PLRG
Programming Language
Research Group

A Framework for Dynamic Inter-device Task Dispatch with Eventual Consistency

* KAIST PLRG
# Samsung Electronics

Jihyeok Park*, Joonyoung Park*, Yoonkyong Lee#,
Chul-Joo Kim#, Byoungoh Kim#, Sukyoung Ryu*

Background

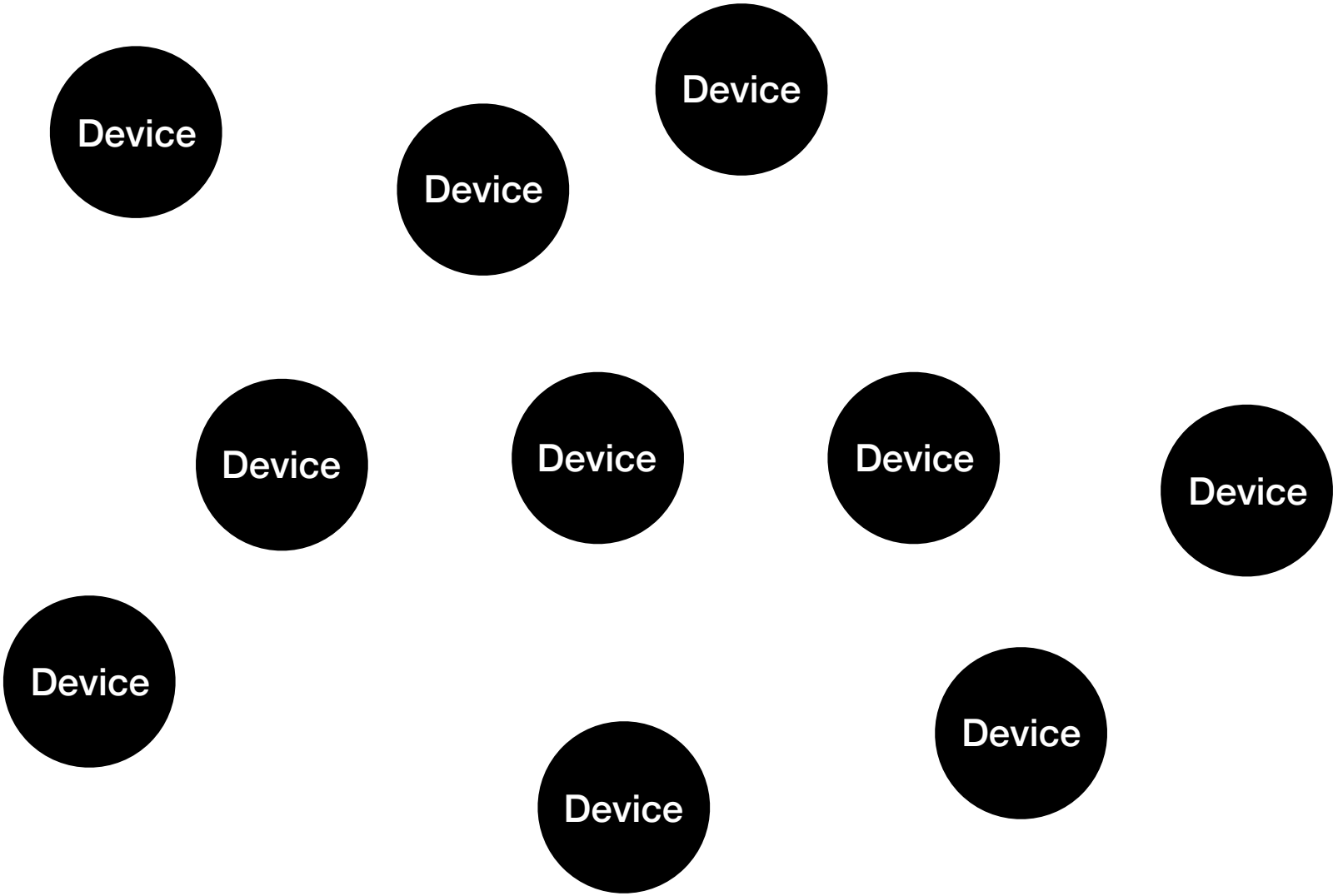
http://guide.servify.in/iot-internet-of-things-explained/

https://www.hughes.co.uk/blog/what-is-screen-mirroring/

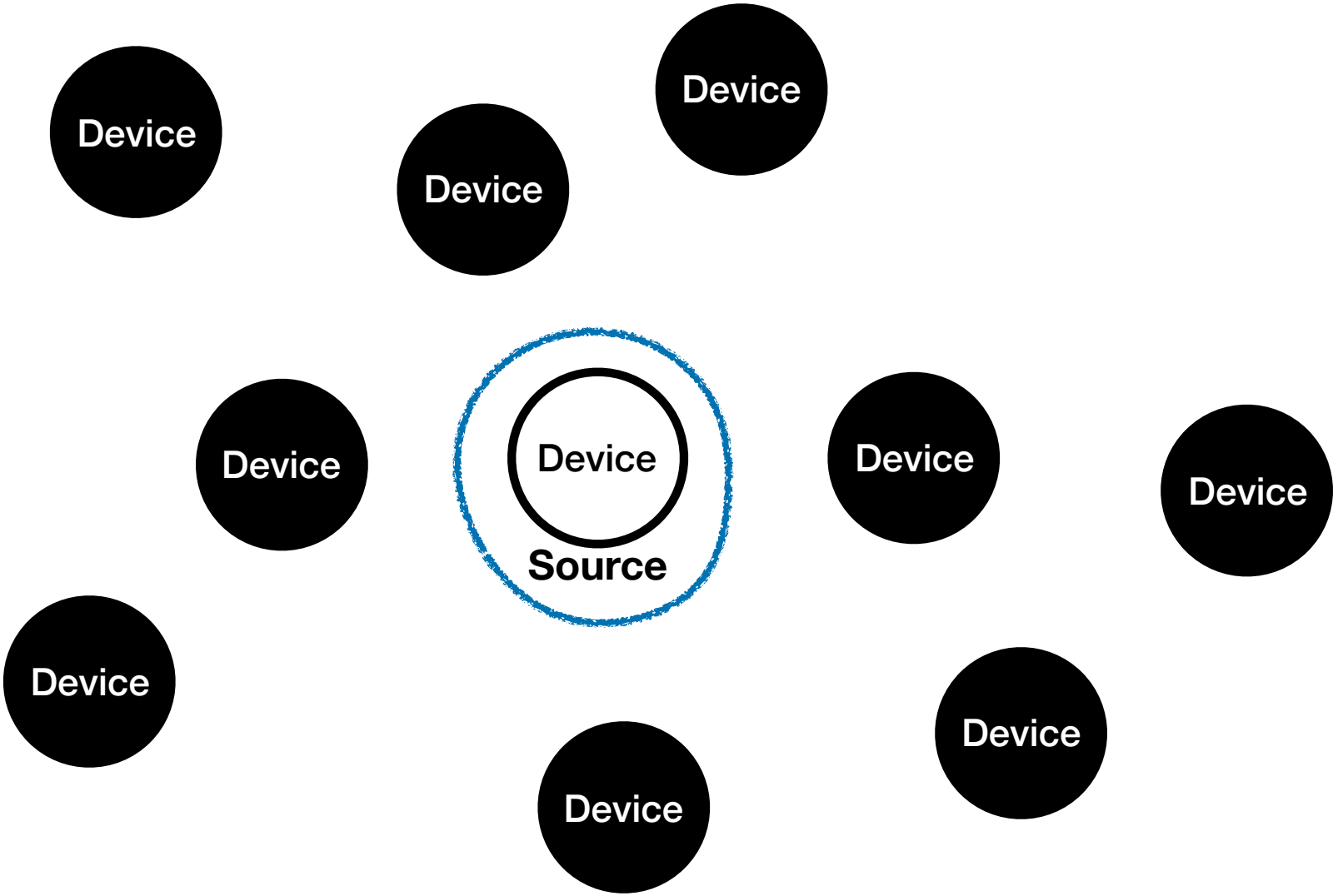
https://dwellhometeam.com/blog/smart-home/#iLightbox%5Bgallery4184%5D/0

Motivation

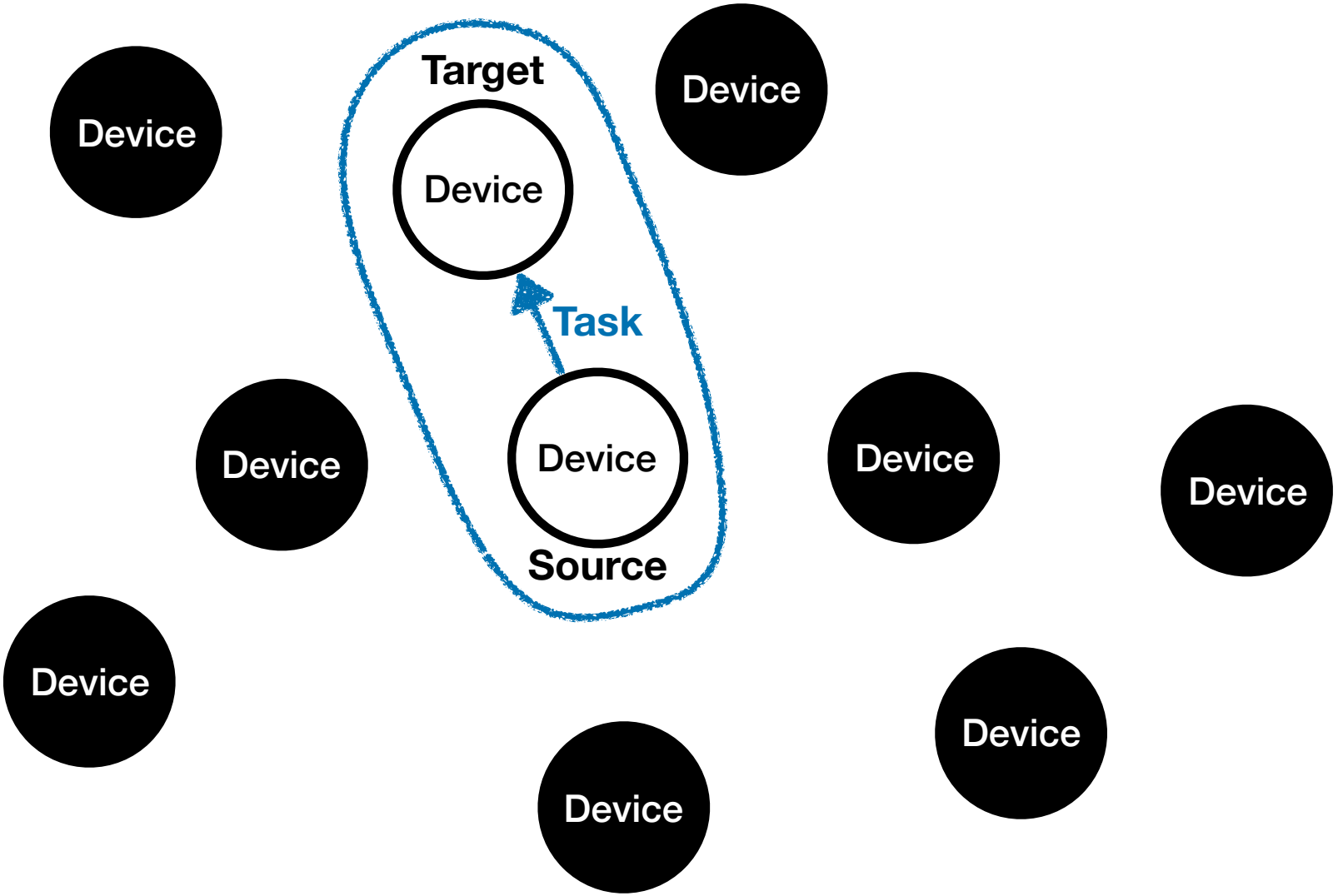
Inter-device Task Dispatch



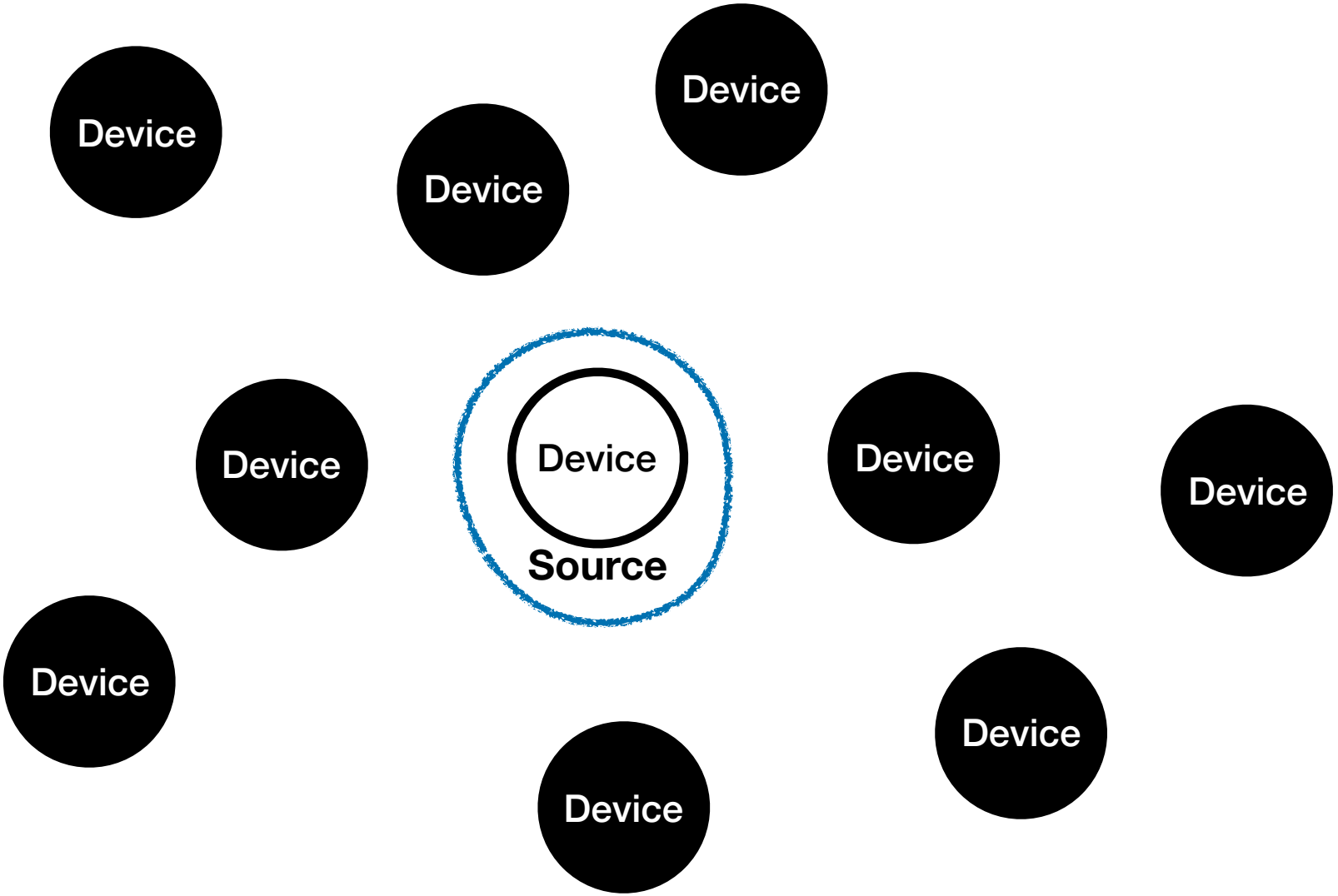
Inter-device Task Dispatch



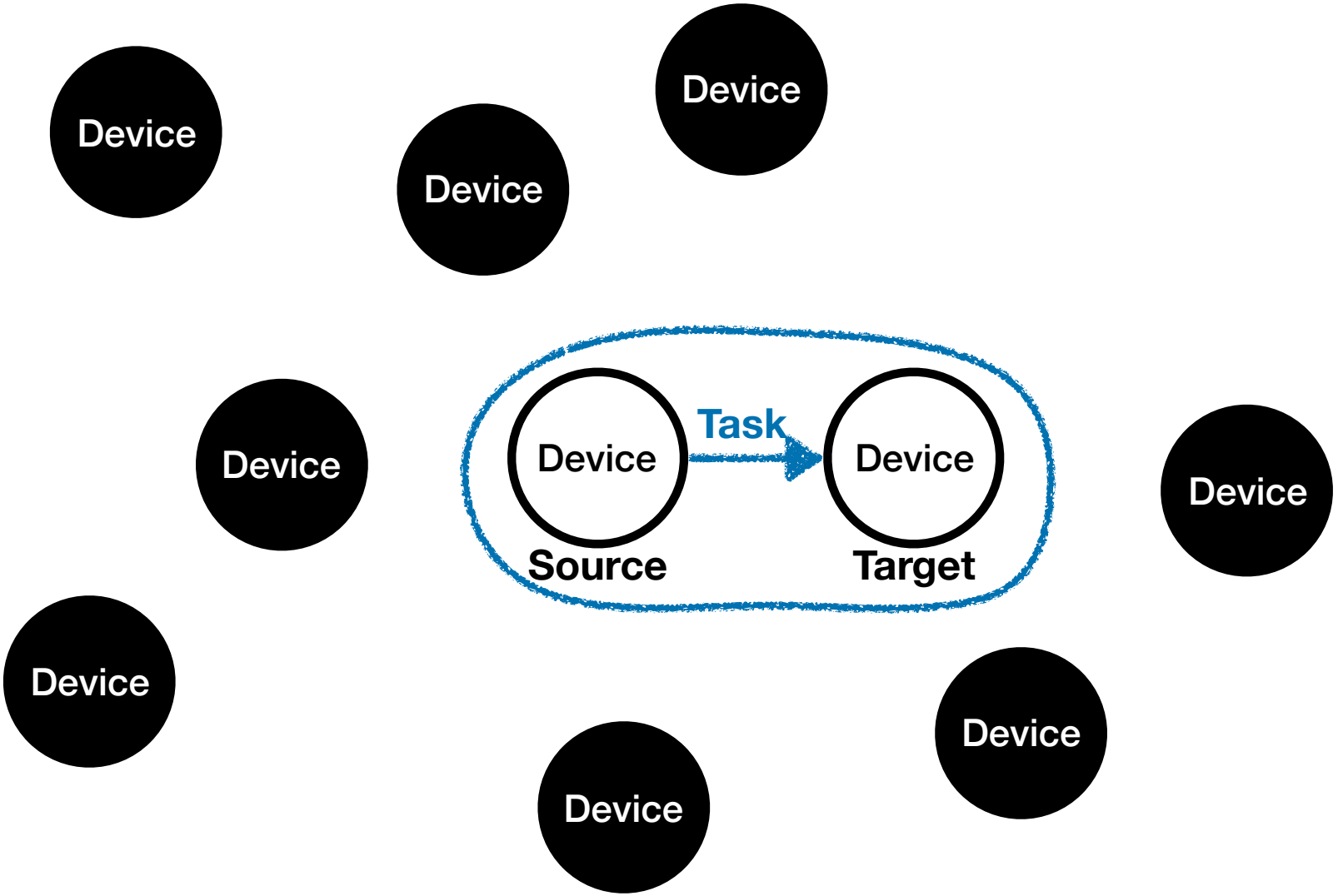
Inter-device Task Dispatch



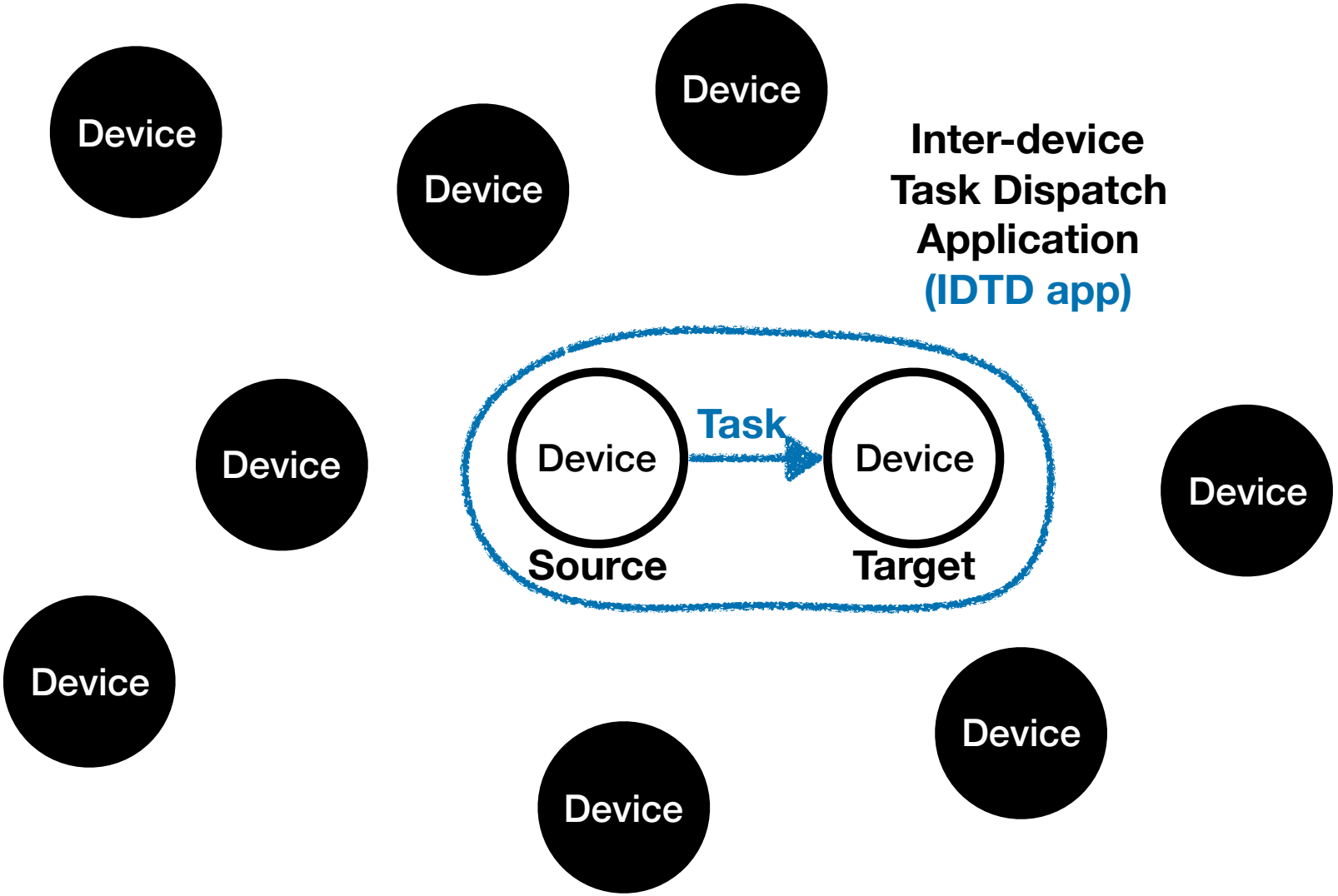
Inter-device Task Dispatch



Inter-device Task Dispatch



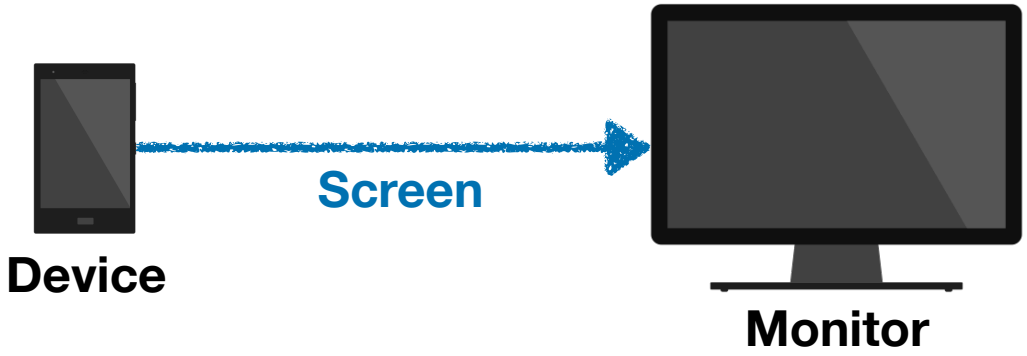
Inter-device Task Dispatch



Current Approaches

- Task Offloading

- Mirroring

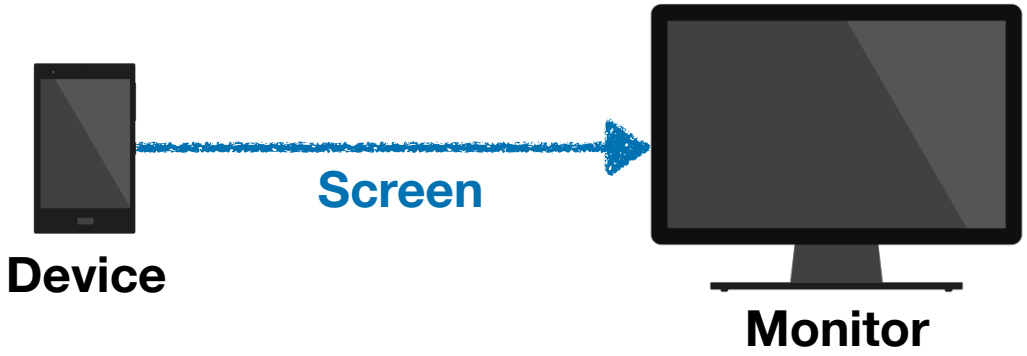


Current Approaches

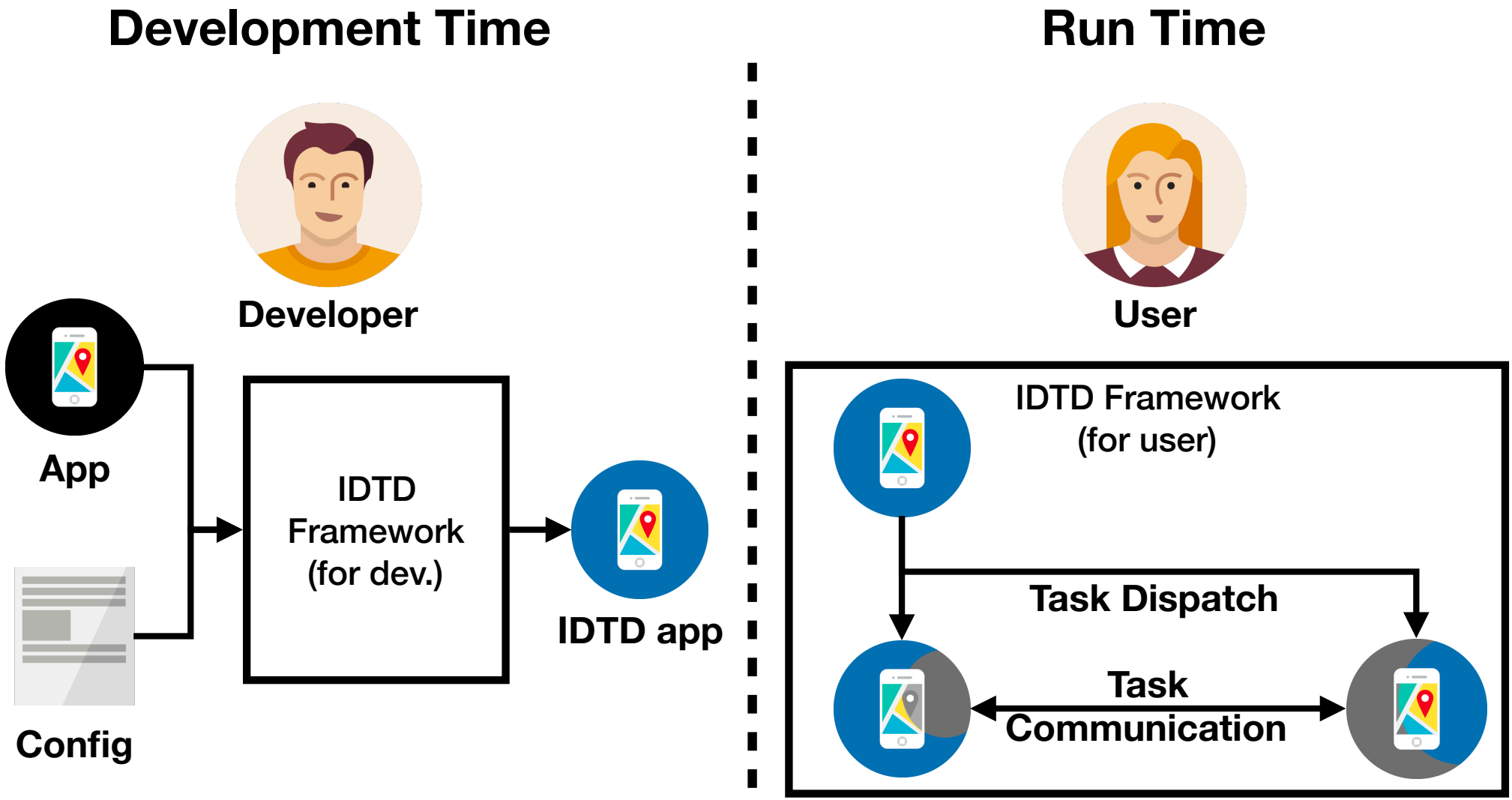
- Task Offloading

No General Framework

- Mirroring

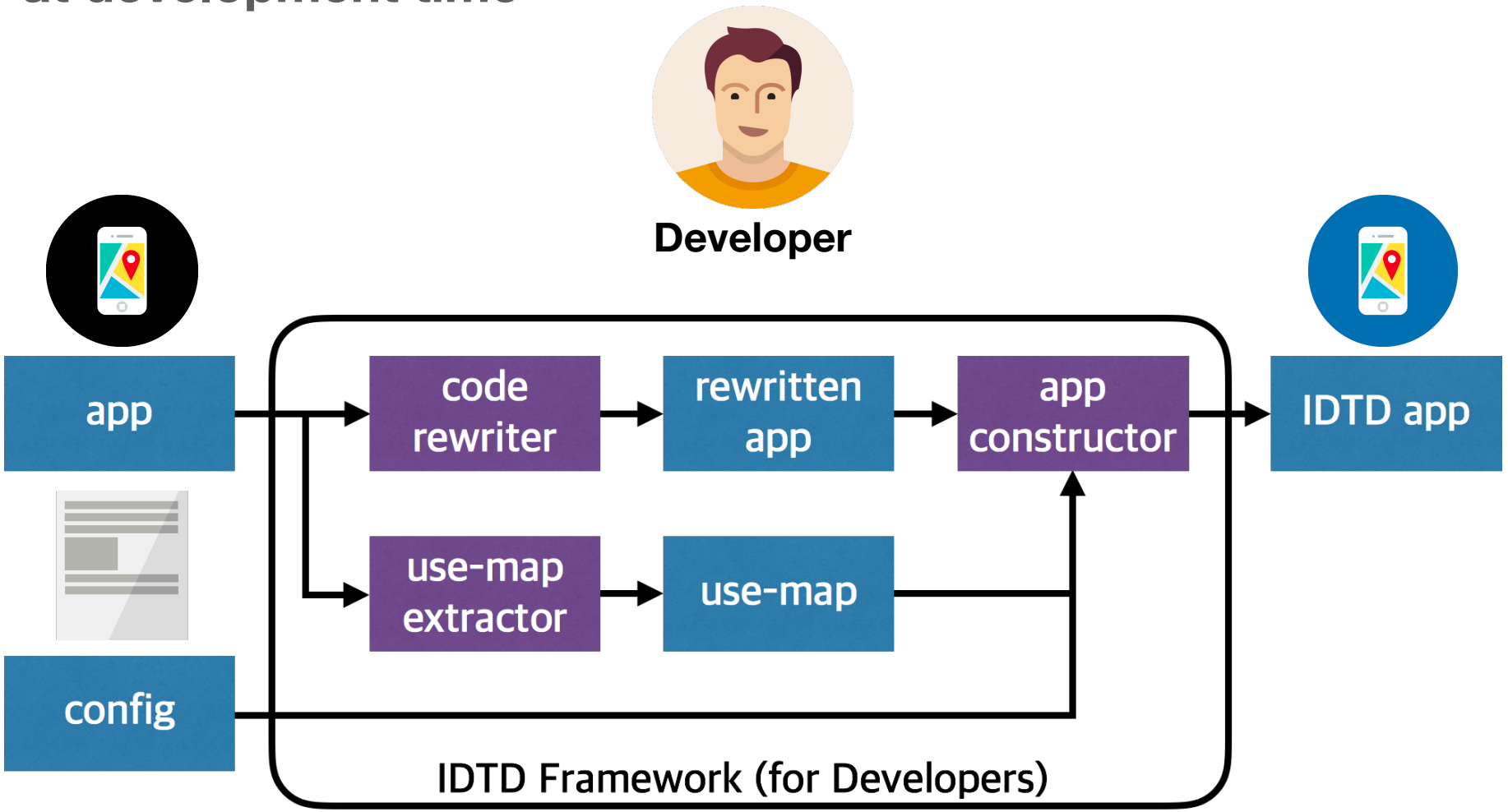


IDTD Framework


Development Time
Run Time
Developer
User
App
Config
IDTD
Framework
(for dev.)
IDTD app
IDTD Framework
(for user)
Task Dispatch
Task
Communication

IDTD Framework

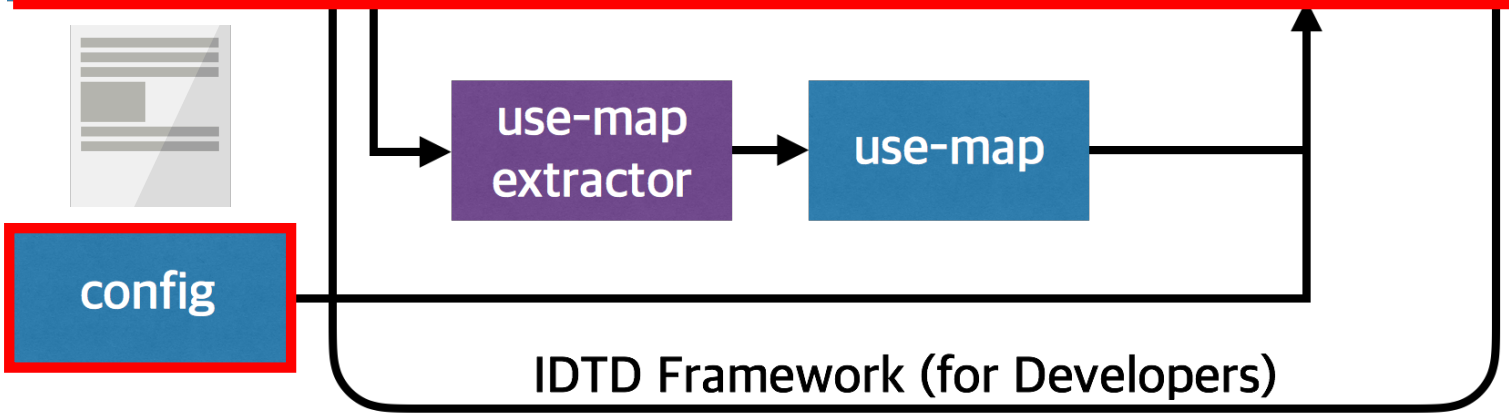
at development time



IDTD Framework

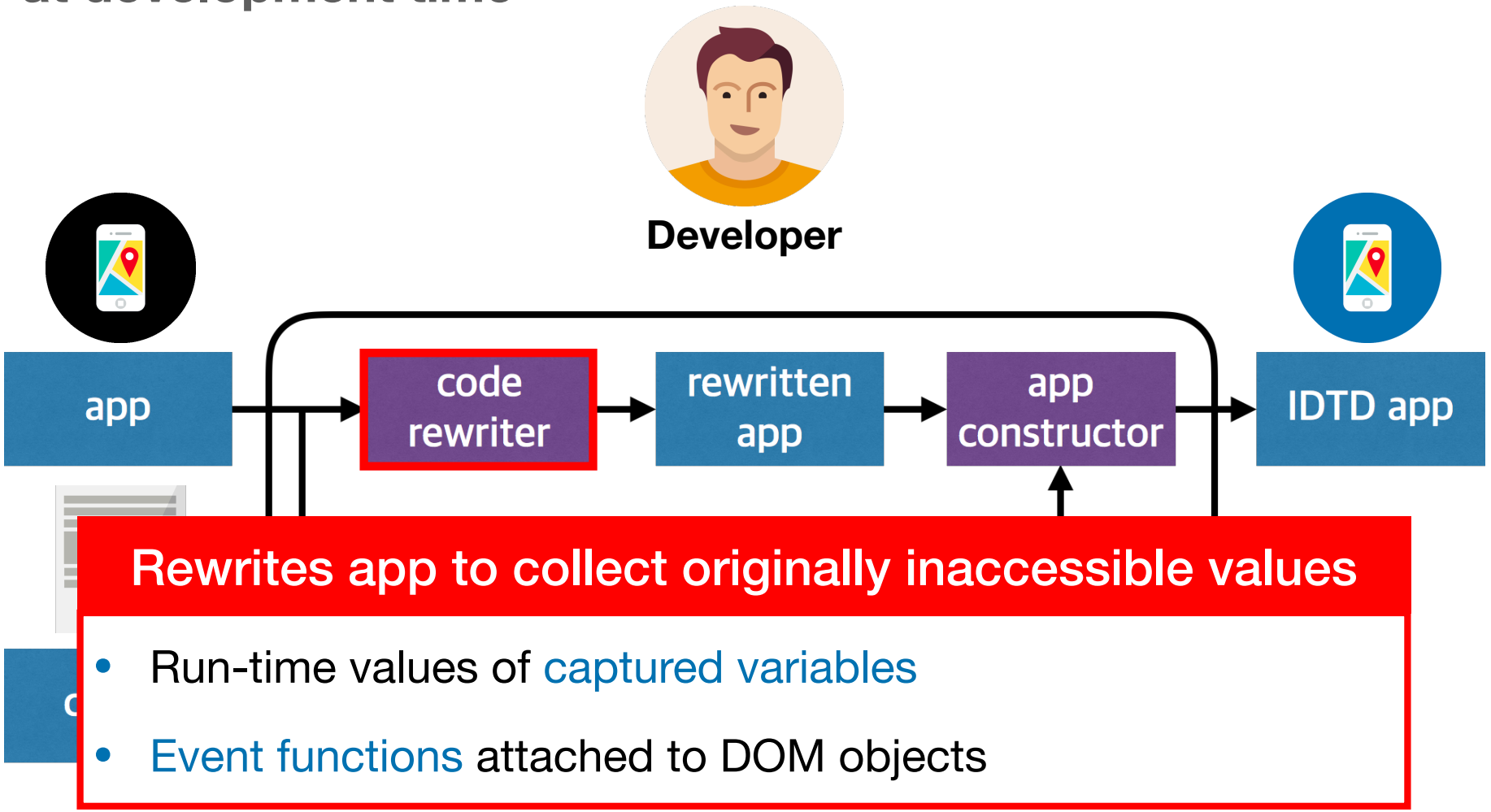
at development time

```
cur := [Elmt Id("gpBar1")]
Elmt Id("gpBar1") :: click -> cur := [Elmt Id("gpBar1")]
Elmt Id("gpBars") :: click -> cur := [Elmt Id("gpBars")]
Elmt Id("gpRestart")::click-> cur := [Elmt Id("gpRestart")]
Elmt Id("gpTotal") :: click -> cur := [Elmt Id("quest1"),
                                       Elmt Id("quest2"), Elmt Id("quest3"),
                                       Elmt Id("gpCup"), Elmt Id("gpTotal")]
Button menu -> cur { screen: both, image: source }
```



IDTD Framework

at development time

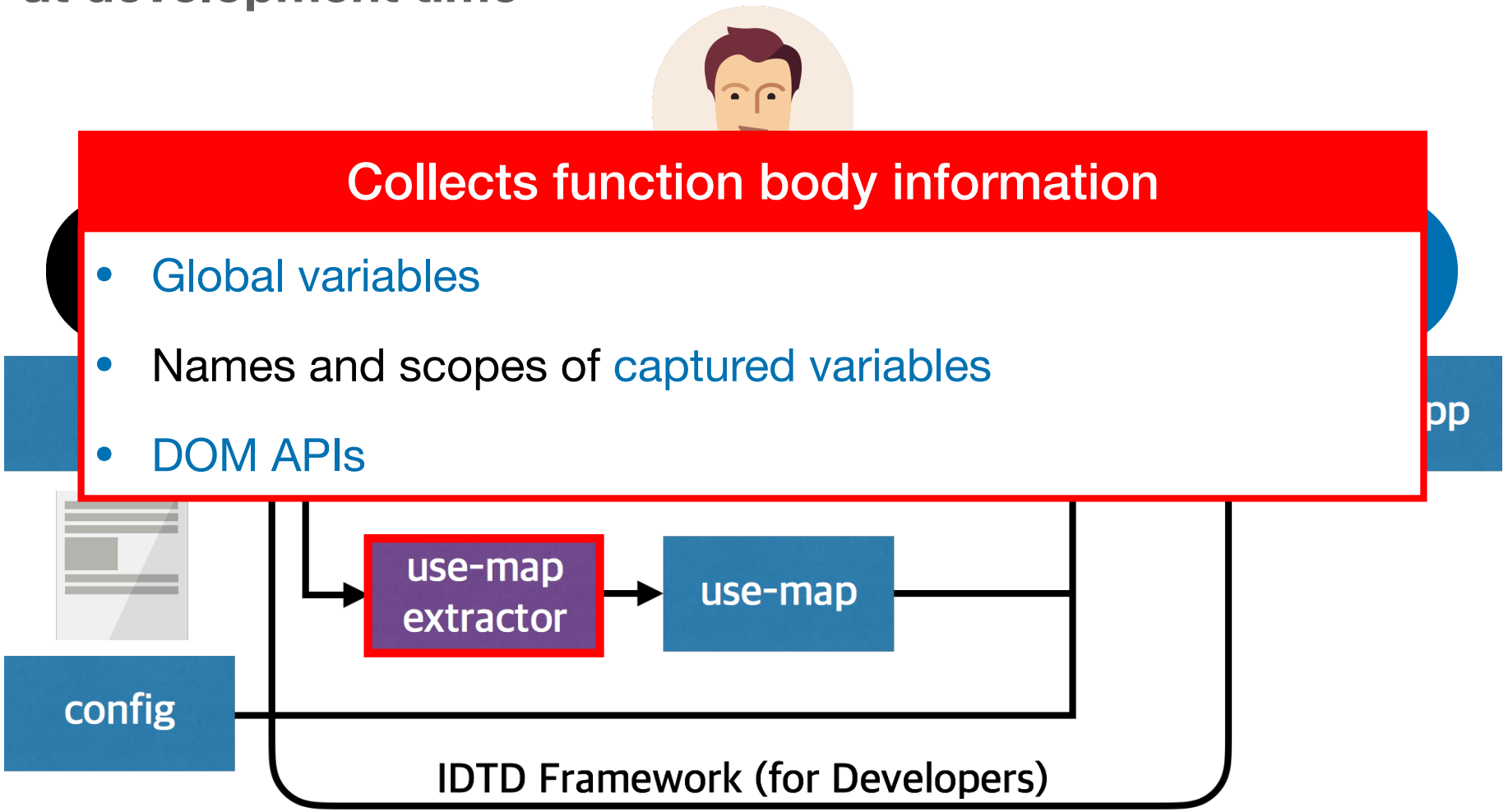


Rewrites app to collect originally inaccessible values

- Run-time values of captured variables
- Event functions attached to DOM objects

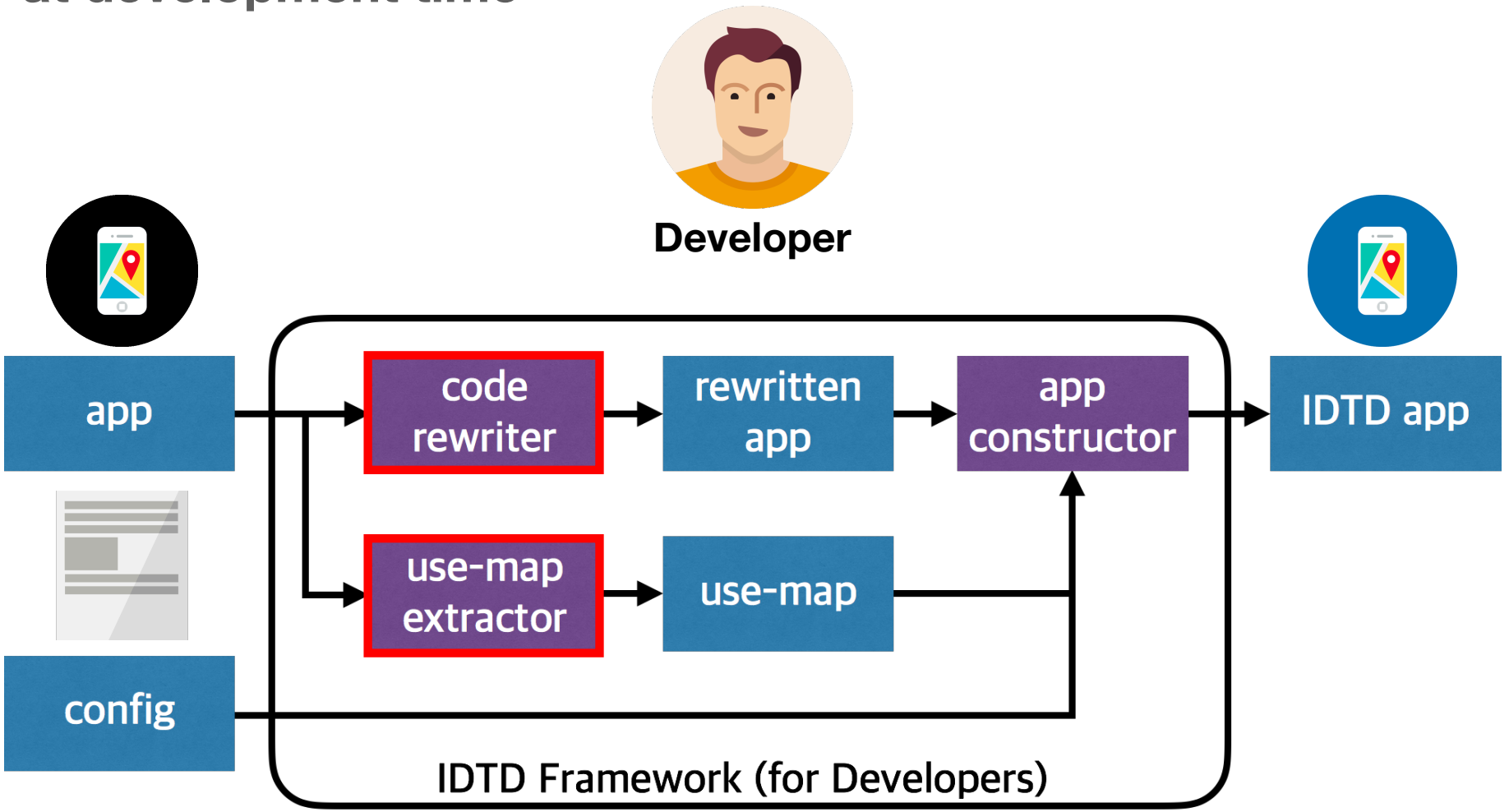
IDTD Framework

at development time



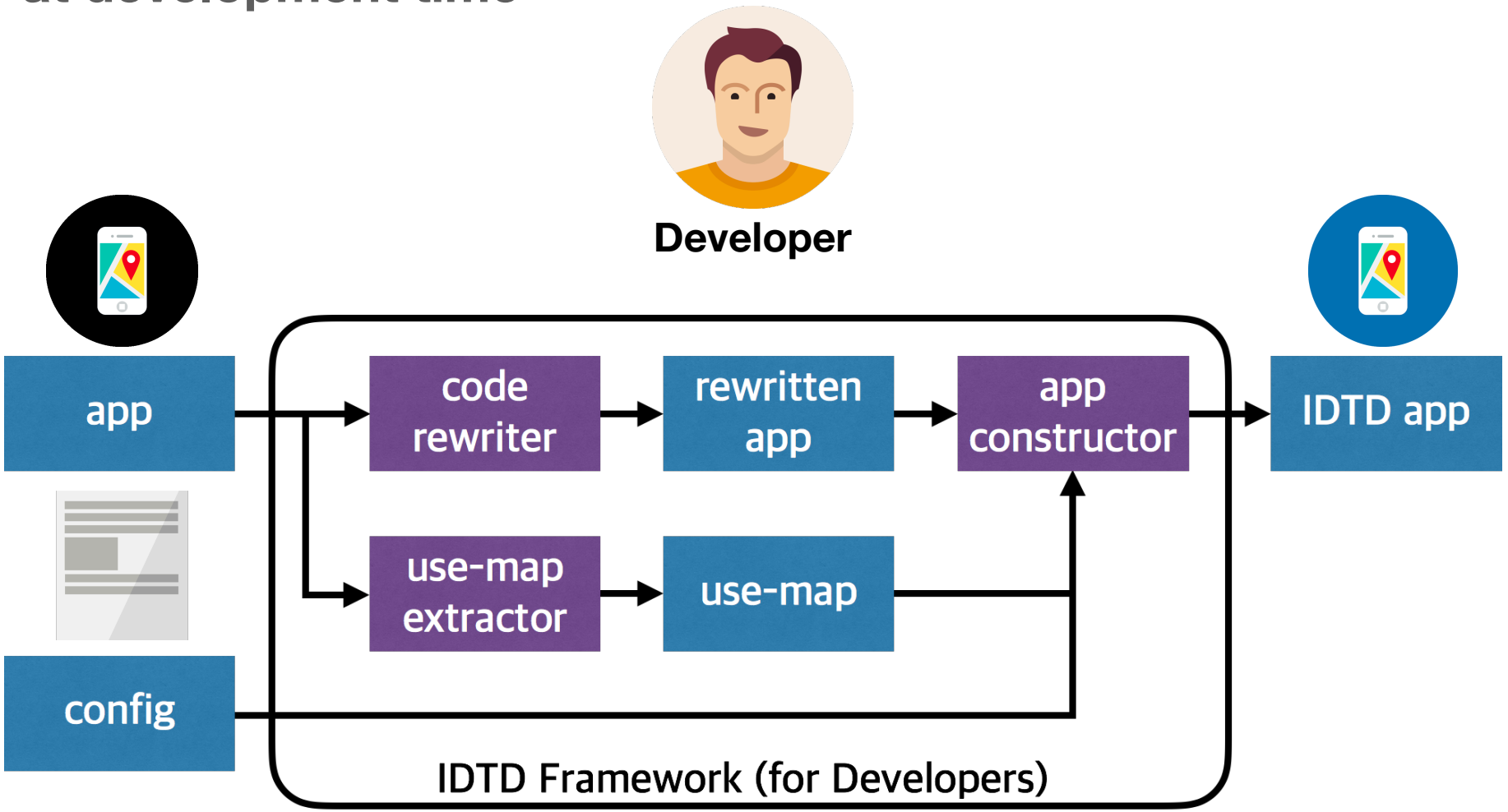
IDTD Framework

at development time



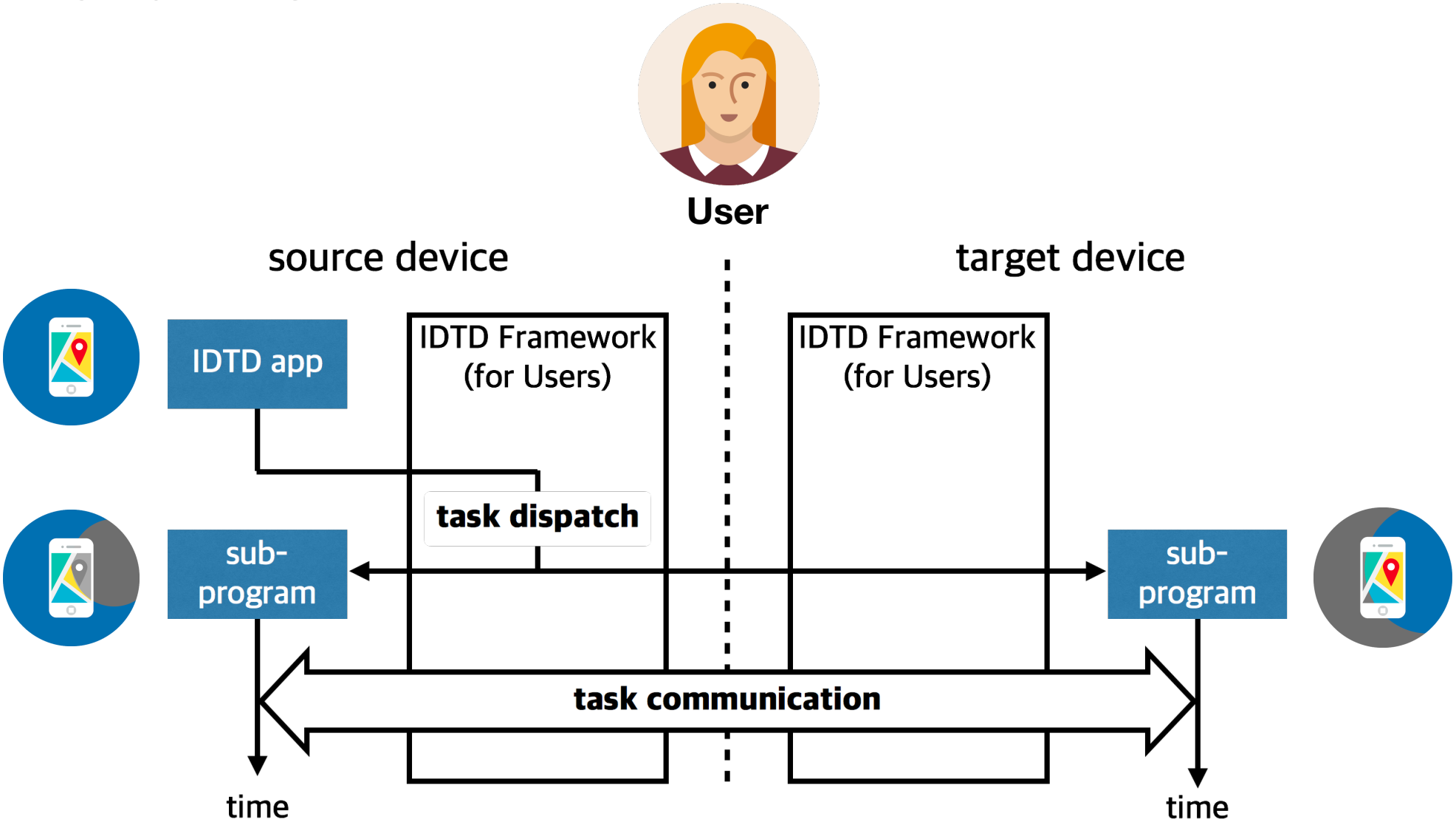
IDTD Framework

at development time



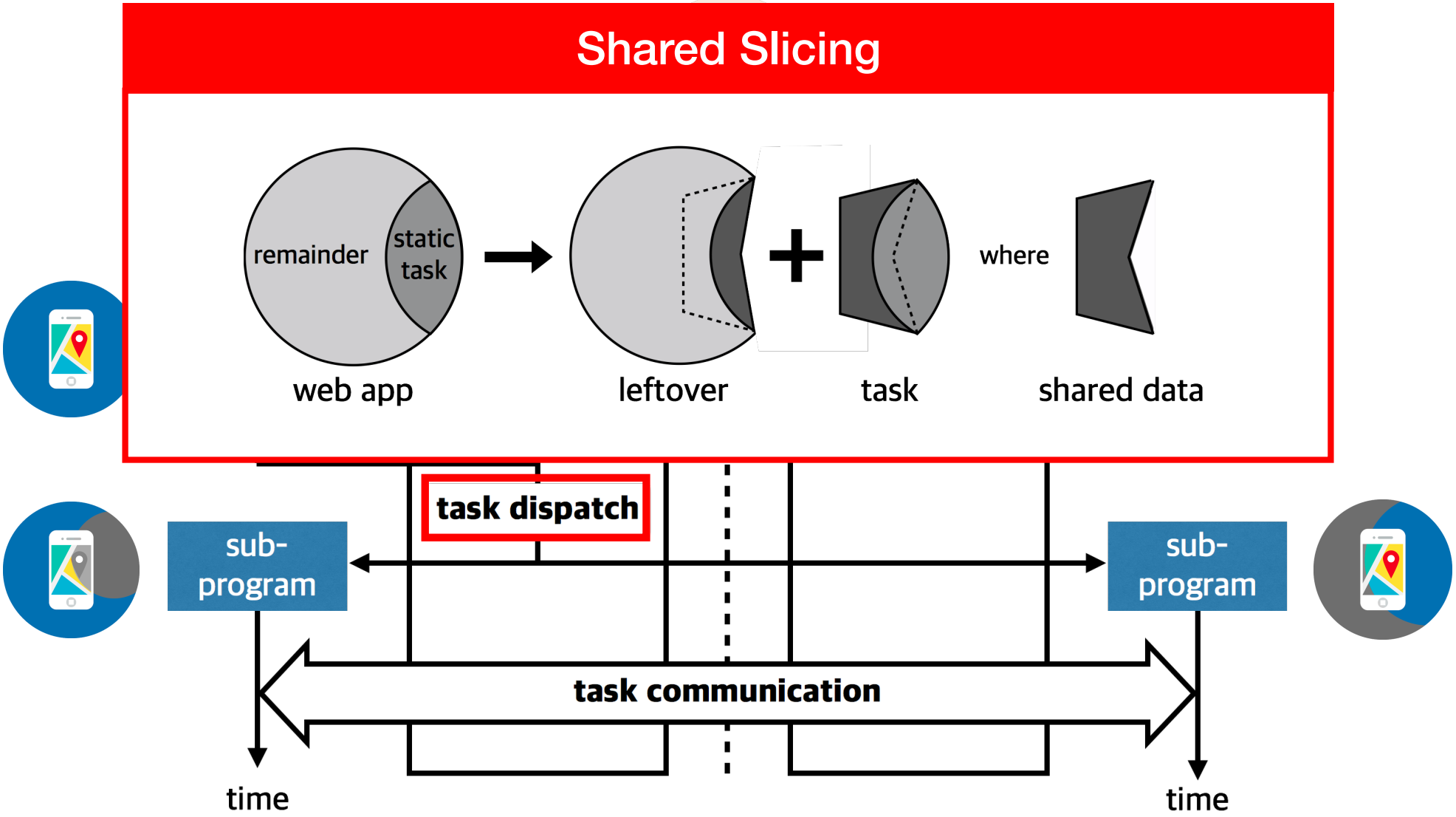
IDTD Framework

at run time



IDTD Framework

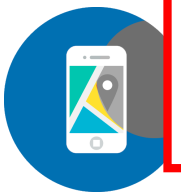
at run time

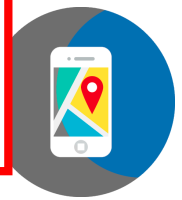


IDTD Framework

at run time

User

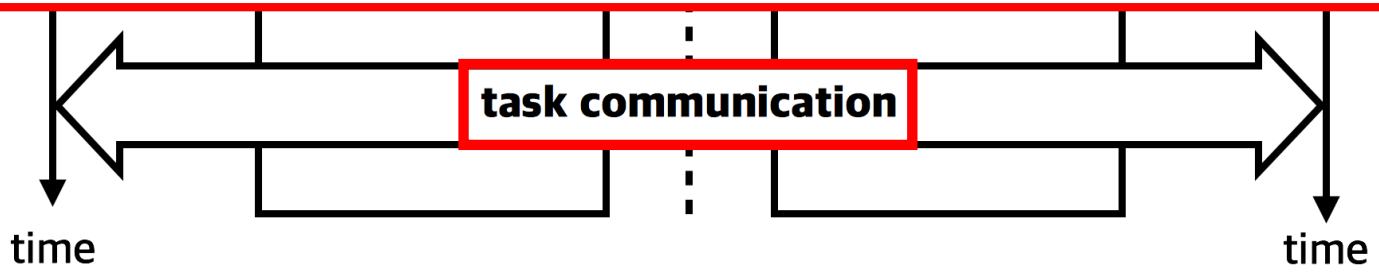




Eventual Consistency

- Guarantees the same status when no more updates
  - Extended from the paper* written by Marc Shapiro et al.
  - LWW-Register and OR-Map over timestamp for JS

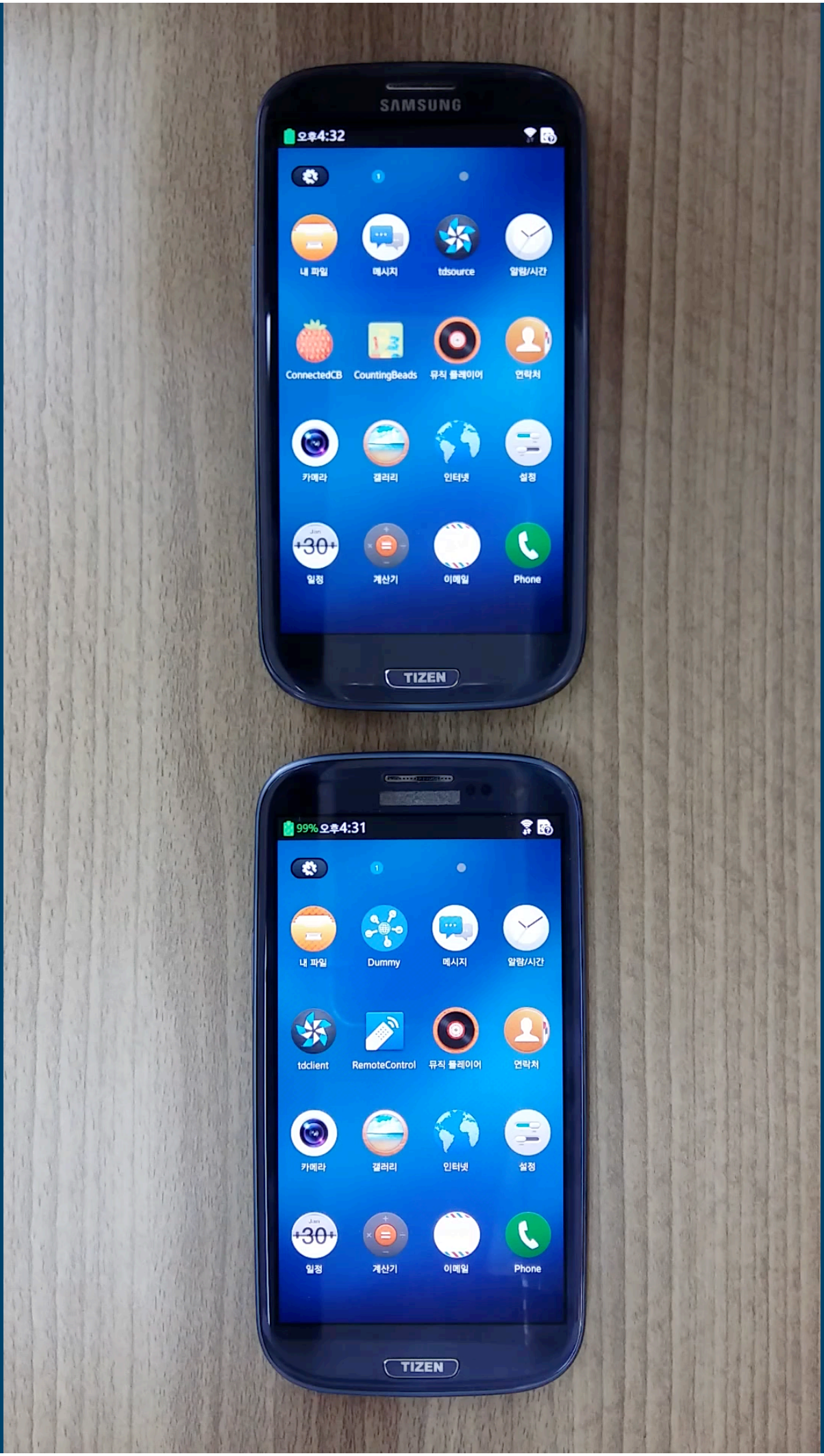
*** Marc Shapiro et al. A comprehensive study of Convergent and Commutative Replicated Data Types.**



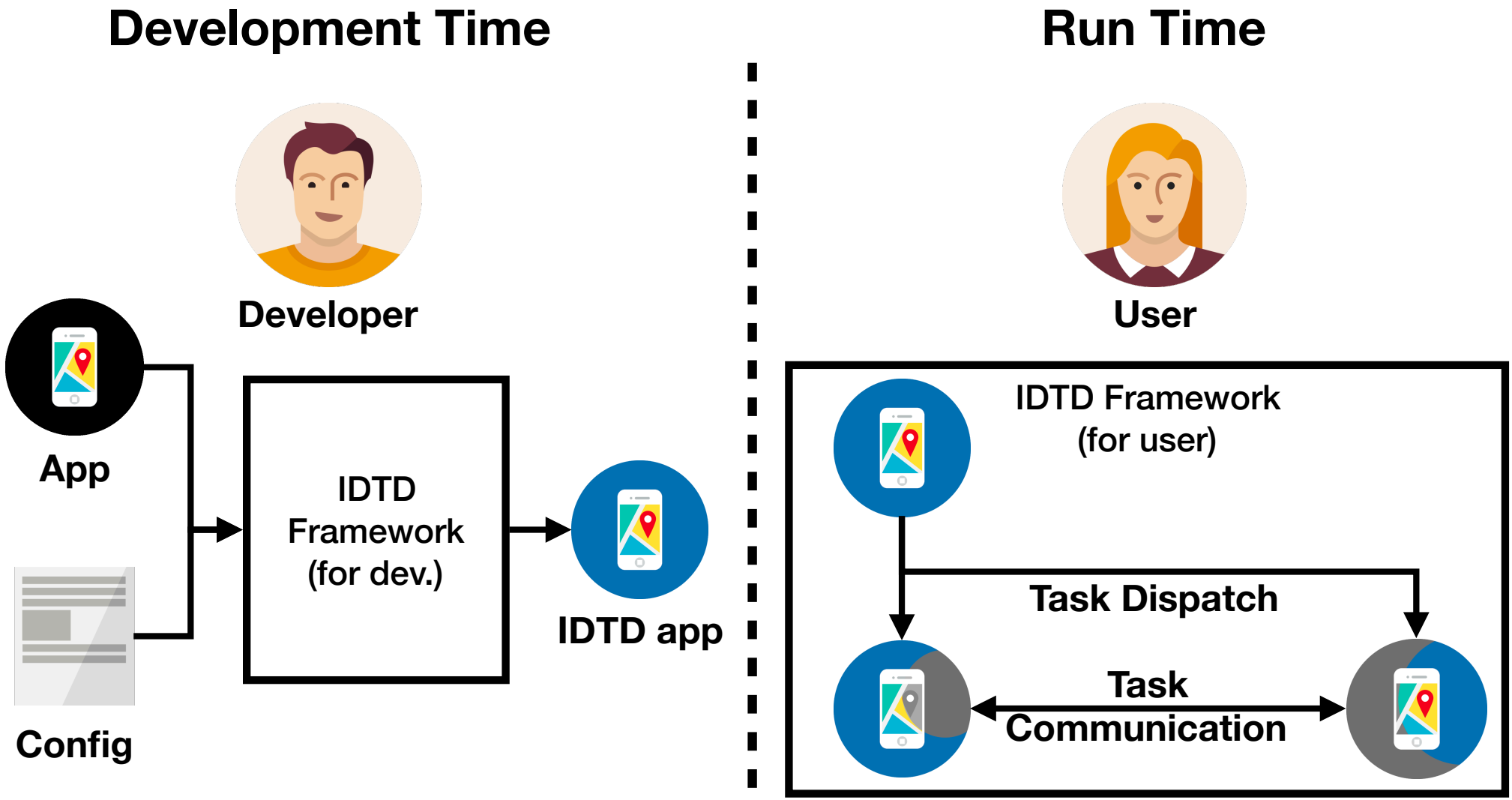
Evaluation

Practicality of the IDTD Framework

- 5 apps from 20 open-source web apps:
  - Counting Beads
  - Hang On Man
  - Make a Monster
  - Mancala
  - Run Rabbit Run


SAMSUNG
오후4:32
내 파일
메시지
tdsource
알람/시간
ConnectedCB
CountingBeads
뮤직 플레이어
연락처
카메라
갤러리
인터넷
설정
일정
계산기
이메일
Phone
TIZEN
99% 오후4:31
내 파일
Dummy
메시지
알람/시간
tdclient
RemoteControl
뮤직 플레이어
연락처
카메라
갤러리
인터넷
설정
일정
계산기
이메일
Phone
TIZEN

Conclusion


Development Time
Run Time
Developer
User
App
Config
IDTD
Framework
(for dev.)
IDTD app
IDTD Framework
(for user)
Task Dispatch
Task
Communication

IDTD applications have vulnerability issues.

1. How to attack IDTD apps?

2. How to defend IDTD apps from such attacks?