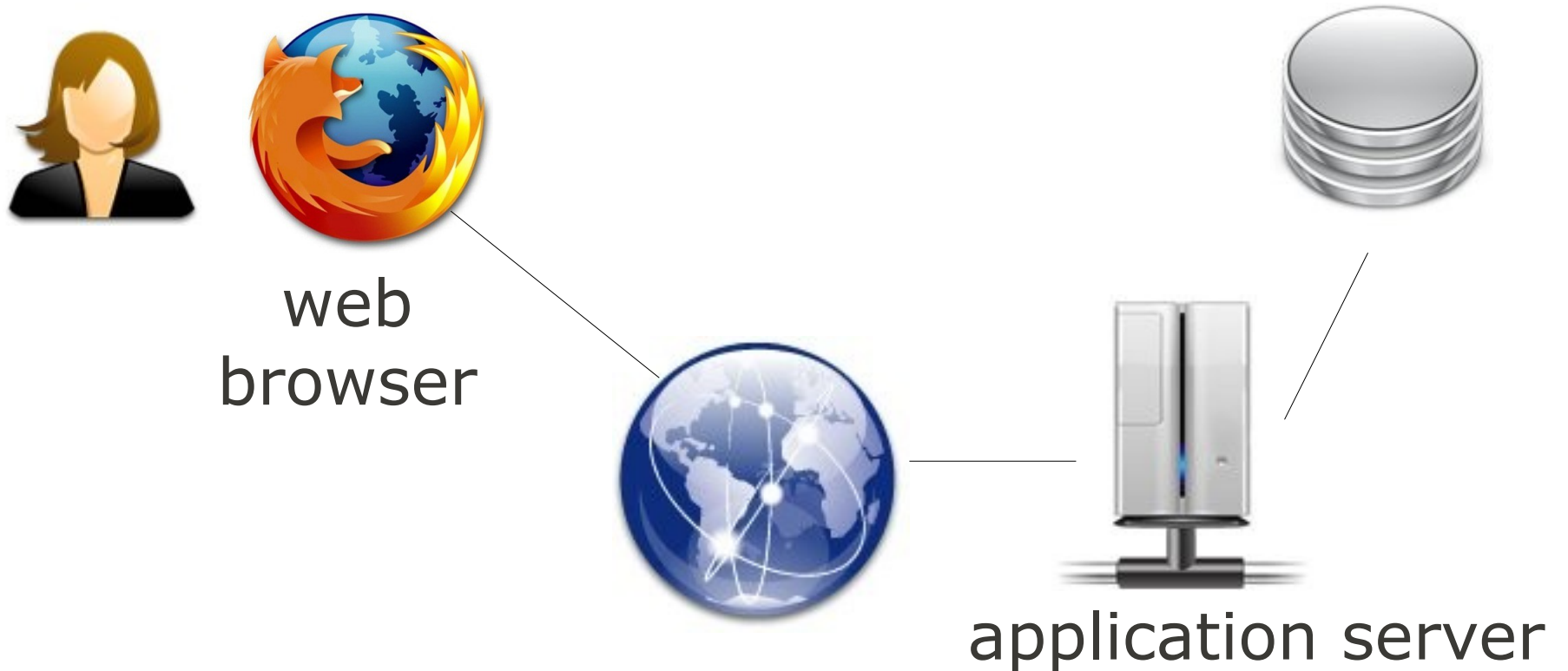
Built-in GUI



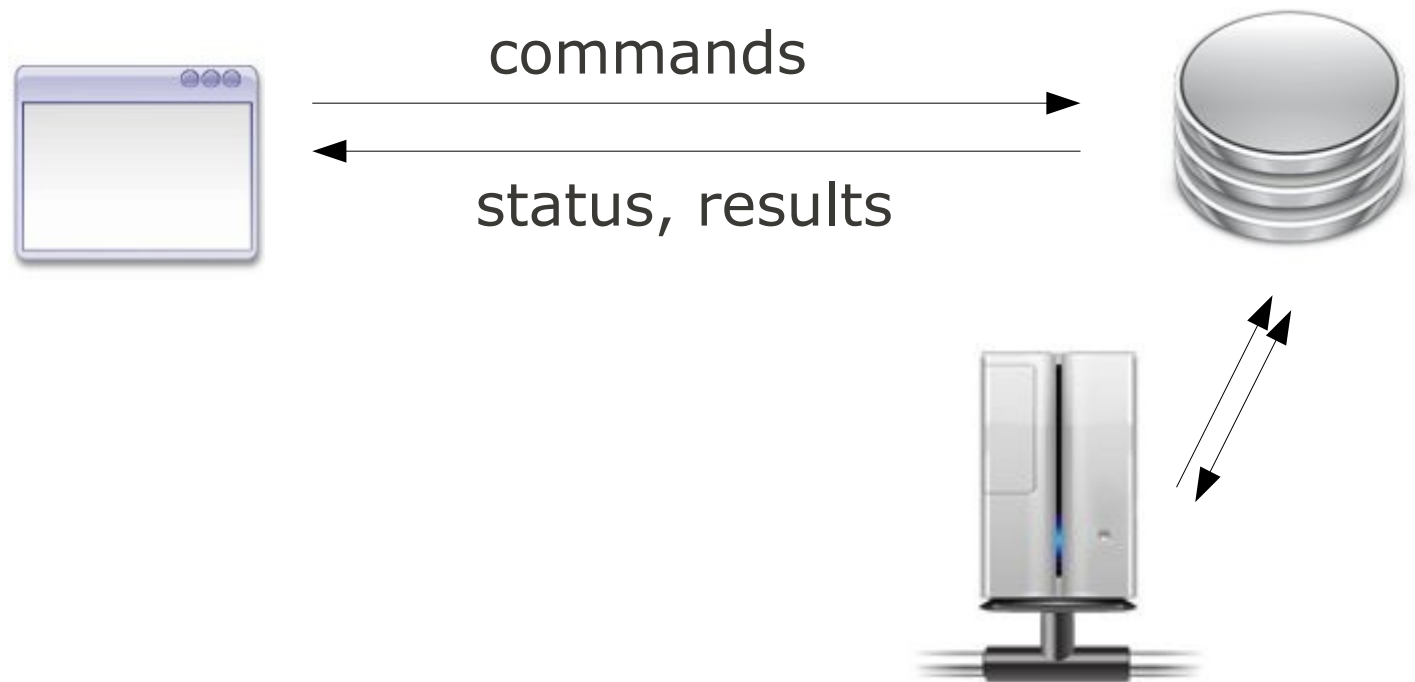
GUI Client for a Remote Database



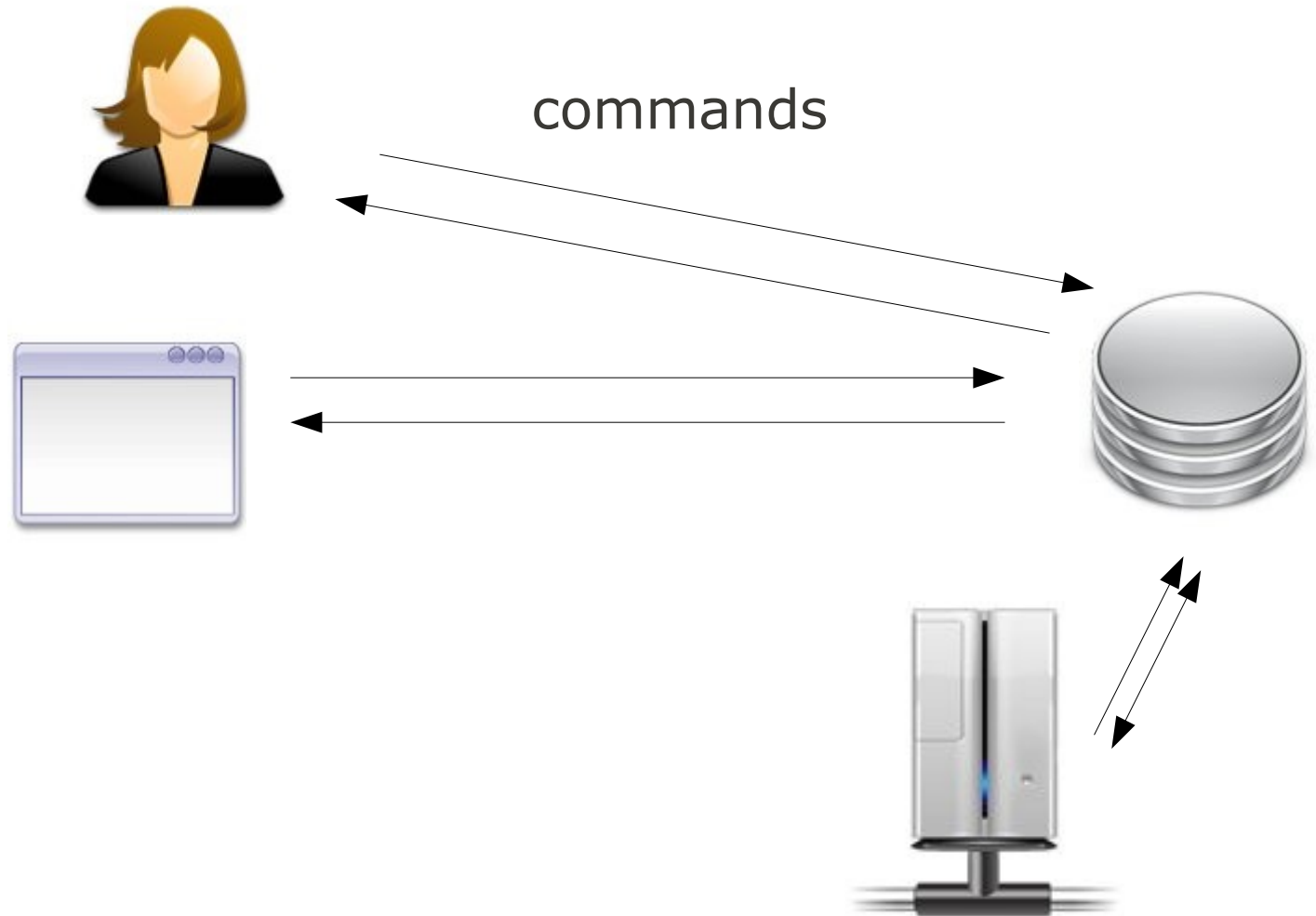
A 3-Tier System



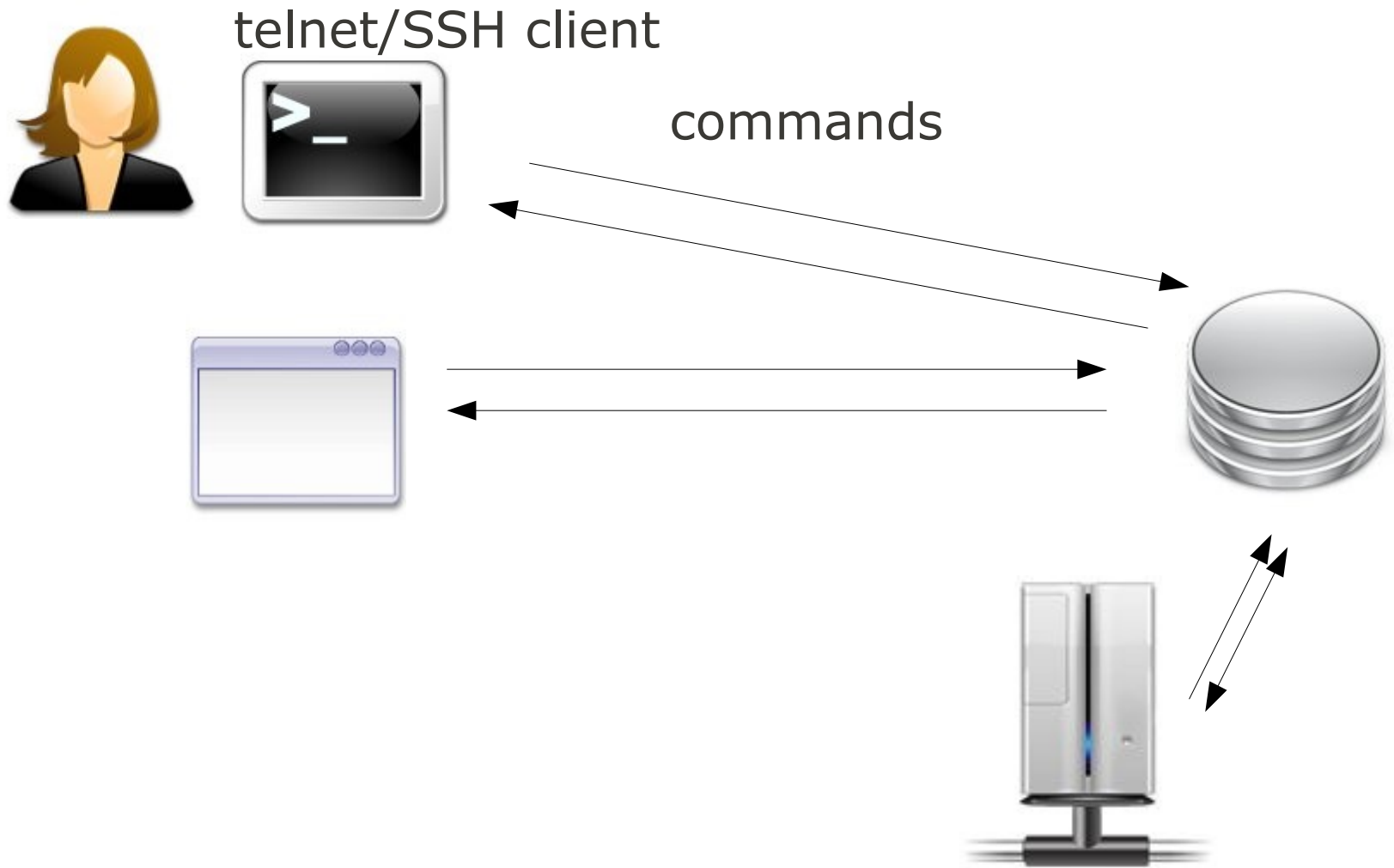
A Query Language



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/>

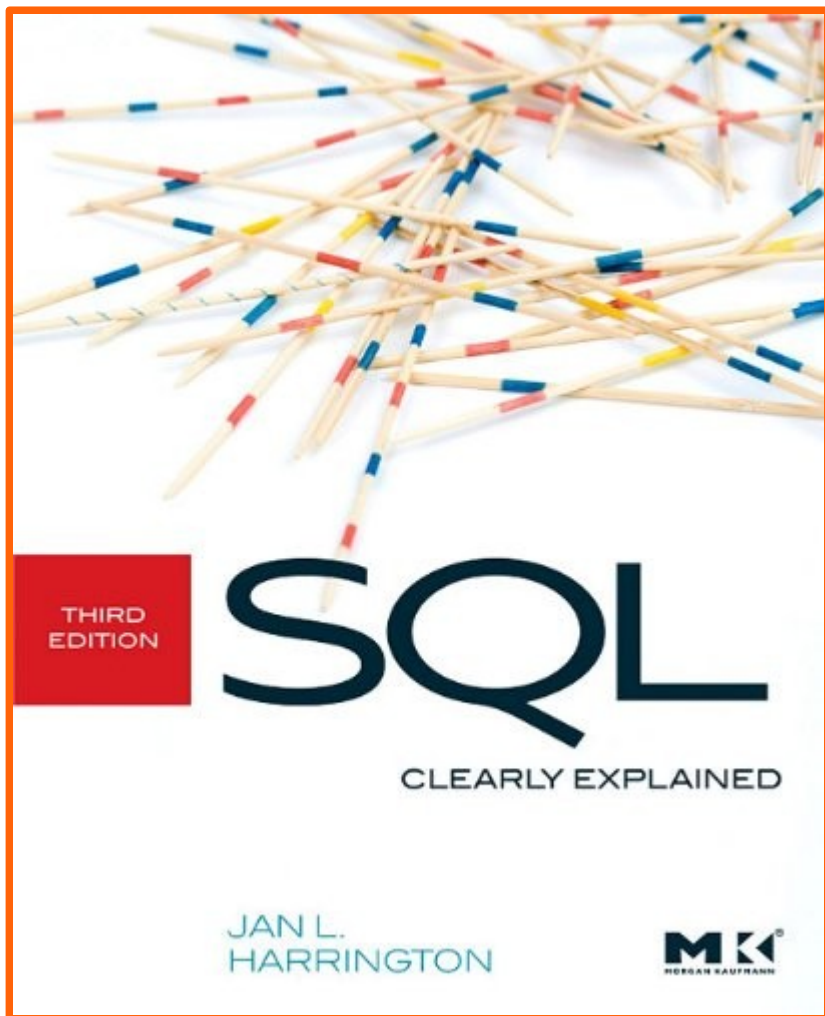
Contact Information

Office hours:

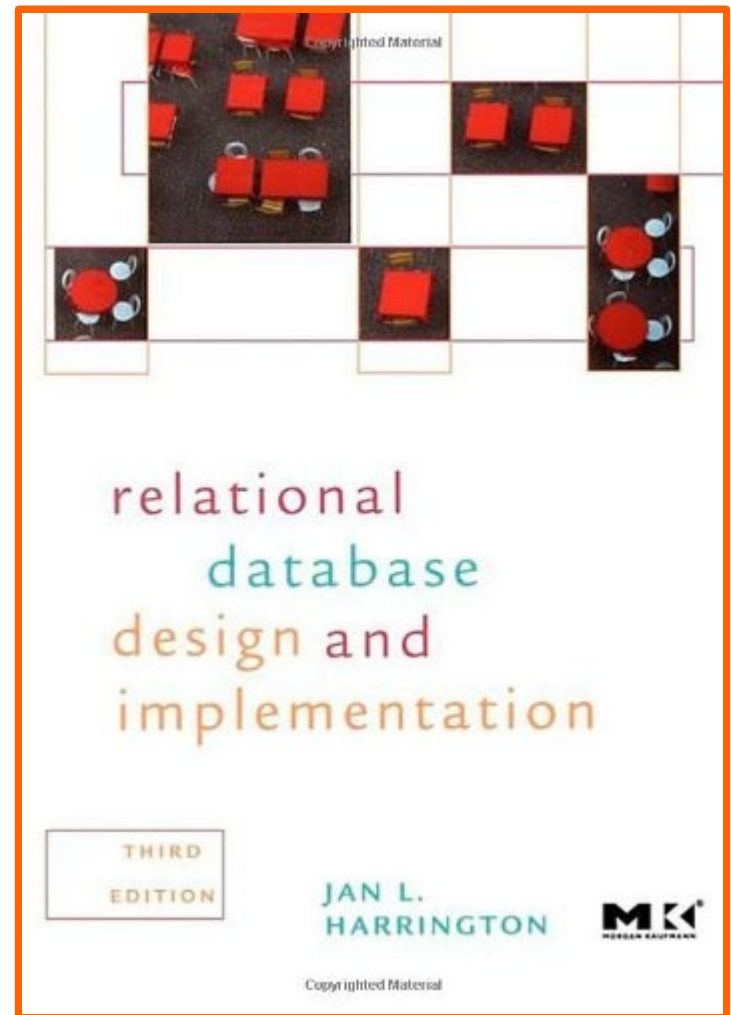
- Mon, 2-3pm, iSouth rm. 328

Email:

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

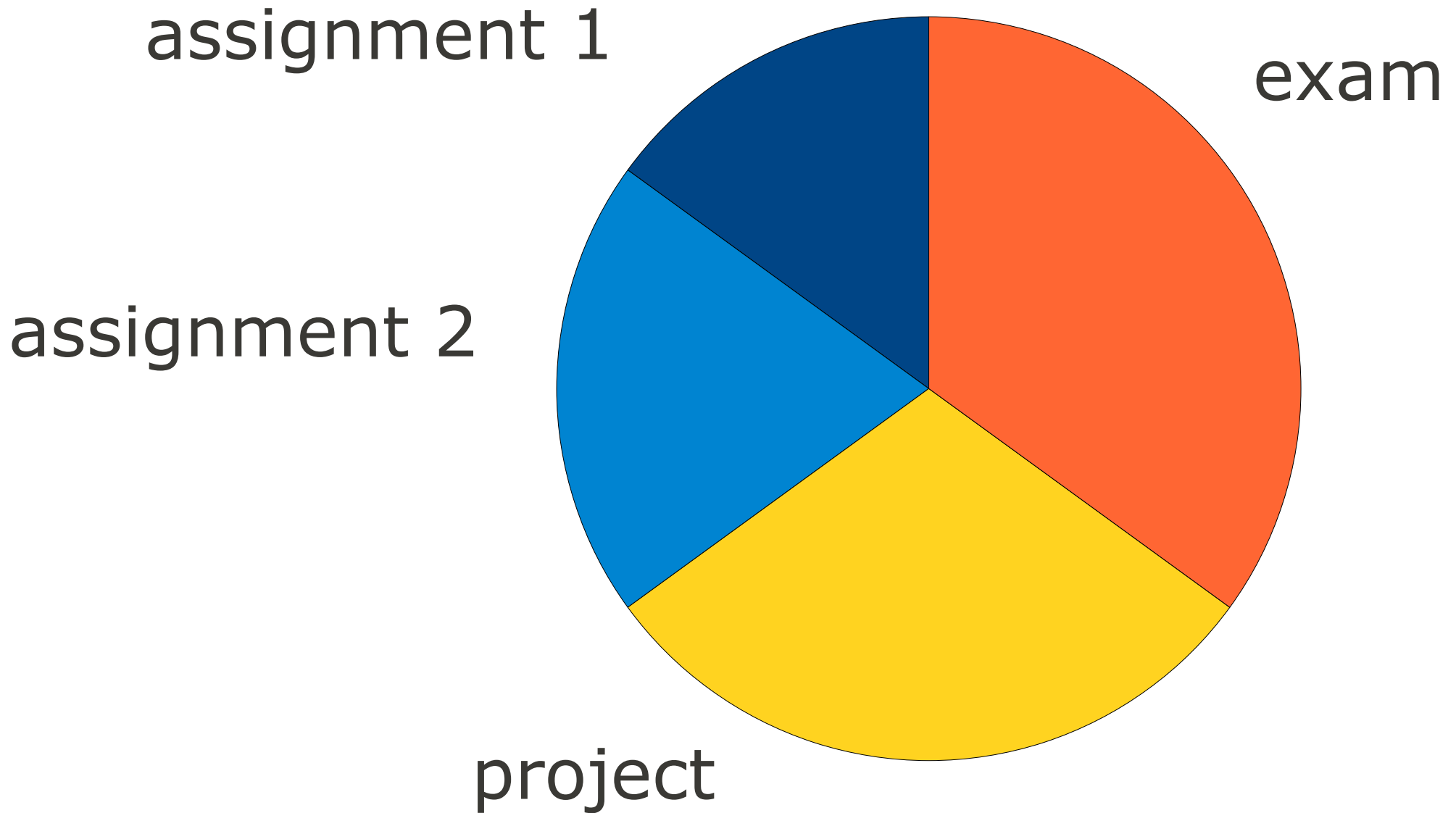


"SQL"



"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

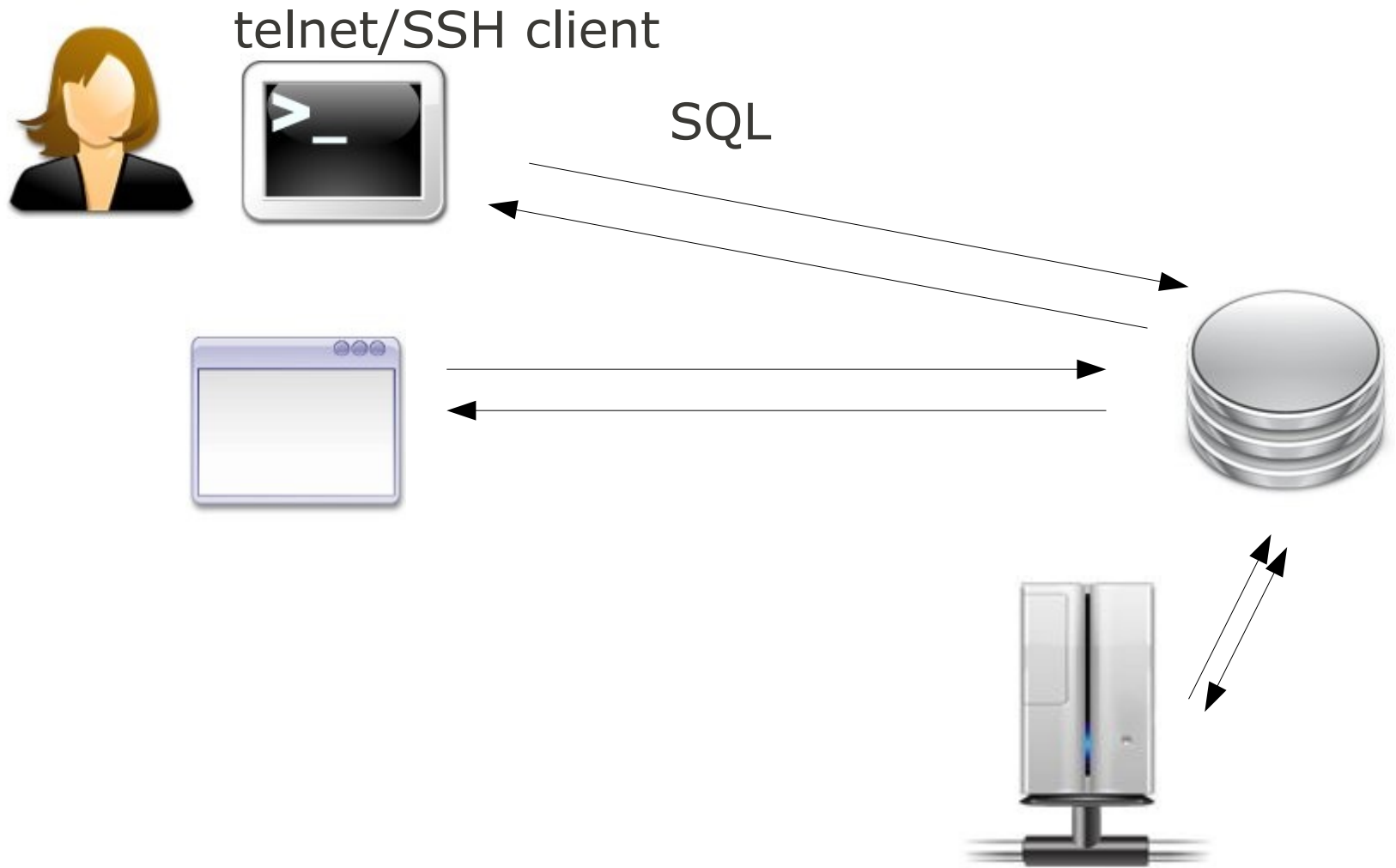
in-class final exam

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 **s**hell"

(a somewhat updated version of the 1971 Thompson shell)

** SSH = "**S**ecure **s**hell"

(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 – list files in a directory

cd – change **d**irectory

mkdir – create (**m**ake) a **d**irectory

rm – delete (“**r**emove”) a file or directory

cp – **c**opy 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

the command

arguments

cp **-r** **/play/yoda** **/tmp/yoda2**

options (may have their own arguments)

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 **manual** 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 | command2

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 "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 copy** (or **ssh + 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).

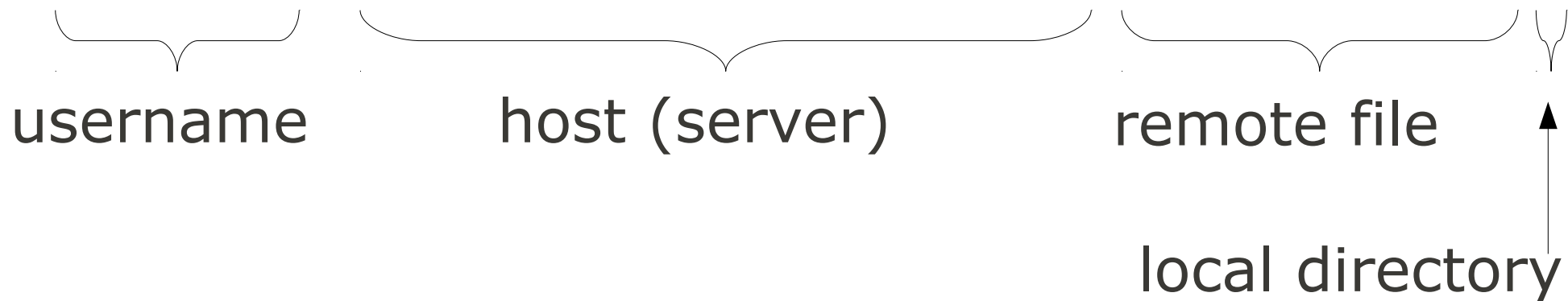
Hint: Windows users can use WinSCP instead.

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.