A Comprehensive and Integrated Meta Model
Supporting Strategy, Business Architecture and Transformation

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Abstract:

Organisations need to change rapidly while ensuring good governance, meeting stakeholder goals, delighting customers, improving efficiency, avoiding risk and being good employers and corporate citizens. This requires a multi-faceted, holistic understanding of our current situation, what the future requires and formulating our path towards a desirable future state. Current business strategy approaches often ignore detail implications of setting goals and adopting new paradigms. Conversely, most enterprise architecture approaches are too inward looking and technology oriented, ignoring many of the contextual and business factors. The author and colleagues at Inspired have evolved a coherent approach to business architecture and enterprise transformation based upon a comprehensive and integrated meta model supporting holistic analysis and innovative decision making. The model bridges strategic planning, enterprise architecture and business analysis drawing from innovation practices, design thinking and strategy models. It has been applied at assurance, banking, services, telecommunications and retail organisations.

This paper describes the path to reaching the meta model, the model itself, and how it supports desirable, rapid and sustainable business transformation.

Keywords:

Business Architecture, Business Strategy, Enterprise Architecture, Meta Model, Business Transformation, Agility, Enterprise Engineering

The Role and Relevance of Meta Models

Organisations (including businesses) are under pressure to provide more value, better customer service, more transparent governance, greater efficiency and returns to shareholders while remaining good corporate citizens and employers[1]. This makes the role of executives very challenging. Add an environment which is increasingly volatile in terms of politics, social change, technology change, legislation, globalisation and disruptive competition and the demands are very difficult to meet. To enhance the quality of decisions while maintaining agility requires better information, knowledge, models and methods.

How do we know what information to collect? How do we organise it so that it is integrated, complete and holistic? These questions are best answered by a competent meta model. Where a model is a partial representation of something in the real world or which we want to create in the real world, a *meta model* operates at a higher level of abstraction, dealing with the *types* of things of relevance in the models. A good meta model can provide us with guidance in terms of: what concepts are relevant, how they are related and what properties it is important to know about for each concept. It contains expert knowledge which can guide practitioners in considering what information to collect, how to organise and categorise it, how to relate items and what properties to populate to support the required analysis and answer the difficult questions. If the meta model is sufficiently detailed and developed using the correct structures itself, then it can form the basis for repository and tooling implementations which can support architects in their work, enhancing productivity, rigour and model quality.

Shortcomings in Current Models

There are a number of existing enterprise architecture and related meta models, including those provided by TOGAF™ [2], Archimate™ [3], DODAF [4] and others [5,6,29]. A recent empirical survey of EA approaches [30] highlights that few organisations are achieving the touted alignment between strategy and transformation initiatives. In our experience of performing enterprise architecture, business engineering and business architecture assignments, we have found that these are lacking in several respects:

- The orientation is often IT derived - the intent of the models was for IT analysts to "get enough information about the business to inform the IT architecture and requirements definition for systems", rather than to design the future business
- Various important business elements that are relevant to transformation and future effectiveness of the enterprise are not addressed. E.g. the popular methods have little coverage of Customers, Offerings, Markets, Channels, Culture, Policy, Brand and other elements. Some more recent models from e.g. Winter&Aier and Hanschke do start to address these issues, but these methods and models are not yet in mainstream commercial use
- The context in which the enterprise operates is hardly addressed, except for Drivers which may influence behaviour. We believe it is important to understand the context to make sensible choices of strategy and organisation design for the future. Issues such as Legislation, Political Issues, Social Change, Brand, Competitors, Partners, Emerging Technology and more must be considered in reaching a competent analysis and design
- Quantitative, financial and qualitative aspects of business health are traditionally used in accounting and strategy, but are not incorporated into architecture analysis. We believe these techniques should be integrated with the business architecture analysis. Techniques which are useful include: SWOT analysis, Critical Success Factors, Balanced Scorecard, Health Check, Holistic Business Scorecard and, of course, traditional accounting measures (Return on investment, return on assets, cash flow..)
- Metrics and measurement are sometimes present, but seldom comprehensive
- Control elements and feedback paths required for sustainable enterprise behaviour are not present
- Capabilities as a modeling approach is much discussed in the literature, but the concept is often "fuzzy". Capabilities, properly defined, are a powerful modeling mechanism and can serve as an "anchor" for many other aspects - for example, organisational responsibility, gap analysis and work package definition

Approach

Our analysis broadly followed a design science format, as described by Vaishnavi and Kuechler [7]. This involves: Being aware of a problem in the domain of interest (in our case Business Architecture and Enterprise Transformation practice), Suggesting improvements, Development of new artifacts (here the meta model), Evaluation of the effectiveness of the intervention, Iteration with Circumspection to apply the insight and learning from one cycle to the next and, finally, Conclusion with analysis and publishing of results.

We have highlighted the problems perceived in the previous section. Our suggested intervention was the enhancement and extension of meta models underlying analysis and tool support to cater for the necessary concepts, relationships and information to support the required analysis to do more informed and effective organisational transformation. Development consisted of the integration of concepts from a variety of frameworks and meta models and derivation and inclusion of meta model fragments to support techniques which are used in strategy formulation, business architecture and enterprise transformation, particularly those addressing the problems which we earlier elaborated. Extended meta models were rapidly implemented and deployed in a web-based EA repository and modeling toolset [31].

Evaluation involved the use of the enhanced meta models in a variety of industrial and commercial real world consulting engagements focussed on enterprise analysis, planning and transformation. The target organisations spanned retail, health care, telecommunications, assurance, banking, shipping and government. This paper is part of the Conclusion phase of reporting and publishing results.

During the iterations, we actually enhanced the meta models for all Enterprise Architecture and adjacent domains, including business, process, application, information, technology, security, risk, programme management, portfolio management and methods management (focussed on EA governance, method and capability improvement). Due to focus of the intended audience of this paper and space limitations, only the business domain (including process) is discussed here. The boundary concepts shared with other domains (e.g. Application Services, Business Objects etc.) are included.

Many sources were used for meta model concepts. Primary sources included TOGAF 9 and later 9.1, Archimate 1.2 and later 2.0, Inspired's previous meta models at Vsn 2.0, DODAF 2.0 Drafts, BPMN and other process modeling approaches and meta models developed for various projects and clients. We constructed meta model fragments to support popular strategy techniques where these were not available. Examples include: Balanced Scorecard [10], Blue Ocean Strategy [11], Business Health Checklist [12], EA as Strategy [13], Critical Success Factors [14], Porter Competitive Forces Model [15], PEST and PESTLE Analysis [16], Relative Channel Costs [17], Boston Consulting Grid [18], Product Lifecycle Analysis [19].

The integration of meta models and meta model fragments derived from strategy models was accomplished as follows:

- Concepts and their associated definitions, examples, identity properties, relationships and regular properties (where available) were acquired. Where these were lacking, they were augmented by the researchers based upon available literature, examples, experience or usage patterns
- Similar Concepts from different sources were identified and examined. Semantic analysis was used to determine how similar the concepts were and if they could be merged. This relied upon the following aspects: Meaning of the term, definition, identity property(ies), relationships, properties describing an instance, example instances
- Where consistent form the previous point, concepts were merged retaining properties and relationships. The best name, avoiding duplication across domains, was chosen for the resulting concept. Similar criteria as for the main concepts are used to validate whether properties and relationships are similar enough to be merged
- Names of resulting properties/relationships were chosen for uniqueness, meaningfulness and, where possible, support for the source framework(s). Reuse of data items from a growing data dictionary was actively pursued. Thus naming across meta model concepts is consistent of, for example, an item such as "Start Date" or "Element Status". Similarly for relationships, reuse of defined semantic pairs was encouraged. E.g. the relationship between a whole and a part is normally reflected as: "includes parts" and from the the other direction "is part of"
- All properties are associated with an apprpriate data type, using basic and available (rich) data types e.g. amount, date, text, long text, html, picture, document etc.
- All relationships are named in both directions. Relationships are identified as belonging to a structural type, consistent with the Inspired Domain Modeling technique [8] that we use for meta modeling. This is based upon UML with extensions for role modeling, following James Odell [9].
- Each unique concept in the resultant meta model is associated with an icon for easy visual identification in models and tool interfaces

Table 1 illustrates the major concepts, their sources and how concepts from different sources have been mapped to the resulting concepts.

Table 1 - Derivation, Conceptual Coverage, Naming, Abstraction and Roles

Source(s)	Concept(s)	Resulting Element(s)	Definition
TOGAF 9.1 Inspired 2.0	Principle Architecture Principle	Architecture Principle	Documents an enduring guide in terms of how decisions are made with respect to Enterprise Architecture. e.g. "We should have at least two sources of supply for any technology chosen" "Buy before Assemble before Build"
TOGAF 9.1 Inspired 2.0	Constraint Constraint	Constraint	An enduring factor that prevents an organization from pursuing particular approaches to meet its goals. For example: Government regulations prevent the export of certain product categories; Staff with a required qualification are in short supply
TOGAF 9.1 Inspired 2.0	Assumption Assumption	Assumption	A statement of probable fact that has not been fully validated at this stage. For example, it may be assumed that an existing application will support a certain set of functional requirements, although those requirements may not yet have been individually validated
TOGAF 9.1 Inspired 2.0	Requirement Requirement	Requirement	A statement of business need that must be met by a particular architecture or Business Initiative.
TOGAF 9.1 Inspired 2.0	Gap Gap	Gap	A statement of difference between two states. Used in the context of gap analysis, where the difference between the Baseline and Target Architecture is identified
TOGAF 9.1 Inspired 2.0	Work Package Business Initiative	Business Initiative	An initiative which will move the business forward from its current situation to a desired future state. Various candidate initiatives may be considered before deciding upon those to approve and pursue.
TOGAF 9.1 Inspired 2.0	Capability Capability	Business Capability	Product and/or Service delivery at a certain volume/level supported by Process / Application / Information / Technology through appropriate Resource at required Location

Source(s)	Concept(s)	Resulting Element(s)	Definition
TOGAF 9.1 Inspired 2.0	Driver Driver	Driver	An external or internal condition that motivates the organization to define its goals. An example of an external driver is a change in regulation or compliance rules which, for example, require changes to the way an organization operates; i.e., Sarbanes-Oxley in the US
TOGAF 9.1 Inspired 2.0	Goal Business Goal	Business Goal	A high-level statement of intent or direction for an organization.Typically used to measure success of an organization. Examples: "Expand into Asia"; "Increase Revenue from Services"
TOGAF 9.1 Inspired 2.0	Objective Business Objective	Business Objective	A quantified goal of the business. Should have a clearly stated intent, a timeframe and a measure of success. Examples: "Increase Service revenues by 10% per annum for next three years" "Reduce staff turnover to below 5% of workforce by Q4 2007"
TOGAF 9.1 Inspired 2.0 TOGAF 9.1 Inspired 2.0 Business Measure-ments and Health Checks	Measure Measure Service Quality Service Quality	Metric / KPI Observation Unit of Measure Target Time Period	A Key Indicator is a measure of performance. It can be linked to a Business Unit, A Business Process or Business Function. Its purpose is to provide guidance in measuring achievement of desirable goals. Examples would include: For an Order Process: Time from Order Acceptance to fulfillment to the customer's satisfaction; For Manufacturing: Percent of products delivered that work first time, out of the box, with no intervention required; For a Start-up Company: Cash Flow vs Cost of Investment An Observation is a measurement of a particular Metric at a given time e.g. 20140201 Service Revenue Collected for Day=220 000 US$ Unit of Measure is the type of units used for a particular Metric and Observation e.g. kg for weight; mph for speed; transactions per minute for throughput A Target level for a Metric at a given time An expression of a time period. These can be Decades, Years, Quarters, Months, Weeks etc. Association of an item with a fine grained time period implies its association with the courser grained time periods within which it occurs e.g. Something associated with a day is also associated with the week and month containing the day.
TOGAF 9.1 Inspired 2.0	Organization Unit Business Unit	Business Unit	A Business Unit is a business, division, department or other business entity that functions autonomously. Typically, it will have its own management, budget, objectives and responsibilities. It may or may not have separate legal status.
TOGAF 9.1 Archimate 2.0 Inspired 2.0	Actor Business Actor Actor	Actor	A person, organization, or system that has a role that initiates or interacts with activities. Examples: a sales representative; a supplier; a partner's application system that sends us transactions. Actors may be internal or external to an organization.
TOGAF 9.1 Archimate 2.0 Inspired 2.0	Role Business Role Role	Role	The usual or expected function of an actor, or the part somebody or something plays in a particular action or event. An actor may have a number of roles. Example: The Actor "Supervisor" may operate in the Role of "Approver" for some activities and "Resource" for others
TOGAF 9.1 Archimate 2.0 Inspired 2.0	Location Location Location	Location	A place where business activity takes place. Can be hierarchically decomposed. May be physical / geographical e.g. France, Paris or logical e.g. Coastal Region; English Speaking Countries
TOGAF 9.1 Archimate 2.0 Inspired 2.0	Function Business Process/ Function/ Interaction Business Function	Business Function	Something that is done in order to contribute to the achievement of business goals. E.g. "Collect Dues from Clients"; "Hire Qualified Personnel". Expressed as [Verb][Object][Qualifying Clause]

Source(s)	Concept(s)	Resulting Element(s)	Definition
TOGAF 9.1 Archimate 2.0 Inspired 2.0	Business Service Business Service Business Service	Business Service	An element of behavior that provides specific functionality or information in response to requests from actors or other services. A service delivers or supports business capabilities, has a defined and published interface, and is explicitly governed. E.g. a Quotation Service could be invoked to obtain product pricing; an Advertise Service could be invoked to advertise products, services or jobs. Services may be performed internally or outsourced. They can be offered by the organization or used by the organisation.
TOGAF 9.1 Archimate 2.0 Inspired 2.0	Contract Contract Contract	Contract	A binding agreement between two or more parties. Normally stipulates respective benefits and responsibilities. E.g. An Employment Contract between a person and an organisation would define the roles and responsibilities of each party
TOGAF 9.1 Archimate 2.0 Inspired 2.0	Process Business Process/ Function/ Interaction Business Process	Business Process	A process represents flow of control between or within functions and/ or services (depends on the granularity of definition). Processes represent a sequence of activities that together achieve a specified outcome, can be decomposed into sub-processes, and can show operation of a function or service (at next level of detail). Processes may also be used to link or compose organizations, functions, services,and processes
TOGAF 9.1 Archimate 2.0 Inspired 2.0	Event Business Event Business Event	Business Event	An organizational state change that triggers processing events; may originate from inside or outside the organization and may be resolved inside or outside the organization. E.g "Proposal Accepted by Client". Can be time related, e.g. "End of Financial Year"
TOGAF 9.1 Inspired 2.0	Control Control	Control	A mechanism to ensure that policies, rules and good governance (including risk amelioration) are carried out. For example, a sign-off control on the purchase request process that checks whether the total value of the request is within the sign-off limits of the requester, or whether it needs escalating to higher authority
TOGAF 9.1 Archimate 2.0 Inspired 2.0	Product Product Product / Service Category	Offering Product Type Service Type	A product or service (or combination thereof) that is offered to the market by the organization. E.g. Delivery Vehicle; Vehicle Repair A means of categorising products with similar characteristics e.g. Mobile Phones vs Fixed Line Phones A means of categorising services with similar characteristics e.g. Retail Banking vs Commercial Banking
TOGAF 9.1 Archimate 2.0 Inspired 2.0	Data Entity Business Object Business Object	Business Object	An object of interest to the business. Any thing or concept about which the business wishes to keep information. Examples include: Customer, Product, Staff Member, Order, Payment, Product Category, Competitor, Contract, Claim
TOGAF 9.1 Inspired 2.0	Information System Service Application Service	Application Service	A service which is offered by an application. Normally services will have a defined interface through which they may be invoked, specifying the mechanism, the protocol and the format of information exchanged.
Archimate 2.0 Inspired 2.0	Value Value	Value	The actual value offered by or exchanged between parties. E.g. a banking customer might receive the value "Investment Returns" from investing funds, while the bank might receive the value "Investment Commission" from the customer.
Archimate 2.0	Meaning	Not included.	Can be shown using Business Communication

Source(s)	Concept(s)	Resulting Element(s)	Definition
Archimate 2.0 Inspired 2.0	Representation Business Communication	Business Communication	A Business Communication is any means by which data, facts, information or intelligence is communicated between parties in a Business Event or Transaction. Examples include: Documents, Printed Reports, e-Mails, Telephone calls
Inspired 2.0	Property	Property	A property or attribute which helps to describe an instance of a Business Object or which appears in information exchanged via communications or interfaces. E.g. Customer Identity; Product Description; Account Balance
Archimate 2.0 Inspired 2.0	Business Interface Channel	Channel	Channels are ways in which we reach our customers and markets. They are important in ensuring we achieve maximum leverage from our investment in product and service development and production capability. It is also vital to understand how the relative volumes via various channels will change over time. An example would be the shift from retail store shopping to Internet shopping. This has obvious implications for the levels of information systems and technology support and infrastructure that we need to provide. While the Internet channel may only be a single percentage figure today, it may become a dominant channel in the future.
Archimate 2.0	Business Collaboration	Not included.	Achieved via exchange of Value or Business Communication
Inspired 2.0	Market Segment	Market Segment	Market Segments are a way of grouping customers with similar needs or profiles. They allow us to assess the relative size and importance of various groupings and categories. They also allow us to devise and manage products and services to satisfy various types of customers. We can see which groups are growing or declining relative to others, thus preparing us to address future needs. Examples: Young Upwardly Mobile Professionals; Senior Citizens; Unbanked Youth
Inspired 2.0	Customer Type	Customer Type	A way of categorising customers. It may be used, for example, to identify retail vs wholesale customers, or those who interact with us physically vs those who interact via web portals
Inspired 2.0	Jurisdiction	Jurisdiction	Jurisdiction is a geography in which a given authority presides. Typically it is a country with specific laws. However, it can also be broader (e.g. the European Union) or narrower (e.g a US State)
Inspired 2.0	Competitor	Competitor	A Competitor is anyone or organization who/which competes for our market or customers. Traditional competitors may be in the same business as us, while non-traditional competitors may come from other sectors. An example of the latter is the challenge posed to traditional book stores by Amazon.com
Inspired 2.0	Stakeholder	Stakeholder Type Stakeholder	Stakeholders include anyone (or any enterprise) with an interest in our organization's continued existence and success. Generally they derive some value from their interaction with us. They typically include: Customers/Clients, Suppliers, Employees, Shareholders, Business Partners, The State (in the guise of the Receiver of Revenue at least). Stakeholders usually provide some form of input to the enterprise and expect some kind of output, which for them has added value over the input.

Source(s)	Concept(s)	Resulting Element(s)	Definition
Inspired 2.0	Resource	Resource	Resources are the things that we need to operate our enterprise. They are normally represented as assets on the balance sheet. Typical resources would include: Capital or access to funding, Plant or physical infrastructure (e.g. in manufacturing or mining), Raw materials inventory, Finished goods inventory, Human resources and skills, Information, patents/designs/trademarks, Contracts or arrangements to our advantage. With respect to architectures, we are particularly interested in the organizational capabilities as they inter-relate to the objects the enterprise is pursuing. There is no point building grand plans which we cannot fund, or which require an infrastructure which we do not have or cannot hope to build. Particularly important to information systems and technology are human resources and skills.
Inspired 2.0	Medium	Medium	The form in which information is conveyed. E.g. Document; Magnetic Tape; Credit Card; Electronic Message
Inspired 2.0	Process Activity	Process Activity	An activity (step) within a Process. E.g. A Billing Process might include activities of: Measure Usage; Calculate Charges; Generate Invoice
Inspired 2.0	Outcome / Object State	Outcome / Object State	The outcome of an activity within a process, typically expressed as the state reached by a business object. E.g. Order confirmed
Inspired 2.0	Business Rule	Business Rule	A Business Rule is an unambiguous statement of a business policy, an algorithm by which a desired result is achieved, or a formula by which a result is calculated. Examples include: POLICY: When there is insufficient stock, supply Category 1 customers fully before allocating stock to any other categories, then place back orders with suppliers to satisfy the balance of orders. ALGORITHM: Use Last In, First Out principle when any staff retrenchments are required. Modify this where necessary to retain affirmative action candidates to meet statutory quotas. CALCULATION: Available Stock = Sum of (Stock on hand per Warehouse) - Committed Stock
Inspired 2.0	Brand	Brand	A Brand is any recognised or registered trademark, copyright or name by which the company or its products are known. Examples include: Windows (for Microsoft) Delphi (for Borland) Levis (for Levi Jeans)
Inspired 2.0	Technology	Technology	This refers to the unique technology employed by the enterprise in delivering its products and services. Examples would include: Insurance Industry: An investment analyst workbench which allows sophisticated analysis and prediction of share prices and investment dealing; Pharmaceutical Company: Drug research techniques, trials and patents as well as manufacturing techniques; Telecommunications: Cellular and land line technology, switching technology, call centre, network management; Music Industry: Recording and distribution technology.
Inspired 2.0	Vision / Mission	Vision / Mission	A concise and motivational statement of a desirable future state. E.g. Kennedy's vision statement: "I commit this nation, by the end of the decade, to land a man on the moon and return him safely to Earth"
Marketing	USP	USP	Unique Selling Proposition: The characteristics of products or services offered that persuade customers to do business with us rather than other suppliers e.g. A USP for Apple is "Ease of Use", a USP for Google's Android is "Open and Portable"
Value Chain	Value Chain	Value Chain	The sequence of top level activities performed by an organisation to fulfill its mission. Usually includes Core activities (e.g. Create Product, Sell, Distribute, Service) and support activities (e.g. Human Resource Management, Process Management, Procurement..)

Source(s)	Concept(s)	Resulting Element(s)	Definition
Accounting Assessment	Asset Liability	Asset Liability	An object of value to the business. Normally something which the business expends money or effort to acquire or create and from which we intend to derive value. E.g. Plant; Patents; Cash An obligation or commitment which will result in reduction of the assets of the business. E.g. Funds in Trust; Pensions Owed
Business Analysis Techniques	Strength Weakness Opportunity Threat / Risk Social Change Political Issue Law Policy CSF	Strength Weakness Opportunity Threat / Risk Social Change Political Issue Law Policy CSF	An internal characteristic of the business which will help it to succeed in achieving its goals An internal characteristic of the business which will reduce the ability of the organisation to succeed in achieving its goals An external factor that provides a potential benefit to the organisation An external factor that provides a potential threat to the organisation Social Change which will impact the performance of the business Political factor that will impact the performance of the business Legal factors and legislation that will constrain or influence the operation of the business High level guidelines set by corporate governance (including board and executive committee) that determines how the organisation will operate Critical Success Factor - (one of) a limited number of factors that will determine how successful the organisation is in pursuing its goals
Inspired 2.0	Standard	Standard	A published, recognised and useful standard which facilitates achievement of goals, typically including: compatibility; interoperability; safety; reliability etc. e.g. CORBA; TCP/IP; SQL '92
via abstraction		Motivation	Any factor which will influence the planning and behaviour of the organisation, usually at a strategic level

Modeling Decisions

A great many modeling decisions were taken during the analysis, design of the meta model and implementation in tooling during multiple iterations. Some key decisions are discussed below.

It became apparent that there were many potential influences to decisions in the planning and architecture process. Traditionally, these had included Vision, Mission, Goals, Objectives and Drivers. The latter including business and technology issues and potentially hiding Risk. With the desire to support additional analyses (e.g. SWOT, PESTLE) etc. it became apparent that there were indeed many motivations. We thus reached an abstraction of Motivation with a rich collection of sub-types to handle the various influencing factors, but still cater for their similarities and differences.

It was also apparent that supporting the great many metrics that different business health and assessment techniques could require would lead to an explosion of the meta model and attendant complexity. We borrowed a pattern used in human health analysis and recording of biological data and described by Martin Fowler [20] and adapted this to provide a generic and user extensible capability for accommodating many existing and potential metrics. This includes the following concepts:
- Metric / KPI - These are named properties of something (e.g. a Business Unit) that we want to monitor
- Unit of Measure - Specifies what units the measurement is taken in, if relevant. E.g. Turnover as a metric might be measured in US$
- Time Period is used to group measurements taken at a certain time or appropriate to a certain period
- Observation is a measured value for a Metric at a Time and in a Unit of Measure
- Target is a goal value for a Metric at a Time and in a Unit of Measure (Target can also be used to record benchmark values)

Resulting Model

Figure 1 - Comprehensive Business Architecture Meta Model

The resulting model, simplified somewhat for presentation purposes, is shown as Figure 1. Boxes represent concepts or types in the meta model. For each concept, there is a description clarifying the intent of the type, its identifying property (which may be composite), example instances, a list of valid properties (with data types), a list of valid relationships to other concept instances and an icon used to represent the concept in models and the tooling user interface.

Normal lines represent associations or relationships. Lines terminating in arrows indicate inheritance (i.e. point from a more specialised to more generalised concept). Lines leaving and entering the same concept box indicate own type relationships. In the original, these are colour coded to indicate four kinds of relationships: blue - typical network or dependency relationships between instances of the type; green - containment or hierarchy; red - inheritance; black - role. Thus, for example, Business Objects can form the objects within a conceptual data model for the organisation, including association, inheritance, containment and role relationships. Another example would be Process Activities, which can have nested (hierarchical) relationships or dependency chains.

Overlapping boxes (e.g. Service Type and Product Type) have been used as a shorthand to indicate that these concepts would be descendants of a common more abstract parent (e.g. Offering) which would carry and propagate to them shared relationships and common properties. This saves visual clutter on the diagram. A relationship to one of the overlapped boxes should be interpreted as valid also to the its companion.

All relationships in the detailed model are named semantically in both directions, e.g.

> Business Process *governed by* Business Rule

Business Rule *governs* Business Process

Plus symbols [+] indicate that these concepts are decomposed further in sub-models. For example, the Motivation concept of Figure 1 translates to the detailed Motivation model showing subtypes in Figure 2.

Figure 2 - Motivation Concept Subtypes as a Sub-model

Relationships in the Meta Model

Space constraints will not permit all of these to be included in the paper. Some representative fragments are shown below to illustrate the type of relationships present.

Table 2 - Illustrative relationships

Source Concept	relationship to> <relationship from	Target Concept
Business Unit	participates in> <governs behaviour of	Contract
	provides> <provided by expects> <expected by	Value
	delivers> <delivered by	USP
	owns> <owned by	Brand
	operates in> <governs activity of	Jurisdiction
	measured by> <measures	Observation
	uses> <used by	Technology

Source Concept	relationship to> <relationship from	Target Concept
	responds to> <affects	Motivation
	owns> <owned by	Business Initiative
	owns> <owned by	Requirement
	responsible for> <performed by	Business Function
	provides> <provided by uses> <used by	Business Service
	delivers> <delivered by	Business Capability
	owns> <owned by	Business Process
	subject to> <reduces value of	Liability
	owns> <owned by	Asset
Business Process	includes parts> <is part of triggered by> <triggers	Business Process
	involves> <involved in	Role
	supports> <supported by	Product Type
	owned by> <owns	Business Unit
	addresses> addressed by	Motivation
	governed by> <governs	Business Rule
	subject to> <applies to	Control
	uses> <used by	Application Service
	involves> <involved in	Actor
	includes> <part of	Process Activitiy
	uses> <used by	Resource

Source Concept	relationship to> <relationship from	Target Concept
	uses> <used by	Business Object
	produces> <produced by receives> <received by	Business Communication
	triggered by> <triggers generates> <generated by	Business Event
	uses> <used by	Document

Types of Analysis Supported

The meta model as shown in Figure 1 & 2 has not yet been applied in practice in its full extent. Specifically, the pattern for the handling of metrics and associated concepts is new and is only now being tried in industry. Almost all the other concepts and structures have been applied in industrial settings in support of enterprise architecture, business architecture or enterprise transformation projects. They have proven competent in supporting EA, BA and transformation analysis. In particular, the rich approach to the handling of goals and other motivations and the linking of these to other elements supports high alignment between business intent and transformation activity. Some of the metrics were supported in earlier implementations by specific extensions.

The overall meta model has proven capable of supporting goals/means analysis, functional analysis, process oriented analysis, capability based planning, management of architecture gaps, their mapping to requirements and subsequent mapping to initiatives and the prioritisation of these initiatives. We have been able to support high level SWOT, PESTLE, CSF, Risk, organisation design and other analyses. Organizations have used TOGAF, Archimate, Zachman, Inspired and other methods without problems.
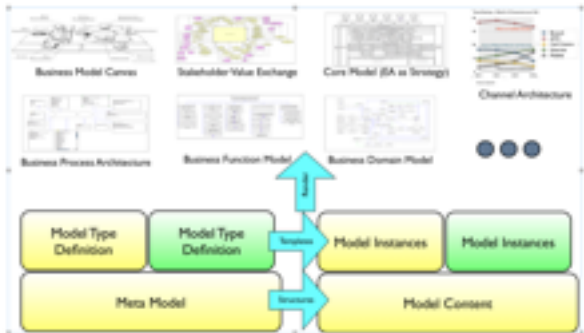

Figure 3 - Use of Meta Model to Support Variety of Model Purposes and Styles

Figure 3 illustrates how the meta model supports structuring an integrated set of content in the repository conforming to the overall meta model. Model Types (equivalent to Viewpoints in some methods) define which meta model concepts are relevant to a given type of modeling and how they should be represented. Meta model concepts can be reused across various Model Types. Concept instances can appear in multiple models (potential of different model types). Models designate which elements to include in a given model / context. Model content is then rendered using the relevant Model Type. Organisations normally select which parts of the meta model to populate based upon project goals, maturity, priorities and availability of information. The content can be built incrementally starting from any perspective. The meta model ensuring that, as content is added, it is consistent and sharable in other analyses performed downstream.

Having used similar patterns to the one we have now introduced for the extensible metrics in our own modeling tool development, we look forward to the ability of organisations to specify, record and analyse the metrics of relevance to their situation. The tool environment we use supports derived properties (using metrics and other properties of model elements as source data) and visualisations using the D3 [28] and other libraries. This combination allows performing a great variety of business analysis techniques and presenting the information in easily consumed form while keeping business strategy and planning techniques integrated with and closely aligned to transformation activity.

Conclusion

We suggest that the combination of areas traditionally covered by enterprise architecture frameworks and meta models with those more normally the preserve of business strategists and economists, together with the extension of both techniques to more fully incorporate contextual variables, allows richer and more competent modeling to support rapid but well considered enterprise transformation.

A caveat is that the meta model on its own facilitates the more holistic analysis, but is not sufficient. It must be supported by good tooling (ideally meta model driven), adoption of appropriate planning, architecture and transformation methods; and creation of appropriate views to address diverse stakeholder concerns. Practitioners performing the collection, analysis, design and specification of requirements must also have the necessary knowledge, skill, experience and maturity to provide competent advice.

Further Work

We hope to merge the work described in this paper with other research into the development of a comprehensive architecture language, which will marry the conceptual and meta model structures with rich forms of representation, visualisation and model management. The author is engaged in research on modification of model symbols in response to underlying data (poly-metric diagramming) to convey more meaning visually and concisely, which can help to generate new insights quickly and with less effort. We plan to apply these ideas in an environment where the meta model described will provide very rich input.

We also hope to incorporate the ideas of Stafford Beer and Jose Perez Rios [27] on viable systems theory as applied to organisations into the meta model. This will enhance the planning with a formal approach to ensuring sustainability as organisations transform.

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