IoT Data Processing Project Documentation

Phase 5

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Project Objective :

The objective of this IoT data processing project is to create a smart home system that efficiently processes and manages data from various IoT devices. The system is designed to enhance automation, enabling real-time monitoring and control of devices within a smart home environment.

Design Thinking Process :

I. User-Centric Approach :

The project began with a user-centric approach, understanding the needs of homeowners and the challenges they face. This involved identifying common smart home devices and determining the most effective ways to integrate and control them.

II. Scalability and Flexibility

The design focused on scalability and flexibility, allowing the addition of new devices seamlessly. The goal was to create a system that adapts to evolving technology and user preferences.

III. Real-Time Responsiveness

Real-time data processing was a key consideration to ensure immediate response to user commands and timely updates on device status.

Development Phases

Phase 1: Smart Home Setup

Device Selection:
Identify and select common smart home devices such as lights, thermostats, and security cameras.

Integration:
Implement device integration protocols (e.g., MQTT, RESTful APIs) for seamless communication between devices and the central processing system.

Phase 2: Technical Implementation

Server-Side Development:

Build the backend system responsible for processing and managing data. Use a micro services architecture for modularity and maintainability.

User Interface:

Develop a user-friendly interface (web or mobile app) for users to monitor and control smart home devices.

Phase 3: Real-Time Data Processing

Event-Driven Architecture:

Implement an event-driven architecture for real-time responsiveness. Use technologies like Apache Kafka for event streaming.

Automation Routines:

Create automation routines that allow users to set predefined rules for device behavior based on specific conditions.

Phase 4: Data Storage Using IBM Cloud

Cloud Storage:

Utilize IBM Cloud for secure and scalable storage of IoT data.

Database Integration:

Implement database solutions for storing historical data, user preferences, and device configurations.

Technical Implementation Details

Smart Home Setup

Devices:

Include devices like smart lights, thermostats, security cameras, and sensors.

Integration Protocols:

Use MQTT for lightweight and efficient communication between devices and the central server.

Real-Time Data Processing

Event Streaming:

Implement Apache Kafka for real-time event streaming.

Automation:

Utilize IBM Cloud Functions for creating serverless automation routines triggered by specific events.

Data Storage Using IBM Cloud

Cloud Storage:

Leverage IBM Cloud Object Storage for secure and scalable data storage.

Database:

Use IBM Db2 or another suitable database for structured storage of device data and user information.

Submission

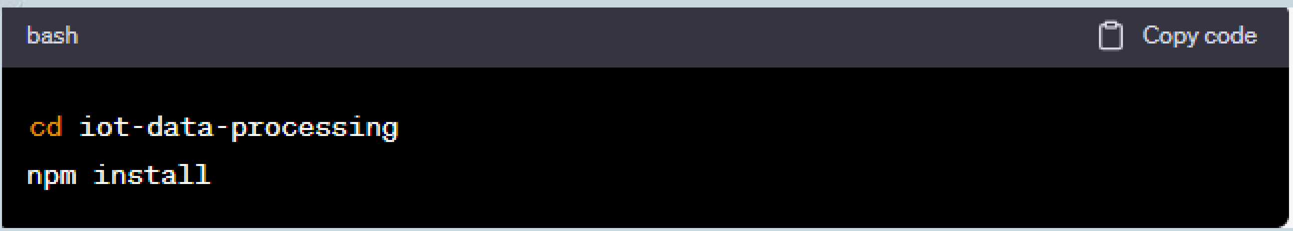
GitHub Repository

I. Keerthu-jk/iot
II. NITHYA222004/Serverless
III. Vengadeswarimalar/vengadeswari
IV. Selvi-punai/iot
V. Prabha-joy/iot

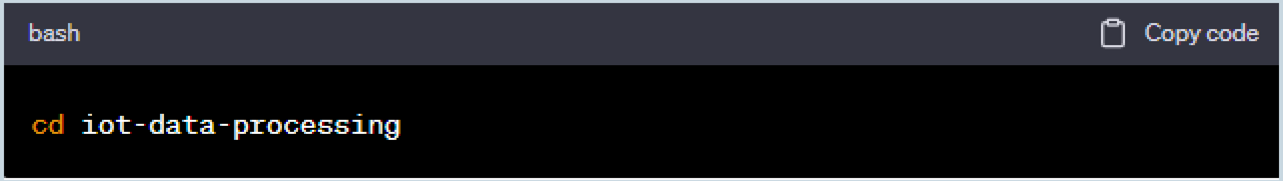
Setup and Deployment Instructions

Selvalakshimi G:
https://github.com/selvi-punai/iot.git
Nithya A:
 https://github.com/NITHYA222004/Severless.git
Keerthana J:
 https://github.com/keerthu-jk/iot.git
Prasanna Balaji C:
 https://github.com/prabha-joy/iot.git
Vengadeswari M:
https://github.com/vengadeswarimalar/vengadeswari.git

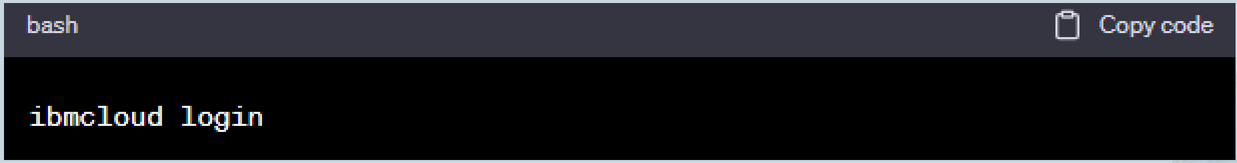
Install Dependencies



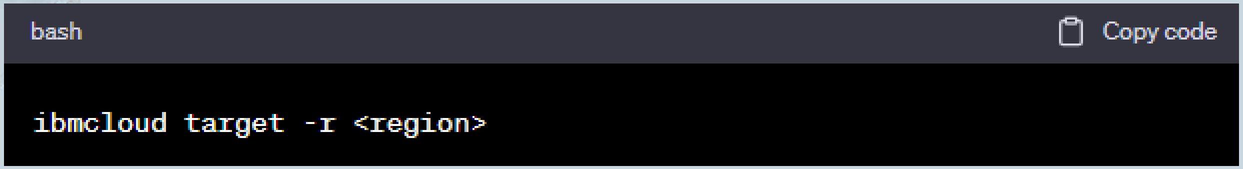
```bash
cd iot-data-processing
npm install
```



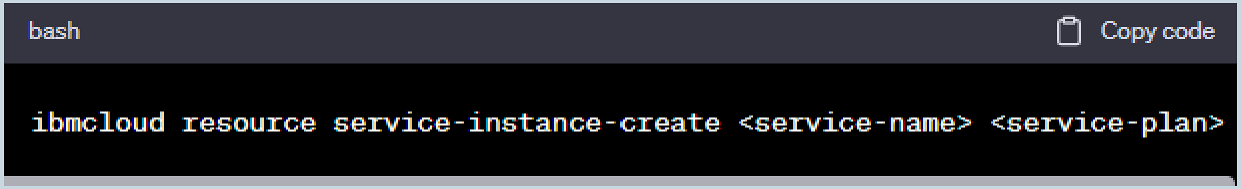
```bash
cd iot-data-processing
```



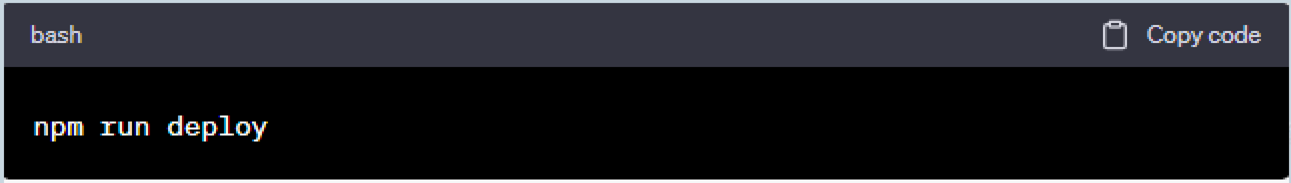
```bash
ibmcloud login
```



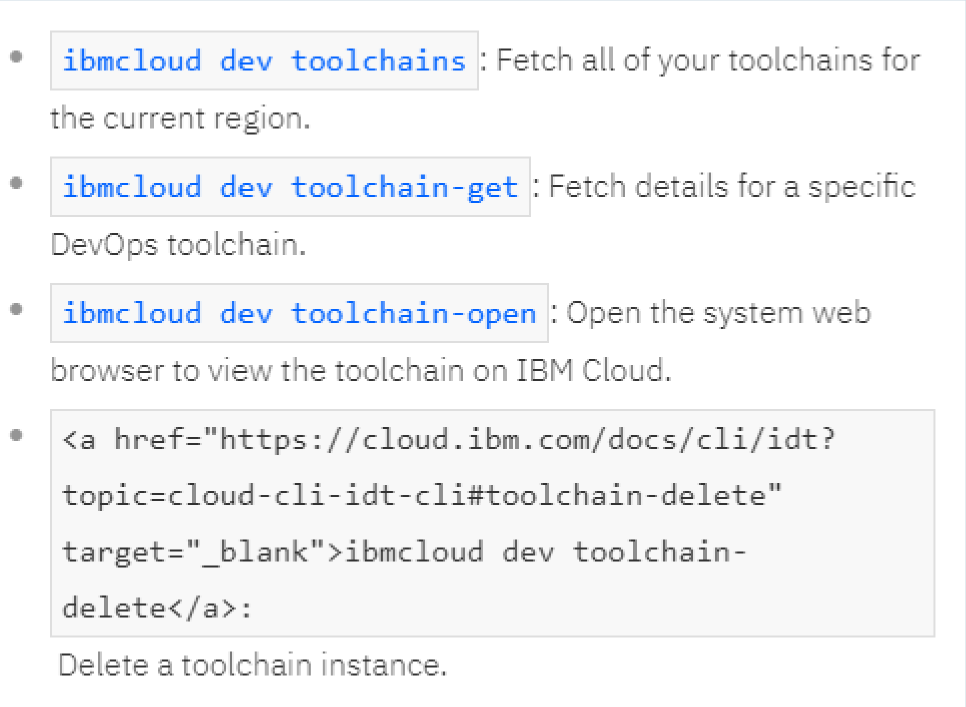
```bash
ibmcloud target -r <region>
```



```bash
ibmcloud resource service-instance-create <service-name> <service-plan>
```

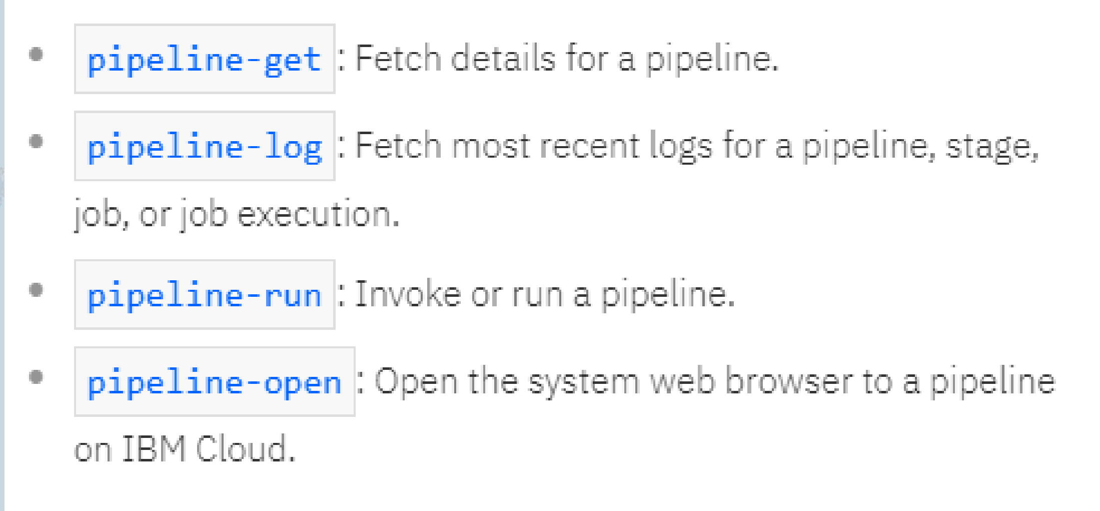


```bash
npm run deploy
```

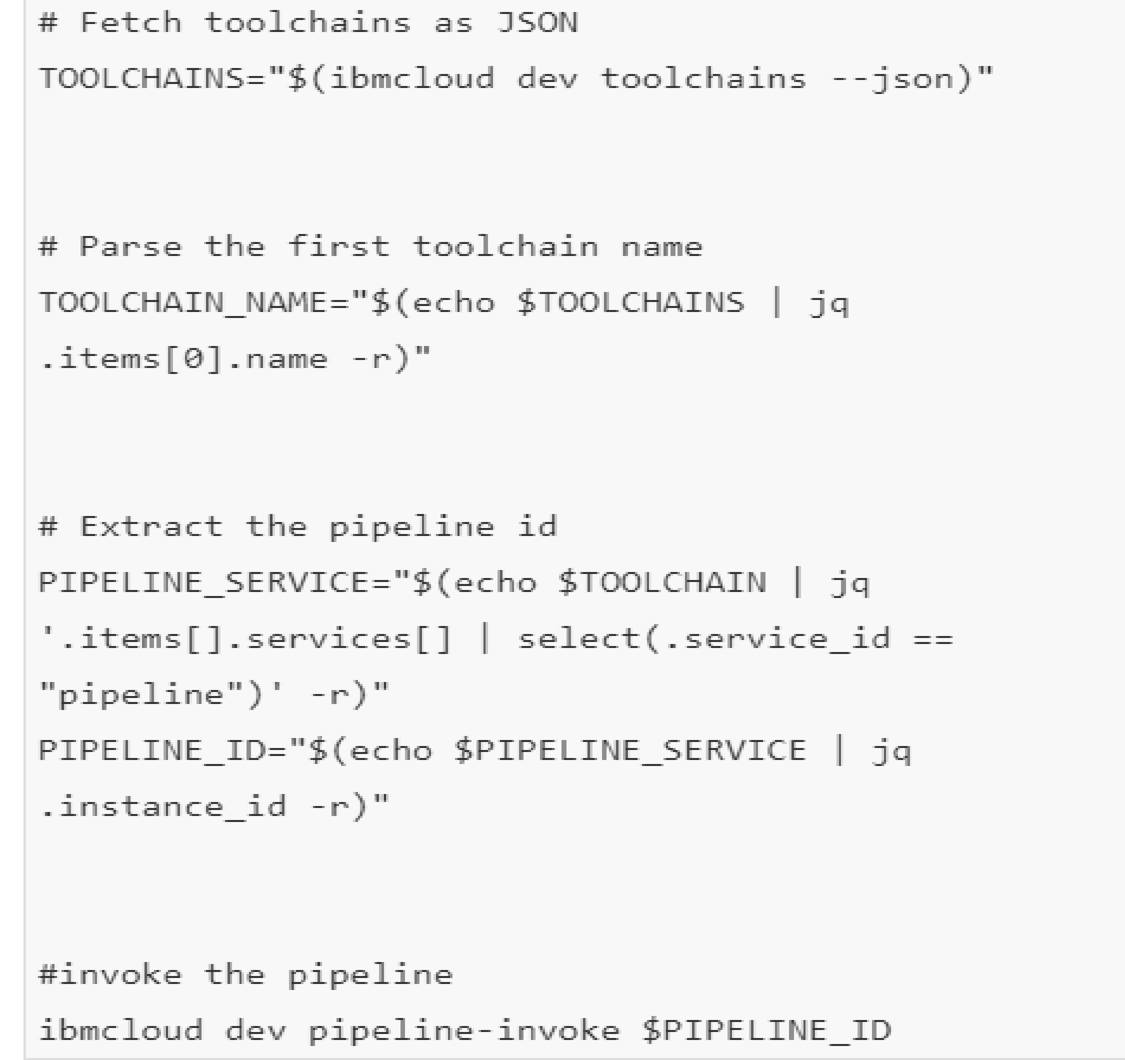


- `ibmcloud dev toolchains`: Fetch all of your toolchains for the current region.
- `ibmcloud dev toolchain-get`: Fetch details for a specific DevOps toolchain.
- `ibmcloud dev toolchain-open`: Open the system web browser to view the toolchain on IBM Cloud.

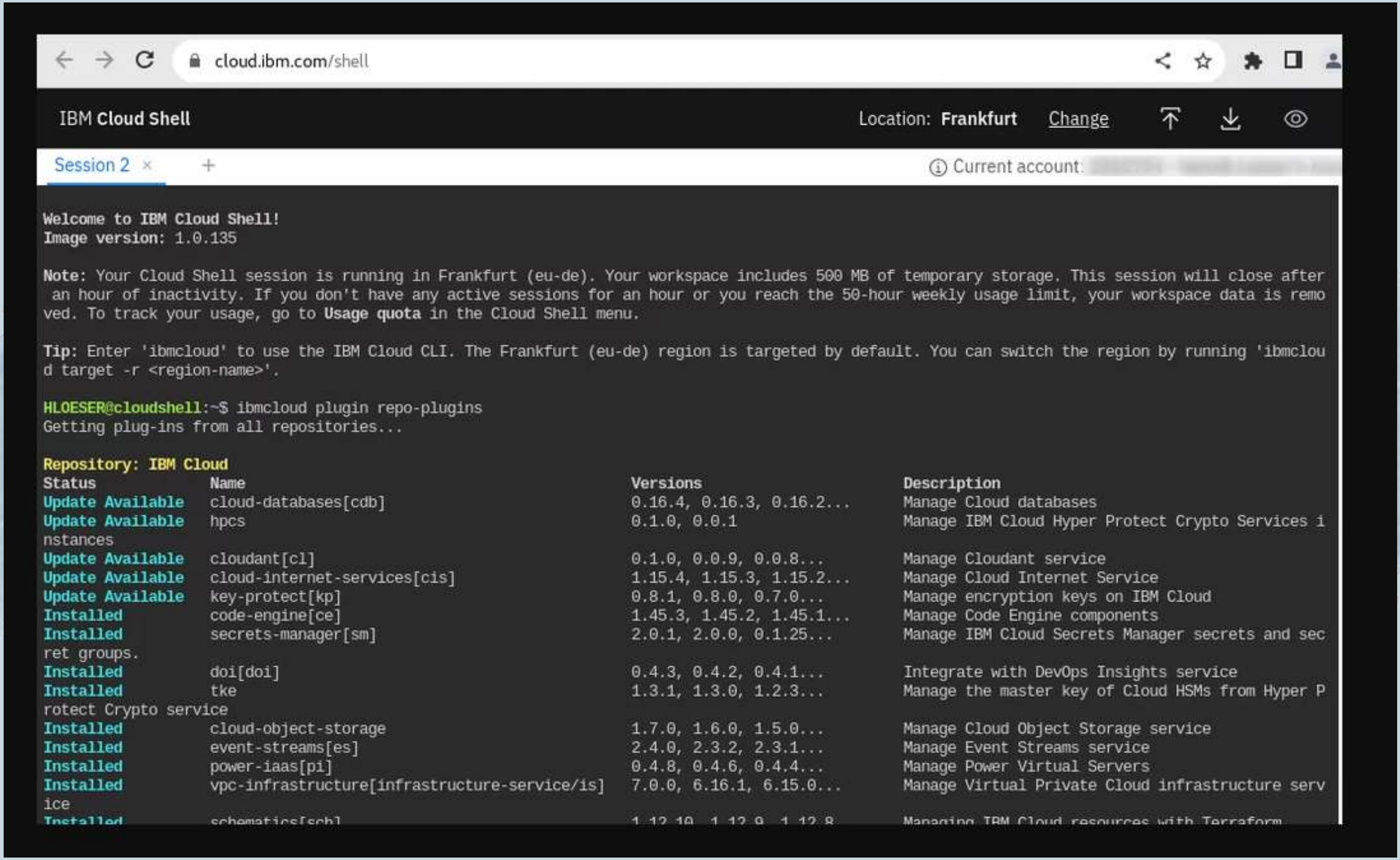
-
  ```
  <a href="https://cloud.ibm.com/docs/cli/idt?
  topic=cloud-cli-idt-cli#toolchain-delete"
  target="_blank">ibmcloud dev toolchain-
  delete</a>:
  ```
  Delete a toolchain instance.



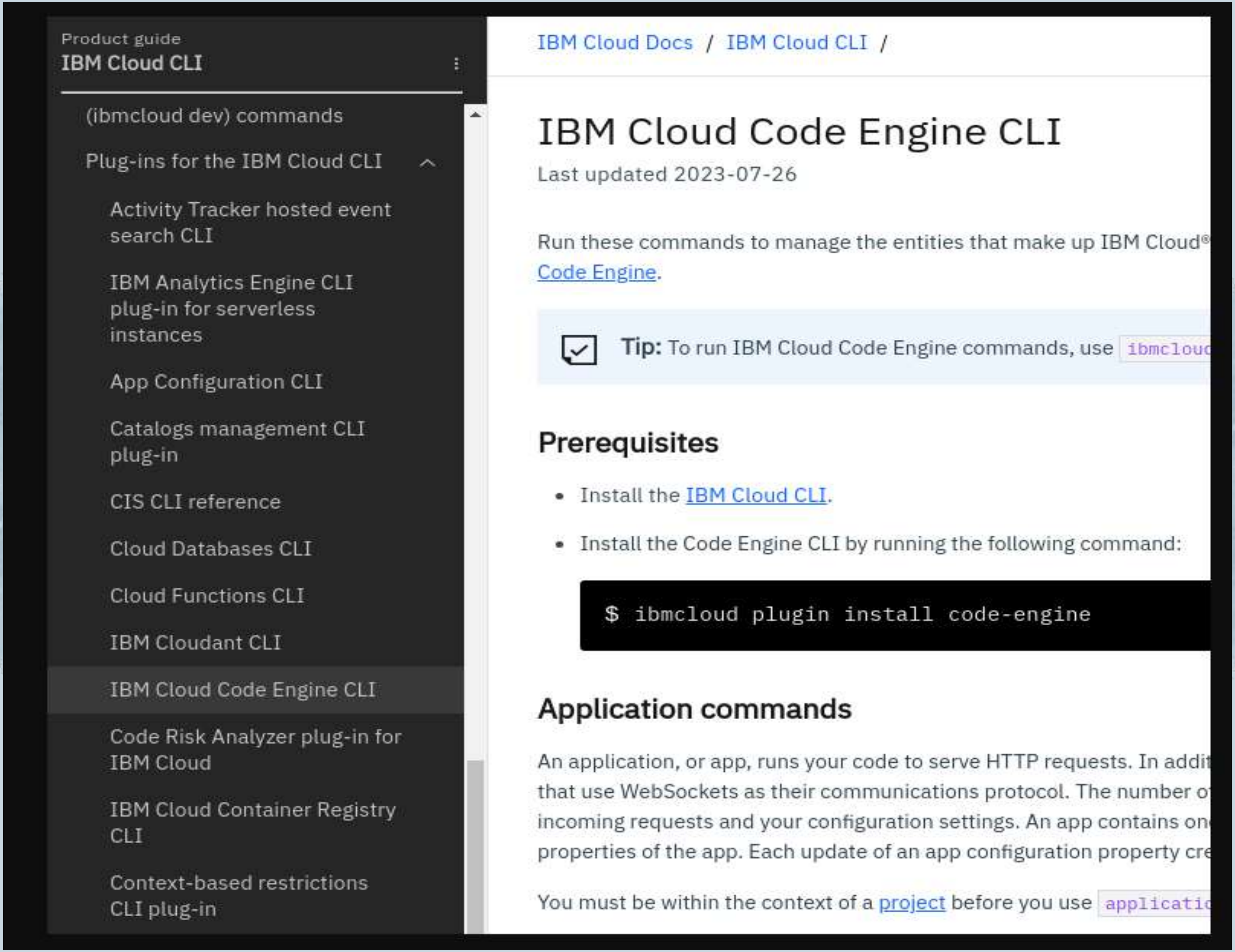
- `pipeline-get` : Fetch details for a pipeline.
- `pipeline-log` : Fetch most recent logs for a pipeline, stage, job, or job execution.
- `pipeline-run` : Invoke or run a pipeline.
- `pipeline-open` : Open the system web browser to a pipeline on IBM Cloud.



```
# Fetch toolchains as JSON
TOOLCHAINS="$(ibmcloud dev toolchains --json)"


# Parse the first toolchain name
TOOLCHAIN_NAME="$(echo $TOOLCHAINS | jq
.items[0].name -r)"


# Extract the pipeline id
PIPELINE_SERVICE="$(echo $TOOLCHAIN | jq
'.items[].services[] | select(.service_id ==
"pipeline")' -r)"
PIPELINE_ID="$(echo $PIPELINE_SERVICE | jq
.instance_id -r)"


#invoke the pipeline
ibmcloud dev pipeline-invoke $PIPELINE_ID
```



```
Welcome to IBM Cloud Shell!
Image version: 1.0.135

Note: Your Cloud Shell session is running in Frankfurt (eu-de). Your workspace includes 500 MB of temporary storage. This session will close after
 an hour of inactivity. If you don't have any active sessions for an hour or you reach the 50-hour weekly usage limit, your workspace data is remo
ved. To track your usage, go to Usage quota in the Cloud Shell menu.

Tip: Enter 'ibmcloud' to use the IBM Cloud CLI. The Frankfurt (eu-de) region is targeted by default. You can switch the region by running 'ibmclou
d target -r <region-name>'.

HLOESER@cloudshell:~$ ibmcloud plugin repo-plugins
Getting plug-ins from all repositories...

Repository: IBM Cloud
Status             Name                                            Versions                       Description
Update Available   cloud-databases[cdb]                            0.16.4, 0.16.3, 0.16.2...      Manage Cloud databases
Update Available   hpcs                                            0.1.0, 0.0.1                   Manage IBM Cloud Hyper Protect Crypto Services i
nstances
Update Available   cloudant[cl]                                    0.1.0, 0.0.9, 0.0.8...         Manage Cloudant service
Update Available   cloud-internet-services[cis]                    1.15.4, 1.15.3, 1.15.2...      Manage Cloud Internet Service
Update Available   key-protect[kp]                                 0.8.1, 0.8.0, 0.7.0...         Manage encryption keys on IBM Cloud
Installed          code-engine[ce]                                 1.45.3, 1.45.2, 1.45.1...      Manage Code Engine components
Installed          secrets-manager[sm]                             2.0.1, 2.0.0, 0.1.25...        Manage IBM Cloud Secrets Manager secrets and sec
ret groups.
Installed          doi[doi]                                        0.4.3, 0.4.2, 0.4.1...         Integrate with DevOps Insights service
Installed          tke                                             1.3.1, 1.3.0, 1.2.3...         Manage the master key of Cloud HSMs from Hyper P
rotect Crypto service
Installed          cloud-object-storage                            1.7.0, 1.6.0, 1.5.0...         Manage Cloud Object Storage service
Installed          event-streams[es]                               2.4.0, 2.3.2, 2.3.1...         Manage Event Streams service
Installed          power-iaas[pi]                                  0.4.8, 0.4.6, 0.4.4...         Manage Power Virtual Servers
Installed          vpc-infrastructure[infrastructure-service/is]   7.0.0, 6.16.1, 6.15.0...       Manage Virtual Private Cloud infrastructure serv
ice
Installed          schematics[sch]                                 1.12.10, 1.12.9, 1.12.8...     Managing IBM Cloud resources with Terraform
```


Product guide
IBM Cloud CLI
(ibmcloud dev) commands
Plug-ins for the IBM Cloud CLI
Activity Tracker hosted event search CLI
IBM Analytics Engine CLI plug-in for serverless instances
App Configuration CLI
Catalogs management CLI plug-in
CIS CLI reference
Cloud Databases CLI
Cloud Functions CLI
IBM Cloudant CLI
IBM Cloud Code Engine CLI
Code Risk Analyzer plug-in for IBM Cloud
IBM Cloud Container Registry CLI
Context-based restrictions CLI plug-in
IBM Cloud Docs / IBM Cloud CLI /

IBM Cloud Code Engine CLI

Last updated 2023-07-26

Run these commands to manage the entities that make up IBM Cloud®
Code Engine.

Tip: To run IBM Cloud Code Engine commands, use `ibmclouc`

Prerequisites

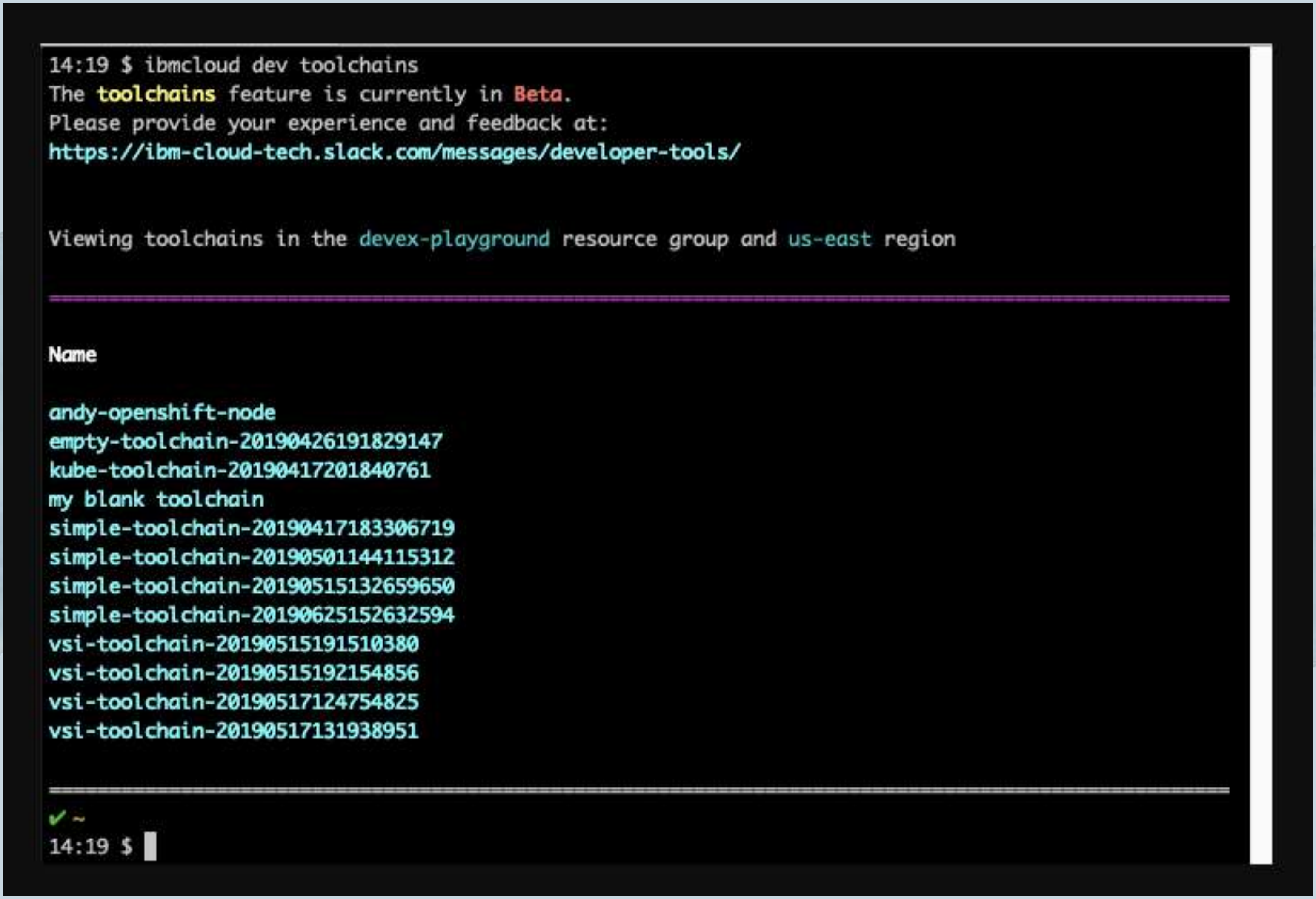
- Install the IBM Cloud CLI.
- Install the Code Engine CLI by running the following command:

```
$ ibmcloud plugin install code-engine
```

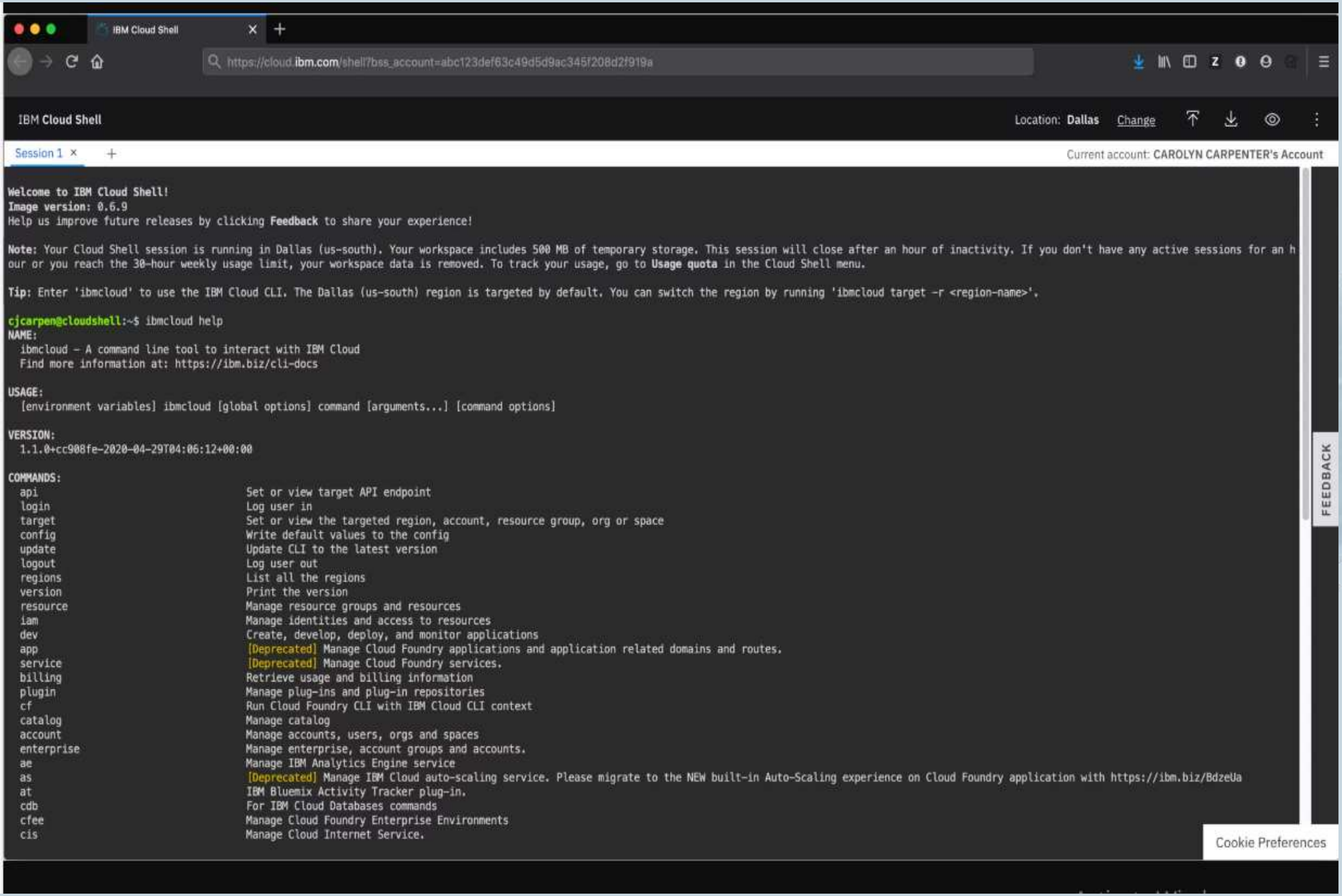
Application commands

An application, or app, runs your code to serve HTTP requests. In addit
that use WebSockets as their communications protocol. The number o
incoming requests and your configuration settings. An app contains on
properties of the app. Each update of an app configuration property cre

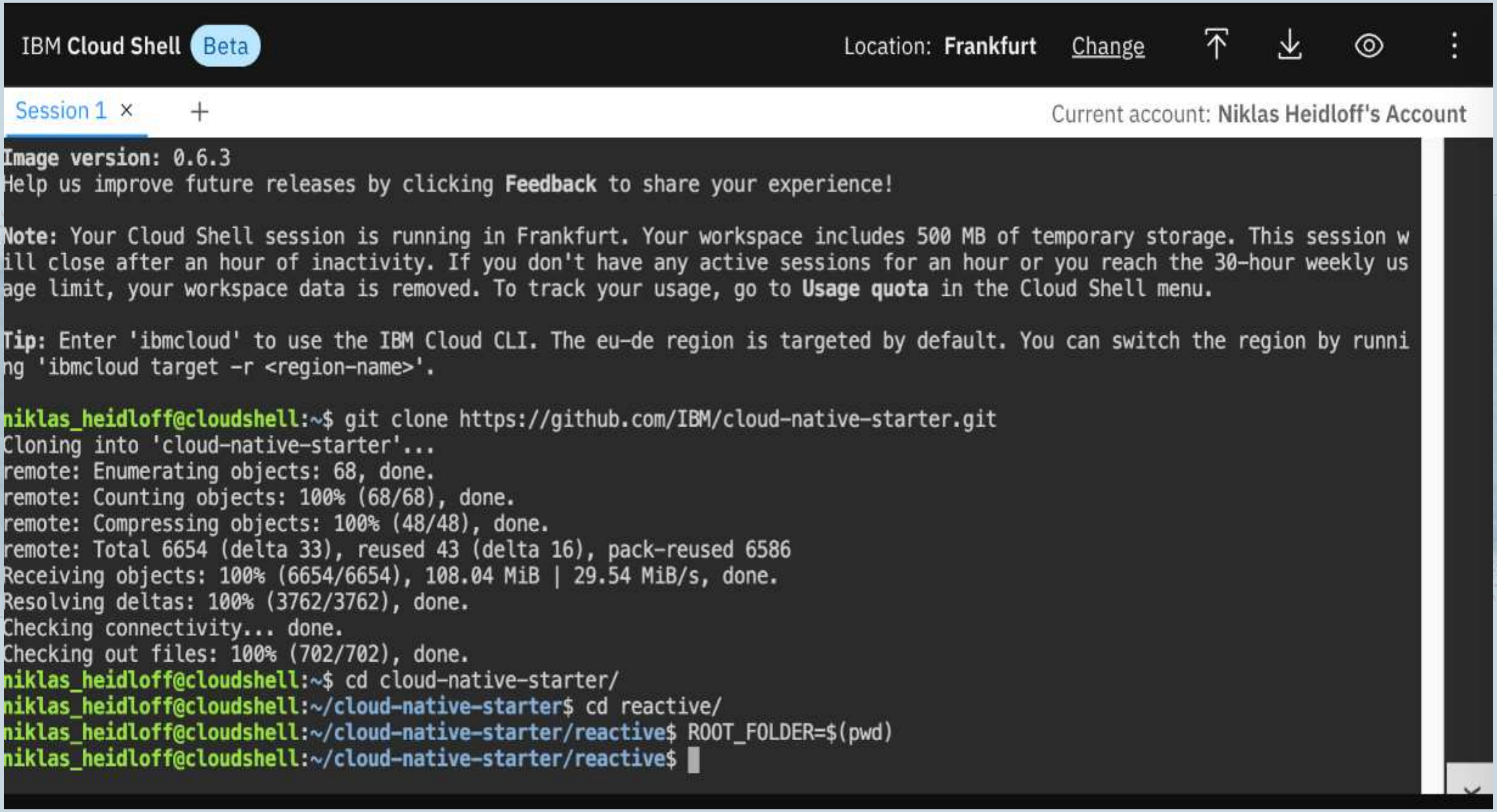
You must be within the context of a project before you use `applicatio`



```
14:19 $ ibmcloud dev toolchains
The toolchains feature is currently in Beta.
Please provide your experience and feedback at:
https://ibm-cloud-tech.slack.com/messages/developer-tools/


Viewing toolchains in the devex-playground resource group and us-east region

====================================================================================================


Name

andy-openshift-node
empty-toolchain-20190426191829147
kube-toolchain-20190417201840761
my blank toolchain
simple-toolchain-20190417183306719
simple-toolchain-20190501144115312
simple-toolchain-20190515132659650
simple-toolchain-20190625152632594
vsi-toolchain-20190515191510380
vsi-toolchain-20190515192154856
vsi-toolchain-20190517124754825
vsi-toolchain-20190517131938951

====================================================================================================
✔ ~
14:19 $
```


IBM Cloud Shell
https://cloud.ibm.com/shell?bss_account=abc123def63c49d5d9ac345f208d2f919a
IBM Cloud Shell
Location: Dallas
Change
Session 1
Current account: CAROLYN CARPENTER's Account
FEEDBACK
Cookie Preferences

```
Welcome to IBM Cloud Shell!
Image version: 0.6.9
Help us improve future releases by clicking Feedback to share your experience!

Note: Your Cloud Shell session is running in Dallas (us-south). Your workspace includes 500 MB of temporary storage. This session will close after an hour of inactivity. If you don't have any active sessions for an h
our or you reach the 30-hour weekly usage limit, your workspace data is removed. To track your usage, go to Usage quota in the Cloud Shell menu.

Tip: Enter 'ibmcloud' to use the IBM Cloud CLI. The Dallas (us-south) region is targeted by default. You can switch the region by running 'ibmcloud target -r <region-name>'.

cjcarpen@cloudshell:~$ ibmcloud help
NAME:
  ibmcloud - A command line tool to interact with IBM Cloud
  Find more information at: https://ibm.biz/cli-docs

USAGE:
  [environment variables] ibmcloud [global options] command [arguments...] [command options]

VERSION:
  1.1.0+cc908fe-2020-04-29T04:06:12+00:00

COMMANDS:
  api                                   Set or view target API endpoint
  login                                 Log user in
  target                                Set or view the targeted region, account, resource group, org or space
  config                                Write default values to the config
  update                                Update CLI to the latest version
  logout                                Log user out
  regions                               List all the regions
  version                               Print the version
  resource                              Manage resource groups and resources
  iam                                   Manage identities and access to resources
  dev                                   Create, develop, deploy, and monitor applications
  app                                   [Deprecated] Manage Cloud Foundry applications and application related domains and routes.
  service                               [Deprecated] Manage Cloud Foundry services.
  billing                               Retrieve usage and billing information
  plugin                                Manage plug-ins and plug-in repositories
  cf                                    Run Cloud Foundry CLI with IBM Cloud CLI context
  catalog                               Manage catalog
  account                               Manage accounts, users, orgs and spaces
  enterprise                            Manage enterprise, account groups and accounts.
  ae                                    Manage IBM Analytics Engine service
  as                                    [Deprecated] Manage IBM Cloud auto-scaling service. Please migrate to the NEW built-in Auto-Scaling experience on Cloud Foundry application with https://ibm.biz/BdzeUa
  at                                    IBM Bluemix Activity Tracker plug-in.
  cdb                                   For IBM Cloud Databases commands
  cfee                                  Manage Cloud Foundry Enterprise Environments
  cis                                   Manage Cloud Internet Service.
```



```
Image version: 0.6.3
Help us improve future releases by clicking Feedback to share your experience!

Note: Your Cloud Shell session is running in Frankfurt. Your workspace includes 500 MB of temporary storage. This session w
ill close after an hour of inactivity. If you don't have any active sessions for an hour or you reach the 30-hour weekly us
age limit, your workspace data is removed. To track your usage, go to Usage quota in the Cloud Shell menu.

Tip: Enter 'ibmcloud' to use the IBM Cloud CLI. The eu-de region is targeted by default. You can switch the region by runni
ng 'ibmcloud target -r <region-name>'.

niklas_heidloff@cloudshell:~$ git clone https://github.com/IBM/cloud-native-starter.git
Cloning into 'cloud-native-starter'...
remote: Enumerating objects: 68, done.
remote: Counting objects: 100% (68/68), done.
remote: Compressing objects: 100% (48/48), done.
remote: Total 6654 (delta 33), reused 43 (delta 16), pack-reused 6586
Receiving objects: 100% (6654/6654), 108.04 MiB | 29.54 MiB/s, done.
Resolving deltas: 100% (3762/3762), done.
Checking connectivity... done.
Checking out files: 100% (702/702), done.
niklas_heidloff@cloudshell:~$ cd cloud-native-starter/
niklas_heidloff@cloudshell:~/cloud-native-starter$ cd reactive/
niklas_heidloff@cloudshell:~/cloud-native-starter/reactive$ ROOT_FOLDER=$(pwd)
niklas_heidloff@cloudshell:~/cloud-native-starter/reactive$ 
```

Conclusion

In conclusion, the IoT data processing project represents a significant step forward in creating intelligent, responsive, and user-centric smart home systems. Through a meticulous design thinking process and systematic development phases, the project successfully addresses the complexities of integrating diverse IoT devices while ensuring scalability, flexibility, and real-time responsiveness.

Reference

The IBM Cloud developer experience team is pleased to announce the latest version of the IBM Cloud Developer Tools CLI.