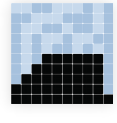
MESA, ABMS IN PYTHON 3

OVERVIEW AND DISSERTATION PROPOSAL

By Jacqueline Kazil

CSS Friday Seminar, March 29, 2018

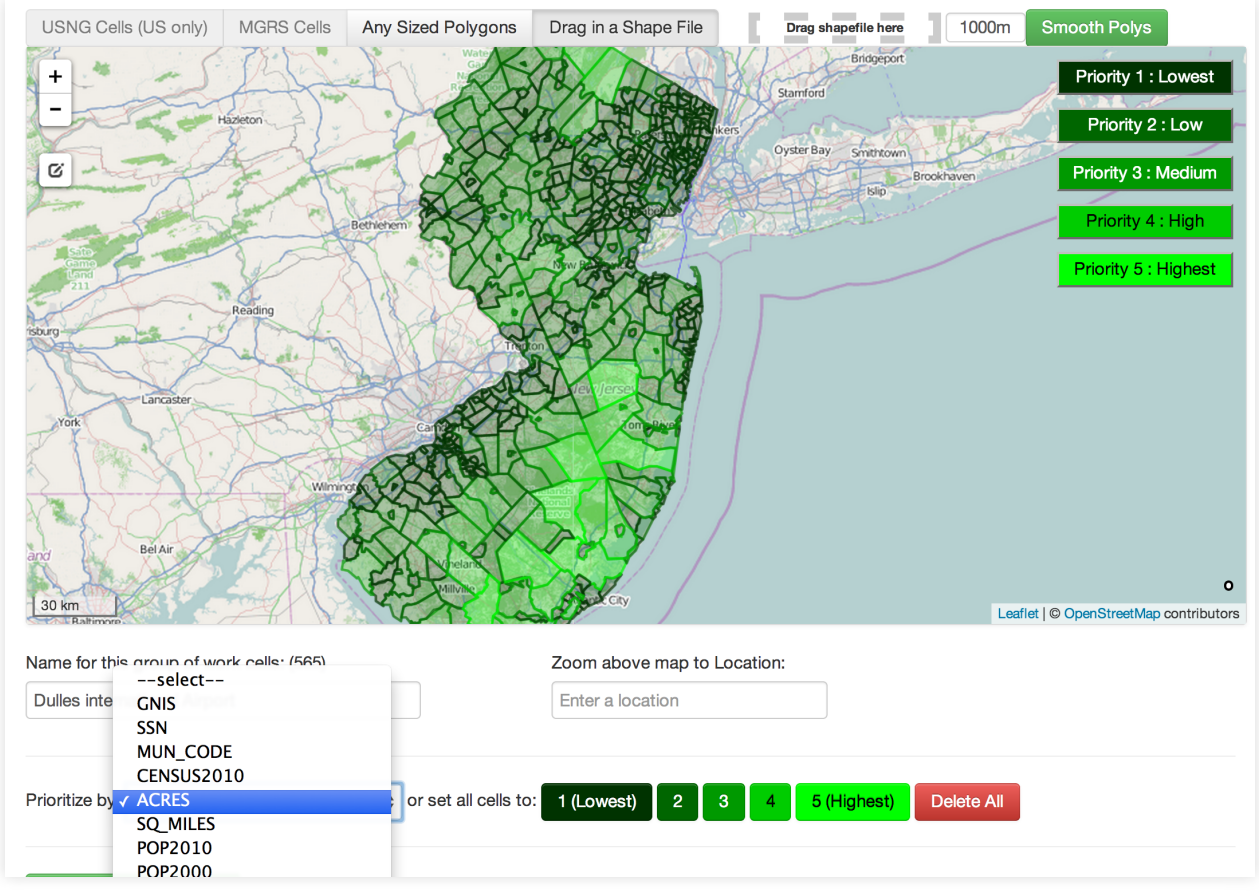


AGENDA

- Mesa - Overview and Live Demo
- Research questions
- Breakdown of work -- four papers
- Questions / discussion about Ph.D proposal
- *Brief discussion of Mesa packages*

BIAS WARNING

BIAS WARNING

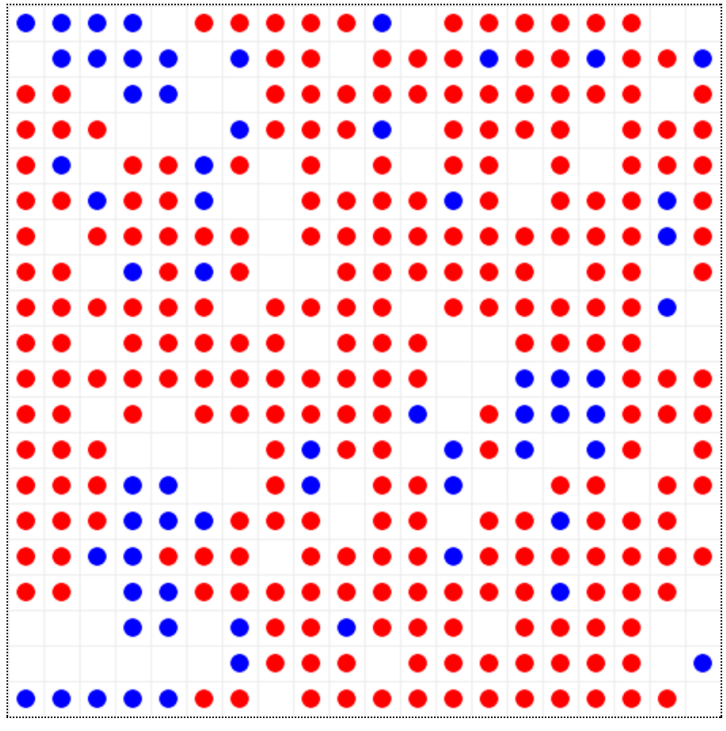


github.com/ngageoint/geoq

MESA: HISTORY & TODAY

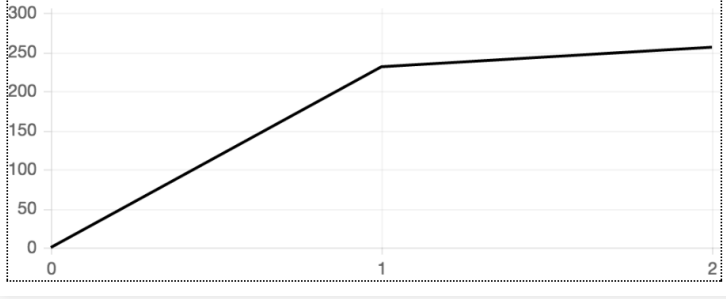
- Started in 2013 w/ David Masad and I
- Up to 45 contributors
- Meet monthly for dev meetings
- Current release 0.8.3 (soon to be 0.8.4)

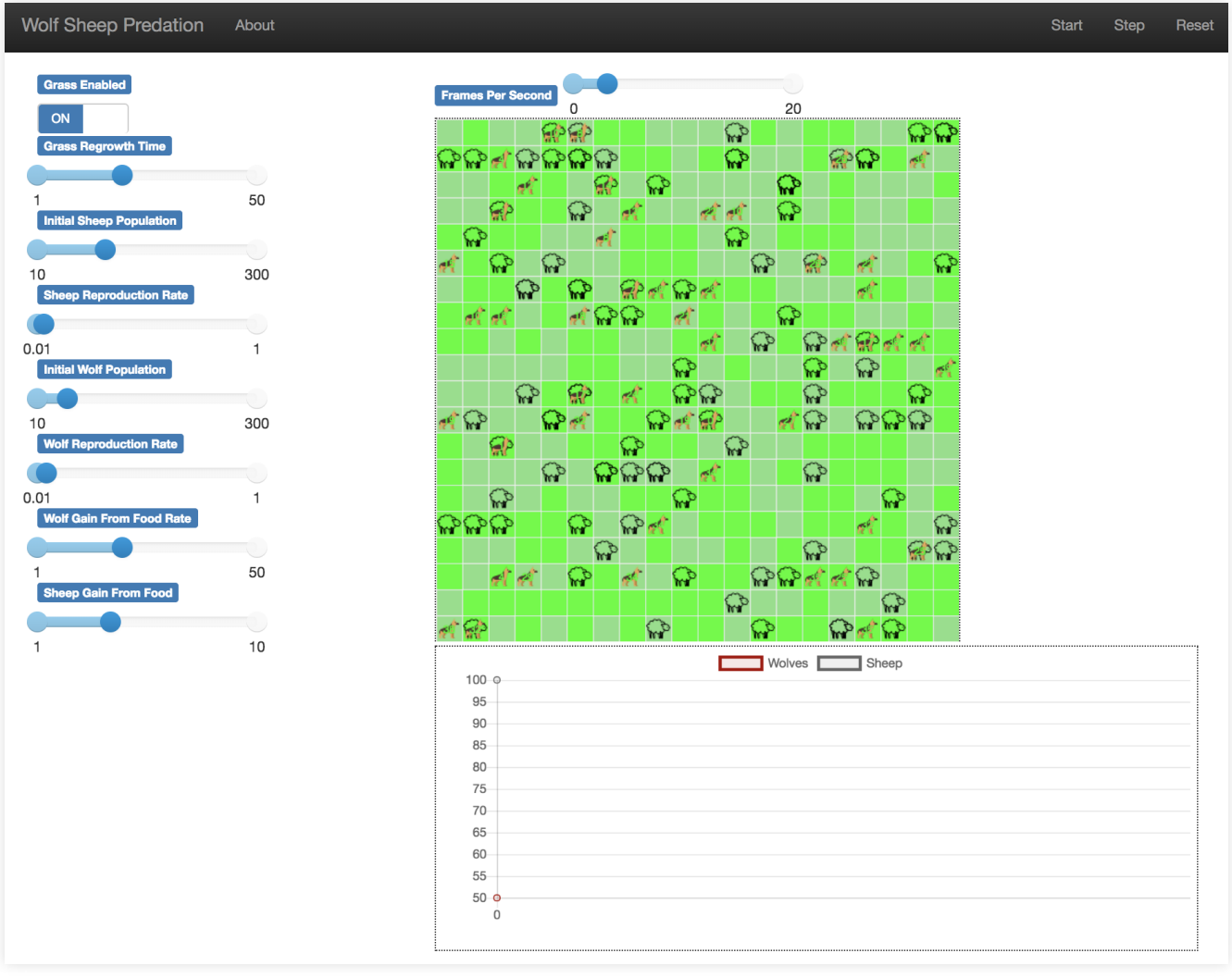
Schelling



fps 3
reset
step
run
pause
Close Controls

Happy agents: 256

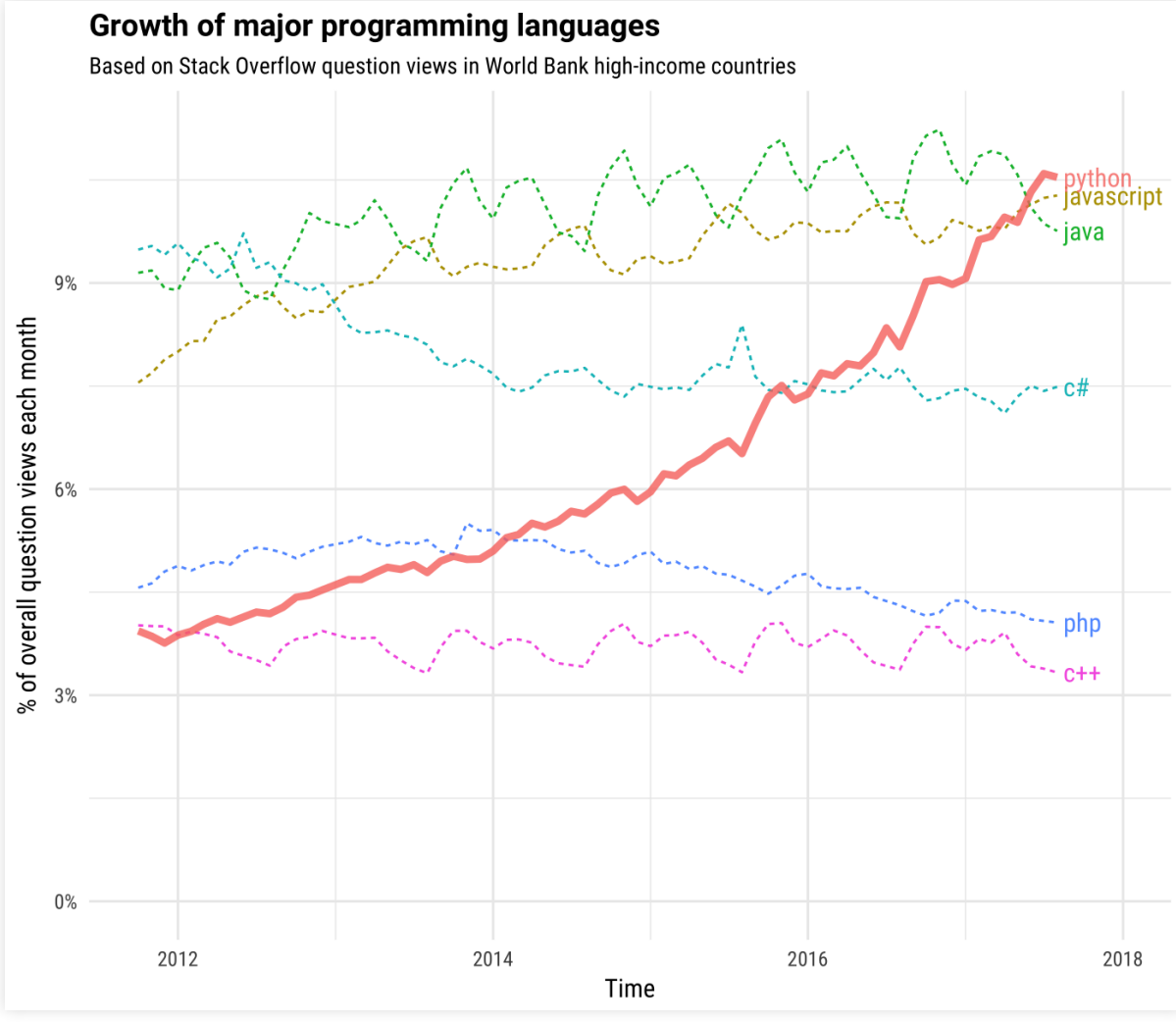



Wolf Sheep Predation
About
Start
Step
Reset
Grass Enabled
ON
Grass Regrowth Time
1
50
Initial Sheep Population
10
300
Sheep Reproduction Rate
0.01
1
Initial Wolf Population
10
300
Wolf Reproduction Rate
0.01
1
Wolf Gain From Food Rate
1
50
Sheep Gain From Food
1
10
Frames Per Second
0
20
Wolves
Sheep
100
95
90
85
80
75
70
65
60
55
50
0

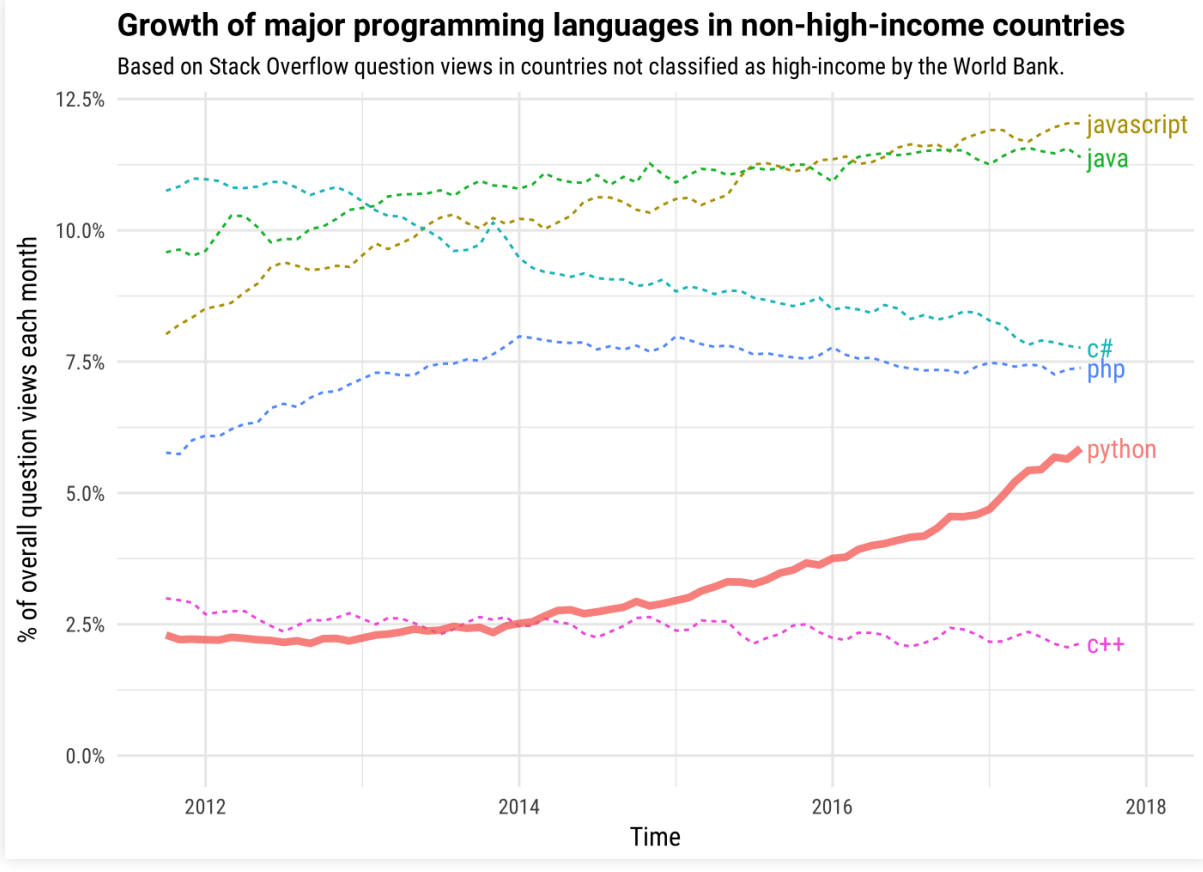
(Mesa Demo)

PYTHON GROWTH AND DATA SCIENCE

- Guido van Rossum's Darpa Proposal (1999): "Computer Programming for Everybody."
  - Source: van Rossum, Guido. âComputer Programming for Everybody.â , July 1999, citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.123.6836&rep=rep1&type=pdf.
- Python is the next big thing for [Insert domain] science.



- Source: Robinson, David, et al. "The Incredible Growth of Python | Stack Overflow." Stack Overflow Blog, 4 Dec. 2017, stackoverflow.blog/2017/09/06/incredible-growth-python/.



- Source: Robinson, David, et al. "The Incredible Growth of Python | Stack Overflow." Stack Overflow Blog, 4 Dec. 2017, stackoverflow.blog/2017/09/06/incredible-growth-python/.

RESEARCH QUESTIONS

Theme one: Python and Open Source

- RQ 1: How can the Python programming language, which is rooted in open source, enable agent-based modeling to a wider audience?
- RQ 2: How does an ABM library in Python compare to the most popular ABM libraries used by researchers?

RESEARCH QUESTIONS

Theme two: ABM in Python compared to other ABMs

- RQ 3: How have development patterns varied on agent-based libraries impacted the success or failure of those libraries?
- RQ 4: How do users want to use an ABM API? What are the expectations?

CHESTERTON'S FENCE

BREAKDOWN OF WORK -- FOUR PAPERS

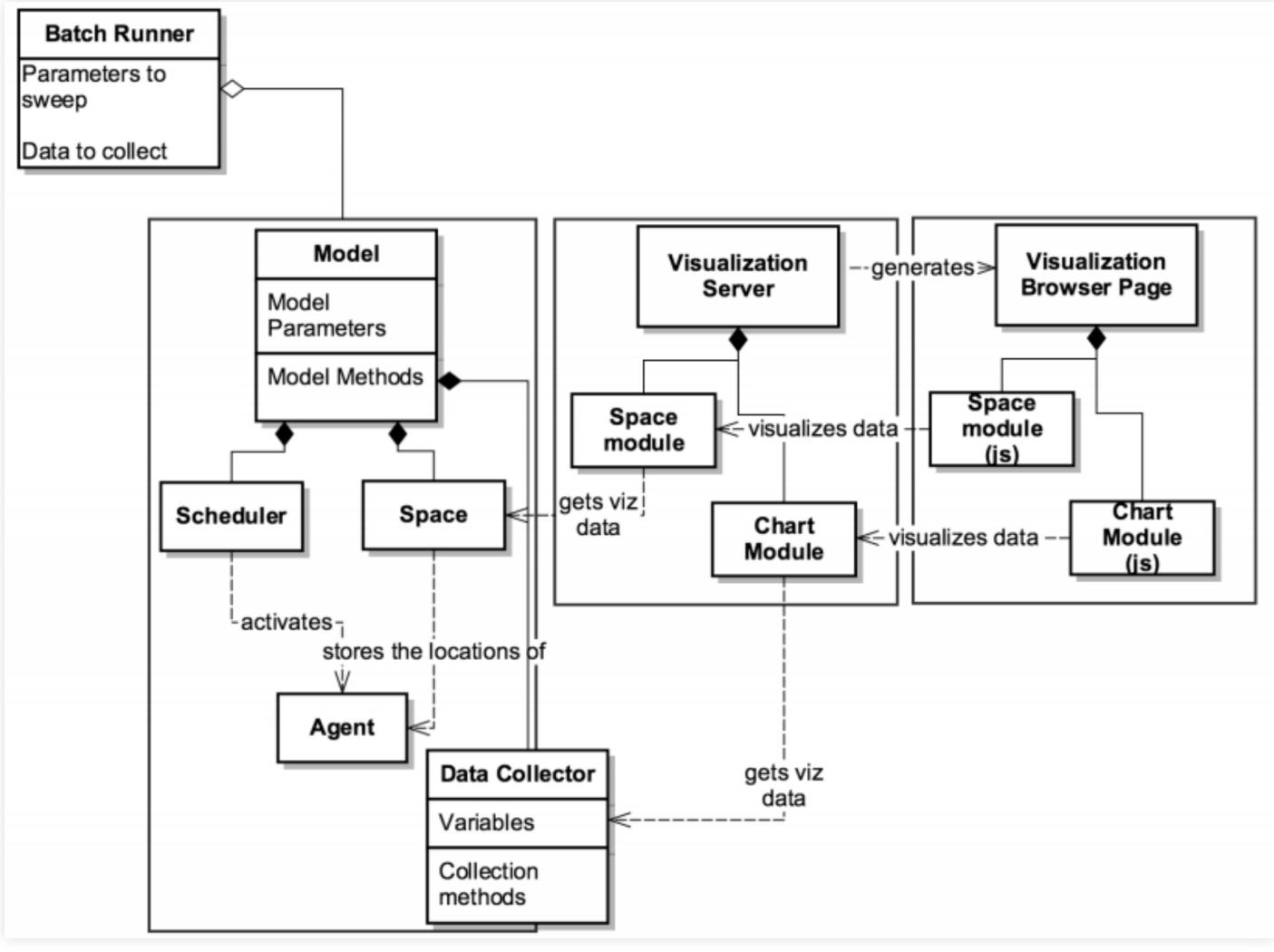
- Comparison contribution patterns for Mesa, Netlogo, Mason, Swarm, Repast
- Mesa paper - architecture, features, sample projects...
- Mesa 1.0 - What do users want - locking the API
- Benchmarking Mesa, against other libraries

PAPER: COMPARISON CONTRIBUTION PATTERNS & CULTURE

- Mesa, Netlogo, Mason, Swarm, Repast
- Popularity of... [framework, language] over time
- Commits, conversations, general activity, release cycles, etc.
- Conferences / Events? - Mesa has no formal ones, but what about Swarmfest?
- Where are they now?

PAPER: MESA

- aka 'the Mason paper' but for Mesa
- Why is Python a good idea? Why is it a bad idea?
- Architecture, features, sample projects, etc
- How we came up with the architecture
- What is the bus factor and how will work carry on?
- Mesa modularity and working with other libraries



- Source: Masad, David, and Jacqueline Kazil. "MESA: an agent-based modeling framework." 14th PYTHON in Science Conference. 2015.

MESA 1.0

- The Mesa team discussed, "What is Mesa 1.0? / What does it mean to be 1.0?"
- Many possibilities came up for 1.0 -- like general housekeeping
- But what does it REALLY mean to be 1.0?
- 1.0 is an opportunity to breaking backwards capatibility
- It means being stable.

PAPER: MESA 1.0, LOCKING THE API

- Talking to users about the good and bad of actually using Mesa.
- i.e. "When you tried to build a model, where did you start?"
- Yes... IRB. No... a survey only won't work
- Methods will be grounds in user-center design

Kenneth Reitz

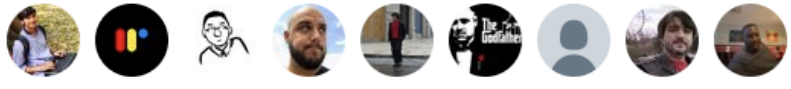
@kennethreitz

Following

P.S. your API is a user interface

12:23 PM - 24 Feb 2016 from Winchester, VA

464 Retweets **805** Likes



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0_urllib2.py

```python
#!/usr/bin/env python
# -*- coding: utf-8 -*-

import urllib2

gh_url = 'https://api.github.com'

req = urllib2.Request(gh_url)

password_manager = urllib2.HTTPPasswordMgrWithDefaultRealm()
password_manager.add_password(None, gh_url, 'user', 'pass')

auth_manager = urllib2.HTTPBasicAuthHandler(password_manager)
opener = urllib2.build_opener(auth_manager)

urllib2.install_opener(opener)

handler = urllib2.urlopen(req)

print handler.getcode()
print handler.headers.getheader('content-type')

# ------
# 200
# 'application/json'
```

1_requests.py

```python
#!/usr/bin/env python
# -*- coding: utf-8 -*-

import requests

r = requests.get('https://api.github.com', auth=('user', 'pass'))

print r.status_code
print r.headers['content-type']

# ------
# 200
# 'application/json'
```

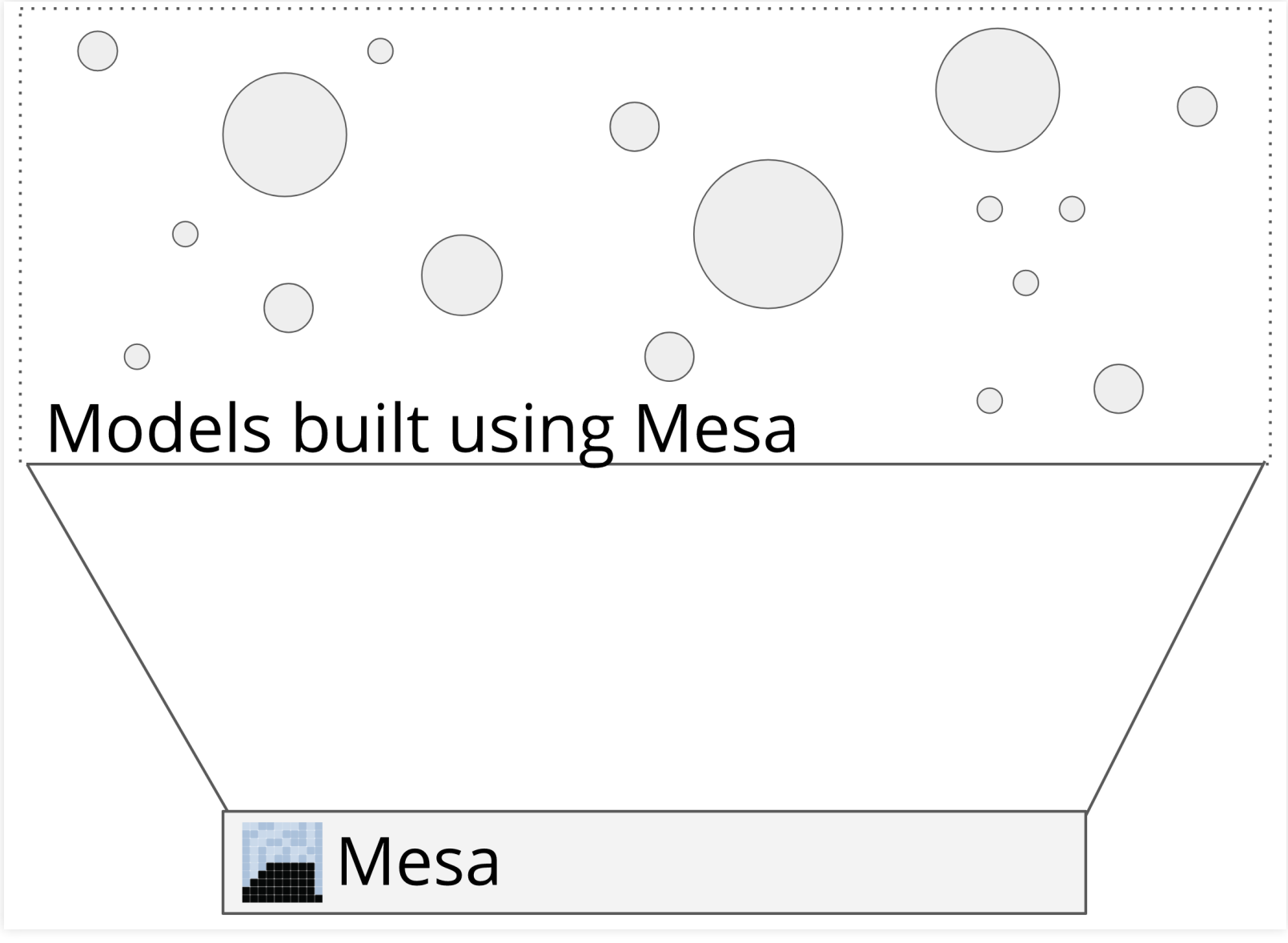
PAPER: BENCHMARKING MESA

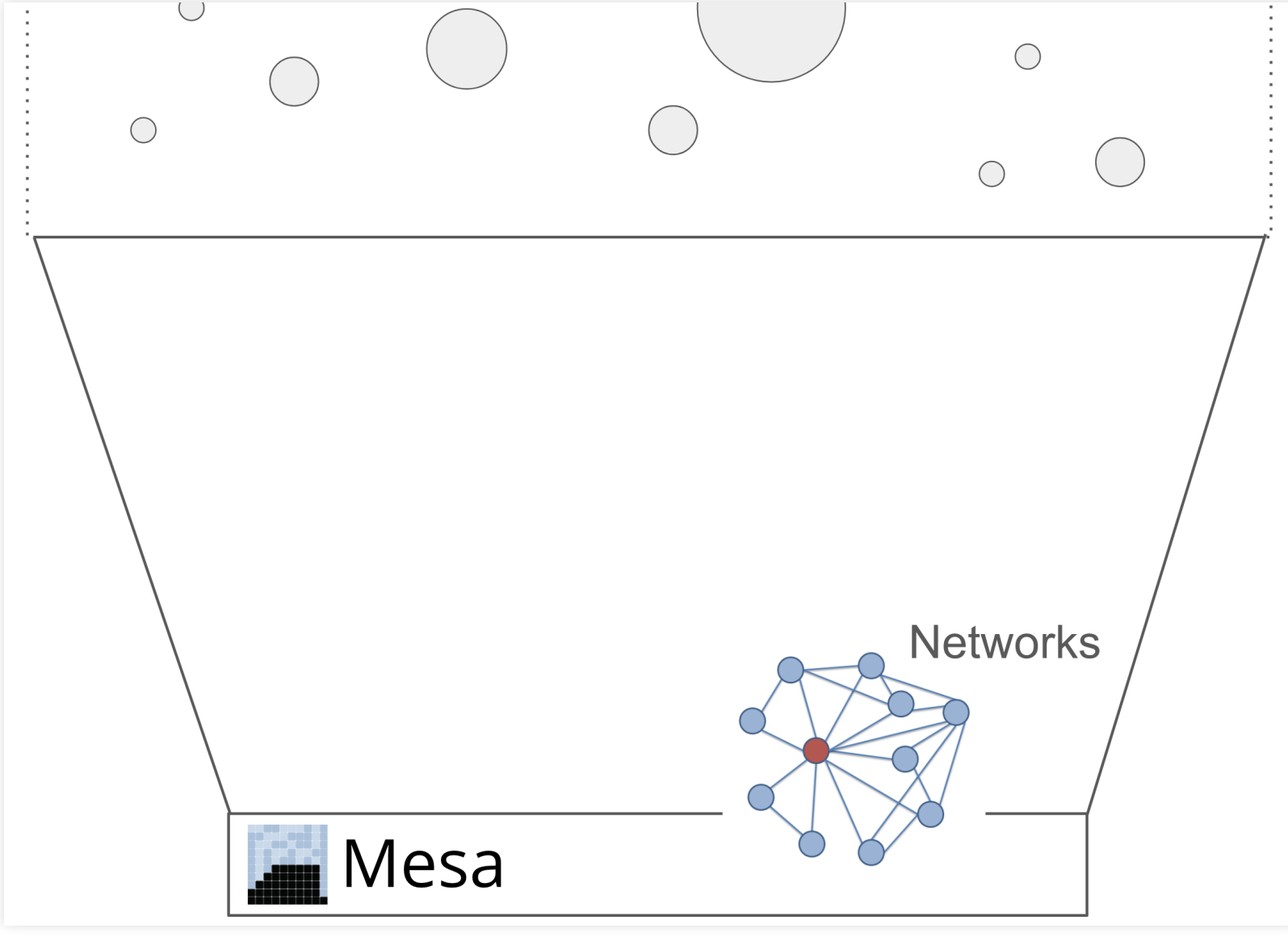
- Looking at same projects in main libraries (i.e. Heat bugs)
- Validating Mesa: Can Mesa provide the same results?
- How does each library scale - 100, 1000, 100,000, 1,000,000
- What are key features that they have
  - i.e. How does Mesa's networks perform against other libraries.

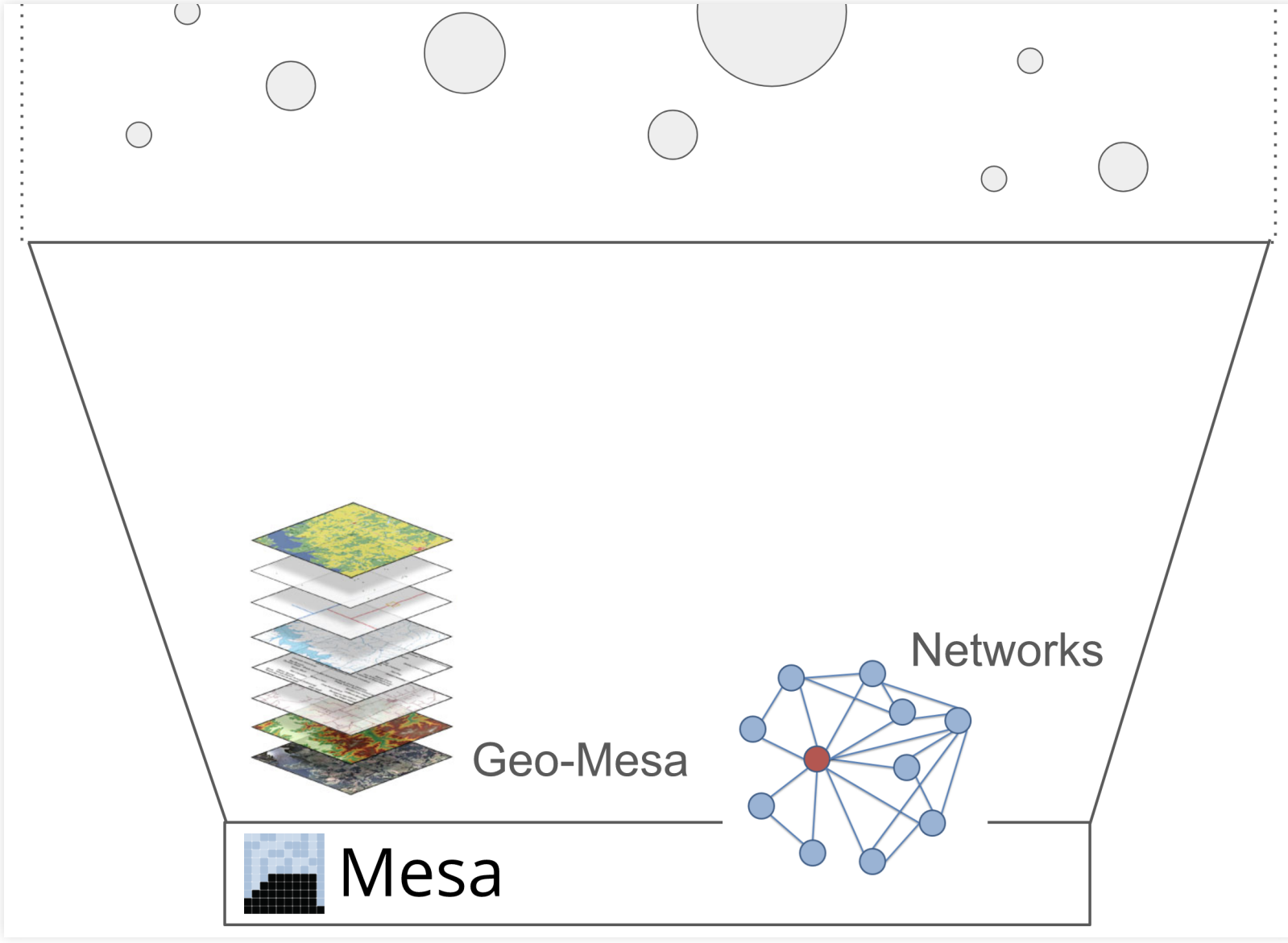
ANY PENDING QUESTIONS / DISCUSSION

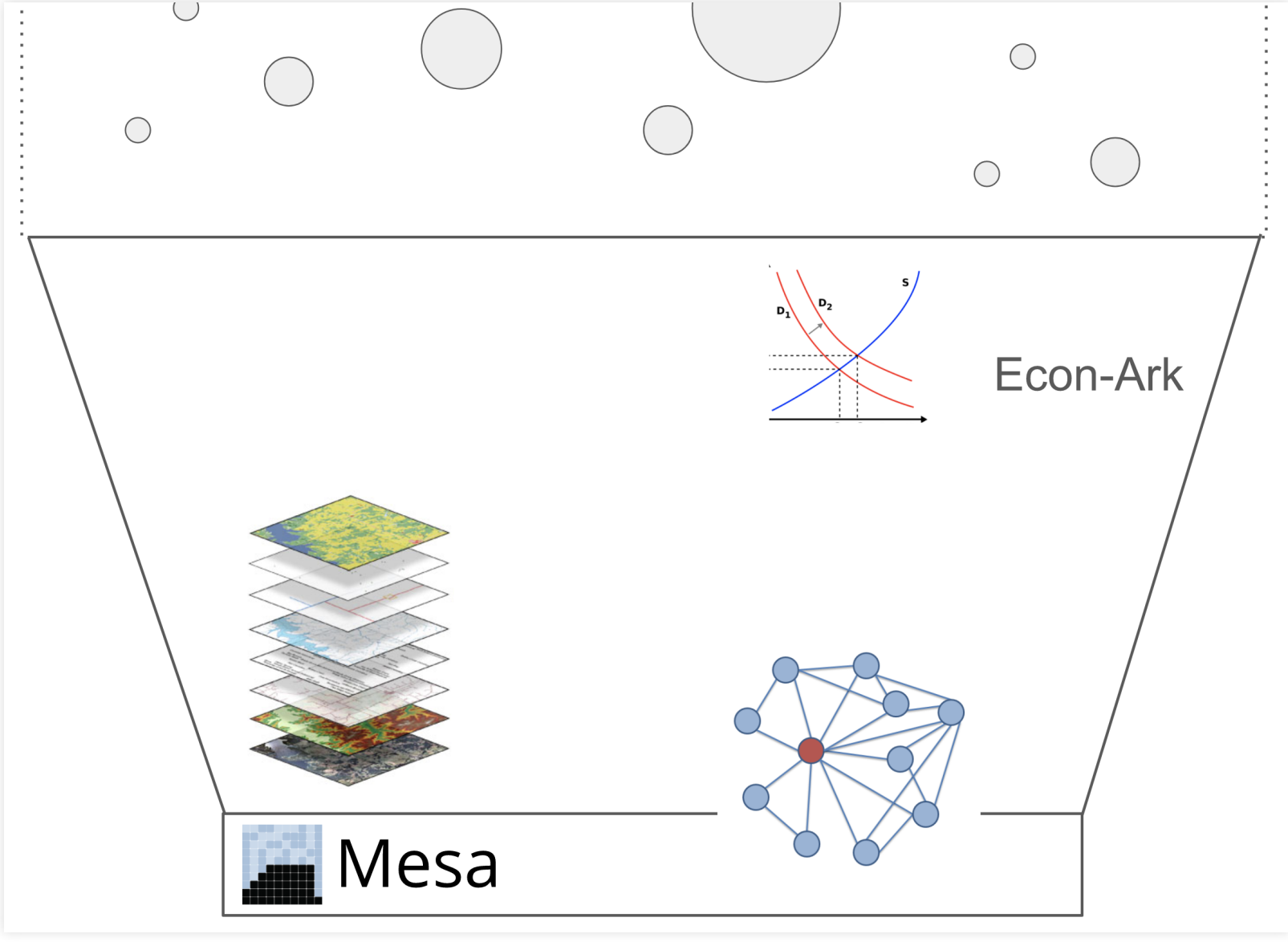
MESA ECOSYSTEM

- Individuals build complemenatary libraries for Mesa
- Libraries include rules for agents or world, minor logic or major features (ie GIS)
- Domain experts manage their respective domains
- Mesa core team might help or facilitate
- This is being documented by Tom Pike in Mesa docs


Models built using Mesa
Mesa


Networks
Mesa


Networks
Geo-Mesa
Mesa


S
D1
D2
Econ-Ark
Mesa

THE END

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