IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

Systèmes en Réseaux
Networked systems

Operational Research
Introduction to the case studies

OR Nice organizers

IMT Atlantique

Case Studies:

1. Optimization of the **energy** network

2. Optimization of the **logistics** network

3. Optimization of the **information** (telecommunication) network

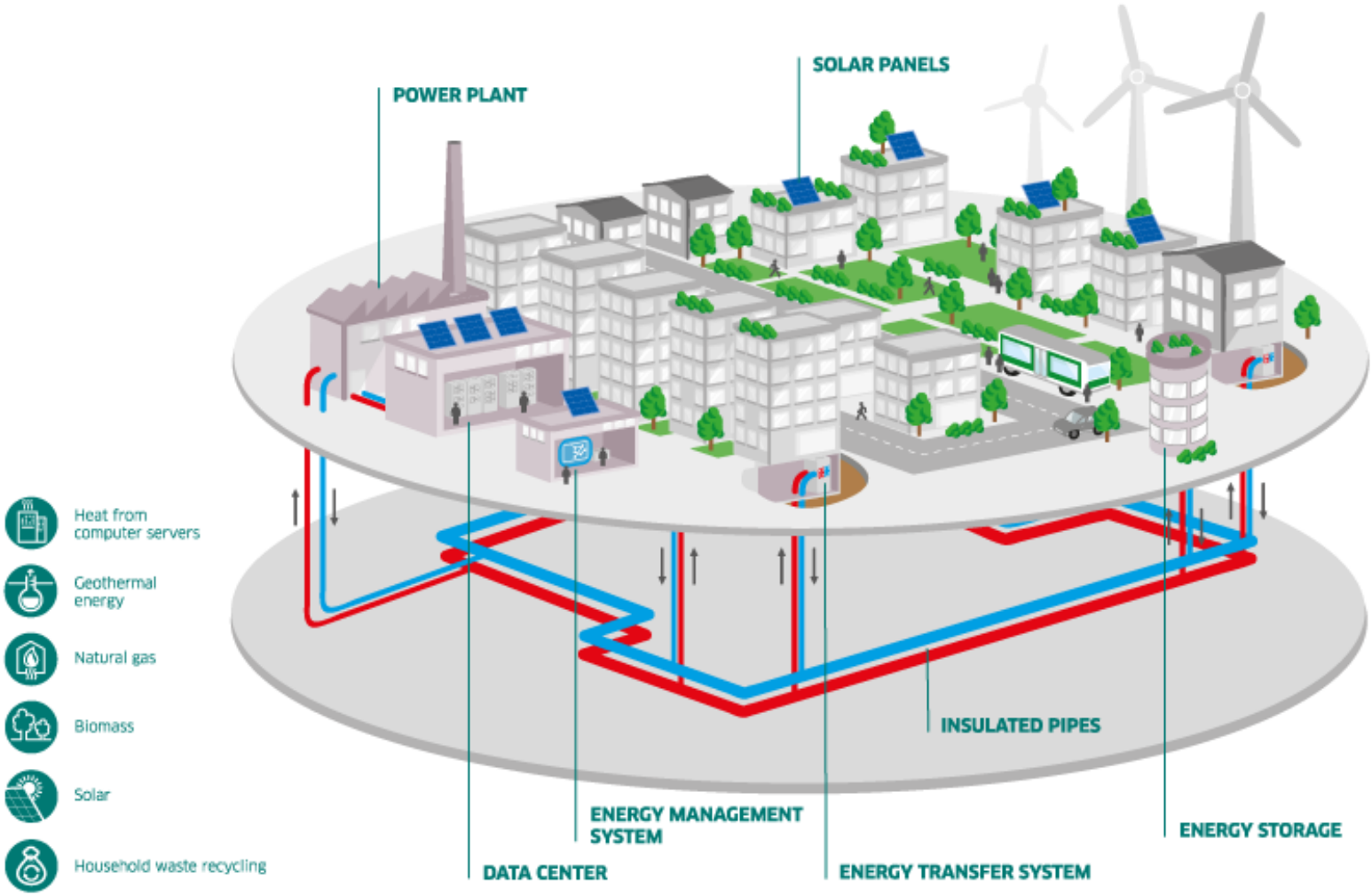
Case Study 1: District Heating Network Optimization (Energy)

District Heating (DH) is a system for distributing heat generated in a *source* location through a system of insulated pipes for residential and commercial usages.

There are a number of **advantages** for a DH:

- Improvement of resource and energy management;
- Reduction in the user-side costs, including operation, maintenance, and safety expenses;
- Flexibility and safety in selection of the energy source such as *biomass* and *geothermal* energy instead of *fossil fuels*.

Case Study 1: District Heating Network Optimization (Energy)



Case Study 1: District Heating Network Optimization (Energy)

The DH network should be **optimized** for several reasons, as for example to have:

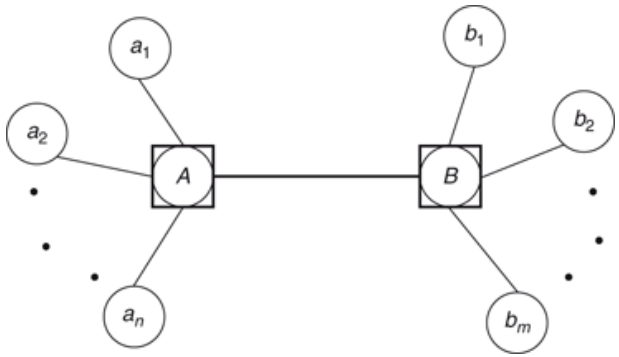
- the minimum heat losses across the network;
- the maximum possible fulfillment of heat demands;
- the minimum cost of constructing the DH network;
- ...

Have a look at the links on the **website** of the course (videos and documents) for further details !

Case Study 2: Hub Location Network Optimization (Logistics)

”**Hubs** are the facilities that are servicing many origin-destination pairs as transformation and tradeoff nodes”

- A hub network is required whenever there is a system and the necessity of **transferring a flow** between each pair of origin-destination nodes;
- The hub network has various **applications** in passenger & cargo transportation (road, rail, air), but even in telecommunication.



Case Study 2: Hub Location Network Optimization (Logistics)

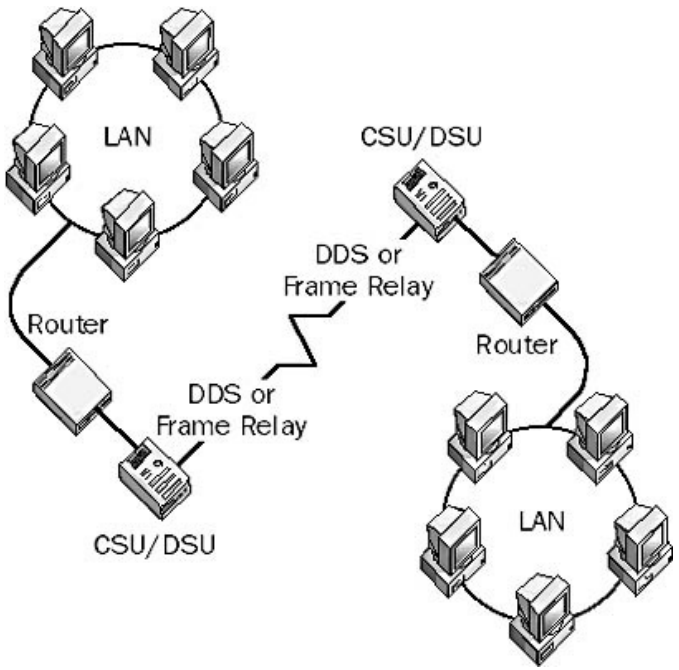
A hub network has several **advantages** as follows:

- Minimum number of connection links in the network, and consequently minimum construction cost;
- Transferring flow in bigger quantities, and consequently minimizing the transportation cost;
- Utilizing different modes of transportation, and consequently minimizing the transportation cost & time;
- ...

Have a look at the links on the **website** of the course (videos and documents) for further details !

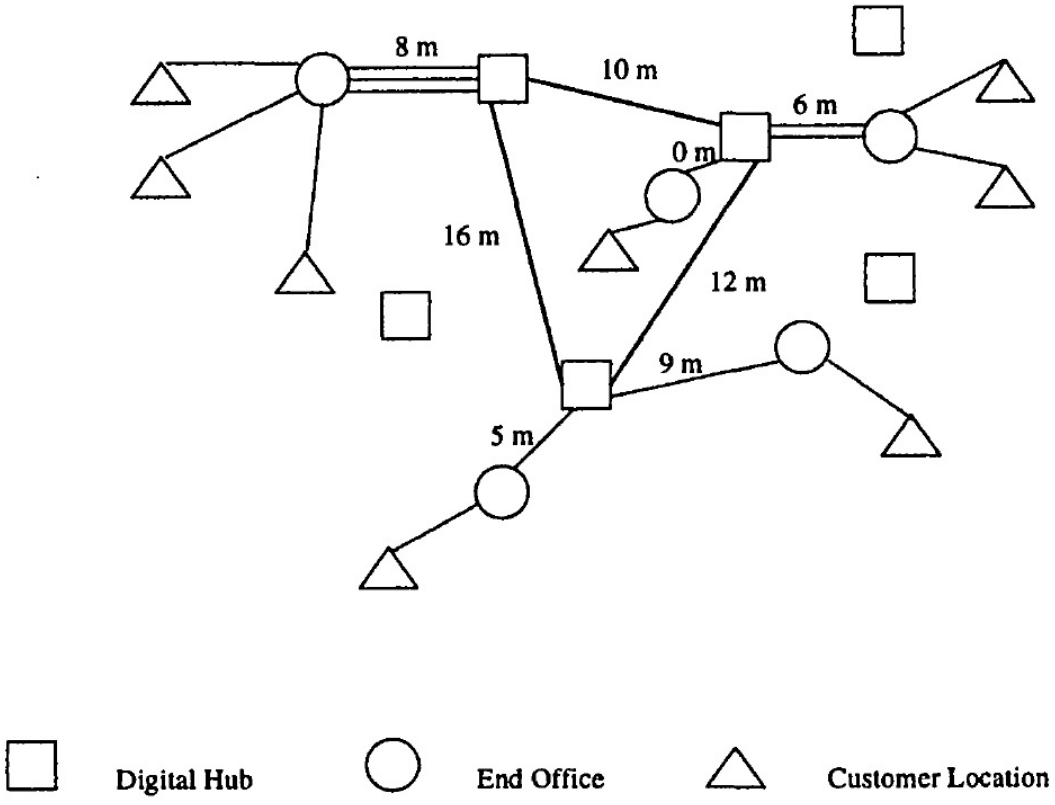
Case Study 3: Telecommunication Network Optimization (Information)

- A **telecommunications** network is a collection of terminal nodes (origin/destination) which are connected so as to enable telecommunication between the terminals;
- The transmission links connect the nodes together;
- The nodes use circuit switching, message switching or packet switching to pass the signal through the correct links and nodes to reach the correct destination terminal;



Case Study 3: Telecommunication Network Optimization (Information)

- Among different types of telecommunication networks, **Digital Data Service (DDS)** is a high-quality digital transport service in the telecommunications industry;
- Developing an optimal design of the network helps to have the highest performance of the network.



Recommendations for doing the case studies

Recommendations

The main steps for solving the problem at hand :

- **Step 1**: Try first to **understand** the problem in general. For this, use search engines, encyclopedia, or read the introductory chapters of textbooks, for example. At the end of this step, you should become familiar with several keywords related to your problem.

- **Step 2**: Try to **discover** the problem in more details. This step is like doing a literature review. You need to look for (research) articles using the keywords of Step 1. For this, search in digital article libraries such as:
  - `https://www.sciencedirect.com/`
  - `https://link.springer.com/`
  - `https://ieeexplore.ieee.org/Xplore/home.jsp`
  - `https://scholar.google.fr/`
  - ...

Recommendations

- **Step 3**: Try to **formulate** the problem with the help of the research articles. During this course, you will learn how to formulate a real problem using a mathematical formulation.

- **Step 4**: Try to **solve** the problem using a resolution algorithm. During this course, you will learn how to solve a real problem using both exact and approximate resolution algorithms.

Do not worry! We are with you step by step :)