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Panel: Technology Impact on Dependability

Integrating COTS Software into Dependable Systems:

Support to the Selection Process

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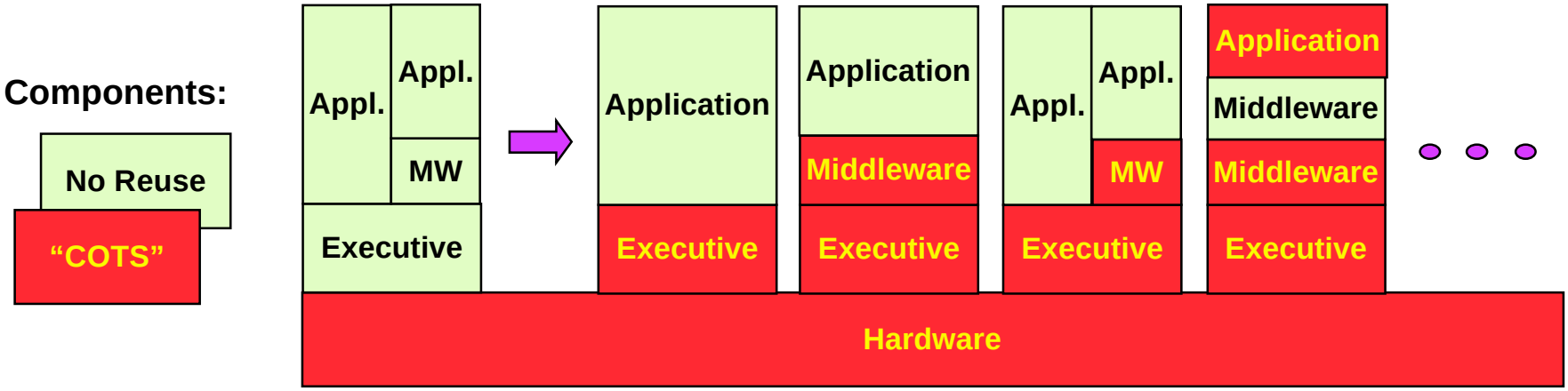
Dependability Benchmarking

Components and Systems Concerned

- **Application:** Oracle, Flight Control,...
- **Middleware:** CORBA, DCOM, OLE,...
- **Operating System:** Unix, Windows, Linux,...
- **Microkernel:** Chorus, LinxOS, PalmOS,...
- **Processor:** Pentium, PowerPC,...

■ Components of a computer system



■ Embedded control systems... RT microkernel-based

■ Large-scale distributed systems... middleware-based

How to Build Dependable Systems from (Undependable) COTS Components?

- Assess the behavior in presence of faults -> Selection
- Level of Confidence sufficient -> Integrate
- Level of Confidence not sufficient:
  - -> Discard!
  - -> Fault containment mechanisms & service degradation
  - -> Error recovery mechanisms & service continuity

Target Systems: Software Executives

- **Motivation**
  - Complex software components whose development requires a great deal of expertise
  - Basic services (management of memory, communication, synchronization, tasks, I/O, files, etc.) supporting application requirements
  - Applications rely heavily on their behavior, including in the presence of faults
- **What executives?**
  - Real-time microkernels: *Chorus, LynxOS, VxWorks,…*
  - Generic OSs: *Linux, Windows,…*
  - Middleware: *Corba, Dcom,…*

Targeting COTS microkernels

Parameter fault injection

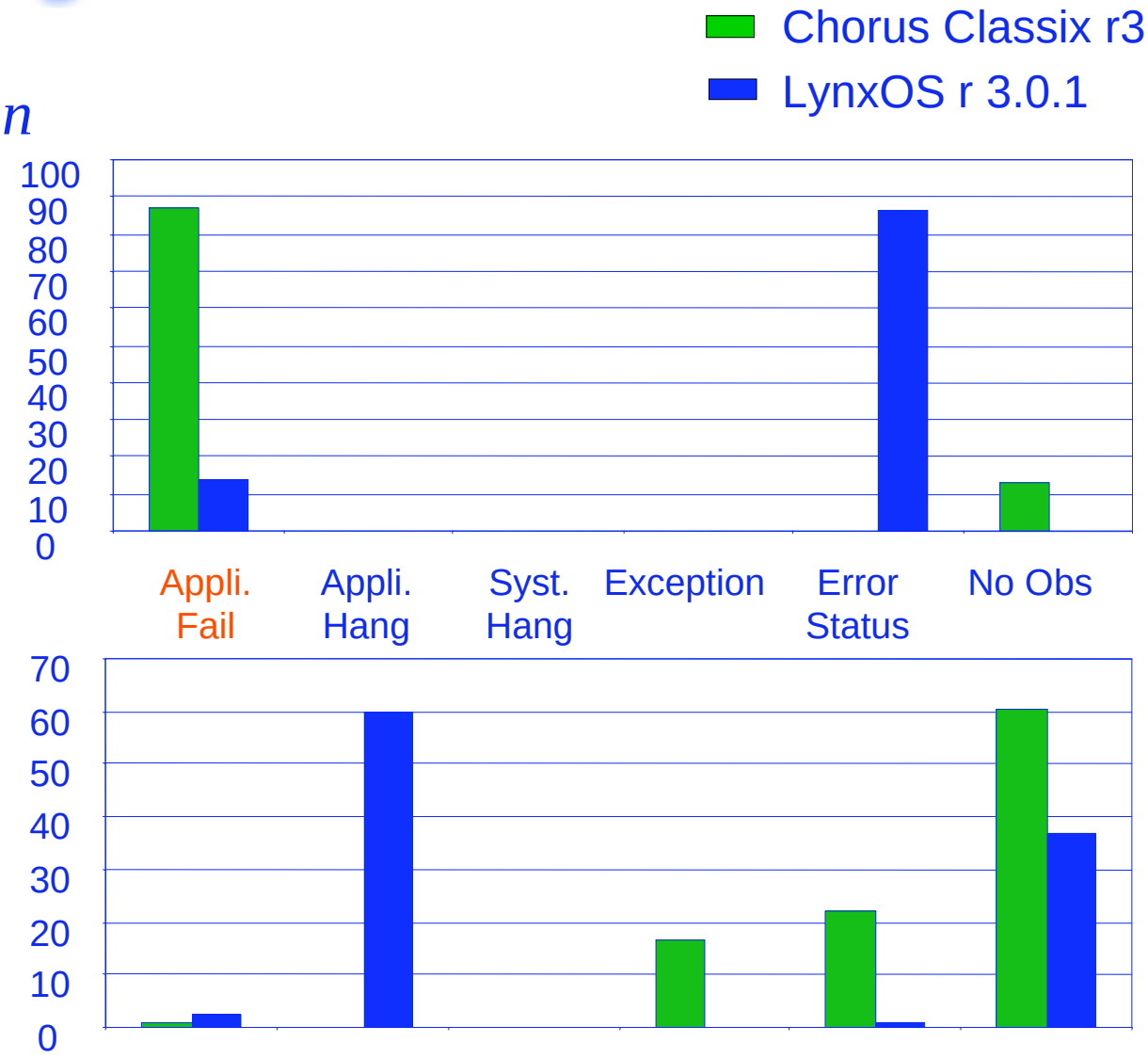
Synchronisation by mutex

Fault injection

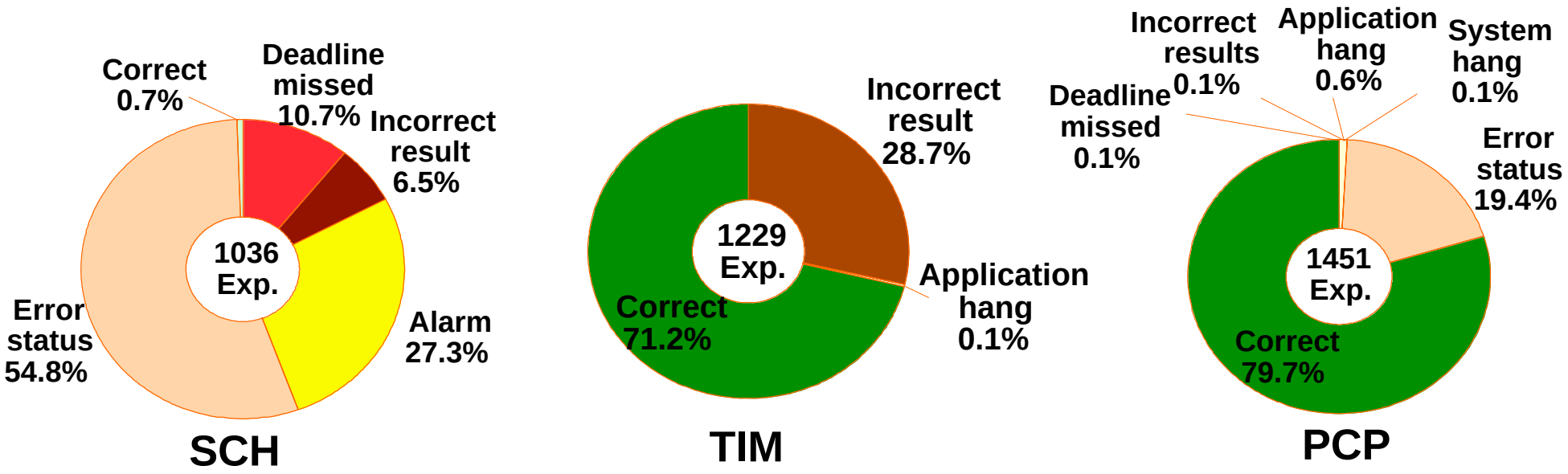
API

Chorus *vs.* LynxOS

Memory management

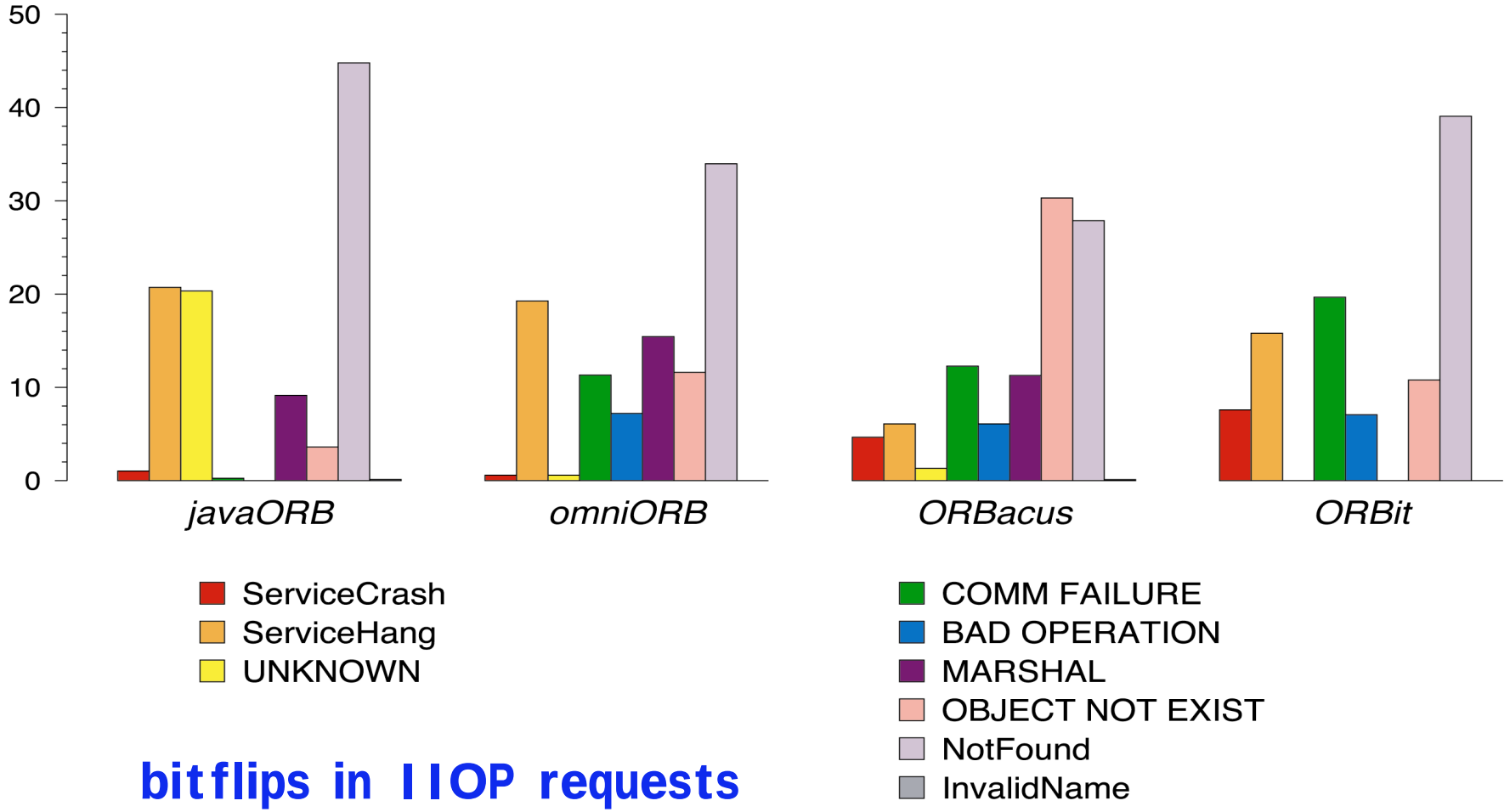


Real-time microkernels features



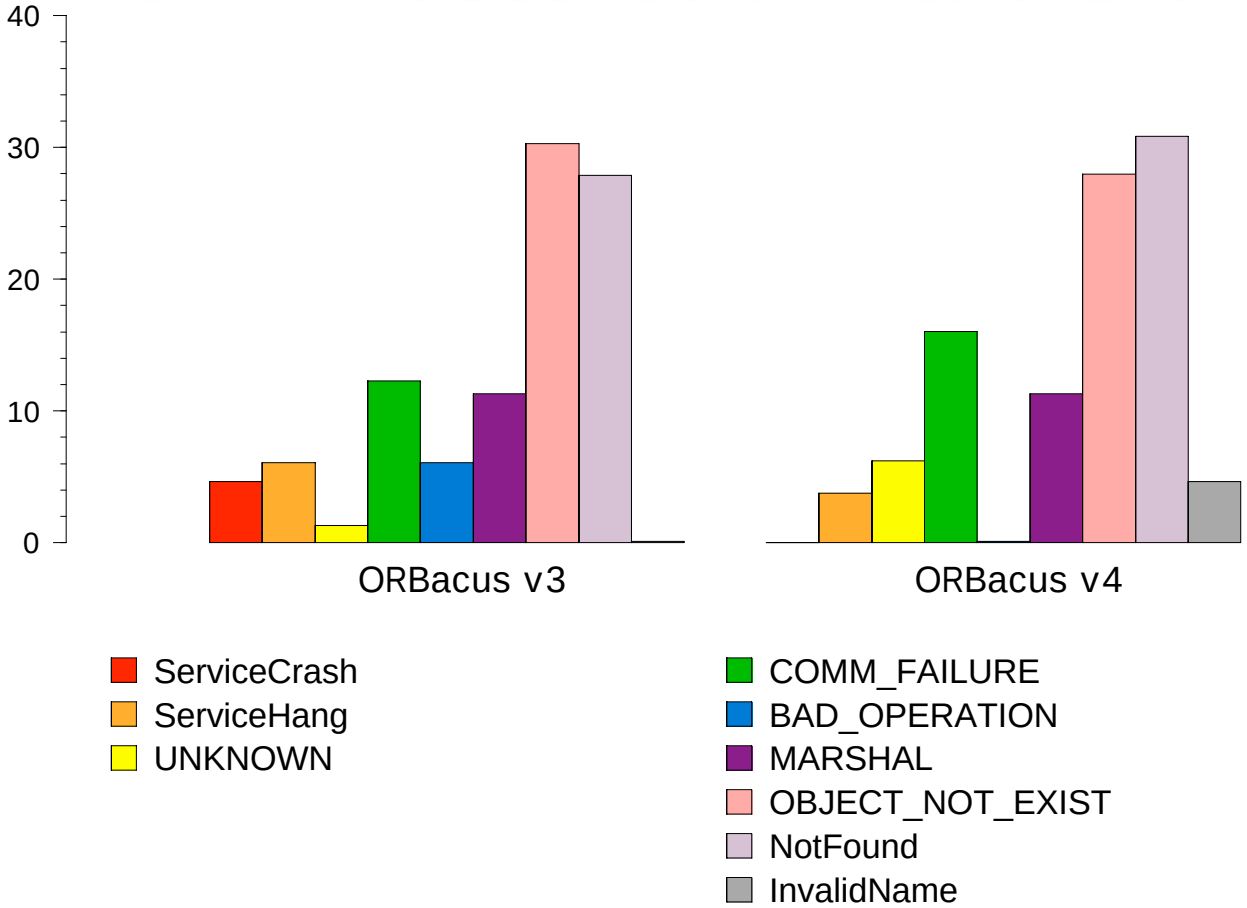
- **Example of 3 fault injection campaigns**
  - SCH: corruption of the running task
  - TIM: corruption of timers
  - SYN: corruption of synchronization system calls
- **Application failures in SCH and TIM and efficient error detection mechanisms in PCP**

Targeting CORBA implementations



bitflips in IIOP requests

CORBA successive versions



- **Situation can change according to the evolution of the COTS implementation through successive versions**

☞ **Additional ED and FT mechanisms must evolve accordingly!**

Conclusion, Ongoing Work & Challenges

- Objective Insights to support Developer's Design Choices and selection of the most robust COTS candidate
- Development of protection mechanisms by means of complementary wrapping techniques
- Solutions to adapt architectural choices, error detection and recovery mechanisms to the evolution of systems in operation
- Crucial need for dependability benchmarking
  - Comprehensive set of Benchmark Prototypes: Transaction Systems, OSs, Embedded Control Applications, …
  - The DBench project had this aim of disseminating Benchmark Prototypes