

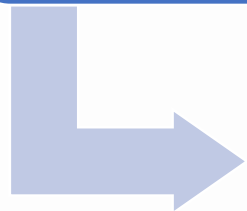
# Data storage, sharing & security.

**ESME – INGE1 INTERNATIONAL TRACK**

# Smart cities ?

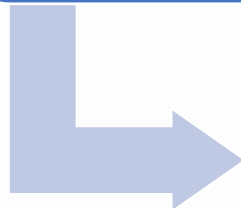
Deploying sensors and captors

- Cameras
- Captors
- etc.



Get/collect the data.

- Get the data from the captors (frequency, **transfer** protocols).

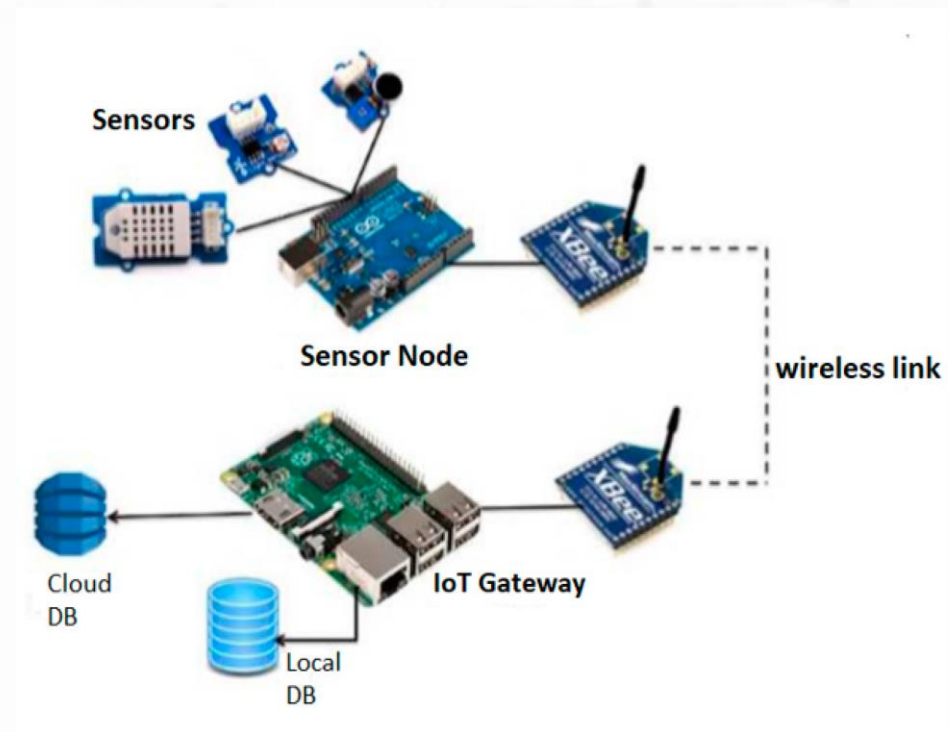


Store & process the data

- Local storage
- External storage devices
- databases



Process the data and make use of it.  
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# Get/collect the data :

- Get the data from these devices and send it to IoT Gateway (raspberry pi for example) for storage & pre-processing (calculations, transformations.)
- Using :
  - Serial port (Arduino).
  - Wireless (Bluetooth or wifi) [needs additional hardware modules]
  - Ethernet [needs additional hardware modules]

# Get/collect the data :

What data do you collect and with what frequency ?

1. Connected ring Théo/P-J (Sport)
2. Automated ventilation system against COVID (Health)
3. Railed (crash detection system in roads)
4. God's lights : guiding illumination in stores (Retail)

# Store the data:

- Send the collected data with any eventual transformation to a data base (Sql or noSql data base).
- Why do we need to do that :
  - To store more data.
  - To make the collected data available for external apps/processes.
- Data base :
  - MySQL, MsSql, Postgres, etc.
  - Redis, Elasticsearch, mongo dB, Cassandra, etc.
  - On local or on the cloud.

# Store the data:

- **Elasticsearch** is a fast search engine that provides a lot of features that allow you to use it for data storage and data analysis.
- ElasticSearch has many innovative features like: JSON/REST-based api and natively distributed in a node/cluster. **It is easy/fast to use and to set up.**



# Store the data ?

- **How elasticsearch works and how it will be relevant/useful for our projects ?**
- **Are there alternatives that we can use ?**
- **How can we choose the right storage system to use ?**

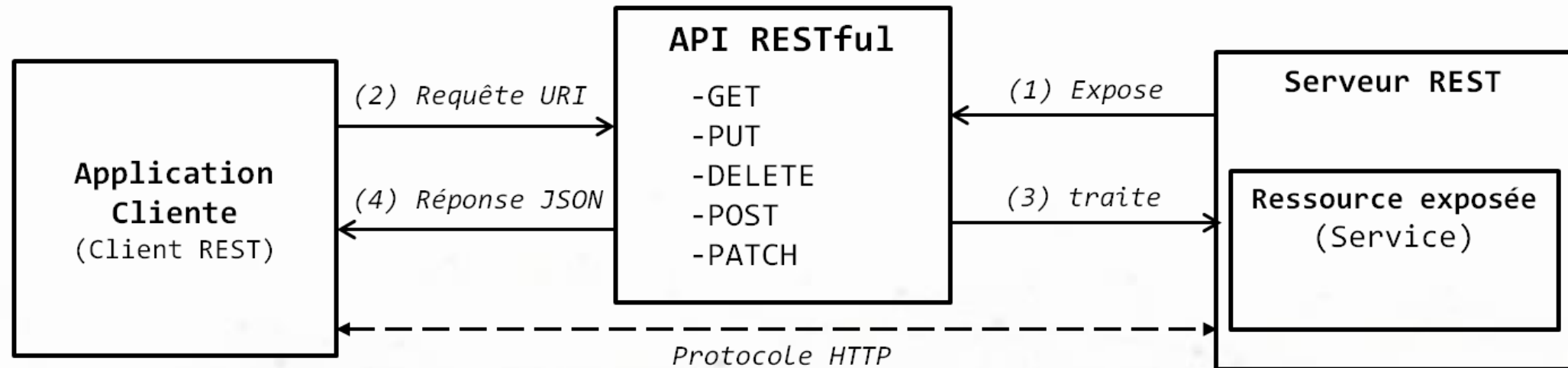
# Store the data ?





# Store the data:

- **Elasticsearch** will allow us to real time analytics of collected data and provide it using **REST endpoints** to external apps:

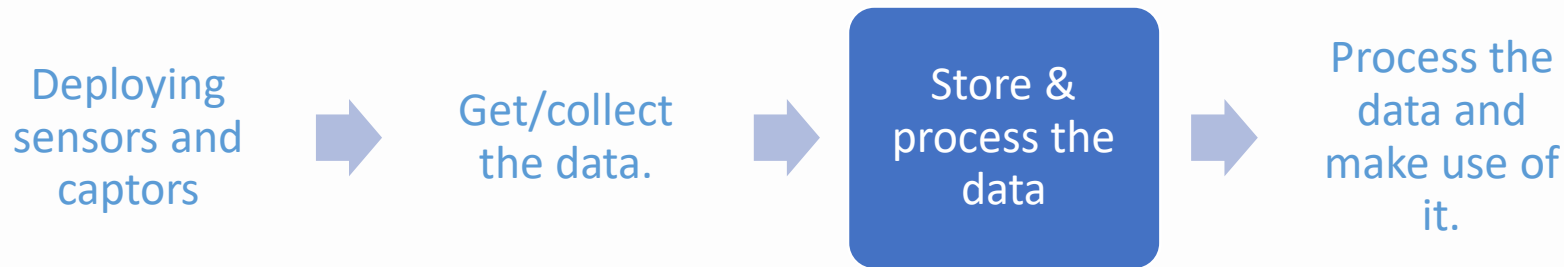


# Store the data:

- **Elasticsearch** is a document-based storage system:

```
{  
  "id":1,  
  "timestamp":123456789,  
  "temperature":12  
}
```

# Points of failure: (security by design)



- IoT devices may be exposed and publicly accessible.
- Data integrity
  - A sensor getting wrong measures for example.
  - Someone altering the data during the transfer.
- **Data storage device or data base are publicly exposed and available.**
  - **Data integrity and availability risks.**
- Applications are not enough secured (again data integrity issues).

# Store the data (securing our data base)

- Limiting access to the data base :
  - Role based access systems (RBAC)
- Audits/logging
- Monitoring
- Backups



# Labs :

- Set up your projects.
- Install python.
- Install elasticsearch on your machine and configure it.
- Add SearchGuard and configure it (demo).
- Install Kibana and configure it.

# Labs :

- Export the metrics (related to Arduino health check and metrics from sensors) from Arduino using serial port:

<https://www.arduino.cc/reference/en/language/functions/communication/serial/read/>

- Send them to your elasticsearch (localhost:9200).
- Create a dashboard to visualize in real time the metrics.