FIRSTLINK

# BigData and Smart City


*April 02 2019 , by Quang Tân Trần*

# Agenda


- **BigData : new concept, new technology**
  - Challenge of BigData
  - Problematics resolved by BigData
- **Keys Of Success**
  - Open Data, the engine of Smart Cities
- **What is Smart City ?**
  - What is a Smart City?
  - The Foundations of the Smart City
  - How Big Data Can Help Smart Cities?
- **Samples of**
  - BigData Usage for the Smart City,
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# BigData : new concept, new technology

*March 10 2019 , by Quang Tân Trần*

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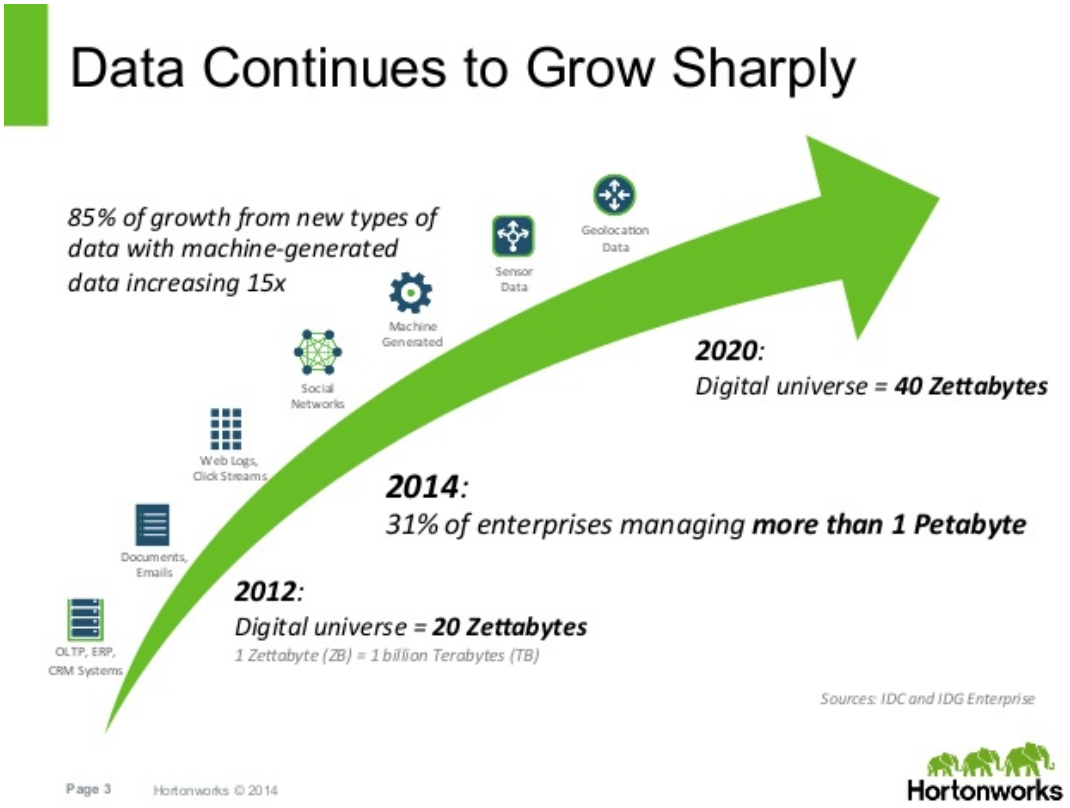
- **Today, whatever the activity domain, the volume of data generated and manipulated continues to increase,**

- **Causes of Strong Data Volume Growth :**
  - Progress in hardware (SSD disk, new processor …) and their cost becoming affordable,
  - Number of users for IT solutions increase,
  - New Sources of Data : machines and sensors are producer of data,
  - Applications Operating, and Machine Information Volume increase,
  - Using Smartphone and Credit Crads,
  - Geolocation,
  - IoT, ...

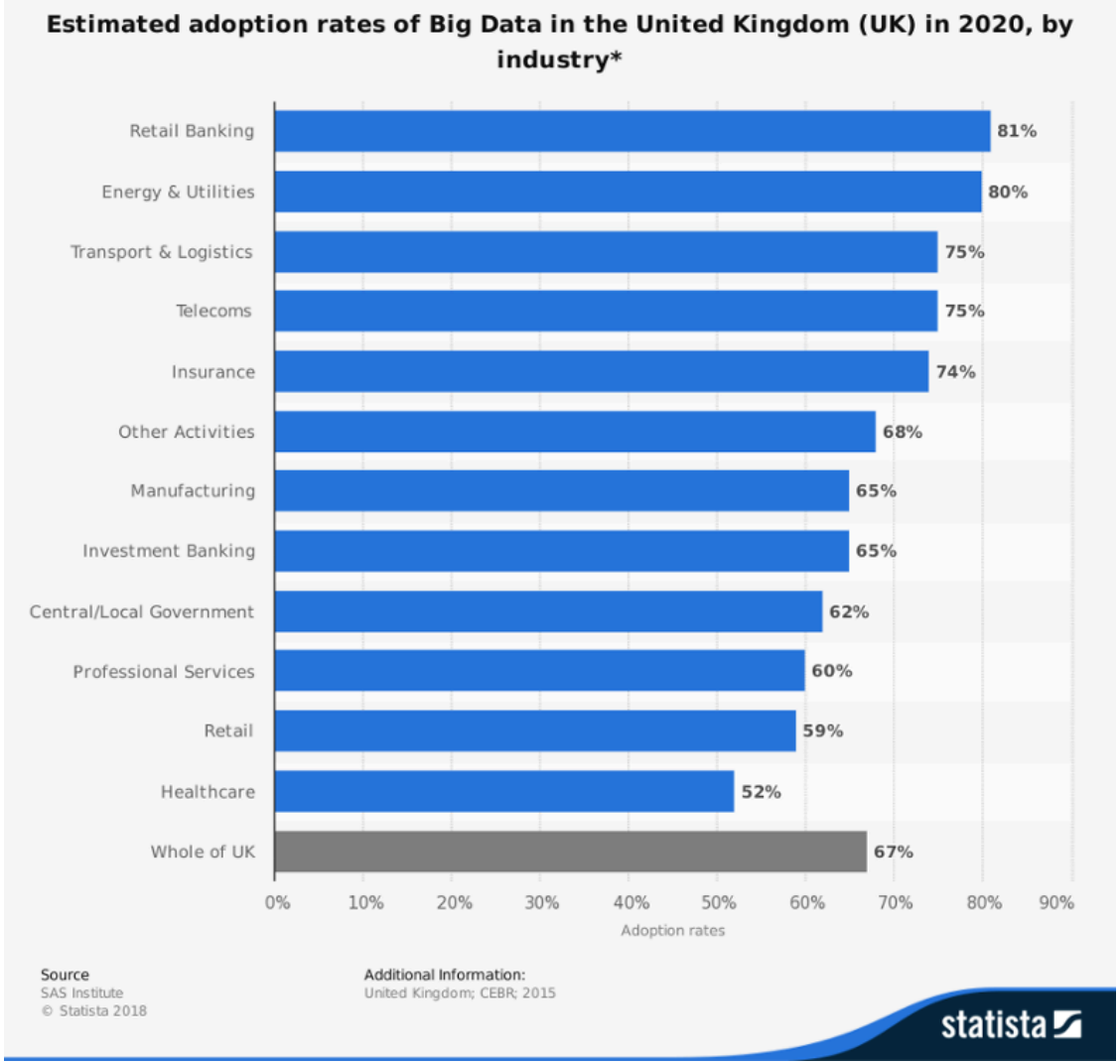


# Challenge of BigData (2/3)

- **The mass of "data" generated in multiple ways is now huge.**
- **The exploitation of these data opens a new era,**
- **Although the process started well before the contemporary digitalization, it represents a considerable change at the technical and cognitive level, as well as at the economic, social and political level,**
- **Transforming organizations around the promotion of information:**
  - Information non-structured,
  - Finesse of information on past operations,
  - More and more forward-looking information.

  => **Big Data will allow the emergence of more relevant predictive models**.
- **Big Data will help facilitate the growth of Smart Cities.**

- **Rates of estimated BigData uses in the United Kingdom in 2020:**



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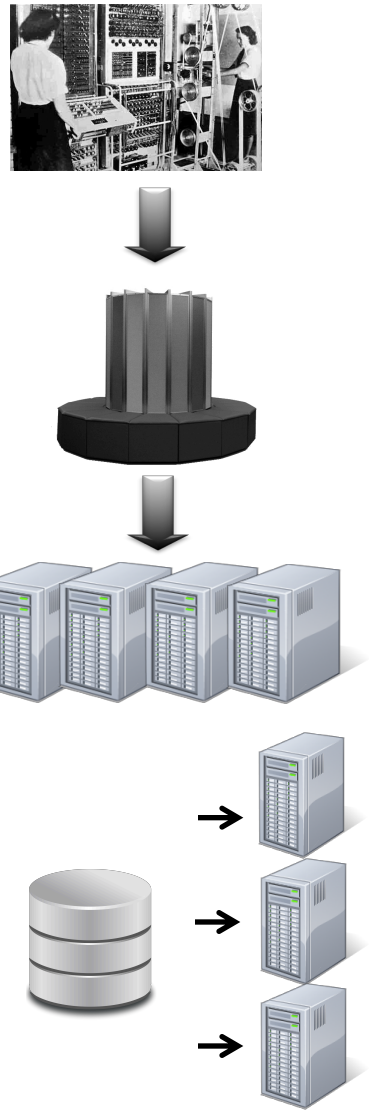
# Problematics resolved by BigData (1/2)

- **Old technologies insufficient :**
  - Mass of data => problems with data storage, their manipulation and analysis,
  - Traditionally, computation has been processor-bound :
    - Relatively small amounts of data,
    - Lots of complex processing,
  - The early solution: bigger computers:
    - Faster processor, more memory
    - But even this couldn't keep up,
  - The better solution: more computers => Distributed Systems,
  - BUT :
    - Programming complexity
    - Keeping data and processes in sync
    - Finite bandwidth
    - Partial failures,
    - Data Bottleneck : Traditionally, data is stored in a central location and copied to processors at runtime,



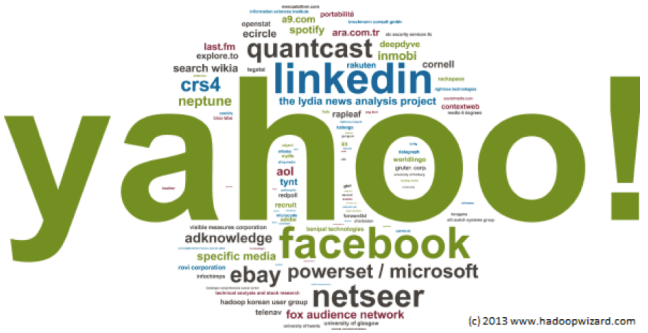
# Problematics resolved by BigData (2/2)

- **Old Technologies of Data couldn't support this high data volume of several tera byte :**
  - Relational Database : accepts only structured data,
  - DataWarehouse : schema-on-write that structure of that data strictly defined before any data written in,
  - Standard Treatment Algorithm : latency,
  - RAID Disk System Architecture : less storage, more expensive, slower (depending on RAID configuration).

- **Needs of new architecture solutions:**
  - Firstly from the giants of the web themselves, like Google, Yahoo, Facebook, Twitter,
  - Hadoop Distributed Platform,
  - NoSQL Distributed Database,
  - Hyper-converged Distributed Storage System Infrastructure.

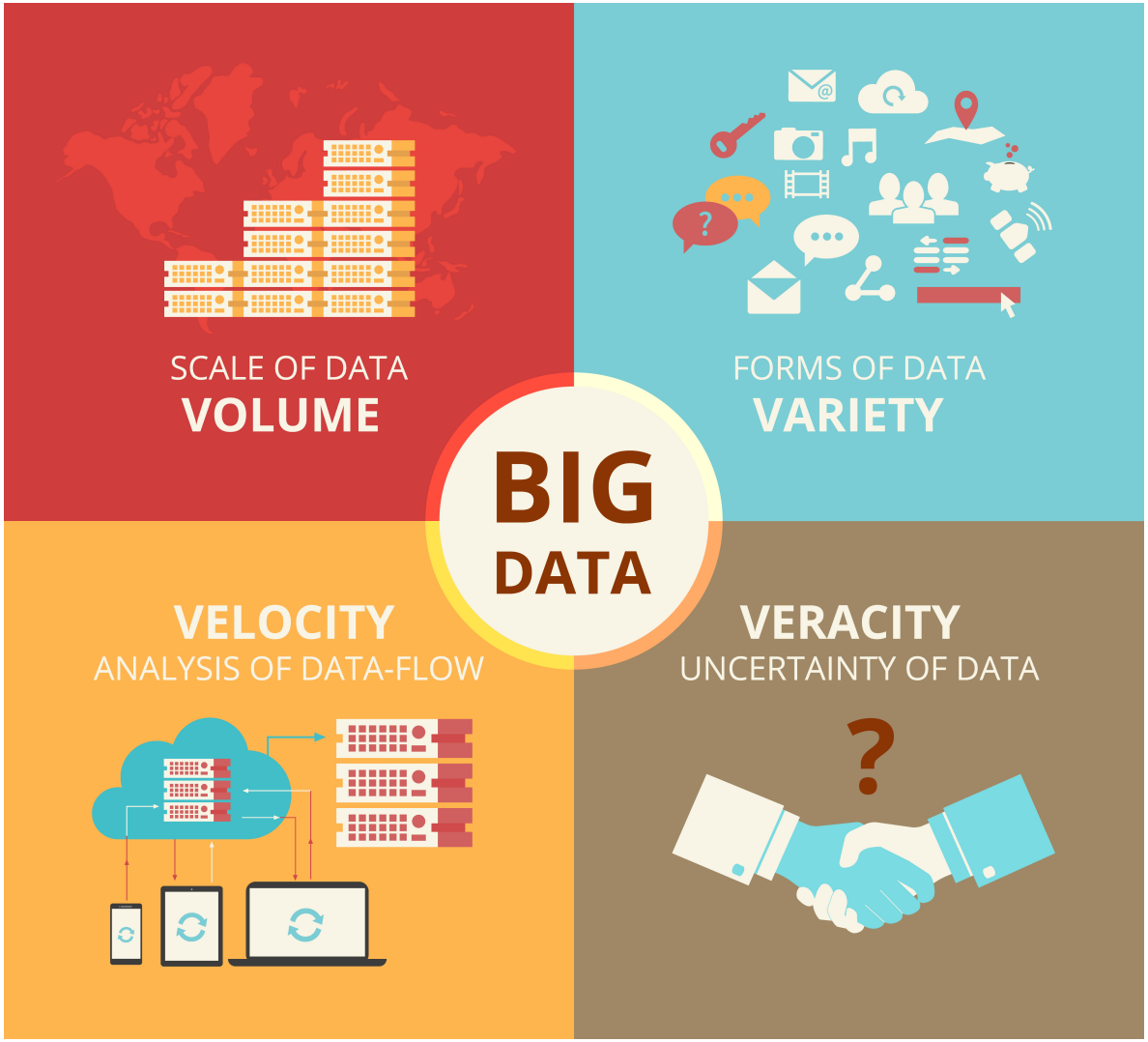
- **Hadoop is "de facto" a platform standard for implementing big data processing, and brings a wide panoplies of solutions to bigdata.**

- **Adoption of BigData Hadoop Platform is rapidly in the world:**
  - All major software companies such as IBM, Oracle, SAP and even Microsoft use Hadoop,
  - Yahoo is invested massively in the Hadoop Project. Since 2006, Yahoo has the largest number of Hadoop machines with more than 42,000 nodes.

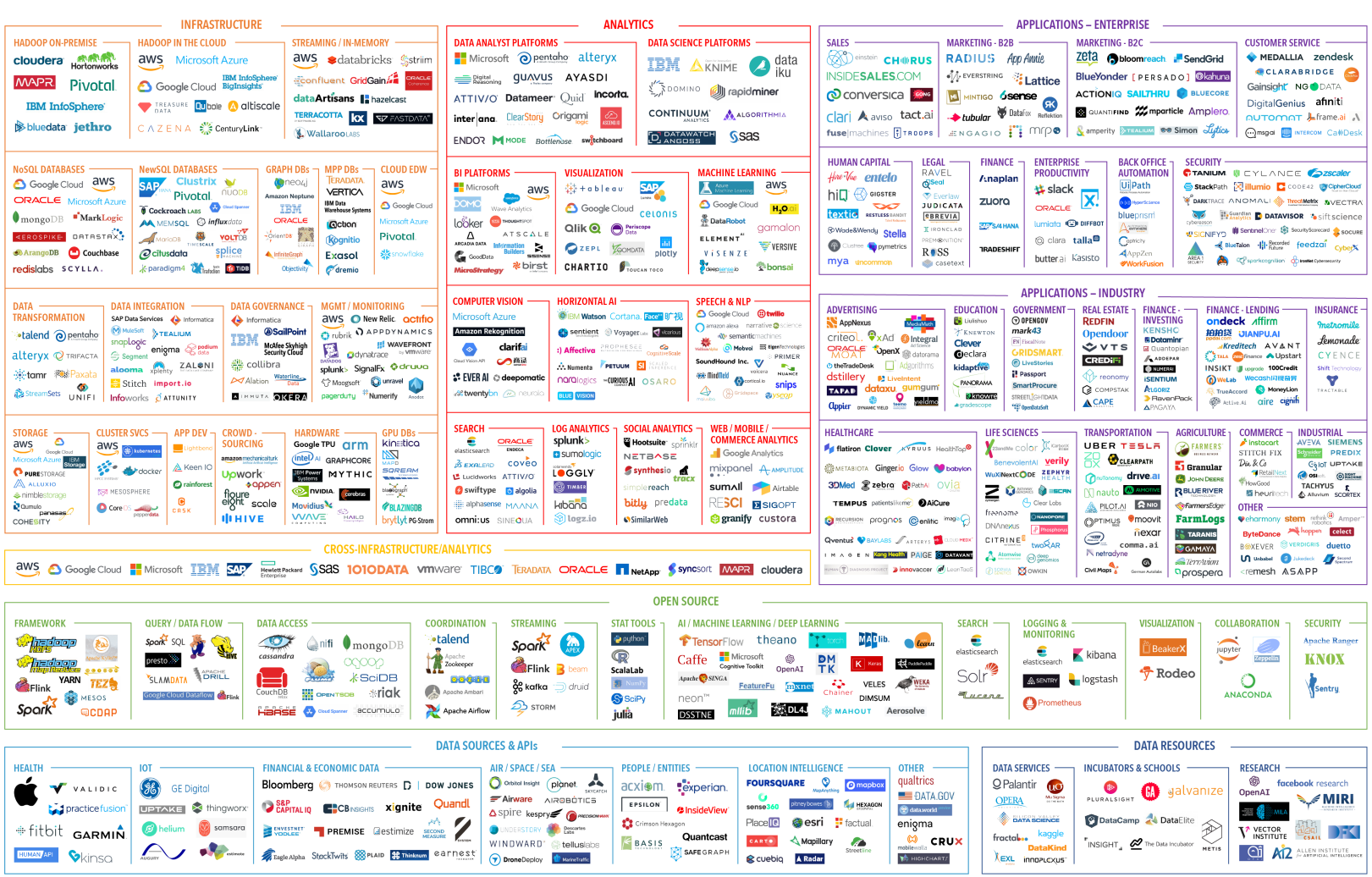


# Definitions of BigData (1/2)

- **Gartner's definition in 2011 : 3Vs**
  - **Volume** (Volume of data),
  - **Velocity** (Speed of Response),
  - **Variety** (Variety of data),
- **+ Today 4th V**
  - **Veracity** (Uncertainty of Data)



# Definition of BigData : Landscape of BigData (2/2)



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# What is Smart City?

*April 02 2019 , by Quang Tân Trần*

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  - **What is a Smart City?**
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- Samples of
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  - Smart Cities.

# What is a Smart City (1/3)

- The term Smart City has lately become a buzzword for all those who run a city,
- According to Mordor Intelligence LLP, the market global smart cities is expected to grow from nearly $ 390 billion in 2014 to nearly$ 1.4 trillion by 2020,
- With an average annual growth rate(TCAM) of 20.5% over the projection period,
- BUT, the expression Smart City remains **opaque** and **relatively poorly defined.**
- **Definition :**
  - A Smart City is a geographical area that has become more effective or more respectful of the environment or socially more inclusive through the use of digital technologies.
  - The goal of a Smart City is to increase its attractiveness for residents and businesses by improving or improving services proposing new ones.
- **Intelligence ultimately lies in improving or creating services through digital technologies.**

# Challenge of Smart City (2/3)

- **The issues related to urbanization:**
  - The last century saw a major revolution, as the philosopher Michel Serres recalls: these last decades have seen the passage of a mainly rural population to an urban habitat,

- **The context :**
  - The city population in 2008 is equalled that of the country side,
  - There are 1.3 million people moving into cities each week,
  - Currently, 50% of the world's population lives in cities,
  - By 2050, this percentage will increase to 70%,
  - 90% of this urban population growth set to occur in Africa and Asia,
  - There are already 28 mega-cities of more than 10 million citizens,

- **The urbanization generates issues :**
  - Cities occupy 2% of the earth's surface and produce 80% of greenhouse gas emissions,
  - Issues around the management of energy and the environment, transport, social political organization, and economic,
  - The increasing concentration of individuals in cities leads irreparably to preserve and optimize their resources and their organization,

- **The target of cities, metropolises and territories is therefore to support this societal, political and environmental issue,**

# Challenge of Smart City (3/3)

- Concentration of services, population explosion, urbanization territories, constitution of metropolises (megalopolises), environmental awareness, pollution, management of travel, energy savings ... all these evolutions that lead public actors to think about the use of digital technologies in order to imagine more management optimal territory.

- In addition, there is a desire to be able to predict the future by using the data collected over the entire territory in order to build models able to anticipate needs and events.

- Whereas it imposes on decision-makers new challenges that sometimes seem insurmountable, it creates many new opportunities for municipal officials,

- Municipal officials need a framework or a roadmap helping them move Smart City initiatives forward in the right direction.

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  - What is a Smart City?
  - **The Foundations of the Smart City**
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  - Smart Cities.

- **Smart mindset**

- The data is at the service of the citizens :
  - Its intelligent treatment is based on participatory principles and transparency,
  - The action of Smart City is a response to their expectations and interests,

- To be smart, the city relies on several data projects involving different urban operators:
  - The Paris City Council has launched an experimental project to measure displacements, atmospheric and noise pollution at the Place de la Nation,
  - These data are visible on the Open Data platform of the city.

- Be alert to the notion of temporality of data in launching and anticipating actions :
  - Anticipating the development of the city or the quality of life of citizens is not defined on the basis of the same data used for the prevention of accidents or the traffic thinning.

- The characteristic pillars of a city are : its economy, mobility, environment, people, way of life and organization.

# Foundations of the Smart City (2/3)

- The idea is to develop means and solutions able to meet the needs of the population while preserving the resources, the environment ...
- The analysis and the valuation of the data offers the cities the possibility to manage finely their economic levers, environmental, citizens ...
- This intelligent management is the ability to link these levers, to allow them to "perform" not individually, but by connecting them to each other,
- Thanks to Big Data and the Internet of Things, these smart, connected cities could reduce pollution, improve cleanliness, solve parking problems, and save energy,
- Samples :
  - Los Angeles optimizes garbage collection tours using sensors in containers,
  - Lyon has launched Hublo, a monitoring center for the exploitation of drinking water. It collects, visualizes and analyzes in real time all data related to the water service of the city. Hublo allows the city of Lyon to better anticipate and organize interventions, reduce leaks and consumption of this resource.

- The cities that have already started, and the ones that are starting, are pursuing more or less the same objectives,

- They expect data collection and processing by different analytical software and Artificial Intelligence tools (neural networks, learning algorithms) that they contribute to :

  - Smooth the traffic and thus reduce the level of pollution,
  - Reduce energy consumption,
  - Facilitate access to services offered by the municipality,
  - Better maintain municipal facilities,
  - Improve the safety of citizens

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  - **How Big Data Can Help Smart Cities?**
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- Samples of
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# How Big Data Can Help Smart Cities? (1/3)

- Data is the lifeblood of a smart city,
- To become a smart city, cities need at least one thing in common : **They all need reliable (sensor) data to base their long-term decisions on.**
- By inserting sensors across city infrastructures and creating new data sources, including citizens via their mobile devices, Smart City managers can apply Big Data analysis to monitor and anticipate urban phenomena in new ways,
- Big data has huge potential to increase and make use of smart city services,
- Big data analysis is implemented to study large volumes of data to uncover patterns and get insights to extract valuable information, to make appropriate strategic moves and business decisions,

# How Big Data Can Help Smart Cities? (2/3)

- Three layers of Data :
  - First is the technology base : which includes a critical mass of smartphones and sensors connected by high-speed communication networks.
  - The second layer consists of specific applications : Translating raw data into alerts, insight, and action requires the right tools, and this is where technology providers and app developers come in.
  - The third layer is usage by cities, companies, and the public : Many applications succeed only if they are widely adopted and manage to change behavior.

# How Big Data Can Help Smart Cities? (3/3)

- Sample on the impact of Big Data on the implementation of Smart Cities:
  - The South Korean city of Songdo, with 65,000 inhabitants and 300,000 workers. Since the early 2000s, a $ 35 billion project has been launched to transform this city into a connected city. This major project involves the firm Cisco, which has ensured that every part of this city benefits from fiber optics.
  - Big Data can help reduce pollution. By incorporating sensors into roads, it is possible to measure total traffic at different times of the day. This data can be sent to a center responsible for coordinating the regulators. Traffic can thus be effectively managed to reduce carbon dioxide emissions,
  - By incorporating sensors into cars, it is possible to guide vehicles to the nearest car park. This will solve the problems related to the lack of parking spaces.

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# Key Of Success

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  - Smart Cities.

# Keys Of Success (1/6)

- What will make it possible to invent the Smart City, are the connections between these networks, the crossing and the exploitation of the data,
- The importance of data in the smart city really makes sense,
- The logic of networks, the collection and processing of data, the evaluation and measurement of their potential and their limits determine the performance of these cities,
- For example, the collection of data on infrastructures and leisure equipment makes it possible to adapt the necessary staff to the days and hours of use => The satisfaction of users and employees is ensured,

- Sorting data, a necessary step :
  - Forecasts of increased data volumes generated and stored, however, require a clear strategy for selecting and sorting data,
  - In the Data Age 2025 study conducted by IDC, Seagate estimates the overall volume of the "datasphere" in 2025 at 163 Zo (zettaoctets), which is 10 times more than in 2016 (16.1 Zo).
  - For cities, it goes without saying that you have to choose which data to collect and how long to keep them.
  - Data from traffic lights, for example, are only of interest for a short time. It's all about making sure they work properly,
  - On the other hand, the images of the surveillance cameras of a public establishment or the place of an accident can be used in the future to identify a person or to decide on the modification of a site if too many accidents occur there.

# Keys Of Success (3/6)

- Integration of data sources : **the main success factor of a Smart City project**
  - Not only are these formats very different, but they come from public and private actors who operate totally heterogeneous systems.
  - It is necessary, for example, to be able to combine the signals emitted by a sensor network with textual data contained in an email and CCTV images to anticipate an incident or to detect and locate a fault.

- Data interoperability (or how to make cities smarter) :

  - The diversity of sources, data, their volumetry, the many actors, requires a steering led by the city.

  - Governance and sharing of these data are two fundamental principles for:
    - ✓ Visualize and understand the operation, consumption of the city and discern malfunctions,
    - ✓ To bring out of this information needs that should be found new uses and new services called "smart",

  - The real conditions of success lie in the interoperability of data, namely the access and sharing of all data via standard formats (including APIs),

  - The challenge is to make the data available in a format that is readable and exploitable by the actors.

# Keys Of Success (5/6)

- Data Sharing :
  - Smart cities need to be built on networks that allow for the free communication of data,
  - Data sharing represents both a requirement and an opportunity for Smart City deployments,
  - The data sharing across citywide departments and platforms is an essential element of any Smart Cities plan.
- Building the digital infrastructure :
  - Sharing data unlocks efficiency and open APIs are the best way to do it,
  - An easy exchange of data via APIs and/or data marketplaces, along with the ability to easily add partners to the ecosystem, are critical components of any smart-city platform.
  - There is also a growing trend for city authorities to release APIs to encourage developers and community organizations to use open data.

# Keys Of Success (6/6)

- The perfect data-sharing platform :
  - A data-sharing should enable cloud-based data sharing,
  - It will improve privacy, interoperability, security and secure data sharing, agile app development and testing,
  - A platform on which many applications can run also offers these capabilities for specialized, domain-specific applications as well as provides access to the most up-to-date technology,
  - The platform should support both public and private sharing,
  - If solutions are going to intermix data, then the governance, security and usage monitoring and management becomes more important to control access.

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# Samples of BigData Usage for the Smart Cities

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  - Smart Cities

# Samples of BigData Usage for the Smart City (1/6)

- Top 7 Big Data Use Cases for the Smart City :

  - **Security** :
    - ✓ Predictive analytics has been used in many cities around the world to help predict where crime may occur, based on historical and geographic data,
    - ✓ In cities like London, Los Angeles, and Chicago, this initiative has paid off. Thanks to the data, it is possible to deploy police officers at specific times in sensitive areas to lower the crime rate without having to make arrests,

  - **Urban planning** :
    - ✓ The data can help plan the construction of buildings and the development of urban spaces,
    - ✓ Models can be developed to maximize access to certain areas or services while minimizing the risk of infrastructure overload. In short, Big Data makes it possible to increase efficiency.
    - ✓ The data also makes it possible to map and predict the impact of an infrastructure on urban space with high

# Samples of BigData Usage for the Smart City (2/6)

- Top 7 Big Data Use Cases for the Smart City :

  - **Transport** :
    - ✓ During the London 2012 Olympic Games, the public transportation network had to handle 18 million trips by spectators from all over the city.
    - ✓ The TFL and the rail operators have used the data and analytical technologies to ensure that the majority of journeys flow smoothly.
    - ✓ They were able to use past event data to predict how many people would travel each day to the stadiums to ensure that transportation was organized efficiently.
    - ✓ Using data to regulate the transport network helps to create efficient and flexible public transport, reduce delays and increase efficiency. The data can predict rush hours, but also monitor equipment to reduce the number of breakdowns and accidents.

# Samples of BigData Usage for the Smart City (3/6)

- Top 7 Big Data Use Cases for the Smart City :

  - **The test of time**:
    - ✓ In many cases, infrastructure in new areas is not resilient enough to support continued growth. It then becomes necessary to make improvements,
    - ✓ Even water and electricity can be affected by a sudden influx of workers or residents. Through modeling and predictive analysis, it is possible for urban planners to see where growth is likely to occur and to measure that growth,
    - ✓ Amenities can be improved depending. Thus, growth can occur with confidence.

# Samples of BigData Usage for the Smart City (4/6)

- Top 7 Big Data Use Cases for the Smart City :

  - **Internet** :
    - ✓ In many cases, governments or businesses are content to provide companies with high Internet speeds and claim that the city has become a Smart City,
    - ✓ In reality, access to the web is one thing, but it must be provided to the right people in the right regions. It is therefore necessary to be able to increase the bandwidth,
    - ✓ Knowing when and where bandwidth should be a priority is an essential component, and data is the compass to move in the right direction,
    - ✓ Concretely, the bandwidth should be mainly high in shopping centers and financial during the week, and in residential areas during the weekend. However, to maximize bandwidth on a more accurate scale, Big Data can help,
    - ✓ For example, if a zone wants to attract more high-tech companies and web developers, it will be necessary to offer a high bandwidth. Data modeling can help you do things more efficiently.

# Samples of BigData Usage for the Smart City (5/6)

- Top 7 Big Data Use Cases for the Smart City :

  - **Durability**:
    - ✓ Monitoring and control are two essential criteria for ensuring the sustainability of a project,
    - ✓ In fact, the data allows governments and businesses to check the positive or negative effects of their decisions on the city as a whole.
    - ✓ Being able to measure the level of pollutants can help spread pollution and concentrate it in areas where it is not likely to hurt citizens.
    - ✓ Monitoring also shows what technologies can reduce pollution and what innovations can help prevent environmental damage.

# Samples of BigData Usage for the Smart City (6/6)

- Top 7 Big Data Use Cases for the Smart City :

  - **Effective spending** :

    - ✓ The main problem with Smart Cities is that large amounts of money are spent on relatively innocuous work,
    - ✓ Small changes or remodeling of landscapes can be considered a waste of public money,
    - ✓ By using Big Data technologies, it is possible to check in advance the impact of spending,
    - ✓ Thus, it is possible to determine how to spend money effectively to improve the city at lower cost.

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  - What is a Smart City?
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  - Open Data, the engine of Smart Cities
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  - BigData Usage for the Smart City
  - **Smart Cities**

# Samples of Smart City (1/1)

- The city of Nanjing, China, has installed sensors into 10,000 taxis, 7,000 buses and 1 million private cars. The resulting data is transferred daily to the Nanjing Information Center, where experts are able to centralize and analyze traffic data and send updates to commuters on their smart phones. With these data insights, government officials have created new traffic routes to improve congestion, without spending money on new roads,

- Trenitalia, Italy's major rail operator, installed sensors on the trains and now gets real-time status updates on the mechanical condition of each train and maintenance predictions that allows Trenitalia to plan a course of action ahead of an unfortunate event. These technological innovations provide travelers with a reliable system and service, while allowing cities to prevent major disruptions,

- LA is replacing 4,500 miles of streetlights with new LEDs. Not only will this result in brighter streets, but the new lights will also be an interconnected system that will inform the city of each bulb's status. If one malfunctions, it can be identified and fixed almost immediately. In the future, we could have lights that change colors or blink to warn citizens of various conditions,

- Large groups of people mean tons of data is generated. Big data is being used to understand when, how, and why crowds form, and to predict their movements and actions.

# The End .

# Thank you …