

Inventory of Tax Technology Initiatives: Case Study In-Year Reconciliation

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The objective of the In-Year Real Time Tax Reconciliation (IYR) project was to accurately adjust personal taxpayers' tax liability in real time to reflect their obligations based on the real-time pay information made available by the modernisation of our PAYE systems. Real time reconciliation of a taxpayer's tax position optimises the use of an individual's rate bands and credits based on their income thresholds, and updates exceptions as appropriate. This project has further reinforced Revenue's strategic goal to ensure that Irish taxpayers are paying the right tax at the right time.

The IYR system utilises existing Java architecture and a distributed event store and stream-processing platform to adjust PAYE cases in real time, based on updates to various data sets as they are processed by their respective applications. IYR is triggered by different events, such as submitting a payslip, changing a customer's date of birth, adding bank details, or actions taken by Revenue caseworkers.

Business Need

Requirements

As part of the PAYE Modernisation project undertaken by Revenue, real-time PAYE tax data became available for all employees from January 2019 onwards. Prior to this, Revenue simply did not have the data to perform in-year tax calculations. Real-time PAYE reporting enabled Revenue to carry out automated tax calculations by leveraging this data.

Several areas were identified where PAYE taxpayers could benefit from a real-time assessment of their tax position. This analysis was carried out as part of Revenue's strategic objective to ensure taxpayers are paying the right tax at the right time, as part of the wider digital transformation of taxation envisioned under Tax Administration 3.0. Specifically, the following scenarios were identified:

- Week One Marker Removal
- PAYE Exemption Marker Removal
- USC Exemption Marker Removal
- Top Rate of USC Marker Addition
- Home Carer Credit Removal

It was determined that these five rules could be automatically checked against in-year calculations carried out by Revenue's backend tax calculator system. The IYR project was undertaken to build out the calculations required to run these rules in the current tax year, and to enable the addition of more rules in the future as required.

IYR Events

An IYR calculation will be triggered by any PAYE transaction on a taxpayer's case, such as being paid or making an in-year claim via PAYE online services (e.g. rental credit). Administrative actions may also trigger IYR, such as when the taxpayer informs Revenue of their bank details via the online myAccount portal. Certain rules relating to Week One will be checked before executing this IYR calculation.

Any change to a taxpayer's position as a result of this calculation is referred to as an "IYR event". It is visible to Revenue caseworkers when reviewing the taxpayer's case:

ITS - EURO - PAYE Basic - [REDACTED]

Reg. No.: [REDACTED] Start Date: 01/01/22 End Date: 31/12/22
 Civil Status: Single Basis of Assess: Not Applicable Qualifying Children: 0
 IT Registered: Notes: [REDACTED]

Date of Birth: [REDACTED] Agent/Appointee: myAccount Assessable
 DLO: Agent Train: [REDACTED] Registered:
 Address: [REDACTED] Blocked:
 Eircode: [REDACTED] Monitored:
 Region/GCD Unit: [REDACTED] E-Output:
 Access Supports:

Src	Description	Reason	Event Date/Time	Updated By	Location
ITS	P21 Issued	Output Management	06/01/23 10:42	BSBU0010	
ITS	End of Year Statement Result	End Of Year Statement	05/01/23 19:16	ENDOFYR	
ITS	eForm 12	eForm 12 Received	05/01/23 19:15	EFORM12	
ITS	Ingredient Input/Amend	PAYE Services Update Received	01/12/22 10:05	PAYEONL	
ITS	Employment Details Amended	In Year Reconciliation	05/10/22 15:51	IYRCALC	
ITS	Ingredient Input/Amend	PAYE Services Update Received	05/10/22 12:17	PAYEONL	
ITS	Employment Details Amended	Submissions&Rates Update Received	05/05/22 01:06	RPNSTDRD	
ITS	Employment Commenced	Employment Update Received	01/05/22 21:18	EMPSEV	
ITS	Employment Ceased	Submissions&Rates Update Received	29/04/22 10:01	SUBAGENT	
ITS	Employee's TCC Issued	Output Management	01/12/21 00:00	PBJBTCL	
ITS	Bulk RPN Creation	PAYE Bulk Issue	28/11/21 04:51	BULKRPN	

Input/Amend Ingredients | Detail | Previous Year | Next Year | Close

Week One Marker

A PAYE employee may end up on a Week One basis (also known as a 'non-cumulative basis'), whereby their employer will deduct Income tax and Universal Social Charge (USC) on a week-to-week basis.

This non-cumulative method of taxation is referred to as Week One (or sometimes Month One) because each pay day will be taxed on its own, separate from previous weeks/months, depending on the employee's pay frequency. Pay and tax credits are not accumulated from the previous 1st January, meaning that employers must calculate an employee's tax differently when they are on a Week One basis.

Revenue may apply a Week One marker to a taxpayer for a multitude of reasons. Over the years, more and more interfaces were introduced to Revenue's systems; for example, payments made by the Department of Social Protection (DSP) would be reported to Revenue for processing. In order to avoid causing hardship for taxpayers, Revenue would err on the side of caution and apply a Week One marker whenever tax credits were reduced.

By performing an IYR calculation, it became possible to automatically review a PAYE taxpayer's Week One status based on the result of the calculation. The Week One marker can then be lifted if no longer advantageous to the taxpayer. IYR does this by performing a tax calculation on both a cumulative and non-cumulative basis. It identifies the taxpayer's liability at that moment in time if there is an overpayment, and it will switch the taxpayer to a cumulative basis if it would be more beneficial to the taxpayer. Any refund due would be incorporated in their next salary payment.

The employee must have a live employment on a Week One basis to trigger this calculation. If the reason for Week One is "Employee Request", we exclude it from this process. Some employees may choose to go on Week One if they do not want their new employer to know the details of their previous employments, pay, and tax.

Tax Credits and Rate Bands

The calculation uses the claimed tax credits and rate bands and is driven off the most recent payslip. The pay date on the payslip is the determining date for credit/rate entitlement. The pay

date and pay frequency are cross-referenced with the income tax calendar to determine the week/month number for tax credits and rate band entitlement.

A taxpayer's IYR calculation is based solely on the tax credits, tax rate bands, and USC rate band values that are allocated to their live employment that is on a Week One basis. USC refers to Universal Social Charge, a tax introduced in 2011 which is payable on an individual's total income.

For cases that have received an in-year tax refund from Revenue, this value is also taken into account in the calculation before removing any Week One marker.

Allowances, Deductions, and Coded Income

All other declared income sources with the exception of DSP payments should be included in the USC calculation. Payments received from the Department of Social Protection (DSP) are exempt from USC.

Both DSP and non-DSP coded incomes are included in the tax calculation by reducing the credit/rate band allocated to the employment.

Department of Social Protection Payments

Any payments received from the Department of Social Protection (DSP) are taxable. The DSP report these payments directly to Revenue, and the tax due is accounted for by reducing the taxpayer's tax credit and rate band. This reduction in tax credits automatically results in the taxpayer being placed on a Week One basis. This is done to avoid causing hardship for the taxpayer.

For example, a taxpayer who is in receipt of DSP payments for the first time starting in April (but with existing employment income such as a pension) will be set to Week One, so as not to end up with excessive tax deducted in their next payslip

If the IYR calculation determines that Week One marker should be removed, the taxpayer's DSP 'ingredient' (coded income) must be updated as well. This is done by comparing Revenue's figure against a table of payments received from DSP. The system runs rules against the DSP table values to determine whether the DSP ingredient should be updated or excluded.

This is then viewable to caseworkers on an internal screen that shows the taxpayer's PAYE details (income, tax credits, rate bands, allocations, etc).

Ceased Employments

If there is a current live employment on a Week One basis and a previously ceased employment on file, then the income details from the ceased employment is included in the IYR calculation.

PAYE Exemption Marker

An exemption from PAYE is available for taxpayers who are 65 or older and whose total income is below the exemption limit (€18,000 for single, €36,000 for joint assessed.) In joint assessed cases if either spouse is over 65 the exemption maybe available.

A taxpayer's PAYE Exemption marker should be lifted automatically if my income levels breach the threshold for the marker. There are different threshold rules for joint assessed customers versus single cases.

USC Exemption Marker

An exemption from USC is available for taxpayers who earn below a certain threshold (€13,000) or who receive certain social welfare payments. USC is only payable on employment income (as opposed to, e.g., DSP payments).

This marker should be updated automatically if a taxpayer's income levels breach the threshold for the marker. If a taxpayer goes over this threshold, IYR will set them to a Week One basis so that the right amount of USC will be paid monthly for the rest of the year. The taxpayer will still end up with an underpayment at the end of the year because they are no longer exempt for the previous months, but it will be for a lesser amount due to the in-year correction.

Top Rate of USC Marker

Certain taxpayers pay a reduced rate of USC if they are over 70 years of age or if they possess a medical card. However, individuals whose total income exceeds a certain threshold (€60,000) are considered to be high earners and are liable to pay the full USC amount. A marker should be added automatically if a taxpayer's income levels breach the threshold for this reduced rate. The marker should be removed automatically if the taxpayer's income levels fall below the threshold.

Home Carer Credit

The Home Carer tax credit can be claimed by a taxpayer who is married or in a civil partnership, and who cares for one or more dependent persons who are not their spouse or civil partner.

A taxpayer's Home Carer tax credit should be lifted automatically if the lower of the two incomes breaches the threshold for the marker (currently €10,400), or if their marital status/basis of assessment is not from the predefined marital status/basis of assessment combination needed to avail of this credit. This can happen if, for example, the credit is carried forward, or if the credit was legitimately claimed in January but then the taxpayers' income levels went over the limit.

Manual Input of Employment Details for IYR

A facility had to be provided to Revenue caseworkers to manually input pay and tax details for a non-assessed spouse's live employment after the death of the assessable spouse. This was necessary to ensure in-year reviews can be processed for joint assessed cases.

Project Delivery

Agile Delivery Method

This project was delivered using an Agile delivery method, with defined user stories and an iterative development cycle. The team's Agile approach adhered to the project delivery methodology set out in our internal Revenue Delivery Method (RDM). RDM is a comprehensive guide for ICT teams containing proven processes, deliverables, and techniques that enable the delivery of high-value ICT solutions and services. RDM is underpinned by international best practice, including CMMI and ITIL standards.

Technology

IYR was written in Java and utilises Revenue's existing Java architecture. A distributed event store and stream-processing platform was used for the reconciliation calculation; PPD data, employee pay and tax data, customer data, and customer financials data are all published to partitioned "topics" whenever they are updated. This data is joined and processed to produce calculation results for the current in-year position. PPD refers to PAYE Period Details, data used internally by Revenue for PAYE calculations.

The tax calculator is a backend application that is used primarily for calculating a PAYE customer's tax picture at a given point in time. Messages are published from upstream applications whenever an employer submits payroll or a case worker amends a case. These messages are published to a number of topics and the tax calculator will consume these updates. The application will join data

from multiple topics together to get a complete set of inputs to perform the relevant calculations.

In addition to the above data sources, there are a few bespoke apps that take data from files Revenue receives from DSP, as well as applications that watch certain database tables for updates and publish to a topic when updates occur.

When a message is consumed, the various data points are joined across these topics and the tax calculator generates an input. This input is a reduced version of the joined objects, which has unnecessary items removed. A minimum of one calculation is then performed on the message before the results of that calculation are published to an output topic, to be consumed by downstream applications.

In-year reconciliation only became possible due to the PAYE modernisation project undertaken by Revenue. The web services introduced by PAYE modernisation allow Revenue to provide employers with updated rates for individual employees in real time. Without these real-time systems, Revenue could not recalculate tax in-year and could not communicate any resulting changes to the employer.

Executing the Calculation

IYR utilises the same calculation process originally developed as part of PAYE modernisation for End of Year Statement functionality.

The process for executing IYR calculations is as follows:

- Case inputs are retrieved from the stream processor.
- These inputs are reduced and stored in a table.
- The inputs are joined together into an input for the tax calculation application.
- Once the input has been prepared, its totals are aggregated.
- With the totals aggregated, a calculation request is prepared.
- The allocation calculator process is then invoked, producing a calculation summary.

At the end of this process, the calculation result is fed back to the tax calculator stream processor and published to the IYR-specific topic.

Once the calculation has ran, the IYR ruleset can be executed.

Code Repository

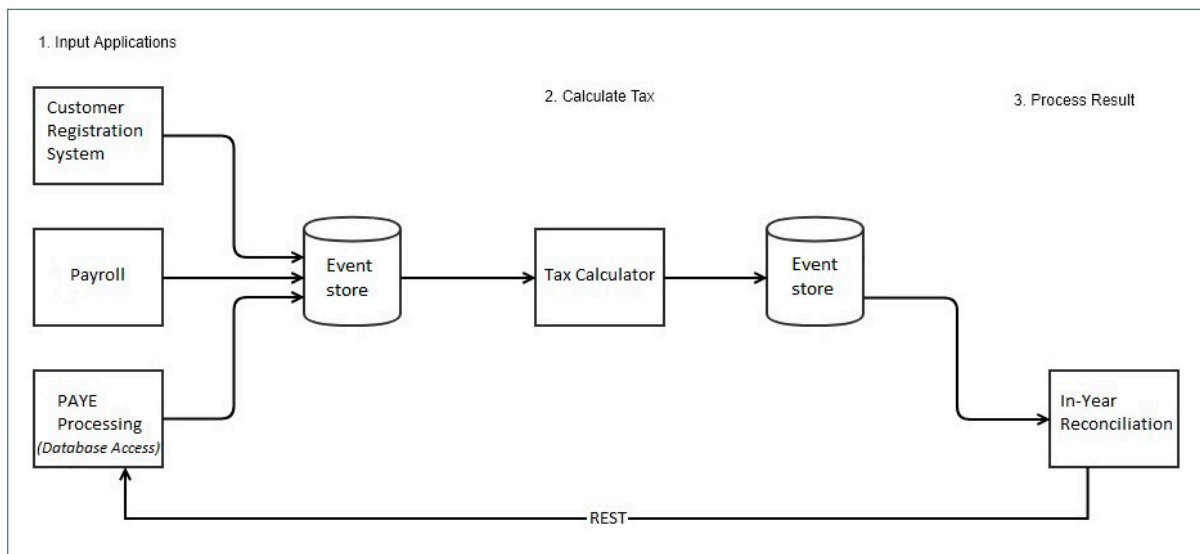
GitLab was used for the project's code repository, to store the code and track changes via version control. An internal technical wiki is also hosted on GitLab to provide project documentation for future developers.

Modular Design

Rules for IYR are modular and do not need to all be turned on at once. This provides Revenue with flexibility to, e.g., hold off on turning on Week One rules until sufficient testing of tax year data generation has been completed. Turning on IYR at the start of the year is not really effective in any case and the rules are generally enabled at the end of March.

Architecture Diagram

The basic processing flow for IYR is illustrated by the following diagram:



This diagram does not illustrate IYR's integration with DSP data. As discussed above, the tax calculator application runs rules against DSP table values to determine whether the DSP ingredient should be updated or excluded. The DSP topic flow is excluded here for simplicity.

Timelines

Originally, in-year reconciliation was envisioned as a deliverable as part of the PAYE Modernisation project, which went live on 1st January 2019. A different solution was planned at this time and some development was done, but it was ultimately deprioritised and dropped as a requirement due to its less-than-ideal implementation.

Development of the IYR project started in June 2021. It was released in September 2022, after around a year and a half of development.

Some code was released to the live environment over the course of the project, but the processing functionality was disabled through configuration. In other words, IYR was performing live calculations, but no events were triggered and no updates were made. This allowed the developers to see how the calculations were working and what would have happened if an event had been triggered.

Triggering the rules against live data during business testing allowed the team to identify unknowns and scenarios that had not been considered during development. During this period and given the impact of real data results, it was decided to extend the scope of the IYR calculator to include additional scenarios, widening the scope and benefit of the project. This factor had the greatest impact on the release timeline.

Business Engagement

The business provided a number of worked examples to illustrate the tax calculations the system needs to perform across all scenarios. This was very helpful for the development team, who did not have the specialised tax knowledge to come up with these scenarios by themselves.

Technical Challenges

Code

In the early stages of development, due to the large amount of data being processed (over 2.7 million cases), there were a lot of exceptions being thrown when generating the tax calculation input, with various root causes. An uncaught exception during stream processing would cause the thread responsible for said processing to shut down on the given node. An exception handling solution was therefore developed to output the details of the exception to a specified topic. Storing exceptions on a topic allowed for easier reporting and provided more information than a simple stack trace. This allowed the team to verify the exact state of the data at the time of exception. This solution was also much easier to maintain than a “try-catch” method.

Complex Scenarios: Business Rules and Testing

The development team had to account for dozens of complex scenarios as part of the business requirements. The team was required to define the business rules for each of these scenarios, as well as the acceptance criteria for testing.

The challenge here was mitigated by good support from the business team. The development team had access to a tax specialist who provided business testing of the code changes, offered continuous feedback, and clarified requirements when needed.

Business Benefits

From a customer service perspective, IYR helps taxpayers pay the right tax at the right time. It has reduced the number of contacts made to district offices by taxpayers.

IYR went live in 2022 and was turned on midway through the year, on the 26th September 2022. As a result, it already had a lot of PAYE data to work with when making tax calculations. A quarter of a million cases were updated by IYR in 2022.

The configuration options used to disable processing during development can now be used by Revenue to enable or disable certain rules via configuration changes, with no code deployment required. The different rules applied by IYR are modular and can be enabled or disabled according to the business needs of Revenue.

Revenue’s IYR is a clear demonstration of the value of real-time reporting in enabling the digital transformation of tax; in other words, it is Tax Administration 3.0 in practice.

Future Development

The IYR project undertaken by Revenue has left the organisation in a position to add additional in-year rules in future, further alleviating the burden placed on taxpayers and caseworkers.

Two such enhancements have been envisioned:

- **Joint Assessed Cases:** This group were excluded from the initial scope of this project, as both spouses would need to have made an overpayment to qualify for an IYR event. It was determined that the calculation effort involved in catching such cases was not worth it for such an edge-case scenario. This could be brought into scope in the future.
- **Yearly Threshold Estimation:** Currently, taxpayers who go over a yearly threshold are subject to a “cliff edge” when placed on a Week One basis by IYR. Ideally we could estimate what the taxpayer will earn in the year by looking at payslips to date and calculating the trajectory, thereby preventing the sudden shock of being placed on Week One late in the year.

Additional rules may be added in future as required.



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