



RTT TECHNOLOGY TOPIC March 2021

Smart Cities From Space

The economics of satellite systems are often justified on the basis of their ability to service geographic areas that are hard or impossible to cover with terrestrial networks, deep rural areas and maritime for example.

Urban applications are considered too bandwidth hungry to be viable for space based networks. A space network additionally has to compete with local area 5G base stations with a minimum coupling loss to user and IOT devices of 45dB so the link budget is also an issue.

Smart cities however have a number of requirements that could be better served from space than from terrestrial networks yielding higher value per bit than existing (lower density) target markets for the satellite industry.

In this month's technology topic/posting we look at the role of satellite systems in enabling a new generation of smart cities in a post Covid world in which space based clocks, co-ordination, communication and cameras enable urban and suburban social and economic efficiency.

Recent [archaeological discoveries in Africa](#) suggest there may have been 'smart settlements' 200,000 years ago linked to gold mining but the concept of smart cities as we know and understand them today is more generally ascribed to the Sumerians 6000 years ago centred on Mesopotamia now known as modern Iraq.

The invention of clay pipes and bricks used to create irrigation systems helped transform the local agrarian economy from subsistence to surplus opening up opportunities to trade, exchange goods and have a good time.

This meant meeting somewhere and voila the city was invented with those bricks used to build buildings and those clay pipes used to build sanitation and heating systems.

However having a good time as the words imply means knowing what the time is. There is no point in planning a party unless you can tell people when and where it's happening. The answer was the solar powered clock also known as the sun dial.

This principle of time as the basis for social, [religious](#) and economic activity remains as true today as it ever was.

But this is not the way in which we typically look at smart cities which are considered as a combination of systems treated as an IT problem to which **information theory** is applied.

It is however better to think about cities as a network (or network of networks) to which **network theory** rather than information theory is applied to realise efficiency improvements.

The starting point for applying network theory to smart cities is to look at **how better timing and synchronisation improves city efficiency.**

We have covered how timing and synchronisation enables telecom network efficiency in three previous technology topics/postings

[Time For 5G, The Role of Big Clocks and Small Clocks in next generation mobile broadband networks February 2016](#)
[A Second Look at Time – April 2016](#)
[Space Time - January 2019](#)

Clocks (solar and mechanical) and cities have a long history together. [The Wells Cathedral Clock has chimed the quarter hour for over 600 years](#) and hasn't stopped yet.

Time has the dual function of ensuring that the things that need to happen at the same time happen at the same time and the things that shouldn't happen at the same time don't happen at the same time.

It is hard to find a function in a modern city or modern city suburb that does not have time as a reference, in fact, I cannot think of a single example. Therefore by implication improving timing and synchronisation will improve city wide efficiency faster and more efficiently than any other process.

The new generation of high count LEOS potentially provides cities with the world's most accurate solar powered clock adding exquisite resolution and resilience to every urban process – the Sumerian Sun dial reinvented and re applied.

The proposition becomes more compelling when combined with imaging systems including optical, infra-red and synthetic aperture sub meter radar. The great thing about a massive multi spectral camera in the sky is that it can see round corners more effectively than terrestrial systems, think ... no more traffic accidents. The speed of LEO satellites (faster speed=improved synthetic aperture performance) enables highly resolved sub metre 3D imaging.

Last but not least there is connectivity but it is not connectivity per se that adds value but the combination of connectivity with a super accurate clock and real time imaging data.

The important consideration here is not latency but latency variability, the Achilles heel of all terrestrial networks.

Satellite networks have visibility to the end to end communication channel which is hard to replicate with end to end routing over terrestrial wireless and fibre. Add a round trip time advantage for city to city communication over more than 10,000 kilometres, Singapore to New York for example, and the benefits of a synchronised smart city from space that can talk to other smart cities from space become increasingly obvious. Minimum latency globally synchronised high frequency trading is just one example of an added value opportunity where satellites deliver clear advantage. It is also easier to make end to end authentication and encryption more secure.

There is however an unanswered question.

In 1927 the German film director Fritz Lang produced the Science fiction drama Metropolis. In the film, rich people fly between sky scrapers, spending their leisure time in pleasure gardens where every need is met.

The City is however dependent on an army of underground workers who toil daily to sustain the lives of the privileged elite existing on a higher plane.

Contemporary smart cities have a similarly uncomfortable dependency on migrant workers who may or may not live underground but are expected to be content with an inferior standard of life. On a global scale this is neither fair nor smart nor sustainable in the longer term. Social and economic inequality directly correlates to political instability so is not even politically justifiable.

In previous technology topics/postings, we have argued the case for a United Nations Global Broadband network, a network in space that could deliver urban (and rural and maritime)

efficiency. It would be a major step forward if these economic gains could be used to reduce the differences in GDP which make migrant working so depressingly ubiquitous.

The Mesopotamians might have invented the smart city but they also invented slavery.

While being a migrant worker is a step up from being a slave it has to be said that social progress over the past six thousand years has been slow – global socialism from space might seem an unlikely route to social equality but on a dark night, all of us can reach for the stars.

Ends

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<http://uk.artechhouse.com/5G-and-Satellite-Spectrum-Standards-and-Scale-P1935.aspx>

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