





























2016 CHI Conference on Human Factors in Computing Systems. ACM, 3227–3231.

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## A IFTTT APPLET

### A.1 Filter Code

In Listing 2, we show an example snippet of filter code. The code snippet conditionally execute actions based on the time of a day.

**Listing 2: An example snippet of IFTTT applet filter code.**

```

1 var timeOfDay = Meta.currentUserTime.hour()
2
3 if (timeOfDay >= 22 || timeOfDay < 8 ) {
4   // Skip sending me a push notification
5   IfNotifications.sendNotification.skip("Too late")
6 } else {
7   // Skip saving the article to Feedly
8   Feedly.createNewEntryFeedly.skip("I already know")
9 }
    
```

## B INTER-RULE VULNERABILITIES

In Table 6, we show the inter-rule vulnerabilities considered by existing work.

**Table 6: The types of inter-rule vulnerabilities considered by existing work.**

| RULER          | Vulnerabilities Considered   |
|----------------|--|
|                | conflict, loop, revert, duplicate, group duplicate condition bypass, action blocking, not enough rules |
| Soteria [30]   | conflict, duplicate, inconsistent events   |
| IoTSan [70]    | conflict, duplicate  |
| SIFT [52]      | conflict   |
| HomeGuard [32] | conflict, duplicate, loop, condition disabling, condition enabling                                     |
| IoTGuard [31]  | conflict, duplicate, loop  |

## C IOT SYSTEM MODELING

### C.1 Device/Service Metadata

In Listing 3, we show the device metadata of a simple heater with a switch attribute and two commands turn\_on and turn\_off.

**Listing 3: An example device metadata of a simple heater.**

```

1 {
2   "ModelType": "SimpleHeater",
3   "Attributes": [
4     {
5       "Name": "switch",
6       "Type": "bool",
7       "Default": "false"
8     }
9   ],
10  "Commands": [
11    {
12      "Name": "turn_on",
13      "Arguments": [],
14      "Transition": {
    
```

```

15      "assignments": {
16        "switch": "true"
17      }
18    },
19    "Effects": [
20      {
21        "EnvironmentalVariable": "Temperature",
22        "Effect": "Increase",
23        "Rate": 1
24      }
25    ]
26  },
27  {
28    "Name": "turn_off",
29    "Arguments": [],
30    "Transition": {
31      "assignments": {
32        "switch": "false"
33      }
34    }
35  }
36 ]
37 }
    
```

In Listing 4, we show the generated service metadata of the Lockitron<sup>8</sup> service in IFTTT with our NLP-aided information flow analysis tool. The Lockitron service has two triggers “Lockitron locked” and “Lockitron unlocked”, and two actions “Lock Lockitron” and “Unlock Lockitron”.

**Listing 4: The service metadata of Lockitron generated with the help of our NLP tool.**

```

1 {
2   "ServiceType": "Lockitron",
3   "Attributes": [],
4   "Commands": [
5     {
6       "Name": "Lock_Lockitron",
7       "Arguments": [
8         {
9           "Name": "lock_id",
10          "Type": "string"
11        }
12      ],
13      "Transition": {
14        "Events": [
15          {
16            "Name": "Lockitron_Locked"
17          }
18        ]
19      }
20    },
21    {
22      "Name": "Unlock_Lockitron",
23      "Arguments": [],
24      "Transition": {
25        "Events": [
26          {
27            "Name": "Lockitron_Unlocked"
28          }
29        ]
30      }
31    }
32  ]
33 }
    
```

<sup>8</sup><https://ifttt.com/Lockitron>