Welcome!
1. Leadership Council Report (*Kerstin Lehnert*)

2. EarthCube Science Support Office (*Mohan Ramamurthy*)

3. Architecture & Implementation Plan Presentation (*Sarah Stamps & Bob Arko*)

4. NSF Update (*Eva Zanzerkia*)

5. Question and Answer Session (*Moderated by Lindsay Powers*)
EarthCube

“EarthCube is a community effort to promote interdisciplinary geoscience by enabling technology, organization, and culture that facilitates connectivity through standards and protocols to existing and emerging resources.”

NSF & GEOSCIENCE COMMUNITY PARTNERSHIP

Geoscience community involvement in decision-making processes

EarthCube

NSF

UCAR
EarthCube Vision

- foster modern modes of scientific inquiry
- that infuse technological innovations
- into the emerging practices of trans-disciplinary knowledge discovery and utilization:
  - digital scholarship,
  - data science and analytics,
  - data and software stewardship,
  - open science,
  - basic research practice in geosciences.
EarthCube Strategy

Build on existing resources, a SoS approach

Architecture

Develop CI that is responsive to community input & assessment

Funded Projects

represent community and inform NSF

Governance

Connect technical development and social/cultural adoption

Community
EarthCube Leadership Council
# New LC Members

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Term</th>
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<tbody>
<tr>
<td>Tim Ahern</td>
<td>Council of Data Facilities Representative, IRIS</td>
<td>July 2016 - July 2018</td>
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<tr>
<td>Janet Fredericks</td>
<td>Member, At-Large, Woods Hole Oceanographic Institute</td>
<td>June 2016 - May 2018</td>
</tr>
<tr>
<td>Rebecca Koskela</td>
<td>Technology and Architecture Committee Representative, Executive Director, DataONE</td>
<td>November 2016 - May 2018</td>
</tr>
<tr>
<td>Simon Goring</td>
<td>Engagement Team Representative, University of Wisconsin, Madison</td>
<td>June 2016 - May 2018</td>
</tr>
<tr>
<td>Scott Peckham</td>
<td>Member, At-Large, University of Colorado</td>
<td>June 2016 - May 2018</td>
</tr>
<tr>
<td>Mohan Ramamurthy</td>
<td>Project Director, EarthCube Science Support Office (ESSO)</td>
<td>May 2016 - April 2019</td>
</tr>
<tr>
<td>Ken Rubin</td>
<td>Science Committee Representative, University of Hawai'i, Manoa</td>
<td>June 2016 - May 2018</td>
</tr>
</tbody>
</table>
Committees & Teams Activities

- Input into the EarthCube Architecture and feedback on AIP (TAC, CDF)
- LC appointed Tiger Teams (e.g. Guidelines for Funded Projects) (all)
- Use Case Working Group (TAC)
- Registry of data facilities capabilities (CDF)
- Map of the Landscape project (LT)
Committees & Teams Activities

- Webinar Series “Doing Geoscience with EarthCube Tools.” (SC)
- Membership in ESIP as a category 5 participant (LT)
- Visiting Graduate Student & Early-Career Scientist Program (SC)
- Early Career Travel Grants (ET)
- Distinguished Lecturer Program (ET)
EarthCube in 2016

- 51 Funded Projects (11 new in 2016)
  - Building new communities
  - Innovating interoperability solutions that link and integrate resources
  - Delivering new capabilities for data capture, discovery, access, processing and analysis
EarthCube in 2016

All-Hands Meeting
EarthCube in 2016

- Transition to EarthCube’s Implementation Phase
  - Feb 2016: Program review by NSF via a Reverse Site Visit
  - Since March 2016: LC actions in response to RSV
  - July 2016: ECTEG transfer to the EC Science Support Office (ESSO) at UCAR
  - Nov 2016: ESSO establishes new Advisory Group
EarthCube Reverse Site Visit

“The report pointed to fundamental concerns with the trajectory of the program and gave detailed recommendations for future program activities.”

- Recommendation from the RSV Committee:
  - Create a clear and concise definition of EarthCube that is shared by everyone.
  - Transition to a more top-down governance style, through empowerment of the Leadership Council.
  - Improve the coordination between community-identified needs, priorities, and standards and the NSF proposal solicitations.
  - Produce an effective implementation plan, balancing “innovation” and “production” to advance cross-disciplinary science goals as well as the development of future data scientists.
Response to the EarthCube Advisory Committee Report

Delivered by the EarthCube Leadership Council

November 23, 2016

https://www.earthcube.org/announcements/reverse-site-visit-response

“… the Leadership Council planned and then initiated actions to effect change across the EarthCube program …”
Priorities Identified

• Clearly define EarthCube’s System of Systems and develop a Solution Architecture (SA) and a plan for its implementation.

• Identify and further develop cross-disciplinary use cases to guide the short- and longer term developments.

• Review and revise governance to align with the needs of the implementation phase.

• Align Funded Projects with program goals & the overall development of the EarthCube System of Systems.

• Improve visibility & recognition of EarthCube’s achievements.
Actions Taken

- Architecture workshop (May 2016)
- Software Assessment Framework workshop (June 2016)
- Development of the SA and AIP.
- Input to NSF’s 2017 EarthCube solicitation.
- Define & implement Funded Project requirements.
- Clarify roles & responsibilities in the governance.
- Strengthen and streamline LC governance processes.
Future Steps

- Adapt, adopt and promote the Implementation Plan
- Develop milestones and metrics in the implementation process
- Develop approaches to integrate projects into the SoS framework.
- Implement Software Assessment tools in the formal evaluation of project outcomes and annual reviews.
- Adapt governance to support the implementation.
- Solicite proposals that address important aspects of the AIP
- Establish an EarthCube Standards Authority.
- Devote more effort to developing the use cases and drivers for the architecture, not only for its first phase but in future phases.
In Memory

M. Lee Allison
1948 - 2016
• The EarthCube and Geoinformatics communities owe Lee Allison and his highly dedicated staff at the Arizona Geological Survey immense gratitude for their innumerable contributions over the years to advance geoinformatics and the geosciences.

• Lee will be dearly missed by all!
EarthCube Science Support Office (ESSO)

• NSF made the ESSO award to UCAR under a three-year Cooperative Agreement;
• Period of Performance: 1 May 2016 – 30 April 2019;
• PI: Mohan Ramamurthy, Director of Unidata and now ESSO

• For the past five decades, UCAR has hosted and supported many community programs on behalf of the geoscience community, so ESSO follows in that tradition;
ESSO Staffing

- ESSO is being staffed by a combination of new staff and existing staff in Unidata and CPAESS (formerly JOSS);
- The new ESSO staff includes:
  - a Project Manager - James Davies
  - a Project Coordinator - Lynne Schreiber
  - a Communication Specialist - Julie Petro
- In addition, several Unidata staff are providing back-office support to ESSO (for travel, budget and contracts, system administration, and meeting planning).

- You can meet the ESSO staff at the EarthCube booth in the Exhibit Hall.
ESSO Responsibilities

- Providing Logistics Support for EarthCube Governance;
- Managing, enhancing and maintaining the EarthCube.org Website and providing;
- Facilitating Community Engagement, Outreach, and effective Communications;
- Helping with the development and implementation of EarthCube’s Architecture;
- Managing and Tracking EarthCube Governance Budget.

ESSO’s overarching responsibility is to provide the needed backbone services to advance EarthCube’s mission, goals, and plans.
ECTEG to ESSO Transition

• Between May and July 2016, the ESSO staff have worked closely with the ECTEG office on the transition of responsibilities as ESSO filled key staff positions.
• Thanks to the generous help and outstanding cooperation from ECTEG, the handoff was smooth and orderly.
External Advisory Group

• Working closely with NSF, ESSO stood up an EarthCube Advisory Group in October 2016.

• The Advisory Group is being asked to guide the development of EarthCube by providing external scientific advice to EarthCube on an ongoing basis; To that end, the EAG will review key EarthCube plans and documents, and provide feedback on the progress of EarthCube in its next phase.

• Cathy Constable, UC San Diego (Co-Chair)
• Joshua Semeter, Boston University
• Gwen Jacobs, University of Hawaii (Co-Chair)
• Dan Stanzione, University of Texas
• Peter Wiebe, Woods Hole Oceanographic Institution
• Ben Evans, NCI Australia
• Thomas Hoffman, EPOS, Postdam, Germany
• Jenni Evans, Penn State University
• Jeff Dozier, UC Santa Barbara
Architecture and Implementation Plan

• In August NSF asked ESSO to develop an Architecture for EarthCube cyberinfrastructure and an accompanying Implementation Plan.
• ESSO did not have the technical staff required to develop the Architecture and Implementation plans internally, so it recruited the services of an outside contractor, Xentity Inc.
• Xentity had previously facilitated the EarthCube Architecture Workshop that was held in May 2016.
• Xentity produced the Solution Architecture and Implementation Plan in November.
• These documents are currently being reviewed by the EarthCube community via the LC, TAC, and CDF.
Architecture Implementation Plan (AIP) Status Update

Bob Arko and D. Sarah Stamps
D. Sarah Stamps
Assistant Professor of Geophysics
Virginia Tech
Department of Geosciences
Geodesy & Tectonophysics Laboratory
AIP-Tiger Team Member

Bob Arko
Systems Analyst, Lead
Lamont-Doherty Earth Observatory
Geoinformatics Research Group
AIP-Tiger Team Member
Executive Summary of Status

October 2016
Solutions Architecture
delivered to:
EarthCube Science Support Office (ESSO)
National Science Foundation (NSF)
Leadership Council (LC)

November 2016
Implementation Plan
delivered to:
EarthCube Science Support Office (ESSO)
National Science Foundation (NSF)
Leadership Council (LC)
Executive Summary of Status

End of January 2017

Community Feedback
Governance Feedback examples:
Technology Architecture Committee
Council of Data Facilities
Executive Summary of Status

July 2017
Select Implementers

September 2017
Architecture Runway and Governance

May and August 2018
Initial Operating Capability Beta+
Executive Summary of Status

February - May 2019
Major Supplier Enhancement Release Beta+

Nov. 2019 - Dec. 2020
Major User Enhancement Release Beta+
High-level Science Overview

**AMAZING SCIENCE!!**

**Simplified EarthCube Flow Diagram**
(a geoscientist’s perspective)

**THE EARTHCUBE** (EC Workbench)
- Scientist works here
- Architects can work here

**EC Ne**
- Existing
- Partner

**DATA FACILITIES**
- Metadata
- EC cybertools
- Others

**Metadata Registry (EC)**
- Metadata & Tools Assessment (EC)
- check metadata

**Services Data Flow Model**
- Content
- Community

**Legend**
- Existing
- Partner
- Metadata = descriptors for data, models, products, and other information
- Registry = metadata description, not a database

**EarthCube**
Transforming Geosciences Research
EarthCube cyberinfrastructure comprised of 3 key components:

1. Registry
   - resources read

2. Assessment
   - resources assessed

3. Workbench
   - resources utilized

**Amazing Science!!**
Geoscientists (external to EarthCube community)
cyberinfrastructure comprised of 3 key components:

1. Registry
   Resources read

1. Assessment
   Resources assessed

1. Workbench
   Resources utilized

Simplified EarthCube Flow Diagram
(a geoscientist’s perspective)
Simplified EarthCube Flow Diagram
(a geoscientist’s perspective)

Geoscientists (external to EarthCube community)

Workbench =

THE EARTHCUBE
(EC Workbench)

EC New
EC Existing
Partner

AMAZING SCIENCE!!

Notes:
Metadata = descriptors for data, models, products, and other information
Registry = metadata description, not a database
High-level Tech and General Overview
Process to Develop the Architecture Implementation Plan
Process

Step#1

Terms + Timeline

EC Support Office responsible for project execution

Xentity, Inc., contracted to develop an Architecture & Implementation Plan (AIP)

EC Tiger Team charged to provide guidance and review

Aug. 26 first meeting convened
Nov. 8 final documents delivered
Process

Step#2

Information Gathering

EC Geoscience 2020 Report
EC Conceptual Designs (3)
EC Gap Analysis of Funded Projects
EC Roadmap 2016
EC Reverse Site Visit Report
EC Use Case Library
EC Architecture Workshop
Process
Step#3

Conceptual Architecture

Describe desired set of technical capabilities

Build on Architecture Workshop:

EarthCube is a System of Systems (SoS)

EarthCube will support a Knowledge Workbench
Process
Step #4
Solution
Architecture

Place Conceptual Architecture in the framework of EarthCube

Main elements:
(1) Portfolio Management
   register, assess, discover resources
   expand and strengthen the community

(2) Knowledge Workbench
cross-domain collaboration space
Process
Step#5
Implementation Plan

Milestones

#0 - Architecture Runway
   (Procurement, Governance)
#1 - Initial Operating Capability
#2 - Supplier Enhancement Release
#3 - User Enhancement Release

Schedule and Risks

Level of Effort
SoS - "a composite system in which the components are heterogeneous, independently managed, and independently operable systems on their own, but are networked (loosely coupled) through EarthCube-endorsed standards to achieve shared goals"

- LC Response to RSV Report
Stakeholder Prioritization

- Geoscientists
- Students
- Council of Data Facilities
- Data Librarians
- Computer Scientist
- Cyberinfrastructure Specialists
- Data Scientists
- Other Large Data Centers
- Policy & Decision Makers
- General Public
1. Cross-Domain Resource Registry

Harvest metadata from partners (read-only copy; no versioning)

Stage > Assess > Release workflow

Inventory of all controlled vocabularies
2. Assessment of Resources for Interoperability

Establish EC Standards Authority

Validation tool available to providers

Save result back to DOI Extended Metadata
3. Resource Discovery

Initial focus on basic search (space, time, identifier, theme, etc) via API

Track all activity via Google Analytics

Advanced search (eg. full-text) to follow Initial Capability
4. Community, Partnerships, Training

Maintain user profiles linked to ORCID, XSEDE, Slack, etc.

SSO login required to assess or annotate

Training modules to facilitate use of Workbench
Workbench Capabilities

1. Process Management
   (Curation, Workflows, ..)
2. Interoperability/Access
   (Transformations, Semantics, Spatial encoding, ..)
3. Service Orchestration
   (Brokering, Syndication, ..)
4. Validation & Analysis
   (Visualization, Assessment, ..)
5. Development Tools
   (Containers, Notebooks, ..)
Every item must have a unique global identifier. **Initial** focus:

**Researchers:**
Open Researcher & Contributor ID (ORCID)

**Resources:**
Digital Object Identifier (DOI)

Provides essential metadata for discovery.
Building the Registry (cont.)

Digital Object Identifiers in EC

Adopt DataCite standard metadata schema

DOIs support more than just Datasets

DOIs can link to other IDs (related resources)

http://schema.datacite.org/
Risks

Time to down-select and procure technologies

Scope creep across modules

Time to ramp up needed governance
~50,000 staff hours to implement through all stages:

- 21% Resource Registration
- 26% Resource Assessment (for Interoperability)
- 8% Resource Discovery
- 31% Community, Partnership and Training Services
- 14% Knowledge Workbench

Level of Effort
AIP
Mapping of Existing Building blocks

[examples: see AIP Step 4, 1.1.4.1]
CINERGI, Ontosoft, GeoLink

REGISTRATION

[examples: see AIP Step 4, 1.1.4.1]
GeoSoft, AdvBio-CZ, ESB

ASSESSMENT

[examples: see AIP Step 4, 1.1.4.1]
ECITE

WORKBENCH

Simplified EarthCube Flow Diagram
(a geoscientist’s perspective)

1. Resource Registry Services
   - Metadata Registry (EC)
   - Check metadata

2. Resource Assessment Presentment
   - Metadata & Tools Assessment (EC)

3. Discovery
   - Use metadata in the EarthCube

4. Community Networking and Tools
   - Use cyber tools in the EarthCube

THE EARTHCUBE
(EC Workbench)

Scientist works here
Architects can work here

Amazing Science

DataCite option using doi's (first iteration of AIP because it's easiest)

DATA FACILITIES

EC New
EC Existing
Partner

[examples: see AIP Step 4, 1.1.4.1]
Moving forward with the AIP

Simplified EarthCube Flow Diagram
(a geoscientist’s perspective)

THE EARTHcube
(EC Workbench)

AMAZING SCIENCE!!

Created by
D. Sarah Stamps, AIP-IT member
Virginia Tech Geoscience
11/3/16

Notes:
Metadata = descriptors for data, models, products, and other information
Registry = metadata description, not a database
Geoscience 2020: Cyberinfrastructure to reveal the past, comprehend the present, and envision the future
EARTHCUBE RESPONDS TO U.S. PRIORITIES

OSTP Memo 2/22/2013

- NSF's Response: Today's Data, Tomorrow's Discoveries
  - Publications – par.nsf.gov
  - Data – practice varies by community of interest

Data Reality

- Diversity of data types
- Timescale of geoscience processes require decades of data
- Resources from community science and individual scientists

Challenge: bringing rest of community into this way of doing business

- Large facilities/field campaigns;
- Individual PIs;
- Public participation community science

http://www.whitehouse.gov/administration/eop/ostp/library/publicaccesspolicy
Top 15 Data Service Entities in GEO Data Management Plans

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<th>Division</th>
<th>OCE</th>
<th>PLR</th>
<th>AGS</th>
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<td>288</td>
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<td>Host/Local Storage (%)</td>
<td>36</td>
<td>59</td>
<td>58</td>
<td>64</td>
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<tr>
<td>Host/Local Only (%)</td>
<td>20</td>
<td>9</td>
<td>48</td>
<td>30</td>
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Number of Mentions in Analyzed DMPs
Iterate with Governance for Funding Opportunities

EarthCube Supports:
- Innovation
- Integration
- Community Development of Resources
EarthCube Integration

- Integration to improve interoperability
- Science Use Cases with identified NSF/GEO Awards
- Deadline: March 14, 2017

Follow Solicitation Proposal Preparation Instructions

Research Coordination Networks

- Target Date: March 14, 2017
NSF EARTHCUBE ROADMAP: FY17 AND BEYOND

Implementation (FY16-17)

- Governance Organization Supported (3yrs)
- Architecture Implementation Plan
- Integration Awards
- RSV Response

- Community-driven meeting
- Use Case Selection
- Architecture decisions “system of systems”
- Implementation Plan review

Assessment/Development (FY18-19)

- Build support infrastructure from Implementation plan
- NSF review of Governance
- Use Case Based evaluation