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Exercise #1

For this exercise, I designed by first creating the root IC cards in the hierarchy, patient, doctor, and pharmacist. Next, for each individual I created the IC cards for software/mechanical functionalities that each individual would require. Finally, the lowest level of ICCs relates to the sensors that support the functions of the software/mechanical ICCs. Among each ICC there are many tasks, and therefore there are several cards for reach to support all tasks. Additionally, for the doctor and patient they both require a calendar IC. To support this, I created only one ICC type of a calendar app, since both doctor and patient could have different instances of the same ICC type. This is similar to the concept of having multiple object instances of the same type supporting different programs.

This hierarchical structure for the patient is a pattern that solves the problem of informing individuals and healthcare professionals with health updates. The environment in this case includes the patient, but it also extends to their physician and emergency medical services, in the event of a critical need. To solve this problem, the patient and physician ICs interact with a healthcare app and healthcare database IC. The information is fed to the healthcare database through a series of requests to the healthcare app. Further extending this information, the healthcare app communicates with a set of lower level sensor IC cards that collect an assortment of health readings from the patient. This is similar to Coplien's HOPP structure, which relied on local symmetry to provide coverage of tasks to upper levels. The sensors provide this symmetry to cover the tasks necessary to provide the health app with information.

The serialization of patient-doctor process is another pattern, which solves the lifecycle of medical treatment. As stated before through sensing and collection, the information is aggregated, compiled, and finally analyzed by the roots of the IC Card tree. This process is connected to bring the doctor, pharmacist, and patient, together to provide healthcare services to the patient. In order to address an individual's health ailments, the doctor is informed through the interaction with the health database and examining the patient. Continuing through this process the doctor can choose to utilize other tools to test the patient. If necessary, the doctor transitions the medical care from his/her responsibility to the pharmacist, when the patient receives the prescription. Continuing through this process, the patient makes a context change to the pharmacy. At this point, the prescription is received through the pharmacist's interaction with the patient and prescription database. When the prescription is filled, this closes the patient's process to receive healthcare treatment.

Patient

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

By Others with Interaction

My Task: Walk
Time Critical Condition: Not Critical
Name of Other IC: Sensor - Accelerometer
Message to Other IC: None
Other IC's Task: Measure the motion of the phone
Card 1of 11 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

Mixed

My Task: Examine the calendar dates available
Time Critical Condition: upon need
Name of Other IC: Calendar
Message to Other IC: Request display dates
Other IC's Task: Display calendar
Card 2of 11 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

Mixed

My Task: Enter appointment information
Time Critical Condition: Not Critical
Name of Other IC: Calendar
Message to Other IC: This is my appointment time and date
Other IC's Task: Store appointment time
Card 3of 11 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

Mixed

My Task: Patient weighs self and enters weight into health app
Time Critical Condition: Once a day
Name of Other IC: Scale, Health App
Message to Other IC: This is my current weight to Health App
Other IC's Task: Weigh patient (scale), Store weight (health app)
Card 4of 11 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

By Others no Interaction

My Task: Open and look at Health App
Time Critical Condition: Not Critical
Name of Other IC: Health App
Message to Other IC: Open health app
Other IC's Task: Display health information
Card 5of 11 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

Mixed

My Task: Decide on the next appointment
Time Critical Condition: upon need
Name of Other IC: Doctor
Message to Other IC: Does this date work
Other IC's Task: This date works
Card 6of 11 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

By Myself no Interacton

My Task: Go to doctors office
Time Critical Condition: upon appointment
Name of Other IC: none
Message to Other IC: none
Other IC's Task: none
Card 7of 11 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

By Others with Interaction

My Task: Get prescription from doctor
Time Critical Condition: upon need
Name of Other IC: Doctor
Message to Other IC: none
Other IC's Task: Information about the prescription
Card 8of 11 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

By Myself no Interacton

My Task: Go to pharmacy
Time Critical Condition: upon need
Name of Other IC: none
Message to Other IC: none
Other IC's Task: none
Card 9of 11 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

Mixed

My Task: Give authentication information and prescription to pharmacist
Time Critical Condition: Upon request

Name of Other IC: Pharmacist
Message to Other IC: authentication and prescription
Other IC's Task: authenticate the patient and prescription
Card 10of 11 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Patient
Description: Person who is utilizing the health software
Interaction Pattern:

By Others with Interaction

My Task: Get prescribed drugs from pharmacist
Time Critical Condition: upon need
Name of Other IC: Pharmacist
Message to Other IC: none
Other IC's Task: Give prescribed drugs and information about the drugs
Card 11of 11 (If necessary please use several IC cards to describe an IC)

Health App

IC Card

IC Name: Health App
Description: Collect and analyze health information from sensors
Interaction Pattern:

Mixed

My Task: Collect health information from sensors
Time Critical Condition: Intermediate sampling from sensors
Name of Other IC: Sensor ICs
Message to Other IC: Display sensor values
Other IC's Task: Send sampled sensor values
Card 1of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Health App
Description: Collect and analyze health information from sensors, send information to doctors, and notify EMS in an emergency.
Interaction Pattern:

Mixed

My Task: Notify EMS because of emergency vital signs
Time Critical Condition: Immediate
Name of Other IC: EMS
Message to Other IC: Send an ambulance
Other IC's Task: EMS will send an ambulance to get the individual
Card 2of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Health App
Description: Collect and analyze health information from sensors, send information to doctors, and notify EMS in an emergency.
Interaction Pattern:

By Myself with Interaction

My Task: Display health stats to patient when requested
Time Critical Condition: At patients request
Name of Other IC: Patient
Message to Other IC: Display of the patients vitals
Other IC's Task: Phone needs to display health information
Card 3of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Health App
Description: Collect and analyze health information from sensors, send information to doctors, and

notify EMS in an emergency.
Interaction Pattern:

By Myself no Interacton

My Task: Analyze health information calculating average and standard deviation
Time Critical Condition: Intermediate sampling from sensors then analyze
Name of Other IC: None
Message to Other IC: None
Other IC's Task: None
Card 4of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Health App
Description: Collect and analyze health information from sensors, send information to doctors, and notify EMS in an emergency.
Interaction Pattern:

By Myself with Interaction

My Task: Send collected health information to physician
Time Critical Condition: Send sensor information periodically (as specified)
Name of Other IC: Doctor Patient Database
Message to Other IC: Send average values and standard deviations of vital signs

Other IC's Task: Receive the information
Card 5of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Health App
Description: Collect and analyze health information from sensors, send information to doctors, and notify EMS in an emergency.
Interaction Pattern:

Mixed

My Task: Collect and store weight information
Time Critical Condition: Upon entry by patient
Name of Other IC: Patient
Message to Other IC: None
Other IC's Task: Enter weight information
Card 6of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Health App
Description: Collect and analyze health information from sensors, send information to doctors, and notify EMS in an emergency.
Interaction Pattern:

Mixed

My Task: Collect accelerometer info
Time Critical Condition: Peridically
Name of Other IC: Sensor - Accelerometer
Message to Other IC: Send motion information
Other IC's Task: Submit motion information
Card 7of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Health App
Description: Collect and analyze health information from sensors, send information to doctors, and notify EMS in an emergency.
Interaction Pattern:

By Myself no Interacton

My Task: Computer Steps
Time Critical Condition: When no accelerometer data is receieved
Name of Other IC: None
Message to Other IC: None
Other IC's Task: None
Card 8of 8 (If necessary please use several IC cards to describe an IC)

Calendar App

IC Name: Calendar App
Description: Store and notify patient of upcoming appointments
Interaction Pattern:

By Myself with Interaction

My Task: Notify patient of appointment
Time Critical Condition: 1 day before
Name of Other IC: Patient
Message to Other IC: Display notification
Other IC's Task: None
Card 1of 2 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Calendar App
Description: Store and notify patient of upcoming appointments
Interaction Pattern:

Mixed

My Task: Store calendar information
Time Critical Condition: Upon entry
Name of Other IC: Patient
Message to Other IC: None
Other IC's Task: Sends appointment information to app
Card 2of 2 (If necessary please use several IC cards to describe an IC)

Blood Pressure

IC Card

IC Name: Sensor - Blood Pressure
Description: Sample the patients blood pressure and send it to the health app when requested
Interaction Pattern:

By Myself with Interaction

My Task: Sample the patients blood
Time Critical Condition: Periodically
Name of Other IC: Patient
Message to Other IC: No message
Other IC's Task: No task
Card 1of 3 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Sensor - Blood Pressure
Description: Sample the patients blood pressure and send it to the health app when requested
Interaction Pattern:

Mixed

My Task: Send blood pressure to health app at request
Time Critical Condition: Upon request
Name of Other IC: Health App
Message to Other IC: Blood pressure values collected since last check

Other IC's Task: Collect blood pressure values
Card 2of 3 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Sensor - Blood Pressure
Description: Sample the patients blood pressure and send it to the health app when requested
Interaction Pattern:

By Myself no Interacton
My Task: Delete previously collected sensor information to free space
Time Critical Condition: After health app collects health information or sensor memory space reaches capacity
Name of Other IC: None
Message to Other IC: None
Other IC's Task: None
Card 3of 3 (If necessary please use several IC cards to describe an IC)

Body Temperature Sensor

IC Card

IC Name: Sensor - Body Temperature
Description: Sample the patients body temperature and send it to the health app when requested
Interaction Pattern:

By Myself no Interacton
My Task: Sample the patients body temperature
Time Critical Condition: Periodically
Name of Other IC: Patient
Message to Other IC: None
Other IC's Task: None
Card 1of 3 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Sensor - Body Temperature
Description: Sample the patients body temperature and send it to the health app when requested
Interaction Pattern:

Mixed
My Task: Send body temperature to health app at request
Time Critical Condition: Upon request
Name of Other IC: Health App
Message to Other IC: Send patients body temperature
Other IC's Task: Collect body temperature values
Card 2of 3 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Sensor - Body Temperature
Description: Sample the patients body temperature and send it to the health app when requested
Interaction Pattern:

By Myself no Interacton
My Task: Delete previously collected sensor information to free space
Time Critical Condition: After health app collects health information or sensor memory space reaches capacity
Name of Other IC: None
Message to Other IC: None
Other IC's Task: None
Card 3of 3 (If necessary please use several IC cards to describe an IC)

Heart Rate Sensor

IC Card

IC Name: Sensor - Heart Rate
Description: Sample the heart rate and send it to the health app when requested
Interaction Pattern:

By Myself with Interaction

My Task: Sample the patients heart rate
Time Critical Condition: Periodically
Name of Other IC: Patient
Message to Other IC: None
Other IC's Task: None
Card 1of 3 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Sensor - Heart Rate
Description: Sample the heart rate and send it to the health app when requested
Interaction Pattern:

Mixed

My Task: Send heart rate to health app at request
Time Critical Condition: Upon request
Name of Other IC: Health App
Message to Other IC: Send patients heart rate values
Other IC's Task: Collect heart rate values
Card 2of 3 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Sensor - Heart Rate
Description: Sample the heart rate and send it to the health app when requested
Interaction Pattern:

By Myself no Interacton

My Task: Delete previously collected sensor information to free space
Time Critical Condition: After health app collects health information or sensor memory space reaches capacity
Name of Other IC: None
Message to Other IC: None
Other IC's Task: None
Card 3of 3 (If necessary please use several IC cards to describe an IC)

Accelerometer Sensor

IC Card

IC Name: Sensor - Accelerometer
Description: Sensor that checks phone motion
Interaction Pattern:

By Myself no Interacton

My Task: Collect the motion as the phone moves
Time Critical Condition: Sample as motion changes
Name of Other IC: None
Message to Other IC: None
Other IC's Task: None
Card 1of 3 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Sensor - Accelerometer
Description: Sensor that checks phone motion
Interaction Pattern:

Mixed

My Task: Send collected motion information to health app
Time Critical Condition: Upon request
Name of Other IC: Health App
Message to Other IC: Sending motion information
Other IC's Task: Request motion information
Card 2of 3 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Sensor - Accelerometer
Description: Sensor that checks phone motion
Interaction Pattern:

By Myself no Interacton

My Task: Delete previously collected sensor information to free space
Time Critical Condition: After health app collects health information or sensor memory space reaches capacity
Name of Other IC: None
Message to Other IC: None
Other IC's Task: None
Card 3of 3 (If necessary please use several IC cards to describe an IC)

Pharmacist

IC Name: Pharmacist
Description: Examines patients, schedules appointments, and implements actions based on patient health
Interaction Pattern:

Mixed

My Task: Check prescription database for availability and if so debit quantity
Time Critical Condition: upon need
Name of Other IC: Prescription database
Message to Other IC: Is this drug available and if so remove needed quantity
Other IC's Task: Debit quantities stored
Card 1of 4 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Pharmacist
Description: Authenticate and administer prescription dosage
Interaction Pattern:

Mixed

My Task: Authenticate patient and prescription
Time Critical Condition: upon need
Name of Other IC: Patient
Message to Other IC: Ask for authentication information and prescription
Other IC's Task: Provide authentication information and prescription
Card 2of 4 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Pharmacist
Description: Authenticate and administer prescription dosage
Interaction Pattern:

By Myself no Interacton

My Task: Collect pharmaceutical drugs and place into appropriate container
Time Critical Condition: Upon request
Name of Other IC: none
Message to Other IC: none
Other IC's Task: none
Card 3of 4 (If necessary please use several IC cards to describe an IC)

IC Name: Pharmacist
Description: Authenticate and administer prescription dosage
Interaction Pattern:

By Myself with Interaction

My Task: Charge patient and give prescription
Time Critical Condition: After filling prescription
Name of Other IC: Patient
Message to Other IC: Prescription information
Other IC's Task: none
Card 4of 4 (If necessary please use several IC cards to describe an IC)

Health Database

IC Card	IC Card
IC Name: Health Database Description: Stores health information received from patients Interaction Pattern: Mixed My Task: Request and store health information Time Critical Condition: Periodically Name of Other IC: Health App Message to Other IC: Request to send health information Other IC's Task: Send health information Card 1of 2 (If necessary please use several IC cards to describe an IC)	IC Name: Health Database Description: Stores health information received from patients Interaction Pattern: Mixed My Task: Display health stats to doctor when requested Time Critical Condition: upon request Name of Other IC: Doctor Message to Other IC: Health data Other IC's Task: View and analyze health stats Card 2of 2 (If necessary please use several IC cards to describe an IC)

Prescription Database

IC Card	IC Card
IC Name: Prescription Database Description: Stores the quantity of prescription drugs available in the pharmacy Interaction Pattern: Quiet State My Task: Store entered quantities of drugs Time Critical Condition: none Name of Other IC: none Message to Other IC: none Other IC's Task: none Card 1of 2 (If necessary please use several IC cards to describe an IC)	IC Name: Prescription Database Description: Stores the quantity of prescription drugs available in the pharmacy Interaction Pattern: Mixed My Task: Display and if needed debit the quantity of the prescription drugs in the database Time Critical Condition: Upon request Name of Other IC: Pharmacist Message to Other IC: This is the amount of drug available Other IC's Task: Debit drug quantity when necessary Card 2of 2 (If necessary please use several IC cards to describe an IC)

Doctor

IC Card

IC Name: Doctor
Description: Examines patients, schedules appointments, and implements actions based on patient health
Interaction Pattern:

Mixed

My Task: Examine patient based on data and health status
Time Critical Condition: Based on appointment
Name of Other IC: Patient
Message to Other IC: Tells results of examination
Other IC's Task: Perform doctors actions when requested
Card 1of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Doctor
Description: Examines patients, schedules appointments, and implements actions based on patient health
Interaction Pattern:

Mixed

My Task: Schedule an appointment
Time Critical Condition: At end of visit
Name of Other IC: Patient

Message to Other IC: Determine an appointment that works for both patient and doctor
Other IC's Task: Determine a date that is acceptable
Card 2of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Doctor
Description: Examines patients, schedules appointments, and implements actions based on patient health
Interaction Pattern:

Mixed

My Task: Enter a new appointment in the calendar
Time Critical Condition: No
Name of Other IC: Calendar App (Doctor)
Message to Other IC: This is the appointment date
Other IC's Task: Store appointment date and time
Card 3of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Doctor
Description: Examines patients, schedules appointments, and implements actions based on patient health
Interaction Pattern:

Mixed

My Task: Examine available dates
Time Critical Condition: Not Critical
Name of Other IC: Calendar App (Doctor)
Message to Other IC: Request display dates
Other IC's Task: Display dates
Card 4of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Doctor
Description: Examines patients, schedules appointments, and implements actions based on patient health
Interaction Pattern:

Mixed

My Task: Consult/analyze patient status with health database
Time Critical Condition: Periodically
Name of Other IC: Health Database
Message to Other IC: Request display health information

Other IC's Task: Display health information
Card 5of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Doctor
Description: Examines patients, schedules appointments, and implements actions based on patient health
Interaction Pattern:

By Myself with Interaction

My Task: Write prescription
Time Critical Condition: upon need
Name of Other IC: Prescription Pad
Message to Other IC: Information about the prescription
Other IC's Task: None
Card 6of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Doctor
Description: Examines patients, schedules appointments, and implements actions based on patient health
Interaction Pattern:

Mixed

My Task: Operate scan machine for patient test
Time Critical Condition: upon need
Name of Other IC: Patient and Scan Machine
Message to Other IC: Operate buttons on scan machine
Other IC's Task: Perform scan
Card 7of 8 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Doctor
Description: Examines patients, schedules appointments, and implements actions based on patient health
Interaction Pattern:

By Myself with Interaction

My Task: Determine if follow up appointment is necessary
Time Critical Condition: Upon need
Name of Other IC: Test results
Message to Other IC: Print results
Other IC's Task: Produce results
Card 8of 8 (If necessary please use several IC cards to describe an IC)

Scan Machine

IC Name: Scan Machine
Description: Performs scan on patient and prints results
Interaction Pattern:

Mixed

My Task: Perform scan on patient
Time Critical Condition: Upon request
Name of Other IC: Doctor, Patient
Message to Other IC: None
Other IC's Task: Operate scan machine
Card 1of 2 (If necessary please use several IC cards to describe an IC)

IC Card

IC Name: Scan Machine
Description: Performs scan on patient and prints results
Interaction Pattern:

Mixed

My Task: Prints scanned results
Time Critical Condition: Upon request
Name of Other IC: Doctor
Message to Other IC: Printed results
Other IC's Task: Take results and analyze them
Card 2of 2 (If necessary please use several IC cards to describe an IC)

Prescription Pad

IC Card

IC Name: Prescription Pad
Description: Display an authenticated patient prescription
Interaction Pattern:

By Others with Interaction

My Task: Display prescription
Time Critical Condition: upon need
Name of Other IC: Doctor
Message to Other IC: None
Other IC's Task: Write the prescription
Card 1of 1 (If necessary please use several IC cards to describe an IC)