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# TELECOMMUNICATION OPERATOR'S TRANSITION TO THE OMNICHANNEL ARCHITECTURE

**The subject matter** of the article is the omnichannel architecture of information systems of telecom operators, functional requirements for it and the processes of transformation from multichannel to omnichannel architecture. **The goal** is to elaborate the reference architecture of telecommunication operator's omnichannel platform, and to transform the existing information architecture according to the principles of omnichannel approach and open digital architecture, what will improve customer experience, increase telecommunication operator's competitiveness and customer loyalty. The following **tasks** were solved at the study: analysis of the current state of information systems in telecommunications; analysis of marketing and technical drivers for transition from multichannel to omnichannel architecture, analysis of specifics of omnichannel approach implementation in telecommunications and related challenges, analysis of functional and system requirements for telecommunication operator's omnichannel platform, elaboration of the reference omnichannel architecture, elaboration of a recommendations for the process of transformation from the existing multichannel architecture of the communication operator to the target omnichannel architecture. To solve these problems, **methods** of system and business analysis were used, in particular, methods of analysis of software requirements, technologies for developing software application architecture. The following **results** were obtained. The current state of the telecommunications services industry in part of customer engagement, and related approaches – the multichannel and the omnichannel one – were analysed. The functional and non-functional requirements to omnichannel implementation were considered. Reference functional and component architecture of omnichannel customer engagement function was proposed. Strategies of transition to modern omnichannel architecture were considered and analysed. **Conclusions**: implementation of omnichannel approach in telecommunications and transition to omnichannel architecture require transformation of CSP's informational architecture itself. It should be performed according to principles of Open Digital Architecture (ODA), and developed in frames functional blocks of ODA. Such a transformation will ensure improving of customer experience, increasing customer satisfaction and customer loyalty, allow CSPs to increase competitiveness by reduce operating costs, improving operational efficiency, and overall business performance.

**Ключові слова:** omnichannel; customer experience; telecommunications; open architecture; architecture transformation.

## Introduction

The telecommunications sector is currently undergoing a process of digital transformation, which includes changes in technologies, IT architecture and business models. One of the aspects of such transformation is the transition from traditional multichannel approach to interaction with customers to an omnichannel one.

Multichannel approach refers to a business using multiple channels to interact with customers, such as email, web, phone, social media, and in-person interactions. Each channel is managed separately, with its own business logic, processes, IT systems, and goals. Customers can choose which channel they prefer to use to interact with the communications service provider (CSP), but there may be little or no coordination and consistency between channels. This can result in a fragmented customer experience (CX).

Omnichannel approach refers to a strategy for providing a seamless and integrated customer experience across multiple communication channels. The goal of omnichannel approach is to enable customers to interact with a CSP through their preferred channel, switch channels while ensuring a consistent and personalized experience across all channels.

The principal drivers of transition to omnichannel approach are the customer expectations from one hand, and CSPs needs to stay competitive in a rapidly evolving market by process optimization, operating costs reducing and customer data analysis. Customer-centric approach is one of the key strategies to improve customer experience and customer engagement, and increase loyalty of subscribers.

The advent of digital technology has fundamentally changed the way customers interact with telecommunications service providers. Traditionally CSPs provide telco-based channels like SMS/USSD, IVR, web-based such as web portals, mobile applications, social media platforms, messengers, email, and physical channels like points-of-sell (POS), physical stores and service centres, self-service kiosks and so on. Currently most of

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customers have digital experience and require mobile accessibility [1], and prefer use digital channels instead of physical one.

Only 15% of customers with mobile service issues and 30% customers with fixed network service-related issues turned to "client services" those provided directly by the operator's staff [2]. But customers who want face-to-face answers or the opportunity to touch and test devices need a seamless CX in physical stores [3]. Today, customers expect to use a variety of digital touchpoints. Thus, omnichannel approach affects telcos' customer engagement activities at every stage of the customer life cycle [4].

Recent research shows that customer's needs for personalization, proactive engagement and transparency in communications, and delivering a seamless experience for both potential customers and sales and marketing employees – as they need to deliver an optimal customer service – became one of the key internal drivers to adopt omnichannel capabilities [5, 6].

## Analysis of recent research and publications

Both multichannel and omnichannel approaches are based on usage of several customer channels [7, 8]. Channels or customer touchpoints are often defined as a customer contact point through which a business interacts with their customers. Currently CSPs uses different kinds of channels. These are traditional for telecommunication providers phone based channels like SMS/USSD, IVR, and call centres; web-based channels like web-portals, mobile applications, messengers and chatbots, and social media.

Off line channels like points-of-sale and retailer shops are still used by part of CSP's customers. But call centre operators, sellers in shop or support engineers use some kind of assistant application, what in common case can be assumed and managed as special kind of digital channel.

In-bound channels are used by customer to investigate products, purchase and manage services, query support from CSP. Out-bound channels are used by CSP for customer notification, marketing activities such as promotional campaigns and call-back services.

Multichannel approach has a number of drawbacks and limitations [7, 8]:

1. Isolated channels – different channels are independent and implement different sets of scenarios. The same workflow (i.e. purchase of some product, service management) may have different implementations on the different channels.

2. Multiple points of configuration – different channels are managed and administrated by different departments using separate tools.

3. Some platforms (i.e. different value-added service (VAS) platforms, Marketing Systems, CMS) implements separate virtual channels – isolated set of scenarios and workflows implemented on some physical channel, which is shared with other systems. For example – separate IVR menus on different short numbers to manage core telecommunication services and value-added services (VAS).

4. Customer journey usually is implemented in frames of some channel. Hopping between channels in scope of one customer journey is impossible or restricted, context of communication is lost. The results are customer disappointing and unsatisfactory, lost on information and lost of time to restore the context of communication.

The result is the multichannel landscape has multidimensional silos making it impossible to create shared business rules and configuration for all channels [8].

According to [9] two main dimensions of customer journey integration are perceived consistency and perceived connectivity of touchpoints. Consistency means receiving the same information as well as experience, and performance across channels. Connectivity means finding no barriers when moving from one channel to another. So, implementation of consisted and seamless customer journey (fig. 1) and interaction with customers and partners is the key point to improve customer experience.

Currently, the telecommunications sector worldwide is at the stage of changing technologies and business models, which has been called digital transformation. It is based on technological innovations such as digital network architecture – IMS and a software-defined network (SDN), development of 4G/5G and IoT/IoE technologies and services, BSS/OSS transition to a cloud-native microservice based component architecture, and the emergence of new business models (including OTT, B2B2x/B2G2x) [11].

Digital transformation is the technological driver and enabler of transition to omnichannel architecture at the same time. As the result of digital transformation, new architectural models, standards and approaches are developed and implemented. It includes recent initiatives of the TM Forum related to the development of standards for Open Digital Architecture (ODA) [12] and open API (Open API), as part of it. New approaches to system and data integration is one of fundamental enablers of omnichannel transformation [13].

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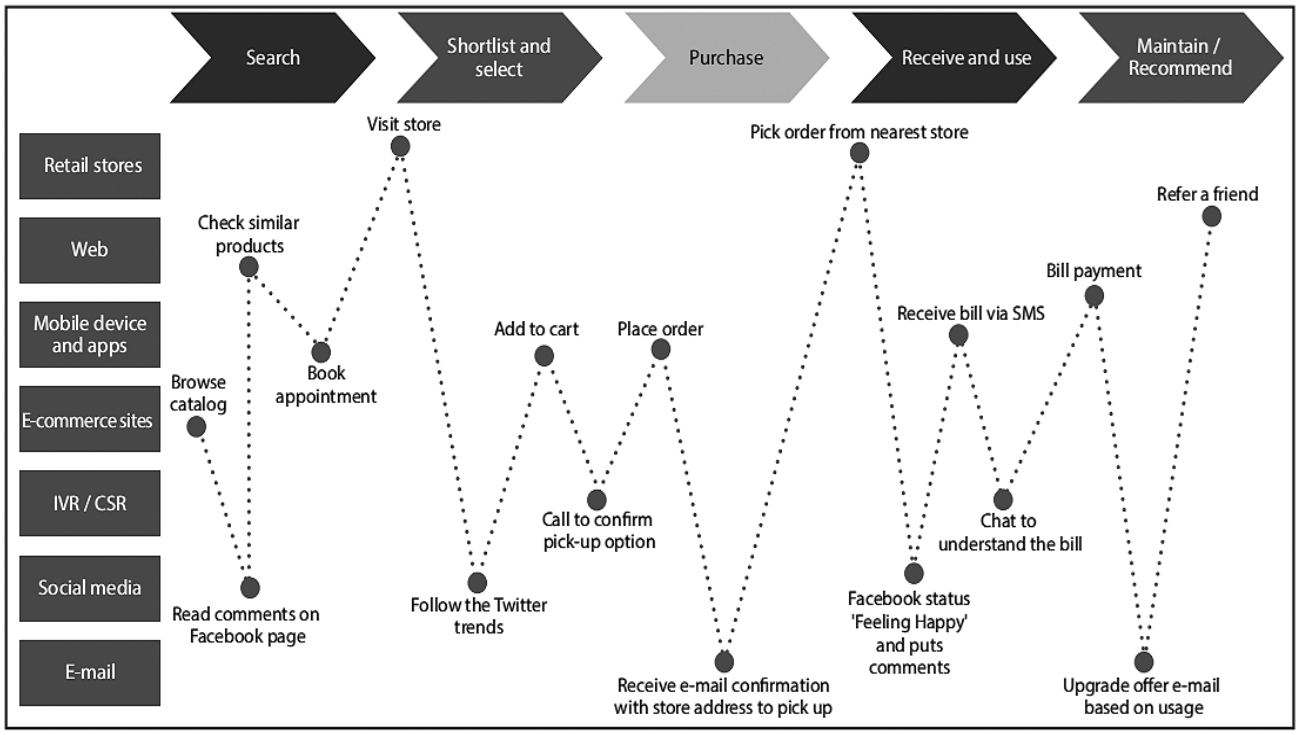


**Fig. 1.** Customer journey in omnichannel environment [10]

Progress in machine learning, AI and data analytic is making it easier for CSPs to improve CX, provide automation of customer requests processing, and analyse customer data. Most of CSPs see the high potential of AI/ML using in customer experience / customer relationship management in such applications as chatbots and personal digital assistant implementation, customer interaction and social media analysis, customer engagement and lead generation [14].

Implementing an omnichannel approach in the telecommunication industry can be complex and comes with the set of challenges. Some key technological complexities and problems associated with implementing an omnichannel approach in telecommunications are described below [11, 15].

Architecture and integration of Systems: telecom companies often have complex and diverse IT infrastructure for customer relationship management, billing, order processing, and other functions. Integrating these systems to provide a seamless omnichannel experience can be challenging and may require significant investments in technology and resources.

Many CSPs, especially the "old" one, have legacy systems that were developed independently for specific functions and services. Integrating these legacy systems with modern omnichannel solutions can be complex due to differences in technology, data formats, and communication protocols. Managing a large number of channels, data sources and inventories of various types is one of the key technical challenges. In many cases legacy systems and environments are too difficult to adjust to an omnichannel strategy, and they are not designed to accumulate and integrate customer data across all touch points.

Data Management: telecom operators deal with vast amounts of customer data distributed between different systems and storages. Ensuring the accuracy, consistency, and security of this data across all channels is crucial for providing a unified customer experience. Data silos and inconsistencies can lead to misunderstandings and frustration for customers.

Channel Consistency: maintaining a consistent experience across various channels is essential. Historically, as part of multichannel approach, different channels were designed and developed independently. Some channels have technological limitations related with channel nature. Differences in service quality, information, or processes between channels can lead to customer dissatisfaction.

Customer Security and Privacy: the telecommunication industry handles sensitive customer and commercial information. Ensuring the security and privacy of customer data across all channels, implementing robust cyber security measures, and complying with data

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protection laws is a critical concern and may be a challenge in omnichannel approach implementation.

Currently, there are a number of omnichannel platforms, frameworks and solutions on the market, both universal and telecom-oriented [16]. Some of these systems are rather omnichannel CRM, which supports only marketing and purchase processes. Use of out-of-the-box omnichannel platform may be a good solution for a green field operator, but comprehensive implementation of omnichannel approach on existing CSP's information infrastructure requires transformation of information infrastructure itself.

**Task of the study.** Thus, it can be concluded that the implementation of the omnichannel approach in telecommunications is associated with challenges related to both organisational transformation and information architecture transformation. In particular, information systems in the field of telecommunications, first of all BSS/OSS, do not meet modern technological and business requirements, and its transformation to modern IT architecture is required [11].

Actual are the following tasks: analysis of the current state of information systems in telecommunications, analysis of marketing and technical drivers for transition from multichannel to omnichannel architecture, analysis of specifics of implementation of the omnichannel approach in telecommunications, and the requirements for the omnichannel platform as part of informational ecosystem of communication operator, development of it reference architecture and recommendations for the process of transforming from multichannel architecture to omnichannel one, that would allow the implementation of omnichannel approach to improve customer experience and increase loyalty of subscribers.

The **purpose of this article** is to analyse high-level functional and system requirements for omnichannel platform in the field of telecommunications, to elaborate requirements for the architecture of such systems and to provide reference architecture of telecommunication operator's omnichannel platform and recommendations for the process of transformation of the existing information architecture of telecom operators according to the principles of omnichannel approach and open digital architecture,what will improve customer experience, increase telecommunication operator's competitiveness and customer loyalty.

**Materials and methods** used in the study are system and business analysis [17, 18], methods of analysis of software requirements, etc.

## Study results

Implementation of omnichannel strategies for service providers, including telecommunication service providers, has notable specific in comparison with common businesses such as retail [15]. Some key distinctions are described below.

The channels for communication service providers may include on-line platforms, mobile applications, physical stores or branches, customer service centres, and self-service portals. Interaction channels may vary based on the nature of the service and channel specific. But communication strategies for CSP prioritize digital experience and mobile accessibility. This results in the channels for telco providers are online-first and mobile-first. This may involve developing user-friendly mobile applications and responsive websites to cater to customers who prefer interacting through their mobile devices.

Telecom service providers offer intangible services rather than physical products. Fulfilment for CSPs usually involve delivering intangible services, such as activating a subscription, providing network connectivity, and ensuring the smooth provision of communication services. The customer journey revolves around services, and customer engagement spans a longer duration, as services are subscription-based and require ongoing relationships. The focus of customer interaction is on maintaining a consistent and positive experience over time, including customer support, troubleshooting and relationship management. This means that omnichannel approach should be applied during all customer's life-cycle and should be implemented on many information systems, not only sales and marketing one.

Billing and subscription management, customer service, and customer support are integral components of service provider's processes. Omnichannel strategies in this context involve ensuring a seamless billing experience, providing transparent information, and managing subscription changes. Providing of customer service is a critical component of omnichannel strategies for service providers. This includes offering consistent and efficient customer support across various channels.

CSPs should leverage real-time data sharing across channels to provide up-to-date information to customers. Whether it's real-time inventory availability or order status, customers expect accurate and timely information. Consistent and timely information about customer, services, products should be available for all channels – so called 360-degree customer view.

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Telecom providers operate in regulated industry, which adds an extra layer of complexity and some restrictions regarding compliance with industry regulations and data protection laws.

**CSP omnichannel requirements analysis**. Hi level requirements for omnichannel strategy implementation can be formulated as follows: it must provide a seamless and integrated customer experience across multiple channels and platforms during whole customer's lifecycle.

Analysis of customer expectations, technological and business specificity of the field of telecommunications, which were discussed above, allows to formulate the following functional and non-functional requirements for omnichannel implementation in the field of telecommunications:

1. Support all phases of customer's lifecycle, not only product discovery and purchase, but also service management, troubleshooting and customer support.
2. Provide unified user experience between different channels. It includes functional capabilities, common business logic and work flows, and customer information sharing between channels. In other hand, nature, specifics, and limitations of different channels should be taken into account.
3. Provide smart seamless channel hopping. Customer can start interaction (customer journey), such as product ordering, service management, troubleshooting on one channel, switch to another channel, and later finish it via third channel. Context should be preserved from the start till the end of interaction. Omnichannel engine should recognize the context, provide necessary data and instructions to channel to continue the interaction.
4. Single source of customer data – so called 360-degree customer view. All channels should receive unified, consistent, and actual information about customer, products, and services.
5. Provide interaction automation, predictive analysis and dynamic recommendations for customer. The last one includes Next Best Action (NBA) and Next Best Offer (NBO) [19]. NBA calculated according to last customer activity and interaction context, NBO – according to customers' needs and preferences.
6. Centralized configuration, process and change management across all channels. This requires real-time data analysis and artificial intelligence.
7. Common contact and notification policy enforcement over all channels. This includes possibility of customer to manage preferable channel(s), time and scope of notification provided by CSP.
8. Provide storage of contact history for needs of statistics and analytic, powered with AI/ML capabilities [19, 20], as well as historical data archiving and retention.
9. Provide comprehensive monitoring of interactions, customer satisfaction, reporting and KPIs – so called helicopter view.
10. Implement security policies, in particular related with storage and management of commercial and personal data.

Also non-functional requirements, such as redundancy and high availability, are important, including the following:

1. No single point of failure. Inaccessibility of some channel, or component of omnichannel engine/platform should not lead to incapability of customer engagement functionality itself.
2. Channels itself are independent one from each other. Channels should be capable to provide basic interaction logic in autonomous mode, in case of failure or inaccessibility of omnichannel engine.
3. In case of failure of some channel, omnichannel engine should switch active interactions to most suitable active channel.

**Functional architecture** of omnichannel platform.

In order omnichannel platform to meet the mentioned above requirements, it should contain the following functional components [10, 21, 22, 23, 24]:

1. Channels are separate customer-faced layer of CSP's informational infrastructure. Inbound channels are used by customers and subscribers to initiate contact or interact with CSP, outbound channels are used by Operator for subscriber notification. Channels implement basic channel logic and can operate in stand-alone mode. Unified channel logic is provided by underlying omnichannel platform. Important part of channel functionality is subscriber identification, and authentication and authorization (AA).
2. Omnichannel engine implements unified customer journey scenarios and business logic, and notification policies. It analyses interactions, perform scoring, and recognize customer intentions and customer journey. Actualization of NBO and provisioning of NBA are the part of this functionality. One of the main functions of omnichannel engine is keeping operative customer data up-to-date, according to its validity period. Customer service data periodically updated from BSS/OSS, customer interaction data – from channels.

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3. Omnichannel orchestrator implements cross-channel customer journey, provides seamless integration of channels and channel hopping, share customer journey context between channels. Part of this functionality is provisioning of relevant NBO/NBA for customer to active channel.

4. 360-degree customer view provides comprehensive information about subscriber from internal profile storage and from external systems

5. Notification engine implement outbound interactions, such as marketing campaigns, subscriber notifications and alerts.

6. Configuration component implements centralized storage and management of data, related with customer interaction rules and policies, work flows and processes configuration.

7. Management interfaces (UI, API). Operator-faced interface provide possibility to manage and configure interaction scenarios, notification policies and rules, generate reports and statistics. Subscribers use corresponding interfaces to manage preferences related to interaction (preferred channels and language, block notifications, and so on).

8. Operative subscriber profile storage. It stores data required for operative decision making and interaction scenarios implementation: key customer attributes from BSS/OSS, customer preferences related to communication with Operator, and context of in-progress customer interaction(s). The sources of operative customer data are BSS/OSS (such as CMS, Billing System, Product Catalogue, Inventory and other). Channels provides interaction context, that includes active scenario, key customer decision points and current termination point of scenario. Operative storage should work in on-line mode and provides cashing capabilities for real-time access.

9. Customer data history storage operates in off-line mode, stores comprehensive information about customer activities over channels during retention period, enriched with historical data from BSS/OSS, and provides data for customer interaction and behaviour analysis.

10. AI/ML empowered decision & prediction subsystem uses historical data for analysis, provides personalized recommendations for subscribers, supports chatbots operation [19, 20].

11. OAM function provides statistics and omnichannel platform monitoring, calculates metrics and KPIs, including Net Promoter Score (NPS) and Life Time Value (LTV).

**Omnichannel platform component architecture** implements functional architecture within the framework of the CSP's information infrastructure. It's proposed to implement it according to modern ODA and Open API standards and approaches [12, 13, 25]. According to ODA reference functional architecture (fig. 2), omnichannel platform is a part of the Engagement Management and Party management functions.

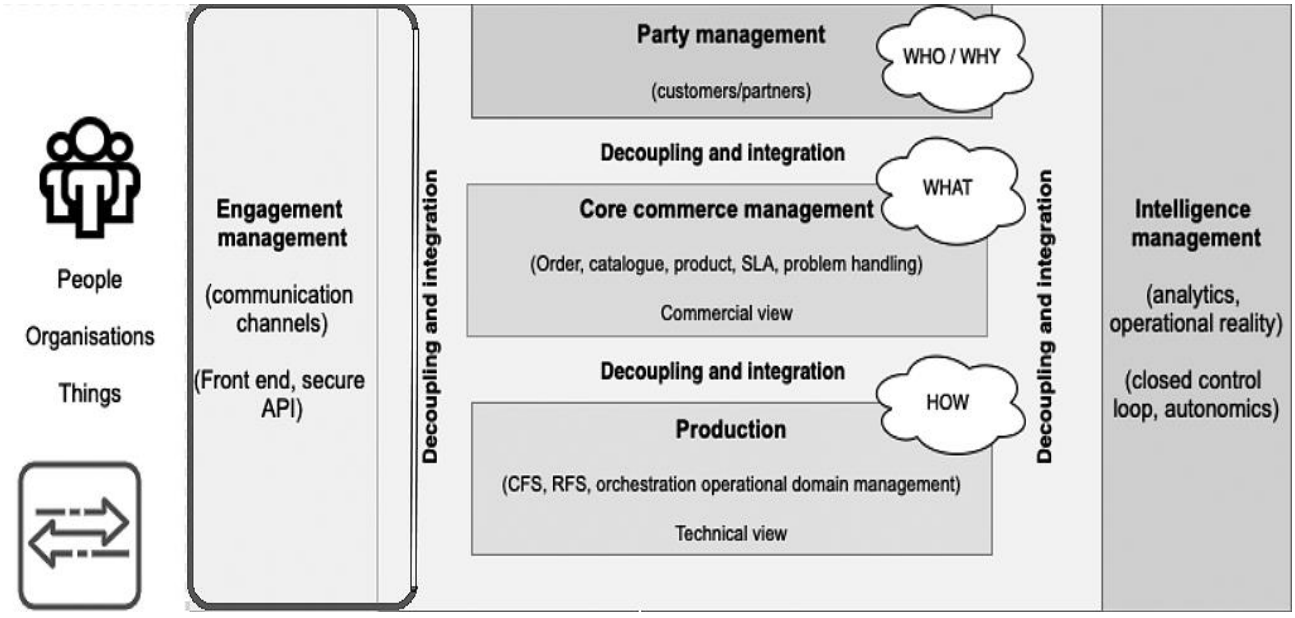


**Fig. 2.** ODA functional blocks grouping based on [13]

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According to [13] the Engagement Management functional block focuses on the interaction with all internal and external actors, which can be people or software agents, customers, employees, partners, third parties, etc. This interaction can be implemented via multiple communication channels. The Engagement Management functional block is a presentation layer only; it does not store any processes, functions or operational data, only implements technical functions needed to provide the right communication context to the user. This functional block is responsible for the front end functionality, authentication and authorisation of users, and management of the user-interaction journeys, including content personalisation and filtering. The important functionality that needs to be provided is the omnichannel experience. The interactions can include providing information or activating processes and functions that are implemented by components from other functional layers using the corresponding APIs. Another important function of this functional block is the so-called API HUB that is responsible for exposing a standardised set of APIs to the partners or other external systems.

The Party Management functional block manages the internal and external actors, such as persons or organisations (referred to as Parties). It focuses on management of the information related to the parties, the party roles and rights, and all related marketing, sales and billing activities.

Proposed omnichannel reference component architecture is shown below (fig. 3), and includes functional components, described in the previous section. Omnichannel platform components interacts with and use functionality provided by other components of CSP's information infrastructure, such as following:

1. Integration layer includes Open API and Event Hub. Open API provides access to functionality and data exposed by all functional blocks, including underlying BSS/OSS components. Event bus aggregates customer related events from BSS/OSS, and push relevant events to omnichannel engine.

2. Security layer includes such components as Single sign-on (SSO), Personal data management (PDM), subscriber Identity management (IDM) and other security functions. It provides unified security capabilities for all functional blocks.

3. AI/ML functionality can be implemented as part of omnichannel platform, or provided by Core and Production layers. For example, campaign management function may provide NBO for customers.

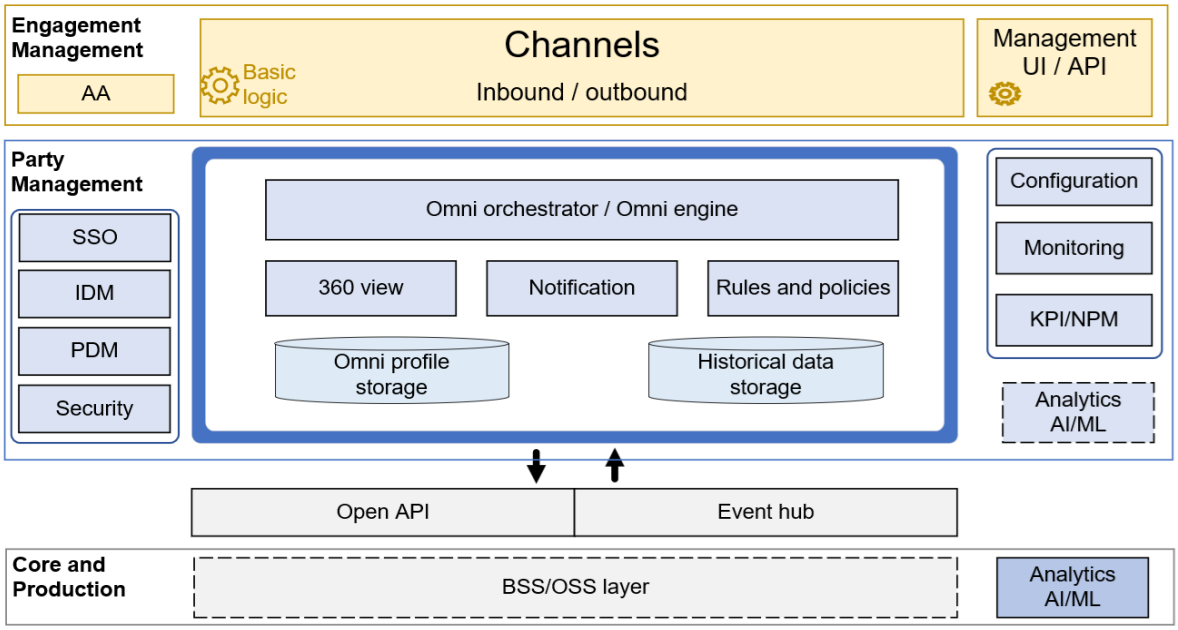


**Fig. 3.** Omnichannel Platform reference component architecture

According to ODA Agile Lifecycle, migration architecture is used as intermediate during CSP digital transformation and transition to open architecture. In frames of such an approach, and transformation strategies described in [26], technical implementation of omnichannel strategy can be provided in several ways:

1. greenfield – parallel deployment of a new omnichannel platform, built on the declared principles, and gradual transfer of existing channels to new platform.

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For example, first, digital channels like web portals and mobile applications are transferred to the new omnichannel infrastructure, then a traditional telco-based channels like SMS/USSD and IVR, then call-centre, and so on. Thus, at the transition stage, there are two customer engagement platforms – the old and the new one – between which channels and processes are distributed;

2. carve-out – gradual deployment of new omnichannel platform components and transition of separate processes related to customer engagement functionality to omnichannel platform. As processes are migrated, unused legacy components and systems are sequentially decommissioned so its functionality are transferred to new components of omnichannel platform. For example, first, marketing processes are transferred, then retail sales, service management processes and so on. It should be understood that existing legacy systems can have monolithic architecture and/or legacy interfaces, and decoupling of customer engagement functionality may require it modernization from their developers and vendors;

3. brownfield – gradual replacement of individual legacy systems, related to customer engagement, with new systems implemented omnichannel approach. For example, first, CRM is replaced, then systems of interaction with partners, subscriber support and so on. The legacy system, all functions of which have moved to the new infrastructure, is decommissioned.

Each of the mentioned above approaches has its own specifics, advantages and disadvantages. The migration strategy should be chosen depending the existing information architecture, customer engagement processes, the available project budget, etc. For large CSP, the parallel deployment of the new omnichannel infrastructure in full requires significant resources, budget and time until the first results will be received. Therefore, a combined (brownfield and/or curve-out) strategy is usually used for gradually transition to a new omnichannel architecture.

It should be understood that technical implementation on omnichannel approach is a part of digital transformation of CSP. The recommendations on process of transformation of the information architecture of telecom operators on the basis of an intermediate architecture built on the basis of the open standardized Open API TMF was proposed in [11]. A necessary condition for transition to omnichannel architecture is at least migration architecture (in terms of ODA Agile Lifecycle) is implemented and integration layer provides access to the functionality and data of existing systems. This should ensure a gradual transition to the target omnichannel architecture.

## Conclusions

The implementation of omnichannel approach in telecommunications and transition to omnichannel architecture require transformation of CSP's informational architecture itself. The reference functional architecture of omnichannel platform is proposed. It was elaborated according to principles of ODA, and developed in frames of the Engagement management and the Party management functions of ODA. Recommendations for the process of transformation of the existing information architecture of telecommunications operators to omnichannel architecture was provided. Transformation to omnichannel architecture should ensure improving of customer experience, increasing customer satisfaction and customer loyalty, allow CSPs to increase competitiveness by improving operational efficiency, and overall business performance.

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# ПЕРЕХІД ОПЕРАТОРА ТЕЛЕКОМУНІКАЦІЙ НА ОМНІКАНАЛЬНУ АРХІТЕКТУРУ

**Предметом дослідження** є омніканальна архітектура інформаційних систем операторів телекомунікацій, функціональні вимоги до неї та процеси переходу від багатоканальної до омніоканальної архітектури. **Мета статті** – розроблення еталонної архітектури омніканальної платформи телекомунікаційного оператора й трансформація наявної інформаційної архітектури відповідно до принципів омніканального підходу та відкритої цифрової архітектури, що покращить клієнтський досвід, підвищить конкурентоспроможність телекомунікаційного оператора та лояльність клієнтів. У роботі передбачено розв'язати такі **завдання**: визначити сучасний стан інформаційних систем у телекомунікаціях; проаналізувати маркетингові й технічні засади переходу від багатоканальної до омніканальної архітектури; виявити особливості реалізації омніканального підходу в телекомунікаціях і пов'язані з цим виклики; вивчити функціональні та системні вимоги до омніканальної платформи оператора телекомунікацій; розробити еталонну омніканальність архітектури; запропонувати рекомендації для процесу трансформації від наявної багатоканальної архітектури оператора зв'язку до цільової омніканальної архітектури. Для розв'язання зазначених завдань упроваджено **методи** системного та бізнес-аналізу, зокрема аналіз вимог до програмного забезпечення, технологія розроблення архітектури програмних застосунків. **Досягнуті результати**. Визначено сучасний стан галузі телекомунікаційних послуг щодо залучення клієнтів та відповідні підходи – багатоканальний та омніканальний. Розглянуто функціональні та нефункціональні вимоги до омніканальної платформи. Запропоновано еталонну функціональну та компонентну архітектуру багатоканальної функції залучення клієнтів. Проаналізовано стратегії переходу до сучасної омніканальної архітектури. **Висновки**. Реалізація омніканального підходу в телекомунікаціях і перехід до омніканальної архітектури потребують трансформації самої інформаційної архітектури оператора телекомунікації. Перехід має виконуватися відповідно до принципів відкритої цифрової архітектури та реалізовуватися в межах функціональних блоків відкритої цифрової архітектури. Така трансформація забезпечить покращення клієнтського досвіду, підвищення задоволеності та лояльності клієнтів, дасть змогу оператору підвищити конкурентоспроможність унаслідок зниження операційних витрат, підвищення операційної ефективності та загальної ефективності бізнесу.

**Keywords:** information process; functional modeling; data flows; laser scanning; stages of engineering and geodetic surveys; Leica GIS tools.

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