Modular Smartphone Production

Specification of an Exemplary Production Scenario

Orders

The starting point for the production of a modular smartphone is an order. The order comes from outside of the scenario (e. g. created randomly) and specifies the different parameters of the smartphone to produce. They comprise:

- The size of the RAM (1 GiB, 2 GiB, 3 GiB, 4 GiB, 5 GiB, 6 GiB, 7 GiB, 8 GiB)
- The CPU (Dual Core, Quad Core, Octo Core)
- The flash memory size (16 GiB, 32 GiB, 64 GiB, 128 GiB)
- The size of the battery (2000 mAh, 2500 mAh, 3000 mAh, 3500 mAh, 4000mAh, 4500 mAh)
- The case material (Metal, Plastic)
- The display size (4'', 4.5'', 5'', 5.5'', 6'', 6.5'')
- Which ports are present (Audio Jack, Dolby Speaker, Stereo Speaker, USB C Port, microUSB Port, microSD Card Slot, SIM Slot, microSIM Slot, nanoSIM Slot)
- Which communication units are present (WiFi, Bluetooth, GSM, UTMS, LTE, 5G, Infrared, GPS, NFC)
- Which sensor units are present (Microphone, Camera, Compass, Fingerprint, Gyroscope, Heat, Humidity)

An order does not necessarily need to make sense to be a valid order (e. g. having a Dolby Speaker and a Stereo Speaker or having no communication unit at all).

Production Steps of a Modular Smartphone

Modular smartphone production consists of combining different modules on the highest level. Their production is further specified in the following sections.
Things start with the Main Module on which all required ports are fixed. The main module with the ports can be bolted into a case to create a Smartphone Skeleton. Into this skeleton, the Communication Module and the Sensor Module can be bolted in either order. After those two modules have been added, the Battery and the Display Module have to be glued to the skeleton in either order. This creates the finished modular smartphone.

Main Module

The Main Module is a combination of the Mainboard, RAM Stick, the CPU, and the Flash Memory which are soldered together.
The type of the Mainboard used places restrictions upon the maximum CPU size that can be used (where Quad Core is bigger than Dual Core) and the maximum number of RAM sticks that can be added.
Within these limits, the configuration of RAM sticks can be chosen freely as long as their combined size matches the size required in the order (e. g. either two sticks with size 2 GiB or one with 4 GiB).

Flash Memory and CPU have no further degrees of freedom.

Ports

The different ports specified in the order should be fixed to the Main Module in an arbitrary order.

Case

A Case can be either cast from a Metal or a Plastic Ingot.

Communication Module

The different communication units specified in the order are soldered to a Printed Circuit Board. The board places restrictions on how many communication units can be added.

Sensor Module

The different communication units specified in the order are soldered to a Printed Circuit Board (the same board as for the communication module is used here). The board places restrictions on how many sensor units can be added.

Battery

A Battery of a given size is created by combining different battery cells of possibly different sizes (similar to the RAM but without restrictions).

Display Module

A Display Module is created by gluing together a Glass and an LCD of the given size.

Workstations

In the following, we state the different Workstations on the shop floor and the tasks they are able to carry out:

- Soldering Station:
    - Soldering Main Module
    - Soldering Communication Module
    - Soldering Sensor Module
- Fixing Station:
    - Adding different Ports to the Main Module
- Casting Station:
    - Creating Metal Cases
    - Creating Plastic Cases
- Bolting Station:
    - Bolting Main Module to Case

    - Bolting Communication Module to Smartphone Skeleton
    - Bolting Sensor Module to Smartphone Skeleton
- Combination Station:
    - Combining Battery Cells to Battery
- Gluing Station:
    - Gluing the Battery to the Smartphone Skeleton
    - Gluing together Glass and LCD
    - Gluing the Display to the Smartphone Skeleton

Starting Products

- RAM Stick
    - 1 GiB
    - 2 GiB
    - 4 GiB
    - 8 GiB
- CPU
    - Dual Core
    - Quad Core
    - Octo Core
- Flash Memory
    - 16 GiB
    - 32 GiB
    - 64 GiB
    - 128 GiB
- Mainboard
    - Max. Dual Core and 2 RAM Sticks
    - Max. Dual Core and 3 RAM Sticks
    - Max. Quad Core and 1 RAM Stick
    - Max. Octo Core and 4 RAM Sticks
- Port
    - Audio Jack
    - Dolby Speaker
    - Stereo Speaker
    - USB C Port
    - microUSB Port
    - microSD Card Slot
    - SIM Slot
    - microSIM Slot
    - nanoSIM Slot
- Ingot
    - Metal
    - Plastic
- Communication Unit
    - WiFi
    - Bluetooth
    - GSM

    - UTMS
    - LTE
    - 5G
    - Infrared
    - GPS
    - NFC
- Sensor Unit
    - Microphone
    - Camera
    - Compass
    - Fingerprint
    - Gyroscope
    - Heat
    - Humidity
- Battery Cells
    - 50 mAh
    - 750 mAh
    - 1200 mAh
- LCD
    - 4”
    - 4.5”
    - 5”
    - 5.5”
    - 6”
    - 6.5”
- Glass
    - 4”
    - 4.5”
    - 5”
    - 5.5”
    - 6”
    - 6.5”

Examples

ShEx Shapes for Linked Data Platform