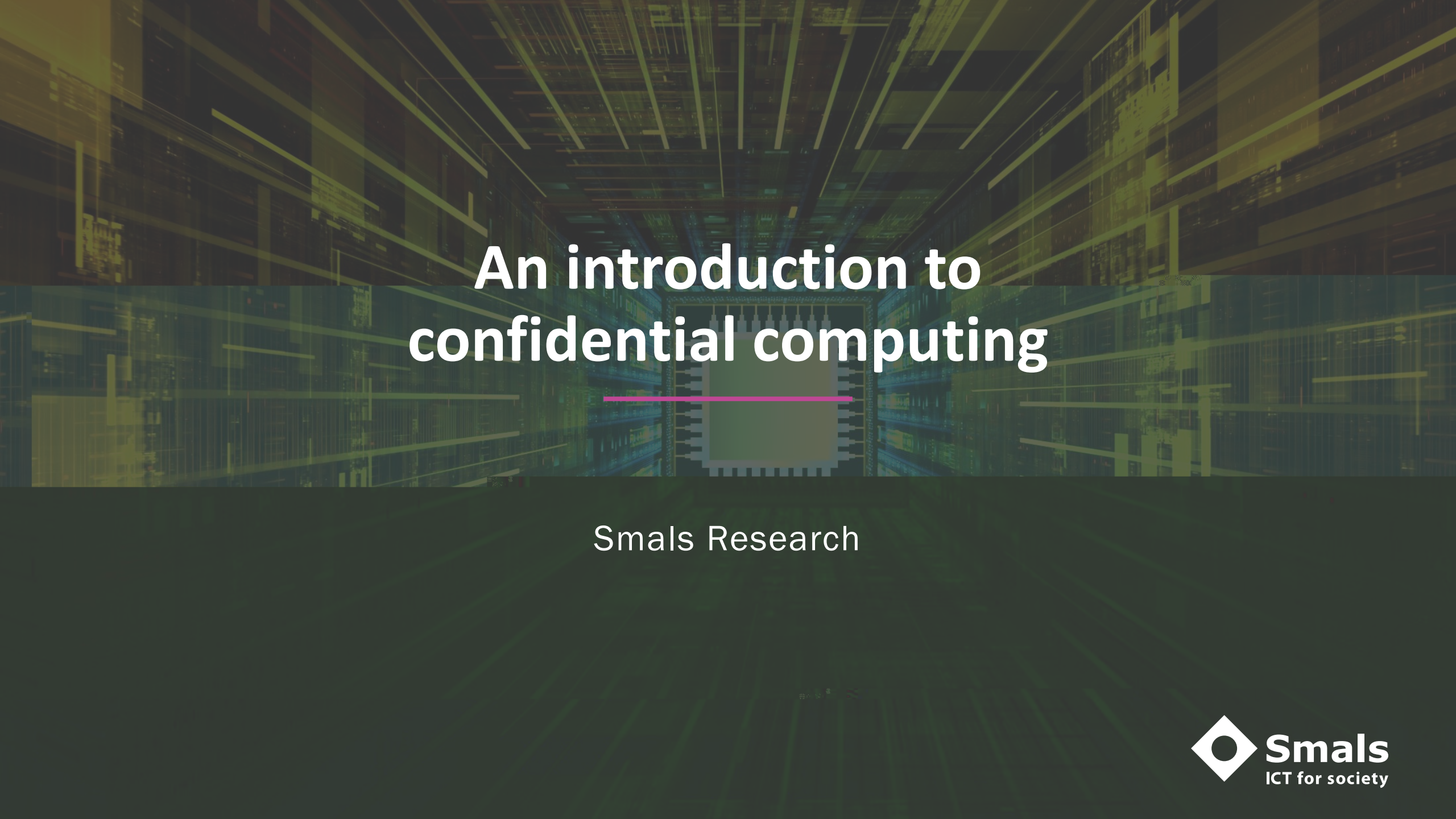

An introduction to confidential computing

Smals Research

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Agenda

General overview

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Market offer for TEE

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Conclusions and recommendations

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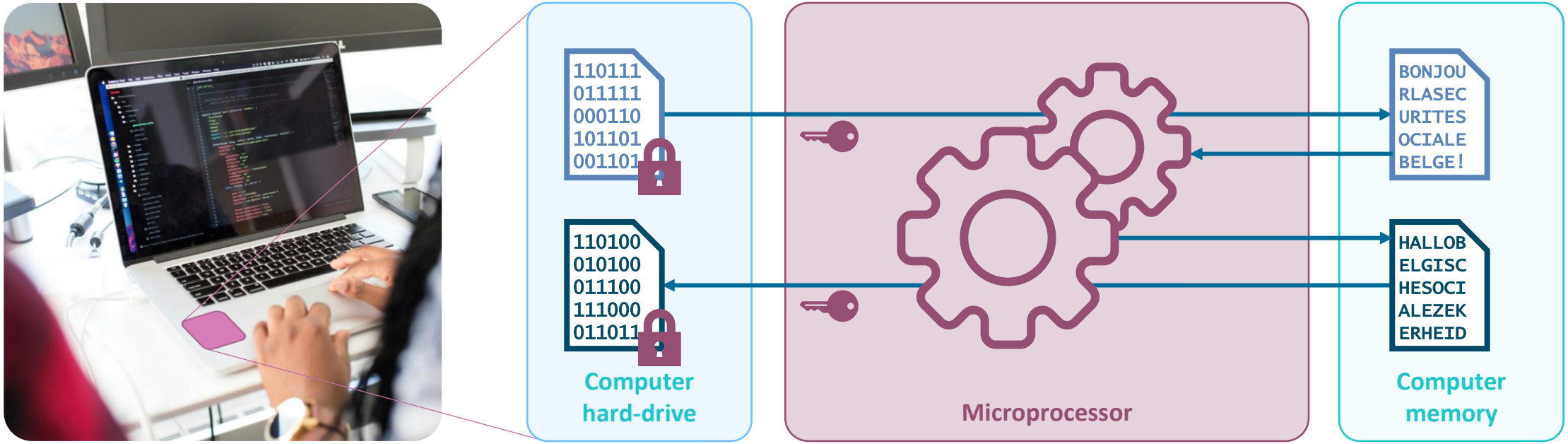
Traditional computation on encrypted data



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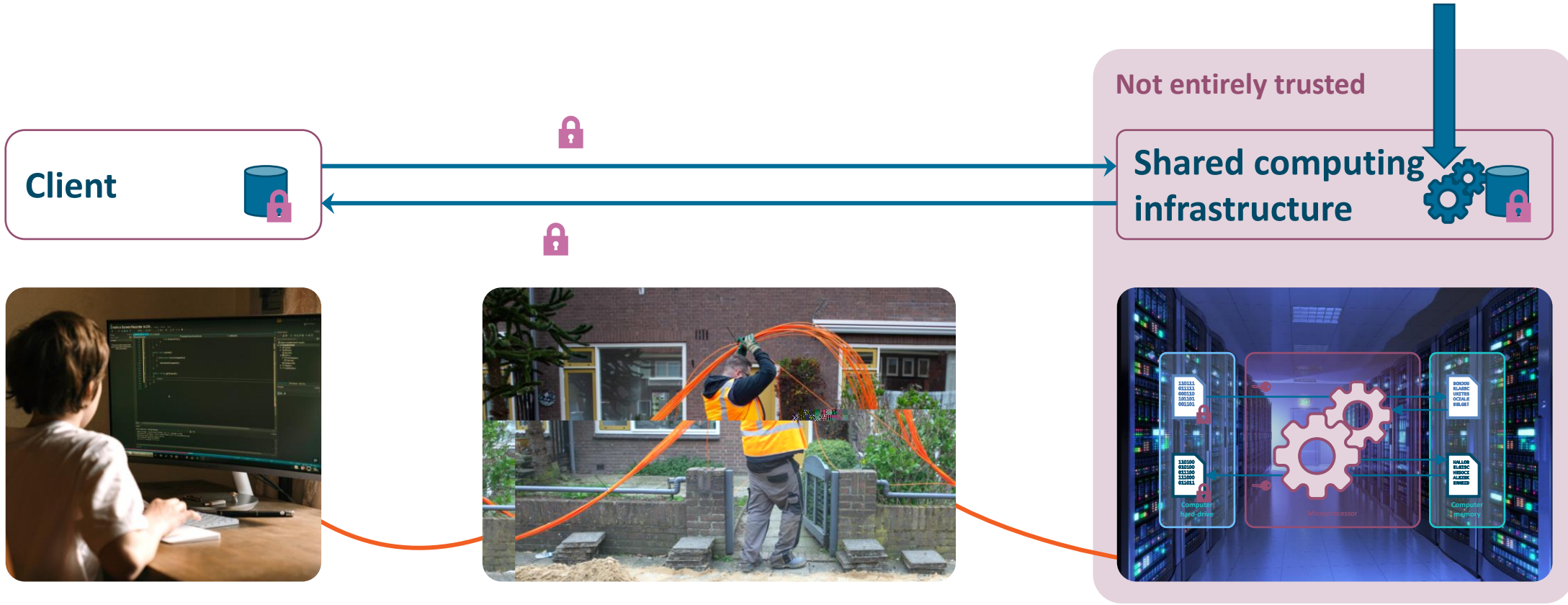
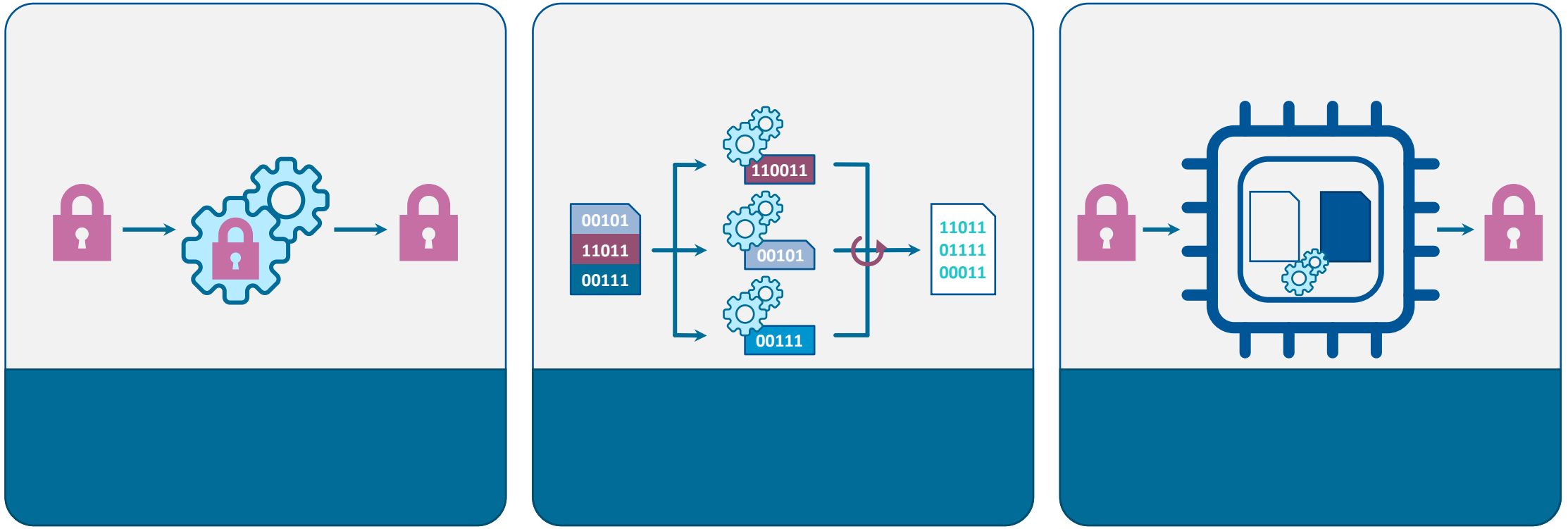
Basic remote computation



Main techniques for trusted remote computation

Aim: move the infrastructure provider outside of the trust boundary



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Homomorphic encryption (HE)

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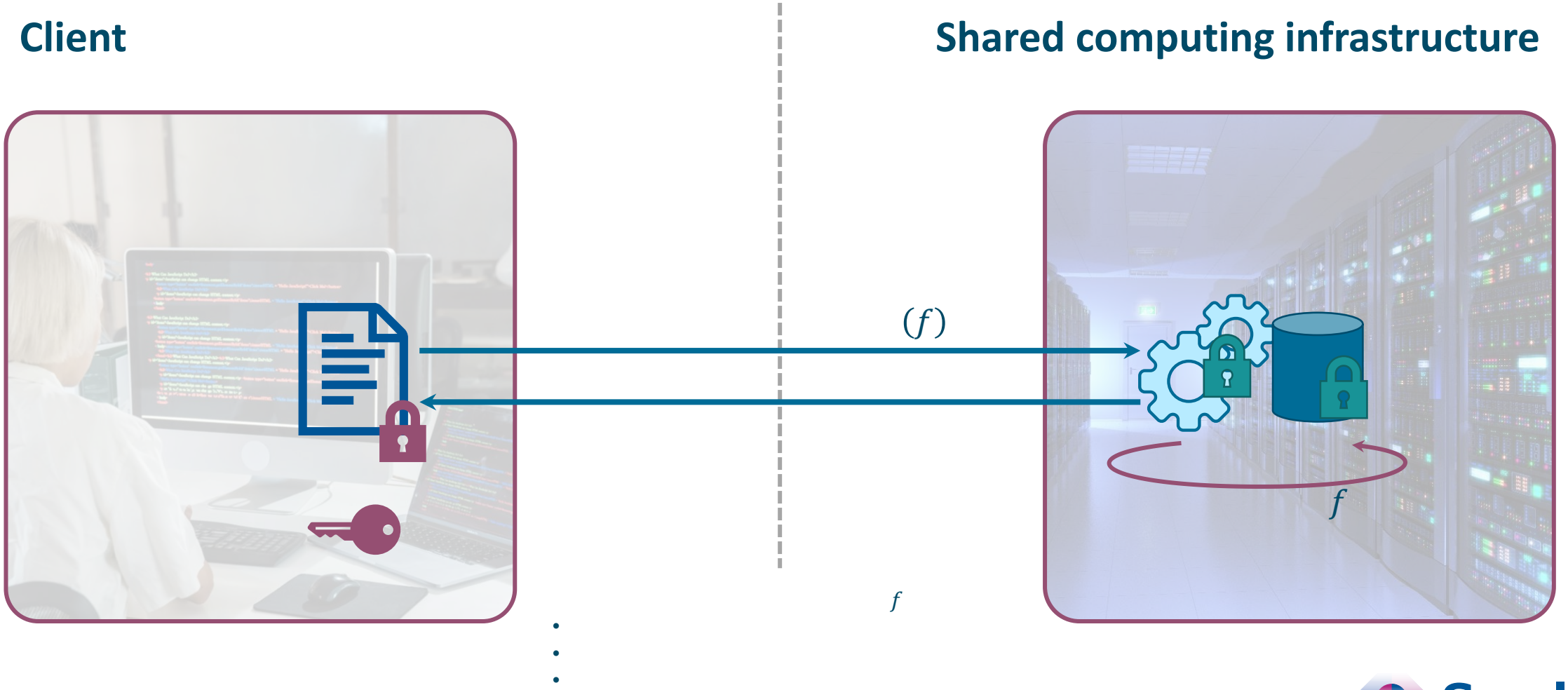
Homomorphic encryption: schematic overview



Advantages and limits of homomorphic encryption

Pros

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Cons

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  - $[\![m_1]\!] \oplus [\![m_2]\!]$
    $[\![m_1]\!] \ominus [\![m_2]\!]$
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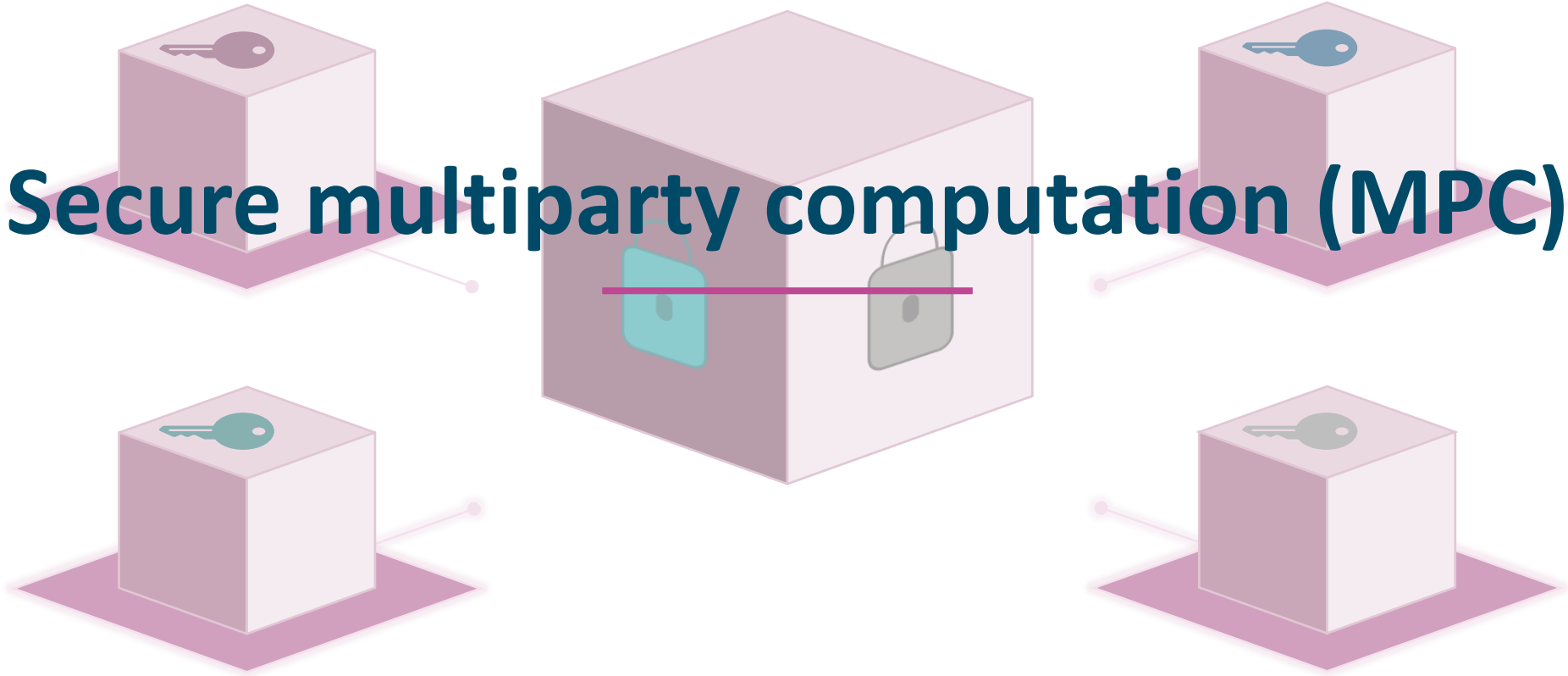
Secure multiparty computation (MPC)



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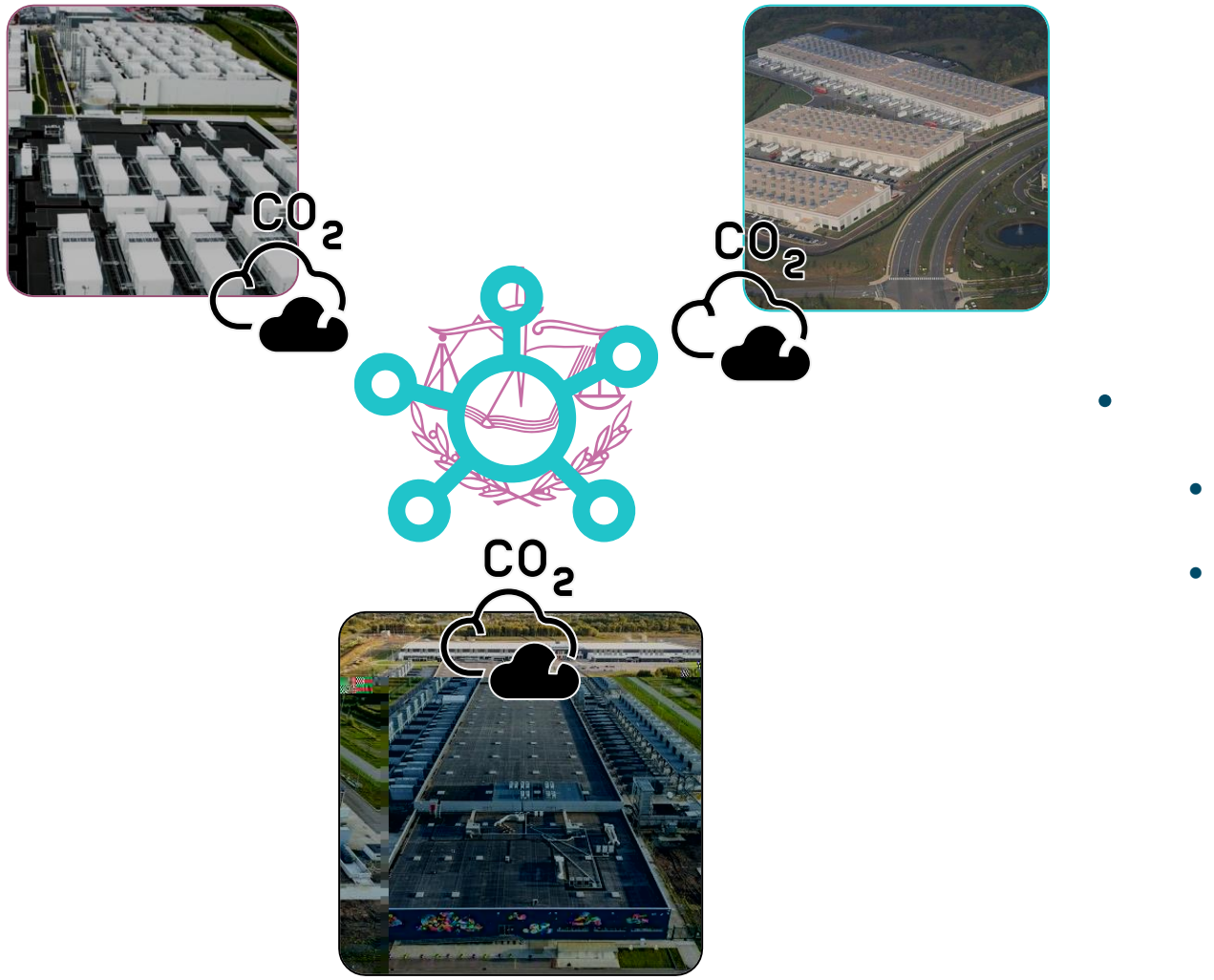
MPC problem example



MPC problem and *a* solution

- **Problem** n $P_1, \ldots, P_n$ x_i f
  - $z = f(x_1, \ldots, x_n)$
  - $x_1, \ldots, x_n$
- **MPC solution example**
  - f $+$ $\times$
  -
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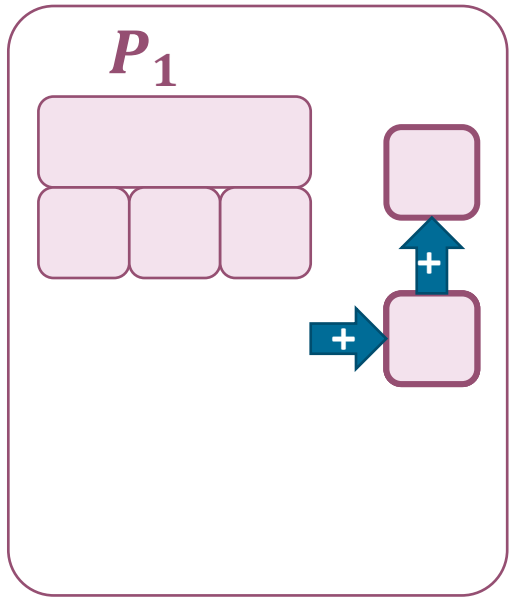
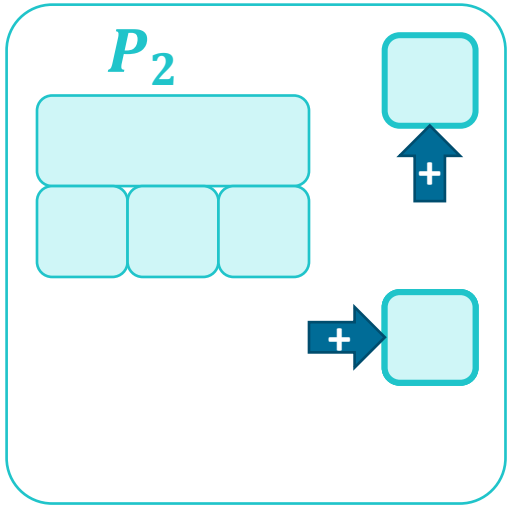
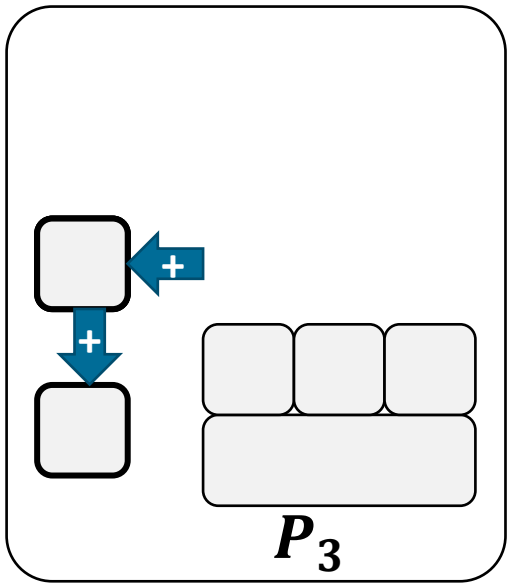
MPC in action: simple addition example





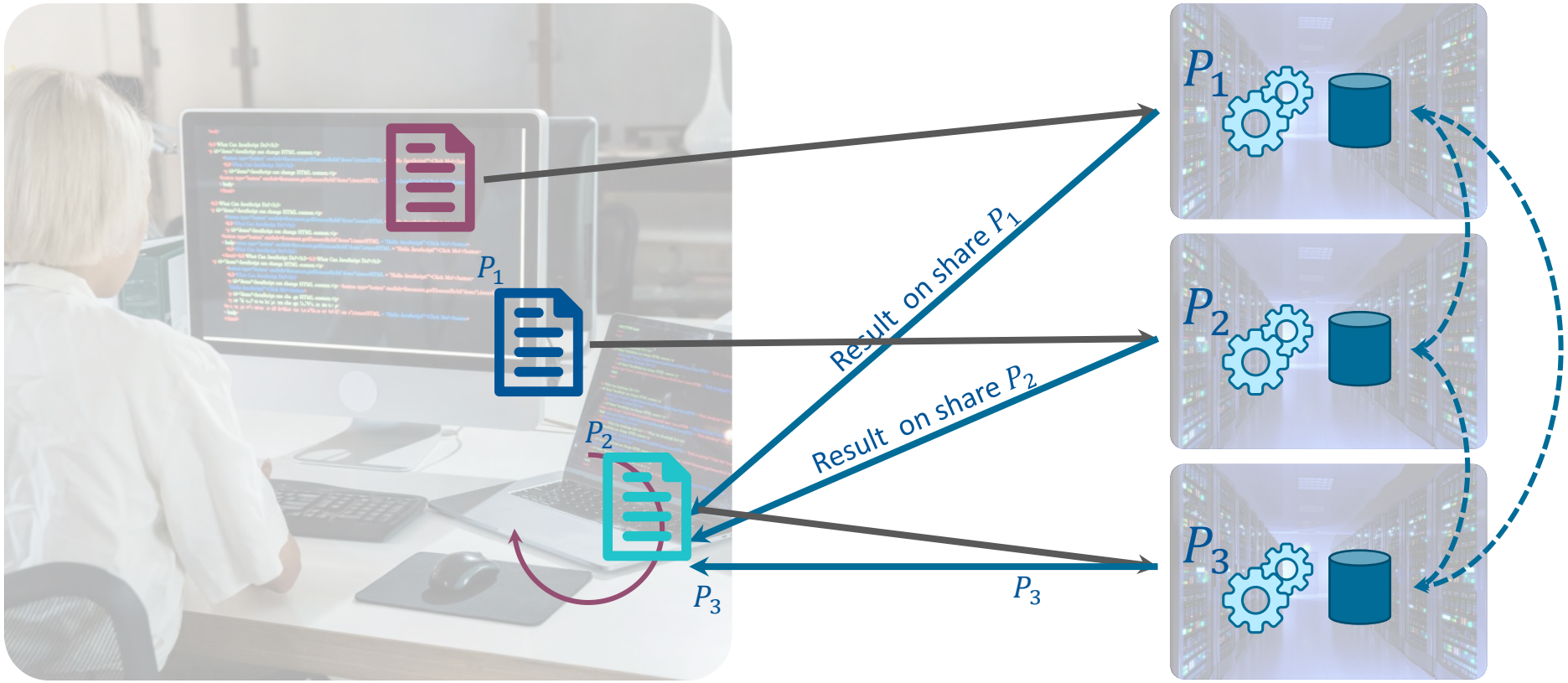


$x \rightarrow (x_1, x_2, x_3)$ $\quad$ $x_1 + x_2 + x_3 = x$

MPC deployment example

Client

Shared computing infrastructures



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Advantages and limits of MPC

Pros	Cons
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Trusted execution environments (TEE)

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Hardware-based isolated execution

- Technical goal

- Rational
- Requirements
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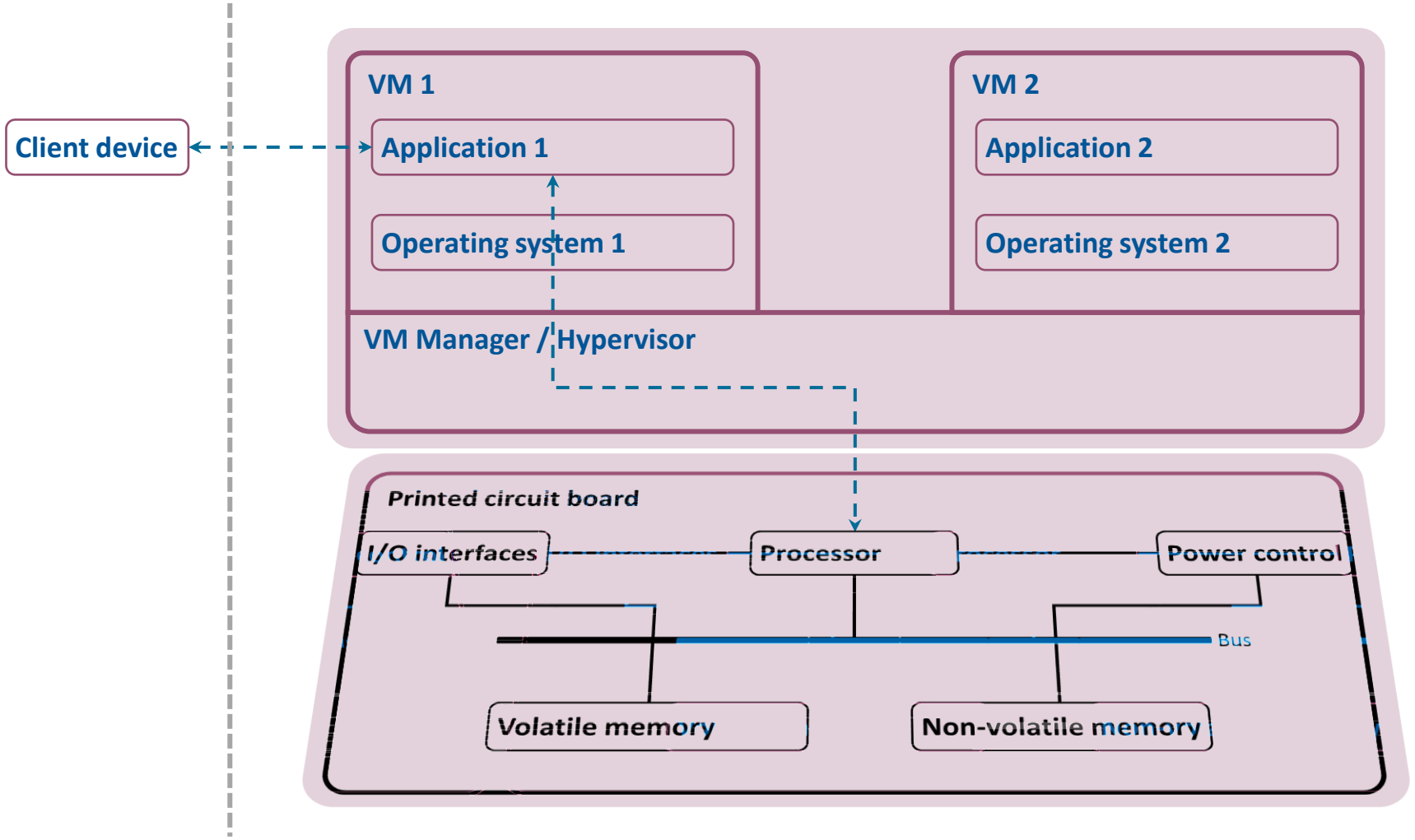
Generic architecture



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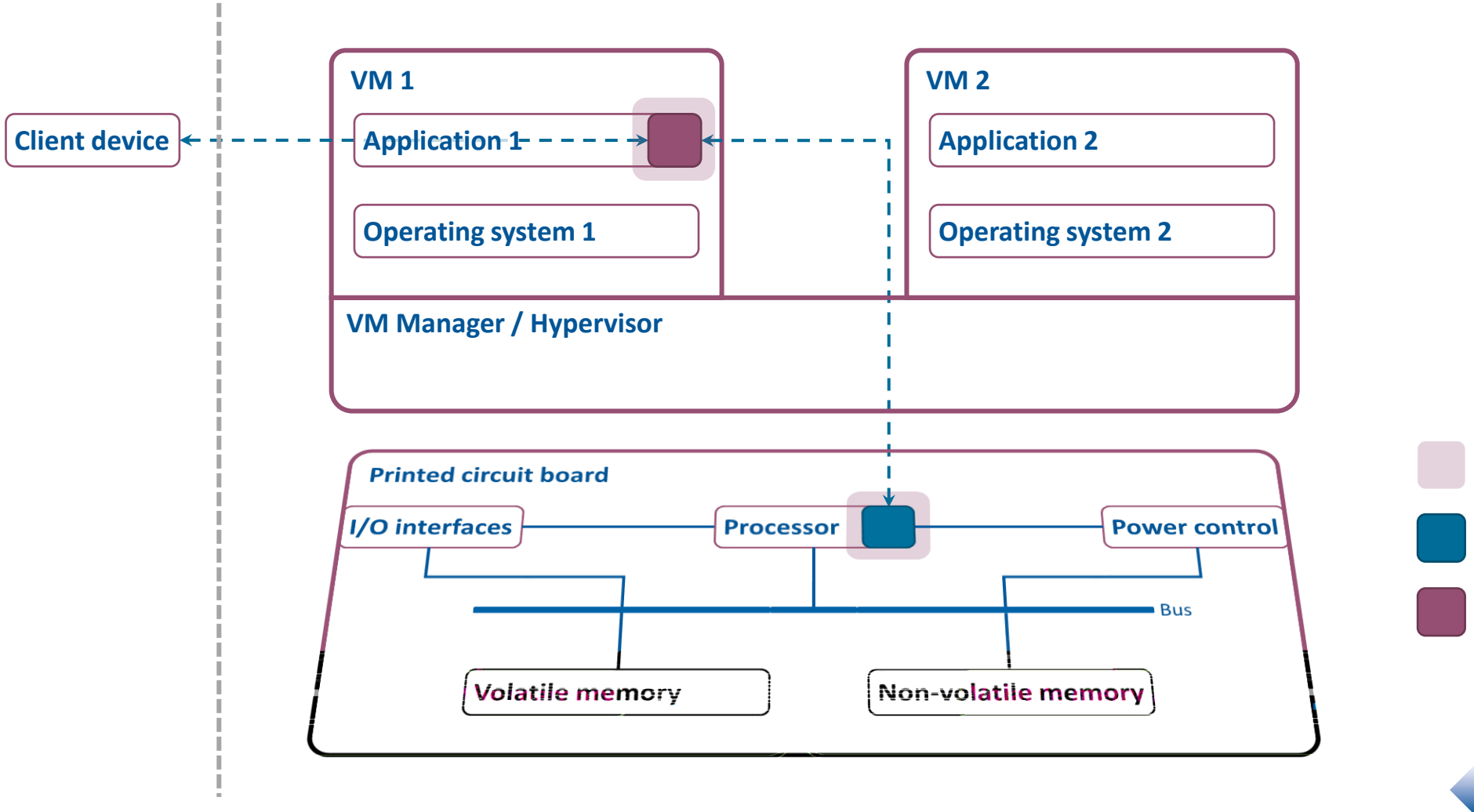
Possible generic architecture with secure hardware



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Verifying integrity of the system

Secure boot

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Attestation

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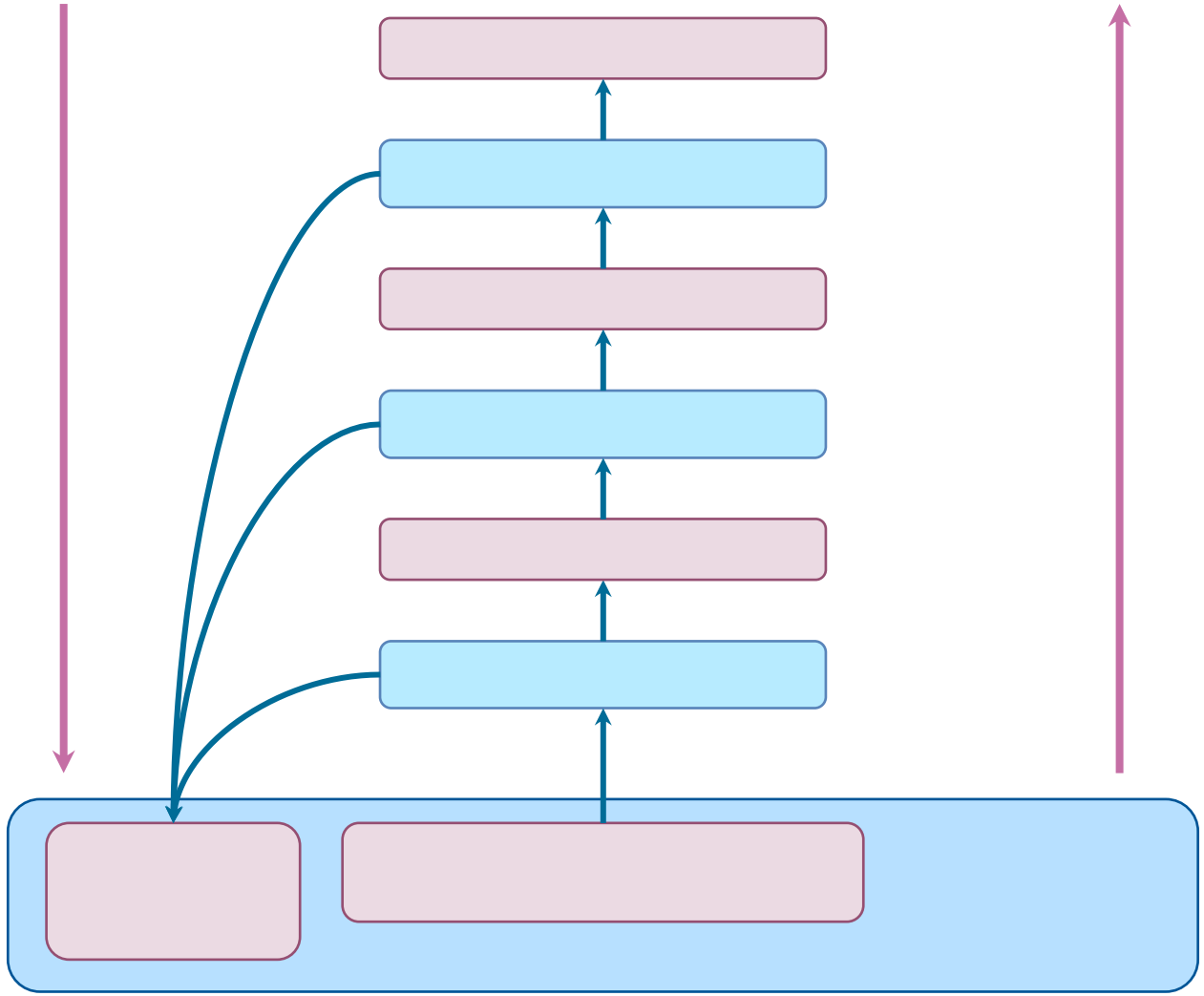
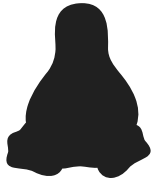
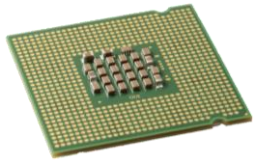
Secure booting sequence example







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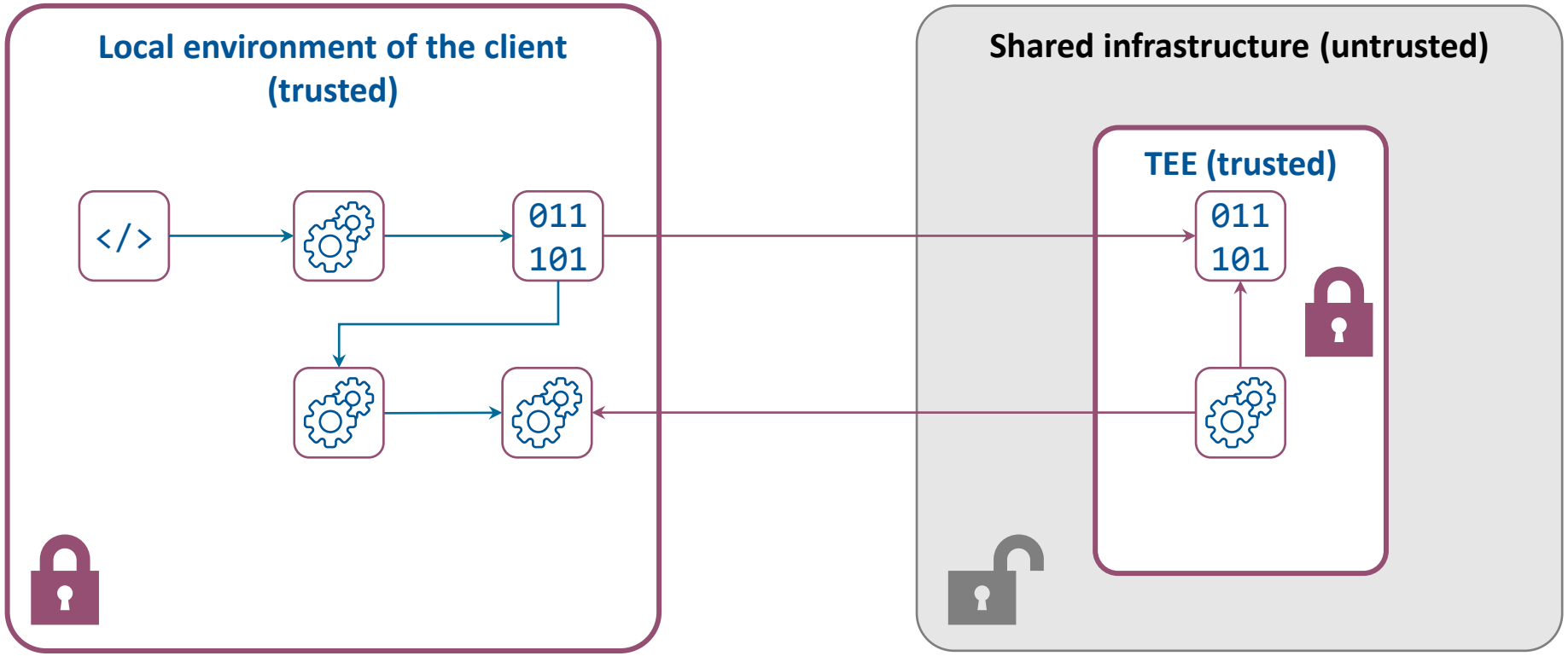
Attestation example



Advantages and limits of TEE

Pros

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Cons

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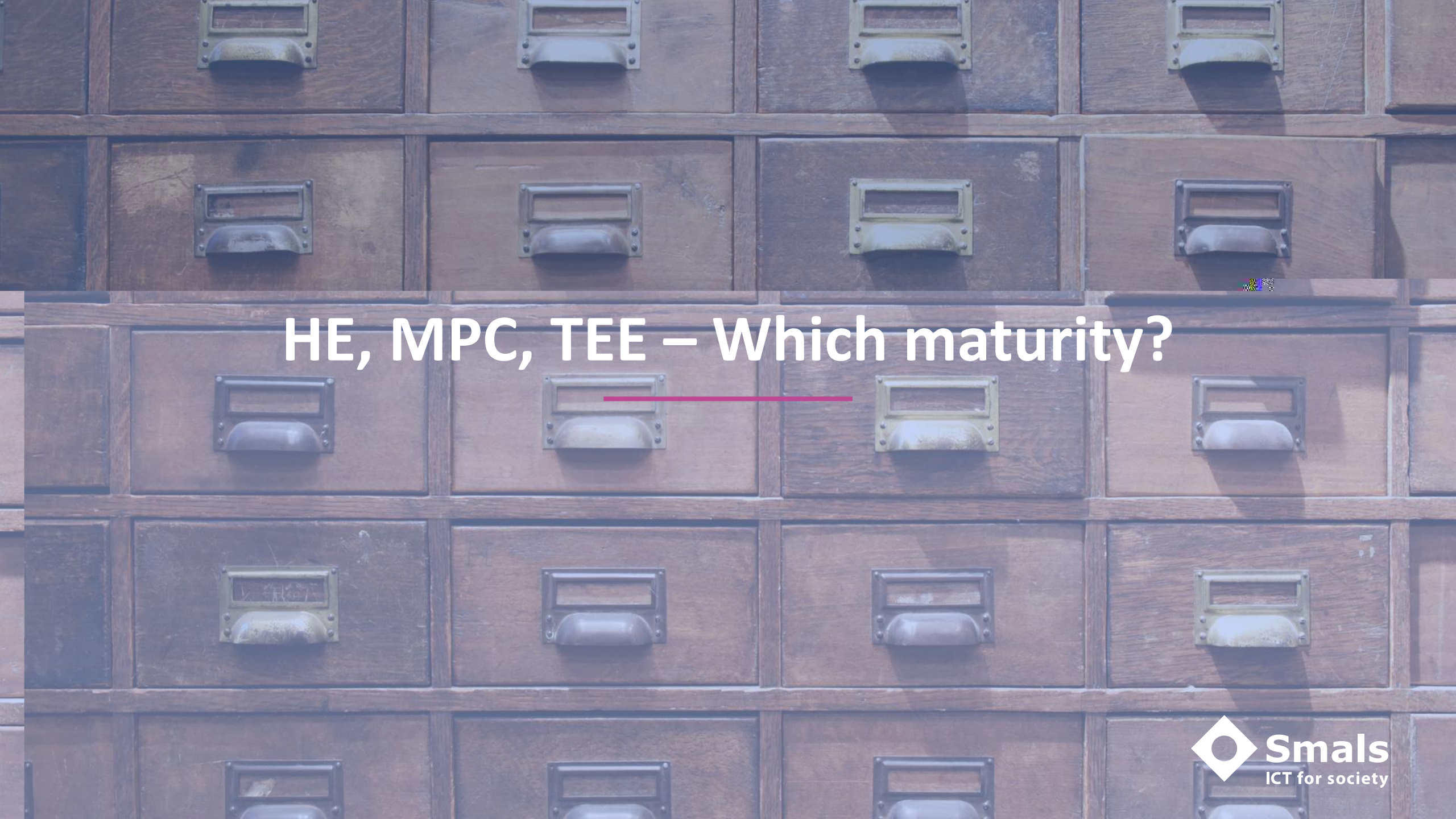

HE, MPC, TEE – Which maturity?

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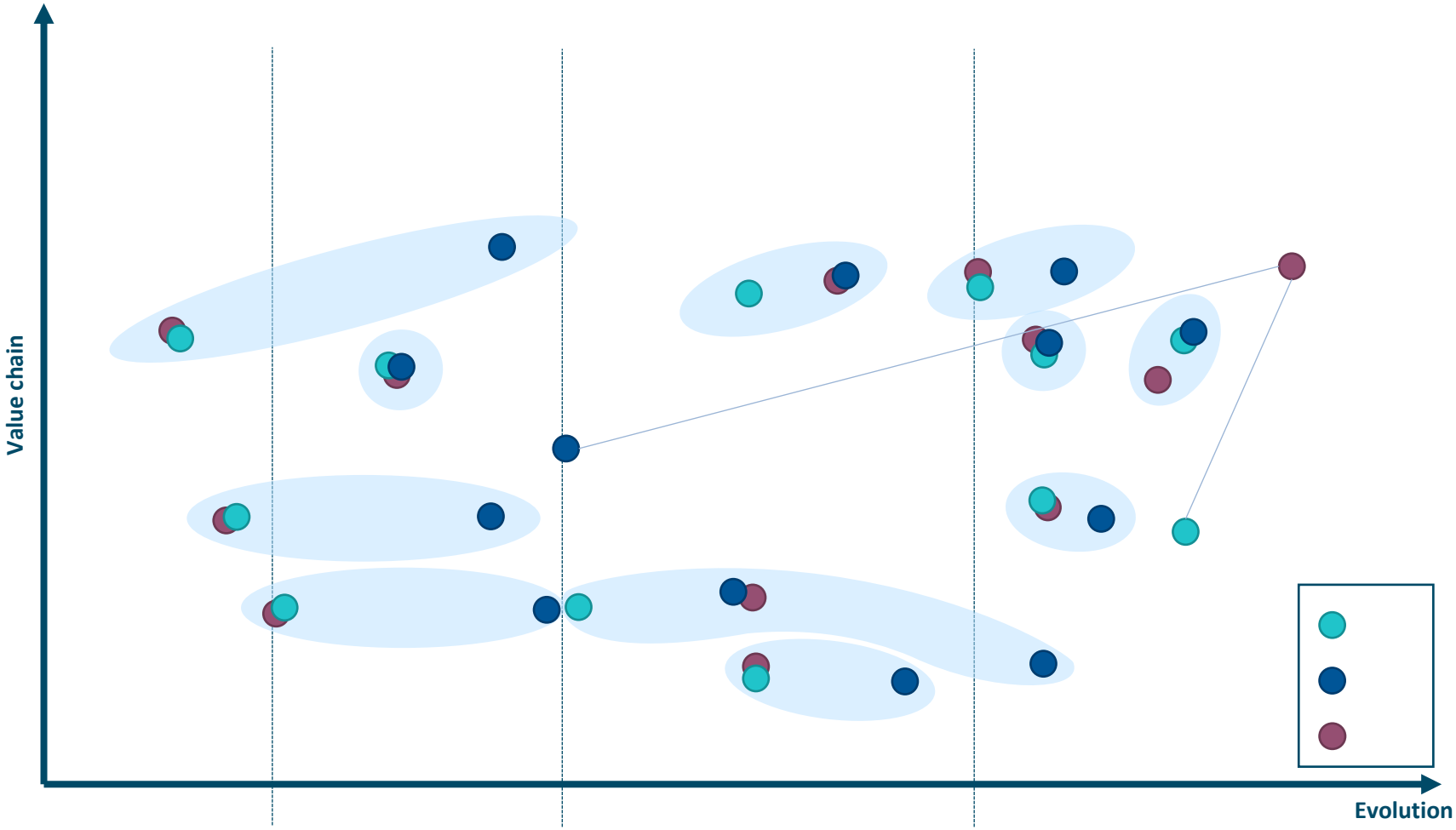
Maturity of confidential computing technologies



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TEE-based market offer

AMD SEV-SNP, Intel SGX / TDX

AWS Nitro and Microsoft Azure

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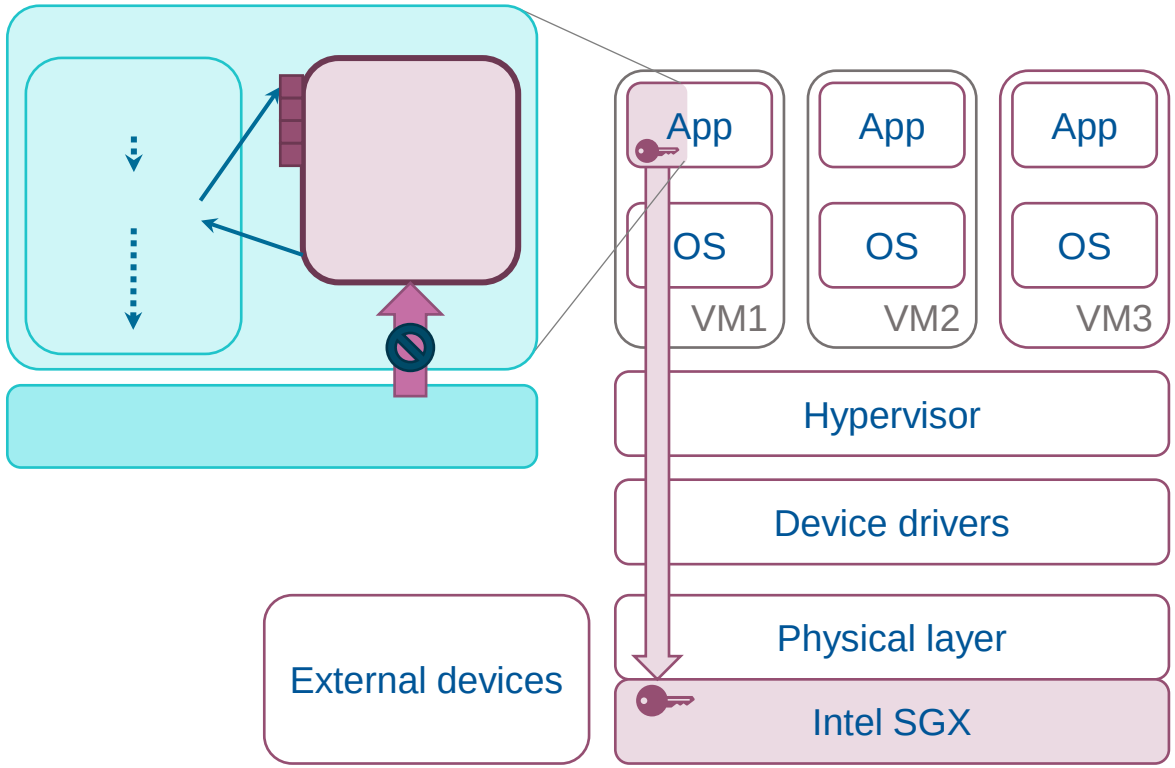
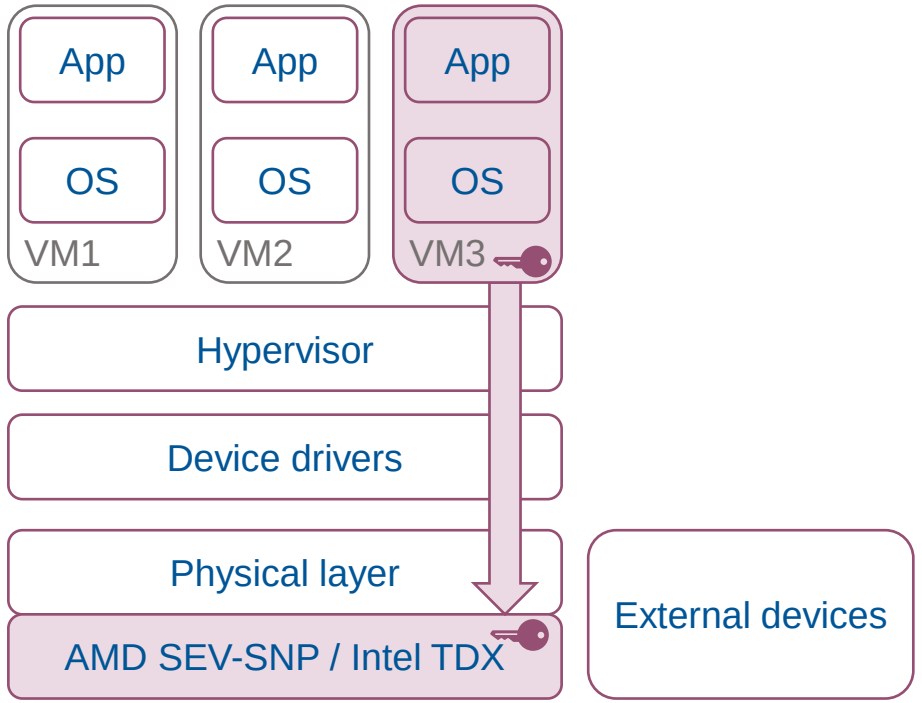
Two main types of hardware-based isolation

Intel SGX



AMD SEV-SNP, Intel TDX



Untrusted element Trusted element

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Confidential computing on Azure

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    - *Microsoft Azure Attestation*

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AWS EC2 with “Nitro” architecture

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AWS “Nitro Enclave”

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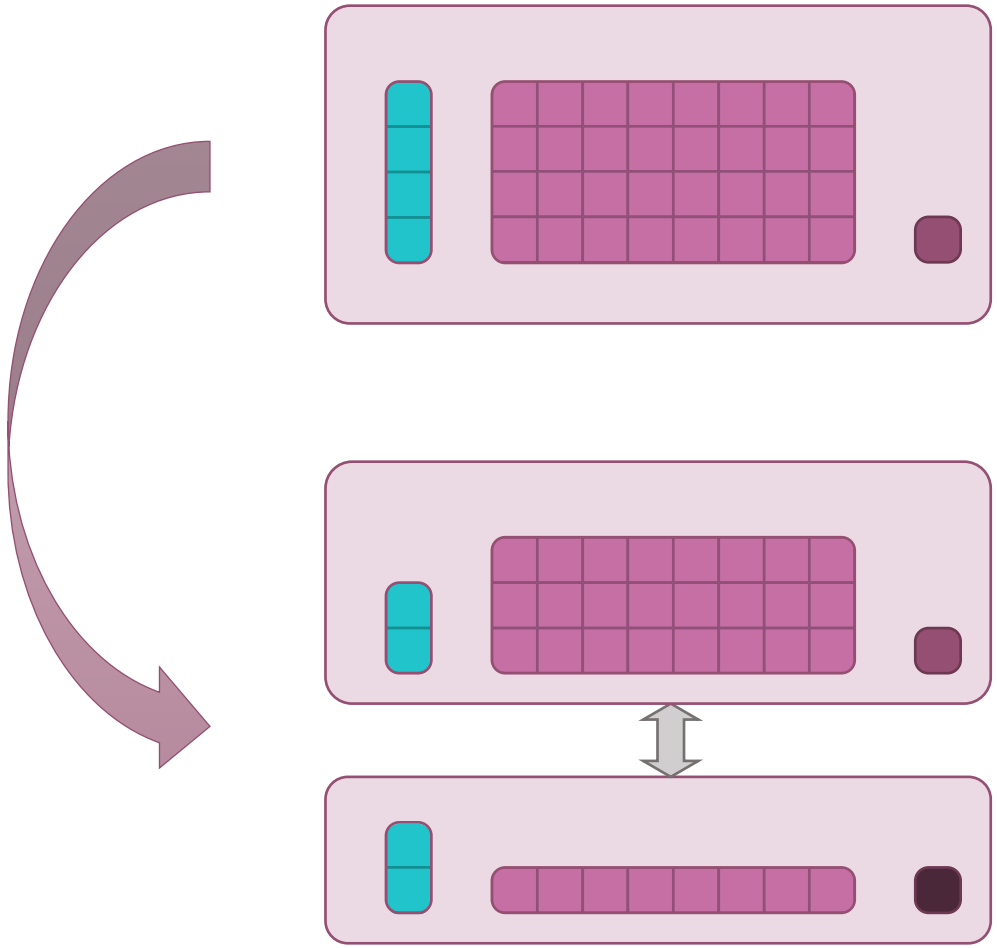

Initiatives and conclusions

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Ongoing initiatives

INAMI

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General remarks

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Recommendations

- Attestation
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- Transparency
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- Key management
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- Training
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- Holistic view
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Additional recommendations

- **Provider access**
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- **Data disposal**
- **Vulnerability disclosure**
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Informatieveiligheidscomité
Kamer sociale zekerheid en gezondheid

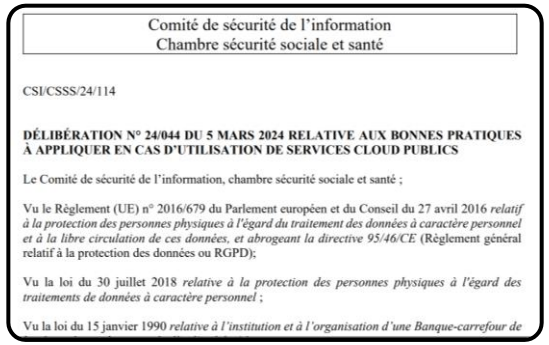
IVC/KSZG/24/114

BERAADSLAGING NR. 24/044 VAN 5 MAART 2024 MET BETREKKING TOT DE GOEDE PRAKTIJKEN DIE TOEGEPAST MOETEN WORDEN BIJ HET GEBRUIK VAN PUBLIEKE CLOUD DIENSTEN

Het informatieveiligheidscomité, kamer sociale zekerheid en gezondheid,

Gelet op de Verordening (EU) nr. 2016/679 van het Europees Parlement en de Raad van 27 april 2016 *betreffende de bescherming van natuurlijke personen in verband met de verwerking van persoonsgegevens en betreffende het vrije verkeer van die gegevens en tot intrekking van Richtlijn 95/46/EG* (Algemene Verordening Gegevensbescherming of AVG);

Gelet op de wet van 30 juli 2018 *betreffende de bescherming van natuurlijke personen met betrekking tot de verwerking van persoonsgegevens*;



Comité de sécurité de l'information
Chambre sécurité sociale et santé

CSI/CSSS/24/114

DÉLIBÉRATION N° 24/044 DU 5 MARS 2024 RELATIVE AUX BONNES PRATIQUES À APPLIQUER EN CAS D'UTILISATION DE SERVICES CLOUD PUBLICS

Le Comité de sécurité de l'information, chambre sécurité sociale et santé ;

Vu le Règlement (UE) n° 2016/679 du Parlement européen et du Conseil du 27 avril 2016 *relatif à la protection des personnes physiques à l'égard du traitement des données à caractère personnel et à la libre circulation de ces données, et abrogeant la directive 95/46/CE* (Règlement général relatif à la protection des données ou RGPD);

Vu la loi du 30 juillet 2018 *relative à la protection des personnes physiques à l'égard des traitements de données à caractère personnel* ;

Vu la loi du 15 janvier 1990 *relative à l'institution et à l'organisation d'une Banque-carrefour de*

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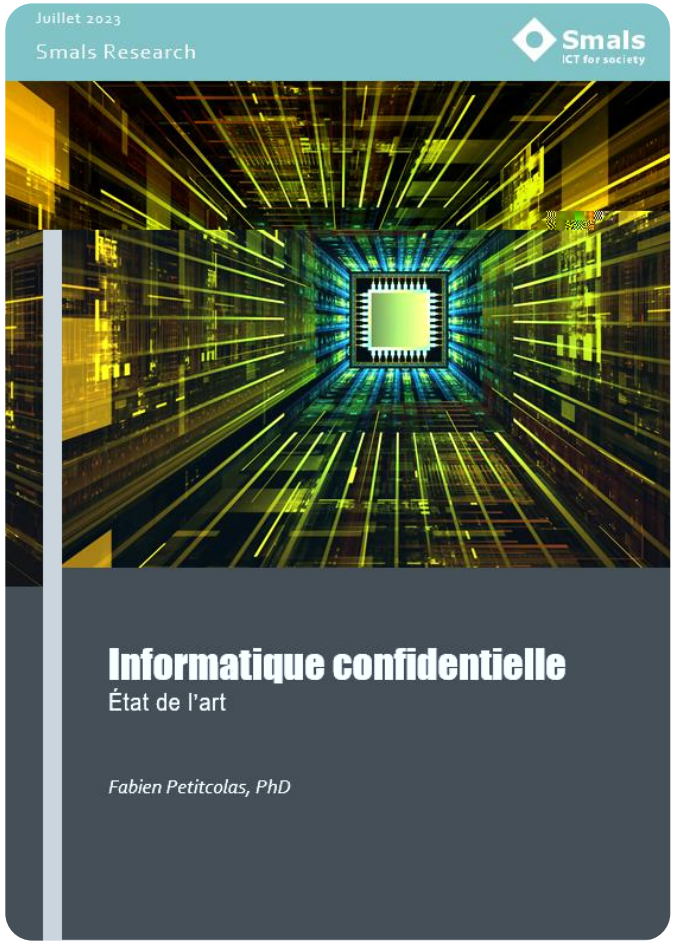
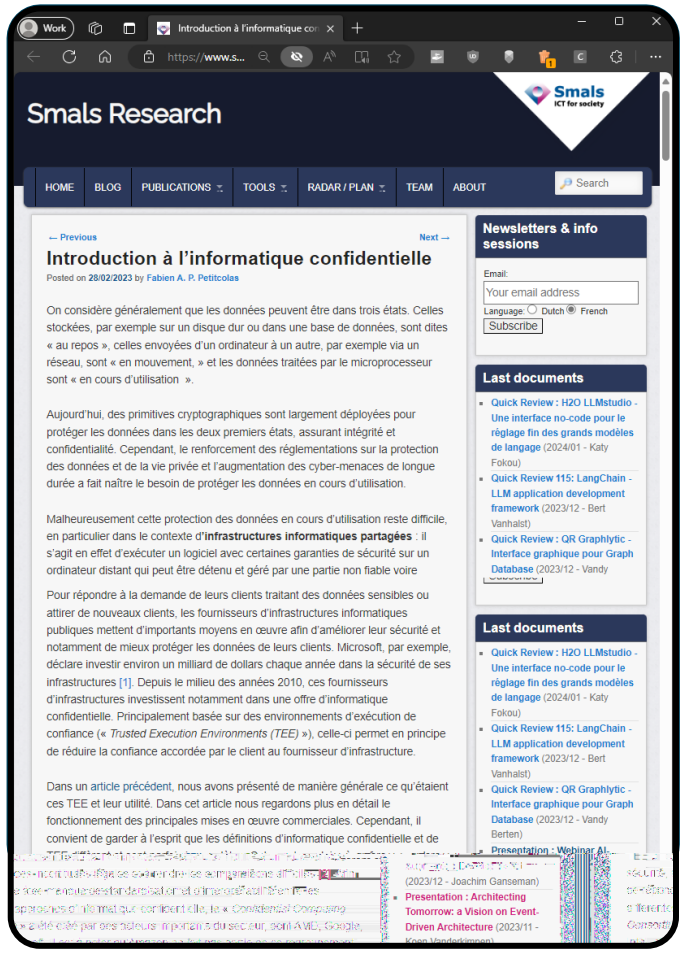
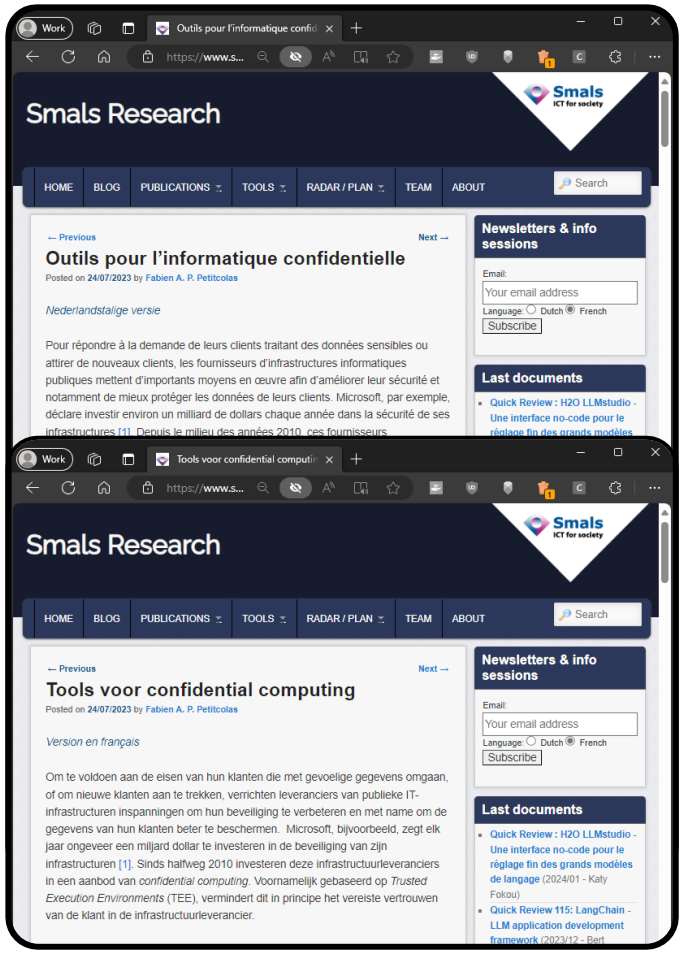
Further reading…







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