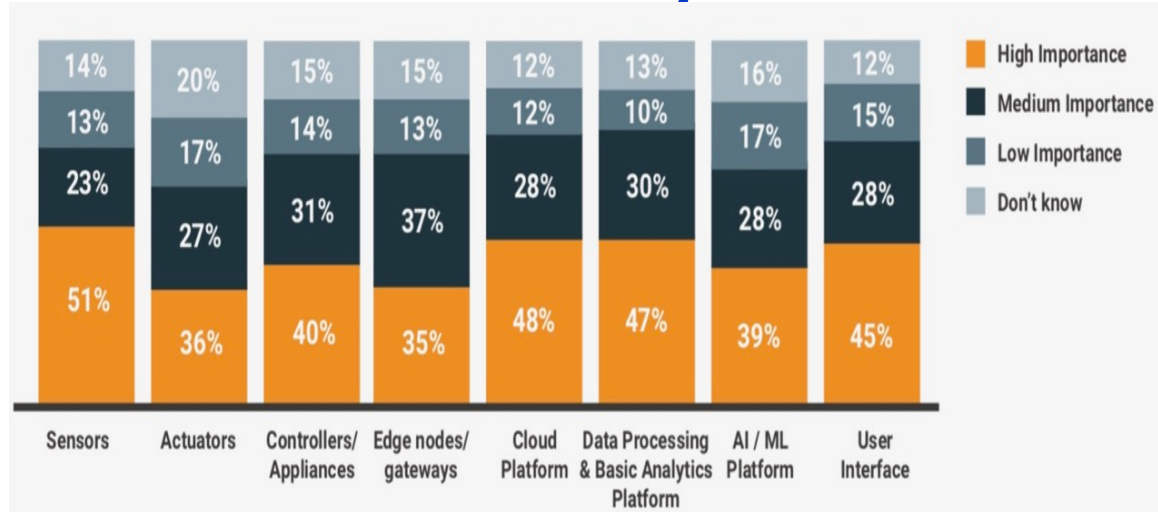# IOT Solution – Case Study

Uma Seetharaman
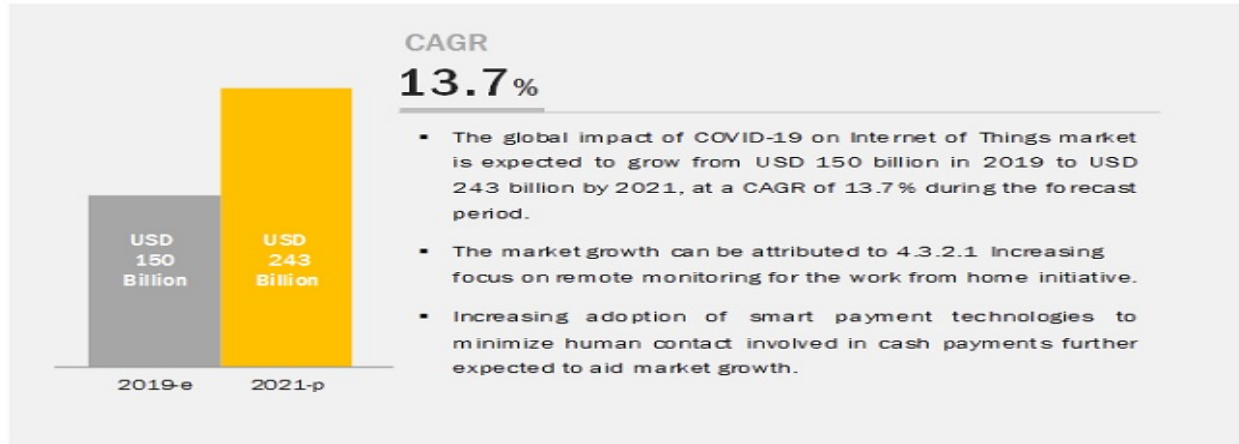
June 19 2020

IOT & Economy

Ranking of importance of technology components in IoT solution. Source: Eclipse Foundation

Attractive Opportunities in the Impact of COVID-19 on Internet of Things Market

CAGR
13.7%

- The global impact of COVID-19 on Internet of Things market is expected to grow from USD 150 billion in 2019 to USD 243 billion by 2021, at a CAGR of 13.7% during the forecast period.
- The market growth can be attributed to 4.3.2.1 Increasing focus on remote monitoring for the work from home initiative.
- Increasing adoption of smart payment technologies to minimize human contact involved in cash payments further expected to aid market growth.
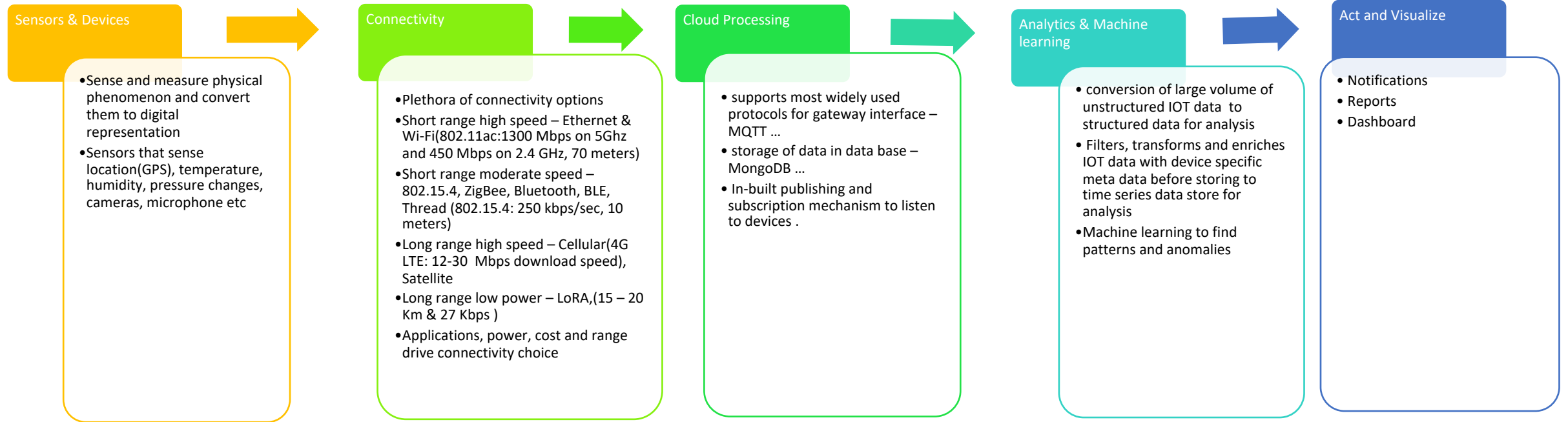
e: estimated; p: projected

Source: Secondary Research, Expert Interviews, and MarketsandMarkets Analysis

- The IoT technologies of highest importance were sensors at 84%, data processing & analytics at 77%, and cloud platforms at 76%.
- 60% are factoring open source technologies into their IoT deployment plants.

- The global impact of COVID-19 on Internet Of Things (IoT) market size is expected to grow from USD 150 billion in 2019 to USD 243 billion by 2021, at a Compound Annual Growth Rate (CAGR) of 13.7%
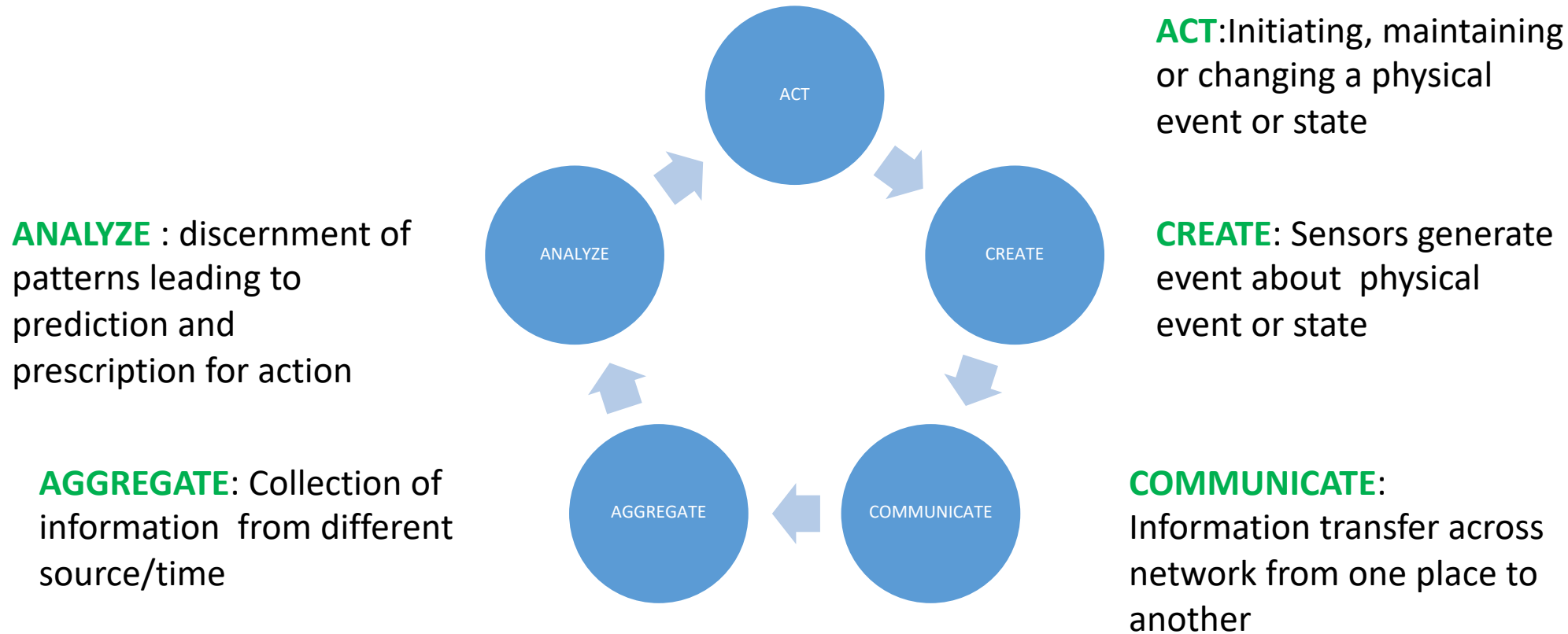
The major factors driving the market growth include increasing focus on
- Remote monitoring for the work from home initiative
- Growing adoption of smart payment technologies to minimize human contact involved in cash payments
- Rising demand for wearable devices.

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IOT Technology Chain

Sensors & Devices

- Sense and measure physical phenomenon and convert them to digital representation
- Sensors that sense location(GPS), temperature, humidity, pressure changes, cameras, microphone etc

Connectivity

- Plethora of connectivity options
- Short range high speed – Ethernet & Wi-Fi(802.11ac:1300 Mbps on 5Ghz and 450 Mbps on 2.4 GHz, 70 meters)
- Short range moderate speed – 802.15.4, ZigBee, Bluetooth, BLE, Thread (802.15.4: 250 kbps/sec, 10 meters)
- Long range high speed – Cellular(4G LTE: 12-30 Mbps download speed), Satellite
- Long range low power – LoRA,(15 – 20 Km & 27 Kbps)
- Applications, power, cost and range drive connectivity choice

Cloud Processing

- supports most widely used protocols for gateway interface – MQTT …
- storage of data in data base – MongoDB …
- In-built publishing and subscription mechanism to listen to devices .

Analytics & Machine learning

- conversion of large volume of unstructured IOT data to structured data for analysis
- Filters, transforms and enriches IOT data with device specific meta data before storing to time series data store for analysis
- Machine learning to find patterns and anomalies

Act and Visualize

- Notifications
- Reports
- Dashboard

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IOT Information

ACT:Initiating, maintaining or changing a physical event or state

ANALYZE : discernment of patterns leading to prediction and prescription for action

CREATE: Sensors generate event about physical event or state

AGGREGATE: Collection of information from different source/time

COMMUNICATE: Information transfer across network from one place to another

ACT

ANALYZE

CREATE

AGGREGATE

COMMUNICATE

Information within Internet of Things creates Value in never ending value loop consisting of 5 stages

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IOT Solution – Case Study

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Track Quarantine – Value Proposition

Problem Statement
- Curb the spread of COVID-19 by effective quarantine of infected or perceived to be infected people
- Countries throughout the world turned to IoT and GPS enabled apps to track and, when necessary, restrict such people's movements.

Solution
- Geofencing where a virtual perimeter is created using GPS, RFID, Wi-fi, Bluetooth/BLE signal, and cellular network.

Challenges
- WiFi, Bluetooth and GPS needs to be ON constantly which drains the battery
- When you walk down the stairs or go down the lift and go right into the mall underneath the building you have no GPS signals at all
- People don't carry their phone switched on 24 *7

AWS Cloud

HTTPS

Quarantine record of patients
- real time location
- location history
- compliance check
- Alert of fleeing person with last locatio
- band status

Over Wifi / LTE

Quarantine track app
- **band state**
- **time stamp**
- **GPS co-ordinates**

Band state via BT/BLE link

Connectivity BLE / BT

Microcontroller

Sensors

Edge Device – wrist band

Band working/tampered
+ GPS coordinates
+ Quarantine period

# Popular Apps to Track COVID-19

Aarogya Setu

- Developed by the **Indian** Ministry of Electronics and IT to notify users if they have crossed paths with someone who has been diagnosed positive.
- Tracking is done via Bluetooth and a location-generated graph that charts proximity with anyone infected.
- Once the app is installed, the users are required to switch on their **Bluetooth and Location** sharing, and keep them on always for effective tracking.
- Aarogya Setu is available in **11 languages** on both Android and iOS platforms.
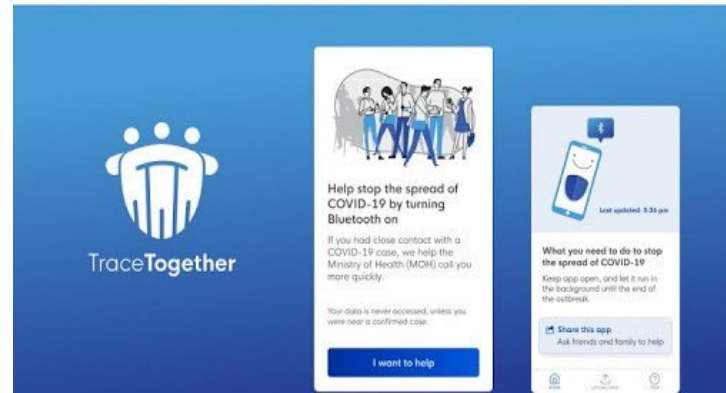
TraceTogether

- Used by anyone with a **Singapore** mobile number and a Bluetooth-enabled smartphone.
- It is a contact tracing app that uses Bluetooth to track infected people and notify those who were in close proximity to them during the past 15 days.
- The app **doesn't collect data about GPS location or WiFI/mobile network**. When two people using the app are close to each other, both phones will use Bluetooth to exchange a Temporary ID. This Temporary ID is generated by encrypting the User ID with a private key held by the Ministry of Health (MOH). It can only be decrypted by MOH, and does not reveal your identity or the other person's identity.
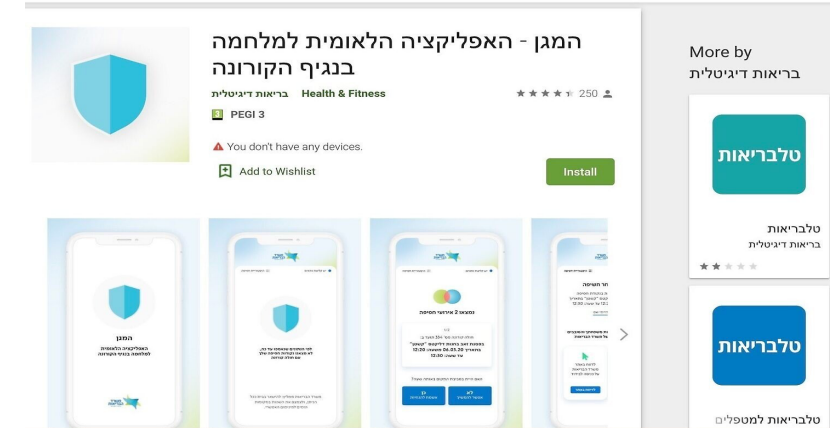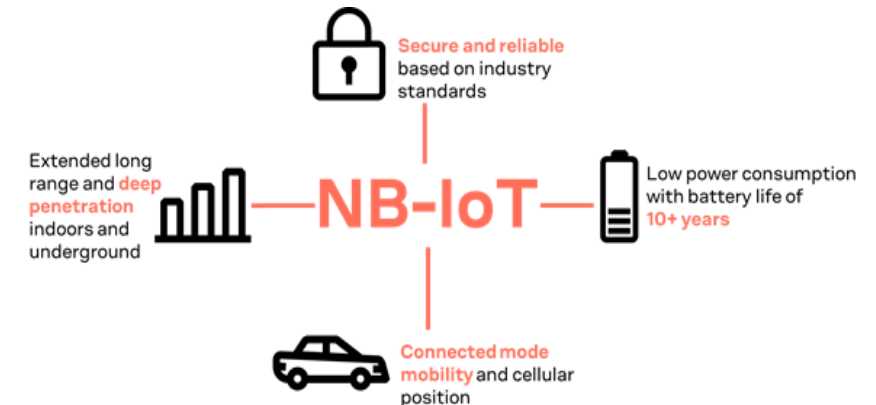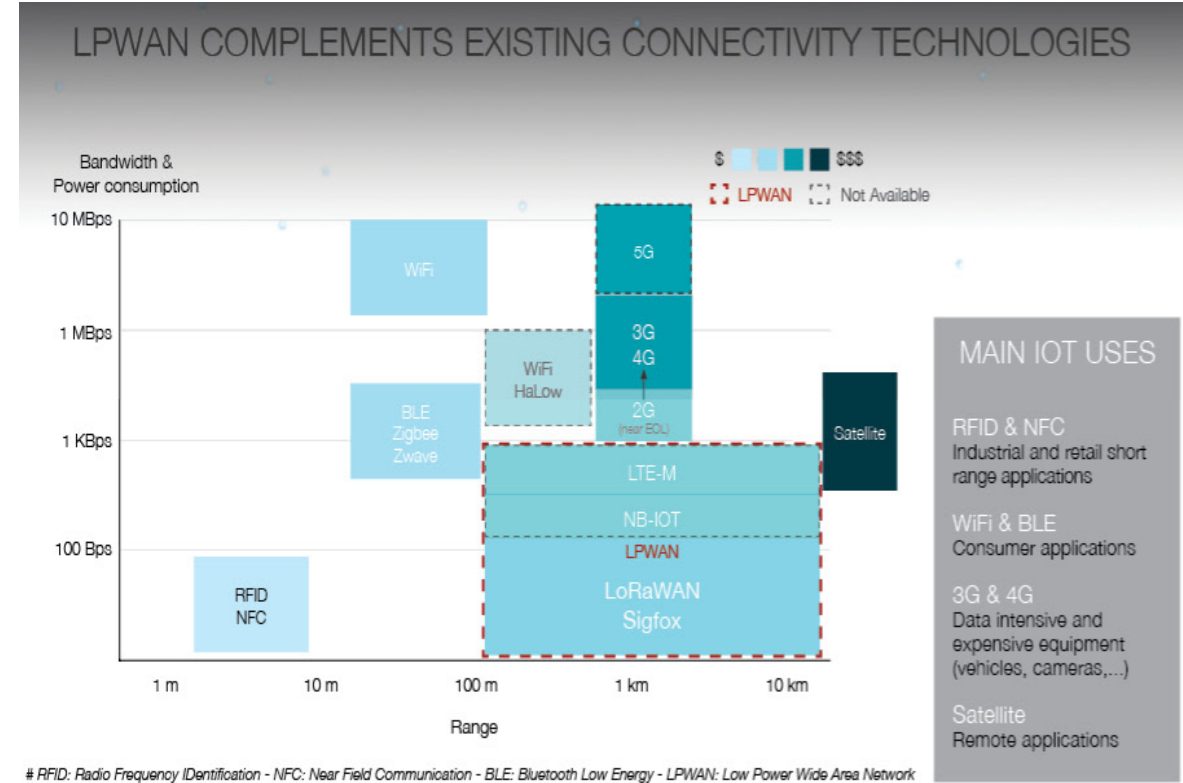
HaMagen

- Launched by the Health Ministry of **Israel**, the app uses contact tracing to contain the spread of the deadly contagion.
- The app allows users to know if in the past 15 days they were close to anyone who has been diagnosed with the virus. Once a user installs the app, his movements are tracked using **location** technology and the information fetched is compared with the ministry data on the whereabouts of those who have been diagnosed.
- If it transpires that a particular user was indeed in proximity with an infected person, the app redirects the person to the health ministry website where he can **register for self-quarantine**.

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LPWAN IOT Options

- Sigfox uses proprietary technology. Uses star topology .
- LoRa is a more distributed concept. They've invested in the standard and are supporting a multitude of partners to provide hardware and infrastructure. They're letting mobile operators roll out infrastructure, as well as allowing it to be used for public and private networks
- Weightless is open-standard that operates in the sub-1 GHz unlicensed spectrum
- Where LTE-M has an advantage is that it will come as part of a regular infrastructure upgrade, so support for it just happens. The challenge for volume is getting the hardware price down
- NB-IoT was first introduced as LTE Cat NB1 in the 3GPP Release 13 standard that also defined LTE-M (LTE Cat M1) - both are LPWA technologies in the licensed spectrum. With 3GPP Release 14, the LTE Cat NB2 standard has been set.

Benefits

- Range: From a few kilometers in dense urban areas up to 15-30 kilometers in rural areas
- Power: ~10+ years of battery life
- Radio Chipset cost: ~$2 or less
- Radio Subscription cost: ~$1 per device/ year

LPWAN COMPLEMENTS EXISTING CONNECTIVITY TECHNOLOGIES

RFID: Radio Frequency IDentification - NFC: Near Field Communication - BLE: Bluetooth Low Energy - LPWAN: Low Power Wide Area Network

Drones – Value Proposition

Surveillance - using drones to monitor people's movement and break up social gatherings that could pose a risk to society

Broadcast - Drones equipped with loudspeakers are used to broadcast messages and information about lockdown measures make public announcements to keep people indoors, take necessary precautions, make social-distancing and wear a mask if stepping outside from home.

Disinfectant spraying - spraying drones are filled with disinfectants and can cover much more ground in less time and 50 times faster than traditional methods. According to DJI, the world's largest drone maker company, a spraying UAV can carry around 16 Litre of disinfectant and cover 100,000 sq meter area in an hour.

Deliveries - Doctors and hospitals need medical supplies and laboratory testing more than ever, and drones are the safest and fastest ways to deliver medical supplies and transport samples from hospitals to laboratories.

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What is hindering IOT

Fragmentation
- Multiplicity of standards
- Interoperability issues at different levels of software and hardware

Software services
- Lack of open IP based connectivity and delay in IPV6 deployment
- Creation of flexible and scalable network

Security and privacy
- Secure and authorised access
- Data integrity at consumer device

Device and Data Management
- Seamless plug and play of sensor nodes
- Management of millions of connected devices
- Handling of data generated by IOT devices

Collective intelligence
- Individual nodes / sensors are not smart enough
- Need to leverage big data and cluster of devices to bring collective intelligence

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Key Takeaways

- There is market for IOT where customer problems can be solved
- Address interoperability at HW/SW in the beginning
- Innovate and solve unique problems in India

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