

The Fu Foundation School of Engineering and Applied

Science

Department of Electrical



Engineering UNIVERSITY

IN THE CITY OF NEW YORK

# Networking & Communications

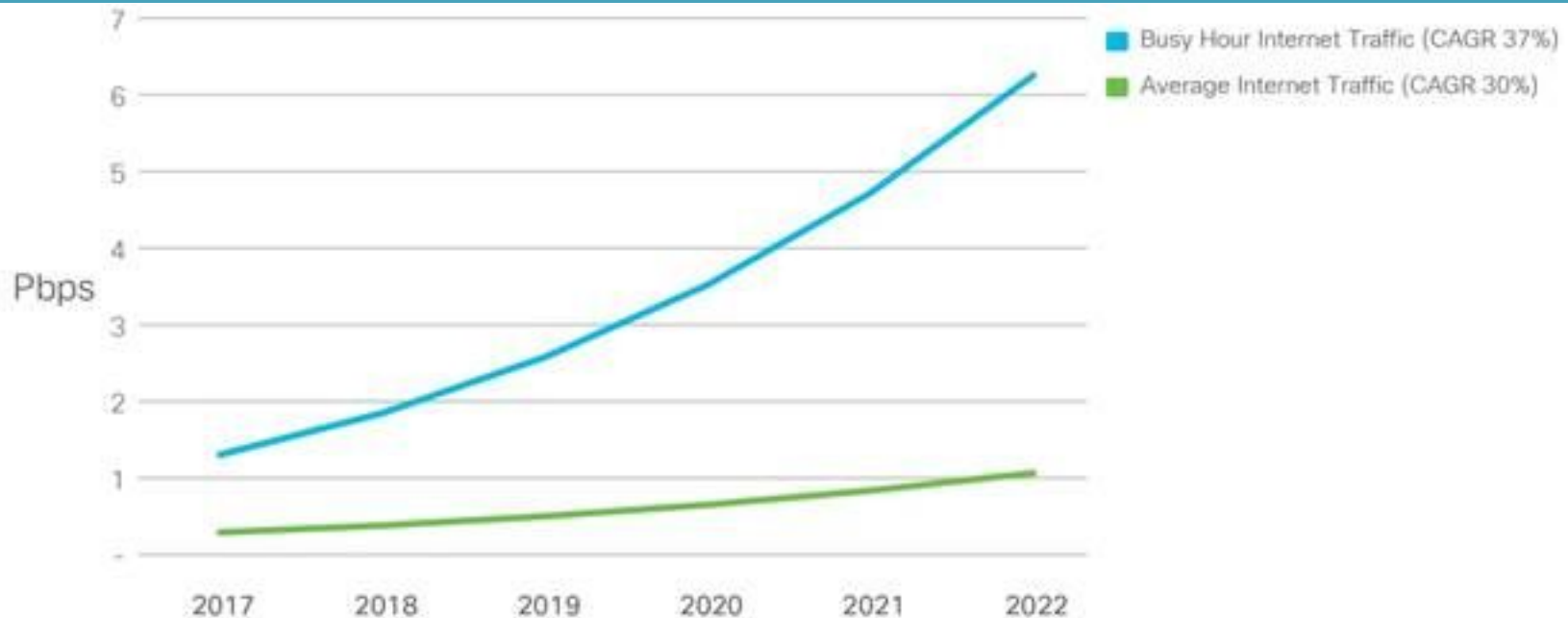
Prof. Javad Ghaderi

# Internet use continues to grow

- Half the world population is online
- One third of the world population uses Facebook
- # of cell phone users exceeds # of toothbrush users



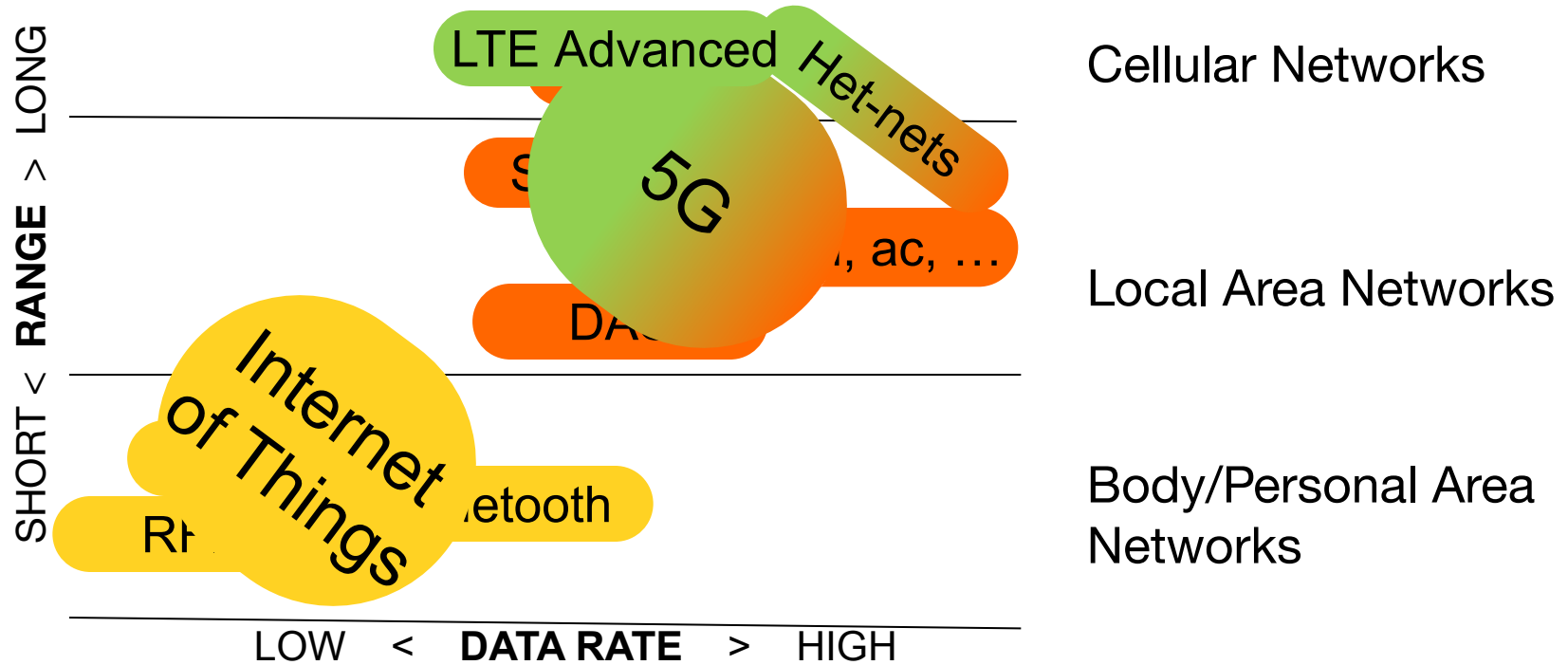
# Internet traffic is exploding



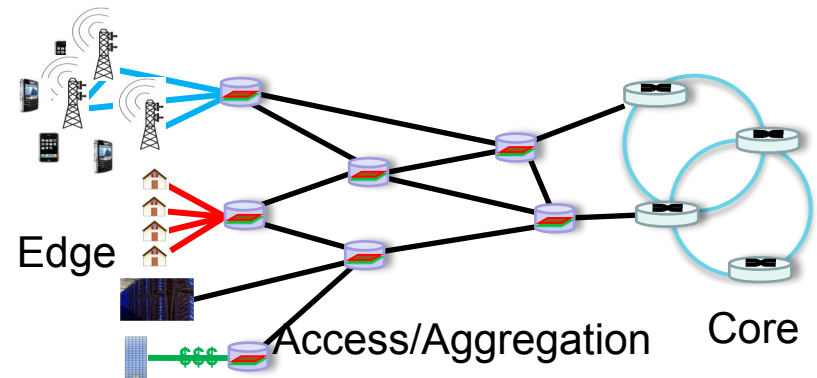
Source: Cisco VNI Global IP Traffic Forecast, 2017-2022

- Unparalleled growth in devices, data rates, and traffic
- 1 billion hours of YouTube streamed every day
- Services evolving from high-speed data and video towards

# Wireless and Wireline Networks



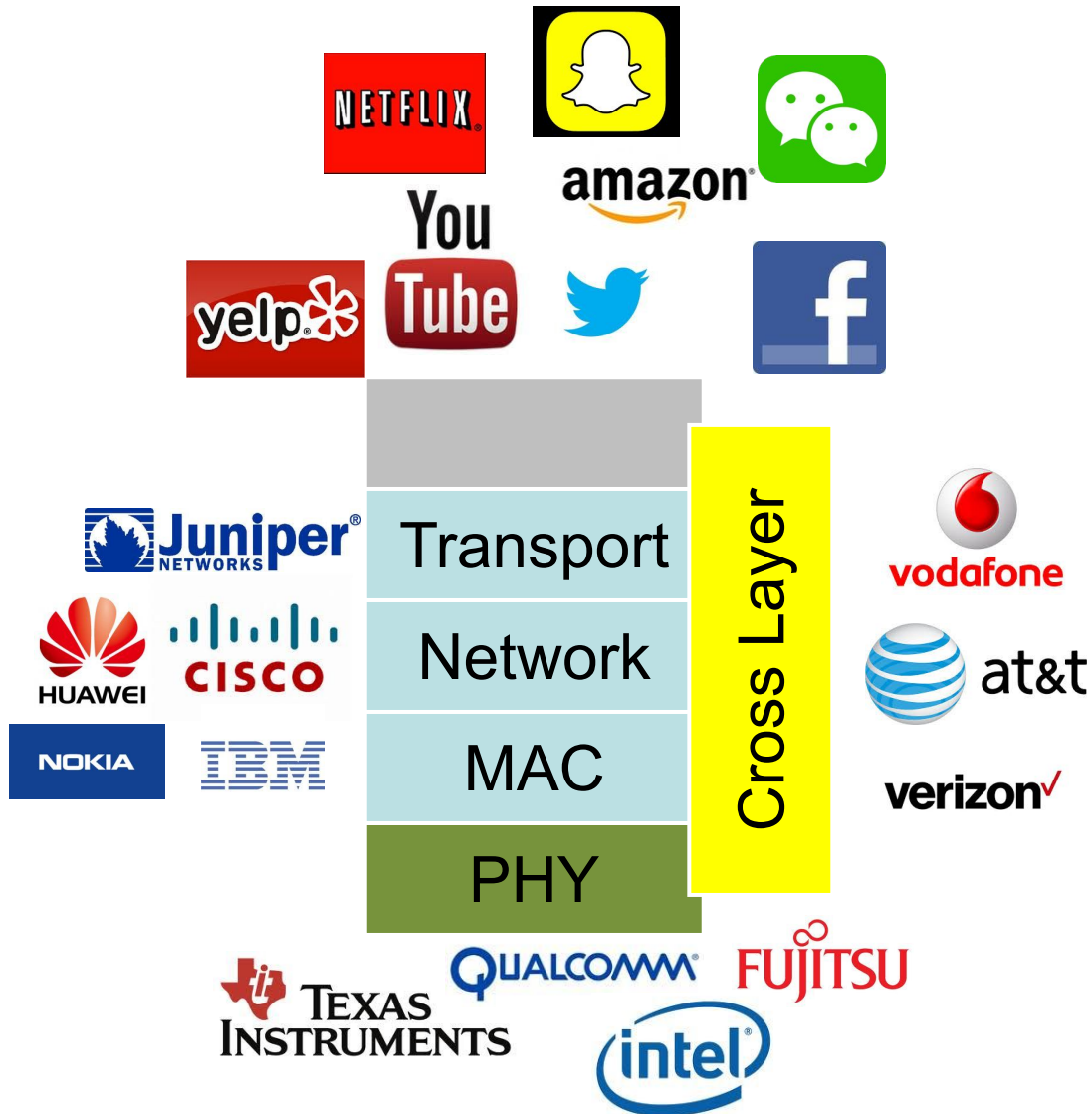
- Data center networks, cloud computing
- Optical networks
- Content distribution networks



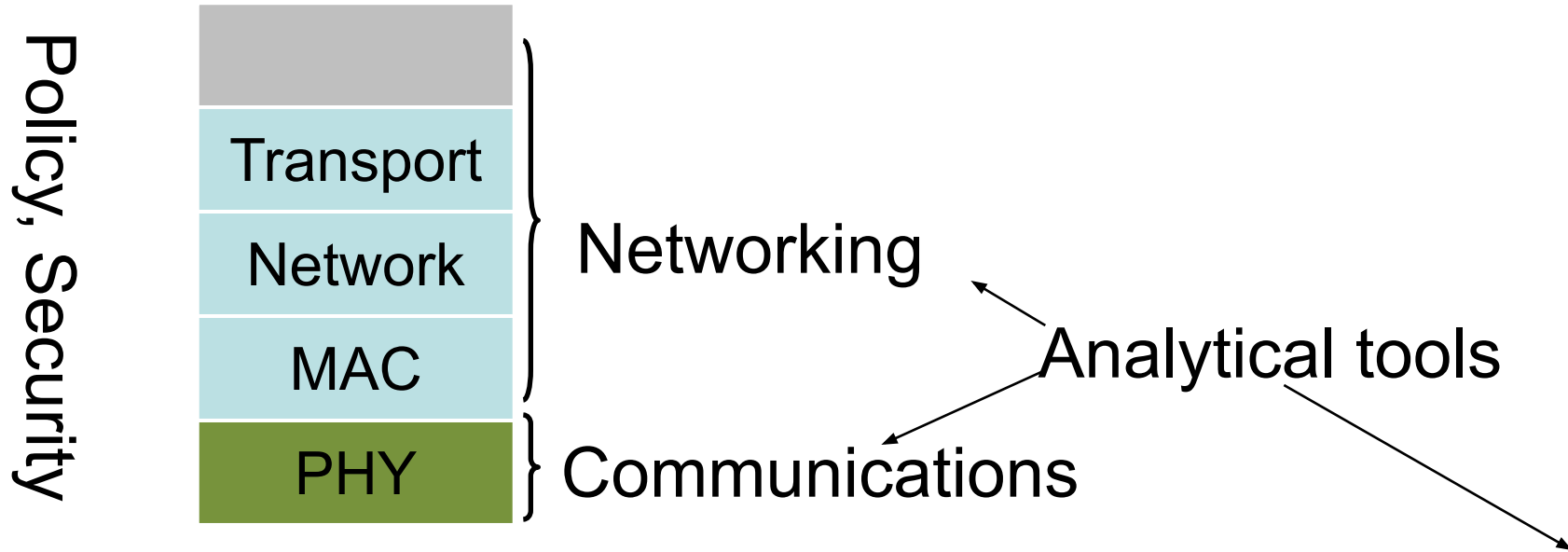
# Networks - Challenges

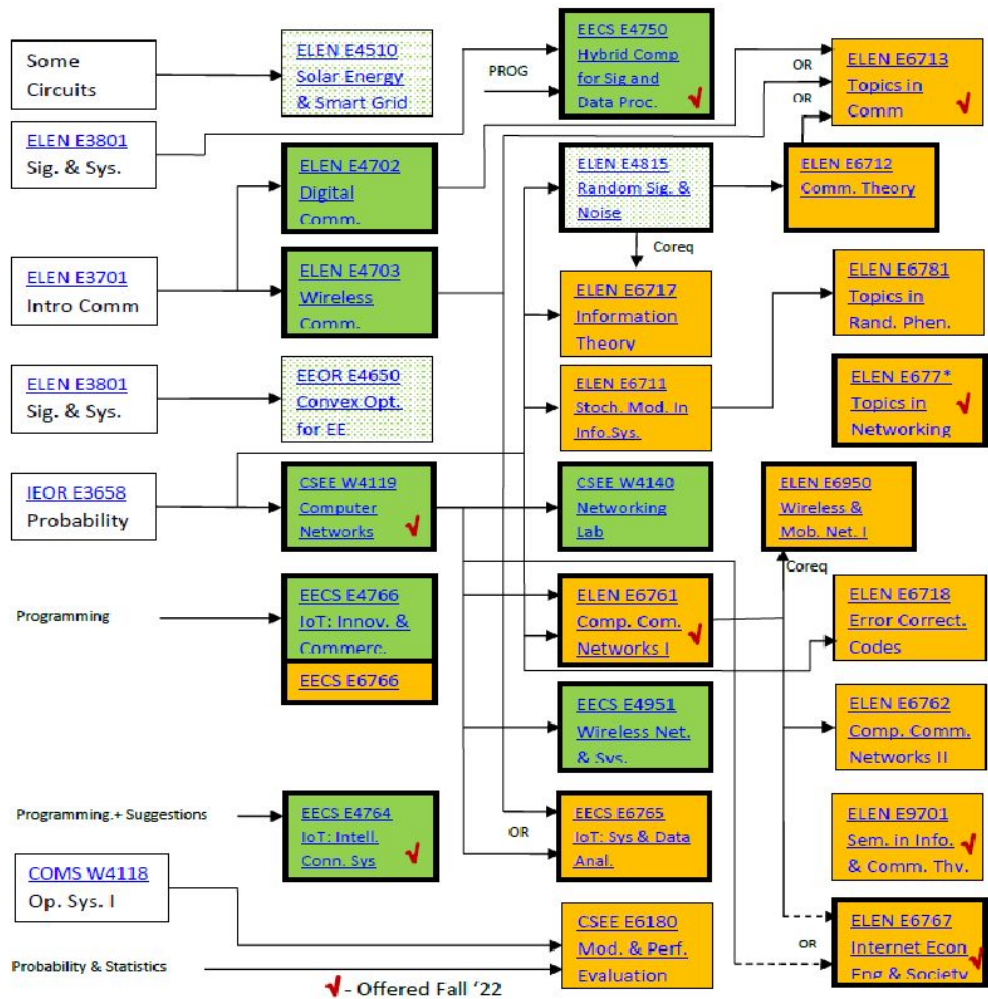
- Available anytime and anywhere, from any device
- Incorporate new technologies, support/enable new classes of applications and services, and meet new requirements
- Scale and adapt to types of applications, topology, mobility patterns, and heterogeneity of devices
- Easily controllable and manageable
- Resource and energy efficient
- Secure and robust to failures and attacks

# Enabled by: Networking and Communications



# Classes





## Legend

- ✓ offered Fall '22
- Bold border=** offered regularly
- Green=** senior/grad
- Orange=** advanced grad
- Dotted=** EE related area

Green = Senior/grad; Orange = Adv. graduate; Dots = EE related area; Bold border = offered regularly;

Attached courses = shared lectures; Updated July 2022

### Recent topics for ELEN E6713, ELEN E677\*, & other related topics courses: (Red=Offered Fall '22)

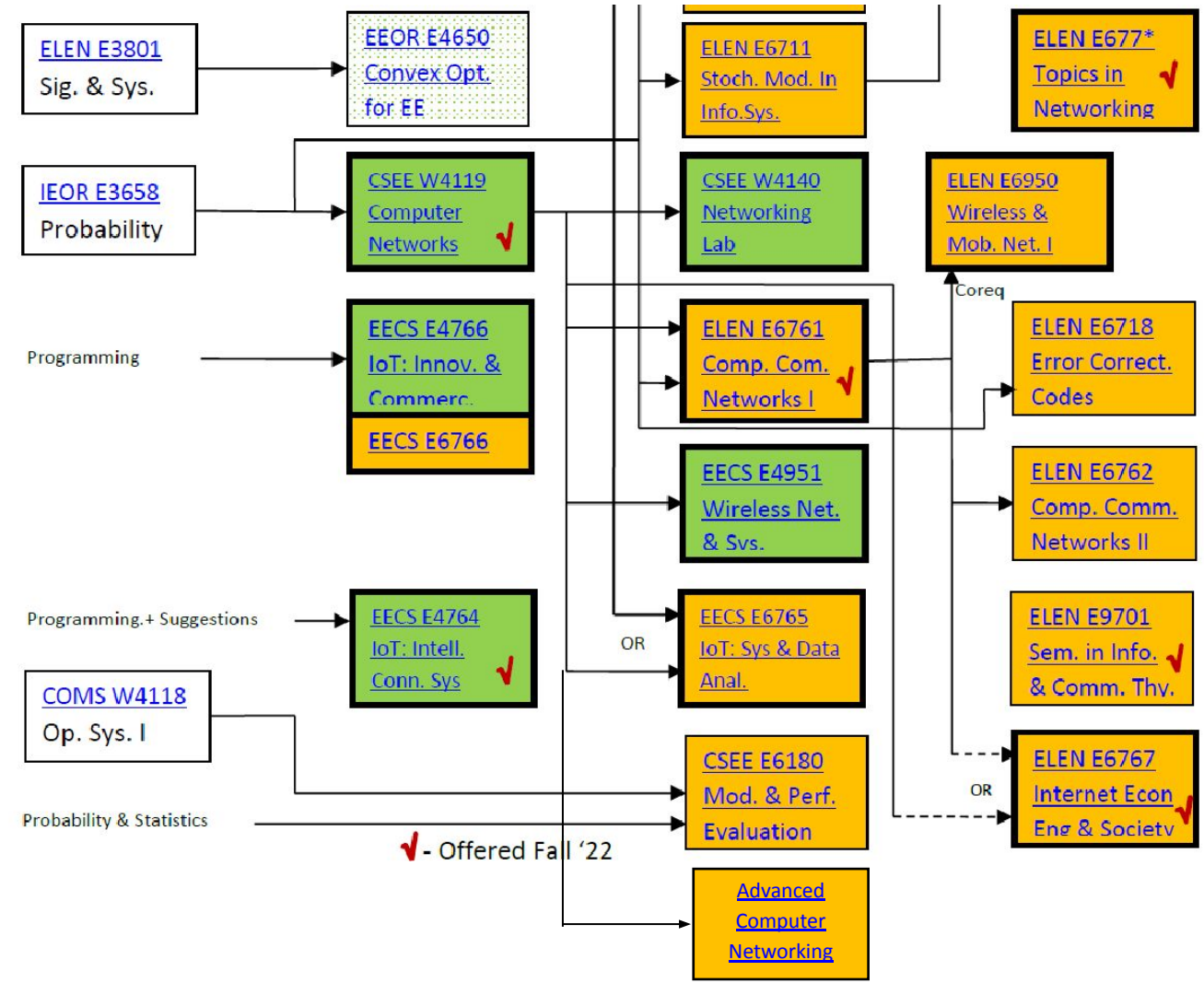
- |  |   |
|--|---|
| ELEN E4902 Topic: IoT - Intelligent Connected Sys. (Fall '15)                | ELEN E6774 Topic: Seminar on Internet Measurements (Fall '20)                   |
| ELEN E6713 Topic: Wireless Sensing (Fall '11, '10)                           | ELEN E6775 Topic: Mesh Optical Networks (Spring '09)                            |
| ELEN E6713 Topic: Cooperative Wireless Communication Sys (Fall '13)          | ELEN E6775 Topic: Adv. Networks: A Systems Approach (Fall '18)                  |
| ELEN E6713 Topic: Modern Digital Modulation Techniques (Spring '17)          | <b>ELEN E6776 Topic: Content Distribution Networks (Fall '22, '21, '09-'18)</b> |
| <b>ELEN E6713 Topic: mmWave &amp; Appl. for 5G (Fall '22, '21, '19, '17)</b> | ELEN E6777 Topic: Communication Protocols (Spring '10)                          |
| ELEN E6770 Topic: Next Generation Networks (Fall '18 - '06)                  | ELEN E6777 Topic: Formal Methods of Comm (Spring '14, '13)                      |
| <b>ELEN E6770 Topic: Network Virtual and Cloud Comp. (Fall '22, '21)</b>     | ELEN E6778 Topic: Applying Net Tech to Phys Sys (Spring '12, '11)               |
| ELEN E6771 Topic: Next Generation IP Networks (Fall '08)                     | ELEN E6779 Topic: 4th Gen Packet-Switched Networks (Spring '13)                 |
| ELEN E6771 Topic: 5G Programmable Networks (Spr'21, Fall '19)                | ELEN E6900 Topic: Adv Topics in Wireless Comm & Net (Spring '15)                |
| ELEN E6772 Topic: Resilient Networking (Spring '08)                          | ELEN E6909 Topic: Network Algorithms & Dynamics (Spring '16, '15)               |
| ELEN E6773 Topic: Network Econ & Engineering (Fall '14, Spring '14)          | <b>EECS E6896 Topic: Quant. Comp. &amp; Comm. (Fall '22, '21, '16)</b>          |
| ELEN E6774 Topic: Cyber-Physical Systems, Transportation (Spring '09)        | <b>ELEN 9701: Seminar in Wireless and Edge Networking (Fall '22)</b>            |



# Networkin g

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✓ - Offered Fall '22

- ELEN E6770 TPC: Network Virtualization & Cloud Computing
- ELEN E6776 TPC: Content Storage & Distribution
- EECS 6897: TPC: Cloud Data Infrastructure
- ELEN 9701: Seminar in Wireless and Edge Networking

# Communication

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## Legend

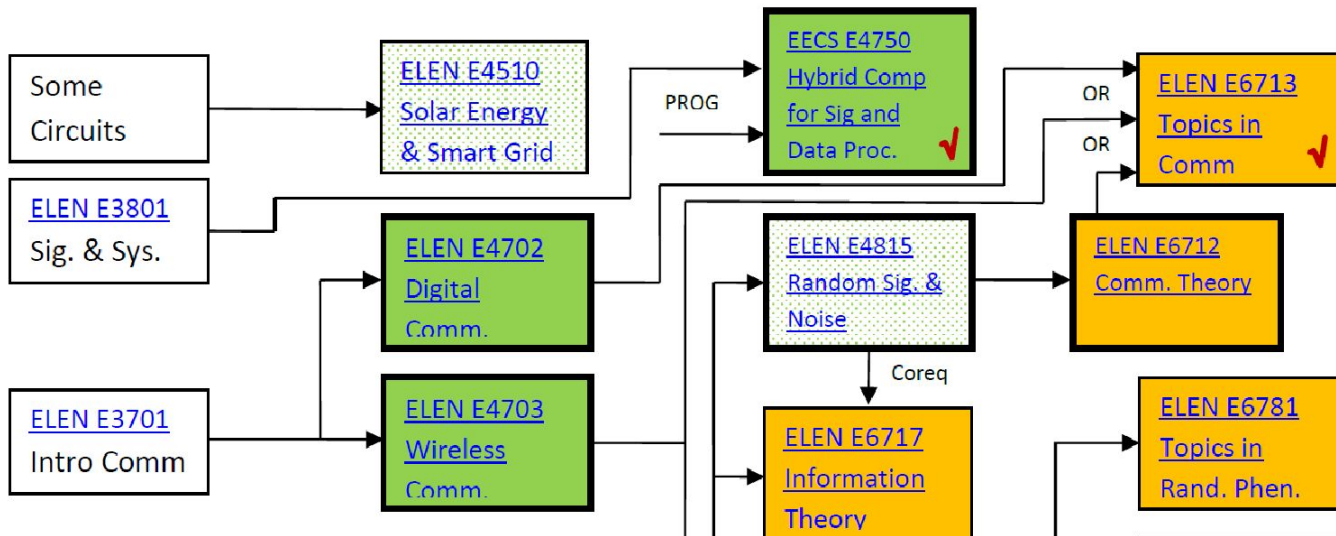
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ELEN E6713 Topic: mmWave & Applications  
for 5G

EECS E6896 Topic: Quantum Computing &  
Comm

# Additional Classes

- **Networking (CS)**
  - COMS E6156: Cloud Computing
  - **COMS 6998 Topics: Cloud Computing & Big Data**
  - **COMS 6998 Topics:** Datacenter Networking
  - COMS W4419: Internet Technology, Economics, and Policy
- **Related**
  - **COMS 4995 Topics: Intro to Networks and Crowds**
  - COMS E6998 Topics: Blockchain Apps
  - COMS 4181: Security
- **Analytical Tools (CS, IEOR)**

# General Advice

- It's a short program – plan ahead
- Don't repeat undergraduate classes...
- Sample several classes
- Consider classes beyond the EE dept.
  - e.g., Networking classes – in EE and CS
- Participate in a research project/s (spring or summer)
- Look for a summer internship (winter)