

# Water@2047 –Water Resources Management

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# Water@2047

## Key Topics for Discussion

- Current scenario and future roadmap for water resource management
- Digitalization of Water Resources Data
- River Rejuvenation: Reviving Fresh Water Systems
- Integrated Water Resource Management in a Nation
- Smart Utilities and Sanitation Intelligence
- Accelerating Water Innovation for Sustainable Futures



The  
**F O U R T H**  
**P A R A D I G M**

DATA-INTENSIVE SCIENTIFIC DISCOVERY

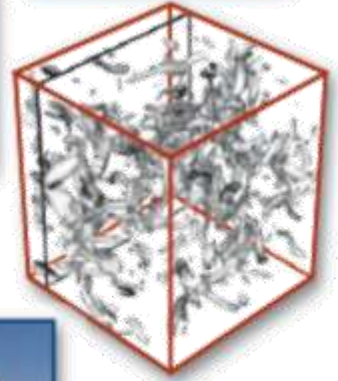
EDITED BY TONY HEY, STEWART TANSLEY, AND KRISTIN TOLLE

# Science Paradigms

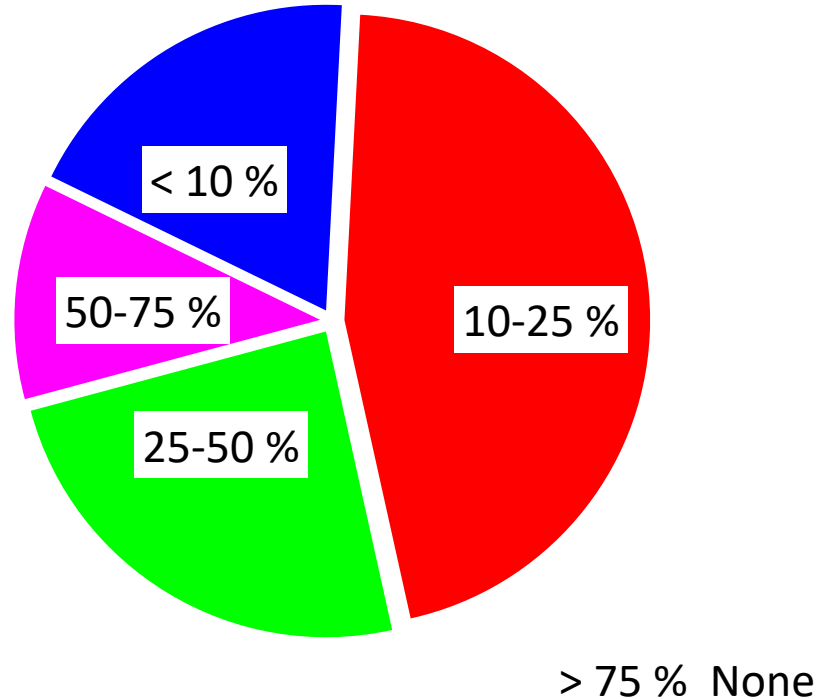
- Thousand years ago:  
science was **empirical**  
*describing natural phenomena*
- Last few hundred years:  
**theoretical** branch  
*using models, generalizations*
- Last few decades:  
a **computational** branch  
*simulating complex phenomena*
- Today: **data exploration** (eScience)  
*unify theory, experiment, and simulation*
  - Data captured by instruments or generated by simulator
  - Processed by software
  - Information/knowledge stored in computer
  - Scientist analyzes database/files using data management and statistics



$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{4\pi G\rho}{3} - K\frac{c^2}{a^2}$$



# What proportion of your research time do you spend on preparing or preprocessing data into appropriate forms needed for research purposes?



Surveys of the water resources community have indicated that data collection and preprocessing is an inordinate fraction of the time required for modeling and analysis

In hydrology most of the easy single site, single variable, low hanging fruit research problems are solved and advances in understanding and better predictions require

- combining information from multiple sources,
- sharing and collaboration
- Easier access to advanced computational capability
- Sustainability and reliability in software



# Hydrologic Data Challenges

- From dispersed State/Central/Private agencies
- From investigators collected for different purposes
- Different formats
  - Points
  - Lines
  - Polygons
  - Fields
  - Time Series

## Data Heterogeneity

The way that data is organized can enhance or inhibit the analysis that can be done

Water quality



Water quantity



Rainfall and  
Meteorology



Soil water



GIS



Groundwater



# What is CWDDR?

CWDDR - Consortium of Water Data Digitalization & Research

## Water Data Issues

### Data

- Enhancing access to, usability
- Reusability of data

### Data Integration

- Combination of information from multiple sources
- Data Intensive Science

### Modeling

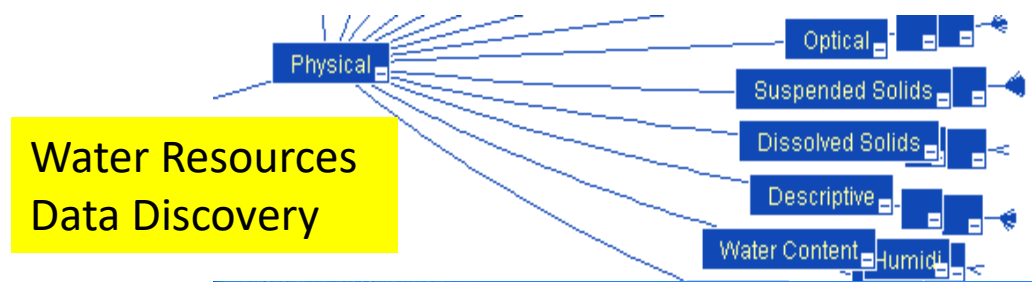
- Using advanced computing using AI & Data Science tools
- Model integration

## Proposed Solution - CWDDR

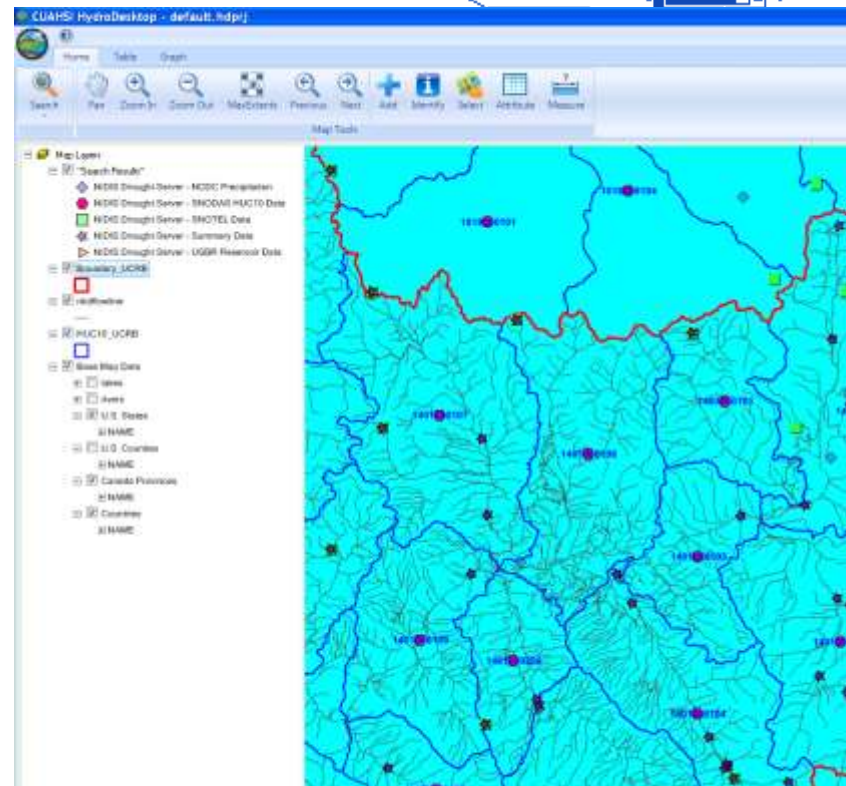
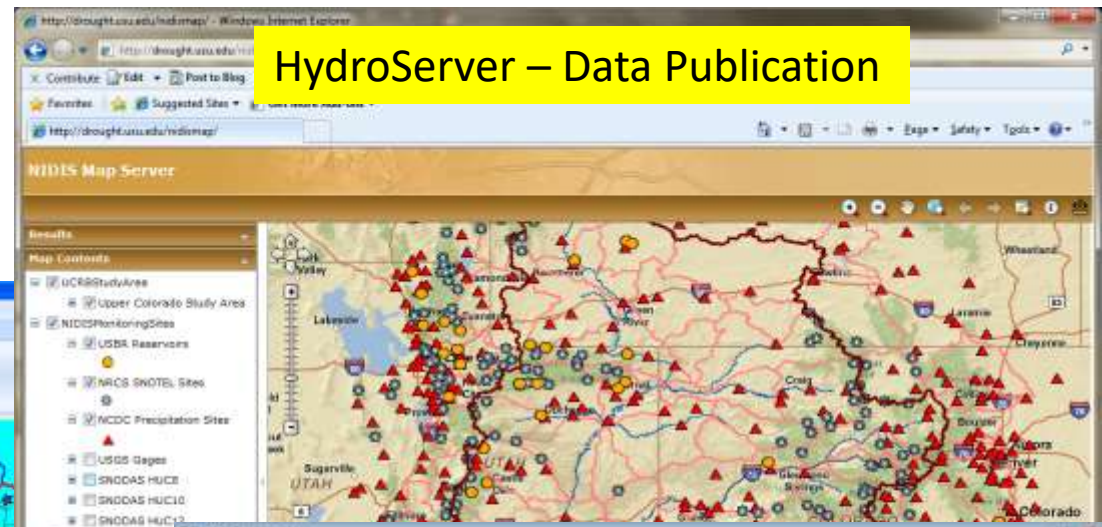
- GeoSmart – Leading Member
- University members
- Affiliate members from Govt. Departments and Industries
- International affiliate members (ex. IWA)
- Corporate members
  
- Main aim is to provide community and Water research support services to advance water research

# CWDDR - WRIS

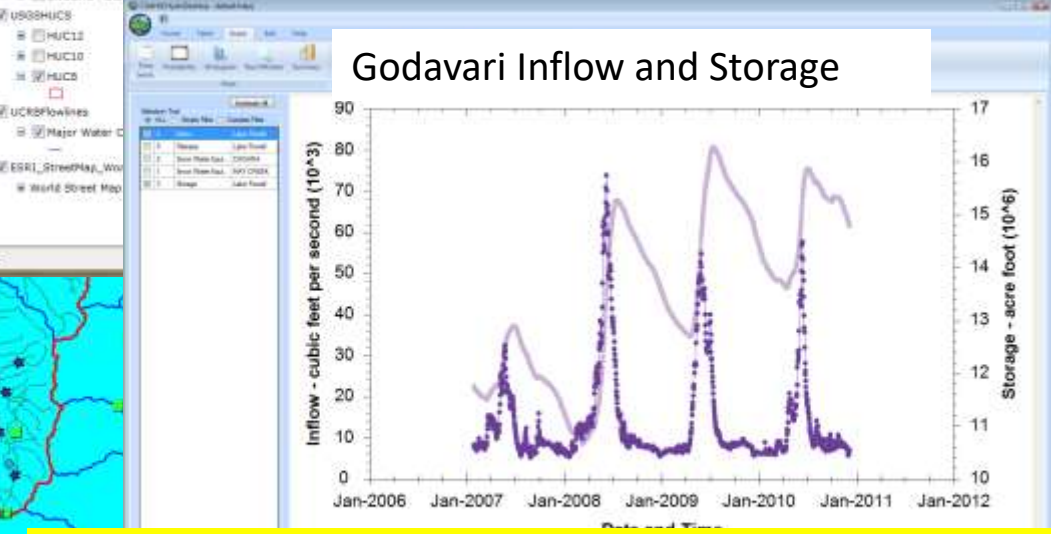
The CWDDR Water Resources Information System (HIS) is an internet-based system to support the sharing of hydrologic and water resources data. It is comprised of hydrologic and water resources databases and servers connected through web services as well as software for data publication, discovery, access, and modeling.



Water Resources Data Discovery

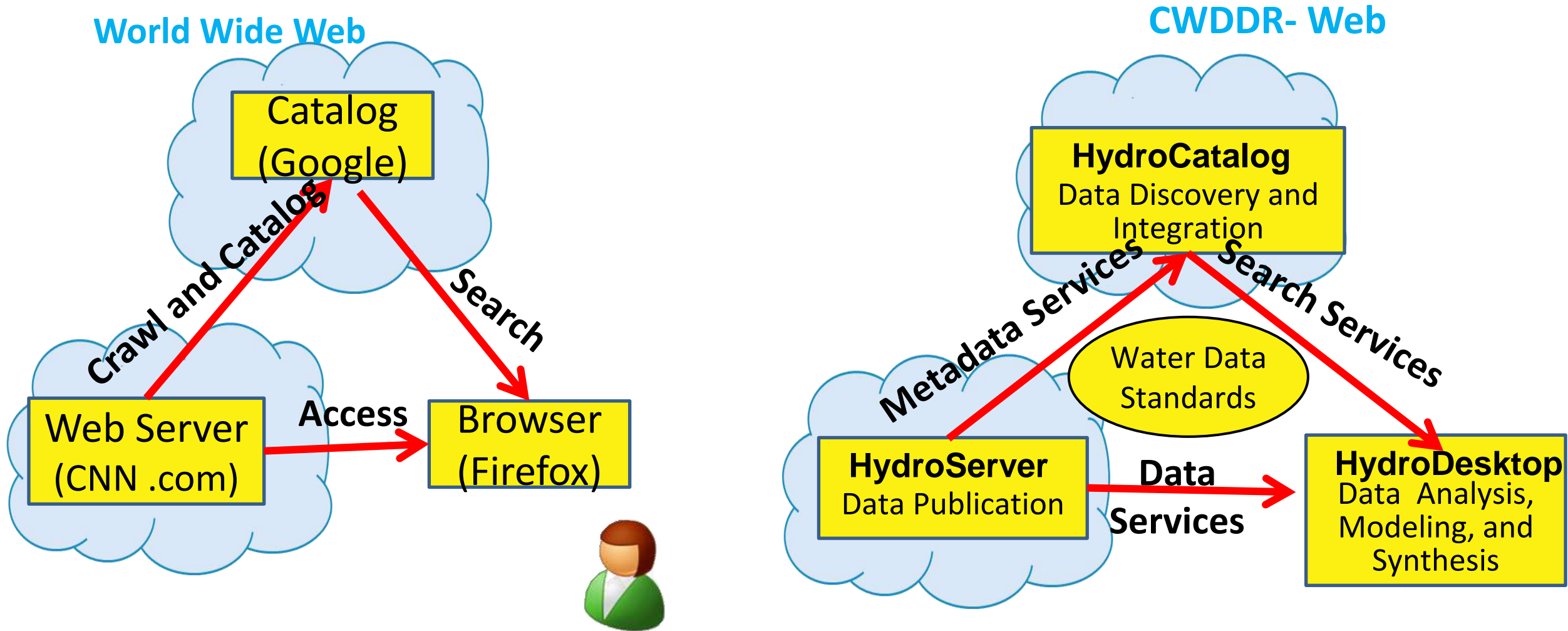


HydroDesktop - Data Access and Analysis



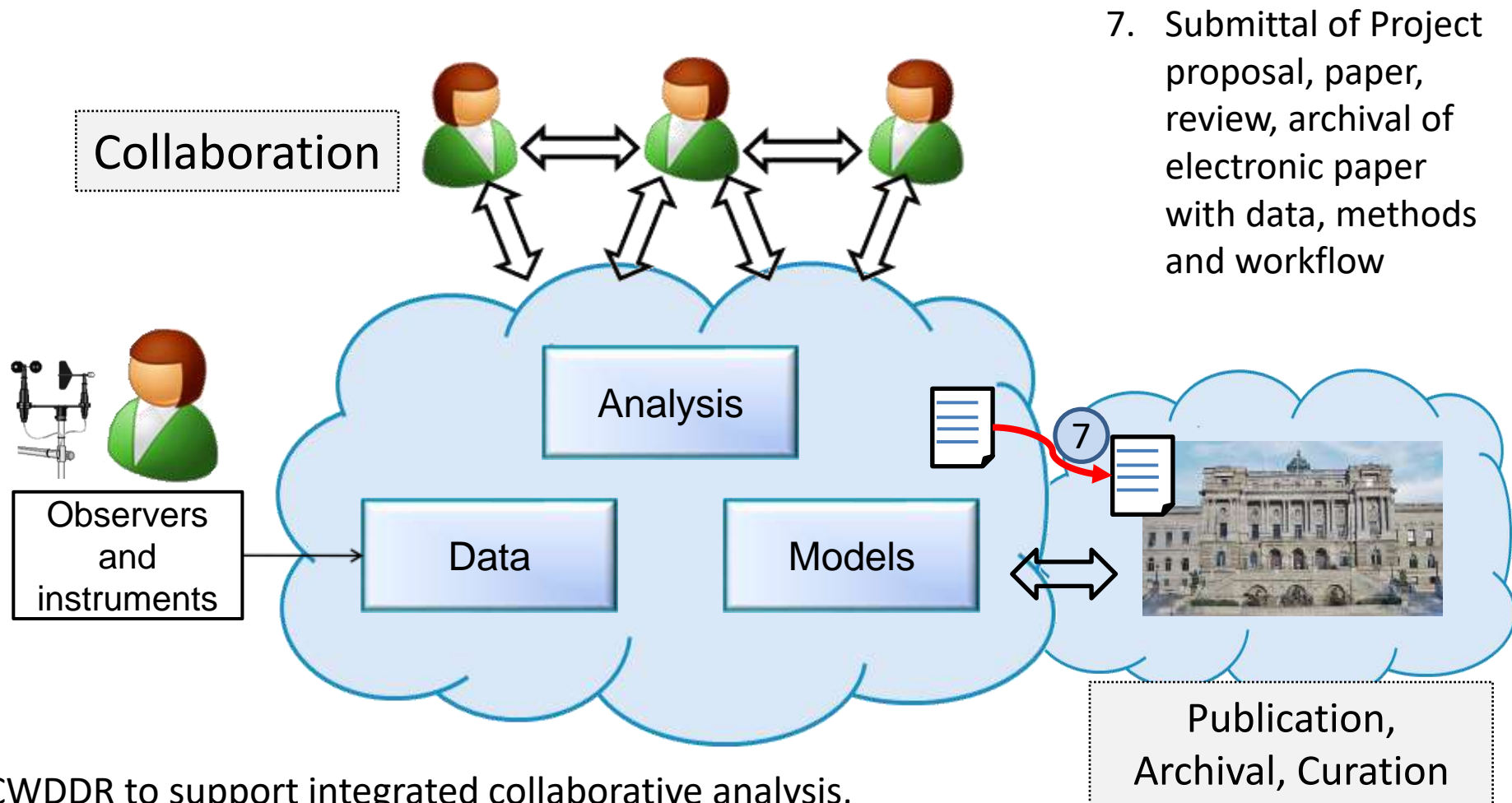
HydroDesktop - Combining multiple data sources

# CWDDR: A Services-Oriented Architecture Based System for Water Resources





# Imagine the Possibilities...



7. Submittal of Project proposal, paper, review, archival of electronic paper with data, methods and workflow

CWDDR to support integrated collaborative analysis, modeling and data publication

Geosmart, DataOne, EarthCube, ...

# Summary

- CWDDR
  - Enhanced Access to Hydrologic and Water Resources Data
  - Combining information from multiple sources
  - A collaborative website for the sharing of hydrologic and water resources data and models
  - To expand data sharing analysis capability
    - Additional data classes
    - Models, scripts, tools and workflows
    - Data Mining
    - Artificial Intelligence
- To the Future
  - Data intensive and advanced computing
  - Cloud and parallel models
  - Software and Models as Services



To boldly go where no one has gone before

# Questions for Panelists

1. What specific initiatives and strategies that need to be implemented to drive the achievement of sustainable water resources management including water-energy-environment nexus?
2. What are the main challenges India currently faces in implementing the ambitious roadmap for water management?
3. What strategies and initiatives can be employed to promote data exchange, modeling capabilities towards Integrated water resources management?
4. What needs to be done to change the attitude and behaviors among the public towards water?
5. How do we motivate water and wastewater utilities (companies/govt. depts) to use smart systems or at least automated systems?
6. What are the priorities to accelerate water innovations and startups for sustainable water future?