Metaheuristics and Simheuristics for Telecommunication Systems in Smart cities

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Madrid - Spain

http://dpcs.uoc.edu/wordpress/

Information about the Lecturer

- Academic Background
  - PhD Fellow in Network and Information Technologies at Open University of Catalonia 2016/2 – Today
  - Master degree in Electrical Engineering at University of Brasilia UnB in 2015
  - Bachelor in Electronic Engineering and Telecommunications at Universidad Autónoma del Caribe UAC in 2011
- Research Areas
  - Adaptive signal processing and Telecommunications
  - Information theoretic learning
  - Metaheuristics, simulation and modeling
- More information
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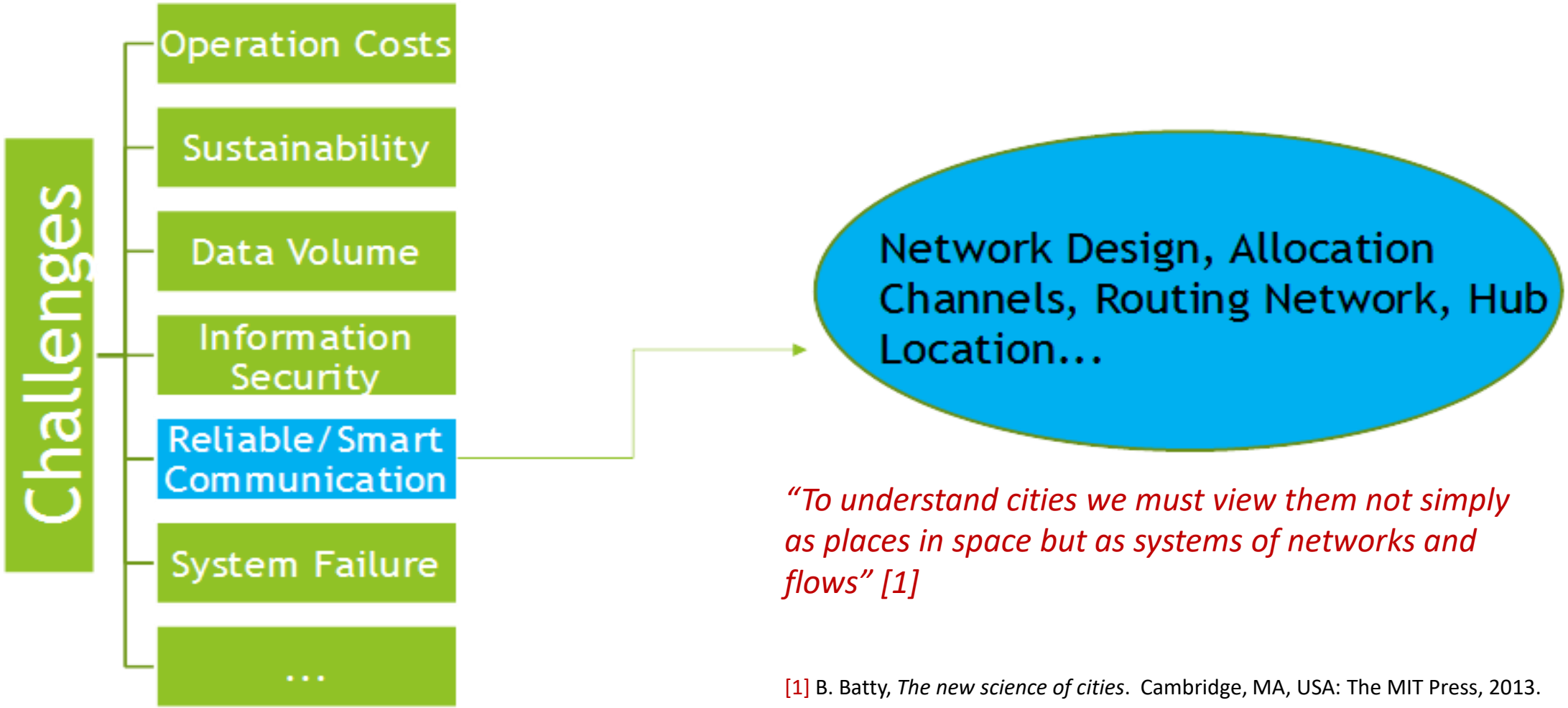
Telecommunication Systems in Smart Cities

Smart cities represent rich and dynamic environments where the use of information, digital and telecommunication technologies are used to improve the city's operations more flexible, efficient and sustainable.

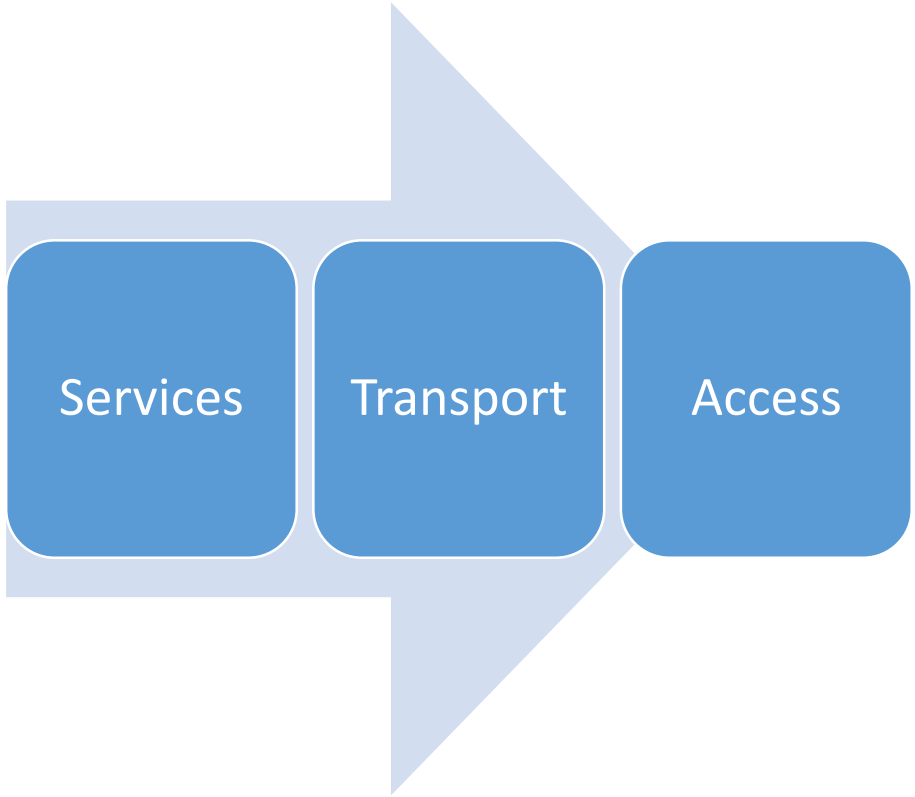
Telecommunication Systems in Smart Cities



"To understand cities we must view them not simply as places in space but as systems of networks and flows" [1]

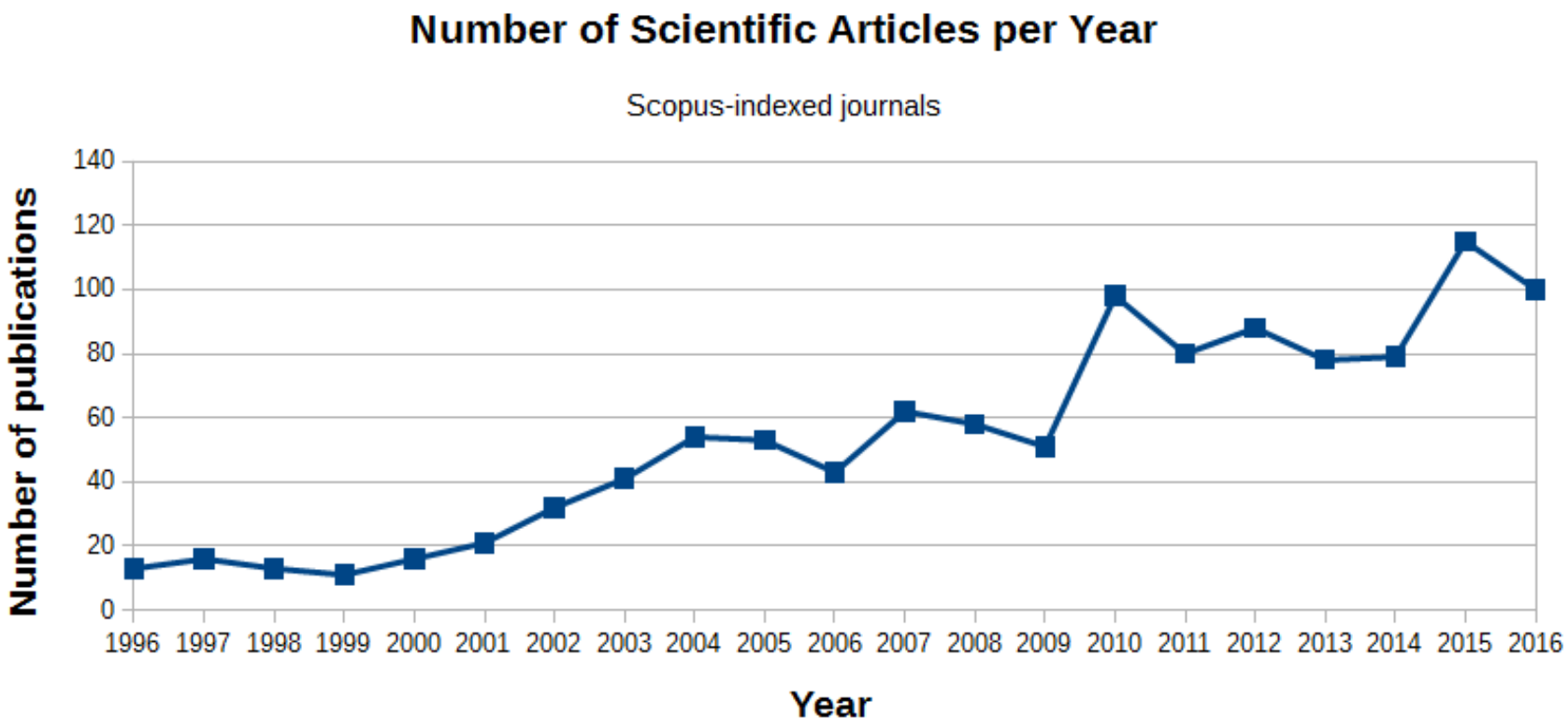
[1] B. Batty, *The new science of cities*. Cambridge, MA, USA: The MIT Press, 2013.

Metaheuristics in Telecommunications



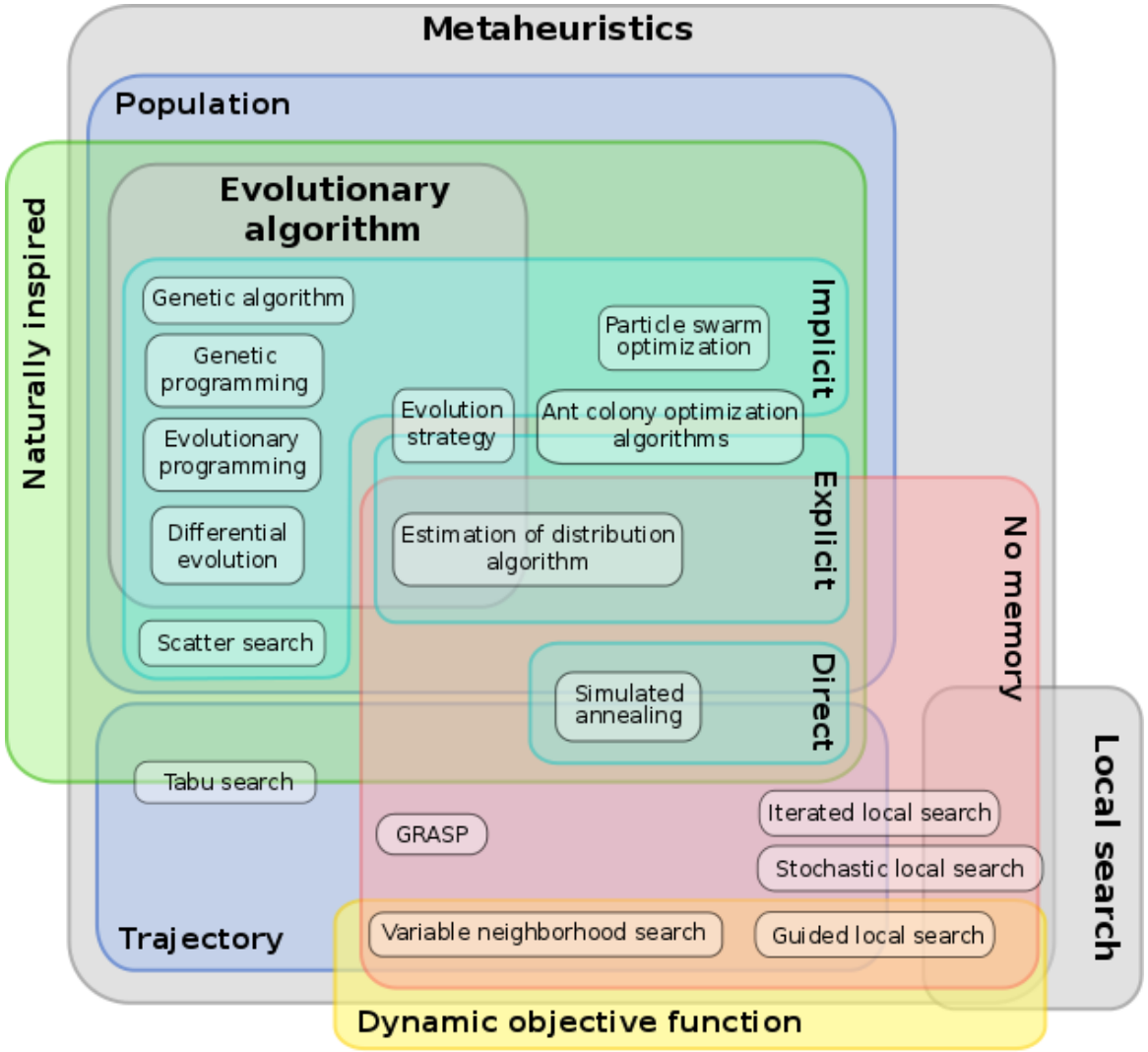
- Efficiency of an algorithm
- Choice of algorithms
- Time constraints
- Others

Metaheuristics in Telecommunications



Most Common Metaheuristics in Telecommunications

- Evolutionary Algorithms
- GRASP
- Tabu Search
- Hill Climbing
- Simulated Annealing
- Scatter Search
- Path relinking
- Problem specific algorithms
- Particle Swarm Optimization
- Nature inspired algorithms



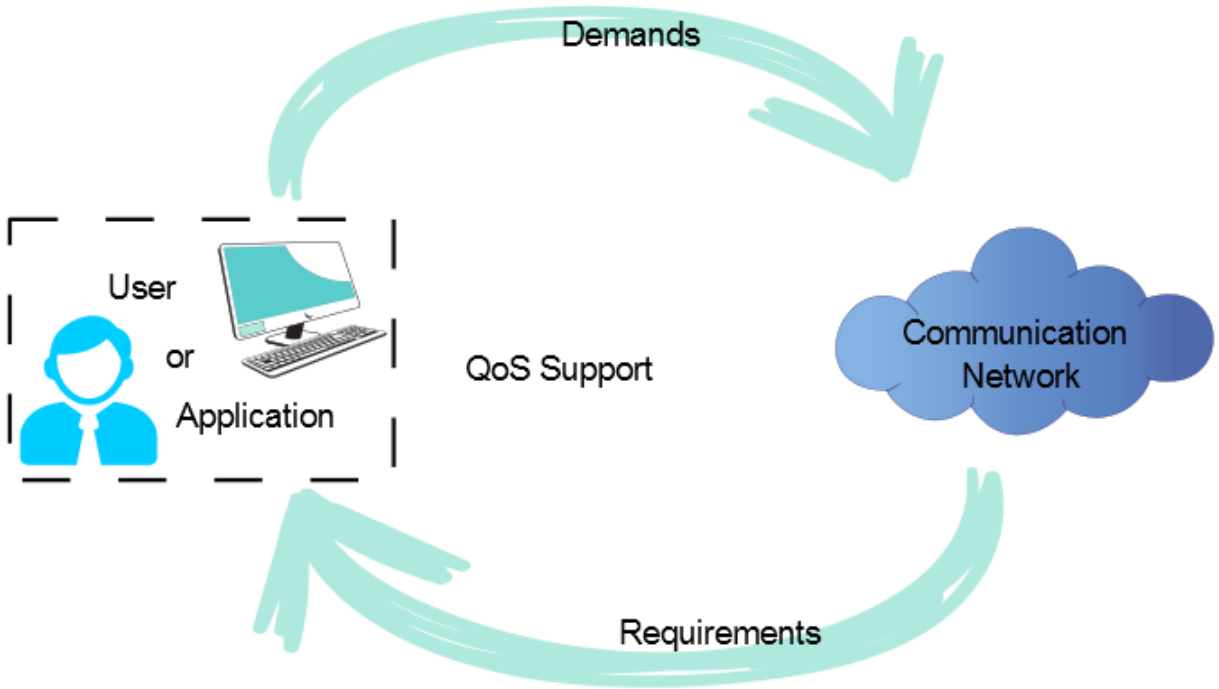
Challenges in Telecommunications

- Fast development of network infrastructures
- Software and Internet services
- Demand for data communications

- Optical fibers and high-speed networks
- Emergent new technologies

- Fast data communications
- New services and applications

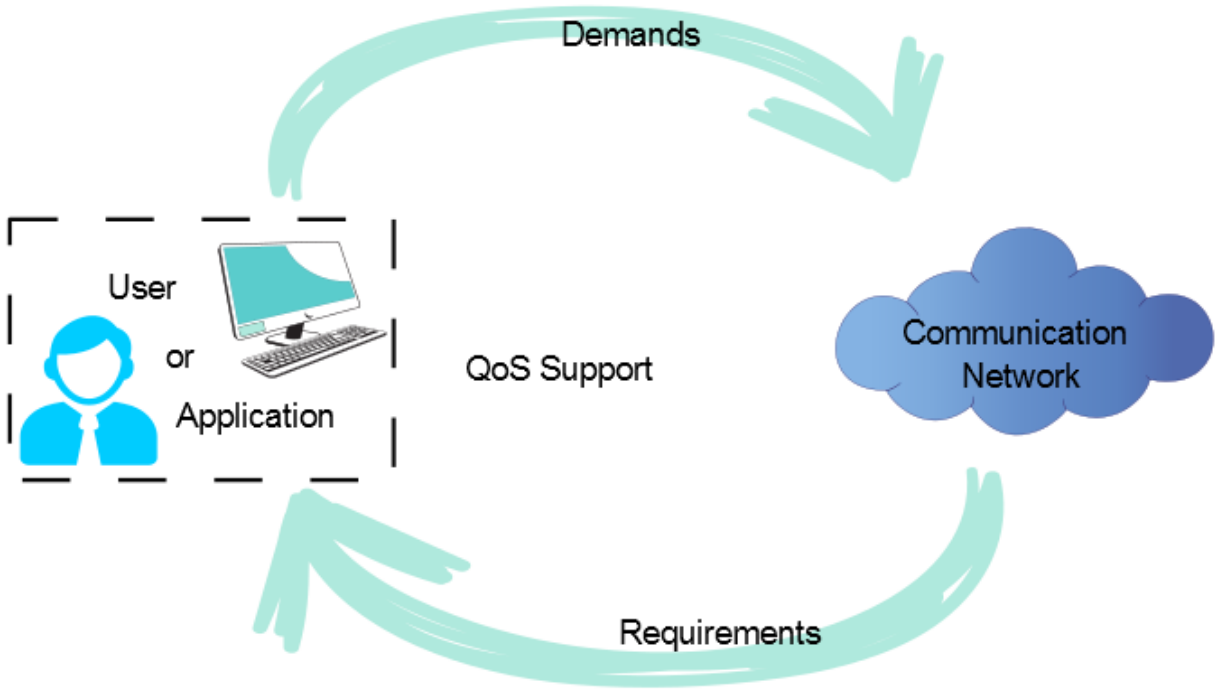
Challenges in Telecommunications



"Network must ensure that data can travel through the network between arbitrary end points"

- Support heavily and loaded networks
- Overload situations
- Traffic patterns
- Multicast or point-to-point traffic
- Routing oscilations and loops
- QoS guarantees

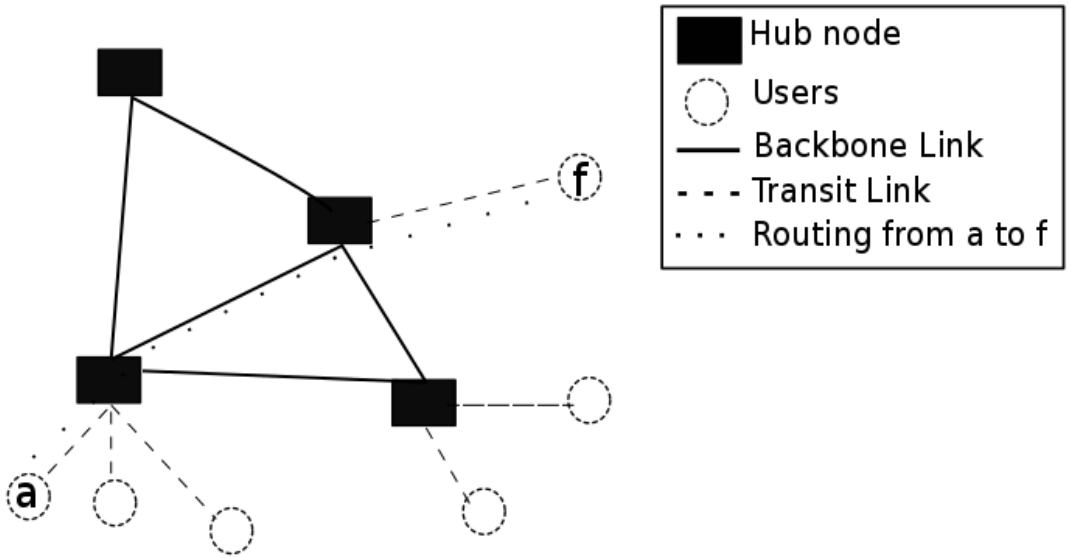
Challenges in Telecommunications



"Network must ensure that data can travel through the network between arbitrary end points"

- Network Design
- Routing
- Other miscellaneous applications

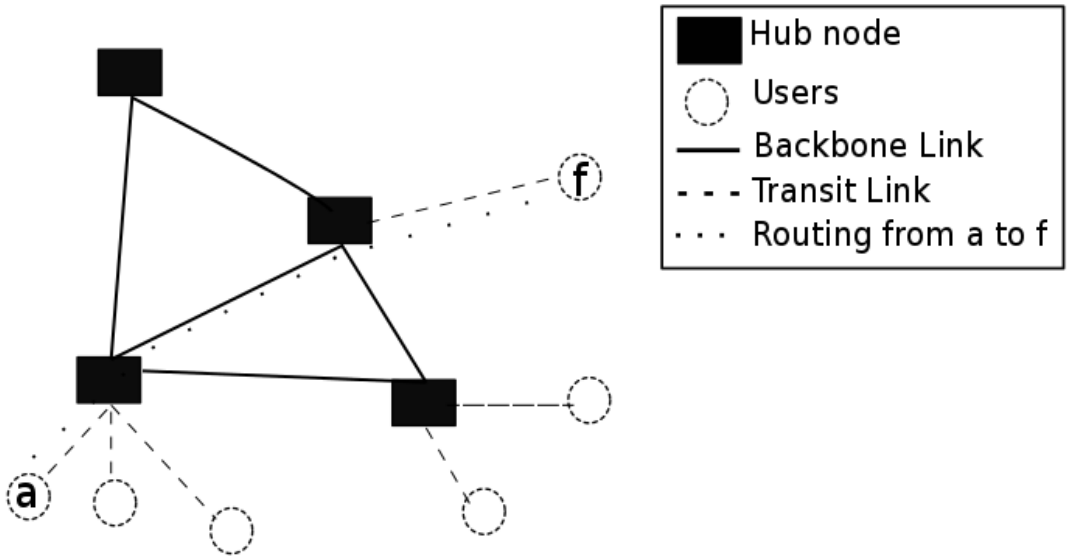
Communication Network Design



- Hub Location Problem

In many-to-many networks, instead of connecting each pair of demand nodes with a direct connection, a hub-and-spoke topology can be successfully used. In the former type of network, direct communication between pairs of demand nodes is usually costly.

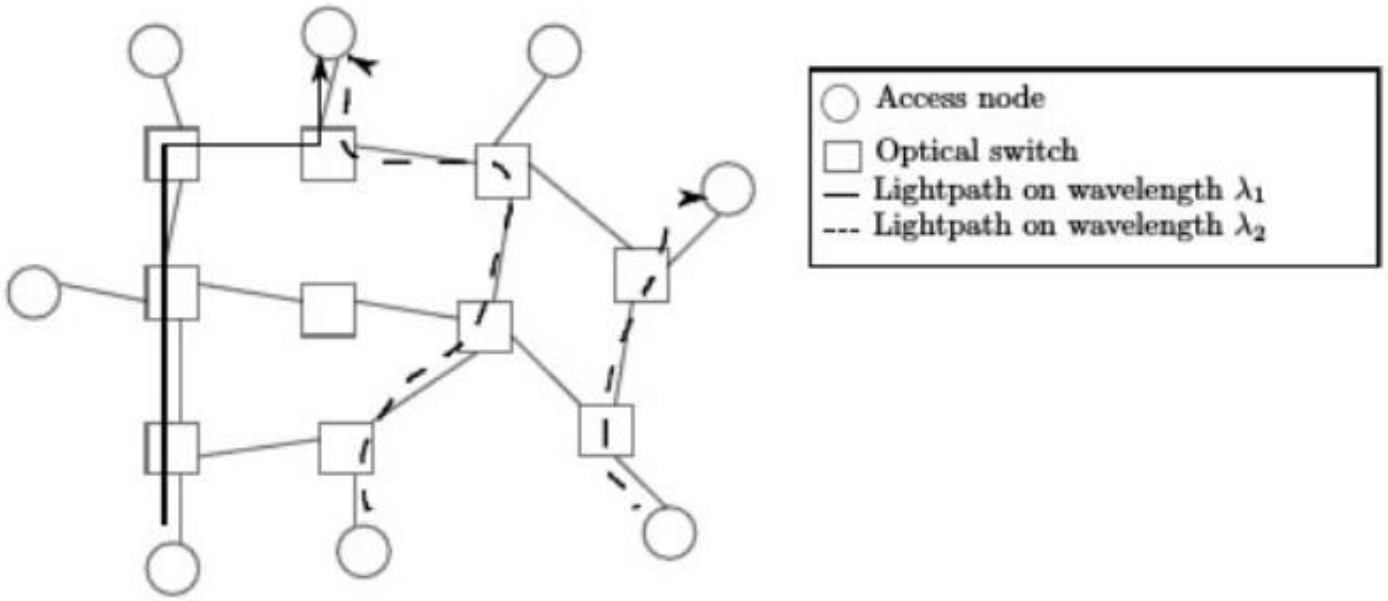
Communication Network Design



- Hub Location Problem

Given a set of access nodes and a set of potential location for the transit nodes, the problem is to decide number and positions of the transit nodes to guarantee that all access nodes are allocated to a transit nodes, satisfying capacity constraints.

Routing



- In a wavelength-routed WDM network, end users communicate with one another via all-optical WDM channels, which are referred to as lightpaths.
- Given a set of connections, the problem of setting up lightpaths by routing and assigning a wavelength to each connection is called the Routing and Wavelength Assignment **(RWA)** problem.

Summary

- Along with the advances in smart cities, huge advances in computer technology and communication networks have been developed.
- Metaheuristics have been applied to a very large variety of problems in telecommunications

- Outlook
  - To address the dynamism and uncertainity presented in some telecommunication problems and review the necessity of hybridization of simulation with metaheuristics and machine learning with metaheuristics.

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THANKS!

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