Singapore's Moments of Life: A Metadata Application

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Abstract

As part of Singapore's smart nation initiative, Moments of Life (MOL) was created as a whole of government mobile application to serve citizens' needs better through technology. A strategic project under the Smart Nation and Digital Government Office, National Library Board Singapore (NLB) was invited to develop a metadata framework for the app. From parenting to active ageing and end of life needs, the app consolidates government services for important milestones in a citizen's life. E-government metadata standards and initiatives based on Dublin Core (DC) started as early as 2000s. The European Committee for Standardization CEN/ISSS has provided a methodology in developing an e-government metadata element set. This paper starts with a review of DC e-government metadata standards and initiatives, and the latest application of metadata for digital government. Thereafter, it presents how NLB applied its methodology to develop an application profile and a faceted taxonomy. As a multi-cultural society with 4 official languages, a common vocabulary is important for data to be shared, re-used and searched across agencies by citizens. This will not only help citizens to search for information more effectively, but it will ready MOL content for structured data implementation for Internet discovery. The challenges faced, features of the mobile app such as profiling and filtering, global search and faceted navigation are effectively achieved with the use of Dublin Core as the metadata schema for supporting MOL.

Keywords:
Metadata; Dublin Core; faceted taxonomy; e-government; digital government; mobile app

1. Introduction

Singapore's Smart Nation initiative was launched in 2014 with the objective of transforming the nation through technology where citizens are empowered to live meaningful and fulfilled lives, enabled seamlessly by technology. Moments of Life (MOL) mobile application (app) is part of this strategic initiative. The initial phase of the project kick-started in April 2017 and focused on parents of young children. Jointly led by the MOL Programme Office and the Ministry of Social and Family Development, over 200 representatives from 15 agencies were involved. MOL's intent is to provide services and information from the citizens' point of view, to make it easier and more convenient for them to interact with the government (PSD, 2018).

National Library Board Singapore (NLB) was invited to develop a metadata framework for the app and a Parenting Portal for the service. Research was conducted on Dublin Core (DC) e-government metadata standards and initiatives, and the latest application of DC metadata for digital government. Henceforth, NLB developed a DC application profile and multi-faceted taxonomy to support the service.

2. E-government and Digital Government

The Organisation for Economic Co-operation and Development (OECD, 2014) defines e-government as "the use of information and communications technologies (ICTs), and particularly

by the Internet, to achieve better government" whereas digital government is defined as "the use of digital technologies, as an integrated part of governments", modernization strategies to bring governments closer to citizens and businesses through the integration of new technologies (e.g. cloud computing, social media, mobile technology) (OECD, 2014). As Falk et al. (2017) pointed out the primary focus of e-government is the online provision of services while digital government is a more comprehensive concept of applying technologies to enable a whole of government transformation.

3. Dublin Core e-Government Metadata Standards and Initiatives

3.1. Background

In the 2000s, the benefits of using metadata in e-government websites were realised (Alasem, 2009). In terms of discovery of government information and services in websites, "metadata can facilitate the discovery of e-government website resources, by identifying resources, bringing similar resources together, distinguishing similar resources, and giving location information" (Tambouris et al., 2007). There has been an increased number of governments concerned with establishing metadata frameworks usually based on DC (Tambouris et al., 2004). As compared to some communities, particularly the library community which criticised DC for its simple structure (NISO, 2010), DC was widely applied for e-government metadata because of its simplicity of creation and maintenance (DCMI, 2005).

3.2. Literature review

There have been a few articles on DC-based e-government metadata standards and initiatives (Tambouris et al., 2004; Tambouris et al., 2007; Alasem, 2009) which provided a comprehensive study on DC-based initiatives and projects on e-government metadata standard and national metadata standards. Rothenberg et al. (2005) conducted research on improving access to digital information in the Dutch Government including analysis of Dublin Core and alternatives. Park et al. (2009) examined DC in relation to interoperability, application profiles and controlled vocabularies and further provided a discussion on the current problems associated with metadata and possible improvements across government agencies in the Government of Canada.

Papers presented in DCMI Conferences include New Zealand's Government Implementation of DC-based Standard (Barham, 2002), Metadata and Controlled Vocabularies in the Government of Canada (Renaud, 2004) and Celebrating 10 years of Government of Canada Metadata Standards (Devey et al., 2010).

3.3. DC-Government Community

DC-Government Community was set up in 1999. It was a forum for the implementation of DC metadata in the context of government agencies and International Government Organizations (IGOs), with the objective to promote the application of DC metadata (DCMI, 2012). The proposal of DCMI Government Application Profile was drafted to clarify the use of DC in a government context (DCMI, 2001). The profile consists of DC-Gov Metadata Element Set (DC-GOVMES) and DC-Gov Metadata Element Set Qualifiers (DC-GOVMES Qualifiers) and a survey was conducted on implementation of DC in government settings (DCMI, 2002).

3.4. European Committee for Standardization

In 2003, the European Committee for Standardization CEN/ISSS drafted two documents to give guidance on the application of metadata for describing resources in the domain of e-government (CEN/ISSS CWA, 2003a) and proposed a metadata application profile based on Dublin Core for e-government in Europe (CEN/ISSS CWA, 2003b). These documents also provided a methodology to assist in determining an appropriate e-government metadata element set and good practice in applying an e-government metadata standard.

4. Digital Government and Application of Metadata

On the application of metadata for digital government, the focus has shifted to Open Government Data (OGD). For example, Zuiderwijk et al. (2016) looked at how to improve the speed and ease of open data use through metadata by conducting quasi-experiments which included the use of datasets in Dublin Core as part of the OGD infrastructure.

Nevertheless, Dublin Core is still an established industry-standard recommended when tagging content including government information as it enables aggregation of common pieces of information from several different sources (Flagg, 2013a). Unlike e-government, the application of metadata for government resources can be on different platforms, such as tablets, smart phones, and other mobile devices. The creation of metadata for structured content based on the method of "Create Once, Publish Everywhere" is recommended instead of re-creating them for different platforms (Flagg, 2013b). Quality metadata can facilitate discovery and retrieval of digital government resources, and can also support informed decision making (New Zealand Government, 2015).

5. Moments of Life (MOL) App

Moments of Life is a Singapore government-wide project to consolidate government services across different agencies, and push relevant services and resources to citizens at timely moments in their lives via mobile app (PSD, 2018). For the initial phase, it supports families with children aged 6 and below by bundling useful services and information on a mobile app platform (Fig. 1). Services from different government agencies on Starting a Family and Parenting are delivered according to a citizen's profile (Fig. 2).

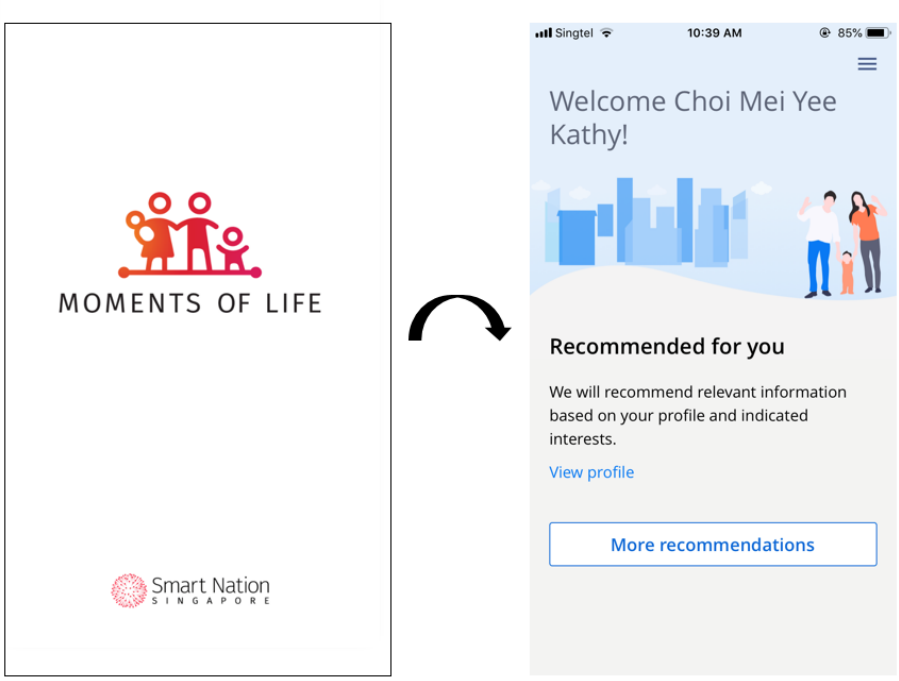

FIG. 1. Moments of Life mobile app landing pages

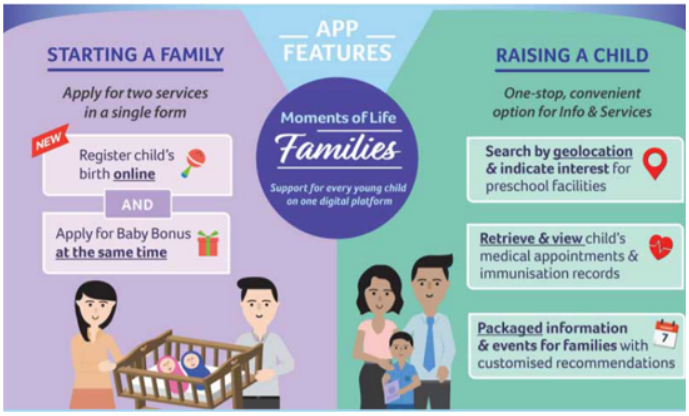

FIG. 2. Moments of Life (Families) services. (GovTech, 2018)

Subsequent to MOL Families, service journeys were identified to cover other aspects of a citizen's life. These service journeys are a citizen-centric approach to bring together related tasks across different agencies in order to provide coherent service delivery. These include: Overseas Singaporeans (covering transactions with the government), Working Adults (covering skills development, career decisions and job transitions), Active Ageing (empowering seniors to access information and perform transactions that support active ageing) and End of Life (empower citizens to take charge of their end of life planning).

6. Use Case to Determine Element Set

As it is important to understand why and how metadata and taxonomy will be used, a use case was developed with reference to the methodology proposed by CEN/ISSS (CEN, 2003a) and a study of the platform for publication of the content to determine the metadata element set. The methodology is illustrated as follows:

Step 1: Determine resources and resource categories to be described by metadata.
For the app, different government agencies' services and resources are to be described using metadata. Some of these service journeys are to be accessed via the app, some via websites and some via both platforms. In order to determine the granularity required of the metadata it is also important to understand the differences between mobile app and website. Imrich (2015) highlighted the following differences:

TABLE 1: Differences between mobile apps and websites

Context	Mobile apps	Websites
Goal	Task completion	Accessing information
Focus	Interaction design	Information architecture
Tools	Task analysis User flow diagram Task related UI patterns	Sitemap Grids & typography Content & navigation analysis

As McVicar (2013) explained, mobile user interface (UI) design considers constraints and contexts, screen, input and mobility, and apps have fewer menu options because of the limited amount of horizontal space on a mobile screen. Since MOL is a mobile app, the development of metadata application and taxonomies need to take into consideration the unique characteristics of a mobile app.

Step 2: Identify stakeholders who will use, create or otherwise deal with the metadata.

The following stakeholders were identified after consulting MOL Programme Office. Resource creators and metadata users are heterogeneous.

TABLE 2: Stakeholders

Stakeholders	Description
Metadata creators	Staff of contributing government agencies
Resource creators	Government departments
Metadata users	Public categorised by target audience

Step 3: Determine use of metadata for each stakeholder.

In this case, how the metadata is used are illustrated below:

TABLE 3: Use of metadata for each stakeholder

Stakeholders	Use of metadata
Metadata creators	Government agencies' staff create and maintain the metadata
Resource creators	Different government agencies' staff create the resources and use the metadata to describe the resources for delivery of the services such as registration of child's birth and baby bonus via the app
Metadata users	Public use metadata to access and discover government services and resources

Step 4: Determine appropriate elements for each use.

Both metadata and resource creators are non-specialists in metadata. DC metadata standard was examined whether it can adequately describe the services and resources and chosen because it is a simple yet effective element set for describing a wide range of networked resources, and allows non-specialists to create descriptive records for information resources easily and inexpensively. There are other benefits, such as simplicity of creation and maintenance, extensibility, etc. (DCMI, 2005) and, it is easily understood by users, i.e. the general public.

7. Metadata Application Profile for MOL App

Through discussions with the MOL Programme Office, Government Technology Agency Singapore (GovTech) and government agencies involved, NLB identified eight DC terms that are relevant across the whole of government and an extension of six data elements from schema.org to describe events. An important consideration was the possibility of exposing these data elements to Internet search engines using structured data namely using schema.org vocabulary. A faceted taxonomy incorporating content type, topic and target audience, was created to help government agencies to tag resources consistently and to facilitate global search and navigation.

TABLE 4: Metadata Application Profile

XML Tags	Field Label	Definition	Remarks
<dcterms:identifier>	Content ID	Agency ID and Content ID in Agency's CMS	Agency ID will be assigned by GovTech when agency registers as an MOL contributor.
	Content URL	URL to the content or event webpage	Must be mobile-responsive.
<dcterms:title>	Title	The title or name of the content.	Limited to 60 characters.
<dcterms:abstract>	Summary	A short snippet of the content.	Summary to be included in the search in future. Agencies are encouraged to write a meaningful summary.
<dcterms:type>	Type	The type of material.	**Use MOL Taxonomy.**

XML Tags	Field Label	Definition	Remarks
<dcterms:subject>	Topic	The topic of the resource.	**Use MOL Taxonomy.**
<dcterms:audience>	Target Audience	A group of people for whom the resource is intended or is useful.	**Use MOL Taxonomy.**
<dcterms:hasPart>	Image URL	URL of image to be used as banner.	Image selected should be descriptive of the article/policy/event. Images should have min. 800px width; landscape
<dcterms:contributor>	Owner (Contributor)	A person or organisation that currently owns the resource or an entity responsible for making the resource e.g. author of an article.	
Applicable only for submitting of events:			
<schema:startDate>	Start Date	The start date and time of the event	Include the start time of the first event, as well as SG time zone (+08:00).
<schema:endDate>	End Date	The end date and time of the event	Include the end time of the last event, as well as the time zone for SG (+08:00).
<schema:location>	Venue	The location of for example where the event is happening	If there is more than one venue, use "Various locations".
<schema:price>	Price	The offer price for attending an event	Use $XX as a standard, if there are multiple pricing, please use "From $XX".
<schema:duration>	Time	Quantity: Duration	If there is more than one venue time range, use "Various timings".
<schema:postalCode>	Postal Code	Postal code of the event location for geospatial tagging.	Optional if various locations.

The mandatory fields are Content ID (assigned by GovTech), Title, Type, Topics, Target Audience and Content URL. For events, the two additional mandatory fields are Start Date and End Date. For better user experience and ease of submission, the number of fields are kept as few as possible.

8. Development of Taxonomies

8.1. Best Practices

Apart from the metadata application profile, NLB also developed a faceted taxonomy to help users to navigate the content in the app. James et al. (2010) pointed out the need to define use cases and considerations of the audience, the platform, depth and breath, and to avoid overwhelming navigation. Nickerson et al. (2013) proposed that a useful taxonomy has the qualitative attributes of conciseness, robustness, comprehensiveness, extendibility and useful explanation, as well as the following qualities for taxonomy development method:

- Consideration of alternative approaches;
- Reducing arbitrary dimensions and characteristics in the taxonomy, relying instead on conceptual (theoretical) foundation or empirical analysis;
- Can be completed in a reasonable period of time;
- Straightforward to apply by users;
- Leads to a useful taxonomy.

In order to ensure scalability, the taxonomy was created based on a bottom-up approach where in-depth topic development is only done for the service journey planned with inputs from content submitters, such as the Ministry of Health for Pregnancy-related topics. So as to keep complexity for both creators and users low, we limited the taxonomy to a 2-level hierarchy and ensured that Preferred Terms versus Non-Preferred Terms are clearly established. Topics will increase

exponentially as more service journeys are rolled out. As such, the display of topics on the app is filtered by target audience and by resource type.

8.2. Faceted Taxonomy for MOL App

Negotiations with submitting agencies on what terms to use took patience, a lot of reasoning and firmness as there are multiple agencies submitting content for a single service journey. It helps to have a lead government ministry for each service journey who can lend their authoritativeness towards the submitting statutory boards or agencies, and a very clear-minded Programme Office who took advice from both NLB and GovTech. The development of each area in the taxonomy always starts with reference to the sitemap of agencies' websites. Three facets of taxonomy were created, specifically target audience, content type and topic (Fig. 3)

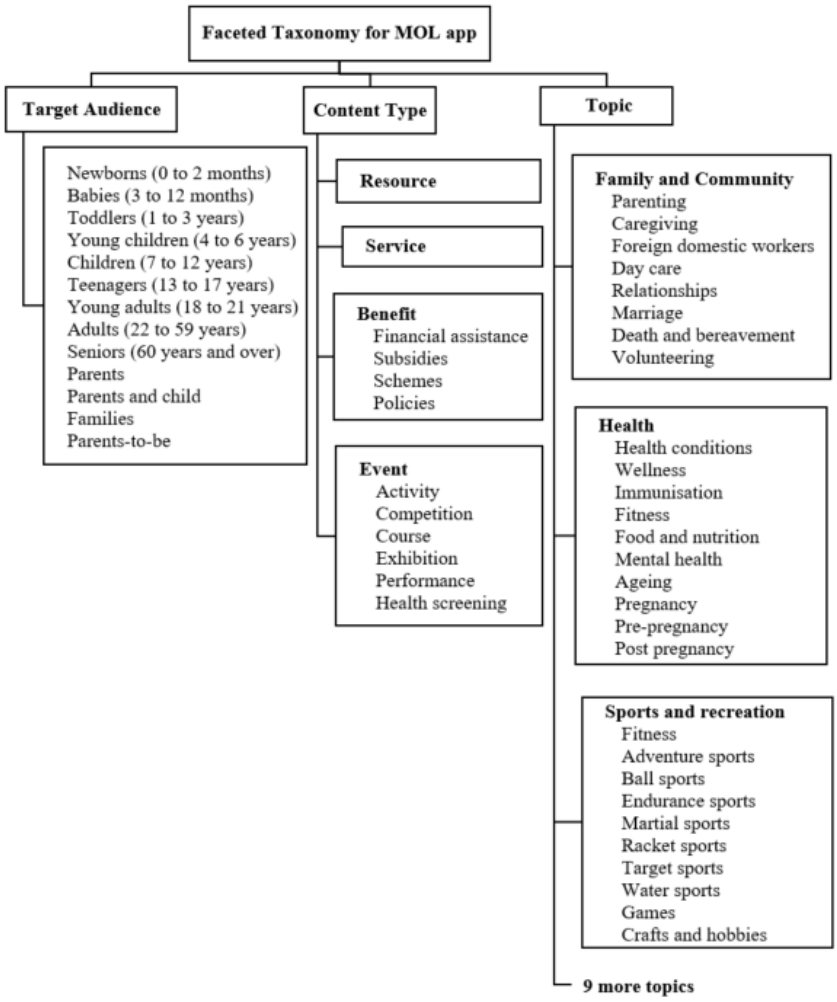

FIG. 3. Faceted taxonomy for Moments of Life mobile app

In order to keep the number of terms low and avoid duplication, NLB took the approach of pairing facets to obtain the required result. Example: pairing "School" and "Young children (4-6 years)" will pull out resources on "Preschool education (4-6 years)". Another example is the pairing of Health topics such as "Food and nutrition" with the appropriate Target Audience to narrow down the results in the navigation pane on the app.

Events are also filtered by Age Group (Target Audience are scoped by age groups), Event Types and Event Categories (topics from the MOL Taxonomy) (Fig. 4). Names of Facets or vocabulary

classes such as Target Audience are deliberately given the flexibility of the use of labels such as "Age Group" and "Event Category" for Topics, to suit the service.

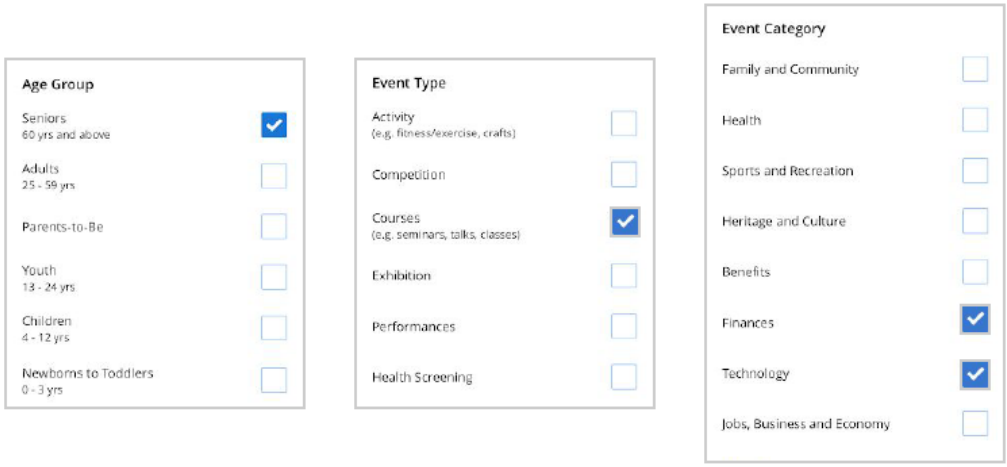

FIG.4. Event filters

Individual agencies' vocabularies can be used without impacting MOL's controlled vocabulary by mapping (Table 5):

TABLE 5: Mapping Agencies Types Vocabulary and MOL Content Type

Agencies Types Vocabulary	**Definition / Scope Note**	**MOL Content Type**
Benefit	A payment or gift that is made by the government to help citizens. Includes subsidies.	Benefit
Activity Resource	A guide that provides clear instruction on a specific activity, such as how is the activity carried out and what is required.	Resource
Article	A piece of writing on a specific topic, forming an independent part of a book, magazine, newspaper or website.	Resource
Blog Post	An entry from a blog. A blog is defined as a user-generated website where entries are made in journal style and displayed in reverse chronological order. For non-blog websites, use Website. For non-blog entries/articles, use Article.	Resource
Book	A written work of fiction or nonfiction. May be printed on paper or in an electronic format.	Resource
Magazine	A publication that is issued periodically, and typically contains articles, essays, stories, etc. by many writers, and often photographs and drawings, frequently specialising in a particular subject or area of interest. May be printed on paper or in an electronic format.	Resource
Online Programme	A training or instructional programme that is conducted on an electronic platform.	Resource
Assessment Tool	A test or instrument used for assessment to evaluate knowledge, understanding, ability, aptitude, personality, interest, etc. Includes psychometric tools.	Resource
Tip Sheet	A summary of short basic practical facts and useful ideas on a topic.	Resource
Video	A recording of moving images, with or without sound.	Resource
Website	A connected group of pages on the World Wide Web regarded as a single entity, usually maintained by one person or organisation, and devoted to a single topic or several closely related topics.	Resource
Service	An organised system of supplying a public need, such as education, healthcare, transportation and communication facilities, public utilities, etc. Includes guides on how to do something, such as a registration procedure, how to apply for a benefit, obtain assistance, etc.	Service
Form	A document used to apply for a service, benefit, event, etc. Includes feedback forms.	Service
Event	An event happening at a specified time and location. Covers all types of events except training courses. Use Course for training courses.	Event
Course	A training or instructional programme conducted at a physical location; a class. Use Online Programme for courses conducted online.	Event

With the use of the taxonomy, user profiling is made possible and relevant content can be pushed to the user, with editable user preferences to deliver a better user experience (Fig. 5).

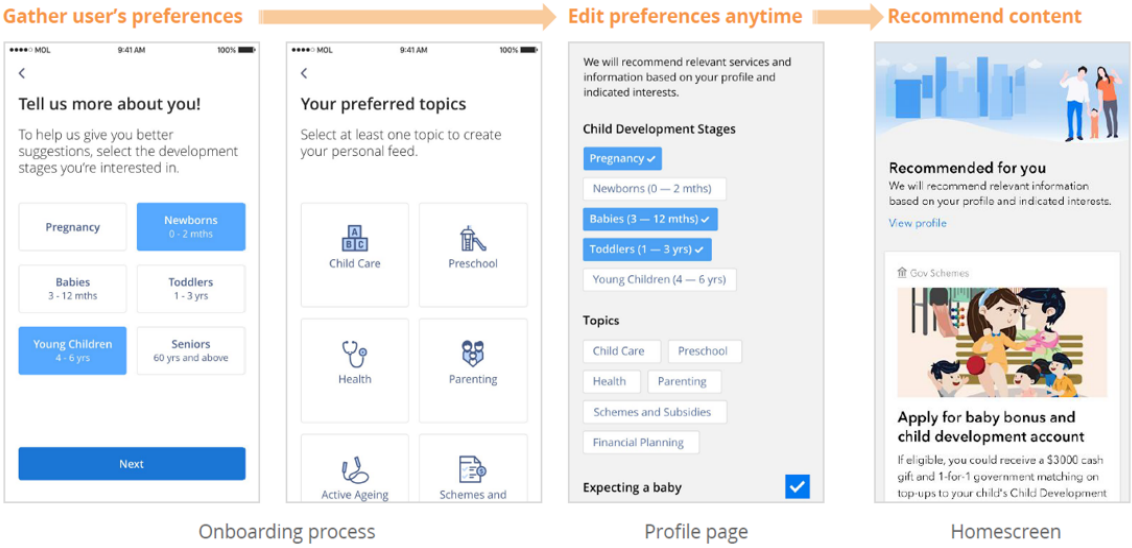

FIG. 5. Pushing relevant content to the user using metadata and taxonomy

Findability is improved by the use of <schema:postalCode> which enables geospatial tagging for events that can be personalised for app users (Fig. 6).

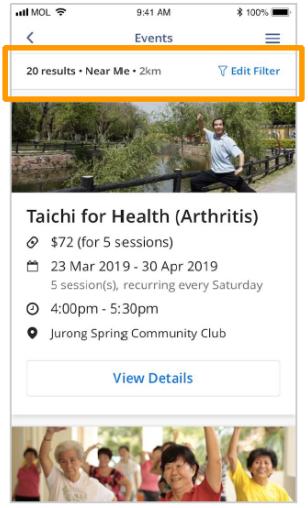

FIG. 6. Events page personalised to user location

8.3. Vernacular Terms

Singapore is a multi-cultural society with 4 official languages comprising English, Chinese, Malay and Tamil. Vernacular translations will be applied to the taxonomy so as to improve user experience. Particularly for the next two service journeys, Active Ageing and End of Life, these services will cater largely to older generation Singaporeans who may be more comfortable with their mother tongue.

9. Lessons Learned

Work on the MOL app is ongoing to deliver new features, which will include enhancements arising from taxonomy updates. Statistical information such as app downloads also need to be broken down to the relevant user profiles such as families, active agers, etc. A new release is being planned for end 2019 after which the initial download figure of about 40,000 is expected to increase. As it was, 7,000 births in Singapore were registered using the app. Users on the Apple App Store rated the app a 4.2 out of 5 (Apple Inc., 2019) and 3.7 out of 5 from Google Play review (Google, 2019).

During the process of working closely with different government agencies on the development of this app, we have learned that content strategy and good understanding of the design and platform of mobile apps are essential to the development of metadata application profiles and faceted taxonomies where metadata-driven content can facilitate content personalisation. For content strategy, we developed use case to formulate a clear strategy to formalise content gathering, analysis and mapping with different government agencies. We had also studied the information architecture, interaction design and visual design of the app to help us look at how to improve user experience and simplify navigation. Metadata-driven content, including DC elements and faceted taxonomies, can be used to filter and deliver the most relevant content to the end-user. In the context of the MOL app, information is thus recommended based on user profiles and indicated interests.

10. Conclusion

Moving forward, government content will be published simultaneously on different platforms, such as websites, tablets, smart phones, and other mobile devices to facilitate timely access to government resources. The method of "Create Once, Publish Everywhere" (Flagg, 2013b) is highly recommended, so that content is available and consumable anytime, anywhere and on any device. But this can only be implemented with the provision of structured content.

Quality metadata and taxonomies are part of structured content and this will also help in search engine optimisation using structured data. For service journeys that will be delivered via websites such as Parenting and End of Life, NLB can translate these MOL content into structured data for schema.org mark-up. However, while we can mark-up the app itself (schema: mobileApplication), it does not seem possible to mark-up app content if they do not exist on a website and are not accessible to search engines' results pages. Using Progressive Web Application (PWA), technology to create a website that behaves like an app will allow search engines to index the content however it does require that this be developed with the requirements from scratch.

An understanding of the user interface and expected user experience of the different platforms is essential to the development of metadata schema and taxonomies. For metadata and taxonomy to be rolled out across whole of government, such as NLB's efforts for Singapore's MOL, it is important not only to know this but to also be constantly plugged to the overall plan and any changes that may happen such as changes to the content contributed or services planned. NLB's good relationship with the MOL Programme Office has helped us in this regard. Knowing and being able to work closely with contributing agencies is also critical in taxonomy development. Keeping things simple is another important consideration as metadata need to be created by non-specialists from these agencies and the onus is on them to ensure good quality metadata is provided.

NLB's experience with the MOL app and the coming challenge of supporting 10 other service journeys across Singapore's whole of government, enables the library's expertise in content organisation to be leveraged across communities, and is our answer to the call for public service transformation and digitalisation of government services.

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