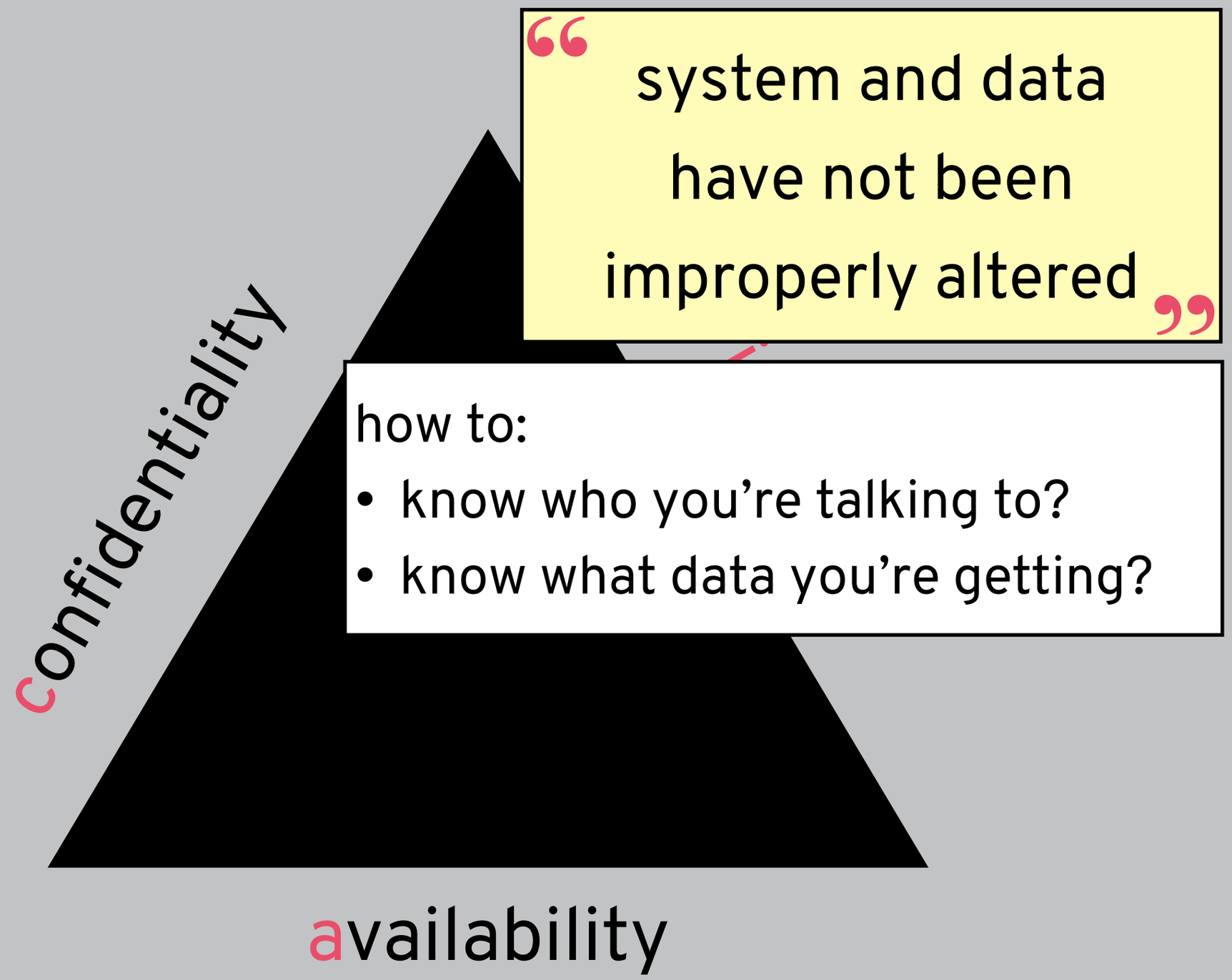
# SECURITY (COMP0141):

## LAST WEEK → THIS WEEK

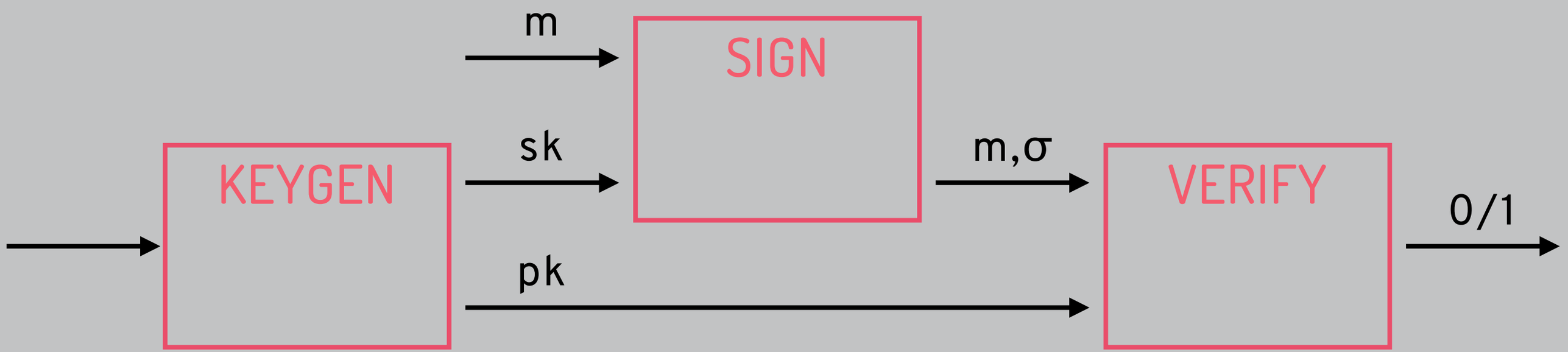
# INTEGRITY


“system and data have not been improperly altered”
how to:
• know who you’re talking to?
• know what data you’re getting?
confidentiality
availability

# CRYPTOGRAPHIC PRIMITIVES

| | setup? | confidentiality/ integrity? | fast? |
|---|---|---|---|
| SE | yes | confidentiality | yes |
| PKE | no* | confidentiality | no |
| digital signature | no* | integrity | no |
| MAC | yes | integrity | yes |
| OWF | no | confidentiality* | no |
| hash function | no | integrity | yes |
| AE | yes | both | yes |

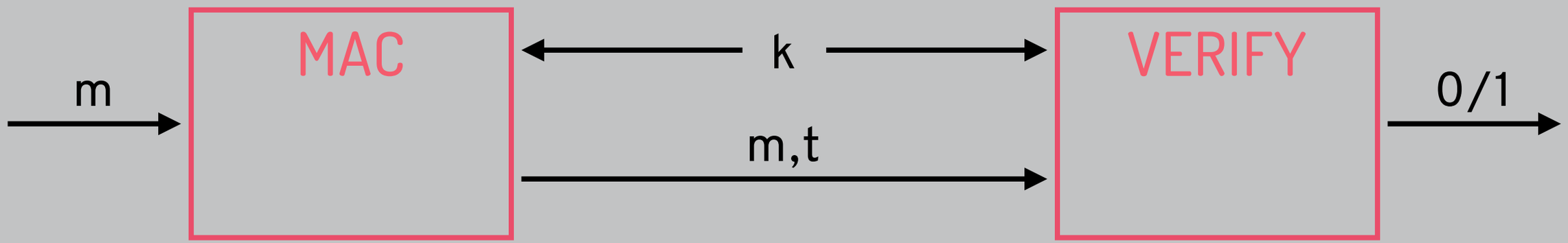
# DIGITAL SIGNATURES




**Correctness:** Valid signatures using valid keys will verify properly (for all k,m and $(pk,sk) \in [KeyGen(1^k)]$, $Verify(pk,m,Sign(sk,m)) = 1$)

**Unforgeability (EUF-CMA):** For a given public key, an adversary can't produce new signatures that verify ($(pk,sk) \leftarrow KeyGen(1^k)$, A gets pk and access to oracle Sign(m), can't output (σ,m) for m not queried to Sign)

# MACS




**Correctness:** Verify(k, m, MAC(k,m)) = 1

**Unforgeability:** hard to generate (m,MAC(k,m)) without knowing k

# HASH FUNCTIONS

Two main security properties:

- **Pre-image resistance:** given H(x) it's hard to find x
- **Collision resistance:** it's hard to find x and y so that x ≠ y but H(x) = H(y)

Applications:

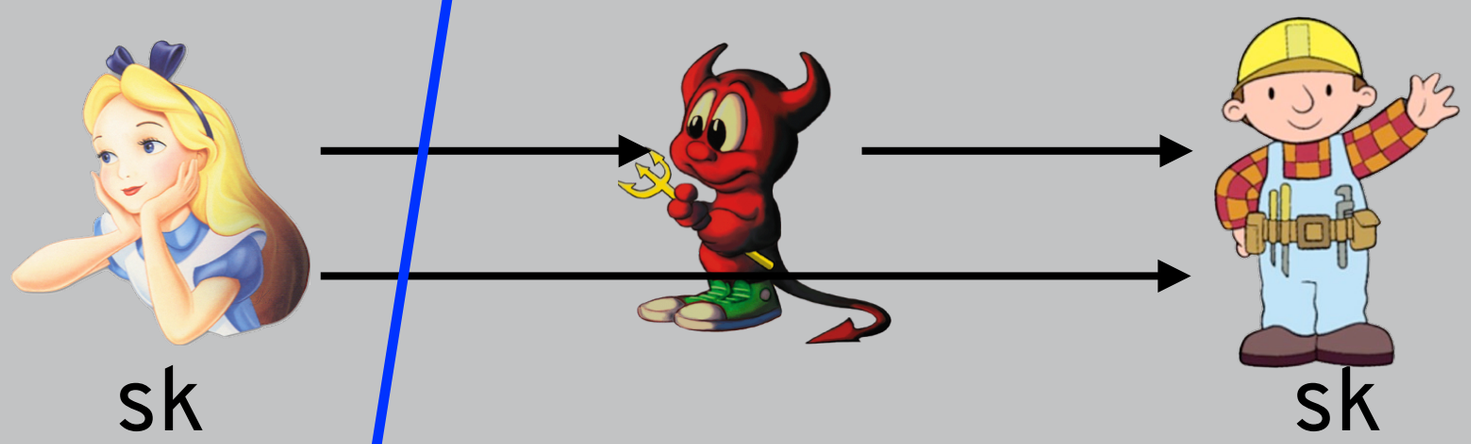
- File checksum
- MACs
- Digital signatures
- Commitments
- Blockchains
- Virus scanning (next week)
- Password storage (Week 7)
- ...and many more!

# AUTHENTICATED ENCRYPTION (AEAD)

goals:

impersonate Alice

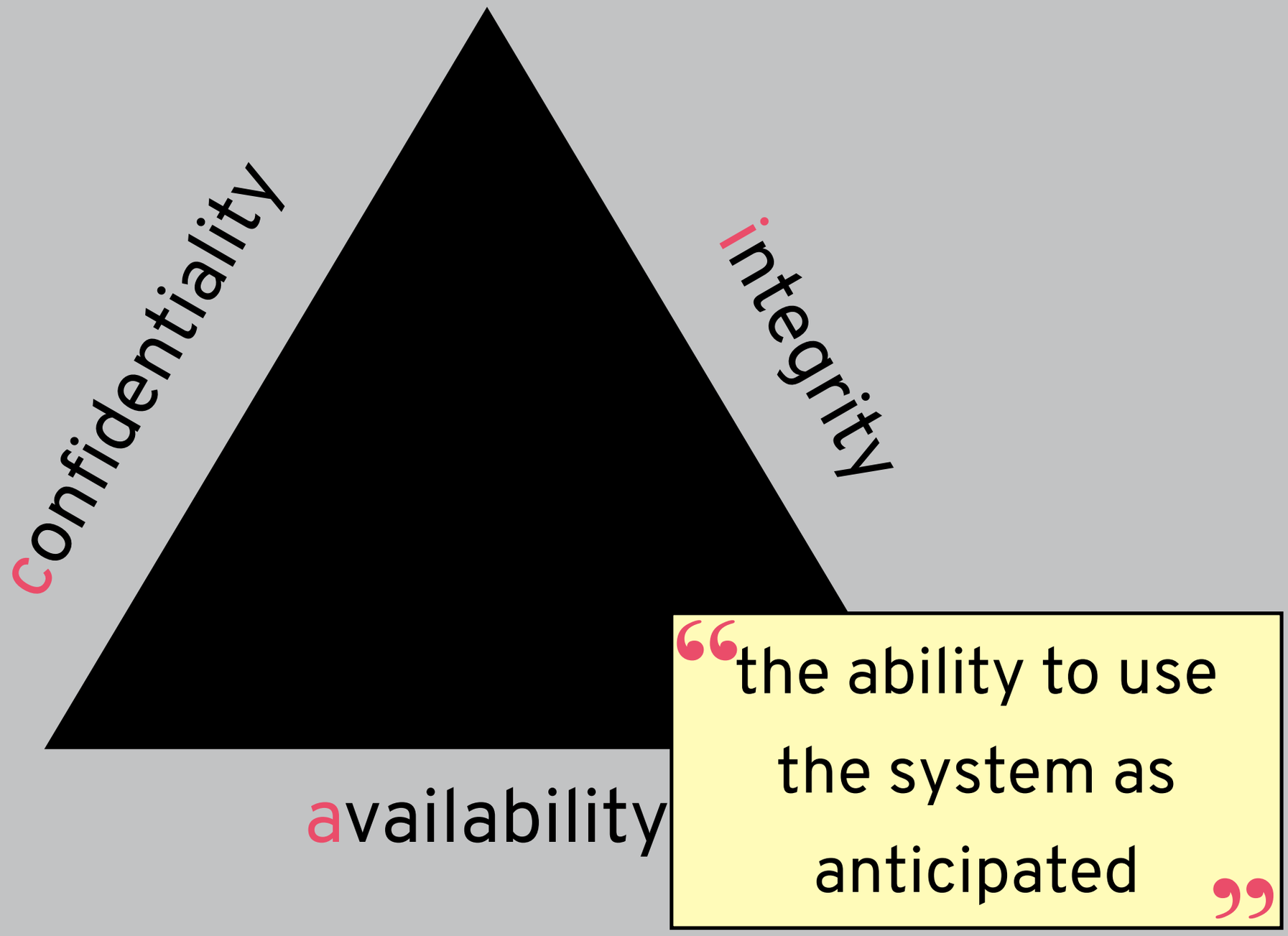
eavesdrop




prevent using encryption

prevent using MACs

# THIS WEEK


confidentiality
integrity
availability
“the ability to use the system as anticipated”