[SR 경력채용] 기술 면접

2021/7/14 (수)
10시~12시(GMT+09:00)

VIRGINIA TECH
DEP. OF COMPUTER SCIENCE
SOFTWARE INNOVATIONS LAB
PHD (2021.5)
안기진

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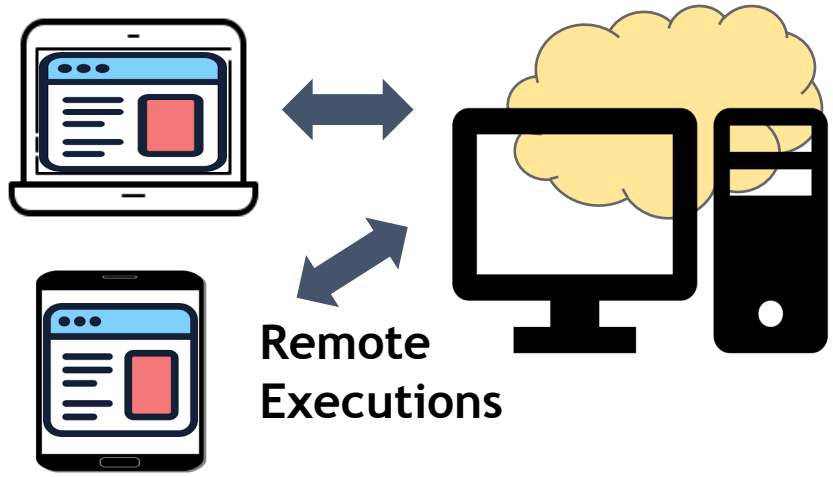
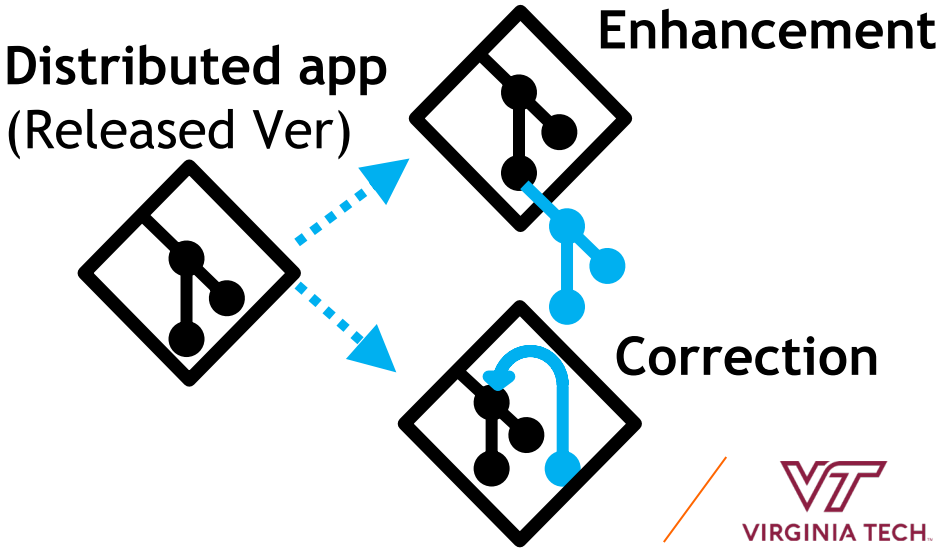
Dissertation Contributions

- Advisor: **Eli Tilevich** (Software Innovations Lab)
- Research Topic: Software Engineering, Distributed Systems (Web)
- New Refactoring: "Client Insourcing"
  - *Creating a Centralized Variant ($\mathcal{P}'$) for the Distributed App ($\mathcal{P}$)*
    - *Declarative approach (z3/Datalog), fuzzing, idempotent execution*
- Demonstrating the value and utility of "Client Insourcing"





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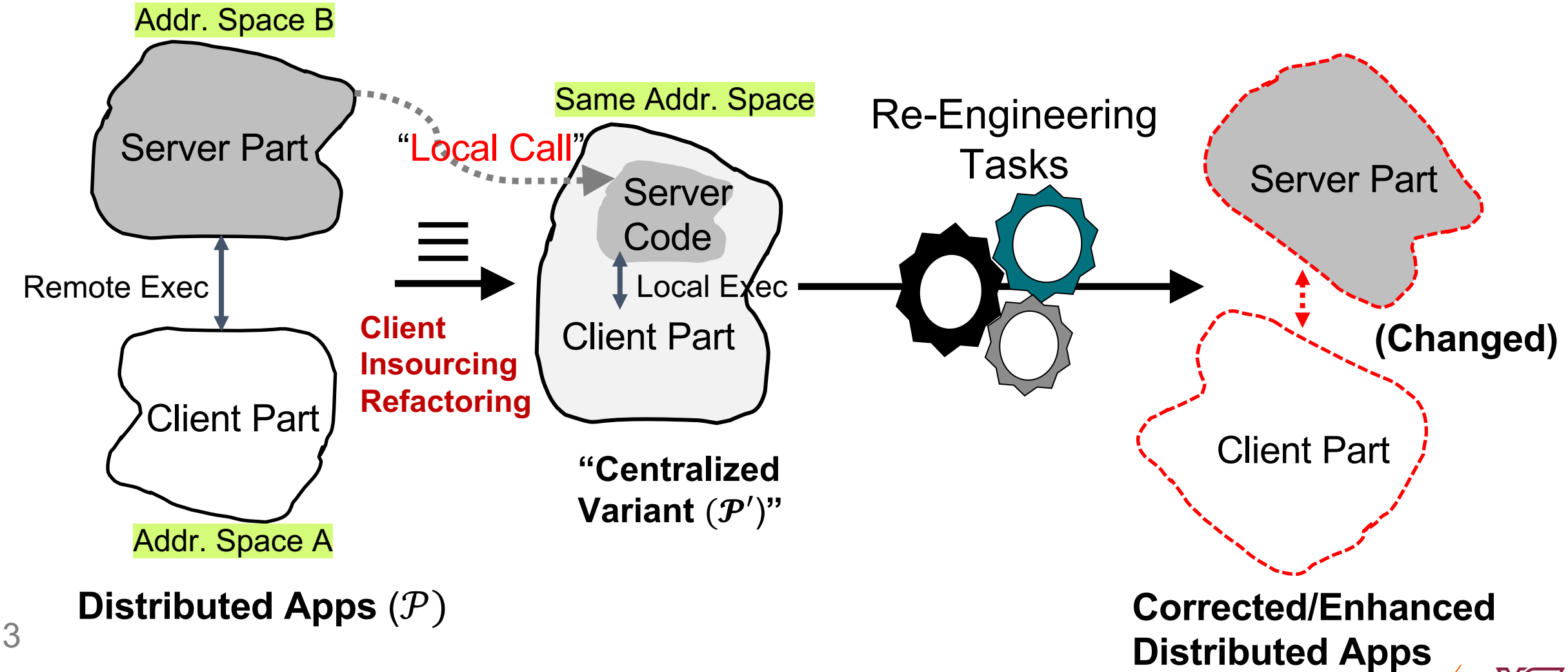
Client Insourcing Refactoring [WWW 2020]



Client Insourcing Refactoring

```
//CLIENT: app/../property-details.ts
unfavorite(event, property){
                        //Marshalling
 this.pServ.unfavorite(property)
 .subscribe(favorite //unMarshalling
     =>{ this.favorites =favorites;}
}
```

1) HTTP **Request** From Client

```
DELETE
/properties/favorite
HOST ..
[{"id":1,"city":..}]
```

Entry Point

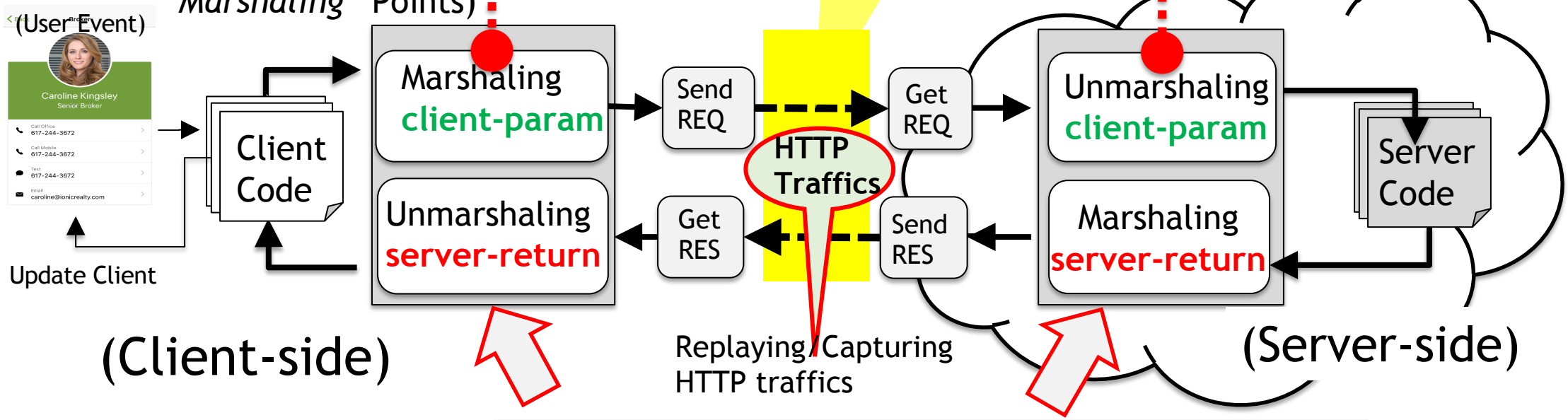
2) HTTP **Response** From Server

```
HTTP/1.1 200 OK
Content-t: json
Content-Len: …
[{"id":2,"city"…]
```

Exit Point

```
//SERVER:server.js
app.delete('/properties/favorites/'
, properties.unfavorite);
//server/properties.js
var favorites = require('./property').favs;
function unfavorite(request, response) {
 var id = request.body.id;//unMarshalling
 for (var i=0; i<favorites.length; i++){
   if (favorites[i].id == id){
       favorites.splice(i, 1);
       break;}}
   response.json( favorites);//Marshalling
}
//SERVER: server/property.js
exports.data = [{id: 1,...}];
exports.favs = [{id:2,…},…,{…}];
```

(Correspondence for "*Marshaling*" Points)



1. Decode {client-parameter, server-return}
2. Instrument code parts that RWs these values

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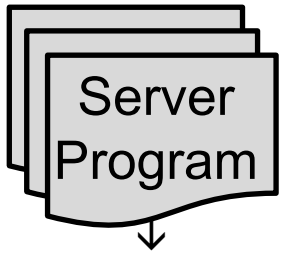
Client Insourcing Refactoring [WWW 2020]

- Extracting Function: Searching all dependent JS code in Entry/Exit points
- Extending *Declarative approach for JavaScript* Analysis (z3py)
  - **GATEKEEPER** [Security'09]: Point-to-Analysis, **JSDep** [FSE'15]: Dependency Analysis

;;Generating Facts



$\mathbf{Write}(s_1, v\_a)$
$\mathbf{Read}(s_2, v\_b)$
$\mathbf{Write}(s_2, v\_b)$
...
$\mathbf{Ref}(s_c, v\_c, V_1)$
$\mathbf{Ref}(s_d, v\_d, V_2)$

;;Rules for Client Insourcing Refactoring

$$\mathbf{DataDep}(s_1, \text{stmt}_2) \leftarrow \mathbf{Read}(s_1, v_1) \wedge \mathbf{Write}(s_2, v_1)$$

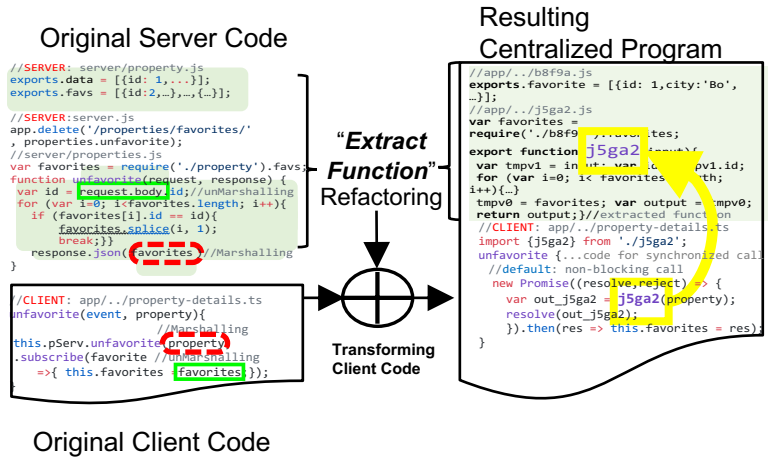
;;JS-Dep, GATEKEEPER

$$\mathbf{UnMar}(s_1, v_{\text{unMar}}, V^{u_{\text{id}}}_{\text{unMar}}) \leftarrow \mathbf{Write}(s_1, v_{\text{unMar}}) \wedge \mathbf{Ref}(v_{\text{unMar}}, V^{u_{\text{id}}}_{\text{unMar}})$$

$$\mathbf{Marshal}(s_1, v_{\text{Mar}}, V^{u_{\text{id}}}_{\text{Mar}}) \leftarrow \mathbf{Write}(s_1, v_{\text{Mar}}) \wedge \mathbf{Ref}(v_{\text{Mar}}, V^{u_{\text{id}}}_{\text{Mar}})$$

$$\mathbf{ExecutedStmts}(s_n, V^{u_{\text{id}}}_{\text{unMar}}, V^{u_{\text{id}}}_{\text{Mar}}) \leftarrow \left(\mathbf{DataDep}(s_n, s_1) \wedge \mathbf{Marshal}(s_1, v_{\text{Mar}}, V^{u_{\text{id}}}_{\text{Mar}})\right) \wedge \left(\neg\mathbf{DataDep}(s_n, s_2) \wedge \mathbf{UnMar}(s_1, v_{\text{unMar}}, V^{u_{\text{id}}}_{\text{unMar}})\right)$$

;;z3 Datalog Engine
Query ExectedStmts for specific HTTP method
{Client Param, Server Return}



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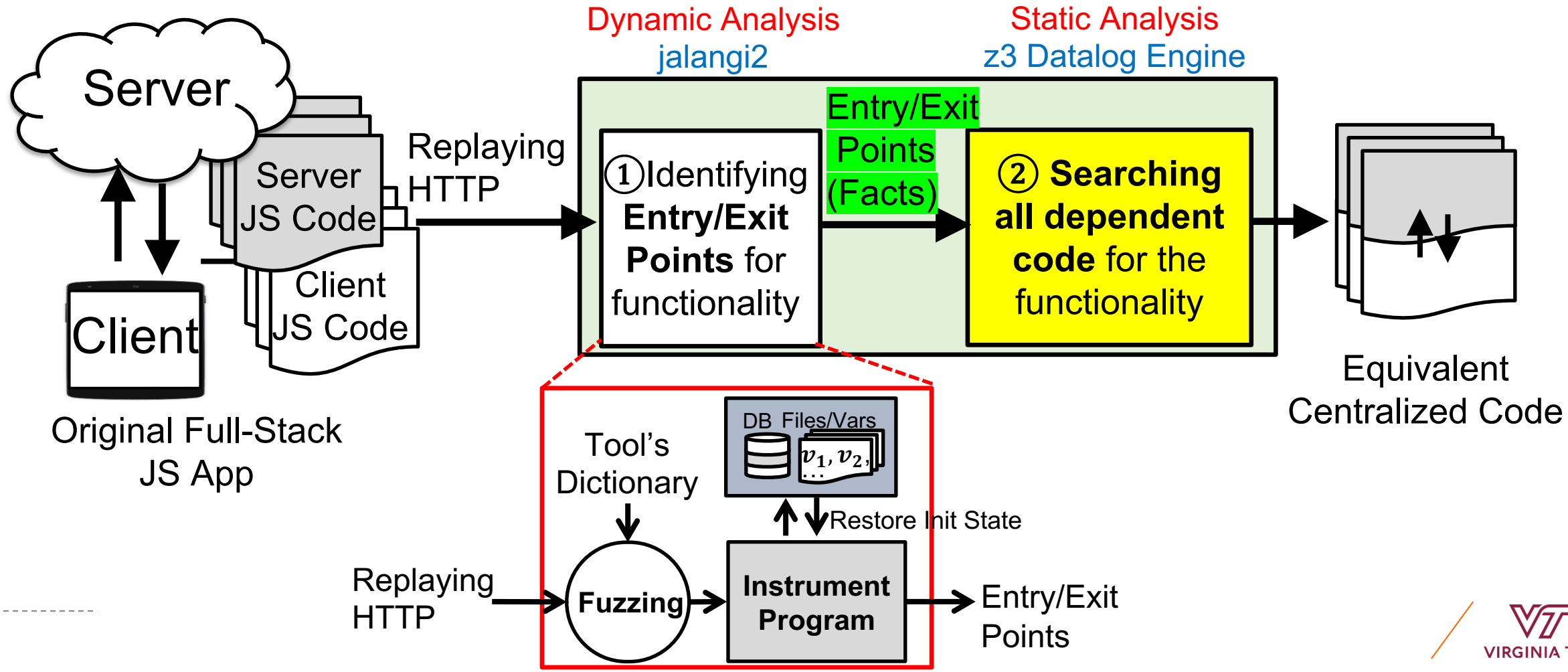
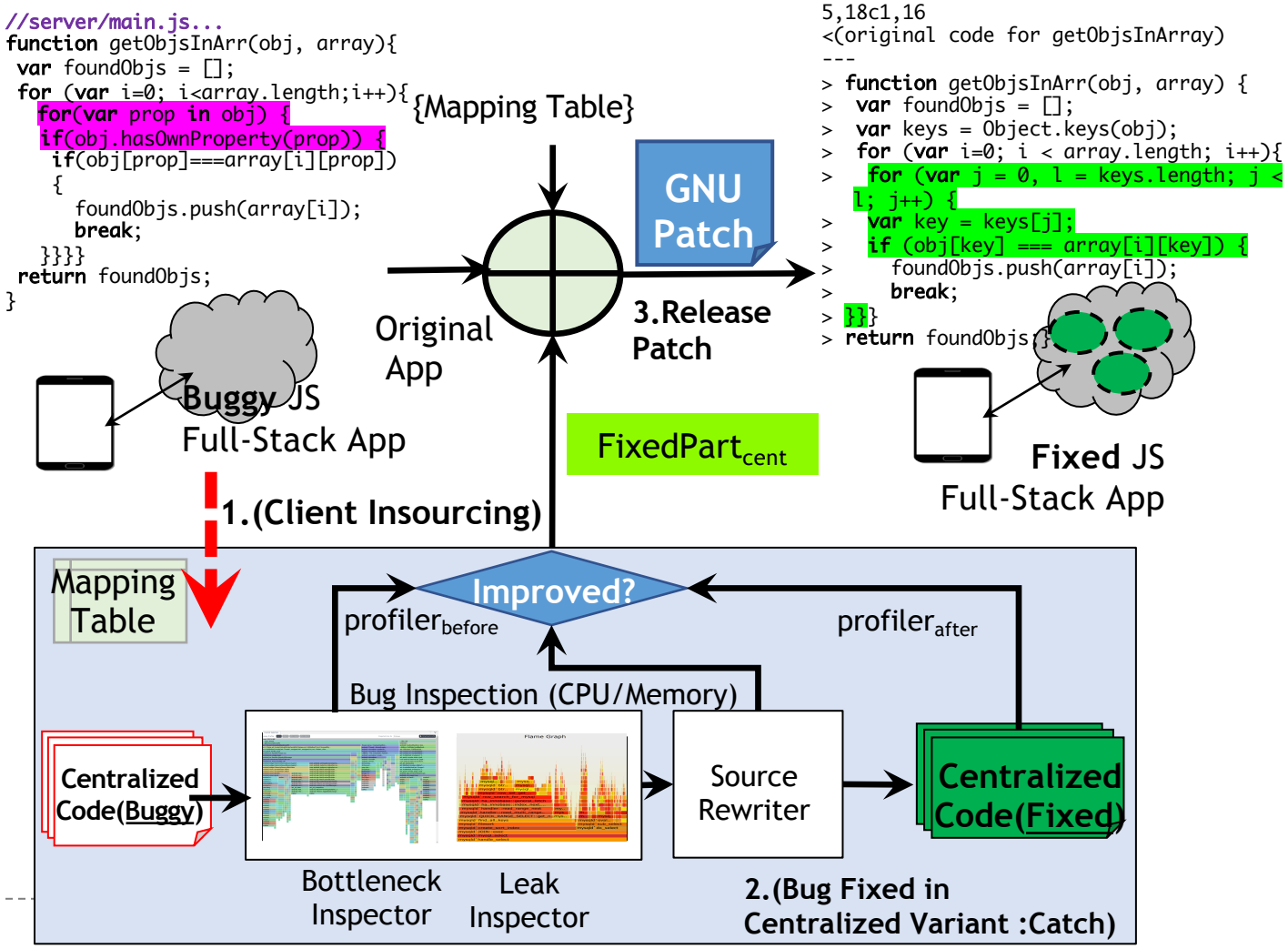
Client Insourcing Refactoring [WWW 2020]

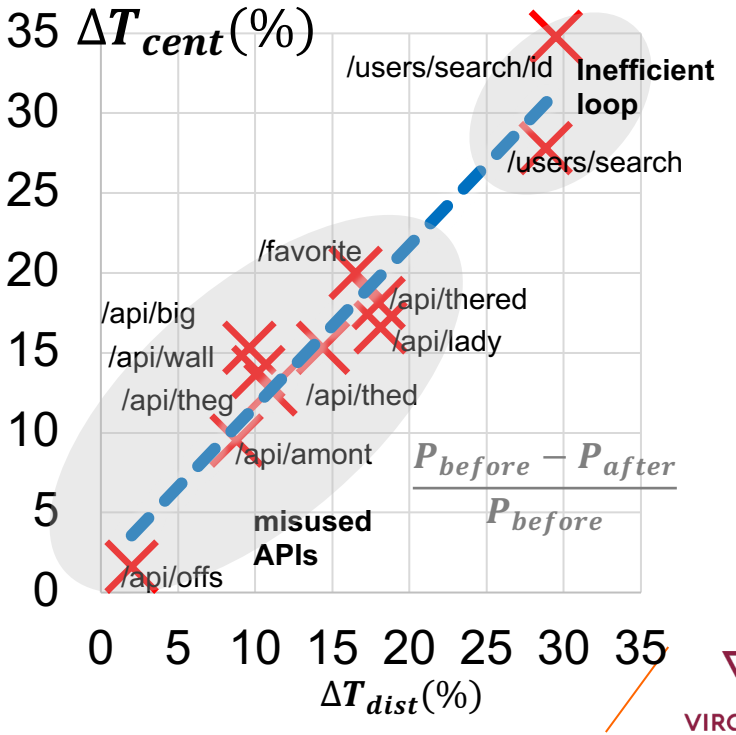
- **Fuzzing HTTP** records, **Idempotency** Executions



Application 1: Bug Fixes [ICWE 2019]



- Fixing Bugs in Centralized Variants and Generating Patches
- **90%** Reduced Time to execute Debugging Task



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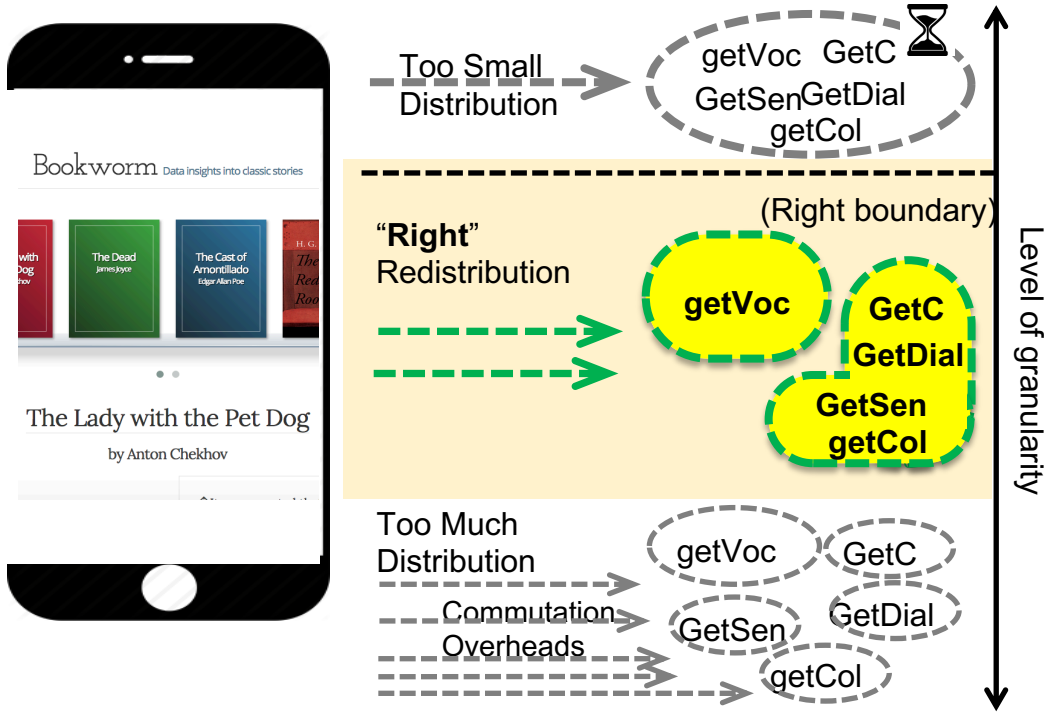
Application 2: D-Goldilocks [SANER 2020]

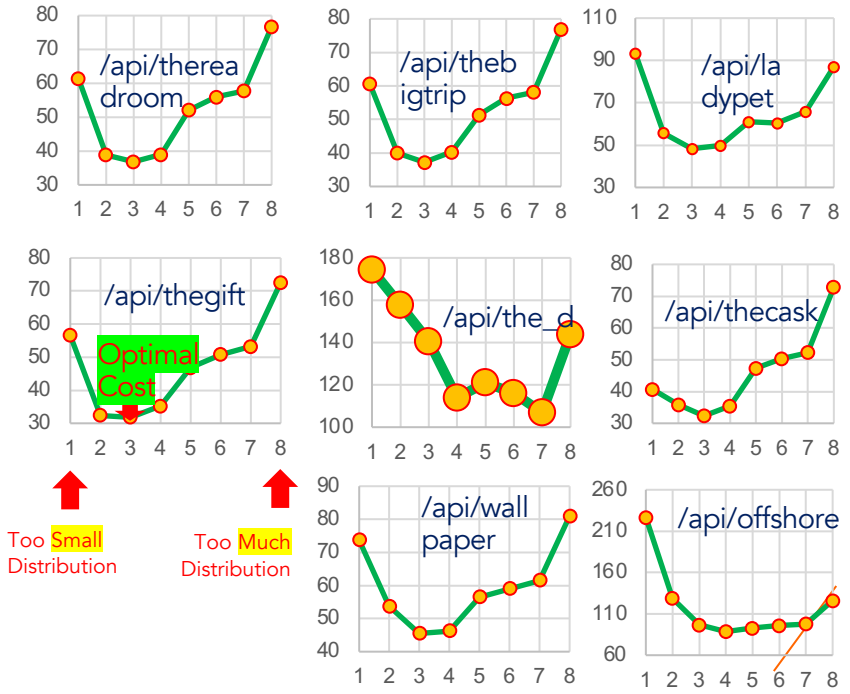
- Correcting il-conceived Distributions
  - Ex) Nano-service anti pattern



Client-Side

Server-Side (/api/ladydog)

- Determine which functional distribution would minimize the cost of distributions
  - $C_{Dist\_Exec}(\mathbf{r}) = \alpha \cdot latency(\mathbf{r}) + (1-\alpha) \cdot \Sigma\ resource(\mathbf{r})$
- Large Distribution Space: Our Tool automates!
  - Ex) 394 × 4139 ~= **1.6 × 10^6** ULOCs



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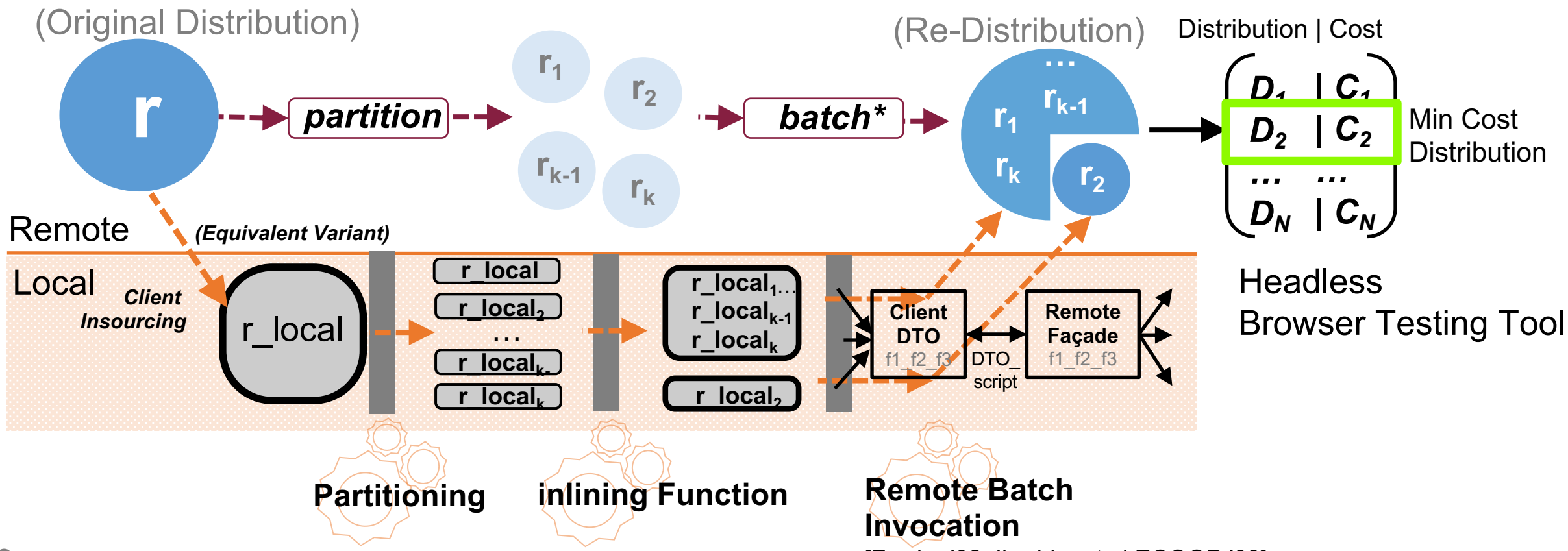
Application 2: D-Goldilocks [SANER 2020]

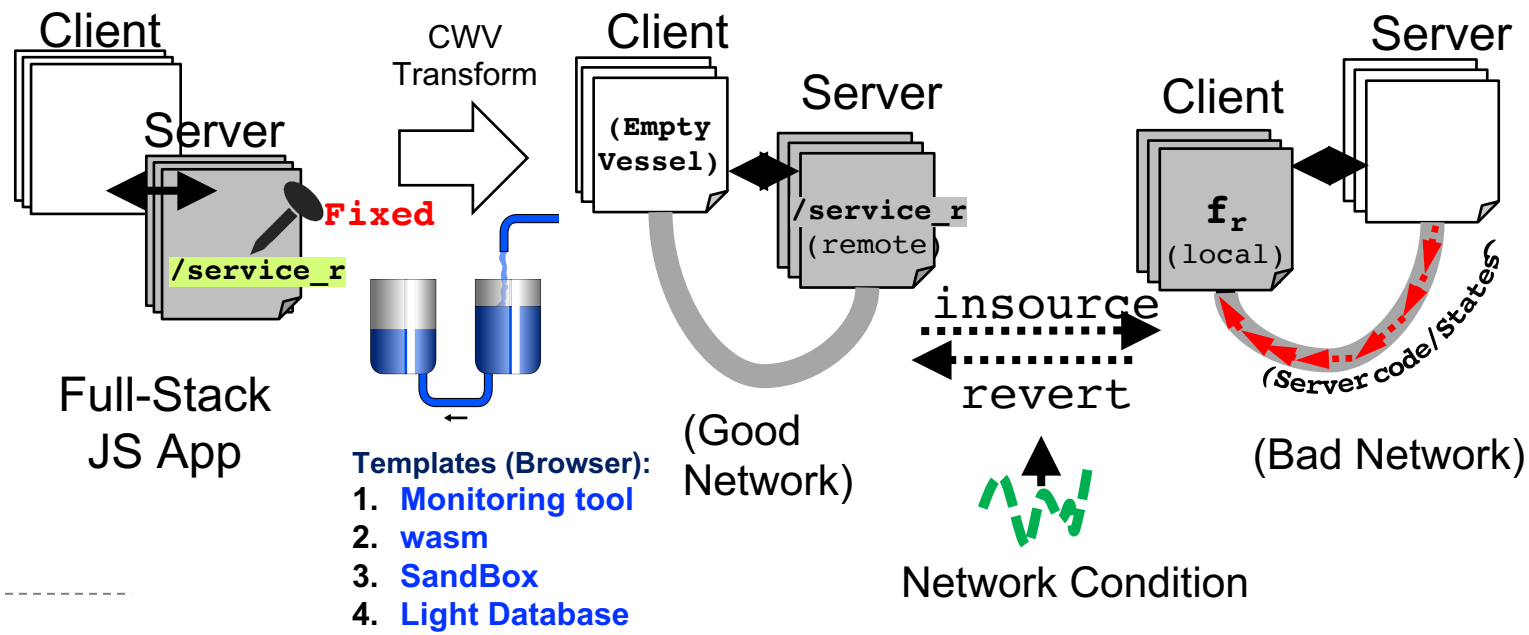
Restructuring Distribution

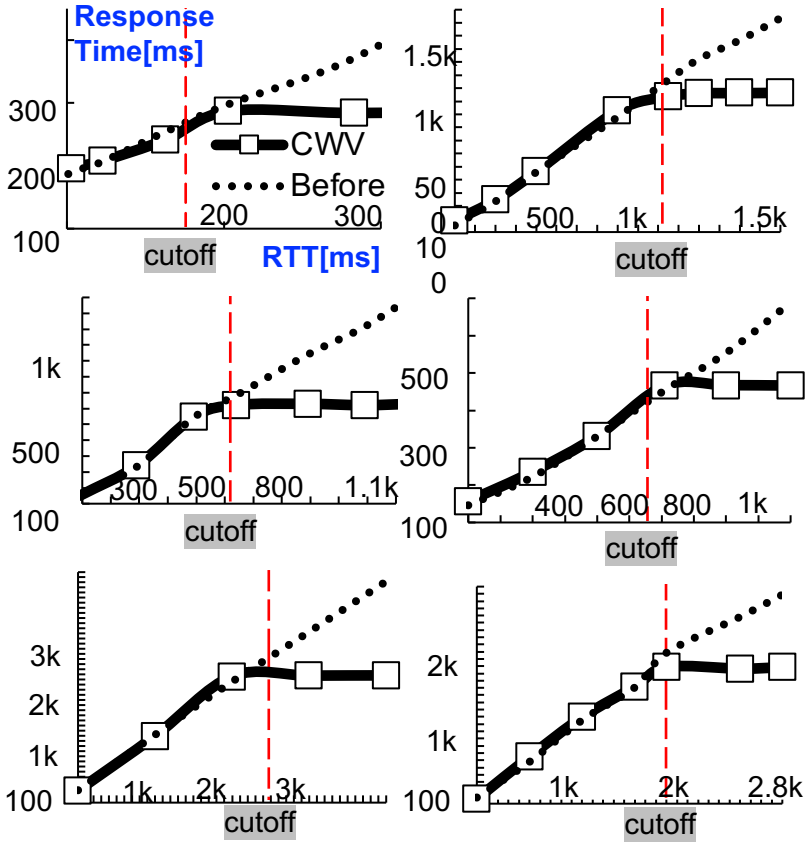


Application 3: Communicating Web Vessels (**CWV**)

Best Paper Award 🏆 at [ICWE 2021]

- **Design** and **Execution Time** Mismatch – Client/Server Arch.
- Client *Insource* or *Revert* {**Code**$_{\text{Server}}$, **State**} based on Exec Conditions
- Automated Program Transformation: Adaptive Arch.





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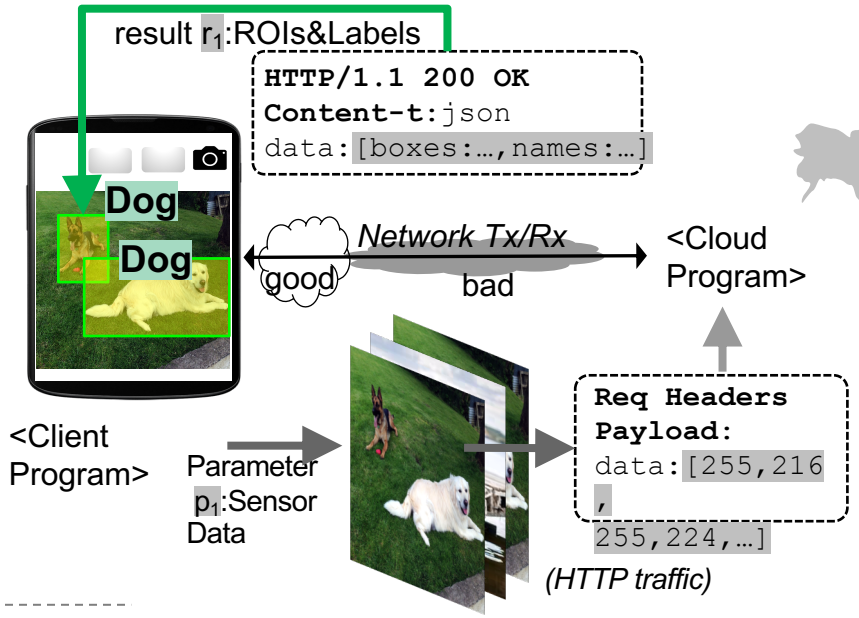
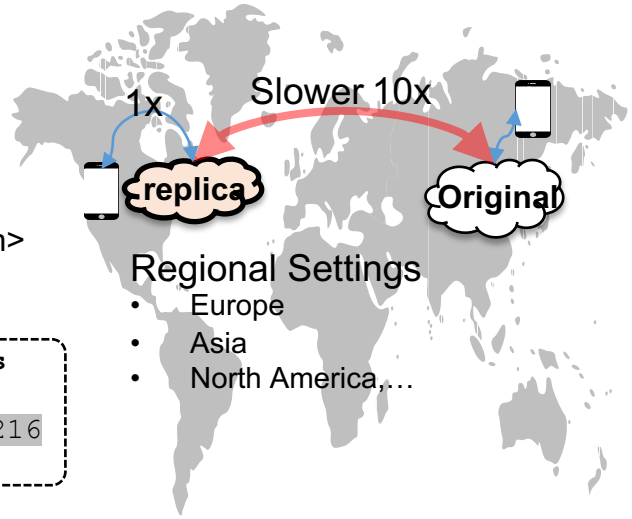
Application 4: EdgeFy (Submitted)

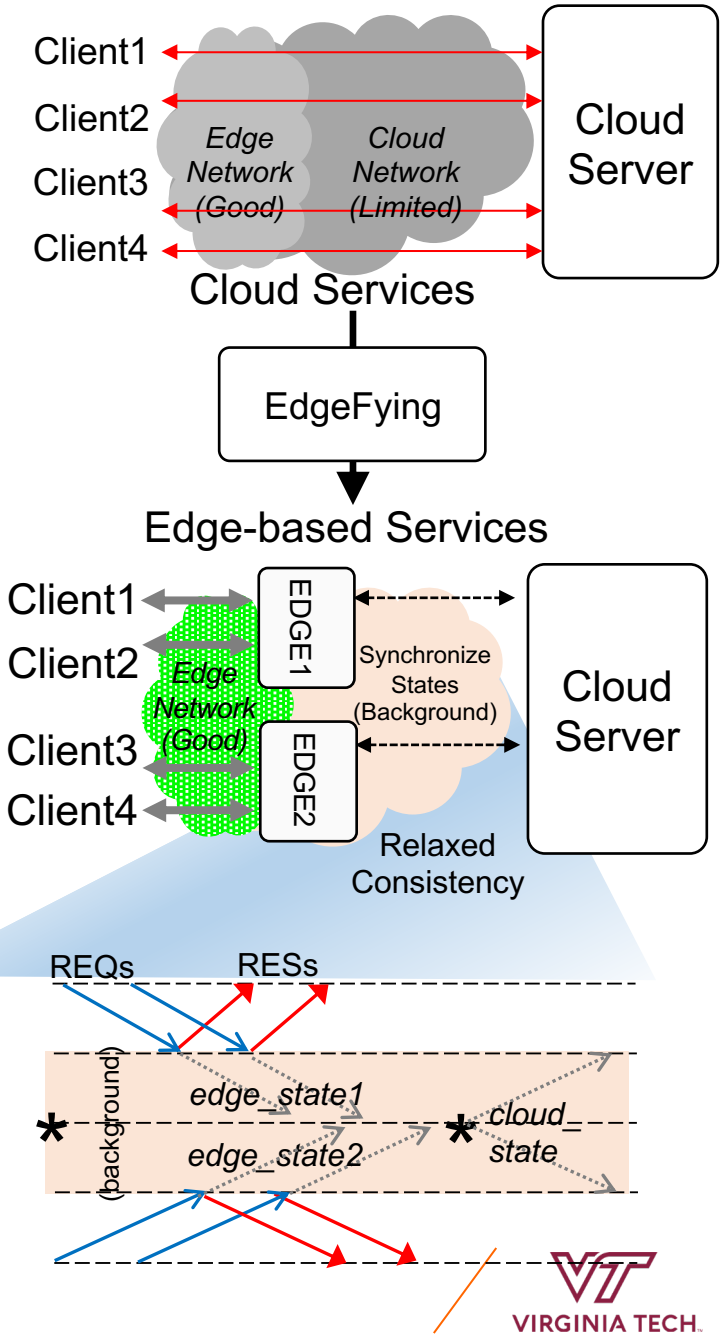
- **Locality** of Cloud-based services
- Network Bottlenecks (**Sensor Data Deluge**)
- **EdgeFy**
  - Replicating {$state_{init}$, ftn_{init}} of Cloud Service
  - Synchronizing States between Cloud and Edge Replicas



ex) Apps of ML (tf.js)



ex) Heroku: Cloud Platform



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Publications in PhD

No.	Paper	Conference	Area	
1.	Client Insourcing	**WWW 2020** (19%, 217/1129)	System (Web)	1st Author/2
2.	D-Goldilocks	**SANER 2020** (21%, 42/199)	Software Engineering	1st Author/2
3.	Catch&Release (Debugging)	**ICWE 2019** (25%, 26/106)	System (Web)	1st Author/2
4.	Comm Web Vessels	**ICWE 2021** (17%, 22/128, Best Paper 🏆)	System (Web)	1st Author/2
5.	EdgeFy: Edge-based framework	**Submitted**	System (Middleware)	1st Author/2
6.	**Project1**: Porting System for Cross-platform apps	**MobileSoft 2018** (Nominated for Best Paper)	Software Engineering	1st Author/3
7.	**Project2**: Distributing Embedded Apps for Trusted Exec. (Optee, LLVM/Clang)	**GPCE 2018**	Software Engineering	2nd Author/3
8.		**Journal of Computer Lang.** (Nominated for Best Paper)	Software Engineering	2nd Author/3

Thank you!

Q & A

Appendix
Other projects

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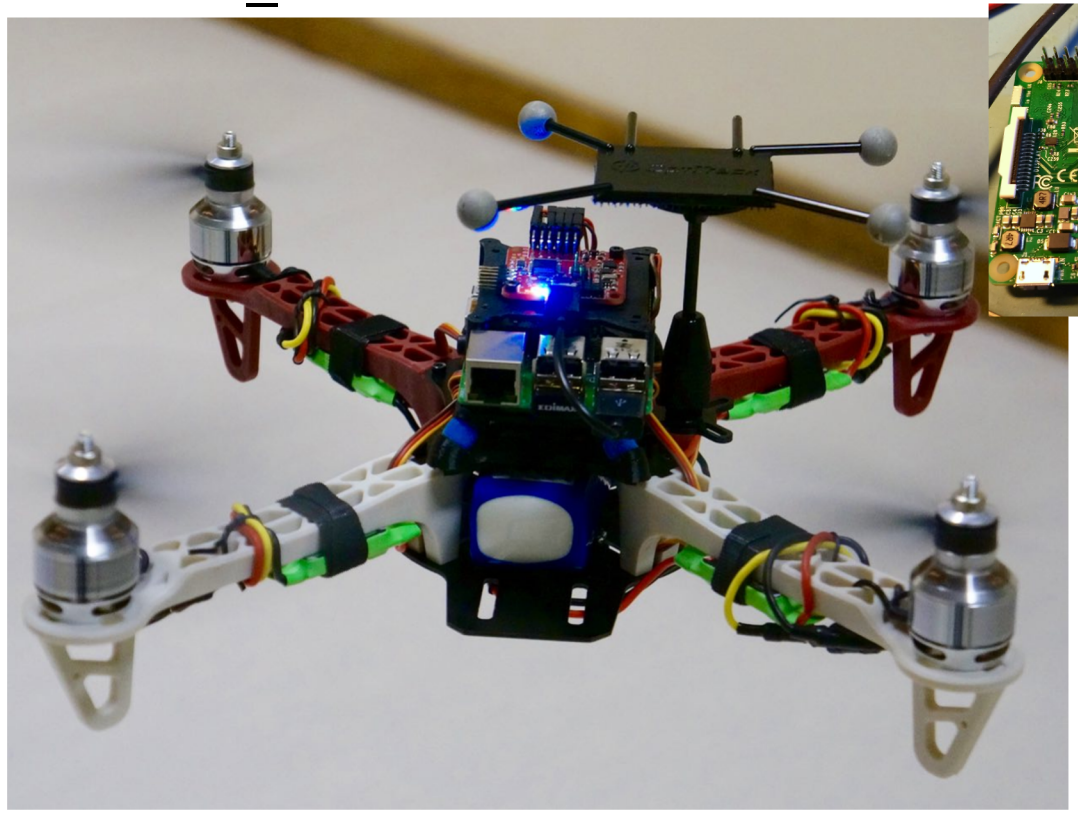
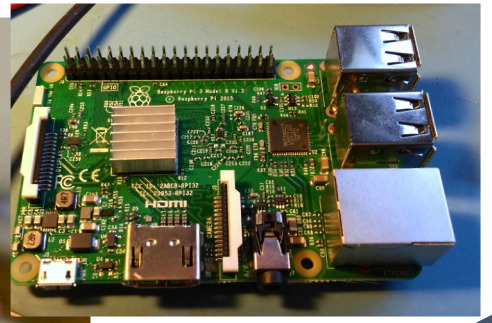
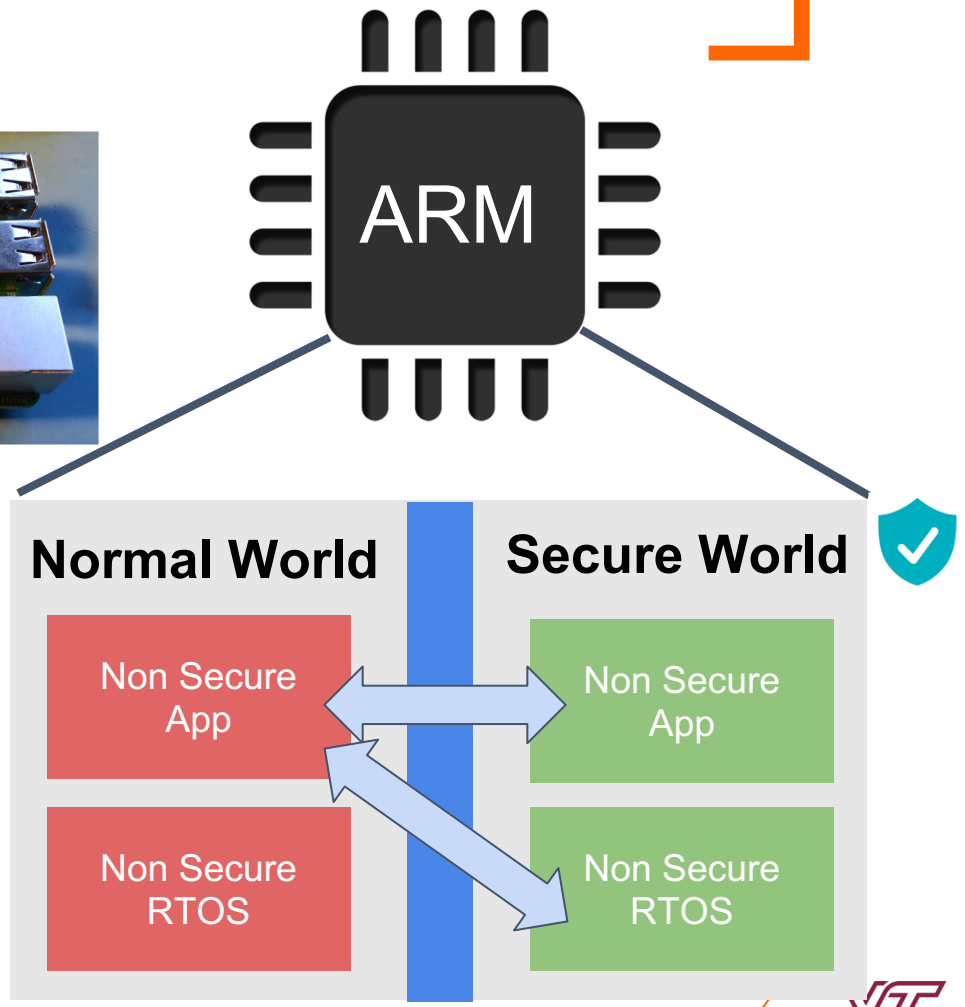
Appendix: Trusted Execution for low cost ARM Arch.

[GPCE 2018], Best Paper Nomination [COLA 2020]

- LLVM, Clang, Optee, SGX
- PX4_firmware







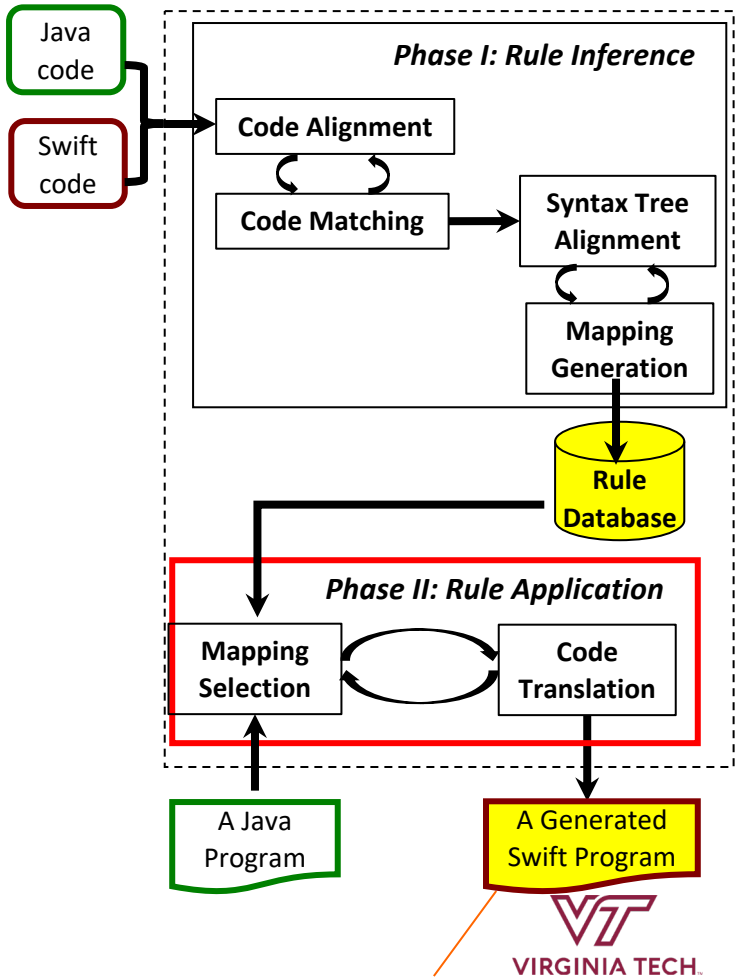
Appendix: Porting System for Cross-platform Apps

Best Paper Nomination [MobileSoft 2018]: Learning Translating Rules/API mappings from Cross-platform Mobile Apps

```
//PieChart.java
1  public class PieChart extends
PieChartBase<PieData> {...
2    private void calcAngles() { ...
3      int entryCount = mData.getEntryCount();
4      int cnt = 0;
5    for(int i = 0; i < mData.getDataSetCount(); i++){
6       IPieDataSet set = mData.get(i);
7     ... }}}
```

```
//PieChartView.swift
public class PieChartView:
PieChartViewBase {…
  private func calcAngles() { ...
    let entryCount = data.entryCount
    var cnt = 0
  for i in 0 ..< data.dataSetCount {
    let set = data[i]
  ...}}}
```

No.	Java Syntax type	Swift Syntax type	Java template	Swift template
1	typeDeclaration	class_decl	public class $p10 extends $p11 {...}	public class $p10: $p11{...}
2	classBodyDecl	function_decl	private void $p20() {...}	private func $p20() {...}
3	**localVarDeclStmt**	**cnst_decl**	**$p30 $p31 = $p32;**	**let $p31 = $p32**
4	expression	expression	$p33.getEntryCount()	$p33.entryCount
5	**localVarDeclStmt**	**var_decl**	**$p40 $p41 = $p42;**	**var $p41 = $p42**
6 7	statement expression	for_in_stat expression	for($p50 $p51 = $p52; $p51 < $p53; $p51++) {...} $p54.getDataSetCount()	for $p51 in $p52 ..< $p53 {...} $p54.dataSetCount
8 9	statement expression	cnst_decl expression	$p60 $p61 = $p62; $p63.get($p64)	let $p61 = $p62 $p63[$p64]



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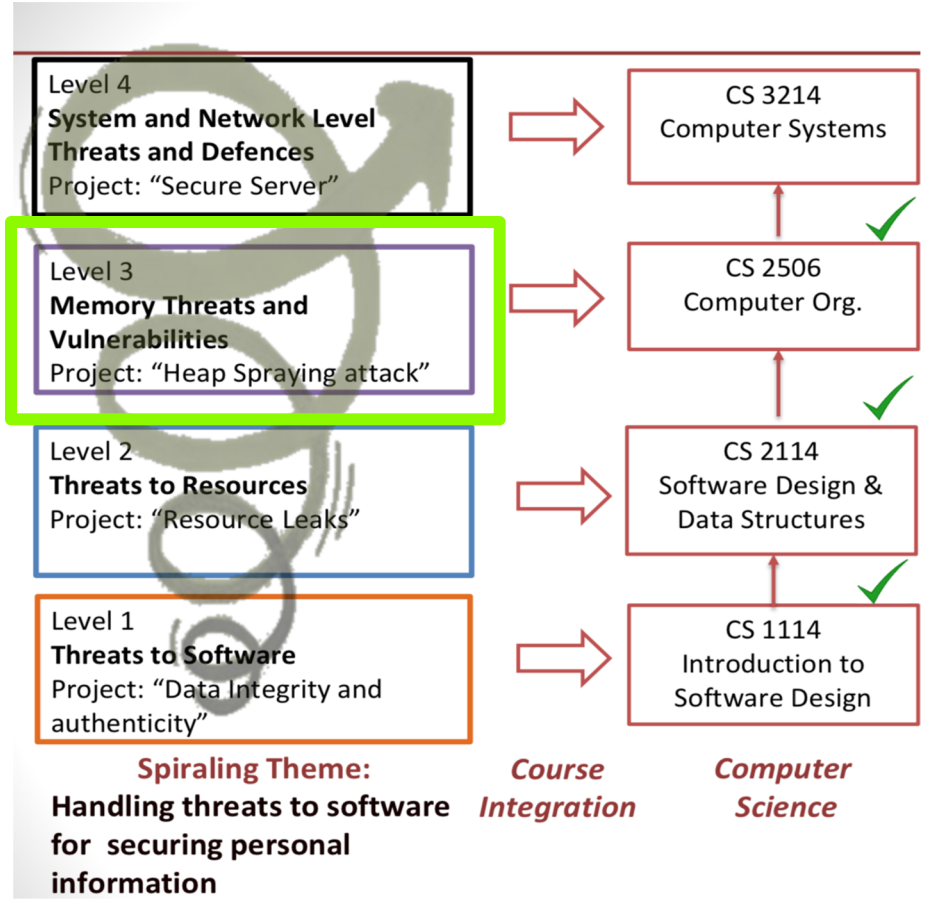
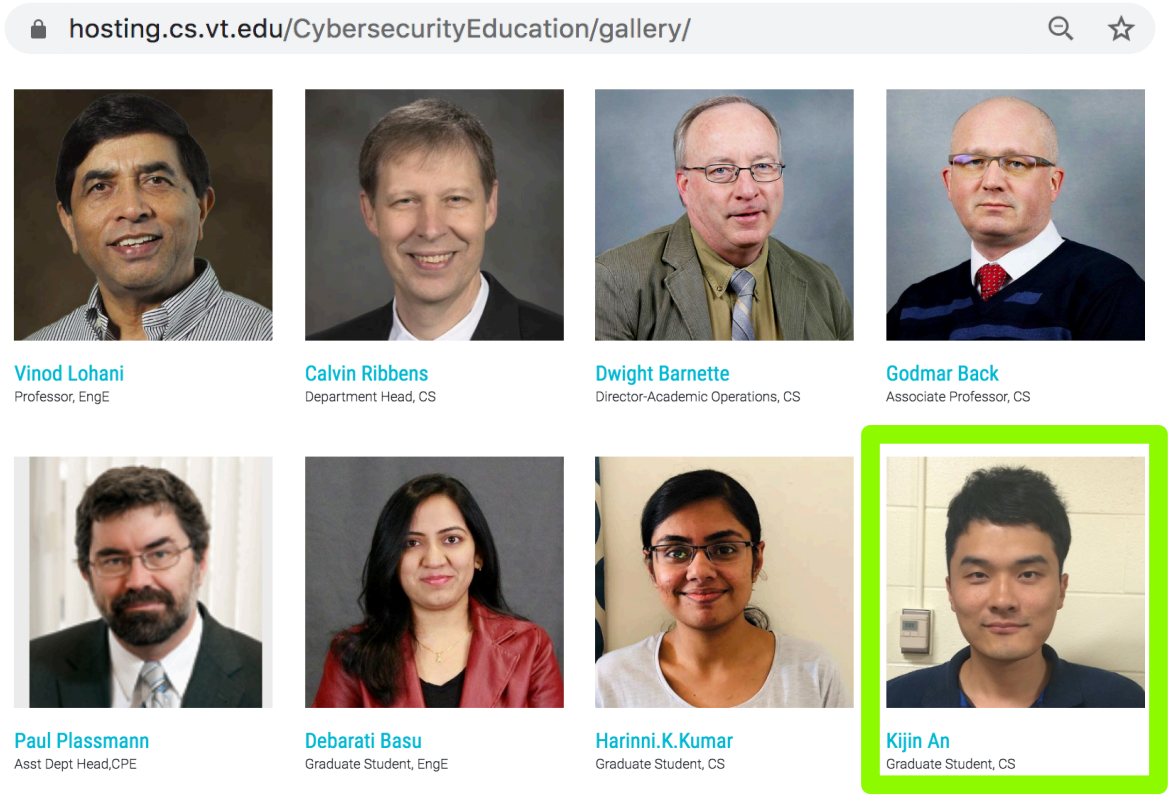
Appendix: Understanding Heap Spraying Attacks

User Study: IRB, 540 undergrads

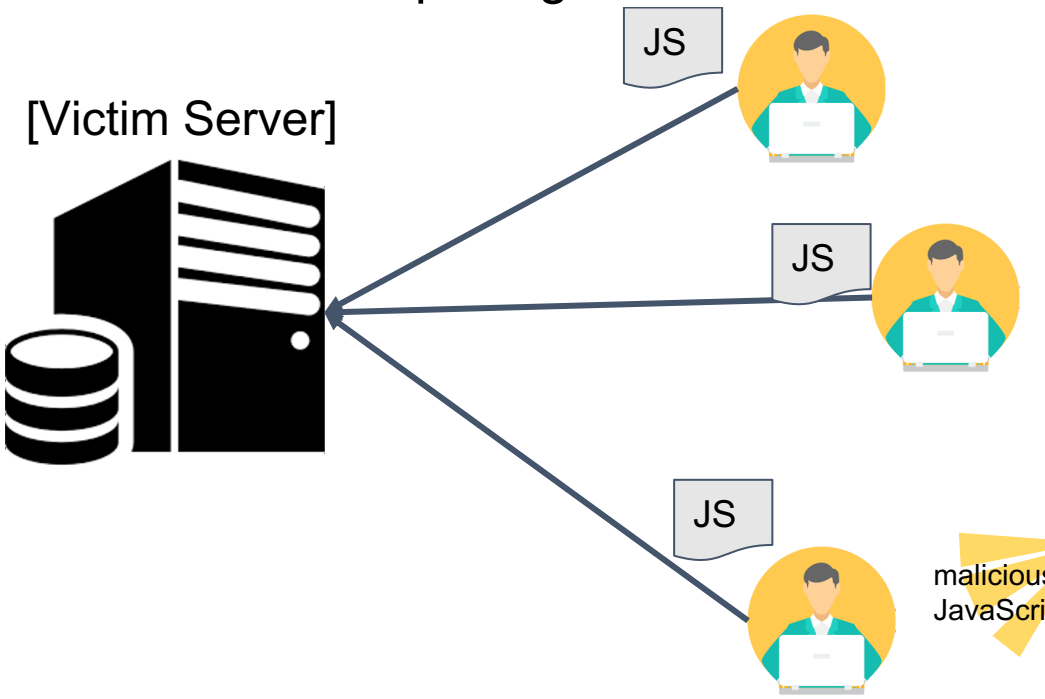


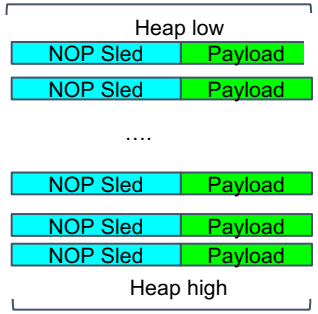


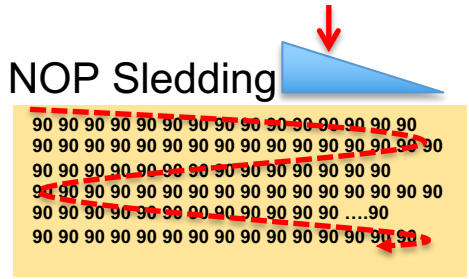
Appendix: Understanding Heap Spraying Attacks

User Study: IRB, 540 undergrads

- Next Level of “Attack Lab”
- Victim Server, Grader
- Extension of JavaScript Engine: V8








```
./sample: file format elf64-x86-64
Disassembly of section .text:
0000000000400078 <start>:
400078:    48 c7 c0 01 00 00 00 mov $0x1,%rax
40007f:    48 c7 c7 01 00 00 00 mov $0x1,%rdi
400086:    48 8d 35 19 00 00 00 lea 0x19(%rip),
%rsi # 4000a6 <hello>
40008d:    48 c7 c2 0e 00 00 00 mov $0xe,%rdx
400094:    0f 05 syscall
400096:    48 c7 c0 3c 00 00 00 00 mov $0x3c,%rax
40009d:    48 c7 c7 00 00 00 mov $0x0,%rdi
4000a4:    0f 05 syscall
```

1. Crafting Assembly Code
2. Heap Spraying with JS Code

Timelines

2003-2007

서울시립대학교 UNIVERSITY OF SEOUL

ECE B.E (4년)
인공지능 **Lab,** 이재호 교수

- Undergrad Intern(2년)
- Agent System (Robotics), Software Engineering

2009

Value Creating University POSTECH POHANG UNIVERSITY OF SCIENCE AND TECHNOLOGY

M.S (2년)
MCNL Lab, 송황준 교수

- Networking, Multimedia (codec)
- WLAN, Zigbee
- 국제논문 4편

2012

SK telesys

Assistant Manager
시스템 **SW** 개발
(3년 4개월)

- 전문연구요원
- WiFi/중계기 시스템 및 원격관리 툴 개발
- WiFi/IPPBX 비지니스 function 개발
- 와이브로, RF/Optic Repeaters

2015

KIST 한국과학기술연구원 Korea Institute of Science and Technology

Researcher (2년 10개월)
Robotics Research,
최종석 책임연구원

- 로봇서비스를 위한 클라우드 시스템개발 :3D시뮬레이터, ML
- 50억 정부과제 실무 (개발/관리) 총괄
- 국제논문: Full Paper 3, Short Paper 7

2015.8
2021.5

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Computer Science, PhD,
Software Innovations Lab,
Eli Tilevich

- Software Engineering
- Distributed Systems
- 국제논문: Full Paper 7, Short Paper 2
- Best Paper 1회, Nomination 2회