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THE BmTS: CREATING A NEW BUSINESS MODEL FOR A NATIONAL STATISTICAL OFFICE OF THE 21ST CENTURY

Invited Paper

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Abstract: Like many National Statistical Offices around the world, Statistics New Zealand faces a number of 'external' and 'internal' challenges in the years ahead. In response to these challenges, Statistics New Zealand embarked upon the Business Model Transformation Strategy (BmTS). Two key architectural elements of the BmTS are the Ten Component Information Model and the utilisation of a Service Orientated Architecture. Statistics New Zealand has seen good progress on these elements with many aspects being in production now and the remaining expected by early 2008.

I. INTRODUCTION

1. Like many National Statistical Offices around the world, Statistics New Zealand faces a number of 'external' and 'internal' challenges in the years ahead. 'External' challenges include: the need to minimise respondent burden, improve timeliness of existing data releases, improve 'time to market' for new data releases, increased use of administrative data, and better access to data (incl. micro-data) by users. While 'internal' challenges include: provide a better work environment for staff, replace an ageing IT platform & application toolset, measure 'value for money' for the New Zealand tax-payer, develop a platform to support future growth. In response to these growing demands, Statistics New Zealand developed its Business model Transformation Strategy (BmTS). The BmTS programme was started in July 2004, three years on we have largely developed the 'core platform' and see a positive way forward. This paper outlines some key architectural directions and progress.

2. The paper starts with some background material, including scope and benefit statements. The paper then briefly outlines the generic Business Process Model and Architectural Models implemented. Following this the paper discusses what we have achieved, including some details on our 'core' prototype solution. Finally, some lessons learned and conclusions.

Goals of the BmTS

3. The BmTS is aimed at delivering a number of benefits to Statistics New Zealand, and provide a solid basis for growth and development, through:

(a) Abstracting the business users and their business processes from the underlying data structures and database systems, moving our statistical staff up the analytical 'value' chain and providing an environment that would facilitate the more challenging data integration and data analysis necessary to meet the increasingly complex policy and research needs of government and the wider research community.
(b) Creating the flexibility to respond to changes in user needs and demands, to make use of new data sources or methods and to provide a flexible range of information access methods; while also providing the ability to more easily match and confront data in order to increase the quality of Statistics NZ information.
(c) Reducing the time to design, build and process information sources, providing more time for analytical and dissemination processes.
(d) Building a professional environment that creates a more satisfying working experience.
(e) Increasing the use of administrative data, reducing the number of individual collections or the need for new collections to create new statistics.
(f) Providing a standard environment and uniform systems that will allow staff to quickly get up to speed with new subject matter. This will also simplify the migration of data and systems as underlying technologies change, while reducing the maintenance cost of separate subject matter systems.
(g) Standardising the skills sets and professional development costs of our staff.
(h) Utilising a smaller number of larger projects that are more likely to have a real rate of return through the reuse of the investment in a number of business areas.
(i) Allowing Statistics NZ to provide standard information management tools and services for official statistical purposes.

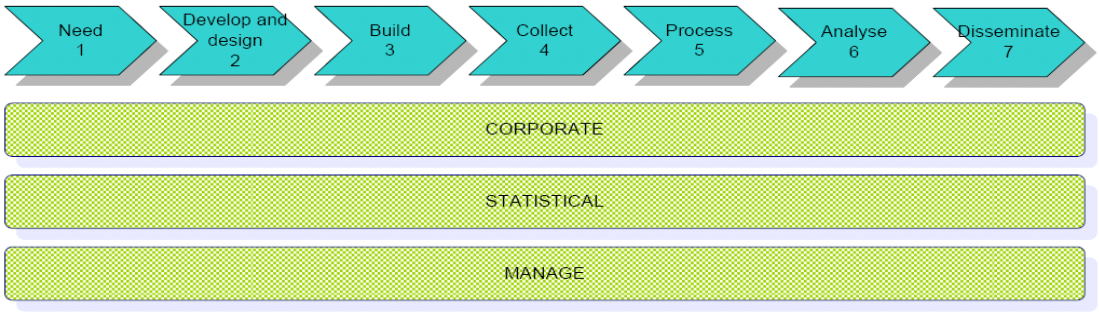
4. Out of the strategy has also emerged a formal, visible governance and decision-making framework (including programme / project governance and leadership model) for making future investment decisions and design choices. The result will be that at key decision points, it will be possible to balance programme/project imperatives (the need to deliver specific results on time and within budget) against the longer-term needs of the wider organisation, and to resolve conflicts between the two.

5. One of the major outcomes of the BmTS is the design and build of a “platform” on which future programmes and projects undertaken by Statistics NZ will be founded. In order to be successful there are four fundamental elements that are seen as critical to the creation of a new business environment for Statistics NZ. These are:

(a) A corporate view of Statistics NZ's data resource to prevail over a collection or even subject specific view.
(b) A robust metadata environment that supports the full lifecycle of Statistics NZ created data (an end to end view of data) and will facilitate the implementation of a national archive.
(c) The definition of a set of generic business processes that will be supported by standard technology environments, that provide the flexibility to adapt to new statistical requirements.
(d) An organisational structure is created that supports the appropriate balance of data management across the Official Statistical System and the specific needs of the various internal business areas and external researchers.

A Generic Business Process Model

6. Statistics NZ's generic 'as is' Business Process Model (gBPM) consists of seven key stages - from the identification of a need at one end, through to the dissemination of statistical outputs to meet that need at the other end. The target end to end model that the BmTS aims to operationalise will focus our resources on the Need, Analyse and Disseminate stages, and reduce the resources spent on the intervening stages (Design, Build, Collect, and Process) once these have been rationalised, streamlined and standardised.



7. The model, shown above, is split into two parts. These are the:
   - Statistical gBPM made up of the operational processes shown by seven teal chevrons, and
   - Infrastructure processes shown by three green bars.

8. The statistical gBPM is Statistics NZ's end-to-end statistical business process. It is known as our statistical value chain: from the identification of a statistical need at one end, through to the dissemination of statistical outputs to meet that need at the other. These processes are generic, across Statistics NZ, down to the sub-process level for all statistical collections and outputs. Some processes are also generic down to the activity level.

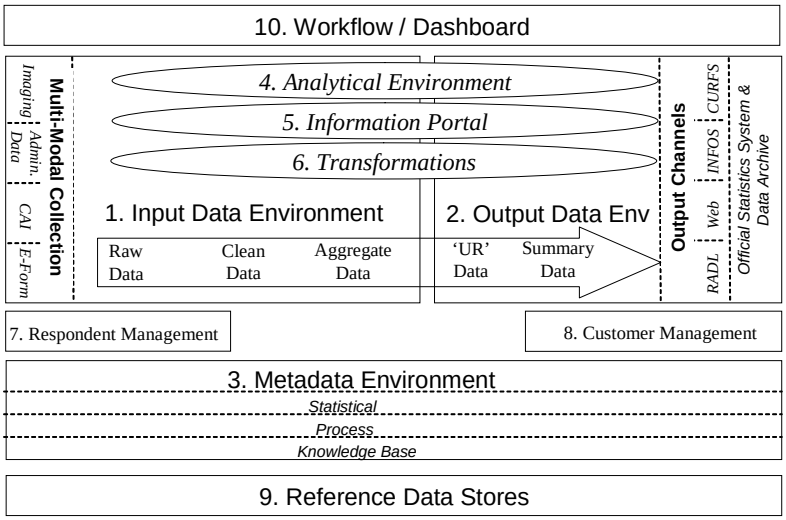
9. The three infrastructure processes support the operational processes. They are on-going processes that Statistics NZ needs, to operate and function as a business.

10. The definition of this model is critical to the identification of the architecture services (encompassing infrastructure, solution, information, data and security) that are required to ensure that the delivery of these services will support the core business of Statistics NZ

Information Architecture

11. Critical to embarking on an architecture journey is the need to define and agree the value chain and hence the core business of the organisation and to understand the required Information Architecture. Statistics NZ was in the fortunate position that, in 2004, this was already underway and whilst not detailed to a very granular level the core components of the gBPM were defined and significant work was being undertaken in defining the Information Architecture.

12. Throughout 2004 and 2005 the following information model was defined for Statistics NZ. The model presents a conceptual view of the ten key business components that are required to make operational the new end-to-end business model sought by Statistics NZ. These components were developed to enable us to deliver on the organisational key strategies, as outlined in the organisational ‘Statement of Intent’, and the broad objectives of the BmTS. This model is used to provide context and design decisions for the BmTS.



A Service Orientated Approach

13. The introduction of Service Oriented Architecture (SOA) into Statistics NZ was the culmination of researching industry trends and evaluating those trends against the new technical challenges that were arising in response to the BmTS.

14. As outlined above, the BmTS has three core deliverables:
(a) A standard and generic end-to-end process or processes to collect, process, analyse and disseminate data (Value Chain).
(b) An approach to data management that is disciplined and consistent (Information Architecture).
(c) An agreed organisation-wide technical architecture as a framework for making system decisions.

15. To support the first two deliverables and to ensure that the third deliverable is achieved Statistics NZ has adopted a Service Oriented Architecture (SOA) approach. A SOA resolves the behaviour of the organisation's IT assets into a set of common behaviours or services. Services can be business services and technical services.

16. The SOA is a key enabler of BmTS exposing common services (business / statistical and technical) as an abstract, decoupled and consistent set of interfaces enabling the communization of as much of the process and data in Statistics NZ's core business. In addition, there are a number of benefits related to the incorporation of third party software; this includes off-the-shelf applications and providing and using services to and from other statistical agencies. Key aspects of the Statistics NZ SOA are that the consumer of the service can find and bind to services at runtime and the SOA extends to the development, deployment and management of services.

Metadata Driven Approach

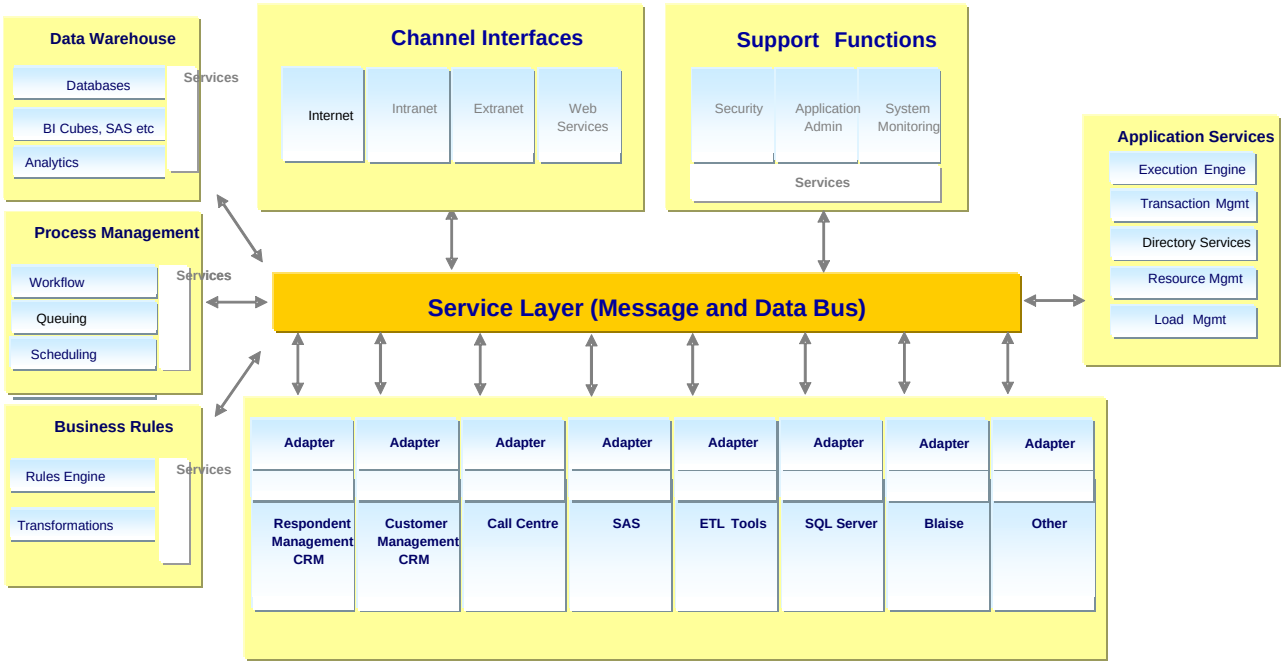
17. In order to achieve many of the desired benefits, metadata was seen as a key element to our strategy. A discussion of metadata in relation to Service Oriented Architecture takes on a slightly different perspective to usual metadata discussions and is taken from the perspective that all of the intellectual property and best practices (methodologies and models) utilised within a Statistical organisation, and in particular those methods and models which enable the translation of data to value added information, are metadata. Organisationally we have also made an explicit link between metadata and knowledge management.

18. The ability to specify and store this metadata once as a corporate resource, provide the ability to access and execute the metadata as enterprise services and abstract these services from any particular underlying data source or format to enable reuse, were key drivers behind Statistics NZ's decision to adopt SOA as an architectural concept.

Implementation of the Service Orientated Approach

19. Statistics NZ has been actively implementing statistical and architecture services (encompassing information, data, application, infrastructure and security) since early 2005. Implementation to date has been strongly focussed on the Collect and Process areas of the Statistics NZ gBPM, as the key benefit to the organisation is the ability to minimise the resource (time, cost and people) efforts currently expanded in these areas.

20. The following diagram depicts the SOA as currently being implemented within Statistics NZ.



What Have We Achieved?

21. Over the last three years there have been a lot of achievements. At the strategic level the following are a few key achievements:

(a) Strategy (White) papers & Broad Logical Design documents for the key components. These papers are now a practical starting point for development projects and represent a move away from silo systems. This is a huge change / paradigm shift for both business and service areas.
(b) BmTS Vision Document - provides a consolidated view of all business requirements as captured in the various BmTS White Papers and Broad Logical Design documents.
(c) Information & Technology Strategy – including a new architecture (described below).
(d) User Interface guide developed and utilised.
(e) Capability assessment (and shift) of Application Services (developers) to the new architecture.
(f) Project Management Framework established and supported through governance arrangements.
(g) Moving the technology development effort from collection projects to component teams and a corporate ‘core’ project team.

22. At a tactical / practical level, the following are a few key achievements:

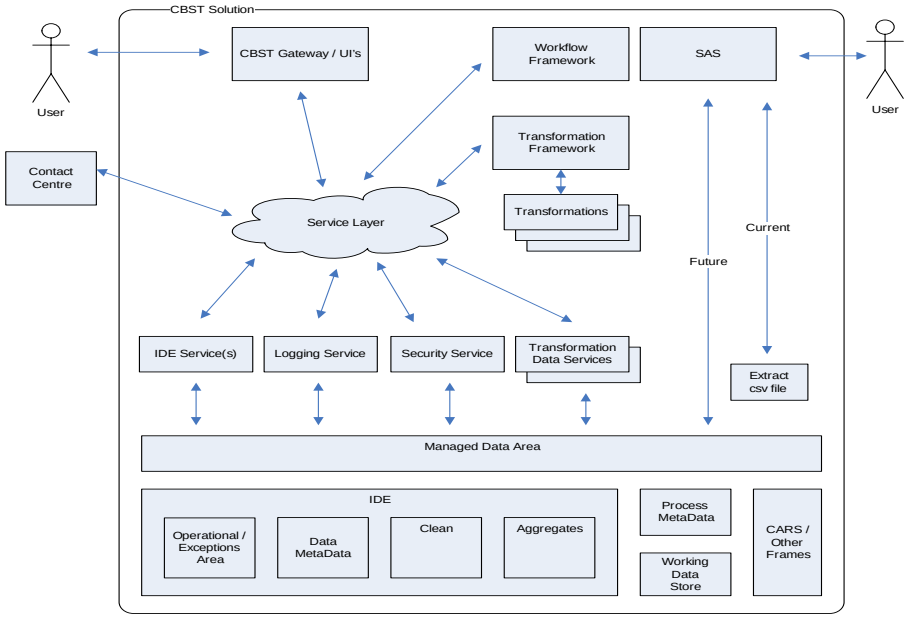
(a) Greater (and better) investment in infrastructure - capacity in dev / test environment set to triple by end of this financial year.
(b) Generic Business Process Model developed, agreed and used.
(c) Agreement on some standard transformation modules and purchasing some from other National Statistical Offices (e.g. BANFF from Stats Canada).
(d) The reuse of components is happening - suggesting the model is really starting to work and take on momentum.
(e) Fact table approach to our data model for all input / unit record data contextualised by its metadata. Now utilised in the production of outputs.
(f) Proof of concept (in the National Accounts area) proved the metadata driven configuration of common workflows & integration of components works and the transparency & visibility of the interim data states.
(g) Prototype solution that instantiates dissemination products.
(h) A standardised 'collection' phase in production, including multi-modal collection, telephony & CRM technology to manage the survey collection life-cycle.
(i) Core (prototype) model completed from 'collect' to 'clean'.

"Core (prototype) model completed from 'collect' to 'clean'" delivery – further explanation

23. In October 2006 it was decided to bring together a (small) team, comprising developers, architects, subject matter experts and statistical methodologists to focus on delivering a prototype solution that took data from the 'load' area of the Input Data Environment through to a 'clean' state. This team was a result of the need to create an architectural model that could be used as a 'cookie cutter' going forward – a key part of their work was the integration of work that was being developed across the programme. The team was specifically brought together as 'experts' in their particular area.

24. In addition to the development of the prototype solution, the aims of this work also included the development of staff to take the ensuing projects forward.

25. In early February, the team delivered a working prototype solution. The diagram below depicts the solution that was delivered.



26. The key elements of the delivery included:
(a) Confirming the design of how transformations / workflow and data fit together.

(b) Extract data from the IDE v2 of both business & social data sources into a SAS dataset to enable analysis.
(c) Apply a data life-cycle approach to either business or social data sources (where applicable) being processed through:
    (i) Standard wrappers working for one SAS program and one C# program (effectively treating them as 'black boxes').
    (ii) BANFF (an imputation tool, written in SAS, from Statistics Canada).
    (iii) Weighting process - either an existing weighting module or GREGWT.
    (iv) Data being extracted and post-processed (micro-edited) through Blaise.
(d) Developed a Transformation Framework (cradle) to support transformations.
(e) Used workflow, coupled with a Dashboard, to drive the transformations.
(f) Creation of 'clean' data area and 'aggregate' data area (as defined in the BmTS IDE White paper), supported through a ‘managed data service layer’.
(g) Strengthened the web services based Service Layer to support all the necessary messaging, logging, security etc. elements.
(h) Resolve the following issues:
    (v) Speed of integration of new transformations into the platform.
    (vi) Loading of metadata.
    (vii) Extent of metadata needed to support the components.
    (viii) Complexity of designs - more KISS principle.
    (ix) Unit Record data management within the SOA.
    (x) K2 (workflow tool) and the Service Layer fitting together in an efficient manner.
    (xi) The potential use of SAS EG in association with K2.
    (xii) Modify the Security Model to meet the current business requirements.

27. At the same time as this development work was being undertaken we were visited by Bryan Fitzpatrick (IT Consultant, ONS / ABS), who made some suggestions about how to communicate the philosophies outlined at the Strategic level at the tactical level.

28. Since completing the above prototype, we have also applied the same model to a single time series (National Accounts) transformation, based on time series data - we just pointed the Service Layer at a different data adaptor and used a different transformation to those used in the end-to-end 'processing' prototype.

29. As a result of this work there is a growing level of comfort within the business and technical areas of the architecture and business model transformation strategy – this is evidenced through the explicit allocation of corporate funds into the 2007/08 and out-year financial plans.

Architecture – Lessons Learnt

30. The lessons we have learned are the following:
(a) The adoption and implementation of SOA as a Statistical Information Architecture requires a significant mind shift from data processing to enabling enterprise business processes through the delivery of enterprise services.
(b) Expecting delivery of generic services from input / output specific projects leads to significant tensions, particularly in relation to added scope elements within fixed resource schedules.
(c) Delivery of business services at the same time as developing and delivering the underlying architecture services adds significant complexity to implementation.
(d) Skilled resources, familiar with SOA concepts and application are very difficult to recruit, and equally difficult to grow.
(e) Without significant governance it is very easy to start with a generic service concept and yet still deliver a silo solution.
(f) The move from ‘silo systems’ to a BmTS type model is a major challenge that should not be under-estimated.
(g) Do not expect to get it 100% right the very first time.

Architecture – Conclusions

31. In conclusion:

(a) Service Oriented Architecture has the ability to support the needs of a Statistical Information Architecture as long as the implementing organisation has completed the pre-requisites of business process modelling (i.e. identified and agreed the value chain) and determined the information architecture which will support the business model.

(b) Undertaking the Service Oriented Architecture journey is not something agencies should undertake without significant preparation and planning and it is recommended that the underlying architecture services are developed and implemented prior to the development and implementation of business services.

(c) While Statistics New Zealand is only partially through its implementation (it will take almost another nine years to complete), Statistics New Zealand definitely sees the approach we are taking as providing the benefits desired, including re-usability and a platform to build upon.
