Release Notes

Shabodi NetAware
Release 2.1

# Abstract

This document provides highlights of the changes that have been made available in the indicated release version of Shabodi's NetAware programmable network platform. Except where indicated all features and capabilities are available for consumption/use in Shabodi's Developer Sandbox and Shabodi's on-premise NetAware product.

For more information about Shabodi's NetAware, APIs, Use Cases and Sandbox visit https://www.shabodi.com/.

# Version Control

| Version | Release | Description | Modified on | Modified by |
|---------|---------|-------------|-------------|-------------|
| **V2.0** | 2.0 | Notes for changes and features available in this release of the AEP. | June 2024 | S Gole, K Howe-Patterson |
| **V2.1** | 2.1 | Changes related to minor release 2.1 | September 2024 | K Howe-Patterson |

# 1 INTRODUCTION TO SHABODI

Shabodi's **VISION** is to enable an ecosystem of network-aware solutions using advanced network services in multi-access, multi-network and multi-operator environments.
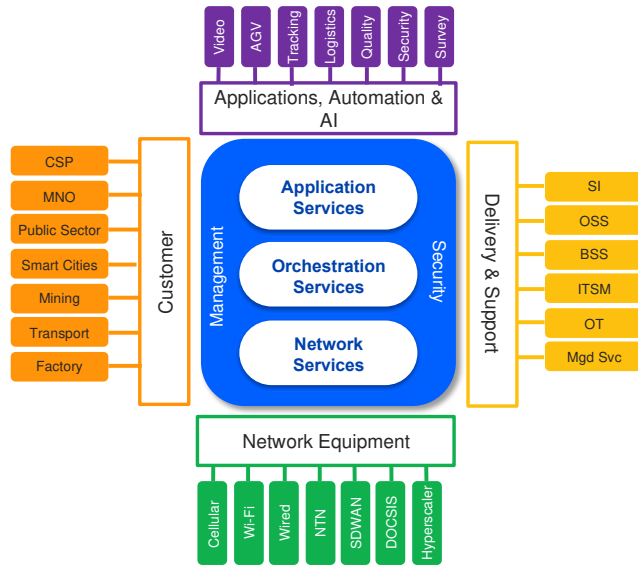


## Shabodi's Value Propositions

▶ **Developers:** *Create* differentiated experiences with simplified access to extended ecosystem

▶ **Enterprise OT & IT:** *Improve* service environment efficiency, spend, sustainability & future-readiness; transform to Industry 4.0

▶ **Support & SI:** *Enhance* delivery ability and suitability with future looking AI-based solutions

▶ **CSP Customers:** *Monetize* network evolution spend; enhance service offering relevance and revenue opportunities with targeted verticals

**The RESULT: accelerated service environment transformation and ROI, with improved sustainability from AI-enabled optimized infrastructure and automation**

*Figure 1 Shabodi's mission: unleash the power of advanced networks*

Shabodi is a technology company creating products that solve some of the world's most challenging problems in the advanced networking domain. However, Shabodi's solutions often span business process, network design and implementation, system integration, technology advisory services and technical consulting. Shabodi relies upon a broad ecosystem of network equipment providers, support and integration partners, and application developers to deliver leading edge solutions to our ecosystem of customers. Shabodi is the nexus that brings these ecosystems of diverse contributors together to deliver advanced network solutions.

**Shabodi's MISSION is to unleash the power of advanced networks.**

Advanced networks exist everywhere. The emergence of commercial offerings of 5G cellular networks by mobile network operators are likely the most visible. However, Wi-Fi, NTN (i.e. satellite), DOCSIS, Fibre, and SD-WAN are all forms of advanced networks. They deploy in many configurations across numerous networking domains – MNO, MVNO, CSP, MSP, and Enterprise amongst the many forms, in either public, private or hybrid models. A wide array of network equipment providers play in this space as well, each with their own commercial and technical drivers. The end result is a wide-open complex network service industry with multiple players all vying to expand their business. Shabodi's solutions smooth out the bumps, making it easier for end-users and application developers to thrive in this advanced networking landscape.

# 2 SHABODI'S NETAWARE: SIMPLIFYING NETWORK-AWARE APPLICATIONS

Shabodi's primary product is the NetAware programmable network platform. It is an API-first product. Shabodi's Simplified APIs abstract and expose the underlying network, providing the application developer with a very quick and easy method of developing applications using the power of programmable networks.

**Without Shabodi?**

Making Network-aware applications is hard. Developers need:

- network knowledge
- to write to every network element API or interface
- to change the application for every different network element
- to change the application if the network elements change

Developers do the heavy lifting of understanding and managing network environments.

**Network Aware Applications without Shabodi**

Sensors & Devices

Network-aware apps    Real Time-apps

NEP/NAPI

NETWORK NODES
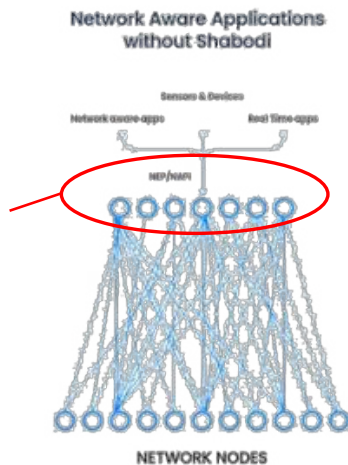
**Network Aware Applications with Shabodi**

Sensors & Devices

Network-aware apps    Real Time-apps

NETWORK NODES

*Write-Once-Deploy-Many*

**With Shabodi?**

**Shabodi does the heavy lifting for developers** by providing a stable, simplified API set that remains consistent even as the underlying infrastructure changes.

**Developers need:**

- *to understand Shabodi's API set and embed in application logic*
- *to focus on solving business problems and creating unique user experiences*

Meaning they **write** the application **once** and **deploy** it in **many** network environments – with ease.
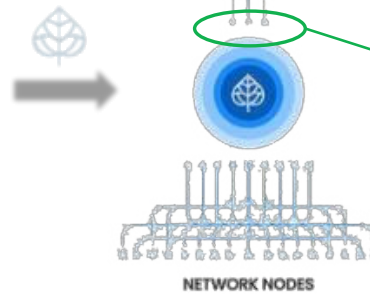
*Figure 2 Simplifying Network-Awareness*

On the northbound side NetAware provides Simplified APIs. These are RESTful APIs with standardized formats designed with developers in mind. While they are simplified, that is, having a very simple and familiar format for developers to integrate into their application logic, they are very powerful in terms of their outcomes. A single API call into NetAware can replace up to 20 distinct calls to network elements and can hide from the application aspects such as network vendor, network congestion and transaction processes, network element authorization and authentication, and so on. Shabodi's NetAware gives time back to developers so they can focus on solving business and/or operations problems delivering superior user experiences. All this without having to spend months (or years) becoming networking experts.

On the south side Shabodi discovers the network elements involved, creating transformations from application-level APIs to the language, security and data model of the network elements. The benefit here is that the network never has to know what application is controlling it, and therefore requires no special adaptations or behaviors to accommodate. The network element simply needs to do what it does best: connect systems, devices and people.

# 3 SHABODI'S NETAWARE LIFECYCLE

## 3.1 MAJOR RELEASES

Shabodi provides updates in the form of major releases 2 times per year – generally in April and October of any given year. The major release is marked with a "x.0" designation. For instance, the major release following release 1.x is 2.0. Shabodi announces the arrival of new releases to all customers at least 3 months in advance, with these announcements detailing the intended content. The current and next 2 major releases are also shown on Shabodi's roadmap, available to all customers and partners.

## 3.2 MINOR RELEASES

Minor updates to the product can be provided to customers and partners between the major release milestones. These minor releases have numerical designations "x.y", such as the first minor release following release 2.0 is 2.1.

Minor releases are delivered when content is ready and required to address critical issues or provide new capabilities such as API upgrades or introductions. The update can be in the form on new configuration files (or knowledge base files), can be patches or can be full software updates. The main theme is the delivery of software that resolves functional impairments and/or functional improvements within the existing product.

## 3.3 NEW KNOWLEDGE BASES AND NETWORK INTEGRATIONS

As new networking devices and/or software versions become available, they can be built into a minor release. This allows customers and partners to rapidly integrate new networking capabilities or onboard new networking vendors/elements within their operational framework without the need to wait for major releases. Where demand requires Shabodi makes every effort to remain current with network elements that benefit customer and partner operations.

## 3.4 NEW APIS

Shabodi's development never stops: we are always finding new ways to innovate and bring new value to customers, partners and our application developer communities. As such new APIs are being developed, tested and delivered on a continuous basis.

Shabodi also contributes to the evolution of APIs or relevant technology in various standards forums, including CAMARA, TMForum and O-RAN. As these API specifications evolve and become commercially relevant, or ready for integration into applications and/or customer/partner operations, Shabodi will deliver beta and production versions.

## 3.5 SHABODI'S DEVELOPER SANDBOX

Whether a major or minor release, Shabodi always delivers new versions of NetAware into the developer sandbox first. This provides partners with a first view of the APIs before they are pushed into production environments, allowing application developers to test against any API changes, or to explore how to integrate new APIs. Once the APIs and/or knowledge bases have been soaked the release is upgraded to production ready and made available to customers and partners for updating their environments.

## 3.6 RELEASE CURRENCY

Shabodi uses an n-2 approach for load currency for on-premise products. This means that customers and partners that have deployed NetAware can skip one major upgrade, but must take the next to stay compliant with support terms. A benefit of this approach is allowing customers to maintain a predictable schedule for product upgrades: with a twice-yearly release schedule upgrade programs can plan on either an April release or an October release. With this certainty in hand other scheduling related to NetAware and networking can be carried out.

Customers and partners are welcome to take loads more frequently, especially minor releases.

# 4 CHANGES FOR CURRENT RELEASE

*As of this release (2.1), Shabodi's AEP (Application Enablement Platform) has been rebranded as NetAware – with focus on making applications network-aware on programmable networks, giving applications control over any programmable network's resources. NetAware is a programmable network platform, the first of its kind in the networking industry.*

*This section reflects the changes from AEP to NetAware.*

The following changes have been made for release 2.1 of NetAware:

As Shabodi's NetAware continues to rollout, engage customers and mature we have the opportunity to gain important feedback concerning the operation, supportability, performance and (especially) API support. Release 2.1 provides a number of updates to the NetAware addressing improvements for API and application integration along with overall performance. API responsiveness has been improved through some changes to internal request processing and based upon performance testing. Applications can now expect much faster and more consistent responses from all API requests. As well, in response to developer feedback from our sandbox and deployment interactions, response codes associated with API requests have been expanded, providing greater granularity for error conditions and allowing for faster resolution of integration issues.

Shabodi's Developer Sandbox has been updated with additional virtual devices to support greater developer capacity. These devices allow us to introduce a two-stage process for accelerated application development and enhanced API integration: Stage 1 uses virtual devices to promote API exploration and integration, testing out the API call structure, timing and responses, and allowing to faster integration testing; Stage 2 uses both virtual and physical devices to see realtime results of changes to network elements – 5G, Wi-Fi and Ethernet.

Between release 2.0 and release 2.1 Shabodi has ramped up performance testing, allowing us to find and resolve performance issues. We have detected and resolved a memory leak affecting long-run traffic, along with certain conditions where logging can fill up disk space causing erratic behavior. Logging has been improved to streamline movement from primary to secondary processing and storage, allowing for less space to be consumed by logs, and for more robust logging to occur. Logs have also been expanded to capture more internal events, including being adapted to Shabodi's improved transaction processing structure allowing for more diverse and faster request transformation through the platform's realtime request stack.

The most significant change for the NetAware is the upgrade of the administrative portal. In this release Shabodi is providing a complete overhaul of the Graphical User Interface (GUI) making it more intuitive and providing different views to help focus administrative and troubleshooting activities. Upon login to the portal administrative users are immediately brought to the Solution View, providing a comprehensive display of the network-aware solution environment including the NetAware and all attached networks, applications and devices. Within this view users can see in real time the status of all nodes and can drill down further to see alerts and alarms, review logs, configure/add/delete nodes and navigate to other views. An additional view open to admin users if the Deployment View where users can get a visual representation of the status of Shabodi's NetAware and can take actions to address any flagged issues. From this view users can see key indicators such as disk utilization, CPU utilization, storage and so on. The navigation menu has been realigned with FCAPS functions allowing for faster, more intuitive movement into and between core admin functions.

## 4.1 SUPPORTED NETWORK ELEMENTS

As of release 2.1 Shabodi's NetAware supports the following additional network elements:

- Core Networks
  - Open5Gs – 2.7.1
  - Druid – 5.2.6.1
- Radio Access Networks
  - Lekha - v200.0.0

- o    Airspan – Release 20.50
- Wi-Fi Networks

  - o    Ubiquity -  UCK G2 Plus UniFi OS 4.0.18
  - o    Cisco - WLC 9800
- SD-WAN Networks

  - o    Arrcus

## 4.2    LOOKING AHEAD

 While release 3.0 was expected to be the next iteration of the NetAware in October 2024, we anticipate this will now be pushed into 2025. A minor release (2.2) is now forecast for November 2024.

The following content is anticipated in the coming releases:

- New CAMARA APIs: SIM Swap, Device Status, Device Group, Location enhancements, network slice booking
- New Shabodi Simplified APIs: Device security, service security, video service, connection (enhancements – slicing, dedicated path, …)
- Portal views:

  - o    Network view – showing end-to-end network path for application transactions across the user/data plane,
  - o    Designer view – provides API authoring creating new service APIs from existing published APIs, integrating with CAPIF compliant catalogue, metering, security, service aggregation and service monitoring; provides a visual capability to build, configure and publish new API groups, packages and individual services,
  - o    Multi-level portals – provides ability to link multiple NetAware deployments into a single administrative portal.
- Portal features:

  - o    RBAC – enhancements to existing user security, allowing for multiple roles and self-defined roles for NetAware administration and service management,
  - o    LDAP/AD integration – ability for enterprises to use their existing credential management services for faster integration of NetAware into operations.
- Updated network integrations: we continue to add new network elements as pre-integrated service components whose network/service APIs are abstracted by the NetAware. We will continue to provide updates for new network element releases.
- Sandbox expansion: as we continue to build out the sandbox capabilities we will be adding the ability for developers, partners and customers to introduce their own core and RAN networks along with their own devices. Sandbox members can already use their own application environments, and even provide Shabodi with their own files to emulate streams.

# 5   CHANGES FOR PREVIOUS RELEASES

*Since release 2.0 and previous releases were branded AEP, the following section(s) retain the AEP moniker.*

The following changes have been made for release 2.0 of the AEP:

1.  Simplified APIs: the following APIs have been enhanced in this release (for descriptions of APIs see Shabodi's API Guide for release 2.0):

    1.1.  Bandwidth – simplified the bandwidth selection and parameters involved in the API request; mapping to CAMARA specifications
    1.2.  Latency – simplified the selection of latency parameters in network elements; mapping to CAMARA specifications
    1.3.  Jitter – simplified the parameters required to select jitter settings; mapping to CAMARA specifications
    1.4.  Location – introduction of location API – aligned with CAMARA with simplified parameter set
    1.5.  Insights – enhanced reporting of network KPIs and activities; provide ability to register against ongoing insights updates
    1.6.  Device Status – introduced new capability to view updates concerning a specified device; simplified API interface allows application to make calls for single devices; aligned with CAMARA specifications

2.  CAMARA APIs

    2.1.  Introduction of CAMARA for Enterprise normalized APIs for QoS, Location, Device Status and Insights. Provides the ability for a CAMARA compliant application to port easily onto Shabodi's API stack, allowing for an application to be written once and deployed anywhere.
    2.2.  Shabodi's CAMARA implementation aligns with CAMARA specifications – documentation for these APIs can be found at https://github.com/camaraproject

3.  Developer Sandbox

    3.1.  Shabodi released its Developer Sandbox in April of 2024, with beta version of AEP 2.0.
    3.2.  The sandbox has been upgraded as of early June with the final production ready version of AEP 2.0 including the above APIs and network integrations for 5G SA and Wi-Fi elements and devices. Developers are onboarded through invitation, and once onboard can schedule time on the sandbox to explore network-aware application development, integrate with network devices and test Shabodi's APIs.
    3.3.  Documentation for Shabodi's APIs and AEP have been made available in the accompanying Learning Management System (LMS) for the Sandbox.
    3.4.  Details on Shabodi's Developer Sandbox can be found here: https://www.shabodi.com/application-developers/

4.  Multi-layer API routing

    4.1.  Enhancing Shabodi's realtime processing of network requests and providing multiple layers between Simplified and Disovered APIs. Allows for greater deployment and network transaction normalization flexibility. Also improves realtime transaction processing throughput.

5.  Near real-time application awareness insights

    5.1.  Earlier iterations of Shabodi's AEP delivered Insights through its Northbound API. In this release the Insights is converted to an standard Shabodi knowledge base, meaning that it can be more easily extended in the future and can run very rapidly as part of the realtime processing portion of Shabodi's platform.

6.  Licensing

    6.1.  Offline license-based installation, before now a full registration with Shabodi, including supplied license number, was required to begin the installation process. The license was provided as part of the installation load package. This has been altered in this release to decouple the installation of software from the license application. This supports instances where multiple instances of AEP are being deployed and commissioned into the enterprise or carrier frameworks without needing a license to carry out basic work. However, there is a point in time, such as when network integrations or application integrations begins where it is no longer possible to operate without a licenses. Alerts and warnings are provided for the administrator to understand the position the system is in and what to do about it.
    6.2.  License based accounting - this new capability has introduced a sophisticated means of tracking deployed API packages on any given AEP, the number of API invocations and how that relates to the contracted levels, and also to meter the number of API calls made. This latter part allows for dynamic usage-based charging for API invocations.

7. Health monitoring

    7.1. Near real-time alerting - a new fault management module added to the system allows for the deciphering of events and detection of alerting or alarming scenarios, and provides the alerts/alarms through northbound APIs. Alerts and alarms are available on Shabodi's published MIB, allowing for BSS/OSS systems to register for updates, and upon taking notice of AEP activity, to take appropriate action. Shabodi can even detect security incidents and flag them for follow-up activity. These incident alerts can be fed into a carriers SIEM to allow for complete and through analysis and resolution of security incidents.

    7.2. Faults tracing- within the fault module this new capability allows for a broader set of faults to be detected and logged. These includes software traps, pods going down, disc utilization threshold alerts, and so on. Faults are sent via MIB API to tan appropriate fault management system within the OSS.

    7.3. Log and Event tracking - extensive logging for all events has been employed. This covers user login, to user changes, to transaction processing, to transaction failures, and many more. Debug logging is also in place for all components. At present debug logging is the default and is far too verbose - corrections are being taken to resolve this issue, and should be available in the next release. All logs are accessible via the Administrative Portal.

8. Configuration

    8.1. Multi-node deployment
    8.2. Plug-in network
    8.3. Update / Delete network
    8.4. Plug-in devices
    8.5. Update / Delete devices

9. Administration

    9.1. Application on-boarding / off-boarding
    9.2. Application to devices mapping
    9.3. Application to API permission assignment
    9.4. PTP level network synchronization

10. Security

    10.1. Token based authorization for the application
    10.2. Network authentication (Open, Basic, PAP)

11. Administrative Portal (Beta)

    11.1. A new addition to the Shabodi platform involves a graphical user interfaced dubbed the Administrative Portal

    11.2. This portal is available to all system users. However, there are restrictions in terms of who can access the views and capabilities. Roles are setup and system configuration time, in conjunction with customer preferences and policies, and set in Role Based Access Control (RBAC).

        11.2.1. From a customer perspective there can only be one master admin at a time
        11.2.2. Shabodi retains super-admin rights to aid customers in supporting the AEP
        11.2.3. Master Admin role is set up by Shabodi at commissioning time
        11.2.4. After that Master Admin may create as many admins for the system as required - however, admins should be tailored for the roles they will play and the views and tasks they will be responsible for.

    11.3. For a thorough description of the admin portal please review the Portal Users' Guide.

# 6 NETAWARE SYSTEM REQUIREMENTS

Shabodi's NetAware can be deployed in disparate environments using multiple deployment strategies. During customer engagements, we work closely with the IT / OT Teams to identify current and future state of network and package default components to be deployed appropriately. Reference System requirements (Server & Software) for different supported are as mentioned below. We have provided Dell Poweredge Servers for reference as they are used more frequently. Shabodi NetAware is not tied to any hardware vendor though can be deployed on any hardware platform.

| Parameter | Sub-Parameter | Lab - Configruration | Small - Configuration | Medium - Configuration | Large - Configuration |
|---|---|---|---|---|---|
| **Purpose** | *Typical deployment* | Lab | Single-site enterprise | Multi-site enterprise | Large enterprise / Service provider |
| | *Zoning* | NA | Single edge | Single edge + MEC | Multi Edge + MEC |
| | *Typical purpose* | Demonstration, POC, App Integration | Commerical use | | |
| **Server Requirement** | *Server per Edge* | 1* Dell Poweredge R760 (1 NIC Card, 8 Core, 16 GB RAM, 100 GB Storage) | 1 * Dell Poweredge R960 (2 NIC Card, 32 Core, 16 GB RAM, 1 TB Storage) | 2 * Dell Poweredge R960 (2 NIC Card, 32 Core, 16 GB RAM, 1 TB Storage) | 3 * Dell Poweredge R960 (2 NIC Card, 32 Core, 16 GB RAM, 1 TB Storage) |
| | *Servers per MEC* | 0 | 0 | 1* Dell Poweredge R760 (1 NIC Card, 8 Core, 16 GB RAM, 1 TB Storage) | 2* Dell Poweredge R760 (2 NIC Card, 8 Core, 16 GB RAM, 1 TB Storage) |
| **Software requirements** | *OS* | Ubuntu 22.04 / RHEL | Ubuntu 22.04 / RHEL | Ubuntu 22.04 / RHEL | Ubuntu 22.04 / RHEL |
| | *RTOS* | No | Optional | Yes | Yes |
| | *Containerized deployment* | Yes | Yes | Yes | Yes |
| | *Containerization platform* | Kubernetes | Kubernetes / OpenShift | Kubernetes / OpenShift | Kubernetes / OpenShift |
| **Transaction volume** | *Transactions / second* | 1000 | 16000 | 32000 | 32000 |
| **HA** | *Uptime / availability* | No | two nines (99%) | three nines (99.9%) | four nines (99.99%) |
| | *DR / Geo redundancy* | No | No | No | Yes |
| | *HA configuration* | No | Softwre redundancy (Active-Active) | Hardware redundancy (Active-Active) | Hardware redundancy (Active-Active- Passive) |
| | *Guaranteed zero data loss?* | No | No | yes | yes |

Further, we understand and acknowledge each customer has a unique environment, underlying platform and performance requirements. Shabodi IT team is happy to jointly work for creating custom deployment strategy meeting desired requirements. From our experience, typically customers start journey with Shabodi NetAware by deploying in lab configuration. Please refer to installation guide to understand system requirements and deployment instructions to get started.