# CodeArts Repo

# Service Overview

**Issue** 01

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HUAWEI CLOUD COMPUTING TECHNOLOGIES CO., LTD.

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# 1 CodeArts Repo Illustration

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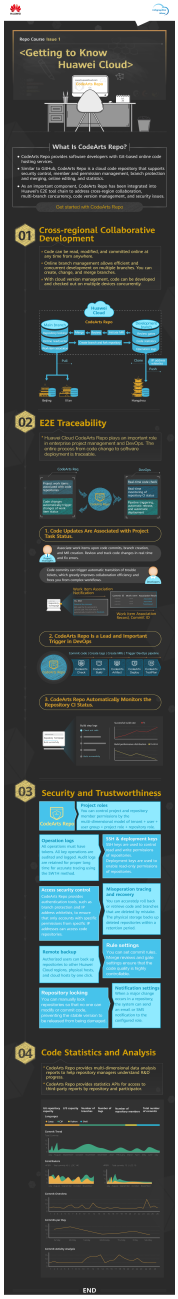
Repo Course Issue 1
<Getting to Know Huawei Cloud>
What Is CodeArts Repo?
01 Cross-regional Collaborative Development
02 E2E Traceability
03 Security and Trustworthiness
04 Code Statistics and Analysis
END

# 2 What Is CodeArts Repo?

## What Is CodeArts Repo?

CodeArts Repo provides software developers with **Git**-based online code hosting services. It is a cloud code repository that supports security control, member and permission management, branch protection and merging, online editing, and statistics. The service aims to address cross-region collaboration, multi-branch concurrency, code version management, and security issues.

- Code can be read, modified, and committed online at any time from anywhere.
- Online branch management allows efficient concurrent development on multiple branches. You can create, change, and merge branches.
- Protected branches prevent pushes to the branches and prevent the branches from being incorrectly deleted.
- The Domain-level IP address whitelist and data transmissions via HTTPS block unauthorized code downloads to secure data.
- Passwords can be reset.

## Why CodeArts Repo?

CodeArts Repo provides efficient and secure code hosting for end-to-end code traceability.

- Innovative full-stack development
- Efficient collaborative code development
- Hierarchical protection
- Code-centered tracing

## CodeArts Repo Working Mode

- CodeArts Repo uses GitFlow as the basic working mode.
- Following the rules suggested by GitFlow, small and medium-sized development teams can better manage their development.
  - **Concurrent development:** Features and patches are developed concurrently.

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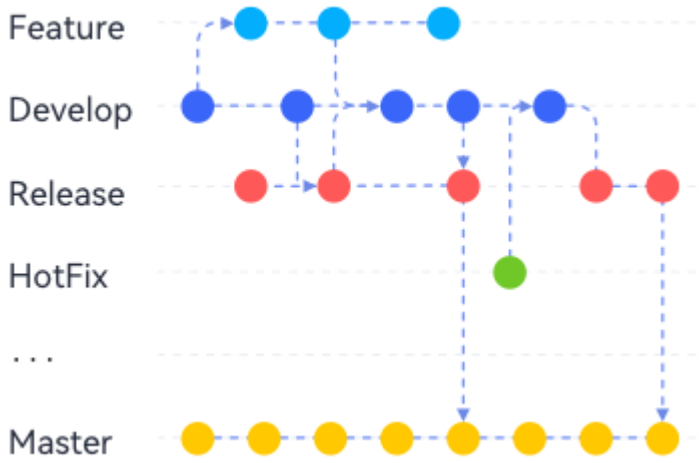
  - **Teamwork:** Developers are aware of the current work of other team members during collaboration.
  - **Flexibility:** Emergency fixes are developed on the hotfix branch.




- Master branch: the most stable branch with complete features and code that can be released at any time.
- Develop branch: a permanent branch with the latest and most complete features. It contains all the code ready for the next release and is used to merge other branches.
- Feature branch: a branch for developing a new feature. Once the development is complete, the feature branch is merged into the develop branch for the next release after passing tests.
- Release branch: a dedicated branch for release preparation.
- Hotfix branch: a branch for fixing bugs in a live production version.

  NOTE

  - All feature branches are pulled from the develop branch.
  - All hotfix branches are pulled from the master branch.
  - All commits to the master branch must have tags to facilitate rollback.
  - Any changes that are merged to the master branch must be merged to the develop branch for synchronization.
  - The master and develop branches are the main branches and they are unique. Other types of branches can have multiple derived branches.

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# 3 Advantages

- **Unified code repository platform**
  - MR mode: The merge request mode is the mainstream development mode in the industry. It is mainly used to submit MRs (PRs), which is similar to the GitLab MR/GitHub PR workflow.
- **High security**

By implementing a multi-layered security framework encompassing transmission security, granular permission controls, stringent security policies, encrypted storage, robust backup and recovery mechanisms, comprehensive code security scanning, and regular security audits, we deliver unparalleled resilience and security for your code hosting for protection of your valuable code assets.

- **Built-in guidelines**

By integrating multiple guidelines, such as repository configuration management, branch development, code reviews, and committer engineering practices, we help you facilitate code development.

- **Efficient collaboration**

We offer a wide range of Git-based development workflows, supporting both branch-based and fork-based modes. We provide support for popular branch modes like Git-Flow, GitHub-Flow, and GitLab-Flow, making it suitable for agile development in small and medium-sized enterprises as well as complex collaboration in larger organizations.

- **High-quality code**
  - Multi-level and fine-grained quality gates for code merge
  - We help you code more effectively by integrating automated detection, such as check of code guidelines, security, repetition, and cyclomatic complexity check.
  - You can review code in multiple forms to improve code quality and share technical experience.
- **One-stop DevSecOps**

It seamlessly works with CodeArts Req and CI/CD services to provide a one-stop DevSecOps software development tool chain.

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# 4 Use Cases

## Remote Collaborative Development

- Targets: small- and medium-sized enterprises, and incubators
- Requirements and challenges: Software developers call for higher development efficiency and agility. To respond, more efficient collaboration management is required. Enterprises also expect lower development costs. However, inefficient development collaboration and frequent merge conflicts are two significant hinders.
- Benefits: Cloud-based code hosting makes collaborative development easier. Multi-branch management and merge requests are effective solutions to merge conflicts.

## University Education

- Targets: university teachers and students
- Requirements and challenges: University teachers and students lack a comprehensive development toolchain, and struggle with time-consuming development environment setup and maintenance. Existing development tools also have a high learning threshold.
- Benefits: CodeArts Repo provides complete code hosting services and abundant repository templates, enabling students to quickly get started.

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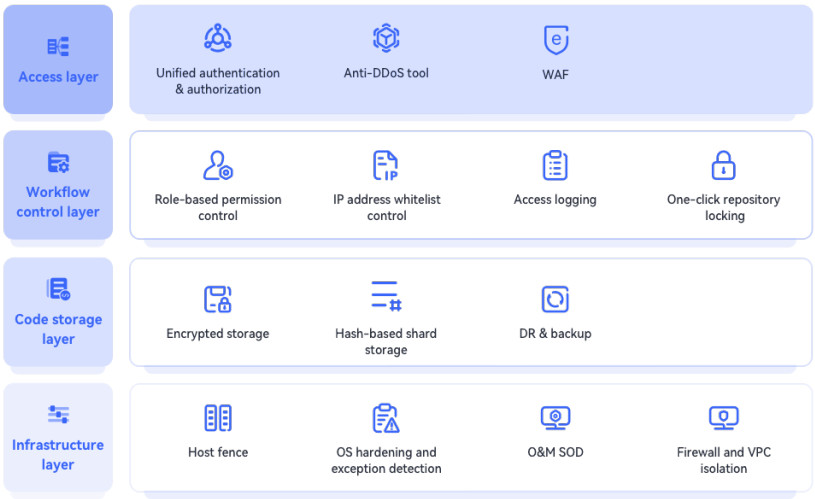
# 5 Function

## 5.1 Ultimate Security and Resilience

Based on the full-stack cloud native architecture and Huawei years of practices, CodeArts Repo provides resilient and secure code hosting. It overs collaborative development of ultra-large products such as cloud, pipe, device, vehicle and IT, billions of code management, tens of thousands of online concurrent operations, high-concurrency code download, and ultra-large storage.




## 5.2 Multiple Git Workflows

### Multiple Collaboration Modes of Job Development

Git-based collaboration modes apply to flexible modes of small- and medium-sized enterprises and complex modes of medium- and large-sized enterprises.

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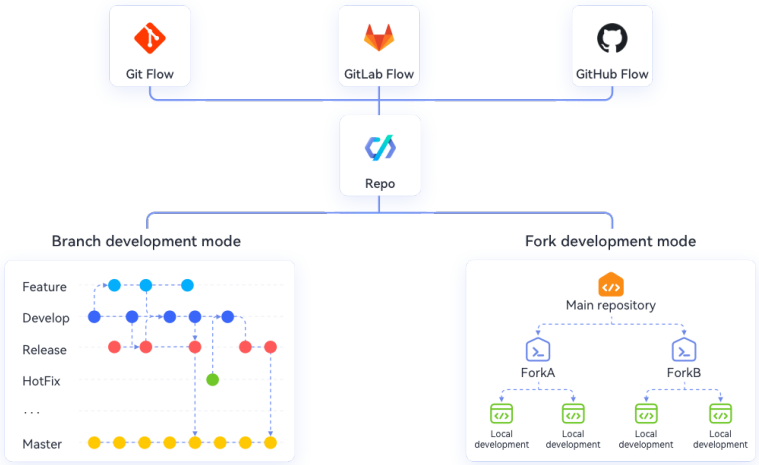
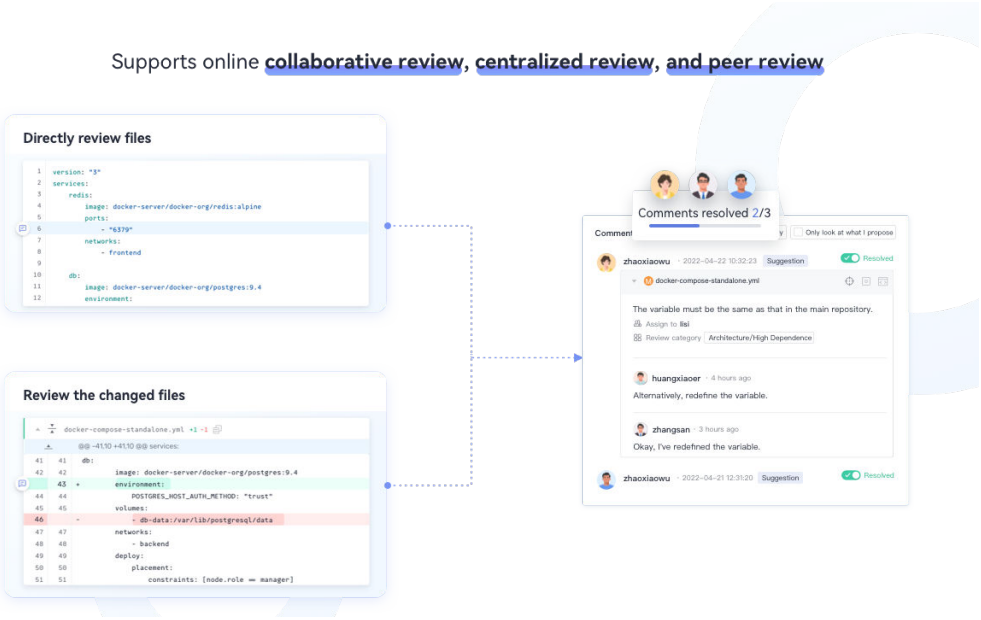



# 5.3 Multi-form Code Reviews

## Multi-form Code Reviews

File-based peer reviews, code reviews of MRs, centralized reviews, distributed collaborative reviews, review templates, automatic reviewer assignment, and review task notification settings are supported. Reviews can be tracked and closed. For details, see **Managing MRs**.

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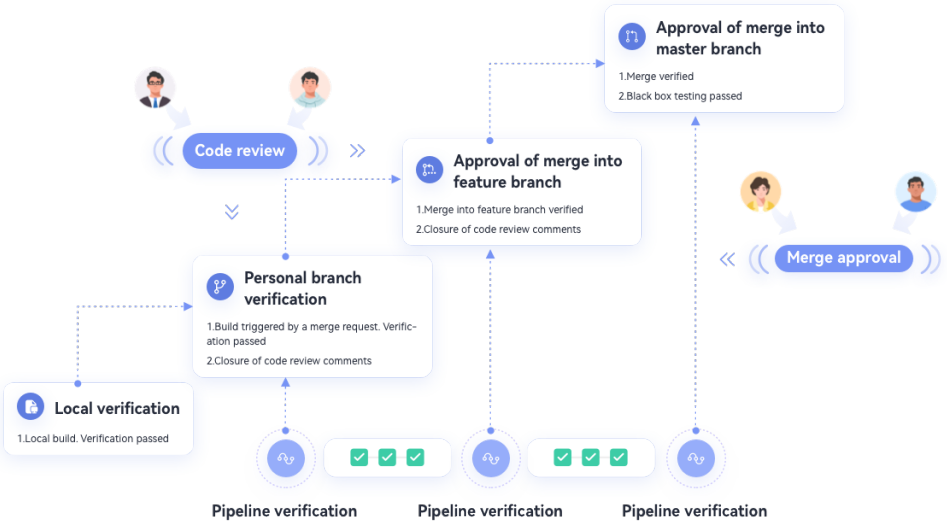
# 5.4 Quality Gates for Code Merge

## Multi-level and Fine-grained Quality Gates for Code Merge

CodeArts Repo supports manual reviews and automatic pipeline integration for code. Only code that meets quality requirements can be merged. Manual reviews support SOD (separation of duties), automatic check, and branch-level control. For details, see **Managing MRs**.




# 5.5 Code-based R&D Asset Tracing

## Code-based R&D Asset Tracing

Trace requirements, tasks, designs, bugs, codes, and versions to master the origin of each line of code, facilitating network problem locating and auditing. For details, see **E2E Settings**.

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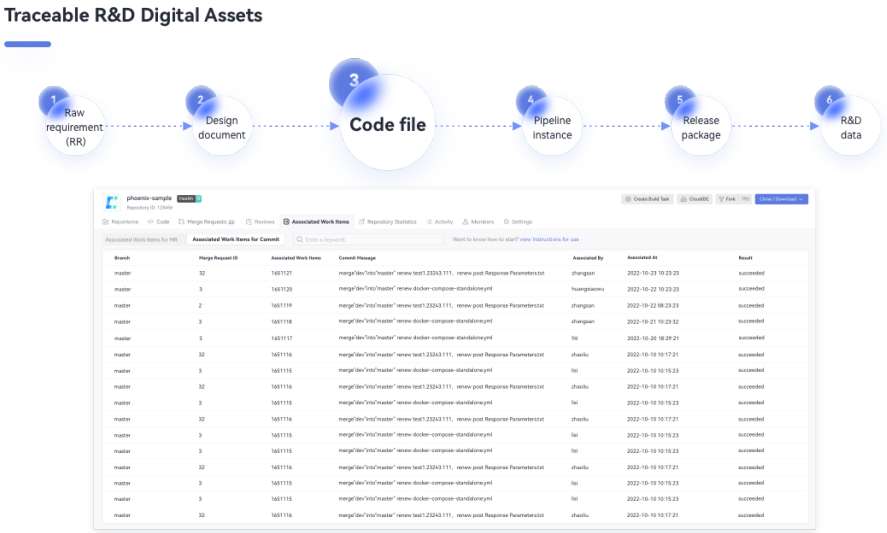


# 5.6 Embedded Repository Specifications and Templates

## Diverse Templates and Standard Development Activities

to unify team development process and facilitate efficiency analysis and improvement based on R&D data.

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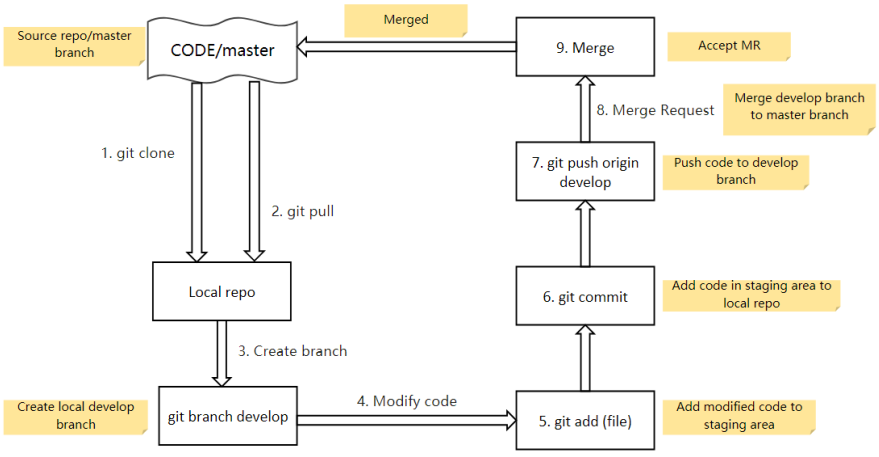
# 6 Principle

A workflow is a simplified representation of a series of tasks and the rules that govern their execution. It provides a good engineering method to solve service problems by outlining and visualizing service process for easy maintenance and expansion.

The following describes the workflows in two development modes.

- **Branch development**: By cloning a central repository of a source project, you can initiate an MR from the new branch to the target branch so that every developer can easily contribute code to an open source project. This mode, without a code review process, is more suitable for small development teams due to the limited need for code reviews in smaller teams. For larger teams, the fork development mode is recommended.




- **Fork development:** It is a flexible and open development model that allows any developer to contribute to open-source projects through forking and merge requests, encouraging community collaboration. This is also an excellent code review mechanism, which makes the communication and collaboration between developers more smooth and flexible and the development work more efficient.

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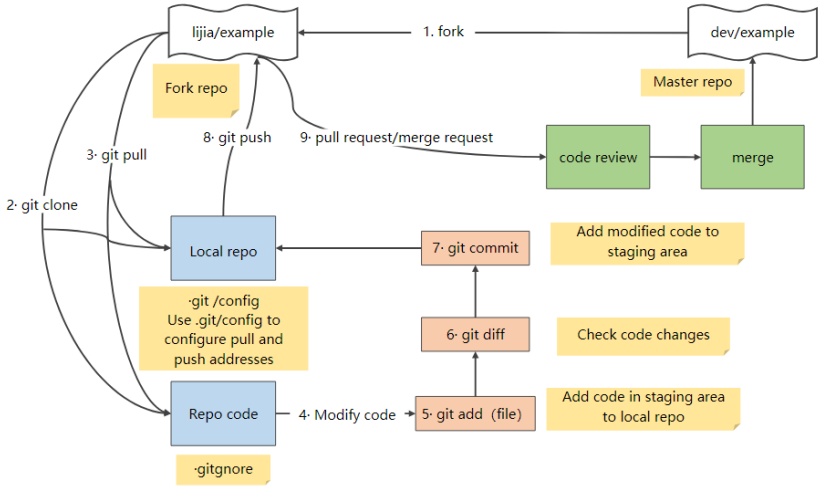


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# 7 Security

## 7.1 Shared Responsibilities

Huawei guarantees that its commitment to cyber security will never be outweighed by the consideration of commercial interests. To cope with emerging cloud security challenges and pervasive cloud security threats and attacks, Huawei Cloud builds a comprehensive cloud service security assurance system for different regions and industries based on Huawei's unique software and hardware advantages, laws, regulations, industry standards, and security ecosystem.

**Figure 7-1** illustrates the responsibilities shared by Huawei Cloud and users.

- **Huawei Cloud**: Ensure the security of cloud services and provide secure clouds. Huawei Cloud's security responsibilities include ensuring the security of our IaaS, PaaS, and SaaS services, as well as the physical environments of the Huawei Cloud data centers where our IaaS, PaaS, and SaaS services operate. Huawei Cloud is responsible for not only the security functions and performance of our infrastructure, cloud services, and technologies, but also for the overall cloud O&M security and, in the broader sense, the security and compliance of our infrastructure and services.
- **Tenant**: Use the cloud securely. Tenants of Huawei Cloud are responsible for the secure and effective management of the tenant-customized configurations of cloud services including IaaS, PaaS, and SaaS. This includes but is not limited to virtual networks, the OS of virtual machine hosts and guests, virtual firewalls, API Gateway, advanced security services, all types of cloud services, tenant data, identity accounts, and key management.

elaborates on the ideas and measures for building Huawei Cloud security, including cloud security strategies, the shared responsibility model, compliance and privacy, security organizations and personnel, infrastructure security, tenant service and security, engineering security, O&M security, and ecosystem security.

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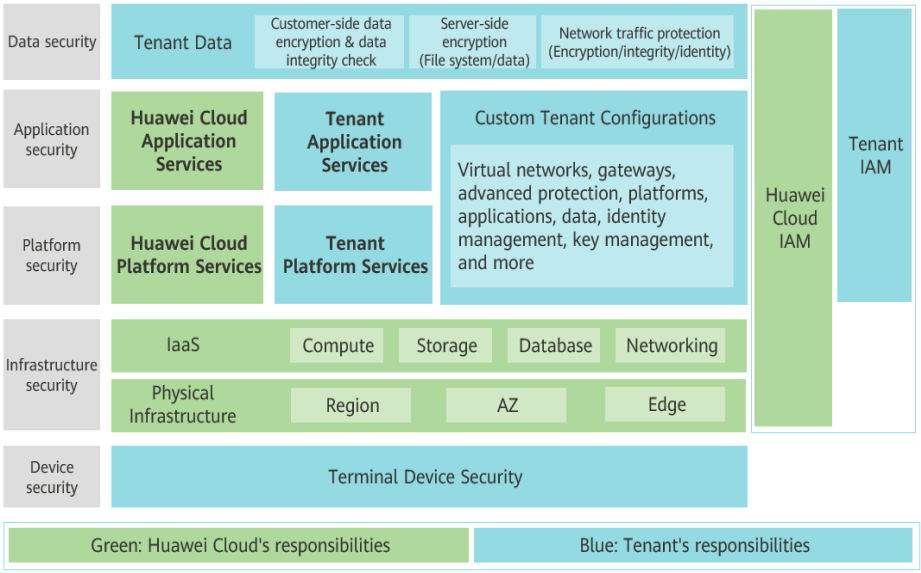
**Figure 7-1** Huawei Cloud shared security responsibility model




# 7.2 Authentication and Access Control

## Authentication

Regardless of whether you access CodeArts Repo through the management console or APIs, CodeArts Repo uses Identity and Access Management (IAM) for authentication.

CodeArts Repo supports two authentication modes:

- **Token authentication**: Requests are authenticated using a token.
- **AK and SK authentication**: Requests are encrypted using an Access Key ID (AK) / Secret Access Key (SK). This method is recommended because it provides higher security than token-based authentication.

For more authentication details, see **Authentication**.

## Access Control

1. **IAM permission management**

   Permission management is a fine-grained authorization based on roles and permissions. Different operation permissions are assigned to different roles based on their work requirements. Users can access only authorized resources.

   Roles in CodeArts Repo include the product manager, test manager, O&M manager, system engineer, committer, developer, tester, participant, viewer, and custom role.

2. **IP address whitelist control**
   - IP address whitelists enhance repository security by restricting access to repositories by IP address.
   - You can access repositories only from whitelisted IP addresses. Access requests from other IP addresses are rejected.

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- IP address whitelists include tenant-level IP address whitelists and repository-level IP address whitelists, and their priorities can be configured.

For details about how to configure the IP address whitelist, see **IP Address Whitelist**.

3. **Repository Locking**

   When a new software version is ready for release, administrators can lock the repository to protect it from being compromised. After the repository is locked, no one (including the administrators) can commit code to any of its branches.

   For details about how to lock a repository, see **Repository Locking**.

4. **Protected Branch Management**

   Protected branches prevent pushes to the branches and prevent the branches from being incorrectly deleted.

   - Secure branches and allow developers to use merge requests to merge code.
   - Prevent non-administrators from pushing code.
   - Prevent all forcibly push to this branch.
   - Prevent anyone from deleting this branch.

   For details about how to configure branch protection, see **Protected Branches**.

5. **O&M SOD**

   The purpose is to standardize O&M scripts throughout the development, test, and release process (including script development, code review, manual test, integration acceptance, release review, script rollout, and version management). Promote and strengthen standardized operation management to ensure process, security, and quality compliance.

6. **Isolation Between Firewalls and VPCs**

   CodeArts Repo uses firewalls and VPCs to isolate networks and resources between tenants.

# 7.3 Data Protection Technologies

CodeArts Repo uses multiple methods to secure data.

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| Method | Description | Reference |
| --- | --- | --- |
| Transmission encryption (HTTPS) | A code repository hosted in CodeArts Repo is flushed to disks on the cloud to prevent people other than the data owner from accessing users' plaintext data and prevent data leakage on the cloud. The code encryption process is transparent to users. Users can use any official Git client to access the code repository on CodeArts Repo. | - |
| Key management | SSH key and deployment key management ensures that the request is initiated by the request initiator so that users can only browse authorized data, securing data. | For details about the SSH key pair and how to obtain it, see **SSH Key**. |
| git-crypt encrypted transmission and storage | git-crypt is a third-party open-source software that can transparently encrypt and decrypt files in the Git repository. | It can encrypt and store specified files and file types. Developers can store encrypted files (such as confidential information or sensitive data) and shared code in the same repository and pull and push them like in a common repository. Only the person who has the corresponding file key can view the content of the encrypted files, but others are not restricted to read and write unencrypted files. For details about encrypted transmission and storage using git-crypt and how to obtain git-crypt, see **About git-crypt**. |
| Sensitive data anonymization and high-value data encryption | CodeArts Repo uses unified and accurate data to support applications and services for data security and privacy. | Logs and databases contain sensitive data, including but not limited to keys and account information. To prevent security issues caused by sensitive data leakage, the data is anonymized or encrypted by CodeArts Repo. The principle is a hash function, which generates a digest for a piece of information to prevent tampering. |

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| Method | Description | Reference |
| --- | --- | --- |
| Anti-DDoS tool | Advanced Anti-DDoS (AAD) is a tool for defending against DDoS attacks. AAD can protect your servers against large volumetric DDoS attacks so your Internet services can keep being available. | AAD supports two traffic diversion modes: DNS resolution and IP address directing to protect website domain names and service ports. Based on the forwarding rules you configure for your services in AAD, AAD directs the DNS domain name resolution or service IP address to the AAD instance IP address or CNAME address for traffic diversion.<br>Access traffic from the public network preferentially passes through an AAD equipment room. Malicious attack traffic is cleaned and filtered in the AAD traffic cleaning center. Normal access traffic is returned to the origin server through port protocol forwarding, ensuring stable access to the origin server. |
| Traffic limiting | Traffic limiting can be used to limit the number of HTTP requests sent by a user within a specified period of time. Traffic limiting is used to protect upstream application servers from being overwhelmed by too many concurrent user requests. | CodeArts Repo mainly uses Nginx and APIGW flow controls. Nginx uses the leaky bucket algorithm to limit traffic. This algorithm is widely used in communication and packet switched computer networks to handle bursts when bandwidth is limited. APIGW flow control limits the number of times an API is called within a specified period to protect backend services and provide continuous and stable services. |
| Backup & DR | Backup and DR not only prevent data loss, but also ensure that services on the server are taken over after the server breaks down to ensure service continuity. This feature ensures that users can continuously use application services, service requests of users can run continuously, and services provided by the information system are complete, reliable, and consistent. | - |

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| Method | Description | Reference |
| --- | --- | --- |
| Hash-based shard storage | Hash-based sharded storage improves confidentiality and privacy. Data sets are divided into independent and orthogonal data subsets based on certain rules. Then, the data is randomly distributed to multiple nodes. No node can access the complete data. They contain only a part of the data. | - |
| Watermark | To prevent unauthorized photos, screenshots, or other means from spreading core assets, you can enable watermark settings. | For details about how to set watermarks, see **Watermarks**. |
| Backup | The repository backup operation secures code and prevents others from deleting code by mistake. There are two backup modes:<br>• Back up the repository to another region of Huawei Cloud.<br>• Back up the repository to your local computer. | For details about how to back up the repository, see **Repository Backup**. |

# 7.4 Auditing and Logging

## Auditing

Cloud Trace Service (CTS) is a professional log audit service in Huawei Cloud security solutions. It can record, store and search operation records on the cloud resources in your account to perform security analysis, audit compliance, track resource, and locate faults.

After you enable CTS and configure a tracker, CTS can record management and data traces of CodeArts Repo for auditing.

For details about how to enable and configure CTS, see **Enabling CTS**.

## Logs

- **Log Tank Service (LTS)**

Log Tank Service (LTS) provides one-stop log collection, log search in seconds, massive log storage, log structuring and transfer. Graphical application O&M, visual analysis of network logs, and operation analysis make organization tracking easier.

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For analysis, CodeArts Repo records system running logs to LTS in real time and stores the logs for three days

LTS monitors logs of servers and databases, and generates alarms by messages or emails for logs that trigger monitoring rules. This ensures that faults and potential risks on the live network can be detected and handled in time, ensures normal service running, and minimizes the impact on user services.

- **Operation Logs**

Operation logs are used to record all behavior activities, related operators, and time points of the code repository, helping administrators and repository owners monitor and trace behavior activities of code repositories.

For details about how to view operation logs, see **Audit Logs**.

# 7.5 Security Risk Monitoring

## WAF Application Protection System

CodeArts Repo interconnects with the Web Application Firewall (WAF) protection system. WAF is also called website application-level intrusion prevention system.

WAF keeps web services stable and secure. It examines all HTTP and HTTPS requests to detect and block the following attacks: Structured Query Language (SQL) injection, cross-site scripting (XSS), web shells, command and code injections, file inclusion, sensitive file access, third-party vulnerability exploits, Challenge Collapsar (CC) attacks, malicious crawlers, and cross-site request forgery (CSRF).

WAF can be deployed in cloud, dedicated, or ELB mode.

## Host Fence

You can set the security fence for the PC device access setting, IP address list, and PC device ID list.

## OS Hardening and Exception Detection

The OS standardization script consists of two parts: **osstdchk.py** (for check) and **osstdfix.py** (for fix). OS hardening must be performed based on Huawei Cloud OS hardening standards.

# 7.6 Security O&M

## Change Operation Process

Use scripts to change the live network on the platform to avoid network faults caused by direct operations on the server console. In addition, operations on the platform must comply with the 1+1 check process. One person performs the operations, and the other monitors and checks the operations to ensure process, security, and quality compliance.

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### Control of Privilege Escalation Operations

Control the rights and authorization process based on the hierarchical risk classification and SOD principle. When a common service alarm is generated, the system must comply with the high-risk and blacklist command control. When a change operation is performed, the system can monitor commands in real time and classify command risk levels based on configured rules. If a high-risk or blacklist command is detected, the system provides a real-time alarm notification, this prevents service interruption caused by unauthorized operations. When an emergency service alarm is generated, privilege escalation must comply with regulations to balance security and efficiency.

### Review of Change Operations

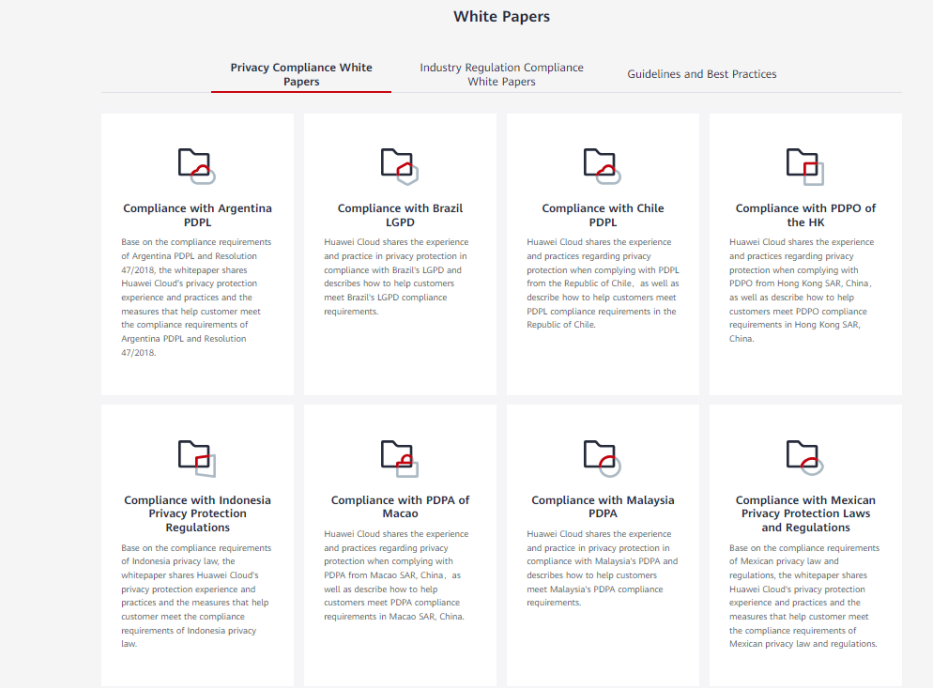
Before implementing a change, you need to apply for a change, review risks, and evaluate the change by the related expert team.

During change implementation, you must check, verify, and monitor services in each step. The check scope includes changed services, peripheral services, global monitoring alarms, dialing tests, and traffic changes to prevent live network faults caused by manual changes.

## 7.7 Certificates

### Resource Center

Huawei Cloud also provides the following resources to help users meet compliance requirements. For details, see **Resource Center**.

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# 8 Constraints

This section describes the constraints on CodeArts Repo.

**Table 8-1** Constraints

| Category | Item | Free Edition | Basic Edition | Professional Edition | Enterprise Edition |
|---|---|---|---|---|---|
| Single repository | Size of a single repository (excluding LFS) | ≤ 1 GB | ≤ 10 GB | ≤ 20 GB | ≤ 30 GB |
| | Size of a single file that can be uploaded (page) | ≤ 50 MB | ≤ 50 MB | ≤ 50 MB | ≤ 50 MB |
| | Size of a single file that can be pushed (local) | ≤ 200 MB | ≤ 200 MB | ≤ 300 MB | ≤ 300 MB |
| | Size of a single LFS file | ≤ 1 GB | ≤ 1 GB | ≤ 2 GB | ≤ 2 GB |
| | Number of lines of code that can be saved online at a time | ≤ 5,000 | ≤ 5,000 | ≤ 5,000 | ≤ 5,000 |
| Total repository capacity | Repository capacity including LFS (Once this capacity is exceeded, some repository functions such as code upload will be unavailable.) | ≤ 10 GB | ≤ 50 GB | ≤ 100 GB | ≤ 500 GB |
| Repository quantity | Repository quantity | Unlimited | Unlimited | Unlimited | Unlimited |

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| Category | Item | Free Edition | Basic Edition | Professional Edition | Enterprise Edition |
|---|---|---|---|---|---|
| Browser | Type | Currently, the following mainstream browsers are supported:<br>• Chrome (recommended)<br>• Internet Explorer 10 or later<br>• Edge (recommended)<br>• Firefox<br>• Safari | | | |
| Resolution | Resolution | The recommended resolution is 1920 x 1080 or higher. | | | |

When the repository capacity exceeds the limit, or the repository is frozen due to arrears or security reasons, some functions will be unavailable. For details, see **Table 8-2**.

If your repository is frozen due to legal reasons or incomplete real-name authentication, you have only the view permission but do not have the operation permission. For details, see **Table 8-2**.

**Table 8-2** Constraints

| Tab Page | Function | Capacity Limit Reached, Account Frozen Due to Arrears or Security Reasons | Frozen Due to Legal Reasons or Incomplete Real-Name Authentication |
|---|---|---|---|
| Homepage | Create a repository | × | × |
| Home | • Associate a work item<br>• Managing a member<br>• Delete a repository | √ | × |
| Code | • Create, edit, delete, rename, and upload a file<br>• Create and delete a directory<br>• Create and delete a submodule<br>• Cherry-Pick and revert a file | × | × |

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| Tab Page | Function | Capacity Limit Reached, Account Frozen Due to Arrears or Security Reasons | Frozen Due to Legal Reasons or Incomplete Real-Name Authentication |
|---|---|---|---|
| Code | Add, delete, edit, reply, and resolve a review and comment | √ | × |
| Branch & Tag | • Create a branch<br>• Merge branches<br>• Create a tag | × | × |
| Branch & Tag | • Edit and delete a branch<br>• Set a protected branch<br>• Delete a tag | √ | × |
| Merge Requests | • Create, edit, close, re-open, and merge a merge request<br>• Cherry-Pick and revert a merge request<br>• Merge requests to resolve code conflicts. | × | × |
| Merge Requests | Add, delete, edit, reply, and resolve a review | √ | × |
| Members | Add, delete, edit, and approve a member | √ | × |
| Repository | Fork a repository | × | × |

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| Tab Page | Function | Capacity Limit Reached, Account Frozen Due to Arrears or Security Reasons | Frozen Due to Legal Reasons or Incomplete Real-Name Authentication |
| --- | --- | --- | --- |
| Settings | • Set a repository<br>• Set a submodule<br>• Sync a deploy key<br>• Free space<br>• Set policies (All)<br>• Integrate services (All)<br>• Set synchronization<br>• Synchronize a repository | √ | × |
| Settings | • Repository information<br>• Notifications<br>• Free space<br>• Repository backup<br>• MR templates<br>• Review templates<br>• Deploy key<br>• Tenant- and repository-level IP address whitelist<br>• Risky operations<br>• Watermark<br>• Repository locking<br>• Audit logs<br>• Tenant-Level usage management | √ | ×<br>**NOTE**<br>All configuration items except repository backup and tenant-level usage management can only be viewed and cannot be modified. |

NOTE

**CodeArts Repo closed**: You cannot access the repository. The system prompts you to subscribe to the service. After CodeArts Repo is re-subscribed, the repository status is restored. If CodeArts Repo has been closed for more than 30 days, the system automatically deletes all repositories, which cannot be restored.

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# 9 Glossary

- Project Administrator

  Project administrator. Generally, the project creator is the project administrator of the project by default.

  The project administrator has all permissions in the project and the permissions cannot be removed or modified. The DevUC controls which members in a project can manage permissions of other members in other projects. Based on the current function, the project creator (also the project administrator) can grant permissions to other project members to manage permissions. (This feature is provided by DevUC and is not perceived to subservices.)

- Repository Owner (Creator)

  When project members with permissions to create a repository created a repository, they become the repository owner and has the full permission on the repository.

- Repository Administrator

  The repository owner, parent repository group owner, and project administrator are repository administrators.

- Repository Group Administrator

  The repository group owner, project administrator, and parent repository group owner are repository group administrators.

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