



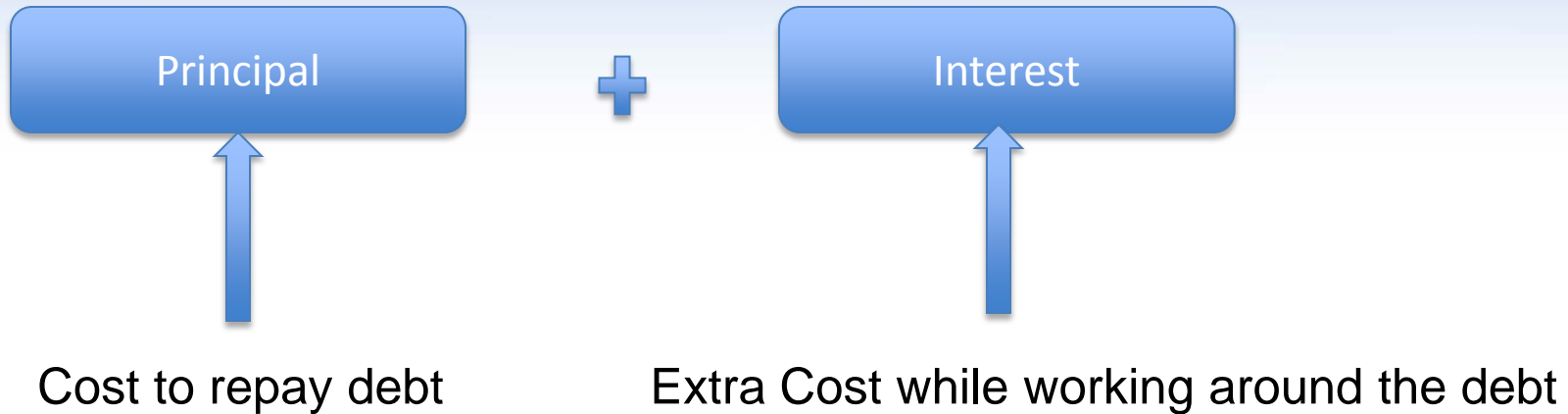
**A Framework
for Estimating Interest
on Technical Debt
by Monitoring Developer Activity Related
to Code Comprehension**

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Technical Debt



Our Focus : Estimating Interest

Current Approaches

- Principal Only :
 - Debt related to architecture, code structure, code complexity and code smells (Kruchten et. al. 2012)
- Principal and Interest :
 - Maintainability ratings (Nugorho et. al. 2011)
 - Extra effort to modify unnecessarily complex code (Curtis et. al. 2012)
- Little focus on estimating interest.
- Current estimates miss impact of debt on developers' code comprehension **effort.**

Hypothesis

While static code metrics have been shown useful in quantifying Principal for estimating Technical Debt,

Our Hypothesis:

Comprehension effort metrics are useful for quantifying Interest.

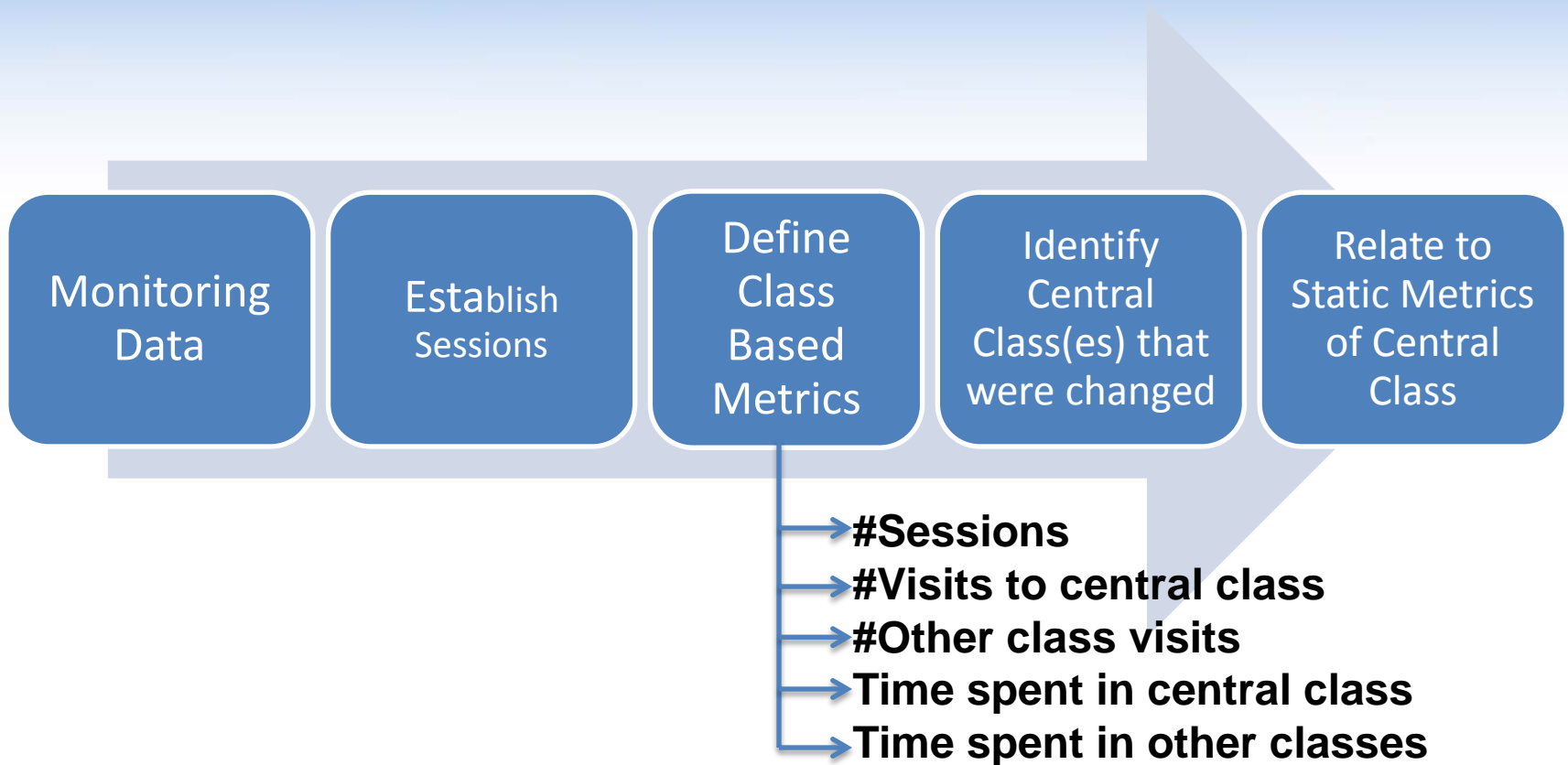
Contributions

Framework to compute Comprehension Effort using Developer Activity Logs:

- Define Class-based Comprehension Effort Metrics computed from developer logs
- Perform initial case study
 - 9 months of developer logs
 - 9888 classes in project

Approach

Goal : Relate static code metrics to developer activity

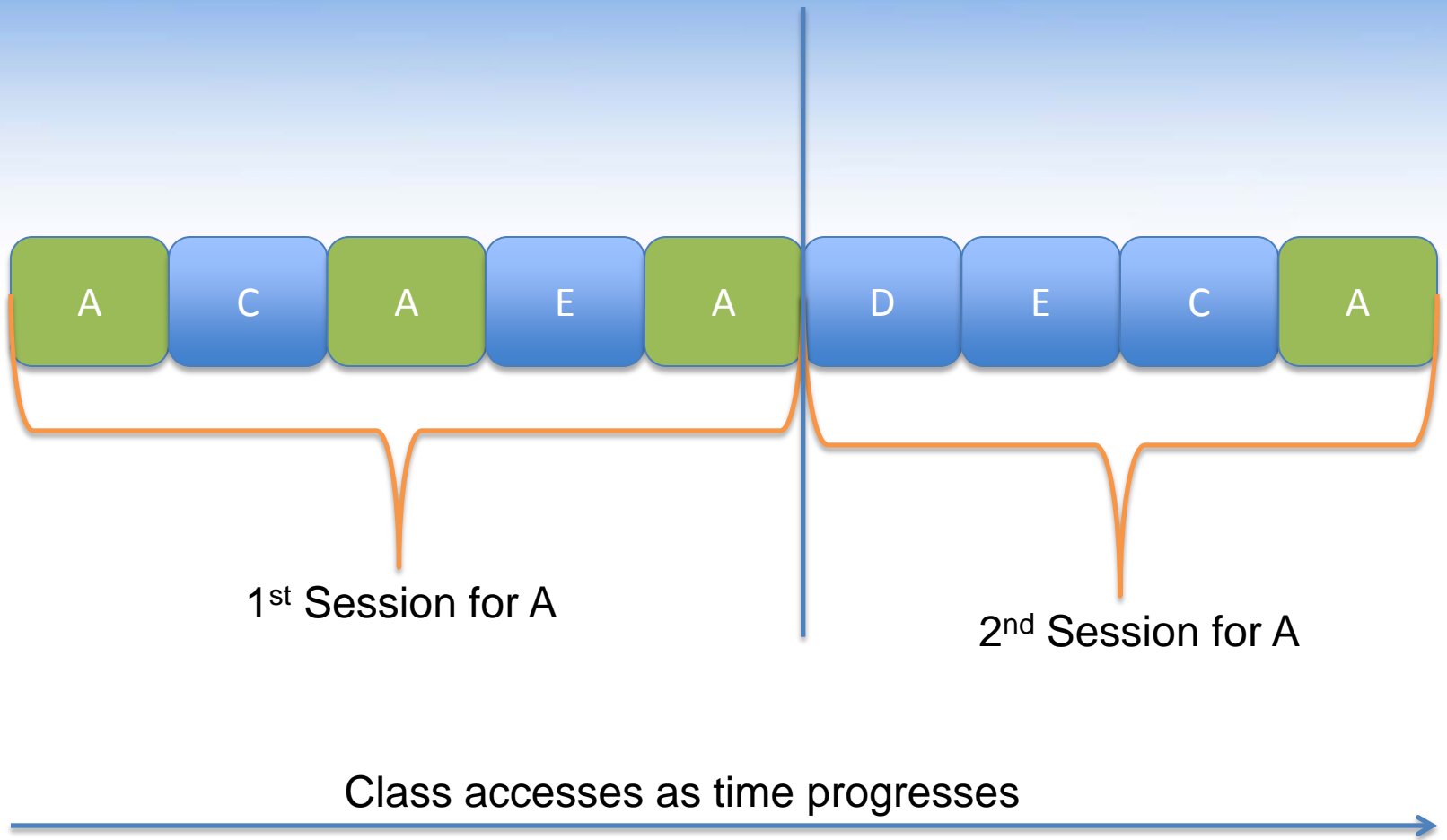


Monitoring IDE Activity with Blaze*

Time-stamp	User	Event	Artifact
22:04:51	N3	View.SourceFile	1acc7366.cs/10
22:04:52	N3	View.OnChangeCaretLine	1acc7366.cs/14
22:04:53	N3	View.OnChangeCaretLine	1acc7366.cs/16
22:04:58	N3	Menu.ViewCallHierarchy	1acc7366.cs/16
22:05:00	N3	View.OnChangeCaretLine	1acc7366.cs/20
22:05:19	N3	View.SourceFile	81c2db1a.cs/1
22:05:22	N3	Edit.Find	81c2db1a.cs/1
22:05:30	N3	Edit.FindNext	81c2db1a.cs/20

* Developed at ABB Inc (Snipes et.al. 2014)

Establish Sessions



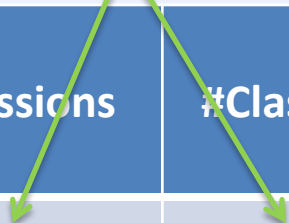
Defining Central Class Based on Effort Metrics

Class	#Sessions	#Class Visits	#Other Class Accesses	Time Spent in Class	Time Spent in Other Classes
A	74	294	78	39 hours	17 hours
B	32	88	52	3 hours	9 hours
C	28	77	52	4.5 hours	9 hours

Comprehension Effort Metrics

Defining Central Class Based on Effort Metrics

Class A visited often and over long period of time



Class	#Sessions	#Class Visits	#Other Class Accesses	Time Spent in Class	Time Spent in Other Classes
A	74	294	78	39 hours	17 hours
B	32	88	52	3 hours	9 hours
C	28	77	52	4.5 hours	9 hours

Comprehension Effort Metrics

Defining Central Class Based on Effort Metrics

Even though No of sessions is low No of Class visits is comparatively high

Class	#Sessions	#Class Visits	#Other Class Accesses	Time Spent in Class	Time Spent in Other Classes
A	74	294	78	39 hours	17 hours
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Comprehension Effort Metrics

Defining Central Class Based on Effort Metrics

Can be interpreted as comprehension time



Class	#Sessions	#Class Visits	#Other Class Accesses	Time Spent in Class	Time Spent in Other Classes
A	74	294	78	39 hours	17 hours
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C	28	77	52	4.5 hours	9 hours

Comprehension Effort Metrics

Relating Effort to Static Metrics

Class	#Class Base	#Class Coupled	#Class Derived	#LOC (Top Rank %)	#Declared Method(Top Rank %)
A	10	272	1	0.05%	0.13%
B	3	98	0	0.12%	2.20%
C	1	32	0	0.70%	6.90%

Class Level Code Structure Metrics

Relating Effort to Static Metrics

Class	#Class Base	#Class Coupled	#Class Derived	#LOC (Top Rank %)	#Declared Method (Top Rank %)
A	10	272	1	0.05%	0.13%
B	3	98	0	0.12%	2.20%
C	1	32	0	0.70%	6.90%

Class Level Code Structure Metrics

Code Smell



Relating Effort to Static Metrics

Class	#Class Base	#Class Coupled	#Class Derived	#LOC (Top Rank %)	#Declared Method(Top Rank %)
A	10	272	1	0.05%	0.13%
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C	1	32	0	0.70%	6.90%

Class Level Code Structure Metrics

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Comprehension Effort Metrics

Relating Effort to Static Metrics

Class	#Class Base	#Class Coupled	#Class Derived	#LOC (Top Rank %)	#Declared Method (Top Rank %)
A	10	272	1	0.05%	0.13%
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C	1	32	0	0.70%	6.90%

Class Level Code Structure Metrics

Highly Coupled Class

Class	#Sessions	#Class Visits	#Other Class Accesses	Time Spent in Class	Time Spent in Other Classes
A	74	294	78	39 hours	17 hours
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C	28	77	52	4.5 hours	9 hours

Comprehension Effort Metrics

Relating Effort to Static Metrics

Class	#Class Base	#Class Coupled	#Class Derived	#LOC (Top Rank %)	#Declared Method (Top Rank %)
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C	1	32	0	0.70%	6.90%

Comparable Value

Class Level Code Structure Metrics

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Comprehension Effort Metrics

Future Work

- Study of correlation static vs log based comprehension
- Large scale statistical study
- Additional comprehension metrics
- Conduct validation study

Acknowledgements : Thank you ABB for supporting this work.