High Performance Computing

Beirut Lebanon

Implementation Roadmap
For HPC Facility

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Table of Contents

Project Introduction

The high-performance computing (HPC) project for Lebanon is a project dedicated for the scientific and technological research purposes that will benefit the Lebanese society at large.

In a collaborate effort between The European Organization for Nuclear Research (CERN) and the Ministry of Telecommunication / OGERO and a handful of major Universities in Lebanon, the parties agreed to Install and Operate the first, in its scale, "HPC4L" High Performance Computing facility in Lebanon.

There are two main goals of the project:
1. For CERN to establish an HPC facility providing high computing power for the CERN/CMS offline computing effort to analyze data produced at CERN's Large Hadron Collider in Geneva, Switzerland.
2. For the Lebanese parties to establish an HPC for research and development, the participating Lebanese parties are:
    a. Lebanese University
    b. American University of Beirut
    c. Université Saint Josef
    d. Lebanese American University
    e. Beirut Arab University
    f. National Council for Scientific Research (CNRS)
    g. Ogero
    h. Ministry of Telecommunication (MoT)

Ogero will provide a location for the new Data Center (DC), CERN will donate the compute, storage, and networking components and the Lebanese parties will maintain and manage the datacenter once the project is implemented, during the operation phase.

This document covers the implementation plan for the project, and it is comprised of the following items:
1. The HPC Datacenter Infrastructure Requirements
2. The HPC Project implementations prerequisites
3. The HPC Project implementations roadmap

The HPC Datacenter Infrastructure Requirements

CERN offers to donate the active components of the Data center as part of his initiative of technology transfer and promoting science in partner countries.

In order to make the place ready for hosting the active components/the donation, the proposed place, in Ogero premises, requires minor civil, electrical, mechanical and finishing works in order to accommodate for the facility systems and equipment as per applicable and international standards. This section includes the requirements for interior construction including but not limited to; fixed partitions, interior doors/windows and frames, hardware, finishes, and other interior specialties and accessories.

Work shall comply with applicable codes and design standards as a minimum, and in accordance with and approval of authorities having jurisdiction.

Materials and assemblies installed in the work shall be reviewed or inspected and it must be in compliance with industry standards and these specifications. Materials submittals procedure shall be put in place and approvals shall be acquired prior any installation.

The following are the images of the proposed place to host the components.

Scope of work for contractor
The contractor shall perform the following civil work for the whole HPC Facility area:

Mechanical Work
The air-conditioning system should be designed to provide the required temperature and humidity conditions recommended by the manufacturers of the servers to be installed within the data center.

General temperature requirements for a data center shall be in the range of 20 to 23 Celsius.

Ambient Humidity Levels shall be in the range of 35 and 50% RH as optimal humidity for system reliability.

Optimizing air flow in this data center has several key benefits. Contractor cabinet distribution solution should be designed to draw in air through the front side. And deplete it from the rear side. So, equipment racks should be arranged to create hot aisles and cold aisles. When implemented, it should use the Air block Data Center

System where needed to prevent any air circuit between cold/hot aisles (using hot air containment system).

Power circuits to the air-conditioning equipment should be distributed among a number of power panels/distribution boards to minimize the effects of electrical system failures on the air conditioning system.

All temperature control systems should be powered through redundant dedicated circuits from the UPS.

Eco friendly gas R410a or equivalent should be used as a refrigerant. The refrigerant gas should not have any action in Ozone layer depletion.

Air supply to the data center should be coordinated with the types and layouts of the server racks to be installed. The air conditioning systems should have sufficient capacity to support the total projected heat load from equipment, lighting, the environment, etc.… (Approximately 100 Kw). and maintain required constant relative humidity levels within the data center. The required cooling capacity should be calculated based on the kW (not kVA) supply available from the UPS system.
Electronic and cooling equipment be automatically shut down in the event of any Fire Fighting suppression system discharge.

All cooling equipment should be isolated and connected to grounding system.

The requirements are:
- Optimum room temperature and moisture levels.
- Design of system room's air delivery and return paths and optimum cabinet configurations for the most efficient cooling.
- Design of cold and hot air ventilation funnels of the system.
- Provide complete design of the fire detection, warning and extinguishing system for the IT room and other service rooms.
- Provide complete design regarding the location of the firefighting tanks, warning and extinguishing control panels.
- Precise the locations of manual fire extinguishing equipment.
- Operating principles of air-conditioning and electrical installation in case of a fire
- Operating principles of doors for the evacuation of personnel in the building and in the system room in cases of fire and emergency
- Design of fireproof walls and doors of the system room

1. Cooling System for IT Room

As agreed internationally, the cooling system installed inside a HPC Facility shall be heavy duty, designed for a long continuous operation (24/7), and have special environmental control features. INROW Cooling is designed to sit between the server racks in a hot aisle containment configuration; it takes advantage of its position close to the server heat source and the higher return temperatures that are associated with it, for an efficient cooling of critical IT equipment.

Row based placement of this system provides intelligent precision cooling at the heat source, ensuring cold air reaches the servers quickly. The airflow takes the shortest, most direct route to reduce energy consumption and optimize performance.

For this configuration, 6 cabinets shall be installed for the first phase, 3 cabinets facing each other's. With a hot aisle configuration for an optimum efficiency for the INROW Cooling, INROW Cooling devices should be installed with this configuration.

2. Air Conditioning System
Aisle containments shall be provided. It shall follow the scheme described in terms of thermal containment system (hot aisle / cold aisle containment).

3. Fire Fighting System
The HPC datacenter shall be provided with a complete firefighting solution for HPC Hall. The HPC datacenter shall be supplied with a complete Firefighting solution for the equipment IT room including all pipes installation. A clean agent fire suppression system provides the highest level of protection for the computer room and the associated electrical rooms. This system would be installed in addition to the pre-action suppression and smoke detection systems. The fire suppression system is designed, upon activation, to have the clean agent gas fully flood the room and the under-floor area. This system consists of a nontoxic gas.
The HPC datacenter shall be provided with a complete firefighting flow calculation for the Hall.

Alternating Current Electrical Work (AC)
- Design of system power starting from the building distribution transformer, including main distribution switchgear, power factor compensation equipment, cable routing, system room distribution switchboards, cables and sockets
- Earthing / Grounding conforming to the protection system design, covering the entire grounding network.
- The HPC datacenter shall be provided with all high voltage connectivity to assure the electricity distribution for all equipment, and Cooling system.
- The HPC datacenter shall be provided with a detailed sizing of equipment such as fuses and cables used in electrical panels.
- The HPC datacenter shall be provide with an Energy Consumption calculation, Peak Demand and Energy Installation Designs.
- Breakers ratings and cables cross sections must be submitted for approval prior installation.

Low Current System Work

- Cabinets should be available as standard floor-standing units. The frame shall be made of welded steel sheet metal profile. Static load of the minimum 800mm width / 1200 mm depth cabinet should support 1300kg static load on the 19" plane.

- Vendor-neutral EIA-310 19in Rack Mounting Compatibility Guaranteed.

- The racks and enclosures designed for are comprehensive, vendor-neutral solutions with a full range of Components. They support entire data environment, including server, networking and communications and storage devices.

- Enhanced door ventilation with scalable options capable of cooling high density solutions.

- Tool less 0U mounting provisions for extensive line of Rack Power Distribution Units (PDUs) for high density applications.

- Integrated features and options for horizontal and vertical routing of high-density cabling.

- Approximately 60-80% perforations in the front and rear doors allowing maximized air through flow.

- 42U cabinet with two 19"planes (front and rear); Welded basic frame from steel profiles, Type of protection IP 20.

- 19" panel/slide mount shall be constructed of steel in cabinet color or alum-zinc and preassembled in the factory. The rails support standard holes pattern and are in accordance to IEC 60297-1. To allow flexible mounting depth the slide mounts.

- Front door: 180° hinges and perforation, 3-point locking and lever handle with DIN profile half cylinder with minimum of 60-80% free-area perforation for single door.

- Removable side panel Cabinet.

- Rear door: double perforated door 180° hinges and perforation.

- Metal and plastic components shall be supplied to establish consistent spacing between the racks or rack-based equipment, and to fill the space to provide an air containment seal at the juncture between two adjacent racks or rack based equipment Cabinets shall be provided with provisions for 42U metered and monitored PDUs (vertical or Rackmount) with remote management capabilities as specified or indicated in tender documents.

- Each network cabinet shall be provided with a cabinet grounding kit, grounding bar, ground wires and all relevant grounding accessories. All enclosure components such as doors, side panels, roofs, etc. should be bonded directly to the frame. Grounding points should be provided on frame to externally bond each unit to building ground.

- The manufacturer shall offer tool-less blanking panel kits to prevent the recirculation of hot exhaust air.

- The manufacturer shall ensure all gaps are blocked to prevent recirculation of hot air. All accessories including but not limited to brushes and air baffles shall be included.

- Where network cabinets are shown adjacent on drawings, a baying kit shall be provided to join the two cabinets.

- By default, all patch panels (fiber & copper) shall be installed at the front of the rack.

- The HPC datacenter shall be provided with a complete layout of HPC Facility white space area.
- The HPC datacenter shall be provided with a determination of optimum rack cabinet locations for optimizing cable lengths and heat dissipation.
- The HPC datacenter shall be provided with an environmental monitoring system design for effectively monitoring heat, humidity, smoke, water leakage, and other parameters.
- The HPC datacenter shall be provided with a liquid leakage system.
- The HPC datacenter shall be provided with a cable routing and color-coding design.
- The HPC datacenter shall be provided with a complete design of HPC Facility raised or hard floor structure and layout, seismic assessments of the area.
- The HPC datacenter shall be provided with a complete design of Network Principle (Schematic) Diagram.
- The HPC datacenter shall be provided with the Structural Cabling Design for different connectivity requirements. (Low Level Design)
- The HPC datacenter shall be provided with the Horizontal, Vertical, Backbone and Optical fiber cabling design and considerations (Fiber Raceway).
- The HPC datacenter shall be provided with an optimum layout of copper, Fiber-Optic Distribution Frames.
- The HPC datacenter shall be provided with a complete design of Network Cable Management systems.

- The HPC datacenter shall be provided with a complete design of physical entries into system rooms.
- The HPC datacenter shall be provided with the Access Control system for entrances of both authorized personnel and visitors into the system room with a procedure and registration management system.
- The HPC datacenter shall be provided with a HPC Facility Management System to monitor security and environmental services with remote access capability.
- The HPC datacenter shall be provided with design and installation of monitoring and surveillance system.
- HPC Facility should be equipped with automated security access controls and all activities are monitored 24x7 via network-based surveillance cameras.

Bill of Quantities

HPC - Bill of Quantities				
Sub Part	**Description**	**Specified Items**	**Unit**	**QTY**
II.1 CIVIL Part				
Masonry	Precast concrete hollow block works, bedded and jointed in cement and sand mortar (1:3): including lintels, galvanized metal expanded mesh, galvanized steel L-anchors where applicable and all necessary accessories; all as specified	Masonry wall 15 cm hollow block	m²	6.5
Glass partitions /Aluminum Side 2000 profile	Supply and install interior Full Glazed Dual Layer partition with 2x6 MM tempered clear glass and ALU frames, with double leaf glass sliding door (150x210) MM, including stainless steel fixation stirrups, 45 cm height substructure between the existing floor and the raised floor level, sealant, hardware and all necessary fixing accessories.	triplex glass partition H=3.25 m	m²	23
		Double leaf Door clear triplex glass including ironmongery and all accessories 150 x 210 cm	U	1
Raised Floor	Supply and install of 600 x 600x 40 MM raised floor tiles 450 MM height, height density chipboard panels, fire resistant, including anti-corrosive pedestals and sub-structure with all necessary accessories.	Technical raised floor H = 450mm with 0,9mm HPL finish (IT Room)	m²	75
		Cable outlet cut in raised floor for HPC rooms Brush grommet	U	6
		Panel lifter	U	2
		Stairs	U	1

Wall Plastering	PORTLAND CEMENT PLASTER. Apply Cement render / plasterwork (all internal) and sand internal plastering including lath, plaster stops and all necessary accessories: as specified and as shown on the drawings (internally)	New walls Plastering	m²	13
Wall Painting	The contractor shall submit prior starting the work the technical data sheets and specification of the required materials to be used to the approval, prepare and apply two coats undercoat, three coats of putty and three finishing coats of emulsion latex water base paint: all as specified. Prepare surfaces and apply 3 coats of putty, one water base undercoat, two layer of fire rated white paint and a third finish layer after completion of works ; as specified or shown on drawings.	Putty for new wall and gypsum board (3 coats)	m²	35
		Fire retardant water-based paint for new wall and gypsum board (undercoat + 2 coats)	m²	35
		Fire retardant water-based paint for ceiling, walls and drop beams (1 coats)	m²	160
Furniture	Rectangular Desk	Desktop Workstation for 1 person (140x60) CM including one open box for PC and one drawer with Lock without handle composed of two egger Melamine wood tops with common modesty panel	U	2
	Office Chairs	High Mesh back chairs on wheel with adjustable armrests, headrest, synchro mechanism	U	2
Gypsum Board Ceiling	Gypsum Board Ceiling	Gypsum board ceiling with maintenance opening	m²	22

II.2 Mechanical Part

Cooling System	Supply, install, program, configure, interface, test & commission a cooling Units as specified on RFP for a perfect operation and to the satisfaction of the engineer.	4 x In Row Cooling Cabinet up to 35 Kw	U	4
Air Containment System		Air Containment System	Lot	1
Fire Fighting and alarm System	Fire Fighting FM200 or Novec	IT Room Phase	Lot	1
		FM200 cylinders (concentration 7,2%)		

		Volume 225 m3		
		including cylinders, valves, actuators, pressure gauge/switch		
		manual lever, nozzles, bracket, hoses, schedule 40 pipes		
	Fire Alarm Detection System for Fire Fighting	Extinguishing Panel 3-zones with battery back-up 24 hrs.	U	1
		Photoelectric Smoke Sensor	U	8
		Electronic sounder with light strobe	U	1
		Manual Release dual action	U	1
		Abort Release	U	1
		Portable extinguisher Clean Agent 6 Kg	U	2
II.3 Electrical Part				
Electrical Cables	The contractor shall deliver and install Electrical Cables, between Generator room, EDL room, and UPS room. In addition all required cabling for lighting, cooling, consoles, desktop and grounding.	Cables needed for complete installation as per site conditions	Lot	1
		Supply and install Floor Mount Industrial socket to deliver power to the IT Racks 32A 5PIN 4P+E	U	24

Conduit, Box and Cable Tray for Electrical Cabling	Supply, install and connect, PVC/EMT wiring insulated conductors, including junction boxes, cable glands, sealing compound, cable sleeves and all necessary accessories including conduits and liquid-tight flexible conduits (for outdoor and wet areas) where necessary. Supply and Install are required cable tray for electrical / data cabling at Electrical room, UPS room and Under raised floor.	All required accessories for installation and fixation of EMT Electrical Metal Tubing should be from same brand, even Steel and galvanized (Connectors, Elbows, Couplings, Nipples, and Surface Boxes).	**Lot**	**1**
		All required accessories for installation and fixation of PVC conduit should be from same brand (Connectors, Elbows, Couplings, Nipples, and Surface Boxes).	**Lot**	**1**
		Cable tray Power size 30cm wide x 5cm high- Tray Type : Perforated - Bottom Type : Perforated - Height: 50 mm - Material: Stainless galvanized - Thickness: 1.5 to 2.0 mm - Width: 300 mm - Length: 3000 mm	**Lm**	**122**
Metered – Monitored Power Distribution **Unit MPDU**	32A, (3P + E), vertically mounted metered and monitored power distribution units (PDUs) with remote management capabilities, suitable for SNMP integration with the DCIM, with Minimum 24 (C13) + 6 (C19)	Nominal AC Voltage (50/60 Hz) 250 to 400 V Max Input Current (at 230 V) (A) 32 A Input Plug 3PIN 2P+E Nominal Load Capacity 22 kW Minimum 24 (C13) + 6 (C19) Operating temperature +0 C … +45 C Operating Humidity 10% 95% RH	**U**	**8**
	16A, (3P + E), vertically mounted metered and monitored power distribution units (PDUs) with remote management capabilities, suitable for SNMP integration with the DCIM, with Minimum 24 (C13) + 6 (C19)	Nominal AC Voltage (50/60 Hz) 250 to 400 V Max Input Current (at 230 V) (A) 16 A Input Plug 3PIN 2P+E Nominal Load Capacity 11 kW Minimum 24 (C13) + 6 (C19) Operating temperature +0 C … +45 C Operating Humidity 10% 95% RH	**U**	**4**
MAIN DISTRIBUTION PANEL	Supply and installation of the following MDBs, including metallic enclosures, circuit breakers, earth-leakage devices, contactors, bus bars, earth and neutral connectors, control and measurement accessories, and necessary accessories and connections, as specified and shown on drawings.	Supply and Install Main Distribution Boards rated 4P 1000A	**U**	**2**
		Supply and Install AC distribution panel board rated 4P, 300A	**U**	**2**
		Supply and Install UPS output distribution boards (UDB-A & UDB-B) rated 4P 350A	**U**	**2**

Sockets & Outlets	Supply, install and connect the following wiring devices, complete including wiring/conducting works back to respective panelboards and all related accessories as specified and shown on drawings.	Wall Sockets 16A/250 V	U	2
		Floor and wall Working Station including : 1 Sockets 16A + 1 Sockets UPS 16 A + 1 Data Socket	U	2
Grounding / Earthing	Supply, install and connect the following cables, PVC insulated, copper conductors, complete including accessories, connectors, lugs, supports, clamps as specified and shown on drawings.	Install a complete earthing system for the Operation Center:- Connect to existing Earth Main Bus Bar at Ogero Facility -Main and distribution Bus BarOperation Center Distribution Bus Bar-Main Earthing Conductor-Earth Cable for Equipment-Clamps and Connection Accessories. earth cables for equipotential bonding from Main earth bar to earth bar in remaining rooms. Cables to run on nearest cable tray. earth cables to bond all racks and panels and raised floor to earth bar	Lot	1
		1x70mm2	Lot	1
		1x50mm2	Lot	1
		1x16mm2	Lot	1
		1x10mm2	Lot	1
		1x6mm2	Lot	1
		Flexible Braid cable type for Raised Floor	Lot	1
II.4 Low Voltage Part				
Cabinets	Supply and Install all Cabinets with accessories	Cabinet 42 U, 800 mm x 1200 mm. Perforated front and back side. Black.	U	6
Data Cabling		Cabling	Lot	1

UTP Cables	Supply, install, connect, label, test and commission a complete structured cabling system for voice and data transmission, including but not limited to CAT6 F/UTP cables, with all required accessories as specified on RFP and for a perfect operation and compliance to the applicable standards and to the satisfaction of the engineer.	UTP Cable CAT6 / Meter	**Lot**	**1**
		Telecommunication outlets Wall mounted RJ45 CAT6A F/UTP data outlet, with 4 pairs CAT6A F/UTP cable to corresponding patch panel.	**U**	**2**
UTP Cable Tray	The contractor shall supply and install a cable tray pathway for all voice and data cables (Including cables of low current system and security systems).	Tray Type : Perforated Bottom Type : Perforated Height: 50 mm Material: Stainless galvanized Thickness: 1.5 to 2.0 mm Width: 400 mm Length: 3000 mm Cable tray Data size 40cm wide x 5cm high	**Lm**	**33**
UTP Patch Panel & Cable Organizer	Fully loaded CAT6 UTP patch panel	**24 Ports Patch Panel** with RJ45 jacks (CAT6A)	**U**	**16**
	Patch Panel Cable Organizer		**U**	**16**
UTP Patch Cord	Supply and install all required UTP Cat6 Patch Cord, to assure a complete connectivity between equipment's and network. Contractor shall install all required patch cords with different distance as required. (Fill all Patch Panel Ports)	CAT6A UTP patch cord, 2, 3, and 5 meters	**Lot**	**1**
Fiber cables and Fiber Patch Cords	Supply, install, connect, label, test and commission a complete structured cabling system for fiber optic and OM4 Laser optimized multimode, Single mode fiber optic cables, LC fiber outlets with all required accessories as specified on RFP and for a perfect operation and compliance to the applicable standards.	**6 Core** OM4 MM fiber cable (Per Meter)	**Lot**	**1**
		12 Core OM4 MM fiber cable (Per meter)	**Lot**	**1**
		Fiber Optic MM OM4 patch cord 2, 3 and 5 meters	**Lot**	**1**
Fiber Raceway	Supply And install a complete fiber optic raceway above cabinet as specified on RFP to assure the fiber optic connectivity between cabinets and equipment. Contractor shall provide all required accessories (Joiners, tubing, elbows, tee, fiber storage loop…) to complete the fiber optic raceway design	Fiber optic raceway size should be 4"x4" (100x100 mm). Yellow	**Lm**	**20**

Fiber Optic Patch Panel & Cable Organizer	Fiber Optic Patch Panel	**24 ports** fiber patch panel MM for OM4 fiber	U	16
	Fiber Optic Cable Organizer		U	16
Labeling	Labeling		Lot	1
IP Closed Circuit Television	Supply, install, connect, label, test and commission a complete IP CCTV system including rigid conduits fixings, frames, programming, software suites, connections and all necessary accessories for a complete and perfect operation as specified on RFP. As per drawing	Cameras 5MP, Motorized Lens, Dome, Infrared 10 m.	U	4
		POE switch 24 Port > 200 W	U	1
		Cabling Cat6A Cables for IP Cameras	Lot	1
Centralized Security and Access Control System	Supply, install, connect, label, test and commission a complete access control system including cables, conduits, boxes, frames, programming, software suites in addition to all necessary accessories for a complete and perfect operation as specified on RFP.	(Authentication Method: Biometric Fingerprint Reader, code and Proximity card). - TCP/IP or RS485 communication for various networking environments. - ID Card capacity Up to 3000. - Access Control interface for 3rd party electric lock, door sensor, exit button, alarm, doorbell.	U	1
		Double Swinging Door Mechanically Operated Panic Exit Devices + Dafesh	U	1
		Electrical door lock to avoid any nonauthorized entrance. Holding Force up to 500Kg. Lock tongue stainless steel structure. Same manufacture as Fire rated door. Power supply 12V/ 5 Amp	U	1
		Cabling Cat6A Cables for Controller connectivity, Electrical Cable for Locks	Lot	1
Environmental Monitoring System	Supply, install, program, configure, interface, test & commission a server room environment monitoring system for temperature, humidity, air flow, differential pressure & other environmental conditions. System shall support external configurable sensors, Web, SNMP, etc...SMS & voice calls connectivity.	Cabinet Temperature and Humidity Sensor	U	12
		Phase 2 IT Room Temperature / Humidity Sensor	U	2
Water Leakage System	Supply and install a complete water leakage solution, including panel, detectors, alarm and solution. System shall support, Web, SNMP,	Water Leakage Cable Sensor for IT room under raised floor	Lot	1

	etc...SMS & voice calls connectivity.	Water Leakage Cable Sensor for water tray inside the gypsum board	**Lot**	**1**
Ultra-Sonic Anti-Rodent System	Contractor shall provide an Ultrasonic Anti-Rodent which prevents rodents (mice and rats) from causing damage to cables.	Ultra-Sonic Anti-Rodent System	**No**	**6**
Data Center Infrastructure Management DCIM	Supply, install, program, configure, interface, test & commission a Data Center Infrastructure Management system as specified and shown on drawings for a perfect operation and to the satisfaction of the engineer & the project's IT department.	DCIM required licenses	**No**	**1**
		Integration & interfacing with environmental monitoring, UPS systems, Precision AC system, electrical power meters, monitored and metered PDUs and static switches…etc.	**Lot**	**1**

The HPC Project implementations prerequisites

The establishment of the HPC facility will be comprised of two Phases:
- Implementation phase and
- Operation phase

The scope of the Implementation Phase is to design, cost and build the HPC facility in accordance with agreed Technical Specifications; and the scope of the Operation Phase is to receive and run data analysis jobs from CMS and to provide additional computing capacity for the Lebanese Parties.

The Implementation Phase

During the Implementation Phase, the Lebanese Parties will collaborate between themselves to execute the activities to set up the HPC facility, and as part of the Operation Phase will jointly manage the HPC facility as a co-location site. A committee (the "HPC Steering Committee") constituted of one technical coordinator from each of the Lebanese Parties, will take all decisions necessary to implement and operate the HPC facility.

The role of the Lebanese Parties:

1. The Lebanese Parties shall contribute to the Implementation and Operation phases of the Project, in cash, in kind, or any combination thereof.

2. The Lebanese Parties shall coordinate the Project through the HPC Steering Committee which shall function in accordance with the framework set out in basic governance of the steering committee section below.

3. The Lebanese Parties shall ensure that the HPC facility makes available sufficient capacity for the CERN/CMS offline computing effort to analyze data produced at CERN's Large Hadron Collider in Geneva, Switzerland. Such capacity is anticipated as being 20% of the HPC facility's fully operational capacity.

The role of CERN:

1. CERN shall contribute to the Project by donating the Equipment and making available the technical expertise set as required for the exclusive purpose of the execution of the Project. Such Equipment and technical expertise are provided without warranty or liability.

2. The donation of the Equipment by CERN is conditional upon the completion of the deliverables set out in the Table of Deliverables below.

3. Subject to provisions set out in this Agreement, the donation of the Equipment shall be to the Ministry of Telecommunications, which in turn shall make it available for the purpose of the Project. Accordingly, ownership of the Equipment shall transfer automatically to the Ministry of Telecommunications upon its shipment from CERN.

In the event that, for whatever reason, the Equipment cannot be donated to the Ministry of Telecommunications, CERN shall at its discretion and in consultation with the Lebanese Parties, consider an alternative recipient from among them.

It is recognized and agreed by the Parties that the Equipment shall be used exclusively for the HPC facility.

The safe disposal of the Equipment upon completion of its use shall be the responsibility of the Ministry of Telecommunications. Any subsequent residual use of the Equipment shall be for peaceful, non-commercial purposes.

The donation of the Equipment by CERN is conditional upon the achievement of the following deliverables by the Lebanese Parties:

1. Table of Deliverables

Public Sector	Private Sector
Refurbishment of the premises (one-off expenses)	

|	
Refurbish premises to host Tier-2 at Ogero, including: ☐ **Insulation, floor, ceiling, walls, doors** ☐ **IT infrastructure (Fibre, Wifi...)** ☐ **Power infrastructure (generator, UPS, distribution...)** ☐ **Security infrastructure** ☐ **A/C for ambient temperature & humidity control** ☐ **Purchase, install and commission chiller for rack cooling** ☐ **Purchase and install water cooled racks** ☐ **Install and commission piping** ☐ **Shipping of the Equipment from CERN and related insurance policy**	☐ **Install computers and storage disks**
Recurrent expenses and support services	

☐ **Local and global network connection**
 ☐ **Electrical Power**
 ☐ **Security (personnel, CCTV ...)**
 ☐ **Fire protection**
 ☐ **Maintenance of technical infrastructure, including: A/C, power distribution, rack water cooling**
 ☐ **Training of students in Facility Management**
 ☐ **Appointment of Communication Coordinator (Ogero in-kind contribution), relying on continuous scientific support from the Deputy Communication Coordinator**
 ☐ **Appointment of Deputy Communication Coordinator (LU in-kind contribution)**
	☐ **System administration 24/7 (LAU in-kind contribution by means of the appointment of a Systems Administrator)**
	 ☐ **Cluster management and user support (AUB in-kind contribution by means of the appointment of a User Support and Operation Manager)**
	 ☐ **Contributions to the Common Fund (50- 100k\$/y to be confirmed by the Steering Committee), to be used to cover:**
	     o **Salary of Scientific Director {50k\$/y}**
	     o **Legal and accounting**
	     o **Maintenance of the servers and disks**
	     o **Support from university students' Scientific outreach and training**

2. The appointment of key roles

- A Scientific Director who will be in charge of coordinating the execution of work packages related to the setup of the Tier-2 matters. The Scientific Director, paid by the HPC facility, will be in charge of:

- Coordinating scientific matters relating to the operation of the HPC facility;
- Mobilizing resources adequate for the scientific operation of the HPC facility;
- Ensuring the implementation of the decisions of the HPC Steering Committee; and
- Following up on the commitments made by stakeholders and reports to the HPC Steering Committee;

- A Resource Coordinator who will be in charge of monitoring and controlling financial matters of the Common Fund.

- A Deputy Communication Coordinator who will assist the Communication Coordinator in ensuring the dissemination of information to all stakeholders and includes outreach to the public and the media.

Ogero shall appoint the following role:

- A Facility Manager who will be in charge of coordinating the execution of work packages related to the Ogero infrastructure and who will provide input to the HPC Steering Committee for decision-making. The Facility Manager will remain responsible to Ogero management.

- A Communication Coordinator who will be in charge of ensuring the dissemination of information to all stakeholders and includes outreach to the public and the media.

- The Implementation Phase shall be completed once all the contributions in the Deliverables Table (above) have been provided.

Diagram for Implementation Phase:
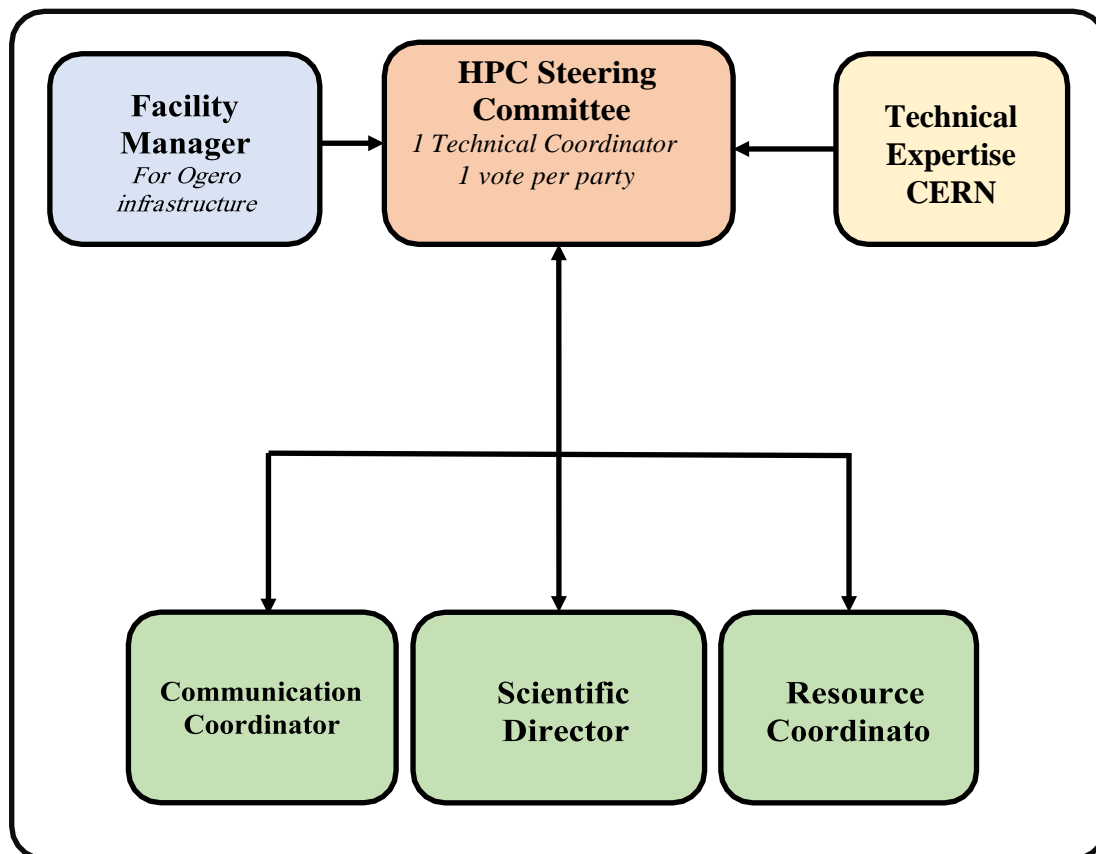
The Operation Phase

As part of the Operation Phase, the HPC facility shall be jointly managed by the Lebanese Parties in accordance with the following allocation of roles and contributions:

- Ogero shall be responsible at its costs for the installation, maintenance (including upgrades and repairs) and support of the power, network, cooling, and physical security of the HPC facility.

- The HPC Steering Committee shall be responsible for the scientific decision-making of the HPC facility as detailed in Annex 2.

In order to deliver the Operation Phase of the Project, the HPC Steering Committee will appoint the following roles:

- A **Scientific Director,** paid by the HPC facility, will have the same role as during the Implementation Phase (above). In the Operation Phase, the Scientific Director will be assisted by the System Administrator, the Facility Manager and the User Support and Operation Manager.

- A **System Administrator** who will be in charge of keeping the servers online and in operation.

- **A User Support and Operation Manager** who will be in charge of managing the use of the HPC facility's computing resources and assisting users with their job submissions.

- A **Resource Coordinator** who will be in charge of monitoring and controlling financial matters.

- A **Communication Coordinator** who will be in charge of ensuring the dissemination of information to all stakeholders and includes outreach to the public and the media.

In the Operation Phase the roles of Resource Coordinator, Communication Coordinator, and Facility Manager will be the same as in the Implementation Phase.

The Operation Phase shall be the exclusive responsibility of the Lebanese Parties. From time- to-time during the Operation Phase, CERN shall provide incidental advice specific to CMS purposes.

Diagram for Operation Phase:
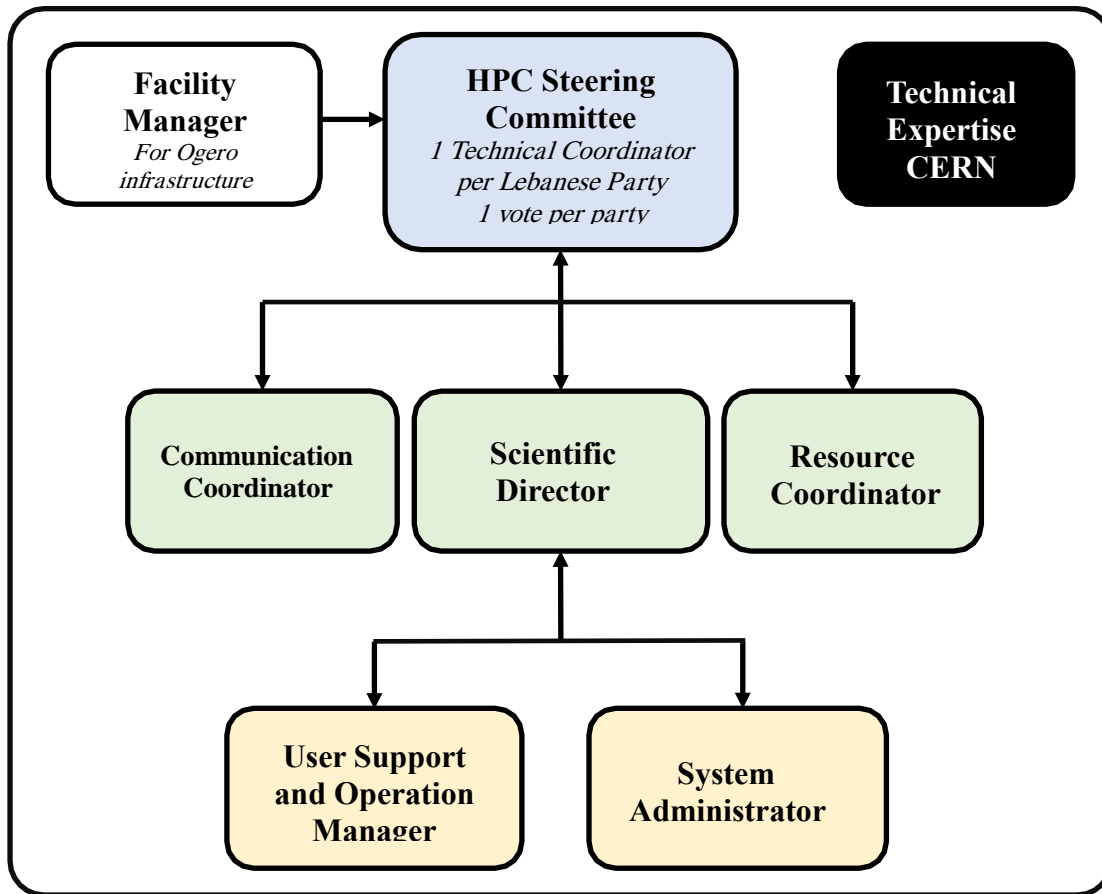
Basic Governance Principles of the HPC Steering Committee

- The HPC Steering Committee shall be comprised of one Technical Coordinator from each of the Lebanese Parties. The HPC Steering Committee shall deliver the Implementation and Operation Phases of the Project, and take scientific decisions related to the functioning of the HPC facility. During its first meeting the HPC Steering Committee shall elect the HPC Steering Committee Chair.

- The HPC Steering Committee shall:

  a. hear the reports of the Technical Coordinators and review progress relating to the Project,
  b. approve the budget and the financial accounts of the HPC facility Common Fund,
  c. modify the internal regulations required for the proper functioning of the HPC facility,
  d. monitor and steer the Project's progress, including the various phases of the project, the implementation phase and the operation phase.
  e. review the budget and cost management in relation to the HPC facility Common Fund,
  f. review status reports on scientific research and performance of HPC facility,
  g. decide on access to the HPC facility and recommendations to the Parties on accession of additional parties to this Agreement.
  h. perform any other duties necessary for the proper execution of the Project.

- The HPC Steering Committee Chair shall convene, organize, and chair the HPC Steering Committee meetings. Before each meeting of the HPC Steering Committee, the HPC Steering Committee Chair will provide the Technical Coordinators with an agenda, and a record of decisions and agreed actions after each meeting.

- The HPC Steering Committee shall communicate and meet on a regular basis and when considered necessary by its members in view of the advancement of the Project, ideally every three (3) months virtually, and at least once a year in person. Each meeting shall be called by the HPC Steering Committee Chair with one-month notice. Extraordinary meetings may be called on request by a Technical Coordinator to the HPC Steering Committee Chair to handle matters that need to be decided before the next ordinary meeting. A Technical Coordinator may appoint a proxy to attend a meeting should he or she not be available

- The quorum for meetings of the HPC Steering Committee shall be a minimum of half the number of the Lebanese Parties that are members of the

HPC facility. The HPC Steering Committee shall strive to reach consensus on decisions, failing which decisions by the HPC Steering Committee shall be taken by simple majority of representatives present and voting. It is understood that no decision by the HPC Steering Committee shall constitute a derogation to a Lebanese Party's internal rules and procedures. This process will apply to all topics listed in Paragraph 2 above.

- CERN shall have a standing invitation as an observer in the HPC Steering Committee during the Implementation Phase and shall have a voice but no voting rights

The HPC Project implementations roadmap

Implementation Phases

Phase 1: Implementation Phase

In the implementation we will focus on completing the technical specifications for building the datacenter, the additional requirements needed to turn the donated servers into a network of interconnected machines that can deliver expected value. In addition, we will focus on ensuring the site at Ogero is being built according to specifications that meets CERN requirements.

The steering committee is a key initiative of this phase, it is composed of key individuals that will drive the execution of the project.

Training workshops are also planned in this phase, where individuals from each participating entity will develop key skills necessary for proper operation of the datacenter.

Training at CERN is another key activity in this phase, where individuals from participating entities will travel to CERN facility and shadow peer engineers that run and operate similar data centers at CERN. These individuals will also be part of the team that will install the donated equipment once they arrive.

Implementation Phase timeline: October 2019 to June 2020

Phase 2: Operation Phase

In the operation phase, the participating entities will be responsible for operating the datacenter. In order to do so, the participating entities need to hire an HPC Datacenter **facility manager**, an HPC Datacenter **system administrator** and an HPC Datacenter

Operation Phase expected kick off: July 2020

Implementations and Operations Budget

Item	Description	Budget
Refurbishment	• Civil and Site Preparation • Mechanical and Plumbing • Safety Systems • Electrical Work • Low Current System • Data Centre Management • Racks and chillers	$480,000 one-time charge
Internet Connectivity	• Cost of yearly internet connectivity between CERN and HPC4L	$720,000/Year
Utilities	• Electricity ($144k/yr.)	$160,000/Year

	• Diesel for generators • ($ 13k - 15k /yr.)	
Common Fund	• Salary of General Manager • Legal and accounting • Maintenance of the servers and disks • Support from students • Marketing and training • Installation of computers and storage disks donated by CERN	$100,000/Year

The following is a list of expected competencies and job requirements for the required positions:

1. **HPC Datacenter Facility Manager:** A Facility Manager will be in charge of coordinating the execution of work packages related to the Ogero infrastructure and who will provide input to the HPC Steering Committee for decision-making. The Facility Manager will remain responsible to Ogero management.

   The following is a job description/ responsibility of the facility manager:

• Oversee all aspects of the data center's critical physical infrastructure. Ensure that all work performed within the space is done to high quality and without impact to internal/external customers
• Manage teams of engineering technicians in all facets of their career
• Engage in improvement projects, often requiring reaching out to a variety of support teams, and drive them from conception to completion
• Coordinates daily with a multitude of third-party vendors ensuring adherence to contracted SLAs
• Effectively and efficiently manage the operations budget and expenditures
• Routinely operate as the afterhours on-call Data Center Facility Manager. This will include responding to any issues within the data centers and managing the investigation, mitigation, and recovery of the issue(s)

• Advanced electrical or mechanical certifications (Bachelor's degree or higher in a relevant engineering discipline)
• Experience working in data centers with an emphasis on building and equipment operation

- An excellent understanding of the electrical and mechanical systems involved in critical data center operations including systems such as feeders, transformers, generators, switchgear, UPS systems, ATS units, PDU units, chillers, pumps, air handling units, and CRAHU units

2. **HPC Datacenter System Administrator**: A System Administrator who will be in charge of keeping the servers online and in operation.

   The following is a job description/ responsibility of the System Administrator:

- Performs system administration, analysis, and maintenance for all servers, storage, and backup systems.
- Responsible for the support and administration of approximately 200 servers.
- Work with stakeholders to plan, manage, and complete systems related tasks and projects.
- Being the primary point of contact for response to major incidents at the datacenter(s) and participate in proactive and timely resolution of such major incidents impacting HPC Datacenter availability
- Implement and oversee all security, assurance, disaster recovery, and compliance policies for the datacenter to ensure all local systems meet requirements supplied by HPC Datacenter internal security and compliance teams
- Assist in developing project schedules, prioritize tasks, and coordinate resources to meet project schedule requirements.
- Manage and allocate disk space to servers as needed utilizing direct attached storage, SAN Storage or internal storage devices as appropriate.
- Interface with users, consultants, technical teams and vendors for maximum guidance in determining the most appropriate selection of server or storage technologies.
- Develop, implement and maintain appropriate tape back-up strategies for all city servers.
- Utilize tools and scripts to manage systems and/or application processes.
- Create and maintain documentation related to system architecture and support processes.
- Participate in change control process. Complete change requests.
- Maintain server hardware and storage devices. Keep systems software and firmware up to date.
- Provides technical support to other departments as required for server, storage, or backup related objectives.
- Identify opportunities for improvement. Examples include but are not limited to tools, processes, procedures, installation, configuration and troubleshooting techniques.

- Implement and monitor appropriate security measures to safeguard the HPC Datacenter infrastructure from physical harm, viruses, unauthorized users, and potential data loss.
- Ability to design solutions to meet the HPC Datacenter defined disaster recovery objectives.
- Maintains a high level of current knowledge regarding systems, technology, and communications.
- Provide on call support during non-business hours.

3. HPC Datacenter Operation Manager: who will be in charge of managing the use of the HPC facility's computing resources and assisting users with their job submissions.

   The following is a job description/ responsibility of the Operation Manager:

- Working across your partner teams, who support contracting, deployment signaling, finance, engineering, security, design and build, and compliance to ensure seamless site operation
- Developing and maintaining relationships with leased facility manager, IT service providers, and partner support teams
- Assuming accountability for planning and monitoring of all physical infrastructure resources required to provide capacity
- Supervising and providing quality control for your datacenter-wide IT maintenance support activities across multiple service lines
- Assisting with the review, reconciliation, and approval of OPEX + CAPEX budgets, allocation of spend, and management of vendor resourcing models
- Responsible for ensuring the accuracy of datacenter information and Point of Contact (PoC) and ensuring documented terms of references to datacenter access, utilization, and capacity allocation.

Summary of implementation requirements

Phase	Key Requirements	Details	Status Update
Implementation Phase	Site Civil and Infrastructure development	New site selected to speed up development. CERN approved; technical specification updated accordingly.	Ogero site selection confirmed, RFP is out
	Technical specifications	Completed and Shared	Specification are out for review with key stakeholders
	Steering Committee establishment	Chair: Dr. Youssef Asfour Scientific Director: Dr. Haitham Zaraket	Established
	Training Workshops	15 days of face to face workshops attended by at least 20 trainees from participating entities to train on datacenter operation	15 days planned, 3 days completed, rest are rescheduled to May due to COVID-19
	Training at CERN	10-15 people from participating entities will go and shadow CERN engineers and train on datacenter operation	Need to identify trainees
	Shipment Delivery		Planned for June 2020
Operation Phase	Facility Manager	Ogero to name an Engineer to become facility manager	
	System Administrator	To be hired	
	Operation Manager	To be hired	

Project Timeline Summary

Octo	Nov	Dec	Jan 2020	Feb	Mar	Apr	May	Jun	July	Aug	Sep

Implementation Phase →

Steering Committee Established

Ogero Site Development →

Operation Phase →

🔴 Ship

Training →

Hire

Technical Specification →

CERN Onsite Training