Revealing the Copy and Paste Habits of End Users

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What We Do Not Know

(And why it matters.)

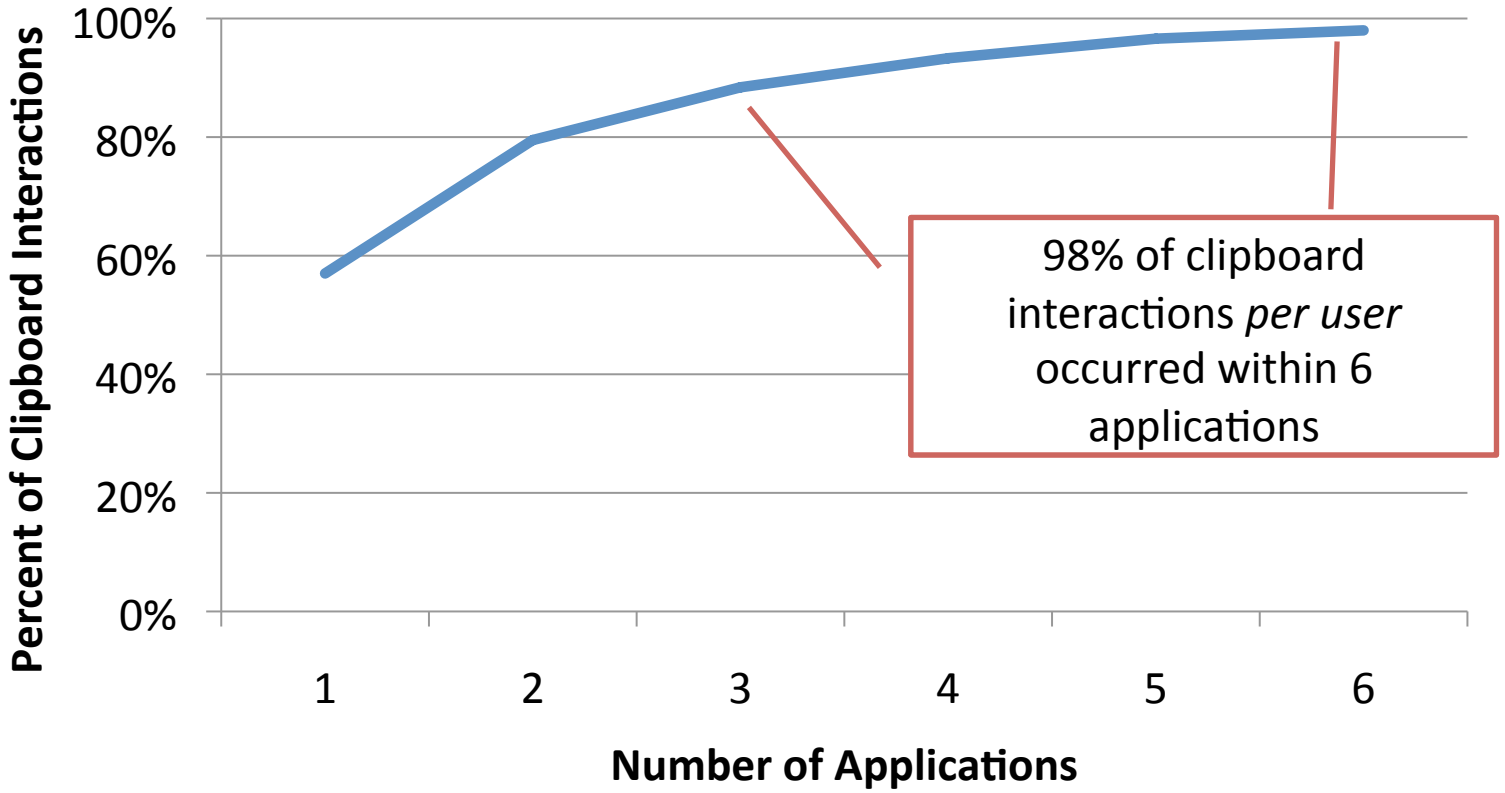
- How frequently is the clipboard used?
- How is the clipboard used across applications?
- In what contexts is data transferred via the clipboard?

Methodology

- Build monitor for clipboard activity
  - Works in Windows XP and Vista
- Distribute tool to end users
  - 15 users, ~50 hours per user
- Process the data
  - 2544 interactions (3% cuts, 45% copies, 52% pastes)
  - Average clipboard interactions per hour: 3.4

How is the Clipboard Used Across Applications?

Application Usage

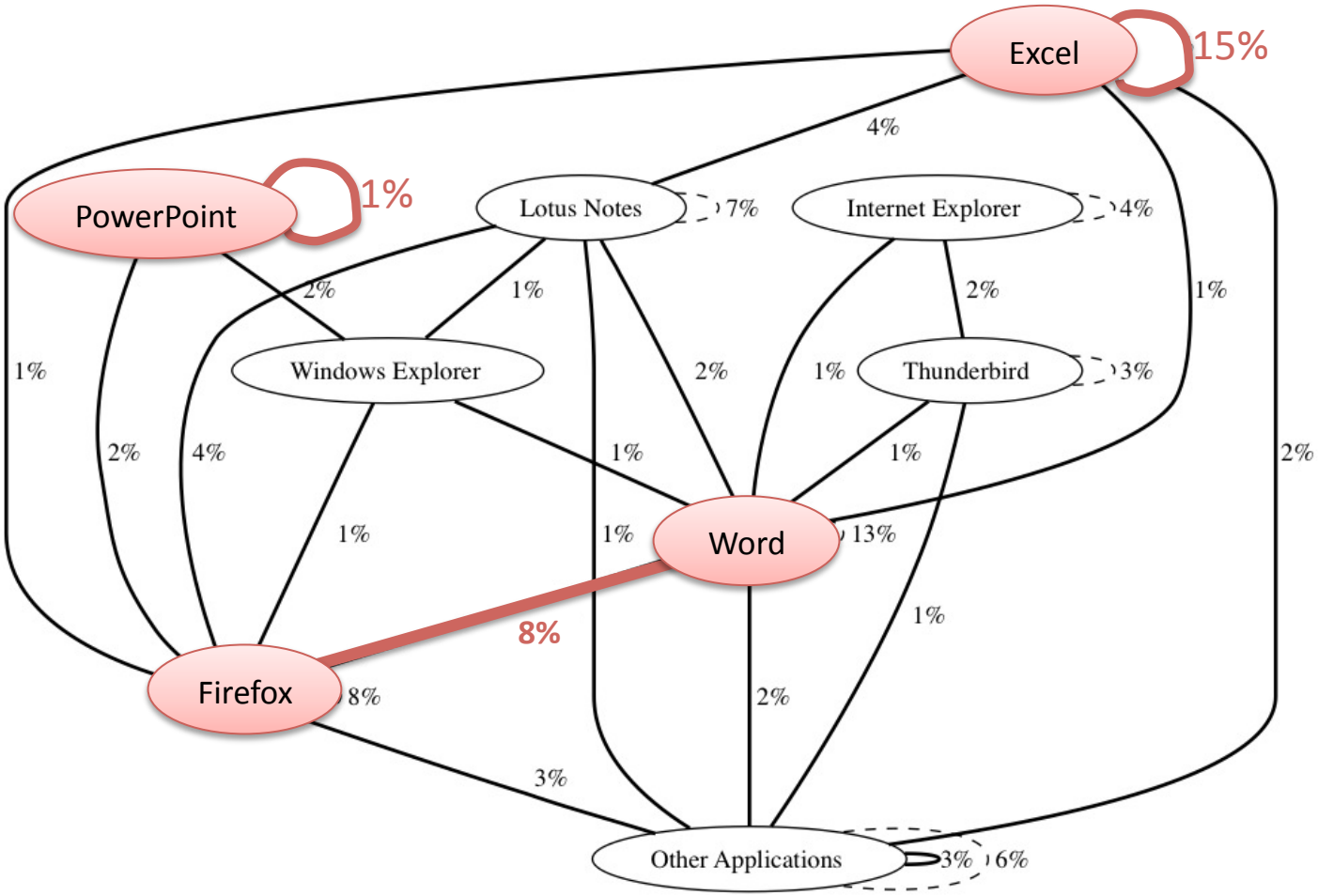


Types of Applications

Type	Percent of Use	Percent as Source -- Destination
Word Processors	26%	36% -- 64%
Web Browsers	23%	58% -- 42%
Email Clients	19%	49% -- 51%
Spreadsheets	18%	51% -- 49%

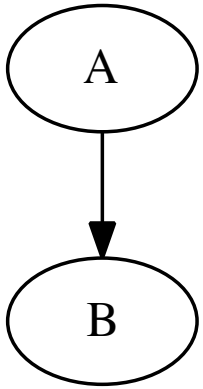
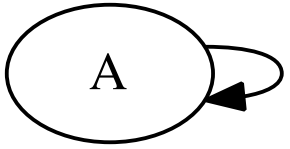
Application Interactions

- 43% of pasted data had been **copied in a different *application***

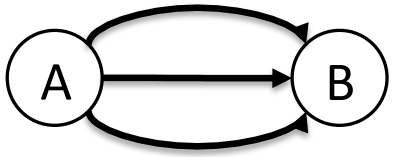


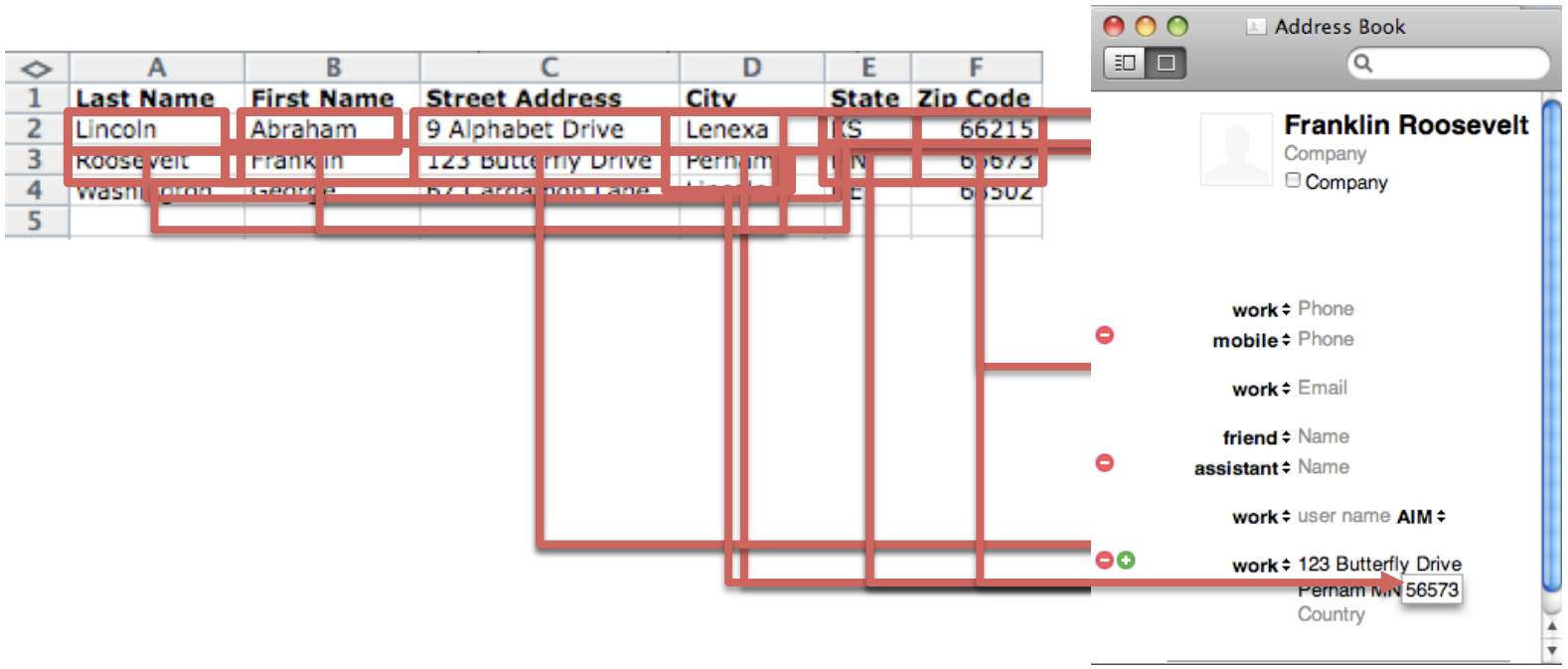
In What Contexts is Data Transferred via the Clipboard?

Elementary Patterns

Pattern	Graph	Overall Usage
Between		65%
Within		35%

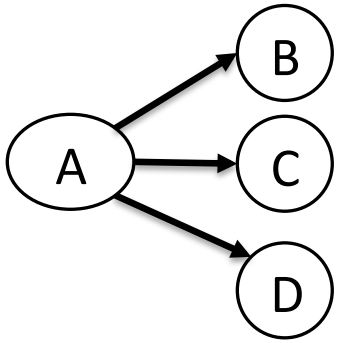
Repeat Pattern

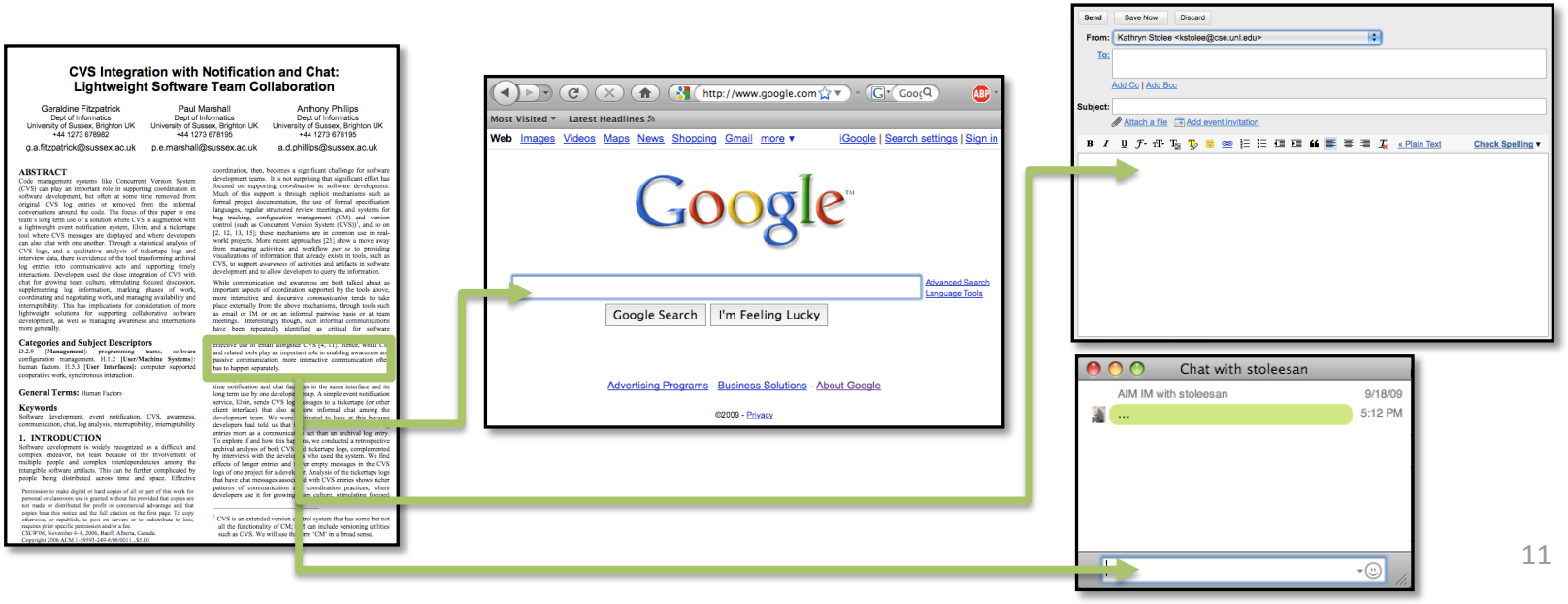
Graph	Overall Usage
	37%



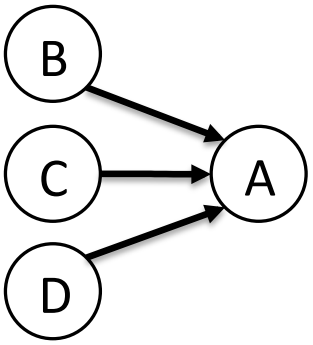
	A	B	C	D	E	F
1	Last Name	First Name	Street Address	City	State	Zip Code
2	Lincoln	Abraham	9 Alphabet Drive	Lenexa	KS	66215
3	Roosevelt	Franklin	123 Butterfly Drive	Pernam	MN	56573
4	Washington	George	67 Cardamon Lane	Mount Vernon	VA	22302
5						

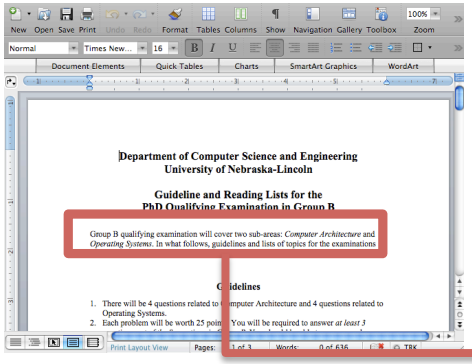
Distribution Pattern

Graph	Overall Usage
	32%



Composition Pattern

Graph	Overall Usage
	18%

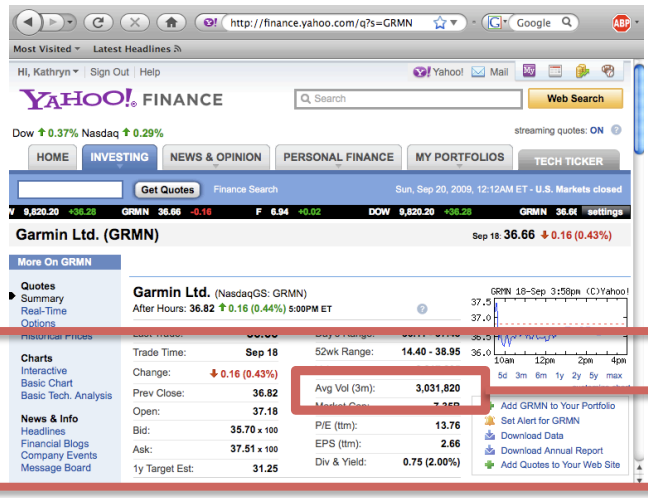


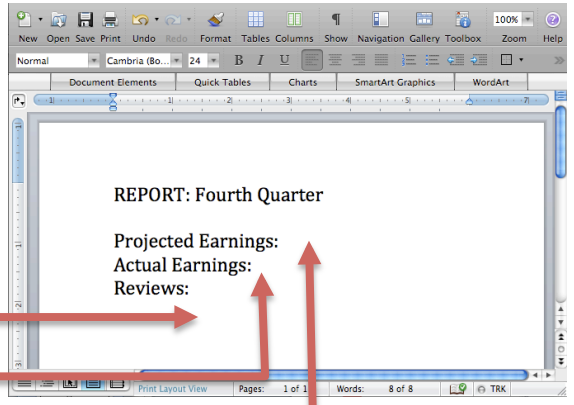
Department of Computer Science and Engineering
University of Nebraska-Lincoln

Guideline and Reading Lists for the
PhD Qualifying Examination in Group B

Group B qualifying examination will cover two sub-areas: *Computer Architecture* and *Operating Systems*. In what follows, guidelines and lists of topics for the examinations

1. There will be 4 questions related to Computer Architecture and 4 questions related to Operating Systems.
2. Each problem will be worth 25 points. You will be required to answer *at least 3*



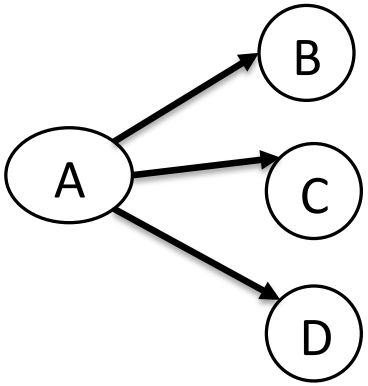


A	B	C
Quarter	Earnings	Diff from Last Year
1	56K	4K
2	48K	2K
3	32K	5K
4	100K	1K

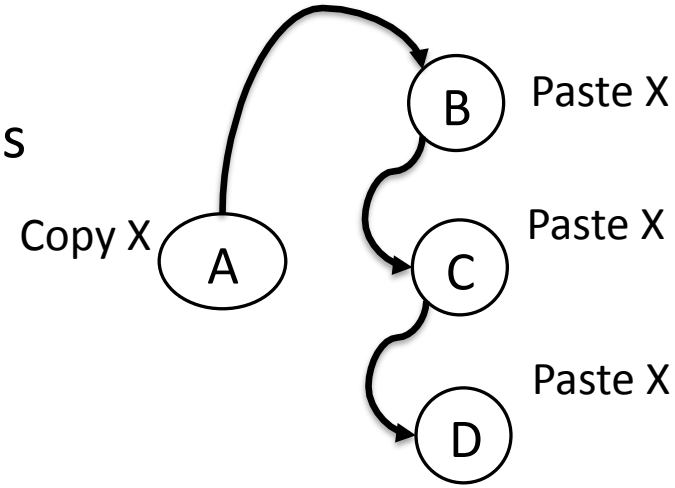
A Closer Look at the Complex Patterns

Distribution Pattern – 32%

Data Flow



Changes in Window Focus

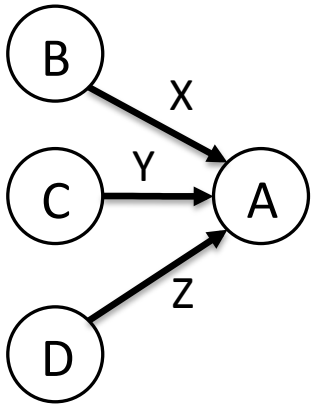


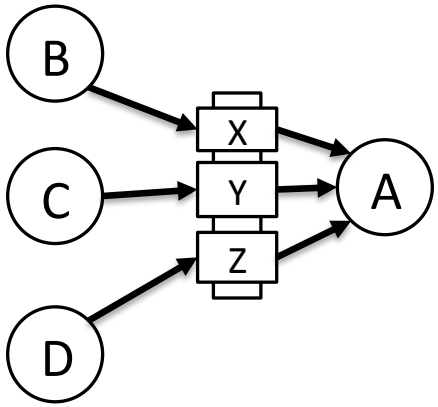
Composition Pattern – 18%

nd z

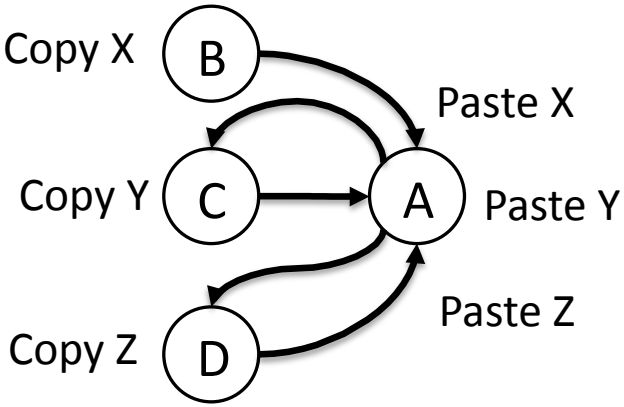
Current Clipboard **Multiple Clipboard Buffers**

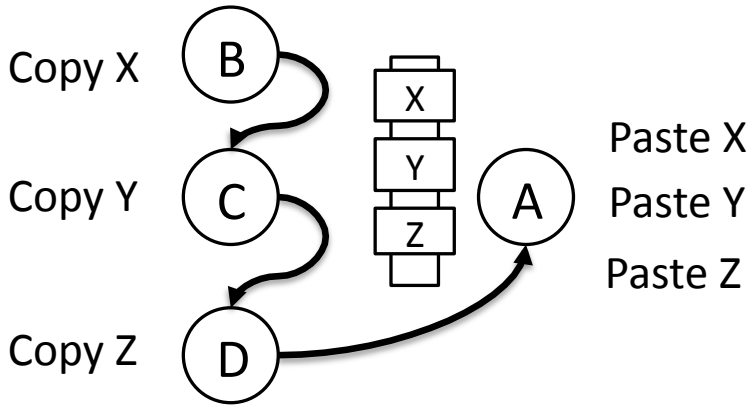
Data Flow





Changes in Window Focus



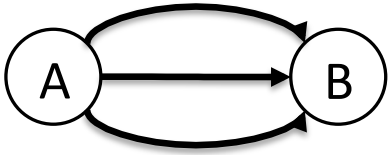


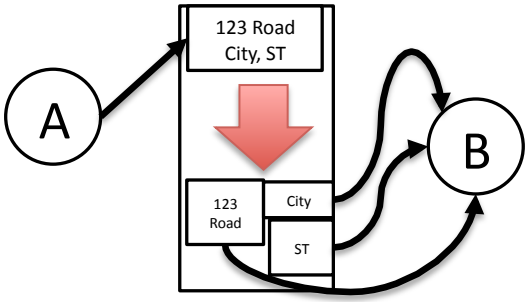
Repeat Pattern – 37%

Current Clipboard

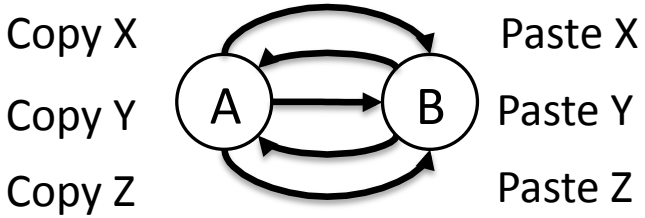
Context Sensitivity:
Term Extraction &
Multiple Pastes

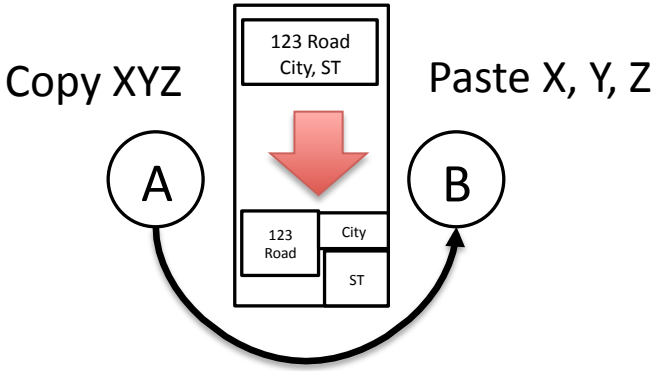
Data Flow





Changes in
Window Focus



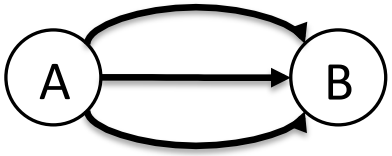


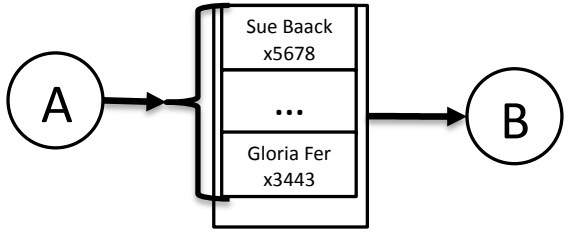
Repeat Pattern – 37%

Current Clipboard

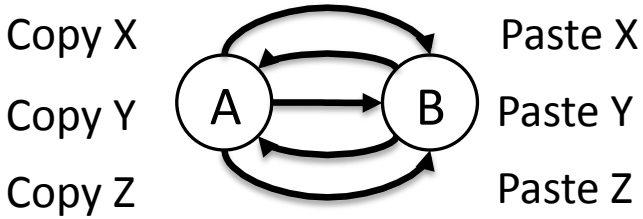
Iteration

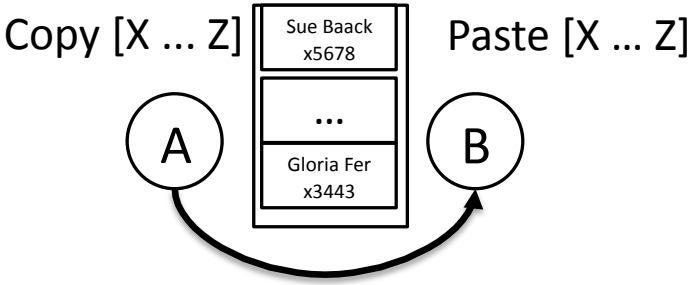
Data Flow





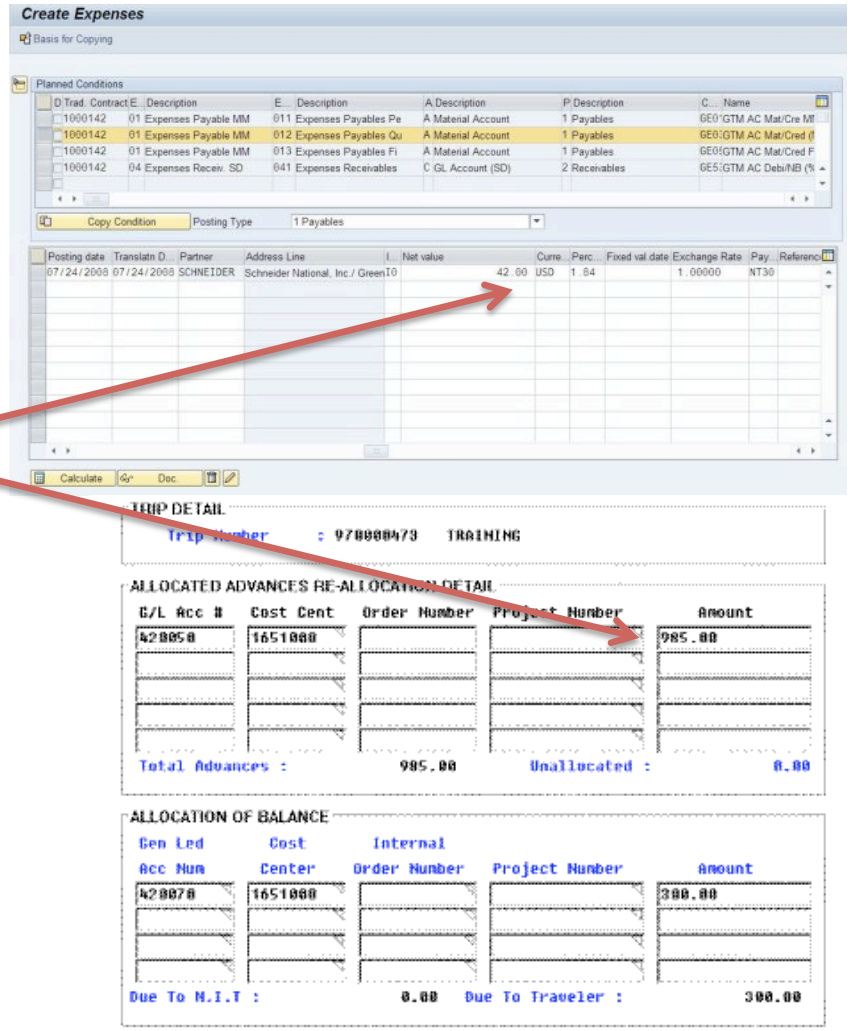
Changes in Window Focus





Distribution Pattern, Revisited

ESTIMATED EXPENSES		
TRANSPORTATION(DESIRED METHOD AND AMOUNT):		
STATE VEHICLE	$	
PERSONAL VEHICLE	£	5.00
AIRFARE	£	515.00
CAR RENTAL		
LODGING	£	436.00
MEALS	£	200.00
REGISTRATION FEES	£	370.00
TAXI & FARES	£	96.00
OTHER EXPENSES		
TOTAL ESTIMATED EXPENSES	$ £	1,622.00



Implications

Table of Tool Support

Feature	Citrine	Clip-Mate	MS Office	Quick Click	Restack & Roll	Topes
Works with all applications		+			+	
Holds multiple items	+	+	+	+		
Extract context from data	+			+		+
Facilitates multiple pastes at once	+			+		
Iterates through multiple items						
Reduces changed in window focus	+	+	+	+		
Helps manage multiple windows					+	
User-defined formatting support						+
Searches for type errors in dest.						+
Searches for context dependencies						
Represents data as objects						
Keeps track of provenance		+				

Conclusion

- We studied how end users use the clipboard
  - End users copy and paste within a few applications
  - End user behavior is repetitive
  - A small set of patterns represents end user behavior
- We identified several support features
  - Context-sensitivity
  - Sequential iteration
  - User-defined formatting support
  - Search for type errors in destination
  - …

Future Work

- Do the results extend to a larger population?
- What is the lifetime of data?
- What transformations are performed on the data?
- How effective can the proposed features be?

- Empirical study scheduled for November

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