



## **Rational decomposition and orchestration for serverless computing**

### **Deliverable D4.4 RADON Models II Companion Document**

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**Executive summary**

This is the companion document of the RADON Models II deliverable (D4.4). The document lists definitions of reusable types to cover the reference application level technologies agreed upon the consortium. Detailed information about the RADON types are provided with respect to the introduced RADON type hierarchy.

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## 1. Introduction

This RADON companion document contains the detailed information regarding the RADON type hierarchy. This document lists the specifications of the initial RADON modeling types to cover the reference application level technologies specified by the consortium. As RADON employs TOSCA for the application models, the type definitions are structured similar to the layout of the official TOSCA specification. The complete type specifications are automatically generated based on the “README.md” files of RADON’s public template library<sup>1</sup>. The output is structured as follows:

- Each type has a name and a short description for its intended use
- A table presents at a glance the internal type name, the full URI, the current version, and the base type from which it is derived from
- If applicable, a table shows the defined “Properties” specifying the name, type, constraints, default value, and description
- If applicable, a table shows the defined “Attributes” specifying the name, type, default value, and description
- If applicable, a table shows the defined “Capabilities” specifying the name, type, valid source types, and defines the occurrence
- If applicable, a table shows the defined “Requirements” specifying the name, matching capability types, constraints, the used relationship type, and defines the occurrence
- A list of “Notes” conclude the specification by highlighting additional information, i.e., the inputs required for TOSCA’s standard interface

### 1.1 Structure of the Document

The document is structured as follows:

- Section 2 lists the TOSCA node type specifications intended to be used for application modeling.
- Section 3 lists the TOSCA relationship type specifications used to express a *Trigger* relationship between a respective node and a serverless FaaS function.
- Section 4 lists the TOSCA policy type specifications that used to model non-functional requirements, i.e., performance, scaling, and testing requirements.
- Section 5 lists the TOSCA artifact type specifications used to attach respective artifacts to modeled RADON applications.
- Section 6 lists the TOSCA capability types that used inside RADON’s node types.
- Section 7 lists custom TOSCA data types, e.g., used to express event type information that triggers a serverless FaaS function.

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<sup>1</sup> <https://github.com/radon-h2020/radon-particles>

## 2. RADON Particles - Node Types

### API Gateway Node Type (Abstract)

Abstract node type representing an API Gateway independently of the underlying provider.

Name	URI	Version	Derived From
<i>ApiGateway</i>	<i>radon.nodes.abstract.ApiGateway</i>	1.0.0	<i>tosca.nodes.Root</i>

#### Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.abstract.CloudPlatform</i>	<i>tosca.relationships.HostedOn</i>	[1, 1]
<i>invoke</i>	<i>radon.capabilities.Invokeable</i>	<i>radon.nodes.abstract.Function</i>	<i>radon.relationships.abstract.Triggers</i>	[0, UNBOUNDED]

### Cloud Platform Node Type (Abstract)

Abstract node type representing a provider-managed cloud platform.

Name	URI	Version	Derived From
<i>CloudPlatform</i>	<i>radon.nodes.abstract.CloudPlatform</i>	1.0.0	<i>tosca.nodes.Root</i>

#### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>name</i>	<i>false</i>	<i>string</i>			Name of the cloud platform

#### Capabilities

Name	Type	Valid Source Types	Occurrences
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<i>host</i>	<i>tosca.capabilities.Container</i>	<i>[radon.nodes.abstract.Function, radon.nodes.abstract.ObjectStorage]</i>	<i>[1, UNBOUNDED]</i>
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## Data Pipeline Node Type (Abstract)

Abstract data pipeline type.

Name	URI	Version	Derived From
<i>DataPipeline</i>	<i>radon.nodes.abstract.Function</i>	1.0.0	<i>tosca.nodes.Root</i>

### Properties

Name	Required	Type	Constraint	Description
<i>name</i>	<i>true</i>	<i>string</i>		Name of the data pipeline

### Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>		<i>tosca.relationships.HostedOn</i>	

## Function Node Type (Abstract)

Abstract node type representing a serverless function independently of the underlying provider.

Name	URI	Version	Derived From
<i>Function</i>	<i>radon.nodes.abstract.Function</i>	1.0.0	<i>tosca.nodes.Root</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>name</i>	<i>true</i>	<i>string</i>			Name of the function
<i>environment</i>	<i>false</i>	<i>map: string</i>			Map of environment variables
<i>entries</i>	<i>false</i>	<i>radon.datatypes.function.Entries</i>			Set of entries

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.abstract.CloudPlatform</i>	<i>tosca.relationships.HostedOn</i>	[1, 1]
<i>endpoint</i>	<i>tosca.capabilities.Endpoint</i>		<i>radon.relationships.abstract.ConnectsTo</i>	[0, UNBOUNDED]

## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>invocable</i>	<i>radon.capabilities.Invocable</i>		[0, UNBOUNDED]

## Object Storage Node Type (Abstract)

Abstract node type representing an object storage independently of the underlying provider.

Name	URI	Version	Derived From
<i>ObjectStorage</i>	<i>radon.nodes.abstract.ObjectStorage</i>	1.0.0	<i>tosca.nodes.Storage.ObjectStorage</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>entries</i>	<i>false</i>	<i>radon.datatypes.objectstorage.Entries</i>			Set of entries

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.abstract.CloudPlatform</i>	<i>tosca.relationships.HostedOn</i>	[1, 1]
<i>invoke</i>	<i>radon.capabilities.Invocable</i>	<i>radon.nodes.abstract.Function</i>	<i>radon.relationships.abstract.Triggers</i>	[0, UNBOUNDED]

## Workload Node Type (Abstract)

Abstract node type representing a workload in general.

Name	URI	Version	Derived From
<i>WorkLoad</i>	<i>radon.nodes.abstract.WorkLoad</i>	1.0.0	<i>tosca.nodes.Root</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>entries</i>	<i>false</i>	<i>radon.datatypes.workload.Entries</i>			Set of entries

### Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>invoker</i>	<i>radon.capabilities.Invocable</i>		<i>radon.relationships.abstract.Triggers</i>	[0, UNBOUNDED]
<i>endpoint</i>	<i>tosca.capabilities.Endpoint</i>		<i>radon.relationships.abstract.ConnectsTo</i>	[0, UNBOUNDED]

## Closed Workload Node Type (Abstract)

Abstract node type representing a closed workload in general.

Name	URI	Version	Derived From
<i>ClosedWorkLoad</i>	<i>radon.nodes.abstract.workload.ClosedWorkLoad</i>	1.0.0	<i>radon.nodes.abstract.WorkLoad</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>population</i>	<i>true</i>	<i>integer</i>	<i>greater_or_equal: 1</i>	1	Population
<i>think_time</i>	<i>true</i>	<i>radon.datatypes.RandomVariable</i>			Think time

## Open Workload Node Type (Abstract)

Abstract node type representing an open workload in general.

Name	URI	Version	Derived From
<i>OpenWorkLoad</i>	<i>radon.nodes.abstract.workLoad.OpenWorkLoad</i>	1.0.0	<i>radon.nodes.abstract.WorkLoad</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>interarrival_time</i>	<i>true</i>	<i>radon.datatypes.RandomVariable</i>			Interarrival time

## Kafka Broker Node Type

This node type represents a Kafka broker that can be scaled out into a Kafka cluster.

Name	URI	Version	Derived From
<i>KafkaBroker</i>	<i>radon.nodes.apache.kafka.KafkaBroker</i>	1.0.0	<i>radon.nodes.java.JavaApplication</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>component_version</i>	<i>true</i>	<i>version</i>	<i>valid_values: [0.10.2.2, 0.11.0.3]</i>	0.10.2.2	The version of the Kafka broker software
<i>scala_version</i>	<i>true</i>	<i>version</i>	<i>valid_values: [2.11, 2.12]</i>	2.11	The Scala version to be used.
<i>kf_heap_size</i>	<i>true</i>	<i>integer</i>		1024	This property allows to set the heap memory size (in MiB) that is allocated to Kafka java process.
<i>zk_heap_size</i>	<i>true</i>	<i>integer</i>		500	This property allows to set the heap memory size (in MiB) that is allocated to Zookeeper java process.
<i>log_cleaner_enable</i>	<i>true</i>	<i>boolean</i>		<i>false</i>	This property allows to enable the default Kafka log cleaner.

### Attributes

Name	Type	Default Value	Description
<i>java_home</i>	<i>string</i>	<i>get_attribute: [ HOST, java_home ]</i>	The path to the Java home at the hosting <i>JavaRuntimenode</i> .

<i>kafka_home</i>	<i>string</i>	<i>get_operation_output: [ SELF, Standard, create, KAFKA_HOME ]</i>	The path to the Kafka home directory.
<i>broker_urls</i>	<i>List of string</i>		represents a list of one or more urls that corresponds to the brokers of this Kafka cluster.

### Capabilities

Name	Type	Valid Source Types	Occurrences
<i>host</i>	<i>radon.capabilities.kafka.KafkaHosting</i>	<i>radon.nodes.apache.kafka.KafkaTopic</i>	[0, UNBOUNDED]

### Notes

- Inputs added to the operations of the *Standard* interface:
  - create: KAFKA\_VERSION, SCALA\_VERSION*
  - configure: IP\_ADDRESS, LOG\_CLEANER\_ENABLE, JAVA\_HOME, KAFKA\_HOME, KF\_HEAP\_SIZE, ZK\_HEAP\_SIZE*
  - start: JAVA\_HOME, KAFKA\_HOME*
  - stop: JAVA\_HOME, KAFKA\_HOME*

## Kafka Topic Node Type

A node type that describes a Kafka topic

Name	URI	Version	Derived From
<i>KafkaTopic</i>	<i>radon.nodes.apache.kafka.KafkaTopic</i>	1.0.0	<i>tosca.nodes.Root</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>topic_name</i>	<i>true</i>	<i>string</i>			The name of the topic.
<i>partitions</i>	<i>false</i>	<i>integer</i>		1	The number of partitions.
<i>replicas</i>	<i>false</i>	<i>integer</i>		1	The number of replicas.

<i>min_insync_replicas</i>	<i>false</i>	<i>integer</i>	<i>greater_or_equal: 0</i>	1	When a producer sets <i>request_required_acks</i> to <i>in_syncs</i> , this value specifies the minimum number of replicas that must acknowledge a write for the write to be considered successful.
<i>retention</i>	<i>false</i>	<i>integer</i>	<i>greater_or_equal: 1</i>	10080	The number of minutes to keep a log file before deleting it.
<i>roll_time</i>	<i>false</i>	<i>integer</i>	<i>greater_or_equal: 1</i>	10080	Controls the period of time (in minutes) after which Kafka will force the log to roll even if the segment file isn't full to ensure that retention can delete or compact old data.
<i>segment_size</i>	<i>false</i>	<i>integer</i>	<i>greater_or_equal: 1</i>	1000000	Log segment file size in KiB.

### Attributes

Name	Type	Default Value	Description
<i>broker_urls</i>	<i>list of string</i>		Represents a list of one or more urls that corresponds to the brokers of the kafka cluster this topic is hosted on.

### Capabilities

Name	Type	Valid Source Types	Occurrences
<i>kafka_topic</i>	<i>radon.capabilities.kafka.KafkaTopic</i>		[0, UNBOUNDED]

### Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>radon.capabilities.kafka.KafkaHosting</i>		<i>tosca.relationships.HostedOn</i>	[1, 1]
<i>openwhisk_in_voker</i>	<i>radon.capabilities.Invokable</i>	<i>radon.nodes.apache.openwhisk.OpenWhiskFunction</i>	<i>radon.relationships.apache.openwhisk.KafkaTriggers</i>	[0, UNBOUNDED]
<i>openfaas_in_voker</i>	<i>radon.capabilities.Invokable</i>	<i>radon.nodes.openfaas.OpenFaaSFunction</i>	<i>radon.relationships.openfaas.KafkaTriggers</i>	[0, UNBOUNDED]

## Notes

- The *openwhisk\_invoker* requirement is optional, and it allows to establish a “Triggers” relationship between the Kafka topic and an OpenWhisk function.
- The *openfaas\_invoker* requirement is optional, and it allows to establish a “Triggers” relationship between the Kafka topic and an OpenFaaS function.
- Inputs added to the operations of the *Standard* interface:
  - *create*: *TOPIC\_NAME, PARTITIONS, REPLICAS, MIN\_INSYNC\_REPLICAS, RETENTION, SEGMENT\_SIZE, ROLL\_TIME*

## OpenWhisk Function Node Type

A node type that represents a function hosted on an OpenWhisk Platform

Name	URI	Version	Derived From
<i>OpenWhiskFunction</i>	<i>radon.nodes.apache.openWhisk.OpenWhiskFunction</i>	1.0.0	<i>radon.nodes.abstract.Function</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>function_name</i>	<i>true</i>	<i>string</i>			The name of the function.
<i>function_runtime</i>	<i>true</i>	<i>string</i>	<i>valid_values: [go_1_11, java_8, ballerina_0_990, nodejs_12, nodejs_10, nodejs_8, nodejs_6, php_7_3, python_2, python_3, ruby_2_5, swift_4_2, dotnet_2_2]</i>		The runtime of this function.
<i>function_package_name</i>	<i>true</i>	<i>string</i>			The name of the package this function belongs to.
<i>entry_point</i>	<i>false</i>	<i>string</i>			The optional entry point at which the function can be found.

## Attributes

Name	Type	Default Value	Description
<i>rest_api_endpoint</i>	<i>string</i>	<i>concat: [ get_attribute: [HOST, api_url], "/api/v1/namespaces/", get_property: [HOST, default_namespace], "/actions/", get_property: [SELF, function_package_name], "/", get_property: [SELF, function_name] ]</i>	The URL at which the function can be addressed via a REST call.

## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>invocable</i>	<i>radon.capabilities.Invocable</i>		[0, UNBOUNDED]

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>		<i>radon.nodes.apache.openWhisk.OpenWhiskPlatform</i>		[1, 1]

## Notes

- Parameters added to the inputs of the *Standard* interface:
  - *FUNCTION\_NAME*
  - *FUNCTION\_RUNTIME*
  - *ENTRY\_POINT*

## OpenWhisk Platform Node Type

A node type that represents an externally managed OpenWhisk Platform.

Name	URI	Version	Derived From
<i>OpenWhiskPlatform</i>	<i>radon.nodes.apache.openwhisk.OpenWhiskPlatform</i>	1.0.0	<i>radon.nodes.abstract.CloudPlatform</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>kubernetes_version</i>	<i>false</i>	<i>version</i>		1.8	The version of the Kubernetes cluster hosting this platform.

<i>auth_username</i>	<i>true</i>	<i>string</i>			The username used for basic authentication.
<i>auth_password</i>	<i>true</i>	<i>string</i>			The password used for basic authentication.
<i>api_host</i>	<i>true</i>	<i>string</i>			The host name to access OpenWhisk API gateway at.
<i>api_port</i>	<i>true</i>	<i>integer</i>		31112	The port to access OpenWhisk API gateway at.
<i>default_namespace</i>	<i>true</i>	<i>string</i>			The default namespace in which resources are deployed.

### Attributes

Name	Type	Default Value	Description
<i>url</i>	<i>string</i>	<i>concat: ["http://", get_property: [SELF, api_gateway_host], get_property: [SELF, api_gateway_port] ]</i>	The full gateway url.
<i>auth_key</i>	<i>string</i>	<i>concat: [get_property: [SELF, auth_username], get_property: [SELF, auth_password] ]</i>	The string used for basic authentication.

### Capabilities

Name	Type	Valid Source Types	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.apache.openwhisk.OpenWhiskFunction</i>	[0, UNBOUNDED]

### Notes

- Parameters added to the *Standard* interface operations:
  - create: KUBERNETES\_VERSION*
  - configure: API\_URL, AUTH\_KEY*

## AWS API Gateway Node Type

A node type that represents an AWS Lambda Function.

Name	URI	Version	Derived From
<i>AwsApiGateway</i>	<i>radon.nodes.aws.AwsApiGateway</i>	1.0.0	<i>radon.nodes.abstract.ApiGateway</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>role_name</i>	<i>true</i>	<i>string</i>			The Amazon Resource Name (ARN) of the execution role
<i>aws_region</i>	<i>true</i>	<i>string</i>			The selected Amazon region
<i>function_name</i>	<i>true</i>	<i>string</i>		<i>index.handler</i>	The name of the lambda function
<i>api_gateway_title</i>	<i>true</i>	<i>string</i>			Name of the API gateway region
<i>api_gateway_resource_uri</i>	<i>true</i>	<i>string</i>			The amount of concurrency that your function has access to

## Attributes

Name	Type	Default Value	Description
<i>arn</i>	<i>string</i>		Amazon's resource name for this entity

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>requires_role</i>	<i>tosca.capabilities.Node</i>		<i>tosca.relationships.DependsOn</i>	[1, 1]
<i>receives_notification</i>	<i>tosca.capabilities.Compute</i>		<i>tosca.relationships.DependsOn</i>	[1, 1]

## Notes

- Parameters added to the *Standard* interface inputs:
  - *role\_name*
  - *lambda\_function\_arn*
  - *aws\_region*
  - *function\_name*
  - *api\_gateway\_title*
  - *api\_gateway\_resource\_uri*
  - *aws\_role*

## Lambda Function Node Type

A node type that represents an AWS Lambda Function.

Name	URI	Version	Derived From
<i>AwsLambdaFunction</i>	<i>radon.nodes.aws.AwsLambdaFunction</i>	1.0.0	<i>radon.nodes.abstract.Function</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>role_name</i>	<i>true</i>	<i>string</i>			The Amazon Resource Name (ARN) of the function's execution role
<i>role_description</i>	<i>true</i>	<i>string</i>			Description of the function's execution role
<i>runtime</i>	<i>true</i>	<i>string</i>	<i>valid_values: [nodejs, nodejs4.3, nodejs6.10, nodejs8.10, nodejs10.x, java8, python2.7, python3.6, python3.7, dotnetcore1.0, dotnetcore2.0, dotnetcore2.1, nodejs4.3-edge, go1.x, ruby2.5]</i>		The identifier of the function's runtime
<i>handler</i>	<i>true</i>	<i>string</i>		<i>index.handler</i>	The name of the method within your code that Lambda calls to execute your function
<i>memory</i>	<i>true</i>	<i>integer</i>	<i>in_range: [128, 3008]</i>		The amount of memory in megabytes that your function has access to
<i>concurrency</i>	<i>false</i>	<i>integer</i>	<i>in_range: [1, UNBOUNDED]</i>		The amount of concurrency that your function has access to
<i>timeout</i>	<i>true</i>	<i>integer</i>	<i>in_range: [1, 900]</i>	3	The amount of time that Lambda allows a function to run before stopping it
<i>schedule</i>	<i>false</i>	<i>string</i>			The schedule in which the platform will invoke this function, can be a rate or a cron

## Attributes

Name	Type	Default Value	Description
<i>arn</i>	<i>string</i>		Amazon's resource name for this Lambda function

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.aws.AwsPlatform</i>	<i>tosca.relationships.HostedOn</i>	[1, 1]

## Notes

- Parameters added to the *Standard* interface inputs:
  - *function\_name*
  - *function\_role\_name*
  - *function\_runtime*
  - *function\_handler*
  - *function\_memory*
  - *function\_concurrency*
  - *function\_timeout*
  - *function\_code\_location*
  - *aws\_access\_key\_id*
  - *aws\_secret\_access\_key*
  - *aws\_region*
  - *schedule*

## AWS Platform Node Type

A node type that represents the AWS platform.

Name	URI	Version	Derived From
<i>AwsPlatform</i>	<i>radon.nodes.aws.AwsPlatform</i>	1.0.0	<i>radon.nodes.abstract.CloudPlatform</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>access_key_id</i>	<i>true</i>	<i>string</i>			The identifier of your AWS access key
<i>secret_access_key</i>	<i>true</i>	<i>string</i>			The secret access key associated to your access key
<i>region</i>	<i>true</i>	<i>string</i>			The region identifier, e.g., us-west-1

## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>[radon.nodes.aws.LambdaFunction, radon.nodes.aws.S3Bucket, radon.nodes.VM.EC2]</i>	<i>[0, UNBOUNDED]</i>

## S3 Bucket Node Type

A node type that represents an AWS S3 Bucket.

Name	URI	Version	Derived From
<i>AwsS3Bucket</i>	<i>radon.nodes.aws.AwsS3Bucket</i>	<i>1.0.0</i>	<i>radon.nodes.abstract.ObjectStorage</i>

## Attributes

Name	Type	Default Value	Description
<i>arn</i>	<i>string</i>		Amazon's resource name for this bucket

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>name</i>	<i>true</i>	<i>string</i>			The name of this bucket.

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.aws.AwsPlatform</i>	<i>tosca.relationships.HostedOn</i>	<i>[1, 1]</i>
<i>invoker</i>	<i>radon.capabilities.Invocable</i>	<i>radon.nodes.aws.LambdaFunction</i>	<i>radon.relationships.aws.Triggers</i>	<i>[0, UNBOUNDED]</i>

## Notes

- Parameters added to the *Standard* interface inputs:
  - *aws\_access\_key\_id*
  - *aws\_secret\_access\_key*
  - *aws\_region*
  - *bucket\_name*

## Azure Cosmos DB Node Type

A node type that represents a Cosmos DB hosted by the Azure platform

Name	URI	Version	Derived From
<i>AzureCosmosDB</i>	<i>radon.nodes.azure.AzureCosmosDB</i>	1.0.0	<i>radon.nodes.azure.AzureResource</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>collection_name</i>	<i>true</i>	<i>string</i>			The name of the collection.
<i>connection_string_setting</i>	<i>true</i>	<i>string</i>			The name of an app setting that contains the connection string used to connect to the Azure Cosmos DB account.
<i>account_name</i>	<i>true</i>	<i>string</i>			The Azure Cosmos account name.
<i>resource_group</i>	<i>true</i>	<i>string</i>			The name of the resource group.

## Notes

- Parameters added to the inputs of the *Standard* interface operations:
  - *create: COLLECTION\_NAME, CONNECTION\_STRING\_SETTING, ACCOUNT\_NAME, RESOURCE\_GROUP*

## Azure Function Node Type (Abstract)

Abstract node type that represents an function hosted on the Azure cloud platform.

Name	URI	Version	Derived From
<i>AzureFunction</i>	<i>radon.nodes.azure.AzureFunction</i>	1.0.0	<i>radon.nodes.abstract.Function</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>function_name</i>	<i>true</i>	<i>string</i>			The name of the function
<i>timeout</i>	<i>true</i>	<i>integer</i>	<i>in_range: [1, 600]</i>	300	The timeout in seconds of the function is alive after the first start
<i>app_name</i>	<i>true</i>	<i>string</i>			The name of the Azure application
<i>app_runtime</i>	<i>false</i>	<i>string</i>	<i>valid_values: [dotnet, node, java, python, powershell]</i>		The identifier of the runtime to be used
<i>app_os_type</i>	<i>false</i>	<i>string</i>	<i>valid_values: [Windows, Linux]</i>		The OS type of the underlying infrastructure
<i>app_storage_account</i>	<i>false</i>	<i>string</i>			The name of the application's storage account
<i>app_resource_group</i>	<i>false</i>	<i>string</i>			The name of the application's resource group

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.azure.AzurePlatform</i>	<i>tosca.relationships.HostedOn</i>	

## HTTP-triggered Azure Function Node Type

A node type that represents an Azure function which is triggered with an HTTP call.

Name	URI	Version	Derived From
<i>AzureHttpTriggeredFunction</i>	<i>radon.nodes.azure.AzureHttpTriggeredFunction</i>	1.0.0	<i>radon.nodes.azure.AzureFunction</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>auth_level</i>	<i>false</i>	<i>string</i>	<i>valid_values:</i> <i>[anonymous, function, admin]</i>		Determines what keys, if any, need to be present on the request in order to invoke the function.
<i>methods</i>	<i>false</i>	<i>List of string</i>			An array of the HTTP methods to which the function responds. If not specified, the function responds to all HTTP methods.
<i>route</i>	<i>false</i>	<i>string</i>			Defines the route template, controlling to which request URLs your function responds. The default value if none is provided is <i>function_name</i> .
<i>route_prefix</i>	<i>true</i>	<i>string</i>		<i>api</i>	The route prefix that applies to all routes. Use an empty string to remove the default prefix.
<i>max_outstanding_requests</i>	<i>true</i>	<i>integer</i>		200	The maximum number of outstanding requests that are held at any given time.
<i>max_concurrent_requests</i>	<i>true</i>	<i>integer</i>		100	The maximum number of http functions that will be executed in parallel.

## Attributes

Name	Type	Default Value	Description
<i>url</i>	<i>string</i>	<i>get_operatoin_output: [SELF, Standard, create, URL]</i>	The URL at which the function can be invoked.

## Notes

- Parameters added to the inputs of the operations of the *Standard* interface:
  - create: AUHT\_LEVEL, METHODS, ROUTE, MAX\_OUTSTANDING\_REQUESTS, MAX\_CONCURRENT\_REQUESTS*
- An output parameter with the name *URL* is expected from the *create* operation of the *Standard* interface.

## Azure Platform Node Type

This is Node Type represents the Azure cloud platform.

Name	URI	Version	Derived From
<i>AzurePlatform</i>	<i>radon.nodes.azure.AzurePlatform</i>	1.0.0	<i>radon.nodes.abstract.CloudPlatform</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>user_name</i>	<i>false</i>	<i>string</i>			The user name used for authentication.
<i>password</i>	<i>false</i>	<i>string</i>			The password used for authentication.
<i>region</i>	<i>false</i>	<i>string</i>			The region in which resources are/will be deployed.

### Capabilities

Name	Type	Valid Source Types	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>[radon.nodes.azure.AzureFunction, radon.nodes.azure.AzureResource]</i>	<i>[0, UNBOUNDED]</i>

### Notes

- Parameters added to the inputs of the *Standard* interface:
  - USER\_NAME*
  - PASSWORD*

## Azure Resource Node Type (Abstract)

An abstract node type to describe a generic Azure Resource. All specific Azure Resources should derive from this type.

Name	URI	Version	Derived From
<i>AzureResource</i>	<i>radon.nodes.azure.AzureResource</i>	1.0.0	<i>tosca.nodes.SoftwareComponent</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>name</i>	<i>true</i>	<i>string</i>			The name of the resource.

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.azure.AzurePlatform</i>	<i>HostedOn</i>	[1, 1]
<i>invoker</i>	<i>radon.capabilities.Invocable</i>	<i>radon.nodes.azure.AzureFunction</i>	<i>radon.relationships.azure.Triggers</i>	[0, UNBOUNDED]

## Notes

- Parameters added to the inputs of the *Standard* interface:
  - NAME*: taken from the *name* property.
- All type-specific Azure Resources should derive from this type.
- This type is the source of all *radon.relationships.azure.Triggers* relationships.

## Resource-triggered Azure Function Node Type

A node type that represents a function that is triggered by an Azure-specific resource. This includes: *Blob storage*, *Cosmos DB*, *Event Grid*, *Event Hubs*, *Microsoft Graph events*, *Queue storage*, and *Service Bus*.

Name	URI	Version	Derived From
<i>AzureResourceTriggeredFunction</i>	<i>radon.nodes.azure.AzureResourceTriggeredFunction</i>	1.0.0	<i>radon.nodes.azure.AzureFunction</i>

## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>invocable</i>	<i>radon.capabilities.Invocable</i>	<i>radon.nodes.azure.AzureResource</i>	[1, 1]

## Notes

- To connect to each triggering resource, use the associated resource-specific relationship type.
- The deployment of an *ResourceTriggeredAzureFunction* is performed by the relationship.

## Timer-triggered Azure Function Node Type

A node type that represents an Azure function that is triggered by a timer.

Name	URI	Version	Derived From
<i>AzureTimerTriggeredFunction</i>	<i>radon.nodes.azure.AzureTimerTriggeredFunction</i>	1.0.0	<i>radon.nodes.azure.AzureFunction</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>schedule</i>	<i>true</i>	<i>string</i>			CRON expression or timespan to describe when and at which frequency the function will be triggered.

## Notes

- Parameters added to the inputs of operations of the *Standard* interface:
  - create: SCHEDULE*

## Destination PB Node Type

This node type acts as the root for all types of destination pipelines.

Name	URI	Version	Derived From
<i>DestinationPB</i>	<i>radon.nodes.datapipeline.DestinationPB</i>	1.0.0	<i>radon.nodes.datapipeline.PipelineBlock</i>

## Midway PB Node Type

This acts as the root node for all midway pipeline blocks.

Name	URI	Version	Derived From
<i>MidwayPB</i>	<i>radon.nodes.datapipeline.MidwayPB</i>	1.0.0	<i>radon.nodes.datapipeline.PipelineBlock</i>

## Pipeline Block Node Type

This acts as the root node for all types of data pipeline models.

Name	URI	Version	Derived From
<i>PipelineBlock</i>	<i>radon.nodes.datapipeline.PipelineBlock</i>	1.0.0	<i>radon.nodes.abstract.DataPipeline</i>

## Source PB Node Type

This node type acts as the root for all types of source pipelines. The READ operation will only be allowed for these node types.

Name	URI	Version	Derived From
<i>SourcePB</i>	<i>radon.nodes.datapipeline.SourcePB</i>	1.0.0	<i>radon.nodes.datapipeline.PipelineBlock</i>

## Publish Data Endpoint Node Type

A node type that represents an endpoint that can receive data.

Name	URI	Version	Derived From
<i>PublishDataEndpoint</i>	<i>radon.nodes.datapipeline.destination.PublishDataEndpoint</i>	1.0.0	<i>radon.nodes.datapipeline.DestinationPB</i>

## Publish Local Node Type

A node type that represents a local endpoint that can receive data.

Name	URI	Version	Derived From
<i>PublishLocal</i>	<i>radon.nodes.datapipeline.destination.PublishLocal</i>	1.0.0	<i>radon.nodes.datapipeline.destination.PublishDataEndpoint</i>

## Publish Remote Node Type

A node type that represents a remote endpoint that can receive data.

Name	URI	Version	Derived From
<i>PublishRemote</i>	<i>radon.nodes.datapipeline.destination.PublishRemote</i>	1.0.0	<i>radon.nodes.datapipeline.destination.PublishDataEndpoint</i>

## Publish S3 Bucket Node Type

A node type that represents a AWS S3 bucket that can receive data.

Name	URI	Version	Derived From
<i>PubsS3Bucket</i>	<i>radon.nodes.datapipeline.destination.PubsS3Bucket</i>	1.0.0	<i>radon.nodes.datapipeline.destination.PublishRemote</i>

## AWS Lambda Pipeline Node Type

A node type that represents a AWS Lambda that can process data.

Name	URI	Version	Derived From
<i>AWSLambda</i>	<i>radon.nodes.datapipeline.process.AWSLambda</i>	1.0.0	<i>radon.nodes.datapipeline.process.FaaSFunction</i>

## FaaS Function Pipeline Node Type

A node type that represents a FaaS function that can process data.

Name	URI	Version	Derived From
<i>FaaSFunction</i>	<i>radon.nodes.datapipeline.process.FaaSFunction</i>	1.0.0	<i>radon.nodes.datapipeline.process.RemoteAction</i>

## Local Action Pipeline Node Type

This belongs to MidwayPB pipeline block. This is for processing the data in the local machine.

Name	URI	Version	Derived From
<i>LocalAction</i>	<i>radon.nodes.datapipeline.process.LocalAction</i>	1.0.0	<i>radon.nodes.datapipeline.MidwayPB</i>

## FaaS Function Pipeline Node Type

To carry out the data analysis on remote machine.

Name	URI	Version	Derived From
<i>RemoteAction</i>	<i>radon.nodes.datapipeline.process.RemoteAction</i>	1.0.0	<i>radon.nodes.datapipeline.MidwayPB</i>

## RouteToRemote Pipeline Node Type

This will allow the user to route the data to the pipeline in remote machine.

Name	URI	Version	Derived From
<i>RouteToRemote</i>	<i>radon.nodes.datapipeline.process.RouteToRemote</i>	1.0.0	<i>radon.nodes.datapipeline.MidwayPB</i>

### Notes

- If the destination pipeline is in the same machine, this will have no effect or this will not be used.

## ConsS3Bucket Pipeline Node Type

This will allow the user to read data from a AWS S3 bucket.

Name	URI	Version	Derived From
<i>ConsS3Bucket</i>	<i>radon.nodes.datapipeline.source.ConsS3Bucket</i>	1.0.0	<i>radon.nodes.datapipeline.source.ConsumeRemote</i>

## ConsumeDataEndPoint Pipeline Node Type

This will allow the user to read data from an endpoint.

Name	URI	Version	Derived From
<i>ConsumeDataEndPoint</i>	<i>radon.nodes.datapipeline.source.ConsumeDataEndPoint</i>	1.0.0	<i>radon.nodes.datapipeline.SourcePB</i>

## ConsumeLocal Pipeline Node Type

Get the data from the local directory.

Name	URI	Version	Derived From
<i>ConsumeLocal</i>	<i>radon.nodes.datapipeline.source.ConsumeLocal</i>	1.0.0	<i>radon.nodes.datapipeline.source.ConsumeDataEndPoint</i>

### TODO

- Unable to use *get\_attribute* in the interface definition.

## ConsumeRemote Pipeline Node Type

Get the data from a remote location.

Name	URI	Version	Derived From
<i>ConsumeRemote</i>	<i>radon.nodes.datapipeline.source.ConsumeRemote</i>	1.0.0	<i>radon.nodes.datapipeline.source.ConsumeDataEndPoint</i>

## Docker Application Node Type

Name	URI	Version	Derived From
<i>DockerApplication</i>	<i>radon.nodes.docker.DockerApplication</i>	1.0.0	<i>tosca.nodes.Container.Application</i>

### Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>radon.capabilities.container.DockerRuntime</i>	<i>node:tosca.nodes.Container.Runtime</i>	<i>tosca.relationships.HostedOn</i>	[1, 1]

<i>storage</i>	<i>tosca.capabilities.Storage</i>			[0, 1]
<i>network</i>	<i>tosca.capabilities.Endpoint</i>			[0, 1]

## Notes

- An *image* artifact can be supplied of type *radon.artifacts.docker.DockerImage* in the node template

## Docker Engine Node Type

Type that represents a Docker runtime to run multiple Docker container applications on a single host.

Name	URI	Version	Derived From
<i>DockerRuntime</i>	<i>radon.nodes.docker.DockerRuntime</i>	1.0.0	<i>tosca.nodes.Container.Runtime</i>

## Attributes

Name	Type	Default Value	Description
<i>port</i>	<i>integer</i>	The port value exposed by the <i>docker</i> capability	Exposed port of the Docker daemon

## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>docker</i>	<i>radon.capabilities.container.DockerRuntime</i>	<i>radon.nodes.docker.DockerApplication</i>	[1, UNBOUNDED]

## Google Cloud Function Node Type

An abstract node type that describes a generic Google Cloud Function.

Name	URI	Version	Derived From
<i>GoogleCloudFunction</i>	<i>radon.nodes.google.GoogleCloudFunction</i>	1.0.0	<i>radon.nodes.abstract.Function</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>function_name</i>	<i>true</i>	<i>string</i>			The name of the function.
<i>function_runtime</i>	<i>true</i>	<i>string</i>	<i>valid_values: [nodejs8, nodejs10, python37, go111, nodejs6]</i>		The runtime environment to execute the function.
<i>memory</i>	<i>true</i>	<i>integer</i>	<i>valid_values: [ 128, 256, 512, 1024, 2048]</i>	256	The limit (in MB) on the amount of memory the function can use.
<i>timeout</i>	<i>true</i>	<i>integer</i>	<i>in_range: [1, 540]</i>	60	The limit (in seconds) on time this function is allowed to execute.
<i>entry_point</i>	<i>false</i>	<i>string</i>			Name of a Google Cloud Function (as defined in source code) that will be executed. Defaults to the resource name suffix, if not specified. For backward compatibility, if function with given name is not found, then the system will try to use function named "function". For Node.js this is name of a function exported by the module specified in <i>source_location</i> .

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.google.GoogleCloudPlatform</i>	<i>HostedOn</i>	[1, 1]

## Notes

- All type-specific Google Cloud Functions should derive from this type.

## Google Cloud Platform Node Type

A node type representing the Google Cloud Platform which capable of hosting resources and functions.

Name	URI	Version	Derived From
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<i>GoogleCloudPlatform</i>	<i>radon.nodes.google.GoogleCloudPlatform</i>	1.0.0	<i>radon.nodes.abstract.CloudPlatform</i>
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## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>sdk_version</i>	<i>false</i>	<i>version</i>			Specifies the SDK version required to manage Google Cloud resources.
<i>project_id</i>	<i>true</i>	<i>string</i>			Specifies the unique project-id to be used.
<i>user_account</i>	<i>false</i>	<i>string</i>			Specifies the user account used to log-in if a service account is not used.
<i>api_key</i>	<i>false</i>	<i>string</i>			Encrypted key that can be used to access certain APIs that do not need to access private user data.
<i>authentication_mode</i>	<i>true</i>	<i>string</i>	<i>valid_values: [user-account, service-account, api-key]</i>		Indicates whether user-account, service-account or api-key authentication should be used.
<i>region</i>	<i>true</i>	<i>string</i>			Indicates the default region of the project.
<i>zone</i>	<i>true</i>	<i>string</i>			Indicates the default zone of the project.

## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>host</i>	<i>osca.capabilities.Container</i>	<i>radon.nodes.google.CloudFunction, radon.nodes.google.GoogleCloudResource</i>	[1, UNBOUNDED]

## Notes

- Inputs added to the *Standard* interface operations:
  - create: SDK\_VERSION*
  - configure: PROJECT\_ID, AUTHENTICATION\_MODE, USER\_ACCOUNT, API\_KEY, REGION, ZONE*
- If the selected *authentication\_mode* is *service-account*, the implementing node template should provide an artifact with the service account key.

## Google Cloud Resource Node Type

An abstract node type to describe a generic Google Cloud Resource. All specific Google Cloud Resources should derive from this type.

Name	URI	Version	Derived From
<i>GoogleCloudResource</i>	<i>radon.nodes.google.GoogleCloudResource</i>	1.0.0	<i>tosca.nodes.SoftwareComponent</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>name</i>	<i>true</i>	<i>string</i>			The name of the resource

### Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.google.GoogleCloudPlatform</i>	<i>HostedOn</i>	[1, 1]
<i>invoke</i>	<i>radon.capabilities.Invokeable</i>	<i>radon.nodes.google.CloudFunction</i>	<i>radon.relationships.google.Triggers</i>	[0, UNBOUNDED]

### Notes

- Parameters added to the inputs of the *Standard* interface:
  - NAME*: taken from the *name* property.
- All type-specific Google Cloud Resources should derive from this type.
- This type is the source of the *radon.relationships.google.Triggers* relationship.

## Google Resource-triggered Cloud Function Node Type

A node type that represents a Google Cloud Function that can be triggered by a Google Cloud Resource, such as, a *Bucket* or a *Topic*

Name	URI	Version	Derived From
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<i>GoogleCloudResourceTriggeredFunction</i>	<i>radon.nodes.google.GoogleCloudResourceTriggeredFunction</i>	1.0.0	<i>radon.nodes.google.GoogleCloudFunction</i>
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## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>inovable</i>	<i>radon.capabilities.Invocable</i>	<i>radon.nodes.google.GoogleCloudResource</i>	[1, 1]

## Java Application Node Type

An abstract type that defines a Java application

Name	URI	Version	Derived From
<i>JavaApplication</i>	<i>radon.nodes.java.JavaApplication</i>	1.0.0	<i>tosca.nodes.SoftwareComponent</i>

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>radon.capabilities.container.JavaRuntime</i>		<i>tosca.relationships.HostedOn</i>	[1, 1]

## Notes:

- A *deployment\_package* artifact can be supplied of type *radon.artifacts.archive.JAR* in the node template.

## Java Runtime Node Type

A type that describes a node capable of installing JRE/JDK and hosting Java applications.

Name	URI	Version	Derived From
<i>Java</i>	<i>radon.nodes.java.Java</i>	1.0.0	<i>tosca.nodes.SoftwareComponent</i>

## Attributes

Name	Type	Default Value	Description
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<i>java_home</i>	<i>string</i>	The <i>java_home</i> attribute exposed by the <i>host</i> capability	The location where JAVA binaries are located
<i>component_version</i>	<i>version</i>	The <i>java_version</i> attribute exposed by the <i>host</i> capability	The version of the Java language (value taken from the <i>host</i> capability).
<i>only_jre</i>	<i>boolean</i>	The <i>only_jre</i> attribute exposed by the <i>host</i> capability	Indicates whether only the JRE is required (value taken from the <i>host</i> capability).
<i>headless</i>	<i>boolean</i>	The <i>headless</i> attribute exposed by the <i>host</i> capability	Specifies whether headless mode is enough as the components are run on a server and do not need equipment such as display or keyboard (value taken from the <i>host</i> capability).

## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>host</i>	<i>radon.capabilities.container.JavaRuntime</i>	<i>tosca.nodes.Container.Application</i>	[0, UNBOUNDED]

## Notes

- Inputs added to the *Standard* interface operations:
  - create*: *JAVA\_VERSION, JAVA\_IS\_JRE, JAVA\_IS\_HEADLESS*
  - delete*: *JAVA\_VERSION, JAVA\_HOME*

## Lambda Function Node Type

A node type that represents an AWS Lambda Function that can be triggered by an AWS resource, a fixed schedule or via an API gateway.

Name	URI	Version	Derived From
<i>AwsLambdaFunction</i>	<i>radon.nodes.aws.AwsLambdaFunction</i>	1.0.0	<i>radon.nodes.abstract.Function</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>role_name</i>	<i>true</i>	<i>string</i>			The Amazon Resource Name (ARN) of the function's execution role

<i>role_description</i>	<i>true</i>	<i>string</i>			Description of the function's execution role
<i>runtime</i>	<i>true</i>	<i>string</i>	<i>valid_values: [nodejs, nodejs4.3, nodejs6.10, nodejs8.10, nodejs10.x, java8, python2.7, python3.6, python3.7, dotnetcore1.0, dotnetcore2.0, dotnetcore2.1, nodejs4.3-edge, go1.x, ruby2.5]</i>		The identifier of the function's runtime
<i>handler</i>	<i>true</i>	<i>string</i>		<i>index.handler</i>	The name of the method within your code that Lambda calls to execute your function
<i>memory</i>	<i>true</i>	<i>integer</i>	<i>in_range: [128, 3008]</i>		The amount of memory in megabytes that your function has access to
<i>timeout</i>	<i>true</i>	<i>integer</i>	<i>in_range: [1, 900]</i>	3	The amount of time that Lambda allows a function to run before stopping it
<i>schedule</i>	<i>false</i>	<i>string</i>			The schedule in which the platform will invoke this function, can be a rate or a cron

### Attributes

Name	Type	Default Value	Description
<i>arn</i>	<i>string</i>		Amazon's resource name for this Lambda function

### Capabilities

Name	Type	Valid Source Types	Occurrences
<i>invocable</i>	<i>radon.capabilities.Invocable</i>		[0, UNBOUNDED]

### Notes

- Parameters added to the *Standard* interface inputs:

- *function\_name*
- *function\_role\_name*
- *function\_runtime*
- *function\_handler*
- *function\_memory*
- *function\_timeout*
- *function\_code\_location*
- *aws\_access\_key\_id*
- *aws\_secret\_access\_key*
- *aws\_region*
- *schedule*

### S3 Bucket Node Type

A node type that represents an AWS S3 Bucket.

Name	URI	Version	Derived From
<i>AwsS3Bucket</i>	<i>radon.nodes.aws.AwsS3Bucket</i>	1.0.0	<i>tosca.nodes.Storage.ObjectStorage</i>

#### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>name</i>	<i>true</i>	<i>string</i>			The name of this bucket.

#### Attributes

Name	Type	Default Value	Description
<i>arn</i>	<i>string</i>		Amazon's resource name for this bucket

#### Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>		<i>tosca.relationships.HostedOn</i>	[1, 1]

<i>invoker</i>	<i>radon.capabilities.Invocable</i>	<i>radon.nodes.aws.LambdaFunction</i>	<i>radon.relationships.aws.Triggers</i>	[0, UNBOUNDED]
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## Notes

- Parameters added to the *Standard* interface inputs:
  - aws\_access\_key\_id*
  - aws\_secret\_access\_key*
  - aws\_region*
  - bucket\_name*

## MongoDB Database Node Type

A node type that describes a MongoDB database.

Name	URI	Version	Derived From
<i>MongoDBDatabase</i>	<i>radon.nodes.mysql.MongoDBDatabase</i>	1.0.0	<i>tosca.nodes.Database</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>authentication_database</i>	<i>false</i>	<i>string</i>			If authorization is enabled by the host, defines the database where the user authentication data is stored

## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>database_endpoint</i>	<i>tosca.capabilities.Endpoint.Database</i>		[0, UNBOUNDED]

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Compute</i>	<i>radon.nodes.mongodb.MongoDBMS</i>	<i>tosca.relationships.HostedOn</i>	[1, 1]

## Notes

- If authorization is enabled by the host, the properties: *user*, *password*, and *authentication\_database* must be assigned values.
- Inputs added to the *Standard* interface:
  - *DB\_NAME*, *DB\_USER*, *DB\_PASSWORD*, *DB\_USER\_AUTH\_DB*

## MongoDB DBMS Node Type

A node type that describes a MongoDB DBMS.

Name	URI	Version	Derived From
<i>MongoDBMS</i>	<i>radon.nodes.mongodb.MongoDBMS</i>	1.0.0	<i>tosca.nodes.DBMS</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>component_version</i>	<i>true</i>	<i>version</i>	<i>valid_values: [3.2,3.4,3.6]</i>	3.6	The version of the MongoDB DBMS
<i>port</i>	<i>true</i>	<i>integer</i>	<i>equal: 27017</i>	27017	The listening port of the DBMS
<i>db_path</i>	<i>true</i>	<i>string</i>		<i>/var/lib/mongo</i>	The path where database files will be stored
<i>authorization_enabled</i>	<i>true</i>	<i>boolean</i>		<i>false</i>	Identifies whether users should be authenticated
<i>administrator</i>	<i>false</i>	<i>string</i>			The username of the administrator

## Attributes

Name	Type	Default Value	Description
<i>url</i>	<i>string</i>	<i>concat: ["http://", get_attribute: [HOST, public_address], get_property: [SELF, port] ]</i>	The URL used to formulate the connection string

## Capabilities

Name	Type	Valid Source Types	Occurrences
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<i>host</i>	<i>tosca.capabilities.Compute</i>	<i>radon.nodes.mongodb.MongoDBDatabase</i>	[1, UNBOUNDED]
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## Notes

- Inputs added to the *Standard* interface operations:
  - create: IP\_ADDRESS, MONGODB\_VERSION, MONGODB\_PORT, MONGODB\_DB\_PATH, MONGODB\_AUTHORIZATION, MONGODB\_ADMIN, MONGODB\_ROOT\_PASSWORD*

## MySQL Database Node Type

Node type to represent the logical database that can be managed and hosted on MySQL.

Name	URI	Version	Derived From
<i>MySQLDatabase</i>	<i>radon.nodes.mysql.MySQLDatabase</i>	1.0.0	<i>tosca.nodes.Database</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>user</i>	<i>true</i>	<i>string</i>			the required user account name for DB administration
<i>password</i>	<i>true</i>	<i>string</i>			the required password for the DB user account

## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>database_endpoint</i>	<i>tosca.capabilities.Endpoint.Database</i>		[0, UNBOUNDED]

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Compute</i>	<i>radon.nodes.mysql.MySQLDBMS</i>	<i>tosca.relationships.HostedOn</i>	[1, 1]

## Notes

- Inputs added to the *Standard* interface:
  - DB\_NAME, DB\_USER, DB\_PASSWORD, DBMS\_ROOT\_PASSWORD*

## MySQL DBMS Node Type

A MySQL database management system.

Name	URI	Version	Derived From
<i>MySQLDBMS</i>	<i>radon.nodes.mysql.MySQLDBMS</i>	1.0.0	<i>tosca.nodes.DBMS</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>root_password</i>	<i>true</i>	<i>string</i>			The root password of the DBMS
<i>port</i>	<i>false</i>	<i>integer</i>		3306	The listening port of the DBMS
<i>component_version</i>	<i>true</i>	<i>version</i>		5.6	The version of the MySQL DBMS

### Capabilities

Name	Type	Valid Source Types	Occurrences
<i>host</i>	<i>tosca.capabilities.Compute</i>	<i>radon.nodes.mysql.MySQLDatabase</i>	[1, UNBOUNDED]

### Notes

- Inputs added to the *Standard* interface operations:
  - configure:DBMS\_ROOT\_PASSWORD,DBMS\_PORT*

## NiFi Node Type

A type representing an Apache NiFi middleware component.

Name	URI	Version	Derived From
<i>Nifi</i>	<i>radon.nodes.nifi.Nifi</i>	1.0.0	<i>tosca.nodes.SoftwareComponent</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>component_version</i>	<i>true</i>	<i>version</i>			The version of Apache NiFi

<i>port</i>	<i>true</i>	<i>integer</i>		8080	The listening port of Apache NiFi
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### Capabilities

Name	Type	Valid Source Types	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.apache.nifi.NifiPipeline</i>	[1, UNBOUNDED]

## NiFi Pipeline Node Type

A type representing a data pipeline hosted on Apache NiFi.

Name	URI	Version	Derived From
<i>Pipeline</i>	<i>radon.nodes.nifi.Pipeline</i>	1.0.0	<i>radon.nodes.abstract.DataPipeline</i>

### Attributes

Name	Type	Default Value	Description
<i>id</i>	<i>string</i>		Unique ID of the pipeline

### Capabilities

Name	Type	Valid Source Types	Occurrences
<i>connect</i>	<i>tosca.capabilities.Endpoint</i>	<i>radon.nodes.apache.nifi.NifiPipeline</i>	[0, UNBOUNDED]

### Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.apache.nifi.NifiRuntime</i>	<i>tosca.relationships.HostedOn</i>	[1, 1]
<i>connect</i>	<i>tosca.capabilities.Endpoint</i>	<i>radon.nodes.apache.nifi.NifiPipeline</i>	<i>tosca.relationships.ConnectsTo</i>	[0, 1]

### Notes

- An *pipeline\_template* artifact can be supplied of type *tosca.artifacts.File* in the node template definition.

## NodeJS Application Node Type

The type of a node that represents a Node.js application, and that installs Node.js runtime if necessary.

Name	URI	Version	Derived From
<i>radon.nodes.nodejs.NodeJSApplication</i>	<i>radon.nodes.nodejs.NodeJSApplication</i>	1.0.0	<i>tosca.nodes.SoftwareComponent</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>node_version</i>	<i>true</i>	<i>version</i>		10.16.0	The version of the NodeJS runtime this application uses.

### Notes

- Inputs added to the *Standard* interface operations:
  - *create: NODE\_VERSION*

## OpenFaaS Function Node Type

A node type that represents a function hosted on an OpenFaaS Platform

Name	URI	Version	Derived From
<i>OpenFaaSFunction</i>	<i>radon.nodes.openfaas.OpenFaaSFunction</i>	1.0.0	<i>radon.nodes.abstract.Function</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>function_name</i>	<i>true</i>	<i>string</i>			The name of the function.
<i>function_language_template</i>	<i>true</i>	<i>string</i>	<i>valid_values: [csharp, dockerfile, docekrfile-armhf, go-armhf, go, java8, node-arm64, node-armhf, node, php7, python-armhf, python, python3-armhf, python3, ruby]</i>		The runtime of this function.

## Attributes

Name	Type	Default Value	Description
<i>function_url</i>	<i>string</i>	<i>concat: [ get_attribute: [SELF, gateway_url], "/function/", get_property: [SELF, function_name] ]</i>	The URL at which the function can be addressed via a REST call.
<i>gateway_url</i>	<i>string</i>	<i>get_attribute: [HOST, url]</i>	The URL of the underlying platform.

## Capabilities

Name	Type	Valid Source Types	Occurrences
<i>invocable</i>	<i>radon.capabilities.Invocable</i>		[0, UNBOUNDED]

## Requirements

Name	Capability Type	Node Type Constraint	Relationship Type	Occurrences
<i>host</i>		<i>radon.nodes.openfaas.OpenFaasPlatform</i>		[1, 1]

## Notes

- Parameters added to the inputs of the *Standard* interface:
  - FUNCTION\_NAME*
  - FUNCTION\_LANGUAGE\_TEMPLATE*
  - GATEWAY*

## OpenFaaS Platform Node Type

A node type that represents an externally managed OpenFaaS Platform.

Name	URI	Version	Derived From
<i>OpenFaasPlatform</i>	<i>radon.nodes.openfaas.OpenFaasPlatform</i>	1.0.0	<i>radon.nodes.abstract.CloudPlatform</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>kubernetes_version</i>	<i>false</i>	<i>version</i>		1.8	The version of the Kubernetes cluster hosting this platform.

<i>basic_auth_user</i>	<i>true</i>	<i>string</i>			The username used for basic authentication.
<i>basic_auth_password</i>	<i>true</i>	<i>string</i>			The password used for basic authentication.
<i>api_gateway_host</i>	<i>true</i>	<i>string</i>			The host name to access OpenFaaS API gateway at.
<i>api_gateway_port</i>	<i>true</i>	<i>integer</i>		31112	The port to access OpenFaaS API gateway at.
<i>prometheus_port</i>	<i>true</i>	<i>integer</i>		31119	The port to access the Prometheus service at.

### Attributes

Name	Type	Default Value	Description
<i>url</i>	<i>string</i>	<i>concat: ["http://", get_property: [SELF, api_gateway_host], get_property: [SELF, api_gateway_port] ]</i>	The full gateway url.

### Capabilities

Name	Type	Valid Source Types	Occurrences
<i>host</i>	<i>tosca.capabilities.Container</i>	<i>radon.nodes.openfaas.OpenFaasFunction</i>	[0, UNBOUNDED]

### Notes

- Parameters added to the *Standard* interface operations:
  - create: KUBERNETES\_VERSION*
  - configure: URL, BASIC\_AUTH\_USER, BASIC\_AUTH\_PASSWORD*

## Apache AB CTT Agent Node Type

This node type represents an agent that can execute load tests with the Apache AB tool.

Name	URI	Version	Derived From
<i>AB</i>	<i>radon.nodes.testing.AB</i>	1.0.0	<i>radon.nodes.testing.LoadTestAgent</i>

## CTT Agent Node Type

This (abstract) node type represents an agent that can execute tests.

Name	URI	Version	Derived From
<i>CTTAgent</i>	<i>radon.nodes.testing.CTTAgent</i>	1.0.0	<i>radon.nodes.docker.DockerApplication</i>

## Deployment Test Agent Node Type

This node type represents an agent that can execute deployment tests.

Name	URI	Version	Derived From
<i>DeploymentTestAgent</i>	<i>radon.nodes.testing.DeploymentTestAgent</i>	1.0.0	<i>radon.nodes.testing.CTTAgent</i>

## Apache JMeter CTT Agent Node Type

This node type represents an agent that can execute load tests with the Apache JMeter tool.

Name	URI	Version	Derived From
<i>JMeter</i>	<i>radon.nodes.testing.JMeter</i>	1.0.0	<i>radon.nodes.testing.LoadTestAgent</i>

## Properties

Name	Required	Type	Constraint	Default Value	Description
<i>jmeter_properties</i>	<i>false</i>	<i>string</i>			Location and filename of a file with JMeter properties (optional)
<i>worker_hostnames</i>	<i>false</i>	<i>string</i>			Comma-separated list of worker hostnames

## Load Test Agent Node Type

This (abstract) node type represents an agent that can execute load tests.

Name	URI	Version	Derived From
<i>LoadTestAgent</i>	<i>radon.nodes.testing.LoadTestAgent</i>	1.0.0	<i>radon.nodes.testing.CTTAgent</i>

## Locust CTT Agent Node Type

This node type represents an agent that can execute load tests with the Locust tool.

Name	URI	Version	Derived From
<i>Locust</i>	<i>radon.nodes.testing.Locust</i>	1.0.0	<i>radon.nodes.testing.LoadTestAgent</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>worker_hostnames</i>	<i>false</i>	<i>string</i>			Comma-separated list of worker hostnames

## QT CTT Agent Node Type

This node type represents an agent that can execute load tests with the DICE QT tool.

Name	URI	Version	Derived From
<i>QT</i>	<i>radon.nodes.testing.QT</i>	1.0.0	<i>radon.nodes.testing.LoadTestAgent</i>

## AWS EC2

### OpenStack Compute Node Type

A type representing a virtual machine on OpenStack.

Name	URI	Version	Derived From
<i>OpenStack</i>	<i>radon.nodes.VM.OpenStack</i>	1.0.0	<i>tosca.nodes.Compute</i>

### Properties

Name	Required	Type	Constraint	Default Value	Description
<i>name</i>	<i>true</i>	<i>string</i>			Name that should be given to the VM in OpenStack

<i>image_id</i>	<i>true</i>	<i>string</i>		OpenStack image ID (image names are not accepted)
<i>flavor_id</i>	<i>true</i>	<i>string</i>		OpenStack flavor ID (flavor names are not accepted)
<i>network_id</i>	<i>true</i>	<i>string</i>		OpenStack network ID (network names are not accepted)
<i>key_name</i>	<i>true</i>	<i>string</i>		OpenStack SSH key name that should be placed on the VM

### Attributes

Name	Type	Default Value	Description
<i>id</i>	<i>string</i>		OpenStack ID of the VM
<i>public_address</i>	<i>string</i>		OpenStack public IP address of the VM

### Notes

- Inputs added to the *Standard* interface operations:
  - create*: *NAME, IMAGE, FLAVOR, NETWORK, KEY\_NAME*
  - delete*: *ID*

## SockShop Node Type

Simple wrapper around the whole SockShop application run with Docker Compose.

Name	URI	Version	Derived From
<i>SockShop</i>	<i>radon.nodes.SockShop</i>	1.0.0	<i>tosca.nodes.SoftwareComponent</i>

## Workstation Node Type

Simple type representing the developers local system.

Name	URI	Version	Derived From
<i>Workstation</i>	<i>radon.nodes.Workstation</i>	1.0.0	<i>tosca.nodes.Compute</i>



### 3. RADON Particles - Relationship Types

#### Triggers Relationship (Abstract)

Abstract relationship type representing connection to an endpoint node.

Name	URI	Version	Derived From
ConnectsTo	radon.relationships.abstract.ConnectsTo	1.0.0	tosca.relationships.ConnectsTo

#### Properties

Name	Required	Type	Constraint	Default Value	Description
interactions	false	list: radon.datatypes.Interaction			List of interactions

#### Triggers Relationship (Abstract)

Abstract relationship type representing triggering of an invocable node.

Name	URI	Version	Derived From
Triggers	radon.relationships.abstract.Triggers	1.0.0	tosca.relationships.Root

#### Valid Target types

- radon.capabilities.Invocable

#### Properties

Name	Required	Type	Constraint	Default Value	Description
events	true	list: radon.datatypes.Event			List of events
interactions	false	list: radon.datatypes.Interaction			List of interactions

#### Publish to Kaka Topic Relationship

This type represents the relationship between a Kafka producer and a Kafka topic.

Name	URI	Version	Derived From
PublishToKafkaTopic	radon.relationships.apache.kafka.PublishToKafkaTopic	1.0.0	tosca.relationships.ConnectsTo

### Valid Target types

- radon.capabilities.kafka.KafkaTopic

### Properties

Name	Required	Type	Constraint	Default Value	Description
request_required_acks	true	string	valid_values: [ no_ack, leader, in_syncs ]	no_ack	This value controls when a produce request is considered completed. Typical values are: no_ack: producer does not wait. leader: producer waits only for the leader broker. in_syncs: producer waits for all in-sync brokers.
message_send_max_retries	false	integer	greater_or_equal: 0	3	This property will cause the producer to automatically retry a failed send request. May result in duplicates.
retry_backoff	false	integer	greater_or_equal: 0	100	This property specifies the amount of time (in ms) that the producer waits before refreshing the metadata of relevant topics to allow for potential leader election.
request_timeout	false	integer	greater_or_equal: 0	10000	This property specifies the amount of time (in ms) that the producer waits before refreshing the metadata of relevant topics to allow for potential leader election. The amount of time the broker will wait trying to meet the request.required.acks requirement before sending back an error to the client.

## Kafka Triggers Relationship (OpenWhisk)

OpenWhisk-specific relationship type representing Kafka-to-OpenWhisk Function communication

Name	URI	Version	Derived From
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OpenWhiskKafkaTriggers	radon.relationships.apache.openwhisk.OpenWhiskKafkaTriggers	1.0.0	radon.relationships.abstract.Triggers
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### Valid Target types

- radon.capabilities.Invocable

### Properties

Name	Required	Type	Constraint	Default Value	Description
events	true	list of radon.datatypes.Event	length: 1		A list of events (1 in this case) of type radon.datatypes.Event that are conveyed to the target

### Notes

- Parameters added to the inputs of the Configure interface:
  - EVENT
  - TRIGGER\_NAME: needed to correctly create and delete the underlying trigger.
- Parameters added to the inputs of the Configure interface operations:
  - post\_configure\_target: BROKERS, TOPIC\_NAME, IS\_JSON\_DATA, IS\_BINARY\_KEY, IS\_BINARY\_VALUE
- The post\_configure\_target operation creates an OpenWhisk trigger based on the Kafka feed, and associates the trigger with the function via a rule.

## AWS Triggers Relationship

AWS-specific relationship type representing AwsResource-to-AwsLambdaFunction communication.

Name	URI	Version	Derived From
AwsTriggers	radon.relationships.aws.AwsTriggers	1.0.0	radon.relationships.abstract.Triggers

### Properties

Name	Required	Type	Constraint	Default Value	Description
events	true	string			List of events

## CosmosDB Triggers Relationship

A relationship type representing CosmosDB-to-AzureCFunction communication.

Name	URI	Version	Derived From
AzureCosmosDBTriggers	radon.relationships.azure.AzureCosmosDBTriggers	1.0.0	radon.relationships.azure.Triggers

### Notes

- The following parameters are added to the inputs of the Configure interface:
  - COLLECTION\_NAME
  - CONNECTION\_STRING\_SETTING
  - ACCOUNT\_NAME
  - RESOURCE\_GROUP
- A template of this type should provide implementation artifacts that deploy the Azure Function specified at the TARGET side.

## Azure Triggers Relationship

An abstract relationship type representing AzureResource-to-AzureCFunction communication.

Name	URI	Version	Derived From
AzureTriggers	radon.relationships.azure.AzureTriggers	1.0.0	radon.relationships.abstract.Triggers

### Properties

Name	Required	Type	Constraint	Default Value	Description
events	true	list of radon.datatypes.Event	length: 1		The event associated with this relationship

### Notes

- The following parameters are added to the inputs of the Configure interface:
  - EVENT: taken from the events property
  - RESOURCE: the name of the SOURCE Azure Resource
  - FUNCTION\_NAME

- TIMEOUT
- APP\_NAME
- APP\_RUNTIME
- APP\_OS\_TYPE
- APP\_STORAGE\_ACCOUNT
- APP\_RESOURCE\_GROUP
- A template of this type should provide implementation artifacts that deploy the Azure Function specified at the TARGET side.

## ConnectNifiLocal Relationship

To establish the connection between two local data pipeline nodes.

Name	URI	Version	Derived From
ConnectNifiLocal	radon.relationships.datapipeline.ConnectNifiLocal	1.0.0	tosca.relationships.ConnectsTo

## Google Cloud Triggers Relationship

Google Cloud-specific relationship type representing GCRsource-to-GCFunction communication.

Name	URI	Version	Derived From
GoogleTriggers	radon.relationships.google.GoogleTriggers	1.0.0	radon.relationships.abstract.Triggers

### Properties

Name	Required	Type	Constraint	Default Value	Description
events	true	list of radon.datatypes.Event	length: 1		The event associated with this relationship

### Notes

- The following parameters are added to the inputs of the Configure interface:
  - EVENT: taken from the events property
  - RESOURCE: the name of the SOURCE Google Cloud Resource
- A template of this type should provide implementation artifacts that deploy the Cloud Function specified at the TARGET side.

## ConnectsToNifi Relationship

To establish the connection between two Apache Nifi systems.

Name	URI	Version	Derived From
ConnectsToNifi	radon.relationships.nifi.ConnectsToNifi	1.0.0	tosca.relationships.ConnectsTo

## Kafka Triggers Relationship (OpenFaaS)

OpenFaaS-specific relationship type representing Kafka-to-OpenFaaS Function communication

Name	URI	Version	Derived From
OpenFaasKafkaTriggers	radon.relationships.openfaas.OpenFaasKafkaTriggers	1.0.0	radon.relationships.abstract.Triggers

### Valid Target types

- `radon.capabilities.Invocable`

### Properties

Name	Required	Type	Constraint	Default Value	Description
events	true	list of <code>radon.datatypes.Event</code>	length: 1		A list of events (1 in this case) of type <code>radon.datatypes.Event</code> that are conveyed to the target

### Notes

- Parameters added to the inputs of the Configure interface:
  - EVENT
- Parameters added to the inputs of the Configure interface operations:
  - `post_configure_target`: BROKERS, TOPIC\_NAME, GATEWAY\_URL
- The `post_configure_target` operation updates the target function by adding an annotation with the topic name, deploys an OpenFaaS Kafka connector, and configures the connector to forward message from the topic to the function.



## 4. RADON Particles - Policy Types

### Mean Response Time Policy

Policy type representing the required mean response time of a request.

Name	URI	Version	Derived From
MeanResponseTime	radon.policies.performance.MeanResponseTime	1.0.0	tosca.policies.Performance

#### Properties

Name	Required	Type	Constraint	Default Value	Description
target_entries	false	list: string			List of target entries
lower_bound	false	float	greater_or_equal: 0.0		Lower bound in seconds
upper_bound	false	float	greater_or_equal: 0.0		Upper bound in seconds

### Mean Total Response Time Policy

Policy type representing the required mean total response time of a request.

Name	URI	Version	Derived From
MeanTotalResponseTime	radon.policies.performance.MeanTotalResponseTime	1.0.0	tosca.policies.Performance

#### Properties

Name	Required	Type	Constraint	Default Value	Description
target_entries	false	list: string			List of target entries
lower_bound	false	float	greater_or_equal: 0.0		Lower bound in seconds
upper_bound	false	float	greater_or_equal: 0.0		Upper bound in seconds

## Auto Scale Policy

Policy type representing an auto-scaling configuration for a TOSCA entity.

Name	URI	Version	Derived From
AutoScale	radon.policies.scaling.AutoScale	1.0.0	tosca.policies.Scaling

### Properties

Name	Required	Type	Constraint	Default Value	Description
min_size	true	integer	greater_or_equal: 1		The minimum number of instances
max_size	true	integer			The maximum number of instances

## Scale In Policy

Policy type representing a scale-in configuration for a TOSCA entity.

Name	URI	Version	Derived From
ScaleIn	radon.policies.scaling.ScaleIn	1.0.0	tosca.policies.Scaling

### Properties

Name	Required	Type	Constraint	Default Value	Description
cpu_lower_bound	false	float	greater_or_equal: 0.0		The lower bound for the CPU
cpu_upper_bound	false	float	less_or_equal: 100.0		The upper bound for the CPU
adjustment	false	integer	less_or_equal: -1		The amount by which to scale

## Scale Out Policy

Policy type representing a scale-out configuration for a TOSCA entity.

Name	URI	Version	Derived From
ScaleOut	radon.policies.scaling.ScaleOut	1.0.0	tosca.policies.Scaling

## Properties

Name	Required	Type	Constraint	Default Value	Description
cpu_lower_bound	false	float	greater_or_equal: 0.0		The lower bound for the CPU
cpu_upper_bound	false	float	less_or_equal: 100.0		The upper bound for the CPU
adjustment	false	integer	greater_or_equal: 1		The amount by which to scale

## AB Load Test Policy

This policy type represents a load test case for the Apache AB tool.

Name	URI	Version	Derived From
ABLoadTest	radon.policies.testing.ABLoadTest	1.0.0	radon.policies.testing.LoadTest

## HTTP Endpoint Test Policy

Policy type representing a test case specification for a HTTP endpoint test.

Name	URI	Version	Derived From
HttpEndpointTest	radon.policies.testing.HttpEndpointTest	1.0.0	radon.policies.testing.Test

## Properties

Name	Required	Type	Constraint	Default Value	Description
use_https	true	boolean		false	If https shall be used
method	true	string		GET	The http method to use
hostname	true	string			The host to use
port	true	integer		80	The port to use
path	true	string		/	The path to use
test_body	false	json			The body to use as json
test_header	false	map of string			The http headers to use

expected_status	true	integer		200	The expected http status return code
expected_body	false	json			The expected body value as json

## JMeter Load Test Policy

This policy type represents a load test case for the Apache JMeter tool.

Name	URI	Version	Derived From
JMeterLoadTest	radon.policies.testing.JMeterLoadTest	1.0.0	radon.policies.testing.LoadTest

### Properties

Name	Required	Type	Constraint	Default Value	Description
jmx_file	true	string			Location and filename of the JMeter test plan
user.properties	false	string			Location and filename of a file with properties for the test plan (optional)

## Load Test Policy

This (abstract) policy type represents a load test case.

Name	URI	Version	Derived From
LoadTest	radon.policies.testing.Test	1.0.0	radon.policies.testing.Test

### Properties

Name	Required	Type	Constraint	Default Value	Description
hostname	false	string			Convenience property to specify a hostname as the target of the load test (optional)
port	false	string			Convenience property to specify a port as the target of the load test (optional)

## Locust Load Test Policy

This policy type represents a load test case for the Apache JMeter tool.

Name	URI	Version	Derived From
LocustLoadTest	radon.policies.testing.LocustLoadTest	1.0.0	radon.policies.testing.LoadTest

### Properties

Name	Required	Type	Constraint	Default Value	Description
locust_file	true	string			Location and filename of the Locust script
locust_conf	false	string			Location and filename of a file with properties (optional)

## Ping Test Policy

Policy type representing a test case specification for a ping test.

Name	URI	Version	Derived From
PingTest	radon.policies.testing.PingTest	1.0.0	radon.policies.testing.Test

### Properties

Name	Required	Type	Constraint	Default Value	Description
hostname	true	string			The hostname to be used as the destination for the ping test

## QT Load Test Policy

This policy type represents a load test case for the DICE QT tool.

Name	URI	Version	Derived From
QTLoadTest	radon.policies.testing.QTLoadTest	1.0.0	radon.policies.testing.LoadTest

## TCP Ping Test Policy

Policy type representing a test case specification for a TCP ping test.

Name	URI	Version	Derived From
TcpPingTest	radon.policies.testing.TcpPingTest	1.0.0	radon.policies.testing.Test

### Properties

Name	Required	Type	Constraint	Default Value	Description
port	true	integer			The port to ping during the test
hostname	true	string			The host to ping during the test

## Test Policy

This (abstract) policy type represents a test case.

Name	URI	Version	Derived From
Test	radon.policies.testing.Test	1.0.0	

### Properties

Name	Required	Type	Constraint	Default Value	Description
ti_blueprint	true	string			Reference to a RADON test infrastructure blueprint
test_id	false	string			Identifier for this test case

## 5. RADON Particles - Artifact Types

### Ansible Artifact

This artifact represents a Ansible implementation.

Name	URI	Version	Derived From
Ansible	radon.artifacts.Ansible	1.0.0	tosca.artifacts.Implementation

### Java Archive Artifact

This artifact represents a Java archive.

Name	URI	Version	Derived From
JAR	radon.artifacts.archive.JAR	1.0.0	tosca.artifacts.File

### ZIP Archive Artifact

This artifact represents a ZIP archive.

Name	URI	Version	Derived From
Zip	radon.artifacts.archive.Zip	1.0.0	tosca.artifacts.File

### InstallPipeline Artifact

This artifact represents an implementation artifact to install a data pipeline.

Name	URI	Version	Derived From
InstallPipeline	radon.artifacts.datapipeline.InstallPipeline	1.0.0	tosca.artifacts.Root

## Docker Image Artifact

This artifact represents a Docker image that needs to be deployed.

Name	URI	Version	Derived From
DockerImage	radon.artifactes.docker.DockerImage	1.0.0	tosca.artifacts.Deployment.Image

## 6. RADON Particles - Capability Types

### Invocable Capability

The type indicates capabilities of an entity that is invocable by an event.

Name	URI	Version	Derived From
Invocable	radon.capabilities.Invocable	1.0.0	tosca.capabilities.Root

### Docker Runtime Capability

The type indicates capabilities of a Docker runtime environment.

Name	URI	Version	Derived From
DockerRuntime	radon.capabilities.container.DockerRuntime	1.0.0	tosca.capabilities.Container

### Properties

Name	Required	Type	Constraint	Default Value	Description
version	false	version			The supported Docker version
publish_ports	false	list of PortSpec		List of ports mappings from source (Docker container) to target (host) ports to publish	
expose_ports	false	list of PortSpec		List of ports mappings from source (Docker container) to expose to other Docker containers (not accessible outside host)	
volumes	false	list of string		List of volume mappings to enable access from the Docker container to a directory on the host machine	
port	true	integer		2375	Port number of the exposed Docker API

## Notes

- When the `expose_ports` property is used, only the `source` and `source_range` properties of `PortSpec` would be valid for supplying port numbers or ranges, the `target` and `target_range` properties would be ignored.

## Java Runtime Capability

The type indicates capabilities of a Java runtime environment.

Name	URI	Version	Derived From
JavaRuntime	radon.capabilities.container.JavaRuntime	1.0.0	tosca.capabilities.Container

## Properties

Name	Required	Type	Constraint	Default Value	Description
java_version	true	integer		8	The version of the Java language.
only_jre	true	boolean		true	Indicates whether only the JRE is required.
headless	true	boolean		true	Specifies whether headless mode is enough as the components are run on a server and do not need equipment such as display or keyboard.

## Valid Source Types

- radon.nodes.java.JavaApplication

## ConnectToPipeline Capability

The type indicates capabilities of an entity that is able to connect to a data pipeline.

Name	URI	Version	Derived From
ConnectToPipeline	radon.capabilities.datapipeline.ConnectToPipeline	1.0.0	tosca.capabilities.Endpoint

## Kafka Hosting Capability

This capability type describes a node that is capable of hosting Kafka Topics

Name	URI	Version	Derived From
KafkaHosting	radon.capabilities.kafka.KafkaHosting	1.0.0	tosca.capabilities.Container

## Kafka Topic Capability

This capability type describes a node that represents a Kafka Topic

Name	URI	Version	Derived From
KafkaTopic	radon.capabilities.kafka.KafkaTopic	1.0.0	tosca.capabilities.Root

### Notes

- A node template that uses this capability should provide values for the the `ip_address` and `port` properties so that topic consumers can establish connection to the suitable Kafka bootstrap server.

## 7. RADON Particles - Data Types

### Activity Data Type

Data type representing an activity of an entry.

Name	URI	Version	Derived From
Activity	radon.datatypes.Activity	1.0.0	tosca.datatypes.Root

#### Properties

Name	Required	Type	Constraint	Default Value	Description
service_time	true	radon.datatypes.RandomVariable			Service time in seconds
bound_to_entry	false	boolean			True if it is bound to the entry
replies_to_entry	false	boolean			True if it replies to the entry
request_pattern	false	string	valid_values: [stochastic, deterministic]		Request pattern

### Entry Data Type

Data type representing an entry at a TOSCA node.

Name	URI	Version	Derived From
Entry	radon.datatypes.Entry	1.0.0	tosca.datatypes.Root

#### Properties

Name	Required	Type	Constraint	Default Value	Description
activities	true	map: radon.datatypes.Activity			Map of activities

precedences	false	list: radon.datatypes.Precedence		List of precedences
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## Event Data Type

Data type representing an event based on the CNCF CloudEvents schema.

Name	URI	Version	Derived From
Event	radon.datatypes.Event	1.0.0	tosca.datatypes.Root

### Properties

Name	Required	Type	Constraint	Default Value	Description
type	true	string			Event type, e.g., s3:ObjectCreated:Put
spec_version	false	string		0.3	CloudEvents spec version
data_content_encoding	false	string			Event's content encoding
data_content_type	false	string			Type of event's data content, e.g., text/xml
schema_url	false	string			URL to the event's schema definition

## Interaction Data Type

Data type representing an interaction on a TOSCA relationship.

Name	URI	Version	Derived From
Interaction	radon.datatypes.Interaction	1.0.0	tosca.datatypes.Root

### Properties

Name	Required	Type	Constraint	Default Value	Description
type	true	string	valid_values: [synchronous, asynchronous]	synchronous	Interaction type
source_activity	true	string			Source activity

target_entry	true	string			Target entry
number_of_requests	true	float	greater_or_equal: 0.0	1.0	Number of requests
network_delay	false	radon.datatypes.RandomVariable			Network delay in seconds

## Precedence Data Type

Data type representing a precedence between two sets of activities.

Name	URI	Version	Derived From
Precedence	radon.datatypes.Precedence	1.0.0	tosca.datatypes.Root

### Properties

Name	Required	Type	Constraint	Default Value	Description
type	true	string	valid_values: [sequence, and-fork, and-join, or-fork, or-join, loop]	sequence	Precedence type
pre_activities	true	list: string			List of pre-activities
post_activities	true	list: string			List of post-activities
parameters	false	list: float	greater_or_equal: 0.0		List of parameters

## Random Variable Data Type

Data type representing a random variable that always takes non-negative values.

Name	URI	Version	Derived From
RandomVariable	radon.datatypes.RandomVariable	1.0.0	tosca.datatypes.Root

## Properties

Name	Required	Type	Constraint	Default Value	Description
mean	true	float	greater_or_equal: 0.0	1.0	Mean value
scv	false	float	greater_or_equal: 0.0		Squared coefficient of variation

## Entries Data Type

Data type representing the set of entries at a serverless function.

Name	URI	Version	Derived From
Entries	radon.datatypes.function.Entries	1.0.0	tosca.datatypes.Root

## Properties

Name	Required	Type	Constraint	Default Value	Description
execute	true	radon.datatypes.Entry			Execute entry

## Entries Data Type

Data type representing the set of entries at an object storage.

Name	URI	Version	Derived From
Entries	radon.datatypes.objectstorage.Entries	1.0.0	tosca.datatypes.Root

## Properties

Name	Required	Type	Constraint	Default Value	Description
get	false	radon.datatypes.Entry			Get entry
put	false	radon.datatypes.Entry			Put entry
delete	false	radon.datatypes.Entry			Delete entry

## Entries Data Type

Data type representing the set of entries at a workload.

Name	URI	Version	Derived From
Entries	radon.datatypes.workload.Entries	1.0.0	tosca.datatypes.Root

### Properties

Name	Required	Type	Constraint	Default Value	Description
start	true	radon.datatypes.Entry			Start entry