Encrypted Client Hello and Network Operators

IEPG Update

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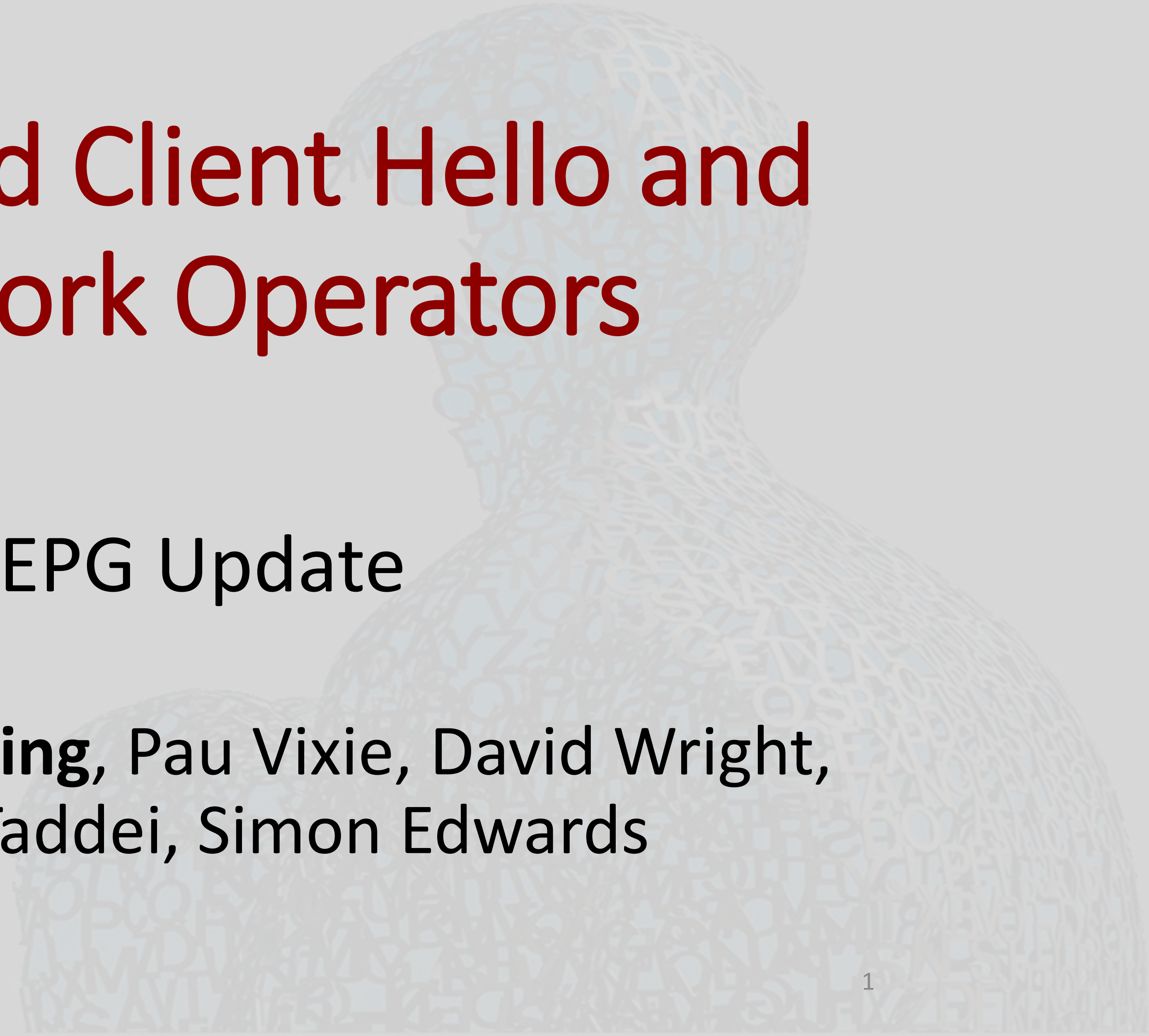
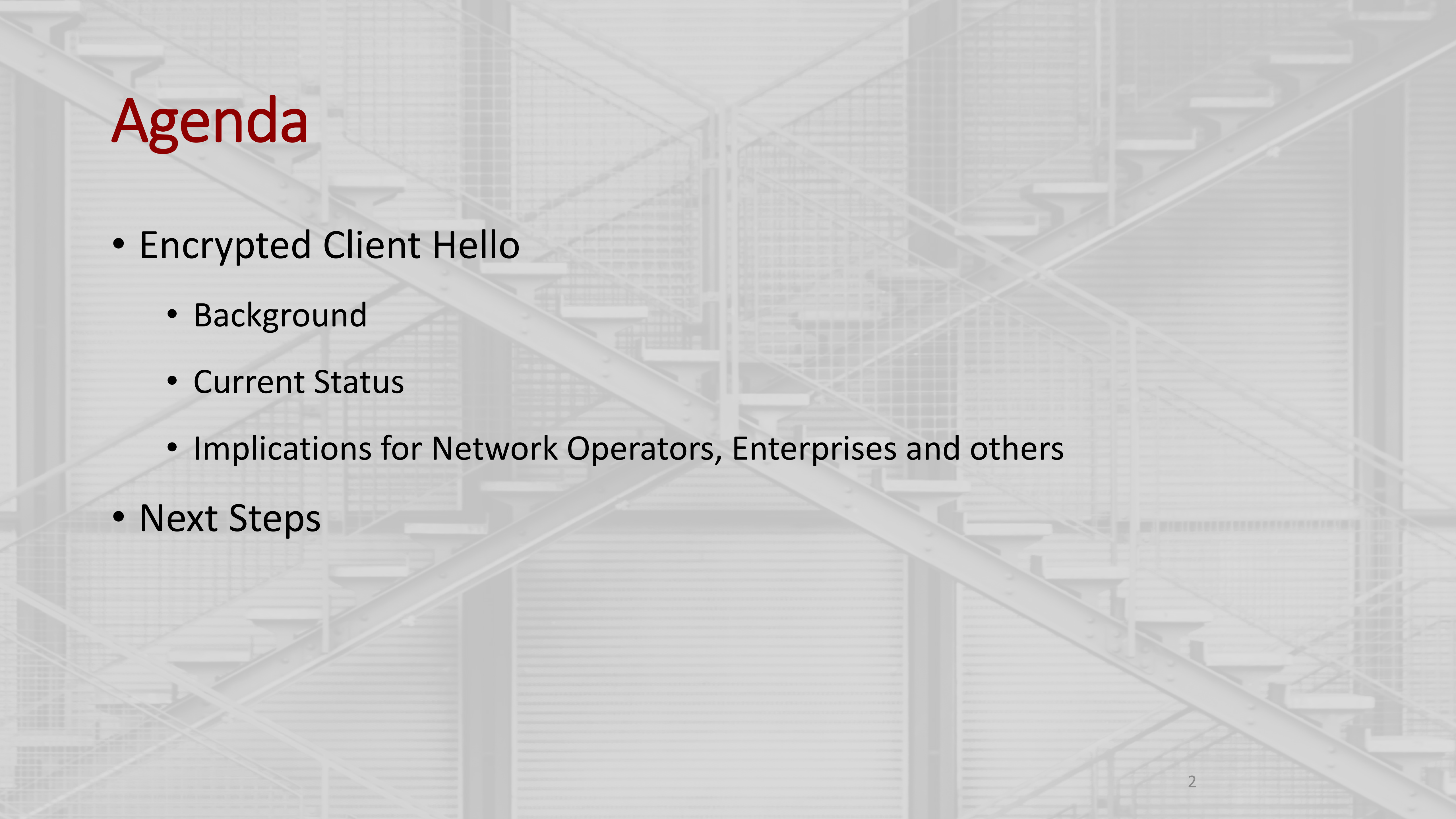
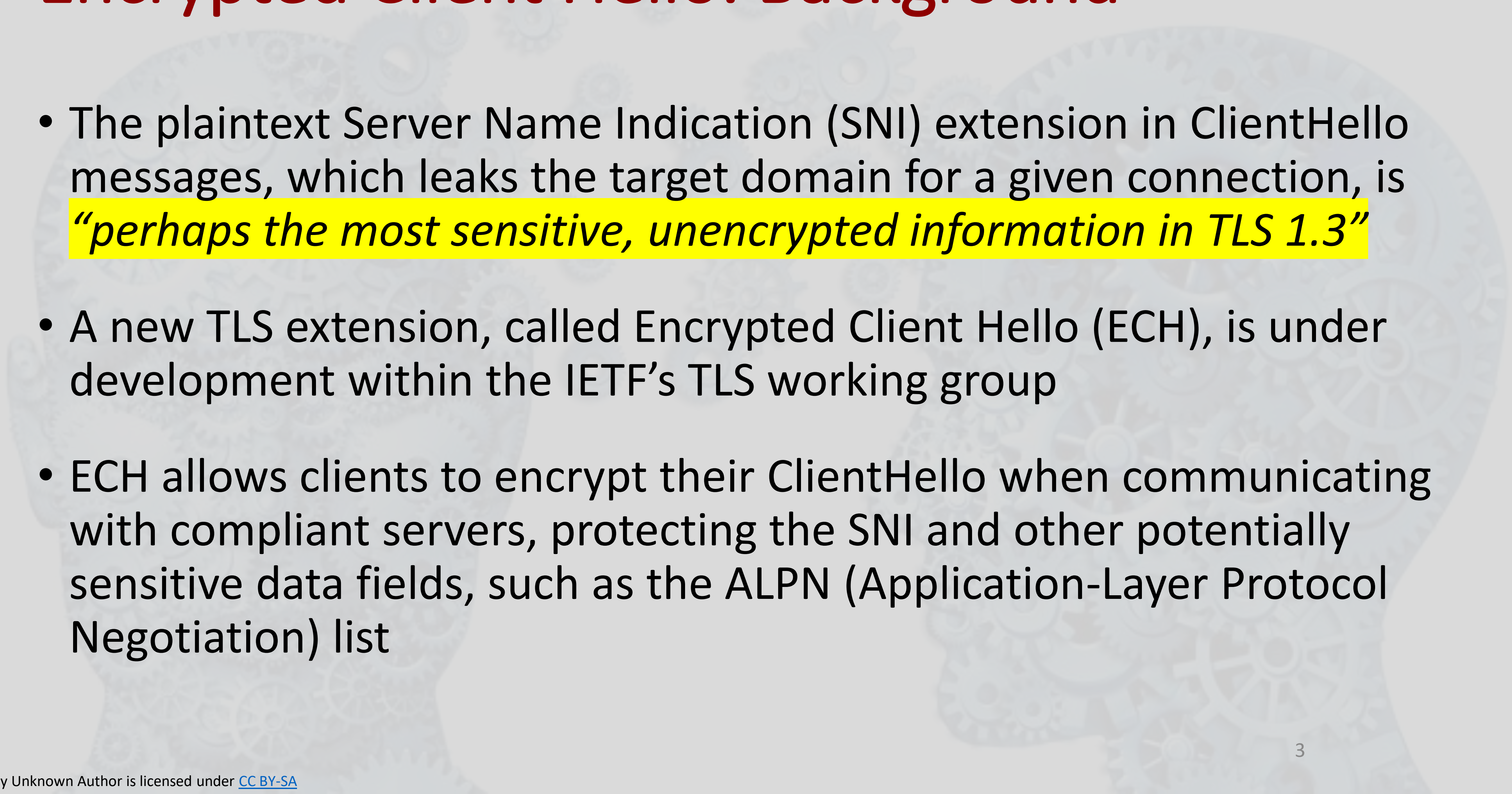




Agenda

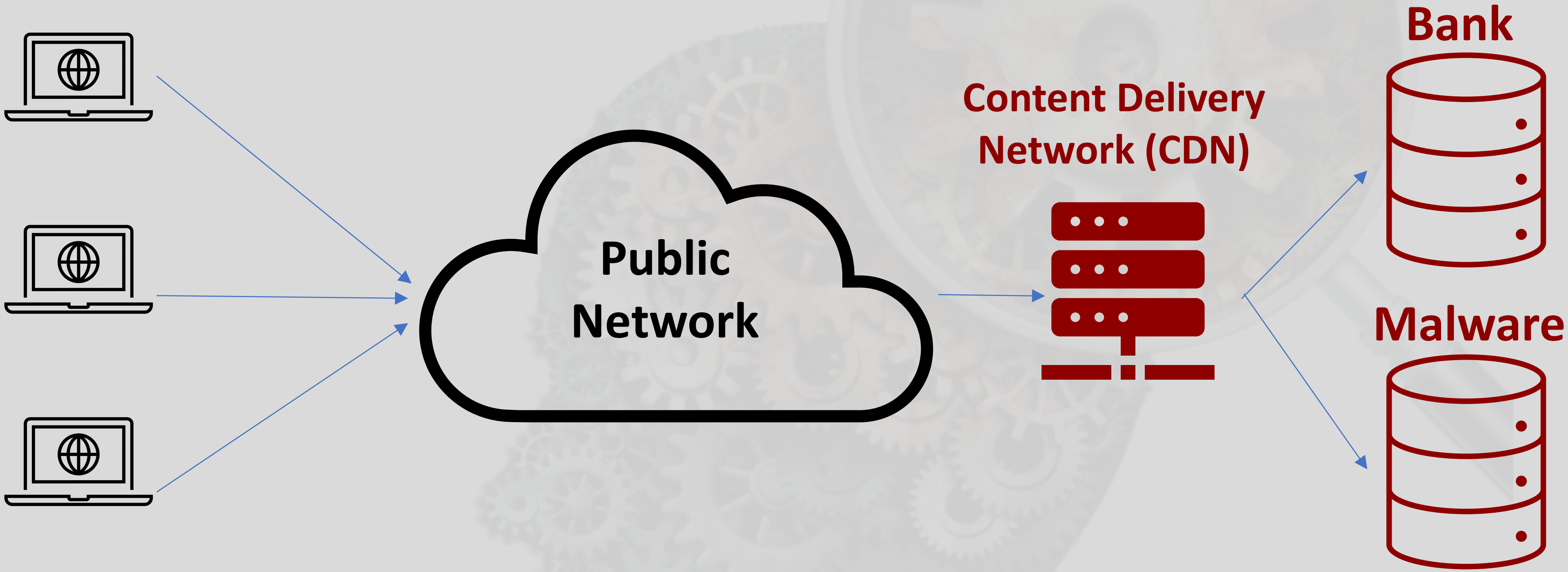
- Encrypted Client Hello
  - Background
  - Current Status
  - Implications for Network Operators, Enterprises and others
- Next Steps

Encrypted Client Hello: Background



- The plaintext Server Name Indication (SNI) extension in ClientHello messages, which leaks the target domain for a given connection, is *“perhaps the most sensitive, unencrypted information in TLS 1.3”*
- A new TLS extension, called Encrypted Client Hello (ECH), is under development within the IETF’s TLS working group
- ECH allows clients to encrypt their ClientHello when communicating with compliant servers, protecting the SNI and other potentially sensitive data fields, such as the ALPN (Application-Layer Protocol Negotiation) list

Encrypted Client Hello: Background



Encrypted Client Hello: Background

RFC 8744 – “Issues and Requirements for Server Name Identification (SNI) Encryption in TLS”

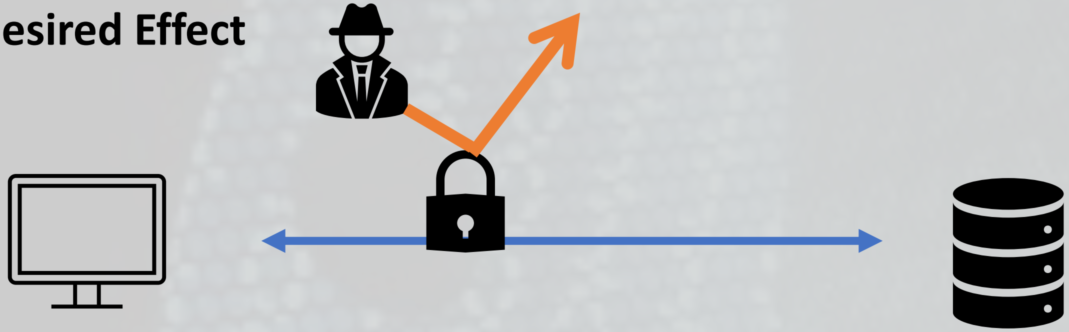
- Includes a brief description of what it characterises as "unanticipated" usage of SNI information (section 2.1)
- A brief (two paragraph) assessment of alternative options in the event that the SNI data is encrypted (section 2.3)
- Asserts that "most of [the unanticipated usage] functions can, however, be realized by other means“
- Does not consider or quantify the affordability, operational complexity or technical capability of affected parties or the privacy implications that might be involved

Encrypted Client Hello: Current Status

- Originally efforts within the IETF’s TLS working group focused on encrypting the SNI data (“eSNI”)
- This evolved into the more comprehensive Encrypted Client Hello (ECH), with interoperability testing and some pre-standard deployments already underway
- The latest draft is accessible at https://datatracker.ietf.org/doc/draft-ietf-tls-esni/
- ECH to become an Internet standard first half 2025?

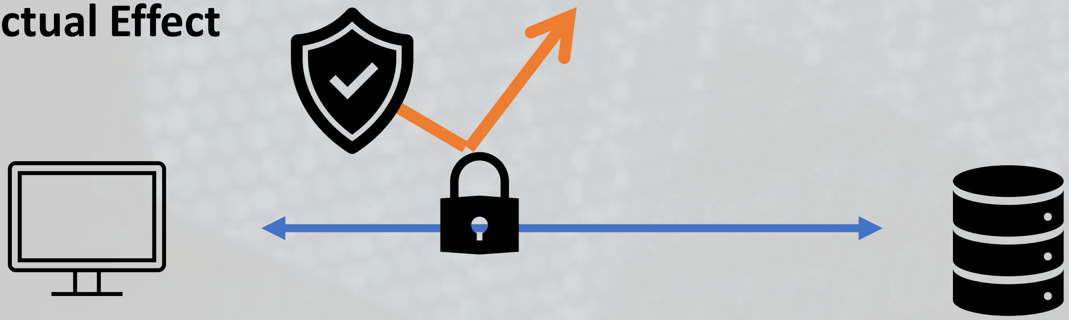
Implications for Network Operators and others

Desired Effect



- Communication with target takes place without observation or interference

Actual Effect



- Content filtering / firewalls bypassed, access policies ignored
- Compliance requirements bypassed
- Unable to differentiate applications using ECH from malware etc
- Potential communication with malicious content
- Potentially undetectable user surveillance and/or data exfiltration by client software
- Access to CSAM, age-inappropriate content etc (eg in schools)

NB Better tools exist for “dissidents”, eg Tor etc

Implications for Network Operators and others

Enterprises

- SNI aids content filtering in enterprises, including to block access to malicious content via phishing, can also help with compliance requirements in regulated sectors
- BYOD is often implemented using transparent proxies, these rely on SNI; alternatives are generally more complex to implement and more invasive of user privacy
- Loss of visibility of SNI data weakens cyber defences as it is used by firewalls as a key indicator of compromise
- Small enterprises generally lack the financial and operational capabilities of multinationals to understand and address these issues

Education

- Schools, for example in the US and UK, are required to operate content filtering which makes use of SNI data
- Enterprise-grade solutions are likely to be beyond their financial or operational capabilities
- Alternative options include
  - ○ Disabling ECH in client software (where possible) or removing that software
  - ○ Abandoning BYOD

  Both options will be disruptive, the first has potentially significant cost implications

Implications for Network Operators and others

Public Networks

- Impact to traffic management / steering to fixed and mobile networks - i.e. CDN steering

- Traffic optimisation across mobile radio networks
  - Potential impact to performance and efficiency
  - Quality of Service steering

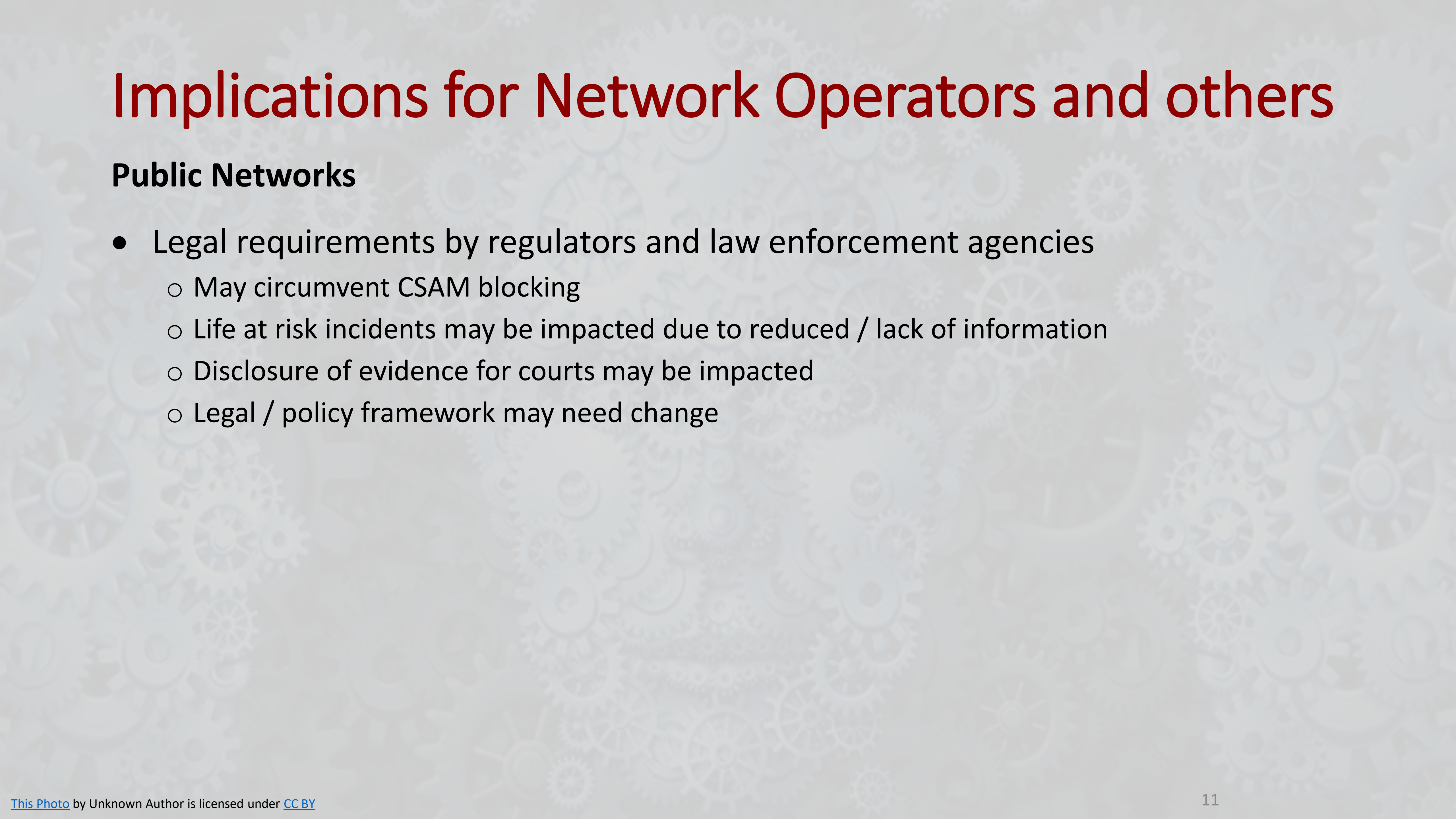
- Engineering / capacity management becomes more difficult

- Operational support / incident management becomes more challenging
  - Increased complexity
  - Limited monitoring

Implications for Network Operators and others

Public Networks

- Zero rating of content no longer possible, a feature that often benefits the least affluent users
  - Important for fixed and mobile network users with data caps
  - Allows access to, for example, health-related content without impacting on the data cap
  - ECH may cause metering to operate without warning
- Traffic classification for consumers is significantly challenged and will need to change
  - Potential impact to value-added services for parental controls, security etc
- Enterprise network protection services – reduced visibility
  - Blocking websites based on content categories: HR policy on acceptable use policy for Internet usage potentially can't be enforced. For example, adult / violence categorised sites can't be blocked for the users accessing the Internet.
  - Protecting corporate users from web-based threats: By inspecting web traffic, the majority of web based malicious code would normally be monitored and blocked before they reach the user's systems.
  - Disruption of cybersecurity controls / content filters policies



Implications for Network Operators and others

Public Networks

- Legal requirements by regulators and law enforcement agencies
  - May circumvent CSAM blocking
  - Life at risk incidents may be impacted due to reduced / lack of information
  - Disclosure of evidence for courts may be impacted
  - Legal / policy framework may need change

ECH: Next Steps for Operators & Others

- Audit internal systems and customer offerings to understand where loss of visibility of SNI data will have an adverse effect

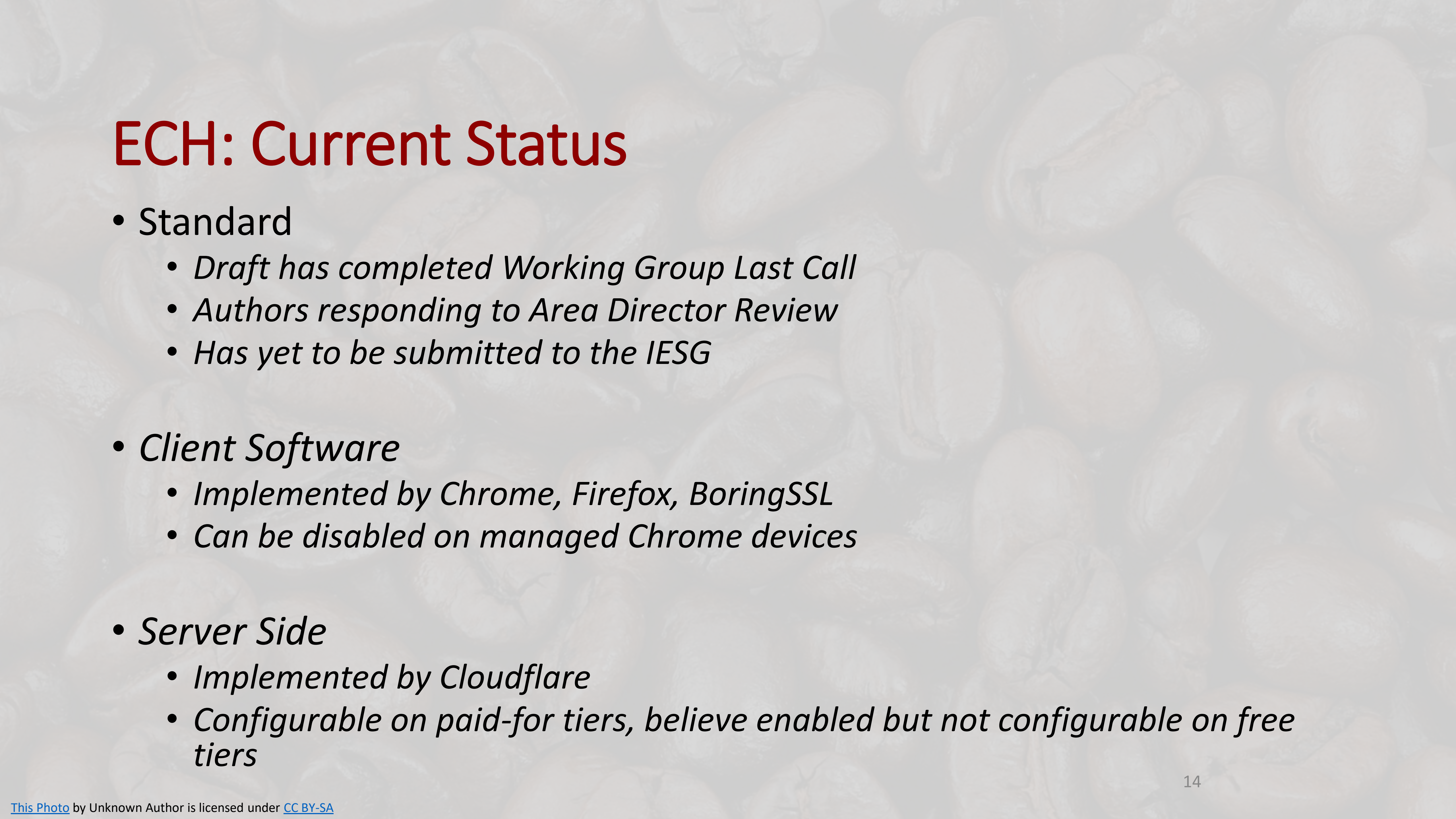
- Engage with security vendors to gauge the latters’ knowledge of, and plans for, ECH and validate whether this is sufficient to meet any on-going security and compliance requirements

- Engage with regulators, legislators and others to reduce non-compliance risks
  - Regulatory activity to minimize the potentially negative effects of ECH on security and safety may be necessary

ECH: Next Steps for Operators & Others

- Consider contributing to the text of our informational draft “Encrypted Client Hello Deployment Considerations” – see https://datatracker.ietf.org/doc/draft-campling-ech-deployment-considerations/

- More generally, engage with the IETF so that Internet standards development reflects the needs of a broad range of stakeholders and is built on an understanding of real-world impacts



ECH: Current Status

- Standard
  - *Draft has completed Working Group Last Call*
  - *Authors responding to Area Director Review*
  - *Has yet to be submitted to the IESG*

- *Client Software*
  - *Implemented by Chrome, Firefox, BoringSSL*
  - *Can be disabled on managed Chrome devices*

- *Server Side*
  - *Implemented by Cloudflare*
  - *Configurable on paid-for tiers, believe enabled but not configurable on free tiers*

Questions?

Don’t forget to join our weekly DNS call, sponsored by DNS-OARC, Mondays at 16:00 UK (currently 16:00 UTC)

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IEPG Briefing

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