Secure Development and System Acquisition

I. Purpose

This policy ensures that development environments are secure and encourages the use of secure coding and development practices. Security needs to be considered at all stages of the development lifecycle from design through to implementation.

Specific coding languages and development tools have different vulnerabilities and require different “hardening” techniques; it is important that these are identified and developers are made aware of their responsibilities to follow them.

II. Scope

These standards apply to all persons involved in the acquisition, development and maintenance of Nested Knowledge's IT environment and are applicable to all Nested Knowledge systems, including applications/systems developed for the Internet.

III. Secure Development Policy

Restrictions on Changes to Software Packages

Modifications to software packages need to be discouraged, limited to necessary changes and all changes should be strictly controlled. Vendor supplied software packages are designed for the mass-market and are generally not designed for organizations making their own changes to them. Usually, the ability to make such changes is locked out by the vendor and customization limited to within the package.

Open-Source Software

Where open-source software is used, it is generally possible for changes to be made by the organization, however, this should be restricted and controlled to ensure that the changes made do not have an adverse impact on the internal integrity or security of the software.

Secure Development Environment

Development environments need to be protected against malicious or accidental development and update of code that may create vulnerabilities or compromise confidentiality. If any form of live data is used in development environments it needs to be especially protected and controlled.

Outsourced Development

Nested Knowledge must supervise and monitor the activity of outsourced system development. Where system and software development is outsourced either wholly or partly to external parties, the security requirements must be specified in a contract or attached agreement.

Supplier Adherence to SDLC

Nested Knowledge employees develop all application code. External platforms (e.g. AWS) may provide architecture, orchestrate deployment of, and execute application code. External libraries (e.g. OSS) are consumed by application code as modules. External platforms and libraries are verified with the following:

- A review of technical documentation
    - Does the platform/library maintain a release history?
    - Does the platform/library publish their development strategies? Does it conform to typical SDLC standards?
    - Does the solution advertise itself as production ready?
- A review of update / release history
    - Does the supplier make regular updates for security patches
        - Automate scanning for existing vulnerabilites using NPM vulnerability scanning, the pypi Safety DB, and GitHub vulnerability monitoring.
    - Does the supplier actively maintain the solution?
    - Does the supplier follow a standardized release versionig system? (e.g. SemVer)
        - Are there reports of major version changes that weren't reported as such?
- Does the solution include a public issue tracker?
    - Are issues (bugs & security vulnerabilities) addressed quickly?
- When available, code & version history review.
    - Do all commits to the repository leave it in deployable condition?
        - Are all commits reviewed & verified by a maintainer / peer?
    - Is code well structured & organized? Does it compile? Does it have/pass a linter?
    - Are new features / patches developed on branches or external to the main deployment branch?
    - Does the solution minimize & verify its dependencies?

Per these criteria, the supplier is assessed for risk in inclusion as a dependency to application code.

Testing Procedures

Our software is tested & verified in two environments, development & production.

In development, code is tested via the following methods:

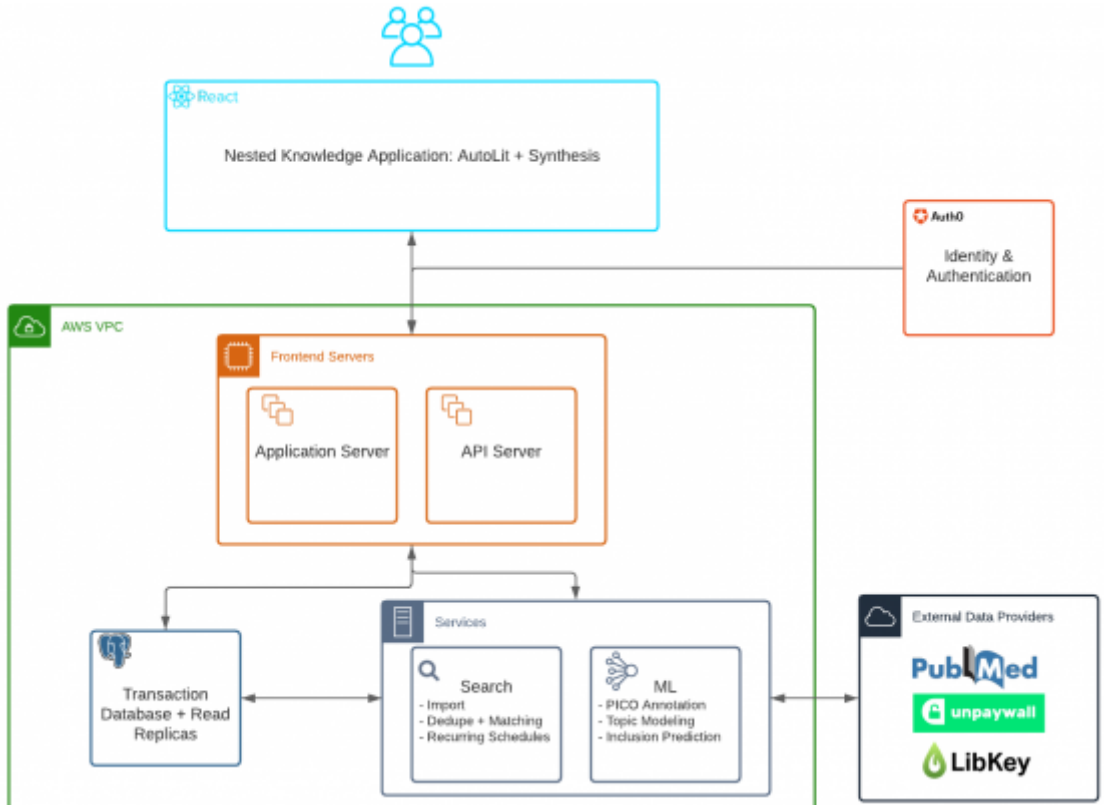
- Automated unit tests, integration tests, functional tests, and linters
    - Unit tests cover shared modules and core functions (e.g. authorization logic)
    - Functional tests cover our most critical features with complex input/output behaviors (e.g. literature search import)
    - Client and frontend servers are covered by linters to identify common errors and improve

code quality
    - All code changes must pass tests and linters prior to acceptance.
- Peer review & testing
    - The reviewing developer reads code, identifying corner cases, assessing security compliance, and verifying correctness
    - A reviewing developer and product manager must verify functionality before any code change is accepted.

In production, new changes in the release are verified by a developer and product manager upon release. If a feature does not function as intended, the release is immediately rolled back and only proceeds once a patch is reviewed and accepted.

System Design and Architecture

The Nested Knowledge client application is served by an application server and hydrated by an API server; both of these servers run behind a load balancer. The API server communicates with the Search and ML backend services as well as the database. Certain functions of backend services communicate with external (public) APIs. The frontend servers, services, and database all run in a Vitrual Private Cloud (VPC) for network isolation. The frontend load balancers are exposed to receieve requests from the public internet. The client and server applications communicate with an external service, Auth0, for authentication; all communications with Auth0 are encrypted.



Security Requirements

All application data are stored and processed inside the VPC. Data leaving the VPC are either

encrypted to the authenticated & authorized client, or, in the case of external providers contain minimal & nonsensitive information (e.g. DOIs for unpaywall, search strings for PubMed). Within the VPC, communications between the database and all services are encrypted.

Nested Knowledge does not manage user passwords or other authorization (handled by Auth0).

Software Applications on NK-Owned Devices

Our application profile in the Business Continuity Plan describes the criticality of software applications used by Nested Knowledge employees on employee-owned devices.

At this time, Nested Knowledge does not issue personal computers or mobile devices to employees or contractors.

Vulnerability and Patch Management

Nested Knowledge uses automated scanning to identify potential vulnerabilities in our operating environment and software dependencies. The risk of a vulnerability is assessed using the CVSS framework.

Our cloud services provider (AWS) provides automated vulnerability reports on operating systems & databases running the application. Alerts derived from these reports are addressed by release engineers:

- The applicability & risk of the vulnerability is verified. If a vulnerability is deemed nonapplicable or low severity, it is added to our issue tracker. If applicable or medium or high severity, the vulnerability is assigned to an engineer immediately.
- The viability of the recommended patch is assessed.
    - Bug fix / minor version patches may be applied with minimal testing.
    - Larger patches requiring updates to our application must pass through our code review process. Any high risk vulnerability is given highest priority in our queue, including dropping actively developed features to procure compatibility for the patch.
- The patch is applied during the next scheduled release window. If a vulnerability is deemed high severity, it triggers an immediate release upon review completion.

Our dependency management tools (NPM & pip) provide automated vulnerability scanning. Every build in our development environment produces a vulnerability report among dependencies. Alerts derived from these reports are addressed by developers.

- The applicability & risk of the vulnerability is verified. If a vulnerability is deemed nonapplicable or low severity, it is added to our issue tracker. If applicable or medium or high severity, the vulnerability is assigned to an engineer immediately.
- The viability of the recommended patch is assessed. Developers will modify the application code as needed to accommodate the patch (e.g. updating to a new API or changing a configuration). All changes are tested and passed through code review.
    - If the vulnerability lacks a patch, the team may:

    - Contribute an upstream patch, for open source dependencies.
    - Mitigate code paths triggering the vulnerability and begin researching alternative dependencies.
- The dependency and/or code change is deployed during the next scheduled release window. If a vulnerability is deemed high severity, it triggers an immediate release upon review completion.

Revision History

This policy will be reviewed on an annual basis. The next review will be completed by November 30, 2022.

Author	Date of Revision/Review	Comments/Description
K. Cowie	12/17/2021	Minor Revisions to Secure Development Policy
K. Holub	12/17/2021	Drafted Supplier SDLC Section
K. Kallmes	11/19/2021	Draft approved