PACEMAKER ATAM

Team member: Tian Lian and Ying Zhang

ATAM Presentation

ATAM is a comprehensive approach to evaluate the software architecture. This approach not only reveals the situation in which the framework meets specific quality objectives, and because it recognizes that architectural decisions affect multiple quality attributes, we can make us more clearly aware of the link between quality objectives - that is, how many Quality goal.

Business Drivers Presentation

Most important functional requirements

The pacemaker is an electronic therapeutic instrument implanted in the body that discharges the electrical impulses of the energy provided by the battery to the pulse generator, through the conduction of the wire electrode, stimulates the myocardium in contact with the electrode, causes the heart to agitate and contract, Due to some arrhythmia caused by the purpose of cardiac dysfunction.

Business goals

To meet the needs of patients, and at the same time to get revenue.

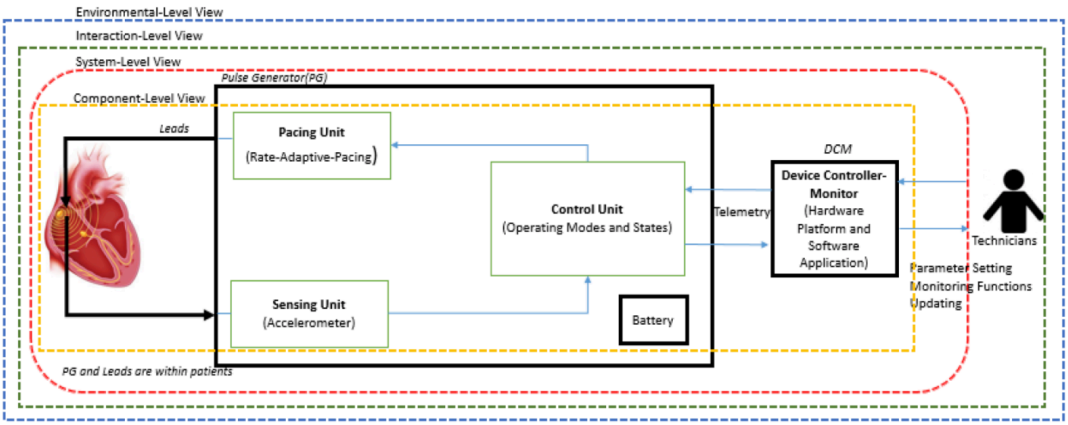
Major stakeholders

- User
- Developer
- Executive
- Tester

The architectural drivers

- Performance
- Availability

Architecture Presentation



Identify architectural approaches

Patterns and tactics

Availability – Feedback Control Loop
Maintainability – Modularity
Error tolerance – Feedback Control Loop
Modifiability – Splitting

Important scenarios

Scenario Refinement for Scenario 1		
Scenario(s):		Project manager ask developer to add a new feature that patients can transfer data of pacemaker to the server to store via WIFI.
Business Goals:		feature-rich product
Relevant Quality Attributes:		Modifiability
Scenario Components	Stimulus:	Project manager ask developer to add a new feature.
	Stimulus Source:	A required new feature, such as transferring data via WIFI.
	Environment:	When it is designed to add the new feature.
	Artifact (If Known):	
	Response:	Add the new feature components into the system then test it and deploy it.
	Response Measure:	Measure the influence on other components and the cost it will take.
Questions:		How much the new feature will cost?
Issues:		May need to train installers to prevent malfunctions and avoid potential legal issues.

Scenario Refinement for Scenario 2	
Scenario(s):	When the pacemaker is in low power about 10 percent left, it can proactively alert.

Business Goals:		Safest system
Relevant Quality Attributes:		Security
Scenario Components	Stimulus:	The pacemaker is in low power.
	Stimulus Source:	Power of pacemaker.
	Environment:	After the pacemaker has been used for a few years, the pacemaker will be in low power.
	Artifact (If Known):	Hardware
	Response:	The pacemaker can proactively alert when in low power.
	Response Measure:	10 percent power left.
Questions:		How big alert should the pacemaker make?
Issues:		May need to train tester to do lots of test to control the alert.

Scenario Refinement for Scenario 3		
Scenario(s):		When patient's heart rate changes suddenly, developer has to make sure that the pacemaker will change the pulse rate relatively in less than one millisecond.
Business Goals:		safest system; feature-rich product
Relevant Quality Attributes:		Performance
Scenario Components	Stimulus:	patient's heart rate changes suddenly
	Stimulus Source:	heart rate
	Environment:	Pacemaker in patient's heart, and heart rate changes.
	Artifact (If Known):	Monitor-controller, software components
	Response:	pacemaker changes the pulse rate
	Response Measure:	one millisecond
Questions:		What is the range of changes of heart rate
Issues:		May change the hardware components.

Scenario Refinement for Scenario 4		
Scenario(s):		When the customer wants to know the status of the pacemaker，customer can read the data from device transferred by WIFI at home.
Business Goals:		Convenient to use, Improve customer service
Relevant Quality Attributes:		Usability
Scenario Components	Stimulus:	The customer wants to know the status of the pacemaker, customer must go to the hospital.
	Stimulus Source:	Data of the pacemaker, such as heart rate.
	Environment:	The customer wants to know the status of the pacemaker.
	Artifact (If Known):	Hardware
	Response:	The data can be transferred by WIFI.
	Response Measure:	When the user requires the data.
Questions:		How large will the pacemaker be after the WIFI hardware be

	added?
Issues:	May need to design to be smallest.

Scenario Refinement for Scenario 5		
Scenario(s):		A beta version of pacemaker project is available for the customers in 12 months.
Business Goals:		Customer satisfactions
Relevant Quality Attributes:		Availability
Scenario Components	Stimulus:	A beta version of pacemaker project is available.
	Stimulus Source:	Customer
	Environment:	Normal operation
	Artifact (If Known):	System components
	Response:	A beta version of pacemaker is available.
	Response Measure:	Satisfy all the needs of customers and finish the project on time.
Questions:		How to clarify all of the use cases?
Issues:		May need to control costs within desired level.

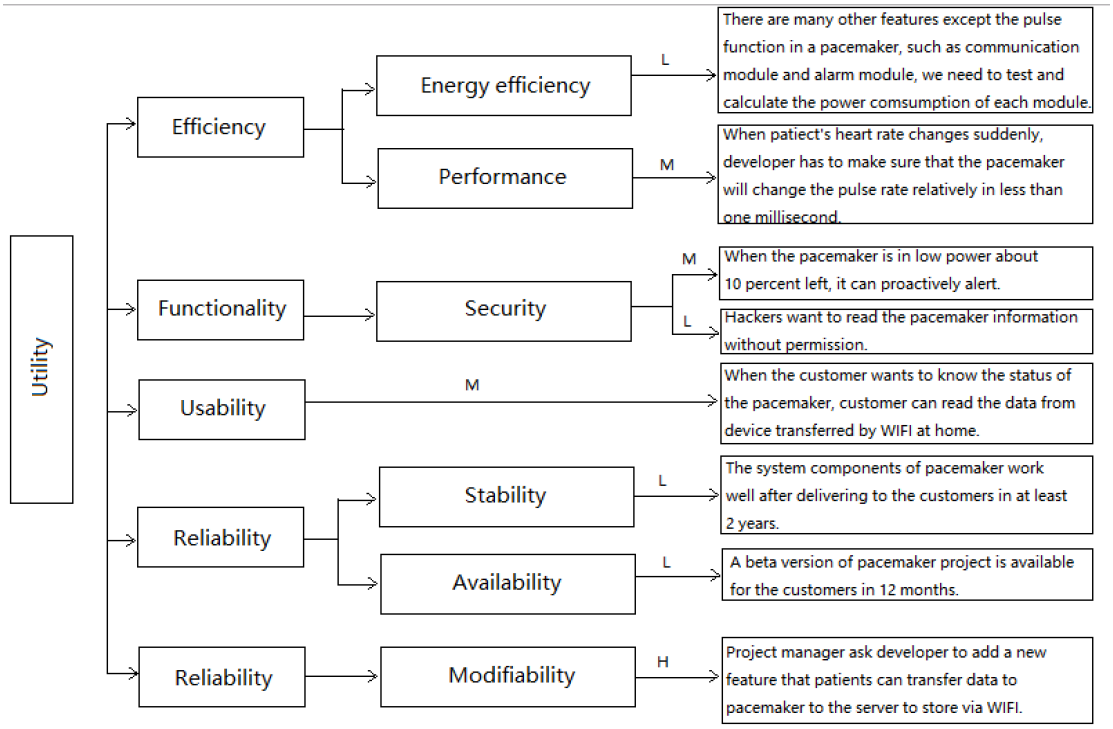
Scenario Refinement for Scenario 6		
Scenario(s):		The system components of pacemaker work well after delivering to the customers in at least 2 years.
Business Goals:		Few repairs
Relevant Quality Attributes:		Stability
Scenario Components	Stimulus:	A stable and robust product.
	Stimulus Source:	Customer service and technical support
	Environment:	Normal operation
	Artifact (If Known):	System components
	Response:	A stable product with few repairs.
	Response Measure:	In 2 years.
Questions:		What are the conditions or events that might lead to a service degradation?
Issues:		May need to find more reliable way to test the project before releasing.

Scenario Refinement for Scenario 7		
Scenario(s):		There are many other features except the pulse function in a pacemaker, such as communication module and alarm module, we need to test and calculate the power consumption of each module.
Business Goals:		Find a most energy efficient mode suit for pacemaker
Relevant Quality Attributes:		Energy efficiency
Scenario	Stimulus:	There are many features consuming power.
	Stimulus Source:	Both pacemaker company and users want the pacemaker to have more functions.

	Environment:	The pacemaker can not be charged unless we take it out
	Artifact (If Known):	
	Response:	We could constrain the running time for communication module, for example, set a window time in a day for user or doctor to download the record.
	Response Measure:	What if doctor need to read record under some emergency situation.
Questions:		What is the balance between power consumption and functionality?
Issues:		Pursuing the energy efficiency may cause some issues on both reliability and security.

Scenario Refinement for Scenario 8		
Scenario(s):		Hackers want to read the pacemaker information without permission.
Business Goals:		Prevent attack from hackers
Relevant Quality Attributes:		Security
Scenario Components	Stimulus:	Hackers trying to attack the pacemaker and the pacemaker do not have enough resources to prevent the attack.
	Stimulus Source:	Hacker
	Environment:	The doctor and users could communicate with pacemaker with a software or an app.
	Artifact (If Known):	Authorization server
	Response:	We could make sure the security of the client end
	Response Measure:	We need to run a authorization server
Questions:		What if the pacemaker itself got cracked?
Issues:		We may need to update the pacemaker version frequently

Generate Utility Tree



Prioritized scenarios list

Scenarios #	Descriptions	Votes
#1	Project manager ask developer to add a new feature that patients can transfer data of pacemaker to the server to store via WIFI.	4
#2	When the pacemaker is in low power about 10 percent left, it can proactively alert.	3
#3	When patient's heart rate changes suddenly, developer has to make sure that the pacemaker will change the pulse rate relatively in less than one millisecond.	3
#4	When the customer wants to know the status of the pacemaker, customer can read the data from device transferred by WIFI at home.	2
#5	A beta version of pacemaker project is available for the customers in 12 months.	1
#6	The system components of pacemaker work well after delivering to the customers in at least 2 years.	1
#7	There are many other features except the pulse function in a pacemaker, such as communication module and alarm module, we need to test and calculate the power consumption of each module.	1
#8	Hackers want to read the pacemaker information without permission.	1

Analyze architectural approaches

The highest ranked scenario is project manager ask developer to add a new feature that patients can transfer data of pacemaker to the server to store via WIFI.

We use modularity approach to ensure the modifiability, it makes the whole system decomposed and become easy to be modified.

trade-offs and risks:

Modifiability will increase maintainability, but meanwhile it may decrease the reliability.

Results presentation

The architectural approaches documented
The set of scenarios and their prioritization from the brainstorming
The utility tree The risks discovered
The trade-off points