

Université **IBM i**

7 novembre 2023

IBM Innovation Studio Paris

S25 - Open Source et IBM i “Next Gen” en action

11:15 / 12:15

13:30 / 14:30

Benoit Marolleau

IBM Client Engineering

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 **infrasdufutur**

#ibmi

#uui2023

#infrastructuredufuturIBM23



Infrastructures du futur



7 et 8 novembre 2023

IBM Client Engineering | EMEA

Custom Demos, Architecture Workshops, MVP Prototyping...

Let's create ↻
value together

Generative AI
with Watsonx

**IBM zSystems &
IBM i Modernization**

Ops Automation
with AIOps

Storage, OpenShift
& Hybrid Cloud

IBM i Next Gen Workshops

01 API-zation / REST / Core Business Integration

IBM Technology Zone

02 DB2 Data Modernization: from Native to SQL

03 OpenShift, Merlin and DevOps



IBM Technology Zone

04 Open-Source Adoption with Legacy on IBM i



IBM Technology Zone

05 Power/IBM i move to cloud: IBM Cloud PowerVS

IBM Technology Zone

06 IBM i Resilience: PowerHA, DB2 Mirror

07 Ansible Automation and AIOps



IBM Technology Zone

08 Data Governance & MLOps with CP4Data



IBM Technology Zone

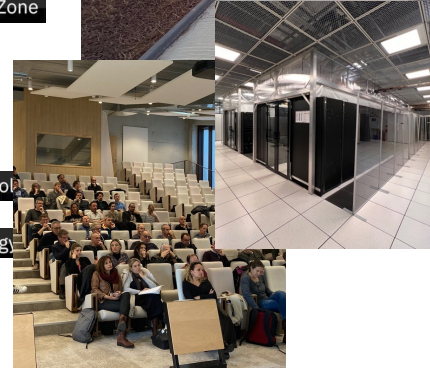
09 Infuse AI in core business apps



IBM Technology Zone

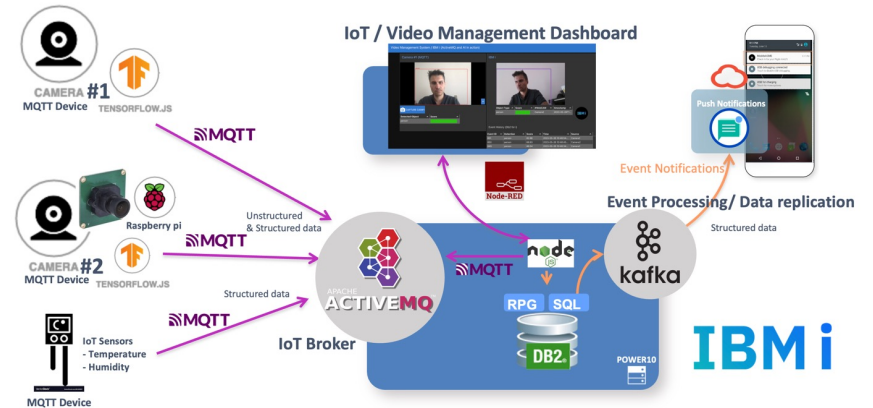
NEW: IBM Watsonx Code Assistant for Z

Contact: benoit.marolleau@fr.ibm.com



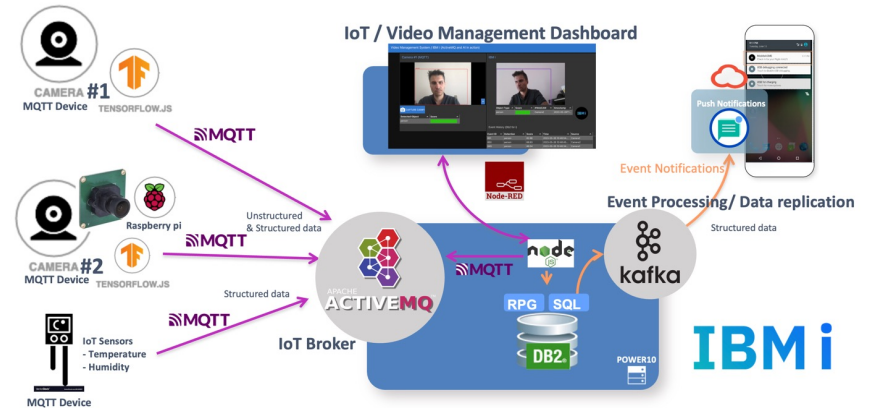
Agenda

- 1. Open Source : les nouveautés – 15 minutes
- 2. Les outils d'intégration - 10 minutes
 - MQTT & ActiveMQ
 - Apache Kafka & Camel
 - Node-RED
- 3. Démonstration – 25 minutes
- 4. Questions/Réponses – 10 minutes



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IBM



Infrastructures du
futur

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Let's
Create

1. Open Source: les nouveautés

Open Source sur IBM i – Rappels



- Pourquoi l'Open Source sur IBM i ?
 - Nouvelles possibilités → ouverture de l'IBM i
 - Pour les **administrateurs** système
 - Déploiement automatisé d'applications, vérification de conformité, clonage de partition, synchronisation de fichiers, gestion de certificats, ZIP/UNZIP, création de sandbox...
 - Pour les **développeurs**
 - Echange de données par messages, gestion de PDF, appel de Services Web, de SMS, gestion événementielle, intégration de flux vidéo, IA, contrôle de sources (Git), DevOps (CI/CD)...
 - Portage d'applications
 - Facilité pour trouver des compétences
 - Evolutions permanentes
 - Passerelle vers l'IA, l'IOT, les technos Web, l'informatique quantique...

Open Source – Rappels

- Des exemples de ce qui a été délivré :

- **Bases de données**

- PostgreSQL, MariaDB, SQLite

- **Langages**

- PHP communautaire, Node.js, Python, R, Perl...

- **Développement et connectivité**

- Node-RED, GCC, Driver ODBC...

- **DevOps**

- Git, Ant, Maven

- **Echange de données, flux de données**

- ActiveMQ, Kafka

- **Editeurs**

- sed, nano, vim

- **Utilitaires**

- Ansible, cURL, jq, rsync, bash, chroot, cloud-init, updatedb, locate, man, 7zip...

- **Serveur HTTP**

- Nginx

Le driver ODBC natif IBM i

- Le driver ODBC est disponible sous 4 OS :
 - Windows
 - Linux
 - Mac OS
 - **IBM i**

- **Pourquoi** un driver ODBC natif IBM i ?
 - Pour pouvoir utiliser les libraries ODBC standard à partir de différents langages (PHP, Python, Node.js, Ruby, R...)
 - Pour pouvoir développer des applications sous Windows/Linux et les déployer sous IBM i

- **Comment** récupérer ce driver ODBC natif IBM i ?
 - En téléchargeant le "IBM i PASE ODBC Driver" à partir du site de téléchargement d'ACS

Le PHP communautaire sous IBM i



- Version gratuite Open Source de PHP
 - Basée sur des RPM
- Installation rapide et facile
 - Par YUM, standard de l'industrie (`yum install php-*`)
 - Ou par IBM ACS (Access Client Solutions)
- Mise à jour facile (`yum update / ACS`)
- Serveur Apache ou Nginx
- Accès à DB2 en ODBC
 - Autres possibilités : connecteurs *ibm_db2*, *pdo_ibm* avec la distribution CommunityPlus+ PHP
- Support
 - Gratuit, communautaire
 - Facturable, par IBM TSS : <http://ibm.biz/ibmi-oss-support>
 - Facturable avec la distribution CommunityPlus+ PHP : <https://cfi-innovation.fr/php/community-plus-php/>

PostgreSQL sur IBM i

- Base de données **relationnelle** Open Source accessible à partir des langages Java, PHP, Python, Node.js, Ruby, R, Perl...
- En complément de Db2 for i
 - PostgreSQL, SQLite, mariadb dans PASE ...
- Interfaces
 - psql : mode commande
 - phpPgAdmin : interface graphique Web développée en PHP



IBM i to Prometheus to Grafana

Blog post by Jesse Gorzinski: "Monitoring IBM i with Prometheus"

<https://techchannel.com/Trends/12/2022/ibm-i-prometheus>

Simplified view

- Passive exporter running on IBM i
- Prometheus running on some central location, preferably Docker or Podman
- Grafana running somewhere, preferably Docker or Podman

Note: IBM i direct to Grafana also works! Prometheus is a standard & scalable database for storing all kinds of data. *(if more than 1 LPAR or VM => better with Prometheus)*



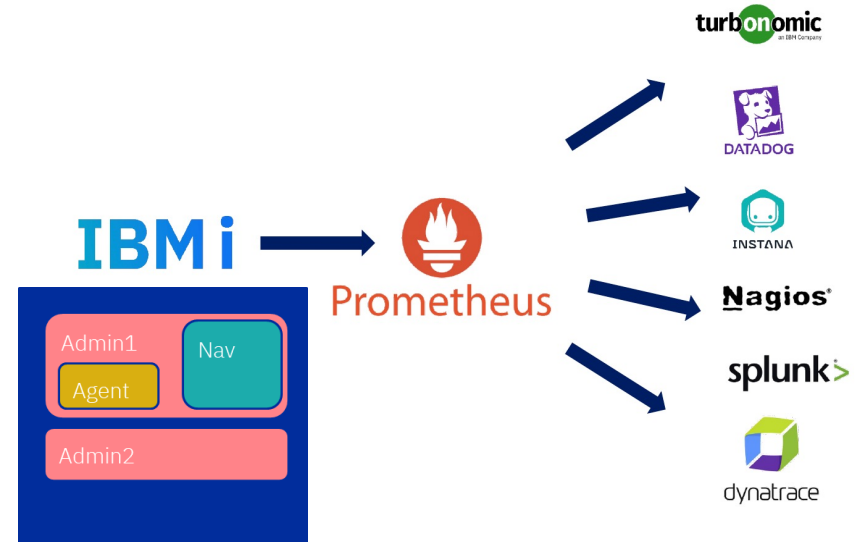
IBM i to Prometheus to anything

1) Prometheus Exporter on GitHub <https://github.com/ThePrez/prometheus-exporter-ibmc>

- Deploys on IBM i, Exports over 400 metrics
- Recently added Database metrics
- Built around SQL, designed to be user-extensible!
- Also works with other databases if need be
- Demo: <http://ibm.biz/ibmi-prometheus>
- <https://techchannel.com/Trends/12/2022/ibm-i-prometheus>

2) Builtin Prometheus Agent on IBM Navigator

- *Prometheus Agent shipped with IBM Navigator*
- *Runs under an Admin Server*
- *Configurable through Navigator*



Open Source et IBM i – Documentation

ibmi-oss-resources

Important resources for anyone interested in open source on IBM i

[View on GitHub](#)



- [Python SQLAlchemy Adapter](#)
- [XMLService](#)
- [ODBC driver](#)
- [PostgreSQL](#)
- [PHP options for IBM i](#)
- [Ruby on IBM i](#)
- [IBM i chroot containers](#)
- [Self-signed TLS certificate validation in IBM i OSS](#)

IBM i Open Source Resources

Important resources for anyone interested in open source on IBM i

Documentation - General

- [IBM i Open Source documentation from IBM](#)
- [Getting Started with IBM i RPMs](#)

Documentation - Specific

- [Node.js toolkit](#)
- [Node.js odbc module](#)
- [Node.js idb-connector module](#)
- [Node.js idb-pconnector module](#)
- [Loopback \(Node.js API framework\) connector](#)
- [Python toolkit](#)

Support

- [Open Source Support for IBM i](#)

Examples

- [IBM i Open Source Examples](#)

Community

- [IBM i Open Source Chat on Ryver](#) (must first join at [this link](#))
- [IBM i Community Slack](#)
- [IBM Community pages for IBM i](#)
- [IBMiOSS LinkedIn group](#)
- [#IBMiOSS hashtag on Twitter](#)

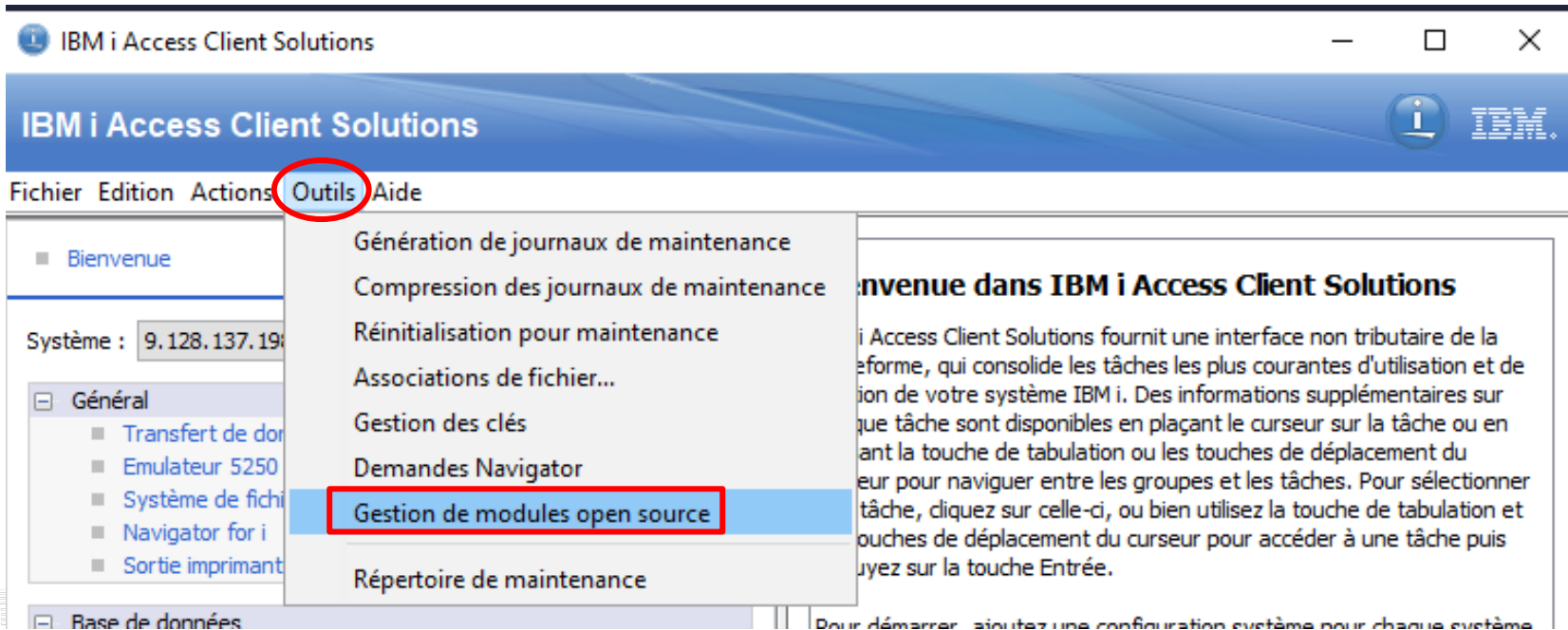
Blogs

- [Kevin Adler's Blog](#)
- [Seiden Group Blog](#)
- [FAQ400 Blog](#)
- [Anand Khekale's Technical Musings](#)

Videos

- [JORI + IBM i: Designing digital transformation](#)
- [FormaServ video library](#)
- [The Bearded Geek on IBM i - Youtube Channel](#)

Open Source et IBM i – *Installation*



Open Source et IBM i – *Support*

- Support compris dans la **SWMA IBM i** :
 - L'installation des packages par YUM ou par ACS
 - Les produits sous licence (5733-DG1 et 5733-SC1)

- Pour les packages **RPM**, deux possibilités :
 - 1. Support **communautaire**, gratuit
 - Suivi d'incidents : <https://github.com/IBM/ibmi-oss-issues/>
 - Chat : <http://ibm.biz/ibmiOSS-chat> (inscription : <http://ibm.biz/ibmiOSS-chat-join>)

 - 2. Support **IBM TSS** (Technology Support Services), facturable
 - <https://www.ibm.com/support/pages/open-source-support-ibm-i>

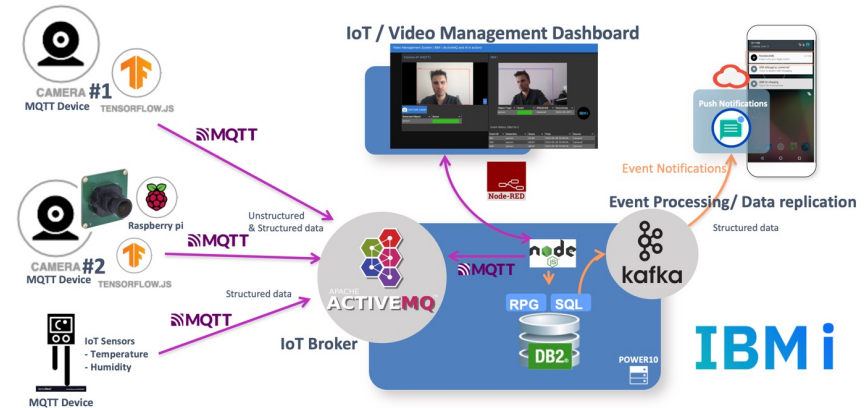
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Let's
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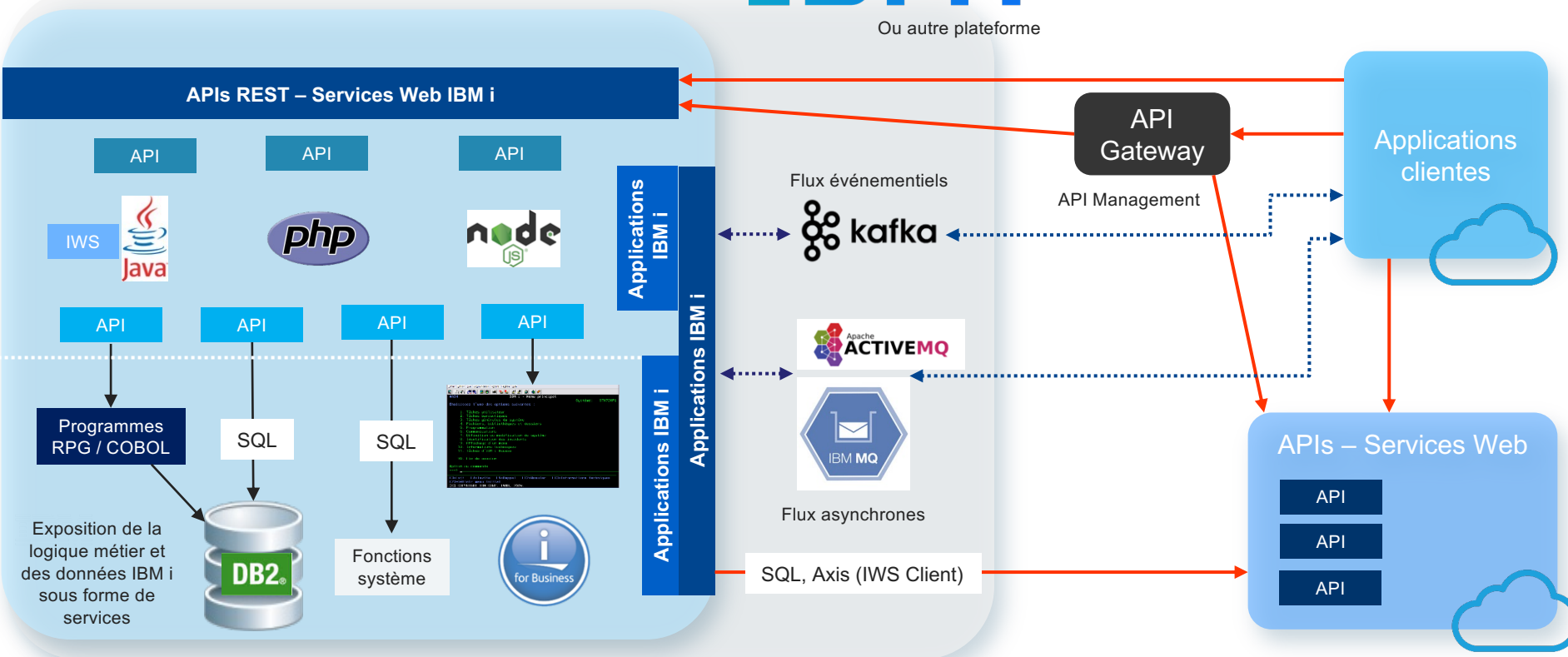
2. IBM i: les outils d'intégration



Intégration IBM i

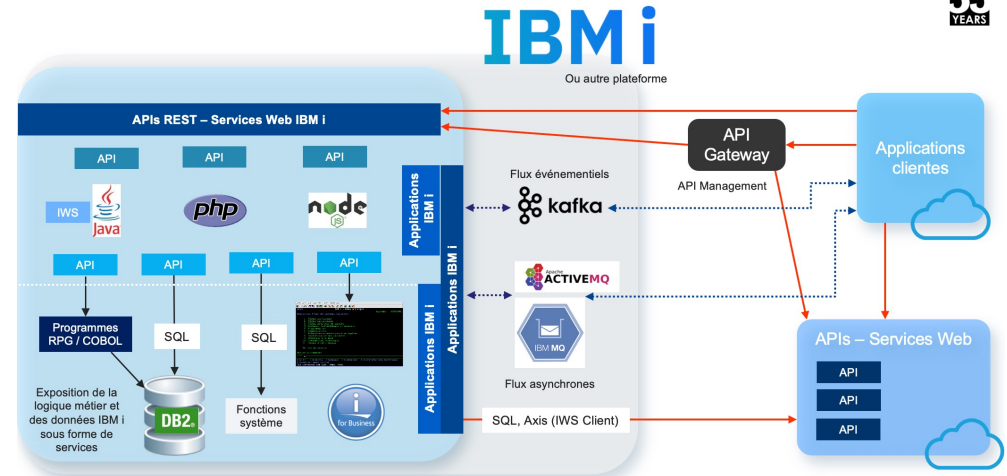
IBM i

Ou autre plateforme



Intégration IBM i

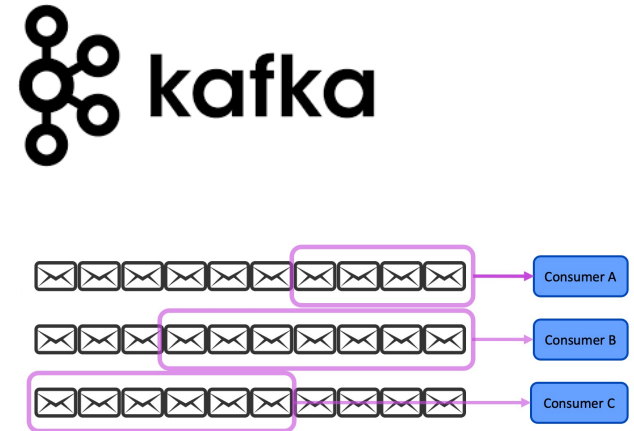
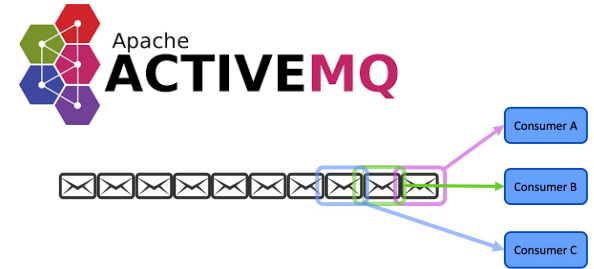
- **Node-RED** : l'outil low-code pour l'intégration et les tableaux de bord
- Apache **Kafka**: la super Data Queue cross-platforme
- Apache **Camel**: le passe-plat multi-protocole
- **ActiveMQ**: le collecteur MQTT



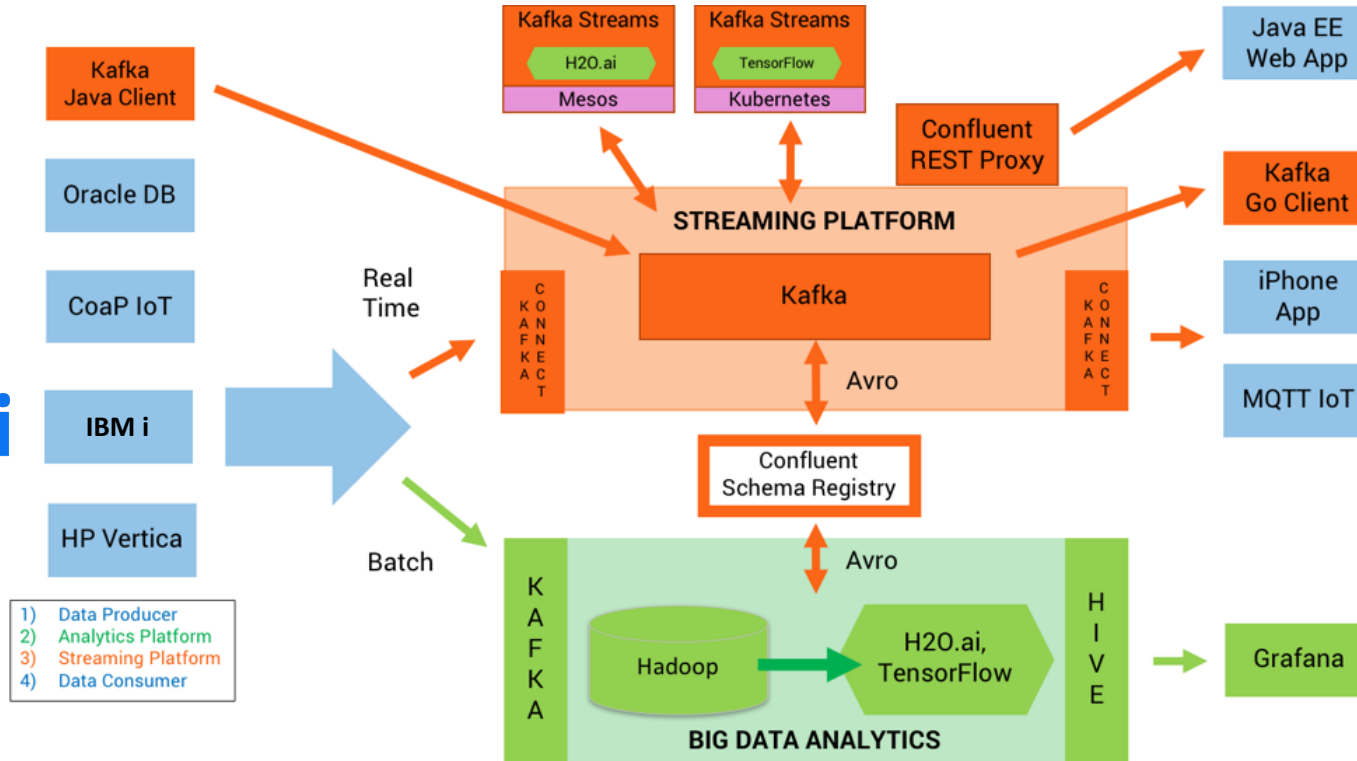
ActiveMQ & Kafka

Disponibles sur IBM i, gratuit, Open Source sous licence Apache 2.0

- Apache **ActiveMQ** : implémentation JMS
 - Fédération de systèmes & Intégration asynchrone
 - Message Broker supportant divers protocoles : JMS, AMQP, MQTT, etc.
- Apache **Kafka** : high-throughput streaming event engine
 - Conçu par LinkedIn, Scalable++, pour traiter des grands volumes de données
 - S'intègre facilement avec Camel...
 - Streaming = on traite **plusieurs** lots/ séries de données à la fois



Kafka – Architecture



Source: <https://www.confluent.io/blog/build-deploy-scalable-machine-learning-production-apache-kafka/>

Kafka sur IBM i

Basé sur Java, tout comme Apache Camel

Kafka Client existe aussi en Node.js....

// **Prérequis** : JVM (Openjdk11...)

```
# yum install wget ca-certificates-mozilla  
gzip tar-gnu openjdk-11 coreutils-gnu sed-  
gnu grep-gnu
```

// **Installation du produit (téléchargement)**

```
# wget
```

```
https://apache.osuosl.org/kafka/2.6.0/kafka\_2.13-2.6.0.tgz
```

// **Démarrage Zookeeper** (coordination vs. Brokers & partitions) dans PASE

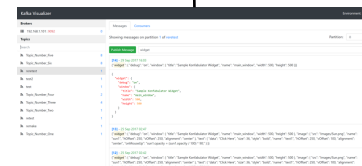
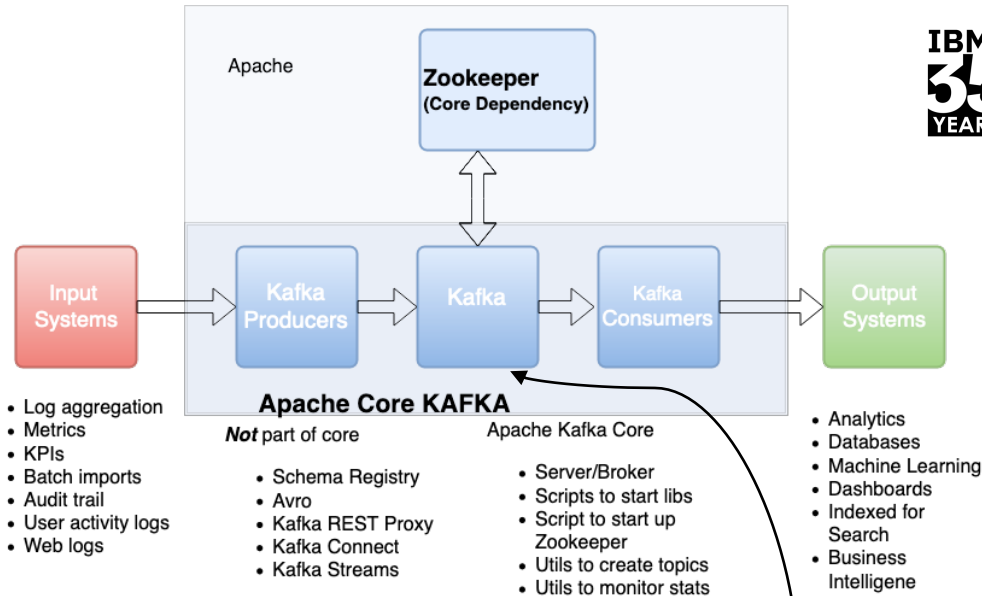
```
# kafka/bin/zookeeper-server-start.sh kafka/config/zookeeper.properties
```

// **Démarrage du serveur** (Broker) dans PASE

```
# kafka/bin/kafka-server-start.sh kafka/config/server.properties
```

// **Test avec un producteur** (ici Application Java) publiant sur un topic "my-topic"

```
# kafka/bin/kafka-console-producer.sh --broker-list localhost:9092 --topic my-topic
```



[Kafka Visualizer](#)
(Graphique)

Kafka, Camel : Service Commander

- Gérer les services IBM I dans PASE facilement :

```

bash-4.4$ sc check all
RUNNING      | as-database (System *DATABASE Host Server)
NOT RUNNING  | ftp (System FTP server)
NOT RUNNING  | zookeeper (Apache Zookeeper Server using OpenJDK)
NOT RUNNING  | kafka (Apache Kafka bootstrap server)
RUNNING      | as-central (System *CENTRAL Host Server)
RUNNING      | navigator (IBM Navigator for i)
NOT RUNNING  | kafkaviz (Apache Kafka Visualizer)
RUNNING      | gitbucket (GitBucket git web platform)

bash-4.4$ sc start kafka
Performing operation 'START' on service 'kafka'
Attempting to start service dependency 'zookeeper' (Apache Zookeeper Server using OpenJDK)...
Service 'Apache Zookeeper Server using OpenJDK' successfully started
For details, see log file at: /home/JGORZINS/.sc/logs/2021-03-12T13:23:31.093-0500.zookeeper.log
Service 'Apache Kafka bootstrap server' successfully started
For details, see log file at: /home/JGORZINS/.sc/logs/2021-03-12T13:23:31.086-0500.kafka.log

```

- Exemples, code, vidéo : <https://github.com/ThePrez/ServiceCommander-IBMi>

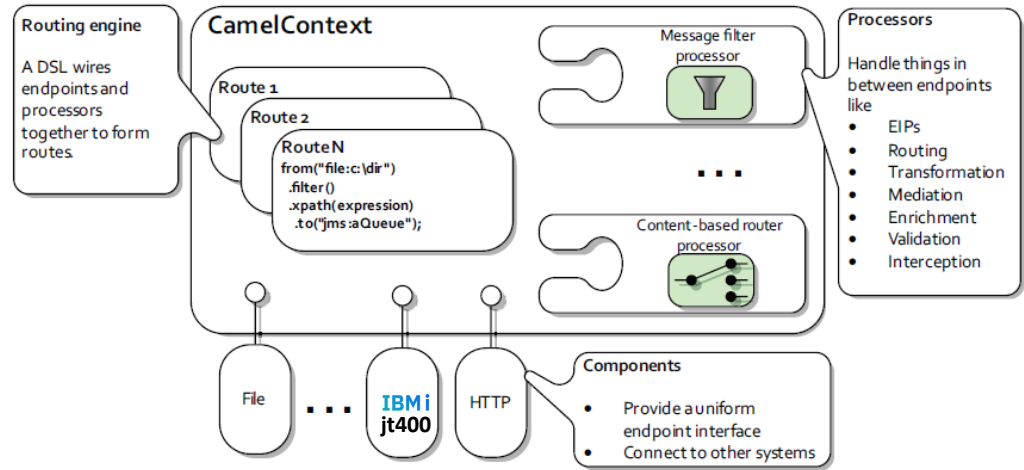
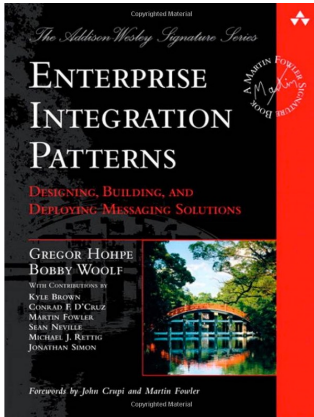
Qu'est ce que Camel ?

Couteau Suisse de l'intégration, disponible sur IBM i

- Projet Open Source Apache fondé sur les "Enterprise Integration Patterns" (EIP)
- Centré autour de 60+ patterns que l'on rencontre dans des projets "Enterprise integration"
- Fournit un langage afin d'implémenter ces patterns (style UNIX pipeline)



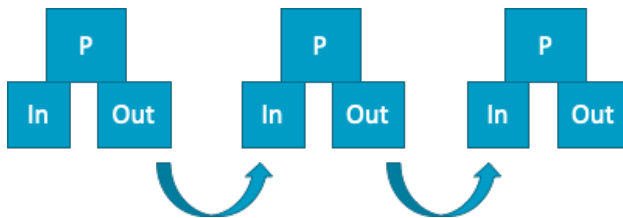
APACHE
Camel



Qu'est ce que Camel ?



- Bibliothèques Java → Une application Camel est une application Java
D'autres langages peuvent être utilisés pour décrire des « Expressions »
- Prérequis : JVM sur IBM i (JV1, Openjdk etc.)
- Camel utilise une concaténation répétable et normalisée d'objets "Processor" et de "Messages" groupés dans un ensemble appelé "Exchange"
 - Message "In"
 - "Processor"
 - Message "Out"



- Note : Camel peut être considéré comme un Node-RED en version programmatique Java : simple, beaucoup de connecteurs, passe-plat entre applications

Synergie entre IBM i et Apache Camel

- Documentation : Apache Camel Component
<https://camel.apache.org/components/latest/jt400-component.html>

To send or receive data from a data queue

```
jt400://user:password@system/QSYS.LIB/LIBRARY.LIB/QUEUE.DTAQ[?options]
```

To send or receive messages from a message queue 

```
jt400://user:password@system/QSYS.LIB/LIBRARY.LIB/QUEUE.MSGQ[?options]
```

To call remote program

```
jt400://user:password@system/QSYS.LIB/LIBRARY.LIB/program.PGM[?options]
```

You can append query options to the URI in the following format, `?option=value&option=value&...`

PATH PARAMETERS (5 PARAMETERS):

Name	Description
userID	Required Returns the ID of the IBM i user.
password	Required Returns the password of the IBM i user.
systemName	Required Returns the name of the IBM i system.
fileSystem	Optional file system name.
remote	Optional remote flag.

QUERY PARAMETERS (33 PARAMETERS):

Name	Description
ccsid (common)	Sets the CCSID to use for the connection with the IBM i system.
format (common)	Sets the data format for sending messages. There are 2 enums: binary and text.
guiAvailable (common)	Sets whether IBM i prompting is enabled in the environment run.
keyed (common)	Whether to use keyed or non-keyed data queues.
searchKey (common)	Search key for keyed data queues.

Camel

Exemple : Bridge Data Queue vers Kafka

- In, Process, Out – Avec URI spécifiques
- Cas d'usage : stream de transactions DB2 vers Apache Kafka

```
final String dtaqUri = conf.getDtaQUri(); //something like -> jt400://username:password@localhost/qsys.lib/mylib.lib/myq.DTAQ?keyed=false&format=binary&guiAvailable=false
final String kafkaUri = conf.getKafkaUri(); //something like -> kafka:mytopic?brokers=mybroker:9092
context.addRoutes(new RouteBuilder() {
    @Override
    public void configure() {
        from(dtaqUri)
        .wireTap("log:msgq_to_email?showAll=true&level=INFO") // This is just for debugging data flowing through the route
        .to(kafkaUri);
    }
});
```

Améliorations DB2 utiles avec Apache Camel

- Les fonctions SQL de publication JSON renvoient les données d'une façon compréhensible pour les consommateurs Kafka/ActiveMQ

```
SELECT JSON_OBJECT(
  KEY 'Department' VALUE
  JSON_ARRAYAGG(JSON_OBJECT(
    KEY 'Id' VALUE X.DEPTNO,
    KEY 'Name' VALUE X.DEPTNAME)))
  AS DEPT_JSON
FROM TOYSTORE.DEPT X;
```

```
call qsys2.send_data_queue_utf8(
  message_data      => scottf.dq_json,
  data_queue        => 'HANDOFF_DQ',
  data_queue_library => 'BANKONOSS');
```

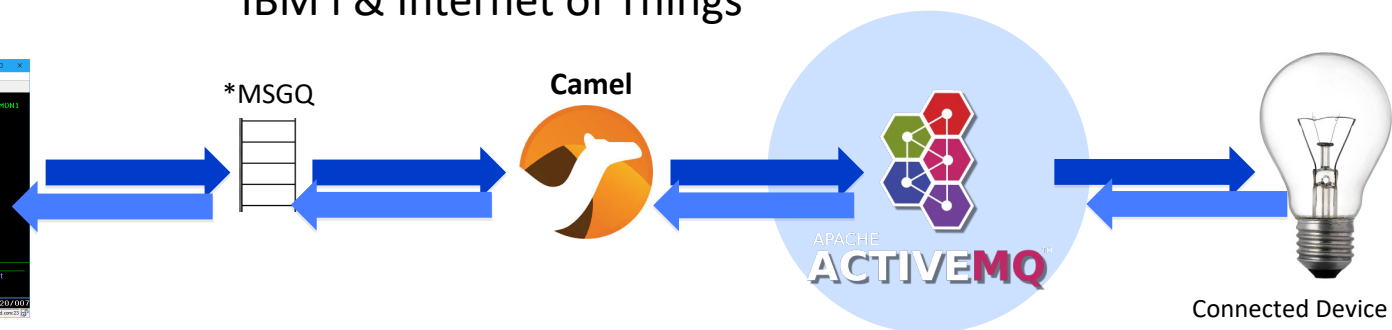
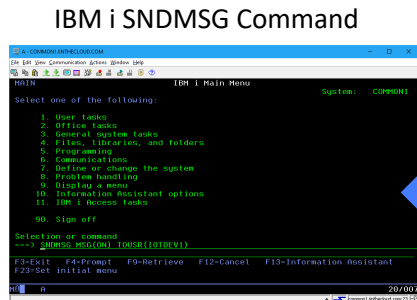
- Les fonctions SQL de gestion des Data Queue permettent une intégration avec les files d'attente (ainsi qu'Apache Camel) directement depuis la base de données

Exemple d'usage

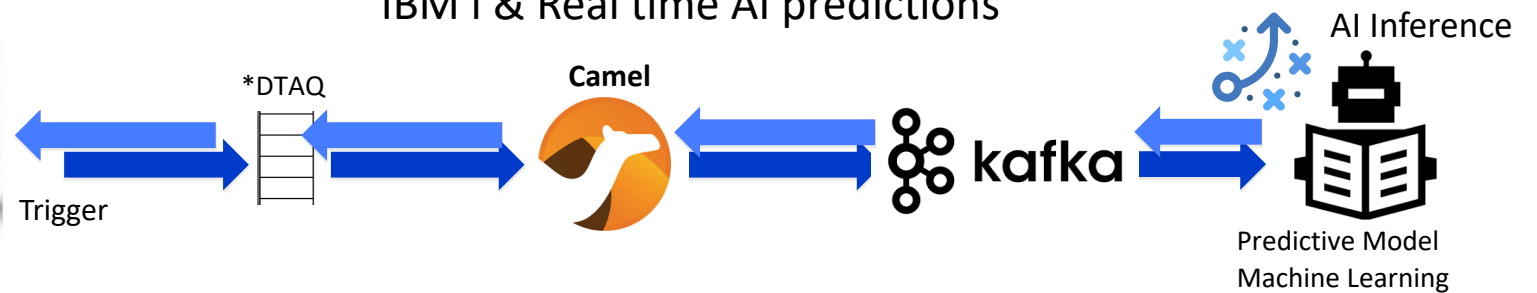
Robustesse & Standardisation



IBM i & Internet of Things



IBM i & Real time AI predictions



Exemple d'usage

Robustesse & Standardisation

Chaque transaction DB2 déclenche l'envoi de données dans un composant externe

Db2 Trigger → Data Queue → Job Camel+Kafka → Composant Externe



-- description: Create ORDER trigger

```
CREATE OR REPLACE TRIGGER OCPDT.ORDEREJB_TRIGGER
```

```
AFTER INSERT OR DELETE OR UPDATE ON OCPDT.ORDEREJB
```

```
...
```

```
CALL QSYS2.SEND_DATA_QUEUE_UTF8 (
MESSAGE_DATA => OCPDT.DQ_ORDER ,
DATA_QUEUE => 'AI' ,
DATA_QUEUE_LIBRARY => 'OCPDT'
) ;
END ;
```

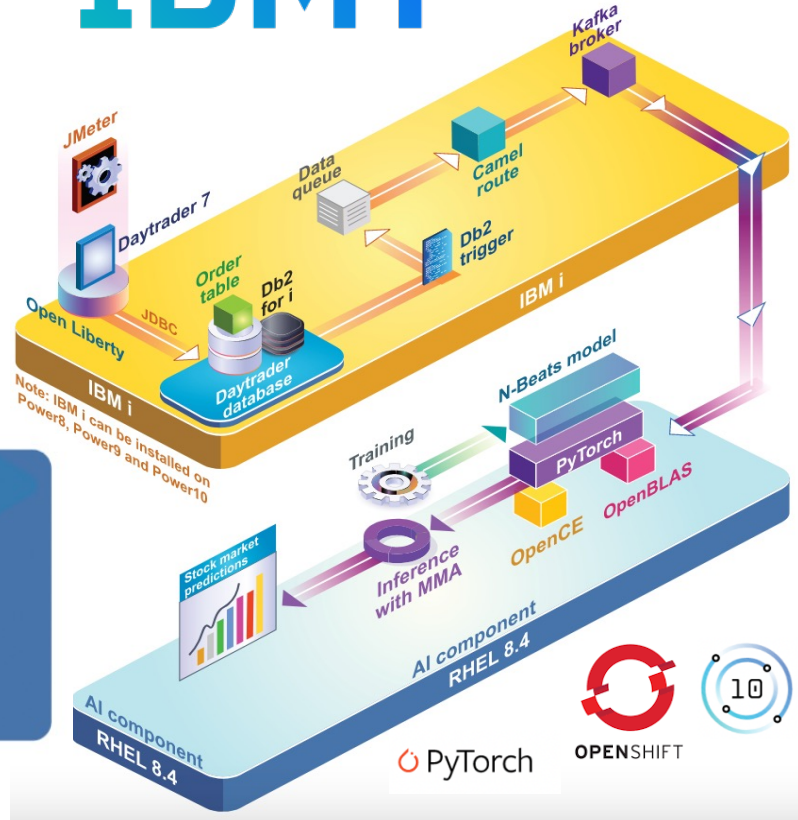
- The DayTrader 7 as a Liberty Application runs on IBM i and creates trade data
- Trade data is stored in Db2 for IBM i
- JMeter runs on IBM i to simulate trades in DayTrader 7 and generates large trades data
- Kafka produces the real-time data stream on IBM i
- PyTorch consumes the Kafka stream as the input of the AI component
- The AI component leverages Power10 MMA to make sequence-based predictions (For example, stock price prediction)

IBM Developer

<https://developer.ibm.com/tutorials/power10-business-inferencing-at-scale-with-mma/>

<https://github.com/ThePrez/Kafka-DayTrader-AI-example/>

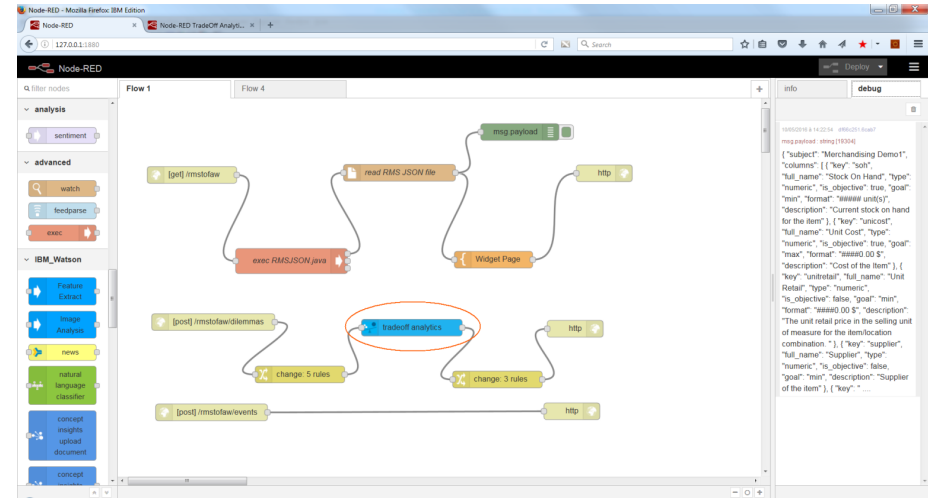
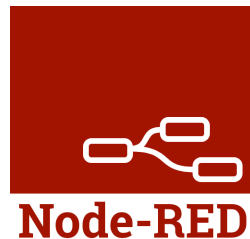
IBM i



Node-RED

<https://nodered.org>

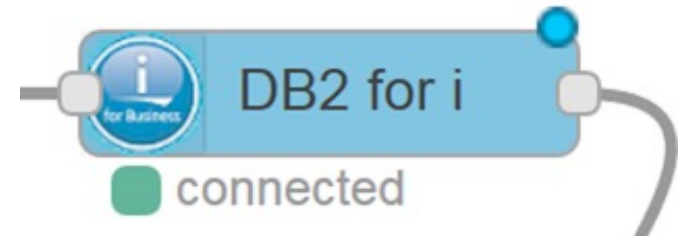
- Node-RED – outil gratuit et open source développé par IBM initialement fait pour l'internet des objets (IoT)
- Permet de coder graphiquement et rapidement, et de connecter matériels, API, applications ensemble
- Editeur Web - flow editor – contient un grand nombre de nodes dans sa palette évolutive : on trouve tous types de nodes dans un repository en ligne
- Basé sur JavaScript (runtime Nodejs)
- Node-RED sur i:
 - Tableaux de bord techniques ou métiers
 - APIisation
 - **Intégration & Protocole MQTT**



Node-RED & IBM i

<https://flows.nodered.org/node/node-red-contrib-db2-for-i>

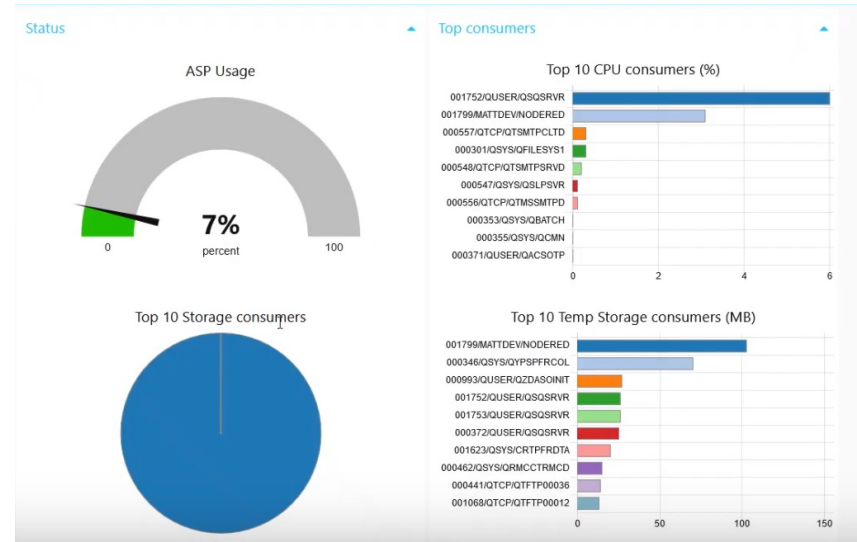
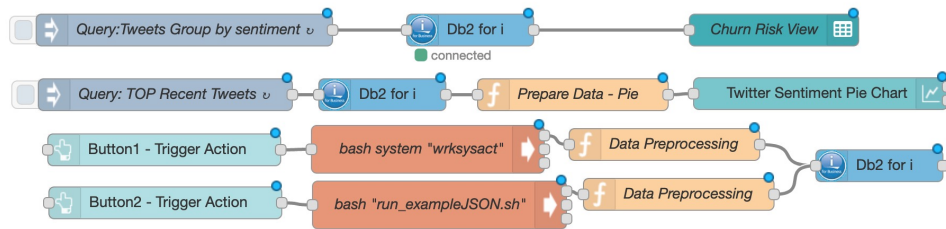
- Noeud [Node-RED](#) pour lire et écrire dans une base de données DB2 for i
- Projet Open Source sur [GitHub](#) créé en juillet 2017
- Téléchargé [+ de 10 000 fois](#)
 - `npm install node-red-contrib-db2-for-i`
- DB2 for i native driver : [idb-connector](#)
 - Plan* : odbc mode (portability) , iToolkit node ...
- Utilisé par tous types de solutions (ERP, CRM,...) et développements en Dev/Test et Production



Node-RED & IBM i

Exemple basique

- Requêtes SQL dynamiques
- Utilisation de nodes [node-red-dashboard](#) afin d'afficher les données et des widgets graphiques sur une interface Web (boutons, graphiques, champs texte, etc.)
- Utilisation de node 'exec' afin d'exécuter des commandes CL / shell (PASE -> ILE)



Node-RED & IBM i

Ecrire un Service Web RESTFull en 5 minutes

10.7.19.71:1880/customers/0019-EFAEP

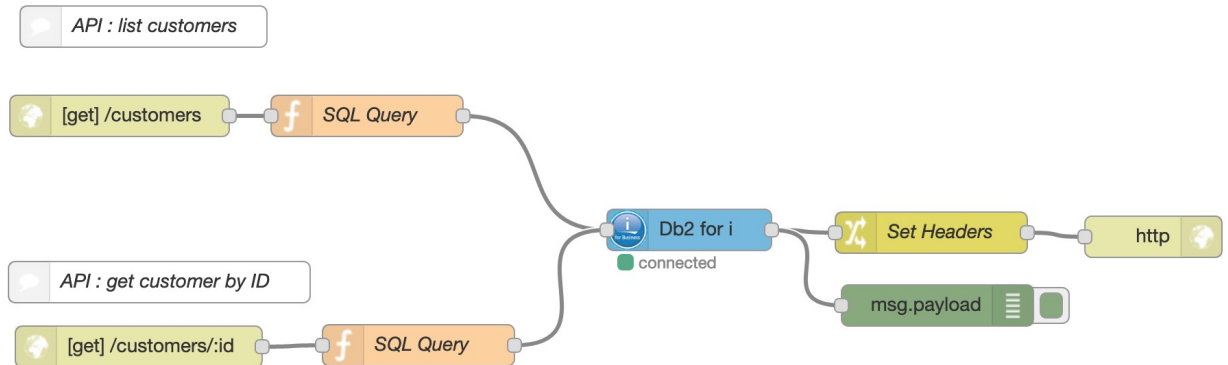
JSON Raw Data Headers

Save Copy Collapse All Expand All Filter JSON

0:

CUSTOMERID:	"0019-EFAEP"
GENDER:	"Female"
SENIORCITIZEN:	"0"
PARTNER:	"No "
DEPENDENTS:	"No "
TENURE:	"72"
PHONESERVICE:	"Yes"
MULTIPLELINES:	"Yes "
INTERNETSERVICE:	"Fiber optic"
ONLINESECURITY:	"Yes "
ONLINEBACKUP:	"Yes "
DEVICEPROTECTION:	"Yes "
TECHSUPPORT:	"No "
STREAMINGTV:	"Yes "
STREAMINGMOVIES:	"No "
CONTRACT:	"Two year "
PAPERLESSBILLING:	"Yes"
PAYMENTMETHOD:	"Bank transfer (automatic)"
MONTHLYCHARGES:	"101.30"
TOTALCHARGES:	"7261.25"
CHURN:	"No "

- Utilisation de nodes "http" pour écouter sur un port et passer les paramètres d'entrée (dans l'URL, ou body...)
- Node "DB2 for i" pour executer les requêtes SQL dynamiques
- Construction de la réponse et réponse HTTP
- Node-RED / Node.js process + DB2 Server job QSQSRVR



Node-RED & IBM i

Comment démarrer ?

- <https://github.com/IBM/ibmi-oss-examples/tree/master/nodejs/node-red>
- Collection IBM i sur [Nodered.org](https://nodered.org) (Nodes à installer et Flows à importer)
- Exemples sur IBM Developer : Premier flow avec [Db2 for i](#), [Helpdesk Chatbot](#)

The screenshot shows the Node-RED flows library interface. At the top, there's a search bar and a 'Sign in with' button. The main heading is 'IBM i Node-RED Collection'. Below it, there's a description: 'IBM i Node-RED Collection based on node-red-contrib-db2-for-i and more. Please refer to the IBM i Open Source repository for more examples.' To the right, there's a 'Collection Info' box showing '6 things', 'Updated 10 months, 3 weeks ago', and a 'Rating: 5 ★ 1 👤'. Below that is an 'Owners' box listing 'bmarolleau' and an 'Actions' box with a 'Rate' section showing five stars.

The main content area displays a grid of flow cards:

- IBM i - Stored Procedure Call using node-red-contrib-db2-for-i**: A flow card by bmarolleau. Description: '### Stored Procedure call with Db2 for i'.
- RESTful API using node-red-contrib-db2-for-i**: A flow card by bmarolleau. Description: '### Simple REST API from a Db2 table.'
- RESTful API on IBM i with simple JWT authentication**: A flow card by bmarolleau. Description: '# RESTful API with simple JWT auth using node-red-contrib-db2-for-i'.
- node-red-contrib-db2-for-i**: A node card by bmarolleau. Description: 'A Node-RED node to access a IBM Db2 for i database'. Version: v0.2.4, 7 likes, 5.0 rating.
- Social media dashboard in minutes on IBM i (Db2 for i)**: A flow card by bmarolleau. Description: '### Social media (Twitter) dashboard - IBM Db2 for i and Postgres versions.'
- Example of using a web front end login modal form**: A flow card by AndyYouens. Description: 'This flow demonstrates how to create a simple web login front-end with Node-RED that allows'.

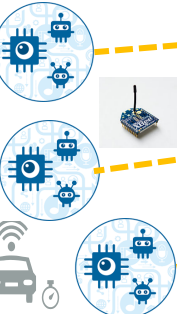
Le protocole MQTT

Industrial Control Systems, SCADA*
 *SCADA : Supervisory Control And Data Acquisition

Legacy Industrial Devices

Edge/ Fog Computing (Machine Learning, etc)

IoT Gateway
 Preprocessing/Filtering/
 Summarization/Intelligence



IoT Devices

Sensors, Cameras, Web data, Social Media, Weather, GPS... embedded intelligence "Edge Computing"

Secure Protocols for data (MQTT)
 Infrastructure & Physical layer (Wireless, wired,..)

PUBLISH →



	Sensor/Actuator
	Agent
	Firmware
	Network Connection
	User Interface

DEVICE

	App Logic
	Analytics
	Agent
	Device Data Store

IoT GATEWAY

IoT Broker
 Data Collection

Private or Public/Dedicated Cloud

← SUBSCRIBE



IoT Applications
 Big Data / Analytics
 AI Techniques...

IoT Data (raw data: "data lake")



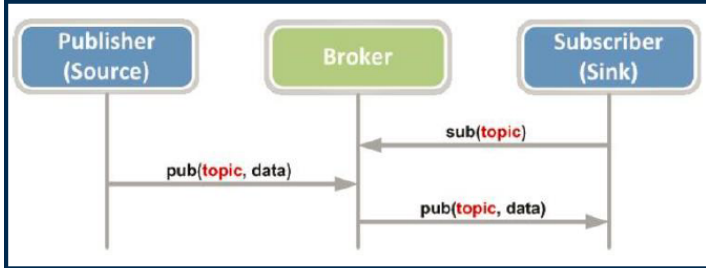
Ex: NoSQL Databases, Time-series data...

	Analytics Data Repository
	Cognitive
	Actionable Insight
	Streaming Computing

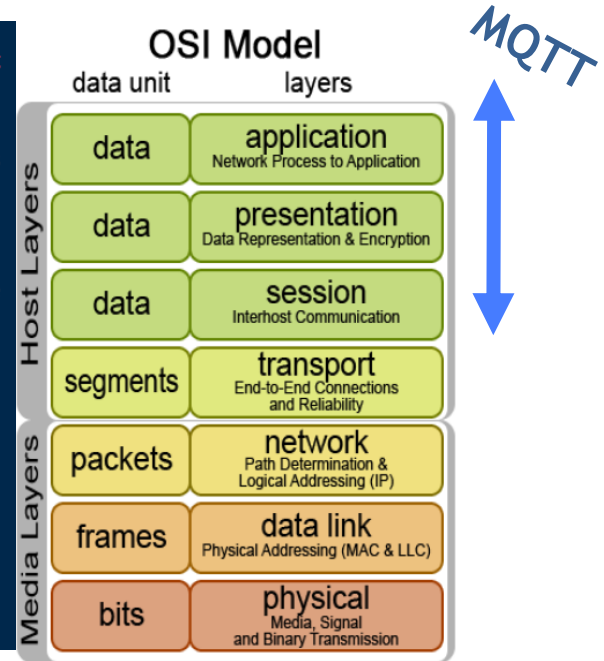
ANALYTICS

Le protocole MQTT

- MQTT(Message Queuing Telemetry Transport) is a machine-to-machine (M2M)/"Internet of Things" connectivity protocol.
- It was designed as an extremely lightweight **publish/subscribe** messaging transport. It is useful for connections with remote locations where a small code footprint is required and/or network bandwidth is at a premium
- MQTT was found by IBM and in 2013 it was donated to OASIS (Organization for the Advancement of Structured Information Standards)



- The publish-subscribe model requires a message broker. The broker is for distributing messages to interested clients based on the topic of a message.



Topic **Publish** Example:

temperature sent from a 'pipeline' device : `iot-2/type/NI/id/pipeline/cmd/msg/fmt/json{"name":"temperature","value":15}`

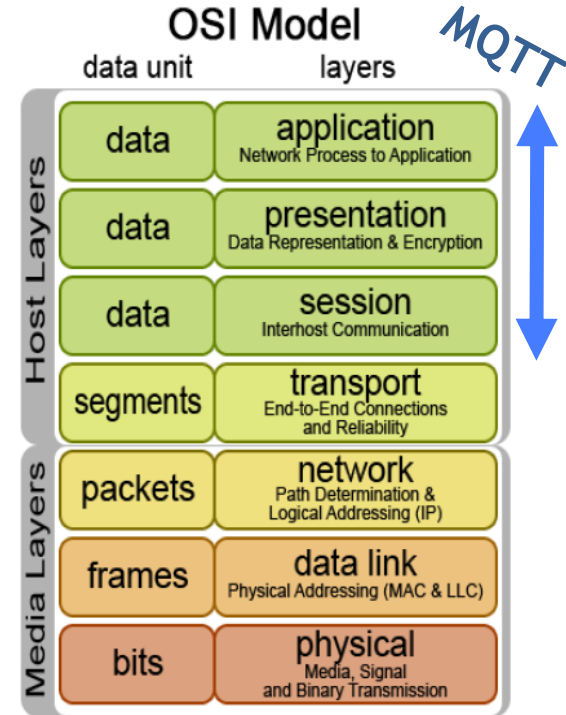
Topic **Subscribe** Example:

`myhome/groundfloor/livingroom/temperature` or `Germany/Bavaria/car/2382340923453/latitude`
`myhome/groundfloor/+ /temperature` (+ is a wildcard equivalent to "any")

Le protocole MQTT

MQTT Characteristics

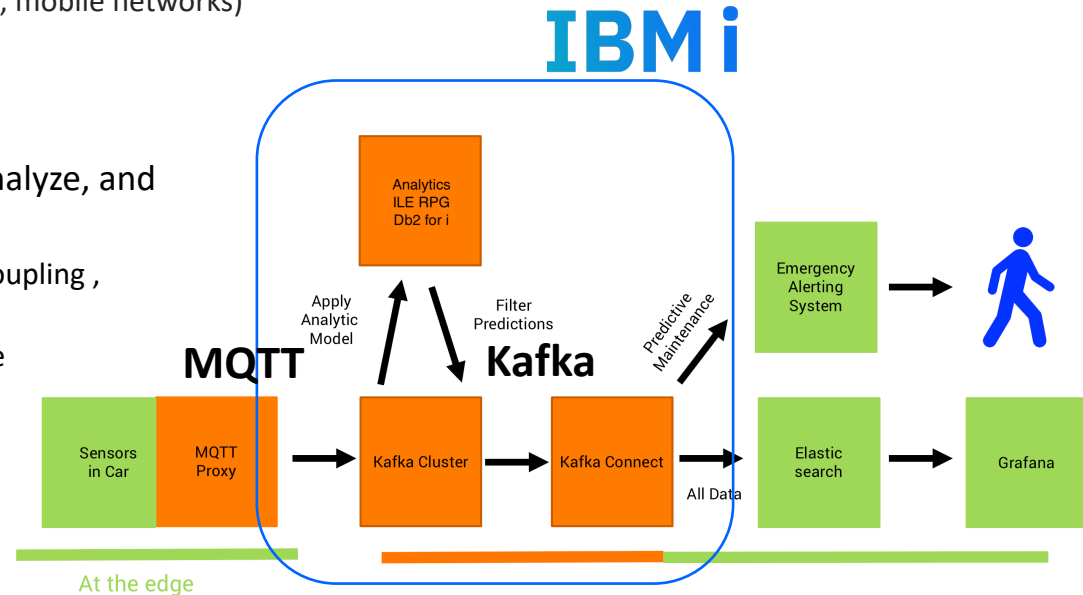
- Lightweight
 - smallest packet size 2 bytes (header)
 - reduced clients footprint
- Security
 - MQTT is over TCP...use SSL/TLS for security
 - username/password on connection
 - Encrypt payload
- Reliable
 - Three QoS levels (0: fire & forget / at most once, 1: At least once, 2: exactly once)
 - Avoid packet loss on disconnections - In case of unreliable networks, MQTT guarantees retransmissions and the delivery of the messages
 - Persistent Session / Clean Session
- Simple
 - TCP Based: socket connection oriented
 - Asynchronous : no wait for response
 - Publish / Subscribe : decoupling producer and consumers
 - Payload agnostic: any data format (text, binary, JSON, XML...)



<https://developer.ibm.com/articles/iot-mqtt-why-good-for-iot/>

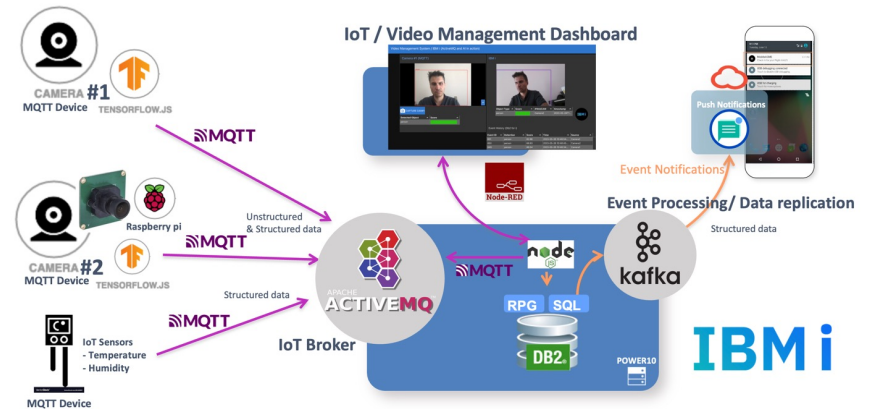
MQTT ou Kafka ?

- **Message Queue**, publish/subscribe pattern
- MQTT is primarily responsible for transmitting data from IoT devices
 - Lightweight,
 - Built for poor connectivity / high latency (e.g., mobile networks)
 - High scalability and availability
- Kafka focuses on storing and reading data.
Once data is published, Kafka can process, analyze, and store the data for future use.
 - Long term storage and buffering for real decoupling ,
Reprocessing of events
 - Good integration to the rest of the enterprise
 - Requires stable network
 - Use case: Change Data Capture
Db2 for i data replication etc.



Agenda

- 1. Open Source : les nouveautés – 15 minutes
- 2. Les outils d'intégration - 10 minutes
 - MQTT & ActiveMQ
 - Apache Kafka & Camel
 - Node-RED
- 3. Démonstration – 25 minutes
- 4. Questions/Réponses – 10 minutes



IBM



Infrastructures du futur

7 et 8 novembre 2023

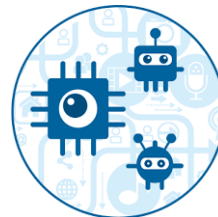
Université **IBM i**

7 novembre 2023



Let's
Create

IBM i



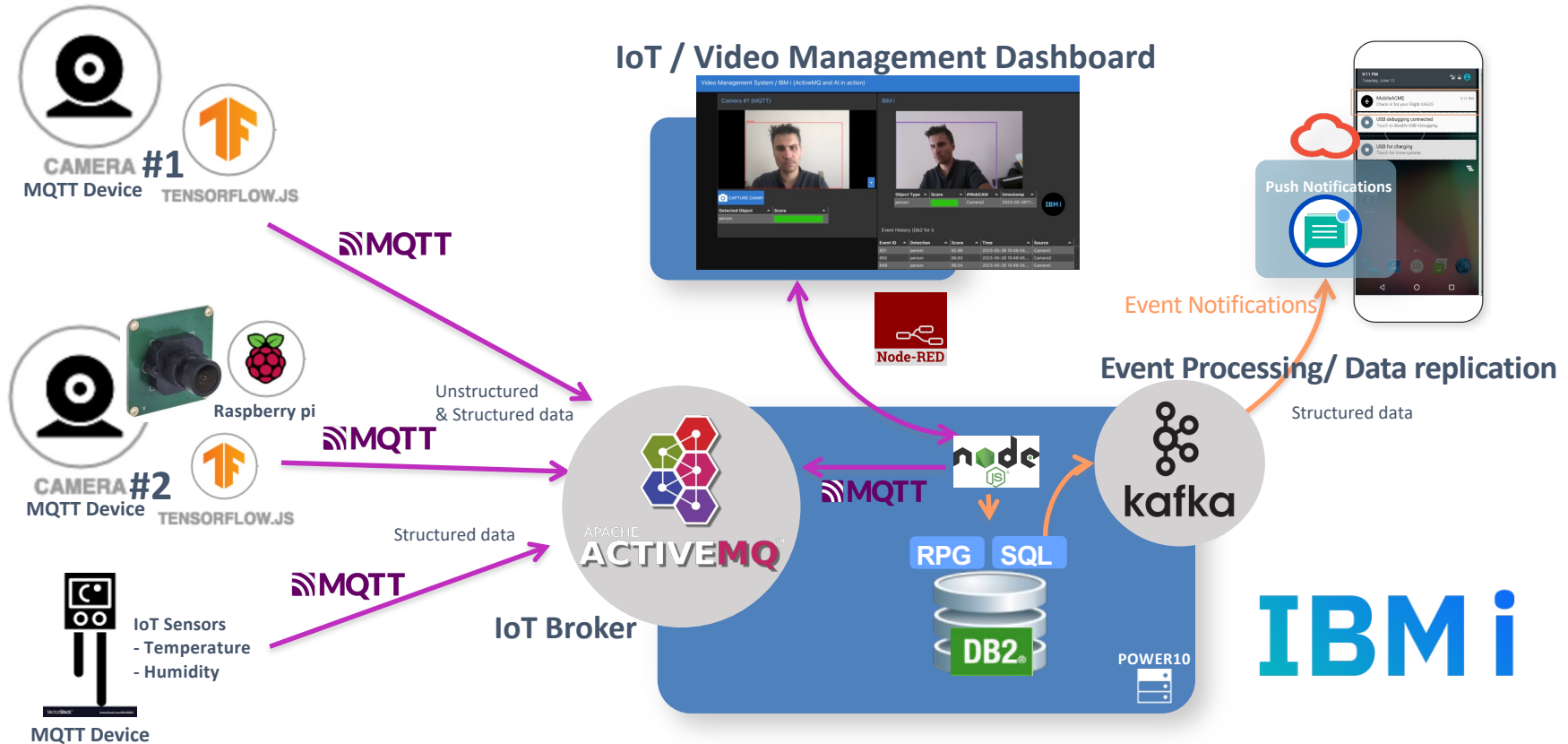
Node-RED

Demo « IBM i Next Gen Apps »



IBM i Next Gen Apps: VMS demo

- ➔ Integration with standard: Kafka & ActiveMQ
- ➔ Open Source : Node.js dashboard on IBM I
- ➔ ILE & Db2 for i : NoSQL/JSON & Geospatial



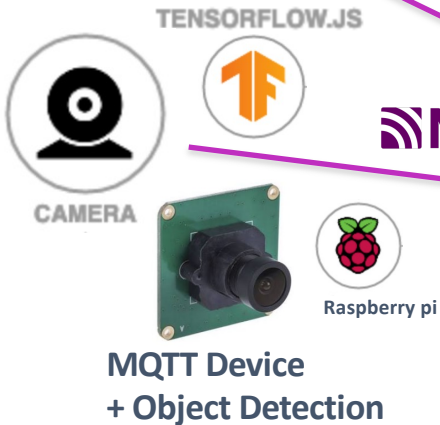
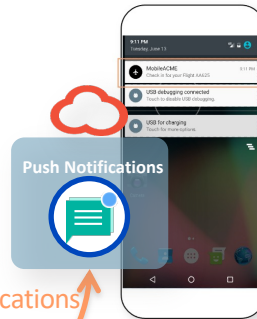
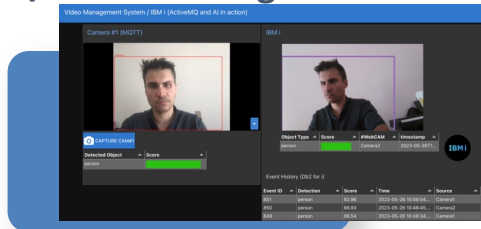
IBM i Next Gen Apps: VMS demo

IBM i in action

- IoT & Event Processing & dashboard
- Db2 for i: NoSQL/JSON & Geospatial Analytics
- RPG: Core Business Rules & integration



IoT / Video Management Dashboard



MQTT



Event Processing



Analytics & Business Rules



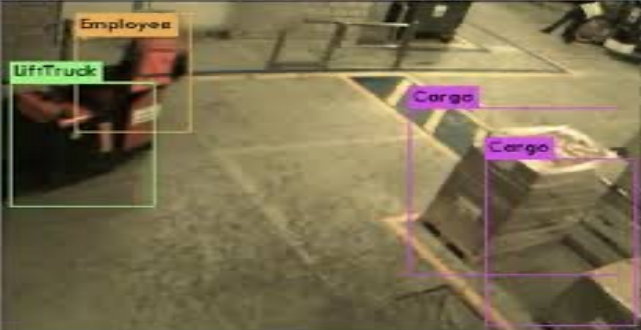
POWER10

IBM i

IBM i Next Gen Apps: VMS demo

Video Management System / IBM i (ActiveMQ and AI in action)

Camera #1 (MQTT)



CAPTURE CAM#1

Detected Object	Score
person	[Green bar]

IBM i




Image received on IBM I (MQTT)

Object Type	Score	#WebCAM	timestamp
person	[Green bar]	Camera1	2023-06-01T1...

IBM i

Aggregated data on IBM I (raw JSON & Relational)

Event ID	Detection	Score	Time	Source	Location	Distance (m)
236	person person	56.38	2023-06-01 18:13:...	Camera1	POINT (-92.503 44.0...	78
235	person	83.79	2023-06-01 18:13:...	Camera1	POINT (-92.503 44.0...	78
234	person	84.48	2023-06-01 18:13:...	Camera1	POINT (-92.503 44.0...	78



Source Video Camera#1
with embedded AI Model inference
(Tensorflow cocossd model)

Object Classes

Camera#

Geospatial
real time processing



Demo

Video Management System / IBM i (ActiveMQ and AI in action)

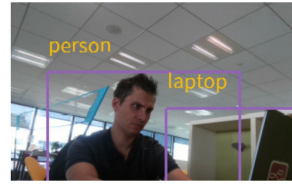
Camera #1 (MQTT)



CAPTURE CAM#1

Detected Object	Score
person	[Green bar]

IBM i - Event Detection Hub (ActiveMQ)



Object Type	Score	#WebCAM	timestamp
person	[Green bar]	Camera2	2023-11-06T12:...
laptop	[Green bar]	Camera2	2023-11-06T12:...

Event Records (Db2 for i)

Event ID	Detection	Score	Time	Source	Location	Distance (m)
on/laptop		53.17	2023-11-06 12:56:1...	Camera2	POINT (-92.503 44.01)	523
on/laptopfr...		51.58	2023-11-06 12:56:0...	Camera2	POINT (-92.503 44.01)	523
on		86.72	2023-11-06 13:55:5...	Camera1	POINT (-92.503 44.006)	78
on		84.35	2023-11-06 12:55:4...	Camera2	POINT (-92.503 44.01)	523
on		88.81	2023-11-06 13:55:4...	Camera1	POINT (-92.503 44.006)	78
on/laptopip...		61.27	2023-11-06 12:55:3...	Camera2	POINT (-92.503 44.01)	523
on/person		79.66	2023-11-06 13:55:2...	Camera1	POINT (-92.503 44.006)	78

- CAPTURE CAM#1
- CAPTURE CAM#2
- RESTART CAM#2

IBM i - Sensor Data (ActiveMQ)

UPDATE

Temperature Room1

Temperature Room1 (vs. time)

UPDATE

Temperature Room2

Temperature Room2 (vs. time)

Dashboard source code (Node-Red)

INTEGRATION & DASHBOARD WITH NODE-RED, ACTIVEMQ AND KAFKA

Dashboard rendering (HTML5 Javascript)

Demo

```
benoit@10.3.61.2's password:
***** IBM i 7.5 Montpellier Client Engineering EMEA *****
```

```
### ##### # # ##### #####
# # # ## ## # # # #
# # # # # # # # #
# ##### # # # # # #
# # # # # # # # #
# # # # # # # # #
### ##### # # # # # #
```

```
***** Contact: benoit.marolleau@fr.ibm.com *****
```

```
[14:10:32][DEMOP.IBM.COM][~/home/benoit]# sc status all
RUNNING | cameltrade (Camel Route for VMS events Kafka streaming)
NOT RUNNING | daytrader (DayTrader)
RUNNING | kafka (Apache Kafka bootstrap server) Port 9092
RUNNING | kafkaviz (Apache Kafka Visualizer) Port 8080
NOT RUNNING | node-red (node-red)
RUNNING | zookeeper (Apache Zookeeper Server using OpenJDK)
```

← PASE service management with Service Commander

```
[14:10:37][DEMOP.IBM.COM][~/home/benoit]#
```

Messages Consumers

Showing messages on partition 0 of vmsevents

Publish Message Search

- (116) -1699275949967 -
{\"table\":\"vmsevents\",\"operation\":\"INSERT\",\"row\":{\"id\":\"1703\",\"objecttype\":\"personlaptop\",\"detection_score\":\"58.52\",\"event_ts\":\"2023-11-06-12.58.18.871000\",\"event_src\":\"Camera2\"}}
- (115) -1699275934797 -
{\"table\":\"vmsevents\",\"operation\":\"INSERT\",\"row\":{\"id\":\"1702\",\"objecttype\":\"personlaptop\",\"detection_score\":\"56.96\",\"event_ts\":\"2023-11-06-12.58.03.824000\",\"event_src\":\"Camera2\"}}
- (114) -1699275919762 -
{\"table\":\"vmsevents\",\"operation\":\"INSERT\",\"row\":{\"id\":\"1701\",\"objecttype\":\"personlaptop\",\"detection_score\":\"78.61\",\"event_ts\":\"2023-11-06-12.57.48.745000\",\"event_src\":\"Camera2\"}}

Kafka server on IBM i
Published message to
(external) Kafka applications →

Demo - Kafka Consumer & Mobile (ntfy.sh) Push notification

Subscription to a topic ("vmsevent"), and send an alert based on a threshold (2 "persons" detected)

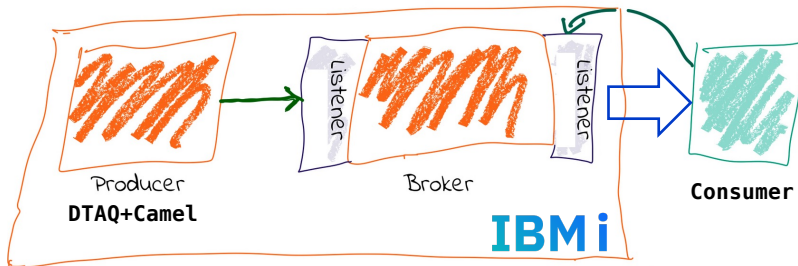
kafka_consume.py

```
import kafka, time, json, numpy as np, requests

topic = "vmsevents"
bootstrap_servers = "10.3.61.2:9092"
consumer = kafka.KafkaConsumer(topic, bootstrap_servers=bootstrap_servers, auto_offset_reset="latest")

assert(consumer.bootstrap_connected())
print(f"Bootstrap '{bootstrap_servers}' connected. Listening...")
print(consumer.topics())

for message in consumer:
    print(message)
    #message = f""""
    #Message received: {message.value}
    #Message key: {message.key}
    #Message partition: {message.partition}
    #Message offset: {message.offset}
    #""""
    message= f""""{message.value}""""
    count = message.count("person")
    print(count)
    if (count>=2):
        print("alert")
        requests.post("https://ntfy.sh/iotvms-events", data="Alert 🤩 2 personnes detectees".encode(encoding='utf-8'))
```



Watson Geospatial Analytics + *HTTP functions*

```
--  
-- Get Geodetic data for one of Scott's fave restaurants  
--  
select st_point(longitude, latitude) as thai_pop_geo  
from json_table(QSYS2.HTTP_GET(  
  'https://geocoding.geo.census.gov/geocoder/locations/onlineaddress?address='  
  concat ADDRESS concat '&benchmark=2020&format=json',  
  '{"header":  
    "User-Agent,Scott","sslCertificateStoreFile":"/home/javaTrustStore/fromJava.KDB"}'  
),  
  'lax $.result.addressMatches[0].coordinates'  
columns(  
  longitude varchar(100) path 'lax $.x',  
  latitude varchar(100) path 'lax $.y'));
```

THAI_POP_GEO
01000000E61000000400000001000000786B8AFF9D024640786B8AF

<https://www.ibm.com/docs/en/i/7.5?topic=concepts-spatial-reference-system>

<https://api-adresse.data.gouv.fr/>

https://www.ibm.com/docs/api/v1/content/ssw_ibm_i_75/sqlp/rbafyhttpoverview.htm

Kafka, Camel, Comment démarrer?

- Exemples "IBM i OSS" <https://github.com/IBM/ibmi-oss-examples/>
 - Dossier « [Camel](#) »
 - Bridge entre data queue & Kafka (Db2->Kafka bridge)
 - Nécessite Kafka
 - Bridge Message queue to email
 - Nécessite un SMTP server
 - Monitoring Disque avec email
 - Nécessite un SMTP server
 - Monitoring Disque avec message queue
 - envoi de messages via message queue *SYSOPR
- Workshop Camel / Kafka en ligne:
 - <https://github.com/ThePrez/FOCUS2020-Workshop/>

Ressources

IBM i RPMs (RedHat Technology) <http://ibm.biz/ibmi-rpms>

IBM i Open Source Support <http://ibm.biz/ibmi-oss-support>

Jesse Gorzinski's blog. <http://ibm.biz/open-your-i>
<https://ibmsystemsmag.com/Power-Systems/06/2020/common-open-source-questions-answered>

Exemples Open Source <http://github.com/IBM/ibmi-oss-examples>

IBM i customer stories <http://ibm.biz/ibmistories>

Community chat <http://ibm.biz/ibmio-ss-chat> (join at <http://ibm.biz/ibmio-ss-chat-join>)

Open Source , ILE , git

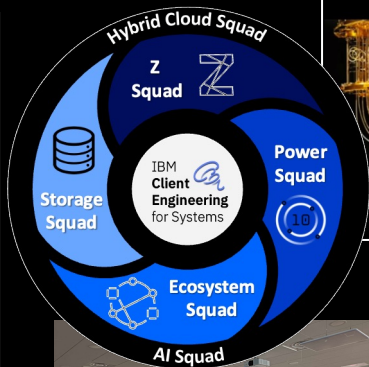
- <https://github.com/OSSILE>
- <https://github.com/richardschoen/iforgit>
- [GIT source control on IBM i](#) (presentation par Nathanael Bonnet, Common France)

Quel IDE choisir ? RDi mais également...

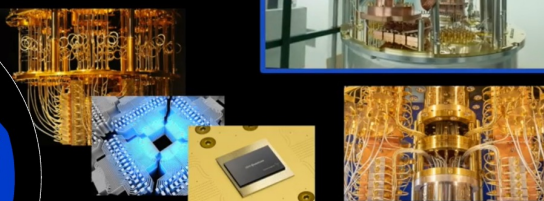
- <https://gist.github.com/kskuhlman/d2cc089a95bae04431b1c231de488a18>
- [vscode - Code for IBM i](#)



IBM Client Engineering



DISCOVER THE POTENTIAL OF QUANTUM!



UNLOCK DATA VALUE!



<https://www.ibm.com/ibm/clientcenter/montpellier>
Client Support PoC, Workshops, Benchmarks...
Partners Workshops & Training
ISV , Integrators....



IBM Watson

IBM Z

AIX
IBM i

IBM Blockchain

IBM Q

IBM Cloud



Red Hat



OPENSIFT



open source