

UNECE

White Paper
Geofencing Facilities
in Transport and
Logistics

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Table of Contents

Introduction	4
Scope	4
Geofence	5
Defining geofences	6
Classification and rules	6
Ruleset for geofencing	8
BIC facility codes	8
SMDG terminals	9
IMO GISIS – port facility number	10
UN/LOCODE	11
Nesting of geofences	12
Drawing and reviewing geofences	14
Railway examples.....	15
Road Examples	19
Boundary rule examples	21
Gate examples	25
Truck queue	31
Structure of the geofence data.....	32
Publication of geofences	33
Downloading the library	34
Glossary	35
References	36
Appendix 1 – Unique identification of multiple geofence areas	37

Introduction

Industry is increasing the use of smart container technology and smart devices (IoT) within their supply chains to improve security, visibility, predictability and to plan more efficiently. They transmit to the smart device's management system, among other things, the location of the assets (such as shipping containers) to which they are attached or embedded. However the context of where the assets are at a given point in time is often not known unless it is part of the transport plan and is situated within an existing virtual geographic boundary, a geofence.

The UN/CEFACT white paper "Smart Containers: Realtime Smart Container Data for Supply Chain Excellence" outlined a number of practical use cases for a wide variety of actors to implement smart containers (or devices) within their supply chain. However, as many parties can be involved in a transport movement, and container owners may make use of several vendors of smart devices, along with the shippers' own smart devices being deployed, there is currently no single definition of a facility, or a methodology to define those facilities with a geofence.

This leads to duplicated effort and, more importantly, differences between definitions of the same facility (terminal, berth, container facility or other) and there is no guidance or methodology on how to draw these geofences or to improve quality when reviewing them.

Scope

The scope of this paper will focus on facilities with codes that are common to all supply chains, namely the BIC¹ facility code and SMDG² terminal code which are child codes of the UN/LOCODE³.

The purpose of this paper is to define the rules for these facilities and outline the methodology, providing consistency and a drive towards quality geofences that can be used and trusted by industry.

Other types of facilities such as shipper locations and logistic platforms (intermodal area) are not within scope of this paper; however the intention is that the paper will serve as a reference for evaluating and drawing geofences for other types of facilities.

¹ Bureau International des Containers - <https://www.bic-code.org>

² Ship Message Design Group - <https://smdg.org/>

³ United Nations Code for Trade and Transport Locations

Geofence

A geofence is a representation of a virtual boundary around a real-world geographic area such as a port or container facility using a collection of latitude and longitude pairs.

Here is an example of HHLA Container Terminal in Hamburg Germany



A geofence serves various purposes, such as enabling a smart devices management system to trigger specific actions based on data received from the smart devices, such as sending a notification when a transport unit (container) enters or exits the defined boundary, enabling efficient geo-queries to filter data based on location, providing a visual understanding of the areas on a map, and facilitating spatial analysis for decision-making. In diverse fields such as logistics, security, environmental monitoring and location-based services, geofences offer a versatile and powerful tool for spatial management and insights. Geofences for facilities should be drawn using **polygons** because the physical boundaries of a facility are complex (as in the example above). Simple shapes, such as a circle or rectangle, are not accurate enough to define a geofence for a facility.

A geofence can be defined at various levels and shapes, depending on the specific use case. For example, at the United Nations Code for Trade and Transport Locations (UN/LOCODE) level, geofences can be used to monitor the movement of goods between different countries or administrative areas. Geofences can also be applied to specific ocean terminals to manage and monitor shipping activities or within a container facility to track the movement of individual containers, enhancing efficiency and security.

Defining geofences

When creating geofences that are used by multiple parties, it is important to have a clear definition that everyone agrees to and that there is a single source of truth. To achieve this we need to define the geofence and rules for easy review and understanding.

Classification and rules

During the creation process of geofences, it is important to define specific guidelines based on the type of facility. Organizations such as BIC, SMDG, and IMO each have distinct rules for the facilities for which they provide codes. Recognizing this differentiation, we will categorize each entity as a distinct 'family' in our framework.

Under this family classification system, a set of geofences would typically be defined.

Examples of such families are the child codes of UN/LOCODE:

1. **BIC facility codes** – depots and other container handling facilities
2. **SMDG terminal codes** - ocean container and roll-on/roll-off terminals
3. **IMO GISIS⁴** – port facilities

Each of the above families could have different definitions and uses for geofencing and would define their own rules for those locations.

To facilitate the creation and review of geofences, the base criteria for rules associated with a family of geofences should consider the following:

- **Boundaries:** how boundaries of geofences are defined, for instance whether berthing areas are included or not;
- **Overlapping:** whether overlapping geofences are allowed;
- **Nesting** and if any related geofences are to be published.

Boundary rules should be clearly defined so that geofences can be unambiguously created, reviewed, accepted and evolved.

⁴ International Maritime Organization – Global Integrated Shipping Information System

Overlapping of geofences needs careful consideration. Overlapping within the same family is generally discouraged as it makes intersecting geolocation data ambiguous. A concrete example can be interpreting whether a smart device entered or departed a geofence for facility A or B. Additionally, in case of transfer of ownership, duty of care or financial implication being determined, overlapping geofences can also result in unexpected or confusing results. Overlaps can, however, exist across *different* families of geofences; for example a container depot or repair yard (identified by a BIC Facility Code) may exist within an ocean terminal (identified by an SMDG code). Instead of overlapping, the recommendation is to apply nested geofences where they relate to areas within a facility.

An example of overlapping facilities within Hamburg can be seen below. The same SMDG terminal 'Eurogate Container Terminal Hamburg' (SMDG code DEHAMEGH) has two BIC container facilities within its boundary, each with their respective BIC codes.



Nesting geofences allows for enhanced precision and control when triggering events from smart device location data. An ocean terminal is represented by a primary geofence linked to its SMDG code. Inside this main geofence, subsidiary geofences define specific areas or berths. Consequently, a container may be situated within a terminal geofence, yet also reside within a berth geofence inside that terminal.

To allow for extension of the base geofence of a facility, a user may wish to create zones of interest in or around the base facility geofence within their platform and link them back to the facility code to allow for the above scenario. This can be achieved by using metadata as described in the 'Nesting of geofences' section later on.

Ruleset for geofencing

For each of the 'families' noted, ongoing updates to their geofence definitions will be maintained over time. Users should consult their respective websites for the latest rules for geofencing their facilities.

BIC facility codes

BIC provides a nine-character code (which is based on the UN/LOCODE) for identifying container-handling facilities globally. This data is accessible through an application programming interface (API) and provides structured data for the facility, covering the name, address and geographic coordinates. Ocean carriers use these codes in their internal systems for maintenance and repair, lease hire, for providing detail in track-and-trace messages and for communicating the pickup and return depot with their customers.

DCSA⁵ standards use BIC facility codes in their information model to define a container facility.

BIC defines the following rules for geofencing container facilities.

1. BIC facility codes (BFC) provide geographic coordinates, which will always be contained within a geofence, that would be sufficient to determine driving directions to a facility. The **geofence** for a BFC will always follow the perimeter of a fenced area that the facility is operating within. The geofence precisely demarcates the perimeter of the facility and thus excludes any area not belonging to the facility. For this reason, simpler shapes such as a circle, a square or a rectangle will not be precise enough.
2. **Overlapping geofences** are not accepted. Each facility **MUST** be unique and have its own non-overlapping geofence.
3. **Nesting of geofences** against a facility is out of scope for BIC to maintain, however others are encouraged to maintain geofences, linked to a BFC, where it is advantageous to do so. In such cases, BIC recommends using the BFC as a key in the nested geofence's metadata and, where possible, describing it using linked data to join it to the BFC.

For more information about BIC facility codes and geofencing, or to access the API, visit <https://www.bic-code.org/bic-facility-codes/>.

⁵ Digital Container Shipping Association: <https://www.dcsa.org>

SMDG terminals

SMDG provides ocean terminal codes using a three-to-six-character reference extension to the UN/LOCODE; this data is accessible from the SMDG website and available from a shared API hosted by BIC.

Ocean carriers and terminals use these codes to identify and communicate loading and discharge locations in the stowage plans of container vessels as well as in ocean vessel schedules. DCSA standards use SMDG terminal codes in their information model to define an ocean terminal.

SMDG has established the following ground rules:

1. SMDG provides geographic coordinates at the centre of a quayside within the defined ocean terminal. This is always within the geofences area. The geofence is usually directly located next to water, including an area covering the berthing areas for ocean vessels. However, for some locations there may be “virtual ports”, where “lighters” are used to transfer containers to/from vessels while at sea.
2. **Overlapping facilities** may be accepted in specific cases. For practical reasons, in some locations there are areas that have their own SMDG code for the terminal but partially share the berthing area for vessels.
3. **Berthing areas** should be defined in addition to the geofence relating to the land. To accurately identify whether a container is on the vessel or in the terminal, this should cover the width of a ship or the reach of the terminal crane(s).
4. **Nesting of geofences** against a facility is out of scope for SMDG to maintain. However others are encouraged to maintain geofences linked to an SMDG terminal where it is advantageous to do so. SMDG recommends using the SMDG as a key in the metadata and, where possible, describe it using linked data to join to the SMDG terminal.

For more information about SMDG terminal codes and geofencing, or to access the API, visit <https://smdg.org/documents/smdg-code-lists/smdg-terminal-code-list/>.

IMO GISIS – port facility number

The IMO GISIS port facility number defines port facilities of all kinds, with a focus on maritime security in compliance with the International Ship and Port Facility Security (ISPS) regulation. The code is made up of a 4-digit extension to the UN/LOCODE. This data is accessible from the [IMO website](#).

A location, as determined by the contracting government or by the designated authority, is where the ship/port interface takes place. This includes areas such as anchorages, waiting berths and approaches from sea, as appropriate.

IMO could implement the following ground rules:

1. IMO GISIS provides geographic coordinates within the port area.
2. **Overlapping facilities** are not accepted. Each facility **MUST** be unique and have its own non-overlapping geofence.
3. **Nesting of geofences** against a facility is out of scope for IMO to maintain. However others are encouraged to maintain geofences linked to an IMO GISIS location where it is advantageous to do so. IMO recommends using the IMO port facility number as a key in the metadata and, where possible, describing it using linked data to join to the IMO facility.

For more information about IMO GISIS port facility numbers visit <https://gisis.imo.org/Public/ISPS/Default.aspx>.

UN/LOCODE

The following guidelines from UNECE Recommendation No. 16 on UN/LOCODES are recommended for those who wish to geofence a UN/LOCODE:

1. UN/LOCODE would contain geographic coordinates within the geofence, this should ideally be the centre point, town hall, municipality or other administrative location within the UN/LOCODE area, as defined in Recommendation 16. The geofence should cover the boundary of the area referenced, for example a city or council administrative boundary. These should follow the outline and would never be simple shapes.
2. UN/LOCODEs do not overlap, as you cannot have two UN/LOCODEs for the same place. However changing boundaries will require maintenance to reflect new codes or deprecated codes.

For more information about UNECE Recommendation No. 16 visit

[https://unece.org/trade/publications/recommendation-ndeg16-united-nations-code-trade-and-transport-locations.](https://unece.org/trade/publications/recommendation-ndeg16-united-nations-code-trade-and-transport-locations)

Nesting of geofences

The concept of nesting a geofence is to allow for the base facility geofence to be extended by linking another geofence, or a collection of geofences, to it. As an example, SMDG rules define each facility must also identify the berthing area of the terminal. This type of geofence should contain metadata indicating it is the berthing area of a terminal, making the geofence more useful when combined with IoT data.

Another entity may wish to make geofences available to its members, or generally available, and the concept of nesting would allow them to become a publisher of a geofence library with a link back to the base facility. A good example might be IANA (Intermodal Association of North America) publishing the truck queue geofences for a given facility in North America.

To achieve this, the geofences to be nested should be coded to enable interoperability and provide clarity to those using them.

The table below highlights some common examples. A maintained list will be published at <https://github.com/bic-org/Facility-Code/blob/master/geofencing/nesting-codes.csv>.

Category	Name	Description
GATE	Gate	The gate or entry point to a container depot or terminal
QUEUE	Queue	The defined area for the queue to enter a terminal gate by road
BERTH	Berth	The defined area for a SMDG terminal to identify the berthing area
ON_DOCK_RAIL	On dock rail	
MAINTENANCE_REPAIR	M&R area	The maintenance and repair area, or roadability area
DANGEROUS_GOODS	Dangerous goods zone	
REEFER_ZONE	Reefer zone	Area for reefer storage or power
CLEANING_AREA	Cleaning area	Wash area
CROSS_DOCKING	Cross docking facility	
CUSTOMS_INSPECTION	Customs inspection	
EMPTY_STORAGE	Empty storage	
CONTAINER_PREPARATION	Container preparation	(E.g. food, textiles, etc.)
QUARANTINE	Quarantine area	For pests and other

- 2) Nested geofences relate to a facility, for example you may have a 'gate' and a 'berth' geofence relating to an SMDG terminal. In some cases, this could also be one to many (i.e. one gate for many terminals or depots within a port area). To link to the facility, you should use the 'parent' tag in properties as an array to allow this.

```
"properties": {  
  "parent": ["NLRTMDDN", "NLRTMDDE"]  
},
```

Drawing and reviewing geofences

When reviewing, it is important to be able to easily decide on the quality of a provided geofence and if it meets the rules of the code list provider. This should be easy to understand and should be repeatable, with a similar outcome, regardless of the participants reviewing a geofence.

Before considering the quality of the geofence we need to understand a few topics which may influence the decisions:

- Smart devices will periodically send geographic coordinates to their management system, the frequency of which can be configured, so smaller geofences such as a small entry gate may not always be triggered.
- Positioning and coverage of the smart device may skew the reported position of the equipment, showing a smart device that is near to the boundary of a geofence as in or out of a geofence when it has, in fact, not moved.

These considerations should not influence the quality. The geofence should always reflect the physical boundaries of the facility.

Adding a buffer zone to the physical fence of a facility to negate the impact of the above is not good practice. Over time the accuracy and conciseness of the reporting will improve. It is the responsibility of the data processor who is receiving the positioning data to post-process and manage variation, dwell times and other factors specific to their smart devices.

With the above in mind, and to facilitate the process of reviewing a geofence and forming a consensus on its quality, here are some examples that can be referenced to overcome common challenges.

Railway examples

Example 1 – Rail lines running through a facility

Container facilities and terminals are often close to or part of a rail network. The rail line is not considered part of the facility if trains do not stop there for loading and unloading.

CMR (Container Maintenance and Repair), Hamburg, Germany

The facility is split, sitting on either side of the railway, except for a small bridge crossing the railway which forms part of the facility.

The rail line is not part of the facility, in that trains do not stop there for loading and unloading, and it is on a different vertical axis to the container facility, in this case below the level of the facility land, hence the decision to include the bridge and exclude the rail.

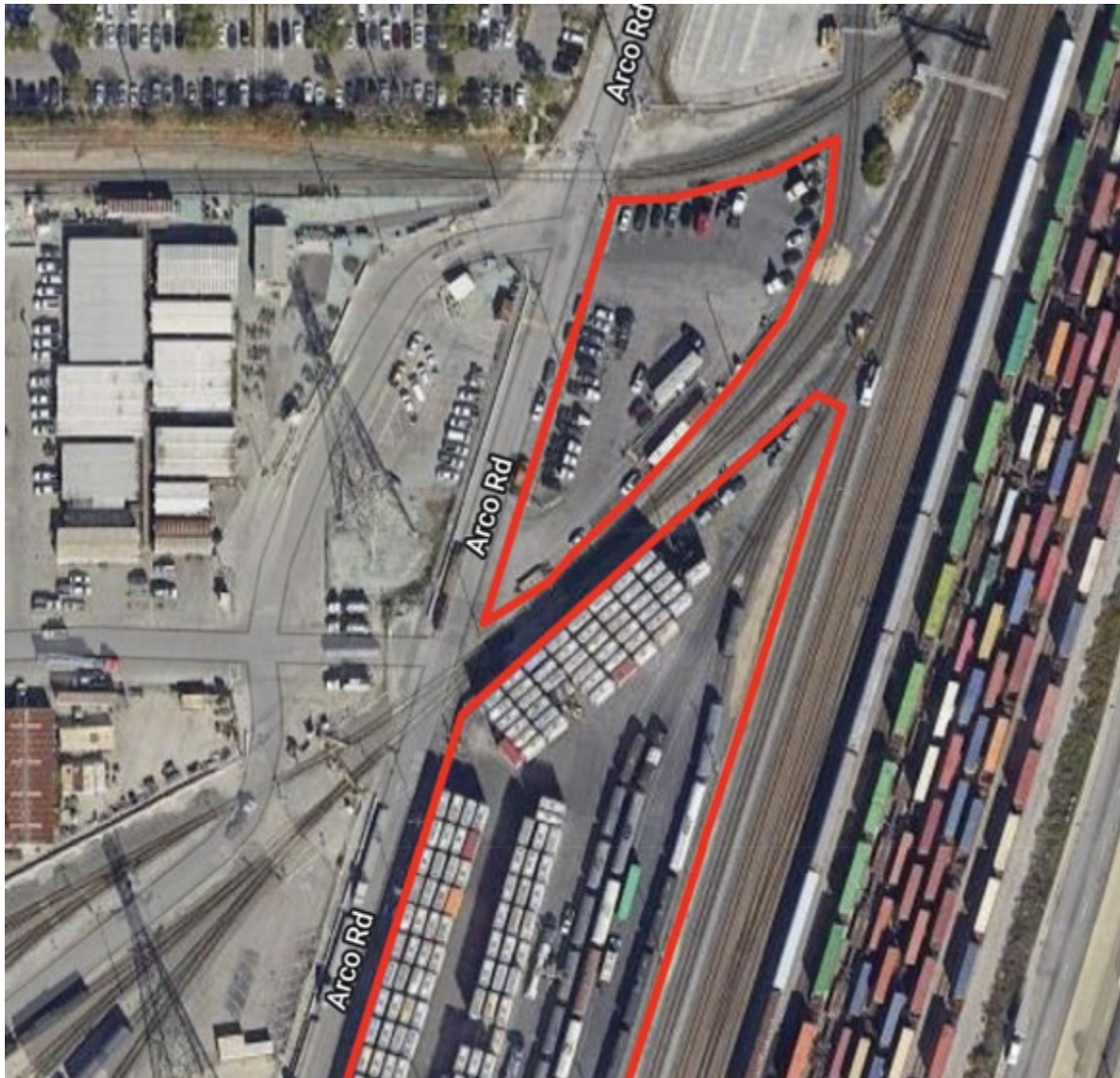
<https://www.bic-code.org/facility-codes/DEHAMCMRA>



Ventura Transfer Company, Los Angeles, USA

The rail is at the same level as the facility land, but not part of the facility, so a second geofence as part of the feature collection is the recommended approach.

<https://www.bic-code.org/facility-codes/USLAXVNTU>



Example 2 – Railhead within a facility

A railhead within the facility where trains will load and unload is part of the facility and should be included within the geofence.

Freightliner Garston, Liverpool, UK

The train line terminates within the facility and there is a railhead where trains will load and unload. This is part of the facility and would be included within the geofence as below.

<https://www.bic-code.org/facility-codes/GBLIVRUIK>



CN Intermodal, Memphis, USA

The rail siding runs through the facility but is used to load and unload containers so this should be considered part of the facility.

<https://www.bic-code.org/facility-codes/us8mimknb/>



Road Examples

Example 1 – Geofence overlapping a public road

Spinelli Erzelli 2, Genoa, Italy

In the case of Spinelli Erzelli 2, the geofence provided overlaps a public road which is not part of the facility. This is not acceptable as it will trigger events unnecessarily, the top left area of the facility needs to be redrawn to follow the fence line.

The facility is also located adjacent to a public road, so care should be taken to follow the fenced line of the facility.

<https://www.bic-code.org/facility-codes/ITGOAGRCA>



Boundary rule examples

Example 1 – Incomplete area of a facility

DIL Container Depot, Yangon, Myanmar

In the case of a geofence suggested for DIL Container Depot (BIC) the geofence is incomplete and not reflective of the full facility. This is common when a suggested geofence only covers a specific area within the facility for a customer or other reason.

For this level of granularity, it is recommended that the software or provider use a nested geofence on top of the base facility that is already defined in the geofence library. This would provide the link between the facility and the third party geofence.

This would allow the combination of the container position and the geofence(s) to indicate that the container is in the facility MMRGNVXCG and in (or out) of the reserved area for that customer.

<https://www.bic-code.org/facility-codes/MMRGNVXCG>



The decision here was to redraw the geofence to include the complete facility. The revised geofence is shown below.



Example 2 – SMDG multiple areas

Some facilities using a single code have multiple areas that need to be geofenced even when they do not intersect with each other.

Leixoes Container Terminal, Leixoes, Portugal

This example below shows Leixoes Container Terminal, PT (SMDG). As there is 1 SMDG terminal code in use for both areas (a decision by the terminal to operate this way) there should be two geofences covering the areas including the berth, as defined in the SMDG boundary rules.

<https://www.bic-code.org/facility-codes/smdg/PTLEITCLA>



West Basin Container Terminal, Los Angeles, USA

Another example is West Basin Container Terminal, Los Angeles, USA (SMDG)

<https://www.bic-code.org/facility-codes/smdg/USLAXWBCT>



Gate examples

Gates are important to identify the entry point into a facility. In most locations this will be the point at which the UN/EDIFACT⁶ CODECO message⁷ is triggered to create a “gate in” or “gate out” event (commonly found in track and trace but also used to determine the turn time of vehicles within the facility) and the “equipment interchange receipt” and “on/off hire” messages.

There are some points to consider when it comes to the gate:

1. The gate may be detached from the facility.
2. The gate may be a well-defined, clear point of entry.
3. The gate may be as simple as a line or cone.

The gate may also be contained within land operated by, or on lease to, the facility, which may include a waiting area for trucks (the queue); therefore identification and attention should be considered around the gate.

For the base facility, ways to draw the geofence around the gate are suggested below. It is also possible to create a nested geofence specifically for the ‘GATE’ area to meet specific business requirements.

⁶ United Nations Electronic Data Interchange for Administration, Commerce, and Transport

⁷ Container gate-in/gate-out report

Fenix Marine Container Terminal, Los Angeles, USA

In the case of USLAXEAGLE (SMDG), the gate in and the truck queue are clearly identifiable from satellite images. You can also see the trucks queuing to enter the facility. Where possible, the line should be drawn crossing the gate area.

<https://www.bic-code.org/facility-codes/smdg/USLAXEAGLE>



Blue Container, Marseille, France

An example of where the 'GATE' is not clearly identifiable can be seen below at depot FRMRSKURI (BIC). In this case, following the fenced area is recommended.

<https://www.bic-code.org/facility-codes/frmrskuri/>



Leixoes Container Terminal, Leixoes, Portugal

This facility in Portugal shows an example where the gate is part of a larger port area serving multiple terminals and container facilities. In this terminal the port is serviced by a dedicated road connection (*VILPL – Via Interna de Ligação do Porto de Leixões*) leading from the main road to the port gate area. Beyond the gate area the road splits into a fork to service both sides of the port area. In these cases, it is recommended to draw an outline of the gate area as a nested geofence and draw the facility by its physical boundary as that may determine the gate in event.

<https://www.bic-code.org/facility-codes/smdg/PTLEITCLA>



Drawing the 'GATE' as a nested geofence is a complex topic and, while out of scope for this paper, it is important to recognize some of the complexities that should be considered. Ultimately those drawing the nested geofence will need to decide on their business rules and use cases for the gate geofence.

Using the terminal in Portugal as an example, the gate area could be drawn depending upon business rules in two ways:

The first is to draw only the gate entry or exit as below. The centroid of the geofence would be good enough for driving directions and the geofence would be reflective of the physical gate area where a truck would present themselves and credentials to enter.



However, the truck parking area could also form part of the 'GATE', as any vehicle that needs to show more paperwork or undergo inspection will need to wait there; so the other view might be to include this area as part of the gate process.



Rotterdam Short Sea Terminal, Rotterdam, Netherlands

For a more complex case we can look at the SMDG terminal Rotterdam Short Sea Terminal (RST) Southside, which has an optical character recognition (OCR) scanner in the internal area of the facility, followed by a larger parking area for holding trucks that require inspection, and then a gate which is shared by multiple facilities. In this example it may be appropriate to have an enlarged gate area to cover the complete gate entry process to suit business rules of the party using the geofence for a gate.

<https://www.bic-code.org/facility-codes/smdg/NLRTMRSZ>



Truck queue

The truck queue is defined as the area where trucks line up to enter a facility. Parts of the queue land may be owned by the facility, or they could be public roads. When drawing a geofence for a 'truck queue' related to a facility, it is important that the start of the truck queue meets with the entry point or gate of the facility. It is only at this point that the truck is no longer queuing to enter a facility, and they have entered a facility, an important definition.

CSX Transportation, Fairburn, USA

<https://www.bic-code.org/facility-codes/USATLTFV>



The area of land past the 'gate' toward the highway is owned by CSX, so it has been provided as part of the geofence for the facility.

It is recommended to exclude this area if providing a matching 'truck queue' as shown in the below example, clearly providing distinct geofences for the 'facility' (in red) and the 'truck queue' (in blue).



Structure of the geofence data

Geofences can be provided in many formats, including the following:

- GeoJson
- KML
- GPX

For interoperability and comprehensive inclusion of facility metadata, we recommend using GeoJson. This format is compatible with many tools and software platforms natively, and is the standard published under IETF RFC 7946⁸. The UN/CEFACT Smart Container BRS⁹ also recommends using GeoJson for polygons, which is part of the data structures under the Buy Ship Pay Reference Data Model. Sharing in this way should facilitate the interoperability of

⁸ This is the GeoJson specification created by the Internet Engineering Task Force (IETF).

⁹ See Annex 2 – Inputs for Smart Container Data Modelling in ECE-UN/CEFACT, *Business Requirements Specification (BRS): Smart Containers*, 2019. Available at https://unece.org/fileadmin/DAM/cefact/brs/BRS-SmartContainer_v1.0.pdf.

geofences. Use of formats such as CSV, that require further processing prior to use, should be avoided.

Publication of geofences

When publishing the geofences they should be published with some metadata covering the following:

- Facility code they relate to
- Facility code provider for identification
- Version of the geofence
- Geofence and type of shape

This could look like:

```
"properties": {  
  "trustGrade": "LOCAL_KNOWLEDGE",  
  "code": "GBLIVJMDA",  
  "category": "FACILITY",  
  "codeProvider": "BIC",  
  "version": "2024-01-22",  
  "url": "https://www.bic-code.org/facility-codes/gblivjmda/"  
}
```

This allows preservation of the source of the geofence, and the same structure can be used to show nested data by changing the 'category' to identify what that specific geofence relates to (i.e. queue, gate or other).

Facility code and code provider

It is important to identify the facility using the coded identifier paired with the code list provider. This will provide the context of where a smart device is and in which type of facility.

Category

The category identifies the type of facility. For the baseline facility 'FACILITY' is used. Other category types can be found in the nesting section.

Version

The geofences should be versioned to provide an anchor in time, improving trust and confidence for the user. Use of the date adds value, as it clearly identifies when the geofence was published, enabling the version to be used as a filter to sort and find earlier or later revisions.

URL

Optionally, a URL to more detail could be included. This may be an anchor to the code list provider's website or a URL to linked-data resources.

ID

This is used to identify a geofence when multiple geofences form part of a collection (i.e. berth areas or separated areas for the same facility). This could be a custom or automated identification system, as outlined in Appendix 1.

Geofence and type of shape

Each facility should ideally have two types of geofence shapes:

- Point
- Polygon

The point should be a single latitude/longitude pair that provides an accurate point on a map to enable point-to-point routing and directions.

The polygon is the most appropriate shape for facilities due to the geographic nature of a container facility or terminal. Use of other shapes such as circles or rectangles would not generally meet requirements and would likely lead to a rejection in the quality checks during a review process. All geofences should abide by the rules defined by the code list provider for what would be an acceptable geofence.

Downloading the library

The library must support interoperability across tools, IoT providers and all supply chain stakeholders interested in utilizing geofences. Achieving this requires standardizing the library's access and import format, enabling users to create consistent imports that remain compatible with future releases and versions.

Given the large number of BIC, SMDG and IMO facilities globally, it is advisable to create a GeoJson file for each facility. This approach simplifies processing and enables users to download incremental updates as needed.

An example of this structure can be found at <https://github.com/bic-org/Facility-Code/tree/master/geofencing/publish-example>.

Each file should be named by the facility code (i.e. DEHAMSWT or USLAXVNTU) and then the code list provider (BIC, SMDG or IMO). The contents will be a valid [GeoJson Feature Collection](#) with all geofence features contained within being for that facility only. The file format is '.json'.

Example naming structure for files:

- DEHAMSWT-SMDG.json
- USLAXVNTU-BIC.json

Glossary

Term	Meaning
Circle (geometric shape)	A round-shaped figure that has no corners or edges. See https://vocabulary.uncefact.org/Circle .
Geographic coordinates	Also known as a latitude/longitude pair. Identifies a point on a map using the latitude and longitude. The coordinate reference system is WGS84 (a global standard for latitude and longitude positions, commonly used in applications like GPS navigation and mapping).
GeoJson	https://geojson.org – Covers the standard for the Internet Engineering Task Force (IETF) under RFC 7946.
IoT	Internet of things: Mechanical or electronic equipment which can collect, report and autonomously transmit digital data.
Line	A single line between two latitude/longitude coordinates. See https://vocabulary.uncefact.org/GeographicalLine .
Logistics platform	A dedicated area equipped with the necessary infrastructure and services for multimodal transportation and value added offerings. Within this space, various stakeholders collaborate to enhance the competitiveness of products by leveraging the shared infrastructure.
Point	A single latitude/longitude coordinate pair. See https://vocabulary.uncefact.org/GeographicalPoint .
Polygon	A collection of latitude/longitude pairs used to create a shape. See https://vocabulary.uncefact.org/Polygon .
Smart device	A device that captures and transmits latitude/longitude position and other information; for example a smart container, IoT device or telematics in a truck.

References

The UN/CEFACT Smart Container white paper contributed to the enrichment of the Buy-Ship-Pay Reference Data Model, providing the necessary data elements and structures required for geofences. This project builds upon that work.

ECE-UN/CEFACT, "White Paper: Smart Containers: Real-time Smart Container data for supply chain excellence Version 1", (ECE/TRADE/C/CEFACT/2019/10). Available at https://unece.org/DAM/cefact/GuidanceMaterials/WhitePapers/WP-SmartContainers_Eng.pdf.

ECE-UN/CEFACT, *Business Requirements Specification (BRS): Smart Containers*, 2019. Available at https://unece.org/fileadmin/DAM/cefact/brs/BRS-SmartContainer_v1.0.pdf

The data attributes and definitions used are taken from the Buy Ship Pay Reference Data Model and are available at <https://vocabulary.uncefact.org/>. The UN/CEFACT web vocabularies are linked data representations of the UN/CEFACT Buy-Ship-Pay Reference Data Model and UN/LOCODE.

The official specification for GeoJson can be found at <https://geojson.org/>

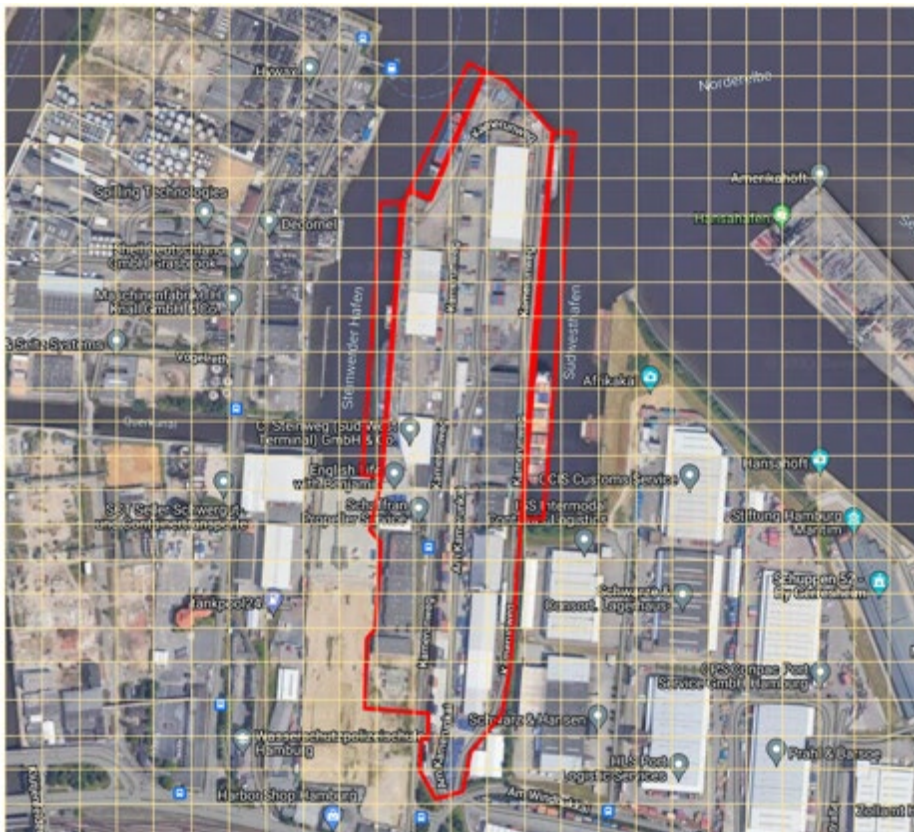
Appendix 1 – Unique identification of multiple geofence areas

One way to ensure easy and unambiguous identification of each area – assuming the map is oriented such that the north points to exactly 0°, east 90°, south 180° and west 270° – would be to traverse the area fully encapsulating the geofence from left to right and top to bottom and number them according to the order in which they are met or intersected.

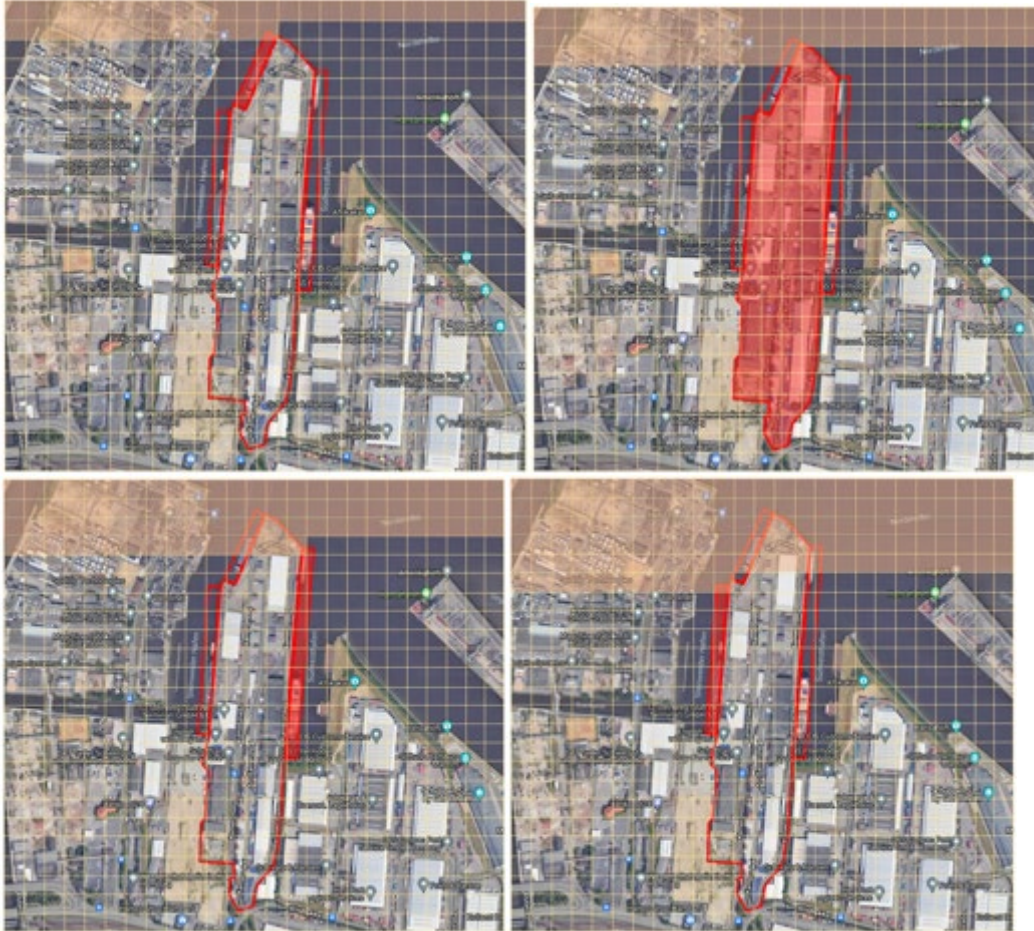
This approach works for any type of facility. For SMDG we would typically see a minimum of two geofences to meet their criteria; for BIC it will be the case when a depot is separated by a road or rail line.

Below is an illustration of how this can be achieved, viewing the facility Sud-West Terminal in Hamburg (DEHAMSWT) with a grid overview.

<https://www.bic-code.org/facility-codes/smdg/DEHAMSWT>



We now follow the approach to determine the most northwest point where a square intersects with the geofence, as in the below diagrams.



For each geofence we assign an 'id' in the properties section. For this facility there are four separate geofences and each would be assigned a numeric identifier, allowing automation of this identifier.

In the event of known labels being applied (i.e. berth numbers) they would ideally take precedence over an automated identifier.

The outcome of the above would look like this.

