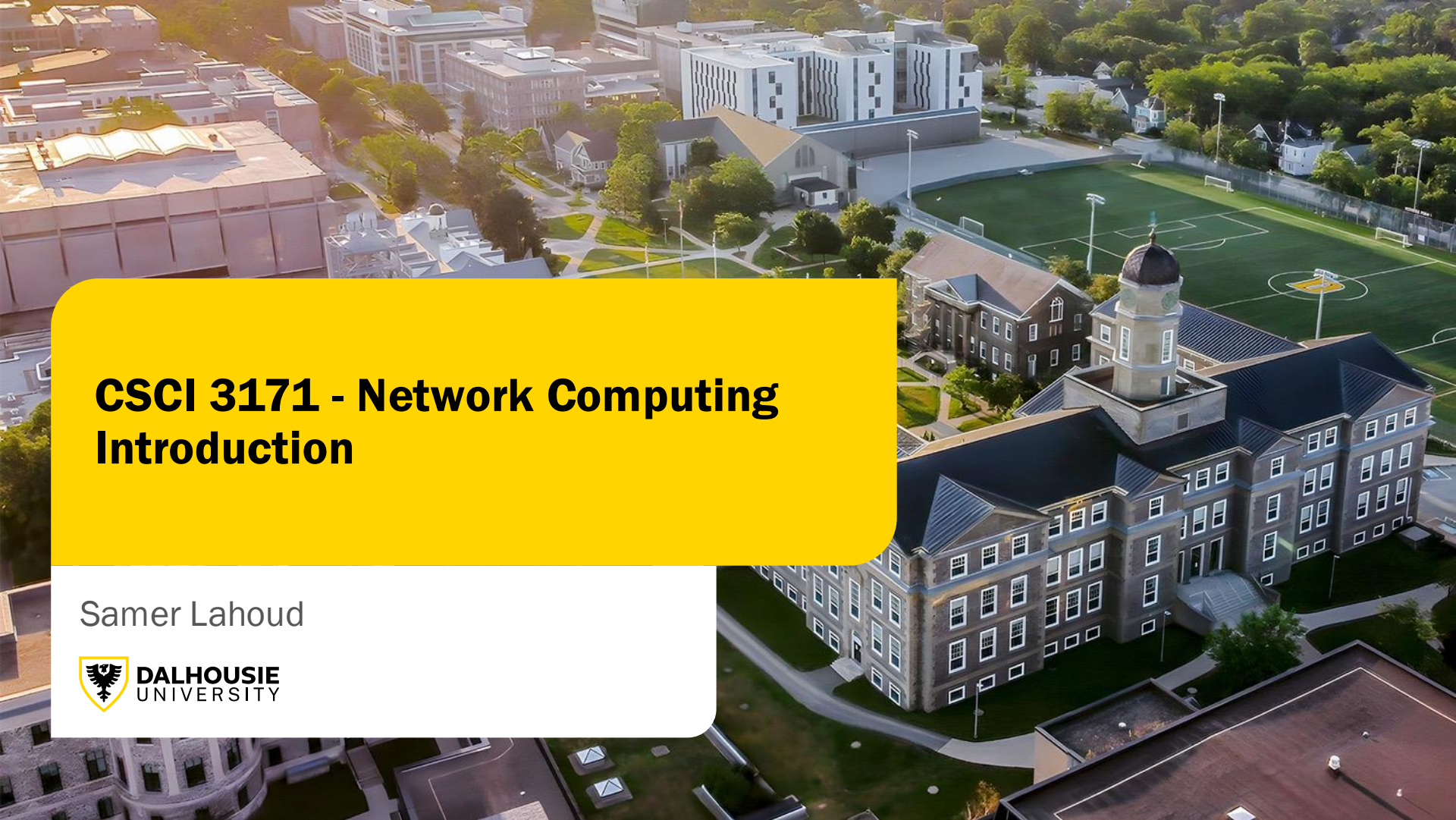


CSCI 3171 - Network Computing Introduction

Samer Lahoud

DALHOUSIE UNIVERSITY

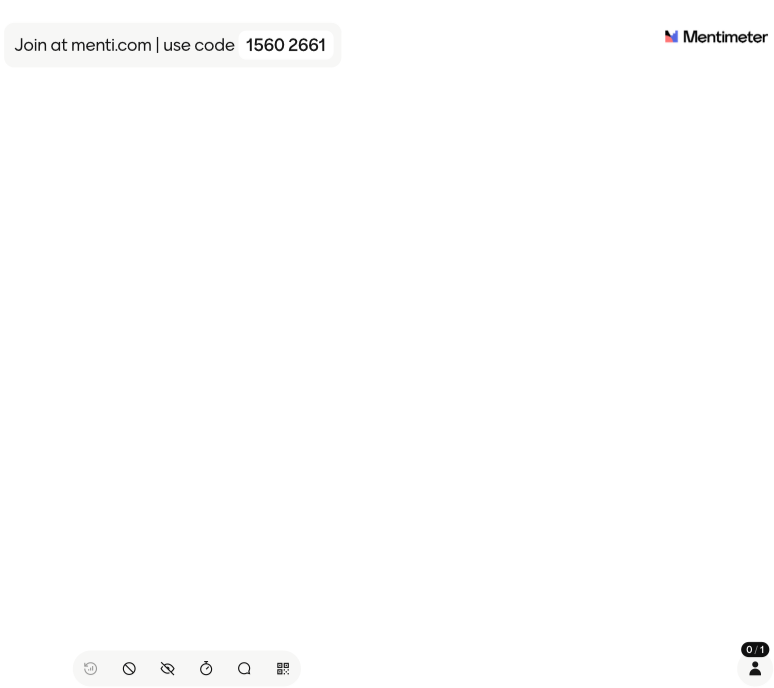
Goal and Roadmap

- Goal:
  - *Big picture* of the Internet
  - Introduction to terminology
- Overview and roadmap
  - What is the Internet? What is a protocol?
  - Network edge: hosts, access network, physical media
  - Network core: packet switching
  - Performance: loss, delay, throughput
  - Packet and circuit switching
  - Protocol layers, service models
  - Internet structure and challenges

What is the Internet?

How To Protect the Internet from Becoming the Splinternet

Internet Society


Join at menti.com | use code 1560 2661
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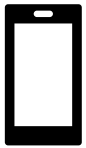
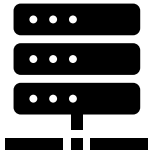
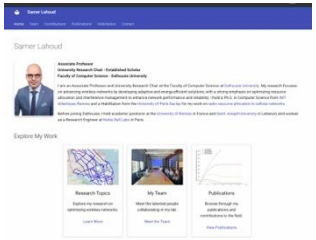
CSCI 3171 - W26
Choose a slide to present
What is the Internet?
0 / 1

What is the Internet?



My smartphone

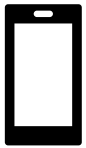




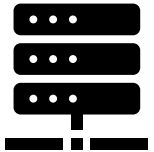
http://samer.lahoud.fr

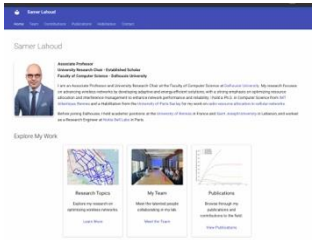
- Devices (hosts or end systems)
  - Smartphones, servers
  - Other examples: IoT devices

What is the Internet?



My smartphone





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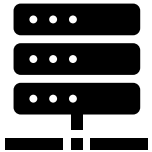
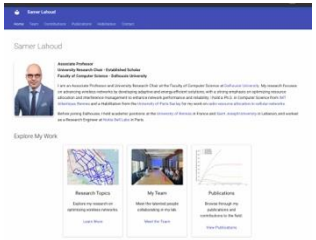
- Services
  - Web
  - Other examples: email, video conference, gaming, file transfer, remote access, instant messaging

What is the Internet?

My smartphone





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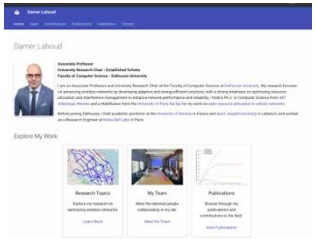
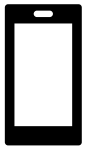
- Applications
  - Browser, web server
  - Other examples: file server, mail client, chat client, mail server, DNS server

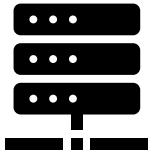
What is the Internet?

```
00 16 47 45 54 20 2f 20  48 54 54 50 2f 31 2e 31   ··GET /  HTTP/1.1
0d 0a 48 6f 73 74 3a 20  73 61 6d 65 72 2e 6c 61   ··Host:  samer.la
68 6f 75 64 2e 66 72 0d  0a 55 70 67 72 61 64 65   houd.fr· ·Upgrade
2d 49 6e 73 65 63 75 72  65 2d 52 65 71 75 65 73   -Insecur e-Reques
74 73 3a 20 31 0d 0a 41  63 63 65 70 74 3a 20 74   ts: 1··A ccept: t
65 78 74 2f 68 74 6d 6c  2c 61 70 70 6c 69 63 61   ext/html ,applica
74 69 6f 6e 2f 78 68 74  6d 6c 2b 78 6d 6c 2c 61   tion/xht ml+xml,a
```





Request



Response

My smartphone

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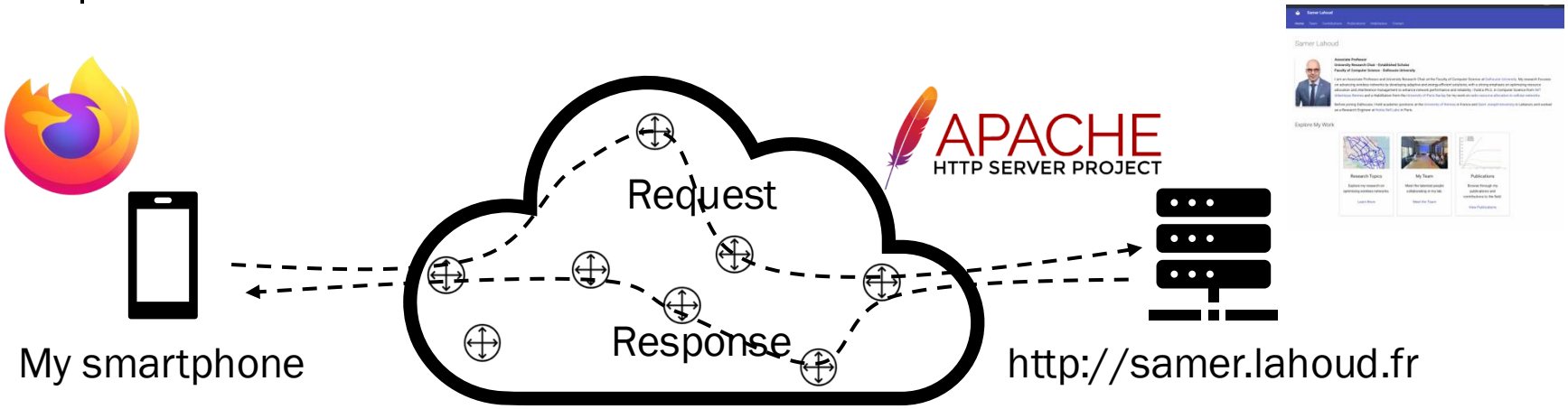
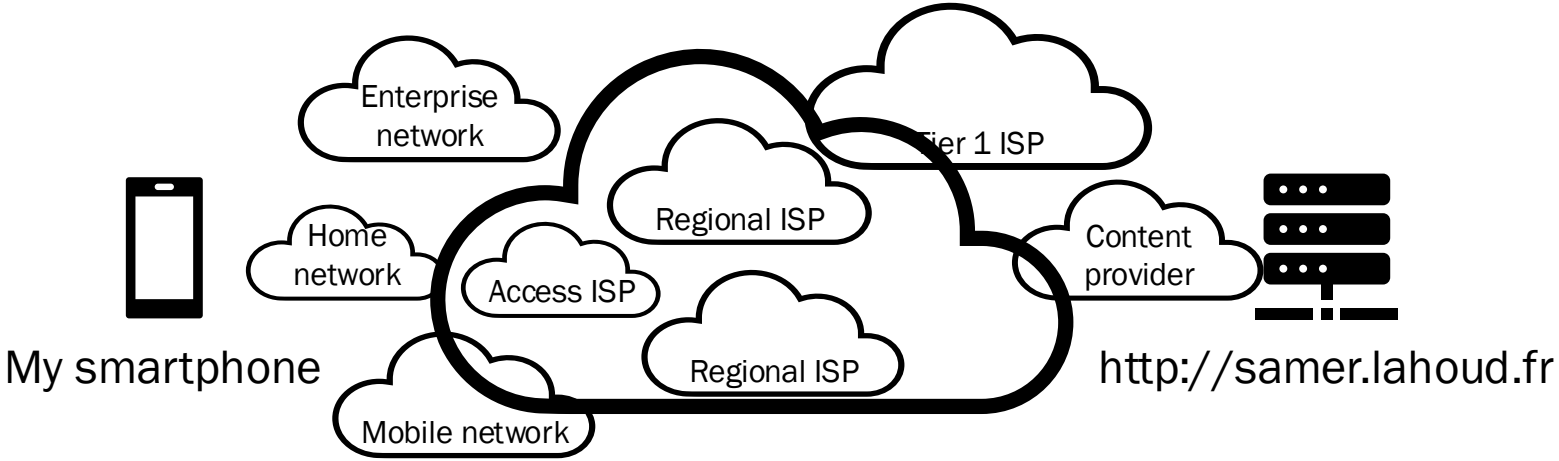
- Protocols
  - HTTP
  - Other examples: DNS, TCP, FTP, WiFi, Ethernet
- Internet standards

What is the Internet?



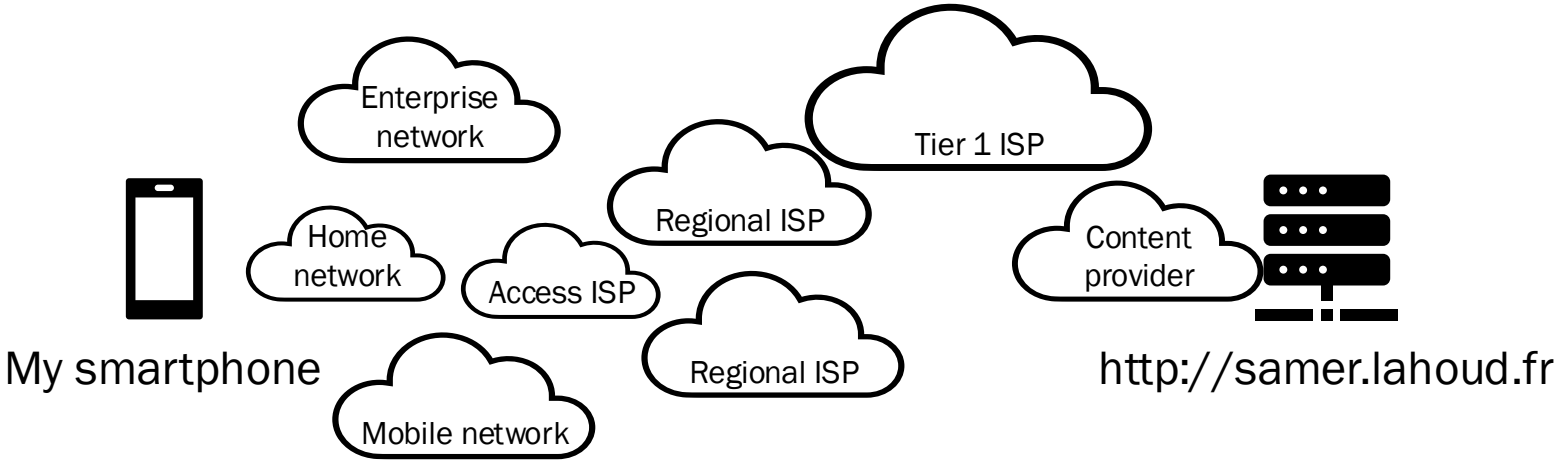
- Packet switches
  - Forward packets towards the destination
- Naming and addressing

What is the Internet?



- Network of networks
  - Home, enterprise, content provider networks
  - Access, Regional, Tier 1 ISPs

What is the Internet?



- Communication links
  - Radio waves, copper cables, fiber optics

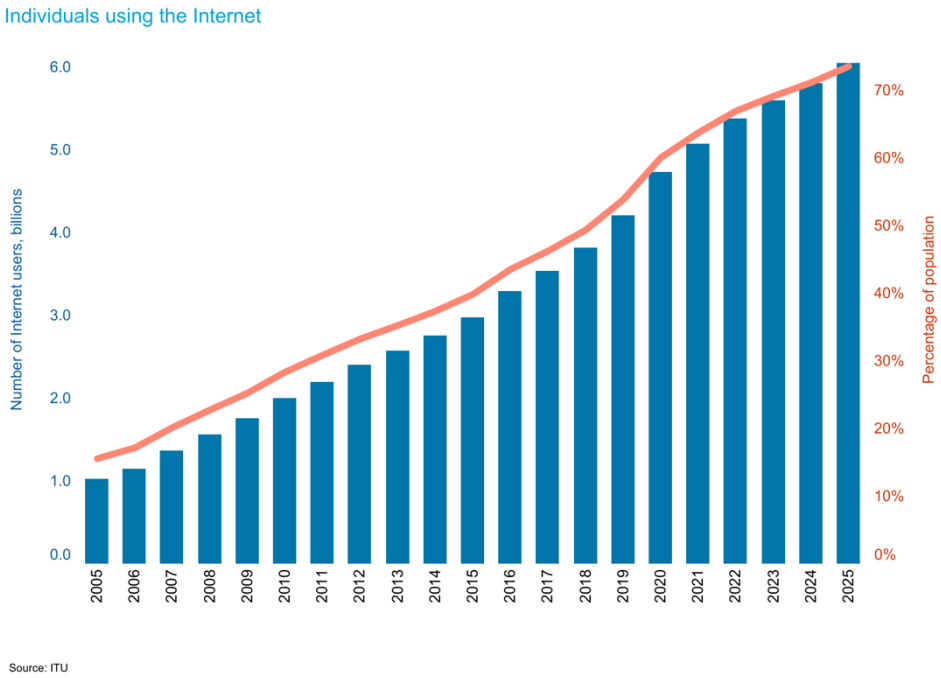
Measuring the Internet

Facts and Figures*

*Source: https://www.itu.int/itu-d/reports/statistics/facts-figures-2025/

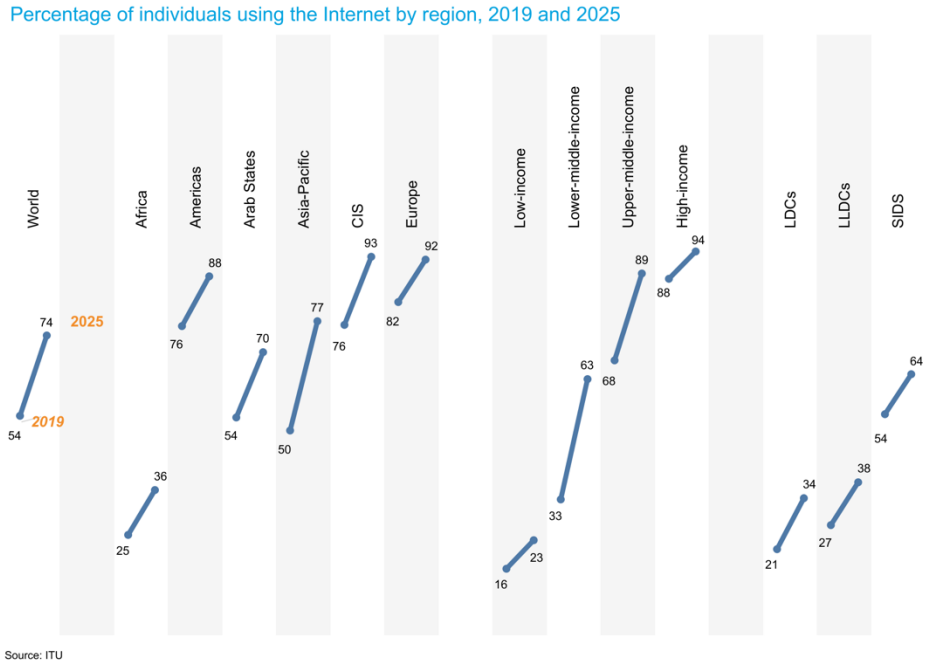
Internet Use

- In 2025, 74% of the world population (6 billion people) are online
  - 2.2 billion people, one-quarter of the global population, are still offline!



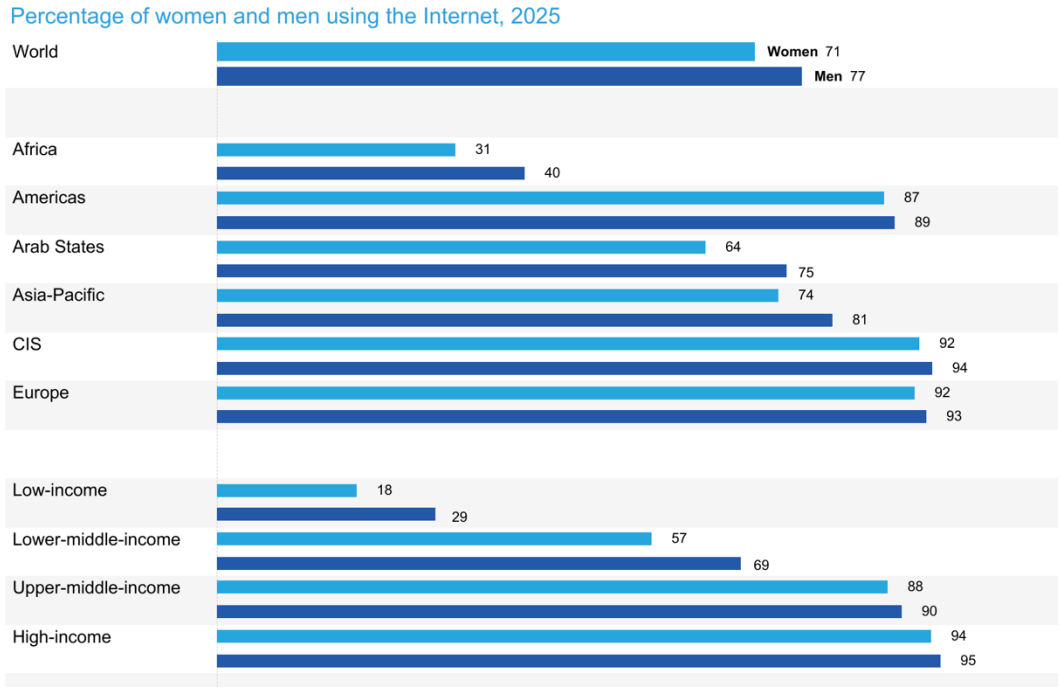
The Digital Divide

- In high-income countries 94% of the population uses the Internet, approaching universality (95%)
- In low-income countries, only 23% of the population is online



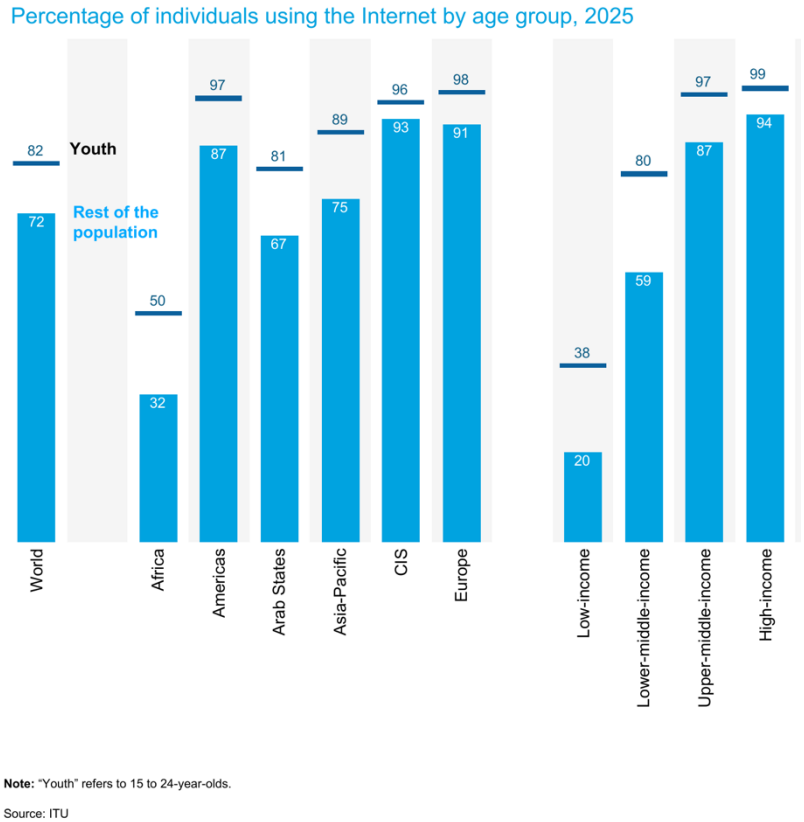
The Gender Digital Divide

- Gender parity has been achieved in the Americas and Europe
  - Gender parity is closely correlated with the level of development



Youth Internet Use

- Universality (95%) has already been reached by the 15-24 age group in high-income and upper-middle-income economies
- Youth in low-income countries are 1.9 times more likely to use the Internet than other individuals

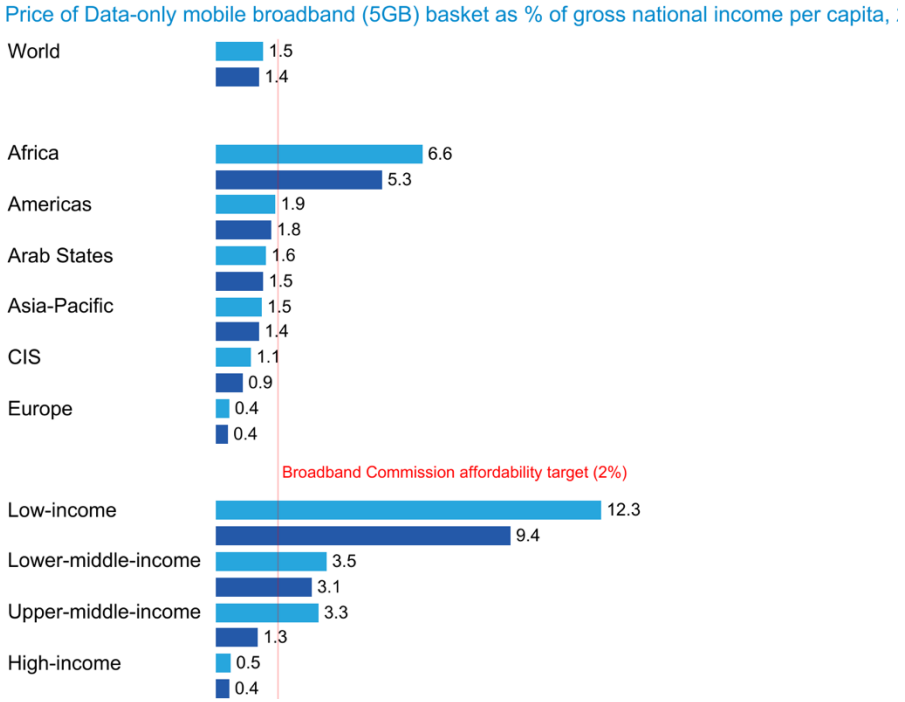


Note: "Youth" refers to 15 to 24-year-olds.

Source: ITU

Affordability of Internet Services

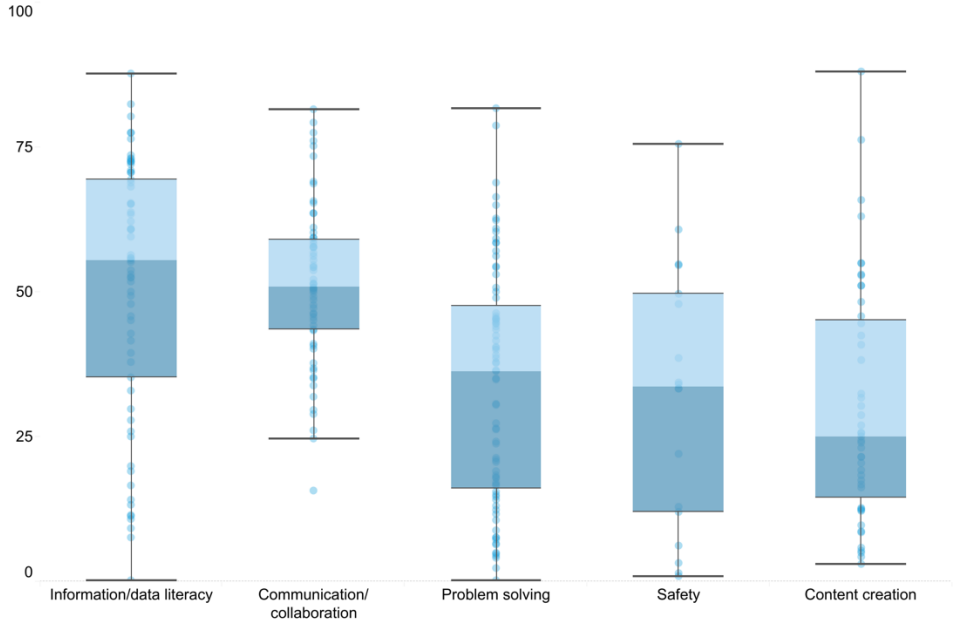
- The global median price of the mobile-broadband basket dropped from 1.5 to 1.4 per cent of gross national income per capita in one year
- Subscribers in a low-income economy pay 22 times as much compared to high income



Internet Skills

- The gap between individuals using the Internet and those with digital skills demonstrates that many may be using the Internet without being able to fully benefit from it or avoid its dangers

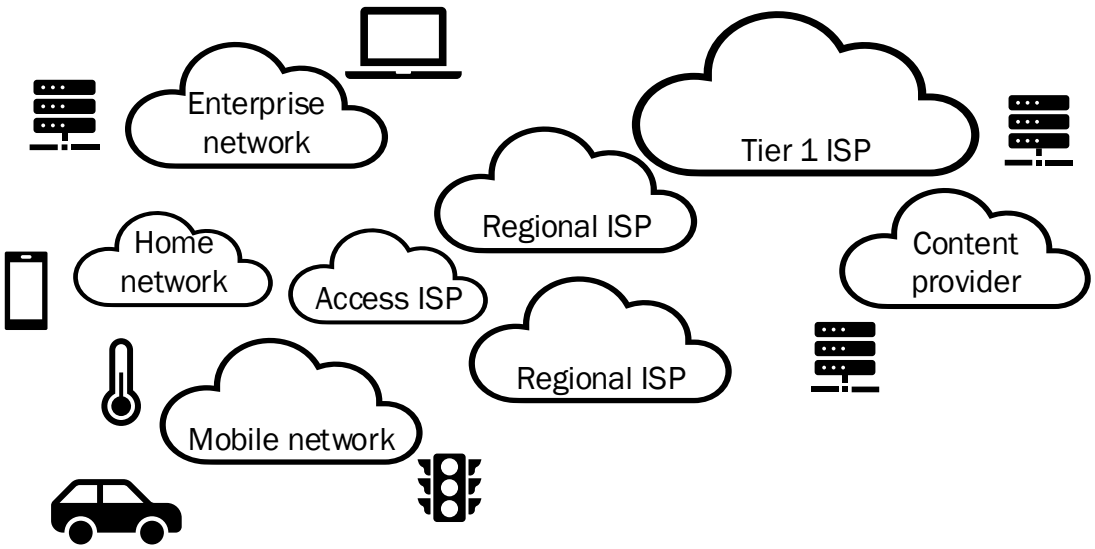
Percentage of individuals with ICT skills, by type of skill, based on most recent data in 2019-2022 period

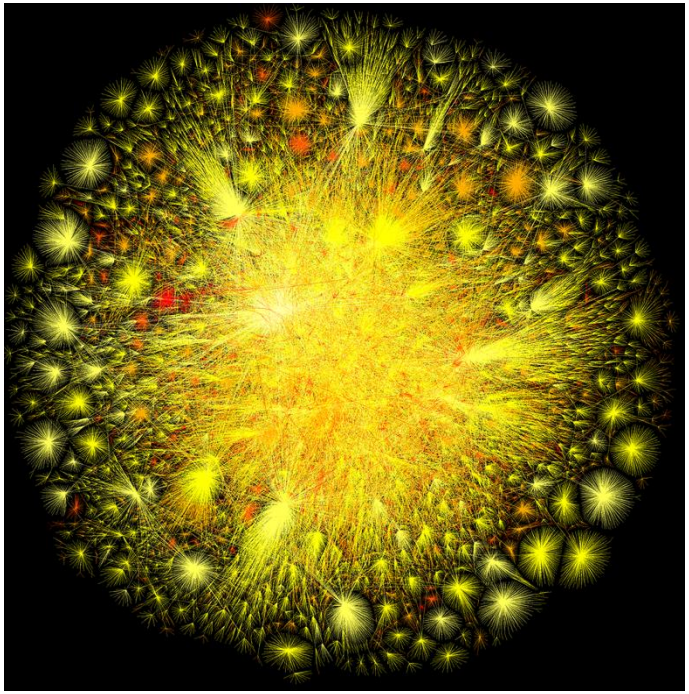


Note: Bars indicate the 25th, median and 75th percentile of all country values. Bottom and top lines indicate minimum and maximum values. *Communication/collaboration* is the average of sending messages (e.g. e-mail, messaging service, SMS) with attached files; making calls over the Internet; participating in social networks; and taking part in consultation or voting via Internet. *Problem solving* is the average of finding, downloading, installing and configuring software; connecting and installing new devices; transferring files or applications between devices; electronic financial transactions; doing an online course; and purchasing or ordering goods or services. *Safety* is the average of changing privacy settings; and setting up effective security measures. *Digital content creation* is the average of using copy and paste tools; creating electronic presentations; using basic arithmetic formula in a spreadsheet; editing online text, spreadsheets, presentations; and uploading self/user-created content. *Information/data literacy* is the average of verifying the reliability of information; getting information about goods or services; reading or downloading newspapers, etc.; and seeking health-related information. Data availability: 64 countries for *communication/collaboration*, 80 countries for *problem solving*, 18 countries for *safety*, 47 countries for *content creation*, and 65 countries for *information/data literacy*. In-scope ages may vary between countries.
Source: ITU

Learning Approach and Outcomes

The Internet Map

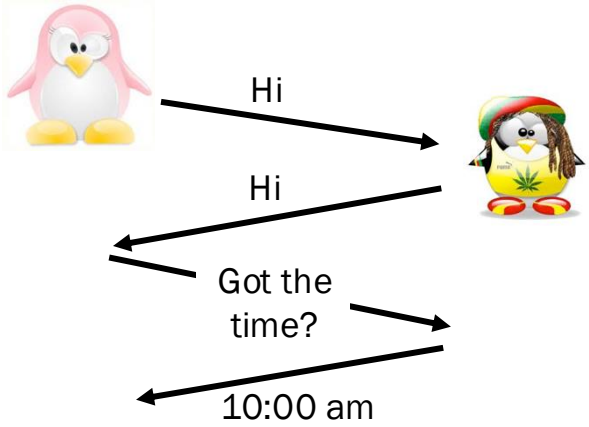




Barrett Lyon's Map of the Internet in 2010 (MoMA Museum)

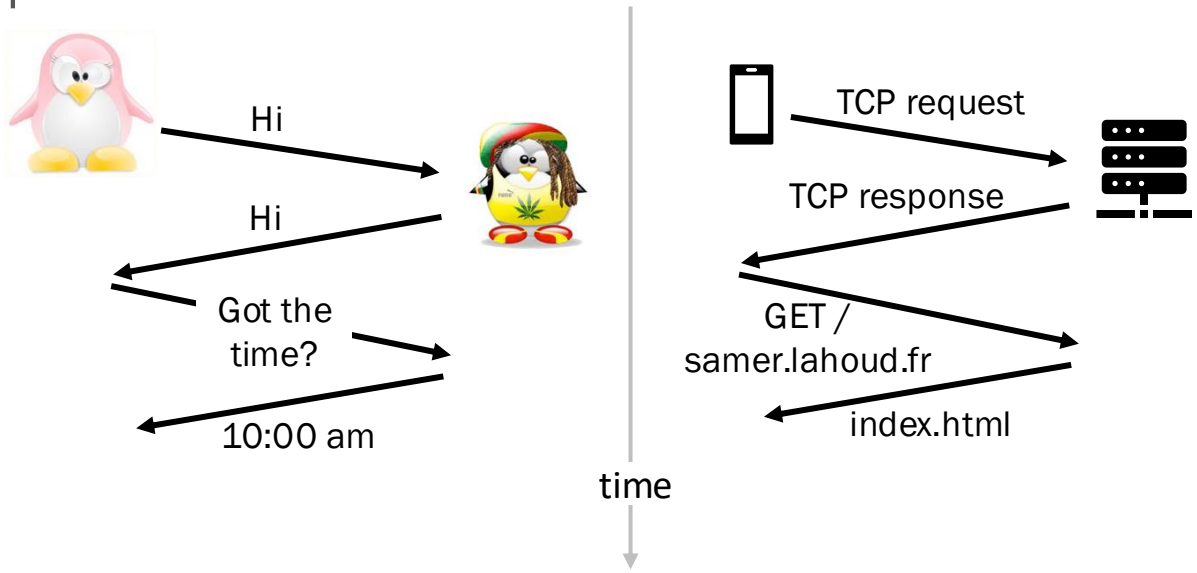
What Is A Protocol?

- Human protocols
  - What time is it?
  - I have a question
  - Introductions
- Rules for:
  - Specific messages sent
  - Specific actions taken
    - when messages received or sent, …
- Network protocols:
  - Devices rather than humans
  - All communication activity in Internet governed by protocols

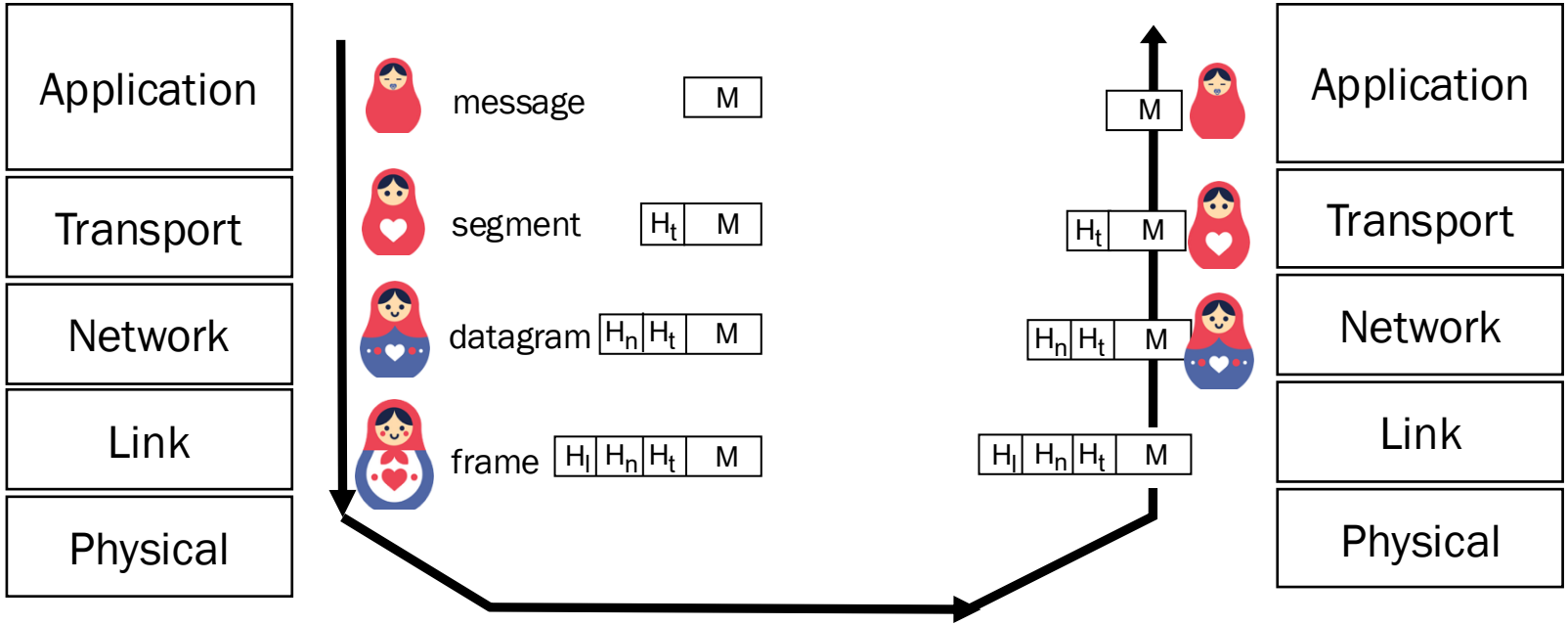


What Is A Protocol?

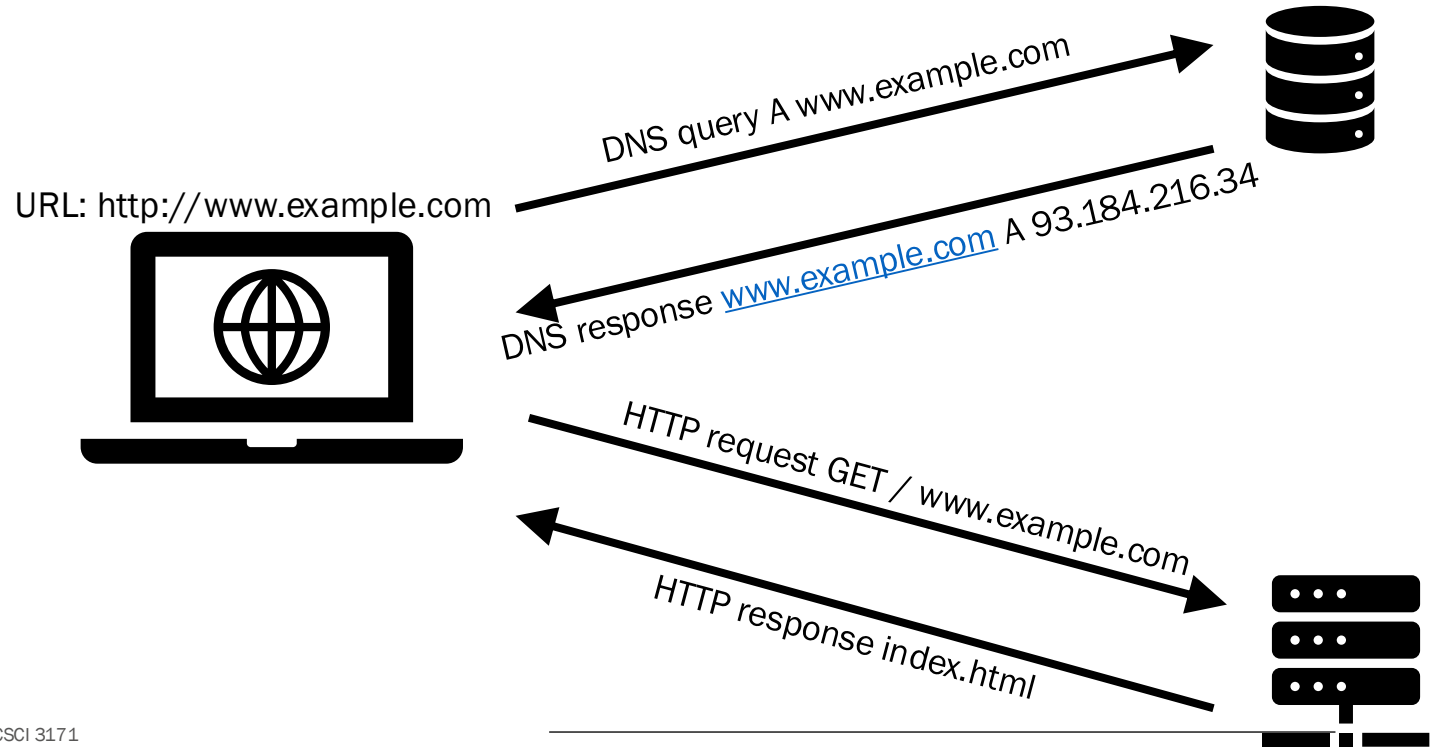
- Protocols define the format, order of messages sent and received among network entities, and actions taken on message transmission, receipt



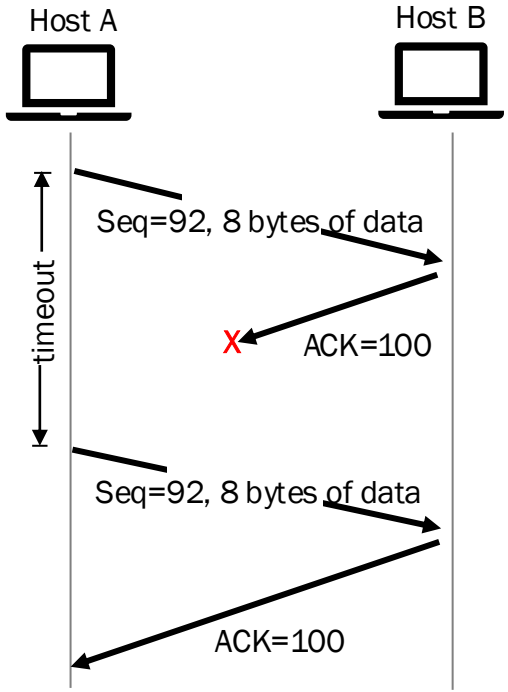
Learning Outcomes Illustrated: 1- The Layer Model



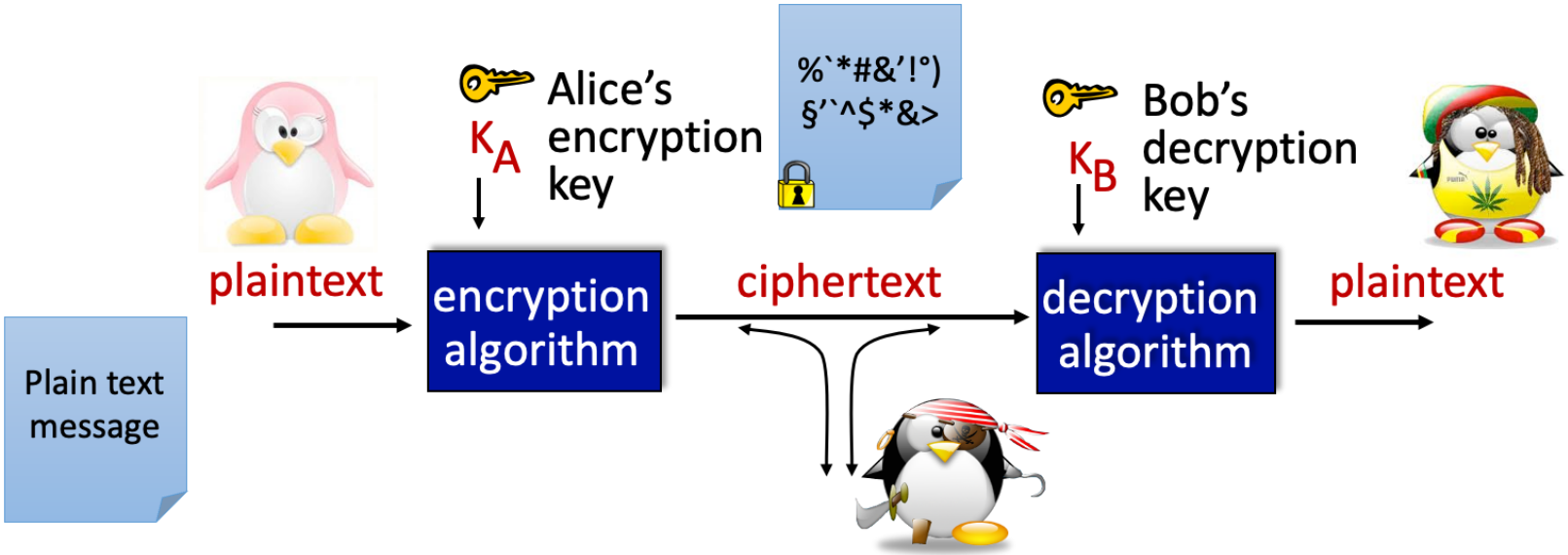
Learning Outcomes Illustrated: 2- The Application Layer



Learning Outcomes Illustrated: 3- The Transport Layer



Learning outcomes Illustrated: 4- Secure Communications



Why a CS Course on Network Computing?

- Foundational knowledge
- Real-world relevance
- Security awareness
- Career opportunities
- Preparation for advanced courses
- Hands-on experience
- Continuous technological evolution

Tentative Schedule

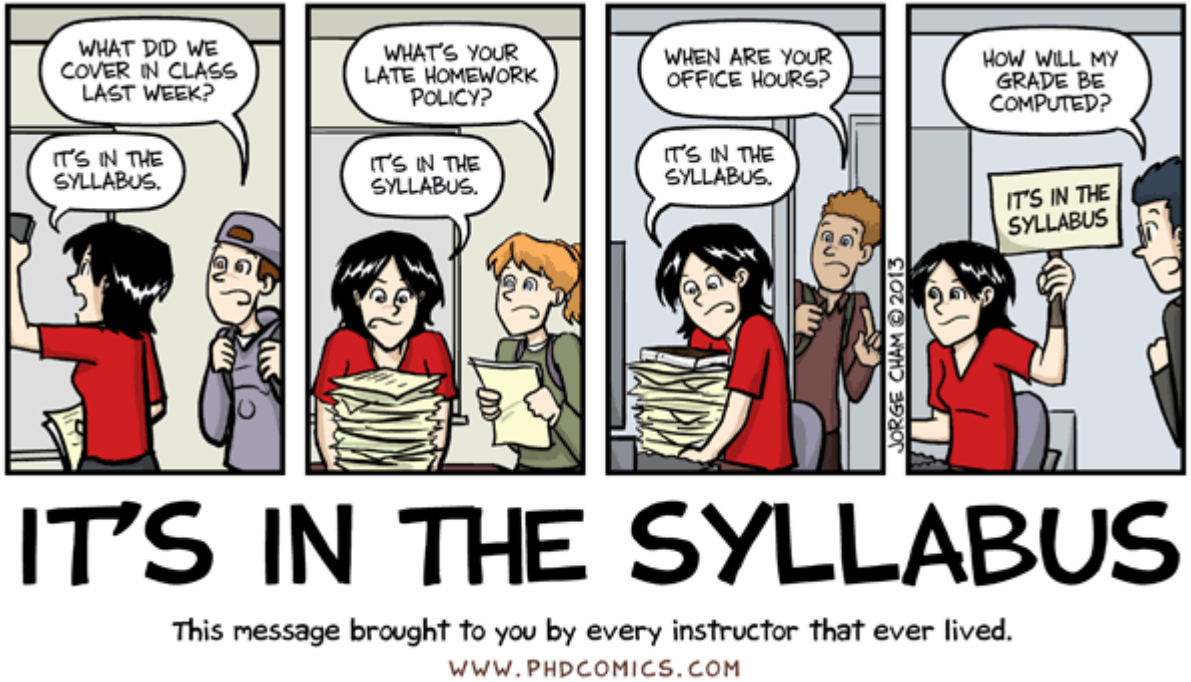
Week	Dates	Lecture	Lab	Assignment
1	Jan 5 - Jan 9	Introduction to Networks		
2	Jan 12 - Jan 16	Introduction to Networks		
3	Jan 19 - Jan 23	TCP/IP Layered Architecture	Lab 1	
4	Jan 26 - Jan 30	The Application Layer	Lab 2	Assignment 1
5	Feb 2 - Fab 6	The Application Layer	Lab 3	
6	Feb 9 - Feb 13	The Application Layer	Lab 4	Assignment 2
	Feb 16 - Feb 20	Study Break		
7	Feb 23 - Feb 27	Socket programming	Lab 5	
8	Mar 2 - Mar 6	Transport Layer	Lab Exam 1	Assignment 3
9	Mar 9 - Mar 13	Transport Layer		
10	Mar 16 - Mar 20	Transport Layer	Lab 6	Assignment 4
11	Mar 23 - Mar 27	Principles of Secure Communications	Lab 7	
12	Mar 30 - Apr 3	Principles of Secure Communications	Lab Exam 2	Assignment 5
13	Apr 6 - Apr 10	Principles of Secure Communications		

Labs

Week	Lab	Delivery
3	Lab 1	Graded report
4	Lab 2	Graded report
5	Lab 3	Graded report
6	Lab 4	Non-Graded report
Study Break		
7	Lab 5	Non-Graded report
8	Lab Exam 1	
9		
10	Lab 6	Non-Graded report
11	Lab 7	Non-Graded report
12	Lab Exam 2	
13		

Grading

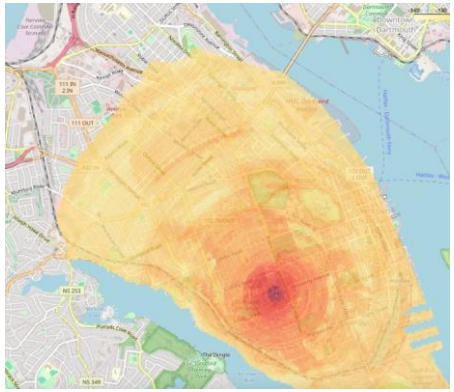
• Assignments	20%
• Lab reports	15%
• Lab exams	20%
• Quizzes during lectures and labs	10%
• Final Exam	35%

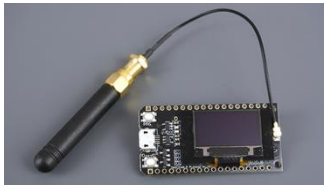

WHAT DID WE COVER IN CLASS LAST WEEK?
IT'S IN THE SYLLABUS.
WHAT'S YOUR LATE HOMEWORK POLICY?
IT'S IN THE SYLLABUS.
WHEN ARE YOUR OFFICE HOURS?
IT'S IN THE SYLLABUS.
JORGE CHAM © 2013
HOW WILL MY GRADE BE COMPUTED?
IT'S IN THE SYLLABUS
IT'S IN THE SYLLABUS
This message brought to you by every instructor that ever lived.
WWW.PHDCOMICS.COM

Syllabus

Who am I?

- Enjoy cooking and (recently) baking
- Play/watch sports
- Teaching networking for the last ~~16~~ 17 years
- Research lab
  - Wireless Connectivity for the Internet of Things
    - Very long-range transmission
    - Battery powered devices
    - Large number of devices





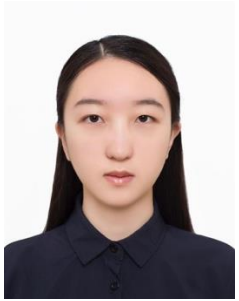
Teaching philosophy

- Generate enthusiasm for networking technologies and their evolution
- Combine theoretical foundation with practical hands-on experience
- Engage in meaningful discussions
- Support success with an ethical behaviour
- Develop analytical skills and critical thinking
- Assess the social and economic impact of networking technologies

TA team

Lead TA:
Richard Purcell
<Richard.Purcell@dal.ca>

Lab TA:
Xinyi Li
<xn394804@dal.ca>



Contact and Office Hours

- Lectures [Room 127]
  - Tuesday and Thursday 08:35 – 09:55 AM
- Lab Sessions [Room 134-143]
  - Monday 11:35 – 12:55 AM
- Office hours will be announced on Brightspace

Questions and inquiries

- Questions related to lectures
  - Contact me on sml@dal.ca
- Questions related the course planning, Brightspace, Labs, grading, etc.
  - Contact Richard.Purcell@dal.ca and cc me