

Faculty of Computer Science, Dalhousie University

9-Jan-2025

DGIN 5201 — Digital Transformation

Lecture 2: Building a Front End

Location: LSC C236 Instructor: Vlado Keselj and FE. Bordeleau
Time: 13:05–14:25

Previous Lecture

- Course Information
- Digital Transformation — One View
- Why two instructors
- Learning outcomes
- Delivery, topics, evaluation, policies
- Overview of the Business part
- Overview of the Computer Science part

Technical Foundations

- Two main foundations of Digital Innovation:
 - Computer as a general computing and information processing device
 - Internet as a general communication infrastructure
- Computer as foundation
 - File system, processes, users
 - Operating system, shell (bash)
 - Programs, utilities, commands, applications
- Internet and communication

The Evolution of the Internet: 1961–The present

- Early Innovation Phase, 1961–1974
 - Creation of fundamental building blocks
 - 1973–74: TCP/IP
- Institutionalization Phase, 1975–1994
 - Large institutions provide funding and legitimization
 - 1986, beside ARPANET, NSFNET began (civilian Internet)
- Commercialization Phase, 1995–present
 - Private corporations take over, expand Internet backbone and local service

More Detailed History of Internet and Web

Early Innovation Phase

1961 — Leonard Kleinrock (MIT) publishes a paper on packet switching networks.

1971 — E-mail is invented by Ray Tomlinson (BBN). Larry Roberts writes the first e-mail utility program.

1973 — Bob Metcalfe (XeroxPark Labs) invents Ethernet and local area networks; client/server computing invented

1974 — “Open architecture” networking and TCP/IP concepts presented in a paper by Vint Cerf (Stanford) and Bob Kahn (BBN).

1980 — TCP/IP officially adopted by DoD; Personal computers invented

Institutionalization Phase

1984 — DNS (Domain Name System) was introduced.

1989 — Tim Berners-Lee (CERN, Switzerland) proposes World Wide Web (HTML and HTTP).

1990 — Internet becomes available to wider public, ARPANET transforms to NSFNET.

1993 — Mosaic, the first graphical Web browser implemented by Mark Andreessen and others (National Center for Supercomputing at the University of Illinois).

Commercialization Phase

1995 — Commercial Internet born: commercialization of the US backbone, Network Solutions takes over domain registration.

1995 — Amazon founded by Jeff Bezos; AuctionWeb (eBay) by Pierre Omidyar.

1998 — Google founded by Larry Page and Sergey Brin.

2004 — Facebook founded by Mark Zuckerberg, Eduardo Severin, Dustin Moskovitz, and Chris Hughes.

2009 — Internet-enabled smartphones become a major extension.

Summary

- This was an overview of the Technical (CS) Part
- We will now take another look at a course calendar overview
- and start the unit on Rapid Prototyping

Course Calendar Overview

2025	Mo	Tu	We	Th	Fr	Sa	Su	
Jan	.6	7	8	9	10	11	12	(w1) Intro
	13	14	15	16	17	18	19	(w2) Rapid Prototyping
	20	21	22	23	24	25	26	(w3)
Feb	27	28	29	30	31	1	2	(w4) Disruptive Innovation
	3	4	5	6	7	8	9	(w5)
	10	11	12	13	14	15	16	(w6)
	17	18	19	20	21	22	23	(study break)
Mar	24	25	26	27	28	1	2	(w7) Emerging topic 1
	3	4	5	6	7	8	9	(w8) Emerging topic 2
	10	11	12	13	14	15	16	(w9) Emerging topic 3
	17	18	19	20	21	22	23	(w10) Emerging topic 4
	24	25	26	27	28	29	30	(w11) Reserved
Apr	31	1	2	3	4	5	6	(w12) Final Presentations
	.7	8	9	10	11	12	13	Report and code

Deliverables and Project Calendar Overview

2025	Mo	Tu	We	Th	Fr	Sa	Su	
Jan	.6	7	8	9	10	11	12	(w1) Intro
	13	14	15	16	17	18	19	(w2) Rapid Prototyping
	20	21	22	23	24	25	26	(w3)
Feb	27	28	29	30	31	1	2	(w4) Disruptive Innovation
	3	4	5	6	7	8	9	(w5) Assignment 1 due
	10	11	12	13	14	15	16	(w6)
	17	18	19	20	21	22	23	(study break)
Mar	24	25	26	27	28	1	2	(w7) Assignment 2 due, prj.spec
	3	4	5	6	7	8	9	(w8) Seminar report 1

	10	11	12	13	14	15	16	(w9)	Sem.report 2, early proto.
	17	18	19	20	21	22	23	(w10)	Sem.report 3
	24	25	26	27	28	29	30	(w11)	Sem.report 4, prj.demo
Apr	31	1	2	3	4	5	6	(w12)	Final Presentations
	.7	8	9	10	11	12	13		Report and code

Part I

Implementing a Solution

2 Unit Overview

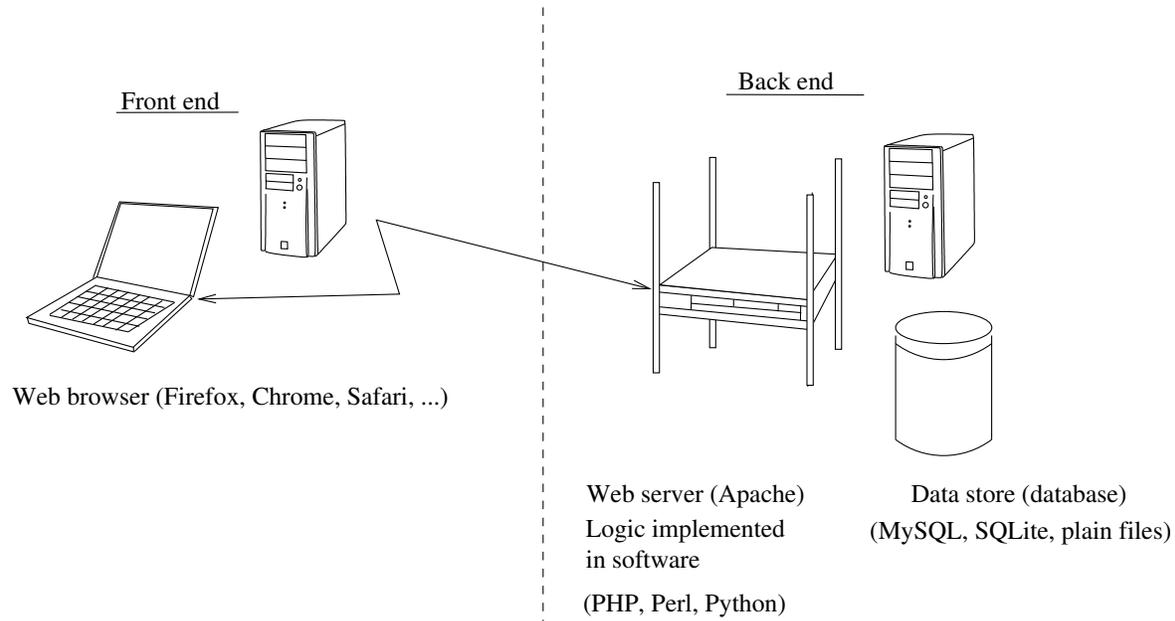
Unit Description

- Implementing a solution: Rapid prototyping
- Review of programming and Web fundamentals
- Hands-on exercises in fundamental technology
- Elements of building a three-tier system
- Techniques for rapid prototype building

Building MVP Example

- How to build an MVP (Minimal Viable Product) in a short time?
 - useful in the Rapid Prototyping model of development
- Course project requires a Three-Tier Architecture
- Three-Tier Architecture:
 1. User interface
 2. Control logic
 3. Data store

Three Tier Architecture



Three-Tier Architecture

Features of Three-Tier Architecture

- Front-end
 - HTML and CSS in a simple form
 - Improvements: JavaScript, AJAX; jQuery, and JS frameworks
- Back-end, logic tier
 - Scripting languages (PHP, Perl, Python, Ruby, etc.)
 - Straightforward: Apache and CGI
 - Improvements: Web frameworks such as Flask, Django, Mojolicious
- Back-end, data store tier
 - Straightforward: plain files, MySQL, SQLite
 - More: MongoDB, Redis, other database systems

Our Approach in this Unit

- Work on hands-on exercises
- Covering concepts and theory
- Exercises aimed at `timberlea` server
- Use your CSID and password
- Use of web site: <https://web.cs.dal.ca/~YourCSID>

Some Background Items

- Check your CSID and password, helpful site: <https://csid.cs.dal.ca/>
- Helpful if you have experience in `ssh` login to `timberlea.cs.dal.ca`

- Mac or Linux: `ssh` can be used from terminal
- Windows: PuTTY can be used
- PuTTY can be installed from <https://www.putty.org/>

Baseline Implementation

- Assume diverse background knowledge and levels
- Baseline Implementation:
 - login to `timberlea.cs.dal.ca` using CSID
 - work with a shell; e.g., `bash`, basic Unix commands
 - use of a plain-text editor: `emacs`, `vi`, `vscode`, or similar
 - use of HTML, scripting languages, JavaScript, CSS
 - plain files for persistent data, database
- Make sure to be familiar with your CSID: <https://csid.cs.dal.ca/>
- Use `ssh` or PuTTY to login to `timberlea.cs.dal.ca`

3 Hands-on e1: Web Site, Shell, Permissions

Using `timberlea` Server

- `ssh` login into `timberlea.cs.dal.ca`
- Windows: you can use the program PuTTY
 - other options available; e.g., MobaXterm
- On Mac: open a Terminal and type:


```
ssh <your_csid>@timberlea.cs.dal.ca
```

where instead of `<your_csid>` you should use your own CSID
- On Linux: similarly to Mac, you open the terminal and type the same command:

```
ssh <your_csid>@timberlea.cs.dal.ca
```

You can now try to login to the `timberlea` server provided by the Dal FCS computing environment. Your own computer may be a Windows machine, a Mac, or a Linux. You need to use the `ssh` secure protocol to login to `timberlea` and on each of these environment you may need a different application to login.

On Windows: If you use a Windows environment, you can use a well-known open-source and free program named PuTTY to login. This will be explained in the next step. If you do not have the PuTTY program, you can install it from the Internet.

To download PuTTY from Internet, you can search it using Google. However, you should not download just any copy of it for security reasons. The official site of PuTTY is:

<http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html>

PuTTY is a free implementation of Telnet and SSH for Windows and Unix, along with an `xterm` terminal emulator.

On Mac: In Mac OS environment, you can click on the search image in the upper right corner and type 'Terminal' to find the Terminal application. Once you open the terminal, you can login to the `timberlea` server by typing:

```
ssh <your_csid>@timberlea.cs.dal.ca
```

where `<your_csid>` is your CSID userid.

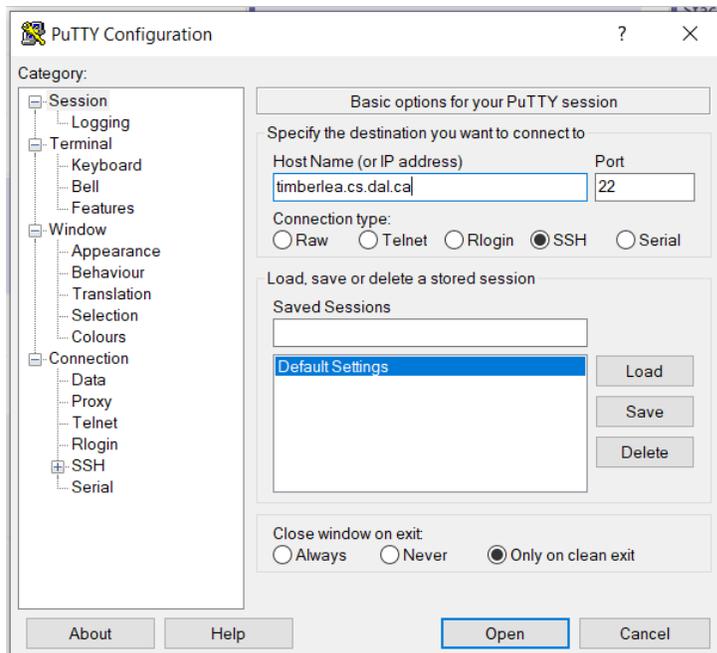
On Linux: In a Linux environment, you should, similarly to Mac, open a terminal and type:

```
ssh <your_csid>@timberlea.cs.dal.ca
```

where `<your_csid>` is your CSID userid.

Running PuTTY

- Double-click the PuTTY icon, and the following window should appear:



You should fill in the basic information: `timberlea.cs.dal.ca` for the Host Name. Make sure that the port number is 22; i.e., Connection type is SSH. You click 'Open' and the login process should start. You are likely to receive a warning about an unknown host key. Normally, this is something that you should be careful about and try to make sure that the offered fingerprint matches the fingerprint of the server, but in a relatively secure network you can accept this connection. Once accepted, the host key is stored with PuTTY and this warning should not appear again.

Hands-on Exercises

- You should use PuTTY or another client to login to `timberlea`
- FileZilla is a good tool to copy files back and forth, but does not provide access to command-line (shell)
- The following exercises should be finished and will be graded as a part of Assignment 1
- Example of command-line (bash shell) access:



Creating a Simple Web Page

- Try command: `pwd`

- Enter directory: `public.html`
- Create directories: `dgin5201/e1`
- Set permissions for this directory to be all-accessible: `chmod` command
- Go to directory `dgin5201/e1` and create file `index.html` with the following content:


```
<html><body>
This is a very small HTML file.
</body></html>
```
- Make `index.html` all-readable and access it over Web

Opening Web Page in a Browser. Now, we can try to open our web page by entering the following URL in a web browser:

`http://web.cs.dal.ca/~userid/dgin5201/e1`

As usual, the `userid` should be replaced with your CS `userid`. The browser should show our very simple web page.

Concepts Review: Example 1

- ssh access, PuTTY, bash shell
- bash commands: `pwd`, `ls`, `cd`, `mkdir`, `chmod`, `rmdir`
- File permissions
- Text editors: `emacs`, `vi`, `pico`, `nano`, or use remote editing: FileZilla, `vscode`
- Emacs editor:


```
emacs index.html or emacs -nw index.html
C-x C-s to save, C-x C-c to exit, C-h t to go through simple tutorial (C- means Ctrl and other key)
```
- HTML: simple tags, `html`, `body`
- Web and HTTP access

Requirements of e1

- At the end of Example 1 (e1), there should be the following directories (folders), files and their permissions:

```
~/public_html/dgin5201                rwx--x--x
~/public_html/dgin5201/e1              rwx--x--x
~/public_html/dgin5201/e1/index.html  rwxr--r--
```

- Content of `index.html` was given previously