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seL4 Present and Future

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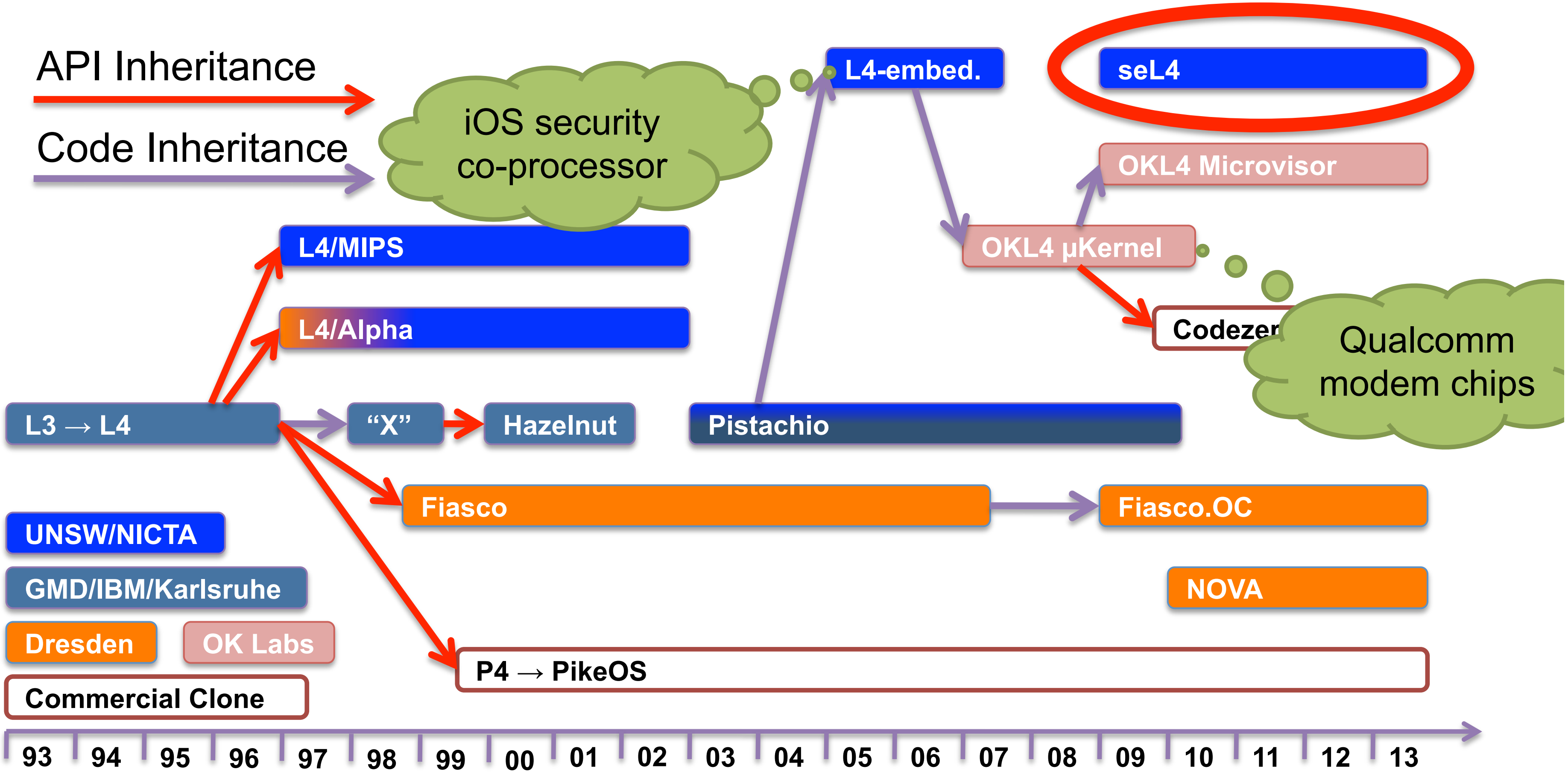
NICTA and UNSW Australia

Australian Government

What is seL4?

seL4: The latest (and most advanced) member of the L4 microkernel family – 20 years of history and experience



What is seL4?

seL4: The world's most (only?) secure OS kernel – provably!

GPLed 2014-07-29

seL4: Mathematical *Proof* of Security

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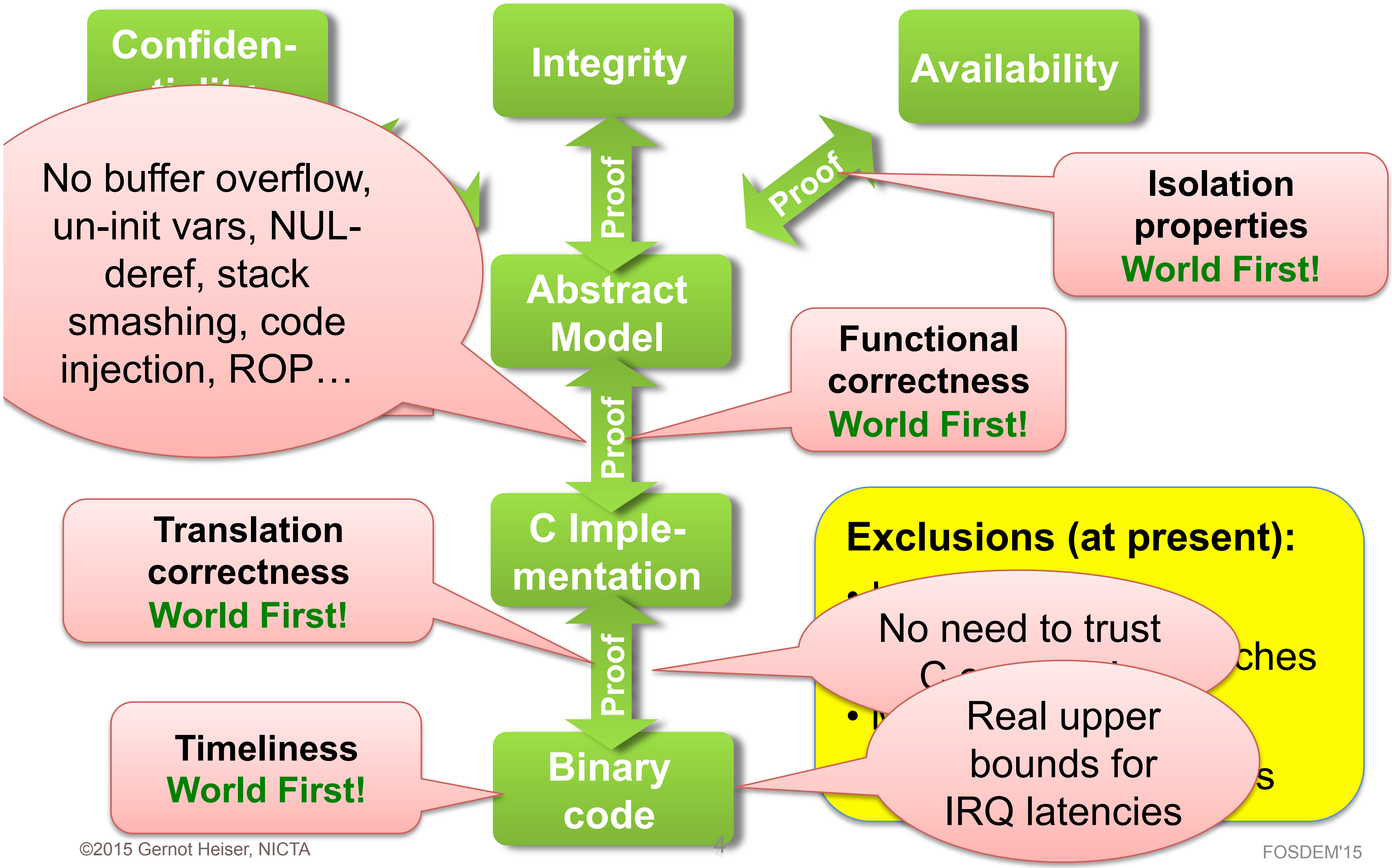
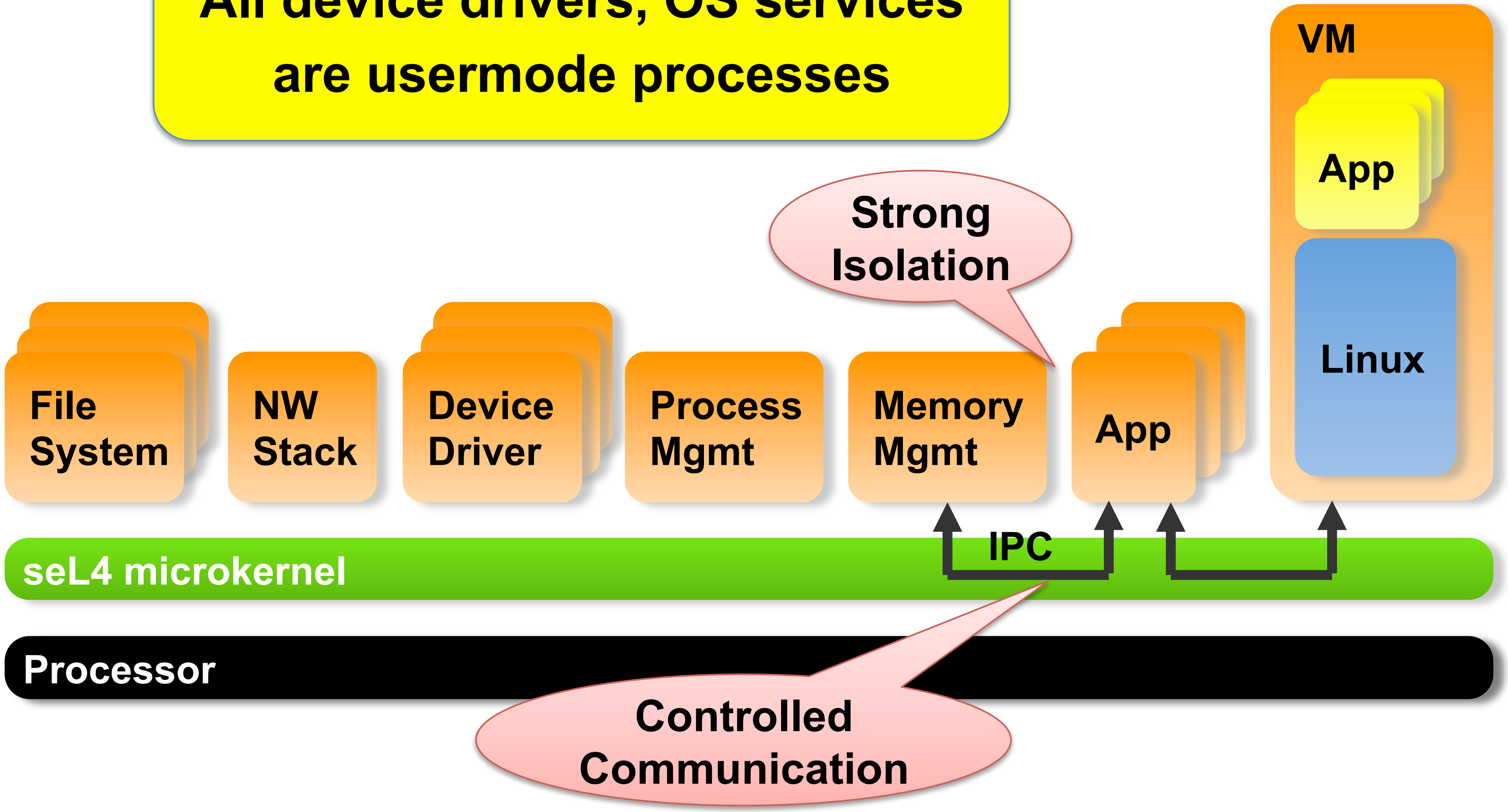


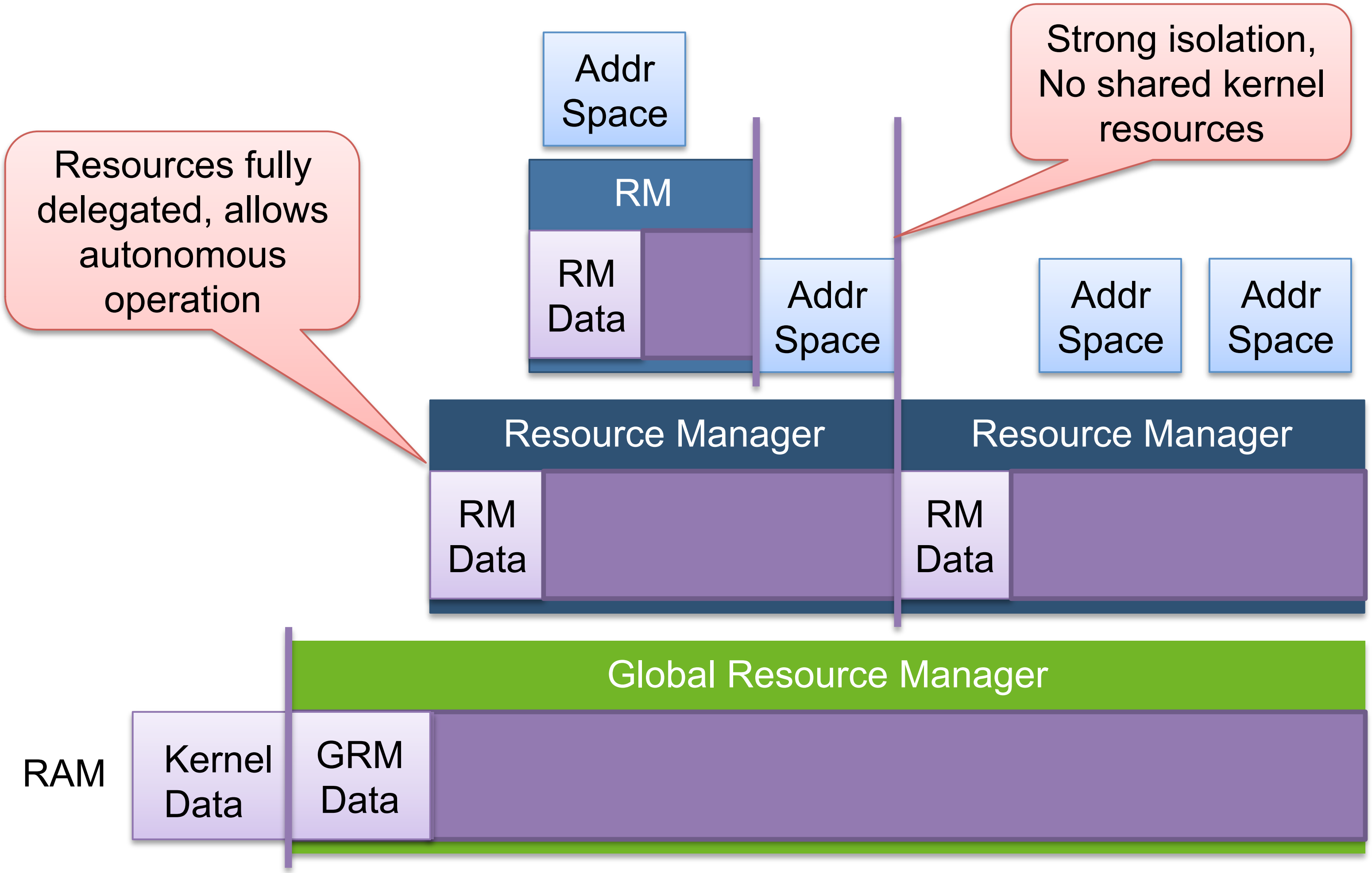
What seL4 is NOT: An Operating System

All device drivers, OS services are usermode processes



What's Different to Other L4 Microkernels?

Design for isolation: No memory allocation in the kernel



High-Assurance System on seL4

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DARPA HACMS Program:

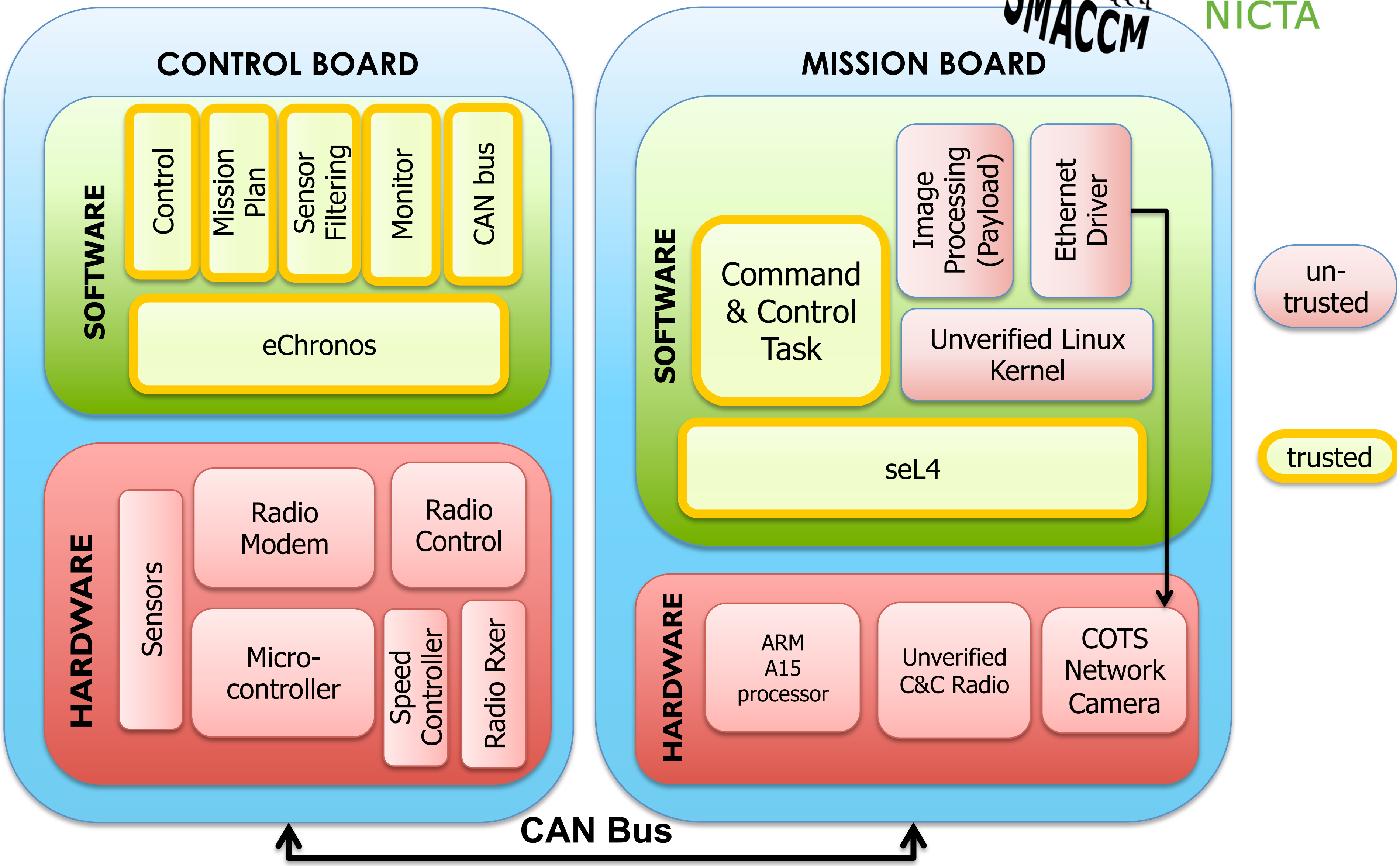
- Provable vehicle safety
- “Red Team” must not be able to divert vehicle

SMACCMcopter
Research Vehicle

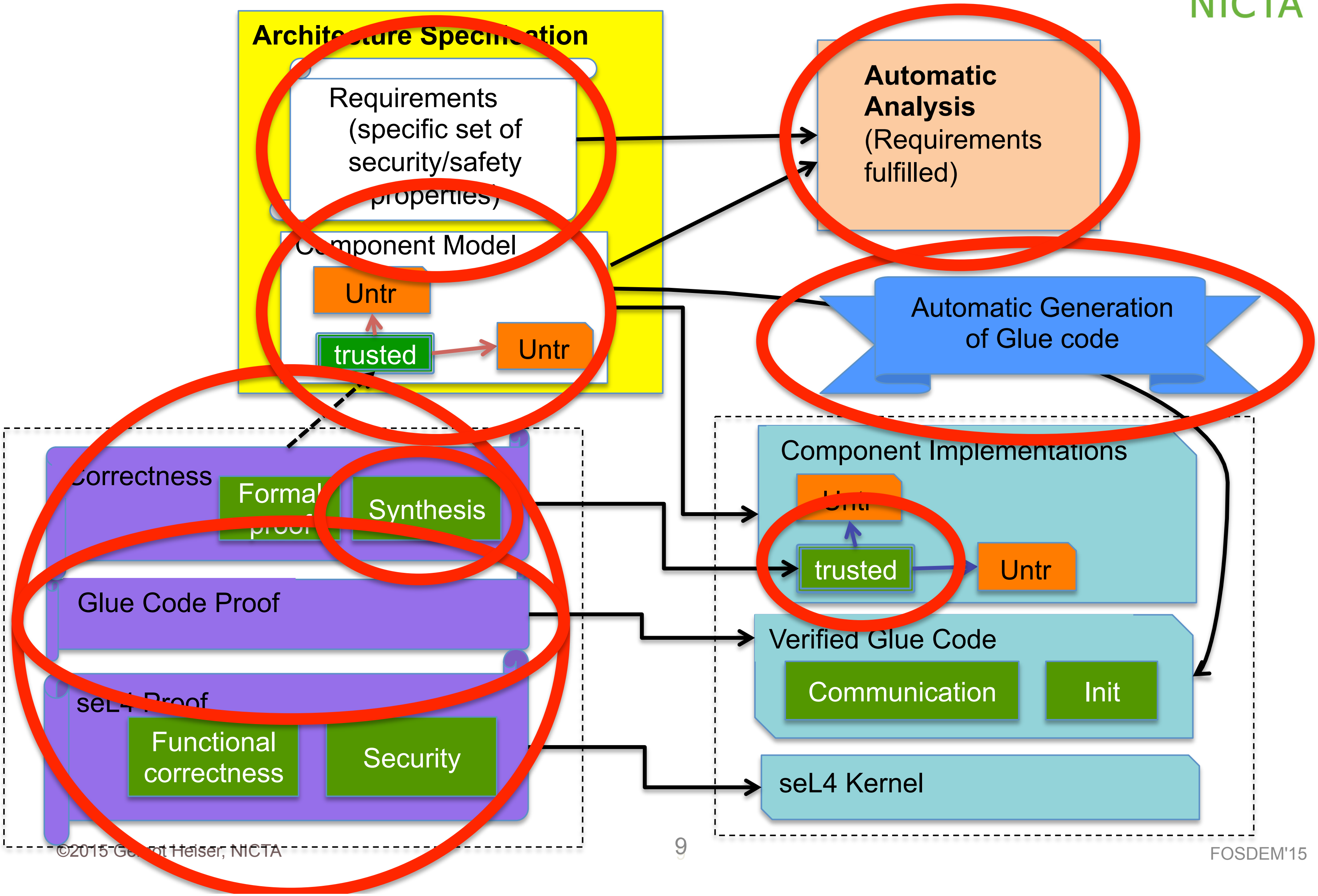
Boeing Unmanned
Little Bird (AH-6)
Deployment Vehicle

NICTA Rockwell Collins BOEING galois University of Minnesota

SMACCM Research Vehicle Architecture



Architecting System-Level Security/Safety



Current NICTA Work on seL4

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- High-performance multicore support
  - Release ETA: few months (ARM, x86)
- Full support for virtualisation extensions
  - Release ETA: few months (ARM, x86)
- 64-bit support
  - Release ETA: few month (x86), ??? (ARM64)

- Mechanisms for eliminating timing channels
  - ETA: 2015 (ARM and x86)

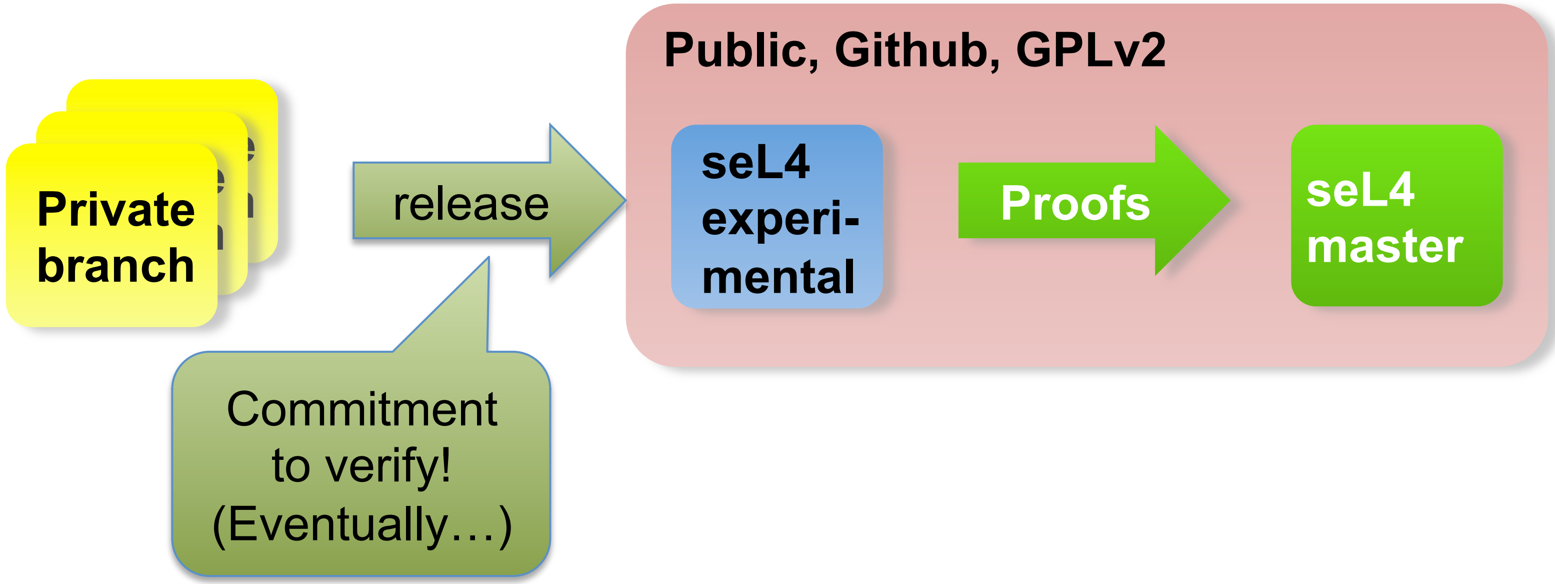
- Temporal isolation and mixed-criticality scheduling
  - ETA: 2015 (ARM and x86)

- Hardware failure resilience (DMR/TMR on multicore)
  - ETA: 2015 (ARM and x86)

What Else Is Cooking?

- Aim: Cost reduction by automation and abstraction
  - Present seL4 cost: $400/SLOC, high-assurance, high-performance
  - Other “high” assurance: $1,000/SLOC, no proof, poor performance
  - Low assurance (Pistachio): $200/SLOC, no proof, high performance
- Device driver synthesis
  - Synthesise driver code from hardware and OS interface specs
  - works already for simple devices
- Code and proof co-generation
  - High-level spec in DSL describes logic, generate C code and proofs
  - File systems as case study
- Type- and memory-safe high-level languages
  - Do verification cheaper in HLL semantics
  - Requires verified HLL run-time and compilers

seL4 Ecosystem: Kernel Development



How Can YOU Contribute?

- Libraries presently extremely rudimentary
  - POSIX! …
- Platform ports
  - Especially popular ARM boards: Tegra, RK3188, Beaglebone, …
- Drivers!!!!!!
  - Very few available ATM
- Network stacks and file systems
  - Presently have lwIP, incomplete functionality
- Tools
  - Have component system (CAmkES), glue generators
- Languages
  - Core C++ support just released, lacks std template lib
  - Haskell presently in progress (with Galois) – stay tuned
  - Python would be **awesome!**

Why NOT Use seL4?

- Very rudimentary programming environment!
  - Fair enough
  - ***You*** can help to fix this!
- I like unsafe/insecure systems!
  - Ok, go shoot yourself
- I like the thrill of danger!
  - Like getting sued for building a critical system on outdated technology
- Actually, I want to use seL4!
  - Right answer ;-)

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