UNIVERSITEIT GENT

FACULTY OF ENGINEERING

Co-evolution of source code and build systems

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Research Question

Build system:
- captures file-level dependencies
  - source-level #include's
  - composition of binaries, libraries, etc.
- "intelligent" decision what to build ➜ incremental build
  - time stamp, MD5 checksum, ...
- configuration of source code and build system

build tool

configuration

Strong link with source code:
- out-of-sync ➜ no or inconsistent build
- rigid build system ➜ less freedom to restructure/refactor code

Claim: build system co-evolves with source code

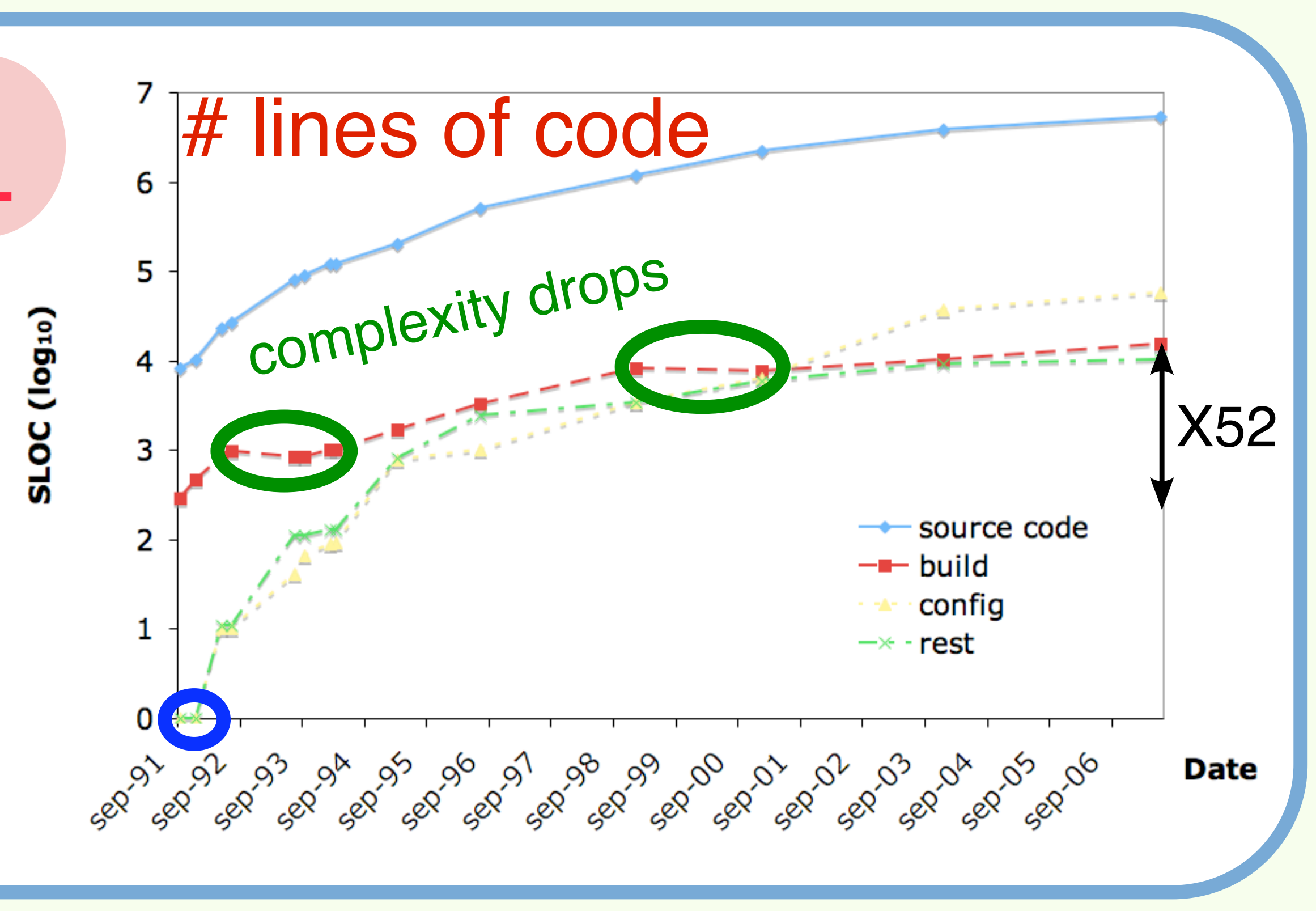
Case Study: Linux kernel

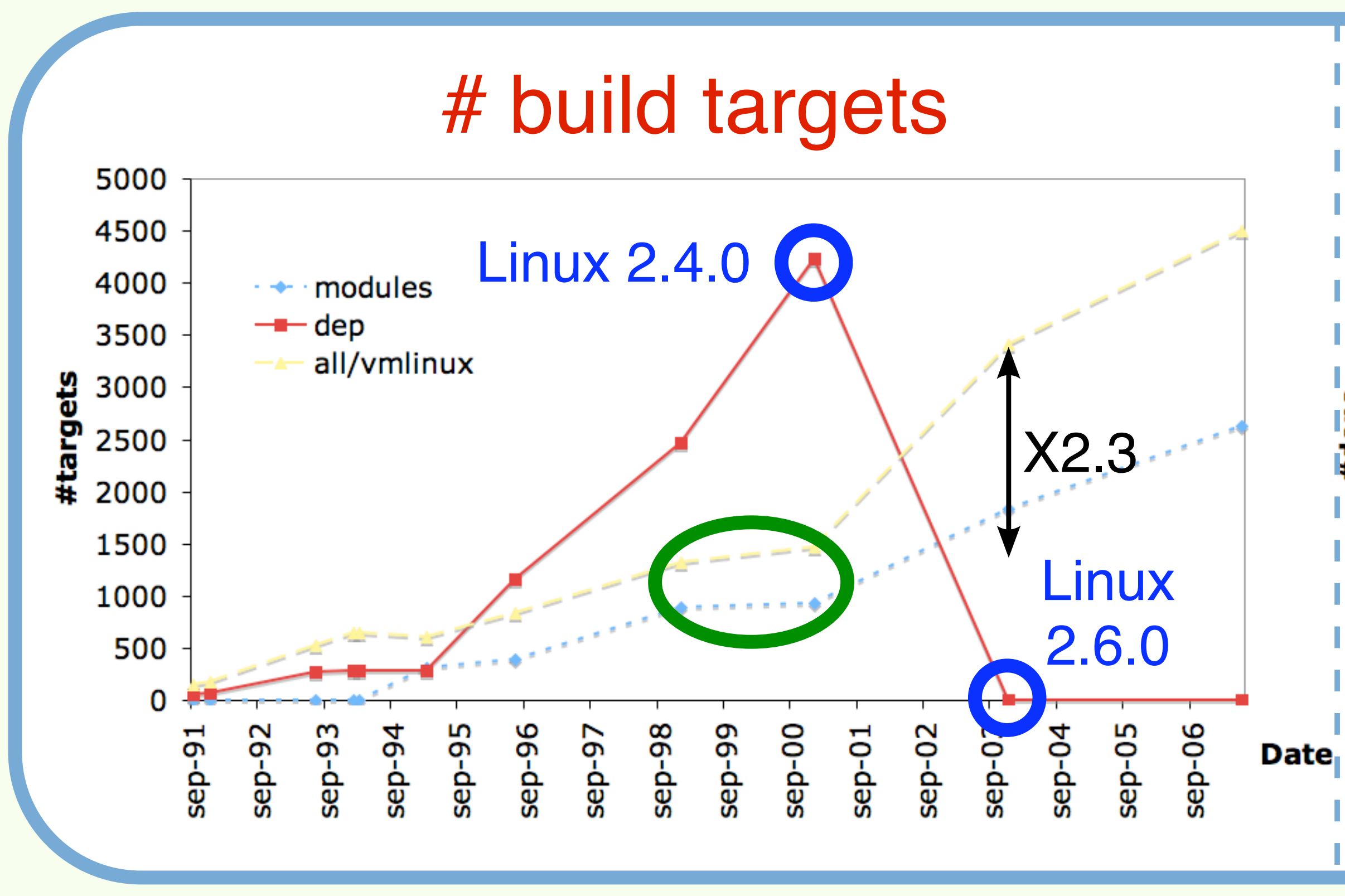
Case:
- Linux kernel from version 0.01 to 2.6.21.5

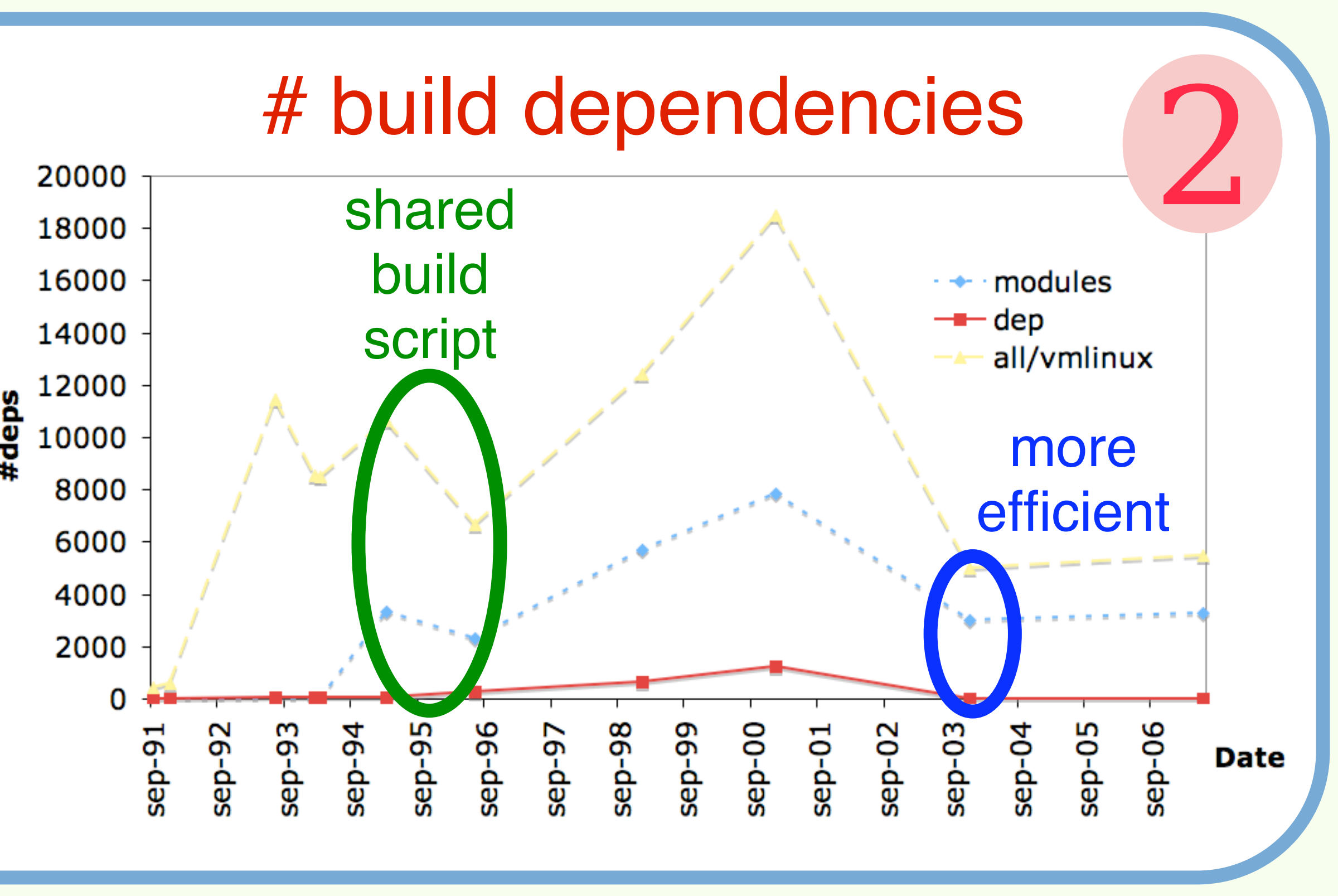
Measurements:
- physical lines of code (SLOC) of source code and build system 1
- complexity of build dependency graph 2
- detailed analysis of big evolution step in build process 3

Tools:
- SLOCCount (*http://www.dwheeler.com/sloccount/*)
- MAKAO:
  - re(verse)-engineering framework for build systems
  - dependency graph of concrete build as underlying model
  - nodes and edges are freely manipulable objects (in OO sense)

1







2

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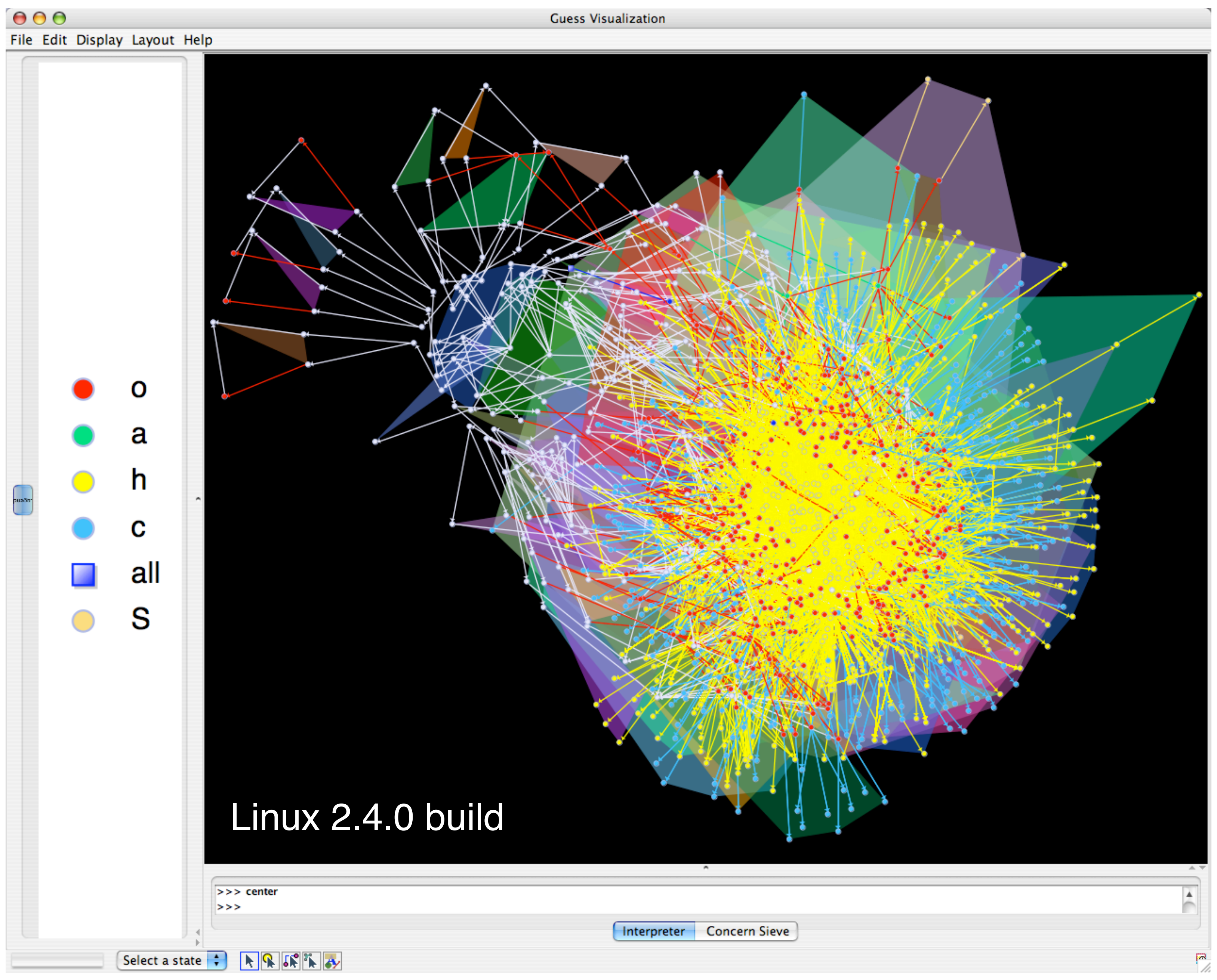

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>>> center
>>>
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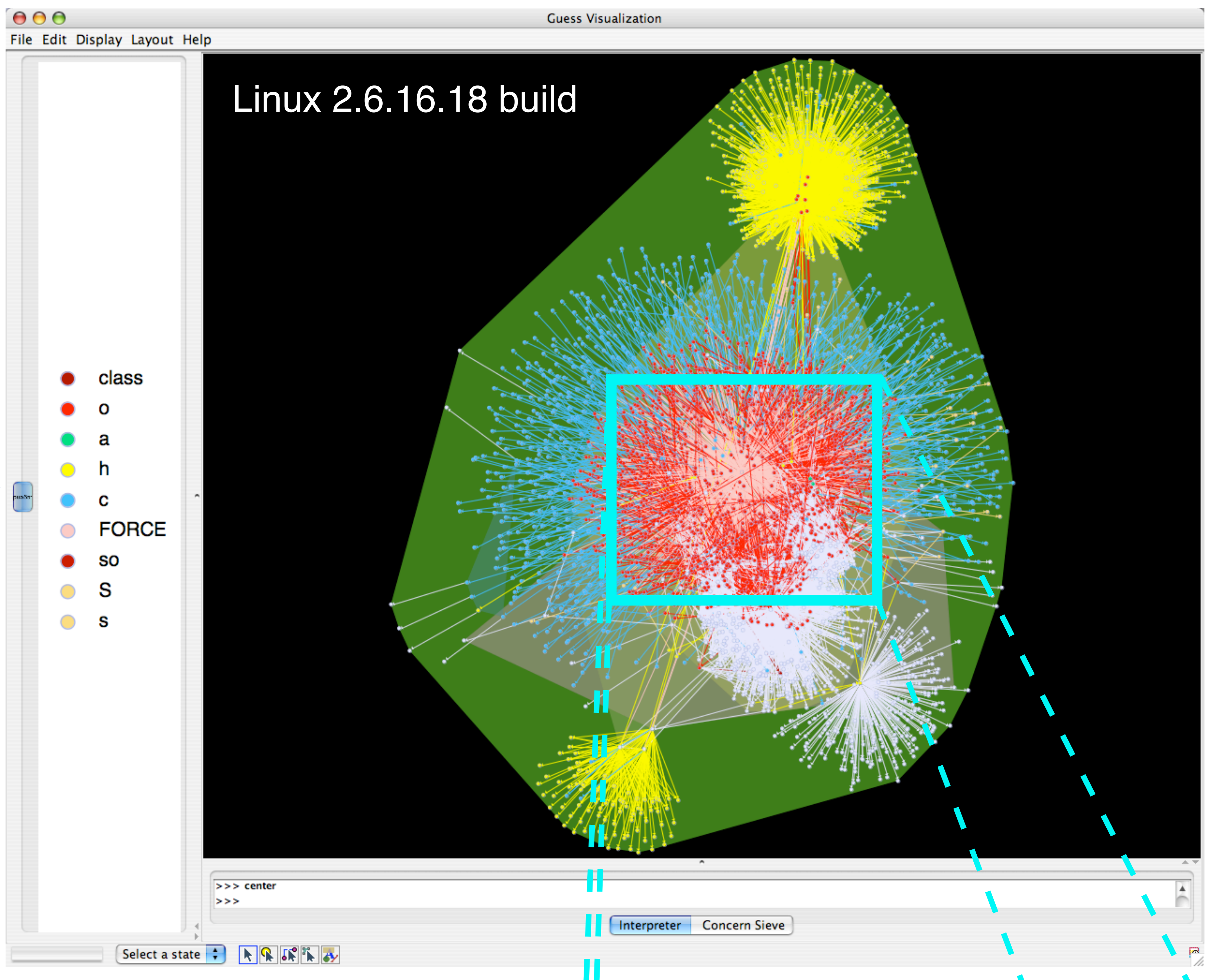
big evolution step

in build process



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>>> center
>>>
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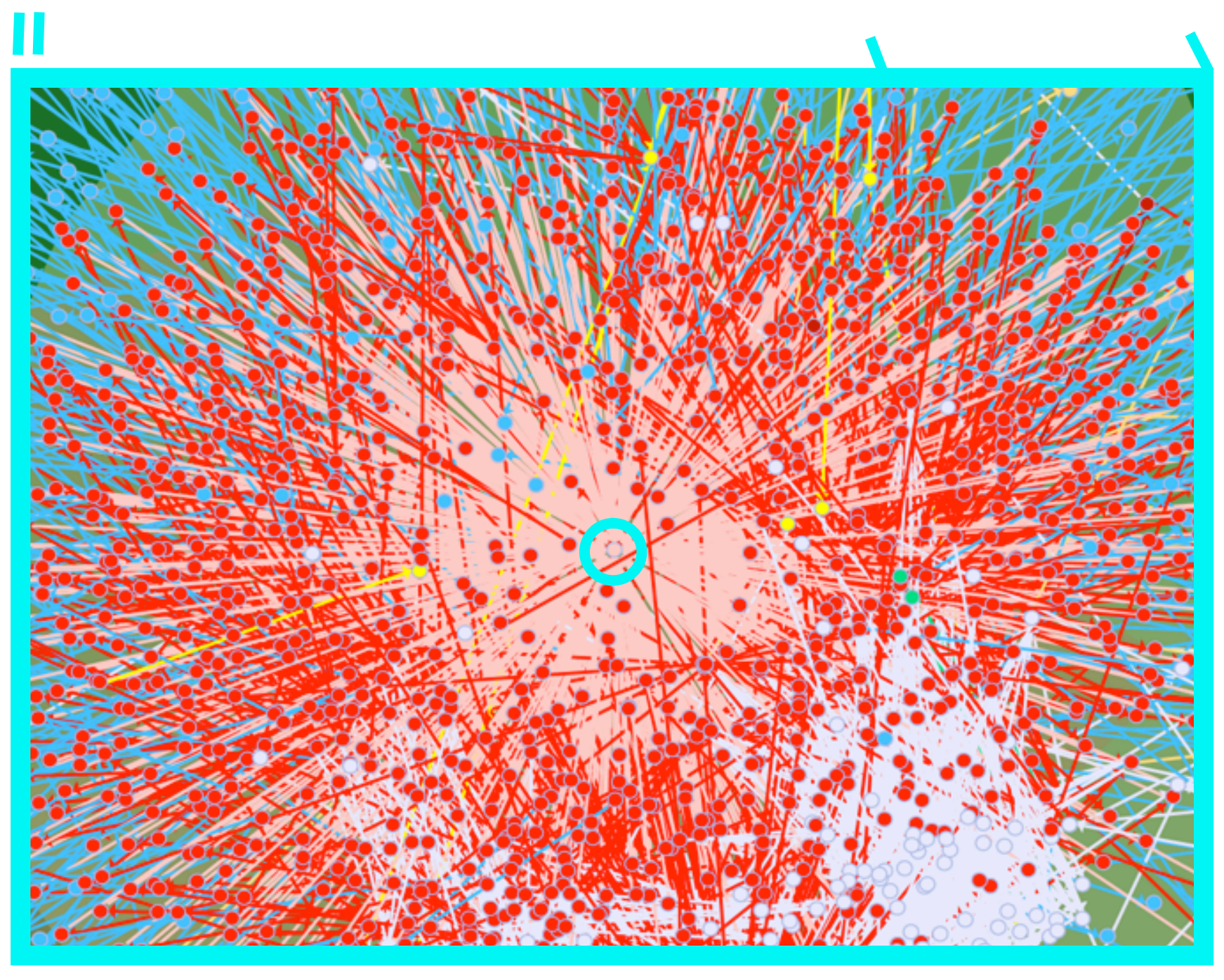
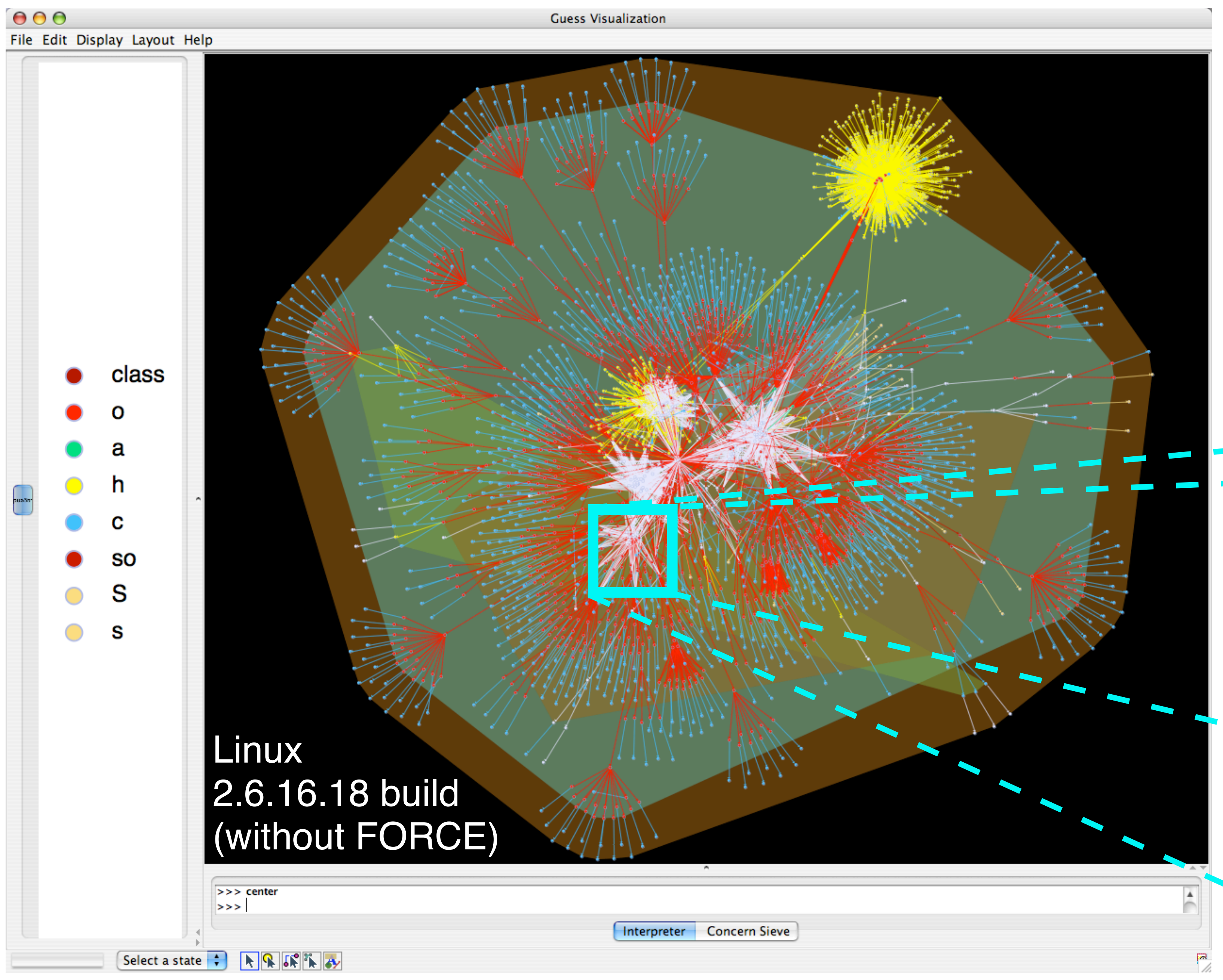
remove FORCE node

FORCE idiom for custom incremental compilation





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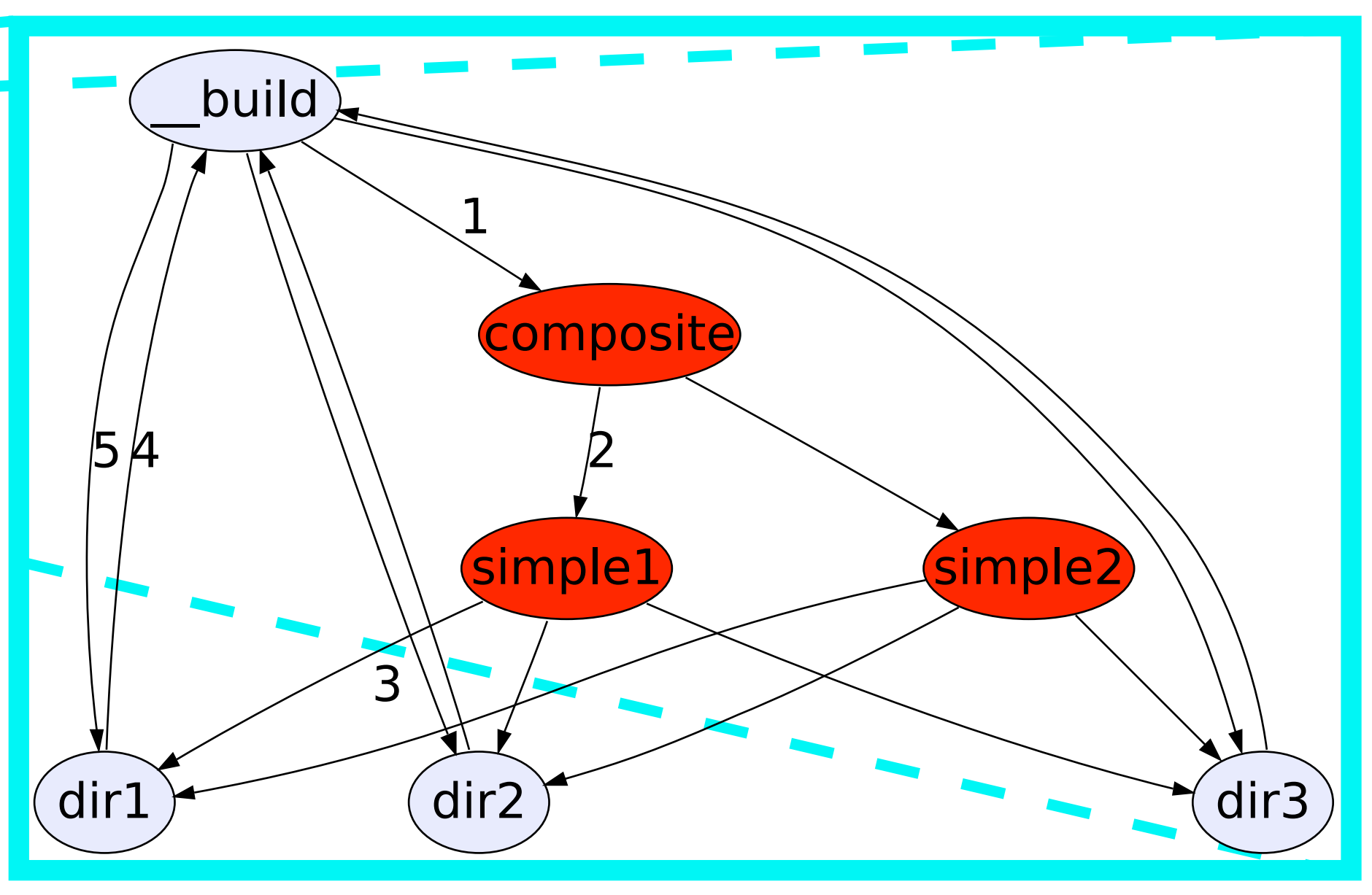

circular dependency chain fixes recursive make flaws

Conclusion

Lehman's laws of software evolution apply:
- build system evolves
- during evolution complexity increases
- maintenance performed to manage this

Future work:
- link with code re-engineering activities
- configuration-aware study