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In Retrospect

In Retrospect

The drastic impacts of the Covid-19 pandemic that affected all areas of life of the entire global community at an unprecedented scale made 2020 an exceptional year in every respect. Not only health care systems but also the private economy, governments, the cultural sector and consumers all over the world were faced with fundamental challenges. The positive effects of digitisation and the importance of access to digital media enabling societal participation to some extent in the crisis, despite contact restrictions imposed to contain the pandemic, became clearly evident in Germany, too: The accelerated shift of economy and trade to the online world and the establishment of new digital solutions for work, learning and entertainment triggered lasting changes, which will not be entirely reversed in post-Covid times. This applies to home office, online fairs or remote schooling as well as to creative concepts of the catering or retail trade and of artists or cultural institutions, who perceive digitisation as an opportunity to deal with the "new normal" and actively shape it to maintain direct contact with their customers and audience, and thus develop a new form of exchange that permits them to continue earning their living.

High-performance digital infrastructures are the essential backbone of any digitisation: Thus, continuous smooth

operation of the name service for .de as a critical infrastructure and DENIC as its operator were more important than ever in 2020. That people spent more time in the digital space in the Covid-19 situation, is also reflected in the rise of annual average DNS queries to the .de name servers. A strong increase in the domestic demand for .de domains led to tripled numbers of new registrations on the previous year and to the largest percentage growth since 2012. On the secondary market, too, .de domains continued to prove a profitable investment, and their average value increased significantly on trading platforms.

Unlike in many other industries, 2020 was anything but a business-critical year from DENIC's point of view – the challenges posed by the unique situation of the pandemic were successfully tackled and the high service level standards met at all times, projects and plans further advanced under the changed circumstances and significant growth achieved.

Business Continuity Management under Covid-19 Conditions

DENIC's core service, the name service for .de domains, which, being a basic infrastructure, is essential for the proper functioning of the German Internet, has been

categorised as critical infrastructure pursuant to the German IT Security Law since June 2017, and must thus be protected against risks and threats by appropriate technical and organisational measures. Due to these statutory demands, the basic requirements for DENIC's staff to work remote were already largely met at the start of 2020, as a result of most business processes having been digitised for a long time. The measures taken on the basis of the risk assessments of DENIC's Business Continuity Management system, which also included a pandemic among the disaster scenarios provided for, enabled DENIC to respond early, fast and comprehensively to the specific challenges, when the Covid-19 situation started to aggravate in Germany, around the end of February 2020. To protect the health of its employees and ensure the safeguarding of operations directly related to it, DENIC gave its staff the opportunity to work from home as early as at the beginning of March. Individual infrastructure gaps were closed, by providing any missing equipment and remote resources, such as VPN access, conference technology, cloud telephony or collaborative online tools for team and project work, were made available to everyone, so that full functionality of all necessary work appliances was guaranteed for all employees to perform all their tasks on a mobile basis outside the DENIC head office in Frankfurt as of

mid-March. Even though a Covid-19-compliant anti-infection and hygiene concept had been implemented for employees and guests over the course of the year, working on site at the Frankfurt office was suspended until further notice in view of the development of the pandemic in the second half of 2020.

Looking back, a positive balance can be drawn with regard to DENIC's remote operation, which extended nearly over the entire business year: All internal functional units consistently maintained full ability to work; strategic developments and technical projects could be carried on in a concerted manner in the remote mode, as well as organisational tasks up to the virtual onboarding of new employees. DENIC's high Service Level Standards were consistently met all through the year. Thus, the critical infrastructure of the .de name service was provided to the Internet community reliably without interruption in these challenging times. The three-week cross-team emergency exercises scheduled for the summer months were also carried out successfully. The technical staff mastered the additional challenge of working effectively from home, within a small time frame under Covid-19 conditions, and business-critical situations were successfully simulated by the distributed teams in various disaster recovery scenarios.

DNS Services

One of the cornerstones of DENIC's activities has always been the continuous optimisation of the operation and security of its name service. The service operated for the .de TLD and DENIC's Anycast customers is provided at a range of name server locations (NSL), which are allocated to one or more service addresses. Since 2020, all name server clouds for .de have an IPv4 and an IPv6 address.

While in the previous years, DENIC focussed on upsizing the existing geographic locations by increasing bandwidths and response capacities and applying more and more automated orchestration tools, top priority – also for reasons of cost optimisation – is now on lateral variability and diversification of locations. Instead of continuing to topologically rely on a limited amount of one-size-fits-all locations, DENIC will use a pool with multiple NSLs of different performance classes in the future, whose capacities, connectivity and availability will be tailored to the respective traffic volume. Scalable infrastructures that allow data traffic to be (re-)routed to or pooled within a variable number of instances – right up to the localisation in ISP networks – will enable more efficient mitigation even of larger and more complex traffic data streams, if necessary. The long-term goal is full redundancy at mini-

mal latency, thus eliminating fate sharing in case of potential attack and further improving the DDoS resilience of systems and customer zones involved.

To this end, DENIC is using virtual NSLs (vNSL), which can be operated on any target platform and thus enable highest possible flexibility. They combine a facilitated rollout and operation of NSLs and the option to expand the footprint flexibly in case of changing query volumes with improved reactivity in case of an incident and optimal cost efficiency through tailored solutions.

In 2020, the rollout of the new vNSL architecture based on last year's prototype was started at existing locations, two new virtual locations in Europe and Australia were pre-configured and set up for initial test operation.

To improve and accelerate its response to potential incidents or attacks on the .de name service, DENIC has developed a basic concept for a big data analysing tool. Initially, the tool shall reflect and help to analyse the operating status of the name server infrastructure via DNS traffic, routing and possibly also server performance data. In the medium term, however, it may also be used for additional purposes, such as capacity planning, or be offered as an upgrade for Anycast customers.

Complementing the DDoS resilience boosting measures for the .de zone already taken in the past, DENIC obtained the ability in the second half of 2020 to mitigate attacks of very large bandwidth on its DNS infrastructure at a scale that goes far beyond the Cooperative's own line capacities. This was achieved by connecting the DENIC systems with those of one of the world leading providers of anti-DDoS services, thus rendering the establishment of large own excess capacities unnecessary. Moreover, DENIC has entered into a cooperation with the Brazilian ccTLD .br, which already had to cope repeatedly with larger-scale attacks. Next to providing mutual DDoS protection, .de and .br regularly exchange knowhow.

Registration Services

Since July 2020, Registry Lock is offered to domain holders by DENIC as a security feature to protect them against cyber attacks, domain hijacking or security gaps. The feature gives the domain holder full control over any changes to their domain data.

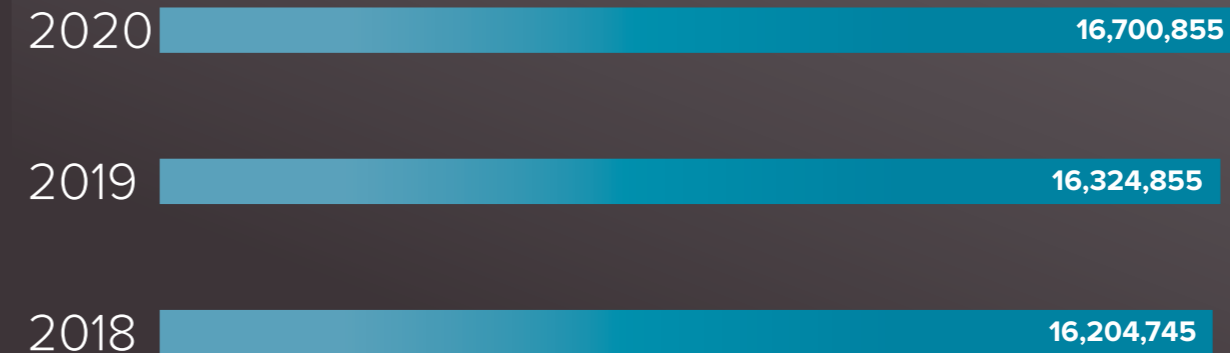
Since November, a streamlined and thus faster and more efficient version of DENIC's TRANSIT procedure has been in place: Introduced 20 years ago to protect against unintentional domain loss when the contractual relationship

between the domain holder and their provider is terminated, the new, tightened procedure combines several communication steps into one. As in the past, the TRANSIT procedure remains free of charge for the domain holder, if they make use of one of DENIC's offered options and either carry out a provider transfer or delete their domain within the set period. If none of this happens, the domain is automatically transferred to fee-based administration by the DENICdirect customer service.

At the end of 2020, DENIC established a dedicated data science team with the specific task to set up a central information system including dashboards for mapping the status and trends in the domain market. Thus, the foundation was laid for consolidating diverse data sources and for aggregating these in target-group-specific dashboards and metrics. In the course of 2021, it shall become possible for the DENIC management and the DENIC members to carry out dynamic, interactive analyses and create visuals of business figures and statistics with the new means and functions. In the future, the available data shall also serve as a basis for other business intelligence applications.

Additionally, DENIC continues to work on an optional certification service for (primarily commercial) domain holders that can be used to confirm that the holder data

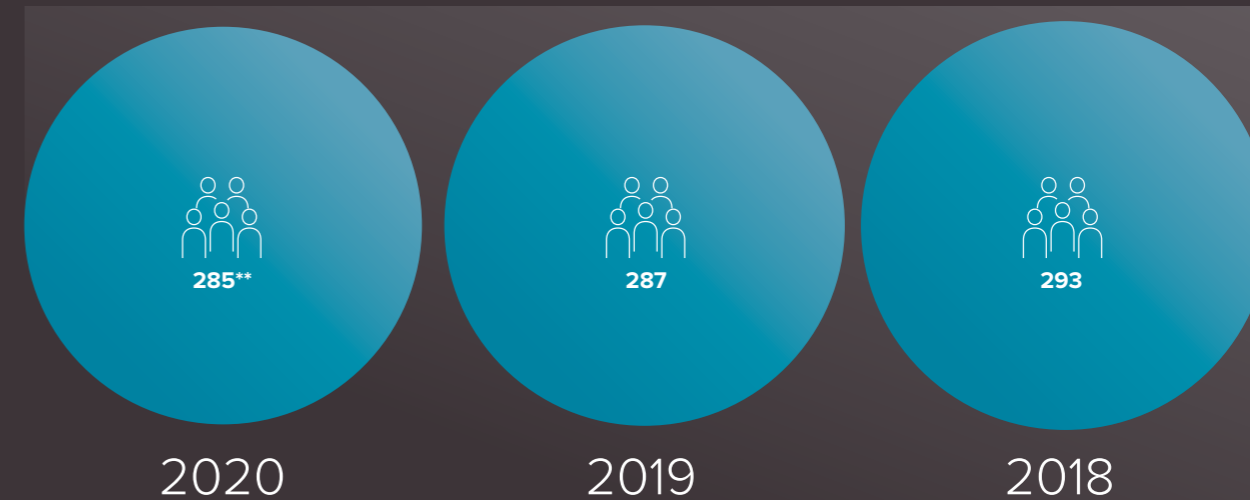
Domains under Management as of 31 Dec.



Workforce as of 31 Dec.



Membership*



*Year-end figures including all membership terminations that take effect from 1 January of the following year, in accordance with DENIC's statutes

**among which 69 from abroad (=24%)

of a specific domain have been authenticated by a trusted third party and that the authorised representative of such commercial holder, who went through the certification process, actually exists.

Delivery Line Infrastructure

Considerations aiming at medium-term reduction of capital expenditure and operating costs in the network, computer and storage areas of its IT infrastructures were a reason for DENIC in the last two years to reassess and revise the existing CI/CD concept of its data center operations and network management from scratch. As part of this review, registry and office services as well as standard DNS applications had to be identified that would be suited for cloud-native solutions of public infrastructure providers. Decisive for a final assessment was, on the one hand, whether scaling advantages can be achieved by migrating entire services or parts thereof into a cloud environment, thus reducing costs through the elimination of own machine instances, also because the constant provision of security, administration and maintenance resources would become dispensable, while keeping the same or achieving an even higher level of performance, reliability and information security. On the other hand, feasibility was analysed in each indi-

vidual case, next to the additional outlay and the amortisation of the costs that would result from the necessary virtualisation and containerisation of the currently used systems and tool chains, part of which proprietary, to enable a potential transfer to cloud-based applications. Further key criteria considered included the various protection and – in case of a public cloud solution – encryption requirements of the data that are stored and/or processed by DENIC. According to the final state of evaluation, a hybrid platform is intended to be realised that maps all productive applications on-premises to DENIC-owned hardware under DENIC management, through active-active high-availability clustering, whereas non-critical applications are planned to be transferred to a cloud-native environment. After all necessary basic services required for migrating the applications to the new, modern operating infrastructure were made available by the design team, in the next step, the product teams will start migrating their individual services to the new platform according to a pre-defined schedule.

The introduction of a company-wide DENIC Enterprise Content Management (ECM) system, which was implemented in various steps, was successfully completed in the course of the year. Thus, the centrally organised recording of documents – including those of the purchas-

ing procedure, incoming invoices and post as well as legal and project files – now is fully secured, and so is their audit-proof archiving, compliant with the applicable legislation.

Emerging Products/Markets

With the implementation of all Identity Authority functions, DENIC set up and completed a marketable ID Authority solution compliant with the ID4me standard in 2020. To establish the product in the market, the domain-based, federated Single Sign-On solution for digital identity management shall initially be offered in the form of an enterprise model, based on the practical experience of DENIC's own in-house production environment with a self-serviced Identity Agent, to subsequently support the propagation of the ID4me standard and the expansion of the ID4me user basis in the medium and long term. The OpenID Connect Identity Assurance Standard of the Open ID Foundation, which was developed with the collaboration of DENIC, reached its Second Implementer's Draft status in May. Staying continuously involved in the Identity Assurance Management Working Group within the scope of the pan-European data infrastructure project GAIA-X opens up additional cooperation options. DENIC co-authored the project's Technical Architecture

and Executive Whitepaper, which was published in June. DENIC is also represented on the board of the non-profit organisation ID4me AISBL (△ id4me.org/), which is responsible for the global coordination of the ID4me initiative. In this context, further positioning and use case opportunities are being pursued. These include projects funded by the German Ministry for Economic Affairs and Energy or by the European Union.

Information Security & Risk Management

Since autumn 2014, DENIC has been certified according to the international standard ISO/IEC 27001:2013, which specifies the requirements for an information security management system (ISMS). In September 2020, the Cooperative passed the recertification procedure successfully. In the related audit, DENIC was once again attested a systematic holistic approach for controlling security-related processes across the company, as well as transparency and traceability of its workflows and an information security risk management that is in compliance with the standard. Following an integrated approach, DENIC also successfully passed the ISO 22301:2012 surveillance audit of its Business Continuity Management System (BCMS), which was first certified in 2016, and convinced the external auditors of a renowned

certification body by its systematic holistic and well-structured BCM approach, which includes multiple "good practices".

Next to maintaining the two certifications, DENIC in 2020 successfully provided evidence about the implementation of the necessary security measures for the protection of the authoritative name servers for .de to the competent supervisory authority, i.e. the Federal Office for Information Security, as required from an operator of a critical infrastructure according to Section 8a of the German IT Security Act (BSIG). The existing standard-compliant implementations of its ISMS and BCMS, and in particular the related processes, procedures and components DENIC has implemented, facilitated the verification procedure.

In August 2020, DENIC merged previously existing isolated risk management solutions into an integrated workflow system. Information security risks, such as failures of registration and information services due to insufficient capacity, are now identified, analysed and assessed with standardised methods, together with overarching risks that result from market developments and trends, new and amended legislation or the operating environment. Thus using synergies, higher transparency is created and

DENIC is better prepared for potential risk scenarios. The restructured Risk Management consequently is a logical complement to DENIC's Business Continuity Management and helps to systematically enhance its corporate resilience.

Organisational Development

With the restructuring of its IT Services division, the establishment of a separate Product Management division and a new orientation of its Data Science division accompanied by an increase in staff, DENIC's organisational structure was fundamentally rearranged in the second half of the year, putting a special focus on market and customer orientation.

Sustainability Management & Corporate Social Responsibility

As a private, not-for-profit cooperative that has committed itself to the benefit and good of the Internet community, DENIC strives to assume responsibility towards the environment and society by acting and operating in an ecologically compatible and socially responsible manner. In 2020, DENIC contributed to operational sustainability by shifting to power supply from 100 percent renewable

energy sources for its head office, which reduced CO2 emissions by more than 160 tonnes annually. Additionally, the Cooperative largely switched to short supply chains and biological or environmentally friendly products in the fields of utilities and facility cleaning.

The future prospects of individual companies as well as of the economy as a whole highly depend on new generations of well-trained specialists. To attract qualified "tailor-made" junior staff, but also as an expression of its social responsibility towards future generations, DENIC has been offering young people a wide variety of training forms and models for many years: Skilled school graduates are trained in-house to become an IT specialist and are usually offered a permanent position afterwards. To promote young academics, DENIC has been a practice partner of Darmstadt University of Applied Sciences in the University's dual study program with a focus on IT security since 2016. In 2020, one student of the bachelor and one of the master course were involved in IT security projects of DENIC as part of their practical phase. Moreover, five student trainees got the opportunity to gain practical experience over a longer period parallel to their studies in different divisions at DENIC, ranging from technical departments to product management, marketing and data science.

Solidarity with others and commitment to the community are general guiding principles for DENIC as a cooperative. In line with this, also in 2020, DENIC sponsored several charity initiatives in Frankfurt, Germany, where its head office is located: the association "Arche Frankfurt e.V." for socially disadvantaged children, the association "Hilfe für Krebskranke Kinder Frankfurt" for children suffering from cancer and the voluntary wish van project "Wünschewagen Rhein-Main" for terminally ill people.



Market & Business Development

Market & Business Development

After a mixed picture in the preceding years, the balance of the business year 2020 was thoroughly positive for DENIC: Contrary to the slump in large parts of the German and international macroeconomic environment due to the Covid-19 pandemic, .de domain registrations recorded the largest growth of the last eight years. Also the non-core business lines DNS Infrastructure Services and Data Escrow Services, which are managed by DENIC eG's dedicated subsidiary DENIC Services GmbH & Co. KG since the end of 2018, developed very positively again and thus additionally secure DENIC's core business. Earnings of the Cooperative remained stable and .de still is the best known and most relevant TLD in the German market.

In 2020, the economic situation in Germany was clearly impacted by the Covid-19 crisis. After ten years of growth, the economy slipped back into a deep recession, similar to the one experienced during the financial and economic crisis of 2008/2009, even though this time the overall impact was less severe: Nevertheless, according to the Federal Statistical Office, price-adjusted GDP fell by 5 percent, which is well below the level of the previous years (GDP 2019: +0.6 percent, 2018: +1.5 percent, 2017 and 2016: +2.2 percent each). When

compared on a European level, however, calculations show that the German economy did comparably well in the year of the crisis (GDP France: -9.4 percent, Italy: -9.9 percent, Spain: -12.4 percent, EU27: -6.8 percent); the US (-4.6 percent; 2019: +2.3 percent) and China (+2.1 percent; 2019: +6.1 percent), though, fared better. The business climate within the domain sector was largely balanced again as far as the Cooperative is concerned: No insolvency proceedings were opened among the DENIC members in the year under review.

.de: Distinctive Growth, Surge in Demand on the German Market

Due to substantial net growth in registration numbers by 376,000 domains or 3.2 percent on the preceding year, the domains under .de management reached a new all-time high of roughly 16,701,000 domains at the end of 2020. After the rather moderate growth of the last few years (2019: 16,325,000, +120,000, +0.7 percent; 2017: 16,314,000, +200,000, +1.2 percent; 2016: 16,115,000, +105,000, +0.7 percent) and the one-time drop in 2018 (16,205,000, -110,000, -0.7 percent), this surge in registrations for the first time in years came close to the positive development of earlier periods. A comparable increase had last been achieved in 2012 with a plus of 3.7 percent,

when the booming times of the noughties were coming to an end (2011: +5.0 percent, 2010: +5.4 percent, 2009: +7.0 percent, 2008: +6.6 percent, 2007: +12.0 percent).

Different from the preceding years, the main driver of this development was the surging domestic demand. It accounted for two thirds of the increase, while the international market continued its consistent organic growth. During the same period, the number of domain holders increased from 8.1 to 8.3 million (7.9 million of these German-based).

Disruptive developments like the accelerated digital transformation, as experienced by almost all areas of the economy and society in the course of 2020, thus clearly show that supposedly mature markets that have been stagnating over a longer period of time, such as the namespace under .de, can turn highly dynamic again when exceptional global situations, such as the Covid-19 pandemic, occur.

The majority of other country code Top Level Domains (ccTLDs), too, could record increase rates exceeding those of the recent past during the pandemic. A strikingly heterogenous picture, in contrast, was still presented by the legacy generic TLDs (legacy TLDs): Only .com con-

tinued its consistent organic growth (151.8m DUM, +6.4m). After major losses in the preceding years, .org managed to slightly gain ground again (10.3m DUM, +300,000), whereas .net with 13.4m DUM stagnated at the level of last year, and .info (4.1m DUM, -800,000) and .biz (1.4m DUM, -100,000) continued their downward trend of the recent years.

Level of Digitisation and Internet Use in Germany

In 2020, 88 percent (2019: 86 percent, 2015: 78 percent) of the German resident population aged 14 years and older used the Internet, 80 percent (2019: 74 percent, 2015: 54 percent) also on mobile devices. 98 percent (2019: 97 percent) of these belonged to the higher, an unchanged 92 percent to the middle and 70 percent (2019: 64 percent) to the lower educational strata. Whilst for 97 percent of the working population in Germany, Internet use has become part of their everyday working life, it is 74 percent among the non-working population.

With an average of 91 percent of male and 84 percent of female Internet users, a gender gap still prevails in Germany in this field. It continues to be particularly pronounced for people with a low level of formal education (79 vs. 61 percent). Among those with a medium or high

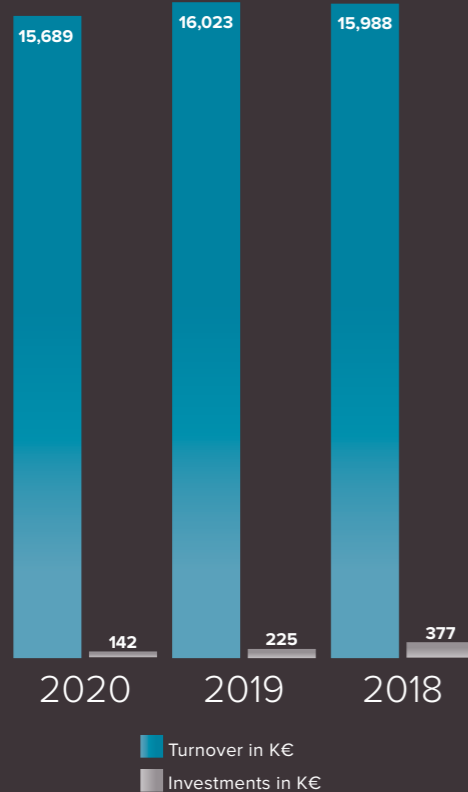
Financial Position	K€	2020	2019	2018
Gross Earnings		13,409	13,805	14,538
Payroll & Material Expenses		12,590	12,992	12,878
Annual Surplus		67	28	329

From the annual surplus of EUR 66,806.85, the amount of EUR 6,680.69 was allocated to the statutory reserve as stipulated by the bylaws.

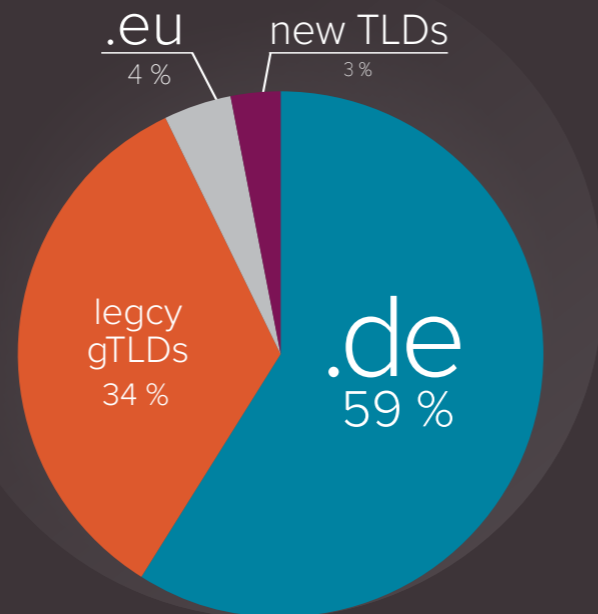
2020 Income	K€	2020 Expenses	K€
Turnover Members	14,542	Material Expenses	2,329
Other Operating Income	192	Payroll Expenses	8,766
Other Non-Operating Income	49	Depreciations	622
Total Gross Income	15,738	Other Operating Costs	3,823
Net Earnings Before Tax (EBT)	211	Total Operating Costs	15,540
Annual Surplus	67		

* Includes income and expense of the DENIC subsidiary in the amount of 955 K€.

Turnover & Investments



2020 Market Shares of Domains Registered in Germany



level of formal education, in contrast, it has nearly vanished (93 vs. 91 percent and 98 vs. 97 percent).

The largest user group, 45 percent (2019: 44 percent), is now considered to be the digital-savvy pioneers with very high digital competence and above-average use of a large number of online services, followed by cautious pragmatists and conservative occasional users amounting to 40 percent (2019: 38 percent); the percentage of offliners dropped from 14 to 12 percent over the year.

In 2020, Germans used on average 3.4 (+0.2) devices and 2.3 (+0.1) mobile devices. Among these, smartphones clearly were in the lead with 84 percent, followed by laptops (66 percent), desktop PCs (47 percent) and tablets (39 percent).

The services and applications most frequently used by Germans include search engines (82 percent), online shopping (78 percent, 2019: 71 percent), instant messaging (76 percent, 2019: 70 percent), online ordering or booking of services (65 percent, 2019: 58 percent), online payment (64 percent, 2019: 55 percent) and on-demand or streaming services (56 percent, 2019: 44 percent). E-learning offers (47 percent, 2019: 36 percent), video conferencing (47 percent), e-govern-

ment services (38 percent) and health and fitness applications (33 percent, 2019: 27 percent), too, recorded new peak values as a result of the limited offline options in the times of Covid-19-based restrictions.

In 2020, 32 percent of the working population in Germany worked from home or used teleworking or mobile working options, at least part time (34 percent of these for the first time since the start of the Covid-19 crisis). Among those doing office work, this share amounted to 59 percent, which is an increase by 29 percent on the previous year. The most severe impediment to mobile work remained for more than two thirds of the working population the type of their work.

Competitors in the Social Media Segment

With the introduction of the social network Facebook and the video-sharing portal YouTube in 2004 and 2005, the worldwide – still uncurbed – boom of social media began. Together with instant messaging services such as WhatsApp, which was launched in 2009, or the video and photo sharing app Instagram, which went online in 2010, these platforms are particularly popular with Y and Z generation users because of their ease of use and simple sharing functions. These users often do not

mind the limited design options and the dependence on platform operators or the extensive data mining and social profiling of these services, and thus prefer them to domains.

Companies and organisations, in contrast, for whom integrity is highly important, are increasingly recognising the advantages of integrated communication when addressing customers. They now rely more and more on a multi-channel approach in which their own website remains the trustworthy, customisable basis of their digital presence and that – in combination with accompanying social media channels as drivers for the selective, event-related increase in visibility and reach – places the website at the center of their Internet activities.

At the end of 2020, there were more than 15.2 million .de domains registered in Germany and more than 7.9 million domestic domain holders, compared with 43.2 (2019: 37.6, 2018: 31.6 million German Facebook users. Assuming a total market volume of 27 (2019: 26.2) million domains in Germany, this results in approximately 1.6 (2019: 1.4) Facebook accounts per domain.

In 2020, all in all, 78 percent (2019: 70 percent) of the German population used on average 3.0 (2019: 2.7) social

media channels: 72 percent (age group 14 – 19 years: 92 percent) WhatsApp (+ 8 percent), 5 percent (age group 14 – 19 years: 12 percent) other messenger services, 48 percent (age group 14 – 19 years: 74 percent) YouTube (+ 8 percent), 46 percent (age group 20 – 29 years: 76 percent) Facebook (+ 4 percent), 25 percent (age group 14 – 19 years: 61 percent) Instagram (+ 9 percent), 9 percent Twitter, 8 percent (age group 14 – 19 years: 36 percent) Snapchat, 7 percent (age group 14 – 19 years: 16 percent) Pinterest, 4 percent (age group 14 – 19 years: 22 percent) Tiktok. As to business and professional online networking services, 6 percent of the German population used Xing and 4 percent LinkedIn.

Thus, another side effect of the Covid-19 pandemic and the restrictions on social life going along with the related lockdowns apparently is an increased use of all types of social media, even by groups of higher age. No statistical data is currently available on the extent to which users in Germany use both domains and social media in parallel or exclusively.

Competitors in the gTLD Segment

Thanks to its dynamic growth, the German country code again achieved a share of 59.3 percent (2019: 60.7 per-

cent, 2018: 61 percent, 2017: 62 percent) in the domestic market during the period under review and could thus clearly sustain its long-standing unchallenged market leadership. The slight decline in the market share over the recent years was mainly due to the launch of the new generic Top Level Domains (new gTLDs). By the end of 2020, they accounted for an accumulated share of around 3 percent (2019: 2 percent) in the German market. The legacy generic TLDs (with .com far in the lead) had an accumulated share of slightly above 34 percent (2019: 34 percent, 2018: 33 percent, 2017: 32 percent), .eu maintained the 3.7 percent of the previous year (2018: 3.9 percent, 2017: 4 percent).

In addition to that, the relevance of .de domains shows not only in their – always prominent – position in search engine ranking but also in the Alexa ranking of the top 1,000 sites in Germany: With a page views share of 35 percent – compared to 50 percent of legacy gTLDs, 13 percent of other ccTLDs and 2 percent of new gTLDs – .de clearly was in the lead compared to other TLDs in Central and Western Europe. Only Italy and most of the Eastern European countries scored higher in their domestic markets with page views shares of more than 50 percent respectively.

The long-standing good reputation of .de domains is also supported by the consistent above-average share of positive use scenarios: A representative sample of 50,000 domains analysed at the end of 2020 by means of periodic crawling resulted in 51 percent of high-content websites (average value ccTLDs: 45 percent / gTLDs: 24 percent); only 19 percent yielded an (mostly HTTP-attributable) error message (average value ccTLDs: 28 percent / gTLDs: 43 percent).

As to the admission of new Top Level Domains by ICANN in 2013 and the launch of another application round planned to start in 2022/2023, DENIC sticks to its attitude of wait and see. Further developments will show whether the large number of new endings will meet with a corresponding lasting demand in the market. The 1,930 new gTLD applications submitted to ICANN included 116 IDN TLDs in 12 international, non-Latin scripts. Roughly 1,400 were individual applications based on unique strings. Only 24 applications originated from South America and 17 from Africa, compared to 911 applications from North America, 303 from Asia Pacific and 675 from Europe. 70 endings were from Germany, 35 of these based on company names (<brand>), 28 on generic concepts, and 8 were so-called geo TLDs and thus referred to geographical names.

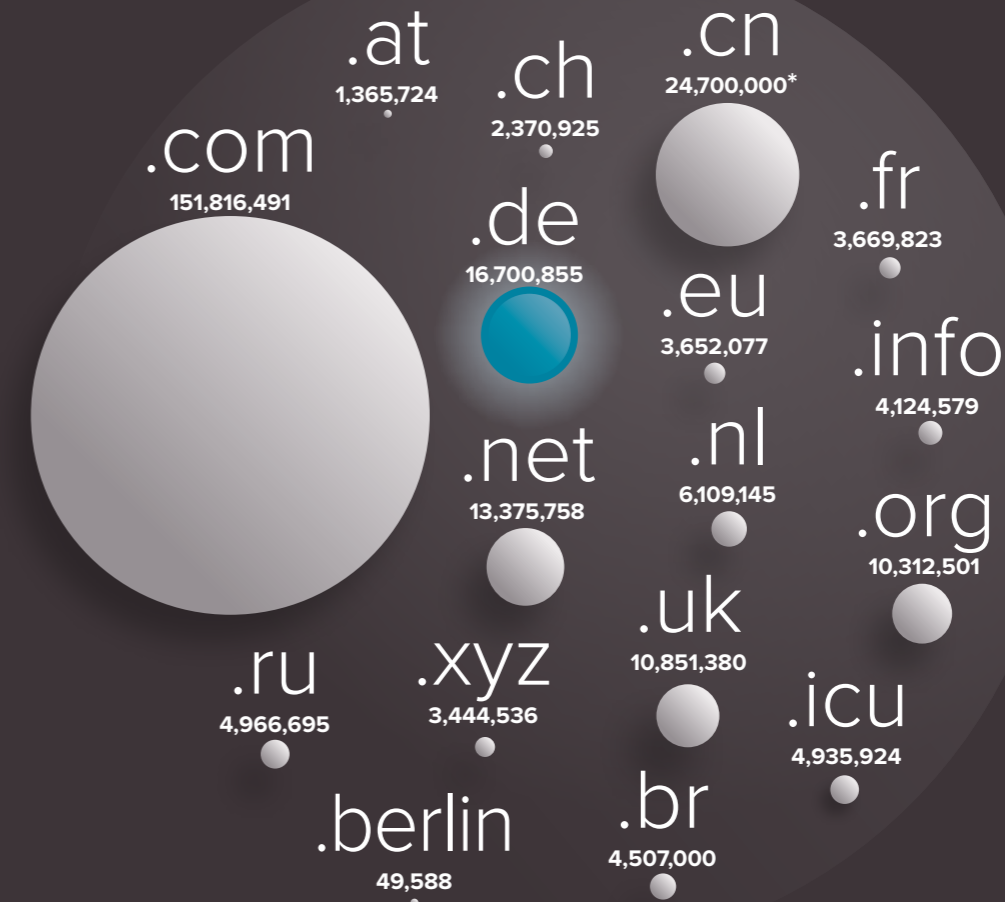
In total, there were just over 654,000 (2019: 615,000, 2018: 590,000, 2017: 475,000) nTLD domains of 559 (2019: 556) endings registered in Germany at the end of 2020. Nearly half (2019: 49 percent, 2018: 47 percent, 2017: 43 percent) of these were accounted for by the ten nTLDs with the largest inventory in Germany (.online, .shop, .berlin, .nrw, .xyz, .club, .hamburg, .bayern, .koeln and .store), and just over a quarter by the top 2. As in 2019, most popular in Germany, behind the consistent market leader .online (ca. 88,000, 2019: ca. 69,000, 2018: ca. 55,000), were .shop (ca. 63,000, 2019: ca. 52,000, 2018: ca. 48,000) and .berlin (ca. 35,000, 2019: ca. 50,000, 2018: ca. 54,000). Compared to the previous year, one TLD (.store) newly joined and one (.one) dropped out of the top ten. While .nrw, .xyz, .club and .hamburg climbed up the ladder, .bayern and .koeln dropped to lower ranks. .gmbh, .app, .email, .ruhr and .cloud followed further down.

Overall registration numbers for the German geo TLDs, i.e. .bayern, .berlin, .cologne, .hamburg, .koeln, .nrw, .ruhr and .saarland, had considerably decreased on the preceding years with jointly only about 116,000 domains by the end of 2020. Before, the figure had remained largely unchanged, settling in the range of around 170,000 (2019: ca. 174,000, 2018: ca. 174,000, 2017: ca. 175,000, 2016:

ca. 171,000, 2015: ca. 160,000, 2014: ca. 250,000 – due to major promotion campaigns on TLD launching). This is by far the lowest level since the launch of the geo TLDs and marks a trend that strongly opposes the significant growth rate of the German national ending .de.

Unlike the international nTLD market, the German sub-market with five purely generic endings and five regional geo TLDs among the top 10 is not governed by speculation. In total, 159 active domestic registrars (of 367 worldwide) offered their customers registrations under new endings in 2020. The top five registrars clearly dominated about two-thirds of the German local market; the top ten registrars controlled slightly more than four-fifths of the overall market.

All in all, 1,239 new gTLDs (2019: 1,235, 2018: 1,232, 2017: 1,227) were delegated at the end of 2019. After deducting the 642 withdrawn applications and the 41 rejected by ICANN, this is roughly 99 percent of all TLDs under ICANN's international new gTLD program. By then, 604 of them had completed the sunrise phase. They accounted for roughly 26 (2019: 29.3, 2018: 23.8, 2017: 20.6, 2016: 24.6) million registrations compared to more than 181 (2019: 176, 2018: 171, 2017: 165) million under legacy generic TLDs, like .com or .net, and 159 (2019: 158, 2018:



*Estimate ZookNic

155, 2017: 146) million under the 323 country code TLDs worldwide (including 71 IDN ccTLDs). Thus, the accumulated share of nTLDs in all TLDs of the world amounted to 7.1 percent (2019: 8.1 percent, 2018: 6.8 percent, 2017: 6.2 percent, 2016: 7.8 percent).

In 2020, about 57.3 percent (2019: 63 percent, 2018: ca. 55 percent, 2017: ca. 49 percent) of all nTLD domains were registered under the top ten nTLDs (.icu, .xyz, .online, .top, .site, .club, .vip, .shop, .app and .work), and about one quarter with just over 25 percent under the top two. Last year's leader .icu, whose registration figures had skyrocketed in 2019 from approx. 300,000 to over 4.8 million, had scored only a moderate increase to 4.9 million DUM by the end of 2020, but maintained its leading position in the nTLD ranking, and also climbed from rank ten to nine in the top 10 of all TLDs. In 2016, .xyz with then roughly six million (2020: ca. 3.4 million) domains had been the first of the new generic endings to make it to the top 10 of all TLDs. In 2018, the then largest nTLD .top with ca. 3.5 million domains held rank 12 among the top 15. By the end of 2020, there were 46 geo TLDs with more than 1,000 registered domains each, following the start of their respective general-availability phase. Roughly two thirds or 63.2 percent (2019: 58 percent) of the international geo market was split between the top ten of this segment

(.tokyo, .nyc, .london, .berlin, .bayern, .africa, .koeln, .amsterdam, .hamburg and .paris), which included four German endings alone. The by far most successful geo TLD .tokyo alone accounted for about 195,000 registrations.

In the meantime, seven years after their gradual introduction, the delegation process of all nTLDs of the first round is nearly completed. During this period, it has become obvious that nTLDs do not form a homogeneous submarket: Depending on their different objectives and strategies ranging from volume to niche market orientation, they show widely varying dynamics, which is reflected in a large disparity of managed domain numbers. Accordingly in 2020, out of the 547 nTLDs available for registration to the wider public or at least to a specific community and thus not subject to general access restrictions for third parties like the brand TLDs, 43 percent still accounted for less than 5,000 registrations, only 11 percent for more than 50,000, 6.4 percent for more than 100,000, and just 2 percent for more than 500,000 (2019: 2.7 percent).

At the end of 2020, about 22,000 domains were registered under the 497 brand TLDs (<brand>). Roughly 15,000 of them were actively used, more than 4,500 also

for e-mail services. Nearly 40 percent – or in total about 8,000 – of these domains, however, were distributed among the three brand extensions most used at that point in time (.dvag, .audi, .mma). Numerous brand TLDs still figure only registrations of the obligatory nic.brand and no other domains so far. A common characteristic of the three currently leading dotBrands is their registration behaviour: They consistently register domains on a long-term basis for their respective sales partners (insurance consultants and/or car dealers) under the umbrella of the .brand to establish it as a trustworthy namespace, also for the end customer. dotBrands originate primarily from the finance and insurance business (88), the trade sector (40) and the automotive industry (36).

The new gTLD market continues to be largely dominated by the strong demand from China. Accounting for 40.2 percent (2019: 43.4 percent, 2018: 38.6 percent, 2017: 33.4 percent) of all registrations, the most populous country in the world was once again far ahead in 2020 of the US whose share was 12.9 percent (2019: 10 percent, 2018: 13.5 percent, 2017: 9.6 percent) of all registrations. Scoring 2 percent (2019: 1.9 percent, 2018: 2.2 percent, 2017: 3 percent), which corresponds to a total volume of about 654,000 (2019: 615,000, 2018: 590,000, 2017: 475,000) of all nTLD registrations, Germany maintained

rank five for the third year in a row, behind Japan (2.9 percent, 2019: 2.7 percent). The share of anonymous registrants, who use a whois proxy service and can thus not be attributed to any country of origin, increased to 22.2 percent in 2020 (2019: 18.6 percent, 2018: 19.8 percent, 2017: 23 percent) and thus accounted for more than one fifth of all registrations. This represents an increase from 6.45 million to roughly 7.15 million or a plus of about 11 percent (2019: 23 percent, 2018: 31 percent, 2017: 470 percent) within one year.

The Niche Sector of ENUM

Business development of the German ENUM domain under .94.e164.arpa has not come up to initial expectations. ENUM (tElephone NUMber mapping) is used to make available a range of Internet and telecommunications services, including (mobile) phone, fax, e-mail or websites, under a single telephone number. Yet, since its launch in 2006, it has not taken root as an enabling technology for innovative services. Not even DENIC's service provision free of registration charge for many years stimulated the service in the retail market. When cost-covering fees were introduced as of the start of the business year 2016, registration for many ENUM domains was not renewed. As a result, registration numbers dropped substantially

over the year by roughly 95 percent to a medium three-digit range. Since then, the remaining ENUM inventory has stagnated at a low level.

Solidary Contribution to Enhanced Internet Security for Many: DNS Infrastructure Services

Third-party operators of ccTLDs, gTLDs or brand TLDs can benefit from DENIC's DNS anycast slave services, which are offered for joint use under a cost-sharing scheme. In addition to operative benefits, such as an enlarged footprint and clearly improved resilience and robustness for the co-users of the service, growing numbers of customers and domains under management (DUM) also result in economies of scale for all connected TLD clients.

Next to providing global anycast network presence, DENIC's service portfolio includes 24/7 monitoring and support as well as optional customised web APIs for advanced monitoring at client's end. Presently, the shared global anycast infrastructure run by DENIC includes 11 locations spread across the EMEA region (Amsterdam, Berlin, Frankfurt, Moscow, Stockholm, Vienna), Asia Pacific (Hong Kong, Seoul) and the Americas (Los Angeles, Miami, São Paulo). Situated close to major Internet ex-

change points, the anycast locations feature large bandwidths, support IPv6 and are fully DNSSEC-enabled. ISO/IEC 27001:2013 and ISO 22301:2012 certified information security and business continuity management systems are implemented at all locations.

On 1 November 2018, the non-member business of DENIC eG was transferred to DENIC Services GmbH & Co. KG. From then on, the newly founded subsidiary took over the full sales and marketing responsibility for the DNS anycast services. However, all related technical infrastructure continues to be run by the parent company DENIC eG.

Compared to 2019, the anycast volume managed by the DENIC group grew by 34 percent over the year 2020. The customers are 15 domain registries (+ 36 percent) that manage 19 TLDs, 15 of these ccTLDs and four geo TLDs from the new gTLD segment. They are located in the European and American markets. By integrating the geo TLDs, DENIC did not only extend its anycast customer portfolio to gTLDs in 2020, but is offering ICANN-compliant DNS infrastructure services for the first time. Additionally, a new customer service portal with support, reporting, emergency and billing functions enhances the user experience and creates greater proximity to the customer.

Multiplied Customer Numbers, Significant Increase in Market Share: Data Escrow Services

In May 2018, DENIC emerged as the only successful bidder from the international tender to become Designated Escrow Agent (DEA) for ICANN-accredited registrars. After its prior accreditation as an ICANN-approved Registrar Data Escrow Agent (TPP RDE) in June 2016 and as a New gTLD Data Escrow Agent for Domain Registries (Registry Data Escrow, RyDE) in July 2017, this was a new milestone.

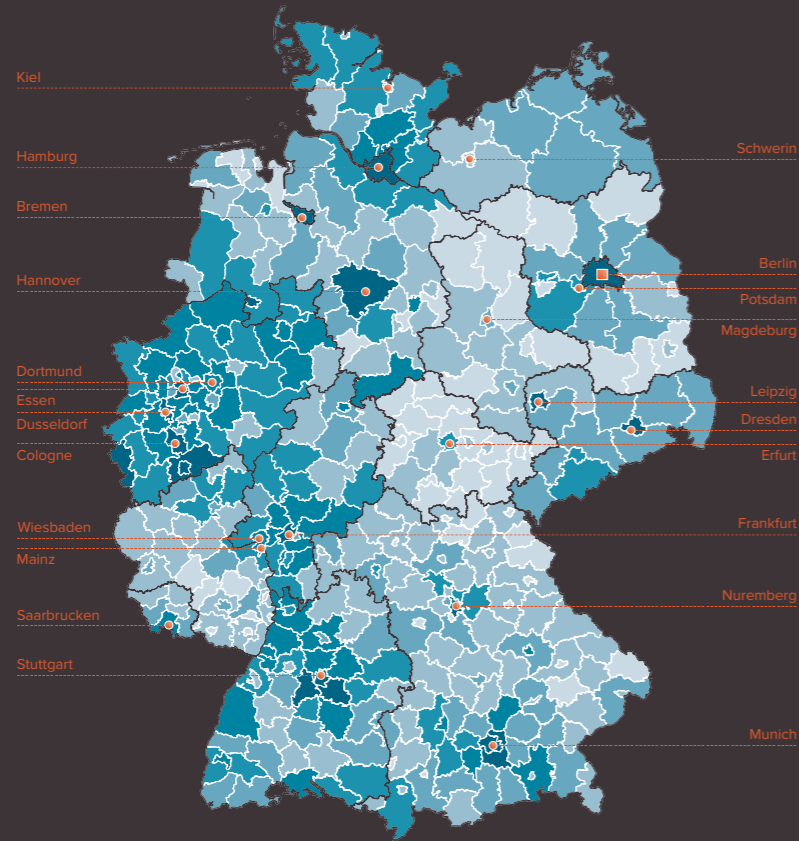
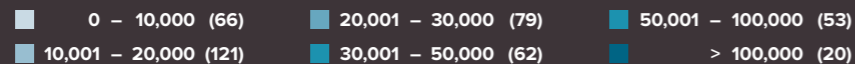
With the spin-off of the non-member business of DENIC eG on 1 November 2018, sales and marketing responsibilities for the data escrow services, which are designed to provide secure storage of their business data for players of the domain industry, were transferred to the newly founded subsidiary DENIC Services GmbH & Co. KG, together with all related ICANN accreditations. In the meantime, the subsidiary has also taken over the operation of the technical infrastructure; DENIC eG as the parent company continues to provide the necessary hardware and ensures reliability of the service by 24/7 on-call service.

In the business year 2020, DENIC Services GmbH & Co. KG continued to expand the data escrow services busi-

ness: At the end of the year, 72 RDE customers had migrated to DENIC. This is an increase of 20 percent within a year. As to Registry Data Escrow (RyDE), 50 customers (plus 56 percent) with a total of more than 7.7 million domains under management (plus 17 percent) had onboarded by the end of 2020. 23 of these were geo TLDs and two were ccTLDs from Europe, the Americas and Asia, nine were brand TLDs and 16 purely generic endings. Another three had signed agreements to migrate in 2021.

As to the generic TLDs, these include two major clients from the top 10 nTLDs, which jointly account for a market share of more than 20 percent in the overall nTLD market. The accumulated market share of DENIC Escrow customers from the geo TLD segment adds up to roughly 45 percent. They include two of the top 3 geo TLDs and five of the eight German geo TLDs.

By now, 10 backend registry operators (BEROs) are using DENIC's Escrow infrastructure. Six of them belong to the 12 large-scale operators who manage more than 10 new gTLDs (nTLDs) respectively. Together, these key accounts manage more than 50 percent of all nTLDs and more than 50 percent of all domains registered under nTLDs.



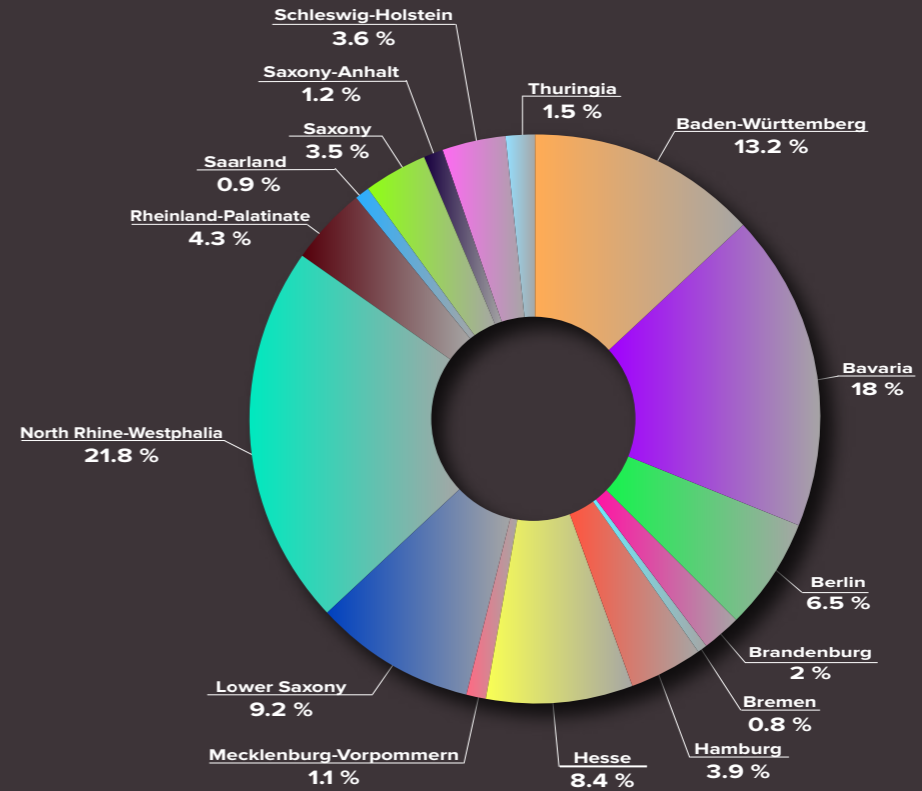
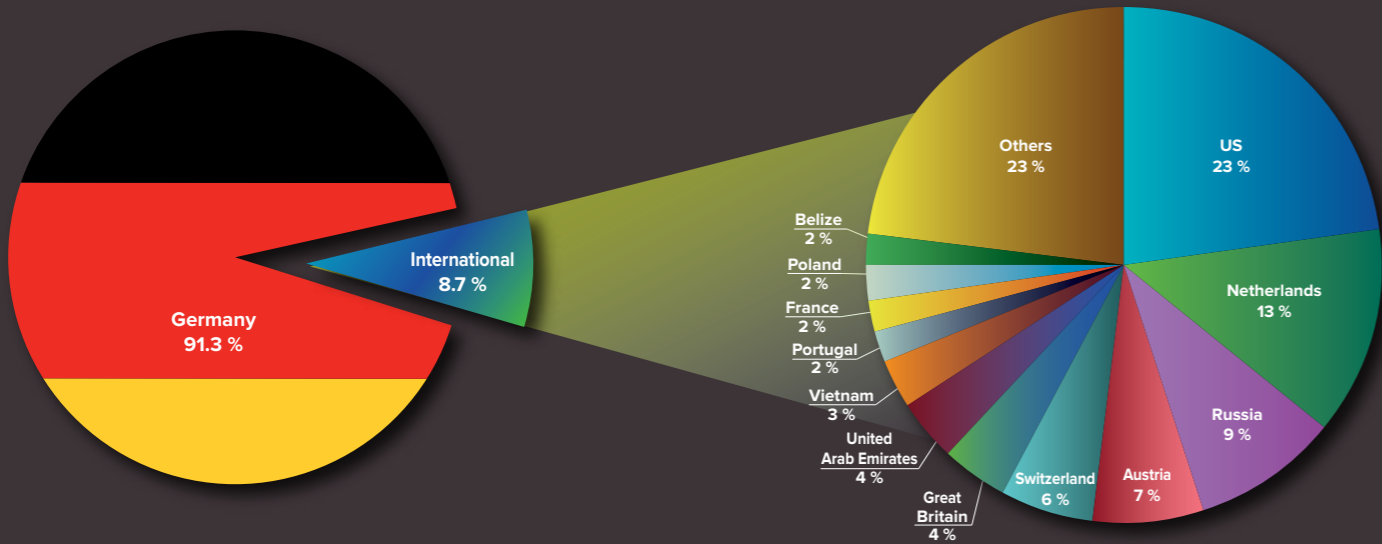
.de Report 2020 was a year of accelerated digitisation. This trend is also reflected in the strong growth (+376,000) in 2020 of domains registered under the German country code .de. DENIC's domain map visually breaks down .de domain registrations within the German territory. It shows the geographic domain distribution in nominal figures and the penetration rate within the country's 401 urban and rural districts at the end of each business year.

2020 saw hardly any changes in the ranking according to absolute domain numbers. The large German cities continued to be dominant in this league. The German capital Berlin (989,000) maintained its very pronounced lead on Munich (630,000) and Hamburg (587,000). All in all, penetration was higher in the urban than in the rural districts. The 20 most densely populated cities alone accounted for about 30 percent of all .de domains. The national inventory of .de domains increased by nearly a quarter of a million, whereby the 291 districts in Germany (+154,000) accounted for a higher share than the 110 cities (+96,000).

Looking at the distribution of domains per 1,000 inhabitants, the federal average increased to 183. This value was exceeded by 46 percent of the urban, but only by 14 percent of the rural districts. Outliers included in the data may reflect local domain traders holding large-scale domain portfolios.

At federal-state level, Hamburg (319) still scored best ahead of Berlin (271) with regard to domain penetration, while Saxony-Anhalt (84) brought up the rear again. All federal states reported an increase in .de domain numbers, except for Saarland and Berlin. The south of Germany reported a larger absolute domain increase than the north. Excluding Berlin, the average percentage domain growth among the states in the east of Germany (+1.5%) fell short of that scored by those in the west (+1.9%) in 2020. The west-east divide thus slightly widened.

At domestic level, the number of .de domains in Germany grew by 1.7 percent to 15.2 million compared to a 2.3 percent plus overall. This means that an increasing share of the growth was attributable to new domains registered by holders from abroad. At the end of 2020, they accounted for about 1.5 million or 9 percent of all .de domains (2019: 1.3 million). The registrants came from all parts of the world, more than three quarters, however, from the top ten countries of origin. The top ranks in the list according to nationalities remained unchanged. The US consolidated its leading position with 328,000 domains or roughly 25 percent of international .de domain holders. The Netherlands with 192,000 domains (13%) and Russia with 133,000 domains (9%) maintained ranks two and three. Then followed Austria and Switzerland with a 7- and 6-percent share respectively in the .de domains held by non-residents.





DENIC – the Networkers

DENIC – the Networkers

It is one of DENIC's main concerns that the Internet continues to exist as a forum of the many and a place of global exchange, a platform for innovation, creativity and business ideas that works beyond all conventional borders. Therefore, DENIC has made the commitment to add to the preservation and enhancement of the single, free, open and secure Internet part of its key set of values. To this end, it builds on strong alliances and is closely networked within a multitude of contexts, at both national and international levels. This enables the Cooperative to remain constantly involved in shaping the Internet of the present and the future, in accordance with the interests of the German Internet community.

A key focus of DENIC's Internet governance activities is on avoiding the Internet's core infrastructure, the identifier system, to be exposed to influences that may encourage it being subjected to conditions and controls that lack a valid legal basis.

Consistently updated and extended, DENIC's information website "**Internet Governance Radar**" (ig-radar.de/en) gives not only long-standing IG stakeholders but also the interested wider public a topical overview of the multi-faceted field of Internet governance and provides them with a basis to engage in the discussion. With a focus on

cyber security, digital economy, digital human rights and technology, the information service briefly introduces the many players and organisations involved in Internet governance and combines these portraits with periodical reports on major political, legal and technical development trends. Supplemented with a calendar of upcoming Internet governance events, the web presence, which was established in mid-2018, is unique in the German-speaking area so far for its fully bilingual (English and German) concept.

DENIC in Coordination and Standardisation Organisations

Since 2009 DENIC has been a member of the Country Code Names Supporting Organisation (ccNSO), which represents the interests of the ccTLDs in the context of **ICANN** (Internet Corporation for Assigned Names and Numbers, icann.org), the central coordination body for Internet infrastructure. DENIC representatives attend the regular ICANN conferences to make sure that the interests of DENIC, its members and the German Internet community are taken into account.

From 2014 to 2016 DENIC was involved in the national and international consultations related to the so-called IANA Stewardship Transition. The negotiations culmi-

nated in a new management model which released the Internet Assigned Numbers Authority (IANA, iana.org) from the US government's scope of responsibility as of October 2016. Thus, the oversight of the central technical functions of Internet address management rendered by IANA were transferred to the global Internet community, which comprises the private sector, governments, civil society and academia and is represented by ICANN.

In line with the new management model, various supervisory bodies were established, which, true to ICANN's principle of diversity, were composed of representatives from all of ICANN's sub-organisations. In October 2019, DENIC's Policy Advisor Peter Koch was re-appointed by the Country Code Names Supporting Organization (ccNSO) to represent the ccTLDs at the Root Zone Evolution Review Committee (RZERC). In February 2017, DENIC's Chief Information Security Officer Boban Kršić was elected to ICANN's second Security, Stability & Resilience Review Team (SSR2). RZERC is a standing committee that monitors and reviews proposed major architectural changes to the administration and the distribution mechanisms of the DNS root zone. The SSR2 team investigates and assesses if ICANN meets its obligation to enhance the security, stability and resiliency of the Domain Name System (DNS). An important task from the community's point of

view is to ascertain whether and to what extent ICANN has implemented action recommendations of the 2012 SSR1 review. The draft final report of SSR2 entered the initial public consultation phase in January 2020.

The final version is assumed to be submitted to the ICANN Board at the start of 2021. Next to recommendations on how to improve the ICANN processes with regard to key aspects of stability, it is also expected to address compliance and transparency of ICANN with a view to malicious use of the DNS.

For two terms, from November 2019 to October 2021, DENIC's Policy Advisor Peter Koch was delegated by the Internet Architecture Board (IAB) to ICANN's Nominating Committee (NomCom) as voting member. The NomCom has the task to select candidates to fill various positions in the ICANN Board as well as a range of leadership positions in ICANN's substructures. Peter Koch holds the seat assigned to the Internet Engineering Task Force (IETF). He is further one of the ccNSO representatives in the IANA Naming Function Review Team (IFRT). The IFRT has the task – as an important consequence of the IANA transition – to conduct a first check of contract performance by the ICANN subsidiary PTI. As member of the ccNSO working group "Retirement of ccTLDs", Peter Koch is involved in developing a retirement policy for ccTLDs. The

policy will close a gap left in the realm of RFC 1591 and the "Framework of Interpretation" (Fol) in case a country code is removed from the ISO 3166 list, which is the basis for determining country codes for ccTLDs.

In October 2020, one of the three annual ICANN meetings was planned to be held in Germany for the first time in 21 years. Thus, important decisions of the international Internet community on the core functions of the Internet would have been taken while Germany also assumed the EU Council presidency. The selection of Hamburg to host the ICANN 69 Meeting honoured the commitment of the German Internet community and was meant to provide an opportunity to introduce German and European perspectives on an even broader basis. Originally, the meeting, which normally brings together around 2,500 to 3,500 participants from academia, technical operators, politics, the private sector and civil society, had been planned to be jointly organised by DENIC and eco – Association of the Internet Industry in cooperation with the city of Hamburg as host, under the auspices of the German Federal Ministry for Economic Affairs and Energy. Due to the contact and travel restrictions resulting from the Covid-19 pandemic, the complete conference had to be conducted as a virtual meeting, except for some hybrid social events organised by the German host committee.

The German hosts and ICANN are currently trying to find a new date in the next few years to achieve the aim of increasing awareness of the Internet issues of the future and facilitating access to the relevant decision-making bodies and institutions by holding a physical ICANN meeting in Germany at a later date.

The **Internet Governance Forum Germany** (IGF-D, igf-d.de), which plays an important role in societal discussions about national and international issues of Internet policy and Internet governance, has been supported in its work by its own advisory board since February 2016. The committee of 29 experts is composed of the Internet policy spokespersons of the different parliamentary groups of the German Bundestag, delegates from the relevant ministries, civil society, the private sector, the technical community and academia as well as from IGF-D's Next Generation section. Represented by its CEO Jörg Schweiger, DENIC has been one of the five technical infrastructure delegates at IGF-D's advisory board since its foundation. DENIC was also actively involved in the establishment of the IGF Deutschland e. V. sponsoring association, which was launched at the end of 2019 to structurally strengthen the idea of a national dialogue on Internet policy. The association deals with the special concerns and interests of German citizens,

companies and authorities in connection with Internet governance as well as with general questions of digital policy coordination at federal level. The Federal Ministries for Economic Affairs and Energy, of the Interior, of Transport and Digital Infrastructure and the Federal Foreign Office support the association's inclusive, open and transparent framework.

Furthermore, DENIC is actively involved in the **Internet & Jurisdiction Policy Network** (I&J, [△ internetjurisdiction.net](https://internetjurisdiction.net)). Since August 2018, DENIC CEO Jörg Schweiger adds the Cooperative's position as a member of the Domains & Jurisdiction Program Contact Group, which is composed of international multistakeholders. Drafting interoperable action guidelines that are to define if and how malicious use of the Internet can or should be tackled by cross-border measures, possibly also at DNS level, the group puts into concrete terms the work plan and guidelines adopted at the 2nd Global Conference of the I&J Network in February 2018, by more than 200 attendants from 40 countries. A final consensus as to a concrete definition and delimitation of DNS abuse has not yet been found. All parties agree, however, that additional stakeholders and user groups, especially from outside the US and Europe, should be involved in the consultations. The Group's activities in 2020 included drafting a guideline for representatives of governments and law enforcement authorities

to create a sufficient level of understanding among them for the large impact of any interventions at DNS level. Founded as a non-governmental organisation in 2012, I&J is supported by a number of international organisations: OECD, EU Commission, Council of Europe, UNESCO and ICANN. Acting as an interface between international and national IG, the initiative facilitates policy coherence and global coordinated action.

Within the **Internet Engineering Task Force** (IETF, [△ ietf.org](https://ietf.org)), which is responsible for technical Internet standards, DENIC in 2020 continued to accompany diverse working groups dealing with the maintenance and further development of the Internet protocols.

At **RIPE** (Réseaux IP Européens, [△ ripe.net](https://ripe.net)), the open forum of European operators of IP networks and network infrastructure, DENIC contributes to shaping the areas which are of major importance for TLD registries. Since 2019, DENIC's Policy Advisor Peter Koch has been a member of the RIPE Database Requirements Task Force which is to draft the new content requirements for the RIPE database. The question which database functions result directly from the role of RIPE NCC as a Regional Internet Registry (RIR) and how this purpose is maintained in the light of claims by third parties is also of considerable relevance for TLD registries.

In Germany's national **CERT Association of Computer Emergency Response Teams** ([△ cert-verbund.de](https://cert-verbund.de)), DENIC contributes its DNS expertise to enhance security on the Internet and better protect German IT networks. The alliance of more than 40 large private, commercial, academic and public CERTs at German national and federal state level regularly meets to discuss how to organise CERT teams, how to treat specific incidents, and how to learn from and prevent IT security incidents in the future.

Since October 2017, DENIC has been a member of the **OpenID Foundation** ([△ openid.net/foundation](https://openid.net/foundation)). The Foundation promotes and protects licence-free OpenID technologies and manages OpenID intellectual property and trademarks. DENIC strives to possibly standardise and obtain certification for its single sign-on identity solution ID4me, developed in conjunction with 1&1 Ionos and Open-Xchange, and its related Domain Name System (DNS) based mechanisms. Since 2019, DENIC has been an active member of the eKYC & IDA (Electronic Know Your Customer & Identity Assurance) working group, where the operators of OpenID Connect 4 Identity Assurance implementations collaborate to jointly develop standards and trust frameworks.

In autumn 2019, the German and French Ministries of Economic Affairs initiated the **GAIA-X** project ([△ data-](https://data-)

infrastructure.eu) with the aim to create a high-performance and competitive, secure and trustworthy data infrastructure for Europe that is supported by representatives from governmental, private and academic sectors in Germany and France, and by other European partners. DENIC is sharing its technical expertise in the meetings of GAIA-X Working Group 1 - "Software & Architecture", Sub-Working Group 1.1 - "Identity and Access Management", where it is actively involved in shaping the requirements and the design of a federated digital identity solution at the European level. In this context, DENIC presented ID4me, its domain-based digital identity solution developed together with a consortium of dedicated project partners and which builds upon the open-source federated ID4me standard and OpenID Connect. In a collaborative approach with its GAIA-X working group peers, DENIC is also investigating which further standards exist in this area and might be suitable for the goals pursued within the scope of the European Data Infrastructure. This is the foundation on which the necessary reference architecture and the basic technical functionalities for a trust concept embracing secure and reliable authentication of providers, nodes, services and consumers/users will be technically defined. The preliminary results of the technical implementation phase (Workstream 2) of GAIA-X are compiled in several publications. As a contributor to the so-called "Technical Architecture Paper" and

co-author of the "Executive White Paper", DENIC, represented by its Head of Software Engineering Marcos Sanz Grossón, was actively involved in the elaboration of the key technical documents. During a hackathon in February 2020, DENIC's ID4me developer team, together with other representatives of the technical Internet community, had already worked out a first concept for a potential Identity Access Management (IAM) solution for the European cloud network. Like DENIC's federated single-sign-on solution ID4me, this concept was also based on the open-source standards OpenID Connect 1.0 and OAuth2 and was thus in line with the principles of openness and transparency of GAIA-X, which involve the use of open source products.

Memberships in the **German Institute for Standardization** DIN e. V. ([din.de/en](https://www.din.de/en)) and the **Competence Center for Applied Security Technology** (CAST, [cast-forum.de/en](https://www.cast-forum.de/en)) have extended the Cooperative's strategic sphere of influence since 2018. As a member of the DIN Standards Committee Information Technology and selected IT Applications (NIA), DENIC was involved in the development of a data privacy standard with a special focus on privacy management, which shall ensure that the international IT security and data privacy standards are applied uniformly all over Europe. As a member of the CAST association with its relation to the Technical University of Darmstadt in

Germany, DENIC is intensifying its bond to research and development in the field of IT security.

Cooperation with State Institutions

In 2014, at the initiative of DENIC, the Internet Infrastructures Working Group (BAK IIS) was founded within the scope of the ICT sector under the **German Critical Infrastructure Protection (CIP) Implementation Plan (UP KRITIS)**. KRITIS is a public-private partnership of critical infrastructure operators, their related associations, parties with a fundamental interest, and the responsible government authorities in Germany. As the working group's chair and spokesperson, DENIC, represented by Chief Information Security Officer Boban Kršić, in cooperation with the Internet hub operators DE-CIX, B-CIX, E-CIX and the Federal Office for Information Security (BSI), is actively involved in the coordination of the technical security requirements for the players in the Internet industry, and thus assumes a vital role in the discussions at supreme level with the competent Federal Ministry of the Interior. In cooperation with the Federal Office for Information Security (BSI), the working group in 2020 published a new orientation guide for documentation of compliance in accordance with Section 8a of the BSI Act (Act on the Federal Office for Information Technology). It includes concrete propos-

als that were derived from KRITIS operators' feedback after the initial verification rounds.

The cross-sector and cross-industry Audits and Standards Working Group (TAK AS), founded in 2016 within the scope of UP KRITIS, is also chaired by DENIC, represented by Boban Kršić. It supports a targeted implementation of the German IT Security Act by the KRITIS Regulation in a resource-efficient way. With the new overarching ERFA Alliance experience group on KRITIS audits ([erfa-kritis.de](https://www.erfa-kritis.de)), a new platform was established at the end of 2020 that promotes an open exchange between the parties involved in the "documentation of compliance process" on how to implement Section 8a of the BSI Act.

Cooperation with Academic Institutions

In 2018, DENIC entered into a cooperation agreement with **CISPA – Helmholtz Center for Information Security** ([cispa.saarland](https://www.cispa.saarland)) to combine research with practical experience in the fields of cyber security and data protection. The cooperation with the scientific excellence cluster is planned to initially extend until 2022. The research areas include testing and optimisation strategies for DENIC's Anycast locations and concepts for the tailored scalability of the implied resources that will yield important information for DENIC with regard to the diversi-

fication of its network topology. An additional focus will be on the development of a resolver reputation service for protection against DDoS attacks and on the establishment of statistics as a basis for developing defence strategies to mitigate infrastructure attacks. In 2020, a first tool chain comprising testing and optimisation strategies for anycast locations was established by CISPA and verified in cooperation with the expert team of DENIC.

DENIC in Associations

In view of the extended namespace on the Internet as a result of the market launch of new generic Top Level Domains (new gTLDs) since the end of 2013, country code Top Level Domains (ccTLDs) need to constantly enhance and strengthen their brand profiles. To pursue this aim, DENIC continues to be deeply involved in a variety of regional associations of national domain registries. All these organisations offer their members a platform to exchange information on best practices and to discuss and build consensus regarding questions of global Internet policies. At the same time, the umbrella associations act as an interface to organisations and bodies like ICANN or IETF that coordinate the Internet, where – speaking with one voice – the ccTLDs have a much better standing.

Right from 1998, when **CENTR** (Council of European National Top Level Domain Registries, centr.org) was founded, DENIC has been strongly committed, partly in key functions, at the association of European ccTLDs. At present, CENTR unites more than 60 registries and organisations as full and associated members. Together they manage more than 80 percent of all country-code domains in the world. The 12 member organisations with observer status include, among others, the European Commission, eco - Association of the Internet industry, and the Association of European Internet Services Providers EuroISPA.

Over the last few years, the CENTR member registries and the ccTLDs operated by them have increasingly been faced with regulatory efforts on national and on EU level. This situation makes it ever more important to have a strong common voice to present joint interests in the dialogue with the competent authorities and political entities. CENTR's activities in 2020 included commenting on the impact assessment of the amendment to the Europol Regulation proposed by the EU Council and Parliament and on the draft of the Second Additional Protocol to the Budapest Convention on Cybercrime. In its role as an association, CENTR also submitted a statement on the Digital Services Act within the framework of the EU Commission's public consultation phase.

In this statement, it appealed to the political decision makers to strictly distinguish between the technical operation of the core infrastructure of the Internet and Internet service providers when considering the amendments to the rules for services on the Internet, as they have previously been defined in the e-Commerce Directive of 2000; the measures should aim at protecting the core infrastructure against unnecessary and disproportionate interference to thus avoid putting at risk the stability of systems and equipment that are essential for the proper functioning of the Internet. With DENIC CEO Jörg Schweiger having been re-elected as Chairman of the CENTR Board of Directors in February 2018, DENIC assumed a prominent role until February 2020 in shaping the association's strategic orientation and further evolution with regard to policy and participation issues.

Taking into account the requirements for concerted measures of IT security at EU level laid down in the NIS Directive and the EU Cybersecurity Act (CSA), a task force was formed in 2019 within the framework of an interdisciplinary initiative of the CENTR Security and L&R (Legal & Regulatory) working groups, which is designed to develop sector-specific security guidelines (S3G) by an industry-driven bottom-up approach. With DENIC's Chief Information Security Officer Boban Kršić as co-leader,

the task force wants to establish a global standard based on proven best practices that could serve as a basis for subsequent certification and introduce it into the political process via the Stakeholder Cybersecurity Certification Group coordinated by the European Union Agency for Cybersecurity ENISA. By the end of 2019, the 30-member CENTR task force had agreed on the project scope and steps in a preliminary draft and recorded these in a draft vision statement. In 2020, detailed analyses followed regarding the applicability of the CSA framework for IT security certification of products, processes and services of DNS service providers and ccTLD registries. Moreover, the framework's interrelation with the requirements of the revised NIS Directive regarding measures for a high common level of cybersecurity across the EU (NIS 2.0) were investigated, with the latter requiring the S3G scope to be defined more precisely.

Since July 2012, DENIC has also been an associated member of the umbrella organisations **APTLD** (AsiaPacific Top Level Domain Association, aptld.org) and **LACTLD** (Latin America and Caribbean Top Level Domain Association, lactld.org). Through these memberships DENIC is not only involved in and benefits from the intercontinental dialogue, but also contributes to further strengthen the coherence and close solidarity among all ccTLDs.

DENIC Events

DENIC regularly organises industry events for its members and other stakeholders, like Domain pulse (domainpulse.org), the annual expert congress of the three D-A-CH area registries, DENIC, nic.at and SWITCH. With high-profile talks and panel discussions, these industry forums offer abundant information about a wide variety of topical technical, legal and socio-political issues of the domain and Internet ecosystem. The 17th domain industry key event in Central Europe with roughly 250 attendants was hosted by nic.at in Innsbruck, Austria. Domain professionals looked at a number of topical challenges of digital progress and the future framework of the Internet together with IT and social research experts and representatives from the private sector, civil society and law enforcement. The spectrum of topics ranged from ICANN's NextGeneration program to promote the participation of young people in Internet governance processes, to strategic employer branding and scouting young talents in view of the demographic change, to the risks and opportunities of artificial intelligence and citizens' rights versus surveillance against the background of the forthcoming launch of the new 5G wireless communication standard.

Sponsoring Partnerships

Also in 2020, DENIC was one of the sponsoring partners of the pan-European **EuroDIG** forum (European Dialogue on Internet Governance, eurodig.org). EuroDIG deals with the specific problems and interests of the European Internet community regarding the development of collective Internet governance strategies. Intending to address not only its legacy audience but also new communities outside the traditional "Internet governance bubble", the 2020 event had originally been planned to be held as part of the EuroScience Open Forum (ESOF) in June in the Italian city of Trieste. Due to the Covid-19 pandemic and the travel restrictions going along with it, the three-day physical meeting was replaced by a streaming format that involved various studios all across Europe. Under the motto "Towards a Sustainable Governance of the Internet" – a reference to ESOF's key fields of exchange – the conference attracted more representatives from science and research than in previous years, despite the virtual format. With a view to the ongoing pandemic, one of the focal discussion issues was the necessary investments in telecommunications infrastructure in order to promote network expansion, Internet access and connectivity throughout Europe, without a paradigm shift to the disadvantage of data protection and digital sovereignty – for instance in the health sector – by newly established

regulatory frameworks. Another key issue that was on the agenda for the first time was how to best reconcile digital transformation and ecological sustainability, and the responsibilities of policymakers, the private sector and end users that go along with it. The results of the open multi-stakeholder platform for an informal inclusive dialogue, which is supported by the Council of Europe and the European Commission, are reported to the international IGF Secretariat and are thus taken up in the global debate about Internet issues of public interest.

As regards promotional activities for the leaders of tomorrow, DENIC was one of the co-founders of the **European Summer School on Internet Governance** (EuroSSIG, eurossig.eu) and has been its main sponsor ever since. In 2020, EuroSSIG was held for the fourteenth time. More than 350 fellows from about 90 countries have attended the academy since it was established by an initiative that had emerged from the World Summit on the Information Society (WSIS). Next to expert presentations, in-depth workshops and discussion rounds, the curriculum comprises realistic simulation games in which the fellows practice the participation and consensus-finding procedures that are common practice in multi-stakeholder environments. Thus, having acquired broad knowledge of the political, legal, sociocultural and technical aspects of Internet governance, fellows are qualified to collaborate in inter-

national Internet governance organisations where some of them already hold (initial) decision-making functions.

Since 2011, the agile working concept with Scrum, Kanban and DevOps is being applied to operational processes at DENIC. In short work cycles, self-organised interdisciplinary teams deliver sustainable, customised solutions of high (technical) quality. In order to further improve agile frameworks as a method and to promote their establishment in practical use, DENIC sponsored a conference of the German agile community, the developers' event "**Frankfurter Entwicklertag 2020**", at the beginning of the year. Other planned sponsoring activities had to be suspended as most of other expert meetings scheduled for a later date in 2020 were cancelled due to the Covid-19 pandemic.

Since 2018, DENIC has supported the local edition of the IT youth hackathon initiative "**Jugend hackt**" in Frankfurt, Germany, where the Cooperative has its head office. The program under the motto "Improve the world with code" aims to promote and network young talents and to bring them together in their local communities with qualified mentors in live hackathons of several days. Here, they jointly develop open data projects and can establish contacts with potential training companies. Due to the Covid-19 pandemic, the project launched in

2013 by the Open Knowledge Foundation Germany and the media education association "mediale Pfade.org" was held as a hybrid event in 2020: Embedded in the NODE festival for political, cultural and digital education of young people, the event offered DENIC not only the opportunity to foster youth empowerment, but also to be perceived as a sponsor by experienced practitioners in the digital sector.



Prospects

Prospects

Germany's economy slid into a deep recession in the pandemic crisis year of 2020. At the same time, however, the increased demand for information and interaction in the digital space incited many societal players who had dispensed with an online presence before to reconsider their attitude. Realising how very important digital networking has become for everyday life triggered a strong boom of the German Internet and domain industry.

Against the background of the digitisation boost accelerated by the pandemic, which exceeded DENIC's growth forecast for 2020 by far, the DENIC Executive Board expects the positive development of the Cooperative to continue. For 2021/2022, DENIC anticipates the number of registered domains to increase steadily at a level above the average growth rates of the last five business years. The actual number of domains under management is impacted not only by the development of the economy and the society at large but also by the extent to which Internet users turn to alternative web presences in social media and, even though only at a low level, by the diversification of the market as a result of ICANN's new gTLD program launched in 2012. This could be fuelled once more by the second round of applications for the introduction of additional new generic top-level domains, which is planned to start around

2023. All in all, DENIC does not expect the admission of further new TLDs to have a substantial impact on the development of .de domains or their high market share in Germany that has been stable for years. Yet, there might be an incentive involved for DENIC's Data Escrow Services business.

In view of the expenditure required for ongoing operation and to constantly augment the resilience of DENIC's technical systems, while market development of the pure domain business has reached a very advanced stage, sales stimulation is an aspect increasingly taken into account when it comes to evaluating the potential of new business opportunities. Next to the provision of domain market data to the registrar channel, readily compiled and structured to allow easy individual statistical analyses, incentive is given by the abolition of the previously mandatory condition for non-resident domain holders to state a summonable postal address in Germany upon registration. Further promising options include such services that would add value to a domain and can thus enhance their overall attractiveness. With vChecked, DENIC plans to establish a new service of such type in the market at the end of 2021: Next to enhancing the quality of holder data, the service is intended to serve the increased information demand of authorities and rights holders, and to also open up an attractive, additional business field for DENIC

members, who will support the development of the service with their know-how.

DENIC in the Digital Policy Debate's Discourse

In its role as DNS operator and TLD registry, DENIC is increasingly affected by regulatory initiatives at national and EU level. Therefore, statements submitted by DENIC itself or made in cooperation with associations within the framework of commenting and hearings on draft laws are consistently gaining importance. The central aim behind these activities is to raise awareness among policymakers of the profound effects caused by regulatory interventions in the DNS landscape. With name resolution having been included in the list of critical infrastructures in 2017, the risk of state interference in registry activities has grown, too. For instance could further-reaching claims by executive authorities for DENIC to take over additional tasks that go beyond the release of whois data for the purpose of tax investigations or criminal prosecution be established. Particular attention will be given by DENIC in 2021 to legislative initiatives for enhancing consumer protection.

Striving to create a more contemporary legal framework adapted to the requirements of the digital age, both the German government and the European Commission have

triggered a reform of numerous laws, some of which in their current version date back to the early 2000s. DENIC is closely monitoring whether such frameworks, which have not included domains or domain registries so far, will possibly be extended in scope, like the **Telecommunications Modernisation Act** (German TKG Amendment) announced for 2021.

With the Regulation on a Single Market For Digital Services (**Digital Services Act**, DSA), the EU Commission has been pursuing a legislative project since mid-2019 to revise the rules for services on the Internet. In contrast to the German Network Enforcement Act (NetzDG), which primarily focuses on social networks, the DSA seeks to establish a more comprehensive framework for so-called "intermediaries" of content. The Cooperative will be watching closely if this will possibly lead to an extension of liability for illegal content, as it is practised to date under the existing e-Commerce Directive, to additional Internet service providers as potential addressees of blocking orders. Up to now, only those DENIC members who offer hosting services have been affected by the regulations.

Relying on the current case law, DENIC maintains a critical and negative stance towards all European and national efforts that aim at imposing self-regulation on DENIC with regard to web content. Neither has DENIC, being a domain

registry only, access to such web content nor is such web content transmitted via the DENIC networks. Thus, DENIC can neither delete any web content nor prevent it from being spread over the web. Furthermore, judging if any given content is legitimate or not does not fall within the area of competence of a private cooperative.

In the triologue negotiations between the EU Parliament, Council and Commission on the **e-Evidence Regulation**, the Parliament's Legal Affairs Committee called for amendments at the end of 2020. Critics fear that due to the diverse judicial systems and varying definitions of criminal offences in the member states, the Regulation will compromise basic judicial structures as a whole by treating the analogue and digital space differently. The Regulation is designed to give police and judicial authorities rapid access to electronic evidence in case of suspicion by authorising them, by order of a local court in their own country, to request inventory and communication data directly from any service provider operating in Europe. For DENIC and its members, the e-Evidence Regulation could mean that they would have to transfer electronic evidence in the form of customer data across borders directly to authorities in other EU countries without any prior verification by a domestic authority of the legality of such a request, for example by checking compliance with fundamental rights against the applicable law of the executing State.

Also highly relevant is the extent to which the redrafted version of the **German IT Security Act** (IT-SiG 2.0), which is currently being coordinated by the competent ministries involved, will have an impact on DENIC and its members, for example as a result of the definition of new threshold values and/or the classification of additional DENIC services – such as the registry function – as critical infrastructure, which already includes the authoritative name servers for the .de zone in Germany. Furthermore, DENIC is keeping an eye on the planned security labelling for critical IT components and the extension of the powers of the Federal Office for Information Security (BSI), which shall be allowed in the future to stop the propagation of malware by DNS blocking and to have malicious traffic from botnets blocked or redirected to state servers on demand. The IT-SiG 2.0 is intended to finally implement the current European **NIS Directive** on security of network and information systems in national law and to anticipate to some extent its planned amendment (NIS 2.0), as part of the EU's Cybersecurity Strategy. Which specific regulation goals the NIS 2.0 pursues for TLD registries and DNS service providers, in particular with regard to ensuring the security, stability and resilience of the DNS and collecting and maintaining registration data for identification purposes, is not clearly defined in the current draft.

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