

PROJET SI

Software Frugality in an Accelerating World



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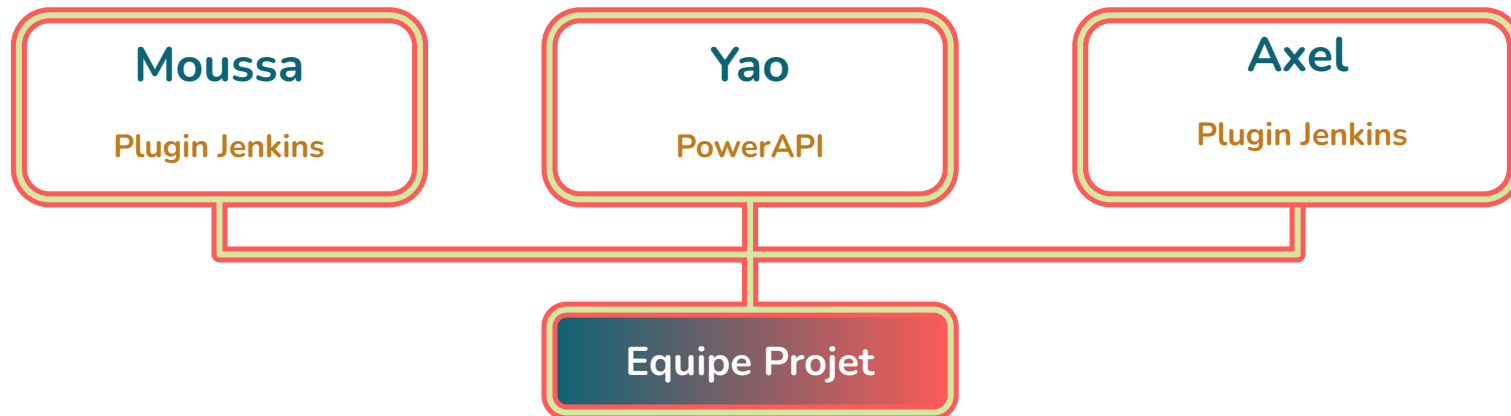


Université
de Rennes

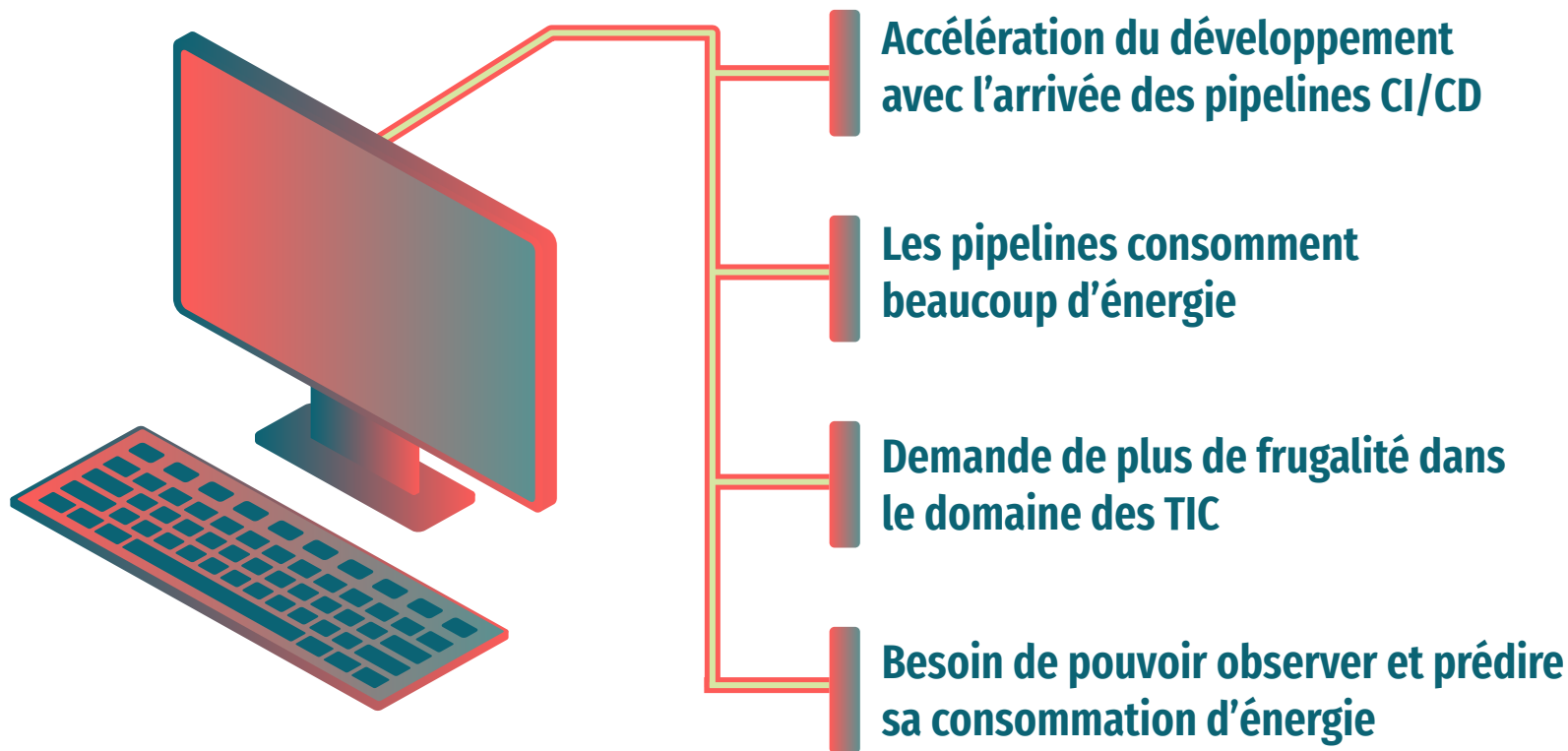
Inria

Axel BERNARD
Paul-David KONAN
Moussa BERTHE
(Ulysse-Néo LARTIGAUD)
(Ariane NICOLAS)

Organisation de l'équipe



Contexte du Projet



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- Analyse et Conception du Projet
- Organisation du Processus de Développement
- Rétrospective du Projet
- Démonstration
- Conclusion





Analyse et Conception du projet



Analyse du Projet

Objectifs

Surveillance de l'utilisation énergétique d'énergie pendant les builds Jenkins à travers un plugin Jenkins

Rapport détaillé de la consommation d'énergie par build et par étape sous la forme de graphiques

Choix

Récupérer les données en énergie (joules) et en puissance (watts)



Conception du Projet

Acquisition des Données

- Fichier RAPL
- Lecture du fichier en direct
- Mesure des données en utilisant l'Outil PowerAPI
- Récupération des données depuis la Base de Données InfluxDB

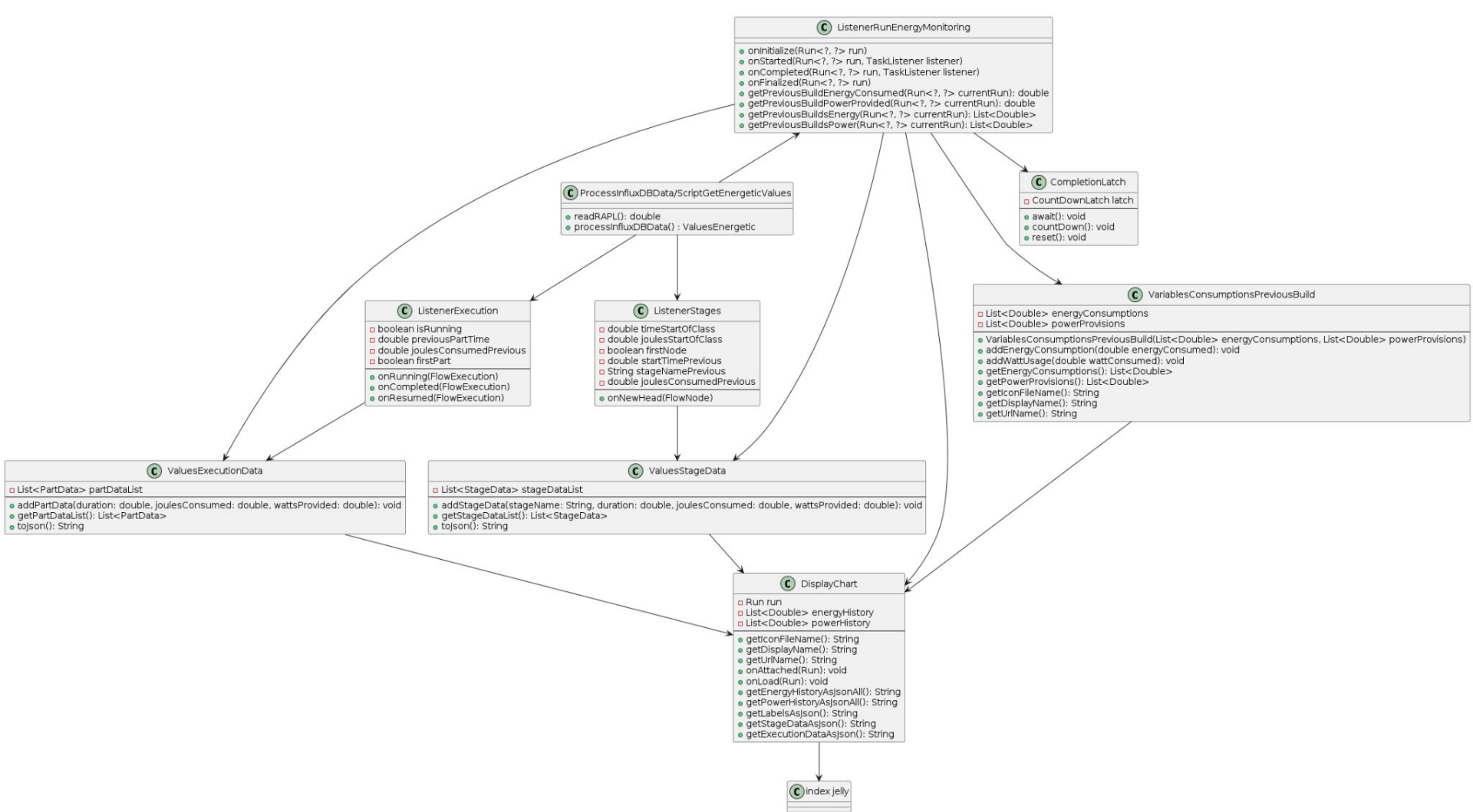


Conception du Projet

Plugin Jenkins :

- Listeners : Run, Execution & Stages
- Actions : Consumption, PreviousConsumptions, Execution & Stages
- DisplayChart (RunAction2)
- Index.jelly

- CompletionLatch
- ScriptGetEnergeticValues
- ProcessInfluxDBData



Architecture globale du système

1

Le plugin Jenkins est téléchargé par l'utilisateur

Lors de l'exécution d'un build, il déploie les conteneurs de Power API et les lance

2

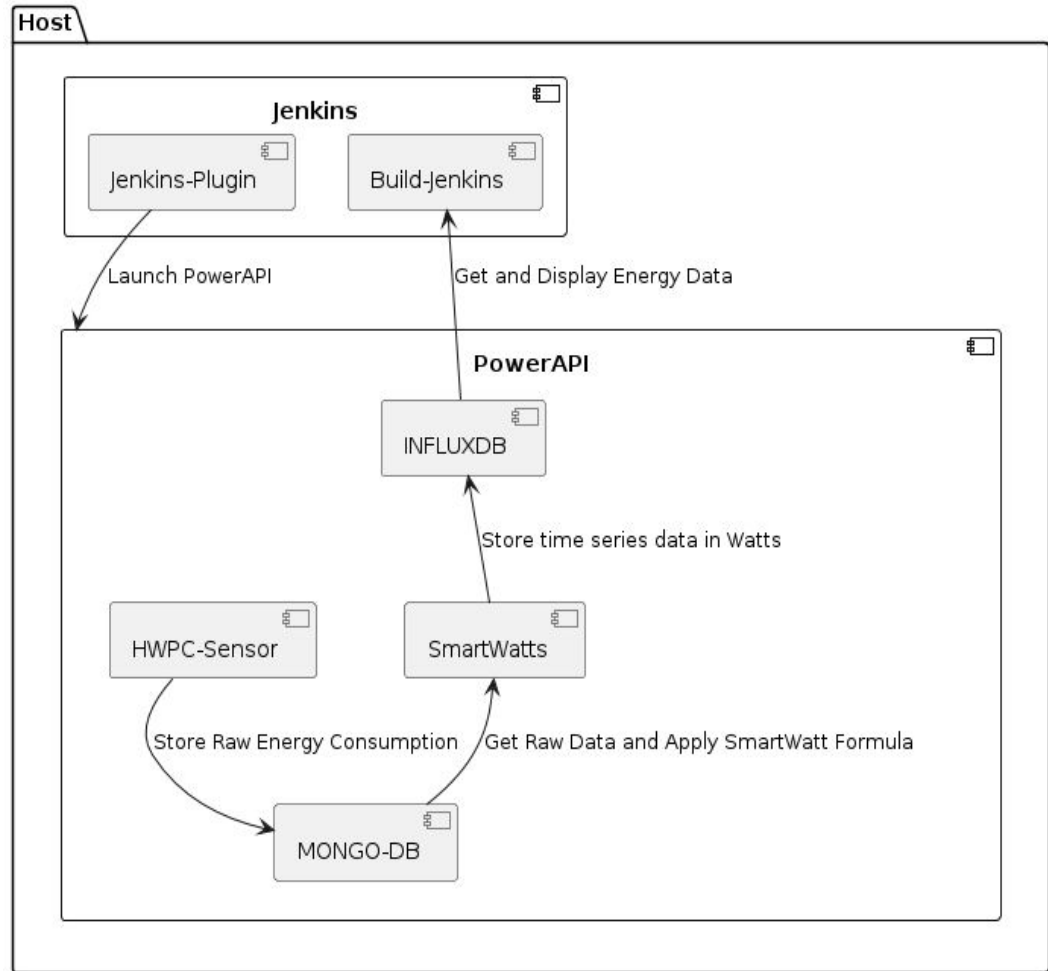
PowerApi collecte les données de consommation du build

3

Les données de consommation traduites en Watts sont stockées dans une base de donnée InfluxDB

4

Les données sont visualisées sous formes de graphes sur la page du Build Jenkins





Organisation du Processus de Développement





Outils Utilisés

Jenkins:

- Outil d'Intégration Continue

Github:

- Outil de Versionning

PowerAPI:

- Outil permettant la mesure de la consommation énergétique de la machine

GoogleDrive:

- Outil permettant de travailler sur la documentation en collaboration



Méthode Agile

Définition des sprints:

- Durée des sprints définis en fonctions des séances et des tâches restantes

Réunions de planification:

- Planification des tâches pour chaque sprint dans le Backlog

Rétrospectives des sprints:

- Discussion sur ce qui a bien fonctionné et ce qui doit être amélioré.
- Rapport journalier / Complétion du Backlog (Introspection)

Contenu des sprints

sprint 0:

- Prendre connaissance des différents outils requis durant le projet et la configuration de l'environnement de travail;

sprint 1:

- Acquérir les données de mesures énergétiques depuis Jenkins

sprint 2:

- Avoir accès à la fonctionnalité précédente via un plugin Jenkins pour l'ajouter facilement à mes projets;
- Afficher la consommation sous forme de graphes;

sprint 3:

- Sauvegarder les données de consommation pour voir leur évolution;
- Afficher la consommation de chaque stage d'une pipeline;

Problèmes rencontrés

- Problème pour identifier le pid de Jenkins
- La surveillance doit être lancée avant même le début du build

Solutions choisies

- Changement du backlog pour commencer à développer Jenkins avec la méthode trouver au sprint 1 bien que moins précise
- Séparation en 2 pôles :
 - Essais PowerAPI
 - Développement Jenkins

Backlog

1	As a developer I want to know the total energy consumption of a specific build (written in the console).	1. Establish a mechanism to initiate consumption measurement with each Jenkins build. (Bash script)	4h30	Done	Done	Moussa Axel	Moussa Axel	14h	Des difficultés ont été éprouvées demandant de faire de plus amples recherches. Plusieurs pistes ont donc explorées avant d'en arriver à la solution choisie.
		2. Know how to collect informations about a build during running	4h	Done	Done	David	David	5h	Plus longue que prévue due à un manque d'information sur le sujet. Nous avons sous-estimé le temps nécessaire.
		3. Develop a way to run the bash script with a Jenkins plugin	1h	Done	Done	Axel	Axel	2h30	Estimation dépassée du fait d'une mauvaise estimation au départ.
		4. Develop a way to format energy consumption data in watts before storing it.	2h	Done	Done	Axel	Axel	1h	Il ne s'agissait que d'une formule de physique qui transforme l'énergie (joule) en puissance (watt)
		5. Show total energy consumption in the Jenkins build output console.	4h	Done	Done	David Axel	David Axel	10h	Nous avons sous-estimé le temps pour l'implémentation.
2	As a developer I want to have access to the previous feature through a Jenkins Plugin to easily add it to my projects	Create a blank plugin and set up the environment	1h30	Done	Done	Axel	Axel	2h (S1)	Conforme à ce qui était prévu dans les choses à réaliser
		Integrate the feature that gives the consumption into this plugin	1h	Done	Done	Moussa Axel	Moussa Axel	2h (S1) 7h00 (S2)	Plus facile que prévu (notamment dû à ce qui a été mis en place précédemment). Le plugin peut désormais s'exporter facilement afin d'être utilisé sur un projet extérieur.
		Create a process to give access to this plugin in any project	6h	Done	Done	David	Axel	2h30 (S1) 1h (S2)	Utilisation d'une librairie que nous ne connaissons pas, mais pas non plus très difficile à appréhender. (Ch)
2	As a developer I want to have access to this total consumption displayed in a dedicated Jenkins tab presented as a chart.	Develop UI components for energy graphs	4h	Done	Done	Axel	Moussa Axel	3h (S2) 2h	Conforme à ce annoncé.
		Manage the integration of consumption data	3h	Done	Done	Moussa	Axel	3h (S3)	
2		Get the builds energy consumption and identifying the consumption for each build through Grafana	5h	Done	Done	David	David	5h(S1)	projet dans Grafana mais lors de l'identification de de l'énergie pour chaque build, j'ai rencontré un problème



Vérification et Validation

Tests Unitaires:

- Tests unitaires avec JUnit sur nos classes principales

Tests Jenkins:

- Test des fonctionnalités propres à Jenkins sur des simulations de projets :
 - Freestyle
 - Pipeline



Déploiement

Environnement de développement :

Outils et technologies utilisés :

- Maven, JUnit
- Jenkins
- Docker

Processus de déploiement :

Étapes pour déployer le plugin dans un environnement Jenkins :

- mvn package
- Manage Jenkins -> Plugins - >Advanced Settings
- Déposer le fichier .hpi du plugin
ou
- Utiliser l'URL

https://settled-leopard-flowing.ngrok-free.app/energy_checker.hpi



Rétrospective du projet



Rétrospectives

Réussites:

- Récupération des Informations Energétiques pour la pipeline entière
- Intégration de PowerAPI au plugin

Défis:

- Bugs
- Génération de la Machine
- Installation de PowerAPI

Améliorations:

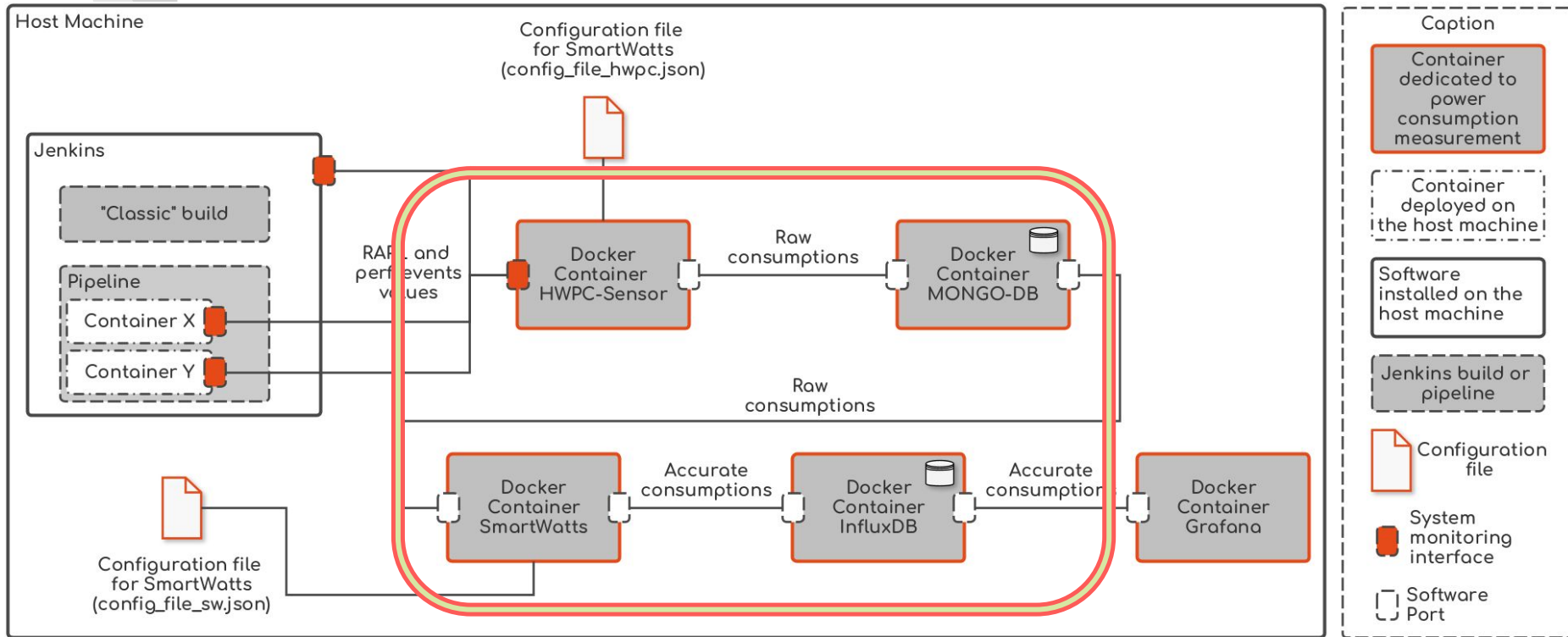
- Linter VSCode
- Onglet Récapitulatif
- Prédiction de la consommation



Démonstration

Conclusion

Base de l'architecture : PowerAPI - Configurator



```
lauching lectureConsummation()
end of lectureConsummation()
startTime = 1.716674302877E12
startConsumption = 22756.119539
endTime = 1.716674342679E12
endConsumption = 23049.245498
Consummation d'énergie pendant le build : 293.12595900000009 Joules
Puissance mobilisé lors du build : 7.36460376362999 Watts
previousBuildConsumption = 0.0
previousBuildProvision = 0.0
History of Energy Consumptions Updated: [293.12595900000009]
History of Power Usages Updated: [7.36460376362999]
Launching chart
Running 0,101 seconds, provided 5.716138613862175 watts and consumed 0.57733000000000745 joules
Part started at: 39,098 seconds
Finished: SUCCESS
```

Organisation de l'équipe

Ariane

Scrum Master
Test de PowerAPI

Ulysse-Néo

Design de l'architecture
Premier Linter VSCode

Axel

Recherches sur les plugins
Premier Plugin Jenkins

Equipe Projet

Moussa

Test de PowerAPI
Diagrammes de séquence

Paul-David

Test de PowerAPI
Diagrammes de séquence

Data migration process infographics

45%

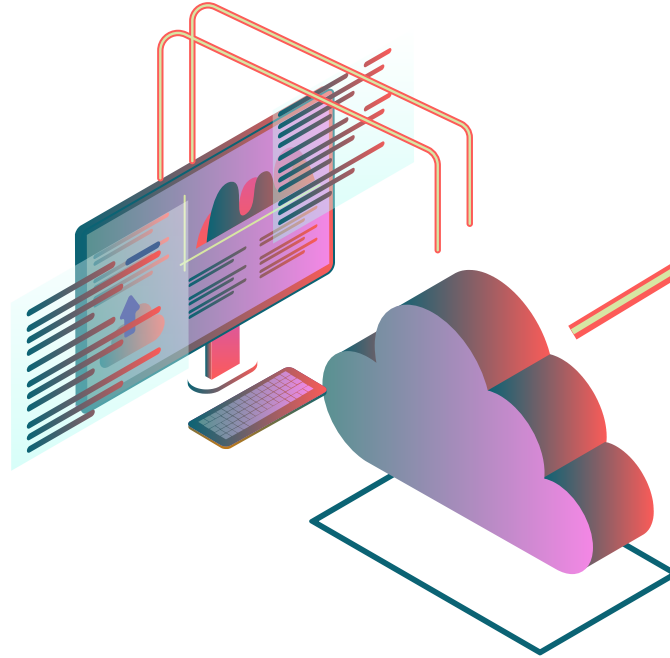
Mercury

It's the closest planet to the Sun and the smallest one in the Solar System—it's only a bit larger than the Moon

55%

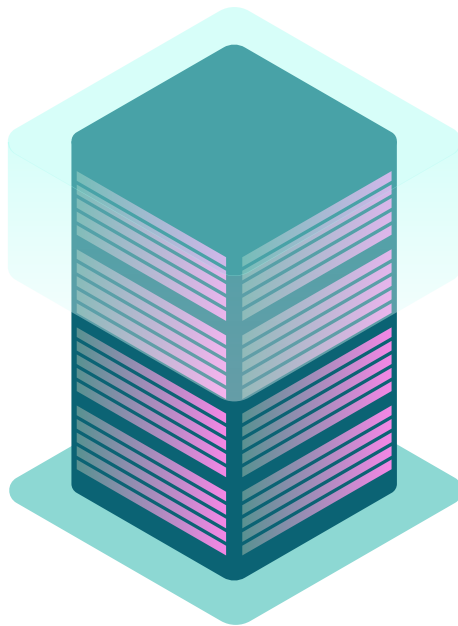
Venus

Venus has a beautiful name and is the second planet from the Sun. It's terribly hot, even hotter than Mercury





Conclusion





USER STORIES

Connaître la consommation
énergétique totale de
l'exécution d'un build

Afficher cette consommation
dans un onglet dédié de
Jenkins sous forme de graphe



Connaître la consommation
d'un processus en particulier
du build

Visualiser l'évolution de la
consommation énergétique au
fil des builds



Prédire la consommation
énergétique d'un projet

Obtenir des conseils et des
bonnes pratiques



Data migration process infographics

Plugin Jenkins

- Création d'un plugin Jenkins qui mesure la consommation énergétique d'un build.
- Mise en place d'un outil externe pour visualiser l'évolution de cette consommation dans le temps.

Neptune

Neptune is the farthest planet from the Sun. It's really cold there

Mercury

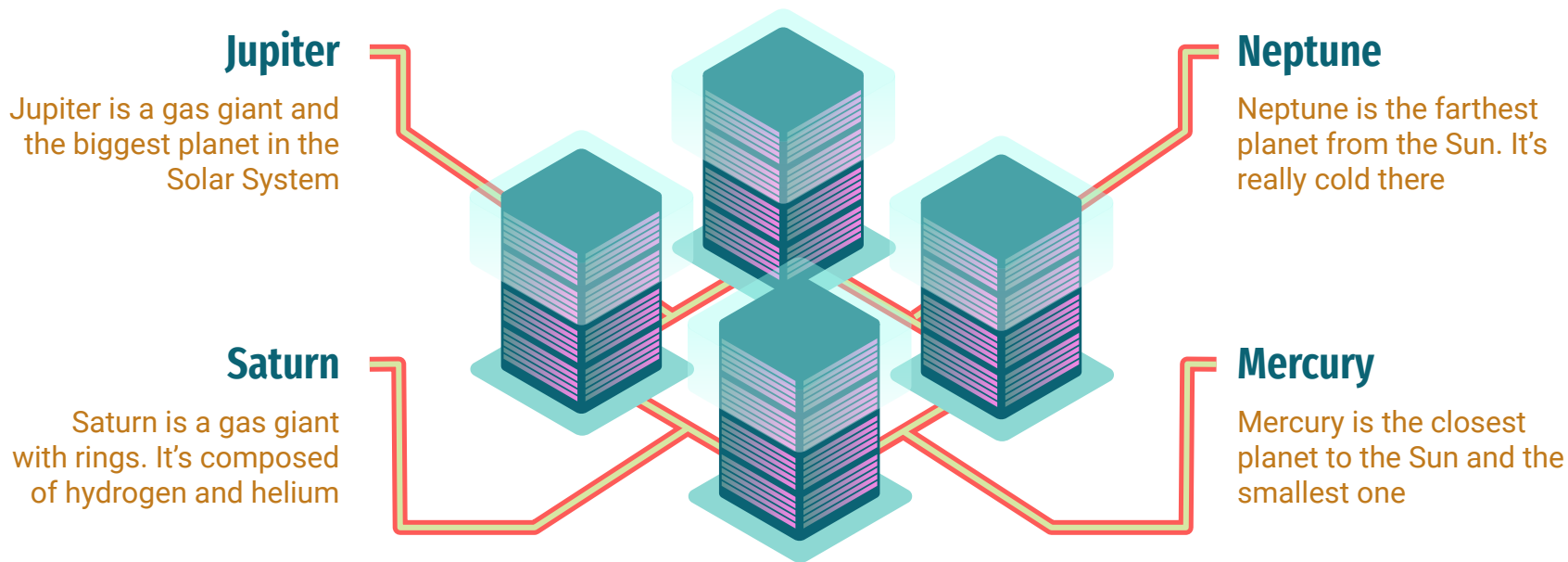
Mercury is the closest planet to the Sun and the smallest one

Earth

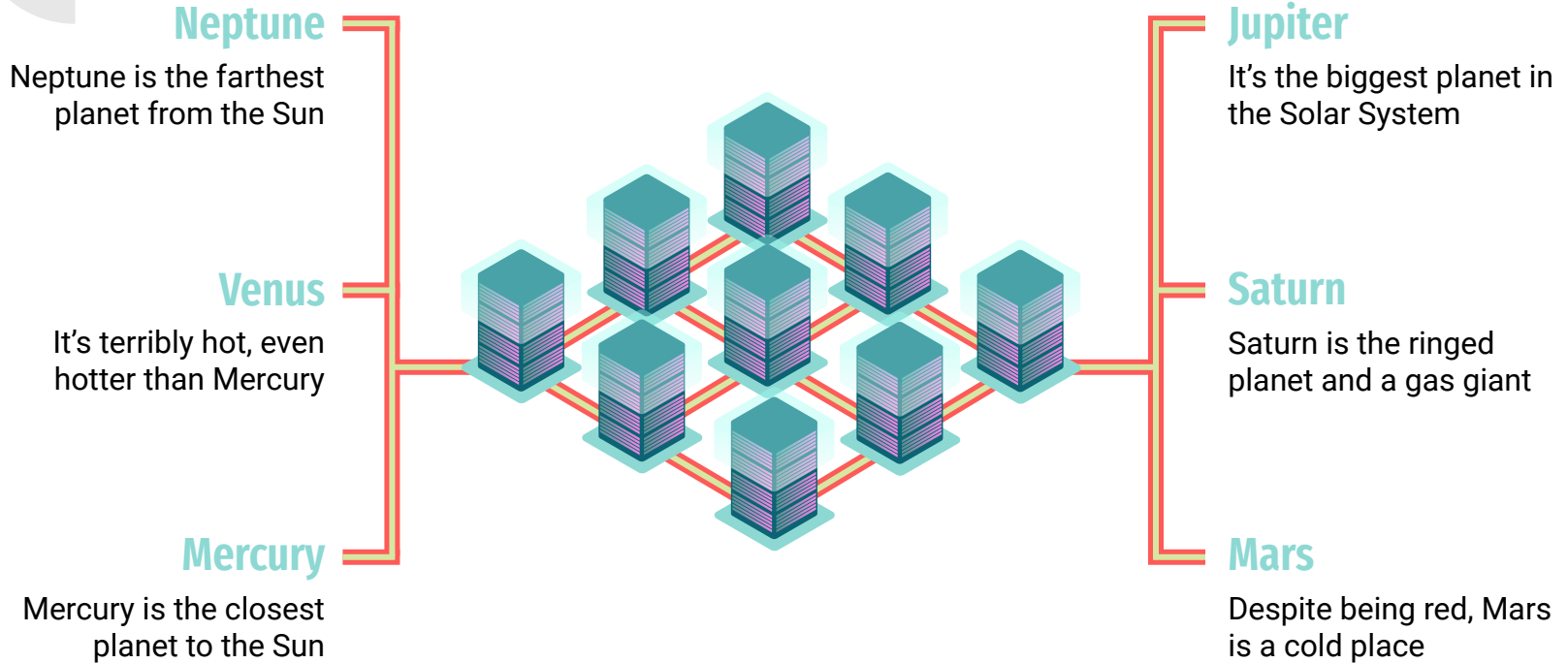
Earth is the third planet from the Sun and where we all live



Data migration process infographics



Data migration process infographics



Data migration process infographics

Neptune

Neptune is the farthest planet from the Sun

Venus

It's terribly hot, even hotter than Mercury

Mercury

Mercury is the closest planet to the Sun

The Sun

It's the star at the center of the Solar System

Jupiter

It's the biggest planet in the Solar System

Saturn

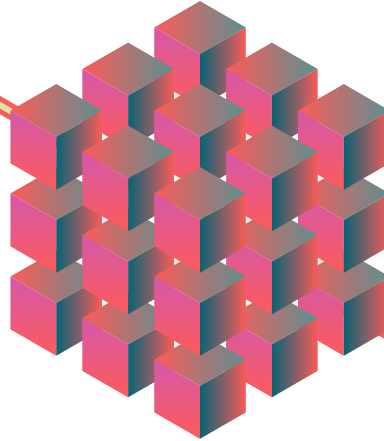
Saturn is the ringed planet and a gas giant

Mars

Despite being red, Mars is a cold place

The Moon

The Moon is Earth's only natural satellite



Data migration process infographics

Jupiter

Jupiter is a gas giant and the biggest planet in the Solar System

Saturn

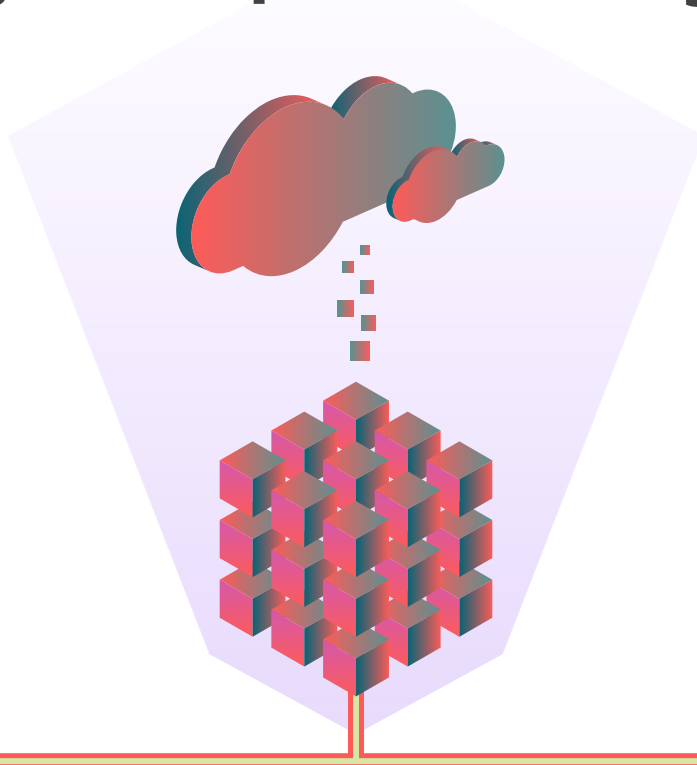
Saturn is a gas giant with rings. It's composed of hydrogen and helium

Neptune

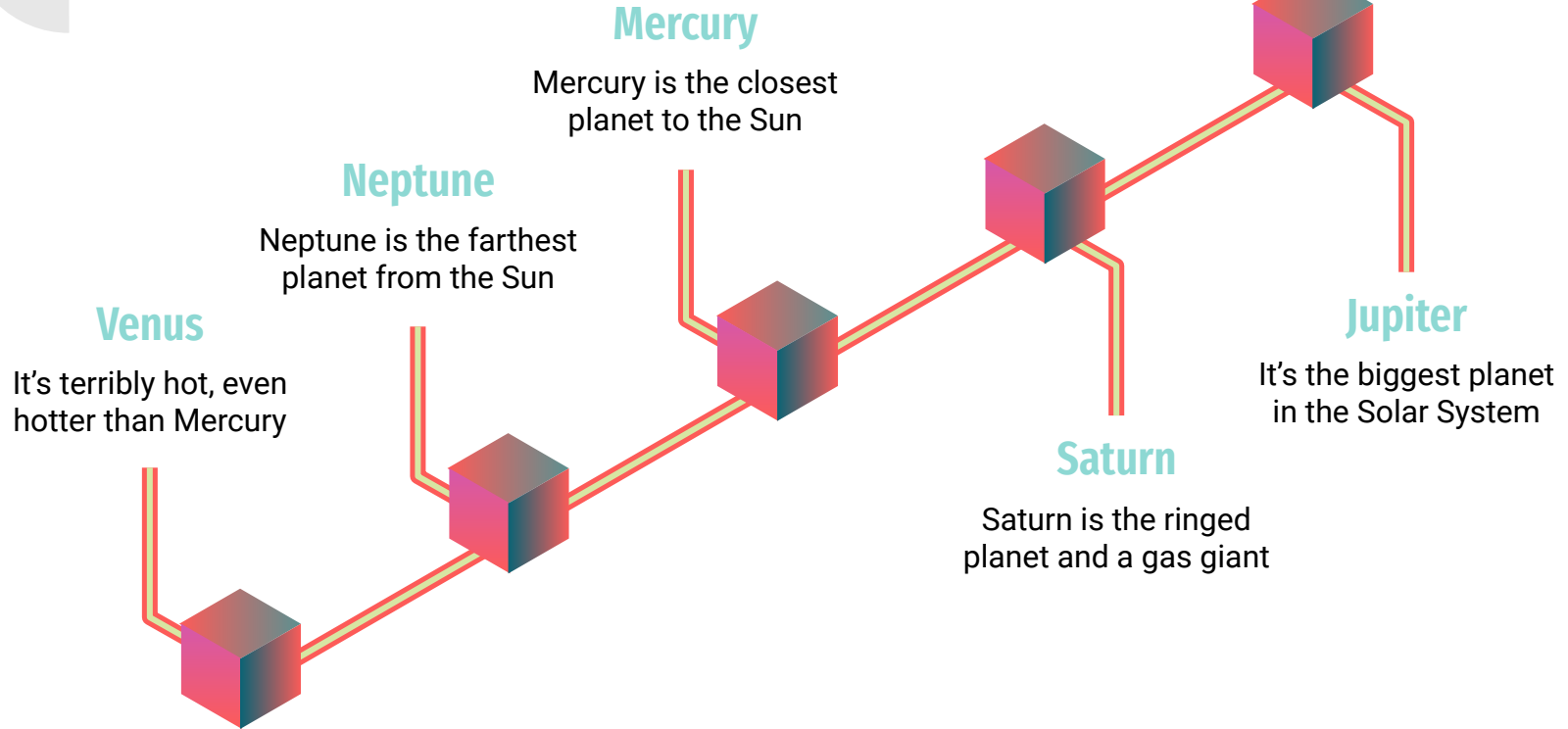
Neptune is the farthest planet from the Sun. It's really cold there

Mercury

Mercury is the closest planet to the Sun and the smallest one



Data migration process infographics



Data migration process infographics

01

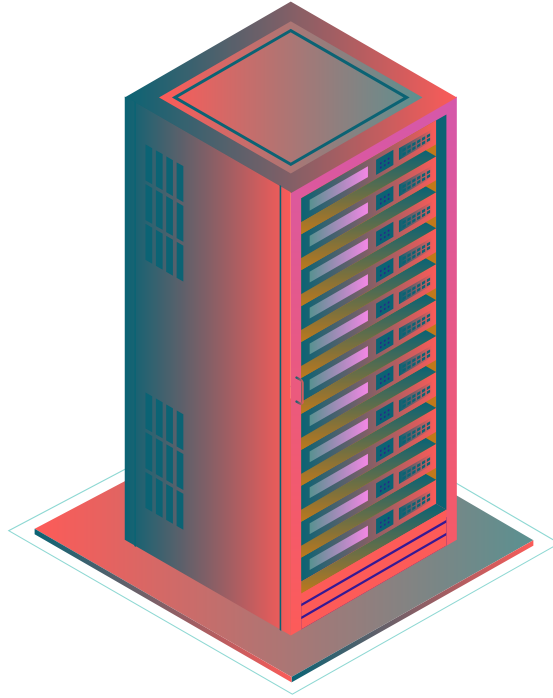
Jupiter

Jupiter is a gas giant and the biggest planet in the Solar System

02

Mars

Despite being red, Mars is actually a very cold place



03

Saturn

Saturn has several rings. It's composed of hydrogen and helium

04

Venus

Venus has a beautiful name and is the second planet from the Sun

Data migration process infographics



35%

Neptune

Neptune is the farthest planet from the Sun. It's really cold there

30%

Saturn

Saturn is the ringed planet. It's a gas giant, composed of hydrogen and helium

23%

Jupiter

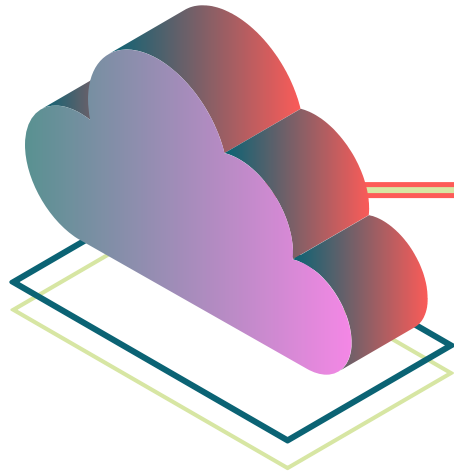
Jupiter is a gas giant and the biggest planet in the entire Solar System

12%

Venus

Venus has a beautiful name and is the second planet from the Sun

Data migration process infographics



Neptune

Neptune is the farthest planet from the Sun

Jupiter

Is the biggest planet in the Solar System

Venus

Venus is terribly hot, even hotter than Mercury

Saturn

Saturn is the ringed planet and a gas giant

Earth

Earth is the beautiful planet where we all live

Mercury

Mercury is the closest planet to the Sun

Data migration process infographics



Neptune

Neptune is the farthest planet from the Sun



Jupiter

It's the biggest planet in the Solar System



Venus

It's terribly hot, even hotter than Mercury



Saturn

Saturn is a gas giant with several rings



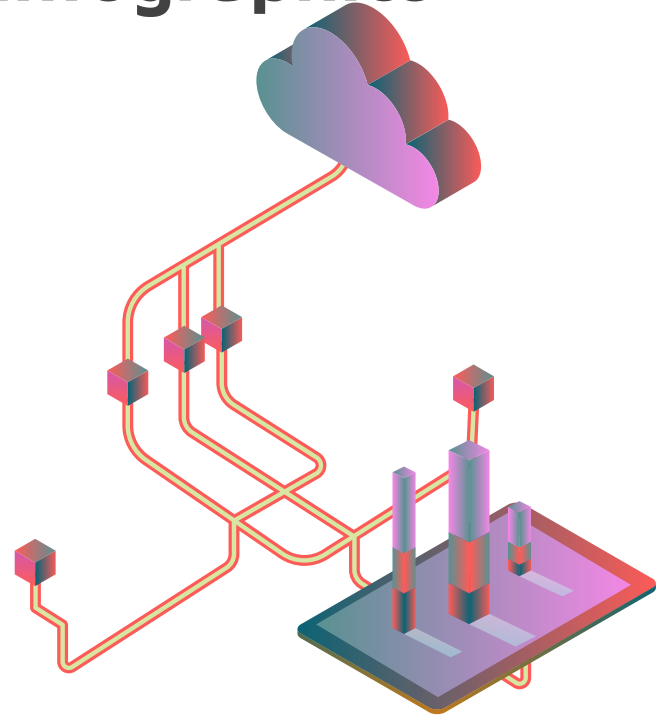
Mercury

Mercury is the closest planet to the Sun



Mars

Despite being red, Mars is a cold place



Data migration process infographics



Venus

Venus has a beautiful name and is the second planet from the Sun

Jupiter

Jupiter is a gas giant and the biggest planet in the Solar System

Mercury

Mercury is the closest planet to the Sun and the smallest one



Data migration process infographics

Ceres is located in the main asteroid belt

Planning



Neptune is the farthest planet from the Sun

Data backup



Venus is the second planet from the Sun

Execution



Mercury is the closest planet to the Sun

Post-mig audit



Data profiling

Jupiter is the biggest planet of them all



Migration design

Despite being red, Mars is a cold place



Testing

Saturn is the ringed planet and a gas giant



Data migration process infographics



Introduction of an additional system

Ceres is located in the main asteroid belt

Shift to a centralized base

Despite being red, Mars is a cold place

Storage capacity expansion

Mercury is the closest planet to the Sun

Moving data to the cloud

Neptune is the farthest planet from the Sun

Legacy system modernization

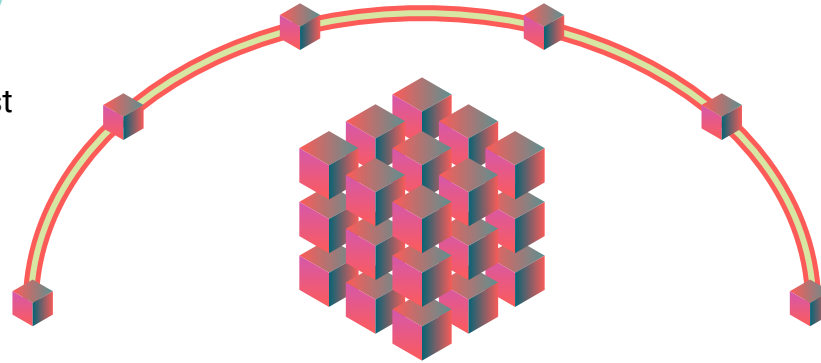
Venus is the second planet from the Sun

Mergers and acquisitions

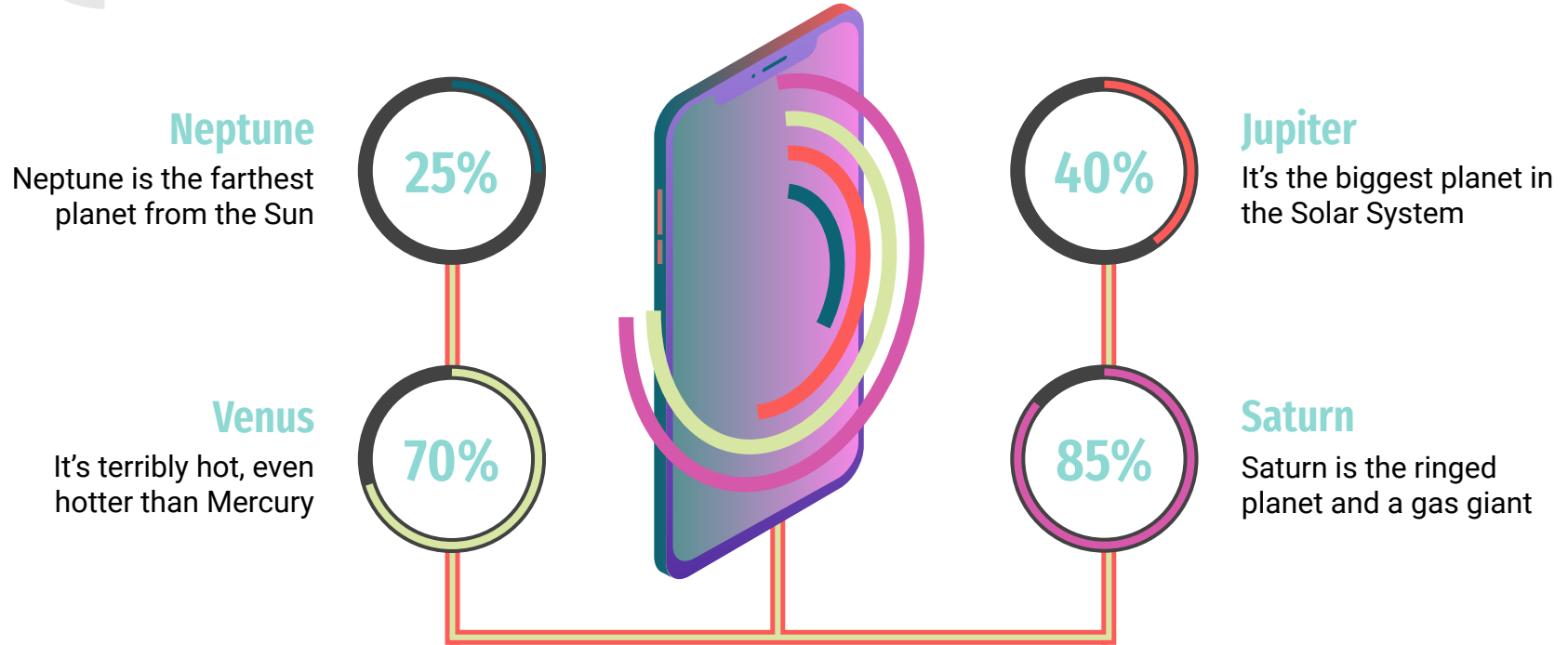
Saturn is the ringed planet and a gas giant

Historical data

Jupiter is the biggest planet of them all



Data migration process infographics





Data migration process infographics

Data	From	To	Data volume
Mars	Admin system 1	Cloud service 1	1.8 GB
Mercury	Admin system 2	Cloud service 2	25.4 GB
Jupiter	Admin system 3	Cloud service 3	12.8 GB
Saturn	Admin system 4	Cloud service 4	59,1 GB
Venus	Admin system 5	Cloud service 5	2.9 GB

Data migration process infographics



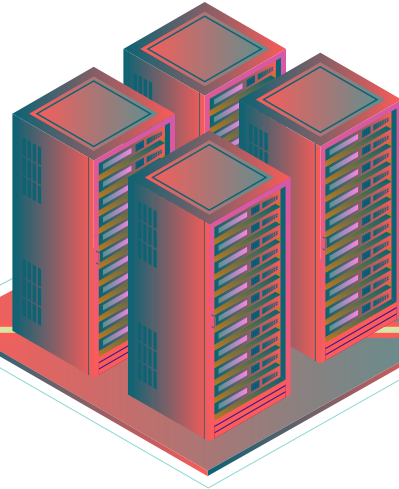
Jupiter

Jupiter is a gas giant and the biggest planet in the Solar System



Saturn

Saturn is a gas giant with ring. It's composed of hydrogen and helium



Neptune

Neptune is the farthest planet from the Sun. It's really cold there

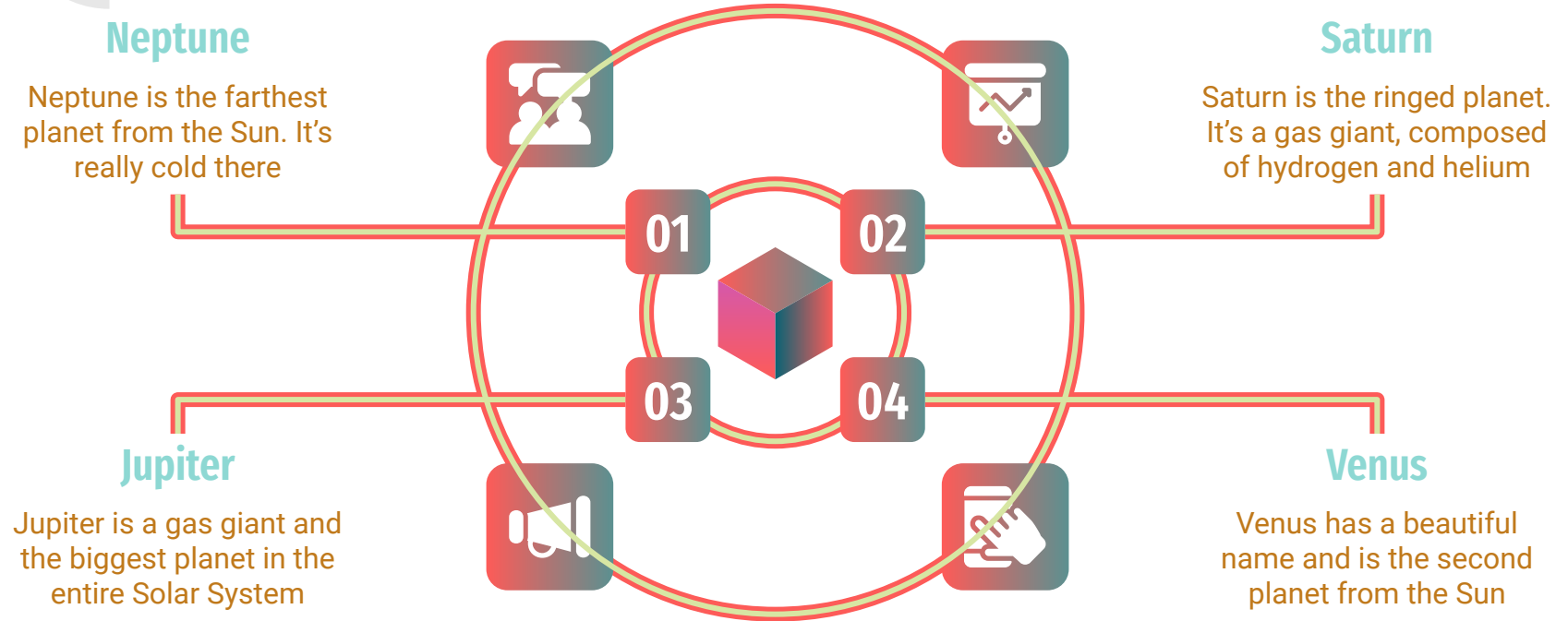


Mercury

Mercury is the closest planet to the Sun and the smallest one



Data migration process infographics



Data migration process infographics

Process	Description	Risk
Phase 1	Despite being red, Mars is a cold place	<div><div></div><div></div><div></div></div>
Phase 2	Mercury is the closest planet to the Sun	<div><div></div><div></div><div></div></div>
Phase 3	Neptune is the farthest planet from the Sun	<div><div></div><div></div><div></div></div>
Phase 4	Saturn is the ringed planet and a gas giant	<div><div></div><div></div><div></div></div>
Phase 5	Venus is terribly hot, even hotter than Mercury	<div><div></div><div></div><div></div></div>

Data migration process infographics



35%

A square progress bar with a red-to-teal gradient. The first 35% of the bar is filled with a lighter yellow-green color. Below the square is a thin horizontal line with the same color gradient and fill pattern.

Neptune

Neptune is the farthest planet from the Sun. It's really cold there



55%

A square progress bar with a red-to-teal gradient. The first 55% of the bar is filled with a lighter yellow-green color. Below the square is a thin horizontal line with the same color gradient and fill pattern.

Mercury

Mercury is the closest planet to the Sun and the smallest one



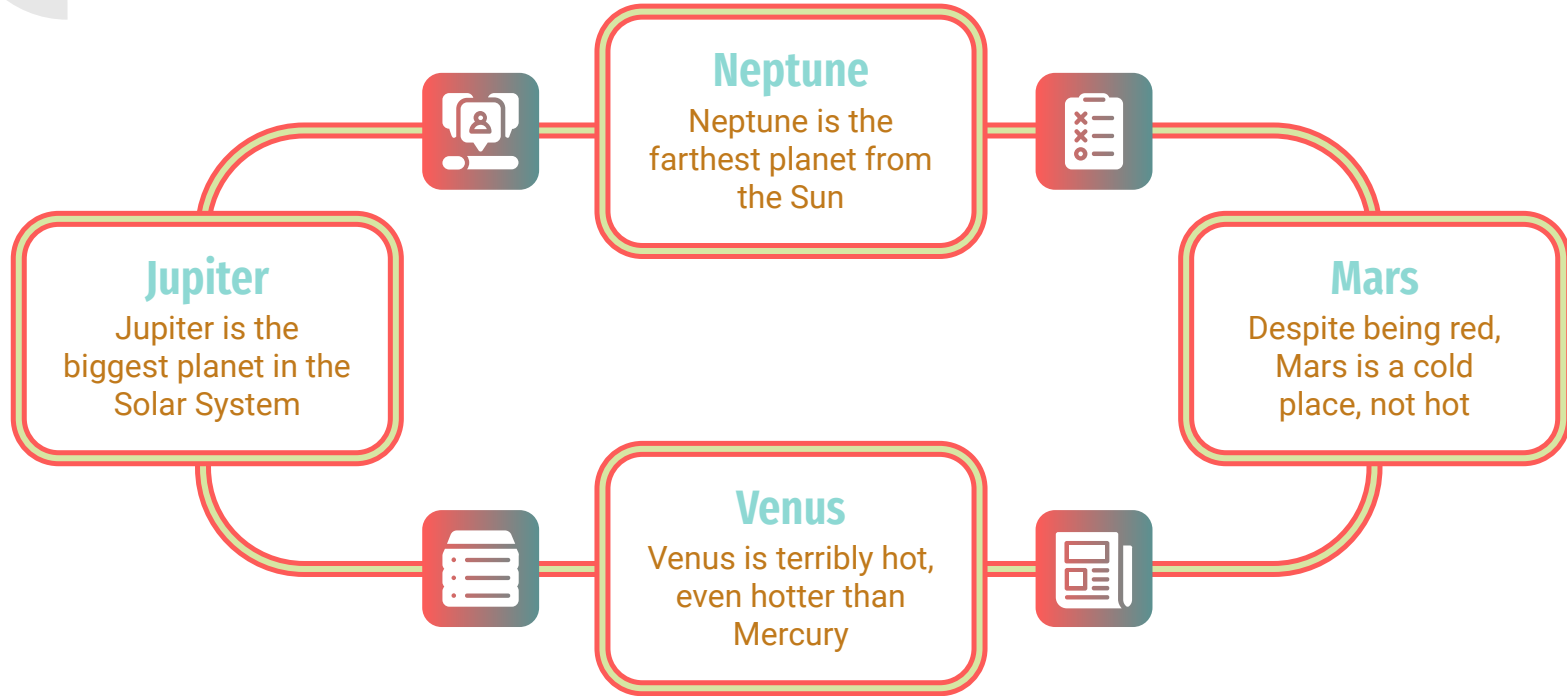
80%

A square progress bar with a red-to-teal gradient. The first 80% of the bar is filled with a lighter yellow-green color. Below the square is a thin horizontal line with the same color gradient and fill pattern.

Jupiter

Jupiter is a gas giant and the biggest planet in the Solar System

Data migration process infographics





Data migration process infographics

Neptune

Neptune is the farthest planet from the Sun

Venus

It's terribly hot, even hotter than Mercury

Mercury

Mercury is the closest planet to the Sun

Jupiter

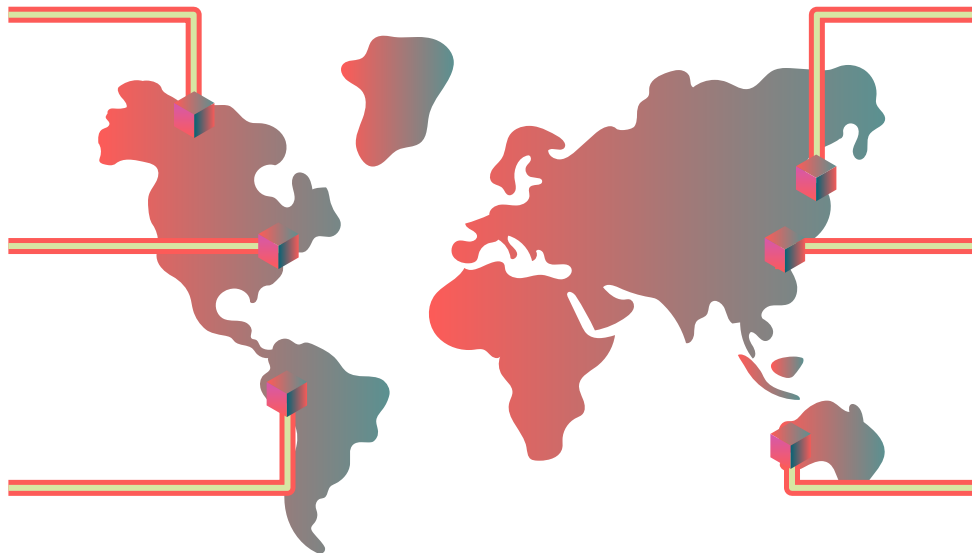
It's the biggest planet in the Solar System

Saturn

Saturn is the ringed planet and a gas giant

Mars

Despite being red, Mars is a cold place



Data migration process infographics



Jupiter

60%

Jupiter is a gas giant and the biggest planet in the Solar System



Saturn

19%

It's the ringed planet. It's a gas giant, composed mostly of hydrogen



Mercury

12%

It's the closest planet to the Sun and the smallest one of them all



Venus

9%

Venus has a beautiful name and is the second planet from the Sun

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