EUROPEAN ARC
ALMA Regional Centre

The European ARC (network)

Martin Zwaan
ALMA Regional Centre manager
ARC@ESO, Garching

The ALMA Regional Centres (ARCs)

The ALMA Regional Centres (ARCs) are the interface between the user communities and the observatory

There is one ARC for each executive:

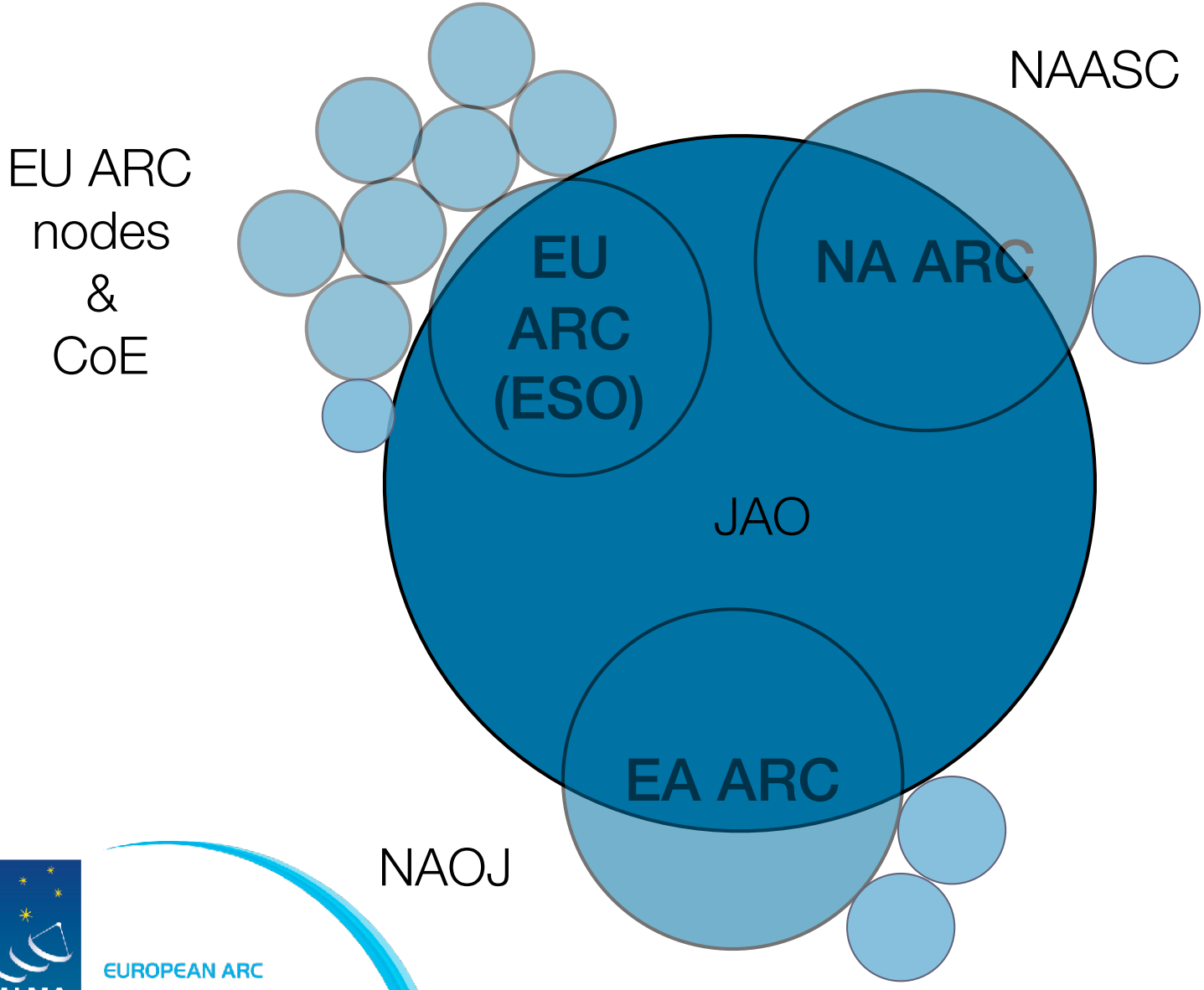
- Europe, North America, East Asia

The ARCs provide operationally critical services to ALMA Operations in Chile and their regional user communities

Close links with the Department of Science Operations (DSO) in Chile

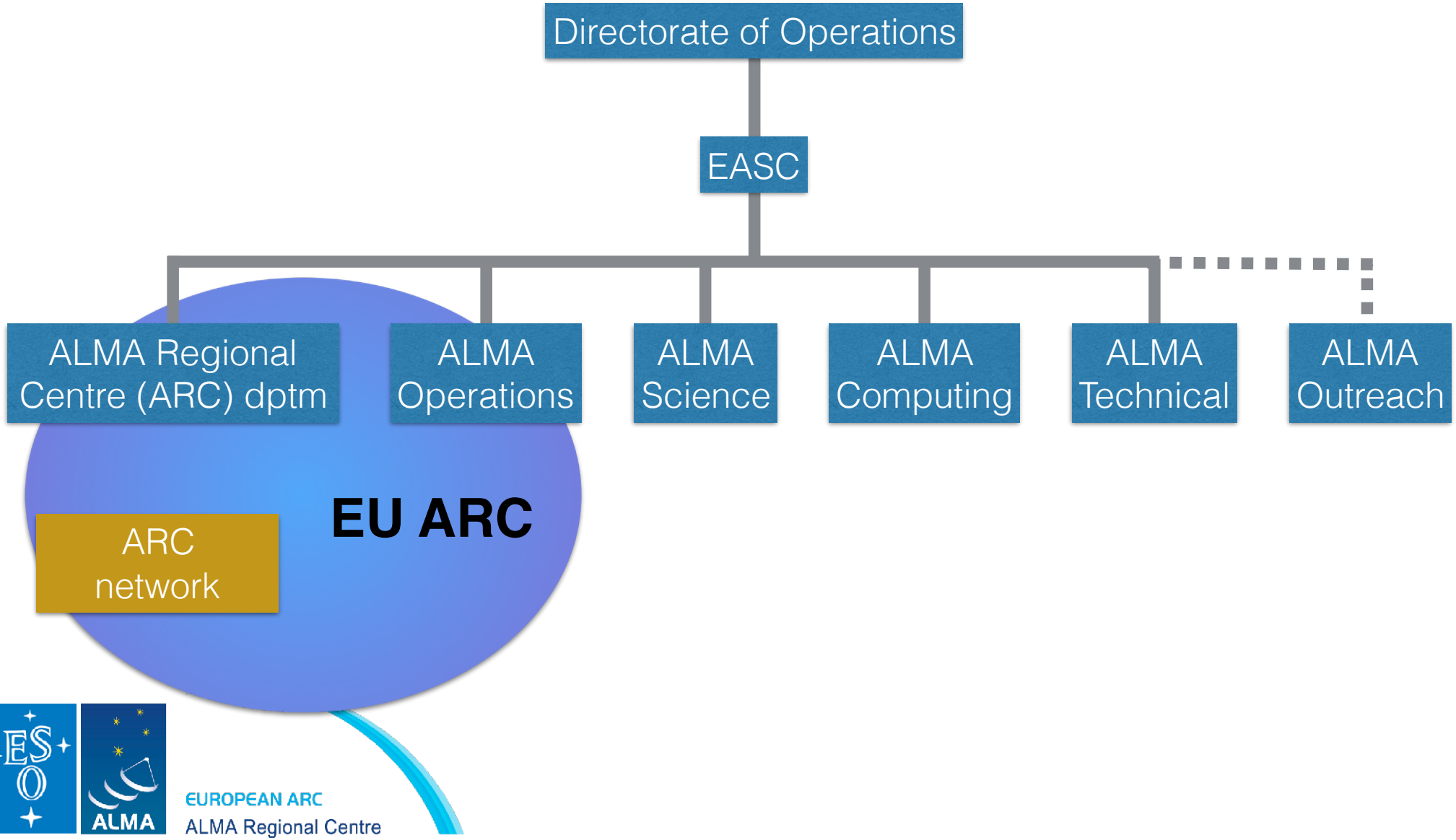
The ARC is the One Stop Shop for all things ALMA

The ALMA Regional Centres (ARCs)



EUROPEAN ARC
ALMA Regional Centre

The European ALMA Support Centre



Geographical distribution of the EU ARC network

EUROPEAN ARC
ALMA Regional Centre

The EU ARC network (I)

The ARCs are the interface between the user communities and the observatory

The European ARC is unique for having a distributed network of ARC nodes

These ARC nodes

- have close ties with the community (active research environments)
- host many of the mm/sub-mm experts in Europe
- are actively involved in ALMA commissioning and optimisation

High level perspective for the ARC network

Provide optimal and uniform user support to the European community

Strengthen European ALMA community

Broaden access to ALMA science

- Make ALMA accessible to all European astronomers and optimise scientific return

Provide expert assistance towards ALMA commissioning and optimisation

Provide tools to users and observatory

- Contribute to ‘making ALMA work’

EU ARC network concepts

Contracts:

- There are no contractual obligations between ESO or ALMA and the ARC nodes
- Collaboration is based on trust and Memorandum of Understanding

Finance:

- ESO does not provide financial support for the ARC nodes
- ARC nodes seek their own funding

Mandates:

- ranging from 'ARC nodes can only do user support' to 'ARC nodes should support ALMA'
- ranging from 'just support ALMA users' to 'be part of general support body (LOFAR, NOEMA, SKA, …)

EU ARC network management

The network is managed by the ARC Coordinating Committee (ACC) consisting of representatives of each node, the head of the ESO ARC Department and the European ARC network coordinator

Head of the ESO ARC Department responsible for successful operation of EU ARC

Coordinator responsible for the overall coordination of the network activities, for maintaining communications and acts as contact person for all ARC staff

Together, they oversee the provision of support in the network

Important decisions within the European ARC network are taken by the ACC through consensus decision-making

ACC informs the ALMA ESAC, a sub-committee of the ESO Scientific Technical Committee (STC).

The ACC, via the ESO ARC, also passes information regarding the network to the JAO, the AMT and the iSOpT

Total current staff levels in EU ARC network (July 2019)

	total staff	ARC related
ESO astronomers/scientists (11+2) + data analysts (2) + fellows (~4)	15 people (+~4)	~10.5 FTE (+archive+admin)
ARC nodes & CoE management, staff, postdocs, software, IT	~50 people	~25 FTE
Total EU ARC network	~69 persons	~35.5 FTE!

The EU ARC network services

Core functions

- Scientific support services
  - Proposal & observation preparation user support
  - Data quality assurance
  - Data product support
  - ALMA Archive operations: host copy, data delivery
- Astronomer on duty shifts
- Face-to-face support

Additional functions

- Extended archive & data reduction support
  - Advanced pipeline
  - Archival research projects
- Support for 'special' projects
- Science community development
  - basic training, schools, workshops

The EU ARC network services

ESO ARC

Core functions

- Scientific support services
  - Proposal & observation preparation user support
  - Data quality assurance
  - Data product support
  - ALMA Archive operations: host copy, data delivery
- Astronomer on duty shifts
- Face-to-face support

Additional functions

- Extended archive & data reduction support
  - Advanced pipeline
  - Archival research projects
- Support for 'special' projects
- Science community development
  - basic training, schools, workshops

The EU ARC network services

ESO ARC

Core functions

- Scientific support services
  - Proposal & observation preparation user support
  - Data quality assurance
  - Data product support
  - ALMA Archive operations: host copy, data delivery
- Astronomer on duty shifts
- Face-to-face support

Additional functions

- Extended archive & data reduction support
  - Advanced pipeline
  - Archival research projects
- Support for 'special' projects
- Science community development
  - basic training, schools, workshops

https://www.eso.org/sci/facilities/alma/arc/user-support/marcus-f2f-visit-request.html

ARC nodes

ARC nodes task - reality

The ALMA Operations Plan (D) and the European ARC Implementation Plan were written in 2007. Things have changed since then

ARC node tasks during full operations, as predicted in 2007:

- Face-to-face user support
- Advanced software developments and maintenance
- Help in archival research
- Storage of advanced data products
- Feedback to ESO ARC
- Community development

Additional tasks that ARC nodes carry out:

- Quality assurance
- Contact Scientists for observing proposals
- Assistance with Science Verification, Commissioning, and EOC
- Various tasks: Helpdesk support, policies, technical advice, etc

Main challenges: diversity

Each ARC node operates under

- Different local structure
  - organisation, embedded in observatory/university etc
- Different funding structure
  - conditions from funding agencies, funding horizons etc
- Different mandates
  - ranging from 'ARC nodes can only do user support' to 'ARC nodes should support ALMA
  - ranging from 'just support ALMA users' to 'be part of general support body (LOFAR, PdB,..)'

Tasks, responsibilities and timelines must be harmonised and synchronised throughout network

Main challenges: funding

Most ARC node activities are supported through local funding agencies

- Funding levels likely to continue for next few years
- Funding agencies expect high quality support to regional users
- Funding agencies may expect type of support to evolve
- ARC nodes need large user base!

ARC nodes continuously need to apply for funding, funding horizon varies

ARC nodes need to adapt to local needs to be eligible for funding

Continuous need to convince governing bodies, funding agencies and users of the benefits of a distributed network

Main challenges: communications

Communication is an art!

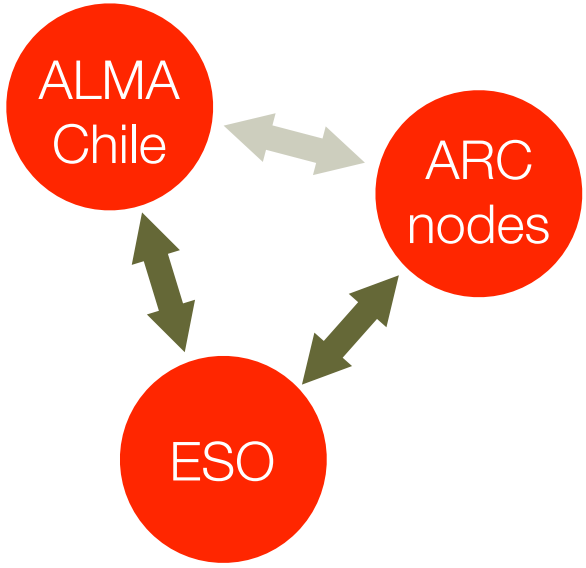
Interactions more challenging in distributed teams

Information flow:

- ARC nodes one extra step removed from observatory: build direct links
- Keep misunderstandings to a minimum and resolve rapidly those that arise

Trust

- Difficult to build - easy to destroy
- Everyone needs to feel/be part of the project



Continuous investment

Main challenges: adapting to changes

Internal factors:

- Operational model evolves: tasks shift from observatory to ARC to nodes (and back)
- Use as an opportunity, but can cause tension with funding agencies etc

External factors:

- Needs of scientific community change
- Funding agencies' requirements change
- Landscape changes

Need to be flexible and inventive in order to remain attractive

Main challenges: collaboration and ownership

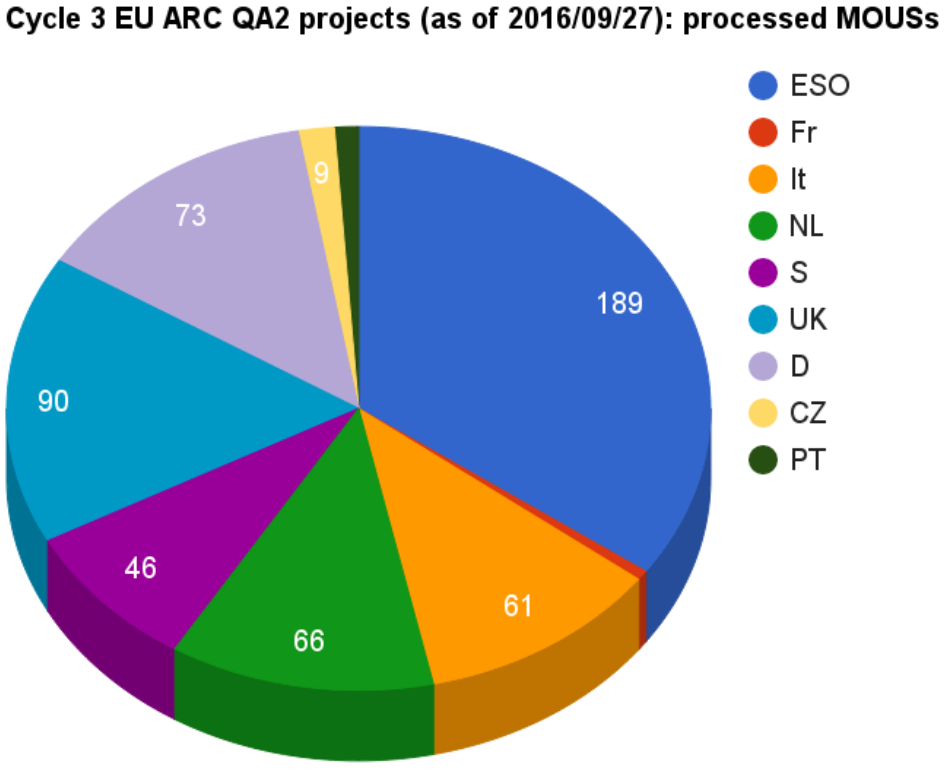
Global ALMA project must consider ARC nodes an integral part of ALMA

- Involvement in commissioning activities
- Involvement in observatory activities
- Development programs (new receivers, software, etc)
- Direct links between observatory and ARC nodes!

Recurrent issue, action is needed

Main challenges: shifting responsibilities

ARC network contributed about 65% of total QA2 workload



EUROPEAN ARC
ALMA Regional Centre

Main challenges: shifting responsibilities

Effort shifting to weblog review as JAO takes over bulk of processing

But: (some) nodes want to keep the expertise for their benefit and that of their communities, even to attract and retain funding

A very good example to keep in mind

The future of the EU ARC network

The mission: Provide support of the highest standards to all European ALMA users and strengthen the European ALMA community

Commitment: Continue the contribution in shaping ALMA, providing expert assistance towards EOC activities and tools to users and the observatory

Support: Moving towards becoming more science-oriented

Nodes: Basing ALMA support structures within broader user support centres

ESO: committed to continuing supporting the European ARC network at the current levels and for as long as there is a need and an interest

Given the success, current structural and organisational model will be kept for the foreseeable future

EU ARC network strategic plan 2019 - 2025

Nodes are different in many ways, though we have managed to provide a very uniform support to all European users and be perceived as an ensemble

Purpose:

- Assess the situation after ~10 years of network
- Think about the mid-term future
- Identify issues and discuss ways forward
- Solicit input (community (UC), committees (ESAC, STC))
- Internal document for reference

EU ARC network strategic plan 2019 - 2025: Objectives (I)

Unique services and expertise that the European ARC network must retain

- Face-to-face user support
- Contact Scientists for approved ALMA projects
- Helpdesk
- Unique scientific or technical expertise
- Enhanced services
- Contribution to ALMA development
- Local community development
- Building the user base
- Quality assurance

EU ARC network strategic plan 2019 - 2025: Objectives (II)

Development of new support procedures

- Archival research support
- Advanced data reduction
- Advanced software development
- Participation in Observatory tasks
- Remote user support
- Remote user participation to training events

Towards science-oriented support

Towards general support centres

ALMA archive: towards an enhanced user experience

Internal and external factors

Internal factors: strengths and weaknesses

- Human resources
- Physical resources
- Financial resources
- Activities and processes
- Past experience

External factors: opportunities and threats

- The ALMA 2030 roadmap
- Correlator upgrade
- Evolution of QA2
- Demographics of the community
- Links to JAO
- New and upcoming facilities

Internal and external factors

Internal factors: strengths and weaknesses

- Human resources
  - Maintain Number of staff and FTE at healthy levels
  - Temporary vs permanent contracts
  - Retain expertise within the network
  - Long term perspective for temporary staff

Internal and external factors

Internal factors: strengths and weaknesses

- Human resources
- Physical resources
  - Distributed nature of the network will be maintained
  - ARC node temporarily loses capacity to carry out tasks

Internal and external factors

Internal factors: strengths and weaknesses

- Human resources
- Physical resources
- Financial resources
  - Varying funding schemes and horizons
  - Stable perspective till ~2022; perspectives for 2022-2025
  - ALMA in the era of new and upcoming facilities
  - Impact of losing one or more nodes

Internal and external factors

Internal factors: strengths and weaknesses

- Human resources
- Physical resources
- Financial resources
- Activities and processes
- Past experience

External factors: opportunities and threats

- The ALMA 2030 roadmap
  - Possibilities of nodes' involvement

Internal and external factors

Internal factors: strengths and weaknesses

- Human resources
- Physical resources
- Financial resources
- Activities and processes
- Past experience

External factors: opportunities and threats

- The ALMA 2030 roadmap
- Correlator upgrade
  - First data expected in 2023
  - Bulk of QA2 to be carried out at the JAO
  - Contingency, in case of back logs

Internal and external factors

Internal factors: strengths and weaknesses

- Human resources
- Physical resources
- Financial resources
- Activities and processes
- Past experience

External factors: opportunities and threats

- The ALMA 2030 roadmap
- Correlator upgrade
- Evolution of QA2
  - Currently need for weblog review
  - Longer term: some nodes wish to continue contributing to QA2 to maintain and expand expertise
  - Possible impact on funding

Internal and external factors

Internal factors: strengths and weaknesses

- Human resources
- Physical resources
- Financial resources
- Activities and processes
- Past experience

External factors: opportunities and threats

- The ALMA 2030 roadmap
- Correlator upgrade
- Evolution of QA2
- Demographics of the community
- Links to JAO
- New and upcoming facilities

Closing remarks

EU ARC network was set up as an experiment but turned out to be very successful: a model for future facilities?

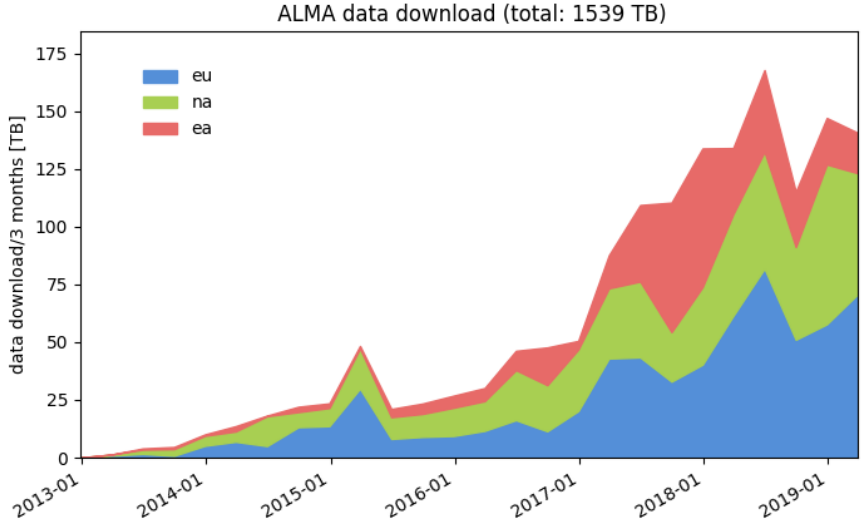
Optimal use of existing expertise

Recognition of skills and effort is essential

In an ever-changing landscape, those that adapt survive

Some ALMA facts

- ALMA construction budget: 1.5 billion USD (2x SKA1???)
- ALMA yearly operations budget ~ SKA yearly operations budget
- EU ARC: yearly budget ~15 fte + compute cluster + ARC nodes
- ALMA user base: ~8000 registered users
  - ~500 unique European PIs and 1700 unique PIs or cols per Cycle



Some notes on ARC/SRC and critical mass

- ~1500 refereed publications (30 Nature papers)
- European ARC supports ~100-150 successful projects per year
- European PIs publish ~150 papers per year
- Most projects are ~10 hours observing time
  - ALMA produces about 0.1 refereed publication per hour of observing time
- Large Programs are 50-100 hours
  - (And some PIs are already struggling with the data…)
- We know from ESO/VLT that #publications/hour goes down with program observing time
- Information content per SKA hour < Information content per ALMA hour
- How many publications per year per SRC are you expecting? Are funding agencies going to support that?

Some random notes

- ARCs fully integrated in Science Operations
  - ARC managers plus Head of Science Operations in Chile form the integrated science operations team
  - ARC hosts ‘subsystem scientists’ for ALMA
  - ARCs and ARC nodes help(ed) with commissioning
  - This is very important to keep the link between SciOps and RCs
- Localised expertise at SRCs… users travel to get the expert help they need
  - Only partly worked for ALMA… funding agencies just want users to go to local support centre
- Homogeneity in RCs: In ALMA guaranteed because ARCs inside baseline ALMA
  - Each SRC has its own set up, different management structure, different computing platforms, …

Some ARC notes - data products

- Advanced data products
  - We are working on plans to provide SRDP
  - ALMA not considering ingesting user-provided APDs, except for LPs
  - Although the standards for these products are very ‘light’ PIs are already complaining
  - You have no control over this once you have given the data
- Trust in the data products, people ~~are~~ were used to have full control. Still working on this for ALMA. ALMA is halfway between traditional model and what SKA wants to do.
  - Missed opportunity by ALMA to not involve community more.

Pipelines and quality assurance

- ALMA had a few very bad experiences..
  - Not ready in time
  - FTEs for quality assurance underestimated by at least order of magnitude
  - Quality assurance moved from observatory to ARCs to ARC nodes
  - Found problems in imaging pipeline used for delivered data.. huge re-processing effort


ESO
ALMA
EUROPEAN ARC
ALMA Regional Centre