

The Hydra on the Web:

Challenges Associated with Extremist Use of the Fediverse – A Case Study of PeerTube

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Glossary

ActivityPub

ActivityPub is an open and decentralised network protocol. As an open protocol, it does not belong to any one company and is not limited to specific products. It offers Client-to-Server and Server-to-Server APIs. ActivityPub is one of the standard protocols for the Fediverse.

BitTorrent

BitTorrent is a Peer-to-Peer-based file-sharing protocol that is used for sharing large volumes of data because of the way it reduces the load on servers. When a file is downloaded using BitTorrent technology, it is transmitted in data fragments from all devices connected to the network, rather than as a complete file.

Instance

In this context, an instance refers to a social media platform set up using PeerTube or any other Fediverse software. Just like standard social networks, instances may allow users to create accounts and upload content. Each instance is managed independently but can communicate with other instances through optional networking.

Peer-to-Peer (P2P)

Peer-to-Peer-technology (P2P) refers to different computers connecting with one another directly, without using a central server as an intermediary. In a pure P2P network, all connected devices are treated equally. The opposite of a P2P network would be the Server-Client model where devices can only access data via a central server.

Network protocol

A network protocol enables communication between different computers that are connected to one another via a network. The protocol sets the rules for the formatting and transmission of data so that different devices can swap messages regardless of their system infrastructure and standards.

Fediverse

The Fediverse is an attempt to create a decentralised alternative to major social networks. The Fediverse includes micro-blogging, video and image-sharing services. The different servers within the Fediverse can communicate with one another, provided the services are using the same network protocol.

Seeds

Seeds act as pre-defined starting points for extensive data collection. Lists of Seeds may be made up of keywords, internet addresses (URLs) or social media channels (accounts). In this report, the term 'seeds' refers to those PeerTube instances which were identified before the network analysis based on existing data (in this case by picking out links from relevant public Telegram channels).

Executive Summary

As part of its project on “Combating Radicalisation in Right-Wing Extremist Online Subcultures”, ISD is investigating smaller platforms to which the German-speaking far-right online scene is retreating. Their aim is to circumvent regulation and moderation on large platforms, for example as required by the German Network Enforcement Act (NetzDG, or 'Facebook Act').

Analyses contained in the report on “Telegram as a Butress” have already made clear the importance of investigating PeerTube. While writing the previous report, the ISD research team came across multiple video platforms with almost identical layouts and functionalities.¹ It was found that eight out of 19 video platforms identified were set up using the free software PeerTube.

PeerTube is an example of a growing socio-technological movement that attempts to turn away from large, centralised platforms towards decentralised and mostly community-managed websites. Instead of a single platform with a monopoly on content, this movement is building a network based on servers that are maintained independently of one another. This is leading to a “hydra effect”: even if connected servers are cut off, the network itself survives, allowing for new servers to be added at will.

While far-right extremists are not the ones driving this phenomenon, it does appear that they are exploiting these new-found possibilities. For example, various far-right figureheads have established platforms via PeerTube where users can in some cases create their own accounts. Some of these PeerTube platforms record millions of visits per month. But it is not just its reach but also its structure which makes PeerTube worth investigating. With PeerTube, individuals or organisations can create their own video platforms where they set the rules for content, moderation and user registration. This is essential for far-right and conspiracy groups and individuals who, according to previous ISD research, prefer audiovisual platforms to other types, such as micro-blogging services. PeerTube is a particularly valuable tool since it is more technologically demanding to host and access audiovisual materials than text files.²

In contrast to centralized platforms such as YouTube, PeerTube content is managed separately by so-called

instances - this refers to the small-scale video platforms created with PeerTube software. Different instances can network with each other and form federations. This allows videos that have been uploaded on one instance to be played on another instance without having to change the website.

PeerTube belongs to the so-called Fediverse, which will be discussed in more detail below. Another difference to centralized video platforms is that this software uses peer-to-peer technology (P2P), which presumably explains the name. The fact that instances are not managed by large companies, but by individuals or groups at their own expense and with the help of free software, also has implications for their regulation.

Key Findings

- There is **no central moderating authority** for managing content. PeerTube offers individuals or groups, whose content has been blocked on centrally managed video platforms for violating the terms of service, an attractive way of continuing to share their content online. Where it is these groups or individuals who control moderation, content can **only be removed from the network by switching off the server.**
- It is difficult to accurately map the size and connections of the Fediverse. The **network is constantly in flux** as the relationships between instances can change rapidly due to blocking and follow requests. Instances can also go offline from one day to the next.
- The instances used by far-right and conspiracy actors make up only a small fraction of the Fediverse network. They **primarily network among themselves.** However, some of the instances that were investigated are **connected to a wider Fediverse through their own highly networked servers.**
- The deletion of extremist YouTube channels is not necessarily reflected in the number of account registrations on the corresponding PeerTube instances. PeerTube is rather used as a back-up option for deplatforming. The frequently observed **phenomenon that not all users migrate to the new platform can also be observed here.**

- Instances are often customised in different ways. For example, each instance varies in whether they permit third parties to register for accounts and upload videos. There is no clear correlation between the numbers of accounts, videos and views. However, the **most watched videos on relevant instances were mostly created by prominent members of the milieu**, which would appear to indicate that persons with a pre-established audience are particularly successful on PeerTube.
 - The instances selected for the five case studies hosted a lot of content that **focused on the COVID-19 pandemic**. Another frequent narrative was an **alleged conspiracy perpetuated by elites** who, according to conspiracy theorists, use events such as the pandemic or Putin's war against Ukraine to further their secret agenda. These findings suggest that PeerTube instances provide safe refuge for disinformation.
 - Because PeerTube is a piece of software that anyone can access and use in a variety of different ways, **state regulation will do little to limit its use by far-right extremists**. While state agencies can enforce individual aspects of the NetzDG against PeerTube instances, many instances do not have the number of users required to impose reporting obligations or requirements to delete content. Moreover, most content is not hosted with the aim of generating profit, which limits the applicability of both the Facebook Act and the EU's Digital Services Act.
 - However, PeerTube's community moderation function **does allow the community to moderate the use of PeerTube for promoting harmful content**. One way of doing this is by isolating extremist instances. Efforts should be undertaken to work with the Fediverse community, i.e. with the server operators and their users, and to develop best practices for identifying and combating extremist activities. This could include further training on how to spot hate speech or setting up a body for reporting extremist instances.
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An Introduction to PeerTube

One of the aims of the “Combating Radicalisation in Right-Wing Extremist Online Subcultures” projects is to advance technological capabilities with respect to investigating far-right subcultures on the internet. The team is also developing approaches to the regulation of so-called alternative platforms. For this reason, ISD, in partnership with CASM Technology, decided to conduct research into PeerTube using Beam, a programme developed for collecting, processing and investigating data on public social networks.

The following piece of research is intended to offer an insight into the ways in which the far right in Germany uses PeerTube software, an area that has been little researched thus far. The first section introduces PeerTube and the wider Fediverse. This is followed by a network analysis of instances that are used by the far right. The networking of the far-right and conspiracy spectrum in the Fediverse is investigated by examining 25 selected platforms, which are based on PeerTube. As a third step, usage data of the whole network is evaluated and five case studies are presented with the aim of illustrating the complexities surrounding PeerTube. This report concludes by looking ahead, including the challenges and opportunities involved in regulating use of free software by the far right.

The Story behind PeerTube

PeerTube was developed by Florian Bigard when he was still a student in France.³ Online, he mostly goes by the pseudonym “Chocobozzz.”⁴ According to his own statements, he began developing a prototype of PeerTube in 2015 after realising that there were no real alternatives to YouTube. In mid-2017, the French not-for-profit Framasoft contacted him in order to develop an alternative to common video platforms.⁵ Framasoft's stated aim is to achieve an “emancipatory digital world.” Their goal is to “de-Google-ify” the internet. The organisation offers platforms and tools designed as alternatives to the products of larger corporations.⁶ On a dedicated website, Framasoft lists the programmes it administers and provides access to corresponding documentation.⁷ The beta version of PeerTube was completed in March 2018 and Framasoft launched a crowdfunding campaign to finance its completion. The crowdfunding campaign was a success and Framasoft released PeerTube 1.0 in October 2018.⁸ In May 2020, Framasoft began another successful

fundraising campaign⁹ in order to develop new functions for PeerTube, including a global search function, improved moderation, and livestreaming.¹⁰ With the newly developed Sepia Search function, PeerTube instances could be searched using keywords.¹¹ While the official PeerTube website maintains a list of instances, Framasoft itself has stated that it does not want to list instances with manipulated metadata or instances hosting content that violates French law.¹²

The motivations behind setting up PeerTube instances are diverse. The Dutch Blender Foundation, which hosts an open-source 3D program, began building its own PeerTube instance after YouTube blocked some of one's videos.¹³ In April 2022, the European Data Protection Supervisor (EDPS) set up two new communication platforms: EU Video, a PeerTube instance, and EU Voice which is based on the micro-blogging software Mastodon. The aim of this pilot phase is to contribute to EU strategy on digital sovereignty and to promote the independence of the EU in a digital world.¹⁴ However, far-right and conspiracy theory movements in the German-speaking world have also made use of PeerTube. A conspiracy theorist listed as under suspicion by the Berlin Office for Protection of the Constitution (Berliner Landesamt für Verfassungsschutz) operated a PeerTube instance for his media portal. The so-called “Querdenken” (“lateral thinker”) movement in Germany also maintains a PeerTube instance. YouTube blocked the main Querdenken channel in May 2021. In response, the founder of the Querdenken movement, Michael Ballweg, announced that he was working on developing an alternative to YouTube, using PeerTube as a foundation.¹⁵

The Functionalities of PeerTube

Interface

At first glance, PeerTube instances appear similar to standard video platforms such as YouTube. However, the operators of each instance can customise the appearance, functions, and terms of use of their instance. For example, many instances have *Discovery*, *Trending*, and *Recently Added* tabs as well as a search function for videos, channels, and playlists. Videos can be searched locally or within the federated network. Some instances also use advanced (unofficial) plug-ins, such as cryptocurrencies that can be earned by interacting with videos.

Many instances specify which functions they offer and what terms of use apply to their platform. Functions include whether the instance allows new accounts to be registered. While some instances create interactive platforms and allow others to upload their own content and comment on videos, others are using PeerTube as their own personal video library which permits only their own content.¹⁶

When users register an account, they automatically receive a channel which videos can be uploaded to. They can then create additional channels which are linked to the same account. When uploading a video, users can choose which channel to add it to and whether a video will be public, unlisted (i.e. only accessible via a URL and not displayed in search results), private, or local (only accessible on the instance hosting the video). In addition to uploading directly from an end device, users can also import video files via an URL or Torrent file. Depending on the rules of the instance in question, having a user account makes it possible to carry out similar interactions to those on standard video platforms. This includes subscribing to channels, creating playlists and commenting on videos. The PeerTube software also allows the download of videos. PeerTube facilitates video-on-demand via WebTorrent and livestreams via HTTP Live-Streaming (HLS).

Channels and videos have a section for donations where bank details, PayPal addresses, or crypto-wallet IDs can be stored. According to its own statements, PeerTube does not provide a standard monetisation function. However, developers can create their own monetisation capabilities using the PeerTube plug-in API.¹⁷ This function is particularly relevant since alternative platforms are being used by far-right and conspiracy actors for the purposes of circumventing suspensions, content removal and demonetisation. By allowing content to be monetised via PeerTube, these instances offer a further affordance in addition to content distribution: the ability to earn money from content.

Peer-to-Peer technology

PeerTube uses P2P technology to save bandwidth when playing videos. P2P networks are built as decentralised networks and are particularly used for sharing large video or audio files. They are the opposite of Client-Server models. On a Client-Server network, all participating

devices are connected to at least one central server where the data is stored and from which information must be accessed. On a P2P network, the participating devices are treated as equals and there is no central server. The end devices have a double function, as both server and client, and communicate with one another directly. The resources of the connected computers are shared.¹⁸ However, it is possible to deactivate the P2P function on PeerTube instances.

One of the benefits of P2P networks is that they make more efficient use of resources and are also more resistant to system malfunctions.¹⁹ Because there is no central server, P2P networks should also be more resistant to censorship as the data is stored on multiple, decentralised end devices. Each device would have to be removed from the network in order to shut it down.²⁰ However, these networks are also less secure as there is no central authority responsible for protecting the systems. Instead, each end device is responsible for its own security.²¹ In the case of PeerTube, the P2P function likely serves to protect bandwidth. To do this, data is presumably stored on the server of each respective instance.²² Since PeerTube still has central servers (instances), it is not a purely P2P network and the devices in the system are not all treated equally.

Federations

One of the central features of PeerTube is the ability to connect instances in order to create so-called federations. PeerTube itself has stated that it does not want to create one giant video platform, but instead aims to establish a network of smaller, independently managed instances.²³ Instances are therefore able to follow each other. Videos from a followed instance are displayed on the follower's instance where they can also be viewed. Requests to follow an instance are not automatically accepted and must instead be approved by the instance in question.²⁴ As soon as the follow request is accepted, videos from the followed instance are also shown there.

Specifically, this means that viewers on instance A can view the videos of a federated instance B without the need to change websites. The video files remain on the server of instance B but can be commented on by a user account on instance A, or any other instance. Equally, channels can be subscribed to either via a local account or via an account on a federated instance.²⁵

This peculiarity of the platform architecture not only ensures that videos spread beyond the borders of individual instances, it also makes it difficult to accurately analyse their dissemination. The individual federated instances do not always synchronise data at the same time. Depending on the research design, there is a risk of obtaining duplicates of videos or losing data on federated instances. For the analysis in this report (except for the content analysis), all videos in the collected data set were only associated with their host instance in order to prevent duplicates from occurring in the data set. Consequently, the data analysis relates only to videos hosted by the instances themselves, and not to all videos which can be viewed on these instances.

Enter the Fediverse

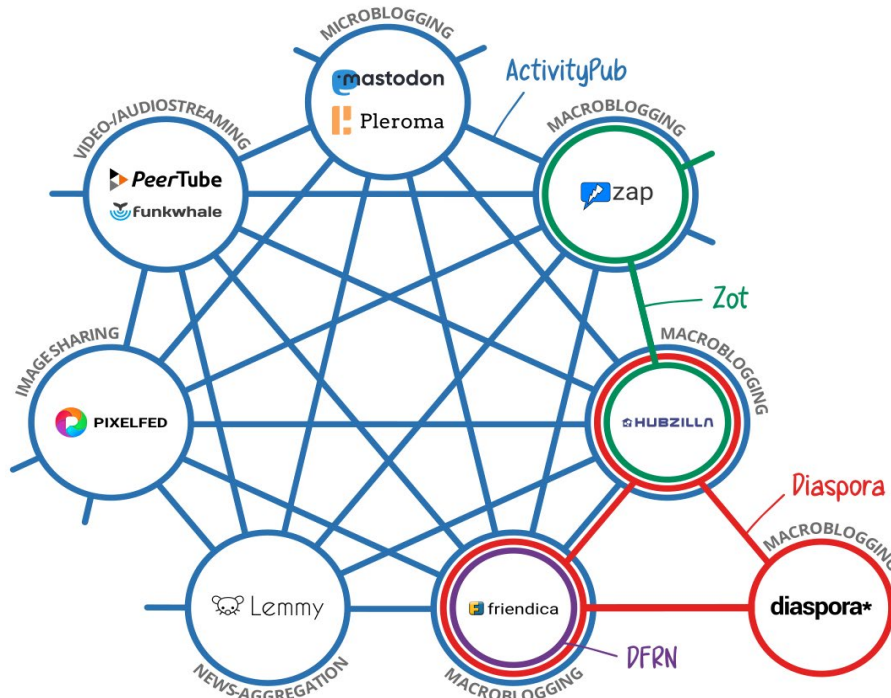
PeerTube not only allows individual video platforms to form a federation, but also enables instances to become part of the so-called Fediverse, a portmanteau of the words “federation” and “universe”. The Fediverse is not a centralised platform managed by an individual company, like Facebook or Twitter. Instead, it is a network of servers that are maintained independently of one another, but which can exchange data. This means that users who have set up an account on a Fediverse server can communicate with people on other federated instances without having to switch websites. Moreover, they can do this across different types of software, so long as they are using the same protocol.²⁶ Holders of an account on an instance of the micro-blogging software Mastodon, for example, can comment on a PeerTube video without having to set up a new account.

The Fediverse is a group of software programmes that often imitate the functions of major platforms. Thus, the Fediverse offers alternatives to platforms such as Twitter (Mastodon, Pleroma), Facebook (Friendica, Diaspora), Instagram (Pixelfed), and YouTube (PeerTube). Shared protocols enable the transfer of data between independent servers. The majority of Fediverse programmes use the ActivityPub protocol.²⁷ There are also other protocols like Diaspora. Fediverse programmes can use multiple protocols simultaneously.

The Fediverse is regarded as a decentralised counter-movement to the Silicon Valley tech giants. The main criticism levelled at these companies by proponents of the Fediverse is that they collect too much data, concentrate their activities on their own platforms, and censor content without justification. The Fediverse presents itself as an alternative to this business model, one that has been developed by a community of volunteers and is independent from major corporations.²⁸ The Fediverse also stands in contrast to some “alt-tech” platforms. The latter were created to offer far-right extremists a new home after being blocked on established platforms. In contrast to these platforms, many people have migrated to the Fediverse because they feel that established platforms are doing too little to moderate content. Some Mastodon users, for example, have complained that Twitter is not taking sufficient action against harassment by far-right extremists and that the Twitter algorithm feeds political polarisation.²⁹ Since the operators of an instance set their own codes of conduct, they can remove undesired content and accounts at their own discretion.

A view into the Fediverse

Who talks to whom - and how?



Imke Senst & Mike Kuketz | All-Protocols-Version 1.1
<https://creativecommons.org/licenses/by-sa/4.0/deed.de>

MORE PLATFORMS AND INFO:
<https://en.wikipedia.org/wiki/Fediverse>

Fig. 1: Illustration of interlinkages and protocols within the Fediverse. Created by Imke Senst and Mike Kuketz.

Use of the Fediverse by Extremists

However, this self-regulation is not without its own issues such as when instances are operated by people who have no interest in eliminating extremist content or instances are built explicitly for this purpose. The Islamic State (IS) began using the Facebook alternative Diaspora in 2014 to disseminate terrorist propaganda after multiple established platforms blocked its accounts. While the team behind Diaspora was concerned about this development, they were unable to do anything to prevent terrorists from using their technology; the reason being that the administration rights, and thus the ability to delete content, rested solely with the server operators.³⁰ In a blog post, Diaspora explained that because of the decentralised nature of the system, it was impossible to remove content from all nodes in the network. However,

the operators had compiled a list of known IS accounts which they would be sharing with affected server administrators. According to Diaspora, all major instances they contacted reacted by blocking the offending accounts. But the blog post also makes it clear that it is only the operators who can make decisions regarding the content hosted on their servers.³¹

Since then, Mastodon has also gone on to experience its own issues with extremist content, despite the fact that its developer Eugen Rochko has explained that he “[doesn’t] want to give [Neo-Nazis] a platform for recruiting.”³² In 2019, the infamous “alt-tech” network Gab migrated to a fork of the Mastodon code, making it the largest node on the Mastodon network.³³ By this time, Gab had struggled for years to keep the platform

online. Many tech companies terminated their business ties with the platform in 2018 after a far-right terrorist announced his attack on a synagogue in Pittsburgh via Gab.³⁴ Following the attack, Google and Apple removed the app from their respective stores. By relocating to Mastodon, Gab can make use of apps created to access Mastodon instances on mobile devices. In response, at least four Mastodon apps for Android or iOS blocked access to Gab. However, developers of other apps believe that excluding individual instances goes against the aims of the Fediverse.³⁵ In a blog post, Mastodon emphasised that while they do not welcome Gab's use of their code, anyone can use the software providing they maintain the user licence and make any modifications public.³⁶

Mastodon once again garnered media attention in the context of alternative platforms when it was revealed that the Truth Social website, founded by Donald Trump, was using Fediverse software. The backend was taken from Mastodon and the frontend from Soapbox, which is primarily used for the Fediverse software Pleroma. The mechanisms for federating the platform were however deactivated, which many observers felt contradicted the purpose of the Fediverse.³⁷ When Truth Social was threatened with legal action, it published its source code.³⁸

A Network Analysis of PeerTube Instances

Methodology

To investigate the use of PeerTube software by far-right and conspiracy actors, ISD conducted a link analysis on relevant Telegram channels. Based on the selection of instances identified in this manner, the team examined their network and the content of PeerTube instances that the far-right and conspiracy theorist scene was linking to.

ISD began the research by compiling a list of PeerTube instances to use as seeds (starting points for data collection). To create the list, the team conducted a link analysis to extract domains from 229 conspiracy theorist and far-right channels on Telegram, the central communication platform for the far right in the German-speaking world.³⁹ These domains were reviewed manually to identify video platforms operated using PeerTube software. At the end of this process, the team was left with 34 PeerTube instances as seeds, of which 25 were connected to another one at the time of data collection (06/07/2022). These instances differed in terms of their subject matter. Some of them were created specifically for uploading extremist content and disinformation, while others were designed to give a wide audience the ability to share videos without adopting any obvious political stance.

With the help of Beam, the research team collected data on those instances that were following the seeds (“Followers”) and those which the seeds were following (“Following”). It is important to note in this context that “Followers” refers not just to individual accounts, but to other instances as well, i.e. independent platforms which in turn may comprise many channels, active users and viewers. This means, for example, that one instance may have just two followers, but these two followers may bring with them communities of several thousand people who can actively use them. At the same time, one instance may have a higher number of follower instances, but these instances may have not many users overall. **The number of followers gives an indication of the degree of networking but does not automatically reveal the absolute reach of an instance.**

PeerTube instances can accept or reject ‘Follow’ requests. The data set was thus cleaned up so that it only

accepted following requests that would show up in the expanded network map. The reasoning behind this was to create maps of the network that are as close to reality as possible. The team analysed three networks: the followers of seeds, the following of seeds, and the bigger networking of the followers of our seeds. For the latter, the team collected data on the followers of instances that were following the seeds. The purpose of this was to better estimate where the seeds being investigated were located within the Fediverse.

The data collected were then analysed using Gephi. The nodes in the following Gephi graphics (s. Figures 2-4) represent instances, while the edges⁴⁰ indicate a follower relationship. The size of the nodes is determined by the number of edges directed towards it (the “in-degree”). Specifically, this means that the larger a node is, the more followers the corresponding instance has. To identify potential categories of instances, the research team used Gephi's modularity algorithm in the network map after two rounds of network expansion. Wherever the algorithm detected similarities in node connections, these were marked with the same colour. This creates different classes of nodes. Instances for whose followers no further information could be collected were coloured in grey. In the network maps, which only represent the first round of the data analysis, only seeds were labelled and no modularity classes were marked. The names of the instances were anonymised so as not to advertise extremist platforms.

Limitations due to Data Access

The following limitations must be considered when analysing the network maps. Firstly, for a quarter of the instances discovered, no data about their network could be collected because the API was unable to reach these nodes. There are many potential reasons for this, such as the server being switched off, the instances' SSL certificates being out of date, or the instances requiring an external log-in.

During data collection, the research team also identified inconsistencies in the relationships between instances. Depending on which instance was used as a starting point to collect data on a follower-following relations, the results could vary. Collecting the followers of an instance and collecting the following of a corresponding follower instance often indicate different relationships,

even though theoretically they should be the same. In concrete terms, this means that an instance may be listed as following another instance even if this relationship does not exist at that time. When the followers of the supposedly followed instance are reviewed, it is possible that the instance in question will no longer appear in the follower list. The reason for this is that the follower and following data are not synchronised at the same time. When an instance blocks a follower, this follower is immediately removed from the instance's follower list, but the following data for the blocked instance appears to be only updated later. Consequently, the metadata on the followership relationships varies depending on which instance it was collected from. It must be assumed, however, that all relationships in the network under investigation did exist at some point in the recent past. Therefore, the most recent figures can be obtained by investigating the follower list of an instance, rather than a following list. In Gephi, this means that the in-degree is particularly relevant for measurements.

Network: First Round of Data Collection

The two maps below depict the networks with the instances that followed the seeds (“followers”) and the instances the seeds followed (“following”) respectively. The instances discovered during the network expansion are marked in grey. Their nodes are all of equal size since data from their network was not taken into consideration in this case.

Followers of the Seed Instances

There are clear differences in networking with respect to the number of followers of the seeds under investigation. While some instances have several dozen followers, others have just a few or none.

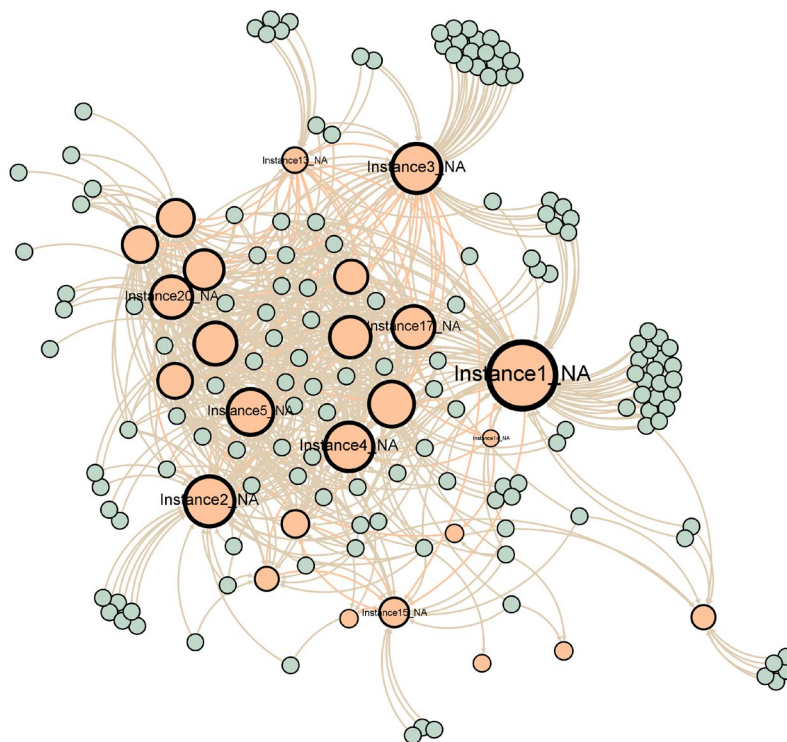


Fig. 2: Network map of the followers of investigated seed instances. The Gephi layout “Force Atlas 2” was used for this study.

The following table lists the five seed instances with the most followers:

Instance Code	No. followers	Description
Instance1_NA	74	Hosts videos of anti-lockdown demonstrations, Discover page shows mix of music, tech, and disinformation
Instance2_NA	49	Discover page has "Politics" category which primarily shares disinformation
Instance3_NA	48	Homepage presents videos on hobbies and also conspiracy theories, Trending page contains disinformation on COVID-19 and the war in Ukraine. Also hosts Reichsbürger (anti-constitutional and revisionist movements in Germany) and far right content
Instance4_NA	47	Belongs to an anti-lockdown group, focuses on COVID-19 disinformation
Instance5_NA	43	Focuses on anti-lockdown movement and its leading personalities

When looking at what content the seed instances with the highest follower numbers focus on, what is striking is the proliferation of disinformation about COVID-19 and vaccines, as well as the high number of recordings of anti-lockdown protests. This potentially indicates that PeerTube is used especially by opponents of public health measures. This movement has produced vast quantities of video material over the last two years – from interviews and podcasts to live-streams of demonstrations and even music videos. As video platforms like YouTube began to act against such activities, the movement was forced to look around for alternatives. PeerTube offered a solution: content can only be removed by the operators of an instance.

The network map shows that there are major differences between the seeds in terms of their degree of networking. Some are completely isolated or have only a handful of followers, while others are followed by over a dozen of other instances. In the case of the latter, it was also observed that their followers sometimes follow only one of the seeds. The centre of the map, however, is made up of a few instances which follow many seeds.

The following table shows which instances followed the most seeds:

Instance Code	Following #Seeds	Description
Instance6_NA	17	Not accessible
Instance7_NA	16	Mixture of music, hobbies, copyrighted material, and disinformation (on vaccinations etc.). Several languages
Instance8_NA	16	Mixture of technology, hobbies, copyrighted material, and political content, including disinformation. Several languages
Instance9_NA	16	Nazi and antisemitic content on the Trending page. Otherwise, lots of content on technology
Instance10_NA	16	Mixture of travel, sports, and disinformation. Several languages
Instance11_NA	16	Prominent federated content from Ukrainian journalists accused of maintaining close ties with the Kremlin. Contains objective and also conspiratorial comments on society and technology. Several languages
Instance12_NA	16	Mixture of music, instructional videos, cryptocurrencies and far-right content

Three tendencies can be identified among the instances listed in the table above. **Firstly, the instances are highly networked and tend to follow hundreds, or in some cases thousands, of other instances. Secondly, the instances only host a few if any local videos. Instead, the videos that are available come primarily from the other instances. Thirdly, the content displayed on the instances is very heterogeneous.** The content is often available in different languages and covers a wide range of interests, with technology being a frequent topic of conversation. While none of the instances outwardly present themselves as decidedly far-right, it is easy to find extremist, polarising and conspiratorial content. These frequently originate from the same federated instances, yet the prominence of these videos invites the question of whether this is due to a large number of such videos or higher click-rates on videos of this kind on the network. The instances also host vast amounts of content that

would be blocked on many other video platforms, e. g. copyrighted or pornographic materials.

Followings of the Seed Instances

The network map of instances followed by the seeds indicates that two of them, Instance3_NA and Instance13_NA, follow a particularly high number of other servers. Instance3_NA follows 1,081 other instances, while Instance13_NA follows 705 instances. There is a steep drop to the instance following the third-most servers, which follows only 18 other instances. The top two, Instance3_NA and Instance13_NA, frequently follow the same instances. However, neither of them are among the five instances which follow the most other seeds. **It must therefore be assumed that these instances are concerned above all with networking as widely as possible in the Fediverse, rather than with forming connections in far-right or anti-lockdown networks.**

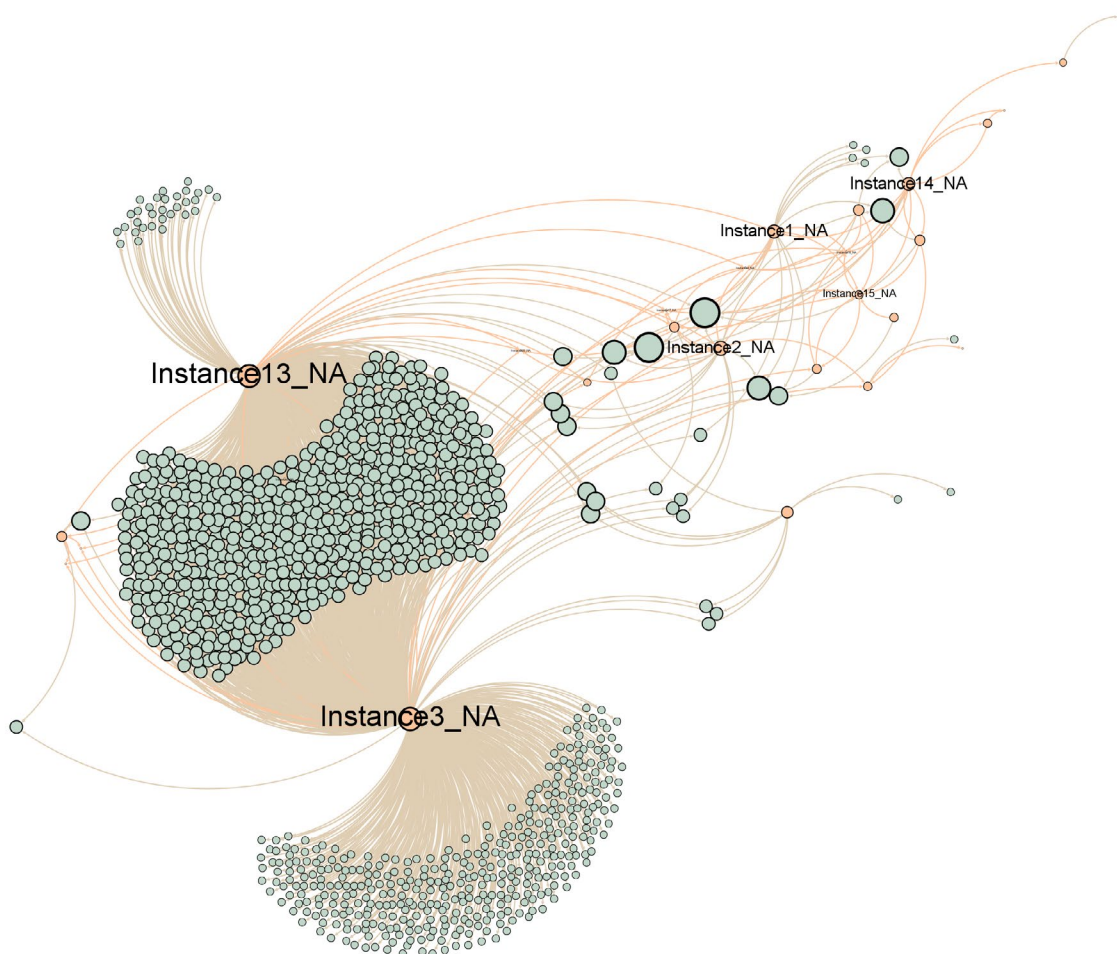


Fig. 3: Network map of the following of the investigated seed instances.⁴¹

The following table shows which seeds follow the most instances:

Instance Code	No. Following	Description
Instance3_NA	1,081	Homepage presents videos on hobbies and also on conspiracy theories, Trending page contains disinformation on COVID-19 and the war in Ukraine. Also hosts Reichsbürger and far-right content
Instance13_NA	705	Different languages. German-language content often contains disinformation on COVID-19 and the war in Ukraine
Instance2_NA	18	Discover page has 'Politics' category which mostly shares disinformation
Instance1_NA	16	Hosts videos of anti-lockdown demonstrations, Discover page shows mix of music, tech videos and disinformation, e.g. regarding the war in Ukraine
Instance14_NA	13	Not currently accessible but provided far-right extremists and New Agers with a platform

The enormous differences in following numbers between seeds could indicate that instances of German-language conspiracy theorists and far-right extremists are less connected in the federation than many other PeerTube instances. Instances which clearly belong to far-right or conspiracy organisations or individuals follow relatively few instances. However, they are still connected to the wider Fediverse through heavily federated instances which follow both extremist and non-extremist platforms.

Evaluating the visualised network makes clear that instances of the German-speaking milieu of far-right extremists, sovereigntists and conspiracy theorists primarily networks among themselves. This is further supported by the list below showing the instances which are most frequently followed by seeds. It becomes apparent here that those instances are usually seeds themselves.

The following table shows which instances are followed by the most seeds:

Instance Code	#Seed followers	Description
Instance15_NA	8	Anti-lockdown movement instance
Instance16_NA	7	Instance of an influential conspiracy theorist, no longer updated
Instance4_NA	7	Part of a group that campaigns against measures to restrict the spread of the COVID-19 pandemic, focuses on medical disinformation
Instance17_NA	6	Belongs to a ufologist who has also shared disinformation on the pandemic
Instance18_NA	5	Disinformation on COVID-19 and the war in Ukraine
Instance19_NA	5	Far-right extremist material and disinformation
Instance20_NA	5	Part of a media company that spreads COVID-19 disinformation

Here, too, it is striking that only Instance15_NA allows user accounts to be registered. On all other instances, only a small number of accounts, which must be approved by the administrators, can upload videos. This indicates that this milieu uses PeerTube in a much less collaborative way than probably intended. On the instances researched, communication thus seems to take place in a hierarchical, rather than in a networked way, as would be the case for most social media.

Based on the follower and following networks of the seeds investigated, we can make the following observation. **Firstly, a small number of seeds are connected to many other instances, thus bridging the gap between the network investigated and the wider Fediverse. Secondly, heavily networked instances are often difficult to characterise due to their heterogeneous content. Nevertheless, blatantly extremist and dehumanising content can often be found on such instances. Thirdly, the seeds often follow one another and are comparatively isolated from the rest of the Fediverse, except for a small number of heavily federated instances.**

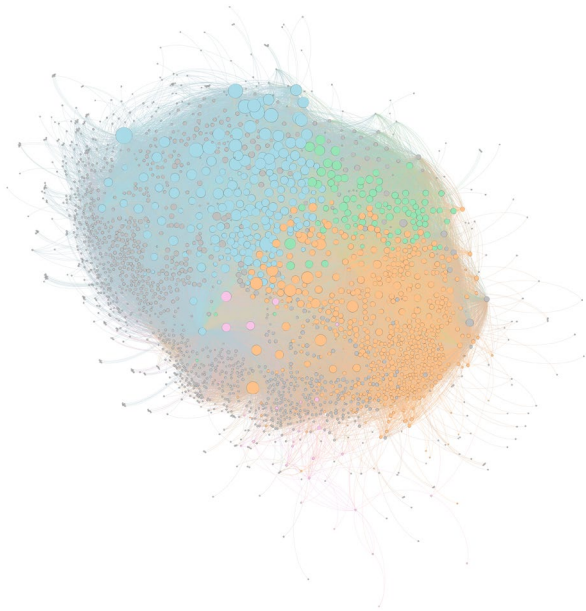


Fig. 4: Network map of followers of seeds and their followers. Four very small clusters have been removed for visual clarity.

Network: Second Round of Network Expansion

In order to gain a better overview of how the seeds' followers are networked, the team collected data about the followers of the newly discovered instances. The result is a heavily connected network containing many of the most important PeerTube instances, including the Framasoft instance itself (framatube.org) (s. Figure 4). Even though Gephi's modularity algorithm has bundled the instances together in different coloured groups based on their connections, they are almost impossible to categorise according to either theme or ideological leaning.⁴² The seeds are almost invisible on the network map because they are relatively isolated compared to other instances and are therefore not prominent in the visualisation. While this network map provides little insight into networking between the seeds, it does show how heavily PeerTube and other Fediverse instances are connected to one another. After two rounds of data collection, the research team was able to identify over 2,300 instances, using just 34 seeds.

The second round supports the finding that conspiracy theorist and far-right PeerTube instances in the German-speaking world make up only a small percentage of the network. At the same time, the instances in question are connected to the broader universe of Fediverse platforms, providing them with favourable circumstances for spreading their content.

Evaluation of Data on Accounts and Videos

Methodology

In order to identify the content being spread by the far right online scene via PeerTube, the different instances were investigated both qualitatively and quantitatively. The next sub-section analyses the entire federated network of 34 seed instances after collecting data about their follower instances. The following sub-section examines particularly important instances with respect to their infrastructure, usage, and content. To explore the usage of the seeds and their followers, we collected data points available through the instances' APIs, including the number of videos, views, and registered user accounts. This data was plotted over time to explore any potential spikes in activity and whether there were correlations between these different activities.

To gain a better understanding of the types of content found on the instances researched, a random sample of 100 videos from instances that served as examples for the different uses of PeerTube was selected and manually categorised inductively. The videos come from both the seeds and their federated network.⁴³ The data collection period for account registrations and videos was from the time when each instance was set up, which differs from case to case, until 25/08/2022. As in the network

analysis, the instances analysed were anonymised so as not to promote extremist platforms.

Evaluation of Data on the Federated Network

Looking at the timeline of account registrations, it is striking that account registrations on seeds were relatively late compared to the wider network. The first accounts on seeds were not registered until late 2018. At this time, most accounts were registered on the single, predominantly English-speaking seed Instance1_DA. A significant increase is not seen until January 2021 when 4,685 accounts are registered on the seeds. Most of these newly created accounts can be traced back to Instance2_DA (2,607) and Instance1_DA (2,064). The ISD study "Telegram as a Buttress" revealed that links to an anti-lockdown instance were being shared as early as January 2021.⁴⁴ These linking activities increased in May 2021 when the movement's YouTube channels were suspended. However, this deletion of the YouTube channels is not reflected in the number of accounts being registered on the instance. The registration levels on the seed instances remained constant until October 2021. In November, 6,248 accounts were registered, of which around 48% can be traced back to Instance2_DA. The instance with the second highest growth in account

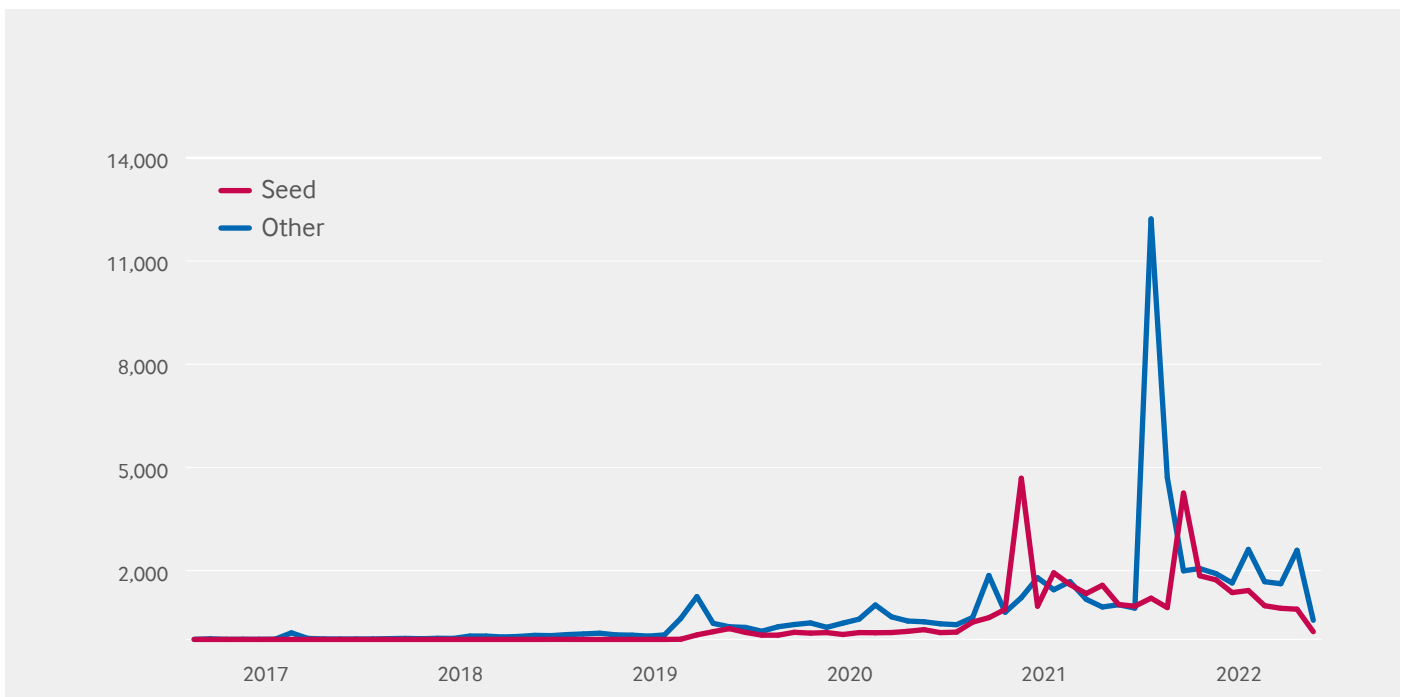


Fig. 5: Timeline of account registrations across the entire network

numbers in the data set analysed is Instance3_DA, also a seed instance, which made up 5% of all account registrations. In short, the seeds tend to be set up fairly recently and quickly gained traction, potentially through their novelty. However, this momentum did not hold up over time.

The month with the most account registrations overall was September 2021. At this time, 1,054 instances had at least one account registered. 13,424 newly registered accounts, or 12%, can be traced back to Instance4_DA.⁴⁵ This instance has its own cryptocurrency which can be earned when others interact with its videos. The instance provides a wide range of content, including disinformation videos describing Ukrainian armed forces as “NATO-backed terrorists” and using the term “Ukronazis”. At the same time, this instance also hosts German-language videos praising National Socialism and denying the Holocaust.

However, registrations of new accounts on seed instances have been markedly reduced since these two peaks in autumn 2021. They maintained a low but stable level on other servers.

Taking a closer look at the ten seeds with the most

account registrations overall, it again becomes apparent that these instances seem to have been created very recently compared to the rest of the Fediverse. Until the end of 2020, accounts had only been created on the English-speaking Instance1_DA. New registrations increased significantly at the beginning and end of 2021, mostly on the anti-lockdown movement instance and especially in January 2021, before once again falling noticeably from December 2021 onwards.

Other instances, such as Instance5_DA and Instance6_DA, were regularly able to record over 100 new account registrations per month over the preceding year. Account registrations then fell to a few dozen, starting at the beginning of 2022. Instance6_DA was no longer accessible via a browser at the time of analysis.

Instance3_DA recorded registrations of new accounts from November 2021 onwards. After a peak of 865 registrations in December 2021, the instance only managed to attract a little over 600 accounts per month over the following months. However, this number decreased dramatically in April 2022, falling to 328 new registrations. In June 2022, 90 new accounts were registered.

These figures raise questions concerning the

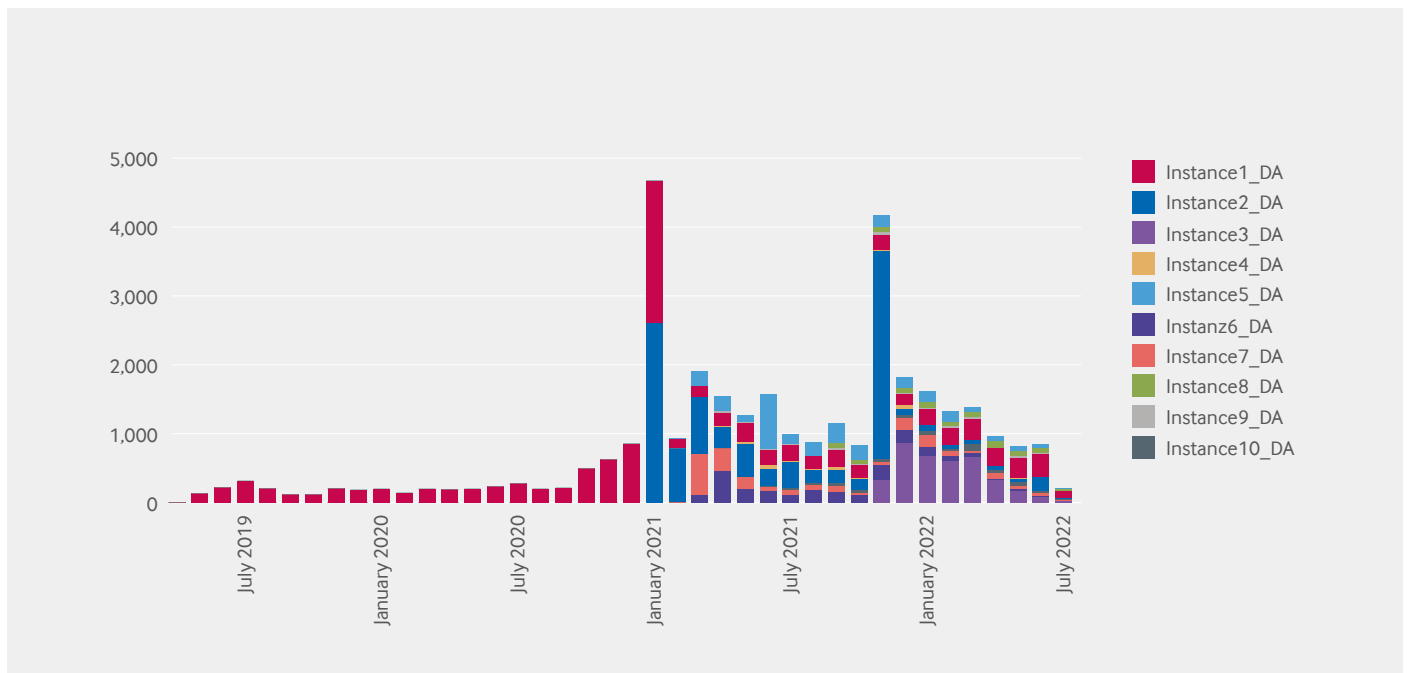


Fig. 6: Timeline of account registrations on the 10 seeds with the most accounts

longevity of individual PeerTube instances as social networks for far-right and conspiracy movements. While new instances regularly see waves of registrations, individual instances are often unable to develop any momentum and registration rates tend to drop off dramatically after a few months. As operators of Fediverse instances bear the maintenance costs, it is unclear how long instances are financially viable without new users.

One possibility is that establishing a community-based social network with many user accounts is not the aim of many members of far-right and conspiracy scenes. An analysis of the video uploads shows that the instances with the most user accounts are not necessarily the ones uploading the most, or most popular videos. Another possibility is that a PeerTube instance is maintained as part of a multi-platform strategy for the event that access to other platforms is denied and a back-up is required.

Videos Uploaded

Looking at the timeline of video uploads, we observe a steady rise in figures, with isolated phases of high activity. We also see that many of the oldest videos originated from seeds. However, at this point in time the seed instances are only responsible for a small percentage of the total number of videos uploaded within the federated network. The first videos in the data set come from January 2015 and can be found on Instance7_DA, the PeerTube instance of a conspiracy theorist. Videos from the wider federation, which since then have made up the majority of the videos, only start appearing in February 2018.

There are large differences between the instances in the data set analysed when it comes to uploading videos. The peak values are mostly triggered by different instances. Some are promoting predominantly extremist or conspiratorial content, while others are spreading more apolitical content. Uploads mostly come in waves,

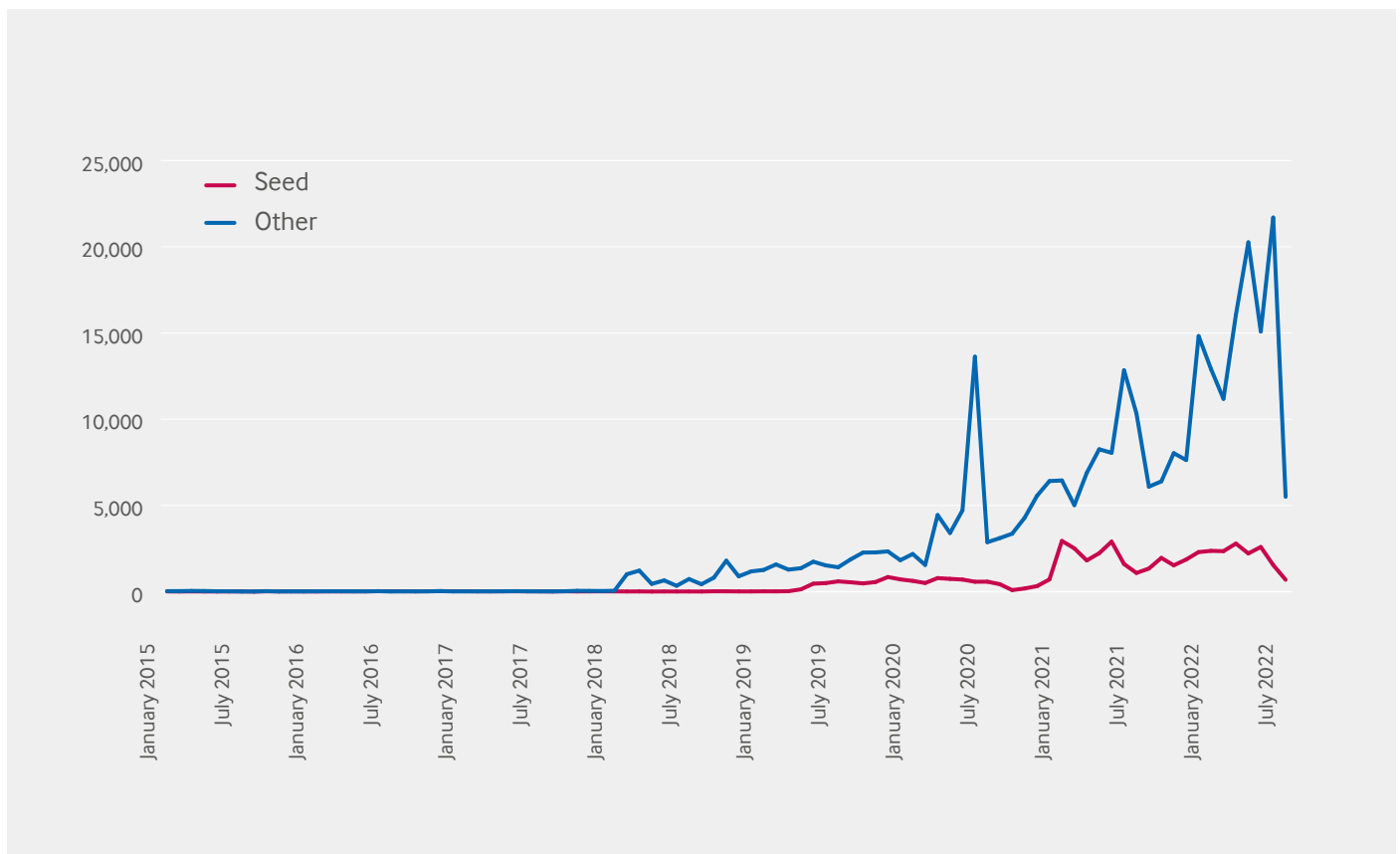


Fig. 7: Timeline of videos uploaded within the federated network

although there is a tendency for the number of videos to grow steadily during the timeline investigated. The seeds make up only a small percentage of this, however, and some of the more active followers are extremist instances from the English-speaking world. **While there are also active instances on the network which do not make extremist content available, many servers do host videos which would most likely be blocked on a centralised platform like YouTube. This does not just mean videos with extremist content or disinformation, but also those which contain copyrighted materials, pornography, depictions of violence, or otherwise offensive content.**

Video Views

The following section analyses data on the number of times videos uploaded in a certain month are viewed. The month metric refers to the month in which the videos being viewed were uploaded. The number of views given does not mean that these videos were accessed in

this particular month. Rather, this number refers to the total number of views of videos which were uploaded in this month.

When comparing the number of videos uploaded per month with the number of views these receive, a strong dissonance becomes apparent. The months with the most video uploads did not necessarily have the most viewer activity. In other words, uploading many videos in a specific month did not translate into receiving many views.

Additionally, we can observe a reverse trend in the split between seed instances and other instances. **Across the observation period, seeds continued to receive more views than other instances, even though they uploaded fewer videos. This could be an indication that uploading many videos does not necessarily lead to many views. A small number of established disinformation media outlets account**

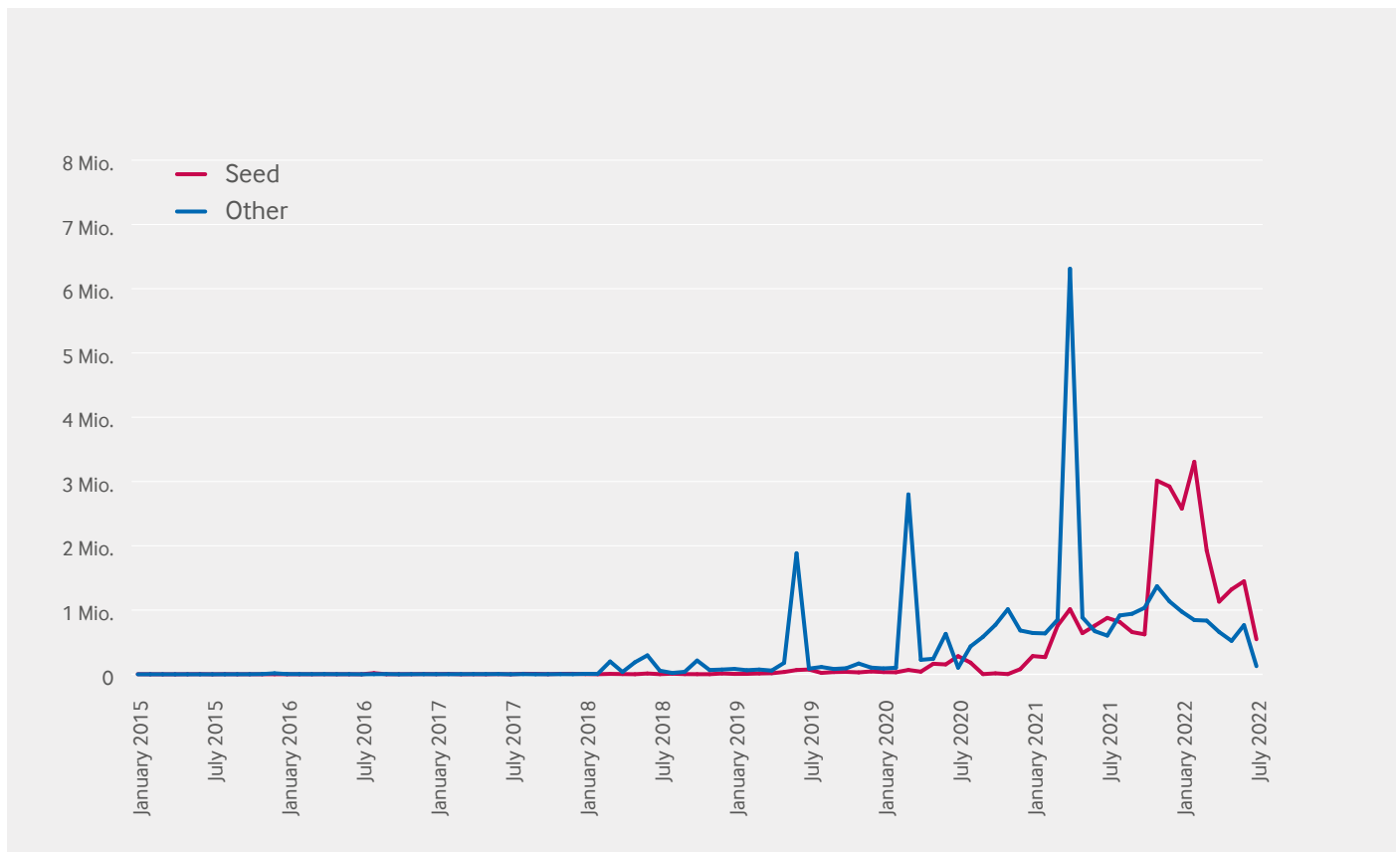


Fig. 8: Number of views of videos uploaded

for a high percentage of viewers, suggesting that successfully migrating one's audience to PeerTube instances depends on the preestablished popularity of personalities. While they can guide their audience towards PeerTube instances, unknown creators might find it more difficult to find to build an audience in the Fediverse. In the sample, no cases of building a successful instance without prior name recognition could be identified.

Case Studies on Instances

The following section presents examples of instances which are relevant for the far-right and conspiracy milieus in German-speaking areas. The section examines both the number of accounts, videos, and views hosted by the instances, as well as the different underlying infrastructures and ways of using the PeerTube software.

Case 1 (Instance_Case1)

This instance sees itself as activist and “censorship-free.”

The platform has channels run by Identitarians and Neo-Nazis. The instance is financed by donations, advertising, and “sponsors” (no further details are provided regarding these sponsors). The platform accepts donations via Bitcoin, PayPal, and bank transfer. Instance_Case1 allows new accounts to be registered and automatically gives them 20 GB of video storage. Additional storage and livestreaming can be obtained on request. According to the instance, the P2P function is deactivated to protect IP addresses.

The trend in account registrations shows that Instance_Case1 was able to attract new members particularly around mid-2021. Conversely, in February 2021 only a single new account was registered. In the following month, this jumped to 209 new registrations, followed by 211 in April. New registrations reached a peak of 788 in June 2021. After a moderate increase in September 2021, with 276 registrations, the numbers slowly dropped off. Just 51 new accounts were registered in June 2022, a 94% decrease within a single year.

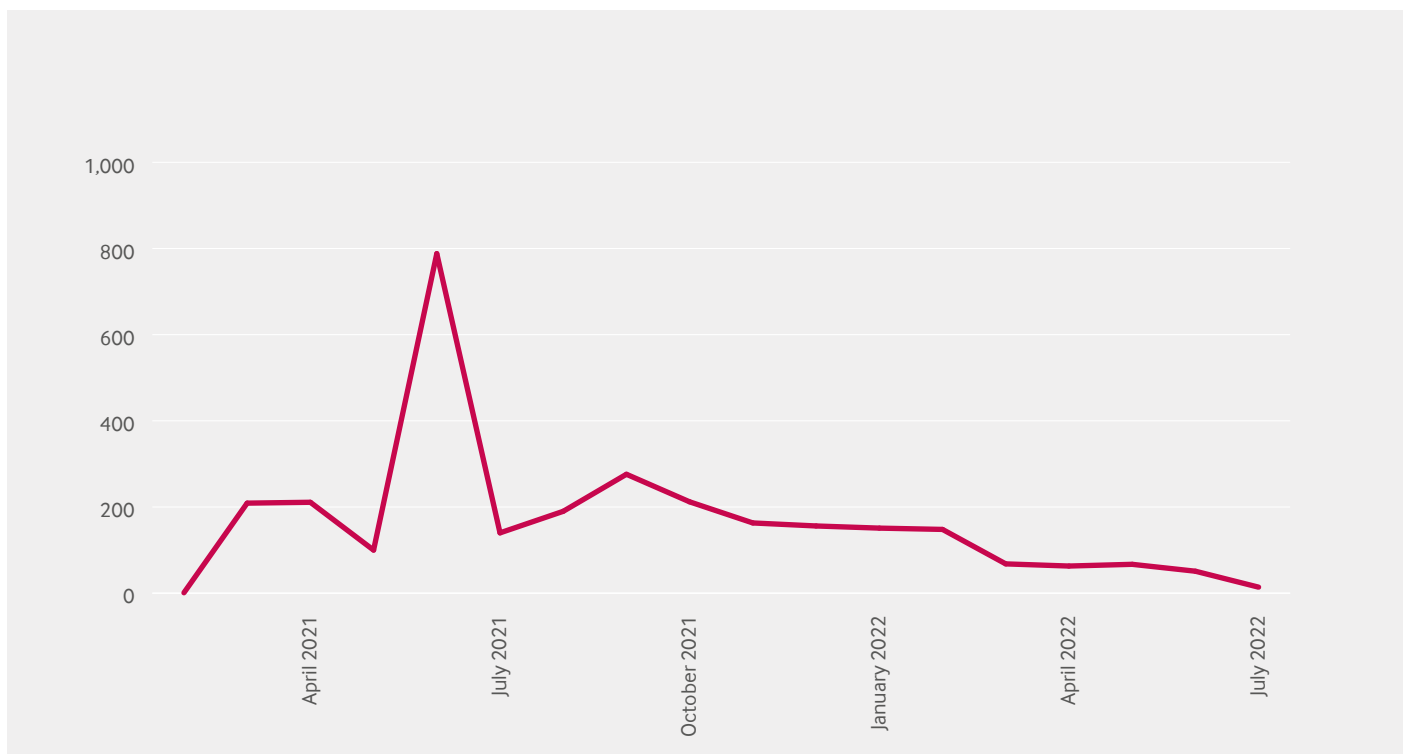


Fig. 9: Timeline of account registrations on Instance_Case1

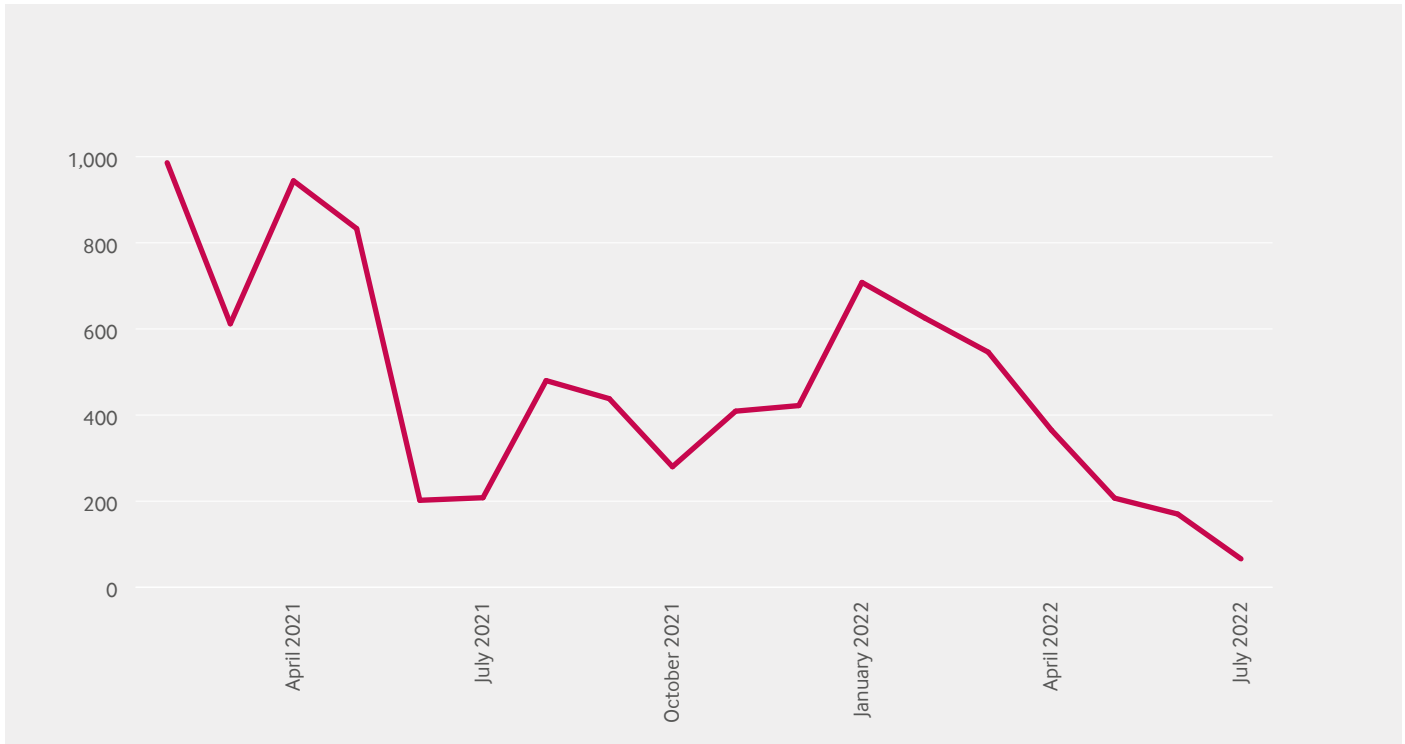


Fig. 10: Timeline of videos uploaded to Instance_Case1

The trend in upload rate stands in stark contrast to account registrations. The most videos (986) were uploaded in February 2021 when there was just one account on Instance_Case1. Conversely, June 2021, the month that saw a large number of new accounts registered, had one of the lowest upload rates at 202 videos. While account registrations declined from Q4 2021 onwards, the number of videos increased, reaching 708 in January 2022. Subsequently, however, these numbers also fell: in June 2022, just 107 videos were uploaded.

Major differences can be observed when comparing view numbers with the instance's upload rate. While videos received somewhere between 50,000 and 250,000 views between February 2021 and November 2021, this number exploded in December 2021 to more than 1.8 million views. Viewing figures peaked in February 2022 at 2.2 million. While these numbers did subsequently drop off markedly, the 841,000 views recorded in June 2022 were still significantly higher than the figures for the

previous June (61,000). This high number of views seems to be attributable to an account run by a disinformation media outlet. This account uploaded its first eleven videos in November 2021, accounting for 60% of the roughly 250,000 views recorded that same month. The videos from this channel made up less than 6% of the total volume, yet they accounted for around 86% of all views on Instance_Case1. This account's videos were also responsible for the sharp rise beginning in winter 2021. In February 2022, 97% of the 2.2 million views stemmed from this account. Interestingly, the disinformation outlet also has its own PeerTube instance. We found that videos were still receiving a lot of views on this instance (1.8 million) until November 2021. Yet, in the following months, these figures fell to below 260,000. One possibility is that the media company shifted its focus from its own instances to the case study instance, Instance_Case1, since this instance had an open registration policy and solid audience. It is also possible that cooperation was established between Instance_Case1 and the media outlet.

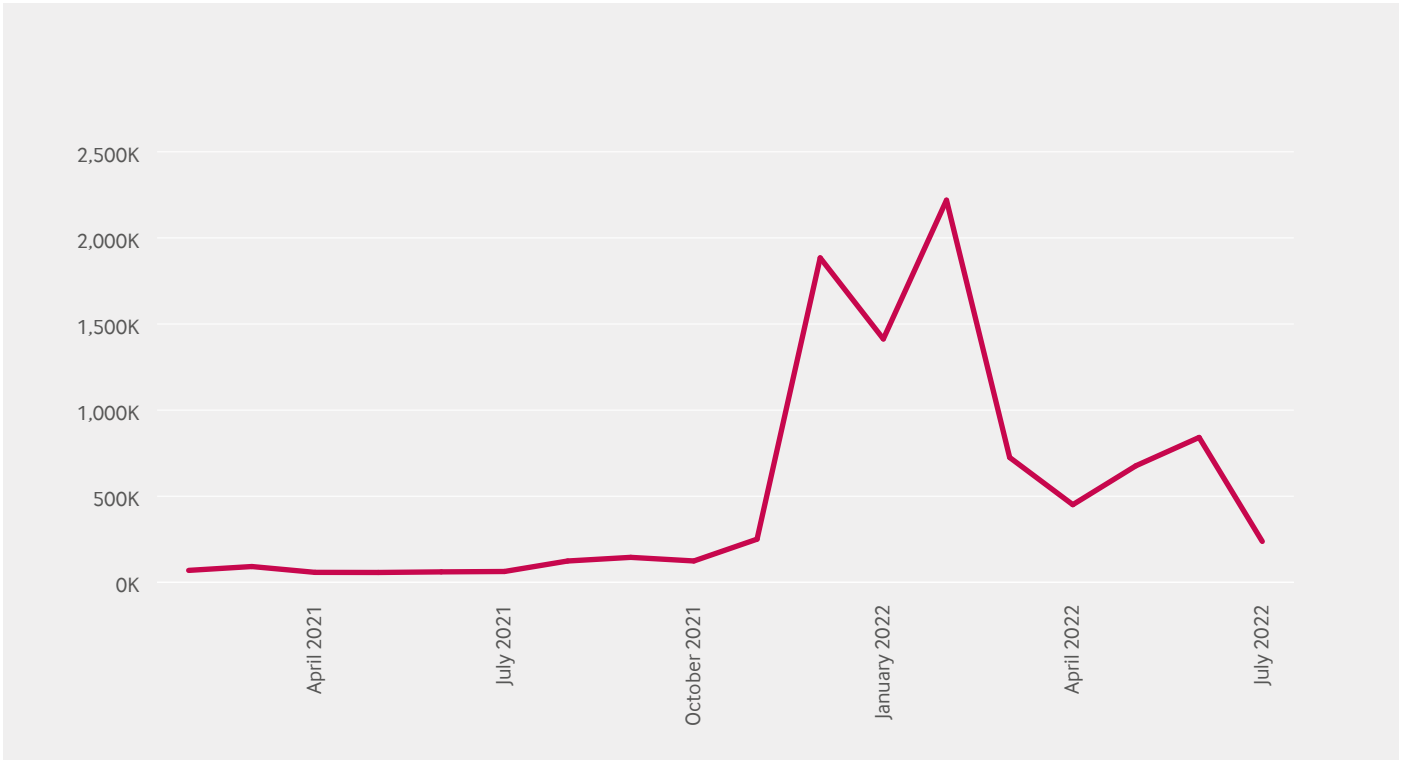


Fig. 11: Timeline of video views on Instance_Case1

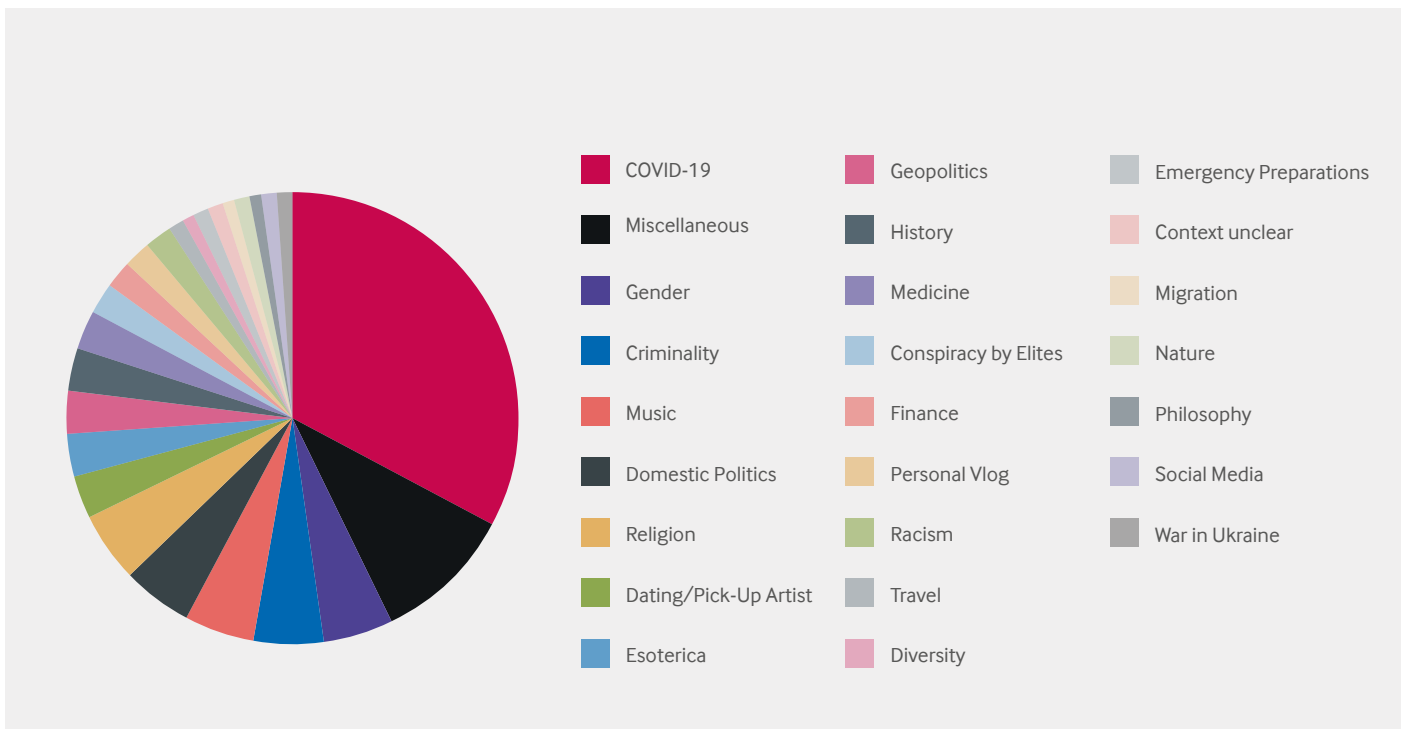


Fig. 12: Overview of subject matter of videos on Instance_Case1

Instance_Case1 hosts videos on a wide variety of topics, but mostly those of interest to conspiracy theorists. The dominant subject was COVID-19. More than a third of the analysed videos were about the pandemic. The second-largest category was “Miscellaneous”, accounting for 10% of videos. This category was applied to videos which address more than one subject; their format often mirrors the news. Crime, German politics, religion, and New Age content each accounted for 5% of the videos. The war in Ukraine was the focus of just 1 in 100 videos.

In summary, Instance_Case1 in many respects behaves like a traditional, centralised video platform. However, it has an ideological focus on conspiracy theory and far-right content. For several months, the instance has been dominated by one single channel. Even though the number of new accounts fell, this channel is clearly able to retain more viewers than older accounts.

Case 2 (Instance_Case2)

An anti-lockdown movement active in Germany, parts of which are suspected of engaging in extremist activities, has its own PeerTube instance. The instance has been around since at least the end of 2020 but first came to prominence in spring 2021 when the movement's main YouTube channel was suspended. Following its suspension, the movement and its regional offshoots began increasingly posting links to the instance via Telegram.⁴⁶ Videos frequently consist of recordings of demonstrations, interviews with prominent leaders of the movement, and pseudo-documentaries which play down the dangers of COVID-19 or warn against vaccinations. One channel stands out in particular. It uploads videos on cryptocurrencies and privacy-focused technologies. These subjects also have their own section dedicated to them on the movement's website. This could potentially indicate that the movement is concerned about surveillance by the state and private organisations.

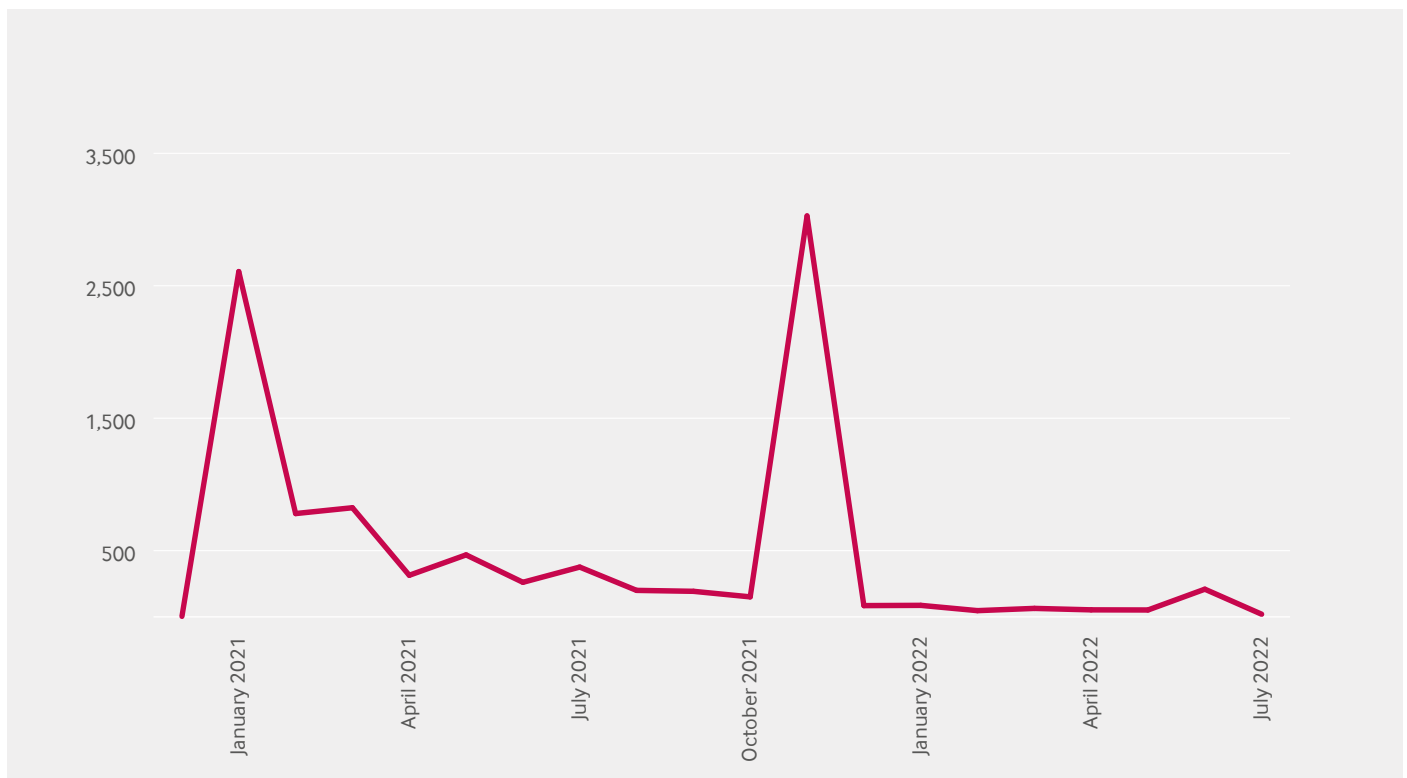


Fig. 13: Timeline of account registrations on Instance_Case2

There are two obvious peaks in registrations of new accounts during the observation period. In December 2020, only four accounts were registered on Instance_Case2, one of which was the official account of the movement. In January, this figure rose sharply to 2,607 accounts, before falling again. The suspension of the movement's YouTube channel in May 2021 does not appear to have had any significant impact on the rate of registration, with just 468 new accounts recorded that month. In November of the same year, however, account registrations recorded a peak of 3,207. While the peak in January 2021 can be explained by the fact that this new instance had only recently been set up, the high number of registrations in November 2021 raises questions. A closer look at the data reveals that the most accounts were registered on 23 November 2021 (1,093) and 26 November 2021 (1,028). On both days, many of the new accounts were created in a matter of seconds, which can be a strong indication of inauthentic activity.⁴⁷ After this increase, almost certainly attributable to spam profiles, in November 2021, the monthly rate fell to less than 90 new registrations before recovering slightly to 209 in June 2022.

The rate of video uploads does not line up with account registrations on Instance_Case2 either. However, we can observe a decline in both figures across the course of 2022. In December 2020, 279 videos were uploaded. While there were only four accounts at this time, this was the second-highest number across the data set. All but one of these videos came from the official account of the movement which maintains 14 channels. The following months saw the number of video uploads decrease. The upload rate then reached a peak of 355 in May 2021. While this was the month in which the group's YouTube channel was permanently suspended, the high number of uploads seems related primarily to two channels which uploaded 116 and 80 videos respectively in this month. However, the upload rate falls off again after this. Not a single month has seen more than 100 video uploads since January 2022. In June 2022, just 17 videos were uploaded.

Similar to the number of video uploads, views also appear to decrease over this period, albeit not at the same rate as video uploads. In January 2021, 25% fewer videos were uploaded than in the previous month, and yet these videos

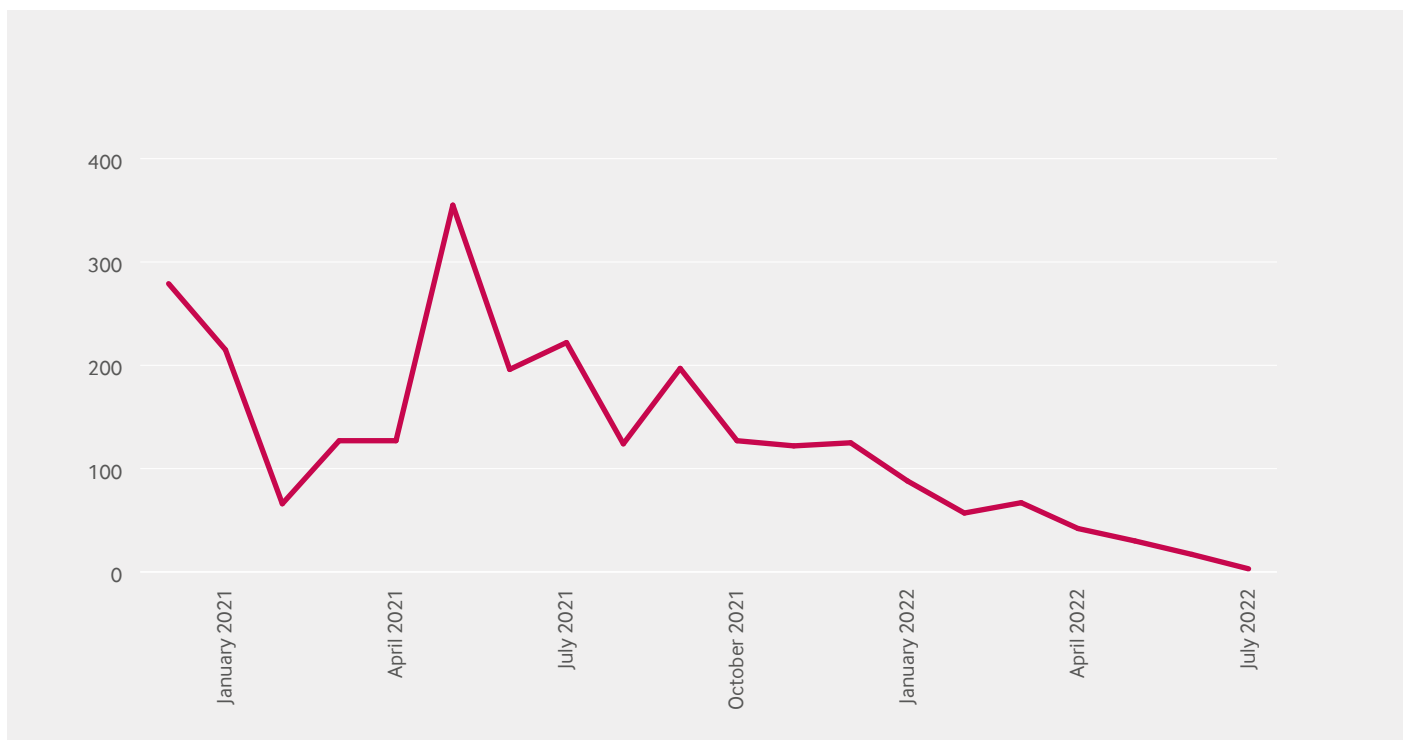


Fig. 14: Timeline of videos uploaded to Instance_Case2

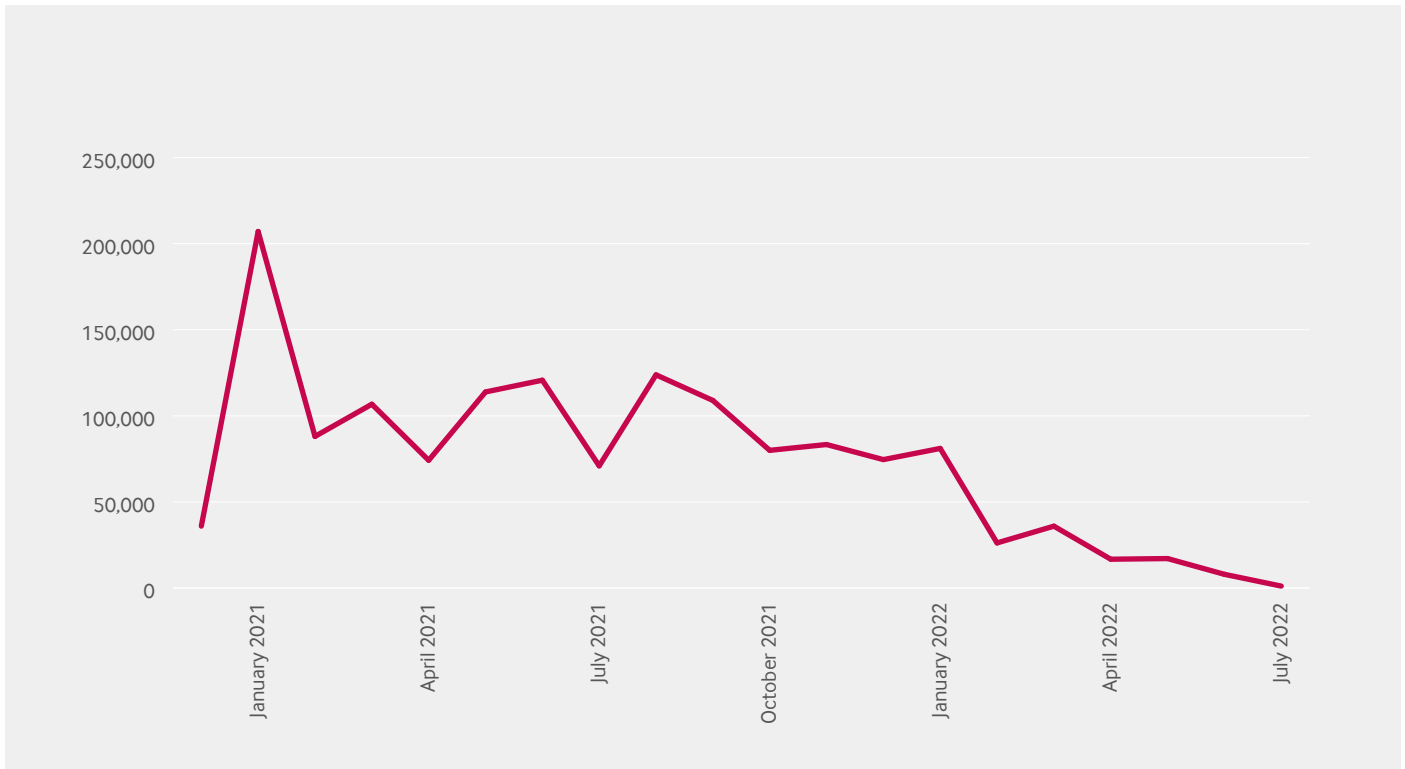


Fig. 15: Timeline of video views on Instance_Case2

received 5.7 times more views at around 207,000. 95% of these views related to videos from the main movement's account. Between February 2021 and January 2022, the number of video views remained relatively stable, with only occasional fluctuations. In February 2022, however, viewing figures began to increase markedly, even though there were fewer video uploads during this period as well. Similar to Instance_Case1, there is one dominant account on Instance_Case2, in this case the account of the operators themselves. This account received half of all views with around one third of the videos. Unlike the disinformation outlet's account in Case 1, however, the rate of uploads and the viewing figures fell as the year progressed.

The dominant topic on the platform is COVID-19. 86% of videos analysed in this sample are about the pandemic.

5% of videos discuss the media, including media reporting on anti-lockdown protests and how social media corporations are addressing disinformation. 3% of all videos imply that there is a conspiracy being perpetuated by powerful elites, with the pandemic being just one part of a greater plan.

Instance_Case2 was quite likely set up in response to impending and actual suspensions on established platforms because here the content cannot be moderated by third parties. However, this instance also appears to have encountered the issues that occur when migrating to one's own platform. It seems that continuously attracting a new audience to niche platforms like PeerTube instances is a tricky undertaking. At the same time, independent platforms appear to also be susceptible to spamming.

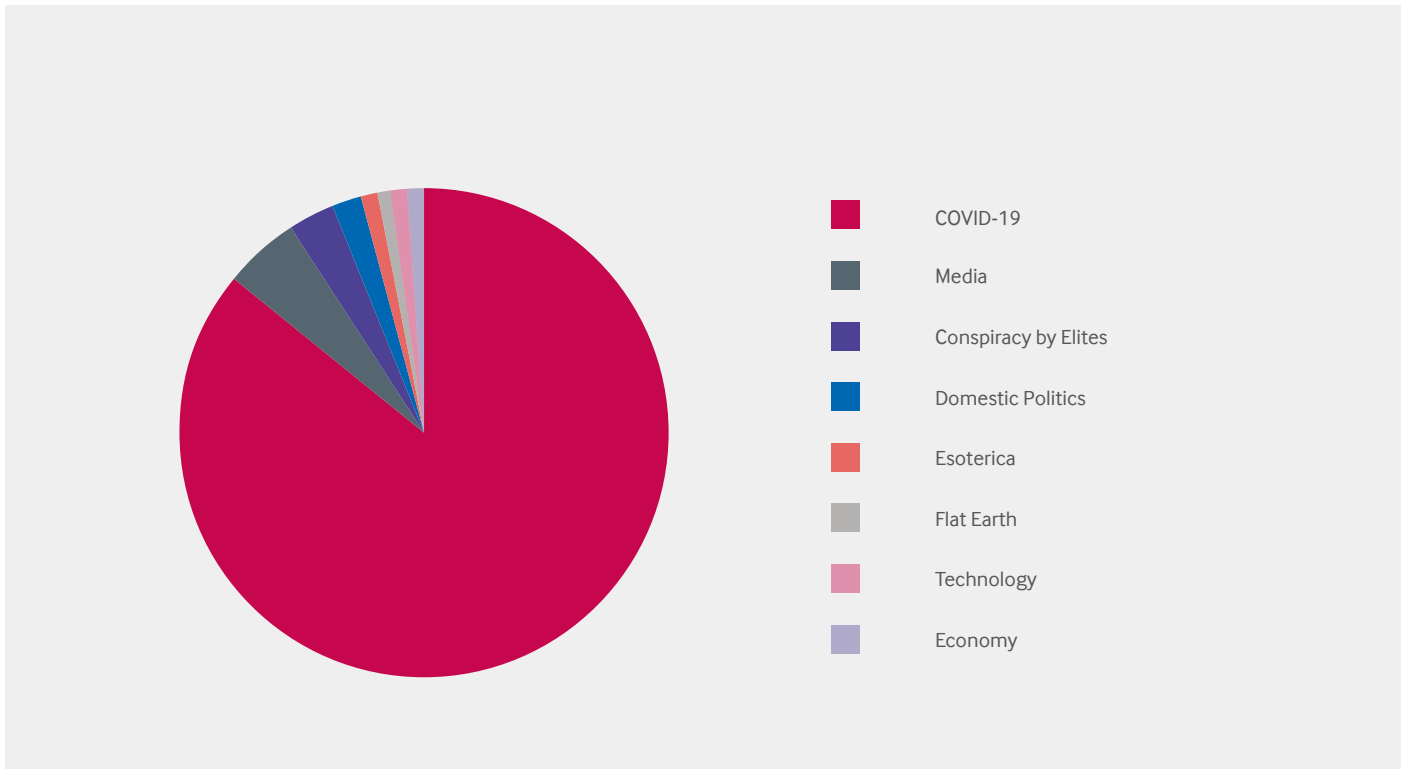


Fig. 16: Overview of subject matter of videos in Case 2

Case 3 (Instance_Case3 and Instance_Case3.1)

These instances appear connected to a far-right esotericist.⁴⁸ His name is mentioned at the very start of the channel list, and there is also a link to his online shop below the sign-up button. In addition to the esotericist's channel, the instance includes other channels, including one run by a media agency that backs Kremlin-narratives, and the channel of the esotericist's assistant.

The infrastructure of Case 3 is markedly different to the infrastructure of the instances investigated above. While third parties can create their own accounts on Instance_Case3, they cannot upload their own videos. In fact, the instance does not host any videos itself. The accounts on Instance_Case3 are intended solely for viewing and commenting on videos on a federated instance (Instance_Case3.1). The latter does not allow everyone to sign up for an account but offers selected personalities and organisations channels for uploading their own videos. In this sense, Instance_Case3 is acting as a sort of interface for Instance_Case3.1. This instance is reserved for some pre-selected channels. Consequently, an analysis of the data on Instance_Case3 and Instance_Case3.1 reveals major differences.

While only eight accounts are registered on Instance_Case3.1, a total of 3,767 are registered on Instance_Case3 (as of July 2022). The first two accounts were registered on Instance_Case3 in July 2021. This was followed by a three-month period, during which no new accounts were registered on this instance. Since accounts were still being set up on the federated Instance_Case3.1 during the preceding months, it can be assumed that the infrastructure was at that time still under construction. In November 2021, Instance_Case3 recorded 339 new accounts. The number of new registrations on Instance_Case3 rose to 865 in December. No new accounts have been registered on Instance_Case3.1 since February 2022. Registrations maintained a relatively high, stable level over the following months, before falling to 328 in April. This number then continued to fall, eventually reaching a rate of just 20 new accounts in June 2022. **This reflects a trend that was also evident in the two examples discussed above: while instances were initially able to attract large numbers of new users after they have been set up, most were unable to maintain this. As this rate continuously dropped off, the number of new registrations one year later was only a fraction of what it was before.**

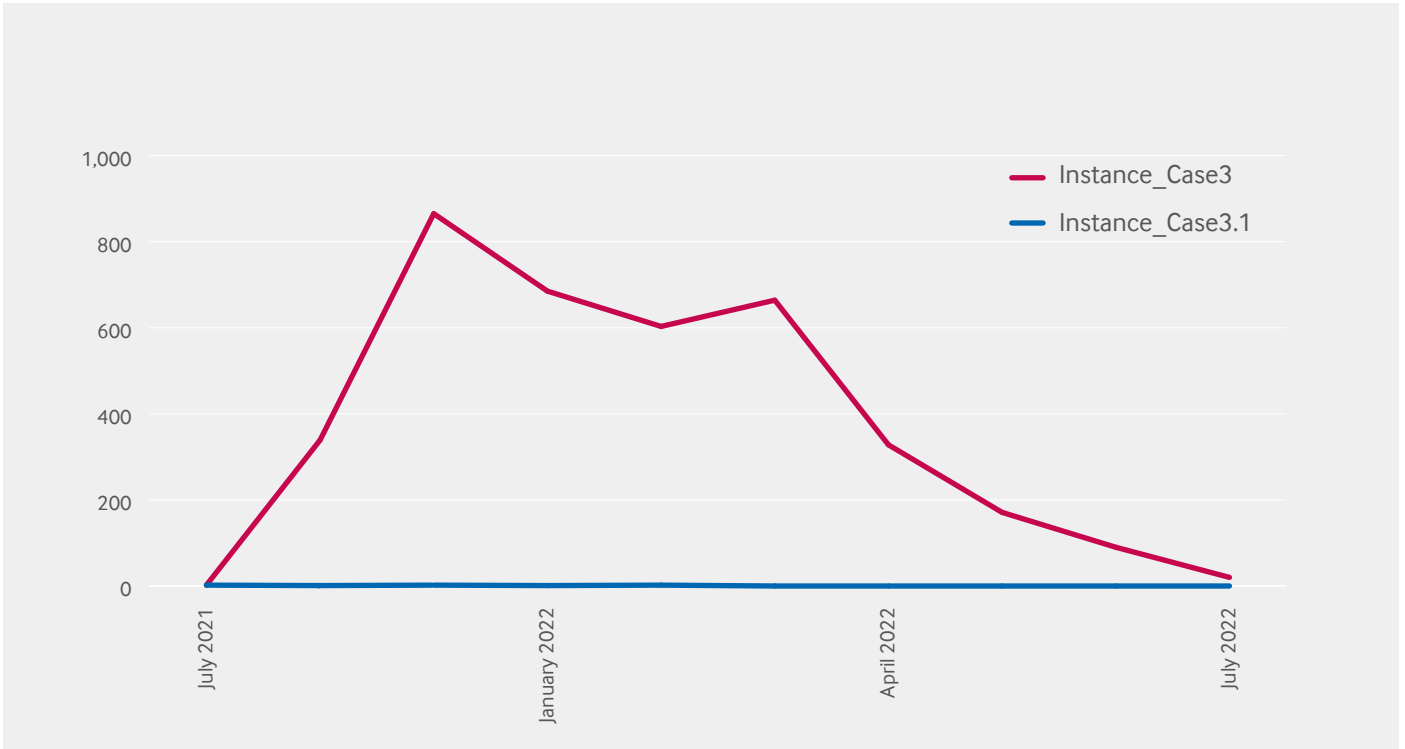


Fig. 17: Timeline of account registrations on Instance_Case3 and Instance_Case3.1

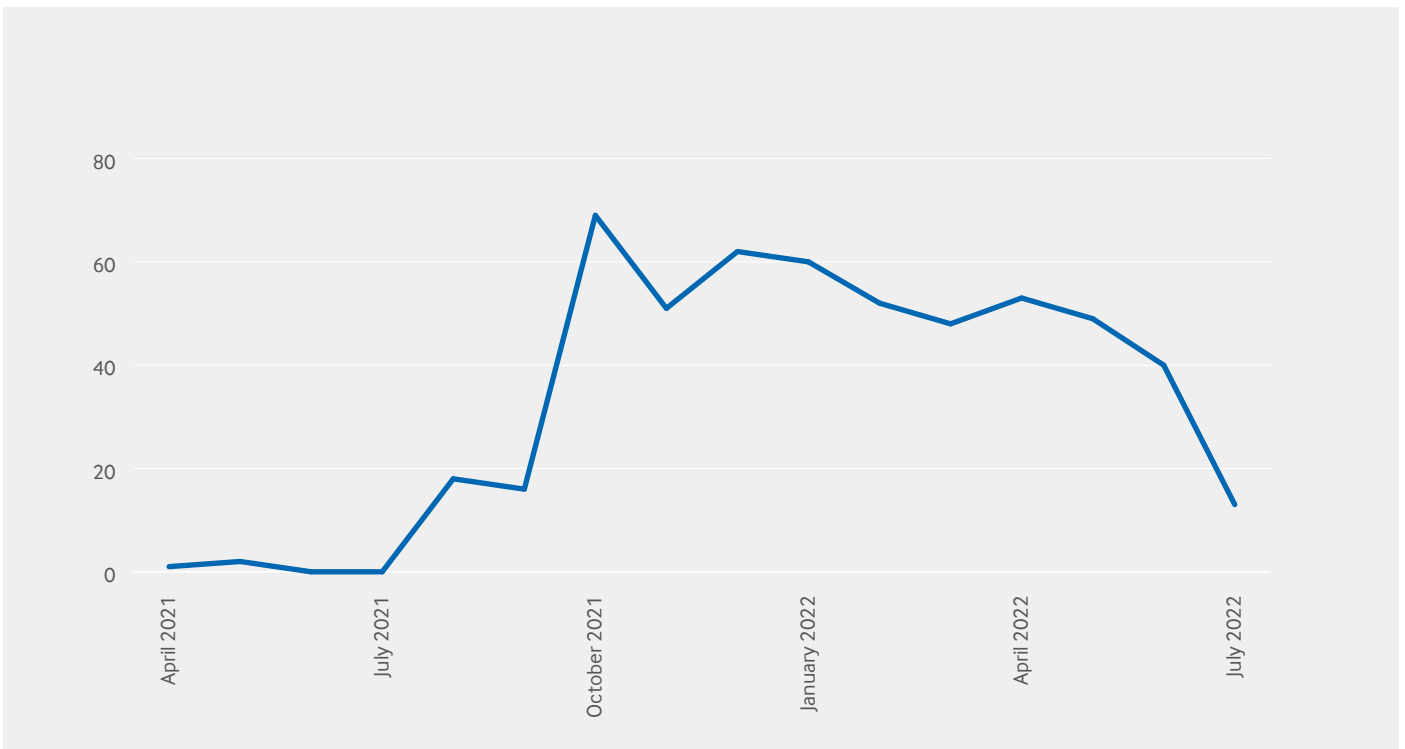


Fig. 18: Timeline of videos uploaded to Instance_Case3.1

Because Instance_Case3 does not host any videos, the following statements relate only to the data on Instance_Case3.1, which is federated with Instance_Case3. After uploading one video in April 2021 and two in May of the same year, this instance remained inactive for a period of two months. 18 videos were uploaded in August 2021, and 16 in September of the same year. The continuous uploading of videos began in October 2021 at 69 videos, after which uploads remained relatively stable, with occasional fluctuations. Until October 2021, all uploads originated from the far-right esotericist's channel. Other accounts only began uploading videos to Instance_Case3.1 in autumn 2021.

The videos from April and May 2021 received just 204 and 1,035 views respectively. In August 2021, an explosion in the number of views to 176,082 can be observed. Viewing figures remained above 300,000 from October 2021 onwards, before peaking at 368,438 in March 2022. Following this peak, however, viewing figures decreased, falling by some 60% by June 2022.

Breaking down the data on Instance_Case3.1 by channel shows that the most activity came from two channels:

the aforementioned far-right esotericist's channel, and a self-described "satire" channel. The far-right esotericist's videos make up 37% of all videos on the instance, while the "satire" channel's videos account for nearly 46%. The right-wing esotericist's videos account for two thirds of total views, with the "satire" channel's views making up one third. The remaining channels attracted just 3% of views. While the right-wing esotericist's videos were clearly the most popular up until April 2022, his viewing figures suddenly dropped off, despite there being no drastic decrease in the frequency of uploads. Although the "satire" channel's videos did not achieve the same popularity as the right-wing esotericist's content, the viewing figures remained relatively constant.

Similar to the two case studies discussed above, the federated instances Instance_Case3 and Instance_Case3.1 also have prominent channels which attract most audience attention. It appears as if interactions with an instance largely depend on the popularity of individual personalities. What is striking about Instance_Case3.1 is the decline in viewing figures on the far-right esotericist's channel, despite no significant decrease in video uploads.

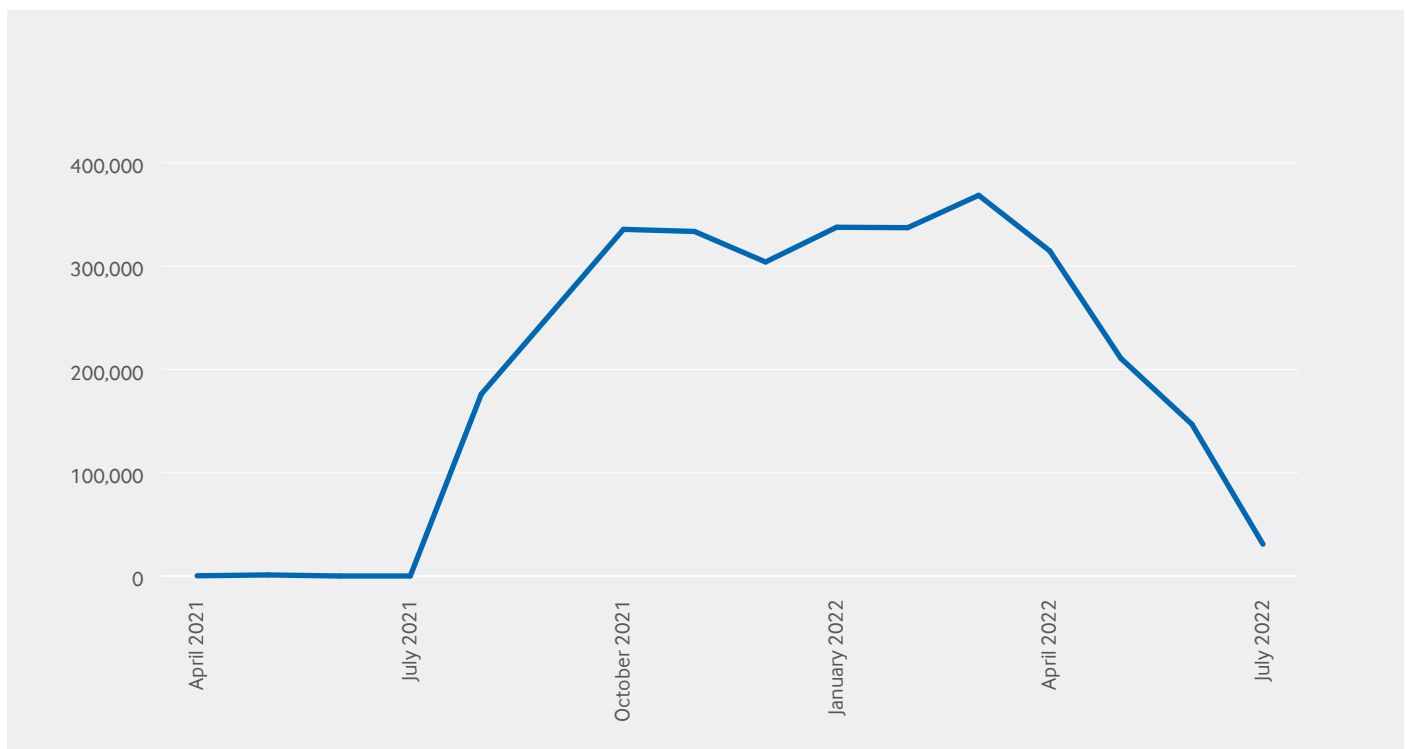


Fig. 19: Timeline of video views on Instance_Case3.1

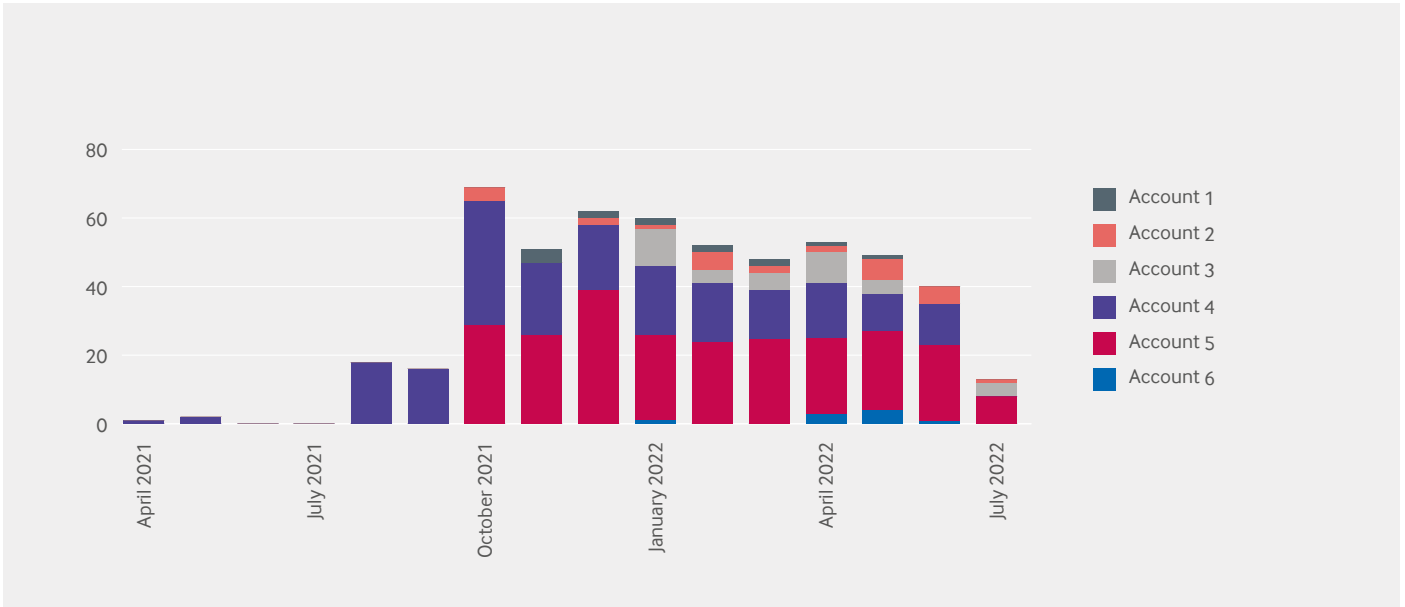


Fig. 20: Timeline of videos uploaded to Instance_Case3.1 by channel

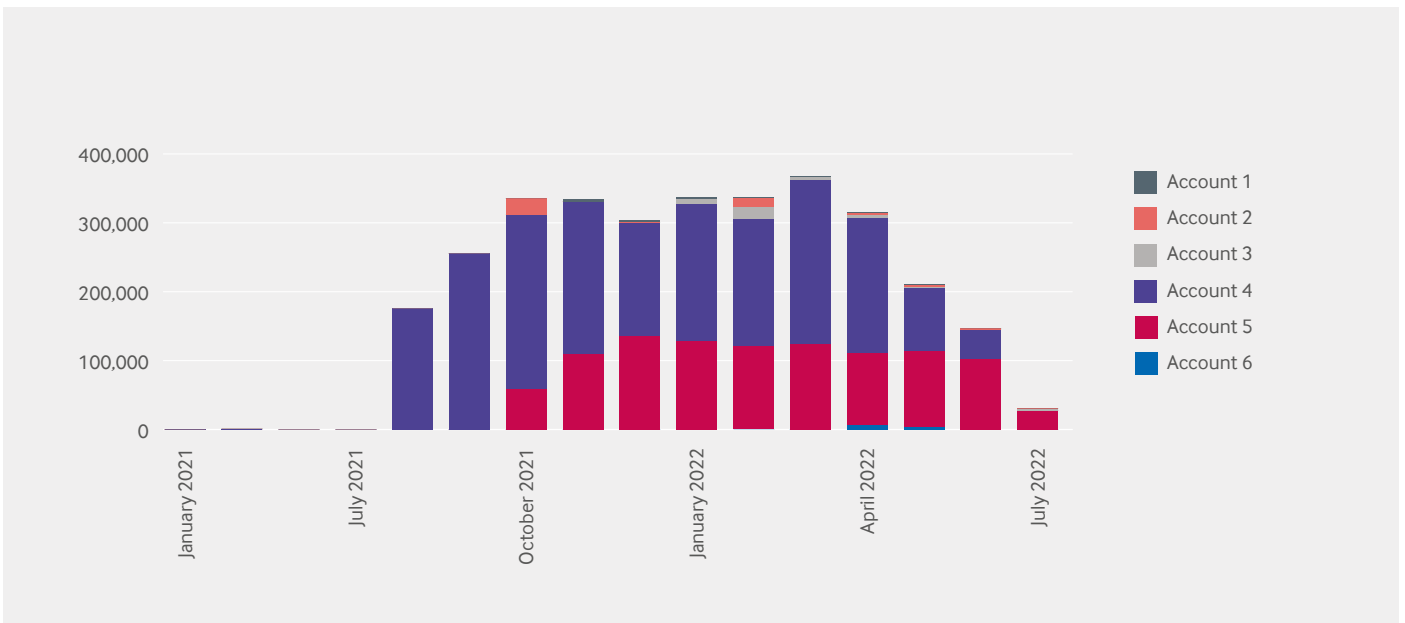


Fig. 21: Timeline of video views on Instance_Case3.1 by channel

The infrastructure of Case 3 as a whole, in that it comprises two instances, is also interesting. Unlike Cases 1 and 2, most users are not able to upload videos. Instead, they can only comment on videos from selected channels by registering via a separate instance.

On the video instance Instance_Case3.1, news formats which address more than one topic are particularly prevalent, accounting for 37% of analysed videos. In these videos, subjects such as COVID-19 and associated public health measures, as well as the Russian invasion of Ukraine and the resulting energy crisis, are addressed with notable frequency. The second-largest category is

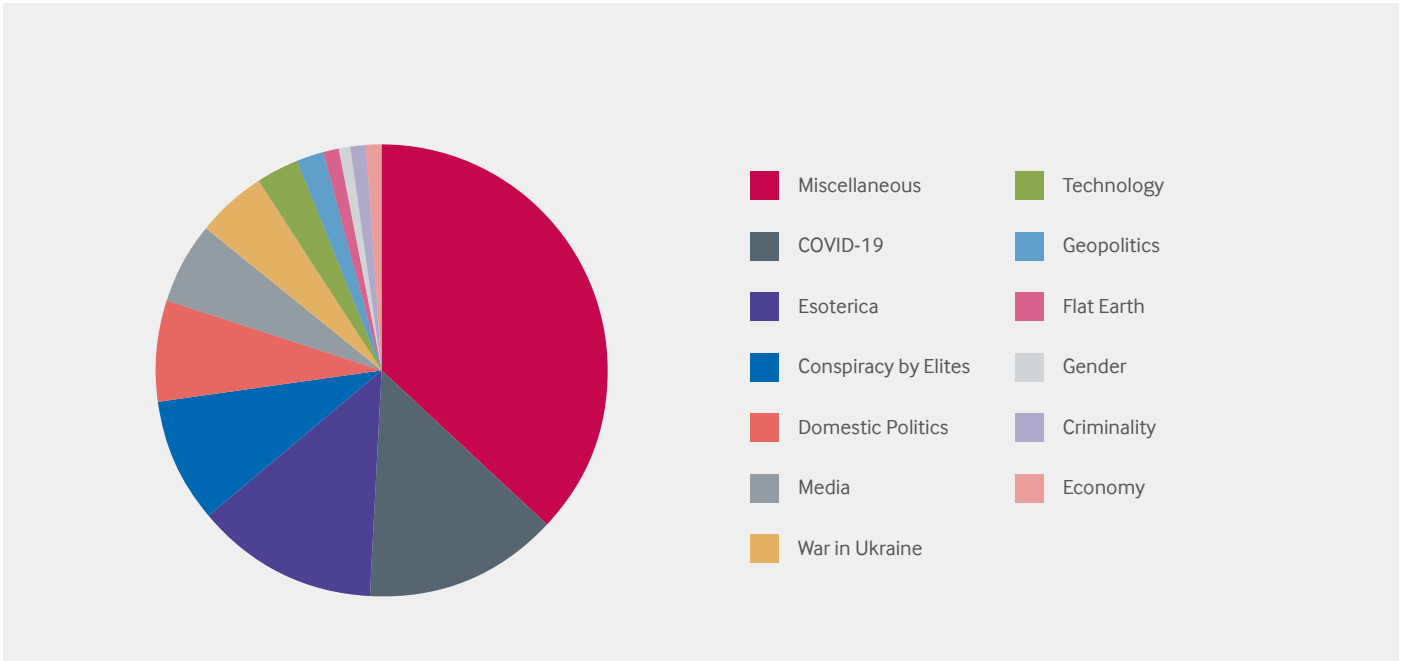


Fig. 22: Overview of subject matter of videos on Instance_Case3.1

COVID-19, accounting for 14% of videos. 13% of videos focus on esotericism and spirituality, while 9% speculate on a supposed conspiracy among sinister elites.

Case 4 (Instance_Case4, Instance_Case4.1, Instance_Case4.2, and Instance_Case4.3)

Case 4 comprises instances connected to a known conspiracy theorist. Similar to Case 3, Case 4 employs an infrastructure comprised of different servers, without connecting to the wider Fediverse. InstanceCase_4 does not host any videos but does follow two other related instances where videos are stored. Thanks to the federation system, all videos can be viewed via Instance_Case4. The instance does have a “Code of Conduct” prohibiting behaviour such as “far-right or far-left ideology, racism, and hate speech”, but it is unclear who these rules are supposed to apply to since third persons cannot register accounts on Instance_Case4 and thus cannot leave comments on videos.

Since outside parties cannot set up accounts on the related instances, the number of account registrations is very small. In November 2021, accounts were registered on four different instances belonging to the Case 4 network. One of these, Instance_Case4.2, is no longer accessible and it was not possible to collect any data on this server. Following this, new accounts were only set

up on a new related instance, Instance_Case4.3. The following data suggest that this is the newest server for uploading videos.

This change in server is easy to identify on the video upload timeline. Up to and including October 2021, all videos were uploaded to Instance_Case4.1. The server appears to have been switched in November 2021. Only 23 videos were uploaded to Instance_Case4.1 in that month, while a full 45 videos were uploaded to Instance_Case4.3. For the rest of the observation

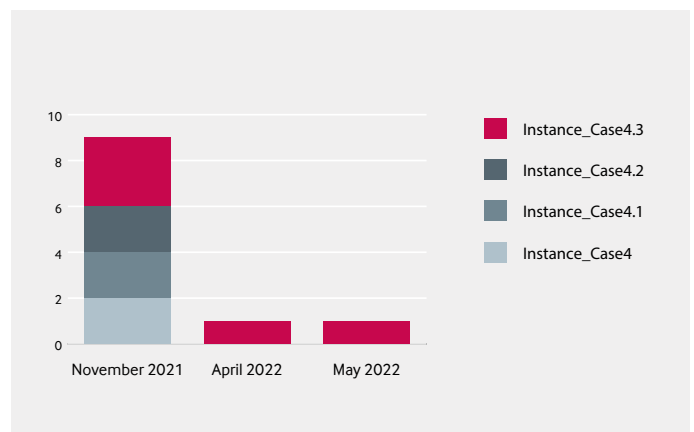


Fig. 23: Timeline of account registrations on the network of Case 4

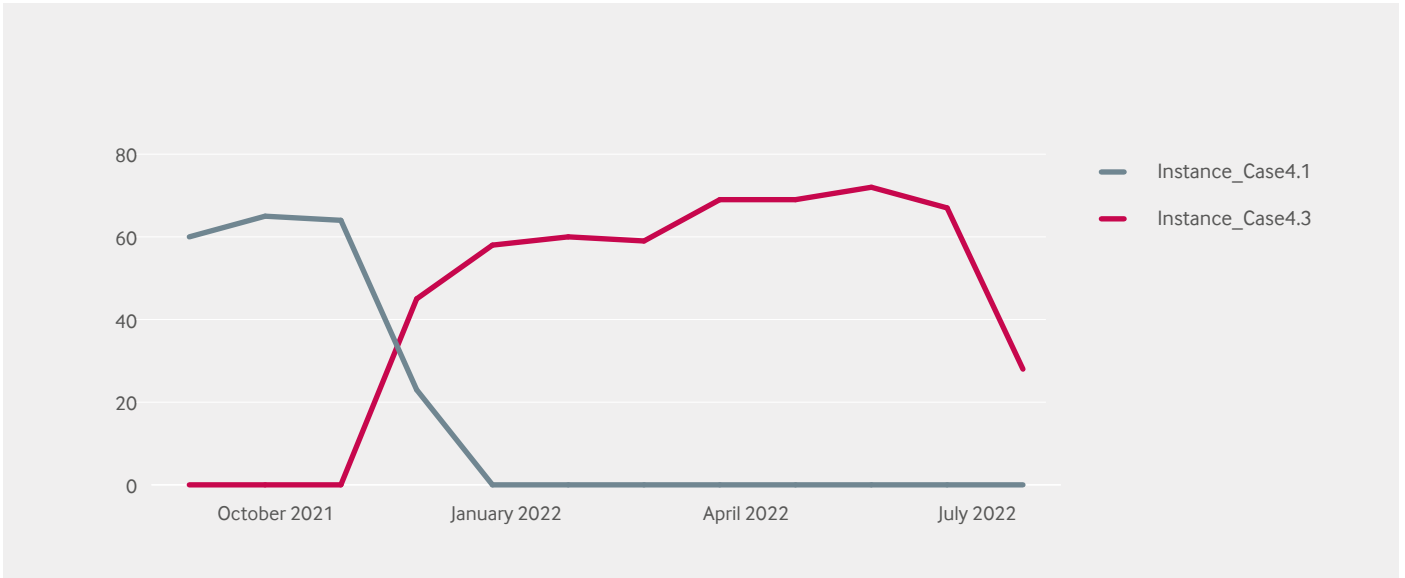


Fig. 24: Timeline of videos uploaded to the network of Case 4

period, all videos were uploaded to this instance, with a regularity similar to the period before the server switch.

The switch in server is also noticeable with respect to video views. However, it does not appear to have had any major impact on the popularity of the videos. With over 520,000 views, the videos from March 2022 were the most frequently viewed. The click rate, however, remained stable, other than the occasional fluctuation.

Consequently, the Case 4 network was able to retain more viewers than instances such as Instance_Case2 or Instance_Case3.1. This suggests that permitting registration of new accounts is no guarantee for more views.

COVID-19 is a prominent topic on the instances investigated in Case 4. The pandemic is the most frequent topic of discussion, accounting for 35% of all videos analysed. At 13% of videos, the second-most frequently discussed

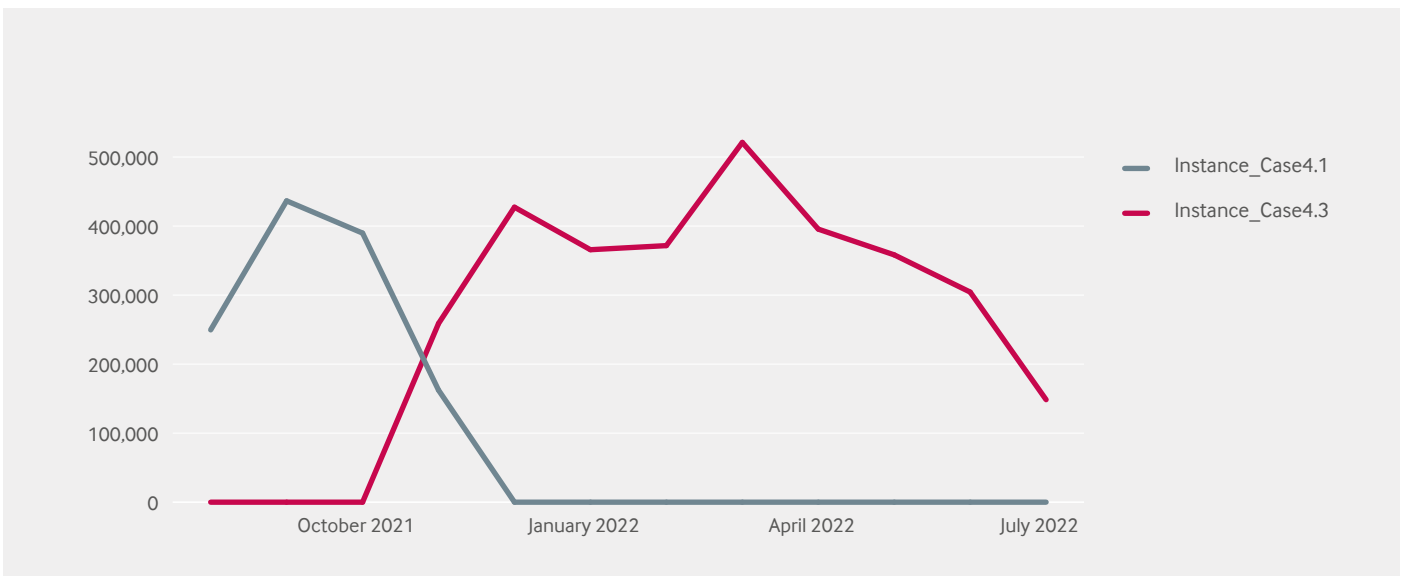


Fig. 25: Timeline of video views on the network of Case 4

topic is the war in Ukraine (since February 2022). 11% of all videos are about a conspiracy perpetuated by sinister elites. 10% of videos tackle the media, mostly by discrediting public broadcasters and established newspapers. 9% address other geopolitical issues.

The Case 4 network illustrates how the popularity of videos on PeerTube appears to be strongly connected to individual personalities or organisations. While the Case 4 network does not permit registration of accounts, it still pulls in more viewers than most other seed instances. This network is also part of a more widely observed trend wherein most of the seeds investigated do not connect with the wider Fediverse network. Instead, the PeerTube software is used to build a non-deletable archive. The change of instance could signal a general issue facing users of self-hosting solutions on video platforms, namely that they require new servers as soon as storage space becomes tight.

Case 5 (Instance_Case5)

This instance is apparently run by a private individual as a hobby. Unlike many other seeds, Instance_Case5 has extensive rules on moderation. For example, depictions of violence, hate-filled or discriminatory content, as well as abuse and harassment are all prohibited. Unlike most other seeds, Instance_Case5 is heavily networked and follows hundreds of other instances. In the network analysis, this instance proved to be one of the most heavily linked seeds. However, as a result of this extensive networking, the instance also offers a platform for content that violates its own rules.

In contrast to its extensive network, Instance_Case5 itself has only a very few accounts registered. At the time of data collection, there were 15 accounts, all from summer 2022. The number of videos uploaded to the instance itself was also comparatively low, at 24 videos. Many videos are about films or music from the niche genre “Psychedelic Space Rock”. The number of views is also low.

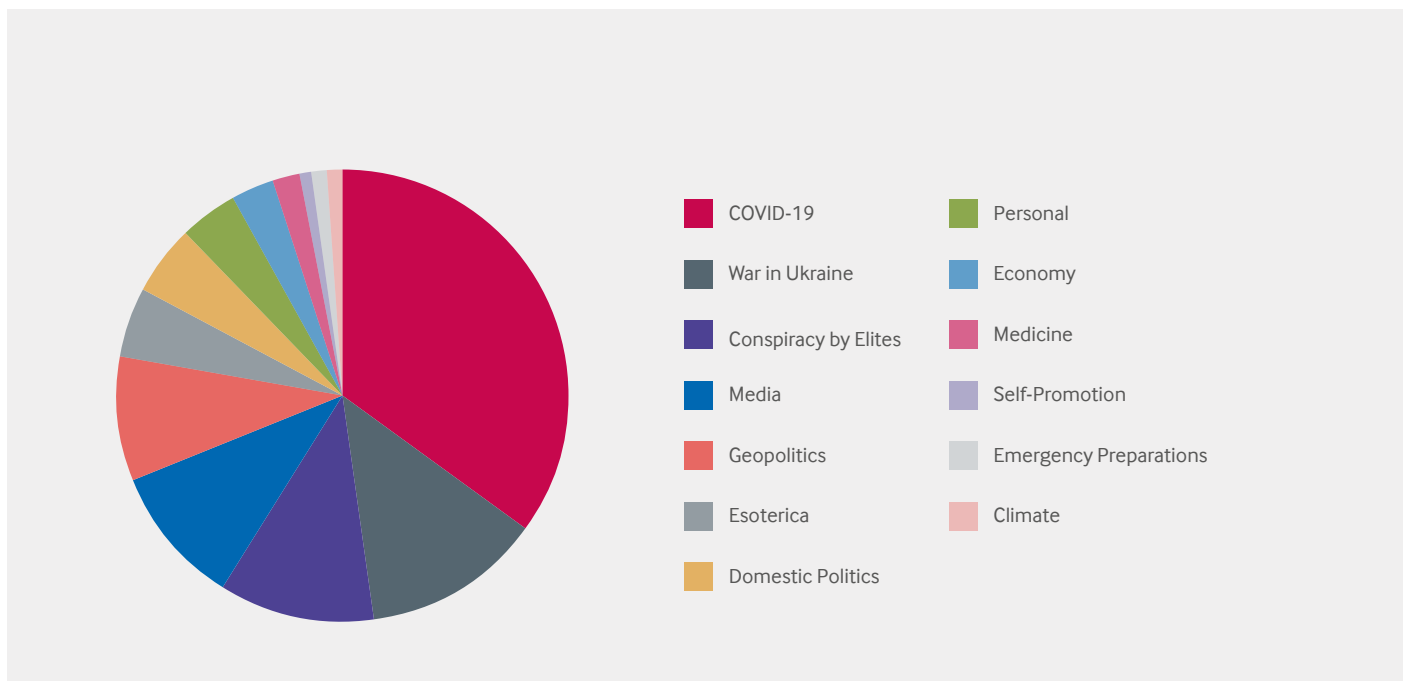


Fig. 26: Overview of subject matter of videos in the network of Case 4

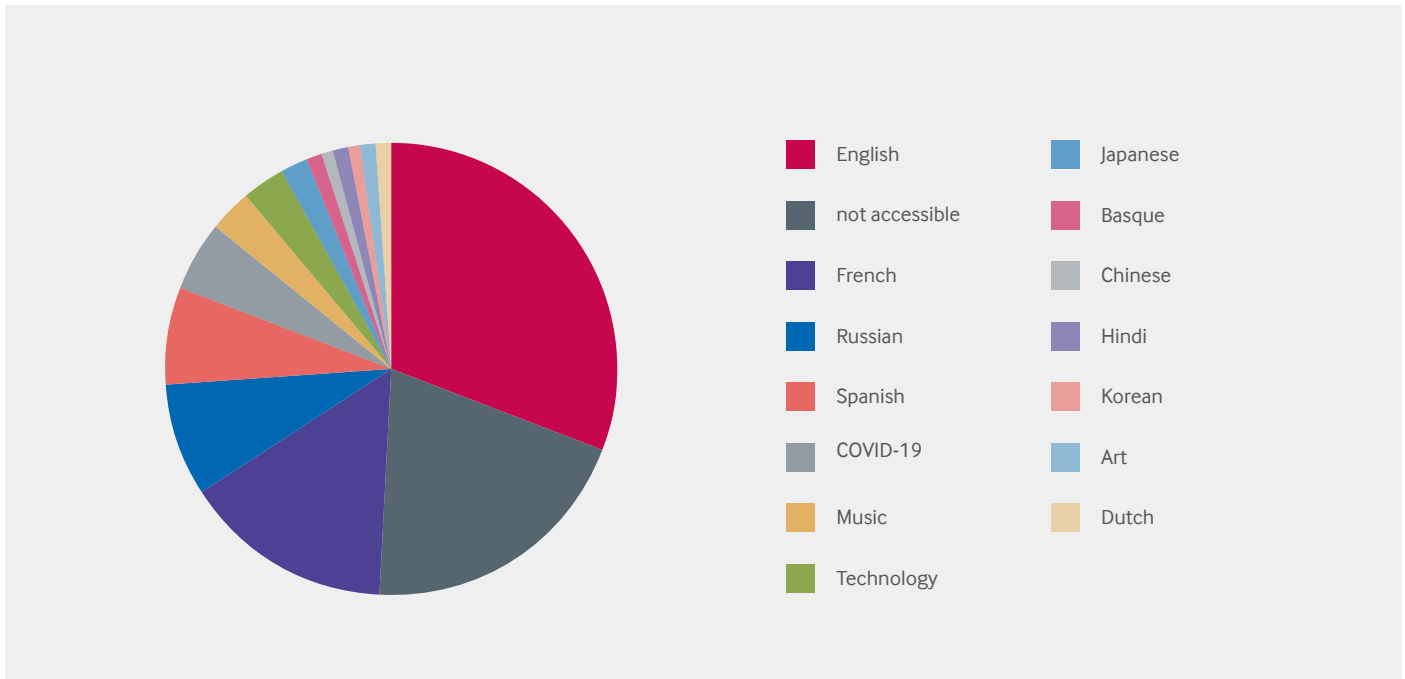


Fig. 27: Overview of subject matter of videos in Case 5

Since Instance_Case5 is heavily federated, the videos are diverse not only in terms of their content, but also their language. To avoid analyzing the content of videos in foreign languages which the team does not speak, all non-German videos were coded only with their respective language code. A fifth of all investigated videos were not in German or could no longer be accessed. Instead, most videos were in English (31%), French (15%), and Russian (8%). The German-language videos predominantly addressed COVID-19, which was the case for 5% of the videos investigated.

Although most videos uploaded to Instance_Case5 were neither extremist nor conspiratorial, and even though only a fraction of the federated videos were in German, it was easy to find videos on the instance which not only violate its own rules on moderation, but which could also be in breach of the law.

At the time of analysis, the livestream of the Christchurch 2019 terror attack was still available on the Trending page under the header “Kebab removal NZ”. The title of the video plays on a propaganda song honouring the war criminal Radovan Karadžić.⁴⁹ Instance_Case5 is also federated with countless German-language instances from the far-right conspiracy scene. Consequently, visitors can watch videos from the instance of a Reichsbürger who conducted a video interview with a convicted Holocaust denier. The videos of Alina Lipp, a vlogger in Donbass who German authorities are investigating for her approval of an illegal war of aggression, can be viewed via a federated instance focusing on the dissemination of German-language disinformation.⁵⁰ The federation system also makes it easy to view English-language videos denying or trivialising the Holocaust.

Differences Between the Case Studies

Each of the cases analysed indicates the differing effects regulation has on major platforms, and equally the potential pitfalls involved in regulating PeerTube instances. Case 1 is spreading disinformation which, while harmful, is not illegal. Case 2 is an example of back-up services for movements and persons suspended by major platforms. Regarding Instance_Case2, the movement which the instance belongs to is reacting to the deletion of its videos by a major platform. At the same time, it is not possible to reach a similarly wide audience on this alternative platform. Case 3 cannot easily be classified as a social network. While all users who have an account on Instance_Case3 can comment on videos, the ability to upload content to Instance_Case3.1 is reserved for just a handful of people and organisations. Case 3 appears to represent a mixed format, comprising a video archive and social network. Case 4 is similarly difficult to categorise. Currently, videos are only uploaded by the operators. It is also not clear whether the platform is being operated with an “intent to make a profit” in the words of the Network Enforcement Act. While it is possible to view the videos free of charge, the instances also belong to a media network and outline ways in which users can make donations. Case 5 shows the consequences of the federation system for platform moderation. While Instance_Case5 does not host any illegal content itself and claims to moderate content, terrorist and anti-constitutional videos on federated instances can be viewed there.

Potential Responses

PeerTube instances and other platforms which were created using “free software” pose different challenges in terms of the regulation of illegal and anti-democratic content compared to centralised platforms maintained by companies such as Meta or Google – not least because there is no central authority that can be legally obliged to block illegal content across all instances. Depending on the licence, developers of a piece of software cannot prevent extremist groups or individuals from using their

code for their own purposes. PeerTube is a free software, meaning that it can be used, copied, and modified by anyone. The basic idea is that users control the program, not the other way around.⁵¹

The term “free software” covers a similar spectrum of programs and licences as “open source” software. However, the philosophies behind both concepts differ. According to Richard Stallman, founder of the Free Software movement, “open source” refers to programs that are freely available for pragmatic reasons, with no ideological principles, while “free software” is “a movement for freedom and justice.”⁵² This differentiation, and the question of whether these two principles are in fact mutually exclusive, is a matter of debate. What is clear is that “free software” is not a neutral term, rather it implies ethical principles.⁵³ A particular matter of concern here is the avoidance of proprietary software which is considered “asocial” and prevents cooperation and community, all the way to a system which is available to everyone to modify and improve.⁵⁴

Far-right extremists cannot be prevented from using “free” and “open-source” software, which makes it sometimes difficult to enforce the law. Yet at the same time, the decentralised structure of the Fediverse creates opportunities for new approaches to (self-) regulation by the Fediverse community, where regulatory approaches have been established beyond the removal or non-removal of content. Examples include the coordinated isolation of certain instances by community-curated blocklists, which individual instances are free to use, such as in the case of Gab.⁵⁵ Developers of so-called plug-ins can also set specific codes of conduct for users. Moreover, requirements can be set for adding instances to searchable indexes,⁵⁶ such as the Sepia Search functionality on PeerTube. PeerTube instances can only find a wider audience once they have been included in such indexes. The Sepia Search Index is therefore moderated and should not contain any instances offering content that is illegal in France, where Framasoft is based (e.g. Holocaust denial).⁵⁷

However, the broad-scale isolation of instances can also have negative consequences, especially if the problematic content comes from just a minority of users. A study into the micro-blogging software Pleroma, which is also a part of the Fediverse, found that less than 5% of the accounts on blocked instances were sharing “toxic” content.⁵⁸ The blocking of instances may be a reaction to this minority, but it also punishes the majority who are not spreading any offensive content. Therefore, this study proposes the following for tempering these side effects: 1) Creating blocklists for topics such as hate speech which are continuously curated by the community; 2) New guidelines that moderate on an account-by-account basis, e.g. using tags; and 3) New guidelines which are automatically applied to repeat offenders after a certain number of violations.

Looking Ahead

PeerTube and the Fediverse as a whole, which was developed as part of a movement to democratise the internet, run the risk of being misused by opponents of democracy for their own ends. Preventing such misuse requires approaches to regulation which go beyond solely legal measures. Instead, moderation in the Fediverse must rely more heavily on community action from users. Law enforcement in the Fediverse in general, and on PeerTube in particular, is facing new challenges due to the decentralised nature of the instance networks.

As the technology proliferates, these challenges will only become more pressing. For this reason, the ISD Germany research team is going to tackle the implications of PeerTube and its decentralised structure with respect to regulation in more detail in its 2022 summary report on the “Combating Radicalisation in Right-Wing Extremist Online Subcultures” project. As Twitter users migrate to the Fediverse software Mastodon following Twitter's takeover by Elon Musk, the reach of these alternative platforms and awareness of the Fediverse will increase - in part due to the rising number of media reports on Mastodon. This trend could further advance the infiltration of Fediverse platforms by extremists. There is therefore a need for more intensive research into the technological and social aspects of the use of the Fediverse by extremists and conspiracy theorists.

Endnotes

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- 43 The same reservations as are mentioned under the network analysis must also be taken into consideration in the following data analyses, such as the reservation that instances do not synchronise their data at the same time and that it was not possible to collect complete information on all instances due to a number of different error messages.
- 44 See "Telegram as a Buttress" 2021. p. 18.

- 45 This instance resembles another instance which was originally included in this study as a seed but subsequently had to be removed due to error messages received during data collection. It is possible that the change in domain name caused this problem.
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