Research On Knowing

Bootstrapping a Language Workbench

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Reinventing computer programming to revolutionize how we learn, understand and create.

Language of Languages (LoLs)

Workbench

Legacy Application Modernization

Automated Test

Mobile, Wearable Devices, Etc.

Programming Language
Fortran
Cobol

Software
Libraries
OS

Programming Language
C
Java
Ruby

Architecture
Batch
Timeshare

Architecture
Client-Server
Web

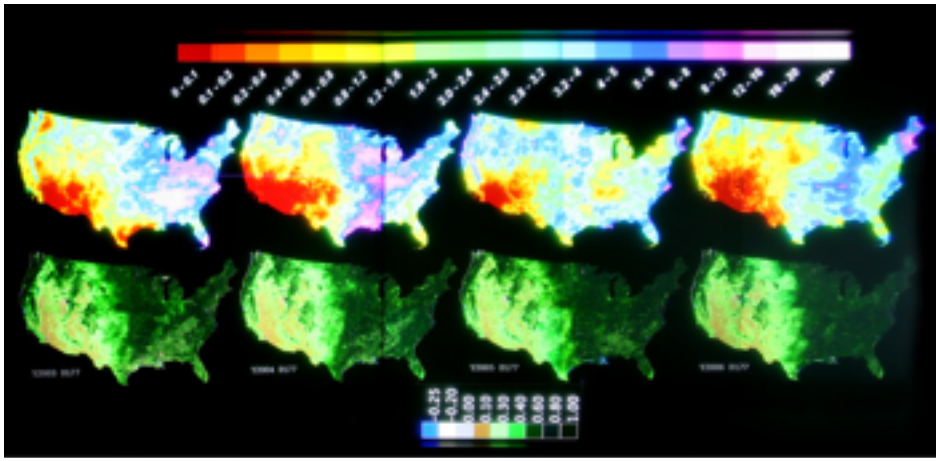
Data
Files
CSV
Relational DB

Data
XML/JSON
Big Data

Graphical Business Model

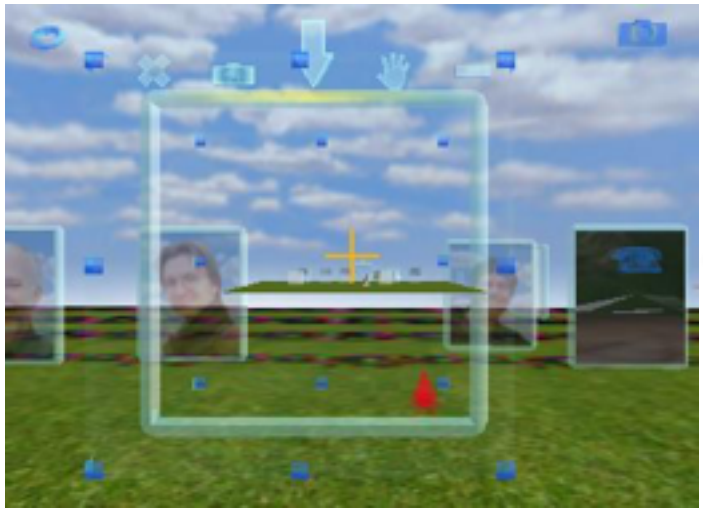
Computing for Climate Change

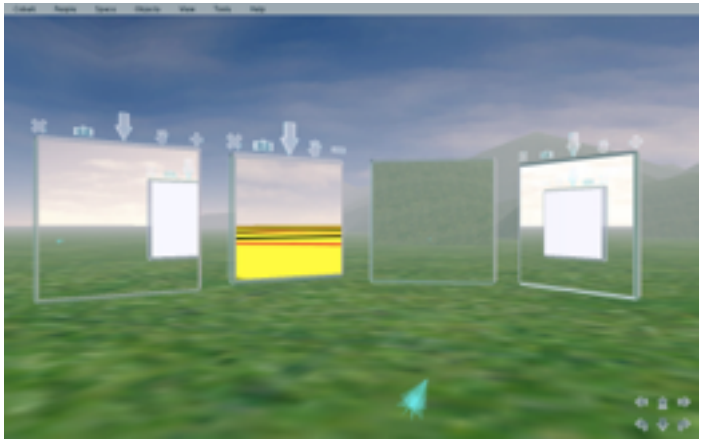
High-level Modeling Languages



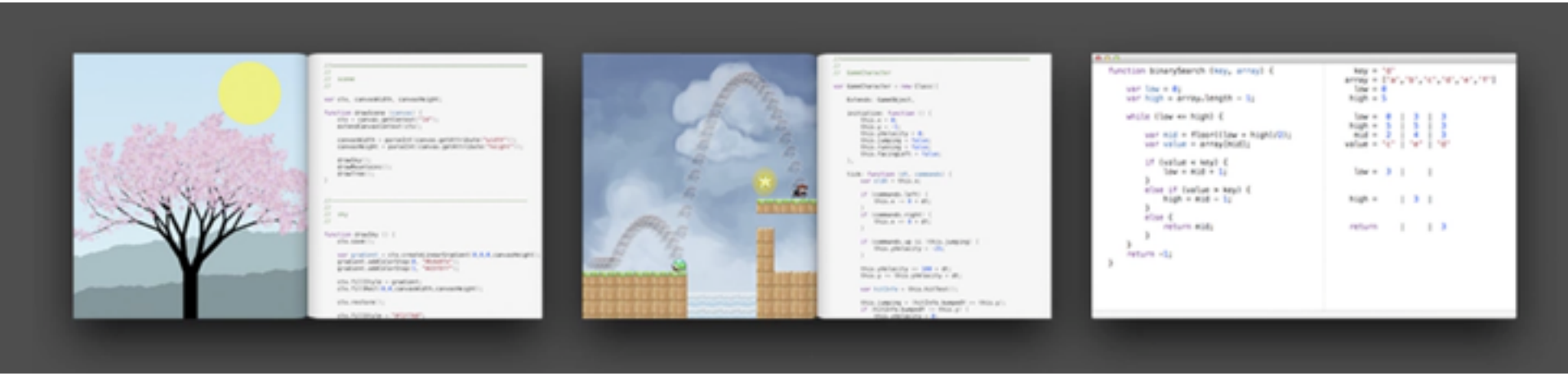
Data Integration & Visualization

3D Gaming Collaboration Environment





A Future of Programming Vision



Inventing on Principle by Bret Victor
http://vimeo.com/36579366

for more…
http://worrydream.com

What is a Domain Specific Language?

Language specialized to a particular application domain or area of expertise

What is a Language Workbench?

Development Environment to create and use Domain Specific Languages

Domain Problem to Solution

Domain Idea

$M=AB$

where $M_{i,j}=\sum_{k} A_{i,k} \times B_{k,j}$

Machine Language
Manual Coding

- slow
- tedious
- error prone

Domain Problem to Solution

Domain Idea

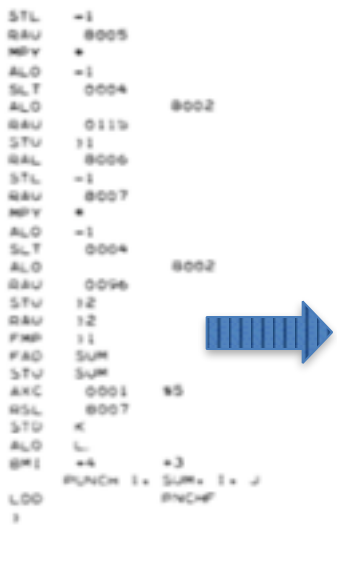
$M=AB$

where $M_{i,j}=\sum_{k} A_{i,k} \times B_{k,j}$

Assembler Coding

- big improvement
- but still pretty
  - slow
  - tedious
  - error prone

SOAP



BINARY

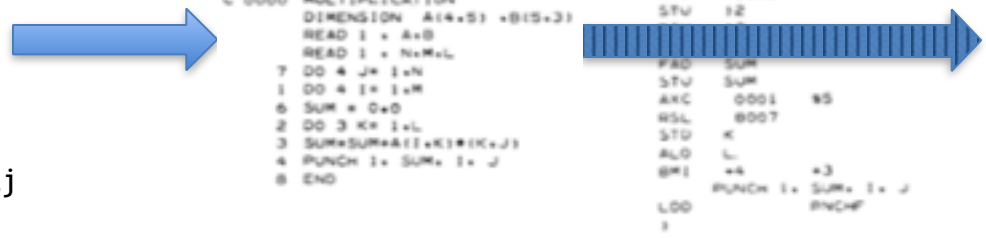
Domain Problem to Solution

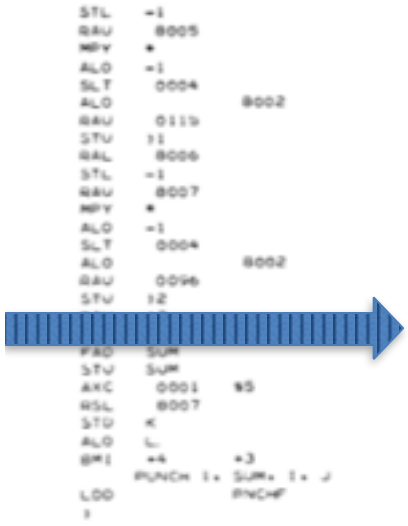
Domain Idea

M=AB

$$\text{where } M_{i,j}=\sum_{k} A_{i,k} \times B_{k,j}$$

FORTRAN
4X Improvement





"Why would you want more than machine language?"

-John von Neumann (1954)

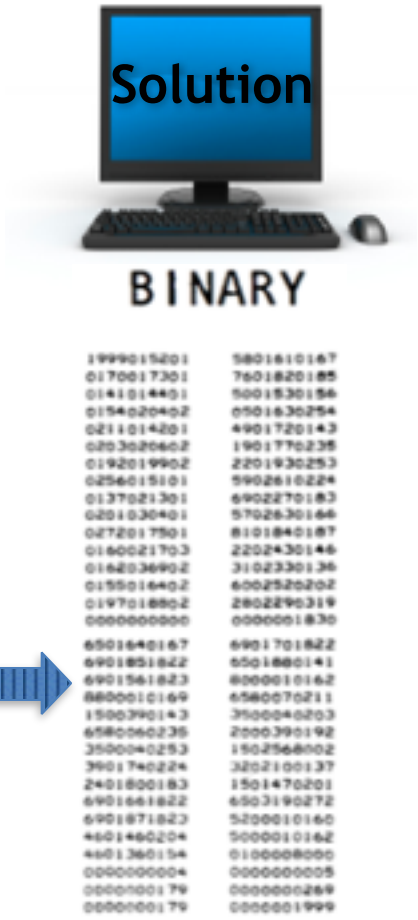
Domain Problem to Solution

Domain Idea

$M=AB$

where $M_{i,j}=\sum_{k} A_{i,k} \times B_{k,j}$

Insert Your Favorite Language



Domain Problem to Solution

Domain Idea

$M=AB$

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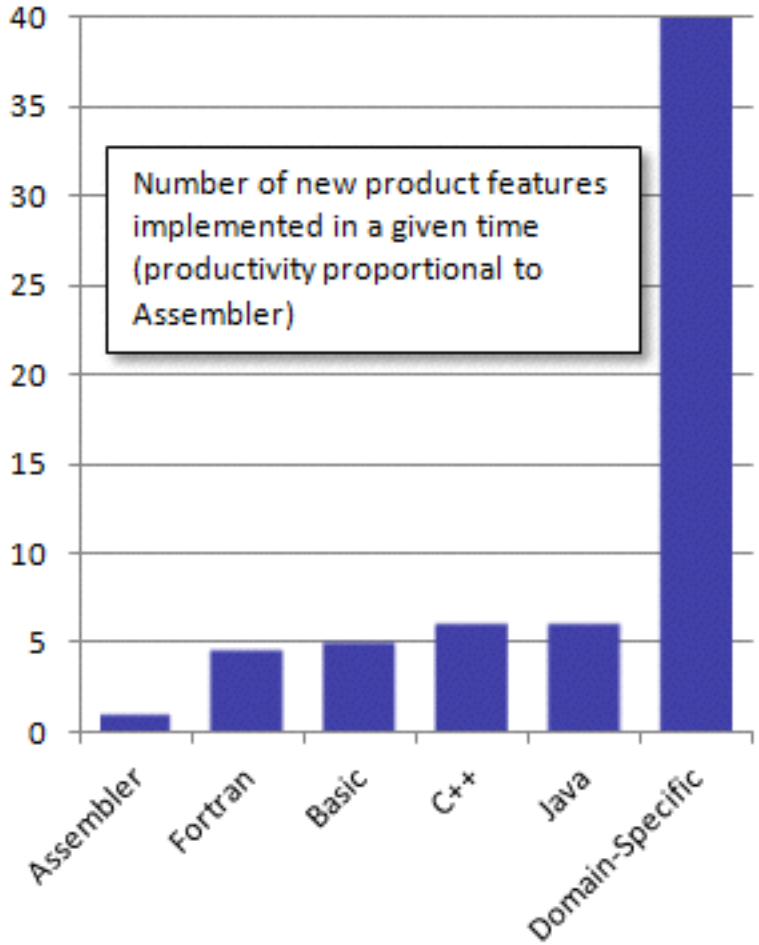
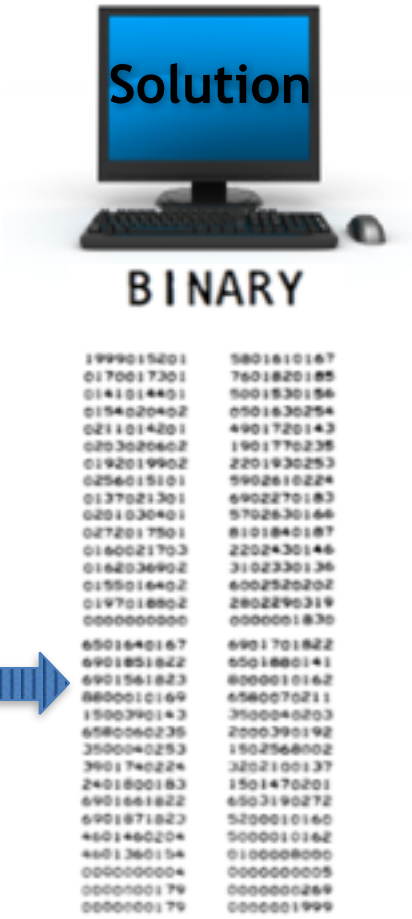




[Software Productivity Research, MetaCase](MetaCase)

Domain Problem to Solution

Domain Idea

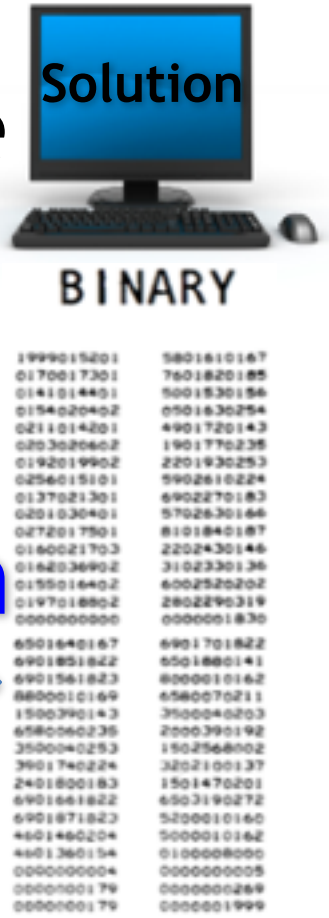
Domain Specific Language
10X over Fortran
40X over Assembler
needs

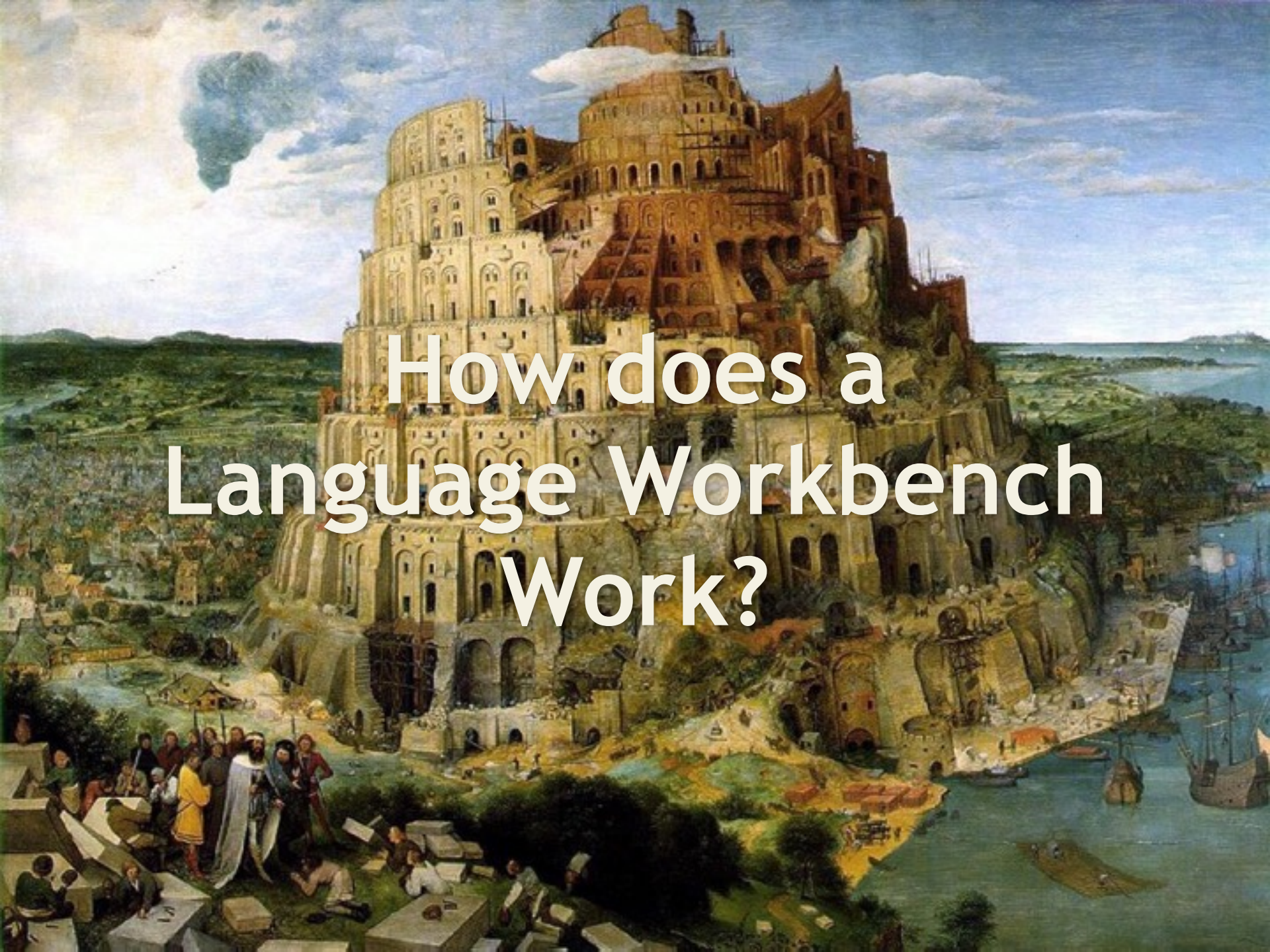
Language Workbench

Metalanguage

$M=AB$

where $M_{i,j}=\sum_{k} A_{i,k} \times B_{k,j}$




How does a
Language Workbench
Work?

Traditional View of Translation

Focus on
Source and
Target Languages

Source Language

FORTRAN

```
C 0000  RECTANGULAR MATRIX
C 0000  MULTIPLICATION
        DIMENSION  A(4,5) ,B(5,3)
        READ 1 , A,B
        READ 1 , N,M,L
      7 DO 4 J= 1,N
      1 DO 4 I= 1,M
      6 SUM = 0.0
      2 DO 3 K= 1,L
      3 SUM=SUM+A(I,K)*B(K,J)
      4 PUNCH 1, SUM, I, J
      8 END
```

Target Language

SOAP

```
STL    -1
RAU    0005
MPY    *
ALO    -1
SLT    0004
ALO            0002
RAU    0115
STU    11
RAL    0006
STL    -1
RAU    0007
MPY    *
ALO    -1
SLT    0004
ALO            0002
RAU    0096
STU    12
RAU    12
FMP    11
FAD    SUM
STU    SUM
AXC    0001    45
RSL    0007
STU    K
ALO    L
BMI    +4      +3
       PUNCH 1, SUM, I, J
LOD            PNCHF
)
```

Traditional Translator

Abstract Syntax Tree

Syntax & Semantic Analysis

Code Generation

FORTRAN

```
C 0000  RECTANGULAR MATRIX
C 0000  MULTIPLICATION
        DIMENSION  A(4,5) ,B(5,3)
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SOAP

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MPY     *
ALO     -1
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RAU      0115
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STL     -1
RAU      0007
MPY     *
ALO     -1
SLT      0004
ALO                 0002
RAU      0096
STU     12
RAU     12
FMP     11
FAD     SUM
STU     SUM
AXC      0001       X5
RSL      0007
STU     K
ALO     L
BMI      +4         +3
        PUNCH 1, SUM, I, J
LOD                 RNCHF
3
```
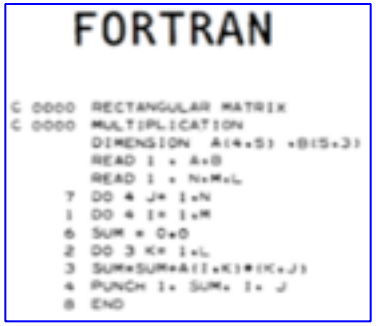
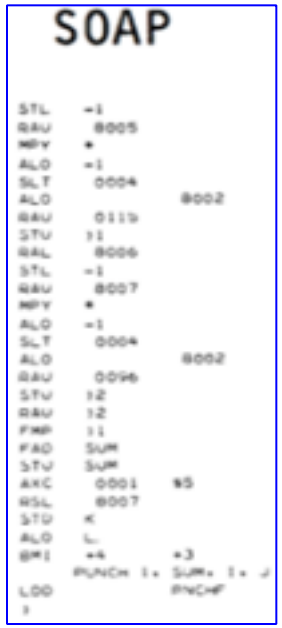

Focus on
Source and
Target Languages

Language Workbench View





Source
Code Generation and
Projectional Editor

Object
Code Generation

Internal Representation like Abstract Syntax Tree

Will the Real Software Please Come Forward?

$$M=AB$$

$$\text{where } M_{i,j}=\sum^{k} A_{i,k} \times B_{k,j}$$

FORTRAN

```
C 0000  RECTANGULAR MATRIX
C 0000  MULTIPLICATION
        DIMENSION  A(4,5) ,B(5,3)
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        READ 1 , N,M,L
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      8 END
```

SOAP

```
STL     -1
RAU      0005
MPY     *
ALO     -1
SLT      0004
ALO              0002
RAU      0119
STU     11
RAL      0006
STL     -1
RAU      0007
MPY     *
ALO     -1
SLT      0004
ALO              0002
RAU      0096
STU     12
RAU     12
FMP     11
FAD     SUM
STU     SUM
AXC      0001    X5
RSL      0007
STU     K
ALO     L
BMI     -4       +3
        PUNCH 1, SUM, I, J
LOD              PNCHF
1
```

BINARY

```
1999015201  5801610167
0170017301  7601820185
0141014401  5001530156
0154020402  0501630254
0211014201  4901720143
0203020602  1901770235
0192019902  2201930253
0256015101  5902810224
0137021301  6902270183
0201030401  5702630164
0272017501  8101840187
0160021703  2202430146
0162036902  3102330136
0155016402  6002520202
0197018802  2802290319
0000000000  0000001830

6501640167  6901701822
6901851822  6501880141
6901561823  8000010162
8800010169  6580070211
1500390143  3500040203
6580060235  2000390192
3500040253  1502568002
3901740224  3202100137
2401800183  1501470201
6901661822  6503190272
6901871823  5200010160
4601460204  5000010162
4601360154  0100008000
0000000004  0000000005
0000000179  0000000269
0000000179  0000001999
```

Can I add another language?

Language of Languages (LoLs)

Workbench

Free

nothing to buy

Open Source

everything accessible

Software as a Service

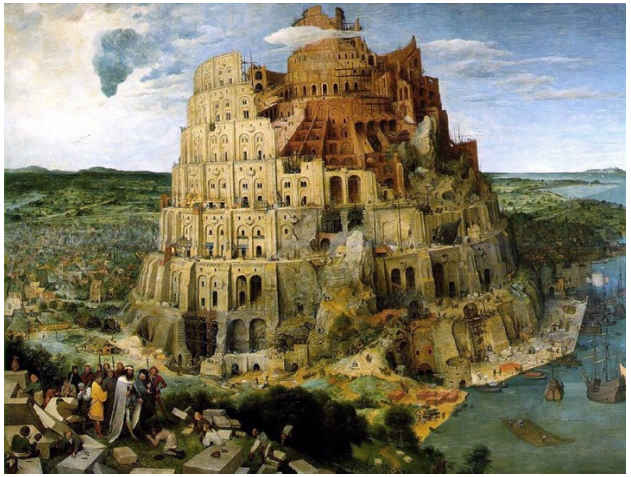
nothing to download, install or configure

Client-side (JavaScript)

your Intellectual Property(IP) doesn't leave your desktop

LanguageOfLanguages.com/workbench/

Low Barrier to Adoption!



Language of Languages (LoLs)

Workbench

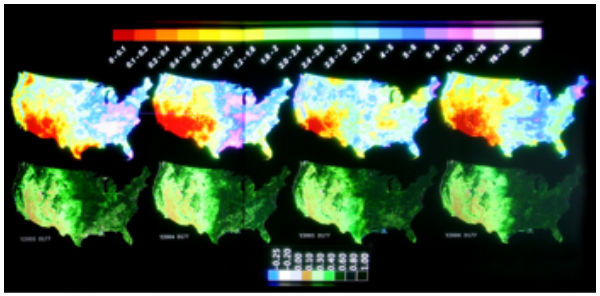
Language Of Languages demo

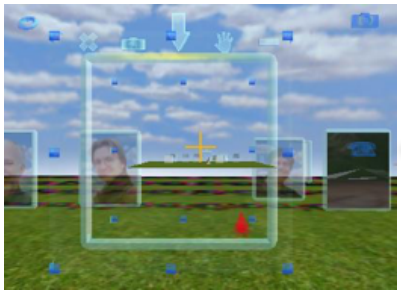
https://github.com/jamiedouglass/LanguageOfLanguages

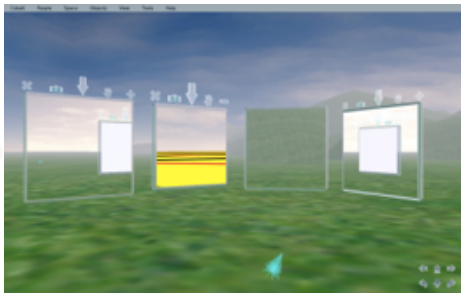
So that's a Language Workbench…

Now What?

Computing for Climate Change

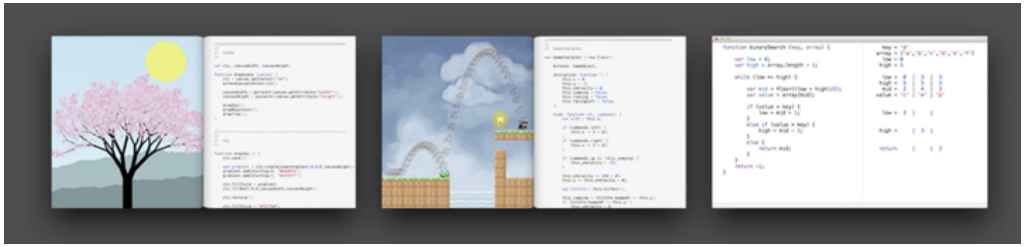






Legacy Application Modernization

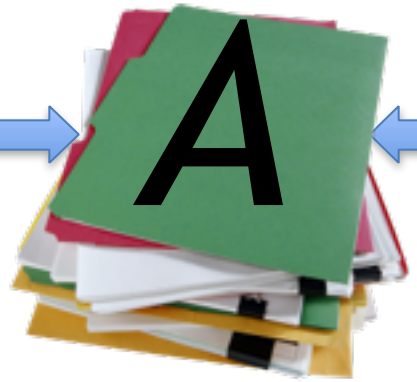
A Future of Programming Vision via Bret Victor



What's
your idea?

Development Areas

Applications



Languages

Tools

A Contributors Experience

—Alyssa Pavao

- How I found out about Language of Languages
  - I heard Andi and Jamie talk about open source at a Western resume writing workshop
  - I followed up to learn more about Language of Languages and how I could get involved
- My current Language of Languages project is Client-side Federated Logon
- What I hope to get out of contributing to Language of Languages
  - learn and demonstrate new skills
  - enhance my computing portfolio and resume
  - advancing language workbench technology
  - working on a fun, open source project

WESTERN'S AWC/ACM PRESENTS

Spice up your resume by learning about & collaborating on real-world open source projects

Open your mind, Open your code

OPEN SOURCE DAY AT WWU

On Saturday May 9th ,

join us in VU565 from 9:30- 5:30

free for students, $ 10 for non

http://www.wwu.edu/emarket/opensourceday/

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Questions

?

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Andi@ResearchOnKnowing.com

https://github.com/jamiedouglass/LanguageOfLanguages