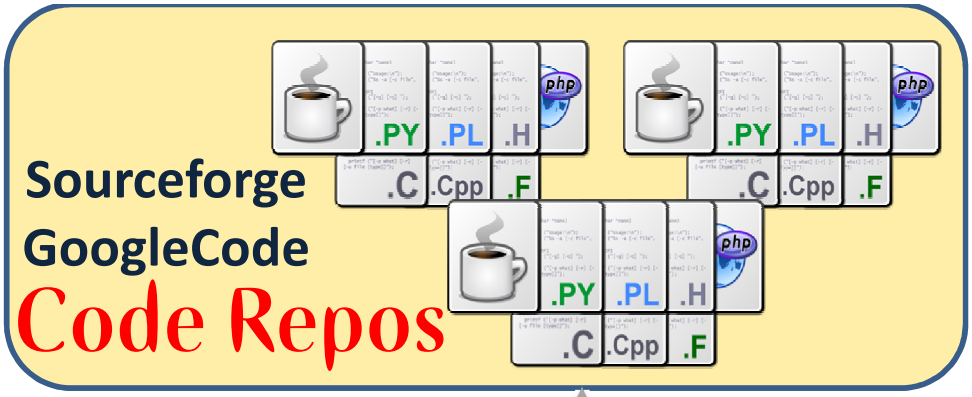
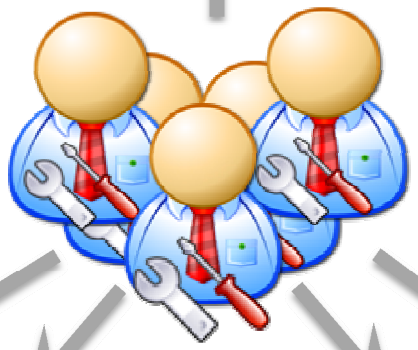
The Road Ahead for Mining Software Repositories

Ahmed E. Hassan

Queen's University

Canada





Source Control
CVS/SVN

Bugzilla

Mailing lists

Historical Repositories

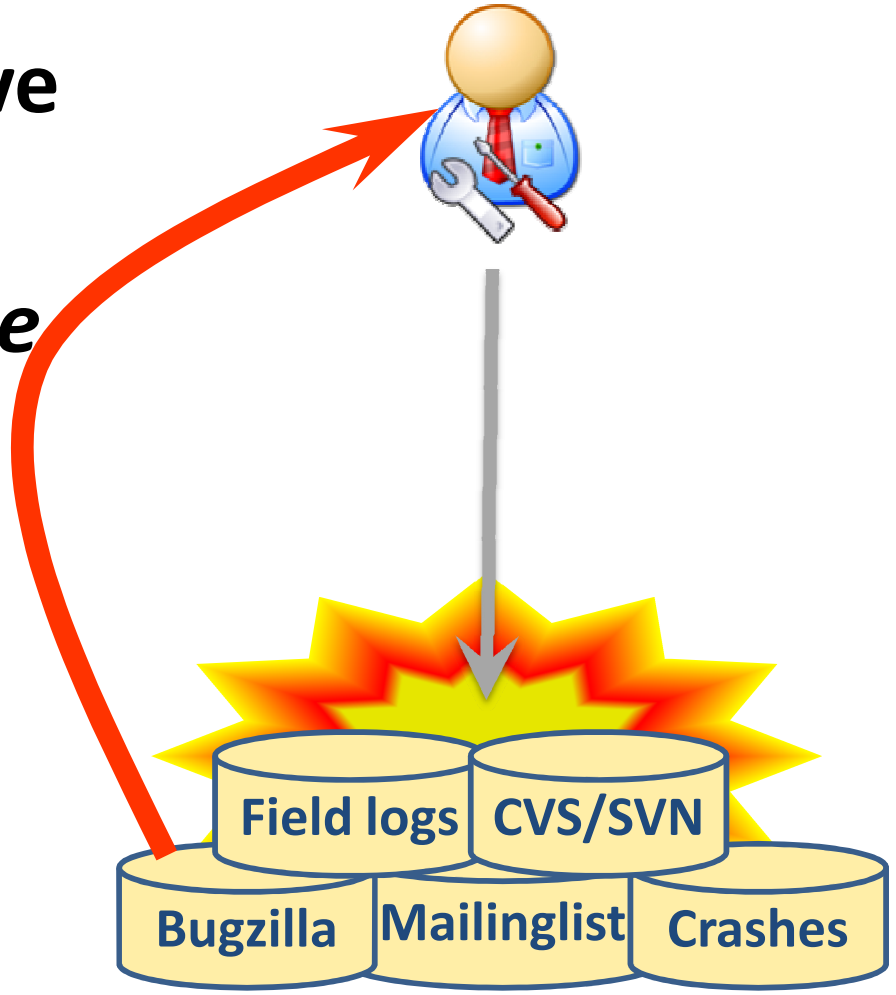
Crash Repos

Field Logs

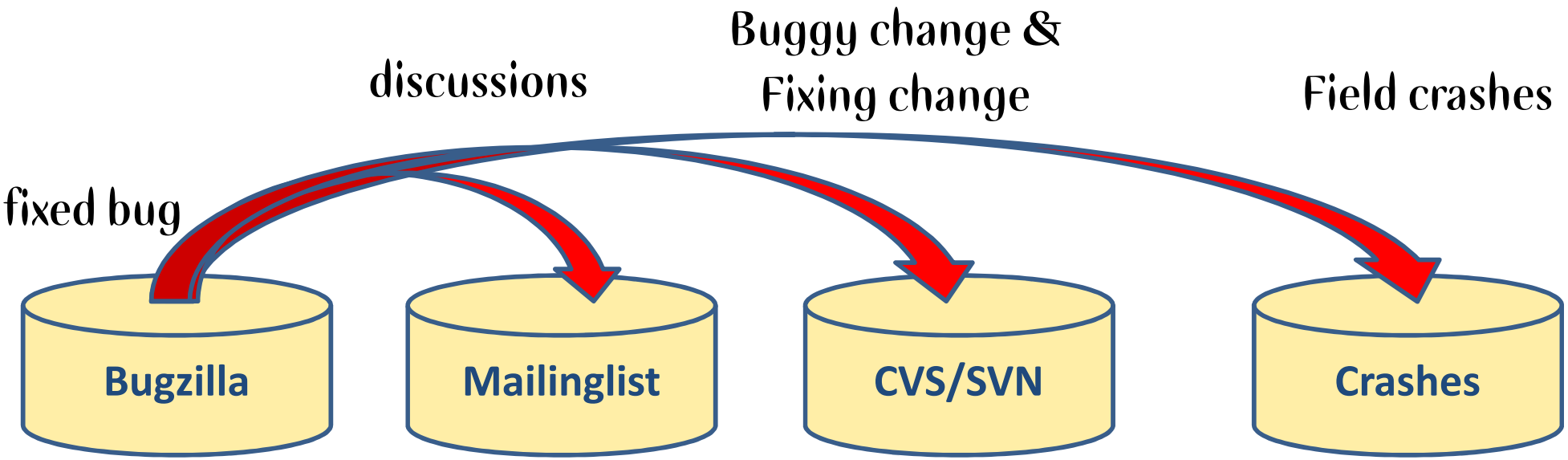
Runtime Repos

Mining Software Repositories (MSR)

- Transforms static record-keeping repositories to **active** repositories
- Makes repos data ***actionable*** by uncovering hidden **patterns** and **trends**



MSR researchers analyze and cross-link repositories



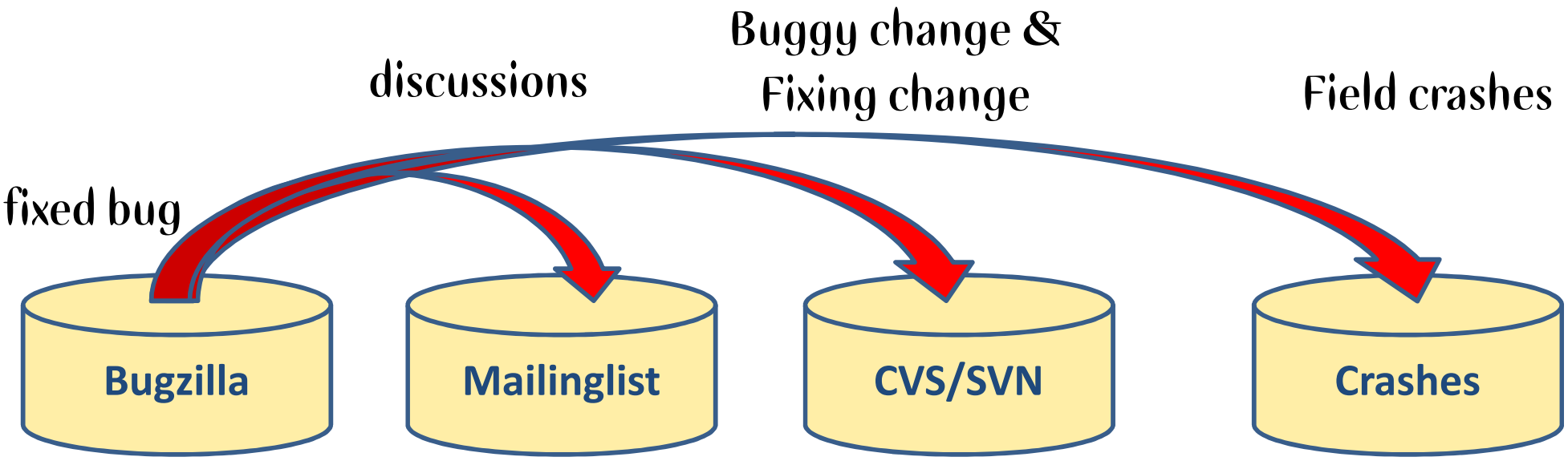
New Bug Report

Estimate fix effort

Mark duplicates

Suggest experts and fix

MSR researchers analyze and cross-link repositories



3-6x

Performance over only static dependencies (Recall 78%, Precision 64%)

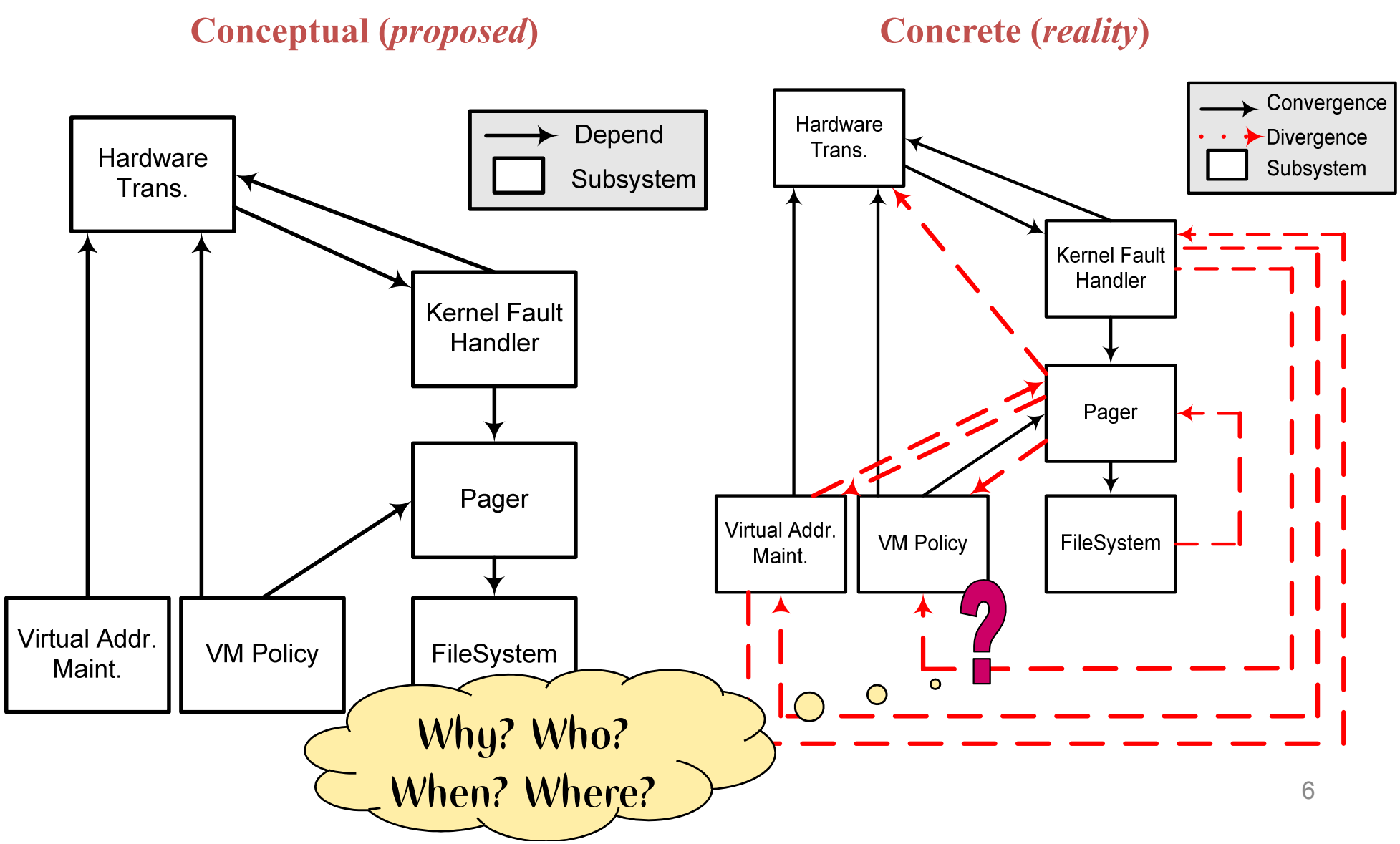
New Change

Suggest APIs

Warn about risky code or bugs

Suggest locations to co-change

Supporting software understanding (NETBSD)



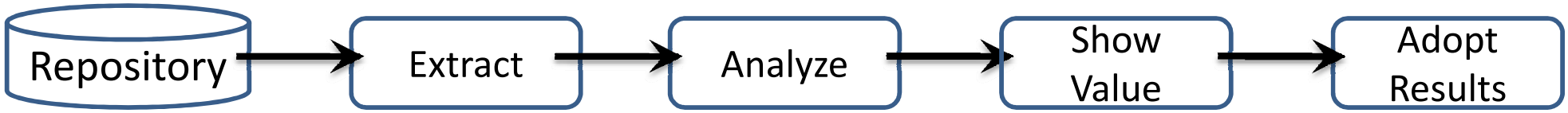
Mining supports software understanding (NETBSD)

- Eight unexpected dependencies
- All except two dependencies *existed since day one*:
  - Virtual Address Maintenance → Pager
  - Pager → Hardware Translations

Auto-generated from CVS repository

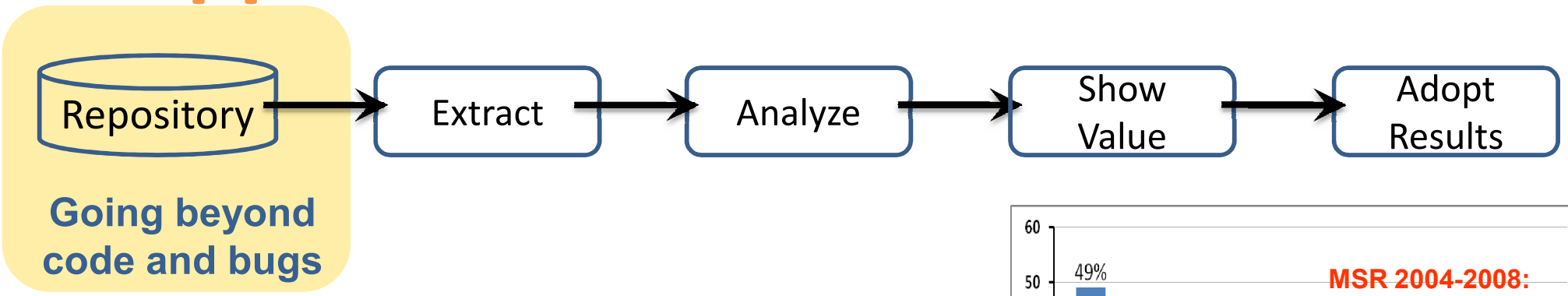
Which?	vm_map_entry_create (in src/sys/vm/Attic/vm_map.c) *depends on* pager_map (in /src/sys/uvm/uvm_pager.c)
Who?	cgd
When?	1993/04/09 15:54:59 Revision 1.2 of src/sys/vm/Attic/vm_map.c
Why?	from sean eric fagan: it seems to keep the vm system from deadlocking the system when it runs out of swap + physical memory. prevents the system from giving the last page(s) to anything but the referenced "processes" (especially important is the pager process, which should never have to wait for a free page).

Opportunities in the Road Ahead

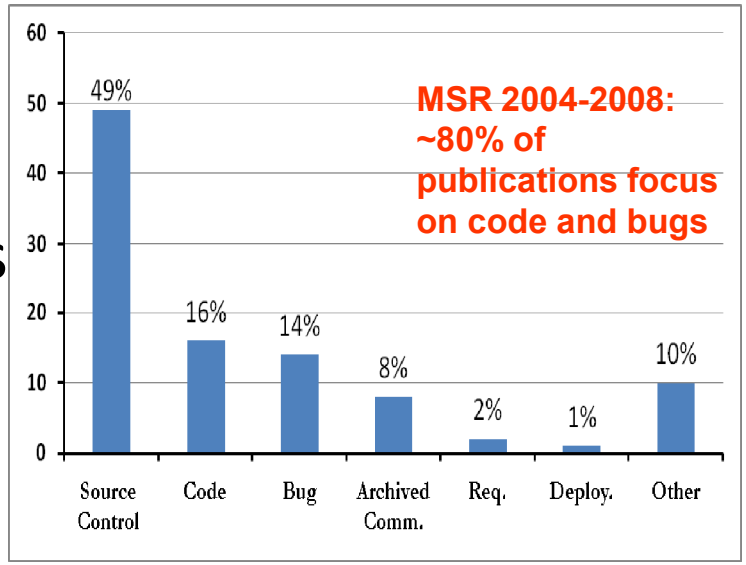


- **Going beyond code and bugs**
- **Taming the complexity of MSR**
- **Showing the value of repositories**
- **Easing the adoption of MSR**

Opportunities in the Road Ahead



- **Explore non-structured data**
  - Social aspects: emails and comments
- **Link data between repos**
- **Seek non-traditional repos**
  - Demonstrate the value of IDE interactions or build failures repos
- **Understand the limitation of repos**
  - Causation vs. Correlation
    - Small number of committers in OS projects



```
main() {
   int a;
   /*call
     help*/
   helpInfo();
}
```

V1:
Undefined func.
(Link Error)

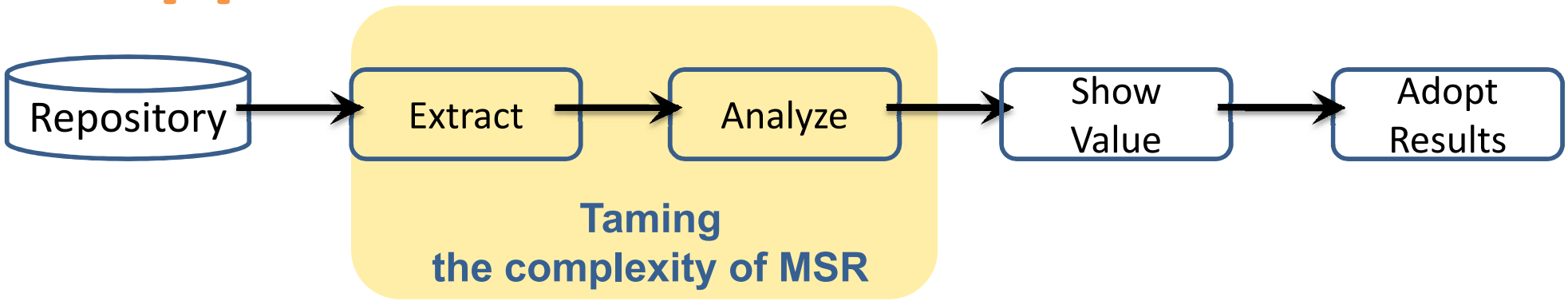
```
helpInfo() {
   errorString!
}
 main() {
    int a;
    /*call
      help*/
    helpInfo();
 }
```

V2:
Syntax error

```
helpInfo(){
 int b;
}
 main() {
    int a;
    /*call
      help*/
    helpInfo();
 }
```

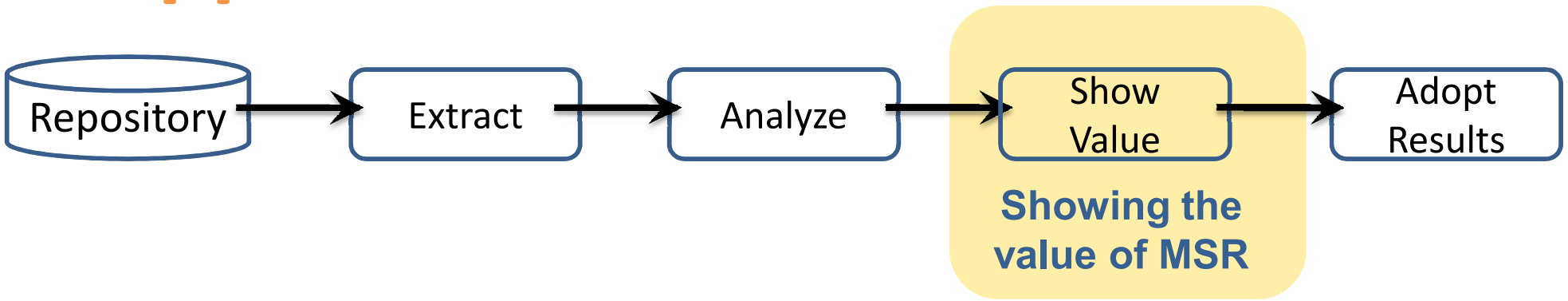
V3:
Valid code

Opportunities in the Road Ahead



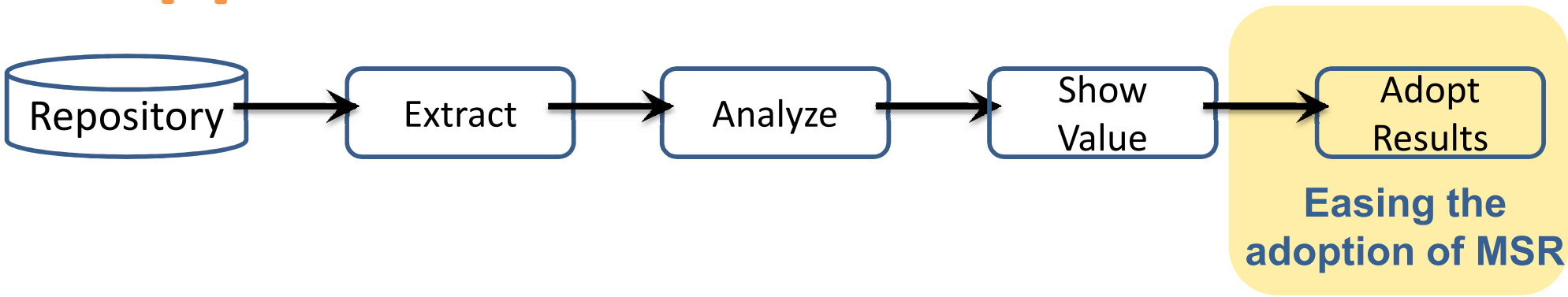
- **Simplify the extraction of high quality data**
  - Toolkits and extracted data (e.g. FLOSSMetrics) are needed
  - Heuristics should be empirically verified
  - Acknowledgement mechanism needed for extractors
- **Deal with skew in repository data**
  - Visualization can help spot skew
  - Guidelines and re-sampling/robust techniques are needed
- **Improve the quality of repository data**
  - Provide tools for annotation of repos data at creation

Opportunities in the Road Ahead



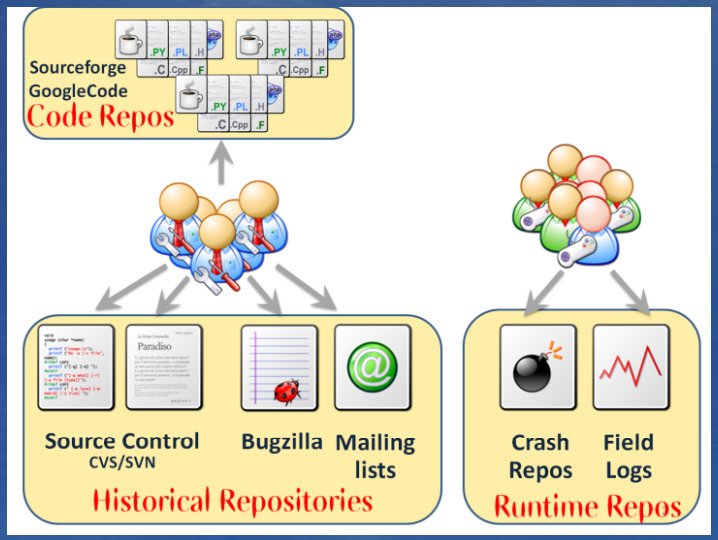
- **Understand the needs of practitioners**
  - Predicting buggy modules:
    - Buggy modules are well-known ☹
  - Predicting fault occurrences at module level is too coarse
- **Study the performance in practice**
  - Tools affecting the repos data
- **Show the practical benefits**
  - Statistical improvements not sufficient
  - Cost of maintenance should be evaluated
- **Evaluate on non-open source systems**

Opportunities in the Road Ahead



- **Simplify access to techniques**
  - Integration into IDEs (HATARI, Hipikat, Myln, eRose)
  - A web service demonstration for an open source project
    - A continuously updating MSR Challenge
- **Help practitioners make decisions**
  - MSR should aim to support not replace practitioners

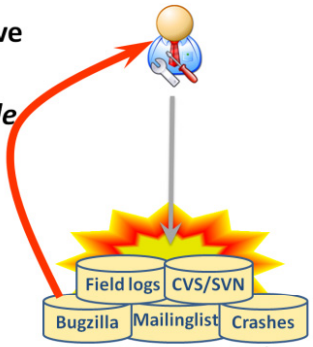
Mining Software Repositories



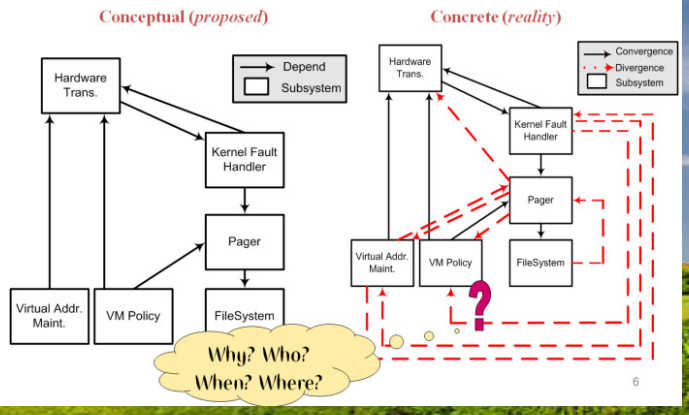
http://msrconf.org

Mining Software Repositories (MSR)

- Transforms static record-keeping repositories to **active** repositories
- Makes repos data ***actionable*** by uncovering hidden **patterns** and **trends**



Supporting Software Understanding (NETBSD)



Opportunities in the Road Ahead

- **Going beyond code and bugs**
- **Taming the complexity of MSR**
- **Showing the value of repositories**
- **Easing the adoption of MSR**