Protecting *e*-Government Against Attacks

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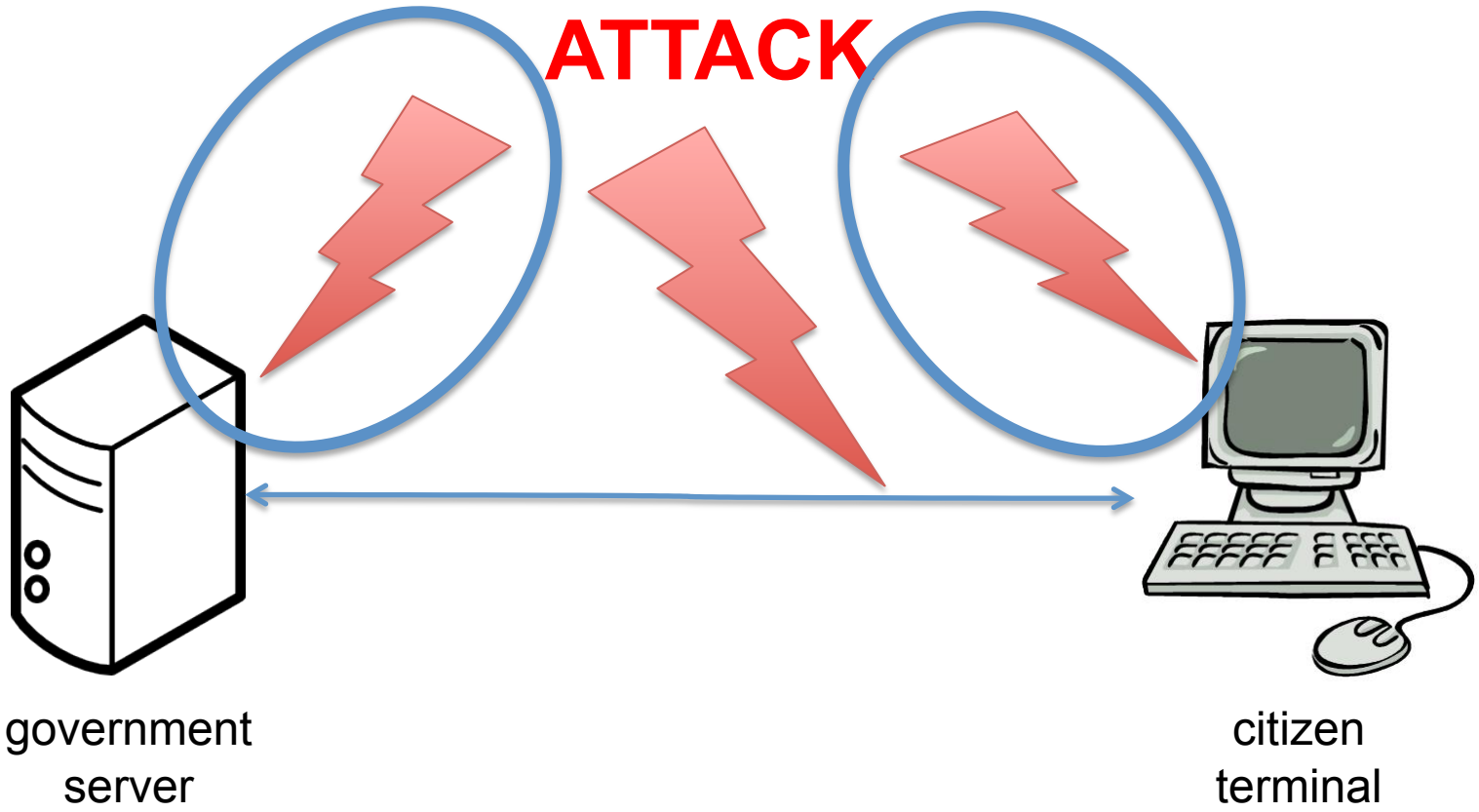
Australian Government
Department of Broadband, Communications and the Digital Economy
Australian Research Council

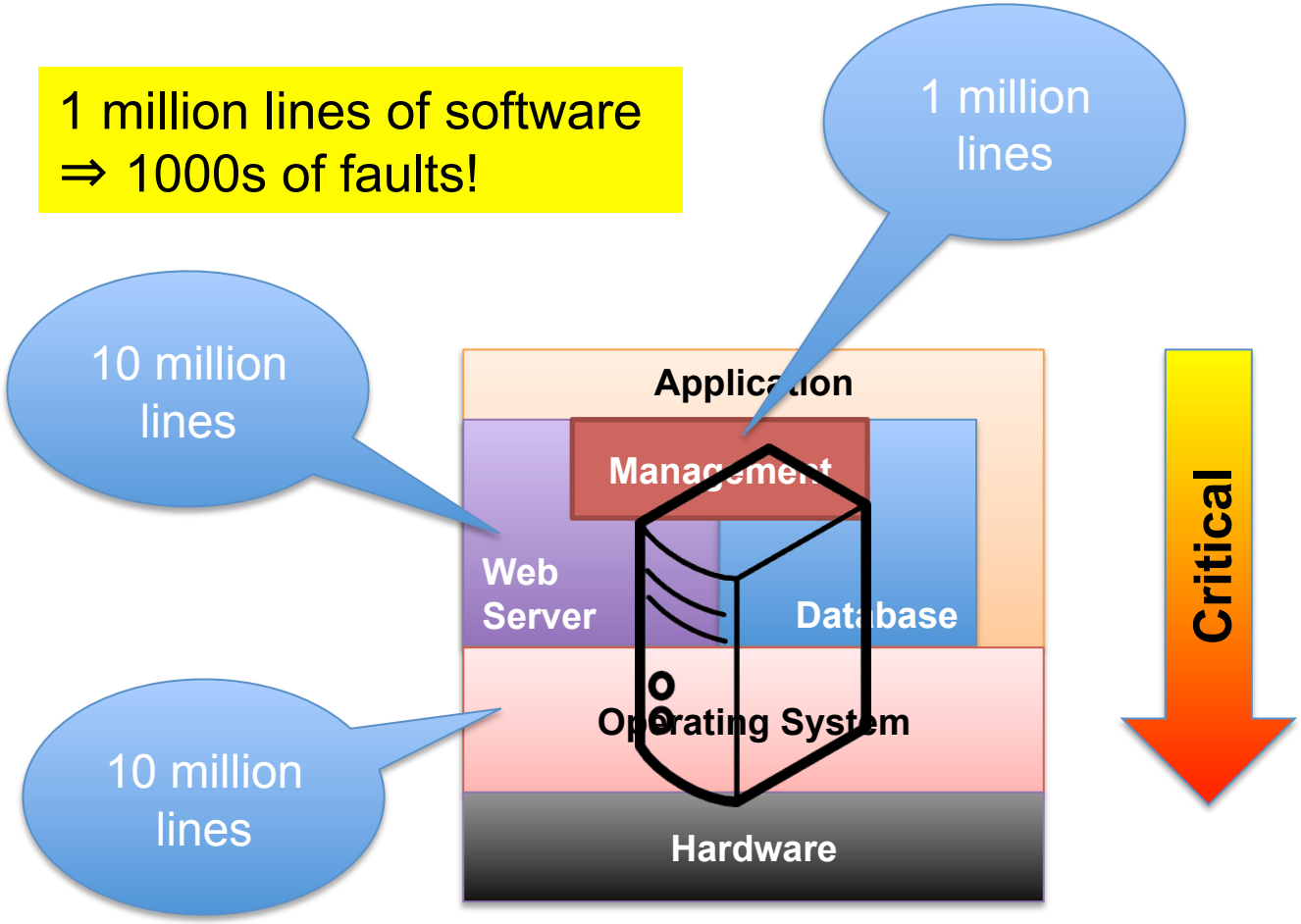
NICTA Funding and Supporting Members and Partners

e-Government Threats



Software Complexity and Attack Surface

1 million lines of software
⇒ 1000s of faults!

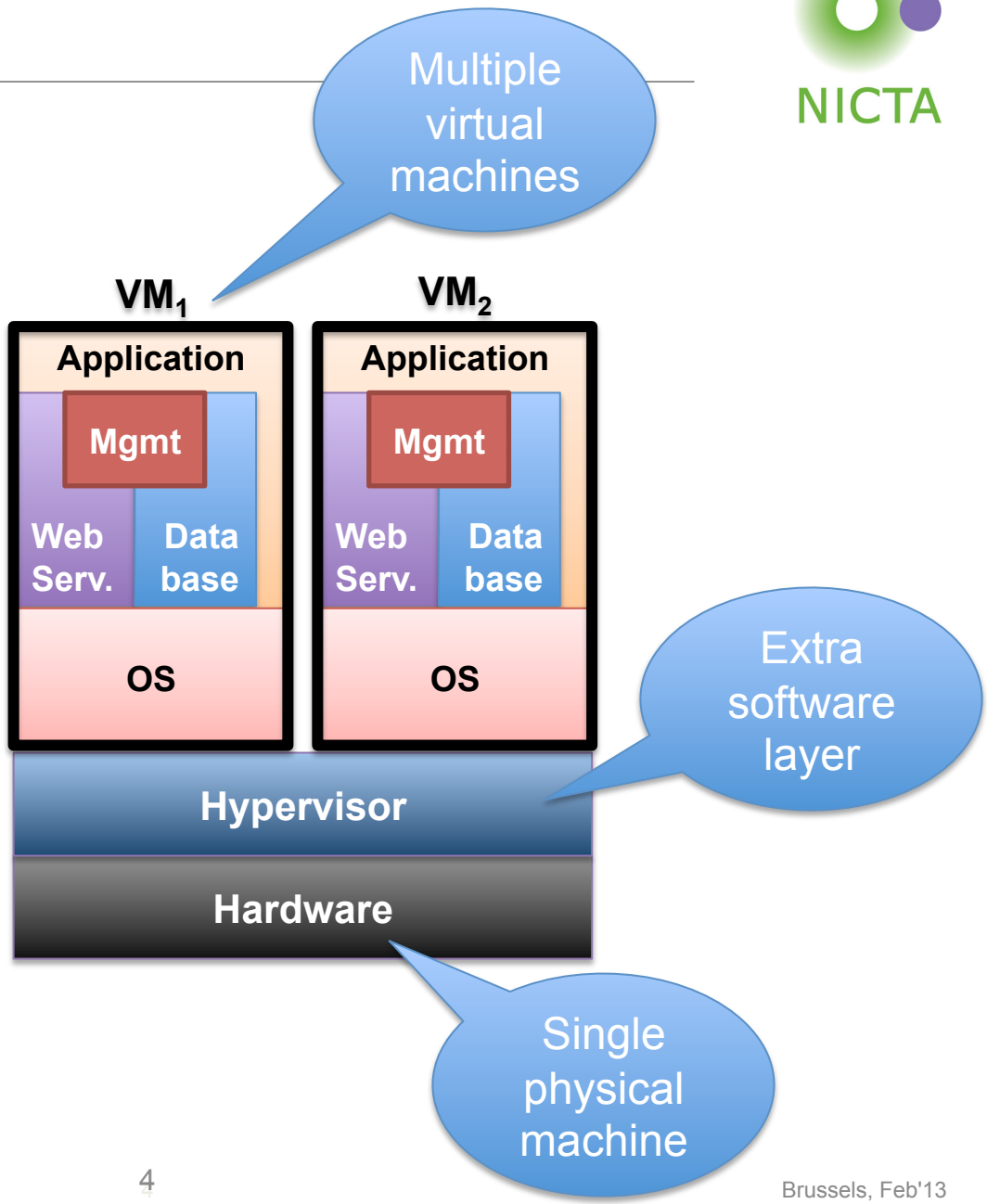


In security-critical software,
>10% of faults become vulnerabilities

Virtualization

Advantages:
- server consolidation
- reduced management cost
- improved utilisation
- reduced energy use

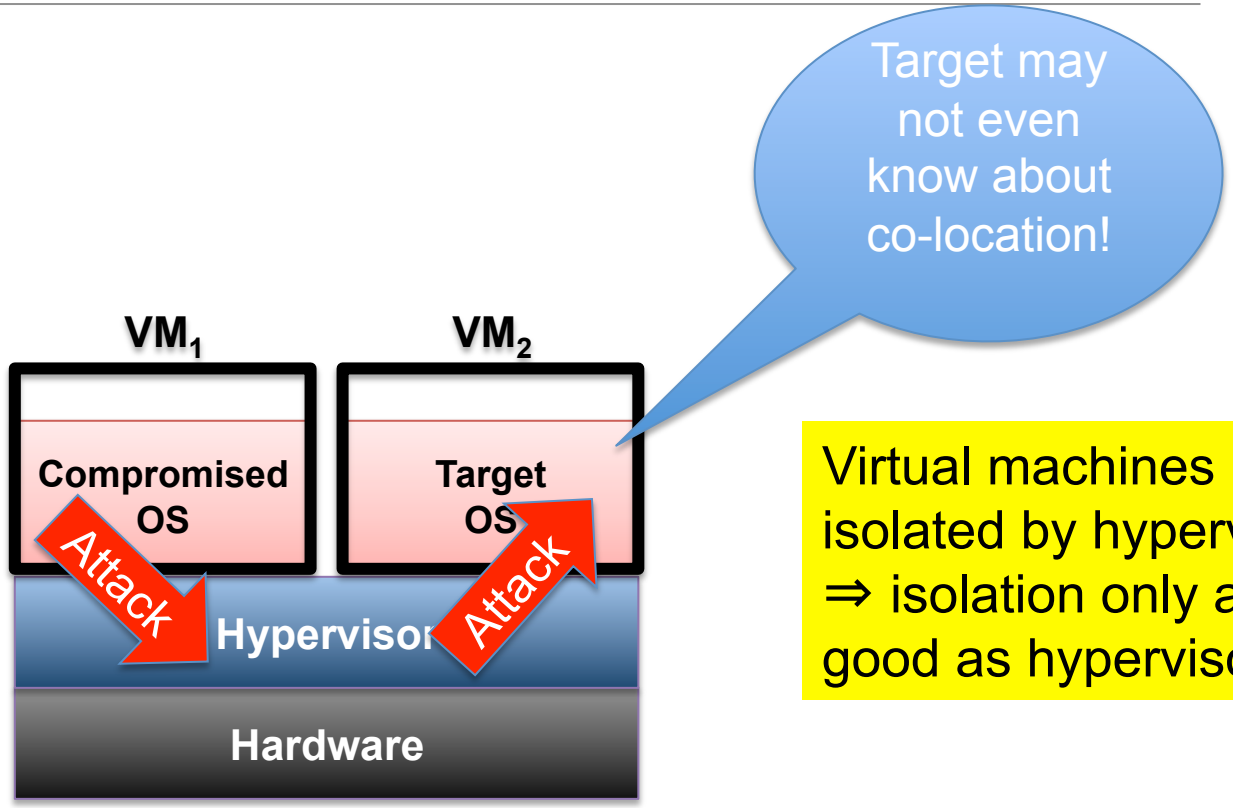
Disadvantages:
- increased attack surface



Attack Surface

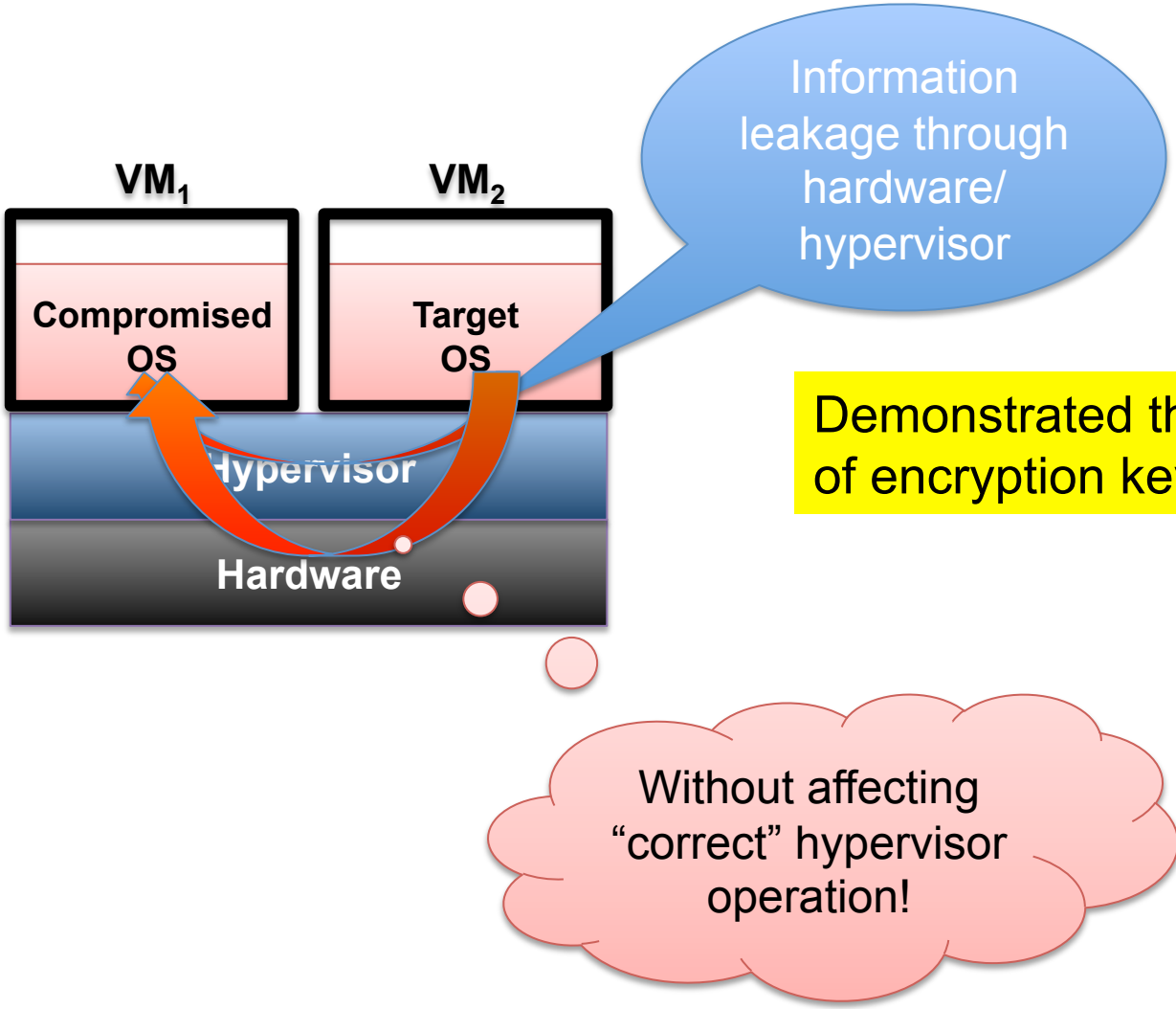
Component	Total size	Critical part	Vulnerabilities
Management	1 MLOC	1 MLOC	100s
Web server, database, application	10 MLOC	1 MLOC	100s
Operating System	10 MLOC	10 MLOC	1000s
Hypervisor	1 MLOC	1 MLOC	100s

Virtualization Attacks: Server-to-Server

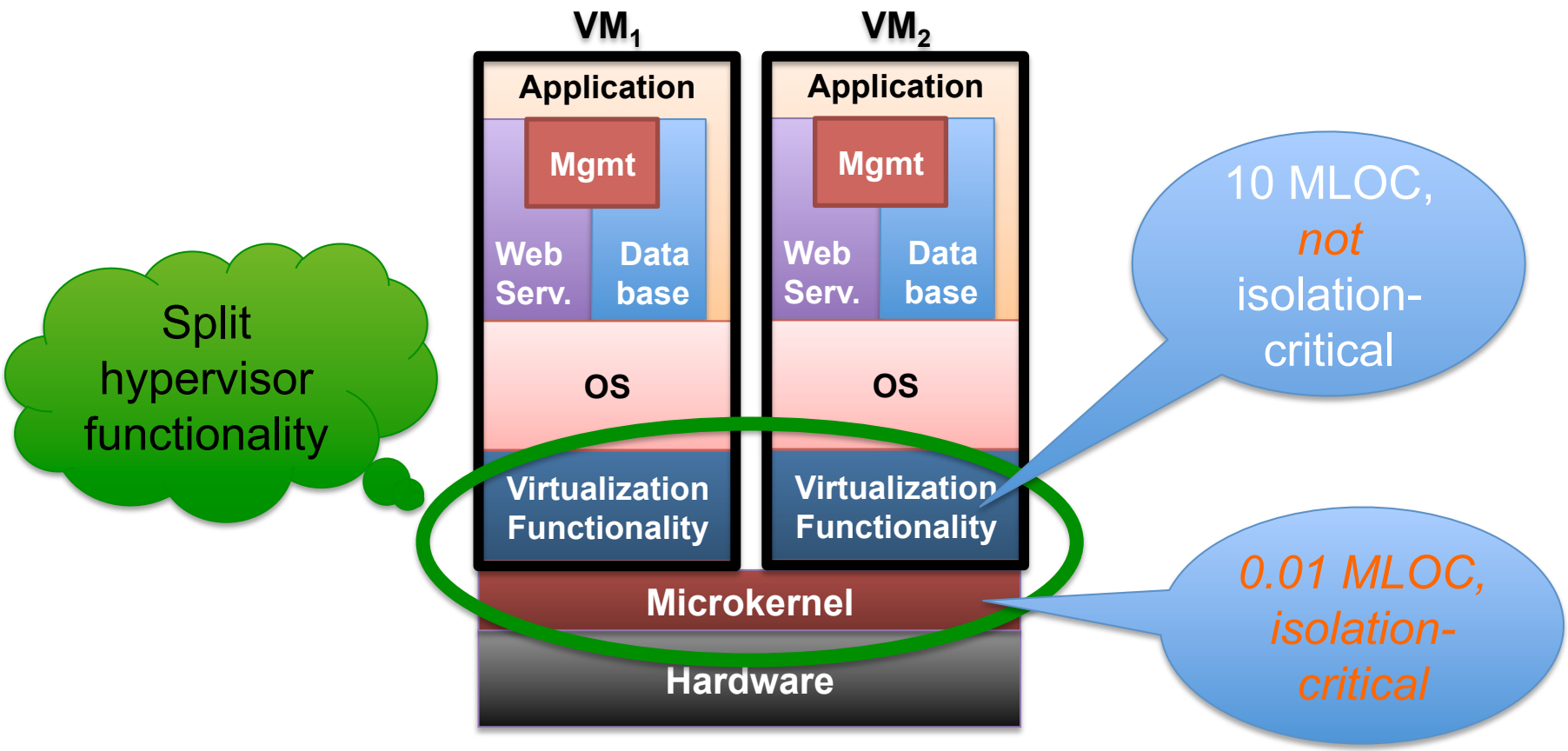


Virtual machines isolated by hypervisor ⇒ isolation only as good as hypervisor

Virtualization Attacks: Side Channels



Decrease Attack Surface: Microkernels



Microkernels

Track record:

- OKL4 microkernel deployed on > 1.5 billion mobile devices
- Developed by NICTA, marketed by Open Kernel Labs

Unparalleled security potential:

- 10,000 lines ⇒ minimal vulnerabilities
- Small enough to *prove* absence of faults

NICTA's seL4 microkernel:

First and only operating-system with *proof* that operation is always according to specification

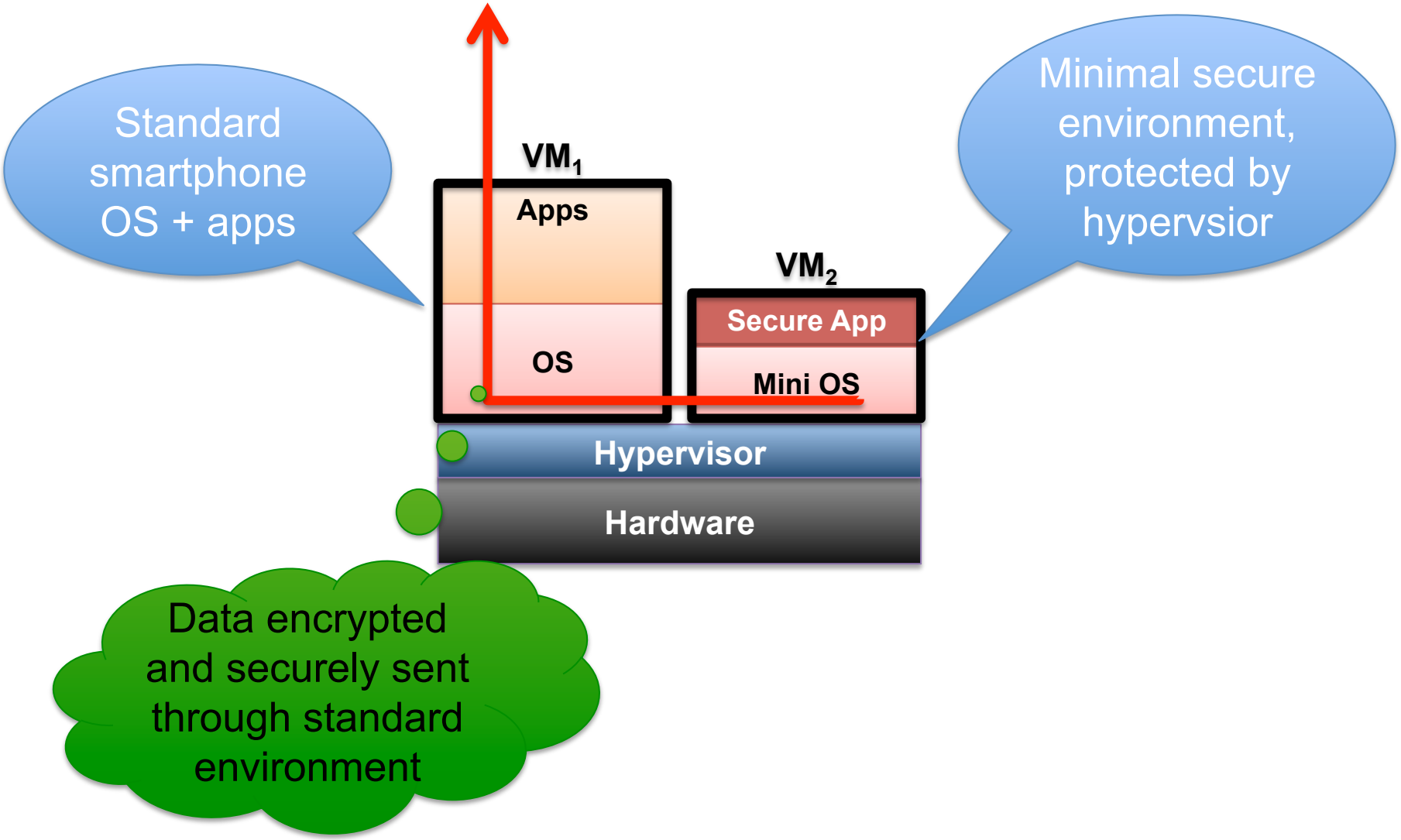
… and as fast as *any* microkernel!

Terminals

Bigger challenge than servers

- Live in uncontrolled environments
- Run large amounts of untrusted software
- Large percentage infected by malware
- Cannot be trusted to keep secrets!

Protecting Terminals – With Virtualization!



Recommendations

NICTA

1. Require *provably* secure virtualization technology (after transition period)
   - provide incentive to industry for delivering secure products

2. Fund development of open-source *provably* secure virtualization technology (equivalent to seL4)
   - avoid private monopoly for critical infrastructure

3. Require certified secure communication functionality on terminals accessing e-government services (after transition period)
   - provide incentive to industry for delivering secure products