Solutions Brief

Nuvla: a collaboration framework to implement edge-to-cloud solutions

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1. Introduction

Edge computing is becoming a standard companion to cloud computing when it comes to implementing successful IoT projects. The naïve approach of sending all data back to the cloud for processing is no longer viable or future-proof. Implementing an edge strategy means processing data close to its source, thereby reducing latency and cost. It is not, however, a simple strategy to implement. Any edge-to-cloud architecture involves the coordination of a highly distributed infrastructure, multiple applications, and several skill sets, either in a single team or across organisations. It also raises a whole raft of questions relating to governance, security and data management.

The open and secure Nuvla® service by SixSq is a *secure edge-to-cloud management platform* which facilitates the implementation of operational edge-to-cloud solutions. The solution leverages near data processing, edge and cloud computing, as well as smart data management. It optimises the different skills required to realise real-life solutions, ensuring the project is put on a path towards success.

The value proposition of Nuvla is explained through the eyes of 5 team members: *Alice*, *Bob*, *Clara*, *Dave* and *Emma*. Of course every organisation is unique, but these roles exist in one form or another in most organisations. Nuvla simply provides a collaboration framework to facilitate work between the area of concern represented by these personae. In reality, one person will often be able to perform several of these roles in an organisation, and Nuvla will work the same.

SixSq's experts are specialised in edge-to-cloud solutions, products and services and have the required skills to support partners and customers in the implementation of their edge-to-cloud architecture. SixSq also provides the training to quickly build the required in-house expertise.

2. SixSq's edge-to-cloud architecture

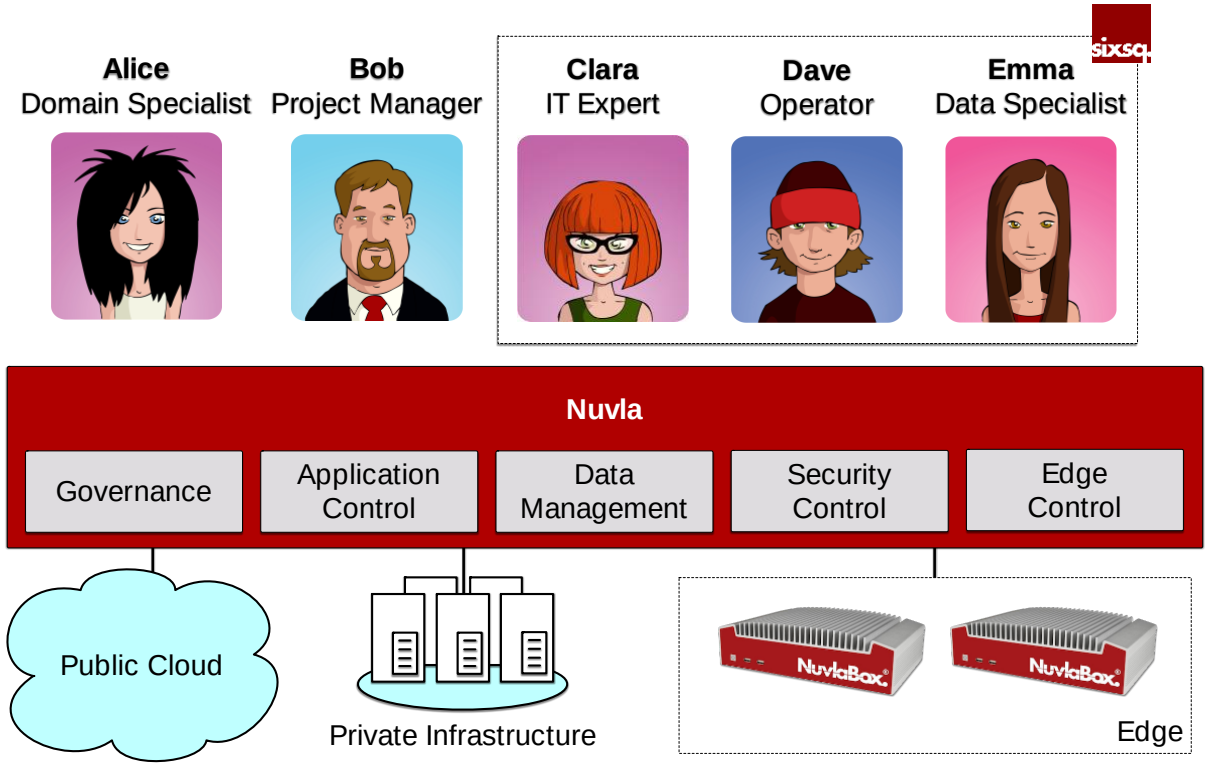

Figure 1: Nuvla® edge-to-cloud overview

Illustrated in Figure 1 Nuvla is a multi-cloud, hybrid-cloud and edge management platform able to interface with numerous cloud providers and cloud solutions. It automates the full management lifecycle, including the deployment, testing, certification and optimisation of applications within cloud and edge infrastructures. Nuvla can be interfaced with a wide range of infrastructures, which can be grouped as follows:

- **Edge device**: Edge devices are typically connected to one or several IoT sensors and/or actuators. The *intelligent edge device* NuvlaBox® is a SixSq product. The NuvlaBox software is certified on hardware platforms from different vendors, ranging from ARM based single board processors such as the Raspberry Pi, all the way to rack mounted and high storage density x86 based machines.
- **Public clouds**: The public cloud industry is rich with many providers, including for example AWS, Microsoft Azure, Google Compute, Exoscale and Digital Ocean. Nuvla provides the ability to interface with all these major public clouds, and many more. Nuvla automates the deployment of container-as–a-service services (e.g. Kubernetes, Docker Swarm), to host the user containerised applications. SixSq does not itself operate any cloud infrastructure. Instead our service is cloud neutral and multi cloud.
- **Private infrastructures**: Many organisations prefer to run their own infrastructure. In the same way as it operates with public clouds, Nuvla securely integrates with any private infrastructure running for example: VMware, Open Stack, Azure Stack. Nuvla can also connect directly to Container-as-a-Service (CaaS), such as Kubernetes and Docker Swarm.

Independently of the infrastructures Nuvla is connected to, organisations using Nuvla benefit from the following features:

- **Governance**: control all aspects of application deployment, access and data management, including a clear audit trail and fine grain authentication and authorisation, as well as event notifications.
- **Application control**: from any private or public container repository, securely configure, deploy, monitor and update applications, including advanced features such as benchmarking and application placement policy.
- **Data management**: data produced at the edge or in the cloud is managed, including data tagging, replication and transfer, as well as data search and access. This feature also works in semi-connected mode, such that in the case of a loss of connection, data transfer or replication resumes once the connection is re-established;
- **Security control**: enables end-to-end security controls from the edge to the cloud, and back, using VPN, identity and access management, as well as integrity enforcement.
- **Edge control**: manage edge devices, including secure registration, update, as well as monitoring and notifications. This works for both the edge operating system and its management functionality, as well as the user applications. Users are automatically notified when an update is available, so that they can instruct Nuvla to safely and automatically deploy the updates.

3. Nuvla stakeholders

The Nuvla platform not only delivers efficiencies to the organisation and project, but also to each team member that interacts with Nuvla. Figure 2 shows the typical team members involved in making the edge-to-cloud project a success. The diagram illustrates the main relationships between different team members and how Nuvla facilitates and organises these exchanges. Working together, they establish the initial steps required to get the project off the ground.

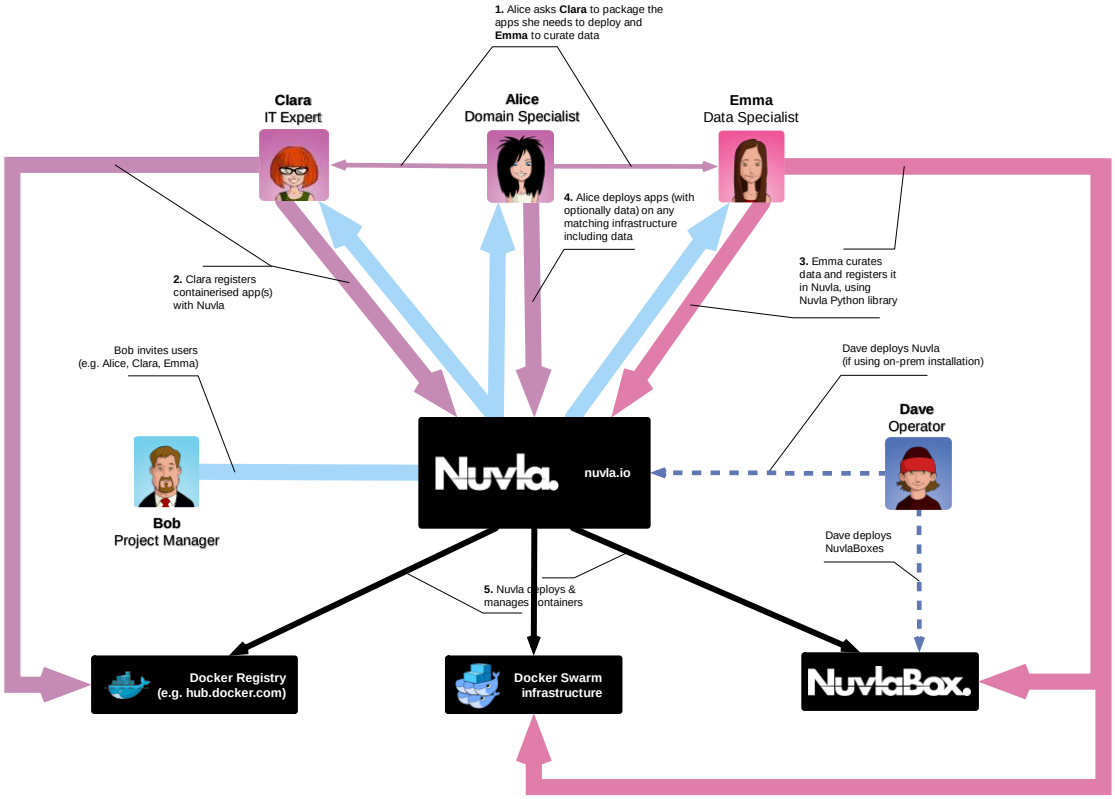

Figure 2: Nuvla® collaboration framework

Alice: the domain specialist

Alice is a scientist who knows the application domain and the algorithms that best suit the type of data she wants to analyse. She is an expert in AI or other algorithms used by her community. Alice's challenge is to select the right algorithm for the problem to be solved.

Alice primarily interacts with the Nuvla App Store, a library of private and public applications, and with the Nuvla Data Store, a selection of curated datasets available across all registered clouds and edges for processing. Applications are packaged such that they can be easily deployed, often with a single click.

Thousands of applications are literally at Alice's fingertips in Nuvla, thanks to its full support of containers and access to container registries, such as Docker Hub. The fact that SixSq supports containers is extremely valuable for Alice. Indeed, this technology is very popular within the software community for packaging and distributing applications, meaning that most popular software solutions are now publicly available in this format. Should Alice not be able to find what she needs in the Nuvla App Store, she can ask Clara (we will introduce her in a moment), the IT specialist, for help (step 1 in Figure 2).

Alice can deploy any of the applications in the Nuvla library herself (step 4 and 5 in Figure 2), onto the edge-to-cloud architecture at any time and as often as needed. She can then process the data and carefully analyse the results, which is her key expertise.

Once datasets are registered with Nuvla, courtesy of Emma (more about Emma very soon), she can use the platform to select datasets she wants to analyse and process, and Nuvla will propose compatible applications and infrastructure in which to deploy them.

Importantly, Alice doesn't need any advanced IT skills for performing her job, thanks to Nuvla, Clara and Emma.

Emma: the data expert

Big data applications require careful management of the data. In agreement with Alice (step 1 in Figure 2), Emma's responsibility is to ensure the right data is at the right place, at the right time and in the right format. Emma knows the benefits of near data processing for a big data project, and recognises that transforming raw data into information at the edge optimises network usage. She can also ensure no sensitive data travels from the edge to the cloud unnecessarily so that data handling complies with privacy regulations, such as GDPR.

Nuvla helps by providing a **data ledger service** (i.e. a metadata catalogue) that Emma uses use to register valuable datasets (step 3 in Figure 2). This allows her teammate Alice to know what data is available where, for her to deploy the right analysis application near the correct data. The data ledger service provides to Emma simple to use tools (e.g. Python and Clojure libraries), which can be used to feed live data, or manual data ingestions.

As a result, using Nuvla, Emma can manage metadata according to Alice's business needs. In return, Alice can focus on what data she wants to process with which application, and let Nuvla do the heavy lifting, automatically and securely (step 4 and 5 in Figure 2).

Clara: the IT specialist

Now that Alice and Emma have agreed on how the data is to be managed and processed (step 1 in Figure 2), Clara can put together an IoT architecture that supports the overall data flow defined by Emma and the processing needs of the applications selected by Alice. This requires special skills of IT specialists like Clara.

Using basic knowledge in scripting and container configuration, Clara can easily create components and stacks for Alice within Nuvla (step 3 in Figure 2). Further, Clara can configure application deployment policies, so that Nuvla can match the right data with the right application.

Nuvla works will virtually all public and private cloud solutions. Clara can therefore create a Container-as-a-Service environment in any public or private cloud, as well as at the edge on NuvlaBoxes, enabling the collection of data for near data processing, including machine learning models

Nuvla deploys an **end-to-end security** strategy for all of its services, including the edge. Clara leverages this to provide Alice and Emma a secure environment minimising any security risk associated with handling data in an edge-to-cloud architecture.

Dave: the operator

Dave is a system administrator. His role is to operate the edge-to-cloud architecture so that it is always up to date and properly running.

Clara puts together the IoT architecture using Nuvla and NuvlaBoxes for Dave to operate (see dotted blue line in Figure 2). Since the entire edge-to-cloud architecture is captured in Nuvla, the handover is simple and clear, ensuring straightforward monitoring and maintenance.

Thanks to the management tools that are part of Nuvla, Dave can properly operate the system with minimum effort. Using the monitoring tools of Nuvla, Dave can set up alerts that will notify him, his monitoring system or any colleagues in case of issues. With the application update feature of Nuvla, Dave can maintain and update the applications selected by Alice to perform her work. This way, she is always sure to have the proper version in place. Using the security management features of Nuvla, Dave can also manage the certificates used, thus ensuring the security of the edge-to-cloud infrastructure.

Once the infrastructure is in place, Dave hands over to Bob, who will then be able to invite all the other team members to get their work done.

Bob: the project manager

Bob manages the team. He is concerned about budget, resource consumption and delivering his project on time, which is challenging when assets are spread across locations. He also wants to give his team the best tools for the job.

Nuvla is key to Bob. It provides a clear overview of how many resources users are consuming on each infrastructure. He can see which applications are being deployed, and where, and when resource limits are being reached. Nuvla provides Bob with all the information he needs to keep his project on track.

Bob can create groups and invite users (see thick blue line in Figure 2). Once authorised by Dave, Bob can invite Alice, Clara and Emma to the Nuvla platform. This gives him the ability to ensure the right people have the right access, and that the right people can collaborate, with risking to lose control.

4. Conclusion

Modern IoT projects require an edge-to-cloud architecture and a team with different skills for their successful implementation. SixSq provides products and services for facilitating the implementation and delivery of these projects, as well as the operation of the resulting systems and services.

To this end, Nuvla provides a simple, yet powerful, framework where each member of the team contributes to the success of the project.

5. About SixSq

SixSq is a leading edge-to-cloud solution provider, working with both public and private cloud infrastructures. The technology is open source and cloud neutral. It allows public and private organisations to benefit from cloud computing while avoiding lock-in. Its smart cloud-in-a-box appliance, NuvlaBox®, is a secure and scalable plug & play edge solution at an affordable price. SixSq's smart multi-cloud, hybrid-cloud and edge management platform, Nuvla®, offers containerised application deployment from a single, simple dashboard.

SixSq's international team consists of highly skilled software engineers, developers and system administrators. The company has been awarded numerous international cloud framework contracts. It is recognised for its unique edge-to-cloud expertise and leadership. SixSq is based in Geneva, Switzerland, and embraces the Swiss ideals of excellence, innovation and precision.

We see ourselves as software artisans of scale and our vision is to unify the cloud and the edge to boost innovation, by bringing closer together: cloud, edge, AI and IoT.

Are you ready to test the future today?

Get in touch: sales@sixsq.com