# CS 464/564: Networks Programming [and Distributed Algorithms]

Stefan D. Bruda

Fall 2023

## Network Programming

- Coordinates:
  - **Course Web page:**

    **http://cs.ubishops.ca/home/cs464**
    **http://cs.ubishops.ca/home/cs564**
  - Instructor: Stefan Bruda (stefan@bruda.ca, Johnson 114b, ext. 2374).
  - Email rules.
  - Office hours?
- Textbook:
  - Douglas E. Comer and David L. Stevens, Internetworking with TCP/IP, Vol. III: Client-Server Programming and Applications, Linux/Posix Sockets Version, Prentice Hall, 2001.
  - Course pack available at Doolittle's Co-Op (printed and electronic)
- **Must have a working account on linux.ubishops.ca or obtain one asap**

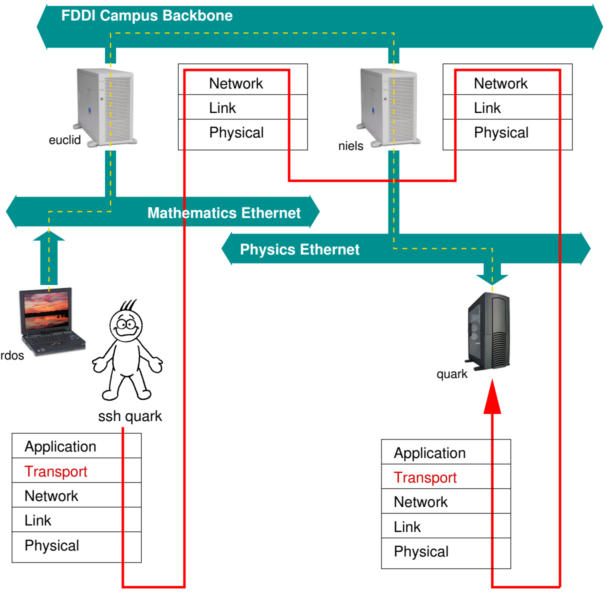
## What is it all about

- A bit of computer networks, a lot of programming
- Or how one can use TCP/IP to communicate across internets
  - We learn how to build distributed applications (using the TCP and UDP protocols, and the client-server paradigm)
  - We will then see what algorithmic features allow us to do so (the IP protocol)
- We use
  - C/C++
  - The TCP/IP protocols
  - The POSIX (Portable Operating System Interface for uniX) standard
  - Berkeley sockets
  - Linux (programming details are largely unchanged in other flavours of Unix, principles are the same for any OS)

## Networks

- Networks are all about transmitting messages between individuals
- As old as mankind
- Consider Stone Age: *A* wants to invite *B* to his place, uses a drum, but *B* is too far away to hear. Then *A* can
  1. get a bigger drum
  2. walk to *B*'s place
  3. ask *C* (who lives halfway) to forward the invitation → networking!
- Of course, we now use computers, fiber optics, satellites, etc. and we send each other emails

# Networks (cont'd)



FDDI Campus Backbone

euclid

Network
Link
Physical

niels

Network
Link
Physical

Mathematics Ethernet

Physics Ethernet

erdos

ssh quark

quark

Application
Transport
Network
Link
Physical

Application
Transport
Network
Link
Physical

| | | |
|---|---|---|
| Application | C/C++ | CS 464 |
| Transport | TCP | CS 464 |
| Network | IP | CS 464 |
| Link | Ethernet | CS 464 |
| Physical | Twisted pair | |

# Protocols

- Networking is all about communication
- In order for two programs to understand each other, they must use a common language i.e., a protocol
  - standard if they are part of the “official” protocol suite, or
  - nonstandard
- Standard protocols exist for many services including remote login, file transfer, and sending and receiving email
- Distributed applications involve communication between a client and a server through some protocol understood by both

# Where do we go from here

- We basically learn how to design, implement, and optimize distributed (i.e., client-server) programs
  - Once this is understood, we will go a bit deeper and talk about the underlying algorithms
- We thus discuss implementations of application protocols
- In doing this, we must introduce and then use concurrency
- During the class, we work in C, or C++ with C constructs when the API being used requires it