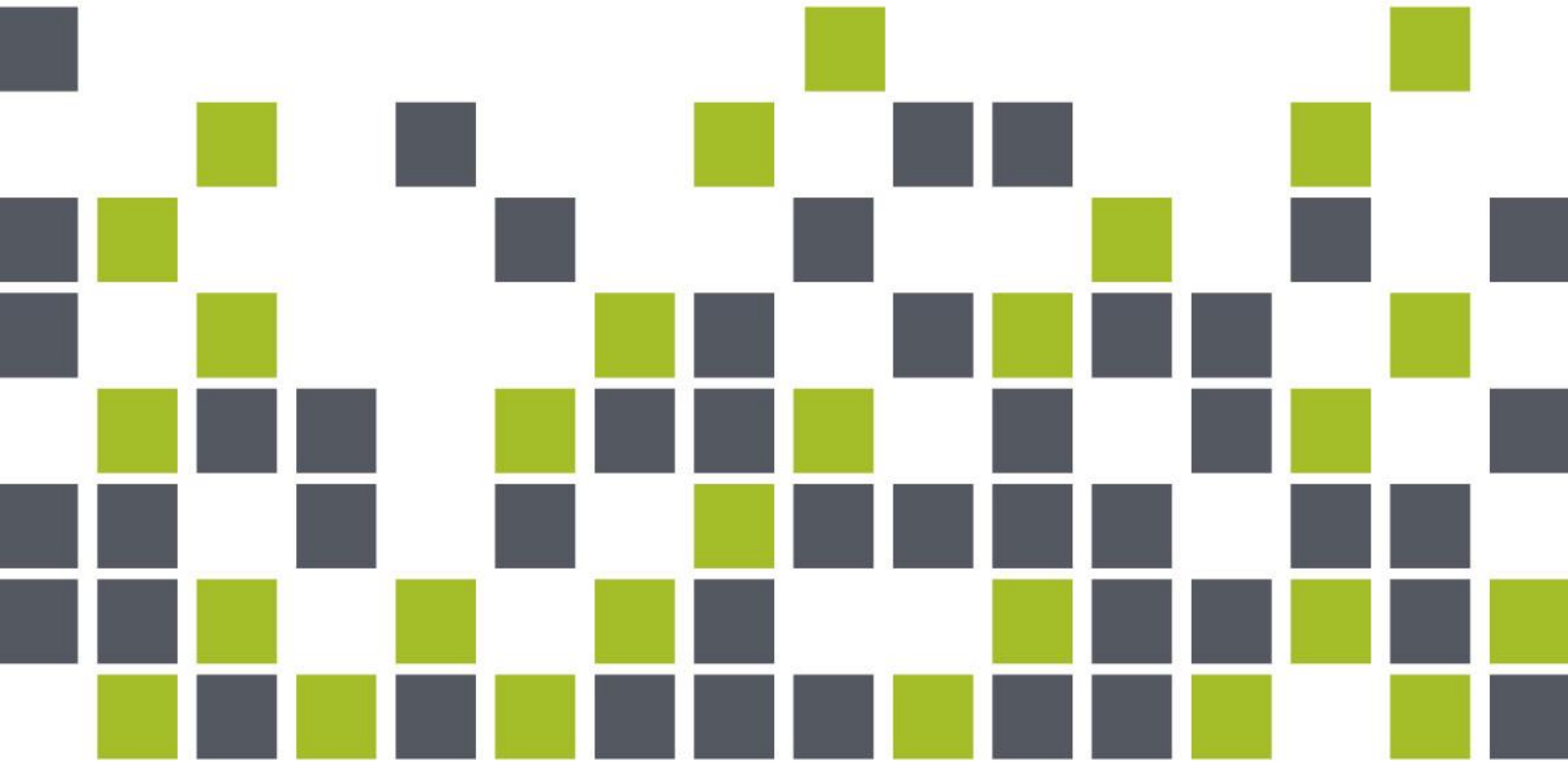
Framework for Migration of Insurance Systems

IDIOM White Paper

IDIOM Solutions (Australia) and IDIOM Limited (New Zealand)



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INTRODUCTION

IDIOM Solutions

IDIOM Solutions Pty Ltd. [ISOL] was created early in 2017 jointly by IDIOM Limited [IDIOM] and new ISOL CEO John Salamito. ISOL's focus is on mitigating the deficiencies and risks posed by legacy insurance/wealth 'Policy Administration Systems' [PAS], with specific focus on the following topics:

- Systems analysis, audit, and remediation
- PAS migration
- Insurance product analysis and rationalization
- Legacy systems renovation and extension
- Policy archive

ISOL brings together three essential capabilities that are required to achieve these objectives, each supported by experienced consultants, and proven, proprietary tools (see Figure 1). The capabilities are built around three system viewpoints:

- The Legacy System(s)
- The 'First Principles' System
- The Future System(s)

To be able to provide order and to maximize opportunity during a complex systems migration, ISOL recommends developing an independent view of the insurers specific customer and regulatory obligations. We call this the 'First Principles' System because it is reconstructed from 'first principles' analysis of customer and regulatory obligations – including Product Disclosure Statements [PDS] and related customer and product documents, and the full extent of the regulatory environment. It is a conceptual system that the insurer is obligated to provide, whether or not it does so in practice. This viewpoint provides a roadmap to guide decision making and to collate information and analysis outputs. It also guides the rationalization of insurance products, and the normalization of insurance data and processes. This can be a significant value-add if done in-stream within a migration.

Collating the first principles system requires deep understanding of the full extent of insurance products and the regulatory environment. It leads naturally to a full compendium of insurance products, their obligations, and their connections to supporting systems. The primary toolset used is the KnowledgeBase™.

Unfortunately, the history of legacy systems development sometimes means that there is a delta between the legacy systems view and the first principles view. To the extent that it exists, this delta represents regulatory risk that is becoming increasingly important as the insurance regulators increase their focus on insurer's obligations.

In order to assess the gap between legacy and first principles systems, analysis of the legacy systems is required. This analysis requires a thorough understanding of the legacy technology

landscape, backed by appropriate tools that can span the potentially 40year technology divide that these systems represent. This provides us with the Legacy Systems view.

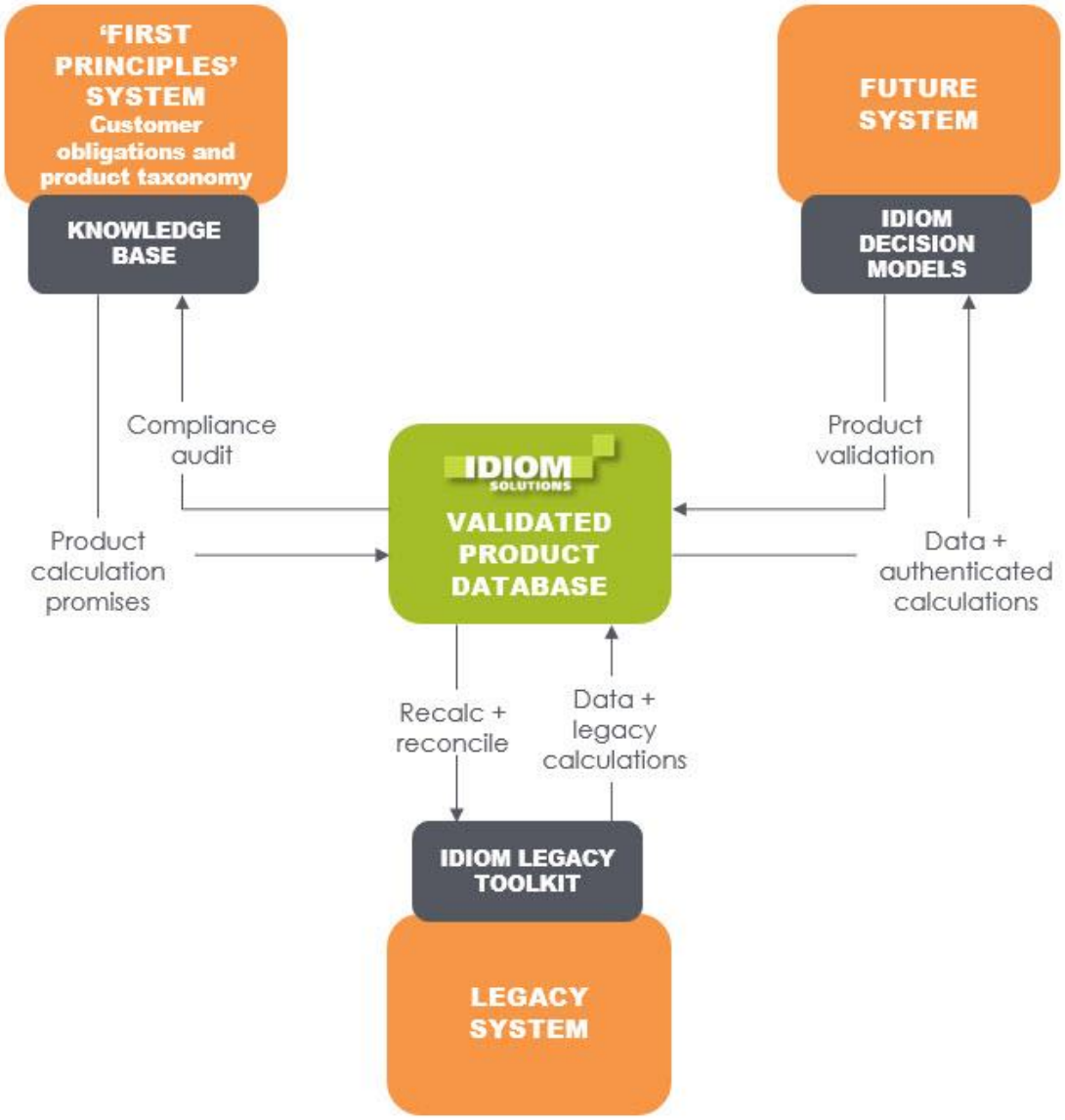


Figure 1

ISOL's legacy systems knowledge and capabilities currently span the following systems:

- Life risk / wealth includes CLOAS, Capsil, Life70, Compass, UNISURE, Calibre, SuperB, SAS, Life400, LIFE–MVS, Talisman, Integral & Sonata
- P&C and R/I includes Polisy, COGEN, Polisy400, Huon / TIG, Sirius / PURE, Insure90, Guidewire, SAP & Duck Creek
- Health includes WHICS, HAMBS plus SAP, Amicus, TriZetto & Oracle

For the sake of clarity, ISOL is not providing generic consulting services for these systems, and is not intending to provide 'business as usual' services in support of these systems.

The First Principles System and the Legacy System viewpoints meet in ISOL's Validated Product Database [VPD]. This is a synthetic system that is created per engagement to ingest the legacy system data and processes, and to normalize them as guided by the first principles. The technology used to reconstruct and then apply legacy and first principles calculations to the normalized data is the IDIOM suite of tools. This toolset allows us to build a complete set of calculations that are fully executable, so that we can execute the calculations at scale across the full set of legacy data to assess the degree of compliance with the first principle obligations.

It is then a relatively mechanical process to migrate the normalised data and to inject these calculations into future system(s).

For the sake of completeness, the IDIOM toolset also includes its own discrete application framework so that if needed, future systems capability can be fabricated directly from the Validated Product Database that sits center stage.

People

The people who help make ISOL a unique value proposition include:

- John Salamito, CEO and Founder
  - Extensive executive (C-Level) Insurance and Financial Services background
  - Business transformation and technology innovator
- Mark Midwinter, Commercial Director
  - 35 years in Insurance IT working for both carriers & IP vendors
  - Founder/Owner/Partner in multiple insurance transformation and IT companies
  - Deep experience in insurance platform transformation and migration worldwide
- Mark Norton, CTO
  - CEO and founder of IDIOM Limited
  - 38 years in IT, all in financial services and insurance
  - Architect of the IDIOM tools and the Decision Centric Development Approach™
- Michael Burgun, Insurance Migration Expert
  - Developer of ISOL's proprietary data extraction and transformation tools
  - Extensive experience in Insurance systems migration world wide
- Ray Sans, Insurance Product Expert
  - Developer of the KnowledgeBase™
  - Insurance product expert

ISOL Approach for Systematic Risk Control

To systematically control risk and assure end-to-end traceability, IDIOM offers a generic framework of five ***Assurance Levels*** and four ***Control Points***. This is summarised in Figure 2.

ISOL's Validated Product Database [VPD] consolidates the data and the essential logic. The VPD can provide both backward assurance to the source PAS and forward assurance to a new PAS.

The pivotal assurance - and also the most complex - is to be assured that data can be re-used by a new PAS and get the same result. This is our *Assurance Level Three*, which implements *Calculations Cleansing*. This is more intricate and complex than *Data Cleansing*.

ISOL's lowest level of assurance, Level One, assures that the legacy data is correctly formatted and compliant with a data dictionary – that is to say, "named data".

ISOL's experience confirms that named data remains ambiguous unless the processes using it are fully understood: that is, data that only complies with *Assurance Level One* will behave unpredictably once ingested by a different PAS. The receiving PAS will face significant obstacles in identifying the cause of anomalies, which requires full traceability and concurrent access to legacy source system code.

APRA Requirement to Consider Fitness-for-Use

The Australian Prudential Regulation Authority's [APRA] Prudential Practice Guide CPG235 'Managing Data Risk' places emphasis on the need for data to have 'fitness for use' before acceptance. Clause 51states:

> 51. *Data validation is the assessment of the data against business rules to determine its fitness for use prior to further processing. It constitutes a key set of controls for ensuring that data meets quality requirements*. [**APRA CPG235**]

ISOL's *Assurance Level Three* involving *Calculations Cleansing* is how we satisfy CPG235, and more generally induce early detection of issues to do with data and related calculations. We do not believe that Data Cleansing alone satisfies CPG-235. Further information on ISOL's approach to managing CPG-235 can be found in the IDIOM whitepaper 'Data Integrity in Financial Services' available here[1]. While APRA is an Australian regulator, the focus and relevance of CPG235 is universal.

Beyond Data . . . Business Knowledge and Product Cleansing

The purpose of data is to use it in business calculations and decisions. The ISOL Knowledgebase™ captures what the business is doing and what it is obliged to do. When fully populated, the Knowledgebase will provide the most comprehensive compendium of such information, which is necessary to support the third and final cleansing - *Product Cleansing* (a.k.a. product rationalisation).

While *Data Cleansing* and *Calculations Cleansing* could help ensure that a new PAS works effectively, *Product Cleansing* will also ensure that it is efficient in a business context. The insurer can gain assurance via *Assurance Level* 4 that any rationalised products will continue to meet all customer obligations.

The KnowledgeBase documents the *First Principle* obligations. It is usual to find errors, oversights, and ambiguities regarding these obligations. In the ISOL approach, these are addressed jointly between ISOL and the ***Accountable Person***.

[1] http://idiomsoftware.com/DOCS/Download/ce5e30f0-e6de-4b77-bfe3-766c28f395fc.pdf

GLOSSARY

Accountable Person means the insurer approved business person or entity that is charged with sanctioning the **Approved Formulas**. ISOL anticipates that this includes product and process owners, actuaries, tax specialists, and such like.

Alert means a record created by the IDIOM Decision Manager Workbench™ that signals a breach of a validation rule (Level Two Assurance), or that a **Controlled Outcome** does not comply with its **Business Policy** (Level Three Assurance).

Assurance Level One is satisfied when the data is valid and complies with a meta dictionary (e.g. a sum insured is a decimal amount).

Assurance Level Two is satisfied when the data is valid and also consistent with other data (e.g. a premium charge can be valid but fails consistency if the policy status – which is a separate datum - is out of force).

Assurance Level Three is satisfied when the calculation of critical **Derived Data** is replicable.

Assurance Level 4 is associated with product and process rationalisation. It ensures that changes that are made to the data after Level Three to support a simplified and rationalised set of data, processes, and products, has not lost any meaning.

Assurance Level 5 is the 'forward' application of Levels Two and Three to a new PAS, thereby providing forward assurance that the future PAS results are harmonious to the source PAS and/or first principles.

Business Policy means the business defined and approved set of methods, algorithms, and constraints that govern the calculation of **Controlled Outcomes**.

Calculation means either a) a formula, or b) the act of calculating, or c) the calculation result as the context requires. Calculation is not used as a proper term in this document.

Cleansing means:

- **Data Cleansing** means the data validation achieved via assurance levels one and two, which assures that the data is valid and internally consistent (but it may not be sufficient for deriving new data values).
- **Calculations Cleansing** means the outcome of assurance level three, which assures that derived data is correctly understood and reproducible.
- **Product Cleansing** means rationalising the business products, data, and processes without loss of business or customer value.

Controlled Outcome is a derived datum that the business declares has critical importance. It should include derived data that is essential to the business mission, and all derived outputs that are prescribed by regulation or published obligations. Reconciliation of the set of Controlled Outcomes at various stages of the migration provides the business with end to end assurance. A Controlled Outcome is assigned to/by the Accountable Person, who is the final arbiter of the **Formula** that derives the outcome value. The existence of a Controlled Outcome is enumerated in a register of Controlled Outcomes.

Control Points are reconciliation points to ensure no loss, nor mismatch, of data from point of extraction to final destination in the new PAS. There are four control points through this data journey.

Derived Data means data that has its value derived through calculation. Most critical system data is derived data, although not all derived data is critical.

First Principles means those obligations and requirements that exist independent of how the same are implemented via systems and processes. They are usually externally focused: e.g. disclosures to customers, undertakings to regulators, and legal requirements.

Formula means the specification of the logic that implements the **Business Policy** governing the derivation of **Controlled Outcomes**. A Formula is a reflection of and a proxy for the Business Policy that governs the outcome value. When defined in IDIOM, a formula is executable across the full extent of policy data within the VPD. A Formula is 'as-built' when it represents the source system PAS, and 'approved' when it has been sanctioned for use in a future PAS. If there is any variation between as-built and approved versions, then appropriate compliance documentation will be created by the Accountable Person for audit and traceability.

- **As-Built Formula** means a faithful transcription of the Formula that is derived from the existing source system.
- **Approved Formula** means a Formula that has been approved by the Accountable Person(s) and is the approved version of the Formula for all future derivations of the relevant Controlled Outcome. Only Approved Formulas are used in the Product Rationalisation process.

IDIOM Decision Manager™ is a proprietary IDIOM tool that enables business SME's to build and test **Formulas**; that is, to codify and test the business logic that implements business policy (especially product rules). Further information about the IDIOM Decision Manager™ and other IDIOM products can be found in the document 'IDIOM Transaction Engine: An Application to Manage Complex Business Entities' available here[2].

KnowledgeBase™ is ISOL's proprietary database application for capturing and structuring business knowledge. It focuses on first principles information.

PAS means a **Policy Administration System** for insurance, wealth, or superannuation policy data. It may be either a legacy or a future PAS as the context requires.

VPD means the **Validated Product Database** which contains (i) policy data, (ii) business/product configuration reference data, and (iii) the Formulas (i.e. the calculation logic defined within the IDIOM Decision Manager) to enable PAS outcomes to be recreated.

[2] http://www.idiomsoftware.com/DOCS/Download/e07606ea-5cd1-460b-bf64-569270cc03bd.pdf

THE ISOL APPROACH

The ISOL approach to assure data migration is multi-dimensional:

- The primary deliverable is to mitigate risk by fully understanding the data and how it is used in (possibly multiple) source PAS's and to simplify this via a sequential three-fold cleansing:
  - data cleansing – to ensure the data is useable
  - calculations cleansing – to ensure the PAS behaviour in response to the data is documented
  - product cleansing – to rationalise products, data, and processes for a simpler end state in a future PAS(s)
- These are assured by:
  - five levels of assurance (incl. Level 5 which requires the future PAS to be installed)
  - four control points
- The process of execution has three distinct phases:
  - abstraction of legacy assets - which is technically driven
  - business reconciliation and normalisation – which is technically and business driven
  - the migration itself – which is relatively mechanical if the above is already completed.

Table 1

OBJECTIVE	ACTIVITY	ASSURANCE LEVEL
Data Cleansing	Technical Led – abstraction of assets	Levels 1 & 2 (Backwards)
Calculations Cleansing	Technical and Business	Level 3 (Backwards)
Product Cleansing	Business Led – including policy decisions to alter products and processes	Level 4
Throw	Mechanical	Level 5 (Forwards)

The following Figure 2 (parts(a) and (b)) is an integrated picture placing these elements in context to one another and with the ISOL and IDIOM tools deployed.

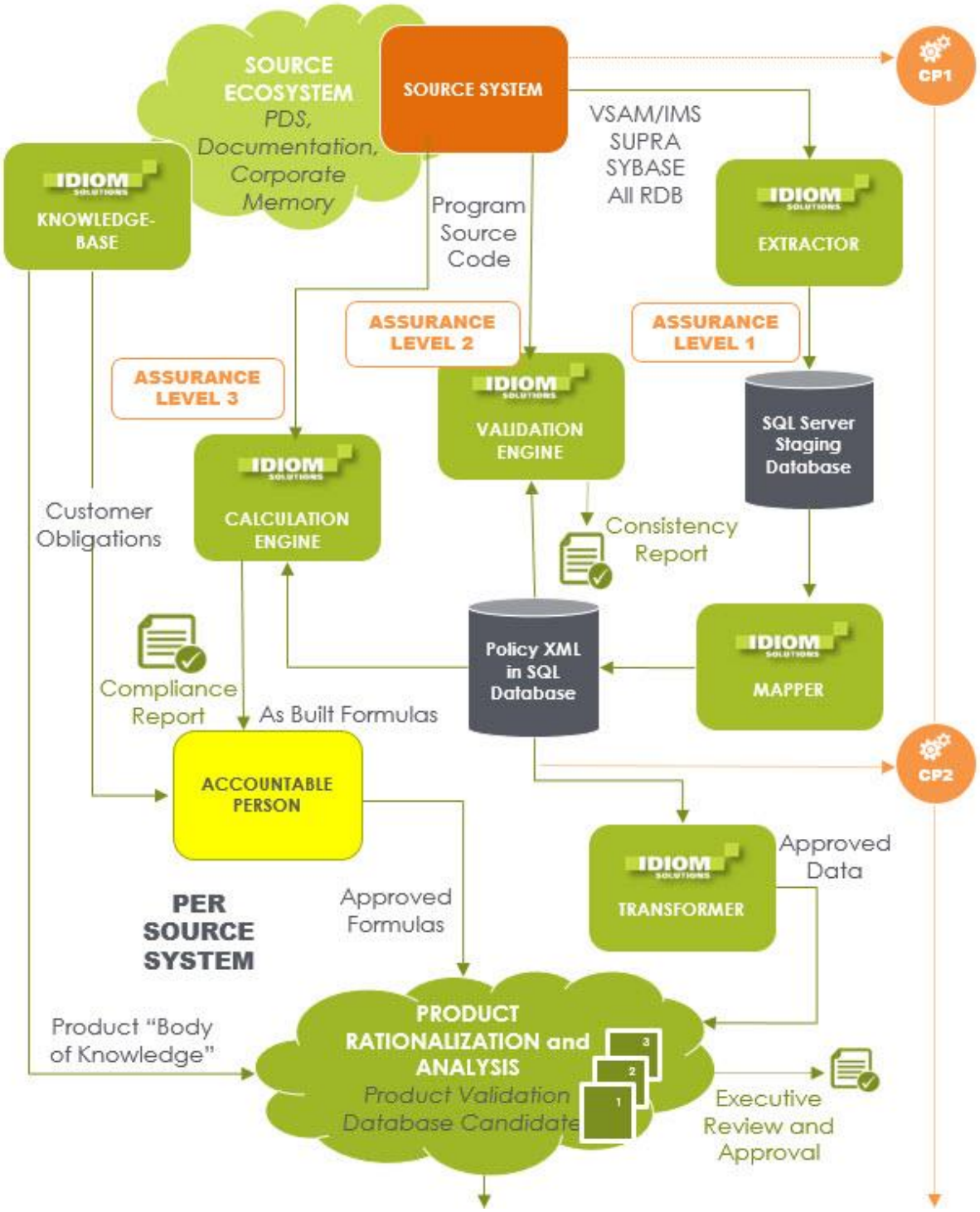

SOURCE ECOSYSTEM
PDS,
Documentation,
Corporate
Memory
SOURCE SYSTEM
CP1
VSAM/IMS
SUPRA
SYBASE
All RDB
KNOWLEDGE-BASE
EXTRACTOR
Program
Source
Code
ASSURANCE LEVEL 2
ASSURANCE LEVEL 1
ASSURANCE LEVEL 3
VALIDATION ENGINE
SQL Server Staging Database
CALCULATION ENGINE
Customer Obligations
Consistency Report
Policy XML in SQL Database
MAPPER
Compliance Report
As Built Formulas
ACCOUNTABLE PERSON
CP2
TRANSFORMER
Approved Data
PER SOURCE SYSTEM
Approved Formulas
Product "Body of Knowledge"
PRODUCT RATIONALIZATION and ANALYSIS
Product Validation Database Candidate
Executive Review and Approval

Figure 2(a)

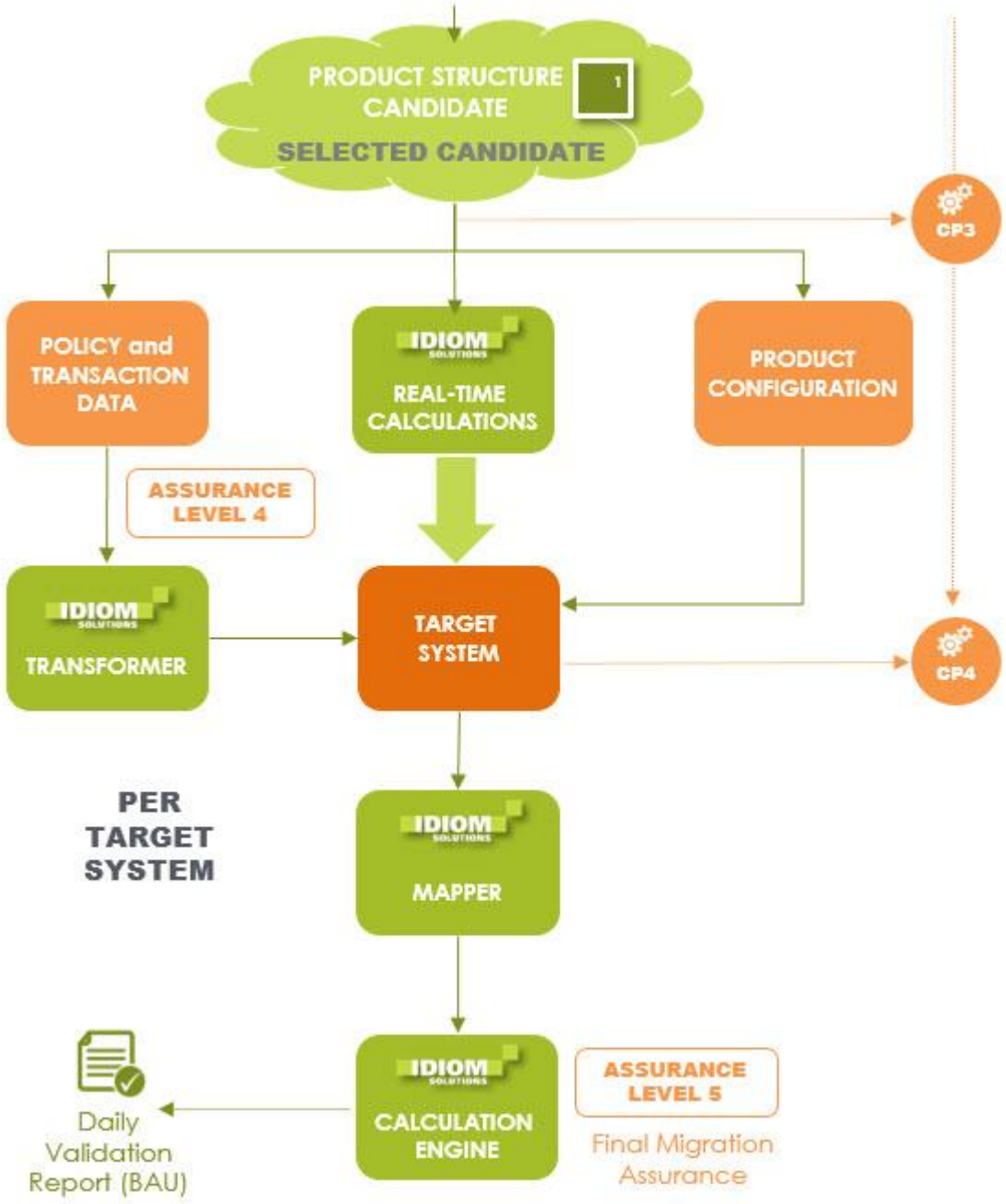


Figure 2(b)

The Deliverables

'Cleanse' is to undertake the necessary corrective interventions not requiring business adjudication, or to be in a position to do so when the business so adjudicates.

After data extraction, the first and necessary act of cleansing is to ensure that the data is type correct, formatted, and compliant with a data dictionary (this is Assurance Level One). The completion of Data Cleansing further involves applying consistency checks between data elements, which in turn enables the much more complex – and risk mitigating – Calculations Cleansing.

Data Cleansing (cross ref: assurance levels 1 and 2)

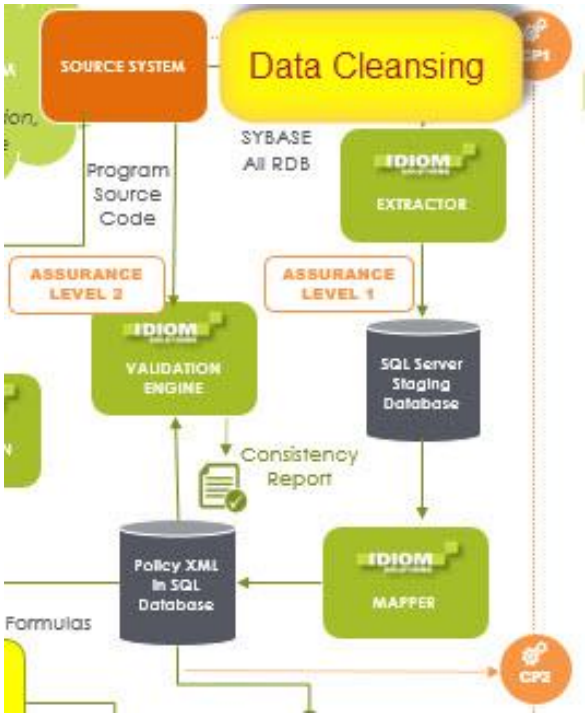


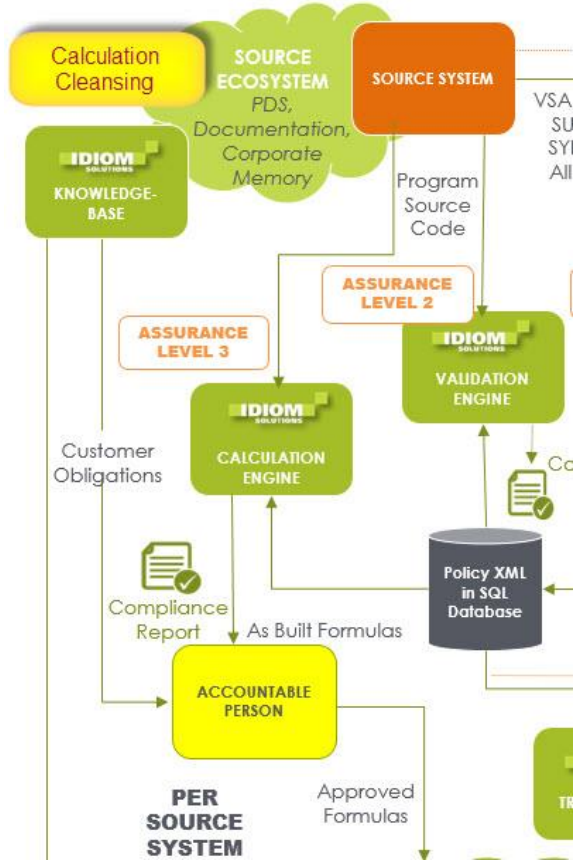
Figure 3

Data may be both valid and incorrect. An example is a valid date of birth that post-dates a valid policy start date. Both dates are valid in format and type and also make sense when taken alone, but when considered together they cannot be correct.

Data cleansing ensures the data in aggregate makes sense. Without this level of cleansing a PAS may give erratic results.

The result is valid data that is internally consistent with other data elements.

Calculations Cleansing (cross ref: assurance level 3)



The purpose of any PAS is to (i) read stored state, (ii) manipulate it into a newly derived state, and (iii) replace the old state with the new state.

These state transitions represent the policy lifecycle and, by definition, involve the derivation of new data values. E.g. from In-Force to Lapsed, or $X to $Y, or Unconditional to Conditional.

Business logic determines the derived data values via a calculation.

Calculations cleansing will result in a correct understanding of how a PAS works, and is achieved when derived data can be recalculated without reference to the source PAS programs.

The source programming logic is effectively replaced by IDIOM's Decision Manager working in conjunction with the Validated Product Database [VPD] data schema,

which is populated by the already cleansed data.

Without this level of cleansing it is not possible to assure that a future PAS can reproduce the same results as the source PAS when using the repurposed data of a source PAS even though the business logic is purportedly identical.

Product Cleansing (cross ref: assurance level 4)

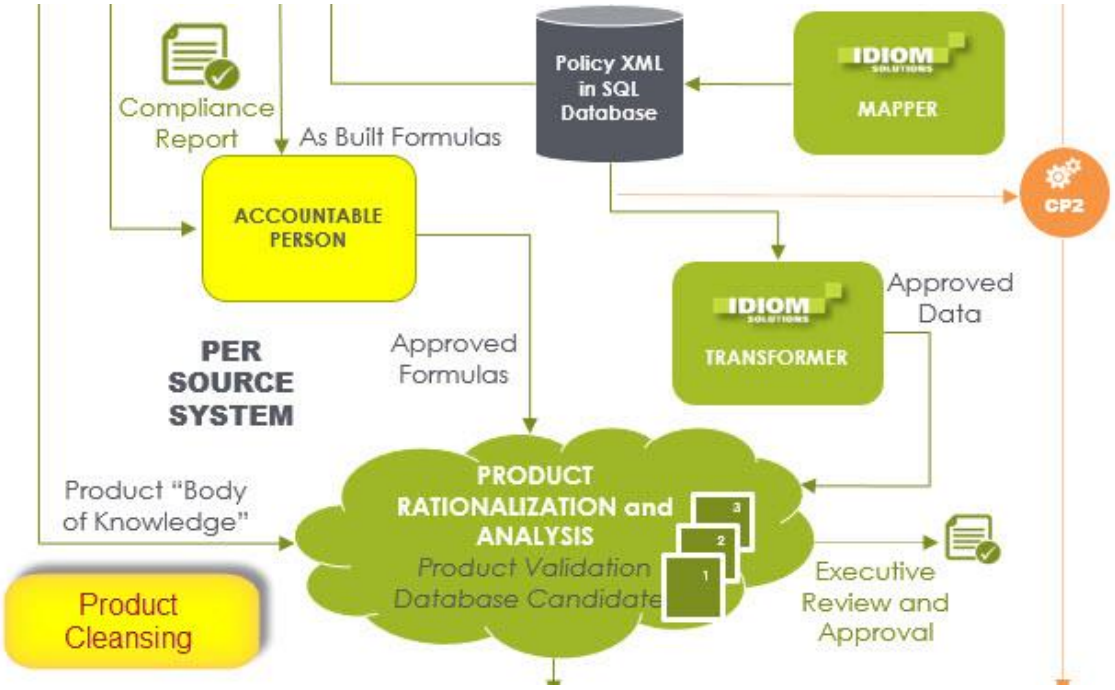


Figure 5

Each PAS usually has many products sharing similar features but implemented slightly differently. This can be aggravated by differences between source PAS's themselves. In total, there is often a high degree of redundancy in achieving the equivalent result for the customer.

Product cleansing is the process of streamlining the diversity of products and associated data and processes without losing either customer or business value, or flexibility (in fact, business agility will improve).

The Major Phases for Delivery

Phase 1: Technical Abstraction

This phase is technical, and occurs for each source system. It is not a requirement of this phase for the business to clarify, correct or align business rules (which happens in phase 2).

The objective is to obtain and create an abstracted view of the source system that includes 100% of the data, and selected calculations as described by the Controlled Outcomes. Recalculation of the Controlled Outcomes provides assurance that the extracted data is fit for purpose.

The data is subject to assurance levels one, two and three as described in the next section before the abstracted model is considered for advancement to the next phase.

Also throughout this phase, the Knowledge Base will be used to collate, analyse, and organise 'first principles' product data, including PDS's, and product and other related documentation.

The final stage of the Abstraction Phase is an assessment of the (recalculated) Controlled Outputs against the available Knowledge Base product view. This assessment will conclude that the Controlled Output is compliant with all known published obligations, or it is not. A Compliance Report is created for subsequent business adjudication. All identified non-compliance issues will be noted in this report. At the conclusion of the Abstraction Phase the source system is fully described and proven in the abstracted model, which can now be used without recourse to the source system.

Phase 2: Business Reconciliation and Normalisation

This phase is business driven. The primary objective is to normalise the calculations, the data, and ultimately, the products themselves into the smallest number of components that can correctly recreate all Controlled Outcomes and deliver the required customer commitments.

Before either data or products can be normalised, we must normalise the calculations, which ultimately determine the meaning of the data (the meaning of the data is the key to the data normalisation process).

Therefore, the first objective of this phase is to get a business validated and approved set of Formulas (see Glossary). Given the importance of these calculations to the subsequent processes and to the business itself, this approval must be authoritative, hence the concept of the Accountable Person (see Glossary).

The Accountable Person must formally approve every Formula that progresses into the Validated Product Database [VPD]. The Compliance Report provides input to this process. Compliant outcomes can be passed with some confidence. Non-compliant outcomes will require some compliance related action on the part of the Accountable Person as required by CPG235 – to modify the Formula, to accept that the Formula is in error, or some other corrective or mitigating action.

When the Formulas deriving the Controlled Outcomes have been approved, ISOL and insurer technical staff can normalise the calculations and then the data.

At the same time, the Accountable Person will be engaged in developing preferred product rationalisation strategies. These strategies will be guided by the information in the Knowledge Base, and by the similarities in Formulas and data that is driving the normalisation process just described.

This process will deliver one or more candidate product taxonomies. In this sense, a product taxonomy is a division of products between and within future PAS. While a single future PAS is plausible, there is often a requirement to accommodate more than one future PAS, in which case each future PAS will have its own Product Structure supported by Product Configurations and its own VPD.

A Validated Product Database contains a set of Product Configurations and a matching set of Policy Data (in XML form). Each candidate product taxonomy is likely to require a different set of configurations, and by extension there will be changes to both data and Formulas. Also, each candidate will require development of IDIOM decision models to do the throw from the source aligned data to the candidate VPD. Therefore, each candidate product structure has a real development cost and the number of candidates should be minimised (for the sake of clarity, 1 is the ideal minimum); nonetheless, this cost is substantially less than attempting the same thing in situ in a production setting.

This phase concludes when there is exactly one candidate product hierarchy per future PAS, and the data and Formulas have been aligned with that hierarchy. The finalised candidate is then subject to a Control Point Check.

Phase 3: Migration to new PAS

The prior phases provide the necessary methods and controls to allow this phase to be relatively mechanical, albeit with strong dependency on the future PAS vendor. The data is again transformed to match the future PAS schema, and the data prepared and thrown.

Following ingestion by the new PAS, there should be a Control Point Check to ensure that the throw is complete, consistent, and correct.

The Assurance Levels

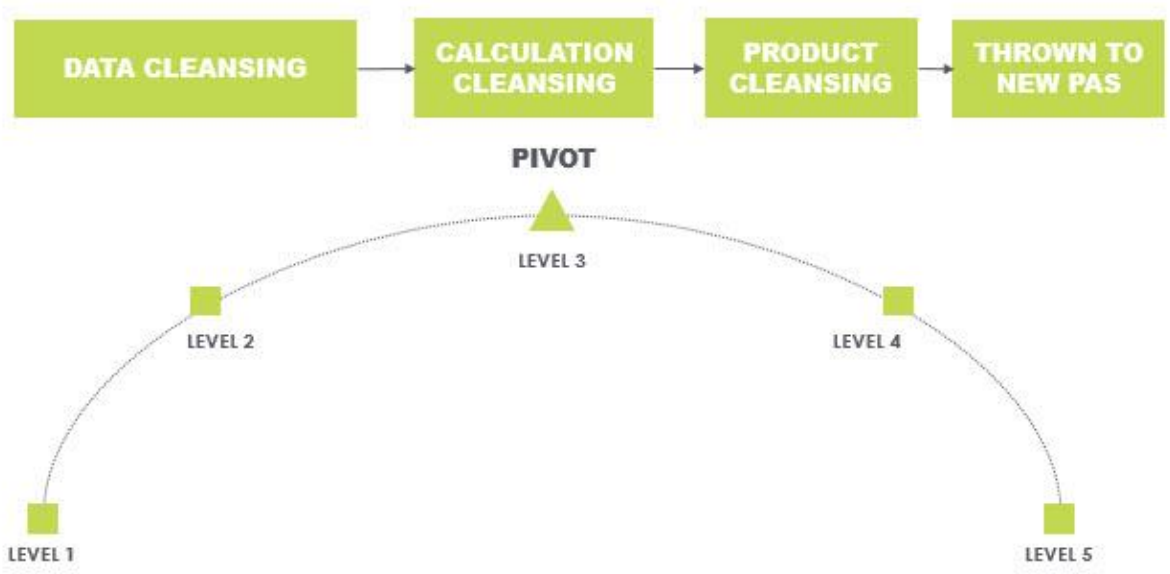
Table 2

LEVEL 1 – FORMAT CLEANSING	LEVEL 2 – DATA CLEANSING	LEVEL 3 – CALCULATION CLEANSING	LEVEL 4 – PRODUCT CLEANSING	LEVEL 5 – MIGRATION COMPLETION
Extract and Clean ***Data is Dictionary Defined and Compliant with that Dictionary***	**Assess for Validity** ***Data is Semantically Validated against Source System Constraints***	**Assess for Compliance** ***Data is Validated against 1st Principle Business Policies***	**Rationalize and Simplify** ***Rationalise Products and Remove Source System Constraints***	**Validate in New Systems** ***Cleaned, Validated, Rationalised Product Data Revalidated in Target Systems***
Data complies with interim SQL "data definition language" definitions	Data values are tested against other data values using business rules defined by the source system	Key values are recalculated and measured against externally published obligations (e.g. PDS's)	Data is transformed, merged, standardized, normalized, and simplified to meet future needs	New Product Configurations and matching policy data are thrown to new system(s) and validated

ISOL promotes 5 levels of assurance for a complete migration. The ISOL assurance levels are designed to provide a quantitative and qualitative assessment of data quality as described by each respective Assurance Level in the adjacent table [Table 2].

Of the five assurance levels, we consider Level Three the natural pivot point because this is where obligations to Customer and Regulator are made explicit. Level Three is therefore discussed first, following a discussion of the more general concept of semantic assurance.

Figure 6



Semantic Assurance

ISOL promotes the concept of semantic[3] assurance, which in this case means that the data is understood and assured in terms of its use in systems.

Semantic assurance requires that the data complies with semantic constraints. Most data are subject to constraint rules that can only be assessed by viewing the data in context using a logic engine.

For instance, a start date cannot be after the end date if both dates share the same context (e.g. a policy); each date may be technically valid (i.e. its representation, value range, and location comply with its data dictionary) when viewed individually, however the presence of the other date imposes a validity constraint that must be obeyed. The relationship between the two dates cannot be described using any existing data definition language or approach and cannot be captured using a data dictionary – the relationship is a mutual constraint on allowed values that is context dependent. Any given field may be subject to many such constraints at the same time (e.g. the start date also cannot precede the birth-date of the life insured, etc).

[3] Semantic Defn: Relating to meaning in language or logic

The context is an important concept and can be described as 'the effects of all other values (regardless of where they are held) on the subject value being validated'.

Semantic constraints are tested and assured at Assurance Level Two.

Semantic assurance also requires that the meaning of the data, as it is interpreted by the programs using it, is understood and retained. It is not self-evident, but clearly demonstrated in ISOL's projects to date, that the meaning of the data cannot be inferred from the data alone.

The clause 'as it is interpreted by the programs using it' is important. The important programs using the data include the programs that calculate the system outputs (for instance premiums, surrender values etc) that match the insurer's obligations to the outside world (especially to customers and regulators). We have referred to these values as the Controlled Outcomes. It is a given that the future PAS will need to reproduce the same output values as the source systems, unless a change is specifically approved by the Accountable Person. Therefore, we need to understand how the data is used to calculate these values, which requires source code analysis of the calculations as demonstrated by the Level Three Assurance.

The Level Three calculations create complex relationships between values that cannot be captured as simple constraints. These relationships are defined by the calculations themselves – for instance each multiplier has a relationship to the product in a multiplication.

It is important that we fully replicate the calculations to ensure that all contributing values are present, and that we understand how they are used in the calculation. How they are used determines their validity. For instance, a premium amount is derived from a plethora of contributing values and conditions; the relationship that each and every value and condition has to the premium value is constant for any given premium value, and these relationships must be revalidated if we are to assert semantic validity of the premium amount.

Both constraint and calculation relationships between fields govern allowed values, and must be validated to be able to assert semantic assurance.

Logic Engine

Semantic validation can only be achieved programmatically using logic[4], which is why the IDIOM Decision Manager™ plays a central role in the ISOL data migration solution.

Building the logic requires us to work at a meta level, using the names and definitions of the data to build the semantic assurance 'idiom[5]' – this idiom is a set of rules that describe the constraints and calculations that determine the correctness of the data in the fields that are described by the dictionary.

[4] For a background on the logic used see https://en.wikipedia.org/wiki/First-order_logic
[5] A speech form or an expression of a given language that is peculiar to itself grammatically. http://www.thefreedictionary.com/idiom. It is this characteristic that gave rise to the word IDIOM in our company name.

These Assurance Level Two and Level Three assessments require development and deployment of a logic engine to evaluate the transaction data [see the Validation and Calculation Engine(s), Figure 2]. The IDIOM Decision Manager™ is a graphical modelling tool that allows SME's to graphically model and test the logic; it then generates high performance, native code implementations of the logic that is executed at scale to evaluate all transactional data.

The scale of the rules that need to be developed and tested is significant in terms of the number of rules and their complexity, however these measures are well within IDIOM's current operational limits.

When the rules are executed, they generate new data outcomes (which IDIOM calls 'Decision's, hence IDIOM Decision Manager). These outcomes include new calculated values, and Boolean interpretations of the comparisons of values. Ultimately, when a breach of any rule is identified, the Decision Models create an Alert for that breach. An Alert is a specific decision outcome that identifies which rule was breached and what transaction (policy) caused the breach.

This new 'hard data' is captured and stored in the purpose-built IDIOM Decision Manager Workbench™ [DMW], from which assurance reporting data can be derived and audited.

The DMW database also supports remediation which is further described in this document.

Assurance Level Three

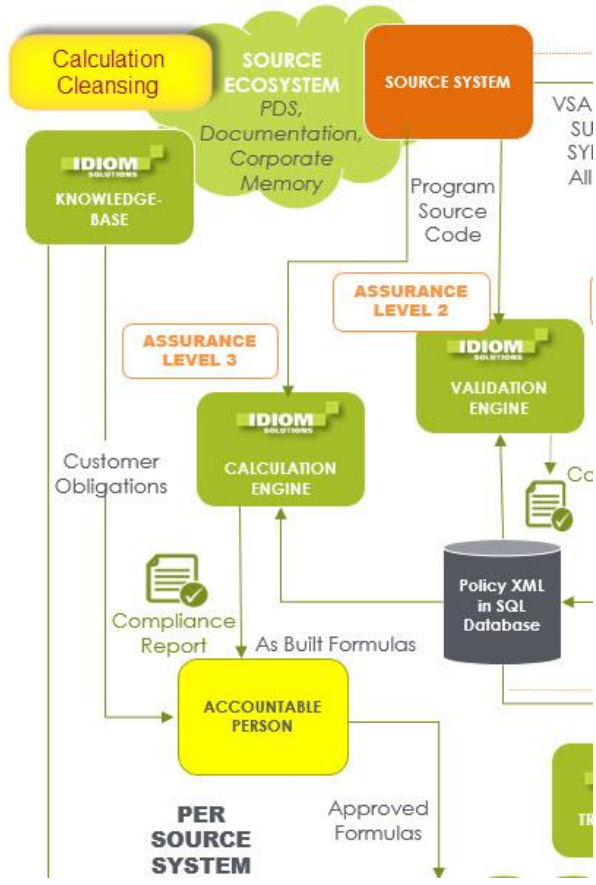


Figure 7

The focus of Assurance Level Three is on the calculation of the system's critical output values, the Controlled Outcomes. This is how we obtain assurance that the data remains 'fit for purpose' in the future PAS, and that the future PAS can be reconciled back to legacy PAS's.

This is an active process, where derived data is independently re-derived. This generates a thorough understanding of the source PAS and traceability back to it. The alternative of passively migrating derived data values will not ensure that a future PAS will produce the same results ongoing as the source PAS did. (And for the sake of clarity and emphasis, it is this derived data that constitutes the purpose of the system.)

Assurance Level Three also draws on the compendium of knowledge that is independently collated into the KnowledgeBase™, especially from first principles

(documents and contracts external to the PAS such as PDS to customer, or technical specifications such as tax office regulations). These first principle directives provide an alternative theoretical view of the Controlled Outcomes.

The KnowledgeBase™ provides a comprehensive compendium of insurance product and systems knowledge, so that an informed assessment can be made about the level of compliance of individual calculations. For instance, if a calculation appears to comply fully, it has passed this assessment (but still may harbour anomalies). On the other hand, if the KnowledgeBase™ of first principles provides clear evidence that a calculation has an oversight (e.g. does not include stamp duty), then the calculation can be reliably described as non-compliant.

Assurance Level Three is now described as a faithful recalculation of the 'as built' Formula to ensure that the source system calculation has been accurately understood and abstracted.

This is followed by an assessment against the first principles version of the same calculation as described (even if incomplete) in the KnowledgeBase™. The Assurance Level Three outcomes are a set of complete, consistent, and correct 'as built' calculations, and an assessment as to the compliance of those calculations.

This is followed by business-driven processes that may adjust the calculations and/or the data prior to normalisation.

Assurance Level Four

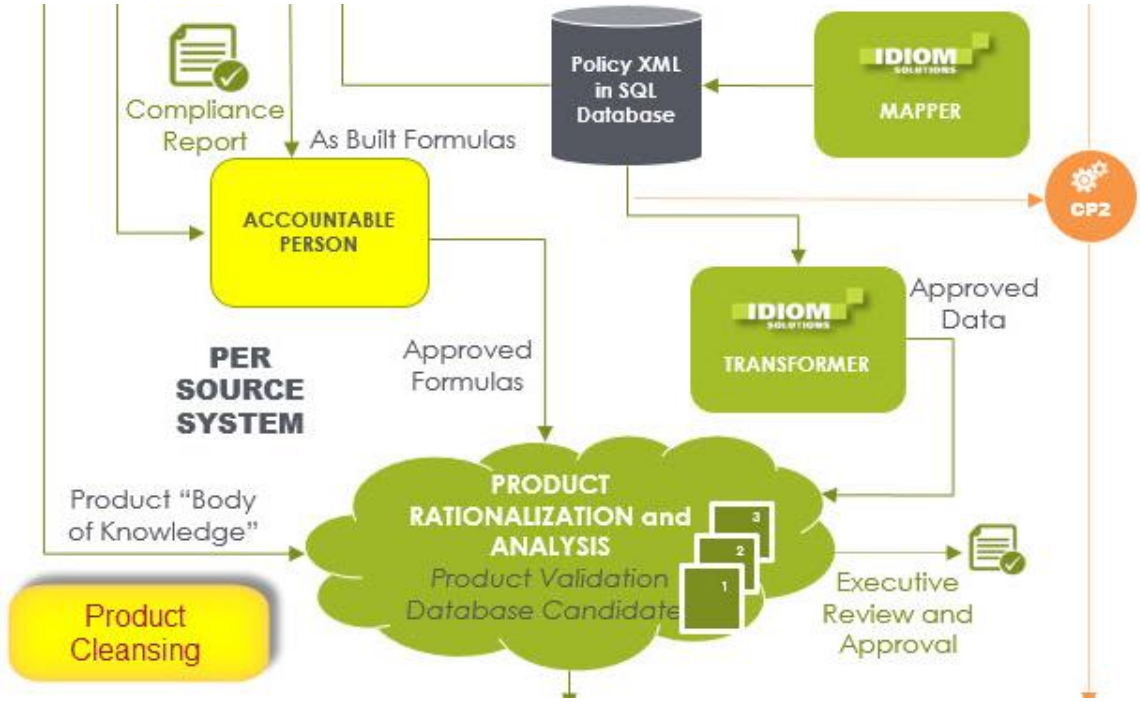


Figure 8

During the migration process, and particularly during the Product Rationalisation process which follows Assurance Level Three, the data will undergo various changes in its

representation and relative location – it will no longer look the same. At no stage should the meaning of the data be affected by these changes unless as directed by a formally approved change in calculation method.

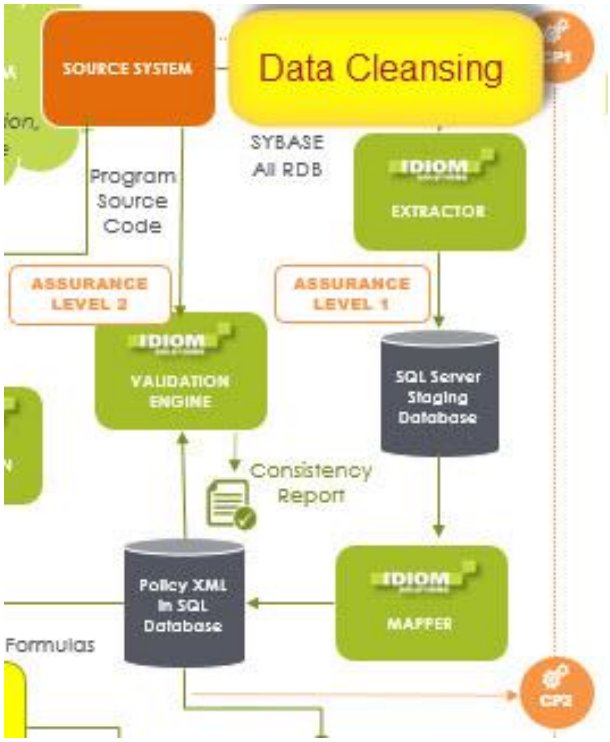
In order to assure this, ISOL reapplies the Level Two consistency checks and the Level Three recalculations at Level Four to provide reassurance that the Product Rationalisation process has retained outputs that match the source system. For work efficiency reasons, this assurance is required prior to providing the rationalised product hierarchy to the future PAS implementers.

Assurance Level Five

Finally, ISOL reapplies Level Two and Three Assurance on the new PAS. At this point the calculations are now being performed by the future PAS and should reconcile to the proven calculations contained in the VPD.

Assurance Level Two

Figure 9



Level Three Assurance recalculates the Controlled Outcomes using existing data, which is data that is externally supplied or previously calculated. In order to avoid calculation errors, it is helpful to determine the quality of this pre-calculation data prior to attempting Level Three Assurance.

Level Two Assurance measures the existing and input data against a series of constraints to determine their state of compliance. Data that breaches the constraints is not compliant.

Assurance Level One

Before we can build the logic that implements Assurance Levels Two and Three, it is necessary that the data must comply with the idiom, which is the meta level dictionary being used to write the logic (e.g. it would be pointless to validate a date if the value in the date field said 'tba').

Therefore, Assurance Level One is assurance that the data complies with the meta dictionary, thus allowing progress to the further semantic levels of assurance. ISOL uses the SQL 'Data Definition Language' [DDL] as the level one validation dictionary. That is, all

transactional data[6] must be compliant with the DDL used by the ISOL 'SQL Server Staging Database'.

Note that this process may require physical changes in the data representation, including EBCDIC to ASCII, binary and hexadecimal representations to character strings, and/or changes to comply with new datatypes. This process is automated using ISOL's proprietary extraction toolset [see the 'Extractor', figure 2], providing fast and safe extraction and conversion of non-relational data.

The DDL used for Level One assurance is then re-cast into a more advanced data definition language, being the XML Schema language (.xsd[7]). During this process, additional meta information is captured, including more complex (data) type information. This information enhances context data that is required to simplify the building and execution of rules.

The Assurance Level One compliant data is then thrown to the matching XML using the new Schema definition as its meta dictionary, so that the additional schema level context data becomes usable in the context of the original transaction data (e.g. policy data).

At the same time, some data elements are normalised around the new Schema data definitions. For instance, legacy systems use many approaches to provide the equivalent of a simple Boolean (which is always true/false in XML); it can be yes/no, binary on/off, one/zero, or even blank = true, blank = false, etc. When ISOL 'throws' from the SQL to XML data representations, these anomalies are corrected to comply exclusively with the XML Boolean definition.

For the sake of clarity, the representation of fields is again being intentionally changed during this process i.e. its representation is changing but not its meaning.

Because of these physical changes in the data representation (but NOT its meaning), ISOL declares a Control Point here and will revalidate every data field for exact semantic equivalence with its source equivalent. This process is described in more detail in the section on Control Points below.

With the data now described by an XML Schema and compliant with that schema, we are ready to begin the level two and three assurance assessments already discussed.

The Control Points

It is necessary during migration that the data is transformed in some way between various stages. For instance, we might go from EBCDIC to ASCII binary encoding in stage 1; we might also transition from primitive Assembler and/or COBOL datatypes to more modern database defined datatypes; and then we go from database defined datatypes to XML datatypes for stages 2 and 3. Then in stage 4 we propose to standardise and realign the product

[6] Note that 'transactions' or 'transactional data' means policy data in this case. The reason that we use the generic terms transaction or transaction data is because the process is repeatable on any form of transaction data and is not explicit to policy data. In particular this may be relevant to conversion of satellite systems, e.g. CRM, Agents, etc.
[7] https://www.w3.org/XML/Schema

hierarchies which are implicit in the transactional data. And in Stage 5 we throw to the target PAS, requiring one last data transformation and the final validation.

The purpose of the control points is to provide an assurance of equivalence between the data contents of each source system at each of the selected 'Control Point's in its migration. The control points incur an additional cost, so the location of each control point reconciliation is selected to de-risk the subsequent step, where that step is proportionately more costly. The first control point reconciliation is proposed immediately prior to Product Rationalisation, the second immediately prior to the throw to the new PAS, and the last following future PAS implementation.

The key to the control points is that the assurance is provided by an extra and quite independent process that provides similar assurance to that of double entry bookkeeping; if there is a zero delta between the migrated data and the independently sourced Control Point data at each control point then we can assert that the migration data at the control point is complete, correct, and consistent with the source.

The requirement to achieve equivalence at each control point step will require us to mirror any transformation in the representation of the data that is occurring at any subsequent step. This implies logic within the derivation of control point comparison data. Therefore, we derive the Control Point comparison data using IDIOM Decision Models.

ISOL's approach to Control Point validation is to independently (and redundantly) maintain the logic within each control point extract that is required, so that we maintain consistency with subsequent steps in the migration. When this is done correctly, the newly generated control point data will match any subsequent control point and vice versa.

The actual assessment of a match will be done by comparing each field in the schema with its match partner. Any mismatch is a fatal error that must be corrected by correcting the underlying transformation or its Control Point equivalent as required, until we have absolute and repeatable equivalence between the Control Point data and the data as it exists in the migration flow.

ACTION PLAN

A Roadmap

In order to move forward using the ISOL approach, the following steps need to be taken.

Phase 1 – Parallel Abstraction

The Abstraction Phase can be executed independently for each source system. Allow 3-6months per system. Systems can be done in parallel if multiple systems.

Note that there is an end-to-end dependency between the completion of Phase 1 for all systems, and the completion of Phase 2, the product rationalisation process.

Phase 3, the final throw(s), cannot be contemplated until Phase 2 is completed. By inference, the Phase 1 abstractions are initially on the critical path.

Phase 2 – Business Rationalisation

The product rationalisation phase as proposed is driven by the Accountable Person. ISOL suggests that the Accountable Person be formalised and activated as soon as possible, if not already in place. Given the Phase 1 activities above, we expect to have a constant stream of issues that require Accountable Person adjudication. At the same time, the Knowledge Base will quickly accumulate a critical mass of product data, and preliminary analysis of product taxonomy candidates can begin.

An early start on Phase 2 will help ensure that the time that Phase 2 is on the critical path is kept to the minimum.

Phase 3 – Final Throw

We expect that the final throw can be prepared and executed in a timely manner when the future PAS is ready. The lead time for future PAS preparation should ensure that the final throw is not on the critical path.

Should an ISOL supplied PAS be required (see later in this document) then ISOL requires a minimum three-month lead time, to be followed by a 100day development sprint. The entire ISOL PAS provisioning (on a minimum viable product basis) should be able to conclude within 6 months elapsed.

Production Use

All of the preceding steps must be able to execute in a single contiguous stream, to be repeated at will for testing purposes, culminating in the final, single-step production throw(s).

ISOL experience to date suggests that this can be usually be achieved system by system within a 48hour window per (i.e. over a weekend) without requiring disruption to business-as-usual that is attributable to the migration process itself (BAU may well be disrupted by other factors related to the business and systems transformations in play).

Product Rationalisation and Analysis

Product rationalisation and analysis will be driven by and coordinated through the KnowledgeBase™. Product synergies, and sharing of features, functions, and calculations will be identified and collated into candidate product taxonomies for consideration by insurer business leaders and the Accountable Person.

The Validated Product Database [VPD] is a sandpit where candidate product taxonomies can be developed and tested. Unwanted candidates can be discarded, while more promising candidates are further developed. One final candidate taxonomy will survive in the form of a preferred Product structure for each (if more than one) future PAS.

The total number of candidates is expected to be absolutely minimal, however the important factor is that different product taxonomies can be contemplated without undue overhead or cost.

Each future PAS anticipated by the candidate taxonomy will have its own instance of a VPD.

The data in each VPD is a combination of product reference data [Product Configuration] and policy transaction data. The VPD Product Configuration data will be synthesised from all of the products that are to be included in that candidate's product family, and may be held (in the VPD) as simple tables, relational tables, or XML as convenience requires.

The VPD policy data will be held as xml in a format that is consistent with the requirements of the Product Configuration. It is a design objective (but not a technical imperative) that there be a single omnibus policy schema for all policy types.

Each candidate will be supported by a series of IDIOM Decision Models that implement the Controlled Calculations, and all transformations and reconciliations.

The primary decision model roles for each VPD will include:

- Transformation: Decision Models will be required to throw the PolicyXML from the source derived schema into the candidate policy schema. If more than one candidate, these models will be normalised (i.e. shared elements will be reusable) to reduce development overhead.
- The approved calculations will be adapted to use the target Product Configuration and the PolicyXML to the extent required to recreate the source system Controlled Outcomes. This recalculation will be an exact match between source and VPD unless varied with Accountable Person approval.

Selection of the Release Candidate(s)

There is the potential to throw to multiple future PAS. This could be desirable if the customisation cost for the preferred PAS is excessive for the strategic value of the products being thrown. A more flexible, lower cost PAS option may be preferred for these products, with ISOL offering its technology as a candidate.

It is highly desirable that the Product Configuration data design that is assumed by the future PAS is used as the starting point for the candidate (product taxonomy) selection process. The rationalisation objective would then be to reduce the number of defined products to the smallest (or otherwise optimal) set that can describe the largest set of policy instances, with priority given to the on-sale products, followed by the in-force products.

The ISOL based re-creation of the Controlled Outcomes will then empirically confirm whether or not the existing future PAS Product Configuration can adequately describe the candidate product set, and/or what customisation and additional features and functions may be required. This in turn may be valuable input to finally confirming any demarcation of products for each future PAS.

This may be an iterative process, leading to an eventual agreed product taxonomy, which may include different Product Configuration approaches for different product hierarchies if the complete portfolio is to be allocated across more than one PAS.

When agreement is reached on the allocation of Products to one or more future PAS, then the next task will occur for each target PAS.

Prepare for Future PAS

When the Product Structure Release Candidate(s) have been selected, further decision model development should occur for each as follows.

- Normalise the idealised calculations by an iterative process of aggregating and conditioning calculation components, and adjusting both the Product Configuration and the PolicyXML as required for maximum simplicity and performance. This process must not materially change any calculated value.
- Produce a Control Point extract of the finished database and reconcile to previous control points. This reconciliation must be exact.

Map to the Future PAS

The process is now ready to throw to the future PAS. The Product Configuration is now in a tested state and is known to work in the context of the PolicyXML. Both the Product Configuration and the PolicyXML schema will now be familiar to the PAS vendor and can be validated in advance. Mapping to the specific schema (DDL or xsd, including ACORD) that is used by the future PAS should be mechanical and low risk. By definition, any mapping conflict will be known in advance and should have been resolved through customisation of the target PAS.

The actual throw can then occur repeatedly as required.

Validate PAS Receipt

The final step is a further control point extraction from the future PAS database. This control point must run prior to acceptance and cutover to validate against the prior control points.

Control Point Development

The control point approach is an additional and discrete development effort that provides an independent confirmation that thrown values have been correctly received at key points.

Additional and independent effort is required if the process is to accord with CPG235, which requires an independent audit. This additional overhead should add between 10-20% to the overall migration development cost described in this document, depending on the intensity of assurance required.

The specifics of the approach require an extract per control point. Note that once the data is in PolicyXML form, this extract is a simple file read.

An IDIOM Decision Model is required to map each succeeding Control Point to its predecessor. This model will mirror the transformations made in the underlying forward transformations, thereby providing the independent confirmation required. The Control Point process is a closed loop, where the data transformations described in the preceding steps are re-done in the Control Point model so that the control point output should match exactly with the source data. If not, either the source transformation logic or the control point logic is wrong and must be corrected.

FURTHER OPTIONS

Calculation Support to the Future PAS

The process as described above will by necessity have recreated all of the critical calculations (the Controlled Outcomes) for each of the source systems. These calculations will have been aggregated, normalised, optimised and validated for the Candidate Release for it to have been successfully validated and promoted.

These calculations will exist as IDIOM Decision Models, which can be natively executed as either JARs (JAVA) or Microsoft C# assemblies (dlls). There are several ways that these existing and tested calculation executables can be used directly by a future PAS.

For the sake of clarity, the following suggestions do not require any further work on, or development of, the validated calculations. If the target PAS does not use the executables directly, then as a minimum the Decision Model logic can be used as a 'perfect specification' of the required calculation functionality.

Direct Call

If the platform allows, the executable can be called directly in the address space of the calling function. If this approach is used, the calling system would be required to instantiate a DOM (or JDOM) that matches the Candidate Release PolicyXML, and pass it into the called executable by reference.

Service Call – Caller Supplies Data

The service call would wrap the executable in a service of the vendor's preference, which may be a queued service, a web service, or any other form of asynchronous or synchronous call to an external process.

The data would need to be provided by the caller in a format which matches the Candidate Release PolicyXML. The results are returned to the caller in the PolicyXML.

Service Call – Service Acquires the Data

The service call would wrap the executable in a service of the vendor's preference, which may be a queued service, a web service, or any other form of asynchronous or synchronous call to an external process.

In this approach, the service would receive a policy key and a service request. The service would read the data from the PAS database and perform the calculation. The results could either be posted back to the database, and/or returned to the caller.

Further Benefits

Given any of the approaches above, it is plausible, even desirable, that the Accountable Person should directly own and manage the calculations on a go forward basis. IDIOM provides extensive support for SME driven unit and regression testing at scale, automated documentation, and audit and control of released artefacts, so that deployment of SME

defined calculations directly into the PAS can be made both risk averse, and transparent and auditable, as prescribed by CPG235. This process is described by one IDIOM customer as 'nimble, continuous, perpetual'.

Audit and Remediation

Even given a perfect throw it is plausible that data will be found to be unfit for purpose in its new environment, or the new environment generates unexpected outcomes. In either case, regular (daily) 'business as usual' data validation and recalculation can provide peace of mind. This process can be implemented on behalf of any future PAS re-using the ISOL calculation assets already described.

The ISOL approach generates a register of precise item by item issues at Assurance Levels Two and Three that can be used to drive further analysis and remediation. It is a feature of the ISOL approach that the identification and analysis of Alerts as described in this document is a precursor step that is intended to progress seamlessly into analysis of remediation options, thence actions, and outcomes.

The ISOL approach fully supports remediation as follows.

When reviewed by SME's, the Alerts are recognised as situations that then require situation analysis as to cause and consequence, followed by analysis of remediation options. The options are subject to governance decision making by the Accountable Person to determine subsequent actions to achieve the remediation outcome.

The IDIOM Decision Manager ™ is purpose built to support this data quality assurance cycle, which is summarised as follows:

- ✓ Identify the Situation;
- ✓ Situation Analysis (cause and consequence) of the Situation;
- ✓ Analyse Options;
- ✓ Governance Decision Point: Accountable Person to select and approve the preferred Option;
- ✓ Perform the Action as required by the Option;
- ✓ Confirm and document the Outcome.

ISOL asserts that this process will help the insurer to meet its obligations under CPG235. Further information on ISOL's approach to managing CPG235 can be found in the IDIOM whitepaper 'Data Integrity in Financial Services' available here.

IDIOM PAS

We have referred to an ISOL supplied PAS. This PAS technology would be supplied in the form of an IDIOM Transaction Engine that is customised to the insurer's needs by directly ingesting the VPD.

Why IDIOM PAS

We have described a process that allows for comprehensive product rationalisation. However, a reduced number of defined products does not of itself reduce the sum of the complexity that is required to support the portfolio.

This complexity may be reflected in data and data structures, supported features and functions, and calculation methods and process sequences. It can be stated with relative certainty that any future PAS has a known and finite ability to define and manage products. Any products that do not fit the available future PAS profile will require customisation of the future PAS if it is to support those products.

At the same time, the products themselves have differing demands for functional support, although all are equal in terms of their requirement for compliance. For instance, the on-sale products require more supporting functionality than the run-off products, which in turn require more than the archival products. The potential differences in required functional support can be used to reduce cost – why pay for 100% functional support for off-sale or archived products? Put another way, what is the minimum that the business needs to invest to ensure that it meets its operational and compliance obligations?

Furthermore, ISOL's anecdotal assessment is that the products that have reduced functional support requirements are also likely to have a greater complexity burden on a future PAS' – that is, it may cost more to implement the least active products in the future PAS.

ISOL therefore proposes the IDIOM PAS concept. The implementation cost of each product in IDIOM PAS will be marginal given the prior existence of a fully formed and validated VPD.

What is IDIOM PAS

At the conclusion of Phase 2 as described in this document, the VPD will contain complete product configurations; all required policy data as PolicyXML; and a complete set of Approved Formulas for the Controlled Outcomes. These assets are the essential elements of a PAS; the remaining PAS functionality is relatively mechanical in nature and easily derived. The required functionality is known and finite, and includes:

- User authentication and authorisation
- Database infrastructure
- Console for administrative functions
- Forms for interacting with Policy data at the transaction level
- Batch jobs for applying scheduled changes to policy data, or for other routine changes and reporting
- Tightly managed integration components to external systems
- Generating customer and third-party documents and communications
- A management dashboard

Over the past 16 years IDIOM has developed all of these capabilities in generic form, which have been recently collated into a single execution framework that we have called the IDIOM Transaction Engine [ITE]. An AZURE PaaS version of the ITE was first used in production with a department of the Government of South Australia for state wide entitlement

calculations in August 2016. It has since been deployed on behalf of a major city council, and as a new direct to consumer insurance sales platform, both in NZ. A non-PaaS version is also available for use in VM or on-premise solutions.

The ITE is more fully described in the whitepaper 'IDIOM Transaction Engine – An Application to Manage Complex Business Entities' [available here].

It provides a complete infrastructure that is quite generic and without purpose when initially supplied. It has been purpose built to ingest verbatim the essential elements of the PAS as described by the VPD, at which time it will perform the majority of the functions of a full PAS. For the sake of clarity, the 'essential elements' of the PAS will be ingested without any further development effort on them.

There are a number of configuration and minor development tasks that will still be required in order to make the IDIOM PAS available for production use. These are described in the following subsections.

Authentication and Authorisation

Provided by an on board Active Directory or by integration with the insurer's preferred home realm. Menu items are declared within the ITE. Could also be integrated with other PAS home realms. The ITE is hardened for use on the open Internet, and includes Auth(0) authentication for passwordless consumer and third-party access (i.e. not domain users).

Database Infrastructure

Database infrastructure will be Microsoft's SQL Server or AZURE SQL (customer preference).

Administration Console

Provided by the ITE Admin Portal. This Portal has a number of in-built functions including policy management (locating, viewing, editing, and any number of specific transaction types, which need to be customised); management of customer communications; and workflow management through management of Bring-Ups (future dated events), management of Tasks (policy specific manual tasks), and batch job scheduling or execution. Further configuration of the Admin Portal to meet insurer's specific needs can usually be achieved in 4-6 weeks.

Forms

An IDIOM Form provides users with a comprehensive webform that is built directly over the PolicyXML. IDIOM anticipates that a single form will provide 100% coverage of all policy data (i.e. the PolicyXML), and that between 50 and 80 transaction level events would need to be executed within or by the Form. These events can be plugged-in to the Forms pre-built event handlers.

The Form can be developed in the proposed 100day development sprint.

Batch Jobs

The ITE provides several default batch jobs including a file pass and BringUps[8]. There are standard design patterns and extensive ITE support for both ingesting and applying batch transaction input files (for example, change requests, payments, etc), and for generating batch output files (for example, financial transactions, commissions, etc).

In general, applying a batch transaction to or from a policy is achieved by a decision model executing within a batch job.

Creation of individual new batch input/output jobs is measured in days to weeks per.

Real-time Integration

The ITE provides extensive inbuilt support for real time or asynchronous transaction level integration, either via web services, or via queues. The specific requirements for these services is dependent on the requirements of surrounding applications. IDIOM typically allows 10-15 days development time per integration end-point.

Customer and Third-Party Documents

The ITE includes an embedded instance of the IDIOM Document Generator. This product uses IDIOM Decision Models to map transaction data (i.e. PolicyXML) to OpenXML documents (i.e. Microsoft Word). The documents can be presented as Word or PDF, and delivered as file downloads and/or email attachments. An outbound email server forms part of the ITE infrastructure.

For the sake of clarity, these are per Policy level documents and not reports. Development of new document specifications is usually measured in hours/days.

Dashboard

The ITE includes a separate Portal for dashboard functionality, which is accessible from the Admin Portal. IDIOM recommends Microsoft's PowerBI as the tool of choice to provide a wide range of real-time and periodic indicators at any level of aggregation, from individual policies to entire portfolios. Dashboards are usually built by the application owner's MIS team.

IDIOM PAS Delivery

Assuming that ISOL proceeds to implement the Validated Product Database, then we typically provide some IDIOM Forms functionality to assist with viewing and managing various aspects of the VPD.

This can very easily advance to an IDIOM PAS 'proof of concept'.

Actual delivery of an IDIOM PAS would need to be planned and costed when the requirements are known, in particular, exactly which products, and by implication what

[8] BringUp is a term that we use for future dated events. BringUps are enumerated events that exist as records in the ITE database, keyed by the PolicyXML to which they relate.

functionality, is to be managed by the IDIOM PAS. This could include a small set of residual products that cannot be easily migrated to future PAS, through to larger sets of products, which for the sake of clarity, could extend to all of the insurer's products i.e. full PAS.

Assuming a fully functioning VPD, then a running instance of IDIOM PAS should be achievable in 100days elapsed from the point of requirements certainty.

IDIOM PAS SaaS

IDIOM would be pleased to discuss provision of the IDIOM PAS on a full-service basis (SaaS) if desired by the insurer. This would include all technical support and provisioning of run-time capacity.

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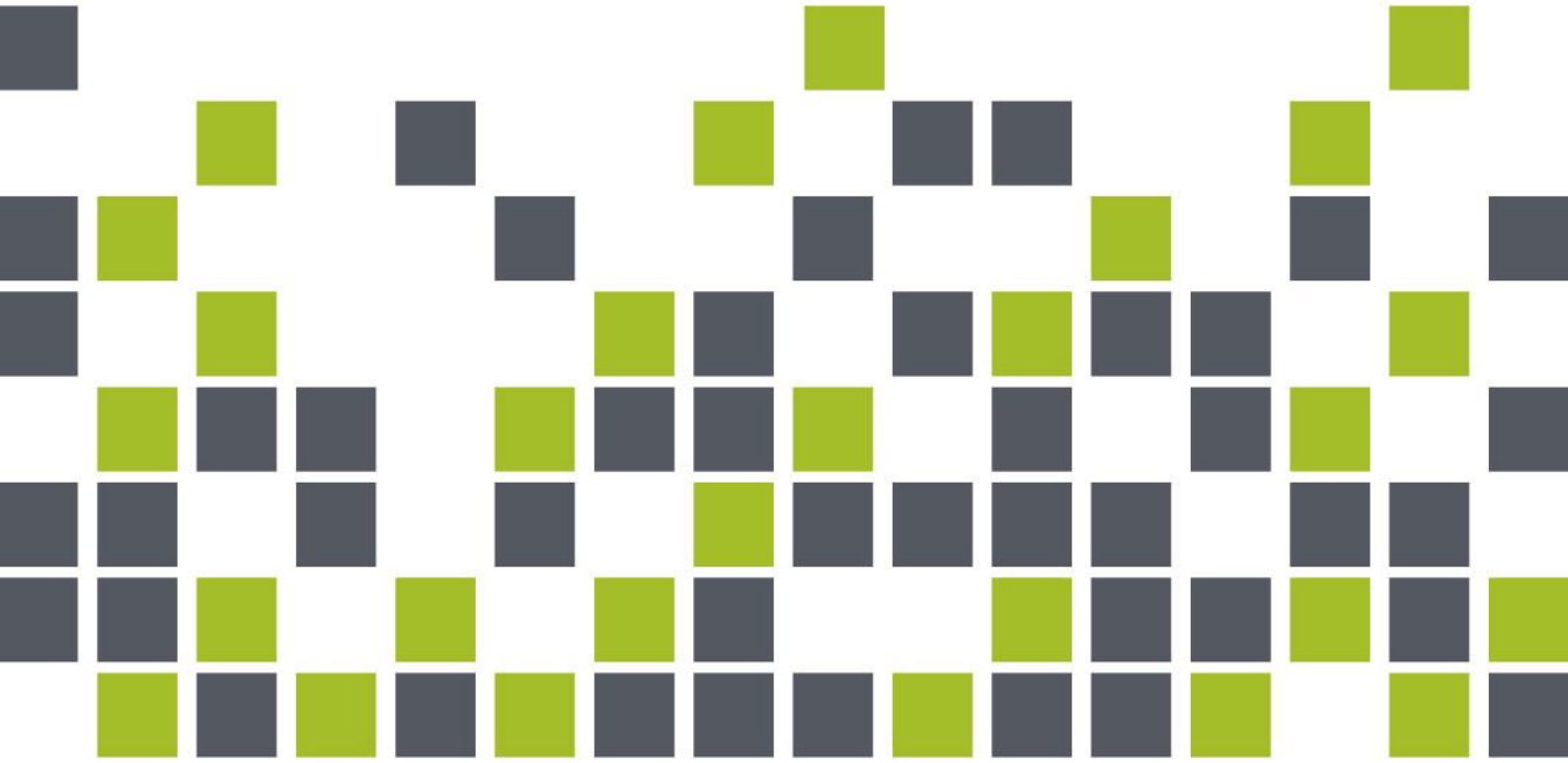

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