

Security Is Not Enough

Privacy in Encryption Regulation and Lawful-Surveillance Protocols

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Abstract

This article argues that security is not enough to fully capture what is at stake in government exceptional access to encrypted data. A conception of privacy as security has little to say about “lawful-surveillance protocols”—an active research agenda in cryptography that aims to enable government exceptional access without compromising systemic security. But the limitations are not contingent on the success of this agenda. The normative landscape today cannot be explained if security is all there is to privacy. And fundamental objections to Apple’s abandoned client-side scanning system gesture beyond security. This article’s contribution is modest: to show that there must be more to privacy than the security mold it has taken. A richer understanding is needed both to assess policy and to guide research on lawful-surveillance protocols.

ACM Reference Format:

Artur Pericles Lima Monteiro. 2026. Security Is Not Enough: Privacy in Encryption Regulation and Lawful-Surveillance Protocols. In *Symposium on Computer Science and Law (CSLAW '26)*, March 03–05, 2026, Berkeley, CA, USA. ACM, New York, NY, USA, 16 pages. <https://doi.org/10.1145/3788646.3789535>

Introduction

Encryption protects privacy, but it can keep law enforcement from information it legitimately needs. Should exceptional access mechanisms be created so that officials can obtain encrypted data when they are authorized by law? The opposition to exceptional access has converged on a reframing of the dispute. It shifts the terms from security vs. privacy to security vs. security. Under this view, exceptional access should be rejected because it would undermine the very mission of law enforcement, as any such mechanisms would also unreasonably compromise citizens’ and national security. A burgeoning research agenda—lawful-surveillance protocols—aims to use cryptography to enable exceptional access without compromising security.

This article argues that security is not enough to fully capture what is at stake in government exceptional access to encrypted data. It has little to say about lawful-surveillance protocols. Indeed, we see this lurking in the response to Apple’s proposed and abandoned client-side scanning system by long-time critics of exceptional access. Yet privacy-as-security’s limitations are not just prospective and contingent on the success of that research agenda. I argue that

the current normative landscape cannot be explained if security is all there is to privacy. My contribution is modest: I aim only to show that there must be more to privacy than the security argument whose mold it has taken in encryption policy. I do not articulate here what an alternative conception of the right to privacy would be.

Section 1 briefly recapitulates the “Crypto Wars.” Section 2 summarizes and contextualizes the privacy-as-security argument. Section 3 surveys and assesses lawful-surveillance protocol proposals. Section 4 shows that not only is privacy-as-security insufficient to evaluate such protocols, but also that it does not explain why exceptional access mechanisms cannot offset any introduced risks by modifying background institutional conditions, such as statutory requirements for interception (Section 4.1). It also fails to justify the exceptional-access positions opponents have taken on government hacking (Section 4.2). In fact, the objections by opponents to Apple’s proposed client-side scanning system themselves require an understanding of privacy that goes beyond security (Section 4.3).

1 The Long Crypto Wars

Disputes about the legal status of cryptography, what it is and what it should be, are long-standing. Tensions trace back at least to the very first days of public-key cryptography [54] in the 1970s [186]. A letter from an NSA official to the IEEE warned that an October 1977 IEEE symposium on information theory would violate the International Traffic in Arms Regulations [163]. The NSA stated that the official had acted in his personal capacity [184], and the symposium went ahead.¹ The NSF temporarily suspended new funding for cryptographic research after pressure from the NSA [17, p. 351]. Even Kahn’s 1967 public-facing *Codebreakers* [93] was subject to deletion requests from the NSA, and before the Defense Department had insisted publication “would not be in national interest” [115, p. 23].²

Though the tensions did not start then, the term “Crypto Wars” referred to the contestation that arose in the 1990s, when encryption regulation made headlines (Section 1.1). At that time, national security and law enforcement officials worried that commercially available encryption would soon take hold of communications and seriously obstruct their mission. Since then, as strong encryption was rolled out and turned on by default to billions of users, efforts to restrict encryption have been championed by law enforcement,



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CSLAW '26, Berkeley, CA

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ACM ISBN 979-8-4007-2447-3/2026/03

<https://doi.org/10.1145/3788646.3789535>

¹Though, acting on advice from Stanford counsel, Martin Hellman presented the paper, instead of his then students Steve Pohlig and Ralph Merkle, as had been planned, as “Hellman had the benefit of the tenure system to support him if he were to get into any trouble” [189, p. 368].

²Levy notes the suppressed passages struck Kahn as unimportant [115, p. 23]. Recent research [164] shows the objections to the passages were raised by British intelligence, with whom the NSA shared the manuscript.

with intelligence officials sometimes explicitly [14, 113] siding with encryption as a matter of national security (Section 1.2). More recently, calls have also been made by other actors and for reasons not limited to law enforcement or national security (Section 1.3).

This section offers a brief recapitulation of the Crypto Wars. It aims to place current discussions in context. While it is sometimes claimed that the conflict was settled in the 1990s, what emerges from this overview is that a full articulation of privacy was never really offered.

1.1 Crypto Wars I: The Clipper Chip

At the center of what has become known as the first Crypto Wars was the Clipper Chip, which implemented the NSA-designed Skipjack algorithm for an escrowed encryption system in encrypted telephony [53, p. 454].³

Clipper was the NSA's reaction to the announcement that AT&T was about to market the \$1,295 Telephone Security Device Model 3600 (TSD-3600) [159, p. 309; 56, p. 233]. The news so worried the NSA that it briefed the President-Elect Clinton's team and managed to make it a priority in the new administration's first hundred days, with Vice President Gore leading policy [158, pp. 488–90]. The FBI, alerted by the NSA [56, p. 83], internally argued that warrant-resistant communications were illegal [159, pp. 308–309], and even prepared a memorandum to AT&T citing civil and criminal sanctions [159, pp. 309–310]. The FBI was willing to go much further, but the NSA's approach prevailed.

The government's strategy was to make adoption voluntary, but inescapable. It planned to rely on the government's purchasing power [74, p. 32] and Fort Meade's secret trove of cryptographic research to make its Escrowed Encryption Standard (EES) an irrefutable proposition.

EES [53] used tamper-resistant hardware (Clipper and Capstone) to encrypt 80-bit session keys with the NSA-designed Skipjack cipher. Communication would be established, however, after the exchange of a "Law Enforcement Access Field", LEAF, containing the session key and a chip unique identifier, which were encrypted with a family key common to all chips, as well as a chip unique key. Such keys were split into components that were held by government agencies. Upon receiving a legitimate request, such agencies would use the chip unique identifier (obtained by the requesting authority by decrypting the LEAF with the family key) to provide the chip unique key. Regulations designated NIST and a division within the Treasury Department as the escrow agents [73, p. 759].

Nine thousand TSD-3600E devices⁴ were acquired just by the Department of Justice [73, p. 769], at the cost of about \$1,000 per unit [31, pp. 318–319].⁵ Mass government purchasing was thought to create market conditions favorable to EES and unfavorable to alternatives [140, p. 442]. The NSA-designed Skipjack algorithm also made superior security claims: it used a longer key (80 bits) and deployed techniques only known to the Agency. The secrecy in the design invited speculation that Skipjack hid deliberate vulnerabilities, which the government sought to dispel by having it audited by a group of external experts whose report corroborated the security

claims [33, p. 126].⁶ With this combination of economic incentives and NSA security guarantees, the government hoped EES would become the *de facto* national standard [140, p. 442], without any new statutory authority.

Yet escrowed encryption itself was challenged vigorously as fundamentally unsafe. A report [1] was particularly influential; its authors, joined by other collaborators, have since published two other reports that form the canon of the debate on encryption policy [3, 4]. Despite this opposition, Clipper was brought down not from the revelation of a security flaw that exposed encrypted data (which was never found [133, p. 63]), though a vulnerability that allowed users to defeat the escrow itself by spoofing the LEAF [30] made front-page news in the June 2, 1994, issue of the *New York Times* [121].

Rather, strong, organized opposition to EES coalesced around the costs to technological innovation and a nascent digital economy (part of the Clinton administration's information superhighway agenda, also championed by Vice President Gore [99, pp. 2–3]). One of the most important early responses was an open letter organized by the organization Computer Professionals for Social Responsibility (CPSR), an online petition to President Bill Clinton that Gurak considers unparalleled at the time [99, p. 41], signed by more than 50,000 people [97, p. 7]. It pointed to both privacy and innovation: "[I]f this proposal and the associated standards go forward, even on a voluntary basis, privacy protection will be diminished, innovation will be slowed" [42].

The hardware-based approach that EES adopted was seen as particularly hampering innovation, not least because it meant that security product offerings would depend on government-authorized component suppliers [56, p. 237]. Despite the relatively low cost per unit of the chips, encryption "was, by the 1990's, becoming an essentially zero-marginal-cost technology, something that could often be implemented in software more easily than by adding specialized hardware" [31]. Trying to salvage the plan, the government switched to a software-based approach (which it named "Software Key Escrow" [74, pp. 33–34] but opponents dubbed "Clipper II" [159, p. 320]), partly in response to congressional pressure against the plan [115, pp. 264–268].

Yet there was still a more fundamental obstacle escrowed encryption posed to the U.S. security industry. It believed the scheme would hurt the U.S. global competitiveness [99, p. 34]. Companies expected that their international clients were unlikely to buy a product that gave the U.S. government, but not their own governments, access to their encrypted data. This issue was folded into a broader push by the industry for loosening export controls imposed through Arms Export Control Act and Export Administration Act authorities and implemented by the International Traffic in Arms Regulations (ITAR), which limited exports to 40-bit keys [55].⁷ Like

⁶Not everyone was satisfied: Schneier and Banisar argued the report's authors were too close to the NSA [159, p. 315].

⁷While less relevant to this article, export controls were a significant part of Crypto Wars I. The Export Administration Act also regulated the export of dual-use (military and non-military) products [48, p. 114]. A complex set of rules and individual evaluations established what could be exported [74, pp. 21–23]; in practice, systems with keys longer than 40 bits were not allowed. The legislation also allowed for the regulation of imports, but a 1996 National Research Council report noted that the regulations imposed no restrictions [48, p. 115]. Practical reasons nonetheless often imposed the development of a single product for both domestic and international markets [18, p. 277; 115, p. 262] or the adoption of a single global consumer standard

³A different piece of hardware, the Capstone Chip, implemented Skipjack for computer communications [30, p. 60].

⁴The "E"-designation models were equipped with the Clipper Chip [31, pp. 318–319].

⁵The Clipper Chip itself cost between \$15 and \$25 per unit [47, p. 480; 48, p. 212].

the strict controls on encryption, which U.S. exporters complained hurt their global standing [55, p. 729], Clipper would put their products at an international disadvantage.

On a parallel track, the U.S. had sought support for an international solution to soothe industry concerns. It tried to inscribe key escrow requirements into the non-binding 1996 Wassenaar Arrangement (which, at the time, limited exports to 64-bit symmetric keys⁸). That effort failed [36, p. 784]. A different effort was made through the OECD. Only France and the U.K. backed the proposal. The document the organization ultimately published⁹ did not adopt the key-escrow strategy proposed by the U.S. Though it called for reconciling market-driven technological development and investigative demands, it was vague and let members free to decide for themselves [102, p. 100]. The global Clipper “effort failed” [140, p. 449].

A congressionally commissioned report by the National Research Council (NRC) had also dealt a setback to the Clipper Chip [48]. Although Clipper critics had been wary that the NRC-convened group was dominated by members who were or had been part of the intelligence and law enforcement communities to deliver an independent assessment [56, pp. 242–243; 115, p. 296], the report criticized key parts of the government’s strategy. The report’s take-home message was telegraphed by its title, *Cryptography’s Role in Securing the Information Society* (CRISIS). U.S. policy was “not adequate to support the information security requirements of an information society,” the group concluded [48, p. 301].

1.2 Crypto Wars II: “Going Dark” and “Apple v. FBI”

The doomsday premonitions by 1990s officials about widespread encryption were exaggerated. As DeNardis writes, “those who developed encryption standards in the 1970s, whether for securing financial data or for preserving the confidentiality of government communication, could never have predicted that cryptography would not be ubiquitously deployed everywhere well into the twenty-first century” [52, p. 218; 56, pp. 257–259]. As late as 2013, Narayanan distinguished between the success in the deployment of what he called “crypto-for-security” and the slow pace of “crypto-for-privacy” [132]. Even well-established encryption disappointed. Jarvis notes that, in 2016, only 40% of internet traffic was encrypted with Transport Layer Security (TLS); the figure would reach 80% in 2019 [92, p. 338; see 100, for a discussion].

In late 2014, when, in the wake of the Snowden revelations [10, 105, 106, pp. 19–27], Apple [154], Google [177], and Meta’s WhatsApp [81] announced they were implementing end-to-end encryption by default, the 1990s anxieties seemed to finally materialize. This meant that officials were no longer able to “seek access to stored communications held by these intermediaries by obtaining a warrant, court order, or subpoena” [194, p. 4] as they had before.

[159, p. 326; 134, p. 158]. As such, the same NRC report concluded export controls were used indirectly to set domestic encryption restrictions [48, pp. 113–114; see also 75, p. 357].

⁸The Wassenaar Arrangement system, which lets each country decide on its own restrictions [55, p. 732], loosened on encryption in 2009 [77, p. 60]. It has since become broadly permissive [57, pp. 3–4].

⁹Recommendation of the Council concerning Guidelines for Cryptography Policy. OECD/LEGAL/0289.

The FBI’s reaction to end-to-end encryption by default was quick. A month after Apple’s announcement, Director James Comey gave a speech at the Brookings Institution claiming “it would have very serious consequences for law enforcement and national security agencies at all levels” [39]. He echoed FBI General Counsel Valerie Caproni’s 2011 warning that officials were “going dark” [35, p. 7]. To Comey, the phrase denoted the problem that “[t]hose charged with protecting our people aren’t always able to access the evidence we need to prosecute crime and prevent terrorism even with lawful authority” [39].

The conflict was not limited to the U.S. For instance, in 2015, Brazilian courts ordered the suspension of WhatsApp after it deployed end-to-end encryption (E2EE) [5]. The Supreme Court stayed the order, but the constitutional challenge (ADPF 403) is still pending [166]. But Crypto Wars II became known for the orders in U.S. cases, often informally referred to as the “Apple v. FBI” cases.

The case pursued by U.S. law enforcement officials before Congress and the court of public opinion [35, 39] elicited responses [24, 97, 123, 176, 180, 194]. The Berkman Klein Center at Harvard University published an influential report [194], and authors of a 1997 report on Crypto Wars I proposals [1] were joined by others, and published the leading analysis “Keys under doormats” [3].

The conflict centered on requests for Apple to assist law enforcement officials in overcoming security features in its own systems. In 2015, the FBI applied for orders directing Apple to assist with investigations by disabling a security feature that erased the device’s data after a number of failed passcode entry attempts [144, 152]. This barred the FBI from launching a brute-force attack against devices it had in its possession and which it was authorized to access. In one of the cases, after a terrorist attack that took the lives of 14 victims in San Bernardino, CA, the FBI obtained permission to access the iPhone used by one of the shooters from the local government agency that employed him and owned the phone [119]. In that case and another in Brooklyn, the government applied for an All Writs Act order compelling Apple to design and use its cryptographic keys to sign and install a modified version of iOS without the passcode-entry deletion trigger [152, pp. 125–128].

Apple responded, contesting the government in an open letter to its customers, signed by its CEO [43, 119] and in court. Its arguments in court primarily were that the government’s orders either were not within the ambit of the All Writs Act or did not meet the tests established by case law for similar assistance. The company also argued that, as a constitutional matter, compelling it to comply with the order would be too burdensome and a violation of the Fifth Amendment’s due process clause, and it had a First Amendment right against compelled speech that protected it from writing the code for the modified version of iOS and signing it with its cryptographic key [152, pp. 125–128].

The clash was mooted when the FBI announced it had been able to unlock the phones with help from a third party [27]. Section 3.2 analyzes the security considerations raised by commentators [3, 194] as it discusses proposals put forward since then.

1.3 Crypto Wars III: A New Chapter?

Chronicling the Clipper Chip debacle and the loosening of export controls in late 2000, Steven Levy crowned a clear winner: “It was

official: public crypto was our friend” [115, p. 307] Indeed, writing about the “Apple v. FBI” cases in 2016, he questioned why the Crypto Wars were being rehashed. To Levy, the conflict had been settled, and the deal was that, if the government “wanted to gain access to encrypted communications and files, they would do so by warrants and their own cryptanalysis, and not by demanding that the systems themselves should be weakened” [116]. Rozenstein correctly countered that public policy is not subject to *stare decisis* [153, p. 1195].

Not only is there no *res judicata*, but Levy’s 2000 conclusion was premature. Snowden revelations commentators believed that a mass surveillance scheme was made possible by a deliberate vulnerability they suspected had been introduced by the NSA to Dual EC DRBG, a pseudorandom number generator [29, 92, 142, 188, pp. 324–327], which had the potential of exposing all TLS/SSL encrypted internet traffic. And in at least one case before the Apple cases, the FBI sought and obtained an order compelling an email provider to hand over its private SSL certificate keys so that the police could launch a man-in-the-middle attack targeting Edward Snowden [114, 138, 143]. Accounting for this, the dividing line between the Clipper Chip saga and “Apple v. FBI” seems less clear.¹⁰

Likewise, the 2015–2016 skirmishes seemed to quickly give way to a truce [103, p. 900]. Yet not much later, as we will see (Section 4.3), Apple reignited the debate when it announced updates introducing client-side scanning for child sexual abuse material, which commentators speculated owed at least in part to pressure from officials against plans to adopt E2EE for iCloud data [124]. Not long after, the European Union started considering client-side scanning as part of its proposed Child Sexual Abuse regulation, which is informally referred to as “Chat Control.”¹¹

As of this writing, the EU proposal had been softened to remove language making client-side scanning mandatory [37], though some have concerns that other provisions could be used to reintroduce the requirement in the implementation of the regulation. Apple eventually rolled out E2EE for iCloud data, which it calls Advanced Data Protection; in the U.K., officials publicly opposed it and later issued an order that it be disabled [125]. Apple disabled Advanced Data Protection in the U.K. and challenged the order, a technical capability notice under the Investigatory Powers Act of 2016; the government sought but was rebuffed in its effort to keep the challenge under seal [96, pp. 522–523]. It was initially reported that British authorities had agreed to drop the order after U.S. high-ranking officials (including the President, the Vice-President, and the Director of National Intelligence) intervened [126]. Later, Apple stated it was “still unable” to offer Advanced Data Protection in the U.K., and news accounts said a second order had been issued, which “stipulated that the order applied only to British citizens’ data” [83]. The status of encryption regulation remains uncertain in other jurisdictions, as noted above.

One way to understand this is as a new chapter of the Crypto Wars, its third installment. Jarvis [92] argues that a proper account of the conflict would begin much earlier than the Clipper Chip, with

the NSA’s reaction to Kahn’s *Codebreakers*.¹² He counts “Apple v. FBI” as the third act. The fact that the push to limit user encryption now comes not just from government officials but also from companies that were mass adopters of E2EE might be a distinguishing factor. And while part of the debate is still about law enforcement, part is not, as Duan and Grimmelmann note [58, p. 15] in their comprehensive analysis of content moderation on E2EE messaging services under U.S. statutory law.

I make no periodization claims. My interest, instead, is to show that, despite longstanding debates and occasional premature declarations of victory, a central question has not been addressed. Others have noted open questions. Feigenbaum observes that “it has not actually been shown that no useful form of LEA can be implemented without creating unacceptable risk” [2019, p. 29]. Hurwitz [2017, pp. 369–371] sees a different social, economic, and technological landscape posing new questions that cannot be taken as settled by the debates surrounding the Clipper Chip. Rozenstein goes further and submits that “[t]here can and will be no permanent resolution to the problem of law enforcement access to encrypted data” [153, p. 1196]. My claim is that, despite the sophistication the debate has acquired, our conceptual understanding of how privacy is implicated remains limited.

2 Securing Privacy

As DeNardis observes, arguments about technological innovation and its economic promises, which weighed heavily in the resolution of the Crypto Wars I, if present, are much less conspicuous today [52, p. 126]. Neither do privacy advocates turn to libertarian cypherpunk arguments that animated some of the Crypto Wars I [91, 149]. Instead of a dispute over the authority of the state to impose restrictions on encryption, what defines the discourse in opposition to the FBI and officials in the United States, Brazil, Australia [50, 86, 173, 174], India [7, 34, 127, 128] and in the U.K. [6, 95] is a savvy *reframing of the terms of the conflict*.

While officials claimed that the security of citizens depended on a sacrifice of their privacy and justified limiting encryption [16, 40, 182], the other side of this debate questioned the very premise of this opposition: it was not privacy versus security, but security versus security [141, pp. 617–619]. To be fair, the 1996 NRC report also argued that viewing cryptography as an opposition between security and privacy was “simplistic” [48, p. 302]:

If cryptography can protect the trade secrets and proprietary information of businesses and thereby reduce economic espionage (which it can), it also supports in a most important manner the job of law enforcement. If cryptography can help protect nationally critical information systems and networks against unauthorized penetration (which it can), it also supports the national security of the United States.

Yet what the reports’ authors considered in a sage exercise of futurecasting is now our rich reality. And scholars have done important work in articulating it. Susan Landau, a leading voice in encryption policy who has written on it for almost three decades

¹⁰One might say that when Crypto War II ended, the NSA took the fight underground, a move entirely unknown to the public until Edward Snowden” [9, p. 288].

¹¹Proposal for a Regulation of the European Parliament and of the Council laying down rules to prevent and combat child sexual abuse, COM(2022) 209 final, 2022/0155(COD). See [15, 179].

¹²Other periodizations have been offered. Landau suggests that “[t]he first skirmish in the ‘Second’ Crypto War occurred in 2003 when the FBI recommended extending the CALEA to Voice over IP (VoIP) providers.” [112, p. 242]. On CALEA, see [90].

[9, p. 286; 8], deserves much credit for reframing security as an ally of privacy and the use of encryption. Though earlier writing gestured toward this move [22, 104, pp. 11–12], its current form appears in her testimony at a 2016 public hearing before the United States House of Representatives [107, p. 24] and is articulated in monograph-length treatment [108].

In that book [2017], Landau places the discussion within a broader cybersecurity perspective. She notes how fragile systems security is and shows how digitization has left everyone exposed to its fragility, from the smartphone user accessing her bank to a nation's critical infrastructure. She describes how vulnerabilities become weapons for cyberwarfare, as in the U.S. attack on Iran's nuclear program. Against this backdrop, she concludes that exceptional-access schemes like those proposed by the FBI exact a steep security price in exchange for evidentiary demands: "The government's role is to provide security—national security and law enforcement—and not to prevent individuals from maintaining their own security" [108, p. 172].

This reframing of the conflict is insightful. It removes the "home-field advantage" that law enforcement and intelligence officials enjoy when the issue is cast as privacy vs. security [171, p. 41]. Privacy usually plays away games on the fields where security questions are decided. It is not only that the institutional design of those fora is oriented toward security as a paramount value. Privacy advocates do not even have enough information to contest the authorities, who benefit from the secrecy imposed on matters of national security and (albeit to a lesser extent) public safety [168, p. 772].

By treating encryption restrictions as a conflict internal to security, privacy advocates "turn[] security arguments on their heads" [131, p. 207]. They reverse how encryption was treated for most of its trajectory, until the turn in the 1970s: once discussed as a matter of national security and regulated on reasons of state, encryption is now cast as a matter of the security of each individual in a society, not only of the state as that society's protector. The right to privacy as a right to security speaks in the language that once belonged only to government officials, even when it relies on ominous scenarios and catastrophe, like "a digital Pearl Harbor" [52, pp. 126–127].

Much of this argument in encryption policy was advanced by cryptography and systems security scholars, including in policy writing and congressional briefing, e.g. [3, 4, 107]. Other influential writing has featured scholars from law and related fields [144, 194]. This important body of work has set aside for strategic reasons (sometimes explicitly, [194, p. 24]) normative discussions that go beyond the security framing.

Privacy-as-security proponents are in good company. In fact, encryption policy has developed in tandem with leading scholarship on privacy, which has been marked by pragmatic thinking [e.g. 170; 87; 84, p. 77; see 130, pp. 216–217]. This scholarship emphasizes procedural questions of oversight [170, p. 1529], and (though perhaps this is not as widely shared among the field [150, pp. 67–68]) rejects non-consequentialist accounts of its value [167, pp. 1144–1145; 169, p. 88]. It should not surprise, then, that encryption policy has likewise focused on such questions.

In fact, while U.S. courts have yet to confront fundamental rights claims about encryption and surveillance, European courts have—and have embraced the pragmatic approach to privacy that emphasizes procedural questions and is amenable to the security conception of privacy at play in encryption policy. In *Podchasov v. Russia* [64], the European Court of Human Rights ruled that providers could not be required to build systems to maintain decryption capabilities. It seized on the impacts on the safety of all users to conclude that the Russian requirement was disproportionate [20]. A commentator writes that "the *Podchasov* judgment seems to leave options open if a decryption technology becomes available that would not weaken the security of all users [165, p. 5]. In previous judgments, both the ECtHR and the Court of Justice of the European Union, applying different legal regimes, emphasized procedural safeguards (or the lack thereof) [20, 191, p. 2].¹³ Procedural safeguards are part and parcel of the pragmatic approach to legal thinking on privacy, as we have just seen. And, as we shall see next, most proposed lawful-surveillance protocols are anchored in procedural safeguards. Both scholarly writing and judicial doctrine have articulated privacy in a manner that is consistent with its treatment in encryption policy.

Securing privacy has been a strategic and important move. My goal is not to refute it. Yet it does not fully capture what is at stake. I make this case in the remainder of the article. Section 3 first surveys and examines vigorous work, which I gather under the heading of lawful-surveillance protocols. This agenda, I argue, fits the mold of privacy as security and seeks to meet the goalposts it sets. Such work necessitates conceptualizing privacy to account for more than security.

I should stress that my argument is *not* that cryptography and systems security scholars ignore or do not value privacy.¹⁴ My claim is also not that any or all of those scholars subscribe to a strong version of privacy as security, according to which all important aspects of the encryption debate are reduced to security, broadly construed. Rather, my position is that privacy-as-security has been the only articulation to gain traction.¹⁵

Next, Section 4 offers two reasons why privacy-as-security does not explain the stances that encryption restriction opponents have taken, even when lawful-surveillance protocols are bracketed. It also examines how an influential critique of client-side scanning carries within it the seeds of concerns that exceed security.

3 Lawful-Surveillance Protocols

As FBI officials spoke of "going dark" in testimony before Congress, some computer scientists began thinking about lawful-surveillance protocols [161]. Pioneering work on this agenda positioned itself as a pragmatic response to Edward Snowden's revelations [69]. This

¹³This is by no means a full analysis of either applicable EU law or Council of Europe law. See [20, 51, 165, 191]. Nor is the claim here that this emerging case law has reduced privacy to safety and oversight; rather, these have been the most salient and more developed discussions. For an argument that exceptional-access mandates are inconsistent with both European regimes because they infringe upon the "essence" of the right to privacy, see [51, pp. 68–72].

¹⁴Landau, for instance, while focusing on security, also refers to the preamble to the U.S. Constitution and the origins of the Fourth Amendment, and recalls the Church Committee [104, pp. 189–190, p. 250; 108, p. 169–172].

¹⁵Of course, I do not ignore that advocacy will often appeal to the value of privacy, nor do I question its worth. This just does not provide the conceptual articulation I argue is missing.

response is premised on the idea that surveillance carried out by intelligence and police agencies can proceed through open processes, using cryptographic protocols to allow the public to oversee their activities, rather than secret processes that require society to trust these agencies without concrete information on which to rely. Proponents of lawful-surveillance protocols regarded surveillance as an inevitable reality [160, p. 1; 68, p. 3] and argued that the best way for cryptography and information-security research to control it is “to design protocols that allow government agencies to collect and use data that are demonstrably relevant to their missions while respecting the privacy of ordinary citizens and being democratically accountable” [160, p. 1].

Lawful-surveillance protocols posit that “by deploying appropriate cryptographic protocols in the context of sound policy and the rule of law, citizens can have both user privacy and effective law enforcement and intelligence” [68, p. 1]. Their thinking was attuned to influential scholarly writing by Solove, to whom privacy and security can be reconciled “by placing security programs under oversight, limiting future uses of personal data, and ensuring that the programs are carried out in a balanced and controlled manner” [171, p. 207]. The agenda follows a broader trend of proceduralization in data protection [84].

Part of this project requires establishing the design principles for the lawful-surveillance protocols so that “citizens can have both user privacy and effective law enforcement and intelligence”. The goal is to confer upon the qualifier in “lawful surveillance” a stronger meaning, not just an indication of the agent behind it (as in “government surveillance”). The agenda aims to establish “lawful, accountable, privacy-preserving surveillance. The idea is to combine cryptographic protocols (SMC, PIR, etc.) with blackletter law” [67, p. 10]. Proponents “advocate[] combining technical protocols with legal and social protocols” [67, p. 10].

This section surveys work that, even if it does not label itself as such, is helpfully understood from the perspective of lawful-surveillance protocols.

3.1 Data Available in Cleartext

The first protocols were aimed at cryptographically regulating access to data that government officials already enjoyed in cleartext [67, p. 11], such as data stored by cloud service providers [69].

A real case motivated a protocol concerning cell towers, the “high country bandits” case [88, pp. 805–807]. In 2010, a group robbed banks in three different cities in Arizona and Colorado. A witness testified to seeing members of the group talking on a cell phone. Based on that lead, the FBI obtained cell-tower connection information for the crime locations and used it to identify cell phone numbers that appeared on all three lists. This allowed officers to single out a suspect, request his subscriber information (name and address) from the phone carrier, and arrest him.

However, in order to compare the cell-tower connection lists and find phones that appeared on all three, the metadata of 149,999 people was disclosed to the FBI, making them vulnerable to use in other circumstances and for other purposes [67, pp. 11–12]. Instead, the academics proposed a protocol that would allow the phone carrier to keep information about connections to cell towers *encrypted* while still meeting the FBI’s demand for numbers

of potential suspects that recur across the different *datasets*. The information corresponding to potential suspects (i.e., those who appeared on all three lists) would be delivered to the FBI without exposing the hundreds of other records; the FBI would have access only to the results of that query across the records. The carrier itself would also not know what or whom the FBI’s interest targeted, because the query (i.e., the specification of the parameters sought by the FBI: phones connected to towers in the vicinity of the crimes at the times they were committed) would be encrypted.

3.2 Data Stored in Encrypted Devices

Other proposals seek to create protocols that provide government officials with cleartext access to data stored in encrypted devices. For instance, data contained in smartphones with full-disk encryption (FDE), which protects data stored on a powered-off device [76, 193], and run-time file encryption (RTFE), which protects devices that are powered on but locked [193].¹⁶

3.2.1 Self-Escrow. Stefen Savage’s proposal identifies two main considerations in debates about encryption regulation. First, the risk of mass surveillance. Second, the risk that an exceptional-access mechanism would be exploited by malicious actors [155, p.1764]. To address these two points, his proposal lists four properties of a suitable system for granting access to authorities: *non-scalability*, with constraints that prevent the system from being used for mass surveillance; *authorization*, with verification of the legal basis for access; *particularity*, via conditions that allow the mechanism to provide access to a single device only; and *transparency*, through conspicuous notice to the user when their device is the target of exceptional access [155, p.1765].

Under his protocol, exceptional access requires that the device be physically obtained and held for a period before which the mechanism would not operate, as a way to avoid mass surveillance and to make clandestine interventions on the device more difficult (e.g., taking advantage of a user’s inattention to compromise the device). The key would be self-escrowed on the device itself to avoid the risks of centrally managing millions of escrowed keys. To provide transparency, the device would display a message upon boot in the event of an unlock attempt. The mechanism would also require the manufacturer’s cooperation, which, according to the author, adds an external check on the police by an entity that already enjoys the user’s trust.

Savage’s proposal partly follows principles adopted by Ray Ozzie in his proposal, which gained attention with a *Wired* article by Steven Levy [117]. Ozzie did not publish a paper outlining his proposal, “CLEAR,” which was discussed in confidential, informal conversations. After the magazine story, Ozzie published slides related to the proposal [139]. The scheme would also be based on self-escrow and unlocking via a key provided by the manufacturer. But Ozzie did not include Savage’s time vaulting and transparency components.

Ozzie’s proposal was heavily criticized [26, 110]. Upon seeing it presented [23], Eran Tromer immediately identified how an adversary could manipulate the police by pretending to target a suspect’s device in order to obtain the key to anyone else’s device [178].

¹⁶See [192] a description of the security mechanisms in iPhone and Android devices.

Tromer’s attack exploits the fact that Ozzie’s protocol does not verify whether the QR code displayed by the device seized by the police actually corresponds to that device. This would create room for someone to hand over to the police a device that impersonates another device, displaying the QR code for someone else’s device (for example, a victim’s phone stolen by the criminal). When the police entered the unlock code into the seized device, that device would then send that information to the attacker (who could thus unlock the victim’s phone). Savage outlined potential mitigations for this attack but did not present a protocol that integrated them [155, p. 1774].

An important factor in Savage’s and Ozzie’s proposals is control over the manufacturer-held authorization or decryption keys required to access the passcode self-escrowed on the device once police had physically obtained it. This would create an opportunity for malicious insider attacks—people working for manufacturers managing those keys—as well as for external attacks aimed at obtaining those keys, including via social engineering. This has been identified as a risk of key-escrow schemes since the 1997 “Risks” report [1, pp. 11–12] and reiterated in “Keys under doormats” [3, p. 4]. A consequence of key-escrow proposals is the creation of new, highly valuable assets for cybercrime—vaults holding billions of cryptographic keys.

Savage’s and Ozzie’s proposals partly mitigate this risk by limiting the immediate utility of compromising manufacturers’ keys, which would not give direct access to the contents of encrypted devices (which, again, would require physical seizure). Savage compares these risks to those inherent in managing the cryptographic keys manufacturers use to sign operating-system updates as legitimate for devices.

Matthew Green points out that the comparison is not apt, because operating-system update keys are used far less frequently—only when updates are issued, for example, monthly [78, 133, p. 60]. This higher frequency of use for a decryption key would also imply that more people have access to it to handle numerous requests throughout the day, as noted by Pfefferkorn [144, p. 7; 133, p. 60]. A National Academies of Sciences, Engineering, and Medicine (NAS) report further stresses that compromising an unlock key would give immediate access to a device’s contents, yielding more direct utility to an attacker than an update-signing key, which would merely open an opportunity for launching an attack [2018, pp. 59–60].

Savage responded that abuse risks could be mitigated with a key-protection mechanism that requires a certain number of people for access, with auditability via access reports [155, p. 1770]. As further mitigation, Varia suggests that exceptional access could occur on the same cadence as current software updates [185].

3.2.2 Social Cost. Another proposal follows the properties identified by Savage for a lawful-surveillance system but modifies them with respect to authorization and transparency. The principle behind the JJE system—*judge, jury and encryption*—is the imposition of a “social cost” for decryption [162]. Unlike Savage’s and Ozzie’s proposals, JJE does not assign the manufacturer the function of unlocking the device. The manufacturer merely develops the system and produces the device in accordance with it. Unlocking then depends on the involvement of two groups: custodians and delegates.

The former would be entities “belonging and operated by the government itself (e.g., district courts), nonprofit groups, corporations, or academic institutions” [162, p. 5]. Custodians would jointly (in a number set by the system) provide an unlock request, which would depend on the approval of the delegates. With that request, the police would then need to find the delegates—the “jurors”—third-party devices whose physical possession would be required to approve the unlock. These delegates would be randomly chosen and known only when the unlock request was approved.

The authors admit that their protocol would not protect devices in situations where “abusive law enforcement to secretly coerce all custodians or to routinely silence citizens selected as delegates” [162, p. 13]. This would also extend to attackers external to the police, such as criminals, even if they would have to compromise custodians and obtain the jurors’ devices.

3.3 Encrypted Communications

Designing lawful-surveillance protocols is much harder with respect to encrypted *communications* (as compared with data *stored* on encrypted devices) [63, p. 10]. One reason is that good security practice for communications is to adopt *forward secrecy*, in which a symmetric key for each session is established and promptly discarded. The advantage of this approach is that it limits any eventual interference by an attacker, who would have access only to communications from the moment of the attack, as opposed to what would happen if asymmetric keys were used to encrypt messages, which would give the attacker access to all communications (that had been encrypted with that key). While email-encryption systems such as PGP use asymmetric keys to encrypt messages, apps such as WhatsApp and Signal adopt *forward secrecy* [3, p. 6]. Moreover, whereas proposed lawful-surveillance protocols for stored data rely on the requirement of physical possession of the device to limit risk, authorities’ demands for communications data generally translate into remote access to communications data intercepted in transit. This adds more complexity and risk to the system [133, p. 65]. A report by a working group composed of people with experience in law-enforcement and intelligence agencies and independent academics considered that research on exceptional access for stored data deserved more discussion but did not “identify any approach to increasing law-enforcement access that seemed reasonably promising” [63, p. 8].

3.3.1 Crumple Zones. One proposed lawful-surveillance protocol that would encompass encrypted communications (and could also be applied to stored data) is described as creating “crypto crumple zones” [190]. The term is an allusion to the automotive engineering structure that allows a vehicle to deform in a way that is safe for passengers in the event of a collision: the car crumples in a controlled fashion, absorbing the impact. Wright and Varia suggest that encryption could also “break a little bit in order to protect the integrity of the system as a whole and the safety of its human users” [190, p. 289].

The scheme embeds cryptographic puzzles into per-message ephemeral keys, making recovery possible but very expensive. Part of the puzzle is designed to match Bitcoin’s proof-of-work computation so the authors can predict real-world marginal cost with reasonable confidence [190, p. 289]. Rather than introducing an

escrow key (or escrowing key bits), this approach offers access by crumpling the encryption key—planned and calibrated insecurity [190, p. 292]. Wright and Varia attribute the problem of mass surveillance to a lack of proportionality in its costs, which their crumple zones would undo [190, p. 290]:

When surveillance is cheap, law enforcement agencies have little incentive to refrain from collecting information on as many targets as possible. . . . When electronic surveillance is expensive, as in the physical world, law enforcement must choose their targets wisely to focus on only the most pressing threats.

To that end, they estimate the computational cost for solving the puzzles that would grant access to encrypted data. By setting an entry cost on the order of hundreds of millions to billions of dollars, they intend that such an investment will select only state agents, who would have such sums to gain access to the data. Other costs would also be set: per geographic region, application or system, user, and message. Each break would require marginal costs (which they estimate between a thousand and a million dollars) in addition to the entry costs, creating economic incentives so that only legitimate targets would be pursued.

Although it depends on fewer external factors and reduces dependence on trust in companies (compared to the escrow schemes above), this proposal does not ensure transparency [162, p. 3] or legal authorization for obtaining the data (i.e., it does not establish a procedure by which only legitimate agents could decrypt the data).

3.3.2 Arleas. A more recent proposal applied to encrypted communications, ARLEAS—*abuse resistant law enforcement access system*—also explores blockchain concepts, but in its public ledger, not proof-of-work [80]. Messages in an ARLEAS system would be encrypted both with the interlocutors’ keys and with a second cipher that enables exceptional access. Decryption via this second cipher requires that the police obtain a judge’s authorization and that this authorization be validated in the system by a transparency function, which publishes information about the interception in the public ledger. Only with the proof of publication related to the authorization can the message be decrypted using the exceptional-access cipher. As the name indicates, the system is not abuse-proof; abuse would occur if judge and police acted maliciously. The public ledger is offered as a cryptographic constraint on this risk, as it would provide transparency while also serving as a key to authorities’ access [80, p. 556].

3.3.3 Content Moderation in E2EE. Important efforts have gone into supporting content moderation in E2EE messaging services. [94] provides an overview; [156] supplies a systematic literature review.¹⁷ The present survey of lawful-surveillance protocols does not encompass all proposals made in this context, which, as mentioned before, is not limited to law enforcement concerns. Some approaches, however, would be consistent with lawful-surveillance protocol requirements to the extent that the access to (otherwise) encrypted data would be controlled not just by policy but also by cryptography [e.g. 157]. Section 4.3 discusses Apple’s protocol, which uses approaches that have also been explored for content moderation in E2EE messaging services, but was instead designed

at the operating system level and for cloud-uploaded images stored on an otherwise FDE iOS device.

3.4 Privacy as Security and the Current State of Research on Lawful-Surveillance Protocols

Researchers with a range of views on exceptional access agree that no proposal can currently be considered viable for implementation on the devices of the billions of people who have smartphones [66, 109, 185]. This includes proponents of lawful-surveillance protocols such as Savage, who emphasizes that his work should be seen as a preliminary contribution toward more advanced research [155, p. 1772]. Other proposals include the same caveat [80, p. 562].

Arguing that exceptional access deserves more research, Feigenbaum considers that “the desire of many in computer security and related communities for the [law-enforcement access] question to be declared ‘asked and answered’ and simply go away is unrealistic” [66, p. 29]. Some argue that the mere existence of such research is problematic because it comes at the expense of research to improve systems security, does not resolve geopolitical problems concerning the use of these mechanisms by non-democratic states, and can be used in the debate to make it seem that the scientific field is divided about the need to protect strong encryption [38]. The U.S. Attorney General did, in fact, use Ozzie’s proposal to defend his position shortly thereafter in a speech at a cybersecurity conference [183]. One response from researchers working on lawful-surveillance protocol proposals is that more research is better, enabling more grounded defenses of encryption against unacceptable proposals [162, p. 13].

It is beyond the scope of this work to discuss the desirability of such research in light of the risks pointed out by its critics. I want to draw attention to what the proponents of lawful-surveillance protocols do *not* discuss: an articulation of the right to privacy that does not subsume it under a right to security. It is important to stress, however, that this omission does not occur because these researchers consider such aspects foreign to their professional responsibilities as academics in a field not dedicated to political or philosophical discussions. On the contrary, their work thoughtfully and explicitly engages with such questions. And, as we have seen, the broader debate concerning encryption and the right to privacy has, in fact, framed the issue as a security problem, redefining the conflict as security vs. security, rather than privacy vs. security.

Even the objections to the proposals examined above do not suggest another way to view them. Thus, for example, the main controversy regarding the proposals of Stefan Savage and Ray Ozzie—so far the most discussed, including outside the fields of cryptography and computer security—centers on a comparison of *risks*. Savage and Ozzie suggest that their proposals do not significantly increase the risks inherent in operating system updates to which users are already exposed [155, p. 1770]. The objection here is that the new risks would be of a different order, given the day-to-day operation imagined for a lawful-surveillance system [78, 144, p. 7]. If, however, one limits the system’s operation to the frequency of normal operating-system update cycles, as Varia contemplates [185], the objection appears less powerful.

As for Wright and Varia’s crumple zones, the objections do not point to flaws in the design principles—described by Green,

¹⁷For a meticulous analysis of U.S. communications privacy statutory law, see [58].

Kaptechuk, and van Laer as “a theoretically elegant solution”—but question whether the proposal achieves appropriate security against malicious actors, whether it offers transparency, and whether it would in fact satisfy authorities’ demands for access [80, p. 555]. The proposal’s premise—that imposing computational costs is the way to reestablish the balance between privacy and security specified by courts for the “physical world” over centuries [190, p. 288]—did not elicit objections.

This limitation of how the right to privacy is considered is found not only in this cryptography and security scholarship but also in public-policy analyses, such as the application of the framework proposed in the NAS report [25]. The framework itself sets out questions for evaluating exceptional-access schemes [133, pp. 87–92]. Concerns about security (as well as economic concerns) are clear and translate into questions about the gains in effectiveness relative to the costs of exceptional-access schemes. The right to privacy is likewise presented in terms of security, in the broader sense described above, of procedures and oversight (Section 2). It is broken down into sub-questions about authorization control and limiting access, resistance to abuse and failures, and spillovers to third-party data about people not targeted by surveillance (for example, those who communicate with the target).

This emphasis on redefining privacy as security fails to account for the extent to which schemes like those described above (Section 3.2, Section 3.3) establish structures that would have to be imposed on everyone, even those about whom there is no suspicion whatsoever. So long as the proposals were secure enough, the NAS framework has nothing to say. This view does not capture encryption as “a tool for shifting power” [151, p. 47]. Even so, such proposals could be presented as meeting the specifications of privacy-as-security. A conception of the right to privacy that takes this into account is needed to guide the development of other protocols and systems.

4 Why Security Does Not Capture What Is at Stake

While the security conception of privacy (Section 2) is important and compelling, it is insufficient for understanding what is at stake. It is a dimension of the right to privacy as it pertains to encryption regulation, but it is not the only one.

The argument, then, is not that the right to privacy should *not* also take this security into account. Yet it must stand alongside another dimension. Understanding privacy as having more than one dimension (or aspect) aligns with influential theories of other fundamental rights. This is Ronald Dworkin’s approach to the value of freedom of expression, which for Dworkin has an instrumental dimension, tied to self-government, and a constitutive dimension, tied to democratic legitimacy [60, pp. 199–200; 59, p. 356 *et seq.*].

Next, I discuss how the lawful-surveillance protocols reviewed above—even with their challenges—raise questions that cannot be properly answered if the right to privacy is reduced to security. I also consider how this understanding of the right to privacy fails to explain why government hacking would be acceptable, a stance adopted by some critics of exceptional-access proposals. The section concludes by considering how the response to Apple’s proposed

client-side scanning system bears the seeds of a conception of privacy that goes beyond security.

4.1 Trading Security

Discussions about exceptional access and lawful-surveillance protocols often assess security by focusing on the changes that would ultimately be introduced in computer systems. They take the perspective of how systems designed according to their principles would meet officials’ demands for access under existing legal arrangements and institutional conditions. Thus, for example, figures about encrypted devices held by the FBI that would require unlocking are frequently cited. These numbers were disputed: at first, the FBI spoke of “about 7,500 mobile devices” [182]—a figure cited even in the NAS report [133, p. 41]. Later, it revised that number down to between one and two thousand [19]. As we have seen, the high number of devices to be unlocked creates a complication [78, 144, p. 7] for the security in managing escrowed keys in proposed protocols like Savage’s (Section 3.2.1). Even modifications, like Varia’s suggested mitigation (relying on normal system updates) [185] operate the lawful-surveillance protocol itself.

Yet encryption advocates rely not on a narrow notion of (computer) security, but a broader notion of national or societal security [136], and rightfully so. Under this notion of security, we could imagine hypotheticals that modify the broader institutional context in which insecure lawful-surveillance protocols are deployed, and yet, by offsetting other factors (outside of the cryptographic protocols), the overall level of security is not diminished.

For instance, U.S. federal law allows wire interceptions (wiretaps) only for a list of predicate offenses.¹⁸ For electronic communications, any federal felony meets the statutory requirement.¹⁹ Such statutory requirements are often seen as “more restrictive than what is required by the Fourth Amendment.”²⁰ Access to the contents of a cell phone is not subject to such stricter requirements (though it is still subject to the Fourth Amendment²¹). We know that law enforcement agencies rely on tools such as those sold by Cellebrite and Grayshift to overcome device encryption and access the contents of cell phones [192, p. 35]. This authority and the more frequent use of such tools (discussed in the next subsection) pose higher risks, resulting from the breadth of the circumstances where surveillance is permitted.

These variables can be modified to offset the insecurity resulting from schemes like those proposed by Savage. For instance, Title III statutory requirements could be extended to access to data stored in personal devices and could be subject to the limited list of predicate offenses required for wire interception applications. This could offset the risks presented by protocols like Savage’s. In fact, the requirements could be stricter still: access to device-stored data could be limited to Class D felonies (punishable by more than five and up to ten years), for example. If what we are assessing is merely the security provided by each scenario, we must concede

¹⁸18 U.S.C. § 2516(1).

¹⁹18 U.S.C. § 2516(3).

²⁰U.S. Dep’t of Just., Just. Manual, §9-7.100.

²¹*Riley v. California*, 134 S. Ct. 2473, 2493 (2014) (“information on a cell phone is immune from search; it is instead that a warrant is generally required before such a search”).

that changes in the legal conditions underlying each protocol could offset the risks of adopting it.²²

Proposals like Savage’s make this assessment more uncertain because the risks they generate lie not only in insider attacks and abuses (such as by malicious police officers and smartphone manufacturer employees) but also in external adversaries [44, pp. 342–343]. Wright and Varia’s proposal (Section 3.3.1) is perhaps the most plausible for gauging such offsetting of insecurity, because the high entry cost of the first crumple zone (hundreds of millions to billions of dollars) would exclude a significant share of external adversaries. Thus, changes in the legal requirements for obtaining stored data could more clearly compensate for insecurity added by mechanisms like Wright and Varia’s.

These considerations are only offered here to show that there must be more to our understanding of the value of privacy as it implicates encryption. I am not endorsing the adoption of any lawful-surveillance protocol; the statutory changes are hypothetical. The point is to show that a securitized right to privacy would say nothing against adopting one of them in these scenarios.

The last section shows that the truce in the Crypto Wars should be seen as tenuous. It would last only as long as there is no proposal strong enough to convince the community (or part of it) of its security. This subsection has sought to show that opponents’ position on exceptional-access mechanisms is precarious even today—at least if it is to be supported solely by privacy-as-security.

4.2 Government Hacking: Tolerated Insecurity

Privacy-as-security is also not enough to explain the stance of opponents of exceptional access on another issue, government hacking.²³

Government hacking has been offered as a way out of the debates over exceptional access [120, p. 328; 28, pp. 1259–1260]. It is described as a way for the “government to continue to support strengthening encryption and simultaneously give law enforcement resources to bolster their capabilities to conduct investigations in an environment of evolving technology and strong encryption” [71, p. 12]. Its adoption is even seen as a direct consequence of the absence of exceptional-access solutions [122, p. 127]. Even critics of exceptional-access schemes and of imposing assistance duties on developers and manufacturers of products that employ encryption accept the use of government hacking [135, p. 66; *but see* 145], which they regard as a preferable alternative. An article authored by several leading critics of exceptional-access mechanisms frames the issue as follows [24, p. 5]:

Put simply, the choice is between formalizing (and thereby constraining) the ability of law enforcement to occasionally use existing security vulnerabilities—something the FBI and other law enforcement agencies already do when necessary without much public

or legal scrutiny— or living with those vulnerabilities and intentionally and systematically creating a set of predictable new vulnerabilities that despite best efforts will be exploitable by everyone.

To discipline and limit the risks of government hacking, the authors argue that the tools should be regulated to control their proliferation, that vulnerabilities should generally be disclosed to developers or manufacturers so they can be patched, and that there should be legislative, judicial, and public oversight. Thus, given that vulnerabilities will always exist [24, pp. 27–30], they argue that the risks associated with government hacking are acceptable.

However, the existence of hacking tools does not affect only the security of investigation targets, as the authors observe [see also 135, pp. 66–67]. Even with strict controls in place, there will always be a risk that such tools will be diverted by insiders or appropriated by external adversaries [118, p. 55067]. This possibility poses a security risk for everyone who uses the device or system for which the hacking tool was designed. That risk is not the same as the risk already present in the vulnerabilities that enable such tools. The same reasoning we saw above applies here with respect to the difference between risks in keys for signing operating-system updates and unlock keys like those envisioned in the proposals by Savage and Ozzie. Vulnerabilities—even publicly known ones [103, p. 899]—still depend on the development of an exploit so that an attack can be launched (for example, to extract data sought by the police). Government hacking tools, whether developed by its agencies or acquired from third parties, provide that utility.

These tools may not have the same immediate utility as an unlock key, particularly in the case of exploits, which would still require knowledge likely beyond the reach of ordinary criminals. But recall that schemes like those of Savage and Ozzie would likewise not grant immediate access to encrypted data—the device would still have to be physically seized. If the police uses commercially developed tools, these risks become even greater. And police do, in fact, use commercial products [181, p. 607]. And the risks are not hypothetical. In 2017, a breach allowed the extraction of 900GB from Cellebrite’s servers, including access credentials and, reportedly, also evidence [45]. The source code of another tool, developed by a Cellebrite competitor, Grayshift, was allegedly obtained by actors who then extorted the company into not publishing it [46]. A report on the use of such tools in the United States concluded that more than 2,000 agencies acquired one, including the fifty largest local police forces and all state forces [101; see also 148].

Bellovin, Blaze, Clark, and Landau also offer another reason to think government hacking poses less risk than the deliberate introduction of vulnerabilities. Even if vulnerabilities expose any given target, it would be much harder to conduct operations against all members of a large population, they argue [24, p. 64]. Once again, we should note that this would not necessarily apply to self-escrow proposals like those of Savage and Ozzie, which involve the “deliberate introduction of vulnerabilities” (the exceptional-access mechanism via self-escrowed keys) but mitigate the risk of abuse for mass surveillance by requiring physical seizure of the device in order to access encrypted data.

That a securitized right to privacy is not sufficient to address the problem becomes even clearer when we consider variations in the legal conditions for access to encrypted data while weighing the

²²Hewson and Harrison caution against conflating institutional safeguards (represented by legal authorization requirements for data access) with safeguards in exceptional-access mechanisms, since part of the insecurity of such mechanisms is independent of their use [89, p. 12]. This point is well taken and does not contradict the discussion here, which assesses system security in light of the risks currently posed by government hacking.

²³Government hacking is discussed here insofar as it is relevant to the argument. For an overview of the current state of affairs in government hacking and the regulation of zero-day vulnerabilities, see [70, 85, 122].

impact of government hacking in fostering a market for hacking tools. Upturn's report on the use of tools such as those sold by Cellebrite and Grayshift estimates millions of dollars in spending on products from these two firms and other vendors [101]. The purchase of such tools with public funds is an important source of revenue for this market [89, p. 8].

From the standpoint of security alone, a scenario in which the police and other authorities stop buying these products while a self-escrow obligation is adopted could counterintuitively yield a *positive* balance for privacy. Consider that withholding current public spending on hacking tools could weaken the market that now incentivizes keeping vulnerabilities in important systems (such as mobile operating systems) secret from the public and from the systems' developers. Without being patched by developers, these vulnerabilities pose risks and reduce user security. The economic cooling of the hacking tool market (resulting from the elimination of a major revenue source) could then lead to greater security, especially against malicious third parties (though not as much against insiders, such as rogue police officers). If it is true that a self-escrow obligation (as in Savage's and Ozzie's approach) would represent less security, the balance between the increase resulting from ending purchases of hacking tools and the decrease resulting from self-escrow could be positive. In other words, taken together, these two measures could offset one another—or even reduce the insecurity to which users are currently subject.

Thus, if the right to privacy is reduced to risks and security, a law that created a self-escrow obligation while prohibiting police acquisition of hacking tools would not merely avoid violating the right to privacy—it would be described as an expansion of that right. The result of reasoning limited to risks and security is that this radical transformation in state surveillance capacities would not even raise problems in terms of the right to privacy.

One objection to the argument here would be to question whether these two measures together (a self-escrow obligation and a ban on the state's acquisition of hacking tools) would, in fact, yield a positive (or neutral) security balance. The argument does not depend on this, however. It is possible that the balance would be negative. In fact, designing a method for rigorously assessing this balance would be difficult [147], perhaps even unfeasible, both because of uncertainties regarding information security and the difficulty of establishing an objective method (not biased toward a given outcome) for calculating the factors at play. My goal is not to design or test any such method. What I want to stress is that it would be a mistake to think that the impact on the right to privacy would be decided solely on the basis of this calculation.

4.3 Apple's NeuralHash and Expanded Protections for Children

In August 2021, the same Apple that had confronted the FBI made an announcement that was seen as the antithesis of its stance in the San Bernardino case [111]. Among other measures for “expanded protections for children” in the next versions of its mobile and desktop operating systems,²⁴ the company introduced a tool to

scan photos for child sexual abuse material (CSAM) [13]. Of course, many other providers already deploy solutions to detect CSAM on their services [82]; PhotoDNA, developed by Microsoft, is one of the most widespread [41, p. 136; 65, p. 12]. The difference in Apple's case lay in how this mechanism would work.

Whereas other tools operated on servers scanning content stored in the cloud, Apple's system would run directly on the device itself [79]. It would apply only to photos stored in iCloud, but it would be client-side. In addition to the on-device system, a second layer of verification would take place server-side, on Apple's servers, eliminating false positives and limiting attacks compared to a model in which the entire system operated only on the device [2, p. 37]. A manual review would follow as a third layer. These latter two layers would only be triggered once the on-device system had identified a certain minimum number of images [12, p. 4]. That threshold was initially set at 30 images [2, p. 36], though Apple retained the ability to modify it [2, p. 37].

The move came after Apple had been publicly criticized as one of the companies that submitted the fewest CSAM reports to authorities [49, 98]. Given this, and considering it was reported that the company had previously been pressured by the FBI not to adopt end-to-end encryption for iCloud [124], the speculation was that the CSAM detection system was a way for Apple to allay concerns in preparation for rolling out an encrypted iCloud. This hypothesis is strengthened by the fact that nothing prevented Apple from scanning files server-side [82, (quoting Matt Green)].

What is striking in this scenario is that Apple faced a choice between maintaining the status quo, in which all user files in iCloud could be accessed from the server—and were therefore available both to officials and to malicious actors—or moving to a scenario where the files would be encrypted under a scheme that could be seen as a form of lawful-surveillance protocol. Apple argued that its client-side scanning system was superior to existing server-side alternatives, which “create[] privacy risk for all users” [11, p. 4]. It boasted that its system “provide[d] significant privacy benefits over those techniques by preventing Apple from learning anything about photos unless they both match to known CSAM images and are included in an iCloud Photos account that contains a collection of known CSAM” [11, p. 4]. To back up its claims, Apple published statements from three respected cryptographers, each offering positive evaluations of the system [21, 72, 146]. David Forsyth concluded that “Apple's approach preserves privacy better than any other I am aware of” [72, p. 2]. Mihir Bellare described the wholesale scanning of all photos (the CSAM detection mechanism against which Apple's model was contrasted) as a means of restricting CSAM that fails to respect the fact that “our photos are personal, recording events, moments, and people in our lives.” He argued that Apple had “found a way to detect and report CSAM offenders while still respecting these privacy constraints” [21, p. 1].

Even the *Bugs in our pockets* report [2] (authored by some of the figures behind the influential *Risks* [1] and *Keys under doormats* [3] reports) does not go so far as to say that a system like Apple's would be riskier than the alternative of server-side scanning. That does not mean the system had no known vulnerabilities [172]: the

²⁴The first involved using machine learning to analyze photos that children using iMessage attempted to send, in order to prevent them from sharing “sexually explicit content” [187]. The second enhanced the Siri virtual assistant to provide guidance on

child sexual abuse material (CSAM). The third, a CSAM detection system, is discussed here.

report noted [4, pp. 12–13] that within 48 hours of NeuralHash’s code being published, researchers had already been able to generate artificially colliding images to create false positives and to manipulate images with imperceptible perturbations to significantly alter the perceptual hash, leading to false negatives. Apple responded by stating it was prepared for collisions and that images that met the threshold of the client-side-based system would go through a secondary, undisclosed classifier before proceeding to manual review [32].

The report raised numerous concerns about the system’s effectiveness—which could even be undermined if its vulnerabilities were manipulated to flood it—and about its potential abuse or expansion beyond CSAM [175]. But it did not claim that the proposed Apple system was less secure or privacy-protecting than the server-side approach.²⁵

Its most fundamental concern seemed to lie elsewhere. After noting that the economic dimension of the system also had to be considered (because Apple’s tool would make surveillance cheap, while democratic societies make searches costly), the report posed the following question [4, p. 16]:

The proposal to preemptively scan all user devices for targeted content is far more insidious than earlier proposals for key escrow and exceptional access. Instead of having targeted capabilities such as to wire-tap communications with a warrant and to perform forensics on seized devices, the agencies’ direction of travel is the bulk scanning of everyone’s private data, all the time, without warrant or suspicion. That crosses a red line. Is it prudent to deploy extremely powerful surveillance technology that could easily be extended to undermine basic freedoms?

If we assume the answer might be No, we must acknowledge that this discussion cannot take place if the right to privacy is reduced to security. That reading is precisely what underpins the privacy-protective assessments of Bellare and Forsyth. Although this framing has dominated recent debates on encryption regulation, it is limited, as shown above. The authors touch on a range of important issues that escape security. I am inclined to agree, for instance, that it matters, as suggested by the report’s title, *Bugs in our pockets*, that the scanning takes place on a device so central to our private lives. There seems to be something intrusive about the user having a system that treats them as an adversary running on their phone. Given that the targeted content is contraband over which no privacy interest may be asserted and how narrow the category of targeted content is (CSAM), any legitimate privacy concern would have to be located at a meta-level, flowing from a normative ascription of privacy to the medium. This would be similar to the approach communications privacy protections take, yet devices are presumably not covered by communications privacy provisions, and any extension may raise complications for ordinary computer searches. The system’s population-wide reach and its

²⁵This comparison would be cumbersome. The assessments that Apple published with its announcement [21, 72, 146] analyze privacy protections compared to a traditional server-side mechanism and with regard to targeted data. Yet the *Bugs* report notes [4, pp. 10–11] that the large-scale introduction of a client-side scanner creates complexity to OS security and creates a new attack surface. A proper comparison would have to account for this source of insecurity, thereby adding a second dimension to the security calculus. That is not the goal of this article.

constant, suspicionless operation likewise strike me as compelling. I mention these directions not to pursue them here, but again to underscore that they require developing a conception of privacy relevant to encryption policy that accounts for more than security.

Conclusion

Encryption policy is certainly better off when the right to privacy is not unjustifiably assumed to impose costs on security. Commentators who argued that weakening encryption can also impose costs on security have made an important contribution to public debate. Much of the credit is owed to cryptography and security researchers. And there is, of course, good strategy in this move, which speaks about privacy in a language that accepts the normative priorities held by government officials seeking exceptional access. Security is not just more strategic because of that; it also seems more quantifiable and, hence, objective.

Yet the security conception of privacy that has driven much of the debate is limited. Success in lawful-surveillance protocols research, broadly consistent with this conception of privacy, would push it to a breaking point. Privacy as security is challenged not just by this prospect, however uncertain it might be. Even the current landscape cannot be fully explained by security alone. The very response to Apple’s now-abandoned client-side scanning proposal intimates as much.

The path ahead as such requires understanding privacy beyond security. This does not mean abandoning security. Any good conceptual account will have to include security as a dimension of the value of privacy. In fact, it is possible that a better conception of privacy will also entail a more normatively grounded, context-sensitive²⁶ conception of security itself.²⁷ There is no reason to believe that this exercise should end back where we started, pitting privacy and security against each other [61, pp. 159–162; 62].

I have not put forward any such conception here. My goal has been to show that there is need for it. A richer conceptual understanding is required not just to assess policy and regulation. Work on lawful-surveillance protocols will also benefit from this; alternative conceptions might help revise the specifications for this agenda. It goes without saying that this project has a better outlook with cross-cutting collaboration, as no useful conception of privacy will ignore what is technologically or mathematically viable, and useful protocols are more likely to yield from well-informed, richer conceptions of privacy. Though normative insight and understanding are not bound by academic disciplines, cryptography and security researchers have pushed forward largely unaided. Legal scholars and other privacy theorists seem to have much work to do.

Acknowledgments

I thank the anonymous reviewers. I am deeply grateful to Susan Landau for her exacting reading and criticism of an earlier draft, which I sought to clarify in this final version. My thanks to the

²⁶As Scheffler and Mayer [2023, p. 426] rightfully emphasize in the context of content moderation in E2EE messaging services, seizing on opinion survey responses about TLS inspection, which showed more support to TLS proxies used by elementary schools and employers [137].

²⁷As Nissenbaum [2005, p. 64] observes, “[T]he quest for computer security has moral force only to the extent that it promotes the common value of freedom from harm. In other words, the issue is not merely why these are classifiable as security concerns but why people *deserve*, or have a right, to be thus secured.”

participants of the 2025 Fellows Conference at Yale Law School's Information Society Project.

This article revises and updates parts of my PhD dissertation [129]. I thank the committee (Diego F. Aranha, Laura Schertel Mendes, Marcel Leonardi, Marta Saad, and Rafael Mafei), and my supervisor, Virgilio Afonso da Silva, to whom I am indebted.

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