Atlas of Living Australia

ALA Infrastructure Implementation

October 2016

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ALA Infrastructure Implementation

This document provides an overview of the Atlas of Living Australia and the suite of software infrastructure and tools which comprise it.

Atlas of Living Australia – context

The Atlas of Living Australia (ALA) is an **e-infrastructure** that is funded by the Australian Government via its National Collaborative Research Infrastructure Strategy (NCRIS). It is a **collaborative partnership** of organisations that have stewardship of biological data and expertise in biodiversity informatics, including museums, biological collections, community groups, research organisations, government (state and federal), and natural resource managers. It delivers a centralised web-based infrastructure to capture, aggregate, manage, discover and analyse all classes of biodiversity data and associated information, through a suite of tools and spatial layers for use by research, industry, government and the community. Its vision is to lead the digital transformation in sharing biodiversity knowledge thereby supporting and enabling high quality research and innovation outcomes to address national and global challenges. It supports a host of activities by its stakeholders from research, biodiversity discovery and documentation, environmental monitoring and reporting, conservation planning, biosecurity activities, education and citizen science, together with enterprises and organisations leveraging off the open infrastructure to create and enhance their own services and products. The ALA is one of Australia's premier research infrastructure facilities and is actively contributing to global advancements in biodiversity data management.

The ALA is founded on the principle of **open access** – collect data once, make it freely accessible and discoverable, use it many times. This is particularly important in the context of public data produced, collected, held and funded by government as well as in a global biodiversity informatics framework such as that outlined in GBIO. The ALA currently holds over 60 million records of more than 111,000 different species from across Australia, and over 470 spatial layers, with its adoption and utilisation illustrated by over 7 billion records having been downloaded for use to date (see ALA Dashboard), an average of 3,500 users per day and about 15 new publications per month mentioning ALA. The ALA is the Australian node to the international open data infrastructure the Global Biodiversity Information Facility (GBIF). The ALA's infrastructure or software is also made available as **open source** software with the intention of encouraging a collaborative approach and community of practice around the infrastructure as well as interoperability and cost saving benefits.

International Engagement

International engagement and impact is one of the key outcome areas for the ALA pursuant to its strategic plan, with an aim to advance Australia's contribution to and participation in international **digital transformation** opportunities (e.g. international data mobilisation and digitisation, visualisation, open data, integration/interoperability, standards, and capacity development), as well as **biodiversity and ecosystem** sustainability opportunities that enable collaboration in international and multilateral biodiversity policy, monitoring, modelling, assessment, accounting and indicator initiatives and projects.

The ALA infrastructure has been used by a number of different countries for their national biodiversity portals, and importantly, this work has been undertaken in collaboration with GBIF. Some example installations include:

- GBIF France – http://portail.gbif.fr/
- GBIF Spain – http://datos.gbif.es/
- CRBio Costa Rica – www.crbio.cr
- ICMBIO Brazil - http://www.icmbio.gov.br/portal/portaldabiodiversidade
- NBN Scotland – http://www.als.scot/

The ALA hopes to grow and develop a global community of expertise and capacity to maintain the infrastructure code base and to be able to assist others in implementing it.

In general, the following principles hold true in respect to new installations:

- People wanting to implement or use the software suite working collaboratively with people who have already implemented it and understand it achieves optimum results for everyone and sets up a constructive working relationship for the future.
- New collaborators have content, data, metadata, expectations for styling and user interaction, language encoding, etc. relevant to their requirements which only they can provide.
- The ALA (and an increasing global community) has the architecture and systems knowledge to assist with constructing the system and teach new collaborators how best to use, manage and maintain it.

A later section in this document "*Implementing ALA Infrastructure*" provides some considerations to take into account when looking to install an instance of the ALA software.

At a higher level, this is also envisaged to contribute to a potential end-to-end integration, interoperability and connectivity from data collection and curation through to indicator derivation and reporting, so that countries and organisations can meet their obligations for reporting under international agreements, and for within-country planning and decision making. The concept would help to cultivate a dynamic and distributed information supply chain including feedback (recognising the technical and social architectures needed) that combines the strengths of best available biological and environmental data within countries together with consistent, fine-resolution global coverage of remotely-sensed environmental layers and modelled biodiversity through various platforms. The following diagram provides an initial articulation of this concept.

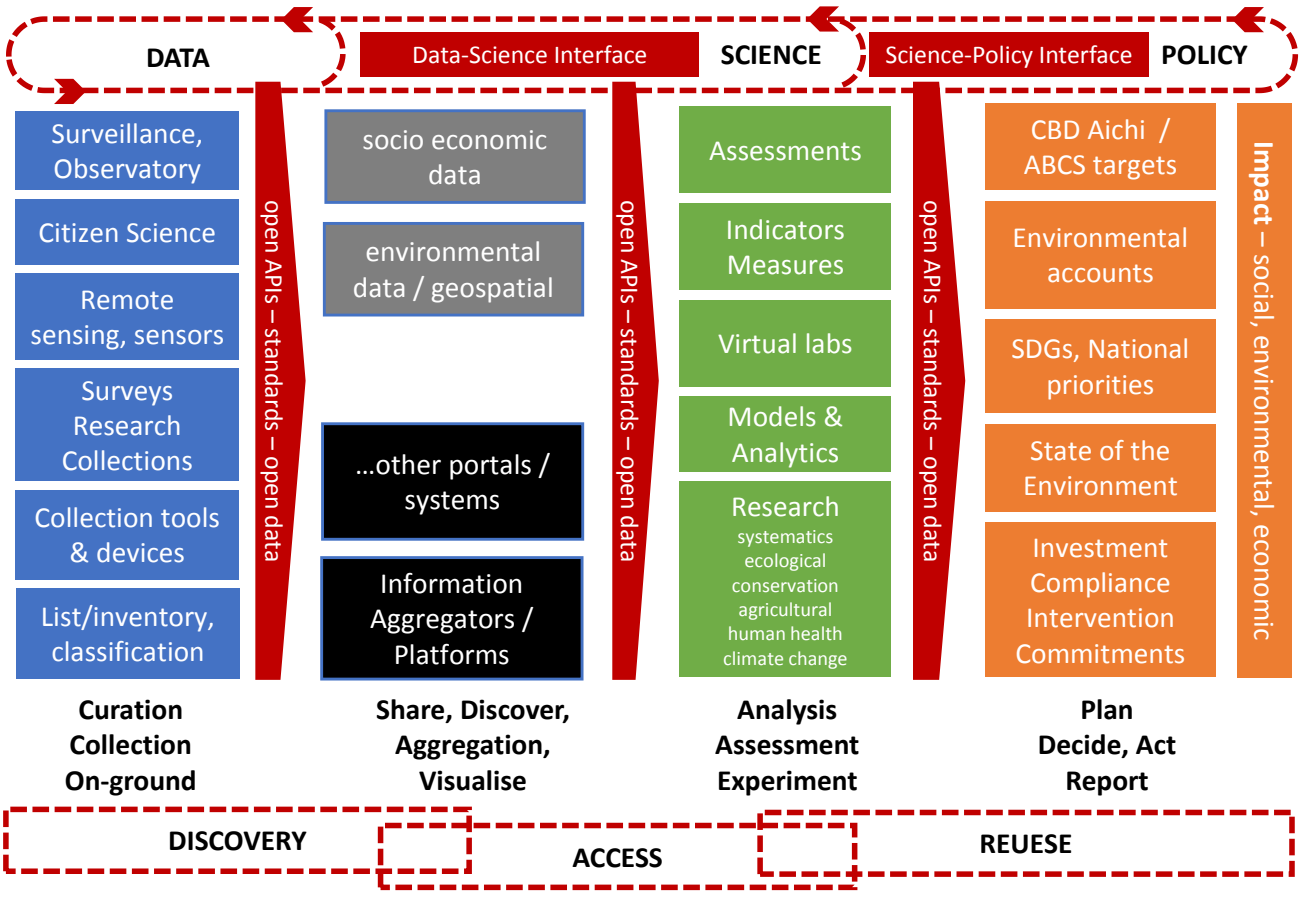


Figure 1 – A conceptual framework and context for the global biodiversity information supply chain

Overview of ALA infrastructure

The following diagrams provide an overview of the key components, tools and functions of the ALA infrastructure:

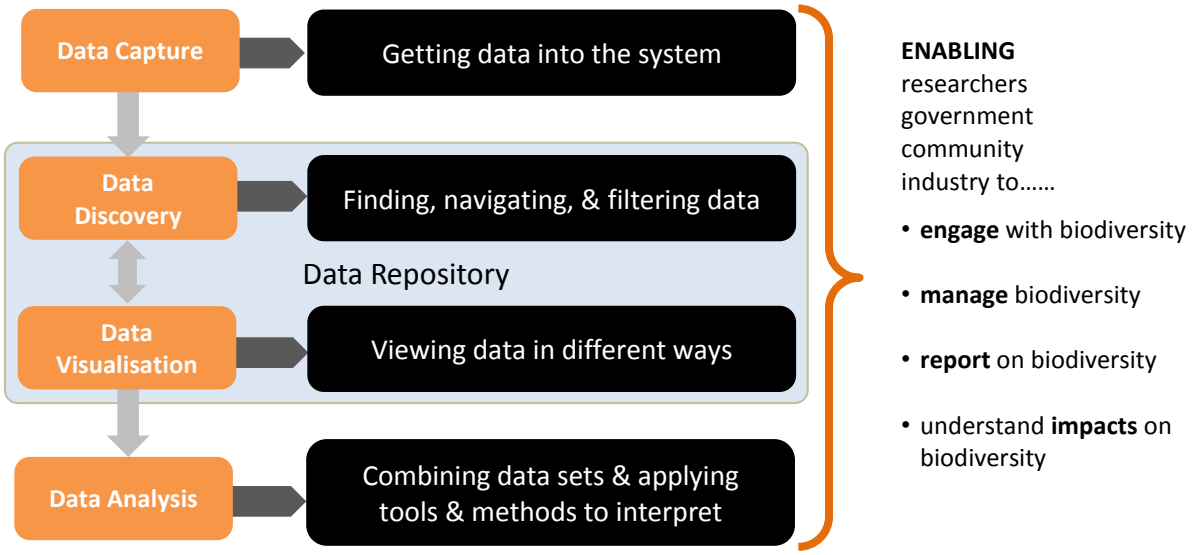


Figure 2 – ALA components and their usage

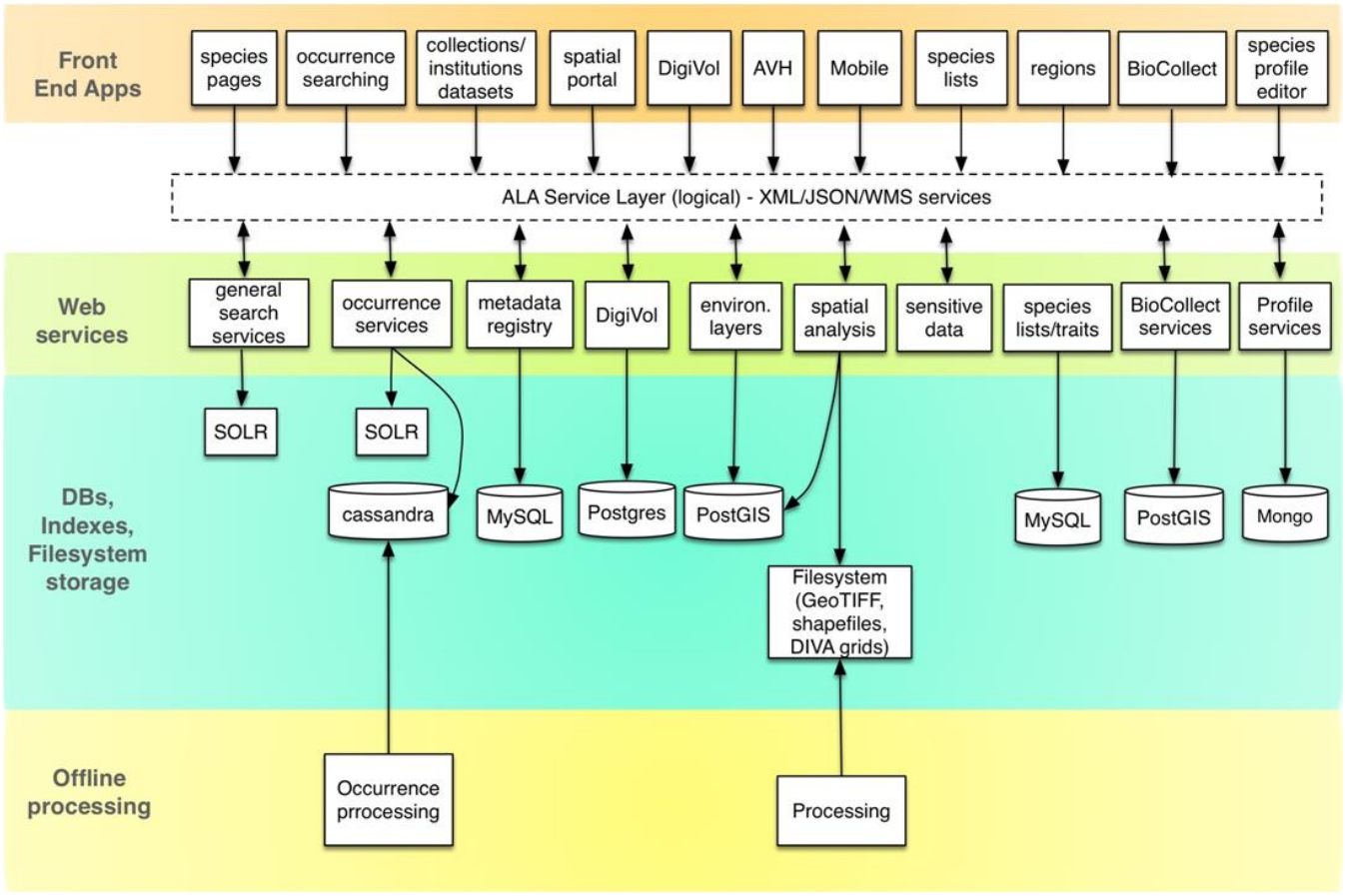


Figure 3 – Generalised architectural model ALA architectural – ANNEX 1 also

ALA infrastructure can be also thought of as an infrastructure that supports a number of different systems – whether they be separate **instances**, installations or implementations of the ALA software suite, or **hubs** that are different interfaces over one common instance of the data infrastructure, providing thematically filtered subsetted views of the data. Also the use of **web services** or open APIs means that others can independently access data and some data processing services. Figure 4 is a simplistic stylized illustration of this concept, and ANNEX 2 provides examples.

Figure 4 – ALA instances, hubs and web services

Data types

Most of the ALA software suite is designed around species names, taxonomy, occurrence based data and related data types. However the ability to support other relevant data types and more effective ways to spatially and temporally represent different data types, presence/absence, etc. are also being explored.

Standards

The ALA infrastructure applies international data standards as much as possible and wherever appropriate. These include Darwin Core (DwC), Darwin Core Archive (DwC-A), Dublin Core, ISO, OGC, and others. The ALA is also an active participant in the further development, maintenance and implementation of relevant international standards.

Architecture

Architecturally, the ALA is an integrated/federated web application comprising a suite of somewhat modular tools and components linked together via a micro-services architecture. Each component conforms to the following basic principles:

- Each component is designed to perform a particular specialised job and, with the exception of integrated service components and plugins, they comprise a database, a server-side application layer and a client-side interface layer.
- Some components provide user/client-facing tools and functionality, whilst others support Administrator level configuration and management of the core system and databases.
- All of the components are co-dependent in some way (i.e. none of them can stand alone and function effectively as a complete tool in their own right). Some of them are required as a foundational core for all externally-facing tools and some tools are “non-core”. ANNEX 1 provides an overview of each component.

- The components interact with each other mostly via web service APIs and there is also a number of plug-in components which can be re-used in different apps. This architecture allows for relatively easy component-based maintenance, as well as the ability to assemble components in different combinations for different purposes or communities.
- Web service APIs can also be exposed publicly, allowing external parties to access data and some application services.
- Both the main ALA software suite and the BioCollect data collection software support the concept of "hubs" – different interfaces over the same back-end. This allows a single instance of the software to support different thematically constrained interfaces which serve different communities. Figure 4 provides a diagram of the "hubs" concept.
- The core set of foundation components have been compiled for relatively easy ansible-script-based deployment. Installation scripts and instructions can be found at https://github.com/AtlasOfLivingAustralia/ala-install.
- Other non-core components can be added as needed.

Open Source

All of the tools and components which have been developed by the ALA are free open source software and, where existing available tools, databases, development frameworks, script libraries, etc. are used, open source platforms are preferentially chosen over proprietary platforms as much as possible. This minimises running costs as licensing is zero or negligible and potential complications with IP can be avoided.

The ALA team is keen to encourage global collaboration and the development of a community of practice and expertise around this software as countries and organisations adopt it. As such, any new installations and further development is strongly encouraged to be done in the true spirit of open source practice - ie. By pull-request/commit from/to the ALA github repository, rather than by forking and independent installation/development.

Implementing ALA Infrastructure

Background information

The References section in Annex 2 provides some useful background documents outlining the history, development, drivers, experiences, lessons learnt and applications of the ALA relevant to making a decision about infrastructure implementation.

Considerations before starting

The amount of time and effort required to implement each instance of the ALA software suite will vary depending on many factors. Giving due consideration to each of the following items, as well as the process steps listed below, will assist with appropriately scaling and estimating the size of the job and the amount of funding and resources required:

- What is the **purpose of the new installation** – which communities are to be served by it and what information and functionality do they require?
- What is the **project scope** – e.g. is it "simply" a copy of an existing installation or are there additional features required such as data collection, species profile management, streamlined data ingestion, nuanced access control and data visibility, etc.?
- **Where would data be sourced** from – e.g. just collections or institutional data holdings, or do other data sources also need to be included, such as citizen science and community data holdings, etc.?
- What is the **volume of data expected** (including growth potential in terms of records and datasets) – spatial and aspatial?
- What **kinds of data** need to be explored through the new facility – e.g. just occurrence point data, or also event and non-DwC/non-biological data, collections data, images/media, genomic, literature, ecological plot, community and survey data, social and participatory data, etc.?
- What **kind of maintenance model** is appropriate and can it be adequately resourced? – e.g. on-going application and community support, software and hardware maintenance, resources, etc.

The process

Following is a general guide to the tasks involved in setting up an instance of the ALA:

1. **Standing up a new instance** of the software is quick and simple – instructions and source code is available from https://github.com/AtlasOfLivingAustralia/documentation (see the "open source" section above for additional considerations). This will install the core set of components and tools, un-styled and with empty databases, then the real work begins.
   Note: The ALA software is best suited to being setup on a virtualised environment, with dedicated virtual machines for the components.
2. **Basic configuration** – connecting components, setting configuration parameters and constraints, etc.
3. **Skinning** – building the theme, style sheets, widgets and navigation model, etc.
   (new instance owner needs to provide input into design, graphics and how they need to be presented). This is a single plugin used by all components.
4. **Content** – adding static content, taxonomic content (taxa, classification tree, species descriptive information, etc.), help text, images and media, etc. (new instance owner needs to provide content and input into how it needs to be presented).
5. **Advanced configuration** – preloading and setting up primary user, organisation/institution, data provider, data resource entities, and sensitive data service (SDS) reference lists (new instance owner needs to provide the data)

6. **Data loading** – transforming, normalizing and loading occurrence datasets, sourcing and loading spatial datasets, etc. This is usually a very significant time/cost component (often under-estimated) and usually requires work by both parties.

7. **More advanced configuration** – creating indexes, linking up spatial layers in tools, etc.

8. **Testing & bug fixing** - normally this is estimated at about 1/3 of the total time and cost.

9. **Knowledge transfer –** an important objective in any collaboration should aim to transfer the technical knowledge to the system owner so that they will have their own in-house capacity for maintenance and further development, as well as to increase the capacity and resilience of the global community of practice.

10. **Adding and configuring other non-core tools/features** will also incur some overhead, depending on what tools are required and the extent of customisation which may be required to these.

11. **Internationalization** (i18n) – Creating language translations as required.

Points 1-9 are a standard requirement and the effort can range from relatively light to heavy depending on whether things that the system owner needs to provide into the process are already done, the scale of data and datasets to be loaded, the degree of customisation needed in the configuration and skinning steps, and many other factors.

In the case of adding non-core tools/features (point 10 and 11), this can be low cost and quick for things like data collection, or it may be more costly and take longer if substantial development effort is needed to deliver required functionality.

ANNEX 1 – ALA Components

Tool / Component	Purpose	Usage	Description	Example
Wordpress website	Static content management and container/binding agent for other ALA apps.	Core (optional)	Wordpress is used as the ALA's CMS for creating and managing static content. It acts as the user interface tool which binds the various separate ALA tools together into a cohesive and reasonably seamless user experience. It provides the basis for styling consistency between apps as well as context-based linkages to apps and tools. NB. This component is optional and any CMS can be used to perform this function	http://www.ala.org.au/
Auth	User authentication, permissions and profile management	Core	Database and management interface for user profiles and permissions. Single sign-on to all Atlas components. Includes O-Auth support enabling login with google/facebook accounts. The Auth app manages user authentication roles and permissions for most ALA apps. The ADMIN interface enables user profile configuration and maintenance. Different role-based permissions can also be applied to the Auth app itself, allowing general users to self-manage specific aspects of their own personal profile.	
Collectory	Management of data entities, entity associations and metadata	Core	Database and ADMIN management interface for metadata associated with organisations, institutions, data providers and data resources. Manages associations between entities and metadata.	http://collections.ala.org.au/
Collections - interface	Discovery and navigation of data for institutional biodiversity collections.	Data discovery & visualisation	A public-facing interface for discovery and navigation of data and metadata for institutional collections organisations such as museums and herbaria. These can be associated with any institution (eg. State, national, academic, private, etc.). It also provides links, content, data summaries and usage statistics for associated data providers and data resources.	
BIE **(Biodiversity Information Explorer)**	Meta data registry, taxonomy, species indexed search	Core Data discovery & visualisation	SOLR index of species names, classifications and associations of all other content linked to taxonomic entities. This is the taxonomic backbone of the Atlas. The UI for the BIE delivers all linked content to users in the context of a particular selected taxon and provides functionality to explore all linked content.	http://bie.ala.org.au/species/Phascolarctos+cinereus#
Biocache	Records database & indexed search	Core Data discovery & visualisation	Darwin Core (DwC) based occurrence record database and associated indexes. The database is NoSQL and can also hold additional non-DwC attribute data. Current ALA visualisation tools don't provide visualisations for non-DwC data. The Biocache also provides mapping and WMS services.	http://biocache.ala.org.au/occurrences/search?taxa=
Alerts	Notifications of new records/events triggering defined criteria	Data discovery	Allows users to set and manage alerts and notifications of new taxon records and events of interest. Alerts can be set for individual taxa or for a set of trigger criteria defined in a Biocache search. Alerts are set for individual users and are managed by them via an interface linked to their personal profile.	http://alerts.ala.org.au//notification/myAlerts

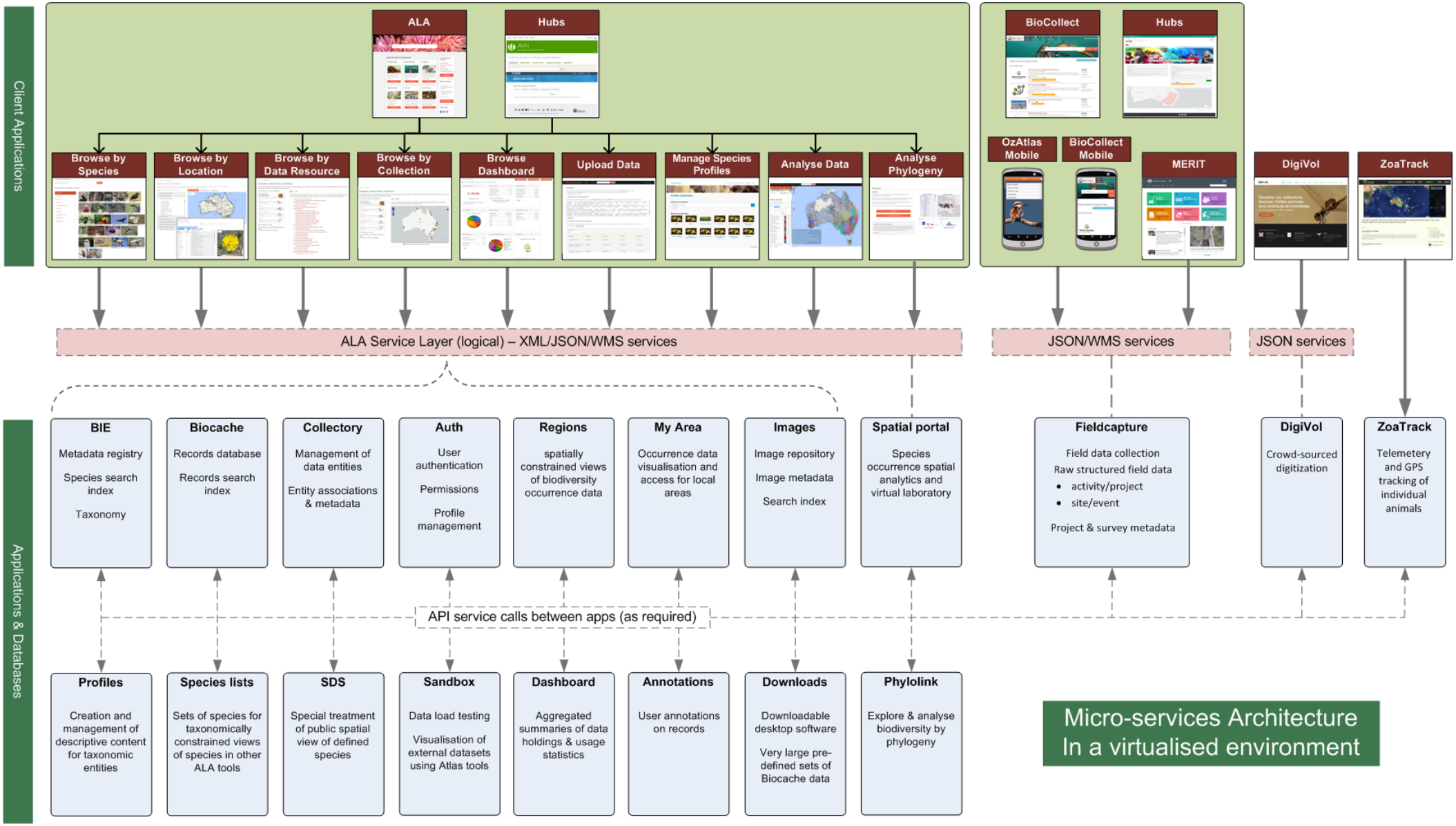
Tool / Component	Purpose	Usage	Description	Example
Annotations	User annotations on records	Data analysis	Annotation service which is embedded within the Biocache record view. Available to all users with access to record. Sends email to record submitter and logs annotation content.	
SDS (Sensitive Data Service)	Special treatment of public spatial view of defined species.	Data visualisation	A back-end data processing service which looks up reference taxon lists and applies pre-defined public visibility rules (spatial accuracy) to species occurrence records for a pre-defined set of taxa. Reference taxon lists and visibility rules are managed in the "Lists" tool.	http://www.ala.org.au/faq/data-sensitivity/
API	User support for application & usage of tools external-facing APIs	Data discovery & access	The API tool is a registry of publicly available web service APIs. It includes documentation for them in the form of usage notes, instructions, examples and code snippets to assist people in using the many available listed APIs.	http://api.ala.org.au/
Regions	Simple spatially constrained views of biodiversity occurrence data.	Data discovery & visualisation	A tool which allows selection of pre-defined spatial entities from pre-set spatial layers stored in the Spatial portal repository. It then provides a filtered summary and view of Biocache records based on the selected spatial area, and access to the filtered record set via: download (as species checklists or full record sets), pass-through linkages to the Biocache and Spatial portal viewers, or pre-defined report outputs.	http://regions.ala.org.au/
Species lists	Sets of species for use in taxonomically constrained views of species in other ALA tools.	Data visualisation	Database and management interface for subsets of the total BIE, constrained by taxon entity. Allows user upload and configuration of any list, as well as reference lists for use by the SDS.	http://lists.ala.org.au/
My Area	Occurrence data visualisation and access for local areas	Data discovery & visualisation	A simple yet powerful visualisation of occurrence data points within a set radius of a defined spatial point. The centroid point can be specified by several means including: map-based drag'n'drop, address/locality search and GPS location. Provides pass-through of record result set to the Biocache visualisation tools and individual record links to BIE visualisation tools.	http://biocache.ala.org.au/explore/your-area
Images	Image repository and associated metadata	Data discovery & visualisation	This is the primary repository for storing and managing images and a very rich set of associated metadata. It also supports some user role-accessible capability (currently immature) for image mark-up and subdivision into associated child images.	http://images.ala.org.au/
Sandbox	Data load testing / visualisation of users external datasets using Atlas tools	Data collection	The Sandbox is a tool for uploading CSV format datasets and dynamically mapping fields in the dataset to the DwC schema. Once successfully loaded and mapped the temporary dataset can be viewed using the ALA Biocache and Spatial portal, as well as download it with the appropriate DwC field mappings. The temporary dataset is stored and accessible via the user's profile.	http://sandbox.ala.org.au/
Dashboard	Aggregated summaries of data holdings and usage statistics.	Data visualisation	A view page containing a wide variety of widgets with dynamic aggregated summaries of data and metadata holdings, data access and usage statistics, etc. Each widget provides dynamic access to BIE and Biocache views of data represented by the selected summary segment. Ie the dashboard can be used to access filtered views of the data based on defined aggregation segments in any of the widgets.	http://dashboard.ala.org.au/

Tool / Component	Purpose	Usage	Description	Example
Downloads	Access to downloadable desktop software and very large pre-defined sets of Biocache data.	Data discovery & access	Downloads is a tool which provides access to download desktop apps developed by the ALA and also to access and download very large (>0.5M records) datasets from the Biocache	http://downloads.ala.org.au/
Spatial portal	Species occurrence data spatial analytics and virtual laboratory.	Data visualisation & analysis	The Spatial portal is the ALA's primary analytics tool. It is a powerful spatial visualisation engine with too many features to cover in a brief overview statement. However, it has several built-in data analysis tools covering most common biodiversity data analysis use cases and also enables data export for more sophisticated analytics in offline tools. The tool is fully integrated with the Biocache and BIE allowing users to easily move between the tools and to pass contextualised information between them for improved usability. Users can easily select from a very wide range of Biocache data and spatial layers stored in the Spatial portal repository, and/or they can temporarily upload their own structured CSV formatted data and/or spatial layers to combine with existing ALA data and perform required analyses in the Spatial portal tool. Data and analyses can be easily exported as analytical products or as inputs to other analytical offline processes. Very rich and sophisticated area-based reports can also be easily generated for any geographic area of interest.	http://spatial.ala.org.au/
Profiles	Creation and management of descriptive content for taxonomic entities.	Data visualisation	The Profiles web app is a tool for creating and managing structured descriptive information about "collections" of species. Collections in this context are sets of species grouped in some thematic way. Each collection can have it's own set of attributes and a species can occur in multiple "collections". Collections are user generated and can have independently configured editorial access privileges.	http://profiles.ala.org.au/
Phylolink	Explore and analyse biodiversity in the context of phylogeny	Data visualisation & analysis	Phylolink is a tool through which biodiversity can be explored from a phylogenetic (or tree of life) perspective. At the core of this tool is the ability to easily intersect a phylogenetic tree with species occurrence records, environmental data, and species character information. The result is powerful ways of combining data to generate flexible and customisable visualisations, profiles and metrics for biodiversity.	http://phylolink.ala.org.au/
BioCollect	Collection of raw structured field data in site/event/ activity/project context	Data collection	BioCollect is a flexible structured field data collection platform developed by the ALA to support communities, ecologists, local government authorities, natural resource management organisations, and others in the collection, management and mobilisation of biodiversity and other associated data. The system provides project-based community engagement support and also enables upload of unstructured data and materials associated with projects.	http://www.ala.org.au/biocollect/

Tool / Component	Purpose	Usage	Description	Example
			BioCollect includes a built-in projects register and comprehensive project finder UI, supporting registration of both projects using the full data collection capabilities of the tool and projects using other data collection tools. BioCollect uses a range of innovative techniques to improve the quality and re-usability of field data and, unlike any other data collection tool, it enables organisations to have their own website, whilst seamlessly integrating with the ALA to make their data usable by others. The system also provides APIs which allow external systems and mobile apps to link directly to specific organisation, project and survey pages and interchange data between them. Species occurrences in activity/event forms generate occurrence records which can be automatically harvested into the Biocache.	
BioCollect mobile	Mobile platform & offline application of the BioCollect tool	Data collection	Supports all features of the BioCollect web app on a mobile platform, as well as the ability to download base map tiles for offline use, ability to record data offline with configurable synch-to-server and connection to device tools in data input forms such as GPS, microphone, audio playback, camera and image viewer. Currently only available as native iOS app with plans for Android and possibly Windows versions at a later time.	https://itunes.apple.com/au/app/biocollect/id1116877865?mt=8
Mobile app (OzAtlas)	Mobile app for browsing and contributing ad-hoc species sightings to the ALA	Data collection & discovery	iOS and Android native apps for submission of ad-hoc unverified single species occurrence records directly to the ALA. The apps also have a mobile version of the “My area” tool as well as using the web service APIs for species name look-up, species page views, and other features. Both versions of the app are currently being updated before being redeployed to the respective app stores.	
MERIT	Structured activity-based data collection of funded “works” type projects.	Data collection	MERIT is a field data collection system which records activity level information for Australian government funded environmental and natural resource management intervention works projects. It can share a common database with the BioCollect system and the structure is similar to the "works" project type in BioCollect. However it differs from BioCollect in that it has configurable funding programme-based workflows and reporting frameworks built into it and that it does not support "survey" type project applications. Species occurrences in activity forms generate unverified occurrence records which can be automatically harvested into the Biocache.	https://fieldcapture.ala.org.au/merit
DigiVol	Crowd-sourced digitization	Data collection	DigiVol is a platform for high quality crowd-source digitisation of specimen labels, expedition & field note books, field data sheets and camera trap images. The Australian site is currently being used for digitization projects from all over the world.	http://volunteer.ala.org.au/

Tool / Component	Purpose	Usage	Description	Example
			Verified records from DigiVol are harvested automatically into the Biocache.	
ZoaTrack	Telemetery and GPS tracking of individual animals	Data collection, visualisation & analysis	The ZoaTrack platform (originally "OzTrack") was designed to assist researchers and natural resource managers, store, analyse, visualise, synthesise and share their animal presence and movement information. It was initially built for those tagging and tracking animals within the Australasian region but is being used by researchers world-wide. The platform hosts a range of home-range density estimator tools which can be compared and overlaid with a range of environmental layers. The results can be exported as KML or shapefiles for viewing and processing in Google Earth or other GIS software. NB. This tool and data stored in the database is not yet integrated with other ALA tools, including the BIE and Biocache.	http://oztrack.org/

Figure 5. ALA architectural model



ANNEX 2 – Use of ALA infrastructure

A. Independent implementations of the ALA software suite

a) Global

- GBIF France – http://portail.gbif.fr/
- GBIF Spain – http://datos.gbif.es/
- NBN Scotland – http://www.als.scot/
- CRBio Costa Rica – www.crbio.cr
- ICMBIO (Brazilian national conservation agency) - http://www.icmbio.gov.br/portal/portaldabiodiversidade
- SiBBR Brazil - https://portaldabiodiversidade.icmbio.gov.br/portal/
- GBIF Portugal (currently in development)
- GBIF Argentina (currently in development) – see http://community.gbif.org/pg/file/read/49679/testing-portal-customized-ala-portal-for-argentina
- Canadensys Canada (currently in development) - http://www.canadensys.net/2016/international-atlas-of-living-australia-workshop
- See – Madrid 2016 workshop for additional details on the status of development by differnet countries : http://www.gbif.es/formaciondetalles.php?IDForm=153#ad-image-0 and Github for other presentations by international hubs - https://github.com/AtlasOfLivingAustralia/documentation/wiki/Presentation-ala-project

b) Within Australia

- Atlas of Prehistoric Australia (APA) - http://apa.ala.org.au/
- Australian Plant Pest Database (APPD) – http://appd.ala.org.au/

B. "Hub" implementations of the ALA software suite

Hubs are different interfaces over one common instance of the data infrastructure, providing thematically filtered subsetted views of the data.

- Australia's Virtual Herbarium (AVH) – http://avh.ala.org.au/
- Online Zoological Collections of Australian Museums (OZCAM) – http://ozcam.ala.org.au/
- Australian Microbial Resources information Network (AMRiN) - http://amrin.ala.org.au/
- Australian Seedbank Partnership – http://asbp.ala.org.au/
- FishMap - http://fish.ala.org.au/
- Murray-Darling Basin Authority (MDBA) – http://mdba-test.ala.org.au/

C. Independent use of ALA web services

Open APIs enable external parties to independently access Atlas data and some data processing services.

- Biodiversity Climate Change Virtual Laboratory (BCCVL)- http://www.bccvl.org.au
- Monash University – http://jockmarshallreserve.com.au/post/fauna/birds/
- Questagame – http://portal.questagame.com/#Home
- Canberra Nature Map - http://canberranaturemap.org/

D. Field Data Collection Software (BioCollect)

This is relatively new software and is still evolving and building recognition and uptake in the community. A general overview of this software is available at https://www.ala.org.au/biocollect. It supports 3 different kinds of projects:

- **Citizen science projects** (all kinds of citizen science survey based projects) –
  a) Project finder - http://biocollect.ala.org.au/
  b) Example project - http://biocollect.ala.org.au/project/index/aaec7218-f91c-45d2-b168-29de97887159
- **Ecological science projects** (systematic plot/transect based surveys) –
  a) Project finder - https://biocollect-dev.ala.org.au/ecoscience
  b) Example project - https://biocollect-dev.ala.org.au/ecoscience/project/index/822bdbe2-d581-4fd7-95c7-8eb238482374
- **Intervention/Works projects** (currently in development)

E. Hubs in BioCollect

The BioCollect tool also supports "hubs" which provide different interfaces over one common instance of the data infrastructure, providing thematically filtered subsetted views projects and data recorded in the tool.

Murray-Darling Basin Authority - https://biocollect-test.ala.org.au/mdba/project/index/4d15b4df-c05b-41bd-ac5b-8a65c9e37d17. This is also an example of integration between ALA and BioCollect hubs.

OTHER USEFUL REFERENCES:

Biodiversity Profiling – this publication explores **key components** for developing a national biodiversity monitoring capability. In particular, it looks at whether an approach that couples natural history collections with mapping data can be used to derive metrics of inferred change in biodiversity status across Australia, or profiles. It also provides attention to the key 'soft' enablers for building such a national capability by reporting on the **lessons learnt** in establishing components of the ALA. This includes an exploration of federated data acquisition approaches, licensing, user needs evaluation to stakeholder engagement and collaboration. Many of the lessons reported are generic and are likely to be useful for other environmental information activities that use a federated model for data acquisition.

http://www.bom.gov.au/environment/doc/biodiversity-profiling.pdf

Towards a national bio-environmental data facility: experiences from the Atlas of Living Australia (Belbin & Williams 2016 – *Spatial Ecology* Vol 30) - This paper outlines the purpose and process of establishing the ALA and discusses the integration of environmental data relevant to biodiversity research in the Australian region and the vision for continually improved services for research, area management, education, and citizen science. The ALA's environmental infrastructure addresses current needs but increased data types, volumes, and resolution suggests new directions are needed to provide quality services into the future. The experience of building the ALA has relevance for other agencies setting up similar infrastructure which supports integrated access to and use of their national biological and environmental information.

http://www.tandfonline.com/doi/pdf/10.1080/13658816.2015.1077962

ATLAS OF LIVING AUSTRALIA
sharing biodiversity knowledge

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