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Topic (i): Changes in statistical processes

NATIONAL ROUTING SYSTEM FOR VITAL EVENTS

Invited Paper prepared by John Menic and Mel Turner, Statistics Canada

I.   SUMMARY

1.   As Canada's National Statistical Office, Statistics Canada often integrates information that originates from provincial/territorial administrative sources. A key area of provincial/territorial responsibility in Canada is the registration of vital events (births and deaths), which plays an important role in Identity Proofing, eligibility for government services, and health and demographic analysis. The National Routing System (NRS) is a secure electronic communications environment permitting provinces, territories and federal departments to exchange vital event information. It allows provincial and territorial vital event registrars to validate *birth* information that is essential to authenticate identity and to notify federal departments of *deaths* in order to manage changes to program entitlements in a timely manner.

2.   The scope of the NRS pilot initiative was to establish data standards and create a secure environment for the exchange of data between two data-producing organizations - the Vital Statistics Offices in British Columbia and Alberta - and the data-subscribing organizations - Statistics Canada, Passport Office (PPTC) and Canada Revenue Agency (CRA). The particular challenge with this initiative was facilitating the electronic exchange of data across the various provincial and federal legacy systems in a standard format, while accommodating each jurisdiction's confidentiality, privacy and data information needs.

3.   This paper will report on both the technical achievements and the governance issues that arose in working across multiple federal departments and across jurisdictions. This pilot system is currently operational among the three federal government departments and two provincial agencies; activity continues to expand this approach to add provinces and agencies in a more timely and cost effective manner yielding significant program cost savings. It will also allow provinces and territories to exchange data between each other more effectively.

II.   THE PROJECT PERSPECTIVE

A.   General Context for the NRS Pilot Project

4.   To understand how the NRS pilot has established a foundation that can be built upon, the following illustrative model is proposed to explain the layered nature of a national communications environment.

National Communications Model
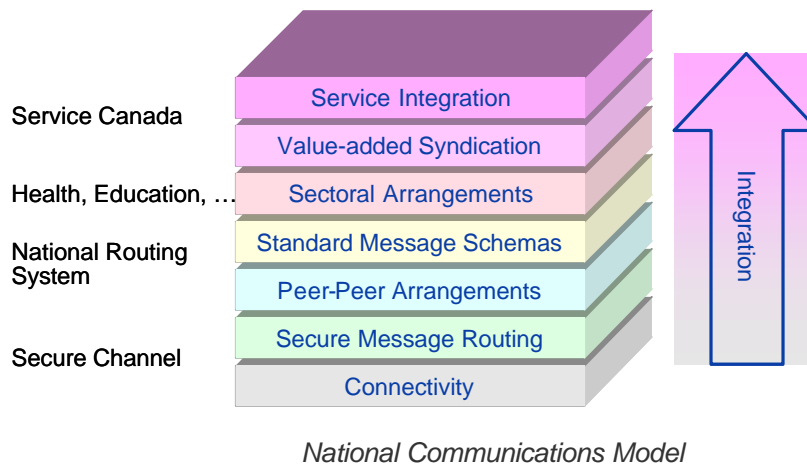
5.   The layers represent increasing degrees of integration, with each layer building on the one below it in terms of capability and in terms of mutual trust among the communities and jurisdictions involved. At the bottom is the Internet, connecting the citizen and businesses to the institutions and governments that serve them. In its basic form the Internet is an untrusted medium that is significantly enhanced by the services of Secure Channel. A particular service developed in the context of the NRS pilot is the Secure Message Routing Service (SMRS) that guarantees the integrity and confidentiality of transactions using a full PKI capability. These characteristics are fundamental to building trust at the higher levels.

6.   The National Routing System represents the next stage in integration by establishing peer-peer agreements and by standardizing the content of messages concerning Vital Events (births, deaths and marriages). Although this paper will focus on Vital Events data, the same foundation could be used by other sectors such as health, education, transportation or trade. The opportunities are only constrained by the time taken to reach agreement on data standards within these sectors.

7.   Further integration, beyond peer-peer exchange of mutually understood and agreed data messages, will come from some form of syndication. Organizations such as Service Canada are negotiating comprehensive agreements with other jurisdictions, not just to exchange data but also to add value by combining information and integrating services. At these higher levels the communication model is described by a hub-spoke metaphor, though there may be multiple hubs to serve parallel agendas.

8.   The strength of a layered model is that it supports simultaneously many useful channels of information sharing for different participants. It is agnostic with respect to jurisdiction and information domain and can accommodate organizations at different stages of information maturity. Even in a world where all levels of this model were implemented, and significant value was being gained from service integration, there would still be applications using only the lower layers. For example, Statistics Canada deals with data partners in many sectors that are outside the service agenda.

B.   History and Funding

9.   The vital statistics organization (VSO) of each province and territory (P/T) within Canada operates its own system of business processes and IT applications to support the collection and management of vital event data (births, deaths, marriages, stillbirths, and legal changes of name) as well as the issuance of vital event registration certificates. Each of these business systems provides vital event data (under federal/provincial agreements) to Statistics Canada (STC). In addition, inter-jurisdictional agreements between the provinces and

territories facilitate the exchange of vital event data between P/T jurisdictions where the exchange is relevant to the operation of another jurisdiction.

10.   The Vital Statistics Council for Canada (VSCC) had recognized that a number of business benefits could be obtained by taking a national approach to the routing of vital event information between the provinces, territories, STC, and other third party organizations such as the Canada Revenue Agency (CRA). These benefits include:

- An improvement in the usefulness of vital event information, resulting in the possibility of improved health care;

- A significant reduction in the time needed to share vital event information between the provincial and territorial VSOs, STC, CRA, and other authorized third parties;

- A reduction in fraud (vital event data is used to authenticate identity);

- A reduction in costs associated with the recovery of benefit overpayments; and

- A reduction in operational costs.

11.   In 2003, Health Statistics Division (HSD) of Statistics Canada undertook a project to research the options available for improving the timeliness and the efficiency of capturing, processing, and exchanging vital event information amongst the members of the Vital Statistics Council for Canada and with third parties such as CRA. This project produced a report entitled "National Vital Event Routing Project: Implementation Options". The report recommended that the National Vital Event Routing System (NAVERS), as it was then known, be constructed in phases starting with the development of a pilot system.

12.   In parallel, the events of September 11, 2001 in the United States had caused Passport Canada (PPTC) to review its current passport application process. The review identified a need to strengthen the integrity of the Canadian passport by adding additional levels of scrutiny to the application review process. One way this was to be achieved was through the electronic validation, in real-time, of all Provincial/Territorial birth certificates provided as proof of Canadian citizenship.

13.   The synergy among Statistics Canada, Passport Canada and the Canada Revenue Agency, along with the VSOs of Alberta and British Columbia, was cemented by the availability of federal funding under Government On-Line (GOL). This partnership agreed to demonstrate the feasibility of a merged solution named the National Routing System through a pilot initiative. Other federal departments and agencies which receive vital event data also expressed interest in signing on to the NRS Project that, when it is fully implemented, will provide a strategic information resource for health, demographic, security, identity, and social program integration.

14.   The pilot would gather information related to the costs, benefits, and viability of a national system. On January 23, 2004, the Treasury Board Senior Advisory Committee – Information Management Sub-Committee (TIMS) recommended the funding approval for the NRS pilot project. An amount of $3,500,000 over fiscal years 2004-2005 and 2005-2006 was sourced from funds chargeable to the respective votes of Statistics Canada, the Canada Revenue Agency, and Foreign Affairs Canada. An additional amount of $625,800 over fiscal years 2004-2005 and 2005-2006 was funded by departmental contributions. In October 2004, an additional $200,000 was made available to cover some of the costs associated with making use of the Secure Channel and its Secure Message Routing Service. The total allocated for the Pilot was $4,325,800.

15.   The NRS pilot project was executed over a two-year timeframe that began on April 1, 2004 and ended on March 31, 2006.

C.   Project Objectives and Scope

16.   A fully implemented NRS is envisioned as a secure communications network that will link together the VSOs of the provinces and territories and federal departments and agencies for the purpose of providing real-time exchange of vital event information. This information flow is essential to authenticate identity, to

determine program eligibility and entitlement to benefits, and to update vital event databases. It will also enable improvements in data quality, timeliness, and cost effectiveness for statistical and administrative programs that are based on vital event information.

17.　　The objectives of the NRS Pilot Initiative were:

- To ascertain whether or not the NRS is a viable and feasible concept that can be implemented nationally to securely and reliably exchange vital event data between the P/Ts, and between the P/Ts and federal partners; and

- To gain experience in the implementation of messaging systems technology in a multi-jurisdictional environment through a limited proof of concept project.

18.　　To meet the objective of assessing the viability and feasibility of the NRS in the long term, the Pilot was designed to:
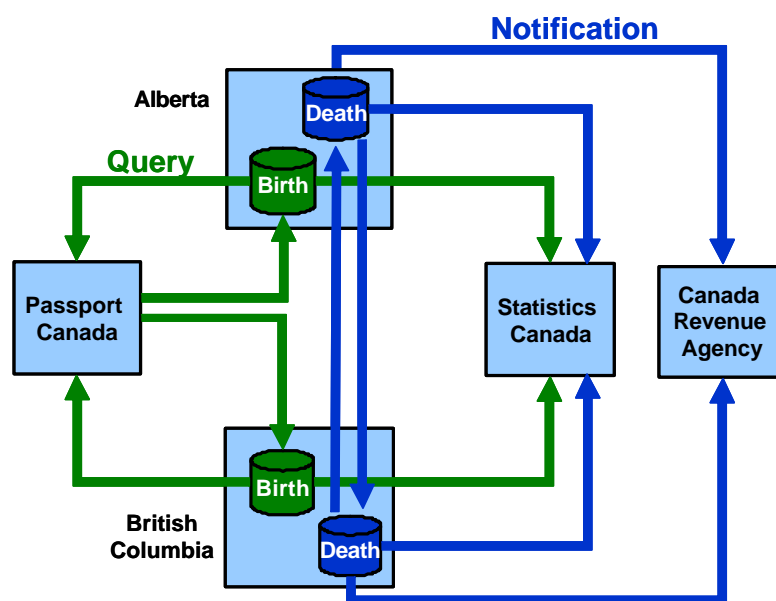
- Evaluate the technical issues related to the NRS;

- Make design recommendations for the full NRS;

- Evaluate the effect of the NRS on vital event data quality;

- Assess the impact of the NRS on existing business processes;

- Quantify the costs of a full implementation of the NRS;

- Quantify the downstream benefits and potential of the NRS;

- Determine if the NRS contributes to the improvement of personal identification authentication and integrity; and

- Evaluate the degree to which the NRS would aid participating organizations in achieving their respective mandates.

19.　　The scope of the NRS Pilot Initiative consisted of the work required to set up and test a network connecting two vital event data provider organizations (AVSA and BCVSA) and three vital event data consumer organizations (STC, CRA, and PPTC). This included the necessary hardware and software required to ensure that the information could flow in a secure manner and according to the standards agreed upon by the partners.

20.　　Two discrete methods of exchanging vital event data were demonstrated by the NRS pilot:

- *Notification*: The two participating VSOs of Alberta and British Columbia, along with STC and CRA demonstrated the feasibility of sending and receiving vital event information. STC and CRA have different requirements for the frequency of receipt and for the level of detail (set of variables); and

- *Query*: PPTC demonstrated the feasibility of querying a VSO's vital event database, in real-time, to ascertain the authenticity of birth certificate information provided for program (i.e. passport) entitlement. PPTC is keenly interested in this functionality as it is deemed a passport security priority.

21.　　The NRS Pilot Initiative was limited to exchanging only two types of vital event information: birth record information (to support the notification *and* query functions) and death record information (to support the notification function).

Notification

Query

Alberta

Death

Birth

Passport
Canada

Statistics
Canada

Canada
Revenue
Agency

Birth

British
Columbia

Death

NRS Pilot Data Flows

22.　The infrastructure and systems put in place for the Pilot were intended for the use of the Pilot alone and were not to be designed with the intent of rolling it into a production environment. (This was a decision of the NRS Pilot Steering Committee.) It was understood by all the partners that the level of effort required to create a production-ready system is much greater from every perspective.

D.　Project Assumptions and Constraints

23.　In conceptualizing the NRS Pilot Initiative, the participating partners made the following assumptions or dealt with the following constraints:

- An effective inter-departmental and inter-jurisdictional governance structure would be put in place to ensure an effective delivery of the NRS pilot;

- The NRS Pilot Initiative would be implemented in one site for each participating partner;

- A common technical interface for all participating federal departments would be developed to interface with the two P/T vital statistics organizations;

- The NRS Pilot Initiative would run in parallel with existing processes. This meant that the pilot site provinces would continue to send data to federal departments/agencies in the usual manner throughout the pilot test period. While this may have resulted in duplication of effort, it mitigated the risks associated with a pilot and the uncertainty that usually surrounds one;

- The NRS Pilot Initiative was constrained in the routing solutions it could consider and agreed to use the Secure Message Routing Service (SMRS). In opting for the SMRS, it was assumed that Secure Channel would be able to provide the functionality required by the NRS Pilot Initiative (including the ability to act as a "blind message router" and the ability to provide open-standards-based secure and reliable messaging) within the specified time and cost constraints. In addition, this functionality as provided by Secure Channel would meet the business and technical requirements identified by the NRS pilot project team.

E.　Additional Benefits of Implementing the Long Term NRS

24.　Through the NRS, the provincial and territorial VSOs will be able to provide vital event information in near real-time to authorized federal departments. Vital event information will be transmitted in standard formats, and will be validated before sending, thus improving both data quality and timeliness. The NRS will enhance document integrity, reduce entitlement fraud, and reduce overpayments upon death of the beneficiary,

resulting in potentially significant debt avoidance and protection of public funds. The NRS will ensure that the data is transferred following established rules and security protocols, thus protecting the privacy of Canadians.

25.   The NRS query functionality will allow all birth certificate information submitted as part of the passport application process to be verified. This will result in a higher degree of confidence that the documents submitted as part of a passport application are valid and legitimate. The NRS query functionality will also allow the submission of other types of vital event queries by NRS participants.

26.   The NRS notification functionality will allow CRA to be notified earlier of death events. This will result in significant debt avoidance and protection of public funds in CRA's major benefit and credit programs, most notably the Canada Child Tax Benefit (CCTB) and the Goods and Services/Harmonized Sales Tax (GST/HST) Credit, and indirectly in a significant number of P/T programs associated with the CCTB and with the GST/HST credit. The notification functionality will allow Statistics Canada to receive vital event data in a more timely fashion and in a standard format, resulting in savings through reduced processing time as well as data quality improvements. Health and demographic analysis programs will also benefit from a more timely and accurate national database.

27.   There are benefits to be gained from including the other vital events. For example, marriages (to identify spousal entitlements), stillbirths (health analysis), and legal name change (identity purposes) in the NRS. It will also be necessary to integrate identity information coming from Citizenship and Immigration Canada for new Canadians and landed immigrants.

III.   GOVERNANCE STRUCTURE

28.   The inter-jurisdictional nature of the NRS Pilot presented many challenges and the fact that the project was completed on-time and within budget in such a multi-faceted and geographically distributed environment is a significant credit to the project teams and management. In the view of the authors, better governance mechanisms or models are required for this kind of initiative if success is to be assured.

Oversight structure for the NRS Pilot
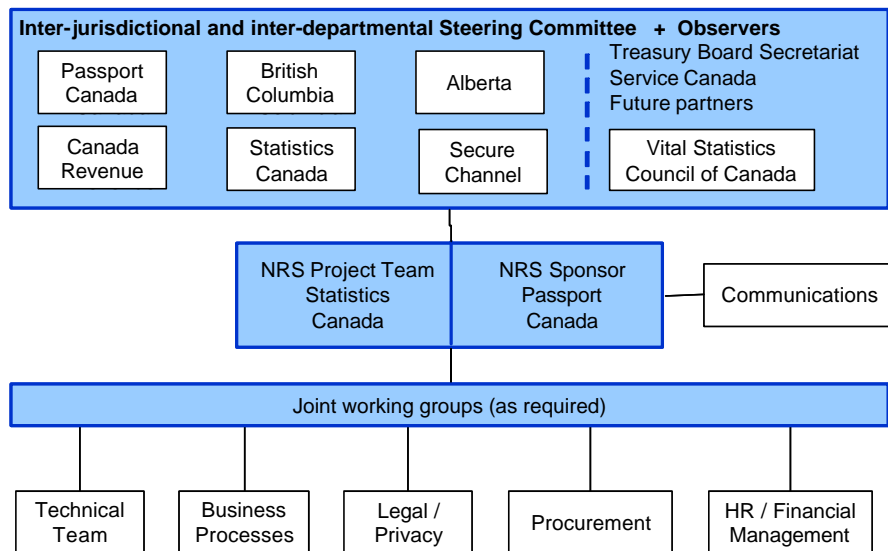
29.   By *governance* we mean the decision structures surrounding the project, not the integrated project team itself. The governance issues relate to jurisdiction (legislative and legal), policy (program strategy and constraints), accountability (responsibility and liability) and funding. Adding to this complexity are the many "small-p" political and personal agendas that interact with the project and that can undermine trust and motivation.

30.   The steering committee included senior management representatives from all the stakeholders, both present and future. This proved to be top-heavy and ineffective from the perspective of project oversight. It required significant effort from the project level to keep stakeholders informed and the project received little guidance. The key contributor throughout was the Vital Statistics Council of Canada (VSCC), which had originally envisaged the project and maintained common objectives and solid relationships among the data suppliers for several years. However, the VSCC is not a legal entity so it could not be the formal project owner.

31.   When similar projects are undertaken in the future it is recommended that a stronger governance structure be put in place. Clear decisions need to be taken with respect to policy and program strategy (preferably in advance of project initiation) and a single legal entity with the authority to direct the project. This controlling entity should be knowledgeable about the required program outcomes and accountable for delivering them. Because the initiative is inter-jurisdictional, a consortium (including commercial components where appropriate) might be a way to simplify the legal structure.

IV.   DATA STANDARDS AND FLOWS
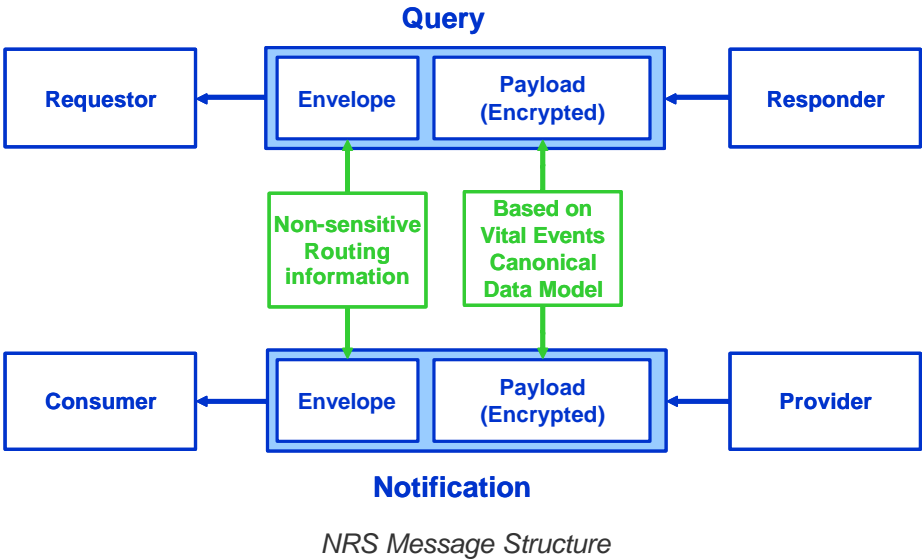
A.   Taxonomy and Model
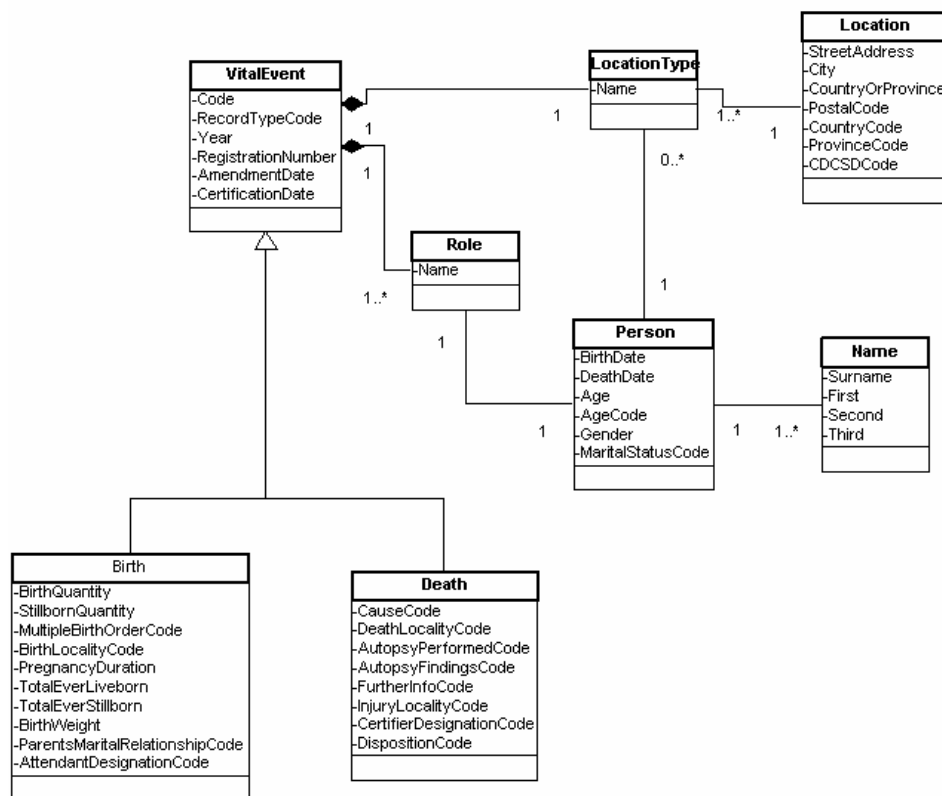
Vital Event Canonical Data Model

32.   National Statistical Offices are often in a unique position with respect to negotiating common data exchange standards because they have had long-term relationships with data providers and with international standardization bodies. In Canada, where the provinces and territories have the legislative mandate for certain sectors (health, education, justice …) within the federal framework, it is often the case that administrative systems develop independently in each jurisdiction and there may be political resistance to harmonization. Statistics Canada, because of its political independence, plays a key role in resolving data standardization issues at a national level even though the major benefits accrue to other federal agencies.

33.   In addition to the possible content of data exchanges, it was also important to standardize the specific message structures and expected semantics of the exchanges. Because the NRS is a peer-peer exchange it was

necessary to accommodate differing needs for each organization (different data elements for example) and respect different agreements on what data could be exchanged.

Query

| Requestor | ← | Envelope | Payload (Encrypted) | ← | Responder |

| | | Non-sensitive Routing information | Based on Vital Events Canonical Data Model | | |

| Consumer | ← | Envelope | Payload (Encrypted) | ← | Provider |

Notification

NRS Message Structure

34.   In the case of the NRS, Statistics Canada's long association with the Vital Statistics Council of Canada was instrumental in reaching agreement on the data model (XML Schema) and taxonomy associated with Vital Events data. This is referred to as the Vital Event Canonical Data Model (VECDM) and is shown above. A *canonical data model* is a data model that is independent of any specific application, but whose names (taxonomy) and formats can be mapped from any application-specific data model.

35.   The following are definitions extracted from the NRS common terminology that apply to this initiative:

Provider	The party that owns the vital event information for which it has an agreement to share, via the system, with other NRS participants (*Consumers*).
Consumer	The party that uses the vital event information provided, via the system, by the vital event information owner (*Provider*) according to a Memorandum of Understanding or Letter of Intent (MOU or LOI) between the parties.
Requestor	The party that, on an as needed basis, queries an owner of vital event information (*Responder*) about a very specific vital event, for either information validation or actual vital event information. A Requestor is a specific type of Consumer.
Responder	The party that, on demand, supplies a *Requestor* with either validation information or actual vital event information about a very specific vital event. A Responder is a specific type of Provider.
Message	This refers to the entire electronic transmission of one communication to an NRS partner. For the NRS, the term *message* and the more precise term *ebXML message* have the same meaning. A message is comprised of two distinct parts: the *envelope* and the *payload*.
Envelope	The *envelope* is the portion of the message that is used to aid in the transmission, routing, authorization, authentication, and validation of the message. SSL encryption is used for the transport layer and allows mutual authentication between the provider to SMRS and from SMRS to the consumer.
Payload	The *payload* is the portion of the message that contains the business

data that is being transmitted as part of the message. For the Pilot, the business data being transmitted is vital event information. The payload is encrypted for the ultimate consumer and cannot be accessed by any intermediate broker.

ebXML (ebMS)	This is the standard protocol adopted by the NRS to exchange messages
Secure Channel (SMRS)	The Secure Message Routing Service acts as a blind broker – it does not decrypt the message payload. The provider credentials and the consumer service id contained in the message header are used for authentication, authorization and ultimately to route the message to the consumer.

B.   Notification Data Flow

36.   Each provider created a middle layer between the Pilot routing component and their backend systems in order to minimize the impact of the routing component on their production environment. This middle layer queues information/events to control the flow of information and to allow for updates to records before they are sent out. After an event is registered by the provider, it can stay in the queue between one hour and five days depending on the event and province.

37.   After the built-in delay a process runs to build the XML payload for each consumer based on rules reflected in the MOU agreements. ORACLE's B2B software does schema validation, encryption, handles retries, sends acknowledgements, and sends the data through Secure Channel SMRS to the consumer. STC uses *Sybase WSI* to decrypt the record and Canada Revenue Agency uses *Entrust*.

38.   The two provinces exchange complete out-of-province death records. Statistics Canada receives most of the fields created in the registration of births and deaths. Canada Revenue Agency receives only a limited number of fields from each death record.

39.   Once a notification is delivered an acknowledgement is sent back to the provider. Reliability is ensured because retries of notification messages continue until an acknowledgement is received.

C.   Query Data Flow

40.   Data extracted from the passport application system are encrypted using Sybase WSI which constructs the query based on rules reflected in the MOU, encrypts, handles retries, sends acknowledgements, and sends the data through Secure Channel SMRS to the provider. Schema validation is not done for queries.

41.   Once a query is delivered to Alberta and British Columbia, an acknowledgement is returned to Passport Canada. Retries continue until the acknowledgement is received to ensure reliability.

42.   The provider returns flags on each queried field to indicate matches and non-matches. Query data as well as flags and birth event/certificate status information are returned in encrypted format.

43.   For queries sent to Alberta an immediate response is returned to PPTC indicating the status of flags. Passport Canada provides the initial adjudication (if required) with follow up with Alberta.

44.   For queries sent to British Columbia an immediate final response is sent back to PPTC only if all fields match. In the case of discrepancies British Columbia will send an interim response and will adjudicate discrepancies between the query data and the data in the database prior to sending a final response.

V.   CONCLUSIONS

45.   The National Routing System Pilot has been an unqualified success. Technical, legal and policy barriers were overcome to deliver a solution within budget that has been in operation for nine months. The

chief technical challenge was to achieve interoperability between software from different vendors. By working with vendors the project team was able to ensure that each organization was able to participate with software of their choice. Legal issues arose in settling liability and accountability among the participants, as well as in resolving differences in operating legislation or policy. On two separate occasions, policy waivers were put into place to allow the project to continue.

46.   The timeliness and standardization of the data have met expectations. Receipt of information through the NRS pilot reduced the gap between the date of death and notification of the event to CRA from weeks to days. Statistics Canada found that the processing and analysis of the data was simplified because each province provided their records in the same format which enabled the reuse of Statistics Canada computer programs.

47.   An unexpected but not altogether surprising result from the Pilot is the impact on data quality. Passport Office (PPTC) quickly uncovered keying errors when submitting queries for verification and the provinces discovered records with unexpected values in their databases. This will lead to improvements in data quality assurance processes throughout the country.

48.   The NRS Pilot project ended on March 31, 2006. By that time, over 200,000 messages had been routed. The success of the project cannot, however, be only judged by the quantity of information that is exchanged. The success of the Pilot is the demonstration that six (five data partners and the Secure Channel services) diverse departments and agencies with different cultures, standards and requirements can work cooperatively towards a common goal.

49.   A further indication of the success of the pilot is that partners are continuing the exchange of data beyond the official project end date. Interim funding from Passport Canada has allowed the project to continue while a detailed business case is developed in support of a full funding request to Treasury Board. This business case will include a cost-benefit analysis for all provinces, territories and federal departments that will participate in the NRS. Negotiations have begun to add another federal department and another provincial agency during the interim phase in order to maintain the momentum and expertise developed during the pilot. A full funding decision is expected late in 2006 or early 2007.