



The Biggest Data Breach

ICCL report on scale of Real-Time Bidding data broadcasts in the U.S. and Europe

Key insights

Real-Time Bidding (RTB) operates behind the scenes on websites and apps. It tracks what you are looking at, no matter how private or sensitive, and it records where you go. Every day it broadcasts this data about you to a host of companies continuously, enabling them to profile you. This report presents the scale of this data breach for the first time.

- RTB is the **biggest data breach ever recorded**. It tracks and shares what people view online and their real-world location **294 billion times in the U.S. and 197 billion times in Europe every day**.
- On average, **a person in the U.S. has their online activity and location exposed 747 times every day** by the RTB industry.
- **In Europe, RTB exposes people's data 376 times a day.**
- Europeans and U.S. Internet users' private data is sent to firms across the globe, **including to Russia and China**, without any means of controlling what is then done with the data.
- The RTB industry generated **\$117+ billion** in the U.S. & Europe in 2021.

178 Trillion

RTB broadcasts about people in U.S. & Europe every year

4,698

companies are allowed by Google to receive RTB data about people in the U.S.

19.6 Million

Google broadcasts about German users every minute they're online

Introduction

1. Foreword and table of contents
2. Scale of the RTB data breach: U.S. & Europe
3. Daily RTB broadcasts per person
4. Google's RTB data breach: U.S. & Europe
5. Biggest broadcasters

Appendices

- 6-8. Tables of RTB companies sending RTB broadcasts in each country
9. End notes and acknowledgements

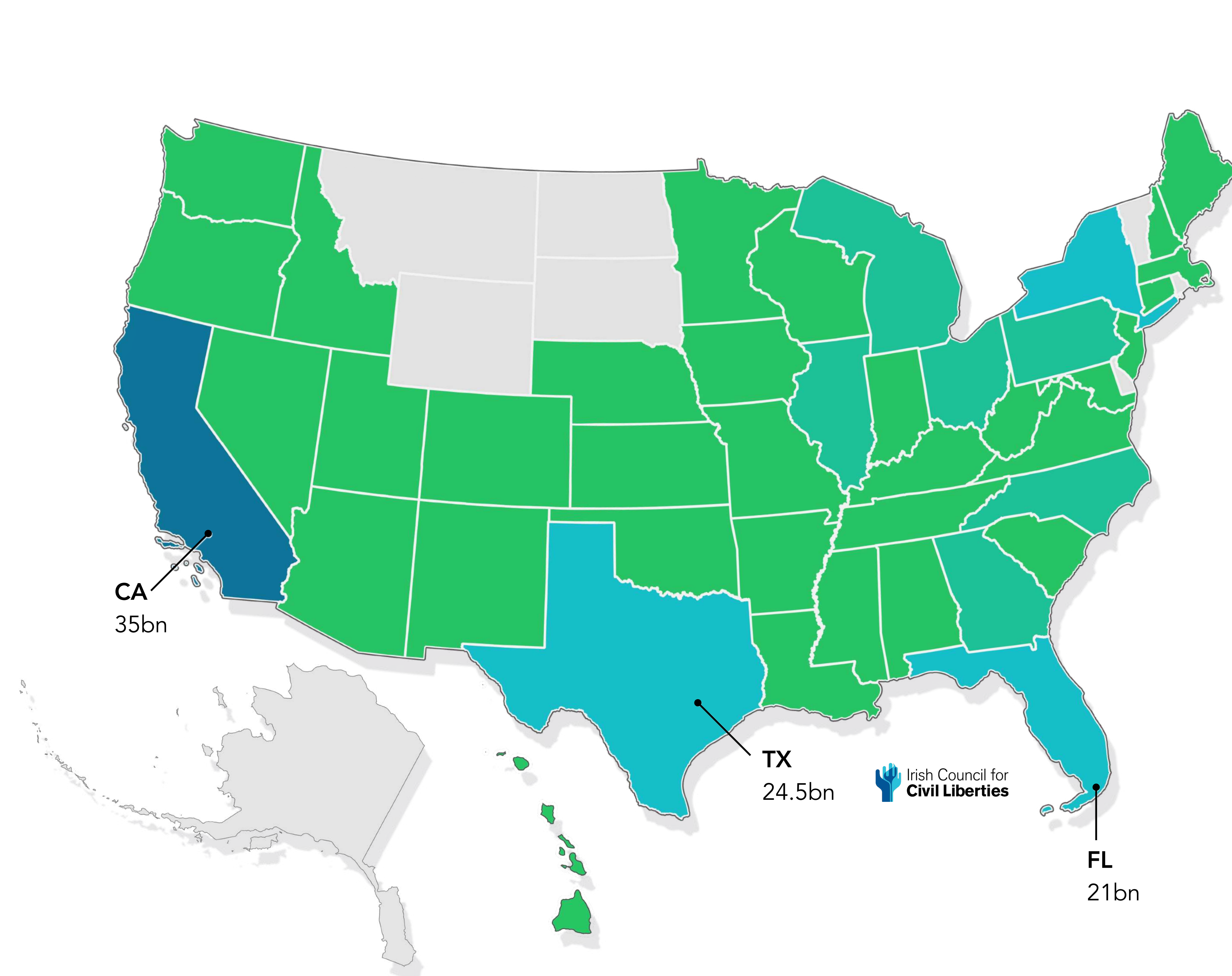
Scale of RTB data breach: U.S. and Europe

The findings:

- U.S. Internet users' online behaviour and locations¹ are tracked and shared 107 trillion times a year.² Europeans' data is exposed 71 trillion times a year.
- RTB firms broadcast RTB data widely. For example Microsoft "Xandr" says it may send data to 1,647 other companies.³

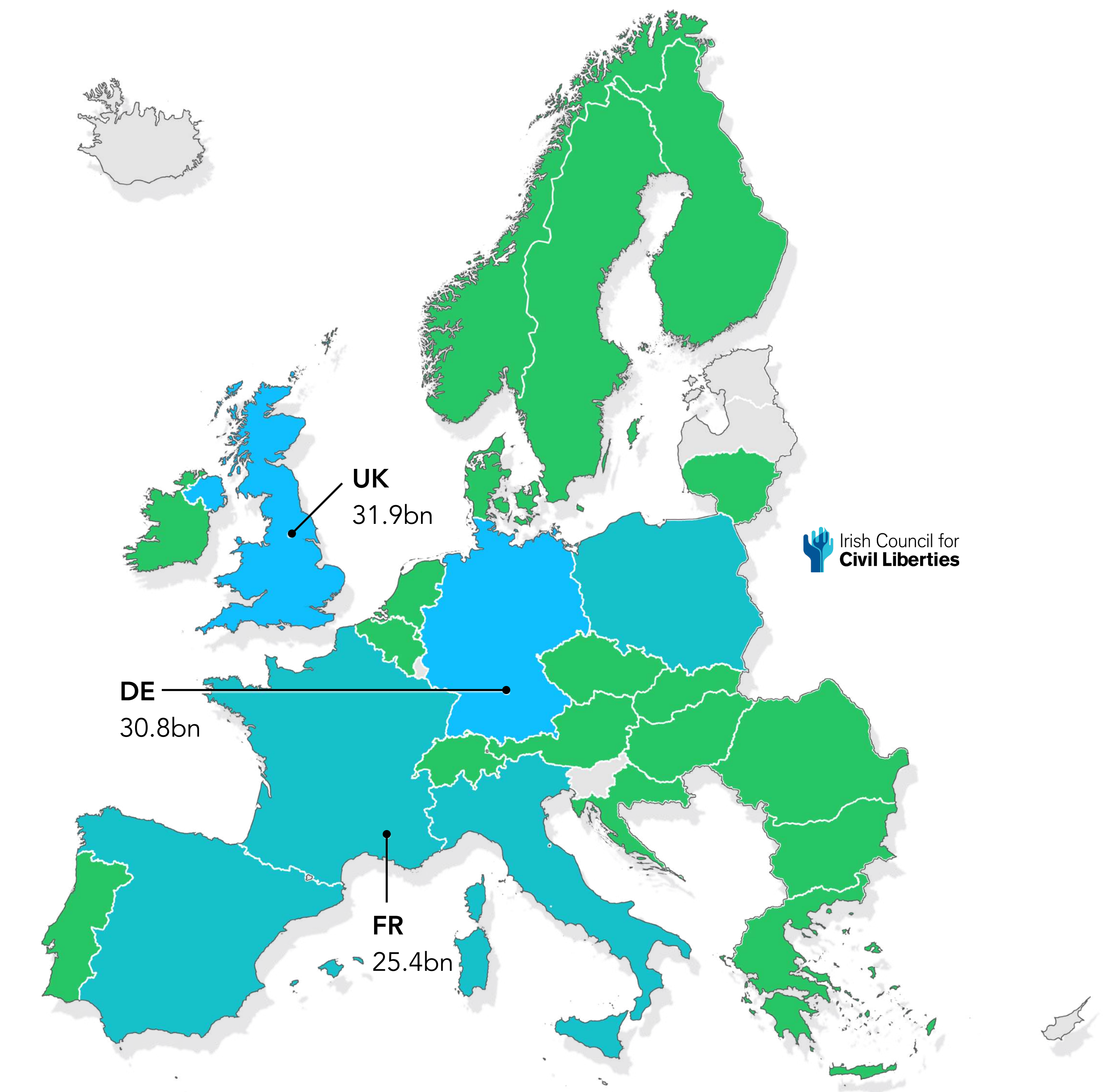
Examples of dangerous RTB data:

There is no way to restrict the use of RTB data after it is broadcast.⁴ Data brokers used it to **profile Black Lives Matter protestors**.⁵ The US Department of Homeland Security and other agencies used it for **warrant-less phone tracking**.⁶ It was implicated in the **outing of a gay Catholic priest through his use of Grindr**.⁷ ICCL uncovered the sale of RTB data **revealing likely survivors of sexual abuse**.⁸



Billions of RTB broadcasts (daily)²

Legend: <1 (grey), 1-8 (light green), 8-17 (medium green), 17-26 (light blue), 26-32 (medium blue), >32 (dark blue)



Biggest data breach ever. Repeated daily.

As we use the Internet, the RTB system records and shares each of our behaviour many times a day.

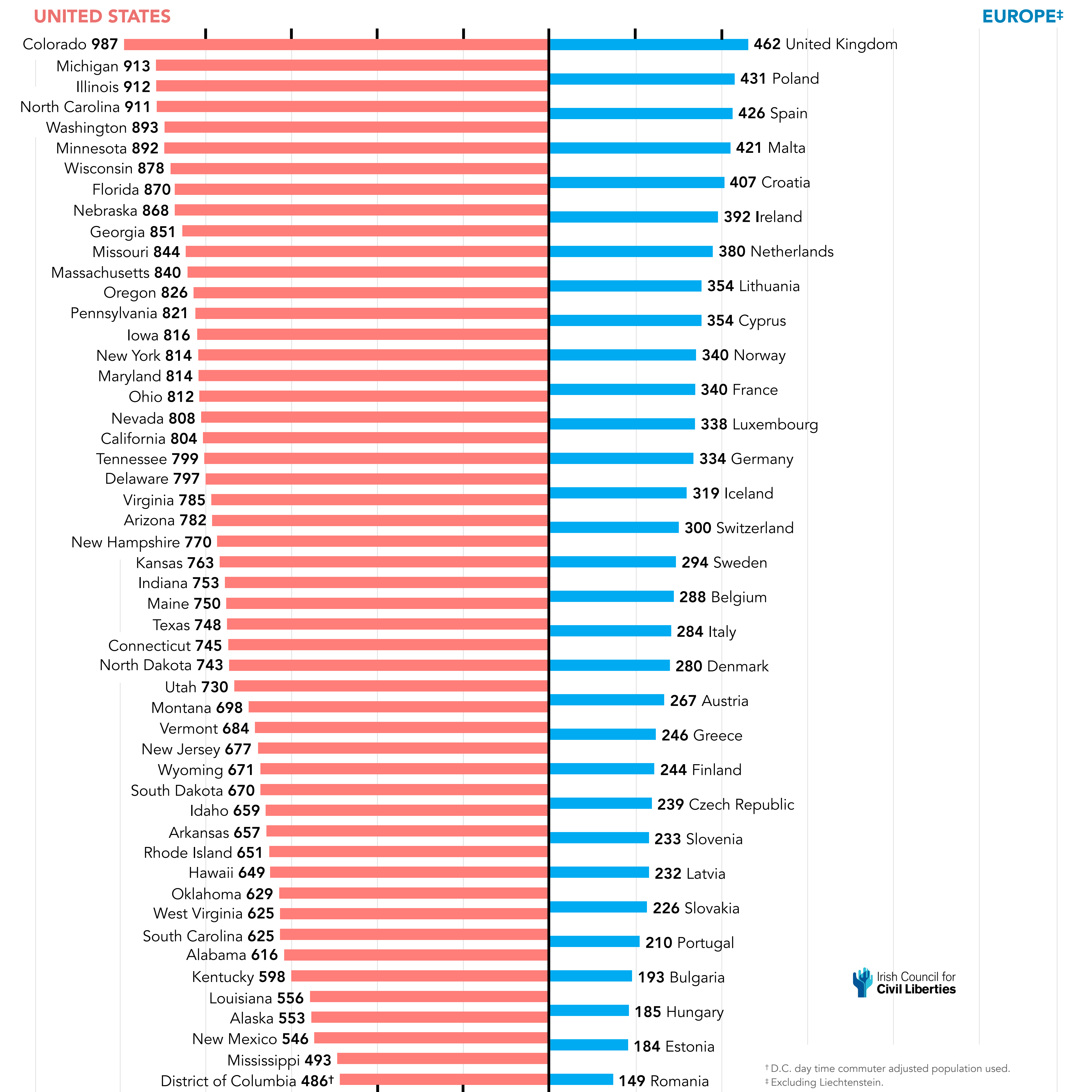
The findings:

- RTB tracks and broadcasts what a person in **Germany** is doing online **roughly once per minute that they are online.**⁹
- A person in **Ohio** will have their online activity and location exposed **812 times every day.**
- People in the **U.S.** have their online activity and real-world location exposed **57% more often** than people in Europe.

Note:

These data show the number of data broadcasts sent about a person, rather than the number of advertisements shown to them.

RTB broadcasts per person (daily)
Estimated RTB broadcasts per day²



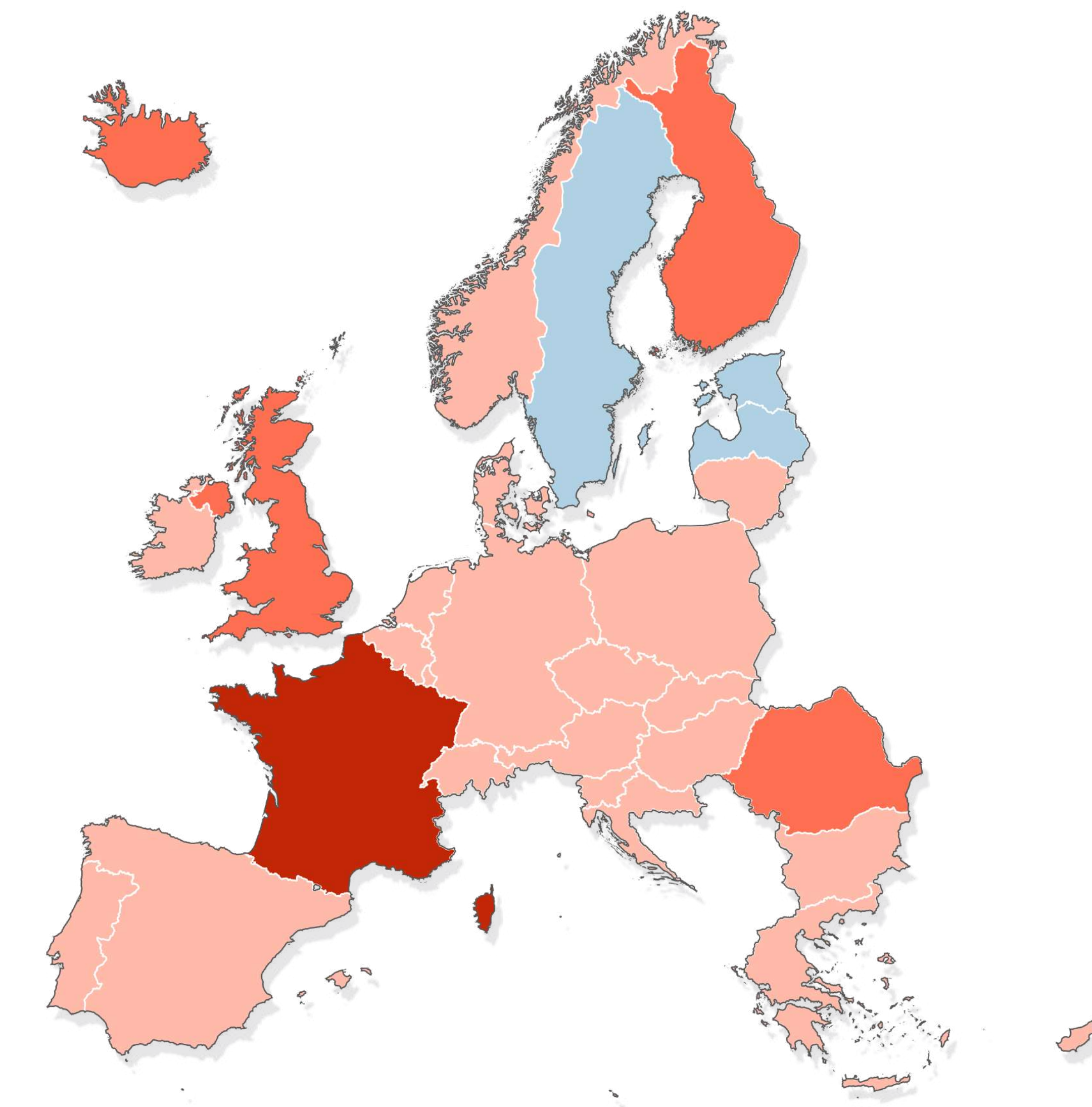
¹ D.C. day time commuter adjusted population used.
² Excluding Liechtenstein.

Google's RTB data breach: U.S. & Europe

Google is the biggest RTB company. It tracks and shares what people in the U.S. and Europe do online and where they are at a vast scale.

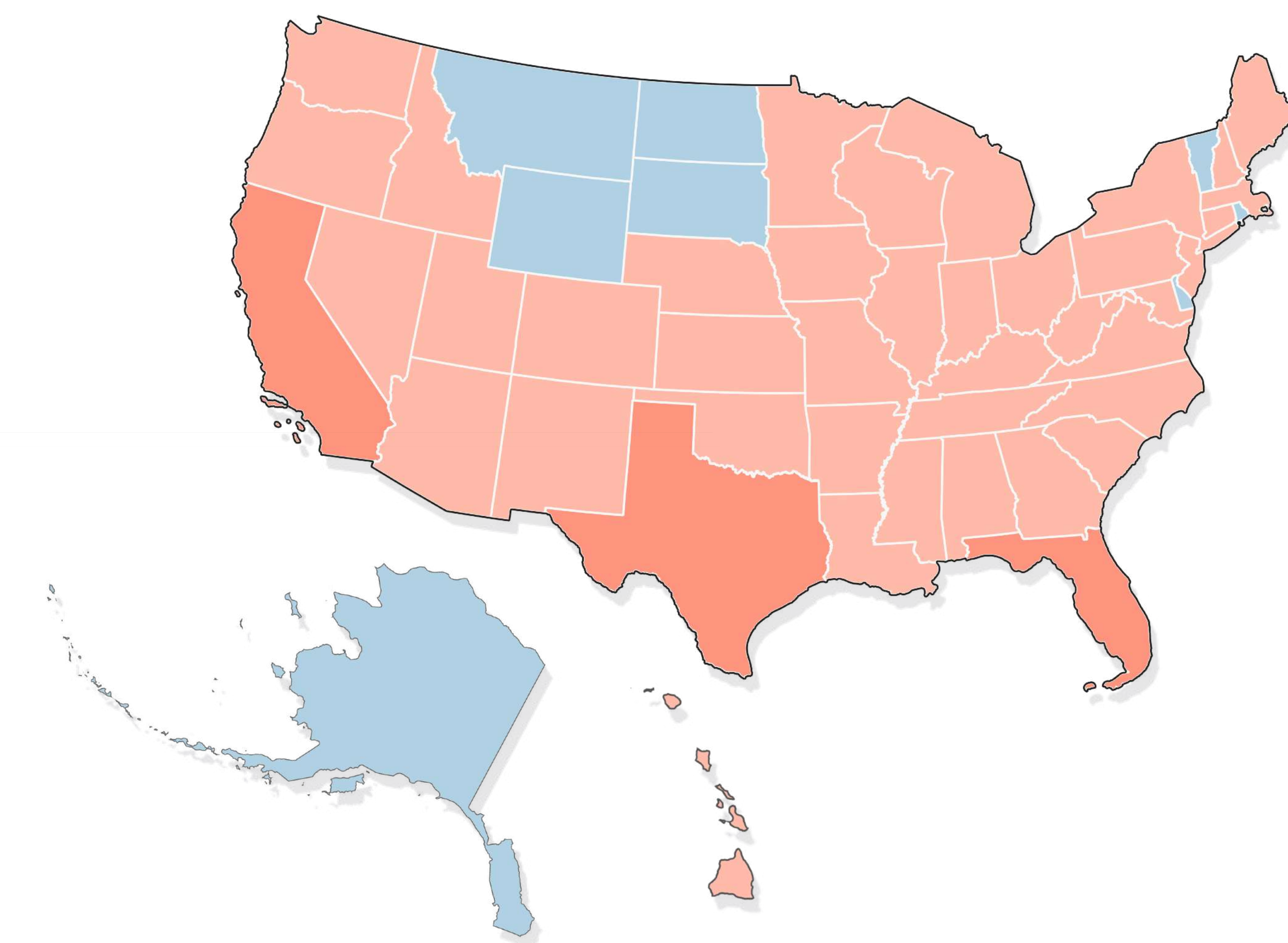
The findings:

- **Thousands of firms (1,058 in Europe and 4,698 in the US)** receive RTB data from Google.¹⁰
- Google broadcasts data such as what people are viewing or doing on a website or app and their "hyperlocal" locations¹¹ **42 billion times every day in Europe, or 31 billion in the U.S.**
- This includes **companies in Russia and China.**¹⁰ There is **no way to know what these firms then do with the data.**⁴
- Google sends **19.6 million** broadcasts about **German** Internet users' online behaviour **every minute** that they are online.⁹



Billions of Google RTB broadcasts (daily)²

<0.1 0.1-2 2-4 4-6 >6 Irish Council for Civil Liberties



Biggest broadcasters

Most advertising on websites and apps is placed using RTB. Advertisers spend \$100 billion per year on RTB in the U.S. & Europe.

Insights:

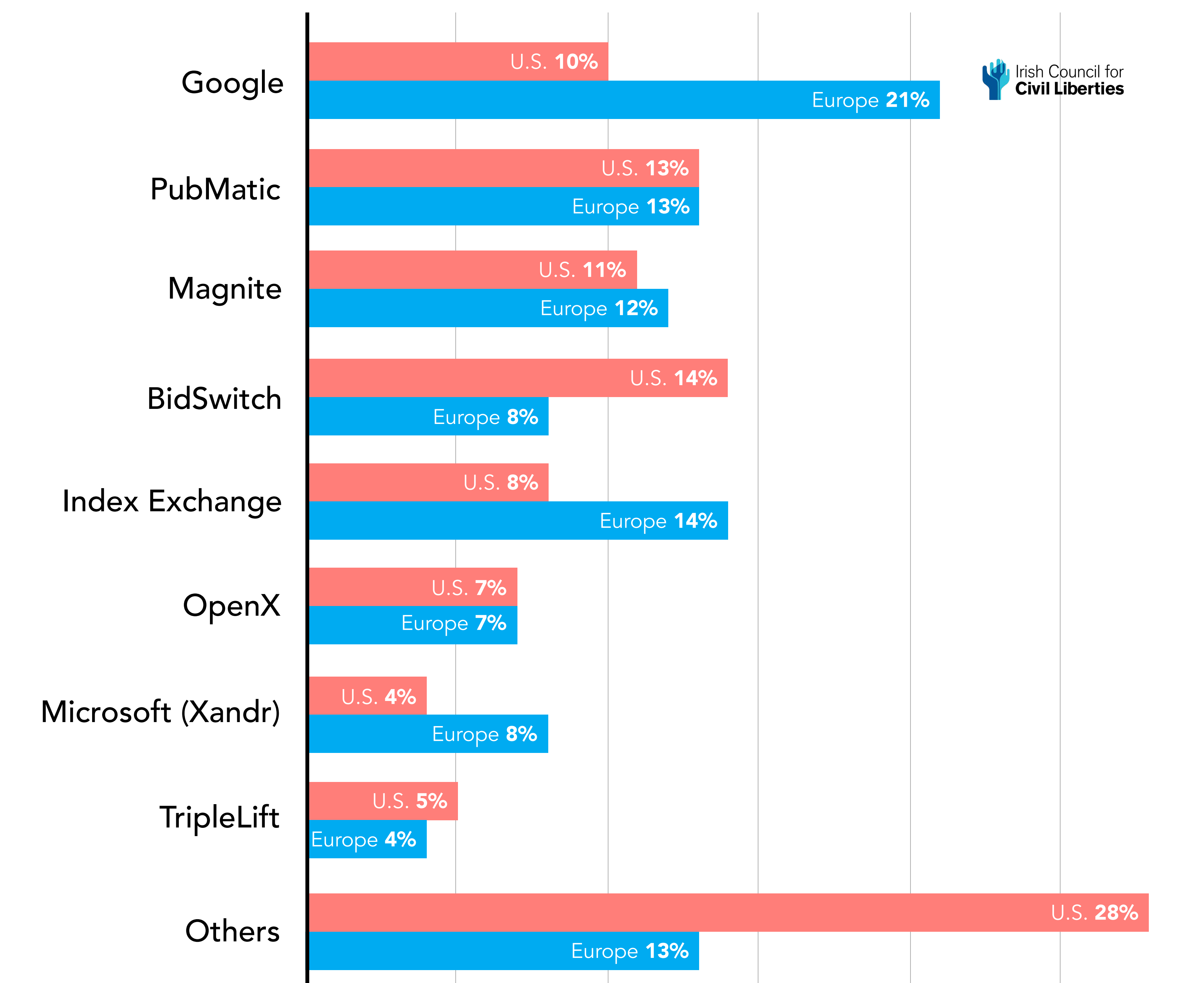
- The biggest RTB companies include **Google** and **Microsoft**.
- The value of the RTB market (estimated “programmatic advertising” spending) was **\$91 billion** in the U.S. in 2021 and **€23 billion** (\$26 billion) in Europe in 2019.¹²

Analysis:

RTB persists despite a succession of controversies. **Microsoft** dramatically increased its involvement in RTB in December 2021 by buying the major RTB firm “Xandr” from AT&T.

The biggest RTB data broadcasters²

Number of RTB broadcasts sent[†]



[†] These percentages should not be taken as a proxy of market size. The chart shows numbers of RTB broadcasts, not number of advertisements placed. A business may send many broadcasts and place few ads.

% share of RTB broadcasts per company per European country

	Google	Index Exchange	PubMatic	Magnite	Microsoft (Xandr)	BidSwitch	OpenX	SmartRTB	TripleLift	Verizon	Improve Digital	Adform	TeadsTv	Sovrn	Media.net	Others
Austria	23%	13%	16%	10%	8%	8%	7%	5%	2%	2%	2%	1%	1%	0%	1%	0%
Belgium	22%	11%	14%	10%	10%	9%	7%	5%	3%	2%	4%	0%	1%	0%	1%	0%
Bulgaria	35%	19%	6%	14%	4%	6%	9%	3%	2%	1%	0%	1%	0%	1%	0%	0%
Croatia	25%	18%	9%	15%	5%	2%	18%	3%	2%	1%	0%	1%	0%	1%	0%	0%
Cyprus	35%	13%	6%	10%	5%	6%	8%	2%	5%	2%	0%	3%	0%	1%	2%	0%
Czech Republic	30%	9%	19%	14%	14%	2%	2%	2%	1%	1%	0%	4%	0%	0%	0%	0%
Denmark	26%	10%	14%	13%	13%	4%	4%	1%	3%	2%	2%	7%	0%	0%	1%	0%
Estonia	30%	14%	10%	16%	5%	7%	5%	2%	5%	1%	0%	1%	0%	1%	1%	0%
France	22%	13%	13%	10%	9%	8%	4%	8%	6%	2%	2%	0%	1%	0%	1%	0%
Germany	21%	19%	15%	9%	6%	7%	7%	5%	3%	2%	3%	0%	1%	1%	1%	0%
Greece	32%	24%	7%	8%	4%	3%	14%	1%	2%	1%	0%	1%	0%	1%	0%	0%
Hungary	38%	7%	7%	20%	6%	5%	5%	3%	3%	1%	0%	1%	1%	0%	1%	0%
Ireland	17%	14%	17%	10%	7%	8%	9%	2%	5%	3%	1%	0%	1%	1%	1%	0%
Italy	22%	10%	13%	11%	6%	10%	6%	8%	2%	3%	3%	1%	1%	0%	0%	0%
Latvia	31%	17%	6%	14%	5%	6%	9%	4%	3%	1%	0%	3%	0%	1%	0%	0%
Liechtenstein	8%	14%	14%	13%	11%	2%	9%	4%	6%	3%	2%	11%	0%	2%	1%	0%
Luxembourg	23%	16%	8%	10%	8%	6%	7%	5%	7%	3%	2%	1%	0%	1%	1%	0%
Malta	17%	14%	9%	10%	8%	4%	11%	3%	10%	5%	0%	2%	0%	3%	2%	0%
Netherlands	20%	9%	16%	22%	9%	5%	5%	3%	3%	1%	4%	0%	0%	0%	1%	0%
Norway	21%	4%	5%	17%	37%	2%	2%	1%	2%	1%	3%	5%	0%	0%	0%	0%
Poland	20%	19%	12%	9%	4%	9%	15%	5%	3%	0%	0%	3%	0%	0%	0%	0%
Portugal	31%	10%	11%	12%	6%	6%	9%	7%	2%	2%	1%	1%	1%	1%	1%	0%
Romania	33%	14%	11%	9%	5%	5%	10%	4%	4%	2%	0%	2%	1%	0%	0%	0%
Slovakia	35%	12%	12%	15%	5%	3%	7%	2%	3%	0%	0%	4%	0%	0%	0%	0%
Slovenia	33%	11%	12%	13%	7%	3%	9%	3%	3%	1%	0%	2%	0%	1%	0%	0%
Spain	18%	13%	15%	12%	6%	8%	7%	8%	3%	2%	1%	1%	1%	1%	0%	0%
Sweden	24%	5%	15%	21%	15%	2%	2%	1%	2%	1%	1%	8%	0%	0%	1%	0%
Switzerland	19%	12%	13%	7%	14%	9%	6%	4%	3%	2%	3%	0%	2%	1%	1%	0%
Finland	24%	7%	10%	19%	24%	2%	2%	1%	2%	0%	1%	4%	1%	0%	0%	0%
Iceland	21%	13%	7%	13%	9%	4%	9%	3%	11%	4%	0%	1%	0%	2%	1%	0%
Lithuania	26%	23%	6%	16%	4%	3%	6%	2%	3%	1%	2%	5%	0%	2%	0%	0%
United Kingdom	18%	11%	14%	13%	10%	11%	6%	2%	6%	2%	1%	0%	1%	2%	1%	0%
EEA & UK total	21%	14%	13%	12%	8%	8%	7%	5%	4%	2%	2%	1%	1%	1%	1%	0%

% share of RTB broadcasts per company per US State

	BidSwitch	PubMatic	Magnite	Google	Index Exchange	OpenX	Sharethrough	TripleLift	Microsoft (Xandr)	Yahoo	Sovrn	Yieldmo	SpotX	InMobi	UnrulyX	Media.net	PulsePoint	GumGum	Smart RTB	Kargo	Others
Alabama	14%	13%	11%	12%	7%	6%	6%	5%	4%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	1%	2%
Alaska	12%	12%	14%	10%	8%	7%	7%	5%	5%	5%	3%	2%	2%	1%	2%	2%	1%	1%	1%	0%	2%
Arizona	13%	13%	13%	10%	8%	7%	6%	5%	4%	4%	2%	2%	1%	1%	1%	1%	1%	1%	1%	0%	2%
Arkansas	14%	13%	11%	11%	8%	7%	6%	5%	4%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	0%	2%
California	12%	11%	13%	10%	9%	8%	8%	5%	4%	5%	3%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Colorado	14%	14%	12%	9%	8%	8%	7%	6%	4%	4%	3%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Connecticut	14%	14%	10%	10%	8%	7%	7%	6%	5%	5%	2%	2%	1%	1%	2%	1%	1%	1%	1%	1%	2%
Delaware	14%	14%	10%	10%	8%	7%	6%	5%	5%	5%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
District of Columbia	14%	13%	10%	7%	8%	6%	9%	7%	5%	5%	3%	2%	1%	2%	1%	1%	1%	1%	1%	1%	1%
Florida	14%	14%	10%	11%	8%	7%	7%	5%	5%	5%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Georgia	14%	14%	10%	11%	8%	7%	7%	5%	5%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	1%	2%
Grand Total	14%	13%	11%	10%	8%	7%	7%	5%	4%	4%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Hawaii	11%	12%	14%	10%	8%	7%	7%	5%	5%	4%	3%	2%	1%	1%	1%	2%	1%	1%	1%	0%	2%
Idaho	14%	13%	12%	11%	8%	7%	7%	5%	4%	4%	3%	2%	1%	1%	1%	1%	1%	1%	1%	0%	2%
Illinois	14%	14%	10%	10%	8%	7%	7%	6%	4%	4%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Indiana	14%	13%	11%	11%	7%	7%	6%	6%	4%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	1%	2%
Iowa	15%	13%	10%	11%	8%	7%	6%	5%	4%	4%	2%	2%	1%	2%	1%	1%	1%	1%	1%	0%	2%
Kansas	18%	13%	10%	11%	6%	6%	5%	5%	6%	4%	2%	2%	1%	3%	2%	1%	1%	1%	1%	0%	2%
Kentucky	14%	13%	11%	12%	7%	7%	6%	5%	4%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	0%	2%
Louisiana	13%	13%	11%	13%	7%	7%	6%	5%	5%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	0%	2%
Maine	14%	13%	10%	11%	8%	7%	7%	6%	4%	4%	2%	2%	2%	1%	2%	1%	1%	1%	1%	1%	2%
Maryland	14%	14%	10%	10%	8%	7%	7%	5%	5%	4%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Massachusetts	14%	14%	10%	9%	9%	7%	7%	6%	5%	4%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Michigan	15%	14%	10%	10%	8%	8%	7%	5%	4%	4%	2%	2%	1%	2%	1%	1%	1%	1%	1%	1%	2%
Minnesota	14%	13%	10%	10%	8%	8%	7%	6%	4%	4%	3%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Mississippi	13%	13%	11%	13%	7%	6%	6%	5%	5%	4%	2%	2%	3%	2%	2%	1%	1%	1%	1%	0%	3%
Missouri	14%	14%	11%	10%	8%	7%	6%	5%	4%	4%	2%	2%	2%	2%	1%	1%	1%	1%	1%	1%	2%
Montana	14%	13%	12%	11%	8%	7%	6%	5%	4%	4%	2%	2%	1%	1%	2%	1%	1%	1%	1%	0%	2%
Nebraska	15%	13%	10%	11%	8%	7%	6%	5%	4%	4%	3%	2%	1%	2%	1%	1%	1%	1%	1%	1%	2%
Nevada	13%	13%	13%	11%	8%	7%	7%	5%	4%	4%	2%	2%	2%	2%	1%	1%	1%	1%	1%	0%	2%
New Hampshire	14%	13%	10%	10%	8%	7%	7%	6%	5%	5%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%

% share of RTB broadcasts per company per US State, continued

	BidSwitch	PubMatic	Magnite	Google	Index Exchange	OpenX	Sharethrough	TripleLift	Microsoft (Xandr)	Yahoo	Sovrn	Yieldmo	SpotX	InMobi	UnrulyX	Media.net	PulsePoint	GumGum	Smart RTB	Kargo	Others
New Jersey	14%	14%	10%	11%	8%	7%	7%	5%	5%	5%	2%	2%	1%	1%	1%	1%	1%	1%	1%	0%	2%
New Mexico	13%	13%	12%	12%	8%	7%	6%	5%	4%	4%	2%	2%	2%	1%	2%	1%	1%	1%	1%	0%	2%
New York	14%	14%	10%	10%	9%	7%	7%	6%	5%	4%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
North Carolina	15%	14%	10%	10%	8%	7%	6%	5%	4%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	1%	2%
North Dakota	13%	12%	11%	10%	7%	7%	8%	6%	4%	4%	3%	2%	2%	1%	2%	1%	1%	1%	1%	1%	2%
Ohio	14%	13%	11%	11%	8%	7%	7%	6%	4%	4%	2%	2%	2%	1%	2%	1%	1%	1%	1%	1%	2%
Oklahoma	14%	13%	11%	12%	8%	7%	6%	5%	4%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	0%	2%
Oregon	13%	13%	12%	10%	8%	7%	7%	5%	4%	4%	2%	4%	1%	1%	1%	1%	1%	1%	1%	0%	2%
Pennsylvania	14%	14%	10%	11%	8%	7%	7%	5%	5%	4%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Rhode Island	15%	13%	10%	10%	8%	7%	7%	6%	5%	5%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
South Carolina	13%	13%	11%	12%	7%	6%	6%	5%	4%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	0%	3%
South Dakota	14%	12%	11%	11%	8%	7%	7%	6%	4%	4%	2%	2%	2%	1%	1%	1%	1%	1%	1%	0%	2%
Tennessee	15%	13%	10%	11%	7%	7%	6%	5%	4%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	1%	2%
Texas	14%	14%	11%	11%	8%	7%	7%	5%	4%	4%	2%	2%	2%	2%	1%	1%	1%	1%	1%	1%	2%
Utah	14%	13%	12%	11%	8%	7%	7%	5%	4%	4%	3%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Vermont	14%	14%	11%	10%	8%	7%	7%	6%	5%	4%	2%	2%	1%	1%	2%	1%	1%	1%	1%	0%	2%
Virginia	13%	14%	10%	10%	8%	6%	7%	5%	4%	5%	2%	5%	1%	1%	1%	1%	1%	1%	1%	0%	2%
Washington	13%	13%	13%	10%	8%	7%	7%	5%	4%	4%	3%	2%	1%	1%	1%	1%	1%	1%	1%	0%	2%
West Virginia	14%	13%	11%	13%	7%	7%	6%	5%	4%	4%	2%	2%	2%	2%	2%	1%	1%	1%	1%	0%	2%
Wisconsin	14%	14%	10%	10%	8%	7%	7%	6%	4%	4%	3%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Wyoming	13%	13%	12%	12%	7%	7%	6%	5%	4%	4%	3%	2%	2%	1%	2%	1%	1%	1%	1%	0%	2%
U.S. total	14%	13%	11%	10%	8%	7%	7%	5%	4%	4%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	2%

End notes and acknowledgements

End notes:

1. See industry standard for data are sent in RTB broadcasts "OpenRTB protocol", IAB TechLab (<https://www.iab.com/wp-content/uploads/2016/03/OpenRTB-API-Specification-Version-2-5-FINAL.pdf>).
2. The number of RTB broadcasts over 30 days is taken from industry figures, whose source is confidential. Note the caveat on this page.
The charts "Billions of RTB broadcasts (daily)" and "Billions of Google RTB broadcasts (daily)" and the findings about numbers of broadcast per population use Eurostat population of European Economic Area Member States (<https://ec.europa.eu/eurostat/web/products-datasets/-/tps00001>) and UK population from UK Office of National Statistics (<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/latest>) and U.S. Census data (https://www.census.gov/data/tables/time-series/demo/popest/2020s-state-total.html#par_textimage_1574439295). We assume that only 90% of the population of each Member State is online.
Population of District of Columbia adjusted for day time commuter population, using US Census estimate (<https://www.census.gov/content/dam/Census/library/working-papers/2015/demo/2015-Laughlin-01-Abstract.pdf>).
3. Listed in "Service Policies", Xandr (preserved at https://www.iccl.ie/wp-content/uploads/2022/01/K13-24032021-service_policies_3-24-2021.pdf).
4. RTB's lack of security is described in "Pubvendors.json", IAB TechLab (<https://github.com/InteractiveAdvertisingBureau/GDPR-Transparency-and-Consent-Framework/blob/master/pubvendors.json%20v1.0%20Draft%20for%20Public%20Comment.md>).
5. See Senators Wyden, Cantwell, Warren, et. al. to the Hon. Joseph J. Simmons, Chairman, Federal Trade Commission, 31 July 2020 (URL: <https://www.wyden.senate.gov/imo/media/doc/073120%20Wyden%20Cassidy%20Led%20FTC%20Investigation%20letter.pdf>, last accessed 12 September 2020).
6. "How Cellphone Data Collected for Advertising Landed at U.S. Government Agencies", Wall Street Journal, 18 November 2021 (<https://www.wsj.com/articles/mobilewalla-says-data-it-gathered-from-consumers-cellphones-ended-up-with-government-11637242202>).
7. See "Grindr User Data Was Sold Through Ad Networks", Wall Street Journal, 2 May 2022 (<https://www.wsj.com/articles/grindr-user-data-has-been-for-sale-for-years-11651492800>) and related recording <https://www.wsj.com/podcasts/google-news-update/grindr-users-data-could-be-purchased-through-ad-networks/ceea7c29-4dfd-4328-9183-b41f1c8d2ec0>.
8. See ICCL submission to Data Protection Commissioner, 21 September 2020 (<https://www.iccl.ie/wp-content/uploads/2020/09/1.-Submission-to-Data-Protection-Commissioner.pdf>).
9. The number of broadcasts per minute in Germany is calculated by dividing the 6.4 billion RTB broadcasts every day by the average number of minutes that Germans spend online per day (326). This average time spent is from a Global Web Index survey of Germans aged 16-64 conducted in Q3 of 2020, published by HooteSuite and We Are Social (URL: <https://wearesocial-cn.s3.cn-north-1.amazonaws.com.cn/common/digital2021/digital-2021-global.pdf>).
10. European list is at "Ad technology providers", Google (<https://support.google.com/admanager/answer/9012903>). U.S. list is at "Ad Manager Certified External Vendors", Google (<https://developers.google.com/third-party-ads/adx-vendors>).
11. See Google's standard for what data are sent in RTB broadcasts "Authorized Buyers Real-time Bidding Proto", Google (<https://developers.google.com/authorized-buyers/rtb/realtime-bidding-guide>).
12. Estimates in "Programmatic advertising spend in Europe 2019", October 2020 (<https://iabeurope.eu/wp-content/uploads/2020/10/Programmatic-Market-Advertising-Spend-2019-Report.pdf>), slide 8; and "Brand Disruption 2020", IAB (<https://s3.amazonaws.com/media.mediapost.com/uploads/IABBrandDisruption2020.pdf>), p. 66. Estimate of value based on € to \$ exchange rate of mid 2019 (€1=\$1.1292).

Caveat:

We regard the figures presented for RTB broadcasts as a low estimate. The industry figures on which we rely do not include Facebook or Amazon RTB broadcasts.

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