

SOEN 342 - Sections 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 (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 and Operations given in the project

TempMonitor

$deployed : \mathbb{P} SENSOR_TYPE$

$map : SENSOR_TYPE \rightarrow LOCATION_TYPE$

$read : SENSOR_TYPE \rightarrow TEMPERATURE_TYPE$

$deployed = \text{dom } map$

$deployed = \text{dom } read$

DeploySensorOK

$\Delta TempMonitor$

$sensor? : SENSOR_TYPE$

$location? : LOCATION_TYPE$

$temperature? : TEMPERATURE_TYPE$

$sensor? \notin deployed$

$location? \notin \text{ran } map$

$deployed' = deployed \cup \{sensor?\}$

$map' = map \cup \{sensor? \mapsto location?\}$

$read' = read \cup \{sensor? \mapsto temperature?\}$

ReadTemperatureOK

$\exists TempMonitor$

$location? : LOCATION_TYPE$

$temperature! : TEMPERATURE_TYPE$

$location? \in \text{ran } map$

$temperature! = read(map^{-1}(location?))$

<i>Success</i>
$\exists TempMonitor$ $response! : MESSAGE$
$response! = 'ok'$

<i>SensorAlreadyDeployed</i>
$\exists TempMonitor$ $sensor? : SENSOR_TYPE$ $response! : MESSAGE$
$sensor? \in deployed$ $response! = 'Sensor\ deployed'$

<i>LocationAlreadyCovered</i>
$\exists TempMonitor$ $location? : LOCATION_TYPE$ $response! : MESSAGE$
$location? \in \text{ran } map$ $response! = 'Location\ already\ covered'$

<i>LocationUnknown</i>
$\exists TempMonitor$ $location? : LOCATION_TYPE$ $response! : MESSAGE$
$location? \notin \text{ran } map$ $response! = 'Location\ not\ covered'$

$$\begin{aligned}
DeploySensor &\doteq \\
& (DeploySensorOK \wedge Success) \oplus \\
& (SensorAlreadyDeployed \vee LocationAlreadyCovered)
\end{aligned}$$

$$\begin{aligned}
ReadTemperature &\doteq \\
& (ReadTemperatureOK \wedge Success) \oplus LocationUnknown
\end{aligned}$$

1.2 Added Schemas and Operations to Formal Specifications

<i>MoveToNewLocationOK</i>
$\Delta TempMonitor$
$sensor? : SENSOR_TYPE$
$location? : LOCATION_TYPE$
$sensor? \in deployed$
$location? \notin \text{ran } map$
$map' = map \oplus \{sensor? \mapsto location?\}$

<i>SensorNotDeployed</i>
$\Xi TempMonitor$
$sensor? : SENSOR_TYPE$
$response! : MESSAGE$
$sensor? \notin deployed$
$response! = 'Sensor \text{ not } deployed'$

<i>GetLocationOK</i>
$\Xi TempMonitor$
$sensor? : SENSOR_TYPE$
$locations! : LOCATION_TYPE$
$sensor? \in deployed$
$locations! = map(sensor?)$

<i>GetAllLocationsOK</i>
$\Xi TempMonitor$
$locations! : LOCATION_TYPE$
$locations! \in \text{ran } map$

$UndeploySensorOK$	_____
$\Delta TempMonitor$ $sensor? : SENSOR_TYPE$	
$sensor? \in deployed$ $deployed' = deployed \setminus \{sensor?\}$ $map' = \{sensor?\} \triangleleft map$ $read' = \{sensor?\} \triangleleft read$	

$$UndeploySensor \hat{=} (UndeploySensorOK \wedge Success) \oplus SensorNotDeployed$$

$$MoveToNewLocation \hat{=} (MoveToNewLocationOK \wedge Success) \oplus (SensorNotDeployed \vee LocationAlreadyCovered)$$

$$GetLocation \hat{=} (GetLocationOK \wedge Success) \oplus SensorNotDeployed$$

$$GetAllLocations \hat{=} GetAllLocationsOK$$