Exam
UML For Embedded Systems - UMLEmb

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Authorized documents: lectures' slides, notes you've taken during lectures, lab sessions results.

A grade is provided for every question. 1 additional point is given as a general appreciation, including written skills and readability.

Also, do not spend more than 20 minutes on question **1** since the modeling exercise is long to perform. At last, consider **making assumptions** on the system so as to reduce the modeling work.

1   Understanding of the Course (4 points, ∼20 minutes)

You probably have noticed an important design difference between SysML and UML: In UML, a specific diagram - the Composite Structure Diagram - is used for connecting ports of classes. On the contrary, SysML doesn't offer such a diagram, and so, ports of blocks have to be connected in a Block Diagram.

(a) What elements are interconnected - using ports and links - in Composite Structure Diagrams? (2 points)

(b) What scheme easily modeled with UML Composite Structure Diagrams is more complex to model with the SysML approach? You may use your design of Exercise 2 to illustrate your point. (2 points)

2   Modeling exercise (15 points, ∼100 minutes)

The goal of this exercise is to model the software system of a base station in charge of handling mobile phones. The time being limited, you may omit modeling details of your

choice, but if you do so, clearly mention which ones you have decided to omit, and why. At last, do not forget to comment your diagrams, grading takes into account as much diagrams and related comments. The base station that you have to model is described with the following simplified specification.

A base station is an equipment that offers a network connectivity to mobile phones located in its area. Basically, it has two network interfaces: a wireless interface to connect to mobile phones, and a cable one to connect to the general network of the phone operator.

The base station can handle up to 2 connected mobile phones. To register, a mobile sends a registration message - containing its id - to the base station, that answers with an acknowledgment. Moreover, a mobile phone must send an "I am alive" message at least every 5 seconds, to which the base station responds with an acknowledgment. A mobile phone not sending its "I am alive" message every 5 seconds is considered as disconnected. When it is connected to a base station, a mobile phone can make or receive phone calls from phones located in the same area, or located in another area, i.e., connected to another base station. To make a phone call, the mobile phone sends a phone number to the base station. The latter either responds with a failure code within 30 seconds, or makes the connection between the callee and the caller.
In case the phone receives a call, it rings. Either the user takes the call within the next 30 seconds, or the call is aborted.
When two phones are connected together, each phone sends a frame of voice data every 4.6 ms, and during 577 µs. The conversation stops whenever either the caller or the callee phone decides to stop the call.

2.1 Analysis (∼60 minutes)

(a) Make the use case diagram of this base station. (3 points)

(b) Make two scenarios, one for the nominal case, and one for a non-regular case. (2 points)

(c) Propose a collection of classes and objects (or SysML blocks) for this system. (1 point)

(d) Refine the two previously performed scenarios. (3 points)

2.2 Design (∼40 minutes)

(a) Propose a design. It may either be based on a UML class diagram and a composite structure diagram (i.e., UML design), or on a SysML block diagram (i.e., a SysML design). (3 points)

(b) Make the state diagram of the most important class (or block) of your system. (3 points)