Master thesis within Smart Cities

Background
For the City of Stockholm, one of the main investigations that remain to advance towards an implementation of a smart lighting solution is 'what kind of platform to invest in?'. There are two main tracks; specialized development or procurement of existing platforms.

The second one is ‘what kind of technology to adopt?’. There’s a jungle of technologies and communication protocols to consider, all with their own advantages and disadvantages.

The majority of today's systems are proprietary solutions from the individual lighting suppliers that only work within their own eco system. Resulting lock-in effects are not sustainable for a large city like Stockholm.

The technological challenge
There are several different communication protocols and media used for lighting control available. They have different architecture and cannot communicate between each other. Here lies the biggest challenge for us as a municipality. The following sections describe some of the technical issues that need to be investigated.

Which protocols to allow in the system?
The independent systems/solutions from suppliers talk over several protocols and need a translation module that translates communications between the platform and the lighting system.

With a standard protocol, no translation is needed. But how do we get existing fixtures to talk this language? What language is best for the city's needs? Is this only for lighting control or does the language include more applications?
How will the system architecture look like? 
Today's lighting installation has a certain architecture when it comes to power distribution. Substations supply the lighting cabinet which distributes the power to the poles and fixtures. Likewise, system architecture for a smart city solution has to be developed.

Should the smart city system follow the same architecture as the power supply? Or should each luminaire communicate directly to the platform?

Power is distributed by cable, but data communication may also be wireless. The following are examples of communication mediums available today.
- Mobile (GPRS / 2G / 3G / 4G / 5G)
- WiFi
- Mesh network
- Fiber

The system architecture must specify which of these may be used in the city's network. Should we provide each lighting cabinet with fiber? Should fixtures with cellular connectivity have to connect directly to the overall platform? Should only one mobile technology be allowed? Should each luminaire have a unique address, or are there places where we control lighting on a Cabinet/Group/Phase level?

**Potential topics for a master thesis**

There are many unanswered questions above that have potential of being completely or partially answered by a master thesis report. Listed below are some possible questions that can be attacked through one or more theses.

- What existing platforms and protocols for smart lighting control are available on the market today, and how well do they comply with the vision for the City of Stockholm?
- What are the opportunities and constraints for smart lighting control in today's system and what measures need to be implemented for the infrastructure to enable a Smart City solution?
- How open or closed should the system be for different technologies or protocols and what requirements should be defined in the system architecture to enable implementation of new technologies in the future?