Gartner

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Gartner Assessment of "Copenhagen Connecting"

Smart City and the Internet of Things enables many different benefits, but our research has shown that boil down to four basic models:

1) Manage and optimize an asset or resource (e.g. connecting street lights to save energy and reduce the cost of maintenance)
2) Monetize – charging on pay-per-use basis or monetizing a data stream/source
3) Operate – remotely operating a device (e.g. controlling valves remotely in a water supply system)
4) Extend – extending digital services to a "thing" such as a software upgrade to an truck or control system

Behind each of these four models lies the foundational element: data. The list of data elements that Copenhagen Connecting is planning on capturing (from Appendix B) will create the foundation for benefits that citizens, private enterprises, and the public sector will receive. If data is captured and analyzed cost effectively, there is opportunity for Copenhagen to employ each of the 4 models listed above in many areas. Most of the benefits in a smart city will come from #1 (Managing). Managing and optimizing city infrastructure, transportation assets, transportation routes, buildings, and parking stand out as the likely areas of benefit based on the list in appendix B. Many of these benefits come in the ability to avoid the costs of doing "rounds," such as driving around to see which garbage bins to empty, parking infractions to ticket, or streetlight to repair – instead a connected asset will immediately signal its need for attention or service. Energy savings and environmental protection are also major benefits of properly managing and optimizing assets. For example, monitoring traffic in a building can help maintain a comfortable environment while reducing energy use.

Behind these four models is a set of capabilities that every city will need to have in place:

- Big data – sensor data from things can vary from small bits of information sent when a threshold is passed to a constant stream of operating data. Many smart cities will deal with building data where thousands of sensors will be sending data. Smart cities will need technologies that have the ability to store and analyze large amounts of data cost effectively. This is where newer data stores (e.g. Hadoop Distributed File System) provide a more cost effective way of storing and processing large amounts of data. For example, keeping historical data on transit traffic data can help optimize the transit network.
- To get the most value of the data listed in appendix, two types of analytical capabilities will be required. Both of these require a different set of technologies. Smart cities should have the ability to do both and apply them the multitude of use cases they may need:
    - Analysis of "data at rest." That is, data that has been stored and will be analyzed historically. For example, traffic data can be analyzed for the last four weeks to help optimize how to time lights better. Parking data could also be analyzed to determine if more capacity is required or new pricing schemes need to be implemented.
    - Analysis of "data in motion." That is, data that is coming in real time and needs to be used/analyzed immediately. For example, in Japan a bridge with sensors can track in real time if a truck is overweight (while it's crossing the bridge) based on tonnage restrictions. It is then fined if there is an infraction.
- Data integration: sometimes cities will want to be able to integrate data from assets to systems. For example, if sensors determine that a city truck needs maintenance, a service request could

automatically be place in the asset maintenance system. This requires the ability for a thing/asset and a system to "talk."

- Wireless internet of things infrastructure: data will be sent from many of the things listed in appendix B in a wireless fashion. This requires the city to have a wireless infrastructure that can reach, and is compatible with, the assets and places listed in Appendix B.

Collectively, the ability to gather and analyze data throughout the city is critical in achieving energy use, environmental, enterprise, citizen-improvement, and budgetary goals. None of the four models listed above (Manage, Monetize, Operate, Extend) can be achieved without the capability to manage and use this data.

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