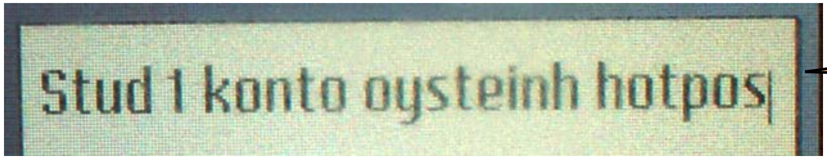
More than one service

Version 091016

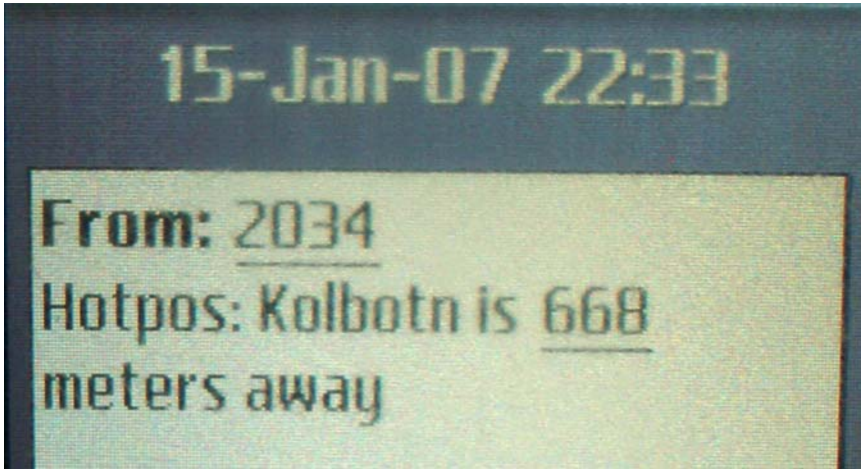
ICU 2-4

Hotpos: finding out where you are



Stud 1 konto oysteinh hotpos

to 2034
(Telenor!!!)

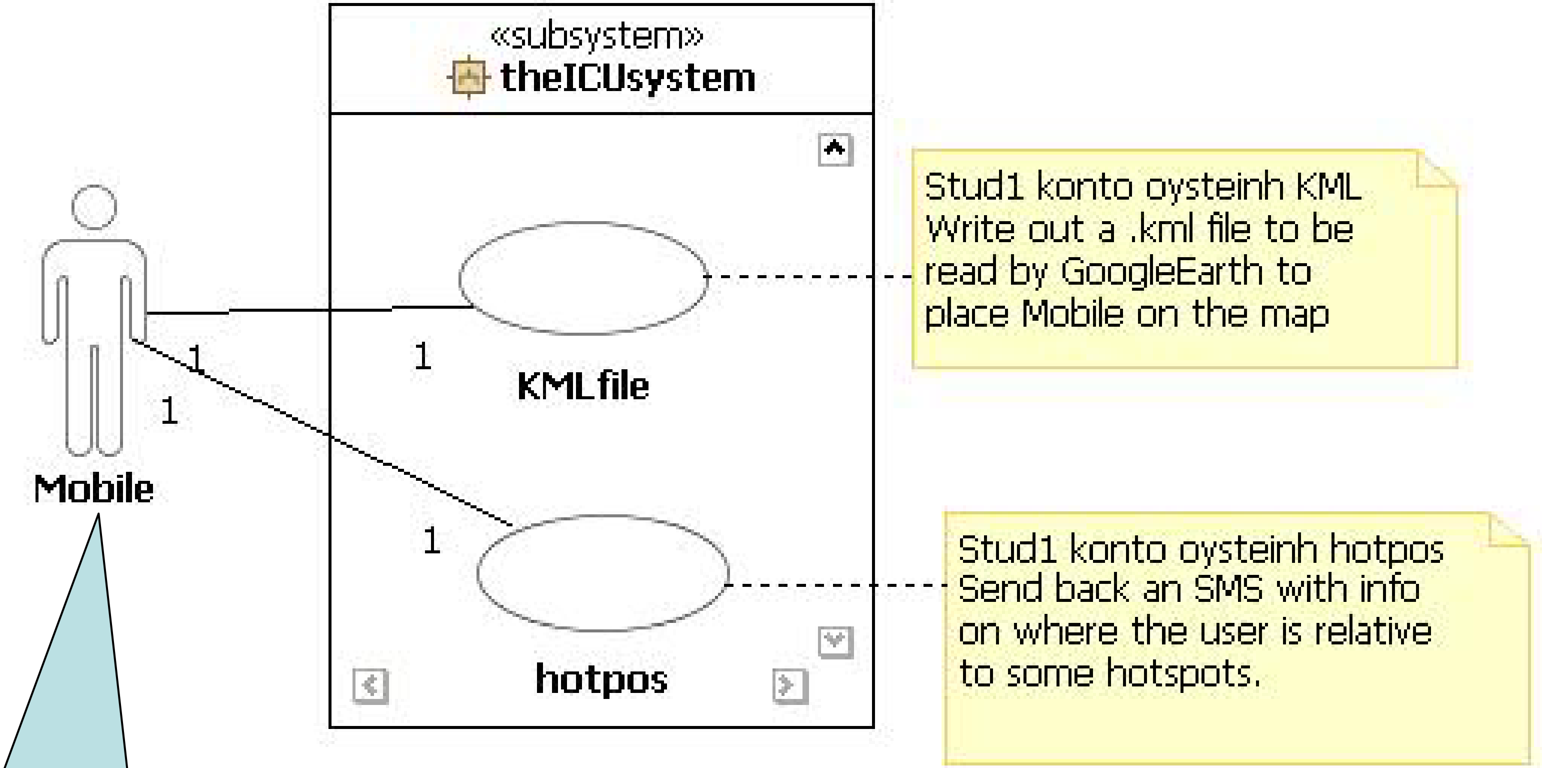


15-Jan-07 22:33

From: 2034
Hotpos: Kolbotn is 668
meters away

INF 5150

Adding a new service

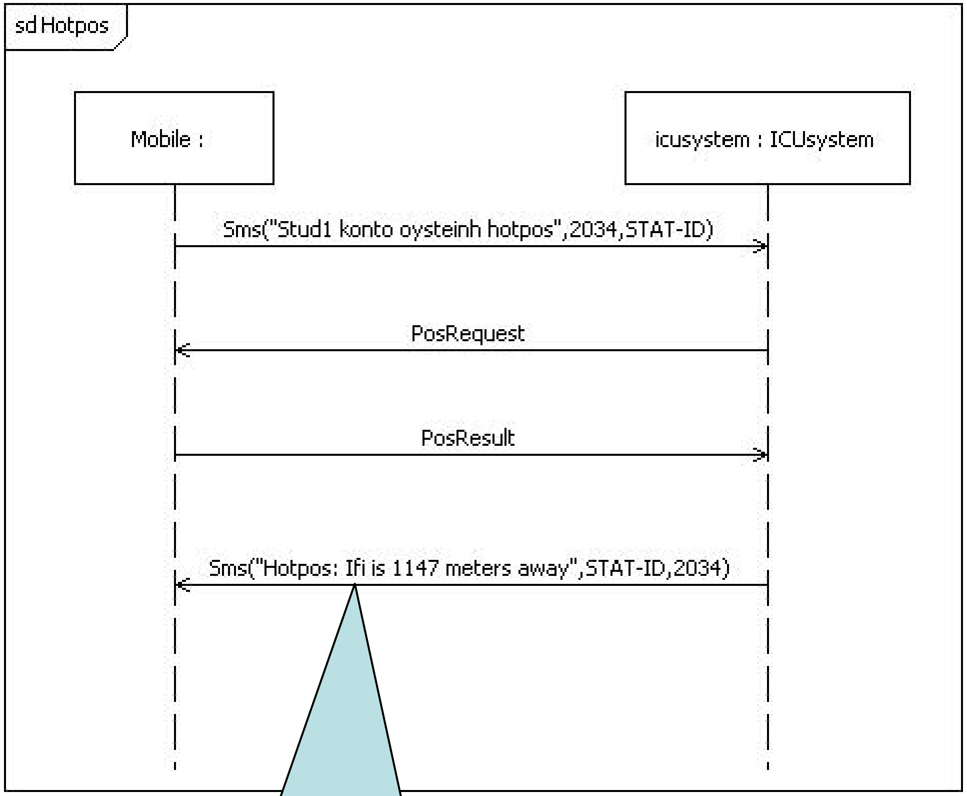


Stud1 konto oysteinh KML
Write out a .kml file to be
read by GoogleEarth to
place Mobile on the map

Stud1 konto oysteinh hotpos
Send back an SMS with info
on where the user is relative
to some hotspots.

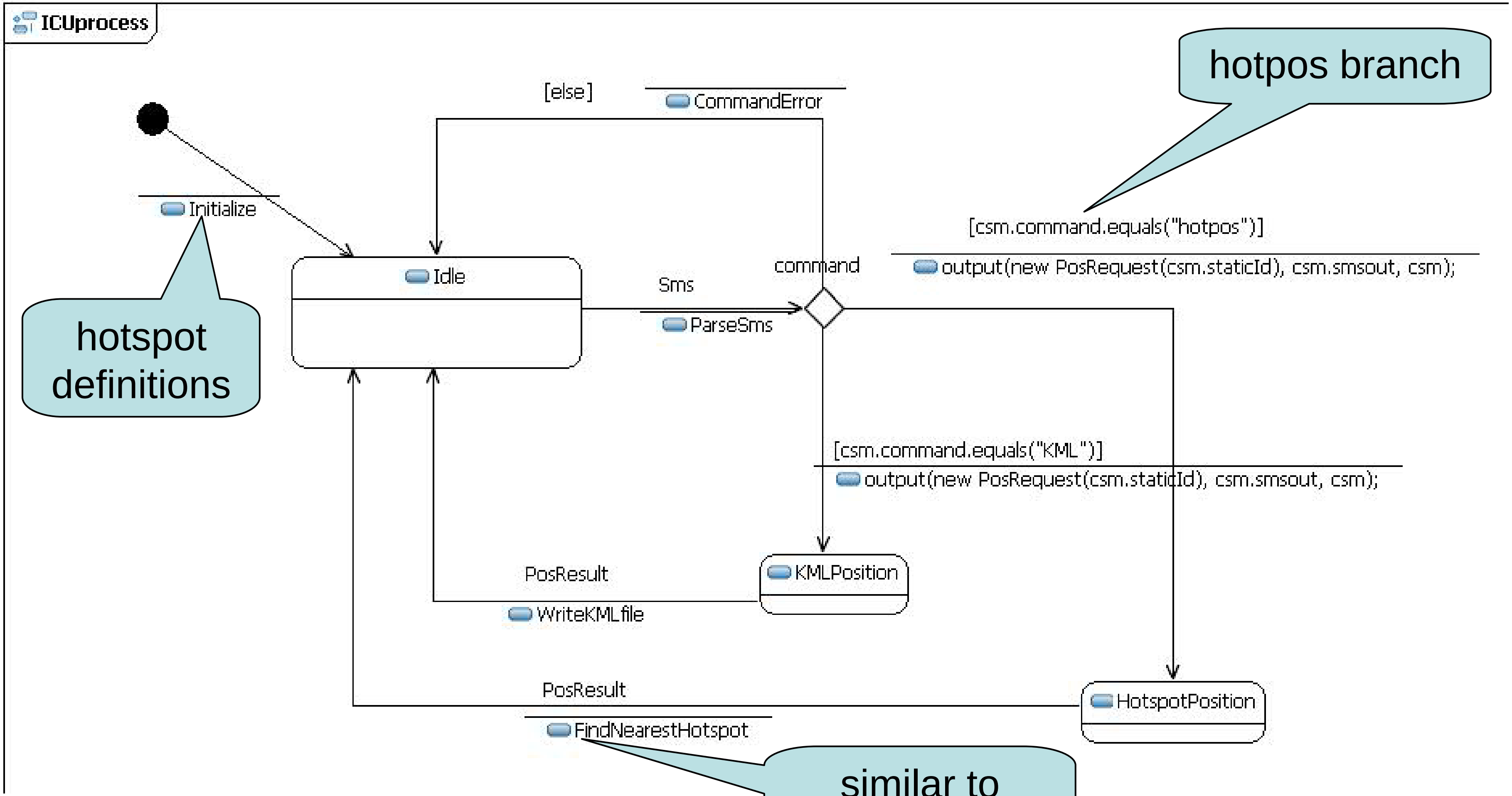
only one user at a time

Hotpos described by a sequence diagram


sd Hotpos
Mobile :
icusystem : ICUsystem
Sms("Stud1 konto oysteinh hotpos",2034,STAT-ID)
PosRequest
PosResult
Sms("Hotpos: Ifi is 1147 meters away",STAT-ID,2034)

need to know where Ifi is

The modified ICUprocess


ICUprocess
[else]
CommandError
Initialize
Idle
Sms
ParseSms
command
[csm.command.equals("hotpos")]
output(new PosRequest(csm.staticId), csm.smsout, csm);
[csm.command.equals("KML")]
output(new PosRequest(csm.staticId), csm.smsout, csm);
PosResult
WriteKMLfile
KMLPosition
PosResult
FindNearestHotspot
HotspotPosition

hotpos branch

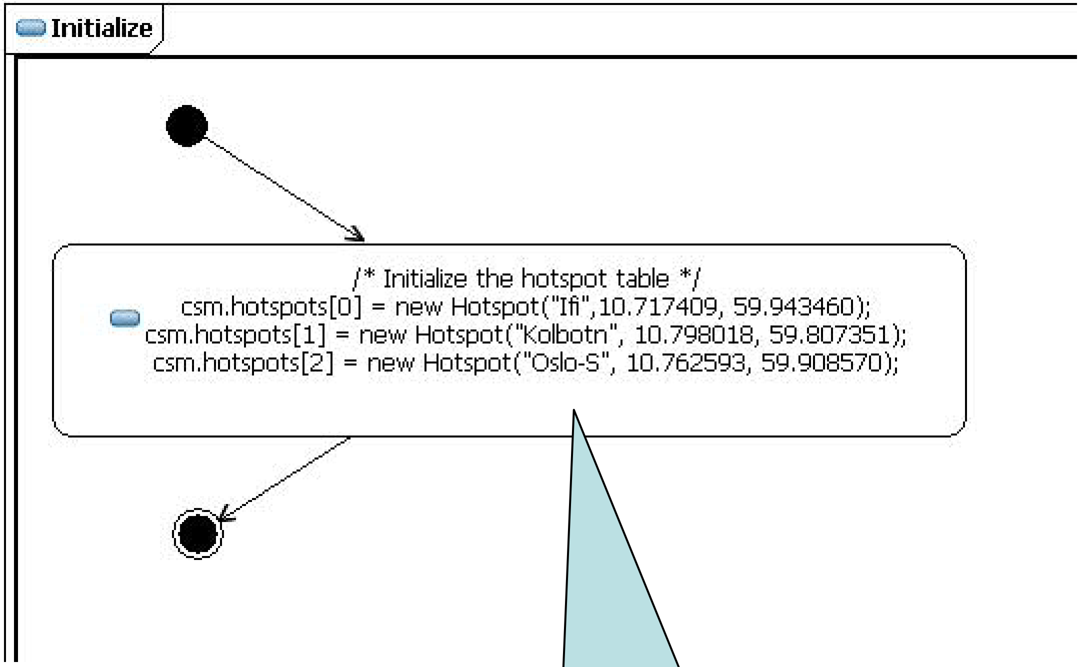
hotspot definitions

similar to WriteKMLfile?

Buzzz 1: Why limiting to one user?

- Make up pairs with one person just beside you
- Discuss for 3 minutes why we have restricted the system to consider only one user at the time

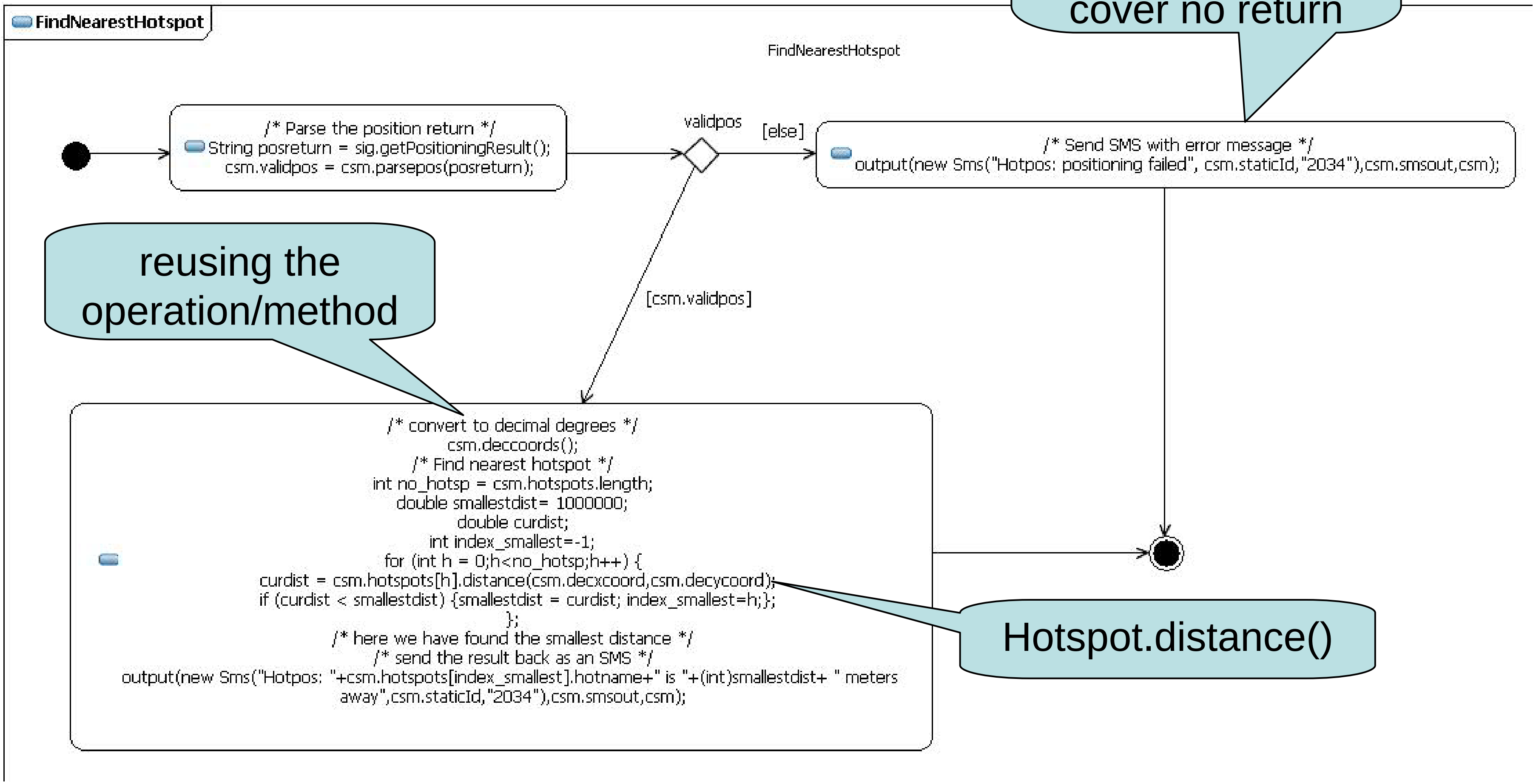
Hardcoding the hotspots



```
/* Initialize the hotspot table */
csm.hotspots[0] = new Hotspot("Ifi",10.717409, 59.943460);
csm.hotspots[1] = new Hotspot("Kolbotn", 10.798018, 59.807351);
csm.hotspots[2] = new Hotspot("Oslo-S", 10.762593, 59.908570);
```

Feel free to add your own hotspots. Remember to change the size of the array

FindNearestHotspot



```
/* Parse the position return */
String posreturn = sig.getPositioningResult();
csm.validpos = csm.parsepos(posreturn);
```

```
/* Send SMS with error message */
output(new Sms("Hotpos: positioning failed", csm.staticId,"2034"),csm.smsout,csm);
```

```
/* convert to decimal degrees */
csm.deccoords();
/* Find nearest hotspot */
int no_hotsp = csm.hotspots.length;
double smallestdist= 1000000;
double curdist;
int index_smallest=-1;
for (int h = 0;h<no_hotsp;h++) {
curdist = csm.hotspots[h].distance(csm.decxcoord,csm.decycoord);
if (curdist < smallestdist) {smallestdist = curdist; index_smallest=h;};
};
/* here we have found the smallest distance */
/* send the result back as an SMS */
output(new Sms("Hotpos: "+csm.hotspots[index_smallest].hotname+" is "+(int)smallestdist+ " meters
away",csm.staticId,"2034"),csm.smsout,csm);
```

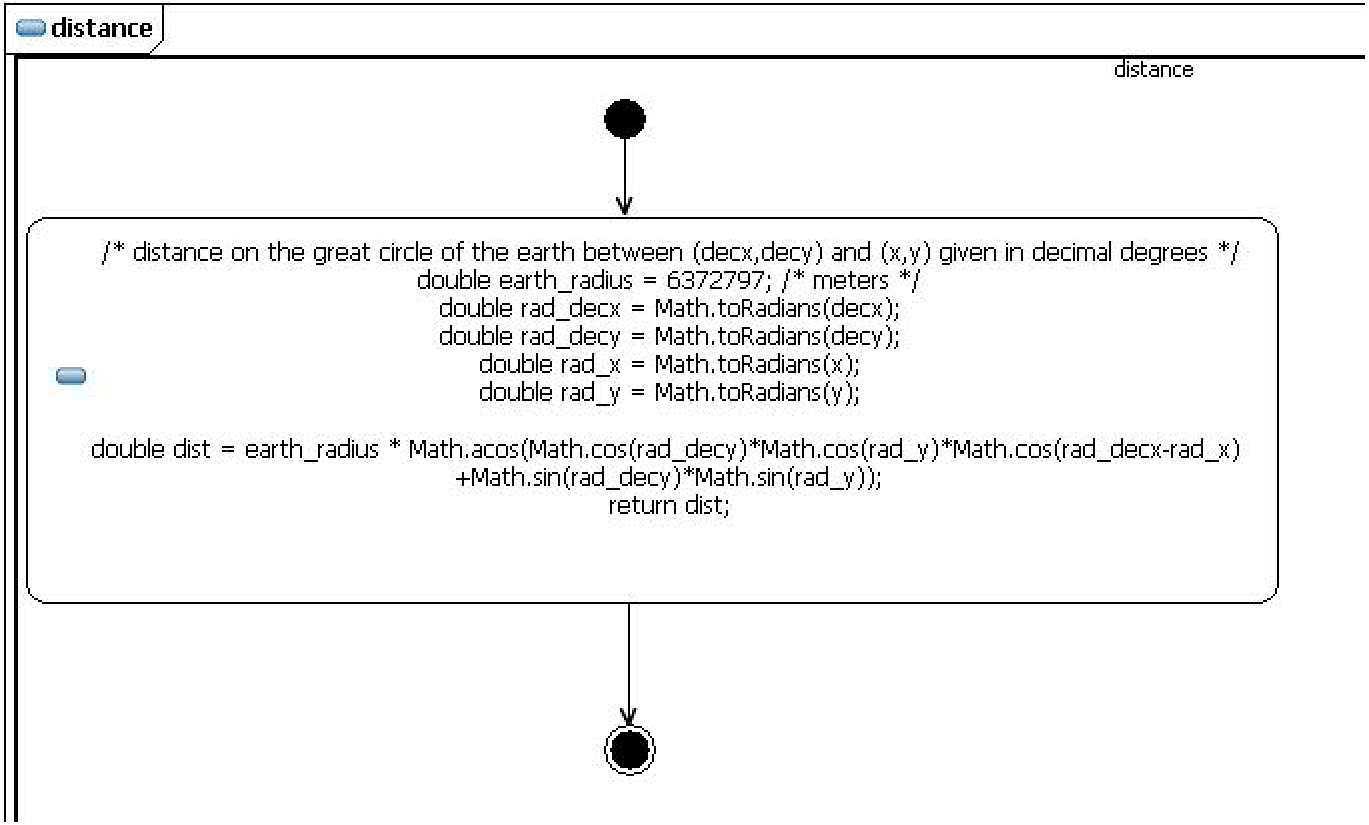
a little robustness, but it does not cover no return

reusing the operation/method

Hotspot.distance()

INF 5150

Hotspot.distance()



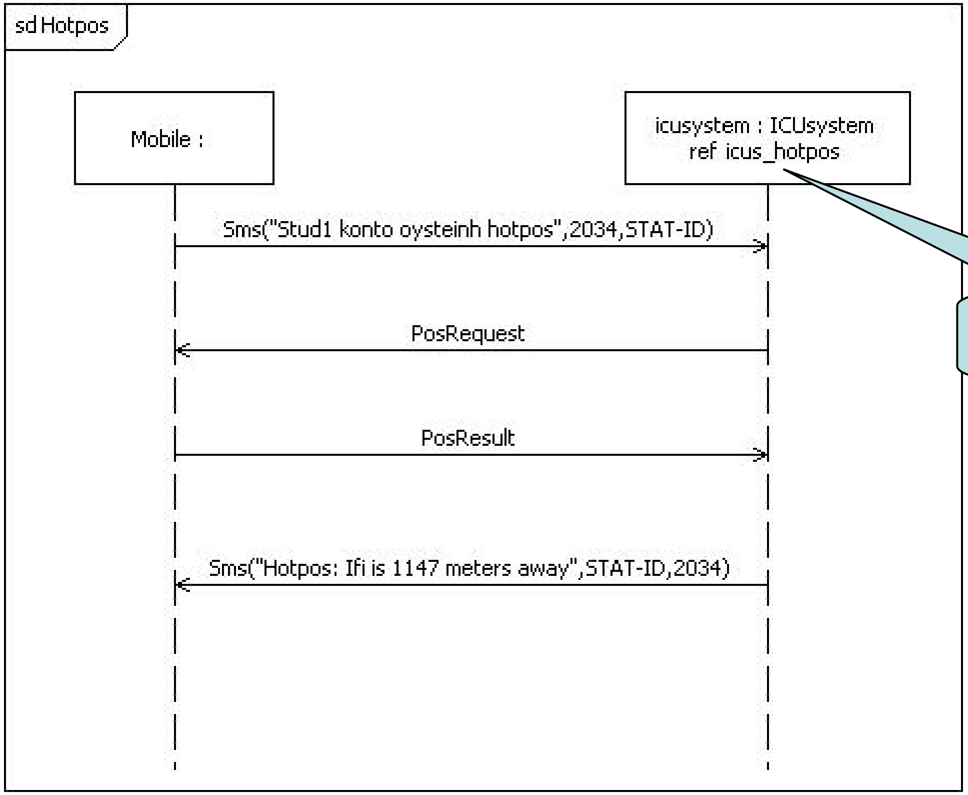
```
/* distance on the great circle of the earth between (decx,decy) and (x,y) given in decimal degrees */
double earth_radius = 6372797; /* meters */
double rad_decx = Math.toRadians(decx);
double rad_decy = Math.toRadians(decy);
double rad_x = Math.toRadians(x);
double rad_y = Math.toRadians(y);

double dist = earth_radius * Math.acos(Math.cos(rad_decy)*Math.cos(rad_y)*Math.cos(rad_decx-rad_x)
+Math.sin(rad_decy)*Math.sin(rad_y));
return dist;
```

Separation of concerns

- We want to separate different concerns of the ICU system through using separate state machines that communicate
- The architecture of the ICUSystem will evolve
- One process controls
  - the handling of SMSes
  - and the production of the KML file
- One process controls the handling of the data
  - which are still going to be hard coded (for now)
- These processes communicate with signals that we define ourselves

Hotpos service – as seen from the context

very similar to ICU2!

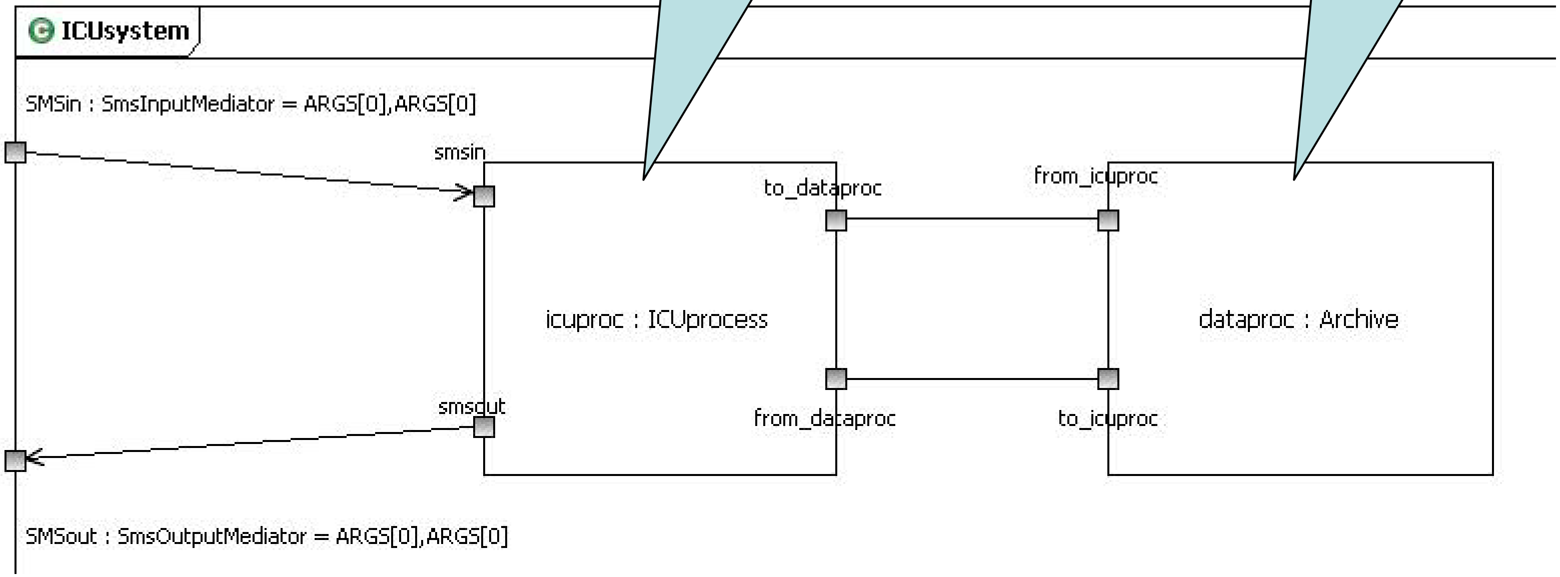

sd Hotpos
Mobile :
icusystem : ICUsystem
ref icus_hotpos
Sms("Stud1 konto oysteinh hotpos",2034,STAT-ID)
PosRequest
PosResult
Sms("Hotpos: Ifi is 1147 meters away",STAT-ID,2034)

what is this?

Inside the ICUsystem

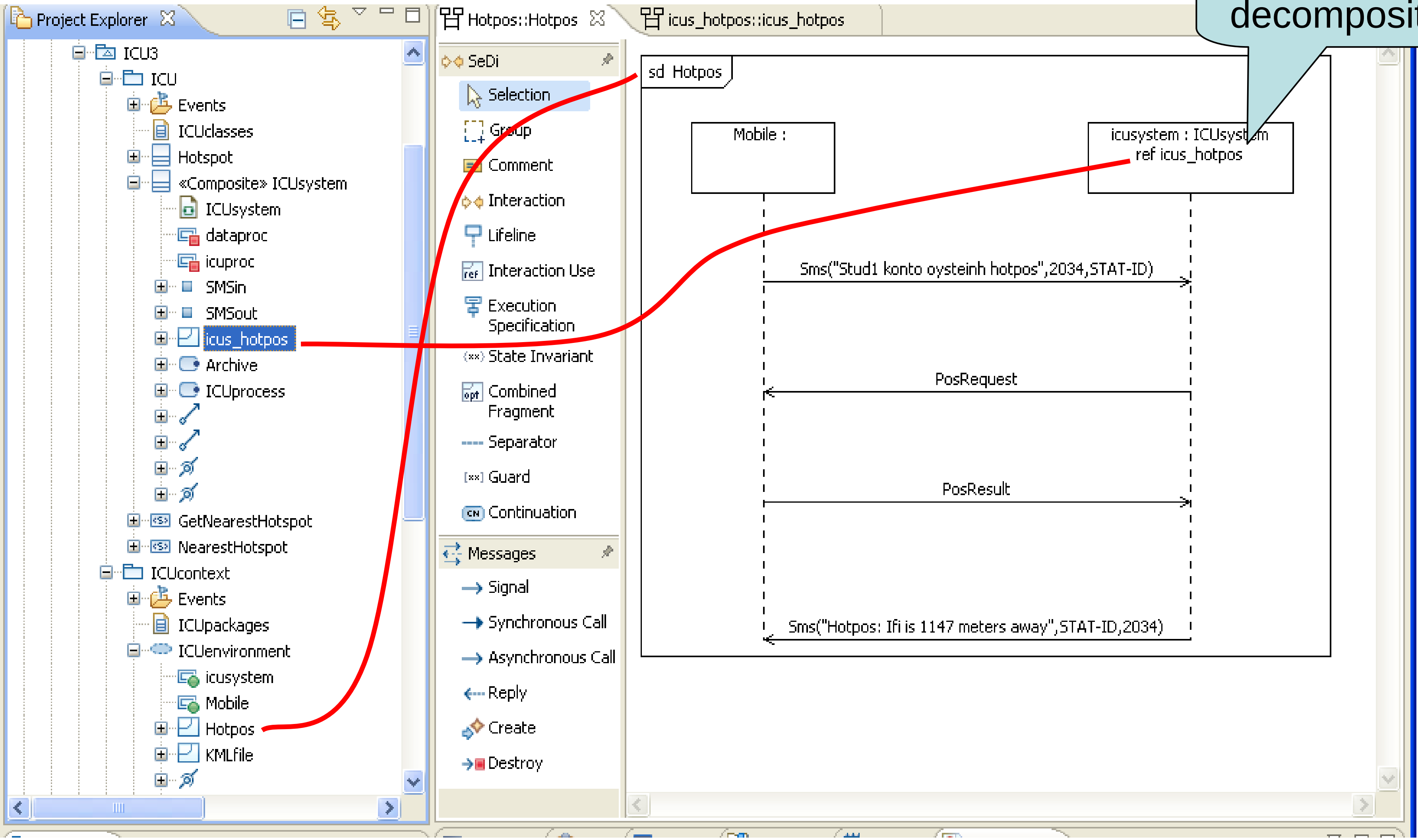
handling communication

handling data

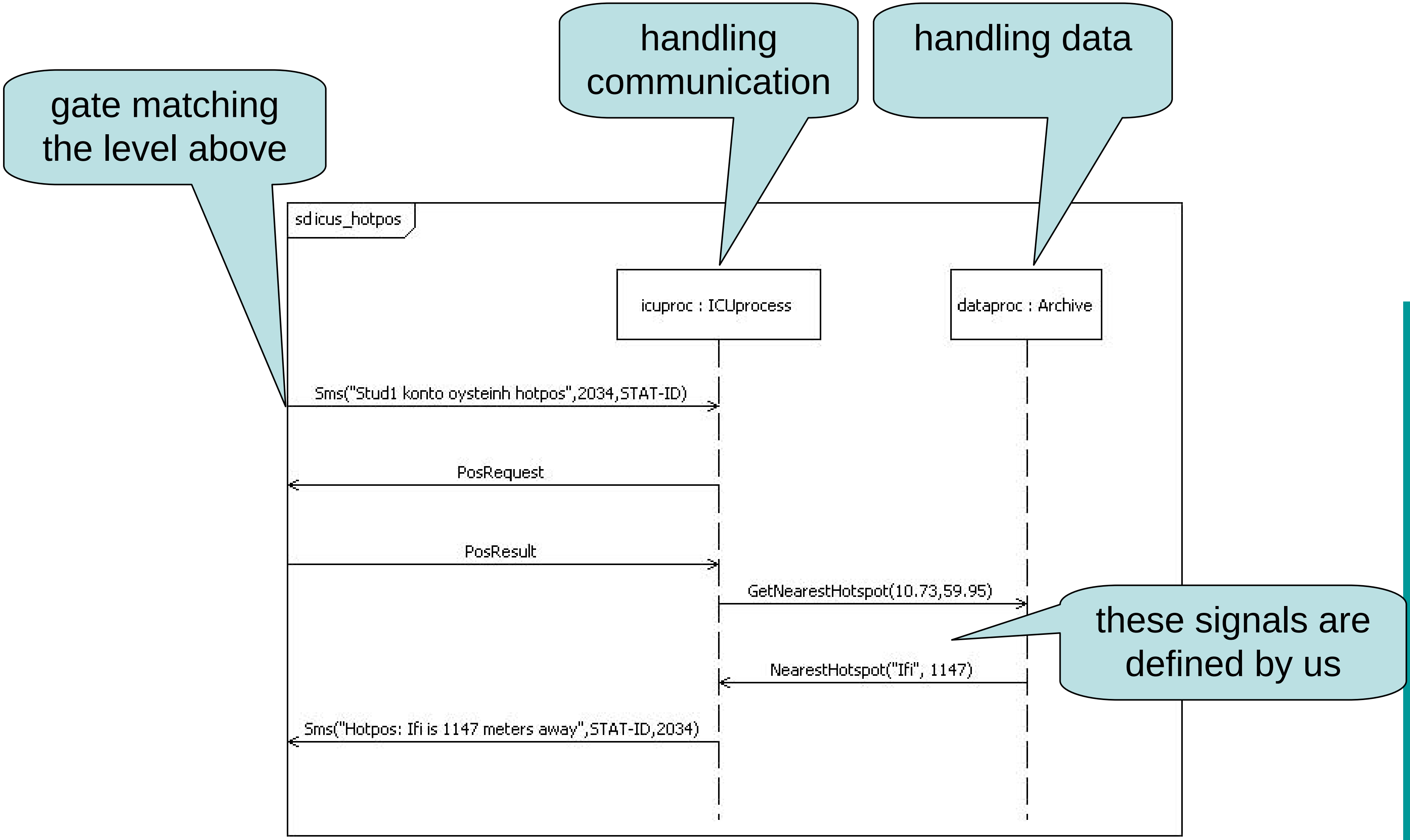


Decomposing the ICUsystem

part decomposition



The behavior inside ICUsystem


sd icus_hotpos
icuproc : ICUprocess
dataproc : Archive
Sms("Stud1 konto oysteinh hotpos",2034,STAT-ID)
PosRequest
PosResult
GetNearestHotspot(10.73,59.95)
NearestHotspot("Ifi", 1147)
Sms("Hotpos: Ifi is 1147 meters away",STAT-ID,2034)

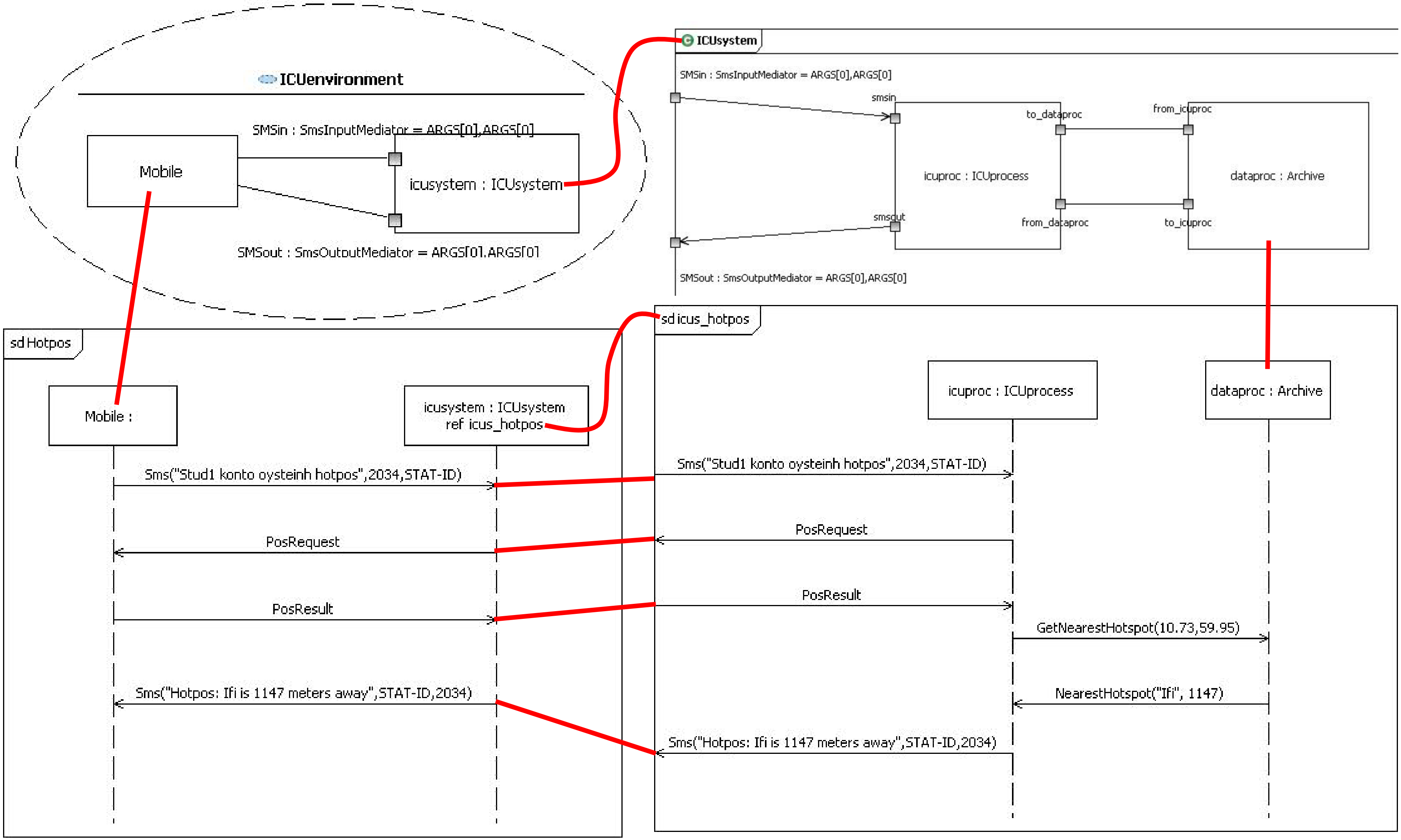
gate matching the level above

handling communication

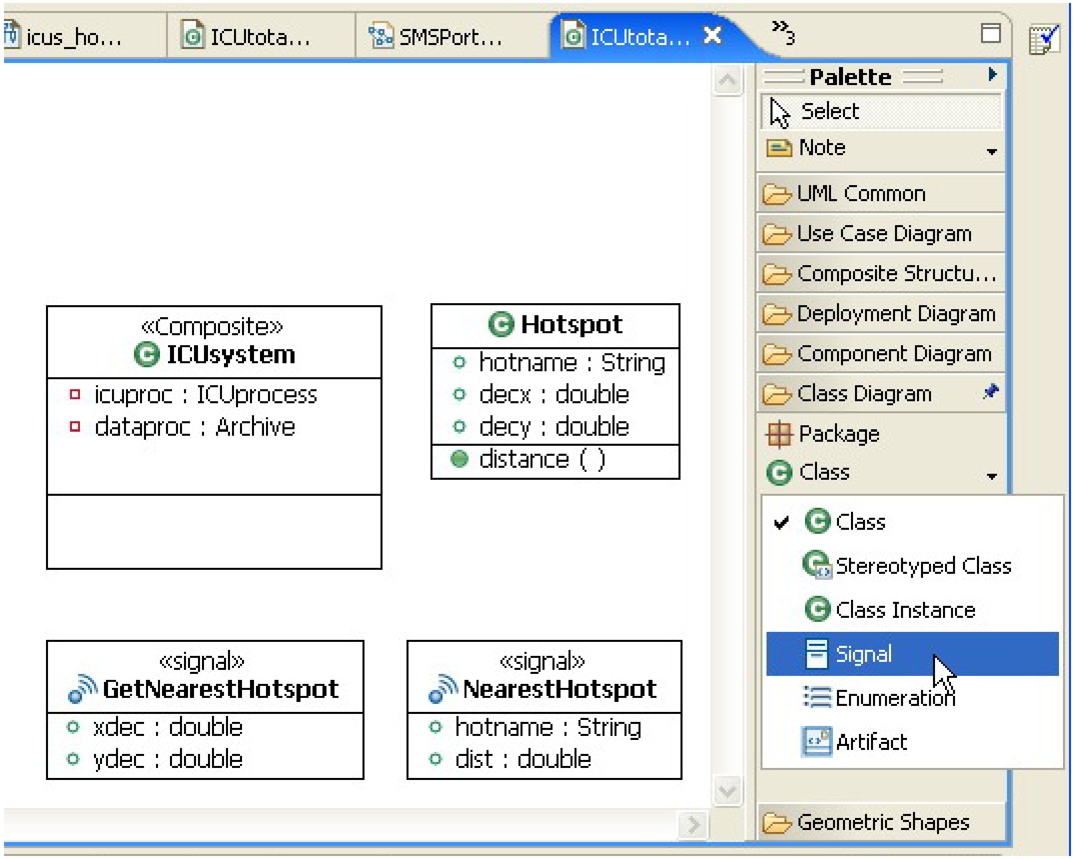
handling data

these signals are defined by us

The essence of decomposition


ICUenvironment
SMSin : SmsInputMediator = ARGS[0],ARGS[0]
Mobile
icusystem : ICUsystem
SMSout : SmsOutputMediator = ARGS[0],ARGS[0]
ICUsystem
SMSin : SmsInputMediator = ARGS[0],ARGS[0]
smsin
to_dataproc
from_icuproc
icuproc : ICUprocess
dataproc : Archive
smsout
from_dataproc
to_icuproc
SMSout : SmsOutputMediator = ARGS[0],ARGS[0]
sd Hotpos
Mobile :
icusystem : ICUsystem
ref icus_hotpos
Sms("Stud1 konto oysteinh hotpos",2034,STAT-ID)
PosRequest
PosResult
Sms("Hotpos: Ifi is 1147 meters away",STAT-ID,2034)
sd icus_hotpos
icuproc : ICUprocess
dataproc : Archive
Sms("Stud1 konto oysteinh hotpos",2034,STAT-ID)
PosRequest
PosResult
GetNearestHotspot(10.73,59.95)
NearestHotspot("Ifi", 1147)
Sms("Hotpos: Ifi is 1147 meters away",STAT-ID,2034)

The classes and signals



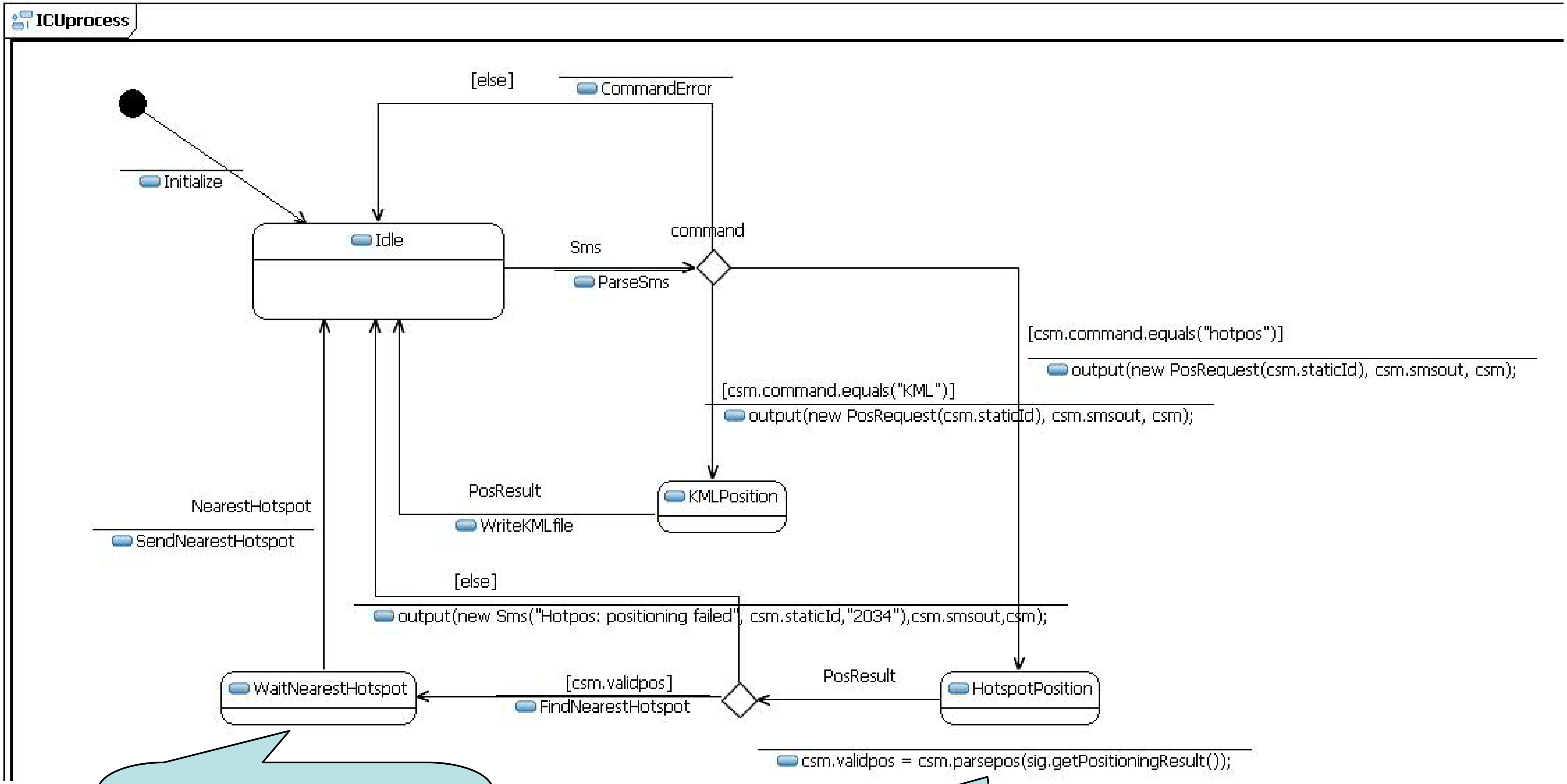
«Composite»
ICUsystem
- icuproc : ICUprocess
- dataproc : Archive

Hotspot
- hotname : String
- decx : double
- decy : double
- distance ( )

«signal»
GetNearestHotspot
- xdec : double
- ydec : double

«signal»
NearestHotspot
- hotname : String
- dist : double

ICUprocess revisited (when intro Archive)

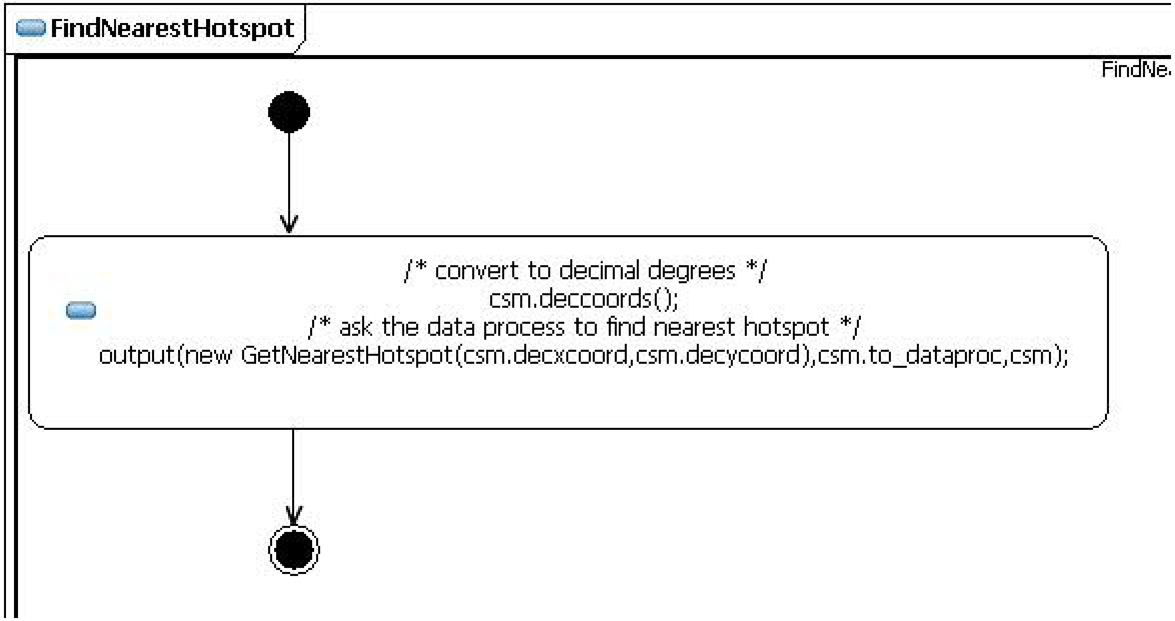


ICUprocess
Initialize
Idle
[else]
CommandError
Sms
ParseSms
command
[csm.command.equals("hotpos")]
output(new PosRequest(csm.staticId), csm.smsout, csm);
[csm.command.equals("KML")]
output(new PosRequest(csm.staticId), csm.smsout, csm);
PosResult
WriteKMLfile
KMLPosition
NearestHotspot
SendNearestHotspot
[else]
output(new Sms("Hotpos: positioning failed", csm.staticId,"2034"),csm.smsout,csm);
WaitNearestHotspot
[csm.validpos]
FindNearestHotspot
PosResult
HotspotPosition
csm.validpos = csm.parsepos(sig.getPositioningResult());

Here the data process does the calculations

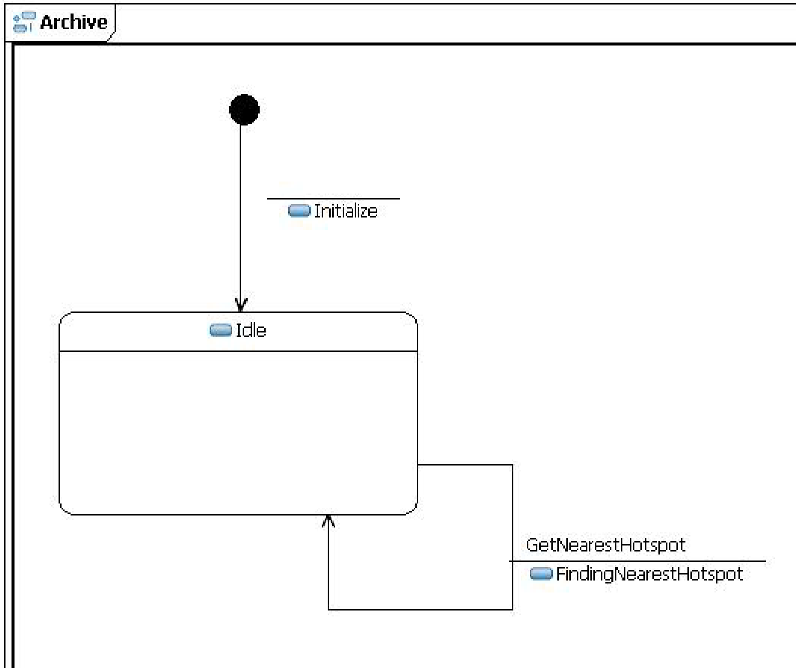
FindNearestHotspot has been split up

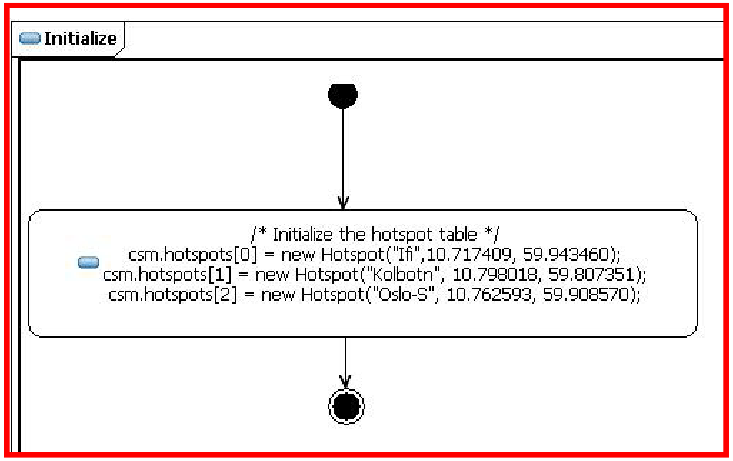
FindNearestHotspot has become pure sending



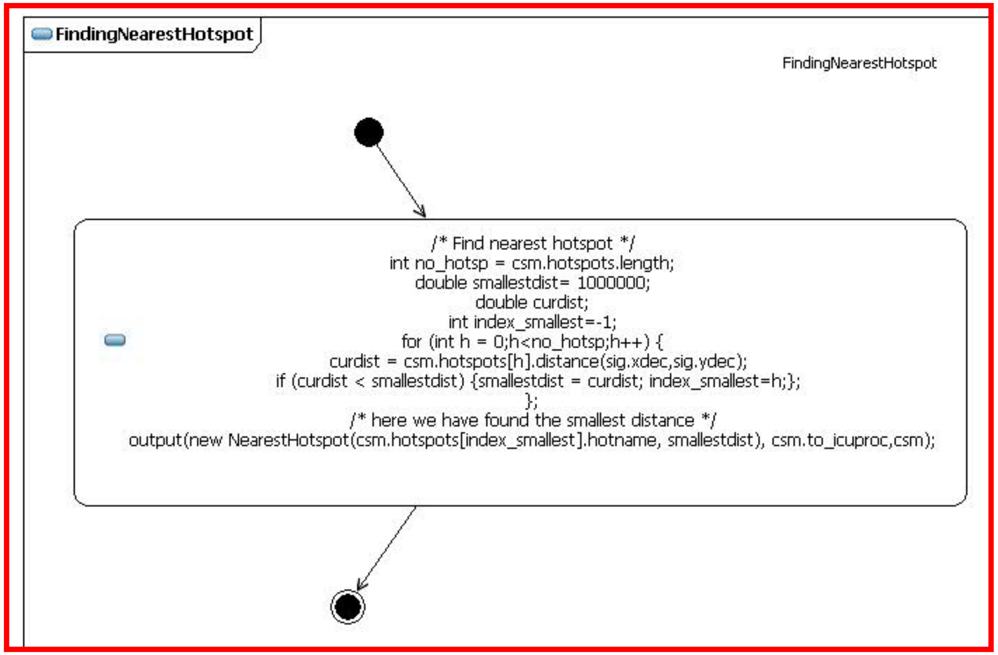
```
/* convert to decimal degrees */
csm.deccoords();
/* ask the data process to find nearest hotspot */
output(new GetNearestHotspot(csm.decxcoord,csm.decycoord),csm.to_dataproc,csm);
```

Archive – the data process





```
/* Initialize the hotspot table */
csm.hotspots[0] = new Hotspot("Ifi",10.717409, 59.943460);
csm.hotspots[1] = new Hotspot("Kolbotn", 10.798018, 59.807351);
csm.hotspots[2] = new Hotspot("Oslo-S", 10.762593, 59.908570);
```



```
/* Find nearest hotspot */
int no_hotsp = csm.hotspots.length;
double smallestdist= 1000000;
double curdist;
int index_smallest=-1;
for (int h = 0;h<no_hotsp;h++) {
curdist = csm.hotspots[h].distance(sig.xdec,sig.ydec);
if (curdist < smallestdist) {smallestdist = curdist; index_smallest=h;};
};
/* here we have found the smallest distance */
output(new NearestHotspot(csm.hotspots[index_smallest].hotname, smallestdist), csm.to_icuproc,csm);
```

Buzzz 2: Why the Archive process?

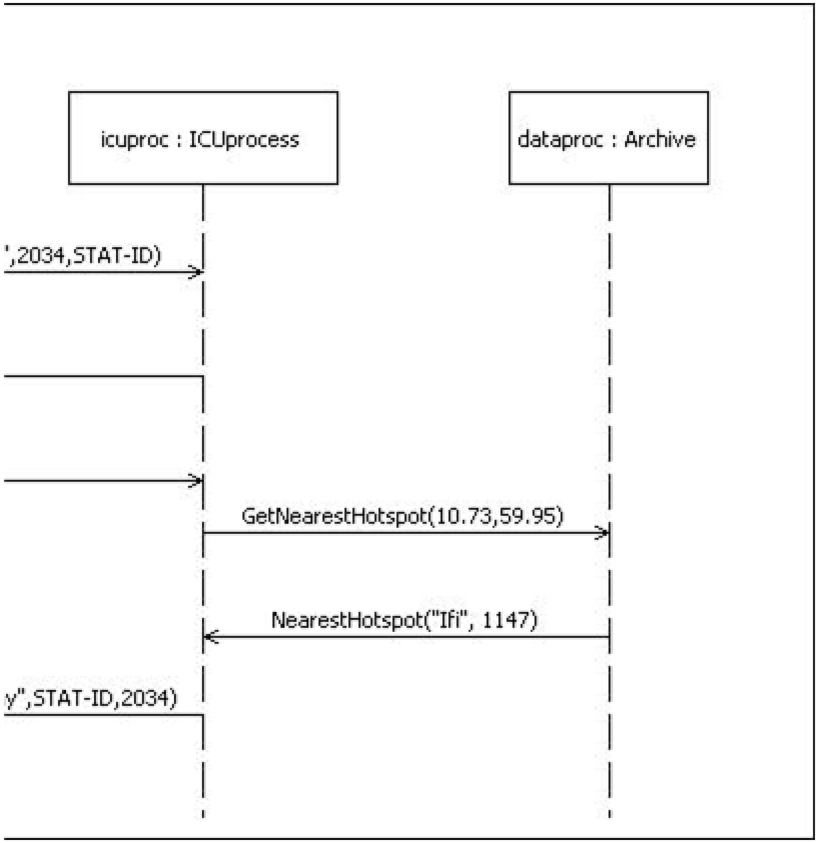
- Pair up with another student
- Discuss 3 minutes what benefits there are with introducing the Archive process

Why the separate data process?

- Isolate the work on the (semi-)persistent data
  - we shall later show how the handling of data can change without changing its interfaces
- Provide a simple critical region
  - this will be clearer later when we interface to a database system that works concurrently with our system
- The Archive process and the ICUprocess can be designed by different persons

How to make the protocol with the Archive?

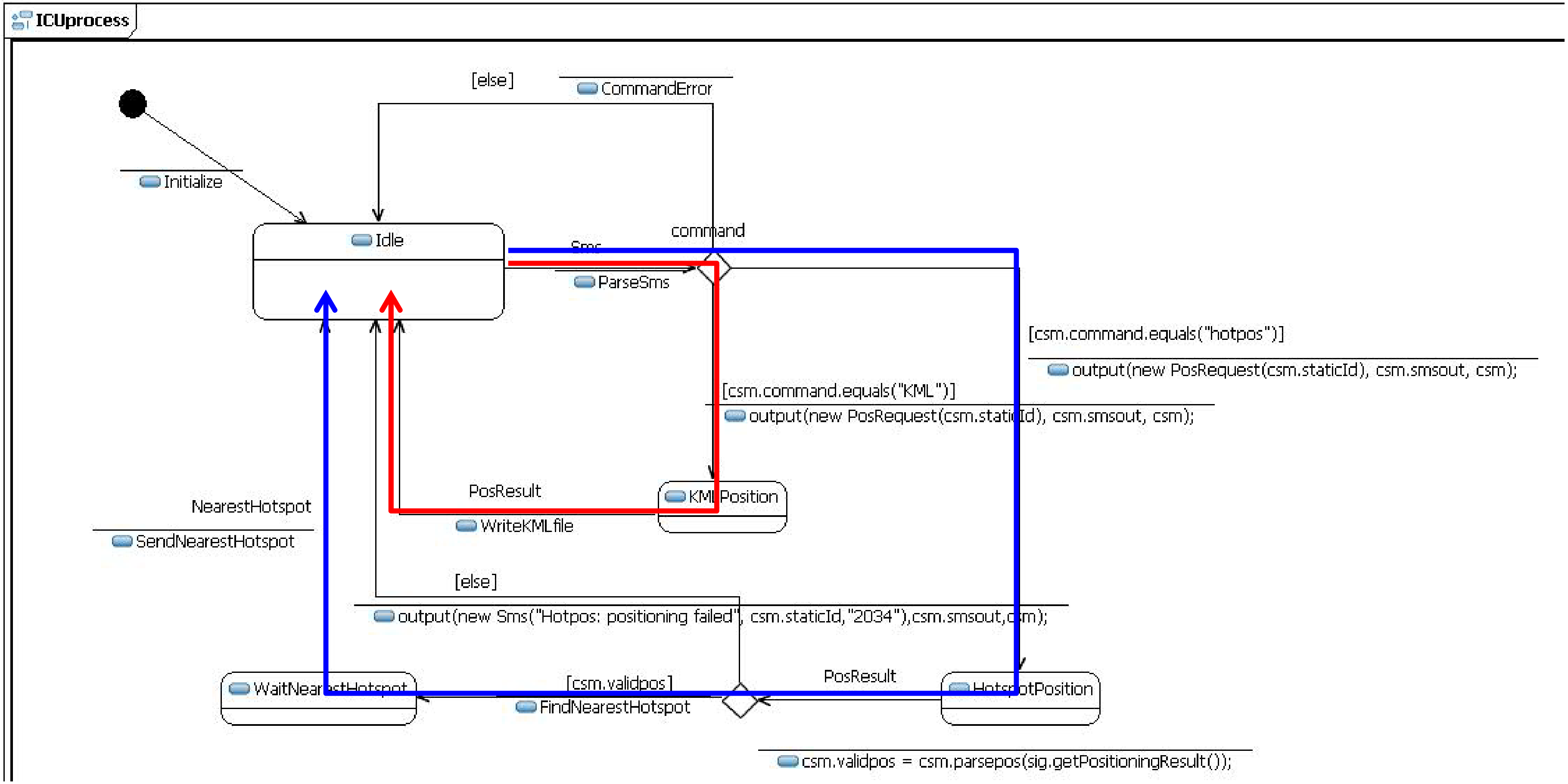
- Signals close to the application
  - this is what we have chosen
  - we want to branch on signals rather than on data
- Signals close to data
  - such as e.g. SQL
  - most important information will be in the parameters and branching will be on decision-nodes
- Do not worry about having too many signal types!



Services as Submachine States

... but we have only one sequential process

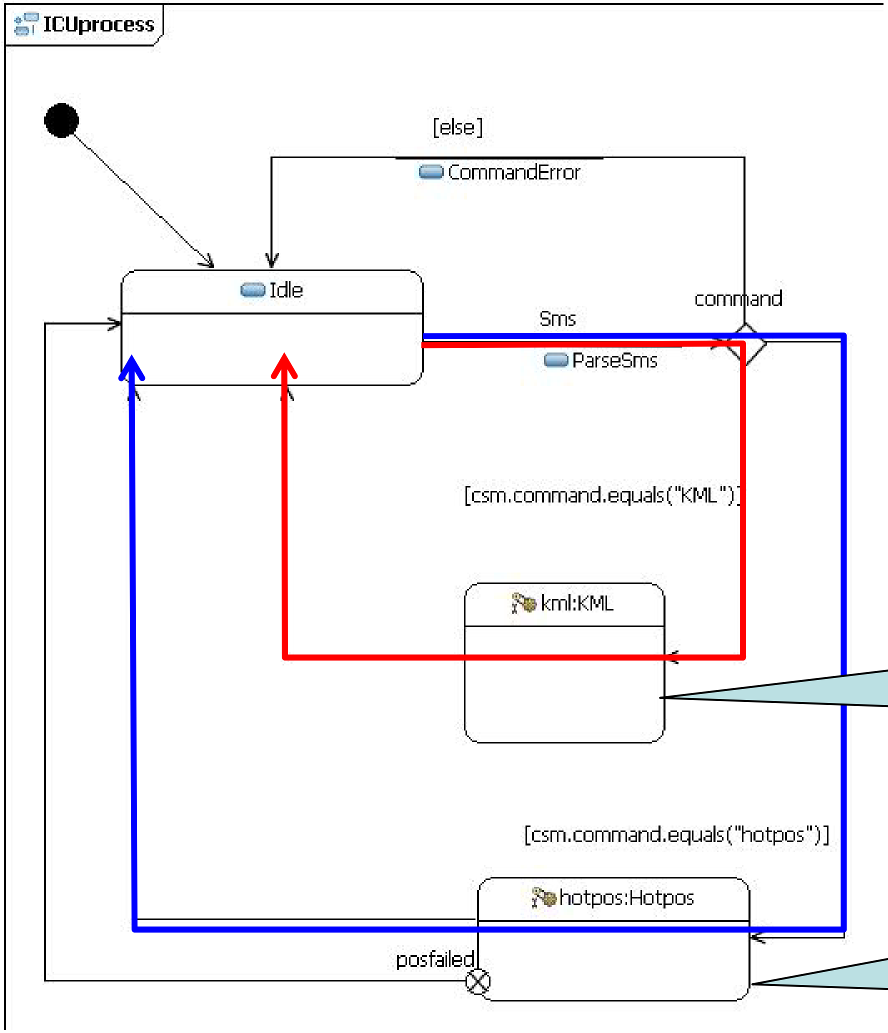
ICUprocess serving 2 services


ICUprocess
[else]
CommandError
Initialize
Idle
command
Sms
ParseSms
[csm.command.equals("hotpos")]
output(new PosRequest(csm.staticId), csm.smsout, csm);
[csm.command.equals("KML")]
output(new PosRequest(csm.staticId), csm.smsout, csm);
NearestHotspot
SendNearestHotspot
PosResult
WriteKMLfile
KMLPosition
[else]
output(new Sms("Hotpos: positioning failed", csm.staticId,"2034"),csm.smsout,csm);
WaitNearestHotspot
[csm.validpos]
FindNearestHotspot
PosResult
HotspotPosition
csm.validpos = csm.parsepos(sig.getPositioningResult());

Separation of Concerns

- Isolate reusable functions
  - through operation/method: *parsepos* and *deccoords*
- Separate independent concurrent tasks
  - through parts in composite structures: *icuproc* and *dataproc*
- Separate different alternating services
  - through submachinestates of internal state machines
  - *KML* and *Hotpos*
  - We have introduced the following invariant:
    - One user (defined by one mobile telephone) can only be involved in one (top level) service at one instant

ICUprocess with 2 submachine states



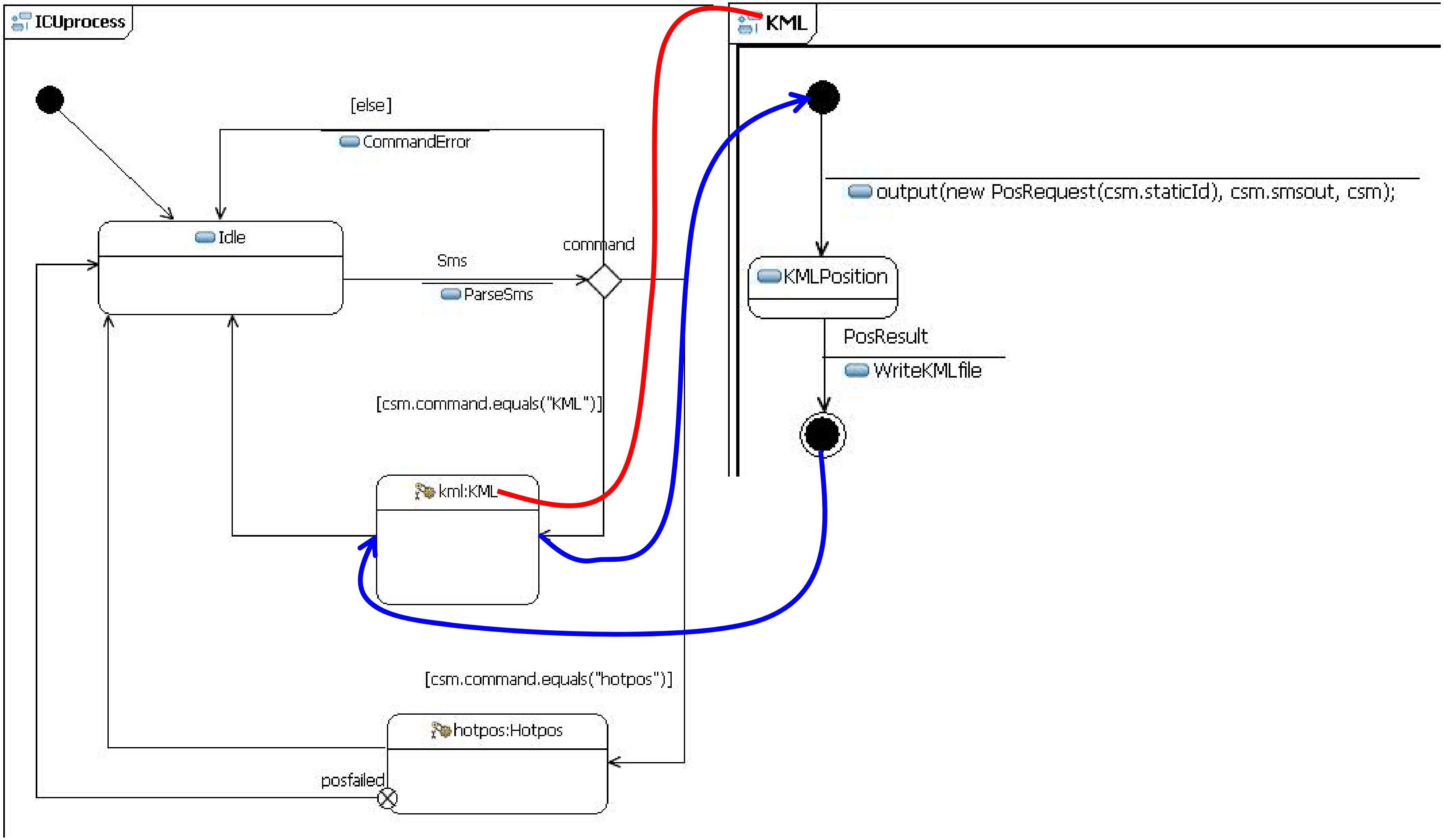
These state machines are not concurrent!

Each submachine state refers to a state machine

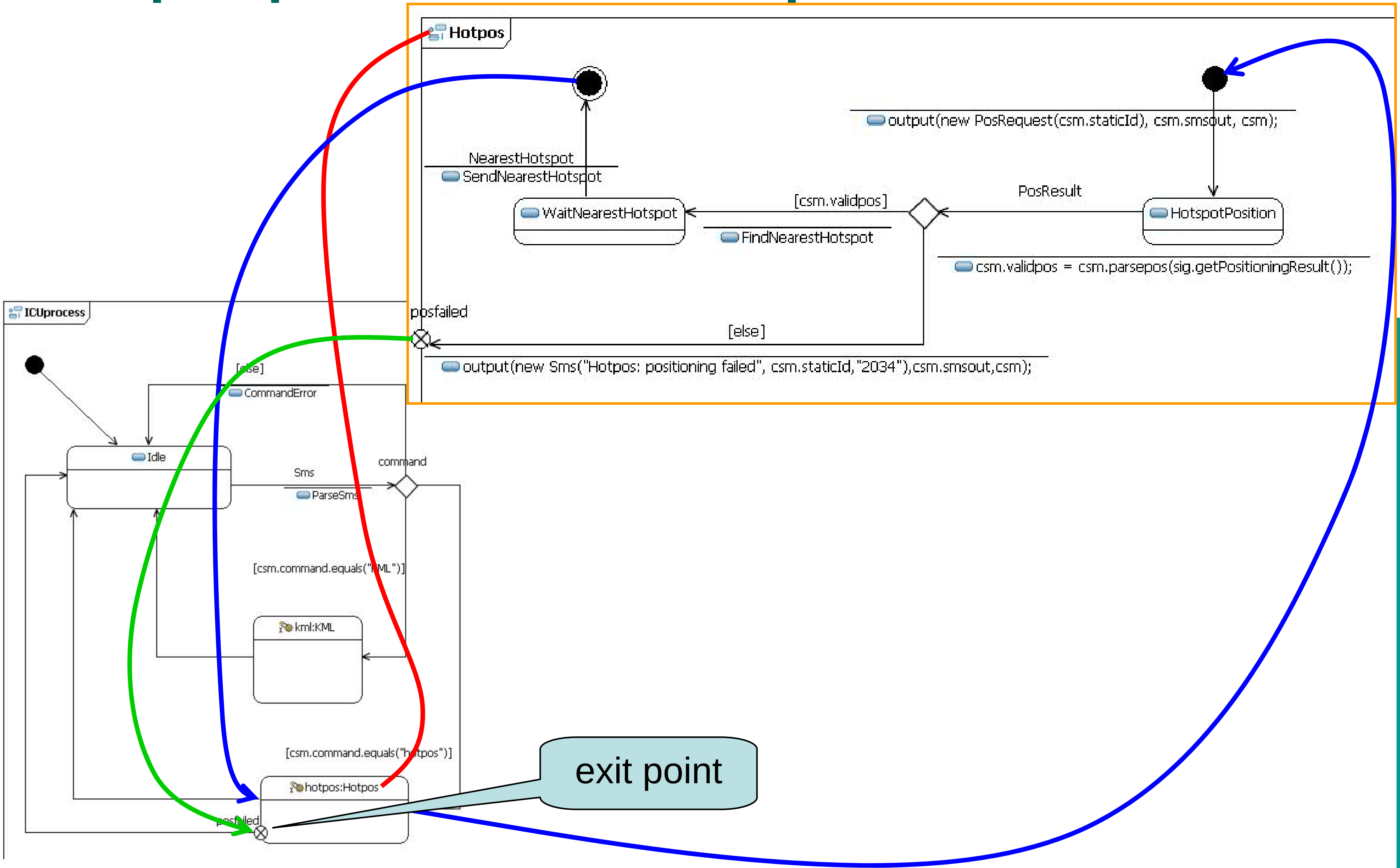
Submachine states

- Submachine states are states
- Submachine states have a state machine definition
  - but at the level of the submachine state, they are perceived only as states
- Submachine states are compiled into JavaFrame composite states
  - which must not be confused with composite structures!!!
  - UML also has something called ”composite states” but they are not as powerful as submachine states. The JavaFrame compiler does not recognize UML composite states.

KML process inside ICUprocess

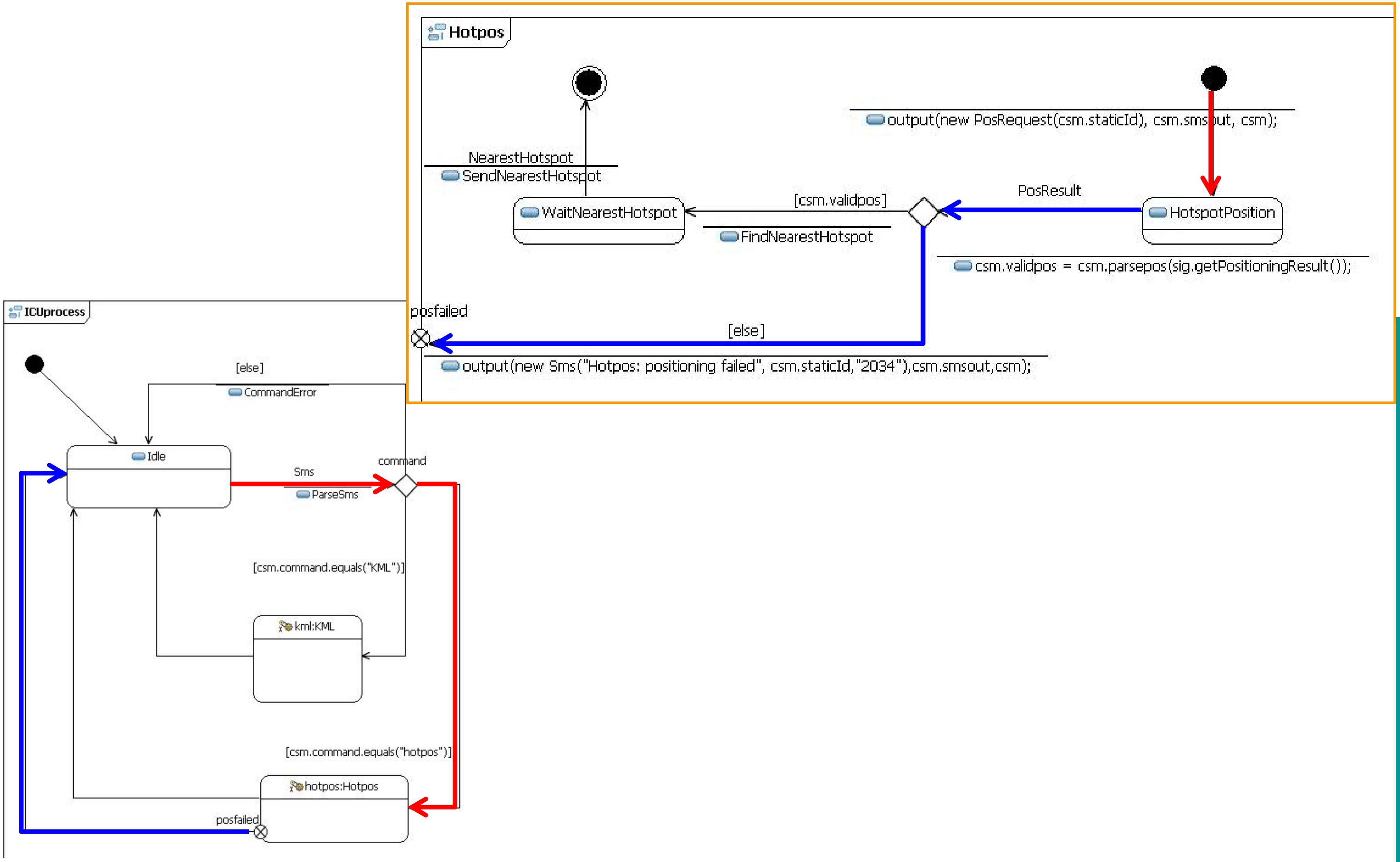


Hotpos process inside ICUprocess

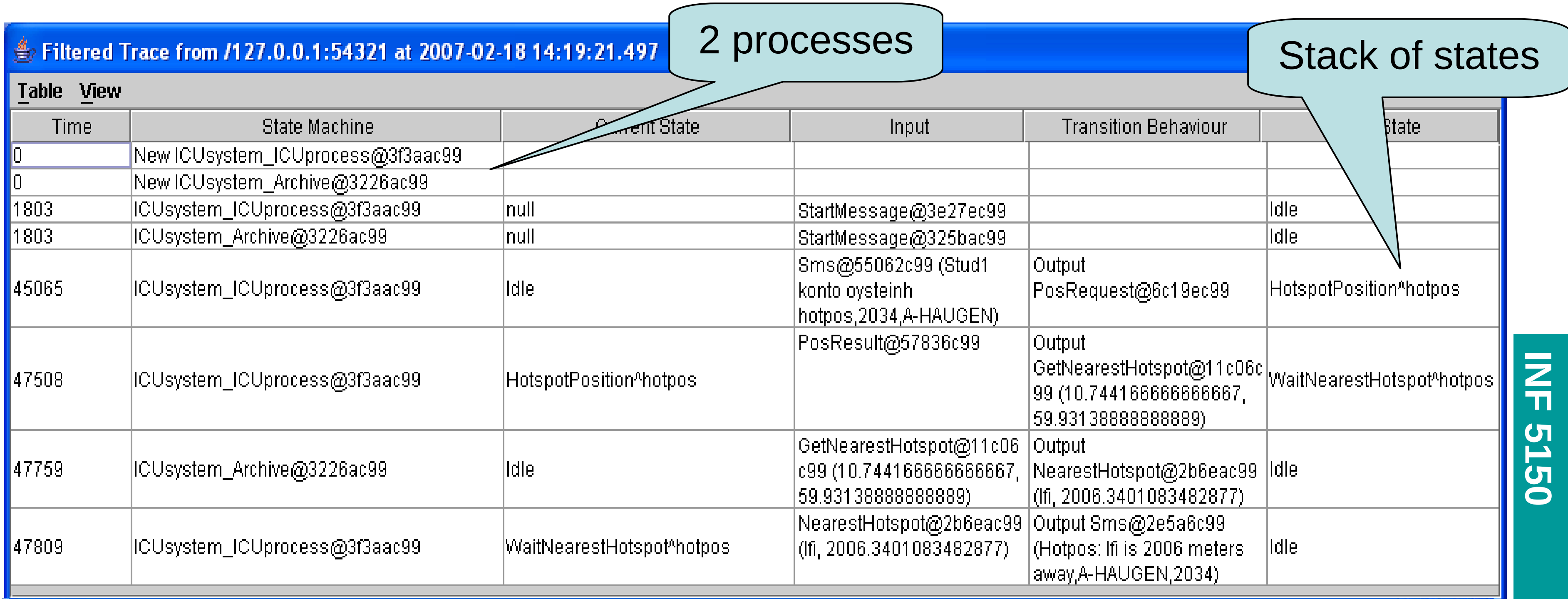

Hotpos
output(new PosRequest(csm.staticId), csm.smsout, csm);
NearestHotspot
SendNearestHotspot
WaitNearestHotspot
[csm.validpos]
FindNearestHotspot
PosResult
HotspotPosition
csm.validpos = csm.parsepos(sig.getPositioningResult());
posfailed
[else]
output(new Sms("Hotpos: positioning failed", csm.staticId,"2034"),csm.smsout,csm);
ICUprocess
[else]
CommandError
Idle
Sms
ParseSms
command
[csm.command.equals("KML")]
kml:KML
[csm.command.equals("hotpos")]
hotpos:Hotpos
posfailed

exit point

Two assembled transitions


Hotpos
output(new PosRequest(csm.staticId), csm.smsout, csm);
NearestHotspot
SendNearestHotspot
PosResult
[csm.validpos]
WaitNearestHotspot
HotspotPosition
FindNearestHotspot
csm.validpos = csm.parsepos(sig.getPositioningResult());
posfailed
[else]
output(new Sms("Hotpos: positioning failed", csm.staticId,"2034"),csm.smsout,csm);
ICUprocess
[else]
CommandError
Idle
Sms
command
ParseSms
[csm.command.equals("KML")]
kml:KML
[csm.command.equals("hotpos")]
hotpos:Hotpos
posfailed

Execution as seen from JFTrace/JFDebug

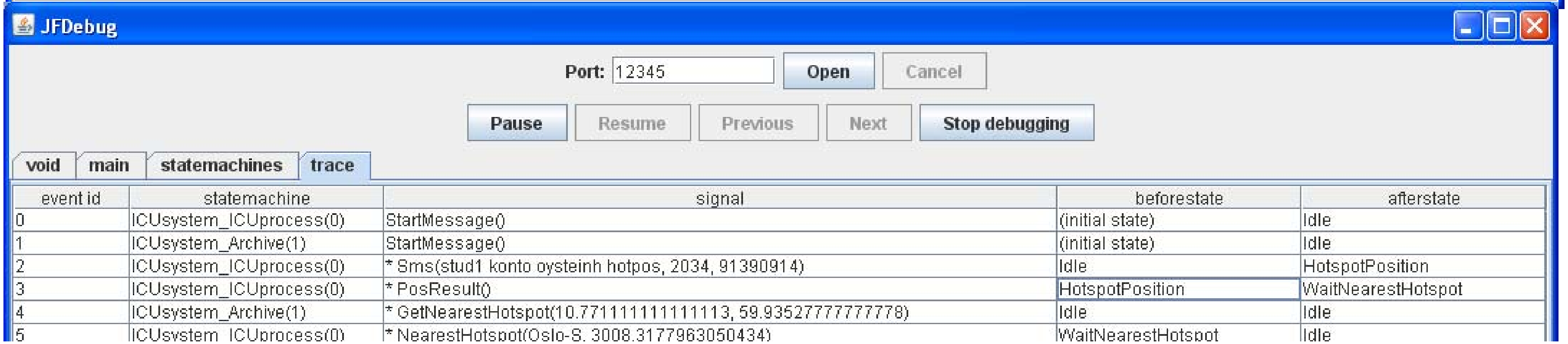


2 processes

Stack of states

Filtered Trace from /127.0.0.1:54321 at 2007-02-18 14:19:21.497
Table
View

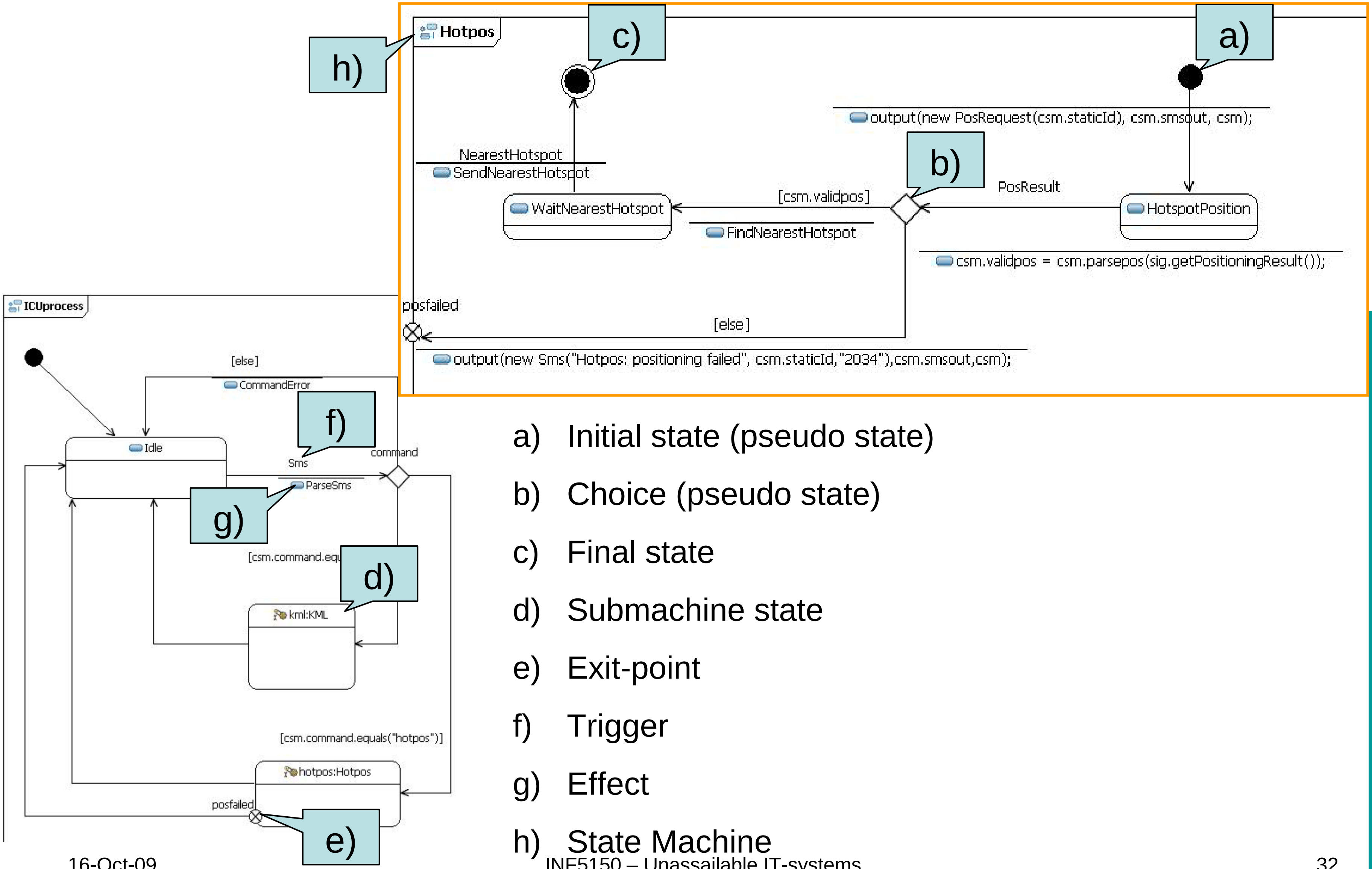
Time	State Machine	Current State	Input	Transition Behaviour	State
0	New ICUsystem_ICUprocess@3f3aac99				
0	New ICUsystem_Archive@3226ac99				
1803	ICUsystem_ICUprocess@3f3aac99	null	StartMessage@3e27ec99		Idle
1803	ICUsystem_Archive@3226ac99	null	StartMessage@325bac99		Idle
45065	ICUsystem_ICUprocess@3f3aac99	Idle	Sms@55062c99 (Stud1 konto oysteinh hotpos,2034,A-HAUGEN)	Output PosRequest@6c19ec99	HotspotPosition^hotpos
47508	ICUsystem_ICUprocess@3f3aac99	HotspotPosition^hotpos	PosResult@57836c99	Output GetNearestHotspot@11c06c99 (10.744166666666667, 59.931388888888889)	WaitNearestHotspot^hotpos
47759	ICUsystem_Archive@3226ac99	Idle	GetNearestHotspot@11c06c99 (10.744166666666667, 59.931388888888889)	Output NearestHotspot@2b6eac99 (Ifi, 2006.3401083482877)	Idle
47809	ICUsystem_ICUprocess@3f3aac99	WaitNearestHotspot^hotpos	NearestHotspot@2b6eac99 (Ifi, 2006.3401083482877)	Output Sms@2e5a6c99 (Hotpos: Ifi is 2006 meters away,A-HAUGEN,2034)	Idle



Port: 12345

event id	statemachine	signal	beforestate	afterstate
0	ICUsystem_ICUprocess(0)	StartMessage()	(initial state)	Idle
1	ICUsystem_Archive(1)	StartMessage()	(initial state)	Idle
2	ICUsystem_ICUprocess(0)	* Sms(stud1 konto oysteinh hotpos, 2034, 91390914)	Idle	HotspotPosition
3	ICUsystem_ICUprocess(0)	* PosResult()	HotspotPosition	WaitNearestHotspot
4	ICUsystem_Archive(1)	* GetNearestHotspot(10.771111111111113, 59.93527777777778)	Idle	Idle
5	ICUsystem_ICUprocess(0)	* NearestHotspot(Oslo-S, 3008.3177963050434)	WaitNearestHotspot	Idle

Write down the names of these elements



a) Initial state (pseudo state)

b) Choice (pseudo state)

c) Final state

d) Submachine state

e) Exit-point

f) Trigger

g) Effect

h) State Machine