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# **ECE 697J – Advanced Topics in Computer Networks**

A Course on Network System Design  
Fall 2003

# Welcome

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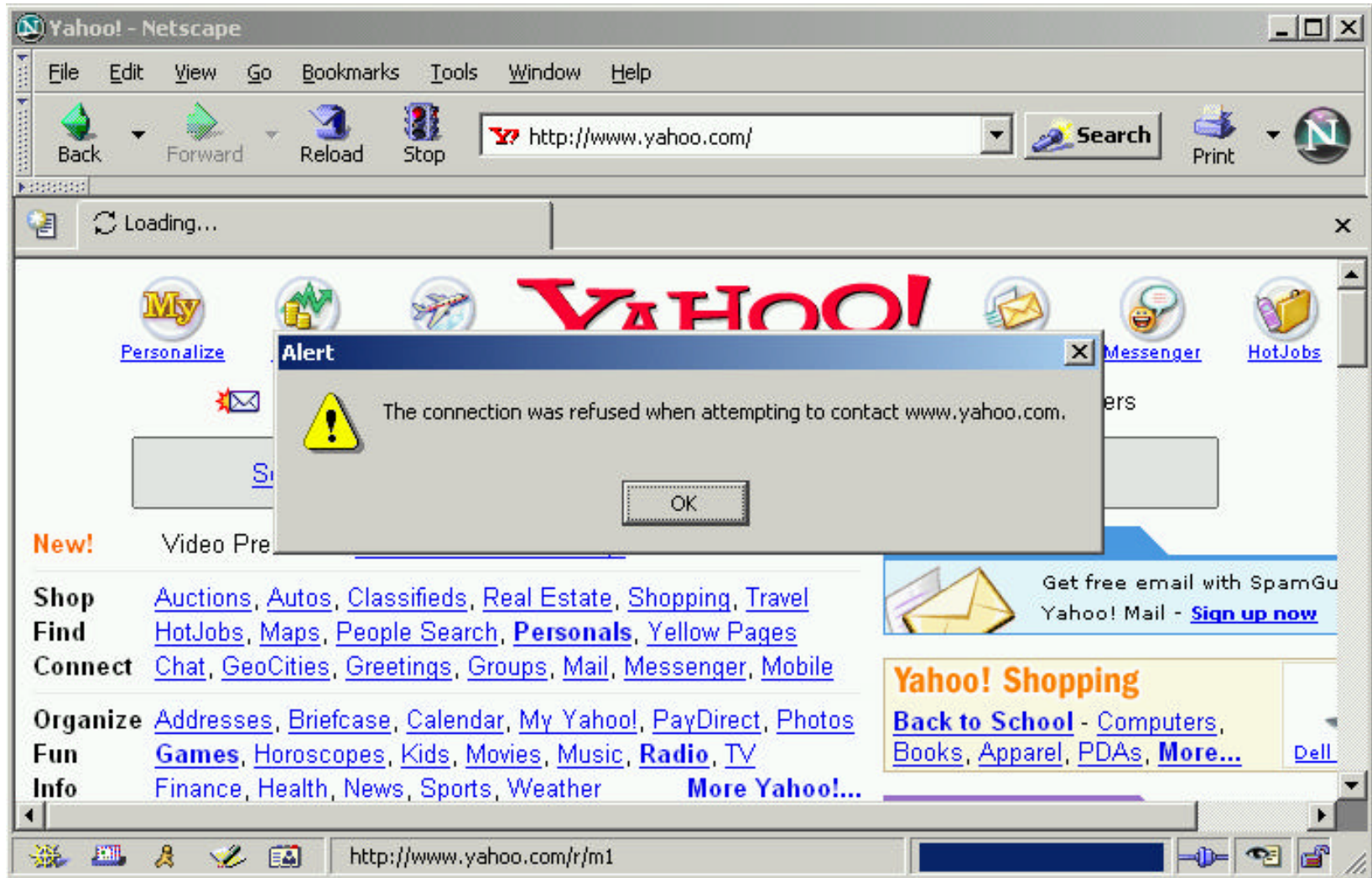
- Who am I?
  - Tilman Wolf, Assistant Professor in ECE
  - Office: KEB 211C
  - Email: [wolf@ecs.umass.edu](mailto:wolf@ecs.umass.edu)
  - Come by anytime
- My research interests:
  - Computer networks
  - How to make networks programmable and adaptable to new uses
  - Network processors
  - Network measurements
  - Network and system security

# What is a Network?

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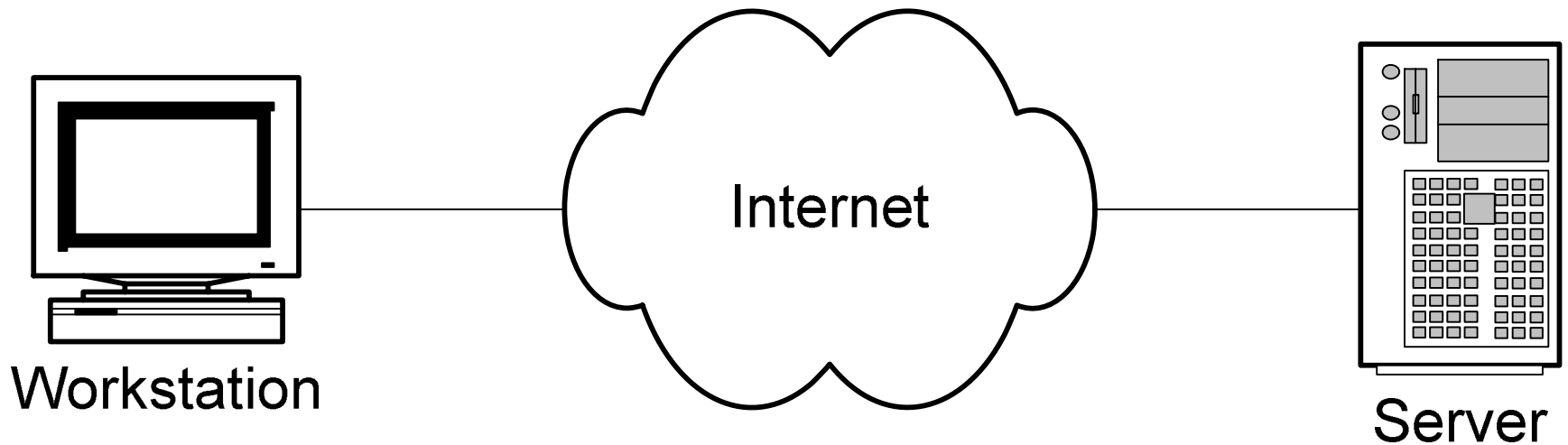
- Or more specifically: “What is the Internet?”

# Answer I

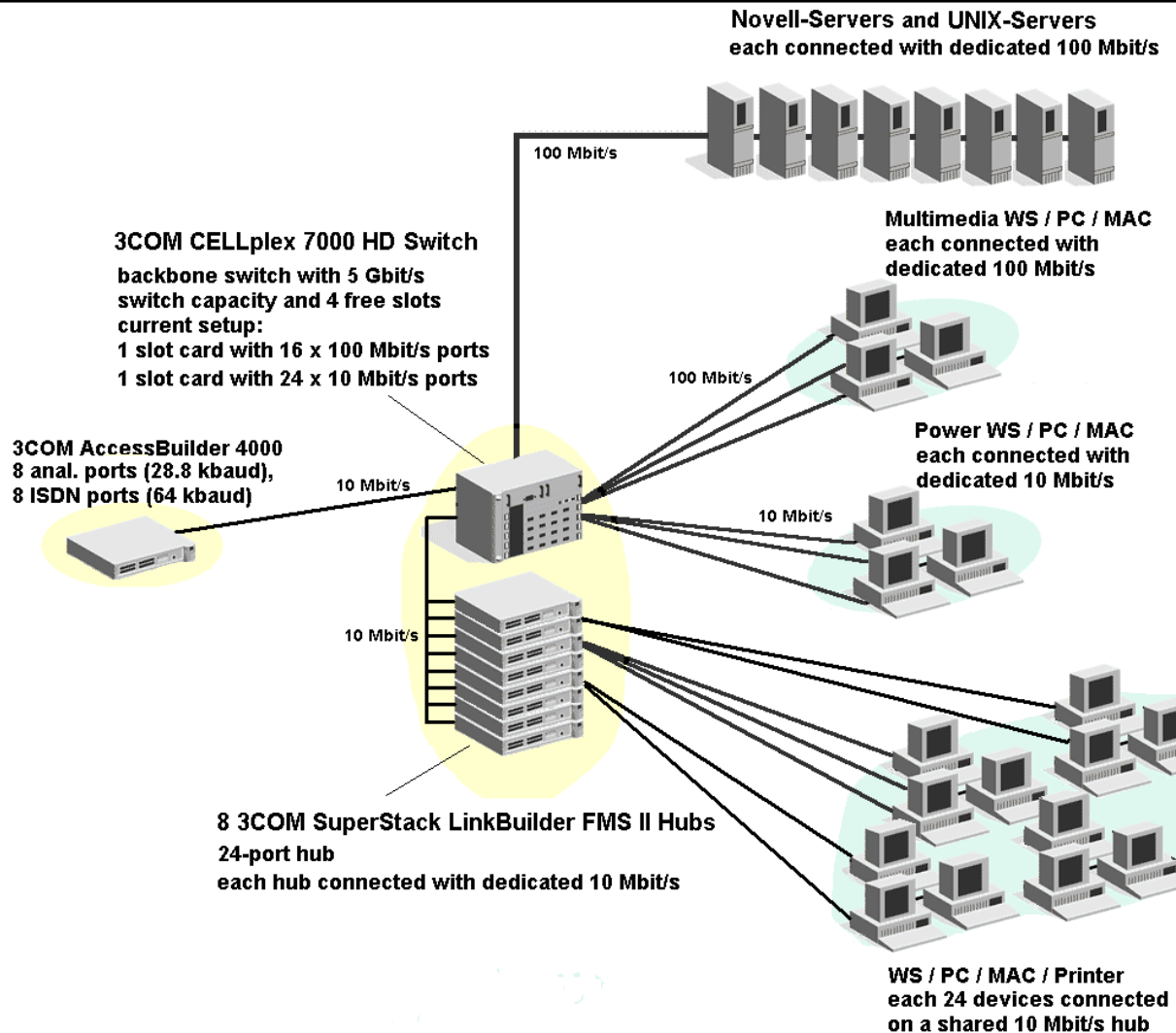


# Answer II

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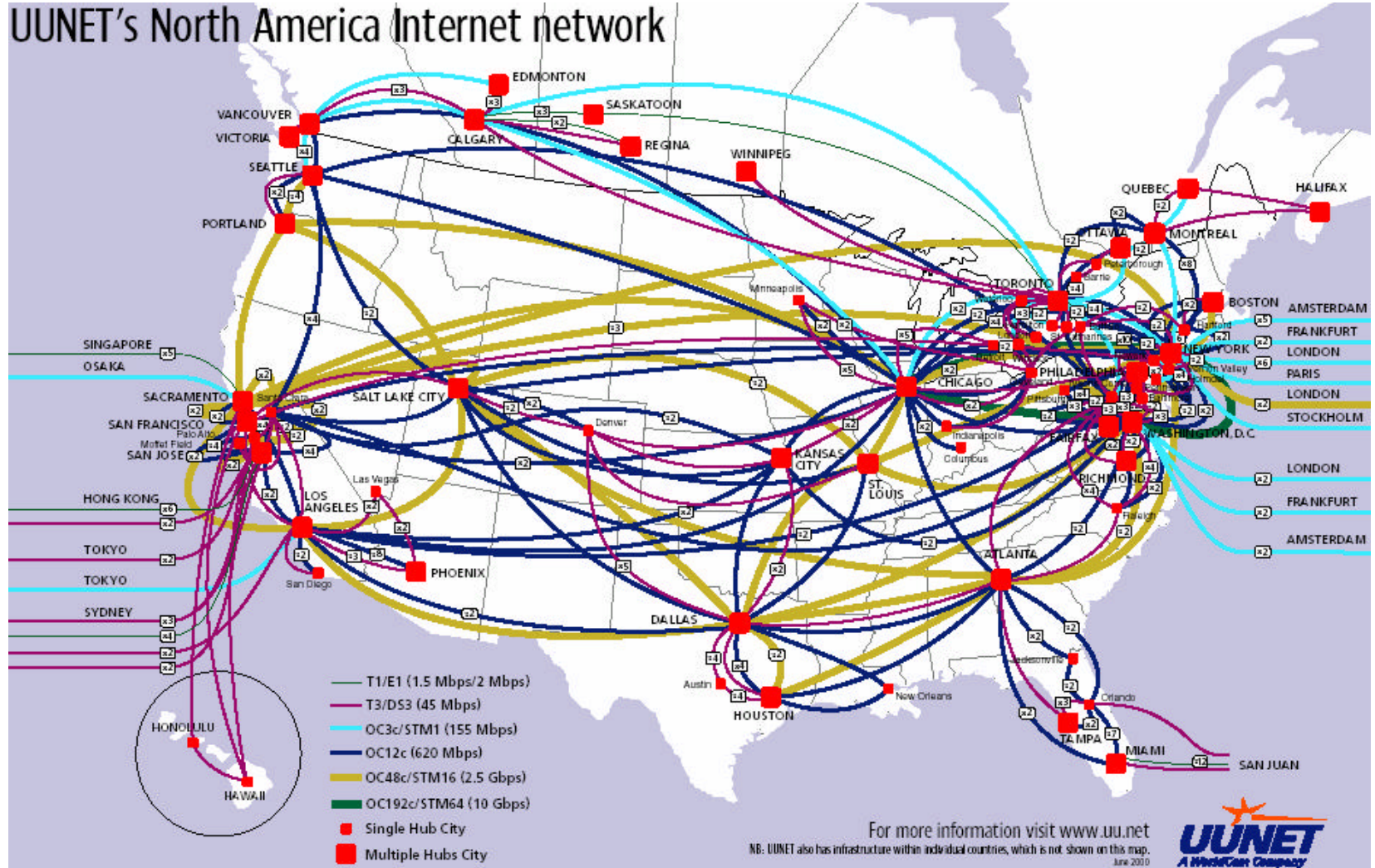


# Answer III



# Answer IV

UUNET's North America Internet network





# What's the Common Theme?

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- Network is a system of interconnected end-systems and routers
- End-systems:
  - Computers/devices that need to communicate
- Interconnection/links:
  - Fiber/wire/radio connections
- Routers:
  - Devices that know how to pass data towards the end-system
- Routers are integral part of the network
- Routers determine the quality/properties of network
  - Functionality
  - Performance
  - Reliability
  - Security
- What will be covered in this course?



# What is this Course About?

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- Course discusses **network systems** (i.e., routers)
  - Functionality of routers
  - How to implement them efficiently
  - How to expand their functionality for next-generation networks
- This is a broad area – we'll focus on
  - Data-plane (not control plane, routing protocols, ...)
  - Packet-based networks (in particular IP networks)
  - Concepts of router functions (not how to setup a Cisco system)
  - Intel IXP network processor (example of a programmable router)

# Syllabus

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- Networking basics
- Packet processing (3 lectures)
- Router architectures (2 lectures)
- Switching fabrics
- Novel network applications
- Active and programmable networks
- Design basics of network processors
- Commercial NP architectures
- Design trade-offs in NP architectures
- Intel IXP1200 (4 lectures + 6 lab sessions)
- Network Measurements
- Network Security
- Future trends and new technologies
- Final projects (3 lectures)

# Why take this Course?

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- Networks are important component of computer systems
- Understanding high-level network protocols is not everything
- Implementation details help understand
  - How things really work
  - Why things break
  - Performance issues
  - Security issues
- Principles are applicable to many systems
- Lab will help you get some hand-on experience
  - Lab is only part of course
- Papers give insight into current research problems

# Course Details

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- Classes: Tuesdays & Thursdays 2:30-3:45
- Class room: Elab 306
- Grade is composed of
  - 20% Presentation
  - 20% Discussion contribution
  - 20% Lab assignments
  - 40% Final project
- There is not final exam or quizzes
- If you read the book/papers, attend class, and do lab assignments, you'll probably do well.

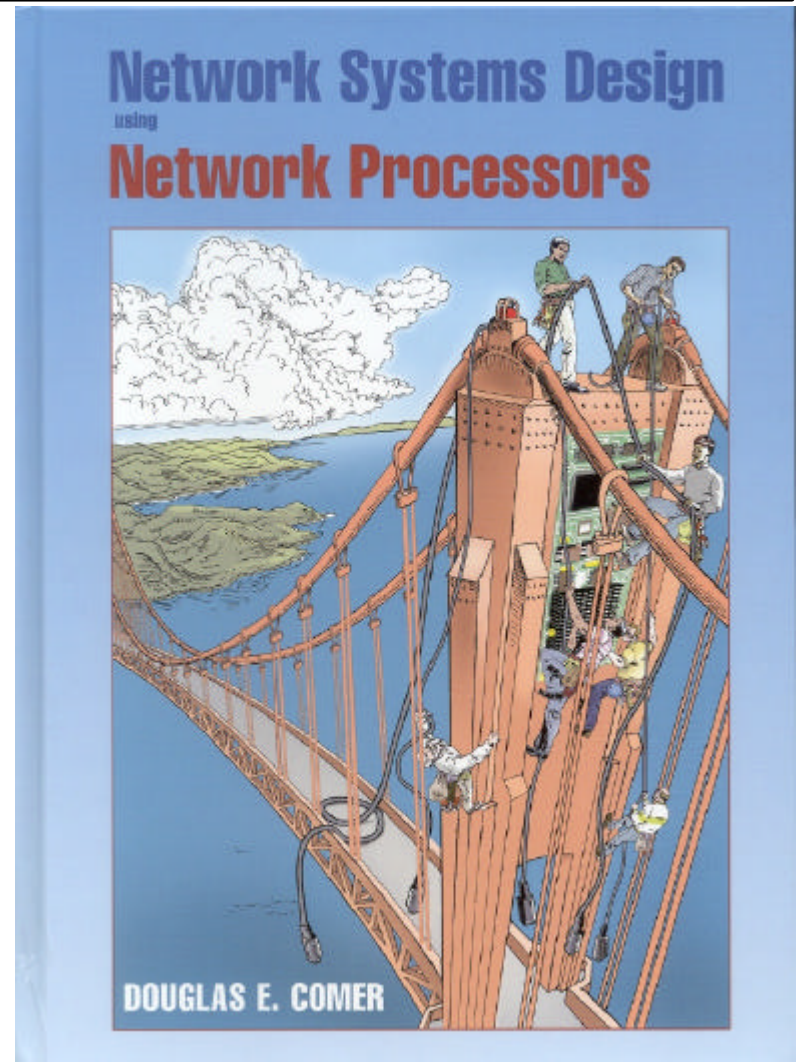
# Grading

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- Presentations
  - Each student will present a paper or book chapter
  - 20–30 minutes PowerPoint presentation
  - Lead discussion for ~10 minutes
  - Grading based on quality of slides and delivery
- Discussion
  - Everybody is expected read book and papers as assigned
  - Discussion in class is important and one of best learning tools
  - Quality and quantity of contributions is considered for grade
  - Class attendance is necessary to make contributions 😊
- Active participation is one main objective of this course
  - Important skill for your professional development
  - Class discussions were the best part of last year's course

# Textbook

- Douglas Comer: “Network System Design using Network Processors,” Pearson/Prentice Hall, 2004.
- Three parts:
  - “Traditional Protocol Processing Systems” = router architectures, packet processing details
  - “Network Processor Technology” = NP architectures
  - “Example Network Processor” = Intel IXP1200 architecture
- Classes will follow book



# Network Processor Lab

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- New lab setup in progress (Marcus 15B)
- Sponsored by Intel
  - PC workstations with IXP1200 network processor
- IXP1200 can be programmed to behave like routers
- Three simple lab assignments
- Also used for final project





# Ground Rules

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- You are encouraged to participate in class
  - Ask questions
  - Feel free to comment on anything
  - Nobody knows everything – don't worry that you may something wrong
  - Respect others
- Academic Integrity
  - You should discuss lab assignments with others
  - Don't copy from others
  - If you do, you will not get any points and may get an overall F
- Let's have fun!

# For next Class

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- Get textbook
- Read pages 1-24 (chapters 1-3)
- Recap networking basics