AWS Smart Cities and the Internet of Things

Amazon Web Services

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amazon.com

Consumer Business

amazon.com

Seller Business

amazon web services

IT Infrastructure Business

https://aws.amazon.com
Today we support millions of organizations in over 190 countries around the world become more agile and more innovative
Including Some of the World’s Greatest Startups

airbnb  coinbase  ZENEFITS  TUNE  RAZER

tinder  Pinterest  duolingo  Flipboard  ARTSY  Candy

lyft  DOJO  coursera  Prezi  Instacart  HAIL 0

CODE  oscar  yelp  chute  GILT  Scribblelive

FUNPLUS  Draft Kings  Zillow  twilio  dropcam  popaya

REDFIN  hungama  Nextdoor  9

kik  Tapjoy  TinyCo  gravityjack

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The World’s Best Enterprises
And Broadly Across The Public Sector As Well

- **Government Agencies**: 2,300
- **Education Institutions**: 7,000
- **Nonprofit Organizations**: 22,000

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By Offering A Wide Selection of Cloud Based Services
Agenda

- Overview
- IoT in Public Sector
- AWS IoT & AWS Platform
- Customer Adoption
Internet of Things (IoT)

26 Billion connected units will be installed by 2020

Key Factors include:

- Lower price point of sensors, processors and networking
- Increased connectivity
- Reducing cost of data storage and compute

Economic value impact is estimated to be up to $11T by 2025

- Large quantities of data to be analyzed and processed
- Every industry vertical and domain expected to be impacted

Sources:
Across Many Industries

- Healthcare and Life Sciences
- Municipal Infrastructure
- Smart Home
- Retail
- Manufacturing, Logistics & Supply Chain
- Agriculture
- Education
- Automotive
## Impact of IoT

<table>
<thead>
<tr>
<th><strong>Cost Savings</strong></th>
<th>Reduces costs, optimize use of resources, allows for real-time feedback</th>
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<tbody>
<tr>
<td><strong>Efficiency</strong></td>
<td>Fine-tune practices and innovate novel services based on data</td>
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<tr>
<td><strong>Decision Making</strong></td>
<td>Enables real-time decision making</td>
</tr>
<tr>
<td><strong>Improved Innovation</strong></td>
<td>Improved citizen service delivery based on data, e.g. improved traffic flow, water management, safer pedestrian traffic</td>
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</table>
### IoT and Smart Cities

AWS works with our public sector customers to help implement robust, cost effective, secure, and scalable IoT solutions.

<table>
<thead>
<tr>
<th>Smart Transportation (Transportation)</th>
<th>Integrated Safety Solutions (Public Safety)</th>
<th>Smart City (City Services)</th>
<th>Connected Healthcare (Public Healthcare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking Solutions</td>
<td>Crowd control / management</td>
<td>Water control / management</td>
<td>Patient tracking and monitoring</td>
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<tr>
<td>Connected smart intersections</td>
<td>Officer safety</td>
<td>Trash and garbage collection</td>
<td>Integrated healthcare with at-home care</td>
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<tr>
<td>Smart routing / navigation</td>
<td>Emergency notification</td>
<td>Lighting control and water metering</td>
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<tr>
<td>Fleet tracking / monitoring</td>
<td>Security solutions</td>
<td>Infrastructure monitoring</td>
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<td></td>
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<td>Building automation systems</td>
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IoT’s role in Smart Cities

IoT alone cannot help a city to become digitally transformed. The power of data from multiple sources – once analyzed – is what makes a city Smart.
Heavy Lifting With IoT

Fully managed cloud platform that lets connected devices easily and securely interact with cloud applications and other devices

Devices
Connect Billions of Devices

Network
Lightweight Communication Protocol

Security
X509 Certificates

Data Collection
DynamoDB, Kinesis, and S3

Smarts
Trigger Lambda Functions
# Benefits of AWS IoT Platform

<table>
<thead>
<tr>
<th>Connect and Manage</th>
<th>Devices can communicate with each other even if they use different or custom protocols</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure Devices and Data</td>
<td>Provides authentication and end-to-end encryption throughout all points of connection, applying policies with granular permissions</td>
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<tr>
<td>Process and Act on Data</td>
<td>Filter, transform, and act upon device data on the fly, based on business rules that you define</td>
</tr>
<tr>
<td>Create a “Shadow”</td>
<td>Device Shadows store the last reported and desired future state of each device even if device is offline. You can retrieve the last reported state of a device or the desired future state through the API or by using the rules engine</td>
</tr>
</tbody>
</table>
AWS IoT: How it Works

**DEVICE SDK**
Set of client libraries to connect, authenticate and exchange messages

**DEVICE GATEWAY**
Communicate with devices via MQTT and HTTP

**AUTHENTICATION**
Secure with mutual authentication and encryption

**RULES ENGINE**
Transform messages based on rules and route to AWS Services

**SHADOW**
Persistent thing state during intermittent connections

**REGISTRY**
Identity and Management of your things

**APPLICATIONS**
AWS Services
3P Services
Uses AWS to stream, analyze, store, and share data collected by 200,000 telematically-enabled machines to provide growers with timely and accurate data for optimal growing conditions.

John Deere can help farmers take action on real-time developments on their farms, plant more efficiently, and improve the yield of their crops.

Video Testimonial
The Philips HealthSuite digital platform analyzes and stores 15 PB of patient data gathered from 390 million imaging studies, medical records, and patient inputs.

Running on AWS provides the reliability, performance and scalability that Philips needs to help protect patient data as its global digital platform grows at the rate of one petabyte per month.
AWS Customers making an impact with IoT

- Tata
  - Fleet Tracking And Monitoring

- Philips
  - Street Lighting

- Illumina
  - DNA Sequencing Instruments

- Kärcher
  - Equipment Management

- dash
  - Connected Car Device

- dropcam
  - Video Monitoring

- Trimble
  - Asset and vehicle Tracking

- Belkin
  - Consumer Smart Device Electronics
AWS IoT Hardware Partners
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Data Analytics

Sensor Data

Machine Learning
Data Warehousing

Open Data
Citizen Data

Audio/Voice
Devices/Sensors
Visual/Motion

Data Sets
Street Bump App Screen Shot
Data + Sensors + Analytics = Smart City

Street Bump: Fix that Road

Data
Mapping and maintenance datasets

Sensors
Mobile app collects real-time data about road conditions

Analytics
Solution analyzes data and identifies potential spots for repair

Impact
- Governments can make decisions about city improvements based on road conditions; plan for long term investments
- Other potential opportunities:
  - Inform commuting patterns
  - Inform procurement and allocation of road improvement equipment
Data + Sensors + Analytics = Smart City

Enigma: Fire Risk Analysis

**Data**
Open Data about Fires in New Orleans

**Sensors**
Fire Alarm Feeds in real-time

**Analytics**
Predict Fire Alarm Deficiencies

**Impact**
- Distribute life-saving smoke alarms to New Orleans’ most vulnerable residents
- For US cities, assign risk score to a city or county based on jurisdictional local fire data
- Other potential opportunities:
  - Allocate emergency vehicles based on risk score
Deep Dive:
Smart Transport Journey Planner and
Open Data API for Cities
(Transport for London)
The Smart Transportation Industry is Growing

Public Transport organizations are providing smart multimodal services to citizens combining:

- **The Physical** - Roads, Trains, Metro, Buses, Taxis, etc…
- **With the Virtual** - Internet, Web, Mobile App, Sign Board, Ticketing and Electronic Payment, Automatic Speech Recognition (ASR), etc…
Challenges in Cities Today

- Shrinking Budgets
- Public Scrutiny
- Aging Systems
- Increased Demand
- Faster Pace of Technology Innovation
Transport Trends in Cities

- Increased Expectations Of Tech Savvy Customers
- Road Congestion Hurting Economic Productivity
- Public Transport Infrastructure Already at Capacity
- Legacy Transport Organizations With Multiple Stand Alone Data Sets
- Increased Demand Particularly from Mobile Devices in Real Time
- City Population Continues to Age & Grow

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TfL Open Data Journey Planner on AWS

- Example AWS Public Sector Customer:
  - Transport for London (TfL)
- Technology:
  - Transport information Journey Planner **Web Site** with an **Open Data API** provides city transportation data to citizens.
  - Igniting a Developer Network to generate innovative **Mobile Applications** around open city data.
With an Open Data Planner and Unified API, You can Kick Start

- **Innovation** - Spark the creativity of a developer network,
- **Niche Products** - Create new markets on availability data,
- **Customer Reach** - Provide information where they are,
- **Data Transparency** - Release data trapped in silos,
- **Customer Satisfaction** - Improved customer planning,
The TfL Open Data Road Map Led to Results

- **31 million journeys per day**
- **83% of Londoners use web site**
- **43% Use travel applications**
- **TfL 80% Savings on Operations of Journey Planner w/Cloud**

- **More than 600 apps and growing**
  - Specialized (niche) products
  - Accessibility, air quality, other

- **19 Legacy data silos**
  - **More that 200 data sources**

- **11,000 Plus API users and growing**
- **1000 Plus tech jobs in London**
- **Millions in transport application investment from external sources**

- **20 million visits per month**
- **Unified API open access**
TfL’s Unified API Data Elements
TfL Open Data Outcomes - Financial

- Deloitte study estimated £15m-£58m per annum benefits from customer time saved in apps powered by TfL open data
- Usage has doubled since – bringing the estimate to £30m-£116m per annum.
- Significant investment in app development firms has attracted hundreds of millions of pounds in technology investment in London and elsewhere off the back of our data
- Around 1,000 jobs estimated to be enabled by this open data ecosystem
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