

# Lifemapper as a Deck of Virtual Components



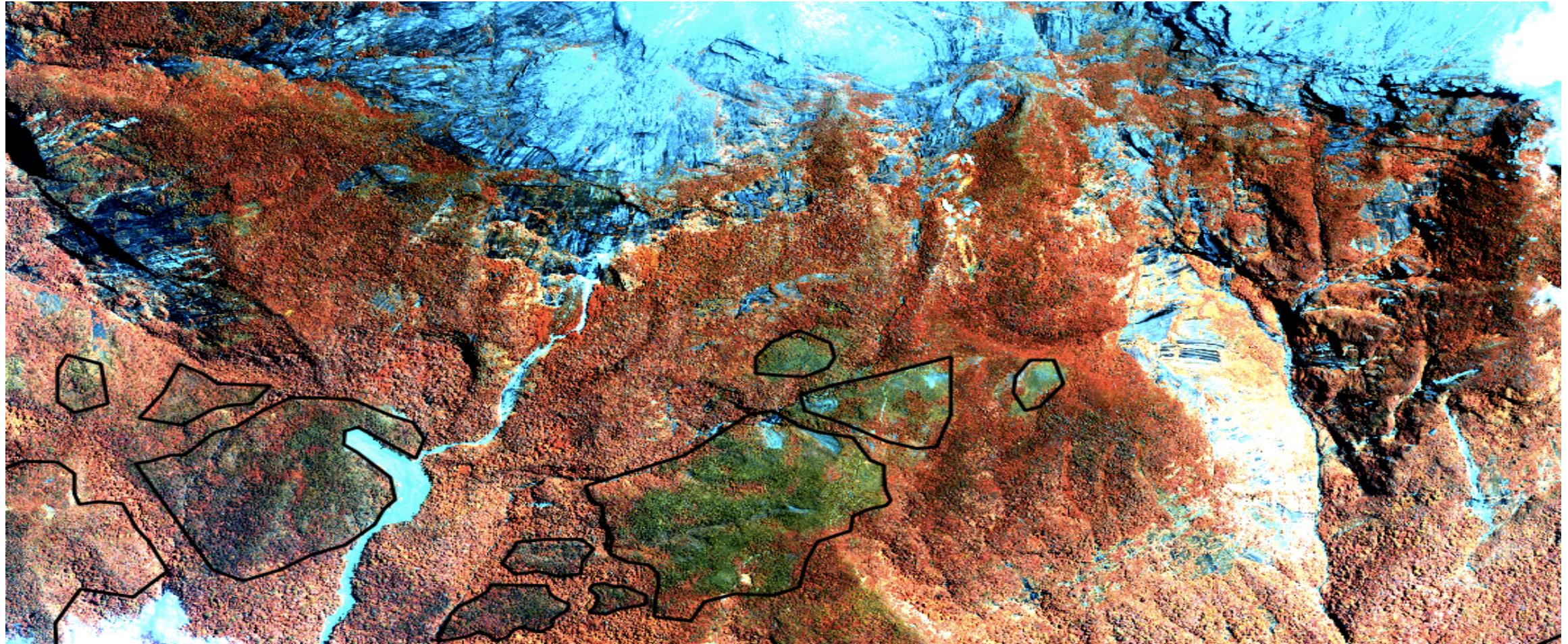
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# Introduction

- VBE goals
  - Deployable Infrastructure to support Mount Kinabalu research
- Background
  - Mount Kinabalu, Sabah Malaysia
  - Lifemapper
- Progress so far
  - PRAGMA 23-26 paved the way
  - ICSE/PRAGMA symposium, UAV data



# Mount Kinabalu imagery



# PRAGMA 27 goals and success

**Decouple components LmWebServer and LmDbserver from KU-specific implementation**

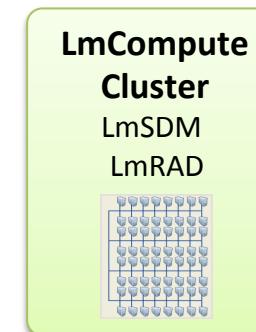
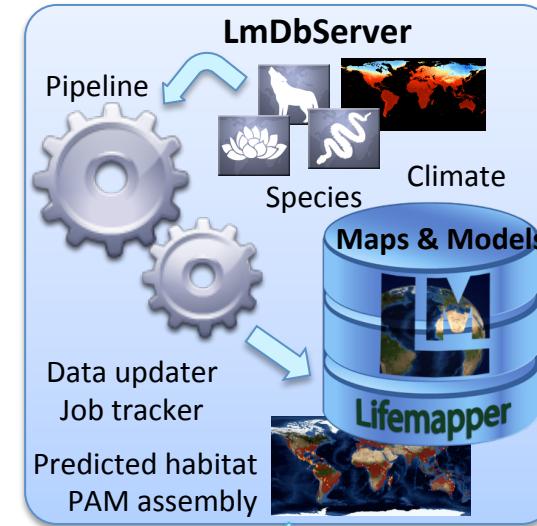
- Automate install and configure process
- Bootstrap database and metadata seeding
  - Automate database definition
  - Automate static input data seeding
- Start job pipeline
  - Reads and inserts dynamic input species data
  - Creates job-chain for each input species

**Connect computational component**

- Request jobs from LmWebServer
- Compute jobs
- Return results through LmWebServer

**Explore virtualization to enable field work**

Lifemapper server cluster



# Virtualization Technologies



- Runs on Linux on x86 hardware
- Ideal to run on clusters
- Advantages in VBE
  - Can create bigger instance
  - Can have long running instance
  - Dynamic input data
  - Intended for use by multiple external clients



## VirtualBox

- Runs on Linux, Windows, OSX
- Ideal for laptops but
  - Must setup networking
  - Instance size/memory is limited by laptop hardware
- Advantages in VBE
  - Can special-purpose instance
  - Can have short-lived instance
  - Pre-defined stable input data
  - Intended for field work (with no network connection) and teaching tool

# Demo: Lifemapper in KVM

- Preparation:
  - rocks-201: virtualized LmCompute at SDSC, compute for Kansas
    - Automated dependencies and install process
    - Made configurable
  - rocks-204: virtualized servers at SDSC, compute for rocks-201
    - Automated install
    - Unbound from Kansas - made configurable
    - Bootstrapped database – big deal!
  - Configured connections
- Demo:
  - Start LmDbServer pipeline, show output, job results
  - Start LmCompute, show job progression
  - Output web services

# From development to production deployment

**Focus: facilitate easy-to-use solutions to provide seamless integration of sw/hw**

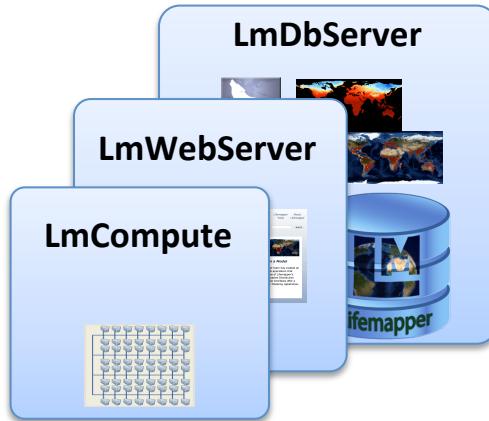
SW		VM		Complete system
 <b>Automate the longest tasks</b> Use Rocks rolls for software build and configuration		 <b>Reuse technology we know</b> Create Virtual Machines or Virtual Clusters		 <b>Replicate the resulting VMs</b> Export VMs
<b>Result</b> <ul style="list-style-type: none"> <li>1. Encapsulate difficulty to install and configure applications</li> <li>2. Know your system real-time status: what is installed, what version, configuration, data</li> <li>3. Robust system: can reliably build and rebuild</li> </ul>		<b>Result</b> <ul style="list-style-type: none"> <li>1. Build Rocks clusters using KVM and VirtualBox</li> <li>2. Virtualize infrastructure to improve hardware utilization and scalability</li> <li>3. Deploy virtual servers for efficient and flexible operations</li> </ul> KVM → to VirtualBox KVM → to EC2		<b>Result</b> <ul style="list-style-type: none"> <li>1. Can enable scientific application running on shared resources (PRAGMA testbed, other)</li> <li>2. Can use VMs as training and reaching out mechanism</li> <li>3. Enables cloning multiple servers. Make one time – use many</li> </ul>

From

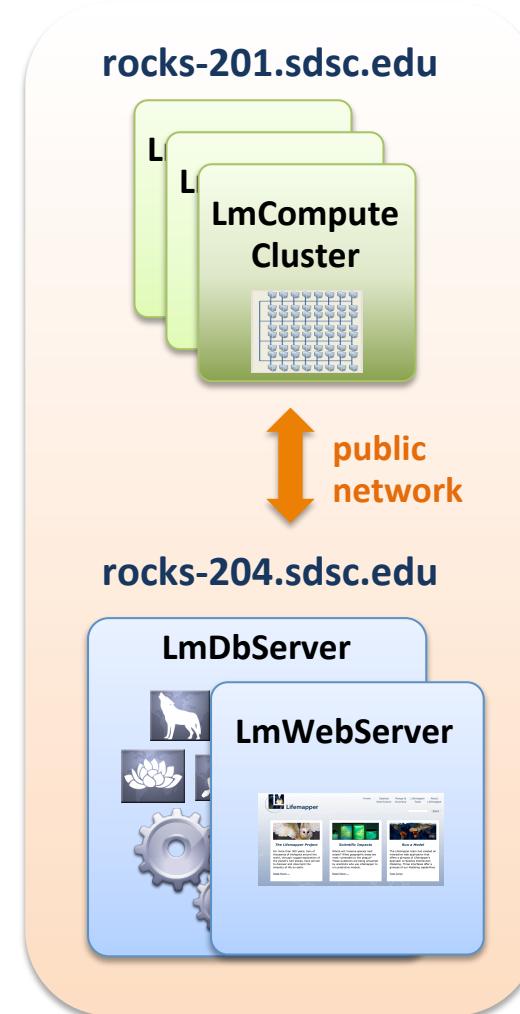


# to Deck of Virtual Components

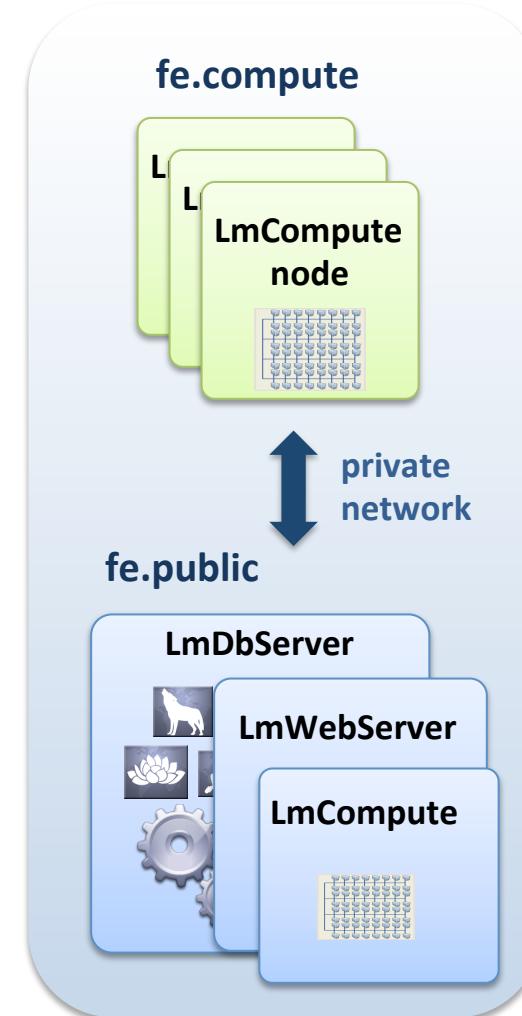
## Lifemapper components



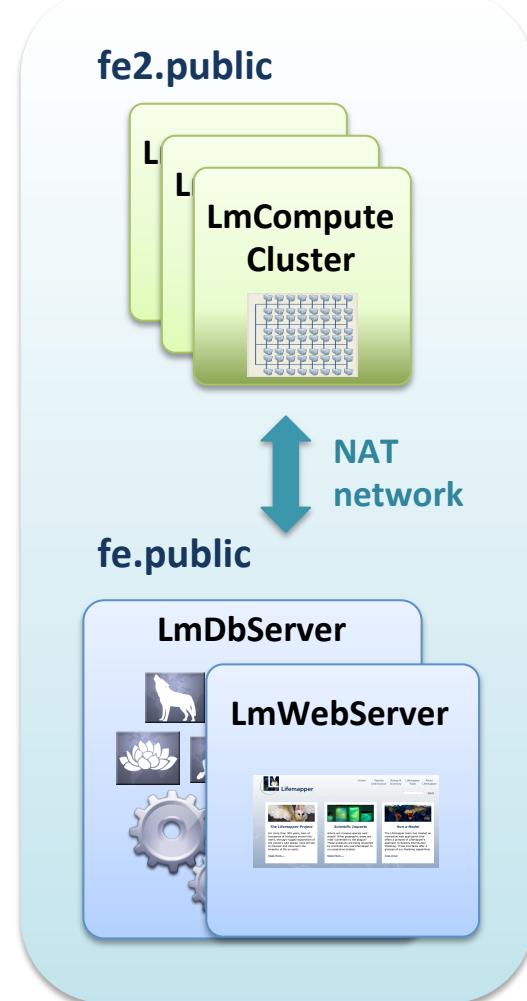
### KVM: 2 virtual clusters



### VBox: 1 virtual cluster



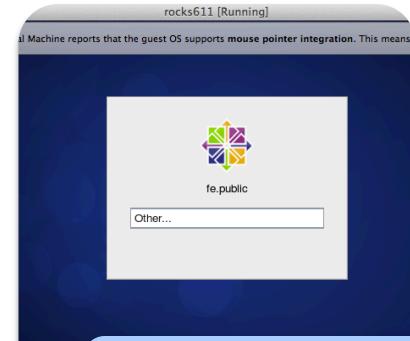
### VBox: 2 virtual clusters



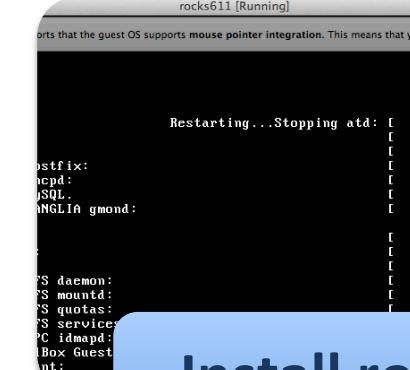
# Lifemapper in VirtualBox on a laptop



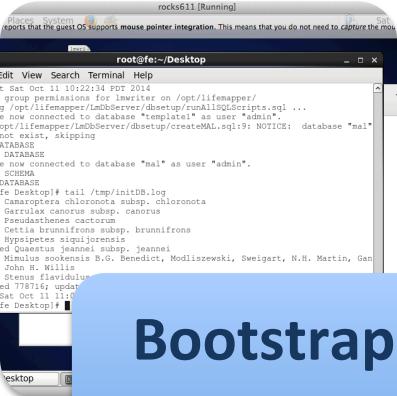
**Import VM**  
• 5 min



**Start VM**  
• 3 min



**Install roll**  
• 15 min



**Bootstrap database**  
• 50 min

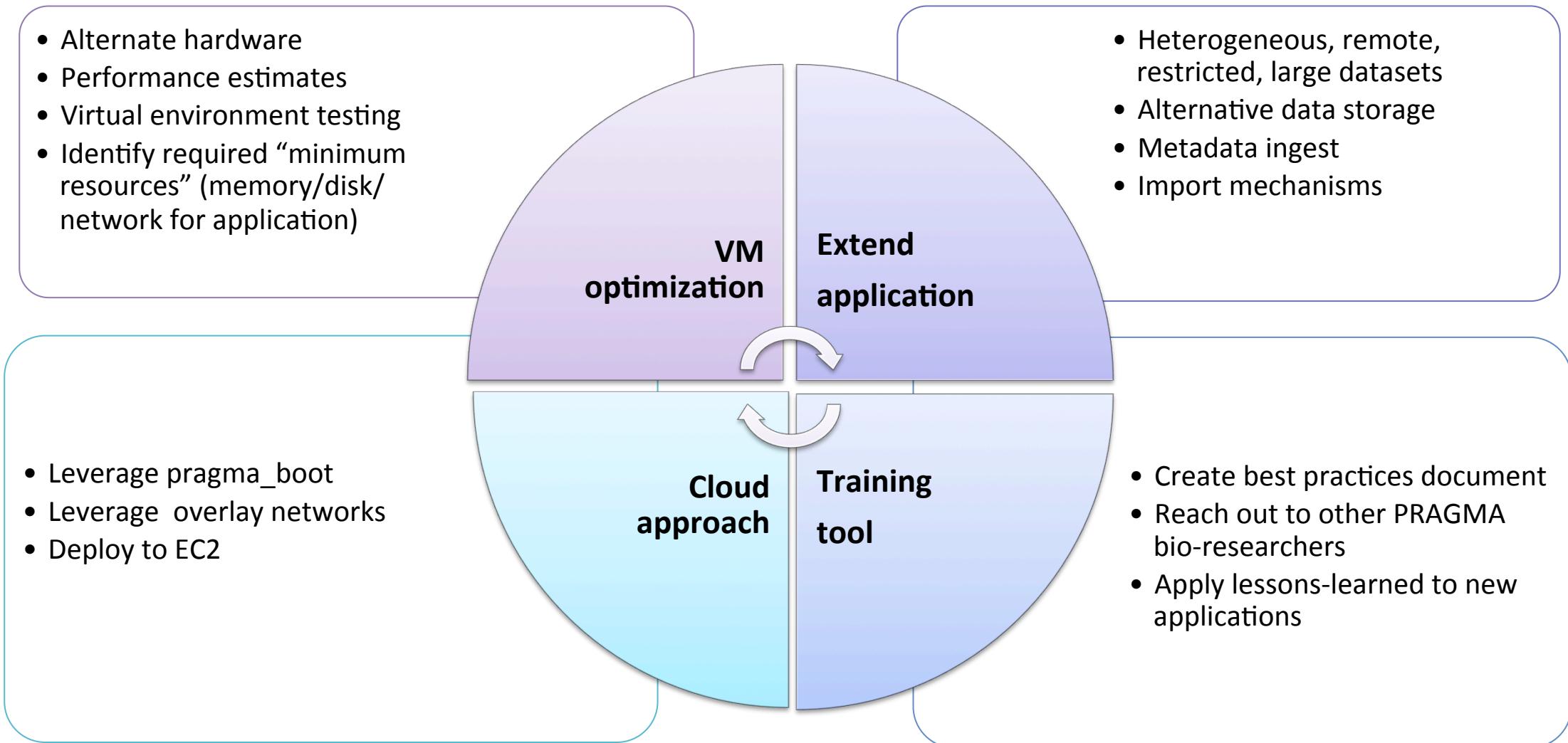
**Setup**

**Use**

## Usage:

- Work in field
- Development platform
- Teaching tool

# Future Work



## Acknowledgements

This work is funded in part by National Science Foundation and NASA grants

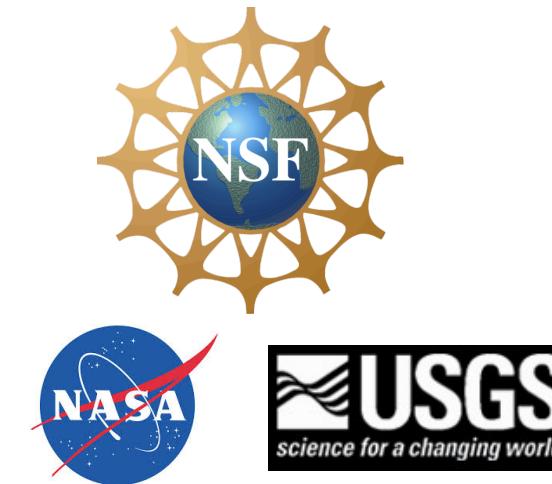
### PRAGMA

US NSF 1234953

### Rocks

US NSF OCI-1032778

US NSF OCI-0721623

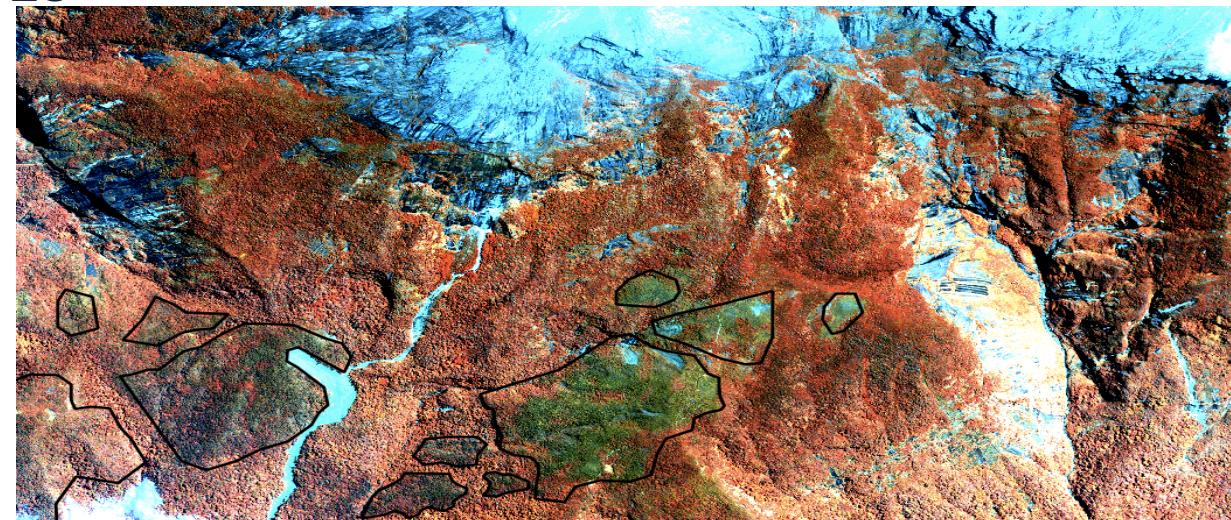


### Lifemapper

US NSF BIO/ABI 1356732

US NASA NNX12AF45A

USGS CESU #G14AC00285





# Questions?

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## Lifemapper

<http://lifemapper.org>  
<https://github.com/lifemapper/>

## Rocks

<http://www.rocksclusters.org>

## Pragmagrid GitHub

<https://github.com/pragmagrid/lifemapper>  
<https://github.com/pragmagrid/lifemapper-server>