FACULTEIT INGENIEURSWETENSCHAPPEN
EN ARCHITECTUUR

BOOSTING MVX SYSTEMS THROUGH MODERN OS EXTENSIONS

Lennert Franssens, student Industriële Wetenschappen in de Informatica

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OVERZICHT

- MVEE
- ReMon met IP-MON
- Seccomp-BPF
- Nieuw design ReMon
- Veiligheid
- Tekortkomingen
- Testresultaten
- Conclusie
- Vragen

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MVEE

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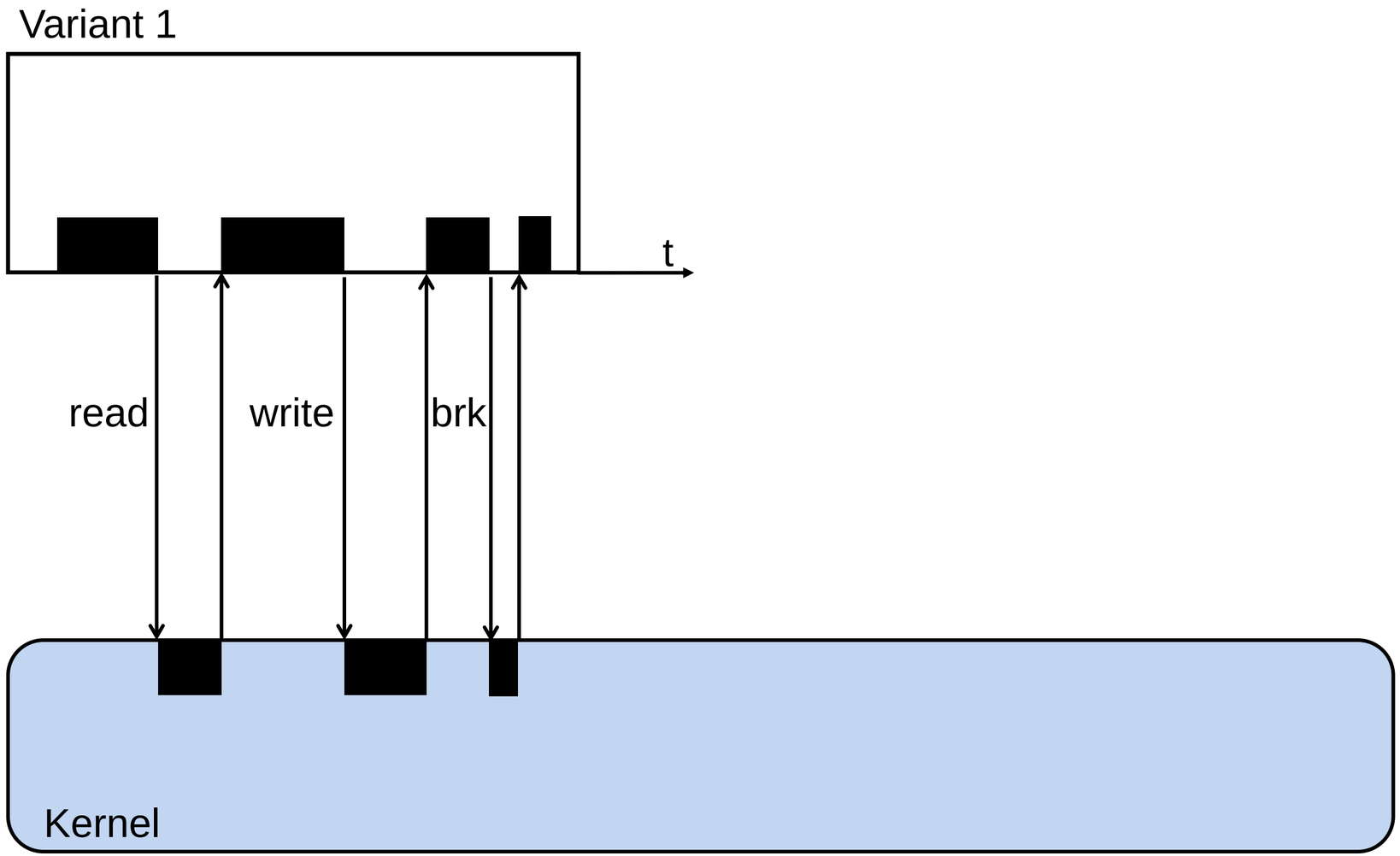
MVEE



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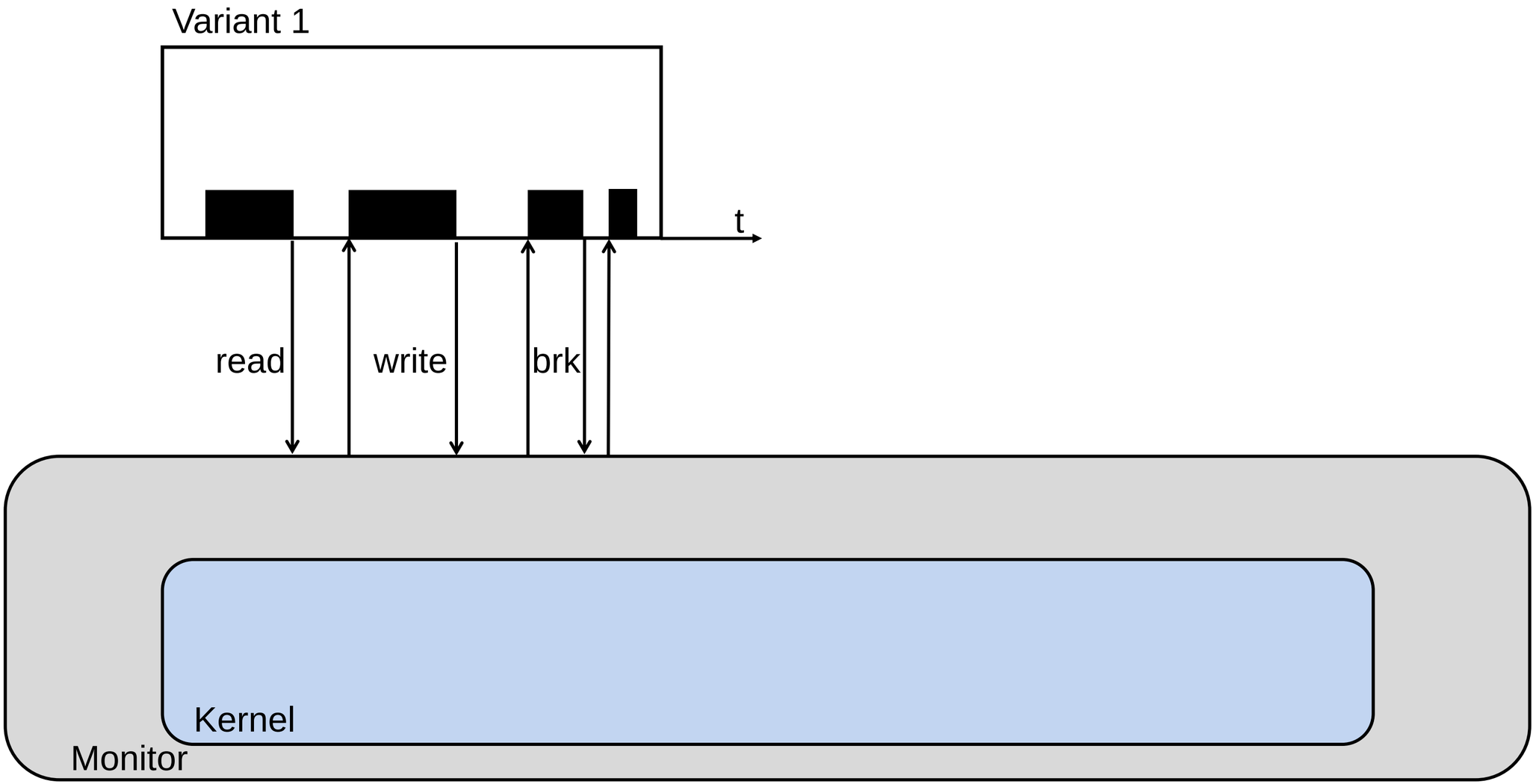
MONITOR – TRACER PROCES



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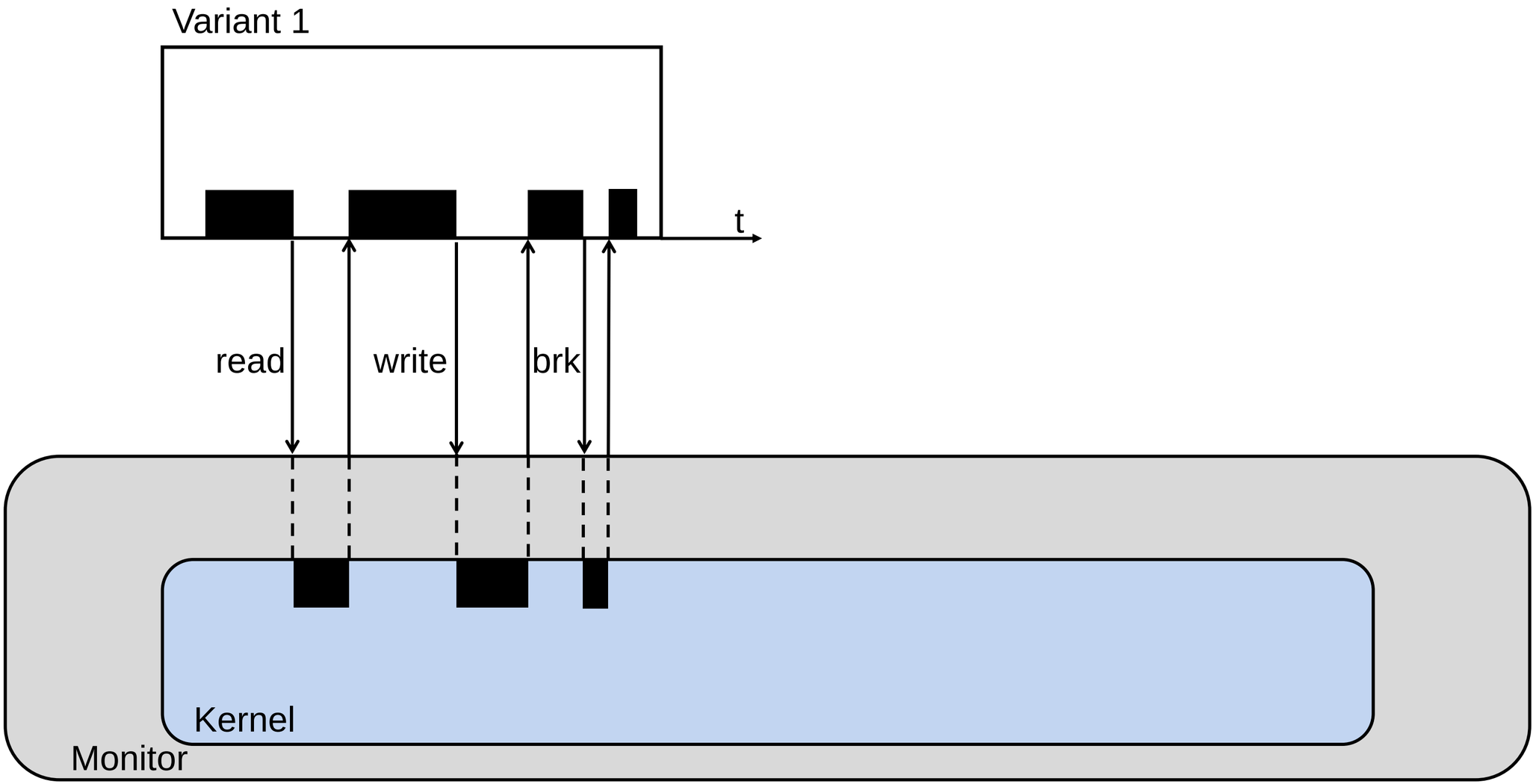

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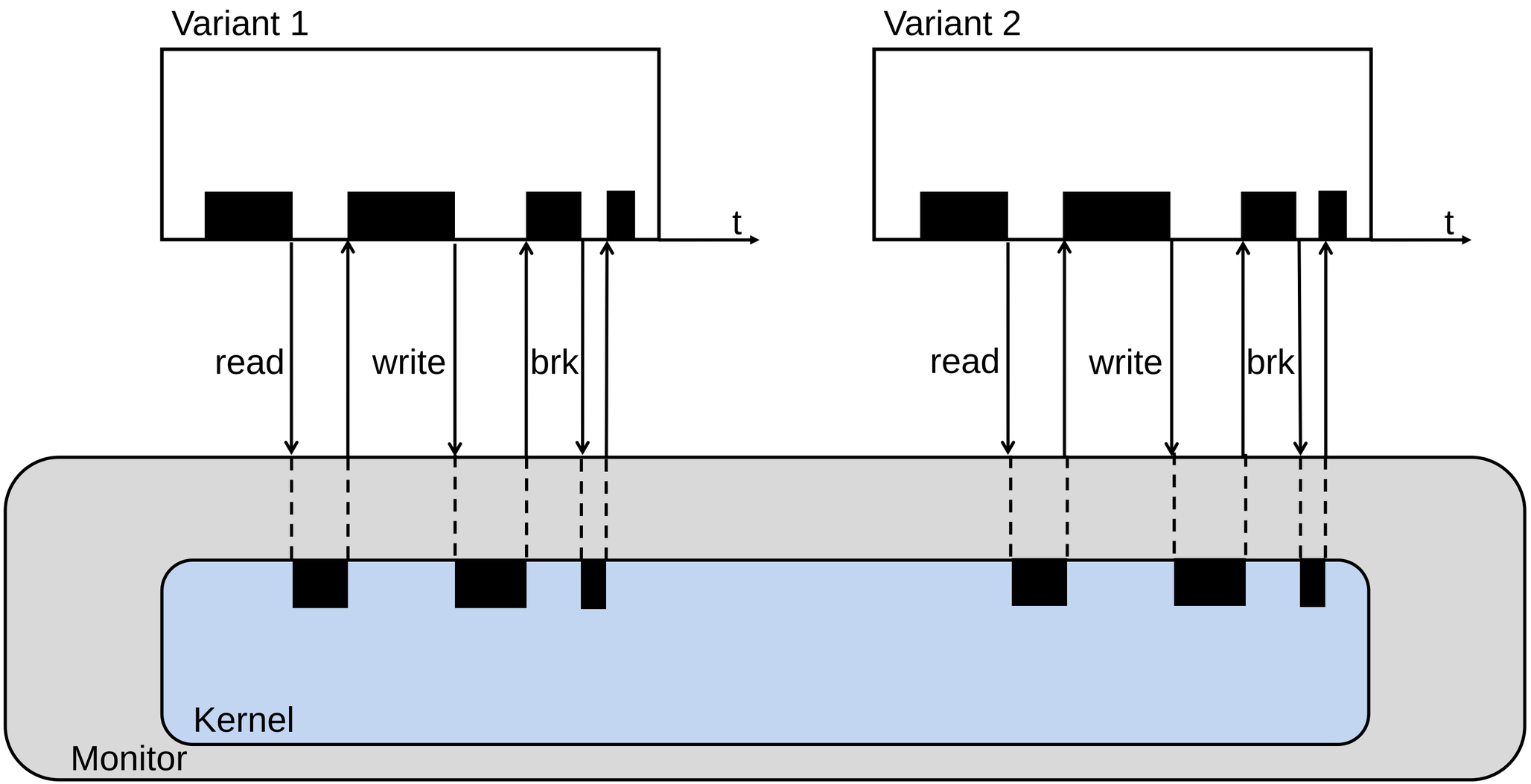

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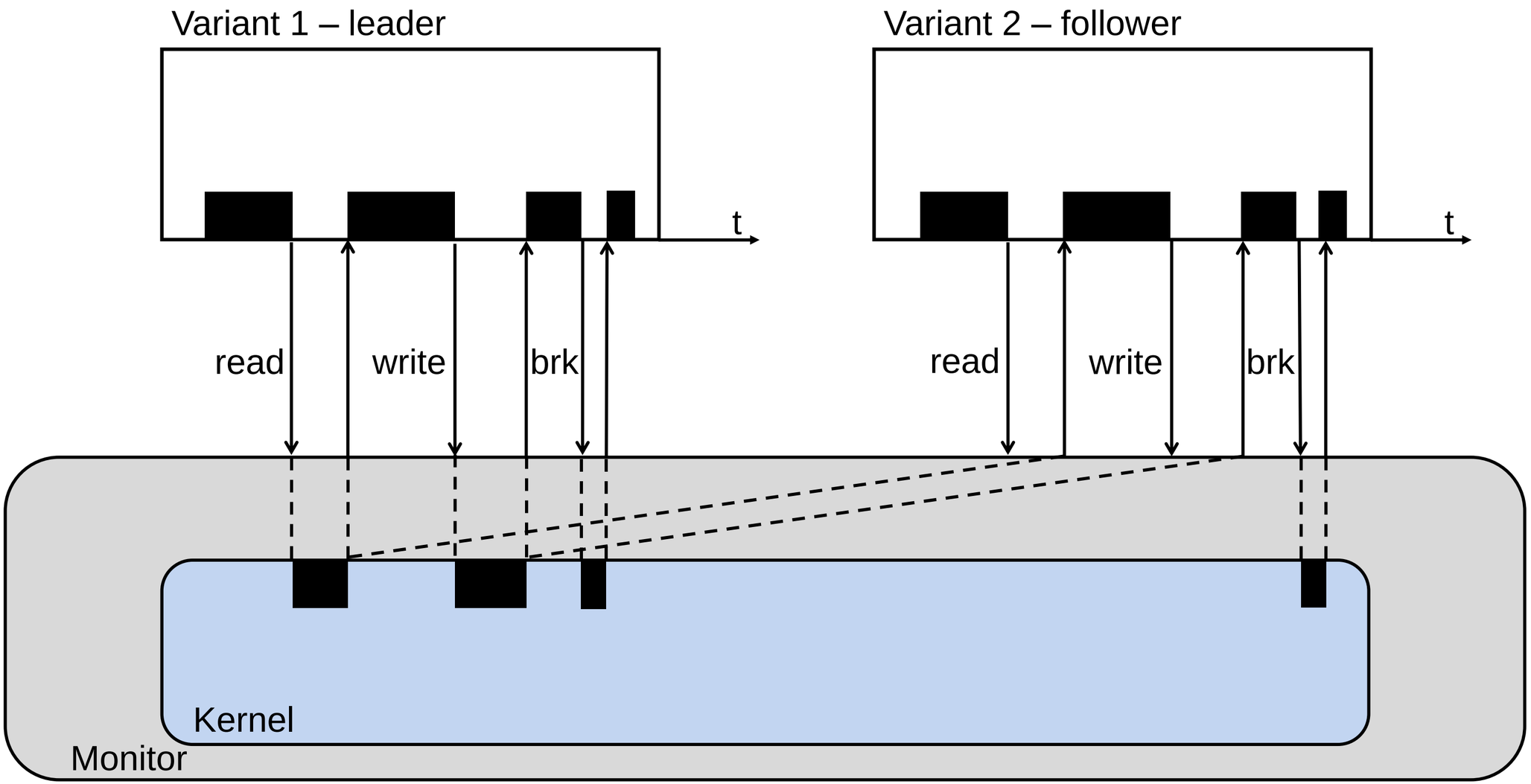
LEADER/FOLLOWER-MODEL VOOR IO REPLICATIE



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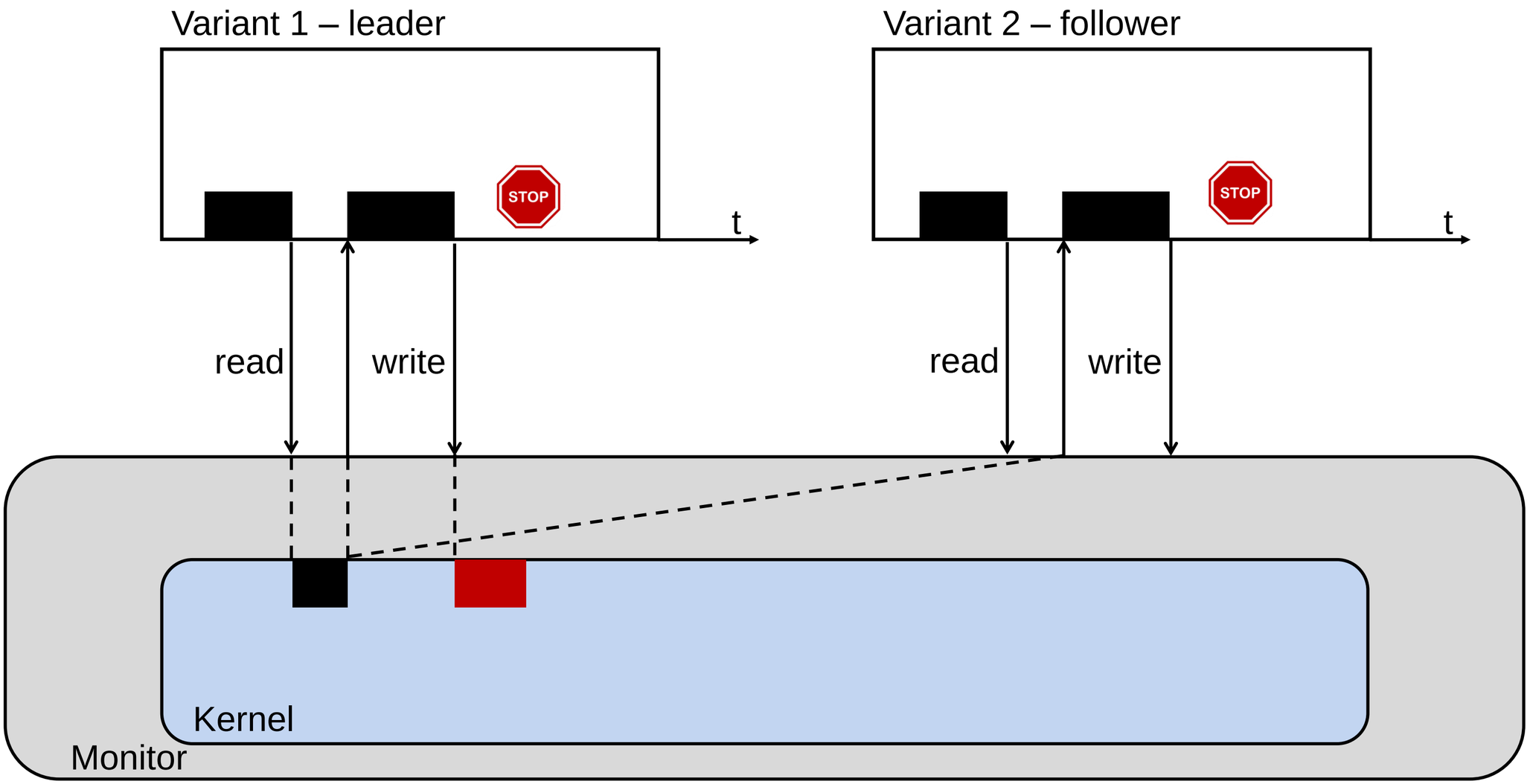
DETECTIE VAN VERSCHIL IN GEDRAG



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GROTE RUNTIME OVERHEAD

- Veel contextswitches
- Beveiliging boven snelheid

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REMON

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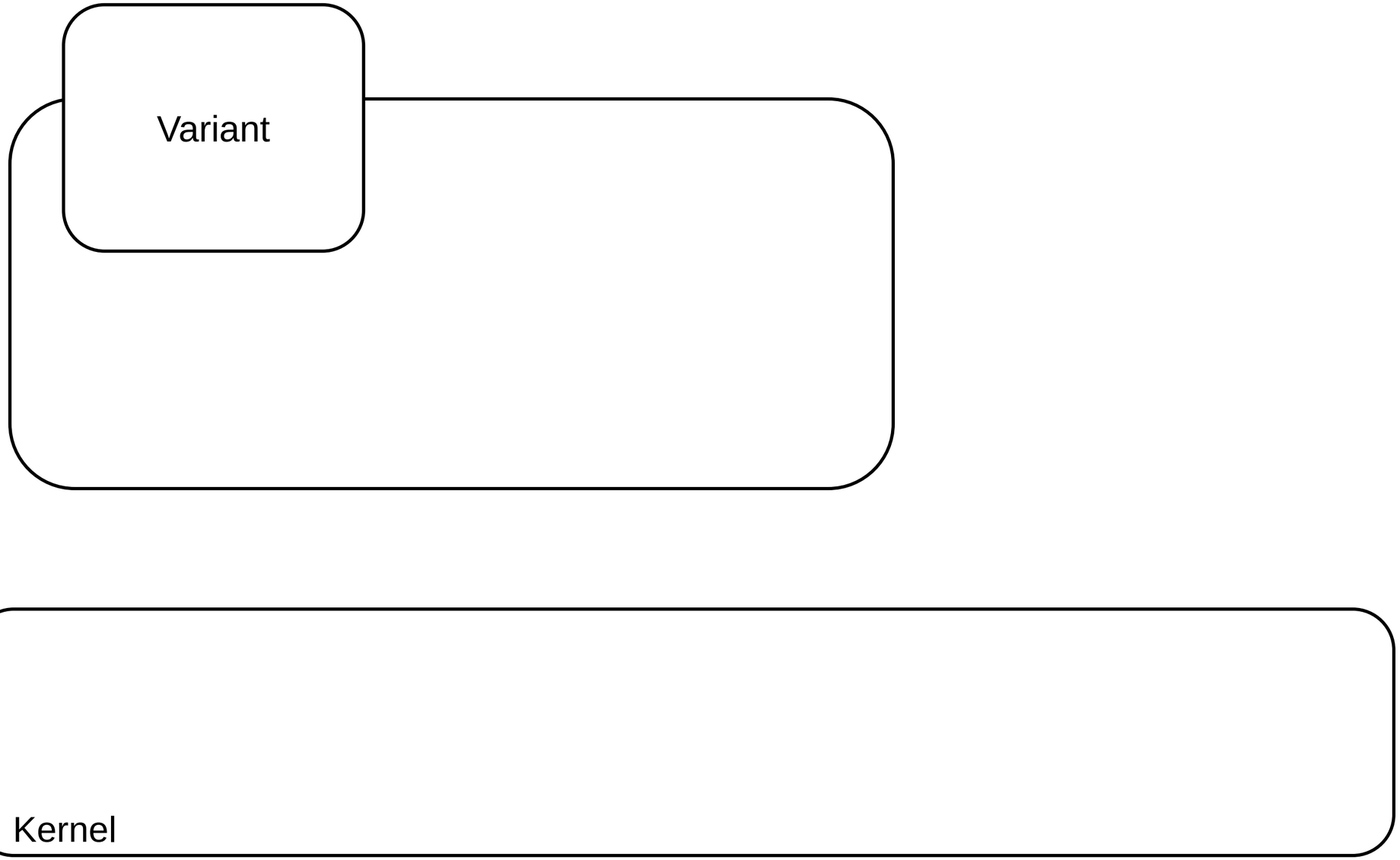
REMON

- Strict Monitoring van veiligheidsgevoelige systeemaanroepen
  - Tracer proces
- Relaxed Monitoring voor niet-veiligheidsgevoelige systeemaanroepen
  - Minder contextswitches

VARIANT VOERT SYSTEM CALLS UIT



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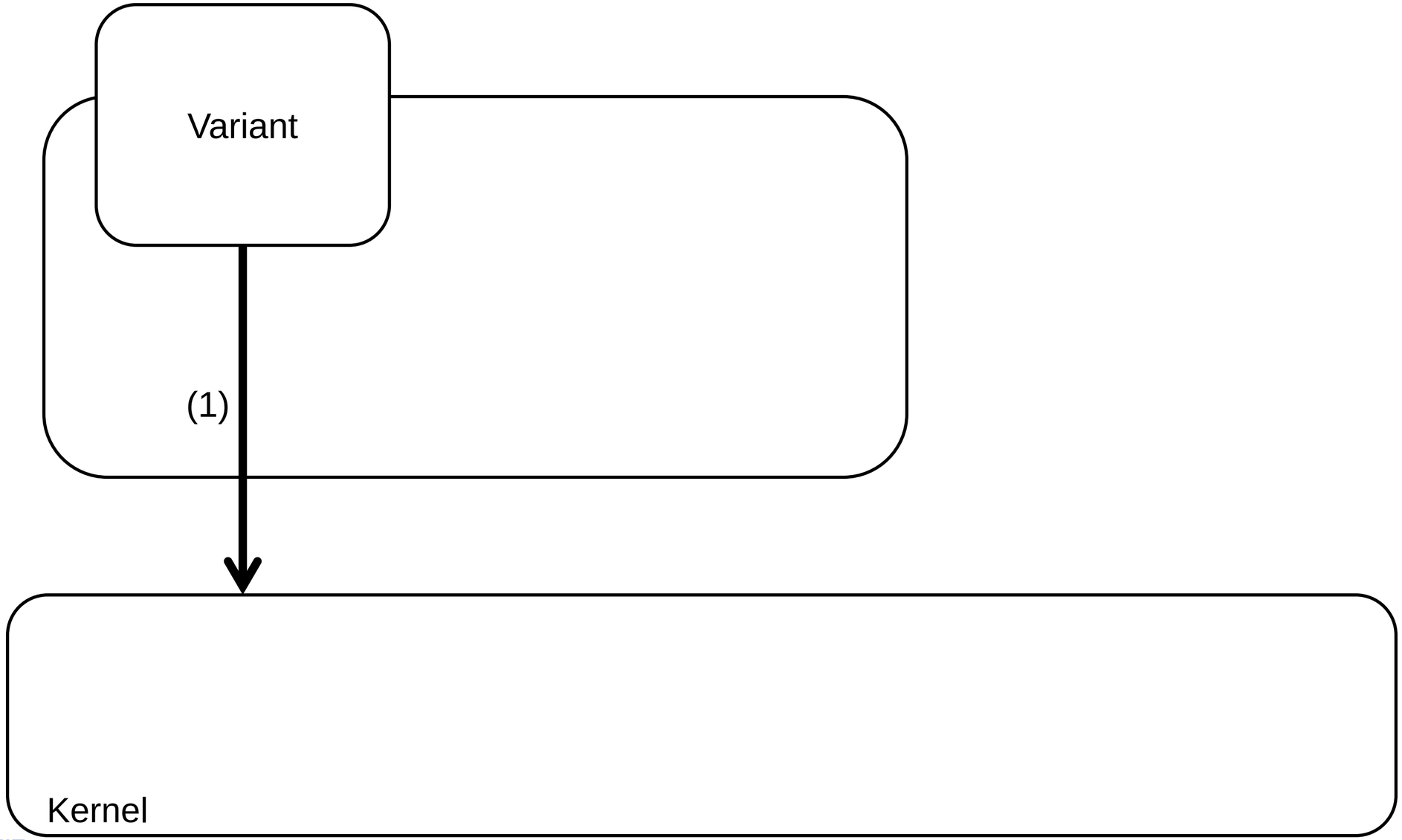

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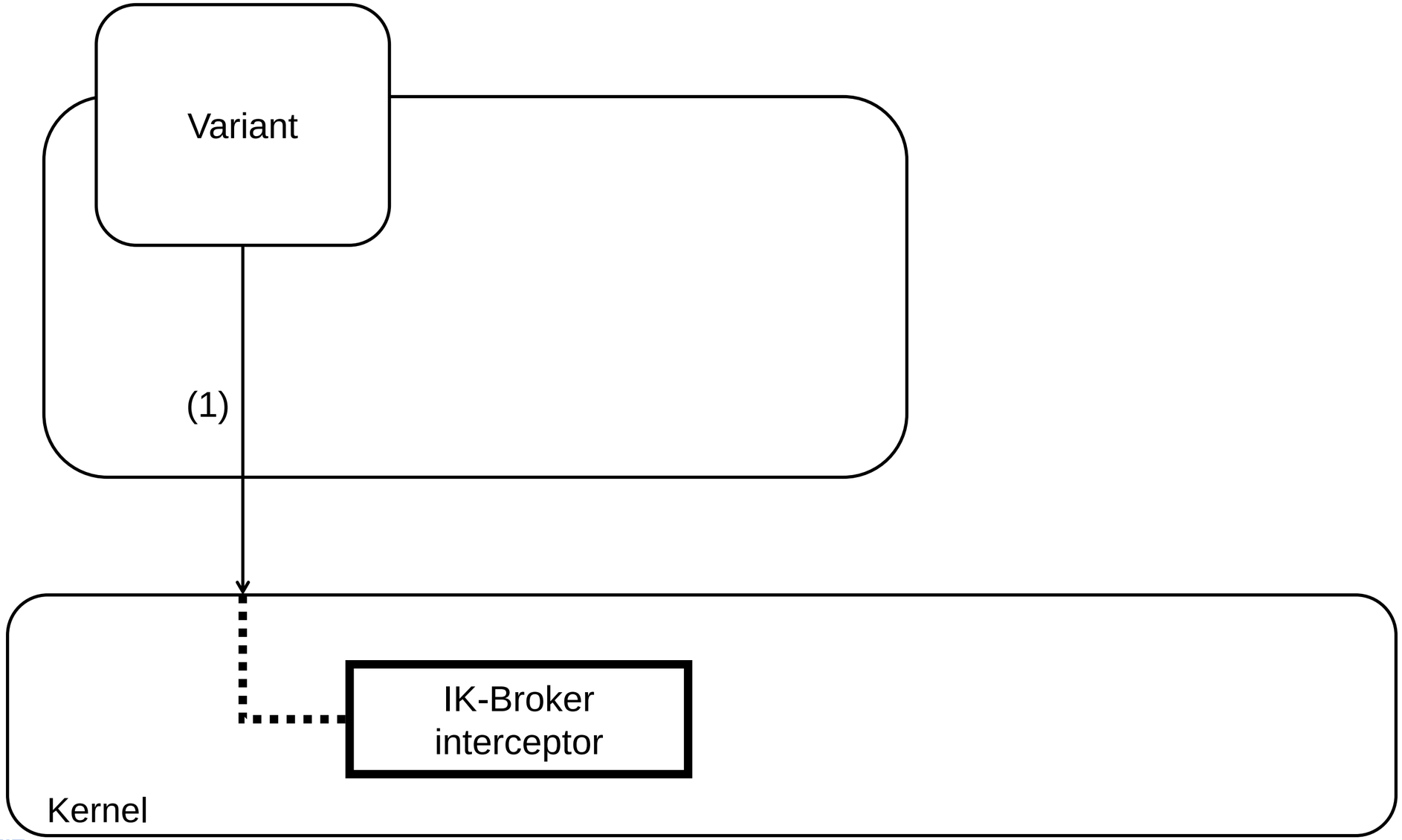

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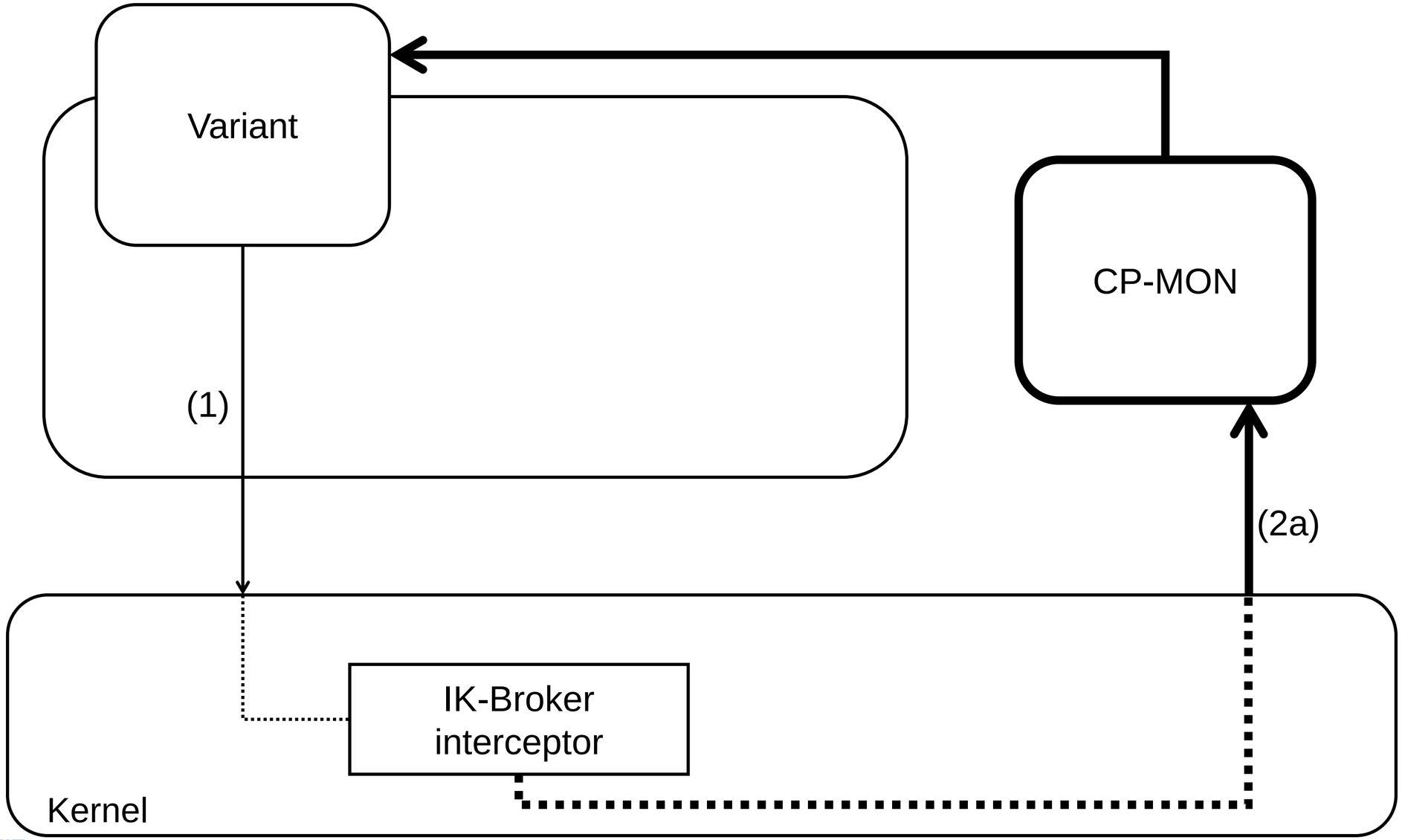

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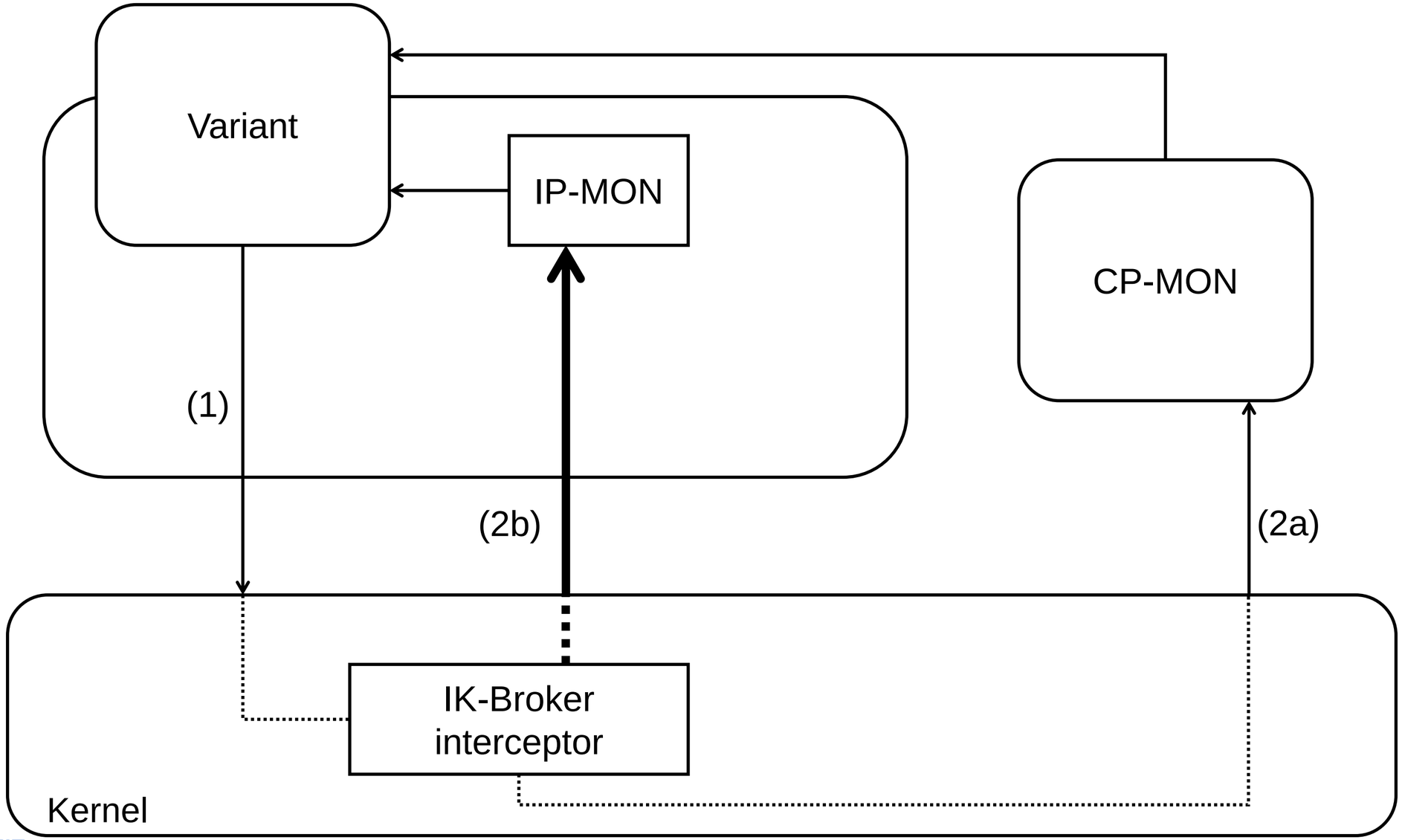

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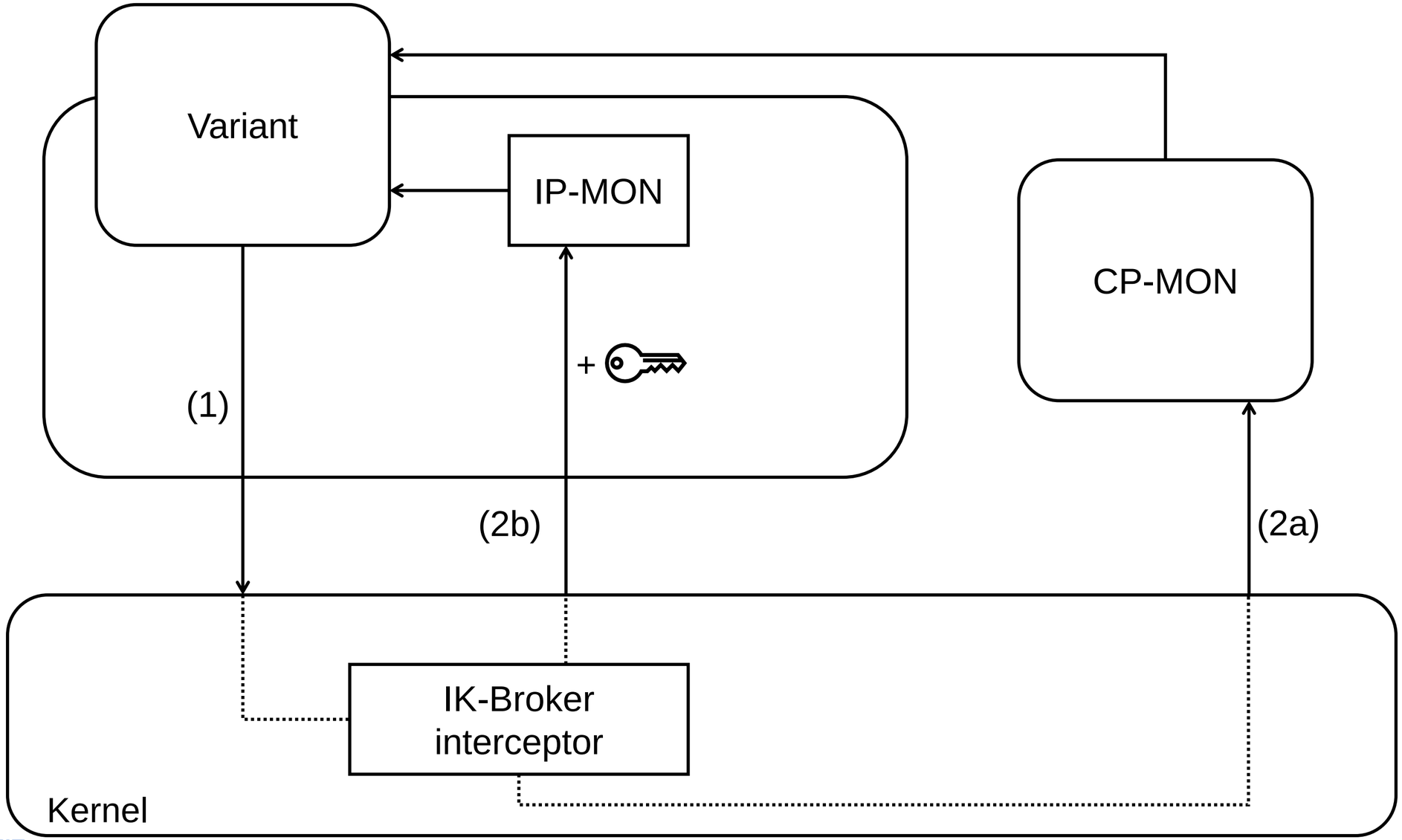

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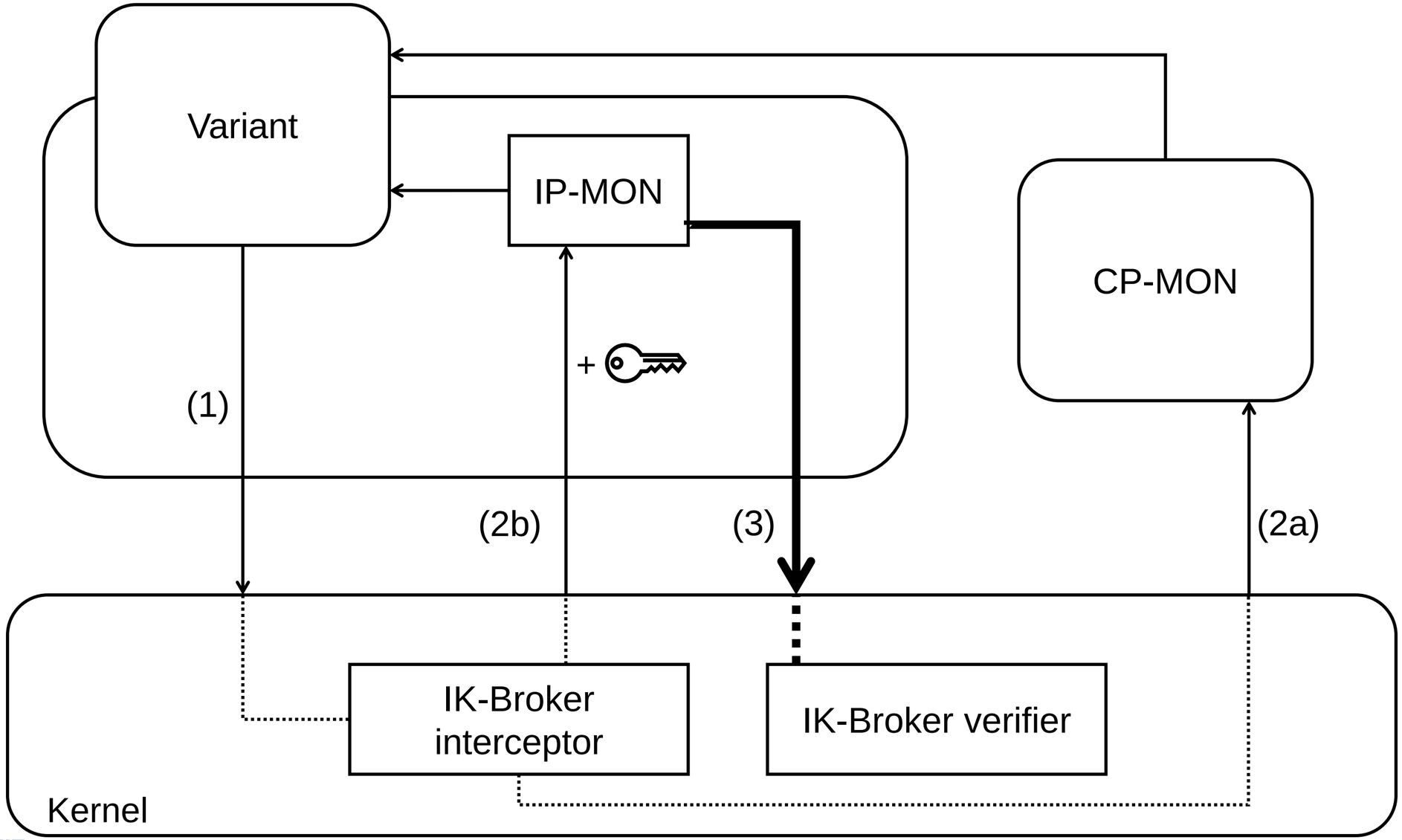

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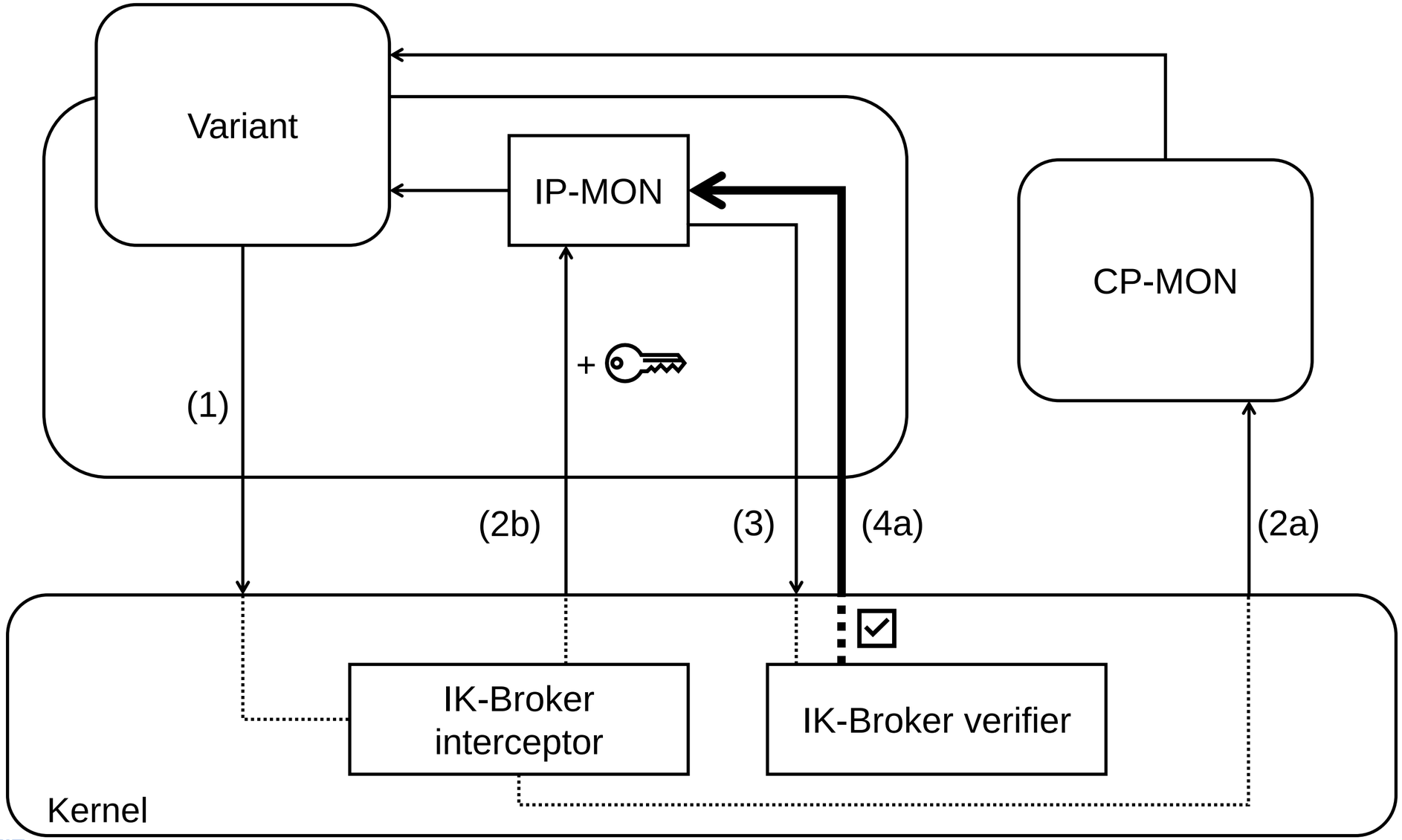

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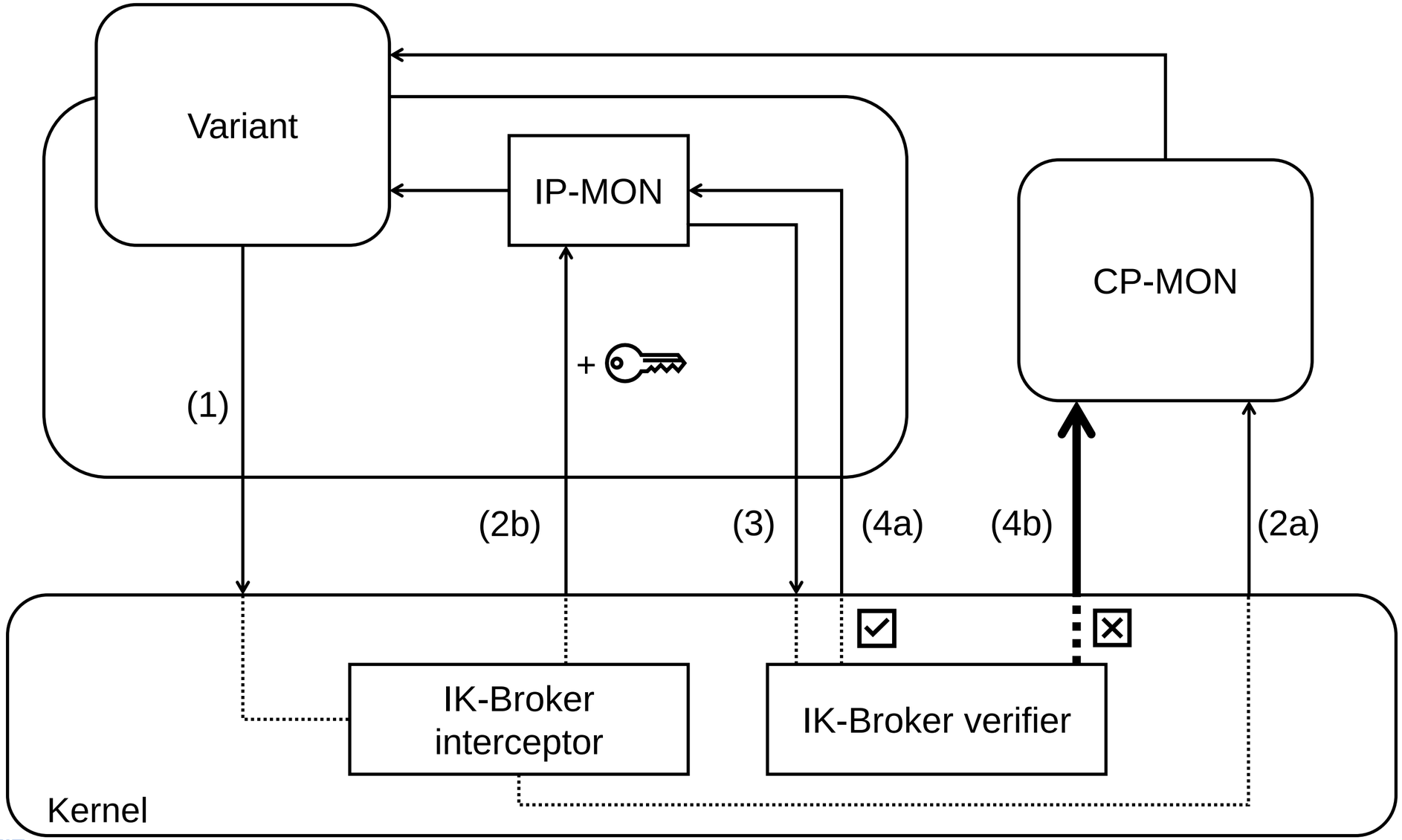

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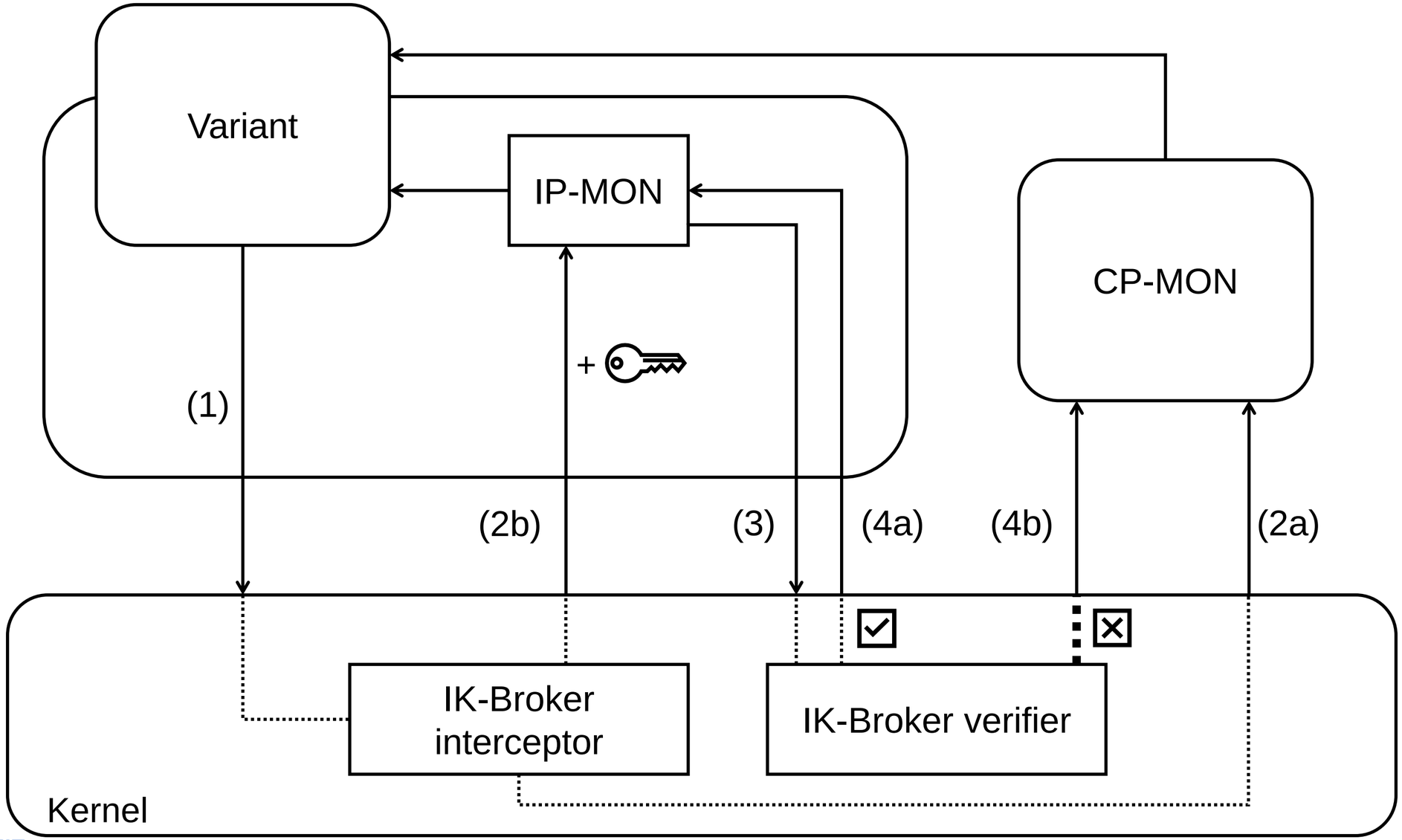

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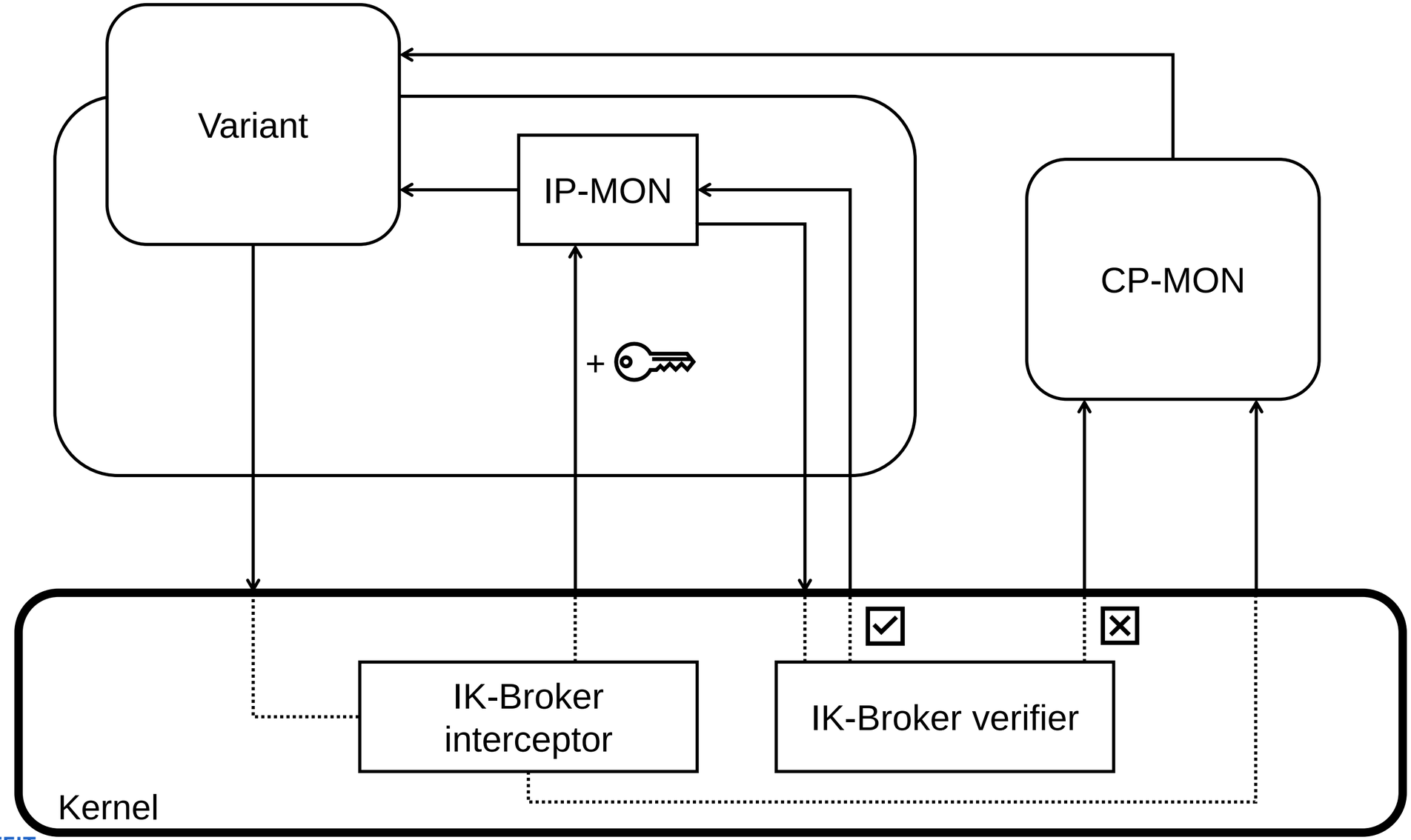

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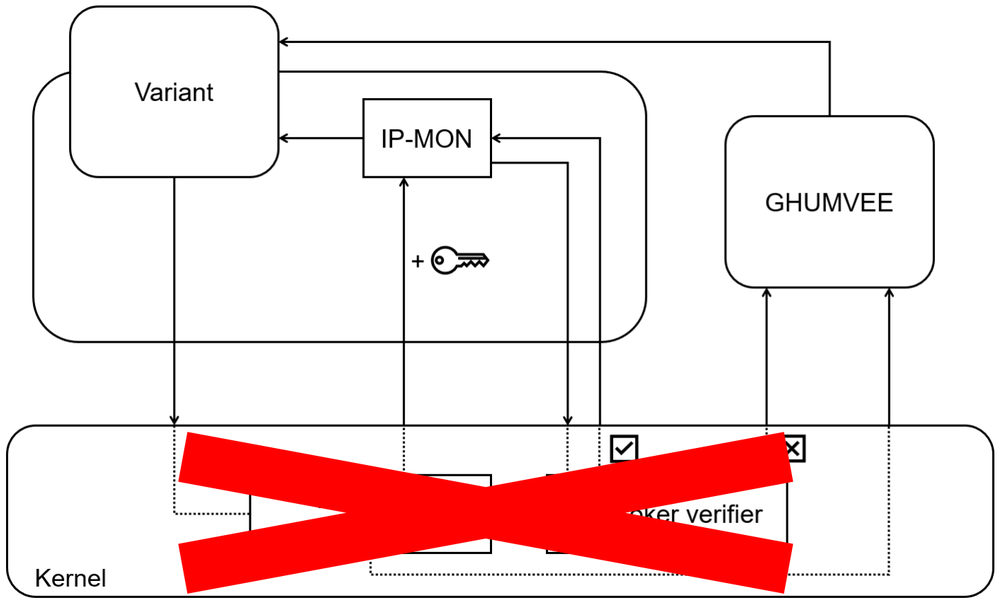
DOELSTELLING

- ReMon aanpassen
  - Kernelpatch vervangen door nieuwe technologieen in de Linux kernel
- Geen verlies van snelheid en veiligheid



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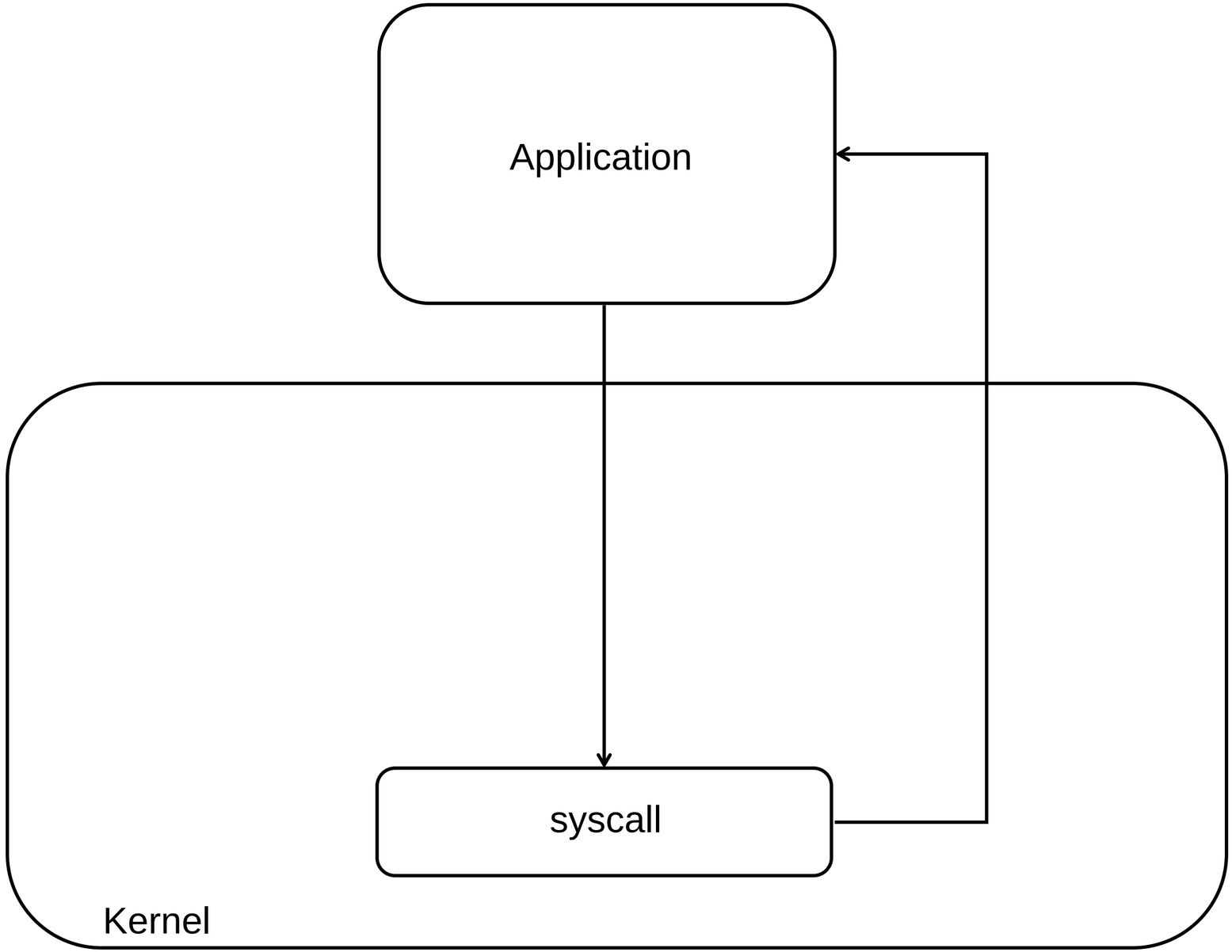
SECCOMP-BPF

SYSTEM CALLS UITVOEREN



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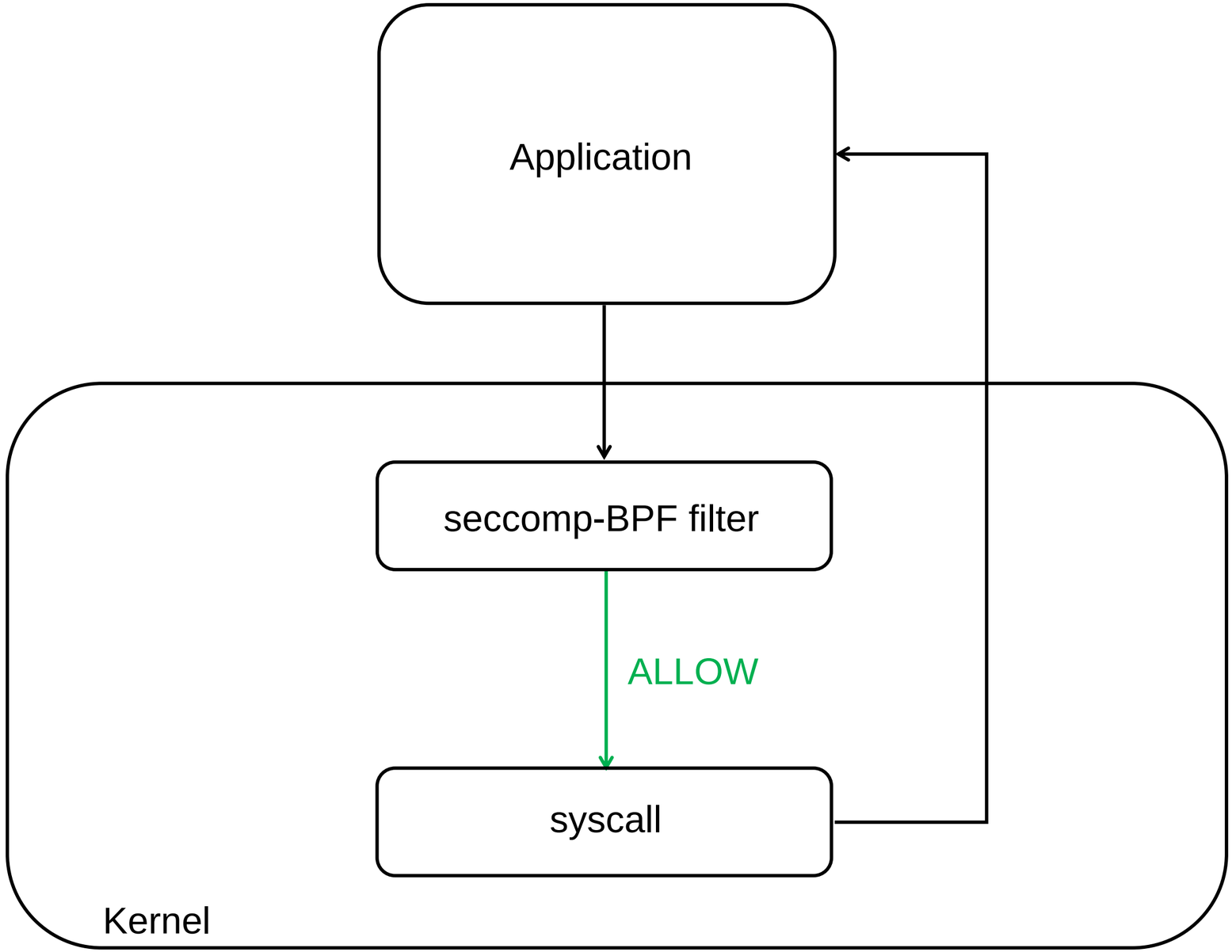
SYSTEM CALLS DOORLATEN



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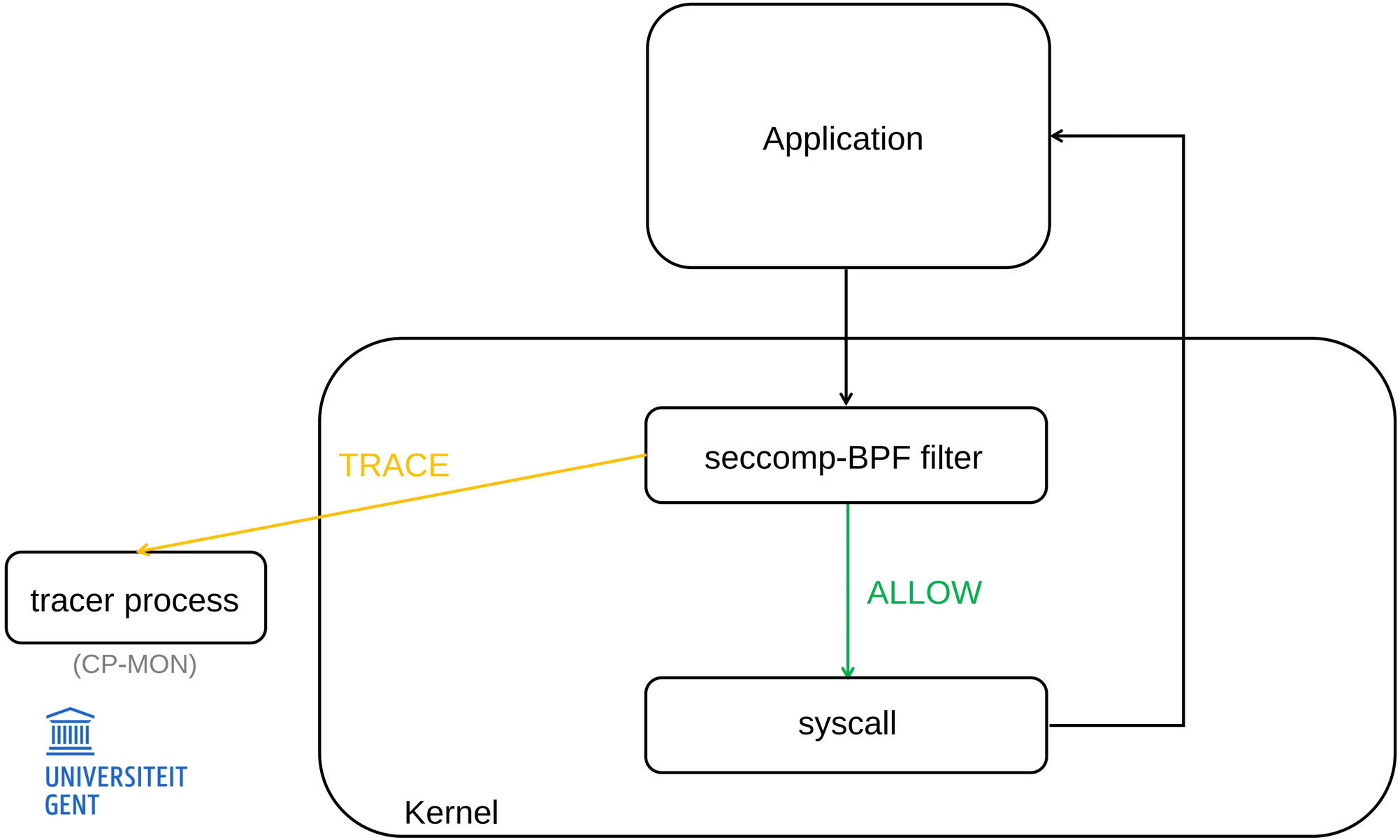
SYSTEM CALLS TRACEN



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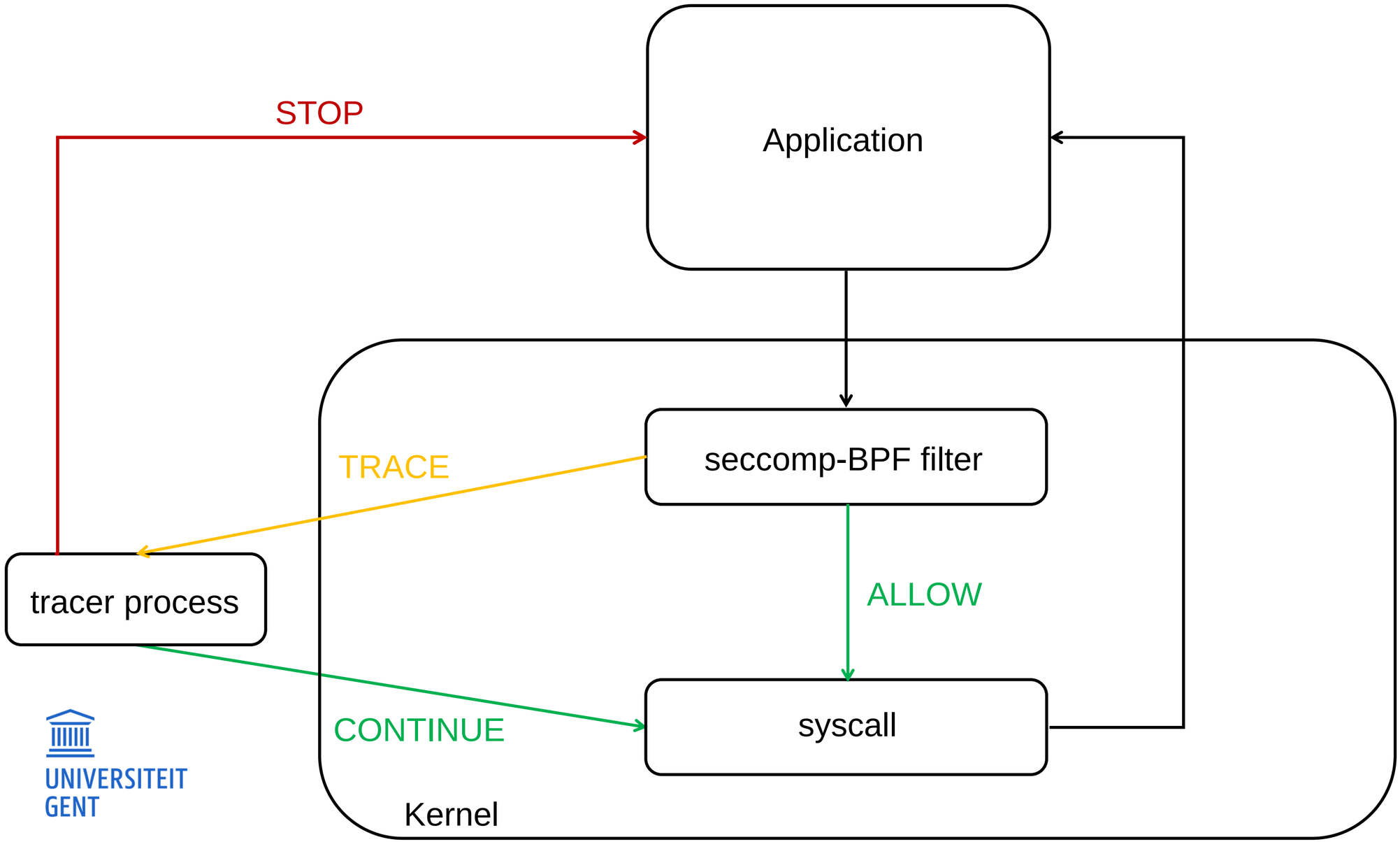
HERVATTEN NA SYSTEM CALL TRACE



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MOGELIJKE ACTIES

- Allow
- Trace
- Errno-waarde terugsturen
  - Systeemaanroep wordt niet uitgevoerd

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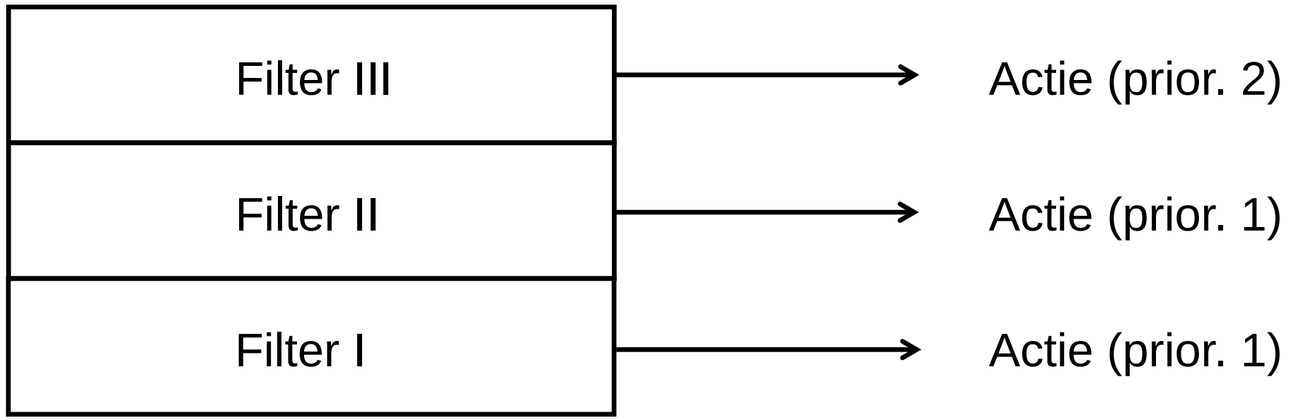
MINPUNTEN

- Errno-waarde is 16 bit dat wordt afgetopt op 12 bit

- Elke actie heeft een bepaalde prioriteit
- Combineren van filters voert elke filter uit en geeft actie met hoogste prioriteit terug

} Combineren van filters geeft vaak ongewenst gedrag



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NIEUW DESIGN REMON MET SECCOMP-BPF

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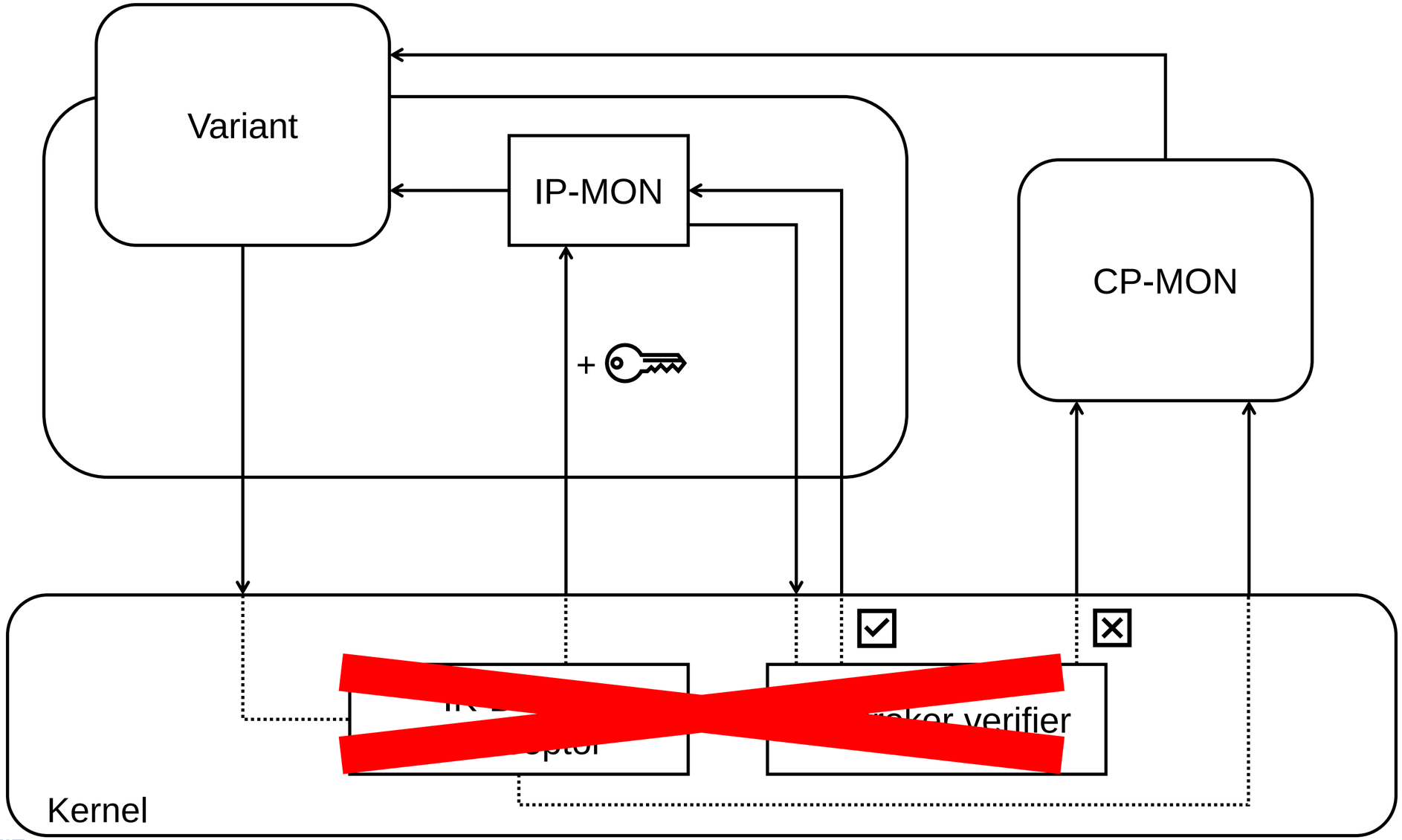
VERVANGEN KERNELPATCH



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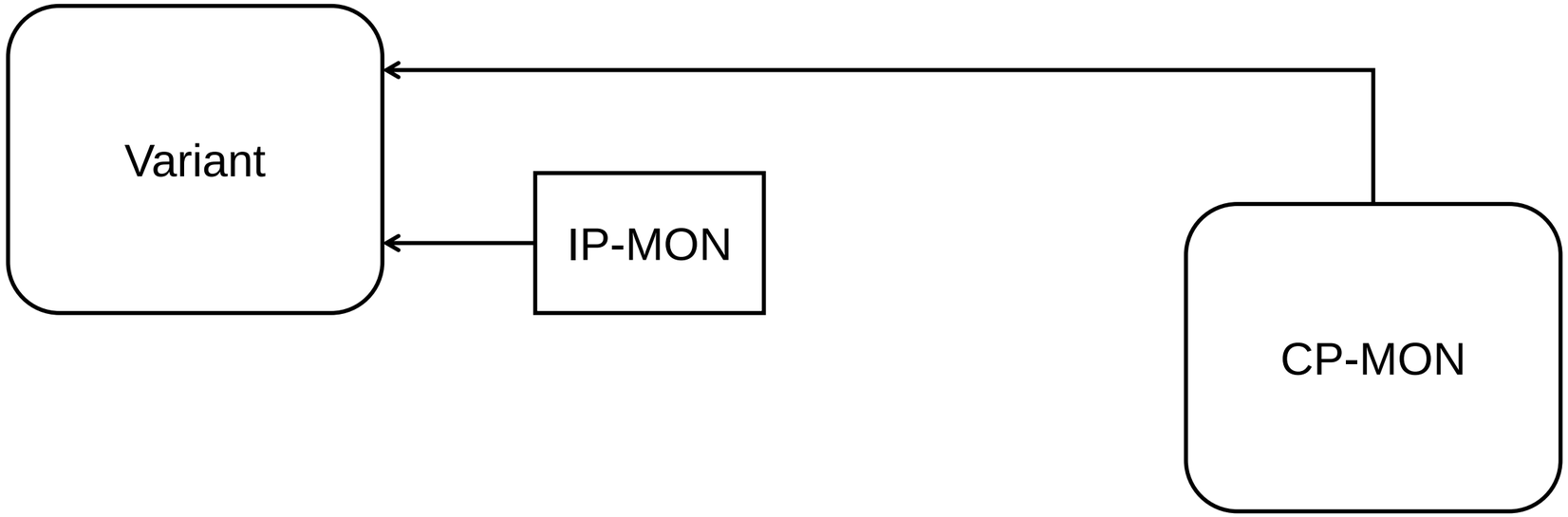

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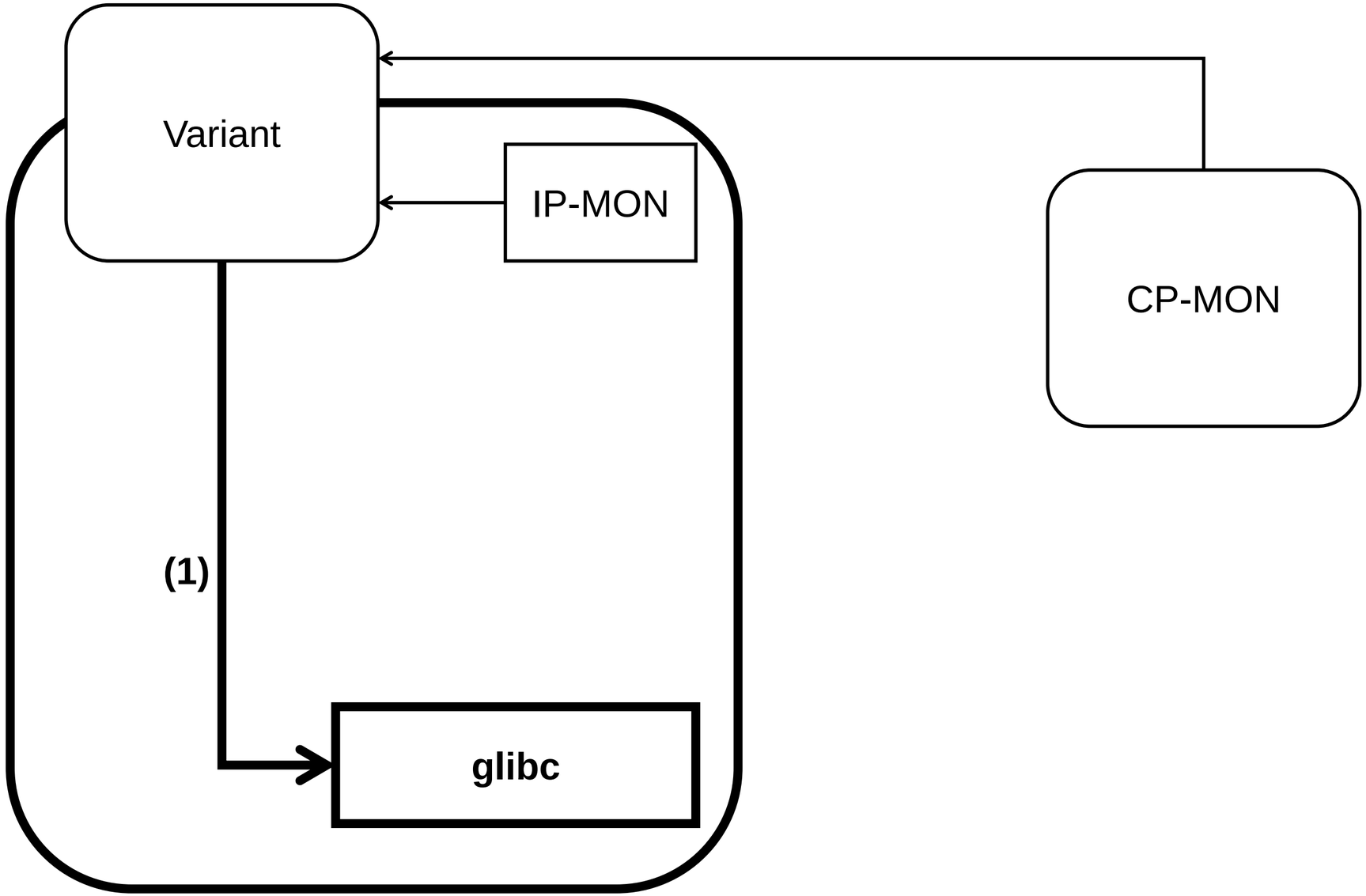

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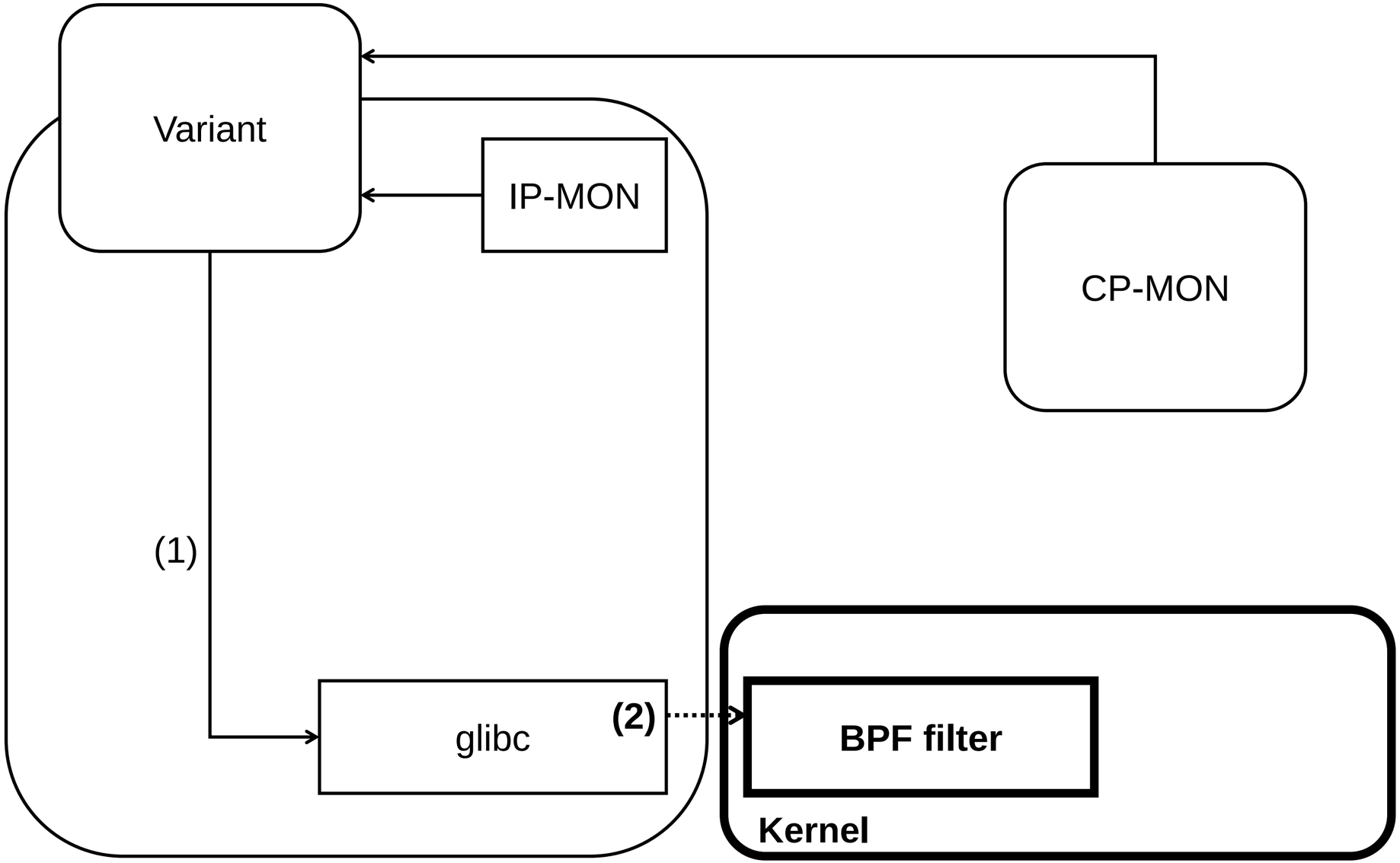

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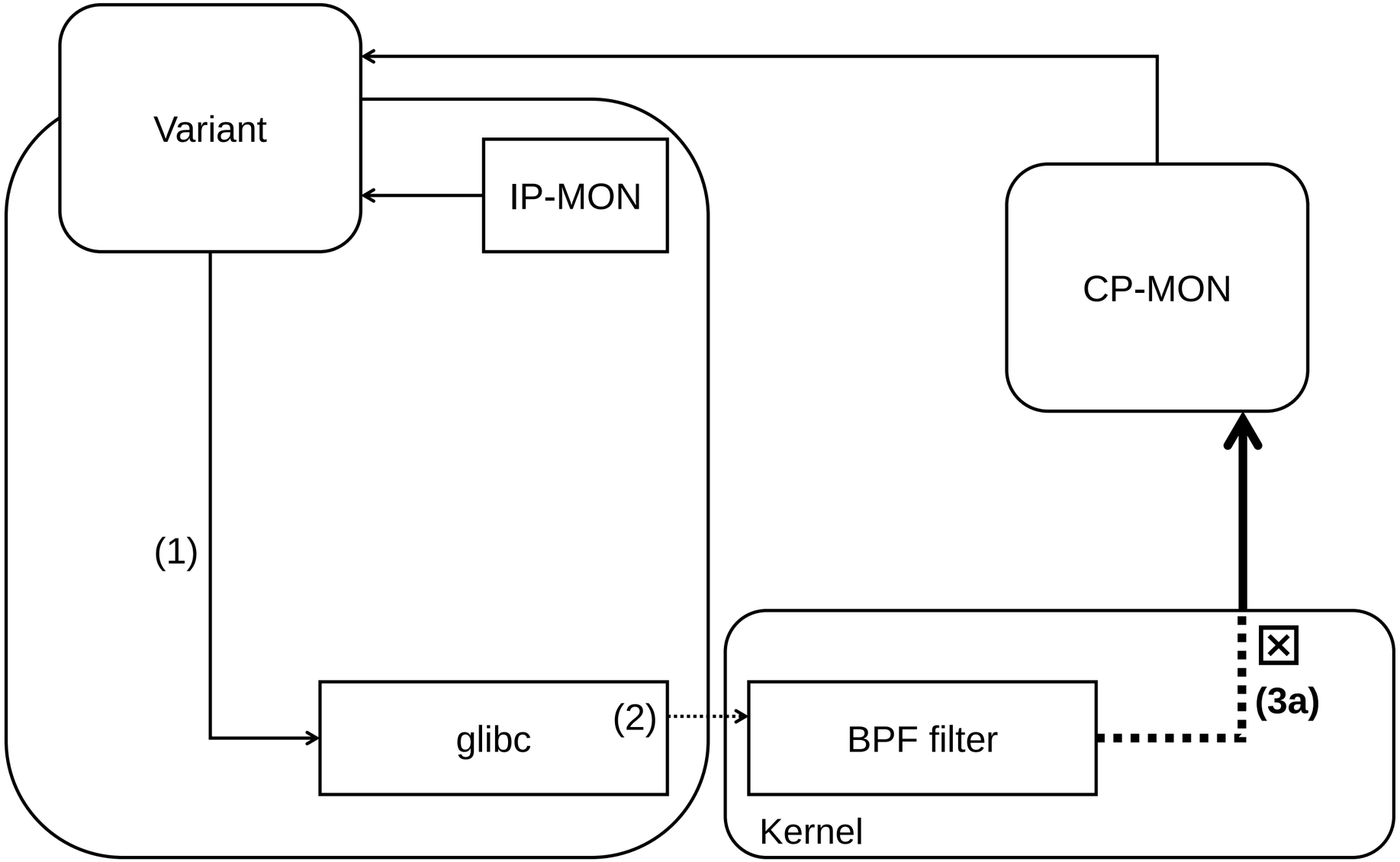

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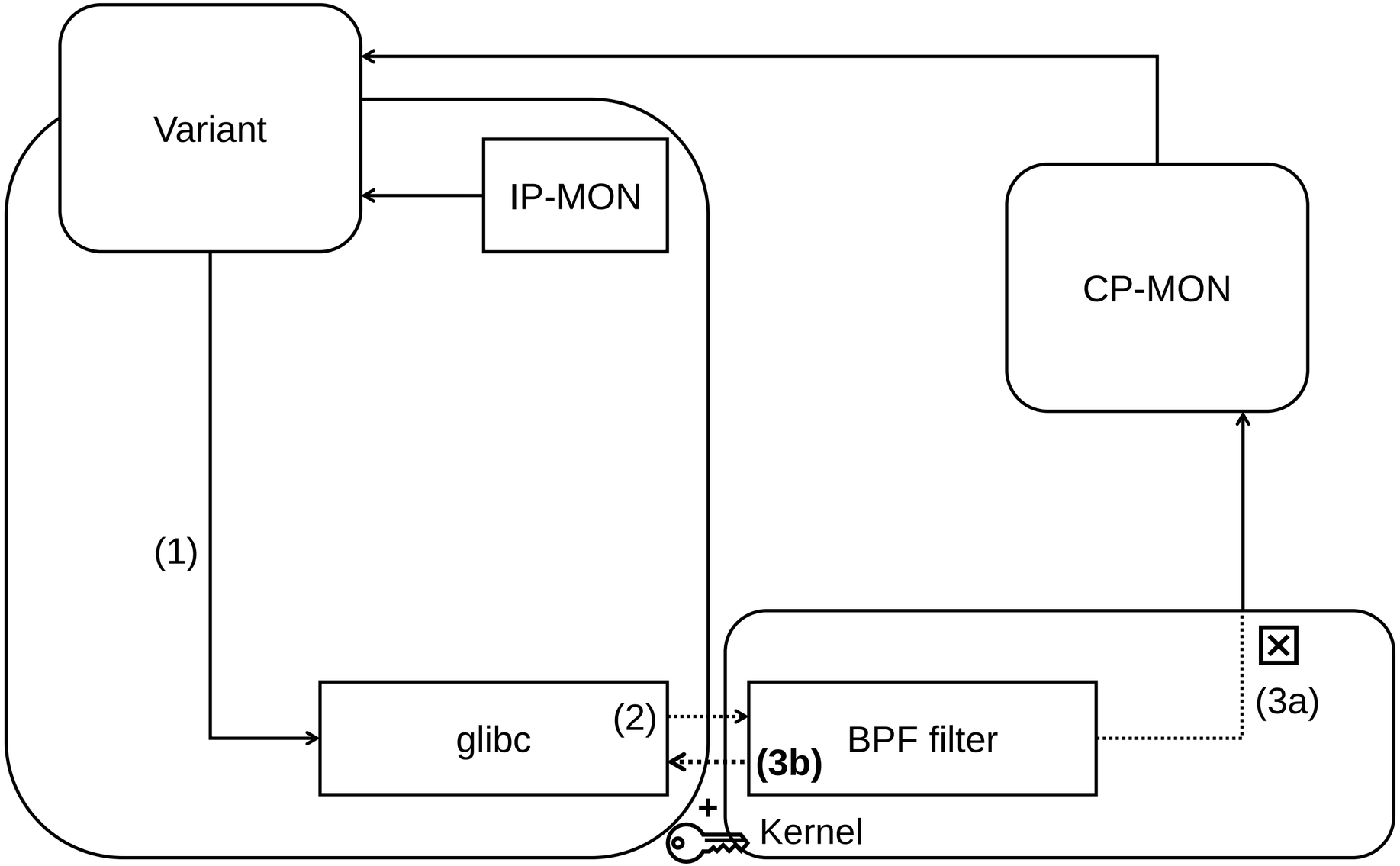

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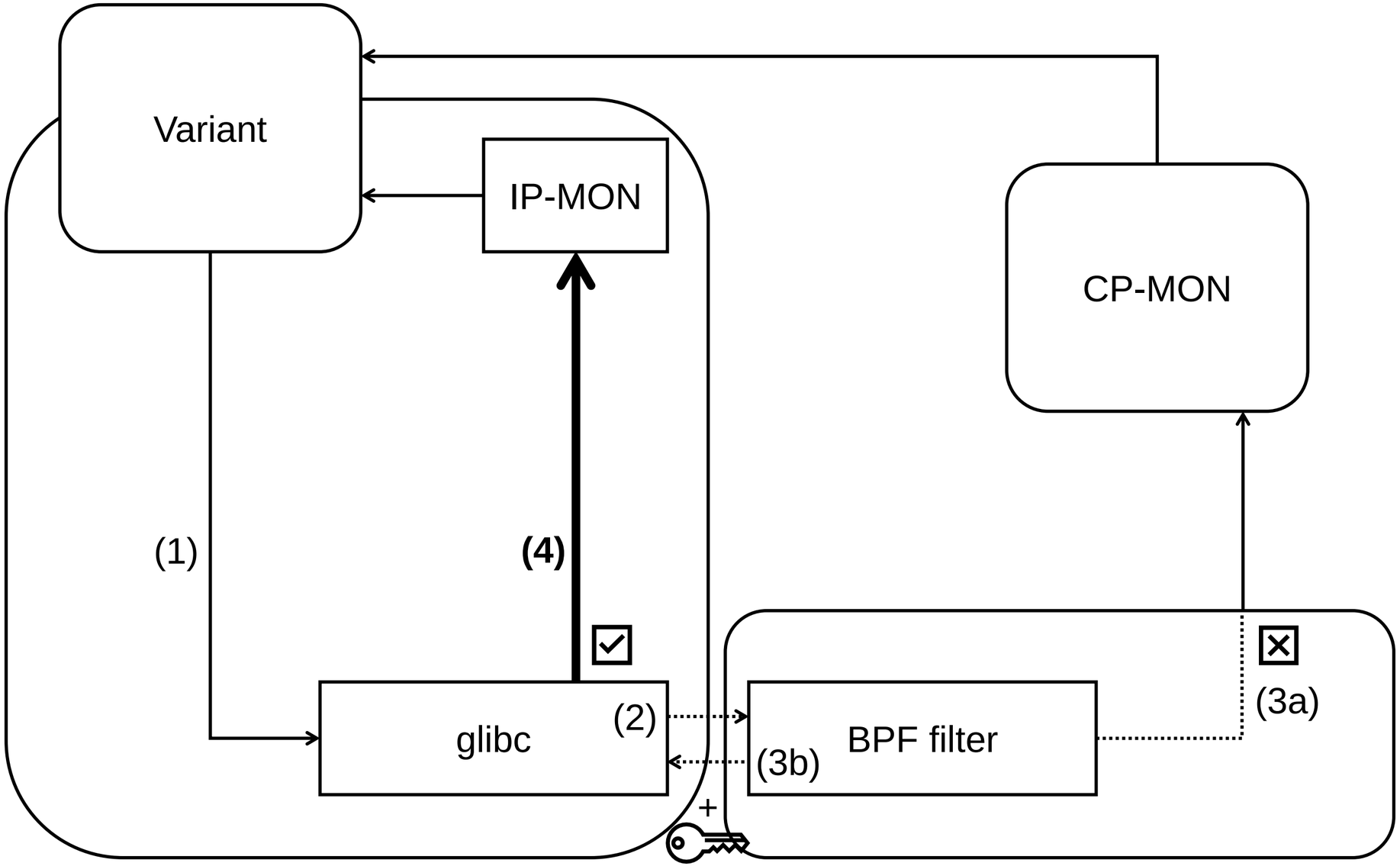

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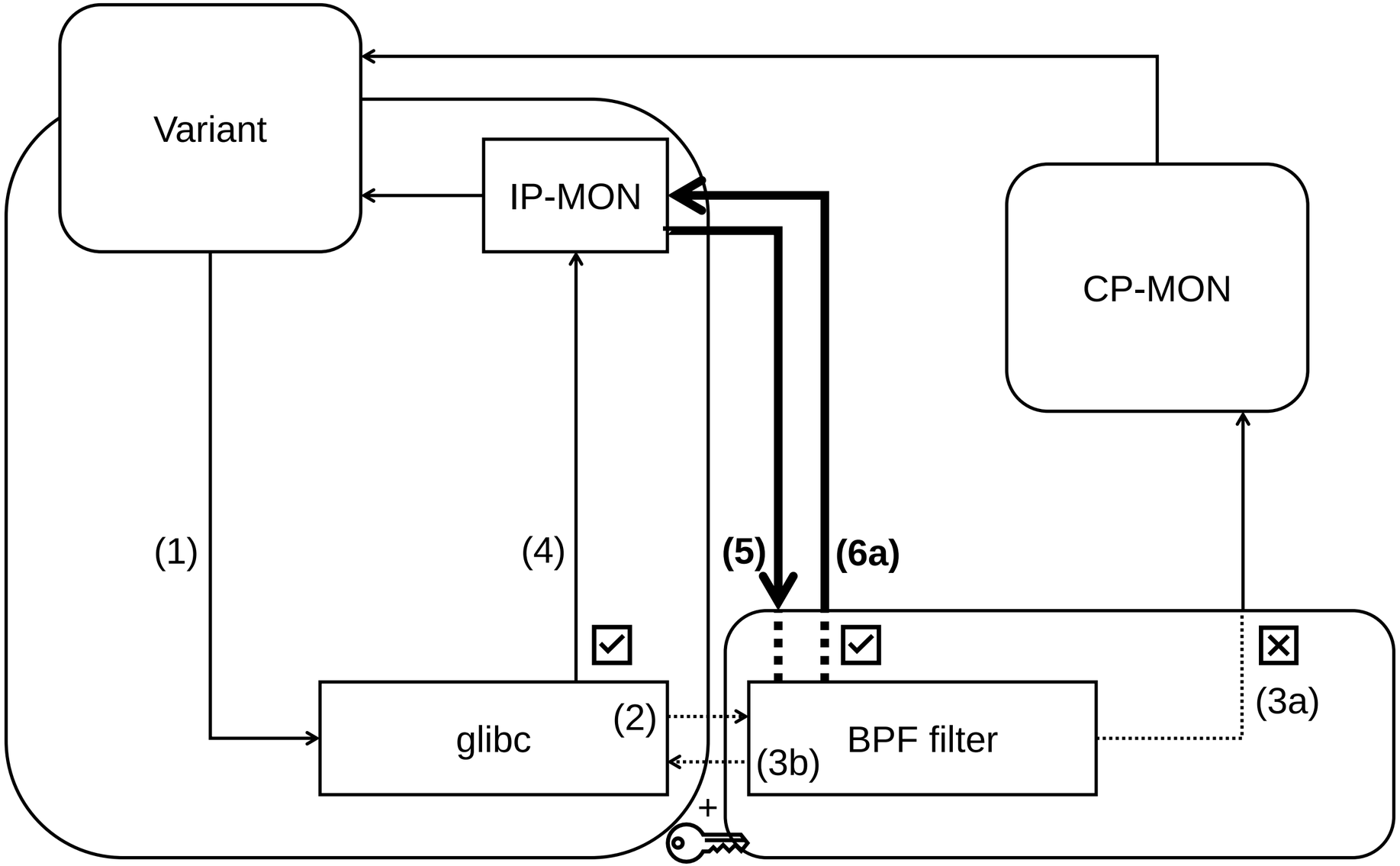

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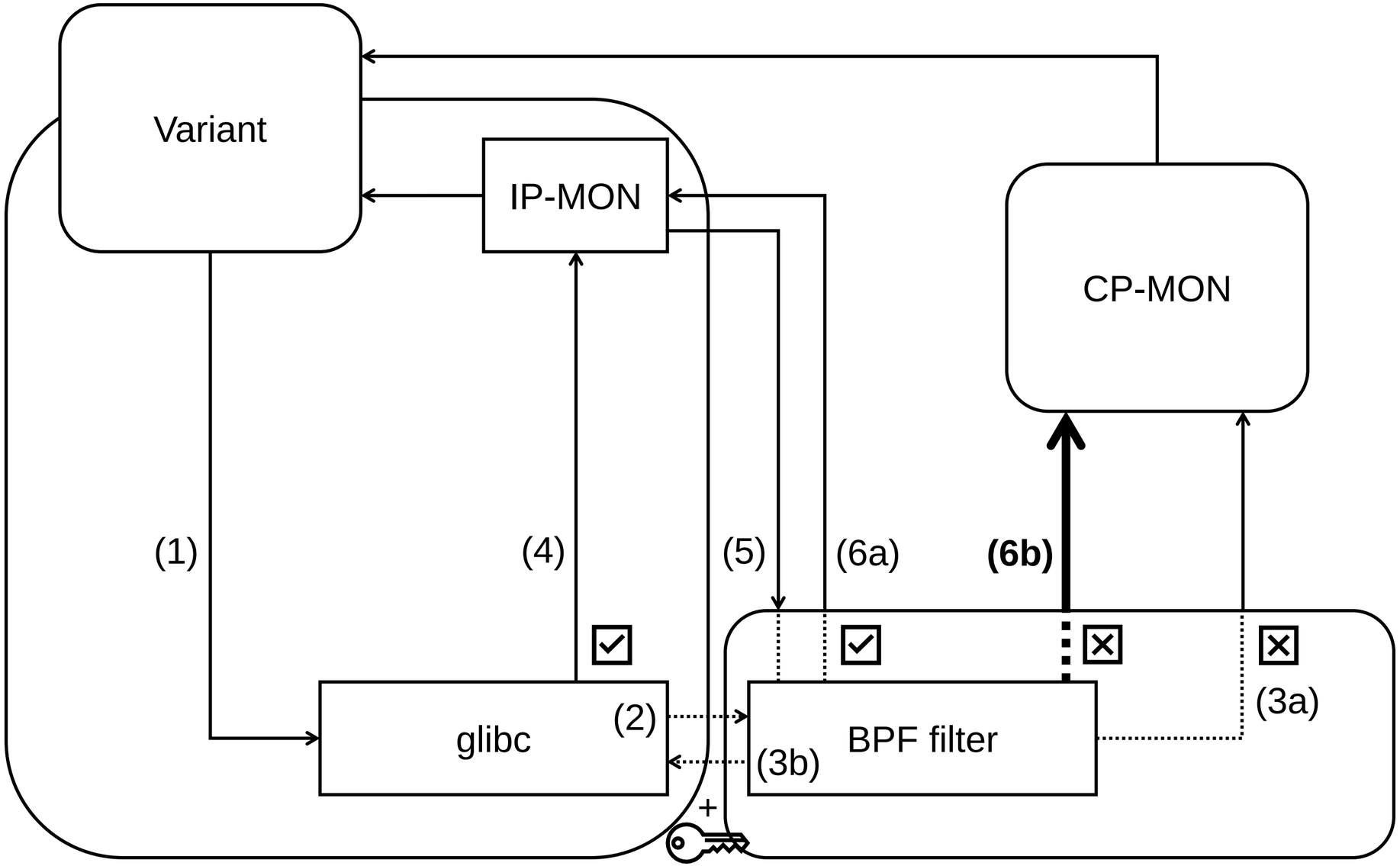

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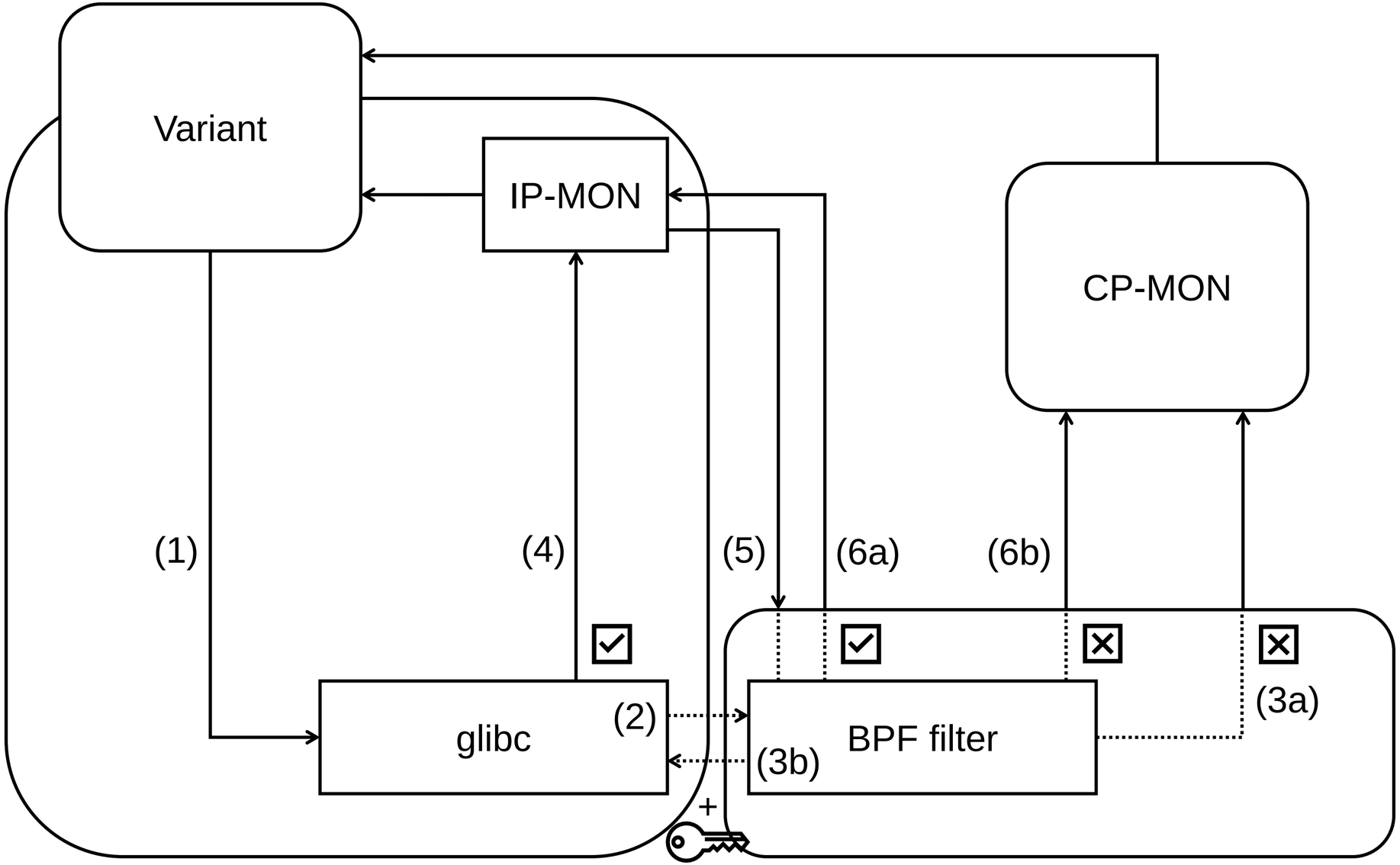
NIEUW DESIGN



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VEILIGHEIDSASPECT

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GROOTTE VAN SECRET

- 12 bit per passage in seccomp-BPF filter
- Meerdere keren passeren in filter
  - 4 keer voor 48 bit

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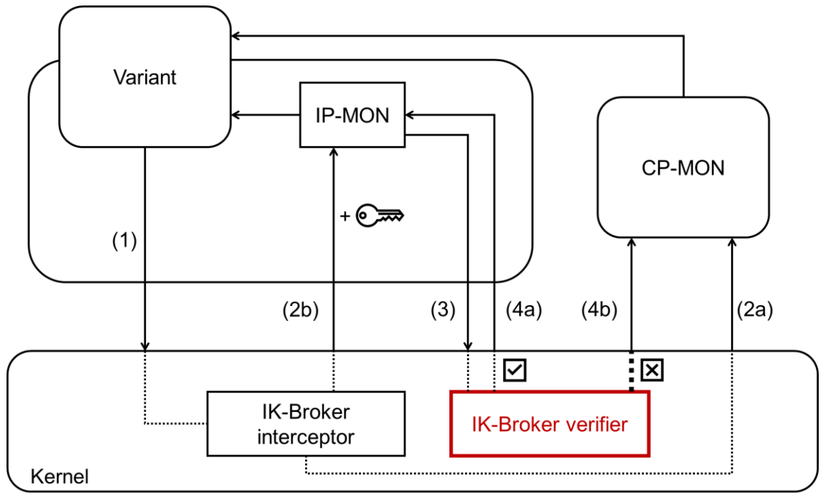
VEILIGHEIDSASPECT EERSTE SECRET

Originele IP-MON

- Kernel geeft unieke secret per systeemaanroep van 64 bit
- Random waarde voor controle in broker verifier



IP-MON met Seccomp-BPF

- Niet meer aanwezig
- Geen unieke secret per systeemaanroep mogelijk
- seccomp-BPF filter is constant
- We kunnen controleren van waar de systeemaanroep komt, geen secret nodig

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VEILIGHEIDSASPECT TWEEDE SECRET

Originele IP-MON

- Unieke 64 bit secret per variant
- Adres van IP-MON

IP-MON met Seccomp-BPF

- Unieke secret per variant
- Adres van IP-MON
- Bij lekken van secret moet de systeemaanroep alsnog via de seccomp-BPF filter passeren voor controle

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TEKORTKOMINGEN

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TEKORTKOMINGEN

- Beperkte set ondersteunde systeemaanroepen in nieuwe versie IP-MON

TESTRESULTATEN

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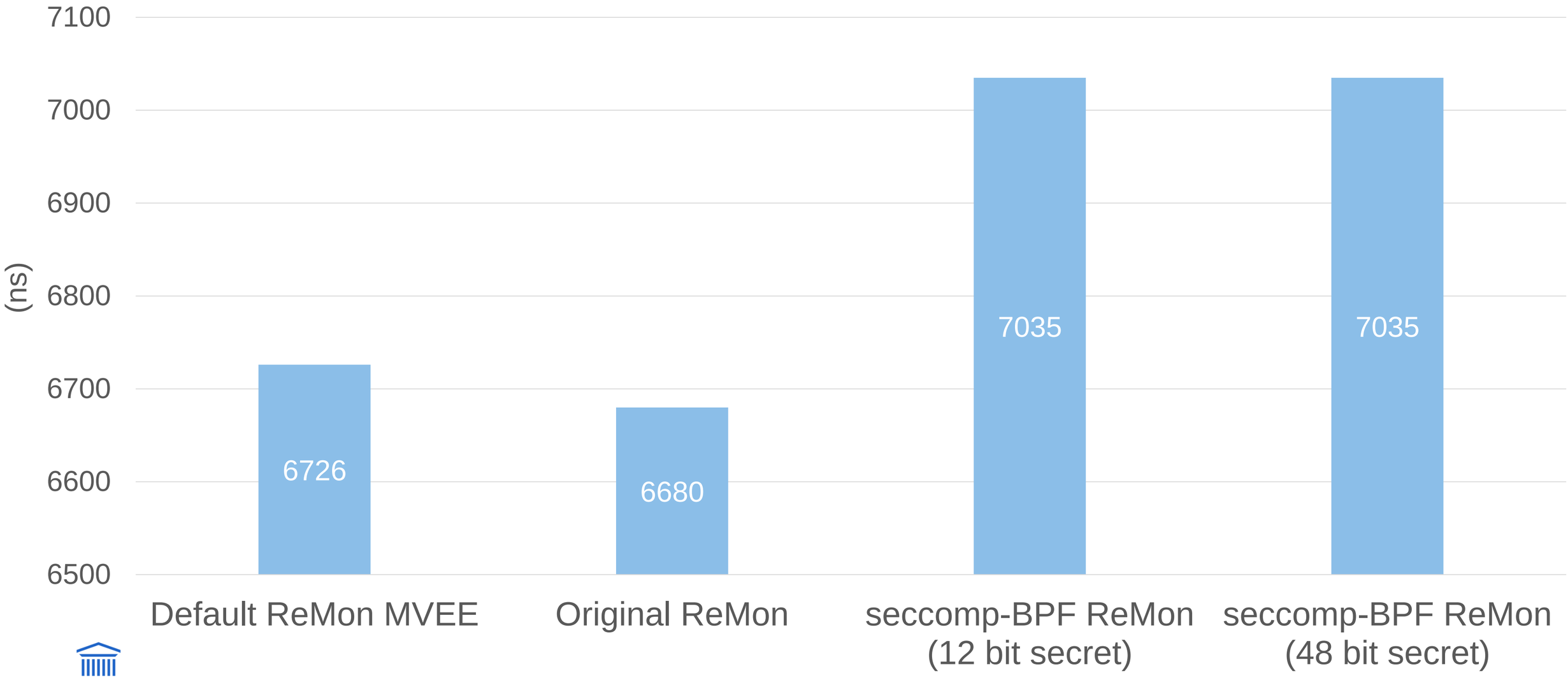
MICROBENCHMARK

- 5 000 000 getpid()-oproepen die elk een syscall aanroepen
- Resultaat is het gemiddelde van de uitvoeringstijd van 1 getpid() over verschillende runs
- Overhead van Seccomp-BPF meten

RESULTATEN – ALLES NAAR CP-MON



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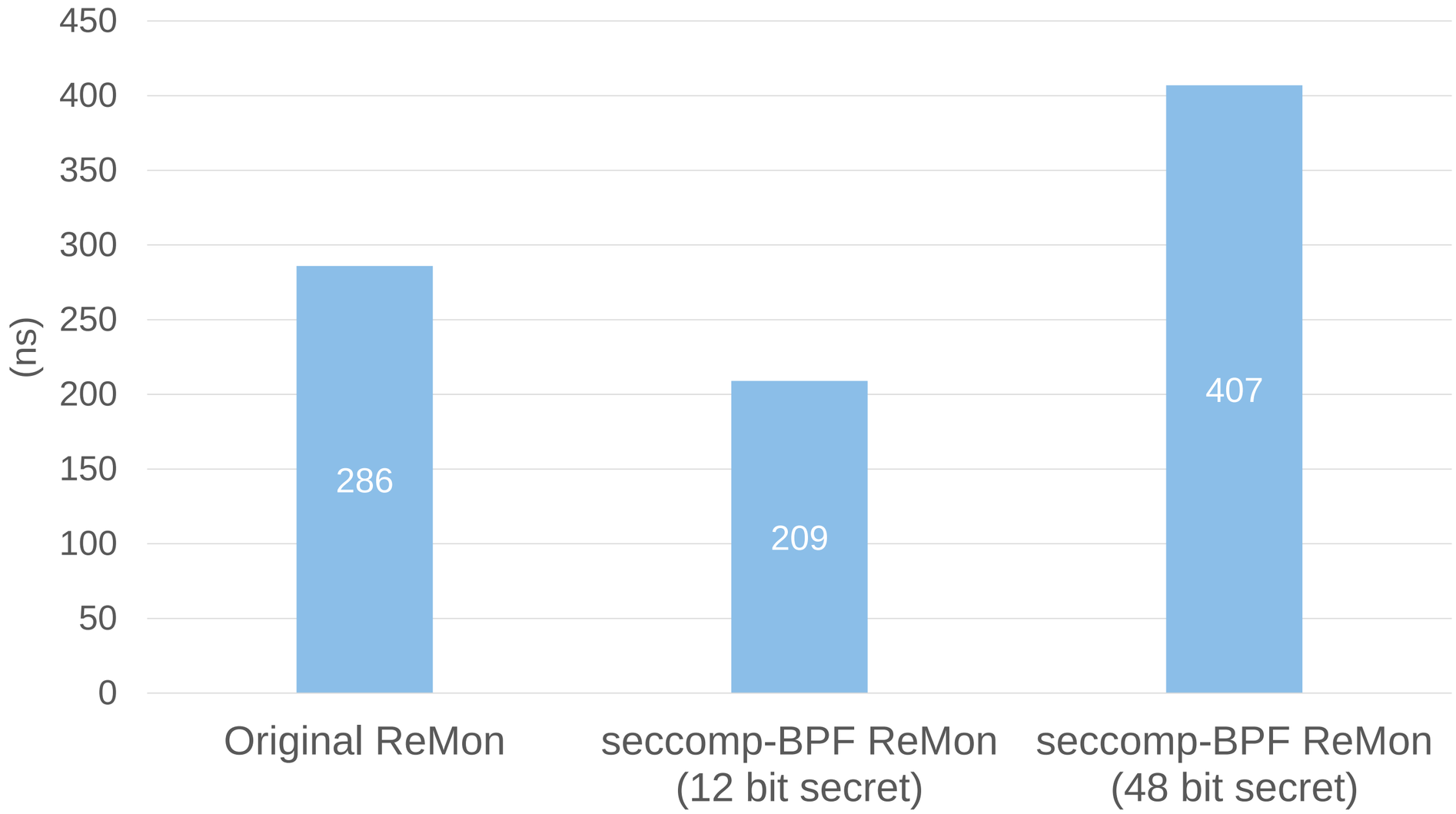
RESULTATEN – GETPID NAAR IP-MON



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NGINX BENCHMARK

- Realistische applicatie
- Latency en network throughput meten
- Twee computers om realistische resultaten te verkrijgen
  - Server die nginx uitvoert onder ReMon
  - Client die aanvragen stuurt naar de server

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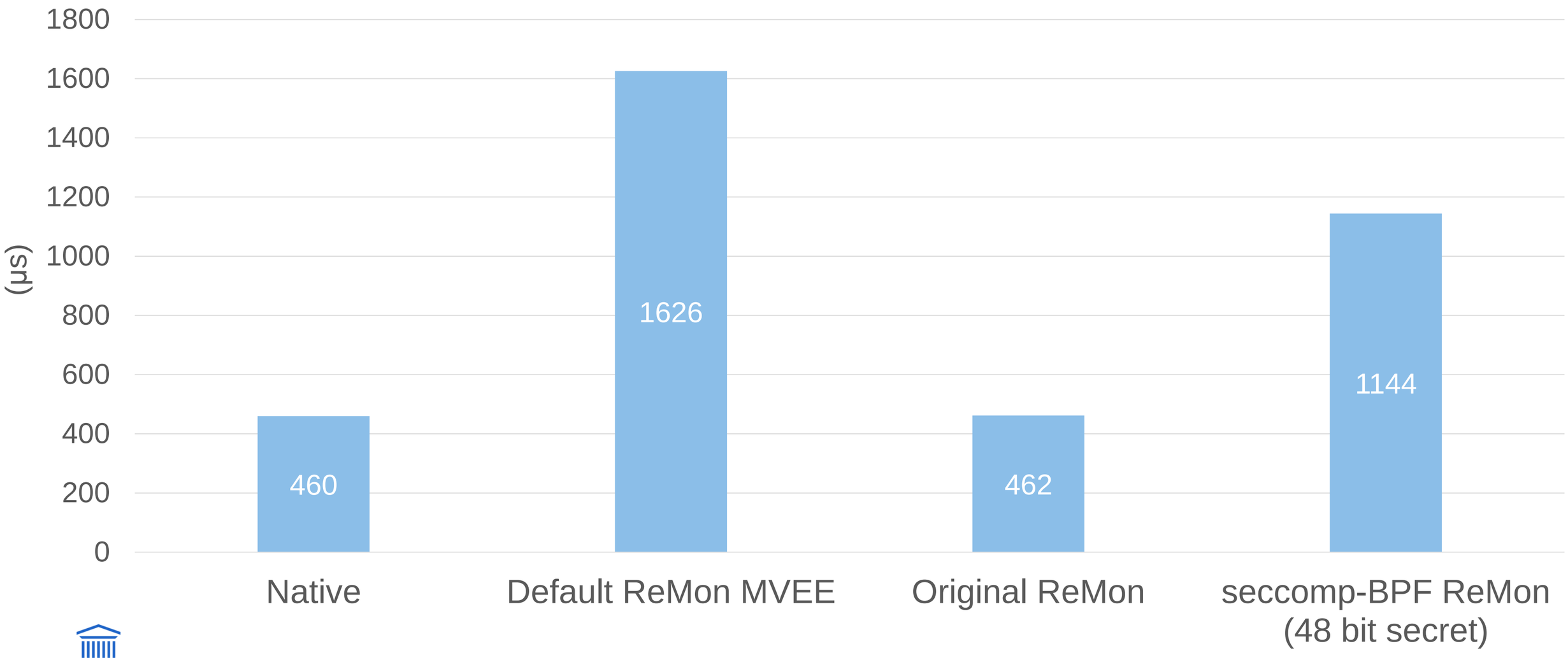
RESULTATEN – LATENCY



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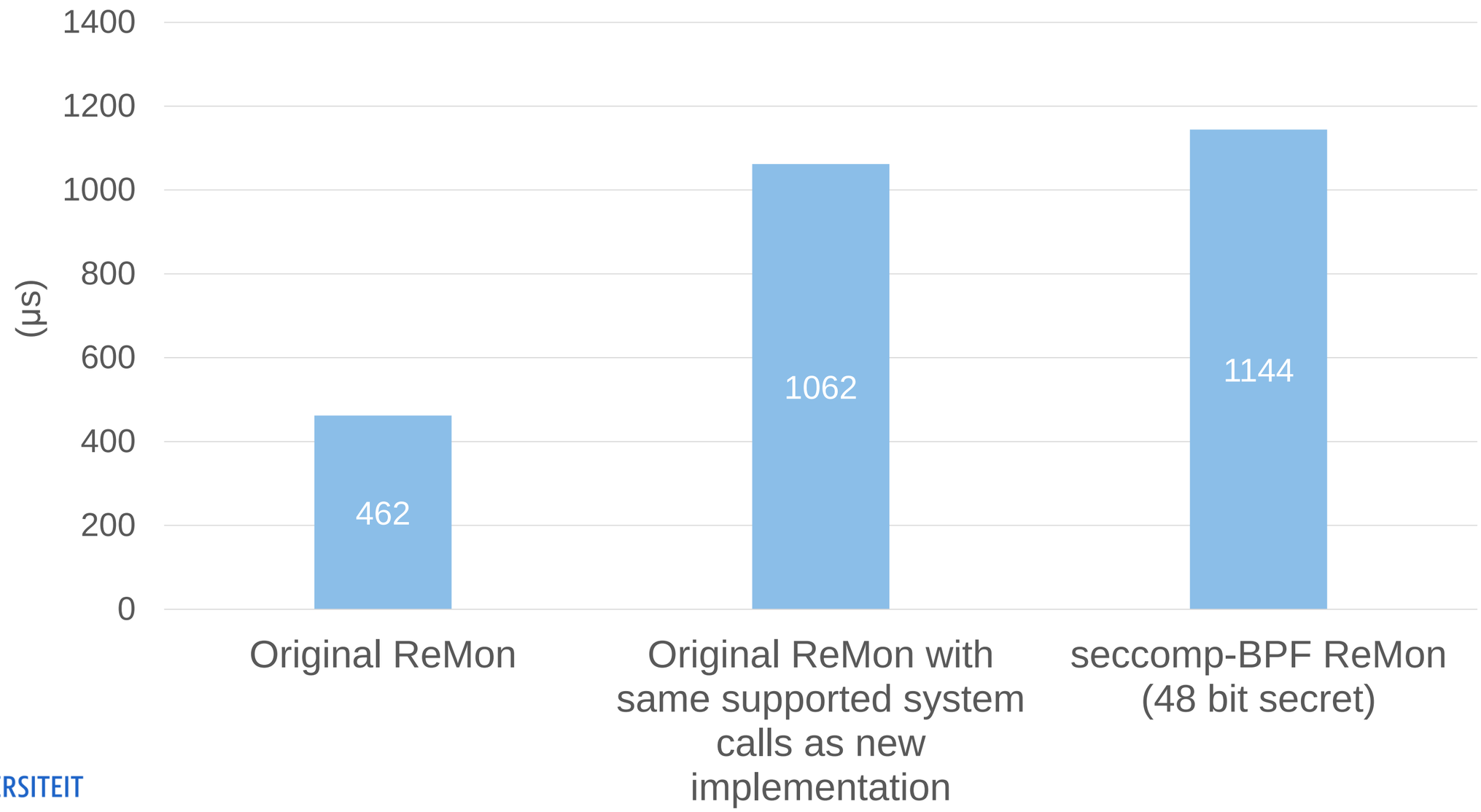
RESULTATEN – LATENCY GELIJKE SET



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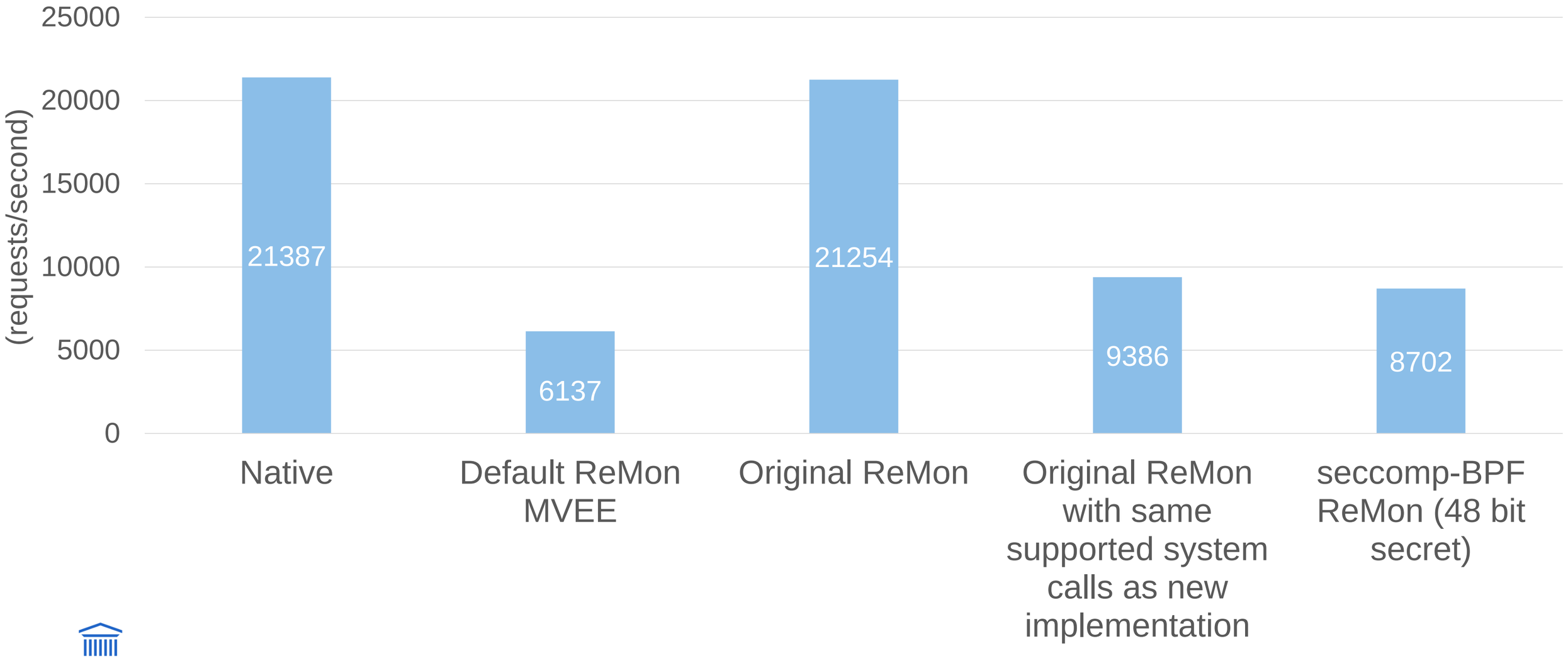
RESULTATEN – THROUGHPUT



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CONCLUSIE

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CONCLUSIE

- Kernelpatch kan vervangen worden d.m.v. seccomp-BPF
- Snelheidswinst t.o.v. traditionele MVEE
- Snelheid in zelfde grootteorde als originele ReMon
- Verder onderzoek naar ondersteunde systeemaanroepen in nieuwe versie van IP-MON

VRAGEN

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