

Purchase Contract

(hereafter the “Contract”)

1. CONTRACTUAL PARTIES

1.1 Fyzikální ústav AV ČR, v. v. i.,

with seat: Na Slovance 1999/2, 182 21 Praha 8,
represented by: RNDr. Michael Prouza, Ph.D. – Director,
Registered in the register of public research institutions of the Ministry of Education, Youth and Sports
of the Czech Republic.

Bank: [REDACTED]

Account No.: [REDACTED]

ID No.: 68378271

Tax ID No.: CZ68378271

(hereinafter the “Buyer”)

and

1.2 M Computers s.r.o.,

with seat: B. Smetany 206, 380 01 Dačice,
represented by: Ing. Michal Štěrba, jednatel,
registered in the Commercial Register at the Regional Court in České Budějovice, C/10669.

Bank: [REDACTED]

Account No.: [REDACTED]

ID No.: 26042029

Tax ID No.: CZ26042029

(hereinafter the “Seller”),

(the Buyer and the Seller are hereinafter jointly referred to as the “Parties” and each of them
individually as a “Party”).



2. FUNDAMENTAL PROVISIONS

- 2.1 The Buyer is a public research institution whose primary activity is scientific research in the area of physics, especially elementary particles physics, condensed systems, plasma and optics.
- 2.2 The Buyer is in the process of implementing a project Reg. No. CZ.02.1.01/0.0/0.0/15_003/0000437 with the title “Cosmology, Gravitation and Dark Sector – CoGraDS” within the framework of the Operational Programme Research, Development and Education (OP RDE) (hereafter the “**Project**”).
- 2.3 The subject matter of this Contract is funded using grant provided to the Project, for which it is destined.
- 2.4 The Buyer wishes to acquire the subject of performance hereof (a computer cluster) in order to carry out cosmological N-Body simulations, solve non-linear partial differential equations on a lattice and to perform Monte Carlo Markov Chain based parameter estimation.
- 2.5 The Seller was selected as the winner of a public procurement procedure announced by the Buyer in accordance with Act No. 134/2016 Coll., on Public Procurement, as amended (hereinafter the “**Act**”), for the public contract called “**High-Performance computer cluster with GPU’s for cosmological N-Body simulations and PDE’s**” (hereinafter the “**Procurement Procedure**”).
- 2.6 The documentation necessary for the execution of the subject of performance hereof consist of
- 2.6.1 Technical specifications of the subject of performance hereof attached as **Annex No. 1** hereto.
- 2.6.2 The Seller’s bid submitted within the Procurement Procedure in its parts which describe the subject of performance in technical detail (hereinafter the “**Sellers’s Bid**”); the Sellers’s Bid forms form **Annex No. 2** to this Contract and an integral part hereof.
- In the event of a conflict between the Contract’s Annexes the technical specification / requirement of the higher level / quality shall prevail.
- 2.7 The Seller declares that it has all the professional prerequisites required for the supply of the subject of performance under this Contract, is authorised to supply the subject of performance and there exist no obstacles on the part of the Seller that would prevent the Seller from supplying the subject of this Contract to the Buyer.
- 2.8 The Seller acknowledges that the Buyer considers the Seller’s participation in the Procedure, provided that the Seller complies with all qualification requirements, as the confirmation of the fact that the Seller is capable, within the meaning of Section 5(1) of the Act No. 89/2012 Coll., the Civil Code, as amended (hereinafter the “**Civil Code**”) of providing performance under the Contract with such knowledge, diligence and care that is associated and expected of the Seller’s profession, and that the Seller’s potential performance lacking such professional care would give rise to corresponding liability on the Seller’s part. The Seller is prohibited from misusing its qualities as the expert or its economic position in order to create or exploit dependency of the weaker Party or to establish an unjustified imbalance in the mutual rights and obligation of the Parties.



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- 2.9 The Seller acknowledges that the Buyer is not in connection to the subject of this Contract an entrepreneur and also that the subject of this Contract is not related to any business activities of the Buyer.
- 2.10 The Seller acknowledges that the production and delivery of the subject of performance within the specified time and of the specified quality, as shown in Annexes No. 1 and 2 of this Contract (including the delivery and invoicing), is essential for the Buyer. If the Seller fails to meet contractual requirements, it may incur damage of the Buyer.
- 2.11 The Seller declares that he accepts the “risk of changed circumstances” within the meaning of Section 1765(2) of the Civil Code.
- 2.12 The Contractual Parties declare that they shall maintain confidentiality with respect to all facts and information, which they learn in connection herewith and / or during performance hereunder, and whose disclosure could cause damage to either Party. Confidentiality provisions do not prejudice obligations on the part of the Buyer arising from valid legislation.

3. SUBJECT-MATTER OF THE CONTRACT

- 3.1 The subject of this Contract is the obligation on the part of the Seller to deliver and transfer into the Buyer’s ownership:

the High-Performance computer cluster with GPU’s for cosmological N-Body simulations and PDE’s (hereafter the “**Equipment**”)

and the Buyer undertakes to take delivery of the Equipment and to pay to the Seller the agreed upon price.

- 3.2 The following activities form an integral part of the performance to be provided by the Seller:
- 3.2.1 Transport of the Equipment incl. all accessories specified in Annexes 1 and 2 of the Contract to the site, un-packaging and control thereof,
 - 3.2.2 Installation of the Equipment including connection to installation infrastructure at the site,
 - 3.2.3 Execution of the acceptance tests specified in Annex 1 of the Contract,
 - 3.2.4 Delivery of instructions and operating and repair manuals Equipment in Czech and English language to the Buyer, in electronic and hardcopy (printed) versions,
 - 3.2.5 Free-of-charge warranty service,
 - 3.2.6 Provision of technical support in the form of consultations during the warranty period.
- 3.3 The subject of performance (Equipment) is specified in detail in Annexes No. 1 and No. 2 hereto.
- 3.4 The Seller shall be liable for the Equipment and related services to be in full compliance with this



Contract, its Annexes, the submitted bid and all valid legal regulation, technical and quality standards and that the Buyer will be able to use the Equipment for the defined purpose. In case of any conflict between applicable standards it is understood that the more strict standard or its part shall always apply.

- 3.5 The delivered Equipment and all its parts and accessories must be brand new and unused and intended for the end customer Fyzikální ústav AV ČR, v. v. i.

4. PERFORMANCE PERIOD

- 4.1 The Seller undertakes to deliver the Equipment to the address specified in Section 7.1 hereof within 8 weeks of the conclusion hereof.
- 4.2 The performance period shall be extended for a period during which the Seller could not perform due to obstacles on the part of the Buyer.

5. PURCHASE PRICE, INVOICING, PAYMENTS

- 5.1 The purchase price is based on the Seller's submitted bid and amount to 9 950 000,00 CZK (in words: Nine million nine hundred and fifty thousand CZK) excluding VAT (hereinafter the "**Price**"). VAT shall be paid by the Buyer and settled in accordance with the valid Czech regulation.
- 5.2 The Price represents the maximum binding offer by the Seller and includes any and all performance provided by the Seller in connection with meeting the Buyer's requirements for the proper and complete delivery of the Equipment hereunder, as well as all costs that the Seller may incur in connection with the delivery, installation and handover, and including all other costs of expenses that may arise in connection with creation of an intellectual property creation and its protection.
- 5.3 The Parties agreed that the Price shall be invoiced after the handover protocol (hereinafter the "**Handover Protocol**") in accordance with Section 10.4 will have been signed between the Parties.
- 5.4 The invoice issued by the Seller as a tax document must contain all information required by the applicable laws of the Czech Republic. Invoices issued by the Seller in accordance with this Contract shall contain in particular following information:
- 5.4.1 name and registered office of the Buyer,
 - 5.4.2 tax identification number of the Buyer,
 - 5.4.3 name and registered office of the Seller,
 - 5.4.4 tax identification number of the Seller,
 - 5.4.5 registration number of the tax document,
 - 5.4.6 scope of the performance (including the reference to this Contract),



- 5.4.7 the date of the issue of the tax document,
- 5.4.8 the date of the fulfilment of the Contract,
- 5.4.9 purchase Price,
- 5.4.10 registration number of this Contract, which the Buyer shall communicate to the Seller based on Seller's request before the issuance of the invoice,
- 5.4.11 declaration that the performance of the Contract is for the purposes of the project "Cosmology, Gravitation and Dark Sector – CoGraDS", Reg. No.: CZ.02.1.01/0.0/0.0/15_003/0000437,

and must comply with the double tax avoidance agreements, if applicable.

- 5.5 The Buyer prefers electronic invoicing, with the invoices being delivered to efaktery@fzu.cz. All issued invoices shall comply with any international treaties prohibiting double taxation, if applicable.
- 5.6 Invoices shall be payable within thirty (30) days of the date of their delivery to the Buyer. Payment of the invoiced amount means the date of its remittance to the Seller's account.
- 5.7 If an invoice is not issued in conformity with the payment terms stipulated by the Contract or if it does not comply with the requirements stipulated by law, the Buyer shall be entitled to return the invoice to the Seller as incomplete, or incorrectly issued, for correction or issue of a new invoice, as appropriate, within five (5) business days of the date of its delivery to the Buyer. In such a case, the Buyer shall not be in delay with the payment of the Price or part thereof and the Seller shall issue a corrected invoice with a new and identical maturity period commencing on the date of delivery of the corrected or newly issued invoice to the Buyer.
- 5.8 The Buyer shall be entitled to unilaterally set off against any receivables claimed by the Seller any of its payment due to:
 - 5.8.1 damages caused by the Seller,
 - 5.8.2 sanctions.
- 5.9 The Seller shall not be entitled to set off any of its receivables against any part of the Buyer's receivable hereunder.

6. OWNERSHIP TITLE

- 6.1 The ownership right to the Equipment shall pass to the Buyer by handover. Handover shall be understood as delivery and acceptance of the Equipment duly confirmed by Parties on the Handover Protocol.



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7. PLACE OF DELIVERY OF THE EQUIPMENT

- 7.1 The place of delivery of the Equipment shall be the server computing center of the Fyzikální ústav AV ČR, v.v.i., at Na Slovance 1999/2, Praha 8, Czech Republic.

8. PREPAREDNESS OF THE PLACE OF DELIVERY

- 8.1 The Buyer is obliged to allow the Seller to install the Equipment at the place of performance. In the case of organizational reasons on its side the Buyer reserves the right to extend the date of commencement of the installation by means of written notification addressed to the Seller at the address specified in paragraph 12.1 of this Contract.

9. COOPERATION OF THE PARTIES

- 9.1 The Seller undertakes to notify the Buyer of any obstacles on its part, which may negatively influence proper and timely delivery of the Equipment.

10. DELIVERY, INSTALLATION, HANDOVER AND ACCEPTANCE

- 10.1 The Seller shall transport the Equipment at his own cost to the place of handover. If the shipment is intact, the Buyer shall issue delivery note for the Seller.

- 10.2 The Seller shall perform and document the installation of the Equipment and launch experimental test in order to verify whether the Equipment is functional and meets the technical requirements of Annexes No. 1 and 2 hereof.

- 10.3 Handover procedure includes handover of any and all technical documentation pertaining to the Equipment, user manuals and certificate of compliance of the Equipment and all its parts and accessories with approved standards.

- 10.4 The handover procedure shall be completed by handover of the Equipment confirmed by the Handover Protocol containing specifications of all performed tests. The Handover Protocol shall contain the following mandatory information:

- 10.4.1 Information about the Seller, the Buyer and any subcontractors,
- 10.4.2 Description of the Equipment including description of all components and serial numbers,
- 10.4.3 Description of executed acceptance tests: type of test, achieved parameters,
- 10.4.4 List of technical documentation including the manuals,
- 10.4.5 Eventually reservation of the Buyer regarding minor defects and unfinished work including the manner and deadline for their removal,
- 10.4.6 Date of signature of the Equipment Handover Protocol.



- 10.5 Handover of the Equipment does not release the Seller from liability for damage caused by product defects.
- 10.6 The Buyer shall not be obliged to accept the Equipment, which would show defects or unfinished work and which would otherwise not form a barrier, on their own or in connection with other defects, to using the Equipment. In this case, the Buyer shall issue a record containing the reason for its refusal to accept the Equipment.
- 10.7 Should the Buyer not exercise its right not to accept the Equipment with defects or unfinished work, the Seller and the Buyer shall list these defects or unfinished work in the Handover Protocol, including the manner and deadline for their removal. Should the Parties not be able to agree in the Handover Protocol on the deadline for removal of the defects, it shall be understood that any defects shall be removed / rectified within 48 hours from the handover and acceptance of the Equipment.

11. SYSTEM UPGRADE

- 11.1 The Buyer reserves the right to upgrade the system through the Seller or other qualified person.
- 11.2 For the purpose of this Contract, the upgrade is in particular installation of new nodes in the same racks, installation of new memory or new disks within the existing nodes or adding new disks or controllers to the storage system.
- 11.3 In the event that the system upgrade is performed by another qualified person, the Buyer shall inform the Seller in advance of two weeks of the upgrade and of the person providing the upgrade and shall provide the Seller with the option to inspect the upgrade at his own cost.

12. REPRESENTATIVES, NOTICES:

- 12.1 The Seller authorized the following representatives to communicate with the Buyer in all matters relating to the Equipment delivery:

[REDACTED]
e-mail: [REDACTED]
tel. [REDACTED]

- 12.2 The Buyer authorized the following representatives to communicate with the Seller:

[REDACTED]
e-mail: [REDACTED]
tel. [REDACTED]

[REDACTED]
e-mail: [REDACTED]
tel. [REDACTED]

- 12.3 All notifications to be made between the Parties hereunder must be made out in writing and delivered to the other Party by hand (with confirmed receipt) or by registered post (to the Buyer's or Seller's



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address), or in some other form of registered post or electronic delivery incorporating electronic signature (qualified certificate) to epodatelna@fzu.cz in case of the Buyer and to obchod@mcomputers.cz in case of the Seller.

- 12.4 In all technical and expert matters (discussions on the Equipment testing and demonstration, notification of the need to provide warranty or post-warranty service etc.) electronic communication between technical representatives of the Parties will be acceptable using e-mail addresses defined in Sections 12.1 and 12.2.

13. TERMINATION

- 13.1 This Contract may be terminated early by agreement of the Parties or withdrawal from the Contract on the grounds stipulated by law or in the Contract.
- 13.2 The Buyer is entitled to withdraw from the Contract without any penalty from Seller in any of the following events:
- 13.2.1 The Seller fails to meet the deadline pursuant to Section 4.1 hereof.
 - 13.2.2 Technical parameters or other conditions required in the technical specification defined in Annex No. 1 and 2 hereto and in the relevant valid technical standards will not be achieved by the Equipment at handover,
 - 13.2.3 Facts emerge bearing evidence that the Seller will not be able to deliver and handover the Equipment.
 - 13.2.4 The Seller will not meet the qualification criteria within the Procurement Procedure.
- 13.3 The Seller is entitled to withdraw from the Contract in the event of the Buyer being in default with the payment for more than 2 months with the exception of the cases when the Buyer refused invoice due to defect on the delivered Equipment or due to breach of the Contract by the Seller.
- 13.4 Withdrawal from the Contract becomes effective on the day the written notification to that effect is delivered to the other Party. The Party which had received performance from the other Party prior to such withdrawal shall duly return such performance.

14. INSURANCE

- 14.1 The Seller undertakes to insure the Equipment against all risks, in the amount of the Price of the Equipment for the entire period commencing when transport of the Equipment starts until duly handed over to the Buyer. In case of breach of this obligation, the Seller shall be liable to the Buyer for any damage that may arise.
- 14.2 The Seller is liable for the damage that he has caused. The Seller is also liable for damage caused by third parties undertaken to carry out performance or its part under this Contract.



15. WARRANTY TERMS

- 15.1 The Seller shall provide warranty for a period of 60 months. The warranty period shall commence on the day following the date of signing of the Handover Protocol pursuant to Section 10.4 hereof.
- 15.2 The warranty covers the wear-out of SSDs and any HDDs.
- 15.3 The Seller undertakes to provide service support under the 8x5xNBD On-Site (NBD = Next Business Day) during the warranty period. Replacement of defective components is obligatory for the Seller to perform only at the place of installation of the Equipment. The repair time may not exceed 14 calendar days for compute nodes and 3 business days for other components. Seller is obliged to deliver a replacement HW before removing the HW claimed.
- 15.4 The defect notification address is support@mcomputers.cz. The notification is effective at the moment of its sending.
- 15.5 Any component which carries its own warranty shall have the warranty period for the period specified therein but at least for the period defined in 15.1.
- 15.6 Any and all costs associated with defect rectification / repair including transport and travel expenses shall be always borne by the Seller.
- 15.7 The repaired Equipment shall be handed over by the Seller to the Buyer on the basis of a protocol confirming removal of the defect (hereinafter the “**Repair Protocol**”) containing confirmations of both Parties that the Equipment was duly repaired and is defect-free.
- 15.8 The repaired portion of the Equipment shall be subject to a new warranty term in accordance with Section 15.1, which commences to run on the day following the date when the Repair Protocol was executed.
- 15.9 Should the Equipment suffer from defects which make it demonstrably unusable for a period exceeding 60 days (defect period) during any six (or fewer) consecutive months during the warranty term, the Seller shall be obliged to rectify such defect by delivering new defect-free Equipment in accordance with Section 2106(1)(a) of the Civil Code within 60 days from the date the Seller was called upon to deliver the new Equipment. The Equipment is demonstrably unusable, when the technical parameters or other conditions required in the technical specification defined in Annex No. 1 and 2 hereto and in the relevant valid technical standards are not met.
- 15.10 In the case of system upgrade in accordance with Section 11., all the warranty terms herein shall remain valid. In the event that the system upgrade is performed by another qualified person, this warranty shall not cover any new components installed as a result of this upgrade. If the Seller refuses to perform a warranty repair due to a defective upgrade performed by a qualified person, he is required to specify the upgrade defect in sufficient detail. The burden of proof to prove defective performance lies with the Seller.



16. GUARANTEE OF THE SELLER

16.1 The Seller agrees that at least for the duration of the warranty he will be able to provide the Buyer with all relevant SW releases and SW versions of the active elements and minor SW releases for the application software offered by the manufacturer so that the delivered solution is in accordance with the Buyer's order and works without any defects, if the Buyer requires such support to be purchased. The Seller further undertakes to obtain the SW products required in a legal way under the conditions specified by the Equipment manufacturer.

17. CONTRACTUAL PENALTIES

17.1 The Buyer shall have the right to a penalty in the amount of 0.2 % of the Price for each commenced day of delay with the performance pursuant to Section 4.1 hereof.

17.2 The Buyer is entitled to reimbursement for each commenced day of delay in removing defects covered by the warranty pursuant to Section 15.3 hereof in the amount of

17.2.1 10.000,- CZK in cases where the subject of performance can work on only 50 % or less of its maximum capacity;

17.2.2 2.000,- CZK in cases where the subject of performance can work on more than 50 % of its maximum capacity.

17.3 The Buyer shall be entitled to claim a contractual penalty against the Seller in the amount of 30 % of the Price, in case he will subsequently take advantage of the opportunity to withdraw from the Contract pursuant to Section 13.2.1 and 13.2.2.

17.4 In case of default in payment of any due receivables (monetary debt) under the Contract, the defaulting Buyer or Seller (the debtor) shall be obliged to pay a contractual penalty at the statutory rate for each commenced day of delay with the payment.

17.5 Contractual penalties are payable within 30 days of notification demanding payment thereof.

17.6 Payment of the contractual penalty does not prejudice the rights of the Parties to claim damages; the Parties exclude use of Section 2050 of the Civil Code.

18. DISPUTES

18.1 Any and all disputes arising out of this Contract or the legal relationships connected with the Contract shall be resolved by the Parties by mutual negotiations. In the event that any dispute cannot be resolved by negotiations within sixty (60) days, the dispute shall be resolved by the competent court in the Czech Republic based on application of any of the Parties; the court having jurisdiction will be the court where the seat of the Buyer is located. Disputes shall be resolved exclusively by the law of the Czech Republic.



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19. ACCEPTANCE OF THE PROJECT RULES

19.1 The Seller, using all necessary professional care, shall cooperate during financial inspections carried out in accordance with Act No. 320/2001 Coll., on Financial Inspections, as amended, or during other financial inspections carried out by any auditing entities (particularly by the Managing Authority of the Operational Program Research, Development and Education) and shall allow access also to those portions of the bid submitted within the Procurement Procedure, the Contract and related documents which may be protected by special legal regulation, given that all requirements set forth by legal regulation with respect to the manner of executing such inspections will have been observed.

20. FINAL PROVISIONS

20.1 This Contract represents the entire agreement between the Buyer and the Seller. The relationships between the Parties not regulated in this Contract shall be governed by the Civil Code.

20.2 In the event that any of the provisions of this Contract shall later be shown or determined to be invalid, ineffective or unenforceable, then such invalidity, ineffectiveness or unenforceability shall not cause invalidity, ineffectiveness or unenforceability of the Contract as a whole. In such event the Parties undertake without undue delay to subsequently clarify any such provision or replace after mutual agreement such invalid, ineffective or unenforceable provision of the Contract by a new provision, that in the extent permitted by the laws and regulations of the Czech Republic, relates as closely as possible to the intentions of the Parties to the Contract at the time of creation hereof.

20.3 This Contract may be changed or supplemented solely by means of numbered amendments in writing, furnished with the details of time and place and signed by duly authorised representatives of the Parties. The Parties expressly reject, within the bounds of Section 564 of the Civil Code, modifications to the Contract in any other manner.

20.4 This Contract is drawn up in three (3) counterparts, each of which is deemed to be the original. The Seller shall receive two (2) counterparts, the Buyer shall receive one (1) counterpart.

20.5 The Parties expressly agree that the Contract as a whole, including all attachments and data on the Parties, subject of the Contract, numerical designation of this Contract, the Price and the date of the Contract conclusion, will be published in accordance with Act No. 340/2015 Coll. on special conditions for the effectiveness of some contracts, publication of these contracts and Contract Register, as amended (hereinafter the "**CRA**"). The Parties hereby declare that all information contained in the Contract and its Annexes are not considered trade secrets under § 504 of the Civil Code and grant permission for their use and disclosure without setting any additional conditions.

20.6 The Parties agree that the Buyer shall ensure the publication of the Contract in the Contract Register in accordance with CRA.

20.7 This Contract becomes valid and effective as of the day of its publication in the Contract Register.

20.8 The following Annexes form an integral part of the Contract:



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Annex No. 1: Technical specification on the subject of performance

Annex No. 2: Seller's bid in respect of part which technically describes the device

20.9 The Parties, manifesting their consent with the entire contents of this Contract, attach their signature hereunder.

In Prague on 20. 11. 2017

In Brno on 31. 10. 2017

For the Buyer:

For the Seller:

RNDr. Michael Prouza, Ph.D.
Director

Ing. Michal Štěřba
Managing Director (jednatel)



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Annex No. 1

Technical specification on the subject of performance

“High-performance computer cluster with GPU’s for cosmological N-Body simulations and PDE’s”

1 Acceptance tests

- 1.1 The Seller must verifiably and reproducibly demonstrate that the cluster meets the specified performance parameters during the acceptance tests once the cluster is installed. The tests mentioned below will be performed on the cluster to verify the Seller’s performance claims.
- 1.2 In case of failure to achieve the specified performance, the Seller will have the option to optimize the hardware so that the system reaches the stated performance, but the acceptance protocol will not be signed until the stated performance is achieved.
- 1.3 **Test 1** - The minimum performance of any compute node must be at least 950 points, as measured by the tool SPEC2006 FP, **Rate**, base.
- 1.4 **Test 2** - The minimum performance of any compute node must be at least 110 as measured by the tool SPEC2006 FP, **Speed**, base.
- The results of the performance Test 1 and Test 2 must be supplied, either by providing official results from www.spec.org for a named equivalent system or by running the benchmark on one of the compute nodes.
- 1.5 **Test 3** - The speed of the HOME and DATA storage systems will be measured for writing of a large data file from 8 clients from a single compute node. It will be determined using:
`iozone -t 8 -Mce -s1000g -r256k -i0 -i1 -F file1 file2 file3 file4 file5 file6 file7 file8`
 Important are the results “Children see throughput for 8 initial writers” (for writing) and “Children see throughput for 8 readers” (for reading). The results of all tests must be for iozone version 3.465 (<http://www.iozone.org>). The test will be performed on the HOME and DATA disk fields to verify the Seller’s claim.

The minimum result of Test 3 should be:

- for HOME at least 500 MB/s for reading and 400 MB/s for writing,
- for DATA at least 2.5 GB/s for reading and 2.0 GB/s for writing.
- The determination of speed must not be based on a presumption of specific favourable conditions or a specific favourable measurement mode (e.g. cache operations), unless such conditions or a mode are explicitly required or stated.
- The determination of data storage speed must be stated for the proposed/delivered configuration designed for standard operation (with full storage capacity). It must not be based



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on presumptions which cannot be ensured or which restrict the use of the data storage or other data storage solutions or which do not comply with the requirements or possible interests of the Buyer. For example, the performance of HOME data storage must not be influenced in any manner by the use of DATA data storage.

- 1.6 **Test 4:** System stability test. The test will be performed by a parallel Linpack HPL benchmark running as a multi-node task using MPI at all compute nodes (running on all CPU but not GPUs) for an uninterrupted 48-hour period. The HPL benchmark configuration file (HPL.dat) for the system stability test will be provided by the Buyer. At the same time, the Buyer will have the root access to the individual compute nodes during the stability test run in order to monitor the CPU load and temperature. Installation, compilation, and commissioning of the HPL test for system stability test will be carried out by the Seller.
- 1.7 **Test 5:** Infiniband Test. For this test, the Seller will establish an appropriate test environment on the systems, including IPoIB implementation (IP over Infiniband). The bandwidth of all Infiniband connections will be tested by an appropriate tool in this environment. It is possible to use e.g. iperf over the IPoIB network for each pair of servers connected to the Infiniband network. The bandwidth measurement for each connection must not be shorter than 5 minutes. The resulting bandwidth of each connection must not differ by more than 10% from the specified requirement of 100 Gbit/s. Gradual measurement is permitted, i.e. Seller does is not required to test all connections simultaneously.

2 Notes and definitions

2.1 Data speed/capacity are stated in units of

- 2.1.1 1MB = 1000000 bytes
- 2.1.2 1GB = 1000 MB
- 2.1.3 1TB = 1000 GB
- 2.1.4 1Gbit = 100000000 bits

2.2 Net usable capacity:

- 2.2.1 Net usable capacity of a storage solution is defined as the space available to the user as configured, not taking into account e.g. capacity used for protection (parity or mirroring) in redundant systems
- 2.2.2 The determination of the net usable capacity of a data storage solution must be stated for the proposed/delivered configuration designed for the standard operation and must not be based on presumptions, which cannot be ensured or which restrict the use of the data storage or other data storage solutions or which do not comply with the requirements or possible interests of the Client.
- 2.2.3 The determination of the net usable capacity must not count on or take into account system features or its components as potential additional space for data storage based upon presumptions, which cannot be ensured (compression, deduplication, etc.) or to allocate more space than it is physically possible or actually feasible without the need for other actions (oversubscription).



2.2.4 The tools, solutions used to determine the capacity must provide credible information and must work with a known size of a data block or a known and accurate unit.

Tab. 1

Description and minimum specification of the Equipment as defined by the Buyer	Description and specification of the Equipment offered by the Seller	Complies YES/NO
1. General Cluster specifications		
The cluster is composed of a number of compute nodes, login front-end nodes and a storage system. The cluster must fit in two water-cooled racks to be supplied by the Seller. All nodes and switches must be rack mountable. The Seller must supply all necessary cables.	The cluster is composed of 28 number of compute nodes, login front-end nodes and storage system. All systems fit in two water-cooled racks. All nodes and switches are mountable to rack. All necessary cables are included.	YES
Minimum number of login front-end nodes is 2.	2 pcs of login front-end nodes	YES
Minimum number of storage front-end nodes is 2.	2 pcs of storage front-end nodes	YES
Each node must have support for PCI-e v3.0 minimum.	All nodes support PCI-e 3.0	YES
Each node (including compute, storage front-end and login front-end nodes) must have one 1 Gb (or faster) Ethernet adapter, RJ45 port. The Ethernet adapter must support booting through PXE.	Each node (including compute, storage front-end and login front-end nodes) have 1 Gb Ethernet adapter, RJ45 port. All these ports support booting through PXE.	YES
Each node (including compute, storage front-end and login front-end nodes) must have one Infiniband adapter, PCI-e 3.0 (or later) based and EDR 100Gb/s minimum. One port suffices.	Each node (including compute, storage front-end and login front-end nodes) have one PCI-E 3.0 Interconnect adapter 100Gb/s in single port.	YES
Backend management:		
KVM: Each cluster node must allow a centralized access to the console (keyboard + monitor) and, at the same time support booting from an external device, both locally (KVM switch, boot with USB – CD-ROM, flash disc, hard disc) and online (online KVM or BMC, boot from a virtual machine).	KVM: Each cluster node allow a centralized access to the console (keyboard+ monitor) and, at the same time support booting from an external device, both locally (KVM switch, boot with USB - CD-ROM, flash disc, hard disc) and online (online KVM or BMC, boot from a virtual machine).	YES
IPMI: The motherboard must contain a management controller (BMC) compatible with specification IPMI 2.0 or higher. The BMC must be able to at least monitor the functionality of the ventilators, temperature of the CPU's and of the motherboard; The BMC must offer a basic remote power management (switch on, switch off, reset).	IPMI: The motherboard contain a management controller (BMC) compatible with specification IPMI 2.0 or higher. The BMC is able to monitor the functionality of the ventilators, temperature of the CPU's and of the motherboard; The BMC offer a basic remote power management (switch on, switch off, reset).	YES



The motherboards of each cluster node must allow changing the boot sequence. We request the option of changing the boot device remotely with help of BMC or KVM.	The motherboards of each cluster node allow changing the boot sequence remotely with help of BMC or KVM	YES
The functionality of the IPMI must be accessible from the command line from a remote Linux system connected to the BMC through the LAN interface. The LAN interface of the BMC must be able to be shared with the 1Gb Ethernet interface. For the connection of the node through the 1Gb Ethernet interface and for the connection of the BMC through LAN, one Ethernet cable must be sufficient. Alternatively, it must be connectible separately, that is, for the connection of the node through the 1Gb interface and for the connection via BMC through LAN two Ethernet cables could be used.	The functionality of the IPMI is accessible from the command line from a remote Linux system connected to the BMC through the LAN interface. The LAN interface of the BMC is able to be shared with the 1Gb Ethernet interface. For the connection of the node through the 1Gb Ethernet interface (one cable) and for the connection of the BMC through LAN. Alternatively, it could be connectible separately, that is, for the connection of the node through the 1Gb interface and for the connection via BM_C through LAN two Ethernet cables could be used.	YES
2. Compute node specifications		
Each compute node must have a minimum of 2 CPU's with x86-64 architecture.	Each compute node have 2 CPUs with x86-64 architecture	YES
Each compute node must have a minimum of 32 physical CPU cores, hyper-threading not taken into account.	Each compute node have 32 physical CPU cores, hyper-threading not taken into account (CPU Xeon Gold 6130, 16core, 2,1GHz, 22MB L3)	YES
The hardware of all compute nodes must be identical (except the GPU node: see section 3).	The hardware of all compute nodes are identical (except the GPU node from section 3)	YES
CPU performance requirements:		
The minimum performance of any compute node must be at least 950 points, as measured by the tool SPEC2006 FP, Rate , base.	Performance of any compute node is 1220 points as measured by the tool SPEC2006 FP, Rate, base	YES
The minimum performance of any compute node must be at least 110 as measured by the tool SPEC2006 FP, Speed , base.	Performance of any compute node is 131 as measured by the tool SPEC2006 FP, Speed, base	YES
Memory:		
Each compute node must have a minimum of 256GB RAM, ECC DDR4 2400MHz (or faster) and a minimum of 8GB per core.	Each compute node has 384GB RAM, DDR4 ECC reg 2666MHz. 12GB per core	YES
All memory channels of all processors must be filled. The same number of DIMM modules must occupy each channel. All DIMMs in all compute nodes must be	All memory channels of both CPUs are filled. The same number of DIMM modules are occupy each channel. All DIMMs in all compute nodes are	YES



identical.	identical	
The total RAM of all compute nodes together must be a minimum 4TB.	The total RAM of all computed nodes together is 10,752TB	YES
It must be possible to double the amount of RAM of each node in a future upgrade by doubling the number of DIMMs.	It is possible to double the amount of RAM of each node in future upgrade by doubling the number of DIMMs (from 12 to 24)	YES
Compute node local disk space:		
Each compute node must have at least 1 SSD to be used for the system and for swap space.	Each node has 1 SSD to be used for the system and for swap space.	YES
The interface of the SSD's must be PCI-e.	The interface of the SSD is PCI-E	YES
The total net usable SSD capacity per node must be at least three times the RAM capacity of the compute node.	Total net SSD capacity per node is three times the RAM capacity of compute node. Datacentre SSD capacity is 1,2TB U.2	YES
Minimum sequential read must be 1800 MB/s.	Sequential read is at least 1800MB/s	YES
Minimum sequential write must be 800 MB/s.	Sequential write is at least 800MB/s	YES
The DWPD of each SSD must be at least 1.0 or better.	The DWPD is at least 1.0	YES
RAID 0 is allowed.	RAID 0 is not used.	YES
The SSD's must be hot-swappable and accessible without dismounting the node from the rack.	The SSD is hot-swappable and accessible without dismounting the node from the rack.	YES
Redundancy is required if some hardware components (e.g. power supplies, etc) are shared by several compute nodes. In the case of a failure of a single hardware component of a node, no more than that node is permitted to fail. All repairs to one node, including its cut from the power source, must be performed without preventing the functioning of any other node.	All compute nodes doesn't have shared components each other than each computed node has only one power supply. In the case of a failure of single hardware component of one node does not interfere with others nodes.	YES
3. GPU node specifications		
One of the compute nodes from part (2) must have four identical GPU's installed.	One of the compute nodes from part (2) has four identical GPUs installed	YES
The minimum performance of any GPU must be at least 7.0 as measured by the tool SPEC2006 Accel, OpenACC , base. The Seller must mention in the offer the values reached by this solution and these values will be tested in the acceptance tests.	Performance of any GPU is at least 7.0 measured by the tool SPEC2006 Accel, OpenACC, base	YES
Each GPU must have 16GB RAM, ECC,	Each GPU has 16GB RAM, ECC	YES



minimum.		
Each GPU must support Nvidia CUDA, compute capability 6.0 (minimum).	Each GPU support Nvidia CUDA, compute capability 6.0	YES
The four GPU's must be connected together through manufacturer's proprietary interconnect.	The four GPU are connected together through manufactures proprietary interconnect (NVlink)	YES
The CPU, memory and local disk configuration of this node must be identical to the other compute nodes.	The CPU, memory and local disk configuration of this node is identical to the other compute nodes (2x Xeon Gold 6130, 12x32GB RAM DDR4 ECC reg 2666, 1x SSD PCI-E 1,2TB)	YES
4. Login front-end specifications		
The hardware specification (CPU, memory) of the login front-end nodes must be identical to the compute nodes, apart from the local disk space and redundancy requirements listed below.	The hardware specification (CPU, memory) of the login front-end nodes is identical to the compute nodes, apart from the local disk space and redundancy requirements listed below.	YES
Login front-end node local disk space:		
Each login front-end node must have SSD's set up as a RAID 1 array to be used for the system and swap space.	Each login front-end node has SSDs set up as a RAID 1 array to be used for the system and swap space	YES
The total net usable SSD capacity per node must be at least two times the RAM capacity of the login front-end node.	The total net usable SSD capacity per node is at least two times the RAM capacity of the login front-end node. 2x Datacenter SSD 800GB U.2	YES
The SSD models must be identical to those as for the compute nodes.	SSD models are identical with compute nodes	YES
The interface of the SSD's must be PCI-e.	The interface of the SSDs is PCI-E U.2	YES
Minimum sequential read must be 1800 MB/s.	Sequential read is at least 1800MB/s	YES
Minimum sequential write must be 800 MB/s.	Sequential write is at least 800MB/s	YES
The DWPD of each SSD must be at least 1.0 or better.	The DWPD is at least 1.0	YES
The SSD's must be hot-swappable and accessible without dismounting the node from the rack.	The SSDs are hot-swappable and accessible without dismounting the node from the rack.	YES
Redundancy: The login front-end nodes must not share any hardware components with any other nodes, so that in case of a failure of any other node at least one login front-end node continues functioning without interruption or degradation of performance. It must be possible to perform all repairs of the login front-end node, or any other node, including	The login front-end nodes doesn't have shared components with second login front-end node. In the case of a failure of single hardware component of one of this node does not interfere with other one.	YES



their cut from a power source, without affecting the functioning of the other login front-end node.		
5. Storage system specifications		
The storage system must consist of two disk fields (HOME and DATA), each connected with the cluster through their own storage front-end node.	The storage system consist of two disk fields (HOME and DATA), each connected with the cluster through their own storage front-end node.	YES
HOME: this disk field will store user data and		
Must have net usable capacity of at least 8 TB.	HOME capacity is 8TB	YES
Must achieve sustainable aggregate speed of sequential operations for 256KB block of at least 500 MB/s for reading and 400 MB/s for writing.	Sustainable aggregate speed of sequential operations for 256KB block of at least 500 MB/s for reading and 400 MB/s for writing	YES
Must export NFS v4 filesystem with Kerberos support.	Will export NFS v4 filesystem with Kerberos support.	YES
Must ensure data protection. RAID6 in configuration 8+2 (or better) or using equivalent technology with the same level of protection (number of parity drives).	Ensures data protection. RAID 6 in configuration 8+2	YES
At least two hot spares must be provided.	Two hot spares drives are provided	YES
All disks within the HOME disk field must be of the same type and size and must be of enterprise class.	All disks within the HOME disk field are the same type and size and are enterprise SAS class.	YES
May consist of groups connected together on the front-end server, but all groups must have the same configuration and each RAID group must be realized using an external controller.	Will consist of groups connected together on the front-end server, all groups have the same configuration and each RAID group is realized using an external controller.	YES
Must be able to rebuild within 24 hours during standard operation (performance decrease is acceptable during rebuild).	Rebuild within 24 hours during standard operation. (performance may be lower during rebuild time)	YES
The disks must be hot-swappable and accessible without dismounting the disk-array from the rack.	All disks are hot-swappable and accessible without dismounting the disk-array from the rack .	YES
DATA: this disk field will store intermediate and final results generated by simulations running on compute nodes (typically files larger than 100 GB) and		
Must have net usable capacity of at least 100 TB	Capacity of DATA is 100 TB	YES
Must achieve sustainable aggregate speed of sequential operations for 256KB block of	Sustainable aggregate speed of sequential operations for 256KB block	YES



at least 2.5 GB/s for reading and 2.0 GB/s for writing	of at least 2.5 GB/s for reading and 2.0 GB/s for writing	
Must be configured with a parallel file system (e.g. Lustre, GPFS or similar)	Configured with a general parallel file system	YES
Must ensure data protection. RAID6 in configuration 8+2 (or better) or using equivalent technology with the same level of protection (number of parity drives).	Ensures data protection. RAID 6 in configuration 8+2	YES
At least two hot spares must be provided.	Two hot spares drives	YES
All disks within the DATA disk field must be of the same type and size and must be of enterprise class.	All disks within the DATA disk field are the same type and size and are enterprise SAS class.	YES
May consist of groups connected together on the front-end server, but all groups must have the same configuration and each RAID group must be realized using an external controller.	Will consist of groups connected together on the front-end server, all groups has the same configuration and each RAID group is realized using an external controller.	YES
Must be able to rebuild within 24 hours during standard operation (performance decrease is acceptable during rebuild).	Rebuild to 24 hours during standard operation. (performance may be lower during rebuild time)	YES
The disks must be hot-swappable and accessible without dismounting the disk-array from the rack.	All disks are hot-swappable and accessible without dismounting the disk-array from the rack.	YES
Storage front-end nodes: there will be at least two identical storage front-end nodes, at least one connected to each of the HOME and DATA disk fields.		
In case of a failure of one of the front-ends, the other must take over to serve as a common storage front end for both the disk fields (HOME and DATA) (reduction of performance is allowed in this scenario).	In case of a failure of one of front-ends, the other will take over to serve as a common storage front end for both the disk fields (HOME and DATA) Performance may be lower in this scenario	YES
The minimum performance of the CPU of a storage front-end node must be at least 220 points, as measured by the tool SPEC2006 FP, Rate, base. The storage front-end node must have a minimum of 128 GB of RAM.	Peformance of the CPU of a storage front-end node is at least 220 points, as measured by the tool SPEC2006 FP, Rate, base. The storage front-end node has 192GB of RAM	YES
The CPU(s) must be from the same manufacturer as for the compute nodes. It is not necessary to have the exact CPU model as the compute nodes, but it is required to be from the same generation.	The CPU are the same manufacturer and the same generation as for the compute nodes.	YES
All memory channels of all processors must be filled. The same number of DIMM	All memory channels of CPU is filled. The same number of DIMM moudules	YES



modules must occupy each channel. All DIMMs in all storage front-end nodes must be identical.	will occupy each channel. All DIMMs in all storage front-end nodes are identical	
In case of Infiniband failure, the storage system must be able to fail over to Ethernet.	In case of Infiniband failure, the storage system will be able to work over Ethernet	YES
Storage front-end local storage:		
Each storage front-end node must have at least 2 SSDs configured as a RAID1 array to be used for the system, swap space and parallel file system metadata.	Each storage front-end node has 2 SSDs configured as a RAID1 array to be used for the system, swap space and parallel file system metadata.	YES
The total net usable capacity of SSDs per node must be at least two times the RAM capacity of the storage front-end node.	Total net usable capacity of SSDs per node is two times the RAM capacity of the storage front-end node. 2x Datacenter SSD 400GB U.2	YES
The SSD models must be identical to those as for the compute nodes.	The SSD are identical to those as for the compute nodes	YES
The interface of the SSD's must be PCI-e.	The interface of the SSDs is PCI-E	YES
Minimum sequential read must be 1800 MB/s.	Sequential read is at least 1800MB/s	YES
Minimum sequential write must be 800 MB/s.	Sequential write is at least 800MB/s	YES
The DWPD of each SSD must be at least 1.0 or better.	The DWPD is at least 1.0	YES
The SSD's must be hot-swappable and accessible without dismounting the node from the rack.	The SSDs are hot-swappable and accessible without dismounting the node from the rack.	YES
The storage front-end nodes must be configured so that it is possible to double the total net usable disk capacity of each of the disk fields by adding additional disks and controllers in new RAID6 arrays in a future upgrade. Such an upgrade must not be limited to solutions provided only by the Seller or by specific manufacturers. The Seller must specify how this can be achieved.	The storage front-end nodes are configured in that way, that It is possible to double the total net usable disk capacity of each of disk fields by connecting enclosure boxes with additional disks and controllers in order to form new RAID6 arrays in future. Such an upgrade isn't limited to solutions provided only be the Seller or by specific manufacturers	YES
General storage system requirements:		
Data storage solution components – disks, power supplies, RAID's, switches, servers must be replaceable during operation without causing any failure of the data storage operation.	Data storage solution components - disks, power supplies, RAIDs, switches, servers can be replaceable during operation without causing any failure of the data storage operation.	YES
At least 4 GB write-back cache is required for all hardware RAID controllers.	Each RAID controllers has 4GB write-back cache.	YES



Components of network HOME and DATA can be shared, but it is necessary to maintain the desired performance parameters while testing both parts of the storage system at once, and the storage system must satisfy redundancy and fail-over requirements.	Components of network HOME and DATA are shared, but performance parameters are retained while testing both parts . Storage system has redundant components.	YES
6. Infiniband interconnect specifications		
Minimum Infiniband bandwidth is EDR 100Gb/s.	Interconnect bandwidth is 100Gb/s	YES
The network must be setup with non-blocking fat-tree topology.	The network could be setup with non-blocking fat-tree topology.	YES
Infiniband managed switch(s) (with subnet manager) must be provided fully configured.	Interconnect managed switch(s) (with subnet manager) is provided fully configured.	YES
Infiniband connection between all core switches.	Interconnect connection between all core switches	YES
All cables must be provided.	All cables provided	YES
7. Gbit Ethernet interconnect specifications		
Gbit (or faster) Ethernet switches must be provided.	48 port Gbit Ethernet switches	YES
All cables must be provided.	All ethernet cables provided	YES
Support for VLAN 802.1q required.	Support for VLAN 802.1q	YES
Support for NTP required.	Support for NTP	YES
Support for IPv6 required.	Support for IPv6	YES
Support for SNMP required.	Support for SNMP	YES
8. Environmental requirements		
Dimensions:		
The whole system must fit within two 19" racks, which must be included in the offer together with rack mount kits.	Whole system fit within two 19" racks , which are included together with rack mount kits .	YES
Both racks must be 48U, 600 or 800 x 1200 mm with cooling backdoor compatible with the FZU (IoP) water cooling system.	Both racks are 48U, 800x1200mm with cooling backdoor compatible with the FZU (IoP) watter cooling system	YES
Specifically:		
The water circuit is operated with input temperature of 12 degrees Celsius and output temperature of 18 degrees Celcius.	The water circuit is operated with input temperature of 12 degrees Celsius and output temperature of 18 degrees Celcius.	YES
The water-cooled rack doors must have a pressure loss smaller than 200 kPa.	The water-cooled rack doors have a pressure loss smaller than 200 kPa.	YES
The distance from the valve to the water-cooled rack is less than 4 m.	The distance from the valve to the water-cooled rack is less than 4 m.	YES
The whole system must occupy no more	Whole system occupy 48U in one rack.	YES



than 60U of the two racks, with the remaining space available for future upgrades.	Remaining space available for future upgrades.	
Power consumption:		
The maximum power consumption of all HPC cluster parts at full operation (including compute nodes, whole storage system with front-end servers, switches, login and admin nodes, fans and all other electrical components) must be less than 28kW. The maximum power consumption and its calculation must be explicitly stated.	The maximum power consumption of all HPC cluster parts at full operation (including compute nodes, whole storage system with front-end servers, switches, login and admin nodes, fans and all other electrical components) is less than 28kW. The maximum power consumption and its calculation must be explicitly stated.	YES
The maximum power consumption of the first rack must be less than 20kW. The maximum power consumption of the 2 nd rack must be less than 8kW. The 2 nd rack must be able to function as a standard air-cooled rack in the supplied configuration.	The maximum power consumption of the first rack is less than 20kW. The second rack will be empty and power consumption of the 2 nd rack 0kW. The 2 nd rack is able to function as a standard air-cooled rack in the supplied configuration.	YES
9. Software requirements		
Operating system: The installed operating system on all nodes must be Scientific Linux 6.0. All installed software below must be at the latest compatible version. The Seller must ensure compatibility with all installed hardware. The Seller must verify that all installed software is properly functioning.	Operating system: The installed operating system on all nodes: Scientific Linux 6.0. All installed software below will be at the latest compatible version. All hardware will be compatible with installed software.	YES
All installed hardware must be compatible with CentOS 7.	All installed hardware is compatible with CentOS 7	YES
The Seller must ensure that all installed hardware is compatible with the Intel C compiler.	All installed hardware is compatible with the Intel C compiler	YES
Open source or proprietary software for system management and administration, scalable distributed computing management and provisioning tools that provide a unified interface for hardware control, discovery, and OS diskfull/diskfree deployment must be installed. In the case of proprietary software, the price of the software (its license, support including solving software conflicts and usability problems, and supplying updates and patches for bugs and security vulnerabilities for at least 3 years), must be included. The	Open source software for system management and administration, scalable distributed computing management and provisioning tools that provide a unified interface for hardware control, discovery, and OS diskfull/diskfree deployment will be installed. The documentation for all the software will be included and will be in English.	YES



documentation for all the software must be included and must be in English.		
Appropriate drivers for all file systems must be installed so that the storage disk-fields can be accessed by all the nodes, at minimum the speed specified in part (5).	Appropriate drivers for all file systems will be installed so that the storage disk-fields can be accessed by all the nodes, at minimum the speed specified in part (5).	YES
The following software must be installed on the HOME storage system and accessible to all the nodes (no requirement for the Seller to provide user support for the listed software after the handover procedure is hereby implied):		
A module environment (e.g. LMOD)	A module environment	YES
GNU c (gcc) and fortran (gfortran) compilers	GNU c (gcc) and fortran (gfortran)	YES
Python versions 2.7 and 3.5, 3.6 on all nodes. They must be installed with the scipy full and cython when available.	Python versions 2.7 and 3.5, 3.6 on all nodes. They will be installed with the scipy full and cython when available	YES
OpenMPI	OpenMPI	YES
Mpich	Mpich	YES
Mvapich 2	Mvapich 2	YES
slurm	slurm	YES
nVidia CUDA toolkit 8.0 (minimum)	nVidia CUDA toolkit 8.0 (minimum)	YES
LAPACK and BLAS packages	LAPACK and BLAS packages	YES
Software compatibility must be ensured.	Software compatibility is ensured.	YES

Tab. 2. - EVALUATION CRITERIA

Value of SPEC2006_FP_rate_base of one compute node (S)	1 220
Number of compute nodes	28
Performance of the HPC cluster (S x number of compute nodes)	34 160



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Gbit Ethernet interconnect specifications

Rozpis součástí	Počet (ks)	Cena CZK bez DPH	DPH 21%	Cena CZK s DPH
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
Celkem		[Redacted]	[Redacted]	[Redacted]

Environmental requirements

Rozpis součástí	Počet (ks)	Cena CZK bez DPH	DPH 21%	Cena CZK s DPH
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
Celkem		[Redacted]	[Redacted]	[Redacted]


Software requirements

Rozpis součástí	Počet (ks)	Cena CZK bez DPH	DPH 21%	Cena CZK s DPH
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
Celkem		[Redacted]	[Redacted]	[Redacted]

Položkový rozpočet

Název položky	Počet (ks)	Cena CZK bez DPH	DPH 21%	Cena CZK s DPH
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
Celkem		9 950 000,00	2 089 500,00	12 039 500,00

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5

Spotřeba				Celkem				
Položka č.	Název položky	Počet [ks]	Max Power Consumption [W]	Typical Power Consumption [W]	Min Power Consumption [W]	Max Power Consumption [W]	Typical Power Consumption [W]	Min Power Consumption [W]
1	Compute node specifications	27	395	270	90	10 665	7 290	2 430
2	GPU node specifications	1	1700	1500	400	1700	1500	400
3	Login front-end specifications	2	415	285	90	830	570	180
4	Storage system specifications	1	1896	1274	719	1896	1274	719
5	Infiniband interconnect specifications	1	136	136	40	136	136	40
6	Gbit Ethernet interconnect specifications	1	40	40	20	40	40	20
7	Environmental requirements	1	0	0	0	0	0	0
8	Software requirements	1	0	0	0	0	0	0
	Celkem		1582	3505	1359	15267	10810	3780