MOWEBA MOBILE: MODELING AND GENERATION OF THE COMMUNICATION OF MOBILE APPS WITH THEIR FUNCTIONS IN THE CLOUD

Emanuel A. Sanchiz F.

19 de octubre de 2017

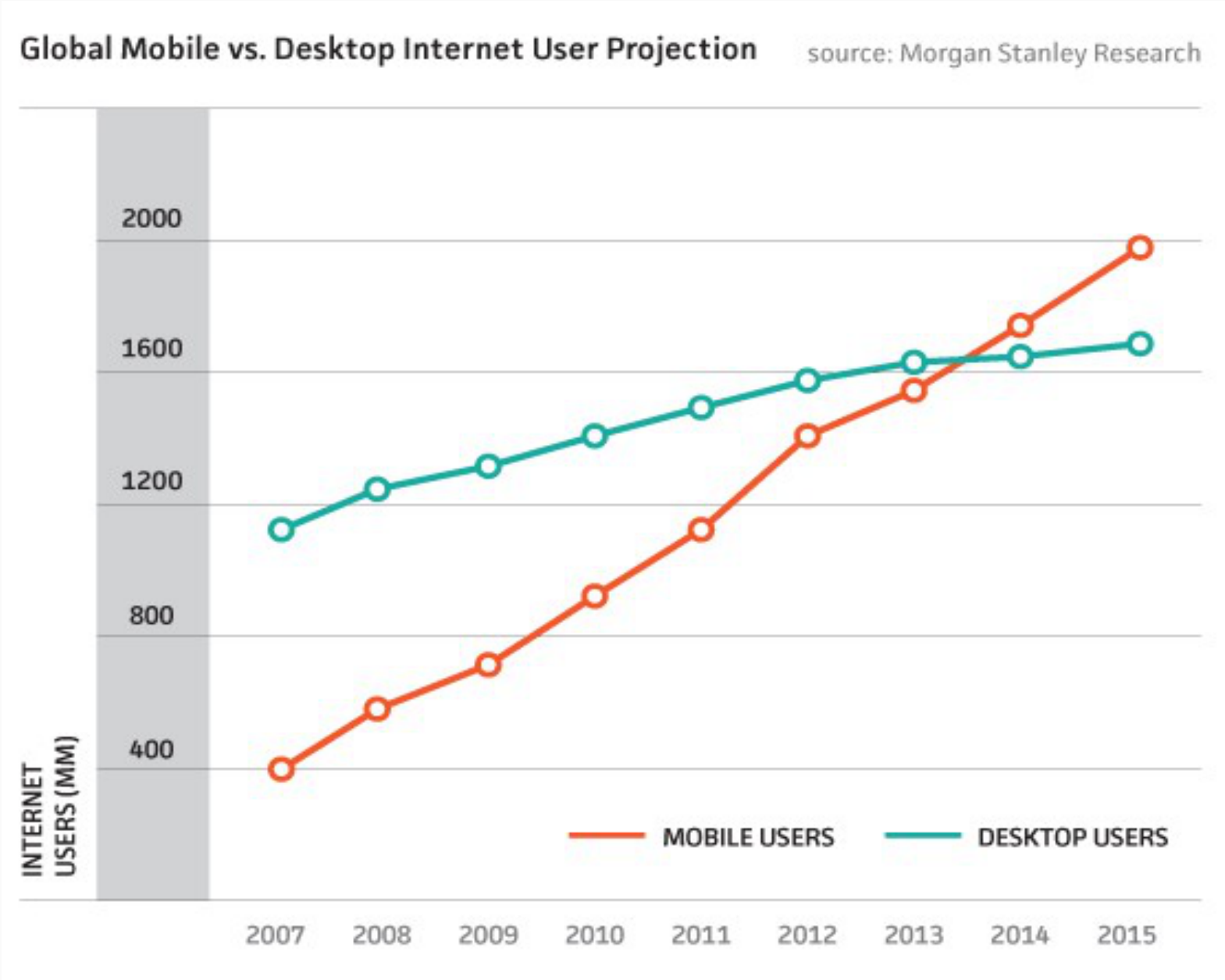
Final Project submitted for the degree of Engineer
DEI - FCyT - UC

"This work has been funded by CONACYT through the PROCIENCIA program with resources from "Fondo para la Excelencia de la Educación e Investigación - FEEI" from FONACIDE. This work has been developed under the project "Mejorando el proceso de desarrollo de software: propuesta basada en MDD" (14-INV-056).

Motivation - Mobile Apps

Popularity of Mobile Devices and Applications

Motivation - Mobile Apps

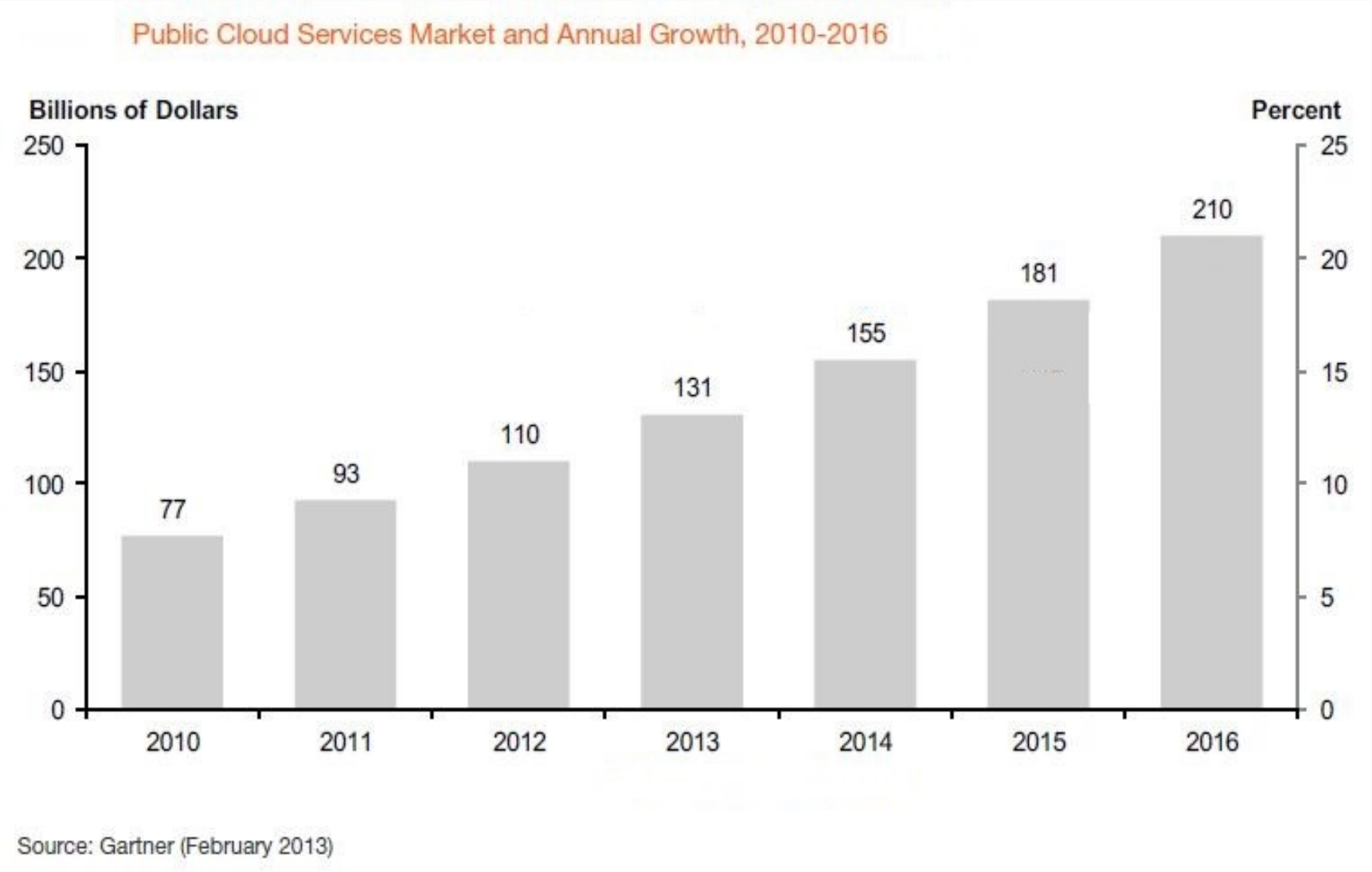


Motivation - Cloud

Popularity of Mobile Devices and Applications

Growth of the Public Cloud Services

Motivation - Cloud



Motivation - MobileApps-FC

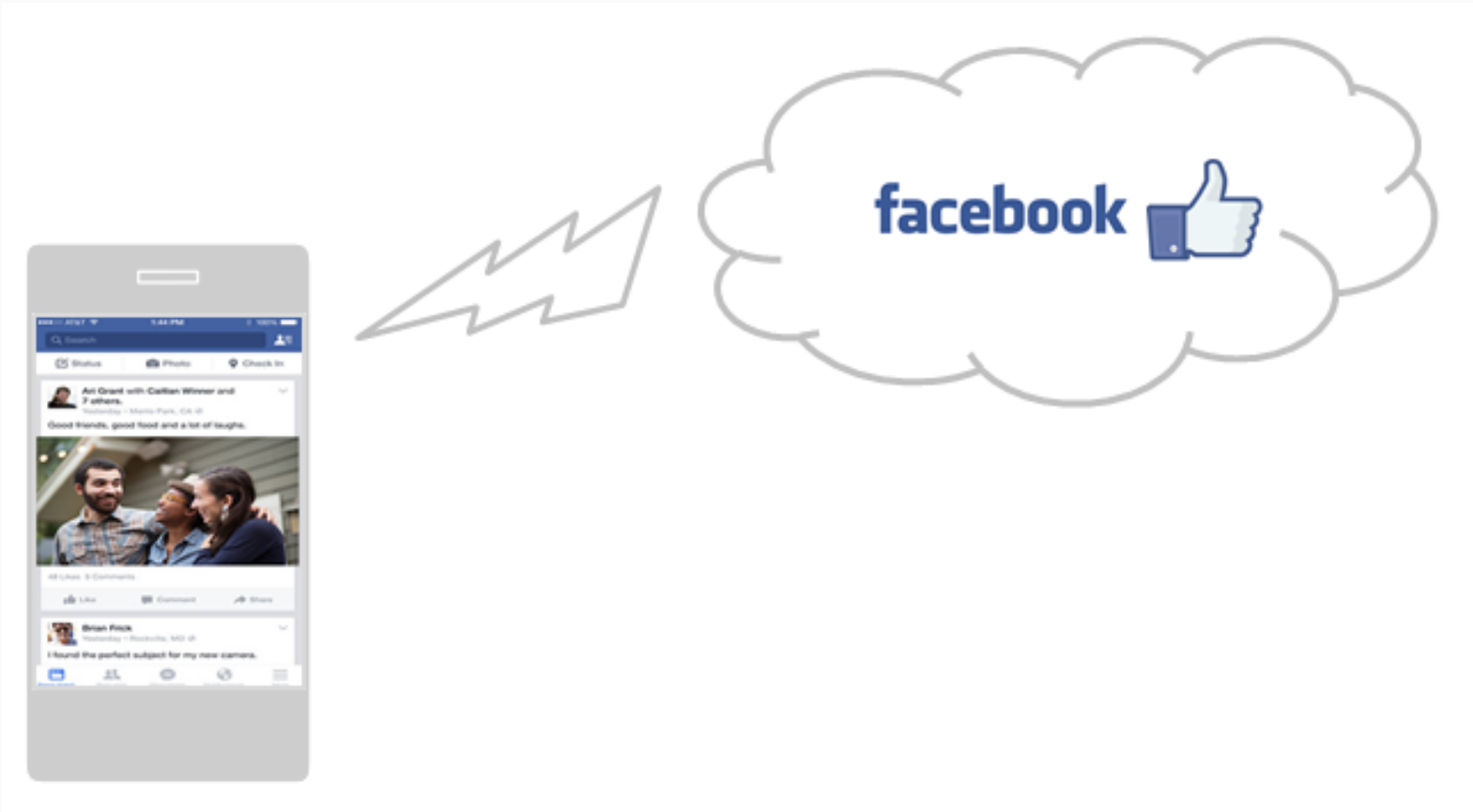
Popularity of Mobile Devices and Applications

Growth of the Public Cloud Services

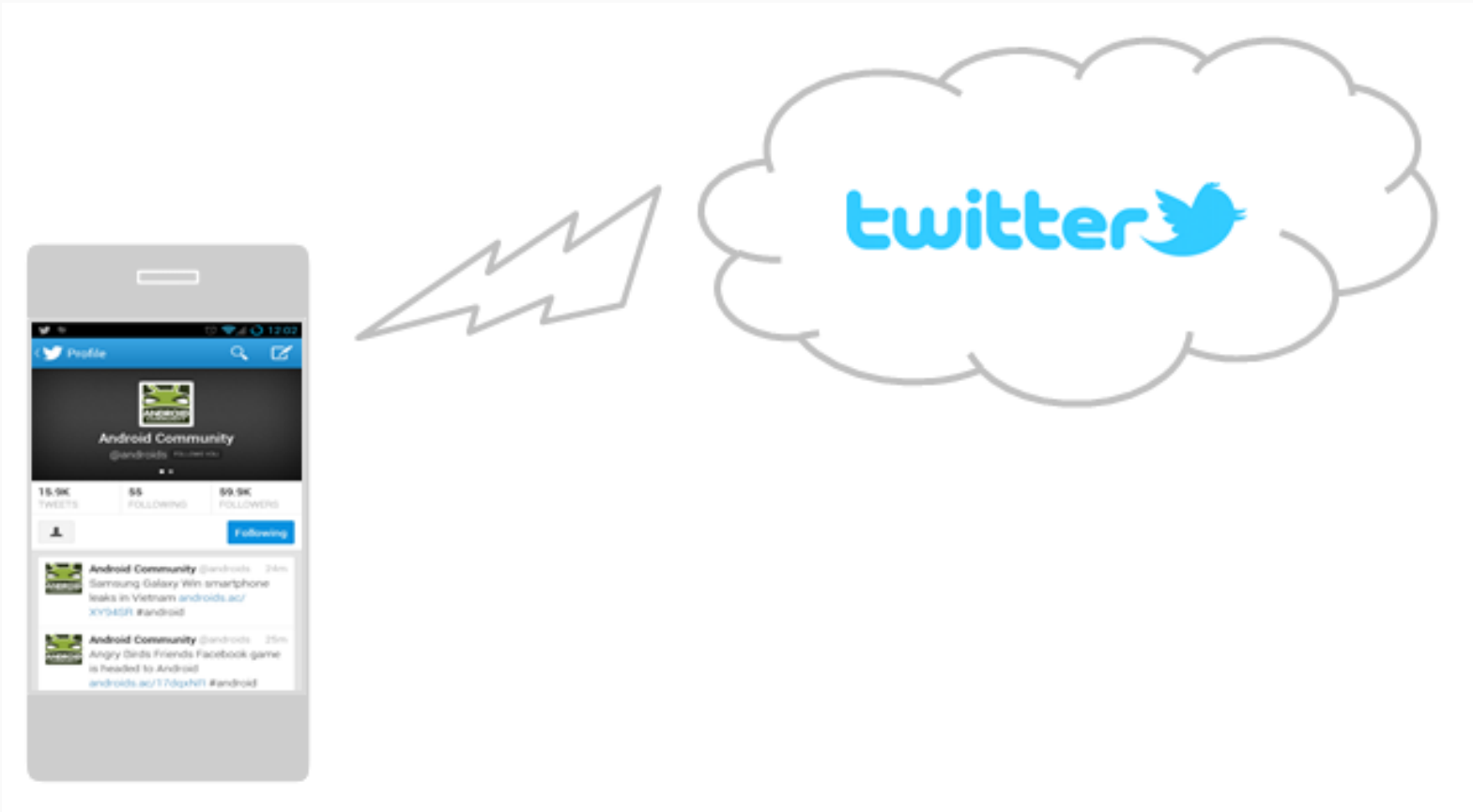
Mobile Applications with Functions in the Cloud

Motivation - MobileApps-FC

Motivation - MobileApps-FC Examples



Motivation - MobileApps-FC Examples

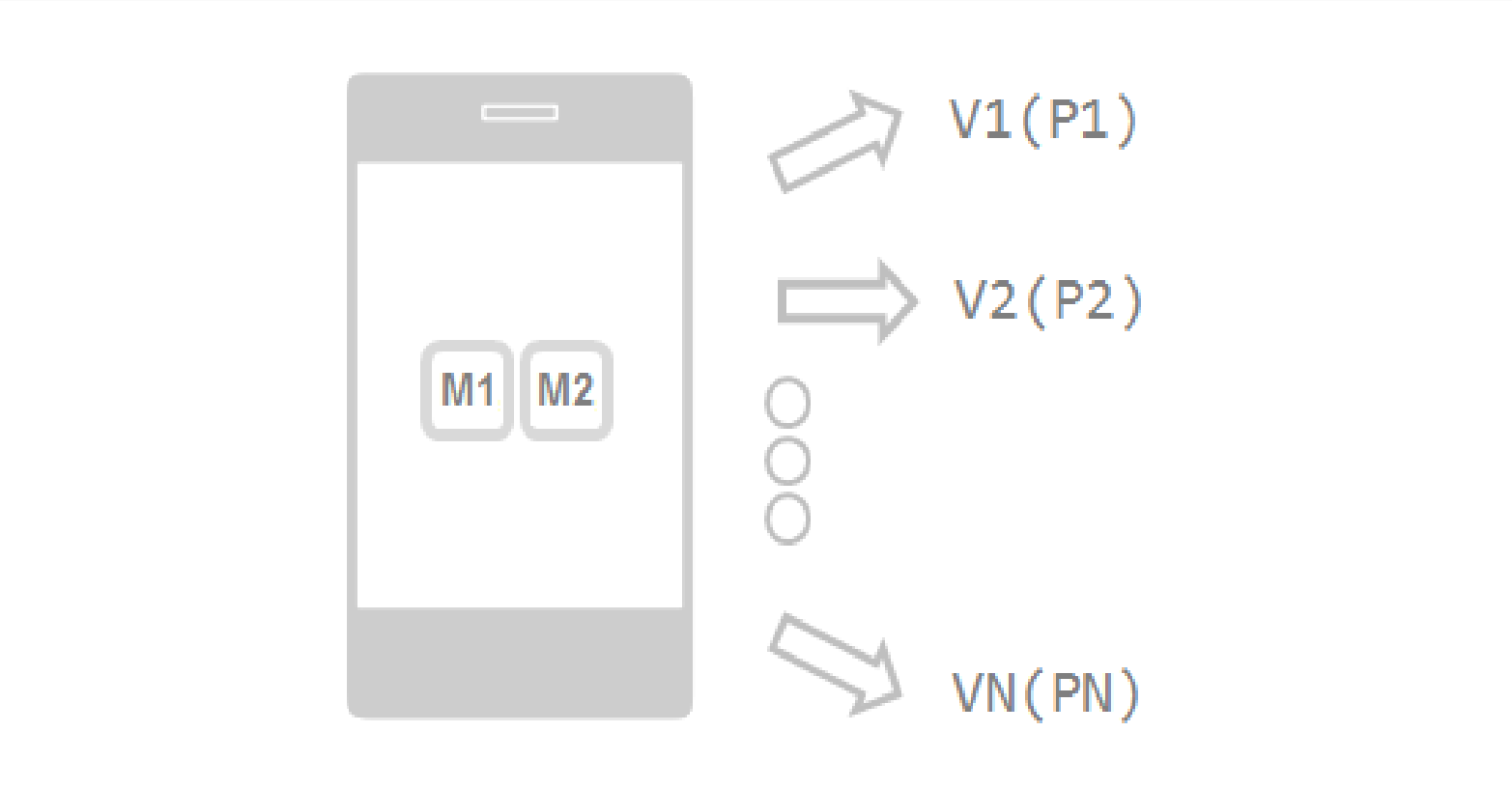


Motivation - MobileApps-FC Examples

Motivation - Portability Challenge

- Popularity of Mobile Devices and Applications
- Growth of the Public Cloud Services
- Mobile Applications with Functions in the Cloud
- Challenge of the Platform Portability

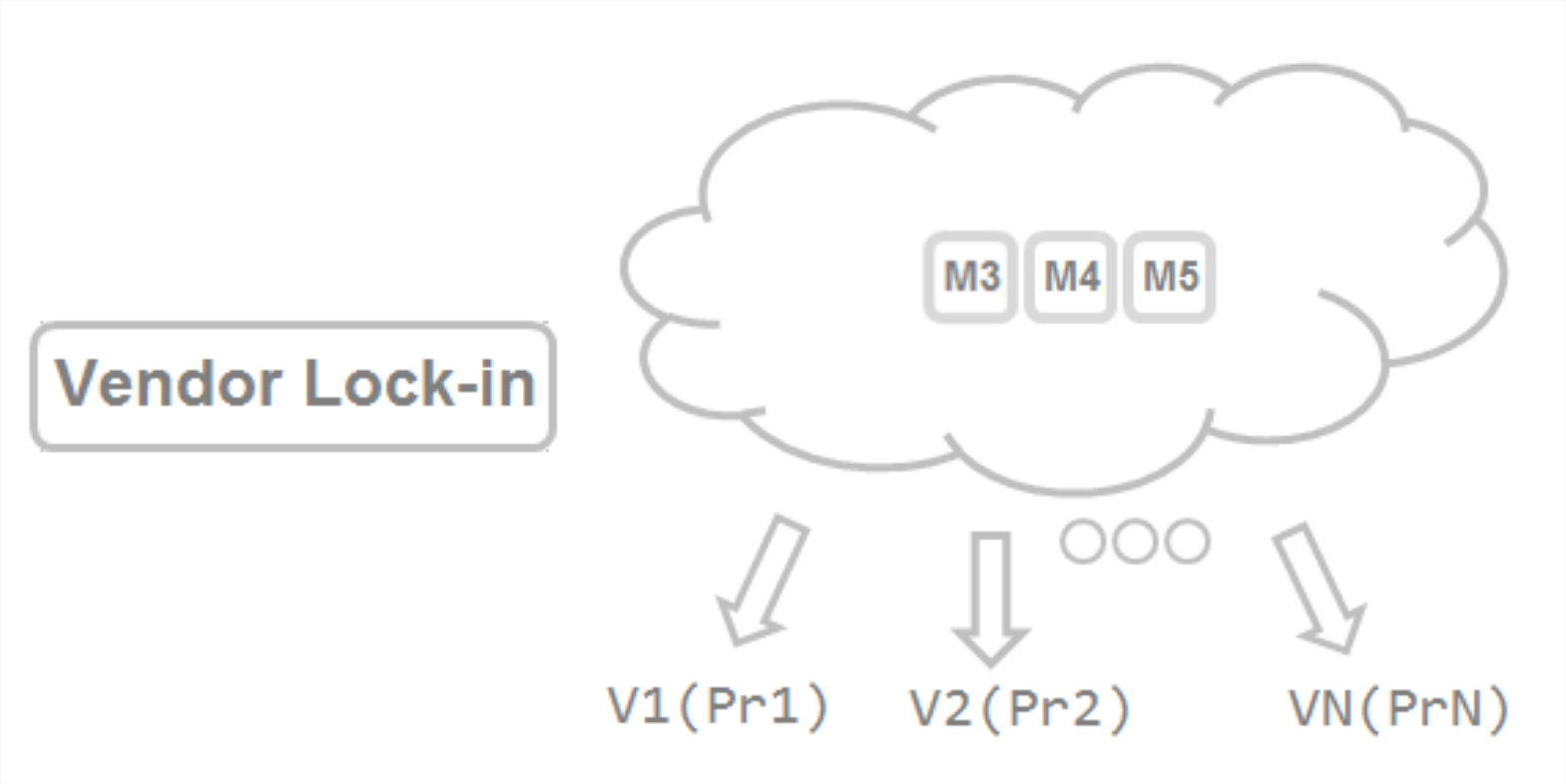
Motivation - Portability Challenge



Greater effort in the development

Observations: VX = Version X, PX = Platform X.

Motivation - Portability Challenge



Considerable effort to migrate

Observations: VX = Version X, PrX = Provider X.

Motivation - MDD as a Solution

- Popularity of Mobile Devices and Applications
- Growth of the Public Cloud Services
- Mobile Applications with Functions in the Cloud
- Challenge of the Platform Portability
- MDD as a Solution

Motivation - MDD as a Solution

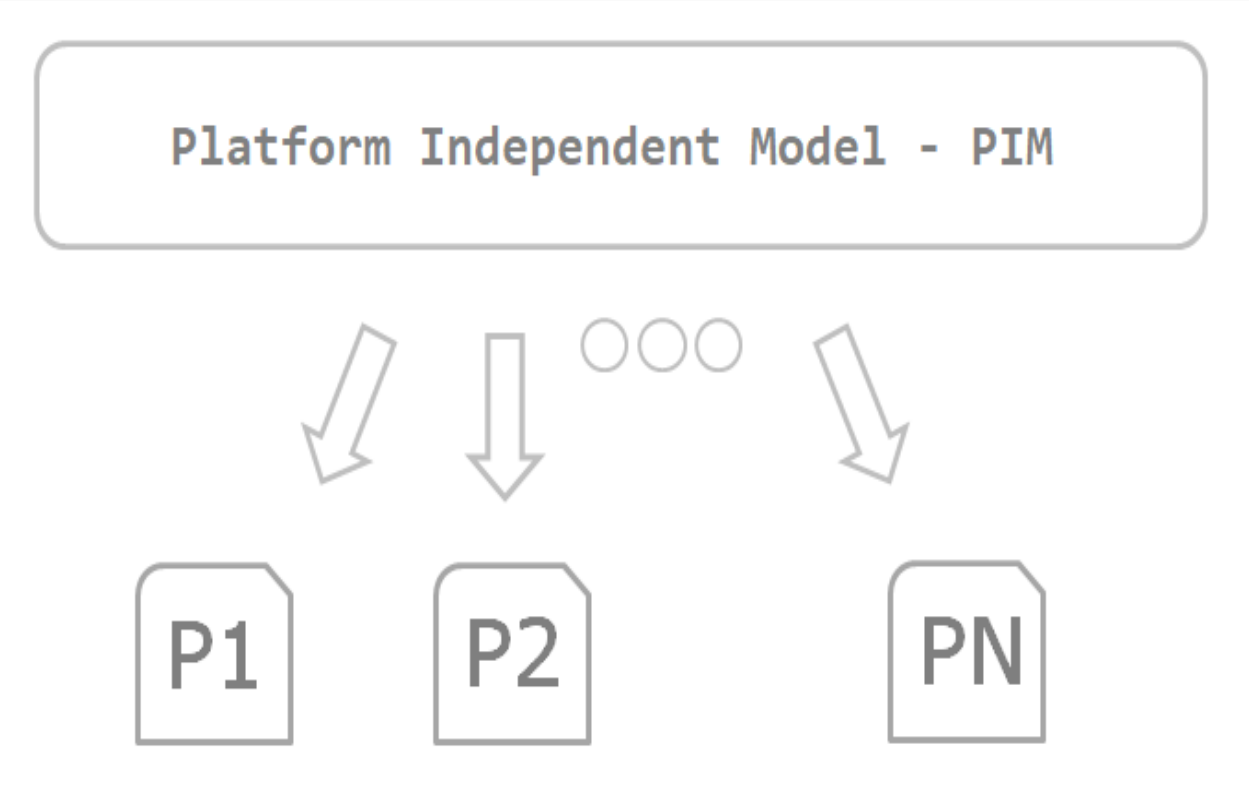
Model Driven Development - MDD

Motivation - MDD as a Solution

Model Driven Development - MDD

Improvement of Portability

Motivation - Improvement of Portability



Motivation - Previous Work

- Popularity of Mobile Devices and Applications
- Growth of the Public Cloud Services
- Mobile Applications with Functions in the Cloud
- Challenge of the Platform Portability
- MDD as a Solution
- Previous Work

Motivation - Previous Work

Architecture Specific Model - ASM

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Clear Separation of Presentation and Behaviour Layers

Motivation - Previous Work

Architecture Specific Model - ASM

Clear Separation of Presentation and Behaviour Layers

Function Oriented Navigation

Motivation

- Popularity of Mobile Devices and Applications
- Growth of the Public Cloud Services
- Mobile Applications with Functions in the Cloud
- Challenge of the Platform Portability
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SMS of the State of the Art[1]

[1] Publications in CLEI 2016 and CLEIej 2017

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Common aspects:

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Additional Comments:

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Additional aspects:

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- Standard Language
- MDD and Open Source
- Native Mobile Applications

Common aspects:

- MVC Schema
- REST Architecture

Additional Comments:

- Low graphical modeling
- Cloud implemented in JAVA

[1] Publications in CLEI 2016 and CLEIej 2017

Goal

Propose a model driven approach for the modeling and generation of the network communication of the MobileApps-FC as an alternative for addressing the extra effort caused by the difficulty of platform portability

Proposed Solution

Adoption of MoWebA

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- Separation of Pres. & Beh.
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Adoption of MoWebA

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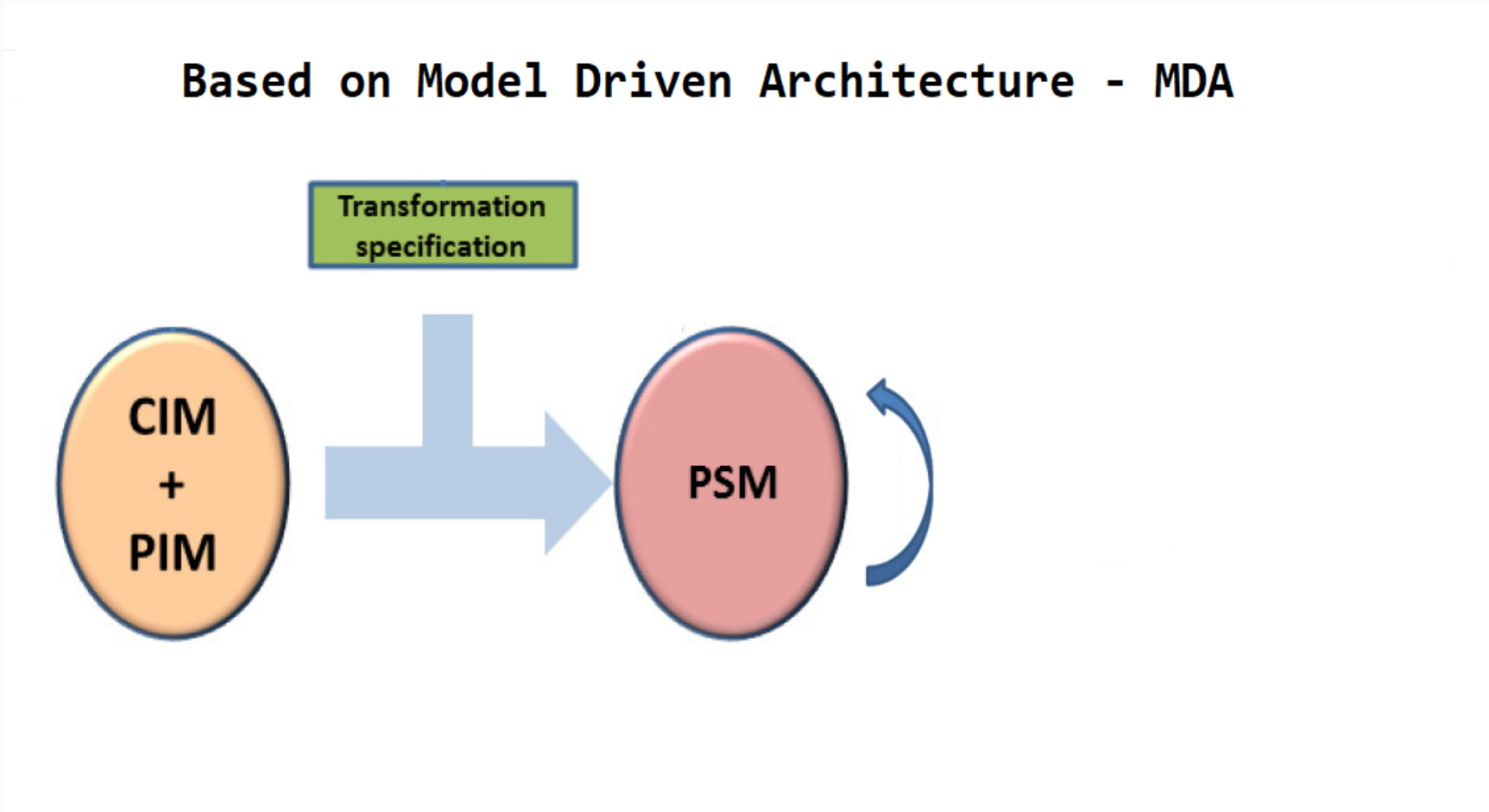
- Separation of Pres. & Beh.
- Function Oriented Nav.
- MVC Schema
- Standard Language
- Graphical Modeling

Proposed Solution - Adoption of MoWebA



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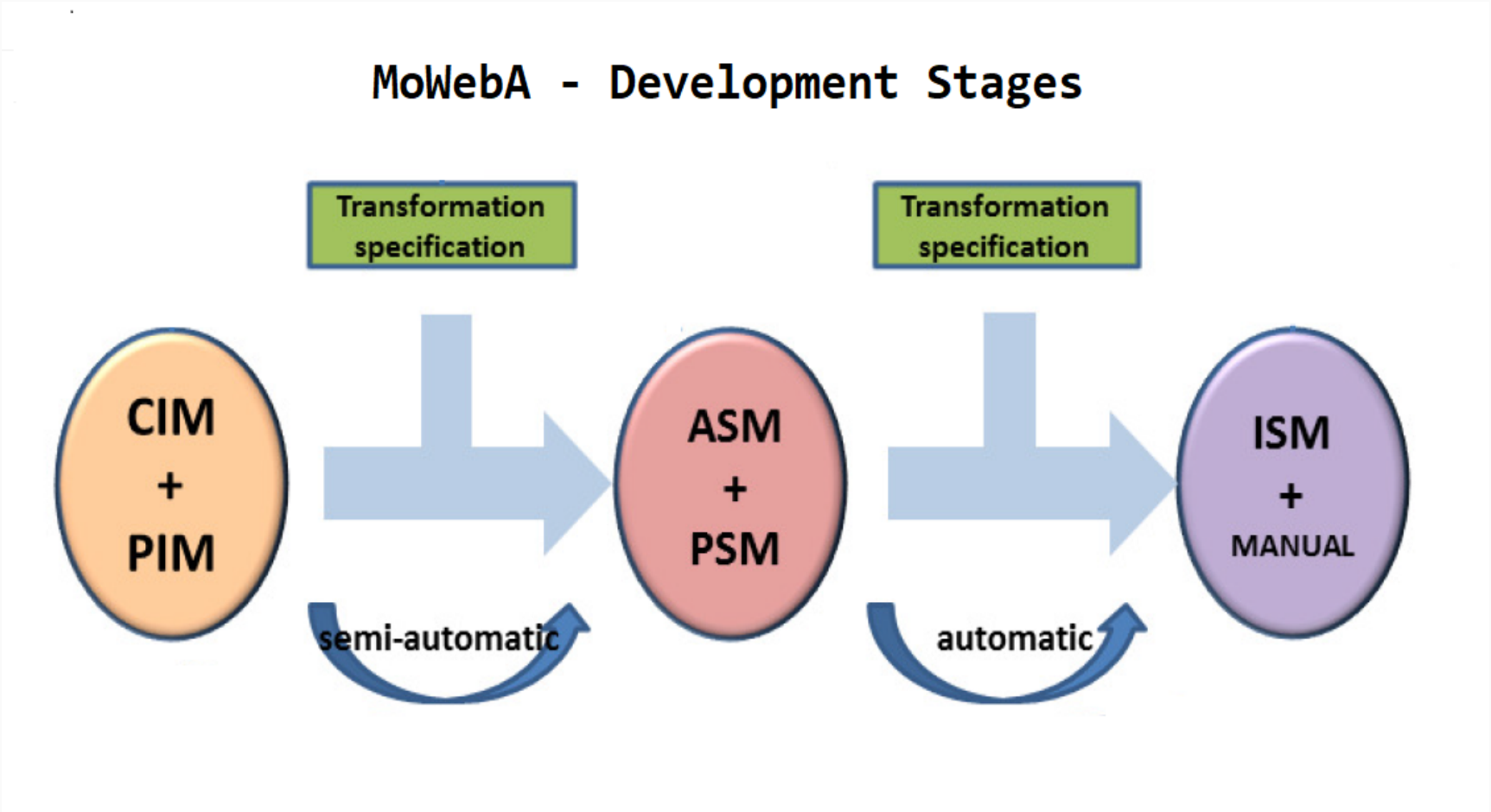
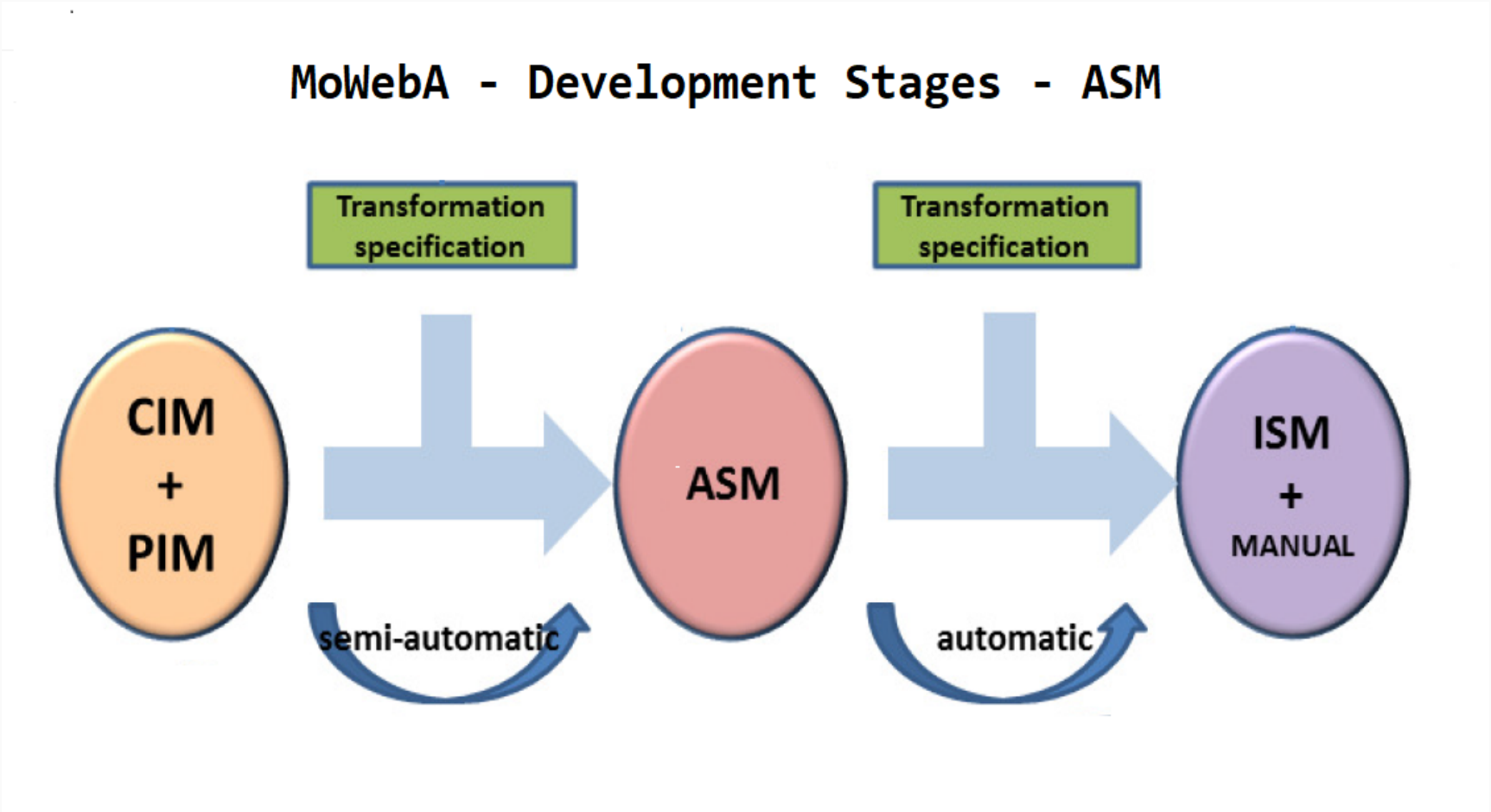
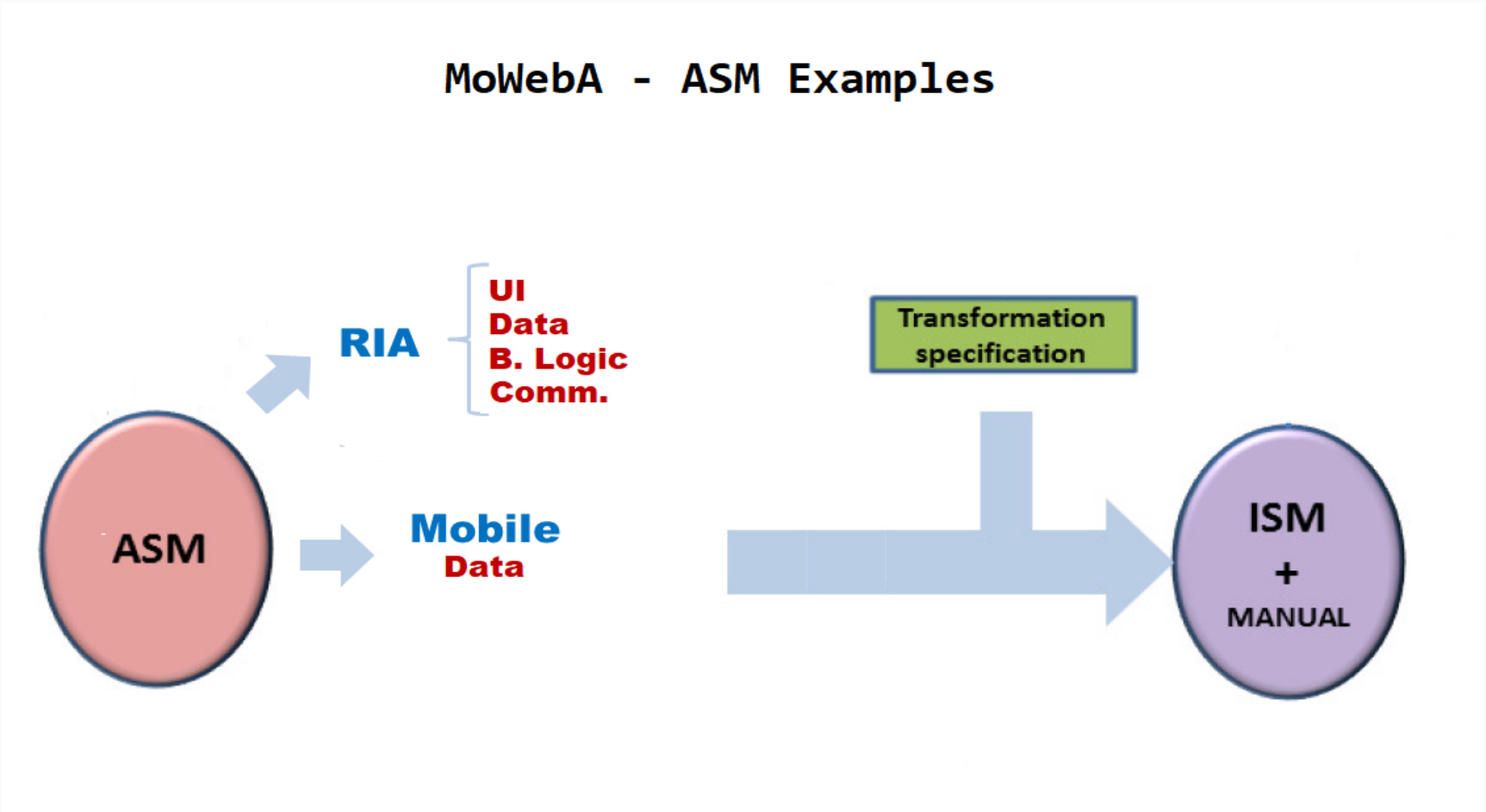


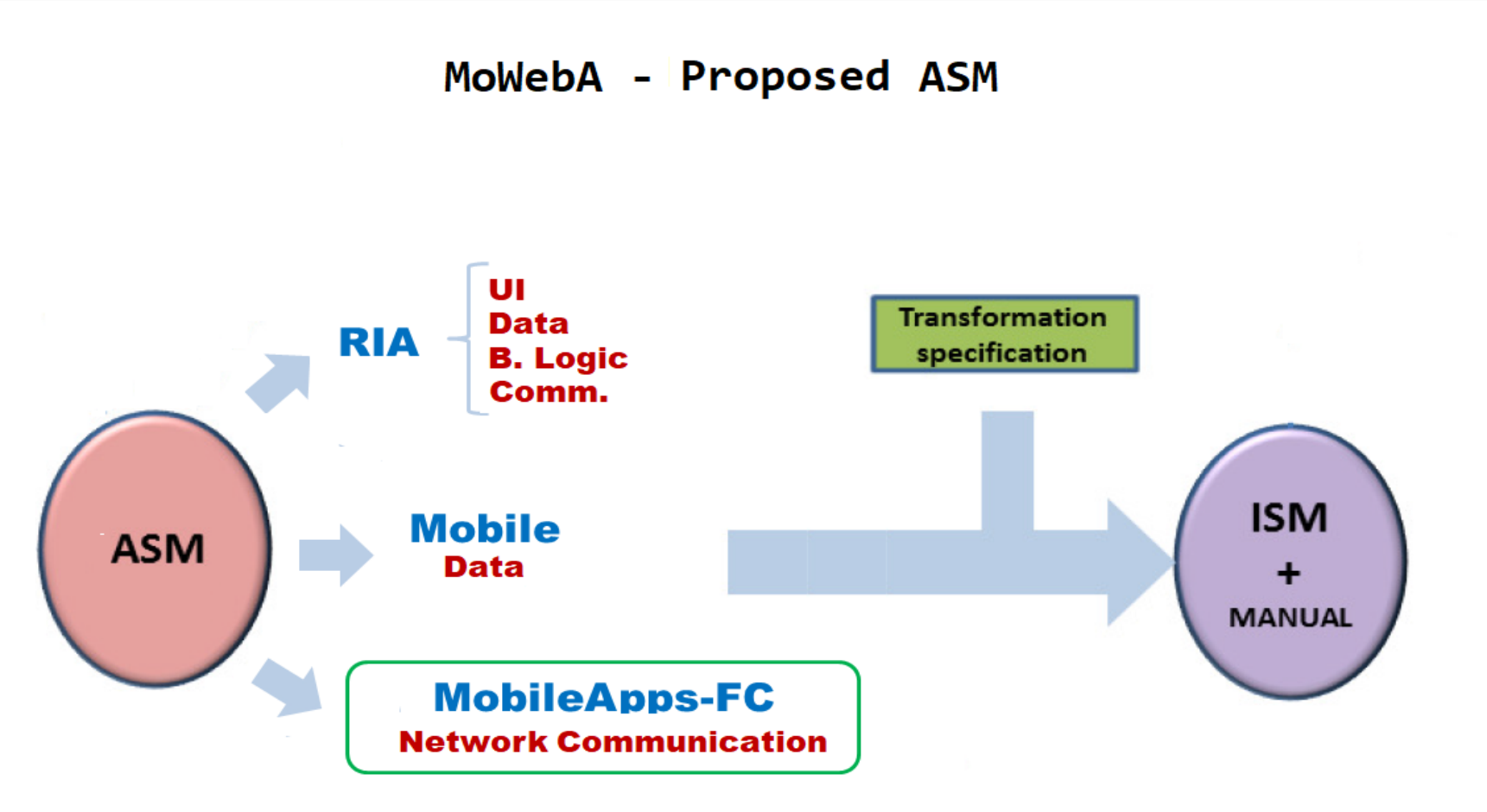
Proposed Solution - Adoption of MoWebA



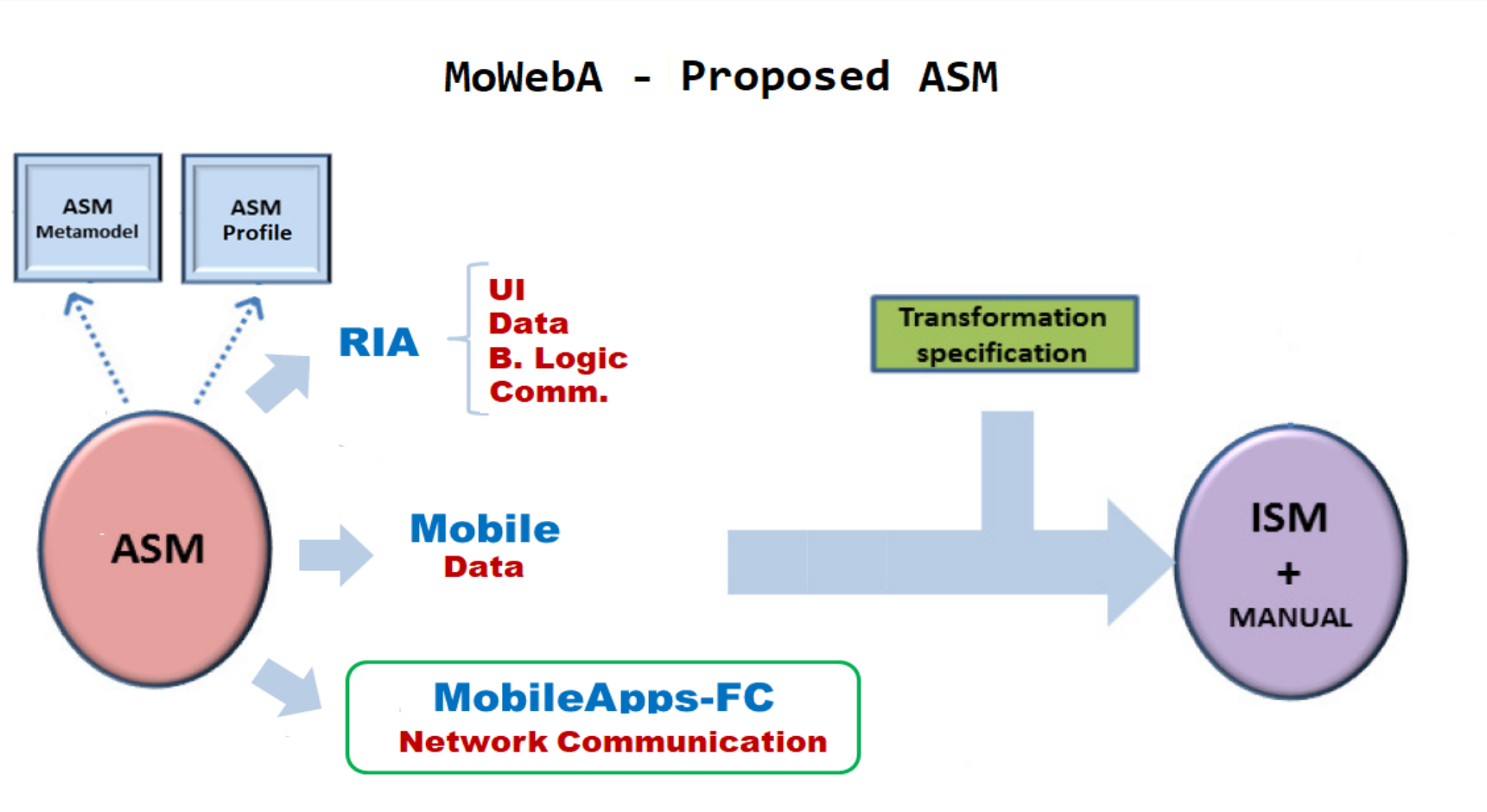
Proposed Solution - Extension of MoWebA



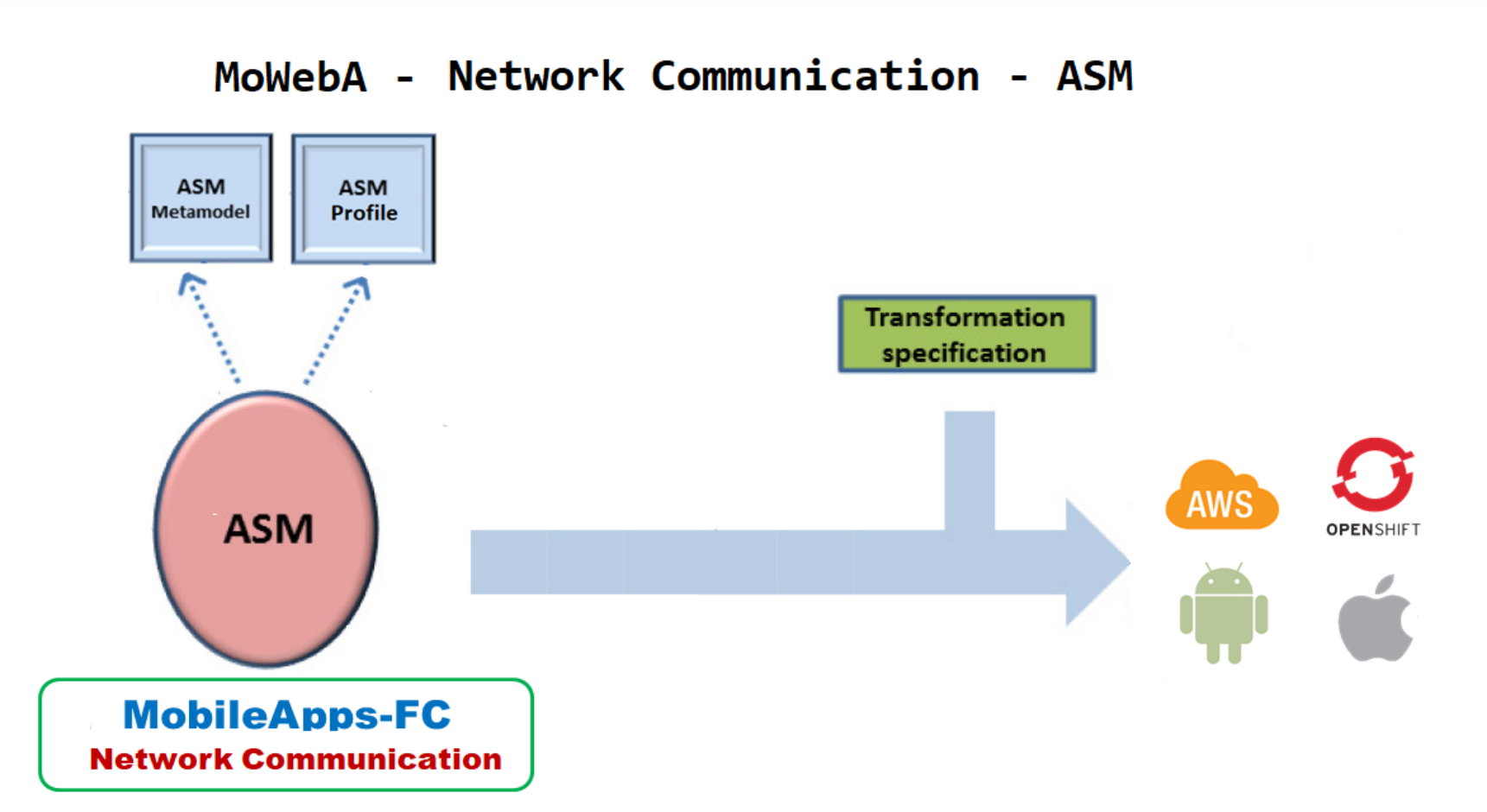
Proposed Solution - Extension of MoWebA



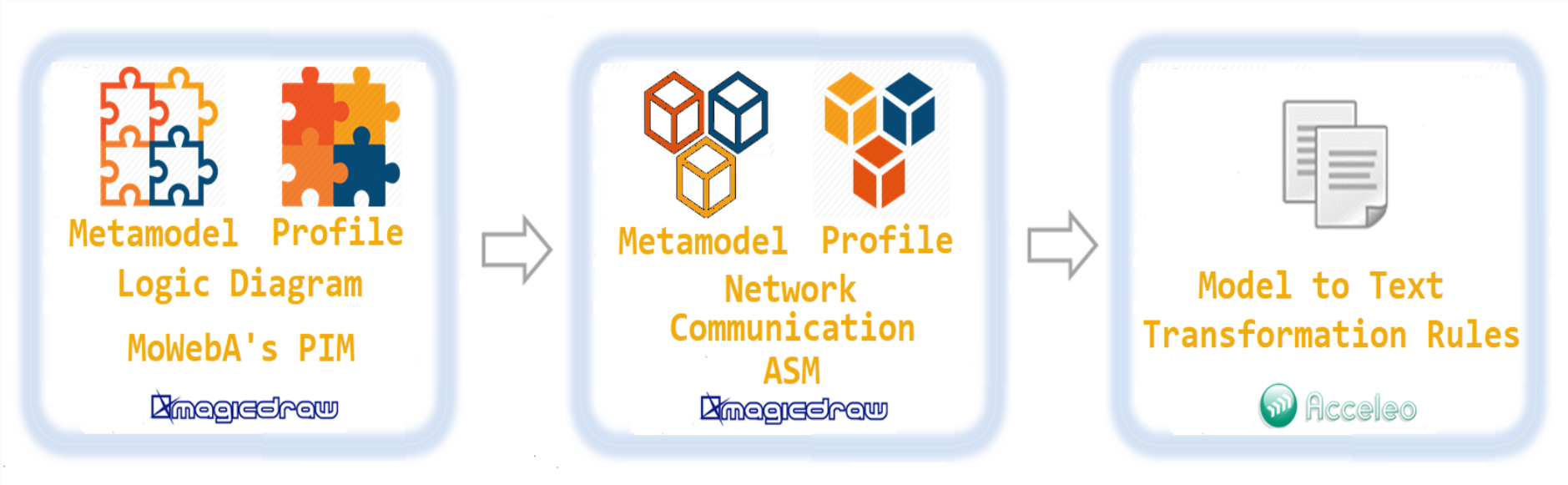
Proposed Solution - MoWebA Mobile



Proposed Solution - MoWebA Mobile



Proposed Solution - Extension Process



Proposed Solution

Extension of MoWebA

MoWebA Mobile

Proposed Solution

Extension of MoWebA

MoWebA Mobile

- Unified Modeling
- REST Architecture
- MDD and Open Source
- Native Mobile Applications
- Javascript - Node.js for the cloud

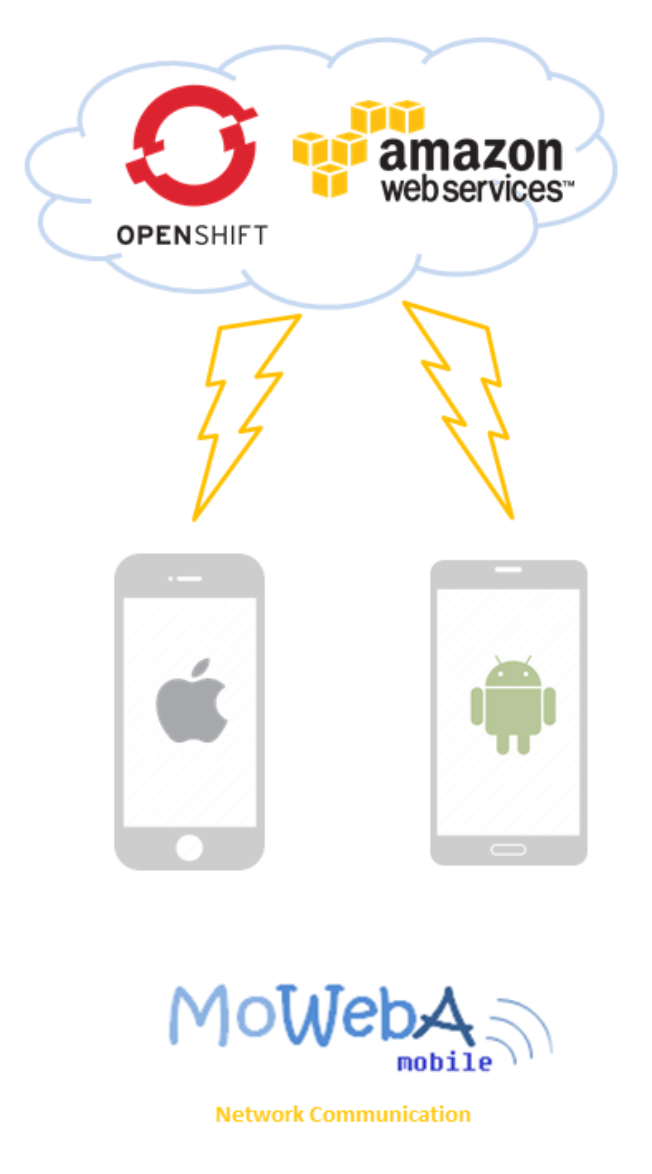
Proposed Solution

Extension of MoWebA

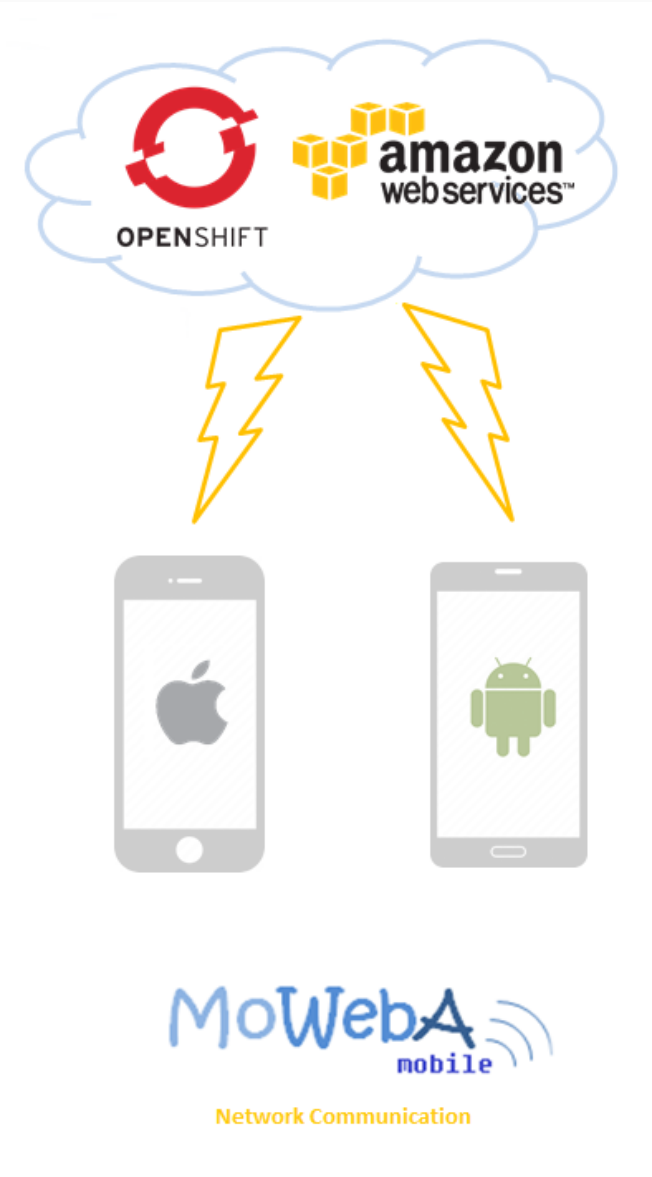
MoWebA Mobile

Network Communication

Proposed Solution - Network Communication

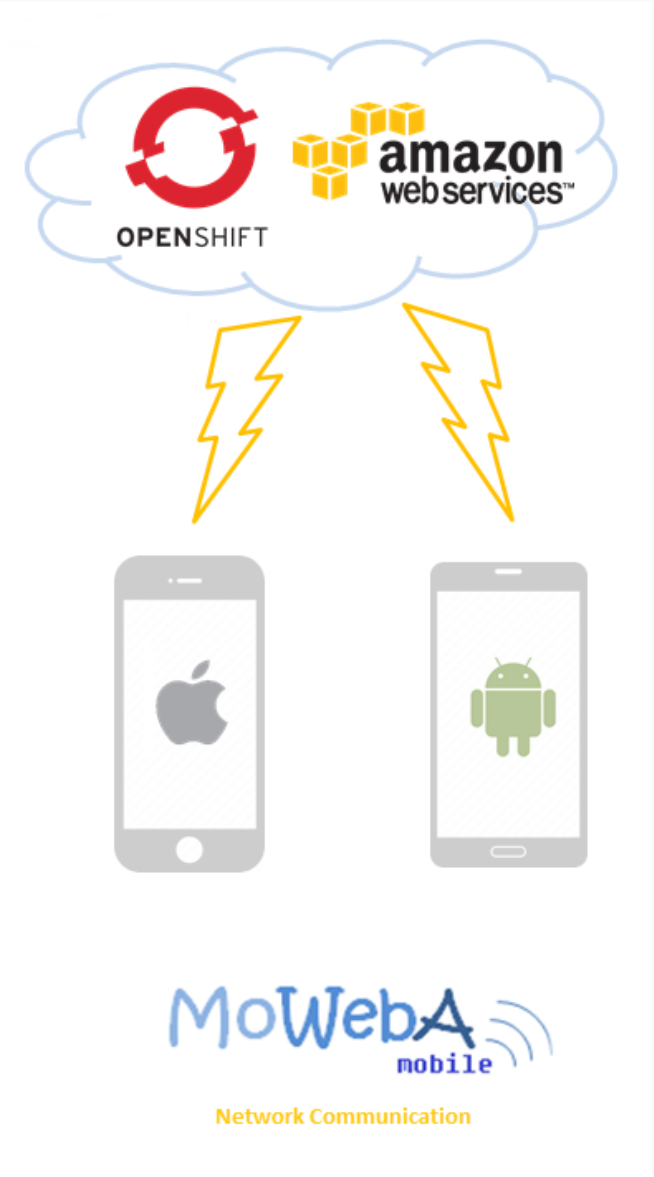


Proposed Solution - Network Communication



Based on:

Proposed Solution - Network Communication



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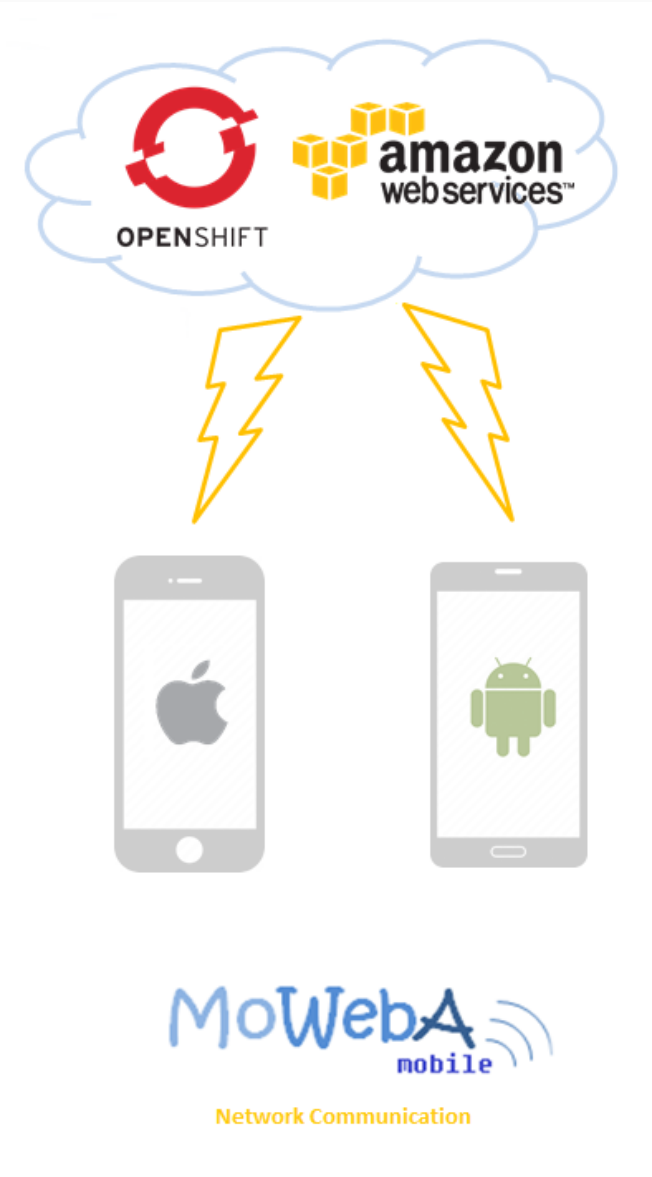
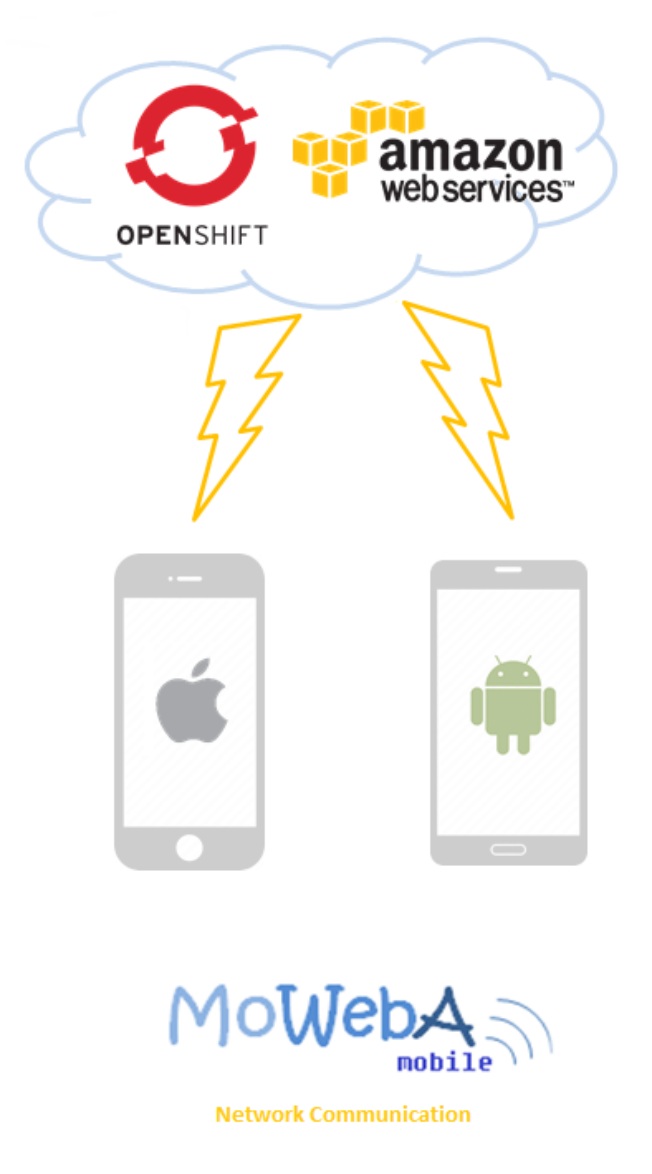


Based on:

- REST Architecture
- Communication Functions

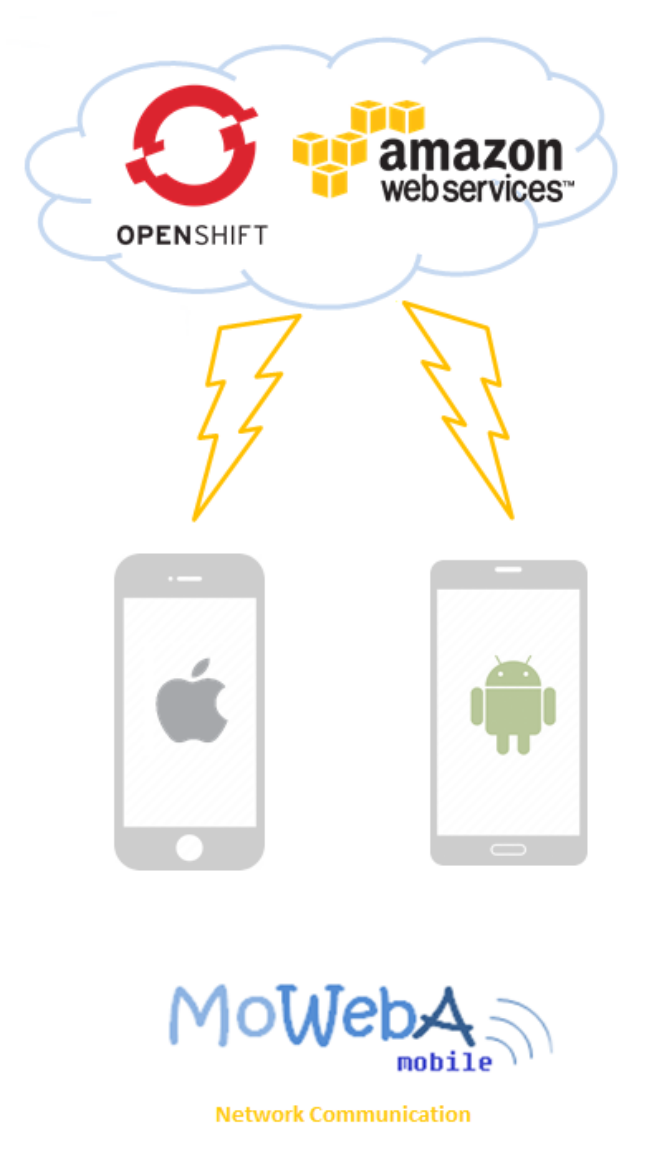
Proposed Solution - Network Communication



Based on:

- REST Architecture
- Communication Functions
  - Light-data

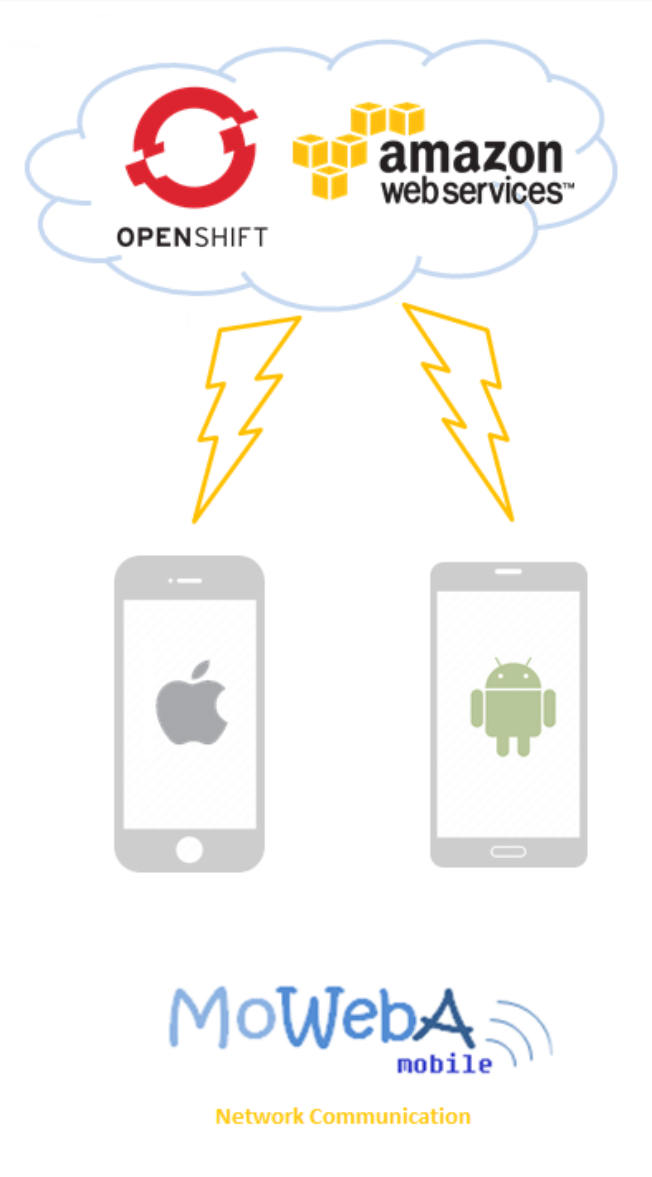
Proposed Solution - Network Communication



Based on:

- REST Architecture
- Communication Functions
  - Light-data
  - Load-image

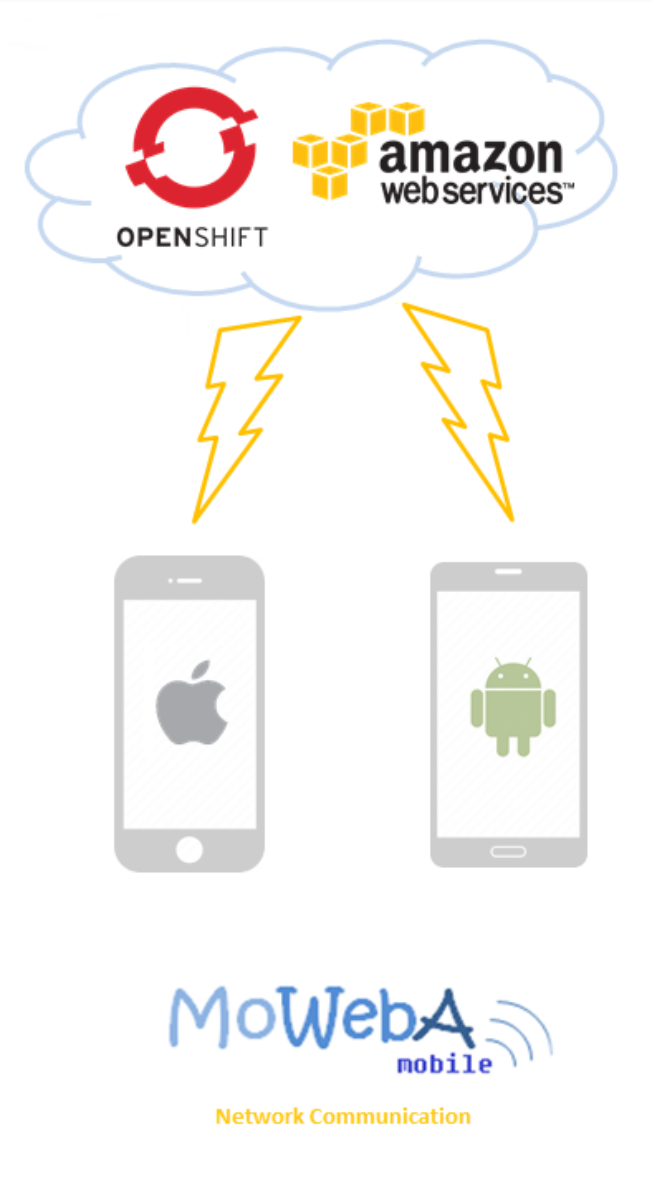
Proposed Solution - Network Communication



Based on:

- REST Architecture
- Communication Functions
  - Light-data
  - Load-image
  - Download-files

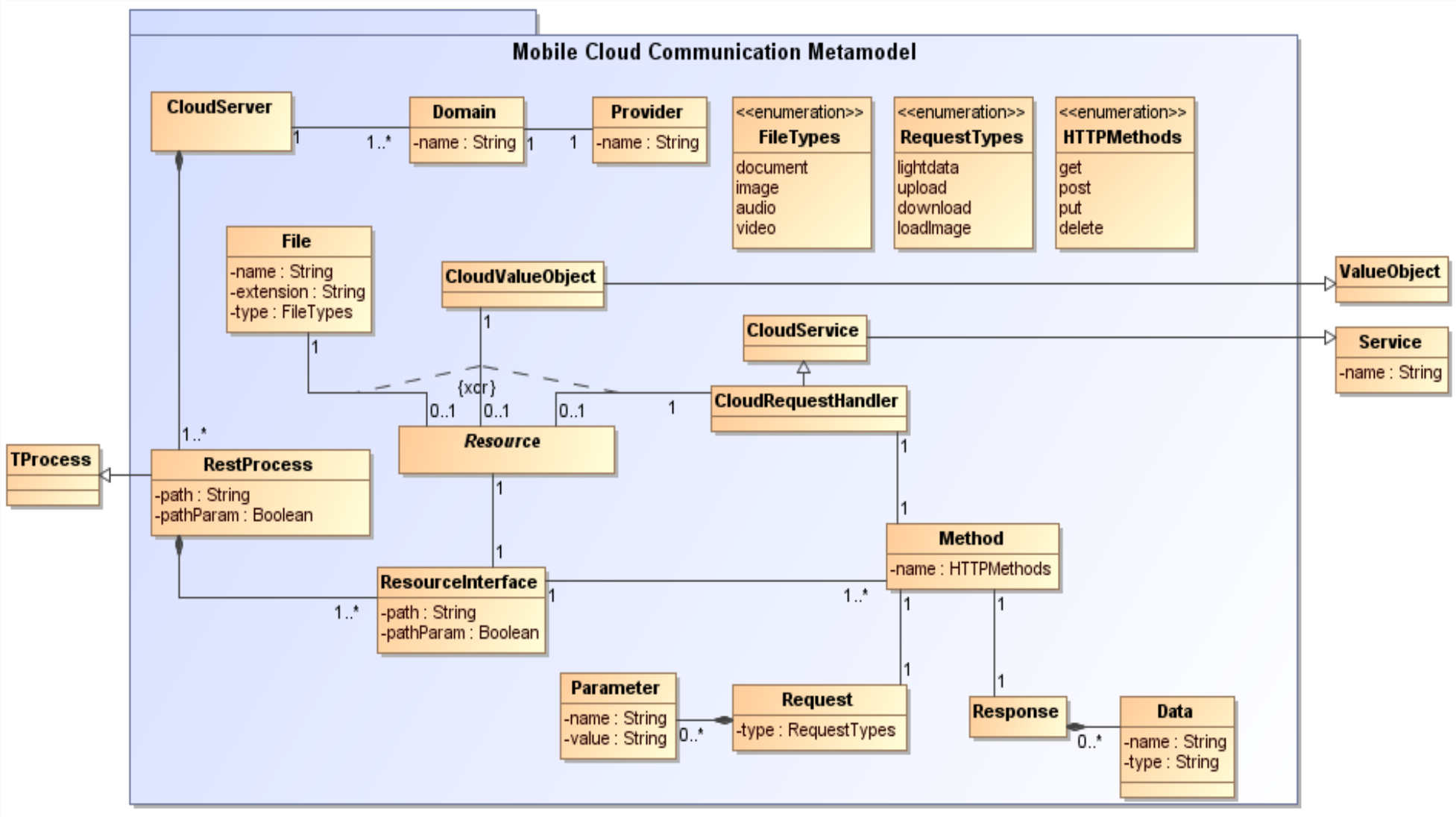
Proposed Solution - Network Communication



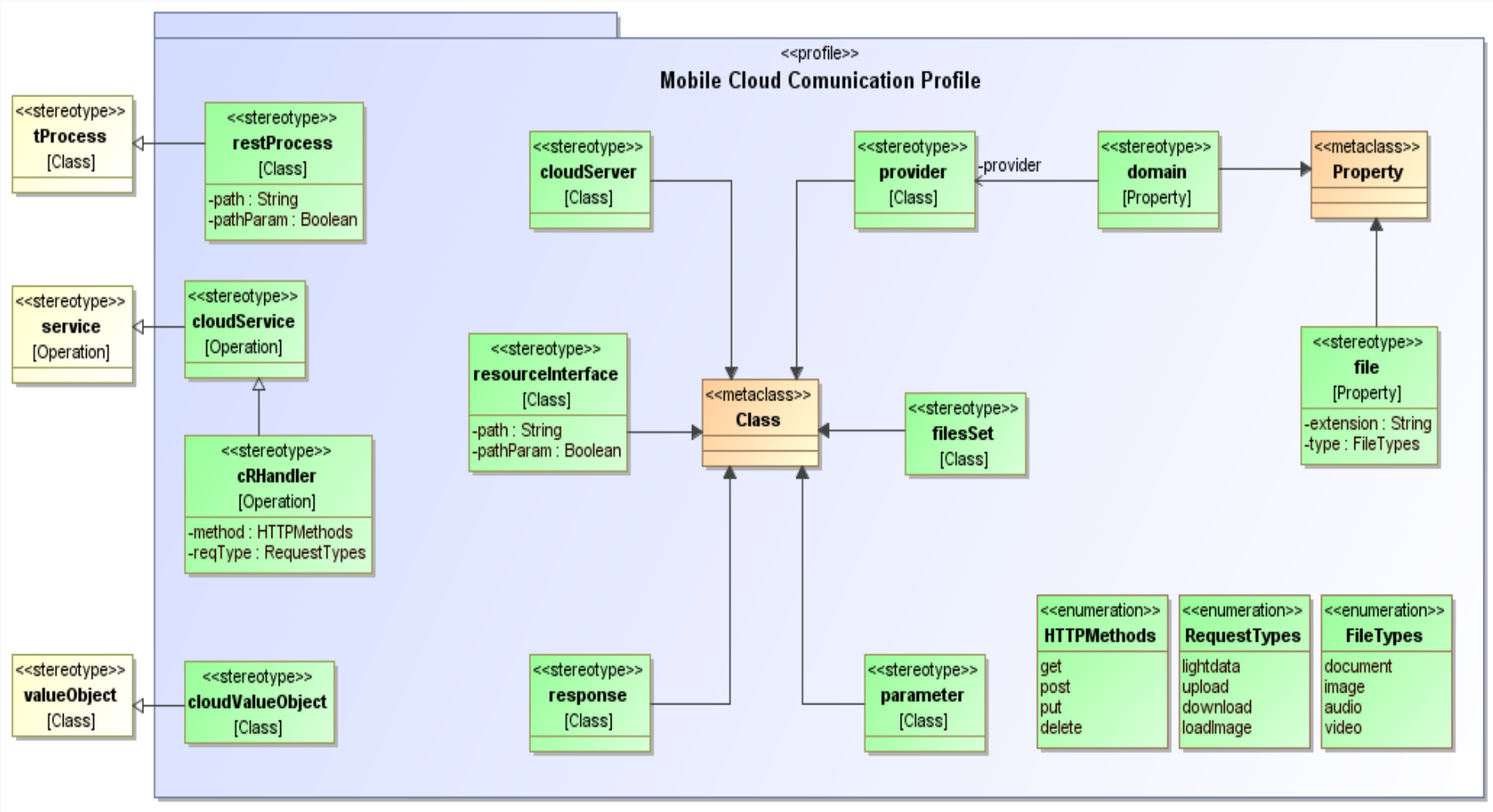
Based on:

- REST Architecture
- Communication Functions
  - Light-data
  - Load-image
  - Download-files
  - Upload-files

Proposed Solution - ASM Metamodel



Proposed Solution - ASM Profile



Proposed Solution - Transformation Rules

Mapping between the model and the target code

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Mapping between the model and the target code

M2T transformation rules

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Languages: MTL, OCL and Java

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Target code generated:

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Languages: MTL, OCL and Java

Target code generated:

- Mobile: Swift for iOS, Java for Android

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Mapping between the model and the target code

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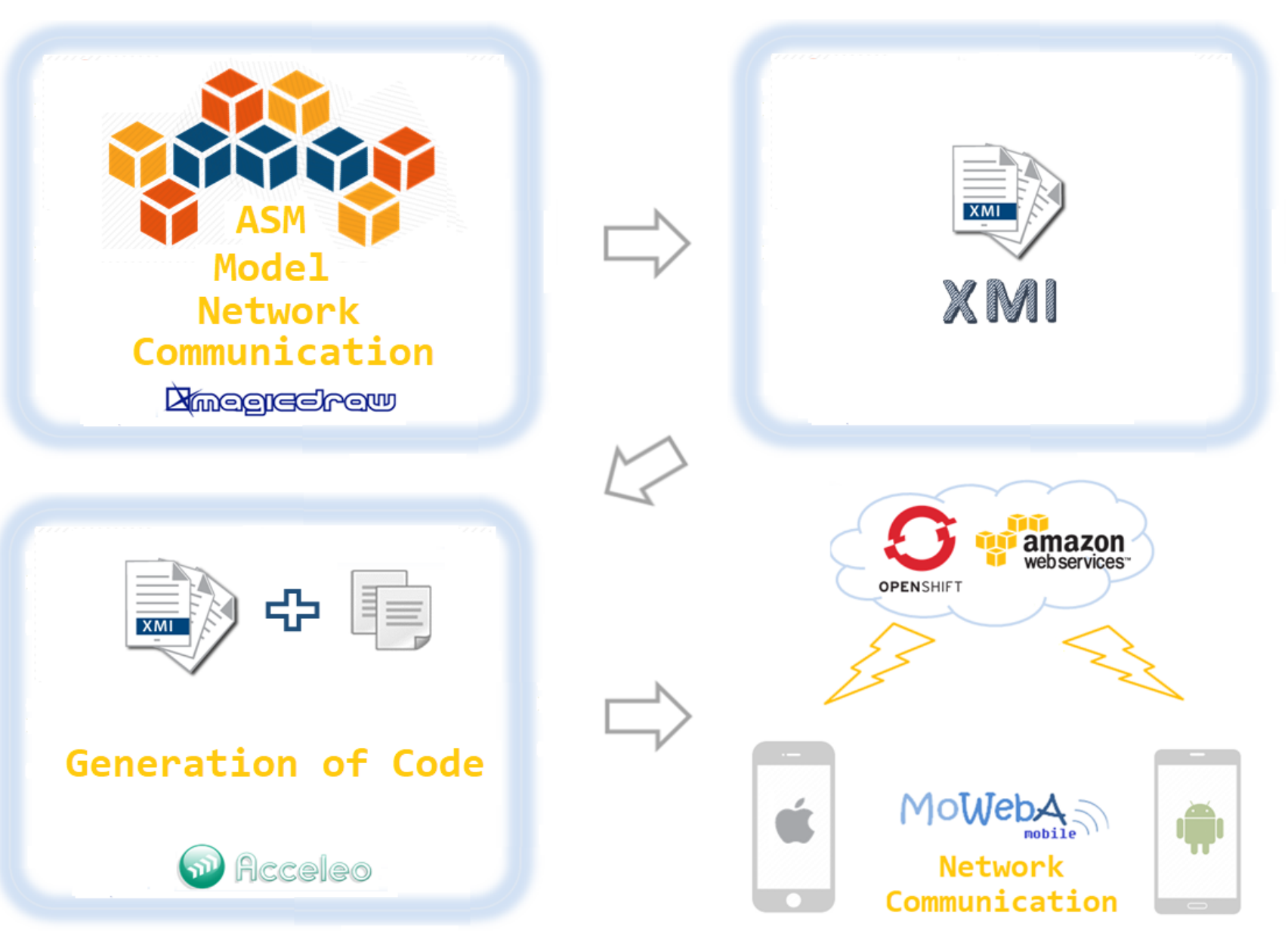
Languages: MTL, OCL and Java

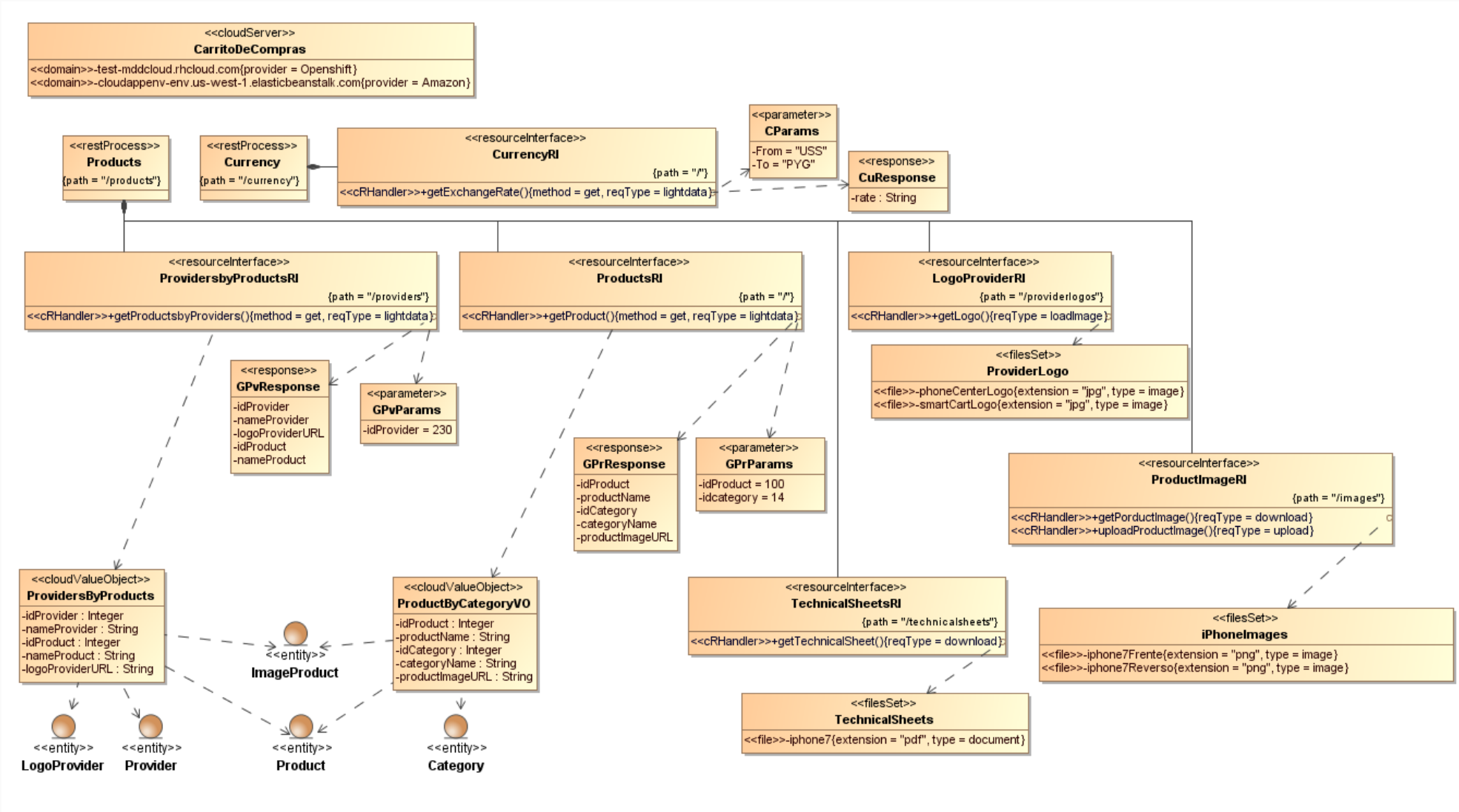
Target code generated:

- Mobile: Swift for iOS, Java for Android
- Cloud: Javascript - Node.js for Openshift and AWS

Proposed Solution - Development Process



Proposed Solution - Example



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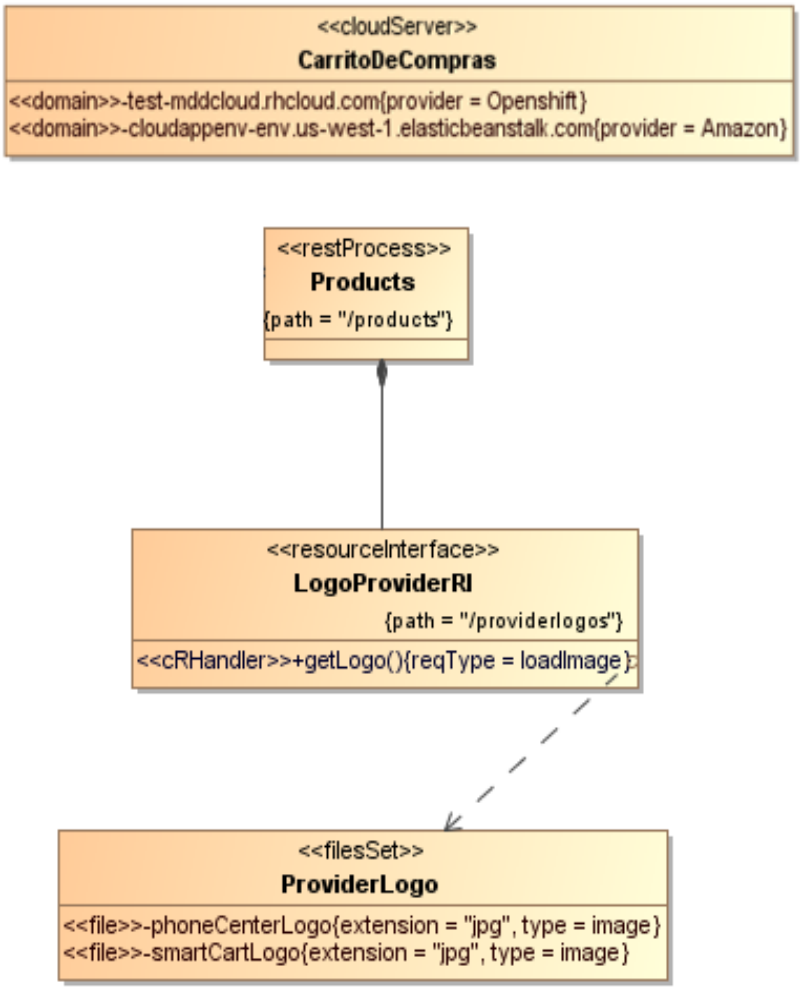
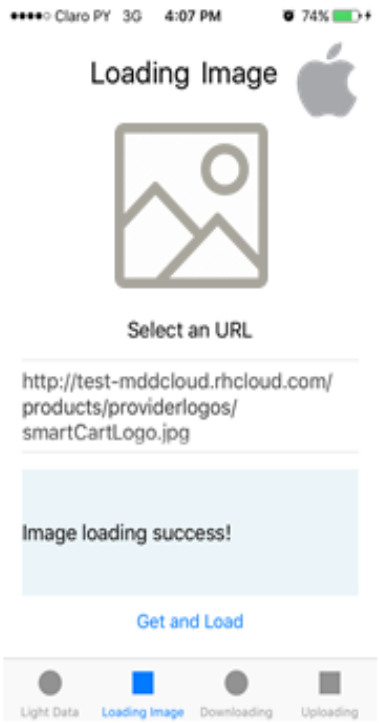
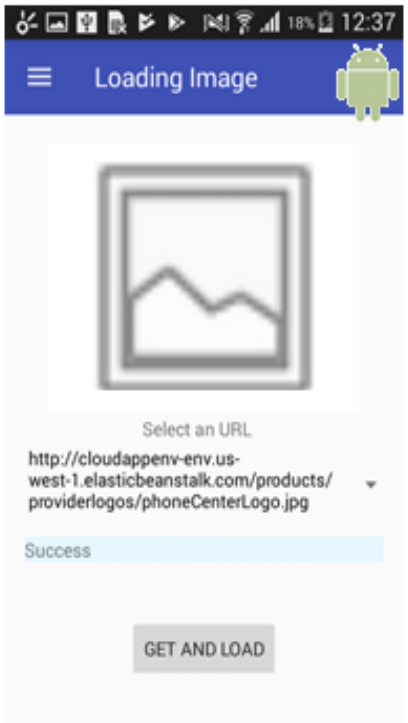


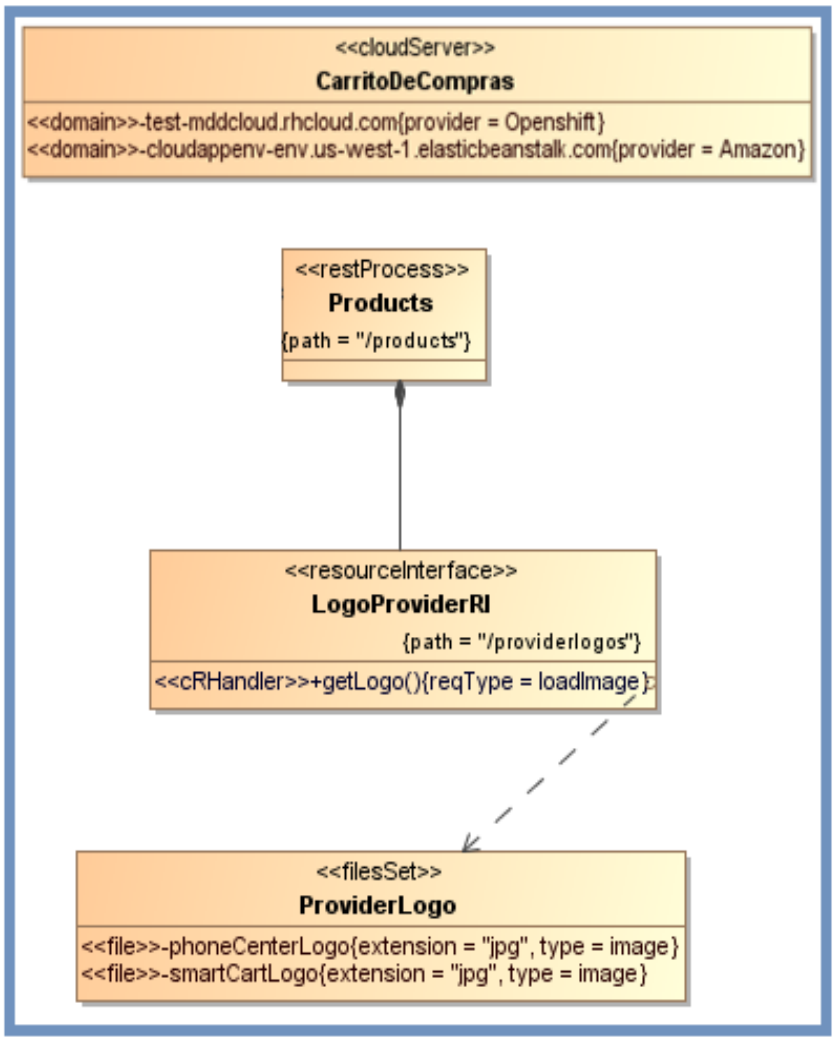


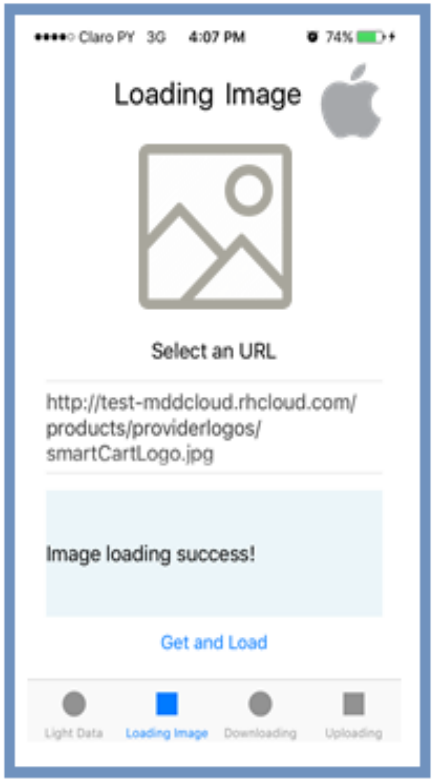


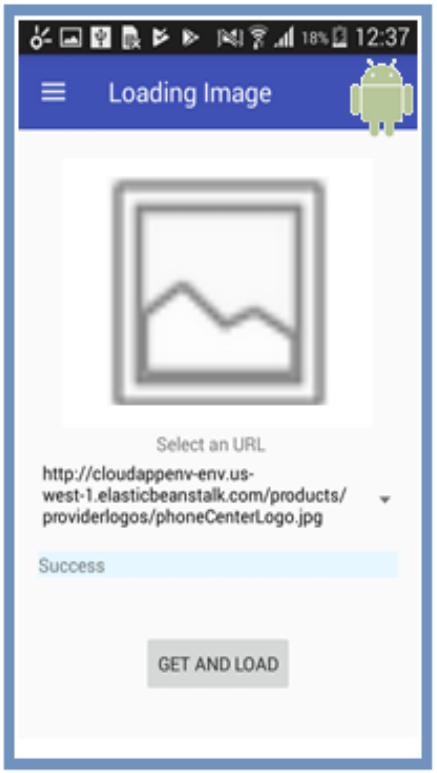
OPENSHIFT

AWS

Proposed Solution - Example







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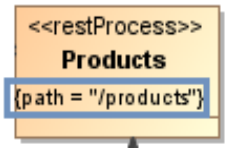

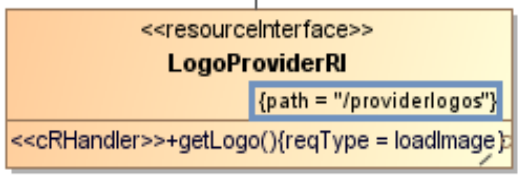

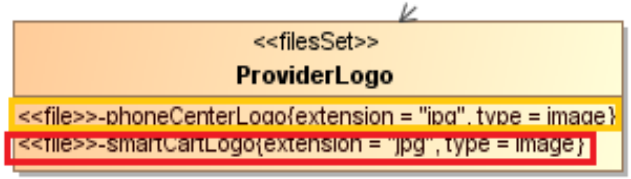

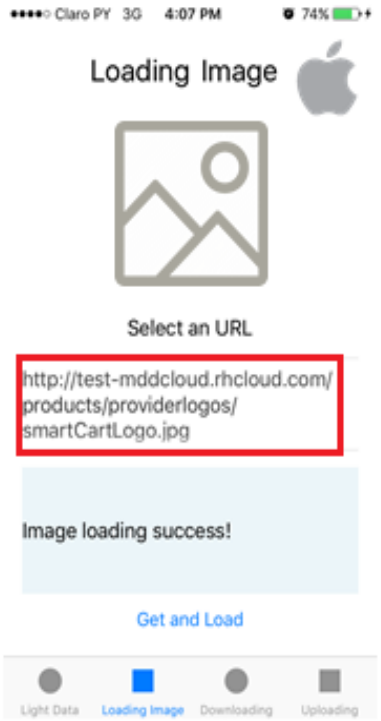

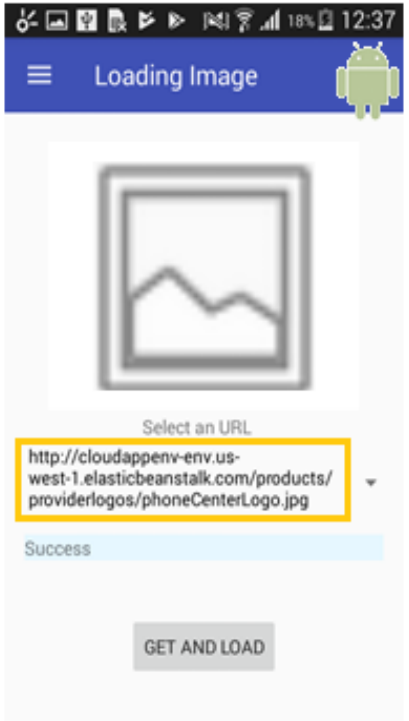

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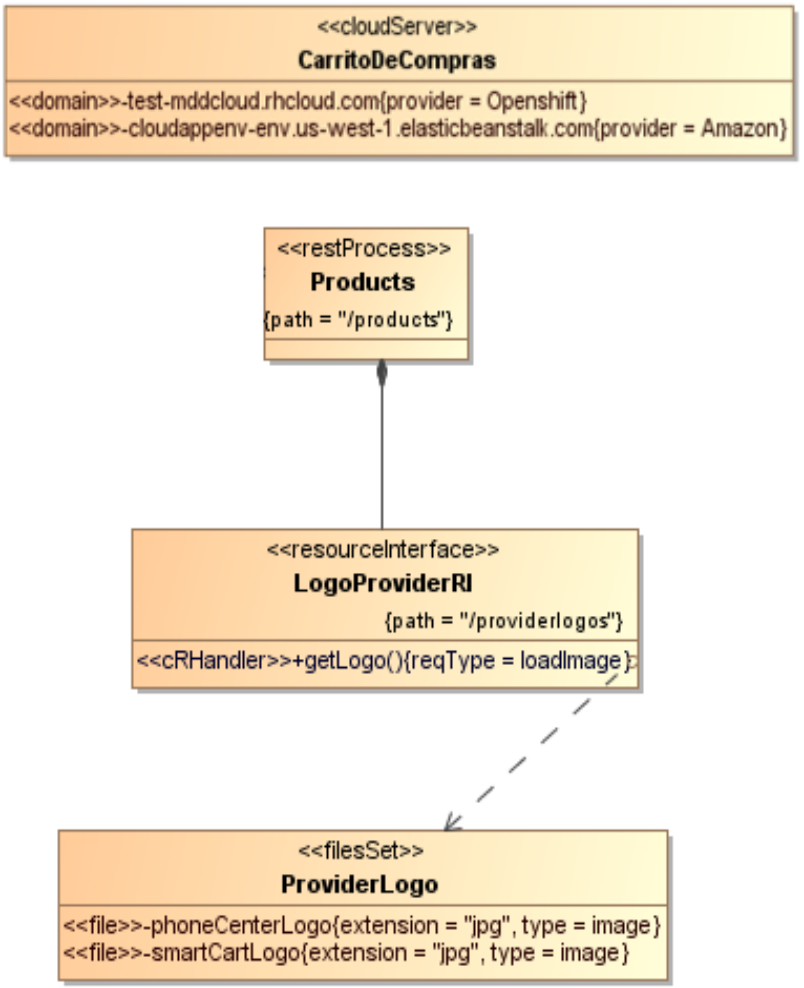

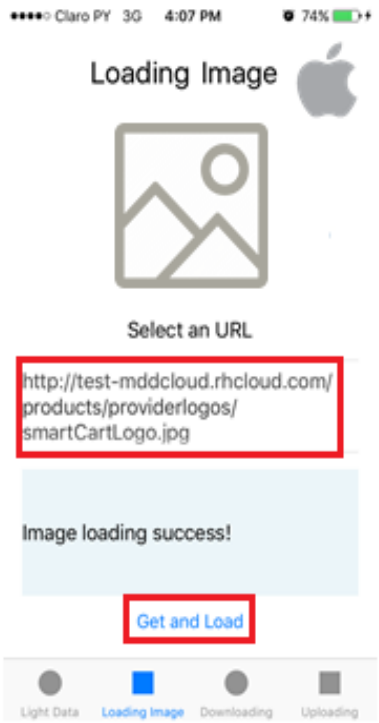

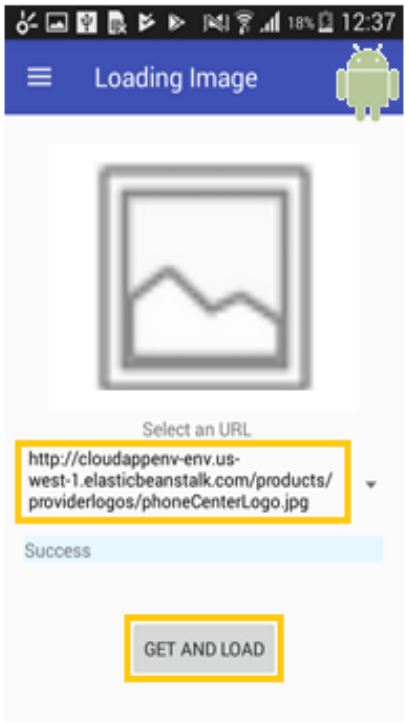

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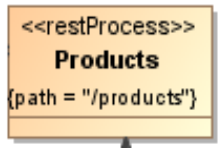

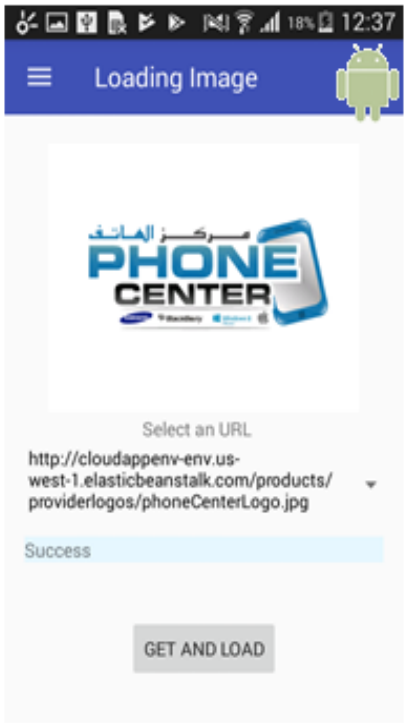

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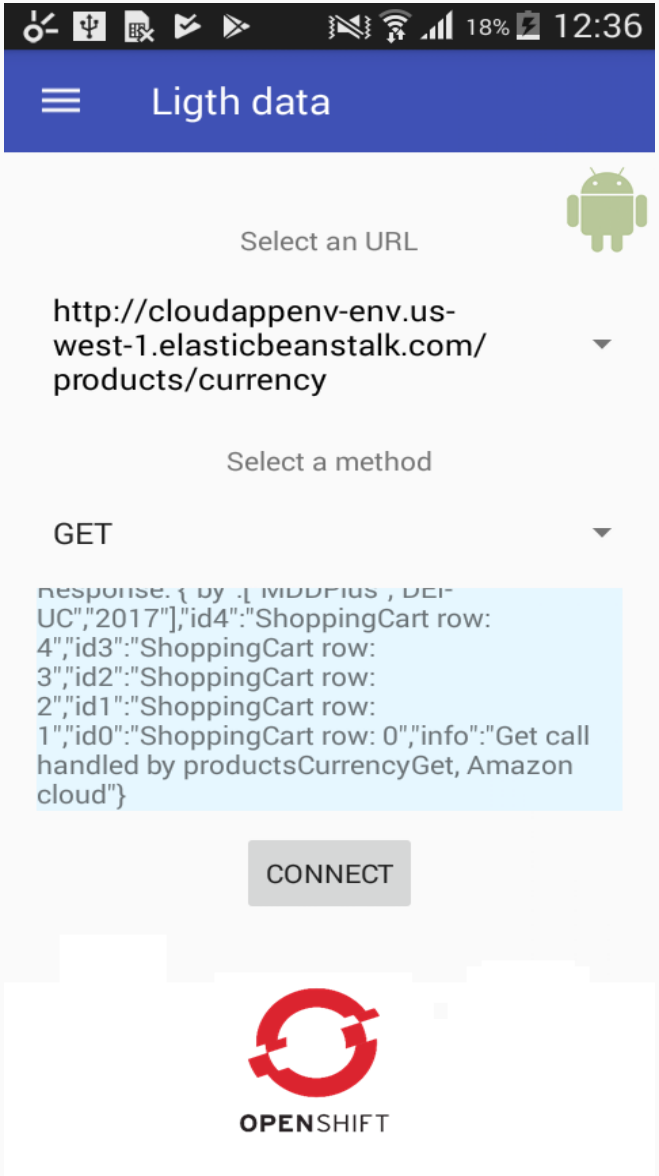

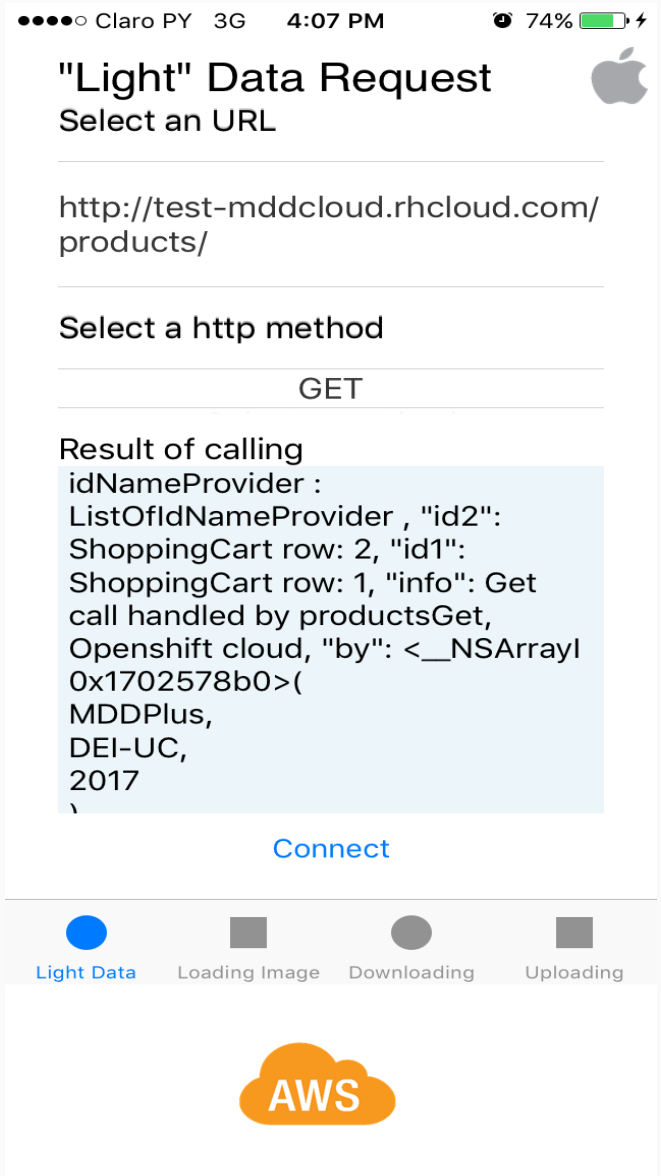

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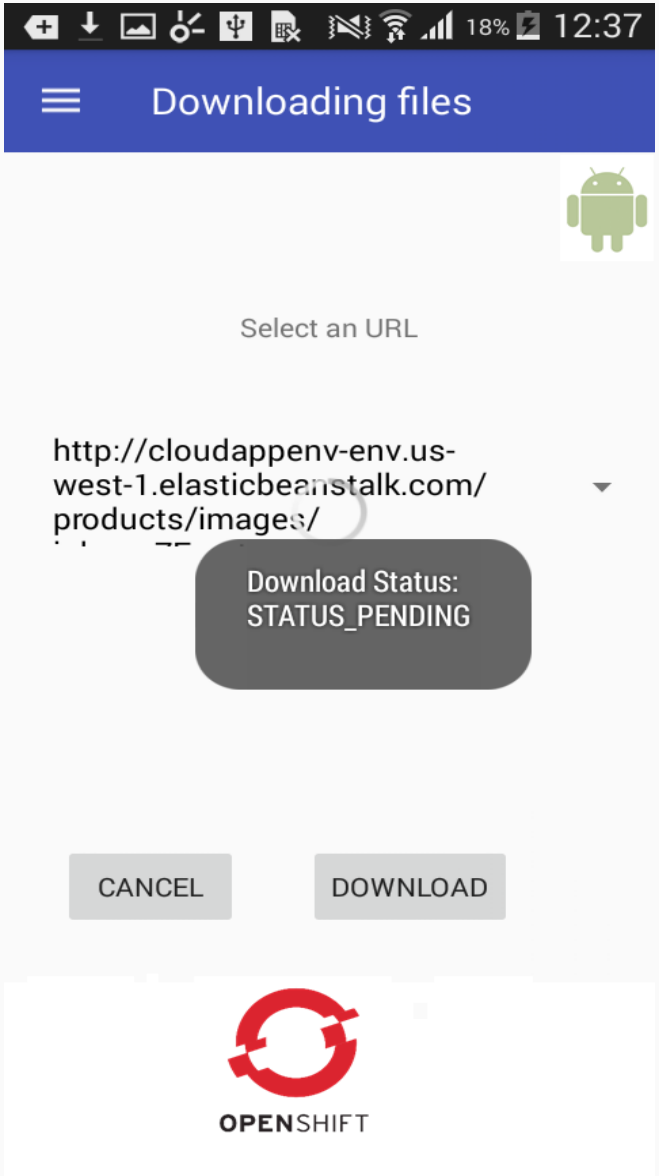

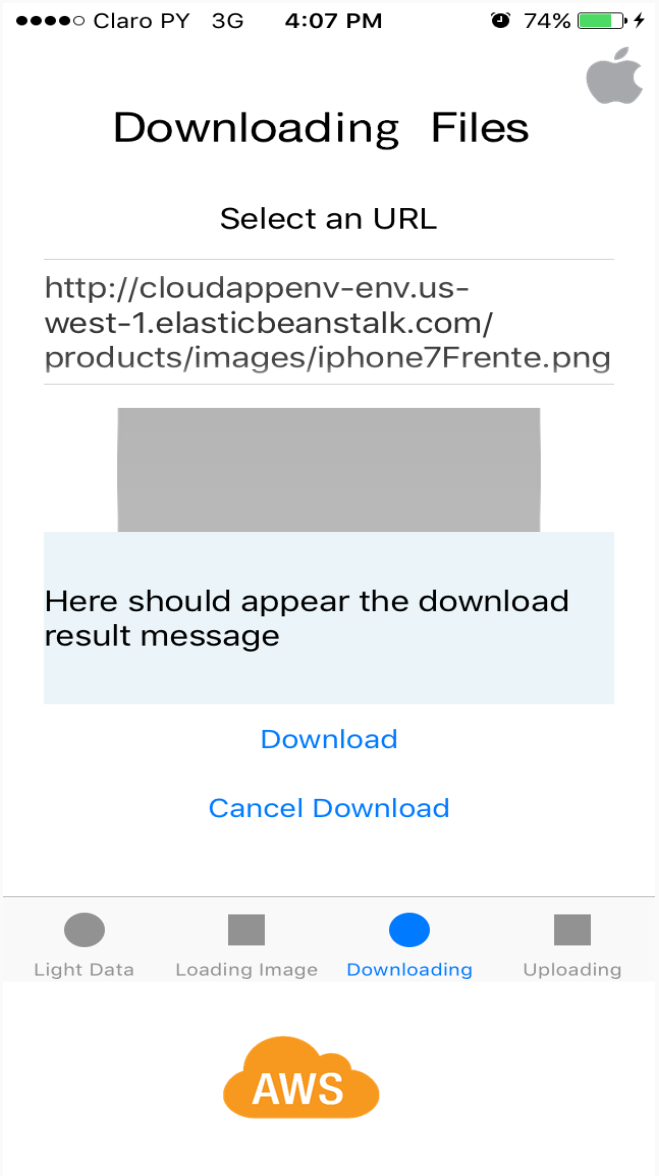

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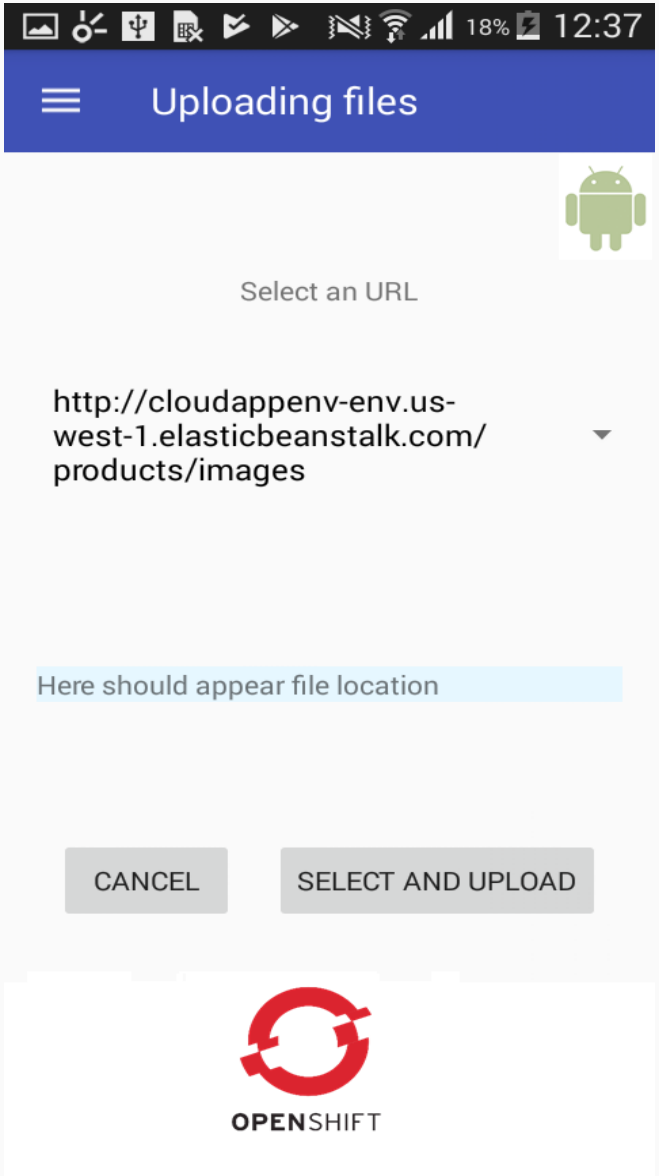

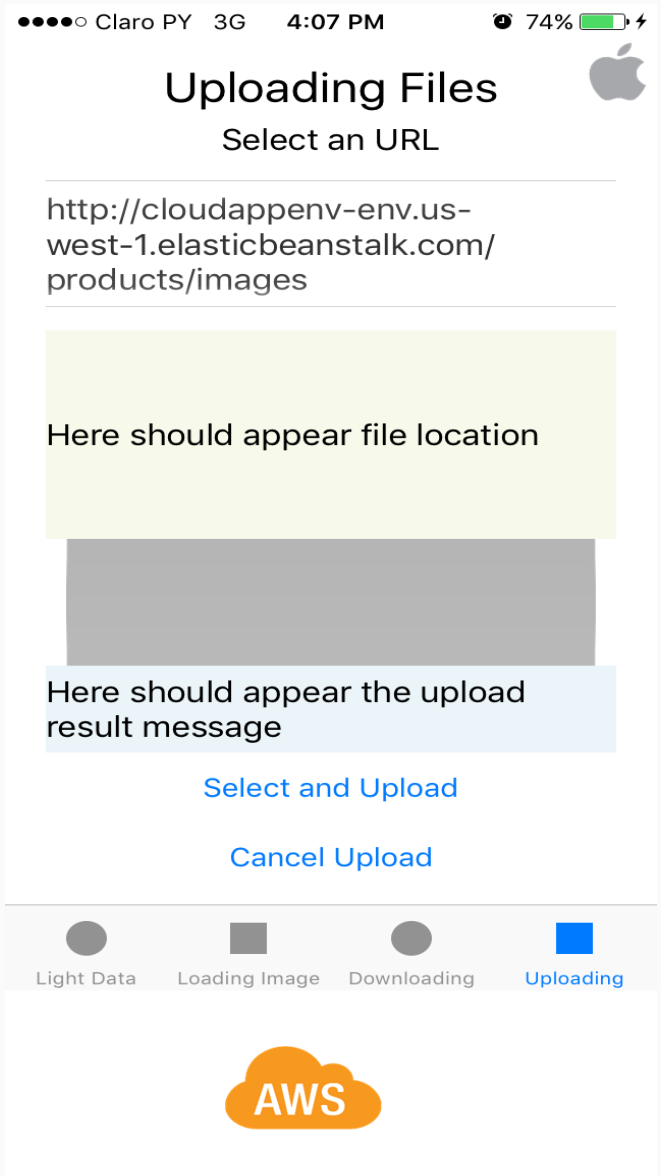

Comparative Studies

Comparative Studies - MoWebA Mobile vs Manual Dev.

Goal: Compare the effort between the manual approach and MoWebA Mobile

Comparative Studies - MoWebA Mobile vs Manual Dev.

Manual Development

Development time* of the network communication																												
Environments	Platforms	Month 1				Month 2				Month 3				Month 4				Month 5				Month 6				Month 7			Total per Platform
Cloud	Node.js	20	20	4	4																								48
	Amazon																					20	12				4		36
	Openshift					12	12						12										12				4		52
Mobile	iOS												20	20	20	20		20	4				4			12	4		124
	Android																			32	32			20	4	4	4		96
Total per week		20	20	4	4	12	12	0	0	0	0	0	32	20	20	20	0	20	4	32	32	20	28	20	4	16	16		
Observations: *Time in hours - Months divided by weeks																										Total		356

MoWebA Mobile

Tool	Light-data functions	Load-image functions	Download-upload files functions	Total
MoWebA Mobile (A)	Cloudserver: 3 min. Lightdata-customer: 23 min. Light-data purchases: 11 min. Light-data productByProvider: 11 min. Light-data currency, function as resource: 5 min. Subtotal: 53 min.	Load-image logo: 6 min. Subtotal: 6 min.	Download-images: 8 min. Download-sheets: 4 min. Upload-images: 4 min. Subtotal: 16 min.	1:15 min. + 5 min. of gen = 1:20 min.

Comparative Studies - MoWebA Mobile vs Manual Dev.

Considerable difference of time/effort

Comparative Studies - MoWebA Mobile vs Manual Dev.

Considerable difference of time/effort

Manual development

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Considerable difference of time/effort

Manual development
- Difficulty of working with different platforms

Comparative Studies - MoWebA Mobile vs Manual Dev.

Considerable difference of time/effort

Manual development
- Difficulty of working with different platforms
- Learning curve

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MoWebA Mobile

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- Difficulty of working with different platforms
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MoWebA Mobile
- Unified modeling, abstraction of platforms

Comparative Studies - MoWebA Mobile vs Manual Dev.

Considerable difference of time/effort

Manual development
- Difficulty of working with different platforms
- Learning curve

MoWebA Mobile
- Unified modeling, abstraction of platforms
- Automatic generation of code from the ASM

Comparative Studies - MoWebA Mobile vs WMP

Goal: Make a comparison against a tool used in the industry, WebRatio Mobile Platform

Comparative Studies - MoWebA Mobile vs WMP

RQ1 - What differences of communication modeling are between MoWebA Mobile and WebRatio Mobile Platform?

Communication	Aspect	MoWebA Mobile	WebRatio Mobile Platform
Data model	Abstraction	Value objects	Entities
	Synchronization	Not considered yet	Automatic method
Files	Path customization	Through the model	Not included
In general	Abstraction	Same project and model	Different projects and models
		No web service concepts	Web service concepts
	Authentication	Not included yet	Included
	Database connection	No	Yes

Comparative Studies - MoWebA Mobile vs WMP

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Comparative Studies - MoWebA Mobile vs WMP

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Comparative Studies - MoWebA Mobile vs WMP

RQ2 - What kind of code do MoWebA Mobile and WebRatio Mobile Platform generate?

Side	MoWebA Mobile	WebRatio Mobile Platform
Mobile	Native mobile app	Hybrid Mobile App
Cloud	Open source code based on Javascript - Node.js	Open source code based on Java

Comparative Studies - MoWebA Mobile vs WMP

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Comparative Studies - MoWebA Mobile vs WMP

RQ3 - Respectively, how many platforms do MoWebA Mobile and WebRatio Mobile Platform generate code for (mobile and cloud)?

Side	MoWebA Mobile	WebRatio Mobile Platform
Mobile	Two (iOS and Android)	Two (iOS and Android)
Cloud	Two (Openshift and Amazon), based on Docker	One (their own cloud platform)

Comparative Studies - MoWebA Mobile vs WMP

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Comparative Studies - MoWebA Mobile vs WMP

RQ4 - How much time do MoWebA Mobile (A) and WebRatio Mobile Platform (B) require to model the network communication?

Tool	Communication based on data model as resources	Communication based on remote functions as resources	Communication based on files as resources (files stored in directories)	Time to connect to the database	Total
A	Cloudserver: 3 min. Lightdata-customer: 23 min. Light-data purchases: 11 min. Light-data productByProvider: 11 min. Subtotal: 48 min.	Light-data currency, function as resource: 5 min. Subtotal: 5 min.	Load-image logo: 6 min. Download-images: 8 min. Download-sheets: 4 min. Upload-images: 4 min. Subtotal: 22 min.	No aplica	1:15 min.
B	Set the services for entities: 3 min. Time to replicate database: 5 min. Subtotal: 8 min.	Exposing the service (currency function): 15 min. Invoking the service (currency function): 6 min. Subtotal: 21 min.	LoadImage : 5 min. Download-images: 5 min. Download-sheets: 5 min. Upload-images: 5 min. Subtotal: 20 min.	Connect to database: 4 min. Subtotal: 4 min.	53 min.

Comparative Studies - MoWebA Mobile vs WMP

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Conclusions - Contributions

SMS published in CLEI 2016 and CLEIej

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Extension of MoWebA to develop the MobileApps-FC

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ASM to design and to generate the network communication

Conclusions - Contributions

- SMS published in CLEI 2016 and CLEIej
- Extension of MoWebA to develop the MobileApps-FC
- ASM to design and to generate the network communication
- Two comparative studies with MoWebA Mobile

Conclusions - Future Works

Build transformation rules between the PIM and the ASM

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Enrich the modeling of the MobileApps-FC

Conclusions - Future Works

- Build transformation rules between the PIM and the ASM
- Enrich the modeling of the MobileApps-FC
- Improve validations of our proposal

Thanks

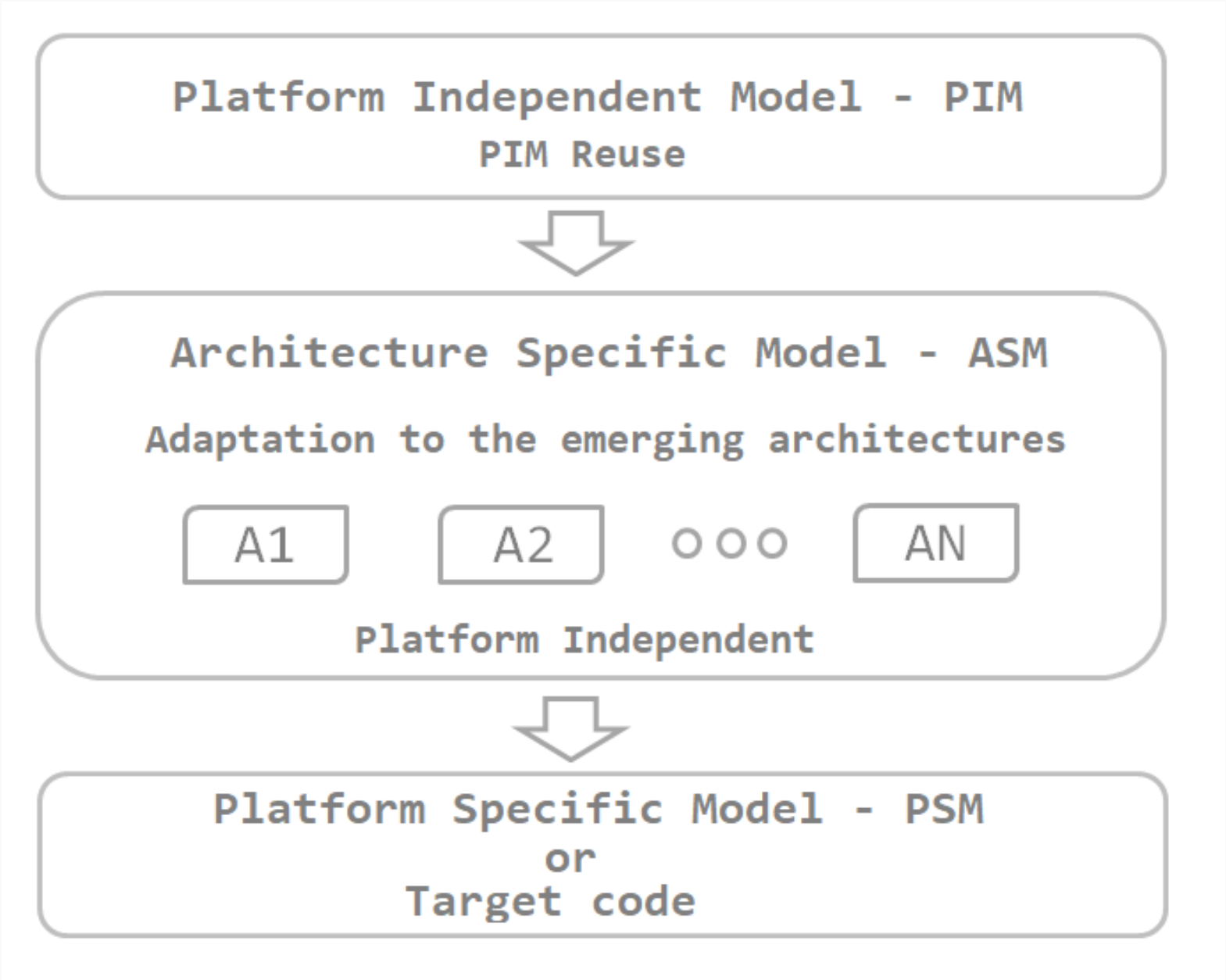
Questions?

Contact

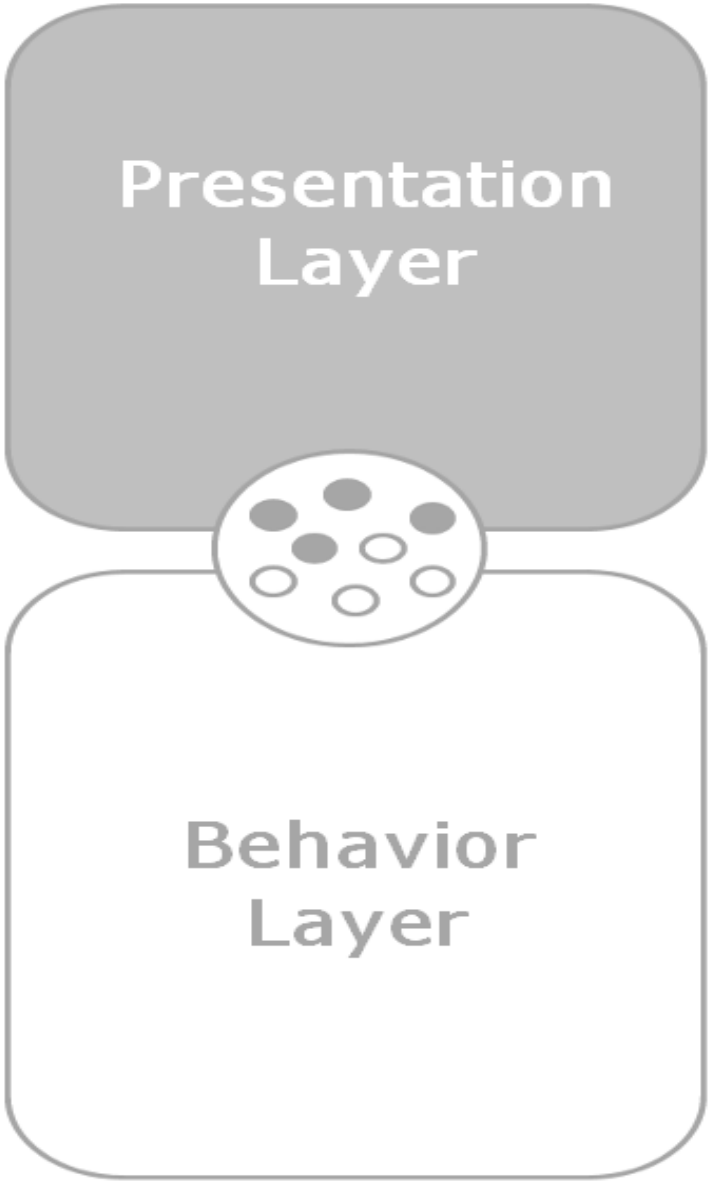
Emanuel A. Sanchiz F.

emanuel.sanchiz@uc.edu.py

Previous Work - ASM



Previous Work - Separation of Pres. y Beh.



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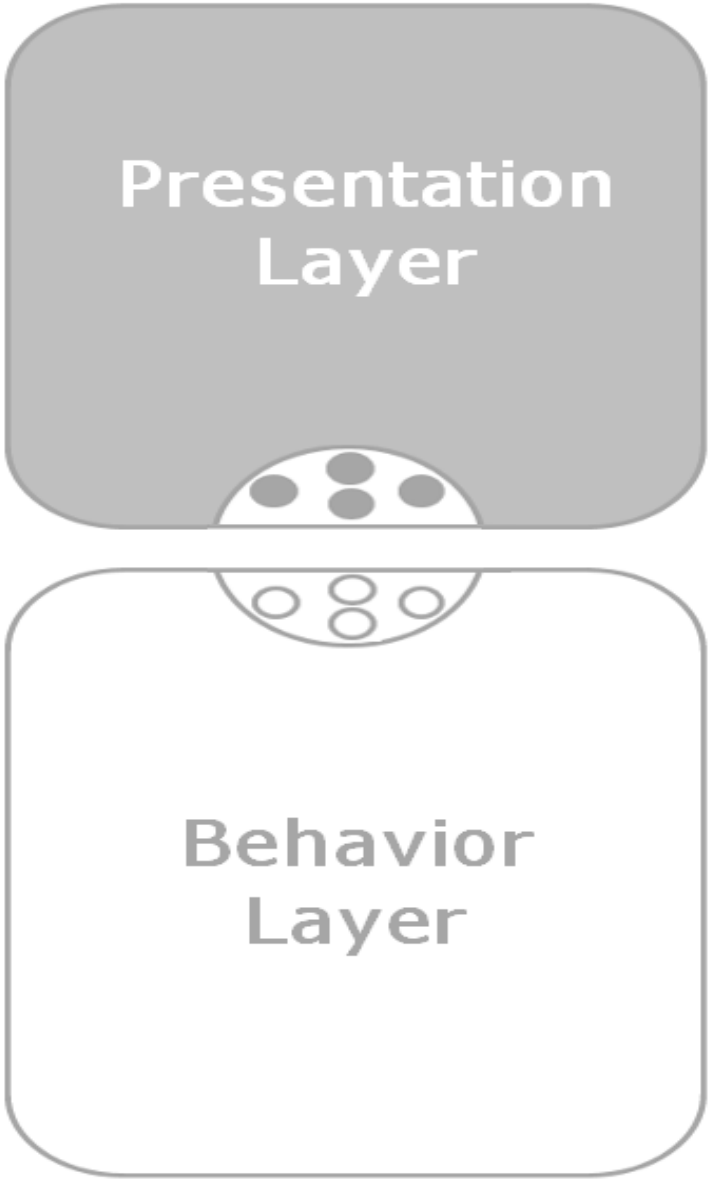
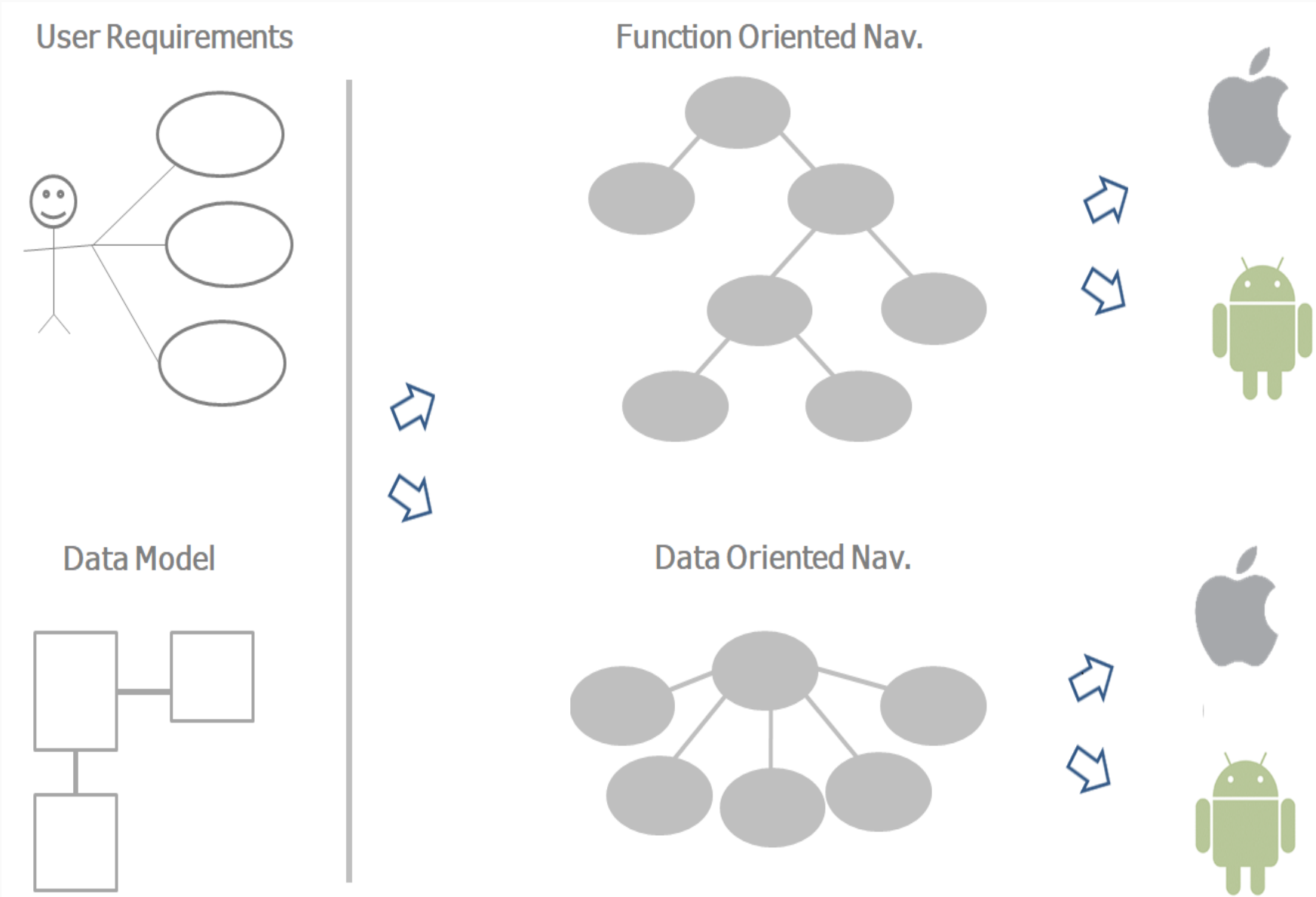
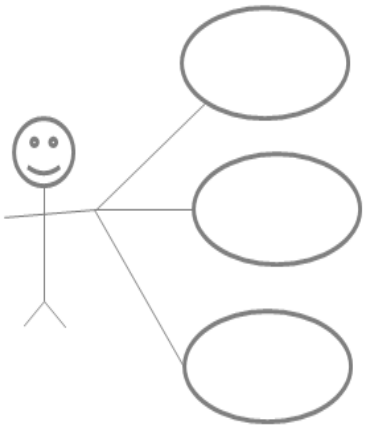


Previous Work - Function Oriented Nav.

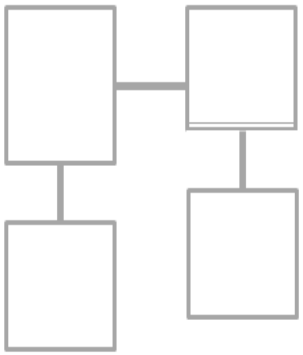


Previous Work - Function Oriented Nav.

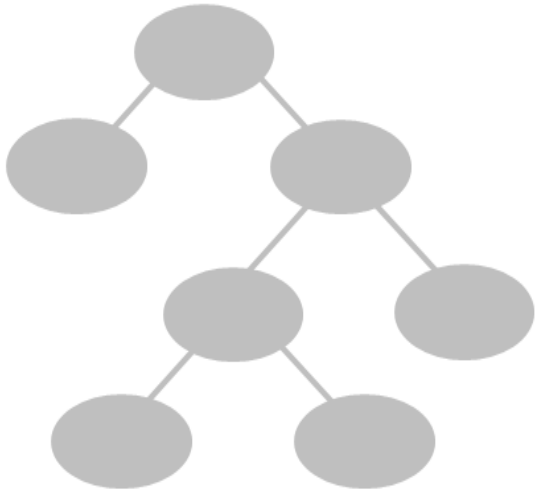
User Requirements



Data Model



Function Oriented Nav.



Data Oriented Nav.