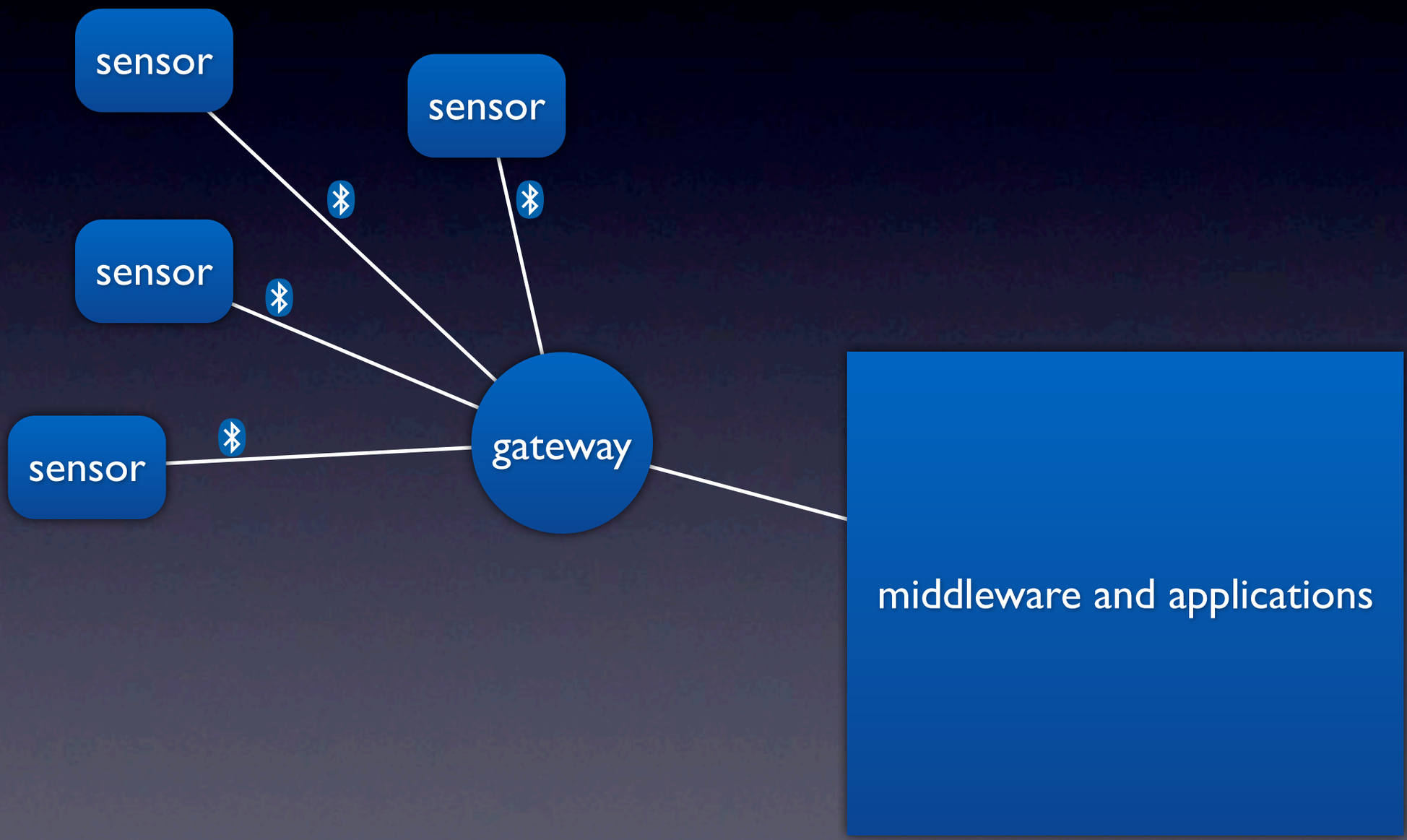
Anonymity properties of stored or transmitted data taken from Bluetooth scans

David Evans
Computer Laboratory
University of Cambridge
United Kingdom

Robert H. Warren
Department of Informatics
University of Zürich
Switzerland

The Scenario



Implications

- Applications know only what the gateway node tells them
- The gateway's behaviour determines the privacy properties of the system

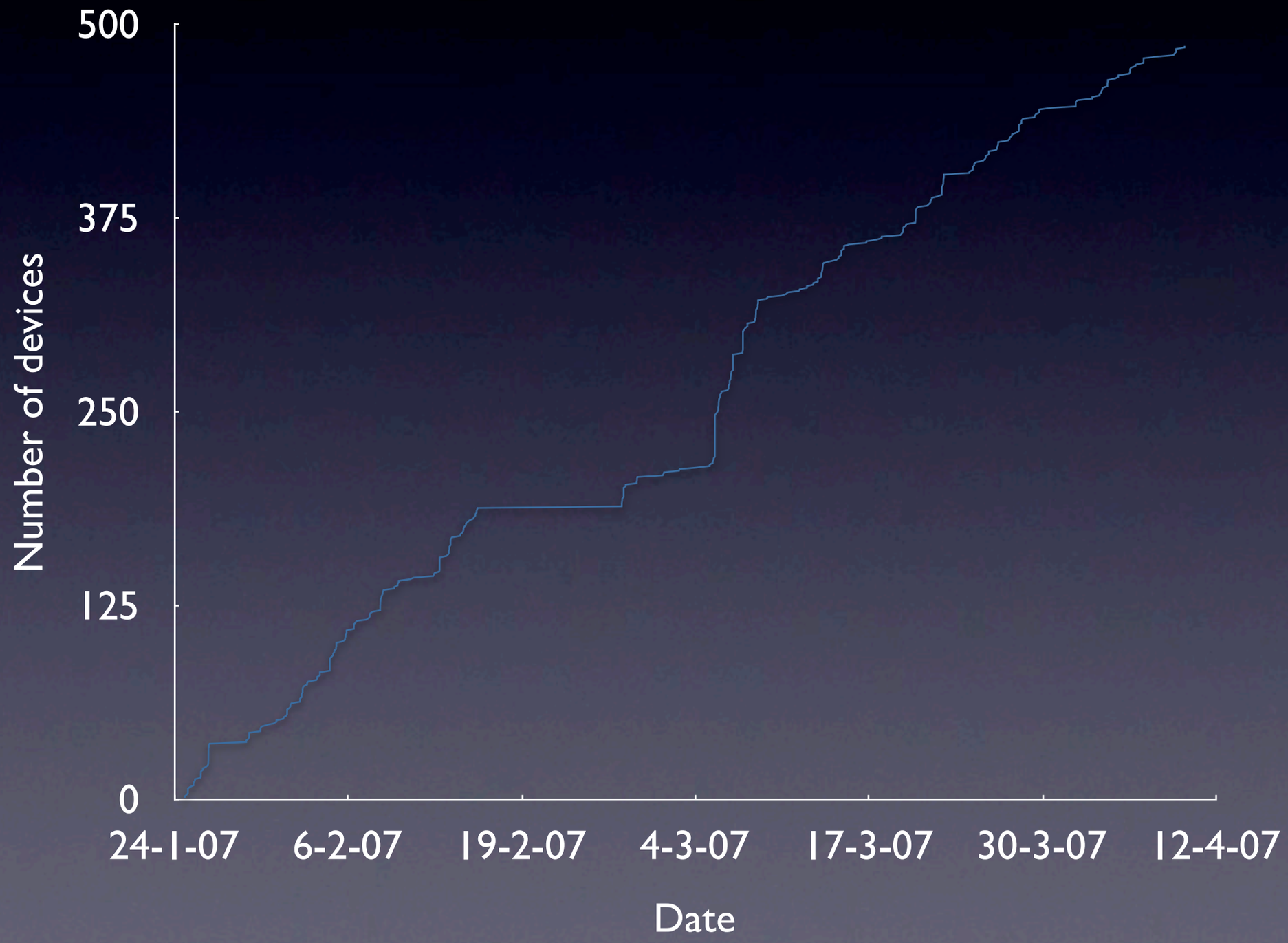
Measuring anonymity

- Anonymity set size
- Information-theoretic reflection of extra knowledge

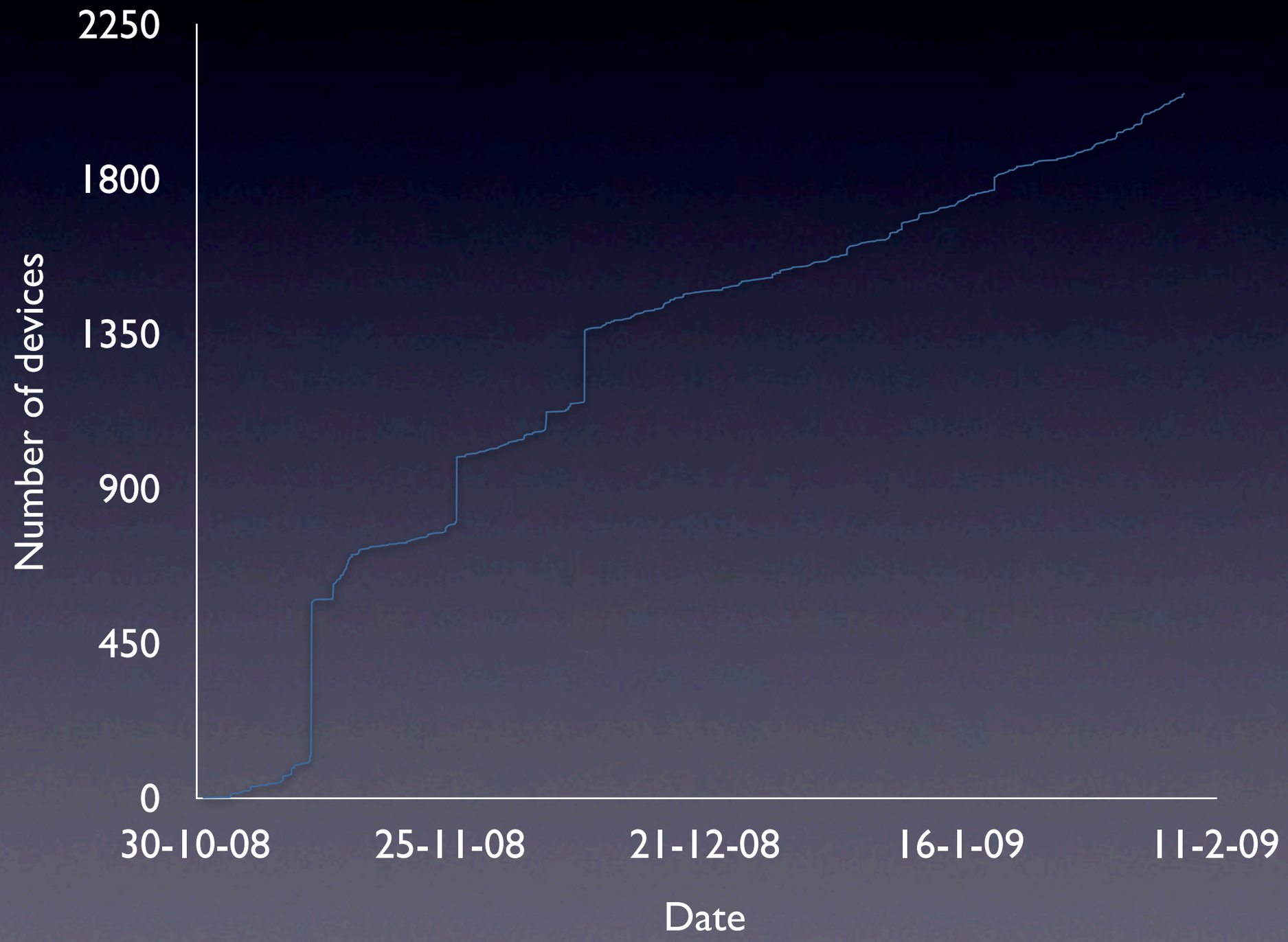
Device attributes

- name
- address
- class
- services offered

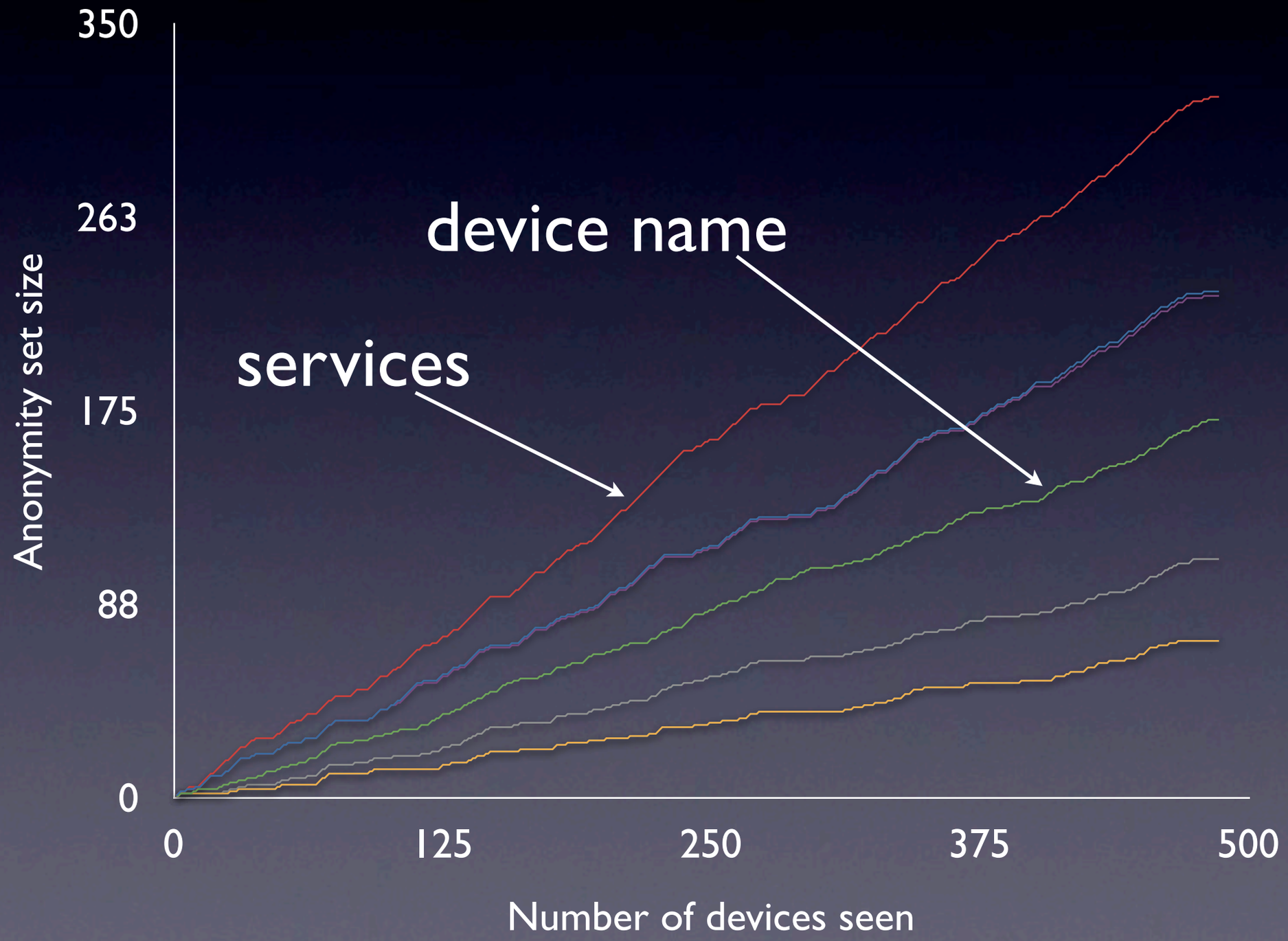
Number of devices seen, data set 1



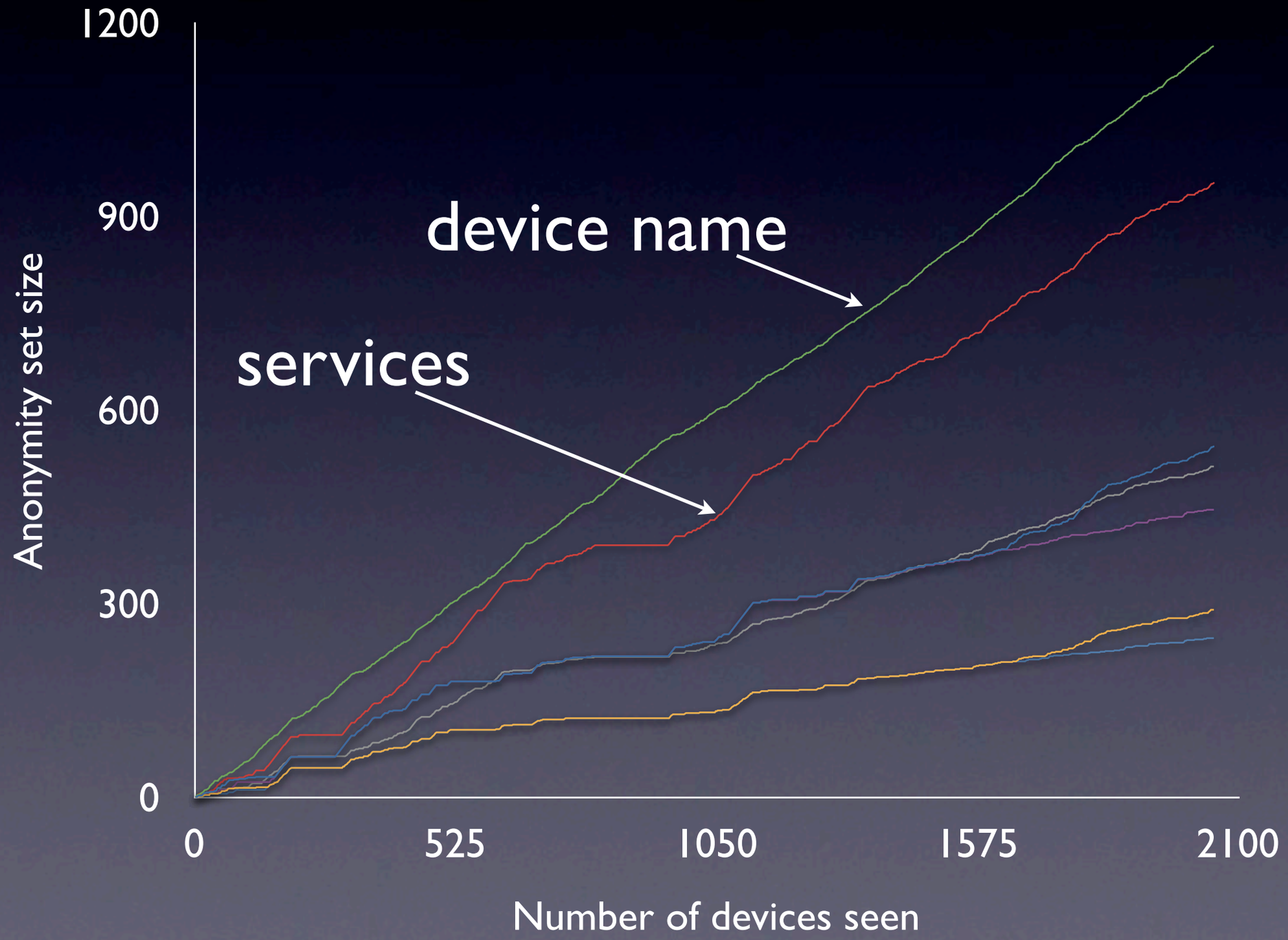
Number of devices seen, data set 2



Maximum anonymity set size, data set 1



Maximum anonymity set size, data set 2



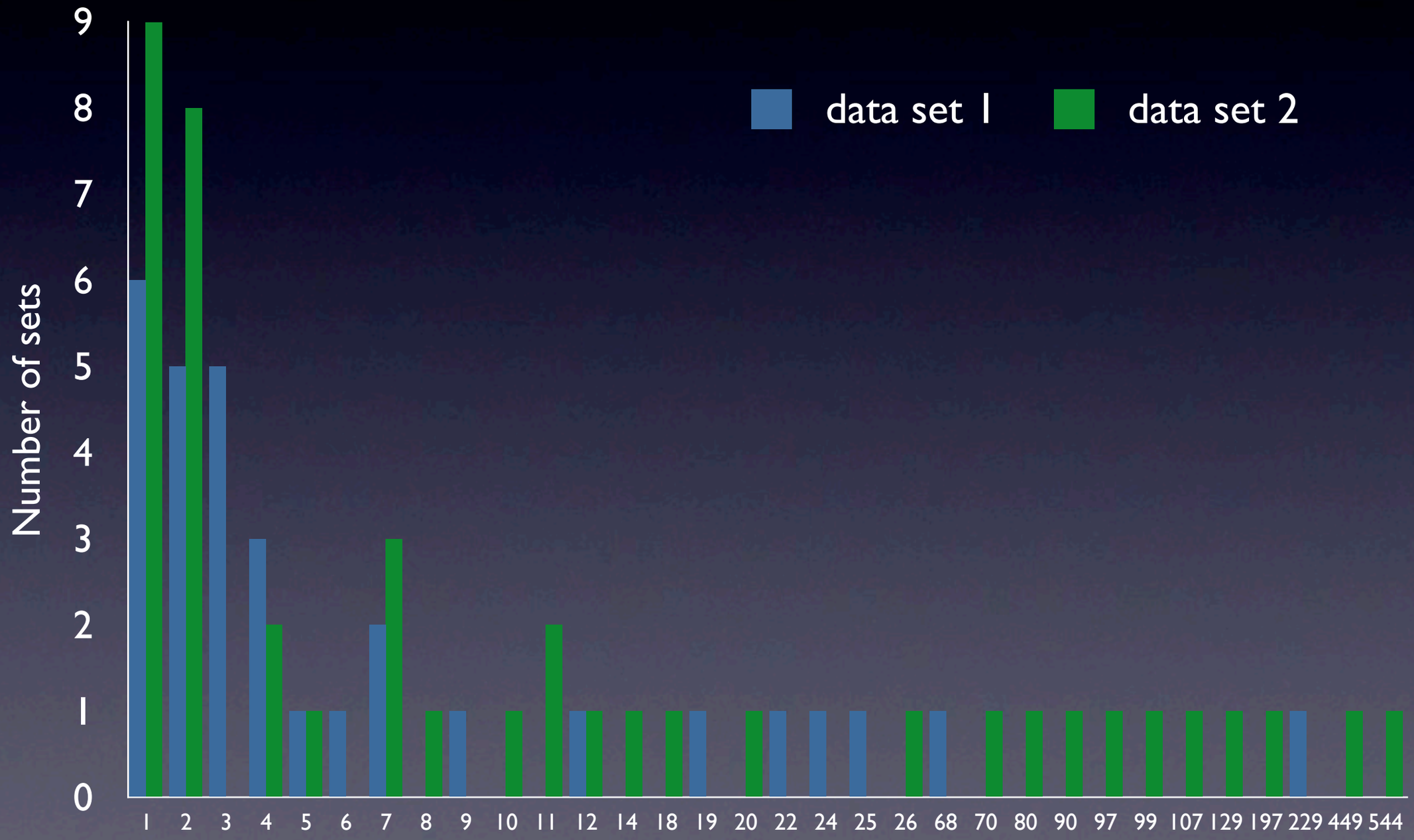
Device popularity, data set 1

Name	Major class	Minor class	Number	Percentage
Phone/Mobile	2	4	317	65.2
Phone/Smart phone	2	12	98	20.1
Computer/Laptop	33	12	16	3.29
Computer/Laptop	1	12	15	3.09
Computer/Palm sized PC-PDA	1	20	8	1.65

Device popularity, data set 2

Name	Major class	Minor class	Number	Percentage
Phone/Mobile	2	4	953	46.5
Audio-Video/ Hands free	4	8	390	19.0
Phone/Smart phone	2	12	371	18.0
Phone/Mobile	34	4	122	5.95
Uncategorised	0	1	56	2.73

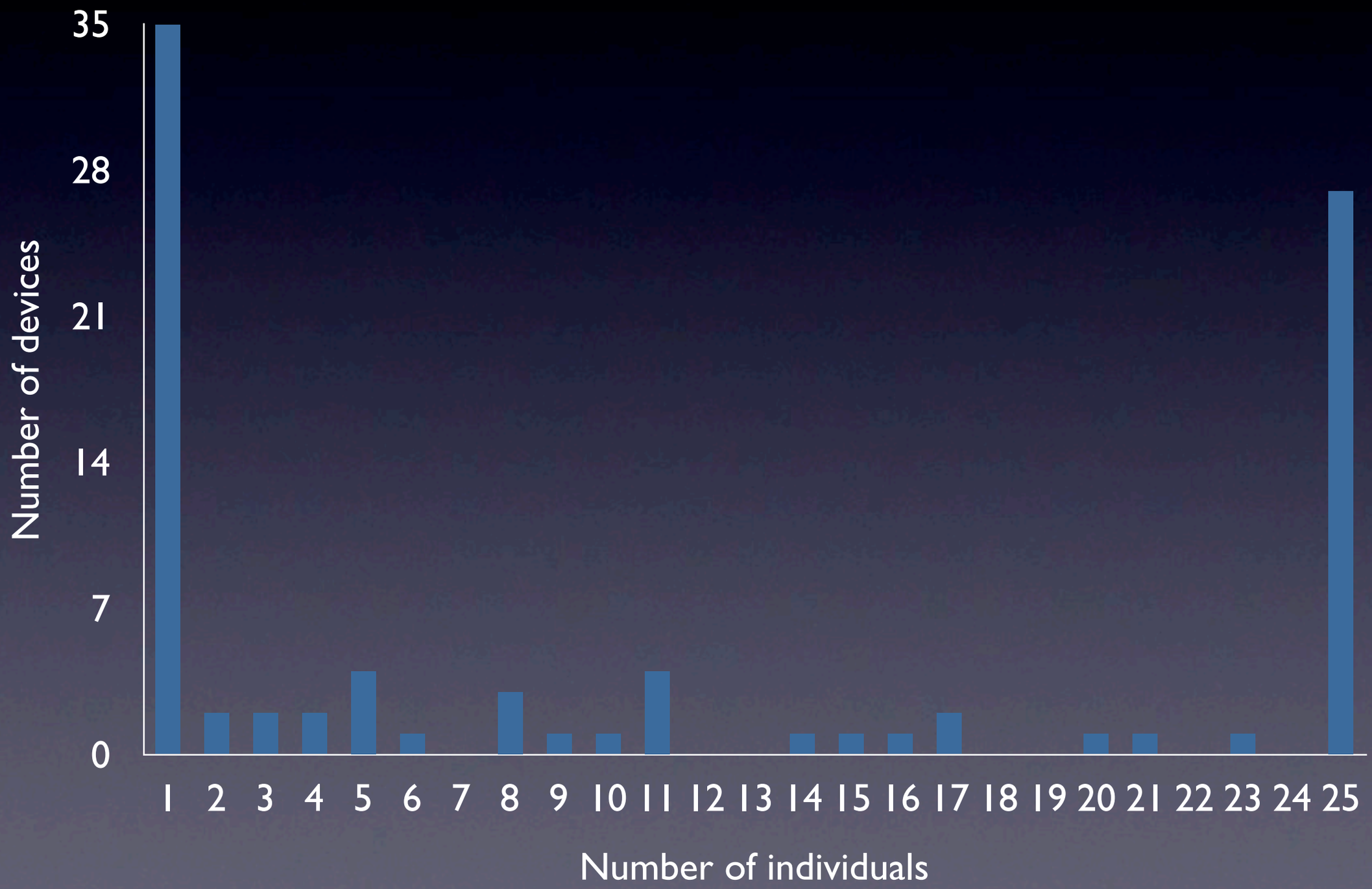
Anonymity actially experienced ({services})



Attributes that identify

Combination	Number of sets of size 1		% devices that are unique	
	Data set 1	Data set 2	Data set 1	Data set 2
1	6	9	1.23	0.439
2	201	454	41.4	22.1
3	218	483	44.9	23.6
4	486	2051	100	100
8	5	6	1.03	0.293
9	10	22	2.06	1.07
10	207	471	42.6	23.0
11	220	491	45.3	23.9

Linking with individuals



Privacy-adverse behaviour

- Real names, phone numbers, etc. in device names
- Using the same nickname in multiple places

Conclusions

- Device class and the list of services offered reveal little
- Device name can offer surprising anonymity but when it doesn't it *really* doesn't
- Users exhibit privacy-adverse behaviour

Future work

- Automated tools to link devices with individuals
- Identification of devices vulnerable to such as input to device pairing
- Exploration of "privacy-free" public data sources

Errata

Number	Name	Description
1	`class`	The class of the device
2	`address`	Device MAC address
3	`name`	Device name
4	`services`	The list of services offered by the device

- {`class`,`name`} is thus combination 1010_2 or 10.