# White Paper:

# Internet of Things (IoT) and Next Generation 911

Jun 2019

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## Introduction

A new and evolving term is becoming the recipient of much investment and interest—the Internet of Things or IoT. As our civilization continues to become more and more dependent on devices using Internet-based communications, IoT represents how the applications, devices and systems interact with or without human intervention.

## Internet of Things, Smart Cities—Can 9-1-1 Keep Up?

According to Gartner, Inc. there will be nearly 26 billion Internet Protocol (IP) capable devices used world-wide by 2020, and connected "things" to 6.4 billion devices by 2016. Another technology research firm, ABI Research, estimates that more than 30 billion devices will be wirelessly connected by 2020. The wide variety of these IP devices is referred to as the "Internet of Things" or "IoT". As more wireless IP devices come into use, the challenge of how emergency communications centers will communicate with people using these devices continues to grow. On the flip side there will be a growing requirement for the IoT devices to directly communicate with the PSAP systems, such as alarms and cameras well as sensors. The original concept associated with Next Generation 9-1-1 systems (NG9-1-1) was to meet this challenge.

## What is the Internet of Things (IoT)?

The range of IoT devices includes a growing list of Smart-phone like devices that transmit and receive communications using voice, text, video, and photos. However, IoT goes beyond the use of Smart devices or phones. Typically, IoT also includes devices, systems, and services that provide machine-to-machine communications (M2M) using a myriad of protocols, domains, and applications.

Broadly speaking the "Things" in the IoT, refers not only to smart phones and smart pads but also heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, industrial process controllers, or field operation devices that assist fire-fighters in search and rescue. "Things" also include appliances like smart thermostat systems and washer/dryers that utilize Wi-Fi for remote monitoring. These devices collect data, interact and communicate with other technologies and devices.

## IoT and Smart Cities

There are predictions by technology firms, university researchers, futurists, and public policy experts that the IoT will continue to grow exponentially, and that this increasing number and variety of computing devices will have significant economic impact.  For example, the UK Government's 2015 budget allocated over $60 million for IoT research.

This is happening because IoT operates using a variety of architectures, standards and platforms, that don't allow cities to facilitate sharing of data across systems and the coordination of processes across domains.  Integrating these systems means getting everything on the same page, so to speak, as part of what is typically called a Smart City initiative.

Our cities have hundreds of traffic and crime surveillance security cameras, our homes are connected to the utility companies by monitoring sensors, and our healthcare is managed by connecting medical staff and patients to a myriad of machines and data bases.  All these applications require the support of 24/7 network availability.

Central Monitoring
Energy Management
Applications for Patients to monitor activity
Home Area Network
Pollution Monitoring
Video Surveillance
Transportation Monitoring
CITY HALL
City Services Safety & Security / Emergency Responce
Traffic Monitoring
Parking Monitoring
Communications

The concept of Smart Cities is to connect government services with the residents, tourists, and commuters through a variety of networks and applications.  Many cities have implemented "municipal broadband" projects in an attempt to on-line access to services.  To do so, some cities have needed to expand access to broadband networks beyond the capacity of the telecommunications operators, known as municipal broadband services.  These solutions are becoming more prominent due to the consumers' increased demand for audio and video applications that are significantly increasing bandwidth requirements by 40% annually, according to industry sources.

WiFi
Public lighting
Video surveillance
Access control
Traffic information
City Hall information
Parking meter
Parking
Traffic control

How does the Smart City concept impact public safety?  We are all aware of the heightened security concerns in major cities and the need for secure, reliable and interruptible security feeds.  Installing devices, such as IP cameras and security sensors, at key assets and infrastructure across an urban area is straightforward, but there are challenges.

1. First, guaranteeing continuous, real-time communication to support mission critical voice and data feeds to an emergency communications center.  The network must be designed as high availability, providing prioritization for public safety
2. The second challenge is to accumulate, analyze, prioritize, monitor and respond to incidents reported by people and "things" such as door alarms, camera sensors, gas leaks, water main breaks and detection of hazardous materials
3. Third challenge is to secure the network(s) from attacks

## What Does the IoT Mean for Emergency Communications?

The challenges to emergency communications is already making itself clear.  Our industry responded by developing standards and implementing the Internet Protocol based Next Generation 9-1-1 (NG9-1-1) systems that provide the technical basis for any device to connect to a 9-1-1 center.  As more states, regions and local jurisdictions plan and implement NG9-1-1, those actions are challenged by consumer electronics firms that are developing more devices using differing protocols and technology to travel on the IP highway.

### Connected IoT Devices Are Everywhere

Besides, the growing use of Smart Phones and the multiple communications apps residing on them, to include, email, text, FaceBook, twitter, Viber, WhatsApp, text, and photos, the PSAP of the future will be challenged by IoT devices that can send data of many types to the PSAP.  Data is also expected to come from IP devices such as sensors and cameras used by transportation electric, telecommunications, water, railroad, transit systems, public utilities, as examples.  As the multitude of new applications used by Internet connected devices continue to expand daily, IoT is also expected to generate large amounts of data from diverse locations that will be needed to be aggregated very quickly, thereby increasing the need to better index, store and process such data.

9-1-1 centers are now getting data from sources such as traffic and surveillance cameras, texts, photos and personal video, making it more and more susceptible to viruses, hacks and denial of service. Telephony Denial of Service (TDoS) is a growing threat, when hackers can seize control of one of more trunks or flood the system with too many calls, stopping the receipt of emergency calls.

Public disasters resulting from hacks of train crossing signals or traffic lights could and will occur. These cameras, crossing signals and traffic lights operate via IP in order to ensure that technologies using multiple protocols can transmit data to each other and to the machines and people monitoring them. This flexibility makes them vulnerable.

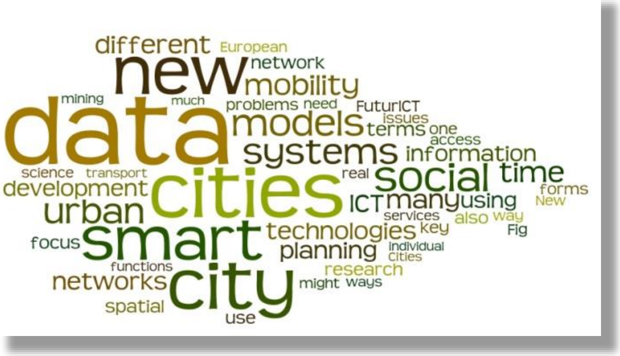
**NG9-1-1 and the TFOPA Cyber Security Guidelines**

Implementing Next Generation 9-1-1 includes the Emergency Services IP Network ("ESInet") that will provide the means to receive and send data from the different kinds of IoT devices that can and will connect to a PSAP. As described in the Task Force on Optimal PSAP Architecture ("TFOPA") Optimal Cybersecurity Approach for PSAPs Report on cyber security,

> "As Public Safety Answering Point (PSAP) 9-1-1 networks transition from TDM-based to IP-based, architecture, as part of the migration to Next Generation 9-1-1 (NG9-1-1), they will face increasing exposure to cyber threats and vulnerabilities that did not exist in the legacy 9-1-1 environment. Cyber risk management strategies are being developed for the communications sector that will benefit the NG9-1-1 ecosystem as a whole".

## 9-1-1 and the Smart Cities of the Future

The future is now, as many municipal broadband projects are being initiated by cities to increase residents and business access to the Internet. City re-thinking the traditional operational model for managing emergency communications will need to adapt to the new broadband infrastructure and the ability to provide a multi-faceted awareness of the incident from not only people calling, but from the Internet of Things that is growing and expanding around us every day. National efforts similar to TFOPA initiative by the FCC are needed to guide this transition and its many challenges.



## Where do We Come In?

Winbourne Consulting is one of the leading public safety communications systems consulting firms in the world. Winbourne Consulting served as the technology consultant to the Fairfax County, VA M-PSTOC to integrated traffic and public safety systems. We are working to link NG911 systems and Intelligent Transportation Systems with Smart Cities initiatives in Vietnam where the solution described above is being implemented. We have worked on multiple NG911 projects in the US as well as city dashboard projects related to 311 data. We can leverage that experience to support our clients planning or implementing IoT and Smart Cities projects.

### About Winbourne Consulting

We have provided consulting and project management services to nearly 250 public safety agencies in the United States and 20 countries. Our clients include 8 of the 10 largest public safety agencies in the U.S.

For more information on how we may assist your agency, please contact: info@w-llc.com, or phone: 703-584-5350.