

Tender Specifications

attached to the Invitation to tender

Invitation to tender N° EMSA/NEG/62/2015 for Architecture evolution to handle big volume of position reports

1 Introduction

The European Maritime Safety Agency (EMSA) was established under Regulation 1406/2002/EC of the European Parliament and of the Council to contribute to the enhancement of European maritime safety.

Among its tasks, the Agency should facilitate cooperation between Member States and the European Commission in the field of European Vessel Traffic Monitoring and Information System in the context of Directive 2002/59/EC.

EMSA contributes to the enhancement of the overall maritime safety system in the European Union. Its goals are, through its tasks, to reduce the risk of maritime accidents, marine pollution from ships and the loss of human lives at sea.

The Agency develops and operates software applications that support member states in implementing European maritime legislation. In order to achieve its tasks the Agency has the need to be supported by a solid ICT infrastructure.

Further information about EMSA can be obtained on its website: www.emsa.europa.eu

2 Objective, scope and description of the contract

The purpose of this procurement is to perform a study that includes the design of a scalable, reliable and resilient architecture to handle a big volume of position information. This study must include the implementation of a Proof of Concept (PoC) that validates such architecture.

EMSA currently receives vessel position information from a variety of sources, including:

- Terrestrial Automatic Identification System (T-AIS);
- Satellite Automatic Identification System (Sat-AIS);
- Long-range identification and tracking (LRIT);
- Vessel Monitoring Systems (VMS);

Vessel position information is received, distributed and analysed using a queuing system (publish/subscribe of position information to multiple consuming applications for analysis purposes) and stored in an Oracle database.

With the increase of the number of sources and the frequency at which these sources send vessel position information, EMSA anticipates an increase of the number of position reports to be handled to a rate of 3.500 messages (individual position reports) per second on average with bursts of up to 20.000 messages per second over 20 seconds. EMSA wants to anticipate architectural changes needed to cope with the abovementioned performance requirements.

As such, the tenderer's offer should provide an architecture proposal, addressing the following requirements:

1. Handle the increased message throughput (3.500 messages per second on average with bursts of up to 20.000 messages per second over 20 seconds);
2. Enrich the position messages with additional vessel information (e.g. vessel identity resolution and vessel cargo) retrieved from external systems;
3. Provide monitoring capabilities and reporting on key metrics for each source of messages (e.g. current and historical throughput from each source, time-interval between detected position of a vessel and delivery of position message to EMSA);
4. Provide a mechanism to distribute processed messages to other systems (system2system interface)
 - a. This mechanism must include the capability of reducing the message throughput to an acceptable load (maximum 1700 messages per second) on the downstream systems, implementing specific business down sampling rules (logic provided in Appendix A), while retaining representative position information for each vessel;
5. Design and implementation of a reusable JMeter load generation tool able to generate the needed load to cope with the previous mentioned requirements;
6. Scalable, resilient and reliable architecture based in two different infrastructure approaches:
 - a. Deployment in EMSA virtual infrastructure (VMWare based), considering its future migration to a Cloud based infrastructure with minimal adaptations;
 - b. Deployment in a Cloud based infrastructure, to be provided by the tenderer.
7. Open source based architecture encompassing components with characteristics providing:
 - a. Tabular, highly optimized NoSQL semi-structured data storage and manipulation (e.g. Apache Cassandra);
 - b. Fault-tolerant, high-speed, distributed large datasets ingestion in near real-time (e.g. Apache Kafka);
 - c. Fault-tolerant, highly distributed data processing coordination (e.g. Apache Zookeeper);
 - d. In-memory, near real-time distributed complex event processing and manipulation (e.g. Apache Spark and Spark Streaming).

The tenderer's offer should encompass, as minimum, the following deliverables:

- Architecture design document
- JMeter load generation scripts
- PoC (proof-of-concept) implementation of the designed architecture in the identified target platforms

Final report describing the obtained results.

3 Contract management responsible body

The European Maritime Safety Agency – Unit A.3, in charge of Operations Support - will be responsible for managing the contract.

4 Meetings

The following meetings are envisaged:

- **Signature of the contract:** Work shall not start before the signature of the contract.
- **Kick-off meeting:** After the signature of the contract, a kick-off meeting will be held in order to present a work break down structure of the tasks and to define the details of the work to be undertaken.
- **Final meeting:** Prior the end of the contract a final meeting shall be held to mark the end of the contract and enable the contracting parties to discuss the work accomplished.
- **Regular management meeting:** regular meetings to be held between EMSA and the contractor. The regularity of these meetings is to be agreed in the kick-off meeting.

EMSA may call for additional meetings if this should be considered necessary for the better execution of the project.

Meetings will be held in EMSA premises in Lisbon, Portugal; although some meetings could be held on the contractors premises or take another form (e.g. virtual) if mutually agreed by EMSA and the contractor. EMSA will not reimburse any travel and subsistence expenses to the contractor, which may be incurred in relation to the attendance of the above meetings.

5 Timetable

The estimated date for signature of the contract is 21/12/2015.

The estimated date of the kick-off meeting is 04/01/2016.

The maximum duration of the contract is 6 months.

6 Estimated Value of the Contract

The maximum budget available for this contract is of 60.000,00 Euro excluding VAT.

7 Terms of payment

Payment will be made in accordance with the provisions of the draft contract available in the Procurement Section under the call to tender EMSA/NEG/62/2015 on the EMSA website at the following address:
www.emsa.europa.eu

8 Terms of contract

In drawing up a bid, the tenderer should bear in mind the terms of the draft contract.

EMSA may, before the contract is signed, either abandon the procurement or cancel the award procedure without the tenderers being entitled to claim any compensation.

9 Subcontracting

If the tenderer intends to either sub contract part of the work or realise the work in co-operation with other partners he shall indicate in his offer which part will be subcontracted, as well as the name and qualifications of the subcontractor or partner. (NB: overall responsibility for the work remains with the tenderer).

The tenderer must provide required evidence for the exclusion and selection criteria on its own behalf and when applicable on behalf of its subcontractors. The evidence for the selection criteria on behalf of subcontractors must be provided where the tenderer relies on the capacities of subcontractors to fulfil selection criteria¹. The exclusion criteria will be assessed in relation to each economic operator individually. Concerning the selection criteria, the evidence provided will be checked to ensure that the tenderer and its subcontractors as a whole fulfil the criteria.

10 Requirements as to the tender

Bids can be submitted in any of the official languages of the EU. The working language of the Agency is English. Bids must include an English version of the documents requested under point 14 of the present tender specifications.

The tenderer shall complete the Tenderer's checklist.

¹ To rely on the capacities of a subcontractor means that the subcontractor will perform the works or services for which these capacities are required.

If the tenderer intends to either sub contract part of the work or realise the work in co-operation with other partners (Joint Offers) he shall indicate in his offer by completion of the form – Information regarding joint offers and subcontracting. The tender must be presented as follows and must include:

Signed cover letter indicating the name and position of the person authorised to sign the contract/Purchase Order and the bank account on which payments are to be made.

Financial Form completed, signed and stamped; available on the Procurement Section (Financial Form) on the EMSA Website at the following address: www.emsa.europa.eu

Legal Entity Form completed, signed and stamped and requested accompanying documentation, available on the Procurement Section (Legal Entity Form) on the EMSA Website at the following address: www.emsa.europa.eu

Tenderers are exempt from submitting the Legal Entity Form and Financial Form requested if such a form has already been completed and sent either to EMSA or any EU Institution previously. In this case the tenderer should simply indicate on the cover letter the bank account number to be used for any payment in case of award.

Part A: all the information and documents required by the contracting authority for the appraisal of tenders on the basis of the points **9, 10, 13.2, 13.3** of these specifications (**Exclusion criteria**)

Part B: all the information and documents required by the contracting authority for the appraisal of tenders on the basis of the **Award Criteria** set out under point **14** of these specifications;

Part C: all the information and documents required by the contracting authority for the appraisal of tenders on the basis of the **Technical and professional capacity** (part of the Selection Criteria) set out under point **13.4** of these specifications.

Part D: setting out prices in accordance with point **11** of these specifications.

11 Price

- Price must be quoted for the project “Architecture evolution to handle big volume of position reports” as described in the section 2 and shall be all inclusive.
- Prices must be fixed amounts and non-revisable.
- Prices must be quoted in euro.
- Under Article 3 and 4 of the Protocol on the privileges and immunities of the European Communities, the latter is exempt from all duties, taxes and other charges, including VAT. This applies to EMSA pursuant to the Regulation 1406/2002/EC. Therefore price and the amount of VAT must be shown separately.

12 Joint Offer

Groupings, irrespective of their legal form, may submit bids. Tenderers may, after forming a grouping, submit a joint bid on condition that it complies with the rules of competition. Such groupings (or consortia) must specify the company or person heading the project and must also submit a copy of the document authorising this company or person to submit a bid.

Each member of the consortium must provide the required evidence for the exclusion and selection criteria. The exclusion criteria will be assessed in relation to each economic operator individually. Concerning the selection criteria, the evidence provided by each member of the consortium will be checked to ensure that the consortium as a whole fulfils the criteria.

If awarded, the contract will be signed by the person authorised by all members of the consortium. Tenders from consortiums of firms or groups of service providers, contractors or suppliers must specify the role, qualifications and experience of each member or group.

13 Information concerning the personal situation of the service provider information and formalities necessary for the evaluation of the minimum technical and professional capacity required.

13.1 Legal position – means of proof required

When submitting their bid, tenderers are requested to complete and enclose the **Legal Entity Form** available on the Procurement Section on the EMSA Website at the following address: www.emsa.europa.eu.

13.2 Grounds for exclusion – Exclusion criteria

To be eligible to participate in this contract award procedure, tenderers must not be in any of the following exclusion grounds:

- a) they are bankrupt or being wound up, are having their affairs administered by the courts, have entered into an arrangement with creditors, have suspended business activities, are the subject of proceedings concerning those matters, or are in any analogous situation arising from a similar procedure provided for in national legislation or regulations;
- b) they have been convicted of an offence concerning their professional conduct by a judgement which has the force of res judicata;
- c) they have been guilty of grave professional misconduct proven by any means which the contracting authority can justify;
- d) they have not fulfilled obligations relating to the payment of social security contributions or the payment of taxes in accordance with the legal provisions of the country in which they are established or with those of the country of the contracting authority or those of the country where the contract is to be performed;
- e) they have been the subject of a judgement which has the force of res judicata for fraud, corruption, involvement in a criminal organisation or any other illegal activity detrimental to the Communities' financial interests;

- f) following another procurement procedure or grant award procedure financed by the Community budget, they have been declared to be in serious breach of contract for failure to comply with their contractual obligations.

13.3 Evidence to be provided by the tenderers

For this purpose the Declaration on Honour available on the Procurement Section on the EMSA Website (www.emsa.europa.eu) shall be completed and signed.

13.4 Technical and professional capacity – Selection criteria

Requirements:

- The tenderer must have a very good level of technical and professional capability in the provision of the requested services, namely know-how, efficiency, experience and reliability in the requested technical domain.

Evidence:

- Demonstrate the experience in systems similar to those in the requested technical domain, in terms of used architectures and technologies, namely but not exclusively:
 - Tabular, highly optimized NoSQL semi-structured data storage and manipulation (e.g. Apache Cassandra);
 - Fault-tolerant, high-speed, distributed large datasets ingestion in near real-time (e.g. Apache Kafka);
 - Fault-tolerant, highly distributed data processing coordination (e.g. Apache Zookeeper);
 - In-memory, near real-time distributed complex event processing and manipulation (e.g. Apache Spark and Spark Streaming).

14 Award criteria

Only the tenders meeting the requirements of the exclusion and selection criteria will be evaluated in terms of quality and price.

The contract will be awarded to the tenderer who submits the most economically advantageous bid (the one with highest score) based on the following quality criteria and their associated weightings:

1. **Quality criterion 1 ($W_1 = 70\%$) – quality of the technical solution** – the bidder shall present the proposed technical solution based on the requirements presented in 2 - Objective, scope and description of the contract. The technical solution to be presented should include:
 - a. A detailed description of the project and activities presented in a Project Plan with an estimation of effort;
 - b. A detailed technical description of the PoC (proof-of-concept) implementation;

- c. Description of the technologies, means, tools that the tenderer shall use to conduct the activities.

and the price criterion and associated weighting:

2. **Price of the bid ($W_{Price} = 30\%$)** – the bidder shall present the total price of the bid.

For all bids, evaluators will give marks between 0-10 (half points are possible) for each quality criterion.

The score is calculated as

$$S = SQ + SP$$

where:

The average quality for quality criterion i is

$$Q_i = \frac{1}{\text{number of evaluators}} * \sum_{\text{evaluator}} \text{mark of the evaluator for quality criterion } i$$

The overall weighted quality is

$$Q = \sum_i Q_i * W_i$$

The score for quality is

$$SQ = \frac{Q}{Q \text{ of the bid with highest } Q} * 100 * \sum_i W_i$$

The score for price is

$$SP = \sum_i \frac{\text{lowest } Price_i \text{ of all bids}}{Price_i} * 100 * W_{Price_i}$$

Only bids that have reached a minimum of 60% for Q_1 , a minimum of 60% for Q_2 will be taken into consideration when calculating the score for quality SQ , score for price SP and score S .

Only bids that have reached a minimum of 70% for the score S will be taken into consideration for awarding the contract.

15 Contracts will not be awarded to tenderers who during the procurement procedure:

- (a) are subject to a conflict of interest
- (b) are guilty of misrepresentation in supplying the information required by the contracting authority as a condition of participation in the contract procedure or fail to supply this information.

16 False declarations

Without prejudice to the application of penalties laid down in the contract, tenderers and contractors who have been guilty of making false declarations concerning situations referred to in points 12 and 13 above or have been found to have seriously failed to meet their contractual obligations in an earlier procurement procedure or grant shall be subject to administrative and financial penalties set out in Article 145 of Commission Delegated Regulation of 29.10.2012 on the rules of application of Regulation (EU) No 966/2012 of the European Parliament and of the Council on the financial rules applicable to the general budget of the Union.

17 Intellectual Property Right (IPR)

Please consult the contract for IPR related clauses.

If the results are not fully created for the purpose of the contract this should be clearly pointed out by the tenderer in the tender. Information should be provided about the scope of pre-existing rights, their source and when and how the rights have been or will be acquired.

In the tender all quotations or information originating from other sources and to which third parties may claim rights have to be clearly marked (source publication including date and place, creator, number, full title etc.) in a way allowing easy identification.

APPENDIX A

Down Sampling requirements#

Functional#

Rule 1a - Message for same ship, same source, same provider.#

Given

2 position reports for the same ship ID, same source and same provider

Where

the timestamp of the first position report + downsampling period > timestamp of the second position report

Then

2nd position report shall be discarded

Notes:

- ID or IDs as provided in the message, there shall be no enrichment or lookup of ship particulars. This means that the following id will be used based on the message source:

Source	ShipParticular used for determining the ID
T-AIS	MMSI
Sat-AIS	MMSI
S-AIS	MMSI
LRIT	IMO
VMS	IR
other	Unsupported. Message will be discarded.

If no ID can be found according to the above rule, the position report will be discarded.

- Source is case sensitive

Rule 1b - Message for same ship, same source, same provider#

Given

2 position reports for the same ship ID, same source and same provider

Where

the timestamp of the first position report + downsampling period <= timestamp of the second position report

Then

2nd position report shall be passed on

Rule 2 - down sampling shall be limited to messages from the same stream#

Given

2 messages for the same ship

Where

either source or provider are different

Then

No down sampling shall be applied

Notes

- Down sampling will be limited to messages within the same stream. A stream is defined as a combination of source (either of Terrestrial AIS or Satellite AIS in the initial implementation) and originator (ExactEarth or FFI will be distinguished in the initial implementation). As an example, if a message for a given vessel is received both from S-AIS provider ExactEarth and from an T-AIS stream, both messages will be passed on by the down sampling component, as different down sampling rules will be applied to each of the two messages. In a later stage elimination of duplicated messages over different data streams may be implemented if required, but this would need to be verified against access rights policies, as one user may be entitled to see a position from one stream but not the other.
- AIS type 5,24 messages shall not be downsampled and will only be passed through to the EMSA downstream processing (for internal client systems) if the VDM sentence is different from the one that was previously received for the same vessel, from the same data stream.
- Messages other than position messages will not be downsampled. In AIS the position message types are 1, 2, 3, 9, 18, 19 and 27.

Rule 3 - Down sampling shall support multiple clients#

Given

2 messages for the same ship, originator and source

Where

2 clients are configured for down sampling component

Then

down sampling period can be different per client. The end point for the different clients will be different. The same message could be passed to 1 of the clients, passed through

for all clients or discarded for all clients according to the other rules described.

Rule 4 - Attribution of Originator#

Given

A position message

Where

the DataAccessRights node is defined on multiple levels

Then

the following order shall be used to determine the Originator for each PositionReport:

1. DataAccessRights/Originator element on the PositionReport
2. DataAccessRights/Originator element on the PositionMessage element that is the parent of the PositionReport if 1. is not available
3. DataAccessRights/Originator element on the root element if 1. and 2. are not available

Note

- a single message may contain PositionReports from different Originators.

Rule 5 - Attribution of source#

Given

A position message containing 1 or multiple PositionReports

Where

Source attribute is defined on multiple levels

Then

the following order shall be used for determining the 'source' for each PositionReport

1. Source attribute defined on the PositionReport
2. Source attribute defined on the root element if 1. is not available

Rule 6 - messages that contain insufficient data to apply the rules described will be discarded#

Given

A message containing 1 or more PositionReports

Where

either the ID, Originator or source cannot be determined for a PositionReport (considering Rule 1a, Rule 3 and Rule 4)

Then

- each PositionReport where either of the above are missing shall be discarded
- other PositionReports shall be evaluated according to the other rules described

Rule 7 - Positions in the future shall be discarded#

Given

A PositionReport

Where

the timestamp is in the future

Then

the PositionReport shall be discarded

Notes:

- to allow for time zone issues an admin may specify an allowable amount of time in the future that will still be allowed.

Rule 8 - no empty messages should be send by down sampling component#

Given

A message containing 1 or more PositionMessages and 1 or more PositionReports

Where

all PositionReports are removed due to down sampling rules as described

Then

The component should not send a message

Rule 9 - a message may contain multiple position reports for multiple vessels#

Given

A message containing multiple PositionReports

Where

The PositionReports are for different vessels

Then
Down sampling rules shall be applied for each PositionReport separately (i.e. considering the correct ID, source, originator and timestamp)

Rule 10 - Down sampling period can be different per source, provider and client#

Given
A PositionReport, with source = SOURCE-A and Provider = PROVIDER-A

Where
a down sampling period is specified as SOURCE-A.PROVIDER-A.CLIENT-A

Then

Client	Outcome
CLIENT-A	the specified down sampling period shall be applied
other	the rules below will be used for determining down sampling period

Where
a down sampling period is specified for SOURCE-A.PROVIDER-A

Then

Provider	Outcome
PROVIDER-A	the specified down sampling period shall be applied for all clients except if above rule defined a different period
other	the rules below will be used for determining down sampling period

Where
a down sampling period is specified for SOURCE-A

Then

Soruce	Outcome
SOURCE-A	the specified down sampling period shall be applied for all clients except if above rules defined a different period
other	the rules below will be used for determining down sampling period

Where
no down sampling period is defined

Then
the down sampling period shall be 0 (i.e. a message will only be removed if a more recent PositionReport for the

same vessel ID, source and originator has arrived before it)

Non-functional#