PL Group

Jeremy Gibbons

Geraint Jones

Daniel Kroening

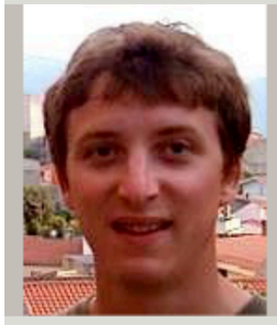
Anthony W. Lin

Andrzej Murawski

Hanno Nickau

Luke Ong

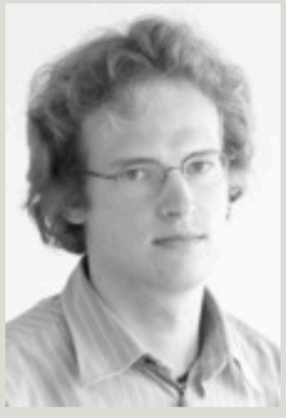
Mike Spivey



Sam Staton

Bernard Sufrin

String Analysis and Applications to Software Security



Daniel Kroening

Anthony W. Lin

String Data Type

Prevalent in today's software

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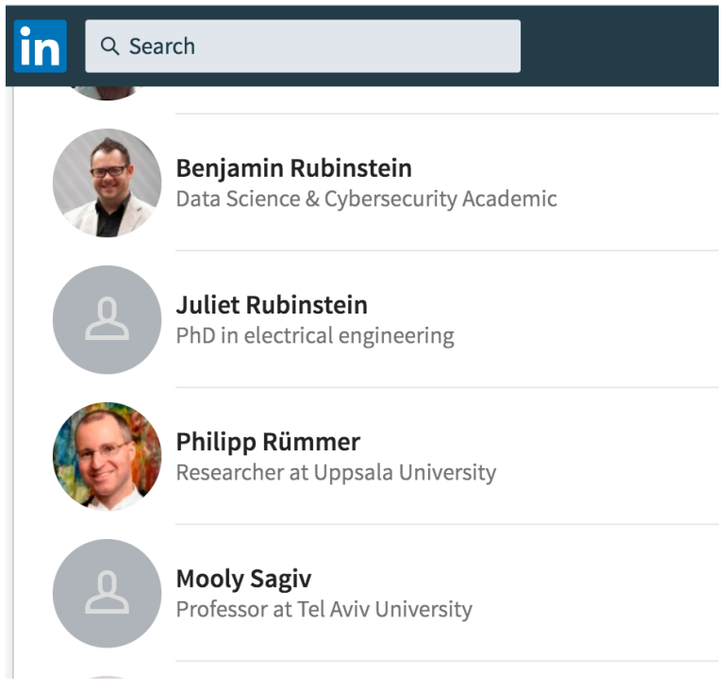

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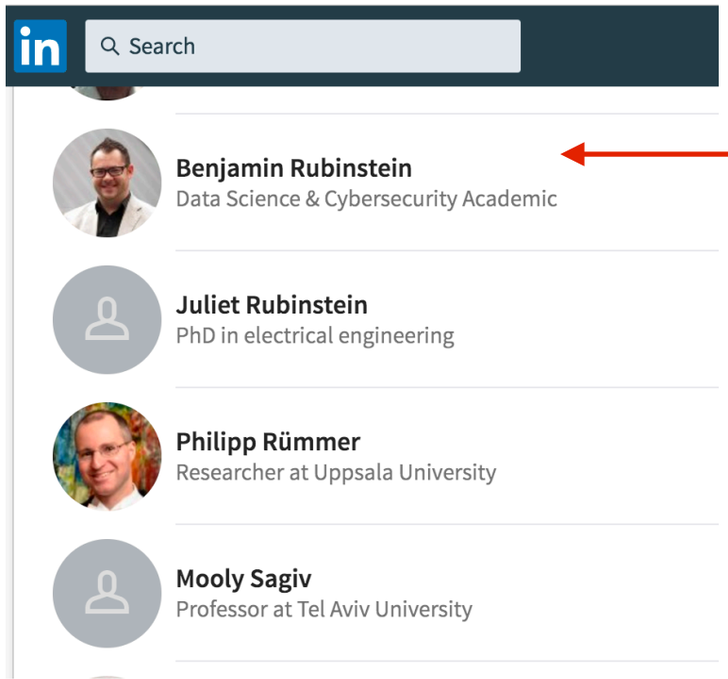

Ben

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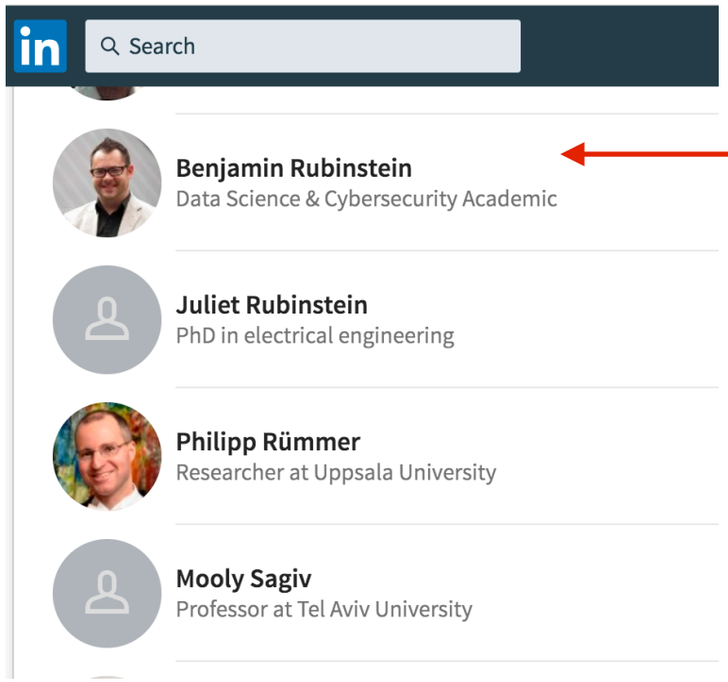

Ben

Dynamically generated by

```
var x = htmlEscape(name);
var y = escapeString(x);
nameElem.innerHTML = '<a onclick=' +
    '"viewPerson(\'' + y + '\')">' + x + '</a>';
```

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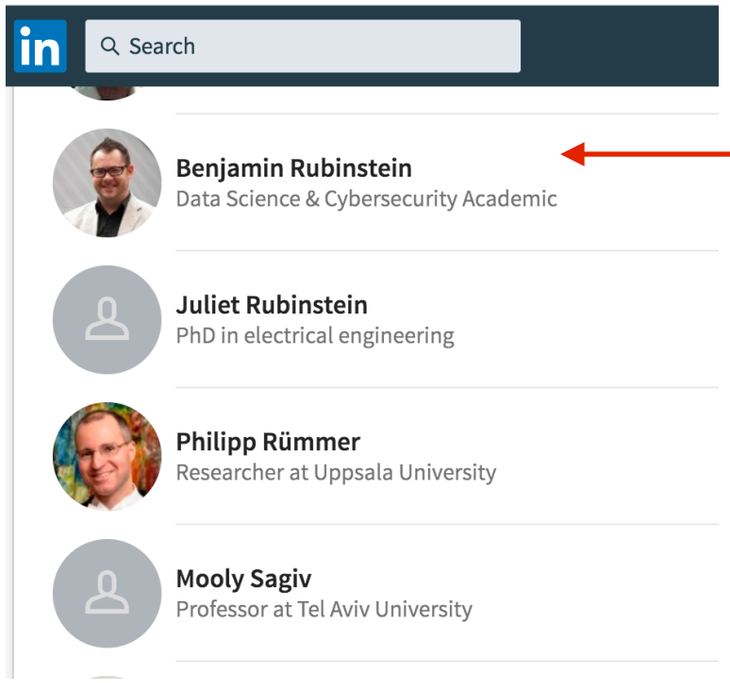

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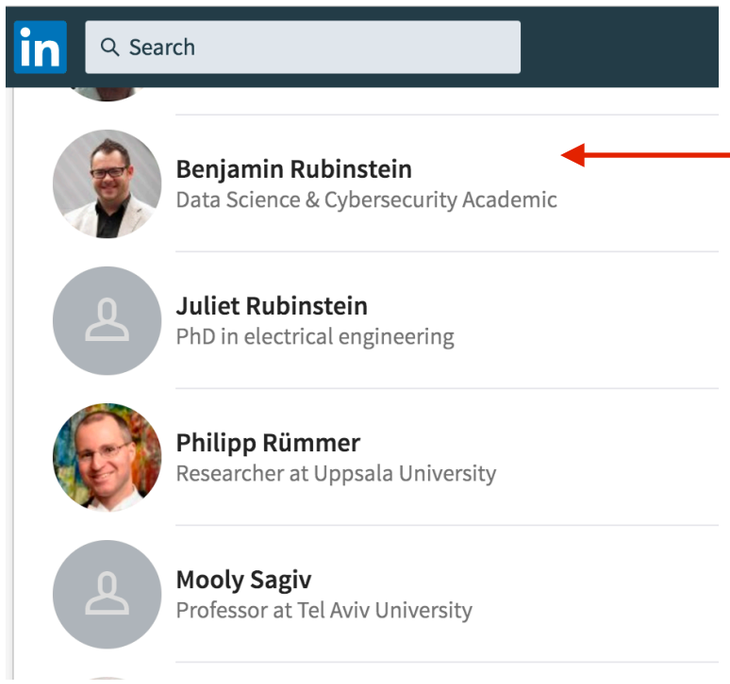

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XSS

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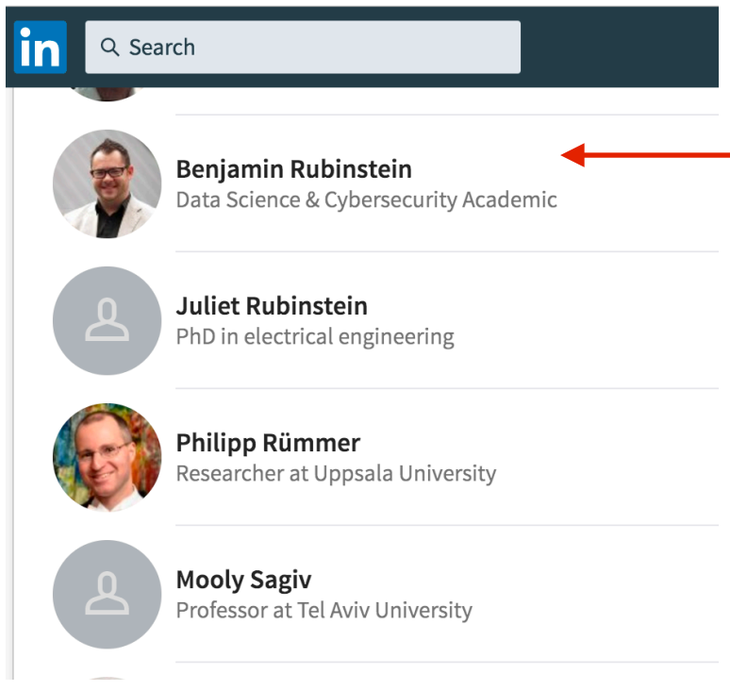

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XSS

Q: Is the program safe?

Approach from Computational Logic

Approach: view program analysis as constraint solving

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Program

```
void foo(String x,String y):
   String v := x + ‘ab’ + y
   String w := y + ‘ba’ + x
   if ( v == w ) { ... }
   …
```

Find x,y that satisfies v == w

Approach from Computational Logic

Approach: view program analysis as constraint solving

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Find x,y that satisfies v == w

Constraint

```
(v = x + ‘ab’ + y) AND
(y = y + ‘ba’ + x) AND
(v = w)
```

Find string substitutions to match equations (satisfiability problem)

Key Challenge

Develop effective **logics** and **solvers** for string analysis problem

Which string operations to permit?

Which ones lead to decidability?

If undecidable but important operations, what can we do?

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If undecidable but important operations, what can we do?

We address all aspects of these challenges

A 50-year-old open problem

Practical string analysis requires concatenation and length constraints

(v = x + ‘ab’ + y) AND
(y = y + ‘ba’ + x) AND
(v = w)

len(x) = len(y)

<u>Question</u>: Is decidable to check satisfiability of such constraints?