# Workload Analysis

## Demand Capacity and Performance

The solution should have capacities to cater to the following workload while meeting the performance levels indicated below:

| **S. No.** | **Item** | **Description** |
| --- | --- | --- |
|  | Biometric Gallery size | Scalable to peak capacity 40 million records |
|  | Biometric Gallery size (Phase-I) | At peak capacity nearly 8.00 million |
|  | Biometric Gallery size (Phase-II) | At peak capacity nearly 32.00 million |
|  | Peak Enrolment per day (Phase-I) | At peak capacity 30,000 enrolments per day |
|  | Peak Enrolment per day (Phase-II) | At peak capacity 50,000 enrolments per day |
|  | Peak Enrolment packet to be uploaded per day (incl. backlog) | At peak capacity 60,000 enrolments per day |
|  | Authentication Request (Phase-I) | At peak capacity 0.5 Million requests per day (12 hours) |
|  | e-KYC Request (Phase-I) | At peak capacity 0.5 Million requests per day (12 hours) |
|  | Authentication Request (Phase-II) | At peak capacity 1.8 Million requests per day (12 hours) |
|  | e-KYC Request (Phase-II) | At peak capacity 1.8 Million requests per day (12 hours) |

The solution shall cater to at least the following indicative performance level:

| **S. No.** | **Item** | **Description** |
| --- | --- | --- |
| A | Response time |  |
| 1 | Enrolment Request (at ABIS Level) | No daily backlog i.e. maximum of 24 hours at peak load |
| 2 | Enrolment Request (at MOSIP Level) | No daily backlog i.e. maximum of 24 hours at peak load |
| 3 | Authentication Request (SDK) | <= 0.5 seconds |
| 4 | Authentication Request (Overall) | >= 3 seconds |
| B | Accuracy |  |
| 1 | De-duplication | FPIR <= 0.1% and FNIR <=1% |
| 2 | Authentication Services | FMR <= 0.001% and FNMR <= 0.05% |
| C | Uptime and Availability |  |
| 1 | De-duplication | 99.5 % uptime evaluated on monthly basis on 24\*7 service window |
| 2 | Authentication Services | 99.99% uptime evaluated on monthly basis on 24\*7 service window |

Table 1: Demand Capacity and Performance Requirements

## Estimated Enrolment Volumes

This section provides the details of the enrolment volumes that will be covered in the various stages of the roadmap provided in Section 2 above. A tabular representation of the estimated volumes in the overall project implementation is given below:

|  |  |  |
| --- | --- | --- |
| **#** | **Item** | **Volumes (in million)** |
| 1 | Phase-I [Social Sector Beneficiaries in RAMED, DAAM and TAYSSIR] | 8.00 |
| 1.1 | Stage-I (Rabat Prefecture) | 0.04 |
| 1.2 | Stage-II (Kenitra Province) | 0.12 |
| 1.3 | Stage-III (Nationwide) | 7.84 |
| 2 | Phase-II [Other Beneficiaries and Targeted Population] | 26.49 |
| 2.1 | Enrolment of 85% of Targeted Population [November 2021 to July 2023] | 22.86 |
| 2.2 | Additional enrolment of 10% of Targeted Population [August 2023 onwards] | 3.63 |
| 3 | Continuous Enrollment (New Born) and Updates (Demo. and Bio.) | 8.90 |
| 3.1 | New Born Enrolment (From 2021 to 2023) | 1.28 |
| 3.2 | Demographic Updates (From 2020 to 2023) | 4.24 |
| 3.3 | Biometric Updates (From 2020 to 2023) | 3.38 |

Table 2: Enrolment Volume Estimates

The table given above is an estimate of the enrolment and update volumes under this program. The detailed explanation of the line items is provided below:

1. The total population of Morocco as per the census data of 2014, stands at 33.77 million. The population at the end of year 2021 is estimated to be 36.31 million which is estimated to reach 39.33 million at the end of year 2030.
2. In the first phase, the beneficiaries under RAMED, DAAM and TAYSSIR are planned to be covered. The approximate number of beneficiaries under these programs is 8 million.
3. For the purpose of enrolment of all the citizens and foreign Residents of Morocco, a figure of 95% of the total population is considered. It is estimated that 85% of the population will be enrolled in Phase-I and Phase-II of implementation. Considering this, the total enrolment volumes in Phase-II come out to be 22.86 million till July 2023. Thereafter, an additional 10% of the population i.e. nearly 3.63 million will be covered August 2023 onwards.
4. In addition to the enrolment volumes as mentioned above, the continuous enrolment of the annual increment in the population (new born children) will be carried out. Moreover, the updates in demographic information such as mobile number, address, email address, etc. will also be carried out. Similarly, the update in biometric information will be carried out at the age of 5 years, 15 years and on demand basis for other registered individuals.

## Estimated Authentication Volumes

The estimated volume of authentication services are provided in this section.

In the Phase-I (between Aug’19 to Oct’21), there is expected to be a one-time usage of e-KYC for all the social sector beneficiaries i.e. 8 million. During this phase, nearly 100 million authentication transactions are estimated per annum. Thus, considering an average of 250 working days in a year, nearly 0.43 million authentication transactions are estimated per day. The authentication transactions are expected to originate from below mentioned schemes:

1. In TAYSSIR, a total of 0.74 million beneficiaries are registered. The beneficiaries are school going children, and it is estimated that these children would authenticate and mark their attendance in school twice each week. These transactions are estimated to be over a period of 250 working days of a year. Thus, nearly 77 million authentication transactions are estimated annually under this program.
2. RAMED is a health insurance scheme where government provides financial support to vulnerable people. It is estimated that the beneficiaries under the scheme will undertake at least three visits in the hospitals and their transactions would need to be authenticated. Thus, the total estimated authenticated transactions is 22.8 million per annum.
3. In the DAAM program, a total of nearly 0.077 million beneficiaries are registered. It is estimated that a beneficiary will undertake at least four authentication transactions in a year. Thus, the total estimated authentication transaction works out to 0.31 million per annum.

The above information is summarized in the table given below:

| **#** | **Parameter** | **Description** | **Sizing Estimations** |
| --- | --- | --- | --- |
| 1 | Authentication |  |  |
| 1.1 | Authentication Example 1 | TAYSSIR Authentications in schools on a daily basis | 77 million per annum [estimated as 0.74 million (per day) x 250 working days] |
| 1.2 | Authentication Example 2 | RAMED Authentications at hospitals | 22.8 million per annum [estimated as 7.6 million x 3 authentications per beneficiary per year] |
| 1.3 | Authentication Example 3 | DAAM Authentications | 0.31 million per annum [estimated as 0.077 million beneficiaries x 4 times per year] |
| 2 | KYC | One-Time |  |
| 2.1 | Authentication Example 1 | TAYSSIR Authentications in schools on a daily basis | 0.74 million |
| 2.2 | Authentication Example 2 | RAMED Authentications at hospitals | 7.60 million |
| 2.3 | Authentication Example 3 | DAAM Authentications | 0.077 million |

Table 3 – Authentication and e-KYC volume estimates during Phase-I

After the end of Phase-I of the implementation, the authentication services and the corresponding authentication volumes would start growing. During peak usage under the Phase-II, it is estimated that 10% of the total population of Morocco would use authentication services on a daily basis. In other words, it is estimated that authentication transactions during Phase-II would be in the range of 3.6 million per day. Thus, the total volumes are estimated to be 650 Million transactions per annum during Phase-II.

## Transaction Volumes

| # | Parameters | Indicative Units |
| --- | --- | --- |
| **Enrolments** | | |
|  | Total number of enrollments till October 2021 | 8 Million |
|  | Total number of enrollments till July 2023 | 30.48 Million |
|  | Size of Enrolment Packet | 3 MB |
|  | Peak enrollment per day (Phase-I) | 30,000 |
|  | Peak enrollment per day (Phase-II) | 50,000 |
|  | Peak Enrolment packet to be uploaded per day (incl. backlog) | 60,000 |
|  | Peak Enrolment batch process per hour (Phase-I) | 1500 |
|  | Peak Enrolment batch process per hour (Phase-II) | 2500 |
|  | Pre-enrolment during peak hour (Phase-I):  a. 8 million enrolments in 2 years  b. Peak hour will see double of average requests  c. 90% of registration happens in 8 hour window | 2,600 Users |
|  | Pre-enrolment during peak hour (Phase-II):  a. 22.5 million enrolments in 2 years  b. Peak hour will see double of average requests  c. 90% of registration happens in 8 hour window | 6,750 Users |
| **Authentication and E-KYC** | | |
|  | Number of authentication requests (At peak load during Phase-I) | 0.50million per day |
|  | Number of e-KYC requests (At peak load during Phase-I) | 0.10 million per day |
|  | Number of authentication requests (At peak load during Phase-II) | 1.80 million per day |
|  | Number of e-KYC requests (At peak load during Phase-II) | 1.80 million per day |
| **Internet Usage** | | |
|  | Web page size | 130Kb, 0.13Mb |
|  | Total number of web users in Morocco | 22.5 Million |
|  | Concurrency percentage per hour | 2.5% |
|  | Number of Concurrent internet users | 5,62,500 |
|  | Average no. of hits by same users during the same login on web page | 2 |
|  | Web users during peak hour | 100,969 |
|  | Web users during peak hour | * 2.5% users/day * Peak hour will see double of average requests |
| **Miscellaneous** | | |
|  | Number of sessions during peak load | 36 million per annum |
|  | Assumed CPU and memory Utilization for Non-ABIS Application | 60% |
|  | Bandwidth at each center | 2 MBPS |

Table 4: Indicative Transaction Volumes

#### Assumptions for Server Sizing

1. All production and non-production servers will be hosted at common Data Centre
2. Baring certain citizen facing applications, DC-DR will be in active passive configuration
3. All servers will be based on x86 architecture
4. Used for hosting high compute requirements with SAN
5. Optimized Data Centre space utilization
6. More compute and memory power per server
7. High compute and memory consuming workloads should use Blades

#### Usage Factors for Storage and Tape Library

1. Host mount points for Blade servers
2. Provides support for storage array based replication to meet DR requirements
3. Host IO intensive workloads like database, data analytics and data warehouse
4. Provide a front-end, fast cache to a tape library infrastructure
5. Shorten the backup window period
6. Enables faster data restoration
7. Provides data retention for longer duration
8. Provides cost effective way of retaining data for longer duration
9. Enables department to meet data compliance requirements

### Data Size

This section provides the details of the data size required to be handled in the RNP information system

| **Parameter** | **Description** | **Sizing Estimations** |
| --- | --- | --- |
| Size of Enrolment Packet | Demographic, Photograph, 2 Iris and Documents | 3 MB Raw Packet |
| Authentication Packet | Demographic, OTP, Iris or Facial | 3-5 KB |
| e-KYC Packet | OTP, Iris or Facial | 30 KB |

Table 5: Data Size

## Estimation of Users

| ***Parameter*** | ***Description*** | ***Sizing Estimations*** |
| --- | --- | --- |
| Total User | Total Number of Users | 150 Users |
| Kit Operators | Field Operators | 2000 |
| Working Hours | 8 hours x 22 working days per month |
| Verification | CNIE Verification | 10 per shift |
| Working Hours | 8 hours per shift x 2 Shift |
| Adjudicators | Manual Adjudication | 10 per shift |
| Working Hours | 8 hours per shift x 2 Shift |
| Contact Centre | Helpdesk Personnel | 10 x 2 Shift |
| Number of Supervisors | 1 (First Shift) + 1 (Second Shift) |
| Contact Centre Seats | 11 (minimum) |
| Waiting time | 2 Minutes (maximum) |
| Working Hours | 8 hours per shift x 2 Shift |
| IT Helpdesk | Helpdesk Personnel | 5 (First Shift) + 5 (Second Shift) + 2 (Third Shift) |
| Number of Supervisors | 1 (First Shift) + 1 (Second Shift) |
| Network Operations Centre | Number of Users | 3 (First Shift) + 3 (Second Shift) + 1 (Third Shift) |
| Working Hours | 8 hours per shift x 3 Shifts |
| Security Operations Centre | Number of Users | 4 (First Shift) + 4 (Second Shift) + 2 (Third Shift) |
| Number of Supervisors | 1 (First Shift) + 1 (Second Shift) |
| Working Hours | 8 hours per shift x 3 Shifts |
| Administrators | DBA, Network Admin, Server Admin, Storage Admin, etc. | 13 (DC) + 4 (DR) |
| Working Hours | 8 hours per shift x 3 Shift |
| Internet Subscriber | No. of Internet Users | 22.5 million (September 2017) |
| No. of Internet Users | 16.9 million (September 2016) |
| Annual growth rate | Annual growth of 33% (10 years) |
| Estimated Users | No. of Internet Subscribers | 10% of Internet Subscribers |
| Concurrency Citizen | Concurrency of Internet Users | 2.5% of estimated users |
| Permanent Service Centres | Citizen Service Centres | 2000 |
| Workload Volume | Number of Registrations Per Day Per Kit | 15 enrolments during Phase-I and 25 enrolments during Phase-II |

## Technical Parameters

| ***Parameter*** | ***Description*** | ***Sizing Estimations*** |
| --- | --- | --- |
| Network Connectivity    \*(For future usage the router sized for 2-5 Gbps is recommended) | Network Connectivity (DC-DR Replication Link) | Dual links of 1 Gbps capacity |
| Network Connectivity (DC-NDC-DR Replication Link) | Dual links of 150 Mbps capacity |
| Network Connectivity (Internet) at the Data Centre | Initially 150 Mbps internet connectivity |
| Network Connectivity (Data Validation) at the Data Centre | Initially 150 Mbps leased line |
| Network Connectivity (TSPs) at the Data Centre | To be provisioned by respective TSP, based on their transaction projections |
| CPU | Utilization upper limits | 60% only for non-ABIS component |
| Re-size/ headroom | Virtual Cores, Memory, and Storage Seamlessly | 25% of the base capacity, only for non-ABIS components in permanent Data Centre |
| Storage | Static & Transaction data | 2,600 TB |
| Reports | Total | 25 types of reports |
| Break-up | 5 Complex Report Type,  10 Medium Report Type,  10 Simple Report Type |
| Communication with External Systems | External interfaces that are likely to interact with the RNP System | Social Benefit Programs (RAMED, TAYSSIR, DAAM, etc.), Financial Switch for Social Benefit Disbursement, Validation with CNIE and Civil Registration, etc. |
| RTO and RPO | For Pilot, the DC-DR will be in same city. Subsequently, the DC and DR will be more than 100 KMs apart | Please refer Section 1.6 |
| Online data retention | NID Data | Always |
| Biometric Centre data | Always |
| Backup window | Incremental data back up every day and full back up every week | 6-8 hrs |

## RTO and RPO

| S. No. | Process | Criticality | RTO | RPO | Business Rationale for RPO and RTO |
| --- | --- | --- | --- | --- | --- |
| 1 | Enrolment | High | 24 hours | ~ZERO | **RTO:** Enrolment is an offline process and officers are required to upload packets once a day hence 24 hrs. is affordable  **RPO (Enrolment Databases):** It is a business requirement that no data shall be lost in the ecosystem (IDMS and CSC) |
| 2 | Authentication | High | ~ZERO | ~ZERO | **RTO:** Authentication is an online process and it is anticipated that majority of government and private organizations in Morocco will use this service to be able to provide further services. Hence RTO is 0  **RPO (Authentication databases including logs):** It is a business requirement that no authentication data shall be lost |
| 3 | Critical Portals | High | ~ZERO | ~ZERO | **RTO:** These portals could be resident facing and any downtime could have major reputational impact  **RPO (Logs databases and enrolment, Authentication databases):** It is a business requirement that no data is lost from the logs database. Authentication and Enrolment databases also have ~ZERO RPOs |
| 4 | CRM | High | ~ZERO | ~ZERO | **RTO:** CRM is a resident facing service and any downtime could have major reputational impact  **RPO (CRM database, call recordings etc.):** It is a business requirement that no data is lost from the CRM databases and maintenance of the databases also may be necessary for compliance to legal requirements. |
| 5 | SOC | High | ~ZERO | ~ZERO | **RTO:** SOC is a very important security operation for IDMS. SOC should never be down as logs from various devices are collected by SOC tool and it is important that logs are always available for investigation purposes  **RPO (Logs file system, SOC configuration etc.):** It is a business and legal requirement that logs are always available |
| 6 | Email | High | ~ZERO | ~ZERO | **RTO:** Email is very critical service as lot of other services depend upon email such as email to residents when PIN generated or when resident authenticates  **RPO (Emails):** Email is a very critical service and lot of internal and partner communications take place on email hence it is a critical service. |
| 7 | Other Portals | Medium | ~ZERO | ~ZERO if data other than logs  ~24 hrs if only logs | **RTO:** It is understood that these portals are not resident facing and criticality  **RPO (Logs databases and enrolment, Authentication databases):** It is a business requirement to ensure there is no data loss in case data other than logs is present. |
| 8 | NOC | Medium | ~ZERO | ~24 hrs. | **RTO:** It is understood that NOC is an important process to monitor the availability of service  **RPO (Ticketing database etc.):** Ticketing database is not a critical database and hence loss of 24 hrs. of tickets can be afforded |
| 9 | Office | Medium | 24 - 48 hours | N/A (No data is stored) |  |

**Pre-registration open NFR queries**:

1. The response time for end user would be less or equals to 3 seconds for one MBps bandwidth. [Mindtree] End user response time should not be considered for performance testing. Response time is only for the round trip of a request from the time it enters MOSIP till it exits)
2. What is the number of unplanned outage allowed per year?

[Mindtree] Availability is a number that depends on the deployment architecture. MOSIP cannot commit to this number. But, can publish best practices for HA

1. What would be RPO and RTO for pre-registration?
2. How many number of roles are there for pre-registration? Citizen and Registration center officer/supervisor(data synch) are two known roles

[Mindtree] May be an admin can be added

1. What are the browsers supported?

[Mindtree] We should test it on the latest versions of chrome and IE and publish that as supported

1. What are the operating systems and versions supported?

[Mindtree] Since pre-registration application is browser based, we need not specify the OS that it runs on. However, this is related to the previous question of the browser support. We can test it on windows and say only Windows is supported.

1. What are the mobile operating systems supported?

Are we developing a mobile version? I do not think so.

1. What is the minimum network bandwidth?

Is this required to be specified?

1. API should be properly authenticated at server end before accessing the service (API gateway)
2. API key should be issued for registration centers for data synch purpose.

[Mindtree] Yes

**Registration open NFR queries**:

1. Given that peak enrolment per day is 50,000 (phase II) and no. of field operators is 2,000 working for 8 hours per day, the time available for each enrolment = 8\*60\*2,000/50,000 = 19.2 minutes per enrolment. Round this down to 15 minutes per enrolment. This in turn drives the time for data entry, move between screens, capture each biometric, authentication, and offline interaction with the individual. Please validate if the figure of 15 minutes per enrolment on average is a fair estimate.

[Mindtree] I think average of 15 minutes is a fair estimate.

1. How many pre-registrations are expected to be downloaded to a client per day? Given a peak of 6,750 pre-registrations per hour and 2,000 enrolment stations, the no. of pre-registrations per station per day can be approximated to 6,750\*8/2,000 = 27. Please validate if 27 pre-enrolments downloaded per day is a fair estimate.

[Mindtree] I think this is a good estimate.

1. How long should the packet upload process take, given that a peak of 60,000 packets will be uploaded from 2,000 stations per day and assuming a once-a-day upload?

[Mindtree] This is really dependent on the network bandwidth between the stations and the central server. Not sure if we can estimate the time. We can only extrapolate and give suggestive numbers for the bandwidth.

1. How long should the pre-registration download take?

[Mindtree] Again depends on the network bandwidth. However, MOSIP can compress and send the data to make it faster.

1. How long should the software update process take?

[Mindtree] This is really subjective and cannot be estimated. If it is entire software download it takes longer or if its just one screen update it takes less time.

1. How long should the data sync take?

[Mindtree] Depends on data and hard to estimate.

1. What is the expected availability of the application?
2. What is the backup policy? Based on the backup requirements, the recovery point objective and recovery time objective can be derived.
3. For how long should the audit logs be retained on the dongle, and how frequently should they be cleaned up?

[Mindtree] It is up to the country to define this period.