SOEN 342 - Sections H and II:
Software Requirements and Specifications

Iteration 2 Project Specification

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1 Partial formal specification in Z

The formal specification of the system introduces the following three types:

$$SENSOR\_TYPE, LOCATION\_TYPE, TEMPERATURE\_TYPE$$

The system's (partial) formal specification is given in the Z language and it consists of schemas and the definitions of operations that constitute the system's exposed interface.

1.1 Schemas

TempMonitor

$$deployed : \mathbb{P}\ SENSOR\_TYPE$$
$$map : SENSOR\_TYPE \pfun LOCATION\_TYPE$$
$$read : SENSOR\_TYPE \pfun TEMPERATURE\_TYPE$$

$$deployed = \mathrm{dom}\ map$$
$$deployed = \mathrm{dom}\ read$$

DeploySensorOK

$$\Delta TempMonitor$$
$$sensor? : SENSOR\_TYPE$$
$$location? : LOCATION\_TYPE$$
$$temperature? : TEMPERATURE\_TYPE$$

$$sensor? \notin deployed$$
$$location? \notin \mathrm{ran}\ map$$
$$deployed' = deployed \cup \{sensor?\}$$
$$map' = map \cup \{sensor? \mapsto location?\}$$
$$read' = read \cup \{sensor? \mapsto temperature?\}$$

ReadTemperatureOK

$$\Xi TempMonitor$$
$$location? : LOCATION\_TYPE$$
$$temperature! : TEMPERATURE\_TYPE$$

$$location? \in \mathrm{ran}\ map$$
$$temperature! = read(map^{-1}(location?))$$

Success

$\Xi TempMonitor$
$response! : MESSAGE$

$response! = 'ok'$

SensorAlreadyDeployed

$\Xi TempMonitor$
$sensor? : SENSOR\_TYPE$
$response! : MESSAGE$

$sensor? \in deployed$
$response! = 'Sensor\ deployed'$

LocationAlreadyCovered

$\Xi TempMonitor$
$location? : LOCATION\_TYPE$
$response! : MESSAGE$

$location? \in \operatorname{ran} map$
$response! = 'Location\ already\ covered'$

LocationUnknown

$\Xi TempMonitor$
$location? : LOCATION\_TYPE$
$response! : MESSAGE$

$location? \notin \operatorname{ran} map$
$response! = 'Location\ not\ covered'$

ReplaceSensorOK

$\Delta TempMonitor$
$sensor? : SENSOR\_TYPE$
$newSensor? : SENSOR\_TYPE$
$location? : LOCATION\_TYPE$

$sensor? \in deployed$
$newSensor? \notin deployed$
$location? = map(sensor?)$
$deployed' = (deployed \setminus \{sensor?\}) \cup newSensor?$
$map' = (map \setminus \{sensor? \mapsto location?\}) \cup \{newSensor? \mapsto location?\}$
$read' = (read \setminus \{sensor?\}) \cup \{newSensor? \mapsto read(oldSensor?)\}$

OldSensorNotDeployed

$\Xi TempMonitor$
$sensor? : SENSOR\_TYPE$
$response! : MESSAGE$

$sensor? \notin deployed$
$response! = 'The\ sensor\ to\ be\ replaced\ is\ not\ deployed'$

NewSensorAlreadyDeployed

$\Xi TempMonitor$
$newSensor? : SENSOR\_TYPE$
$response! : MESSAGE$

$sensor? \in deployed$
$response! = 'The\ new\ sensor\ is\ already\ deployed'$

GetAllLocationsTemperaturesOK

$\Xi TempMonitor$
$allLocationsTemps! : LOCATION\_TYPE \leftrightarrow TEMPERATURE\_TYPE$

$allLocationsTemps! = map \lhd read$

NoSensorsDeployed

$\Xi TempMonitor$
$response! : MESSAGE$

$deployed = \varnothing$
$response! = 'No\ sensors\ are\ deployed'$

UnreportedSensorTemperatures

$\Xi TempMonitor$
$response! : MESSAGE$

$\exists s : SENSOR\ TYPE \ @\ s \in deployed \land s \notin \mathrm{dom}\, read$
$response! = 'Some\ sensors\ have\ no\ temperature\ data'$

1.2 Operations

$$DeploySensor \mathrel{\hat{=}} (DeploySensorOK \land Success) \oplus (SensorAlreadyDeployed \lor LocationAlreadyCovered)$$

$$ReadTemperature \mathrel{\hat{=}} (ReadTemperatureOK \land Success) \oplus LocationUnknown$$

$$ReplaceSensor \mathrel{\hat{=}} (ReplaceSensorOK \land Success) \oplus (OldSensorNotDeployed \lor NewSensorAlreadyDeployed)$$

$$GetALLLocationsTemperatures \mathrel{\hat{=}} (GetAllLocationsTemperaturesOK \land Success) \oplus (NoSensorsDeployed \lor UnreportedSensorTemperatures)$$