

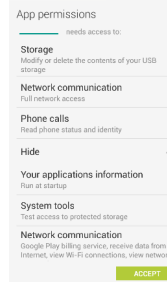
Android Permissions

Android applications have to request permission to access privacy-sensitive functions on phones.

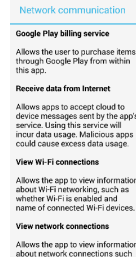
- Internet
- Read/write messages
- SMS messages

All-at-once model leads to contact harvesting by several companies, including large multi-national and consequent investigations by regulation authorities.

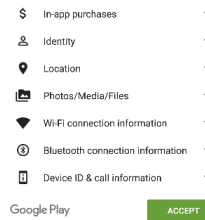
Evolution of Permission Screens



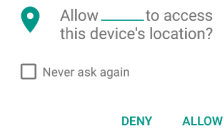
Explicit



Explicit II



Grouped



Request

Questions

- Given the potential dangers to privacy, questions pop up:
- What investment is required from users to read all the permissions for the applications they download?
 - What is the opportunity cost for Android smartphone users if they would actually read all the user permission screens?
 - How do different Android permission models change the cost to privacy?
 - What is the opportunity cost to the United States?

Rough Estimation Methods

$$Cost = T_R \times wage$$

$Cost$, the opportunity cost
 T_R , the time it takes to read permissions
 $wage$, the average hourly wage

$$T_R = n \times Words \div R$$

n , the average number of applications downloaded
 $Words$, the number of words on a permission screen
 R , the average reading rate

See more details in the paper, available from the FTC workshop website and at:

<http://www.winlab.rutgers.edu/~janne>

See also elasticpathing.org and securegestures.org for other work.

Opportunity Cost

Models	Lower Bound	Point Estimate	Upper Bound
Explicit	\$0.52	\$1.86	\$4.34
Explicit(II)	\$2.32	\$8.40	\$20.14
Grouped	\$0.05	\$0.25	\$0.76
Grouped(II)	\$0.32	\$1.77	\$5.16
Grouped(III)	\$0.63	\$2.83	\$7.43
Request	0	\$0.16	\$0.75

Annual opportunity cost for person if read at leisure

Models	Lower Bound	Point Estimate	Upper Bound
Explicit	\$4.23	\$14.96	\$34.83
Explicit(II)	\$18.58	\$67.24	\$161.21
Grouped	\$0.41	\$2.06	\$6.03
Grouped(II)	\$2.53	\$14.19	\$41.35
Grouped(III)	\$5.05	\$22.71	\$59.46
Request	0	\$1.29	\$6.03

Annual opportunity cost for person if read at work

Models	Lower Bound	Point Estimate	Upper Bound
Explicit	\$2.407B	\$3.405B	\$4.404B
Explicit(II)	\$10.569B	\$15.032B	\$20.375B
Grouped	\$234.9MM	\$469.8MM	\$763.4MM
Grouped(II)	\$1.468B	\$3.229B	\$5.226B
Grouped(III)	\$2.877B	\$5.167B	\$7.516B
Request	0	\$293.6MM	\$763.4MM

Annual opportunity cost in millions and billions to the USA if permissions are read at work.