Automated Service Builder
Framework for Globally Distributable processing

Overview

ASB is a platform and application agnostic solution for implementing complex processing chains over globally distributed processing and data resources. ASB provides a "low coding" solution to develop a data processing facility based on orchestrated workflows.

Users can define, configure and run algorithms embedded in workflows. ASB provides functions to register new processes, import and dockerize user defined algorithms, graphically edit workflow definitions, executing processors with user-defined parameters, and access the results stored in private S3 buckets either directly using the integrated web console or using S3 compatible client libraries and applications. ASB has implemented a customisable ontology-based mechanism that verifies the consistency of the dataflow between processes. Only compatible process parameters may be connected to pass data within workflows. Unconnected input parameters are treated as user defined inputs for which a Web-based interactive interface is automatically generated.

ASB's Generic Flexible Orchestration means that processor tasks are orchestrated by the workflow engine independent of the location of the actual
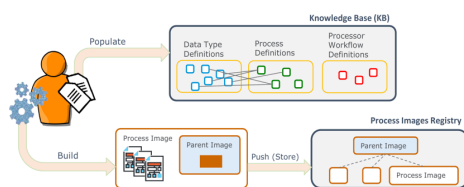

Figure 1 Process to populate the ASB framework

executable files and independent of the underlying programming languages and related technologies.

User algorithms are packaged, deployed and executed on user-selected platforms which can be where the data is located.

Algorithm developers and software specialists benefit from ASB's Process Import Tool that ingests user's own algorithms and libraries to be included in the ASB knowledge base (Figure 1). Imported algorithms can be used by other users providing a platform to co-develop algorithms for faster development cycles, easy substitution of modules in processing chains for comparative studies and scalability at processing platform and algorithm levels.

ASB is offered as a paid service, integrated into a project or as a license based product installed on a cloud platform of choice. Space Applications Service ASB technical team is ready to support.

Using ASB

ASB is a "low coding" solution that provides tools to allow users to ingest algorithms and libraries and organise these into processing chains (workflows). ASB caters for users with preliminary algorithms to test or algorithms ready to be used to create a systematic highly scalable big data processing service. In both cases the approach to ingesting the user's algorithms is the same. With algorithms coded and libraries identified to be used ASB provides an import tool to ingest the algorithms to build process images and populate the Knowledge Base. The Process Import Tool is implemented as a separate module that can be packaged and run either separately, or within a Docker container.

APPLICATIONS
ASB caters for users with preliminary algorithms to test or algorithms ready to be used to create a systematic highly scalable big data processing service.
ASB is designed for defining, managing and executing complex heterogeneous processing chains (workflows) using globally distributed data and processing resources.

SERVICES AVAILABLE
- Service to scientists and data analysts to perform data processing
- Product for use in developing processing facilities requiring highly scalable solutions
- Implementation and customisation

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ABOUT SPACE APPLICATIONS SERVICES
Space Applications Services NV/SA is an independent Belgian company founded in 1987, with a subsidiary in Houston, USA.
Our aim is to research and develop innovative systems, solutions and products and provide services to the aerospace and security markets and related industries. Our activities cover manned and unmanned spacecraft, launch/re-entry vehicles, control centres, robotics and a wide range of information systems.

All interactions with the ASB platform components are performed through their respective APIs.

Repeated use of the import tool allows users to create custom processors for use in workflows. All the processes to be executed by the processor are deployed and registered in the platform with the process metadata being registered in the Knowledge Base. A graphical workflow editor (Figure 2) is used for identifying the processes and specifying the flow of the data between these processes (output to inputs connections).
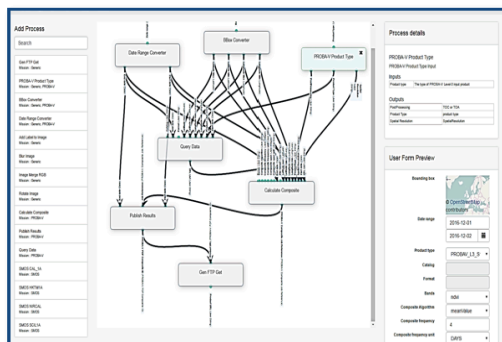

Figure 2 Graphical Workflow Editor

Data flows that are undefined in a workflow are treated as user provided inputs. Input parameters can be given a default value, be configured as visible but read-only for the users or simply hidden.

A form is dynamically generated and includes all the process inputs present in the workflow not connected to a process output and not configured as hidden (Figure 3).

Systematic (event driven or scheduled) and on-demand processing using the generated parameterisation form are supported.

Figure 3 Parameterisation Form

Operation Environments

There are two distinct environments: the Controller Node, and a distributed, potentially Cloud-based Execution Environment, in which Worker Nodes are deployed (Figure 4).
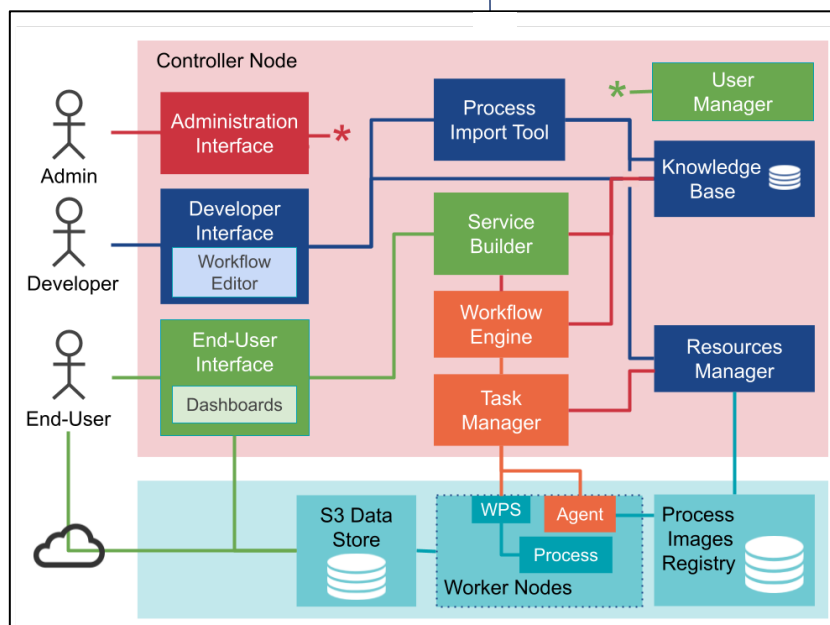

Figure 4 Controller Node & a distributed, potentially Cloud-based Execution Environment

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The Controller Node comprises a number of core components, exposing their functions through remotely callable (SOAP or REST) APIs making it possible to distribute the components on several (physical or virtual) hosts, should it be necessary. Its physical location is of little importance. It can be deployed locally or remotely, in a dedicated server, or in a Cloud, in a self-managed host or in a Kubernetes cluster.

Worker Nodes are physical or Virtual Machines (VMs) running in static infrastructures or in Cloud-based Environments. By default, these machines run an Agent and have no pre-installed processes. Workflow processes are dynamically deployed and executed, automatically balancing the load among the nodes.

The available Worker Nodes are automatically detected and used to deploy workflow processes. This makes it possible to scale the processing resources dynamically.

Multi-platform support

ASB allows users to develop their application on any platform of their own choice and then decide how to integrate it into ASB. Developers collaborating to develop complex workflows will import their algorithms and share them with their co-developers. While service providers may wish to make the algorithm available as a service and charge to use the service on their own platform. Imported algorithms can be used as a process in a workflow. A process in a workflow can be assigned to any platform for execution for which the user has been assigned access.

ASB Components

Knowledge Base

The Knowledge Base contains the information necessary to generate the products. In particular, it stores the definition of knowledge elements such as data types, input and output parameters, processes and processors.

Process Import Tool

The Process Import Tool is a Web application which allows importing and preparing user code as dockerized processes. Templates are used to make sure users have a correctly built process that includes the inputs and outputs. Popular Programming languages (Python, R, Java) and libraries (GDAL, SNAP) are installed. Other languages and libraries can be resolved by importing the libraries when the docker is built. The Process Import Tool makes it possible for users to create their own libraries of modules that can be used to build workflows and share with co-developers. The Process Import Tool imposes no restrictions on the programming language.

Service Builder

The Service Builder transforms product requests into Workflow Execution Orders by fetching the necessary definitions from the Knowledge Base, injecting user-provided inputs if any, and resolving the dependencies between the processes. The Orders are transmitted to the Workflow Engine for execution.

Workflow Engine

The Workflow Engine is in charge of executing processor workflows.

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BECOME A USER

ASB is offered as a service, implemented by Space Applications Services or as a product to develop a processing facility supported by Space Applications Services.

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Individual process execution requests are sent to the Task Manager.

Task Manager

The Task Manager's role is to abstract the execution of each task launched by the Workflow Engine, by hiding the Cloud Environment where the tasks are executed. The Task Manager balances the load of the tasks stemming from the Workflow Engine according to the resources deployed in the Cloud.

Resource Manager

The component maintains a registry of all the processes that can be deployed.

Process Images Registry

The Process Images Registry stores the image of the Docker containers in which the processing services are installed. Images are available for download, instantiation and execution. Each of these images may be instantiated and started multiple times within the same VM or within several VMs.

Developer Interface

The Developer interface is the web-based graphical front-end that allows algorithm and workflow developers to import new algorithms as individual processes, combine these processes into workflows, test the execution of these workflows, and finally share them as applications with End-users. Individual processes may also be shared among the developers.

End-user Interface

The End-user interface is the web-based graphical front-end that allows End-users to discover the available

workflows, execute them immediately, providing the requested inputs, or configuring deferred executions, e.g. triggered by an event or at a given interval. The interface allows monitoring the progress of the executions and accessing the past and present execution reports. An integrated S3 console gives access to the buckets where processing results (including data files and log traces) are stored.

Dashboards

The ASB framework integrates a general purpose Web-based dashboard with editable layout which allows End-users to select the visualisation components to include on the screen and how they must be organised. A pre-existing set of visualisation components is included and more may be implemented depending on the needs.

Administration Interface

The Administration interface gives access to the various administration interfaces implemented in the ASB Core Components running in the Controller Node.

EOEPCA Compatibility

Work is on-going for extending the ASB framework with the ability to create operational services compatible with the EOEPCA reference implementation. The possibility to import and execute EOEPCA compliant applications is already included. Support for EOPCA compliant workflows will be added in the future.

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