A Cognitive Serverless Framework for the Cloud-Edge Continuum

D3.9 COGNIT FaaS Model - Software Source - d

Version 1.0

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Abstract

COGNIT is an AI-enabled Adaptive Serverless Framework for the Cognitive Cloud-Edge Continuum that enables the seamless, transparent, and trustworthy integration of data processing resources from public providers and on-premises data centers in the cloud-edge continuum. The main goal of this project is the automatic and intelligent adaptation of those resources to optimise where and how data is processed according to application requirements, changes in application demands and behaviour, and the operation of the infrastructure in terms of the main environmental sustainability metrics. This document offers a catalogue of those open source software resources developed in WP3 "Distributed FaaS Model for Edge Application Development" during the Fourth Research & Innovation Cycle (M22-M27) as part of the implementation of several of the main components of the COGNIT Framework (i.e. Device Client, COGNIT Frontend, and Edge Cluster).

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Deliverable Metadata

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Document History

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0.1	22/04/2025	Draft	Initial Draft
0.2	24/04/2025	Peer-Reviewed	Reviewed Draft
1.0	30/04/2025	Submitted	Final Version

Peer Review History

Version	Peer Review Date	Reviewed By
0.2	23/04/2025	Yashwant Singh Patel (UMU)
0.2	24/04/2025	Antonio Álvarez (OpenNebula)

Summary of Changes from Previous Versions

First Version of Deliverable D3.9

[1] A deliverable can be in one of these stages: Draft, Peer-Reviewed, Submitted, and Approved.

Executive Summary

This is the fourth "COGNIT FaaS Model - Software Source" report that has been produced in WP3 "Distributed FaaS Model for Edge Application Development". It provides a short description, licence, version, code repository and user guide, as well as the design, testing, and verification references of each of the software requirements that have had active development tasks during the Fourth Research & Innovation Cycle (M22-M27) in connection with these main components of the COGNIT Framework:

Device Client

- **SR1.1** Interface with COGNIT Frontend
  Implementation of the communication of the Device Client with the COGNIT Frontend.
- **SR1.2** Interface with Edge Cluster
  Implementation of the communication of the Device Client with the Edge Cluster.
- **SR1.3** Programming languages
  Support for different programming languages.
- **SR1.4** Low memory footprint for constrained devices.
- **SR1.5** Security
  Device Runtime must be secured.
- **SR1.6** Collecting Latency Measurements
  Latency measurements against Edge Clusters should be acquired by the Device Client.

COGNIT Frontend

- **SR2.1** COGNIT Frontend
  Provides an entry point for devices to communicate with the COGNIT Framework for offloading the execution of functions and uploading global data.

Edge Cluster

- **SR3.1** Edge Cluster Frontend
  The Edge Cluster must provide an interface (Edge Cluster Frontend) for the Device Client to offload the execution of functions and to upload local data that is needed to execute the function.
- **SR3.2** Secure and trusted Serverless Runtimes
  The Serverless Runtime is the minimal execution unit for the execution of

functions offloaded by Device Clients.

This deliverable has been released at the end of the Fourth Research & Innovation Cycle (M27). The final release will take place at the end of the Fifth Research & Innovation Cycle, in M33.

Table of Contents

Abbreviations and Acronyms

AI	Artificial Intelligence
API	Application Programming Interface
DaaS	Data as a Service
FaaS	Function as a Service
REST	Representational State Transfer
SDK	Software Development Kit

1. Device Client

SR1.1 Interface with COGNIT Frontend	
Description	Implementation of the communication of the Device client with the COGNIT Frontend.
Licence	Apache 2.0
Version	release-cognit-3.0
Design	D3.4 → [SR1.1] Interface with COGNIT Frontend
Code	Public repository
User Guide	Repository README
FAQ	Wiki documentation
Testing	D5.5 → 9.1 Device Client
Verification	D5.5 → 9.1 Device Client

SR1.2 Interface with Edge Cluster	
Description	Implementation of the communication of Device client with the Edge Cluster
Licence	Apache 2.0
Version	release-cognit-3.0
Design	D3.4 → [SR1.2] Interface with Edge Cluster
Code	Public repository
User Guide	Repository README
FAQ	Wiki documentation
Testing	D5.5 → 9.1 Device Client
Verification	D5.5 → 9.1 Device Client

SR1.3 Programming languages	
Description	In this development cycle the Python implementation of the new COGNIT Framework architecture is introduced. The C version for this new architecture is pending for implementation, and as a result, it remains the same as the previous development cycle.
Licence	Apache 2.0
Version	release-cognit-3.0 (Python version) release-cognit-3.0 (C version)
Design	D3.4 → [SR1.3] Programming languages
Code	Public Repository (Python version)
	Public Repository (C version)
User Guide	Repository README (Python version)
	Repository README (C version)
FAQ	Wiki documentation (Python version)
Testing	D5.5 → 9.1 Device Client
Verification	D5.5 → 9.1 Device Client

SR1.5 Security	
Description	Device Runtime must be secured.
Licence	Apache 2.0
Version	release-cognit-3.0
Design	D3.4 → [SR1.5] Security
Code	Public repository
User Guide	Repository README
FAQ	Wiki documentation
Testing	D5.5 → 9.1 Device Client
Verification	D5.5 → 9.1 Device Client

2. COGNIT Frontend

SR2.1 COGNIT Frontend	
Description	Provides an entry point for devices to communicate with the COGNIT Framework for offloading the execution of functions and uploading data.
Licence	Apache 2.0
Version	release-cognit-3.0
Design	D3.4 → [SR2.1] COGNIT Frontend
Code	Public repository
User Guide	Repository README
Testing	D5.5 → 9.2 COGNIT Frontend
Verification	D5.5 → 9.2 COGNIT Frontend

3. Edge Cluster

SR3.1 Edge Cluster Frontend	
Description	The Edge Cluster shall provide an interface (Edge Cluster Frontend) for the device client to offload the execution of functions and to upload local data that is needed to execute the function.
Licence	Apache 2.0
Version	release-cognit-3.0
Design	D3.4 → [SR3.1] Edge Cluster Frontend
Code	Public repository
User Guide	Repository README
Testing	D5.5 → 9.3 Edge Cluster
Verification	D5.5 → 9.3 Edge Cluster

SR3.2 Secure and Trusted Serverless Runtimes	
Description	The Serverless Runtime is the minimal execution unit for the execution of functions offloaded by devices.
Licence	Apache 2.0
Version	release-cognit-3.0
Design	D3.4 → [SR3.2] Secure and Trusted Serverless Runtimes
Code	Public repository
User Guide	Repository README
FAQ	Wiki documentation
Testing	D5.5 → 9.3 Edge Cluster
Verification	D5.5 → 9.3 Edge Cluster