FIND
Diagnosis for all

Specimens Electronic Referral Tracking System (SERTS) – High Level Features

Version: 1.00

Updated: 17/02/2025

Contents

1. Introduction

The goal of this document is to provide high level requirements to guide the conceptualization and development of an integrated digital specimen referral and tracking system in Kenya. The document will highlight key features of the system (in scope), model solution architecture, as well as out-scope details. This is the first step in terms of documenting system specifications.

The document should be referenced together with existing guidelines and operating procedures for specimen referral process in Kenya. The implementation, technical, and user requirements will not be detailed in this document.

2. Vision

A digital solution for managing data as specimens are referred from one facility (collection or referring facility) to a testing facility and where required paper results are transported back to the referring facility. The envisioned solution should support tracking of individual specimens throughout this referral process, especially “chain of custody” events during hand-offs from one person (entity) to another. The digital solution will also provide analytical output such as reports and summary visual outputs such as dashboards with key specimen referral system (SRS) program indicators tailored to different cadres/functions within MOH and partners.

The solution is intended to be rolled out nationally covering different counties and implemented by different partners. The implementation of specimen referral may operationally differ across counties.

3. Problem statement

Adoption of electronic tools for specimen referral is relatively low in Kenya. According to the Integrated Specimen Referral System (ISRS) mapping report conducted in 2024, only 9.2% of facilities use electronic tools. The report further noted that expanding access to electronic systems and standardizing ISRS tools across counties would improve the accuracy and consistency of referral processes, ultimately enhancing healthcare delivery. The widespread use of manual logs raises concerns about the consistency, timeliness, and accuracy of data for monitoring SRS performance to inform forecasting and planning such as turn-around-time, number of specimens referred, distance coverage etc. To address this problem,

there is need to digitize data capture throughout the specimen referral process by having a standardized digital system that can be utilized by any facility/organization involved in specimen referrals with a view to improve efficiency, accuracy, and near real-time data management.

4. Goals

The goals of SERTS, which relates to the program needs and use cases, are as follows:

a) To improve specimen referral process in Kenya by supporting efficient and near-real time monitoring of the key objectives of the specimen referral process. These objectives are timeliness, specimen quality, biosafety, accessibility, and cost efficiency.
b) To enhance visibility of the chain-of-custody (location, processing status, custodian) of the specimens that have been referred and the paper results that have been returned.
c) To improve the quality and consistency of the data collected and reported across the specimen referral process as per the current guidelines and ensure data confidentiality and security.
d) To easily analyze data and summarize key information on SRS performance through dashboards and reports to different stakeholders and decision makers for reporting and programme improvements.

5. Scope

The envisioned scope of the SERTS covers:

a) The processes starting after a specimen is collected from a client at a collection facility for testing at a different location and ends after the specimen is received at the testing location.
b) The process starting after paper results for a referred specimen are released at the testing location and ends when physical results are received at the collection facility.

5.1. Technical Considerations

In designing the digital solution, the following technical considerations should be made:

a) To streamline the data collection process considering the context of each actor in the specimen referral process. Key factors to consider include:
    i. Is the actor based in an office setting?
    ii. What is the reliability and availability of electricity and internet?
    iii. What digital devices/hardware exist or best fit the work environment?
b) To align and build on the existing digital eco-system in Kenya to ensure ease of systems and data integration to other health information systems such as KHIS, remote login, and EMRs at health facilities.
c) To support integration with other digital systems such as the rider's management and allocation system that are owned by third parties or counties.
d) To safeguard data privacy and security through user authentication, role authorization, and data protection.

In addition to the goals and considerations above, the following guiding principles apply as well:

a) Support the process actors to make use of the data to analyze outputs and performance of the specimen referral system.
b) Support the end users' configurations in line with permissions and privileges for the actor in response to changes or occurrences in the operating context: e-g if the pre-arranged transport provider is not available, the privileged user should be able to capture the details of the alternative used.

Additional principles and considerations will be made during the development lifecycle

5.2. Process actors:

SERTS will be designed to support the following process actors in line with the current specimen referral guidelines:

TABLE 1: PROCESS ACTORS

ID	Role | User	Goal | Need	Notes
PA-1	Collection Facility	To prepare and package specimen(s) for referral and release them to the transporter. To see summary of specimens collected, transported within	PA-1 will capture the specimen details, allocate individual specimens to a shipment, package specimens, and once ready, release the package to the transporter. The package will include the specimens and the relevant documentation including specimen

ID	Role | User	Goal | Need	Notes
		agreed TAT and specimens rejected etc To request the transporter to pick up the specimens for transport. To notify the testing facility of incoming specimen and the test required/requested. To monitor the status of the referred specimen and when the results are ready in a timely manner. To receive the paper results.	collection time, specimen type, requested test, etc. There are critical date and time indicators to be closely monitored for this role. Key status of a referred specimen include: "ready for pickup, on-transit to testing lab, received at the testing lab, processing, results ready"
PA-2	Transporter	To be notified when the packages are ready for pick-up and delivery. To deliver the package from the collection facility to the defined destination and confirm delivery. To report any incidents that compromises integrity of the package or is a possible biosafety/biosecurity risk.	PA-2 will confirm reception of the package and indicate the destination and confirm the details of intended recipient. There are critical date and time indicators to be closely monitored for this role. PA-2 will deliver the package to the destination and handover the package to the consignee. PA-2 will document any incidents such spillage, breakage lost that could happen during the journey. PA-2 will collect paper results from the testing facility and deliver them to the collection facility.
PA-3	Testing Facility	To be notified of expected specimens to plan reception and processing (manage workload). To receive the specimens from the transporter and confirm receipt.	PA-3 will confirm reception of the package from PA-2 and document the integrity status. PA-3 will check the package and its contents, document any nonconformities, and inform the collection facility.

ID	Role | User	Goal | Need	Notes
		To quality check the specimens from the transporter and provide feedback on nonconformities. To dispatch the results back to the collection sites in both paper and electronic format. To see summary of specimens collected, transported within agreed TAT and specimens rejected etc	PA-3 will document the outcome of the specimen testing and dispatch the results back to the PA-1. There are critical date and time indicators to be closely monitored for this role.
PA-4	Program Manager[1]	To generate various reports based on the defined indicators. To use the information from SERTS to report to other reporting systems (manual or electronic) To know the incidences and bottlenecks in the specimen referral program on a timely manner. To configure the key parameters for specimen referral such as facilities, routes, riders, distances	PA-4 will generate management and monitoring reports consistent with their respective level e.g. at facility, county, partner, or national level. At national level PA-4 will track and compare performances across different levels and service providers and monitor adherence to service contract KPIs. PA-4 will regularly monitor the status of specimen referral through dashboards and exception reporting. Add facilities and their geo-codes, routes, transport routes, associated costs and ETA etc
PA-5	System Admin[2]	To administer and maintain the system in healthy status	PA-5 will undertake sys admin tasks such user management, performance monitoring, and support program managers in system configurations.

[1] Program manager may be multiple persons at different level e.g. at facility, county, partner, national. The scope of each may vary based on the roles and privileges at each level

[2] Sys admin may include multiple persons cascaded at each level. For instance, facility level sys admin to administer settings for the specific hospital.

5.3. Configuration and metadata

SERTS will allow configuration of key settings and metadata by the System Admin (PA-5) to make the system adaptable to different scenarios. Some configurations will include:

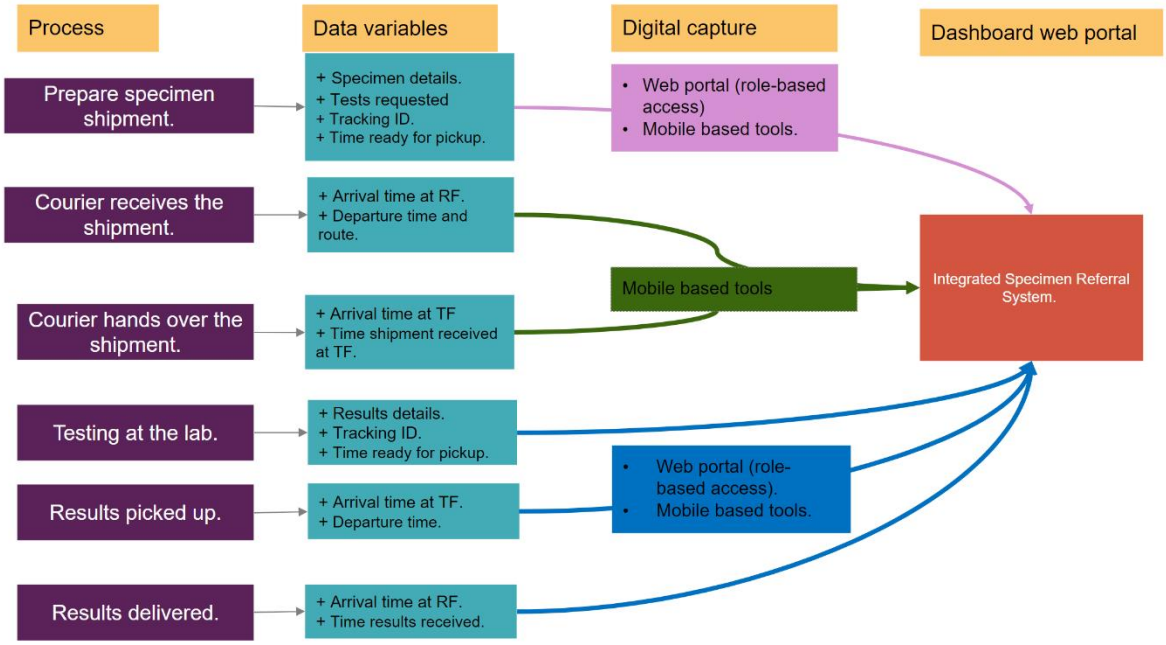
1. Facility config:
    a. Facility details (based on KHIS or KHMFL) including their geo-codes if available.
    b. Facility testing capacity: the maximum number of tests per day.
    c. Assigned transporters. It is envisioned that each facility will be assigned one transporter (personnel resource)
    d. Additional facility details as may be required.
2. Referral routes and the distance. Mapping for referral routes and the distance.
3. Transportation mode and the cost per unit distance/per package.
4. Other metadata configurations will be discussed during the design phase.

5.4. Data collection

SERTS will have capability to "get" data primarily through direct data entry by the different actors. Intuitive data capture forms should be developed to minimize data entry errors by having data quality checks. Where a native mobile based application is required for data collection, we recommend using publicly available applications such as Kobo Collect which will capture the data and transmit to the SERTS database.

Table 1: process data variables figure below shows some of the data variables to be captured along the referral process. Incidence data such as lost packages or damage of shipment will be collected and tagged to the shipment.

1: process data variables



The table below shows a mapping of recommended modes/devices to access the SERTS by different actors and in different settings.

Role | User	**Power**	**Internet**	**Other infrastructure**	**Mode of access**
Specimen Referrer and receiver	Reliable	Reliable	Good working computers and work top.	Login to web-portal on computer browser
	Unreliable	Reliable	No computers and working space	Loging to web-portal using a tablet.
	Unreliable	Unreliable	No computers and working space	
Transporter	NA	Reliable	Can move along with tablet	Use web-portal via tablet
	NA	Unreliable	Can move along with tablet	Use app for data input (mobile or tablet)
	NA	NA	Cannot move along with tablet	Mobile app
Program Manager and System Admin	NA	NA	NA	Web portal on computer browser recommended.

5.5. Tracking and notifications

SERTS shall support tracking of the specimen by notifying defined audiences when some pre-set thresholds are met, or events occur e.g. when facility requests for specimen pick up, when the transporter departs the collection facility, and when the transporter arrives at the testing laboratory.

The notifications will be through delivered as dashboards as shown in Figure 2: Dashboards notifications. Other approaches such as emails, SMSs, mobile-app notifications should be provisioned considering the requirements such as SMS and email gateways, growing restrictions on background activities on mobile app, and the data privacy and protection requirements. Figure 3 shows the different specimen statuses as a specimen moves throught the referral process.

Figure 2: Dashboards notifications

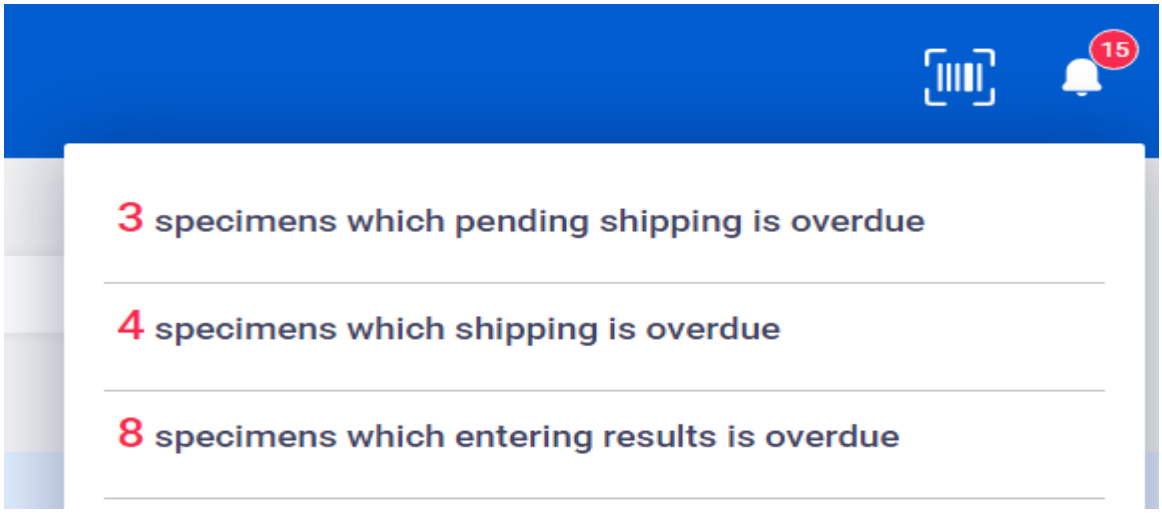
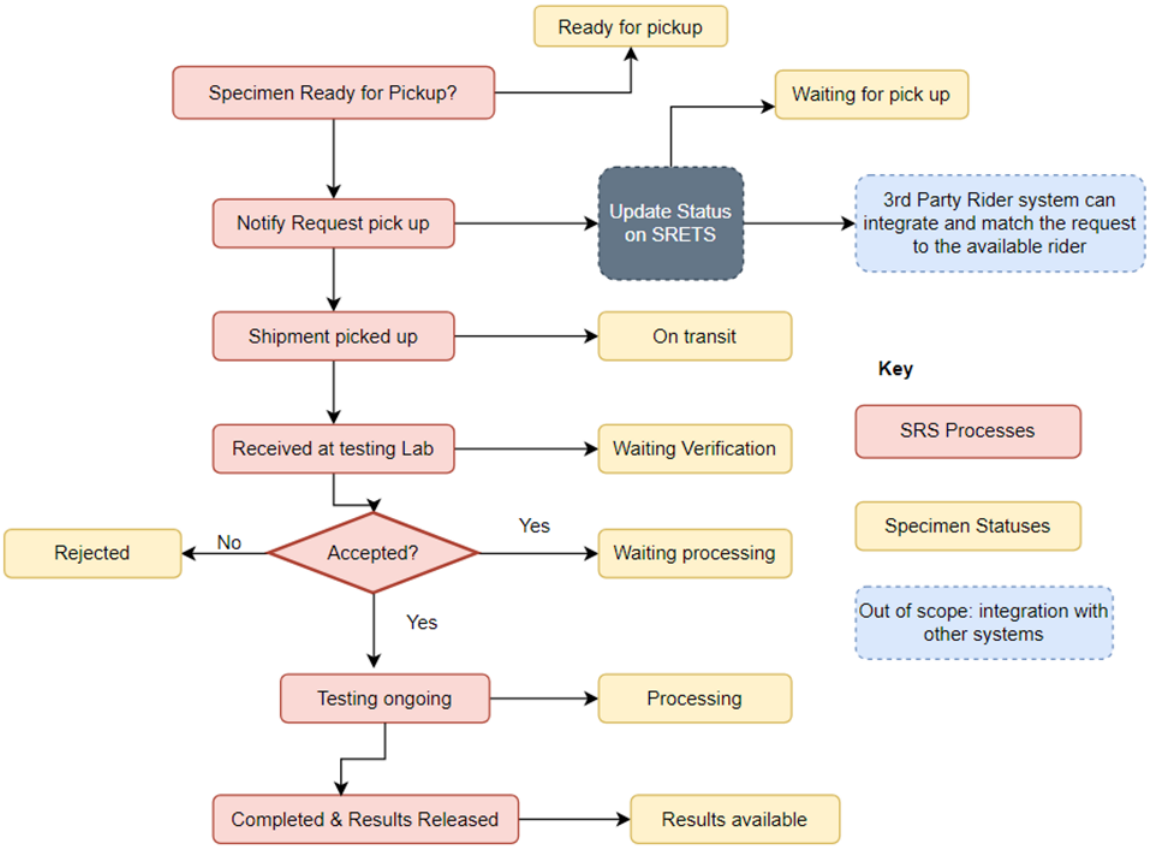


Figure 3: SRS process and monitoring statuses



5.6. Data use and reporting

SERTS will support data use by availing data visualizations and reports with key program indicators. These indicators include:

i. Number of specimens and results picked up and transported across the network – disaggregated down to collection facility and by sample type/test.

ii. Number of specimens and results delivered across the network – disaggregated by hub/laboratory and by sample type/test.

iii. Number of specimens not delivered within 3 days (or as to be configured).

iv. Number of trips completed and kms travelled – disaggregated by route.

v. Number of visits to each facility.

vi. Number of shipments made – disaggregated down to collection facility.

vii. Number of transporters participating in network – disaggregated by county.

viii. Time spent by transporter at site.

ix. Movement of packages/shipment with time/date stamps.

x. Number of visits that result in 0 specimens collected – disaggregated by collection facility.

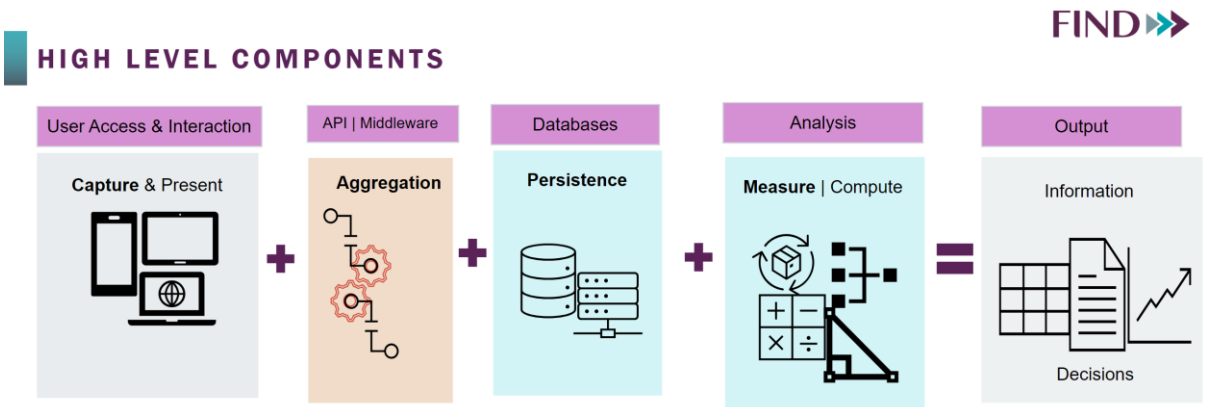
This list of indicators will be refined further during the design phase.

5.7. Application architecture:

SERTS will adopt a modular technical architecture for ease of maintenance and to allow flexibility for future enhancements. The detailed architecture and sub-systems interactions will be developed once the detailed specifications are determined. At the minimum the following modulars are envisioned:

i. Data capture module with at least 2 variants: Web portal, mobile app. We will explore popular and mature open-source mobile apps for data capture such Kobo Collect
ii. Business and application module comprising of:
    a. API layer to support integration with other systems such as KHIS, EMR, LIMS, transport hailing systems for rider request management etc.
    b. Business logic module: for enforcing data quality and calculating indicators.
    c. System configuration and administration module.
iii. Database module.
iv. Data visualization module where dashboards and reports will be visualized. We will explore popular and mature open-source ETLs and data visualization tools.

The diagram below shows a model of different components that will be orchestrated to deliver the envisioned electronic system.



6. Out-of-scope

a) Processes that are not within the specimen referral process, i.e. specimen collection and testing.
b) Return of results will be limited to uploading of results report as opposed to data entry forms configured for every test.
c) Integration with real-time monitors e.g. temperature and GPS trackers.
d) Though SERTS will have APIs for integration with other systems such as EMRs, rider hailing, logistics, and KHIS, the actual implementation of integration with such systems.
e) The management, real-time tracking, and maintenance of the fleet used for transport e.g. maintenance schedule, fuel consumption tracking.
f) The management of the transporters (riders) whether 3 parties or county owned. This includes “searching for the available or nearest” rider to match to a request for pick up. Please note the SERTS will have capability to integrate with such systems.