Flatware Services: CCA Simulation Repository

Sharing Astrophysical Simulation Data

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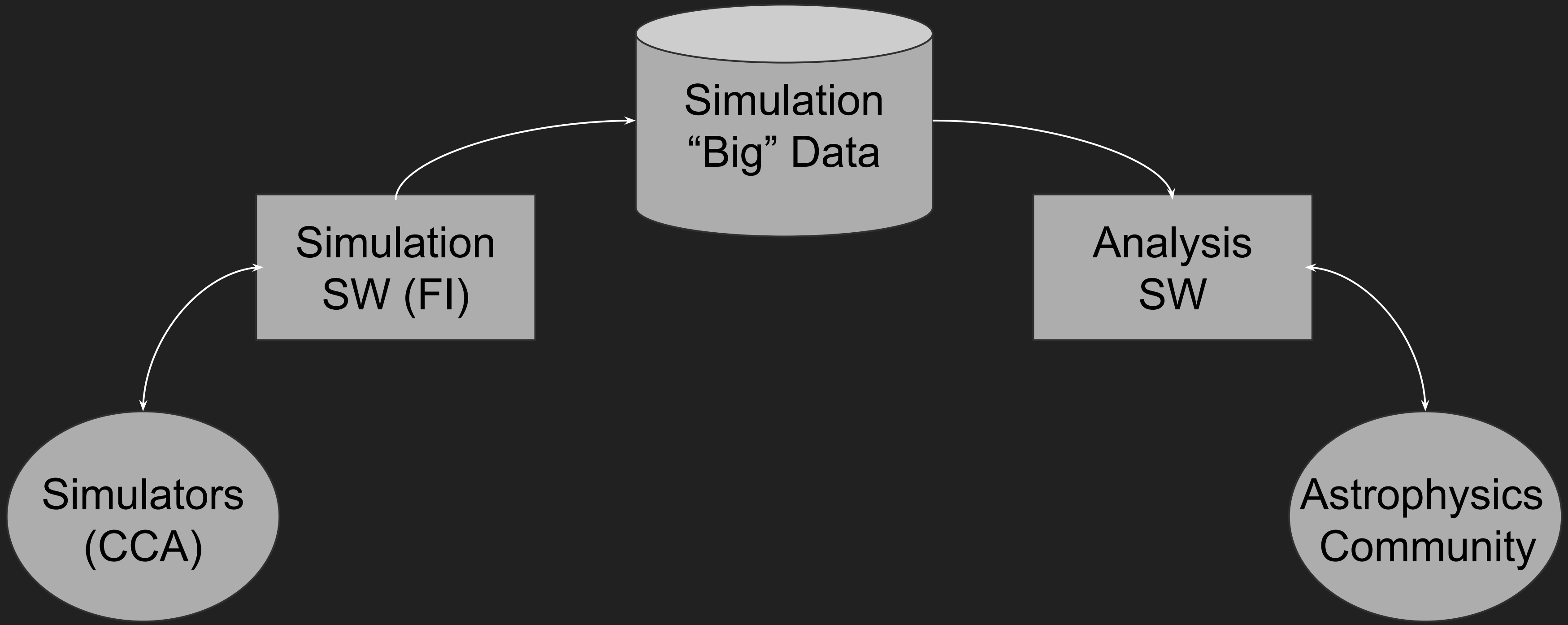
The Problem



Simulation “Big” Data

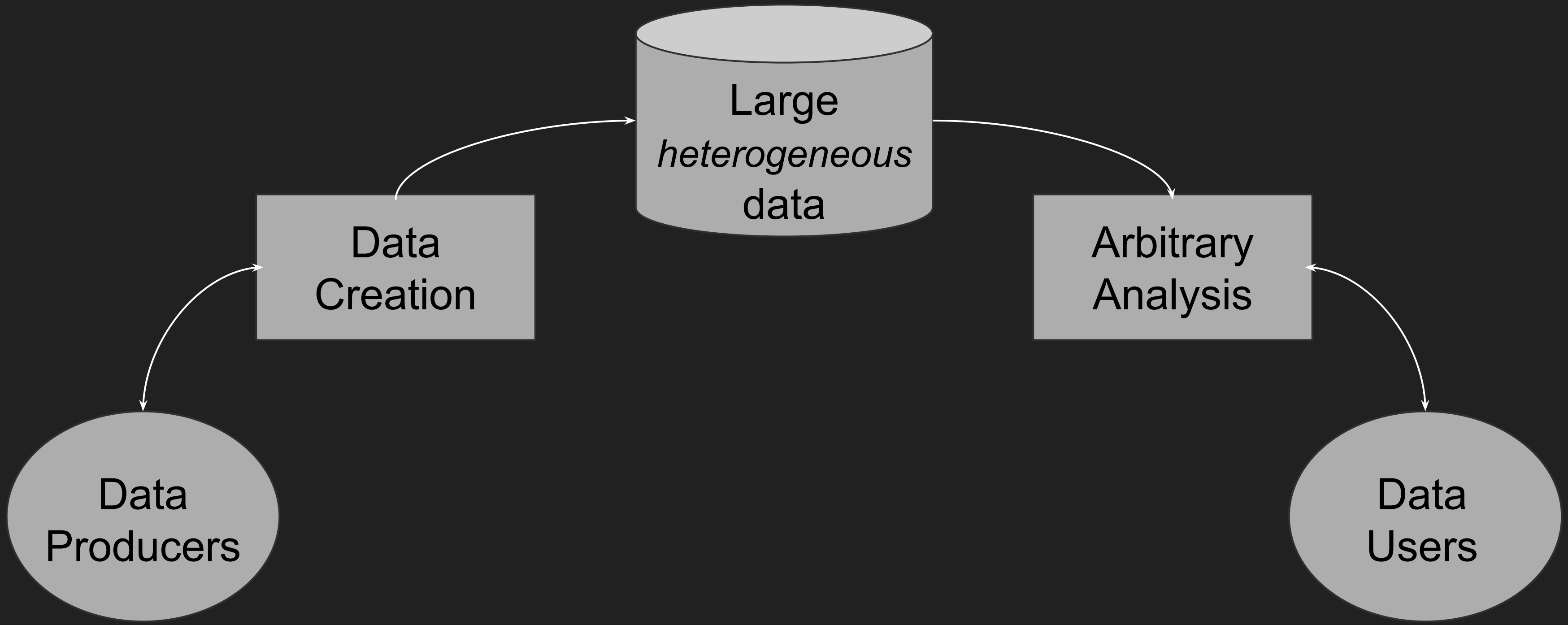
Simulation SW (FI)

Analysis SW

Simulators (CCA)

Astrophysics Community

The Problem



Large *heterogeneous* data

Data Creation

Arbitrary Analysis

Data Producers

Data Users

Approaches

- Download big files: bring data to users
  - Easy to provide, allows full, arbitrary access
  - Significant user investment: need enough storage/compute, understand data formats
- Provide computational environment: bring users to data
  - Data producer investment: provide computational resources, interface
  - FI: unrestricted HPC/shell access to...
  - SciServer: complete walled-garden ecosystem
  - Requires balancing user scaling and restrictions
- Provide limited querying capability, partial downloads
  - Query interface defines abilities, development vs. computational cost
  - SQL: users write SQL text query, execute with some time/size limit
  - Illustris: API (and python client)
  - CosmoHub: SQL+data exploration, limited API

Challenges

- Documentation
    - Users need to understand how to find what they want, how to use what they get
- Generalizability
    - Custom-made solutions specific each data set
    - Hard to add new datasets, adapt analysis code to new data
- Performance
    - Big transfers and big computations have cost
    - Users (and providers) can wait days for results

Astrosims Data Repository

- Goal: bring relevant subset of data to user
  - Intuitive, well-documented: direct, consistent access to data, structure
  - General, extensible: easy to add & query new datasets without changing code
  - Fast, performant: filter, explore, download data interactively, low-cost
  - API: allow direct, seamless access from code

- Focus on tabular (catalog) data
  - Flexible, dynamic schema (field definitions)
  - Build on elasticsearch (lucene) database
- Demo

Future work

- Standardize field definitions, units
- Access to snapshot volume data
    - Formats are fairly specific to datasets
    - Standard formats (yt)? Conversions can be lossy
    - Standard API/links based on catalog objects, dataset-specific operations
- More complex queries
    - Multiple fields (“*x* > *y*”)
    - Joins/cross-matches between datasets
- Meta-structure, discovery across datasets
- Improve UX design, style
- Generalizations, other applications
- Hosted at SDSC on kubernetes as PoC, built on docker hub
    - Now available for more public data serving applications