Cloud Network Flow Course

Objective

This course covers the fundamentals of Content Distribution, i.e., how to jointly store/cache and deliver information over a cache-enabled network, and the fundamentals of Service Distribution, i.e., how to jointly store, process, and deliver information over a distributed cloud network with integrated storage, computation, and communication resources.

The course is highly recommended for students and researchers in the basic science areas of statistics, signal processing, data compression, and data transmission, as well as the applied science fields of communications, networking, and cloud computing.

Expected learning outcomes

This course provides students with the knowledge, tools, and methods to understand:
- the fundamentals of content distribution, i.e., how to jointly store/cache and deliver information over a cache-enabled network
- the fundamentals of service distribution, i.e., how to jointly store, process, and deliver information over a network with storage, computation, and communication resources.

The knowledge learned in this course has wide applicability to highly impactful technology sectors, from the design and optimization of communication networks and systems, the design and optimization of content delivery networks, systems, and algorithms, and the design and optimization of future highly distributed cloud-integrated networks supporting next-generation applications.

Detailed syllabus
- **PART 1: Content Distribution**
  - Network information flow, network coding, multicast
  - Caching, index coding, content reuse
  - Fundamental of network compression
  - Fundamental distributed storage which special focus on dynamic content
- **PART 2: Service Distribution**
  - Cloud network flow, service representation, cloud-network representation
  - End-to-end service optimization, joint communication-computation-storage resource allocation
  - Dynamic cloud network control, stability region, Lyapunov control,
  - Network slicing, system automation, metaverse experiences

Examination

The examination will consist in
- completing a project which requires modelling and formulation of the problem, identification of the system architecture (solution architecture), and validation of the solution via analytical or numerical performance analysis (in required the knowledge of matlab, python, pycharm)
- short oral presentation