In the Field Monitoring of Software Applications

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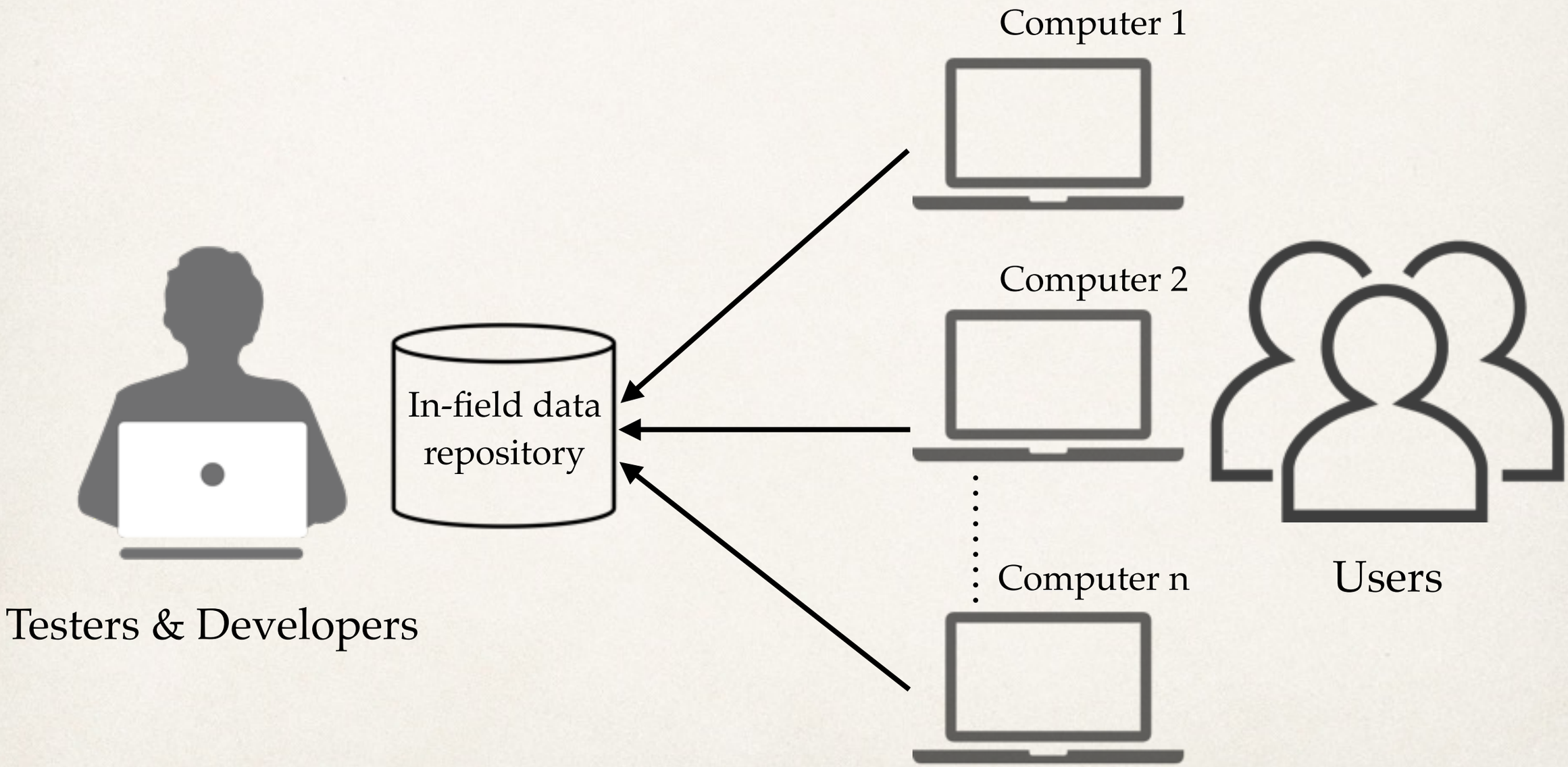
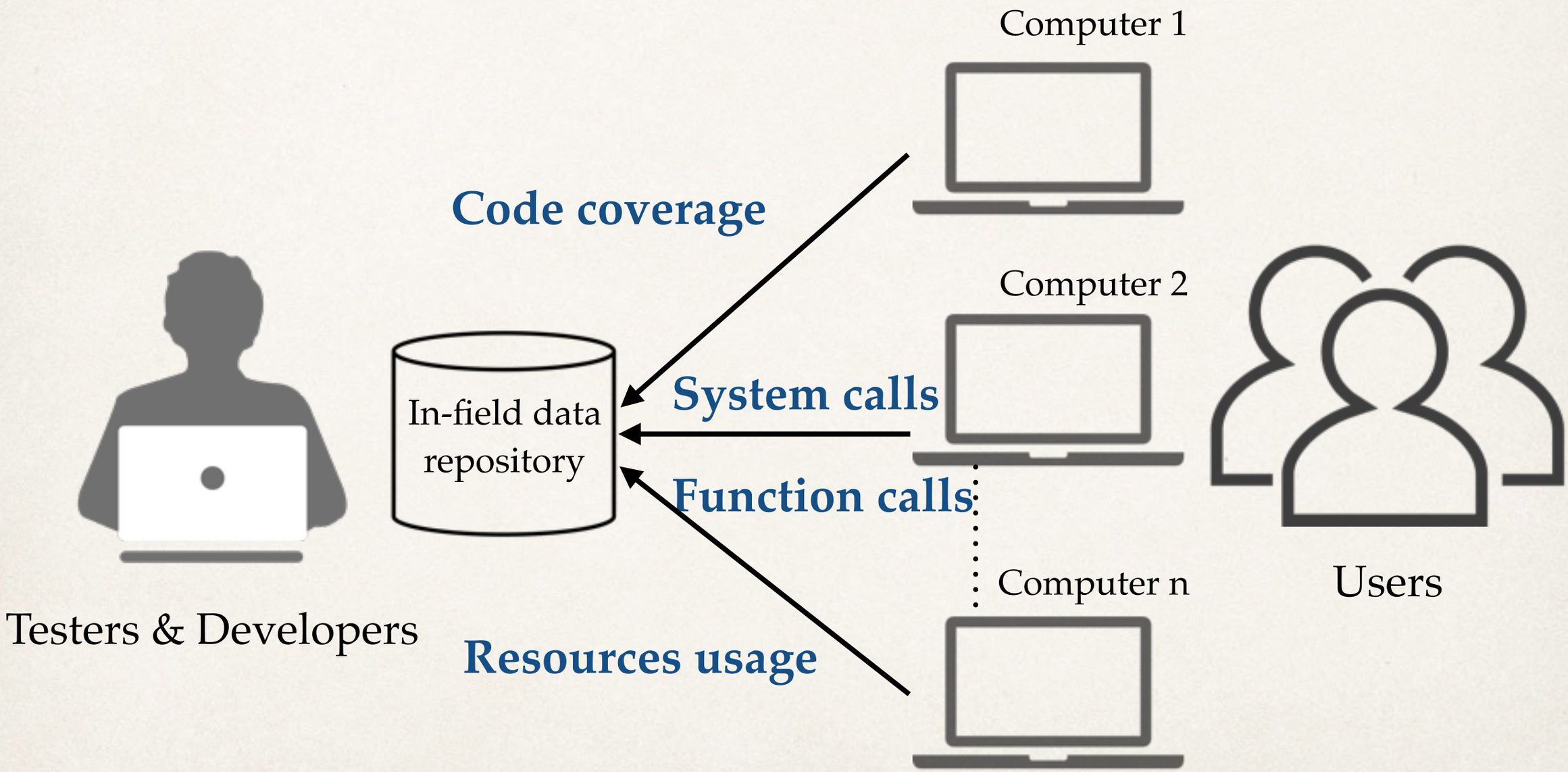
Monitoring Software



Monitoring Software



Monitoring Software

- Debugging
- Field failures reproduction
- Protocol verification
- Fault detection
- User profiling
- Testing
- …

- A technique for enabling and supporting debugging of field failures (Clause *et al*. - 2007 - IEEE ICSE)
- BugRedux: reproducing field failures for in-house debugging (Jin *et al*. - 2012 - IEEE ICSE)

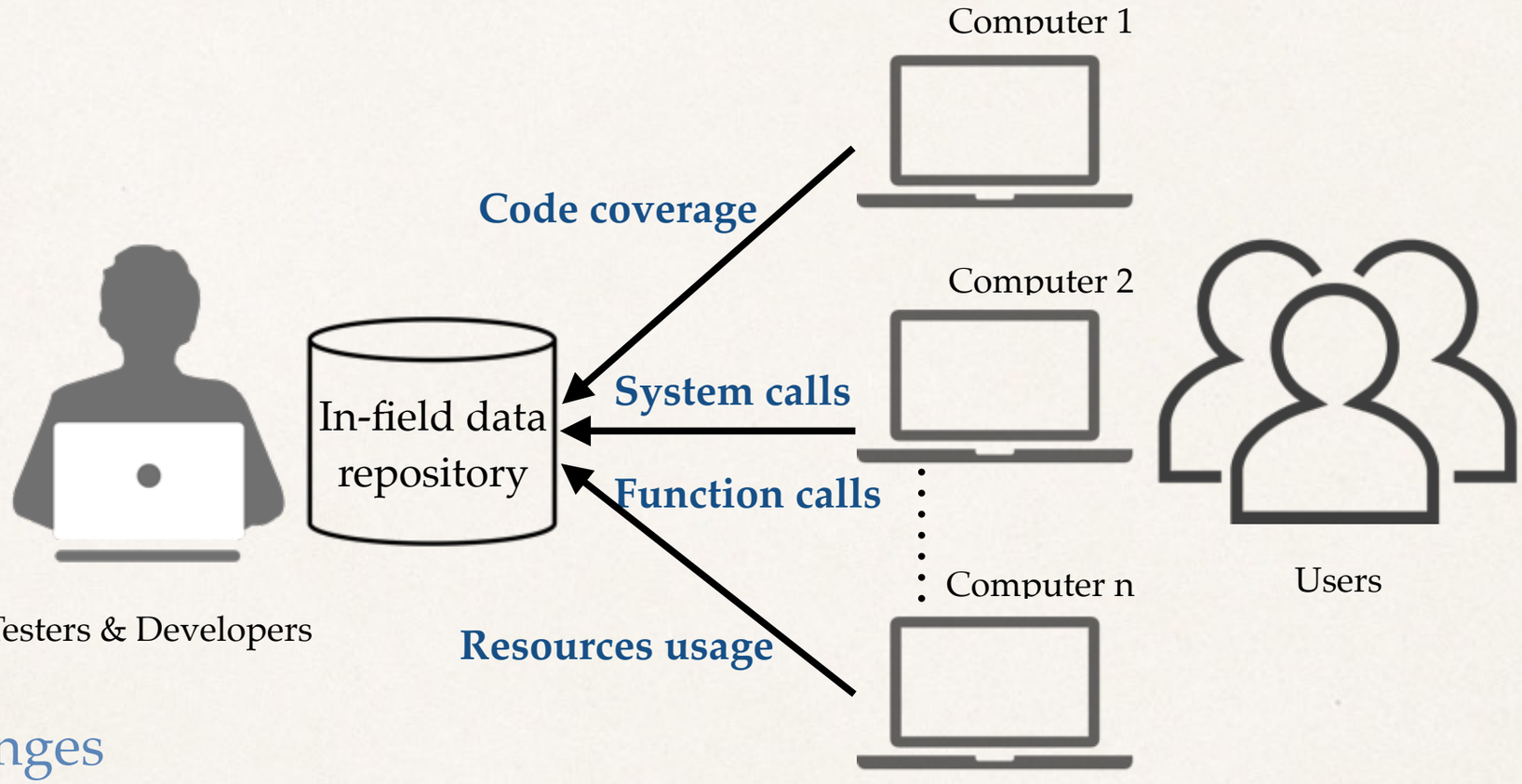
- Bug isolation via remote sampling (Liblit et al. - 2003 - ACM SIGPLAN Notices)
- Instrumentation and sampling strategies for cooperative concurrency bug isolation (Jin et al. - 2010 ACM SIGPLAN Notices)

- Profiling deployed software: Assessing strategies and testing opportunities (Elbaum *et al*. - 2005 - IEEE TSE)

- Residual test coverage monitoring (Pavlopoulou et al. - 1999 - IEEE ICSE)

- A taxonomy and catalog of runtime software-fault monitoring tools (Delgado et al. - 2004 - IEEE TSE)
- Gamma system: Continuous evolution of software after deployment (Orso et al. - 2002 - ACM ISSTA)
- Monitoring deployed software using software tomography (Bowring et al. - 2002 - ACM SIGSOFT Notices)

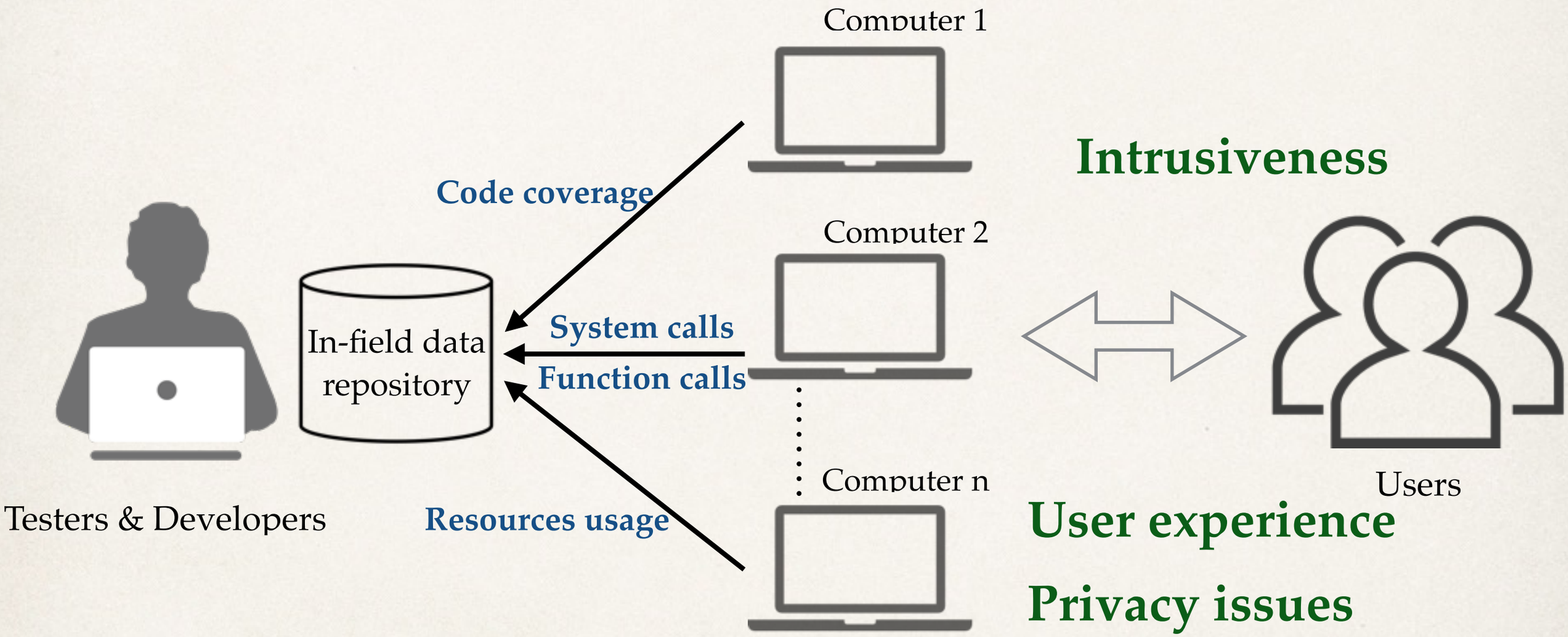
Monitoring Software



Challenges

- Online
- Large amount of collected data
- Non-trivial operations
- **Non-intrusive**

Research Problem



Preliminary Studies

Objective

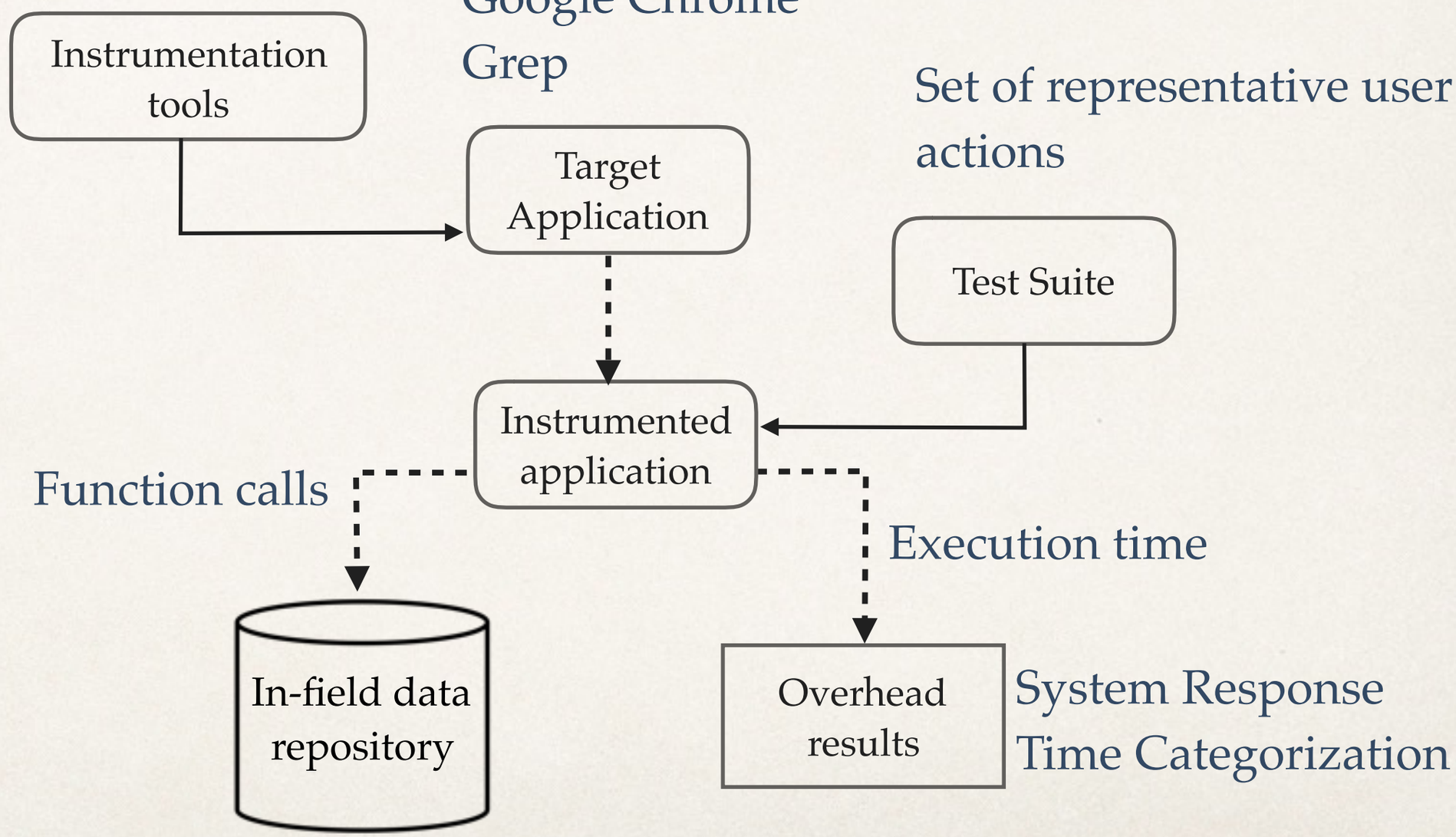
- To evaluate the user experience when collecting data from field and to identify the most relevant variables

Research Questions

- Do different types of collected data affect the user experience?
- Does the overhead introduced by monitoring activities depend on the context?

Procedure

Pin Binary Instrumentation
LLVM
BCEL
AspectJ



MS Excel
Google Chrome
Grep

Set of representative user actions

System Response Time Categorization

System Response Time: Seow approach*

- Instantaneous: 100 - 200 [ms]
- Immediate: 0.5 - 1 [s]
- Continuous: 2 - 5 [s]
- Captive: 7 - 10 [s]

* 40 years of searching for the best computer system response time (*Interacting with Computers* - Dabrowski *et al.*)

MS Excel - Function Calls Collection

Action	Base case [s]	Instrumented instance [s]	Overhead [%]	Category
Fill column X (1..10)	5,980	8,052	**34,65**	**Continuous->Captive**
Fill column Y (X*X)	9,886	27,963	**182,85**	
Fill column Z (X*Y)	9,897	28,022	**183,14**	
Launch “Go to cell”	1,356	1,383	**1,99**	=
Search cell	0,210	0,220	**4,76**	=
Perform sum	1,288	1,382	**7,30**	=

Monitoring nowadays

Distributive monitoring

- Monitoring deployed software using software tomography (Bowring et al. - 2002 - ACM SIGSOFT Notices)
- Gamma System: Continuous evolution of software after deployment (Orso et al. - 2002 - ACM ISSTA)

Statistical instrumentation

- Bug isolation via remote program sampling (Liblit et al. - 2003 - ACM SIGPLAN Notices)
- Instrumentation and sampling strategies for cooperative concurrency bug isolation (Jin et al. - 2010 ACM SIGPLAN Notices)
- Profiling deployed software: assessing strategies and testing opportunities (Elbaum et al. - 2005 - IEEE TSE)

Selective instrumentation

- Residual test coverage monitoring (Pavlopoulou et al. - 1999 - IEEE ICSE)

Research ideas

- Adaptative monitoring
- Statistical/Selective instrumentation
- Distributed monitoring

Context

Project ERC LEARN
(Leonardo Mariani)

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