



## Annual Review for Seapath

# Seapath

## **Brief Description:**

SEAPATH, Software Enabled Automation Platform and Artifacts (THerein), aims at developing a “reference design” and “industrial grade” open source real-time platform that can run virtualized automation and protection applications (for the power grid industry in the first place and potentially beyond). This platform is intended to host multi-provider applications.

## **TSC Chairperson:**

Aurelien Watare (aurelien.watare@rte-france.com)

## **TSC Members and Affiliations:**

Eloi Bail (Savoir-faire Linux) / TAC representative

Tony Milne (Advantech)

Ferry Huberts (Locamation)

Sander Janson (Alliander)

## **Contributed by:**

Savoir-faire Linux, RTE, Alliander, GE Renewable Energy

## **Key Links**

**Github:** <https://github.com/seapath>

**Website:** <https://www.lfenergy.org/projects/seapath/>

**Artwork:** N/A

## **Mailing lists:**

- <https://lists.lfenergy.org/g/SEAPATH>
- Slack LFEnergy #seapath (49 members)

## **OpenSSF Best Practice Badge URL:**

<https://bestpractices.coreinfrastructure.org/en/projects/5398>

# Early Adoption Project review criteria

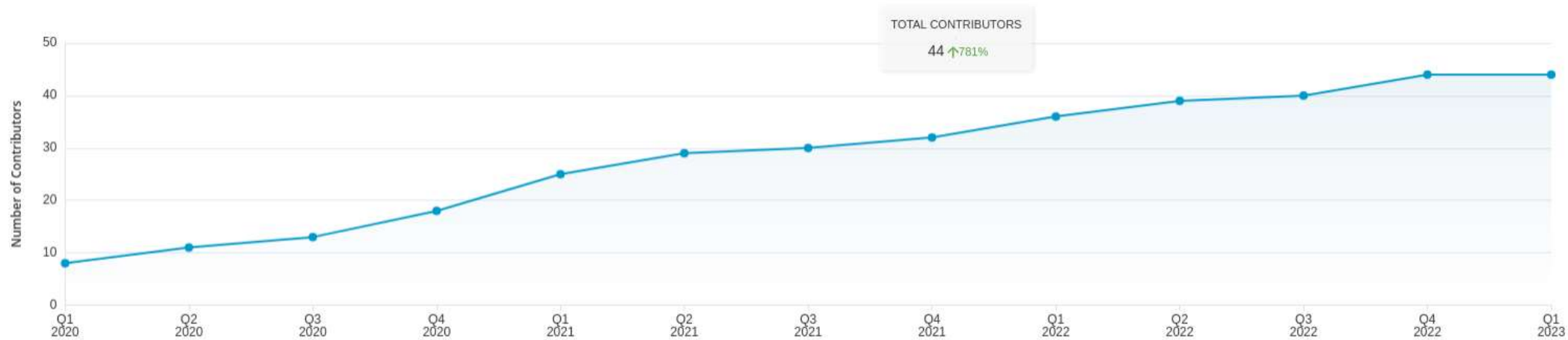
To be considered for the Early Adoption stage, the project must meet the following requirements:

- Demonstrate growth in the project's community, including
  - Growth in the number of commits to the project, number of project committers, and organizational diversity of contributions and committers. [✓]
  - Production or planned production use of the project by at least two independent end users which, in the TAC's judgment, are of adequate quality and scope. [✓]
- Technical Governance of the project is operational, as measured by:
  - A Technical Steering Committee with at least 5 members and a chairperson elected by the members, holding regular open meetings. [✓]
  - Achievement of the OpenSSF Best Practice badge at the ['Silver' Level](#). [✓] [64% completed](#)
- Development of a growth plan, to be done in conjunction with their project mentor(s) at the TAC. This plan should address the following points:
  - Since these metrics can vary significantly depending on the type, scope, and size of a project, the TAC has final judgment over the level of activity that is adequate to meet these criteria. [✓]
  - Release plans for the next 18 months. [✓]
  - Target end-users. [✓]
  - Identification of any regulatory or standards body requirements for deployment, and plans for implementation. [✓]
  - Plans for growth of project contributors and committers to support the growth plan. [✓]
  - Identification of any infrastructure resources needed to fulfill the growth plan [✓]
- Presentation to the TAC of the project's growth, technical governance, and growth plan.

# Contributions [1/2]

## Contributor Strength

Unique aggregate contributors across all hosted projects.



# Contributions [2/2]






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**Organizations**

Past 3 Years

Top 10 Organizations Order by: Commits

Name	Logo	Contributors	Last Activity	Commits	LOC Added	LOC Deleted	Pull Request Activities	Issue Activities
Savoir-faire Linux		9	12/20/2022	1.23K	65.24K	31.73K	434	48
RTE (Reseau de Transport d'Electricite)		3	12/19/2022	222	20.27K	3.13K	342	14
International Business Machines Corporation		1	10/07/2020	3	0	0	0	0
Linaro Limited		1	12/08/2021	2	31	4	19	10
BBC		1	12/03/2021	1	2	0	0	0

## Organizations contributing and/or using in production



GE Renewable Energy

# Keys achievements [1/2]

Functionnalités	Branch	Feature Description	Status
<b>Ability to host virtual machines that can run real-time applications</b>			
Linux OS with real time kernel and KVM	Debia...		done
Customize the Linux OS to ensure the real-time behavior of virtual machines	Debia...	in yocto it's is done during the configuration of the image, before it's is build from source code. In debian it is a ansible playbook that is applied once the image is installed	done
Prepare the system to isolate resources from real time machine	Debia...	it's done by applying ansible playbooks and using	done
Monitor the performance with dedicated tools	Debia...	cyclicttest are included in the CI and are launch through a playbook	on going
Write a white paper on the subject	Debia...	white paper that explain the strategy	not started
<b>Ensuring Security and Compliance through Access to Necessary Tools and Resources</b>			
Hardening of the OS (yocto)	Yocto	compliant with lots of requirements of the french ANSI NT28 standard. Test has been added to validate the behaviour	done
Hardening of the OS (debian)	Debian	où sont les tests ?	on going
	Debia...		on going
<b>Implementing High Availability Cluster Feature for Resources (Virtual Machines, Virtual Networks, Storage)</b>			
Cluster	Debia...	based on corosync and pacemaker	done
Distributed storage	Debia...	based on Ceph and rbd	done
Recommanded architecture for 3 nodes	Debia...	architecture in triangle without external switches	done
<b>Capability to Automatically Track and Evaluate the Impacts of Modifications on the Platform through Extensive Testing</b>			
CI yocto	Debia...	tests are done by launching ansible playbooks via jenkins each time there is a change on the meta-seapath repo	done
CI debian	Debian	redesign of the CI with github action and integration of business tests (IEC61850)	on going
<b>Ensuring Remote Monitoring, Supervision, and Administration of the Platform</b>			
Deploy and configure the cluster	Debia...	the deployment is deployed with ansible. All that is needed is to install the OS on each machine and to complete the inventories	done
Deploy and configure the virtual networks	Debia...	the configuration of Ovs is done with ansible	done
Monitor the state of the cluster	Debia...	the monitoring is done via SNMP	done
<b>Facilitating Consistent and Standardized Remote Deployment of Updates on the Platform</b>			
Snapshot the system with LVM + APT	Debian	it is possible to make a snapshot of the system before updating it	done
A / B system update with swupdate and hawkbit	Yocto	A/B partition strategy and rollback in case of failure	done
<b>Ensuring High Performance and Accurate Delay and Jitter Prediction in the Virtual Network</b>			
Benchmark and test of the different solutions eBPF, SR-IOV, DPDK	Debia...	Comparative studies has been made and several solutions could be implemented	done
Specify a solution depending on the performance needed and implement it in the platform	Debia...	proposed a solution that have the minimum level of complexity while ensuring the performance needed for IEC61850 SV streams and a low footprint	on going
Implement of the specified solution	Debia...		not started

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**EB1**

[https://docs.google.com/spreadsheets/d/1JFsdVjtrs81tylfzdT-9vAAC4kLHehMV\\_LPGMf63E/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1JFsdVjtrs81tylfzdT-9vAAC4kLHehMV_LPGMf63E/edit?usp=sharing)

Eloi Bail; 12/01/2023





# Keys achievements [2/2]

Facilitating Easy Deployment of Virtual Machines for Users through Clear Guidelines and User-Friendly Tools			
Create VMs	<div>Debian</div>	The vm-manager tool is used to manage virtual machines within a cluster, and it is capable of handling various functionalities. Additionally, Ansible can be used to automate the actions of vm-manager, enabling the simultaneous management of multiple VMs	<div>done</div>
Start/Stop VMs	<div>Debian</div>		<div>done</div>
Disable/Enable VMs	<div>Debian</div>		<div>done</div>
Deploy multiple VMs	<div>Debian</div>		<div>done</div>
Allowing Users to View and Modify Current Configuration of Virtual Machines and Handle Rollbacks as Needed			
Create and manage snpashot of a VM	<div>Debian</div>	The vm-manager tool is used to manage virtual machines within a cluster, and it is capable of handling various functionalities. Additionally, Ansible can be used to automate the actions of vm-manager, enabling the simultaneous management of multiple VMs. In complement the tool edit_metadata is a graphical tools that can be used to edit the xml file of a VM running in the cluster	<div>done</div>
create/delete colocation constraint	<div>Debian</div>		<div>done</div>
edit_metadata of a VM that is running in the cluster	<div>Debian</div>		<div>done</div>
List Clone/Print status	<div>Debian</div>		<div>done</div>
Ensuring Hardware-Agnosticism and Independence from Specific Hardware on the Platform			
Validate if a specific hardware meets the requirements in term of performance	<div>Debian</div>	Even if we minimized dependencies they are minimum requirements regarding the CPU, and the capability of NIC (SR-IOV) A lab is needed with a CI and advanced testing to be able to give a liste of material that are compliants	<div>on going</div>
Implementing Strong and Reliable Time Synchronization Based on Precision Time Protocol (PTP)			
Benchmark and test of several solutions	<div>Debian</div>	The host has to be sync in ptp and the guest sync to the host clock with the PHC and ptpkvm. However the guest also need to retrieve the status of the sync of the host. It can be done through vsock or share folder	<div>done</div>
Create a White Paper on the subject	<div>Debian</div>		<div>not started</div>
Ensuring Scalability and Optimal Performance for Small Systems and Large Clusters			
Minimize the footprint of the host	<div>Debian</div>	Work has been done to minimize the load average of the host OS. The 2 OS (yocto and debian ) have a similar footprint	<div>on going</div>
Minimize the footprint of guests/VM	<div>Debian</div>	The approach is to give the guests only what's needed to achieve the requiered performances. It this way it differs from conventionnal realtime approach	<div>on going</div>
Minimize the footprint of the network / virtual network	<div>Debian</div>	Avoid dedicated full CPUs, filtering and so on	<div>on going</div>
Cybersecurity			
UserGroup management	<div>Debian</div>	Manage with ansible	<div>done</div>
Service minimisation	<div>Yocto</div>	image minimal in yocto, work in progress for debian	<div>on going</div>
Network access restrictions	<div>Yocto</div>	Ovs restrictions for yocto, work in progress for debian	<div>on going</div>
CI Testing	<div>Yocto</div>	Implementend for yocto, work in progress for debian	<div>on going</div>
Tools and guidelines to be compliant with national and international cybersecurity age	<div>Debian</div>	work in progress to first match with ANSSI criterias	<div>on going</div>

# Growth Plan

- Install Seapath **in a real substation** (without protection application)
- **Multiply POC** in utilities
- **Enhance testing** with industry real use cases linked to Seapath Github to test:
  - Realtime, Cybersecurity, Cluster
  - VM that includes tools to do IEC61850 tests specifically Sample Values


  - ✓ Make Seapath as a reference test platform
  - ✓ R&D partnership to create full multi-vendor virtualized digital substation based on Seapath
- Write **white papers** about
  - Networking: state of the art on networking for virtualization to match low consumption and performance
  - Cybersecurity: policy and test developed based on ANSI standard


  - ✓ Share the state of the art
- Configuration tools to **adapt Seapath for all substation configurations**

# Areas the project could use help on

- Give more exposure to the Seapath project
- Enhance the collaboration with other LFEnergy projects

# Feedback on working with LF Energy

- LF Energy provides a clear governance to
  - ✓ Facilitate the open sourcing of code
  - ✓ Enrol industrials to use / collaborate
  -
- TSC / TAC provides the an international framework of industrial collaboration

# TAC Open Discussion