

[WIP] Simple guide how to use ICS - Information coordinator service

See also: JIRA link: ☒ **NONRTRIC-965** - Simple sample rApps using nonrtric/sample/* services IN PROGRESS

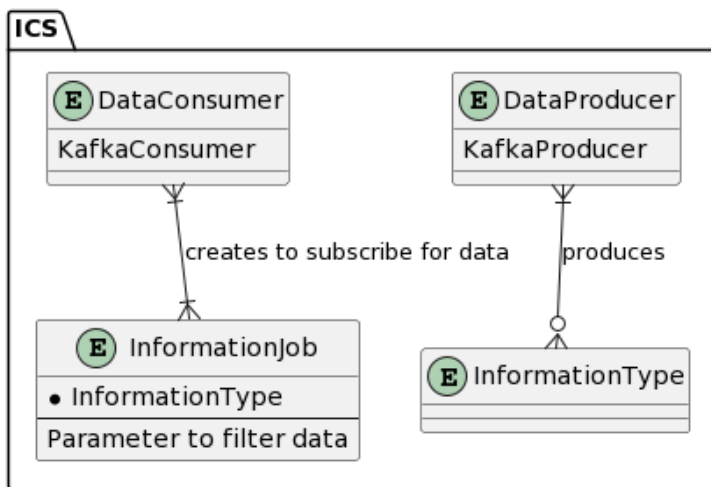
What is it (Data management and exposure) Service that manages data subscriptions. It separates data consumers from data producers (for different vendor). Data consumer doesn't need to be aware of where the data source.

Where is it: <https://github.com/o-ran-sc/nonrtric-plt-informationcoordinatorservice> mirror of <https://gerrit.o-ran-sc.org/r/nonrtric/plt-informationcoordinatorservice>

Historical names: Information Coordinator Service (ICS), Enrichment Information Coordinator.

Terminology:

- **Information Type:** Represents the types of data that can be produced by data producers and consumed by data consumers.
- **Information Job:** Represents an active data subscription by a data consumer, specifying the type of data to be produced and additional parameters for filtering.
- **Data Consumer:** Represents entities that consume data and manage data subscription jobs.
- **Data Producer:** Represents entities that produce data.



API offered in ICS:

- **Data producer API:** *Information Type* and *Information Producer*
 - Producer **CALLBACKS:** GET *healthcheck* (supervision); *Information Job* Creation/Modification/Delete.
- **Data consumer API:** *Information Type Subscription* Creation/Modification/Delete (REGISTERED/UNREGISTERED); *Information Job* (Creation/Modification/Delete) and GET *Information Type*
 - Consumer **CALLBACKS:** POST *Information Type Status:* REGISTERED/UNREGISTERED invoked when a *Information type* status has been changed
- **Service status API:** Returns statistics such as Number of Producers Types and Jobs

ICS Docker Image:

1. Building the docker image from source and run it on port 8083 http

```
git clone "https://gerrit.o-ran-sc.org/r/nonrtric/plt/informationcoordinatorservice"
cd informationcoordinatorservice
mvn clean install
docker run -d -p 8083:8083 o-ran-sc/nonrtric-plt-informationcoordinatorservice:latest
```

Or use the pre-built image

```
docker run -d -p 8083:8083 nexus3.o-ran-sc.org:10001/o-ran-sc/nonrtric-plt-informationcoordinatorservice:1.6.0
```

2. Import the swagger.json in Postman (informationcoordinatorservice/api/ics-api.json) as an OpenAPI3.0

3. Replace the baseUrl with <http://localhost:8083> (in the Data management and exposure variables), and change accordingly {{infoTypeId}} from : infoTypeId

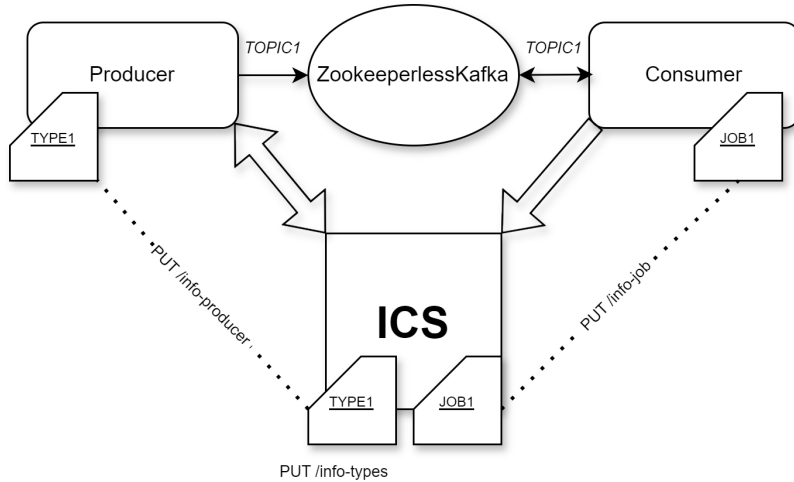
Other variables will be :{{infoJobId }}/{{infoProducerId}}/{{infoTypeId}}/{{subscriptionId}} etc

4. ICS flow:

a) Create a type (PUT /info-types)

b) Create a producer (PUT /info-producers) {supports type for filtering}

c) Create a job (PUT /info-jobs) {consumer subscription}



a) ICS type: Stores the data schema of what's sent between the producer and consumer.

PUT {{baseUrl}}/data-producer/v1/info-types/{{infoTypeId}}

Body:

```
{
  "info_job_data_schema": {
    "topicName": "example_topic",
    "key": "example_key",
    "message": "example_message"
  },
  "info_type_information": {}
}
```

b) Onboarding a producer in ICS:

PUT {{baseUrl}}/data-producer/v1/info-producers/{{infoProducerId}}

Body:

```
{
  "supported_info_types": ["example_info_type_id"],
  "info_job_callback_url": "http://example.com/job_callback", //POST JobCallbackUrl() + "/" + infoJob.getId();
  "info_producer_supervision_callback_url": "http://example.com/producer_supervision_callback"
}
```

"jobCallbackUrl" and "producerSupervisionCallbackUrl" are used for communication between a service and external producers in the context of the Information Control Service (ICS).

- jobCallbackUrl:** This URL serves as a callback endpoint for the producer. When the service needs to communicate or interact with the producer regarding a specific job, it sends requests to this URL. In the stopInfoJob() method, the service constructs a URL by appending the job ID to the jobCallbackUrl of the producer. Then it sends a **DELETE** request to this URL, effectively stopping the job. In the startInfoJob() method, the service sends a **POST** request to the jobCallbackUrl to start a job in the producer.
- producerSupervisionCallbackUrl:** This URL is used for health checks or supervision purposes. The service can send requests to this URL to check the health or status of the producer. In the healthCheck() method, the service sends a **GET** request to the producerSupervisionCallbackUrl to check the health of the producer.

In summary, both URLs facilitate communication between the service and external producers, enabling actions like starting and stopping jobs, as well as monitoring the health and status of the producers.

c) Giving the consumer a job definition:

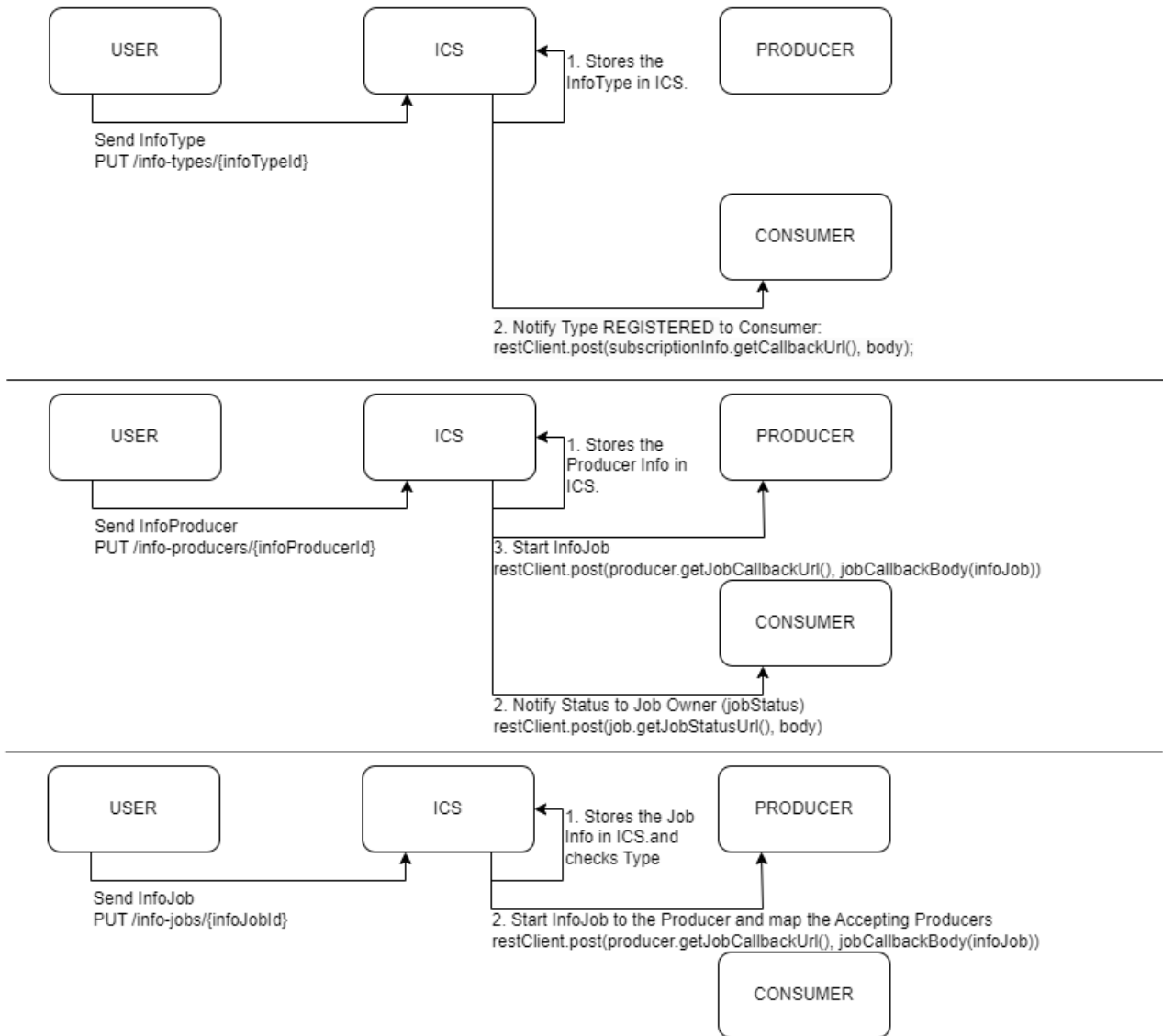
PUT {{baseUrl}}/data-consumer/v1/info-jobs/{{infoJobId}}

Body:

```
{
  "info_type_id": "example_info_type_id",
  "job_owner": "example_owner",
  "job_definition": {
    "example_key1": "example_value1",
    "example_key2": "example_value2"
  },
  "job_result_uri": "http://example.com/job_result",
  "status_notification_uri": "http://example.com/status_notification"
}
```

1. Authorization check: POST to the Authentication Agent (from the starting config *config/application.yaml*)
2. Validation: The URLs are used only for URI validation
3. Consumer starts a job on the Producer POST `producerCallbacks.startInfoSubscriptionJob->restClient.post(producer.getJobCallbackUrl(), jobCallbackBody(infoJob))`

ICS Callbacks Flow



Demo Application - Java Producer and Consumer

Sample application: [ics-producer-consumer](#)

Script for the demo: [start.sh](#)

```
bash start.sh
```

Running the script will check the requirements and start 4 containers:

1. Kafka(localhost:9092)
2. ICS(localhost:8083)
3. Producer(localhost:8080)
4. Consumer(localhost:8081)

The Producer implements these callbacks in order to work with ICS:

1. **GET** *SUPERVISION_URL* Return 200
2. **DELETE** *JOB_URL* + "{infoJobId}" Return 200
3. **GET** *JOB_URL* Return 200 and a collection of *JOB*
4. **POST** *JOB_URL* Return 200 and send in body a *JOB* (It receives data from ICS)

The [Consumer](#) implements these callbacks in order to work with ICS:

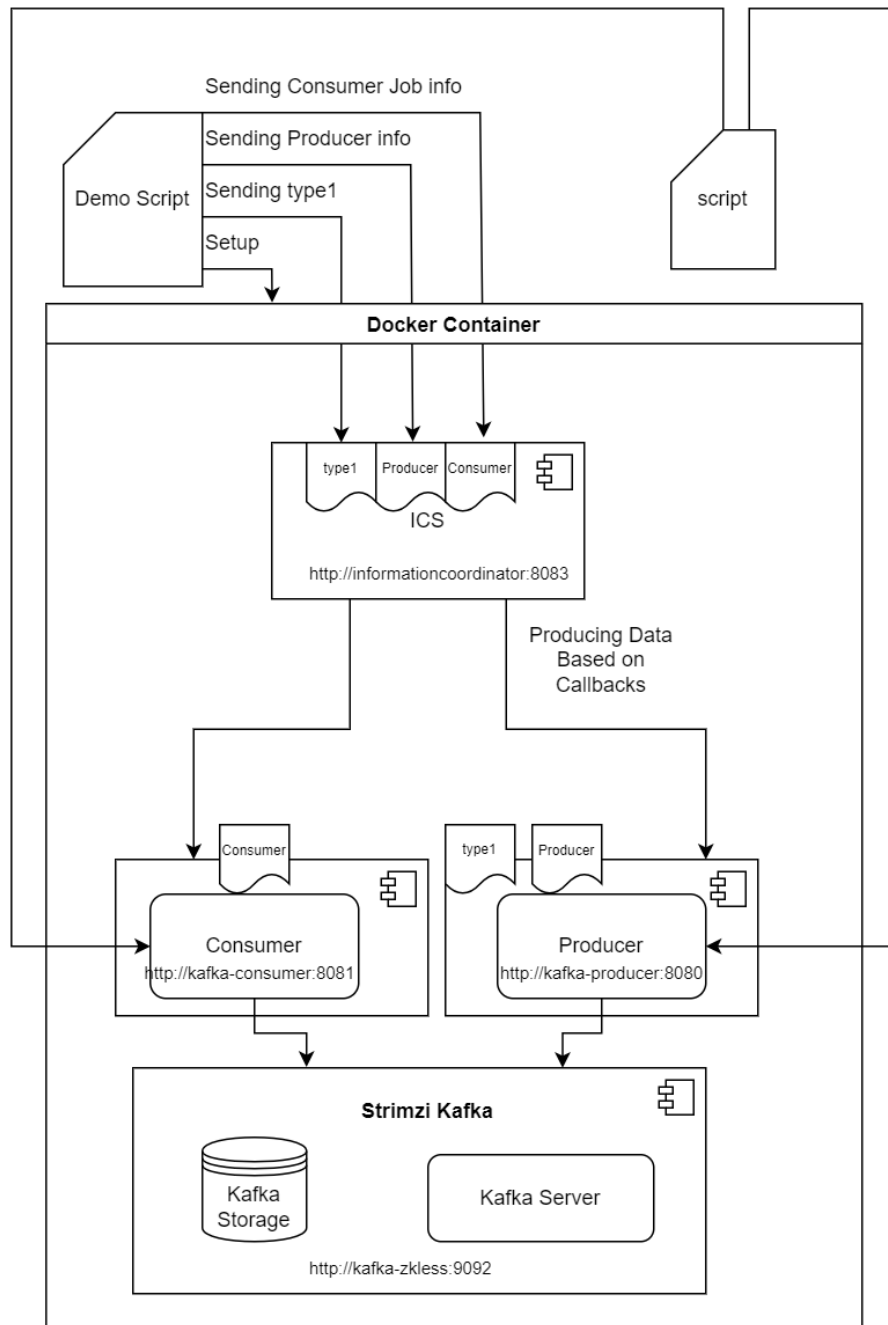
1. **POST** */info-type-status* Return 200 when a Information type status has been changed (It receives data from ICS) Status: *REGISTERED* /*UNREGISTERED*

This also assumes that the Demo Application has a definition of a *TYPE* and a *JOB* on that type.

Run the demo:

The demo.sh script will:

1. Check the system for dependencies such as Maven, Java, Docker and docker-compose
2. Package the demo application for a producer and a consumer and build the docker images
3. Start the docker container in the same docker network with docker-compose
4. After Strimzi kafka is up and running the user can run manually `./runproducer.sh` and `./runconsumer.sh` in different shells or use `demo.sh` to start the producer and consumer
5. The script will send type1 to ICS, which is already predefined in the demo application
6. The script will send the producer info to ICS
7. The script will send the consumer job info to ICS
8. ICS will trigger the demo application based on its callbacks
9. Data is produced on the demo application
10. The script sends docker logs of the Producer Callback function of ICS
11. The script sends docker logs of the Demo applications



Demo Producer Docker logs

```
2024-04-02 12:48:05 INFO c.d.p.p.SimpleProducer:141 - {"bootstrapServers":"kafka-zkless:9092","topic":"mytopic","source":"com.demo.producer.producer.SimpleProducer","message":"yGHwxSIxW","key":"f8f1a7a7-a78e-4c7d-9b8d-108bb0cc9e2c"}
2024-04-02 12:48:06 INFO c.d.p.p.SimpleProducer:141 - {"bootstrapServers":"kafka-zkless:9092","topic":"mytopic","source":"com.demo.producer.producer.SimpleProducer","message":"KNiBP10zfN","key":"b058d00f-bbcd-4d2c-936b-6327847d4c2a"}
2024-04-02 12:48:07 INFO c.d.p.p.SimpleProducer:141 - {"bootstrapServers":"kafka-zkless:9092","topic":"mytopic","source":"com.demo.producer.producer.SimpleProducer","message":"V6fH1NkdeH","key":"ae1a83a3-d8a7-40c8-9d98-529230f8b585"}
2024-04-02 12:48:08 INFO c.d.p.p.SimpleProducer:141 - {"bootstrapServers":"kafka-zkless:9092","topic":"mytopic","source":"com.demo.producer.producer.SimpleProducer","message":"m76qvRFh6f","key":"abccde52-fa72-4fd4-99ab-5bc21514d825"}
2024-04-02 12:48:09 INFO c.d.p.p.SimpleProducer:141 - {"bootstrapServers":"kafka-zkless:9092","topic":"mytopic","source":"com.demo.producer.producer.SimpleProducer","message":"t7FJYnFr43","key":"0602239e-34e9-45a6-a04a-3c67b4c7d9e4"}
```

+++++

Demo Consumer Docker logs

```
2024-04-02 12:48:05 INFO c.d.c.c.SimpleConsumer:158 - {"message":"Topic: mytopicMessage: yGHwxSIxW"}
2024-04-02 12:48:06 INFO c.d.c.c.SimpleConsumer:158 - {"message":"Topic: mytopicMessage: KNiBP10zfN"}
2024-04-02 12:48:07 INFO c.d.c.c.SimpleConsumer:158 - {"message":"Topic: mytopicMessage: V6fH1NkdeH"}
2024-04-02 12:48:08 INFO c.d.c.c.SimpleConsumer:158 - {"message":"Topic: mytopicMessage: m76qvRFh6f"}
2024-04-02 12:48:09 INFO c.d.c.c.SimpleConsumer:158 - {"message":"Topic: mytopicMessage: t7FJYnFr43"}
```

+++++

ICS logs

```
2024-04-02T12:48:05.615Z DEBUG 1 --- [or-http-epoll-2] o.o.i.c.r1producer.ProducerCallbacks : Job subscription 1 started OK 1
2024-04-02T12:48:05.820Z DEBUG 1 --- [io-8083-exec-10] o.o.i.repository.InfoTypeSubscriptions : Added type status subscription 1
```

GUI Consoles and Panels

Automatic

Running the script : [red.sh](#) will

1. Bring the sandbox setup (Kafka and ICS)
2. Build the local images for the producer and consumer
3. Redpanda console (visual monitor kafka data flow) and the NONRTRIC control panel (visual data type job subscriptions).

```
bash red.sh
```

There are the options to skip the build or the GUIs

```
bash red.sh --skip-build --no-console
```

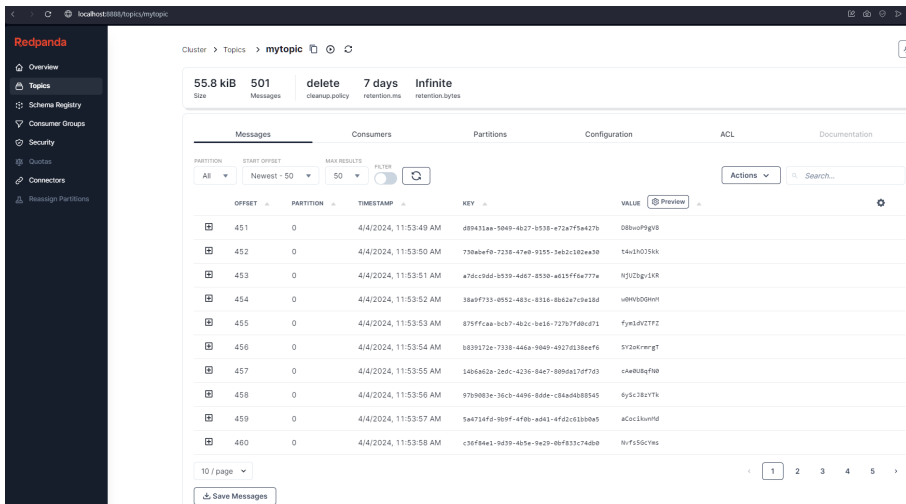
Manual

Redpanda Console:

After kafka is up and running

```
docker-compose -f docker-composeRedPanda.yaml up -d
```

Redpanda console available at: <http://localhost:8888>



Manual NONRTRIC-controlpanel:

git clone "<https://gerrit.o-ran-sc.org/r/portal/nonrtric-controlpanel>"

Changed the configuration files as shown here:

```
/nonrtric-controlpanel$ git diff ./docker-compose/
diff --git a/docker-compose/.env b/docker-compose/.env
index 69fdd12..257ac73 100644
--- a/docker-compose/.env
+++ b/docker-compose/.env
@@ -16,9 +16,9 @@
#

#CONTROL_PANEL
-CONTROL_PANEL_IMAGE_BASE="nexus3.o-ran-sc.org:10004/o-ran-sc/nonrtric-controlpanel"
+CONTROL_PANEL_IMAGE_BASE="nexus3.o-ran-sc.org:10002/o-ran-sc/nonrtric-controlpanel"
CONTROL_PANEL_IMAGE_TAG="2.5.0"

#NONRTRIC_GATEWAY
-NONRTRIC_GATEWAY_IMAGE_BASE="nexus3.o-ran-sc.org:10004/o-ran-sc/nonrtric-gateway"
+NONRTRIC_GATEWAY_IMAGE_BASE="nexus3.o-ran-sc.org:10002/o-ran-sc/nonrtric-gateway"
NONRTRIC_GATEWAY_IMAGE_TAG="1.2.0"
\ No newline at end of file
diff --git a/docker-compose/control-panel/docker-compose.yaml b/docker-compose/control-panel/docker-compose.yaml
index 2716ed8..a42b7a8 100644
--- a/docker-compose/control-panel/docker-compose.yaml
+++ b/docker-compose/control-panel/docker-compose.yaml
@@ -16,18 +16,17 @@
version: '3.5'

networks:
- default:
-   driver: bridge
-   name: nonrtric-docker-net
+ kafka:
+ ...skipping...
diff --git a/docker-compose/.env b/docker-compose/.env
index 69fdd12..257ac73 100644
--- a/docker-compose/.env
+++ b/docker-compose/.env
@@ -16,9 +16,9 @@
#

#CONTROL_PANEL
-CONTROL_PANEL_IMAGE_BASE="nexus3.o-ran-sc.org:10004/o-ran-sc/nonrtric-controlpanel"
+CONTROL_PANEL_IMAGE_BASE="nexus3.o-ran-sc.org:10002/o-ran-sc/nonrtric-controlpanel"
```

```

CONTROL_PANEL_IMAGE_TAG="2.5.0"

#NONRTRIC_GATEWAY
-NONRTRIC_GATEWAY_IMAGE_BASE="nexus3.o-ran-sc.org:10004/o-ran-sc/nonrtric-gateway"
+NONRTRIC_GATEWAY_IMAGE_BASE="nexus3.o-ran-sc.org:10002/o-ran-sc/nonrtric-gateway"
  NONRTRIC_GATEWAY_IMAGE_TAG="1.2.0"
\ No newline at end of file
diff --git a/docker-compose/control-panel/docker-compose.yaml b/docker-compose/control-panel/docker-compose.yaml
index 2716ed8..a42b7a8 100644
--- a/docker-compose/control-panel/docker-compose.yaml
+++ b/docker-compose/control-panel/docker-compose.yaml
@@ -16,18 +16,17 @@
@@ -16,18 +16,17 @@
   version: '3.5'

  networks:
  - default:
  -   driver: bridge
  -   name: nonrtric-docker-net
+  kafka:
+  external: true

  services:
    policy-control-panel:
      image: "${CONTROL_PANEL_IMAGE_BASE}:${CONTROL_PANEL_IMAGE_TAG}"
      container_name: policy-control-panel
      networks:
      - default
+      - kafka
      ports:
      - 8080:8080
      - 8082:8082
+      - 8181:8080
+      - 8282:8082
      volumes:
      - ./control-panel/config/nginx.conf:/etc/nginx/nginx.conf:ro
diff --git a/docker-compose/docker-compose.yaml b/docker-compose/docker-compose.yaml
index 64bcb99..c30aa2c 100644
--- a/docker-compose/docker-compose.yaml
+++ b/docker-compose/docker-compose.yaml
@@ -16,6 +16,5 @@
@@ -16,6 +16,5 @@
   version: '3.5'

  networks:
  - default:
  -   driver: bridge
  -   name: nonrtric-docker-net
\ No newline at end of file
+  kafka:
+  external: true
diff --git a/docker-compose/nonrtric-gateway/config/application-nonrtricgateway.yaml b/docker-compose/nonrtric-gateway/config/application-nonrtricgateway.yaml
index 7230175..c620b03 100644
--- a/docker-compose/nonrtric-gateway/config/application-nonrtricgateway.yaml
+++ b/docker-compose/nonrtric-gateway/config/application-nonrtricgateway.yaml
@@ -26,12 +26,8 @@
@@ -26,12 +26,8 @@
    httpserver:
      wiretap: true
    routes:
  - id: A1-Policy
    uri: https://policy-agent:8433
    predicates:
  - Path=/a1-policy/**
  - id: A1-EI
    uri: https://ics:8434
+  uri: http://informationcoordinatorsservice:8083
    predicates:
  - Path=/data-producer/**,/data-consumer/**

  management:
diff --git a/docker-compose/nonrtric-gateway/docker-compose.yaml b/docker-compose/nonrtric-gateway/docker-compose.yaml
index fbf3d9b..138229d 100644

```

```

--- a/docker-compose/nonrtrtc-gateway/docker-compose.yaml
+++ b/docker-compose/nonrtrtc-gateway/docker-compose.yaml
@@ -16,16 +16,15 @@
  version: '3.5'

  networks:
  - default:
  - driver: bridge
  - name: nonrtrtc-docker-net
+ kafka:
+ external: true

  services:
    nonrtrtc-gateway:
      image: "${NONRTRTC_GATEWAY_IMAGE_BASE}:${NONRTRTC_GATEWAY_IMAGE_TAG}"
      container_name: nonrtrtc-gateway
      networks:
      - default:
+      + kafka:
+        aliases:
+          - nonrtrtc-gateway-container
      ports:
(END)

```

```

docker-compose -f ./nonrtrtc-controlpanel/docker-compose/docker-compose.yaml \
-f ./nonrtrtc-controlpanel/docker-compose/control-panel/docker-compose.yaml \
-f ./nonrtrtc-controlpanel/docker-compose/nonrtrtc-gateway/docker-compose.yaml up -d

```

ICS informations displayed here: <http://localhost:8181>

The screenshot shows the 'Non-RT RIC Control Panel' web interface. The top navigation bar is dark blue with the title 'Non-RT RIC Control Panel'. Below the navigation bar, there's a section titled 'Information Coordinator'. The main content area is divided into two sections: 'Producers' and 'Jobs'.

Producers Section: It contains a table with three columns: 'Producer ID', 'Producer types', and 'Producer status'. There is one row with the value '1' in the 'Producer ID' column, 'type1' in the 'Producer types' column, and 'ENABLED' in the 'Producer status' column.

Jobs Section: It contains a table with six columns: 'Job ID', 'Producers', 'Type ID', 'Owner', 'Target URI', and 'Status'. There is one row with the value '1' in the 'Job ID' column, '1' in the 'Producers' column, 'type1' in the 'Type ID' column, 'demo' in the 'Owner' column, 'http://kafka-producer:8080/producer/job' in the 'Target URI' column, and 'ENABLED' in the 'Status' column.

At the bottom of the 'Jobs' section, there is a 'Items per page: 10' dropdown menu.

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