Mobile Opportunistic Traffic Offloading: A Business Case Analysis

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***Abstract*—Mobile cellular network operators in all over the world are facing dramatic challenges due to widespread distribution of smartphones, tablets, and other mobile devices that are demanding data-hungry multimedia services. Seventh Framework Programme (FP7) Mobile Opportunistic Traffic Offloading (MOTO) project tries to alleviate this burden on mobile operators by investigating a next generation traffic offloading architecture that can exploit both cellular to other wireless infrastructures as well as offloading device-to-device ad hoc communications between users devices. On the other hand, business case analysis of this new approach has yet to be analyzed. This paper discusses a forecast analysis of the application of MOTO solution within offloading market by investigating different business models and scenarios as well as value chains between new actors. The simulations results, which are also supported by mobile operators historical data, demonstrate achievements of MOTO approach over main financial indicators and various trade-offs involved in the deployment scenarios.**

***Keywords*—business models, opportunistic offloading, value chain.**

I. Introduction

FP7 MOTO project proposes a traffic offloading architecture that exploits a diverse set of offloading schemes, including offloading from cellular to other wireless infrastructures (such as Wi-Fi), and also offloading to multi-hop ad hoc communications between users devices in a synergic manner[1]. The aim of the project is to develop new coordination mechanisms and inter-technology scheduling policies for controlling the offloading process between multi-operator infrastructures and opportunistic networks formed by user terminals. MOTO coordination protocols enable network operators to use various offloading strategies by dynamically allocating offloaded traffic to wireless infrastructures and opportunistic technologies based on the monitored status of data dissemination process (e.g., measuring the fraction of users that have received contents by a certain time). Through these coordination points, operators could balance the offloaded traffic assigned to each access point in their (cellular or Wi-Fi) wireless infrastructures.

On the other hand, developing a business model and performing business case analysis of MOTO solution is yet another important dimension that needs to be explored while developing the technology. Appropriate business models can create value through the exploitation of business opportunities and provide benefits to customers in order to create this value. Moreover, it can give insights into how a company can create value and gain competitive advantages over its developed product [1, 2].

A. Related Works and Our Contributions

There are different studies in terms of both technological and business context of mobile opportunistic networks in the literature. In the technology domain, mobile data offloading has been studied extensively in the literature [3, 4]. The main idea behind data offload is to divert low value, high volume data traffic into an alternative access network such as Wi-Fi. In the business domain, mobile data offloading (especially into Wi-Fi access networks) has also received increased attention over the last couple of years due to initiation of real deployments of offloading products by mobile operators [5, 6, 7]. White papers in [5] and [6] analyze the economic trade-offs involved by deploying a Wi-Fi offload network through different case studies. The paper in [5] shows how mobile operators providing seamless mobile Wi-Fi offload can save costs by creating alternative access networks and by differentiating their offers. The paper in [6] demonstrate that operational expenditures (OPEX)-related costs, such as monthly site rental and backhaul expenses, determine the viability of a Wi-Fi offload network and the importance of right balance between Wi-Fi coverage area and access point (AP)

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[1]http://www.fp7-moto.eu/

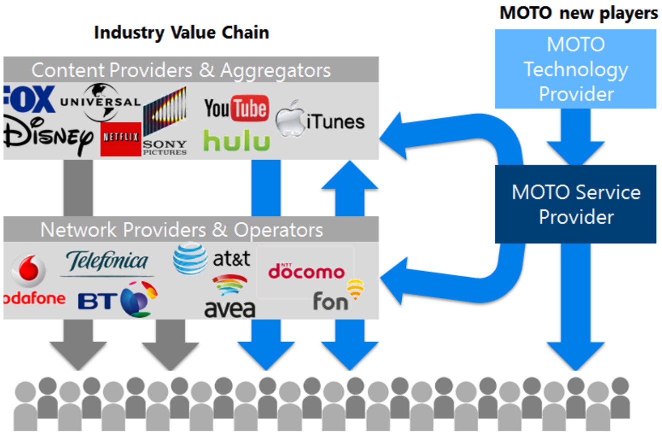

Fig. 1: MOTO Value Chain.

densities. The analysis in [7] shows that Wi-Fi added to small cells greatly improves the small-cell business case in terms of per-bit total cost of ownership (TCO) and integrated of Wi-Fi into mobile operators maximizes the benefits in terms of efficiency and per-bit costs.

However, most of the above studies are examining the typical scenarios of Wi-Fi offloading opportunities and none of these business studies are investigating business models and scenarios for the case of existence of offloading through device-to-device and opportunistic communications while considering the benefits of mobile operators. The purpose of this paper is to combine a framework for understanding the business models, scenarios, value chains, new actors for the application of MOTO platform inside the business ecosystem of a mobile operator. The organization of this paper is as follows: Section II describes the MOTO value chain. Section III discuses about two business case analysis, offloading business case and MOTO enabled service business case, finally Section IV gives conclusions.

II. MOTO Value Chain

In this section, we describe MOTO value chain which defines new actors and their relationships with the existing players that could be used directly or indirectly for developing, creating and marketing a product or process, or for creating and providing a service. Fig. 1 depicts a simplified value chain for a MOTO business ecosystem. From Fig. 1, three main levels have been defined in the value chain: *MOTO Technology providers* are those entities that develop and offer MOTO technology. This may include MOTO Service Platform and MOTO software for the terminals. In this case, the MOTO solution (including platform, terminal functionalities and Application Programming Interfaces (APIs)) developed is exploited as a technology solution that can be sold (by a company providing this solution) to any entity that wants to deploy MOTO related services, e.g. mobile operators, media content providers, etc. *MOTO Service providers* are those entities that purchase technology from MOTO technology providers and offer MOTO related services to other entities or directly to end users. In this case, MOTO solution is exploited as service. For instance, a MOTO service provider (e.g. an operator with MOTO technology solution) offers MOTO services to other entities willing to use MOTO, e.g. content providers. *End consumers* are those entities that consume MOTO related services provided by MOTO service providers.

Within each of the levels, several entities can also be represented. Some of these entities may fit into different levels, depending on the roles they play. Also note that an entity may adopt more than one role. For instance, a company might be both a MOTO technology provider and a service provider at the same time or an operator may behave as a MOTO service provider and an end consumer (i.e. self-consumer).

III. Business Case Analysis

For the business case analysis activities, two business case examples that cover different values propositions have been performed. In the first one, a mobile operator is acting as the end consumer of a MOTO solution and value is derived from the traditional benefits of offloading. In the second one, a MOTO enabled service is exploited and the operator is acting as the MOTO service provider, being a content provider the end consumer. In both cases, the operator is playing the main role of the value chain. As a matter of fact, the business cases have been particularized for mobile operators case by gathering real market inputs and prospections of the mobile operator. Note that both approaches provide a complete view of the most relevant MOTO technology commercial applications. Additionally, those approaches can also be combined so that the operator may use its MOTO platform for both value propositions and also for benefiting from different synergies.

A. *Offloading Business Case*

This business case is exemplifying the value provided by MOTO when it is mainly used for offloading purposes

Total Mobile Subscribers	N_{tot}
Total Revenue Improvement	R_{tot}
CAPEX savings due to offloading	S_{capex}
Total Traffic Offloaded per year	T_{tot}
Total Cost (Platform + Client + Maintanence)	C_{tot}
Cumulative Net Impact	I_{tot}
Acquisition	N_{aqu}
Churn	N_{churn}
Average Revenue Per User (ARPU)/month	R_{user}
Mobile Traffic/user/month	T_{user}
Smart phone subscribers after MOTO	N_{smart}
Smart phone subscribers before MOTO	N^{o}_{smart}
MOTO Offloading gain (%)	G_{off}
Savings per MB (Euro)	S_{MB}
MOTO enabled smartphones (%)	ρ_{moto}
MOTO Service fee	F_{moto}
Advertisement revenue	R_{ad}
Number of Expected Contracts	N_{con}
Number of Advertisement per Contract	N^{ad}_{con}
Price per Advertisement	P_{ad}
Fixed monthly service fee	F_{mon}
Advertisement revenue share for operator (%)	ρ^{op}_{ad}

TABLE I: Symbols of parameters used in simulation analysis.

	2016	2017	2018	2019	2020
N_{tot} w/ MOTO [k]	18180	19429	20743	22237	23829
N_{tot} w/o MOTO [k]	18160	19355	20580	21945	23345
T_{tot} [GB]	713	1250	1690	2844	5296

TABLE II: Evolutions for total number of subscribers with and without MOTO and traffic offloaded with MOTO.

Revenue Improvement	2016	2017	2018	2019	2020
R_{tot} [M€]	0.16	0.62	1.42	2.67	4.64
Income w MOTO [k]	144	161	180	201	224
Income w/o MOTO [k]	145	162	181	204	229
CAPEX savings					
S_{capex} [M€]	0.20	0.33	0.41	0.63	1.06
C_{tot} [M€]	2.40	1.82	1.73	1.63	1.50

TABLE III: Revenue improvements, CAPEX savings and cost structures.

by a mobile operator. Within the MOTO value chain, the mobile operator is acting as an end consumer which purchases MOTO technology from a MOTO Technology provider. It is also assumed that the operator is in charge of maintaining and operating the MOTO platform. The value is quantified from two factors: **i) Capital expenditures (CAPEX) savings** provided by a cost effective network capacity increase. **ii) Customer satisfaction improvement**, which entails an acquisition rate increase and a churn reduction.

In order to calculate total mobile subscribers as well as total traffic offloading forecasts over the next five years from 2016 to 2020 using Eq. (1), mobile subscriber numbers evolution, churn and acquisition rates (current & evolution)), mobile traffic per user per month current & evolution) and smartphone subscriber numbers current & evolution) of mobile operator's centralized database in Turkey is used using the historical data from 2009 to 2015. For forecasting of churn and acquisition rates, smartphone subscribers and mobile traffic/user/month, second order polynomial regression model is used. A summary of all the parameters used throughput the simulations are given in Table I.

Similarly, some information such as ARPU per month of mobile operator in Turkey is gathered from Information and Communications Technologies Authoritys website [8]. As an example, considering the inputs, the assumptions and the sensitivity analysis cases defined above, Table II is obtained for the total number of subscribers and traffic offloaded through MOTO where

$$N_{tot}\text{ (current)} = N_{tot}\text{ (previous year)} + (N_{aqu}\text{ - }N_{churn})$$
$$T_{tot} = T_{user} * N_{smart} * G_{off} * \rho_{moto}. \tag{1}$$

Revenue, savings and cost structure: Two main benefits are quantified: **i) Revenue improvement** due to customer satisfaction increase. The introduction of MOTO is improving acquisition and churn figures with regards the case without MOTO. **ii) CAPEX savings** due to offloading.

The cost structure is divided into three main contributors: **i) MOTO platform initial investment** (purchase) and yearly licenses. **ii) MOTO client costs:** a license fee per MOTO client installation has been assumed. The total amount has been derived by considering the expected number of MOTO enabled devices. These devices can be either upgraded from factory or by the installation of an application from the market. **iii) Deployment, operation & maintenance costs** related to MOTO platform and MOTO clients distribution.

Table III represents the revenue improvement, CAPEX saving structure as well as cost structure using Eq. (2) where $G_{off} = 65\%$ (based on MOTO experimental results [9]), S_{MB} decreases 0.3€ to 0.2€ and with assumptions Γ from 0.75% to 2% and R_{user} from

	2016	2017	2018	2019	2020
I_{tot} [M€]	-2.0	-0.9	0.1	1.7	4.2
Cumulative I_{tot} [M€]	-2.0	-2.9	-2.8	-1.1	3.1

TABLE IV: Net and Cumulative Impact for Offloading Business Case.

7€ to 10€ between 2016-2020.

$$\begin{gathered} R_{tot} = R_{user} * (N_{smart} - N^{o}_{smart}) \\ S_{capex} = T_{tot} * S_{MB}. \end{gathered} \tag{2}$$

Table III shows that biggest contributor to the revenue is subject to customer satisfaction improvement. Thus, a good marketing a communication effort should be carried out for the subscribers to understand the benefits of MOTO.

The cumulative net impact is calculated as

$$I_{tot} = R_{tot} + S_{capex} - C_{tot}, \tag{3}$$

and the results are shown in Table IV.

In general terms, Table IV shows positive results with sustainable revenue and cost structures: i) An accumulated net impact of 3.1 M€ that translated into net present value is 0.68 M€. ii) An acceptable payback period of less than 5 years. iii) A relevant return of investment of 34%. iii) Breaking point would be reached in the second year after service launch.

B. *MOTO Enabled Service Business Case*

This business scenario is exemplifying the exploitation of service that relies on MOTO technology. For example, the service can be a media sharing service used in crowed events (stadiums, concerts, etc.). Users attending these events share pictures, videos, etc. among the attendants, through a MOTO enabled service. It is assumed that a content provider owns this service and acts as a MOTO end consumer. On the other hand, the operator is playing the role of the MOTO Service provider by offering related services to content providers. Similarly to the previous one, this business case is also defined from the perspective of the operator. Two revenue streams are considered; one coming from a *recurring fee* operator is charging the content provider; another one coming from *advertising* as shown in Eq.(4)

$$\begin{gathered} R_{tot} = F_{moto} + R_{ad} \\ F_{moto} = N_{con} * F_{mon}, \quad R_{ad} = N^{ad}_{con} * P_{ad} * \rho^{op}_{ad} * N_{con}. \end{gathered} \tag{4}$$

	2016	2017	2018	2019	2020
MOTO Service Fee [M€]	0.15	0.30	0.60	0.75	1.05
Advertising revenues [M€]	0.01	0.02	0.03	0.05	0.11

TABLE V: Total Revenue Breakdown for MOTO enabled service business case.

	2016	2017	2018	2019	2020
I_{tot} [M€]	-0.4	0.2	0.5	0.7	1.1
Cumulative I_{tot} [M€]	-0.4	-0.2	0.3	1.0	2.1

TABLE VI: Net and cumulative Impact for MOTO enabled service business case.

The service is assumed to be free for the subscriber. Content providers monetize it through advertising. Part of these revenues is also shared with the operator.

Table V depicts the breakdown between the two revenue sources defined above for assumptions of ρ^{op}_{ad}=30%, $F_{moto} = 150$k€, $P_{ad} = 0.02$€ (as per market consensus) and N^{ad}_{con}, P_{ad} values incrementing from 1 to 7 over the years using Eq.(4). It clearly shows that the main revenue contributor is the recurrent fee charged by the operator to the content providers. Considering the same costs structure as the previous case, the net impact is calculated as,

$$I_{tot} = R_{tot} - C_{tot}, \tag{5}$$

and the results are shown in Table VI.

This business case shows better results than the previous one: i) An accumulated net impact of 1.1 MM that translated into net present value is 1.09 MM. ii) A very good payback period of less than 3 years. iii) A high return of investment of 221%. iv) Breaking point would be reached during the second year after service launch. Considering revenue structure, these results are mainly driven by the number of contracts the operator signs with content providers. Thus, content providers should perceive value on using MOTO, both as an enabler for new services and as an enhancement for their existing ones.

IV. Conclusion

In this paper, the business models, value chains and different business scenarios that are applicable for the MOTO solution have been presented for both technology and service providers. In order to support the studies, simulation results have been performed using the mobile operators data in order to show the trade-offs and future gains involved for different business cases analysis. Simulation results demonstrate positive results for the investment of MOTO solution not only as an offloading mechanism, but also as an enabler of new services.

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