INFO 151
Web Systems and Services

Week 1 (T1)

Dr Philip Moore

Dr Zhili Zhao

Degree Overview

INFO 151 – Web Systems and Services

- The degree addresses *Data Science*
- Data science includes web systems and information systems
- INFO 151 description:
  - Provides students with fundamental concepts for designing, coding, testing, and deploying software systems
  - Introduces programming concepts and activities by demonstration, example, and exercise
  - Addresses Client-side and Server-side coding

Course Overview

Weeks 1 – 3

- Introduction to Web Systems and Services
- Creating Web-Pages and Web-Sites with a Markup Language
- Introductory HTML 4 and HTML 5 with CSS

Weeks 4 – 6

- Client-Side Web Programming
- Object Oriented Programming
- Introductory and further JavaScript

Weeks 7 – 9

- Server-side Programming
- Introductory PHP
- Introduction to Database, SQL, and MySQL

Course Overview and Delivery

Course Assessment

Introduction to the *Internet* and *internet*

Introduction to Web Systems and Architectures

Overview of Database Systems

Course Delivery

INFO 151 – Web Systems and Services

- The course will be delivered over a period of 10 weeks
- Weeks 1 to 9 will be the teaching period where we will deliver:
  - 2 tutorial sessions each week
  - 1 practical laboratory session each week
- In week 10 there will be practical work in the laboratory
- For details of the assignments and team project see: the INFO 151 Course Structure (2020) document available from *Moodle*
- The final examination will be held at the end of the semester
  - The location and scheduled dates will be notified over *Moodle*

Grading and Assessment

- The course assessment and grading:
  - There will be 1 individual final examination
  - There will be 2 individual assignments
  - There will be 1 group project
- The team project will be undertaken by small teams
  - Each team will be 3 (or maximum 4) students in each group
  - Each groups will be self selecting
  - In the event of any problems the tutors will assign students to teams
- Assessment information is provided in the course documentation
- The assessment will include *graded attendance* and *participation* in tutorial and laboratory sessions

Course Software

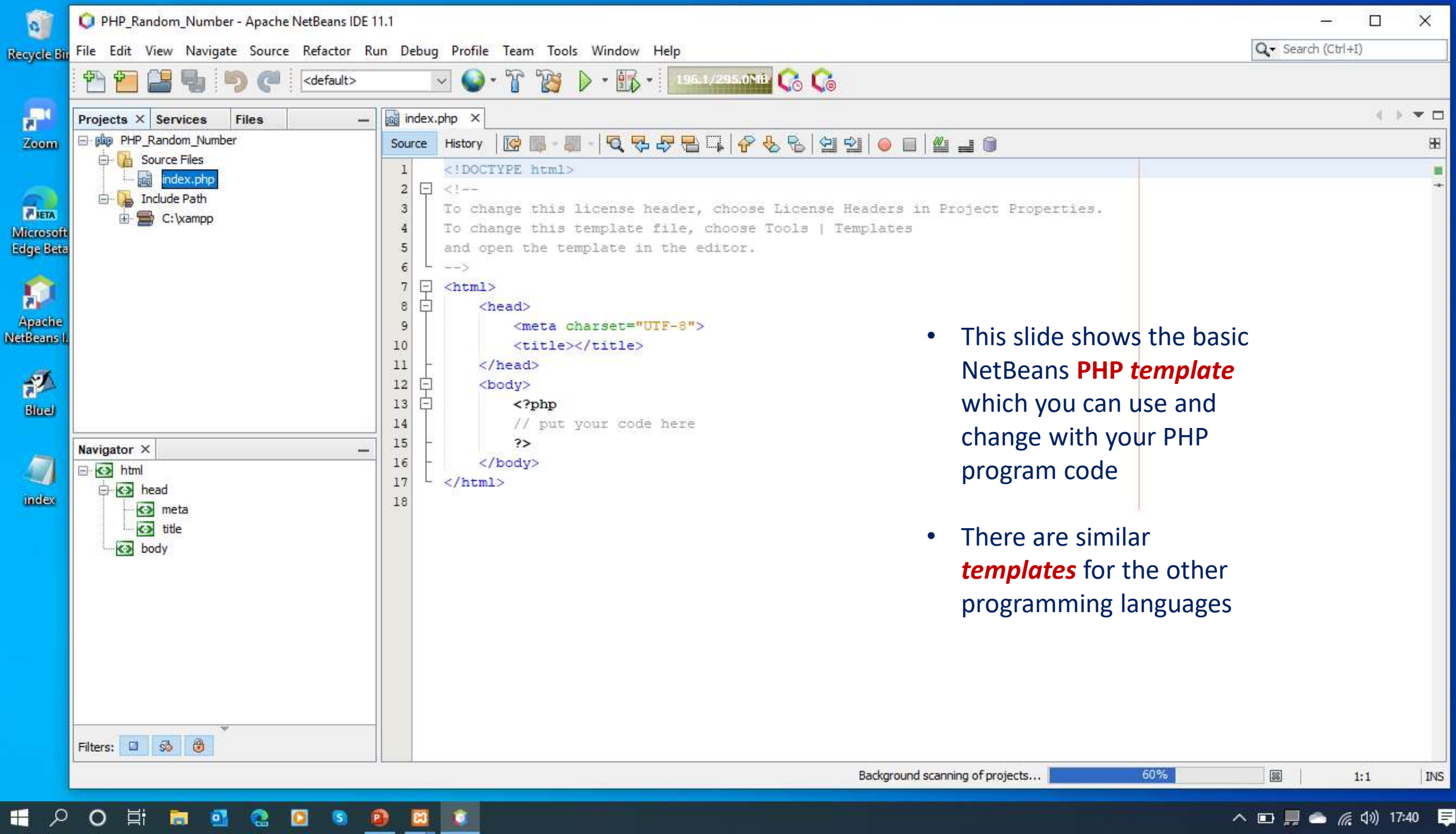
- The course will use an *Integrated Development Environment* (IDE) and programming framework
- For the programming of HTML, JavaScript, PHP, and MySQL:
  - The NetBeans IDE and programming framework will be used
  - An integrated server (XAMPP) will be used
- For the creation and building of web pages and web-sites
  - All programming and development will use the NetBeans IDE or if you wish a simple text editor (NetBeans recommended)

Course Software

- The following software will be installed on the computers in the laboratory
  - The ***NetBeans*** IDE
  - The ***XAMPP*** server
- The software will be demonstrated in the laboratory and will be used for the building of the teaching examples, individual assessments, and the team project
- The NetBeans IDE and XAMPP server is available for (free) download and installation on personal computers
  - Details will be provided in the course documentation

Templates

- The ***NetBeans*** IDE is a programming environment which simplifies the writing and running of program code
- NetBeans is a programming framework:
  - Enables some simple automation when writing program code
- When creating a project (addressed in the laboratory tutorial):
  - Net Beans creates a template file
  - The template can be used when writing your program code
  - The following slide shows the NetBeans IDE and a PHP template file (*index.php*)



- This slide shows the basic NetBeans **PHP *template*** which you can use and change with your PHP program code

- There are similar ***templates*** for the other programming languages

Required Course Resources

- The sources of information and resources for JavaScript may be found at:
  - The w3schools.com web-site (Chinese version)
  - The URL: https://www.quanzhanketang.com/
- The w3schools.com web-site has limited resources for PHP and MySQL
  - The recommended course textbook for PHP and MySQL (including JavaScript) is:
    - Sams Teach Yourself PHP, MySQL & JavaScript All in One SIXTH EDITION
    - This book is available in the University Library

Supplied Course Resources

- Other resources will be provided as required
  - Resources and course information will be available on INFO 151 ***Moodle*** course website
    - Each student will have a personal username and password
- The PowerPoint slides use in the tutorial and laboratory sessions
  - Will be made available in pdf form
  - The slides will be made available ***following*** the tutorial and laboratory sessions

Student Data Storage and Backup

- The course is designed around the use of computerised systems and resource availability
  - This is a computer course – we limit the use of paper-based systems
- Students will be given a virtual partition on the University server to store their course work
  - The data storage will be username and password protected
- Students are responsible for their data
  - Data back-up is essential, and any loss of data is the student's responsibility
  - Loss of data will not be accepted as a reason for late (or no) delivery of assignments

Student Communication

- Important:
  - Each student has been provided with a University email
  - All communications with students will use their email
  - Email will be used for all queries with and by tutors
  - Social-media (such as WeChat will not be used)
- It is the student's responsibility to check the *INFO 151 Moodle* course website where:
  - All course information and notices will be provided
  - All course resources will be provided

Document Preparation

Presenting Your Assignments

- You will be required to submit written reports in *English* for all individual and team assignments
- You will write and prepare your reports using Microsoft Word
- There are problems when printing documents prepared using Microsoft Word:
  - Different operating systems and printer software will reproduce the document differently
- When your document is completed:
  - Always print (or export) the document as a pdf file
  - A pdf file will always be printed in the same format
- Badly presented documents will receive a lower grade

INFO 151 – Web Systems and Services

Course Schedule

Semester One: October to December 2020

Class Teaching Program

The course teaching structure is based on a 9-week teaching program. There will be 2 tutorial groups (classes). For each group there will be a total of 4 hours (2 @ 2 hours) of tutorials and 2 hours (1 @ 2 hours) of Lab work. The scheduling for the sessions will be over 3 days (Monday, Wednesday, and Friday). Assessment and grading will use individual assignments, a team project, and a final examination.

The normal mode of delivery which would be on a 'face-to-face' basis. However, due to the Covid-19 virus there will be changes to the delivery of this course. The delivery will use 'blended' learning which uses: (a) online tutorial sessions, lab sessions, and office hours, (b) some 'face-to-face' tutorial sessions, lab sessions, and office hours, and (c) practical exercises and coursework completed in the laboratory sessions and online. The tasks are set out in the coursework documents provided over the *Moodle* course website.

The practical exercises and coursework have been designed around the 'blended' learning approach and are essential to generate an understanding of the basic principles of the topics introduced in this course. This understanding will be essential in the assessments (the assignments, team project, and examination).

The course will provide a recommended course book (available from the School Library) with supplementary course resources made available on the INFO 151 University course web site. The PowerPoint slides used in the tutorials will be made available (in pdf format on the INFO 151 Moodle course website) following completion of the week tutorial sessions.

Instructor Information

- Dr Philip Moore: email: philip.moore@outlook.com
- Dr Zhili Zhao: email: zhaozhl@lzu.edu.cn

Teaching Schedule and Location

Philip Moore

Print

Copies: 1

Print

Printer

HP6468DC (HP DeskJet 2600...
Offline

Printer Properties

Settings

Print All Pages
The whole thing

Pages:

Print One Sided
Only print on one side of th...

Collated
1,2,3 1,2,3 1,2,3

Portrait Orientation

A4
21 cm x 29.7 cm

Normal Margins
Top: 2.54 cm Bottom: 2.54 c...

1 Page Per Sheet

Page Setup

INFO 151 – Web Systems and Services
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- Dr Zhili Zhao email: zhaozhl@lzu.edu.cn

Teaching Schedule and Location

Table 1: INFO 151 Teaching Schedule

Group A (Class 1 and Class 2)*					
Mon	Tue	Wed	Thu	Fri	Sat
T 08:30-10:10 Room: 110 Feiyun building		T 08:30-10:10 Room: 110 Feiyun building		L 14:30-16:10 Room: 110 Feiyun building	
Group B (Class 3 and Class 4)*					
Mon	Tue	Wed	Thu	Fri	Sat
T 10:30-12:10 Room: 110 Feiyun building		T 10:30-12:10 Room: 110 Feiyun building		L 16:30-18:10 Room: 110 Feiyun building	

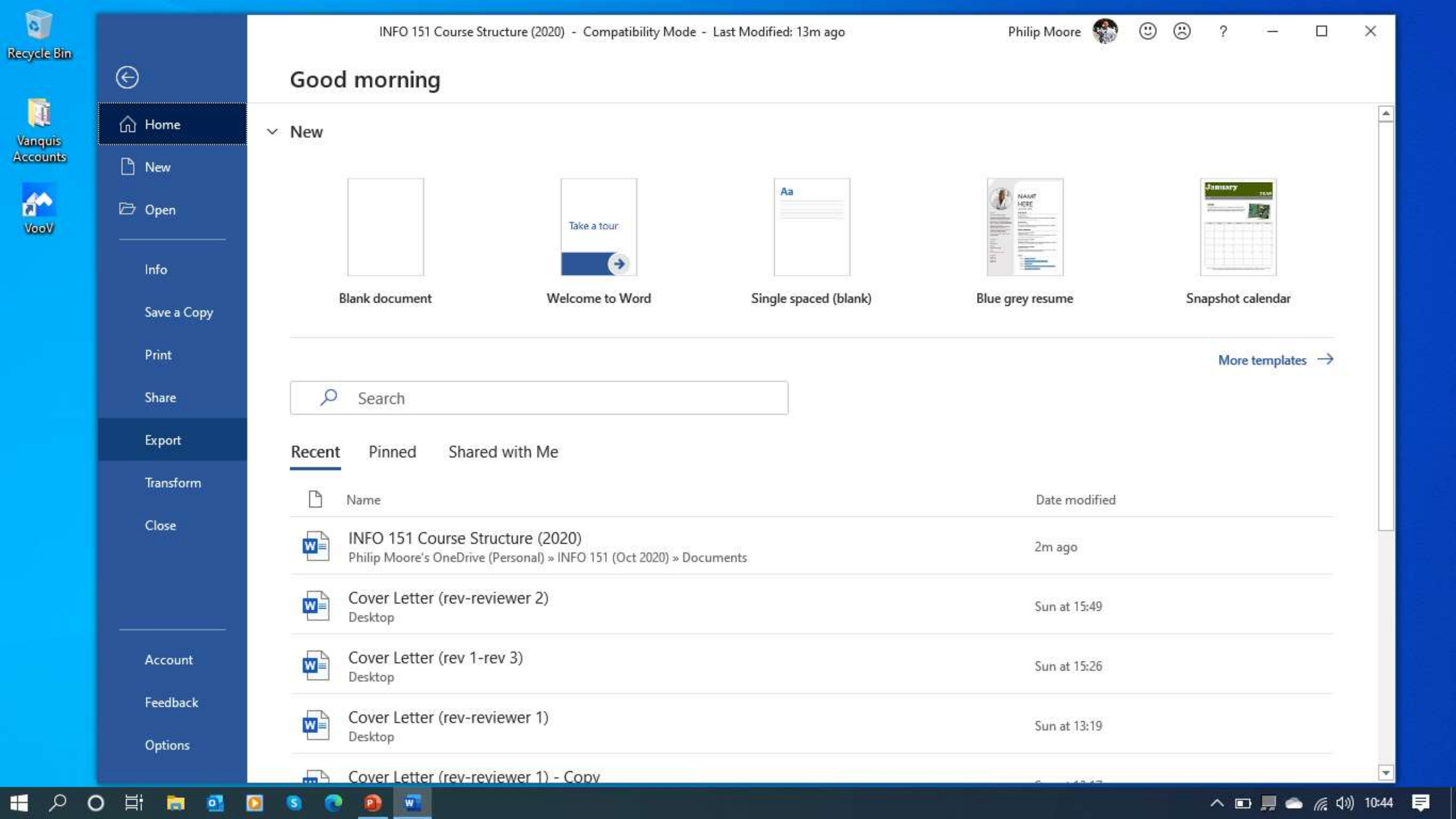
Note 1: The course will be provided using tutorial sessions and practical work in the laboratory. There are two tutorial groups (group A and group B). The location and schedule for the teaching

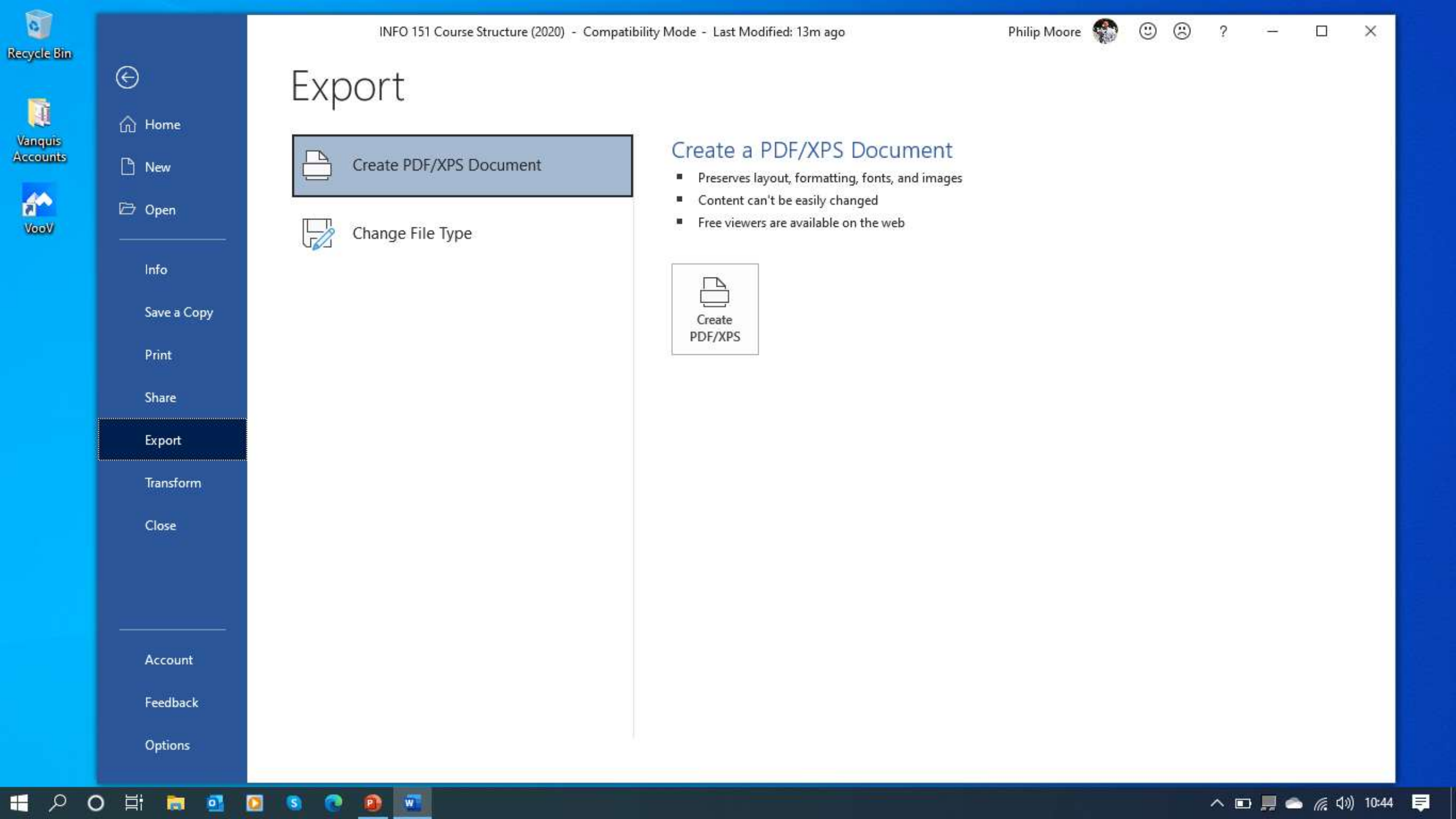
28.9.20

49%

Home
New
Open
Info
Save a Copy
Print
Share
Export
Transform
Close
Account
Feedback
Options

10:44


Recycle Bin
Vanquis Accounts
VooV
INFO 151 Course Structure (2020) - Compatibility Mode - Last Modified: 13m ago
Philip Moore
Good morning
Home
New
Open
Info
Save a Copy
Print
Share
Export
Transform
Close
Account
Feedback
Options
New
Blank document
Take a tour
Welcome to Word
Aa
Single spaced (blank)
Blue grey resume
January
Snapshot calendar
More templates
Search
Recent
Pinned
Shared with Me
Name
Date modified
INFO 151 Course Structure (2020)
Philip Moore's OneDrive (Personal) » INFO 151 (Oct 2020) » Documents
2m ago
Cover Letter (rev-reviewer 2)
Desktop
Sun at 15:49
Cover Letter (rev 1-rev 3)
Desktop
Sun at 15:26
Cover Letter (rev-reviewer 1)
Desktop
Sun at 13:19
Cover Letter (rev-reviewer 1) - Copy
10:44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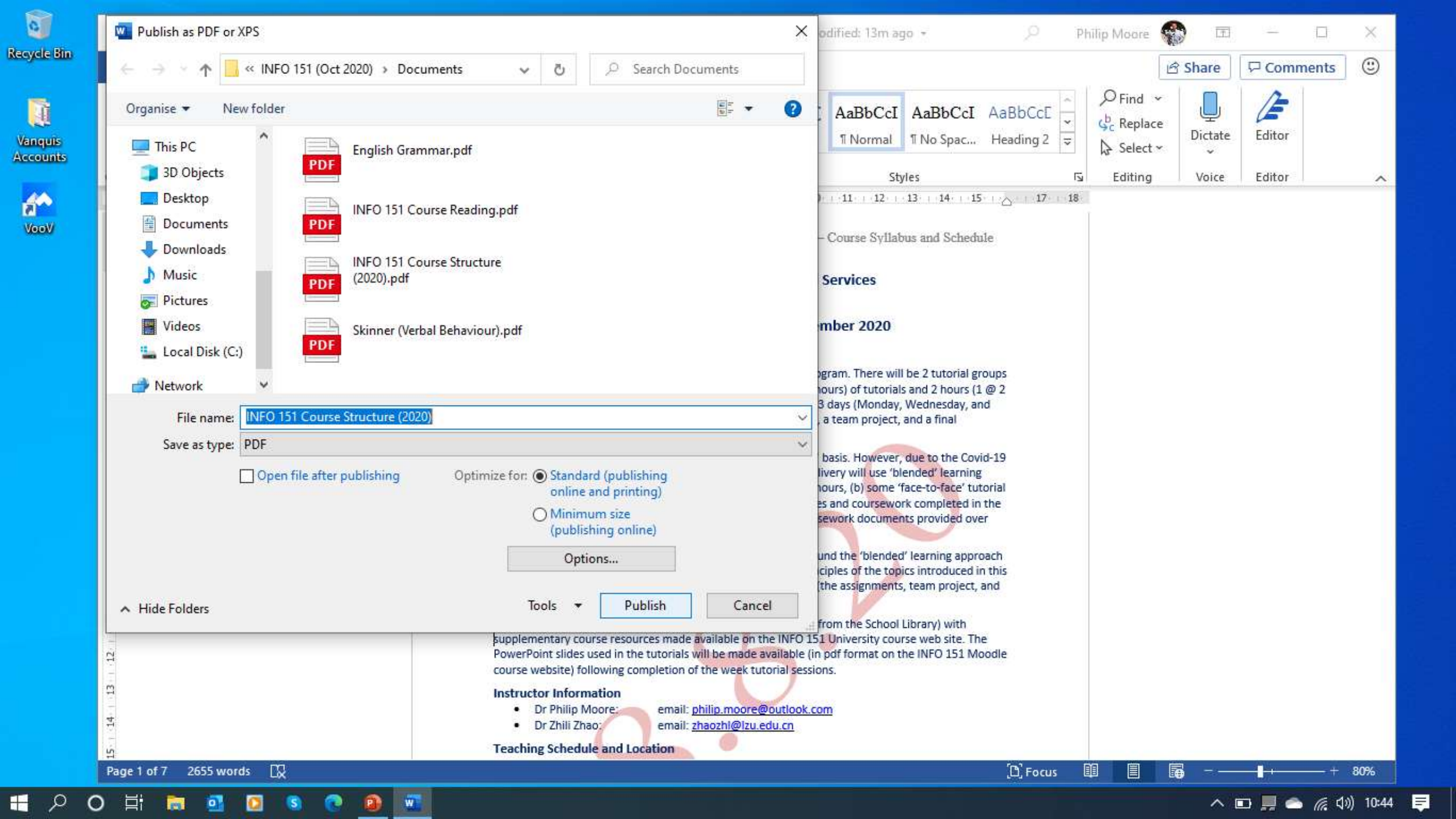
INFO 151 Course Structure (2020) - Compatibility Mode - Last Modified: 13m ago
Philip Moore
Export
Home
New
Open
Info
Save a Copy
Print
Share
Export
Transform
Close
Account
Feedback
Options
Create PDF/XPS Document
Change File Type
Create a PDF/XPS Document
Preserves layout, formatting, fonts, and images
Content can't be easily changed
Free viewers are available on the web
Create PDF/XPS
10:44


Publish as PDF or XPS
« INFO 151 (Oct 2020) › Documents
Search Documents
Organise
New folder
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
Network
English Grammar.pdf
INFO 151 Course Reading.pdf
INFO 151 Course Structure (2020).pdf
Skinner (Verbal Behaviour).pdf
File name: INFO 151 Course Structure (2020)
Save as type: PDF
Open file after publishing
Optimize for: Standard (publishing online and printing)
Minimum size (publishing online)
Options...
Hide Folders
Tools
Publish
Cancel
Philip Moore
Share
Comments
Find
Replace
Select
Dictate
Editor
Styles
Editing
Voice
Editor
Course Syllabus and Schedule
Services
mber 2020
supplementary course resources made available on the INFO 151 University course web site. The PowerPoint slides used in the tutorials will be made available (in pdf format on the INFO 151 Moodle course website) following completion of the week tutorial sessions.
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Teaching Schedule and Location
Page 1 of 7
2655 words
Focus
80%
10:44

Keyboard Shortcuts

- You may save time and be more efficient if you use keyboard shortcuts:
  - To save your work use: ctrl + S
  - To copy sections (or all) of your work use: ctrl + C
  - To paste your copied work (using ctrl + C) use: ctrl + V
  - To print your work (to a connected printer) use: ctrl + p
- The S, C, and V are not capitalised
- It is is much quicker and convenient than using the dropdown menu and can be used frequently and quickly!
- It can prevent loss of work by saving regularly!

A Brief History of the Internet (or WWW)

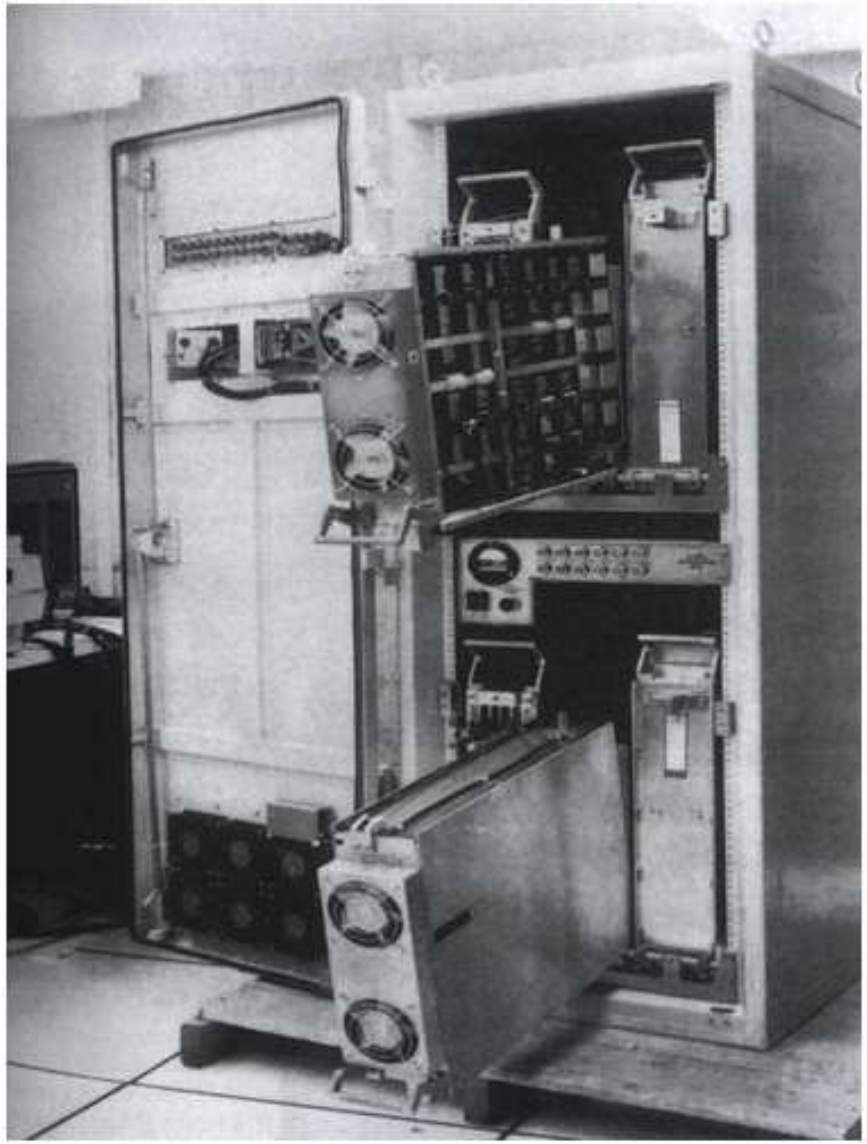
The Internet – A Brief History

- The ***Internet*** can be traced back to the 1960's with the creation of the ***ARPANET***
- The *Internet Protocol* (IP) dates from 1978
  - It is a set of pre-defined rules designed to enable computers to communicate regardless of the operating system
  - However:
    - While the IP enabled enabled information exchange
    - To find information the location must be known

1967: Lawrence Roberts of ARPA publishes plan for the first computer network system – the ARPANET

Packet switches were needed. Called Interface Message Processors (IMP), the contract was awarded to BBN

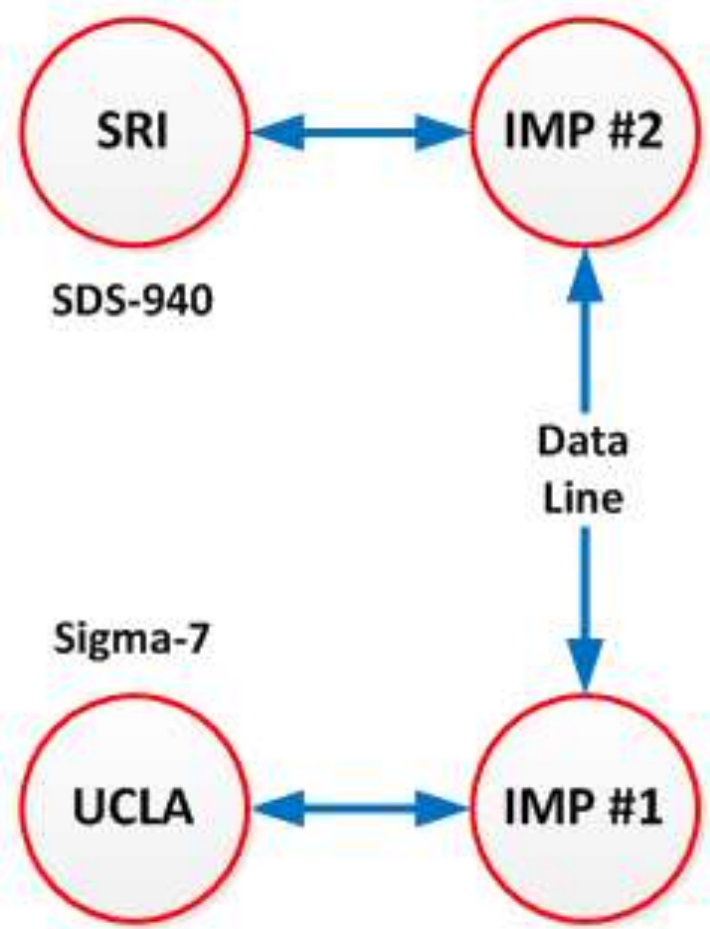
Oct 1969: IMPs installed in UCLA, Stanford, UCSB and Utah

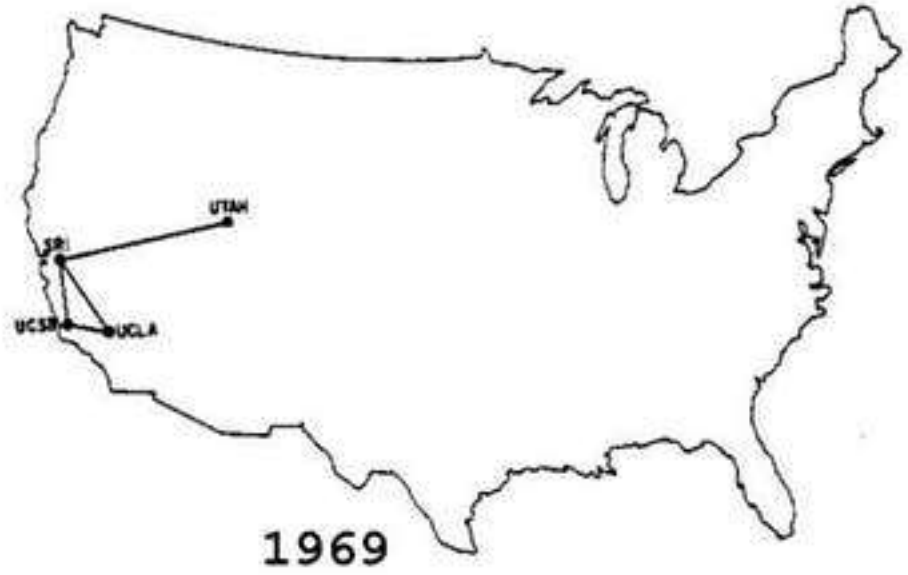


Interface Message Processor

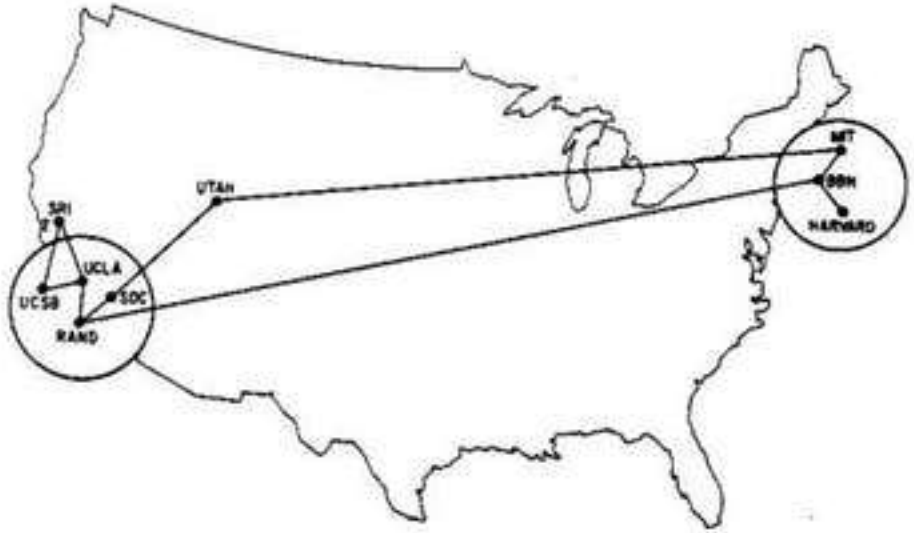
Interface Message Processors (IMP)

- Shown in the figure is the layout of the first network between Stanford Research Institute (SRI) and the University of California (UCLA)
- The IMP No. 2 is an interface to the mainframe computer at SRI and the data from IMP No. 1 which is an interface to the mainframe computer at UCLA
- The IMP changes the data into a format the mainframe computer can access

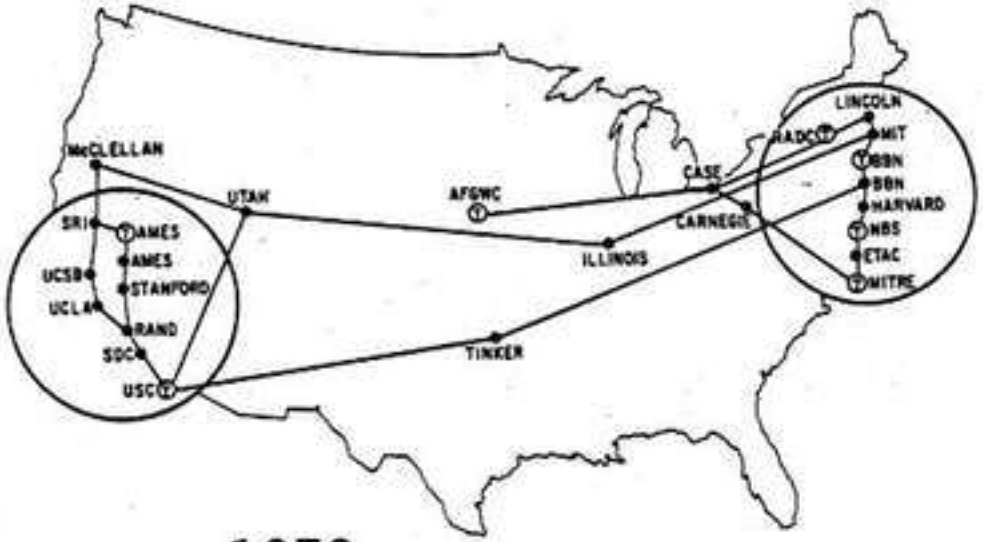




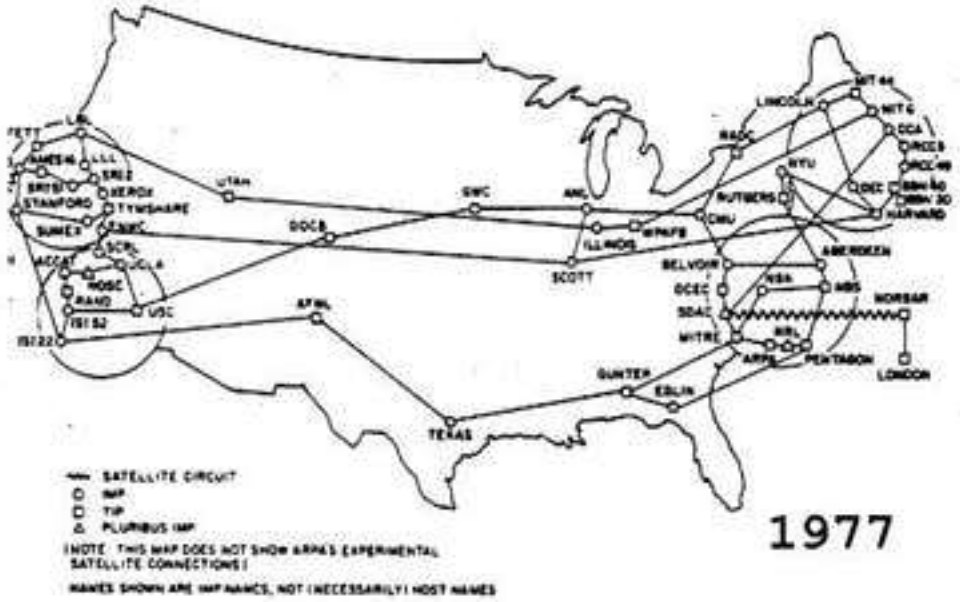
1969



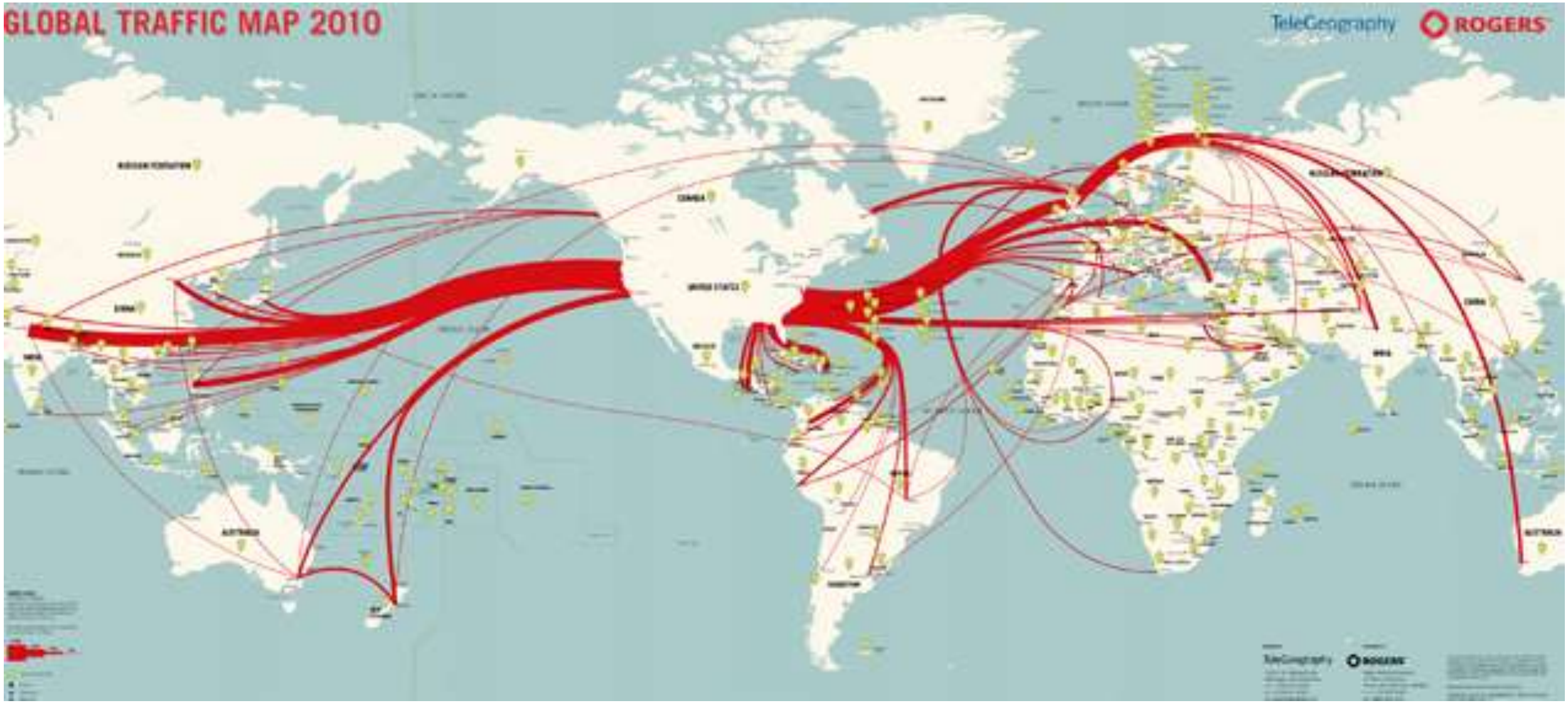
1970



1972



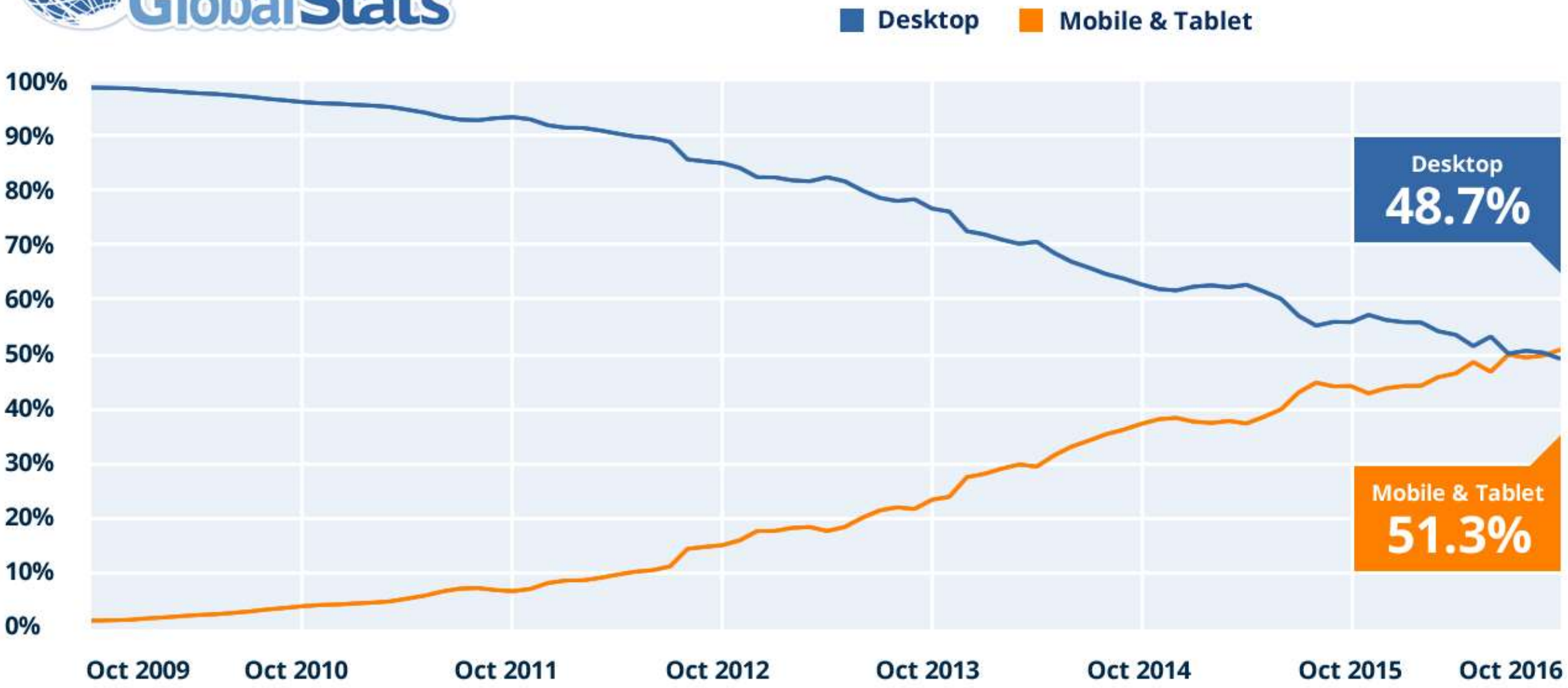
1977

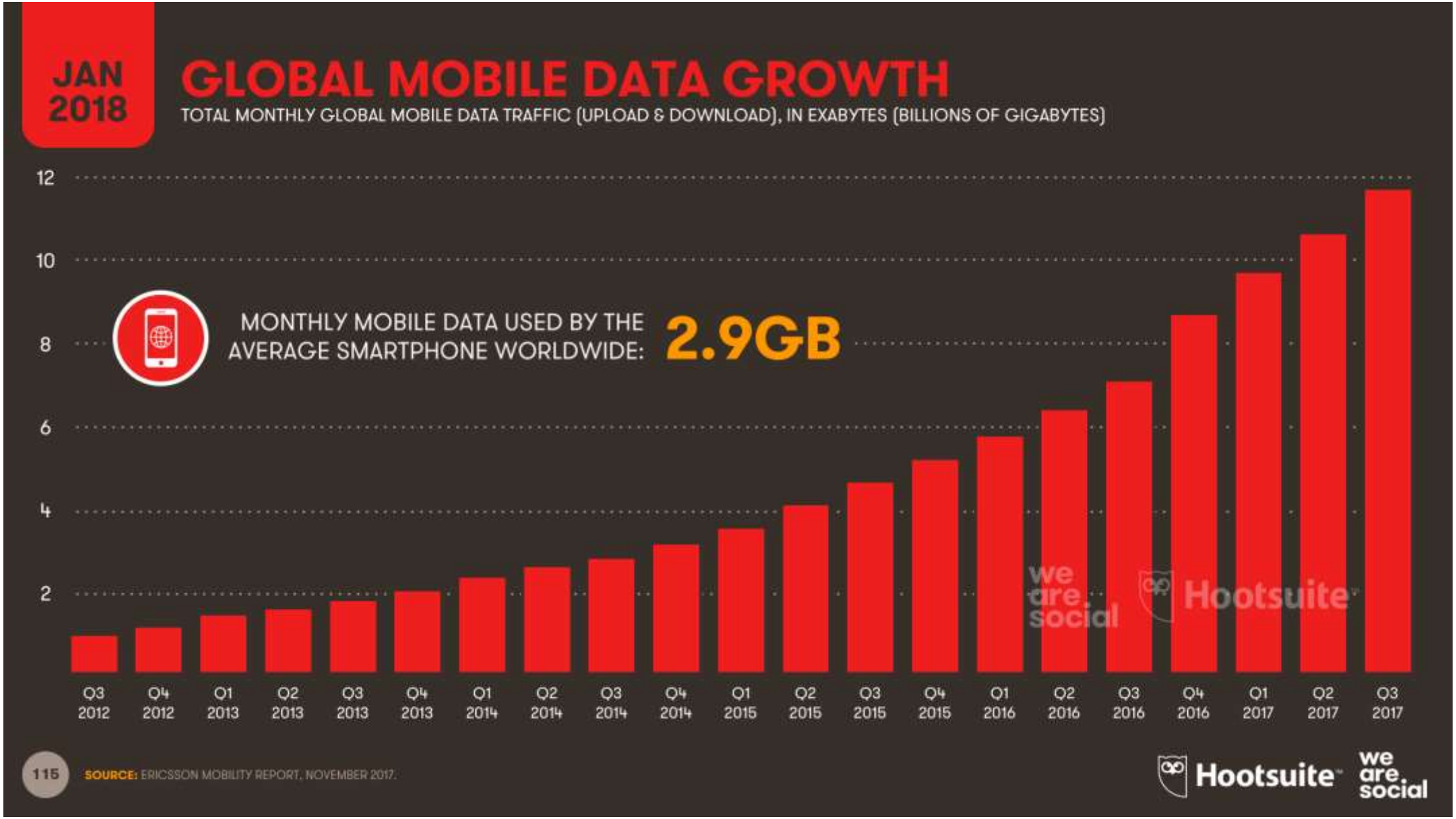

GLOBAL TRAFFIC MAP 2010
TeleGeography
ROGERS

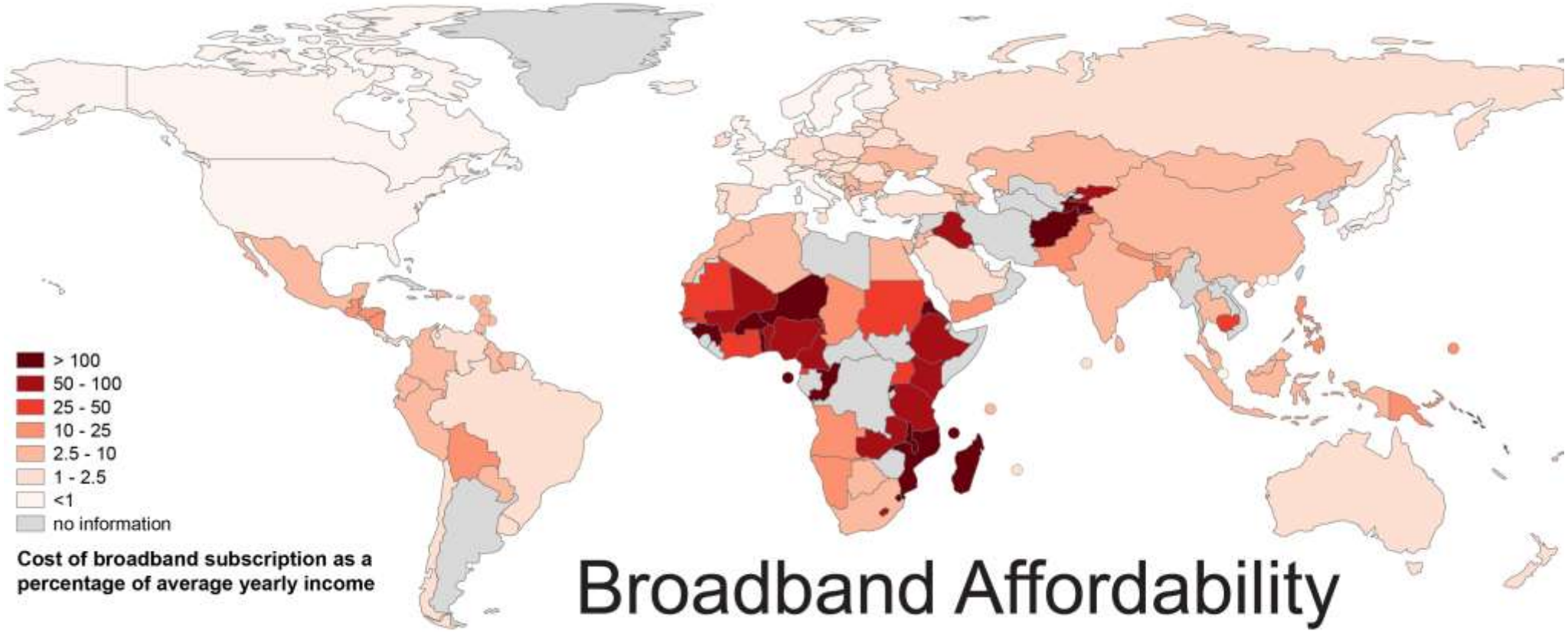
StatCounter GlobalStats

Internet Usage Worldwide

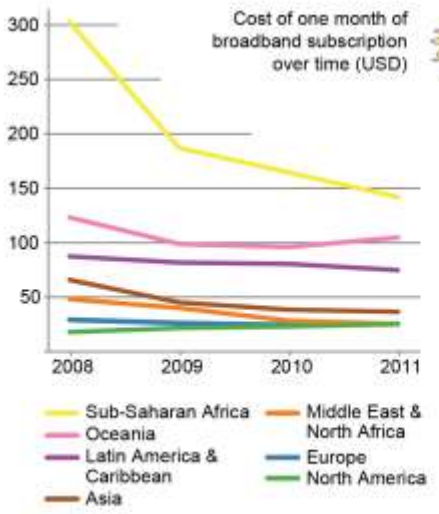
October 2009 – October 2016

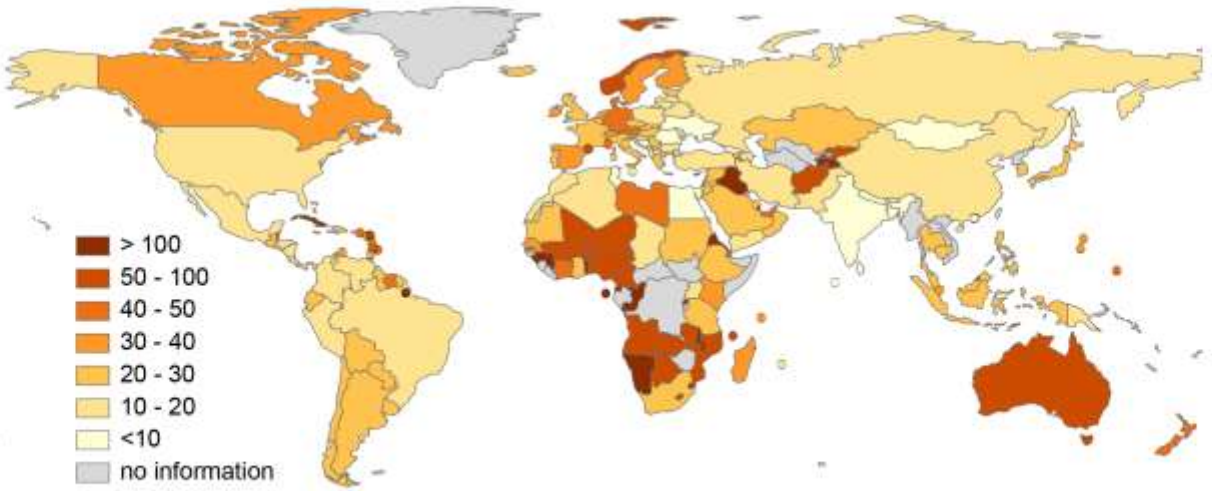



JAN 2018
GLOBAL MOBILE DATA GROWTH
TOTAL MONTHLY GLOBAL MOBILE DATA TRAFFIC (UPLOAD & DOWNLOAD), IN EXABYTES (BILLIONS OF GIGABYTES)
12
10
8
6
4
2
MONTHLY MOBILE DATA USED BY THE AVERAGE SMARTPHONE WORLDWIDE: 2.9GB
Q3 2012
Q4 2012
Q1 2013
Q2 2013
Q3 2013
Q4 2013
Q1 2014
Q2 2014
Q3 2014
Q4 2014
Q1 2015
Q2 2015
Q3 2015
Q4 2015
Q1 2016
Q2 2016
Q3 2016
Q4 2016
Q1 2017
Q2 2017
Q3 2017
we are social
Hootsuite
115
SOURCE: ERICSSON MOBILITY REPORT, NOVEMBER 2017.
Hootsuite
we are social



Broadband Affordability



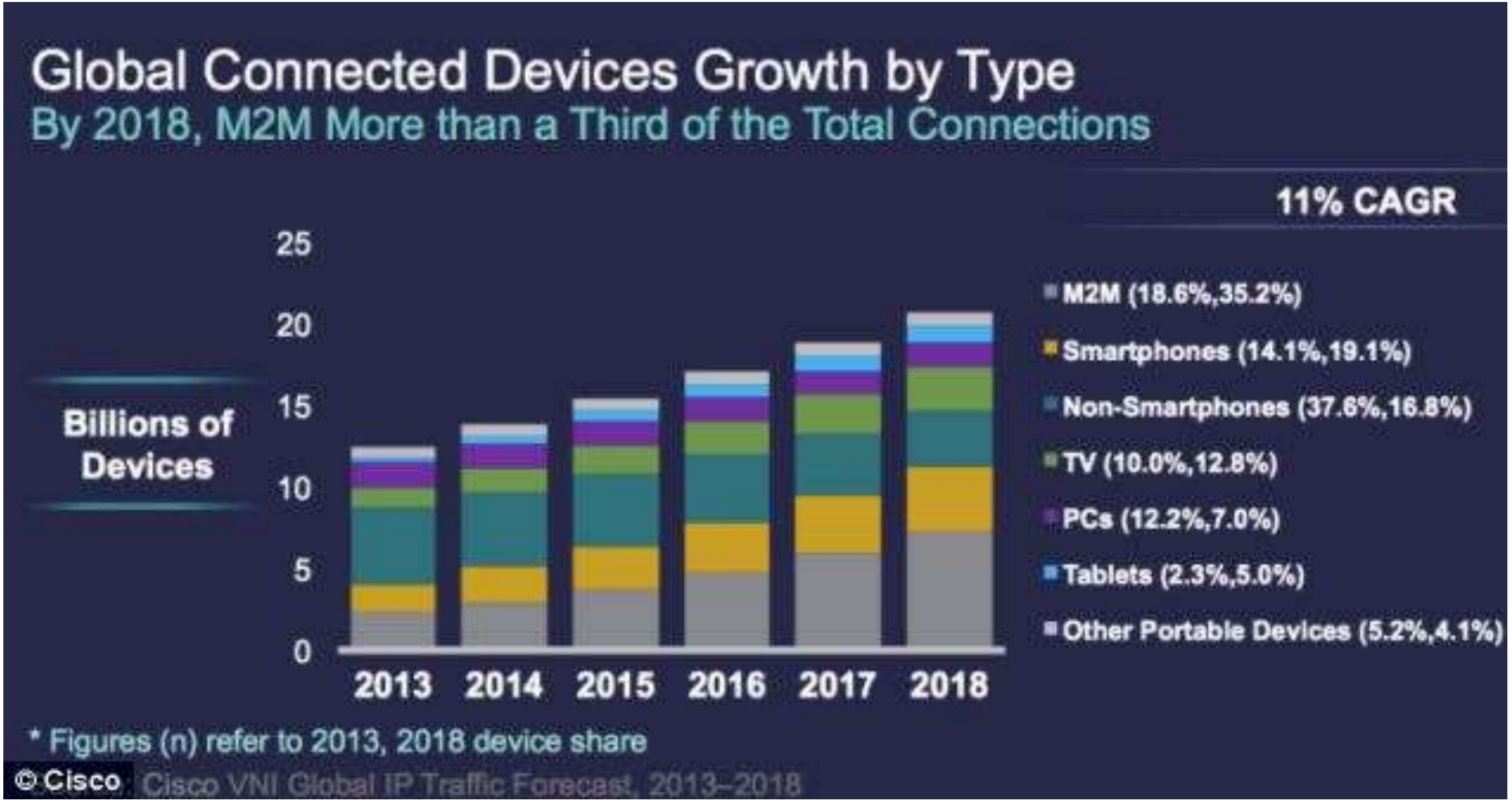


Cost of one month of broadband subscription in 2011 (USD)

oiioiioii Oxford Internet Institute
oiioiioii University of Oxford
oiioiioii

by Mark Graham
(@geoplace)
and Stefano De Sabbata
(@maps4thought)
Internet Geographies at
the Oxford Internet Institute
2014
geography.oii.ox.ac.uk

data sources:
ITU • itu.int
World Bank • data.worldbank.org


Global Connected Devices Growth by Type
By 2018, M2M More than a Third of the Total Connections
11% CAGR
Billions of Devices
25
20
15
10
5
0
2013
2014
2015
2016
2017
2018
M2M (18.6%,35.2%)
Smartphones (14.1%,19.1%)
Non-Smartphones (37.6%,16.8%)
TV (10.0%,12.8%)
PCs (12.2%,7.0%)
Tablets (2.3%,5.0%)
Other Portable Devices (5.2%,4.1%)
* Figures (n) refer to 2013, 2018 device share
© Cisco
Cisco VNI Global IP Traffic Forecast, 2013–2018

Internet Technologies

The Internet – TCP and IP

- *Transport Control Protocol* (TCP) and the *IP Protocol* merged in 1978 to form the *TCP/IP* protocol
  - The TCP/IP suite is a set of *Internet* rules and procedures
- The *TCP* protocol
  - defines how applications create channels of communication across a network
  - manages how messages are assembled into smaller *packets* before they are transmitted over the internet and reassembled (in the right order) at the destination address.
- The *IP* protocol
  - defines how to *address* and *route* each packet to reach the right destination.
  - Each *gateway* computer (on a network) checks this *IP* address to determine the destination address

Uniform Resource Locator (URL)

- A feature of *Internet* (and *intranet*) is the address used to identify the location of information and resources on the www.
  - The address is termed the *Uniform Resource Locator* (URL)
  - Requests are made to servers from web-browsers using the URL for the resource required
- An example or a URL is:
  - https://www.quanzhanketang.com/
  - All URL addresses follow these syntax rules without spaces

The Internet – HTTP

- In the early 1990's the *Hypertext Transfer Protocol* (HTTP)
- HTTP is the language of the Internet and enables:
  - Information on the Internet to be accessed from *anywhere* by *anyone* (with a computer and Internet connection)
  - Users create linked web-pages using *hypertext* links
  - HTTP can be seen in web-page url addresses:
    - https://en.wikipedia.org/wiki/ARPANET

HTTP *vs* HTTPS

- In the URL:
  - https://www.quanzhanketang.com/ (links are often underlined)
- Note: the https://...
  - *HTTPS* is an extension of the HTTP
  - It provides secure communication over a computer networks
  - It is widely used on the Internet.
  - The communication protocol is encrypted using *Transport Layer Security* (TLS) (or its predecessor *Secure Sockets Layer* (SSL)

Types of Web-Page

- There are two types of web-page:
  - A *static* (termed *stateless*) web page
  - A *dynamic* (termed *stateful*) web page
- A simple HTML web page is *stateless*
- A simple HTML web page when extended using JavaScript, PHP, and MySQL becomes a *stateful* web page
- While a *stateless* web page may use a *two-tier* architecture
- A *stateful* web page requires a *three-tier* architecture

The Internet and intranet

- In practice the *Internet* can be:
- The ***Internet*** (also known as the *World Wide Web* (www))
  - Is a system which allows linked documents (and parts of documents) to be connected using hypertext links.
- An ***intranet***
  - Is a local (or restricted) communications network, an example is a private network
  - A company intranet can provide a single starting point to access internal and external resources
- An ***intranet*** is established in *local-area-networks* (LAN) and *wide-area-networks* (WAN)

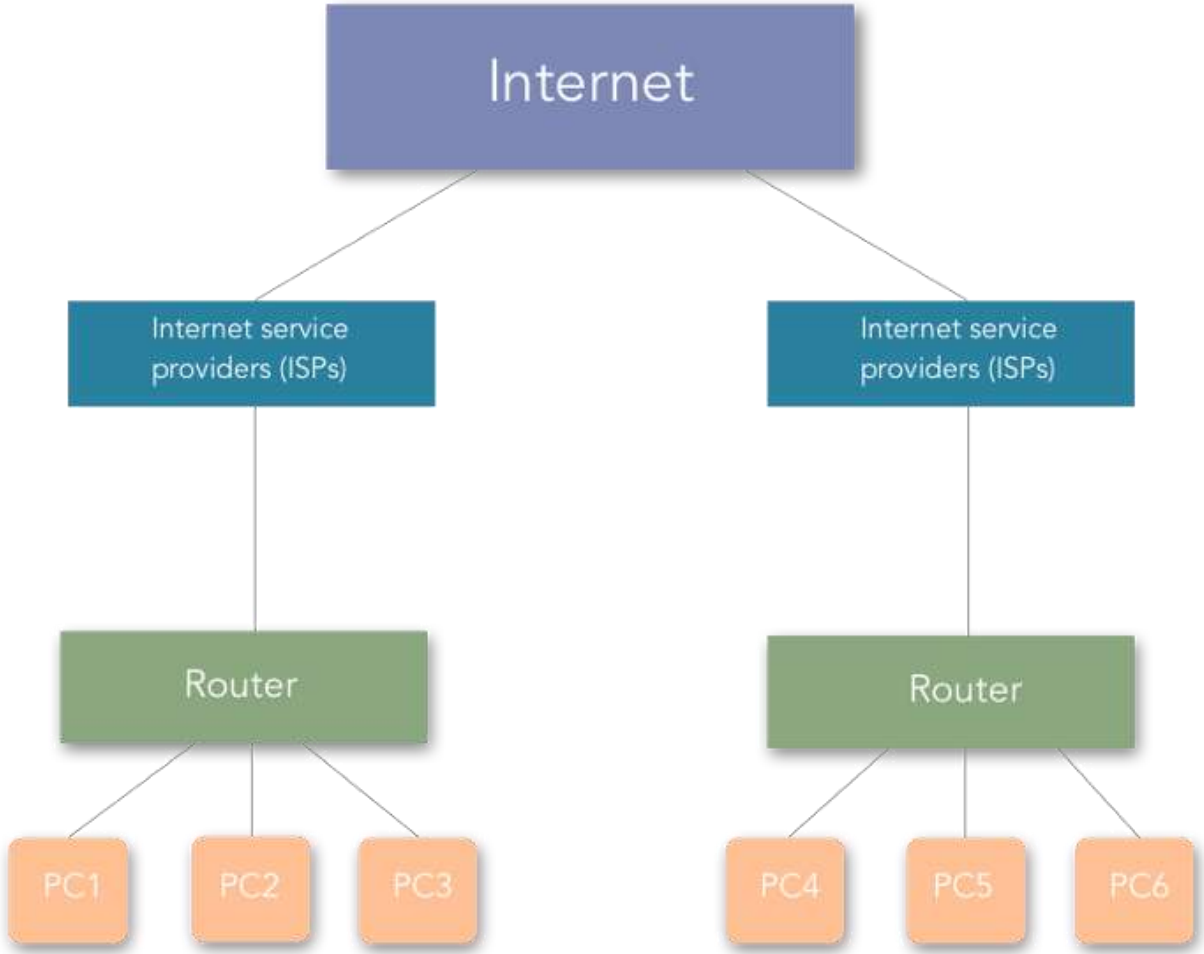
Area Networks

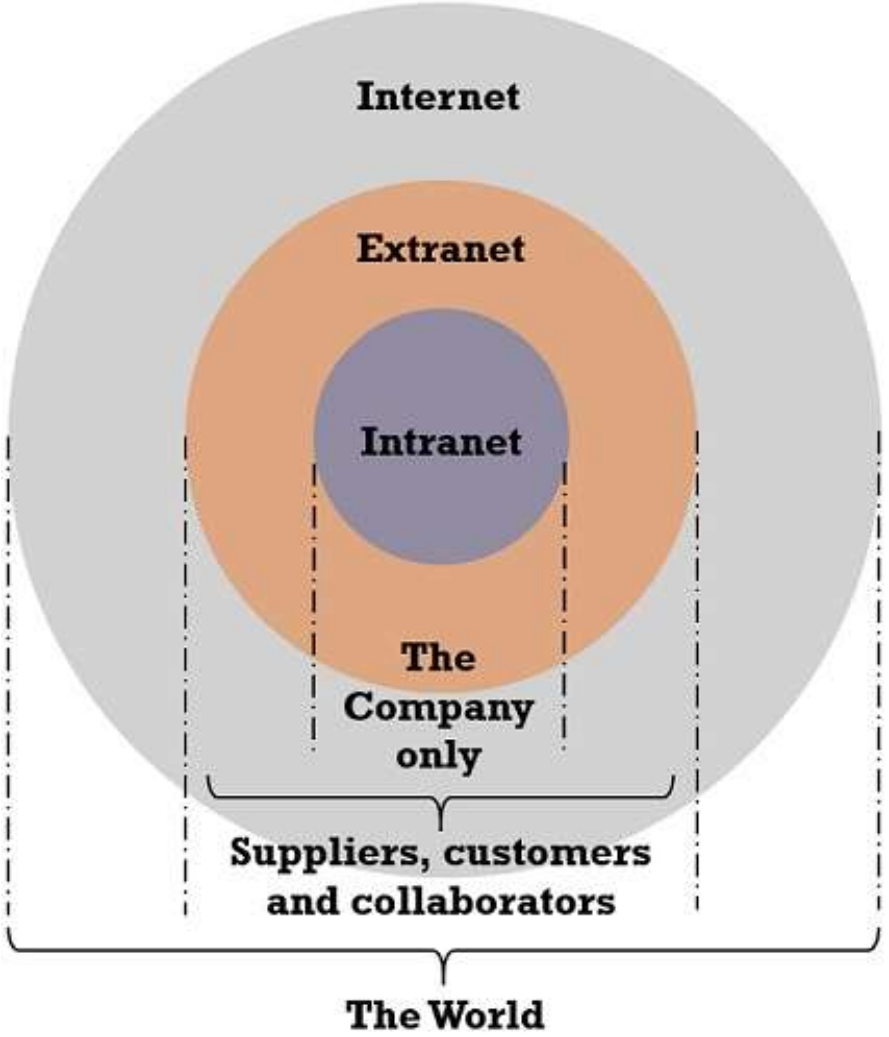
- A *Local Area Network* (LAN) is a:
  - Computer network that interconnects computers within a limited area such as a residence, school, laboratory, university campus, or office building
  - The two most common technologies in use for local area networks are: *Ethernet* and *WiFi*
  - In future mobile networks (e.g., 4G and 5) may replace the current technologies
- A *Wide Area Network* (WAN) covers a larger geographic distance

Ethernet and Wi-Fi

- *Ethernet*:
  - Is a family of computer networking technologies commonly used in:
    - Local Area Networks (LAN) / Metropolitan Area Networks (MAN) / Wide Area Networks (WAN)
  - It was developed in the late 1970's and commercially introduced in 1980 and standardized in 1983 as IEEE 802.3
  - It has retained high levels of backward compatibility and been refined to support higher bit rates and longer link distances.
- *Wi-Fi*:
  - WiFi is a family of radio technologies commonly used for wireless local area networking (WLAN) of devices

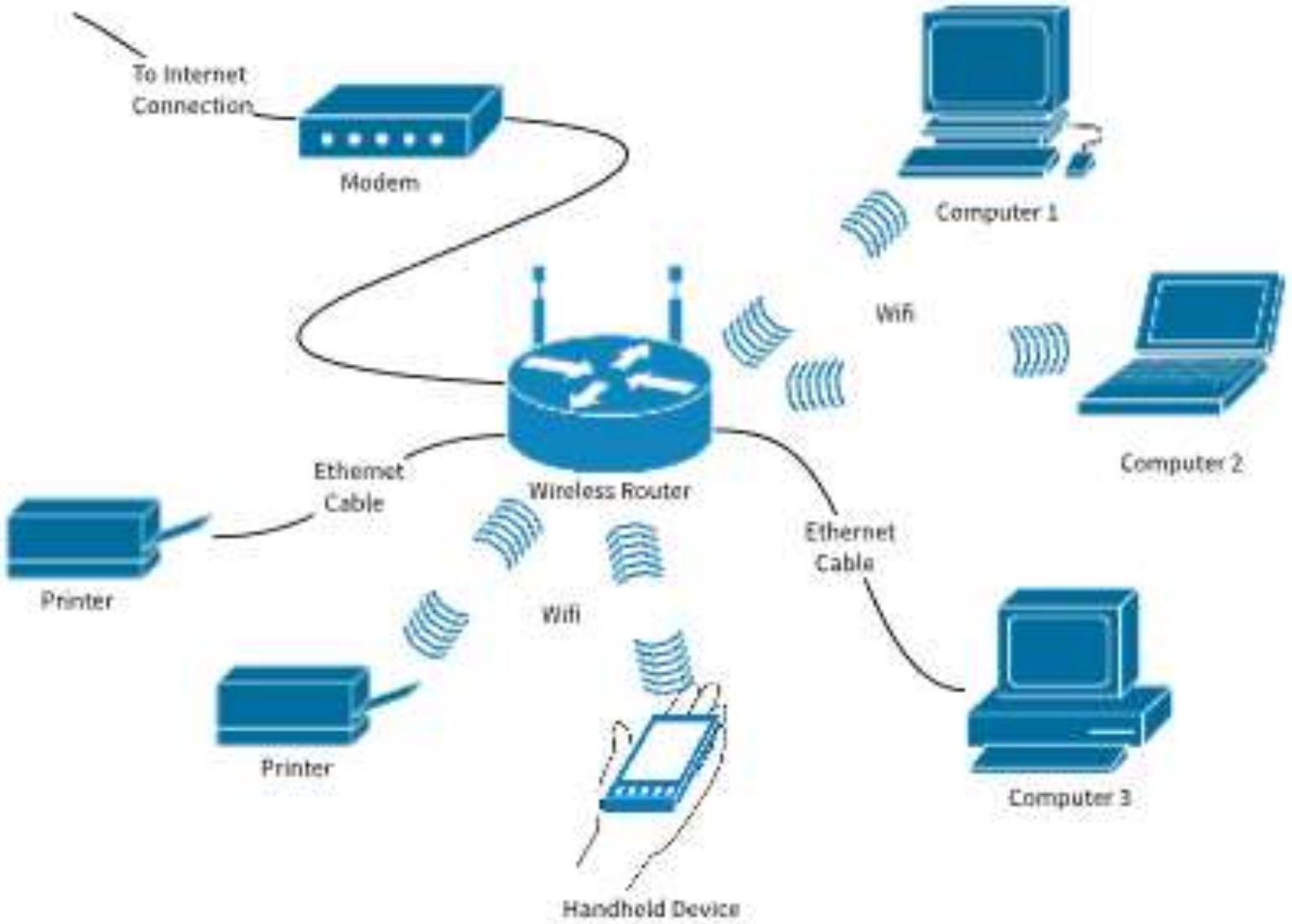
Internet *vs* Intranet





Ethernet


IBM Compatible
IMac
Server
Ethernet
Laptop computer
IBM Compatible


To Internet
Connection
Modem
Computer 1
Wifi
Computer 2
Wireless Router
Ethernet
Cable
Printer
Ethernet
Cable
Wifi
Printer
Computer 3
Handheld Device

Web Systems
and
Web System Architectures

Web Systems

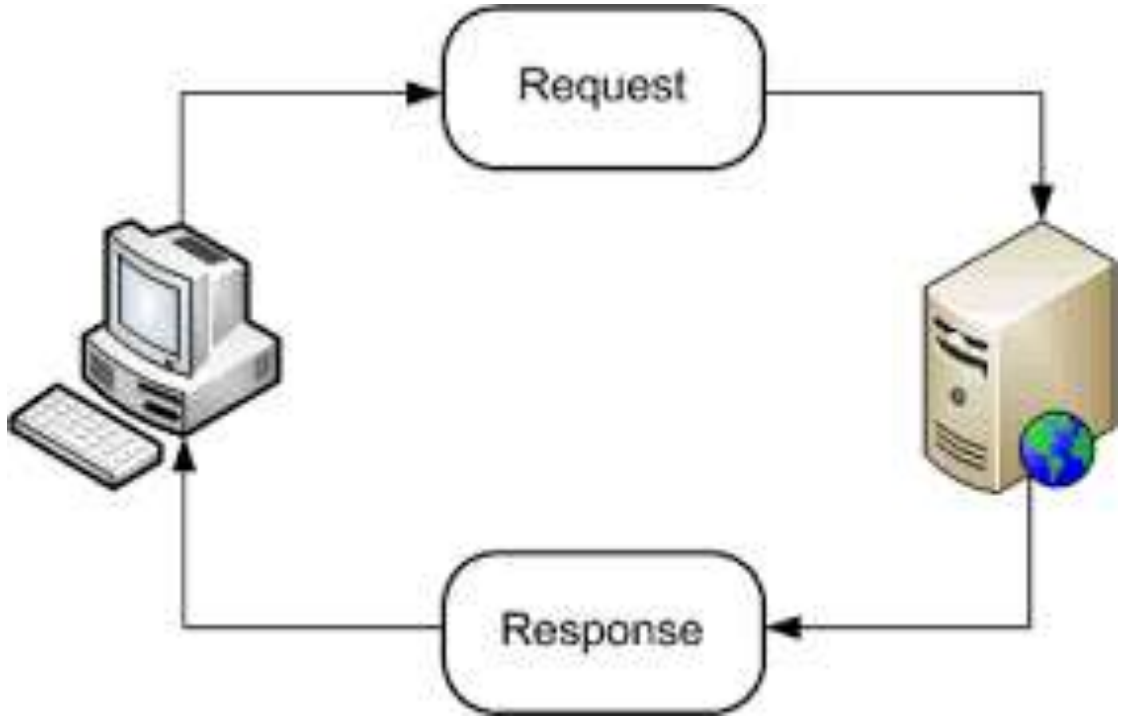
- Web systems architectural models
  - Are conceptual models that describe and define the configuration of a system addressing a systems:
    - Structure
    - Hardware and software
    - Behaviour
    - System design
  - A conceptual model is
    - A formal description and representation of a system
    - A model is organized in a way that supports reasoning about the structures and behaviours of a system

Web Systems Architectures

- There are three types of architecture found in web-systems
- ***two-tier*** *architectures*
- ***three-tier*** architectures
- ***three-tier*** architectural model for a database application
- We will briefly introduce the architectures with conceptual models showing their configuration

Web-Systems Request / Response Interactions

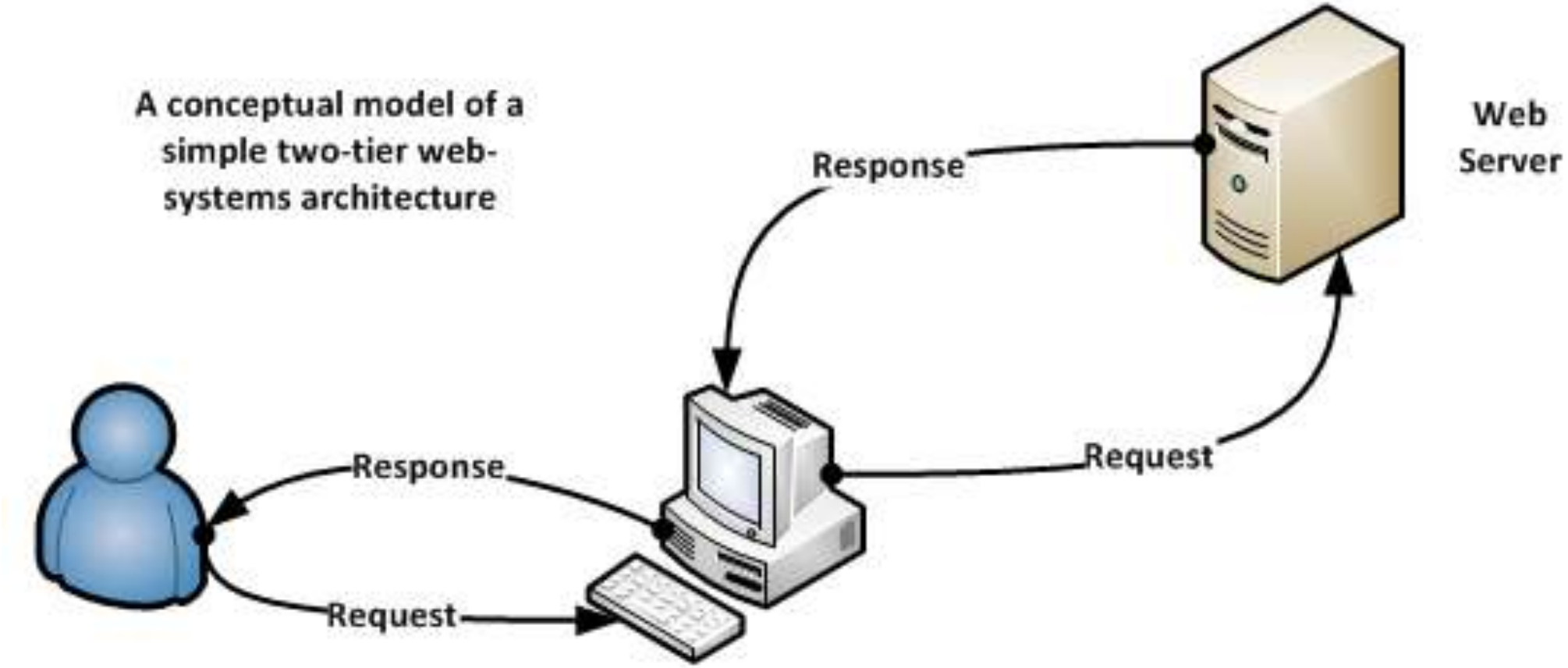
- When a web-page is opened
  - There are a series of interactive requests and responses
  - The interactions are between the client (a web-browser) and the web server that hosts the requested resources
  - Each request tells the server that the client wants a specific resource(s)
  - The response to the request delivers the resource content.
- The figure shows this interaction in a 2-layer web systems architecture



Two-Tier Architecture

- ***two-tier*** *architectures*
  - A client tier (client computer systems and web browsers)
  - A second tier where the web server is located
- Interactions
  - A user requests a web-page or resource
  - The local web-browser requests a resource from a web server
  - A web-server sends a response to the web browser
  - The web browser shows the web-page or processes the resource

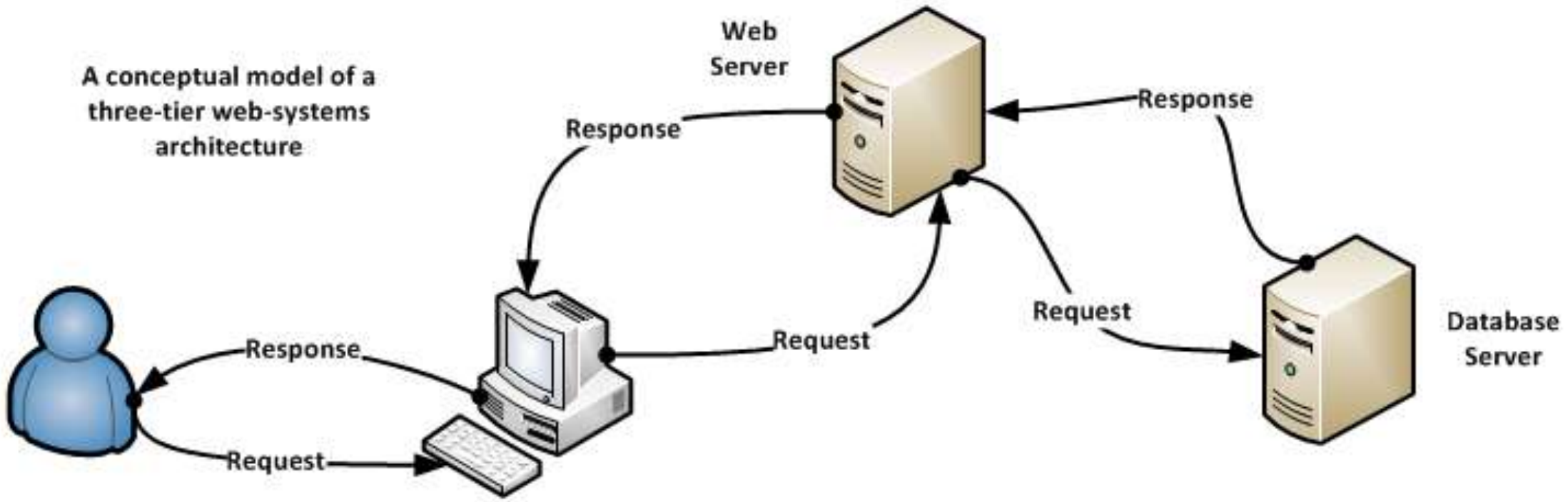
Two-Tier Web-Systems Architecture



Three-Tier Architectures

- ***three-tier*** architectures
  - A client tier (client computer systems and web browsers)
  - A middle tier where the web server is located
  - A third tier where a database server is located
- Interactions
  1. A user requests a web-page or resource
  2. The local web-browser requests a resource from a web server
  3. The web-server sends a request to the database server
  4. The database server sends a response to the web-server
  5. A web-server sends a response to the web browser
  6. The web browser shows the web-page or processes the resource

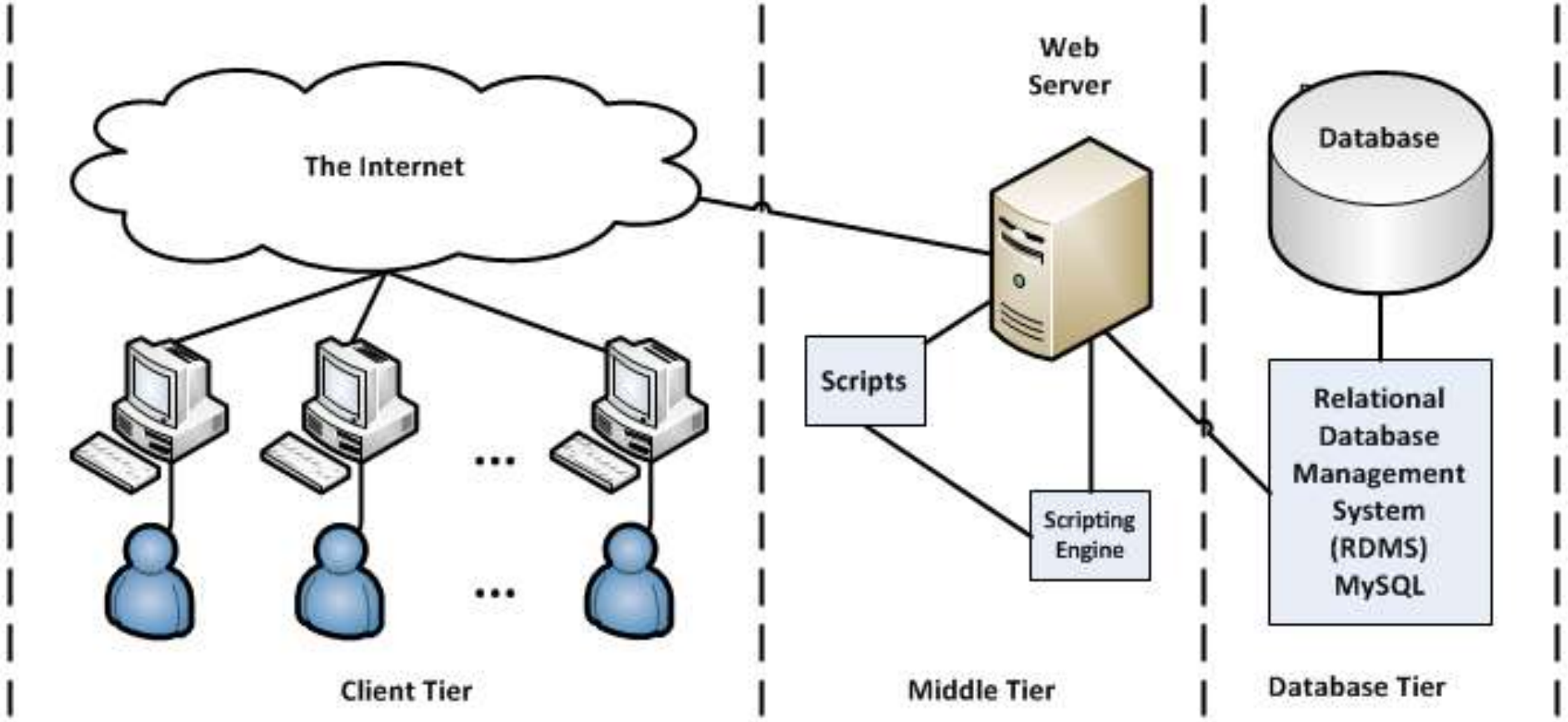
Three-Tier Web-Systems Architecture



Web Systems Database Applications

- In developing web-systems database applications
  - In the client tier
    - Clients computer systems
    - Web browsers
    - Scripts (JavaScript)
- The client tier connects to the middle tier
  - In the middle tier
    - Web server
    - Scripting engine
    - Scripts (PHP)
- The middle tier connects to the database server

Three-Tier database Application Architecture



A three-tier architectural model of a web-systems database application

‘Real-World’ Web System Architectures

- The three web-systems architectures are design models of typical architectures
- In *‘real-world’* web systems
  - The configuration of physical servers will vary
  - There are physical servers in the second and third layers
  - There is a separate database server (Holding for example the MySQL server)
  - All the physical components are created within a single physical server using dedicated partitions (*virtual servers*)
- The design of a web system is based on
  - The size of a web-site measured in terms of the anticipated number of ‘hits’
  - The database function will be designed based on the number of user records

Database Overview

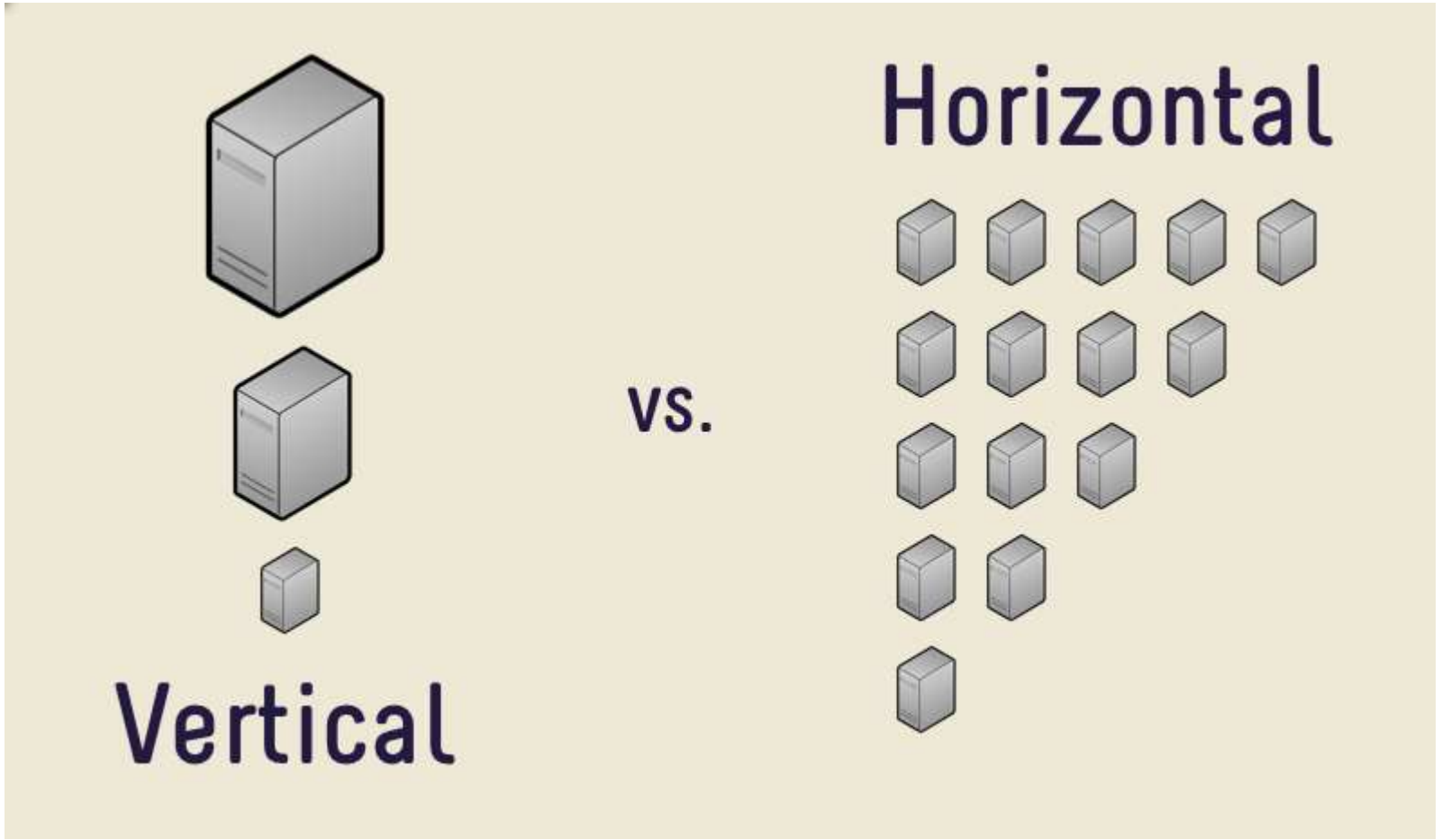
Database Technologies

- There are multiple database technologies in *'real-world'* Internet systems
  - *Relational Database Management Systems* (RDMS) (*structured* data)
  - *NoSQL* database systems (*unstructured* data)
- From a web systems design perspective
  - A RDMS database is located and run from a single server (or *virtual server*)
  - A NoSQL database is generally implemented using *horizontal* and *vertical* scaling

Web Systems Database Technologies

- Web systems applications (both large and small) generally use cloud-based (Internet) systems
  - A typical example of a cloud-based system is an email application
- Current large web-systems applications often use *NoSQL* database systems where
  - Data may be stored in multiple locations within a country (or)
  - Data may be stored in multiple locations in many countries
  - The data storage uses both *horizontal* and *vertical* scaling
  - MySQL is generally restricted to small (local) scale applications
- This course is restricted to the use of the two/ three tier architecture using MySQL

Server Scaling



Conclusion

- We have provided:
  - An overview of the course and the *subjects* we will cover
  - An overview of the course *assessment*
  - An introduction to the *Internet* and *internet*
  - An overview of web systems *architectures*
  - A brief introduction to *design* and *conceptual models*
  - A brief introduction to *database technologies*
  - A brief introduction to the *basic types of web pages*