Combining Our Past Creating Our Future

A case study on the Archives Central Database redevelopment for a Digital Future.

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Let us save what remains: not by vaults and locks which fence them from the public eye and use in consigning them to the waste of time, but by such a multiplication of copies, as shall place them beyond the reach of accident.

– Thomas Jefferson to Ebenezer Hazard, 18th February 1791

Foreword

As archivists, we are at times caught in a contradiction of history and our own profession's making. We strive to maintain order and make available physical mountains and digital megabits of historical information in our repositories, yet the history of the organisation and the people who manage those records within goes unwritten. While the following article is focussed on the recent upgrade of our digital repository, it also serves as the first manuscript to detail the relatively short existence of Archives Central, a unique information management institution within New Zealand.

Our History

The history of Archives Central begins in 1989, when the New Zealand Local Government Reforms were enacted. This was the most significant reform of local government in New Zealand since the abolishment of Provinces in 1876, with 850 local bodies being amalgamated into 86 local authorities made up of regional and territorial levels.[1] The resultant enlarged authorities were required not only to merge multiple predecessor councils' closed archives and open records with their own, but also continue council processes at pace - the metaphorical lifting a bucket whilst standing in it. As with any change in local or central government, the results were varied. Numerous local authorities' setup dedicated archival repositories, with the best-known example in the Manawatū-Whanganui Region being

the Ian Matheson City Archives. Others struggled with the changing times and continue to do so to this day.

The need to reduce costs, increase efficiency and share resources amongst councils has grown as time marches onwards. The Manawatū-Whanganui Local Authority Shared Services (MW LASS) was formed in 2008. Consisting of seven-member regional, district and city councils in the Central North Island, the primary function of MW LASS is to combine council functions and services at a lower cost or in a more productive manner than if a council undertook it as a sole operator. The success of the initiative was proven in the first 4 years of operation, with ratepayers accruing savings of over $2 million across all services provided by MW LASS.[2] A speech at the launch of the Archives Central website made by then Minister of Internal Affairs Nathan Guy stressed the importance of preserving local history and embracing the digital future.[3]

Archives Central opened its doors at 40 Bowen Street, Feilding as a shared facility in October 2012. Initially, the facility stored and provided access to council staff and the public the physical archives of the Rangitīkei, Manawatū, Tararua and Horowhenua district councils, and Horizons Regional Council. Palmerston North and Whanganui city councils maintained a digital presence through the public digital database, with the physical collections stored in their respective locations.

Figure 1. The Archives Central Team in early 2020. Front Left to Right – Danya Anderson, Evan Greensides and Heather Taylor

Kete – The Innovation Basket

The original Archives Central digital repository ran on Kete open-source software, developed by Horowhenua Library Trust and managed by Katipo Communications Limited.[4] Originally developed as a replacement Information Library System (ILS) solution, Kete was, "a community-built digital library of arts, culture, and heritage resources: images, video, audio, documents, web-links, encyclopaedia-like articles, and discussion threads, with related material clustered together".[5] The Archives Central iteration utilised "baskets" to manage council collections of series and records according to the Australian Series System, with agencies being separate entities. The Kete platform also incorporated innovative features, including RSS feeds to facilitate data reuse. Kete utilised the Ruby on Rails language's open-source OAI software library to create a built-in OAI-PMH for each digital repository. This enabled DigitalNZ to harvest participating Kete sites quickly and efficiently, "thus building up the metadata records that users could search via the DNZ search site or through external services using the DNZ API".[6] This integration led to a steady increase in unique visitors, page views and total searches for Archives Central from 2012 onwards.

The inherent modifiability of the Kete system was also exploited to develop several innovative solutions specifically requested by Archives Central. One such module was the ability to bulk import/export data to/from the database. The ability to add metadata in bulk, where substantial amounts of information can be replicated *ad infinitum* for similar records within a series, was critical, especially for an institution where a single transfer's total record count can potentially run into the tens of thousands. The ingest function was extended to allow updates to existing records on the database, updating those entries and fields listed in the file and verifying records via the unique system ID. Another innovative module was the creation of a location control module and user interface. Designed to show staff the current location of records and boxes, control movements of physical material, create tracking lists and search by physical location, this functionality greatly enhanced staff ability to retrieve physical records.

Difficulties

By 2015, the Kete platform celebrated its 8th birthday, being adopted by over 30 New Zealand organisations in that time. While a first stage update was completed in 2014, no further upgrades were progressed for multiple reasons - funding from participating organisations was not forthcoming, caring for New Zealand libraries digital collections was out of scope for

the Horowhenua Libraries Trust, and National Library's resources were focussed on development of Supplejack and migrating Kete records into the upgraded DigitalNZ platform.[7] The vulnerability of a small, New Zealand-based development community with limited funding to maintain an open-source platform had been exposed. As a result of stalled development, the Archives Central version of Kete began to approach end-of -life status, reaching a point where the system returned substantial amounts of HTTP 400 (client error) and 500 (server error) codes daily. On a long enough timeline, with technological developments marching onwards, the platform would cease to operate with modern servers and web browsers.

Other users of Kete across New Zealand were contacted by Archives Central to assess the viability of upgrading the platform and funding capabilities. All replies noted that consideration was focussed on migrating away from Kete or that another solution was already in place. As the theoretical replacement DigitalNZ platform focussed on digital content and did not provide scope for the management of paper-based archives, the search began for a replacement digital solution.

Users

Within a positive customer-led feedback loop, the first crucial steps are to ask for opinions and collect data. The discovery stage of the process was initiated through an in-person canvassing of our 7 member councils' records teams, part of an established Archives Central Technical Group. To supplement answers, an online survey for public researchers and general users was launched. In addition, we shoulder tapped experts in the digital database and information management sectors for advice and guidance around specialist subject matter including metadata fields, Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), application programming interface (API), and other crucial issues.

While the critical functioning problems detailed in the previous section were raised by internal users, the following are a selection of user quotes from the Archives Central Needs Assessment which reveal several other issues considered from an External User Experience (UX) point of view:

> *The website design is dated and confusing – there is no responsive functionality, design capabilities or mobile site…*
>
> *Search functionality not meeting expectations of non-expert users…*
>
> *There is limited ability to integrate maps, with no ability to incorporate bounding boxes or polygons…*

Animations and slideshows are out of favour/hinder the working environment...

Images uploaded are separate entities from text records.[8]

These problems led to user confusion, imprecise search results displayed, duplicate records/images and a high bounce rate on pages. There was also an increasing expectation with the exponential rise of smartphone use, processing power and capabilities, that the digital repository would be either mobile-friendly or mobile-first. The most pressing problem was that if Kete stopped working on modern browsers, member councils and the public would not have digital access to archives that, according to legislation, are mandated to be accessible.

One way of defining the principles that would drive the overall development of a replacement platform was to undertake a 'one or the other' principles preference survey. The choices for Technical Group users were accuracy or usability; simplicity or powerful functionality; community engagement or standards compliance; control or collaboration; free access to content or strict legal compliance.[9] Another measurement tool to assess user worth of the digital repository was the ranking of values from a set list. Value drivers are factors that increase the worth of a product, service, asset or business which could be a differentiating capability that makes the product a must-have for customers. In our analysis, collaboration between councils, the public and Archives Central, as well as compliance with relevant legislation, scored highest for Technical Group members.[10]

The answers collated through the survey process were critical to forming a picture of how our users viewed the current system, their requirements and how we could best serve them when assessing digital solutions. The process led to an executive summary which guided the project going forward:

Our vision is to create a replacement database and platform that is user-friendly, powerful and exceeds the needs of MW LASS member councils now and for the foreseeable future.

Based on the components, functions and features that the project team, in conjunction with feedback from our stakeholders, have decided upon, our goal is to create a modern, flexible digital database and platform that is mobile-compatible, retains the ability to increase functional capabilities and links with national content aggregators to increase our exposure beyond MW LASS boundaries. [11]

Method & Candidate Assessment

Analysis in hand, our team started to assess potential candidates for a replacement platform. A pool of proprietary systems and off-the-shelf solutions were drawn together before the Council of Australasian Archives and Records Authorities (CAARA) scoring system was applied to each candidate. The CAARA scoring system provides a high-level view of the principles of an archival management system and incorporated all four elements of the ADRI Framework: receiving, accessioning, managing and access.[12] The system also included technical and functional questions which would form the backbone of the replacement digital system. Examples of the applied scoring system included:

- Principle - System must be extensible for development of new functionalities
- Technical - Must be able to export to open standards
- Technical - Compatible with significant NZ Heritage APIs, such as Digital NZ
- Functional - Must be able to import archival description data from external sources

Scoring was between 1 and 10, with a total of 76 questions.[13] All candidates scored above 100, with most potential solutions proving to be adequate for Archives Central requirements at this higher-level.

From an initial pool of a dozen systems, we were able to whittle the number down to four for further analysis: Vernon CMS, New Zealand Micrographic Services (NZMS) Recollect, Archives Space and Islandora. These systems were chosen as they ranked highest within the CAARA scoring system and provided an even balance of off-the-shelf products and open-source platforms. In-house discussions ensued, with the two open-source solutions receiving a higher score on the CAARA ranking system due to the specific characteristics of open-source software approaches relative to long-term solution viability, functionality and flexibility, and established community support. To choose between Archives Space and Islandora, staff placed emphasis on our learnings from the falling away of the Kete support community and adopted a view to not only manage physical archives efficiently, but also embrace a future filled with born-digital objects and the semantic web. Of these two solutions, only Islandora8 incorporated a full web Content Management System (CMS), enabling a full spectrum of web interaction for our users, including

search engine optimisation (SEO), digital exhibitions, media carousels and publication pages. Islandora was chosen for its support of linked data via incorporation of services including Blazegraph, Triplestore, Resource Description Framework (RDF) and SPARQL graph queries.

Development Phase

A half-day meeting with members of the Archives Central Technical Group followed, laying out the Archives Central staff rationale, the direction we had followed during the process and demonstrations of the final four digital solutions. After assessment, consultation on the CAARA scoring system and presentations, the group agreed that Islandora would be the system to adopt, with Catalyst IT undertaking development work. With Phase I of the project complete, milestones were set out for following phases.

Phase #	Description
Phase II	Engage developer for software solution architecture – Structure intent Setup project management platform as primary communication channel Agree on project milestones and deadlines
Phase III	Data Migration – Preserving critical data for future use/re-use Development & Implementation User Testing & Staff training – Testing, Learning, Adapting Shutdown of old Archives Central website – Launch of new site

Figure 2. Follow-on phases of the project.

To manage development cycles and emerging issues throughout the project, Gitlab was chosen as the software development and IT operations platform (also known as DevOps). Gitlab offers a location for online code storage and capabilities for issue tracking. As a centralised repository, it enables hosting of different development chains and versions, allowing users to inspect previous code and roll back in the event of unforeseen problems.[14] At a basic level, individual issues are created and can be assigned to users, participants added, labels and milestones applied, time tracking enabled, due dates created and user permissions/confidentiality

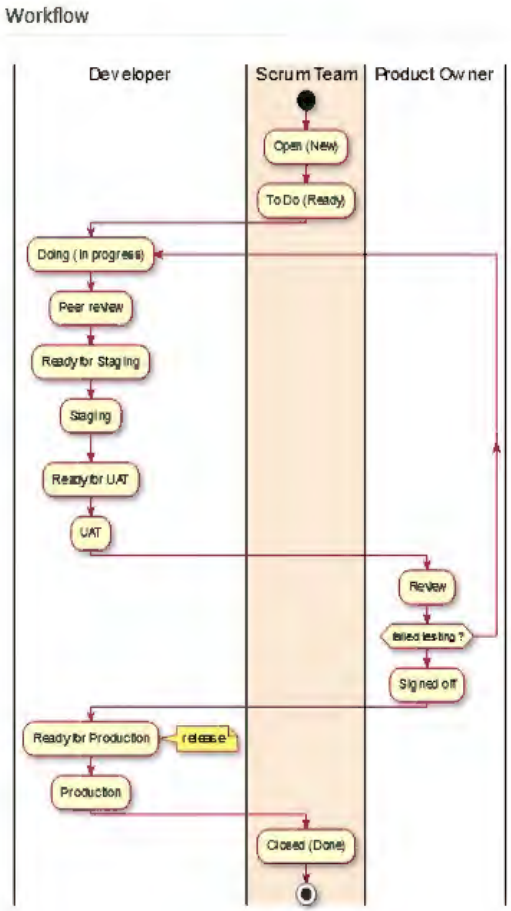

Figure 3. Agreed upon process for issues during the Development Phase.

enforced. As a project progresses, Kanban boards can be utilised by teams. Kanban boards allow "Scrum Teams" to plan, visualise, and manage sections of work during a series of "sprints". Boards were set up according to an agreed upon workflow chart, with the Developer and Product Owner assigned specific responsibilities within the process. The boards ranged from "Open" and "Doing" at the beginning, on to "Staging" and "Review", ending with "Sign Off" and "Closed". Failed testing would start the process afresh.

The agreed process allowed the developers to provide continuous delivery milestones, keeping the Archives Central team informed of progress and acting as a centralised store house for development specific information.

A positive outcome of the adoption of Gitlab was that it meshed well with current Archives Central practice, as staff had previously adopted Agile methodology and principles into every-day business operations and processes. In addition, the Kete database was produced via open-source software. The adoption of open source based Gitlab as a project management platform was a natural outcome. The Archives Central team found the process intuitive and increased efficiency to a large degree so that a dedicated Archives Central Gitlab instance was eventually adopted to manage archives-only projects.

The New Way to Manage Old Records

We recognised early on that a new database would be required to incorporate flexibility in order to manage born-digital records and media, including support for commonly used Microsoft Office file formats, web archives (WARC), flexible metadata, external authorities and linked data. On this last point, it was agreed that Semantic Web (W3) conventions were the future path for digital information, which are explained as:

> *…a Web of Data — of dates and titles and part numbers and chemical properties and any other data one might conceive of. The collection of Semantic Web technologies (RDF, OWL, SKOS, SPARQL, etc.) provides an environment where application can query that data, draw inferences using vocabularies, etc.*
>
> *However, to make the Web of Data a reality, it is important to have the huge amount of data on the Web available in a standard format, reachable and manageable by Semantic Web tools. Furthermore, not only does the Semantic Web need access to data, but relationships among data should be made available, too, to create a Web of Data…*
>
> *To achieve and create Linked Data, technologies should be available for a common format (RDF), to make either conversion or on-the-fly access to existing databases (relational, XML, HTML, etc).*[15]

The use of the General International Standard Archival Description (ISAD-G) on the Kete database allowed Archives Central to capture important datasets and apply basic relationship links in the past. For example, an agency creates an item; the physical item is stored at a physical location; the item acts as a parent record for several types of media; comparable items are grouped into series; an organisation controls multiple agencies.

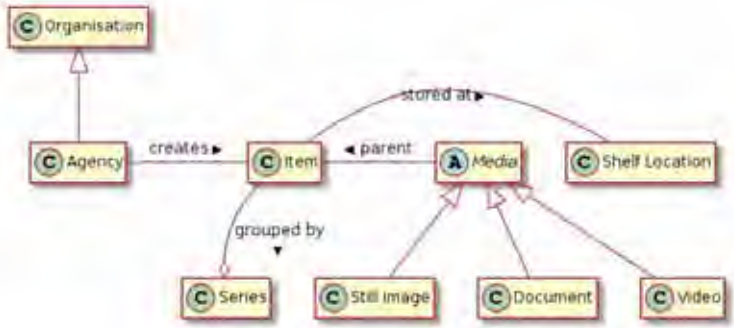

Figure 4. Existing relational model, Kete database.

To take full advantage of Semantic Web conventions, a comprehensive taxonomy was required. The International Council of Archives (ICA) Records in Context - Conceptual Model (RiC-CM) provided the answer. RiC-CM combines four separate descriptive standards into a single standard: General International Standard Archival Description (ISAD-G); International Standard Archival Authority Records—Corporate Bodies, Persons, and Families (ISAAR-CPF); International Standard for Describing Functions (ISDF); and International Standard for Describing Institutions with Archival Holdings (ISDIAH). At its heart, RiC-CM is described as, "...[a] model for archival description [that] aims to be a comprehensive descriptive standard that reconciles, integrates, and builds on the four existing standards... RiC aims to move from a hierarchical model to "multidimensional description" modelled in the form of a graph or network.".[16] Analysis of RiC-CM, along with the implementation of Resource Description Framework (RDF) as a standard model for data interchange on the Islandora platform, proved that the integrative nature of the model would allow increased flexibility and relational links over the previous utilisation of ISAD-G.

Another problem that arose was that the previous Kete platform had "siloed" records and series within a council collection. This issue limited the ability to link to other related council collections, an important feature with the overlap of multiple regional, district and city councils' boundaries and functions over time. The RiC-CM model overcame this issue through the addition of relational pathways between agents, series, records and media. A record with multiple agencies input was previously owned by a single creating agency, with any further information on creation or management held via the free-text Descriptive Note field. With the RiC-CM model, this record would reside within a single council collection, but could now incorporate multiple creating, managing or holding agencies through the relationship type field. A series containing a record could also be linked to other antecedent, subsequent or related series, forming an unbroken history of council functions and projects and aiding researchers in the search for similar records and media.

The Project Begins

With new system structures agreed and Gitlab in place, the start of the Archives Central digital repository Development Phase began on Monday, 2nd March 2020. The first weeks for Catalyst IT were dedicated to building the User Acceptance Testing (UAT), staging and production environments. With the system retaining nine unique regional, district and city council collections, unique council sections were created and permissions for

council users defined to control access, uploading of digital material and ability to make modifications to records. Basic pages were added, a web form linked to our in-house request management system was created to automate user requests and Search Engine Optimisation (SEO) friendly paths were established.

On the archival side of development, two prominent issues were progressing. Firstly, the management of copyright via multiple licensing systems. Four types of Creative Commons New Zealand Version 3.0 licenses were already in use on the Kete system, but the need to future-proof and cover a wide spectrum of copyright permissions for all our users required us to look further afield. It was decided that six types of Creative Commons Version 4.0 licenses would be adopted. The 4.0 licenses were chosen as they incorporated three "Layers" - the Legal Code Layer, the Commons Deed, or Human readable, Layer and Machine-Readable Layer. The result is a coverage of use and re-use rights that lawyers, content creators, content aggregators and machines can read and understand.[17] Rights Statements were also adopted as an auxiliary licensing system - it was decided to activate 4 of the 12 licenses as the majority overlapped with Creative Commons licenses. The final piece of the puzzle was to condense a multitude of user-generated values for a 'Copyright of Item' field from Kete. As this was a free-text field, a variety of entries held the same meaning, but varied slightly (i.e. Four individual entries, each being, "No known Copyright", "No known Copyright restrctions" [sic], "No known Copyright restriction", and "No knwon Copyright restrictions" [sic]).[18]

The second issue to complete was the implementation of basic OAI-PMH (Open Archives Initiative-Protocol for Metadata Harvesting). This step was progressed to continue exposing metadata surrounding records and media hosted on the Archives Central database to DigitalNZ and web search engines. This involved defining Dublin Core variants that included DigitalNZ usage fields - the default Dublin Core protocol would return only generic fields, including title, identifier and description. DigitalNZ's Metadata Dictionary allowed for a wider array of fields to be matched, such as copyright licenses and start and end dates.[19] An accessible OAI endpoint was set up, allowing the National Library Team to easily create and run a harvesting script for the Islandora digital repository and conduct incremental harvests of newly created or edited items. Since the implementation of OAI-PMH, DigitalNZ has seen a drastic reduction in elapsed time to harvest metadata from the database - from 13 days for a full harvest on the Kete platform to a range of nearly 9 minutes, down to 12 seconds, for Islandora.[20] [21]

COVID strikes

On Monday, 23rd March Prime Minister Jacinda Ardern announced New Zealand would enter Alert Level 3 at 1:40pm, and that after Wednesday, 25th March the country would go into Alert Level 4 for a minimum of 4 weeks. In the weeks leading up to what would be termed the first lockdown, the Team at Archives Central had tracked the spread of COVID and prepared for a home-working environment. With restrictions in place and no access to physical archives for the next month, the digital repository development would be our team's sole focus.

Lockdown coincided with week 4 of the redevelopment project, at which time the UAT environment was functional, Archives Central employees given necessary application permissions and home IP addresses white-listed, allowing the first testing of the Islandora system by backend users. Testing started off slowly, with familiarisation of new metadata fields, creation of single records and uploading of several types of media. After system familiarisation, we understood the modifications required to efficiently create records and update existing metadata. This learning was crucial in developing a bulk ingest Comma Separated Value (CSV) spreadsheet template utilising core metadata fields developed in the RiC-CM project. This development also allowed the system to attach media to records in bulk – by first uploading multimedia to Catalyst Cloud, a unique Uniform Resource Locator (URL) could be added to the bulk ingest spreadsheet via the "file" field. After the first pass of the CSV created the digital record, a second and third pass applied the file information and digital media to the record. Where multimedia was previously added to a single record at a time, the automation of the bulk ingest process by Archives Central staff increased team efficiency dramatically and reduced arrangement and description project times.

Figure 5. Mapping of Kete fields to Islandora fields used as part of the project administration

Unfortunately, word constraints for this article do not allow for elaboration on other issues we worked through during the Development Phase. These other issues included location control via containers,

creation of a geographical place name taxonomy utilising the official New Zealand Gazetteer, PDF and OCR text extraction for documents and setting up facet search results, URL standard naming conventions and redirects, amongst others.

Migration and Launch

The final piece of the puzzle also proved to be the most difficult - migrating all 200,000+ records from Kete to Islandora. Initial conversations with DigitalNZ at the beginning of the redevelopment project in July 2019 revealed that the Extract, Transform and Load (ETL) process would be complicated and that a Kete extraction tool would be created to assist migration.[22] The extraction tool was created by Walter McGuinness as a docker-based, Elixir language tool which, "migrates Kete's data to modern PostgreSQL based tables and columns using standard data types rather than Kete specific Extended Fields... returning JSON or TSV files... so that you can import the data into other systems."[23]

During the initial Discovery Phase with Catalyst IT, multiple options to perform the Extract stage were listed - via existing OAI-PMH, Screen-scraping HTML, Kete MySQL Database, or use of the Kete extraction tool. Using existing OAI-PMH was ruled out due to extended Kete fields being collapsed into a single Dublin Core field, leading to a loss of semantic meaning. Screen-scraping was also discounted due to loss of relational data points between records. In the end, a combination of the Kete MySQL Database and Kete extraction point tool were utilised to extract a wide variety of information and media, though certain fields were deemed unnecessary for migration. These included historical user search terms, metadata surrounding previous bulk imports/exports and 36,894 rows of every CAPTCHA generated since 20 May 2010.[24]

The Transform Stage brought about opportunities to enrich existing data - standard Extended Date Time Format (EDTF) was adopted; duplicated data, primarily between records and media, were merged; reciprocal relations were added and filled gaps where Kete had viewed them as non-mutual; and, key terms were changed to provide better definition for users and to align with RiC-CM (i.e.. "Item" to "Record" and "Agent" instead of "Agency"). Finally, as detailed above, the Load Stage provided us with the ability to utilise the Drupal Migrate framework to customise CSV and XML templates for ingest processes, with the option to complete the same for JSON and SQL templates in the future.

During the migration process we encountered problems that tend to crop up when large amounts of information are migrated from one platform

to another. An example of learning through testing is detailed below in an e-mail reply dated 5th May 2020:

As discussed, I tried a complete migration on our Staging instance last night. Unfortunately, it halted after 10564 out of 201075 rows…

In this case I think it's something in the Islandora pipeline. The first issue is the default JSON Web Token Expiry of two hours; JWT is how Drupal authenticates with the microservices and our migration is longer than two hours and so things began to fail after that; I've deployed a longer token expiry time.

Otherwise I think it's a memory issue; the migration has to hold all of the 200,000 plus rows in memory in case there are references to them…[25]

Although best efforts were made at the Extract Stage to utilise customised processes, the migration period ended up being complicated and drawn out over multiple weeks. Optional platform developments were pushed into the backlog channel to free-up resourcing for data migration. While the migration issue pushed back the planned launch date from late March to early June, the continued functionality of the Kete website and a significantly lower number of public and council requests gave the development team breathing room to complete migration in full. At the end of the migration stage the following statistics were recorded as follows:

- 211,708 individual records
- 174 Accessions
- 3880 Series
- 7.3 gigabytes of public documents and media (including 6,400 jpegs and tiffs)
- 33 megabytes of private document files
- 816KB private image files.[26]

Archives Central 2.0

On 2 June 2020 at 9:41am, the new Archives Central site went live. Post-launch, Archives Central was determined to be the fifth institution globally to implement Islandora8, alongside other prestigious institutions including Johns Hopkins University and Carnegie Mellon University.[27] The Islandora platform for Archives Central includes the following features:

Figure 6. Aerial Photograph Contact Print, Napier-Taihape Road, SN 6668, Sheet A/2. 30th October 1985. New Zealand Aerial Mapping Archives Central. Ref: RDC 00245:1:A/2. Archives Central /node/130306

- Mobile and tablet-friendly platform
- Solr enterprise-search platform for indexing, replication and load-balanced querying. Advanced search functionality returns relevant items which can be filtered according to council, type, content type, media type, included in (Series) and tags
- Enhanced browsability via listings for Agents, Accessions, Series and Records.

- A modern, zoomable, high resolution web-based viewer for digitised items via OpenSeaDragon. High-resolution images are maintained via Cantaloupe dynamic image server.
- RiC-CM provides machine-readable metadata and a common framework that allows data to be shared and reused across application, enterprise, and community boundaries.
- A dedicated Triplestore database utilising Blazegraph, allowing a range of relations to be built between Agents, Series and Records over time and convey the benefits of Linked Data.

The International Council of Archives (ICA) also confirmed Archives Central to be one of the first institutions in the world to adopt the Records in Context - Conceptual Model for the description of records.[28] The project was a high-risk endeavour, taking place in a historically risk-averse sector, utilising leading edge technology and theoretical concepts - and it paid off.

Conclusion

Archives Central is now well-positioned to continue preserving metadata, allow for born-digital only content transfers from member councils and adhere to international standards across the information management sector. Over time, Archives Central will add more features to empower our users and make full use of the Islandora platform. In-house analytics show a continued linear monthly rise for total search terms since launch: (+70%), unique visitors (+74%) and unique page views (+38%).[29]

Never forgetting our archival duty, the original Archives Central Kete database was fully harvested and archived by DigitalNZ before shutdown. It is now maintained via the National Library of New Zealand for use by historians, web researchers and the public.[30]

In the intervening 10 years since opening, Archives Central has proven to be a shared services success story. We have expanded to 10 participating councils, our digital repository contains over 230,000 individual records, we store over 4,000 linear metres of physical records and archives, and we maintain a leading-edge digital repository platform that is future fit. We will continue to live by our motto: “Combining our past, creating our future”.

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