Faculty of Computer Science, Dalhousie University *03-Feb-2026*

DGIN 5201 — Digital Transformation

Lecture 7: Rapid Prototyping

Location: McCain 2170 Instructor: Vlado Keselj
Time: 10:05–11:25

Part I

Rapid Prototyping

2 Unit Overview

Unit Description

- Implementing a solution: Rapid prototyping
- Review of Digital Technology foundations
- Hands-on exercises
- 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?
- Consider a Rapid Prototyping model of development

Planning Process of System Development

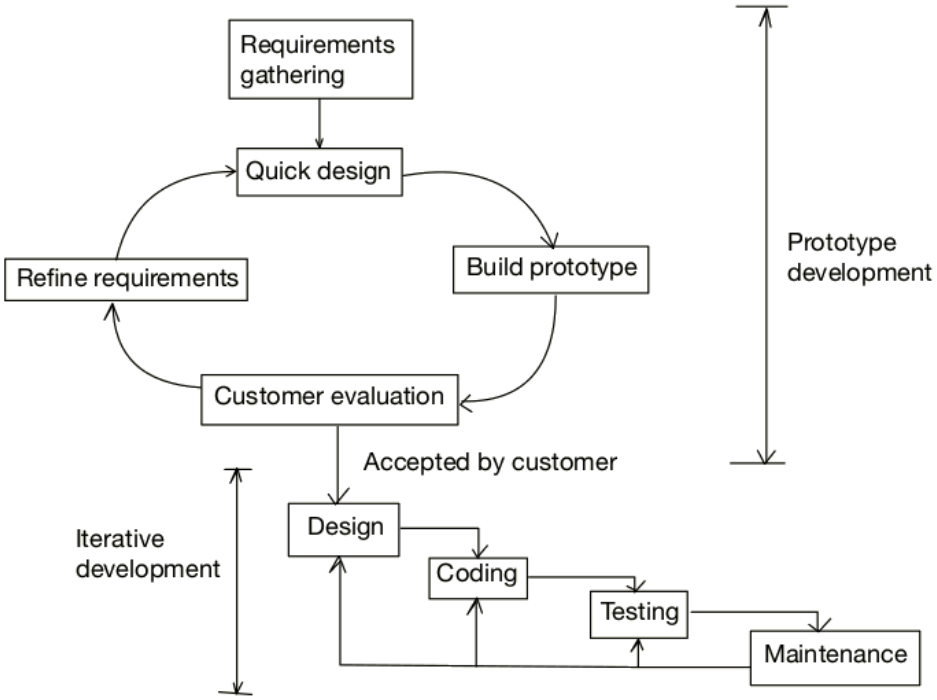
- One choice is the classic Waterfall model:
  Requirements, Design, Implementation, Testing, Maintenance
- or, closer to the industrial practice:
  Specifications
  Requirements
  Architectural design
  Detailed design
  Coding
  Integration
  Testing
  Delivery

Which Development Process to Use?

- Waterfall Model is overkill and not completely appropriate
  - follows the "big bang" model of development

- Rapid Prototyping Model is more appropriate
- However, it should not be a rapid "hacking" model
- Have a clear plan to try to make clear steps forward
- Keep a log with completed tasks, and what to do next
- Keep iterating working prototype, and after each iteration be able to declare success and walk away

Rapid Prototyping Model



A Less Formal Approach to Development Process

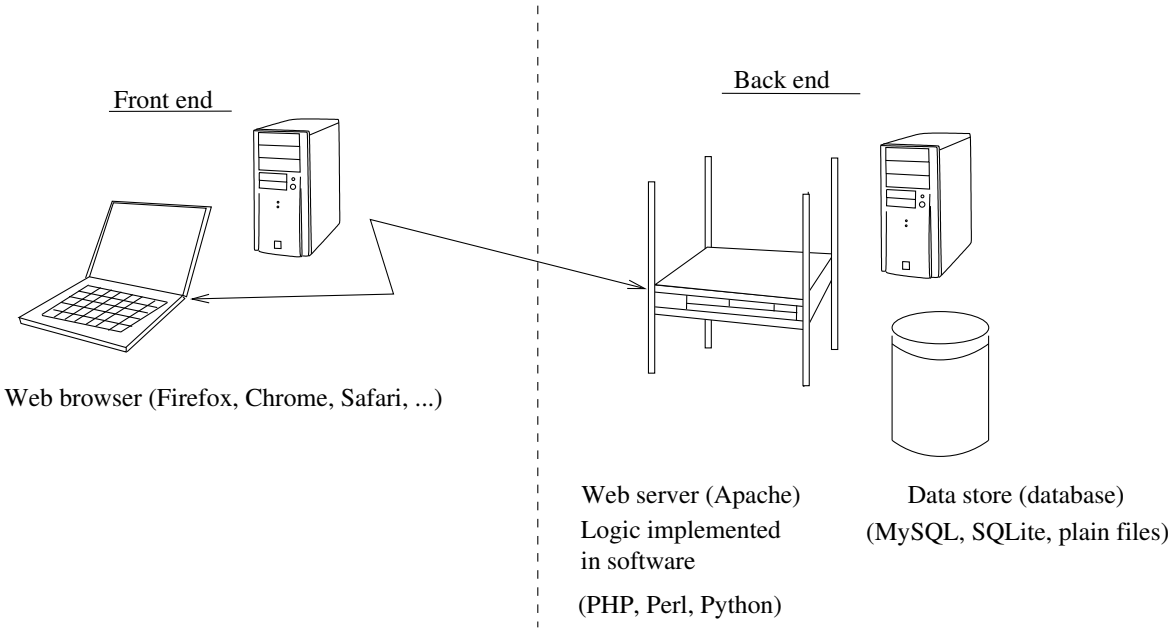
- Conceptual design
  - general description, sketches, scenarios, screenshots, rough diagrams
- Requirements Specification ("what")
  - precise ideas and requirements; understanding that once requirements are set it will be costly to change them
- Architectural Design ("how")
  - overall structure diagrams: components and connections, subsystems, interactions and interfaces, languages, systems, connectivity, data availability
- Implementation ("what by when")
  - make prototype and iterate, get real users asap, prepare tests as you go

Building a Three-Tier Architecture

- 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 (new): `ssh` can be used from terminal
- Windows (older): 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-tex editor: emacs, vi, vscode, or similar
  - use of HTML, scripting languages, JavaScript, CSS
  - plain files for persistant 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`
- First step: open a Terminal or Command Line Interface:
  - Command Line on Windows
  - Terminal on Mac
  - Terminal on Linux
- use the `ssh` command:

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

  where instead of `<your_csid>` you should use your own CSID
- Older Windows: you can use the program PuTTY
  - other options available; e.g., MobaXterm

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.

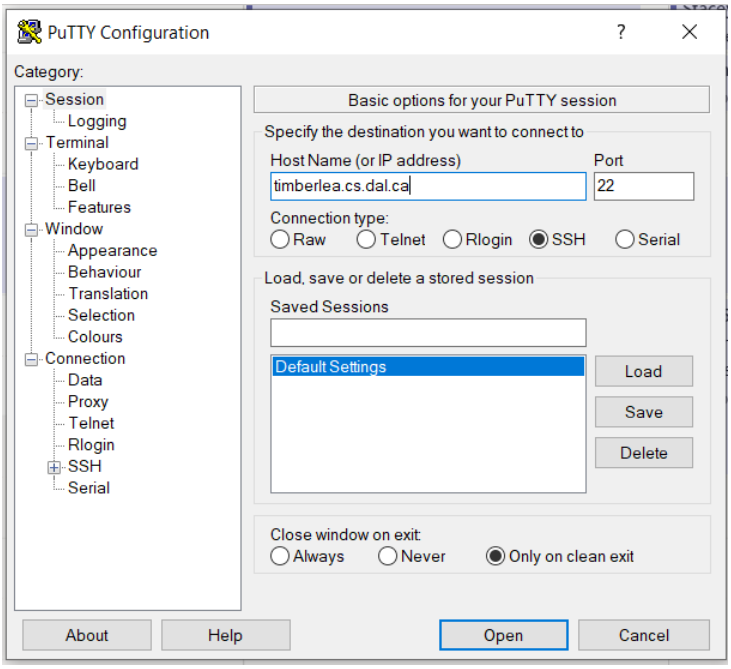
On Linux: In a Linux environment, you should, similarly to Mac, open a terminal and type:

```
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:

Concepts Review

- Shell (a.k.a., terminal, command-line interface)
- Operating System
- Internet connection, TCP/IP
- SSH, Port (port 22)
- DNS System, Email exchange, HTTP, etc.
- Public-key cryptography
    - Public key, private key