IoT as an Enabler for Smart Water Management

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Agenda

Examples of Water Management History
World Population Evolution and Water problems
Internet of Things (IoT)
IoT & Smart Water Management

Examples of Water Management History

Water monitoring history : Zaghouan Aqueduct

with scanty rainfall (approx. 446.1 mm/per year) the majority of ancient cartage water was supplied from wells and cisterns in individual homes

These cisterns collect rainwater, they were often at least two meters deep so could hold several thousand liters of water.
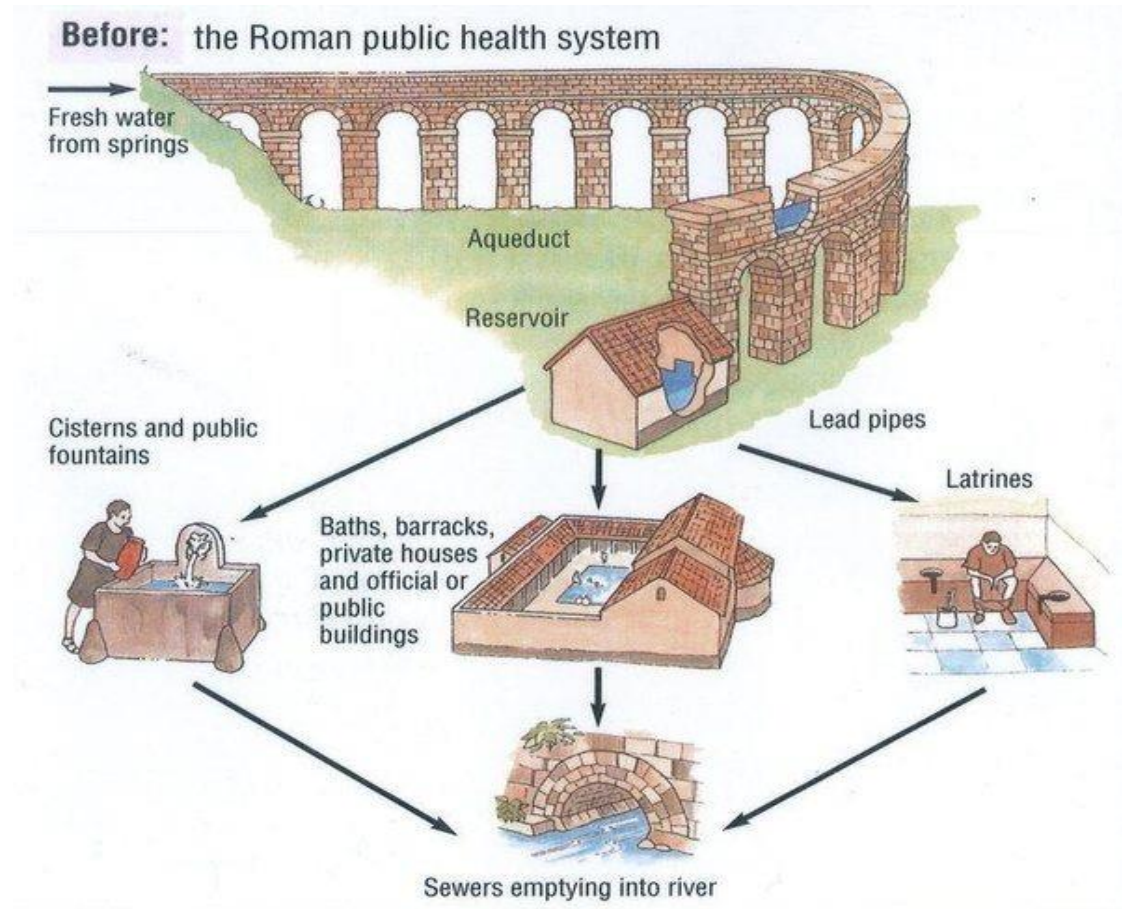

Source: http://www.roman-empire.net/articles/article-025.html

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Water monitoring history : Zaghouan Aqueduct

when Rome conquered Carthage, the new settlers found themselves in front of conditions different from those in Rome:

- There is no enough water supply for the new arrivals.

-The Roman architecture is based on pervasive water features, such as : baths and fountains, so how would it be possible to setup such infrastructures in Carthage?

Water monitoring history : Zaghouan Aqueduct

Before: the Roman public health system

Fresh water from springs

Aqueduct

Reservoir

Cisterns and public fountains

Lead pipes

Baths, barracks, private houses and official or public buildings

Latrines

Sewers emptying into river

During the time of Roman emperor Hadrian and during five years, Carthage city has suffered from long drought. As a result of water shortage, the emperor was convicted that the water supply of Carthage should not rely on Rainwater

In order to supply Carthage with fresh water, new water collection and distribution facilities were constructed thanks to a magic combination between both civilizations techniques.

Roman : (aqueducts and *castella*)

Carthaginians : (cisterns)

Source: https://www.quora.com/How-do-Roman-fountains-work

Water monitoring history : Zaghouan Aqueduct

The largest complex of its kind was made

This is the largest complex of its kind ever made. It combines three components: the catchments of four main sources with endowment of a monumental frame, known under the name of "temple of the waters", of a great archaeological value.

A 132 km aqueduct running in general to flower or underground route and many parts of which mark the landscape in many places with arches of more than 20 m high.

The storage tanks of the Maalga in Carthage, to which must be added the large public baths of Carthage, said baths of Antonin, located at seaside and which constituted the ultimate goal and the result of all.

Built in the early 2nd century AD, this complex has since marked the landscape to this day and has experienced exceptional longevity since, even today, much of its pipes is still functional

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Water monitoring history : The Aghlabid Bassins (Kairouan)

Built in 862 A.D.

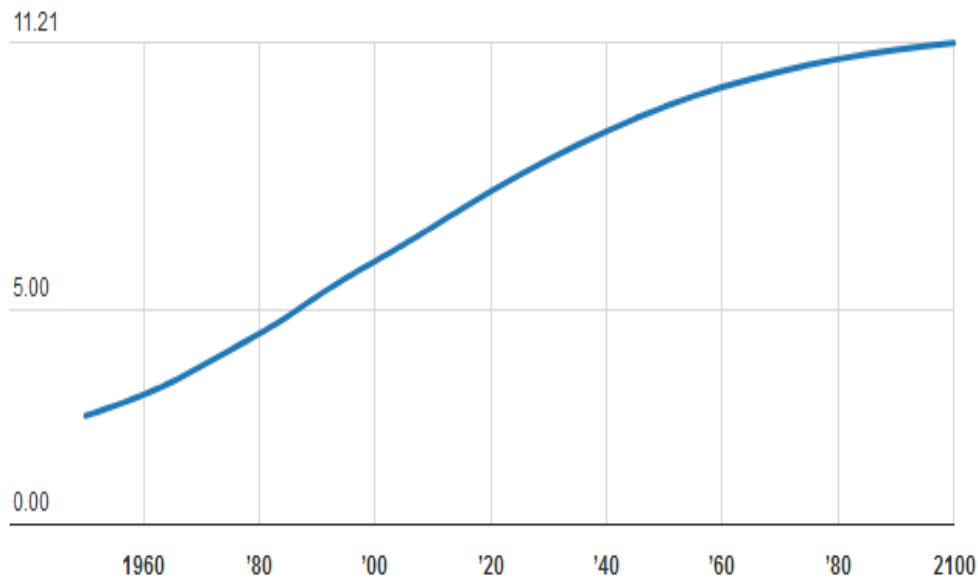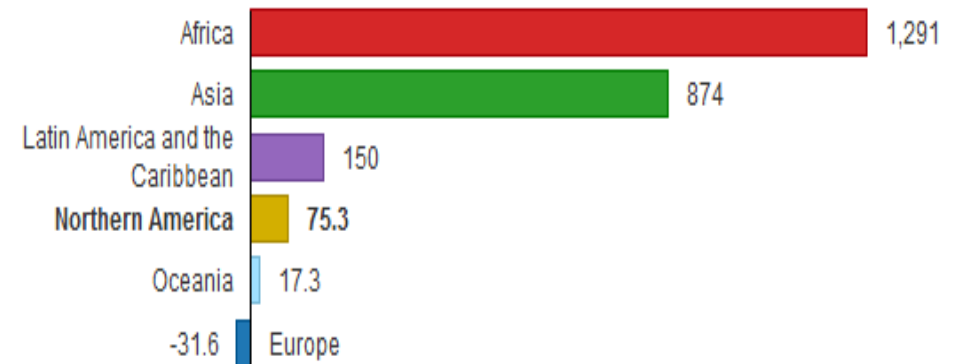Covered Area: 11000m^2

Full capacity: 63000 m^3

World Population Evolution and Water problems

World population evolution

World Population and Projection to 2100 (Billions)

Regional Population Change (2015 - 2050)

Region	Change
Africa	1,291
Asia	874
Latin America and the Caribbean	150
Northern America	75.3
Oceania	17.3
Europe	-31.6

Source: https://blogs.worldbank.org/opendata/future-world-s-population-4-charts

With the explosion of urban populations, providing public services efficiently and sustainably is becoming an increasingly important challenge, mainly providing fresh water for every dweller.

https://www.independent.ie/incoming/article34456159.ece/ALTERNATES/h342/BUSINESS-urbanisation.png
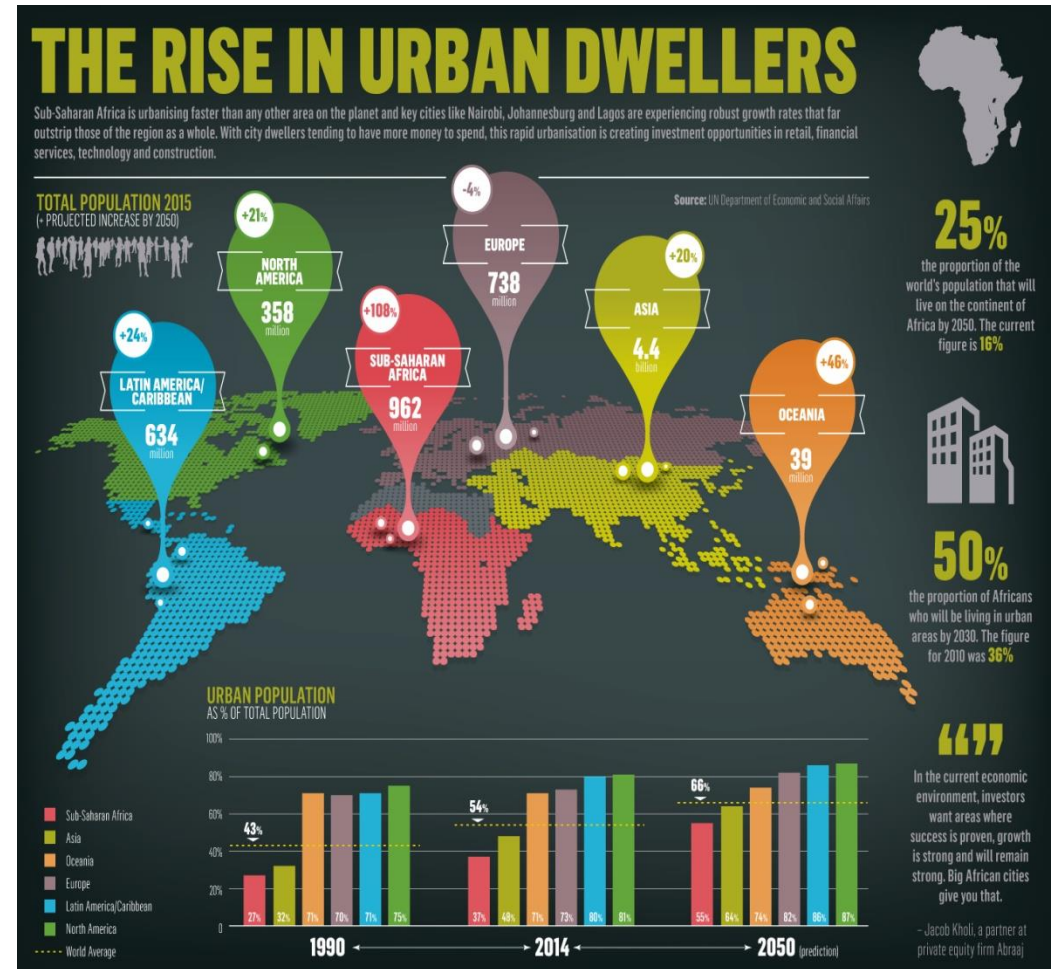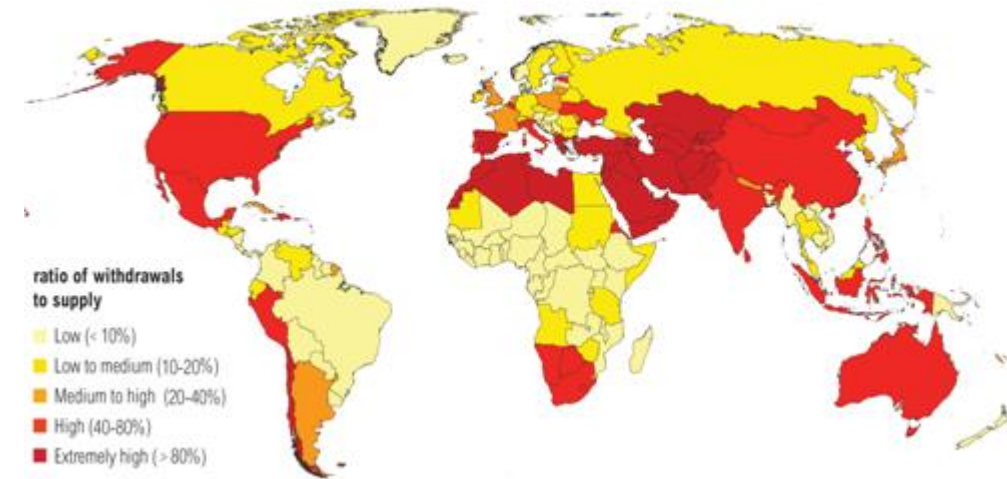
Water stress

More than a billion people now live in water-scarce regions, and as many as 3.5 billion could experience water scarcity by 2025.

' World resources institute'

"Water stress is increasing in a majority of the world, especially in already vulnerable areas such as the Middle East, North Africa and Australia.

" Rutger Hofste, research analyst for the World Resources Institute's water team.

Water Stress by Country: 2040

ratio of withdrawals to supply

Low (< 10%)
Low to medium (10-20%)
Medium to high (20-40%)
High (40-80%)
Extremely high (> 80%)

Source: http://www.wri.org/sites/default/files/uploads/water_stress_world_map_lan

Water : some statistics

97.5 % of the planet water is a salt water.

By **2050**, at least **one in four people** is likely to live in a country affected by chronic or recurring shortages of freshwater. 'UN World Water Development Report'.

By **2025**, the demand for water is expected to rise by **56%** more than is currently available.

The global consumption of water is **doubling every 20 years**, more than **twice** the rate of human population growth. 'Food and Agriculture Organization (FAO)'.

Total Water on Earth

97% Saline water (oceans)

3% Fresh water

Icecaps and Glaciers 68.7%
Ground Water 30.1%
Other 0.9%
Surface Water 0.3%
  87% Lakes
  11% Swamps
  2% Rivers

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28 July 2010 – Safe and clean drinking water and sanitation is a human right essential to the full enjoyment of life and all other human rights, the General Assembly declared that almost **900 million** people worldwide do not have access to clean water.

How ICTs are helping to make cities smart and sustainable ? In particular, How ICTs are recognized as strategic enabler in the process of developing innovative solutions to address the problems of water ?
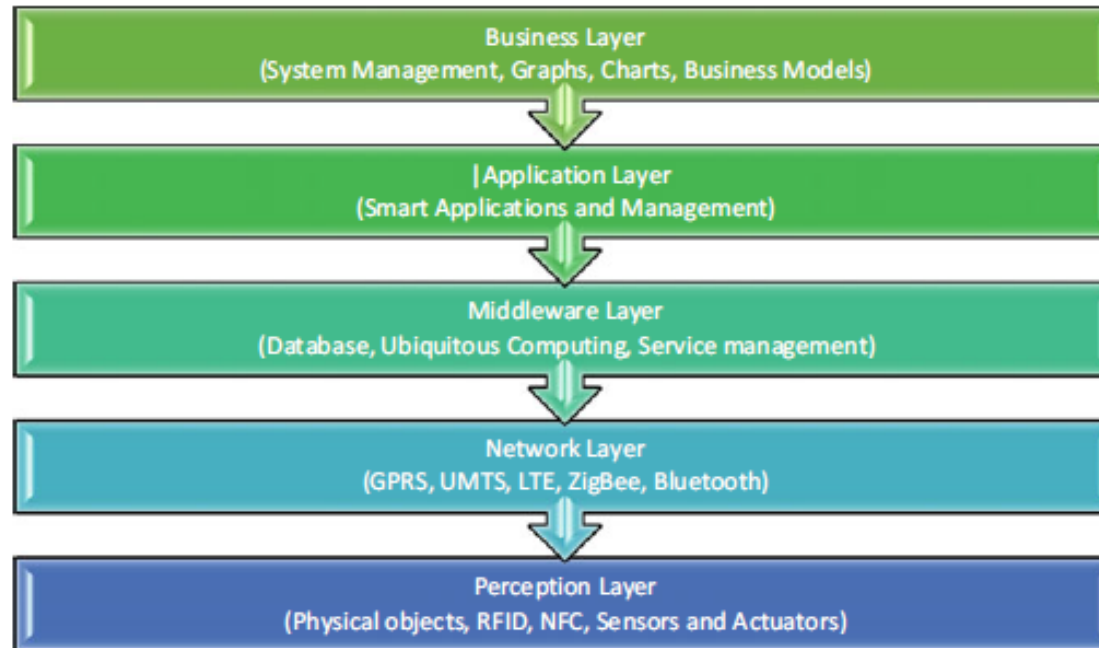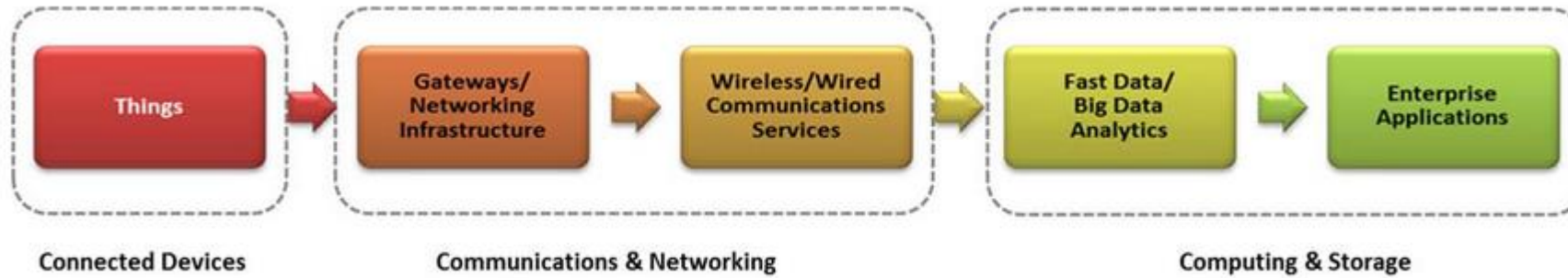
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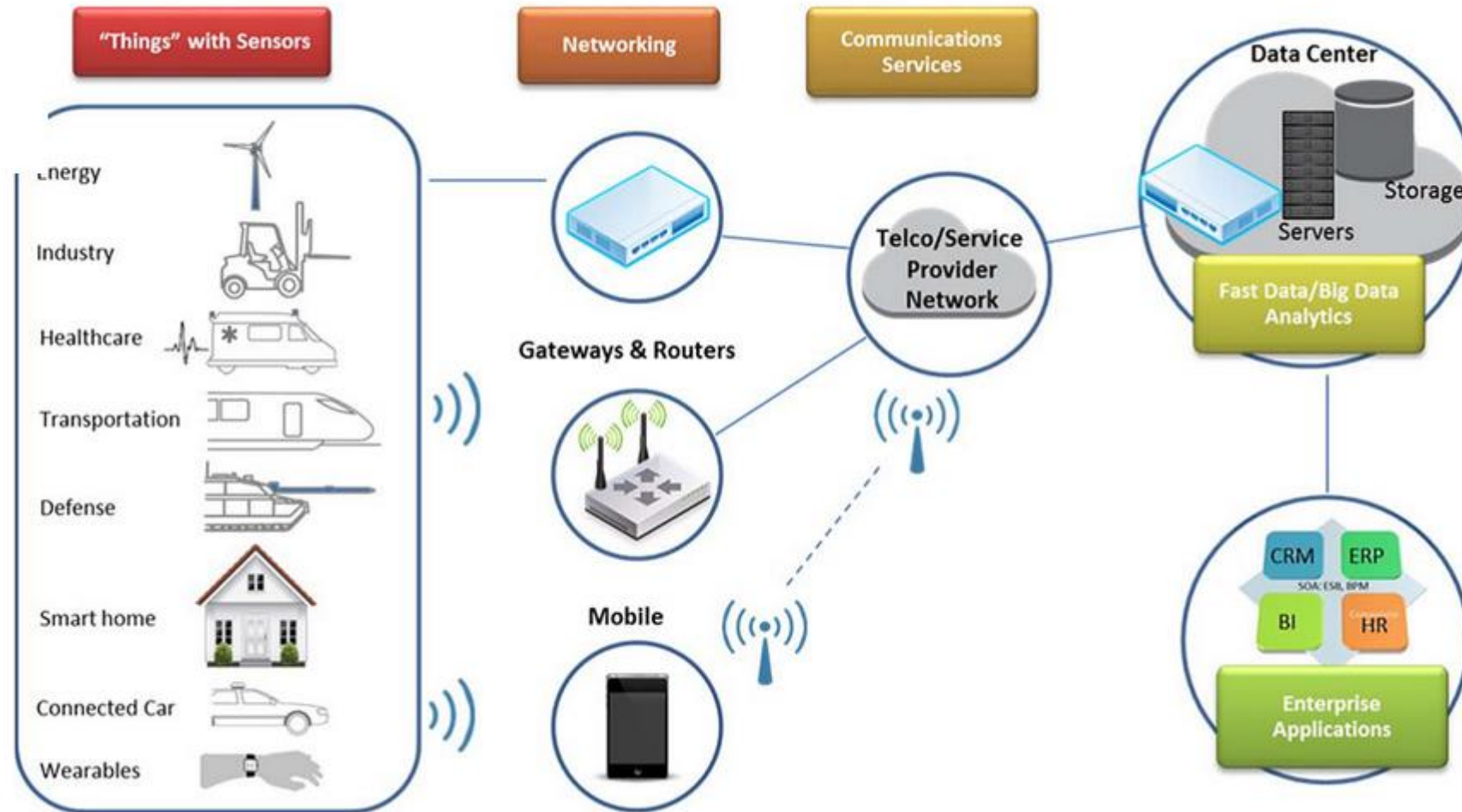OF ACHIEVEMENTS

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Internet of Things (IoT)

✓ a hyper-connected global ecosystem in which "things" communicate with other "things" whenever needed to deliver highly diversified services to the user

✓ There will be more than 50 billion smart objects by 2020

IoT architecture layers
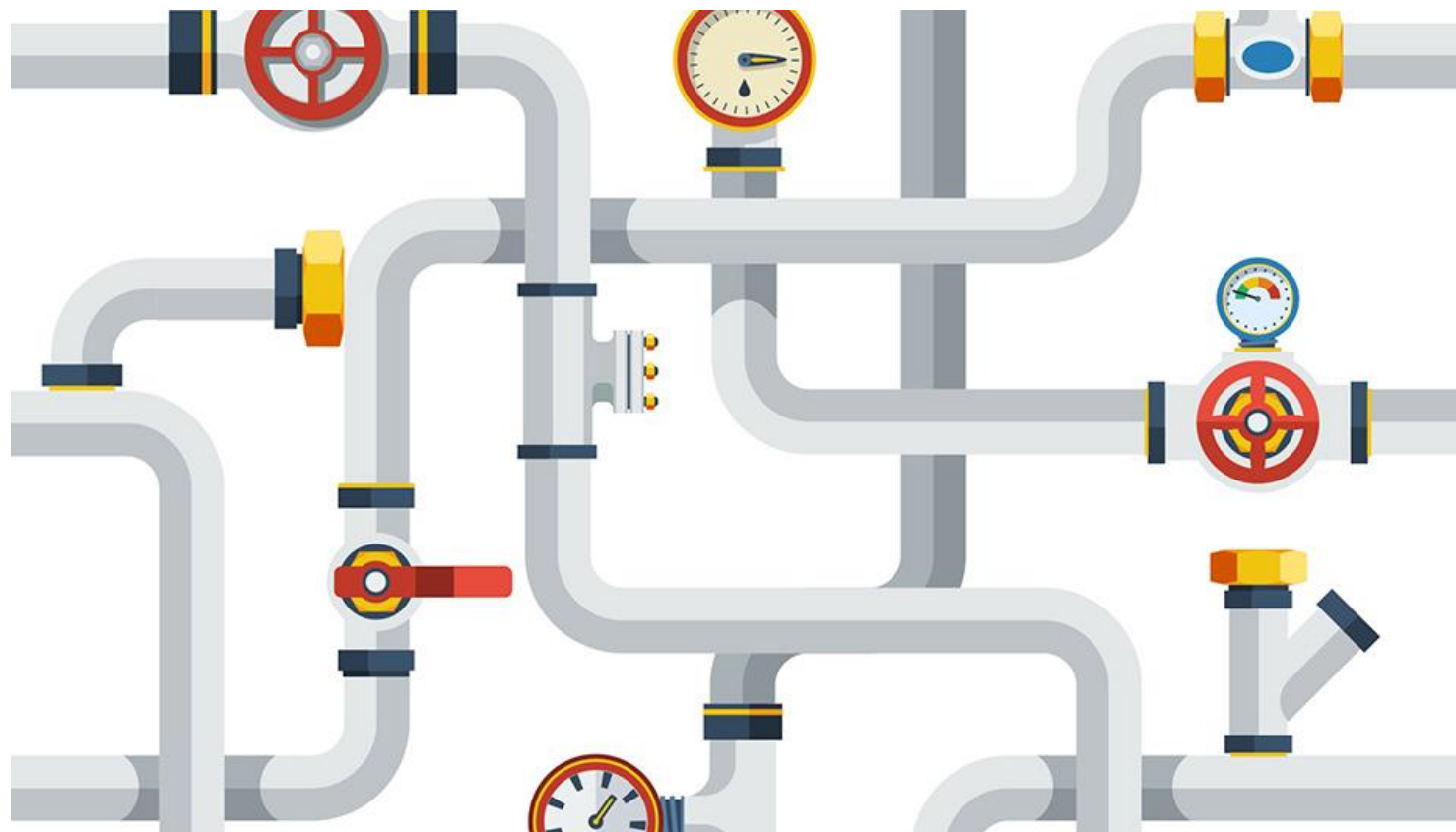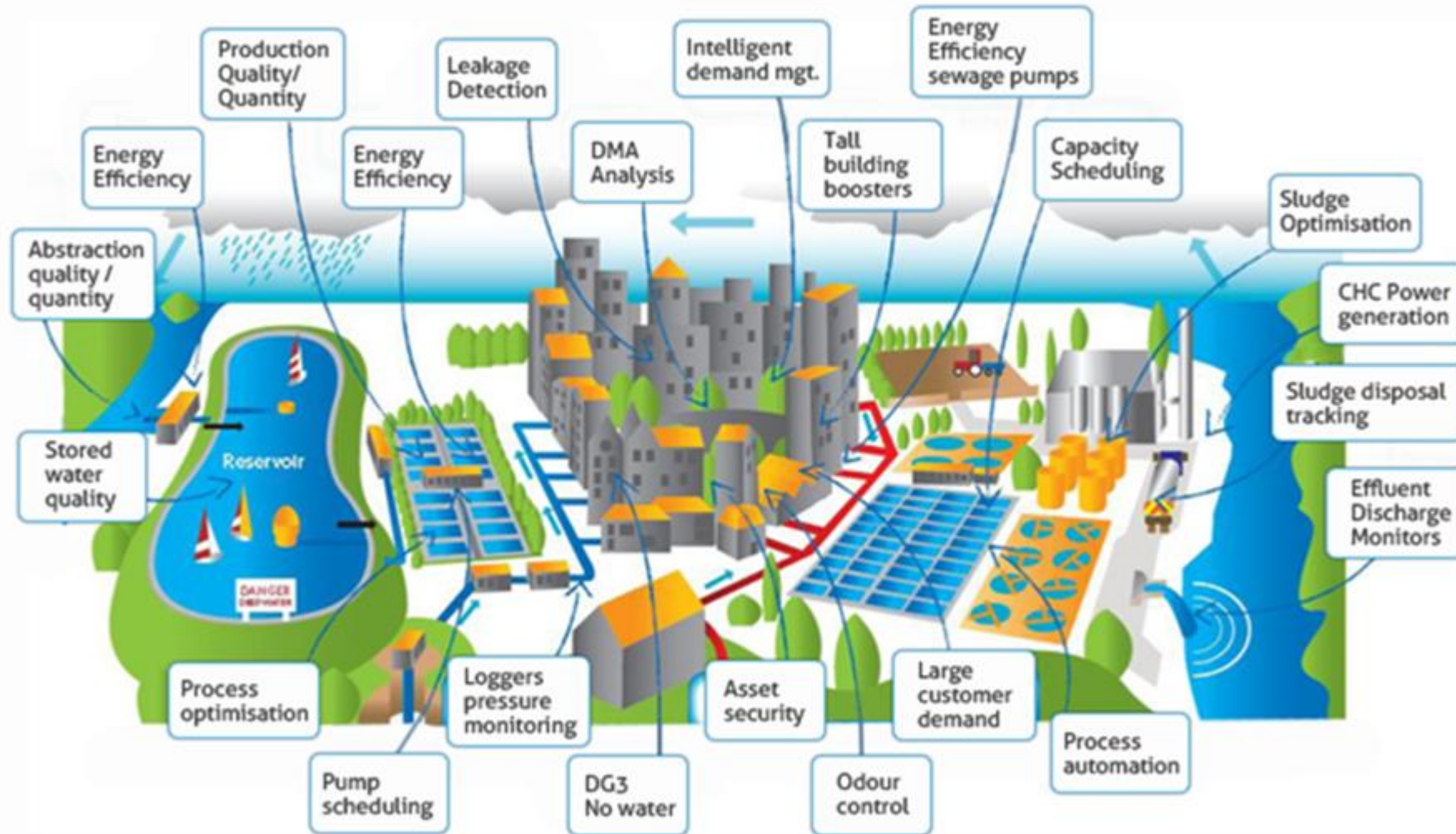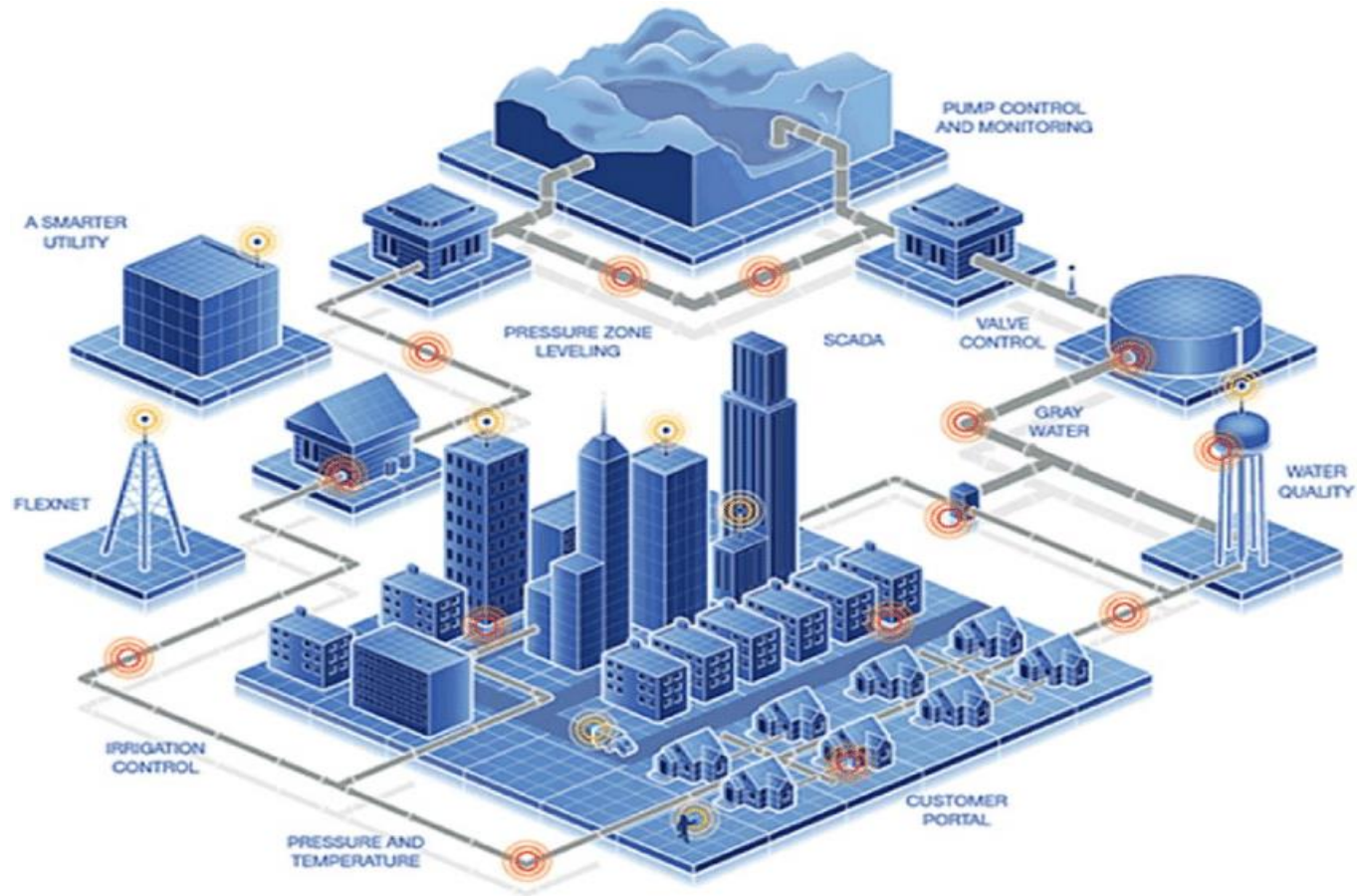
IoT architecture layers

Source: https://datafloq.com/read/internet-of-things-more-than-smart-things/1060

IoT & Smart Water Management
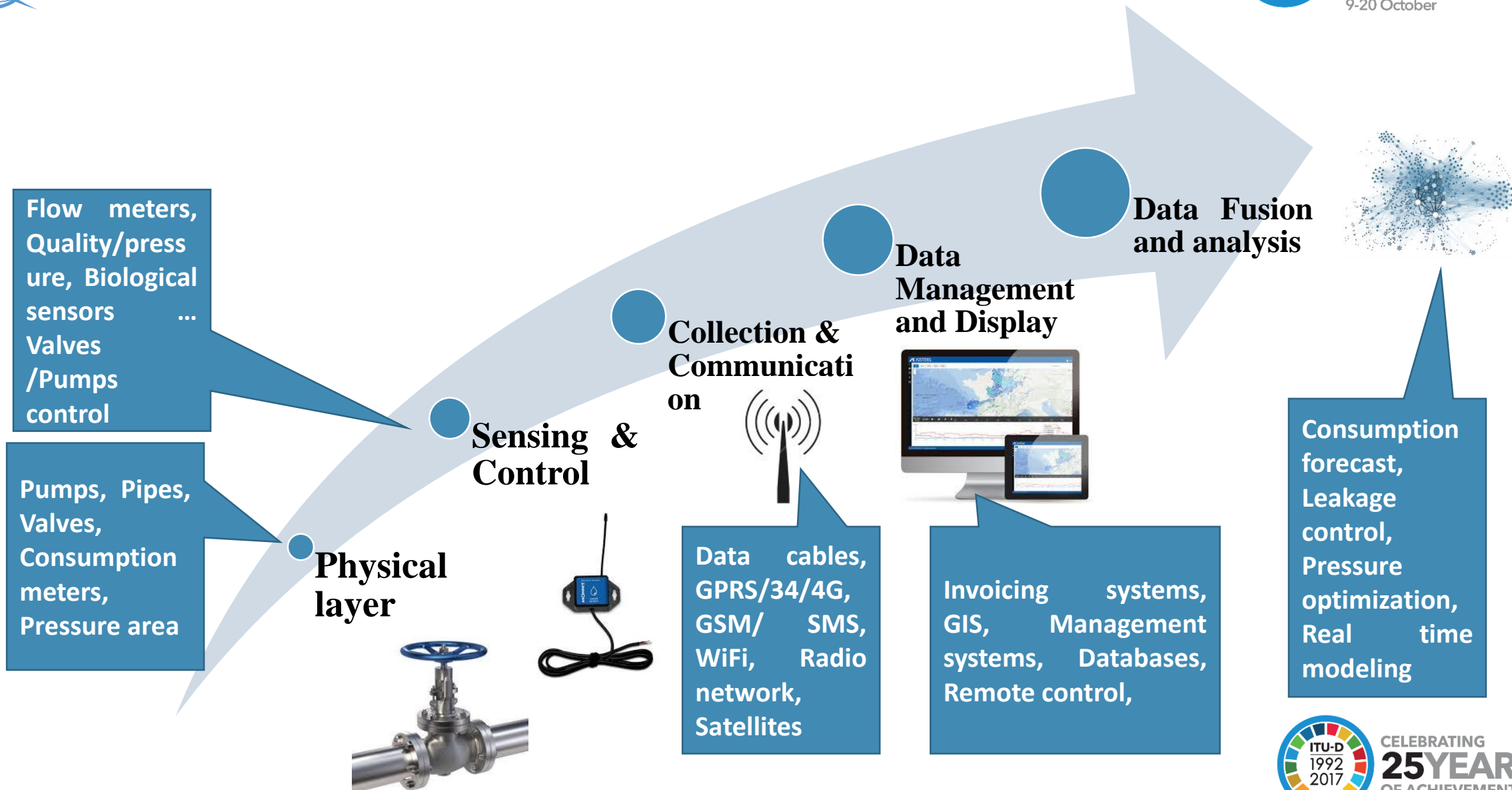
Water management Digital Transformation

Source: http://www.huawei.com/minisite/huaweiconnect2016/en/IoT/Intelligent-water.html

IoT for smart water

Source: http://www.aquamatix.net/

Source: http://www.mobiloitte.com/blog/driving-digital-transformation-smart-cities-iot-prospects-challenges

Flow meters, Quality/pressure, Biological sensors ... Valves /Pumps control

Data Fusion and analysis

Data Management and Display

Collection & Communication

Consumption forecast, Leakage control, Pressure optimization, Real time modeling

Pumps, Pipes, Valves, Consumption meters, Pressure area

Sensing & Control

Physical layer

Data cables, GPRS/34/4G, GSM/ SMS, WiFi, Radio network, Satellites

Invoicing systems, GIS, Management systems, Databases, Remote control,

Smart Combined Sewer Overflows: Efficient optimisation is achieved through intelligent management systems.
Source: greatlakes.org

Smart Irrigation and Agriculture: Commercial uses of water can be optimised to ensure sustainable use.
Source: agreenstarlandscape.com

Smart Ultrapure Water: A series of sensors can ensure high water quality and monitor conditions in the system.
Source: organo.co.jp

Smart Wastewater Management: Wastewater can be managed to monitor quality and levels.

Smart Water Supply Management: Water resources and environment can be managed to ensure sufficient supplies and quality.
Source: treehugger.com

Source: usa.siemens.com
Smart Water Distribution Management: Water in utility grids can be monitored to optimise distribution and asset management.
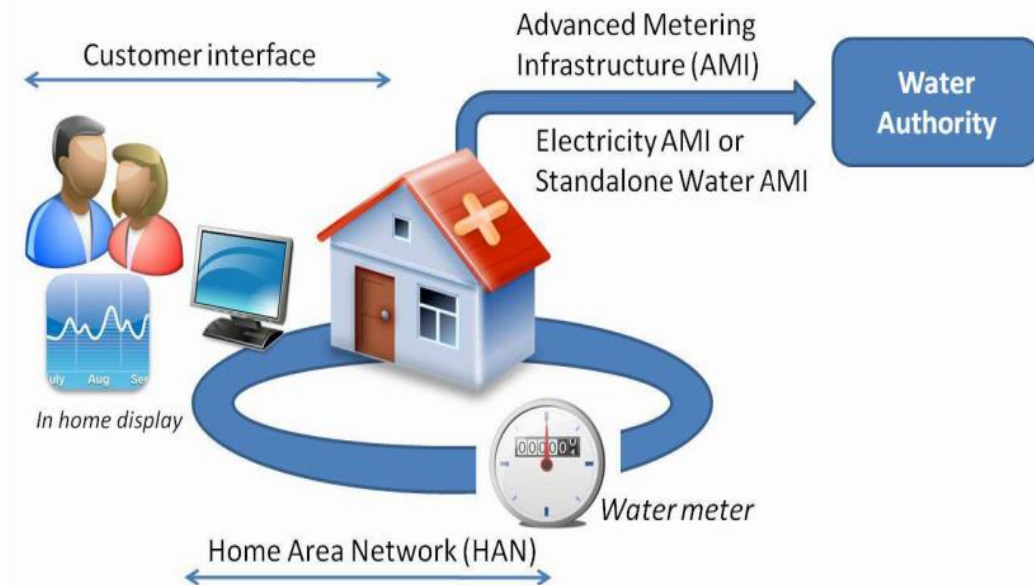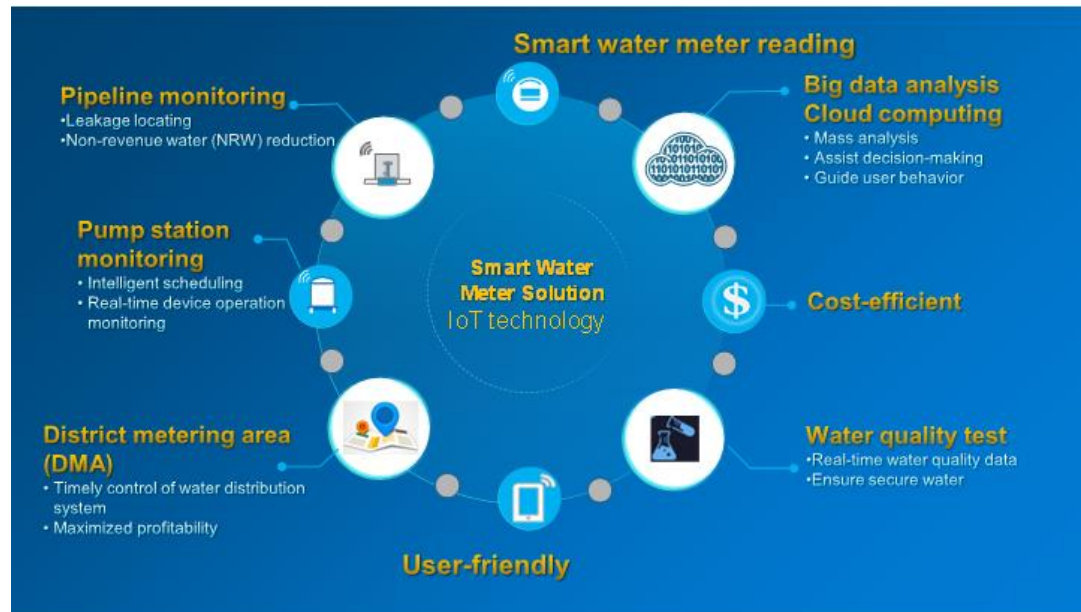Source: Google Images

Source: precisionmeters.co.za

From mechanical meter to Smart water metering

Smart Water Metering Market worth $14bn by 2024: Global Market Insights, Inc.

Source: http://developer.huawei.com/ict/en/site-iot/article/liteos-smart-meter

Source: http://cdn.intechopen.com/pdfs/22755.pdf

IoT impact in smart water Management
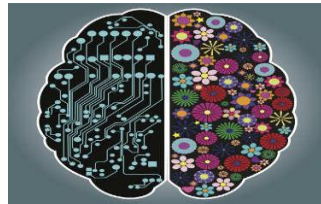
Measure smarter   Communicate better   Analyze easier   Improve revenue   Increase efficiency

Thank You