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**EUROPEAN COMMISSION
STATISTICAL OFFICE OF THE
EUROPEAN UNION (EUROSTAT)**

**ORGANISATION FOR ECONOMIC COOPERATION
AND DEVELOPMENT (OECD)
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ECONOMIC AND SOCIAL COMMISSION
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Topic (i): Architecture

Building Organisational Capability for Plug and Play

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I. Introduction

1. National statistical organisations are confronted with a range of challenges driven by client demands for new and innovative statistical products, improved data quality, delivered faster and at less cost. Equally, there are demands to reduce the costs of information provision and potential for new, vast sources of information to be tapped. These expectations, demands and opportunities are brought into sharp relief by a background of on-going budget constraints.
2. Like other NSOs, the Australia Bureau of Statistics (ABS) is looking to meet these challenges through transformation of its business. The ABS 2017 Program has been established to radically transform the way ABS collects, collates, manages, uses, reuses and disseminates statistical information. It will drive a standards based, enterprise approach to transformation through investment in its statistical information infrastructure and the re-engineering and unification of business processes. The aspiration is to transform the ABS into a business where new end-to-end statistical processes are largely assembled and configured by business users pulling together components of the statistical process in a plug and play manner.
3. This paper outlines the journey ABS has embarked upon from previous ways of working to the new paradigm of a highly industrialised, interoperable world where new statistical products are assembled from modular components and business processes. It describes some of the key success criteria and challenges to establish supporting capabilities that will enable the transformation - new governance structures and investment processes, partnerships between business and ICT teams, Enterprise and Service Oriented Architecture principles, development practices, and so on.
4. The paper also provides a contextual overview on how ABS's ICT division must itself transform, and work with business groups in order to ensure that new, modular capabilities take into account all elements of the organisation's (enterprise) architecture - business, information, application and infrastructure. The paper describes the approach and some of the key initiatives to architecture development in the context of 'Plug N Play' capability.

II. ABS Transformation

A. Driving Organisation Change

5. The challenges facing national and international statistical systems are well documented^{1, 2, 4, 5, 6, 7}. The Australian Bureau of Statistics (ABS) responded to these challenges with the establishment of the Information Management Transformation Program (IMTP) in 2010² which has subsequently been carried forward into the ABS 2017 Transformation Program³.

6. The ABS 2017 Transformation Program was established in February 2012, as a separate organisational group, reporting to a Deputy Australian Statistician. The rationale behind this re-structure was recognising, in order to transform, we need to have a major impetus to get started while at the same time continuing to deliver our on-going statistical and services work program. Quarantining the work being done to deliver the ABS of the future from our business as usual (BAU) minimises the risk and pressure on our existing work program (which is large, complex, and growing).

By quarantining and consolidating the major change initiatives, we provide a greater impetus for change and greater integration of all of the change elements.

7. The key goals of the ABS 2017 Transformation Program are:

- To reduce the cost and time of delivering ABS business;
- Grow ABS business through new statistical products and services; and
- Deliver a fully digital Census (2016) on time, to budget and quality.

A number of cost cutting projects have been centralised under the ABS 2017 program.

8. Investment in ABS's statistical and information management infrastructure will deliver significant additional benefits that will be essential to our ability to fulfil our role as Australia's national statistical agency over coming decades.

These benefits include:

- A more sophisticated data acquisition platform from which the full value of the strategic data assets held by Federal and State/Territory Departments can be more cost-effectively realised.
- An increased data integration capability that will enable the ABS to become a significant integration authority for Federal and State/Territory Governments. The resulting and primarily longitudinal and time series data will enable policy makers to better understand the cost-effectiveness of key investments.
- An increased emphasis and capability in the areas of analysis and better interpretation of data for users.
- Greater and faster access to ABS data and in particular micro-data for evidence-based policymaking.

9. Initial key priorities for the ABS 2017 program include developing fundamental infrastructure required for the ABS vision; operationalizing some of this infrastructure with early adopters; building

[1] Brian Pink, Jenine Borowik & Geoff Lee, *The case for an international statistical innovation program –Transforming national and international statistics systems*, Statistical Journal of the IAOS: Journal of the International Association for Official Statistics, IOS Press, <http://iospress.metapress.com/content/2h5764574t6318r4/>

[2] <http://www.unecce.org/fileadmin/DAM/stats/documents/ece/ces/ge.50/2011/wp.10.e.pdf>

[3] http://www.unecce.org/fileadmin/DAM/stats/documents/ece/ces/ge.50/2012/15_Australia.pdf

[4] <http://www.unecce.org/fileadmin/DAM/stats/documents/ece/ces/ge.50/2011/wp.5.e.pdf>

[5] <http://www.unecce.org/fileadmin/DAM/stats/documents/ece/ces/ge.50/2011/wp.3.e.pdf>

[6] <http://www.unecce.org/fileadmin/DAM/stats/documents/ece/ces/ge.50/2011/wp.13.e.pdf>

[7] <http://www1.unecce.org/stat/platform/display/hlgbas/Strategic+vision+of+the+High-level+group+for+strategic+developments+in+business+architecture+in+statistics>

enterprise level online collection (eCollection) capability for ABS household and business collections; transforming the 2016 Census business model; and transforming the receipt and load of administrative data.

10. The ABS is preparing a business case to submit to Government for proposed funding for the Transformation Program. In the meantime, progress towards transformation is limited to availability of internal funds. A program of strategic engagement with key stakeholders in Commonwealth government is being undertaken to support the funding bid.

11. Developing the capabilities within an organisation to successfully deliver organisation transformation on the scale envisaged is, in itself, a significant challenge. Supporting capabilities and change management initiatives include:

- A Program Management Office (PMO), containing functions that will support the successful delivery of re-engineered business processes, methods and tools to the ABS.
- Comprehensive change management and communication strategies to fully engage and positively influence staff.
- Development of an Enterprise Architecture (EA) reviewing our current business, and identifying the ABS's future state.
- Sustained international collaboration for the adoption of statistical standards and models.
- Workforce sourcing and development strategies to build and develop the capabilities for the future.
- New governance structures for strategic investment prioritisation, design and delivery. See table 1.

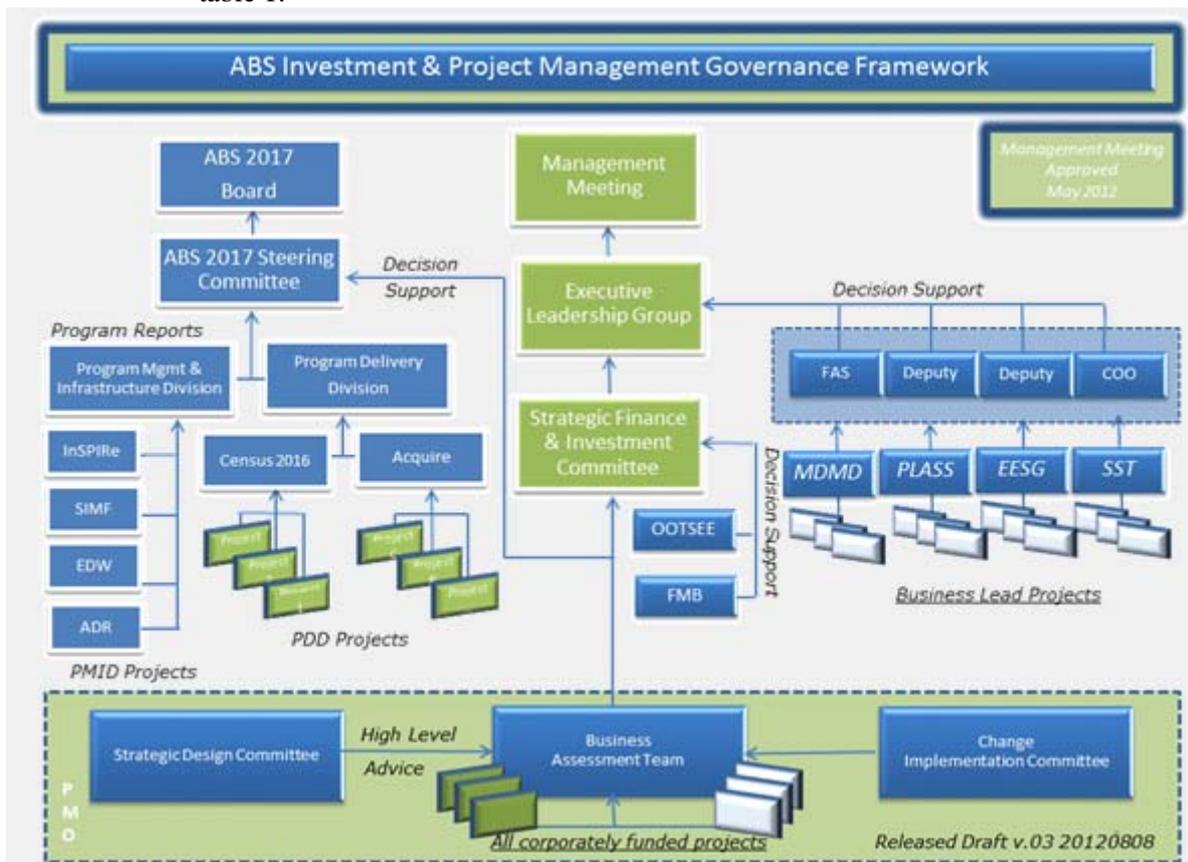


Table 1

12. Continued focus and effective governance is required to balance the transformation effort while maintaining high quality business-as-usual activities.

The ABS recognises that our transformation program is vital to Australia's statistical future, but also

acknowledges that our current ‘business-as-usual’ statistical program is the foundation of our reputation and value. Protecting and valuing this core part of our business is a key component of our success.

B. ICT Environment and challenges

13. The ABS has been well served by technology services for many years and recognised as a leader in the efficient use of technology for business benefit. Cross government benchmarking reviews have highlighted the ABS’s progressive approach to cost effective technology infrastructure deployment, e.g. server virtualisation.

14. However, there has been no additional funding for technology infrastructure investment for well over a decade. The approach to application development has mirrored and supported a separate and siloed business approach to individual surveys and statistical products. The current application portfolio consists of a large number of in-house developed silo applications. This aging technology environment is siloed, fragile, inflexible and increasingly costly to maintain or modify. Indeed, a significant amount of our statistical capability is tied up in maintaining this fragile system.

15. At the same time, the world has become far larger, more complex, volatile and interconnected and as such measuring real world changes has become significantly more challenging. Our users are facing more complex economic, social and environment problems that require the capability to quickly bring together and integrate data over time from a range of both new and existing sources. Our current technology environment, that has served us well in the past, is increasingly not up to the challenges of meeting user expectations in a rapidly changing and expanding ‘big data’ world. Furthermore, generating productivity savings required to meet increasing labour costs and tight budgetary constraints is not possible.

16. The Technology Services Division (TSD) in the ABS is responding to these challenges, working in partnership with the ABS 2017 Transformation Program Group and business subject matter areas to create the ABS of the future.

Whilst defining, developing and delivering the **new** technology environment for the ABS of the future, it was also necessary to review the way in which ICT was managed within the ABS. This resulted in a significant change in approach – in effect an ICT Change program to **deliver** the ABS Transformation Program.

17. The new approach to the strategic management of ICT within the ABS has progressed changes covering:

The Business Model of ICT

- Role of TSD in strategic ICT leadership.
- Roles and expectations of business leaders in the governance and application of ICT, in partnership with TSD.
- Strong governance and decision making for ICT investment priorities, aligned within organisation governance frameworks.
- Updated funding and financial management models for ICT

The Technology Services Division

- TSD Structure aligned to the new ABS organisation structure and priorities.
- Development of ICT Policies, strategies and technology directions to support ABS transformation and the changing role of the ABS.

- Development of capabilities and new skills to architect, design, deliver and support enterprise solutions within a Service Orientated Architecture (SOA) approach.

18. The challenges for TSD (and for the ABS) are to manage the balance across a range of competing requirements and priorities:

- Strategically architected enterprise solutions vs. business imperatives for rapid implementation.
- Effective support for business as usual on-going statistical programs vs. strategic ICT investment.
- Integration and bridge between the 'old' (current) and new technology environment.
- Developing new technology skills and capabilities whilst managing risks across the current environment.

III. Plug 'N' Play

A. Architectural Approach

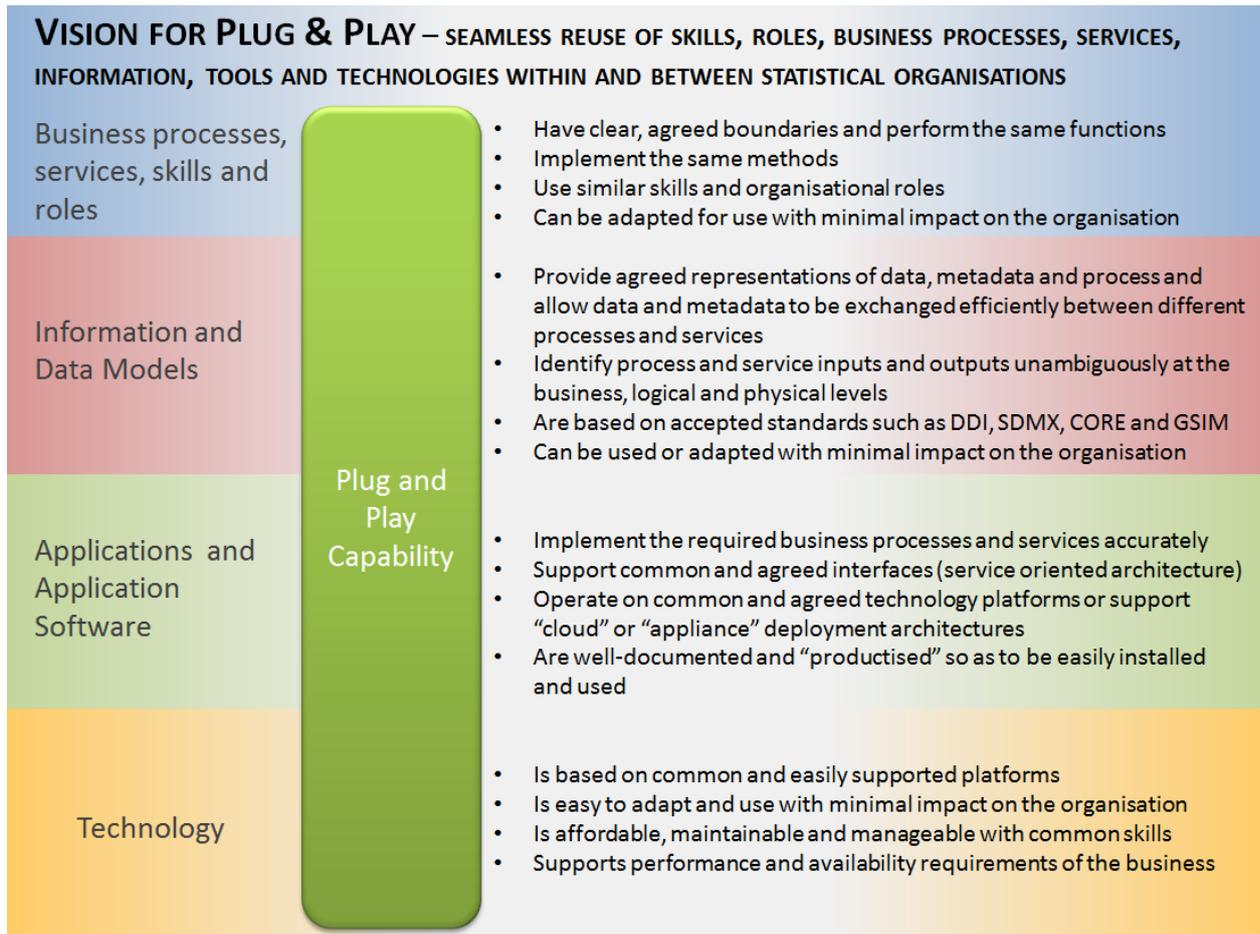
19. A component can be said to be 'plug and play' if it can replace another component without any disruption of the surrounding pieces. A plug and play environment is created when we can substitute D into ABC to make ADC without disrupting A and C.

20. We should recognise in practice that pluggability is not purely an attribute of B and D. A and C themselves need to be built so as to be able to interact with B, D and others. In other words, just having one pluggable component is not enough. The entire end-to-end environment needs to be pluggable.

21. In the general case, a component will be pluggable if it is able to:

- Accept input from all its candidate predecessors and provide output to all its candidate successors
- Work within an end-to-end orchestration environment in which it is invoked as a service.

We can map this to The Open Group Architecture Framework (TOGAF) domains as follows:



B. Development Challenges

22. The conditions, processes and architectural standards to support a modular approach to development based on flexible assembly of reusable and shareable metadata driven components is described in the ABS paper ‘Platform for International Collaboration’.²

23. The concept of plug and play is illustrated well in the development and marketing of “Apps” for an iPhone or a piece of software for a home/work PC which runs Windows (like Word, Photoshop or a game). You download the App and install it on your iPhone/PC and it just works. It works because the foundation blocks that Apps are built upon, known as operating systems, are very tightly controlled. Examples of operating systems are IOS for Apple devices and Windows for Microsoft.

24. However, where underpinning operating systems (i.e. foundation blocks) are different the development of software for ‘plug n play’ is more challenging. This is the case with large organisations (including large statistical organisations), where at the server end, the operating systems vary (Windows, Unix, different versions of Linux). In considering development of plug-and-play components, international statistical organisations will need to make strategic choices. Do they build sharable components/apps for one

² http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.50/2012/20_Australia.pdf

platform or for all? And to what extent can the international statistical community all largely agree on what platforms to develop for?

There are two options:

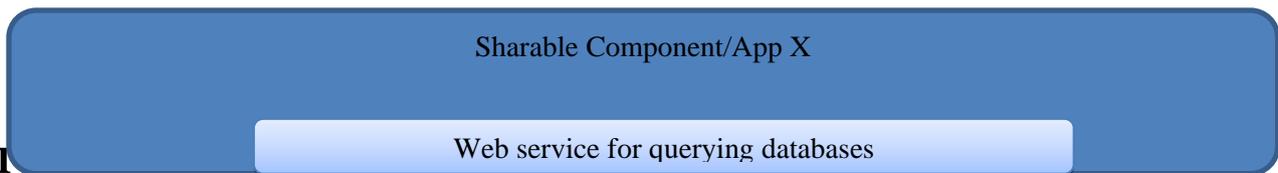
- (i) We build sharable components/apps to interface with the most common building blocks organisations are likely to use e.g. Oracle, MSSQL, Postgres in the database space, SAS, R in the analytical space.
- (ii) We build sharable components/apps that have standards based interfaces.

Option 1 vs. Option 2 illustration

Option 1: Different organisations decide that sharable component/App X needs to talk to Oracle, MSSQL, MySQL, Notes and PostGRES databases. Code to connect to each of these has to be built into the sharable code (let's call them "connectors"). Any organisation using these database technologies could then relatively easily plug the sharable component/app into their existing database systems using the connectors.



Option 2: Organisations agree that the best approach is to provide a standard web service interface to the code for accessing databases. Each agency would then need to build translators that could read the web service and translate it into code that their database tools can run.



A. Enterprise Architecture

25. In 2010, the Bureau of the Conference of European Statisticians created the High-Level Group for Strategic Developments in Business Architecture in Statistics. The High-Level group developed a vision paper³ to provide the necessary coordination and strategic direction to the many international initiatives currently working on related topics, including the Statistical Network. In 2011, The High-Level group commissioned a workshop of many groups interested in various aspects of business architecture for statistics.⁴

26. The ABS has outlined the themes of metadata, process, architecture, and collaboration as a deliberate confluence, dominating ABS business and architecture strategy.⁵

27. The Technology Services Division has been working in partnership with the ABS 2017 Transformation Program Office in the development of the ABS Enterprise Architecture. ICT involvement in the development, promotion and use of the Business and Information architectures has helped inform the Applications and Technology Architecture development.

28. Most recent work on the Applications Architecture has been focused on three areas:

- Applications Architecture Taxonomy - a plan of what logical applications we would need to support the business; like a town plan for the applications.

³ <http://www1.unece.org/stat/platform/display/hlgbas/Strategic+Vision>

⁴ <http://www1.unece.org/stat/platform/display/hlgbas/Workshop+on+Strategic+Developments+in+Business+Architecture+in+Statistics>

⁵ <http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.50/2010/wp.3.e.pdf>

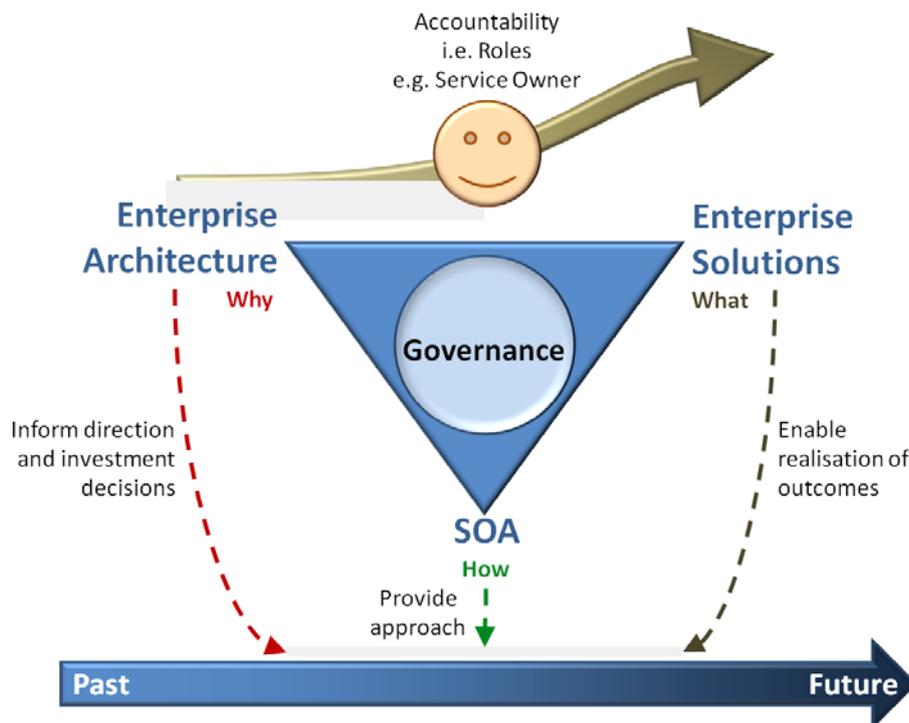
- Applications Portfolio and Roadmap - health assessment of the current catalogue of applications, the pipeline of new applications, archive of decommissioned applications, and the roadmap of what should change when.
- Applications Reference Model - patterns, practices and standards that describe the way applications should be built.

29. In the Technology Architecture space, an ABS Technology Architecture paper has been produced. This outlines the broad categories of technologies in use (or potentially in use) in the ABS. Next steps are to update technology roadmaps, identify gaps and opportunities for rationalisation, and map relationships between technologies and applications.

B. Service Oriented Architecture and Enterprise Solutions.

30. Service-oriented architecture (SOA) has moved beyond hype to widespread acceptance as an IT strategy for delivering business value. SOA promotes the notion of modularity, providing overwhelming flexibility and superior economics for addressing business demands. However, undertaking the transformation to SOA is not without its challenges. If left unchecked, your inventory of SOA assets will become unmanageable; the reuse of services will diminish in favour of custom development; or even worse, modifications will be made to your existing services that break other business processes. The purpose of SOA governance is to help ensure that this does not happen.

31. Enterprise Architecture, Enterprise Solutions and Service Orientated Architecture work together:



32. The development of 'Plug N Play' enterprise solutions with a Services Oriented Architecture yields a number of benefits:

- Increased agility in the face of change: avoids "system" lock-in; can change a bit at a time; and external "services" used as they emerge.

- Improved operating efficiency: Less manual processes and an implementation – agnostic paradigm to facilitate greater reuse = less programming, testing and training and maintenance, and a faster release to production.
- Reduced cost of doing business: a new survey can be “assembled” using existing services.

33. Experience to date indicates many legacy applications contain components that can be made to like “services”.

34. Some of the challenges include:

- Governance Design and oversight: Are they being developed to standards; Are they meeting their SLAs; What changes are planned;
- Defining and establishing who owns the Business Services? Typically this is not an end-to-end process, e.g.: a slice through different collections, requiring buy-in across different business areas;
- Who pays upfront costs of initial investment, shared services, ongoing maintenance?
- Performance; Business (meets business need); Technical (reliable, maintainable); Security (International Standards for SOA Security, Oracle IAM); Granularity (Too many or too few services); Single Point of Failure (Have back up to “single points”)
- Different organisational behaviour, with more cross team collaboration, information sharing, and firmer decision-making.
- Greater complexity (more moving parts) requires robust services, simple rules for a complex environment, and strong compliance.

35. Moving from a bespoke, siloed systems approach to one of designing and delivering Enterprise Solutions is a major transition requiring significant and sustained commitment of resources. It is not just a business transition: business processes and services to deliver statistical capabilities, but IT services aligned to business services integrated across the technology environment. New skills and capabilities, new development practices and tools, and an on-going program of change management, education and communication are pre-requisites to success.

36. Some realities to face with Enterprise Solutions:

- Business Benefits are usually delivered over the long term. These include increased agility in the face of change, improved operating efficiency, and reduced cost of doing business.
- Down sides are evident in the short term: upfront costs to establish base, and develop capabilities, changes of organisational culture, process and approach.

37. In developing new ICT capabilities for building Enterprise Solutions a number of projects and initiatives have progressed. These include:

- SOA governance and roles
- SOA Principles and Policies
- An SOA competency centre and Test Centre
- An SOA services catalogue
- Developing architectural ‘prototypes’ using a vertical slice across projects, and a wrapping services prototype – exposing legacy systems as web series.

38. Enterprise Solutions Workshops have been held to progress these initiatives, with aims of: establishing governance processes and key standards; - through to attempting to find answers to developer level problems, such as establishing best practice guidelines for creating Web services, designing a series of tutorials to help Web services “newbies” get started, understanding how and when to use DDI in the ABS, and determining how to manage security for services oriented architecture.

C. Maturity Matrices

39. The ABS is using Enterprise Solution Architecture Maturity Matrices as a means to assess, progress and manage activities. These are based on the concepts used by the (US) National Association of State Chief Information Officers (NASCIO) Enterprise Architecture (EA) Maturity Model and Software Engineering Institute (SEI) framework, as referred to the Open Group.

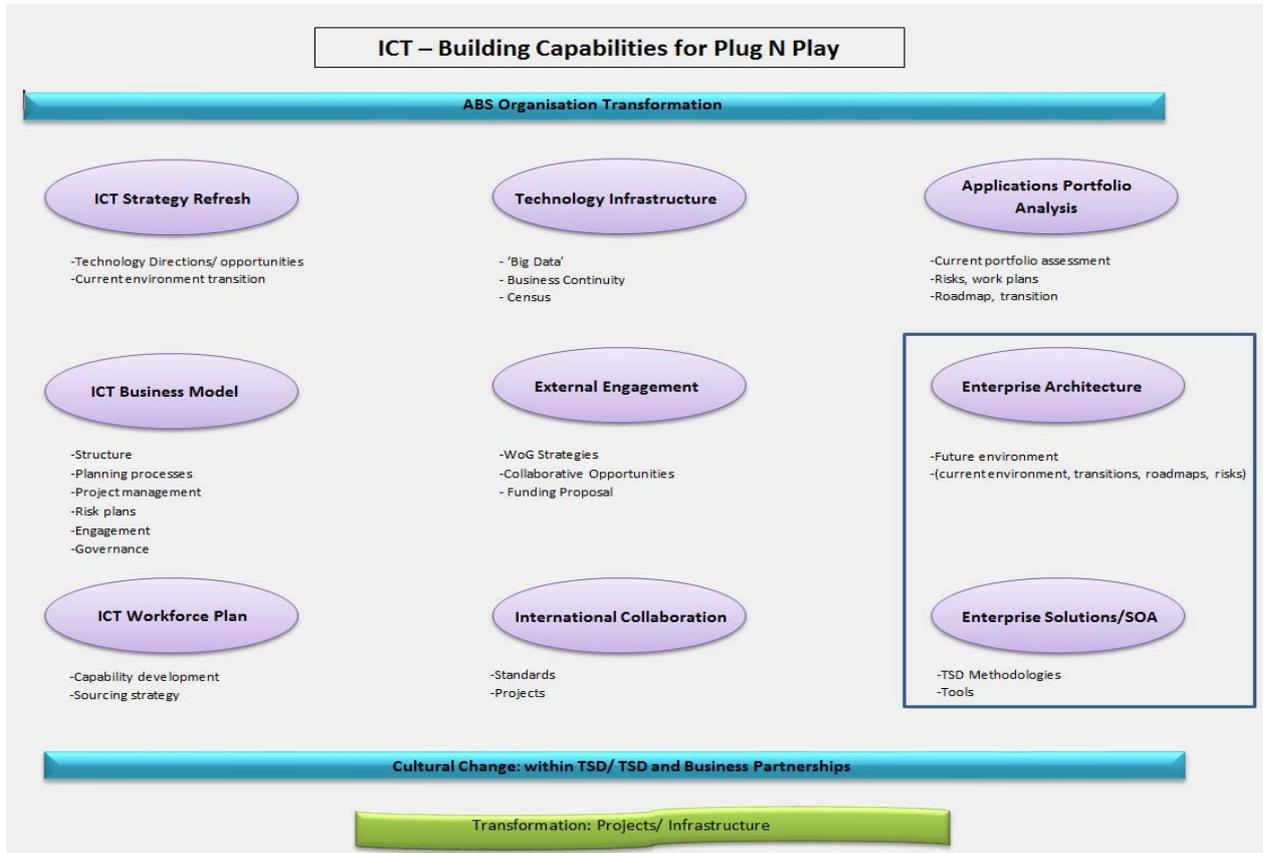
40. The Maturity Domains are:

Domain	Description	Impact on Enterprise Solutions
Enterprise Architecture	EA as a whole and not the sum of its parts	Provides the high level vision, goals, and objectives with associated strategy and tactics that steers IT directions
Business Architecture	Business aspects & practices	Provides clarity of business needs in consistent and relatable terms for IT developments
Information Architecture	Information in all forms and levels	Provides clear guidance and standards for semantic, canonical, logical, and physical entity modelling, transmission and translation. Sets common standards for information types, instances, and attributes.
Applications Architecture	All applications that provide business functionality	Provides directions and standards for COTS, GOTS, & bespoke.
Technology Architecture	All platforms that stack up to support running of applications	Provides directions and standards for all software and hardware.
Service Oriented Architecture	The transition and continuity of SOA as part of the IT strategy	Provides focused direction and standards for adoption and ongoing use of SOA.
Security Architecture	As a whole across all of EA	Provides direction and standards for Business; Info; Apps; and Technology domains.
Governance Architecture	Overall management and governance of governance processes and practices	Ensures ongoing effectiveness of compliance in all domains.

41. The Maturity Dimensions by which domain can be evaluated are:

V. ICT – Leading & Enabling Transformation

43. Architectural development and building ICT capabilities for ‘Plug N Play’ enterprise solutions are critical components to ABS transformation. These strands are interwoven across a broad range of key ICT initiatives:



44. A contemporary ABS ICT Strategy is critical for the ABS Transformation program, which requires a continued focus on innovative technology to realising outcomes. The ICT strategy is a key component of guidance and input to the ABS business case seeking funding for transformation. The ICT strategy also provides the framework to guide investment decisions, particularly when there are, trade-offs and interim milestones to the future state.

45. Changes to the ICT Business Model need to be progressed and embedded in the processes and behaviours of the organisation: These include planning, governance and prioritisation of ICT investments; engagement; roles and responsibilities of technical and business leaders; and the organisation, structure and operations of the Technology Services Division.

46. ICT workforce plans address issues of ICT capacity and capability over the transformation journey. These set out the sourcing strategies, acquisition and development of new skills and capabilities that are required to develop, deliver and support the technology environment of the future. Maintaining technical and business system skills and knowledge relevant to the current environments is critical to manage risk and support on-going statistical programs.

47. Effective engagement with a broad range of Stakeholders continues to be both an important challenge and an opportunity. An active role in influencing and participating in whole of Government Technology Strategies and initiatives is both critical and expected. At the same time, it is essential to progress opportunities for collaborative development and re-use of technology infrastructure and solutions across the federal and state governments and the research sector to deal effectively with the requirements for data integration and analysis. Strategic engagement with key stakeholders across government is essential to support the funding bid for transformation and new and on-going statistical programs.

48. Work is in progress to develop Technology Infrastructure Strategies for foundation infrastructure services supporting the future state ABS, whilst addressing current business priorities. These include:

- Updated business continuity capabilities, including expansions in Data Centre and internet gateway facilities;
- Revisit the end user computing delivery model including enhanced support for remote access solutions and video conferencing;
- Infrastructure services to support the 2016 Population Census; and
- Shared infrastructure services for ABS 2017 program of work transformation projects.

49. The ABS is an influential contributor to International Statistical Collaboration. Strategic developments in Business Architecture in Statistics and development of commonly agreed standards are two critical components. The challenge is to move beyond simply a collaborative (“stand alone”) approach to development to co-design and co-develop.

50. An analysis of the current Applications Portfolio is underway, which assesses future business value and future technical fit. In determining alignment to the future directions of ABS (2017 transformation and ICT strategies), the assessment points to longer-term value strategies – invest, migrate, decommission. The applications portfolio analysis also shows business value from a risk and performance perspective, combining criteria from business and technology assessments- current criticality, reliability, skills availability etc. This provides indicators to levels of transitional support and transition roadmaps to the future state.

51. Strong Partnerships between the TSD and Statistical and Business leaders are critical to the successful delivery of on-going statistical programs and the ABS 2017 transformation program in an environment of significant change and financial pressure, and to initiate and embed cultural change. This includes:

- Shared vision and objectives, which balance an ongoing statistical program with an enterprise approach to transformation.
- A common understanding of the narrative that links ABS corporate priorities and ICT investments.
- Recognition of the changing role of statistical services in the external environment and their underpinning technology.
- Clear accountabilities and responsibilities.
- Strong underpinning governance and planning processes.
- Early engagement in identifying and addressing business issues and opportunities.

VI. Summary

52. Like other NSO’s, the ABS is faced with the challenges of increased client demands, reduced costs of information provision, and tapping new, vast sources of information in the digital age. The ABS 2017 program has been established to meet these challenges through business transformation.

53. The ABS Technology Services Division (TSD) must transform itself, building new skills and capabilities to play a leading role in organisational transformation. ICT Specialists must work in partnership with subject matter experts and methodologists, to build capabilities in support of component-based development and re-use.

54. Key success criteria and challenges are to establish the supporting capabilities that will enable transformation. These include: new governance structures and investment processes, development of Enterprise Architecture and Service Oriented Architecture polices, principles and processes, new development tools and practices, new workforce skills and capabilities, and a sustained cultural change program.