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Abstract

A review of critical in-house software tools and services.

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Executive Summary

The software developed in GÉANT projects requires an infrastructure that allows geographically dispersed developers to work together in an efficient manner to develop software with good quality and security practices. In GN5-1, this infrastructure of software development support tools, which started to be constructed in GN4-3, is maintained by WP9 T2 to provide both a consistent storage place for developed software and effective tools for the testing, integration, and deployment of the developed applications and systems.

This document describes the software development environment provided by WP9 T2, including software development management and ticket tracking, code repository, artifact repository, continuous integration and delivery, code quality analysis, dependency and license analysis, and testing environment.

The document also contains information regarding the use of tools by project participants and service availability.

1 Introduction

GÉANT is a collaboration of European National Research and Education Networks (NRENs) which deliver an information ecosystem comprising infrastructure and services. A part of the service offering is based on software that is developed collaboratively with NRENs and other partners within the GÉANT projects. Since the GN3 project which started in 2009, the issue of quality assurance for software developed within the project has been dealt with by dedicated units that are responsible for continued development and improvements of the existing suite of tools and processes which support the full software development lifecycle.

The aim of this report is to review the toolkit that is provided by WP9 T2 in order to effectively support the development teams in their daily work, and to facilitate tasks such as code quality analysis or dependencies and licensing faced by other teams embedded in the Software Governance and Support Task.

This report is limited to the tools provided as part of WP9 T2. It should be noted that, despite attempts to continually update the portfolio, some teams may choose to use tools and services that are not part of the portfolio.

This document is structured as follows:

- Section 2 provides an insight of the complexity involved in the collaboration of multiple software development teams under the umbrella of GÉANT projects.
- Section 3 gives an overview of the tools available for developing and managing projects.
- Section 4 details and reviews the individual software tools services
- Section 5 provides a brief conclusion.

2 GÉANT Software Development Teams and Projects

GÉANT project brings together the software engineers from various NRENs, who collaboratively produce software that supports the delivery of various services, such as trust and identity services or network management services. The GN5-1 software portfolio currently comprises 46 software projects (recorded in the Software Catalogue [SWCat]). These projects are at different stages of development, and use different programming languages, technologies, and application templates. Some of them are used as internal supporting tools, some are shared or used by NRENs, others contribute to wider open-source communities.

Over 400 people, who form over 20 software teams, have contributed to the software development effort in GN4-3, either by making a commit in the code repository or by creating a task in the issue tracker system [SWCat]. These teams are geographically dispersed, communicate remotely, and have to synchronise their work. They need to use, to a greater or lesser extent, the same basic set of tools and practices to support the software development process [GN43D9.2].

At the product or service management level, the Product Lifecycle Management (PLM) methodology has been adopted within GÉANT. The PLM is a process that helps projects to pass through various phases of software development and maintenance. Common Best Practices can help software teams meet PLM requirements and facilitate a smoother transition between development phases by identifying a set of practices.

The main challenge of streamlining the software development process in the GÉANT project is to provide an infrastructure that ensures efficient collaboration and communication between distributed teams by offering tools that are tailored to requirements and common practices. It is crucial to provide tools that support the used software development methodologies such as Agile, and the Scrum framework which is embedded in the broader context presented by the PLM and the Information Technology Infrastructure Library (ITIL).

Another challenge is ensuring the quality and reliability of the software and services that are provided by the project , especially where these are complex and heterogeneous systems. This requires rigorous and consistent testing procedures, as well as tools and environments that can cover all possible scenarios and requirements. This is solved by automated testing, continuous integration, and delivery. DevOps is a set of practices and culture that aims to improve the collaboration, communication, automation, and quality of software development teams. DevOps can play a vital role in distributed development teams.

3 Software Development Tools Infrastracture

GÉANT delivers a full suite of supporting tools and virtual machines (VMs) for software tests and development. The software tools form a technology stack which supports the full development lifecycle from requirements management, through issue and task management, source code repository, continuous integration and deployment service, to binaries repository and production deployment.

Software development tools (see Section 3.1 and Section 3.2 for more details):

- GÉANT GitLab — Collaboration tool for the projects developed and managed in GÉANT Project
- Atlassian Tools:
  - GÉANT Jira — Project Management and Issue Tracking Service
  - GÉANT Bamboo — Continuous Delivery and Deployment Tool
  - GÉANT Bitbucket — Git Repository Management
  - GÉANT Confluence — a wiki for sharing information

Software tools services (see Section 4 for more details):

- GÉANT Jira — Project Management and Issue Tracking Service
- GÉANT Bamboo — Continuous Delivery and Deployment Tool
- GÉANT Bitbucket — Git Repository Management
- GÉANT Artifactory — Repository management service which supports all major packaging formats, build tools and CI servers
- GÉANT GitLab — Collaboration tool for the projects developed and managed in GÉANT Project
- GÉANT SonarQube — Continuous inspection of code quality to perform automatic reviews with static analysis of code to detect bugs, code smells, and security vulnerabilities on 20+ programming languages
- GÉANT Software Catalogue - Repository of information about software projects and teams
- GÉANT Mend - Platform for supporting the process of managing and approving third party software components from the security and compliance of software licences view point.
- GÉANT Quality Assurance Lab — IaaS for developers and testers

All tools are available from the Software Tools Portal, an entry point for each project participant to an environment designed to support the development of better software with quality by design [SWPortal].

The main challenges and opportunities for enhancing the software development process in the GÉANT project are for the Support Tools sub-task to provide the latest versions of the tools in use, ensure these are kept up-to-date and that security patches are made available as soon as possible. It is also important to provide a toolbox that meets the needs of projects at different stages of development. Therefore, two parallel tool technology stacks were introduced in 2019: GitLab and Atlassian. GÉANT developers can select a self-hosted GitLab instance or an Atlassian tools stack (Jira+BitBucket+Bamboo). GitLab meets the growing interest in collaborative environments such as GitHub, which offers a variety of capabilities (such as an issue tracking system, CI/CD, QA) within one product.

A particularly important difference between the two is that, for example, the Atlassian JIRA provides advanced support for various project and change management methodologies. In GitLab this is considerably simplified, but still sufficiently advanced to meet developers' needs while, at the same time, reducing the entry threshold for change management systems integrated into the version control system. The following sections describe the main features of both environments.

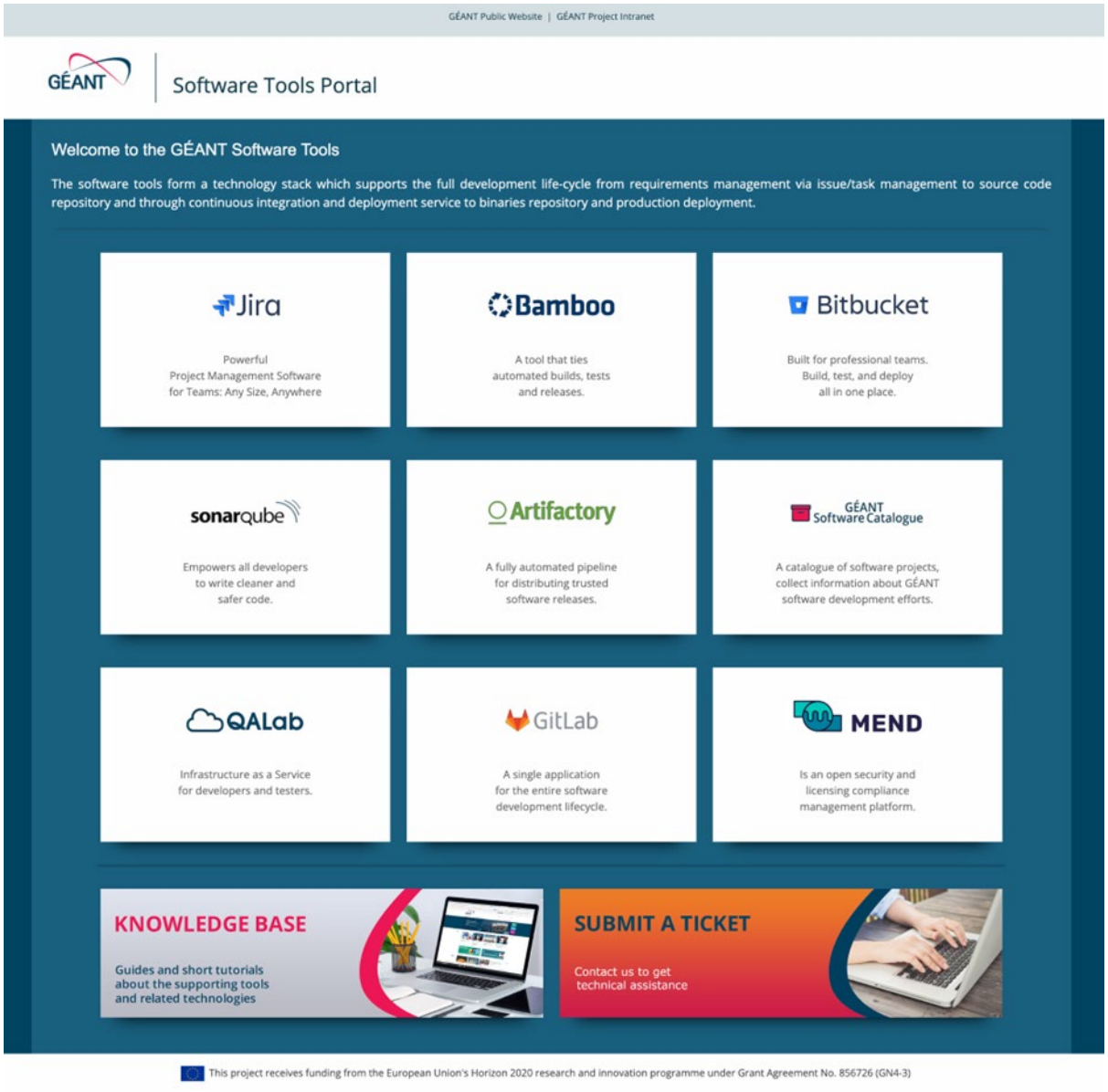


Figure 2.1: Software Tools Portal

3.1 Software Development with GitLab

GitLab is a collaborative tool for projects developed and managed by the GÉANT project. It allows you to create, view, and manage code and project data through powerful branching tools. It also integrates with other GÉANT services, such as Artifactory, SonarQube, and the Quality Assurance Testbed. A typical software development process with GitLab service is as follows:

- Discover: GitLab can be used to envision, design, and prioritise projects. Issues can be created to capture user stories, epics to group related issues, and labels to categorise and prioritise them. GitLab's wiki feature can be used to document project requirements and design specifications.
- Plan: GitLab can be used to plan project milestones and sprints. Issues can be assigned to milestones and their progress tracked on the milestone page. GitLab's issue boards allow workflows to be visualised and tasks to be managed.
- Build and Test: GitLab allows developers to write, review, and merge their code. They can create branches for each feature or bug fix, and use merge requests to collaborate on code with inline comments and approvals. GitLab's CI/CD pipelines can be used to automate the testing and deployment processes. GitLab can be integrated with Artifactory to store artifacts and dependencies, and with SonarQube to analyse code quality and security.
- Deploy: GitLab can be used to deploy code to different environments, such as staging, production, or the Quality Assurance Testbed. GitLab's environments feature allows the health and status of deployments to be monitored, and GitLab's deploy tokens or SSH keys provide secure access to servers.
- Operate: Developers can use GitLab to support and maintain active software projects. They can use GitLab's incident management feature to respond to unplanned events and restore services using reliable methods for prioritising incidents and resolving them quickly. GitLab's error tracking feature allows integration with external services like Sentry or Rollbar to track and fix errors in applications.
- Observe: GitLab allows the performance and availability of applications to be monitored. GitLab's metrics feature can be used to collect and display metrics from Prometheus or other sources. In addition, GitLab's logging feature makes it possible to view and search logs from an application or infrastructure.

3.2 Software Development with Atlassian Tools

Atlassian tools are a suite of software development tools that help developers review, test, and manage their code. They include Jira Software, Bamboo, Bitbucket, and Confluence which are provided for the GÉANT project community. They also integrate with other GÉANT services, such as Artifactory, SonarQube, Software Catalogue, Mend, and Quality Assurance Testbed. A typical software development process with Atlassian tools is as follows:

- Discover: Developers can use Confluence (a wiki provided to the GÉANT project community) to create product research documents and share design files [Wiki]. They can create Jira issues directly from the wiki portal for user stories, epics for larger user flows, and labels for categorisation and prioritisation.
- Plan: Jira Software can be used to plan project milestones and sprints. Issues can be assigned to sprints and their progress tracked on the sprint board or the backlog view. Jira Software's roadmaps feature can be used to visualise the project timeline and dependencies.
- Build and Test: Bitbucket can be used to write, review, and merge code. Branches can be created for each feature or bug fix, and pull requests can be used to collaborate on code with inline comments and approvals. In addition, Bamboo or Bitbucket Pipelines can be used to automate testing and the deployment processes. Bitbucket or Bamboo can be integrated with Artifactory to store artifacts and dependencies, and with SonarQube to analyse code quality and coverage.
- Deploy: Bamboo or Bitbucket Pipelines can be used to deploy code to different environments, such as staging, production, or the Quality Assurance Testbed. Bamboo's deployments feature or Bitbucket's environments feature can be used to monitor the health and status of deployments, and Bamboo's SSH tasks or Bitbucket's deploy keys provide secure access to servers.
- Operate: Developers can use Jira Service Management or Jira Software's incident management feature to support and maintain active software projects. They can create service requests or incidents for customer support or operational issues, and triage them using queues or SLAs. They can also use Jira Software's error tracking feature to integrate their own service with a web page user interface to track and fix errors in their application.

- Observe: Bamboo or Bitbucket Pipelines can be used to monitor the performance and availability of applications. Bamboo's metrics feature or Bitbucket's insights feature allow metrics from various sources to be collected and displayed.

4 Software Tools Services

4.1 JIRA

JIRA is a proprietary issue tracking product that provides bug tracking, agile project management and a service desk portal for the end users of services and products. JIRA is based on three concepts: Project, Issue and Workflow. It comprises JIRA Core and the Jira Software and Jira Service Desk extensions.

The aim of Jira is to support general project and process management for teams. The Jira instance which is provided to the GÉANT project participants is composed based on three pillars: Core, Software and Service Desk. While all of them support project management and issue tracking, individually they are specialised for particular tasks like general project management with support for process and task management (Jira Core), software development according to Scrum or Kanban methodologies (Jira Software), and dedicated setups for customer and user support channels (Jira Service Desk).

Each project in Jira is preconfigured based on the needs and methodology introduced by the particular team. This configuration by default contains types of requests, the workflow, fields that are available at the various stages of processing, and the permission and notification schemes. Each of these types implements a selected type of request management adapted, for example, to software development according to Scrum methodology or user support with support for monitoring the compliance of request handling with the agreed Service Level Agreement (SLA).

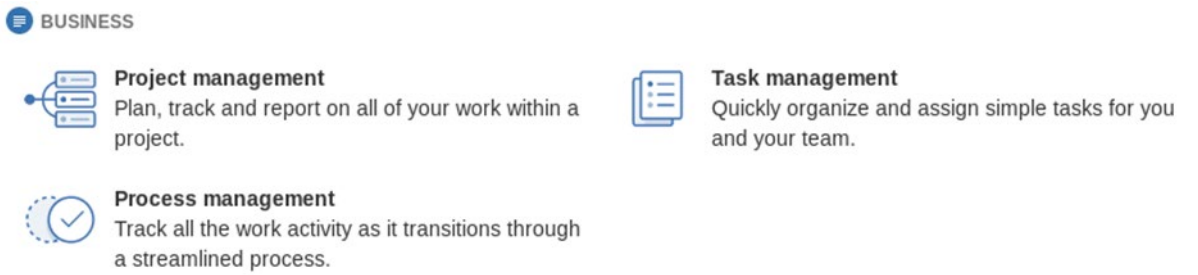


Figure 4.1: Jira Core supported project types

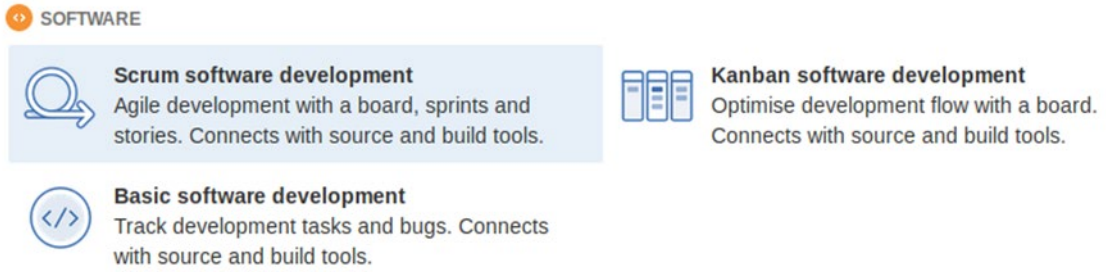


Figure 4.2: Jira Software supported project types

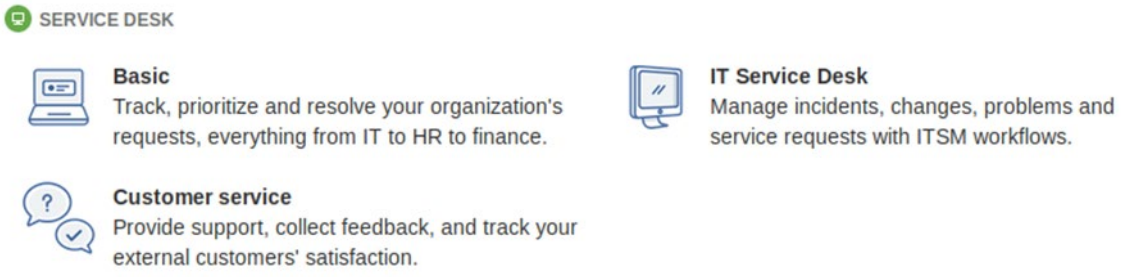


Figure 4.3: Jira Service Desk supported project types

Below is an example of a Scrum Board, which is a virtual board for managing the team's tasks during the current sprint (a specific working time provided for in the Scrum methodology to achieve increments of functionality and value for the user of the software under development).

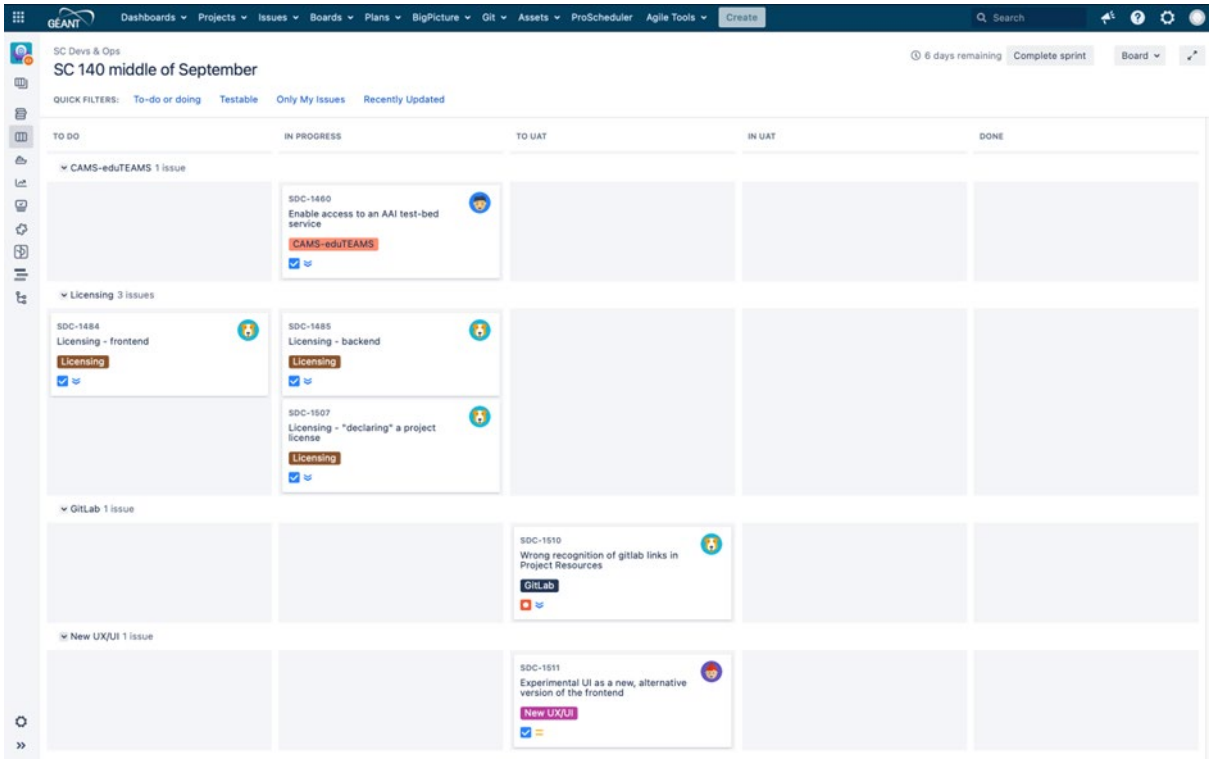


Figure 4.4: Jira Software Scrum Board supports issue management according to the Scrum methodology

The next figure shows the default view of the Service Desk Portal which allows the user to report problems and requirements related to the tools provided within WP9 T2 or a service provided by the task such as code review requests.

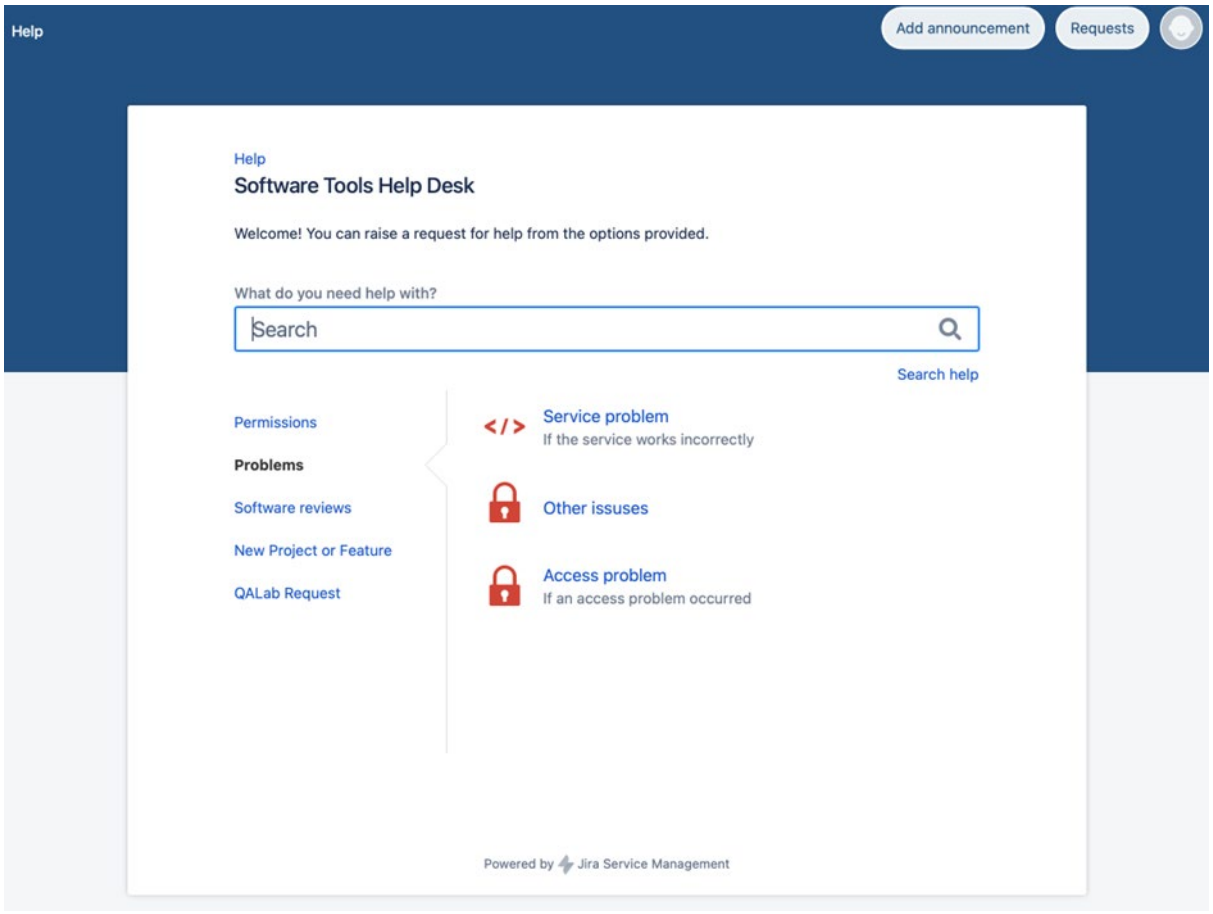


Figure 4.5: Jira Service Desk - a user support function for receiving user requests and feedback

JIRA	
URL	https://jira.software.geant.org
Access Method	Federated IdP
Knowledge Base	https://wiki.geant.org/display/GSD/JIRA+-+issue+tracking+system
Total users	280
Total projects	86
Issues	16000+
Availability of services[1]	99.545%

Table 4.1: Basic information about the Jira service

[1] Availability of service from 01-01-2023 00:00:00 to 01-07-2023 00:00:00

4.1.1 Assessment

JIRA is performing within spec and according to requirements. The metrics indicate that the application is actively used by a moderate number of users to manage various project. The application is also used as a help desk portal by the WP9T2 Software Governance task .

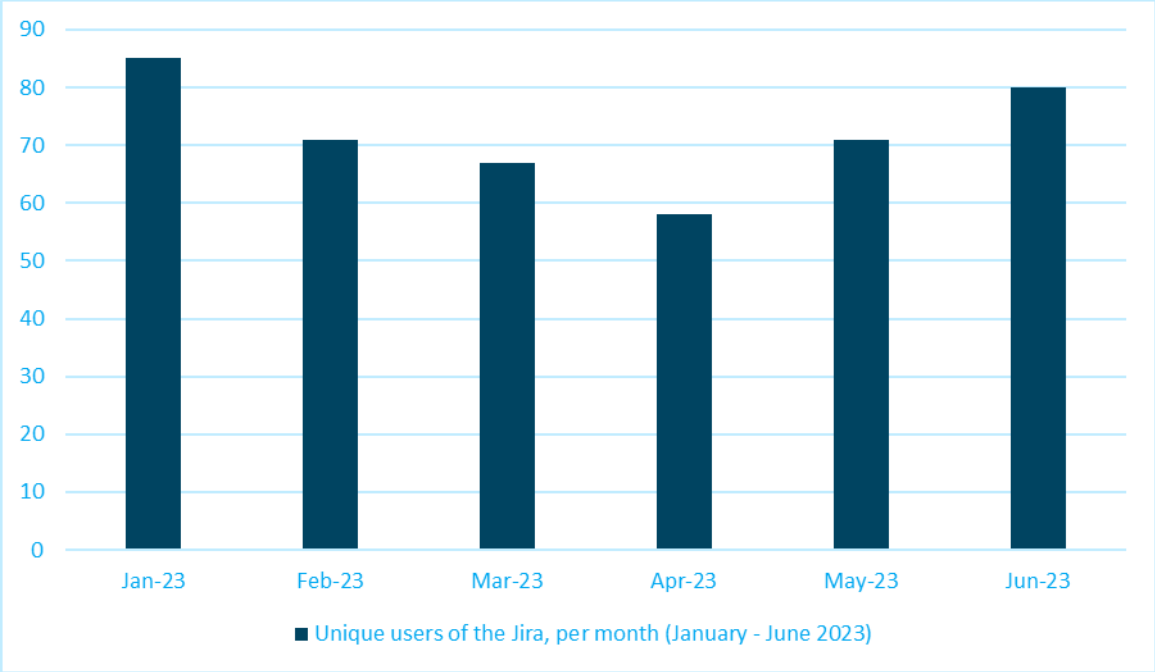


Figure 4.6: Unique authenticated eduGAIN users of the Jira, per month (January - June 2022)

4.1.2 Near-Term Development Plans

Integration with eduTEAMS is planned to be completed in the fourth quarter of 2023. Following on from that, only regular maintenance and support are expected to be required.

4.2 Bamboo

Atlassian Bamboo is one of the services offered that allow software developers to automate their CI/CD process. The entire workflow can be configured in Bamboo through a graphical user interface. Within one project many independent CI/CD pipelines can be configured. This makes it possible to separate the processes related to software development from testing by defining distinguished job sets for builds and tests.

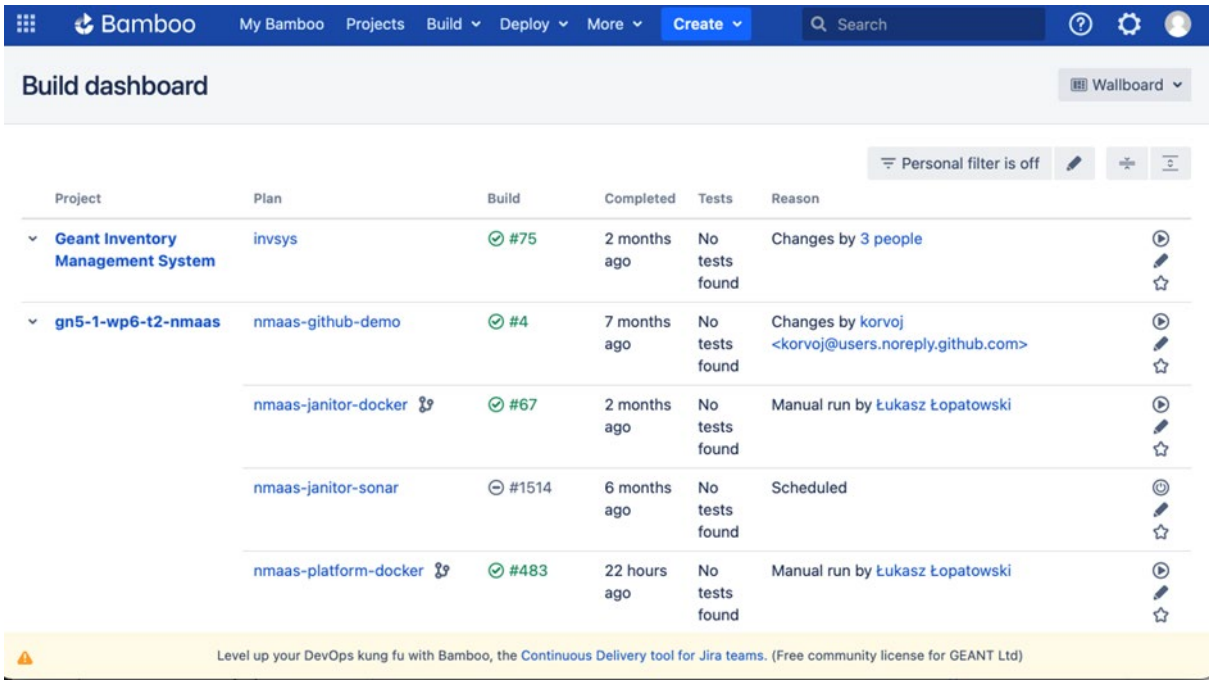


Figure 4.7: Bamboo build dashboard

Deployment definitions are a separate functionality. They make it possible to configure many environments (e.g., production, test, stage) within one project, into which the built software is implemented. Deployments can be launched depending on defined conditions, for example, the result of execution of a given pipeline. There are also generated statistics of CI/CD tasks and others activities. Bamboo's functionality can be extended by installing plugins. Integration with Atlassian Jira provides the ability to link individual builds to specific issues in JIRA and track the status in the Jira interface. The integration with the Atlassian Bitbucket Git repository enables the CI/CD process to be started automatically after each code commit to the Bitbucket repository.

Bamboo	
URL	https://bamboo.software.geant.org/
Access Method	Federated IdP
Knowledge Base	https://wiki.geant.org/display/GSD/Bamboo
Total users	117
Total projects	8
Issues	51
Availability of services[2]	99.974%

Table 4.2: Basic information about the Bamboo service

[2] Availability of service from 01-01-2023 00:00:00 to 01-07-2023 00:00:00

4.2.1 Assessment

Bamboo is performing within spec and according to requirements. The metrics indicate that the application is actively used by a small number of users to manage four projects actively developed in the reporting period (Jan – June 2023).

The build activity indicates the level of activity for all plans (projects). Each build is triggered manually by the user or by a repository change (commit or merge command).

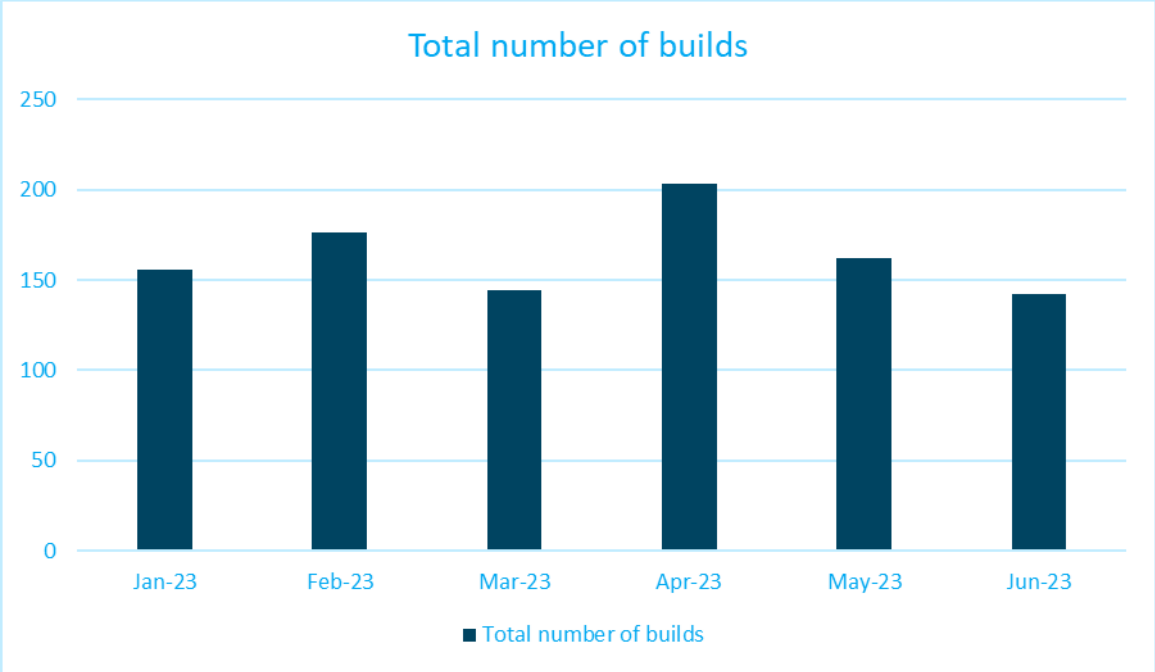


Figure 4.8: The build activity indicates how many builds were triggered for all projects, per month

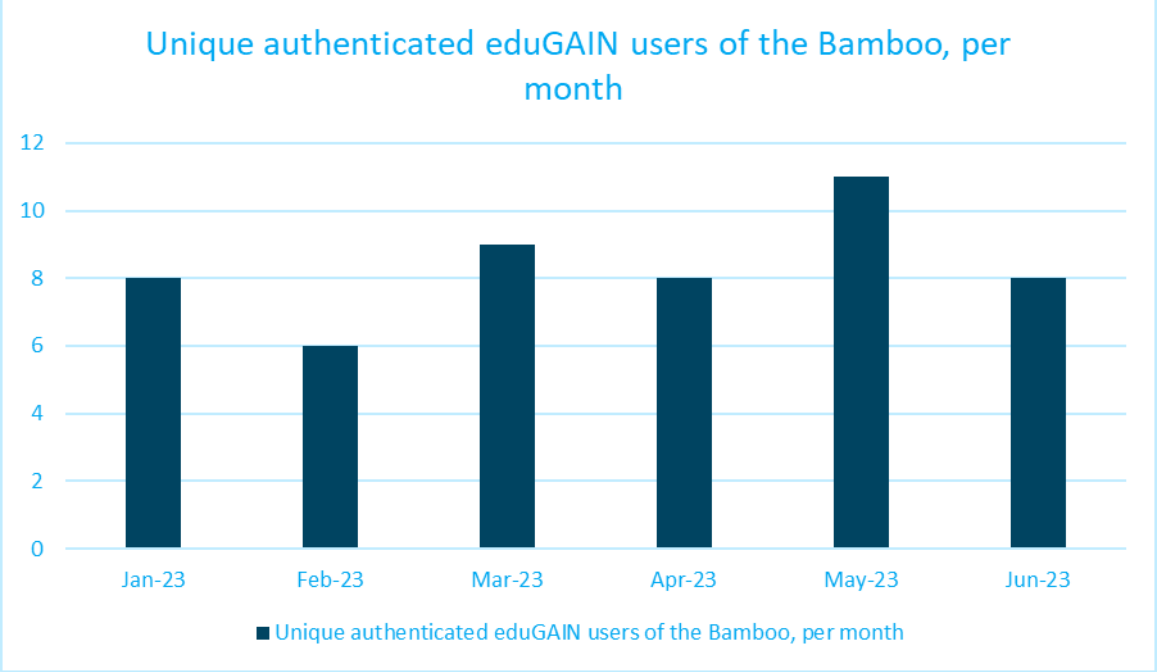


Figure 4.9: Unique authenticated eduGAIN users of Bamboo, per month (Jan-Jun 2023)

4.2.2 Near-Term Development Plans

Integration with eduTEAMS is planned to be completed in the fourth quarter of 2023. Following on from that, only regular maintenance and support are expected to be required.

4.3 Bitbucket

Atlassian Bitbucket is an integrated Git repository management solution. It allows users to manage their projects in one place, using a web interface. Repositories are organised in projects which makes it easier to manage user access. All changes in files are presented in graphical form and can be easily compared with the previous state. The entire history of changes can be also presented. Bitbucket simplifies team work by providing advanced features for pull requests. Bitbucket functionality can also be extended by installing plugins. Bitbucket can be integrated with Atlassian Jira, which allows Jira issues to be linked with concrete commits in the Bitbucket repository. It also integrates with Atlassian Bamboo, making it possible to automatically start the CI/CD process defined in Bamboo for every new code that is pushed to the Bitbucket repository.

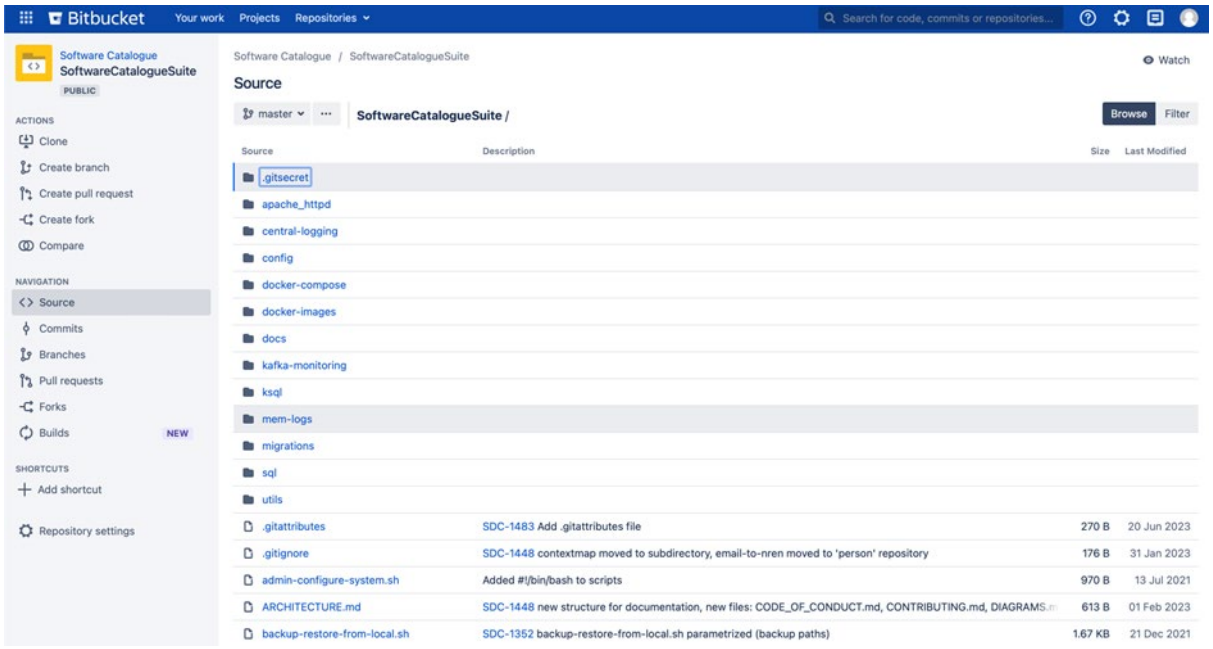


Figure 4.10: Bitbucket public project source code panel

Bitbucket	
URL	https://bitbucket.software.geant.org/
Access Method	Federated IdP
Knowledge Base	https://wiki.geant.org/display/GSD/Bitbucket
Total users	167
Total projects	59
Availability of services[3]	99.550%

Table 4.3: Basic information about the Bitbucket service

4.3.1 Assessment

Bitbucket is performing within spec and according to requirements. The metrics indicate that the application is actively used by a moderate number of users to manage five projects actively developed in the reporting period (Jan – June 2023).

[3] Availability of service from 01-01-2023 00:00:00 to 01-07-2023 00:00:00

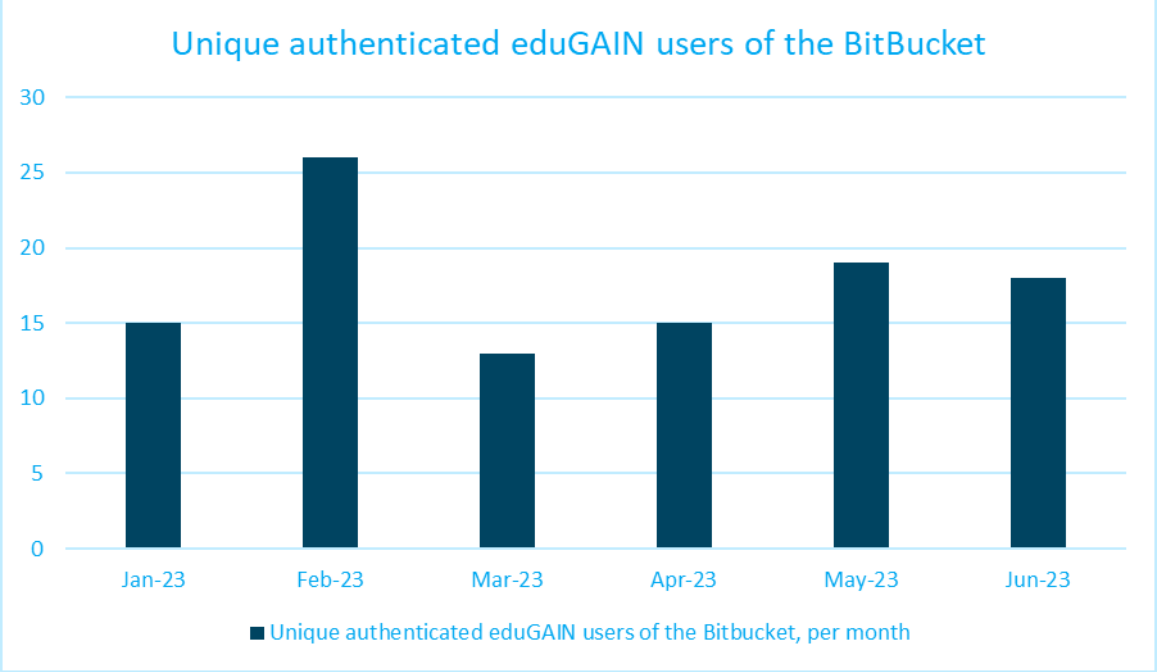


Figure 4.11: Unique authenticated eduGAIN users of the BitBucket service, per month (January - June 2023)

4.3.2 Near-Term Development Plans

Integration with eduTEAMSis planned to be completed in the fourth quarter of 2023. Following on from that, only regular maintenance and support are expected to be required.

4.4 Artifactory

The JFrog Artifactory Pro instance is a versatile solution for storing and managing different types of binary artifacts. It supports a number of formats, including Maven, Helm, npm, Python, RPM, and deb. Artifactory can also be used as a mirror for external repositories for all supported packages. All artifacts can be protected or made publicly available. The graphical user interface makes it easy to browse and manage all resources, as well as to manually deploy and download them.

Artifactory also includes the functionality of a Docker image repository. This allows it to be used not only at the development and testing stage of the software development cycle, but also for software distribution in production environments.

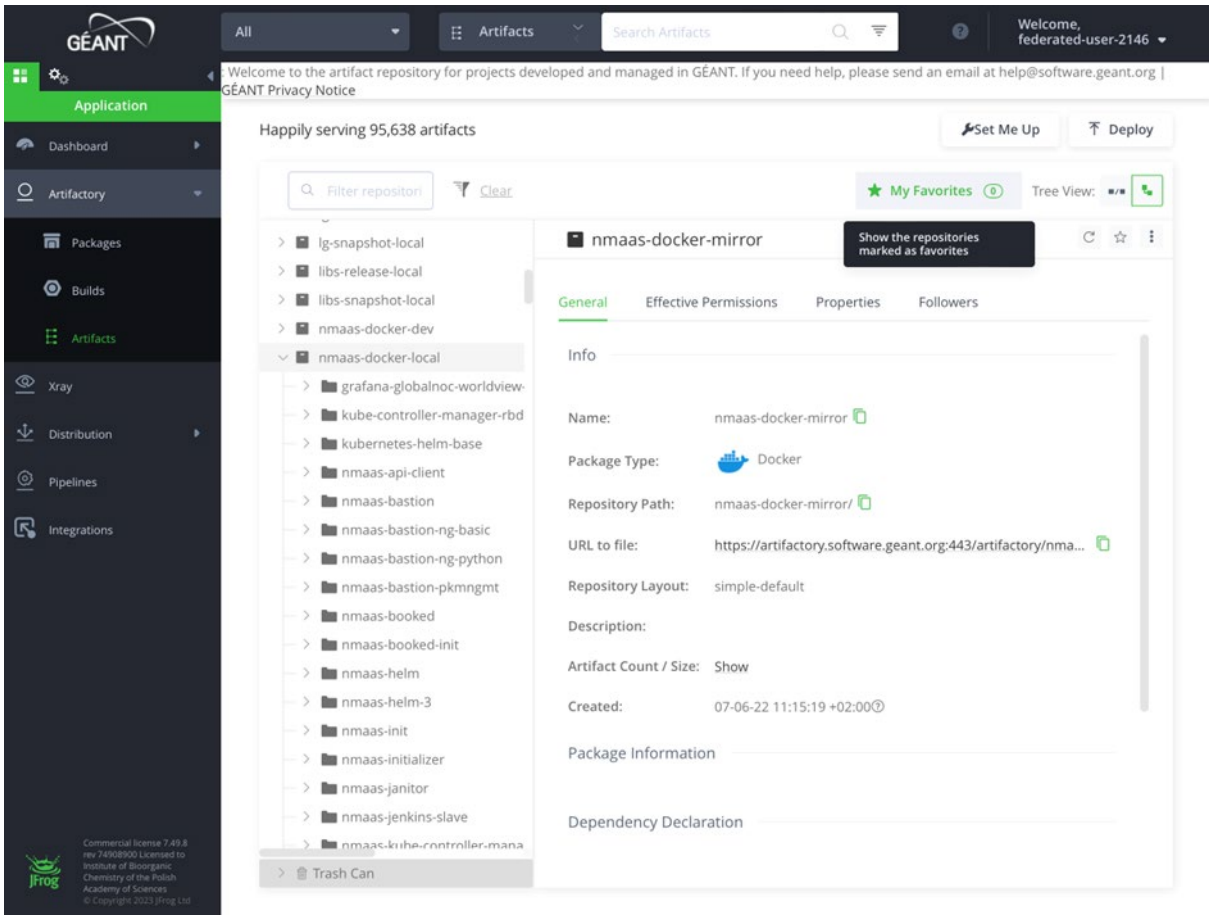


Figure 4.12: Artifactory repositories view

Artifactory	
URL	https://artifactory.software.geant.org/
Access Method	Federated IdP
Knowledge Base	https://wiki.geant.org/display/GSD/Artifactory+Pro+-+Artifact+Repository
Active repositories	19
Total repositories	80
Total artifacts	95,637
Binaries Size:	255.97 GB
Availability of services[4]	99.950%

Table 4.4: Basic information about the Artifactory service

[4] Availability of service from 01-01-2023 00:00:00 to 01-07-2023 00:00:00

4.4.1 Assessment

Artifactory is performing within spec and according to requirements. The metrics indicate that the application is actively used by a small number of users to manage 19 active repositories in the reporting period (Jan – June 2023). As Artifactory is available via API with build management tools (like Maven) and IDE, it should be mentioned that currently developers have 11 active tokens assigned to users. These tokens allow automated access to repositories without the need to log in to the web application via eduGAIN. This functionality decreases the number of direct authentications via federated IdP. Another reason for the low number of web application logins is the integration of Artifactory with continuous delivery services and automatically dependency and releases management.

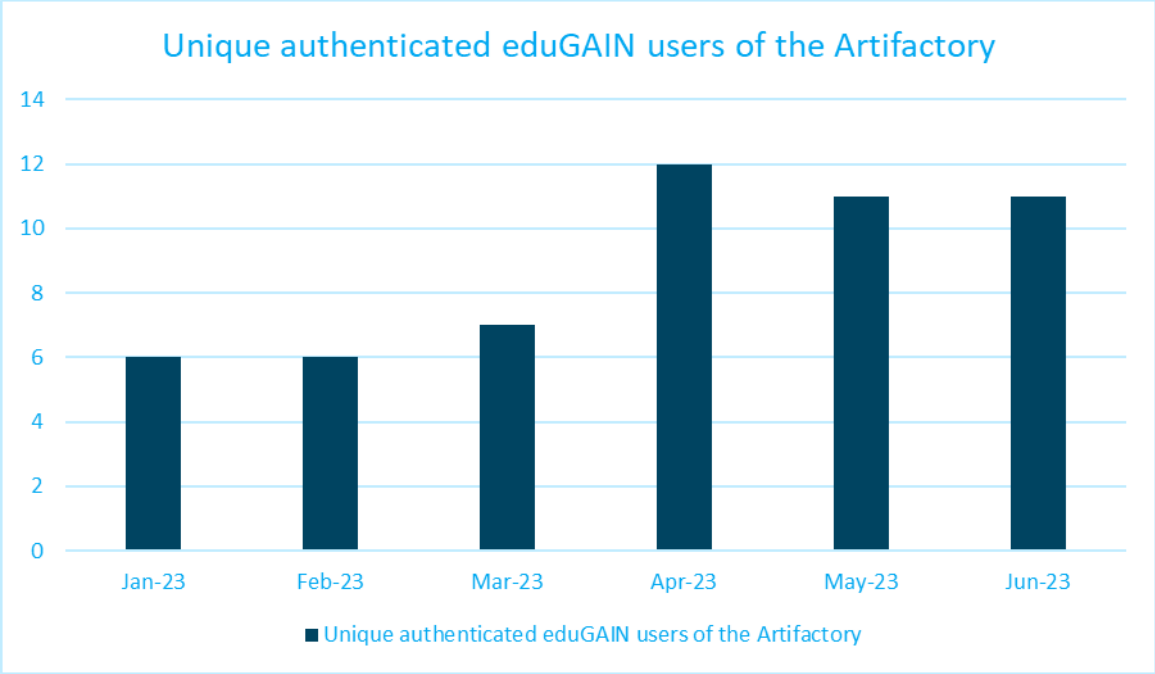


Figure 4.13: Unique authenticated eduGAIN users of the Artifactory service, per month (January - June 2023)

4.4.2 Near-Term Development Plans

Integration with eduTEAMS is planned for the fourth quarter of 2023. Following on from that, only regular maintenance and support are expected to be required.

4.5 GitLab

GitLab is an integrated platform for software development and teams that cooperatively work on a software project. This tool is primarily a code repository based on the Git system. However, it offers many functions used throughout the software development process, which are accessible through a web interface. In addition to tracking and documenting code changes, GitLab also offers its own extensive CI/CD system. The entire CI/CD workflow is configured in a text file using a flexible and rich set of commands. CI/CD tasks created in this way can be run on executive units, which can be run on a dedicated server or a developer's laptop. GitLab also has a built-in registry of docker images and a repository of artifacts that can be shared with other tools. Project management functions are also built into GitLab. These include milestone management, wiki pages, and a tickets system with a tickets dashboard view. GitLab can be integrated with services and applications such as Atlassian Jira, GitHub, and Microsoft Teams.

GitLab was introduced in July 2019 to the development tools environment in the GÉANT project based on user requests. Since then it has been operated based on the free Ultimate license granted on the basis of earlier OSS-compliant GÉANT licenses. It allowed the use of user group import for SAML connector which provided smooth integration with eduGAIN and simple permission management. Because of changes introduced in Gitlab's Open Source Program policy and the requirement to provide unrestricted access to private repositories for project participants, it was migrated to the GitLab community edition, a free version with some limited functions in July 2023.

However, after identifying that teams used features that were not available in the community version, the decision was made to introduce a second instance of GitLab Ultimate Edition in parallel. Due to the way fees are charged and their amounts, this instance is available to a limited set of projects that use advanced features in the area of security and code quality monitoring, as well as continuous integration and delivery.

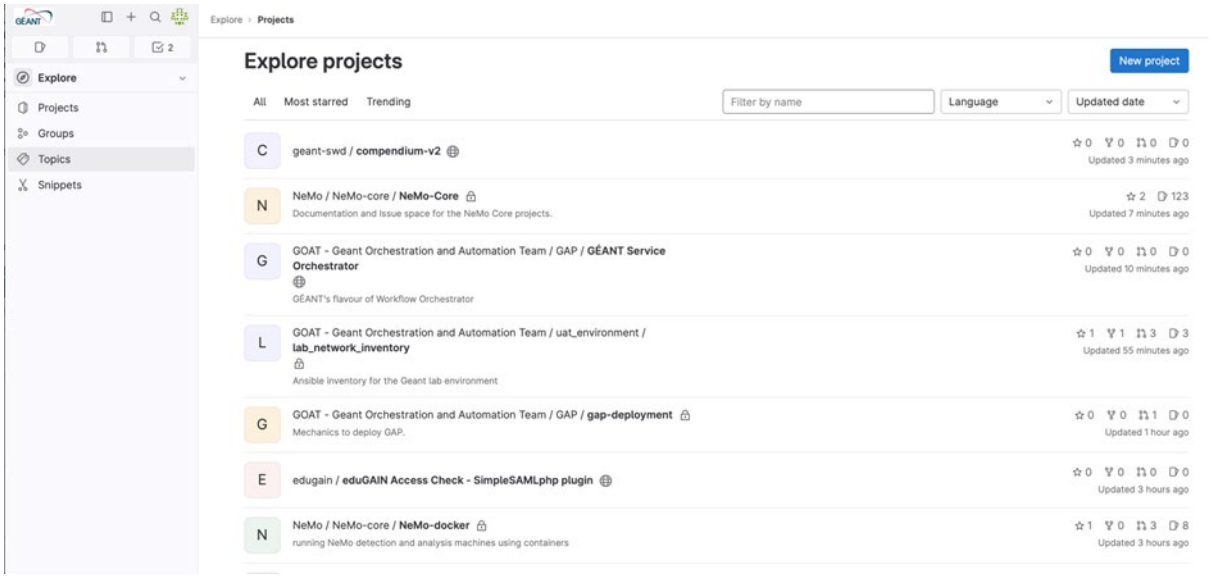


Figure 4.14: GitLab Explore projects page with listed open (globe icon) and closed (padlock icon) projects

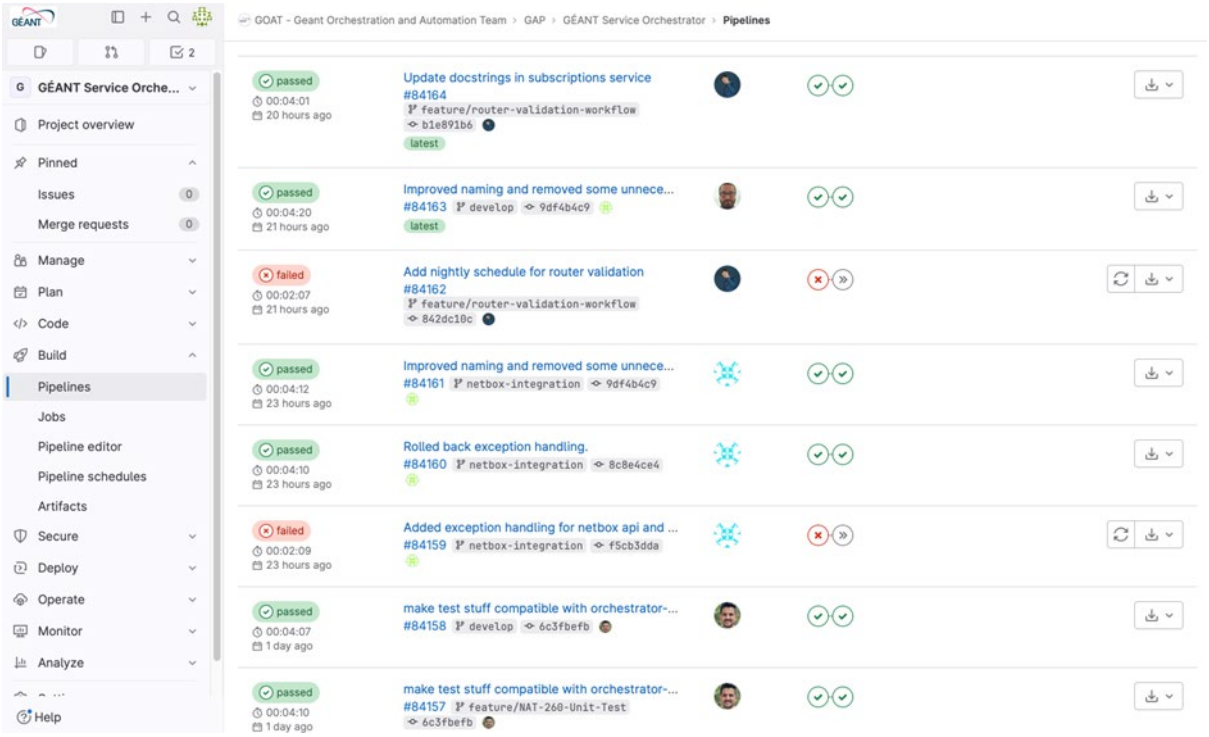


Figure 4.15: GitLab Build and Pipelines page view example - continuous integration and delivery monitoring page

The two instances of GitLab that have been available to project participants since July 2023are compared in table below.

	GitLab Community Edition	GitLab Ultimate Edition
Website	https://gitlab.software.geant.org/	https://gitlab.software.geant.org/
Authentication and Authorisation	eduTEAMS	eduGAIN (restricted number of users)
Project types	Standard development project	Advanced projects utilise advanced pipelines used for service delivery and deployment. Some of them utilise security and dependency scanning supported in GitLab.
Number active user accounts	Unlimited Total over 408	Limited Max. 20 with permission to change source code or issues.
Availability of services[5]	99.056%	

Table 4.5: Basic information about the GitLab service

[5] Availability of service from 01-01-2023 00:00:00 to 01-07-2023 00:00:00

Due to the great interest and popularity of GitLab as a continuous integration tool, it has been integrated with Kubernetes (K8s). This integration allows users to build and run their application as Docker containers in the K8s environment directly from the GitLab CI/CD Pipeline. After creating project in GitLab users can request resources in K8s cluster for development and testing purposes.

User can control the development environment (start/stop application) directly from GitLab CI/CD, and run containerised applications available under <app-name>.ks.qalab.geant.org. Resources in K8s cluster are reserved for each GitLab project separately and can be stored on persistent volumes.

4.5.1 Assessment

GitLab instances are performing within spec and according to requirements. The metrics indicate that the instance was actively used by a large number of developers to manage over 400 repositories in the reporting period (Jan – June 2023). Both instance user databases contain 417 accounts.

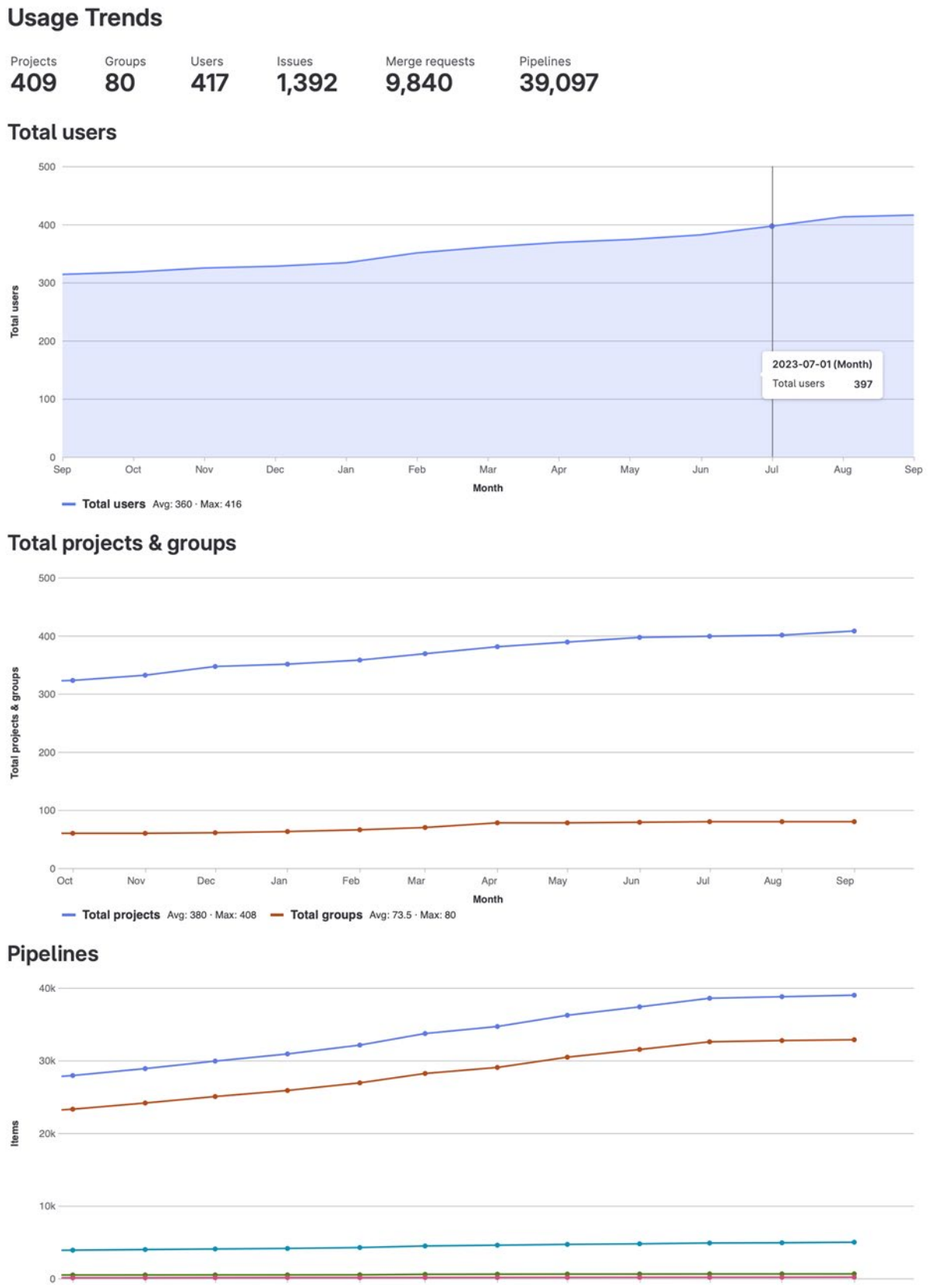


Figure 4.16: GitLab Community Edition instance usage trends based on service statistics, per month (October 2022 - September 2023)

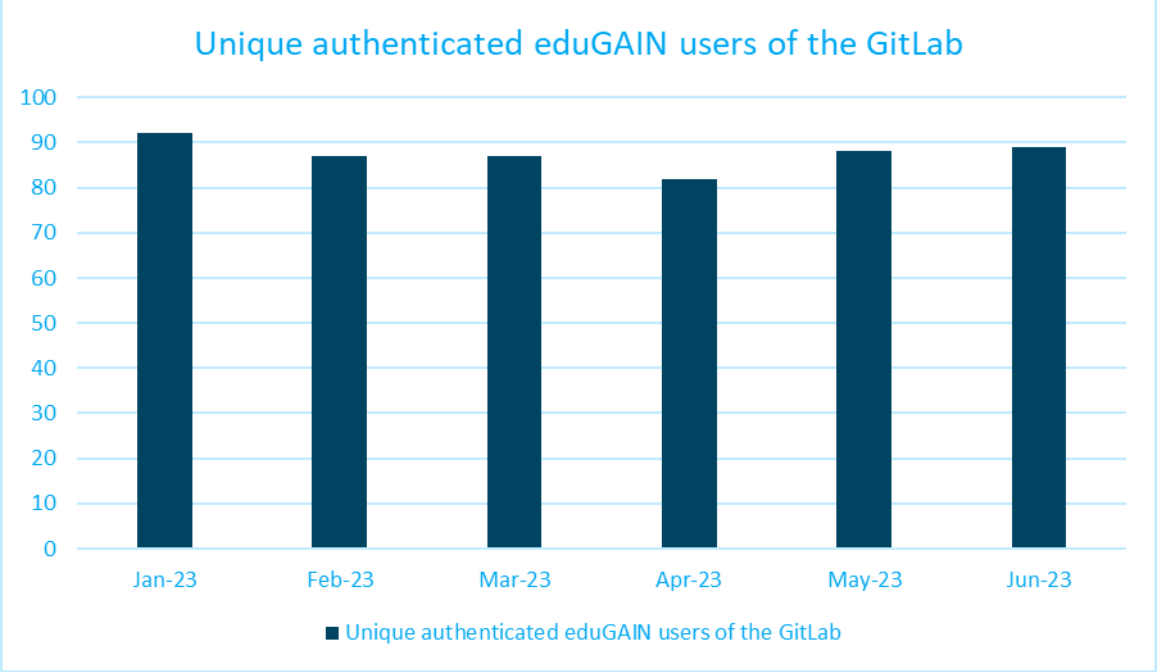


Figure 4.17: Unique authenticated eduGAIN users of the GitLab service, per month (January - June 2023)

4.5.2 Near-Term Development Plans

Integration of the Ultimate Edition instance with eduTEAMS is planned for the fourth quarter of 2023 to increase the number of accounts available to developers within this installation.

Following on from that, only regular maintenance and support are expected to be required.

4.6 SonarQube

SonarQube is a web-based open-source platform used to measure and analyse the quality of source code. Its static code analysis provides insights into code issues and technical debt, helping to assess the code quality in a software project, and also to estimate the remaining effort needed for achieving the production level. SonarQube also supports reporting on quality with regard to unit tests through reporting a code coverage percentage. The SonarQube features reduce the chances of deploying broken or untested code, particularly during the maintenance phase. The usage of such a tool helps to identify many bugs and vulnerabilities that would otherwise stay undetected and could cause damage. Its tracking of quality norms allows enforcing them and making the code more reliable and readable. Readability increases productivity and quality, as developers must read many lines of code before editing. Making the code easier to read and thus easier to modify. SonarQube supports a wide range of programming languages.

The scanning is started by a CI job (Bamboo, Gitlab CI or GitHub Action), and the users can adjust the way the scan works to fit their workflows. Basing on the SonarQube capabilities, WP9 T2 supports and helps users to set up the Continuous Testing approach. The users who store the software code on Gitlab and GitHub are empowered to build and trigger their own CI pipelines, including the automated code analysis with SonarQube. In fact, the whole scan can be self-provisioned by the users, who need to issue a personal access token from SonarQube.

The application is also used as a part of the software review services that WP9 T2 offers to the GN community.

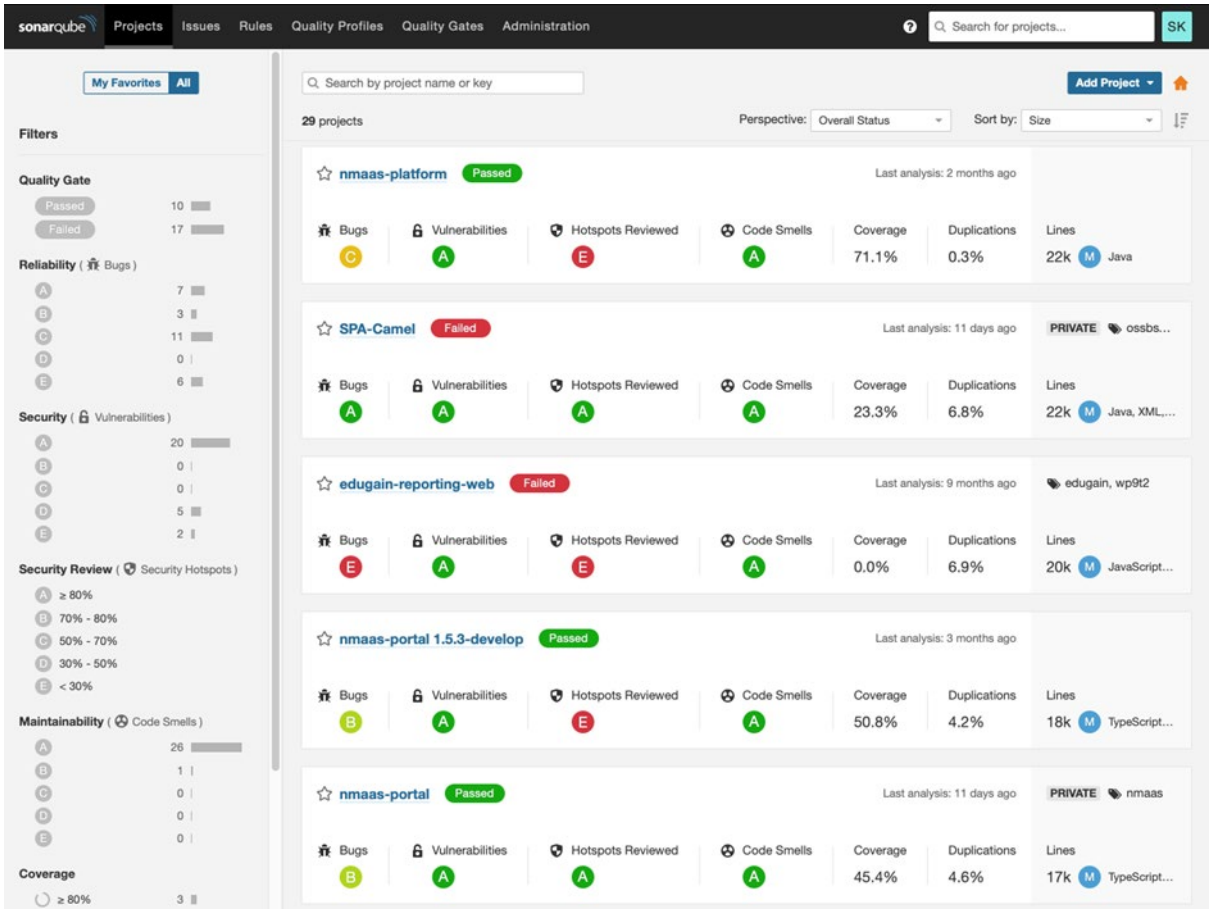


Figure 4.18: SonarQube service dashboard page

SonarQube uses the software version, or a time- or date-defined period to identify the new code. New code often introduces new issues, particularly if the previously written code has been in production and was pruned of errors by more extensive testing, usage, and maintenance. The new code perspective allows the developers to focus on the code they add or change, instead of looking at the technical debt that is already in the system, and thus quickly spot and early fix new issues.

SonarQube	
URL	https://sonarqube.software.geant.org
Access Method	Federated IdP
Knowledge Base	https://wiki.geant.org/display/GSD/SonarQube+-+source+code+analysis+tool
Total projects	29
Total users	129
Lines of Code	401,514
Availability of services[6]	99.950%

Table 4.6: Basic information about the SonarQube service

4.6.1 Assessment

SonarQube is performing within spec and according to requirements. The metrics indicate that the application is actively used by a small number of users to manage projects actively developed and analysed in the reporting period (Jan – June 2023).

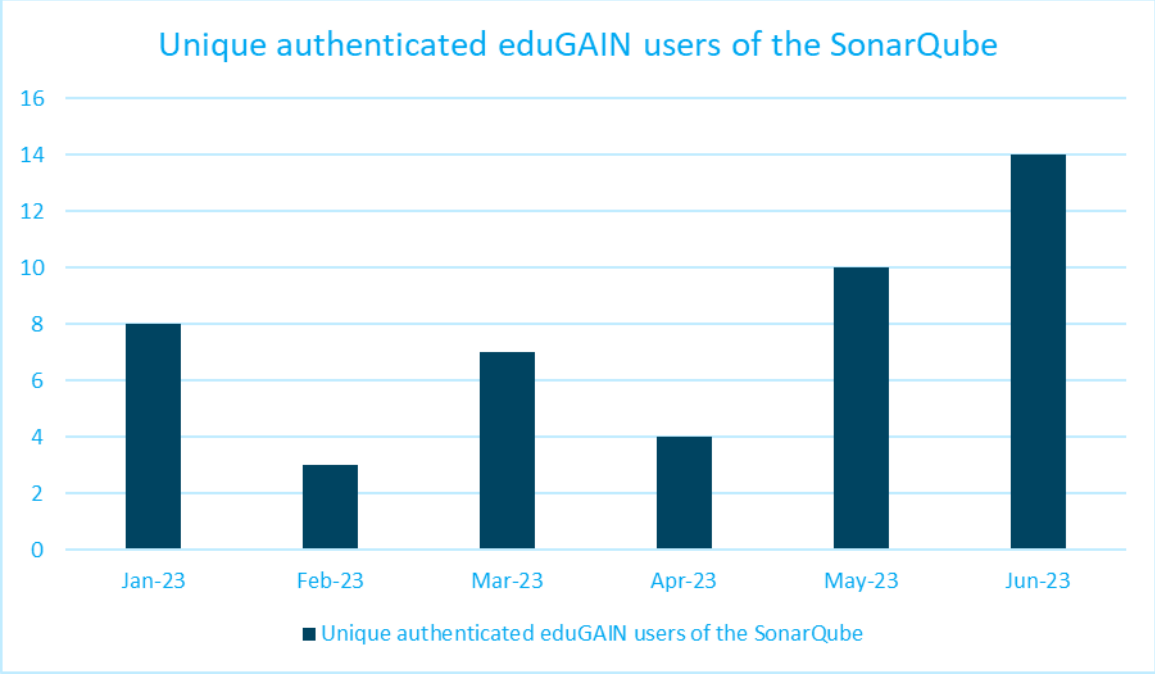


Figure 4.19: Unique authenticated eduGAIN users of the SonarQube service, per month (January - June 2023)

[6] Availability of service from 01-01-2023 00:00:00 to 01-07-2023 00:00:00

4.6.2 Near-Term Development Plans

Integration with eduTEAMS is planned for the fourth quarter of 2023. Following on from that, only regular maintenance and support are expected to be required. It is also planned to customise the SonarQube features (such as the Quality Gates) to match the current workflows of GN software teams and thus increase its usage.

4.7 Software Catalogue

The Software Catalogue (SC) aims to establish an up-to-date repository of information about software projects and teams in order to facilitate and support the GÉANT software engineering community, and to create a base and starting point for further analysis and reporting on GÉANT software development efforts, in particular for Work Package and Task leaders, the PLM, Software Governance and Support, and other interested parties. The Software Catalogue is provided using the SaaS delivery model.

The Software Catalogue was launched in February 2019, and keeps working on the long-term mission of building and sharing the "big picture" of GÉANT software development efforts. The SC does this in an automated way by exploring project resources like Git, JIRA, GitHub, GitLab, and many others. The SC may be compared to other available directories like, for example, Apache Projects Directory.

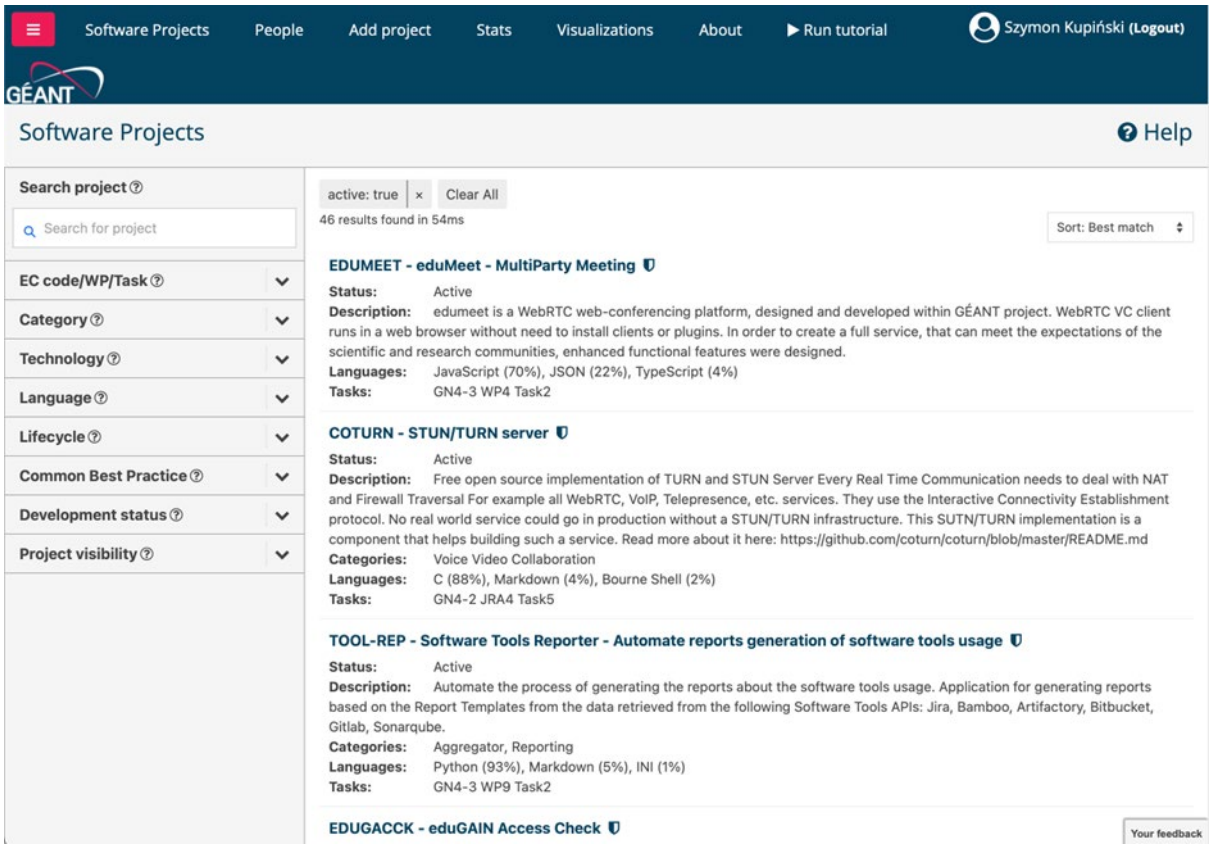


Figure 4.20: Software Catalogue main page - 'Software Projects' page

Software Catalogue	
URL	https://sc.geant.org/
Access Method	Federated IdP
Knowledge Base	https://wiki.geant.org/display/GSD/Software+Catalogue
Total projects	46
Software contributors (GÉANT members)	125
Availability of services[7]	99.950%

Table 4.7: Basic information about the Software Catalogue service

4.7.1 Assessment

The Software Catalogue is performing within spec and according to requirements. The metrics indicate that the application is actively used by a moderate number of users to access information about 46 active project analysed in the Software Catalogue in the reporting period (Jan – June 2023).

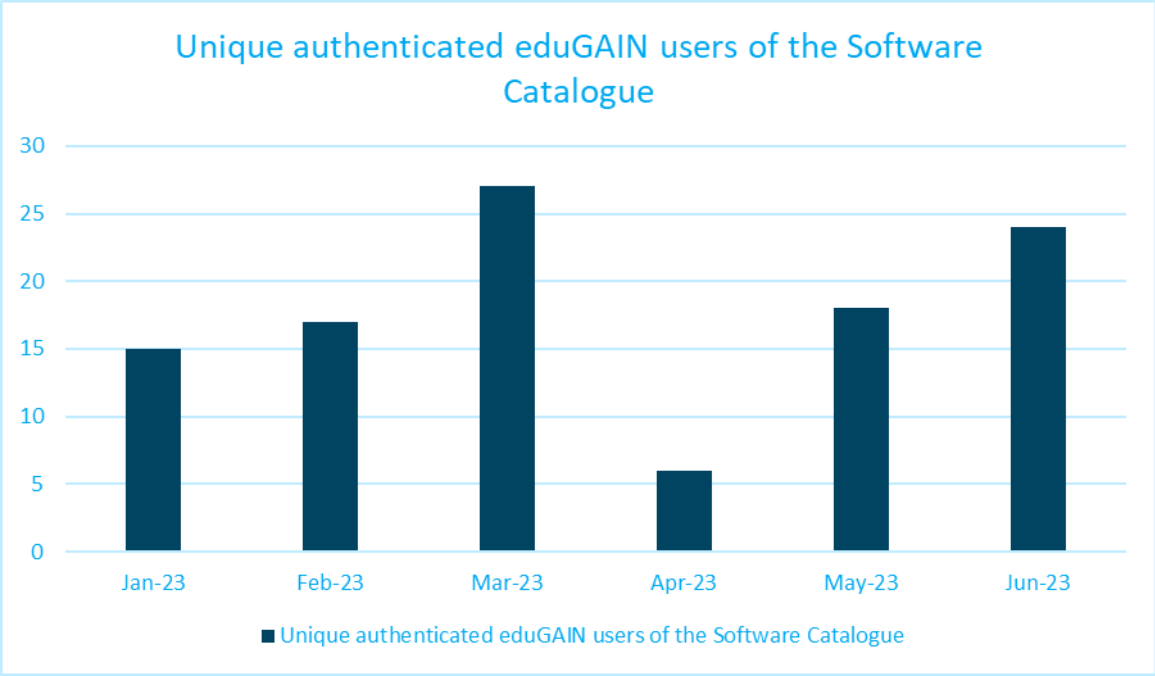


Figure 4.21: Unique authenticated eduGAIN users of the Software Catalogue service, per month (January - June 2023)

[7] Availability of service from 01-01-2023 00:00:00 to 01-07-2023 00:00:00

4.7.2 Near-Term Development Plans

Integration with eduTEAMS is planned for the fourth quarter of 2023. On top of regular maintenance and support, further development includes usability enhancements (e.g., by introducing a new user interface layout) and the introduction of Quality Badges (e.g., indicating that a software product has the correct license).

4.8 Mend

Mend helps GÉANT projects comply with the IPR policy guidelines by scanning directories to find software components, identifying vulnerable libraries and licensing conflicts or risks, and displaying the results in the Mend web application without actually scanning the source code. By default, it checks the digital signatures of used components in the Mend database to detect all open-source or commercial components in the product. Mend is a platform that allows users to connect to a given GÉANT product (without having to review the code) and check the compliance of the product with a predefined IPR policy. The verification is performed by 'scanning' the project, which generates a compliance report.

The application is also used as a part of the software license analysis, which the WP9 T2 Software Governance task offers to the GN community [GN43D9.5].

The standard way of using Mend is the integration of the Mend scan in a Continuous Integration (CI) pipeline that triggers the scan automatically on each commit in the host repositories such as GitLab and Bitbucket.

Figure 4.22: Mend service home page

Mend	
URL	https://app-eu.whitesourcesoftware.com/Wss/WSS.html#!login;orgToken=dcc85041-eb5a-43dc-9229-d0127184c473
Access Method	Federated IdP
Knowledge Base	https://wiki.geant.org/display/GSD/Mend+-+Software+Composition+Analysis+tool
Total projects	44

Table 4.8: Basic information about the Mend service

4.8.1 Assessment

Mend is performing within spec and according to requirements. The metrics indicate that the application is actively used by a small number of users to access information about 44 projects analysed by the Mend service in the reporting period (Jan – June 2023).

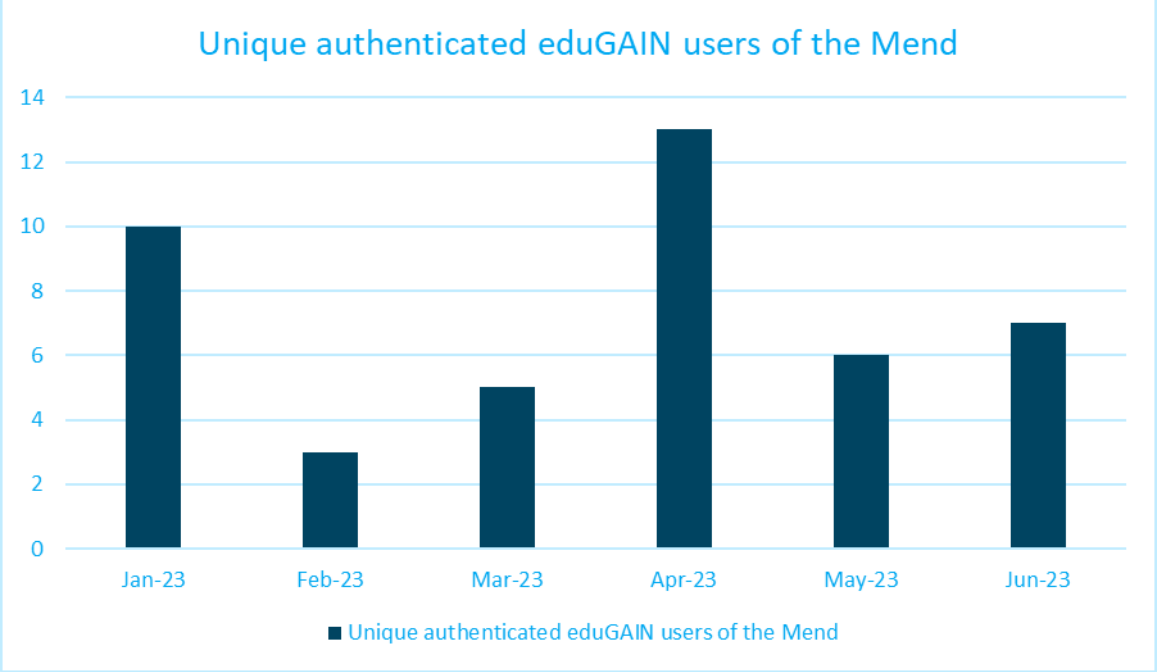


Figure 4.23: Unique authenticated eduGAIN users of the Mend service, per month (January - June 2023)

4.8.2 Near-Term Development Plans

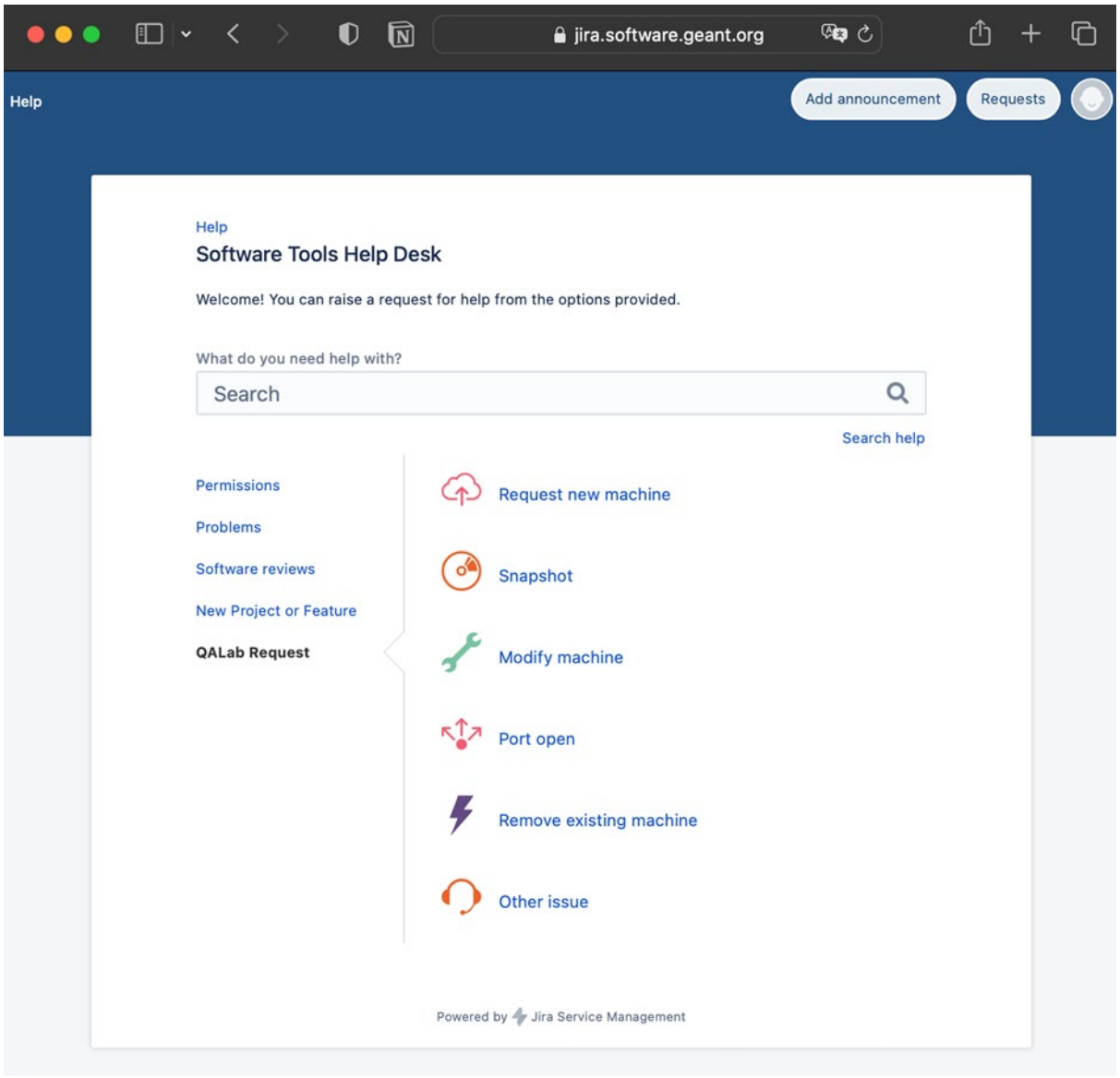
Integration with eduTEAMSis planned for the fourth quarter of 2023. Following on from that, only regular maintenance and support are expected to be required.

4.9 Quality Assurance Lab

The GÉANT Quality Assurance Lab (QALab) infrastructure is an environment where development teams can request virtual machines, mainly for demonstration or testing of developed software.

The process of requesting resources within the QA Lab infrastructure is managed via the Service Desk, based on JIRA, and maintained by WP9 T2. Once a virtual machine (VM) is created and assigned to the requestor, the VM is available via SSH keys. As far as operating systems are concerned, Ubuntu server and CentOS are currently available. Developers assigned to the requested machines have full root access to the machine; however, once the machine is broken, it is simply rebuild from scratch and handed over again.

QALab hosts VMs assigned permanently to development teams as well as up to 50 Virtual Machines running in parallel and assigned to development teams on a resource-booking basis. Such limitations are due to hardware constraints and a number of assigned public IP addresses.


jira.software.geant.org
Help
Add announcement
Requests
Help
Software Tools Help Desk
Welcome! You can raise a request for help from the options provided.
What do you need help with?
Search
Search help
Permissions
Problems
Software reviews
New Project or Feature
QALab Request
Request new machine
Snapshot
Modify machine
Port open
Remove existing machine
Other issue
Powered by Jira Service Management

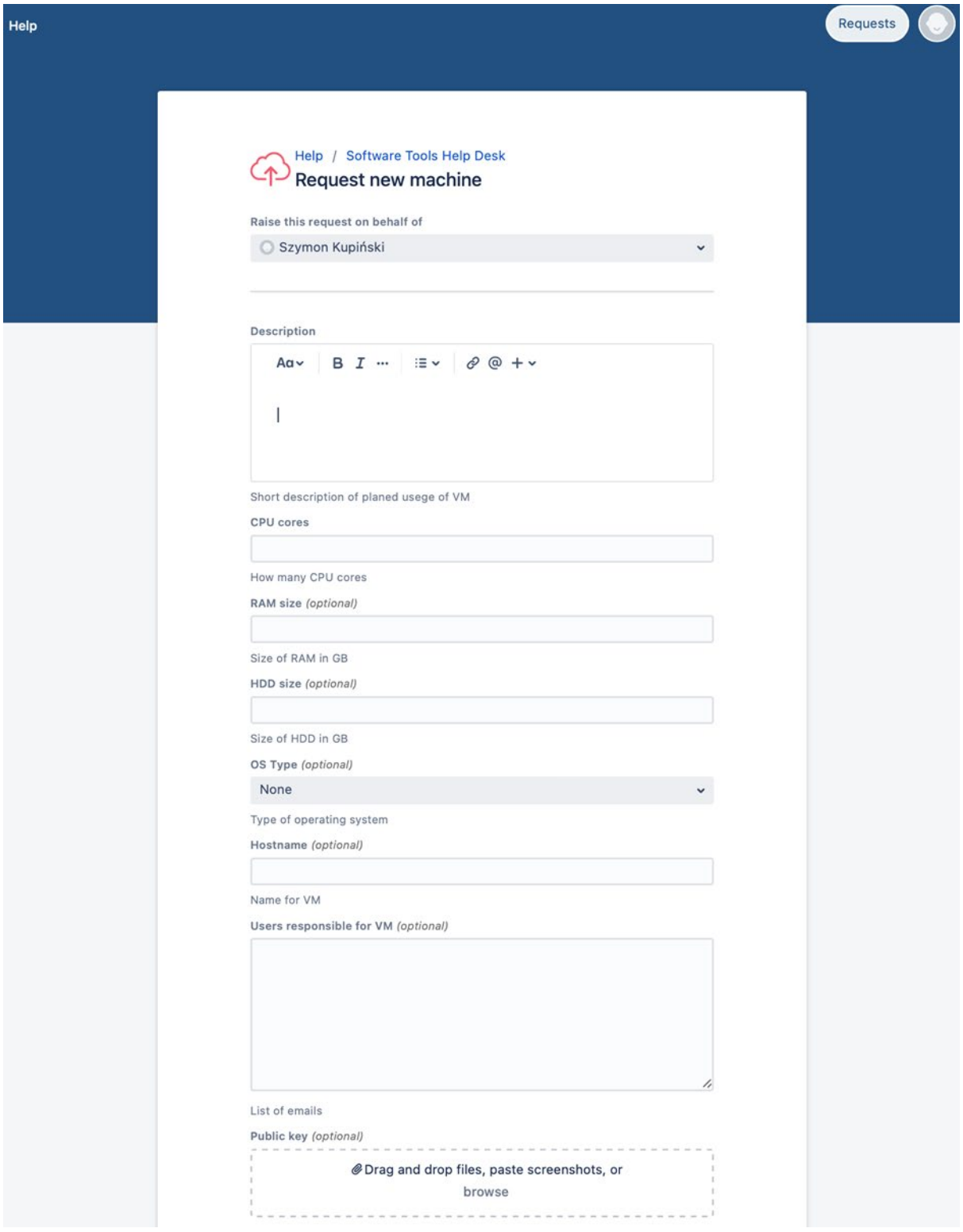


Figure 4.24: Supporting tools help desk - QALab Request

QALab	
URL	https://jira.software.geant.org/servicedesk/customer/portal/2/group/18 Service desk – QALab Request
Access Method	Federated IdP
Knowledge Base	https://wiki.geant.org/display/GSD/Quality+Assurance+Testbed
Total VMs	52
Memory Size Provisioned	238GB
Memory Size Used	204GB
vCPU	110
Availability of QA Lab (based on dhcp machine)	99.999%

Table 4.9: Basic information about the QA Lab service

4.9.1 Assessment

QA Lab is performing within spec and according to requirements. The metrics indicate that the VMs is actively used by a small number of users. The QA Lab is based on two clusters.

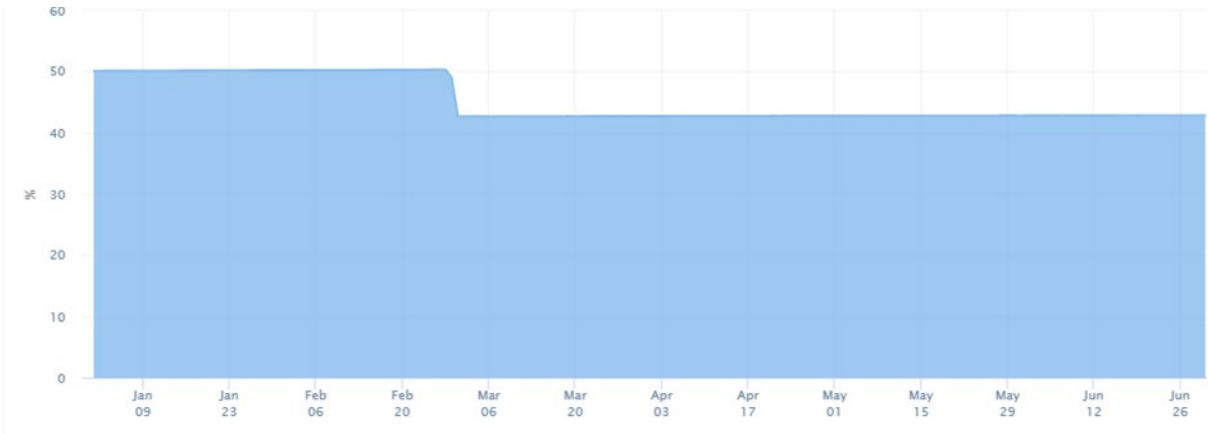


Figure 4.25: Cluster 1 - memory usage (GB)

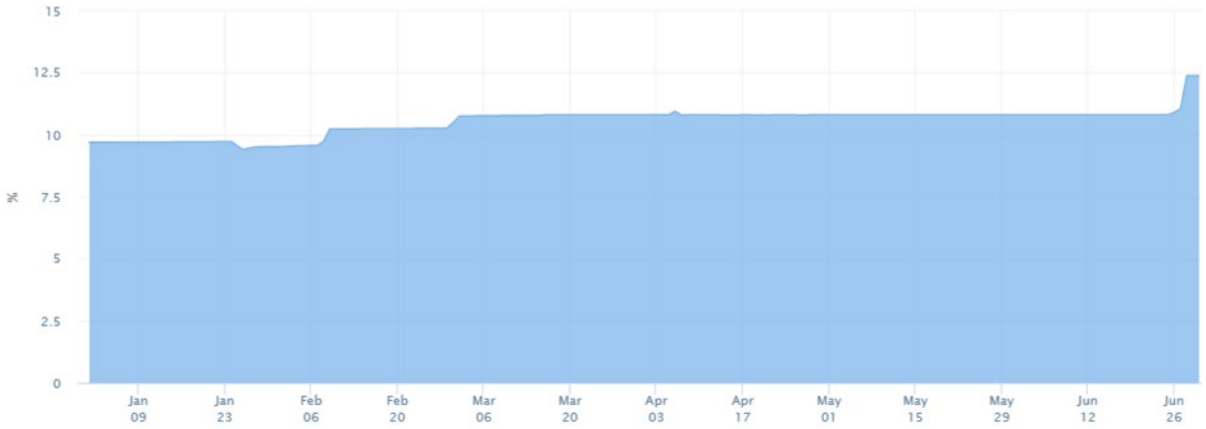


Figure 4.26: Cluster 2 - memory usage (GB)

Figure 4.27: Cluster 1 - CPU usage

Figure 4.28: Cluster 2 - CPU usage

4.9.2 Near-Term Development Plans

There is no plan about near term development, only regular maintenance and support are expected to be required.

5 Services Evaluation and Feedback

5.1 Service Availability

According to WP9 T2's Key Performance Indicators (KPIs), the Software Development Support Infrastructure is available 99% of the time (excluding planned maintenance periods).

1	https://artifactory.software.geant.org	99.548%
2	https://bamboo.software.geant.org	99.974%
3	https://bitbucket.software.geant.org	99.550%
4	crowd.geant.net	100% - service was shut down in February 2023
5	https://gitlab.software.geant.org	99.499%
6	https://jira.software.geant.org (requires login)	99.545%
7	https://sc.geant.org	99.549%
8	https://sonarqube.software.geant.org	99.561%
9	QA Lab (availability of DHCP machine)	99.986%

Table 5.1: Basic information about the QA Lab service

5.2 Services Usage

Based on the data collected in the Software Catalogue, approximately two thirds of software projects are carried out using the infrastructure provided by WP9 T2 as part of the project. Taking into account the size of projects expressed in lines of code, the larger the project, the more often its development is carried out on the presented infrastructure.

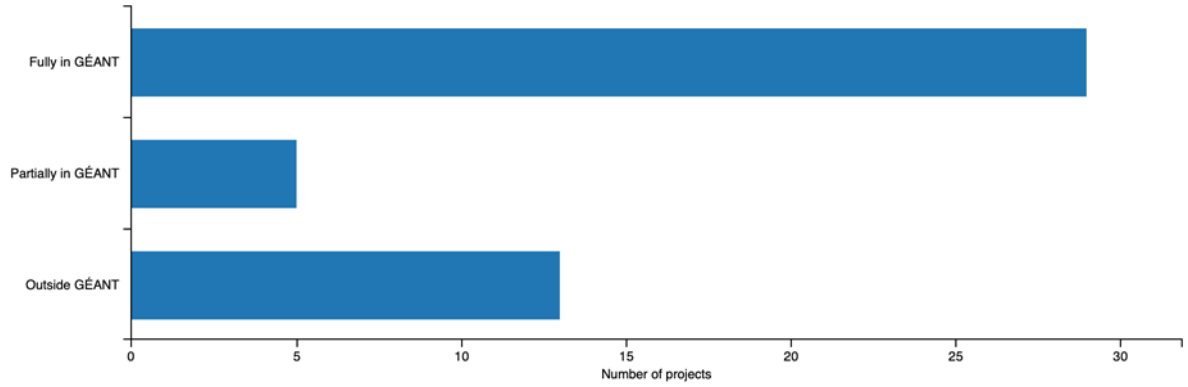


Figure 5.1: Software development hosting infrastructure (based on Software Catalogue analysis results)

5.3 User Feedback

5.3.1 Service Desk and Knowledge Base

Users who encounters an issue while using a tool can get technical assistance using the Service Desk Portal. Using the search box, they are provided with content from the knowledge base space [Wiki]. If a satisfying response was not available on the knowledge base, the user can submit a ticket via the Software Tools Help Desk [SWDesk].

The issue category can be selected based on search results. Available options are:

- Permissions – for granting permissions to existing projects.
- Problems - for reporting any issue regarding security, access to a particular service or with a service itself.
- New Project or Feature - for requesting a new feature or project.
- QA Lab Request - for any issue related to Virtual Machines in QALab.

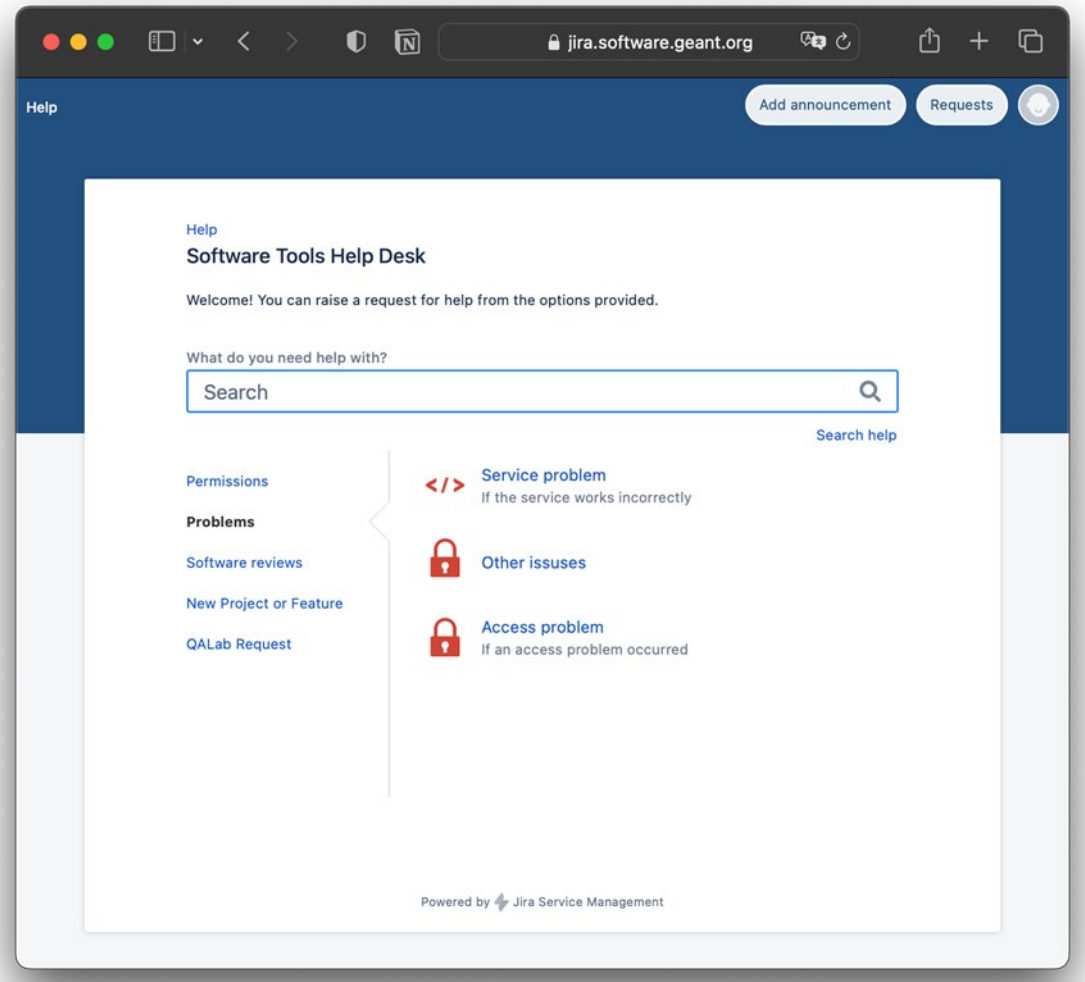


Figure 5.2: Supporting Tools help desk welcome page default view

5.3.2 Email Contact Point

A second communication channel is provided via a dedicated email address: help@software.geant.org. Users can contact the Software Tools team via email about technical issues regarding Software Development (SWD) Infrastructure and QALab. Based on their email, a new issue is raised in the Service Desk project and progressed like any other issue reported directly in Jira.

5.3.3 Mailing List

The Software Tools maintenance team uses the developers@lists.geant.org mailing list to inform the community about planned service unavailability windows and significant infrastructure changes.

6 Conclusions

The Software Tools infrastructure enables the automation of IT processes, which is an essential part of allowing the GÉANT project to manage digital products and customer experience. The realisation of fast flow, fast feedback, and fast improvement can be seen from the underlying technology as DevOPs culture, Agile teams, containerisation, CI/CI pipelines or Infrastructure as a Code. This not only results in faster development, but also improves the quality of IT-related products and services.

The tools meet the required functionalities of providing the set of services needed to develop software in distributed teams in an effective and efficient way. Developers can work based on two predefined tool stacks, using GitLab or Atlassian, and they can also combine tools to provide a more effective stack dedicated to particular project needs and their own preferences. Services like SonarQube and Mend are mostly used by the WP9 T2 subtasks Software Licence Management and Software Tests, and analysis teams to improve the availability of their services. The service availability KPI was met for each monitored service in the last reporting period. Updates to services hosted directly by WP9T2 are planned in advance and carried out after prior communication of service unavailability dates to users, and all services are urgently updated in the event of security vulnerabilities.

The GN Software tools are constantly evolving to meet GN software community needs, which follow changes in technologies, tools, and approaches as well as Open Science. The GitLab Community Edition deployment and Open Project profiles in the Software Catalogue respond to global software development, which relies on the source codes being open to everyone, and the software products which are jointly developed with engineers outside GN5-1. The Mend tool helps to manage risks associated with the infringement of IPR, whereas the SonarQube tool helps to get constant insight into security vulnerabilities, which importance gained even more importance in the light of development of cybersecurity. Network automation which is also expressed as Orchestration, Automation, and Virtualisation (OAV) brings together software engineers and network engineers through the extensive use of Agile and DevOps practices.

References

[GN43D9.2]	https://geantprojects.sharepoint.com/sites/gn4-3/Work-Packages/WP9/Deliverables%20Documents/Software%20Policy/GN4-3_D9.2-Software-Policy.pdf
[GN43D9.5]	https://geantprojects.sharepoint.com/sites/gn4-3/Work-Packages/WP9/Deliverables%20Documents/G%C3%89ANT%20Software%20Services%20Report%20(3)/D9.5_Project-Software-Test-Report.pdf
[SWCat]	https://sc.geant.org/
[SWDesk]	https://jira.software.geant.org/servicedesk/customer/portal/2
[SWPortal]	https://software.geant.org
[Wiki]	https://wiki.geant.org

Glossary

CE	Continuous Exploration
CD	Continuous Delivery
CI	Continuous Integration
IdP	Identity Provider
IP	Internet Protocol
IPR	Intellectual Property Rights
ITIL	Information Technology Infrastructure Library
K8s	Kubernetes
NRENs	National Research and Education Networks
OAV	Orchestration, Automation, and Virtualisation
OSS	Operational Support Systems
PLM	Product Lifecycle Management
QALab	Quality Assurance Lab
SaaS	Software as a Service
SC	Software Catalogue
SLA	Service Level Agreement
SSH	Secure Shell
SWD	Software Development
T	Task
VM	Virtual Machine
WP	Work Package