Combining Conceptual and Domain-Based Couplings to Detect Database and Code Dependencies

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Common problems in software maintenance

Systems with legacy code, e.g., COBOL

Hybrid systems, e.g., Python and Java

Multi-tier systems

Inaccessible maintenance history

Despite the issues...

Perform impact analysis

Information suitable for domain experts

User Interface Components (UIC)

How?

Domain-based coupling

Conceptual coupling

Combination

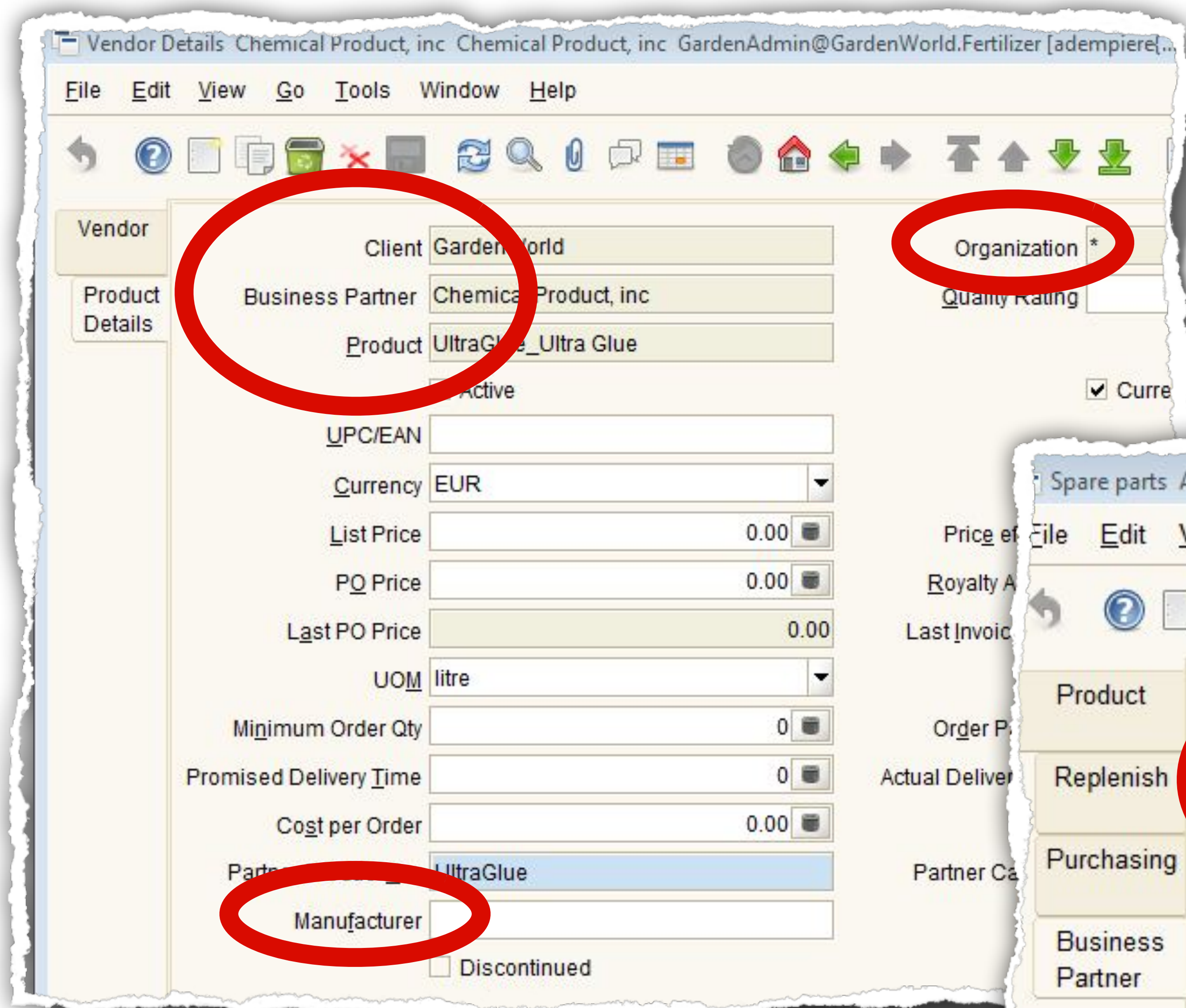
Motivations

Domain-based approach works without access to source code or design documents

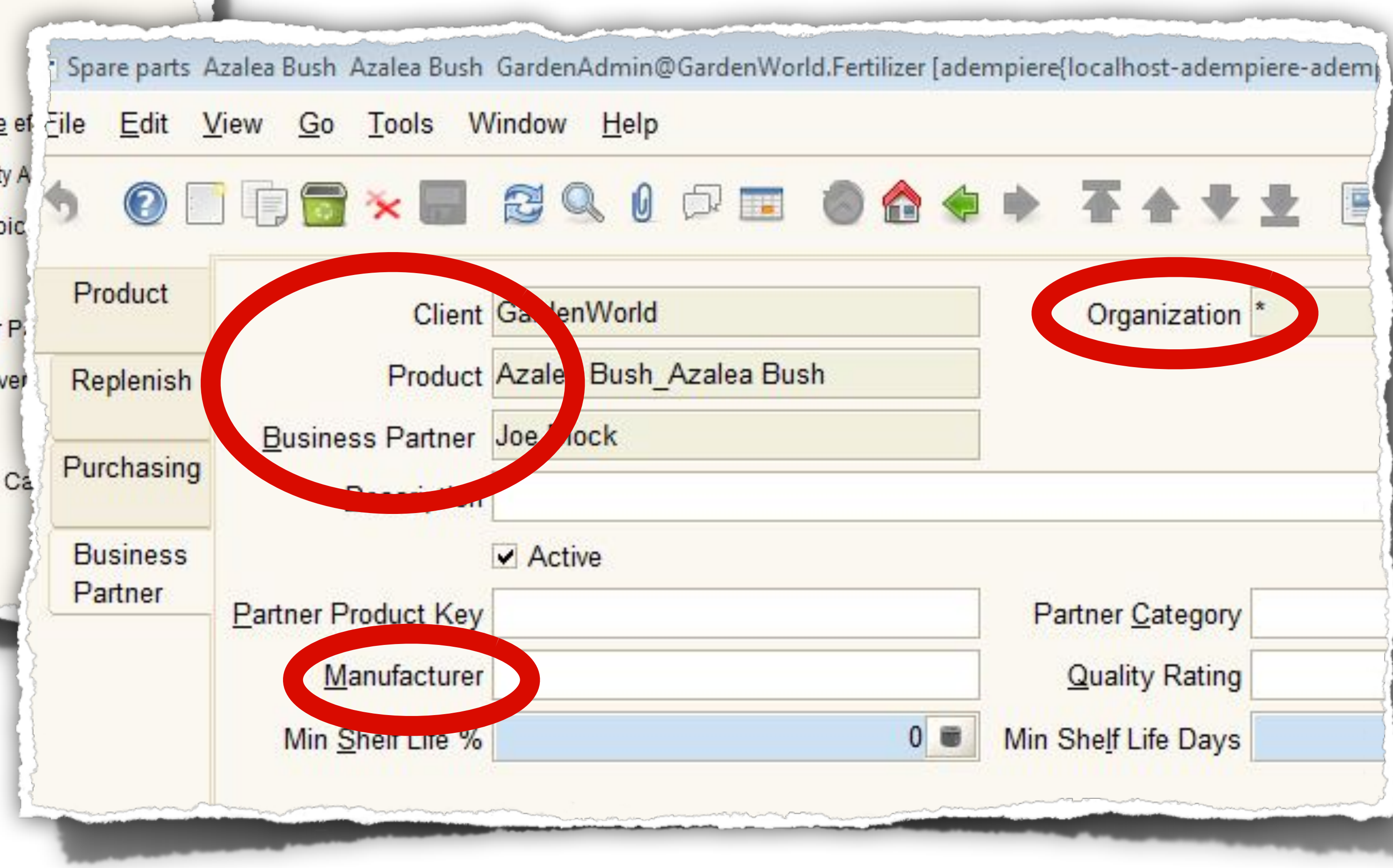
Conceptual coupling approach is language independent

The approaches complement each other

Example of UICs



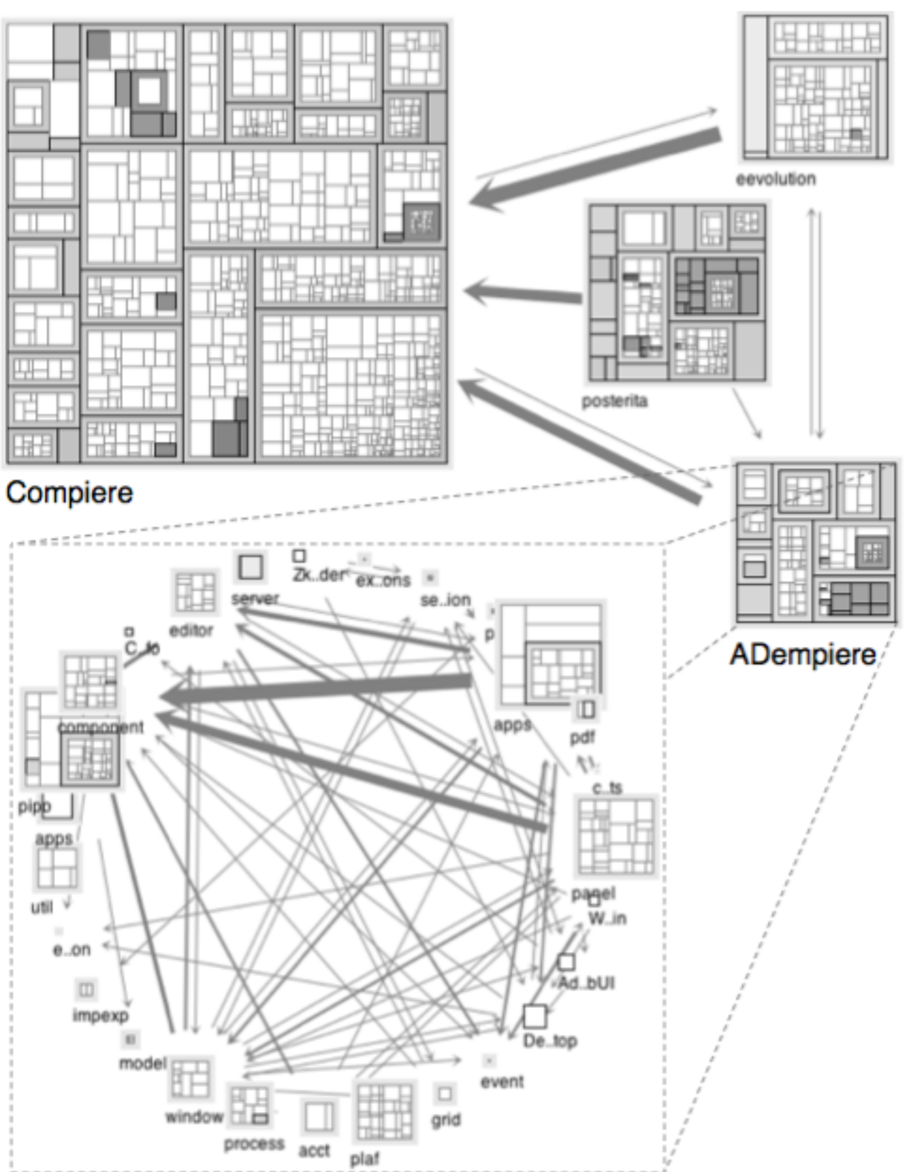
Domain variables



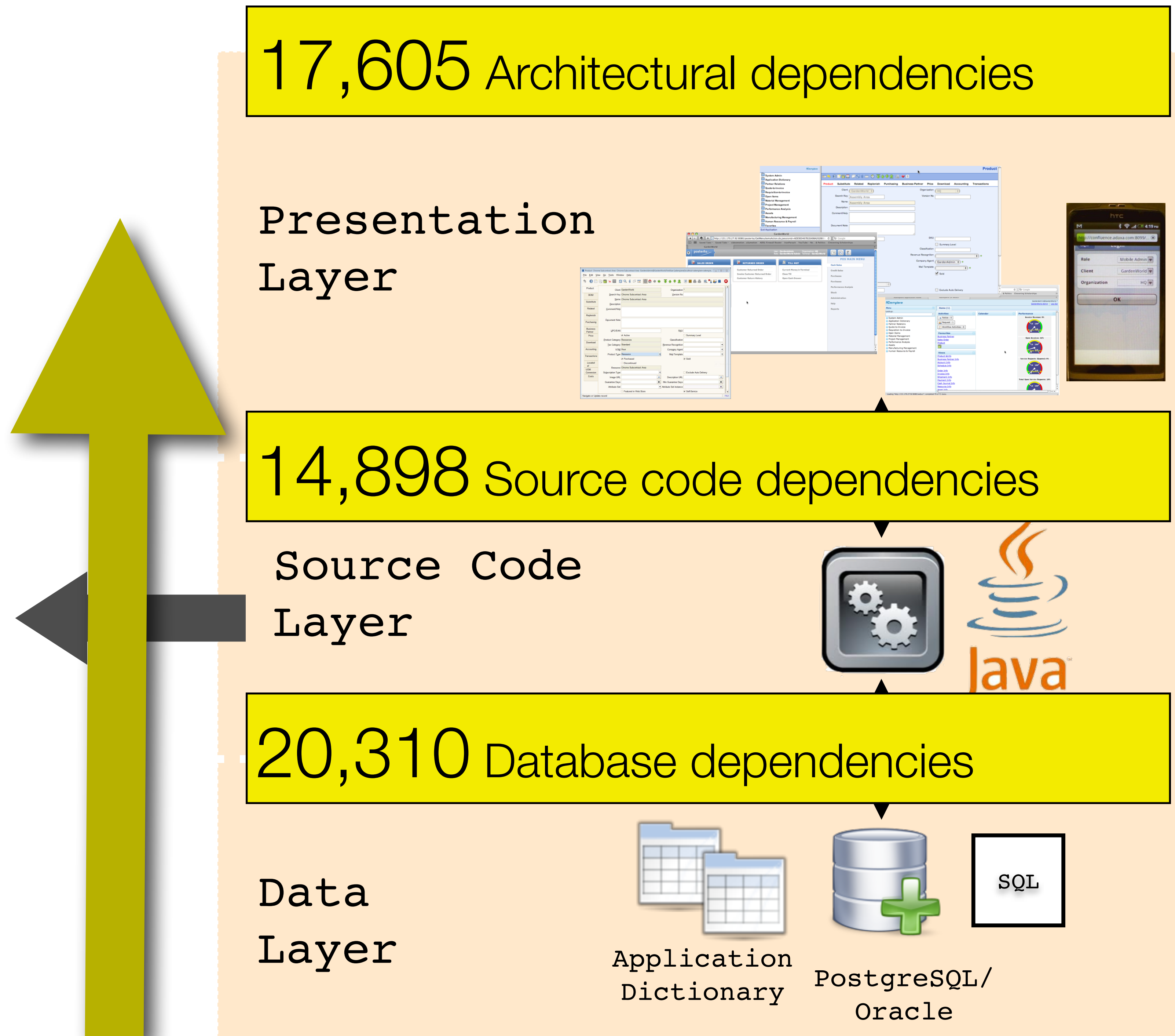
Case Study

- 120,111 times downloaded in 2011
- 3,531 Java Classes
- 2,569,854 lines of code
- Four distinct interfaces
- 347 screens

Dependencies



M. Lungu and M. Lanza, Softwarenaut, CSMR 2006



Case Study - Orthogonality

Do conceptual and domain-based coupling identify orthogonal dependencies?

Case Study - Orthogonality

	Architectural Dependencies (UICs)		
	CP 10	**CP 20**	**CP 30**
C (int) D	26%	26%	26%
C (diff) D	35%	38%	39%
D (diff) C	25%	25%	25%

C (int) D: Set intersection of correct dependencies identified by both conceptual and domain-based coupling

C (diff) D: Set difference of correct dependencies identified by conceptual and domain-based coupling

D (diff) C: Set difference of correct dependencies identified by conceptual and domain-based coupling

Case Study - Orthogonality

	Architectural Dependencies (UICs)		
	[illegible]	CP 20	CP 30
C (int) D	[illegible]	26%	26%
C (diff) D	[illegible]	[illegible]	39%
D (diff) C	[illegible]	[illegible]	[illegible]

Metrics are orthogonal!

C (int) D: Set intersection of correct dependencies identified by both conceptual and domain-based coupling

C (diff) D: Set difference of correct dependencies identified by conceptual and domain-based coupling

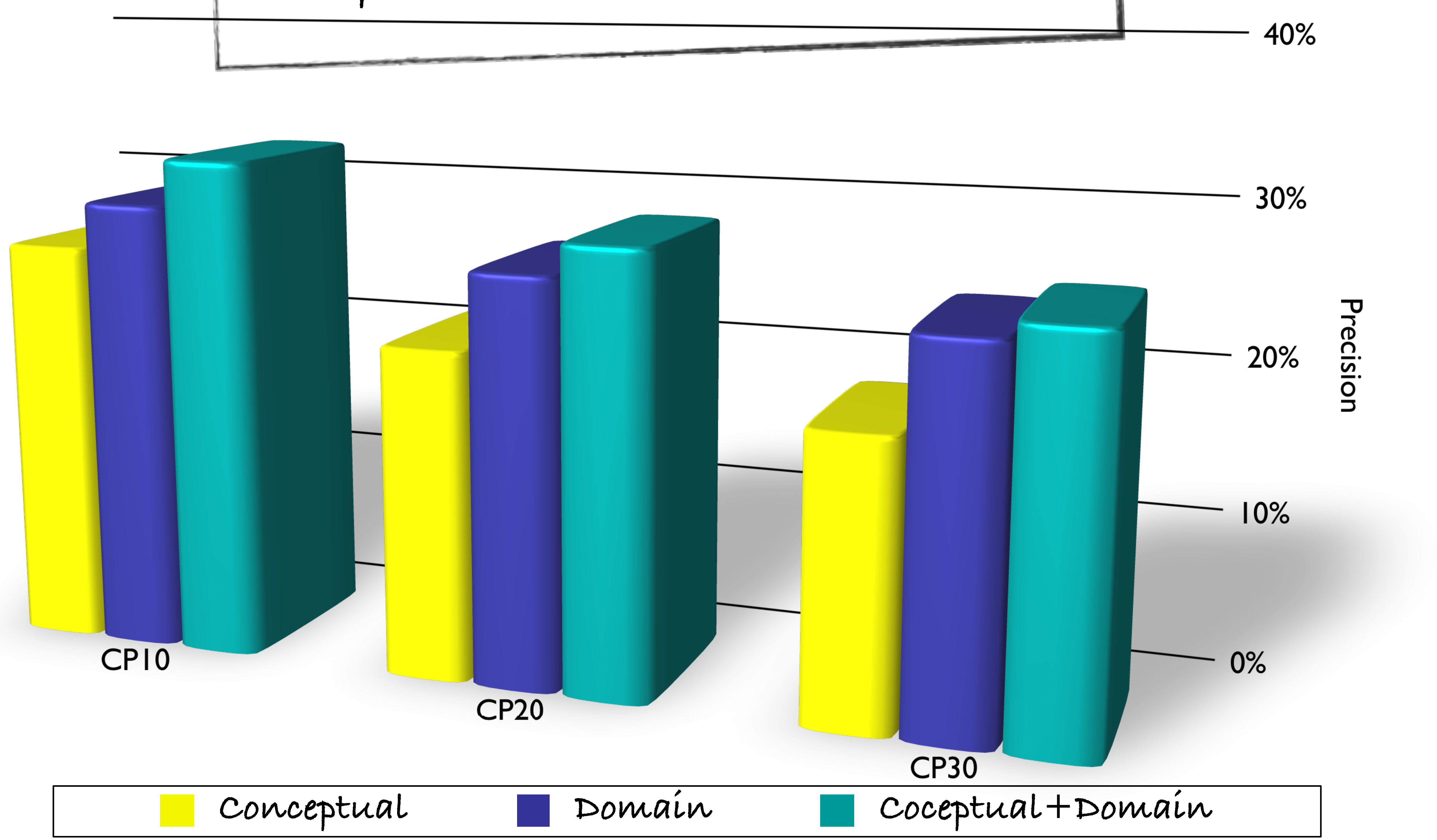
D (diff) C: Set difference of correct dependencies identified by conceptual and domain-based coupling

Case Study - Accuracy

Does combing conceptual and domain-based coupling improve the accuracy our ability to identify dependencies?

Case Study - Accuracy

Is it possible to improve the accuracy?



Case Study - Accuracy

The combination of conceptual and domain dependencies yields an improvement for identifying dependencies

Wilcoxon sign-ranked test indicates our findings are typically statistically significant

Case Study - Accuracy

...tion of conceptual and domain ... improvement for iden...

Wilcoxon sign-ran... ...gs are typically statistically sig...

The combination outperforms either individual technique.

Conclusion

Conceptual and domain-based coupling identify orthogonal sets of dependencies

Combining the metrics improves our ability to predict dependencies

Recall improvements of up to 7% over the baseline approach

Precision improvement up to 24% over the baseline approach

Thank You

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http://www.cs.wm.edu/semeru