



MONASH
University

MONASH
INFORMATION
TECHNOLOGY

Week 1 - Introduction
FIT2094 - FIT3171 Databases
Clayton Campus S2 2019.



Your Databases Teaching Team - Clayton

Chief Examiner:
Dr Marc Cheong

Lecturers (Alternating Lectures):
Dr Marc Cheong
Mr Brendon Taylor

Head TAs:
Mr Peter Huynh (Admin)



(De facto adviser: Mr Lindsay Smith)

Your Databases Teaching Team - Clayton

Tutors (alphabetical order)

1. Arif Hidayat
2. Brendon Taylor
3. Dwi Rahayu
4. Harsha Dilshan Perera
5. Jiang Ou
6. Joe Shao
7. Joe Trakunphutthirak
8. Manoj Kathpalia
9. Peter Huynh
10. Rodion Sharlov
11. Thejani Dineshika Wedikkara Arachchi
12. Vidya Saikrishna

Overview (Hour 1)

- **[Clayton] Communication channels - important!**
- How are the two units run?
 - incl. weekly activities
 - overview of assessments
- Unit Guide
- Moodle
 - Intro quiz is a hurdle
- **Penalties for Plagiarism, Collusion - important!**
- Teaching Method (Peer Instruction in Lecture)

... then COFFEE BREAK!

[CLAYTON] Communication Channels

- As this unit is very large in enrolments...
 - ...plus in terms of staffing = 2 Clayton lecturers + 2 head tutors...
- We have a unified email role account:
FIT2094-FIT3171.AllCampuses-x@monash.edu
 - Monash Gmail will autocomplete it once you type FIT2094...
- Please don't send individual staff your emails
 - If there are any major issues, contact mgmt via role account - we do not tolerate any abuse of our staff.**
 - As per the Unit Guide**

Email contact with staff

1. Students must use their Monash University email account when communicating with staff via email, **non-Monash email addresses will not be responded to.**

2. **Specifically for CLAYTON campus:** students are required to address unit-related emails (e.g. special consideration and other administration matters) to **FIT2094-FIT3171.AllCampuses-x@monash.edu** - this is because of the large cohort size and that there are multiple lecturers and Head TAs in the unit.

Clayton students which do not adhere to this policy will not be responded to.

How are the two units run?

- FIT2094 and FIT3171 have the SAME lecture!
 - Either Thursday on campus - Marc's lecturing it
 - Or Friday on campus - Brendon's lecturing it
 - Or participate in either LiveStream (a staff member will be the chat moderator/host).
- FIT2094 and FIT3171 have the SAME tute!
- FIT2094 and FIT3171 have the SAME assignments
- **HOWEVER: the units have DIFFERENT exams, each exam tests different LEARNING OUTCOMES based on difficulty level.**

A typical week...

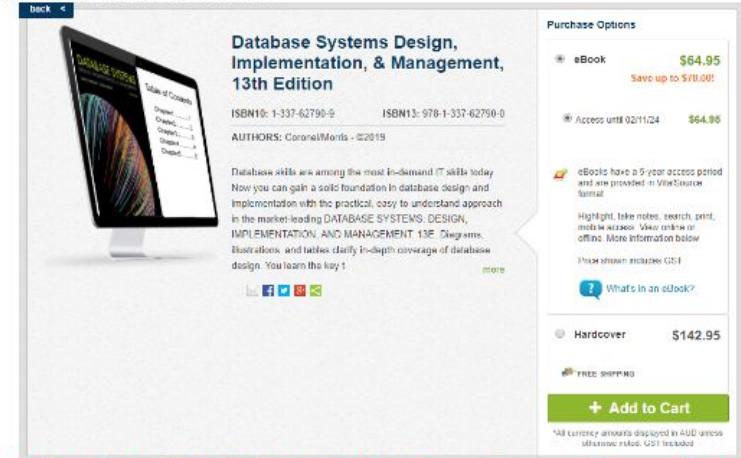
- BEFORE class:
 - Pre-reading: textbook - either buy or borrow from library and share in your class/study group (next slide).
 - Pre-reading: tute sheet and some pre-lecture notes (GDocs, linked via Moodle)
 - Week 2 onwards: Quiz open from Wednesday 12:00, closes Tuesday 23:59, auto-marked by Moodle. (Australian timezone)
 - LENIENCY ONLY FOR WEEK 1 - quiz open Thurs and closes Wed
- Tutes
 - (tutes and labs are the same thing, terms used interchangeably!)
 - 2hrs face-to-face session, guided by expert TAs
 - complete tasks/discussion/coding, do hands-on work and discussion as per the Tute sheet. **Marks to be awarded for participation.**
- Lectures (sometimes after tutes in the week)

Textbook

- Options include:

- Borrow from library and share in your class/study group.
- Students can use older copy (12th Ed) to save \$\$\$.
- Discounted textbook promo code →

DATABASE SYSTEMS DESIGN, IMPLEMENTATION & MANAGEMENT, CORONEL/MORRIS, 13th edition, ©2019- ISBN 9781337627900



FANCY A 10% DISCOUNT? Purchase directly from CengageBrain by following the steps below!

Step 1: Go to the Cengage Brain site: <http://www.cengagebrain.com.au/shop/index.html> new students simply **Create a Cengage Brain Account** or if you have an existing Cengage Brain Account, just enter your Username and Password.

Step 2: Click on this link for the prescribed text for your unit:
<http://www.cengagebrain.com.au/shop/search/9781337627900>

Step 3: Select 'eBook' and click 'add to cart'.

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Overseas students: Students based overseas, can purchase the eBook via link:
<http://learn.cengage.com/overseas>

Best of luck with your studies!

Outline and assessments S2/2019

Assessment summary

NOTE: From 1 July 2019, the duration of all exams is changing to combine reading and writing time. The new exam duration for this unit is 2 hours and 10 minutes.

Examination (2 hours): 50%; In-semester assessment: 50%

Assessment task	Value	Due date
Pre-Lecture Quizzes	5%	Weekly prior to the lecture (Weeks 2 to 11)
Participation and Q&A within the lab class	5%	Weekly in the lab (Weeks 2 to 11)
Assignment 1 Part A - Initial Database Design	5%	Week 5, Monday 9:00 am
Assignment 1 Part B - Database Design	20%	Week 9, Friday 11:55pm
Unit Test - SQL and Database Theory.	15%	Week 10 (during the campus-specific time reserved for the test).
Paper 1	50%	To be advised



Weekly Outline S2/2019

Week	Activities	Assessment
0		No formal assessment or activities are undertaken in week 0
1	PART I: The Relational Model Introduction to Database	
2	Relational Model	Pre-lecture Quiz Questions due weekly prior to the lecture (Weeks 2 to 11). Participation and Q&A assessed weekly within the lab class (Weeks 2 to 11).
3	PART II: Database Design Conceptual model - E/R Diagram and UML	
4	Logical model - E/R Transformation	
5	Normalisation	Assignment 1 Part A - Initial Database Design Due.
6	Database Implementation (DDL)	

7	PART III: The SQL Database Language SQL I	
8	Update, Delete and Transaction Management	
9	SQL II & Triggers	Assignment 1 Part B - Database Design Due.
10	SQL III	Unit Test - SQL and Database Theory.
11	PART IV: Web Database Implementation Database Connectivity and Web Technologies - Querying Data	
12	Web Technologies - Manipulating data	
	SWOT VAC	No formal assessment is undertaken in SWOT VAC
	Examination period	LINK to Assessment Policy: http://policy.monash.edu.au/policy-bank/academic/education/assessment/assessment-in-coursework-policy.html

Unit Guide

- ... is your best friend!
- **UNIT GUIDE CONTENTS DIFFER PER UNIT
(FIT2094 vs FIT3171) esp. LEARNING OUTCOMES.**
- Let's check them NOW.

Moodle

- ... is another of your best friends!
- FIT2094 and FIT3171 have the **same Moodle throughout** for BOTH units...
 - (except for any EXAM REVISION parts).
 - NB: Moodle has just been upgraded, so navigation can be confusing if you used it before.
- Moodle links to weekly ‘eBooks’ or pre-reading content...
 - Tute Notes and Pre-Lecture (Preview) Slides
 - On Google Drive as a Doc file (read-only)
 - ...or a low-bandwidth (‘Lite’) published version.

Moodle - Hurdle S2/2019

Introduction

Students must familiarise themselves with the various parts of the unit before the end of Week 1.

This includes the following core items:

- Reading and fully understanding the unit guide for the respective unit code.
- Understanding what the best point of contact is, for students' respective campuses.
 - **Especially important for Clayton campus!**
- Installing and understanding the use of SQL Developer, which is heavily required for the unit.
 - **Refer to UNIT INFORMATION above.**
- Fully understanding the assessment items, and key dates.
- Fully understanding the weekly lab participation requirement (5%).
- Fully understanding the assignment policies, including special consideration as well as late penalties.
- **Accepting and acknowledging the "student charter", including good behaviour in forums, and zero tolerance for abusive behaviour.**

The Week 1 content remains locked until students have passed the following quiz and acknowledged the "student charter" within.

Note that the quiz has no marks (and unlimited retries).



Important information and expectations for students



You need to pass ALL questions in this quiz before you can engage with the content.

This quiz contributes NO MARKS to your overall final grade, and is here purely as a HURDLE to make sure you are aware of the expectations for the unit.

You have unlimited tries, but if you fail, you need to wait 5 minutes before retrying.

Penalties for Plagiarism and Collusion

- DO NOT copy from other students, the Internet, textbooks, sample code...
- DO NOT complete assignments/quizzes in a group (unauthorised), or have someone else do your work...
- **SEVERE PENALTIES - INCL. LOSS OF MARKS, SUSPENSION, AND EXCLUSION FROM UNI...**

–Always follow the policy:

<https://www.monash.edu/students/admin/policies/academic-integrity>

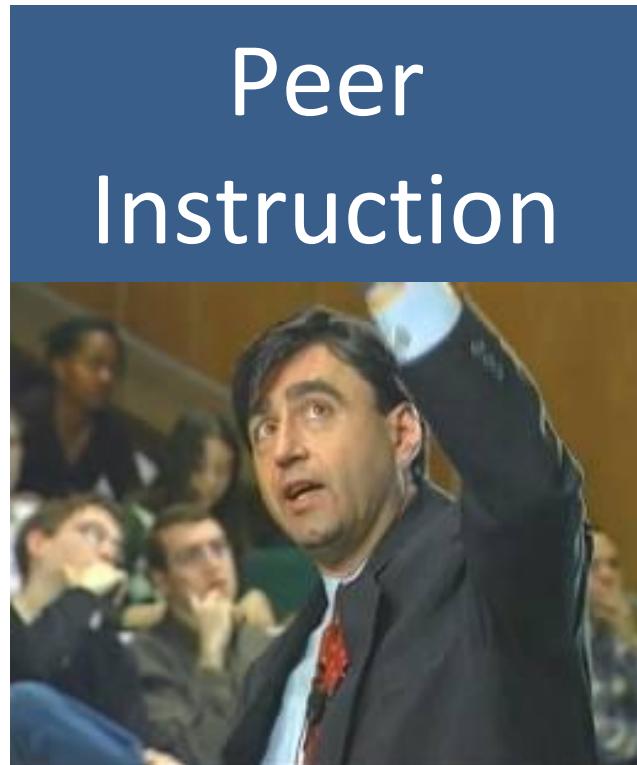
**–The teaching team knows how to find out if your work is not your own...
If you know ‘where to find answers’, so do we.**

Penalties for Plagiarism and Collusion

- The teaching team knows how to find out if your work is not your own.
- If you know ‘where to find answers’, so do we.
 - Every semester we report to the Faculty and the Associate Dean: Stack Overflow, WeChat - 微信 groups, ‘Study Heroes’ sites, assignment ‘help’ ... and more.
- The ASSOCIATE DEAN is aware of the methods used to cheat in OUR SPECIFIC unit.
- Cheaters?
 - Your group mate will also be in trouble!
 - There are also more severe cases (noted by the Associate Dean).
 - The Unit Test and Exam - much much harder than you think...

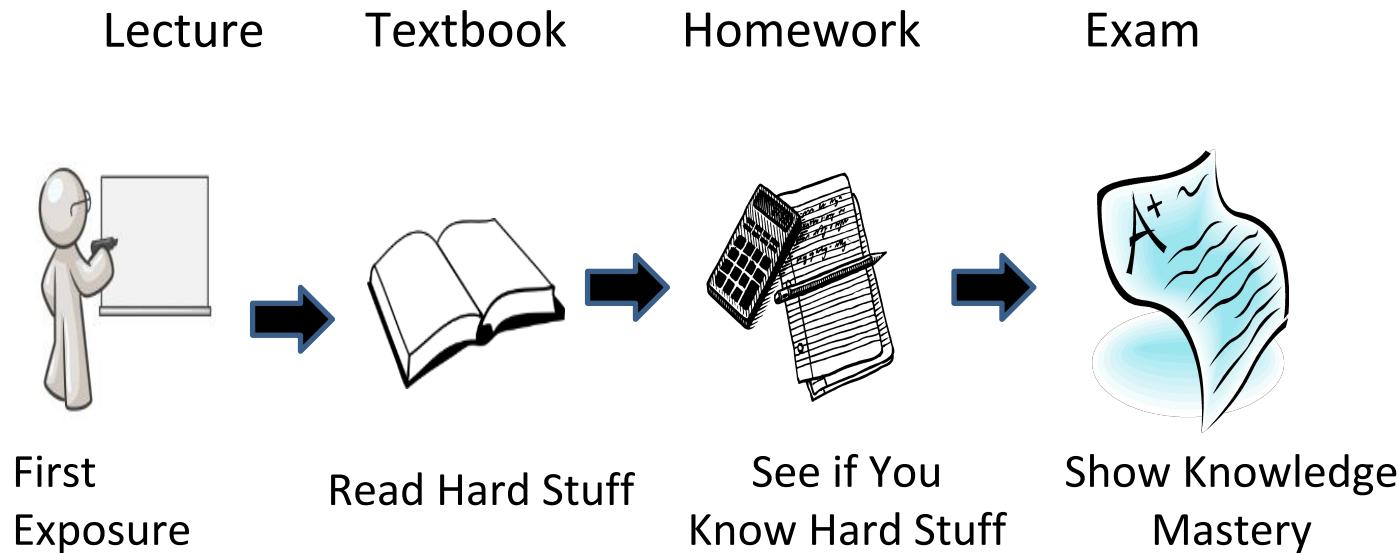
Teaching Method

- Your peers help you to understand the concepts through discussion.
- Lecture includes a series of discussions on concepts.
- The lecturer guides the discussion.

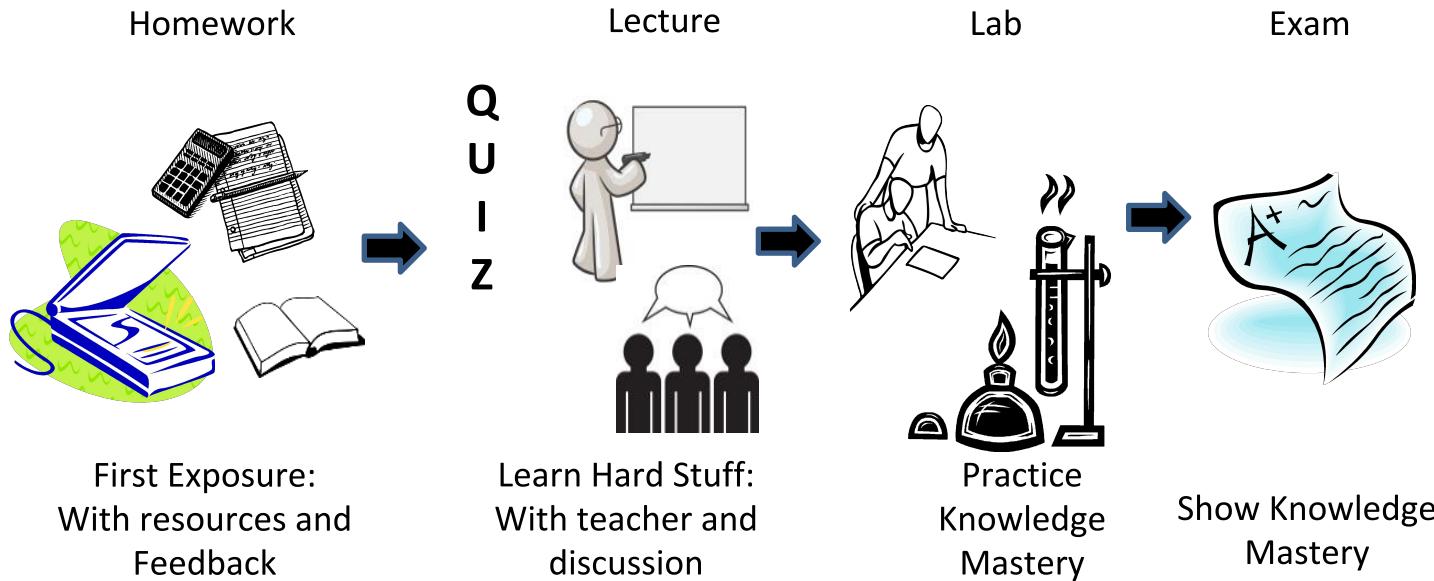


Prof Eric Mazur, Harvard University

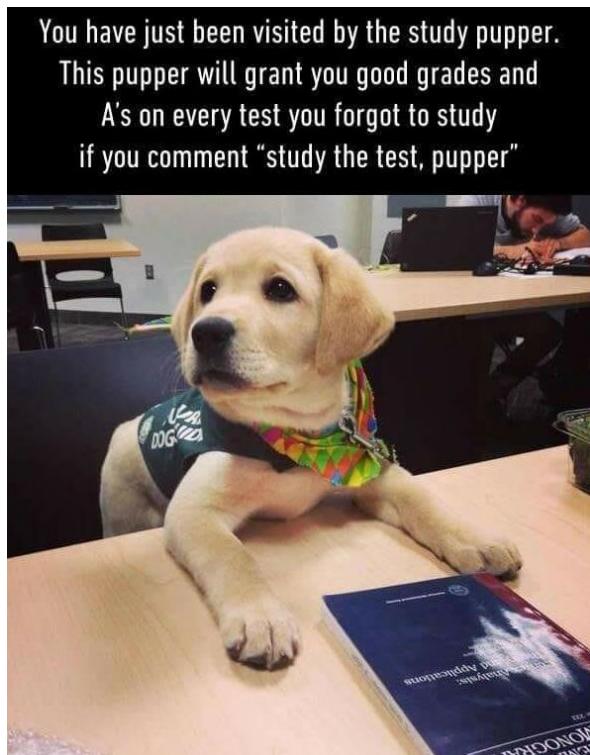
Traditional Teaching Method



Peer Instruction – Full Picture



Why Peer Instruction?



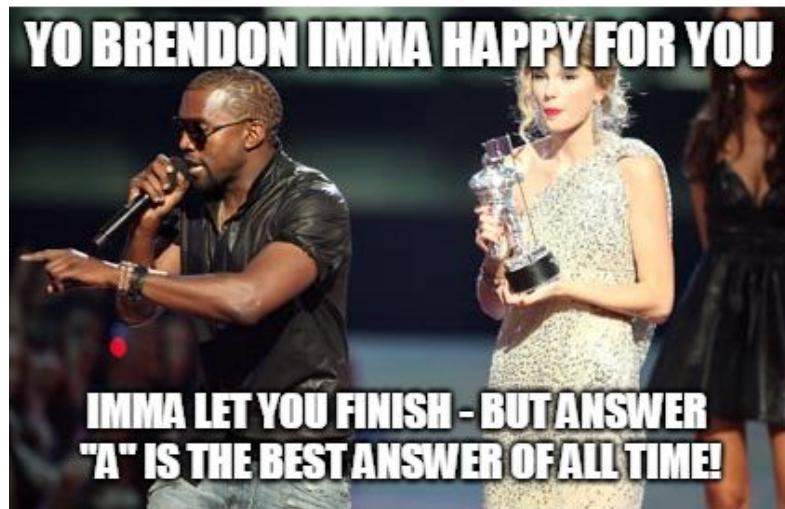
- Learn/practice hard concepts in class
- Build and test one's understanding in a supportive environment.
- Develop critical thinking, communication and reflection skills.
- Engage students to take ownership of their learning.

Things are different...

- Pre-lecture activities are crucial.
 - Your lecture experience will depend on your preparation.
- Attending lectures is very important
- Our lecture slides are NOT your notes!
 - Create your own notes during pre-lecture reading.
 - Annotate difficult concepts, revisit the annotation after lecture/tutorials.
 - It is better not to take notes during lecture. You should be prepared before the lecture, then **think, discuss and ask questions** during lectures.
 - After all, if you're not prepared, you can't attempt the quiz (in future)

Discussion Questions – Scenario

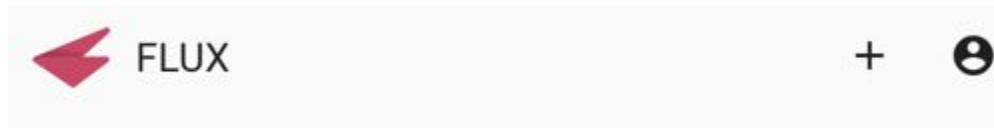
- Lecturer shows a question.
- Student answers using the response system.
- If uncertainty arises...
 - Group discussion (2-3 students) – need to get a consensus.
 - Class wide discussion.



Why The Scenario?

- Pose carefully designed question
- First: Think for yourself and select answer
 - Checks your understanding and create an opinion to base your discussion during the group discussion, if needed.
- If needed (e.g. tough question)
 - Discuss: Analyze problem in teams of 2-3 → Practice analyzing, talking about challenging concepts → Reach consensus
 - Group vote: Everyone in group votes → You must all vote the same → Convince your group or get convinced by your group.
 - Class wide discussion.

Using FLUX



- Visit <https://flux.qa> presenter/dashboard on your Internet-enabled device
- Log in using your Authcate details
- Touch the + symbol
- Enter the code for your lecture.
- Answer questions when they pop up.

These slides with the blue background are Clayton FLUX slides!

[Q1] Clayton students: Which of the following ways are best for discussing a special consideration case - e.g. prolonged illness - in the unit?

- a. Moodle forums
- b. Email Brendon.Taylor at monash.edu
- c. Email Peter.Huynh at monash.edu
- d. Contact Donald Trump
- e. Email FIT2094-FIT3171.AllCampuses-x@monash.edu
- f. Special consideration automatically granted (none of the above)

These slides with the blue background are Clayton FLUX slides!

[Q2] Clayton students: Which student(s) will NOT be guilty for plagiarism and/or collusion?

- a. Snoop Lion copies SQL code from StackOverflow for a weekly tute.
- b. Kanye West finishes one question in the assignment together with Kim Kardashian.
- c. Jack Nicholson answers the quiz for Leo DiCaprio in exchange for a beer and 50 dollars.
- d. Dilbert accidentally pasted some SQL code for the assignment on the forums. Garfield pastes this code into his own assignment - and it worked!
- e. All of the students above are GUILTY.

These slides with the blue background are Clayton FLUX slides!

[Q3] Clayton students: Do I have to attend my assigned tutorial class, or can I go to any class?

- a. As long as you go to at least one tutorial class a week, it doesn't matter.
- b. You must attend your assigned tutorial class.
- c. Work commitments is a reasonable reason to go to an alternative tutorial class.
- d. If I have a timetable clash, it's okay to attend another class.

These slides with the blue background are Clayton FLUX slides!

[Q4] Clayton students: Which database management systems are you most familiar with?

- a. Oracle
- b. MySQL
- c. MS Access
- d. SQL Server
- e. Other DBMS
- f. I am not familiar with any DataBase Management Systems.

Is it bad to get it **WRONG? NO!**

Lindsay's anecdote:

"It is better to be **WRONG and understand why you are **WRONG**, rather than, getting the **RIGHT** answer but **NOT** knowing **WHY** it is the **RIGHT** answer!"**

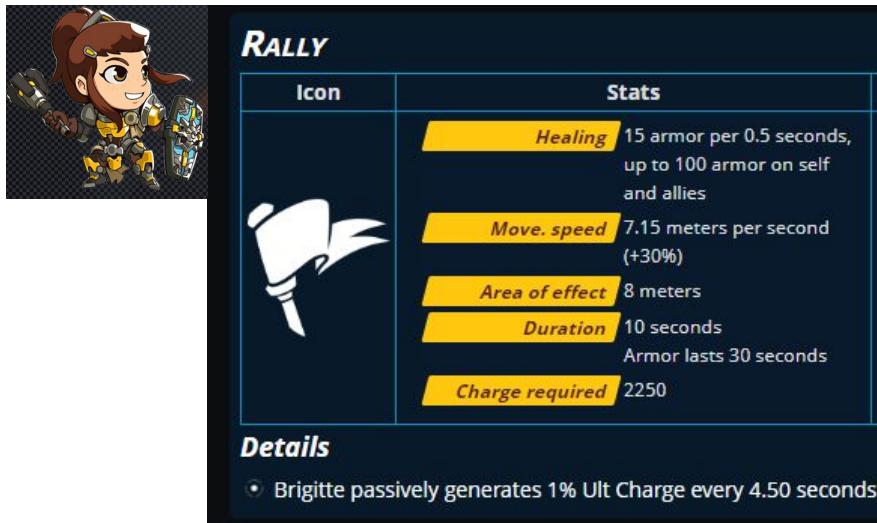
[Marc's anecdote]

Marc's anecdote: “Better get it wrong now and learn from it, rather to get it wrong in the exam and fail it”.

Do your best, even if you get it wrong now...
...as long as you learn!

vs

Get it wrong in the exam...



The image shows the skill card for Brigitte's ability, RALLY. It features her character icon on the left, followed by the ability name "RALLY". The card is divided into two main sections: "Icon" and "Stats". The "Icon" section shows a white megaphone icon. The "Stats" section contains five entries: "Healing" (15 armor per 0.5 seconds, up to 100 armor on self and allies), "Move. speed" (7.15 meters per second (+30%)), "Area of effect" (8 meters), "Duration" (10 seconds, Armor lasts 30 seconds), and "Charge required" (2250). Below the stats, under the heading "Details", is a bullet point stating: "Brigitte passively generates 1% Ult Charge every 4.50 seconds."





Coffee break - see you in 10 minutes.

Overview (Hour 2)

- An overview of relational database management systems (RDBMS)

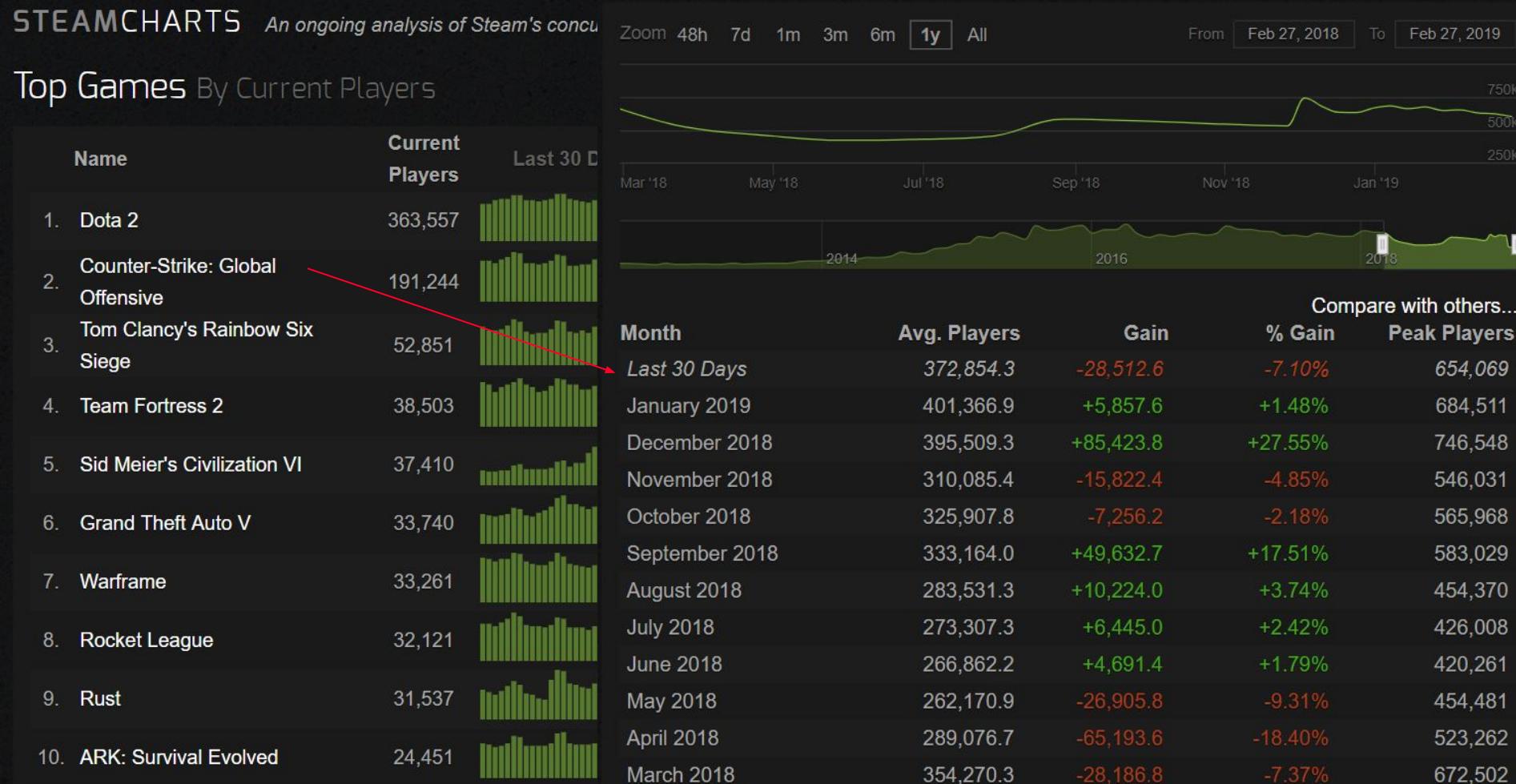
[Marc's Anecdote]

The screenshot shows a Salesforce application interface. At the top, there is a navigation bar with icons for a cloud, 'Lemonade', and various menu items: 'Drink Orders', 'Reports', 'Battle Stations', 'Resources', and 'Supplies'. Below this, a specific record is displayed: 'Drink Order D-0003' for a 'Lemonade Basic' flavor, size 'Large', and price '\$5.00'. The record was created by 'Marc Cheong' on '30/09/2018 4:03 PM'. A modal window is open over the main content, titled 'Salesforce Salaries in the United States'. It provides information that 'Salesforce.com, Inc. is an American cloud-based software company headquartered in San Francisco, California.' It includes a link to 'Wikipedia' and a search bar. The modal also displays a section titled 'Popular Jobs' with five entries, each showing a job title, the number of salaries reported, the average salary per year, and a salary distribution chart. The jobs listed are: Software Engineer (\$126,834), Senior Software Engineer (\$130,381), Senior Member of Technical Staff (\$135,345), Commercial Sales Executive (\$172,811), and Principal Software Engineer (\$142,208).

Job Title	Average Salary	Salaries Reported	Salary Distribution Range
Software Engineer	\$126,834 per year	262 salaries reported	\$65,000 to \$201,000
Senior Software Engineer	\$130,381 per year	130 salaries reported	\$65,000 to \$201,000
Senior Member of Technical Staff	\$135,345 per year	41 salaries reported	\$65,000 to \$201,000
Commercial Sales Executive	\$172,811 per year	12 salaries reported	\$25,000 to \$227,000
Principal Software Engineer	\$142,208 per year	14 salaries reported	\$65,000 to \$201,000

Img src: Salesforce / Google Info Box / Indeed.com

[Brendon's Anecdote]



Let's travel back to 1960s

- Relational databases do not exist yet
- Let's create a database to record the information on Monash students
 - What kind of approaches do we have?
 - What kinds of problems are involved?

What is a database?

database

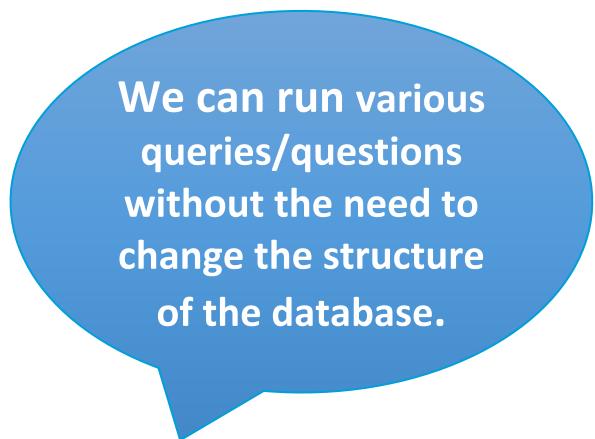
/'dætəbeɪs/ 

noun

plural noun: databases



How do we
structure our data?

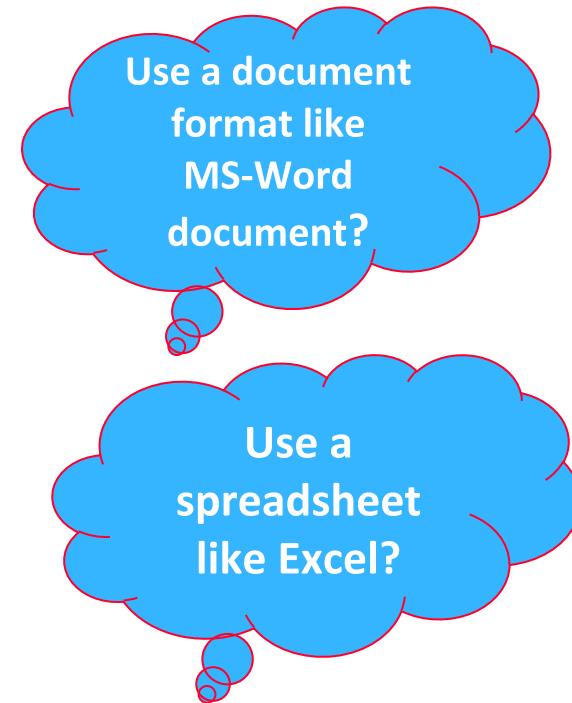


We can run various
queries/questions
without the need to
change the structure
of the database.

a structured set of data held in a computer, especially one that is accessible in various ways.

"a database covering nine million workers"

How do we structure our data?



- How easy is it to answer a number of queries?
- What kind of guarantee do we have from the systems on data integrity after a modification
 - (eg deletion, update or insertion of one or more records to the system?)

Data Redundancy – a student data spreadsheet

STU_NBR	STU_LNAME	STU_FNAME	STU_DOB	UNIT_CODE	UNIT_NAME	ENROL_YEAF	ENROL_SEM	MARK	GRADE
11111111	Bloggs	Fred	1-Jan-90	FIT1002	Computer Pr	2013	1	66	C
11111111	Bloggs	Fred	1-Jan-90	FIT1004	Database	2013	1	80	HD
11111112	Nice	Nick	10-Oct-94	FIT1001	Computer Sy	2013	1	80	HD
11111112	Nice	Nick	10-Oct-94	FIT1001	Computer Sy	2012	1	35	N
11111114	Sheen	Cindy	25-Dec-96	FIT1001	Computer Sy	2012	1	78	D
11111114	Sheen	Cindy	25-Dec-96	FIT1004	Database	2013	1	60	C
11111113	Wheat	Wendy	5-May-90	FIT1001	Computer Sy	2012	2	65	C
11111113	Wheat	Wendy	5-May-90	FIT1004	Database	2013	1	78	D

What would happen if we delete Fred's enrolment in FIT1002? What happens to the details of FIT1002 information such as its name?

How would you update the mark for Cindy's enrolment in FIT1001? (Imagine the spreadsheet contains thousands of students and each student has 12 enrolment entries).

How would you introduce a new unit, eg FIT2133 Programming in Python into the spreadsheet when no student is enrolled to the unit yet?

Why do we have so many problems in the previous example?

- The structure of the data causes some data management problems or data anomalies.
- The software was not designed to deal with the type of reporting required.

How do we solve it?

STU_NBR	STU_LNAME	STU_FNAME	STU_DOB
11111111	Bloggs	Fred	01/JAN/90
11111112	Nice	Nick	10/OCT/94
11111113	Wheat	Wendy	05/MAY/90
11111114	Sheen	Cindy	25/DEC/96

UNIT_CODE	UNIT_NAME
FIT1002	Computer Programming
FIT1001	Computer Systems
FIT1004	Database

STU_NBR	UNIT_CODE	ENROL_YEAR	ENROL_SEMESTER	MARK	GRADE
11111114	FIT1001	2012	1	78	D
11111111	FIT1002	2013	1	60	C
11111111	FIT1004	2013	1	80	HD
11111112	FIT1001	2012	1	35	N
11111112	FIT1001	2013	1	80	HD
11111113	FIT1001	2012	2	65	C
11111113	FIT1004	2013	1	78	D
11111114	FIT1004	2013	1	60	C

- Keep details of student, unit and enrolment separately, BUT keep the **relationships** among them in the system.

Relational Model
Relational Database
Relational Database
Management systems

DATABASE

STU_NBR	STU_LNAME	STU_FNAME	STU_DOB
11111111	Bloggs	Fred	01/JAN/90
11111112	Nice	Nick	10/OCT/94
11111113	Wheat	Wendy	05/MAY/90
11111114	Sheen	Cindy	25/DEC/96

UNIT_CODE	UNIT_NAME
FIT1002	Computer Programming
FIT1001	Computer Systems
FIT1004	Database

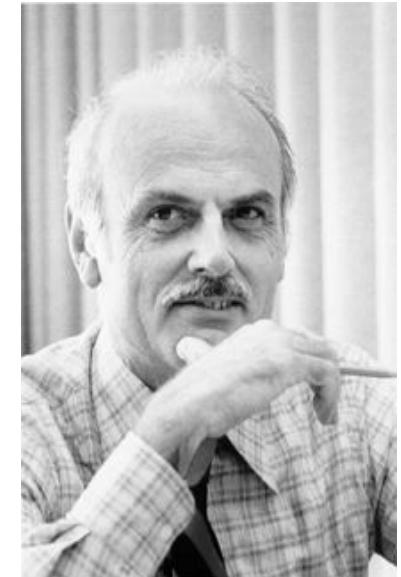
STU_NBR	UNIT_CODE	ENROL_YEAR	ENROL_SEMESTER	MARK	GRADE
11111114	FIT1001	2012	1	78	D
11111111	FIT1002	2013	1	60	C
11111111	FIT1004	2013	1	80	HD
11111112	FIT1001	2012	1	35	N
11111112	FIT1001	2013	1	80	HD
11111113	FIT1001	2012	2	65	C
11111113	FIT1004	2013	1	78	D
11111114	FIT1004	2013	1	60	C

Entities/Tables

A collection of
tables and
their
relationships is
a DATABASE

1970: Relational model

- An IBM scientist
- Proposed and developed the relational model
- Also proposed normalisation forms
- Resistance from IBM to implement his model
- Turing award (1981)



E.F. Codd
(1923-2003)

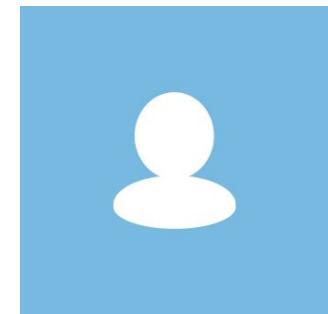
- Relational model in week 2
- Normalisation in week 5
- E. F. Codd, “[A Relational Model of Data for Large Shared Data Banks](#)”, *Comm. Of ACM*, 1970

1974: SQL

- Developed at IBM
- Initially called SEQUEL (Structured English QUERy Language)
- Doesn't strictly follow Codd's theory
- Oracle: the first commercially available implementation of SQL in 1979
- SQL in weeks 7, 8, 9 & 10
- D Chamberlin, R Boyce, “[SEQUEL: A structured English query language](#)”, *ACM SIGFIDET*, 1974



Donald Chamberlin (1944-)



Raymond Boyce
(unknown - 1974)

1976: Conceptual model

- Proposed Entity-Relationship Model (ER diagram)
- A systematic process to design a relational database
- Database design process in week 3 & 4
- Peter Chen, “The entity-relationship model—toward a unified view of data”, *ACM TODS*, 1976



Peter Chen (1947 -)

1979: Oracle

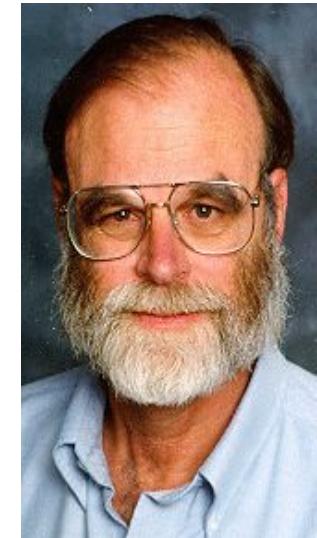
- Inspired by Codd's ideas
 - First commercial release in 1979
 - Most popular RDBMS
 - Introduced PL/SQL in 1988
(Procedural Language/SQL)
-
- Oracle SQL in week 7, 8, 9 & 10



Larry Ellison (1944 -)

1981: Transactions management

- Introduced transaction management
- Turing award (1998)
- Presumed lost at sea in 2007
- Transaction management in week 8
- Jim Gray, “[The Transaction Concept: Virtues and Limitations](#)”, *VLDB*, 1981



Jim Gray (1944 -)

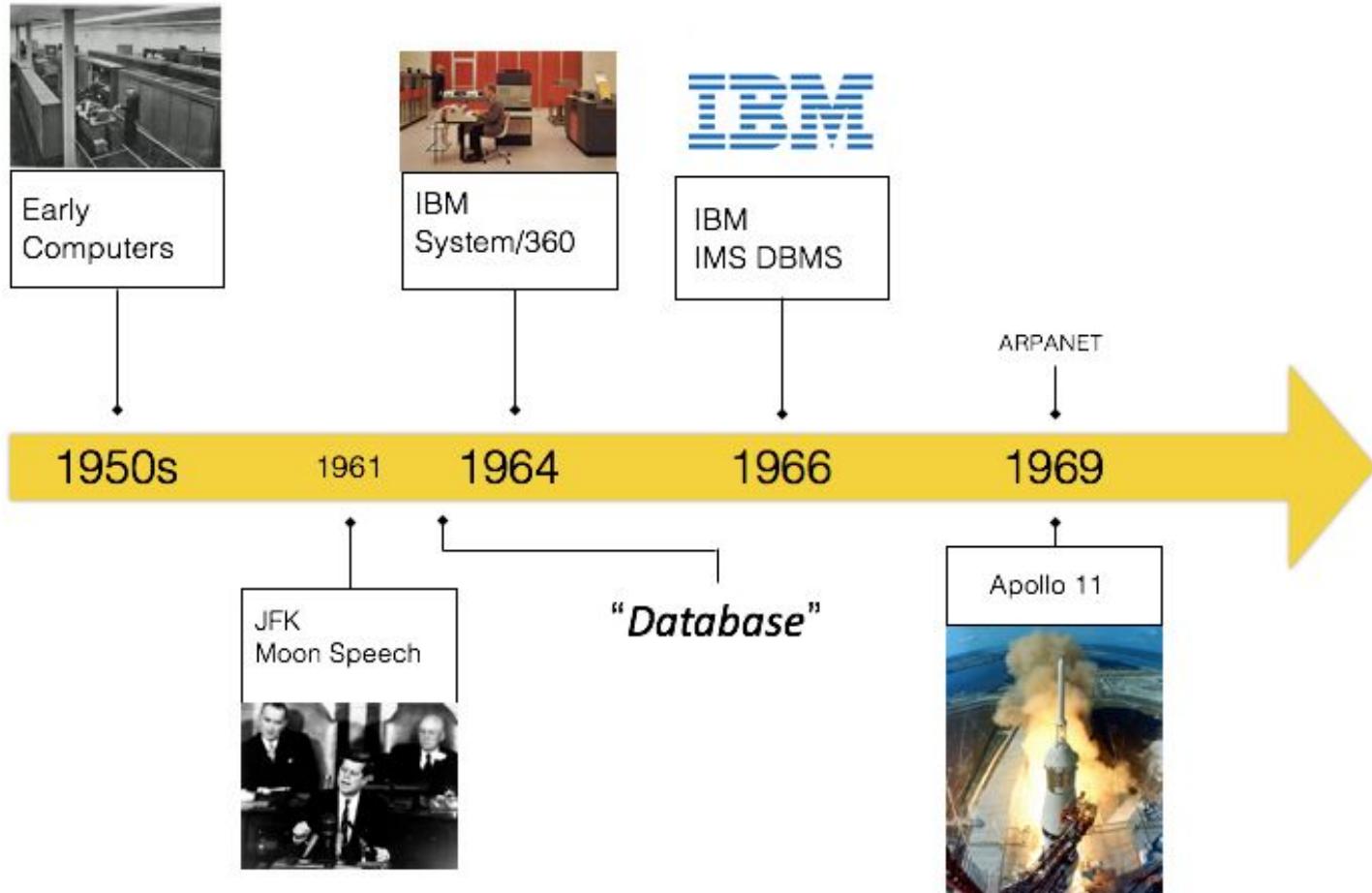
Data Management Today

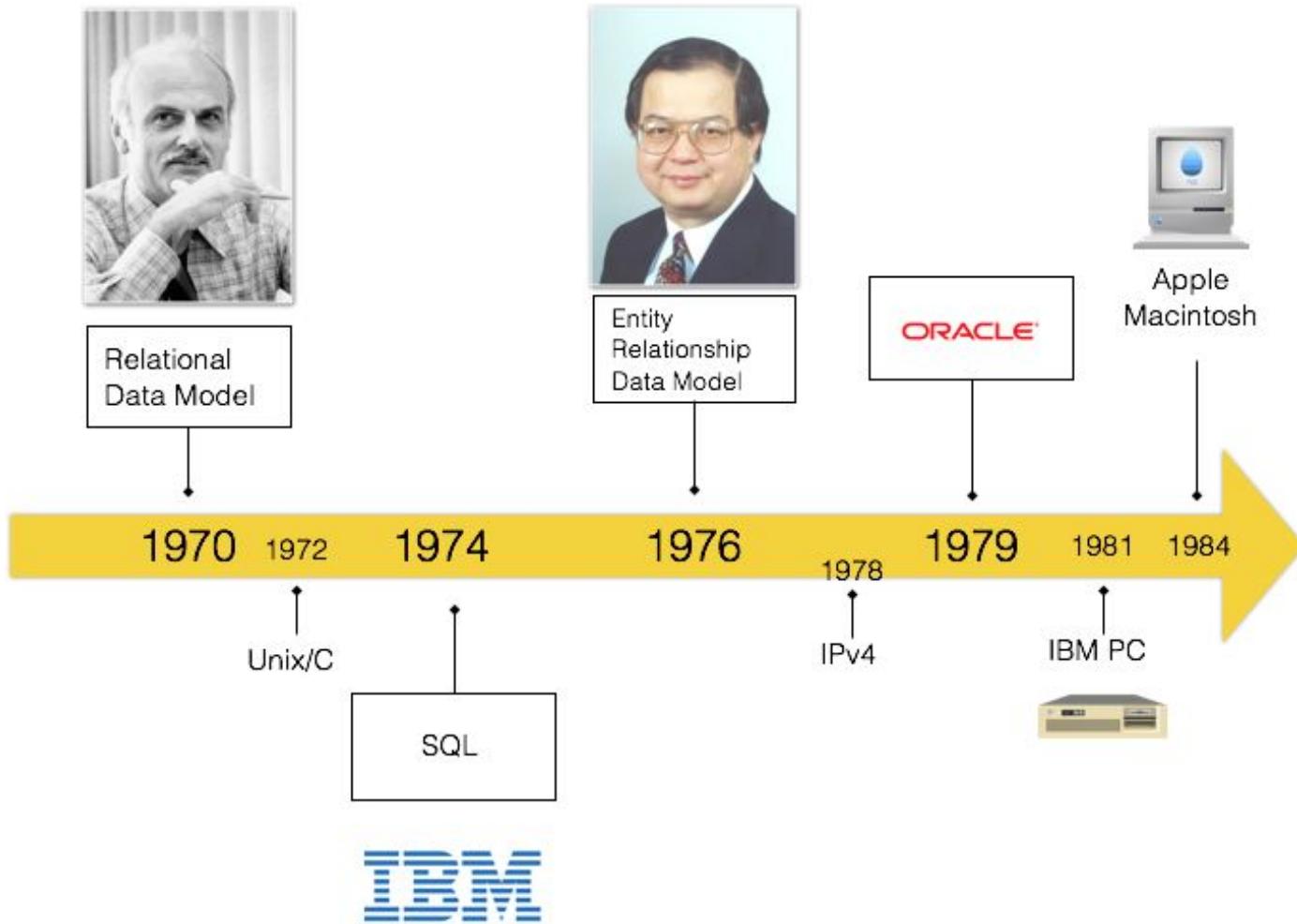
- Relational databases are still very popular. But ...
 - Social Networks (Facebook, Twitter, Foursquare etc.)
 - Multimedia data (YouTube, Pinterest, Facebook etc.)
 - Data streams (Twitter, computer networks)
 - Spatial data (Road networks, Google Earth, Space etc.)
 - Textual data
 - Web data
 - Big Data
 - ...

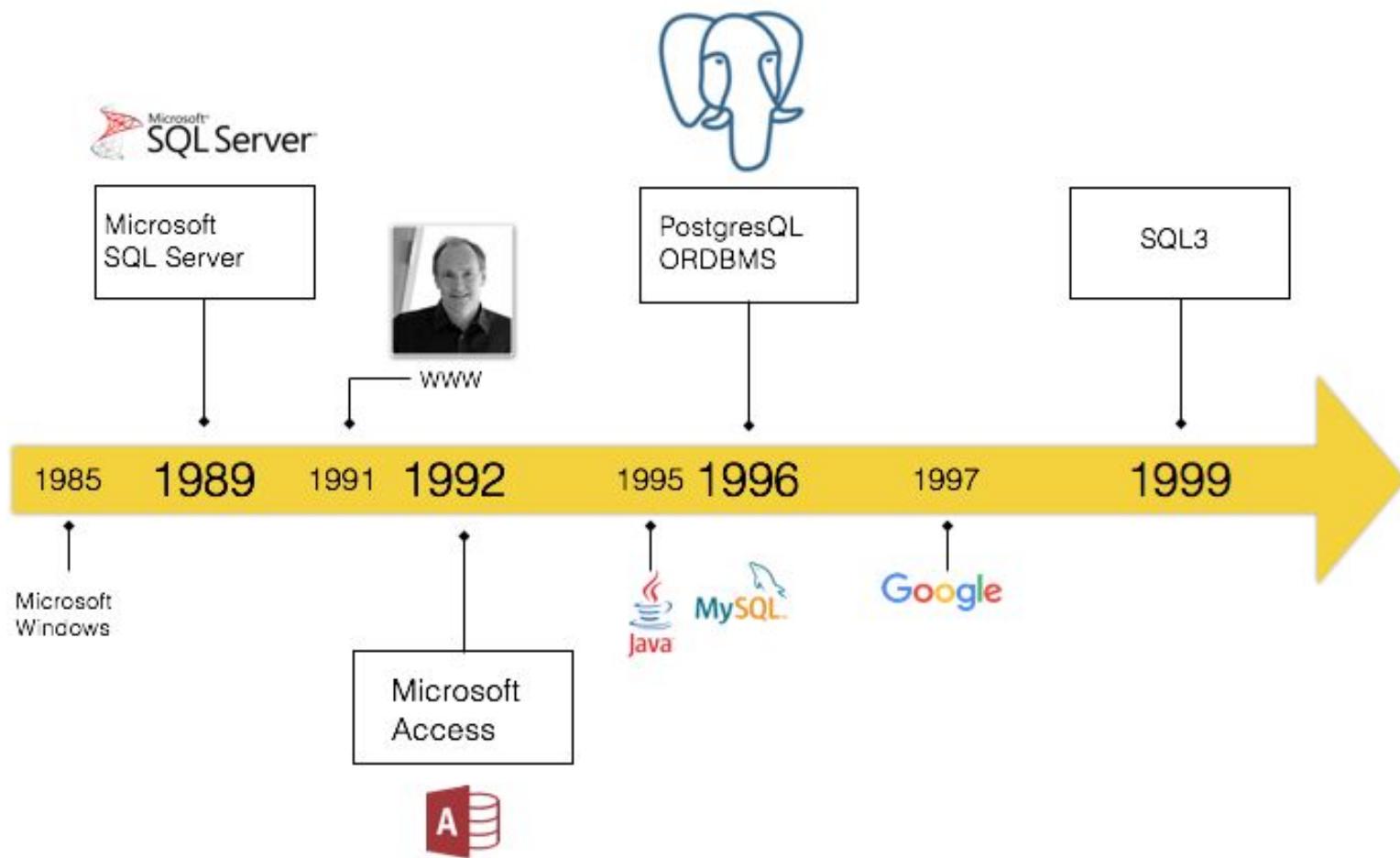


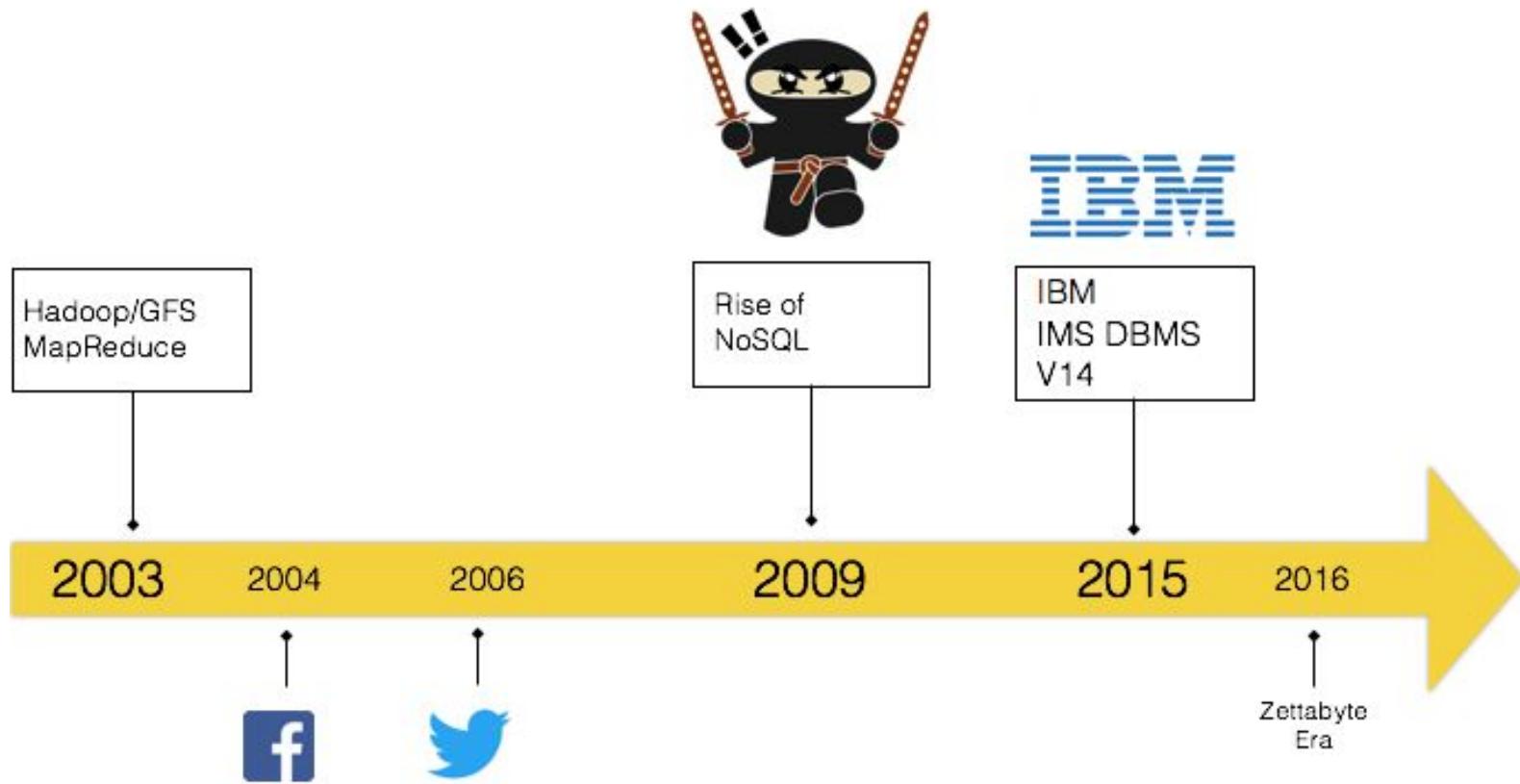
<https://goo.gl/zMxG3b>

In Perspective ...







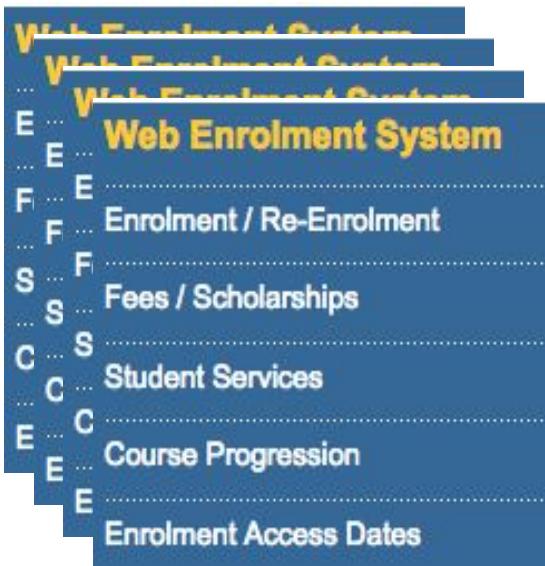


RANK	DBMS	TYPE	INTRODUCED
1	 ORACLE®	Commercial, Relational DBMS	1979
2	 MySQL™	Open source, Relational DBMS	1995
3	 Microsoft® SQL Server®	Commercial, Relational DBMS	1989
4	 PostgreSQL	Open source, Relational DBMS	1996
5	 mongoDB	Open Source, Nosql - Document Store	2009
6	 IBM DB2	Commercial, Relational DBMS	1983

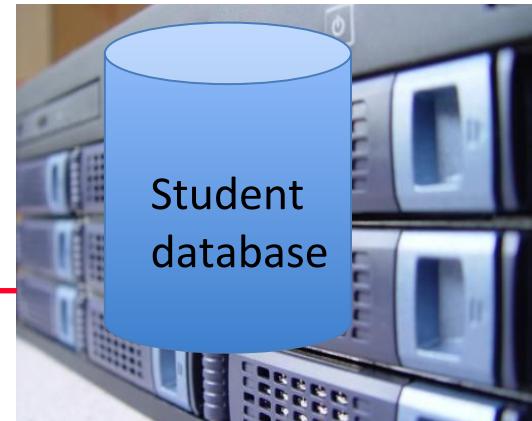
350 systems in ranking, July 2019

Rank			DBMS	Database Model	Score		
Jul 2019	Jun 2019	Jul 2018			Jul 2019	Jun 2019	Jul 2018
1.	1.	1.	Oracle 	Relational, Multi-model 	1321.26	+22.04	+43.47
2.	2.	2.	MySQL 	Relational, Multi-model 	1229.52	+5.89	+33.45
3.	3.	3.	Microsoft SQL Server 	Relational, Multi-model 	1090.83	+3.07	+37.42
4.	4.	4.	PostgreSQL 	Relational, Multi-model 	483.28	+6.65	+77.47
5.	5.	5.	MongoDB 	Document	409.93	+6.03	+59.60
6.	6.	6.	IBM Db2 	Relational, Multi-model 	174.14	+1.94	-12.06
7.	7.	↑ 8.	Elasticsearch 	Search engine, Multi-model 	148.81	-0.01	+12.59
8.	8.	↓ 7.	Redis 	Key-value, Multi-model 	144.26	-1.86	+4.35
9.	9.	9.	Microsoft Access	Relational	137.31	-3.70	+4.73
10.	10.	10.	Cassandra 	Wide column	127.00	+1.82	+5.95
11.	11.	11.	SQLite 	Relational	124.63	-0.26	+9.35
12.	↑ 13.	↑ 13.	Splunk	Search engine	85.49	+0.87	+16.25
13.	↓ 12.	↑ 14.	MariaDB 	Relational, Multi-model 	84.44	-0.76	+16.92
14.	14.	↑ 18.	Hive 	Relational	80.87	+1.82	+23.25
15.	15.	↓ 12.	Teradata 	Relational, Multi-model 	77.83	+1.18	-0.40
16.	16.	16.	Solr	Search engine	59.64	-0.84	-1.88
17.	↑ 18.	↑ 19.	FileMaker	Relational	57.90	+0.10	+1.51
18.	↓ 17.	↓ 17.	HBase	Wide column	57.54	-0.50	-3.24
19.	↑ 21.	↓ 15.	SAP Adaptive Server	Relational	56.65	+1.54	-5.47
20.	20.	↑ 21.	Amazon DynamoDB 	Multi-model 	56.42	+1.16	+6.79

Relational database systems in action: End-users' view



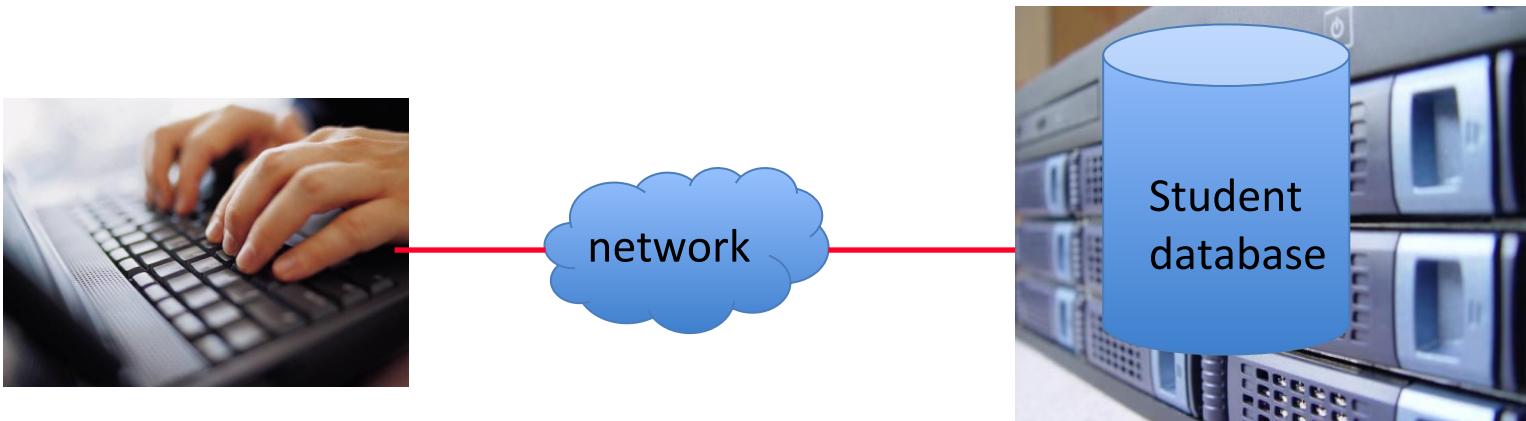
Front end application
(client)



Student Database is
implemented in an
Oracle DBMS
(server)

Database Systems in Action

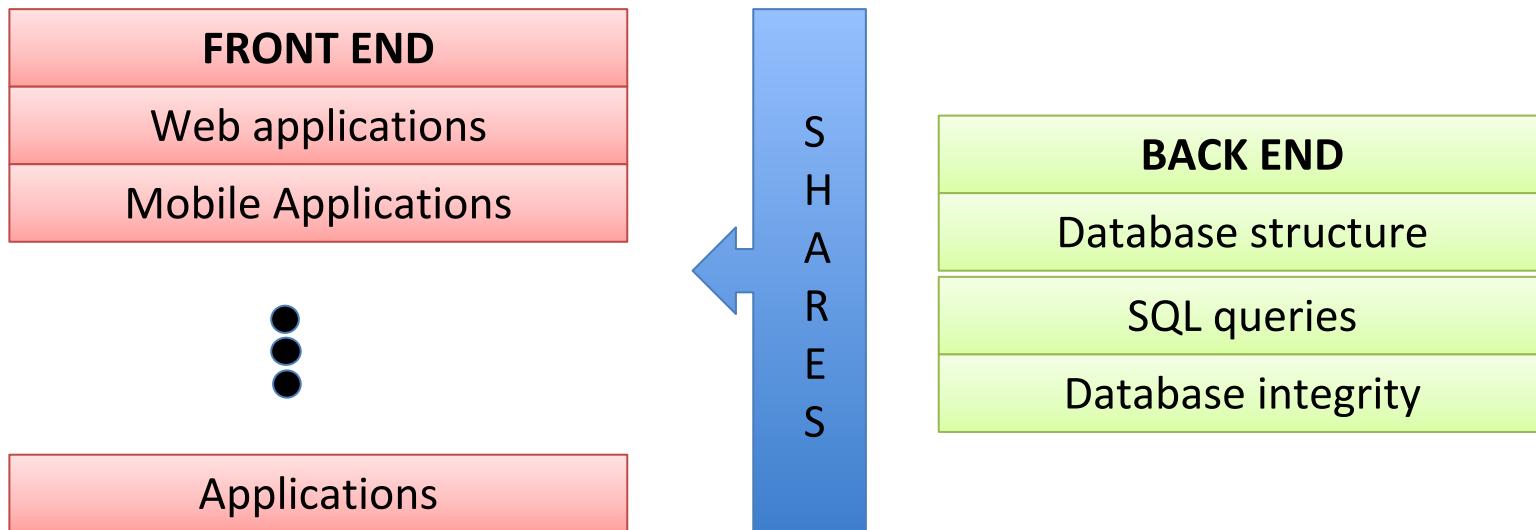
Developers' View



Development environment (client, eg
SQL Developer, Integrated
Development Environment for web
scripting)

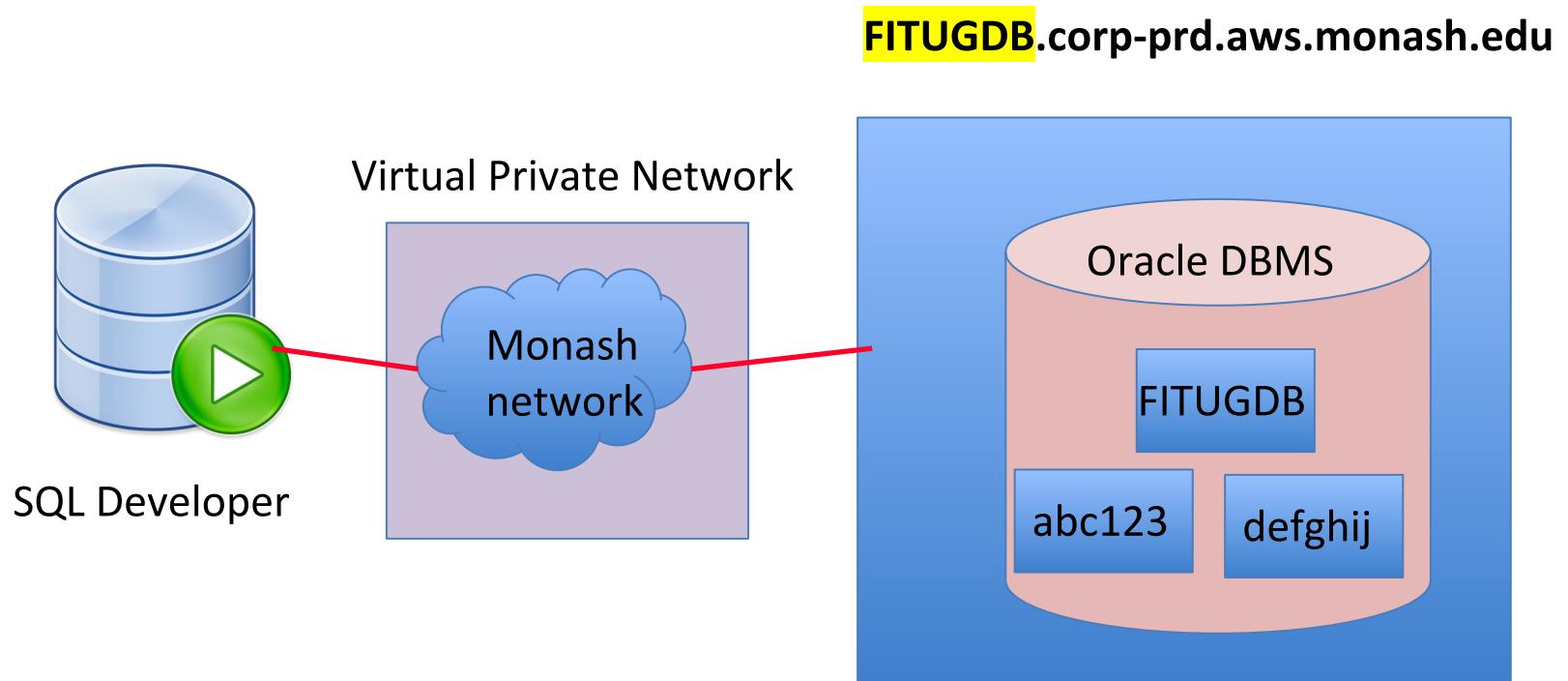
Student Database
(server)

Developing Application with Database

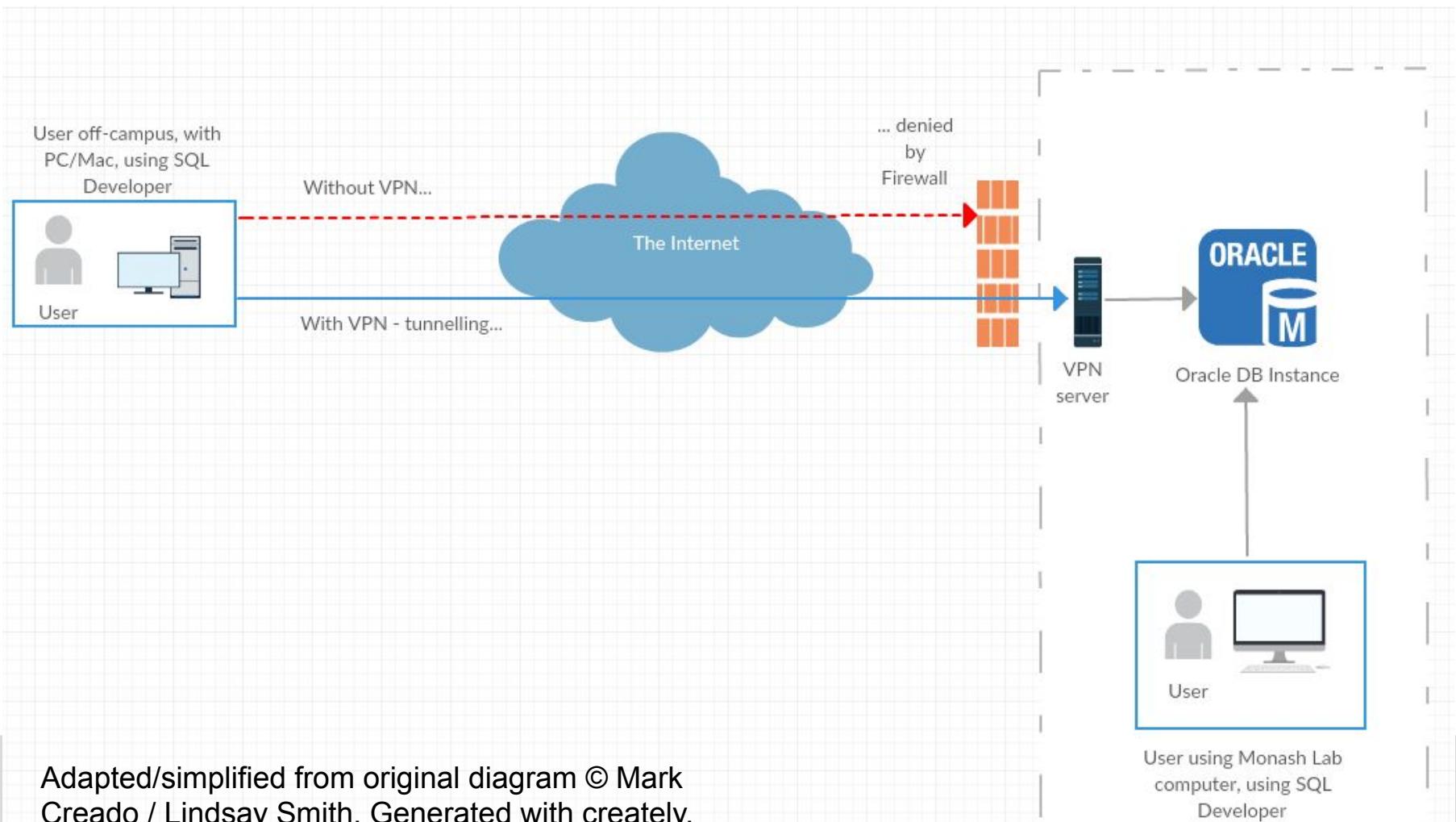


In this unit, we will concentrate on building the back end.
Database Designer.

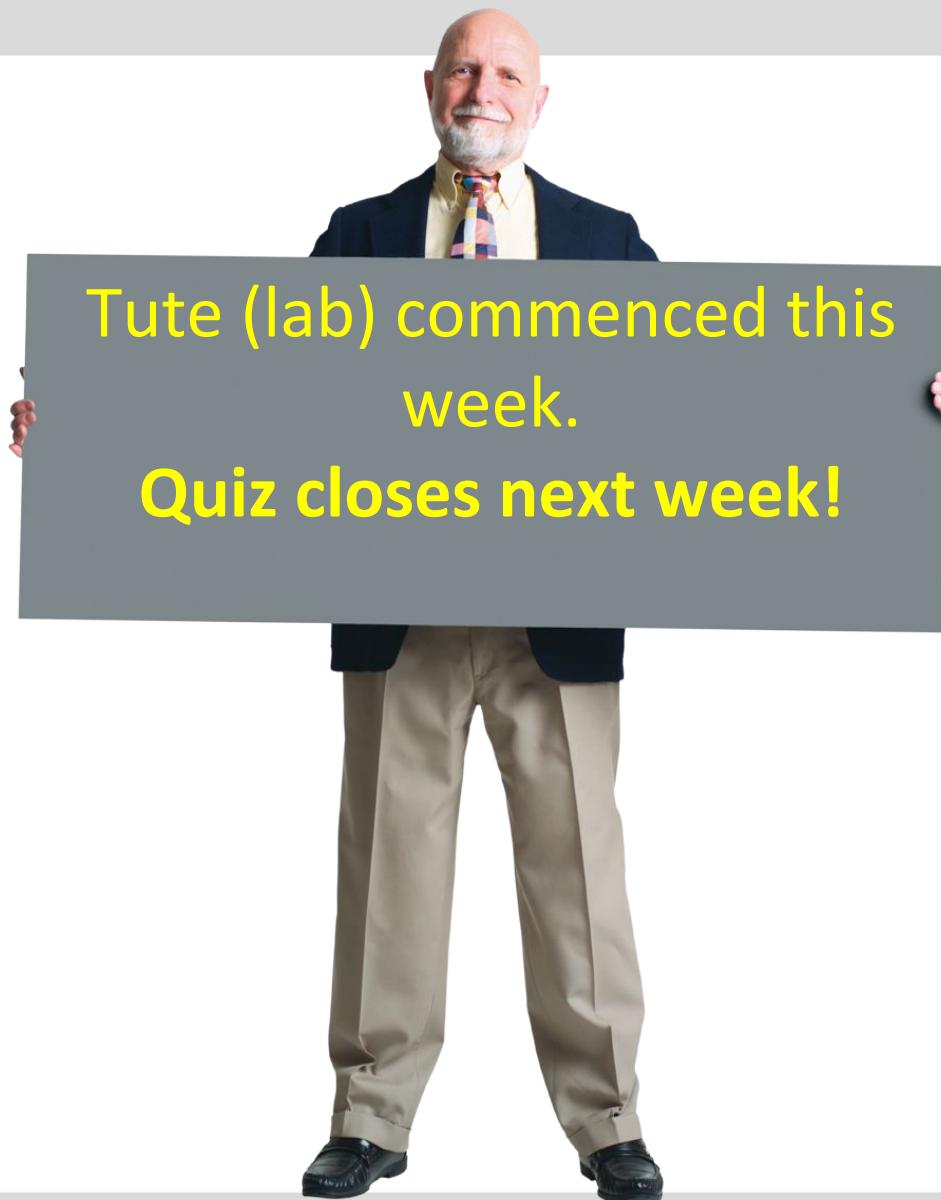
Our Database Systems Environment



Our Database Systems Environment - VPN usage



Adapted/simplified from original diagram © Mark Creado / Lindsay Smith. Generated with createley.



Tute (lab) commenced this
week.
Quiz closes next week!