



# Mauritius National Information Technology Strategy Plan (NITSP)

## **MAURITIUS NATIONAL IDENTITY CARD (MNIC) PROJECT: ARCHITECTURE DESIGN REPORT**

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## 1 INTRODUCTION

The focus of the current state assessment of the MNIC project was two-fold. Firstly, it portrayed the current people identification infrastructure administration by the two main government agencies (the Civil Status Division and the Ministry of Social Security and National Solidarity). Secondly, it traced the usage of the identification infrastructure by other government agencies.

The MNIC architecture definition is a logical follow-up of the current state assessment and it particularly aims at the enhancement of the present people identification infrastructure. This enhancement would be aligned to Government's vision of an effective and efficient public sector that would bring Government closer to the people.

The figure below emphasises the position of the architecture design in the three-stage approach to derive the MNIC master plan.

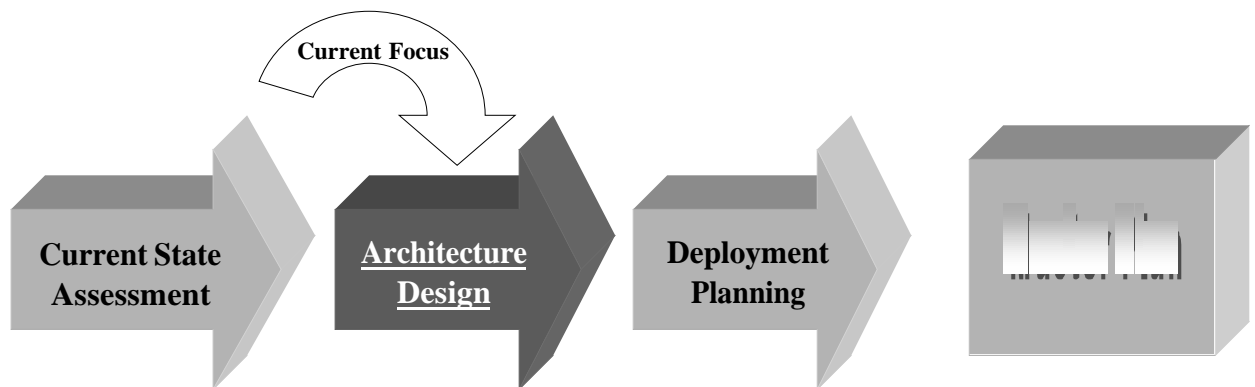


Figure 1-1: Three-stage approach to derive the MNIC master plan

### 1.1 Objectives

The objectives of the MNIC architecture definition are as follows:

- a) To define the MNIC blue print and its key components to bridge the gaps identified in the current state assessment.
- b) To serve as a guideline for future applications that will be built upon the proposed identification architecture.

## 1.2 Approach

Figure 1-2 below illustrates the integrated framework employed for defining the MNIC architecture. The framework provides a holistic approach for defining the MNIC goal and strategy, the key processes, the high-level information requirements, the technology needs, and the people and organisation required for implementing the MNIC project successfully.

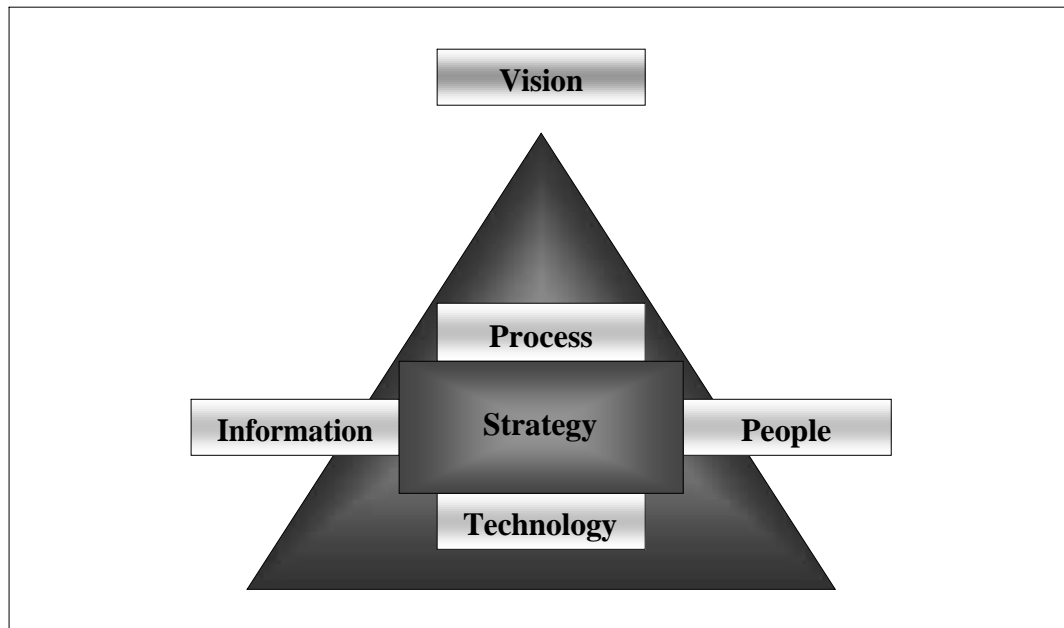


Figure 1-2: The proposed conceptual view of MNIC architecture

The framework that guides the definition of the MNIC Architecture is based on the National Information Resource Planning (NIRP) methodology. The NIRP approach aims at identifying strategic information assets for systematic management and sharing. Moreover, it would provide a basis for streamlining work processes for better results, thus enabling sound long-term social and economic planning.



### **1.3 MNIC Architecture Definition**

Essentially, an architecture specifies how a system operates mechanically by summarising its components, the way the components are linked, and the way the components operate together.

**a) *MNIC Goal & Strategy***

The MNIC goal provides a pictorial view of the future by highlighting how the members of the public will interact with the new system. It will depict the key strategy employed to enhance the interaction by improving the quality of services, work procedures and minimising rework.

**b) *Process***

The process perspective defines the processes redesigned to increase productivity, reduce errors and decrease turnaround time of services. Many time-tested principles are employed to review and improve the current processes and procedures to create a process architecture that when carefully implemented, will create quantum improvements.

**c) *Organisation***

The organisation perspective defines the human resource policies and practices to support the new processes. Jobs, skills, roles, responsibility and the entire organisation architecture are also considered to ensure the change is managed to produce the intended results.

**d) *Information***

The information perspective defines the data policies and practices to enable the new processes. Standardisation of data definition and the proper maintenance of information architecture are essential to the execution of these processes and the feedback which will allow corrective actions to be taken.

**e) *Technology***

The technology perspective defines the technology policies and practices to automate the processes and allow information to be delivered to the right person at the right time. Technical architecture including the network, system hardware and software, and the application architecture consisting of the application software and environment, are key enablers for translating the MNIC goal to reality.

Each of the above five components is now considered in turn.

## 2 MNIC GOAL & STRATEGY

The MNIC goal is to improve the convenience, efficiency, reliability and accessibility of all government services, thereby bringing the Government closer to the people of Mauritius.

The key strategies supporting this MNIC goal are as follows:

- To adopt a one-stop service approach to ensure greater convenience be accorded to our people.
- To modernise the Government operations by reviewing its policies and redesigning work processes for greater efficiency.
- To create an integrated infrastructure to improve the reliability and accessibility of all government services which utilise it.

The conceptual architecture diagram below was conceived based on the three key strategies defined above.

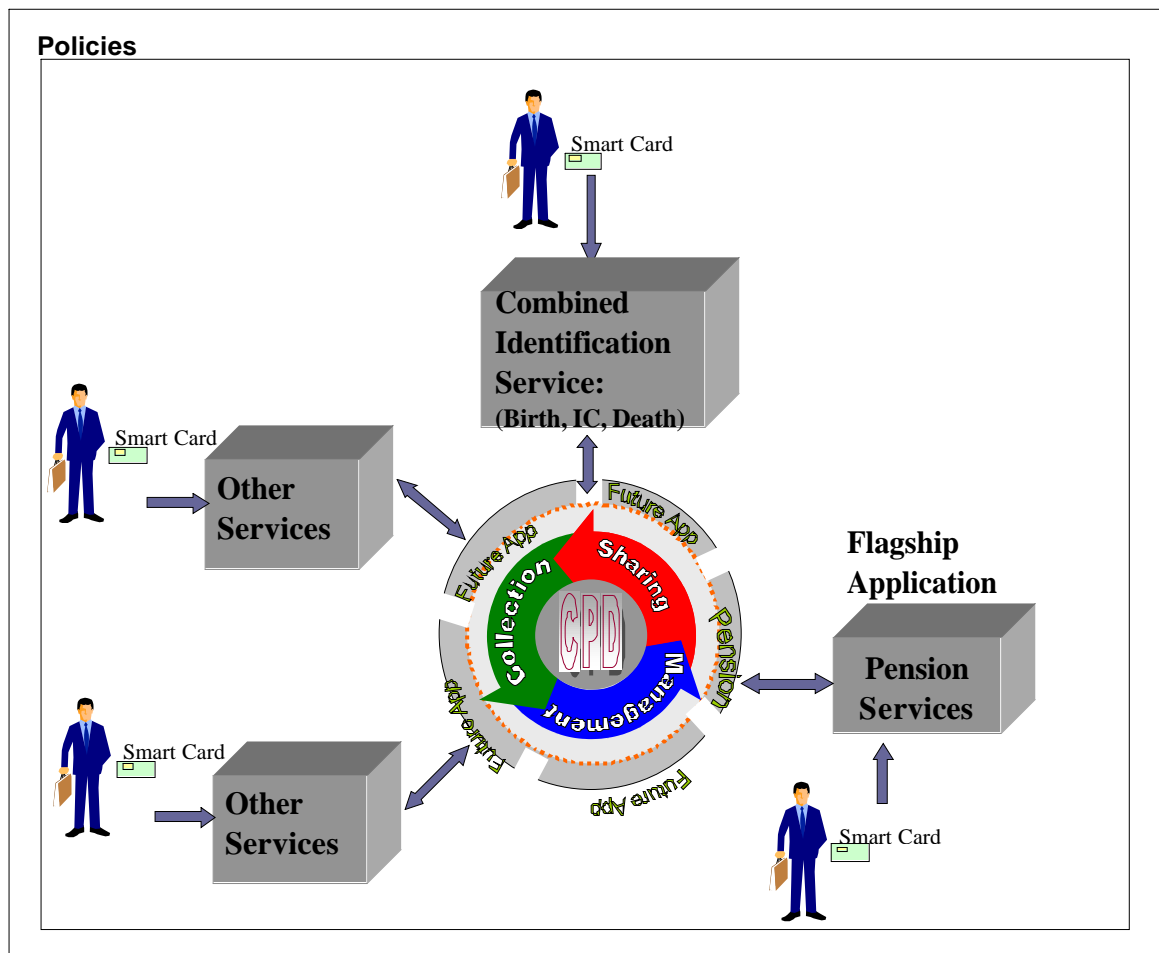


Figure 2-1: Proposed conceptual view of MNIC Architecture

CPD: Central Population Database  
 Box : One Stop Service

Innermost ring : Integrated Infrastructure  
 Concentric rings: Redesign of work





## **2.1 Conceptual view of the proposed MNIC architecture**

The diagram on the previous page illustrates the proposed people identification infrastructure in operation. Smart card technology would gainfully enable the various services which are portrayed in the diagram.

The essence of the identification engine rests on an up-to-date, accurate and secure database of the citizens of Mauritius.

The innermost ring precisely depicts the central population database (CPD) upon which government services will be built. The maintenance of a reliable identification infrastructure entails the collection of data at source and its subsequent update at one point. This nuclear approach requires sound data administration and management – illustrated by the three arrows circulating around the central population database.

The new identification environment requires a one-stop combined identification service offering a set of stapled services namely birth registration, IC registration and card issue, and death registration. This service would interface directly with the public and therefore maintain people information within the cradle to grave cycle. Hence, this combined service point would be the lead contributor to the central population database as creator of people identification records and its subsequent update.

Government agencies which dispense a service to the public are expected to operate in a one-stop mode. People identification and authentication would be supported by smart cards to ensure the provision of timely services to the rightful recipients.

The provision of pension-related services is expected to constitute the first flagship application that would stem out of the new identification environment. Smart cards would be used to this end, and one-stop-shop pension services would operate. Likewise, other flagship applications could bud out once smart cards have gained public confidence and a smart pension service becomes a showcase project.

The above description consolidates the strategies which support the MNIC goal. The entire architecture warrants the modernisation of government procedures and the streamlining of operations which would ultimately compress the customer servicing times. An integrated people identification infrastructure would thus be the innermost core supporting the provision of timely government services.



### **3 PROCESS ARCHITECTURE**

#### **3.1 Guiding Principles**

The following are the principles that have been taken into account for designing the new processes that would bridge the gap for meeting the challenges that were identified earlier.

- a) The combination of several tasks into one.
- b) The capture of data only once - when it is first created. As far as possible, data common to ministries and departments should be shared.
- c) Allowing decision points where work is performed.
- d) Incorporating controls into information processing.
- e) Making people who actually use a process do the work.
- f) Working in parallel rather than sequentially, followed by the requisite integration.
- g) Treating geographically dispersed resources as one.

#### **3.2 The Proposed Process Architecture**

The proposed process architecture is crafted along the lines of the conceptual view of the MNIC architecture which is explained in section 2. The proposed people identification administration process comprises three main components:

- a) Collection of information from source and its maintenance
- b) Management of information at a hub level which would be the central tapping point
- c) Sharing and usage of information

The above architecture would allow to trace the identity of an individual from birth to death. This new process would allow a one-point maintenance of the individual's data thus facilitating its usage by public sector agencies. Processes would thereby be streamlined resulting in better administration of information and more efficient services for the public.

The tables that follow describe the proposed processes in the new environment together with the impact they will have on existing procedures and regulations. Processes that have a bearing on existing legislations or requiring new policies (A) or have technology implementation implications (T) are classified according to their degree of criticality (High, Medium, Low).



**3.2.1 Processes for creating people information**

**3.2.1.1 Registration of birth**

<b>Process Description</b>	<b>Policy Implications</b>	<b>Criticality</b>
1. The declarant calls up at any Civil Status Office (one-stop service) bringing along his NIC and attestation of birth.	Currently, the declarant has to call on the office nearest to his residence, or where the child is born.	High (A) Low (T)
2. The attestation of birth would contain the child's particulars: name, address, sex, blood group and the NIC would provide the national identification number of the parents	The NIC of the parent is presently not compulsory. Blood group of the child is not available.	High (A) Medium(T)
3. Civil Status Officer ascertains the identity of the declarant by the latter's identity card. Any other information needed (address) can be obtained online from the Central Population Database.	No need for witnesses.	High (A)
4. The birth is then registered online capturing the following data: date of birth, date of registration, name of the child, ethnic group, sex, place of birth, blood group and information on parents (ID Number).	The registration is actually done manually in registers.	High (A)
5. A unique Identity Number is system-generated and given to the child. This number is centrally generated from the Central Population Database.	The identity number is presently only issued at the registration for NIC at 18.	High(T)
6. One extract of certificate is given to the declarant on the spot.	The birth certificate is given one week later in current processes.	Low

Table 3-1: Registration of Birth

**Issues addressed by this new process**

- a) A single identification token, namely the National Identity Card, is sufficient to identify the declarant.
- b) Furthermore, online verification and validation of information renders the system more secure. The previous two step-process where the declarant first registers for birth and then collects the birth extract in one-week time, has been collapsed into a single customer visit.
- c) The registration process can take place at any Civil Status Office whereas the previous one needed to take place either at the birth place of the child or at the present residence of declarant. The service is thus easily accessible to the public.
- d) The National Identity Number is the Unique Identifier that will be used throughout the person's life.
- e) No register needs to be filled in as all information is available online through the system. Problems in relation to paper-work are eliminated (such as illegible handwriting and transcription errors) and the process bears lower administrative costs.



- f) There is no need for witnesses.



**3.2.1.2 Re-Issuance of Birth Certificate**

Process Description	Policy Implications	Criticality
1. The claimant needs to be the person himself or his immediate relatives, and calls at any Civil Status Office in the island.	Currently, the claimant has to call on the office where his birth was registered or at the head-office.	High
2. The claimant needs to produce his identity number and/or exact name. From the latter data, all the necessary information needed to reproduce the Birth Certificate can be derived.		
3. The Birth Certificate is issued on the spot to the claimant.	The birth certificate is given one week later in current processes.	Low

Table 3-2: Re-Issuance of Birth Certificate

**Issues addressed by the new process**

- a) The process involves only one trip from the perspective of the public.
- b) All necessary information for verification and reproduction of the certificate can be obtained on-line.
- c) There is no need for recent birth certificate for marriage registration, etc., since all information (such as annotations) is updated and available on-line.

**3.2.1.3 First issue of National Identity Card**

Process Description	Policy Implications	Criticality
1. A person who turns 18 has to call at any one of the NIC issuing centres with one, or more, of the following documents (depending upon the case considered): Birth Certificate or Naturalization Certificate or Passport, to get his NIC.		
2. The name of the applicant is cross-checked against the Central Population Database. The photo, the fingerprint and the signature of the applicant are captured, as are any changes in the person's particulars (e.g. address). By default, the right-hand thumbprint would be used for authentication purposes and this thumbprint would be encoded in the NIC. The left-hand thumbprint would be used in case the right-hand thumbprint is injured, etc. A suitable fingerprint-capture convention should be adopted to cater for cases where thumbprint capture cannot be effected.	The fingerprint capture has to be rendered compulsory.	High





Process Description	Policy Implications	Criticality
3. After validation, the above data are appended to the person's information in the Central Population Database.		
4. The person should call at the same centre one week later to collect his NIC <i>against payment of a token fee</i> . The payment will sensitise the cardholder about owning a multi-purpose identification token that enables access to a panoply of government services.	The first NIC is presently given free.	High

Table 3-3: First issue of National Identity Card

### 3.2.1.4 Re-Issuance of National identity Card

Process Description	Policy Implications	Criticality
1. In case of loss, the person would have to produce his birth certificate. Alternatively, he could recall his ID Number. The aim is to retrieve his record from the database. In the worst case, his fingerprint could be used to trace his record on the database.		
2. In case of a re-issuance for reasons other than card loss (e.g. change of name), the document certifying the particulars such as a marriage certificate or change of name certificate must be produced.		
3. All verifications are done on-line, and any previous NIC is flagged in the system as invalid.	The fees should be sufficiently dissuasive, which is actually not the case	High
4. A fee is required for issuing a new card and this should be prohibitively high. The fees are even higher for further re-issues to discourage negligence in usage of the card. <i>Payments could be Rs 100 for a first re-issue, Rs 500 for a second re-issue. The latter fee could be incremented by a further Rs 100 for each subsequent re-issue.</i> Charges should be claimed for card replacements due to loss and misuse only.	The fees should be sufficiently dissuasive, which is actually not the case	High
5. The applicant should call at the same centre one week later to collect his new NIC.		

Table 3-4: Re-Issuance of National identity Card



**3.2.1.5 Termination of the validity of card**

Process Description	Policy Implications	Criticality
1. The validity of the NIC will be terminated in case of death of the holder.		
2. The NIC is flagged as invalid, and is collected at the Civil Status Office for eventual destruction.	This is not done actually	High (A) Low (T)

Table 3-5: Termination of the validity of card

**Issues addressed by the new processes regarding National Identity Card**

- a) Information such as name, date of birth etc. need not be re-captured since they are already available on the system.
- b) There is more security in the system to identify those asking for a new NIC. The existence of a photo as well as the fingerprint make it sufficiently accurate to positively identify a person when he comes for a re-issue of the card.
- c) Identification of deceased can be done precisely as a unique identifier is used.

**3.2.1.6 Registration of death**

Process Description	Policy Implications	Criticality
1. The declarant calls up at any Civil Status Office bringing along: his NIC, NIC and/or birth certificate of deceased person, medical certificate stating cause of death issued by a medical practitioner or police form if the cause of death has been accidental or is of criminal nature.	The NIC and/or birth certificate of deceased person is not compulsory.	Low
2. Civil Status Officer ascertains the identity of the declarant and verifies the documents produced.		
3. The following information are captured: the date of death, age of death, cause of death, place at death.		
4. The NIC of the deceased is returned to the Civil Status Office and the deceased's record is flagged as invalid in the system. The card will be eventually destroyed.	This is not done actually.	Medium
5. One extract of certificate is given to declarant on the spot.		

Table 3-6: Registration of death

**Issues addressed by the new process**

- a) The process involved just one trip from the perspective of the public.
- b) Basic information on the deceased person such as name, date of birth need not be re-captured.
- c) The NIC of the deceased is collected and cannot therefore be misused by someone



### 3.2.2 Further recommendations for maintaining up-to-date people information

- a) Since the Central Population Database should, at any point in time, reflect the actual status of the population, any change concerning the particulars (e.g. address) of individuals stored on the database should be notified to the Civil Status Office within a *fortnight*.
- b) The appropriate infrastructure should therefore be made available to the population to act accordingly. For example, changes in people's data could be communicated to any one of the Civil Status Offices around the island.
- c) Failure to notify the competent authority about any changes could lead to the denial of timely services to the people concerned. Moreover, a fine (say, Rs 500) could be imposed to ensure that unnecessary administrative costs are not incurred through the use of outdated information.
- d) In line with government's vision to get closer to the people, it is recommended to implement one-stop shop facilities whereby a range of services could be provided over a single counter. For instance, the registration of birth, marriage and death could be stapled with the provision of such services as recording and updating changes in the particulars of citizen.
- e) The person concerned should personally call on any Civil Status Office with his NIC, and officially declare the changes to be made. In case of minor, he should be accompanied by his parent or responsible party, and produce his birth certificate as well as the NIC of the parent or responsible party.
- f) In the case of a whole family changing address, one adult alone can do the necessary changes, provided he produces his NIC as well as the NICs and birth certificates of all the other family members concerned.

### 3.2.3 Processes for sharing of people information

The setting up of a national population database will provide the latest information on the citizens of the country. Further, a unique identification number assigned to every citizen will be used in all applications ensuring a proper integration. The latter would therefore enable different Ministries and Departments to share common data. Besides, it ensures that all agencies use a single common reference for people identification. This will ensure that a person can be uniquely identified as compared to the present situation where a person can be referenced by a multitude of reference indicators. It will improve the rate of correct identification of the right person and ensure that the right service is dispensed to the right person.

The central population database is a resultant hub spinning from information derived from various primary sources. The Civil Status Division would be the major contributor of data to the Central Population Database. This configuration does not exclude the Civil Status Division from maintaining a database that is specific to its operations.

The process of sharing information on the Central Population Database would be through two mechanisms:

1. Push mechanism
2. Pull mechanism

The push mechanism deals with those agencies that furnish information to the Central



Population Database, e.g. the Civil Status Division. When the record of an individual is affected by changes, such updates would be posted to the Central Population Database on a periodic basis.

The pull mechanism may concern agencies that would use data from the Central Population Database. It will up to these consumer-organisations to pull information within clearly defined policies and procedures.

The push or pull mechanisms may operate in one of three modes:

1. Batch only, or
2. On-line only, or
3. Both batch and on-line.

For example, changes in the address of people would be pushed to the Central Population Database on an on-line basis.

The information architecture in section 5 paints an overall perspective of the data elements that would be subject to sharing.

### 3.2.4 Flagship Application

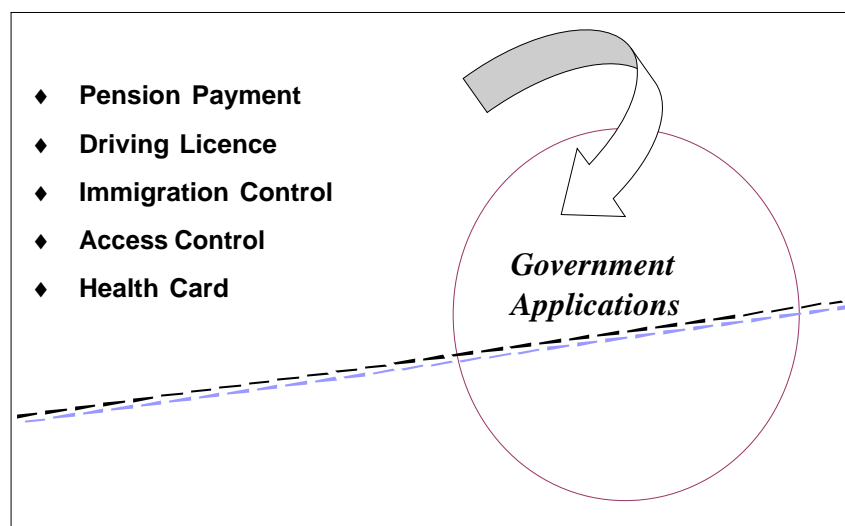
The design of a sound MNIC Architecture coupled with the use of smart cards will trigger off new applications that would modernise the government services.

For example, pension payment using smart card can be considered as a flagship application. This application would leverage and demonstrate the usefulness and benefits of a reliable identification architecture. This function covers around 100,000 citizens and is administered centrally by the Ministry of Social Security and National Solidarity.

The following processes would support the disbursement of pension using smart card technology (Smart Pension Service):

- a) Registration of pensioners
- b) Payment of pension
- c) Termination of pension payment

Other flagship applications could stem out as the people identification infrastructure becomes operational. However, it is imperative to demarcate commercial applications from government applications as illustrated in figure 3-1 below.





**Commercial  
Applications**  
*Working Team Report on National IT Strategy Plan (Phase II)*

*Figure 3-1: Flagship applications*



3.2.5 Processes for a Smart Pension Service

3.2.5.1 Registration of pensioner

Process Description	Policy Implications	Criticality
1. Any employer should register any new staff with the Ministry of Social Security. The Identity Number of the employee is used as the unique identifier. Any future contribution of the employer and employee to some fund on behalf of the employee will be done using the employee's National Identity Card (NIC) Number as identifier.	At present, some employers use Social Security Number.	High (A)
2. The Ministry of Social Security will adopt a proactive stand concerning the registration of pensioners. Since all information concerning the population is available at the Central Population Database, the Ministry should take the initiative to inform all those eligible for such pension of the procedures to follow for registration at least two months before by accordingly issuing a notice to this end.		
3. The claimant and / or a proxy can call on any Social Security Office for registration. The NIC of the claimant (as well as the proxy if present) has to be produced. Any verification concerning the eligibility for pension and the authenticity of the claimant or proxy can be done on-line. The required information about the proxy (if any) will be recorded in the pension database.		
4. In case, the claimant cannot travel to register and eventually won't be in a position to collect the pension himself, and is therefore represented by a proxy, it should be made clear that the same proxy should register and eventually collect the pension on behalf of the claimant.	Proxy's details are mandatory.	High
5. The mode of pension payment should be determined, and any further necessary information provided. For example, if bank transfer is chosen as payment mode, then a bank account number should be given.		
6. After one week, a letter is sent to the claimant (and proxy) informing him about the pension amount he is eligible and the procedures to follow to cash the pension.		
7. Any future change concerning the amount of the pension, procedures for payment, etc. should be notified to the claimant well in advance.		

Table 3-7: Registration of pensioner



**3.2.5.2 Pension payment**

Process Description	Policy Implications	Criticality
1. This refers to the payment of pension to the claimant or proxy. Payment can be made through (i) bank transfer, (ii) direct payment through post-office.		
2. In case of bank transfer, the claimant or proxy can draw the pension through the means available at the bank, e.g. debit card, through cashier.		
3. In the case of payment through post-office (any one), the payment could be made through either a cash dispenser or by the post-master or both. In the former case, the cash dispenser may be equally used for post-office banking services.		
4. In any case, the claimant should produce his NIC and in case of a proxy, the latter should produce his NIC as well as the NIC of the claimant and a verification of pension payment details is effected.		
5. In case of positive identification, payment is made and the time, date, place of payment are captured into the system and the last date of payment into the smart card at the same time.		

Table 3-8: Pension Payment

**Issue addressed by new process**

- a) Payment of pension can be effected in any post-office in case of such a payment mode.

**3.2.5.3 Termination of pension**

Steps	Policy Implications	Criticality
1. This refers to termination of pension payment as a result of death.		
2. Information on death cases is recorded by the Civil Status Offices and will be reflected immediately in the Central Population Database. This can be made available to the Ministry of Social Security.		
3. The Ministry of Social Security would update its own database on a regular basis (e.g. daily) to take note of such events, and thereby terminating the pensions for those concerned.		

Table 3-9: Termination of Pension

## 4 ORGANISATION ARCHITECTURE

### 4.1 Guiding Principles

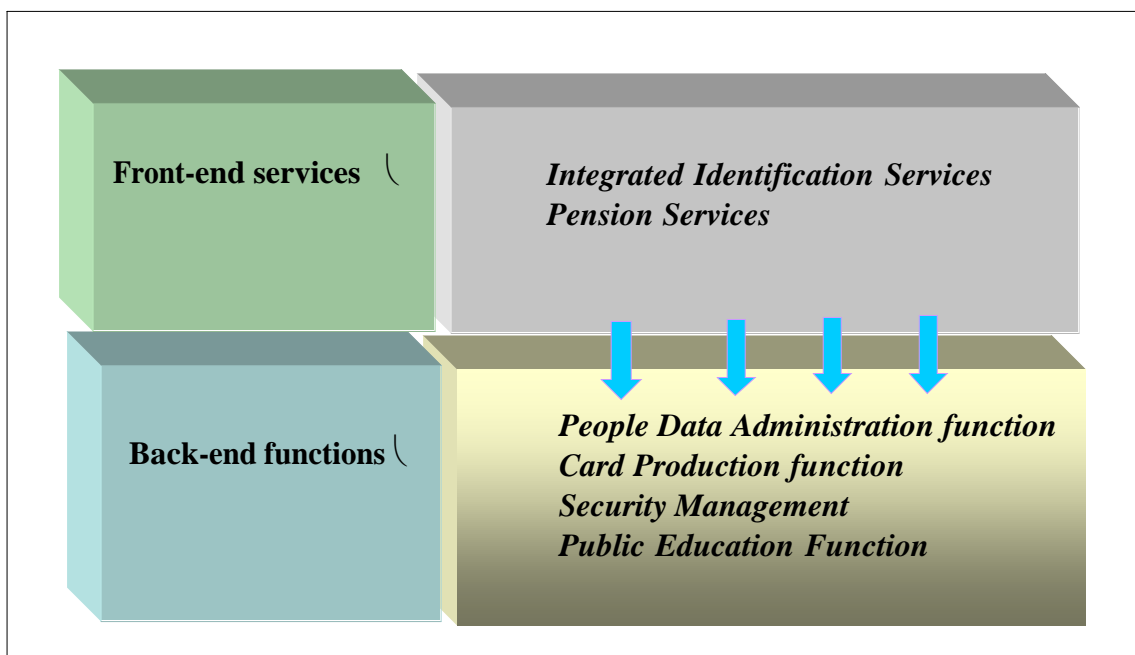
The following are the principles that have been taken into account for defining the new organisational setup that would bridge the gap for meeting the challenges that were identified earlier. These principles would lead to the organisation of functions around processes in such a way that the latter should yield a product or service to a customer.

- a) Ensuring staff participation and commitment for service improvement by rewarding individual, team and unit performance.
- b) Assessing impact on human resources and resolving the associated issues.
- c) Provision of an open and timely communication.
- d) Encouraging continuous learning and skills development at all levels.

### 4.2 The Proposed Organisation Architecture

The use of smart cards would modernise the provision government services enabling one-stop services. It is imperative that a holistic approach be adopted in the definition of one-stop-shop government services. This would directly impact the quality of the service offered to the citizen in terms of service turnaround time, the number of visits required and the proximity of the government services from the public.

Figure 4-1 depicts the proposed organisation architecture.





*Figure 4-1: Proposed organisation architecture*



### **4.3 Organisational requirements for a combined identification services function**

The people identification infrastructure administration addresses the creation of people identity, thus involving the registration of birth, issue of identity card, and the recording of death. This would imply that the combined identification services would take on board the card management services from the NIC Unit of the Ministry of Social Security.

The spectrum of responsibilities that would be handled by the combined identification services function would include the following, among others:

- a) Combined Identification Services
- b) People Information Administration Function
- c) Key Management Function
- d) Card Production Function

These are now considered in turn.

#### **4.3.1 Combined Identification Services**

The combined identification services are as follows:

- a) Registration of birth
- b) Issue of NIC
- c) Registration of death
- d) Maintenance of people information (e.g. change of address, name)

The above list is not exhaustive as it only covers the services that are within the scope of the MNIC project.

#### **4.3.2 Proposed People Information Administration Function**

The setting up of a reliable identification infrastructure calls for the people information administration function at the combined identification services unit on a centralised basis.

This new function would comprise the following activities:

- a) Consolidate information received from different sources
- b) Enforce policies to achieve single source of information entry
- c) Arbitrate information sharing and access rights
- d) Establish control for information security, recovery, privacy and integrity
- e) Encourage public access to information subject to legislation and government policies.
- f) Manage redundant storage of information, except when required by legislation.

The above function calls for the recruitment, training of new / existing staff who would be involved in this support function.

The following skills would be required:

- a) Data administration, i.e. the setting of information definition standards and procedures
- b) Database Administration, i.e. undertaking design, development, implementation and operational tasks with logical and physical databases
- c) Information access, i.e. provision of tools and techniques that would enable external users to access information.



#### **4.3.3 Proposed Key Management Function**

The key management function covers the following:

1. Trusted officers to enter secrets and safe keep the administrative smart cards such as key card, production card, terminal injection card, SAM (secure access module) card.
2. To generate SAM cards as and when new terminal/card reader being introduced to the system.
3. Depending on the security level of the system and complexity of the project, the number of key managers to enter the secrets could range from 4 to 12.
4. Depending on the system requirement, the same or newly trusted officers would need to regenerate another set of keys (and administrative cards) on a periodical cycle, say every 1 year, to prevent the key from compromising.
5. A card production supervisor controls the number of cards to be produced by each operator by entering the correct supervisor password to the production card and key in the appropriate quantity.
6. The card production supervisor also controls the stock level of the smart cards and account for all cards produced, issued, returned and damaged.
7. A card production operator has to print and personalise the customer cards by entering the correct operator password to the production card when signing on to the system.
8. The card production operator also performs visual QC check and makes enquiry to the system after production of the card to ensure printed data tally with personalised data stored in the chip. This operator also performs basic routine maintenance of the smart card printer such as changing of ribbon and cleaning of roller.

#### **4.3.4 Proposed Card Production Function**

The new card production function would involve a three-stage approach encompassing registration, production and delivery. An appropriate organisational framework would have to be set up for the purposes of:

- a) Bulk IC conversion exercise
- b) Normal card production function

These two functions are considered in detail in the deployment plan.

##### ***Normal Card Production Function***

This function deals with the production of card on an as and when needed basis for citizens turning 18 years of age.

This will involve the production of about 30,000 cards per year.

This function would make use of the infrastructure set up during the bulk conversion exercise. However, the smaller number of cards to be produced will necessitate a reduction in equipment and personnel, both for the registration and card production functions.

The registration function will be relevant registration centres. Each registration centre would operate one counter and this will involve a team of four officers: one supervisor, one PRO, one person for operating the data capture equipment (blood group, photograph, signature, fingerprint) and one officer for administrating database transactions and handling general queries.



The production function will take place at the centralised card production centre. It is suggested that only two card production machines be kept – one for normal production and one as back up in case of breakdown and/or servicing of the other one. The production centre will receive data captured from registration centres and will produce the identity cards twice weekly on a batch basis. This will ensure the optimum usage of the machine as well as minimal wait time for the applicants.

The normal card production function would require the following human resources:

- one supervisor,
- one person for stock control,
- two operators for the card production machine (although two machines are housed, only one will be effectively used at any point in time),
- one person for quality control,
- two persons for delivery and dispatch, and
- one officer for administrating database transactions.

Also, it is proposed that the above officers be conversant with the overall card production system to ensure continuity in the production service as a contingency measure to guard against staff leaves.

After quality control checks, the cards produced will be sent to the centres where registrations took place for delivery to the applicants.

#### 4.4 Social Security – Proposed Pension Function

The proposed pension function is based on three sub-processes, namely,

- a) registration of pensioners,
- b) payment of pensions, and
- c) termination of pension payment.

The table below indicates the human resource requirements that would be required to support the new pension payment function:

Role	Responsibilities	Skills set required	No of officers
<b>Local Office :</b>			
Registration officer	Registration, validation, and creation of pensioner's record	Knowledge of social security legislation, working knowledge of computers and smart cards	1 per local office
Information desk officer	Act as an interface between the Ministry and the public by handling queries from customers	Communication skills and working knowledge of pension function	
<b>Head Office :</b>			
Payment of pension	Transfer of funds to payment points	Knowledge of fund management and government financing policies	5
Reconciliation of payments	Reconcile actual payments against expected payments		
Termination of	De-registration and closing of	Knowledge of social security	1



pension payment	pensioner's record	legislation, working knowledge of computers	
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*Table 4-1: Human resource requirements for new pension payment function*



#### **4.5 Public Education Function**

The success of the MNIC project is highly dependent upon the perception and acceptance of the new smart card-based identification token by the public.

In order to achieve these objectives, an effective and efficient campaign should be launched with the following aims:

- the public should be properly and timely sensitised on the benefits that will be derived from the new identification infrastructure.
- the importance of such information for the government for planning and development purposes should be clearly emphasised.

## 5 INFORMATION ARCHITECTURE

### 5.1 Guiding Principles

The following are the principles which have been taken into account for designing the new information architecture.

- Subjecting information to proper administration for consistency and integrity.
- Sharing, exchanging and reusing information to reduce costs of duplicate data capture.
- Protection of information to improve privacy, avoid loss and increase public confidence.
- Retention of information for future use.
- Stewardship to ensure accountability and quality of information.

### 5.2 The Proposed Information Architecture

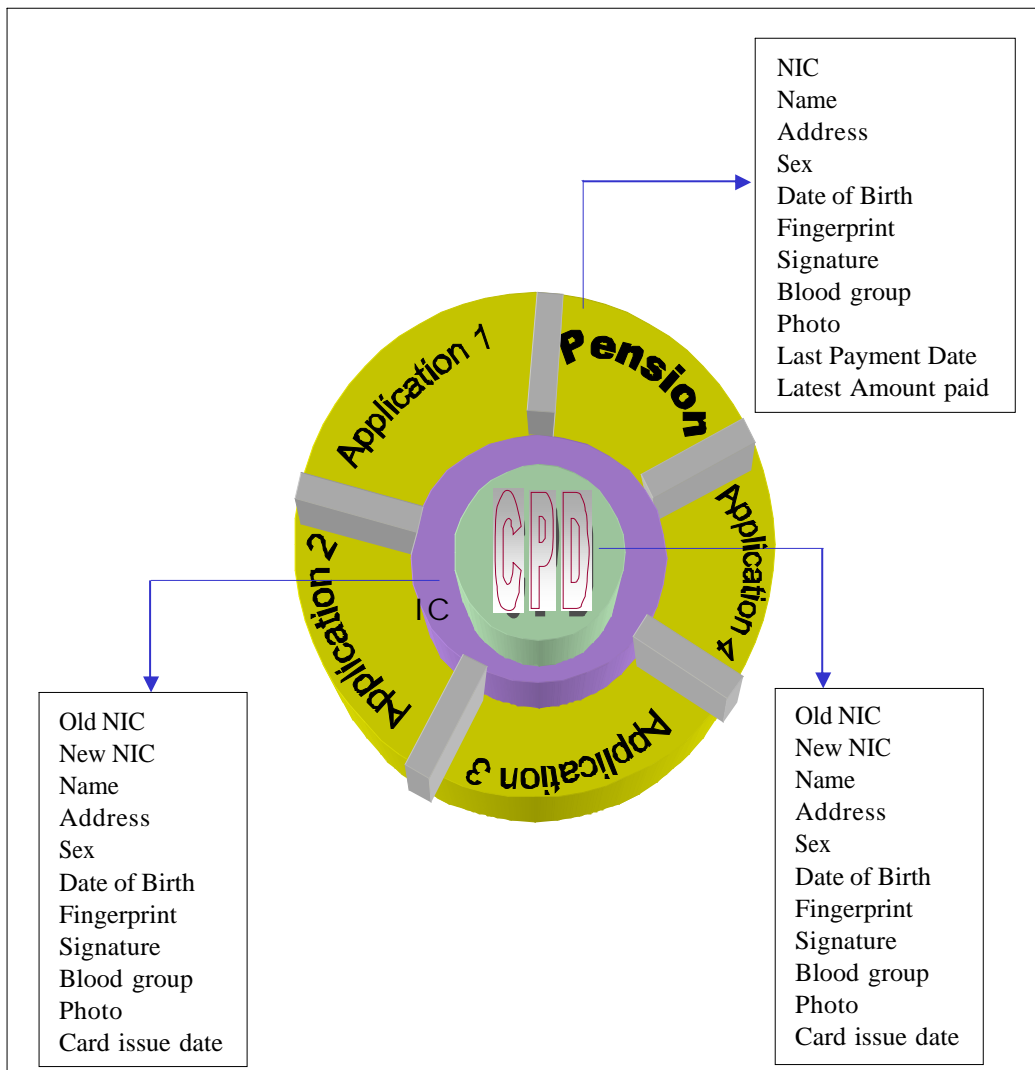


Figure 5-1: Proposed information architecture



### 5.2.1 Common People Information for Sharing

Annexes A.1 and A.2 depict instances at which a person's data are required for identification purposes. The following items of people information have been identified as being common to several governmental agencies.

- a) NIC number
- b) Name
- c) Address
- d) Date of birth
- e) Fingerprint
- f) Photo
- g) Signature
- h) Sex
- i) Blood group

These are now discussed at length with regards to their proposed structure.

#### a) NIC Number

This part addresses the unique identifier that will be used for positively identifying a person. The present NIC number format has been examined and its limitations are highlighted in the current state assessment report (lengthy, not year-2000 compliant, derivative of manual records). To overcome these limitations, a new identifier format is being proposed.

The present NIC number format consists of 14 characters as follows:

Character	Remarks
1 <sup>st</sup>	First letter of surname
2 <sup>nd</sup> to 7 <sup>th</sup>	Date of birth (ddmmyy)
8 <sup>th</sup> to 9 <sup>th</sup>	Code of Civil Status Office where Registration of Birth took place
10 <sup>th</sup> to 13 <sup>th</sup>	Folio number
14 <sup>th</sup>	Check Digit (modulus 17)

Table 5-1: Current NIC format

The proposed format is as follows:

Character	Remarks
1 <sup>st</sup>	Century prefix [ R : years prefixed by 18; S : years prefixed by 19; T : years prefixed by 20] – R is the 18 <sup>th</sup> letter of the alphabet, S the 19 <sup>th</sup> and T the 20 <sup>th</sup> .
2 <sup>nd</sup> to 3 <sup>rd</sup>	Year of birth (yy)
4 <sup>th</sup> to 9 <sup>th</sup>	6-digit system-generated serial number
10 <sup>th</sup>	Check Digit (could be modulus 11)

Table 5-2: Proposed NIC format

This new format overcomes the limitations which are inherent to the present NIC number.





**b) Name Format**

The proposed name format is as follows:

Field	Format
Surname	Char(50)
First Name	Char(50)
Maiden Name	Char(100)

Table 5-3: Proposed Name format

This name format was suggested by the Central Informatics Bureau in light of the Civil Service Computerisation Programme to ensure uniformity in systems handling names.

**c) Address Format**

In March 1995, a World Bank Mission visited Mauritius to appraise the Services Sector Modernisation Project. One of the components of the project was the Public Services Component that comprised two sub-components: the Strengthening of the Institutional Set-up for use of IT in the Public Sector and the Creation of a National Land Information System. During the mission, it was agreed that the foundation project comprised, *amongst others*, Establishment of a common data architecture forming the basis for common data to be captured and maintained in one government agency only. In that context, an Address Reform Committee was set up to look into the address format and structure to be used by all government organisations.

The Address Reform Committee endorsed the following address format:

Field	Format
Flat & Block Number / Apartment Name	Char(50)
Street No./Name	Char(40)
Locality	Char(30)
Town/Village	Char(30)
Municipality Ward/Village Council Area Code	Char(3)
Postcode	Char(5)

Table 5-4: Proposed address format

**d) Date of birth**

The date of birth will be captured in the Central Population Database using the ddmmyyyy format. dd stands for day, mm for month and yyyy for the year.

**e) Fingerprint**

Fingerprint capture has to be rendered compulsory. The format proposed for storing the fingerprint on the smart card would be minutiae-based and the Central Population Database would store this data in two formats: image-based and minutiae-based.



The image format reflects the data captured (finger print) at source and would effectively be used to generate the minutiae of the finger print – depending on the algorithm used.

Even though minutiae based systems require less data, they are much more robust, especially when compared to other methodologies of fingerprint systems. The basis for all world wide forensic fingerprint identification systems today is found in the ability to identify and match these basic characteristics (minutiae) in the fingerprint images.

Further details on fingerprint -based data are annexed. (Annex A.3)

**f) Photo**

Several image formats have been considered with regards to the storage of photos on the Central Population Database.

The JPEG format is recommended as the format to hold the photos on the Central Population Database for the following reasons :

- The image file is in a compressed format, hence using less storage space
- This technique compresses colour photographic images with no visible loss.
- It stores 24-bit-per-pixel colour data.

**g) Signature**

The use of biometrics based information, namely photo and fingerprint, would provide a positive means of identifying an individual and these features could be considered as stable over time. This is not the case with signature which tends to be less stable and easier to replicate. Further, some people are not able to sign.

The use of signature is not considered to be a reliable means of identification. Its presence on the central population database could be considered subject to the condition that it be used in conjunction with some other identification data, e.g. NIC number.

The format to store the signature data could be GIF.



5.2.2 Information Content on the National Identity Card

INFORMATION	CARD DATA		Is data on the CENTRAL POPULATION DATABASE?	Size (bytes)
	VISIBLE ON CARD	ENCODED IN CHIP		
Color Photo (Digitised)	√		Yes	
Name	√		Yes	
Maiden Name	√		Yes	
Sex	√		Yes	
Signature	√		Yes	
ID Number – Old	√		Yes	
ID Number – New	√	√	Yes	20
Date of Birth	√		Yes	
Date of Issue of Card	√	√	Yes	10
Blood Group	√		Yes	
Coat of Arm (Color)	√			
Fingerprint (minutiae)		√	Yes	600
Fingerprint (image)			Yes	
Residential Address		√	Yes	200
Last Month Pension Cashed		√		10
Amount Paid for Last Pension		√		10
Pay Point of Last Pension Cashed		√		10
Class of Driving		√		10
Expiry of License		√		10
<b>Total</b>				<b>880</b>

Table 5-5: Information to be stored on NIC

The above sizing computation does not include the overhead space that is required. In view of additional applications that could eventually be accommodated, it is recommended to opt for a card with a total capacity of 4 kilobytes.

### 5.3 Conceptual diagram of the Central Population Database

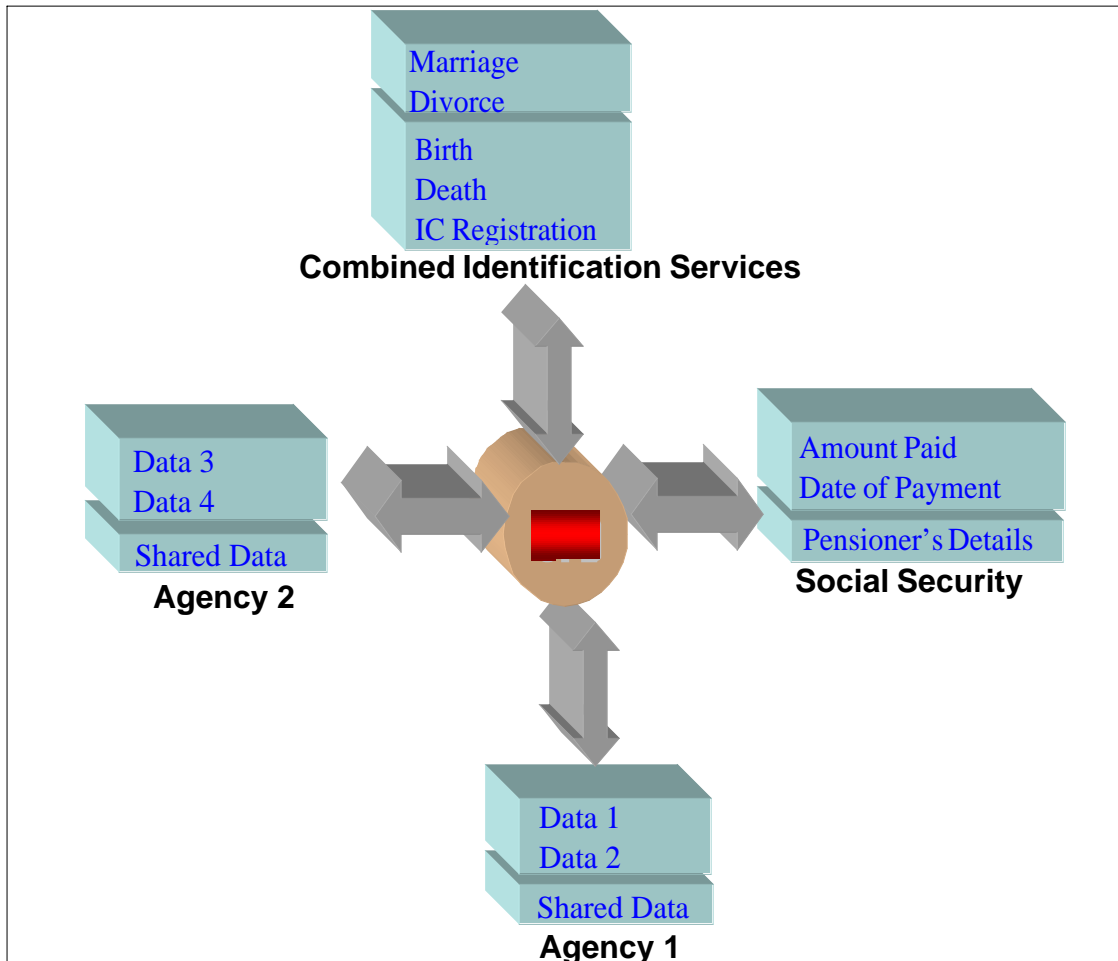


Figure 5-2: Conceptual view of the Central Population Database

The above diagram positions people information within the context of the central population database. It rests on the premise that each item of information can be in one of three states at any one point in time, namely creation, sharing and consumption.

The overall architecture is a star topology the central point of which is the Central Population Database, which can also be referred to as the people hub. Any data item is created by the organisation that owns it through relevant processes. For all data items that necessitate sharing, it will be the responsibility of the owner organisations to push those data on the people hub. The latter will eventually push all updated people records to the agencies that require the usage of people information, mainly for identification purposes.

For instance, the birth registration process would result in the creation of a citizen's record. Part of this new record will subsequently be forwarded to the Central Population Database. A user agency will accordingly obtain this record for its own internal consumption.



The Central Population Database can subsequently be expanded to house additional information that requires sharing. This will ensure that all information sharing takes place through the hub, thereby eliminating the need for other secondary, parallel sharing mechanism. However, factors such as transaction volumes and the frequency of access should be considered and analysed to determine the feasibility of enabling the sharing via the hub.

## **6 TECHNOLOGY ARCHITECTURE**

### **6.1 Introduction**

One of the critical tasks in the MNIC Project Planning phase is the design of the Technology Architecture (TA). Essentially, the TA defines the overall technical architecture which is needed to support the complex and diverse Information, Process and Organizational changes surfaced in the MNIC Architecture Design.

It is important to note that the TA described in this document is relevant only to the extent of the planning horizon undertaken for planning stage (i.e. 3 - 5 years). The TA has to be constantly reviewed by the technology planners, taking into account of the changes in application requirements as well as technology advances. Thus, the TA is expected to evolve over time and provides a baseline from which the Mauritius Government can manage its technology resources effectively.

The TA is a conceptual plan which logically defines the engineering components of the technical infrastructure. The major components of this infrastructure are the various hardware platforms, operating environments and connectivities. It also consists of a set of applicable technical standards which are either existing Government-wide direction or choices made by the Project Team based on leading industry de facto standards. In areas where standards still do not exist, a desirable list of features would be described instead.

### **6.2 Guiding Principles**

The following are the principles that have been taken into account for designing the new technology that would bridge the gap for meeting the challenges that were identified earlier.

- a) Share common systems to reduce costs.
- b) Use modular components to increase flexibility.
- c) Standardize interfaces between systems to increase interoperability.
- d) Distribute processing, storage and communication capabilities to increase responsiveness.
- e) Network and workstation orientation - Elaborate more on this bullet point
- f) Manage technology infrastructure through architecture.

### 6.3 Concept of Design

Essentially, the MNIC TA is a distributed system architecture comprises various technology components working co-operatively to provide a single system image. This TA document strives to derive the conceptual architectural specifications independent of any platform-specific solution. Examples of vendor-specific products are cited only to increase the level of understanding and serve as a point for further exploration and evaluation. The Logical Architecture and its analysis are presented in this document.

From the Logical Architecture, major physical components are then organised into different levels to facilitate discussion. The physical configuration thus derived serves as an illustration to explain the necessary hardware components which are required for constructing the infrastructure of MNIC IT environment.

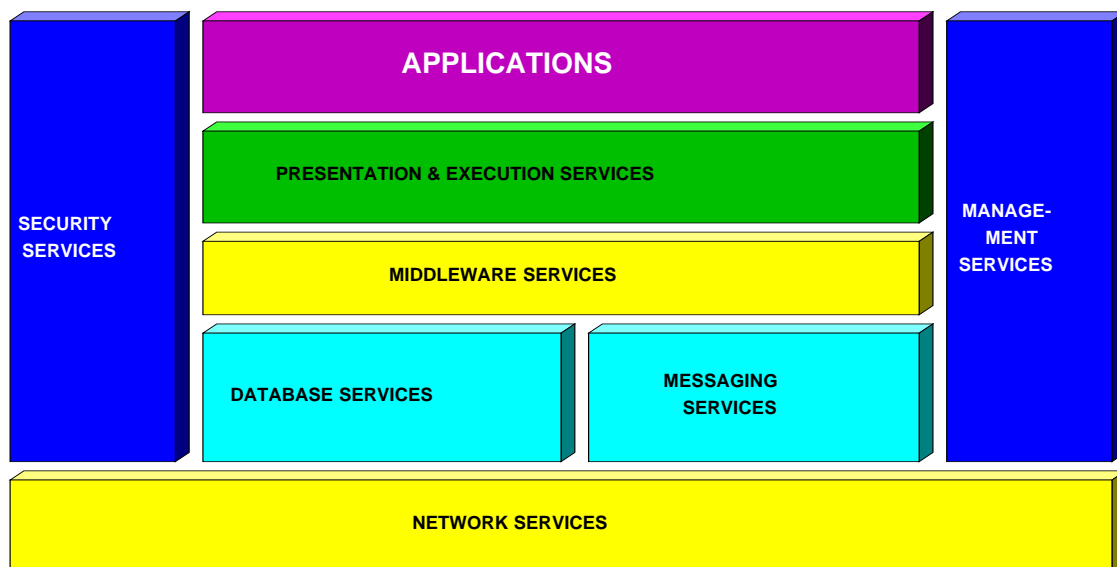


Figure 6-1: Physical configuration of Technology Architecture

Applications provide the functionality for automating business processes. For 'make' or 'buy' solutions, it is necessary to define the characteristics of tools for developing and integrating different application systems and components.

Presentation and Execution Services provide the underlying operating system routines for the execution and presentation of applications.

Middleware Services hide the complex details of accessing multiple databases on different platforms through use of standard database access language, application programming interfaces and gateway products.

Database Services provide the efficient management of vast amount of data in centralised or distributed manner.

Messaging Services provide the foundation for organisation-wide electronic communication at



disperse locations.

Network Services enables all components in the TA to interact with one another across the entire network with high level reliability.

Security Services ensure that security in a distributed system architecture adopted by MNIC TA is not compromised.

Management Services provide tools for managing networks, systems and databases.

Technology in consideration:

- a) Smart Card Technology such as Card Production, Distribution and Usage Technology
- b) Internet Technology
- c) Distributed Computing Environment
- d) Client/Server Technology
- e) Object-Oriented Technology
- f) Middleware Technology
- g) Workflow Management
- h) Imaging Technology
- i) Networking Technology
- j) Biometric Technology

#### **6.4 Physical Architecture**

Physically, the TA is organised in a 3-level fashion as outlined below:

- Level I** - Departmental Database Servers, Gateway Servers
- Level II** - Workgroup Servers
- Level III** - Workstations and Peripherals

The 3 levels are connected via a comprehensive physical network infrastructure providing the necessary connectivities for moving vast amount of information between various business units of the department.

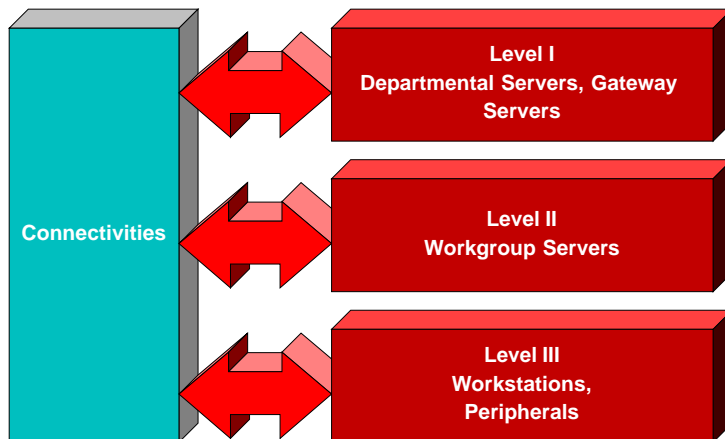


Figure 6-2: Organisation of technology architecture

#### 6.4.1 Departmental Database Servers

Departmental Database Servers are mid-range platforms that will house large amount of information managed by a Database Management System. An appropriate platform is recommended at this level for managing complex transaction processing and database management.

#### 6.4.2 Gateway Servers

Workgroup servers are either RISC-based or Intel-based Servers which provides on-line services such as Systems Network Architecture (SNA) support or middleware services.

#### 6.4.3 Workgroup Servers

Workgroup servers are Local Area Network (LAN) servers which provides the file, print and messaging services. These servers also contain distributed information such as unstructured data type (i.e. textual and image data) for performance reasons. These data are replicated to other Workgroup servers at pre-defined intervals.

#### 6.4.4 Workstations

These are intel-based PCs running desktop OS Windows 95, Windows NT. The choice of the type of PC hardware has become increasingly less significant as the choice of desktop OS would usually mask the hardware differences.

#### 6.4.5 Local Area Connectivities

This would cover structured data cabling, network interfacing card and hubs.

#### 6.4.6 Wide Area Connectivities

This encompasses communication lines, routers and modems.



**6.5 Requirements and Rationale**

<b>BROAD TECHNOLOGY REQUIREMENTS</b>
<b>a) Ease of End-User Access</b>
– The new computing environment must provide single point access to all MNIC applications at any location throughout all Civil Status Division offices.
– It must provide a consistent look and feel throughout the entire department.
<b>b) Connectivity, Within and Without</b>
– It must be able to facilitate information flow between various geographically dispersed office units. It must provide a means for sharing of unstructured information such as document and images between these office units and Ministry Headquarters.
– It must allow the applications to tap into various approved sources of information in other computing environments directly. The technology architecture must facilitate and enable information flows among these agencies.
– It must allow access to external on-line services such as Internet etc.
– It must continue to provide access to interdepartmental applications throughout the interim migration process while computing resources are right-sized. Connectivity must be preserved to the current establishment.
<b>c) Efficiency and Availability</b>
– It must allow end-users to optimise the use of heterogeneous computing and computing resources available, right at their desktop.
– As the technology is woven into the fabric of day-to-day operations, it must be highly resilient and fault tolerant in order to ensure high availability and minimal uncertainty.
<b>d) Ease of Maintenance</b>
– The management of the technology infrastructure must be automated in order to minimise the cost of maintenance. Self-diagnostic equipment must become an increasing feature at the workplace.
<b>e) Security and Confidentiality</b>
– Flexible access control to information repositories must be provided to protect the information from malicious or accidental modification and erasure, and to ensure the privacy of sensitive data.
– Secure modes of transmission of sensitive information across various communications media must be provided to ensure privacy.
– Sufficient protection of information from catastrophic loss, whether natural or man-made, must be provided.
<b>f) Flexibility and Scalability</b>
– It must not only support the new processes and enable the co-ordination of among governmental activities, but also allow changes to the government processes to be supported quickly and cheaply.



BROAD TECHNOLOGY REQUIREMENTS	
–	The technology architecture should allow rapid deployment of new resources in the case of expansion of the organisation, and maximisation of benefits in the case of consolidation.
–	The technology architecture should allow the rapid adaptation and integration of new technologies into the organisation.

## 7 CONCLUSION

The design of the MNIC architecture bridges the gaps identified in the current state assessment report. To this end various changes are warranted. New processes have been devised, organisational adjustments have been proposed, information conversion is critical and the requisite support technology has been recommended.

The next step is to unfold the roadmap that would portray the deployment efforts required in the configuration of a new national people identification system.

## 8 ANNEX

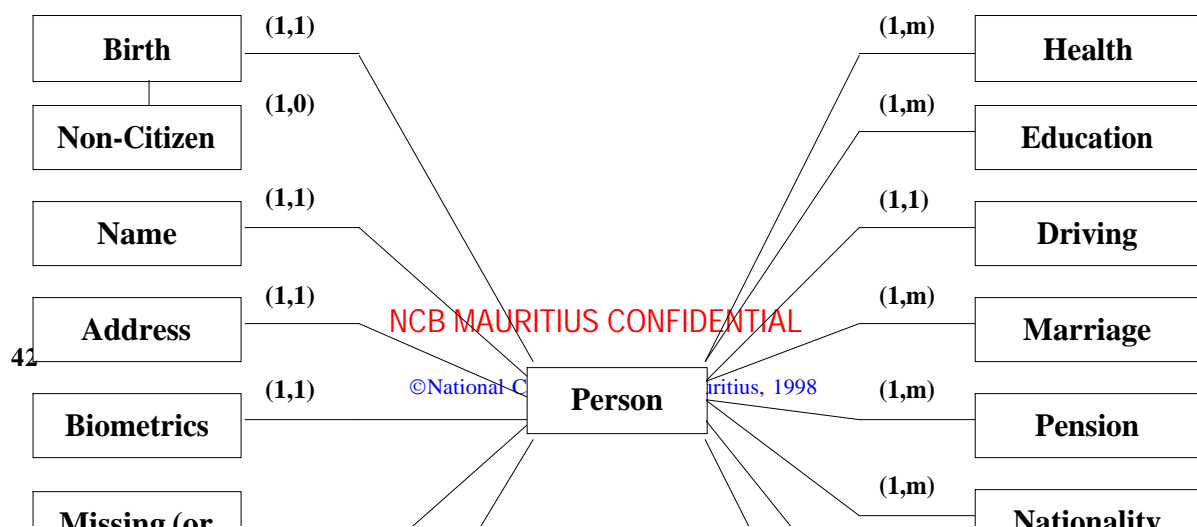
### 8.1 Information Modelling

Data entity is defined as things / concept / place /person that can be distinctly identified about which you need to have information, example, citizen, birth details, etc.

A relationship between two entities is a logical meaningful connection. It implies that values for the associated data items are in some way dependent on each other. A relationship expresses a business rule between two or more entities.

Cardinality defines the type of relationships between entities; example, one-to-one, one-to-many and many-to-many.

The diagram below shows the relationships between entities that have been identified to form part of the people identification architecture. As such, each entity corresponds to an instance when a person's information is created for subsequent usage. The bracketed pair of numbers on each line represents the relationship between two entities.





**Key :** (1,1) denotes a one-to-one relationship between two entities  
 (1,m) denotes a one-to-many relationship between two entities  
 (n,m) denotes a many-to-many relationship between two entities

Figure A-1: Entity relationship diagram

**Note :** Main attribute of the entity PERSON is National Identity Number which would henceforth be issued at birth.

## 8.2 Entity Ownership

The table below indicates the ownership of the entities depicted in the previous diagram. The ownership entails the collection, maintenance and termination of the records associated with those entities.

Entity	Ownership
Birth	Civil Status Division
Name	Civil Status Division
Address	Civil Status Division
Biometrics	Civil Status Division
Person's Identity	Civil Status Division
Marriage	Civil Status Division
Death	Civil Status Division
Missing	Civil Status Division
Nationality	Home Affairs Division, PMO
Non-Citizen	Home Affairs Division, PMO
Pension	Social Security



Driving	Police Department
Immigration	Police Department
Health	Ministry of Health
Education	Ministry of Education
Election	Electoral Commissioner's Office

Table A-1: Entity ownership

### 8.3 Storing fingerprint-based data on the central population database

Every person is believed to have unique fingerprints. This makes fingerprint matching one of the most reliable methods for identifying people. Fingerprints are well understood and widely accepted as a unique form of human identification. Fingerprints are known to be naturally stable throughout a lifetime and fingers are readily accessible for non-intrusive sensing. Time-tested fingerprint comparison methods are known to be capable of distinguishing individuals reliably within extremely large populations.

There are a number of ways in which a fingerprint-based security system could work with smart cards. For example, the template of a person's fingerprint could be stored on the card, and a user's identity can be verified by comparing the template to a record of the print. The classical approach to fingerprint analysis identifies the relative positions of the small ridge bifurcations and ridge endings (minutiae) on the finger and uses these to classify the print.

The following formats have been considered with regards to the storage of photos on the Central Population Database :

- Bitmap (BMP)
- Graphics Image File (GIF)
- Joint Photographic Experts Group (JPEG)

These are now considered in turn.

#### **BMP Format**

BMP files are graphic files, normally saved in this format by Windows-applications. In this format the image is not compressed. The graphic is saved pixel by pixel, which results in large files. This affects the loading-speed.

The quality of a BMP image is very good, because of the pixel-by-pixel saving technique. All Windows-applications can work with this format. This can not be said about the GIF and JPEG file formats. However, BMP takes a lot of free disk-space and is really slow at loading.

#### **GIF Format**

The GIF compression technique is a technique which is capable of compressing graphics files but which can only store 8 bits/pixel. This means that the maximum number of colours that can be used is 256. Of course, graphics with less than 256 colours can be compressed by GIF. Black and white images can also be compressed by GIF compression, even a graphic with 256 grey-scale levels can be compressed without loss.

GIF is therefore a compression technique which matches mostly every inexpensive computer display. GIF compression comes out really handy for graphics which are made out of large



single colour borders and repeating patterns, such as linedraws and simple cartoons. So, GIF is really good at simple images. The technique is lossless on such graphics, and it compresses them quite well.

The GIF-compression technique has been designed for compression of computer-drawn images. Those images usually have no more than 256 colours and use a lot of sharp edges, straight lines and borders.

#### **JPEG Format**

The JPEG-compression technique has been designed for high compression of high-colour, photographic images that take up a lot of space. So, it can be used to compress original high-colour, photographic images. It stores 24-bit-per-pixel colour data instead of 8-bit-per-pixel data.

JPEG is 'lossy', meaning that the decompressed image isn't quite the same as the original one taken. There are lossless image compression algorithms, but JPEG achieves a much greater compression than is possible with lossless methods. A useful property of JPEG is that the degree of loss can be varied by adjusting compression parameters. This means that the image maker can trade off file size against output image quality. Another important characteristic of JPEG is that decoders can trade off decoding speed against image quality, by using fast but inaccurate approximations to the required calculations.

With JPEG sharp edges tend to become blurred unless a very high quality setting is used. The blurriness is particularly objectionable with text that's only a few pixels high. JPEG can typically achieve 10:1 to 20:1 compression without visible loss, bringing the effective storage requirement down to 1 to 2 bits/pixel. 30:1 to 50:1 compression is possible with small to moderate defects, while for very low quality purposes such as previews or archive indexes, 100:1 compression is quite feasible.

Besides, the threshold at which errors become visible depends on the viewing conditions. The smaller an individual pixel, the harder it is to see an error; so errors are more visible on a computer screen (at may be 70 dots/inch) than on a high-quality colour printout (300 or more dots/inch). Thus a higher resolution image can tolerate more compression.