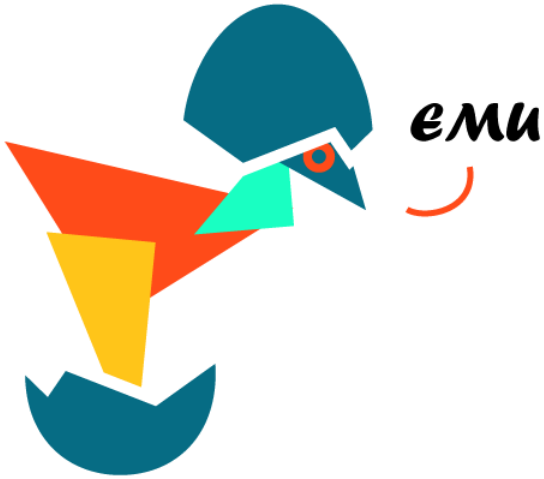


EMU: Element Manipulation Language

Philip Liou
Project Manager

Steve Pappas
Language Guru

Michael Wojcieszek
System Architect

Celia Hsu
System Integrator

Yi-Chen Lin
Verification & Validation

5/16/2013

Outline

Motivation

Introduction

Syntax

Translator Architecture

Software Tools

Run-time Environment

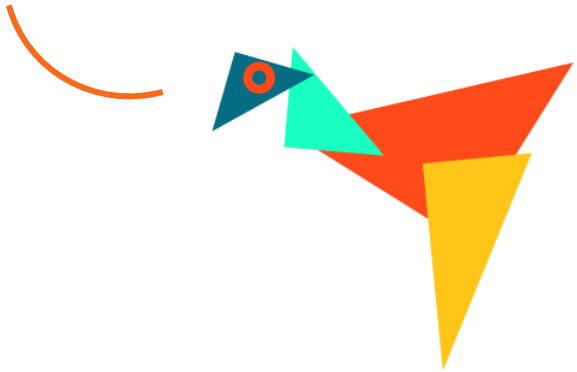
Compiler-Generator Tools

Test Plan

Project Management

Conclusions / Demo

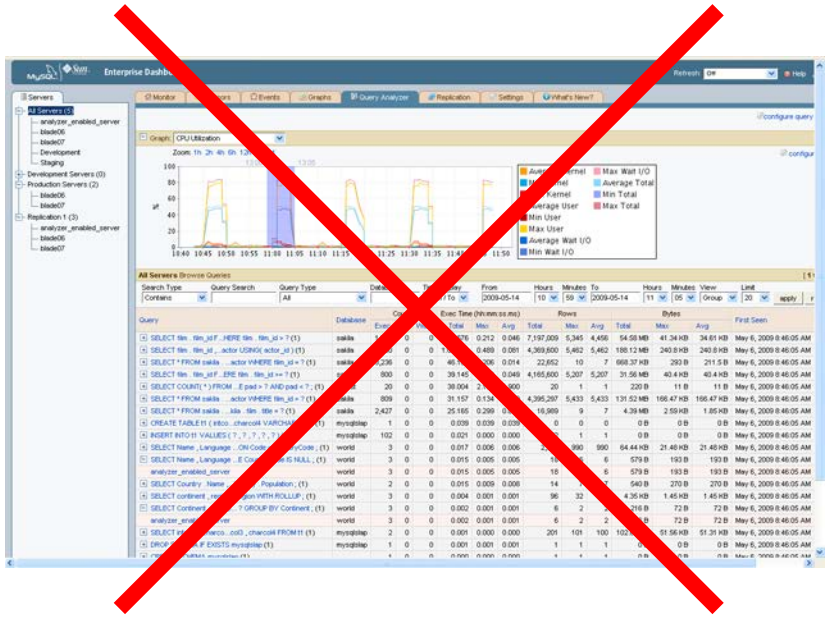
Why EMU?

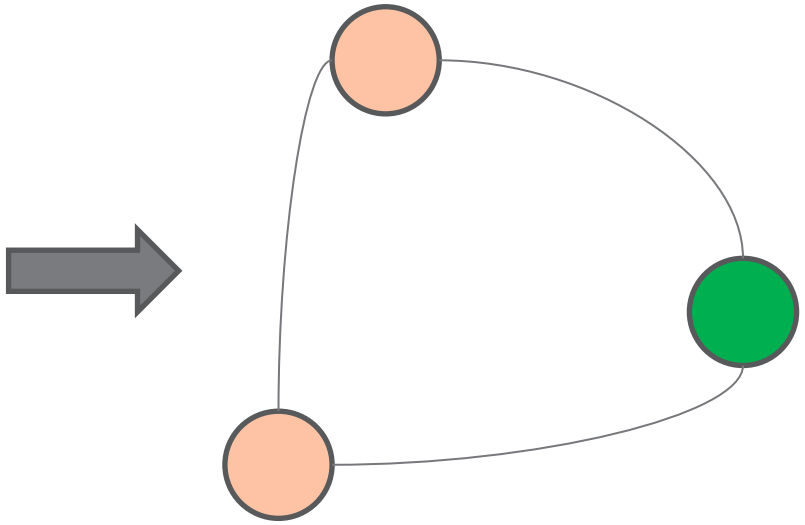


Motivation

Why Emu?

- Easy tasks with easy tools



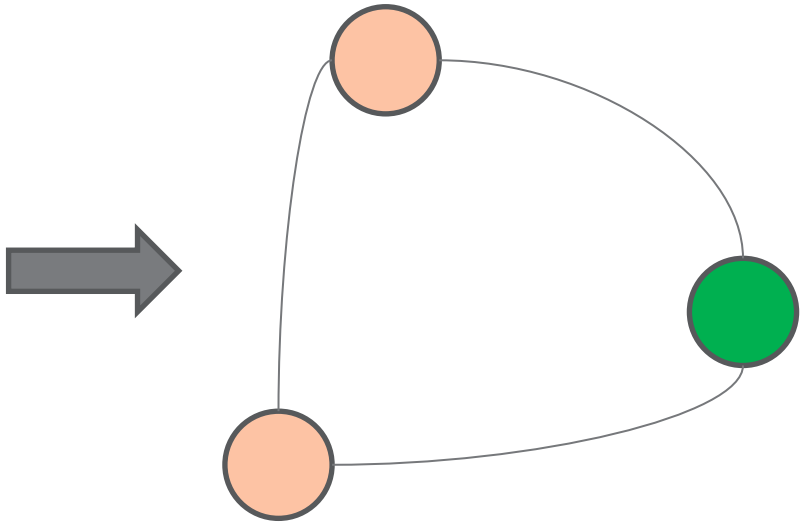


Motivation

Why Emu?

- Easy tasks with easy tools

```
type Song;
type Artist;
$Artist art1 = <"Kelly Clarkson">.add();
$Song kc1 = <"Stronger">.add();
$Song kc2 = <"Dark Side">.add();
$Edge e = <kc1, kc2, 3.0>.add();
art1 -> [kc1, kc2];
```



Introduction

Shan-Chi Hsu (System Integrator)

Introduction

- **EMU** is a programming language that helps the expression and manipulation of relationships between data by graph-like structures.
- A **Node** represents an object with a specific type defined by developers.
- EMU provides two ways of expressing relations between *Nodes*: **references** and **edges**.

Introduction

- What are the characteristics of EMU?
  - **Intuitive** : The structure is similar to a general graph.
  - **Familiar** : Much of the syntax is similar to that in Java.
  - **Visual** : A built-in function is provided to visualize data.
  - **Reusable** : Object construction code can be used across multiple programs.
  - **Flexible** : The construction is not tied to a rigid schema.

Syntax

Shan-Chi Hsu (System Integrator)

Syntax

- Data Types : int, double, string, array, Edge, Node
- Control Statements : if/else, while, for, foreach
- Basic operators : =, ==, !=, &&, | |, >, <, >=, <=, +, -, *, /, %, +=, -=, *=, /=, %=, ++, --, [], ()
- String operators : +, +=
- Node/Edge operators : < >, .refs(), .edges(), .value, .type, ->, <->, *
- Array operators : .length, +=, -=
- Built-in functions : print(), graph(), .opposite(n), .add(), .remove()

Syntax

```
# Declare Node types
type Song;
type Artist;
# Create an Artist node with value “Kelly Clarkson”
$Artist art1 = <"Kelly Clarkson">.add();
# Create Song nodes
$Song kc1 = <"Stronger">.add();
$Song kc2 = <"Dark Side">.add();
# Create an edge between kc1 and kc2 with weight 3.0
$Edge e = <kc1, kc2, 3.0>.add();
# Create references of the Artist node to Song nodes
art1 -> [kc1, kc2];
# An equivalent way to create references
# art1.refs() += [kc1];
# art1.refs() += [kc2];
```

Syntax

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# Declare Node types
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# Create an Artist node with value “Kelly Clarkson”
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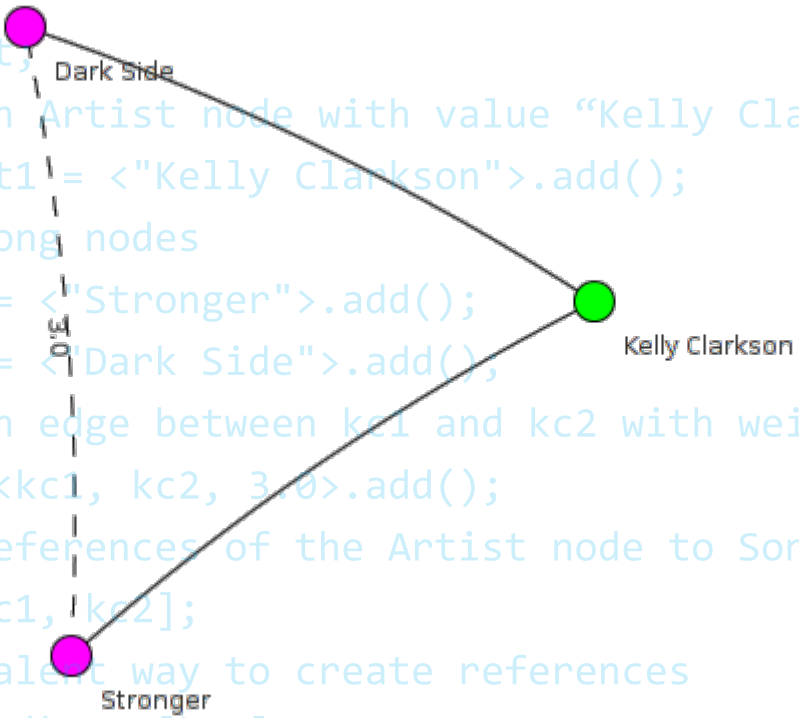
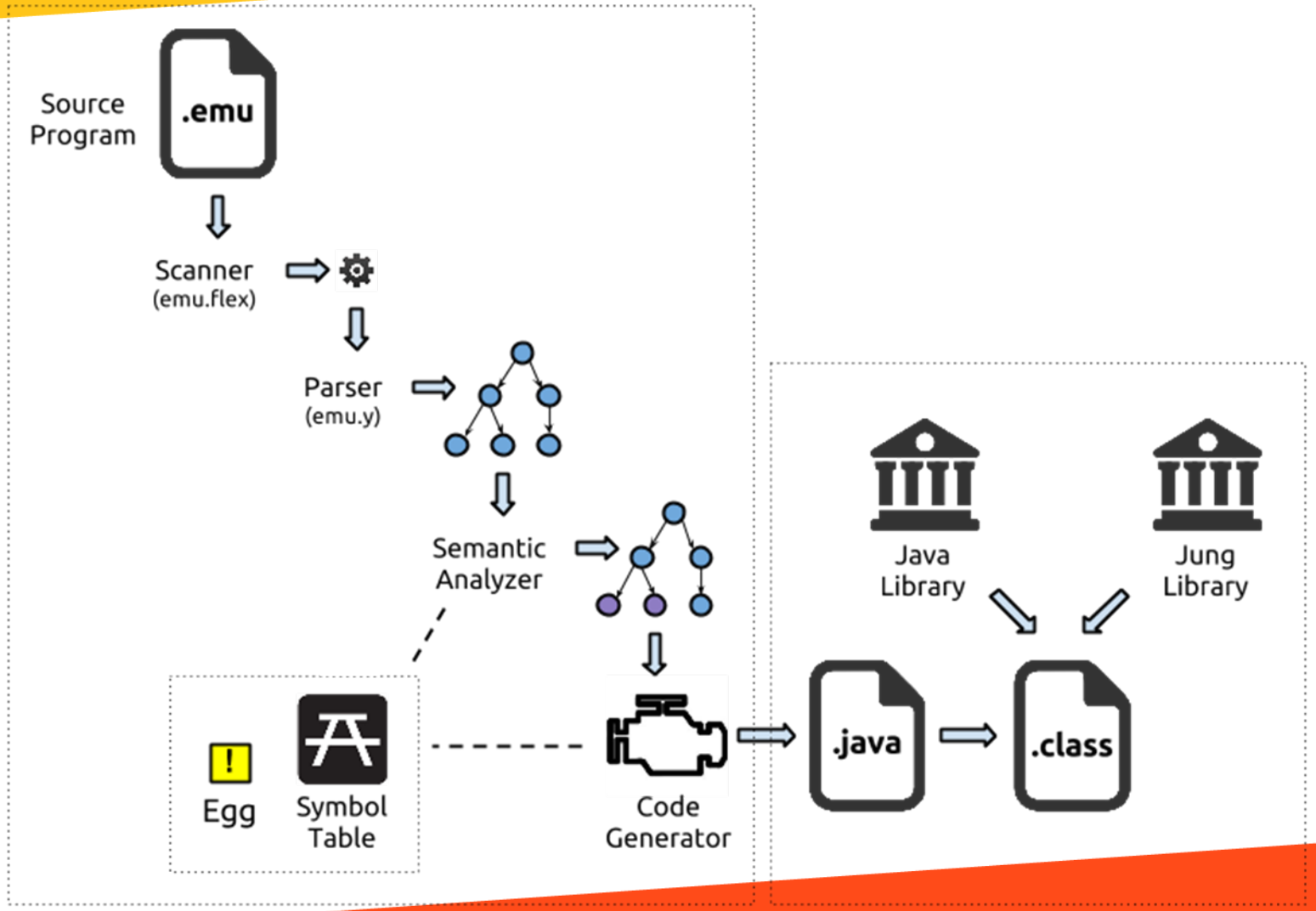


Translator Architecture

Mike Wojcieszek (System Architect)

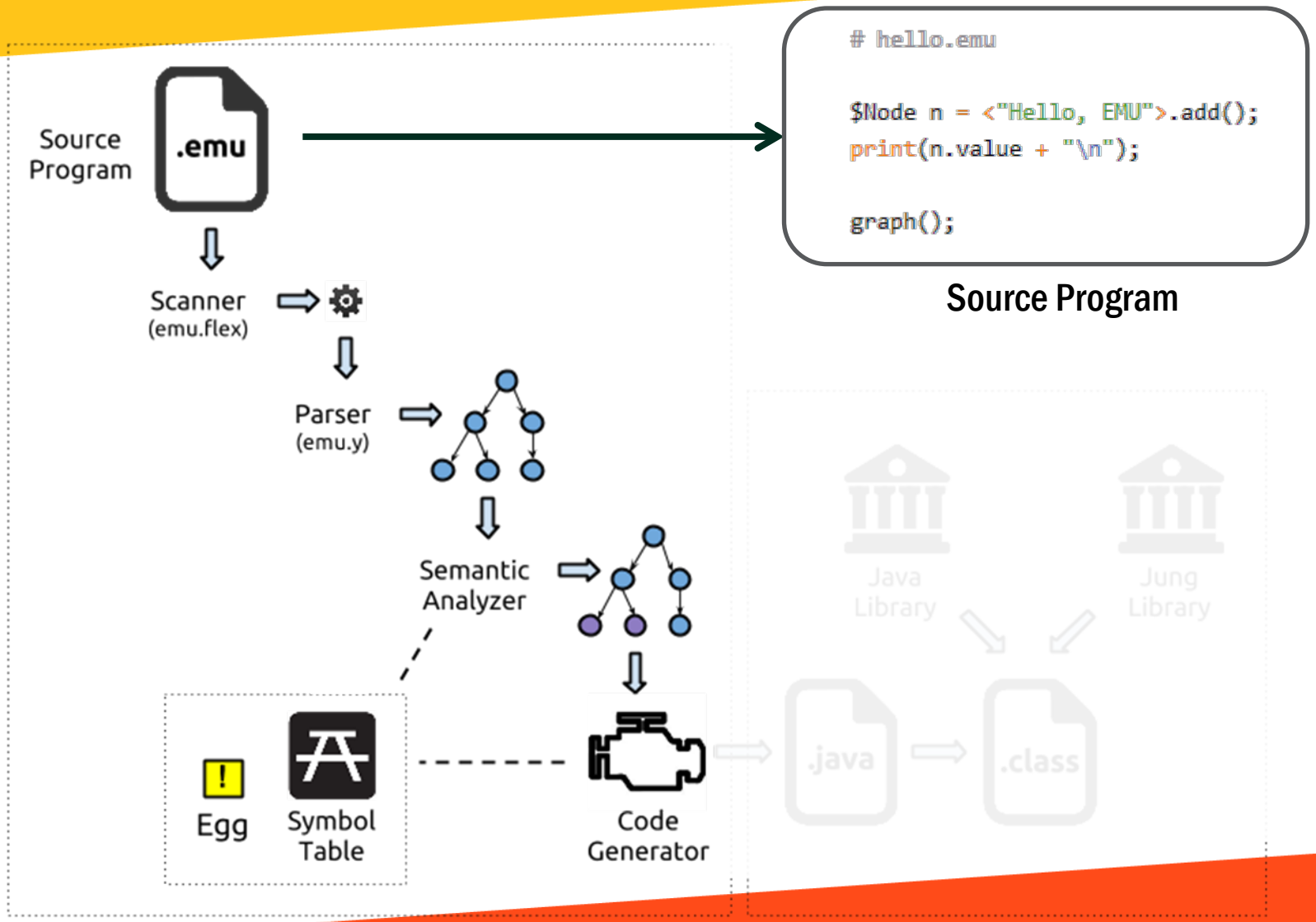
Translator Architecture



EMU Compiler

JAVA Compiler

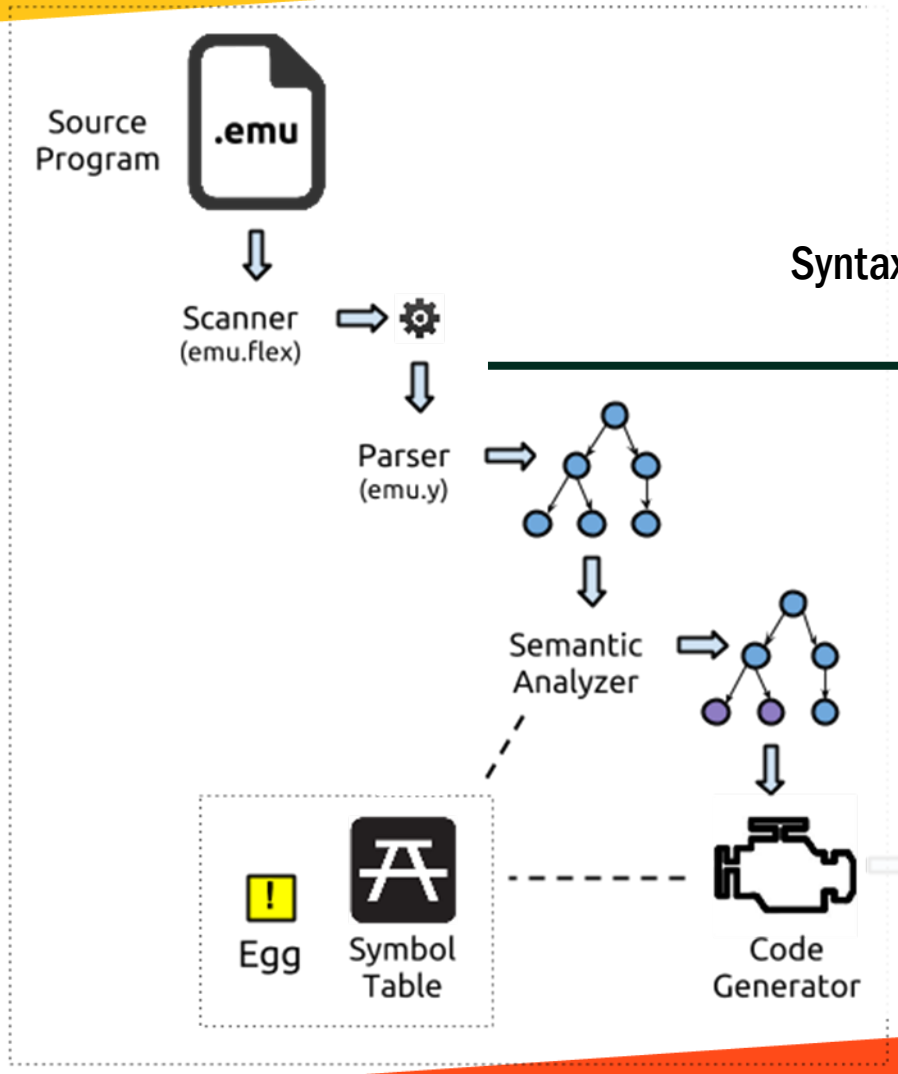
Translator Architecture




```
# hello.emu

$Node n = <"Hello, EMU">.add();
print(n.value + "\n");

graph();
```

Source Program

Translator Architecture



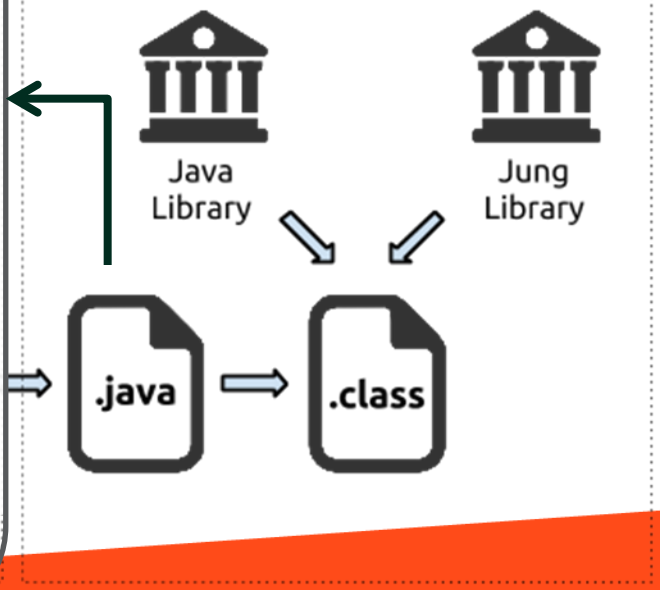
Syntax Tree

```
ProgramItems:
  ProgramItem:
    Decl:
      Initializer:
        TypeSpec:
          EMUTYPESPECIFIER: $Node
        AssignmentExp: =
          IDNode: n
          InitializerExp:
            STRINGLITNode: "Hello, EMU"
          MemberCall: add
ProgramItems:
  ProgramItem:
    Stmt:
      ExpressionStmt:
        Expression:
          FunctionCall: print
            Expression:
              AdditiveExp: +
                PostfixExp : dot
                  IDNode: n
                  MemberCall: value
                STRINGLITNode: "\n"
ProgramItems:
  ProgramItem:
    Stmt:
      ExpressionStmt:
        Expression:
          FunctionCall: graph
```

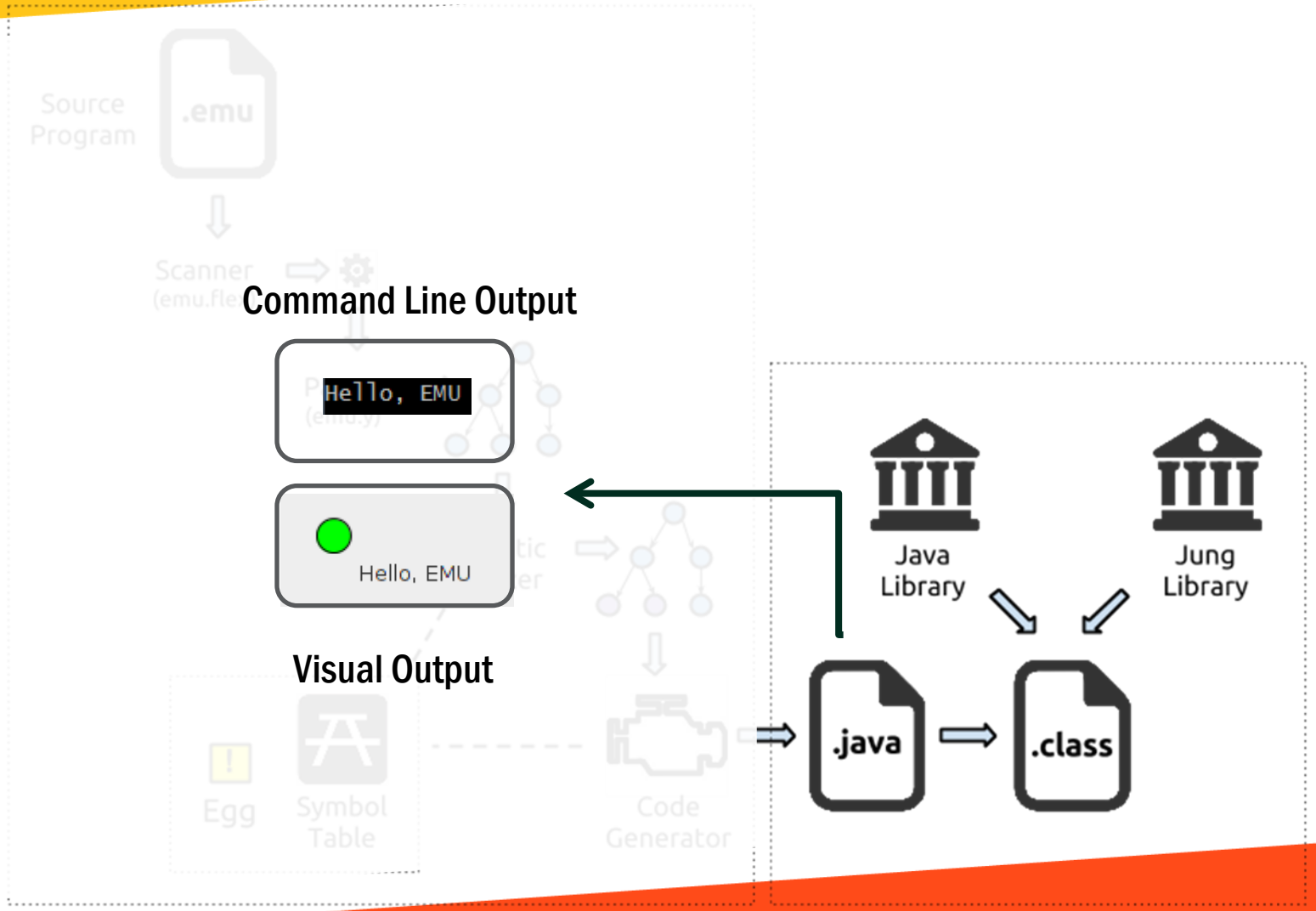
Translator Architecture

```
/* hello.java - auto generated by emuc at 2013-05-15 19:30:40.892 */

import emulib.core.*;
import java.io.*;
import java.util.*;

public class hello {

  private static Printer _pEMU = new Printer();
  private static Graph _gEMU = new Graph();

  public static void main(String args[]) throws IOException {
    Node n = new Node("Node", "Hello, EMU");
    _gEMU.add(n);
    _pEMU.print(n.getValue()+"\n");
    _gEMU.visualize();

  }

}
```

JAVA Source Code



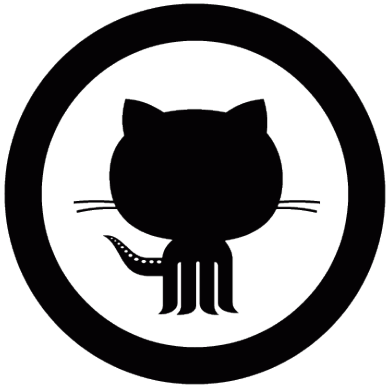
Translator Architecture

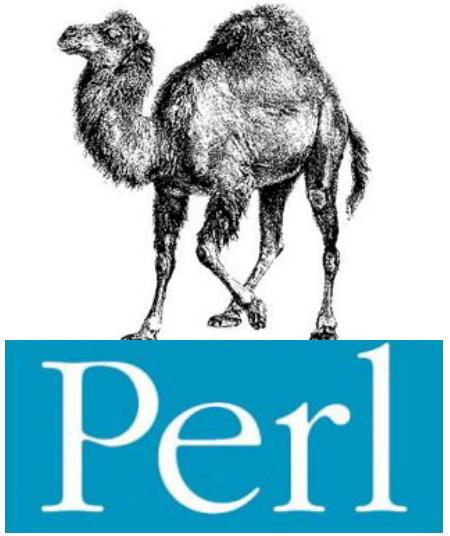


Software Tools

Steve Pappas (Language Guru)

Software Tools





Software Tools - Scripts

build - Makefile

```
> ./build
> ./build –t <test_file>
> ./build -c
```

emuc - Compiler Script

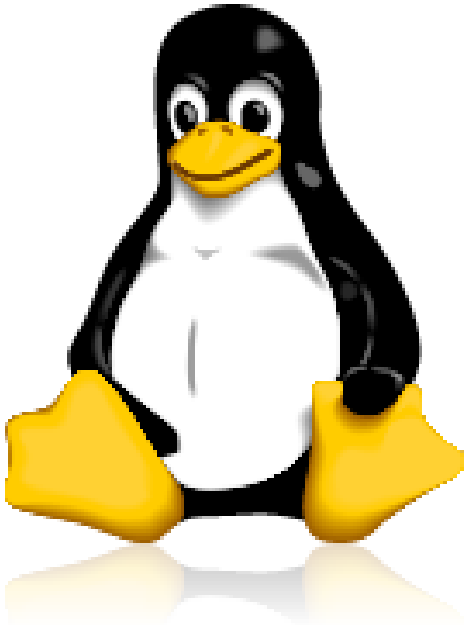
```
> ./emuc source.emu
> ./emuc –x source.emu
```

Flags:
-h or -help: Display help text
-c or -clean: Remove build and temporary files from directory
-t or -test: Run all regression tests and determine PASS or FAIL
-p or -print: Used in conjunction with -t, just print AST for each regression test
-g or -generate: Used in conjunction with -t, just generate solution file for specific test case

Run-time Environment

Steve Pappas (Language Guru)

Run-time Environment



Compiler-Generator Tools

Yi-Chen Lin (Testing and Validation)

Compiler-Generator Tools

LEXER

PARSER

VISUALIZATION LIBRARY

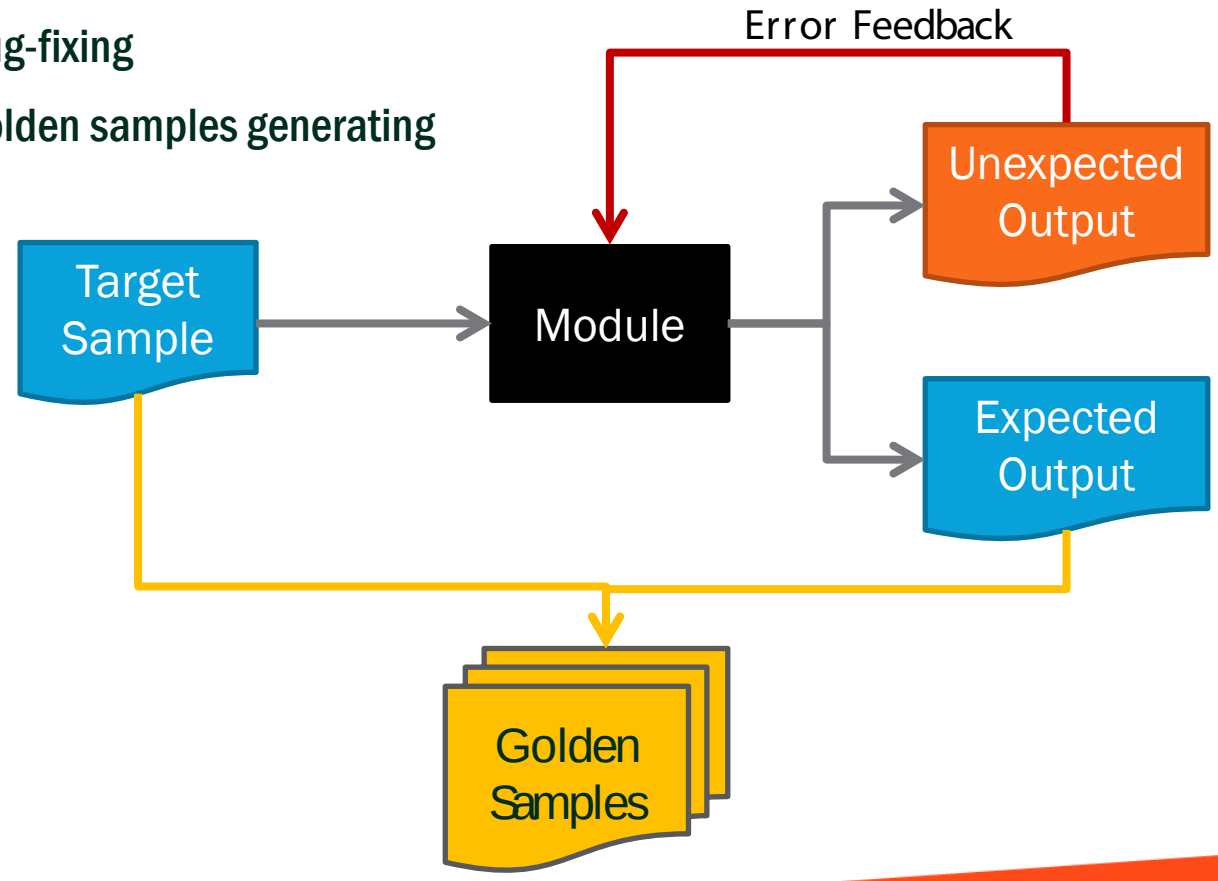
Test Plan

Yi-Chen Lin (Testing and Validation)

Test Plan

Iterative

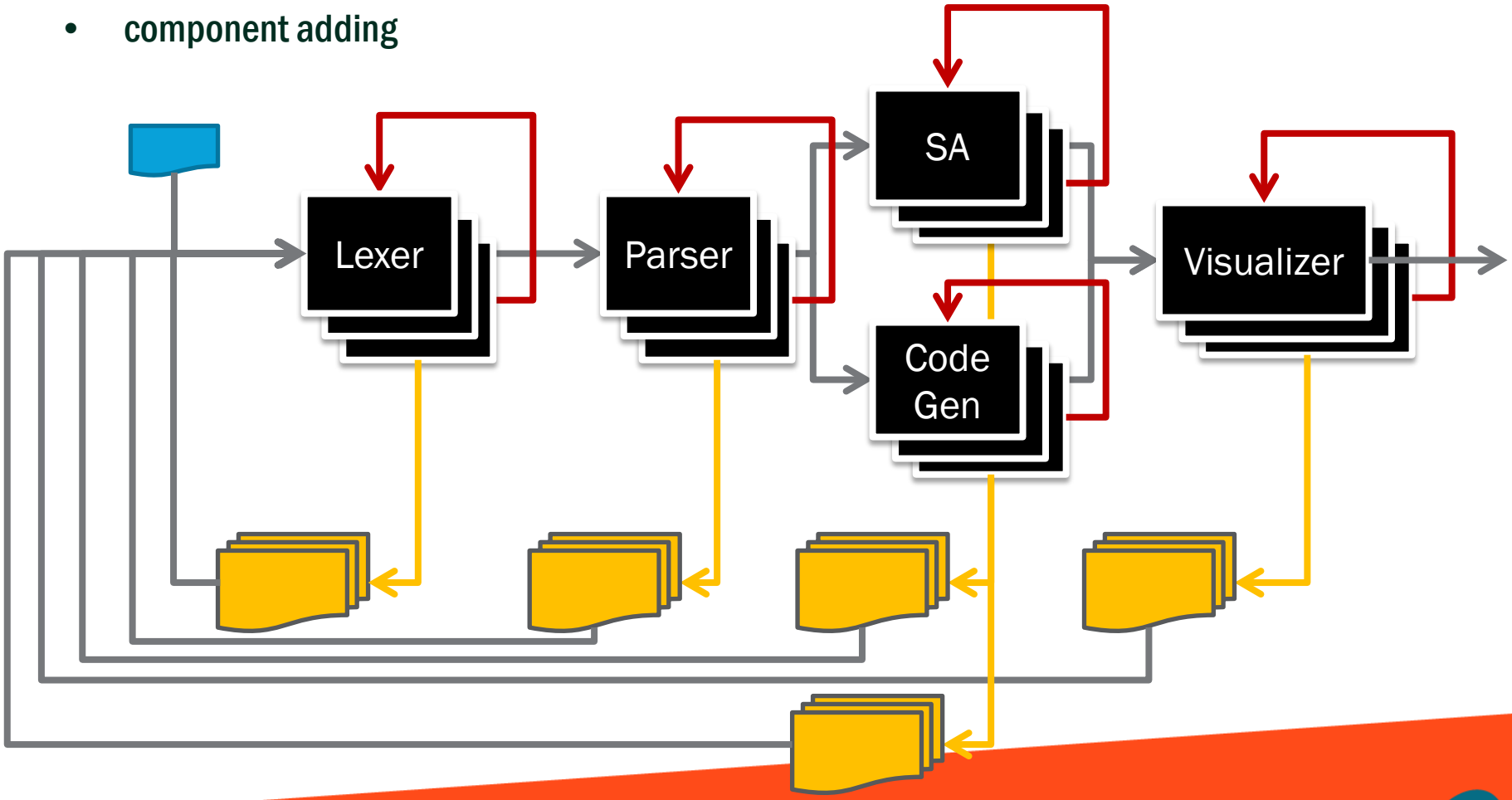
- Bug-fixing
- Golden samples generating



Test Plan

Regression

- component adding



Project Management

Philip Liou (Project Manager)

Project Management

Project Planning

- Define Roles and Responsibilities
- Set Milestones

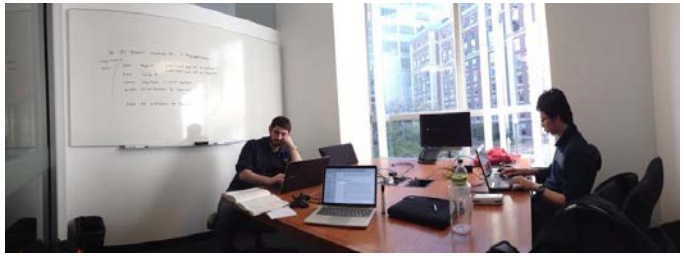
Task #	Task description	Start date	Finish date	Progress	Status
1	**Deliverables**	**2/4/2013**	**5/10/2013**	**70%**	
1.1	White Paper	2/4/2013	2/27/2013	100%	100%
1.2	Language Tutorial	3/4/2013	3/27/2013	100%	100%
1.3	Language Reference Manual	3/4/2013	3/27/2013	100%	100%
1.4	Final Presentation	4/10/2013	5/10/2013	0%	
2	**Front-End**	**3/4/2013**	**4/25/2013**	**100%**	
2.1	Lexer	3/4/2013	4/25/2013	100%	
2.2	Parser	3/4/2013	4/25/2013	100%	
2.3	Grammar	3/11/2013	4/25/2013	100%	
3	**Translation**	**3/4/2013**	**4/30/2013**	**70%**	

Project Management

- Task Tracking
- Frequent Progress Emails

Collaboration and Communication

- Suite of Collaboration Tools
- Meeting Rooms



Demo

Conclusions

Yi-Chen Lin (Testing and Validation)

Conclusions

Why EMU?

- Easy to use for visualizing relationships

What could be different?

- Tools research
- Time management

Lesson Learned

- Gauge the expectation
- Communicate with others
- Meet with mentors
- Don’t fall behind
- Use line numbers

Thank you!