Call for Participation in AIP-8

GEOSS
Architecture Implementation Pilot (AIP)

Issue Date of CFP: 28th January 2015

Due Date for CFP Responses: 27th February 2015

Kickoff meeting: 23rd March 2015

GEOSS Architecture Implementation Pilot, Phase 8
Call for Participation

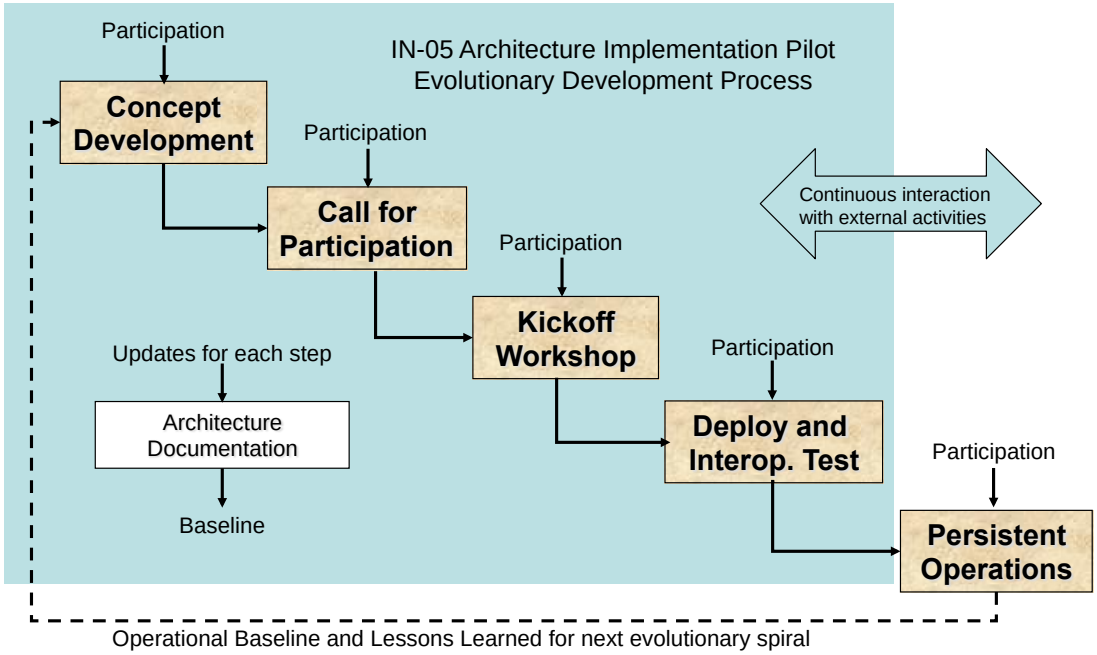
1 Introduction

The GEOSS Architecture Implementation Pilot (AIP) develops and deploys new process and infrastructure components for the GEOSS Common Infrastructure (GCI), as well as for the broader GEOSS architecture. The requirements for AIPs are based on meeting user needs and community scenario requirements. The results of the AIPs are conveyed to the GEO Implementation Boards for consideration as to whether the components should be transitioned to the GCI and other GEO Tasks as operational elements. In this way the AIP supports the elaboration of the GEOSS Architecture and informs the standards process in terms of real-world usability, feasibility and capability.

Where applicable, the Apps will be registered in the GCI as discoverable resources.

2 Roadmap

AIP employs an evolutionary development process whereby the architecture, the delivered systems, and the stakeholders co-evolve. Stakeholder needs are reassessed in each iteration of the architecture; the architecture is used to guide each system as it moves through development, and appropriate versions are used to evaluate each system on delivery. Architectures developed under this approach emphasize flexibility and adaptability. This approach is well suited to software system development where it is impossible to postulate all of the requirements and the system development can proceed iteratively.



1.

Figure 1 - AIP Development Approach

Phase 8 of AIP builds upon the foundation laid down by AIP Phase 7: to develop and deploy easy-to-use online (Web and Mobile) Apps that demonstrate the value of standards-based access to EO data and services registered with GEOSS.

The Apps development is the central ingredient of the central "Information to Knowledge" - theme, that adhere to the following principles:

- Championed by field users (see scenarios below) and ideally stimulate interest in providing more data to GEOSS
- Easy to use and Interactive
- Standards based
- The Model Web, for better understanding of physical systems
- Provide a real-world test of operational protocol and format standards, which may provide useful information for standards revision, adoption and documentation.
- Cross SBA, "Desilofication" – combine cross SBA datasets and resources
- Go beyond visualization (We know how to do this) and focus on Data analytics, predictive analytics, simulations, graphs, tables, …
- Machine learning
- As near real-time as possible

The "Information to Knowledge" theme is very user centric (user requirements for the App) and driven by real-world scenarios, with an emphasis on "the Model Web".

> The Model Web is a concept for improving the access to, and interoperable use of Earth System Models. The observations and models support decisions related to societal benefits. Collectively, the contributed systems of GEOSS work together to: address identified common user requirements; acquire observational data; process data into useful products; exchange, disseminate, and archive shared data, metadata and products; and monitor performance against the defined requirements and intended benefits. (From the GEOSS Future Products Workshop)[1] Another key reference for the GEO Model Web is described in "Environmental model access and interoperability: The GEO Model Web initiative" (Nativi, S., Mazzetti, P., G. Geller in [2])

A new element in the AIP-8 roadmap is the "Linking Knowledge" theme. This theme focuses on Community Portals as **"a community-focused website that provides a human interface to content that may come from distributed resources."** Community Portals provide the context of a community of knowledge to bring together the distributed resources into a framework familiar to that user community. Activities in AIP-8 will include:

- Community Portals interacting with and using the resources made available by the GCI
- The GCI interacting with the Community Portals.

The "Linking Knowledge" theme is a companion to the "Information to Knowledge" – theme. The Community Portal Paper indicated the need for better interaction between community portals and the GEOSS. AIP-8 will pilot the various interoperability arrangements (continuation of the CPP, but more actionable) (between a community pilot and the GEOSS and between GEOSS and

[1] http://earthzine.org/2013/10/01/geoss-future-products-recommendations-from-a-workshop/

[2] http://www.sciencedirect.com/science/article/pii/S1364815212000898

a community portal) as well as organize a plugfest between volunteering communities and organizations that run the GEOSS Portal and the GCI.

The "Data Sharing" theme supports the central theme, in close collaboration with the Data Sharing Working Group. AIP-8 will continue to pilot potential components for the GCI, to support the Apps and online applications that interact with the GCI.

AIP-8 will be successful if we can demonstrate Apps that meet the above requirements and that these same Apps can be easily reconfigured to ingest other data sets for similar decision-making activities. AIP-8 will also provide feedback to the standards developing communities and other GEO groups to encourage the use of standards and provide feedback on the 'fit-for-purposes' of the used standards (feedback).

The "Capacity Building" theme is a supporting action to the central theme. This theme underlines that we need to share the knowledge that we build up during AIP, so that others can learn from our activities to deploy similar Apps and activities or to further build upon them.

AIP-9 will continue with the central "Information to Knowledge" theme, but with other scenarios and more complex data processing and more end-user engagement. Other themes can be added, based on GEO Plenary feedback and input.

3 Content

The components of the CFP include the following:

- **Continue to develop and deploy easy-to-use online (Web and Mobile) Apps that demonstrate the value of standards-based access to EO data and services registered with GEOSS. Target areas include:**
  - Flood and drought Monitoring, Food security and Energy management
  - Environmental monitoring using Mobile Sensors, Citizen Observatories, Crowd Sourcing
  - Crop insurance
  - Agriculture and Water pollution
  - Wind and Solar Energy Potential Estimator
  - Earth cover change detection
  - Ocean observations and commercial fisheries
  - Precision farming
  - Disaster monitoring and management
- **Community Portals**
  - Understand the various interoperability arrangements needed in order for the GCI and Community Portals to interoperate.
  - The Community Portal activity can bring together the developers of the GCI and Community Portals to test the proposed interoperability arrangements.
- **Activities to support the key Apps and the community portals**
  - Deploy and integrate standard technologies to facilitate data access, including user authentication, security, privacy and geoprocessing workflows
  - Mobile and Web app development frameworks
- **Build toward the vision of the Model Web**
  - Models are the codification of the best understanding we have about physical phenomena and process and should be further applied

- The vision of Model Web should be a basis for development: *A dynamic web of models, integrated with databases and websites, to form a* consultative infrastructure *where researchers, managers, policy makers, and the general public can go to gain insight into "what if" questions*.
- Adopt a step-wise approach, considering low hanging fruits and integrating existing components. Involve Users, adopting social approaches to progress business models. Lower entry barriers: e.g. filling the gap between the Business Processes Design (Abstract) and Executable workflows. Link with analogous initiatives stemming from different areas (e.g. medicine, biology).
- Develop an Integrated Model Web based on the existing technologies, e.g., OpenMI and ESMF. Further testing of OpenMI and ESMF together should be encouraged to increase the community understanding of concepts that are in common and implementations approaches that differ to meet different operating environments.

Responding to the AIP-8 CFP

Components Baseline

Development Schedule

The AIP-8 schedule assumes results will be presented at the GEO-XII, hosted by the National Institute of Statistics and Geography (INEGI) and scheduled for 13th of November 2015 in Mexico-City, Mexico. Space will be allotted in the Plenary agenda each day to highlight GEOSS accomplishments (components) which are aligned with, and illustrate, this theme. Therefore, it is anticipated that results from AIP-8 will be featured prominently in this regard. Ideal candidates would demonstrate how data, information and services in GEOSS, across all nine SBAs, may be used in a concrete way to help communities manage their resources towards the accomplishment of Water-Energy-Food Security, especially in the developing world.

A kickoff workshop will be held for AIP-8, on March 23 in Norfolk VA, USA in close collaboration with the GEOSS Science and Technology Workshop (http://www.gstss.org/2015_Norfolk_4th/). If you participate in AIP-8, please plan to attend the physical kickoff.

Responding to the CFP by 27st February 2015 will support the most efficient, coordinated development of GEOSS based upon a shared understanding of resources participating in AIP-8. CFP responses are requested to be brief.

This CFP is issued by the GEOSS Design and Interoperability (IN-05) Task Team and guided by the Infrastructure Implementation Board (IIB).

4 Continue to Develop and deploy easy-to-use online (Web and Mobile) Apps and demonstrate the value of standards based access to EO data and services registered with GEOSS

4.1 User Scenarios guide development

Earth observation data are complex in their structure and are difficult to apply to real-world problems. To further the value of GEO and GEOSS, data should be manifest through neutral and

expert-based Apps that cater to the interests of all Societal Benefit Areas (SBA) by accessing and integrating multi-source EO data and services registered with GEOSS.

Through AIP-8, GEO is encouraging development of several Web-based Apps that would support the interests of all SBAs, ideally through cross-SBA problem spaces. This will make GEOSS more relevant to decision makers when dashboards or graphical products and alerts can be derived from its riches. It also adds value to GEO where such interfaces are created and highlighted in GEOSS as a unique, new synthesis of data.

This approach would stimulate the development of interactive Apps with models or alert interfaces that consume GEOSS data. It also would demonstrate the value of access to open data, standards and models to address real-world problems via GEOSS. This could potentially be a new area of focus for GEO through 2025 and underscore the value of publishing open data and its relevance to decision support.

AIP-8 will focus on developing 3-5 integrative, multi-source, Web-based Apps that are tailored to a specific area of interest, support multiple SBAs, are useful in multiple geographic regions, and can be accessed by users with limited network connections. These Apps are expected to provide interactive dashboard and visualization interfaces on data, models or simulations to support decision makers. Using or enabling standards-based Web services and their interfaces is required for these Web Apps to work. Hosting geoprocessing or modeling services in the Cloud is also a likely element to support these scenarios, especially where remote data are computationally merged to answer questions.

The scenarios below are the results of multiple interviews with community experts conducted during January and February 2014. They are a generalized synthesis of descriptions of real-world cross-SBA, end-user problems that could be addressed through resources registered in GEOSS. This CFP invites potential participants to provide additional details and contribute resources required to fulfill the objectives of each key App in support of end user needs.

AIP-8 is looking for organizations that are interested in working across environmental disciplines (Societal Benefit Areas in GEO) to solve a specific real-world problem using existing data (as Near Real Time as possible) to go beyond showing/visualizing the data. The App should:

- analyze the data – going beyond “what-if” scenario's, monitor alert situations (Common Operating Picture);
- use results in a framework for policy and decision-making;
- develop a new app or extend an existing app (not reusing/rebranding an existing app);
- develop non-expert (non-complex) dashboard Apps that visualize and monitor variables; and
- possibly bring in, for example, the Google Earth rendering engine/API.

For each of the scenarios of interest, specify in your response: the Champion(s), Sponsor(s) and Participants, End-User(s) names or organizations driving the requirements, an overview of the app functionality (Use case), the method of deployment (Mobile or browser-based or both), app framework, used data sources and standards (OGC) based interoperability access method (protocol), and functional gaps. If ancillary services are required, specify nature, accessibility method and optional associated licenses.

As part of AIP-8, it may be necessary to set up standards-based services on marginally-accessible data to support these operational scenarios. Some Apps may require additional Web services,

such as geoprocessing or authentication, to adequately support the needs of a given app. Although these capabilities may not be highly visible in the Apps they may be required for their success. Successful Apps and infrastructure development in AIP-8 aims to increase the use of GEOSS resources by supporting decision-makers in applying both *in situ* and remotely sensed data, and by extending results from previous GEO developments through integration with remote services registered with GEOSS, and thus visible through the GEOSS Common Infrastructure (GCI).

During the execution of AIP-8, regular teleconferences will be conducted with the app development leads and the SBA representatives to discuss progress and evaluate the scenarios that are driving the app development.

AIP-8 also seeks to give demonstrations of the Apps during the GEO-XII plenary.

Deliverables per item or scenario

- Deployed and documented key Apps and the supporting infrastructure in support of the agreed end user requirements.
- Registration of these Apps with GEOSS so they can be featured in the GEOSS Portal.
- Demonstration of app development results in video.
- Documentation of results, issues, and benefits in Engineering Report format.

The following scenarios provide examples of the kinds of Apps that AIP-8 could develop. It is not meant to be an exhaustive list.

4.2 Flood and drought monitoring, Food security and Energy management

Description:

App accesses and calculates stress change in vegetative cover over any nominated region, with basemap, population, and infrastructure, reinforced with meteorological, hydrologic, and climatic summaries to inform decision-making. Users could subscribe to weekly reports or status alerts. Could include a population estimator 'doodler'.

4.2.1 Flood prediction

Enable app users to evaluate current conditions and simulations of streamflow and flooding using coupled access to global meteorological data, streamflow, evapotranspiration, aquifer recharge, river discharge information (accessible through OGC SOS), satellite precipitation data (multispectral, multitemporal information), sensed soil moisture, and models. As the information from the past is also available, the user can turn back the clock to analyse how the environment has changed over time.

An app that helps to predict floods based on the comparison of real-time river discharge information with the available statistical information and visualize this in a way that scientists and decision makers can base their flood or drought based decisions on.

4.2.2 Coastal Vulnerability monitoring through mangrove and peat lands (alternative)

Though small in terms of relative area, mangroves and peat lands are disproportionally important to humans because of the high value ecosystem services they provide. Yet, despite their rich biodiversity and

economic values, the total global area of peat and mangroves has declined significantly in the last years. Mangroves and coastal peat lands are under severe threat from land conversion, changing freshwater flows, infrastructure development, logging, sea level rise and drainage leading to subsidence.

Coastal zone managers are responsible for the safety and wellbeing of the coastal population, the economic development as well as the sustainable use of coastal ecosystems. They are facing problems like mangrove and peat land decline, coastal erosion, floods and saltwater intrusion on farmland.

To make informed decisions, they need information systems that integrate all relevant hydrological, geomorphological, ecological and socio-economic data and provide analysis tools and models for assessing the status and trend of coastal systems.

The app would make simulation models of

- Local and regional water budgets of coastal peat lands and swamp forests -> effects of drainage on the water budget, soil subsidence, greenhouse gas release and flood risk
- Coastal erosion -> effects of mangrove degradation/loss on coastal geomorphology and prediction of coastal erosion

The following variables are relevant for the implementation

- Land use (landuse & landcover change e.g. multitemporal satellite data),
- Vegetation (biodiversity, peat land and mangrove forest extent, biomes, biomass, stored carbon e.g. multitemporal satellite data)
- Weather / Climate (precipitation, climate change scenarios)
- Water Cycle (freshwater flows, groundwater levels and change, subsurface flow, drainage e.g. monitoring and modelling data)
- Ocean (sea level change, currents, wind direction, waves, erosivity)
- Coast (erosion risk, resistivity e.g. digital elevation models, geological and geomorphological data)
- Socio economic data (risk and vulnerability, economic scenarios, food supply, water supply)

4.2.3 Managing food security through subsidizing electricity for groundwater pumping

Punjab contributes about 45% of the wheat and 25% of the rice to India's central food pool, which means a procurement of about 70% and 80%, respectively, of Punjab´s local production by the central government. These food flows play a key role in India's food security and are not only enforced by law but also actively encouraged through subsidies on electricity for groundwater pumping and Minimum Support Price (MSP).

Pakistan's wheat production is 9th largest in the world, with the majority (76%) produced in the Punjab Province (FAO). Pakistan is self-sufficient for wheat demand, and exports to countries such as Afghanistan, Sri Lanka, UAE, Bangladesh, Sudan, Yemen, and Kenya. 85% of wheat production takes place under irrigation systems, with the remainder being rain-fed. Flooding from the Indus River also plays a key role in Pakistan's food security.

What is the actual performance of the regions metabolic pattern in relation to different criteria of local sustainability (feasibility, viability and desirability)? What are the options for the region given existing trends in population growth and food prices and given a possible future reduction of subsidies for electricity use in agriculture?

The generalized objectives of this case study were to: (i) Characterize the actual performance of the metabolic pattern of the region in relation to different criteria of local sustainability (feasibility, viability and desirability); (ii) explore the options for the region given existing trends

in population growth and food prices and given a possible future reduction of subsidies for electricity use in agriculture, using three distinct perspectives: the household, the interface region/country, and the interface country/international market.

Policy makers are considering making electricity available for free to farmers who are using it to pump irrigation water. An app that has all of the information needed to make a correct decision about how much energy to provide would be useful.

The app would feature a dashboard that includes:

- Precipitation (measured and forecast)
- Soil moisture
- Moisture requirements for the crops at that stage of their development
- What will be the value of the crop with and without irrigation from this point onward
- How much irrigation is needed to raise soil moisture to required levels
- How many hours of irrigation is required
- How deep is the water and how much energy is required to run the pump for an hour
- What is the loss of revenue with this amount of pumping
- What is the cumulative loss of revenue due to pumping for irrigation from the start of the growing season
- What is the relative height of the groundwater table and how has it changed in the past year

4.2.4 Ocean observations and commercial fisheries

Description:

Oyster farming: the influence of acidity and salinity has a big impact on oyster farming. Careful monitoring and understanding of the oceans salinity and acidity indicators when seeding the oyster banks is crucial. Waters that are too acid destroy the larvae oyster seeds.

Fish farms are vulnerable to temperature fluctuations and ocean temperature. Using remote sensed data the community can project water temperature changes that would be lethal to the fish in the farm and take appropriate action to harvest the fish before the temperature gets too high.

The key app uses a variety of ocean related datasets: SST, currents, salinity, habitat extent, seawater temperature to support the local fishing community to harvest the fish at the right moment.

4.3 Environmental monitoring using Mobile Sensors, Citizen Observatories, Crowd Sourcing

Description:

Application suited to use in areas with near-real time EO feeds and alerts on air temp, air quality, wind, flood-forecast/streamflow, earthquake, species monitoring, and other local public environmental information, coupled with local street network (directions, routing), critical facilities, basemap, utilities data, links to other data sources. Users can subscribe to timely reports or status alerts.

Data is typically gathered from three sources:

- Citizens: (from the occasional observer to the professional surveyor) can collect a variety of environmental data properties while in the field with a location-enabled smartphone, based on pre-assigned tasks. Forms would be prepared to *collect* or *verify* (qualitative aspect) observed weather (clouds, temperature, rainfall, etc.), high-water marks, individual species location, mapped feature properties (road name, stream name, water body name) and locations.

- Sensors: With the proliferation of consumer and professional sensors, environmental data properties can be collected from fixed locations (rooftops, poles, etc.) and moving features (buses, cars, etc.).

- Social Media: Natural phenomena are increasingly signaled firstly on social media like Facebook and Twitter, before they are picked up by other instrumentation further away from the epicenter of the event – harvesting this information using natural language processing added to the crowd sourced information datasets.

Some observations should not be available for general public consumption and access can be granted to specific users only. This requires user authentication. AIP-5 and AIP-6 have developed an access federation. AIP-8 seeks to further develop this access federation (see supporting activities for the key Apps).

AIP-8 seeks to develop an OGC SWE Profile for Citizen Science.

4.4 Wind and Solar Energy Potential Estimator

Description:

1 in 5 people on Earth live without access to electricity. This directly affects their ability to work and to learn. 3 billion people use wood, charcoal or animal waste to cook their meals and heat their homes – exposing them to dangerous smoke and fumes. Solar and wind atlases provide reliable data to access renewable energy potentials.

Based on a user's smart mobile-specified location determines the suitability for providing preliminary screening of sites of interest for wind and solar developments. These publically shared maps, based on scientific calculations taking into account a number of essential variables, can be used to create a regional, concerted action to develop renewable energy.

4.5 Earth cover change detection

Description:

Using the full historical Landsat archive, enable registered users to identify landscape features and quantify and visualize their change over time, then share the results as an open data product for others to see and use. (Note: Google Earth Engine does this - could analytical access be opened to GEO registrants?)

4.6 Precision Farming

Description:

Using the full historical Landsat archive, enable registered users to identify landscape features and quantify and visualize their change over time, then share the results as an open data product for others to see and use. (Note: Google Earth Engine does this - could analytical access be opened to GEO registrants?)

4.7 Crop Insurance

Description:

Farmers can insure their crops with insurance companies that base their policy predictions on Earth observation information, such as soil moisture, weather forecasts etc.

4.8 Agriculture and Water pollution

Description:

As stated by FAO (Food and Agriculture Organization [3]), agriculture is the single largest user of freshwater resources, using a global average of 70% of all surface water supplies. Except for water lost through evapotranspiration, agricultural water is recycled back to surface water and/or groundwater. However, agriculture is both cause and victim of water pollution. It is a cause through its discharge of pollutants and sediment to surface and/or groundwater, through net loss of soil by poor agricultural practices, and through salinization and waterlogging of irrigated land. It is a victim through use of wastewater and polluted surface and groundwater which contaminate crops and transmit disease to consumers and farm workers. Agriculture and water pollution is therefore a subject of several national and/or continental legal acts, such as European Nitrate Directive, European Water Directive or Common Agriculture Directive applicable in all European Union Member States.

Regular monitoring through sensor networks is needed in order to support the evidence of agriculture and water pollution. Such evidence stems from the legal frameworks, as well from farmer's and citizen's needs. It is beneficial to use the sensors networks according to the OGC implementation specification adopted also as ISO 19156:2011 Geographic information -- Observations and measurements (O&M). The O&M approach is the key for near real-time obtaining of relevant data, its filtering according to the user's needs, as well as publishing in the form standard OGC Web services and/or technologies like Google Earth API.

4.9 Disaster monitoring and management

Description

Only in 2013, 22 milion people were displaced because of natural disaster events. This Call For Proposal wants to address the issue of monitoring and managing disaster events such as earthquakes, tsunamis and volcanoes.

Disaster monitoring and management will continue to be developed in AIP8, with special focus on the integration of activities coming from different agencies, the development of registrations and other resources nationally and internationally through the Access Broker, and the conversion

[3] http://www.fao.org/docrep/W2598E/w2598e04.htm

of geospatial data through interoperable interfaces, so to make all the resources available when needed to the highest amount of people.

The focus of AIP8- pilots will be on the increasing connectivity both national and international, provided by GEOSS GCI framework, the development of applications (both mobile and desktop) to use GEOSS resources and the development of tests use metrics for disaster monitoring and management.

5 Pilot interaction between Community Portals and the GCI

A Community Portal is a website that provides relevant, up-to-date and specific information to a group.

Over the past year as a subtask of the GEOSS Design and Interoperability Task (IN-05), a team with representatives from the developers of the GCI components and from GEO communities interested in leveraging their capabilities have been developing a Community Portal Paper (CPP) to serve as a guide to those interactions. While the initial focus of the activity was on a community portal's access to GEOSS resources through the GCI, the scope has been broadened to consider the full range of community-developed components (portals, Apps, catalogs, brokers, specialized services, etc.) and the potential two-way interactions between the GCI and the community components. The document is intended to demonstrate the benefits to be gained by fully exploiting these respective capabilities and to provide examples, tutorials and best practices that will enable and support the implementation of the required interfaces.

While the input into the CPP is open to all interested GEO communities, the AIP participants are particularly qualified to share their experience in utilizing the GCI. As early adopters of the GCI, they are using it to advance their own objectives, but they can also provide critical feedback to the developers of the GCI components, and advice and guidance to other community teams. The CPP writing team has good representation from previous AIP participants and was a participant in AIP-7 but that interaction was mostly limited to sharing status and plans of the respective activities.

In AIP-8, the intent is to have significantly greater AIP-CPP engagement under the "Linking Knowledge" theme. To that end, those responding to this AIP-8 CFP are requested to consider doing the following:

- State interest in contributing to the CPP activity.
- Describe how a proposed component will use the GCI to access EO data and services, or;
- How proposed a component (e.g. tool, broker) can be directly accessible via the GCI.
- Identify implementation challenges and/or need for assistance from GCI component developers.
- Summarize benefits of pilot activity and anticipated contributions to the CPP.

Following the AIP-8 Kickoff, those participants who have expressed interest in the CPP activity will be invited to share their plans on a CPP telecon. This will give the AIP-8 participants an opportunity to present their ideas to the developers of the GCI components on the CPP team and to get their immediate feedback. Subsequent telecons with individual AIP-8 teams will be facilitated by the CPP team to address any specific implementation issues. Throughout AIP-8, the CPP writing team will endeavor to capture the best practices and lessons-learned from the AIP teams and incorporate them into the recommendations document. At the conclusion of AIP-8, a "plugfest" will be held at an appropriate GEO meeting to demonstrate the benefits of utilizing

GCI-community component interoperability, with the goal of inspiring greater engagement and similar initiatives in the future.

6 Activities to support the key Apps

Deploy and integrate standard technologies to facilitate data access, including user authentication, and geoprocessing workflows. AIP supports increased usability, stability and reliability of the entire GEOSS technology stack and stimulate the adoption by all *users* – data providers, system integrators, and end-users.

To support this goal, AIP-8 will seek support for the key Apps, to include:

- Mobile or Web app development frameworks.
- User Authentication.
- Geoprocessing workflows to support the key Apps.
- Support for registration and re-use of key Apps and data sources through the GCI.
- Build on and increase the use of the GCI by making more resources discoverable and useable. New GCI functionality from brokers and for data sharing will be emphasized.
- Increase in-situ data availability as an example of GEOSS Future Products.
- Promote and increase the capabilities of the GEOSS Testing Facilities.

AIP-8 will seek to promote tutorials, server and client toolkits, expert guidance, and access brokers to aid data providers in providing synchronous online access to their data. Tutorials needed to get data online in AIP-8 will be developed in coordination with the Standards and Interoperability Forum (SIF), which manages an outline of tutorial topics and provides tutorial templates. Tutorials are developed and deployed in the Best Practices Wiki (BPW). Emphasis will be placed on planning for multi-year persistence of the online data access, as well as for quality of service. (See also GCI and IN-03[1] documents)

6.1 Supporting technologies related to geo-processing, access control, and data sharing

AIP-8 expects the key Apps to interoperate with the GCI for the purpose of discovery of GEOSS resources, where appropriate, to insure consistent and reliable access to GEOSS resources. There is an expectation that all key Apps, their services, and supporting data will be registered with GEOSS GCI to assure discovery and access by others.

6.1.1 Authentication and Single Sign-On

AIP-8 will continue to further develop and solidify the work from the AIP-6 Data Sharing Technology Working Group. AIP-6 resulted in the successful demonstration of single sign-on (SSO) using both OpenID and SAML-2 in the context of a SAML-2 authentication federation. This means that trusted OpenID users are able to authenticate within a SAML-2 federation, via a trust gateway. This trust gateway was built for AIP-6 by the EC FP-7 COBWEB project. This SSO solution is sought to provide capabilities for one or more of the applications developed for AIP-8 in section 2, above.

For AIP-8, there are still two primary use cases that need to be implemented and demonstrated.

- SAML-2 users, from a SAML-2 federation, authenticate with a data provider utilizing OpenID. This requires an appropriate trust gateway be built.

- SAML-2 users from different SAML-2 federations authenticate against each other's federations. This requires an appropriate trust gateway be built. This use case needs to extend to any number of SAML-2 federations.

- The above two use cases are problematic. First, for data providers using OpenID for authentication, the trust gateway needed to accept SAML-2 users can be more complicated than plain OpenID support. This maximizes a data provider's effort to support the GEOSS authentication and SSO model. Second, SAML-2 to SAML-2 authentication is very difficult to achieve, since it requires all SAML-2 federations participating in GEOSS to trust each other. Building a trust gateway for each pair of SAML-2 federations is unmanageable, which suggests a certain level of central administration. There are commercial products available that supply this central authentication hub functionality, that allows many different authentication protocols to be bridged, and for all those associated authentication federations to "trust" each other. However, reinventing the wheel in this regard is not desirable. AIP-8 will research and discuss a viable solution to these problems in deploying and sustaining a GEOSS-wide authentication and Single Sign-On federation. Time permitting, an exercise may be implemented to demonstrate success.

The authentication details still need to be defined, but must be in alignment with the GEO Data Sharing Principles and the authentication use cases. This effort requires modifications to the GEOSS Web Portal and the GEOSS Discovery and Access Broker. Participation from these teams is highly encouraged and needed.

6.1.2 Service Hosting, Caching and Geoprocessing Services

The focus of AIP-8 on the development of light key applications that can be used on mobile and browser devices with limited Internet bandwidth may require additional proxy services to be made operational to 1) put marginally accessible data into a Web Service environment at a data center or in the Cloud, 2) perform computational analysis on multiple remote data sources in order to produce contextual data products and services for a given application and 3) to support caching of geospatial data for off-network usage.

Capabilities are sought to host, cache and process GEOSS data sources to improve accessibility and utility of the data for the AIP-8 applications where good data exist, but data services are not provided by the producing organization. Candidate standards for this include, but are not limited the OGC Web Map Service (WMS), Web Map Tiling Service (WMTS), Web Coverage Processing Service (WCPS), Web Feature Service (WFS), and GeoPackage.

6.1.3 Tutorials and Use Metrics

GEOSS tutorials are developed in coordination with the Standards and Interoperability Forum (SIF), which manages an outline of tutorial topics and provides tutorial templates. Tutorials are developed and deployed in the GEOSS Best Practices Wiki (BPW). Each participant in AIP-8, whether for key applications or supporting technologies, is encouraged to contribute to the tutorial exercise. This will allow the GEOSS tutorial collection to grow, which helps the GEOSS community of data providers and data users better understand GEOSS and how to interact with it.

AIP-8 will develop and solidify the work from the AIP-7 Data Sharing Technology Working Group. AIP-6 and AIP-7 resulted in the definition of what the use metrics will be and the use cases to support the successful operations of collecting and reporting these metrics in the context of the applications articulated in Section 2. Development of a Use Metrics component for the GCI is necessary. This component should reflect the use cases developed and support the collection and reporting of data use metrics for the GEO Secretariat and GEOSS users.

Prior to AIP-8, the use metrics effort was focused on data providers. However, with the focus of AIP-8 on applications, it is desirable to have these applications report use metrics as well. In this way, it will be possible to collect metrics on how the data discovered and accessed via GEOSS is being used.

The use metrics effort requires modifications to the GEOSS Web Portal and the GEOSS Discovery and Access Broker. Participation from these teams is highly encouraged and needed.

AIP-8 participants are strongly encouraged to provide input for the tutorials!

6.1.4 Service Testing

In an effort to further mature the interoperability of services behind the key Apps, AIP-8 will use the AIP-2 test facility (provided by USGS) to provide persistent procedures to test GEO-identified Web services and protocols and operational monitoring of services including: WMS, ESRI ArcIMS Image, WFS, WCS, SOS, ArcGIS Map Server, ArcGIS Image Server, ArcGIS Feature Server, ISO 23950/Z39.50, Web Accessible Folder (WAF) and CSW.

The Service Test Facility is intended to ensure proper and interoperable use of GEOSS components and services in Apps and interfaces. The Test Facility is intended to promote predictable and reliable access to services registered with the GEOSS Service Registry. The Service Status Checker quality results are proposed to be integrated into the GCI , applied to all registered services, and made visible to end-users through the GEOSS Portal as part of AIP-8.

6.1.5 AIP8- Capacity Building

In order to improve the capability of the GEOSS resources, each entity participating to the CfP should think to include an activity for sharing its knowledge and data at a certain level. All these will be posted on the Best Practices wiki of IEEE and will constitute a pool for discussion or inquiry, if needed. All the material and knowledge, if working and authorized, will be shared at a higher level or can become a tutorial (please see the above sections).

7 Responding to the AIP-8 CFP

Organizations can contribute to AIP in multiple ways: through in-kind contributions of programming resources, defining user requirements, funding of specific activities or providing access to services, software licenses or hardware for the duration of this iteration of the Architecture Implementation Pilot (see development section).

Responses are anticipated to be on the order of 5 pages or less.

Responses should follow the following outline:

- Overview

- Describe the role and type of contributions made by your organization for this CFP. Identify the type and value of in-kind services - programming, software license, hosting, facilitation, documentation – or funding targeted to specific app development or supporting technology deployment.
- Proposed Contributions for each Activity
    - Develop and deploy easy-to-use online (Web and Mobile) key Apps that address the needs of decision-makers and the public based on EO and other data, and demonstrate the value of standards-based access to EO data and services registered with GEOSS to support the key Apps. (short: Key App)
    - For each of the key Apps listed herein, specify or expand information on:
        - Champion(s), Sponsor(s)
        - The SBA(s) supported by the app
        - End-User(s) names driving the requirements
        - Overview of App functionality (Use case) (New, Existing, Extension)
        - Application Framework
        - Deployment: Mobile | browser-based | both
        - Data sources, standards based interface protocols (OGC), and gaps
        - Required Ancillary services
    - Deploy and integrate standard technologies to facilitate resource access, processing, and sharing (including user authentication, geoprocessing workflows, software that reads/writes cached data), capacity building. For each technology solution, provide details on the following points:
        - Type of contribution (software, service, hosting, documentation, etc.)
        - Key App(s) supported by this solution
        - Data sources supported by this solution
        - Standards used by this solution
        - How and where this solution will be deployed and accessed
- Paragraph describing the Responding Organization

A template for responding to this CFP is available at
http://earthobservations.org/geoss_call_aip.shtml

8 Engineering Architecture Baseline

The GEOSS Architecture Tasks have defined an approach to defining the elements of the GEOSS Service Oriented Architecture. This architecture is intended for use by the developers of GEOSS and should not be a requirement for Users. For example: while the GCI shows the users "resources", engineering development needs to discuss components and services.

- **Components** allow for coordinated management of the system. Components are combination of hardware, software and networks. Components are built, deployed and persist to provides Services.

- **Services** are how components interact. The doorway to a service is an interface. Services and interfaces are defined using GEOSS Interoperability Arrangements – either Special Arrangements or, preferably, International Standards. Interoperability Arrangements are listed in the GEOSS Standards and Interoperability Registry (SIR).

- **Use Cases** are descriptions of what can be achieved using the Services, e.g., Discovery, Access, Workflow. See AIP Use Case as defined in the AIP-5 CFP architecture[4].

- **Scenarios** to meet GEOSS User Needs are accomplished with Use Cases. The AIP Engineering Reports provide scenarios for several previous SBAs[5]

The GEOSS Common Infrastructure (GCI) components (Figure 2) are the main operational components. Development components are outside of the GCI in Figure 2. For definitions of the developmental components see [AIP 2010-2[6]], [AIP 2011-2[7]], and GEOSS BPW[8]

[4] http://www.earthobservations.org/documents/cfp/201202_geoss_cfp_aip5_architecture.pdf

[5] http://www.earthobservations.org/geoss_call_aip.shtml

[6] http://www.earthobservations.org/documents/cfp/20100129_cfp_aip3_architecture.pdf

[7] http://www.ogcnetwork.net/AIP3ERs

[8] http://wiki.ieee-earth.org/

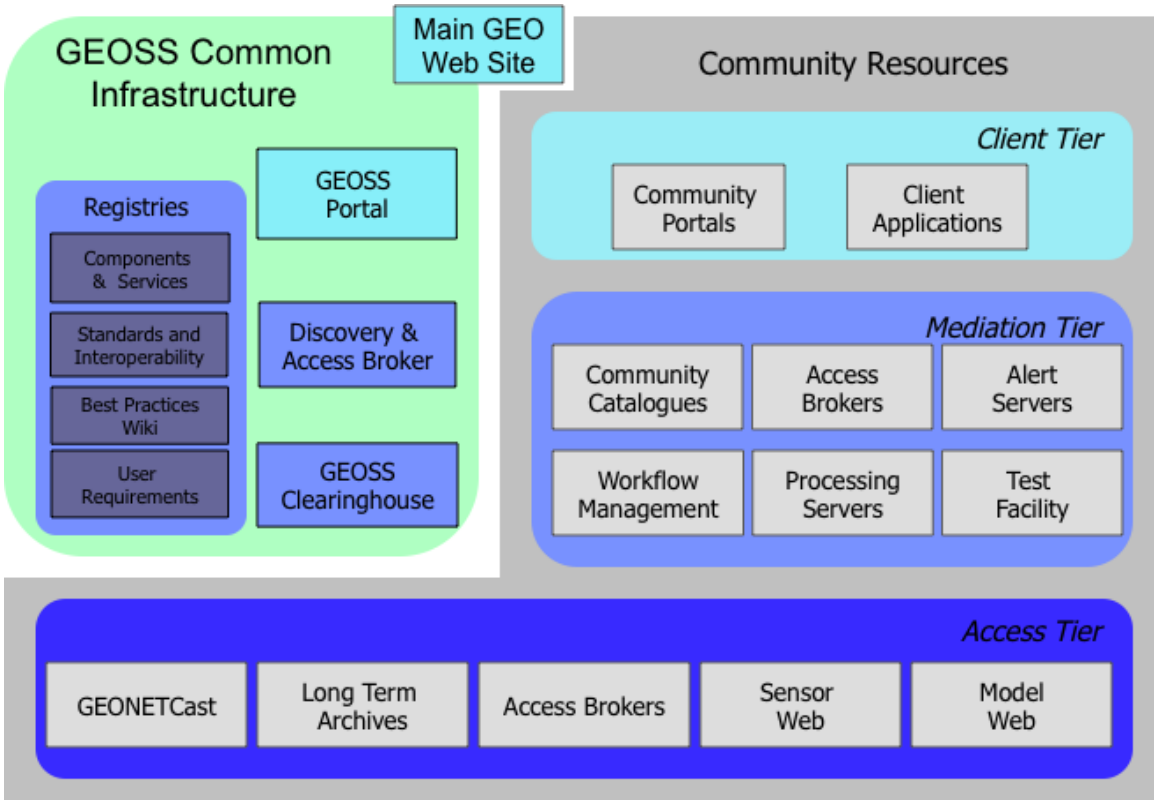


Figure 2 – GEOSS Engineering Components

9 Development Schedule

AIP develops and pilots new process and infrastructure components for the GCI and the broader GEOSS architecture through an evolutionary development process consisting of a set of phases. Each phase addresses a set of SBA and geoinformatic topics. The result of an AIP development phase is a milestone that allows GEO to examine (1) the elements of the architecture that have advanced to sufficient maturity to be considered part of the mature system baseline, and (2) the elements of the architecture that need to be enhanced or added to better meet the goals of GEO. For a full description of the AIP Development Process see [AIP 2014-1[9]].

The initial schedule for AIP-8 development is show below.

AIP-8 will be executed in accordance with the GEOSS AIP Development Process. The following table details the major events associated with the AIP-8 process:

CFP Issued	**28th January 2015**
CFP Response Due Date	**27th February 2015**
Kickoff	**23rd March 2015**
Results demonstrated at GEO-XII Plenary in Mexico-City, Mexico	**13th November 2015**
Completion of AIP-8 activities	**31st January 2016**

[9] http://www.earthobservations.org/documents/cfp/201403_geoss_cfp_aip8_development_process.pdf