IFPUG FP and SNAP Analysis of Wearable Devices

New Questions demand New Solutions!

ISBSG

IT Confidence 2020

Sushmitha Anantha
And
Saurabh Saxena

AGENDA

01

Wearable Devices

- Background,
- Growth
- Categories
- Communication model

02

Function Point Analysis for Wearable Devices

- Applications and Boundary Analysis
- Identifying Data Functions
- Sizing Transaction Functions

03

Beyond Function Points

- SNAP Approach
- Examples

04

What Else?

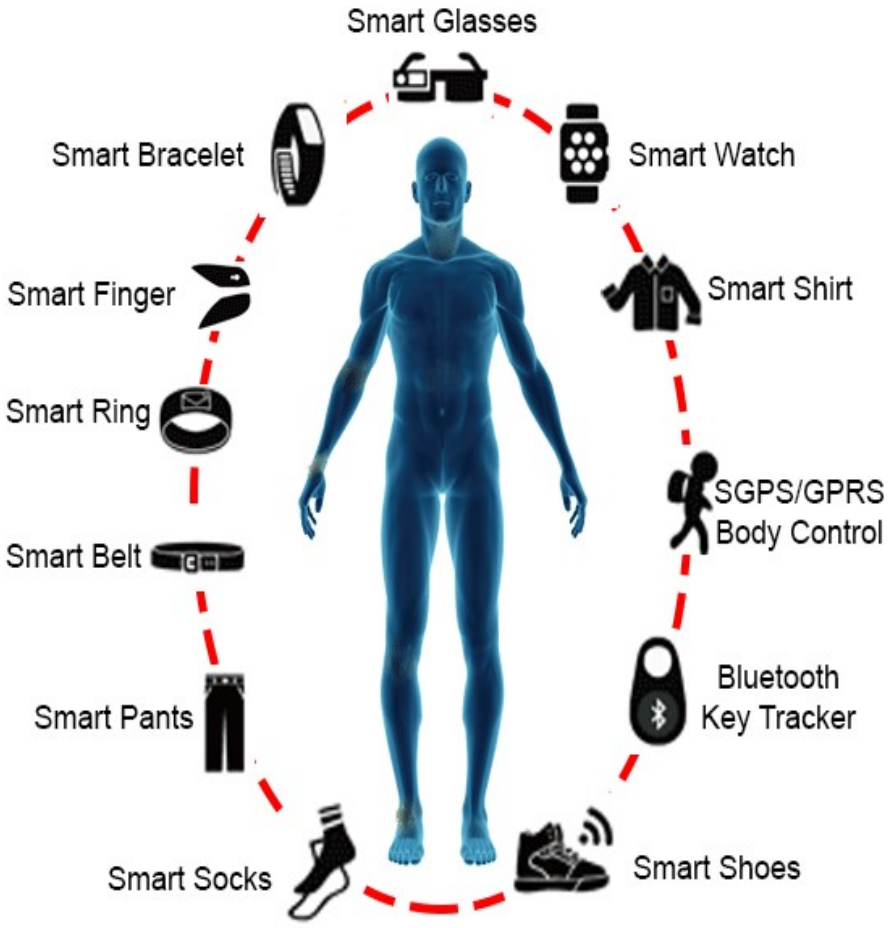
- Sizing Challenges
- Metric Questions - Productivity & Benchmarks?
- Road-ahead & Conclusion

About the Authors

- **Sushmitha** is a Function Point Expert and Productivity Champion working for a leading Services Organization with Global presence.
- She is the current IFPUG **Partnerships & Events Committee Chair**
- She has worked for more than a decade in the fields of function point, related metrics, and function points productivity measurement in different domains, methodologies and technologies.
- She has **authored various whitepapers** related to function point measurement and metrics

- **Saurabh** is a Certified Function Point Specialist from IFPUG & Certified Project Management Professional from PMI. He works for **Amdocs** India.
- He is the current Chairperson of IFPUG **International Membership Committee** and IFPUG India Country Representative
- He is Key member of **IFPUG SNAP** committee & is involved in SNAP development and implementation across the world
- He has vast experience providing **Training, Mentoring & Coaching** in Software Measurement, Benchmarking and Estimation domains

Wearable Devices - Background



What?

- Electronic technology or devices incorporated into items that can be comfortably worn on a body
- Used for seamless tracking information on real time basis and store it in cloud for various purposes.

The need

- Has potential influence on fields of health and medicine, fitness, aging, disability, education, transportation, enterprise, finance, fashion and more
- The US military employs headgear with displays for soldiers using a technology called holographic optics

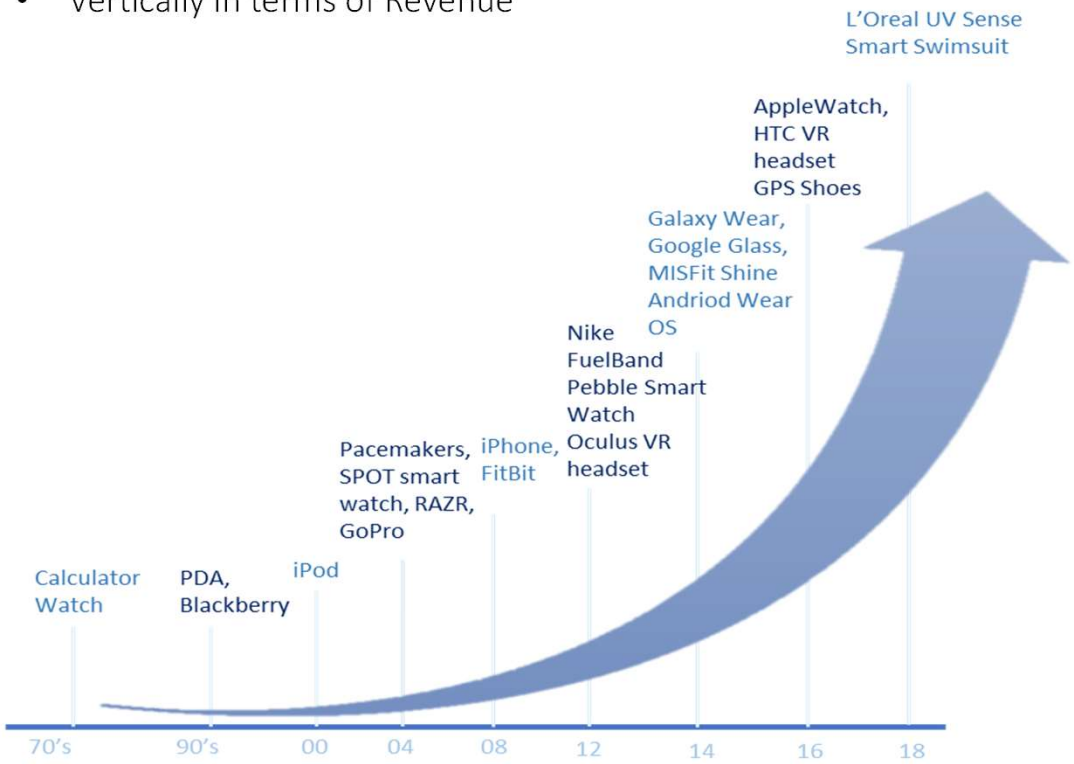
Challenges

- Creating meaningful impact on the users, their lives, habits or behaviors
- Limit Invasion of privacy - This is due to the huge amounts of data that has to be captured and transferred to companion/3rd party applications
- Limited display area, limited computing power, limited volatile memory, non-conventional shape of the devices, abundance of sensor data, complex communication patterns of the apps, and limited battery size

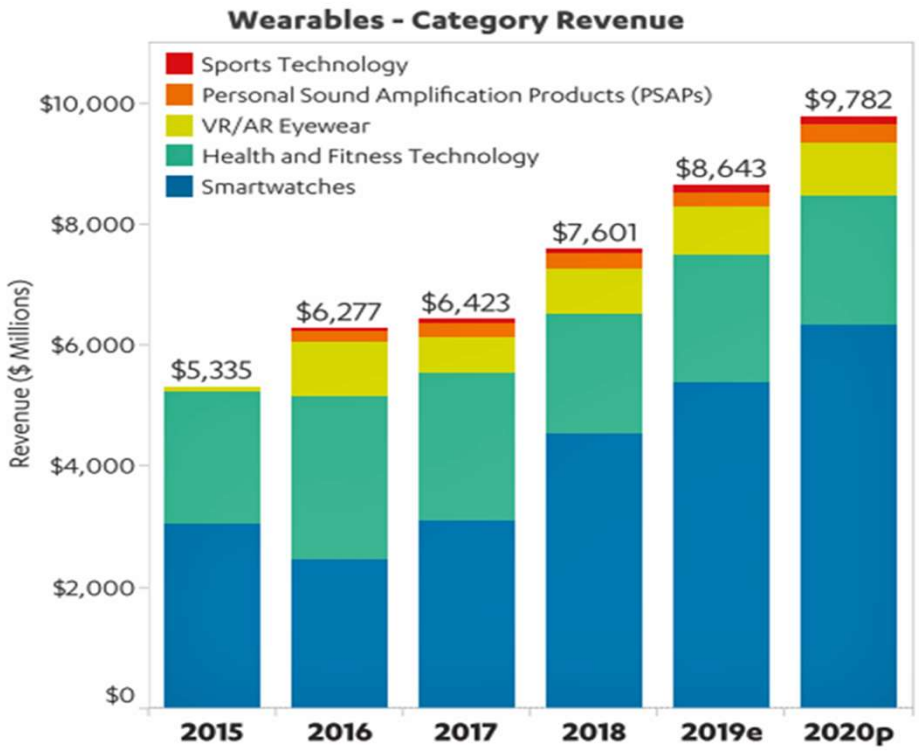
Wearable Devices - Growth

Growth of Wearable Devices and Technology

- Horizontally covering more and more areas
- Vertically in terms of Revenue



Indicative Timeline of Wearable Technology Growth conveyed through important products



U.S. Consumer Technology Sales and Forecasts, July 2019, Consumer Technology Association (CTA)

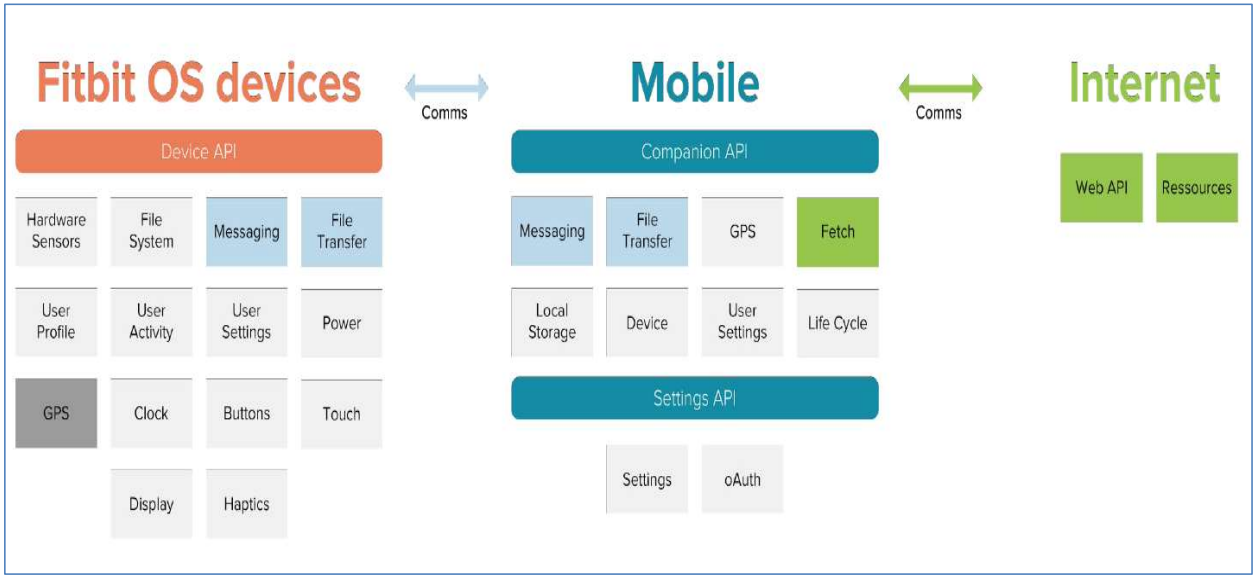
Wearable Devices – Categories

- Smart Watches: A watch that does more than just telling time. It provides users notifications on their calls, messages, emails, social media updates, etc.
- Fitness Tracker: Helps keep a track of the number of steps the user walks each day and continuously monitors the heart rate. Using this information, the devices is able to calculate and report accurate data on calorie burn and exercise done by the user.
- Head Mounted Display: Takes you to a different world of virtual reality. It provides virtual information directly to your eyes.
- Sports watches: The wearable devices is especially built for sports personnel who love running, cycling, swimming etc. These devices come with GPS tracker and records information on the user's pace, heart rate etc.
- Smart jewelry: Smartwatches are designed as jewelries specially targeting women. These jewelries notify the users of their text messages, calls or emails when their phone is out of reach.
- Smart Clothing: The smart electronic devices are incorporated into the Wearable Clothing to give an interesting and fashionable look.
- Implantable: These wearable electronics are surgically implanted under the skin. These are usually used for medical reasons like tracking contraception's, insulin levels etc.

Wearable Devices – Communication Model

For Simplification, we have taken FitBit Devices as example and approached the sizing problem

- FitBit Devices have local Storage and Sensors and Display for interaction with external world.
- They store limited data about User Profile and Activity
- Simple Apps on FitBit can access User Data
- FitBit Devices interact with Companion Devices such as Mobile.
- Companion Apps store the User Data and Analytics in Cloud. They support Dashboards, User Interaction and Progress Tracking.



Platform Architecture

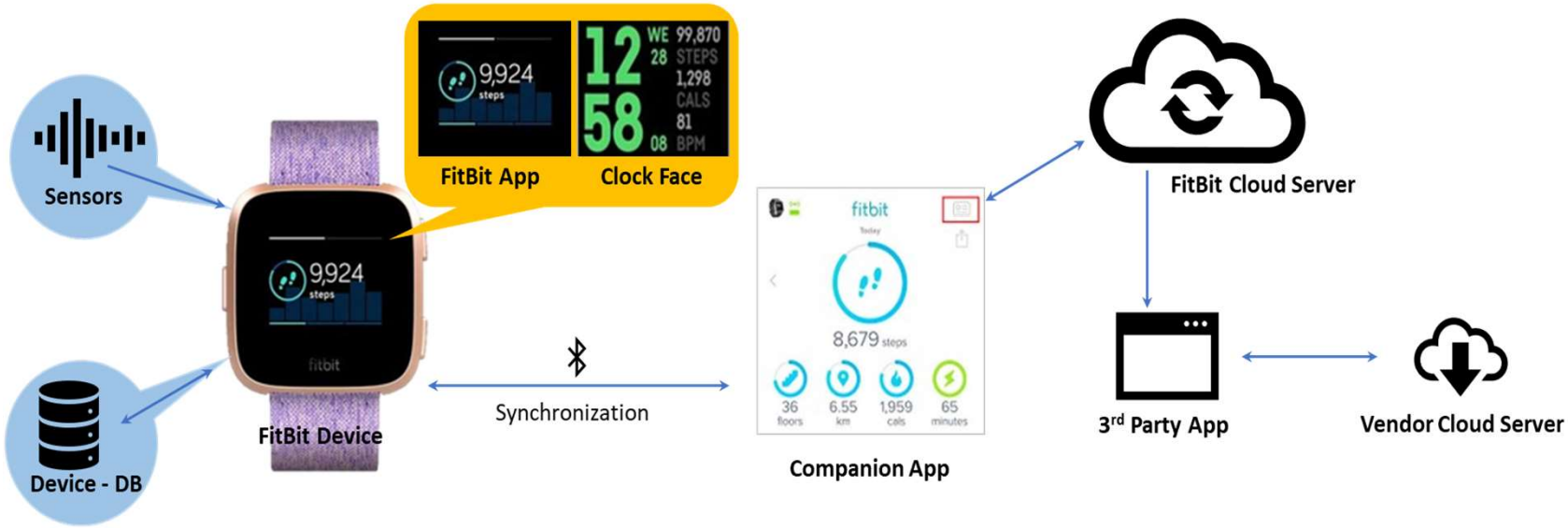
Function Points – Understanding

- IFPUG Function Point (FP) is a global standard to measure **size of software** in terms of functional requirements
- Measure based on functionality and **user view**
- Is **independent** of and isolated from how software is built, e.g., **language, technology, methodology, platform**
- **Linear, scalable and comparable**
  - 1000 FP = 2 x 500 FP
  - 3000 FP coded in COBOL in waterfall model ar e functionally equivalent to 3000 FP coded in J ava in Agile

Wearable Devices – Applications

Mainly two categories

1. Simple Apps and Clock faces on wearable devices
2. Companion Apps on companion devices such as mobile phone or PC



FPA of Wearable devices – Boundary Question

Purpose of Sizing → Scope of Sizing → Application Boundary

Apps on Fitbit and Mobile companion Apps - How to decide on the boundary?

- FitBit Companion Apps hosted on paired Mobile device and native Apps hosted in FitBit are to be treated as separate boundaries
- Web version of the Companion Apps may not qualify to be separate Application than the Mobile version

Purpose of the FP Sizing needs to be established before deciding on Application Boundary.
Hint: *User see Companion apps hosted on paired mobile devices providing additional functionalities/features than the native apps hosted in FitBit as providing. Web version and mobile version are same, just hosted on different platforms (should be counted in SNAP)*

Apps on Fitbit and clock faces

- Different Apps installed in FitBit need to be treated as separate Applications – Hint: *all providing different unique functionalities to user*

- All Clock faces from a single vendor can be treated as single Application Boundary. Clock faces designed by different vendor may have to be treated as separate boundary, based on the Purpose of FP Sizing – Hint: *separate development teams maintaining for different vendors, also associated measurement data, such as effort, cost, and defects tracked separately*

FPA of Wearable devices – Data Functions

- Consider what data Trackers can track
- Consider what data analysis and aggregation can result in?
- Consider the Application Boundaries
- Apply logical grouping and decide Data Functions

Internal Logical File (ILF) - user recognizable group of logically related data or control information maintained within the boundary of the application being measured

External Interface File (EIF) - user recognizable group of logically related data or control information, which is referenced by the application being measured, but which is maintained within the boundary of another application

FPA of Wearable devices – Data Functions

- Due to limited onboard memory, Fitbit devices only store high resolution data for 5-7 days
- Device must sync with Companion App at least once in 5 Days
- If a device has not synced for more than 5 days, the device will start to remove the oldest high-resolution data and store only daily aggregate values
- Typical Data stored in FitBit Device and Cloud are listed
- This Data Can be used to arrive at Logical Files

Data Stored on FitBit Device:

Granularity - Seconds, Minutes
- Heart Rate

Granularity - Minutes, Hours, Days
- Steps
- Intensity
- Calories
- Sleep Data

Granularity - Days
- Floors
- Distance
- Food Logs
- Activity Logs

Ad-Hoc
- Weight

Data Stored on FitBit Cloud:

Base Data
- Heart Rate
- Steps
- Intensity
- Calories
- Sleep Data
- Floors
- Distance
- Food Logs
- Activity Logs
- Weight

Analysis Trends
- Heart Rate
- Steps
- Calories
- Sleep Data
- Distance

Data Functions in Wearable Devices

Types of Data	Description	FitBit App/ FitBit Companion App/ External App/ Code data
Identifiers	User name, email address, mailing address, phone number, IP address, account ID, device ID, cookie ID, and other similar identifiers	FitBit App – ILF FitBit Companion App - ILF
Demographic information	Gender, age, health information, and physical characteristics or description	FitBit App – ILF FitBit Companion App - ILF
Commercial information	Basic payment information and records of the Services or devices you purchased, obtained, or considered (for example, if you added them to your shopping cart on the Fitbit online store but did not purchase them)	FitBit Companion App - ILF
Biometric information	Your exercise, activity, sleep, or health data, including the number of steps you take, distance traveled, calories burned, weight, heart rate, sleep stages, active minutes, female health data, Live Coaching Services data, etc.	FitBit App – Multiple ILFs FitBit Companion App – Multiple ILFs
Internet or Other electronic network activity information	The usage data we receive when you access or use our Services. This includes information about a) Interactions with the Services accessed	FitBit Companion App - ILF
	b) Information about the devices & computers you access the services, , including IP addresses, browser type, language, operating system, Fitbit or mobile device information (including device and application identifiers), the referring web page, pages visited, location (depending on the permissions user have granted Fitbit), and cookie information	Technical, not counted

Data Functions in Wearable Devices

Types of Data	Description	FitBit App/ FitBit Companion App/ External App/ Code data
Geolocation data	GPS signals, device sensors, Wi-Fi access points, and mobile tower IDs	FitBit App – ILF FitBit Companion App - ILF
Electronic, visual, or similar information	Your profile photo or other photos	FitBit Companion App DP is DET on User Profile
Professional or Employment related information	Any information (like your name, email address, or similar information) that your employer provides to us so that we can invite you to participate in or determine your eligibility for Fitbit Services that they offer to their employees	FitBit Companion App Professional Profile (ILF)
Bank payment details	Bank account number, Card details, details to make payments	FitBit Companion App - EIF
Other information	Additional account information such as your biography or country	FitBit Companion App – RET of User Profile ILF
	Information for features of the Services, for e.g., an alarm, information about your friends, and logs for food, weight, sleep, water, or female health tracking; Live Coaching Services data (provided by you or your coach); messages on the Services;	FitBit App – Alarm (ILF) FitBit Companion App Multiple ILFs – Friends, Sleep, Food, Weight etc.. Alarm
Inferences	Drawn from any of the above, including the number of calories you burned, distance you traveled, sleep insights, and personalized exercise and activity goals	FitBit Companion App -Analysis/Inferences (ILF)

Data Functions in Wearable Devices

Types of Data	Description	FitBit App/ FitBit Companion App/ External App/ Code data
Data with Vendors, Partners	Corporate affiliates, service providers, and other partners who process it for them. These partners provide Fitbit with services globally, including for customer support, information technology, payments, sales, marketing, data analysis, research, and surveys	Needs Case-by-Case Analysis
Legal Data	Information pertaining to law, regulation, legal process, or governmental compliance	Reference Only/ Static
Security information	Masked / Encrypted SPI data (Sensitive Personal Information)	Typically Non-Functional

FPA of Wearable devices – Transactions

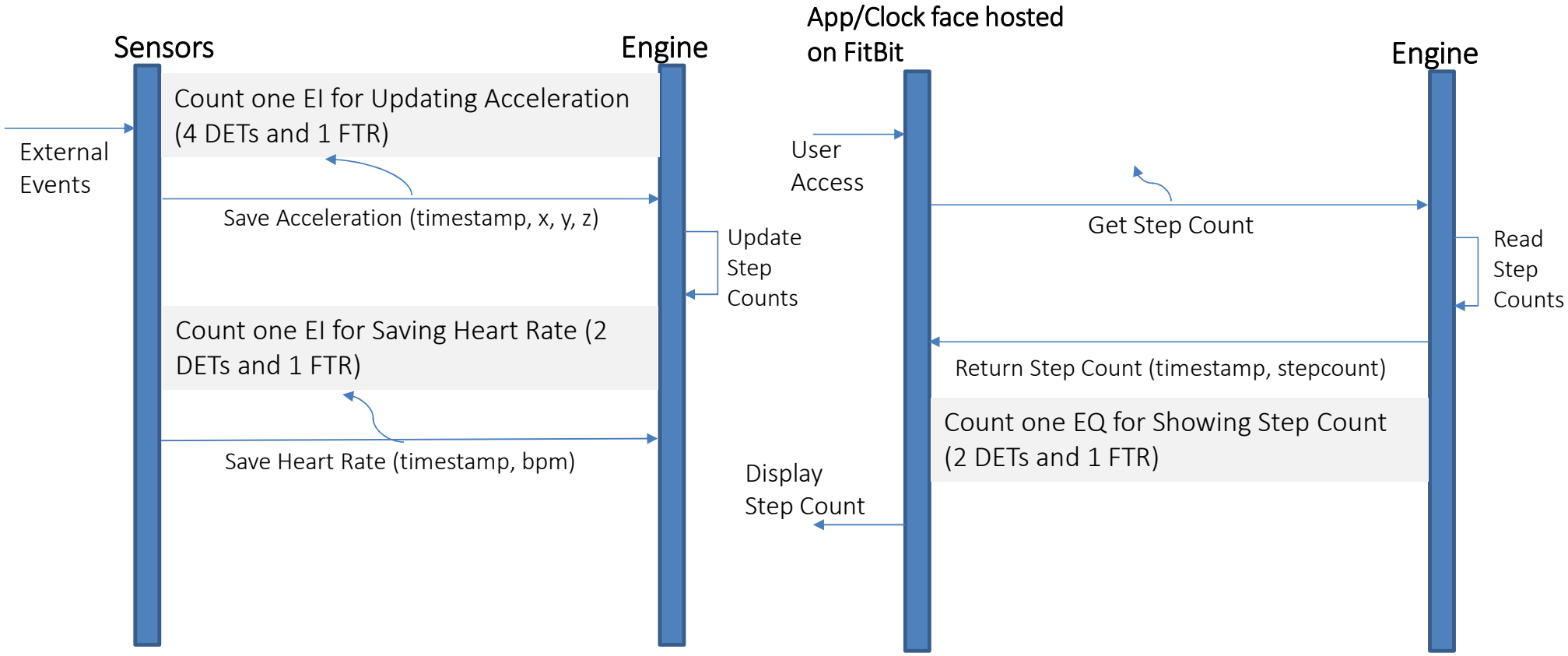
- Be aware of different modes of transactions on Bluetooth, using APIs and though UI screens
- Give a thought around data shared with third party applications
- The Device APIs are accessible by applications which run on Fitbit devices only
- The Companion APIs are accessible by applications which run within the Fitbit mobile application only

External Input (EI) - elementary process that processes data or control information sent from outside the boundary

External Inquiry (EQ) - elementary process that sends data or control information outside the boundary

External Output (EO) - elementary process that sends data or control information outside the boundary and includes additional processing logic beyond that of an External Inquiry

FPA of Wearable devices – Transactions



Transactions can be counted using the Interactions between the Apps, provided in the form of Sequence Diagram, Use case or Flow diagrams. APIs can provide DET details and FTRs can be identified with help of process flow.

FPA of Wearable devices – Transactions

Sizing Spotify App on FitBit

Prerequisites for Spotify to work:

- Device to be connected should have Spotify App and User Logged in
- Device must be connected with Internet

Features:

- List the devices to be connected
- FitBit communicates with Connected Device
- Control Spotify on the Connected Device via FitBit
- Play, Pause, Navigate, Shuffle
- Choose Playlists , Save Favorites

List shows possible devices to be paired with. 1 Control DET, 1 Displayed, Devices Data is Referred to Show the Names.

List of Devices – EQ (2 DETs, 1 FTR)

Connection request establishes link between devices and alters the behavior of the system. Device Name and Control DETs are considered with no explicit FTR.

Connect to Device – EO (2 DETs, 0 FTR)

All Commands such as Play, Pause, Shuffle, Favorite get executed in Paired Device.

Sizing Approach:

Paly – EO (5 DETs for screen + 2 For Communication, 1 FTR)

Pause – EO (1 DET for screen + 2 For Communication, 0 FTR)

Shuffle – EO (3 DETs, 0 FTR)

Favorite – EO (3 DETs, 0 FTR)

List Libraries and List Playlists can be considered as EQs.

List of Libraries – EQ (2DETs, 1 FTR)

List of Playlists – EQ (2 DETs, 1 FTR)

Remember:
On-Screen Transactions may accompany additional flows. Ensure evaluation of EP Rules such as Completeness while counting Transactions

Transactions can be counted using the UI Screen flows or Wireframe flows.

FPA of Wearable devices – Transactions

Approach:
FitBit Companion Apps hosted on paired Mobile device and native Apps hosted in FitBit are treated as separate boundaries

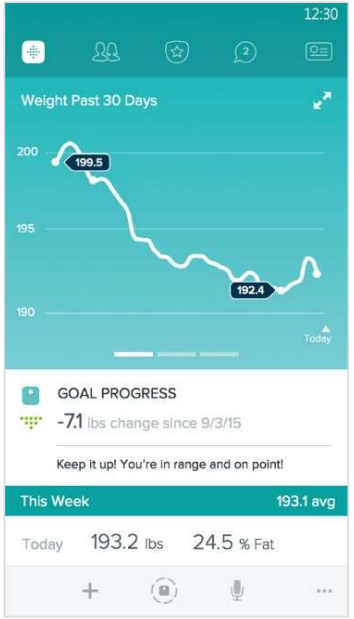
Non-trivial communication between FitBit App and Companion App must be evaluated when sizing transactions.

Though the cloud storage used by the Companion App resides outside the device, Logical Entities maintained on Cloud must be treated as 'internal'

Remember:
If transaction includes interaction with other Apps, unique DETs used for communication must be included.

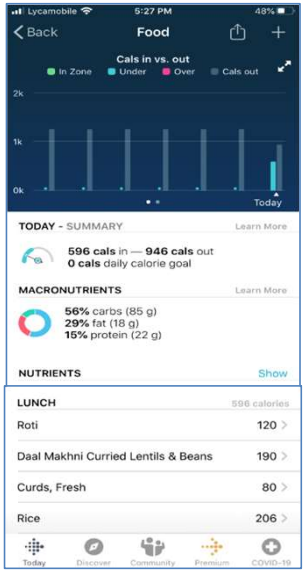
Dashboard Page is treated as Single Consolidated Report. Above Screen shows an EO with >19 DETs and >2 FTRs (At least Steps, Heart Rate, Device Status, Distance Metrics)

Goal Progress Screen is also an EO as it displays derived data and dynamic graphs. Displays around 12 DETs and 3 FTRs (Goal, Weekly Statistics and Progress)

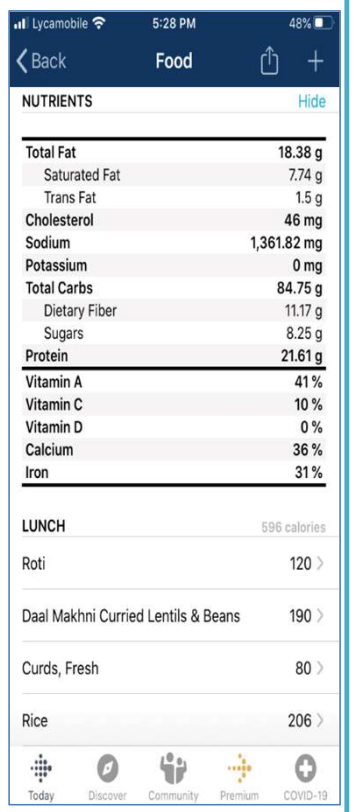


Counting Example 1

View Lunch details; DETs: 9 ('Date', 'Total Cals', 'Food item', 'Food item calories', 'Calories%', 'Fat%', 'Protein%', 1 each for Action and Messages); **FTRs**: 2 ('Food', 'Calories');
Average EO (5 FPs)



- Weekly Food dashboard
- Charts (1 Bar, 1 Gauge, 1 Pie)

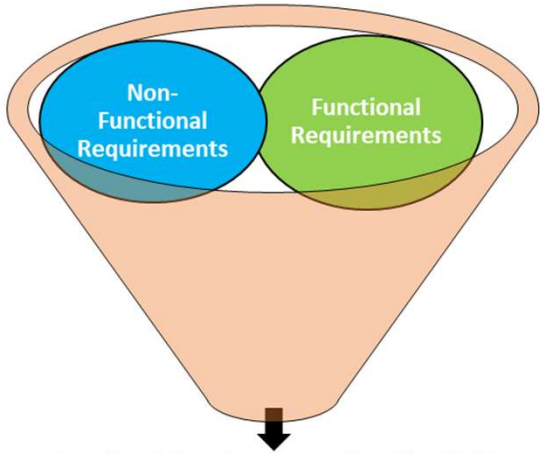


Drill down view Nutrients; EO

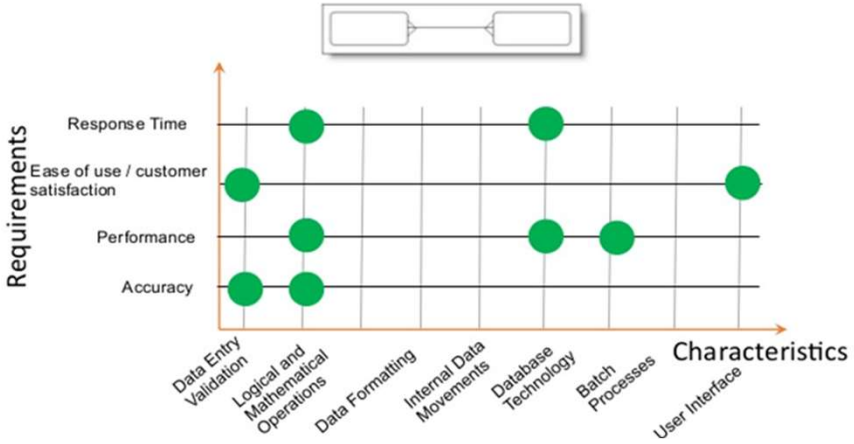
FPA of Wearable devices – What's left?

- Security Requirements
- Protocols used
- Platforms supported
- Cloud Support
- Clock faces with UI elements not adding Functionality

SNAP Approach



- Traditional projects enjoy great success with FP sizing
- Complex systems with multiple interfaces & layers of architecture report challenges to size FP
- Several requirements in projects not eligible for FP sizing
- IFPUG launched Software Non functional Assessment Process (SNAP) methodology to size non-functional requirements



Mapping Technical requirements into SNAP categories and sub-categories

- A requirement may have FRs (FP) and NFRs (SNAP)
- One NFR may fall under multiple categories of SNAP

Changes covered by SNAP

- Complex calculations behind calculation of heart rate, step count etc. (**1.2 Logical and Mathematical Operations**)
- Internal data transfer between components (**1.4 Internal Data Movements**)
- Displaying information in local language in addition to English (**1.3 Data Formatting, 3.2 Database Technology for code table creation**)
- Aesthetics – eye catching colorful & large fonts for texts, images, backgrounds (**2.1 User Interfaces**)
- Static text, static web pages, tool tips (**2.2 Help Methods**)
- Sensitive Personal Information (SPI) data should be encrypted and masked by the application before passing on to the other system (**1.3 Data formatting**)
- Mobile and Web version of same apps (**3.1 Multiple platforms**)

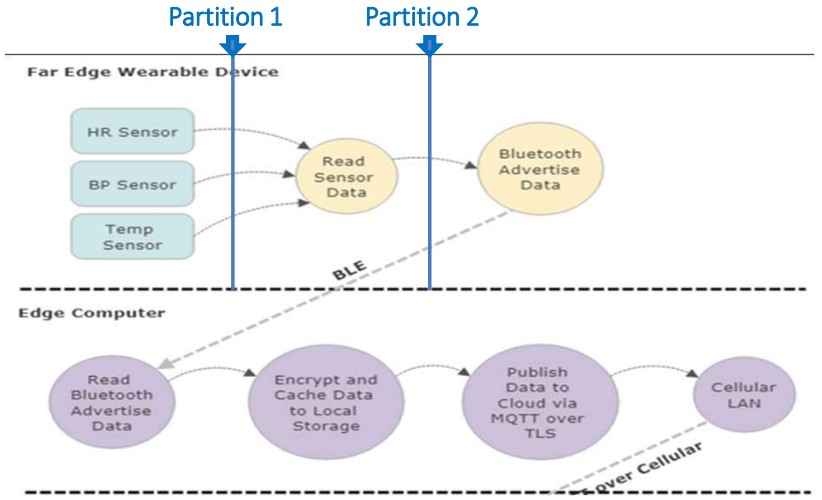
SNAP Examples

2.1 User Interfaces

Functionality	Change Description	# of UI Elements Impacted	# of UI Properties	SNAP Points Calculation	SNAP Points Value
Provide Clock Face	1. New Clock face 2. Look and feel to make it more readable (Big Font, Bright Color) 3. Background image	7	1	2*# unique UI elements	14

***Multiple Date formats (DDMMYY) will be counted under 1.3 Data formatting category**

1.4 Internal Data Movements



Functionality	Partition	# FTRs	Complexity	# DETs	SNAP Points Calculation	SNAP Points Value
HR Data to BT Communicator	2	<3	LOW	3	4*#DETs	12
BP Data to BT Communicator	2	<3	LOW	3	4*#DETs	12

Wearable devices – Sizing Challenges

- Most applications are developed by enthusiasts and may not include formal documentation associated. This makes FPA difficult
- Line between technical details and user details is very thin
  - For example, timestamp is a very essential field in case of wearable devices, whereas in most of the general-purpose systems timestamps are ignored
- Even when APIs are published, very limited documentation on flows, interactions and data model are available for devices.
- For most of the third-party Apps, interactions are not mentioned. Assumptions may have to be made during FPA.

Metric Questions – Productivity, Benchmarks?

- Productivity calculation must be straight forward, unless there are very different project efforts involved due to the nature of these applications
- Functional Productivity based on FPs, non-Functional Productivity using SNAP

Open Questions:

- Can current benchmarks be comparable with these type of Apps?
- Is it better to treat such Apps specially and create a separate benchmark data pool for these?

Conclusion and Road Ahead…

- Using publicly available documentation, data models, screen images and architecture diagrams, it was possible to perform the FP Sizing of applications.
- If detailed FP sizing must be done, more extensive documentation would be needed. In real projects, gathering such documentation wouldn't be a challenge.
- Other categories of wearable devices may pose additional challenges towards FPA. IFPUG CPM must be consulted while breaking down any specific scenarios.
- SNAP analysis was limited due to scarcity of detailed information. Having actual project details, more comprehensive SNAP Analysis is possible.

Road Ahead…

- Productivity of smaller Apps must be studied in isolation before using available benchmarks as reference for estimating or pricing such Apps.
- If significant gap in productivity is observed, special treatment may be required for Apps around wear able and handheld technologies.
- Study of wearable device App Productivity Trends may interest ISBSG.

References

- IFPUG CPM
- IFPUG SNAP Manual
- https://www.healthpopuli.com/2019/07/17/the-growth-of-emerging-consumer-electronics-categories-are-adding-to-digital-health-platforms/
- https://www.youtube.com/watch?v=tDx4WjPWBL0
- https://www.analog.com/en/analog-dialogue/articles/pedometer-design-3-axis-digital-acceler.html
- https://www.fitabase.com/resources/knowledge-base/learn-about-fitbit-data/data-resolutions/
- https://www.fitbit.com/us/legal/privacy-policy#:~:text=When%20your%20device%20syncs%20with,your%20device%20to%20our%20servers.&text=We%20collect%20this%20type%20of,device%20or%20mobile%20device%20settings

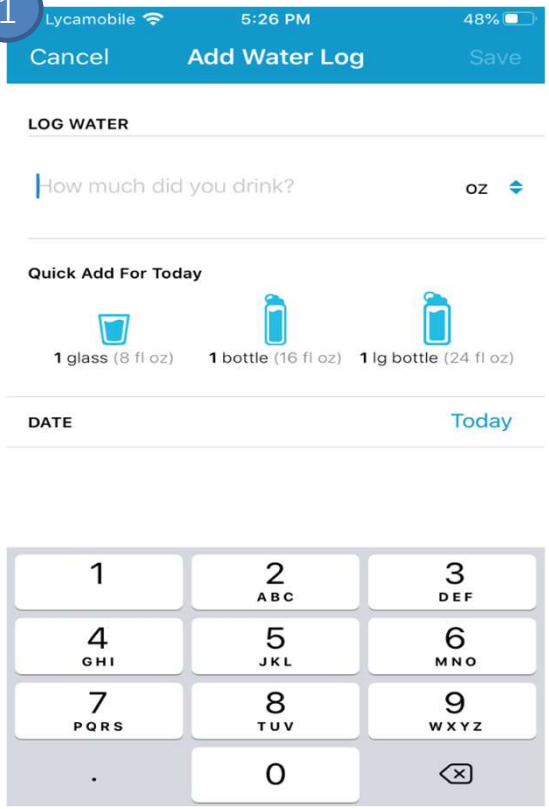
Screenshot Sources

- https://www.androidcentral.com/how-manage-your-body-weight-and-nutritional-goals-fitbit-android
- https://www.fitbit.com/dk/app
- https://www.theverge.com/2020/2/3/21115761/spotify-fitbit-music-stream-how-to

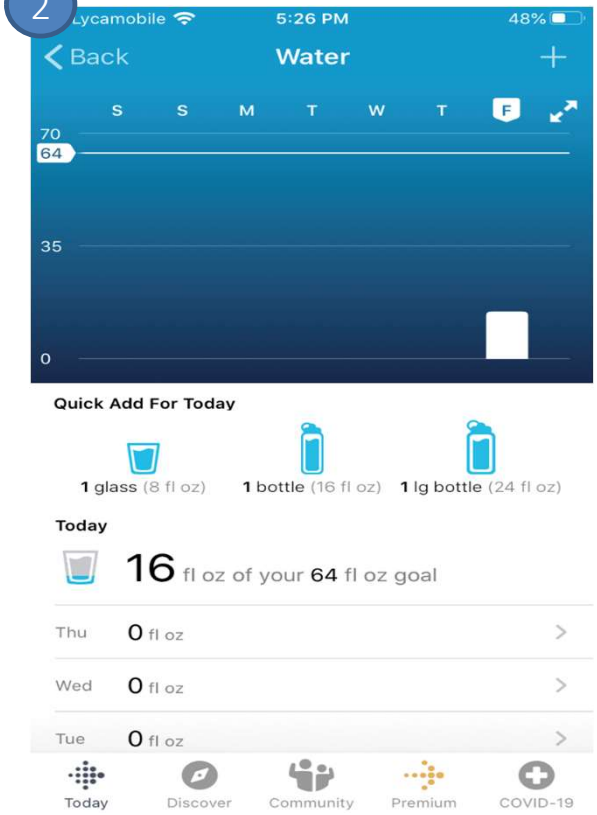
THANK YOU

Example : Water log

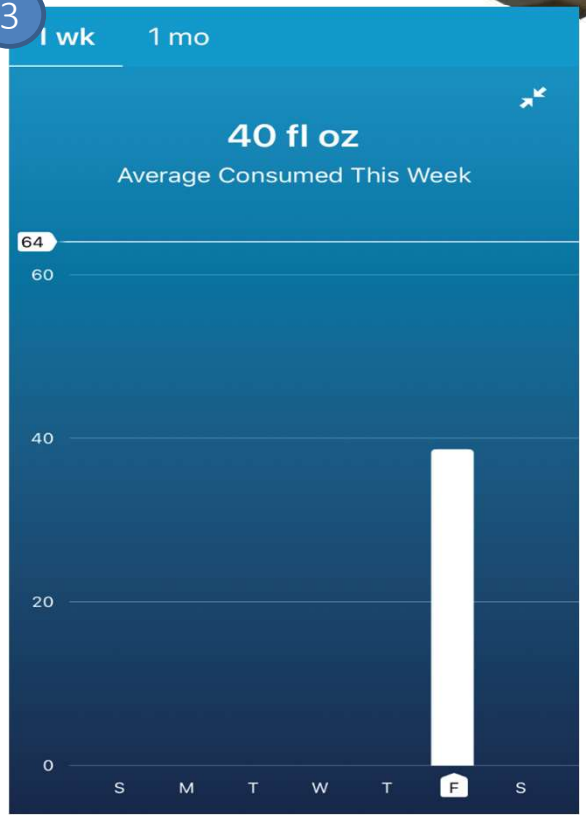
1



2



3



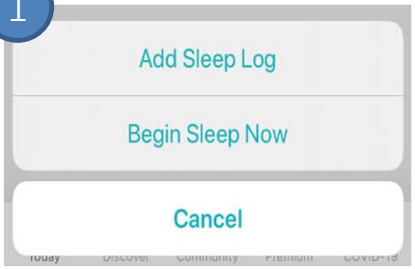
Transactions

1: Add Water consumption (Low EI)
2: Quick Add For Today – Is it unique process?
3: View ‘Water consumption’ of Today (Low EQ)
4: Average Water consumption this week (Low EO)

Function Points: 3+3+4 = 10 FPs

FPA of Wearable devices – Transactions

1

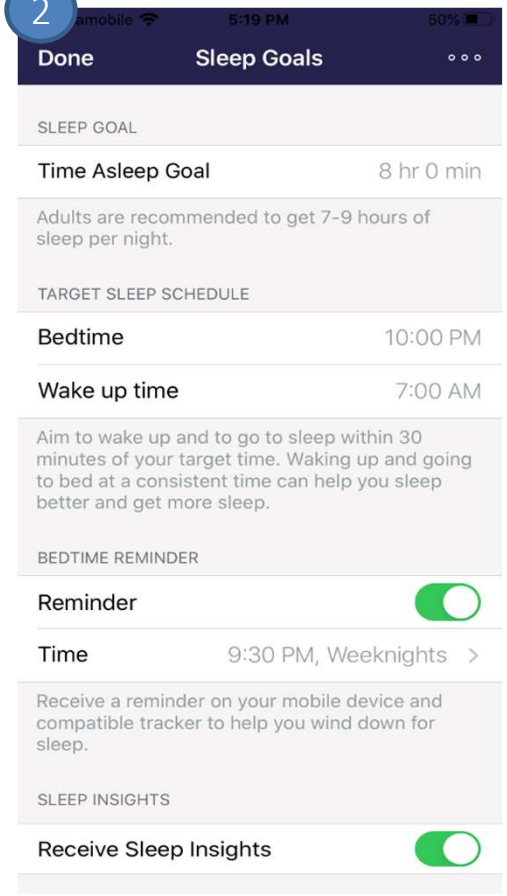


Add Sleep Log process:
1: Click 'Add Sleep Log'
2: Fill in details -> Done
3: Details saved

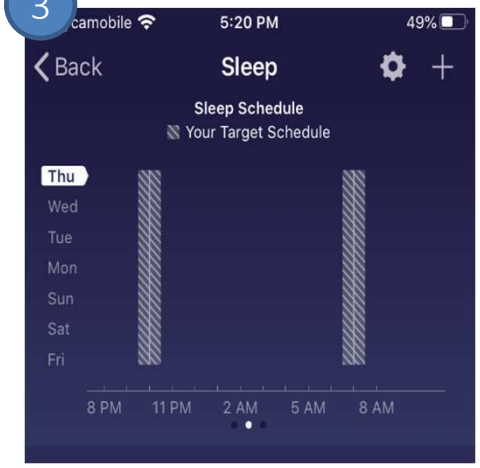
Transaction : Add Sleep Log (EI)

DETs: 8 ('Time Asleep Goal', 'Bedtime', 'Wake up time', 'Bedtime Reminder flag', 'Bedtime', 'Receive Sleep insights flag', Action 'Done', Message 'Saved Successful')
FTRs: 1 (Sleep details)
Complexity: Low
Function Points: 3

2



3



Other processes:
- → View Sleep log saved details (Low EQ)
- → Remove Sleep goal (Low EI)
- → Remove target bedtime (Low EI)
- → Remove target wakeup time (Low EI)

Function Points: 5 * 3 = 15 FPs