Monetization and pricing of the 5G-enabled smart residential services

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Abstract— Fifth generation of mobile networks (5G) brings superior performances and promises to enable numerous innovations. To capitalize on its potential, the operators worldwide explore the best strategies on how to monetize the 5G capabilities, leveraging on new partnerships and entering into new ecosystems. This paper narrows the monetization question to the segment of residential users and addresses the use of 5G network slicing capability and appropriate pricing strategies. It aims to illustrate monetization possibilities that operators have in the domain of smart residential services and to outline the requirements that such scenarios impose on operators' business support solutions.

Keywords - 5G, network slicing, monetization, pricing, smart residential services

I. INTRODUCTION

Operators around the world are launching the fifth generation of mobile networks (5G). The significant capital investment they have made in technology enabling this just increases the importance and urgency of finding new revenue streams. That is why their focus is shifting from technology to the opportunities of monetizing superior capabilities of new networks [1]. While connectivity remains the core of their offering, the growth in the saturated telco market can come only from innovation. Novelty is required in terms of services, but also in terms of business and monetization models. Operators are still formulating and evaluating their industry strategies, business models, and corresponding use cases [2], [3].

The revolutionary potential and improvements that the 5G can bring to different industries, and consequently the monetization prospects from the enterprise segment have been already identified. However, the new value proposition for the consumer market and corresponding monetization opportunities are still to be explored in detail [4], [5]. This paper aims to address the monetization possibilities in the case of 5G-enabled services intended for the residential customer segment. It is organized as follows. Chapter II provides an overview of the recent academic and industry papers and engagements relevant to this subject. Chapter III explores the new pricing and charging methods for residential subscribers, as a part of new business models enabled by 5G network technology. It also defines the requirements of operators' business support systems (BSS).

Chapter IV discusses the proposed monetization and pricing models, their implications on the operator's business, and gives suggestions for future work.

II. MONETIZATION AND PRICING INNOVATIONS IN TELECOMMUNICATIONS NETWORKS

A. Related works

Over the years, the offerings of telecommunications operators have evolved from voice-centric to the provisioning of broadband data services. To differentiate themselves from the other players in the market, operators have been deciding to build their competitive advantage based on attractive pricing or based on service quality [6]. At the same time, both the telco industry and scholars have been exploring how the quality of service (QoS), expressed using measurable technical parameters or quality of experience (QoE), based on subjective user perception, can influence end-users willingness to pay for new telco services. Different pricing frameworks proposed in the literature, have taken into consideration the network operation mode, availability of network resources, and user's sensitivity and adaptability to service price change or service quality degradation [7].

The development of the Internet of Things (IoT) has opened up the possibilities for operators to step out of their traditional roles. Besides the network and communications, operators could select to offer devices, platform and data storage, and data management and data processing [8]. The taxonomy of the pricing models applicable to IoT communication and data collection as presented in [8] differentiate the following:

1. Economic concept based pricing models including:
   - Cost pricing
   - Consumer perceived value pricing
   - Supply and demand model
   - Smart data pricing
   - Option pricing
2. Optimization-based pricing models including:
   - Game theory and auction-based pricing

- ▪ Utility maximization
- ▪ Knapsack problem [8]

Finally, for the subject of this paper important aspect is the pricing of the smart services for individual or residential customers. In the bibliometric analysis conducted in [9] , the authors found out that despite a growing interest and a significant number of papers related to the various topics associated with smart services, relevant economic aspects such as pricing strategies are rarely considered in the literature [9].

B. Monetization possibilities in 5G networks and ecosystems

The transition from 4G to 5G is not a one-step jump, but rather, a multi-step evolution over many years. Each incremental step in this evolution enables enhancement of the existing use cases and/or introduction of new use cases. [10]. Consequently, in the case of 5G offerings that leverage enhancement of the existing network capabilities only, applicable pricing and monetization strategies are similar to the existing ones. For the improved offerings related to mobile data or IoT, operators adjust the legacy tariff schemes.

This has been confirmed in the first 5G offerings to the consumer market. Operators tried to attract users by applying different changes in the existing pricing strategies for mobile data, e.g. [11]:

- ▪ Increasing both the data volumes and/or data rates and corresponding prices of their plans (i.e. "more for more" strategy)
- ▪ Increasing the data volume and/or data rate on premium price plans, keeping its pricing constant to allow premium users to experience the benefits of 5G.
- ▪ Keeping the data volume in the plan constant, but reducing its price to incentivize the users to experience 5G [11]

These strategies have shown more or less success depending on the local market specificities. However, 5G is much more than increased data volume or speed. The real increase in operators' revenue from the consumer segment is expected to come from the new content, applications, and services enabled by 5G, such as for example apps and services including AR/VR [11], [12]. In this context, the crucial feature of the 5G network, and one of the initial goals when it was designed, is a great level of adaptability to different requirements. Adaptability is achieved through the concept of network slicing [13]which allows the definition of a required logical network end to end. Network slicing enables the same physical network to efficiently embrace a plethora of services with very different service level requirements. The realization of this concept leverages the technological advancement in the areas of Software-Defined Networking (SDN) and Network Functions Virtualization (NFV) that allow the implementation of flexible and scalable slices [13]on common network in-

frastructure. The concept of network slicing allows different communication needs to be addressed in an agile way and at the same time revolutionizes operators' business prospects. This is a complete change of paradigm: instead of considering mobile network capabilities for defining a commercial offer, network characteristics can be defined according to the requirements of the planned commercial offer [2].

To capitalize on network slicing business potential requires a reconsideration of the legacy business models and allied charging and settlement rules. Basic charging models related to network slices as identified by TM Forum [13] are the following:

3. *Resource-Based Model.* This model assumes charging based on resource deployment (e.g., core, radio, transport resources), irrespective of consumption. In the typical case for such a mode, the slice consumer controls the resources deployed for the slice as well as who can consume the slice [13].

4. *Consumption-Based Model (As-a-Service Model).* Charging based on resource consumption (e.g., duration during which slice was configured and active or a number of users/devices connected with slice). In this case, a network slice is offered as-a-service platform where multiple consumers (typically enterprise) join and consume the same slice [13] .

5. *Value/Performance-Based Model* charges the value that the slice is bringing to the slice consumer. Value is delivered through the commitment to the relevant Service Level Agreement (SLA) or as the slice contribution in the overall service offered to the end-user [13].

6. *Capability Based Model.* In this case, network slice management capabilities are offered to the enterprise customers to manage the slice themselves [13]

The final charging and billing scenario may be a combination of one or more models outlined above. Additionally, a service scenario could include one or more slices [13].

Furthermore, the 5G network allows everything to be connected, from people to things, which will generate huge volumes of data. Data monetization could unlock a significant revenue stream for the operators. The most advanced among them are currently exploring how can monetize their massive data asset based on blockchain technology. [2], [5]

Most of the foreseen 5G use cases will be enabled through the operator partnerships with the third parties. In the new ecosystems, they can offer a powerful wireless communication infrastructure empowering and enabling others to innovate, then share the revenue with them. Besides the connectivity, operators can expose to the partners and monetize the other assets and capabilities they have in their organization (e.g. IoT platform)[3], [5].

III. MONETIZATION OF NETWORK SLICING IN THE SMART RESIDENTIAL SERVICES

This paper focuses on the monetization possibilities related to 5G-enabled services which span different aspects of people's daily lives in their homes. These services are referred as smart living services or smart residential services. Examples of such services are residential community management (e.g. smart waste management, etc), monitoring of health parameters for the people with chronic diseases, robot assistance for the disabled or elderly people living alone, innovative retail and delivery services, or the advanced gaming and entertainment services (e.g. immersive experience of the different sports or art performances) [14]. The majority of these services also rely on the slicing concept [15].

Following the increasing needs of the urban population related to online education and entertainment, this paper further explores the scenario related to immersive learning services. It assumes that the offering to the residential segment can be expanded by introducing different extended reality (XR)-enabled training courses, which both kids and adults can attend from their homes. Depending on the training subject, the traditional learning content can be enriched by everything from virtual reality (VR) to mixed reality (MR), augmented reality (AR), and haptics. The main actors in such a scenario are the end-user, operator, devices provider, and learning content provider. Mian interactions between them, assuming that the operator is the key player in the ecosystem, are outlined in Fig 1 below.

The proposed scenario includes a Business to Consumer (B2C) interactions between the operator and the residential user and Business to Business (B2B) interactions between the operator, device provider, and learning content provider. On top of the base subscription, the operator sells to the end-user the immersive learning service, which is actually a bundle that includes learning content, corresponding 5G enabled devices (e.g. AR/VR glasses, smart gloves, headset, etc), and the appropriate connectivity for this type of service. To enable an immersive experience when learning for example how to play some instrument or how to get another hands-on skill, connectivity requirements are very strict (e.g. low latency), thus operator will implement it through a dedicated network slice. Referring to the network slice charging models [13] described in the previous chapter, the model proposed for this case would be a Value-based model, i.e. operator should build the end-user premium price considering the meaningful experience that such a service will bring to him/her. Further differentiation can be made by introducing some of the well-known concepts from mobile data pricing, i.e. to offer dynamic incentives to those end-users who are ready to accept to use the service only when the network resources are idle.

A. Impact on operator's charging and billing systems

The new generation of the mobile network forces an evolution in operators' charging and billing solutions. The 3GPP 5G Core updated architecture and standard define new charging requirements, where the most important include a 5G Charging Function (CHF). They also replace the previous diameter-based protocols with the new Service Based Interface (SBI) to implement the new REST-based 3GPP charging architecture. These major changes will affect not only the real-time (online) charging systems but also have an impact on back-office and offline processes such as CDR (Call Detail Record) handling, roaming reconciliation and charging, revenue assurance, and billing [3], [10].

Additionally, evolved charging and billing solutions should be capable to support new 5G specific parameters, such as Network Slice Selection ID (NSSID).[10], [16].
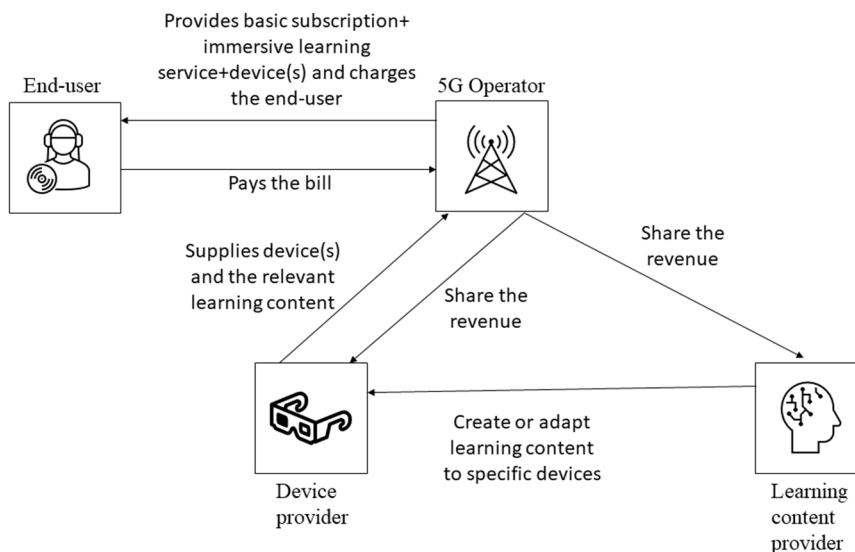

Fig. 1 Immersive learning scenario

For the immersive learning scenario outlined above, the operator's business support solutions (BSS) should be capable to charge the customer for the basic subscription plus the premium for the service-specific bundle including a dedicated slice. In the B2B part of the proposed scenario, the operator needs specific agreements with device provider(s) and learning content provider(s). For the topic of this paper, it is important to mention that the operator business support solutions should be capable to support revenue share with the partners mentioned above and based on the different parameters defined in the agreement.

IV. DISCUSSION AND IMPLICATIONS

Monetizing the opportunities that 5G enables in the residential consumer segment will require new and more dynamic ways of selling connectivity to the end-users. In most cases, this will require an operator to satisfy a combination of instant, personalized, and application or service-specific requirements for network performance.[13] Overall user experience will depend not only form the service delivery but also on the way the service is packed and priced [3]. 5G monetization models should be simple and understandable for the end-users and at the same time capable to support complex interactions with partners, which put new demands on operators' business support solutions [16].

This paper provides an overview of the possible scenario and thus can be sued as a starting point to define a detailed pricing strategy for a smart living service that uses network slicing capabilities. Lack of details, for example, the proposal of 5G specific parameters from the Event Data Record (EDR) that could be used for charging, presents the main limitation of this paper. This is planned to be specified in future work and taken into consideration within the analysis of the complete business model and detailed impact on the operators' BSS.

REFERENCES

[1] TM Forum, "IG1179 5G Revenue Management – Impact Assessment v2.0.1 | TM Forum." [Online]. Available: https://www.tmforum.org/resources/standard/ig1179-5g-revenue-management-impact-assessment-v2-0-0/. [Accessed: 03-May-2022].

[2] TM Forum 2018, TR276 Introducing 5G Monetization R18.5 - TM Forum | TM Forum. 2018.

[3] Ericsson, "Getting creative with 5G business models," 2021. [Online]. Available: https://www.ericsson.com/en/telecom-bss/forms/bss-for-5g. [Accessed: 10-May-2022].

[4] McKinsey, "5G monetization for consumer use cases | McKinsey," Nov-2021. [Online]. Available: https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/unlocking-the-value-of-5g-in-the-b2c-marketplace. [Accessed: 03-May-2022].

[5] MIT Technology Review Insights, "The 5G operator: Platforms, partnerships, and IT strategies for monetizing 5G," MIT Technology Review, Mar-2020. [Online]. Available: https://www.technologyreview.com/2020/03/24/950372/the-5g-operator-platforms-partnerships-and-it-strate-

gies-for-monetizing-5g/. [Accessed: 29-Aug-2021].

[6] A. S. Chouhan, V. Sridhar, and S. Rao, "Service provider strategies in telecommunications markets: analytical and simulation analysis," Sādhanā 2021 461, vol. 46, no. 1, pp. 1–10, Feb. 2021.

[7] V. R. Djogatovic and M. Djogatovic, "Modelling Quality and Pricing in Next Generation Telecom Networks," 2021, pp. 2365–2377.

[8] N. C. Luong, D. T. Hoang, P. Wang, D. Niyato, D. I. Kim, and Z. Han, "Data Collection and Wireless Communication in Internet of Things (IoT) Using Economic Analysis and Pricing Models: A Survey," IEEE Commun. Surv. Tutorials, vol. 18, no. 4, pp. 2546–2590, Oct. 2016.

[9] S. Dreyer, D. Olivotti, B. Lebek, and M. H. Breitner, "Focusing the customer through smart services: a literature review," Electron. Mark., vol. 29, no. 1, pp. 55–78, Mar. 2019.

[10] Ericsson, "What is the 5G Charging Function? - Ericsson," 2020. [Online]. Available: https://www.ericsson.com/en/telecom-bss/forms/5g-charging-function. [Accessed: 10-May-2022].

[11] Omdia and Tarifica, "5G Pricing Innovations, a joint e-book from Tarifica and Omdia," Dec-2021. [Online]. Available: https://1b3a08-1e392.icpage.net/5g-pricing-innovations-a-joint-e-book-from-tarifica-and-omdia. [Accessed: 10-May-2022].

[12] Ericsson, "Bringing the heat to stadiums: Monetizing 5G immersive experiences - Ericsson," 2021. [Online]. Available: https://www.ericsson.com/en/telecom-bss/forms/bring-the-heat-gated. [Accessed: 10-May-2022].

[13] TM Forum, "IG1179A Network Slice Monetization v1.0.0 | TM Forum." [Online]. Available: https://www.tmforum.org/resources/standard/ig1179a-network-slice-monetization-v1-0-0/. [Accessed: 03-May-2022].

[14] GSMA, "GSMA | Case Studies - 5G in Verticals in China 2022 | Internet of Things," Mar-2022. [Online]. Available: https://www.gsma.com/iot/resources/greater-china-5g-vertical-2022/. [Accessed: 10-May-2022].

[15] B. Dzogovic, B. Santos, J. Noll, V. T. Do, B. Feng, and T. Van Do, "Enabling smart home with 5G network slicing," in 2019 IEEE 4th International Conference on Computer and Communication Systems, ICCCS 2019, 2019, pp. 543–548.

[16] Ericsson, "5G Monetization: unlock new revenues and services - Ericsson." [Online]. Available: https://www.ericsson.com/en/telecom-bss/5g-monetization. [Accessed: 10-May-2022].