

# HTCondor at Cycle Computing: Better Answers. Faster.

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We believe utility access to technical  
computing power  
accelerates discovery & invention

# The Innovation Bottleneck:

Scientists/Engineers  
forced to size their work to the  
infrastructure their organization bought

# Our slogan

- Better Answers. Faster.
- We want our customers to get the resources they need when they need them

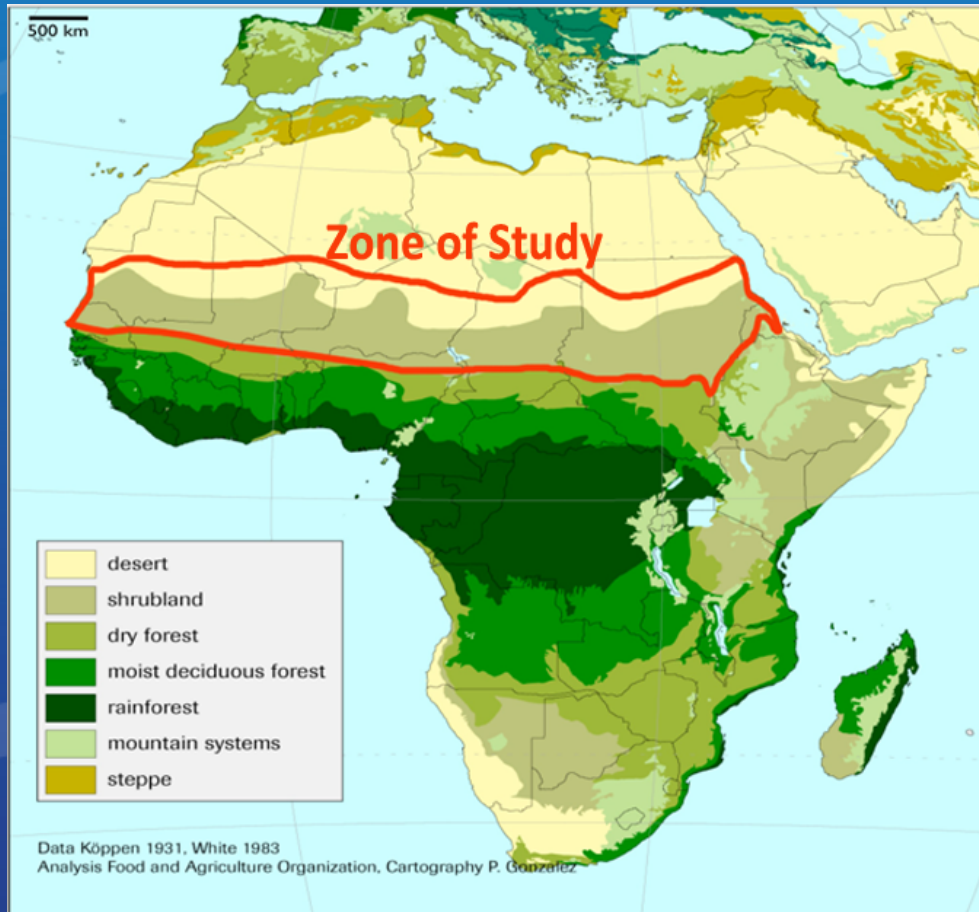
Better Answers...

# Measure woody biomass on the southern Sahara at 40-50 CM scale

- NASA project in partnership with
  - Intel
  - Amazon Web Services
  - Cycle Computing

# Project goals

- Estimate carbon stored in trees and bushes in arid and semi-arid south Sahara
- Establish a baseline for future CO<sub>2</sub> studies of the region



Desert  
Sahara

Savanna  
Sahel  
(*Acacia* spp., *Mimosaceae*)

Dry Woodland  
Sudan  
(*Sclerocarya birrea*,  
*Anacardiaceae*)

Moist Deciduous Forest  
Guinea  
(*Kigelia africana*, *Bignoniaceae*)

Rainforest  
Congo  
(*Aucoumea klaineana*,  
*Burseraceae*)

Africa Biomes

# The input data

- Images collected from satellites
- ~ 20 terabytes total

# The workflow

- Pleasantly parallel
- Each task takes 20-30 minutes
- 0.5 million CPU hours total

# The workflow

- Tasks have two parts
  - Orthorectification and cloud detection
  - Feature detection
    - Uses 2-20 GB of RAM

# AWS setup

- Spot instances
- C3 and M3 instance families
- Data staged into S3

# Job Submission

- DataMan uploads data from local Lustre filer to S3
- When transfers complete, DataMan creates a record in CycleCloud
- CycleCloud batches records and builds HTCondor submit files

# Job Submission

- Easy for the scientist

The screenshot displays the DATAMAN web interface. At the top, there's a navigation bar with 'DATA' and 'REPORTS' tabs, and an 'ADMIN' dropdown. Below this, the interface is split into two main panels. The left panel, titled 'localhost', shows a file browser with columns for Name, Size, User, Group, and Last Modified. It contains one entry: 'tmp/' with a size of 357.41 MB, owned by root/wheel, last modified on 4/13/15 at 6:23 PM. The right panel, titled 'My Vault', also has the same columns but is empty, displaying 'No files found'. Between these panels are four vertical arrows indicating transfer directions: a right arrow, a right arrow with a circular arrow, a left arrow with a circular arrow, and a left arrow. Below the file panels, there's a 'Transfers' section with tabs for 'Transfers' and 'Scheduled Transfers'. The 'Transfers' tab is active, showing a table with columns: Request Time, Source, Destination, Progress, Rate, Size, and Time Left. The table is currently empty, displaying 'No rows to display'. At the bottom of the interface is a 'Terminal' button.

# What's next?

- Proof-of-concept is wrapping up
- Operational project expected to take approximately 1 month

**Faster....**

# Improve hard drive design

- HGST runs an in-house drive head simulation suite
- In-house grid engine cluster runs the simulations in 30 days
- ~620K compute hours

# We can make this faster!

- On Wednesday: “Hey, guys! Can we have this done by this weekend?”

# We can make this faster!

- Un-batch the sweeps: 1.1M jobs
- 5-10 minute per-job runtime

# Enter the cloud

- Used 10 AWS availability zones, spanning 3 regions
- Spot instances from the m3, c3, and r3 families

# Pool setup

- One pool per availability zone
- Two schedulers per pool

# How we did it

- CycleCloud autoscaled multiple instance types and multiple availability zones
- CycleServer spread jobs across multiple schedulers/pools based on load
- Used Amazon S3 instead of a shared filer

# HTCondor configuration

- Very little!
- NEGOTIATOR\_CYCLE\_DELAY and NEGOTIATOR\_INTERVAL set to 1
- CLAIM\_WORKLIFE set to 1 hour
- \*\_QUERY\_WORKERS set to 10

# HTCondor configuration

- SHADOW\_WORKLIFE set to 1 hour
- JOB\_START\_COUNT set to 100
- Disabled authentication

# We did it!

- Went from 0 to 50k cores in 23 minutes
- Peaked at ~ 70K cores from 5689 instances
- Simulation completed in 8 hours
- Infrastructure cost: \$5,594

# Where do we go from here?

**Better-er answers. Faster-er.**



# If you build it, they will come

- Large financial institution actuarial modeling
  - Originally just wanted to do Federal Reserve stress tests
  - Then month-end actuarial runs
  - Now regularly use 8000 cores in AWS

# Coming concerns

- Data movement
- Multi-provider cloud usage
- Seamless burst to cloud

# We write software to do this...

*Cycle Computing easily orchestrates workloads and data access to local and Cloud technical computing*

- Scales from 100 - 100,000's of cores
- Handles errors, reliability
- Schedules data movement
- Secures, encrypts and audits
- Provides reporting and chargeback
- Automates spot bidding
- Supports Enterprise operations



# Does this resonate with you?



We're hiring software  
developers, HPC  
engineers, sales, etc.

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