INVITATION TO TENDER

ECMWF/ITT/2019/BOND20

PROCUREMENT OF NETWORK

FABRIC LAYER

AND

INTERNET EDGE LAYER

at ECMWF, Tecnopolo di Bologna, Bologna, Italy

Volume II:

Specification of Requirements

27 March 2019

Table of contents

Tables

Figures

Background

Definitions

Definitions used in this Invitation to Tender (ITT) are listed here:

Acceptance Date	the date or dates on which the Pilot Infrastructure successfully complete the relevant Acceptance Test
Agreement	volume III of this ITT including all schedules thereto
Bill of Materials (BoM)	the list of hardware, software and services that will be purchased for the Deployment Phase 1
Contract	the documents defining the Parties' rights and obligations comprising the Agreement, ECMWF's Letter of Acceptance of Tender, the ITT Documentation and the Contractor's Tender in accordance with Clause 2.1 of the Agreement
Centre	ECMWF
Contractor	successful Tenderer
Data Hall	a space within the data centre that is used to host IT infrastructures and the high-performance computers and related services
Data Handling System (DHS)	large-scale Data Handling System is used to store and retrieve data that is needed to perform weather modelling, research in weather modelling and mining of weather data
Data Storage	a space within the data centre that is used to host tape library infrastructure and related services
DHS Leaf Switch	a switch which provide connectivity to ECMWF's DHS table library infrastructure and to which the DHS ToR Leaf Switch connect
DHS ToR Leaf Switch	a switch to which tape library storage connects
Delivery Date	the dates, as specified in the Deployment Phase 1 Delivery Date in Volume III, or on a Purchase Order, on which the Works shall be deemed to be delivered at the ECMWF Site of Reading or Bologna
Deployment Phase 1	the first phase of Works carried out by ECMWF
ECMWF	European Centre for Medium-Range Weather Forecasts
Edge Leaf Switch	two switches in each Data Hall that are used for the connection to the Internet Edge routers and the perimeter firewalls, and the interconnection with the other Data Hall
Fabric Layer	the infrastructure that interconnects the network components together to provide connectivity to all IT systems in the data centre

First Response Time	the number of minutes, hours, or days between when a customer submits a support ticket and when a customer support representative provides an initial response
Functional Test	the test that will be performed on the Works outlined in Clause 3.2 of Schedule 4 of Volume III
High Performance Computer Facility (HPCF)	super-computing facility used to produce weather forecasts and scientific research
HPC Leaf Switch	a switch to which an HPCF clusters connects
High Performance Network (HPN)	the name used by ECMWF to describe the Fabric Layer infrastructure
Hypercare	the stabilisation period after an installation is completed
Internet Edge Layer	the infrastructure that connect ECMWF to the Internet and WAN services
ITT	this Invitation To Tender
Low Level Design / LLD	the stage where a solution's hardware and software components are designed and configuration templates created
Manufacturer	original equipment manufacturer of the supplied hardware and software components
Pilot Infrastructure	the infrastructure that will be used for the testing of the selected solution
Preferred Bidder	the Tenderer selected by ECMWF for the award of this Contract
Reading DC Edge Leaf Switches	two switches deployed in the Reading Date Centre LAN to establish the site-to-site connectivity between ECMWF sites of Reading and Bologna
Reliability Test	the test that will be performed on the Works outlined in Clause 3.3 of Schedule 4 of Volume III
Requirement	a singular documented physical or functional need that a design, product or process aims to meet
Server Leaf Switch	a switch to which servers connect
Services	all the services listed in the Bill of Materials or on a Purchase Order, to be provided by the successful tenderer to ECMWF under this Contract
Spine Switch	a switch to which only Leaf Switches connect
Tender	a response to this ITT
Tenderer	an organisation bidding for this ITT
Tests	the tests that will be performed on the Works outlined in Schedule 4 of Volume III

Works	all hardware & software furnished and all Services to be performed by the successful tenderer under this Contract
You	the recipient of this ITT, a prospective “Tenderer”

Introduction

This Invitation To Tender (ITT) has been prepared by the European Centre for Medium-Range Weather Forecasts, (governed by its Convention and associated Protocol on Privileges and Immunities which came into force on 1 November 1975, and was amended on 6 June 2010) ("ECMWF") for the purposes of obtaining proposals from Tenderers for the procurement of High Performance Network (HPN) "Fabric Layer" equipment and "Internet Edge Layer" equipment. ECMWF is an independent intergovernmental organisation supported by 34 States. Information on ECMWF's activities can be found at:

https://www.ecmwf.int/en/about

Installation will be at ECMWF's new data centre at Tecnopolo di Bologna, Via Stalingrado, Bologna, Italy from late Q3 2019 onwards. The HPN "Fabric Layer" infrastructure is the network backbone that interconnects the other network components together to provide connectivity to all IT systems in the data centre. The "Internet Edge Layer" infrastructure is used to connect ECMWF to the Internet and WAN services, including connectivity to the Regional Meteorological Data Communication Network (RMDCN), a private IPVPN that provides a computer network infrastructure for the meteorological community on behalf of the World Meteorological Organisation (WMO). Additional information on ECMWF's current Computer Environment and LAN can be found at:

https://www.ecmwf.int/en/computing/our-facilities

https://www.ecmwf.int/en/computing/our-facilities/networks

ECMWF's new data centre

In June 2017 ECMWF Member States approved the proposal by the Italian Government and the Emilia Romagna Region to host ECMWF's new data centre in Bologna. The new data centre is currently being built on the site of the new Tecnopolo di Bologna campus that is redeveloping the unused buildings and grounds of a former tobacco factory. ECMWF's headquarters are to remain in the UK. Details about the new data centre can be found here:

https://www.ecmwf.int/en/about/media-centre/press-kit-bologna-host-ECMWFs-new-data-centre

ECMWF expects the Bologna data centre will be run with a small staff complement, that includes a 24 hour a day, 7 days a week, 365 days a year (24x7x365) operations team responsible for the monitoring of the infrastructure.

The Networks and Security infrastructure

The Networks and Security infrastructure to be deployed in Bologna will provide the enabling connectivity and security services required by all IT services operated by ECMWF. The infrastructure is made up by the following three main components:

- **Fabric Layer**: the infrastructure that provides network connectivity to ECMWF's ICT platforms and services, including the High Performance Computer Facility (HPCF) and Data Handling System (DHS) systems;
- **Security Layer**: the infrastructure required to control critical internal and external data traffic to protect ECMWF from internal and external threats;

- **Internet Edge Layer**: the infrastructure required to provide connectivity between the Security Layer and the wide area network through ECMWF's Internet, RMDCN and telephony SIP connectivity;

In addition to the above mentioned three layers, physically segregated networks and infrastructures will be used to address specific needs:

- **Offices Networks in Reading and Bologna**
- **Management & Monitoring**
- **Auxiliary services: DNS, DHCP, and IPAM (DDI) and Network Time Protocol (NTP)**
- **Auxiliary services: Application Control and Load Sharing**

The following corporate high-level design overview gives an idea about the design components that form the Networks and Security infrastructure:

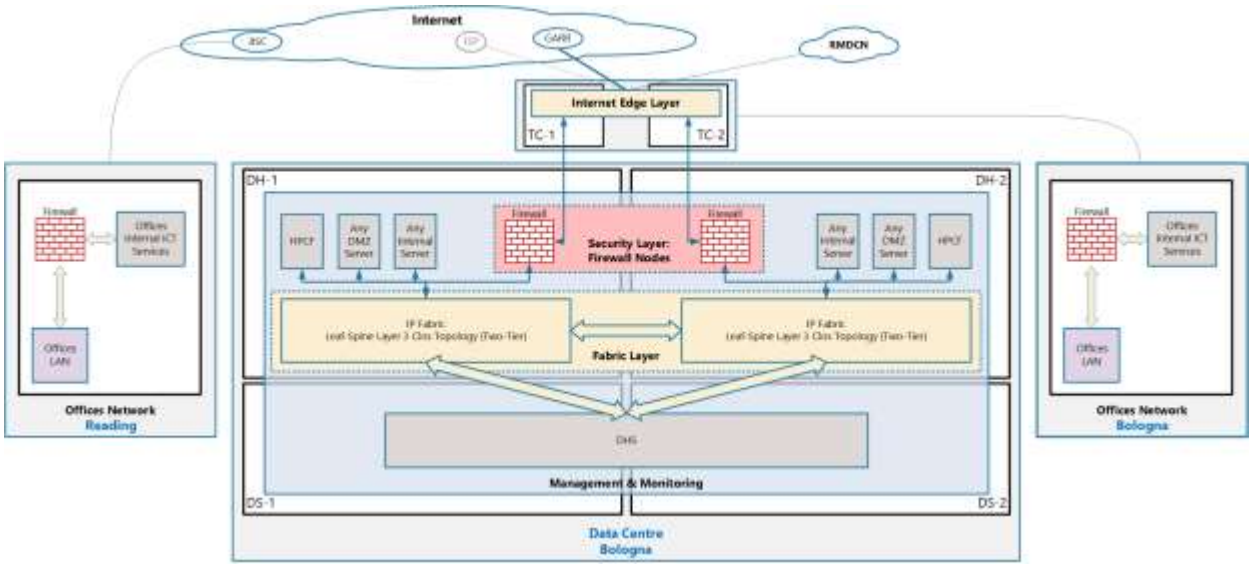

Figure 1: Corporate network and security design overview

Scope of the ITT

The purpose of this Invitation to Tender (ITT) is for ECMWF to enter into a long-term contract for the supply of equipment and its associated maintenance and support services, and other services to build a network “Fabric Layer” and a network “Internet Edge Layer” and management and monitoring tools that will be purchased and installed by ECMWF as part of the new networks and security infrastructure at ECMWF's new data centre at Tecnopolo di Bologna, Via Stalingrado, Bologna, Italy from late 2019 onwards.

The ITT will also include:

- professional services for the design validation and onsite engineer presence during the Deployment Phase 1
- training of ECMWF staff

ECMWF have pre-selected three (3) manufacturers in the context of this ITT: Arista Networks, Inc., Cisco Systems, Inc. and Juniper Networks, Inc.. This ITT is therefore open to Tenderers who are certified resellers of one of these three manufacturers. A Tenderer can only propose a solution or solutions that use products made by one of these three manufacturers. The notable exception to the utilisation of one of the three manufacturers is optical transceivers and direct attached cables where non-Original Equipment Manufacturers can be used in the proposed solution or solutions.

This ITT is for the initial purchase of Works for the Deployment Phase 1 followed by further purchases of additional Works on a call-off basis over the life of the Contract. The term will be for a minimum period of three (3) years, with ECMWF having the option to extend on an annual basis thereafter to a maximum term of eight (8) years.

Further information is included in Volume I (Instructions for Tenderers and Conditions of Tender) of the ITT.

ITT timetable

ECMWF envisages the following timetable for this ITT[1]:

Date	Description
27th March 2019	Date for release of tender by ECMWF
24th April 2019[2]	Clarifications close
8th May 2019	14:00 local UK time - Closing date for receipt of tender response
20th - 23rd May 2019	Presentation by shortlisted tenderers (dates/time to be announced by ECMWF)
June 2019	Evaluation of tenders
July 2019	Preferred bidder(s) notified and negotiations of contractual terms
July / August 2019	Signing of the Contract and issue the purchase order for the Deployment Phase 1
August / September 2019	Start of the Tests
Middle of October 2019	Start of the Deployment Phase 1 phase in Bologna

Table 1: Envisaged timeline for this ITT

[1] ECMWF reserves the right to amend these dates at any point. If ECMWF decides to amend any of the dates or milestones portrayed above then it shall notify the Suppliers who have expressed an interest or Tenderers via the eprocurement portal.

[2] It has to be noted that ECMWF will be closed at the following public holiday dates: 18th of April (PM only), 19th of April and 22nd of April 2019.

Evaluation method and selection criteria

Tenderers will be evaluated, utilising the Evaluation criteria detailed in Table [2] below, based on both written proposals and any oral presentations. However, ECMWF reserves the right to use information other than that provided by the Tenderers in its evaluation.

The following are the key evaluation criteria and their associated weighting that will be used as part of the evaluation process. ECMWF will be looking for strong capability in all the following aspects:

Evaluation criteria	**Weighting**
Tenderer's credentials • Pre-Qualification Requirements; • Presentations, Demonstrations and Site Visits; • Support Capabilities; • Professional Services; • Service Delivery and Acceptance Tests.	20%
Compliance with technical and operational Requirements • Fabric Layer; • Internet Edge Layer; • Management and Monitoring Solution; • Support and Training; • Transceivers and Cables.	40%
Pricing and Agreement	40%

Table 2: Evaluation Criteria & Weighting

The evaluation of the Tenderer's Credentials will be based on the Tenderer's response to section "Appendix 1 Tenderer's Credentials" of this volume II document.

The evaluation of the Tenderer's compliance with technical and operational Requirements will be based on the Tenderer's response to section "Appendix 2 Technical and Operational Requirements" of this volume II document.

The evaluation of the Tenderer's response to the Pricing and Agreement criteria will be based on the Tenderer's financial submission in response to section "Appendix 3 Pricing and Agreement" of this volume II document.

The evaluation process will be split into three stages.

1. The first stage of the evaluation will be based on the information provided in Volume IA Tender Submission Form and the responses to section "A1.1 Pre-Qualification Requirements" of this volume II document and will determine a shortlist of Tenderers for consideration for the second stage. Tenderers who are not shortlisted to stage two will not be considered further for this ITT.

The ECMWF evaluation team shall be permitted to review other parts of the Tender if the team considers this is necessary to determine which Tenders should be fully evaluated in the second stage.

2. The second stage of the evaluation will be based on a full evaluation of the Tenders, including the response to Volume 1A, and will determine a shortlist of Tenderers for invitation to the third stage. Tenderers who are not shortlisted to stage three will not be considered further for this ITT.

3. The third stage will involve either a presentation / Q&A session on ECMWF premises in Reading by the short-listed Tenderer(s) and/or a site visit(s) for ECMWF staff to the premises of the shortlisted Tenderers to meet the team(s) responsible for the ongoing solution support (for example service desk personnel and field engineers). Both options should involve the key bidder staff nominated for this ITT and are expected to take place during the month of May and June 2019 - ECMWF envisages giving at least one week's notice of such. At these events, the Tenderer will have the opportunity to showcase the aspects of their proposed solution or solutions and both parties shall have the opportunity to clarify any outstanding elements of the ITT response. Following the event(s) and any subsequent clarifications, the shortlisted Tenderer(s) will be invited to submit their 'best and final offer' Tender to ECMWF, for final evaluation[3].

As a result, a Preferred Bidder(s) will be established with whom final contract negotiations will be opened. ECMWF reserves the right to negotiate with one or more Tenderers before taking a decision on awarding the Contract. Within one (1) month following the notification of award of the Contract, the unsuccessful Tenderer may request, in writing, feedback from ECMWF on the evaluation of the Tenderer's Tender submission[4].

ECMWF Questions during Evaluation

During the evaluation of Tenders, ECMWF reserves the right to ask questions to clarify aspects of Tenderers' submissions. ECMWF will expect Tenderers to answer such questions promptly (normally with one business day of receipt). ECMWF will address questions by email to the contact you nominate in your Volume IA Tender Submission Form and you should ensure that your contact's emails are monitored at all times during our evaluation.

[3] ECMWF will review the initial evaluation results for the shortlisted Tenderers and may adjust these results in line with their findings during the presentation / Q&A session and/or the site visit and any revisions made in the 'best and final offer' Tender.

[4] It is at ECMWF's sole discretion if, following any request from a Tenderer, it provides feedback on the Tenderer on their Tender submission

Organisation of this document

In accordance with the evaluation method and selection criteria listed in the previous section, the remainder of this ITT is organised as follows:

- Tender Requirement Instructions;
- Appendix 1 Tenderer's Credentials;
- Appendix 2 Technical and Operational Requirements;
- Appendix 3 Pricing and Agreement.

Tender Requirement Instructions

Tenderers should note that they need to ensure that Requirements are fully addressed, since a partial response may not be considered or evaluated. This includes the Requirements present in this section, in the appendices and in the embedded Excel spreadsheets.

In this document, Requirements are categorised by the bold notations **M**, **D** or **R** to the left of the pertinent section.

Requirement category	Definition
M	denotes a MANDATORY Requirement: a Requirement that must be adhered to, or a performance Requirement that must be met in order that the tendered solution can be accepted by ECMWF. ECMWF will not consider a tendered solution that fails to meet a mandatory specification Requirement (marked M) unless the tenderer offers valid reasons why the feature in question is either unnecessary for, or irrelevant to, the tendered solution or is deemed as an improvement over that specified.
D	denotes a DESIRABLE feature. The extent to which any tender offers features listed as desirable (marked D) will be one of the factors taken into account in selecting the winning tender. If offered, the feature must be included in the overall price for the Works.
R	denotes a REQUEST for information. A response must be given to all such requests. Requests for information (marked R) are intended to provide a description of the construction, philosophy, operation and the cost implications of the tendered solution in areas that are regarded as being of particular importance. A clear response to such requests will be of assistance to ECMWF in the tender evaluation process.

Table 3: Categories of Requirements

With regard to the Tenderer's ability to accommodate the Requirements, the Tenderer must use the following schema for completing the **Detailed Description** and **Self-Score** columns:

1. When populating the **Detailed Description** columns, Tenderers should note that, where relevant, when addressing that a Requirement is met, tenderers must give minimum sufficient detail to explain

the way in which the Requirement is met - a simple expression, such as “compliant” or “agreed”, will not normally suffice.

- Unless stated otherwise, the Detailed Description should be no longer than 250 words. Where word counts above 250 words are allowed, the higher limit will be clearly stated. Any text above the maximum specified word count will not be evaluated.
- Attachments/Annexes should not be submitted, unless the Requirement expressly requests or authorises their submission.
- Tenderers are reminded that referencing web sites or providing hyperlinks does not provide an acceptable means of informing their submission. Any references of these types will be ignored and will not be evaluated.

2. Any additional features not listed in the ITT as Requirements, but which the tenderer feels may be relevant, should be clearly identified and supported by descriptive material.
    - Note that ECMWF seeks focused responses, rather than responses which include a significant amount of standard marketing material. If you wish to include marketing material in your proposal documentation set, it should be provided as discrete documents and limited to only marketing material which is directly relevant to the response and marked as "Marketing Material". ECMWF reserve the right not to evaluate Marketing Material if it deems it to be irrelevant.
3. When populating the **Self-Score** column, the Tenderer must self-score following the definitions in the table below to provide an indication of compliance with the Requirement

Self-Score Value	**Definition**
3	Tenderer fully meets or exceeds the ECMWF Requirement.
2	Tenderer partially meets the ECMWF Requirement. The Requirement will be met as part of a future commitment. In the Detailed Description column, describe how the Requirement will be fully met. Specify, where applicable, associated timescale and cost.
1	Tender does not meet the ECMWF Requirement at the time of response. The Requirement will be met as part of a future commitment. In the Detailed Description column, describe how the Requirement will be fully met. Specify, where applicable, associated timescale and cost.
0	Tenderer cannot meet the ECMWF Requirement.

Table 4: Self-scoring values and definitions

Self-Scores will be validated by ECMWF to ensure they have been completed accurately. Where ECMWF’s assessment is different to the Tenderer’s Self-Score, ECMWF may ask the Tenderer to review and justify its Self-Score.

Tenderers must address the Requirements listed in the table below together with the Requirements listed in the Appendixes.

Tender Requirement			
Requirement number	**Requirement**	**Detailed Description**	**Self-Score**
M(1)	Tenderers must ensure that all Requirements in this ITT are addressed and a response, in electronic format, is posted to ECMWF's eProcurement Portal prior to the deadline; partial responses will not be considered. N.B. efforts have been made to remove duplicate Requirements, where this may occur, please still address the Requirement and/or reference your first response.		
M(2)	Tender documentation must be written in English.		

Except for the Requirements listed in Appendix 1.2 of this Volume, Tenderers should note that responses to all Requirements specified in Volumes I and II of this ITT must be submitted by the Tender Closing Date. Tenderers invited to make presentations or give presentations to ECMWF in Stage 3 of the evaluation process may be required to address the Requirements set out in Appendix 1.2

Appendix 1 Tenderer's Credentials

A1.1. Pre-Qualification Requirements

Pre-Qualification Requirements			
Requirement number	**Requirement**	**Detailed Description**	**Self-Score**
M(3)	Tenderers must confirm that, with the notable exception of optical transceivers and direct attached cables, the proposed solution or solutions use products made by one of the following manufacturers: • Arista Networks, Inc.; • Cisco Systems, Inc.; • Juniper Networks, Inc..		
M(4)	Tenderers must confirm they are a certified reseller/partner/integrator of one of these manufacturers: Arista Networks, Inc., Cisco Systems Inc., and Juniper Networks Inc.. Tenderers must indicate and provide evidence of the level of accreditation/partnership.		
M(5)	Using section 6 of Volume IA (Tender Submission Form), tenderer must provide an executive summary of their proposal to: • fulfil the Fabric Layer High Level Design description in paragraphs A2.1.1, A2.1.2 and A2.1.3; • fulfil the Internet Edge Layer High Level Design description in paragraphs A2.2.1 and A2.2.2; • meet the Requirements described in spreadsheet "Volume II TechSpec / Fabric Layer spreadsheet - Technical specifications"; • meet the Requirements described in spreadsheet "Volume II TechSpec / Internet Edge Layer spreadsheet - Technical specifications"; • meet the Requirements described in spreadsheet "Volume II TechSpec / Management and Monitoring - Technical specifications". (The response to this Requirement must be no longer than 1000 words but may also contain diagrams).		
M(6)	Tenderers must list the core technical competencies of their organisation. This must include the details of what is considered to be the key technology areas supported by the organisation. (Maximum 500 words).		

R(7)	Tenderers are invited to indicate the technical certifications/accreditations/awards relevant to this tender that their organisation holds.		
R(8)	Tenderers are invited to indicate their proposed account management structure as follows: • describe your governance processes to manage an effective relationship and the successful delivery including roles and responsibilities of people involved from both sides, the frequency of the different meetings and the purpose of each meeting; • describe the key management dashboards and empirical information that you suggest are used to govern the relationship; • propose how continuous improvements will be made to the governance process.		
R(9)	Tenderers are invited to provide a description of their territorial presence in Italy, with focus on the Bologna area.		
M(10)	Tenderers must confirm that they have the capabilities to provide 24x7x365 support and break/fix maintenance of all hardware components in Bologna		
R(11)	Tenderers are invited to describe their capabilities to provide 24x7x365 support and break/fix maintenance of all hardware components in Bologna.		
M(12)	Tenderers must confirm that they have the capabilities to provide 24x7x365 support in English.		
R(13)	Tenderers are invited to specify whether the support and maintenance of the manufacturer's hardware and software equipment can be done directly by the Manufacturer.		
D(14)	Tenderers shall state their ability to offer professional services for onsite engineer presence during the Deployment Phase 1.		
R(15)	Tenderers are invited to describe their organisation's approach to working in a relevant multi-vendor environment, with evidence supporting their success of working in such an environment.		
R(16)	Tenderers are invited to describe their organisation's approach to problem solving in a relevant environment, with evidence supporting their success at solving.		
R(17)	Tenderers are invited to Describe their organisation's standard Project Management process.		
R(18)	Tenderers are invited to provide detail / evidence of any Project Management certifications.		
R(19)	Tenderers are invited to describe their organisation's standard Quality Management process.		
R(20)	Tenderers are invited to provide detail / evidence of any Quality Management certifications.		
R(21)	Tenderers are invited to describe their organisation's standard Information Security management process.		

R(22)	Tenderers are invited to provide detail / evidence of any Information Security certifications.		
R(23)	Tenderers are invited to provide details of the installed base for the solution of the kind proposed in response to this ITT in Europe and world-wide.		
R(24)	Tenderers are invited to provide references of customers in the EU they delivered comparable solution to.		
M(25)	Tenderers must confirm that they are able to quote prices in Euros (€) and that, if selected by ECMWF, Tenderers will be prepared to contract in Euros (€).		

A1.2. Presentations, Demonstrations and Site Visits

Requirements for Presentations, Demonstrations and Site Visits			
Requirement number	**Requirement**	**Detailed Description**	**Self-Score**
M(26)	If requested by ECMWF, tenderers must give a presentation of their tender at ECMWF in Reading. The date of the presentation will be made known following receipt of the tenders but is likely to be during the week commencing 20 May 2019.		
M(27)	If requested by ECMWF, tenderers must provide demonstrations of the proposed solution or solutions. Arrangements for the time, location and exact content of the demonstrations will be made following receipt of tenders.		
M(28)	If requested by ECMWF, tenderers must organise a site visit for ECMWF staff to their premises to meet the team(s) responsible for the ongoing sultion support. Arrangements for the time, location and exact agenda of the site visit will be made following receipt of tenders.		

A1.3. Support Capabilities

Requirements for Support Capabilities			
Requirement number	**Requirement**	**Detailed Description**	**Self-Score**
M(29)	Tenderers must commit to the provision of support services for 24 hours per day, 365/366 days per year including bank holidays for software and hardware support with a First Response Time of no more than two (2) hours for priority P1, P2 and P3 tickets.		
R(30)	Tenderers are invited to provide a description of their standard support process, including: • process you use to record, manage and report Incidents;		

	• what methods can clients use to raise incidents with your Service Desk; • first Response Times that you are able to provide; • target resolution times that you are able to provide; • time for permanent fix of an incident.		
R(31)	Tenderers are invited to provide incident resolution statistics for the year 2018 about how many incidents have been resolved within applicable SLAs (e.g.: P1, P2, P3).		
R(32)	Tenderers are invited to describe the nature, capacity, and capability of their support lines: first, second and third.		
M(33)	Tenderers must confirm that a fault reference number or equivalent will be issued within no more than 5 minutes of a ticket being raised.		
R(34)	Tenderers are invited to describe how the Help Desk service is to be implemented. In particular, if the Tenderer is a reseller it shall describe which parts of the service are carried out by the reseller and which parts, if any, are carried out by the Manufacturer. If some parts of the service are carried out by the Manufacturer, the Tenderer shall describe at which point of the process this occurs.		
R(35)	Tenderers are invited to describe how an on-site professional services request will be handled, for example, how the effort is estimated and the lead time required from the time when a purchase order for the service is placed.		
R(36)	Tenderers are invited to describe the processes in place to deal with delivery of equipment that may be: • "Dead on Arrival"; • incorrect; • shipped to the wrong address.		
R(37)	Tenderers are invited to describe what contingency plans are in place to continue the supply of spare parts after the failure of the normal sources of such parts.		
R(38)	Tenderers are invited to describe any remote monitoring and diagnostic capabilities, such as analytics that may be used to proactively identify failures.		

A1.4. Professional Services

Following the award of Contract, ECMWF together with the Contractor will validate the Low Level Design and prepare the configuration files for the Deployment Phase 1. ECMWF will be responsible for the deployment and maintaining the configuration files and the general topology after this.

ECMWF may require onsite engineer presence during the Deployment Phase1 to assist with the configuration and deployment work. The Tenderers are invited to propose their services to fulfil this need.

Requirements for Professional Services

Requirement number	Requirement	Detailed Description	Self-Scoring
D(39)	Tenderers shall state which professional services they can offer to validate the Low Level Design required to: • fulfil the Fabric Layer High Level Design description in paragraphs A2.1.1, A2.1.2 and A2.1.3; • fulfil the Internet Edge Layer High Level Design description in paragraphs A2.2.1 and A2.2.2; • meet the Requirements described in spreadsheet "Volume II TechSpec / Fabric Layer spreadsheet - Technical specifications"; • meet the Requirements described in spreadsheet "Volume II TechSpec / Internet Edge Layer spreadsheet - Technical specifications"; • meet the Requirements described in spreadsheet "Volume II TechSpec / Management and Monitoring - Technical specifications".		
D(40)	Tenderers shall state which professional services they can offer to support ECMWF during the Deployment Phase 1, including onsite engineer presence at ECMWF site in Bologna.		
R(41)	Tenderers are invited to state if they can offer additional professional services such as: • perform a firmware upgrade of an IP fabric at ECMWF site in Bologna; • add a spine switch on a production IP Fabric network at ECMWF site in Bologna.		

A1.5. Service Delivery and Acceptance Tests

As described in Schedule 4 of Volume III, the testing of the agreed solution for the Fabric Layer and Internet Edge Layer infrastructures will be performed at ECMWF premises in Reading as follows:

1. ECMWF together with the Contractor will agree the exact topology and the size of the Pilot Infrastructure that will be used for the testing, but it must be based on the agreed solution and its associated Low Level Design and must include all Spine Switches, all Edge Leaf Switches, the two Internet Edge Routers, two Server Leaf Switches, two DHS ToR Leaf Switches and two DHS Leaf Switches;
2. ECMWF together with the Contractor will deploy the Pilot Infrastructure in ECMWF's data centre located in Reading;
3. Following completion of the deployment of the pilot infrastructure, the Contractor will perform its standard installation test;
4. Following completion of the Contractor's standard installation test, a Functional Test period of at least 7 days will start whereby ECMWF will run various diagnostic, check-out, demonstration and test routines. The purpose of the test is to establish that the equipment is functional, and that various aspects of its performance and behaviour are in accordance with the published specifications, the tender documents and the Contract;
5. Following the completion of the Functional Test, a User Acceptance Test period of at least 28 days during which a batch of tests will be run to ensure that the functionalities required to fulfil the LLD of the agreed solution are fully functional;
6. Following the completion of the User Acceptance Test, the Pilot Infrastructure will be dismantled and moved to ECMWF's data centre in Bologna by the Contractor.

Requirements for Service Delivery and Acceptance Tests			
Requirement number	**Requirement**	**Detailed Description**	**Self-Score**
D(42)	Tenderers shall outline their proposed method of Project Management, their specific experience in applying that method of Project Management in a relevant environment and the composition of their Project Team.		
M(43)	Tenderers must confirm their acceptance of Schedule 4 of Volume III that contains the standards of tests, which must be met by the equipment before ECMWF will accept it.		
M(44)	Tenderers must commit to providing a delivery lead time for equipment when providing the quote pertaining to that equipment.		
R(45)	Tenderers are invited to specify the lead time for delivery of equipment after a placement of the purchase order.		

Appendix 2 Technical and Operational Requirements

A2.1. Fabric Layer

A2.1.1. Fabric Layer – General description

The Fabric Layer is primarily used for the exchange of large amounts of operational data, most of which is hosted within the data centre. It is based on a stage-3 Clos network fabric, also known as Layer 3 IP Fabric or Leaf-Spine architecture, which is the current state-of-the-art network architecture for medium and large-scale data centres.

To address ECMWF's network design Requirements, there will be two segregated IP Fabrics, one in each Data Hall. They will be considered as two separate data centres and network connectivity between the two IP Fabrics will be based on a multi-site topology with Data Centre Interconnect (DCI), using EVPN. It is estimated that by 2023, each IP Fabric should be able to carry a peak of 1Tbps of data traffic. The preferred connectivity type to connect storage and compute is 25GbE, although it is acknowledged that 10GbE connectivity will be required for legacy servers and infrastructures. The network equipment will use 100GbE for the links between the Leaf and Spine Switches.

ECMWF has a mix of Bare Metal, Virtual, Container based and Openstack based infrastructure, in a multi-tenancy environment. The IP Fabric network topology is composed of Leaf Switches and Spine Switches whereby Leaf Switches mesh into the Spine to form the access layer that delivers network connection points for storage and compute. The hardware components are as follows:

- **Spine Switches**: switches to which only Leaf Switches connect.
- **Edge Leaf Switches**: two switches in each Data Hall will be used for connection to the Internet Edge routers, the perimeter firewalls and for DCI the other Data Hall
- **Server Leaf Switches**: switches to which servers connect.
- **DHS ToR Leaf Switches**: switches to which tape library storage connects
- **DHS Leaf Switches**: switches which provide connectivity to ECMWF's DHS table library infrastructure. Multiple Top of Rack (ToR) switches are connected on these.
- **HPC Leaf Switches**: switches to which the HPCF clusters will connect.

- **Reading DC Edge Leaf Switches**: two switches deployed in the Reading Date Centre LAN to which two diversely-routed 100Gbps circuits will connect to establish the site-to-site connectivity between ECMWF sites of Reading and Bologna.

The network will have to accommodate all the different workloads and it should be able to provide connectivity and multihoming to connected servers either via VXLAN+EVPN or via direct BGP peering with the hosts.

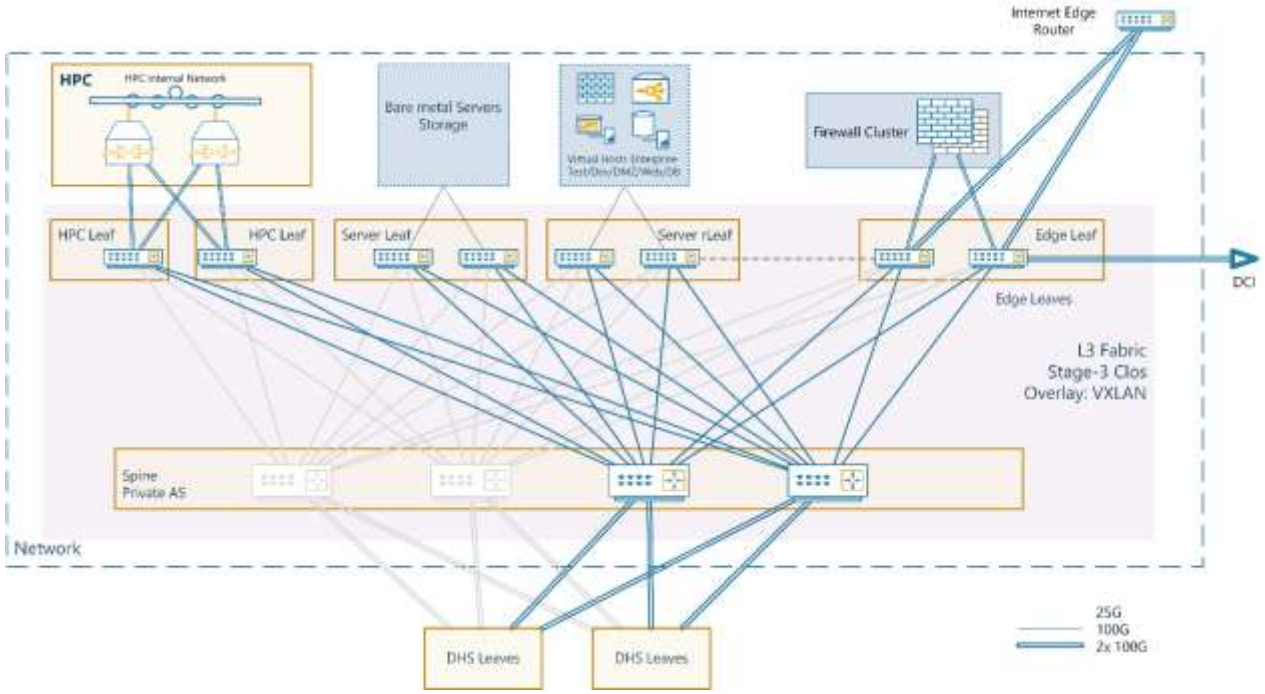

Figure 2: Fabric Layer High Level Design

A2.1.2. Fabric Layer - High Level Design description

A2.1.2.1. Routing design

Each Data Hall IP Fabric will be operating independently form the other Data Hall to increase the resiliency of the Bologna Data Centre network. The technologies that will be used to allow communication between the two Data Halls are the same as the ones used to interconnect distant sites. As a result, the intention is to use the same configuration to interconnect the new DC in Bologna and the existing DC in Reading during the migration period and for any future needs to interconnect the Bologna DC with a DR, Cloud or Co-Lo infrastructure sites.

An IP Fabric is made up of two network components: Underlay and Overlay:

- Underlay network: the switches that form the Layer 3 IP Fabric, communicate with each-other using a dynamic routing protocol (BGP in the case of ECMWF), forming a common network. It allows all network nodes to discover and communicate with each other;
- Overlay network: a “virtual” layer that dictates how hosts connected to fabric Leaf Switches communicate with each other via bridging or routing and allows to stretch a layer 2 network (a VLAN) over a Layer 3 IP Fabric. It binds VLANs together with the tunnelling protocols used to allow for communication between hosts connected to the various VLANs.

To facilitate the network segmentation and security in depth approach, multiple Virtual Routing and Forwarding instances (VRFs) will be configured on the overlay network. As per best practice, a VRF will be used for every tenant. Tenants are the network segments that have been identified having a security requirement for network segmentation.

A2.1.2.2. IP Fabric Underlay network

ECMWF will be using eBGP for the Underlay network. ECMWF will be using a different AS number per Leaf, utilising the following features:

- Private, dedicated AS per Leaf (or per pair of Leaves when multi-homing is required);
- Simplified troubleshooting of route source based on AS number;
- Rack-local subnets can be tracked by AS number;
- A new AS number for each rack (or pair of racks when Multi Chassis Link Aggregation is used).

A2.1.2.3. IP Fabric Overlay network

The overlay network dictates how hosts connected to Fabric Leaf Switches communicate with each other via bridging or routing and allows to stretch a layer 2 network (a VLAN) over a Layer 3 IP Fabric.

ECMWF will use Ethernet VPN (EVPN) to provide the IP Fabric Overlay network. It is a standards-based technology that provides virtual multipoint bridged connectivity between different Layer 2 domains over an IP backbone network. EVPN provides a solution for multipoint Layer 2 VPN services with advanced multihoming capabilities and a separation between the control and the date planes.

- Control plane: Multiprotocol BGP (MP-BGP) is used, amongst other things, to optimise/eliminate flooding of Broadcast, Unknown unicast, Multicast) (BUM) traffic;
- Data plane: provides, using Virtual eXtensible LAN (VXLAN) encapsulation, a network virtualisation technology that enables easy creation of location-agnostic layer 2 adjacencies between systems that have no direct layer 2 connection.

A2.1.2.4. Network segmentation: tenant design

To improve on Data Centre security, ECMWF will be following best practice of network segmentation. Multiple VRFs will be created to that effect to allow free traffic between VLANs on the SAME VRF and traffic forwarded via the firewalls for the VLANs that needs to go from one VRF to another.

Tenant design in the Edge Leaf Switch

The below describes tenant separation and connectivity at the Spine and Leaf layers. Tenant design in the Edge Leaf Switch has the following design characteristics:

- Each tenant gets its own VRF;
- Each tenant VRF can have multiple bridge domains (VLANs/VXLANs);
- Generally, bridge domains within a VRF can switch and route freely;
- Bridge domains between VRFs must not switch and route freely, but go via a firewall;
- Each bridge domain must provide VXLAN Layer 2 gateway functionality;
- Each Bridge Domain (BD) will have a routed Layer 3 interface;

- Integrated Routing and Bridging (IRB) interfaces must be able to perform inter-VXLAN routing.

Tenant design in the Leaf device

By comparison to a tenant design on an Edge Leaf Switch, tenant design in the Leaf devices is very simple, with the following design characteristics:

- Leaf devices are Layer 2 only (no IRB interfaces);
- By default, all traffic is isolated per bridge domain;
- Although a given tenant might own BD1, BD2, and BD3.

A2.1.2.5. Multihoming

Very often servers require bonding on two paired ports that connect to different switches for redundancy. In this case a pair of Leaf Switches is used within a rack (or on two adjacent racks) to provide multihoming for the servers. Multi Chassis Link Aggregation (MLAG) is configured to provide the port-channel and an iBGP session is configured between the two Leaf Switches to avoid traffic black-holing. Both Leaf Switches redistribute the connected subnets and advertise an aggregate (summary) to the overlay network.

A2.1.2.6. Equal Cost Multi Path and fabric resiliency (ECMP)

Traffic from one server to another on a different rack is load-balanced across all available routes, increasing the total available bandwidth.

A2.1.2.7. Cloud-Native and microservices applications

To address future ECMWF needs, the network design will be able to support cloud native technologies such as Kubernetes and Docker.

A2.1.2.8. Generic server and storage connectivity

At the Fabric Layer, generic bare-metal servers including hypervisors and storage systems, will be connected to a Leaf consisting of a pair of switches. Where required VLANs/VXLANs will be presented to the servers either configured for bonding using Multi Chassis Link Aggreggation, or without. This will provide multihoming and continuity of service should a switch or uplink fails / needs servicing.

A2.1.2.9. Network interface aspects

Maximum Transfer Unit (MTU)

To ensure optimum performance on the network, all network infrastructure will have platform MTU set to 9216, with a view of allowing for an end station MTU of 9000 in addition to any encapsulation required by network overlay and virtualisation technologies.

IP loopback addresses

IPv4 and IPv6 loopback interfaces will be used for routing process, and any network "service" IPs (e.g. VXLAN VTEP), as per best practices. Should a link fail, continuity of device connectivity will thereby be ensured/maintained as an alternative routing path will be made available.

Point to point interfaces

Point to point interfaces shall use /31 for IPv4 (as per RFC3021 [https://tools.ietf.org/html/rfc3021]) and /127 for IPv6 (as per RFC6124 [https://tools.ietf.org/html/rfc6124]) linknets, to ensure optimum utilisation of IP space and improve security.

Link Aggregation (LAG) and Multi-Chassis LAG (MLAG)

Various manufacturers support an ability to aggregate multiple physical links into a single logical link - this is termed Link Aggregation (LAG) and is defined by [802.1AX-2014] standard. Additionally, certain manufacturers extend this ability by supporting formation of LAGs between multiple devices at each end, sharing elements of switch control plane to achieve this. This feature is commonly known as MLAG. MLAG will be used by devices that can be uplinked in this way and where L2 connection is required.

Link Aggregation Control Protocol (LACP)

While LAGs and MLAGs can be formed by manual assignment of links, Link Aggregation Control Protocol (LACP) is also defined by IEEE 802.1AX-2014 standard and it enables automatic addition and removal of links from (M)LAGs, due to both failure conditions and misconfiguration.

Convergence optimisations: BFD and LFS

BFD is an active keep-alive method designed to ensure sub-second (often around 100ms) convergence in case of link failure. Similarly, LFS is a physical layer protocol that enables identification of local or remote physical link faults for fast links. These technologies will be used to ensure speedy protocol (re)convergence during network link failure / maintenance.

First Hop Redundancy Protocols

Active-active FHRPs will be used for provision of end station gateways if possible, else VRRP would be used. Separate instances will be used for IPv4 and IPv6, to mitigate against outages caused by fate-sharing.

Quality of Service

QoS will be configured when required on the relevant network devices to ensure that at times of congestion (for example due to a link failure), the traffic is processed in a deterministic fashion.

A2.1.3. Fabric Layer - Oversubscription

The following over-subscription ratios are required for the Deployment Phase 1, based on two Spine Switches in each IP Fabric:

- Edge Leaf Switches: 2:1;
- Server Leaf Switches 5:1;
- DHS ToR Leaf Switches 5:1;
- DHS Leaf Switches: 2:1;
- HPC Leaf Switches: 2:1.

The oversubscription ratios can be lowered in the future by increasing the number of Spine Switches.

A2.1.4. Fabric Layer – Proposed solution description

Fabric Layer - Requirements for the Proposed solution description			
Requirement number	**Requirement**	**Detailed Description**	**Self-Score**
M(46)	Tenderer must provide a summary of the technical solution or solutions that they propose to: • fulfil the High Level Design description in paragraphs A2.1.1, A2.1.2 and A2.1.3; • meet the Requirements listed in spreadsheet "Volume II TechSpec / Fabric Layer - Tech Specs". More than one solution can be proposed. (The response to this Requirement must be no longer than 1000 words for each proposed solution but may also contain diagrams).		
M(47)	Tenderers must complete the "Volume II TechSpec / Fabric Layer - Tech Specs" spreadsheet annexed with this tender document.		

	If more than one solution is proposed, then a separate "Volume II TechSpec / Fabric Layer - Tech Specs" spreadsheet must be completed for each additional solution.		
M(48)	Tenderers must describe the overall architecture with respect to recognition of failing hardware components and interaction between hardware components.		
R(49)	Tenderers are invited to describe other aspects of the overall architecture including: • mechanisms for bandwidth management and buffering techniques, especially in the case when oversubscription occurs; • capacities; • latency; • handling of new data flows.		
R(50)	Tenderers are invited to state the forwarding performance of the Switches; they are also invited to identify the software features whose use may adversely affect this performance and indicate the performance impact.		
R(51)	Tenderers are invited to describe how buffer space is allocated to an oversubscribed port or backplane link and specify the maximum buffer space available per port and per Port Pool.		
R(52)	Tenderers are invited to describe what happens when a Port Pool's buffer space is exceeded and dropping of packets has become unavoidable.		
M(53)	Tenderers must guarantee that software features specified as available in the Tendered solution or solutions are technically and operationally compatible, unless explicitly stated otherwise. Any such incompatibility must be described including any impact on system functionality.		
M(54)	Tenderers must guarantee that software features required to provide the purposed solution or solutions are available for at least eight (8) years from the date of Contract signature.		
R(55)	Tenderers are invited to describe any additional features not listed in the ITT as Requirements, which the Tenderer feels may be relevant and beneficial to the proposed solution or solutions.		
R(56)	Tenderers are invited to describe how network micro-segmentation could be implemented in the proposed solution or solutions.		
R(57)	Tenderers are invited to describe how elephant flow management could be implemented in the proposed solution or solutions.		
R(58)	Tenderers are invited to describe how container versions of the Manufacturer's operating system could be implemented in the proposed solution or solutions.		

A2.2. Internet Edge Layer

A2.2.1. Internet Edge Layer – General description

The Internet Edge functional block constitutes a critical component of the network design responsible for connection of the enterprise to the Internet and WAN services, including telephony circuits. The block is designed with high availability in mind, with no single points of failure and catering for a variety of failure modes without affecting service performance.

The Internet Edge Layer consists of two Internet Edge routers.Each router will be physically connected to multiple ISPs and to the pairs of Edge Leaf Switches in both Data Halls, ensuring shortest and deterministic forwarding path under normal operations. The Internet Edge routers are also interconnected with each other and most of the connections are based on 100Gbps circuits.

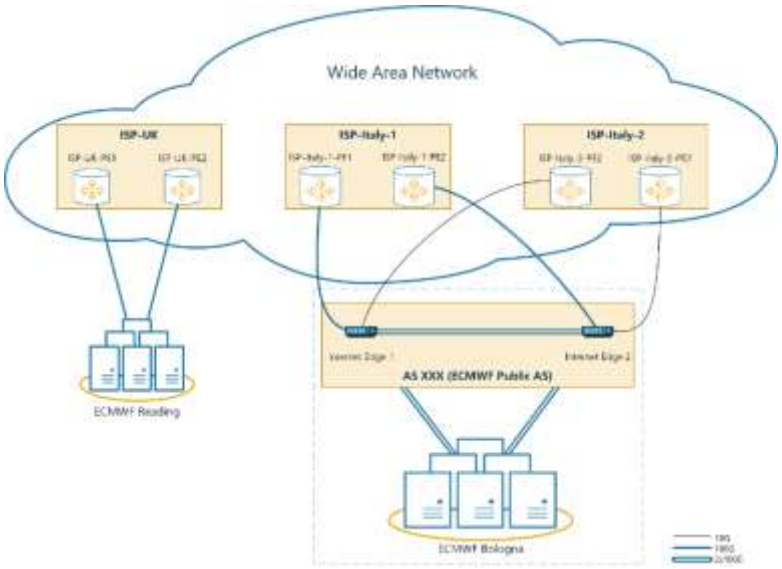

Figure 3: Internet Edge Layer High Level Design

A2.2.2. Internet Edge Layer – High Level Design description

A2.2.2.1. Internet connectivity to ISP-Italy

The following describes how the access to ISP-Italy Internet services will be achieved:

- Physical connectivity shall be via a single 100Gbps link between each Internet Edge router and ISP-Italy PE;
- If connection to between the routers is indirect, BFD shall be enabled to ensure fast convergence after an indirect failure of ISP-Italy PE router;
- Two eBGP peerings, one over IPv4 for IPv4 traffic and one over IPv6 for IPv6 traffic, will be configured between the Internet Edge router and ISP-ITALY-PE router, utilising MP-BGP set to advertise IPv4 and IPv6 AFIs (respectively) and both Unicast and Multicast SAFIs;
- Routers will use IPv4 loopback address for IPv4 peering and IPv6 loopback addresses for IPv6 peering, with peerings secured via MD5 Authentication and TTL security;
- Outbound, each router will advertise an aggregate route for both halls and the Bologna Offices, as well as many specific routes (that will be different for each router), to facilitate load-sharing;
- Internal (private) AS numbers will be stripped from all outbound advertisements;
- Inbound the router will permit a default route only.

A2.2.2.2. Connectivity to Fabric Layer Edge Leaf Switches

This section describes how the connectivity to the Fabric Layer will be done using the Edge Leaf Switches devices:

- Physical connectivity shall be via a dual 100Gbps link between Internet Edge router and each of the Edge Leaf Switches;
- Two eBGP peerings, one over IPv4 for IPv4 traffic and one over IPv6 one for IPv6 traffic, will be configured between the Internet Edge router and Edge Leaf Switch, utilising MP-BGP set to advertise IPv4 and IPv6 AFIs (respectively) and both Unicast and Multicast SAFIs;
- Routers will use IPv4 loopback address for IPv4 peering and IPv6 loopback addresses for IPv6 peering, with peerings secured via MD5 Authentication and TTL security;
- Outbound, each router will advertise a default route to both halls, but will set a community towards the non-local hall, so that the default route is less preferred;

- Inbound the router will permit internal routes only;
- Edge Leaf Switches will have an 'edge' VRF configured, to be used for connectivity to Internet Edge routers.

A2.2.2.3. Connectivity to SIP trunks (Telephony)

The plan is to use dedicated circuits to carry outgoing SIP voice traffic to/from Bologna.

- SIP trunks will be terminated on each router, via a tunnel with ISP-ITALY acting as SIP transit provider (subject to ISP-ITALY permitting that);
- Alternatively, SIP trunks will be terminated on each router in a dedicated DMZ VLAN.

A2.2.2.4. Connectivity between the Internet Edge routers

This part describes the two Internet Edge routers' connectivity.

- Physical connectivity shall be via quad 100Gbps links between the Internet Edge routers;
- Two iBGP peerings, one over IPv4 for IPv4 traffic and one over IPv6 one for IPv6 traffic, will be configured between the Internet Edge routers, utilising MP-BGP set to advertise IPv4 and IPv6 AFIs (respectively) and both Unicast and Multicast SAFIs;
- Routers will use IPv4 loopback address for IPv4 peering and IPv6 loopback addresses for IPv6 peering, with peerings secured via MD5 Authentication and TTL security;
- Outbound, the routers will be permitted to learn all the internal, RMDCN and default routes;
- Inbound, the routers will be permitted to advertise all the internal, RMDCN and default routes.

A2.2.2.5. Site-to-site connectivity between Reading and Bologna

ISP-ITALY and ISP-UK will be providing ECMWF with and end-to-end L3 VPN service that will be used to provide the Reading-Bologna site-to-site connectivity.

- Connectivity between Bologna and Reading sites will be achieved by using Ethernet VPN (EVPN, defined in RFC7432 [https://tools.ietf.org/html/rfc7432]) technology;
- Using EVPN enables an enterprise to establish both a L3 VPN service or, when combined with Virtual eXtensible LAN technology (VXLAN, as defined in RFC7348 [https://tools.ietf.org/html/rfc7348]), a L2 VPN service;

- Two sets of indirect eBGP peerings will be set up between each of Bologna Internet Edge routers and each of Reading Internet Edge routers;
- First set of eBGP peerings will provide underlay network - it will consist of IPv4 (and if supported, IPv6) peering advertising IPv4 AFI and Unicast SAFI, and will be used to exchange router loopback addresses used for overlay connectivity and VXLAN VTEPs;
- Second set of eBGP peerings will provide an overlay network - it will consist of IPv4 and IPv6 peerings advertising L2VPN AFI and EVPN SAFI, which will facilitate the exchange of IP Prefixes and MAC-IP bindings.

A2.2.2.6. AS number and advertising multiple paths in BGP

To ensure that the solution meets the scalability, flexibility and multi-provider peering needs, ECMWF will use its own AS number. This would allow ECMWF to peer with different ISPs simultaneously, as well as offering greater potential for traffic engineering.

A2.2.3. Internet Edge Layer – Proposed solution description

Internet Edge Layer - Requirements for the Proposed solution description			
Requirement number	**Requirement**	**Detailed Description**	**Self-Score**
M(59)	Tenderers must provide a summary of the technical solution or solutions that they propose to: • fulfil the High Level Design description in paragraphs A2.2.1 and A2.2.2; • meet the Requirements listed in spreadsheet "Volume II TechSpec / Internet Edge Layer - Tech Specs". More than one solution could be proposed. (The response to this Requirement must be no longer than 1000 words per solution but may also contain diagrams).		
M(60)	Tenderers must complete the "Volume II TechSpec / Internet Edge Layer - Tech Specs" spreadsheet annexed with this tender document. If more than one solution is proposed, then a separate "Volume II TechSpec / Internet Edge Layer - Tech Specs" spreadsheet must be completed for each additional solution.		
M(61)	Tenderers must describe the overall architecture with respect to recognition of failing components and interaction between components.		
R(62)	Tenderers are invited to describe other aspects of the overall architecture including: • mechanisms for bandwidth management and buffering techniques, especially in the case when oversubscription occurs;		

	• capacities; • latency; • handling of new data flows.		
R(63)	Tenderers are invited to state the forwarding performance of the Intenet Edge Routers; they are also invited to identify software features whose use may adversely affect this performance and indicate the performance impact.		
R(64)	Tenderers are invited to describe how buffer space is allocated to an oversubscribed port or backplane link and specify the maximum buffer space available per port and per Port Pool.		
R(65)	Tenderers are invited to describe what happens when a Port Pool's buffer space is exceeded and dropping of packets has become unavoidable.		
M(66)	Tenderers must guarantee that software features specified as available in the Tendered solution or solutions are technically and operationally compatible, unless explicitly stated otherwise. Any such incompatibility must be described including any impact on system functionality.		
M(67)	Tenderers must guarantee that software features required to provide the purposed solution or solutions are available and will continue for at least eight (8) years from the date of Contract signature.		
R(68)	Tenderers are invited to describe any additional features not listed in the ITT as Requirements, which the Tenderer feels may be relevant and beneficial to the proposed solution or solutions.		

A2.3. Management and Monitoring Solution

A2.3.1. General description

Deployed in a physically-segregated management and monitoring network, the management and monitoring solution is used to administer and monitor the Fabric and Internet Edge Layers.

Requirements for the Management and Monitoring Solution			
Requirement number	**Requirement**	**Detailed Description**	**Self-Scoring**
M(69)	Tenderers must provide a summary of the technical solution or solutions that they propose to meet the Requirements listed in spreadsheet "Volume II TechSpec / Management and Monitoring - Tech Specs". More than one solution could be proposed. (The response to this Requirement must be no longer than 1000 words per solution but may also contain diagrams).		
M(70)	Tenderers must complete the ""Volume II TechSpec / Management and Monitoring - Tech Specs" spreadsheet annexed with this tender document. If more than one solution is proposed, then a separate "Management and Monitoring - Technical specifications" spreadsheet must be completed for each additional solution.		
R(71)	Tenderers are invited to provide Networks Functions Virtualization case studies of their management platform.		
R(72)	Tenderers are invited to describe how orchestration and automation would be implemented in the proposed solution or solutions.		
R(73)	Tenderers are invited to describe how performance monitoring and telemetry would be implemented in the proposed solution or solutions.		
R(74)	Tenderers are invited to describe any additional features not listed in the ITT as Requirements, which the Tenderer feels may be relevant and beneficial to the proposed solution or solutions.		

A2.4. Support and Training

A2.4.1. Support of the Tendered Hardware and Software

Requirements for Support of the Tendered Hardware and Software			
Requirement number	**Requirement**	**Detailed Description**	**Self-Scoring**
M(75)	Tenderers must explicitly undertake to provide spare parts and support for the hardware and software acquired under this ITT in accordance with Schedule 3 of Volume III for at least for at least eight (8) years from the date of Contract signature. Where this involves an arrangement with the Manufacturer, responsibility for the provision of such support must in any case rest with the Tenderer.		
R(76)	Tenderers are invited to describe their policy regarding maintenance, spare parts and support for the hardware, firmware and software of the Deployment Phase 1 on reaching their respective end of life. In particular, any replacement policy or policies for components that will no longer be supported should be stated.		

A2.4.2. Training

Requirements for Training			
Requirement number	**Requirement**	**Detailed Description**	**Self-Scoring**
M(77)	Tenderers must provide training and knowledge transfer programme, given at ECMWF's Reading premises or elsewhere, which must provide up to 10 ECMWF operational staff with sufficient understanding of the working of the software and hardware being tendered to enable them to provide effective day-to-day and emergency operational support including documentation, administrative tools, performance analysis, software upgrades and changes to configuration files.		
R(78)	Tenderers are invited to state which training programme is available for ECMWF operational staff during the course of the Contract..		

A2.5. Transceivers and Cables

ECMWF would like to have the possibility to use third-party transceivers. This section assesses the possibility and feasibility of doing so.

Requirements for Transceivers and Cables			
Requirement number	**Requirement**	**Detailed Description**	**Self-Scoring**
M(79)	Tenderers must confirm that the optic transceivers and direct attached cables used in the propose solution or solutions are compatible with the proposed network equipment.		
M(80)	Tenderers must confirm that the optic transceivers and direct attached cables used in the propose solution or solutions are compliant with the applicable relevant standards.		
M(81)	Tenderers must confirm that each transceiver and direct attached cables is individually tested at the factory and again tested by the supplier after coding.		
M(82)	Tenderers must confirm that in the event when optical transceivers and direct attached cables are excluded from support but purchased as part of the Contract, the optical transceivers and direct attached cables will fall under the standard warranty terms subject to the warranty period starting on time of purchase.		
D(83)	Tenderers shall confirm that limited life-time warranty for the proposed transceivers and direct attached cables is five (5) years or more from time of purchase.		
D(84)	Tenderers shall confirm that advanced product replacement for transceivers and direct attached cables is two (2) years or more from time of purchase.		
R(85)	Tenderers are invited to provide information on failure rates of each transceiver and direct attached cables type of the proposed solution(s).		
M(86)	Tenderers must state what is their policy in regard to support of 3rd party optic transceivers and direct attached cables.		
M(87)	Tenderers must specify whether the use of third-party optic transceivers and direct attached cables is possible in the proposed solution or solutions.		
R(88)	Tenderers are invited to provide details of how support incidents will be handled if 3rd party optic transceivers and direct attached cables are being used on the Manufacturer's hardware.		

Appendix 3 Pricing and Agreement

ECMWF expects to see full pricing transparency in your Tender response and to be able to understand the figures first time without the need to clarify with the Tenderer in question.

Where applicable, please ensure that all and any conditions and/or restrictions are made explicit e.g. unanticipated expenditures (rush charges, etc.) and including the net pass-through of third-party costs/commissions/discounts.

When providing full and transparent breakdown of any summary figures, the Tenderer must be specific on how these are derived i.e. unit costs, day rates, quantities, discounts, exchange rate, how peronnel effort is split between phases of work, etc.

Pricing Requirements

Tenderers are required to quote prices on the following basis:

a) Prices quoted by Tenderers in the Bill of Materials shall be firm and fixed;
b) For the Deployment Phase 1 and its associated Bill of Material, prices are fixed and firm for six (6) months after the closing date from receipt of tenders and ECMWF can use these prices to place orders at Contract signature;
c) For purchases beyond the Deployment Phase 1, guaranteed level of discounts from Manufacturers' prices for hardware and support will apply;
d) The prices and discounts quoted against (b) can be used for any additional purchase orders placed by ECMWF beyond the Deployment Phase 1;
e) Prices must be quoted in Euros (€) and ECMWF will use Euros (€) in the Contract.

Requirements for Pricing and Agreement			
Requirement number	**Requirement**	**Detailed Description**	**Self-Scoring**
M(89)	Tenderers must provide their pricing for the bill of materials using the "Volume II BoM" spreadsheet annexed with this tender document. Tenderers are invited to add as many lines as necessary to the spreadsheet to provide the pricing of all the elements required by the poroposed solution. If more than one solution is proposed, then pricing must be provided for each solution using a separate spreadsheet.		
M(90)	Tenderers must confirm that all related costs to cover all the Works under Deployment Phase 1 includes the following: • all equipment and Hardware; • all software licences relating to the Works (if applicable); • all Maintenance and Support Services, are required for 24hours/day, 7 days/week for the equipment and software (if applicable) – you must also detail all the support level options and associated SLAs; • delivery; • acceptance testing • support during the stabilisation period after a system launch i.e. "hypercare" (expected to be 6 months duration) • documentation and training.		
M(91)	For the Deployment Phase 1, Tenderers must confirm that prices: • encompass the costs of the mandatory features as described in this ITT;		

	• be quoted in Euros (€); • be inclusive of shipping, delivery; • be exclusive of all appropriate import duties and UK or Italian taxes; • be valid for six (6) months after the closing date for receipt of tenders; • state the level of discount off Manufacturer's list price for supplying equipment; • state the level of mark-up off Manufacturer's list price for supplying equipment.		
M(92)	For the Deployment Phase 1, Tenderers must state the level of discount off Manufacturer's list price for supplying equipment in the "BoM" spreadsheet annexed with this tender document. (including any software licenses associated with the hardware). If different discounts apply to different types of equipment then this must be clearly indicated. The Supplier shall also state the list price, the mark-up (both in terms of percentage) and the final price.		
D(93)	Tenderers that use a reference pricelist that is in a currency other than Euros (€) must provide the currency exchange rate or rates applied to obtain the pricing in Euros (€).		
M(94)	Tenderers must quote firm and fixed prices that are valid for acceptance by ECMWF for six (6) months after the closing date for receipt of tenders.		
M(95)	For purchases that are not part of Deployment Phase 1, Tenderers must give guaranteed levels of discount on the Manufacturer's standard list prices for all components of the Works and describe how list prices can be periodically made available to ECMWF during the course of the Contract.		
M(96)	For later purchases that will take place after the completion of the Deployment Phase 1, the Contrarctor's quotes must be exclusive of all appropriate import duties and UK or Italian taxes.		
M(97)	Tenderers must state the maximum price of support services for future equipment (equipment that does not form part of Deployment Phase 1) and software licences acquired under this Contract as a percentage of the applicable discounted purchase price of the equipment or software licence.		
M(98)	Tenderers must provide quotes for different levels of the support services for the equipment listed in the "Volume II BoM" spreadsheet provided for a period of three (3) years.		
D(99)	In the case when third party optic transceivers and direct attached cables are used in the propose solution or solutions, Tenderers shall provide quote in the "Volume II BoM" spreadsheet. Tenderers shall state the level of discount and mark-up off third party list price.		