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Inventory of access modalities provided by the research infrastructures

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1 Introduction

A very broad range of access modalities to support users of research infrastructures exist. Different approaches are implemented successfully in different situations. There is a clear common impact of current relevance. The user communities with guaranteed fully-supported facility access are restricted to those communities which can afford to build and operate infrastructures. Truly open ensured access to the science and technical opportunities with the required level of technical training and support for communities which are not facility partners is dependent on availability of funding without national spending restrictions.

2 Access modalities in current use on physical science infrastructures

Modern operational infrastructures are typically the outcome of a long competitive scientific-funding-technical development process, involving committed funding agencies responding to the strengths and ambitions of their communities. A major factor in infrastructure approval is evidence that the facility will be in demand from the funders' user community. Hence, once a facility is operational, the responsible agencies and operators invariably have new-user access approval systems which favour the relevant communities which are the sources of funding.

Nonetheless, in many cases, it is recognised that providing access to a wider new-user community has advantages for an infrastructure operator. These advantages are in part to maximise facility science impact, both for the good of the subject and strengthening the facility overall case for continued national/partner funding investment. A part is to expand the user pool, with some external scientists potentially attracted to work at the funders' institutions, or develop critical mass locally and become future full partners. A part is to train users who may become future key technical support staff, a group often in short supply. A factor is altruism: being good global citizens.

It is the variety of modalities which deliver that wider access which we consider here. We distinguish between "allocated resource" users, those who define which target/instrument setup/experiment details are to be implemented by an infrastructure, and "archive" users, those who are provided with access to data/results/research products initially defined by an allocated resource user. There is of course a continuum of user involvements between these limiting cases.

We note that "access" typically means much more than simply an allocation of some unit (hour, day, dataset download…) of use of an infrastructure. Potential users must be informed of opportunities, given technical training in the whole access process, from proposal preparation through data acquisition to data reduction, analysis and interpretation, until publication. Both facility-focussed and more general subject-focussed training schools are popular ways to achieve the more general awareness aspects of this, commonly independent of a specific approved research proposal. For some facilities a distributed network of support centres helps users at all stages of the process, from proposal preparation to data analysis. These are particularly notable in new fields and/or very technically complex facilities. "Hands-on" technical support is typically a necessary requirement for effective facility use, and its provision is an integral part of an access modality.

Access to an infrastructure costs money. There are several common approaches to assigning a monetary value of a unit of access to an established infrastructure. The first is to include the infrastructure capital, development and operations costs to date, plus current actual operations costs (and often, decommissioning costs). It is this model that is usually applied when a new partner organisation is joining an extant infrastructure to provide long-term access for its community. An alternative is to consider only actual operations costs, without capital depreciation or facility enhancement budgets. It is this second model which has proven successful for small amounts of access with limited timescale commitments. It is that which is implemented by EC funding, with eligible operational costs defined through a TA1 form. A third model has been investigated by many

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communities, which includes an added “value” for “uniqueness” for rare or highly specialised capabilities. Experience has shown that lack of agreement on subjective valuations has delayed and/or undermined attempts to broaden facility access.

Modality-one: pay. There are many projects or experiments which require guaranteed access to a facility for a fixed period. Examples include guaranteed supplementary observations for a high-priority facility (gravitational waves, space missions), or projects which require for their success ensured long-term access for time-domain studies (exo-planet radial velocity and/or transit photometry is a topical example). This inevitably supports the richer countries/groups, as well as those who compete and are successful in external funding competitions, like ERC. The cost is a matter for agreement between the partners.

Modality-two: in-kind. A variant of modality-one, applied widely when large consortia are needed in place because of the scale of a project, is that an interested community provides a mix of cash and in-kind benefit. Large astronomical surveys often adopt this model. Again, this strongly favours mature and well-financed communities.

Modality-three: GTO. A common way to upgrade/modernise/improve facility competitiveness is to reward instrument build consortia with guaranteed access (Guaranteed Time Observations - GTO – is a common term). The external consortia raise their own funds, sometimes heavily subsidised by the infrastructure for high-priority developments, to develop facility upgrades. These range from instruments, instrument enhancements, through extra telescopes in an array to beamline stations on synchrotrons. In return the user group get dedicated high-priority facility access for their own science. This is a standard and proven way to fund new instruments, where ERC funding has been high impact. The facility enhancement is clearly of longer-term benefit to the wider community and can lead to exceptional and timely science (eg VLTI upgrades led to a Nobel prize, as well as widely applicable capabilities).

Modality-four: Barter. There are successful examples of two or more communities providing mutual access to complementary capabilities owned by each partner with no exchange of funds. For example, two nationally-funded telescopes may each have a unique instrument of interest to the other community. The partners agree to allow some access by the other national community to each facility. A challenge in establishing such arrangements is establishing mutually agreed valuations of the resource. Experience shows these tend to be limited to the “uniqueness lifetime” of both capabilities. This is often short, as high-demand high-performance capabilities are continually being requested/funded/provided through an infrastructure’s lifecycle, so that alternative responses to a community demand arise.

The modalities listed above are relevant only to users who are members of (relatively) well-funded communities with available access to competitive infrastructures. We now consider access modalities of wider applicability.

Modality-five: Open-sky. Allow open peer-reviewed access using facility funds. This is common for very large/expensive infrastructures, eg ESO, but operates at all facility scales. In general this access for users beyond the main funding partners is limited to a fairly small resource fraction. Implementation involves monitoring to avoid exploitation by communities which could but do not reciprocate with comparable access to their facilities. This modality benefits users from outside the owners’ communities, as facility “own users” give up access. Useful access however requires more than simply infrastructure time. Users must be trained and supported in the technical and data processing skills, and have travel and associated costs paid. This support system is often less well provided.

M5.1 Special case one: a set of facilities which can function only with a fully open access model. This is “open-skies” in astronomy jargon. Examples are highly-distributed “arrays” of facilities which become uniquely competitive when operating in coordination, eg EVN, VLBA, global VLBI astronomy, or Time Domain astronomy. These communities are naturally multi-national. The concept of “national share” or “national user group” can become meaningless for a small partner

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which might provide valuable but not game-changing extra capability, and might have only a small or specialist "national" community. They might, in another example, have a facility (historical local telescope?) of minimal stand-alone utility, and need to be part of the larger system to attract local operational support. There the reward is to remain functional, providing an operational system to teach/train local students even with only a small fractional access to the local facility. Indeed, a major reward is to be able to join competitive consortia doing the best science. However, national limits on spending funds still exist. So users from outside the "array" consortium, and possibly even those from less advantaged consortium members, lack user-support funding. They get the data, but not the level of support appropriate to fully exploit the scientific potential of the data.

M5.2 Special case two: as for 5.1, but with dedicated user support funding, to level the competition for all science-approved user projects, regardless of user location. Challenge – where does the funding come from?

M5.3 Open-sky motivation: Why do facilities give open access? A part is to maximise science impact, strengthening the facility overall case for continued national funding investment. A part is to expand the user pool, with some external users potentially attracted to funders' institutions. A part is to train users who may become future key technical support staff, who are often in short supply. A factor is just being good global citizens. There is also a sense of national prestige/influence here, in which there is a perceived benefit to attract users from other organisations/countries. A facility can benefit in national support from the international recognition they receive via a true open-skies policy, not open skies on a tiny fraction of the total facility time. There are instances when this became a negative issue when funders noticed what they perceived as a too-large international use of some facility.

Modality-six: Funds without national restrictions. This is the present EC funding case. It ensures funding is available so that the same level of support is provided to all users who pass scientific evaluation criteria. This support is delivered in a variety of ways. The simplest case is that an "external" user is provided with funds to cover the costs required to use (possibly including a physical visit) an infrastructure to obtain data, while the infrastructure operator is reimbursed the differential costs of facility provision and the required extra user support. Where relevant, technical training to potential external users, in both observations and data processing may be provided.

Modality-seven: innovative. Special cases, for example when access is provided through network funding (eg ChETEC), with explicit diversity conditions and other limits in place, to meet the networking goals.

3 Virtual Access Modalities

Virtual access is that where a user does not interact with an infrastructure directly, but requests data from an archive purely on-line. Archives range from very large special-purpose facilities (NASA, CDS, ESA, ESO) which are funded to provide no-cost global open access, to smaller and more specialised. User access may be fully open and anonymous at one limit, or require registration and approval prior to access at the other. In special cases a user may need technical/scientific support to use the archive data. In others it may be supported by adequate documentation, and be "science ready". There are cases where a registered user may request special observations, which then become available in "science ready" form through an archive. Given this diversity, funding requirements may be to support (some fraction of) the facility operational costs, or a fractional share fee "per-user", and may range significantly in costs.

4 Allocation Processes

Allocation processes are typically independent of the applied access modality, are naturally determined by the requirements of technical and scientific assessment of proposals for access to an

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infrastructure, and are remarkably similar in application. A common approach for open-access TNA provision is a specially established Resource [Time commonly] Allocation Committee (TAC) or equivalent.

An alternative is to use the available local facility-access system, and identify “external” projects either during or after the assessment process. The increasing adoption of blind/anonymous proposal review, especially on very major infrastructures, may require some pre-review eligibility selection. Facility-specific TACs typically have as members external and independent science experts, and so are similar in operation to a special-purpose “external TNA” TAC.

Appendix one lists some examples of current or recent EC-supported trans national access implementation approaches.

Appendix 1:

Contract	Topic	Infrastructure	Call Frequency	Common Allocation panel?	Travel cost refunds	Inter facility budget rebalancing
OPTICON	Astronomy	Telescopes	6 Monthly	Yes	Done Centrally by PS Institute	Yes
Radionet	Radio Astronomy	RadioTelescopes/VLBI (also VA)	Varies by facility	No: use facility TACs	Done centrally by Co-ordinator Institute	By Board agreement
AHEAD	X-ray Astronomy	Test facilities	Open	Yes	Done locally by Host Infrastructure	Preparation pre-visits also funded. Yes
AHEAD	X-ray Astronomy	Training/Data reduction/ expertise centres	6 Monthly	Yes, virtual meetings	Done locally by Host Infrastructure	Yes, mid contract Via board decision and EC negotiation
AHEAD	X-ray Astronomy	Research Exchange visits	6 Monthly	Yes	Done centrally by WP leader institute	
Jerico-Next	Coastal Waters	Ships/platforms/buoys	3 over contract ~1/year	Yes	Done Centrally by Co-ordinator Institute	Yes post facto
Jerico-Next	Coastal Waters	Databases	Virtual Access	N/a	N/a	N/a

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Ingrid-2	Social Science	Databases/expertise centres	3 Monthly	Yes		
Vetbionet	Biology	Biosecure labs and Sample collections	Always open	Yes 2-Stage. Initial outline then full proposal	Done locally by host Infrastructure	Via MT discussion and decision
ERigrid	Smart Power Distribution	21 Technical Laboratories	6 Monthly	Yes. 2-Stage. Technical then science	Done locally by host Infrastructure	
Hydralab+	Sea Levels/ Climate change	Water testing tanks/wave machines	2 calls over contract	Yes	Done locally by host Infrastructure	Rarely, Difficult to move funds between contractors
ELTER	EcoSystem Research, esp biodiversity,Climate change.	Visits to sites (18 in network). Single or Multi-site projects	3, roughly annual, early in year	Yes, internal	Done locally by host site	Yes
HPC-Europa3	High power computing	Visits to Computer Centres for mentoring and free computing time	Every 3 Months	Yes. 2 stage Process. technical then science	Done locally by host facility	Possible, but not ever needed as facility demand is high.

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