24/10/2024

Ref.	Risk Description	Short Name	Work-package	Potential impact on project	Owner	Inherent Risk			Existing Controls	Current and proposed mitigation	Residual Risk			Action Required	Change since last review	T1	T2	Project	Operational	Reputational	Financial
						Likelihood	Impact	Total			Likelihood	Impact	Total								
1	**ANTARES storage system may suffer from degraded availability or inadequate performance**	**Antares Storage System Problems**	A1	Experiments would be unable to keep up with data rate from CERN or other sites. Service may be unable to handle planned level of reprocessing or analysis.	AD	4	5	20	Reliability good but some indication of performance related problems at high transaction rates. Extensive testing of infrastructure. Close liaison with CERN. Pro-active monitoring. Change control system. Limit number of major upgrades. Close liaison with experiments. Resilient architecture.	ANTARES is mature as a project (2 years experience in full production). Recently, demands have begun to rise on the max write rates of the system, which constitute the bulk of the risk.	4	5	20		ANTARES is mature as a project (2 years experience in full production). Recently, demands have begun to rise on the max write rates of the system, which constitute the bulk of the risk. These two factors balance each other so no change overall.						
2	**Outage of the UK T1 for 1 week or more (cooling failure, network failure etc)**	**Outage of UK T1**	A1,B	Tier-1 would not be able to operate and would be unable to meet MoU commitments. Knock on effect on UK Tier-2s.	AD	4	6	24	Well tested disaster management system will initiate prompt remedial action. Staff prepared to work overtime. Resilient network connectivity and cooling system. UPS. Environment monitoring and callout system.	Some resilience is available in the International Tier-1 structure. Tier-2s could work with other Tier-1s if required. Some fall back services are provided by the Tier-2s. The LHCONE link is now proven capable of backing up the LHCOPN, as happened during the DC24 challenge.	3	4	12		Impact reduced due to improved resilience.	x			x	x	
3	**Failure of T1 to meet WLCG MoU service level commitments for availability/responsivness**	**Failure of T1 to meet SLA or MoU**	A1,B	Due to falling staff levels at the Tier-1 it becomes increasingly difficult to respond in a timely manner. In the event of a major failure (rather than a slight technical failure) experiments would be unable to carry out their full program of work at the Tier-1. We may suffer reputational damage. Additional pressures on "potential energy saving" mandates also add risk here.	AD	7	5	35	Production team and callout system. Disaster management system. Resilient, segmented infrastructure. Performance metrics. Change control system. Well established hardware procurement system with reserve capacity to handle short term procurement delays.	Much of the work of the team is directed towards ensuring MoU commitments are met. Production team will continue to enhance the services ability to respond rapidly and effectively to problems. Increase further the emphasis on change management and testing. Improve ability to carry out transparent interventions, by architecture, virtualisation and instancing improvements.	4	5	20		No change. (but added "energy savings" mandates to narrative)	x			x	x	
4	**Significant loss of custodial data at the T1**	**Significant loss of custodial data at the T1**	A1, B	Reputational damage. Although copies are usually held elsewhere in the world copying back to RAL may be operationally problematic or even in extreme cases impossible.	AD	6	8	48	Metadata catalogue backups and live off site copy. Checksums. Media recovery procedures.	Extensive disaster recovery testing. Routine data dipsticking/validation. Regular media repacking.	3	5	15		No change.	x			x	x	
5	**Substantial loss of or damage to hardware at the T1 (Fire, flood, theft, flooring failure, cooling failure ...) hardware damage exceeding £2m**	**Loss or damage to hardware at T1 >£2M**	A1	Could not meet MoU commitments. Corrective action would be impossible within existing funding and when funded may take many months to carry out.	AD	1	10	10	Building access control system and physical protection. Environment monitoring, automated shutdown and callout system. Fire alarm and fire suppression system. Cooling system resilience. Disaster management system.	Ensure close liaison with site services to pre-empt weaknesses when they are identified in the infrastructure.	1	10	10		No Change	x			x	x	x
6	**Significant disaster at the Tier-1, leading to prolonged outage (fire, flood, JANET unavailable for long period, etc.)**	**Disaster at T1 leads to prolonged outage**	A1	Very long term outage of the Tier-1: UK unable to meet its commitments to wLCG over substantial period	AD	0.5	8	4	Environment monitoring and callout system to stop problems becoming critical. Other wLCG Tier-1s take over services.	Resilient site network paths and infrastructure. Attempt to associate UK Tier-2s with other Tier-1s now a possibility owing to improved network infrastructure.	0.5	8	4		No Change	x			x	x	x
7	**Failure to retain or recruit key technical staff at RAL**	**Recruitment and retention problems at RAL**	A1,B,C	Inability to meet GridPP deliverables, milestones and metrics because of lack of staff	DK	9	6	54	Ensure that STFC management are aware of problems when/if they occur	Well documented processes & procedures for key systems are used to share essential knowledge. This allows technical staff to have the minimum knowledge required to ensure critical systems stay online and at a minimum level of operation, in the case of a loss of expertise. Staff given appropriate ownership of key systems, recognition within STFC and opportunities to share key personal successes within the GridPP community (at collaboration and other meetings). Use of apprenticeships and internship where appropriate to help fill the recruitment pipeline.	7	5	35		No Change: STEM payscale improvements make retention and hiring more competitive, but soft pause in recruitement makes it harder to action if necessary. Currently all funded roles are filled.	x			x		
8	**Failure to procur, deploy or operate hardware at GridPP sites**	**Failure to procur, deploy or operate hardware**	A, B	Problems with procurement such as late delivery or other supplier related issues. Large batches of h/w could fail acceptance testing or develop faults during production use. Significant reduction in capacity could adversly affect GridPP's abilitiy to meet the WLCG MoU commitments.	AD,SS	4	7	28	1. Monitoring of available disk space/cpu utilisation. 2. Procurements take account of experiment requests. 3.Track hardware failures and observe trends. 4. Documented clear recovery procedures. 5. Throughly test new hardware prior to deployment. 6. Changes in site procurement policy 7. PMB oversight of procurement at GridPP sites.	If jobs do not require site specific data then redirect them to other sites. If data is required then replicate it elsewhere and run jobs. Run a fast procurement to increase capacity - if not a short term effect. Close liason with institutional procurements teams.	4	6	24		Decreased inherent & residual likelihood - procurement and delivery cycles back to steady pre-COVID timescales.	x	x		x		
9	**Insufficient Network bandwidth delivered**	**Insufficient Network Bandwidth**	A, B	Lack of bandwidth would prevent data flowing from the Tier 0, & 1 and onto the Tier 2s at a rate sufficient to process the data at required speeds.	PC	4	5	20	The Tier1 has a failover link for the LHCOPN. Tier-2s are liaising with JANET to upgrade links at major sites.	Exploit second OPN link if necessary, Tier-2s are generally well connected and GridPP has good communications links with JANET/JISC. Actual measured throughput should deliver as expected.	3	5	15		No Change. RAL bandwidth currently v good compared to load; most Tier2s are increasing their site bandwidth in line with NFL.	x	x	x	x		
10	**Over contention for Resources**	**Over contention for resources**	A, B	Resources are so heavily used that conflicts arise between major VOs stemming from a change in experiment requirements subsequent to project proposal.	DB	4	5	20	Quarterly review of resources and priorities at Resource Meetings. Weekly review of storage resources at Castor meetings. Ability to redefine intra-experiment CPU fairshares at short notice.	Purchase more hardware and/or improve profiling and procurement.Reduce non-LHC experiment resources. Agree programme priorities through PMB and STFC.	3	5	15		No change - pledges are okay up to the end of the 12-month look ahead.		x	x	x	x	
11	**Unexpected support requirements by non-LHC VOs**	**Increase non-LHC use**	A,C	Mandated non-LHC VOs (IRIS) have increased support + resource requirements that conflict with required effort for LHC VOs + core functions.	DB	3	5	15	Resource allocation risk offloaded substantially to IRIS + their RSAP process - less pressure on the 10% general share. Support for VOs also shared with IRIS + dedicated share of T1 Liaison FTEs. Most access via shared DIRAC system which centralises support needs.	Improve documentation and other "self-support" roles.	2	5	10		Reworded Risk to reflect that the *resource* risk is mostly now on IRIS + the VOs requesting resources via it. This risk, for GridPP, mostly reflects the support effort needed to get VOs working with GridPP's resources. Reduced inherent likelihood to reflect rebalancing of support.		x	x	x	x	
12	**Difficulty with STFC budgets due to Capital vs Resource limitations**	**Capital vs Resource at the Tier-1**	A,B,C	The Split of funding between Capital and Resource, can cause problems due to the changing classification of computer equipment	DB	4	6	24	Quarterly review of Tier 1 spending situation. Salaries are always classed as resource, but the boundary for equipment purchases makes predicting the capital requirement difficult.	Increase communications with STFC to ensure plan is appropriate.	4	5	20		No change.	x	x	x	x		x
13	**Insufficient funding to meet hardware commitments at Tier-1**	**Insufficient funding at Tier-1**	B	Less hardware available to meet international obligations and MoUs as well a suser expectations. See BREXIT risk.	DB	8	8	64	Detailed trends and costings based on 10 years of purchases to maximise resources procured from spends.	Extend hardware service lifetimes by 1-2 years to soften the depreciation curves in period of lean spending.	8	7	56		Significantly increased due to STFC budget uncertainty, especially within the 2025+ window, and significant requested reprofiling of GridPP7 budget.		x				x
14	**GridPP unable to respond to (unexpected) Technology Shifts - WLCG expts exploit new technology not supported at GridPP sites.**	**Technology Mismatch**	A,B,D	In the absence of significant development effort, GridPP would be unable to respond to new developments in technology cause mismatch between experiment processing requirements and available hardware.	DC	5	7	35	New technology directions are closely monitored by involvement in research work groups on Tokens, DOMA, and HEPIX. . GridPP technology group meets regularly.	Work packages invest some small fraction of effort directly on new technologies with a view to bringing them mainstream when both mature enough and appropriate to the overall project (now WP-D) WLCG TEGs and WLCG TDR update.	3	5	15		Inherent and residual likelihoods reduced, as we are in the middle of Run 3 where stability of platforms is favoured.		x	x	x		
15	**Loss of experienced personnel or insufficient manpower at T2s**	**Loss of experienced personnel at T2s**	A2,B,D	Sites may not be able to diagnose and fix problems as quickly. Ability to react to changing situations or to upgrade will be compromised.	RJ	5	5	25	GridPP7 staffing levels predicted. Multiple Tier-2s provide resilience to the project.	Two people at main sites. Grid Operations team spreads knowledge and expertise across sites. New models of working adopted to cope with falling staff levels at smaller sites.	4	5	20		Risks reduced (and residual risk re-balanced to integer values) to reflect reduced uncertainty for duration of GridPP7 staff budgets.		x		x		
16	**Insufficient funding to meet hardware commitments at T2s**	**Insufficient funding at T2s for h/w**	A2	Less hardware available to meet international obligations and user expectations.	RJ	8	8	64	Funding models are different at different sites. Not all sites would be affected the same way and some sites may be able to add resources to compensate.	Extend hardware service lifetimes by 1-2 years to soften the depreciation curves in period of lean spending.	8	7	56		Significantly increased due to STFC budget uncertainty, especially within the 2025+ window, and significant requested reprofiling of GridPP7 budget.		x				x
17	**Middleware or software at T2 sites not fit for purpose**	**Tier-2s are not fit for purpose**	A2,B	Lack of staffing at Tier-2 sites reducing effort to respond to poor or non-functional middleware. Complex middleware takes significant effort to plan upgrades, deploy and test.	RJ	5	6	30	The same middleware and software is used at T1 and T2 sites across the world. wLCG will work with experiments to solve problems.	Community effort and shared knowledge is distributed trough week operations and storage meetings. Bi-weekly technical meetings held to discuss pain points in detail	4	6	24		Likelihoods reduced by 1 to reflect final end of DPM transitions and increasing stability in other platforms. StoRM and ARC-7 remain worries.		x		x		
18	**Correlated extended downtime at multiple T2s due to power or other shortages.**	**Correlated loss of Tier-2 resource**	A2,B	Loss of a significant portion of the Tier-2 pledged resource, impacting on ability to meet international obligations and user expectations.		2	3	6	Tier-2s are distributed across the country, and on distinct parts of the power distribution network. Many host data centres have resilient power systems.	Mechanisms for managing power usage and load shifting at sites to accommodate any potential mandated power-reduction strategies from government. Increased efficiency of sites to reduce total power overheads. Invest in resilience at datacentre power levels.	2	2	4				x		x		
19	**Correlated downtimes at core T2 storage and dependant non-core T2 storageless sites.**	**Upstream core Tier-2 storage correlated downtimes**	A2,B	Increased "halo" of downtimes at non-core Tier-2s correlated with storage loss at core Tier-2 hosting files they are dependant on. Potentially increased risk of reduction of resource impacting ability to meet international obligations and user expectations.		3	3	9	Where possible, technologies are used which do not correlate non-core Tier-2s strongly with a single core Tier-2 as a storage host (for example, all CMS workloads, ATLAS workloads with Virtual Placement).	Development of further technologies to reduce the dependance of non-core Tier-2s on a single storage endpoint - work in Rucio, DIRAC etc.	2	2	4				x		x		
20	**Experiment software runs inefficiently, to the detriment of UK physicists**	**Expt. s/w runs poorly**	C	Workload would not be able to fully exploit the resources available. Expts would need to invest effort in improved computing model.	SS	4	6	24	Experiments have reviewed computing models in preparation for LHC Run 3. Special arrangements are made for certain customers.	Experiment support posts and the grid support team will be available to all sites. Good dialogue with special customers required to ensure appropriate planning.	3	4	12		Inherent risk reduced as considerable work has been committed on improving expt software efficiency (and is ongoing).			x	x		
21	**Reputation risk due to a serious security problem**	**Security problem affecting reputation**	B,C	Security problems may bring down the whole of GridPP or even wLCG, given that all Sites run very similar software. A major outage is likely to attract significant outside interest and GridPP is likely to suffer damage to its reputation. Threats rising and ability to deal with is decreasing and impact on operations is rising	DK	8	8	64	Act on many fronts in parallel to handle vulnerabilities to avoid incidents, to contain and handle incidents quickly when they do happen and define and enforce appropriate policies to control actions of participants. Dedicated security resource part of GridPP7	We lead the Joint Security Policy Group of wLCG/EGI, the security vulnerability group of EGI . Established experienced security team in place. Many staff have recently recieved security training. New closer relations are being developed with IRIS and JISC security teams and a stronger monitoring and reporting on patching status is being developed.	5	7	35		No change (geopolitical factors remain challenging, work to mitigate keeps pace)			x		x	
22	**Non-availability of T1 &2 service or compromised data due to security vulnerability**	**Loss of GridPP service due to security**	B,C	Extended service downtime, loss of data, inability to process and analyse data.	DK	8	7	56	Well organised operational security incident handling led by the GridPP Security Officer in collaboration with the Tier 1 and Tier 2 system managers. Vulnerabilities in the middleware are handled today by EGI to prevent incidents happening.	The GridPP security effort is essential to reduce the risks from known security vulnerabilities, to handle incidents when they do occur, to train system managers, to define and encourage security best practice, e.g. timely system patching, and to continuously monitor the status. Many staff have recently recieved security training.	5	7	35		No change (but remains challenging)			x	x		

23	**Insufficient effort to support the VOs or the users**	**Insufficient VO/user support effort**	B,C	New user groups (VOs) or users of the main LHC VOs are not able to make use of the Grid to do their research.	SS	7	5	35	Dedicated experiment support post at the Tier-1 and Tier-2 s for LHC Vos however an increase in non LHC VOS could stretch resources. Extensive Web documentation. User Coordinator can liaise with the experimental users.	Tier-1 resource meeting with the User Coordinator provides a forum to discuss new user requirements. GridPP-Support mailing list setup to coordinate help to new users.	3	5	15		No change.	x	x	x	
24	**Mismatch between expected/planned and actual hardware costs over project duration.**	**Mismatch between actual and expected (in planning) hardware costs**	B,C	Project would not be able to deliver the pledged resources resulting in (a) political damage and eventually (b) disadvantage to the UK experiments as the level of resource falls	DB	7	7	49	Monitor UK purchases for last 10 years and extrapolate with comprehensive modelling.	Cross check with CERN predictions but there is a residual exchange rate uncertainty on top of the technological uncertainty.	4	6	24		Risk reduced as hardware costs are falling / unit performance faster than we expected in GridPP7 budget. However, this risk has been reworded to reflect that it only concerns *hardware price prediction* and not the budget awarded to the project itself.	x			x
25	**Funding for central services that GridPP relies on insufficiently funded.**	**Core service funding insufficient**	B	Resources within the NGI on which GridPP is planning to rely are not available. For example, the Certificate Authority is not funded or has inadequate effort to meet GridPP needs.	DB	7	4	28	Close collaboration with STFC to ensure GridPP is aware of progress and any issues.	Call on GridPP contingency to fund extra posts to cover the core staff.	5	2	10		Residual and inherent risk rising, due to general funding uncertainty, but mitigated for central services.	x			x
26	**Breakdown of core operations structures - for example in the NGI/EGI infrastructure**	**Breakdown of NGI/EGI infrastructure**	B	Without a central ticketing (GGUS) interface or Grid Operations database the ability to follow up on problems, inform of upcoming downtimes and general communications between sites and users is interrupted.	SS	3	3	9	Core services are hosted on high-availability hardware. The GOCDB has a failover capability to another region, but we will transition to the GGUS replacement within the timeframe of this register.	NGI structure in place and the existing central instances serve as a backup. After the transition the UK instances will be placed on high resilience equipment and procedures put in place for rapid deployment of new services.	3	3	9		No change	x	x		x
27	**Insufficient travel funds for effective engagement and contribution to wLCG and for internal operation of GridPP.**	**Insufficient travel funds**	B,C	GridPP would experience difficulty in keeping up with developments in operations, in updating staff skills (through attendance at technical meetings) and in keeping up to date with experiment requirements.	DK	5	4	20	Careful management of resources and prioritisation to ensure sufficient travel funds are available	Increase the use of phone and video conferencing for attending meetings (though noting such facilities are not always available and they are frequently less optimal than attendance in person).	3	3	9		Inherent and residual risks slightly increased - recent international conferences have been more expensive than we had expected, and whilst this is manageable, we are tracking this.	x	x		x
28	**Critical middleware no longer supported**	**Critical middleware no longer supported**	B,C	The significant Grid middleware code base needs to be properly maintained and supported throughout the project. The development community is now reduced to a skeleton staff and maintenance problems can arise especially with data management components; transitions of software to new distribution releases (ie post RHEL-7) has been mixed in responsivity.	DC	5	6	30	Existing GGUS mechanisms enable bug reporting by sysadmins to a small number of expert developers, but transition to new GGUS replacement is within timeframe of this register. Data support staff enable appropriate deployment choices, workarounds and bug fixes to be made.	Culture of fully-tested code and minimal change established. Maintenance of expertise and support staff in recognised critical areas. Reductions in functionality, if necessary. Community based support model in process of being established. GridPP in-house development effort for some critical software (xrootd, Rucio, DIRAC).	5	5	25		No change over all (but mix of risk factors has changed). Risk 33 is now folded into this risk.	x	x		
29	**Unplanned infrastructure costs**	**Unplanned infrastructure costs**	B,C	If extra costs arise at the T1 or T2, there is the possibility that funds will not be sufficient to buy the required hardware. Risks failing to meet WLCG pledge, and reputation risk. Risk of needing to ration resources due to electricity etc costs	SS/PG	6	4	24	Tier-2 costs spread across sites - if one site cannot meet the price GridPP is paying, then other sites can increase their share. Increasing risk of electricity costs or networking costs.	GridPP contingency available for extra costs at the Tier-1 or systematic increases at the Tier-2s.	4	5	20		No change (there are other sources of financial risk)	x			x
30	**EGI does not continue or the UK does not continue to be a member.**	**Loss of EGI.eu**	B	Access to services run by EGI, Loss of co funding for services run within the UK. Loss of access to future funding oportunities, such as Horizon 2020.	DK/AD	4	3	12	Essential posts are part of the GridPP7.	Call on GridPP contingency to fund necessary posts. Reallocate work to other staff if possible.	3	2	6		No change	x	x		x
31	**Financial Uncertainty**	**Financial Uncertainty**	B,C	Uncertainties can make staff retention difficult. Lack of long term funding would result in inadequate resources and service being provided to serve the needs of the UK Particle Physics Community.	DB	10	6	60	STFC funding (even in the 12 month timescale) is completely uncertain, as is the final profiling of GridPP7's originally agreed budget.	Raise issues with GridPP Oversight Committee and directly with STFC [ongoing]	10	5.01	50		Risk is actualised on basis of STFC communications with GridPP7 PI, and other projects under STFC.	x			x
32	**Conflicting opinions amongst GridPP stakeholders**	**Conflicting opinions amongst GridPP stakeholders**	B,C	Disatisfaction amoungst users or site administrators could result in reduced utilisation of the resources and adversly affect the quality of research carried out.	DB	5	5.01	25	1. Weekly PMB meetings. PMB minutes widely circulated to members of the community. Operations and sites meetings held weekly, with good coomunication between the PMB and the OPS team via cross membership. Collaboration meetings held regularly. Pressure from financial uncertainty makes all these things more difficult.	More F2F meetings, More CB meetings, Sites visits.	3	4	12		Inherent and residual risks increased due to above financial uncertainty and resulting potential pressure.	x	x	x	