

# Report Iot Interfaces From Hardware To Software And Wireless Communication

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# 1 Compute geographic bounding box

## 1.1 \*What is geographic bounding box ?

- **Bounding box** is the limitation or the border which contains all the sensor of our system, according to my knowledge bounding box is also the perfect area in which the sensor can interact efficiently. Beside, bounding box can determine the distance of the sensors and how far the signal can reach.

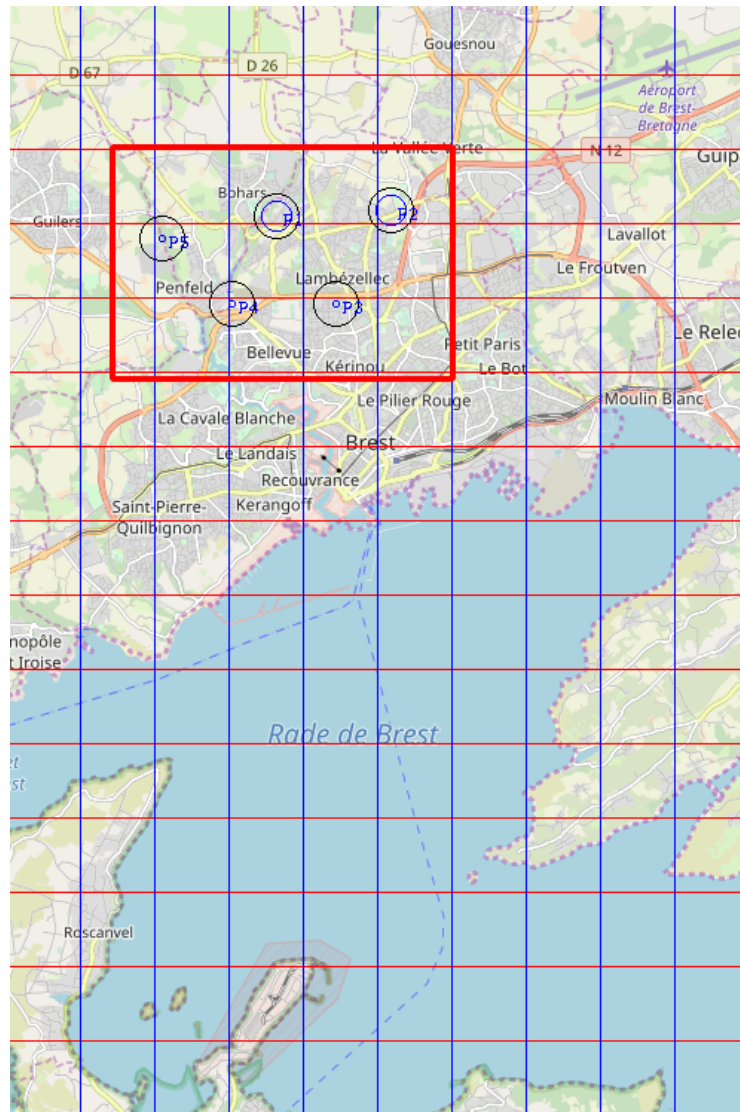


Figure 1: The red bounder is the bounding box in physical world.

## 1.2 \*How can we determine the bounding box ?

- **Step 1:** We need to create the behaviour file whose name is "nodes-test-include.occ". In this file, we need to add two classes one is "Node" and the other is "Mux". "Node" represents the sensor, "Mux" is the method that displays all the output from "Node".

- **Step 2:** We need to get the x-y coordinator of each sensor by using the "Node" class in "nodes-test-include.occ" file. To do that we can access to the global array "NetLocation" in "halongtpnet.occ" file which contains all the information of each sensor.

- **Step 3:** After we find the bounding box, we need to use cooperation techniques to send the coordinator of bounding box to all sensor.

- **\*Note:** To find the bounding box we need to find the most left and most right value of the coordinator.

## 1.3 Code

```
DATA TYPE BBox
RECORD
    INT Top, Left, Bottom, Right :
:
PROTOCOL diam.proto IS BBox: -- Output type is BBox
PROC Node ([]CHAN OF diam.proto in, out, VAL INT Identity,
CHAN OF BYTE toMux)
    -- MyXLoc, MyYLoc are variables which store xLoc, yLoc
    INT MyXLoc:
    INT MyYLoc:
    --
    [MaxFanOut] BBox BBuf:
    BBox myBBox:
    SEQ
        MyXLoc := NetLocation[Identity][xLoc]
        MyYLoc := NetLocation[Identity][yLoc]
        -- Initial BBOX
        myBBox[Left] := MyXLoc
        myBBox[Right] := MyXLoc
        myBBox[Top] := MyYLoc
        myBBox[Bottom] := MyYLoc
```

```

SEQ Turns=0 FOR MaxNodes-1
SEQ
  — Create input and ouput section
  PAR
    PAR i=0 FOR SIZE out
      out[i] ! myBBox
    PAR i=0 FOR SIZE in
      in[i] ? BBuf[i]
  — Calculate max left , right , top , bottom section
  SEQ i=0 FOR SIZE in
    SEQ
      IF
        myBBox[Left] > BBuf[i][Left]
        myBBox[Left] := BBuf[i][Left]
      TRUE
      SKIP
      IF
        myBBox[Right] > BBuf[i][Right]
        myBBox[Right] := BBuf[i][Right]
      TRUE
      SKIP
      IF
        myBBox[Top] > BBuf[i][Top]
        myBBox[Top] := BBuf[i][Top]
      TRUE
      SKIP
      IF
        myBBox[Bottom] > BBuf[i][Bottom]
        myBBox[Bottom] := BBuf[i][Bottom]
      TRUE
      SKIP
  — Printing section
  toMux ! 'L'
  toMux ! ':'
  out.number(myBBox[Left], 0, toMux)
  toMux ! ' '
  toMux ! 'R'
  toMux ! ':'
  out.number(myBBox[Right], 0, toMux)
  toMux ! ' '
  toMux ! 'T'
  toMux ! ':'
  out.number(myBBox[Top], 0, toMux)
  toMux ! ' '
  toMux ! 'B'
  toMux ! ':'
  out.number(myBBox[Bottom], 0, toMux)
  toMux ! '*n'
  SKIP

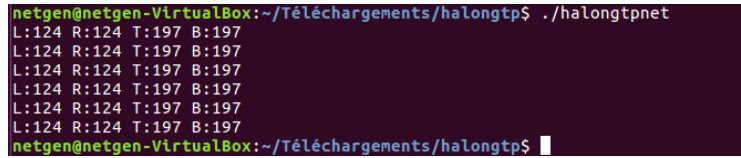
```

:

## 1.4 Result

Compile command: Kroc -lcourse halongtpnet.occ

Run command: ./halongtpnet



```
netgen@netgen-VirtualBox:~/Téléchargements/halongtp$ ./halongtpnet
L:124 R:124 T:197 B:197
L:124 R:124 T:197 B:197
L:124 R:124 T:197 B:197
L:124 R:124 T:197 B:197
L:124 R:124 T:197 B:197
L:124 R:124 T:197 B:197
netgen@netgen-VirtualBox:~/Téléchargements/halongtp$
```

Figure 2: Display bounding box coordinator on terminal.

## 2 Find the maximum elevation

### 2.1 \*How can we find the elevation of each cell ?

- **Step 1:** We need to create the behaviour file whose name is "nodes-test-include-cell.occ". In this file, we need to add two processes one is "CellNode" and the other is "Mux". "CellNode" represents each cell in the map, "Mux" is the method that displays all the output from "CellNode".

- **Step 2:** We need to get the elevation of each sensor by using the "CellNode" process in "nodes-test-include-cell.occ" file. First, we can get all the parameter of all cell in the "halongtpData0.occ". Second, through these parameters we can access to each "CellNode" in the "halongtp0.occ" so that we can get the elevation of each cell.

- **Step 3:** After we find the elevation, we need to use cooperation techniques to send the elevation to all sensor and find the maximum elevation.

## 2.2 Code

```
DATA TYPE BBox
  RECORD
    INT Top, Left, Bottom, Right :
  :
  PROTOCOL diam.proto IS BBox: — Output type is BBox
  PROC CellNode ([]CHAN OF diam.proto in, out,
  VAL INT Identity, CHAN OF BYTE toMux)
    — Get all cells in the array
    CellArray myCell:
    — Get position of each cell
    CellPosition myPosition:
    — Get currently elevation
    REAL64 myElevation:
    — Buffer is used to store all the elevations
    [MaxFanOut] REAL64 elvBuf:
  SEQ
    myCell := Cells[Identity]
    myPosition := myCell[position]
    myElevation := myPosition[elevation]
    SEQ Turns=0 FOR MaxNodes-1
      SEQ
        PAR
          PAR i=0 FOR SIZE in
            in[i] ? elvBuf[i]
          PAR i=0 FOR SIZE out
            out[i] ! myElevation
        SEQ i=0 FOR SIZE in
          IF
            myElevation < elvBuf[i]
            myElevation := elvBuf[i]
          TRUE
          SKIP
        out.real64(myElevation, 0, 0, toMux)
      toMux ! '*n'
  :
```

## 2.3 Result

Compile command: Kroc -lcourse halongtp0.occ

Run command: ./halongtp0

```
netgen@netgen-VirtualBox:~/Téléchargements/halongtp$ kroc -lcourse halongtp0.occ
Warning-occ21-halongtp0.occ(2548)- parameter stderr is not used
Warning-occ21-halongtp0.occ(2548)- parameter stdin is not used
Warning-occ21-nodes-test-include-cell.occ(30)- not usage checking dynamic replicated PAR
Warning-occ21-nodes-test-include-cell.occ(32)- not usage checking dynamic replicated PAR
Warning-occ21-nodes-test-include-cell.occ(36)- variable 'elvBuf[..]' is undefined here
netgen@netgen-VirtualBox:~/Téléchargements/halongtp$ ./halongtp0
239.5
239.5
239.5
239.5
239.5
239.5
239.5
239.5
239.5
239.5
239.5
239.5
239.5
239.5
239.5
```

Figure 3: Display maximum elevation on terminal.