



## **Business Rules Excellence Awards**

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***Deloitte Limited (New Zealand)***

*Nominated by IDIOM Limited, New Zealand*





## EXECUTIVE SUMMARY / ABSTRACT

Deloitte Limited (New Zealand) provides professional services including payroll remediation services to clients throughout New Zealand. NZ enacted complex holiday and termination payment rules in the Holidays Act 2003 that payroll systems have generally failed to implement correctly. The law requires remediation for the last six-years of payroll.

Deloitte developed a rules-based approach to validate, transform, recalculate, and remediate complex payrolls over the full six-year period. The rules are continuously adapted and used by Deloitte consultants throughout the approach, which was first applied to the NZ Police payroll remediation, resulting in a payout exceeding \$NZD40m to 20,000 staff.

Deloitte has so far remediated the payrolls for more than 20 employers across the country (both public and private), hundreds of thousands of employees, and eight underlying payroll platforms.

This submission describes how Deloitte's use of rules has given it an agile and cost-effective process to recalculate and remediate payroll systems at scale. The NZ Police case is used as a reference case to highlight key elements of the solution described herein.

## OVERVIEW

Deloitte Limited (New Zealand) [Deloitte] provides professional services including pay-roll consultancy services to Government and private sector clients throughout NZ.

Payroll systems have attracted global attention for their complexity and scale, with Canada's Phoenix project and the Government of Queensland's Health Department payroll providing examples of what can go wrong.

In 2003 the NZ Government enacted complex holiday and termination payment rules in the 'Holidays Act (2003)' [the Act] that payroll systems have generally failed to implement correctly - Deloitte estimates that up to 80% of the country's payrolls are not compliant. The law has recently been strengthened with increase regulatory powers and substantial civil penalties. Errant employers are required by the Act to remediate the last six-years of payroll, with several enforceable actions already issued.

The main issue with compliance with the Holidays Act is that most payroll systems are based on hours (i.e. hours \* rate) whereas the Holidays Act is written around days and weeks.

The essence of the act is that when an employee takes a public or annual leave holiday, or any cash equivalent in termination or other special pays, then they should get the same pay as they would have if they had worked that specific day. The Act requires a calculation of the proximate daily pays for the preceding 4 weeks, and for the preceding year – the correct holiday pay rate is the greater average of these. This is an easy calculation for regular 40 hours per week employees but when overtime, commission, and variable day pattern rosters are taken into account it becomes very difficult to configure a traditional COTS payroll system to comply with the Act.



In 2014 Deloitte was approached by NZ Police to review and remediate the NZ police payroll to ensure compliance with the Act. This was one of the earliest known examples of non-compliance, which has since been found to be widespread.

Deloitte realized that a rules initiative was required and approached a local rules tool vendor for support. Together Deloitte and the vendor developed an approach to build rules that audit, validate, transform, recalculate, and remediate complex payrolls over the full six-year period, with an additional year for the prior 12-month daily average.

The process has since been made more reusable by building a separate decision model of the underlying Holidays Act legislation, and then using targeted decision models to transform customer specific payroll data for use by the generic Holidays Act model. These models continue to evolve, progressively codifying the expertise that is being built up through multiple customer engagements.

Deloitte has so far remediated the payrolls for over 20 employers across the country (both public and private), hundreds of thousands of employees, and eight underlying payroll vendor platforms.

This process is continuously optimized by codifying the knowledge gained from each engagement into the rules, to the point that eight payrolls are now being remediated in parallel using the same number of staff as for the first remediation.

During the remediation process, Payroll systems are often found to have systemic inaccuracies, which require rules-based correction before complete recalculation of the payroll can be attempted. Sometimes, this correction and recalculation must be embedded into the standard 'business as usual' payroll process pending correction of the payroll application itself.

More recently, there has been a perceived need to provide a 'light-weight' remediation service for smaller payroll users. This service is under development.

## **BUSINESS CONTEXT**

### ***The Complexity***

In 2003, the NZ Government passed the Holidays Act (2003), which has ultimately proven to be complex legislation that cannot be implemented in payroll systems through configuration, with the proportion of non-compliant systems estimated to be up to 80%.

The complexity arises because the payroll systems usually calculate payroll on an hourly basis for wage workers, or on fixed periodic payments for salaried workers. In both cases, and somewhat intuitively, holiday entitlements are usually calculated by these systems on the same basis as the regular payments.

Unfortunately, the Act requires leave payments to be calculated at a daily rate that is the higher of: the average daily rate of the last 4 weeks; or the average daily rate of the last 12 months.





This causes an immediate issue because daily payments are not standard calculations for payroll systems, so that there is a need to convert wage or salary payments into daily equivalents, each of which incurs different issues.

The hourly calculation must take into account not just all hours worked, but the rates paid for the hours, including overtime rates and other time-based allowances that increase the effective per hour rate. For instance, work that flows over onto a public holiday can trigger an additional payment that must be rolled back into the period to which it relates.

For the salaried workers, the daily rate varies simply because of the number of working days in the month.

In both cases, all additional payments must also then be prorated into the period to which they apply. For instance, a weekly shift allowance will be pro-rated across all days in that week; whereas an annual bonus must be prorated across all days worked in that year. The scope of additional payments includes payments made for leave taken, thus adding a regressive element to the calculation. For instance, a high bonus in a month can increase the daily rate for leave taken in the following month, which will in turn increase the daily average for that month, etc.

For the sake of clarity, all payments made to employees are covered by the Act and need to be included in the calculated daily rates.

Once all amounts have been apportioned to each and every day's payment, the rolling 4 week and 12 months averages need to be calculated, so that leave taken on any given day can be paid according to the highest of these rolling averages. This requires a rolling daily recalculation because of the regressive factor i.e. each holiday payment changes the relevant averages.

Further complexity is added because holiday pay is a common element of termination pays, and so the recalculation and remediation must include all terminated employees, with a six-year remediation horizon defined by the Act.

Notwithstanding the above already complex scenario, the largest challenge in all of the projects has been quality of data and undisciplined use of the systems.

For example:

- 'Annual Leave' payment code is sometimes used both for 'Annual Leave Taken' and 'Annual Leave Entitlement' paid out on termination of the employment. These need to be treated differently depending on where in the employment period they appear.
- It has also been seen that some organizations do not separately record 'Public Holiday Observed' with its own pay code, so in these cases a diary of all public holidays needs to be kept to generate these entries, as the Act stipulates that a 'Public Holiday Observed' needs to be paid according to a formula in the Act.
- Situations where balances and hours paid have, in accordance with ancient practices, been cleared following payment have also been encountered so that these values have had to be regenerated from first principles.



With the above as background, we can now overlay the commercial reality of a recalculation and remediation. The employer, who has paid in good faith to date, is now charged with the cost of remediation, and any additional payouts that are incurred, which can be substantial. This creates price sensitivity.

At the same time, the employees have by now discovered that they have been paid incorrectly under the Act and are concerned to verify that the remediation and go forward payments are correct.

And due to the complexity of the Act, both require a trusted third-party advisor who can authoritatively warrant that the payments are correct following remediation. Deloitte provide expert payroll consultancy services to customers throughout NZ and are perfectly suited to this role.

However, in 2014 when the first remediation was being negotiated with NZ Police, there was no technically viable solution for the automated recalculation and remediation required. At this point Deloitte sought a rules-based solution, and the Police re-remediation project became the trailblazer for many subsequent remediations.

## **THE KEY INNOVATIONS**

### **Business and Operational Impact**

#### ***Why Do Customers Seek Remediation?***

There are significant and compelling reasons for prompt and efficient remediation of payrolls in error.

First and foremost, following a recent adjustment to the Employment Relations Act, the Labour Inspectorate (the NZ Government Labour Regulator) is empowered to audit payrolls without cause, and substantial civil penalties can be imposed on companies that do not comply with the Act. Such penalties, if incurred, would almost certainly exceed the cost of calculating and paying remediation.

Secondly, the legal and financial perils that are implicit in any company's payroll is an issue for all stakeholders, with particular emphasis on any company involved with merger or acquisition activities. These perils must be quantified and remediated before the mergers and acquisitions can take place without legal and financial risk.

#### ***National Importance***

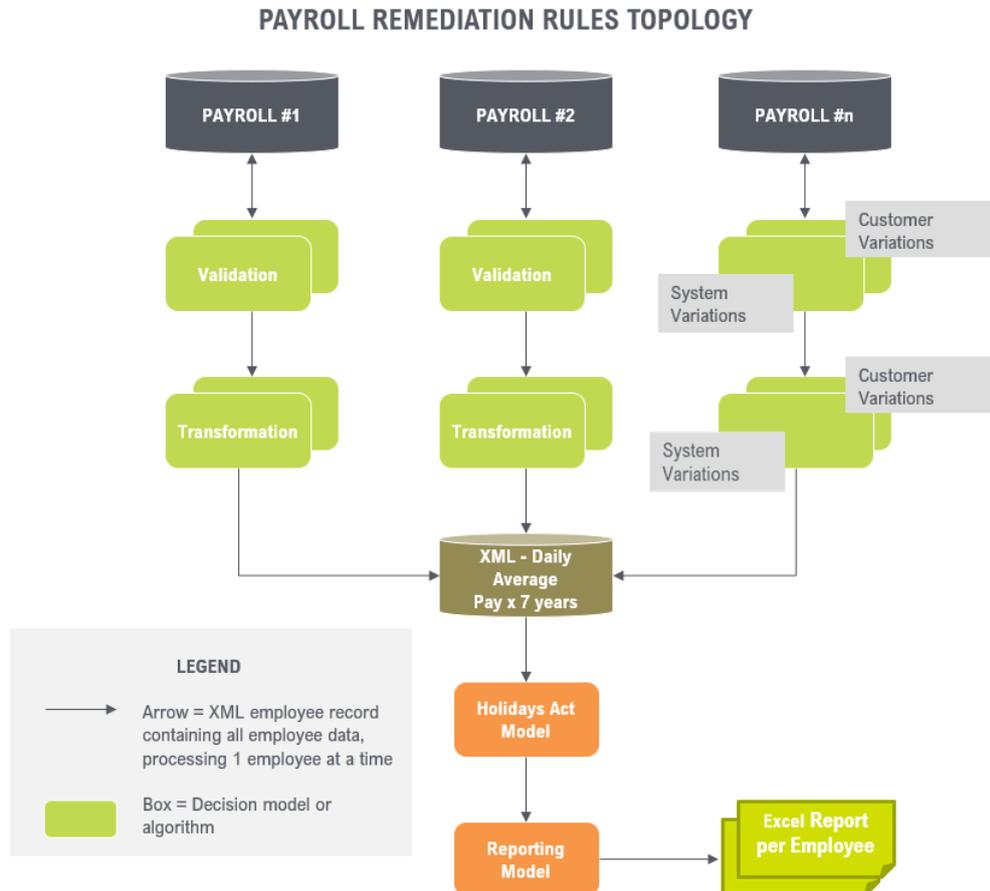
The cost of calculating the remediation is a direct imposition on the national economy. An efficient process for this is of national importance.

Also, the employees invariably benefit from the recalculation and remediation, meaning significant wealth redistribution throughout the economy.

#### ***The Rules Topology***

Using their expert understanding of the Act and of the payroll systems in the market, Deloitte were able to develop a conceptual recalculation and remediation approach to be implemented by rules.

This approach resulted in the rules topology in the diagram below.



### Diagram Narrative

In this diagram (see above), an arrow represents the flow of data as a single XML document per employee for the entire remediation period (six plus one years). All data required by the process is described in this record. The XML is read and updated by the various decision models (square boxes) as it passes through them. A decision model is a complete multi-step algorithm that achieves the purpose of the model indicated by its label and the related discussion in this document.

The top tier of the Diagram represents the various payroll systems in the market. Eight different vendor systems have been remediated to date, including global brands.

The process starts by mapping the payroll data to the XML using mapping technology provided by the rules product vendor. This starts an iterative process of validation and correction of the input data. As might be expected, this part of the process is the lengthiest and most arduous.





A standard model for each payroll system is used to perform the validations and correct known issues for that payroll platform. These are supplemented by customer specific models to make further adjustments to correct any issues that arise from that customer's specific use of the payroll platform, which can vary over time under different administrators.

When the data passes the validation gate and is deemed (by the rules) to be valid for the remediation process, it is processed by the transformation model(s). This model turns raw payroll data into the daily rate format that is used by the Holidays Act Model. The output of the transformation includes the average daily rates for the entire seven-years.

The Holidays Act model is a pure and concise implementation of the Act and has been warranted by Deloitte experts as an accurate implementation of the Act. It is never varied for a customer or payroll system. The Holidays Act Model calculates the correct holiday payments for comparison with the actual payments made.

When complete, the XML flows to the reporting Model, which calculates each day's remediation adjustment, and then transforms the entire XML into a format that corresponds to an Excel spreadsheet. The final step is to convert the employee XML to Excel, which is distributed to the parties to provide the definitive audit trail and final report for the regulator, the employer, the employee, and their advisors.

### **Iterative Process**

Building out the models has been a continuous process that 'learns' with each customer engagement. There have been more than 20 engagements to date covering hundreds of thousands of employees and generating substantial payouts. As each improvement is made, the process becomes more accurate, faster, and less resource intensive, and is now the most cost efficient and accurate solution in the market (some alternative approaches have been audited post remediation and found to still not be compliant!).

Notwithstanding an efficient process, the full process cycle described above is a substantial and expensive engagement even for Tier 1 customers.

For smaller employers, a more cost-effective solution is required. So more recently, the approach has been adjusted to allow customers to supply their own data via Excel that is manually prepared to comply with the input requirements of the Holidays Act Model, which will be made available on a SaaS basis to achieve the same end as the Tier 1 solution without a requirement for high levels of consulting. This approach is still under development.

Deloitte NZ compete in this space with their global competitors. Deloitte believe that the rules-based solution now being used is the most efficient in the market, and all else being equal, this means that they are inherently better able to compete.

A separate business unit has been established for this purpose, which is now generating significant and profitable revenues for Deloitte NZ.





## Innovation

Payrolls are traditionally complex applications. This complexity arises from the variability of national legislation, the number of discrete calculations involved, and the propensity for frequent variations in contract terms and conditions across various groups of workers and across time.

By way of example, the Queensland Health Department (Australia) has now acknowledged a \$AUD1.4bn blowout on a payroll implementation for an approximate work-force of 100,000. More recently, Canada has acknowledged a similar size failure across its Federal payroll systems in the Phoenix project, which has now been abandoned. And in NZ, the ~100,000 teachers payroll system for the Ministry of Education has had a \$NZD100m cost blowout. The point of these examples is to emphasise that payroll is complex and non-trivial, even without the Act.

In order to assess the NZ holiday entitlement, there is a need to ensure that the proximate daily rates can be established, which means recalculating items including base pay, overtime, holidays, allowances, cash-ups, long service leave, etc. That is, the entire payroll needs to be recalculated and refactored to determine effective daily rates for every day for the full seven-years. Only then can the correct holiday pay be determined, which is a critical input into the final adjustment calculation. Note that any change in system or administrator during the seven years compounds this complexity.

In this solution, an adjustment amount per day for six years is calculated, and then mapped into an Excel spreadsheet along with supporting data for full disclosure to the employee and their advisors.

During the remediation process, Payroll systems are often found to have systemic inaccuracies, which require rules-based correction before complete recalculation of the payroll can be attempted. Sometimes, the correction and recalculation must be embedded into the standard payroll process pending correction of the payroll application itself. This is easily done by simply injecting the relevant decision model(s) into the underlying payroll system's processing cycle.

A critical innovation that was applied to this project was the development of a rules topography as described in the previous topic. A rules topography lays out a map of the rules architecture that guides the analysis and development of rules and is somewhat comparable to a data architecture. It is a critical step for the normalization of rules and helps to ensure that rules development is fully normalized.

A rules topography lays out the topics that have strong rules cohesion within them. These topics often align with areas of organizational or consulting expertise and define areas of rules reuse. In the case of this project, the rules are built in layers around the core Holidays Act model, so that only customer specific differences need to be codified into customer specific decision models. Decision models that pre-exist for different vendors systems are reusable across customers, as are other layers of transformation and validation rules as the data migrates from the source systems through to the central Holidays Act model.



## Impact and Implementation

### **The NZ Police Payroll Remediation**

The NZ Police payroll remediation is the reference case that exemplifies the generic Deloitte solution. In 2014, the existing Police payroll system was reviewed to assess the correctness of termination pay and was found to have multiple systemic errors over a period of decades. The Regulator required a recalculation and determination of per member adjustments for all members terminated between 1/4/2004 and 27/10/2011.

Deloitte was retained to undertake the recalculation and remediation.

A rules-based calculation engine was developed to correct the payroll calculation errors and reprocess all termination payments for people terminated in the relevant period to determine their correct pay in accordance with the NZ Holidays Act 2003. Then to calculate deltas against actuals and generate remediation payments (total value approaching \$NZD3m).

Following the successful conclusion of the Termination Pay Project, Deloitte were further requested by NZ Police to recalculate all payments covered by the Holidays Act 2003 (i.e. not just termination payments) and to remediate a number of issues under their collective agreements. This resulted in a further total remediation payout exceeding \$NZD40m. Per member reconciliation spreadsheets were produced to provide full transparency of the recalculations over 6 years.

The general approach for recalculation and remediation of payrolls to comply with the Act was developed at this time. Using the Police project as a reference case, the project was required to:

- ✓ Retrieve the required source data from the Payroll System Database (e.g. Employment Details, Allowances, Payments Made, Leave Taken, LWOP Days etc.)
- ✓ Construct an intermediate data structure suitable for the analysis
- ✓ Calculate what the payments should have been and compared these with payments made
- ✓ Produce a report with references to the individual inputs and the intermediate calculated structures to provide a detailed audit trail to support remediation payments (or the lack thereof).

The complexities involved in this project included:

- ✓ The underlying payroll systems have varying data quality, including in-consistent and irregular data (e.g. leave taken following termination)
- ✓ Data structures and database keys changing over time as systems mi-grated
- ✓ Running different Calendars for different parts of the country
- ✓ Data to be analyzed reached as far back as 8 years
- ✓ All nuances in the Holidays Act over the full-term including definitions of Base Rate, Ordinary Rate and Average Weekly Earnings



- ✓ Creating an intermediate data structure representing each day the person was employed, to be marked with the amount the employee was paid that day in aggregate, or if leave was taken
- ✓ Calculating TOIL and Special Care Cash Ups
- ✓ Calculating Annual Leave, Long Service Leave, Shift Workers Leave and Statutory Holiday pay outs
- ✓ Comparing the Calculated Amount to the Amount Paid
- ✓ The Amount Paid was not uniformly found and needed to be located from different places depending on time period
- ✓ Refactoring the results into a day-by-day report format to be published as Excel for the employee and their advisors.

Following the remediation described above, it became apparent that payroll systems throughout NZ were not calculating correctly according to the Holidays Act. In April 2016, the Government increased employer obligations to correct this, and penalties for failure accordingly. The Labour regulator was further empowered and has issued a number of actionable enforcements.

At this time, Deloitte formed a Centre of Excellence (2-3 people) with support from the rules product vendor, and the solution that is described herein was productized and taken to market. The COE is responsible for the continued evolution of the reusable models throughout the solution, and for training new consultants on a regular basis as the team expands.

## **HURDLES OVERCOME**

### **Management**

Building an efficient process for the full cycle from customer engagement through to final remediation and payout required building a multi-disciplinary team in a new business unit.

The team's resources include the following skillsets: sales, customer account management, payroll subject matter experts, payroll vendor system experts, database experts, rules authors, and testers. The team is split across two organisations.

This unit was modelled on a military style task-force, where all required skills belong to a common reporting structure, and prior organisation or role boundaries cease to be relevant when the team is operational.

### **Business**

The new business unit has had to meet the needs of managing up to ten customers at a time in the presales process, and then pipelining up to eight remediation projects in parallel on a continuous basis through the team's processes.

The task-force approach has proven effective in meeting this need with a minimum of resources.



Notwithstanding the efficiency of the process when compared with competitors, the entire topic is a substantial net cost to the employers, and there is significant price resistance. As a result, short form remediations are being developed, where employers can simply supply pre-defined datasets (database, XML, or Excel/CSV) for interpretation by the Holidays Act model. A Software-as-a-Service approach is being investigated.

## Organization Adoption

This is a new and self-contained business unit established by Deloitte for this purpose.

Nonetheless, there are now multiple other use cases for the underlying rules capability that are being investigated by Deloitte across multiple jurisdictions.

## BENEFITS

### Cost Savings / Time Reductions

This process is simply the most efficient in the market when measured by hours to achieve the outcome and provides a substantial hurdle for competitors. The more recent short form and SaaS process options will expand the market to include smaller employers and reduce costs further for employers that take advantage of it.

### Increased Revenues

This process has built a profitable new revenue stream from a dedicated unit.

The process has built core IP in the form of the Holidays Act model and various transformation models for different vendor Payroll systems. This IP is owned by the proprietors of the business unit and is separately charged as an add-on to the consulting fees. This improves top-line and bottom-line revenue when compared with the standard consulting revenue model.

### Quality Improvements

This process has codified best practice and provides verifiable assurance of compliance. This is reassuring for the employer and the employees.

Depending on the depth of the investigation employed, there is often a side effect of general payroll verification and/or identification of anomalies that require correction in the underlying system.

## BEST PRACTICES, LEARNING POINTS AND PITFALLS

### Best Practices and Learning Points

- Developing a rules topography to guide rules development is an important pre-cursor step to take in any rules development and is essential for effective normalization of rules.
- Rules should be fully normalized – this means the fewest number of rules to implement the required algorithms, which by definition means that the algorithm is in its simplest form.



- Normalized rules allow greater agility (less to change), fewer errors, more reuse, and less development effort.
- When rules are normalized, it follows that patterns for reuse of rules must be achieved at many levels, with special emphasis on the decision model itself. This is the driver for a rules topology.
- Identify and develop the core rules first. These are the rules that define the purpose of the system. Then follow through with development of transformation rules, validation rules, and finally workflow and reporting rules. That is, build from the inside out, starting with the core, and working back to the inputs (via transformations and validations), and then working forward to the outputs (new state values, reports, workflows).
- Use the best subject matter experts to develop the reusable rules in order to codify and then leverage their expertise.

### Pitfalls

- In general, avoid the antithesis of the above.
- Don't build monolithic rules structures that mix purpose and expertise.
- Don't mix rules by type in the same algorithm (e.g. core calculation, transformation, validation, workflow, etc.).

## COMPETITIVE ADVANTAGES

Competitive advantage accrues from three critical areas.

Firstly, the Holidays Act itself has been codified and reviewed for accuracy. It now exists as a single decision model that is a definitive and executable version of the Act that is reusable for all payrolls.

Secondly, the speed and development efficiency of the rules tool means that existing payroll systems can be quickly re-factored from wage/salary centric to day-rate centric as required by the Holidays Act decision model.

Finally, individual contract-based calculations within any Payroll System can be quickly reconfigured as decision models to validate and/or correct systemic errors in the underlying system(s).

Considered together, these advantages ensure that no competitor can offer a faster or more accurate recalculation and remediation.

Notwithstanding, there is a concerted effort being made to continue to improve (i.e. reduce) the recalculation and remediation time and costs, particularly for the benefit of smaller businesses.

These efforts are focusing on building more generic transformation capabilities to feed into the proven recalculation model. Excel spreadsheets are a viable medium for supply of payroll data for smaller employers because these can be more easily developed and populated by businesses without in-house IT shops.



When the Excel input schema and process model is available, it is likely to be provided under a SaaS model for unattended use by the employer/customer. Access to an individual verification model for use by individual employees is also under consideration, also to be made available under a fee-based SaaS model.

## TECHNOLOGY

The technology used for rules offers a number of compelling features:

**Scale and Complexity of Rules:** The rules development paradigm, and its supporting decision engine, is required to deal with all terms and conditions found in employment contracts across the full extent of the labor market, as well as all standard payroll calculations, and the calculations required by the Act.

The recalculation process uses a variety of decisioning techniques such as: derivation, augmentation, aggregation, creation, generation, accumulation, date boundary, and general pattern matching to assemble and convert the raw payroll data into a format that can be used for recalculation and remediation for compliance with the Act.

We process seven-years of complete payroll data per employee in a single XML record, with the largest employer in NZ having circa 100,000 employees. Note that seven-years is likely to span many sets of employment terms and conditions, and occasionally spans payroll systems boundaries when the payroll customer switches systems. We have also found that changes in administrative behavior throughout the 7year term mean that the use and meaning of different data elements varies over time. These changes in use and meaning are material but not obvious; when found, additional rules are generally required to standardize the data in these fields.

**Performance:** While calculations are not required in real time, it is important that elapsed run-time is acceptable (a few hours max) to effectively support the development and testing process. It is a feature of the rules technology used that the rules engine is both stateless and thread-safe. The rules development paradigm explicitly focuses on entity level data and calculation, in this case, an individual employee. Every available thread can be used to process an employee entity end-to-end.

The vendor supplied Mapping technology supports multiple processes, each of which runs multiple threads. In general, one core can run slightly more than 1 process. Therefore, the number of cores and processes required for adequate run-times is determined by the size of the payroll file, in particular the number of employees. Our largest payroll to date has used 32 cores to run 40 processes in parallel, usually pro-cessing a member end-to-end in about 1 second. The more complex Police project final production run was completed in four hours, using data extracted from an Oracle Database and processed by six parallel run-time processes (around 2 seconds per employee).

**Ease of Use:** The above techniques must be easily accessible to Deloitte's payroll subject matter experts [SME] using graphical, language neutral interfaces.

The rules development is performed by the team of Deloitte consultants. Training in the tool and the substantial range of pre-existing models is required regularly. This training is provided



by the 'center of excellence', which is also continuing to evolve the pre-existing models as new edge cases come to hand. Training takes 1-3days, de-pending on the complexity of the immediate target payrolls.

**Data Agility:** A simple change to an XML schema is all that is required to introduce new facts into the scope of the rules. Data can be added at will on an ongoing basis and are immediately available to subsequent rules processing.

This data is supplied to the rules by the vendor supplied mapping tool that explicitly supports the decision engine processing cycle. The mapping tool reads the source data and assembles it into entity level XML (one per employee) very quickly; it then distributes it across as many rules engine instances as required to achieve the de-sired throughput.

**Time Sensitive:** The rules tool uses effective dates at all levels, across all components, from individual data items, through individual logical operations, formulas, and any aggregation of the same through to entire decision models. This effective da-ting means that one decision model can easily manage contract terms and conditions that change on annual boundaries, and is critical if there has been a system change within the 7year period, which generally requires a substantial change in the pro-cessing model at an arbitrary date.

**On Board Execution:** The rules tool has an on-board execution engine and extensive support for both on-board step-by-step and full regression/simulation testing. This allows an independent rules development cycle that means rules can be developed independently of the application(s) they will service.

For payroll remediation, rules must be able to be developed and tested in isolation, using masked data use-cases. There are multiple reasons for this. Firstly, privacy issues limit the movement and distribution of live data. Secondly, the Payroll customer is not always in a position to provide the required processing capacity and access to the full payroll in a timely manner for the remediation team, while continuous on-site development (even via VPN, which is not always available) is awkward and time consuming. Self-provisioning is important.

Accordingly, the on-board execution capability is fully utilized for development and unit testing, with payroll runs on live data only used for UAT and production runs.





## THE TECHNOLOGY AND SERVICE PROVIDERS

**Deloitte Limited** <https://www2.deloitte.com/nz/en.html>

Deloitte brings together more than 1200 specialists providing New Zealand's widest range of high quality professional services. We focus on audit, tax, technology & systems, strategy, performance improvements, risk management, corporate finance, business recovery, forensics and accounting services.

**IDIOM Limited** [www.idiomssoftware.com](http://www.idiomssoftware.com)

IDIOM supplies the IDIOM Decision Manager™, which was used to construct all decision models referenced in this case study. IDIOM Decision Manager™ is a graphical modelling tool that is used by subject matter experts to build, test, and deploy very large and complex decision models for any domain.

IDIOM also supplies the IDIOM Mapper™, which is used to acquire data from a relational database or other sources, to render it for use by decision models, and to then execute the decision models at scale.

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