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Review of Serverless Frameworks

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Outline

- Introduction and motivation
- Review Analysis
  - Goal
  - Scope
  - Search Process
  - Criteria
  - Results
- Challenges

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Introduction

Melodic

Big data cloud

A single, universal platform for optimized deployment and management of applications in the cross-cloud environment.

functionizer

Serverless extension to Melodic platform enabling the management of serverless components.

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Motivation

- To unlock the serverless vendor lock-in
- To optimize serverless component deployment
- To make serverless usage more efficient and devops-friendly

Complete multicloud deployment platform - **MELODIC**

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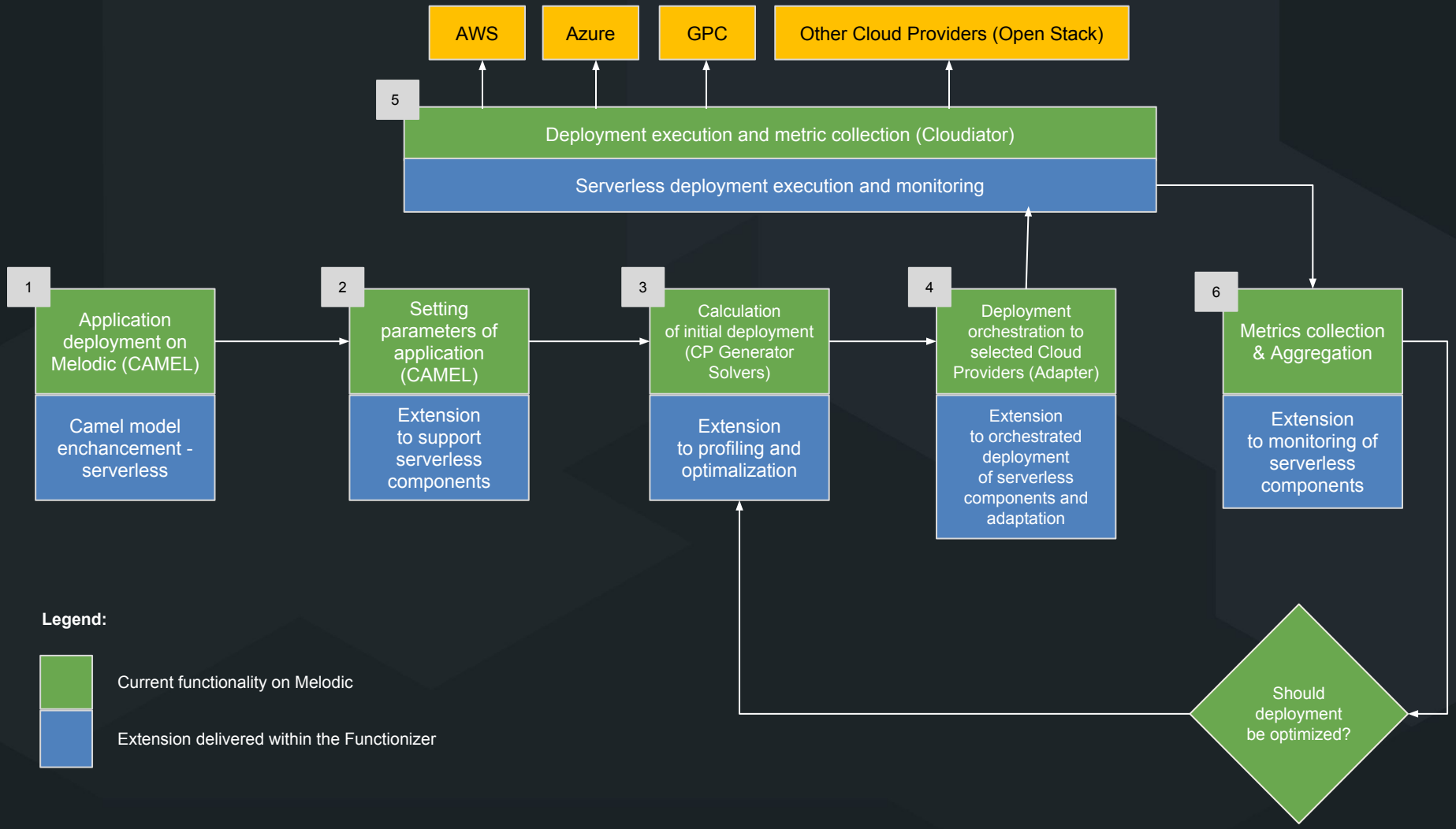
Architecture idea

Functionizer - initial architecture flow



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Introduction

- Serverless computing attains momentum
  - Multiple advantages:
    - Zero administration
    - Infinite elasticity
    - Minimal cost
    - Capability to handle unanticipated workloads
  - Multiple applications:
    - Image processing
    - Video processing
    - Scientific computing
    - Edge computing

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Introduction

- Traditional big cloud providers came into play
  - Offer serverless platforms
    - Mostly in beta version with known limitations
  - Plus added-value services to lock-in customers
    - e.g., trigger-oriented or state-handling
- Lock-in issue can be addressed via the use of serverless platforms which
  - Abstract away from technical specificities
  - Make the life of the devops easier via the supply of serverless component development & deployment CLIs

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Introduction

- Serverless frameworks differ wrt:
  - The level they abstract from
  - The level of support to the serverless application lifecycle
- Main question for devops:
  - Which serverless framework to choose based on the devops needs?

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Review Goal

- We provide an answer to this question via a review on serverless frameworks based on carefully designed set of criteria spanning the serverless application lifecycle
- We view a serverless framework as: *a software middleware that abstracts away from serverless platform specificities and eases the deployment and provisioning of multi-cloud serverless applications*

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Review Scope

- Two kinds of serverless frameworks reviewed:
  - Abstraction frameworks (e.g., serverless.com)
  - Provisioning frameworks (e.g., Fission)
    - Enable to operate mini-serverless platforms over existing clouds
- We have not reviewed frameworks which abstract from just one serverless platform
- We have not also reviewed proprietary frameworks
- Both latter are filtering criteria in search process

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Review Search Process

- Multi-source search process utilising
  - Search engines (e.g., Google)
  - Scholarly repositories (e.g., Web of Science)
- Findings:
  - CNCF pointer to multiple frameworks: https://landscape.cncf.io/grouping=landscape&landscape=serverless
  - Numerous articles pointing or proposing such frameworks

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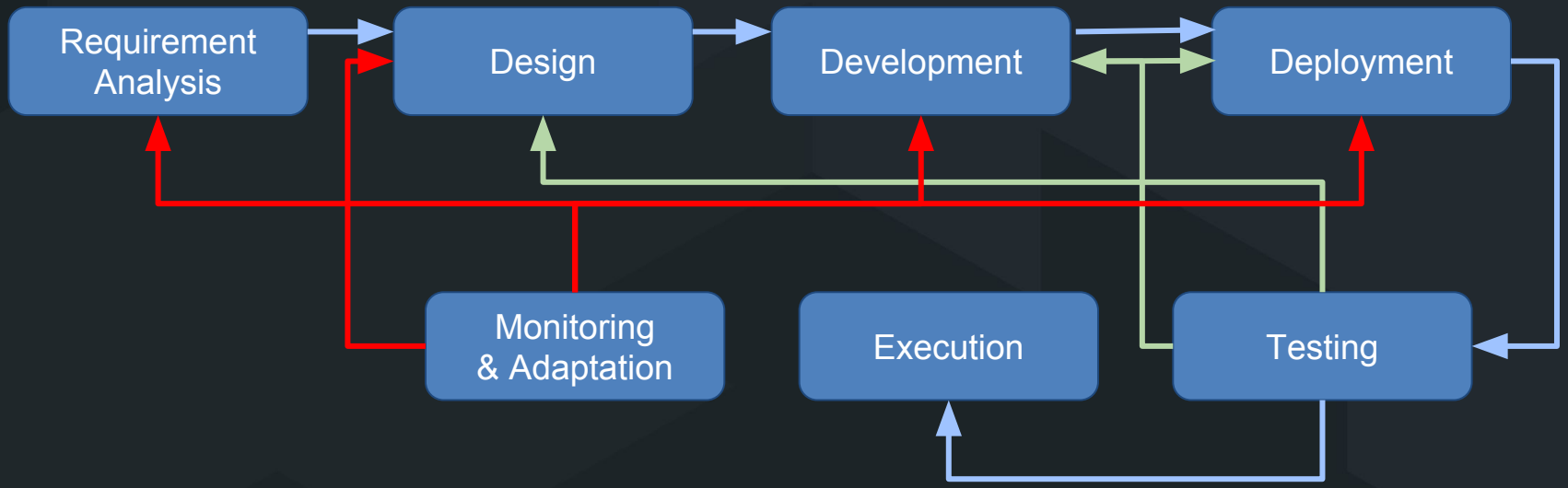
Review Criteria

- Based on the (serverless) application lifecycle



Nomenclature:

Normal flow Runtime adaptation flow Adaptation flow

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Review Criteria

- Design
  - Composition: composition flow description
  - FaaSification: process to produce functions out of existing code
- Development:
  - Language: support for multiple languages
  - Function Development Kits (FDKs)
  - Integration: wrt other frameworks and platforms

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Review Criteria

- Deployment
  - CI/CD
  - Versioning
- Testing: support to different types of testing
- Execution
  - Event coverage
  - Execution support: via a CLI or UI or both

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Review Criteria

- Monitoring & Adaptation
  - Logging: level of logging supported
  - Metric support: richness of metric set used to monitor serverless components
  - Monitoring UI
- Security: support for both authentication & authorisation to regulate the controlled access to functions

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Review Results

Serverless Frameworks								
Phase	**Criterion**	Fission	Kubeless	Iron Functions	Sparta	Fn	Snafu	Serverless
Design	Compos.	Workflows			AWS Step	Flow		AWS Step
	FaaSific.						Yes	
Dev.	Language	NodeJS, Python, Ruby, Go, PHP, Bash, any linux exec.	NodeJS, Python, Ruby, Go, PHP, Ballerina	Go, .NET, Javascript, Java, Lambda, Python, Ruby, Rust	Go	Any	Python, Java	Javascript, C#, F#, Scala, Python, Java, Goland, Groovy, Kotlin, PHP, Swift
	FDKs					Yes		
	Integr.			Picasso	AWS Lambda	AWS Lambda	AWS Lambda, OpenWhisk, Fission, Kubeless	AWS Lambda, Azure Functions Fission, Kubeless Google Functions, OpenWhisk SpotInst, kubeless, Fn

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Review Results

		Serverless Frameworks						
Phase	**Criterion**	Fission	Kubeless	Iron Functions	Sparta	Fn	Snafu	Serverless
Deploy.	CI/CD				Yes			Yes
	Version.				Yes			Yes
Testing						Unit		Unit
Execution	Event Cov.	HTTP, Cron, MQ	HTTP, Cron, MQ, Stream	HTTP, MQ, Alarm	HTTP, MQ, Stream	HTTP, MQ	HTTP, MQ, FS, Cron	HTTP, Cron, MQ, Stream
	Support	CLI	Both	Both	CLI	Both	CLI	CLI
Monit.	Logging	Simple	Adv.	Simple	Simple	Adv.	Simple	Adv.
	Metrics	Resource	(Succ.) Call Num, Exec. Time	Not Def.	Custom	Count, Duration, Resource	Exec. Time	CloudWatch
	UI		Yes		Yes	Yes		Yes
Security			U/RBAC, Adv. Auth.	2-level Auth.	RBAC		UBAC, Basic Auth.	U/RBAC, Adv. Auth.

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Challenges

- Overall Vision: abstraction framework supporting the adaptive provisioning of mixed applications
- Two main directions to support this:
  - Integration of serverless frameworks with multi-cloud application management frameworks
  - Improvement of serverless frameworks wrt the application lifecycle

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Challenges

- Design
  - C1: Novel design methods & techniques for mixed applications
  - C2: FaaSification of applications
    - FaaS-readiness tools
    - Improve FaaSification tools by also covering other languages
  - C3: Serverless component composition:
    - Reuse vast knowledge & experience in workflow modelling & scientific computing
    - Better integration with different types of events

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Challenges

- Development
  - C4: integration of serverless frameworks as plugins in development frameworks
  - C5: FDK improvement
    - Better & more uniform coverage of progr. languages
    - FDK extensions over: (a) enhanced error handling; (b) proper data binding & capabilities to extend it; (c) arbitrary calls to any kind of function/component

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Challenges

- C6: Deployment reasoning for mixed applications
  - C6.1: matching component requirements with cloud/platform capabilities
  - C6.2: appropriate formulation and solving of resp. optimisation problem
- C7: Modelling to support matching & reasoning:
  - C7.1: mixed application modelling covering all possible aspects
  - C7.2: cloud/platform offering modelling
- C8: Automatic (custom) serverless platform reconfiguration based on app. requirements and configuration patterns / details

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Challenges

- Testing
  - C9: Unit testing spanning additional languages
  - C10: Development and/or extending existing integration methods for mixed application integration testing
- Execution
  - C11: Realisation of Event Gateways based on right abstraction methods & concepts from event programming

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Challenges

- Monitoring & Adaptation
  - C12: Advanced monitoring & evaluation capabilities
    - Support for custom metrics
    - Metric aggregation
    - Mechanisms for event pattern detection
  - C13: Cross-level adaptation of mixed applications along with
    - The ability to sense the “problematic” situations
    - The ability to semi-automatically generate the right adaptation rules

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Functionizer & Melodic

Melodic website:

www. melodic.cloud

Download and develop:

https://melodic.cloud/download.html

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