National Cyber Security Centre

a part of GCHQ

prompt: An image showing the positive ways in which AI will help to nurture our ecosystem in a cyber security landscape, securing an open and resilient digital society

Annual Review 2023

Making the UK the safest place to live and work online

A note on our front cover, produced with artificial intelligence (AI)

The front cover of this year's Annual Review, along with the illustrations included within, were created using an image generator, powered by artificial intelligence (AI). Working closely with a design agency, we wanted to explore the opportunities that AI presents as well as its limitations.

This effort has been an iterative one, as initial prompts used included 'cyber security', 'future' and 'technology'. These prompts alone generated the stylised green coding, dark quasi-dystopian images and men in hoodies hunched over laptops which we have become accustomed to, reinforcing a stereotypical representation of cyber security.

When asked to show people within these images, biases were common, too.

When we amended the prompts to incorporate 'inclusion', 'open and resilient society' and 'diversity', the images began to change – and with our design agency, we created a front cover which better aligns to the kind of future the NCSC aims to shape for the whole of society.

These tools will have their uses but what this exploration reinforces is that an inclusive, diverse, and open future of cyber security requires our collective intent – it will not happen organically, without effort.

Generative AI tools pose ethical, legal, and existential questions which society is grappling with, and will continue to grapple with, for years to come. While AI as an emerging technology presents a huge opportunity for global governments and wider society, in the context of increasing interest and intrigue from the UK public, it's vital that those using these technologies understand the cyber security risks, as our CEO Lindy Cameron warned earlier this year.

It is incumbent on us all to use AI responsibly and for us at the NCSC, working with industry and governments around the world to ensure that cyber security is thoroughly considered during the development of new AI technologies.

About the NCSC

The National Cyber Security Centre (NCSC), a part of GCHQ, is the UK's technical authority for cyber security. Since 2016, it has worked to make the UK the safest place to live and work online, and bring clarity and insight to an increasingly complex online world. This review of its seventh year reflects highlights and milestones between 1 September 2022 and 31 August 2023. It also looks ahead to future challenges.

As part of a national security agency, not all its work can be disclosed publicly but the review seeks to describe the year with insights and facts from colleagues inside and out of the organisation.

Contents

Timeline

2022

7 September
Lindy Cameron discusses international collaboration in deterring malign actors with industry, at the 13th Billington Cyber Security Summit in Washington

8 September
The NCSC mourns the death of Her Majesty the Queen whom we will always fondly remember for officially opening our doors in February 2017

20 September
The UK and our allies expose Iran's Islamic Revolutionary Guard Corps for exploiting cyber vulnerabilities for ransomware operations

12 October
The NCSC issues fresh guidance following recent rise in supply chain cyber attacks

14 November
Cyber Aware campaign launched to help keep online shoppers more secure in the run up to Christmas

9 December
The NCSC and DCMS publish code of practice for app store operators and app developers

2023

11 January
The NCSC provides support to Royal Mail following a cyber attack

19 January
The NCSC hosts members of the national Computer Emergency Response Team for Ukraine (CERT-UA) to discuss Russia's illegal invasion and building cyber resilience

3 February
Lindy Cameron visits India for a series of meetings with cyber security leaders on the shared opportunities and challenges the UK and India face in cyberspace

6 February
13 national teams claimed victory at the 2023 CyberFirst Girls Competition finals

27 February
Lindy Cameron speaks about the importance of good cyber hygiene among the public sector at Cyber Security Scotland

14 March
The NCSC publishes thought leadership piece on the security of large language models, following the rise in popularity of ChatGPT

21 March
The NCSC urges organisations to utilise its Cyber Action Plan and Check Your Cyber Security services as part of its Cyber Aware campaign

11 April
Anne Keast-Butler announced to succeed Sir Jeremy Fleming as the Director of Government Communications Head Quarters (GCHQ)

13 April
The NCSC and international partners share new advice to encourage software manufacturers to embed secure-by-design and secure-by-default principles into their products

17 April
The NCSC's Cyber Advisor launches to support small and medium-sized businesses without in-house cyber expertise

19 – 20 April
The UK's flagship cyber security conference CYBERUK is held in Belfast for the first time

19 April
New NCSC report assesses the threat to UK industry and society from the use of commercial cyber tools and services

19 April

The NCSC issues warning of emerging threat to critical national infrastructure from a new class of state-aligned cyber adversary

20 April

UK and international partners publish joint guidance to help communities create secure smart cities

9 May

UK and international allies issue joint advisory exposing Snake malware and its use in operations carried out by Centre 16 of Russia's Federal Security Service (FSB)

13 May

The NCSC provides support to the Eurovision Song Contest to improve cyber security resilience

24 May

UK and its allies issue new warning about China state-sponsored cyber activity targeting critical national infrastructure networks

7 June

The NCSC works with UK organisations to respond to the MOVEit vulnerability and data extortion incident and publishes guidance

14 June

UK and international partners issue a new joint advisory warning of the enduring threat posed by the LockBit ransomware operation

14 June

Lindy Cameron emphasises the importance of building security into AI technologies in a major speech at the Chatham House Cyber 2023 conference

30 June

The NCSC marks 20th anniversary of first response to state-sponsored cyber attack

6 July

The NCSC's sixth annual Active Cyber Defence (ACD) report highlights success in preventing millions of cyber attacks from reaching the UK

23 July

New shadow IT guidance published to help organisations manage rogue devices and services within the enterprise

3 August

The NCSC and allies reveal most common cyber vulnerabilities exploited in 2022 in new advisory

24 August

The NCSC launches the research problem book, laying out the areas of cyber security that need cooperative research over the next 5-10 years

31 August

UK and allies support Ukraine calling out Russia's GRU for new Infamous Chisel malware campaign

Ministerial foreword

We live in a dangerous, volatile world. The events of the last year have demonstrated the extent to which geopolitical crises and technological change impact us all, threatening not just our traditional security but our economic security.

The new front line is online. As this Annual Review shows, the methods of attack are proliferating. The number of hostile state and non-state actors with access to such tools is growing. The ways in which these countries, organisations and individuals can do us harm – from bots undermining our democracy, to hacks disrupting our public services, to ransomware attacking our businesses – is expanding. The rapid rise of artificial intelligence is accelerating the pace of change, compounding the threats and lowering the barrier to entry. As a result, the cyber world is a more dangerous place than ever before, and cyber security is rising up our risk register.

The Government treats cyber security with the same urgency and importance as we treat our traditional defences. The National Cyber Security Centre is on that frontline, building and maintaining our resilience in the face of a rapidly expanding array of threats. Indeed, this year's Annual Review demonstrates how the NCSC continues to lead the way, producing expert analysis of new technologies and emerging risks and opportunities. This technical expertise underpins our collective efforts to tackle threats from malicious cyber actors, and demonstrates the NCSC's world-class advisory function.

Given the pace of change, it is vital that we get ahead of these fast-developing technologies to ensure the right mitigations are in place before the risks emerge. That is why the UK hosted the first ever AI Safety Summit in Bletchley Park in November 2023. Through that summit we started to spearhead a new form of multilateralism, one that brings together countries, companies, academics and other experts in the field. Because it is only by working together that we will make AI safe for everyone.

That same approach is needed towards cybersecurity more broadly. We need a whole-of-society approach, where Government and industry work in partnership - to defend as one - to make us all more resilient as a nation. And those who can must work to shift the burden away from end users and increase protections for all of us, as we increasingly live our lives and do our work in the virtual world. As I said to CYBERUK in Belfast in April, I urge businesses to look again at their security and strengthen it where they can. In turn the government will do its bit, including through the National Protective Security Authority.

This next year will come with new challenges. But by working together in partnership, underpinned by our values and alliances, and by building on the vital work of the NCSC to make the UK the safest place to live and work online, we will be ready for them.

The Rt Hon Oliver Dowden CBE MP

Deputy Prime Minister and Chancellor of the Duchy of Lancaster, and Secretary of State in the Cabinet Office

Director GCHQ

Since my appointment as Director GCHQ earlier this year I have been hugely impressed by the efforts of our cyber security experts at the NCSC. The sheer breadth of our work is neatly captured in this review's timeline of activities over the past 12 months. Joining international partners in calling out the activities of malicious actors, producing timely guidance to help organisations stay secure and delivering an outstanding CYBERUK conference in Belfast are just a few of the ways the NCSC has been working to keep us all secure online.

The context in which the NCSC operates continues to be challenging. Cyber security remains a priority as part of GCHQ's overall support to Ukraine in the face of Russia's illegal invasion, as does the NCSC's response to new and emerging threats, including that to critical national infrastructure (CNI) from state-aligned actors.

The recent acceleration of progress – and media attention in – the field of artificial intelligence (AI) cannot have escaped anyone's attention, and this of course has major cyber security implications. AI has the potential to improve cyber security by dramatically increasing the timeliness and accuracy of threat detection and response, and while AI offers fantastic opportunities, all sectors need to be clear-eyed about the related cyber security risks. The NCSC has been championing the case for taking a 'secure by design' approach to AI, by building cyber security into technology solutions from the outset. Another vital consideration is to ensure diversity and ethics are built into every stage of AI's development. Potential limitations and biases are cleverly demonstrated by the NCSC's use of AI to create images for this review.

We can trace the roots of AI to GCHQ's beginnings in Bletchley Park, where the government's 2023 AI Safety Summit took place. In Bletchley, as in GCHQ today, our brilliant people, technology and tradecraft have always invented and mastered new technology to make sense of data and protect the UK from harm.

In an unpredictable world where technology evolves at ever greater speed, the NCSC has always adapted to opportunities and challenges. I have no doubt that with our range of technical expertise and collaborative spirit the organisation will continue to do so.

Anne Keast-Butler
Director of GCHQ

CEO NCSC

I am very proud to present the seventh Annual Review of the National Cyber Security Centre, a part of GCHQ. Today, seven years on, our mission remains to make the UK the safest place to live and work online.

We must continue to adapt to meet ever-evolving cyber security challenges. Whether these come in the form of rapid development of technologies such as Artificial Intelligence (AI) or state adversaries seeking to gain advantage over us, we must ensure that the UK, as a responsible cyber actor, stays (at least) one step ahead.

In this year's Annual Review, we reflect on key developments, achievements and trends from the last year. We've also included five areas of specific interest to the cyber security community – setting out the NCSC's thinking on **AI cyber security**, on **securing the UK's Critical National Infrastructure**, on **defending our democratic processes**, the future of **UK cyber security services** (including the NCSC's role in their provision), and reflecting back on **what we have learned from Russia's further invasion of Ukraine**.

To make sure that the NCSC continues to focus our work where it is most needed, and to deliver against the objectives in the government's National Cyber Strategy, we will focus on three priorities over the coming year.

First, we must **improve the UK's cyber resilience** to the most significant cyber risks. We will continue to improve our understanding of the threats we face and use this knowledge to strengthen resilience in the areas that carry the most risk for the UK, be that across government or to the companies involved in delivering our critical national infrastructure. We have learned a lot about our resilience in light of the ongoing war between Russia and Ukraine, which remains the most sustained and intensive cyber campaign ever. But as the threat landscape evolves, we will need to measure the impact we can have on resilience, as well as work with others to maximise our success.

Secondly, we must **retain our edge**. Technology is developing faster than ever, and, in an increasingly unpredictable world, our adversaries are seeking to use this change for their own advantage. We must ensure the UK retains its edge in the face of future cyber security challenges, including those emanating from China, which we know poses an epoch-defining challenge in the years to come, as well as those posed by future technology shifts. We will need to ensure that the technology we deploy throughout our economy is secure by design, and that we have the technological capabilities and partnerships for the future to enable us to counter these threats as they evolve.

And finally, the NCSC will only be successful in its mission if **we are the strongest organisation we can be**. We must continue to evolve as the UK's national technical authority on cyber security, deepening our expertise and continuing to increase the diversity of our workforce. We will continue to listen to and learn from external specialists, ensure our services work for those who use them and engage in public debates about the implications of evolving technology for our democratic values.

Lindy Cameron

CEO of the National Cyber Security Centre

Chapter 1

> **Threats and Risks**

The global threat landscape is ever-changing, so it has never been more important for the NCSC, as the UK's technical cyber security authority to continue to identify, monitor and analyse key cyber security threats, risks, and vulnerabilities. The NCSC enables and supports wider government and society to anticipate and respond to new and recurring challenges.

This year has seen the emergence of state-aligned actors as a new cyber threat to critical national infrastructure (CNI), the continuation of Russia's illegal invasion of Ukraine, and the concerns around the potential risks from AI – all of which drive the need for NCSC interventions and support.

The key threats the NCSC continues to track and respond to include:

China

The rise of China as a technology super-power poses an epoch-defining challenge for UK security and, as NCSC CEO Lindy Cameron highlighted in her speech at this year's CYBERUK, we risk China becoming the predominant power in cyberspace if our efforts to raise resilience and develop our capabilities do not keep pace.

With our partners, we continue to see evidence of China state-affiliated cyber actors deploying sophisticated capability to pursue strategic objectives which threaten the security and stability of UK interests.

In May, the NCSC and international partner agencies issued a joint advisory highlighting how recent China state-sponsored activity had targeted critical infrastructure networks in the US and could be applied worldwide. And in October, MI5 Director General Ken McCallum warned about the state threat to cutting-edge start-ups working on UK research and innovation.

The challenge is global and systemic, and close collaboration with allies and industry will be crucial in further developing our understanding of the cyber capabilities threatening the UK.

Russia

Since Russia's further invasion of Ukraine in February 2022, the NCSC has helped Ukraine to develop its cyber resilience. We continue to see further cyber activity targeting Ukraine by Russia and Russia-aligned actors. Beginning in 2022, this included a wave of distributed-denial-of-service (DDoS) and data wiper attacks against Ukrainian government and industry. However, the impact on Ukraine has been less than expected, in part due to well-developed Ukrainian cyber security and support from industry and international partners, including the UK's own cyber programme.

Iran

In January, the NCSC issued an advisory highlighting spear-phishing activity against targeted individuals in sectors of interest to Iran, including academia, defence, government organisations, NGOs, think tanks, as well as politicians, journalists and activists.[1] In July, the UK government highlighted the rising threat from Iran including increased efforts to kill or kidnap individuals perceived to be enemies of the

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1   https://www.ncsc.gov.uk/news/spear-phishing-campaigns-targets-of-interest

regime outside of Iran, including in the UK.[2] Iran remains an aggressive and capable cyber actor and will almost certainly use cyber for its objectives. The NCSC continues to work closely with government and industry partners to understand and mitigate the cyber threat from Iran.

Democratic People's Republic of Korea (DPRK)

Cyber is one of the means through which the DPRK aims to improve their poor economic situation through illicit revenue generation and sanctions evasion, to further consolidate the current regime, and to strengthen and maintain its ability to defend itself against perceived hostile actors. Raising

funds via cyber thefts is widely reported, and cyber attacks against a variety of institutions, companies, and government organisations in search of information and credentials is also prolific.

Ransomware

Ransomware remains one of the most acute cyber threats facing the UK, and all domestic organisations should take action to protect themselves from this pervasive threat. The now-normal approach of stealing and encrypting data continues to be the primary tactic cyber criminals use to maximise profits. However, data extortion attacks, in which data is stolen but not encrypted are a growing trend in the threat landscape.

Between September 2022 and August 2023, we received **297** reports of ransomware activity ('tips'), triaged into **28** NCSC-managed incidents, 18 of which were categorised as C3 and above. The top five sectors reporting into the NCSC were academia (50), manufacturing (28), IT (22), finance (19) and engineering (18). Although academia appears high in our statistics, we do not have any specific evidence of actual targeting of this sector.

2 https://www.gov.uk/government/news/uk-steps-up-action-to-tackle-rising-threat-posed-by-iran

Cyber proliferation

Commercial proliferation will almost certainly be transformational to the cyber threat landscape. Commercial cyber tools and services lower the barrier to entry to both state and non-state actors, enabling them to access cost-effective capability and intelligence they would not otherwise be able to acquire. This creates an opportunity for misuse in the absence of oversight or an understanding of how international norms apply. The NCSC continues to support government with the UK's international response working with like-minded countries, to ensure advanced commercial cyber capabilities are developed, sold, and applied in a way that is legal, responsible, and proportionate as part of the UK government's ambition to instil responsible behaviours in cyberspace.

Cyber-enabled fraud

Fraud continues to be one of the most significant threats facing UK businesses and citizens. In 2021 more than 80% of all reported UK fraud was cyber-enabled, but only 32% of UK citizens thought they were likely to become a victim. Over the past year, the UK government's Cyber Aware campaign supported individuals and small businesses to significantly improve their personal cyber resilience with two simple steps:

- use a password based on three random words
- secure accounts by enabling two-step verification (2SV)

Critical national infrastructure (CNI)

2023 has seen the addition of state-aligned actors to the ongoing threat from state actors, as a new and emerging cyber threat to CNI. While the cyber activity of these groups often focuses on DDoS attacks, website defacements and/or the spread of misinformation, some have stated a desire to achieve a more disruptive and destructive impact against western CNI, including in the UK. The NCSC continues to prioritise the resilience of UK CNI.

AI / Large language models

Our adversaries – hostile states and cyber criminals – will seek to exploit AI technology to enhance existing tradecraft. In the short term, AI technology is more likely to amplify existing cyber threats than create wholly new ones but it will almost certainly sharply increase the speed and scale of some attacks. There is now a significant amount of activity across the NCSC and wider government to assess and respond to the potential threats and risk posed by AI.

Incident management

Within the NCSC, the Incident Management (IM) team deals with all the cyber attacks that are reported to us, focusing in particular on incidents of national significance for the UK.

This year we saw a jump in reports of cyber attacks coming into the NCSC, but the volumes that reached the threshold of national significance remained broadly stable. There were, however, more incidents at the top end of the scale, reflecting more high-level and damaging incidents against the UK.

We received 2,005 reports, an increase of almost 64% from last year's 1,226. 371 were deemed serious enough to be handled by the IM team (compared with 355 last year). Of these, 62 were nationally significant (63 last year) and four of them were among the most severe incidents the NCSC has had to manage (compared with one last year) due to the sustained disruption they caused and the victims' links to critical infrastructure via supply chains.

The NCSC issued 24.48 million notifications, informing subscribing organisations of potential malicious activity detected on their networks, or exposure to a vulnerability, through our automated Early Warning service. Of these, 258 notifications were considered serious enough for a bespoke service from the IM team.

The NCSC was made aware of 327 reports that involved the exfiltration/extortion of data, which is an increase on last year and is indicative of the value that both cyber criminals and nation state actors find in data. All types of data can be manipulated by these actors, meaning unsuspecting organisations could be considered targets.

The highest proportion of incidents handled by the NCSC resulted from the exploitation of applications. This involves an actor exploiting a vulnerability in a public-facing application to gain unauthorised access to a target network. Incidents resulting from these vulnerabilities can be some of the most widespread, for example in the Citrix vulnerability (CVE-2023-3519) the NCSC was required to deal with 13 separate nationally significant incidents involving the exploitation of this vulnerability. To aid the prevention of incidents such as this, caused by poor cyber hygiene, the NCSC sent over 16,000 notifications of vulnerable services via our Early Warning Service.

Incident management

- This year we received an all-time high of **2,005** reports*, an increase of almost 64% from last year's 1226.

- The NCSC issued **24.48** million notifications, informing organisations that they were experiencing a cyber incident, through our automated Early Warning service.

- **327** incidents involving the exfiltration/extortion of data (18.5% increase on last year).

*Increase in reports attributed to change in data collection and cannot be compared directly to previous years.

tips

incidents

HEDDLU
GOGLEDD CYMRU
NORTH WALES
POLICE

TÎM TROSEDDAU SEIBER
CYBER CRIME TEAM

PREPARE
businesses to effectively deal
with cyber incidents

PREVENT
young people from moving
into cyber crime

PROTECT
communities from the
latest cyber threats

PURSUE
cyber offenders and bring
them to justice

HEDDLU
GOGLEDD CYMRU
NORTH WALES
POLICE

TÎM TROSEDDAU SEIBER
CYBER CRIME TEAM

PARATOI
busnesau er mwyn ymdrin â
digwyddiadau seiber yn effeithiol

HEDDLU
GOGLEDD CYMRU
NORTH WALES
POLICE

TÎM TROSEDDAU SEIBER
CYBER CRIME TEAM

HGCTroseddauseiber

prompt:

An image / illustration identifying and analysing cyber security threats to individuals and organisations and making sure systems are secure to stay one step ahead of adversaries and cyber criminals.

commentary:

We wanted to show how cyber attacks are a critical threat to our national security and everyday lives and how the NCSC is leading the UK's defence by supporting government, critical national infrastructure and citizens to help to reduce the harm from cyber security incidents.

Case study: Russia – an acute and chronic cyber threat

In cyberspace, Russia continues to be one of the world's most prolific cyber actors. It dedicates significant resources towards conducting cyber operations around the globe and poses a significant and enduring threat to the UK. But what have we learnt from Russia's cyber operations in Ukraine so far, and how might the value of cyber operations or use of capabilities differ depending on context to achieve their strategic objectives?

Russian cyber activity against Ukraine

On 24 February 2022, a cyber attack against Viasat, a US satellite communications company, began approximately one hour before Russia launched its further invasion of Ukraine. It was an attempt to cripple Ukrainian military operations and communications which spilled over into Europe affecting both organisations and citizens.

This was followed by destructive and disruptive cyber attacks on Ukrainian CNI, telecoms providers, government entities and an attempted attack on power grids. There has been a significant amount of wiper activity and these attacks have often accompanied military operations.

The integration of Russian cyber operations into its wider military campaign objectives has had an effect, but not on the scale many were expecting.

Since at least Russia's illegal annexation of Crimea in 2014, Ukraine has worked tirelessly to build its cyber resilience and with western support, their defences have stood up robustly to Russia's initial onslaught.

Attacks in the latest stages of the conflict now seem opportunistic rather than strategic. But why haven't we seen more destructive activity from Russian cyber actors?

This could be due to a number of factors: the presence of state-aligned actors contributing to a 'chaotic' landscape; Russia not having enough coordination between different military actors; Russia taking a more cautious approach as to when to 'burn' its best capabilities; Russian actors relying on some elements of Ukrainian infrastructure themselves; and, fundamentally, the incredible resolve of Ukrainian cyber defences in rapidly responding to cyber attacks, and bringing themselves back online.

Whatever the case, it is clear cyber defenders have more of a say in what happens in this conflict than some of the rhetoric on Russia's offensive cyber capabilities suggests.

Russian information advantage

In this conflict, much of the battle has been in the information space, with Russian actors waging operations to gain intelligence on adversaries, to contest the very information about the war itself and the nature of the conflict, shaping the information space to its advantage.

And, while Russian cyber actors remain an acute threat, causing high-profile incidents, the impact is becoming more chronic as the targeting shifts to reflect Russia's new geopolitical reality.

Cyber espionage continues to be used as an important tactical weapon, strategically and operationally, in supporting Russian political and economic objectives in Ukraine and around the world.

Since Russia's further invasion of Ukraine, their cyber operations have expanded to include anything or anyone with a connection to Ukraine which seeks to gain an information advantage on the battlefield and geopolitically.

This has obviously included traditional military and government targets, although cyber has provided Russia with new means to achieve their objectives. In August, along with the Security Service of Ukraine and Five Eyes partners, we publicly revealed that Russian military intelligence service (GRU) capabilities are targeting Ukrainian battlefield information, in this case from Android devices.

However, the reach of Russia's cyber operations has also stretched to academics, think tanks, logistics and transport hubs, manufacturing companies, supply chains, charities and unassuming Internet of Things (IoT) devices.

For example, as stated publicly by Rob Joyce, Director of Cybersecurity at the NSA, Russia has targeted IoT surveillance cameras to aid their warfighting efforts, and routinely target the transport sector. Microsoft warned in December 2022 of Russia potentially targeting countries that provide vital supply chains of weaponry and humanitarian aid.

The point here is to not assume you are not important enough for Russian spies to take an interest, if it furthers their aims and objectives.

An initial interaction with an individual or organisation (in the form of an unsolicited approach on LinkedIn or an email with a malicious link) is all it could take to allow hostile actors into your networks and find the information they want to use for their advantage.

The risk of supply chain compromise also continues to loom large. In 2021, we and our US partners attributed the unauthorised access of SolarWinds Orion software and subsequent targeting to Russia's Foreign Intelligence Service (SVR).

These incidents are part of a wider pattern of cyber intrusions by the SVR who have previously attempted to gain access to governments across Europe and NATO members and who continue to exploit vulnerabilities to this day.

A chain is only as strong as its weakest link.

Russian patriotic hackers

Over the past 18 months we have seen a new class of Russian cyber adversary emerge. State-aligned actors (the favoured language used by the UK government to describe these groups) are often sympathetic to Russia's further invasion and are ideologically, rather than financially, motivated.

They have been emboldened to act with impunity regardless of whether or not they have Russia's backing.

Our Canadian allies wrote publicly about the emergence of the groups and highlighted how Russia has sought to project power by deploying destructive cyber attacks against the strategic CNI targets of their adversaries as geopolitical crises escalate. This includes aspirations to sabotage the operational technology (OT) utilised across CNI. We share their concerns; some non-state groups probably have a higher risk appetite than state groups we have tracked for years.

Some such groups may seek to tamper with any vulnerable CNI networks they can access, without being able to understand or control the impact of their actions.

These state-aligned actors might seemingly offer the Russian state 'plausible deniability' in its attacks, but that is where attributions by the UK government and our allies, together with technical advisories by the NCSC are critical in unmasking the Russian state's intent and holding such actors to account.

These groups create a new set of unintended consequences, operating without constraints in a conflict – including unpredictable behaviour, heightening the risk of miscalculation. They also ask profound questions about who gets to operate in cyberspace and how.

Russian speaking ransomware: organised crime gangs (OCGs)

Russian language criminals operating Ransomware and 'Ransomware as a Service' (RaaS) continue to be responsible for the most high-profile cyber attacks against the UK. Several of these groups are known to have varying links with the Russian state and many of their activities are tolerated.

Sanctions, indictments, and rewards levied on the likes of EvilCorp and the group behind Conti has seen them draw on the wider ecosystem to distance themselves from the larger OCG branding.

The ransomware model continues to evolve, with a well-developed business model, facilitating the proliferation of capabilities through RaaS. This is lowering the barriers to entry and smaller criminal groups are adopting ransomware and extortion tactics which are making a huge impact.

It is possible that Russia, or indeed any state, could purchase access to supportive companies and low equity/disposable capabilities to enact attacks, including destructive attacks through ransomware. This would help them distance themselves from attribution and to enable them to scale without having to garner accesses themselves.

However, most ransomware incidents are not due to sophisticated attack techniques. Success for the criminals is usually due to the result of poor cyber hygiene. Organisations are often not following NCSC advice and there are still very large volumes of victims. In fact, ransomware attacks are rising. If organisations are not taking the correct protective measures the threat will continue unabated as threat actors seek to exploit opportunities and maximise profits.

Russian attempts to manipulate democratic institutions

It is no secret that Russia seeks to weaken and divide their adversaries by interfering in elections using mis and dis-information, cyber attacks, and other methods.

The UK government assesses that it is almost certain that Russian actors sought to interfere in the 2019 general election. In the coming months, with UK and US elections on the horizon we can expect to see the integrity of our systems tested again.

Protecting our democratic and electoral processes against foreign interference, whether from Russia or any other state, is and always will be an absolute priority for the NCSC and we will continue to support the government's critical work in this area.

In the 'Defending Democracy' paper later in this report, we explore this theme in greater depth and identify the threats and security challenges our democracy faces online and how a collective effort across the whole of society and in partnership with allies is required to ensure our democratic institutions, traditions and values are well-prepared for this new phase in digital development.

What can cyber defenders do about it?

We may not necessarily be able to anticipate specific cyber attacks from Russia but we do prepare for all outcomes by investing in the UK's cyber resilience.

And while NCSC services like Cyber Essentials are not intended to prevent attacks from sophisticated adversaries, the controls outlined are a good foundation on which to build and make them work a little harder.

Russia's cyber activity may seem erratic, but it is targeted and dependent on its goals and motivations. They act in their own interests, and they are challenging our notion of what we consider to be critical and how we prioritise resilience across society.

Regardless of the threat, where it is coming from, and which methods are used, put simply we need to implement better cyber hygiene. We have the information and tools at our disposal to defend ourselves. We just need to use them better.

Chapter 2

> **Resilience**

The NCSC continues to support government, public and private sector critical national infrastructure (CNI), citizens, and organisations of all sizes across England, Wales, Scotland and Northern Ireland to raise awareness of cyber threats and improve resilience for the whole of society.

Cyber resilience is essential to the UK's economic and national security interests. The NCSC's services and interventions are working to enhance the UK's ability to prepare, respond, recover, and learn from cyber attacks to make the UK the safest place to live and work online.

August 2023 marked 18 months since the publication of the National Cyber Strategy 2022, and it remains at the heart of the government's comprehensive plan to keep our country safe online and grow our cyber industry. As outlined by the Deputy Prime Minister Oliver Dowden, "since its publication, we have become more secure against cyber attacks, and we have taken decisive action against our adversaries".

Central to these efforts are a whole of society approach, bringing together private and the public sectors, "defending as one so we can prosper as one". This is in line with the government's approach to resilience as set out in the government's Resilience Framework.

Trust groups

Central to our whole of society approach, the NCSC has ensured long-lasting and meaningful impact by building trust groups, industry-specific communities of Chief Information Security Officers (CISOs) in businesses and organisations. This is now an established model that sees us work in collaboration with the trust groups on raising the cyber resilience in their sectors for: those larger organisations that make up the groups; the thousands of smaller organisations that sit within their supply chains; those citizens that are their customer base. This approach ensures engagement and nuance, allowing businesses, large and small, to access guidance and information, while also participating in a supportive community.

Share and defend

When it comes to raising the resilience of citizens and small organisations, our programmes of work focus on securing citizens and small organisations online at scale, reducing the burden on them to act. Our Takedown Service in this programme is approaching 10 million takedown records for malicious infrastructure. By taking down malicious domains quickly, it reduces the number of people who fall victim to scams. To further strengthen those protections, the NCSC is building the Share and Defend capability. This capability will enable the sharing of government and industry data around malicious domains, at scale and in near real time, enabling the protection of citizens and small organisations upstream by their service providers. We are currently sharing data tactically with several major UK ISPs, whilst working collaboratively with industry to develop the capability, identify relevant datasets and place protections where they will have the most impact for users.

Cyber Essentials

Appetite for the NCSC's Cyber Essentials scheme continues to grow. The number of Cyber Essentials certificates awarded in the past year has increased by 21% to 28,399 overall; while the total number of Cyber Essentials Plus certificates awarded was 9,037 – an increase of 55%. In total 141,712 Cyber Essentials certificates have been awarded since the scheme began. The scheme is proving its efficacy too, with data suggesting that 80% fewer cyber insurance claims are made when Cyber Essentials is in place.

Cyber Essentials

28,399 certificates awarded (⬆21%)

9,037 Cyber Essentials Plus certificates awarded (⬆55%)

321 Certification Bodies right across the UK (⬆6%)

80% fewer insurance claims with Cyber Essentials in place (Insurers' data)

By business size		
	Cyber Essentials certificates	Cyber Essentials Plus certificates
Micro	35%	36%
Small	34%	28%
Medium	20%	21%
Large	11%	15%

Top 3 reasons given for certification

To generally improve security

Required for government contract

Required for commercial contract

other

35%   28%   15%   22%
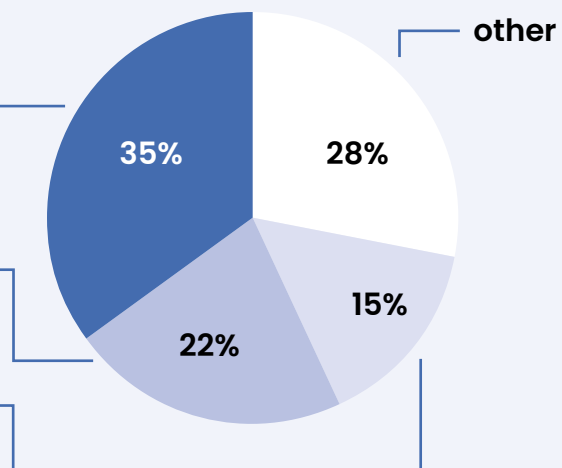
- The estimated fail rate for Cyber Essentials across all organisation sizes has dropped from 3.4% to 2.45%.

- This year saw an increase in the proportion of Cyber Essentials (increase of 4%) and Cyber Essentials Plus certificates (increase of 17%) issued to micro-organisations

- Of sole traders, micro and small organisations, around 30% told us it was the first time that they'd implemented the CE controls.

- The proportion of organisations that say they will recertify (89.2%) and those saying they would recommend the scheme (78.9%) have both increased.

- The proportion of smaller organisations (<50 staff) say that the scheme makes them feel more secure (+2.5%), gives them a trusted source of information (+12.1%), and that they feel more confident implementing cyber security controls themselves (1.7%) have all increased.

- A large proportion of Cyber Essentials customers (62.1%) report having learned something new about cyber security from implementing the controls, and many were repeat customers.

The Funded Cyber Essentials Programme

The Funded Cyber Essentials Programme was launched to provide support to some of the most vulnerable small organisations in the UK. Initially targeting legal aid and charity sub-sectors, the Programme provided funding and technical support to gain Cyber Essentials Plus certification. 369 applications were approved in the first cohort (78% charities and 22% legal aid), with over 90% of organisations claiming that they feel more confident about cyber security after completing the process. The Programme is currently expanding to support small organisations and start-ups working on emerging and advancing technologies.
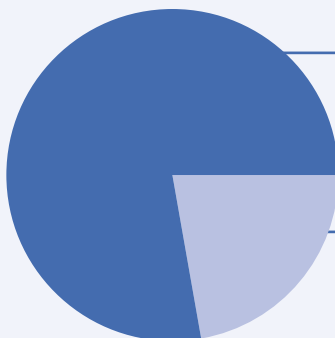
Funded Cyber Essentials

369 applications approved in first cohort

80% of organisations who have completed the programme have stated an intention to renew the certification next year.

78% Charities

22% Legal aid firms

91% of these organisations claimed that they feel more confident about cyber security after completing the process

Cyber Advisor scheme

This year, the new Cyber Advisor scheme was launched to consumers, offering small organisations a network of 56 NCSC-assured providers (as of August 2023), to help with reliable, cost-effective cyber security advice and practical support. This work aims to improve basic cyber security in small organisations and reduce the likelihood of the most common cyber attacks.

Existing schemes continue to grow. Following an update that puts industry at the heart of the scheme, Assured Cyber Security Consultancy now has 26 providers offering risk management and security architecture consultancy. While the CHECK scheme now has 44 assured pen-test providers, who responded to over 4500 requests last year.

In August, a new Level 2 service was introduced to our assured Cyber Incident Response (CIR) scheme. Its aim is to support a wider range and larger number of victim organisations, by providing access to high quality, assured incident response services. With 13 providers assured across Levels 1 and 2, now more organisations can have confidence that the company they use has the right expertise to help them.

Assuring Industry

26 companies assured to offer Risk Management and Security Architecture Consultancy

44 CHECK pen-test providers, responding to 4500+ requests

56 brand new Cyber Advisors onboarded

13 assured providers of Cyber Incident Response

Active Cyber Defence (ACD)

Now in its sixth year, the Active Cyber Defence collection of products and services continues to make the UK measurably safer from cyber attacks. Threat actors come and go, and the types of vulnerabilities being introduced and exploited continue to evolve. However, most of our ACD initiatives address enduring cyber security challenges: sharing knowledge of threats, closing down vulnerabilities, and responding to breaches. We believe that automation is the best way of generating the scale and reach required to tackle these challenges of today and tomorrow.

For all these reasons, we see ACD as a core part of how the NCSC will improve the UK's cyber resilience over the coming years, as we continue to build services designed to protect UK citizens and organisations.

When ACD was launched in 2016, we developed services with the protection of government organisations specifically in mind. However, at the core of the UK's National Cyber Strategy is a 'whole of society' approach, which is why we've broadened the utility of ACD products and services to a wider range of users, from small business owners to the education and charity sectors to citizens being able to report scam emails to the NCSC's Suspicious Email Reporting Service (SERS). This conscious shift to designing and developing 'radically simple' digital services, (with accessibility and ease of use as core design principles) can help provide the benefits of vulnerability checking to those individuals and organisations that do not have a dedicated security function.

We also want to make it simple for users to find, sign up to and manage our services, whilst reducing duplication and providing a smoother, more integrated user experience. We built the MyNCSC platform to turn that vision into reality. The platform brings several ACD products and services together into a single, coherent experience tailored to show the content, vulnerabilities, and alerts most pertinent to each user. These are currently Mail Check and Web Check. We plan to gradually increase the number of ACD products and services integrated with MyNCSC and have started migrating our customer organisations' use of Early Warning to the platform.

This year's ACD report noted the challenges of developing new services, which included improvements in levels of defensive capability, the need for a more dynamic commercial cyber security services market, and the growing sophistication of commodity threats. This has meant embracing different ways of 'getting things done', whether that's building services ourselves, contracting with market-leading UK companies, or engaging with collaborative projects.

Active Cyber Defence

Mail Check

Helps public and third sector assess and improve email security compliance to prevent criminals spoofing email domains.

- **Over 2,700** organisations are now using Mail Check
- **Over 24,000** domains, **60%** of which are protected by DMARC

14,400 domains protected by DMARC

Email Security Check

Available to all UK organisations to help users check an email domain for two important areas of cyber security:

- email anti-spoofing
- email privacy

Used to complete 90,000 checks across 34,000 unique domains

Takedown

Works with hosts to remove malicious sites and infrastructure from the internet.

- The known share of global phishing dropped to **1.19%**, in 2016 the figure was over **5%**
- Number of fake UK government phishing scams decreased from **6,300** the previous year to **5,300** in this reporting period
- **1.8 million** cyber-enabled commodity campaigns removed

The number of fake UK government phishing scams decreased by almost 19%

Suspicious Email Reporting Service (SERS)

Allows the public to report potential scam messages for removal by the Takedown service.

- **Over 10 million** reports received into SERS during the review period
- Total number of reports reached over **23.9 million** (since it launched in April 2020)
- **86k** scam URLs removed, bringing total takedowns attributed to SERS since it launched to **261k**

261k scam URLS have been removed since SERS started
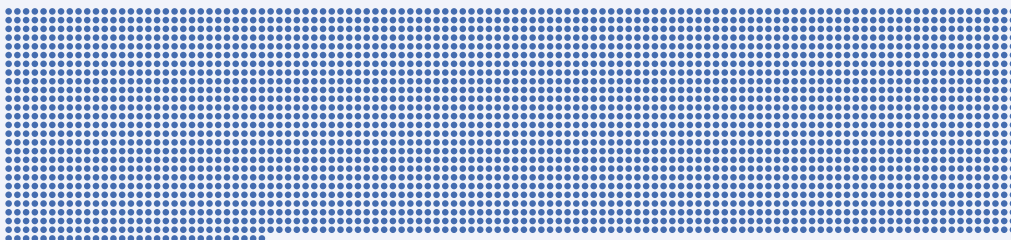
Early Warning (EW)

A vulnerability, compromise and open attack surface notification service.

- Has been integrated into MyNCSC this year and over **96%** of organisations migrated

- Notified about **323,000** unique IP address having a form of vulnerability and **10,200** unique IPs about a malware infection

- The top five malware families notified on EW are Mirai, Andromeda, Conficker, Ramnit, and Pony

- The top five vulnerabilities notified on EW are CVE-2022-41082 (Microsoft Exchange); Exposed RDP; Open Recursive DNS Resolver; Exposed HTTP Management Service; and CVE-2023-21529 (Microsoft Exchange)

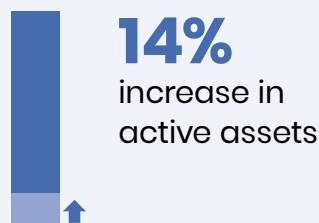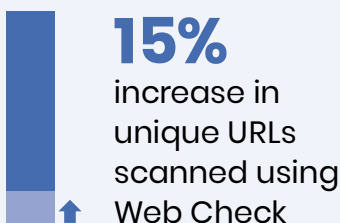- We have **8,704** customers using EW at the end of the reporting period

🔍 **TOP 5 MALWARE FAMILIES**

avalanche-andromeda

downadup

gamarue

qsnatch

ramnit
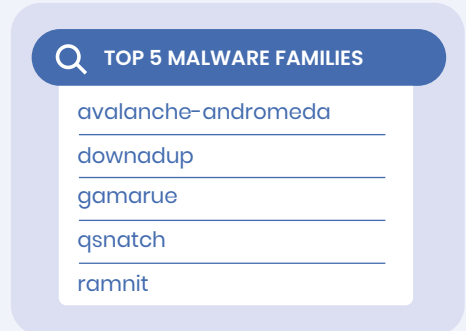
Web Check

Helps users find and fix common security vulnerabilities in their websites.

Service now has **2,999** organisations using Web Check

15% increase in unique URLs scanned using Web Check

14% increase in active assets

15% decrease* in urgent findings reported to users, along with remediation advice
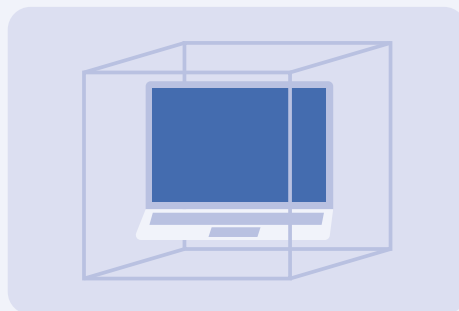
*Web Check is now provided via MyNCSC.

Exercise in a Box (EiaB)

A free toolkit providing scenarios for organisations to refine their response to cyber security incidents.

- New users increased from **16,808** to **21,524** which sees an increase of over **4,500** users which is on par to the previous year, giving a **28%** increase.

Protective Domain Name Service (PDNS)

Prevents users from accessing malicious domains or IP addresses.

- Organisations using PDNS rose **20%** (from **1,140** to **1,363**)

HTTPS://

Check your Cyber Security

In March 2023, we launched Check your Cyber Security (CYCS), our first free active service specifically for small organisations and sole traders. Through IP and browser checks, CYCS identifies and provides advice on common vulnerabilities. To date, approximately 24% of CYCS users have an out-of-date browser and the most common browser used is Google Chrome. FTP and MySQL have been identified as the most common IP vulnerabilities reported to users.

The NCSC is investigating repeat users to track effectiveness of mitigation advice and additional support required. Currently, 4% of users have subscribed to reminders, signalling a desire by users to utilise the tool on a regular basis to monitor their cyber security enduring usage.

Check your Cyber Security

A range of free tools available to all UK organisations to help users identify common vulnerabilities in their public-facing IT, which now includes Email Security Check which launched last year as a standalone service and has now been subsumed into Check your Cyber Security.
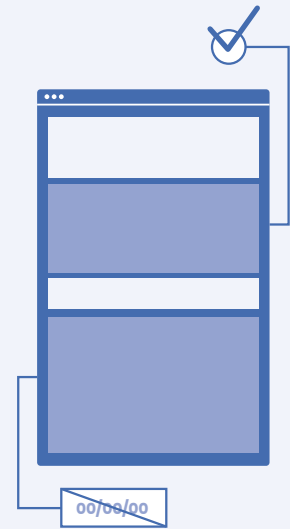
18,285
IP checks completed since product launch in March 2023
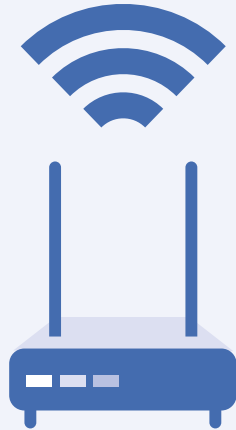
14,672
browser checks completed since product launch in March 2023

2,526
users received at least one finding

2,876
users were using an out-of-date browser

Used for **90,000** checks across **34,000** unique domains

Assured services

Looking beyond ACD, we've also 'badged' certain assured industry services to help organisations that don't have the necessary skills to differentiate quality. We'll keep investing in proven delivery models but stay attuned to new approaches as the consumption of IT services shifts (for example, through cloud provision). However, whilst we can identify quality, we can't drive quantity; that comes from market demand.

Ensuring there are enough providers offering quality services needs the full range of government and industry levers to be used. For example, larger organisations asking for Cyber Essentials in their supply chain will not only improve resilience, but will incentivise more providers to offer the service, upskilling their staff in the process. This will help build a thriving cyber sector, discussed further in this report.

prompt:

The importance of cyber resilience for UK critical national infrastructure

commentary:

We used a descriptive prompt to generate an image we feel represents CNI and how we can digitally protect our national infrastructure – the image includes an individual, to highlight the societal element and how CNI supports many different parts of our lives.

Case study: Securing the UK's critical national infrastructure

CNI is evolving

Critical national infrastructure (CNI) consists of the most important systems in the UK today. This includes those that provide safe drinking water, electricity and keep the country connected to the internet. They keep the UK's economy functioning and ensure government can operate as effectively as possible.

CNI was historically focused on physical assets, such as buildings, housing, energy and infrastructure. These tend to change infrequently, as moving infrastructure to an entirely new industrial estate didn't happen often. However, the pace of change sped up as the UK became more dependent on digital infrastructure. The systems underpinning communications, financial networks, and the internet change more rapidly and are often highly distributed. Our understanding of CNI has also evolved, moving towards a more holistic view of critical systems rather than purely physical assets. These systems often operate independently of UK-based infrastructure. These changes have delivered immense opportunities for the UK while simultaneously reshaping the risks associated with our CNI and our approach to managing them.

The threat has changed...

Due to the changing geopolitical environment, including the ongoing war in Ukraine, the rise of state-aligned groups from around the globe, and an increase in aggressive cyber activity, it is highly likely the cyber threat to UK CNI has heightened in the last year.

The NCSC still assesses that ransomware remains one of the greatest cyber threats to UK CNI sectors. This has been evidenced by international incidents including attacks against Colonial Pipeline and the Irish Health Executive, and within the UK against South Staffordshire Water, Royal Mail International and even one impacting NHS 111. Some of these attacks have also highlighted the possibility of disrupting CNI through attacks on key suppliers, who may have weaker security and thus present an attractive opportunity for adversaries.

While criminality online is the most significant threat in terms of volume, the most advanced threats to CNI come from nation states, including Russia, China, Iran, and DPRK.

In May, the NCSC issued a joint advisory revealing details of 'Snake', a sophisticated espionage malware used by Russian cyber actors against their targets. These targets included CNI operators, and the targets were in more than 50 countries across the world.

There is sometimes a misconception that state activity is all about espionage. Or that it is only targeted at trying to steal government secrets. But that's not the case.

Another joint advisory issued by the NCSC earlier this year exposed China state-sponsored activity targeting networks across CNI sectors in the US and it carried a warning that the same malicious techniques could be applied worldwide.

It detailed how the actors had been observed taking advantage of built-in network administration tools on targets' systems to evade detection after an initial compromise.

This kind of latent threat activity cannot be discounted and it demonstrates the interest that state-sponsored actors have not only in compromising CNI networks but persisting there too.

Jen Easterly, Director CISA, noted that such targeting "...wasn't for espionage or data theft... it was more likely for disruption and destruction" and CNI operators should be alert to this and follow the actions in the advisory to hunt down this activity and mitigate.

Nation states and profit-oriented cyber criminals are not the whole picture, however. The NCSC published an alert to operators of the UK's CNI in April about the emergence of state-aligned groups as an adversary, some of whom have stated a desire to achieve a more disruptive and destructive impact against western CNI. Without external assistance, we consider it unlikely that these groups have the capability to deliberately cause a destructive, rather than disruptive, impact in the short term. But they may become more effective over time.

While we don't believe, right now, that anyone has both the intent and capability to significantly disrupt infrastructure within the UK, we know that we can't rely on that situation persisting indefinitely. Uplifting cyber resilience can take several years to achieve, so it's therefore important to prioritise that uplift before the threat further materialises against our CNI or its key dependencies.

The threat is evolving. While we are making progress building resilience in our most critical sectors, we aren't where we need to be. We will continue to work with partners across government, industry and regulators to accelerate this work and keep pace with the changing threat, including tracking their resilience in line with targets set out by the Deputy Prime Minister.

Situational awareness

To counter the risk posed by these threats, we believe that it's essential to understand the risks to our CNI before our adversaries do, so that we can reduce the window where an attack could be successful. Often critical services will rely on complex supply chains to function and so mapping supplier dependencies and relationships plays a crucial part in gaining confidence in your security. This enhanced situational awareness will be increasingly important in times of heightened threat – but being mindful about supply chain security from procurement through to deployment should be a perennial consideration for operators.

In addition to our work understanding the UK's CNI, we need to continue improving our aperture on CNI risk. For example, it will be key to understand flaws in the design of the UK's CNI (such as inadequate network segregation) which adversaries may seek to exploit, as well

as maintaining awareness of unmanaged vulnerabilities and the attack surface visible to adversaries online. It may also be necessary to expand threat hunting for nation states who could seek to pre-position on UK CNI.

Prioritising cyber security

The UK's CNI is operated by public and private sector organisations. However, while they are subject to the ever-increasing threats described above, they also face a range of other commercial pressures and therefore tackling cyber threats is not always prioritised as highly by CNI operators as we would like.

Operators of the UK's CNI may be positioned to deliver shareholder value and profit, incentives that can take priority over investment in the secure operation of critical systems. Firms with less mature security can also be incentivised to constrain information sharing during incidents, limiting the NCSC's ability to effectively support and respond.

The public sector, whilst not motivated by profit, prioritises the delivery of these critical services, but unfortunately, this can also come at the expense of security considerations.

The NCSC has been working with government, industry, and regulators to address this imbalance. The government has set targets for CNI operators to achieve resilience against common attack methods as quickly as possible and to put in place more advanced protections where appropriate. Effective regulation plays a key role so the government is also strengthening the regulatory framework, to improve its coverage, powers, and agility to adapt, within the context of broader national security risk and rapidly changing threat and technology.

The NCSC, as national technical adviser for cyber security, is central to this work, in particular by helping government, regulators and industry to measure and validate the necessary improvements in CNI cyber security and resilience, including through the development of the Cyber Assessment Framework (CAF) which has been widely adopted.

However, in addition to raising the security baseline, it's also important for organisations to understand how they will address periods of heightened threat, as we are seeing now. Those organisations need to have worked through how they will temporarily increase their cyber security and resilience measures, at all levels of the organisation, to minimise the likelihood of a successful attack and to have proactively worked to reduce the impact should an attack occur.

What should we do next?

The NCSC has worked to address these challenges by supporting the creation of a revised criticalities process to identify and assess critical systems across the UK. In addition, we have helped create the Knowledge Base, a world-leading tool which permits government to understand the relationships between and impact of any disruption to critical systems, regardless of the hazard involved.

To better understand the resilience of these systems, the NCSC created the CAF as a framework to assess cyber resilience and worked with regulatory authorities to set thresholds for security and resilience based on preventing, detecting, and recovering from historic and plausible future attacks. This has helped to pull together the NCSC's expertise, enabling organisations to have a much greater understanding of their cyber resilience, and take action to improve it.

However, we need to keep progressing these efforts. We need to continue to work together as a community to address the gaps in the UK's cyber security posture. This starts with gathering better data to improve our visibility and better inform our decision making. We need to understand where organisations commonly struggle to address security challenges and how adversaries are attempting to exploit those weaknesses, so that we can work as a community to address such gaps. The NCSC, in collaboration with industry, wider government and regulatory bodies, is thus analysing data on the cyber resilience of UK CNI, to better understand how we can help ensure the resilience of our CNI.

We also need to continue to forge better international partnerships to ensure that we can learn from and work together with governments, industries, and relevant forums overseas on this shared challenge. It's clear that we all depend on similar infrastructure and face similar threats, and so creating a common toolkit for managing them is key. We've therefore continued to run closed information exchanges with key CNI operators and participate in international forums to better drive-up standards.

Working to limit the impact of cyber attacks against the UK's CNI, especially those conducted by nation states, is challenging but achievable. It's something that we need to do together.

prompt:

An illustration of a historic ballot box protected by multiple padlocks.

commentary:

We used a relatively simple prompt to generate an image bringing to life the need to secure our democratic process – metaphorically represented through a super-secured, physically protected ballot box.

Case study: Defending our democracy in a new digital age – at the ballot box and beyond

With a general election on the horizon, the NCSC signals the security challenges our democracy faces online.

From generative chatbots to ultrafast connected devices, the speed and scale at which technology is changing our everyday lives has rarely been so evident.

The evolving landscape presents many opportunities and efficiencies for our economy and society, but we must also ensure our democratic institutions, traditions and values are well prepared for this new phase in digital development.

With elections on the horizon, including a general election, and with people around the world set to go to the polls from Belgium to the US in the next year, the UK and its allies cannot be complacent to the threat of foreign cyber interference and attempts at influencing our democratic processes. The NCSC is working with our allies around the world to share insights and approaches to help improve collective cyber resilience of global democracy.

Defending democracy is a critical part of the NCSC's mission as it gets to the heart of what it means to keep the UK safe, and to act responsibly, in cyberspace.

As part of a cross-government effort, alongside partners in industry, civil society and others, we are working to protect the values at the foundation of our society.

Responding to threats

Protecting our democracy in cyberspace requires a continuous effort as the cyber threat to the UK's democratic institutions and processes is significant and comes from many malicious actors.

Over the past year, the NCSC has surged its efforts to advise on the smooth running of local elections, political party leadership contests and once-in-a-generation constitutional events such as the Coronation of His Majesty the King.

We have supported a range of entities involved in the democratic process with their responses to cyber incidents, ranging from phishing attacks to more sophisticated compromises.

And we have provided longer-term guidance for improving resilience, both across supply chains that underpin the functioning of key services and to individuals active in our democracy, such as politicians, where we have seen them being targeted.

Looking ahead

The next general election is set to take place before the end of January 2025, with local and mayoral elections scheduled next May. The NCSC is already working with key stakeholders across government, UK parliament, the devolved administrations and legislatures, and industry to prepare for it.

When the UK goes to the polls, the act of casting your vote is completed using pencil and paper, significantly reducing the chances of a cyber actor affecting the integrity of the results.

However, the act of voting marks the end of the sprint, as a significant amount of cyber-resilience building needs to take place before this to secure the services which support our elections and the integrity of an open public discourse.

The government's Defending Democracy Taskforce has established the Joint Election Security Preparedness unit (JESP), which takes overall responsibility for coordinating electoral security and drives the government's election preparedness.

It plays a central role in convening government departments, the devolved administrations and legislatures, and security resources to ensure our systems and processes are resilient.

And for those who have a direct role to play, the NCSC has existing defending democracy guidance, which is currently being refreshed. We strongly encourage following the recommended steps to ensure online protections are in place.

An evolving landscape

The threat landscape has evolved significantly since the 2019 general election.

The changing geopolitical situation, especially with the war in Ukraine, has made the prospect of influencing the political discourse in democracies ever more attractive to state actors.

The emergence of state-aligned actors, who share similar goals to nation states but can act with less restraint, has created a new class of adversary for the UK to counter.

The shape-shifting rise of ransomware and extortion attacks, as outlined in a recent joint report with the National Crime Agency[3], has emphasised the ongoing importance for public and private

sector organisations to strengthen their defences – even if their involvement in running elections is indirect.

And technological developments, including artificial intelligence, are shaping at pace how we think about the security outlook.

The NCSC assesses that democratic events, such as elections, almost certainly represent attractive targets for malicious actors and so organisations and individuals need to be prepared for threats, old and new.

Novel threats

AI has the power to transform our society for the better, but at the NCSC we are alert to the risk that these technologies might pose from those looking to interfere or otherwise undermine trust in our democratic system.

While the UK's use of paper voting in General Elections makes it significantly harder to interfere with our elections, the next election will be the first to take place against the backdrop of significant advances in AI. But rather than presenting entirely new risks, it is AI's ability to enable existing techniques which poses the biggest threat.

For example: large language models will almost certainly be used to generate fabricated content, AI-created hyper-realistic bots will make the spread of disinformation easier and the manipulation of media for use in deepfake campaigns will likely become more advanced.

Any interference or attempts to undermine our political discourse are completely unacceptable and the UK government is committed to enhancing our capabilities and countering the threat from online harms, such as disinformation.

3 https://www.ncsc.gov.uk/whitepaper/ransomware-extortion-and-the-cyber-crime-ecosystem

However, it is important for the general public to be aware that the threat landscape is changing and as with any kind of new technology, alongside realising the benefits, there is always potential for misuse.

High-risk individuals

Good cyber hygiene is important for all citizens but for those who work in particularly high-risk roles or have access to sensitive data, vigilance is crucial. One of the most notable trends we have seen over the past year is a rise in individuals' personal accounts being targeted. This is not a mass campaign against the public but a persistent effort to target people whom attackers consider might hold information of interest.

This kind of activity is not new. In January, the NCSC warned that Russia-based and Iran-based actors had been conducting spear-phishing campaigns against politicians, journalists, activists and other groups.[4] However, these types of campaigns continue.

In particular, we have seen personal accounts targeted instead of corporate ones, as security is less likely to be managed in depth by a dedicated team. The NCSC has therefore expanded its work to offer more personal support to those at higher risk.

Earlier this year, we launched a new opt-in service which allows us to alert high-risk individuals directly if we identify evidence of malicious activity on their personal devices or accounts, and to swiftly advise them on steps to take to protect themselves.

Defending our values

Protecting individuals who carry out important roles in our democracy is a key part of improving resilience and reducing the chances for malicious actors to interfere.

However, the threat to our democracy is part of a much bigger picture, with the threats we face also posing a risk to our values shared around the world.

In cyberspace, there are no borders, and we know authoritarian governments are increasingly using cyber means to target and repress critics, dissidents, and civil society at home and abroad.

The use of cyber capabilities to undermine our freedoms is a global issue requiring an international response and as a responsible cyber actor the UK is engaging in initiatives.

Collective action

Defending the UK's democratic institutions and processes is a priority for the NCSC. However, it is not something we can achieve alone.

It requires a collective effort across the whole of society, including industry and in partnership with allies, to defend our values and make the UK an unattractive environment for hostile actors.

Our democracy is founded on the principle of participation; every member of the public across the four nations of the UK has a stake, and everyone has a role to play in defending it.

By acting now to strengthen systems and accounts – rather than waiting until an incident occurs or an election is called – we can help make our society safer online.

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4 https://www.ncsc.gov.uk/news/spear-phishing-campaigns-targets-of-interest

prompt:

Hyper realistic image of a family stepping into a phone screen, white background, the phone screen is a window into the future of cyber security, you can see wires. Transparent overlay on the screen of the world map, bright colours.

commentary:

We used a very descriptive prompt to generate the image we envisaged of how smartphones, computers and the internet have become a fundamental part of modern life and that it's difficult to imagine how we'd function without them. From living and working online, banking and shopping, and email and social media the imagery talks to our strategic objective of bolstering the cyber resilience of individuals, families, businesses and organisations across the world.

Case study: The next generation of UK cyber security services

When the NCSC was set up in 2016, a central aim was to identify and implement ideas to improve the UK's cyber security, at reach and scale, in ways we could measure. From this came our suite of ACD initiatives designed to reduce the vast number of relatively unsophisticated attacks that impact people and organisations across the UK, by harnessing automation and data.

That core aim also drives the work we do to assure cyber security services provided to businesses and consumers by the wider cyber security industry. We assess what industry is providing against NCSC standards and use the NCSC brand to help consumers identify services that they can trust. This assurance encourages users to take up the services that provide the biggest benefits to national cyber security, at a reach and scale that government could not achieve by itself. It also stimulates the market to develop solutions to the existing and emerging cyber security challenges that we all face.

Together, these industry and NCSC-developed services provide a powerful set of solutions to a broad range of cyber security problems. They've had real impact as the Resilience section of this Annual Review shows in numbers. ACD has provided a model for partner nations to adapt to their own national contexts and set the scene for overarching regulatory concepts.

But we all know cyber security never stands still. For example, the general challenges our ACD products and services seek to address endure – find and fix vulnerabilities, share actionable knowledge about threats, detect and respond to breaches – but they shift as those threats develop and as the way technology is used changes constantly, for everyday life, for attack and for defence.

The big question we're focused on here is how to use what we've done and learnt so far to chart the course for cyber security services in the UK to the end of the decade. How can government and industry develop and deliver the holistic cyber security "offer" needed to keep the UK the safest place to live and work online? Closer to home, what should the NCSC do and – increasingly – how should it support others?

Where do we go from here?

We've come a long way by focusing on what the NCSC can – in collaboration and partnerships with others – imagine, build, test and deliver. If our intention is reach and scale, we think the time is right for an ambitious expansion in scope and purview. That means taking a fresh look at:

- The NCSC – as a national technical authority and part of GCHQ – focusing on the things it does best, working in a different way with…

- …new centres of cyber security excellence and endeavour being developed by government under the auspices of the 2022–2030 Government Cyber Security and 2023 Fraud Strategies, and…

- …combining with the broad capacity and capability of industry and academia to catalyse and incentivise development and delivery of the range of services the UK needs and an evidence-based approach to their evaluation.

Getting the relationships right between these three is key to making sure that everyone living and working in the UK feels the benefit of cyber security at a national level.

What should the NCSC's future contribution be?

The NCSC vision for its digital and assured industry services is to focus in on the things we're set up to do best: innovation, data, and partnerships.

On innovation: as a national technical authority we deal every day with the cyber security problems our customers face, and the way those challenges are likely to develop in future. We combine our technical expertise and relevant relationships from government, academia, and industry to develop solutions that can be tested against the challenges that we all face. This approach is at the heart of ACD, and we want to get back to doing more of it.

On data: the cyber security community is on a journey of turning cyber security from an art, dependent on a few expert individuals, to a science that can be scaled. At its heart, this requires data; so that knowledge can be shared, hypotheses tested and impact measured. It's not always easy, but it is essential. Our experience to date (and the history in other fields, such as medicine) is that such an approach results in significantly improved outcomes, transparency and trust.

Over the past year we've been exploring with partners the challenges defender communities have working on together at an organisational, sector or national level. It's clear that data is going to take an increasingly important role in helping defender communities to defend as one, in an efficient and increasingly evidence-backed way.

Working together is the best way to build the picture of vulnerabilities and threat we need to defend the UK. Next year NCSC will be working to address some of the challenges identified this year, making it simpler for defender communities. We'll also be doing the things only NCSC can do.

We will continue to publish our findings in line with the NCSC's commitment to transparency and responsible use of artificial intelligence et al.

On partnerships: nearly everything that the NCSC does, we do with our partners in some form. The challenge of scaling cyber security means that we need to better leverage our existing partnerships and develop new ones to make much more out of them than we currently do where our services are concerned. We need to do this in multiple areas: for example, we are working closely with the UK Cyber Security Council to develop and oversee the specialist standards the UK needs to manage its cyber risk, enabling NCSC to focus on other areas.

How do we need government's cyber security capabilities to develop?

We often say that cyber security is a team sport. What might that mean for the way the NCSC needs to work with government partners on the future of digital and assured industry services? Two recent developments show us the way.

The first is the development of the Government Cyber Coordination Centre (GC3), announced in 2022, which will coordinate cyber security efforts across the public sector. The GC3 will start by coordinating resilience response to incidents and vulnerabilities", transforming how cyber security data and threat intelligence is shared, consumed, and actioned across government. This presents a huge opportunity to galvanise the way services are developed, delivered, and used over the coming years, and to build the foundations for an approach to government cyber security that is driven by data and rooted in evidence.

The May 2023 Fraud Strategy emphasises "tackling fraud at source and incentivising every part of the system to take fraud seriously". This reinforces the need for a whole ecosystem of support across the UK that builds on the unique strengths of the NCSC as national technical authority in concert with the ability of the PROTECT network and Cyber Resilience Centres amplifying on the ground across the nation.

And beyond that?

It remains a strongly held NCSC view that the "team" extends well beyond government when it comes to achieving cyber security success at the national level. Over the past 12 months, the NCSC has been working with industry to launch new schemes, targeting a wider set of customers, and assuring industry to work in new and expanded areas on behalf of the NCSC – and there is more to come. But where do we see potential to drive systemic improvement?

Simpler, more accessible services

Our work with small organisations, backed up by research, highlights a need for products and services that help users find and fix basic vulnerabilities in their websites, email configuration, and infrastructure. These need to be optimised for ease of use so that users can take manageable steps that bring about modest but effective reductions in risk from commodity attacks. Industry-provided services Cyber Essentials and Cyber Advisor give trusted expertise, whilst the initial NCSC contribution has been to prove the concept through services like Check Your Cyber Security (now incorporating Email Security Check) and we plan to do more. But – back to reach and scale – what we really want to do as a national centre is develop the general statement of what good looks like for this family of products so that others can lead the charge.

Cyber security as science

As a data-driven organisation, measuring the impact of these services is critical to ensure we are making a difference. But it's hugely challenging and still needs significant research. The four Research Institutes, supported by the broader Academic Centres of Excellence in Cyber Security Research community, offer access to world class academics which will continue to help us tackle this challenge.

An exciting future

We're confident that, in close partnership with our colleagues across government, our collaborators in academia, and our friends in industry, the coming years are full of opportunities. Getting cyber security right allows companies and organisations to flourish; if we don't, the risks – whether to businesses or to the functioning of society – can be existential. Only by working together can we develop, deliver, and make best use of cyber security services that we will all need to continue to live and work safely online.

Chapter 3

> **Ecosystem**

It is estimated that the UK cyber security sector is now worth £10.5 billion[5], with close to 2,000 firms in the UK now actively providing cyber security products and services, employing over 58,000 people – an increase of over 5,000 jobs over the past year. The sector is growing, as is the need for talented professionals[6]. Cyber security remains the largest UK security exports sub-sector, with UK cyber exports increasing from £4 billion in 2020 to £5 billion in 2021, a growth rate of 20%.

The NCSC plays an important role in strengthening the country's cyber ecosystem, cultivating talent and developing young minds to future-proof our national security. We continue to deepen our efforts in ensuring skilled people, quality products and trusted services are readily available to support organisations of all shapes and sizes.

An essential part of this work is cultivating fertile ground for excellence, at every stage – whether that's through secondary or higher education or bringing together innovative startups. The NCSC is inspiring school pupils and providing undergraduate opportunities; highlighting universities that commit to excellence in cyber security research and education, helping new businesses create solutions to the UK's biggest cyber challenges, and assessing and assuring industry to support a thriving cyber security sector.

Rising employment figures, with a 10% growth in the cyber sector last year, demonstrate that we are moving in the right direction. However, a shortage of skilled candidates in the labour market with the appropriate technical cyber security skills is still cited as the single biggest barrier (44%) to recruiters.

Another area of focus within the ecosystem is equality, diversity, and inclusion - an issue that the NCSC is addressing at an organisational level, as well as within the wider ecosystem too.

The NCSC understands the importance and impact of an inclusive ecosystem, within our organisation and within the wider sector too. Initiatives like the CyberFirst Girls Competition address an under-represented female workforce. A fresh drive to remove barriers to entry to our Assured Services schemes was also kickstarted, encouraging providers that tackle issues of under-representation in the cyber security workforce to apply.

By developing a diverse, technically skilled workforce and supporting an innovative and forward-looking industry, the NCSC's initiatives and schemes are strengthening both the UK's resilience and its world-class cyber ecosystem.

5 UK cyber security sectoral analysis 2023 – GOV.UK https://www.gov.uk/government/publications/cyber-security-sectoral-analysis-2023/uk-cyber-security-sectoral-analysis-2023
6 UK defence and security export statistics 2021; https://www.gov.uk/government/statistics/uk-defence-and-security-exports-for-2021/uk-defence-and-security-export-statistics-2021

UK's cyber security sector at a glance

£10.5 billion

⬆ UK cyber security sector worth £10.5 billion (up c.3%)

1,979

⬆ cyber security firms (up 7.7%)

58,005

⬆ (full-time equivalents) people working in a cyber security related role (up 10%)

Inspiring talent

The NCSC's CyberFirst programme, which provides opportunities for young people to get into cyber security, saw nearly 9,000 girls take part in this year's Girls Competition. Over 56,000 girls have now taken part in the competition since 2017. The CyberFirst Schools & Colleges scheme saw an impressive 48 more schools and colleges receive a CyberFirst schools award for "first-rate technology and cyber security teaching". Since the initiative launched in 2020, 105 schools and colleges have attained CyberFirst recognition for helping to develop cyber ecosystems around the UK. This summer also saw 2,500+ students apply for 800 places at our week-long camp; 43% of applicants were from female students and 47% from ethnic minority communities.

CyberFirst Girls Competition

56,000+

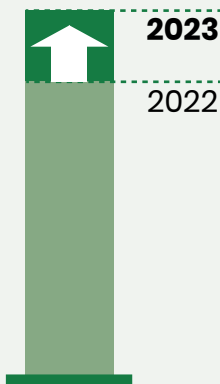girls have taken part in the competition since inception in 2017

589 schools and
2,444 teams took part

13 regional and national finals

2023

2022

85%

8,700+ girls entered, up from 7,000 last year

85% of schools participating in the Girls Competition were state run

CyberFirst Bursary Scheme

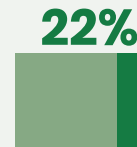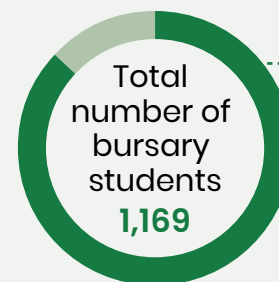**125** students joined CyberFirst bursary scheme

42% of those awarded bursaries were female

22% of those awarded bursaries were from ethnic minority backgrounds

Total number of bursary students **1,169**

87% of those who have graduated are now in cyber security roles

Nurturing skills

The CyberFirst Bursary programme continues to support the next generation of cyber talent, offering undergraduates a substantial bursary and paid training each summer. This year, 125 students were offered new bursaries and of those 42% were female candidates. In addition, the programme is supported by over 240 industry, academic and government members.

Over the last year, a further 14 postgraduate and 5 undergraduate cyber security focused degree courses have met the NCSC's certification standard. Prospective students now have a choice of 75+ postgraduate or undergraduate NCSC-certified degrees from just under 50 universities nationwide. And our community of Academic Centres of Excellence in Cyber Security Education (ACEs-CSE) continued to expand with 15 universities now achieving recognition for their high-quality teaching and impactful outreach activities.

Fuelling innovation

The NCSC for Startups programme continues to grow, with companies such as RevEng.AI and Lexverify harnessing artificial intelligence in innovative ways. We also ran a series of activities to support programme graduates on their growth journeys. Our alumni have now raised over £512m in investment and created over 1,600 jobs. In Belfast, at CYBERUK 2023, we hosted a local startups workshop focusing on improved collaboration between academia and industry. We also delivered Innovators Challenge events nationwide to inspire the next generation of entrepreneurs. Over 95 students from NCSC-certified degree courses took part in the 3-day events, giving them the opportunity to put their cyber studies into practice and create solutions to real-world cyber security problems.

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Academia

14 postgraduate and **5** undergraduate degrees taking the total now to **77** degrees from **49** universities throughout the **4** nations of the UK

15 Academic Centres of Excellence in Cyber Security Education (ACEs-CSE) (**12** Gold and **3** Silver Awards)

NCSC For Startups

66
companies are part of NCSC For Startups

£512m+
total investment raised (previously £430m)

1,600+
jobs created (previously 700)

i100 scheme

Between September 2022 and August 2023, the NCSC's Industry 100 (i100) scheme has continued to grow and make a positive impact on our mission. An additional 41 new participants joined the scheme this year seeing the community grow to 123 with a further 98 ongoing enquiries.

Highlights include:

- the NCSC's work to bring Fujitsu into the i100 community was included in the PM's G7 announcement launching the Japan-UK Cyber Partnership
- the scheme directly contributed external expertise to NCSC's work to deliver:
  - UK Legal Sector Cyber Threat report
  - NCSC's Cyber Security Toolkit for Boards
  - Cross financial sector incident playbook

CYBERUK 2023

The UK government's flagship cyber security conference, CYBERUK was held for the first time in Northern Ireland ensuring that we have hosted the event across the United Kingdom. Already recognised globally as a hotspot for cyber security innovation, by 2030 it is estimated that the cyber security sector could add £437m in value to the Northern Irish economy, generating £2.9bn cumulative Gross Value Added over the next decade.

Our commitment to ensuring a diverse skills pipeline was demonstrated with a dedicated Ecosystem Zone bringing together key academic and industry partners – including CyBOK and the UK Cyber Security Council – who, with the NCSC and DSIT are creating an ecosystem that is self-sustaining, ensuring dynamic and inclusive delivery and support to the UK's national security and prosperity.

Event facts

Held in Northern Ireland for the first time

£2.6m boost to the local economy

2,350+ in-person delegates from **38** countries, with **10,000** views online during the event period

170+ speakers across **37** sessions, including UK Deputy Prime Minister the Rt Hon Oliver Dowden, UK Minister of State for Security the Rt Hon Tom Tugendhat, and Acting National Cyber Security Director to the White House Kemba Walden
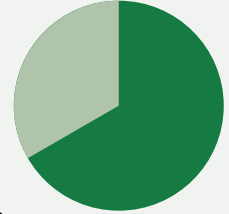
120+ companies sponsored or exhibited at CYBERUK

Delegate feedback

Two thirds of delegates are more likely to invest in, support or engage with the Northern Ireland cyber security sector as a result of attending

Over 93% rated the event as good/excellent

Nearly 90% felt more informed on how to secure an open and resilient digital future

Chapter 4

> **Technology**

As technology develops, the cyber security threat we face is evolving too. Since the launch of ChatGPT, the interest in Artificial Intelligence (AI) has taken off dramatically. There is rarely a day when AI does not feature in national news. The NCSC has been researching AI security for several years and has been working with our international counterparts, as well as the public and private sector in the UK, to realise the benefits and protect against the risks associated with AI.

But there are other critical areas of technology which don't make the headlines as often which the NCSC considers just as important in the future. These include semiconductors (as core components of all electronic devices), cryptography (that will keep our data safe from the threat from future large-scale quantum computers) as well as telecoms security, socio-technical research, and assessing risks from radio frequency transmissions. The NCSC has contributed to two national technical strategies led by the Department for Science, Innovation and Technology (DSIT), providing expert cyber security advice on building resilience to protect our national security.

The importance of secure and resilient critical technology is never far from the NCSC's mind. In the past year, we have published 15 pieces of guidance, 53 blogs and set out the five most significant 'cross-cutting' problems which the NCSC believes need concerted and significant collaborative effort over the next decade in our research problem book (which we discuss in further detail below).

Artificial intelligence (AI)

The whole field of artificial intelligence is developing at a phenomenal pace. In this rapidly evolving arena, we must ensure that cyber security is both a core requirement of AI technology throughout its life cycle and integral to its development from the outset.

Our primary objective is to ensure that cyber security does not become a secondary consideration but is recognised as an essential precondition for the safety, reliability, predictability, and ethics of AI systems.

Taking a 'secure by design' approach to development will help society and organisations realise the benefits of advances in AI, but also help to build wider trust that AI is safe and secure to use.

In the last year, we have published three blogs about the risks associated with AI and large language models (LLMs), spoken at conferences globally to emphasise the importance of building AI technologies on secure foundations, and have shaped the government's AI agenda.

Quantum computing and semiconductors

DSIT has published two national technical strategies in the past year covering emerging technologies that have critical implications for cyber security, and experts in NCSC have advised on the technical positions in those strategies.

The National Quantum Strategy focuses on investment in and development of quantum technologies. Quantum computing has substantial economic potential, but also provides a threat to cryptography. The NCSC's role is clearly defined within the strategy as the lead organisation in government on advising on mitigations to this threat. The strategy also sets out our key technical messages, focusing on the need to prepare for a future transition to post-quantum cryptography. Additionally, through discussions as part of the strategy development, and with the UK Quantum Communications Hub, we have helped set a government vision for future quantum networking to share information between quantum devices.

Building on the UK's specific semiconductor strengths, DSIT's National Semiconductor Strategy focuses on the resilience of systems on which we rely to combat cyber attacks. The UK's leadership on chip design positions us well to take a leading global role in this area, supporting initiatives such as the 'Digital Security by Design' programme led by UK Research and Innovation, which offers a potential step change in attack mitigation.

The NCSC research problem book

In August, we published the latest iteration of the NCSC research problem book with the aim of guiding cyber security research towards the most critical security challenges that we have identified as significant barriers to improving cyber security.

Two problems worth specific mention are:

Problem 1 – How can we build systems we can trust when we can't trust any of the individual components within them? Hardware is becoming more complex all the time and it's difficult to gain confidence in long global supply chains. This in turn means diminished confidence in individual computers, circuit boards and microchips. But to protect our critical national infrastructure, defence and intelligence systems and more besides, we need to build computer systems we can rely on.

Problem 5 – How can we accelerate the adoption of modern security mitigations into OT? Operational technology (OT), such as the industrial control systems (ICS) that operate factories, smart cities and our energy infrastructure, often lack many of the security controls and mitigations that we take for granted in IT. This means that if threat actors manage to reach OT systems, they may then be able to use relatively simple techniques to have a physical real-world impact. Research in the areas below could contribute to significantly improving the security of OT systems.

Technology assurance

As technology, and the way it's used, continues to evolve at a rapid pace, the need to update the way we gain confidence in its cyber resilience came into sharper focus this year. Any new approach must raise the bar across a broad landscape and also enable new technology solutions to be imagined, creating a thriving ecosystem underpinned by cyber-resilient technology. This year, in collaboration with Adelard, we've formalised the method that underpins our new approach to technology assurance: Principles Based Assurance (PBA). Key to the success

of making PBA a reality is the ability to leverage industry partners, and so the NCSC has also begun the first steps towards standing up our national network of Cyber Resilience Test Facilities (CRTFs) which will independently assess a range of technologies at scale, that has a national impact in uplifting cyber resilience.

Technology crosses many international boundaries, both in terms of sales and interoperability, and the NCSC recognises the importance of mutual recognition between PBA and other assurance schemes. To this end we've continued our international dialogue, as well as across the different parts of UK government, to ensure that this new assurance regime can have the greatest impact possible.

UK Telecoms Lab (UKTL)

Telecoms networks are fundamental to the security of the UK's digital infrastructure and digital economy. To help test, research and improve the security of telecoms equipment, DSIT have established a new state-of-the-art UK Telecommunications Lab in Solihull, operated by the National Physical Laboratory (NPL). Advice from the NCSC's world-leading telecoms security experts has been central to the success of the programme. The need for the facility was first recognised by DCMS and the NCSC in 2019, and the creation of this facility in 2023 is a key milestone after years of effort, and testament to a successful partnership between DSIT, NCSC and NPL.

Vulnerabilities

The number of Common Vulnerabilities and Exposures (CVEs) in commodity technology continues to rise, a trend we expect to continue. There are many factors that contribute to an over 50% growth in reported vulnerabilities over the past five years, which include for example, a greater motivation to discover and report vulnerabilities. The rise does not necessarily imply a worsening security posture, but rather a greater level of discovery capacity and capability within government, industry, and academia to find latent issues. More indicative of the security posture, is to assess reported vulnerabilities against a measure of 'forgivability'. Vulnerabilities that come about because of development constructs that are known to carry greater degrees of risk and that are so trivial to find they are almost immediately apparent by inspection are examples of 'unforgivable' vulnerabilities. No technology will ever be devoid of bugs, and some of these bugs will turn out to be exploitable security vulnerabilities. But even though the concept of unforgivable vulnerabilities was introduced over 15 years ago, such vulnerabilities are still being found – sometimes in major products produced by companies. It is this situation which needs to change both for current and future technologies if we are to achieve our objective of a safer and more resilient society.

Security-conscious developers will not only seek to avoid the unforgivable vulnerabilities, but to put a process in place to receive and mitigate more complex vulnerabilities that are more subtle and can be forgiven for their presence. Some vendors choose to operate a bug bounty programme, which pays researchers for vulnerabilities they submit. When the NCSC receives a bug bounty payment for vulnerabilities that we have disclosed, we donate the money to charity. Earlier this year we disclosed a vulnerability in Chrome that was fixed and assigned CVE-2023-1530. The disclosure was also awarded a $7,000 bug bounty that Google doubled to $14,000 when it was donated to charity.

Vulnerability Reporting Service

Over the past five years the NCSC's Vulnerability Reporting Service (VRS) has helped secure government systems and services from a wide range of security issues, such as cross-site scripting vulnerabilities and dangling domains, preventing the reported vulnerabilities from turning into incidents.

The VRS has provided the people reporting vulnerabilities – the finders – with a route to report these vulnerabilities and a way to directly communicate and include the system owner. The VRS has also raised awareness of vulnerability disclosure with system owners and demonstrates how it can help secure the systems, products, and services they manage.

It has been hugely successful. So much so that the VRS, as described in the Government Cyber Security Strategy, will move into the developing Government Cyber Coordination Centre (GC3), a joint venture with the Cabinet Office. This move will help the VRS deliver more effective coordination and further improve the resilience of the UK government.

Earlier this year, the finder community were key to reporting cross-site scripting vulnerabilities affecting Citrix ADC and Citrix Gateway instances across UK government. In 2021, finders reported and helped UK government rapidly remediate vulnerabilities affecting Microsoft Exchange servers.

We would like to thank our partners in helping us create the VRS and we will be showing our thanks to our finder community by awarding NCSC Challenge Coins to those finders who have shown themselves to be exemplars of the vulnerability disclosure community.
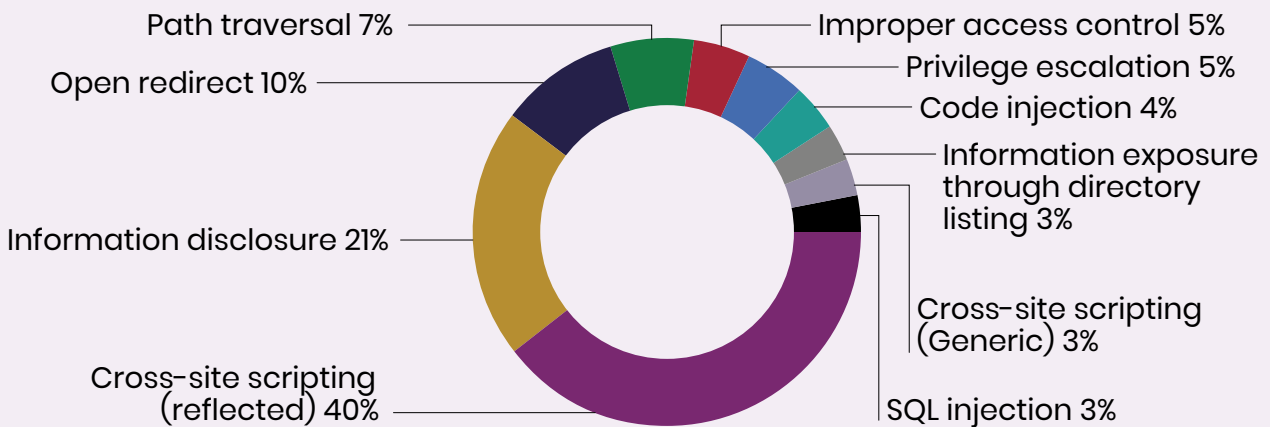
Researchers (the finders)

Annual breakdown of researchers
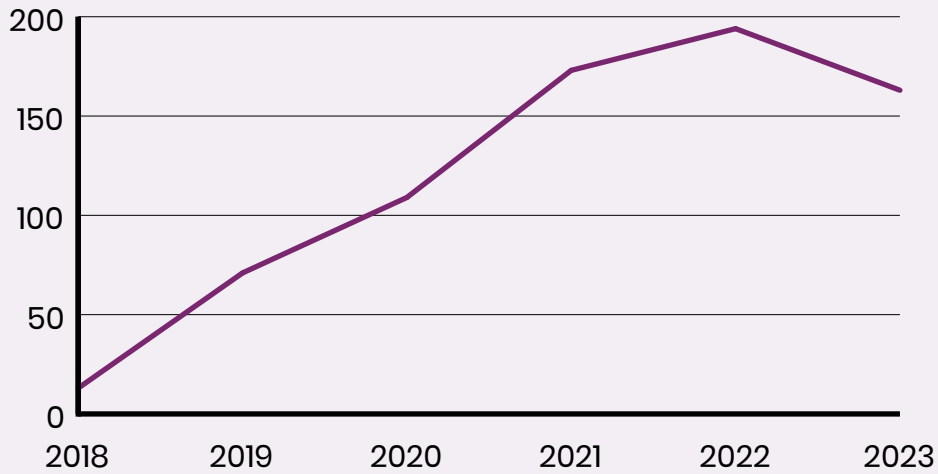
We are proud of the fact that finders from across the world have taken an interest in the security and resilience of the UK government and submitted vulnerability reports. Working with our platform provider (HackerOne) we have seen the majority of finders who submit reports originate from outside of the UK.

The vulnerabilities

Path traversal 7%
Open redirect 10%
Information disclosure 21%
Cross-site scripting (reflected) 40%
Improper access control 5%
Privilege escalation 5%
Code injection 4%
Information exposure through directory listing 3%
Cross-site scripting (Generic) 3%
SQL injection 3%

The Vulnerability Reporting Service data shows that the majority of the vulnerabilities reported are cross-site scripting. The second most common relate to information disclosure, which is largely caused by content management system (CMS) plug-ins.

However, a consistent mitigation of a large percentage of vulnerabilities is to ensure system owners are running the latest version of the software and any installed plug-ins.

The system owners

Reports by department type

Department	Percentage
Local	73%
Central	21%
Other	6%
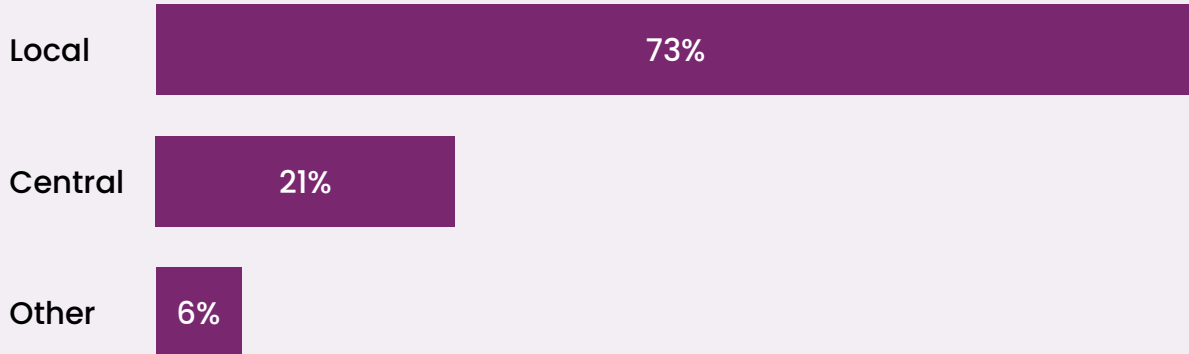
System Owners broadly fall into three categories:

Local – Local government; providing services at local level from county level, down to town or parish councils. It can also include local public services such as GP surgeries, and fire and police services.

Central – Central government departments with overall governance and decision-making at a national level, such as national regulatory bodies. Some central government departments have their own vulnerability disclosure programme (VDP) through the Disclosure for Government Scheme.

Other – Exceptions for significant but out-of-scope cases, such as CNI. 'Other' will also include any spam reports.

Guidance

This year, our best-practice guidance on cloud computing has scored well with NCSC stakeholders, aligning with an ever-increasing number of businesses adopting cloud computing. Since ChatGPT secured global coverage earlier this year and excitement around the capabilities of AI has grown, the NCSC has leveraged its technical knowledge into practical guidance, to concentrate on the real opportunities and potential risks for the UK.

As a reminder that some cyber threats are evergreen, our phishing guidance remains among our most popular content. We're committed to keeping our content current, reflecting changes in threat and how to counter it.

Guidance

15

A total of 15 new or revamped pieces of guidance were published in 2023

53

1.7 million user visits

Along with 53 blogs on a range of topics, with over 1.7 million user visits

🔍 **The most searched terms were:**

|		
'password(s)'	**2,490**	searches
'phishing'	**2,004**	searches
'Cyber Aware'	**871**	searches

Capability

➡ The NCSC and DCMS published the Code of Practice for app store operators and developers. It will encourage them to meet a minimum bar for security and privacy.

➡ The NCSC hosted an international workshop virtually and in Manchester, focusing on the security of compressed machine learning models, particularly in the context of embedded or edge devices.

➡ The NCSC provided support to AUKUS in establishing best-practice security culture.

➡ The NCSC vulnerability management team responded to significant vulnerabilities including those affecting the MOVEit managed file transfer software and a critical vulnerability affecting Fortinet devices.
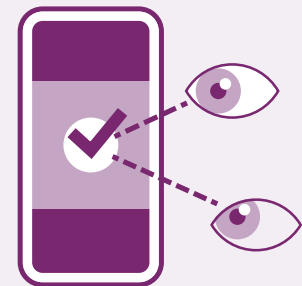
7 https://www.gov.uk/government/publications/code-of-practice-for-app-store-operators-and-app-developers/code-of-practice-for-app-store-operators-and-app-developers-new-updated-version#implement-a-vulnerability-disclosure-process

commentary:

To visualise AI in the present day we took inspiration from the past and wondered what the great Alan Turing would think about the developments in AI since he first proposed an experiment to define a standard for a machine to be called "intelligent", known as "The Turing Test", over 70 years ago.

A founding father of AI, who worked for the forerunner to GCHQ, Turing represents the values that the NCSC strive to uphold to this day.

Case study: The cyber security of artificial intelligence

Over the last year, we have all witnessed the significant increase in interest around artificial intelligence (AI) – p articularly following the launch of ChatGPT. This has been accompanied by many, often dystopian, predictions about how AI will impact almost every aspect of our lives in the coming years.

While many people will have encountered some varieties of AI such as large language models (LLMs) like ChatGPT, the field of AI is incredibly broad. As the UK's national technical authority for cyber security, the NCSC has been focused on understanding the cyber security challenges and opportunities that AI presents for many years.

And as this exciting field of technology develops, we continue to conduct research into AI to understand its vulnerabilities and keep track of how our adversaries are seeking to exploit AI in an irresponsible and unethical manner for their nefarious ends.

While much of the debate around AI focuses on its broad existential risks, there are many immediate security concerns which the rapid development of AI brings. Alongside industry and international partners, we are working to provide clear guidance to understand and manage these risks. We must also remember that while the risks of AI are significant, at its core AI is a type of software, so while many of the challenges it creates are new, there are also many lessons that we have learnt from previous generations of cyber security practice that we can use to secure this rapidly developing technology.

AI also presents the cyber security sector with significant opportunities to develop new and innovative ways to defend ourselves against hostile actors. Over the coming years, the NCSC will continue to work collaboratively with industry and academia to maximise the benefits of AI to cyber security.

Inaugural AI Safety Summit

The AI Safety Summit held at Bletchley Park in November 2023 brought together world leading AI nations, organisations, civil society groups and experts for the first time to discuss the global future of AI, including how to tackle frontier AI risks and how to improve frontier AI safety.

The Summit placed great emphasis on the importance on global collaboration, and the resulting Bletchley Declaration on AI saw 28 countries, including the US and China, as well as the EU agreeing to ensure that AI is developed and deployed safely and responsibly, so AI's enormous potential can be harnessed for the benefit of humanity.

This announcement was followed by agreement to support the development of an independent and inclusive 'State of the Science' Report, led by the Turing Award-winning scientist Yoshua Bengio. The major AI companies and several countries also signed up to state-led testing of the next generation of frontier AI models before they are released. This was in addition to the UK Government launching the world's first AI Safety Institute; a new global hub based in the UK tasked with testing the safety of emerging types of AI.

The challenges posed by frontier AI were never going to be resolved during a single summit, which is why participants committed to meet again in 6 months at a mini virtual summit, hosted by the Republic of Korea, followed by an in-person summit in France a year from now.

Cyber security challenges of AI

Cyber security of AI was a common thread running throughout the Summit discussions, particularly when it came to managing the risks that may arise from potential intentional misuse or unintended issues of control of frontier AI.

Frontier AI models hold enormous potential to power economic growth, drive scientific progress and unlock wider public benefits, while also posing potential security risks if not developed responsibly. That is why cyber security is such an essential pre-condition for the safety of AI systems. It is required to ensure resilience, privacy, fairness, reliability, and predictability.

NCSC CEO, Lindy Cameron, who attended the Summit alongside GCHQ Director, Anne Keast-Butler, who also serves on the External Advisory Board for the AI Safety Institute, and Jen Easterly, Director US Cybersecurity & Infrastructure Security Agency (CISA), reiterated her long held support for a 'secure by design' approach, where security is integral to the development of AI systems from the outset, and throughout the lifecycle.

Need for AI to be 'secure by design' and built on secure foundations

One of the biggest challenges around the cyber security of AI is one that is common to any technology: ensuring that it is 'secure by design' and built on secure foundations.

As AI becomes more prevalent across the technology ecosystem – and increasingly incorporated into critical systems – we need to ensure that these systems are being designed and deployed securely to avoid harm to individuals and systems, for example putting personal safety or data at risk.

We must remember lessons from the early days of the internet. In the 1990s, new technology was rapidly rolled out – the world wide web, web browsers, the first search engines, text messages – with very limited focus on security considerations. And we continue to pay the price, for example with the presence of vulnerabilities in core email and web protocols that were not secure by design.

As AI technologies are rolled out, there are several significant risks that may make our technology ecosystem more vulnerable.

First, if security is only a secondary concern in the development of AI systems, we risk vulnerabilities being designed into new systems.

Second, AI will require the development and innovation of existing technology stacks. This development is likely to exacerbate existing vulnerabilities within these tech stacks and introduce new ones. And just as supply chain security is vital in current technology, it will remain incredibly important as AI is integrated into technology stacks.

Thirdly, it is likely that as AI is incorporated into existing IT functions, it could be integrated into legacy hardware, firmware, software, and applications, which may hold outdated security protocols.

AI security must therefore apply across this integration of technology stacks to be not only 'secure by design', but also built on secure foundations and to consider security across the whole lifecycle of the technology. It requires organisations seeking to implement AI technology within their systems to consider the system as a whole – including the underlying infrastructure and supply chains – and not just the AI component. This requires security to be made a business priority within the supply chain of emerging technology, rather than simply a technical feature.

Machine learning risks

Most applications of AI are built using machine learning (ML) techniques. ML enables a system to 'learn' for itself about how to derive information from data, with minimal supervision from a human developer. But the use of ML creates its own risks.

Training AI using most ML algorithms requires huge volumes of data, but there is no inherent mechanism for filtering out bad, inaccurate, or toxic data. Therefore biases, inaccuracy and misinformation can be intentionally, or unintentionally, built into AI with poor training or poor data. And even if it is wrong, AI can still appear extremely convincing.

As a result of this vulnerability in ML-trained AI, a new category of attack has been introduced that we need to counter: adversarial attacks.

In simple terms, adversarial attacks are an attempt to trick ML algorithms to influence the outcome of the AI. There are several methods of adversarial attack, including data poisoning

attacks, where the attacker attempts to contaminate the data used in the ML process.

Cyber security opportunities of AI

While there is significant focus on the risks of AI, we must also ensure that we take advantage of the significant opportunities that AI brings to cyber defenders.

Already, AI is already being used to detect known types of fraud, through the detection of anomalies in user actions. In consumer banking, this can be applied to improved monitoring of card usage, more quickly blocking fraudsters from using another user's credit card by identifying strange individual transactions. AI will be able to improve detection and triage of cyber attacks. As AI detects patterns and relationships between data, it can be used to recognise malicious emails and cluster them to identify phishing campaigns, which are then more easily mitigated.

It can be used to support cyber defenders, with analysis of logs and files, network traffic, supporting secure code development and testing, and threat intelligence. LLMs, in particular, are proving to be beneficial in finding vulnerabilities in source code and potentially spotting – and even fixing – flaws before attackers get the chance to exploit them. AI is incredibly quick, so could be used to pick up on potential attacks more rapidly if a vulnerability is exploited, speeding up the process of finding and fixing security vulnerabilities, and making malware analysis more efficient. Over time, it is likely we will see AI providing a generation of more secure code through faster learning.

However, not all of these cyber security improvements will come automatically. We need to foster a community that encompasses the entire cyber security ecosystem and focuses on growing

this sector in a way that is diverse and inclusive. We also need to ensure that where AI is used to enhance cyber security that we are doing all we can as a community to avoid introducing and reinforcing bias into cyber security analysis and threat monitoring. That is why the NCSC is working closely with the Alan Turing Institute to both help develop and benefit from research on AI and cyber security across a range of topics.

Challenges around the fundamentals of AI

As we have already highlighted, AI models have new, inherent weaknesses and vulnerabilities – which need to be understood by those developing them. Some cutting-edge AI models can be incredibly complex – often even their creators don't fully understand exactly how they work or what happens inside the model. This lack of 'explain-ability' is one of the key safety and security challenges.

Another central challenge is around the security and confidentiality of users' data. The fundamental operation of AI systems relies on continued access to large, representative and often sensitive datasets – this goes against normal cyber security approaches of restricting access to sensitive systems and components.

Some of the risks that flow from this are straightforward; for example, through either malicious activity or accidents, confidential information could be leaked. But there are other data risks; for example, AI models can allow adversaries to reconstruct the data they were trained on through querying the models. It's not only the integrity of the output or what it can do that is important; the data and models of the AI are valuable assets in and of themselves and should be appropriately protected.

Use of AI by hostile adversaries

AI has the potential to dramatically change the scale of the cyber security challenge that we face. Hostile adversaries are already using LLMs to develop increasingly sophisticated phishing emails and scams.

In the coming years, AI could be used to conduct targeted or untargeted cyber attacks and it is also likely to lead to the further proliferation of cyber capability to a wider range of actors. Generative AI also has the potential to create synthetic cyber environments which could be used for criminal purposes or fraud.

Risks to organisations using AI

As the opportunities of AI become more obvious, an increasing number of organisations are seeking to use it. It is vital that as they develop AI capabilities they understand the heightened and novel risks that they are running by doing it – and how best to mitigate them.

The NCSC has already provided guidance to organisations seeking to integrate LLMs into their business operations. Our understanding of the capabilities, weaknesses and vulnerabilities of LLMs will continue to develop as use cases and applications of the technology increases. As a result, organisations should make sure they are comfortable with the 'worst case scenario' of whatever the LLM application is permitted to do.

How the NCSC is maximising the benefits of AI

As the UK's national technical authority for cyber security, the NCSC's role is to understand and promote the cyber security of AI technologies, working with government, academia and industry.

The NCSC has published, and will continue to publish, guidance to support a range of different groups – from cyber security professionals to business leaders – as they seek to understand and realise the benefits that AI offers.

A number of alumni companies from the NCSC for Startups programme are using AI in a variety of ways. Meterian uses AI to boost its speed and comprehensiveness of indexing open source vulnerabilities to give enterprises the best visibility and auto-remediation of open source supply chain risks when using programming languages as old as Perl, C/C++ or the next generation language Rust. Lexverify uses AI (advanced NLP) for real-time prevention of legal, compliance, and cyber risks on electronic communications, and Visible uses AI-generated reports to provide highly detailed insight into how individuals are perceived online.

The NCSC itself is also seeking to make use of AI as part of our mission to keep the UK the safest place to live and work online. We are currently using machine learning to spot complex patterns of activity across multiple ACD datasets. For example, correlating events from our protective DNS service with those from our host-based logging capability to identify hidden malicious behaviour. We are also investigating new opportunities for ACD to incorporate improved human-AI teaming, as well as researching the potential for autonomous capabilities in the future.

In the near future, we plan to use AI to more effectively spot mutated forms of malware to enable the identification and release of indicators of compromise (IOCs) more quickly than traditional software reverse engineering or code matching allows. We also plan to identify patterns in the use of commodity services – like blockchain-based DNS – used by malware actors in order to flag potential IOCs before they have even gone live. Longer term, we plan to use the huge volumes of data generated by the NCSC's ACD products and services to identify obscure patterns of malicious behaviour across the entire government technology estate among other areas.

Afterword

This year's review demonstrates the sheer scale and breadth of the NCSC's work to inform, influence and equip audiences with the tools, motivation and confidence they need to live and work safely online in the UK.

2024 will bring considerable challenges and more opportunities. As has been set out in this review, the protection of democratic processes will be a focus for the NCSC in the UK, as well as for global partners, as key elections shape the coming year. The NCSC is determined to remain agile in its approach, to ensure the UK is competitive and proactive aiming to sharpen its focus on emerging technologies, like artificial intelligence and quantum computing. We'll prioritise our collaboration with sector partners, nationally and globally to reach our organisational aims. And 2024 will see CYBERUK move from Belfast to Birmingham, building on our commitment to ensure the NCSC's presence and guidance is felt across the UK.

Our heartfelt thanks to all those working inside and alongside the organisation, this year and every year. Our sector-leading whole of society approach hinges on strong collaboration with industry, businesses, government departments and wider sector partners, critical to the success of our collective aim to ensure the UK is the safest place to live and work online.

We can all be proud of our collective teams' achievements, ensuring the online security of individuals and organisations, and we remain united in our pledge to ensuring cyber security remains a top priority for the UK and around the world.

As NCSC CEO Lindy Cameron outlined in her Foreword, we must be focused on the future if we are to deliver a more resilient UK.
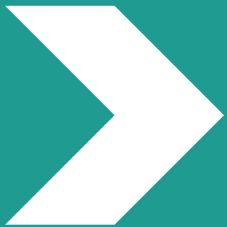
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