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

Project

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1 Formal specification in Z

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

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

The system's 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

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

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

ReadCollectionOK

$\Xi TempMonitor$
$outputLocationsTemperatures! : \mathbb{P}(LOCATION\_TYPE \times TEMPERATURE\_TYPE)$

$outputLocationsTemperatures! = \{\ l : LOCATION\_TYPE;$
$\quad t : TEMPERATURE\_TYPE \mid l \in \operatorname{ran} map \land (t = read(l))\ \}$

1.2 Operations

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

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

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