

# Enhancing Supply Chain Management with SOA and Web Services

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### Agenda

- • Who are we?
- What have we done?
  - Architecture
  - Integration Infrastructure
  - Projects
    - Electronic Proof of Delivery
    - Vehicle Inventory Update
- What have we learned?
  - Benefits
  - Business Challenges
  - Technical Challenges
- Where to from here?



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## Introduction to Toyota Motor Corporation of Australia

### Introduction

- TMCA is a fully-owned subsidiary of Toyota Motor Corporation
- Represents Toyota, Lexus and (until recently) Daihatsu brands in Australia
- Manufacturing plant in Melbourne – for Camry and Avalon
- Sales and Marketing based in Sydney

### 2004 Figures

- #1 market share in Australia, Holden #2, Ford #3
- Domestic Sales of 201,000 (both locally-manufactured and imported)
- Export Sales of 65,000 Camry units to mainly the Middle East
- Production of 114,000 (Camry and Avalon)
- 4700 employees
- 250+ dealerships
- \$7.5b revenue



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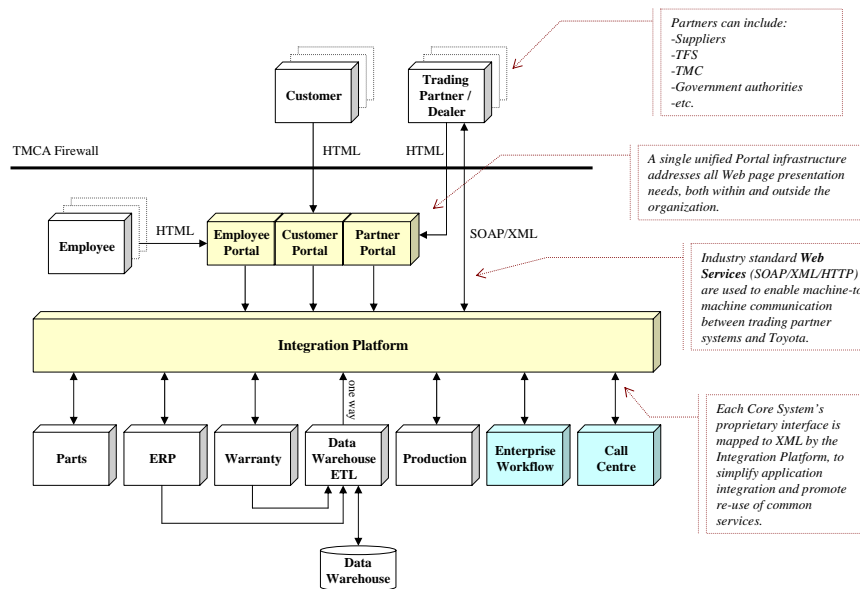
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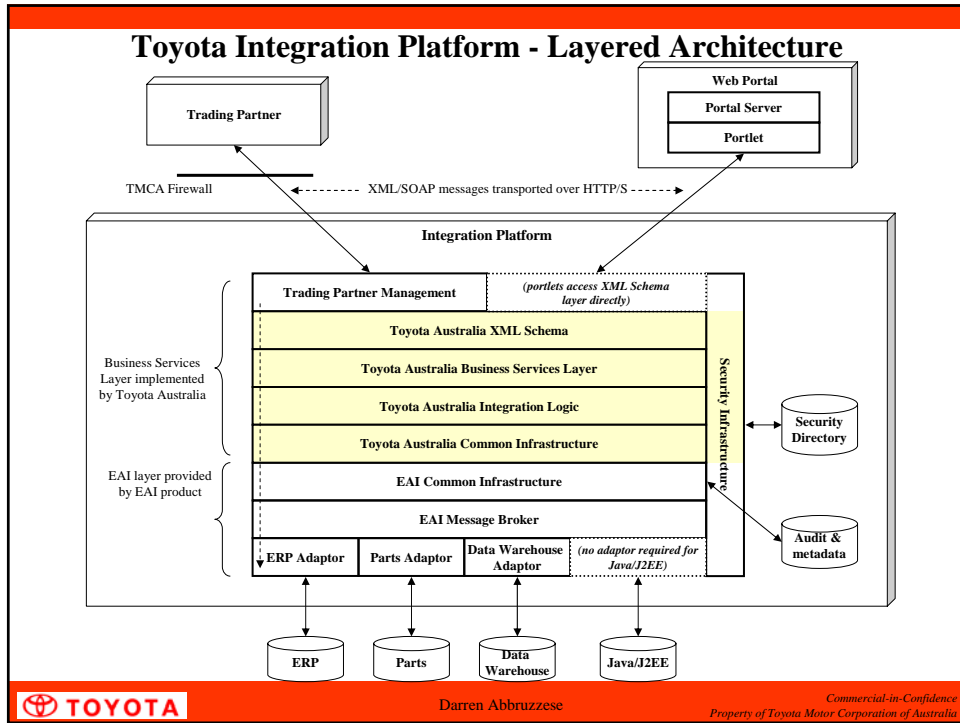
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## Why did we create an SOA?

- Reduce the large number of point-to-point IT solutions in Toyota
  - Lowers long term maintenance costs
  - Enables a scalable, resilient and secure architecture
- Reduce coupling between systems by using standard data formats
  - Easier to leverage existing data and business logic into new applications
- Develop common, reusable business services to:
  - Increase developer productivity
  - Reduce “time to market”
  - Allow Toyota to exploit new eBusiness opportunities
- Implement a standards-based architecture to support cost effective in-house or outsourced development, avoid vendor lock-in and allow choice of “best of breed” tools for both Toyota and its Trading Partners
- Build in-house knowledge and skills through consistent adoption of products and technologies, reducing the required breadth of skills, and reducing the reliance on numerous external suppliers

## Toyota IT Architecture Overview





### Is it really SOA?

- **Yes:**
  - Loosely-coupled
  - Coarse-grained
  - Asynchronous (mostly)
  - Self-contained
  - Inter-operable
- **No:**
  - Not discoverable
  - Not dynamically-bound

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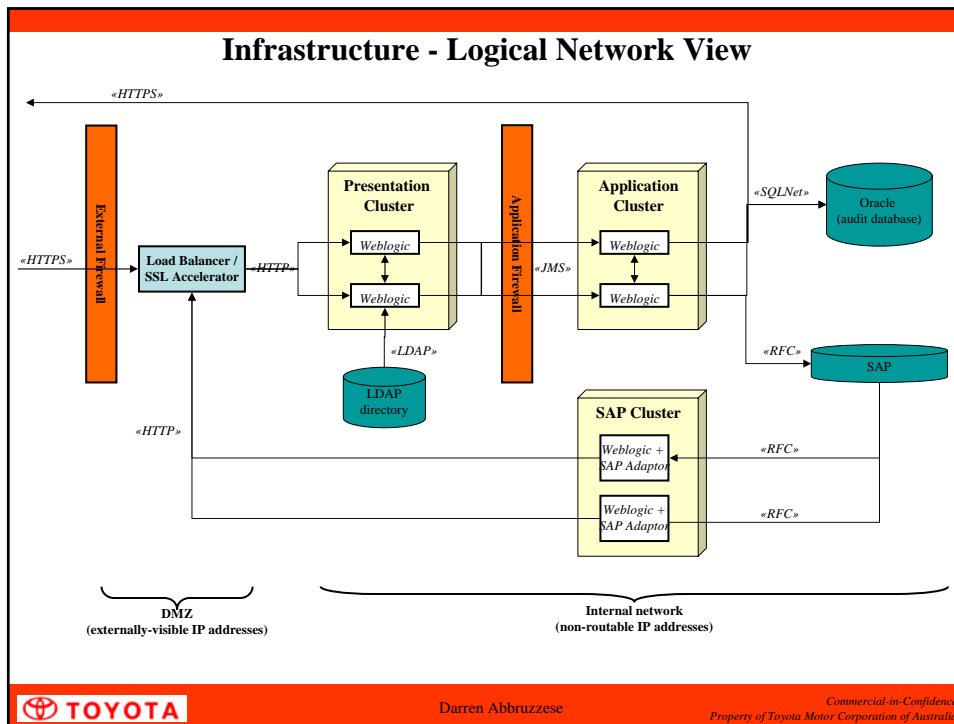
## What infrastructure have we built?

- Integration Platform consists of:
  - *iBus* (messaging infrastructure for Web Services, allowing XML/SOAP messages to be reliably exchanged between systems)
  - *Business Services* (the 'services' of the SOA)
  - *Web Application framework* (for building complex JSP-based user interfaces which utilise Business Services)
  - *Adaptors for Core Systems* (e.g. SAP)
  - *Common Framework* (re-usable services such as logging)
- Designed and implemented in-house
- Uses BEA Weblogic for J2EE infrastructure (result of an evaluation process of EAI products in 2002)
- All external interfaces are fully compliant with Web Services standards – no proprietary dependencies, no Java vs .NET



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- ### Hardware
- No single points of failure
  - Throughput of 80 TPS achieved at low cost
  - Clusters of low-cost commodity machines (rack-mount dual-CPU Intel servers)
  - Redhat Linux
  - High availability achieved through redundancy at each layer – rather than expensive hardware or OS clustering
  - Uses BEA Weblogic clustering technology
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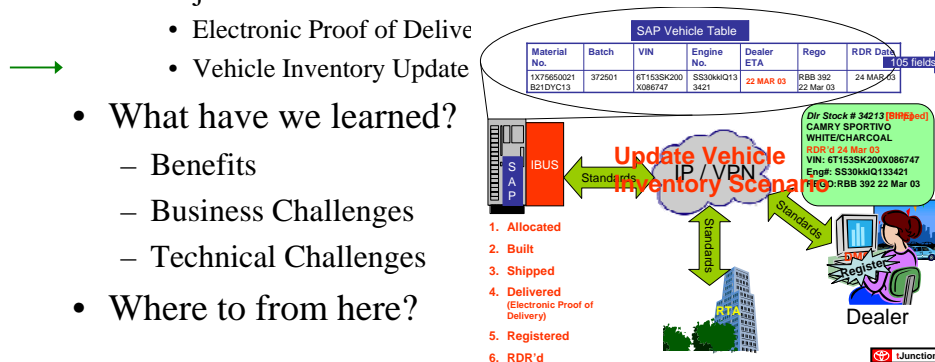


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## AutoDESA (Automotive Data Exchange Standards Australia)

- A voluntary, not-for-profit alliance of interested parties within the Australian automotive industry
- Purpose: to promote standardization of data interchange between automotive dealer management systems (DMS) and corporate manufacturer and distributor systems
- Benefits: efficiencies throughout automotive value chain through adoption of common standards
- Membership includes all major manufacturers, distributors and DMS vendors
- Data Dictionary sub-committee develops and approves XML schemas (e.g. vehicle inventory)



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## Benefits of SOA to TMCA

- Ability to rapidly and cost-effectively develop and deploy new applications to exploit business improvement opportunities
- Ability to integrate systems without requiring an expensive point-to-point solution: each successive integration becomes faster as we build up our services and framework
- Re-using our existing IT investment in Core Systems to enable new applications and to target new users
- Ability to interact with external parties in standards-based manner without developing custom solutions each time
- Avoiding lock-in to proprietary products
- Increasing in-house learning



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### **Business Challenges & Conclusions**

- Concentrate on business analysis before jumping into technology – fancy technology won't make up for the lack of a business case!
- Dealing with multiple external parties poses serious management challenges – can take far more time and cost on a project than actual technical implementation
- Need to agree on content of messages (e.g. how to represent a vehicle) not just transport (XML/SOAP) – this takes much longer; need commitment from all parties, hence AutoDESA
- Don't try to re-architect the whole enterprise at once – bite off small pieces where you can incrementally build up your architecture whilst delivering business benefit on a project-by-project basis



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### **Technical Challenges & Conclusions**

- Employ a small number of highly experienced practitioners who can guide your architecture and development - design is still "hard", leading-edge technologies do not take this away
- Build business services not just RPC Web Service wrappers
- Stick to open standards, even if it's harder than a out-of-the-box solution
- Be prepared for teething problems, "rolling your own" in some areas, and hand-holding partners, as this is new technology that is not fully mature – but don't be afraid, Web Services are here now and ready to be used for internal and external integration
- Make pragmatic decisions and build incrementally rather than trying to achieve the ideal SOA immediately
- Keep close track of emerging standards in this area
- Choose a vendor who is committed to following and actively driving industry standards



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## Where to from here?

- Make true re-use of business services to realise new opportunities
  - *Showroom system.* Expose core TMCA data to dealerships in order to market and sell vehicles more efficiently. Capture data from the dealerships in real-time to improve business decisions
  - *Company Fleet.* Re-use “vehicle” services to better manage the company fleet business.
- Start building larger scale, workflow based systems to integrate disparate parts of the business.
- Retire custom developments with third-party products as and when industry vendors catch up to the various Web Services specs.
- Educate and promote the benefits of SOA and web services to other Toyota affiliates.



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