



National Federated Compute Services
NetworkPlus

Umbrella Recommendation Discussion Document

*Detailed Umbrella Recommendations - for discussion at
Birmingham Conference*

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Chapter 1

Recommendations - Deliver First

1.1 B1 Common Data Movement, Cataloguing, Access and Storage Standard

Data is foundational to research computing, and in consequence the ability to store, access and move data within the federated system is a fundamental consideration for federation of research computing services. We recommend that a holistic, federated approach be taken to data movement, access, and storage. To do this effectively, both the technical barriers to movement of data and the governance and policy barriers must be considered.

A number of projects considered the actual transfer (copying) of data. Based upon these we make the following recommendations:

- A **standard set of data transfer mechanisms** should be identified, supporting data movement at different scales, enabling users to access data efficiently within the federation.
- Mechanisms should support transfer of both large and small datasets, and tooling should be provided to allow access to partial selections of data sets.
- Mechanisms should be suitable for operation without the manual intervention of Research Technical Professionals and should support integration into automated workflows.
- Transfer (copy) mechanisms should support the application and change of access controls, including support for fully open sharing of data, without credentials, as well as providing support for researchers working in international collaborations.

This will provide the technical mechanisms necessary to support data flow between DRIs, allowing data to move across the country and enabling users to access the datasets that they need where they need them.

The ability of users to fully exploit the potential of the federation to provide access to data is dependent on being able to identify and locate relevant datasets. A federated approach should also be taken to the **organisation and discoverability** of data. We recommend that:

- A **service catalogue that publishes the details of services within the federation which host research data** should be rapidly established.
- Relevant domains should be supported in constructing and operating their own **Centralised Metadata Catalogues**, building on existing data catalogues where available, and these should be wherever possible interoperable.
- A pathway for evolution of the service catalogue into a single **Federation Data Catalogue** should be established. This Federation Data Catalogue should be search-

able, allowing data sets from across services to be identified, accessed and used from a single portal.

This will support users in their data interactions, enabling access to and discovery of data, and making data available for wider use with appropriate metadata.

At various points NFCS projects have identified that integration of data access with authentication and identity is key. We therefore recommend that:

- Data federation should at all points **integrate with Federated Identity and Access Management**.
- This integration should support both data access for users and the tracing of access and citation of data.

This will ensure that data federation takes full advantage of the capability offered by Federated Identity and Access Management.

The governance of research data in the UK should be carefully assessed and improved to enable the accessibility of data to researchers, whilst ensuring alignment with current, and future, UKRI Data Policy. We recommend that:

- A **national strategy for data contracting** should be established to support more effective contracting for data sharing, enabling data sharing agreements to be efficiently set up.
- This should consider standardised approaches across institutions, to include templates, technical audits and policy.
- This should also consider the requirements arising in relation to sharing of sensitive and commercial data.
- Consideration should be given to the establishment of a **National Data Advisory Service** to support efforts to share data.

This will support both researchers and legal professionals at different institutions by providing a framework in which data can be shared with confidence, a process which at present can require excessive amounts of both effort and time. e

Table 1.1: Project Recommendations relevant to Umbrella Recommendation B1

Project	Recommendation(s)
ACCoRD	Various
Exploring a Data Centre API for Federated Data Movement	Various
Federated Data Access Across the DRI	Various
Federated Data Movement	Various
Research Data Landscape Survey	Various
Towards Federated Laboratory Data Management	Various
Everything Everywhere All at Once	EEAAOO-08
Enhancing HPC Adoption through User Centred Design	UCDSN-04



1.2 D1 Federated Identity and Access Management

A key repeated theme across projects has been the necessity of a Federated Identity and Access Management framework. As well as being a key enabler of user access to services this can be built upon to support a variety of other recommendations within the roadmap. We recommend that:

- A **common Identity and Access Management Framework** for UK DRI should be established.
- In order to ensure interoperability this framework should be compliant with the AARC BluePrint.
- This framework should be capable of evolving to support new technologies and requirements.
- Specific requirements for the framework, including persistent IDs across career, virtual organisations and inter-federation bridging, should be assessed in concert with the DRI community.
- A governance regime should be established for this Framework. Where required it would both resource and commission services and SLAs, as well as decide on resilience and operational targets.
- Authentication routes for users not covered by the common federation should be included, along with an "IDP of last resort" to support users with no viable Identity Provider.

Such a framework will represent a fundamental building block of federation. A well crafted IAM solution will support onboarding of new user groups, migration between services and deployment of federated services across DRI.

Table 1.2: Project Recommendations relevant to Umbrella Recommendation D1

Project	Recommendation(s)
Federated IAM for Existing Infrastructures	Various
Exploring Governance for MyAccessID	Various
Job Orchestration on Heterogenous Systems	CONST-01
Everything Everywhere All at Once	EEAAOO-03
Federated Edge-HPC Architectures for AI Workflows	FEDGE-06
Evaluation of Secure Federated Kubernetes Storage for TREs	FEDK8S-04
Towards Federated Laboratory Data Management	LABSCI-02.1
Research Data Landscape Survey	RDLS-02



1.3 D2 Coordinated Cybersecurity Governance and Operations

Cybersecurity is a key concern for the federation and coordination in this area is essential to ensure the confidence of both users and service providers. Establishing an agreed baseline on what appropriate security provision looks like will be an important precursor that will support a coordinated approach to the subsequent development and enhancement of cybersecurity measures. We recommend that:

- A **coordinated Cybersecurity Governance and Risk Management** approach should be developed, to avoid divergent and potentially incompatible approaches to cybersecurity across DRI due to differing practices between DRI providers. This must be integrated with the overall Federation Governance model.
- A **mapping exercise of policy and process requirements from DRI funders** should be conducted, to better understand the existing governance environment, and support the rollout of federated Cybersecurity Governance.
- A **shared baseline should be identified**, taking account of the DRI funders' requirements, and potentially based upon a standard framework (for example, the NCSC Cyber Assessment Framework), adapted with sector specific guidance.
- All cybersecurity governance and policy must consider the support requirements of organisations who do not currently have the capacity for full compliance in this area, avoiding unnecessary proliferation of policies and certifications, and ensuring a proportionate approach to compliance.
- **Appropriate training** to support both users and DRI providers should be provided.
- Resource must be provided both to **support operational teams at DRI**, as well as to **track incidents at a Federation level**, with an agreed and coherent approach to response to cybersecurity incidents. A Federation level Cyber Security Incident Response Team (CSIRT) may be an appropriate model.
- **Real time information sharing for Incidents and Incident Response** should be put in place across the DRI Federation.

These recommendations should support federated service operators in better managing and coordinating their cybersecurity posture and associated risks, and should ensure an effective response to cybersecurity incidents across the DRI Federation.

Table 1.3: Project Recommendations relevant to Umbrella Recommendation D2

Project	Recommendation(s)
DRI Cybersecurity	Various



1.4 D3 Federation Governance and Operating Model

The overall Federation Governance and Operating Model will cut across many aspects of federation, providing the overall framework in which the federation will be managed and operated. Recommendations relating to Governance, one of our three pillars, have therefore naturally emerged from multiple projects spanning various aspects of federation. These recommendations highlight that a clear Governance and Operating Model is essential for building and developing a successful federation. We recommend that:

- **A Federation Governance and Operating Model** be established, including functions which shall:
 - Refine and own a strategic vision for federation - a "purpose for federation".
 - Mandate the shared tools, technologies and technical frameworks to be used in federation.
 - Define Governance and Roles which encourage alignment with strategic goals and priorities.
 - Assess and monitor risks to enable strategic agility over time.
 - Foster trust and transparency across the federation, including through identification and regular review of decisions that affect the boundary of the federation.
- Provide a Federated Culture and Learning Observatory, to sit alongside the Federated Governance Model, reflecting on culture, learning and inclusion to support coordination across communities.
- The model deployed should be designed to be broadly aligned with, and supportive of, relevant recommendations elsewhere in this document.
- Care should be taken to ensure representation both from key existing communities including commercial and industrial users, users with sensitive data and research communities not yet engaged with Research Computing, but also with communities which will emerge over time such as those working on Quantum Computing. Representation should be reviewed periodically to take account of changes in these groups.

Development and deployment of such a Federation Governance and Operating Model will not only ensure that the federation that is aware of, and responsive to, the needs of the user community, but will also enable the federation to adapt to whatever changes the coming decades bring.



Table 1.4: Project Recommendations relevant to Umbrella Recommendation D3

Project	Recommendation(s)
Inclusive Futures	Various
UNITED	Various
Everything, Everywhere, All at Once	EEAAO-06
Supercomputing and Superpositions	QUANTUM-09
Enhancing HPC Adoption through User Centred Design	UCDSN-04

1.5 E1 Single Front Door, Onboarding, Admin and Support

While it is natural to focus on the actual research work conducted on DRI, onboarding, admin and support can represent significant pain points for users and DRI managers, impeding the ability to make progress with impactful research activities. Various projects engaged with the difficulties faced in these areas, highlighting that improving experience for all involved should be considered a priority. We recommend that:

- A **User-centred Single Front Door** for end users of DRI should be established.
- This should be a guided route helping users understand what types of Research Computing Service are available and appropriate for their problem, which services are relevant, what costs apply and what support is available.
- The route should include plain language explanations and sector-specific use cases, with care to ensure that this includes information that is accessible and relevant for non-traditional users.
- The single front door should include a **Centralised, Searchable UK DRI Platform**, including at a minimum a mapping of what DRI facilities exist, what they support and how to access them.
- The single front door should further provide **clear access routes to support** both for federation and for specific services which users may engage with.
- A **minimum national project-to-access information profile** should be defined and published, covering stable project identifiers, dates, people and roles, events and conditions to ensure standardised project metadata. This should allow for local extension.
- **Reusable guidance and policy defaults** should be defined, identifying who may manage different aspects of DRI access, distinguishing operational delegation from institutional accountability and providing auditable models.
- A **coordinated capability for lifecycle communications** should be established to communicate grant and project changes which impact access, covering all stages of the user lifecycle.
- Cross-council and cross-DRI **communities of practice** should be established for research administration, RSE, governance, service providers, funders and researchers. This should maintain shared definitions, surface implementation



problems, coordinate outputs and prevent duplicated local work.

- Planning appropriate access to and provision of RSE and RTP expertise should be an integral part of the process of allocation, rather than requiring users to investigate this following allocation.

In undertaking these recommendations we can ensure that the onboarding, admin and support processes are as aligned and supportive of user needs as possible, lowering barriers to access and use of the federated system.

Table 1.5: Project Recommendations relevant to Umbrella Recommendation E1

Project	Recommendation(s)
Bridging the Gap - aligning project admin with access to DRI	Various
Enhancing HPC Adoption through User Centred Design	Various
Barriers for Biology Researchers	BIO-01
Surveying Accessibility for Junior Researchers	JUNIOR-02
Supercomputing and Superpositions	QUANTUM-07

1.6 E3 Culture, Widening Participation and User Needs

Among the 26 flexible funded projects within NFCS we have had a fantastic representation from projects investigating the needs of user groups new to Research Computing, and others who are not always fully considered. Involvement has spanned a broad range of disciplines, including projects focusing on biology and arts and humanities researchers, users in the health and built environment sectors and users in the emerging field of quantum computing. From these and other projects it is clear that a key focus of federation needs to be consideration of variations in research culture between communities, a focus on widening participation and an effort to develop and maintain an understanding of the full breadth of evolving user needs. We recommend that:

- A systematic and recurring **mapping of how different user communities understand federation and DRI** should be undertaken and used to inform communication and engagement strategies.
- A **community-led approach to widening participation in a federated digital research infrastructure** should be taken, including cross-disciplinary coordination with other research communities to share practice, platforms, tools (e.g. codes and workflow managers), and standards for interoperability.
- Policies and support mechanisms should be designed to **recognise and accommodate non-linear, iterative and flexible models of working**, as linear project lifecycles may not work for all users.
- Requirements of differing communities should be assessed and capabilities **beyond the traditional Research Computing methodology** made available as appropriate. This includes persistent and remote graphical access to services.



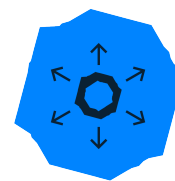
- Community gateways should be aligned and integrated with the single front door, providing researchers with sector-specific guidance on accessing federation and DRI.

The greater understanding of and support for user communities that these recommendations will generate will ensure that access to DRI can be made available to all users, and that emerging user groups can be efficiently and effectively brought on board.

Table 1.6: Project Recommendations relevant to Umbrella Recommendation E3

Project	Recommendation(s)
Federation in the Arts and Humanities	Various
Barriers for Biology Researches	Various
Everything, Everywhere, All at Once	Various
Inclusive Futures	Various
Surveying Accessibility for Junior Researchers	Various
UNITED	Various





Chapter 2

Recommendations - Enablers

2.1 A2 Federated Access Mechanisms

Federated identity establishes who a user is and what authority they hold. Access mechanisms provide the means through which that authority can be exercised across participating services without requiring service-specific credentials or bespoke local account management. Proven approaches exist within large-scale federated heterogeneous infrastructures, such as the Worldwide LHC Computing Grid. Federation should build on this and similar experience while recognising that different services may adopt different access technologies. We recommend that:

- **Interoperable approaches for authorisation and access** across federation be built.
- These should take into account **production federation experience**.
- **Existing approaches** including **tokenised authentication mechanisms** should be leveraged wherever possible.
- **Reference implementations** should be developed and evaluated across multiple and heterogeneous DRI environments.
- These should be used to demonstrate and ensure that different access approaches can be harmonised through **common policy, identity and governance frameworks**.

Through these actions we can achieve not a single mandatory implementation, but interoperable approaches that allow authority, permissions, and policy to be applied consistently across federated compute, data and storage services.

Table 2.1: Project Recommendations relevant to Umbrella Recommendation A2

Project	Recommendation(s)
Tokenised Authentication for Research Computing Services	Various
Federated Data Access Across the DRI	Various

2.2 B3 Federated Trusted Research Environments

Trusted Research Environments are an increasingly important component of UK digital research infrastructure, providing controlled access to sensitive and regulated data. Significant work is already underway through DARE UK and related activities to understand how secure research environments can interoperate whilst maintaining appropriate governance and assurance. Federation creates a need for compatible security patterns that allow data and workloads to move between participating environments without weakening local control. We recommend that:

- A **common approach** should be identified and standardised for **interoperable encrypted storage**, supporting greater portability and load sharing between TREs.
- This approach should **adapt to existing storage systems** at host TREs, and institutions should be supported in hosting local encryption keys and with integration with federated IAM.
- The encrypted storage approach should be **integrated with the federated cybersecurity governance**, and mapped to the shared cybersecurity baseline.
- The use of **open source** technologies to provide the common approach should be considered to provide transparency and trust, and feedback mechanisms established to support communities in engaging with and supporting improvement of the approach.

These recommendations should provide not a single mandatory storage platform or security implementation, but interoperable approaches to provide a trusted foundation for sensitive data services across federation. Users will be able to access different TREs with confidence about the security of their data, and organisations considering their use can have a clear understanding of what is entailed.

Table 2.2: Project Recommendations relevant to Umbrella Recommendation B3

Project	Recommendation(s)
Evaluation of Secure Federated Kubernetes Storage for TREs	Various



2.3 E2 Skills, RSE and Communities of Practice

The success of DRI Federation is dependent upon access to a sufficiently large pool of users and providers with the skills necessary to deploy, access and effectively exploit federation. This requires active support for skills development, alongside efforts to ensure that these skills are promulgated across the communities. The creation of a national skills programme is therefore a priority. We recommend that:

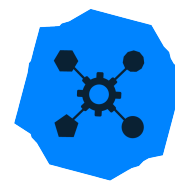
- A **coordinated training and skills programme** should be established, to support the broad adoption and long-term operation of DRI federation and to coordinate DRI skills more broadly across the country.
- This should **avoid duplication of effort** and provide signposting, and where appropriate, support existing communities of practice, resources and offerings.
- This programme should ensure the availability of training and access to communities of practice for both users and providers of DRI federation.
- The programme should oversee and support **federation-level support networks** both for general users and to support specific groups, such as junior researchers. These networks will coopt existing informal support, rather than duplicating effort.

The creation of a training and skills programme will ensure that users and providers have the necessary skills to progress and exploit federation, whilst complementing, supplementing and sharing other key DRI training resources.

Table 2.3: Project Recommendations relevant to Umbrella Recommendation E2

Project	Recommendation(s)
DRI Cybersecurity	CYBER-04
Everything, Everywhere, All at Once	EEAAO-10
Federated Data Movement	FMOVE-07
Federated Edge-HPC Architectures for AI Workflows	FEDGE-08
ACCoRD	ACCoRD-02.3
Barriers for Biology Researchers	BIO-02
Surveying Accessibility for Junior Researchers	JUNIOR-01





Chapter 3

Recommendations - Deliver Later

3.1 A1 Federated Workflows and Job Orchestration

In federating UK DRI there is immense potential to deliver efficiencies through use of automated workflows, operating across heterogeneous DRI facilities and supporting novel and difficult workloads. This is enabled by several of the "Do It Now" category recommendations, including both Federated Identity and Access Management, and Tokenised Authentication. We recommend that:

- A review of **workflow and job orchestration technologies used by communities across DRI** should be undertaken, and the key technologies used across communities identified.
- Integration of these technologies with DRI federation should be demonstrated and documented, to support both DRI operators and users.
- Appropriate workflow technologies for different communities should be highlighted in the Single Front Door, and their integration into federation owned by the relevant Communities of Practice.
- Workflow platforms should be leveraged to support sandboxes for communities - portable, reproducible pipelines built on open standards with playgrounds where researchers can experiment safely.
- A concerted approach should be taken to the integration of workflow platforms into data producers such as laboratories. This may take the form of a common workflow tool for laboratories, easing federation by creating a standardised environment for technical and administrative collaboration.

These recommendations will provide access to workflow and job orchestration tools across the federated DRI. While we do not expect it to be feasible to deploy a single workflow platform for all users, clearly identifying, signposting and supporting appropriate selections to support differing user communities will enable DRI users to take advantage of these technologies, and to deploy workloads not easily supported by DRI today.

Table 3.1: Project Recommendations relevant to Umbrella Recommendation A1

Project	Recommendation(s)
Job Orchestration on Heterogenous Systems	Various
Exploring a Data Centre API for Federated Data Movement	Various
Federated Edge-HPC Architecture for AI Workflows	Various
Towards Federated Laboratory Data Management	Various
Federation in the Arts and Humanities	A&H-02.3
Enhancing HPC Adoption Through User Centred Design	UCDSN-03

3.2 A3 Industry and Public Sector Access

Delivery of the full benefit of DRI Federation for the UK is dependent upon the ability to fully support the integration of Commercial, Industry and Public Sector users. Clear consideration is therefore needed as to how we best support these categories of user. We recommend that:

- **Requirements gathering exercises** be conducted for users outside of the UK Research Community, with specific focuses on Commercial/Industrial users and priority Public Sector users.
- Specific guidance and, where necessary, governance should be provided for managing sensitive commercial data.
- The shared cybersecurity baseline should be clearly documented, with sufficient detail to allow users in the commercial and public sectors to understand the level of assurance offered by the security environment being operated.
- Non Research Community users should be **supported at the Single Front Door**, and, where none already exists, supported to establish appropriate communities of practice.
- **Interoperability of the DRI Federation with cloud providers** should be supported, with appropriate documentation and governance. Cloud providers who choose to integrate with Federated IAM and the supported workflow technologies should be supported in doing so.

These recommendations will support a greater exploitation of the DRI Federation by Commercial, Industry and Public Sector users. In expanding the user base of DRI in this manner we can spread the transformative benefits which federated DRI offers, to the benefit of the UK.

Table 3.2: Project Recommendations relevant to Umbrella Recommendation A3

Project	Recommendation(s)
Federated Edge-HPC Architecture for AI Workflows	Various
Job Orchestration on Heterogenous Systems	Various
Enhancing HPC Adoption through User Centred Design	Various



3.3 C1 Software Supply Chain

Supply chain attacks pose a key concern for Cybersecurity, including for DRI, hence securing the supply chain both for software and containers is critical. We recommend that:

- A **community based mapping exercise** should be undertaken to establish key supply chain characteristics of the existing capabilities that constitute the DRI Federation, including software hardware, and services. This will cover aspects including ownership, licensing and nation state involvement.
- An **appropriate review process** should be applied to new DRI components.
- A **federated container registry** infrastructure should be deployed, with support for cache registries at appropriate constituent DRIs.
- Regular and automatic vulnerability scanning of all containers should take place.
- Policies should be developed for container lifecycle, and for the treatment of unmaintained and vulnerable containers.

These recommendations will allow us to better protect future DRI from supply chain vulnerabilities and attacks. A federated container registry will further support the access of users to useful tools for conducting research.

Table 3.3: Project Recommendations relevant to Umbrella Recommendation C1

Project	Recommendation(s)
Federated AI Container Registry Feasibility Study	Various
Enhancing HPC Adoption through User Centred Design	UCDSN-03
DRI Cybersecurity	CYBER-02



3.4 C2a AI Research-Support Services

AI technology and techniques are currently rapidly changing the way we approach much of the modern world. It is vital therefore that the DRI Federation supports users and operators in making appropriate use of AI to deliver maximum advantage whilst mitigating associated risks. We recommend that:

- **On-premise, or in-federation, LLM facility** provided, with configurable knowledge-base sources, LLM back-end and access control policies.
- DRI sites be supported in using this facility to deploy **AI Helpdesk Facilities** to better support users.
- Users to be supported in using this facility for large scale data analysis.
- Researchers be supported with **agentic coding assistants**.

These recommendations will ensure that users and DRI operators are provided with access to AI Research Support Services with appropriate safeguards and governance, enhancing their ability to adapt to and benefit from DRI Federation.

Table 3.4: Project Recommendations relevant to Umbrella Recommendation C2a

Project	Recommendation(s)
Federated AI Helpdesk	Various



3.5 C2b Responsible AI Governance

Along with the necessity of supporting AI Research Support Services we are obliged to consider how federated governance is applied. We recommend that:

- A **federation wide governance framework** be developed for AI integration, adoption and user support.
- Alongside this a **dedicated security workstream** be deployed tracking both agentic AI and relevant emerging technologies which may impact federation cybersecurity.
- Federated Data Services be supported in developing, sharing and adopting appropriate safeguards against large scale data scraping.
- A federation wide documentation standard should be developed to ensure suitability for AI consumption.

These recommendations will ensure that users and DRI providers can take advantage of AI in a governed and responsible manner.

Table 3.5: Project Recommendations relevant to Umbrella Recommendation C2b

Project	Recommendation(s)
Federated AI Helpdesk	Various
Federation in the Arts and Humanities	A&H-01.1, 01.3, 02.1
DRI Cybersecurity	CYBER-02.4



3.6 F1 Fair and Transparent Allocation

The allocation and accounting of DRI resource, as well as careful management of scheduling, is a fundamental factor that will be critical to the success of the federated DRI. When done well, this has the potential to improve transparency, fairness and utilisation; if done badly, this may impede effective use. We recommend that:

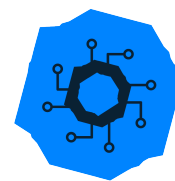
- A **unified data collection standard** be established for DRI, capturing a minimal agreed schema at both system and per-job levels.
- Define a **standard efficiency metric** across federated DRI and report this alongside occupancy based accounting.
- Establish a **cross-system benchmarking and exchange rate** framework such that allocations can be portable across heterogeneous systems.

These will be initial steps in supporting transparency of operation across the federation, better informing and empowering users, funders and DRI providers.

Table 3.6: Project Recommendations relevant to Umbrella Recommendation F1

Project	Recommendation(s)
FAIR Compute	Various
Bridging the Gap	Various
Enhancing HPC Adoption through User Centred Design	UCDSN-05, 07





Chapter 4

Recommendations - Horizon

4.1 C3 Quantum-HPC Integration

Quantum computing is an exciting emerging technology which currently sits on the horizon, but which shows great promise. Given that there is a realistic prospect of exploitation within a few typical DRI planning cycles, it is vital that the DRI Federation be prepared for it's arrival. We recommend that:

- A **minimum viable federated quantum-DRI access service** be defined and demonstrated, alongside reference hybrid quantum-HPC and quantum-AI architectures. This will centre Federated DRI sites in providing the main route by which users discover and access quantum resources.
- Users should be provided with **simulator first entry pathways** for access to quantum technologies, along with **common programming and middleware** expectations for how hybrid workflows will operate across federation.
- Quantum literacy should be incorporated into the federated skills and training approach, and federated governance updated to account for management and allocation of quantum technologies.

These recommendations will support federation in best prerparing to adopt and make available to users novel quantum technologies as these become viable.

Table 4.1: Project Recommendations relevant to Umbrella Recommendation C3

Project	Recommendation(s)
Supercomputing and Superpositions	Various

4.2 F2 Carbon and Resource Aware Federation

DRI operation is inherently energy-intensive, hence there is an imperative to take action to mitigate the environmental impact of the federated DRI system. Such actions need to align with Work to achieve national and organisational Net-Zero goals. We recommend that:

- Federation governance should **take as an input the output of the currently on-going NetDRIVE project**, which is working to develop a common vision for sustainable provision of DRI, and consider how best to progress this vision.
- Federation should adopt an agreed **Sustainability vocabulary** and wherever possible **embed carbon and resource aware decision making** into federated computing.
- Alongside the communities of practice a **coordinated programme including training and knowledge exchange** should be deployed covering carbon aware computing, sustainability assessment, governance and other key environmental sustainability issues.

This will allow federation to best support users and DRI providers in contributing towards the achievement of national and organisational Net Zero and Sustainability goals.

Table 4.2: Project Recommendations relevant to Umbrella Recommendation F2

Project	Recommendation(s)
Net Zero and Circular Economy Federation	Various

