

```
/**
 * CUDA Kernel Device code for combined rotation and cropping of a list of images.
 */
template <unsigned int block_size>
global void
rotateAndCropTexture kernel(float *rotatedImages, float *image, int neuron_size,
int neuron_dim, int image_dim, float *cosAlpha, float *sinAlpha)
{
    int x2 = blockIdx.x * blockDim.x + threadIdx.x;
    float cosAlpha_local = cosAlpha[blockIdx.z];
    float sinAlpha_local = sinAlpha[blockIdx.z];

    if (inputData.verbose) cout << "\n Size of SOM = " << som.getSize() << endl;
    float *d_som = cuda alloc float(som.getSize());
    cuda_copyHostToDevice_float(d_som, som.getDataPointer(), som.getSize());

    // Memory allocation
    int rotatedImagesSize = inputData.numberOfChannels * inputData.numberOfRotationsAndFlip * inputData.neuron_size;
    if (inputData.verbose) cout << "\n Size of rotated images = " << rotatedImagesSize * sizeof(float) << " bytes" << endl;
    float *d_rotatedImages = cuda_alloc_float(rotatedImagesSize);

    if (inputData.verbose) cout << "\n Size of euclidean distance matrix = " << inputData.som_size * sizeof(float) << " bytes" << endl;
    float *d_euclid = cuda_alloc_float(inputData.som_size * inputData.som_size * sizeof(float));

    // Prepare trigonometric values
    float *d_cosAlpha = NULL, *d_sinAlpha = NULL;
    int prMetricValues(&d_cosAlpha, &d_sinAlpha, inputData);

    int x2 = blockIdx.x * blockDim.x + threadIdx.x;
    int y2 = blockIdx.y * blockDim.y + threadIdx.y;
    int x0margin = x0 - margin;
    int y0margin = y0 - margin;

    float cosAlpha_local = cosAlpha[blockIdx.z];
    float sinAlpha_local = sinAlpha[blockIdx.z];

    int x1 = (x2-x0margin)*cosAlpha;
    int y1 = (y2-y0margin)*cosAlpha;
}
```

Astronomy in the Cloud

using cloud infrastructure to cooperate, scale, and democratise e-science

Crowd-sourcing / Citizen Science



The screenshot shows the homepage of the Galaxy Zoo website. The browser address bar displays 'www.galaxyzoo.org/#/'. The navigation menu includes 'CLASSIFY', 'STORY', 'SCIENCE', 'GALAXY ZOO' (in a yellow banner), 'DISCUSS', 'PROFILE', and 'LANGUAGE'. Social media icons for Facebook, Twitter, and RSS are visible. The main heading reads 'Few have witnessed what you're about to see' with a subtext: 'Experience a privileged glimpse of the distant universe as observed by the SDSS, the Hubble Space Telescope, and UKIRT'. A large image of a spiral galaxy is featured. Below it, the 'Classify Galaxies' section explains the need for help and includes a 'Begin Classifying' button. At the bottom, there are two columns: 'How Do Galaxies Form?' and 'History of Galaxy Zoo', each with a short introductory paragraph.

Crowd-sourcing / Citizen Science



The screenshot shows the Zooniverse website interface. At the top, there are two browser tabs: one for 'www.galaxyzoo.org/#/' and another for 'https://www.zooniverse.org'. The main content is organized into three sections: Climate, Humanities, and Nature. Each section contains several project cards with images and brief descriptions.

Climate

- Modelle des Erdklimas aus Logbüchern von Kriegsschiffen**
Helfe Wissenschaftlern Wetterbeobachtungen von britischen Royal Navy Schiffen aus dem 19. Jahrhundert zu bergen.
- Classify over 30 years of tropical cyclone data.**
Scientists at NOAA's National Climatic Data Center need your help.
CycloneCenter

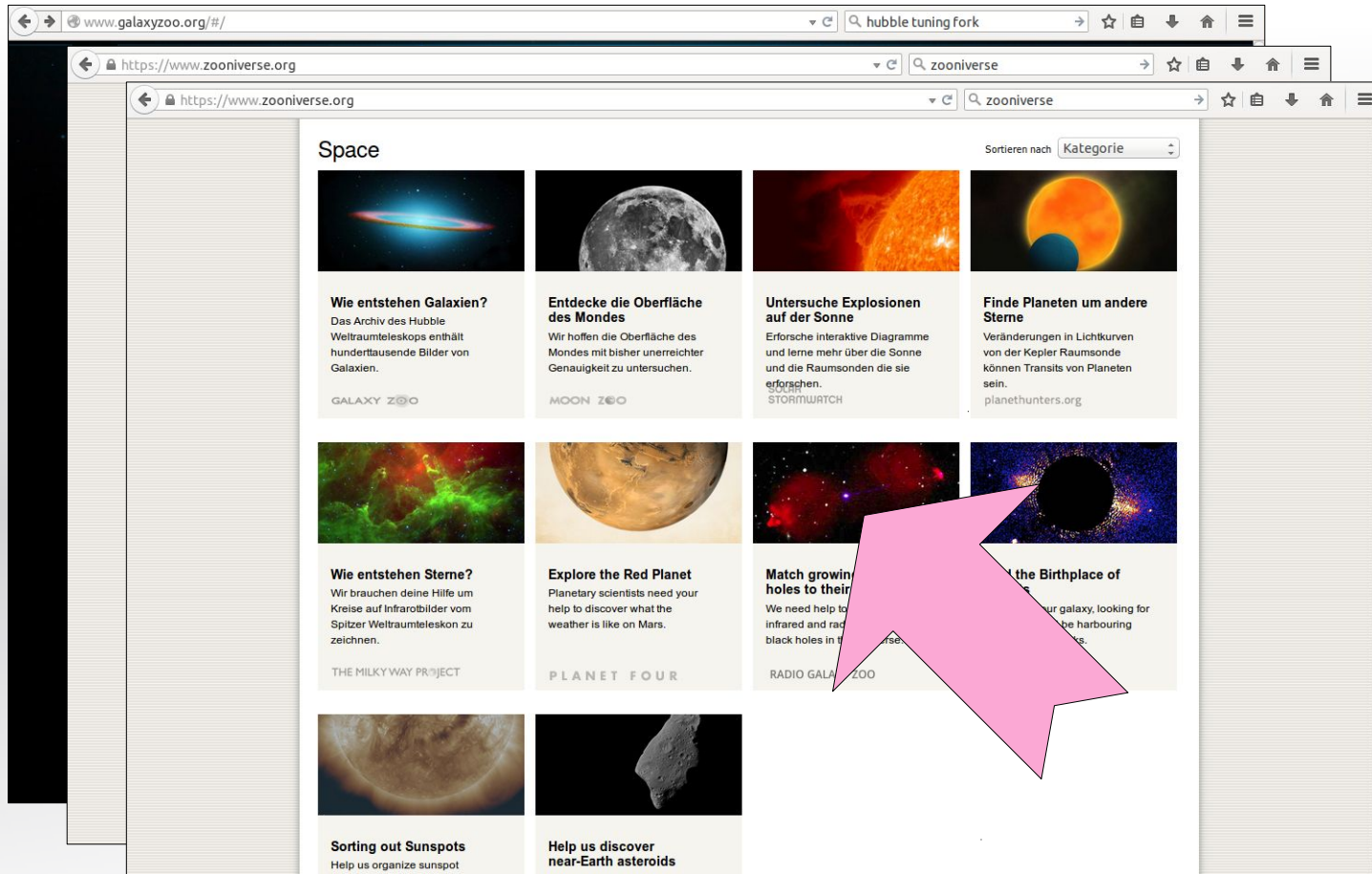
Humanities

- Studiere das Leben der Alten Griechen**
Die gesammelten Daten von Ancient Lives wird Wissenschaftlern helfen die Oxyrhynchuskollektion zu untersuchen.
UNIVERS
- Explore soldiers' diaries from the First World War**
Annotate and tag diaries from the First World War.
OPERATION WAR DIARY

Nature

- Hear Whales communicate**
You can help marine researchers understand what whales are saying.
WHALES
- Help explore the ocean floor**
The HabCam team and the Woods Hole Oceanographic Institution need your help!
SEAFLOOR EXPLORER
- You're hot on the trail of bats!**
Help scientists characterise bat calls recorded by citizen scientists.
BAT DETECTIVE
- Go wild in the Serengeti!**
We need your help to classify all the different animals caught in millions of camera trap images.
SNAPSHOT SERENGETI

Crowd-sourcing / Citizen Science



Crowd-sourcing / Citizen Science

A screenshot of a web browser displaying the Galaxy Zoo Radio website. The browser's address bar shows 'radio.galaxyzoo.org'. The website has a dark blue background with a starry pattern. At the top, there is a navigation menu with links for 'CLASSIFY', 'SCIENCE', 'TEAM', 'PROFILE', 'TALK', and 'BLOG'. The 'GALAXY ZOO RADIO' logo is prominently displayed in the center. Below the logo, the main heading reads 'In Search of Erupting Black Holes', followed by a sub-heading: 'Help astronomers discover supermassive black holes observed by the KG Jansky Very Large Array (NRAO) and the Australia Telescope Compact Array (CSIRO)'. A paragraph of text explains the search for black holes and their effects on galaxies. A yellow 'Begin Hunting' button is located at the bottom left of the main content area. On the right side, there is a large image of two galaxies with jets of material extending between them. In the top right corner of the website, there is a user profile for 'polsterer' with a 'SIGN OUT' button and a language selector set to 'English'. At the bottom right, there is a small line of text: 'NASA, ESA, S. Baum and C. O'Dea (RIT), R. Perley and W. Cotton (NRAO/AUI/NSF), and the Hubble Heritage Team (STScI/AURA)'.

www.galaxyzoo.org/#/

hubble tuning fork

https://www.zooniverse.org

zooniverse

radio.galaxyzoo.org

radio galaxy zoo

polsterer SIGN OUT English

CLASSIFY SCIENCE TEAM PROFILE TALK BLOG

GALAXY ZOO
RADIO

In Search of Erupting Black Holes

Help astronomers discover supermassive black holes observed by the KG Jansky Very Large Array (NRAO) and the Australia Telescope Compact Array (CSIRO)

Search for Black Holes

Black holes are found at the center of most, if not all, galaxies. The bigger the galaxy, the bigger the black hole and the more sensational the effect it can have on the host galaxy. These supermassive black holes drag in nearby material, growing to billions of times the mass of our sun and occasionally producing spectacular jets of material traveling nearly as fast as the speed of light. These jets often can't be detected in visible light, but are seen using radio telescopes. Astronomers need your help to find these jets and match them to the galaxy that hosts them.

[Begin Hunting](#)

NASA, ESA, S. Baum and C. O'Dea (RIT), R. Perley and W. Cotton (NRAO/AUI/NSF), and the Hubble Heritage Team (STScI/AURA)

Radio Galaxy Zoo



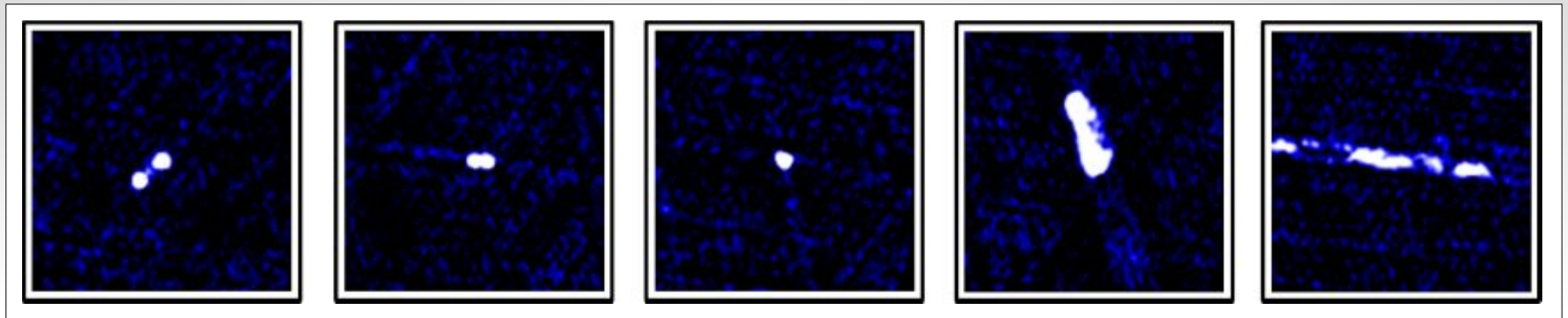
The screenshot shows the Radio Galaxy Zoo web interface. At the top, there is a navigation bar with the following links: CLASSIFY, SCIENCE, TEAM, GALAXY ZOO RADIO (highlighted in a blue and yellow banner), PROFILE, TALK, and BLOG. In the top right corner, there is a user profile for 'polsterer' with a 'SIGN OUT' link and a language selector set to 'English'. The main content area features a large blue-tinted image of a galaxy with white radio contours overlaid. To the right of the image are three circular icons: a magnifying glass, a monitor, and a keyboard. Below the image is a slider control labeled 'Radio' on the left and 'IR' on the right. Underneath the slider is the instruction 'Click on any radio contour or pair of jets'. At the bottom, there are four buttons: 'Cancel' (red), 'Reset All' (red), 'No Contours' (blue), and 'Done' (blue).

Radio Galaxy Zoo

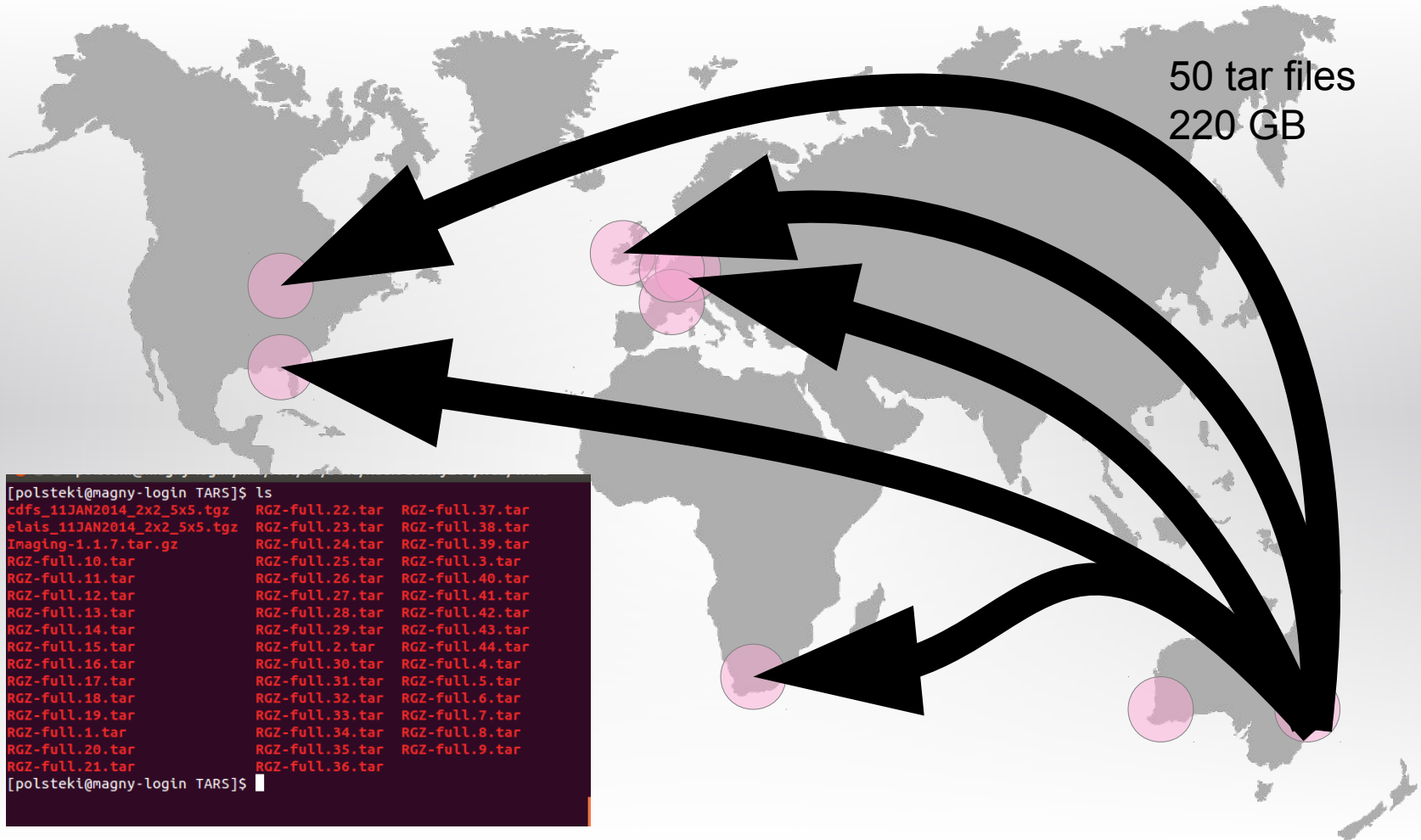


→ Banfield, et. al. 2015

classify
and
match
in the order of **200k** objects



Starting the Project

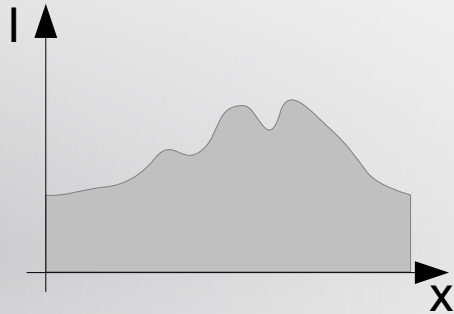


Preprocessing

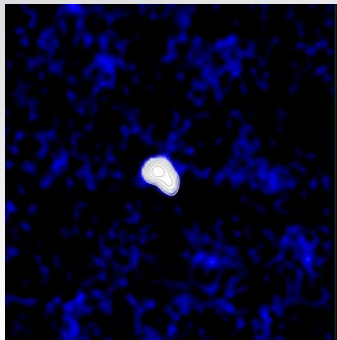
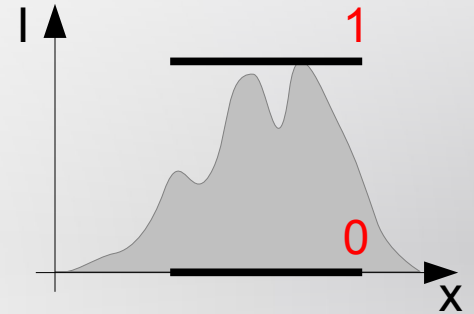


extract
matrix from fits

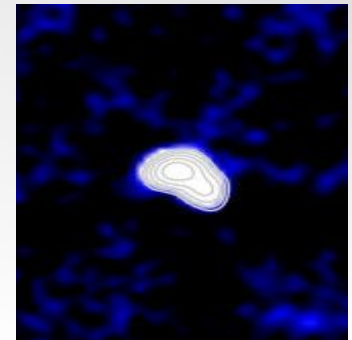
$$\mathbf{A} = \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1n} \\ A_{21} & & & A_{2n} \\ \vdots & & & \vdots \\ A_{n1} & A_{n2} & \cdots & A_{nn} \end{bmatrix}$$



normalize
flux relative to the maximum



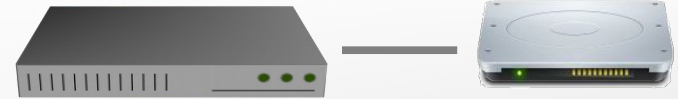
cutout
interesting region



Speeding up Preprocessing



single core python = **48**
hours



with  **hadoop**

on **4x16** cores = **4**
hours



file **access** is still the bottleneck!

New Images Extracted



```
[polsteki@magny-login TARS]$ ls
cdfs_11JAN2014_2x2_5x5.tgz  RGZ-full.22.tar  RGZ-full.37.tar
elais_11JAN2014_2x2_5x5.tgz  RGZ-full.23.tar  RGZ-full.38.tar
Imaging-1.1.7.tar.gz       RGZ-full.24.tar  RGZ-full.39.tar
RGZ-full.10.tar            RGZ-full.25.tar  RGZ-full.3.tar
RGZ-full.11.tar            RGZ-full.26.tar  RGZ-full.40.tar
RGZ-full.12.tar            RGZ-full.27.tar  RGZ-full.41.tar
RGZ-full.13.tar            RGZ-full.28.tar  RGZ-full.42.tar
RGZ-full.14.tar            RGZ-full.29.tar  RGZ-full.43.tar
RGZ-full.15.tar            RGZ-full.2.tar   RGZ-full.44.tar
RGZ-full.16.tar            RGZ-full.30.tar  RGZ-full.4.tar
RGZ-full.17.tar            RGZ-full.31.tar  RGZ-full.5.tar
RGZ-full.18.tar            RGZ-full.32.tar  RGZ-full.6.tar
RGZ-full.19.tar            RGZ-full.33.tar  RGZ-full.7.tar
RGZ-full.1.tar             RGZ-full.34.tar  RGZ-full.8.tar
RGZ-full.20.tar            RGZ-full.35.tar  RGZ-full.9.tar
RGZ-full.21.tar            RGZ-full.36.tar
[polsteki@magny-login TARS]$
```

Similarity Measure



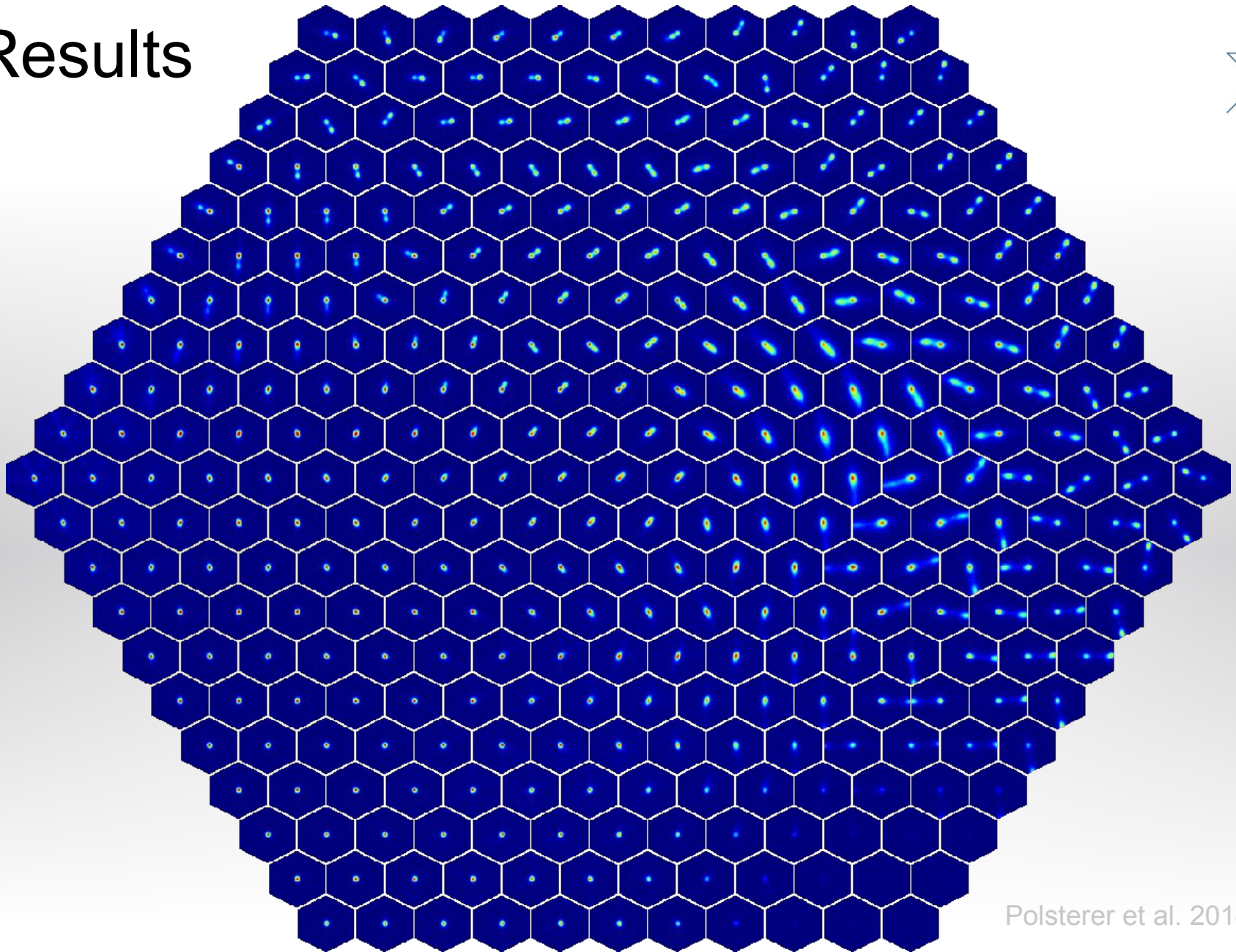
calculate the pixel based
Euclidean distance

for all possible
rotations
and find the best matching angle

A series of green, 3D-style letters spelling 'rotations' are arranged in a semi-circular arc. Each letter is rotated at a different angle, demonstrating the process of testing various orientations to find the best match.

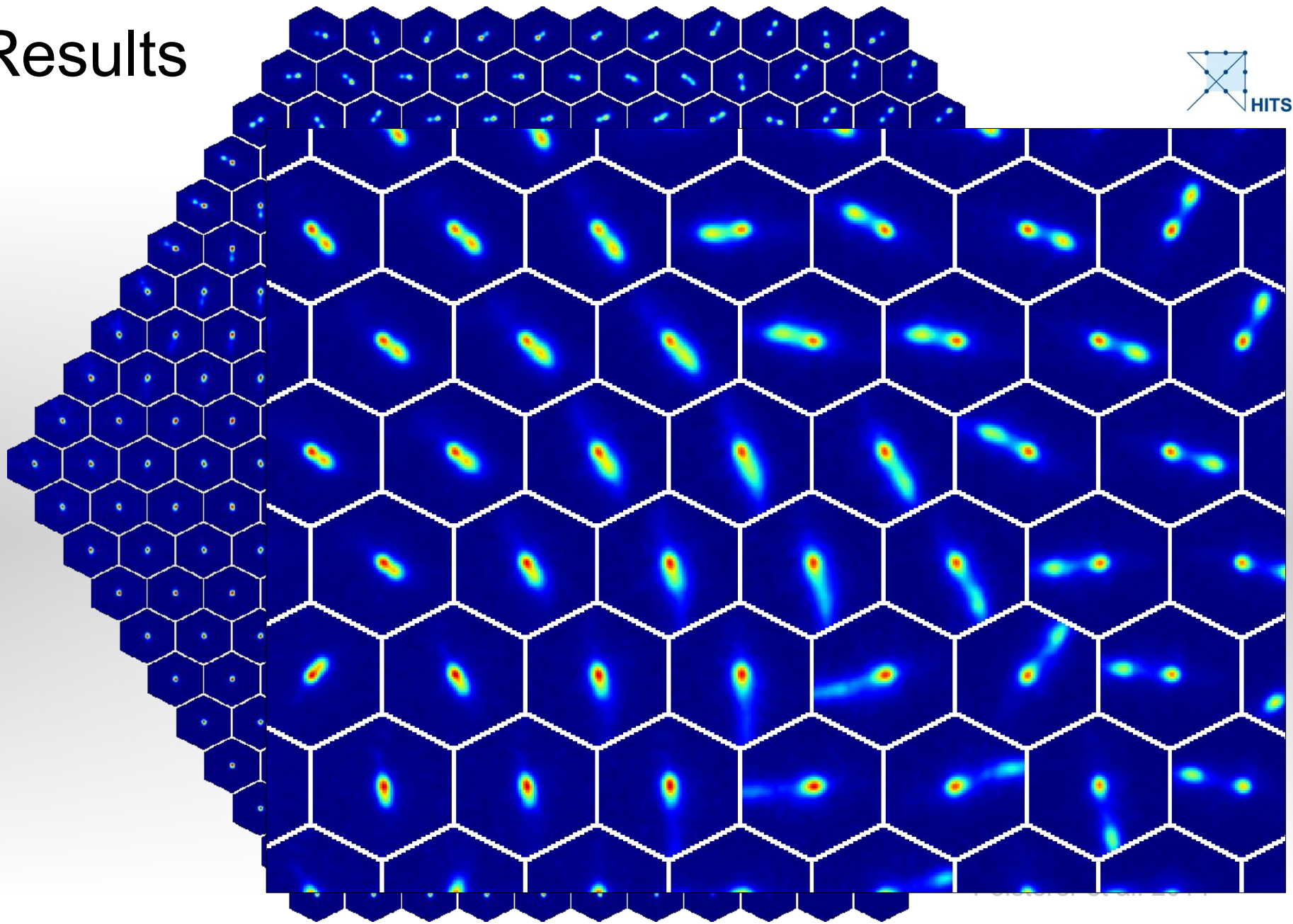
via
minimization → **GPU**

Results

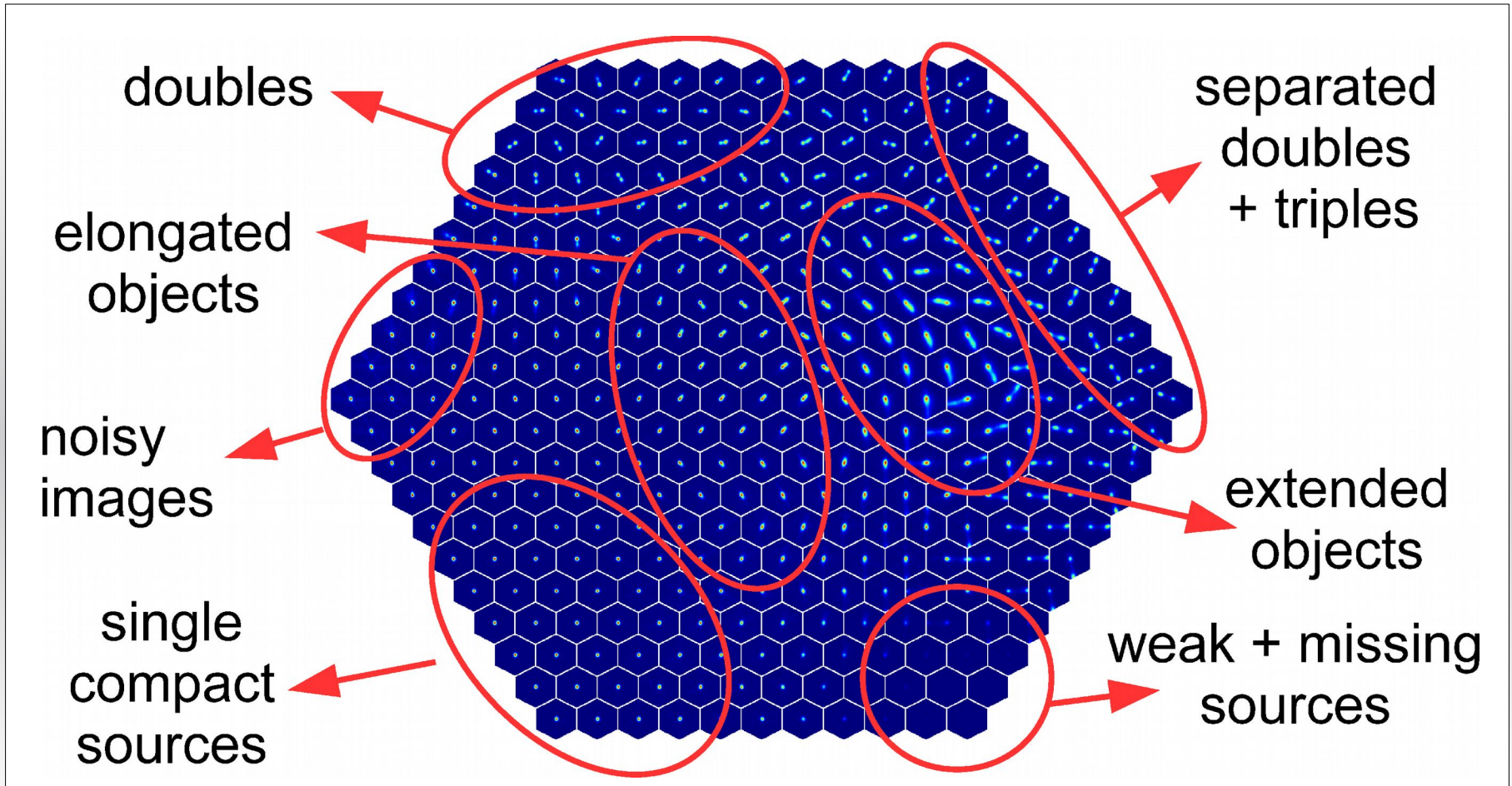


Polsterer et al. 2014

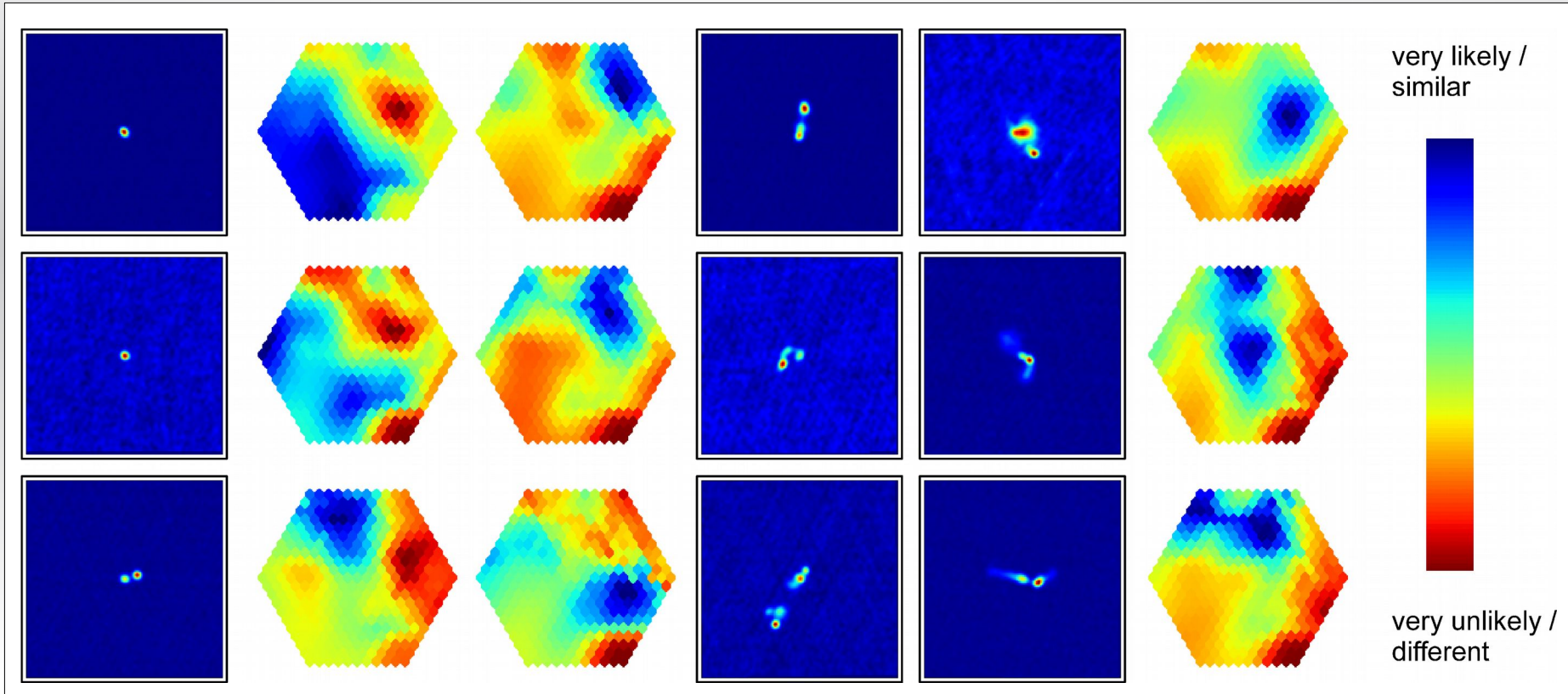
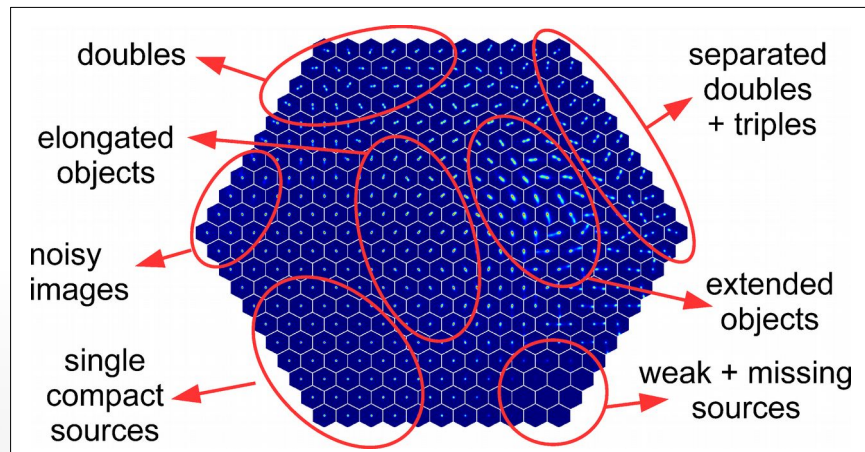
Results



Results and Analysis



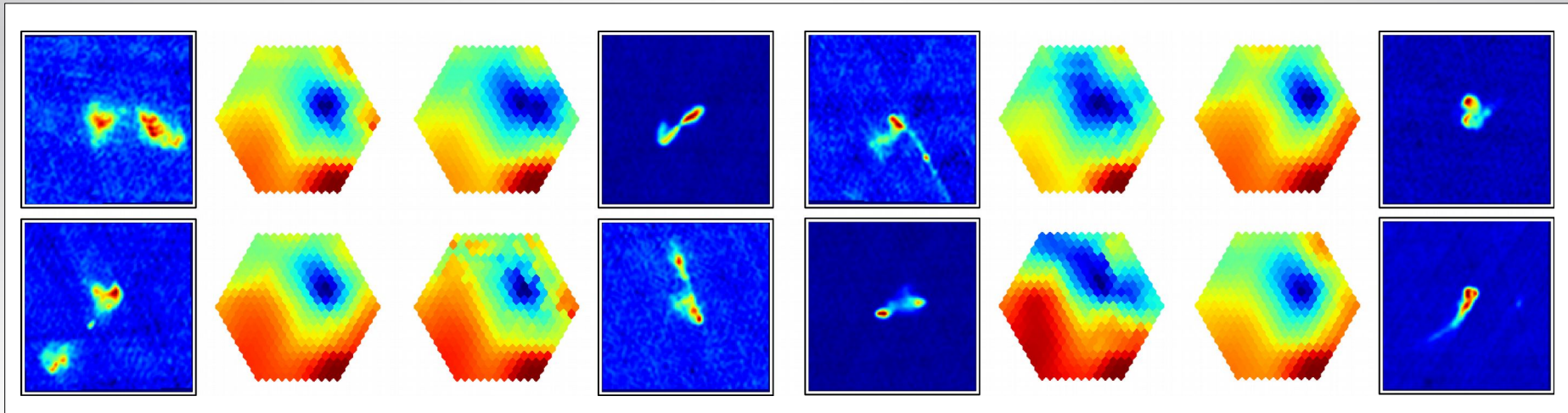
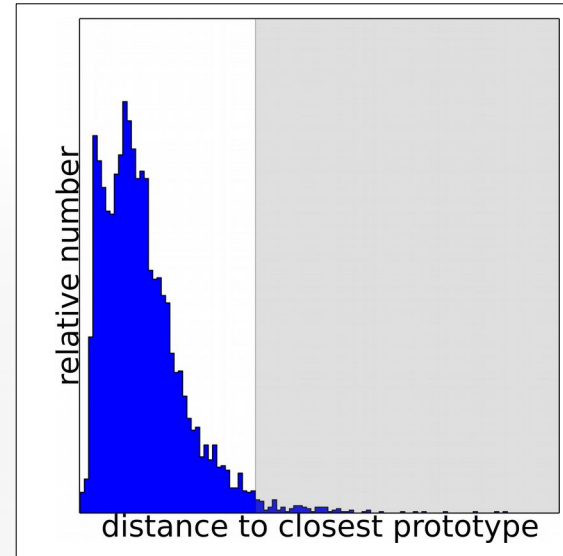
Processing



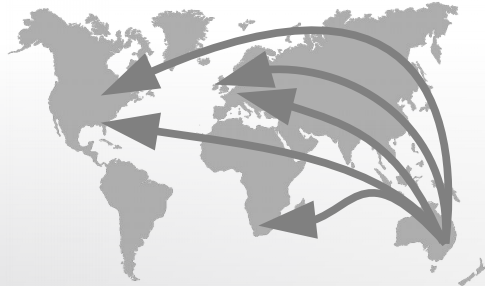
Interesting Objects



select
outliers
based
on distribution of distances



The Downsides of this Approach



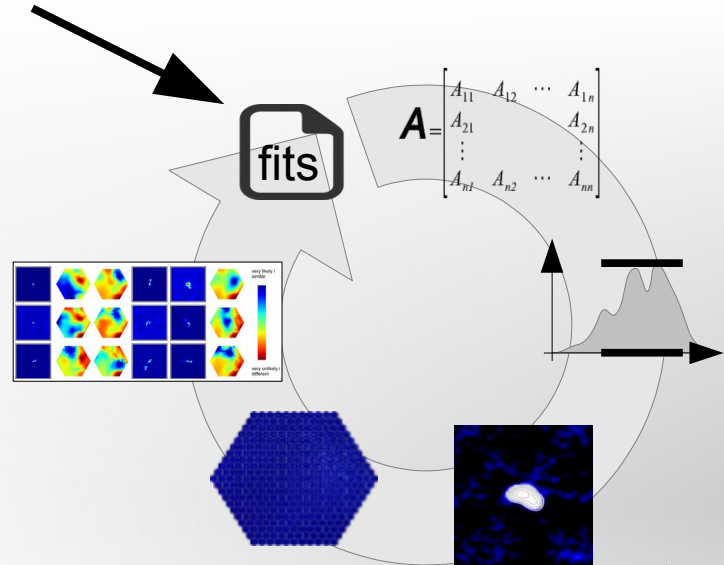
a lot of local copies

no orchestration of work-flow



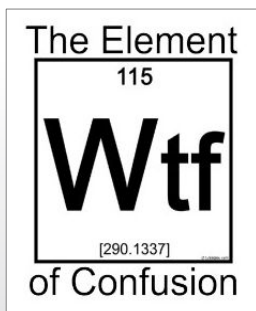
bad exchange of intermediate results

very exclusive concerning hardware requirements



NVIDIA Tesla K40

A new Project



Widefield ou**T**lier **F**inder
(Ray Norris)

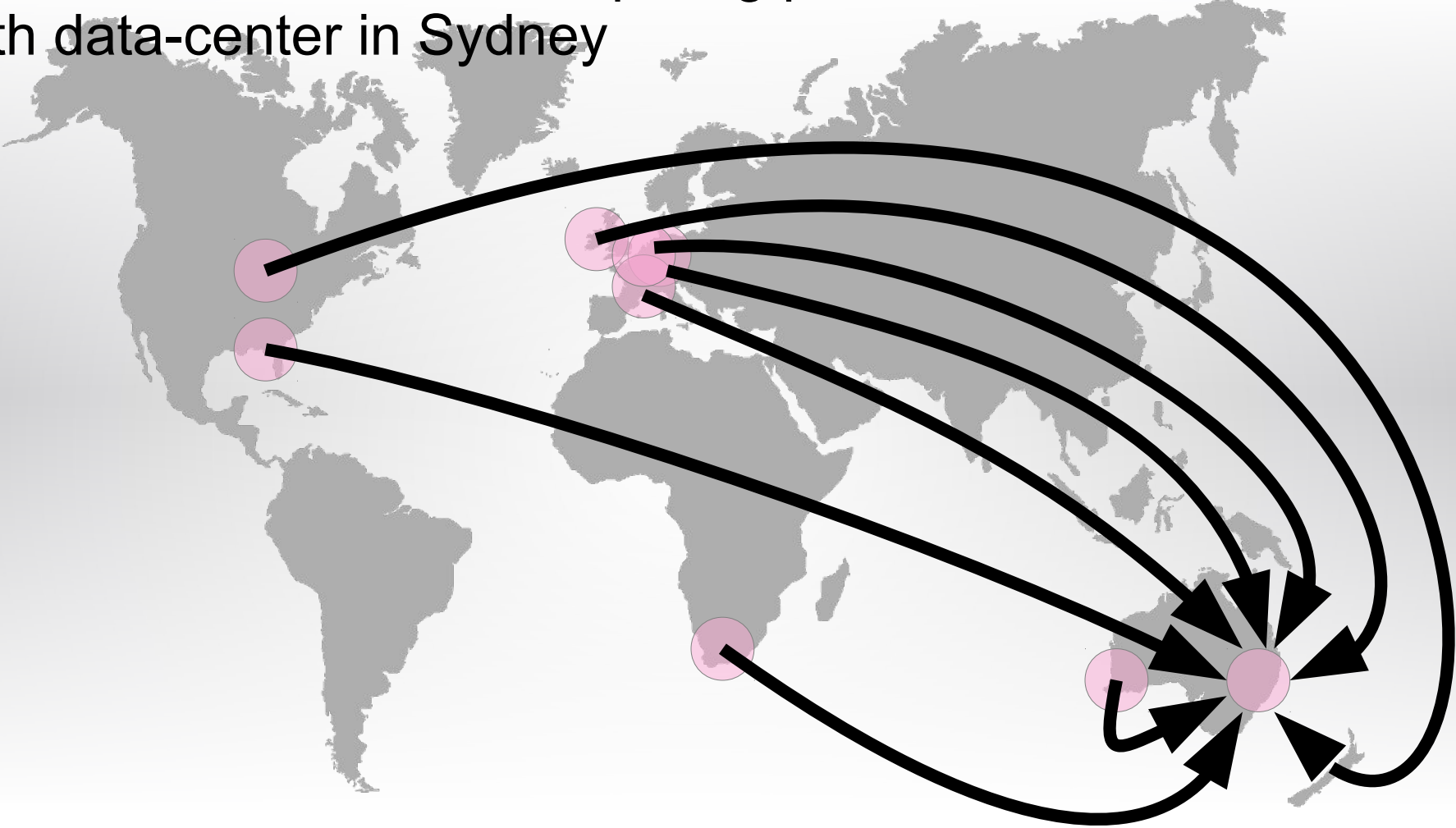
ASKAP-EMU project from **2.5 mill.** → **70 mill.** known radio sources

develop methodology to discover
unexpected
science in large data sets

A new Concept



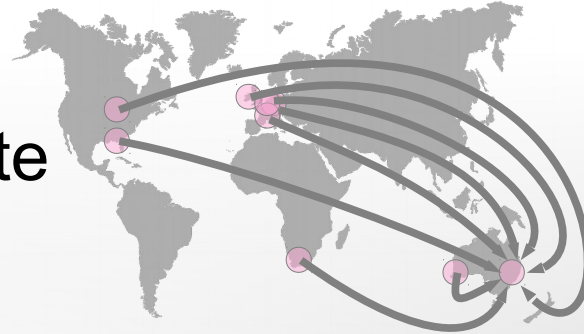
use commercial cloud computing provider
with data-center in Sydney



The Concept

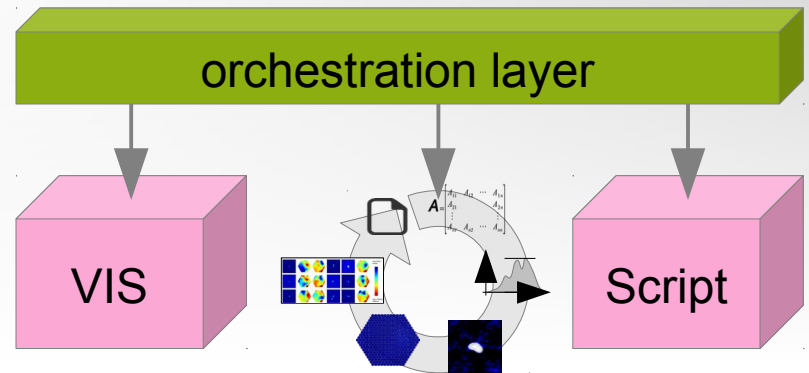


centralized storage and compute



embedded repository and project management tool

script all preprocessing and provide orchestration



Why use a Company?

international project:

- who is providing resources?
- who has the infrastructure?
- who provides the services?

why not run our own science cloud?

- using open stack



Why use a Company?

international project:

- who is providing resources?
- who has the infrastructure?
- who provides the services?

why not run our own science cloud?

- using open stack

who does currently
provide this
for astronomy?



Commercial Cloud Provider

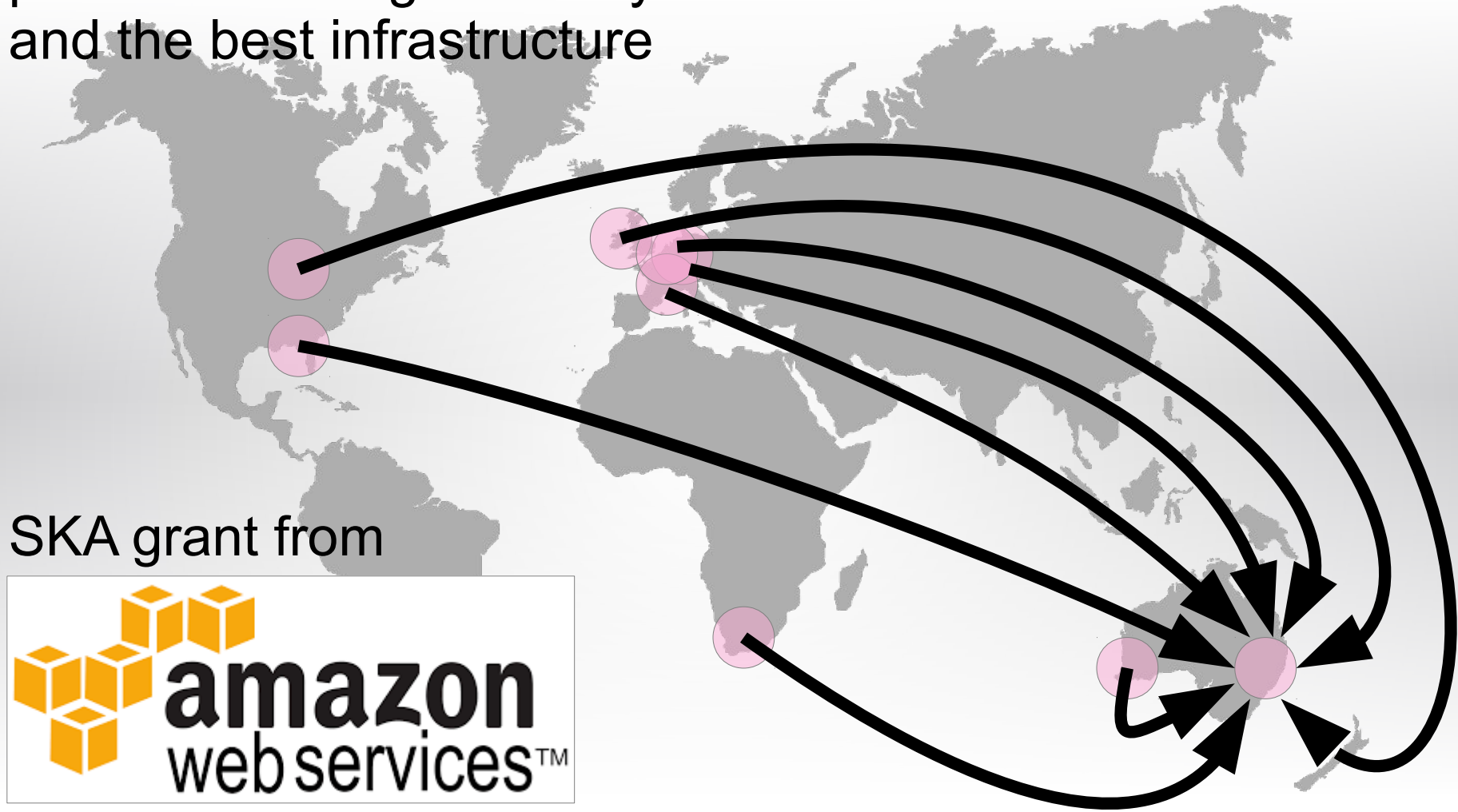
There are many Cloud Providers



Use Amazon Web Services



provides the largest variety of services and the best infrastructure



SKA grant from



What is really new?

scaling **UP** and **DOWN** immediately

no longer depending on
exclu\$ive
hardware requirements

no **difference** between small university institutes and
large research centers

data via credits
challenges open to all

Basics



The screenshot displays the AWS Management Console interface. At the top, the browser address bar shows the URL `https://eu-central-1.console.aws.amazon.com/console/home?region=eu-central-1`. The navigation bar includes the AWS logo, 'Services', 'Edit', and user information for 'R&D AIN HITS gGmbH' in 'Frankfurt'.

The main content area is titled 'Amazon Web Services' and lists various services grouped into categories:

- Compute:** EC2 (Virtual Servers in the Cloud), EC2 Container Service (Run and Manage Docker Containers), Elastic Beanstalk (Run and Manage Web Apps), Lambda (Run Code in Response to Events).
- Storage & Content Delivery:** S3 (Scalable Storage in the Cloud), CloudFront (Global Content Delivery Network), Elastic File System (Fully Managed File System for EC2), Glacier (Archive Storage in the Cloud), Storage Gateway (Integrates On-Premises IT Environments with Cloud Storage).
- Database:** RDS (MySQL, Postgres, Oracle, SQL Server, and Amazon Aurora), DynamoDB (Predictable and Scalable NoSQL Data Store), ElastiCache (In-Memory Cache), Redshift (Managed Petabyte-Scale Data Warehouse Service).
- Networking:** VPC (Isolated Cloud Resources), Direct Connect (Dedicated Network Connection to AWS), Route 53 (Scalable DNS and Domain Name Registration).
- Developer Tools:** CodeCommit (Store Code in Private Git Repositories), CodeDeploy (Automate Code Deployments), CodePipeline (Release Software using Continuous Delivery).
- Management Tools:** CloudWatch (Monitor Resources and Applications), CloudFormation (Create and Manage Resources with Templates), CloudTrail (Track User Activity and API Usage), Config (Track Resource Inventory and Changes), OpsWorks (Automate Operations with Chef), Service Catalog (Create and Use Standardized Products).
- Security & Identity:** Identity & Access Management (Manage User Access and Encryption Keys), Directory Service (Host and Manage Active Directory), Trusted Advisor (Optimize Performance and Security).
- Analytics:** EMR (Managed Hadoop Framework), Data Pipeline (Orchestration for Data-Driven Workflows), Kinesis (Real-time Processing of Streaming Big Data), Machine Learning (Build Smart Applications Quickly and Easily).
- Mobile Services:** Cognito (User Identity and App Data Synchronization), Device Farm (Test Android, Fire OS, and iOS apps on real devices in the Cloud), Mobile Analytics (Collect, View and Export App Analytics), SNS (Push Notification Service).
- Application Services:** API Gateway (Build, Deploy and Manage APIs), AppStream (Low Latency Application Streaming), CloudSearch (Managed Search Service), Elastic Transcoder (Easy-to-use Scalable Media Transcoding), SES (Email Sending Service), SQS (Message Queue Service), SWF (Workflow Service for Coordinating Application Components).
- Enterprise Applications:** WorkSpaces (Desktops in the Cloud), WorkDocs (Secure Enterprise Storage and Sharing Service), WorkMail (Secure Email and Calendaring Service).

On the right side, the 'Resource Groups' section explains that a resource group is a collection of resources that share one or more tags. It includes buttons for 'Create a Group' and 'Tag Editor'. Below this, the 'Additional Resources' section provides links for 'Getting Started', 'AWS Console Mobile App', 'AWS Marketplace', 'AWS Lambda', and 'Service Health'. The 'Service Health' section shows a green checkmark indicating that all services are operating normally, with an update timestamp of 'Sep 09 2015 08:45:02 GMT+0200' and a link to the 'Service Health Dashboard'.

Basics



The screenshot shows the AWS Management Console interface. The browser address bar displays `https://eu-central-1.console.aws.amazon.com/console/home?region=eu-central-1`. The navigation bar includes 'AWS', 'Services', and 'Edit' menus. The main content area is titled 'Amazon Web Services' and lists various services categorized into Compute, Storage & Content Delivery, Database, Networking, Developer Tools, Management Tools, Security & Identity, Analytics, Mobile Services, Application Services, and Enterprise Applications. The 'Identity & Access Management' service is highlighted with a red rectangular box. On the right side, there are sections for 'Resource Groups', 'Additional Resources', and 'Service Health'. The 'Service Health' section shows a green checkmark and the text 'All services operating normally.' The footer of the console contains the URL `https://console.aws.amazon.com/iam/home?region=eu-central-1`, copyright information for 2008-2015, and links for 'Privacy Policy' and 'Terms of Use'.

Basics



Dashboard

- Details
- Groups**
- Users
- Roles
- Policies
- Identity Providers
- Account Settings
- Credential Report
- Encryption Keys

Welcome to Identity and Access Management

IAM users sign-in link:
<https://astroinformatix.signin.aws.amazon.com/console> Customize | Copy Link

IAM Resources

Users: 1 Roles: 0
Groups: 2 Identity Providers: 0
Customer Managed Policies: 1

Security Status

4 out of 5 complete.

<input checked="" type="checkbox"/>	Delete your root access keys	▼
<input type="checkbox"/>	Activate MFA on your root account	▼
<input checked="" type="checkbox"/>	Create individual IAM users	▼
<input checked="" type="checkbox"/>	Use groups to assign permissions	▼
<input checked="" type="checkbox"/>	Apply an IAM password policy	▼

Feature Spotlight

Introduction to AWS IAM

0:00 / 2:16

Additional Information

- [IAM documentation](#)
- [Web Identity Federation Playground](#)
- [Policy Simulator](#)
- [Videos, IAM release history and additional resources](#)

Feedback English

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Basics



Account:

User Name:

Password:

I have an MFA Token [\(more info\)](#)

[Sign-in using root account credentials](#)

An illustration for Amazon API Gateway showing a yellow shield, a smartphone, and various network icons connected by lines, set against a grey background with circuit-like patterns.

Introducing
Amazon API Gateway
Easily build and run your APIs at AWS scale

English

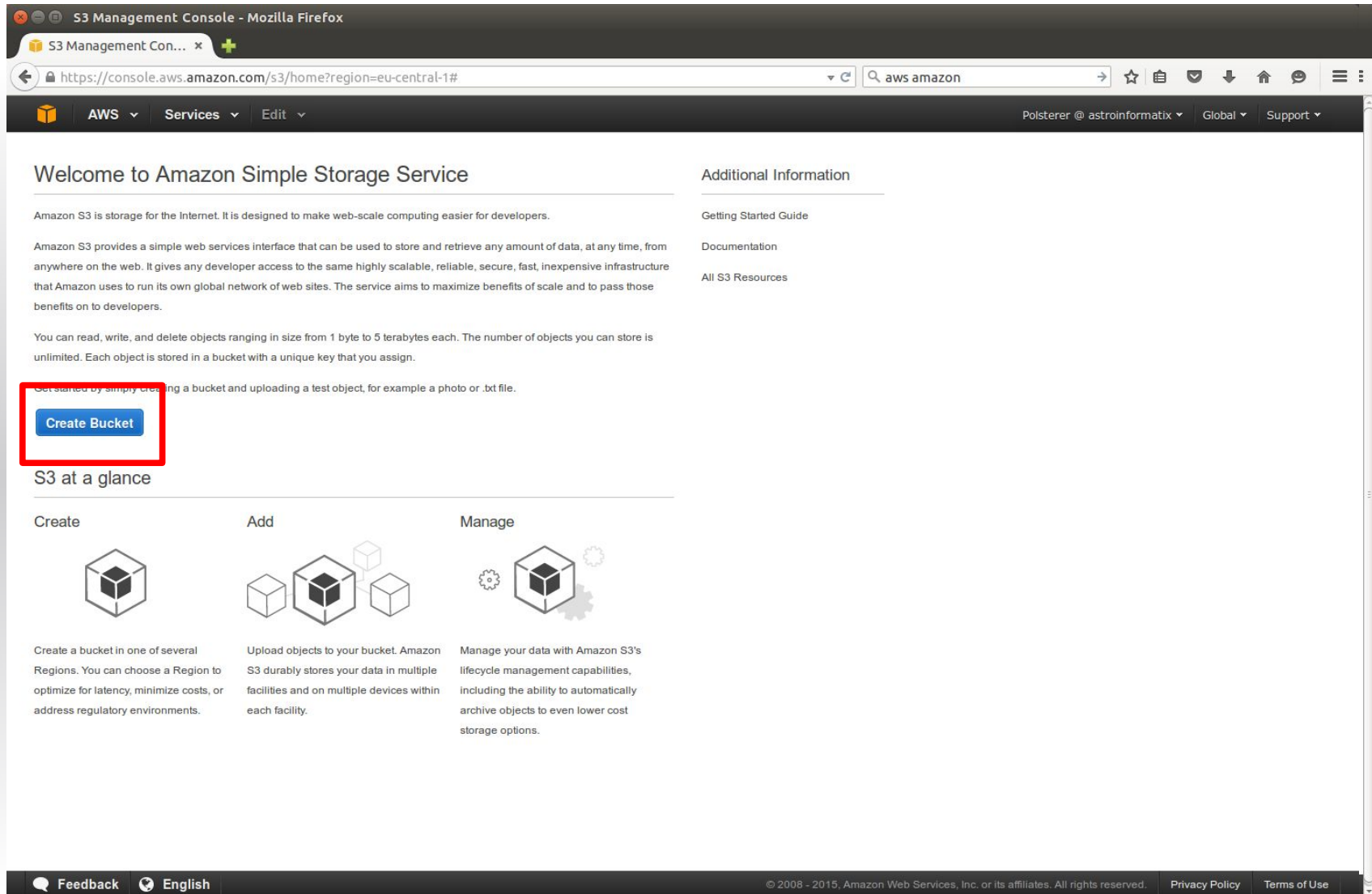
[Terms of Use](#) [Privacy Policy](#) © 1996-2015, Amazon Web Services, Inc. or its affiliates.

Simple/Scalable Storage Service (S3)



The screenshot shows the AWS Management Console interface. The 'Storage & Content Delivery' section is expanded, and the 'S3' service is highlighted with a red box. The S3 service is described as 'Scalable Storage in the Cloud'. Other services listed include EC2, Elastic Beanstalk, Lambda, CloudFront, Elastic File System, Glacier, and Storage Gateway. The right sidebar shows 'Resource Groups' and 'Additional Resources' with links to documentation and mobile apps. The bottom of the console displays 'Feedback', 'English', and copyright information.

Simple/Scalable Storage Service (S3)

A screenshot of the Amazon S3 Management Console in a Mozilla Firefox browser. The browser address bar shows the URL 'https://console.aws.amazon.com/s3/home?region=eu-central-1#'. The page title is 'S3 Management Console - Mozilla Firefox'. The main content area is titled 'Welcome to Amazon Simple Storage Service'. It contains several paragraphs of introductory text and a 'Create Bucket' button highlighted with a red box. Below this is a section titled 'S3 at a glance' with three columns: 'Create', 'Add', and 'Manage', each with an icon and a brief description. The footer contains 'Feedback', 'English', and copyright information for Amazon Web Services, Inc. (© 2008 - 2015).

Welcome to Amazon Simple Storage Service

Amazon S3 is storage for the Internet. It is designed to make web-scale computing easier for developers.

Amazon S3 provides a simple web services interface that can be used to store and retrieve any amount of data, at any time, from anywhere on the web. It gives any developer access to the same highly scalable, reliable, secure, fast, inexpensive infrastructure that Amazon uses to run its own global network of web sites. The service aims to maximize benefits of scale and to pass those benefits on to developers.

You can read, write, and delete objects ranging in size from 1 byte to 5 terabytes each. The number of objects you can store is unlimited. Each object is stored in a bucket with a unique key that you assign.

Get started by simply creating a bucket and uploading a test object, for example a photo or .txt file.

Create Bucket

S3 at a glance

Create



Create a bucket in one of several Regions. You can choose a Region to optimize for latency, minimize costs, or address regulatory environments.

Add



Upload objects to your bucket. Amazon S3 durably stores your data in multiple facilities and on multiple devices within each facility.

Manage



Manage your data with Amazon S3's lifecycle management capabilities, including the ability to automatically archive objects to even lower cost storage options.

Simple/Scalable Storage Service (S3)

A screenshot of the Amazon S3 Management Console in a Mozilla Firefox browser. The browser's address bar shows the URL 'https://console.aws.amazon.com/s3/home?region=eu-central-1#'. The page title is 'S3 Management Console - Mozilla Firefox'. The main content area displays 'Welcome to Amazon Simple Storage Service' and 'Additional Information'. A modal dialog box titled 'Create a Bucket - Select a Bucket Name and Region' is open in the foreground. The dialog box contains the following text: 'A bucket is a container for objects stored in Amazon S3. When creating a bucket, you can choose a Region to optimize for latency, minimize costs, or address regulatory requirements. For more information regarding bucket naming conventions, please visit the [Amazon S3 documentation](#).' Below this text, there are two input fields: 'Bucket Name:' with the value 'radiogalaxyzoq' and 'Region:' with a dropdown menu showing 'Frankfurt'. A red rectangular box highlights these two input fields. At the bottom of the dialog box, there are three buttons: 'Set Up Logging >', 'Create', and 'Cancel'. The background of the console shows a 'Create Bucket' button and a 'S3 at a glance' section with three columns of information.

Simple/Scalable Storage Service (S3)



The screenshot shows the AWS S3 Management Console in Mozilla Firefox. The browser address bar shows the URL: <https://console.aws.amazon.com/s3/home?region=eu-central-1#>. The page title is "S3 Management Console - Mozilla Firefox".

The main content area is titled "Bucket: radiogalaxyzoo". It displays the following information:

- Bucket:** radiogalaxyzoo
- Region:** Frankfurt
- Creation Date:** Wed Sep 09 08:54:23 GMT+200 2015
- Owner:** 59f8d57afd5753a2e044243915dbc33aa4c9f3718ec1e70dcb0943b3d446f4ea

Below this information is a list of configuration options, each with a right-pointing chevron icon:

- Permissions
- Static Website Hosting
- Logging
- Events
- Versioning
- Lifecycle
- Cross-Region Replication
- Tags
- Requester Pays

A red rectangular box highlights the list of configuration options.

At the bottom of the console, there is a footer with "Feedback" and "English" links on the left, and "© 2008 - 2015, Amazon Web Services, Inc. or its affiliates. All rights reserved.", "Privacy Policy", and "Terms of Use" on the right.

Simple/Scalable Storage Service (S3)



The screenshot shows the AWS S3 Management Console in a Mozilla Firefox browser window. The browser address bar shows the URL `https://console.aws.amazon.com/s3/home?region=eu-central-1#`. The console header includes the AWS logo, navigation menus for 'Services' and 'Edit', and user information for 'Polsterer @ astroinformatix'. Below the browser window, a terminal window titled 'polsteki@magny-login:~' is open. The terminal shows the command `aws configure` being executed, with the following prompts and responses:

```
[polsteki@magny-login ~]$ /home/polsteki/aws configure
AWS Access Key ID [*****YNUQ]:
AWS Secret Access Key [*****mmwA]:
Default region name [eu-central-1]:
Default output format [json]:
[polsteki@magny-login ~]$
```

A red rectangular box highlights the input fields for the AWS Access Key ID and the AWS Secret Access Key. Below the terminal window, a white text box contains the command:

```
aws sync RadioGalaxyZoo s3://radiogalaxyzoo
```

At the bottom of the screenshot, there is a footer with 'Feedback' and 'English' links on the left, and copyright information '© 2008 - 2015, Amazon Web Services, Inc. or its affiliates. All rights reserved.' along with 'Privacy Policy' and 'Terms of Use' links on the right.

Simple/Scalable Storage Service (S3)



The screenshot shows the AWS S3 Management Console interface. The browser address bar displays the URL: `https://console.aws.amazon.com/s3/home?region=eu-central-1#`. The page title is "S3 Management Console - Mozilla Firefox". The navigation bar includes "AWS", "Services", and "Edit" menus, along with the user name "Polsterer @ astroinformatix" and "Global" region. The main content area shows the "radiogalaxyzoo" bucket details. On the left, a table lists the bucket's contents:

Name	Storage Class	Size
RGZ	--	--
download.sh	Standard	66 bytes

On the right, the bucket properties are displayed:

- Bucket:** radiogalaxyzoo
- Region:** Frankfurt
- Creation Date:** Wed Sep 09 08:54:23 GMT+200 2015
- Owner:** 59f8d57afd5753a2e044243915dbc33aa4c9f3718ec1e70dcb0943b3d446f4ea

The "Permissions" section is expanded to show "Static Website Hosting" options, which are highlighted with a red box:

You can [host your static website](#) entirely on Amazon S3. Once you enable your bucket for static website hosting, all your content is accessible to web browsers via the Amazon S3 website endpoint for your bucket.

Endpoint: `radiogalaxyzoo.s3-website.eu-central-1.amazonaws.com`

Each bucket serves a website namespace (e.g. "www.example.com"). Requests for your host name (e.g. "example.com" or "www.example.com") can be routed to the contents in your bucket. You can also redirect requests to another host name (e.g. redirect "example.com" to "www.example.com"). See our [walkthrough](#) for how to set up an Amazon S3 static website with your host name.

Do not enable website hosting

Enable website hosting

Redirect all requests to another host name

The footer of the console includes "Feedback", "English", "© 2008 - 2015, Amazon Web Services, Inc. or its affiliates. All rights reserved.", "Privacy Policy", and "Terms of Use".

Simple/Scalable Storage Service (S3)




Amazon S3 Masterclass - Mozilla Firefox

Amazon S3 Mastercl... x


www.slideshare.net/AmazonWebServices/amazon-s3-masterclass

www.slideshare.net/AmazonWebServices/amazon-s3-masterclass

Welcome to the AWS Cloud.




Be the first to clip this slide



Masterclass

Amazon S3

Ian Massingham — Technical Evangelist
ianmas@amazon.com
@IanMmmm



Clip slide 1 of 142

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pam09
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george.james
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Elastic Cloud Computing (EC2)



The screenshot shows the AWS Management Console interface. The top navigation bar includes the AWS logo, 'Services', and 'Edit' dropdowns. The main content area is titled 'Amazon Web Services' and is organized into several columns of service cards. The 'Compute' column is highlighted with a red box and contains the following services:

- EC2** (Virtual Servers in the Cloud)
- EC2 Container Service (Run and Manage Docker Containers)
- Elastic Beanstalk (Run and Manage Web Apps)
- Lambda (Run Code in Response to Events)

Other columns include:

- Developer Tools:** CodeCommit, CodeDeploy, CodePipeline.
- Mobile Services:** Cognito, Device Farm, Mobile Analytics, SNS.
- Application Services:** API Gateway, AppStream, CloudSearch, Elastic Transcoder, SES, SQS, SWF.
- Enterprise Applications:** WorkSpaces, WorkDocs, WorkMail.
- Storage & Content Delivery:** S3, CloudFront, Elastic File System, Glacier, Storage Gateway.
- Database:** RDS, DynamoDB, ElastiCache, Redshift.
- Networking:** VPC, Direct Connect, Route 53.
- Management Tools:** CloudWatch, CloudFormation, CloudTrail, Config, OpsWorks, Service Catalog.
- Security & Identity:** Identity & Access Management, Directory Service, Trusted Advisor.
- Analytics:** EMR, Data Pipeline, Kinesis, Machine Learning.

On the right side, there is a 'Resource Groups' section with a 'Create a Group' button and a 'Tag Editor' button. Below it is the 'Additional Resources' section with links for 'Getting Started', 'AWS Console Mobile App', 'AWS Marketplace', and 'AWS Lambda'. At the bottom right, the 'Service Health' section shows a green checkmark and the text 'All services operating normally.' with an update timestamp of 'Sep 09 2015 08:51:01 GMT+0200'.

Elastic Cloud Computing (EC2)



EC2 Management Console - Mozilla Firefox

S3 Management Con... x EC2 Management C... x

https://eu-central-1.console.aws.amazon.com/ec2/v2/home?regi Search

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EC2 Dashboard

- Events
- Tags
- Reports
- Limits
- INSTANCES
 - Instances
 - Spot Requests
 - Reserved Instances
- IMAGES
 - AMIs
 - Bundle Tasks
- ELASTIC BLOCK STORE
 - Volumes
 - Snapshots
- NETWORK & SECURITY
 - Security Groups
 - Elastic IPs
 - Placement Groups
 - Key Pairs**
 - Network Interfaces
- LOAD BALANCING
 - Load Balancers

Resources

You are using the following Amazon EC2 resources in the EU Central (Frankfurt) region:

- 0 Running Instances
- 0 Elastic IPs
- 0 Volumes
- 0 Snapshots
- 0 Key Pairs
- 0 Load Balancers
- 0 Placement Groups
- 1 Security Groups

Create Instance

To start using Amazon EC2 you will want to launch a virtual server, known as an Amazon EC2 instance.

[Launch Instance](#)

Note: Your instances will launch in the EU Central (Frankfurt) region

Service Health **Scheduled Events**

Service Status: **EU Central (Frankfurt):**

- EU Central (Frankfurt): This service is operating normally
- No events

Availability Zone Status:

- eu-central-1a: Availability zone is operating normally

Account Attributes

Supported Platforms

- VPC

Default VPC

- vpc-36cf215f

Additional Information

- [Getting Started Guide](#)
- [Documentation](#)
- [All EC2 Resources](#)
- [Forums](#)
- [Pricing](#)
- [Contact Us](#)

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Elastic Cloud Computing (EC2)



A screenshot of the AWS EC2 Management Console in Mozilla Firefox. The browser address bar shows the URL: https://eu-central-1.console.aws.amazon.com/ec2/v2/home?regi. The console header includes 'AWS', 'Services', 'Edit', and user information 'Polsterer @ astroinformatix'. The left sidebar shows navigation options: EC2 Dashboard, Events, Tags, Reports, Limits, INSTANCES (Instances, Spot Requests, Reserved Instances), IMAGES (AMIs, Bundle Tasks), ELASTIC BLOCK STORE (Volumes, Snapshots), NETWORK & SECURITY (Security Groups, Elastic IPs, Placement Groups, Key Pairs, Network Interfaces). The main content area has buttons for 'Create Key Pair', 'Import Key Pair', and 'Delete'. Below these is a search bar with the text 'Filter by attributes or search by keyword' and a result 'None found'. A message states: 'You do not have any Key Pairs in this region. Click the "Create Key Pair" button to create your first Key Pair.' The 'Create Key Pair' button is highlighted with a red rectangle. At the bottom, there is a 'Select a key pair' section with three empty slots. The footer contains 'Feedback', 'English', copyright information '© 2008 - 2015, Amazon Web Services, Inc. or its affiliates. All rights reserved.', 'Privacy Policy', and 'Terms of Use'.

Elastic Cloud Computing (EC2)



EC2 Management Console - Mozilla Firefox

S3 Management Con... x EC2 Management C... x

https://eu-central-1.console.aws.amazon.com/ec2/v2/home?ref= Search

AWS Services Edit Polsterer @ astroinformatix Frankfurt Support

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group 7. Review

Step 1: Choose an Amazon Machine Image (AMI) Cancel and Exit

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own AMIs.

Quick Start 1 to 22 of 22 AMIs

My AMIs		Amazon Linux AMI 2015.03.1 (HVM), SSD Volume Type - ami-a6b0b7bb	Select
AWS Marketplace	Free tier eligible	The Amazon Linux AMI is an EBS-backed, AWS-supported image. The default image includes AWS command line tools, Python, Ruby, Perl, and Java. The repositories include Docker, PHP, MySQL, PostgreSQL, and other packages.	64-bit
Community AMIs		Root device type: ebs Virtualization type: hvm	
<input type="checkbox"/> Free tier only ⓘ		Red Hat Enterprise Linux 7.1 (HVM), SSD Volume Type - ami-dafdcfc7	Select
	Free tier eligible	Red Hat Enterprise Linux version 7.1 (HVM), EBS General Purpose (SSD) Volume Type	64-bit
		Root device type: ebs Virtualization type: hvm	
		SUSE Linux Enterprise Server 12 (HVM), SSD Volume Type - ami-a22610bf	Select
	Free tier eligible	SUSE Linux Enterprise Server 12 (HVM), EBS General Purpose (SSD)	64-bit

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Elastic Cloud Computing (EC2)



EC2 Management Console - Mozilla Firefox

S3 Management Con... x EC2 Management C... x

https://eu-central-1.console.aws.amazon.com/ec2/v2/home?ref= Search

AWS Services Edit Polsterer @ astroinformatix Frankfurt Support

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group 7. Review

Step 1: Choose an Amazon Machine Image (AMI)

SUSE Linux
Free tier eligible
SUSE Linux Enterprise Server 12 (HVM), EBS General Purpose (SSD) Volume Type. Public Cloud, Advanced Systems Management, Web and Scripting, and Legacy modules enabled.
Root device type: ebs Virtualization type: hvm
64-bit

Ubuntu
Free tier eligible
Ubuntu Server 14.04 LTS (HVM), SSD Volume Type - ami-accff2b1
Ubuntu Server 14.04 LTS (HVM), EBS General Purpose (SSD) Volume Type. Support available from Canonical (<http://www.ubuntu.com/cloud/services>).
Root device type: ebs Virtualization type: hvm
64-bit

Microsoft Windows
Free tier eligible
Microsoft Windows Server 2012 R2 Base - ami-86393e9b
Microsoft Windows 2012 R2 Standard edition with 64-bit architecture. [English]
Root device type: ebs Virtualization type: hvm
64-bit

Amazon RDS
Are you launching a database instance? Try Amazon RDS.
Amazon Relational Database Service (RDS) makes it easy to set up, operate, and scale a relational database of your choice (MySQL, PostgreSQL, Oracle, SQL Server) in the cloud. It provides cost-efficient and resizable capacity while managing time-consuming database
Hide

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Elastic Cloud Computing (EC2)



EC2 Management Console - Mozilla Firefox

https://eu-central-1.console.aws.amazon.com/ec2/v2/home?ref=...

AWS Services Edit Polsterer @ astroinformatix Frankfurt Support

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group 7. Review

Step 2: Choose an Instance Type

<input type="checkbox"/>	General purpose	m4.large	2	8	EBS only	Yes	Moderate
<input type="checkbox"/>	General purpose	m4.xlarge	4	16	EBS only	Yes	High
<input type="checkbox"/>	General purpose	m4.2xlarge	8	32	EBS only	Yes	High
<input type="checkbox"/>	General purpose	m4.4xlarge	16	64	EBS only	Yes	High
<input type="checkbox"/>	General purpose	m4.10xlarge	40	160	EBS only	Yes	10 Gigab
<input type="checkbox"/>	General purpose	m3.medium	1	3.75	1 x 4 (SSD)	-	Moderate
<input type="checkbox"/>	General purpose	m3.large	2	7.5	1 x 32 (SSD)	-	Moderate
<input type="checkbox"/>	General purpose	m3.xlarge	4	15	2 x 40 (SSD)	Yes	High
<input type="checkbox"/>	General purpose	m3.2xlarge	8	30	2 x 80 (SSD)	Yes	High
<input type="checkbox"/>	Compute optimized	c4.large	2	3.75	EBS only	Yes	Moderate
<input type="checkbox"/>	Compute optimized	c4.xlarge	4	7.5	EBS only	Yes	High

Cancel Previous **Review and Launch** Next: Configure Instance Details

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Elastic Cloud Computing (EC2)



EC2 Management Console - Mozilla Firefox

https://eu-central-1.console.aws.amazon.com/ec2/v2/home?region=eu-central-1

Polsterer @ astroinformatix Frankfurt Support

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Tag Instance 6. Configure Security Group 7. Review

Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

⚠ Improve your instances' security. Your security group, launch-wizard-1, is open to the world.

Your instances may be accessible from any IP address. We recommend that you update your security group rules to allow access from known IP addresses only.

You can also open additional ports in your security group to facilitate access to the application or service you're running, e.g., HTTP (80) for web servers. [Edit security groups](#)

AMI Details [Edit AMI](#)

Free tier eligible **Ubuntu Server 14.04 LTS (HVM), SSD Volume Type - ami-accff2b1**

Ubuntu Server 14.04 LTS (HVM), EBS General Purpose (SSD) Volume Type. Support available from Canonical (<http://www.ubuntu.com/cloud/services>).

Root Device Type: ebs Virtualization type: hvm

Instance Type [Edit instance type](#)

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.small	Variable	1	2	EBS only	-	Low to Moderate

[Cancel](#) [Previous](#) [Launch](#)

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Elastic Cloud Computing (EC2)



A screenshot of the AWS Management Console in Mozilla Firefox. The browser address bar shows the URL: https://eu-central-1.console.aws.amazon.com/ec2/v2/home?region=eu-central-1. The console header includes the AWS logo, navigation menus for 'Services' and 'Edit', and user information for 'Polsterer @ astroinformatix' in the 'Frankfurt' region. The main content area is titled 'Launch Status' and features a green success message: 'Your instances are now launching'. Below this, it states that instance launches have been initiated with the ID 'i-06a2ecc7' and provides a link to 'View launch log'. A blue notification box encourages users to 'Get notified of estimated charges' by creating billing alerts. The section 'How to connect to your instances' explains that instances will be in a 'running' state and provides instructions on how to monitor and connect to them. A dropdown menu lists helpful resources such as 'How to connect to your Linux instance', 'Learn about AWS Free Usage Tier', 'Amazon EC2: User Guide', and 'Amazon EC2: Discussion Forum'. At the bottom, there are links to 'Create status check alarms' and 'Create and attach additional EBS volumes'. The footer contains 'Feedback', 'English', copyright information for Amazon Web Services (2008-2015), and links to 'Privacy Policy' and 'Terms of Use'.

Elastic Cloud Computing (EC2)



The screenshot shows the AWS EC2 Management Console interface. The 'Connect' button is highlighted with a red box. The instance details for 'i-06a2ecc7' are shown below.

Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm
	i-06a2ecc7	t2.small	eu-central-1b	running	Initializing	None

Instance: i-06a2ecc7		Public DNS: ec2-54-93-120-221.eu-central-1.compute.amazonaws.com	
Description	Status Checks	Monitoring	Tags
Instance ID	i-06a2ecc7		Public DNS
			ec2-54-93-120-221.eu-central-1.compute.amazonaws.com
Instance state	running	Public IP	54.93.120.221

Elastic Cloud Computing (EC2)



The screenshot shows the AWS EC2 Management Console interface. A modal dialog box titled "Connect To Your Instance" is open. The dialog has a close button (X) in the top right corner. It contains the following text:

I would like to connect with A standalone SSH client
 A Java SSH Client directly from my browser (Java required)

To access your instance:

1. Open an SSH client. (find out how to [connect using PuTTY](#))
2. Locate your private key file (ec2access.pem). The wizard automatically detects the key you used to launch the instance.
3. ~~Your key must not be publicly viewable for SSH to work. Use this command if needed:~~

```
chmod 400 ec2access.pem
```
4. Connect to your instance using its Public IP:

```
54.93.120.221
```

Example:

```
ssh -i "ec2access.pem" ubuntu@54.93.120.221
```

Please note that in most cases the username above will be correct, however please ensure that you read your AMI usage instructions to ensure that the AMI owner has not changed the default AMI username.

If you need any assistance connecting to your instance, please see our [connection documentation](#).

Close

Elastic Cloud Computing (EC2)



The screenshot shows the EC2 Management Console in Mozilla Firefox. A terminal window is open, displaying the output of the 'top' command on an Ubuntu instance. The terminal output shows system statistics and a list of processes. A 'Close' button is visible at the bottom right of the terminal window.

```
top - 06:42:16 up 4 min, 1 user, load average: 0.06, 0.07, 0.05
Tasks: 98 total, 1 running, 97 sleeping, 0 stopped, 0 zombie
%Cpu(s): 0.0 us, 0.0 sy, 0.0 ni,100.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
KiB Mem: 2048484 total, 259504 used, 1788980 free, 8240 buffers
KiB Swap: 0 total, 0 used, 0 free. 196068 cached Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1	root	20	0	33504	2860	1496	S	0.0	0.1	0:01.26	init
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kthreadd
3	root	20	0	0	0	0	S	0.0	0.0	0:00.00	ksoftirqd/0
4	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kworker/0:0
5	root	0	-20	0	0	0	S	0.0	0.0	0:00.00	kworker/0:0H
6	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kworker/u30+
7	root	20	0	0	0	0	S	0.0	0.0	0:00.06	rcu_sched
8	root	20	0	0	0	0	S	0.0	0.0	0:00.05	rcuos/0
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/1
10	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/2
11	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/3
12	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/4
13	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/5
14	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/6
15	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/7
16	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/8
17	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcuos/9

Elastic Cloud Computing (EC2)



The screenshot shows the AWS EC2 Management Console in a Mozilla Firefox browser. The page title is "EC2 Management Console - Mozilla Firefox". The address bar shows the URL: `https://eu-central-1.console.aws.amazon.com/ec2/v2/home?region=eu-central-1`. The navigation bar includes "AWS", "Services", "Edit", and the user "Polsterer @ astroinformatix".

The main content area displays the "Instances" page. A table lists instances with columns: Name, Instance ID, Instance Type, Availability Zone, Instance State, Status Checks, and Alarm. One instance is visible with Instance ID `i-06a2ecc7`, Instance Type `i3.xlarge`, Availability Zone `eu-central-1b`, Instance State `running`, and Status Checks `2/2 checks ...`. An "Actions" menu is open over this instance, showing options: Connect, Get Windows Password, Launch More Like This, Instance State (with sub-options: Start, Stop, Reboot, Terminate), Instance Settings, Image, Networking, and CloudWatch Monitoring.

Below the table, the instance details for `i-06a2ecc7` are shown. The Public DNS is `ec2-54-93-120-221.eu-central-1.compute.amazonaws.com`. The Instance state is `running` and the Public IP is `54.93.120.221`.

The left sidebar contains navigation links for EC2 Dashboard, Events, Tags, Reports, Limits, INSTANCES (Instances, Spot Requests, Reserved Instances), IMAGES (AMIs, Bundle Tasks), ELASTIC BLOCK STORE (Volumes, Snapshots), NETWORK & SECURITY (Security Groups, Elastic IPs, Placement Groups, Key Pairs, Network Interfaces), and I/O PERFORMANCE.

Elastic Cloud Computing (EC2)



The screenshot displays the AWS EC2 Management Console interface. The top navigation bar includes the AWS logo, 'Services', 'Edit', and user information 'Polsterer @ astroinformatix'. The left sidebar lists navigation options such as 'EC2 Dashboard', 'Events', 'Tags', 'Reports', 'Limits', 'INSTANCES', 'IMAGES', 'ELASTIC BLOCK STORE', 'NETWORK & SECURITY', and 'LOAD BALANCING'. The main content area features a 'Launch Instance' button, a search bar, and a table of instances. One instance is visible with the following details:

Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm
	i-06a2ecc7		eu-central-1b	running	2/2 checks ...	None

An 'Actions' menu is open over the instance, listing options: 'Connect', 'Get Windows Password', 'Launch More Like This', 'Instance State', 'Instance Settings', 'Image' (highlighted), 'Networking', and 'CloudWatch Monitoring'. A sub-menu for 'Image' is also visible, containing 'Create Image' and 'Bundle Instance (Instance store AMI)'. Below the table, the instance details for 'i-06a2ecc7' are shown, including the 'Public DNS' (ec2-54-93-120-221.eu-central-1.compute.amazonaws.com) and 'Instance state' (running).

Elastic Cloud Computing (EC2)




Amazon EC2 Masterclass - Mozilla Firefox

Amazon EC2 Master... x


www.slideshare.net/AmazonWebServices/amazon-ec2-masterclass

www.slideshare.net/AmazonWebServices/amazon-ec2-masterclass

Welcome to the AWS Cloud.




Be the first to clip this slide



Masterclass

Amazon EC2

Ian Massingham — Technical Evangelist
ianmas@amazon.com
@IanMmmm



Clip slide 1 of 107

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EMEA Public Sector
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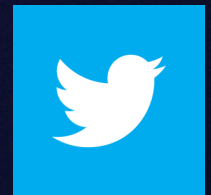
Conclusion



thanks to **Virtual Observatory** we know
how to access data

we still need to learn how to
uniformly
process and
analyze data

Thank you for your attention!



@AstroInformatix