

## MTAT.03.229 – Enterprise System Integration

### Regular Exam – 2 January 2012

(40 points)

**Notes:**

- The exam is open-book and open-laptop. Web browsing is allowed, but you are not allowed to use e-mail clients nor instant messaging clients.
- If you find that there is not enough information in the text below to answer a given question, and you need to make additional assumptions, please write down your assumptions together with your answer.

Sparks AS is a company providing automotive maintenance services. Below is a summary of the landscape of existing information systems within Spark AS, their users and the main business process that these systems are intended to support.

### **Entities**

Within Sparks, the order management system maintains information related to maintenance activities. The *order management system* interacts with the following parties:

- *The customer:* customers may interact directly with the order management system for the purpose of tracking a maintenance activity (also called a “work order”).
- *Clerks* in the customer service department as well as team leaders in the repairs department have access to the order management system for the purpose of creating, viewing and updating work orders.
- *The warehouse management system:* the order management system may interact with the warehouse management system to check for the availability of parts that are needed in a work order and to order such parts. Employees in the warehouse also interact with this system to check stock levels and order new parts (especially for commonly-used parts). The system also maintains information about the prices of the parts available in the warehouse.
- *The reseller’s catalogue:* the order management system may interact with a catalogue provided by a certified reseller to order parts that are required in a work order and not available in the warehouse.
- *The garage booking system:* the order management system interacts with the garage booking system to book a service bay and a mechanic to perform the required work. Mechanics have access to the garage booking system.
- *Insurance information system:* a customer’s vehicle may be insured in which case repairs need to be billed to the insurer. The insurance information system maintained by each insurance company maintains information of insurance details of customers. This system also accepts invoices for repairs made to vehicles of insured customers.
- *Financial system.* A separate sub-system at Sparks that is responsible for issuing invoices (and that also provides many other functions that are not relevant to this scenario).

## **Business Process**

The following text is a description of the “work order request” business process. It was written down by an external consultant 3 years ago and was given as part of the requirements to the team that built the order management system. It does not reflect exactly how Spark AS currently works, but rather how it should work according to this consultant.

The order management business process starts with the receipt of a request for work order from a customer. It finishes when either the order management system schedules an appointment with the customer or the customer rejects the quote for work order.

Upon the receipt of a request for work order, the order management system (with input from a customer service officer) estimates the required supplies, spare parts and labour and prepares a quote with the estimated cost for the maintenance activity. If the customer says that his vehicle is insured, the order management system communicates with the relevant insurance company’s information system to determine if the insurance company will accept to pay for the repair. There is one insurance information system per insurance company. At present, Spark deals with two insurance companies, but other companies might be connected to Sparks in future.

Depending on the insurance plan, the customer’s insurance may cover for the full maintenance costs or a contribution may be required from the customer and this needs to be taken into account to prepare a quote.

After the insurance check, the order management system prepare and sends the quote to the customer, who can either accept or reject the quote through the order management system. If the customer accepts the quote, the order management system contacts the warehouse management system to check if the required parts are in stock before scheduling an appointment with the customer. If some parts are not in stock, the order management system notifies the customer who can decide whether to obtain the parts by themselves, or to order them through Sparks. In both cases, the customer communicates their decision to the customer service department. If the customer decides that Sparks has to provide for the required parts, the customer service department orders the required parts by interacting with the catalogue of a certified reseller.

Once all required parts are in stock or have been ordered, the order management system schedules an appointment with the customer to bring their vehicle in, and interacts with the garage booking system to book a suitably-equipped service bay and a suitably-qualified mechanic to perform the work. Finally, a confirmation of the appointment is sent to the customer directly from the garage booking system.

After the car has been repaired, the customer comes to the customer service desk to pick up the keys. If the customer is satisfied by the repair, the invoices are produced by a separate “financial system”. If the insurance company is paying, the invoice is sent directly to the insurance company. If the customer is paying, the invoice is issued immediately to the customer. In some cases, one invoice (for part of the amount) is sent to the insurance company, and another invoice (for the remaining amount) is issued to the customer.

### **Tasks:**

1. Design a Level 0 interaction diagram for the Sparks order management system. **[5 points]**

2. Design a choreography for the above process. You can use Flowcharts, UML activity diagrams, BPMN or Sequence Diagrams to present the choreography. **[5 points]**
3. Design a service-oriented architecture for Spark's order management system. Your design should show the services and front-end applications involved in the SOA and the main dependencies between these services. For each front-end application and for each service in the SOA, you should indicate the scope and purpose of the front-end/service. To present your proposed SOA, you may use textual descriptions, diagrams (e.g. layered architecture diagrams) or a combination of text and diagrams. **[10 points]**
4. For each service you identified in Task 2, describe the operations of this service, including the inputs and outputs of each operation. **[15 points]**
5. Provide a state diagram for the main resource(s) involved in this scenario. The term "resource" should be interpreted in the sense given to this term in Web-based architectures (e.g. REST). **[5 points]**