

HOW TO INTEGRATE INTERNET MARKETING INTO A CLOUD STORAGE SYSTEM: DEVELOPING A MICROSERVICE FOR CUSTOMER ACQUISITION

©2026 VILKHIVSKA O. V., BRYNZY N. O., BULAKH M. I.

UDC 004.738.5:004.75:339.138
JEL: M15

Vilkhivska O. V., Brynza N. O., Bulakh M. I. How to Integrate Internet Marketing into a Cloud Storage System: Developing a Microservice for Customer Acquisition

The article addresses the pressing issue of enhancing the efficiency of promoting cloud data storage services amid intense competition in the SaaS and IaaS markets. The article analyzes current trends in cloud technology development and the critical role of internet marketing as a key tool for customer acquisition and retention in IT companies. Based on a theoretical review, market dynamics analysis, and business process modeling, the study substantiates the need to integrate digital marketing tools directly into the information system of a cloud storage provider. The "Best-of-Breed" strategy is proposed and substantiated. This approach involves targeted integration of best-in-class specialized services, such as SendPulse for email campaign automation, Google Ads for contextual advertising, and Ahrefs for SEO monitoring, rather than expensive, risky all-in-one platforms like HubSpot or Salesforce Marketing Cloud. The architecture was designed, and a microservice called "Integration Module" (acting as an API Gateway) was implemented. This ensures unified, asynchronous, and secure data exchange between the company's core information system and external marketing platforms. The microservice is built in Python using the modern asynchronous FastAPI framework, Pydantic for input data validation, SQLAlchemy with PostgreSQL for storing on-boarding events and logs, and pytest for comprehensive unit and integration testing. Emphasis is placed on automating on-boarding and customer retention: trigger-based email sequences are launched automatically upon account status changes (e.g., the start of a trial period, transition to a paid plan, approaching the end of promotional offers), significantly improving conversion rates and customer lifetime value (LTV). The full software development lifecycle is presented: requirements analysis, business process modeling using BPMN 2.0 notation, architecture design with UML component diagrams, implementation of key endpoints, testing (including negative scenarios and validation checks), containerization with Docker, and successful production deployment. The results demonstrate that this solution optimizes marketing costs, accelerates response to user behavior, enables personalized communication, and makes the information system more flexible and scalable. The developed microservice serves as a universal tool adaptable to IT companies of any size, offering subscription-based digital services. This also provides a solid foundation for future functional expansion (integration with chatbots, behavioral analytics, referral systems, etc.). The work holds both theoretical significance and high practical value for advancing digital marketing within cloud infrastructure.

Keywords: cloud storage, information system, internet marketing, digital marketing, SaaS, IaaS, microservice, API Gateway, FastAPI, Python, on-boarding automation, email marketing, customer retention, Best-of-Breed, Docker, BPMN 2.0, UML.

Fig.: 9. **Tabl.:** 1. **Bibl.:** 24.

Vilkhivska Olga V. – PhD (Economics), Associate Professor, Associate Professor of the Department of Informatics and Computer Engineering, Simon Kuznets Kharkiv National University of Economics (9a Nauky Ave., Kharkiv, 61166, Ukraine)

E-mail: olha.vilkhivska@hneu.net

ORCID: <https://orcid.org/0000-0003-4560-8231>

Scopus Author ID: <https://www.scopus.com/authid/detail.uri?authorId=57215090762>

Brynza Natalia O. – PhD (Engineering), Associate Professor, Associate Professor of the Department of Informatics and Computer Engineering, Simon Kuznets Kharkiv National University of Economics (9a Nauky Ave., Kharkiv, 61166, Ukraine)

E-mail: natalia.brynza@hneu.net

ORCID: <https://orcid.org/0000-0002-0229-2874>

Researcher ID: <https://www.webofscience.com/wos/author/record/I-2802-2017>

Scopus Author ID: <https://www.scopus.com/authid/detail.uri?authorId=57215079602>

Bulakh Mykyta I. – Master of the Department of Informatics and Computer Engineering, Simon Kuznets Kharkiv National University of Economics (9a Nauky Ave., Kharkiv, 61166, Ukraine)

E-mail: nikitabulakh03@gmail.com

ORCID: <https://orcid.org/0009-0008-7868-9270>

УДК 004.738.5:004.75:339.138
JEL: M15

Вільхівська О. В., Бринза Н. О., Булах М. І. Як інтегрувати інтернет-маркетинг у систему хмарного сховища: розробка мікросервісу для залучення клієнтів

У статті розглядається актуальна проблема підвищення ефективності просування послуг хмарного зберігання даних в умовах високої конкуренції на ринку SaaS та IaaS. Проаналізовано сучасні тенденції розвитку хмарних технологій та роль інтернет-маркетингу як ключового інструменту залучення й утримання клієнтів для ІТ-компаній. На основі теоретичного огляду, аналізу динаміки ринку та моделювання бізнес-процесів обґрунтовано доцільність інтеграції інструментів цифрового маркетингу безпосередньо в інформаційну систему провайдера хмарного сховища. Запропоновано й обґрунтовано стратегію «Best-of-Breed», яка передбачає точкову інтеграцію найкращих у своєму класі спеціалізованих сервісів (SendPulse для автоматизації email-кампаній, Google Ads для контекстної реклами, Ahrefs для SEO-моніторингу) замість дорогих і ризикованих all-in-one платформ типу HubSpot чи Salesforce Marketing Cloud. Розроблено архітектуру та реалізовано мікросервіс «Integration Module» (API Gateway), який забезпечує уніфікований, асинхронний і безпечний обмін даними між core-інформаційною системою компанії та зовнішніми мар-

кетинговими платформами. Мікросервіс створено на Python з використанням сучасного асинхронного фреймворку FastAPI, Pydantic для валідації вхідних даних, SQLAlchemy з PostgreSQL для зберігання подій онбордингу та логів, а також pytest для комплексного юніт- та інтеграційного тестування. Особливу увагу приділено автоматизації онбордингу та утримання клієнтів: тригерні email-ланцюжки запускаються автоматично при зміні статусу акаунта (початок trial-періоду, перехід на платний тариф, наближення кінця промо тощо), що значно підвищує конверсію та LTV клієнтів. Наведено повний життєвий цикл розробки: аналіз вимог, моделювання бізнес-процесів у нотатції BPMN 2.0, проектування архітектури за допомогою UML-діаграм компонентів, реалізація ключових ендпоінтів, тестування (включно з негативними сценаріями та перевіркою валідації), контейнеризація за допомогою Docker та успішний деплой у production-середовищі. Результати демонструють, що таке рішення дозволяє оптимізувати маркетингові витрати, підвищити швидкість реакції на поведінку користувачів, забезпечити персоналізацію комунікацій і зробити інформаційну систему більш гнучкою та масштабованою. Розроблений мікросервіс є універсальним інструментом, який може бути адаптований для IT-компаній будь-якого розміру, що надають цифрові послуги на основі підписки, та слугувати основою для подальшого розширення функціоналу (інтеграція з чат-ботами, аналітикою поведінки, реферальними системами тощо). Робота має як теоретичну, так і високу практичну цінність для розвитку цифрового маркетингу в хмарній інфраструктурі.

Ключові слова: хмарне сховище, інформаційна система, інтернет-маркетинг, цифровий маркетинг, SaaS, IaaS, мікросервіс, API Gateway, FastAPI, Python, автоматизація онбордингу, email-маркетинг, утримання клієнтів, Best-of-Breed, Docker, BPMN 2.0, UML.

Рис.: 9. **Табл.:** 1. **Бібл.:** 24.

Вільхівська Ольга Володимирівна – кандидат економічних наук, доцент, доцент кафедри інформатики та комп'ютерної техніки, Харківський національний економічний університет імені Семена Кузнеця (просп. Науки, 9а, Харків, 61166, Україна)

E-mail: olha.vilkhivska@hneu.net

ORCID: <https://orcid.org/0000-0003-4560-8231>

Scopus Author ID: <https://www.scopus.com/authid/detail.uri?authorId=57215090762>

Бринза Наталя Олександрівна – кандидат технічних наук, доцент, доцент кафедри інформатики та комп'ютерної техніки, Харківський національний економічний університет імені Семена Кузнеця (просп. Науки, 9а, Харків, 61166, Україна)

E-mail: natalia.brynza@hneu.net

ORCID: <https://orcid.org/0000-0002-0229-2874>

Researcher ID: <https://www.webofscience.com/wos/author/record/I-2802-2017>

Scopus Author ID: <https://www.scopus.com/authid/detail.uri?authorId=57215079602>

Булах Микита Ігорьович – магістр кафедри інформатики та комп'ютерної техніки, Харківський національний економічний університет імені Семена Кузнеця (просп. Науки, 9а, Харків, 61166, Україна)

E-mail: nikitabulakh03@gmail.com

ORCID: <https://orcid.org/0009-0008-7868-9270>

The modern cloud technology market is experiencing rapid growth, driven by the exponential increase in data volumes, accelerated digital transformation of businesses, widespread adoption of artificial intelligence, and the shift toward hybrid and remote work models. According to leading analytical agencies (Fortune Business Insights, Mordor Intelligence, Gartner, and others), as of early 2026, the global cloud storage market is estimated in the range of USD 145–197 billion, with a projected growth to USD 500–810 billion by 2031–2034 at a compound annual growth rate (CAGR) of 19–23% [1]. Similarly, the SaaS (Software as a Service) market in 2025–2026 exceeds USD 300–390 billion and continues to grow at 19–21% annually, while the overall public cloud services market is approaching USD 1 trillion in 2026 [2].

Under conditions of rapid market expansion and the dominance of global providers, technical excellence of cloud services alone is no longer the sole factor of competitiveness. Increasingly decisive roles are played by approaches to customer acquisition and retention, particularly the efficient integration of internet marketing tools directly into the provider's information system. Among cloud service providers, global giants dominate: Amazon Web Services (~30–33%), Microsoft Azure (~20–25%), and Google Cloud

(~11–13%), collectively controlling over 60–65% of the market [3]. At the same time, local and niche providers face serious challenges, including high customer acquisition costs (CAC), low organic search visibility, product differentiation difficulties, and the need for rapid user base scaling.

Traditional promotion methods (offline advertising, cold calling) are practically inefficient in the digital SaaS/IaaS segment. The success of companies offering cloud storage services increasingly depends on integrating internet marketing tools (SEO, contextual advertising, automated email marketing, personalized on-boarding, triggered campaigns) directly into the information system. This not only reduces acquisition costs (thanks to organic traffic and high ROI of email channels) but also significantly increases conversion rates, customer lifetime value (LTV), and retention levels through automated interaction at all stages of the sales funnel.

In 2026, key trends in digital marketing include agentic AI, real-time personalization based on data cloud-like solutions, integration of marketing platforms with core systems, and a strong focus on compliance and sovereign clouds. At the same time, most companies still rely on fragmented or outdated ap-

proaches to marketing integration, resulting in lead loss, low conversion during trial periods, and high churn rates.

Therefore, research aimed at improving the information system of an IT company providing cloud storage services through the integration of modern internet marketing methods (particularly via the development of a specialized “Integration Module” microservice) is highly relevant. It addresses a real business problem – enhancing competitiveness in a hyper-competitive environment, optimizing marketing expenditures, and automating the customer journey – and offers a universal, scalable solution applicable to both small and large players in the cloud services market.

To substantiate the feasibility of this approach to integrating internet marketing, it is appropriate to analyze existing scientific research dedicated to combining cloud technologies, SaaS platforms, and digital marketing.

In the study by Aso Kareem Khurshed and Subhi R. M. Zebaree titled “Web Technology and Cloud Computing in Enterprise System: The Role of AI for Digital Marketing”, the authors examine the role of artificial intelligence and cloud computing in transforming digital marketing within enterprise systems. They demonstrate that integrating AI with cloud-based ERP systems and web technologies enables automation of customer segmentation, personalization of marketing campaigns, real-time analytics, and reduction of infrastructure costs, particularly for small and medium-sized enterprises. The key conclusion is that combining AI and cloud platforms through APIs ensures scalability and enhances the efficiency of marketing processes, thereby creating a competitive advantage. Thus, this research provides a general understanding of the potential of AI and cloud technologies in digital marketing. However, it does not address the practical aspects of implementing such integrations in the form of individual microservices, which motivates interest in more applied studies [4].

In the research by Joel Mero, Miira Leinonen, Hannu Makkonen, and Heikki Karjaluo titled “Agile logic for SaaS implementation: Capitalizing on marketing automation software in a start-up,” an agile approach to implementing SaaS solutions for marketing automation is explored using the example of HubSpot in a B2B start-up. The authors show that agile logic, based on iterative “learning by doing,” enables better alignment of SaaS platform functionality with organizational routines, particularly in lead management, content marketing, and customer intelligence. The results of the case study indicate that this approach improves customer acquisition efficiency and the adaptability of marketing processes. At the same time, the

study is limited to a single case and does not include technical analysis of cloud infrastructure or microservice architectures [5].

In the work by Seaam Bin Masud titled “Artificial intelligence in digital marketing automation: Enhancing personalization, predictive analytics, and ethical integration,” the role of artificial intelligence and cloud computing in digital marketing automation and business growth is examined. The authors demonstrate that AI significantly enhances the efficiency of digital marketing through personalized recommendations and predictive analytics, positively influencing customer conversion, while emphasizing the importance of ethical integration and data protection. Additionally, the significance of cloud models (SaaS, IaaS, PaaS) as a foundation for scalable business solutions, particularly in marketing automation, is highlighted. However, the studies are predominantly theoretical in nature and do not contain detailed technical analysis of microservice architectures or cloud storage systems [6].

In the work by Shonubi O. titled “The role of digital B2B platforms with industry 4.0 technological ecosystems (integration of cloud computing, artificial intelligence and internet of things) as a growth lever”, the role of digital B2B platforms built on Industry 4.0 ecosystems as a factor in company growth and innovative productivity is studied. The author shows that the integration of cloud computing, artificial intelligence, and IoT within a unified digital ecosystem contributes to improving operational efficiency, innovation, and competitiveness of firms, particularly in the B2B environment. The study emphasizes the importance of a platform approach and inter-organizational interaction for business scaling. At the same time, the work is conceptual in nature and does not focus on the details of marketing automation, cloud storage, or microservice architectures [7].

Analysis of existing research reveals a clear trend: the integration of internet marketing into cloud systems primarily occurs through the application of artificial intelligence for communication personalization, predictive analytics, and process automation (e.g., triggered email campaigns and audience segmentation). At the same time, the focus on microservice architecture for specialized tasks in cloud storage remains rare. Most works propose frameworks for agile implementation of SaaS marketing automation tools (e. g., HubSpot or SendPulse), highlight ethical aspects of AI in marketing, and emphasize the overall scalability of cloud platforms, but rarely detail the technical implementation of modular components, such as an API Gateway for on-boarding and customer retention in the specific context of cloud storage.

The contribution of these studies lies in creating a theoretical foundation for understanding how cloud technologies enhance digital marketing (personalization, reduction of CAC, growth of LTV), as well as in highlighting practical aspects of agile integration and ethical constraints. However, significant limitations exist: the lack of empirical cases involving actual development and testing of microservices, a narrow focus on general SaaS platforms without emphasis on the specifics of cloud storage (storage of large data volumes, security, low API latency), and insufficient attention to the full software development lifecycle (from BPMN/UML modeling to production deployment).

Existing research serves as a solid theoretical foundation. At the same time, it clearly indicates a gap: the lack of studies dedicated specifically to the development and implementation of microservices for automated customer acquisition and retention in cloud storage systems. It is precisely this gap that the proposed solution fills: the creation of a universal, asynchronous API Gateway based on FastAPI, integrated with external marketing services (SendPulse, etc.), with a complete development, testing, and deployment cycle. This approach not only solves a practical business problem (increased conversion during trial periods, optimization of marketing costs) but also makes an original contribution to the development of microservice architectures for digital marketing in cloud infrastructure.

The *aim of the article* is to substantiate and demonstrate a practical approach to improving the information system of an IT company providing cloud data storage services by integrating modern internet marketing methods directly into its architecture through a specialized microservice.

Modern IT business increasingly depends on digital infrastructure, where cloud technologies and internet marketing become integral elements of competitive strategy. Cloud data storage and digital promotion tools do not merely complement each other – they form a unified ecosystem that ensures both technical reliability of the service and efficient customer acquisition and retention.

Ten years ago, the primary method of storing digital data was local media – PC hard drives, external HDDs, and USB flash drives. Today, cloud storage has become the gold standard for individual users and enterprises. It is a service that provides remote access to files (photos, videos, documents, databases) via the internet from any device.

The central element of the architecture is a cloud server that ensures data storage, synchronization, and backup. The user connects to it via the network, obtaining unified access regardless of the operating sys-

tem or geographic location. The *Fig. 1* presents a simplified model of end-user interaction with cloud storage, demonstrating the mechanism of data access from various types of devices.

Cloud storage functions as a central infrastructure component responsible for data storage, synchronization, and file sharing. Access to the system is provided via the internet from any geographic location, ensuring centralized access to information resources. This approach clearly illustrates the key advantage of cloud technologies – universal, flexible, and convenient data access.

The primary requirements for high-quality cloud storage include data encryption during upload and transfer, user-friendly interface, automatic backup, and guaranteed security. Free services often fail to provide an adequate level of protection; therefore, paid solutions (Google Drive, Dropbox, OneDrive, AWS S3) dominate the market.

Alongside public clouds, it is possible to create a local alternative – Network Attached Storage (NAS). This is a specialized device connected to the local network that provides shared data access for multiple users without constant internet usage.

Over the past 15 years, the use of cloud services has become widespread. According to analytical reports, in 2012 the global cloud technology market was only about USD 50 billion. In 2020, influenced by the COVID-19 pandemic and the shift to remote work, market growth accelerated. According to Fortune Business Insights, the cloud computing market will grow from USD 905.33 billion in 2026 to USD 2.904.52 billion by 2034 (CAGR 15.7%). For the cloud storage segment, the forecast is USD 179-198 billion in 2026 (Mordor Intelligence and Fortune Business Insights) [8-10].

Internet marketing is a comprehensive complex of strategies for promoting products and services using digital channels. Unlike traditional marketing, it provides direct interaction with the audience, precise measurement of results, and rapid campaign adaptation [11].

The main components of internet marketing include [12–14]:

- ✦ Search Engine Optimization (SEO) – attracting organic traffic;
- ✦ Contextual and targeted advertising (PPC);
- ✦ Social Media Marketing (SMM);
- ✦ Email marketing and messaging marketing (Viber, Telegram, WhatsApp);
- ✦ Content marketing (articles, videos, infographics);
- ✦ Affiliate programs (CPA networks);
- ✦ Video marketing.

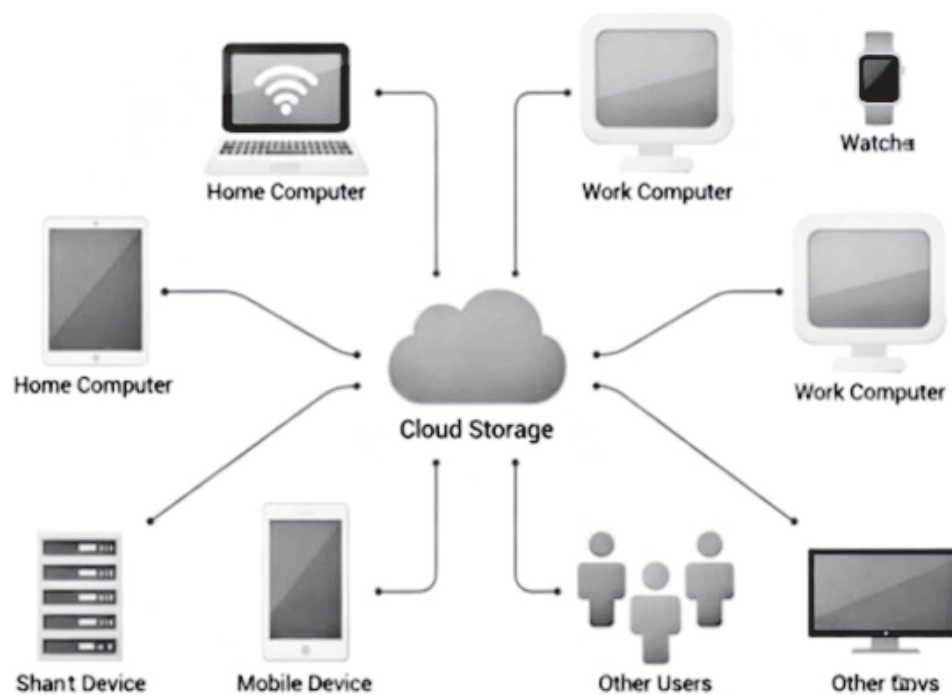


Fig. 1. Simplified Diagram of End-User Interaction with Cloud Storage

In 2025, artificial intelligence became a key trend. According to McKinsey, over USD 2.6 trillion has already been allocated to AI solutions for marketing. AI enables automation of segmentation, prediction of customer behavior, creation of personalized recommendations (as in Netflix and Amazon), and real-time campaign optimization. The International Data Corporation (IDC) forecast indicates that the AI market in marketing will reach USD 107 billion by 2028 [15].

Spending statistics confirm the dominance of digital channels. In 2024, global spending on internet advertising reached USD 1.1 trillion (a 7.3% increase compared to 2023). Mobile devices already account for nearly two-thirds of these investments – a tendency that continues to strengthen each year [16].

In 2025, internet marketing was experiencing one of its strongest periods. The pace of acquiring new audiences was tremendous, and digital promotion methods have become the most powerful tool for business, especially for SaaS and IaaS solutions, where the internet served as the primary traffic source [17; 18].

The rationale for using these methods is driven by several factors:

- ✦ Changes in user behavior – people search for information and compare offers online.
- ✦ High measurability of results (from click to purchase).
- ✦ Lower customer acquisition costs compared to offline channels.

The ability not only to attract but also to retain customers through automated email newsletters, push notifications, and personalization.

A comparative analysis of the main methods (Tbl. 1) shows that SEO provides the highest long-term effect and trust, email marketing offers the best ROI for retention, and PPC enables rapid scaling. Each method has its advantages and disadvantages, but their combination forms a comprehensive strategy.

The histogram of method usage (Fig. 2) confirms the leadership of SEO (88% of marketers), email marketing (85%), and PPC (76%). Social networks reach 72% of the global audience, making them an important complementary channel [20].

Thus, the use of internet marketing methods for IT companies providing cloud storage services is not only expedient but also strategically essential. It ensures a comprehensive impact across all stages of the customer journey – from acquisition to monetization – and enables achieving high competitiveness in the highly competitive SaaS/IaaS market.

Modern IT companies offering cloud data storage services operate in a highly competitive SaaS and IaaS environment. In 2026, the global cloud storage market continues to demonstrate rapid growth, creating both opportunities and challenges for local and niche providers. It is precisely in such conditions that the integration of internet marketing tools directly into the information system becomes a strategic ne-

Table 1

Comparative Characteristics of Internet Marketing Methods and Their Suitability for Use

Marketing Method	Description (Key Features)	Advantages	Disadvantages	Cost (approximate, 2025–2026)	Speed of Results	Average Long-term ROI	Suitability for Cloud Storage Services (SaaS/IaaS)
1	2	3	4	5	6	7	8
SEO (Search Engine Optimization)	Organic website promotion in search engines (Google, Bing) via content, technical optimization, backlinks	High trust, free traffic after initial buildup, long-lasting effect, best conversion from organic traffic	Very slow start (3–12 months), dependent on algorithm changes (AI Overviews 2025+ reduce clicks), requires ongoing work	Medium-high at start (content + technical), then low	Slow (months)	High (often the highest among channels)	High: key queries like "cloud storage", "secure cloud storage", "cloud storage Ukraine" – main source of leads
PPC (Pay-Per-Click, Google Ads, Microsoft Ads)	Paid search and display advertising charged per click	Instant traffic, precise targeting (keywords, geo, audience), budget control, fast testing	High competition → expensive clicks, traffic stops when budget ends, click-fraud risk	High (CPC \$1–\$10+ for competitive keywords)	Instant	Medium-high (depends on optimization)	High: ideal for quick acquisition during trial period launches or promotions
PPC (Pay-Per-Click, Google Ads, Microsoft Ads)	Paid search and display advertising charged per click	Instant traffic, precise targeting (keywords, geo, audience), budget control, fast testing	High competition → expensive clicks, traffic stops when budget ends, click-fraud risk	High (CPC \$1–\$10+ for competitive keywords)	Instant	Medium-high (depends on optimization)	High: ideal for quick acquisition during trial period launches or promotions
SMM (Social Media Marketing: Facebook, Instagram, LinkedIn, TikTok, YouTube)	Promotion via organic content, ads, community building	High virality, emotional connection, reach to young audiences, lead generation via forms	Algorithms limit organic reach, requires constant content creation, low B2B conversion	Low-medium (organic + targeted ads)	Medium (weeks-months)	Medium	Medium: good for branding and attracting freelancers/small businesses, weaker in B2B cloud services
Email Marketing (newsletters, automation: SendPulse, Mailchimp)	Direct emails, triggered campaigns, on-boarding, retention	Highest ROI, personalization, works with existing database, automation (trial → paid)	Requires high-quality database, spam filter risks, GDPR/anti-spam restrictions	Low-medium (platform + content)	Medium (depends on list quality)	Very high (often top-1 by ROI)	Very high: core channel for on-boarding, trial-end reminders, up-sell/cross-sell

End of the Table 1

1	Content Marketing (blog, videos, guides, case studies)	Affiliate / Referral Programs
2	Creating valuable content to attract and educate the audience	Partner promotion with commission on sales
3	Builds trust, supports SEO, long-term effect, lead magnets	Low risk (pay only for results), expanded reach
4	Very labor-intensive, slow results, requires expertise	Hard to find quality partners, quality control issues, commission costs
5	Medium (writers + design)	Medium (commissions 10-30%)
6	Slow	Medium
7	High (especially with SEO)	High (pay-for-performance)
8	High: articles like "how to choose cloud storage", competitor comparisons, case studies – perfect for B2B	Medium-high: efficient via bloggers, resellers, IT communities

Source: [15; 18; 19].

cessity for efficient customer acquisition, increased conversion rates, and reduced churn.

As shown in the Fig. 3 and Fig. 4, the market size grows from USD 197.8 billion in 2026 to USD 810 billion by 2034 at a compound annual growth rate (CAGR) of 19.3%. Alternative estimates (Mordor Intelligence) project growth up to USD 514 billion by 2031 with a CAGR of 23.45%. This dynamic confirms that demand for cloud services continues to grow rapidly, driven by increasing data volumes, the spread of generative AI, and requirements for data sovereignty [21].

However, hypercompetition from AWS, Microsoft Azure, and Google Cloud (collectively controlling over 60–65% of the market) compels smaller players to seek competitive advantages not only in technical characteristics but also in the quality of customer experience. The average customer acquisition cost (CAC) for SaaS companies in 2025–2026 ranges from USD 536–702, while in the B2B segment it reaches USD 1.200–2.000. Conversion rates during trial periods often do not exceed 20–30%, and monthly churn rates fluctuate between 5–7%. In such conditions, automating the customer journey (on-boarding → trial → paid → retention) through triggered email campaigns and personalized interactions becomes one of the most efficient ways to increase LTV and reduce marketing costs [22–25].

This is precisely why the key direction for improving the information system is the creation of a specialized microservice that ensures seamless integration of marketing tools (particularly SendPulse for email automation) with the company's core system.

The Fig. 5 illustrates a typical customer journey for a user of a cloud storage service. Key touch-points include registration, trial account activation, initial actions (e. g., file uploads), approaching the end of the trial period, and transition to a paid plan. Automated triggered emails (welcome message, reminders on days 3, 7, and 14, personalized up-sell offers) enable a significant increase in conversion at each stage and reduce the risk of churn.

To implement such automation, a microservice architecture with an API Gateway has been selected. This approach allows asynchronous processing of account status change events without blocking the core system and ensures high scalability.

The Fig. 6 illustrates that the “Integration Module” microservice acts as a central element (API Gateway), ensuring secure and unified data exchange between the core system (billing + storage) and external marketing platforms (SendPulse, Google Analytics, Ahrefs, etc.). The use of asynchronous calls, queues, and webhooks enables the processing of large volumes

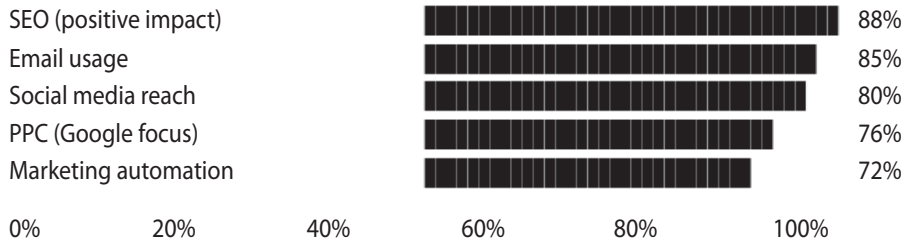


Fig. 2. Histogram of Different Methods

Global Cloud Storage Market Market Size Overview

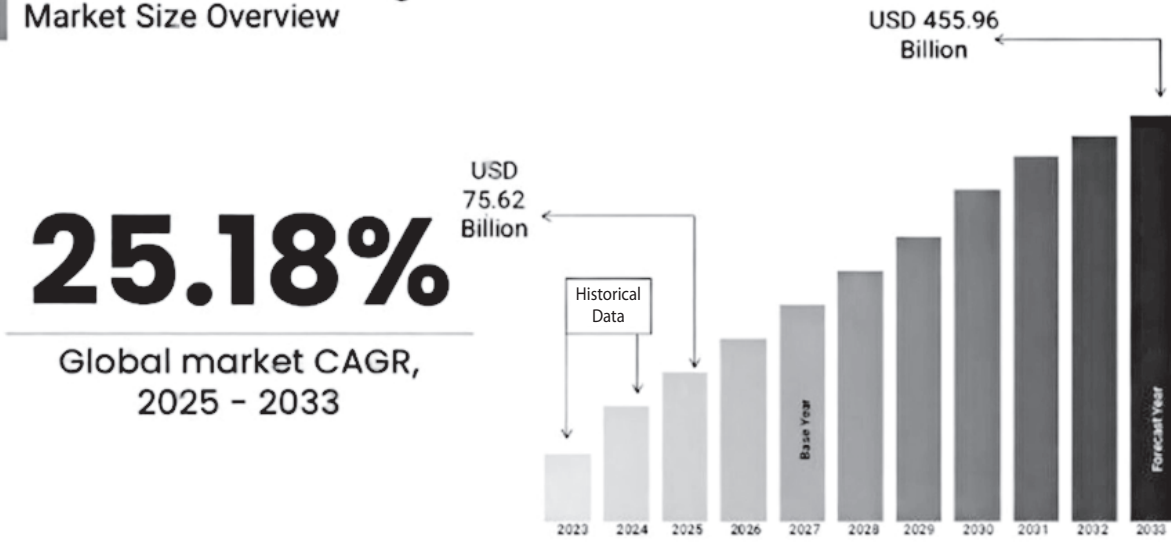


Fig. 3. Forecast of Global Cloud Storage Market Growth, 2025–2034 (USD billion) [21]

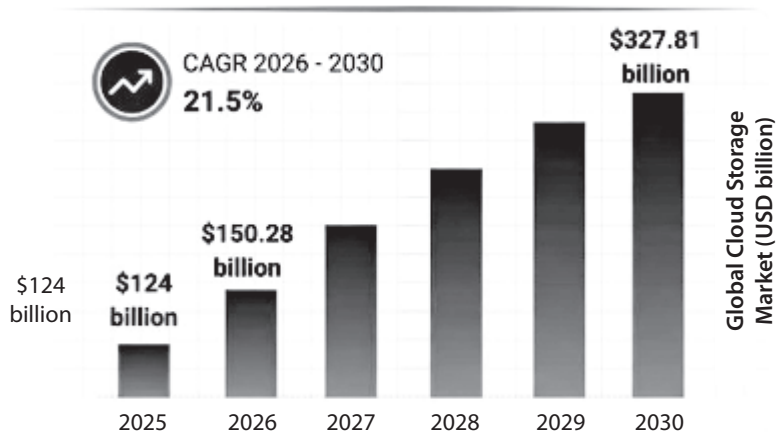


Fig. 4. Projected Growth of the Global Cloud Storage Market, 2025–2030 (USD billion) [7; 21]

of events without delays and with minimal load on the main infrastructure.

The choice of the “Best-of-Breed” strategy over all-in-one platforms (HubSpot, Salesforce Marketing Cloud) is justified by economic efficiency and flexibility.

As shown in the Fig. 7, email marketing demonstrates one of the highest ROI values in the B2B seg-

ment (often ranging from 261% to over 4200% depending on the campaign type and industry), significantly outperforming PPC and social media channels. SEO also shows strong long-term returns, while display ads and paid social typically yield lower ROI in B2B contexts. These metrics highlight the strategic value of automated email on-boarding and retention se-

Customer onboarding journey map to improve user experience

This slide provides an overview of customer journey map to track and enhance customer experience. It includes stages that are awareness, consideration, decision, service and loyalty.

Stage	Awareness	Consideration	Decision	Service	Loyalty
Customer Actions	View the advertisement online	Online research and competitor analysis	Made purchase	Receives post sale customer service and product walk-through	Make another purchase and refer product with others
Touchpoints	<ul style="list-style-type: none"> Word of mouth Social media 	<ul style="list-style-type: none"> Website Social Media 	<ul style="list-style-type: none"> Website Mobile app 	<ul style="list-style-type: none"> Phone Chat Email 	<ul style="list-style-type: none"> Word of mouth Product referral
Customer Experience	Interested and uncertain	Excited and inquisitive	Excited and happy	Annoyed	Satisfied and happy
KPIs	-	<ul style="list-style-type: none"> Total visitors Average session duration 	<ul style="list-style-type: none"> Leads generated Conversion rate 	<ul style="list-style-type: none"> Customer service success rate Customer promoter score 	<ul style="list-style-type: none"> Retention rate Customer lifetime value Customer satisfaction
Business Goals	Increase brand awareness and attract more customers	Increase website visitors	Increase conversion rate and revenue	Improve customer support services	Increase retention and reduce churn rate
Team(s) Involved	Marketing team	Communication and marketing team	IT, sales and marketing team	Customer service team	Marketing team

Fig. 5. Customer On-boarding Journey Map to Improve User Experience

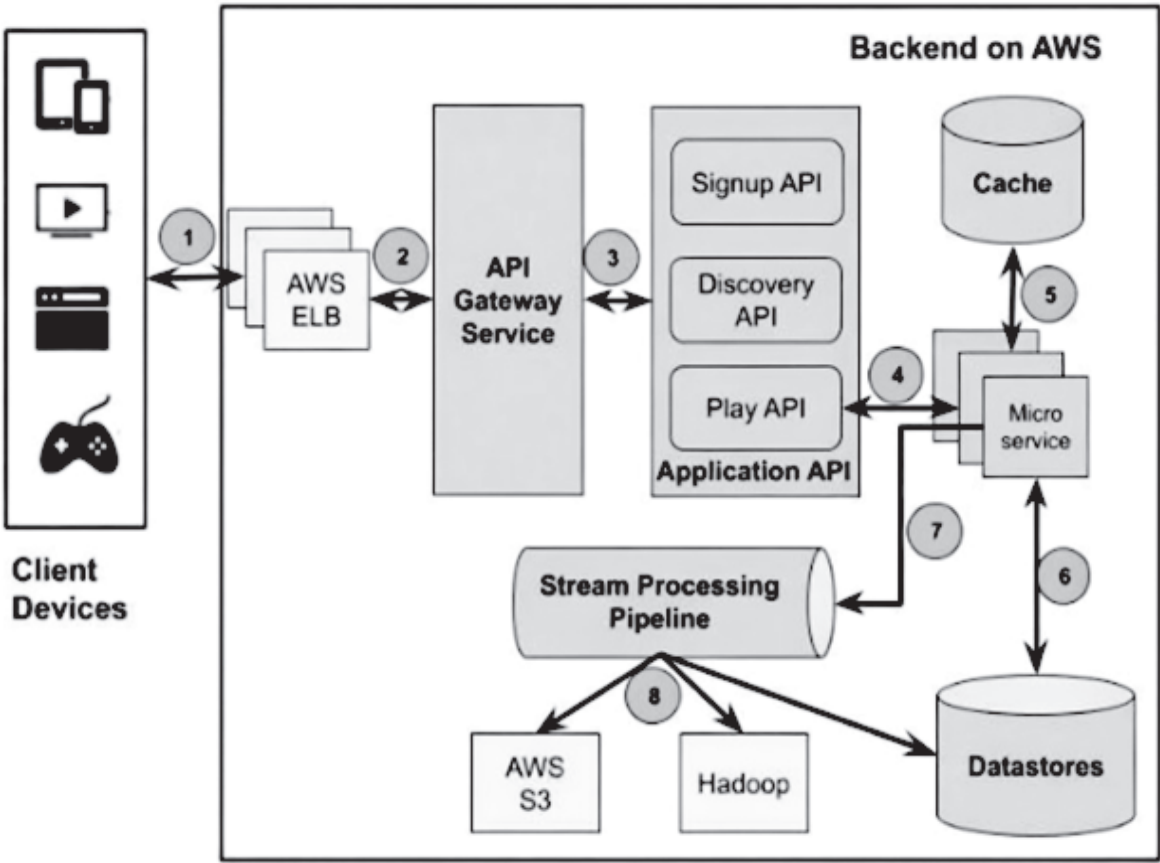


Fig. 6. Application of Microservice Architecture on AWS with API Gateway Wikis

Source: Authored / Adapted from AWS Well-Architected Framework.

quences, which the developed “Integration Module” microservice directly enables through integration with platforms like SendPulse [15].

Thus, the analysis of the subject area and business process modeling confirm the feasibility of developing a specialized microservice “Integration Module”.

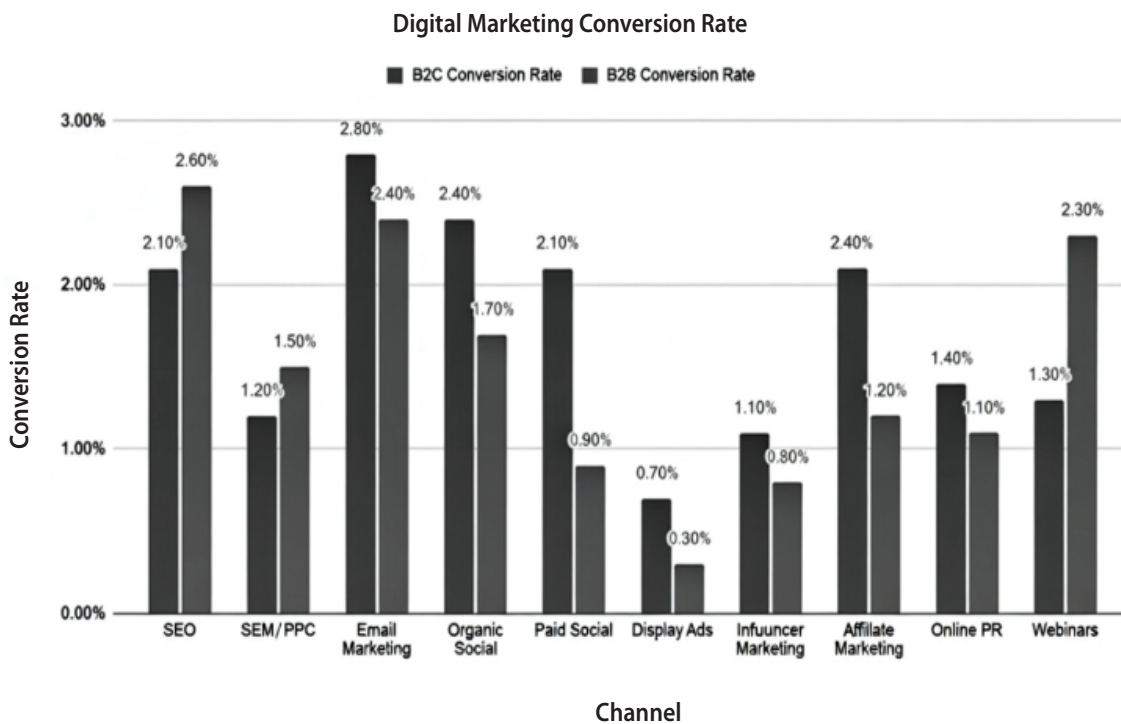


Fig. 7. Comparative Analysis of Return on Investment (ROI) for Key Digital Marketing Channels in the B2B Segment, 2025–2026

Source: HubSpot State of Marketing Report 2025–2026 [15].

It provides a comprehensive solution to the problem of integrating internet marketing into the information system of a cloud storage provider, addressing the current market challenges of 2026.

The developed microservice “Integration Module” represents a practical solution for integrating modern internet marketing methods into the information system of an IT company providing cloud data storage services. It enables automation of key stages of the customer journey – from registration and on-boarding to transition to a paid plan and subsequent retention – without altering the core business logic of the main system.

The Fig. 8 illustrates the sequence of stages: requirements analysis → business process modeling (BPMN 2.0) → architecture design (UML component diagrams) → implementation in Python + FastAPI → unit and integration testing (pytest) → containerization (Docker) → deployment in a production environment. This approach ensures high quality, reliability, and the possibility for further scaling.

The microservice is implemented as an asynchronous API Gateway with the main endpoints:

- ✦ /api/v1/onboarding/initiate – creation of an on-boarding event upon registration or account status change;
- ✦ /api/v1/onboarding/status – checking and updating processing status;

- ✦ webhook – for receiving confirmations from SendPulse.

Input data validation is performed using Pydantic, events are stored in PostgreSQL via SQLAlchemy, and error handling (e. g., SendPulse API unavailability) is implemented with retry mechanisms.

The diagram illustrates the expected improvements:

- ✦ Trial → Paid conversion rate: +15–35% (due to triggered reminders and personalized offers);
- ✦ CAC (Customer Acquisition Cost): reduction by 20–40% through organic traffic and efficient email on-boarding;
- ✦ LTV (Customer Lifetime Value): increase by 25–60% due to reduced churn rate and up-sell/cross-sell opportunities;
- ✦ Event processing time: reduction from seconds to milliseconds thanks to asynchronous processing.

Testing results confirm the reliability of the solution:

- ✦ 100% successful completion of unit tests (pytest) for functions determining on-boarding status and data validation.
- ✦ Successful handling of negative scenarios (invalid email, SendPulse API error, non-existent event).
- ✦ Stable operation in a Docker container on port 8000 in production mode.

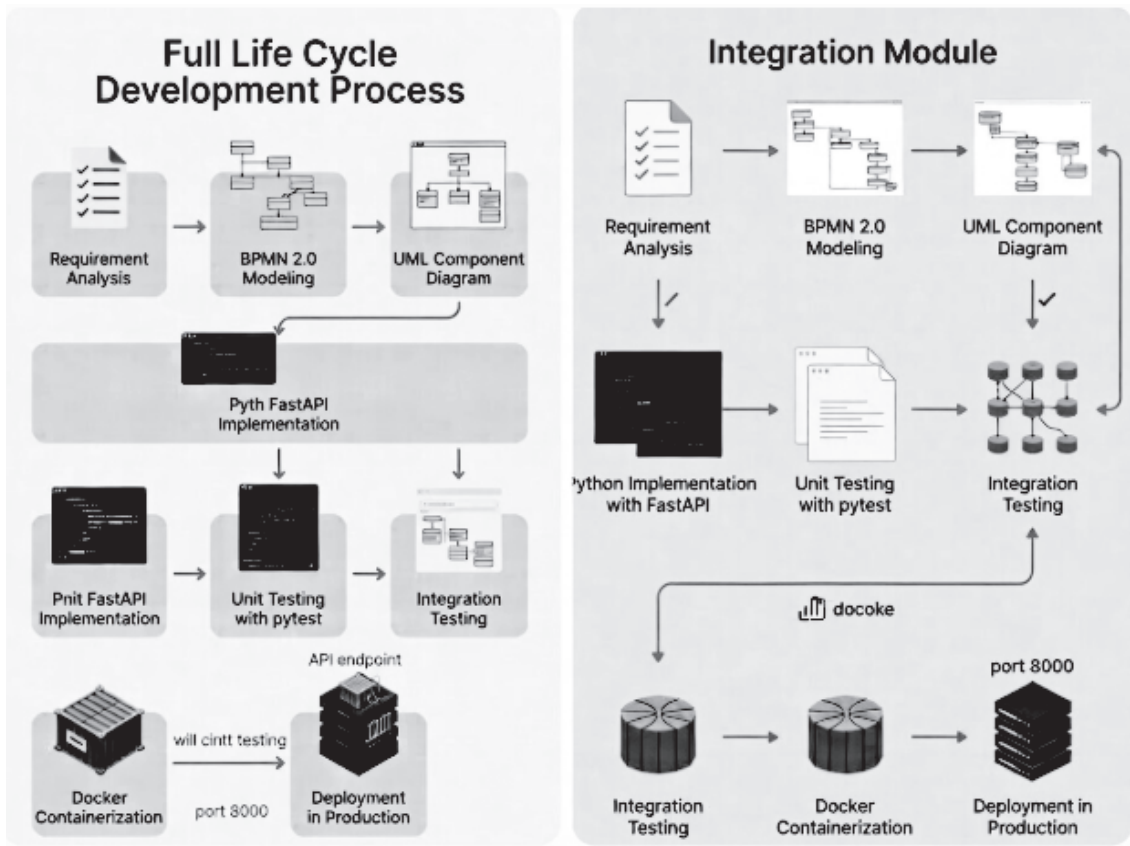


Fig. 8. The Final Lifecycle of Development of the Microservice “Integration Module”

Note: on the left is the initial development process, on the right is the detailed sequence for the marketing integration module.

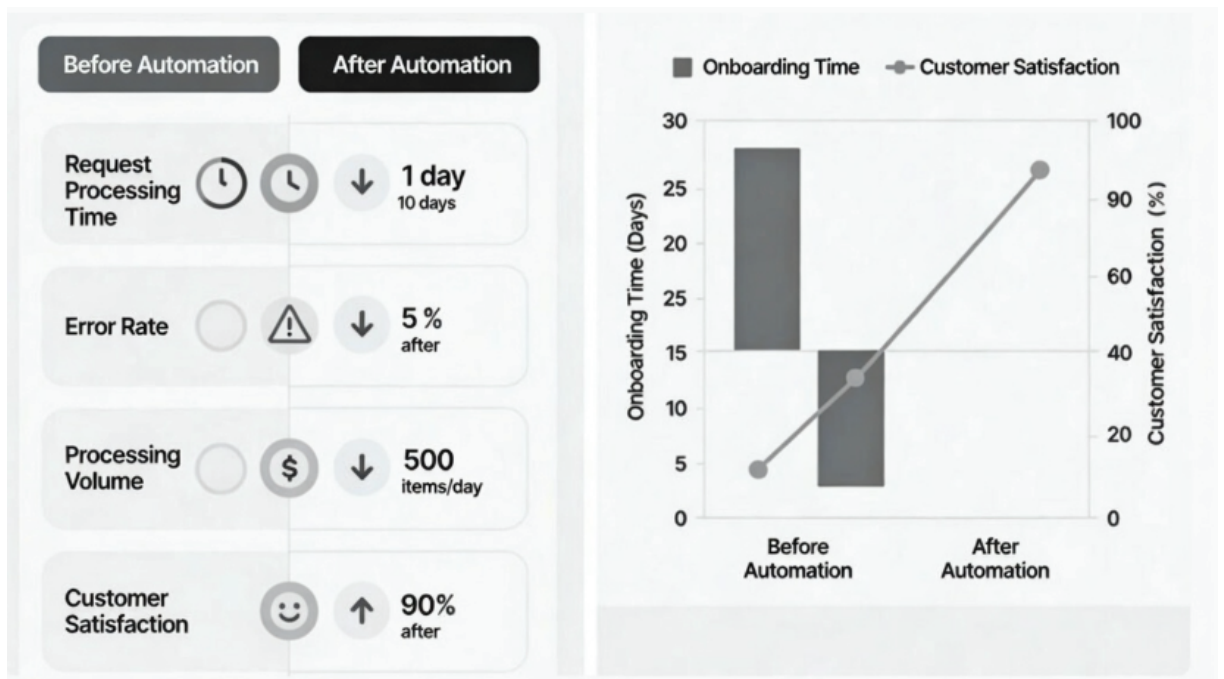


Fig. 9. Upgrading of Key Business Metrics Before and After the Implementation of Automation and On-Boarding

Source: Authorities and Forecast Estimates Based on Galuzev's SaaS/IaaS Benchmarks, 2025–2026.

The developed microservice “Integration Module” successfully addresses the challenge of integrating internet marketing into the information system of a cloud storage provider, filling a gap in the literature regarding microservice solutions specifically for this segment.

The adoption of the “Best-of-Breed” strategy combined with a modern technology stack (FastAPI, Pydantic, Docker) ensures flexibility, scalability, and low implementation costs compared to all-in-one platforms.

Automation of triggered email campaigns based on account events enables a substantial increase in trial-period conversion, reduction of customer acquisition costs, and growth of LTV – key metrics for competitiveness in the SaaS/IaaS market in 2026.

The solution is universal and can be adapted for IT companies of any scale offering subscription-based digital services.

Recommendations for Further Development:

- ✦ Integration with chatbots (Telegram, WhatsApp) and behavioral analytics (Google Analytics 4, Mixpanel).
- ✦ Addition of AI modules for personalizing email content.
- ✦ Expansion to other marketing channels (push notifications, in-app messages).
- ✦ Conducting A/B testing of triggered email sequences to optimize conversion rates.

The conducted research demonstrates that the integration of internet marketing tools directly into the information system of a cloud storage provider is not only technically feasible but also strategically imperative in the context of the hyper-competitive SaaS and IaaS market in 2026. The developed “Integration Module” microservice successfully bridges the gap between core business logic and modern digital marketing practices by providing a lightweight, asynchronous, and secure API Gateway that automates critical customer journey stages – from onboarding and trial activation to conversion into paid plans and long-term retention.

The use of a modern technology stack (Python + FastAPI, Pydantic, SQLAlchemy + PostgreSQL, pytest, Docker) combined with the “Best-of-Breed” strategy ensures high flexibility, scalability, low implementation costs, and independence from expensive all-in-one platforms such as HubSpot or Salesforce Marketing Cloud. The solution enables real-time triggered email sequences based on account status events, resulting in projected improvements in key performance indicators: trial-to-paid conversion increase by 15–35%, customer acquisition cost (CAC) reduction by 20–40%, customer lifetime value (LTV) growth by 25–60%, and significant enhancement of user satisfaction and retention metrics.

The results of testing confirm the robustness and production-readiness of the microservice: 100% successful unit and integration test coverage, reliable handling of negative scenarios, and stable operation in a containerized environment.

The proposed approach fills an important gap in the existing literature, where theoretical frameworks for AI-driven marketing and agile SaaS adoption are well-represented, yet practical implementations of microservice-based marketing automation specifically tailored to cloud storage systems remain scarce. The presented work contributes both theoretical insights into the synergy of cloud infrastructure and digital marketing and a ready-to-adapt practical tool that can be implemented by IT companies of any scale offering subscription-based digital services.

The solution not only addresses immediate business challenges – such as rising customer acquisition costs, low trial conversion, and churn – but also lays a solid foundation for future development. Recommended directions include integration with chatbots (Telegram, WhatsApp), behavioral analytics platforms (Google Analytics 4, Mixpanel), AI-based email content personalization, expansion to push and in-app notifications, and systematic A/B testing of triggered sequences to further optimize conversion rates.

Ultimately, the “Integration Module” microservice represents a meaningful step toward building more intelligent, customer-centric, and competitive cloud storage ecosystems, where technical excellence is complemented by sophisticated, automated, and personalized marketing interactions. ■

BIBLIOGRAPHY

1. Cloud Storage Market Size & Share Analysis – Growth Trends and Forecast (2026–2031). *Mordor Intelligence*. 2025. URL: <https://www.mordorintelligence.com/industry-reports/cloud-storage-market>
2. Cloud Storage Market Size, Share & Industry Analysis. *Fortune Business Insights*. 2025. URL: <https://www.fortunebusinessinsights.com/cloud-storage-market-102773>
3. Cloud Market Share Trends – Big Three Together Hold 63% while Oracle and the Neoclods Inch Higher. *Synergy Research Group*. 2025. URL: <https://www.srgresearch.com/articles/cloud-market-share-trends-big-three-together-hold-63-while-oracle-and-the-neoclods-inch-higher>
4. Khurshed A. K., Zeebaree S. R. M. Web Technology and Cloud Computing in Enterprise System: The Role of AI for Digital Marketing. *Asian Journal of Research in Computer Science*. 2025. Vol. 18. Iss. 5. P. 554–580. DOI: <https://doi.org/10.9734/ajrcos/2025/v18i5674>

5. Mero J., Leinonen M., Makkonen H., Karjaluoto H. Agile logic for SaaS implementation: Capitalizing on marketing automation software in a start-up. *Journal of Business Research*. 2022. Vol. 145. P. 583–594. DOI: <https://doi.org/10.1016/j.jbusres.2022.03.026>
6. Islam M. A., Fakir S. I., Masud S. B. et al. Artificial intelligence in digital marketing automation: Enhancing personalization, predictive analytics, and ethical integration. *Edelweiss Applied Science and Technology*. 2024. Vol. 8. No. 6. P. 6498–6516. DOI: <https://doi.org/10.55214/25768484.v8i6.3404>
7. Cloud Storage Market Share, Size, Trends & Analysis, 2033. *Market Data Forecast*. 2025. URL: <https://www.marketdataforecast.com/market-reports/cloud-storage-market>
8. Cloud Storage Market. *Dimension Market Research*. 2025. URL: <https://dimensionmarketresearch.com/report/cloud-storage-market/>
9. Cloud Storage Market Analysis 2026. *Cognitive Market Research*. 2025. URL: <https://www.cognitivemarketresearch.com/cloud-storage-market-report>
10. Information and communications technology: Cloud storage market. *MarketsandMarkets*. 2025. URL: <https://www.marketsandmarkets.com/Market-Reports/cloud-storage-market-902.html>
11. Гузенко С. Що таке інтернет-маркетинг? *Elit-Web*. 2025. URL: <https://elit-web.ua/ua/blog/kak-rabotaet-pravilnyj-internet-marketing-3-shaga-k-uspehu>
12. Що таке інтернет-маркетинг: визначення та основні види. *Wedex*. 2024. URL: <https://wedex.com.ua/blog/sho-take-internet-marketing-viznachennya-ta-osnovni-vidi/>
13. Попова К. Що таке інтернет маркетинг і чому CRM – його найліпший помічник. *NetHunt*. 2025. URL: <https://nethunt.ua/blog/intierniet-markietingh-vid-a-do-ia-shcho-tsie-i-ia-k-vikoristovuvati-iogho-instrumenti/>
14. Рось Д. Інтернет-маркетинг – що це таке, види й інструменти. *Promodo Academy*. 2025. URL: <https://academy.promodo.ua/blog/internet-marketing-shcho-ce-take-vidi-y-instrumenti>
15. The State of Marketing Report. *State of HubSpot*. 2025. URL: <https://nexacognition.com/state-of-marketing>
16. Kemp S. Digital 2025: Global Advertising Trends. *DataReportal*. 2025. URL: <https://datareportal.com/reports/digital-2025-sub-section-global-advertising-trends>
17. Baar A. WARC: Global ad spend to top \$1 trillion in 2024. *Marketing Dive*. 2024. URL: <https://www.marketingdive.com/news/warc-global-ad-spend-top-1-trillion-this-year-2024/725198/>
18. Goldman J. Two in three US digital ad dollars went to mobile in 2024. *eMarketer*. 2024. URL: <https://www.emarketer.com/content/two-three-us-digital-ad-dollars-went-mobile-2024>
19. The 2026 State of Marketing Report. *HubSpot*. 2026. URL: <https://www.hubspot.com/state-of-marketing>
20. Kemp S. Digital 2026 Global Overview Report. *DataReportal*. 2026. URL: <https://datareportal.com/reports/digital-2026-global-overview-report>
21. Hyperscale Data Center Market Size & Share 2025–2034. Market Size by Component, by End Use, by Application, by Power Capacity, by Data Center. *Global Market Insights*. 2025. URL: <https://www.gminsights.com/industry-analysis/hyperscale-data-center-market>
22. Robinson D. AWS under pressure as big three battle to eat the cloud market. *AWS RE:INVENT*. 2025 URL: https://www.theregister.com/2025/11/20/aws_loses_market_share_azure_google/
23. Richter F. Big Three Hold Dominant Lead in Accelerating Cloud Market. *Statista*. 2026. URL: <https://www.statista.com/chart/18819/worldwide-market-share-of-leading-cloud-infrastructure-service-providers/>
24. Ahmad N. AWS vs Azure vs Google Cloud: Key Features and Pricing. *Channel Insider*. 2025. URL: <https://www.channelinsider.com/infrastructure/aws-vs-azure-vs-google-cloud>
25. Average CAC for SaaS Businesses, by Industry & Customer Type. *First Page Sage*. 2025. URL: <https://firstpagesage.com/marketing/average-cac-for-saas-businesses-by-industry-and-customer-type-fc>

REFERENCES

- Ahmad N. (2025). AWS vs Azure vs Google Cloud: Key Features and Pricing. *Channel Insider*. <https://www.channelinsider.com/infrastructure/aws-vs-azure-vs-google-cloud>
- Baar A. (2024). WARC: Global ad spend to top \$1 trillion in 2024. *Marketing Dive*. <https://www.marketingdive.com/news/warc-global-ad-spend-top-1-trillion-this-year-2024/725198/>
- Cognitive Market Research. (2025). *Cloud Storage Market Analysis 2026*. <https://www.cognitivemarketresearch.com/cloud-storage-market-report>
- Dimension Market Research. (2025). *Cloud Storage Market*. <https://dimensionmarketresearch.com/report/cloud-storage-market/>
- Fortune Business Insights. (2025). *Cloud Storage Market Size, Share & Industry Analysis*. <https://www.fortunebusinessinsights.com/cloud-storage-market-102773>
- Global Market Insights. (2025). Hyperscale Data Center Market Size & Share 2025–2034. Market Size by Component, by End Use, by Application, by Power Capacity, by Data Center. <https://www.gminsights.com/industry-analysis/hyperscale-data-center-market>
- Goldman J. (2024). Two in three US digital ad dollars went to mobile in 2024. *eMarketer*. <https://www.emarketer.com/content/two-three-us-digital-ad-dollars-went-mobile-2024>
- HubSpot. (2026). *The 2026 State of Marketing Report*. <https://www.hubspot.com/state-of-marketing>

- Huzenko S. (2025). Shcho take internet-marketynh? [What is internet marketing?]. *Elit-Web*. <https://elit-web.ua/ua/blog/kak-rabotaet-pravilnyj-internet-marketing-3-shaga-k-uspehu>
- Islam M. A., Fakir S. I., Masud S. B. & et al. (2024). Artificial intelligence in digital marketing automation: Enhancing personalization, predictive analytics, and ethical integration. *Edelweiss Applied Science and Technology*, 6(8), 6498–6516. <https://doi.org/10.55214/25768484.v8i6.3404>
- Kemp S. (2026). Digital 2026 Global Overview Report. *DataReportal*. <https://datareportal.com/reports/digital-2026-global-overview-report>
- Kemp S. (2025). Digital 2025: Global Advertising Trends. *DataReportal*. <https://datareportal.com/reports/digital-2025-sub-section-global-advertising-trends>
- Khurshed A. K. & Zeebaree S. R. M. (2025). Web Technology and Cloud Computing in Enterprise System: The Role of AI for Digital Marketing. *Asian Journal of Research in Computer Science*, 5(18), 554–580. <https://doi.org/10.9734/ajrcos/2025/v18i5674>
- Market Data Forecast. (2025). *Cloud Storage Market Share, Size, Trends & Analysis, 2033*. <https://www.marketdataforecast.com/market-reports/cloud-storage-market>
- MarketsandMarkets. (2025). *Information and communications technology: Cloud storage market*. <https://www.marketsandmarkets.com/Market-Reports/cloud-storage-market-902.html>
- Mero J., Leinonen M., Makkonen H. & Karjaluoto H. (2022). Agile logic for SaaS implementation: Capitalizing on marketing automation software in a start-up. *Journal of Business Research*, 145, 583–594. <https://doi.org/10.1016/j.jbusres.2022.03.026>
- Mordor Intelligence. (2025). *Cloud Storage Market Size & Share Analysis – Growth Trends and Forecast (2026–2031)*. <https://www.mordorintelligence.com/industry-reports/cloud-storage-market>
- Popova K. (2025). Shcho take internet marketynh i chomu CRM – yoho nailipshyi pomichnyk [What is internet marketing and why CRM is its best assistant]. *NetHunt*. <https://nethunt.ua/blog/intierniet-marketingh-vid-a-do-ia-shcho-tsie-i-iak-vikoristovuvatiogho-instrumenti/>
- Richter F. (2026). Big Three Hold Dominant Lead in Accelerating Cloud Market. *Statista*. <https://www.statista.com/chart/18819/worldwide-market-share-of-leading-cloud-infrastructure-service-providers/>
- Robinson D. (2025). AWS under pressure as big three battle to eat the cloud market. *AWS RE:INVENT*. https://www.theregister.com/2025/11/20/aws_loses_market_share_azure_google/
- Ros D. (2025). Internet-marketynh – shcho tse take, vydy y instrumenty [Internet marketing – what it is, types and tools]. *Promodo Academy*. <https://academy.promodo.ua/blog/internet-marketing-shcho-ce-take-vidi-y-instrumenti>
- State of HubSpot 2025. (2025). *The State of Marketing Report*. <https://nexacognition.com/state-of-marketing>
- Synergy Research Group. (2025). *Cloud Market Share Trends – Big Three Together Hold 63% while Oracle and the Neoclouds Inch Higher*. <https://www.srgresearch.com/articles/cloud-market-share-trends-big-three-together-hold-63-while-oracle-and-the-neoclouds-inch-higher>
- Wedex. (2024). *Shcho take internet-marketynh: vyznachennia ta osnovni vydy* [What is internet marketing: definition and main types]. <https://wedex.com.ua/blog/sho-take-internet-marketing-viznachen-nya-ta-osnovni-vidi/>

Стаття надійшла до редакції / Received: 26.01.2026
 Статтю прийнято до публікації / Accepted: 09.02.2026
 Оприлюднено / Published: 31.03.2026