Exercise 1 of CS2310 - Software Engineering

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Problem: *The purpose of this exercise is to experiment with patterns in software engineering. (a) Use the IC cards to specify the activities involved in organizing a personal health care system such as processing sensor input from blood pressure meter, body temperature, heart rate and so on, scheduling routine and non-routine appointments with physician, obtaining and processing prescriptions, following up test results and so on. (b) Can you identify certain patterns from the above activities? Describe some of the patterns you have identified. (see the article by James Coplien.)*

1. Activities Specification

The heath caring can be generally divided into several phases, including medical data collection, physician appointment, diagnosis, procedure/prescription and billing, etc. And, the phases are performed in sequential steps, which are described using IC cards as shown in Appendix section.

1.1. Organize the health care

Multiple members, such as nurse, physician and therapist, will be involved, and each will do a specific task. And, thus a top level IC card is used to organize the complicated tasks.

IC card is shown in Figure 4a.

1.2. Collect data

Here, we assume the patients are capable of collecting the sensor data by themselves and then they remotely send the data to nurses to let them make an initial judgement. And, we further assume the nurses just keep the data and decisions, wait for the later appointment call from the patients.

IC card is shown in Figure 4b.

1.3. Schedule physician

Now, the patient starts to call the hospital to make an appointment with a physician.

IC card is shown in Figure 4c.

1.4. Make appointment with physician

The front office checks the schedule of the specified physician to determine accept or reject the patient's appointment.

IC card is shown in Figure 5a.

1.5. Registration

The patient walks into hospital to receive diagnosis and treatment. And he or she first registers at front office.

IC card is shown in Figure 5b.

1.6. Diagnosis

After the registration is done, the patient receives diagnosis of physician.

IC card is shown in Figure 5c.

1.7. Procedure

With the diagnosis results of the physician, the therapist or nurse does the procedure.

IC card is shown in Figure 6a.

1.8. Prescription

With the prescription, the pharmacist gives drugs to the patient.

IC card is shown in Figure 6b.

1.9. Billing

Now, all is done and the payment comes.
IC card is shown in Figure 6c.

2. Patterns Identification

The identified patterns are reported as follow:

2.1. One complicated task can be decomposed into several sub ones to solve.

The whole health care system is complicated and time consuming, and multiple people are being involved. To make things controllable and doable, we just divide the whole task into several smaller ones, and each person, or a group of person, just take care of a specific job. For instance, the nurse just receives the medical data from patients and do an initial judgement for physicians; and front office just helps patients to do the registration and also prepares the final bills.

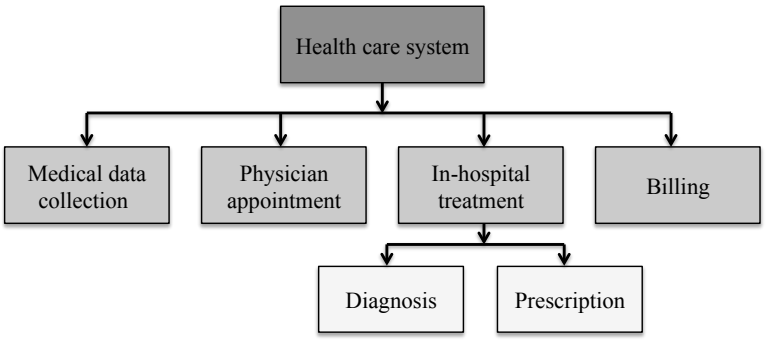

Figure 1: Pattern - subjob.

2.2. Different agents should collaborate with each other to finish a task.

Sounds likewise to the aforementioned pattern? Yes, it is the counterpart. By dividing a task into sub-jobs, each piece can be easily finished. However, sub-job are not solely independent with each other, they should takes the input from certain task and also outputs to some other tasks, and they together should ensure the whole task proceed smoothly. Pretty like Map-Reduce philosphy.

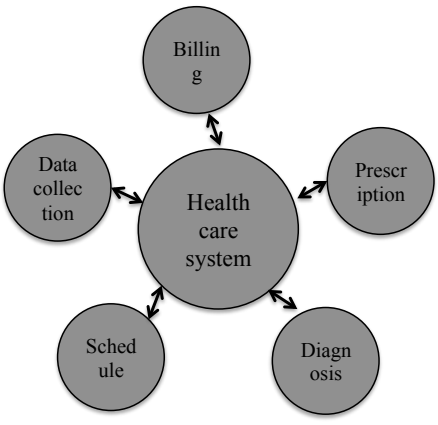

Figure 2: Pattern - collaboration.

2.3. One prerequisite task must be finished before moving to the next step.

The steps are moving in chronological order, partially like an assembly line. Without the previous steps being done, the following steps cannot be performed. For example, if the patients haven't collected the data, the nurse cannot give a judgement and the following appointment cannot be triggered; and further, the physicians, therapists and pharmacist do noting but just waiting.

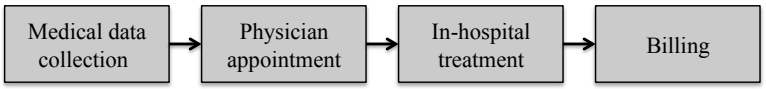

Figure 3: Pattern - chronological order.

3. Appendix

IC Card IC Name: Organize health care

Description: Organize a personal health care system
Interaction Pattern:

Mixed
My Task: Organize all members to prepare for the health care
Time Critical Condition: Must be done before the health care starts
Name of Other IC: Staff members
Message to Other IC: Please be prepared for health care
Other IC's Task: Prepare for health care
Card 1of 1 (If necessary please use several IC cards to describe an IC)

(a) organize

IC Card IC Name: Record medical data

Description: Record sensor inputs
Interaction Pattern:

By Myself with Interaction
My Task: Collect necessary medical data for physician
Time Critical Condition: None
Name of Other IC: Nurse
Message to Other IC: Here is my sensor records
Other IC's Task: Take down the data and recommend physician
Card 1of 1 (If necessary please use several IC cards to describe an IC)

(b) data collection

IC Card IC Name: Schedule a physician

Description: Schedule an appointment a physician
Interaction Pattern:

By Myself with Interaction
My Task: Schedule a physician
Time Critical Condition: None (schedule is still on-going)
Name of Other IC: Front office
Message to Other IC: I want to schedule with physician xxx.
Other IC's Task: Check the schedule
Card 1of 1 (If necessary please use several IC cards to describe an IC)

(c) schedule physician

Figure 4: IC cards 1-3

IC Card IC Name: Handle appointment

Description: Check the schedule to decide accept or reject the appointment
Interaction Pattern:

By Others with Interaction
My Task: Check the available time of nurses and physicians
Time Critical Condition: None (schedule is still on-going)
Name of Other IC: Nurse, Physician
Message to Other IC: When are you available to have a health care?
Other IC's Task: Vote available time slots
Card 1of 1 (If necessary please use several IC cards to describe an IC)

(a) appointment with physician

IC Card IC Name: Front office registration

Description: Patient walks in to have the health care
Interaction Pattern:

By Others with Interaction
My Task: Help the patient to finish the registration
Time Critical Condition: Finish before the predetermined time
Name of Other IC: Nurse, Physician
Message to Other IC: The patient is registering, please be prepared
Other IC's Task: None
Card 1of 1 (If necessary please use several IC cards to describe an IC)

(b) registration at front office

IC Card IC Name: Diagnosis

Description: Physician do the diagnosis
Interaction Pattern:

By Others with Interaction
My Task: Do the diagnosis for the patient
Time Critical Condition: None
Name of Other IC: Therapist, Nurse
Message to Other IC: Please do the procedure for this patient
Other IC's Task: Do the procedure
Card 1of 1 (If necessary please use several IC cards to describe an IC)

(c) diangnosis

Figure 5: IC cards of 4-6

IC Card IC Name: Do procedure

Description: Do the procedure according to the diagnosis
Interaction Pattern:

By Others with Interaction
My Task: do the procedure and provide prescription
Time Critical Condition: none
Name of Other IC: Pharmacist
Message to Other IC: Please give drugs with the prescription
Other IC's Task: Give drugs
Card 1of 1 (If necessary please use several IC cards to describe an IC)

(a) procedure

IC Card IC Name: Give drugs

Description: Give drugs according to the prescription
Interaction Pattern:

By Myself with Interaction
My Task: Provide drugs to patient
Time Critical Condition: None
Name of Other IC: Front office
Message to Other IC: Please do the billing
Other IC's Task: Prepare the bill
Card 1of 1 (If necessary please use several IC cards to describe an IC)

(b) drugs

IC Card IC Name: Billing at front office

Description: Do the billing
Interaction Pattern:

By Myself with Interaction
My Task: Prepare the bill for patient
Time Critical Condition: None
Name of Other IC: None
Message to Other IC: None
Other IC's Task: None
Card 1of 1 (If necessary please use several IC cards to describe an IC)

(c) billing

Figure 6: IC cards of 7-9