ELECTRIC CAPITAL

January — December 2023

DEVELOPER REPORT

DeveloperReport.com

Executive summary

Developers are a leading indicator of value creation.

Developers build apps that deliver value to users. Killer apps attract customers. New customers bring more developers. Because crypto is significantly open source, we have an unprecedented ability to measure this developer-value creation flywheel in an emerging industry.

We analyzed 485 million code commits across 818k repositories to create the 2023 Developer Report. This is 20x more code than the first Developer Report in 2019. The community contributing to the report has grown 25x since 2019 with 356 people contributing to make this report.

While developers overall are down 24%, the most valuable segment of developers (2+ year tenure who contribute the most code) continues to steadily grow.

- Developers who have been in crypto for 2+ years are at an all-time high after growing at 52% annualized for the past 5 years.
- Developers who have been in crypto for more than 1 year grew 16% YoY and are 63% of all monthly active developers.
- In contrast, Newcomers who have been in crypto for less than 12 months dropped -52% YoY.
- Overall developer number losses can be attributed to a record number of new developers who joined in 2022 and churned.

Crypto is now clearly Multi-chain.

- 30% of developers support more than one chain, up 10x from 3% in 2015.
- Developers who support 3+ chains grew to 17% of all developers in 2023, an all-time high.
- Growth in developers is not correlated across projects. Some projects gained developers while others lost them. Developers are voting with their feet on which projects they believe provide real utility.

Crypto is global. The US continues to lose developer share.

- 72% of developers are outside of North America.
- The US has lost -14% developer share since 2018 and is now only 26% of crypto developers.
- South Asia, Latin America, Eastern Europe, Western Africa, and Southern Europe collectively grew developer share by +20% since 2018.

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Methodology: Not all code commits are created equal

We fingerprinted 485M commits to create the 2023 Developer Report. We fingerprint each commit to remove commits that are forks. Fingerprinting is a technique used to identify commits originating from upstream projects. We look at the files and lines changed, the commit message, committer, author, and associated dates. This helps ensure we do not count copy pasted code.

We count developers who support multiple chains. We segment developers based on the number of chains they support. Total developers include Single-chain and Multi-chain developers.

We identify "bots" that are committing code. "Bots" are not always malicious. Often, they are automations that a team puts in place. We detect and remove those.

We undercount total crypto developers. There are many more crypto developers than accounted for in our report. Some teams are working on important closed-source projects. Some teams will open source their code later. We also undercount developers in roles such as testing or release engineering as their efforts may not result in unique code contributions.

Not all commits are created equal. Some code commits may be routine changes, whereas others represent hours of accumulated research and analysis. Despite these caveats, we consider the analysis in this report directionally and relatively accurate.

Finally, it requires more than developers to build crypto products that reach mainstream adoption. This is a dramatic undercounting of the total number of people building in crypto.

Feedback
We are always looking to improve. Please share feedback with us at devreport@electriccapital.com.

Contribute
Learn more and contribute at our GitHub:
github.com/electric-capital/crypto-ecosystems

Thank you to our data providers.

Allium THE BLOCK codeslaw Dune Token Flow

About Electric Capital

Electric Capital is a leading crypto venture firm. We are early-stage investors in many well-known Layer-1 platforms, Layer-2 platforms, DeFi protocols, NFT projects, DAOs, developer tools, and other breakout crypto businesses. Learn more at ElectricCapital.com.

We share this data publicly in the hopes of helping the crypto community better understand the industry's collective progress. We are grateful to the individuals in the community who contribute to our GitHub, the foundations who help us validate our analysis, and the friends who offer feedback on drafts.

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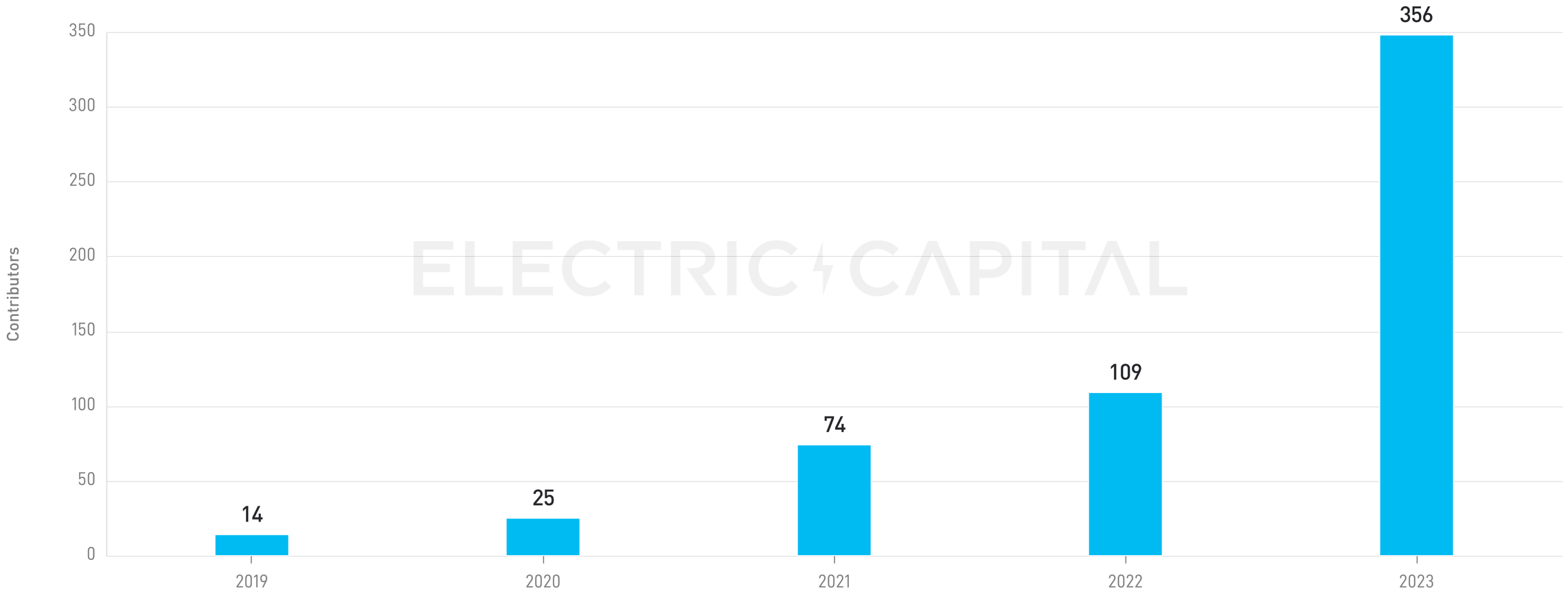
+350 volunteers in the crypto community who added to the GitHub taxonomy that powers this report and scrubbed data!

A record 300+ people contributed to mapping crypto repositories in 2023

Number of Developer Report contributors



Thank you to the 356 people who contributed via GitHub

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Thank you to the 356 people who contributed via GitHub (cont.)

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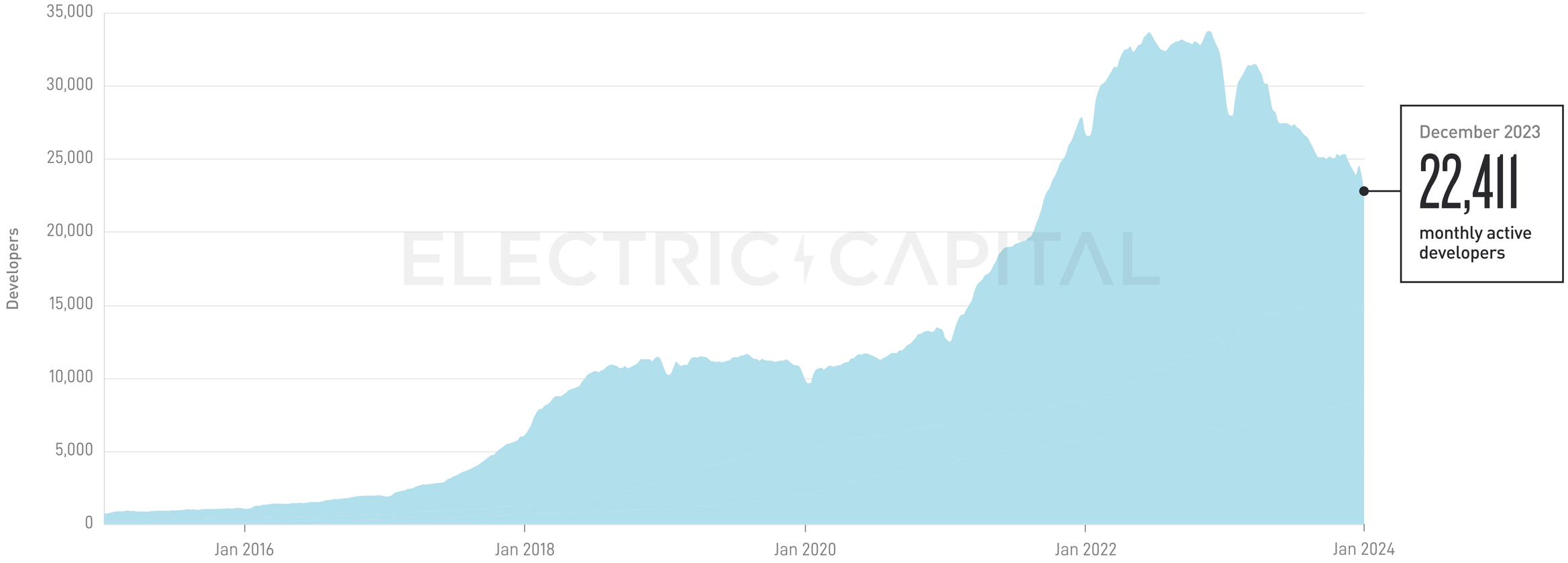
01

Developer Overview

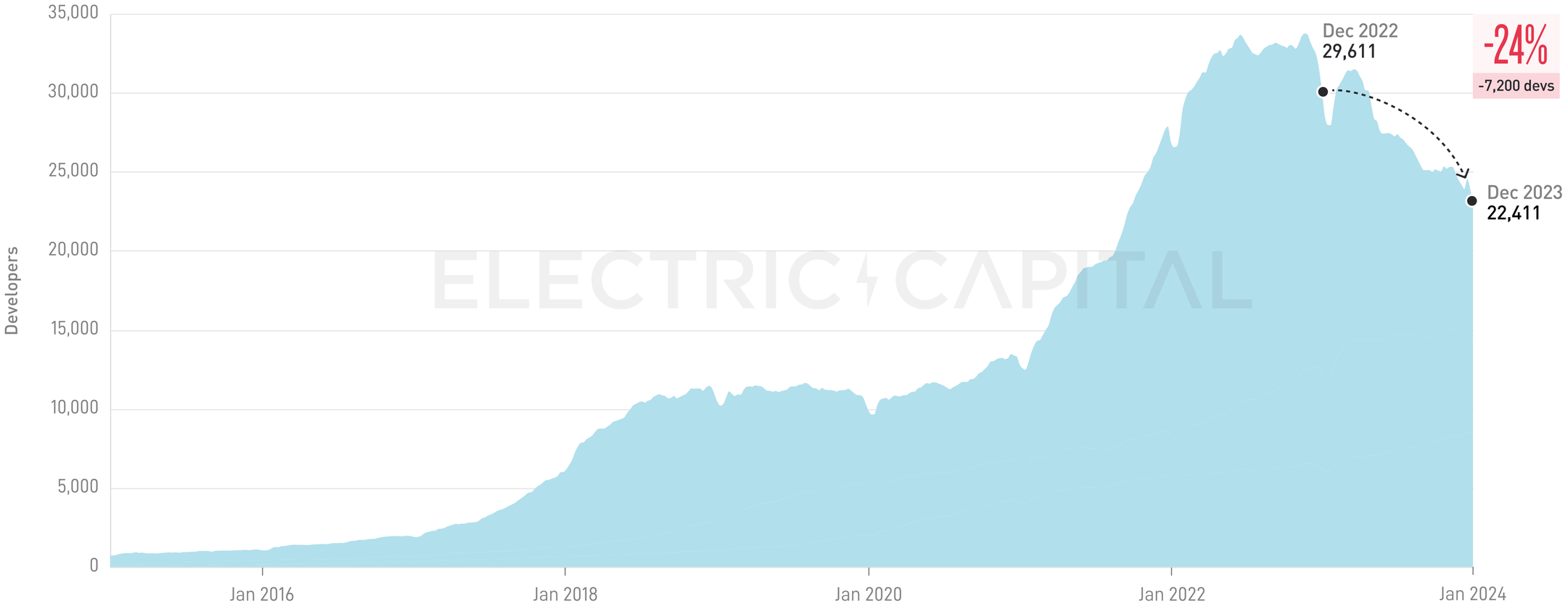
22,411 monthly active open-source developers contribute to crypto

All crypto monthly active developers



Monthly active developers fell by -24% in 2023

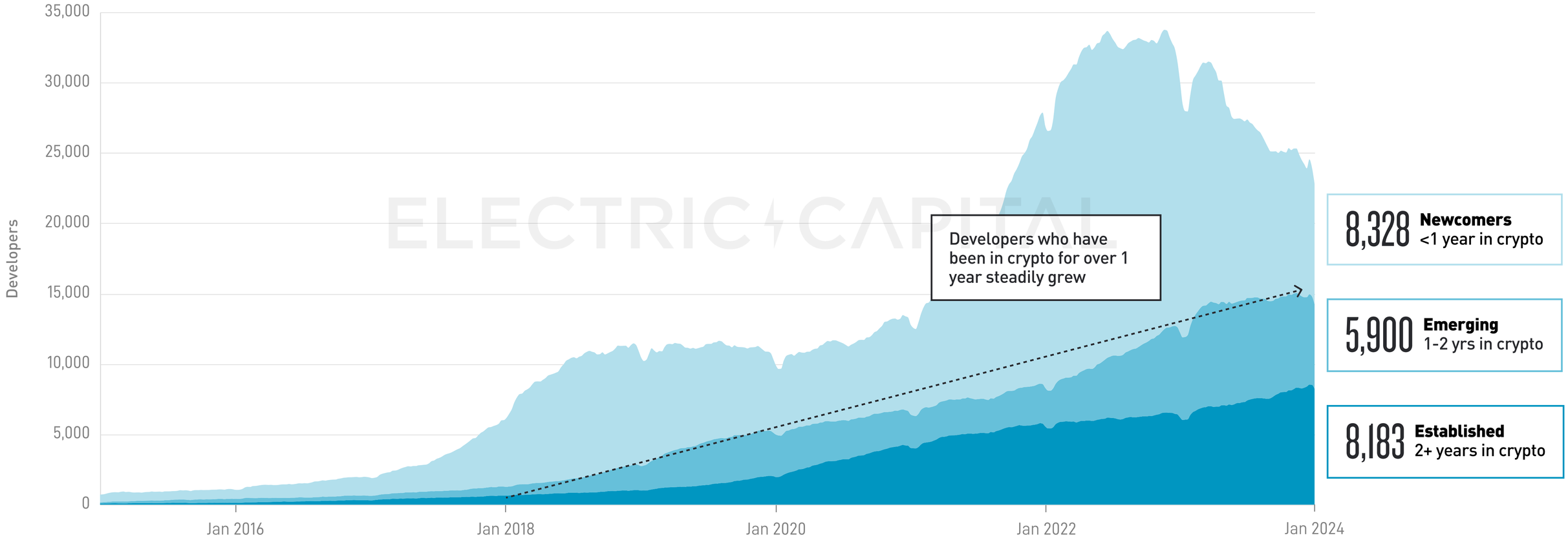
All crypto monthly active developers



But devs working in crypto for 1+ years grew steadily

Segmenting developers by their tenure shows steady growth of Emerging and Established developers

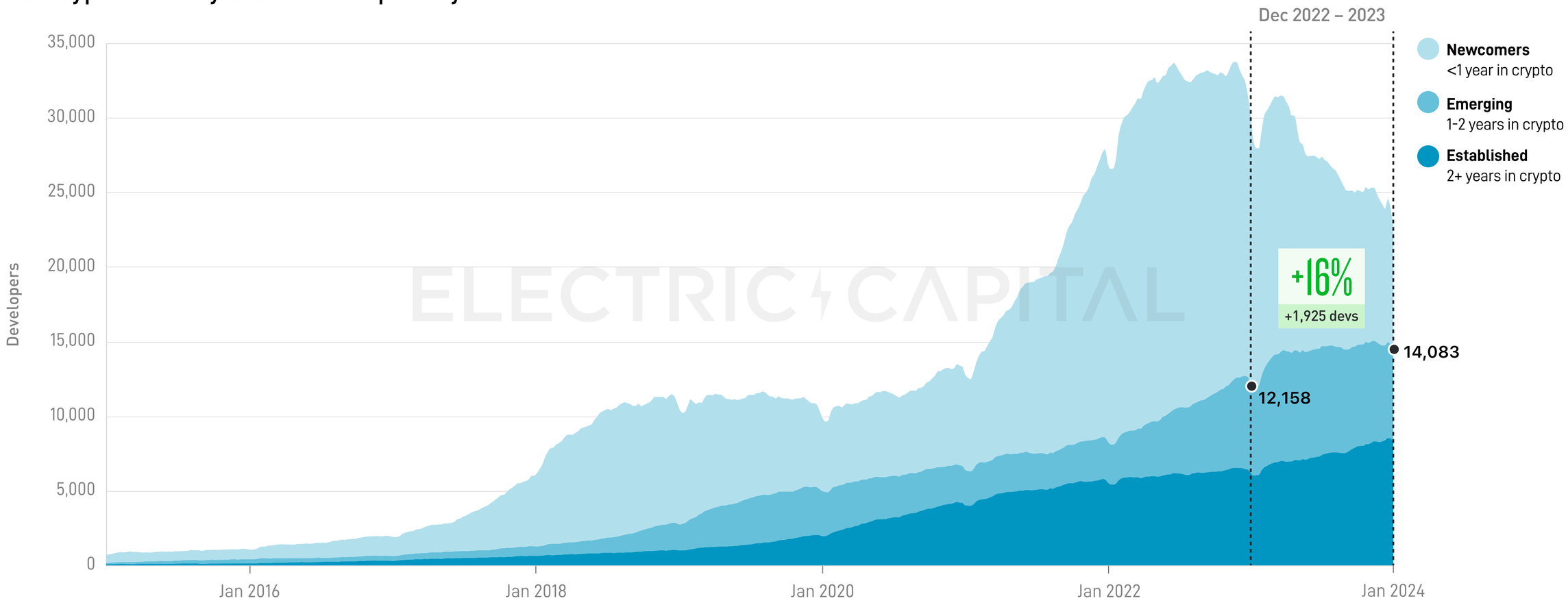
All crypto monthly active developers by tenure



Experienced devs (1+ years) grew by +16% (+1,925) in 2023

This reflects an increase of +1,925 developers outside of Newcomers

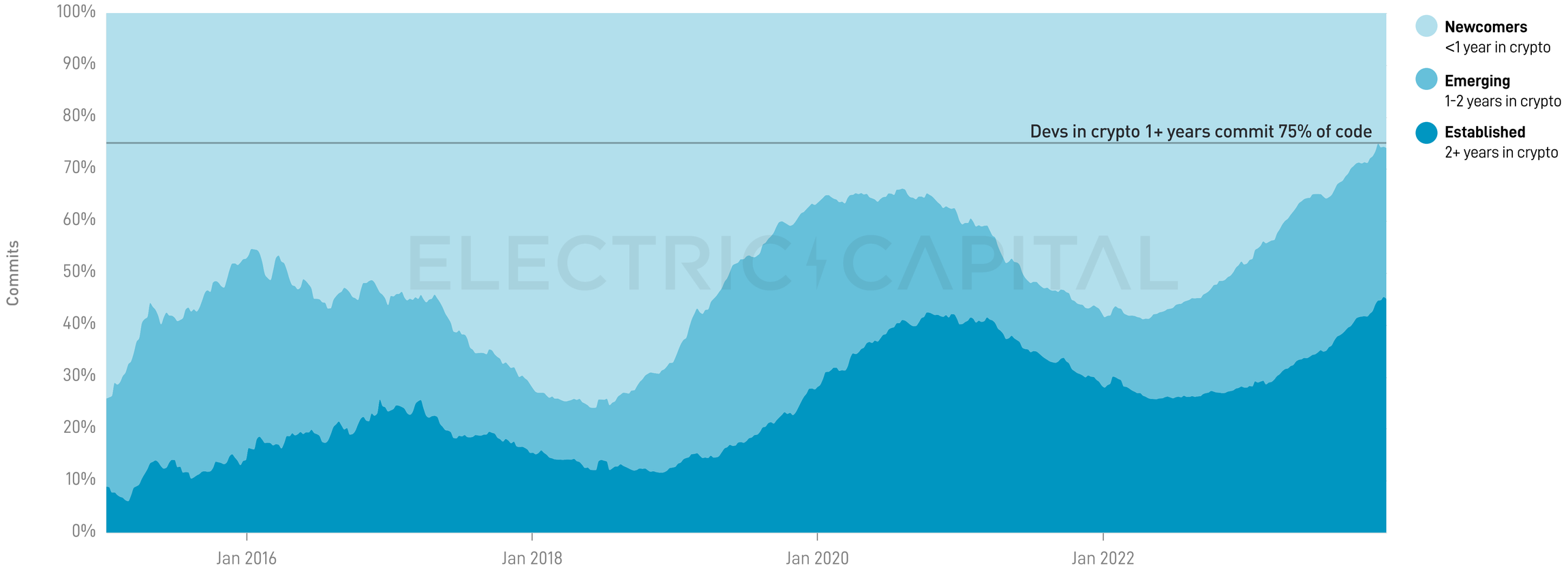
All crypto monthly active developers by tenure



Why do we care about how long developers have worked in crypto?

Experienced devs push more code: 75% of code is created by developers in crypto 1+ years

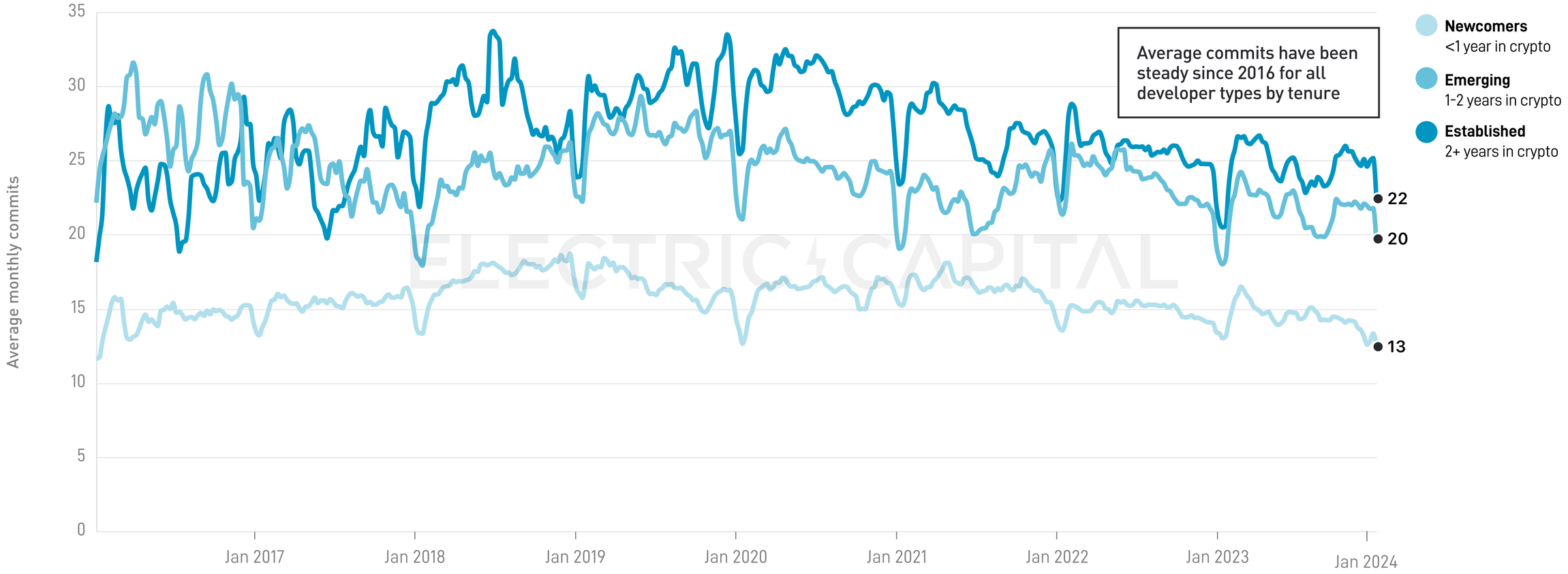
All crypto commits made by developers of different tenures



Devs working in crypto for >1 year commit consistently more than Newcomers

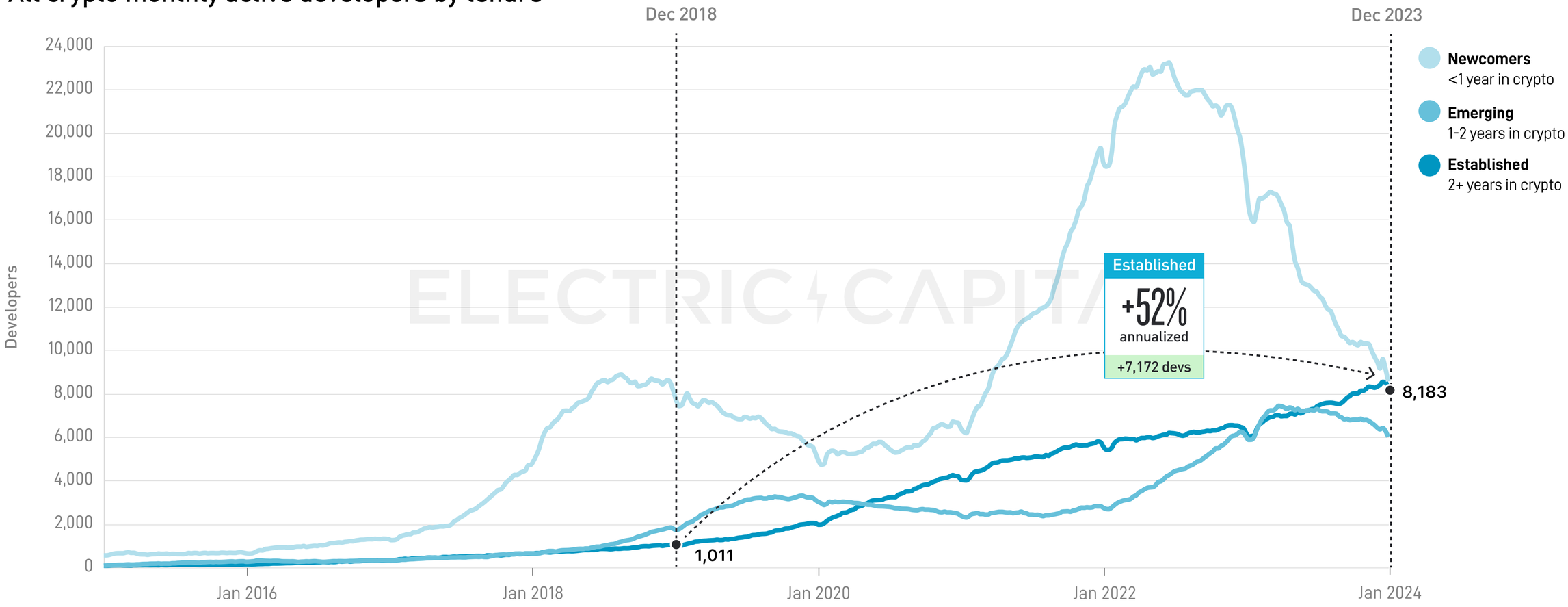
Established and Emerging devs combined make an average of 3x more code commits than Newcomers

All crypto average monthly commits made by developers of different tenures



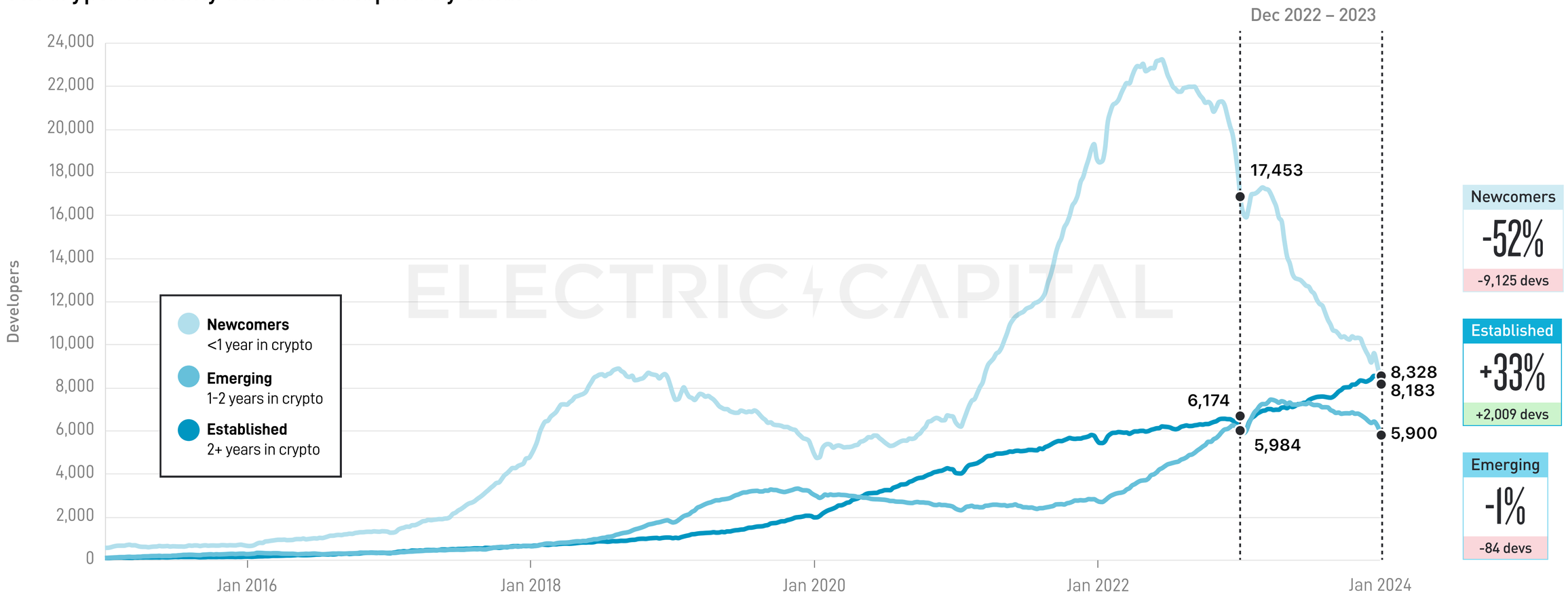
Established devs have grown +52% per year for the past 5 years and are at all-time highs

All crypto monthly active developers by tenure



Developer losses came from the least tenured developers: Newcomers fell by -52%

All crypto monthly active developers by tenure



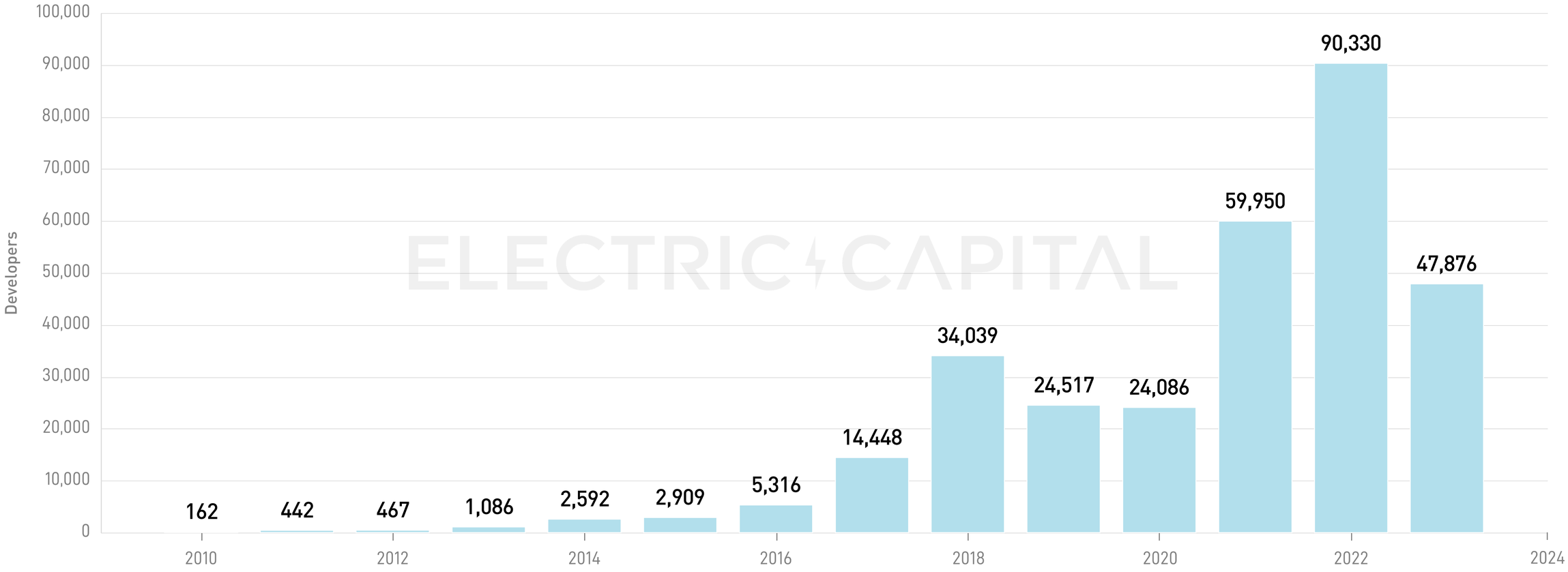
Why do the number of Newcomers rise and fall?

Let's take a closer look at how Newcomer activity has changed over time.

Newcomers tend to follow crypto asset price appreciation

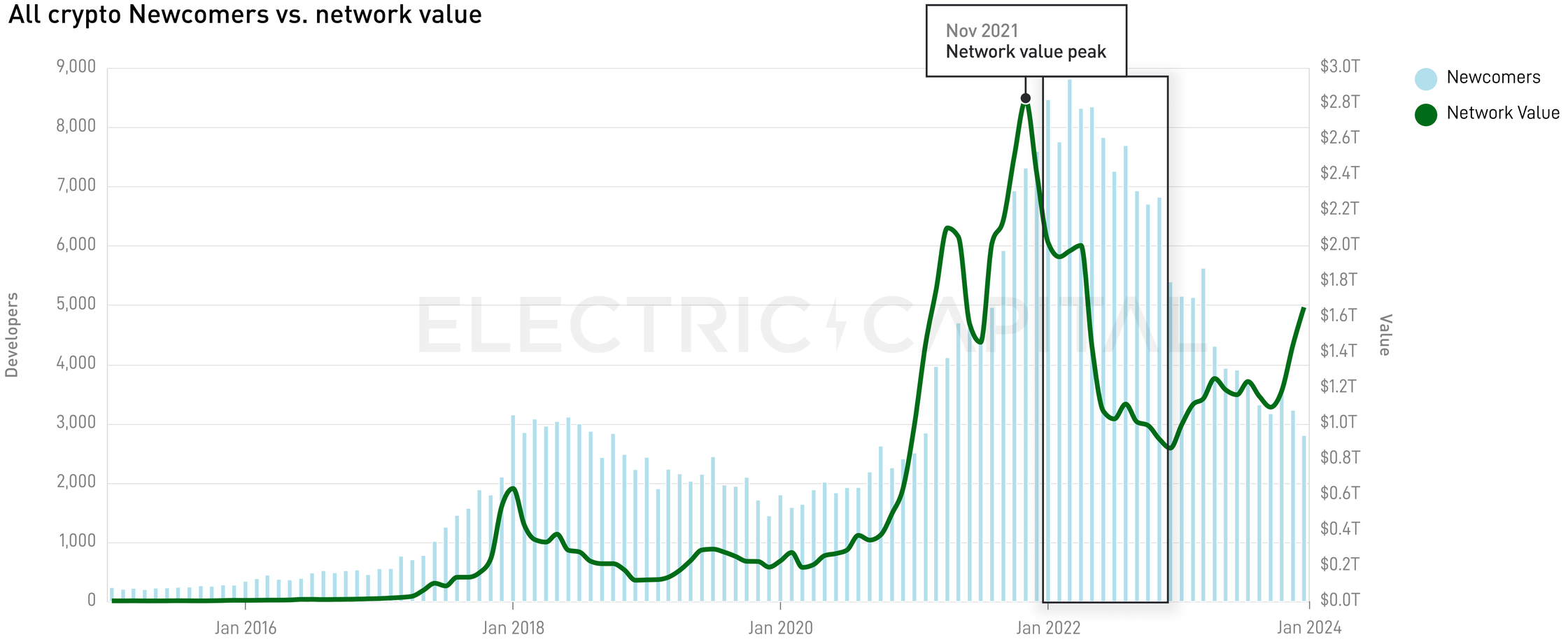
90,330 developers joined crypto in 2022

All crypto Newcomers by year



More than 6.5K Newcomers joined crypto every month in 2022 following a historical high in crypto network value

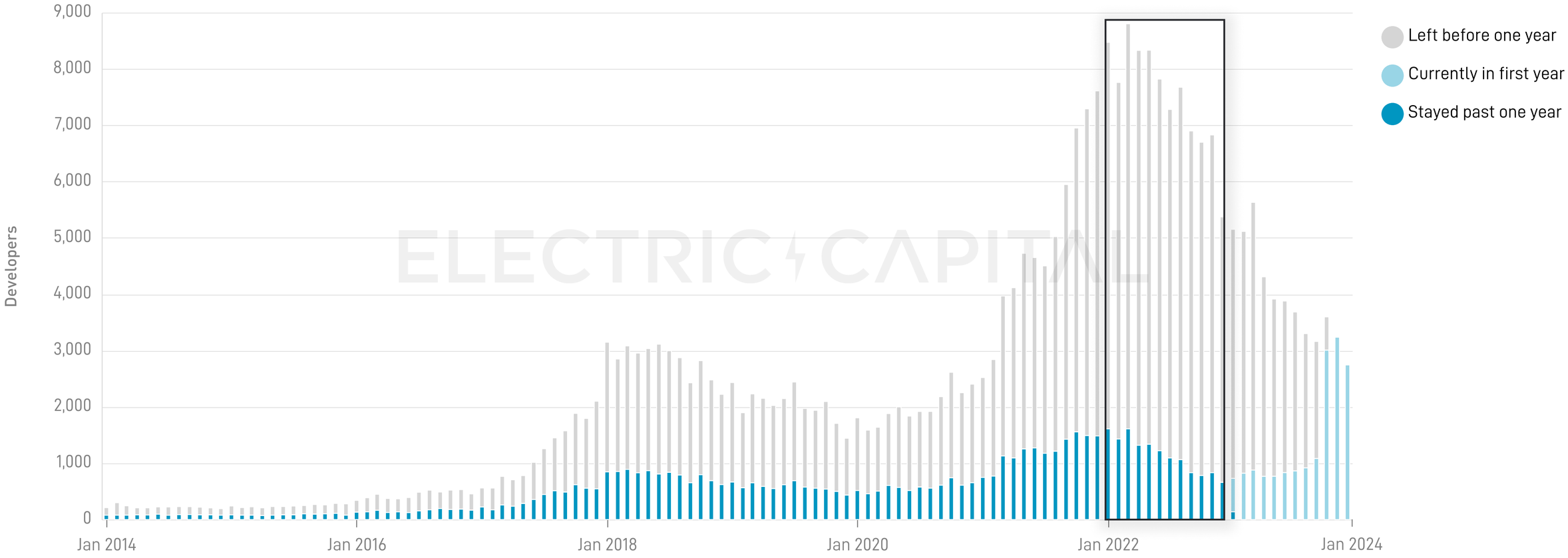
All crypto Newcomers vs. network value



2022 Newcomers account for most of 2023 developer losses

Newcomers who joined in 2022 are the ones who churned and are driving the overall -24% developer loss

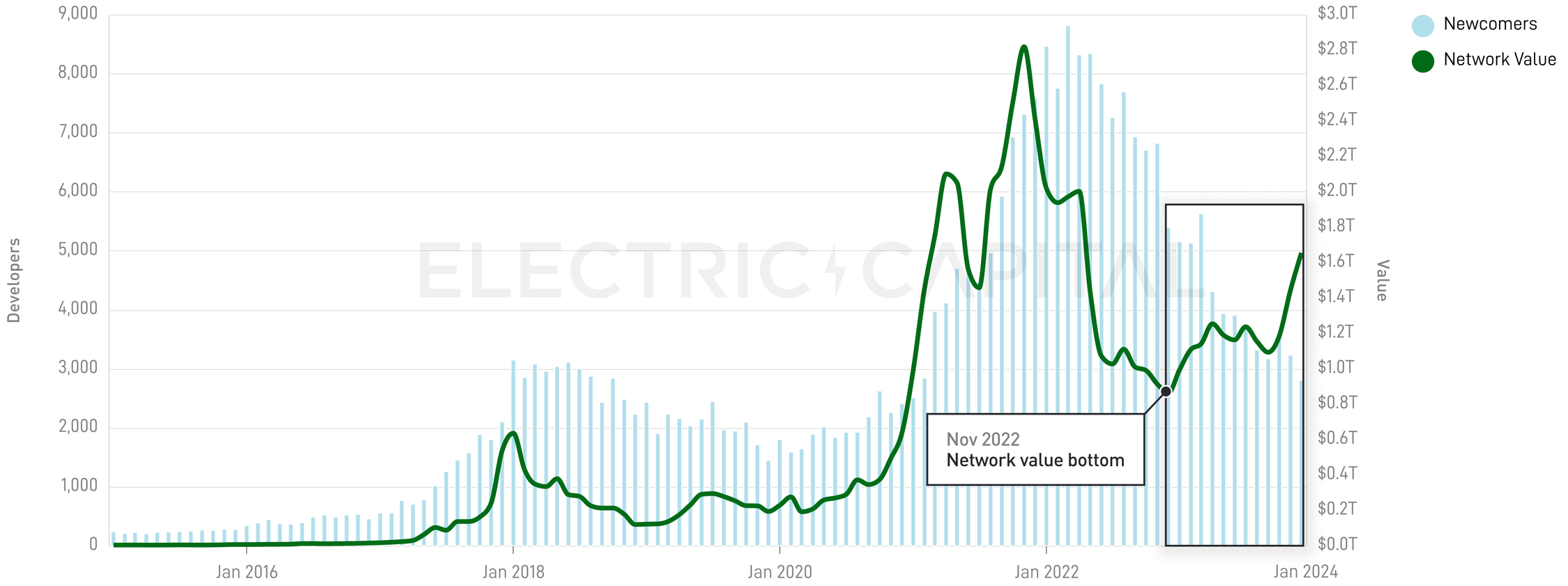
One year retention of Newcomers who joined in a given month



Newcomers joined crypto in 2023 deep into a bear market

More than 3K developers joined almost every month despite network value lows in the beginning of 2023

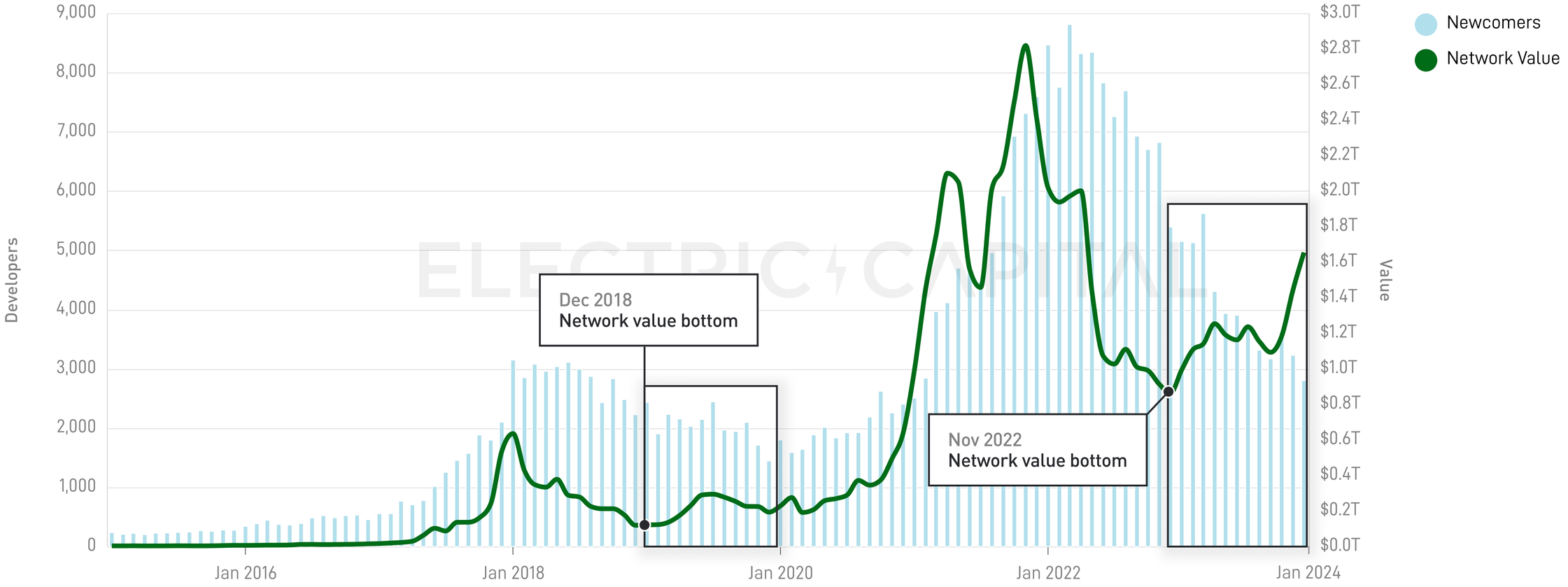
All crypto new developers vs. network value



1.95x more monthly new developers joined in this bear vs. the last

3,990 Newcomers per month joined in this bear market compared to 2,045 per month in the last bear market

All crypto Newcomers vs. network value



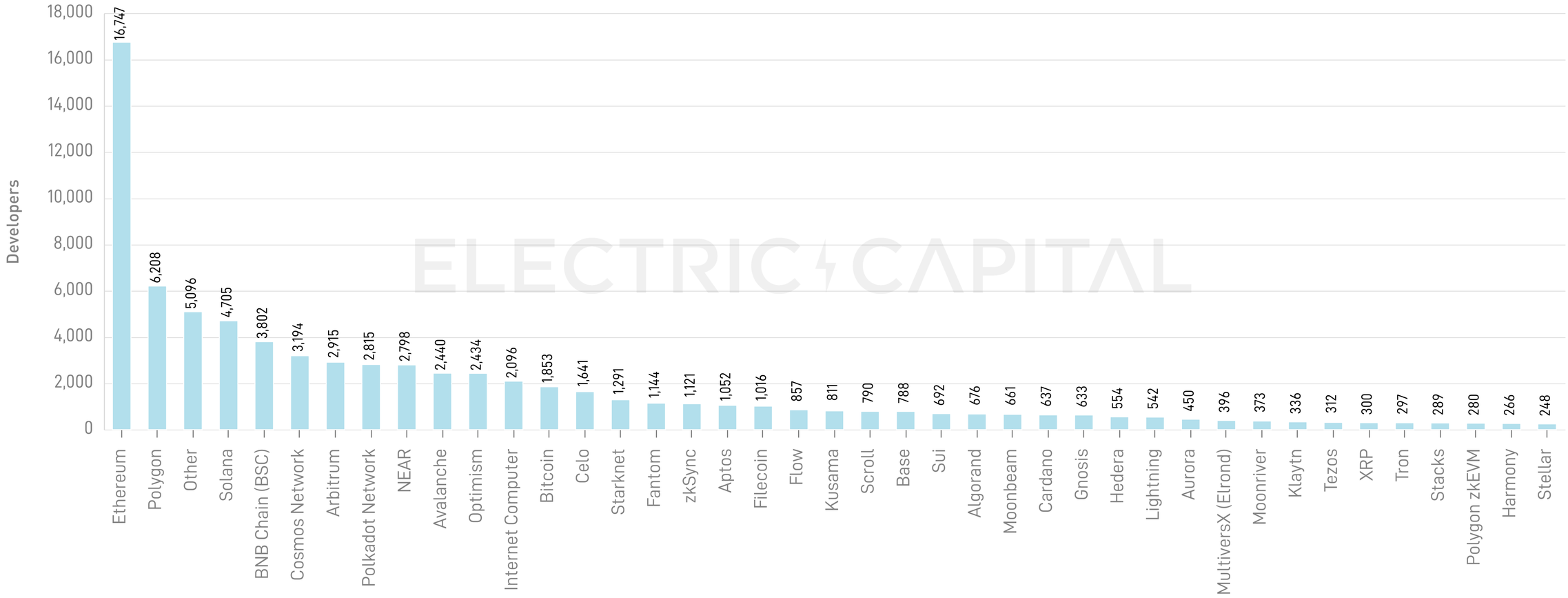
01

Developer Overview

What drew Newcomers to crypto in 2023?

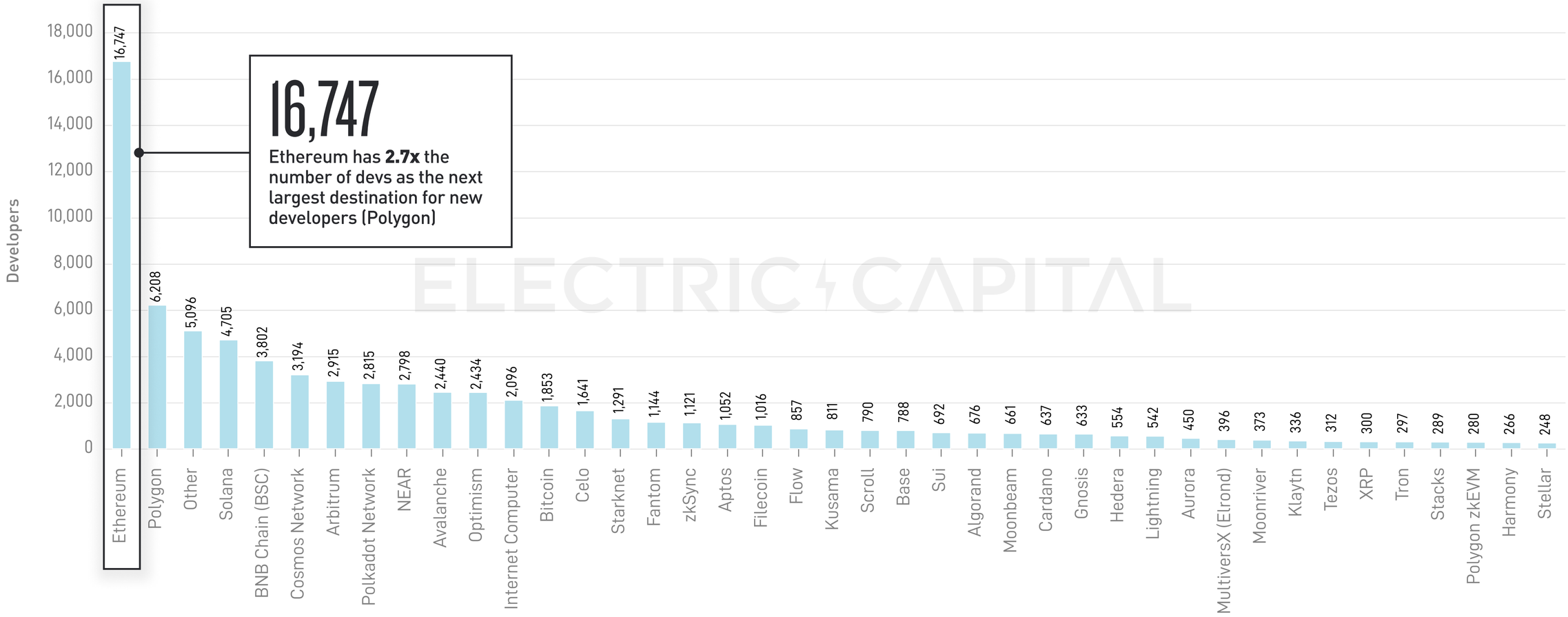
Which ecosystems drew in Newcomers in 2023?

Number of Newcomers who wrote code in each crypto ecosystem in 2023



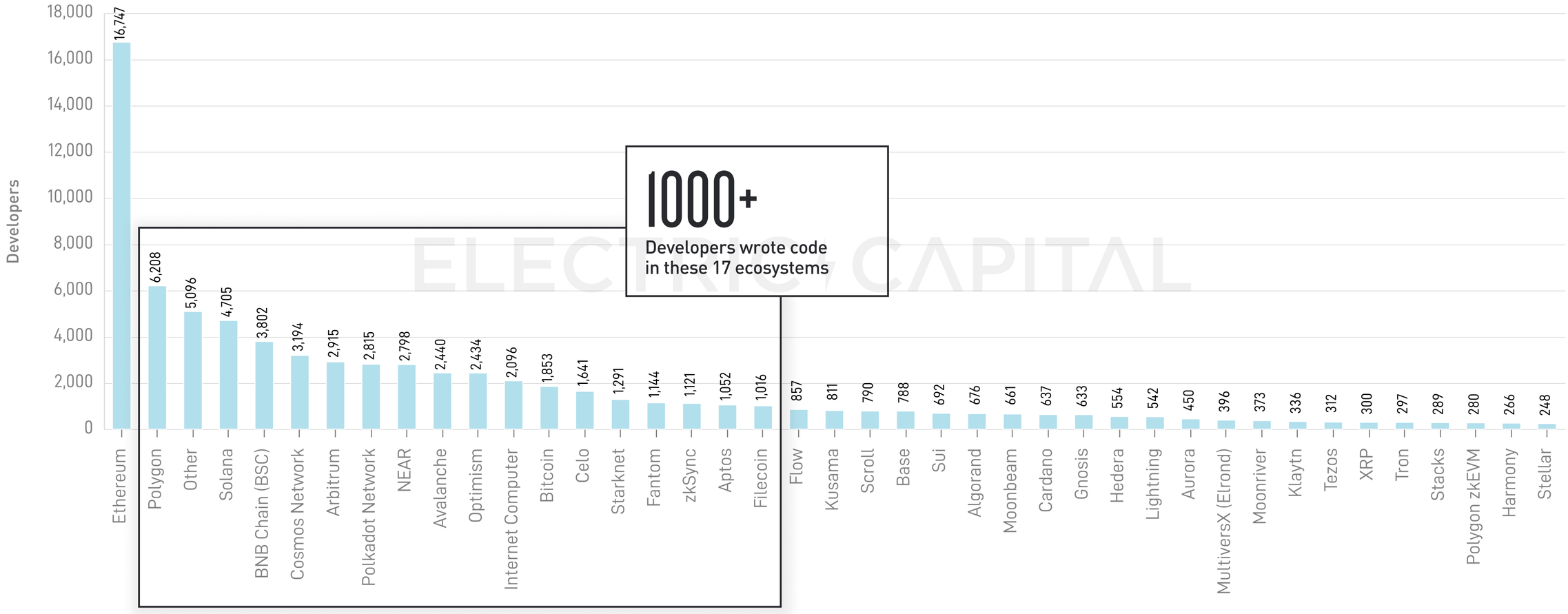
16.7k Newcomers wrote code in Ethereum, 2.7x more than the next largest ecosystem

Number of Newcomers who wrote code in each crypto ecosystem in 2023



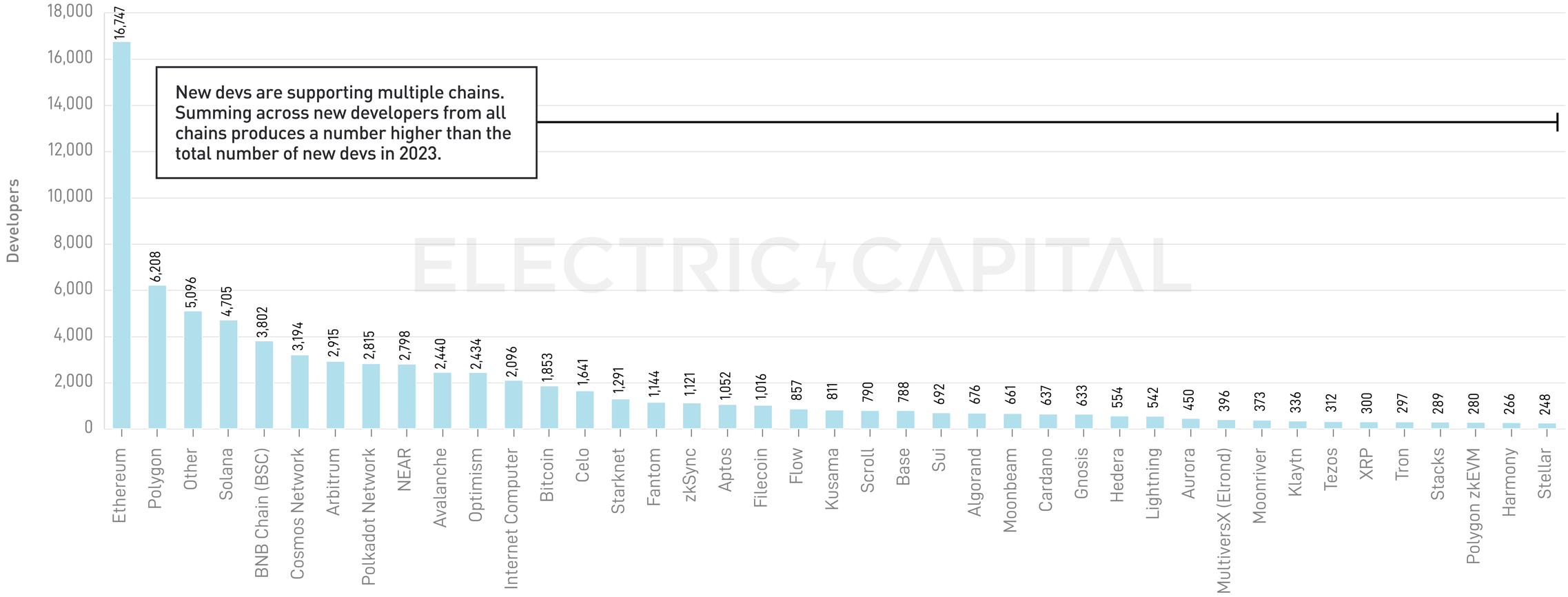
There is a large torso of popular ecosystems: 17 ecosystems with 1000+ new developers from 2023

Number of Newcomers who wrote code in each crypto ecosystem in 2023



Newcomers support *multiple chains*: Adding across ecosystems produces 100%+ of Newcomers because devs support 1+ chains

Number of Newcomers who wrote code in each crypto ecosystem in 2023



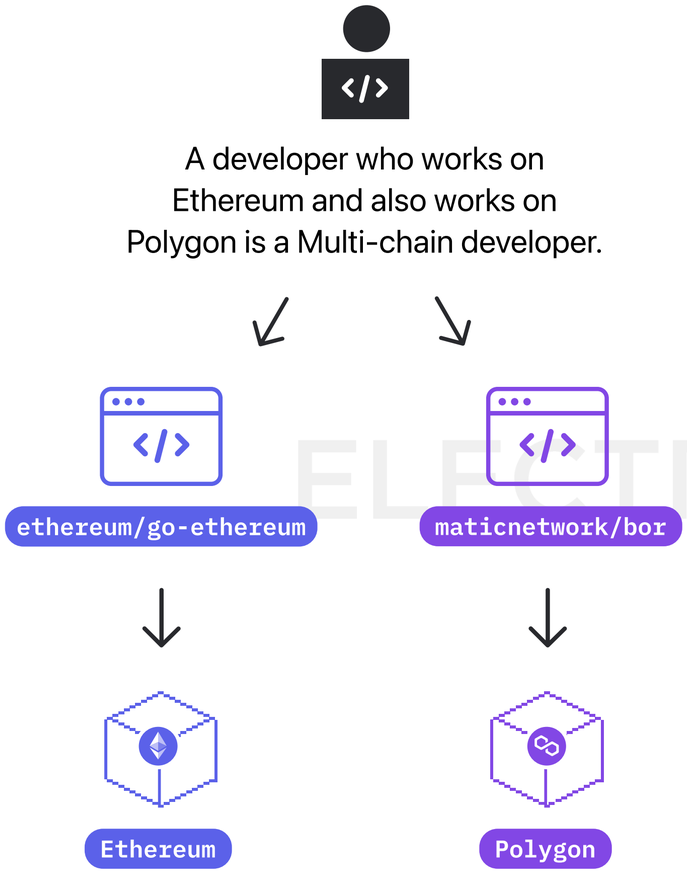
01

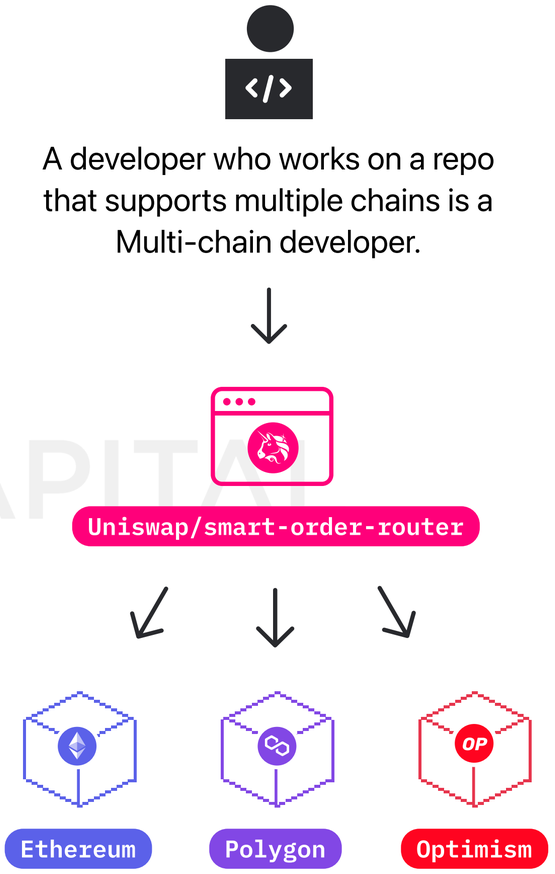
Developer Overview

Many developers now contribute to multiple chains across crypto.

Let’s better understand Multi-chain developers.

Multi-chain developers build for more than one chain

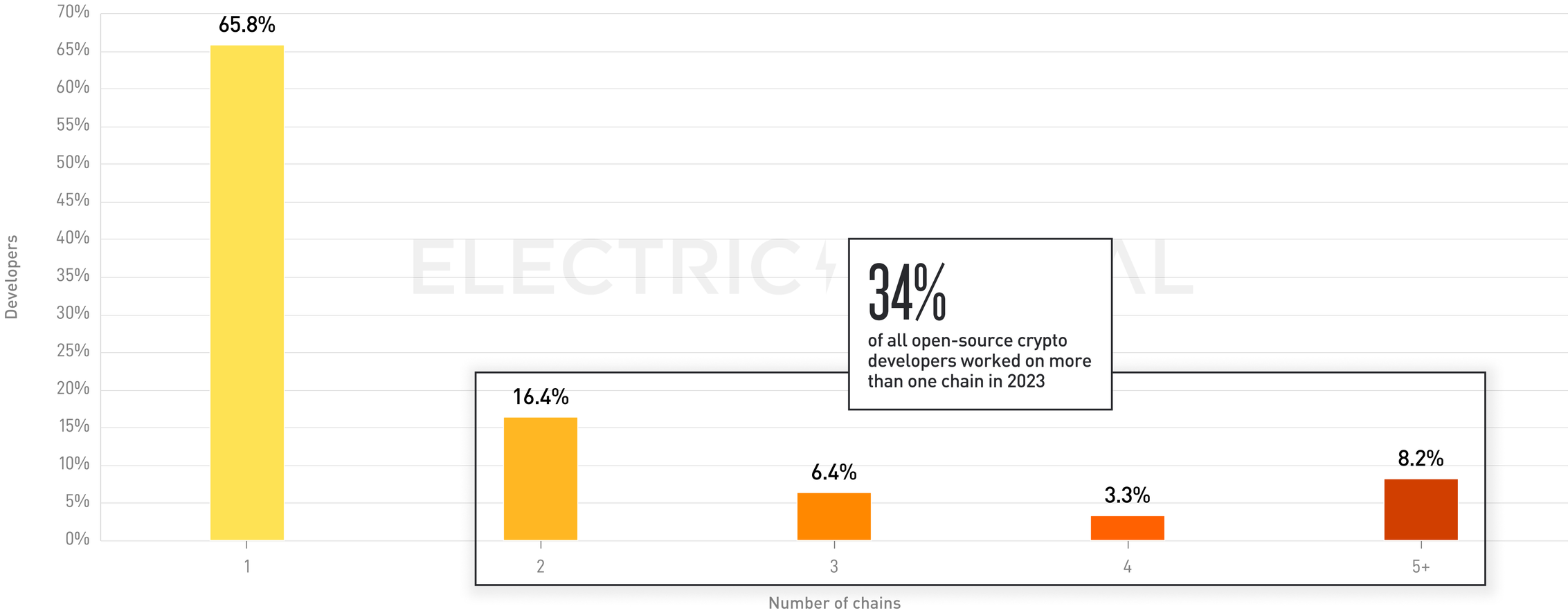




Multi-chain developer status is is based on activity in a rolling 28 day window. A developer who works on more than 1 chain any day in the 28 -day window is a Multi-chain developer in that time period.

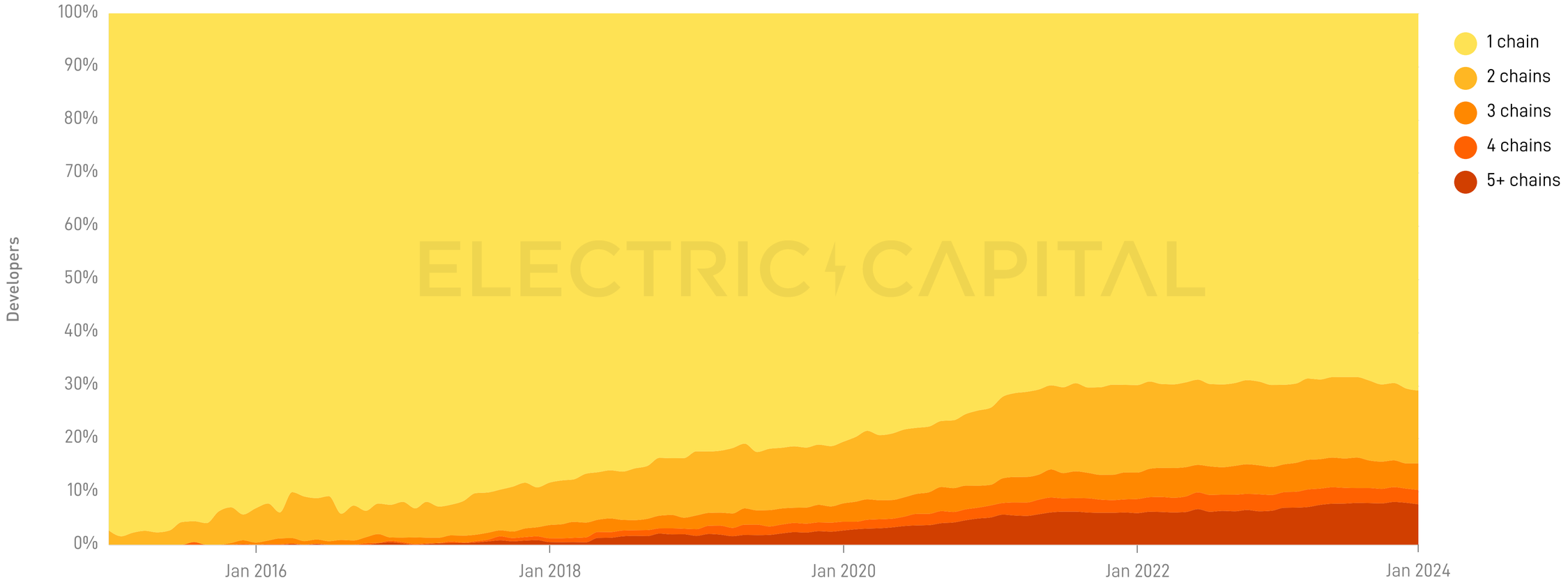
34% of all developers in 2023 built for multiple chains, with 8.2% supporting five or more chains

Number of chains that all developers supported in 2023



Let's look at monthly active developers by the number of chains they build for over time....

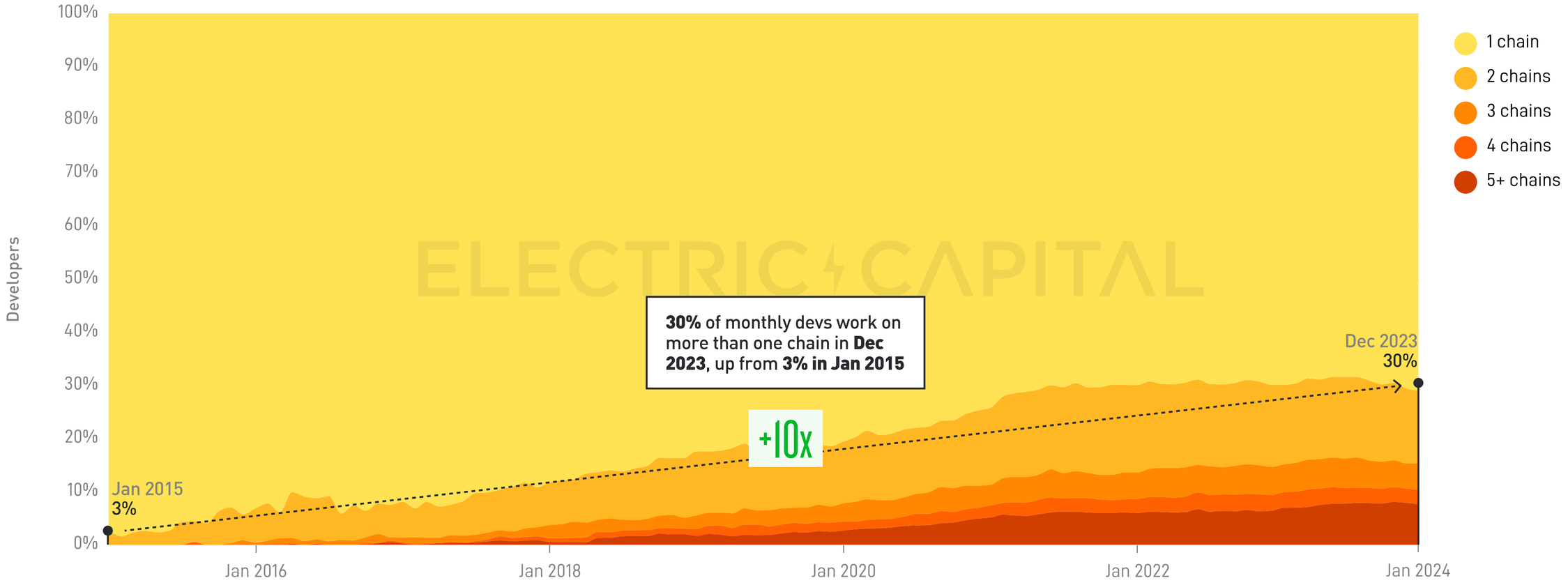
All crypto monthly active developers by the number of chains they support



Multi-chain developers 10x'd since 2015

Only 3% of monthly active devs supported multiple chains in Jan 2015

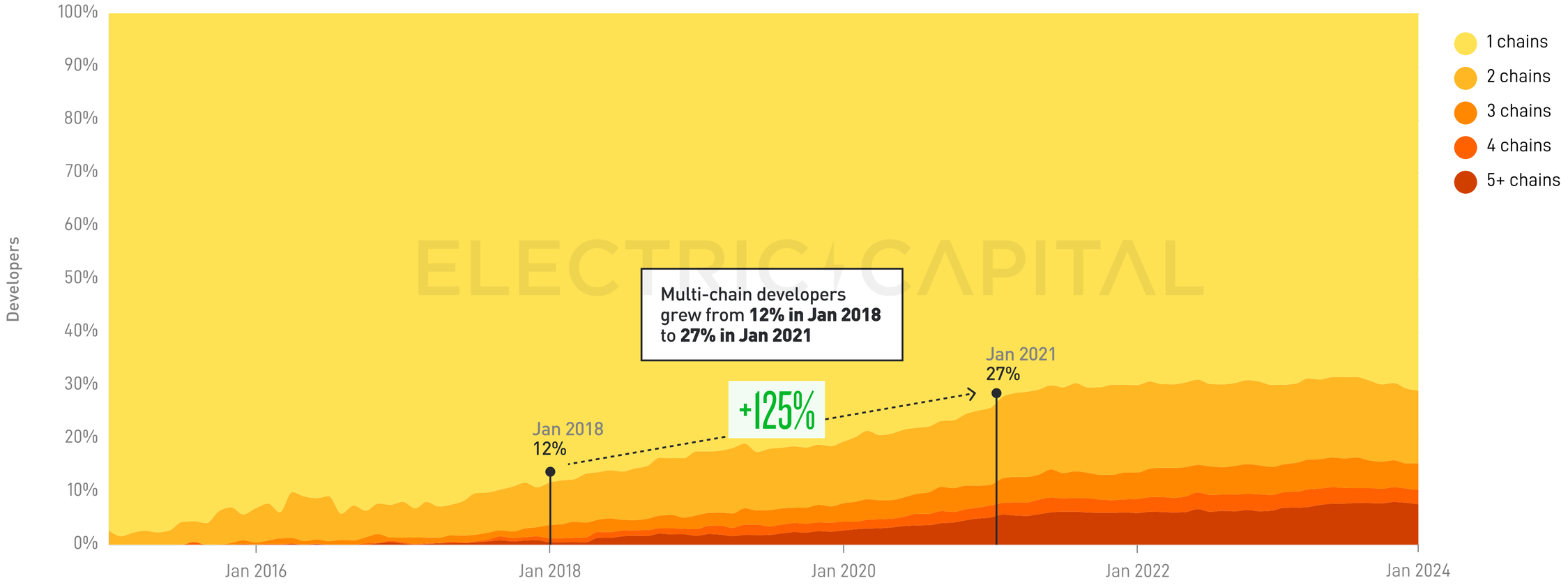
All crypto monthly active developers by the number of chains they support



Multi-chain developer growth accelerated after 2018

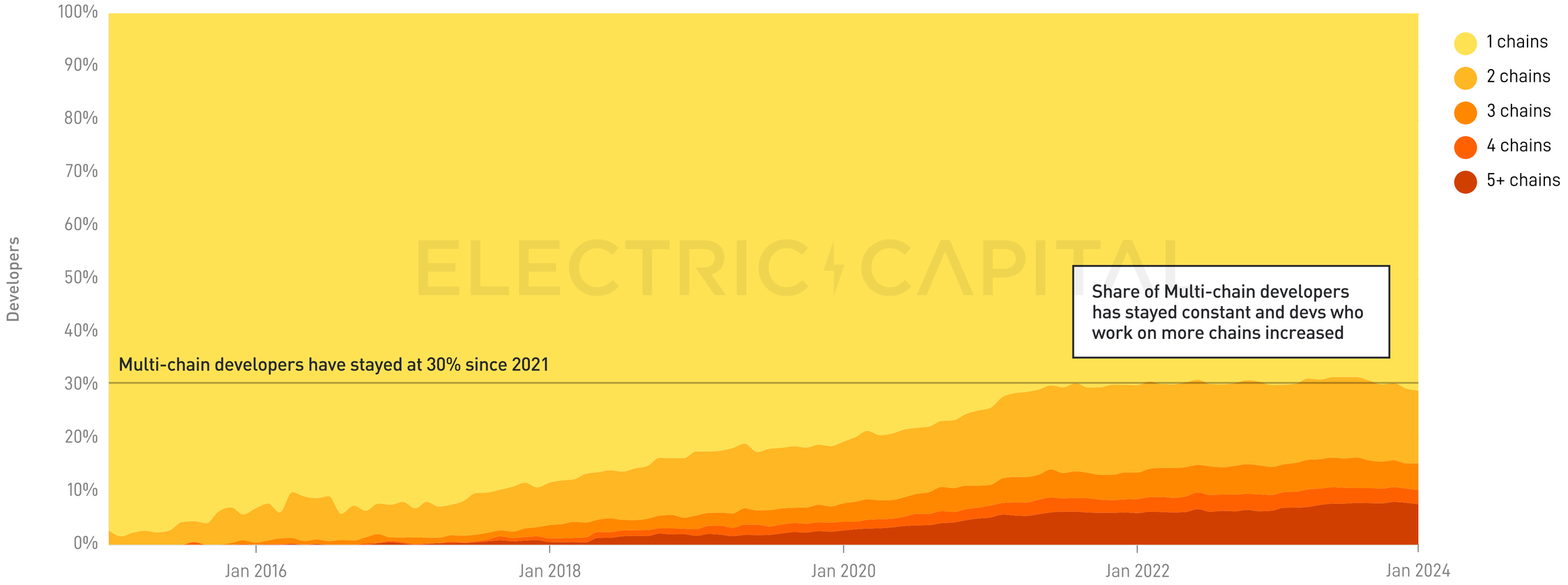
Multi-chain monthly active developers grew +125% in the years after 2018

All crypto monthly active developers by the number of chains they support



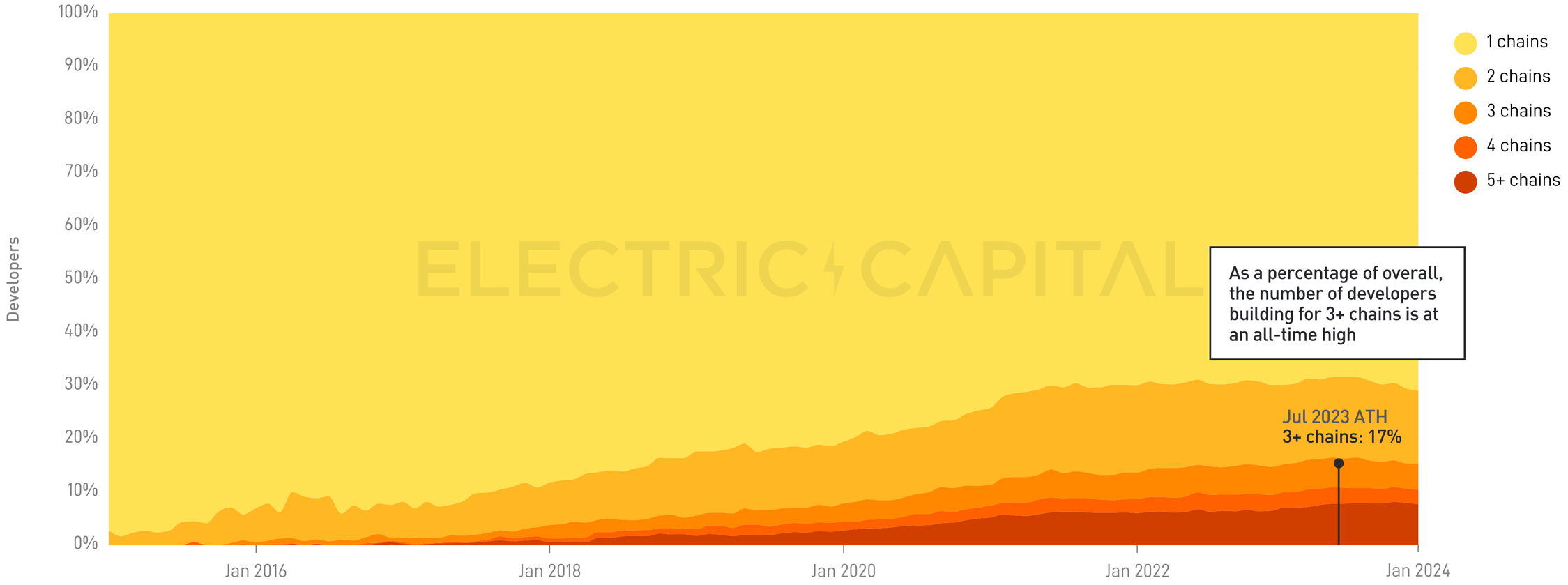
30% of devs have been working on 2 or more chains for 3 years

All crypto monthly active developers by the number of chains they support



1 out of 6 devs write code that impacts 3+ chains (all-time high)

All crypto monthly active developers by the number of chains they work on



Which chains have developers in common?

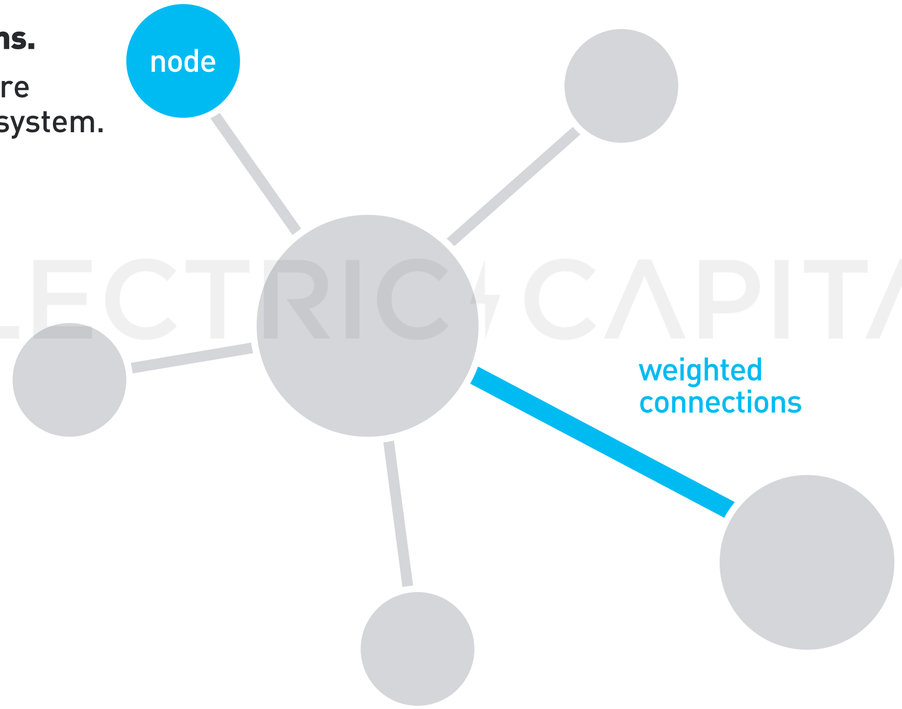
Let’s look at how Multi-chain developers work across multiple chains.

To understand Multi-chain behavior, we can create a network graph where each node is an ecosystem & each line represents shared developers

We filter down to Full-time developers and ecosystems that share at least 6 developers in common

Nodes represent ecosystems.

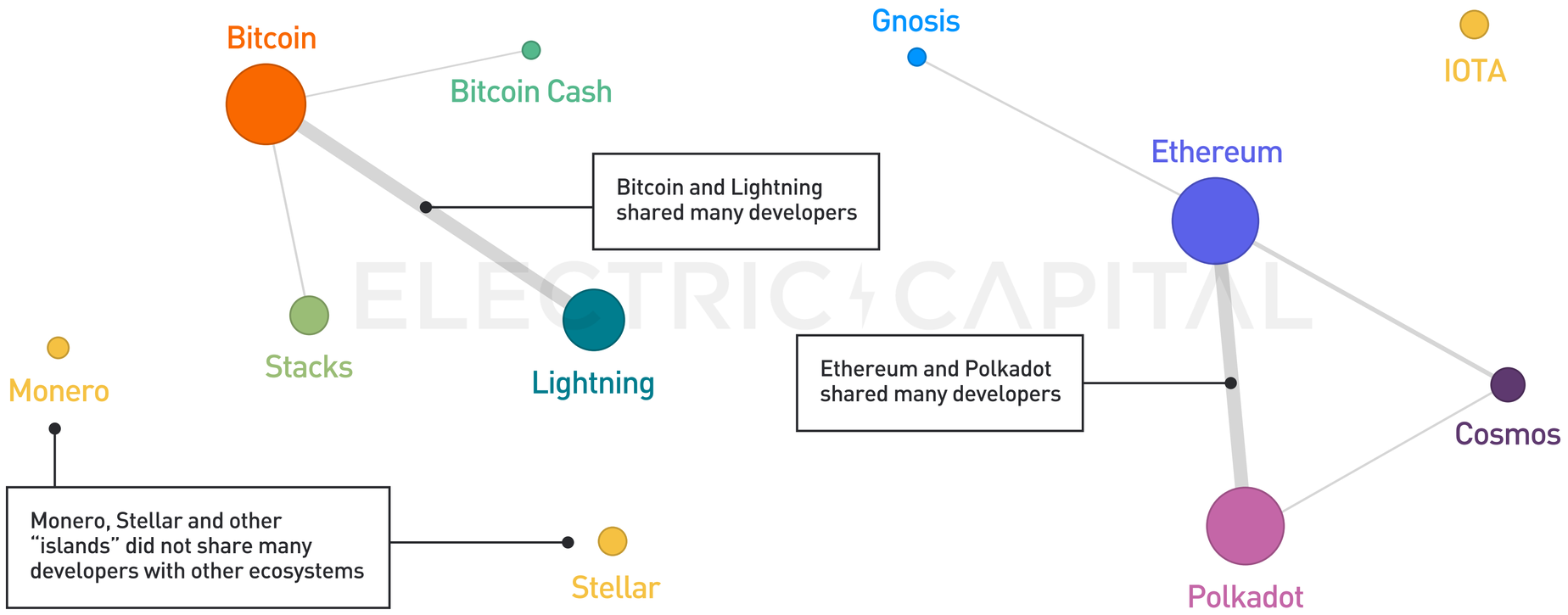
The bigger the node, the more developers work in that ecosystem.



Lines connecting nodes represent developers who work in both ecosystems.

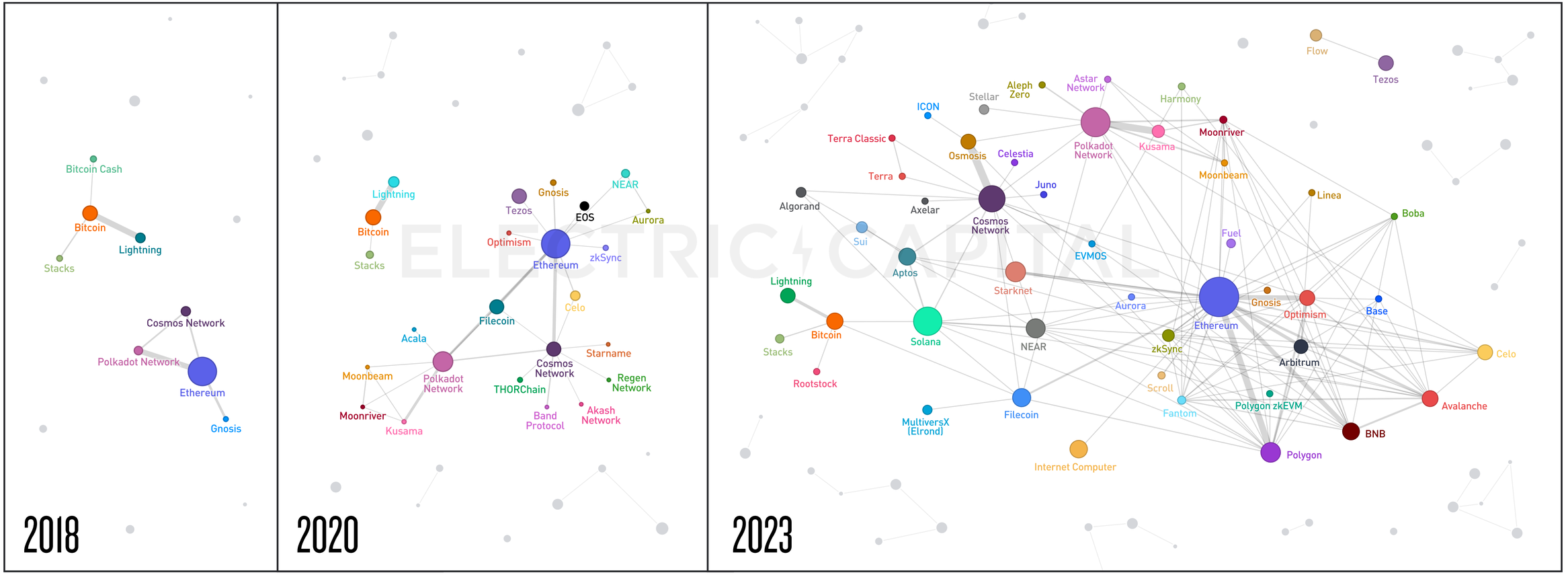
Thicker lines represent more shared developers.

In 2018, most Multi-chain developers worked across Bitcoin-Lightning and Ethereum-Polkadot



Today, developers are building across several clusters of interconnected ecosystems

More ecosystems are sharing more developers over time



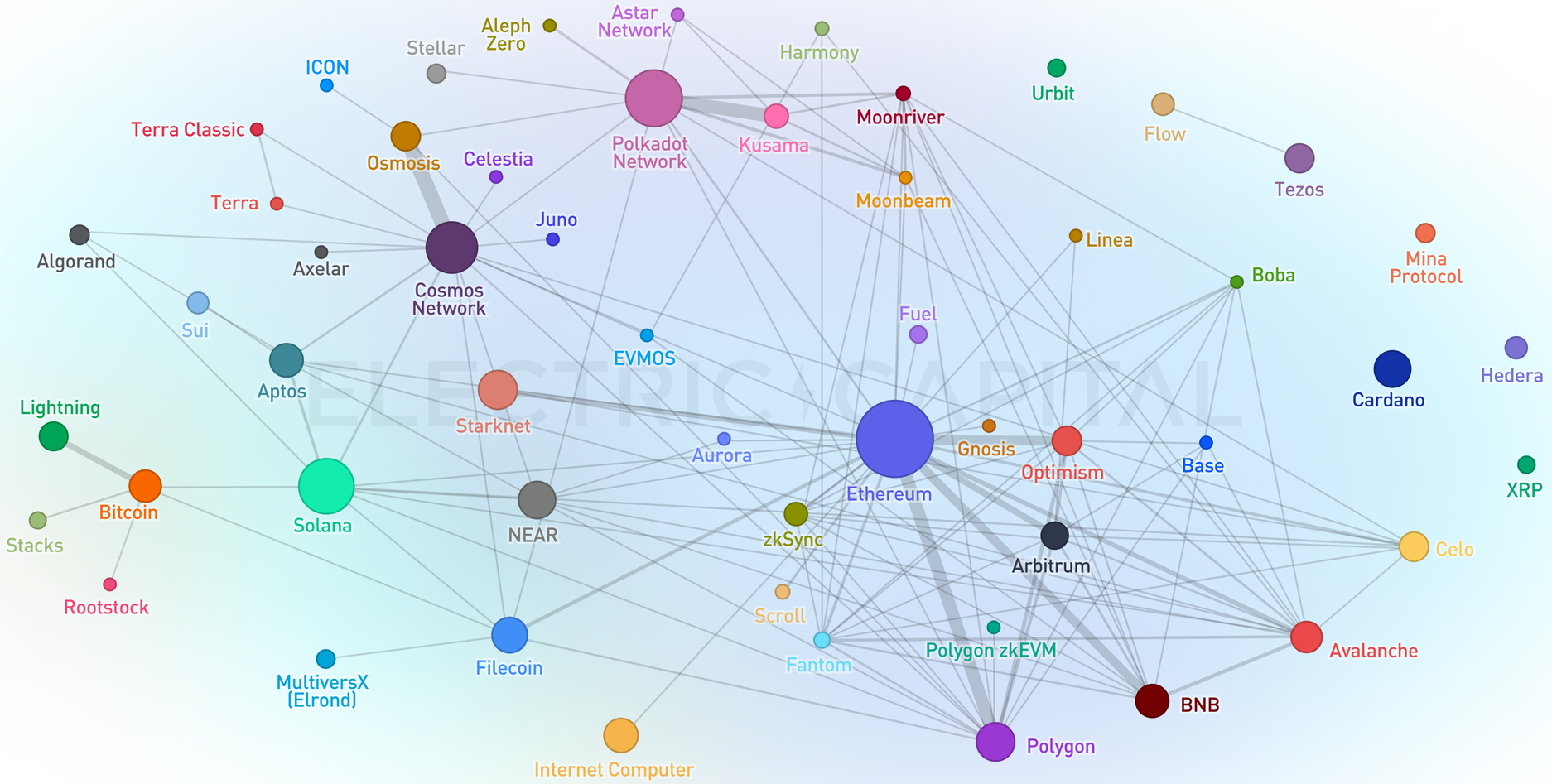
01

Developer Overview

Let’s take a closer look at 2023...

Who shares developers with another chain during 2023?

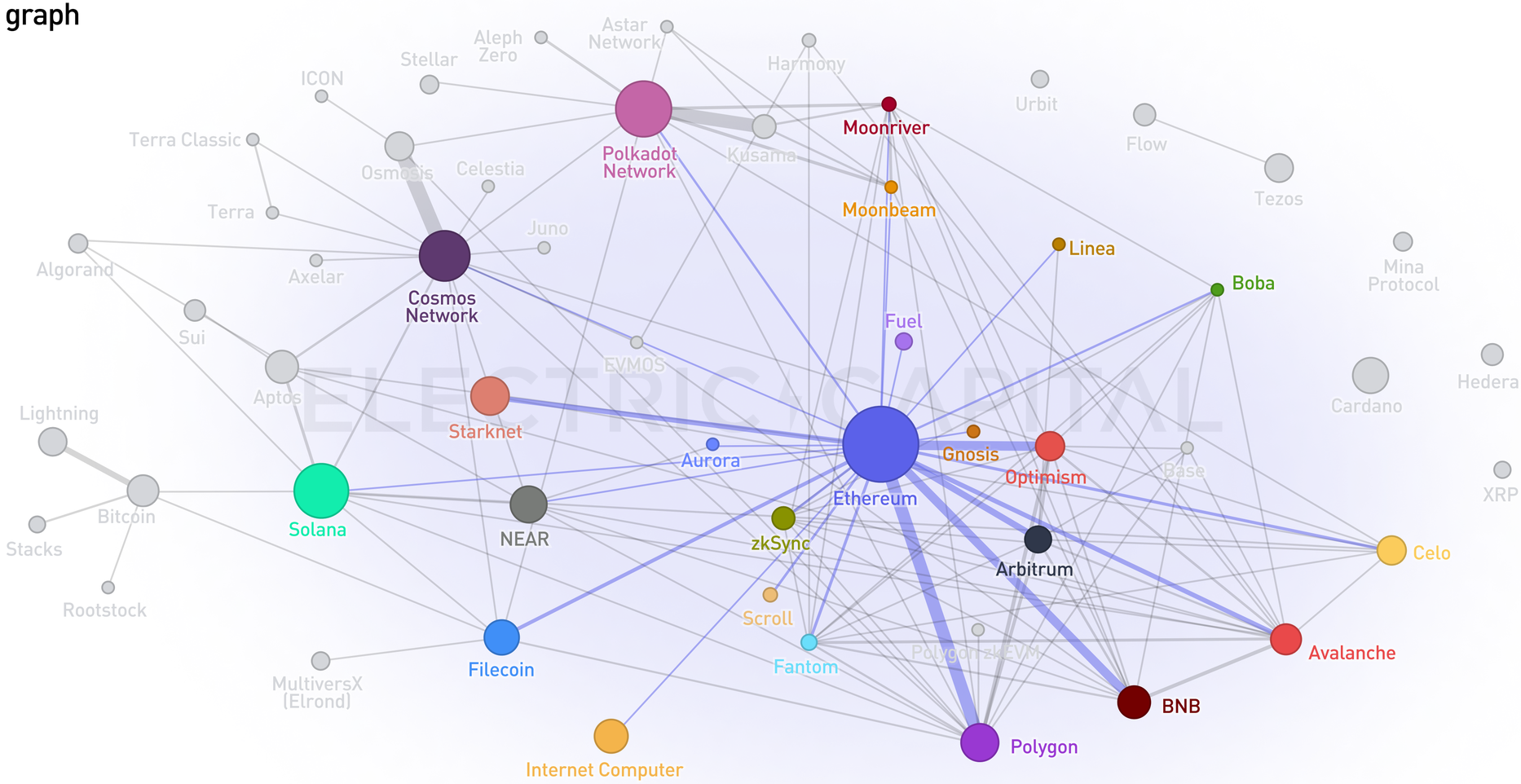
2023 network graph



Only ecosystems that share 6+ Full-time devs are shown. Ecosystems without lines does not mean they did not share devs, only that they shared fewer than 6 Full-time devs.

Ethereum shares 6+ developers with over 20 other chains

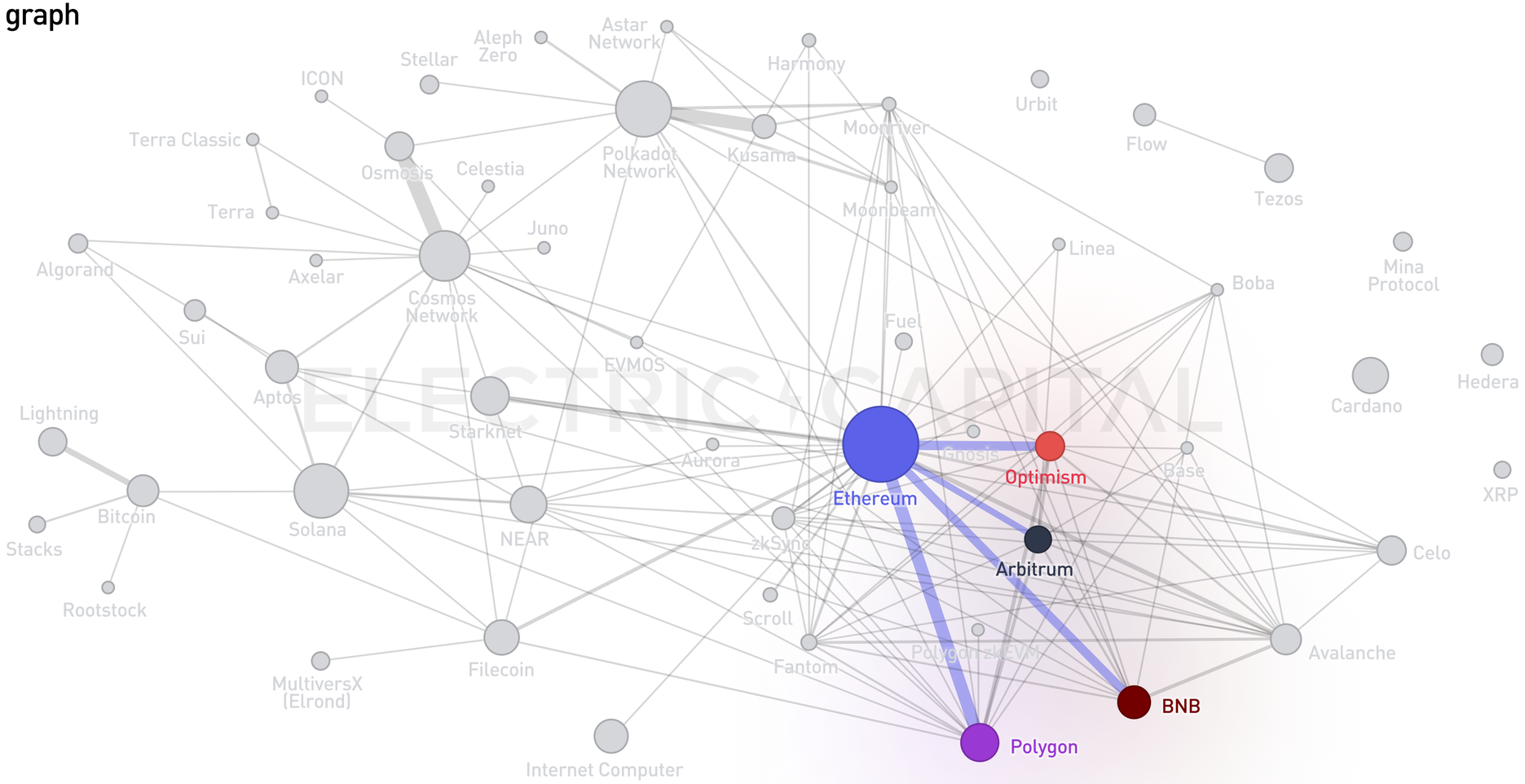
2023 network graph



Only ecosystems that share 6+ Full-time devs are shown. Ecosystems without lines does not mean they did not share devs, only that they shared fewer than 6 Full-time devs.

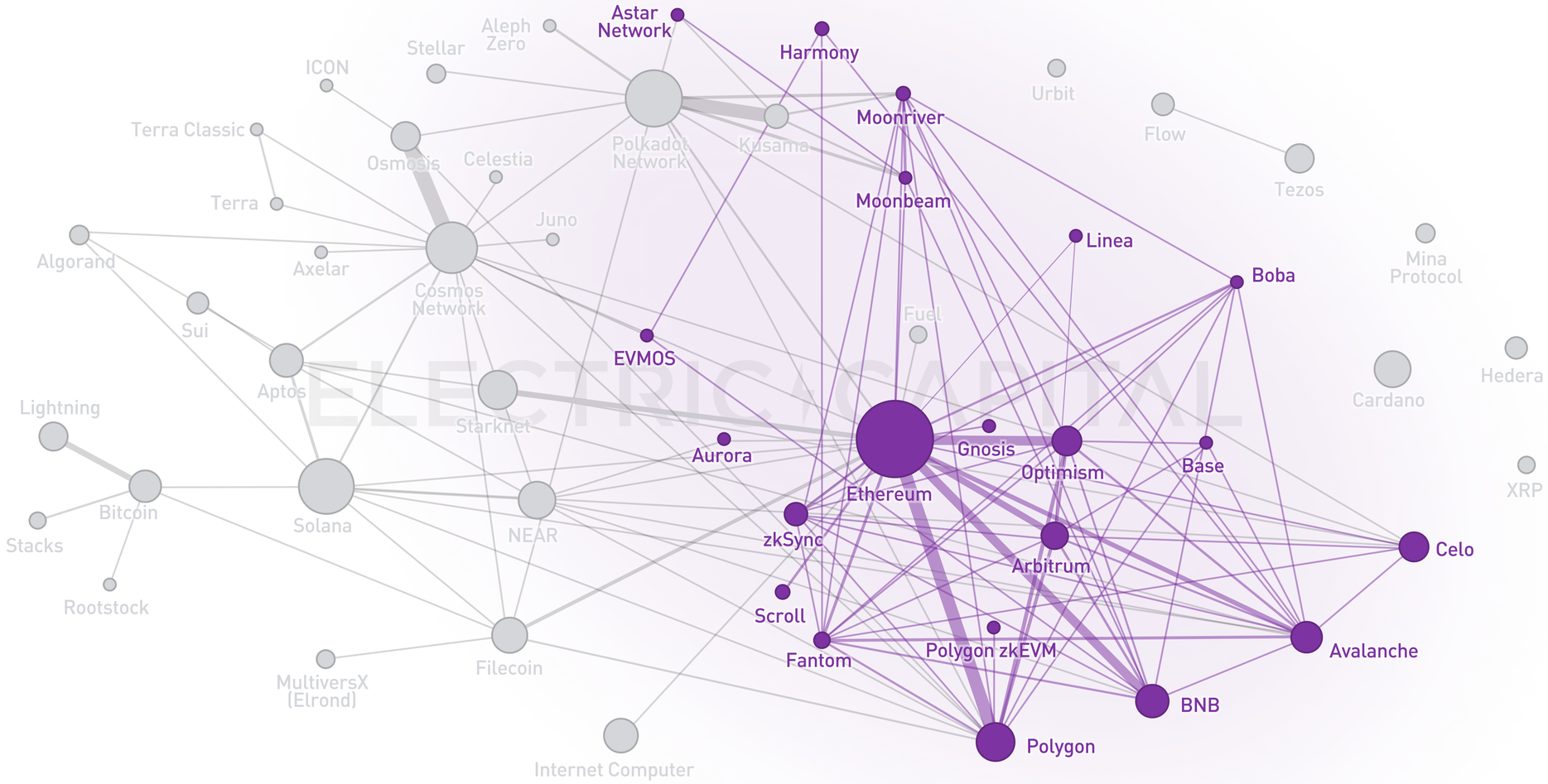
Ethereum shares the most devs with Polygon, BNB, Arbitrum, & Optimism

2023 network graph



Only ecosystems that share 6+ Full-time devs are shown. Ecosystems without lines does not mean they did not share devs, only that they shared fewer than 6 Full-time devs.

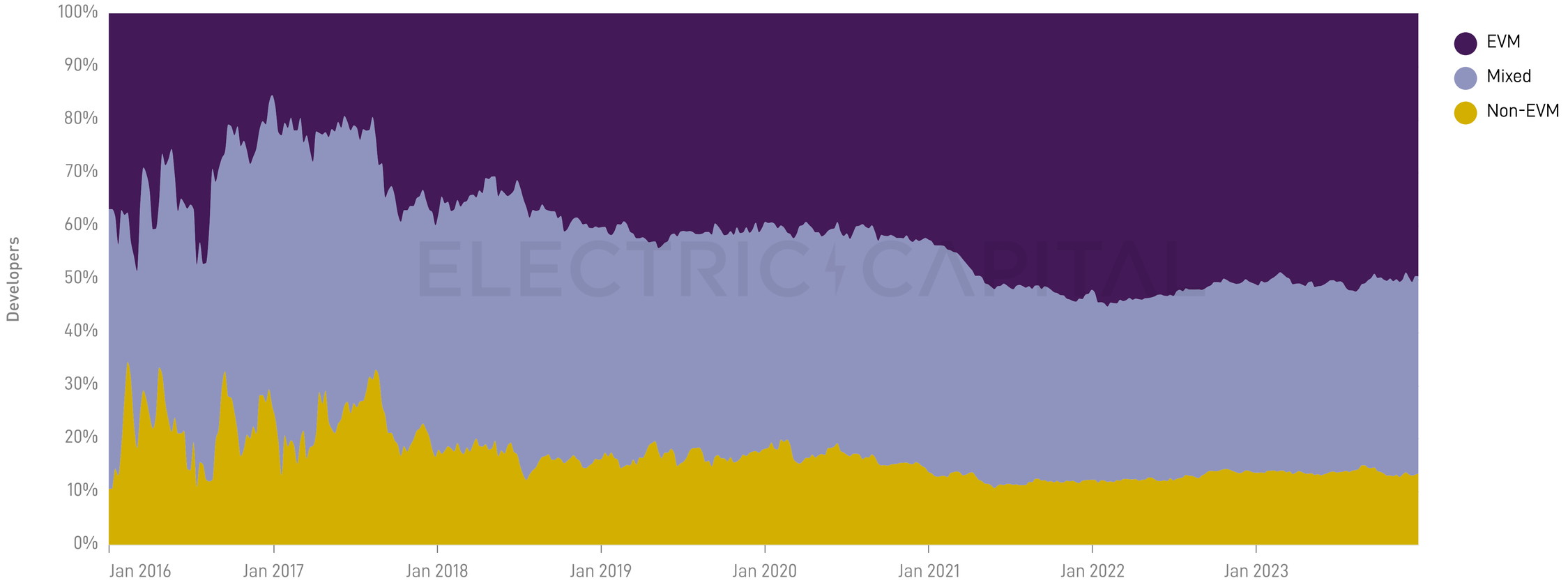
Unsurprisingly, EVM-compatible chains share devs with other EVM chains



Only ecosystems that share 6+ Full-time devs are shown. Ecosystems without lines does not mean they did not share devs, only that they shared fewer than 6 Full-time devs.

We can segment Multi-chain developers by whether they work on EVM only chains, non-EVMs only, or a mix of both

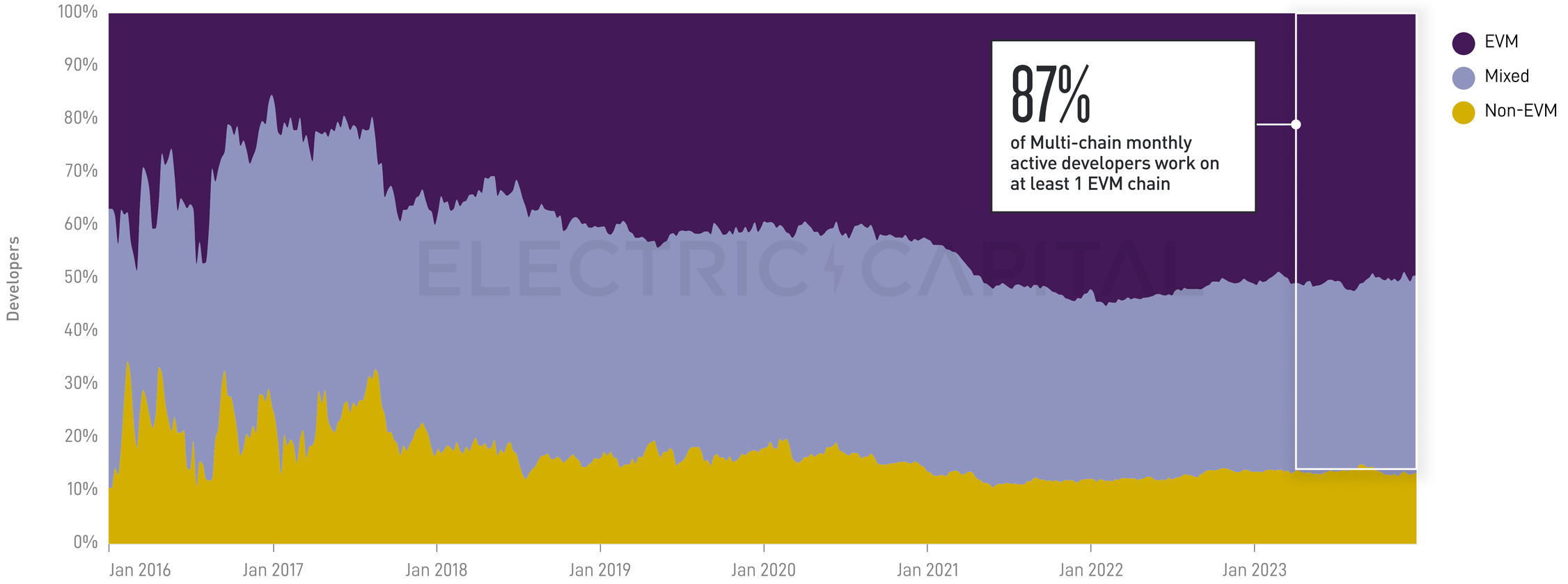
Distribution of Multi-chain developers by the types of chains they work on



87% of Multi-chain devs work on at least 1 EVM chain

Only 13% of Multi-chain devs work on non-EVM chains

Distribution of Multi-chain developers by the types of chains they work on

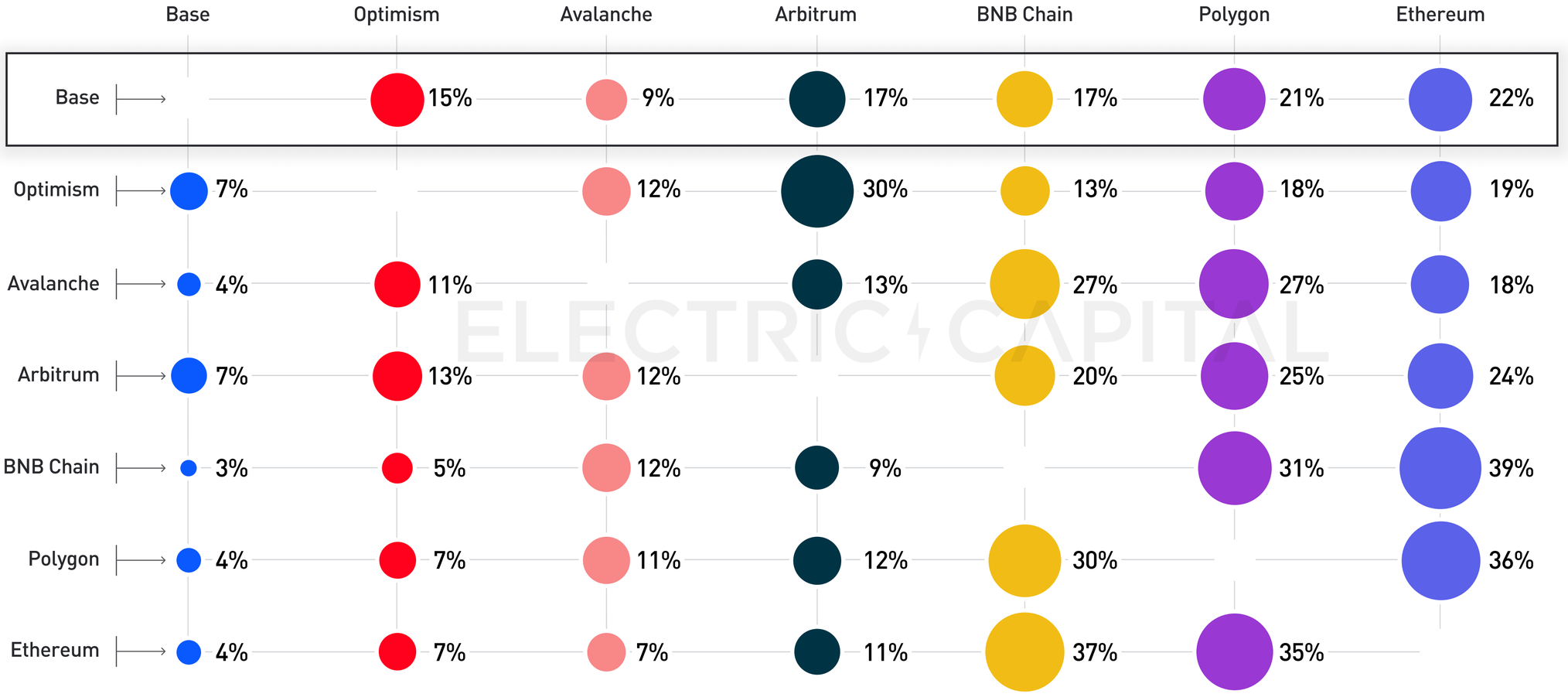


Since 87% of Multi-chain devs are in EVM ecosystems, we can look at *deployed* code on-chain to understand developer behaviors more deeply.

Let's see if on-chain deployers of code reflect the same affinity as open-source developers...

We can look at the percentage of shared contract deployers across different EVM chains

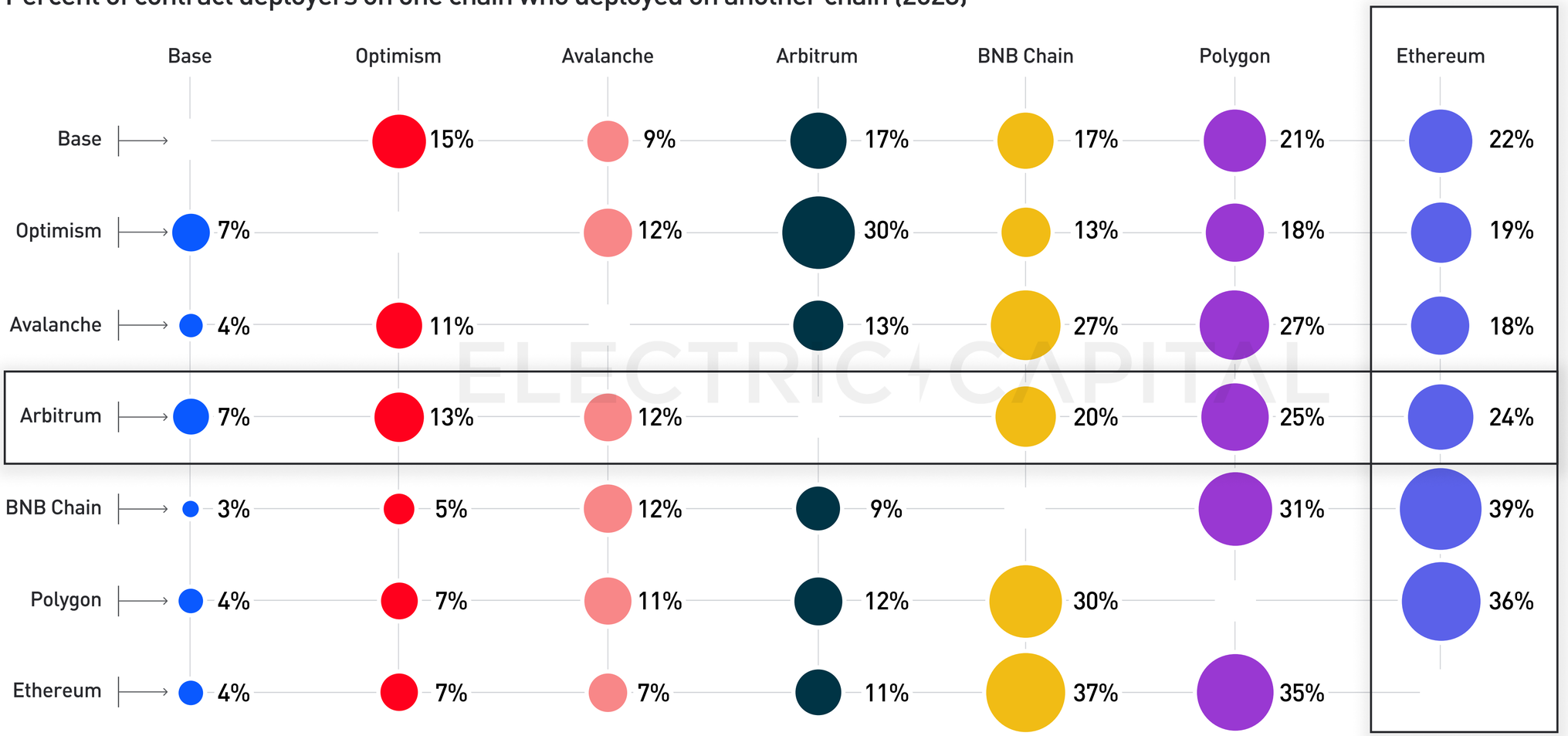
Percent of contract deployers on one chain who deployed on another chain (2023)



Each row corresponds to a blockchain. Circles indicate the percentage of deployers who also deploy on another chain listed at the top.

We can look at the percentage of shared deployers across different EVM chains (cont.)

Percent of contract deployers on one chain who deployed on another chain (2023)



This column indicates the percentage of Multi-chain deployers that other chains share with Ethereum

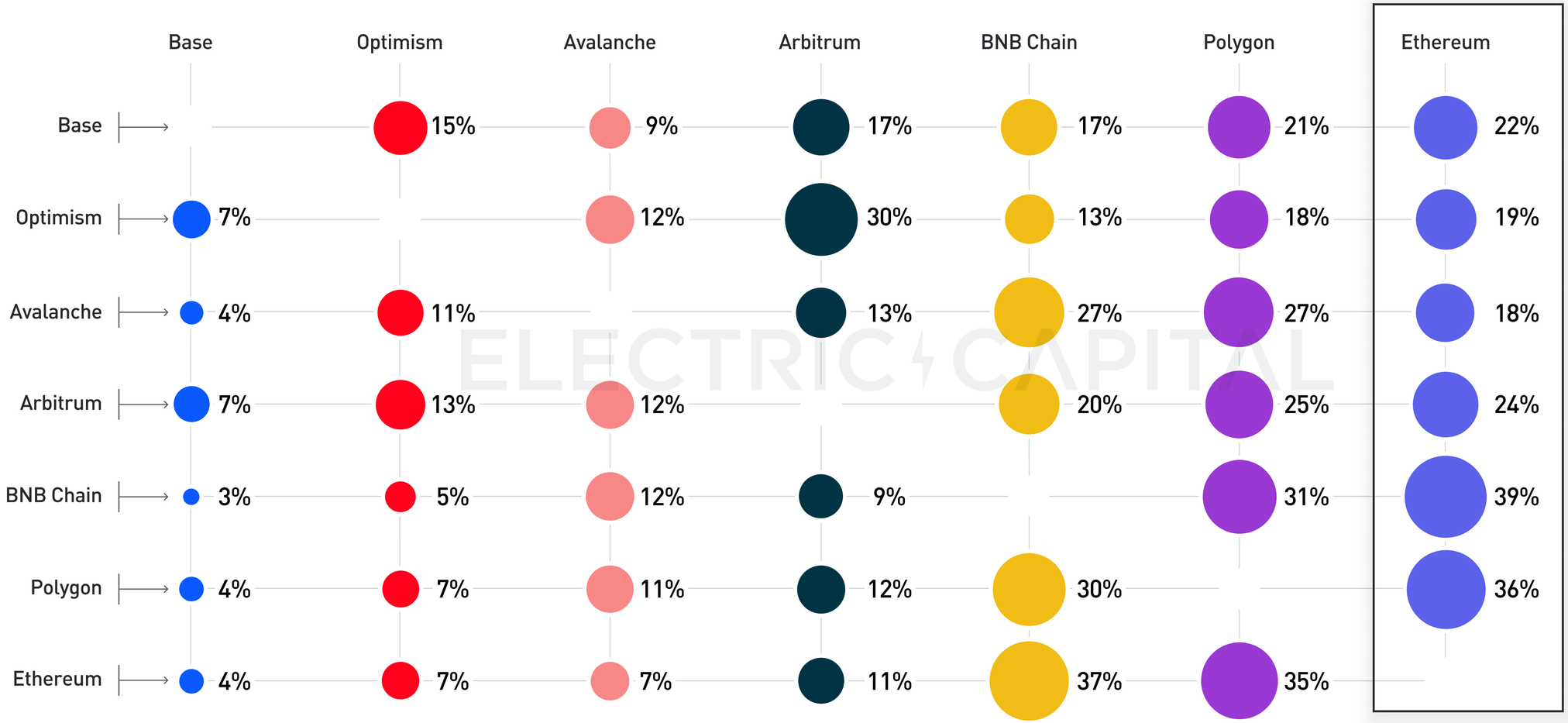
This row indicates the percentage of Multi-chain deployers Arbitrum shares with chains listed at the top

ELECTRIC CAPITAL

Most chains share a large number of deployers with Ethereum

BNB shares 39% of its Multi-chain deployers with Ethereum, Polygon 36%, and Avalanche the lowest at 18%

Percent of contract deployers on one chain who deployed on another chain (2023)

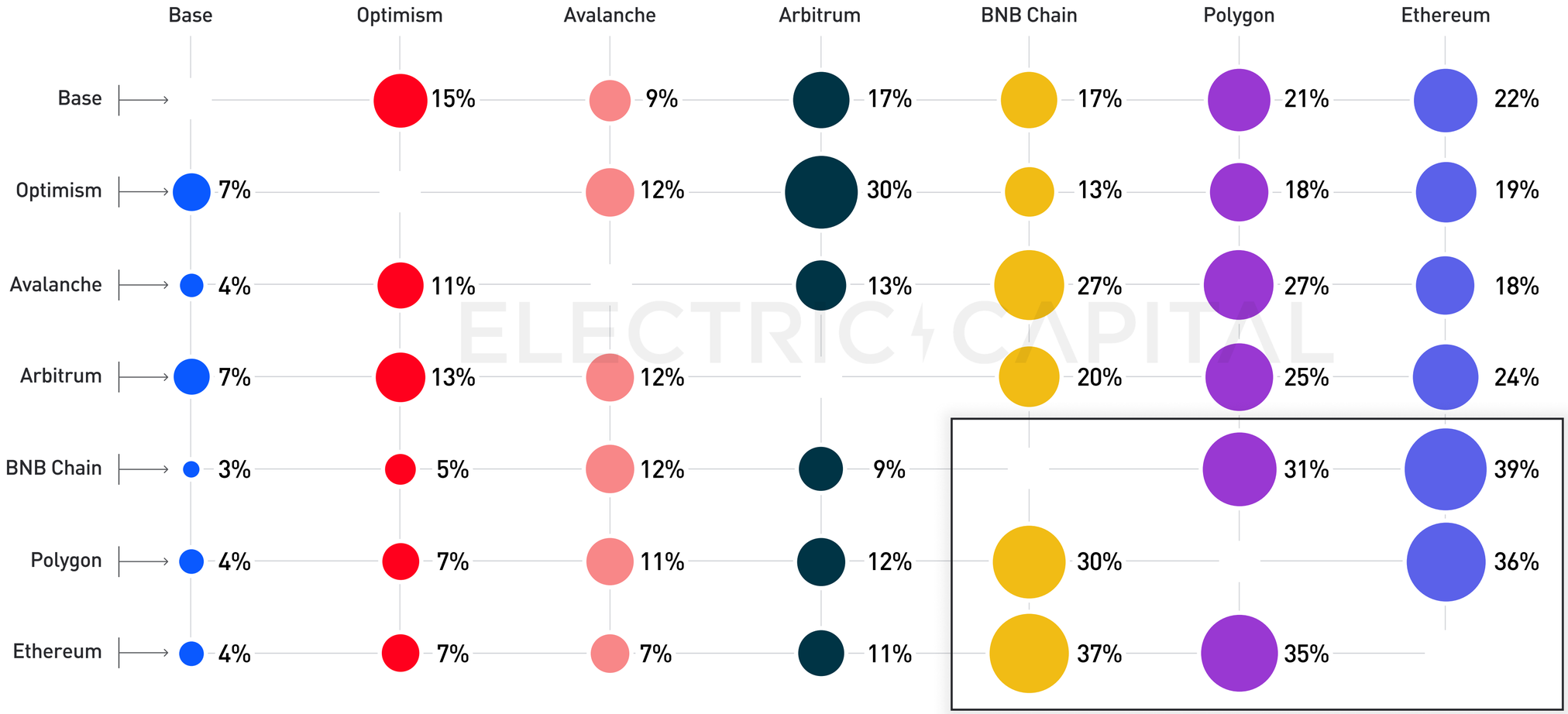


This column indicates the percentage of Multi-chain deployers that other chains share with Ethereum

Most cross-pollination is between Ethereum, Polygon, & BNB

37% of Ethereum's Multi-chain deployers are also deployed to BNB; 35% are deployed to Polygon

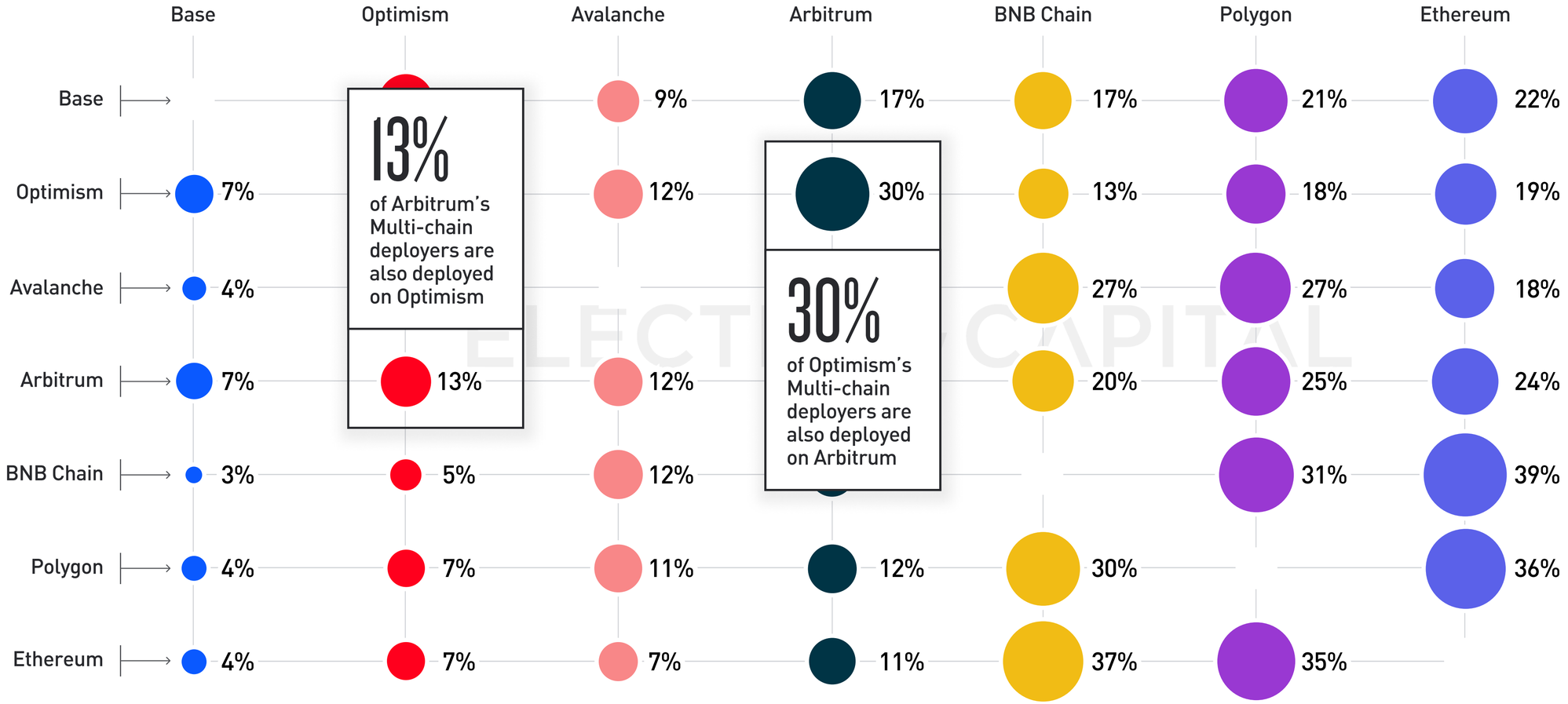
Percent of contract deployers on one chain who deployed on another chain (2023)



BNB, Polygon, and Ethereum all share at least 30% of their Multi-chain deployers with each other

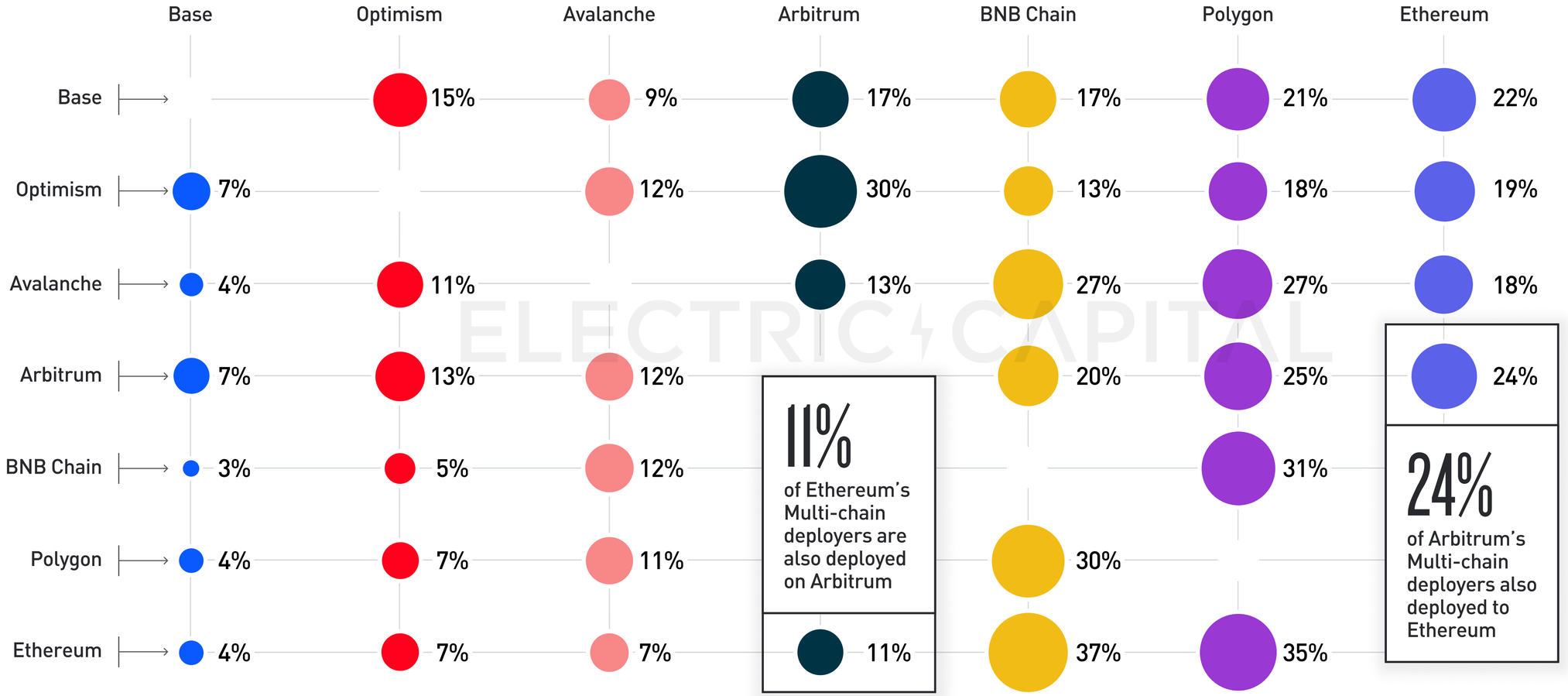
30% of Optimism Multi-chain deployers deploy to Arbitrum, and only 13% of Arbitrum Multi-chain deployers deploy to Optimism

Percent of contract deployers on one chain who deployed on another chain (2023)



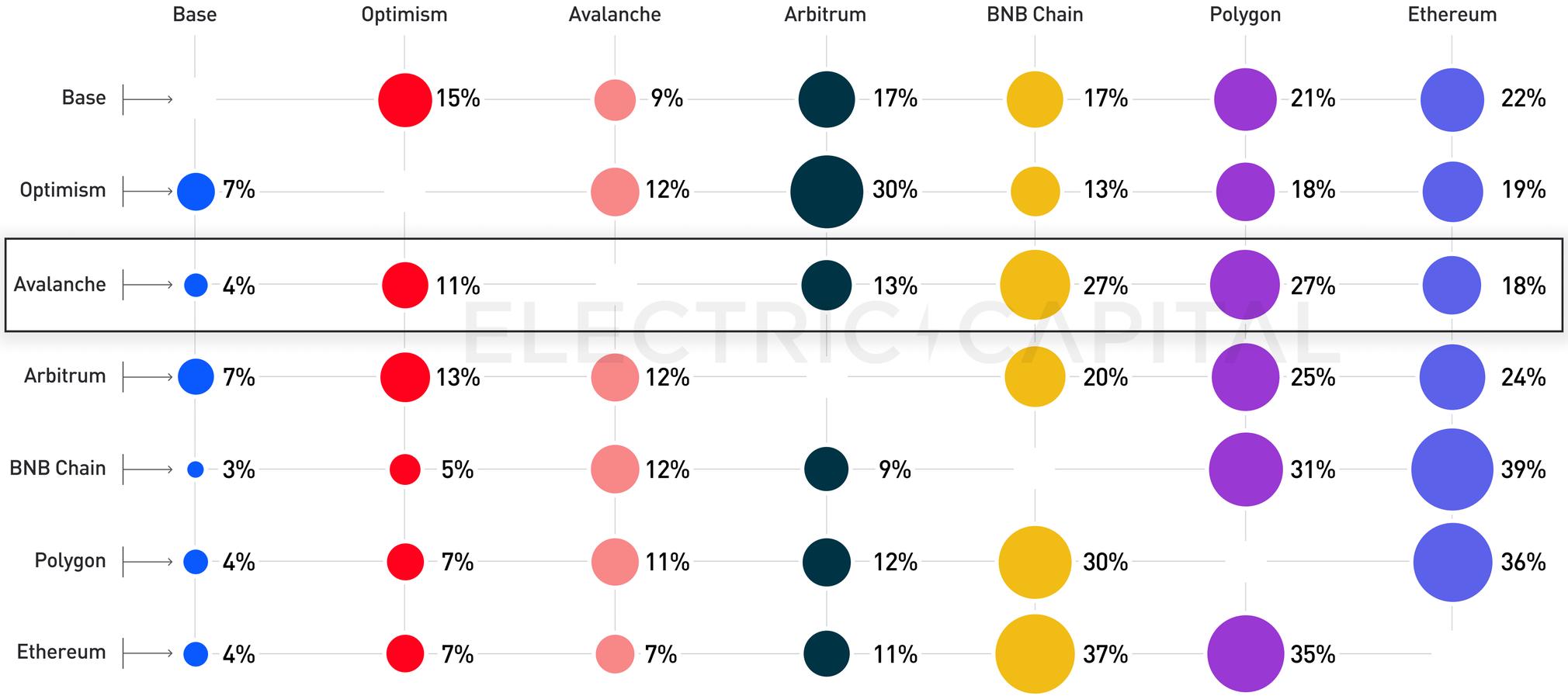
24% of Arbitrum Multi-chain deployers also deploy to Ethereum, and 11% of Ethereum Multi-chain deployers deploy to Arbitrum

Percent of contract deployers on one chain who deployed on another chain (2023)



Avalanche deployers are much more likely to deploy to BNB, Polygon, and Ethereum and less likely to deploy to ETH L2s

Percent of contract deployers on one chain who deployed on another chain (2023)

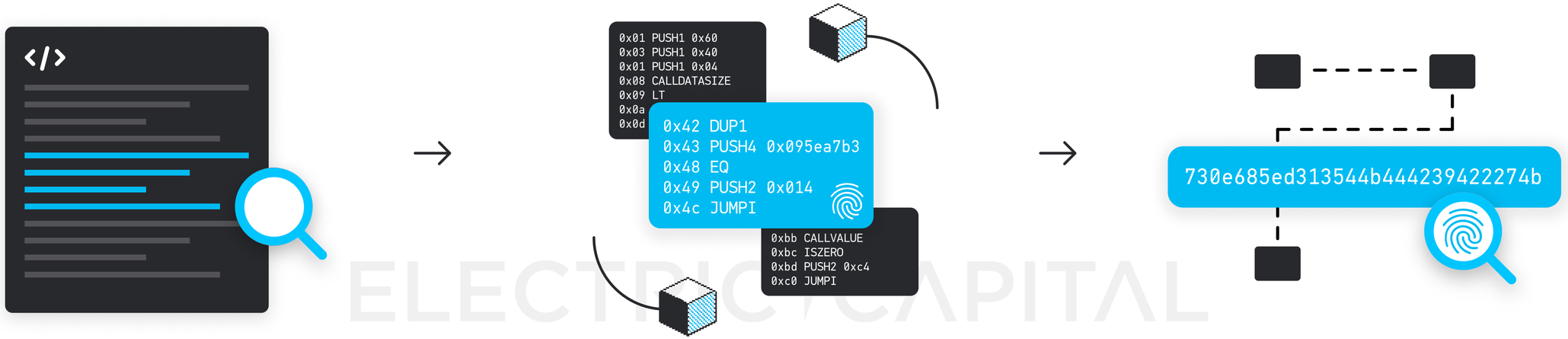


Where is new code *first* deployed?

New code = innovation.

Where is the innovation coming from?

How do we detect where innovation originates?
We detect when new EVM code is deployed via fingerprinting



ELECTRIC CAPITAL

01

First, we identify the **logic blocks** that determine how a smart contract works by analyzing its source code and bytecode.

02

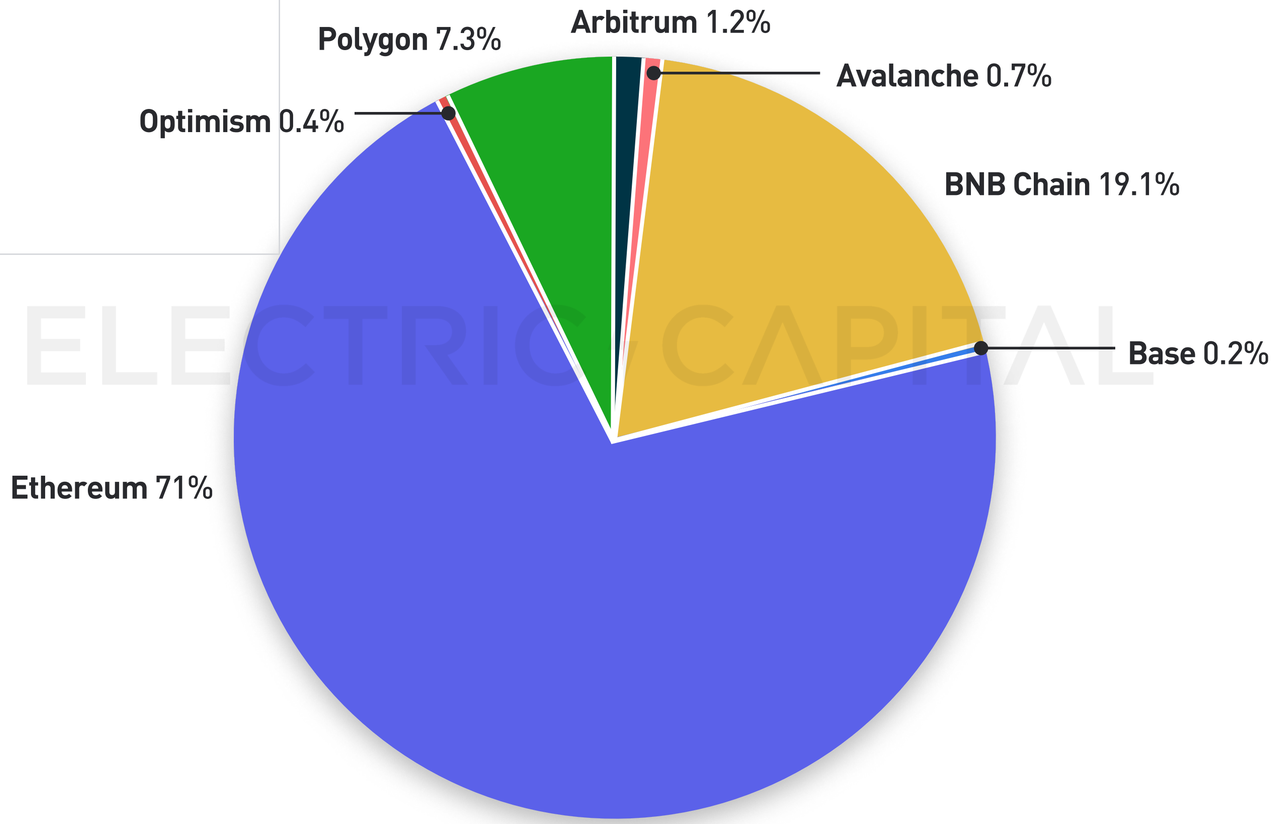
Then, we create a **unique identifier ("fingerprint")** for each logic block using a cryptographic function.

03

Since each logic block is **uniquely identifiable**, we can tell which contract first introduced the logic to the blockchain, and which contracts reuse the logic in the future.

71% of contract code is initially deployed on Ethereum

Distribution of source chains used for initial deployments (2023)

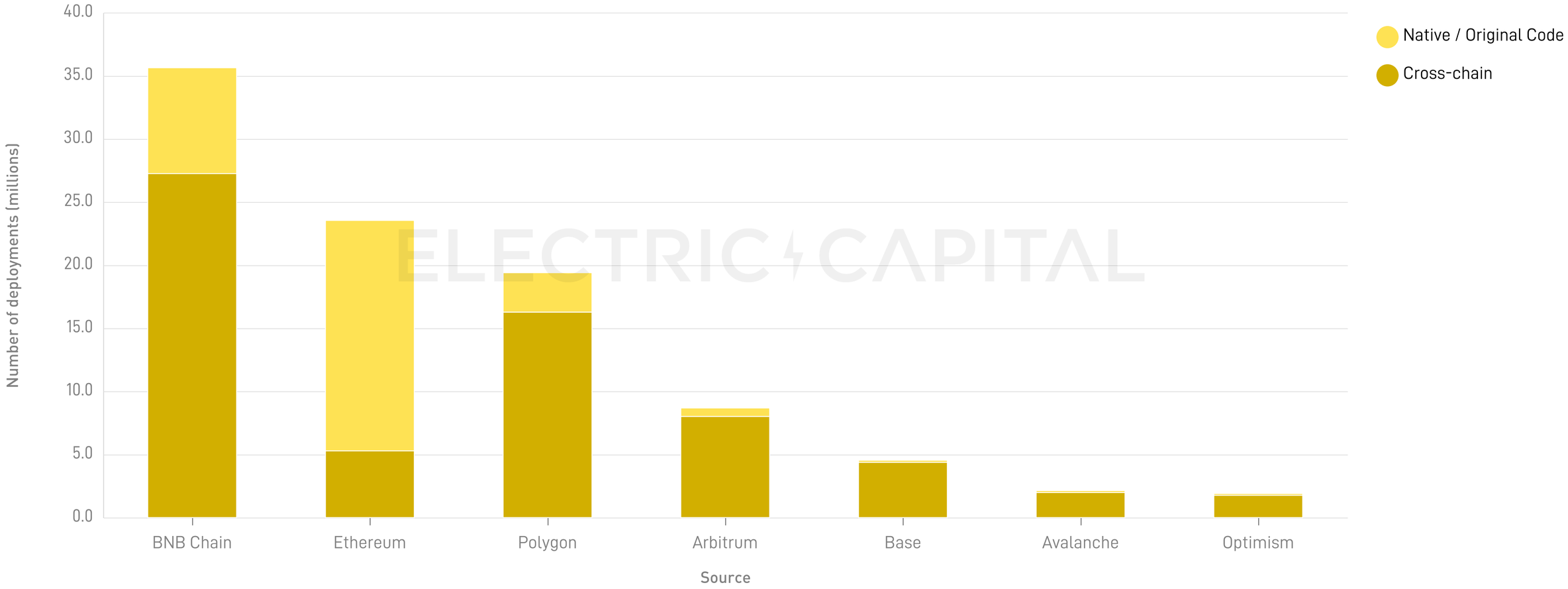


ELECTRIC CAPITAL

Ethereum's code is mostly unique and homegrown

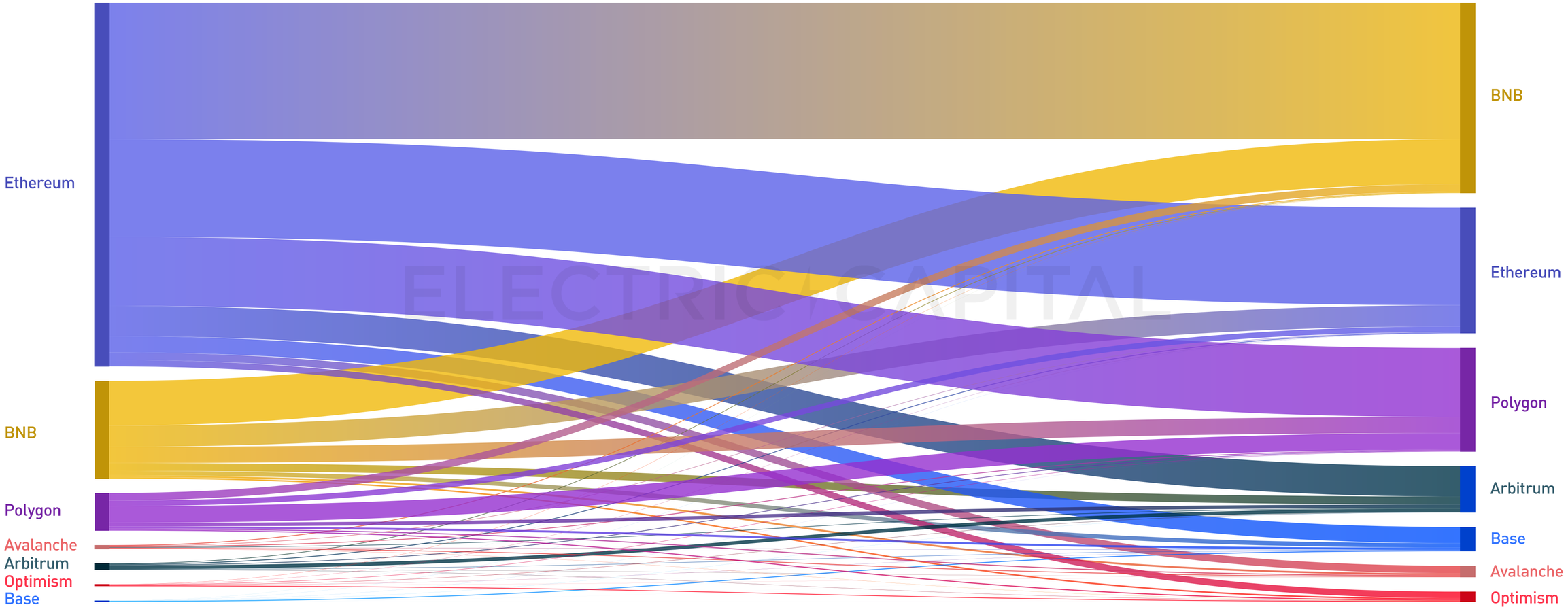
Deployments on other EVM chains often can trace their origins to another chain

Number of Control Flow Graph (CFG) deployments with different node sources: Native vs. Cross-chain



We can trace where every block of new logic is first deployed and where it is deployed next, showing from where code is pulled

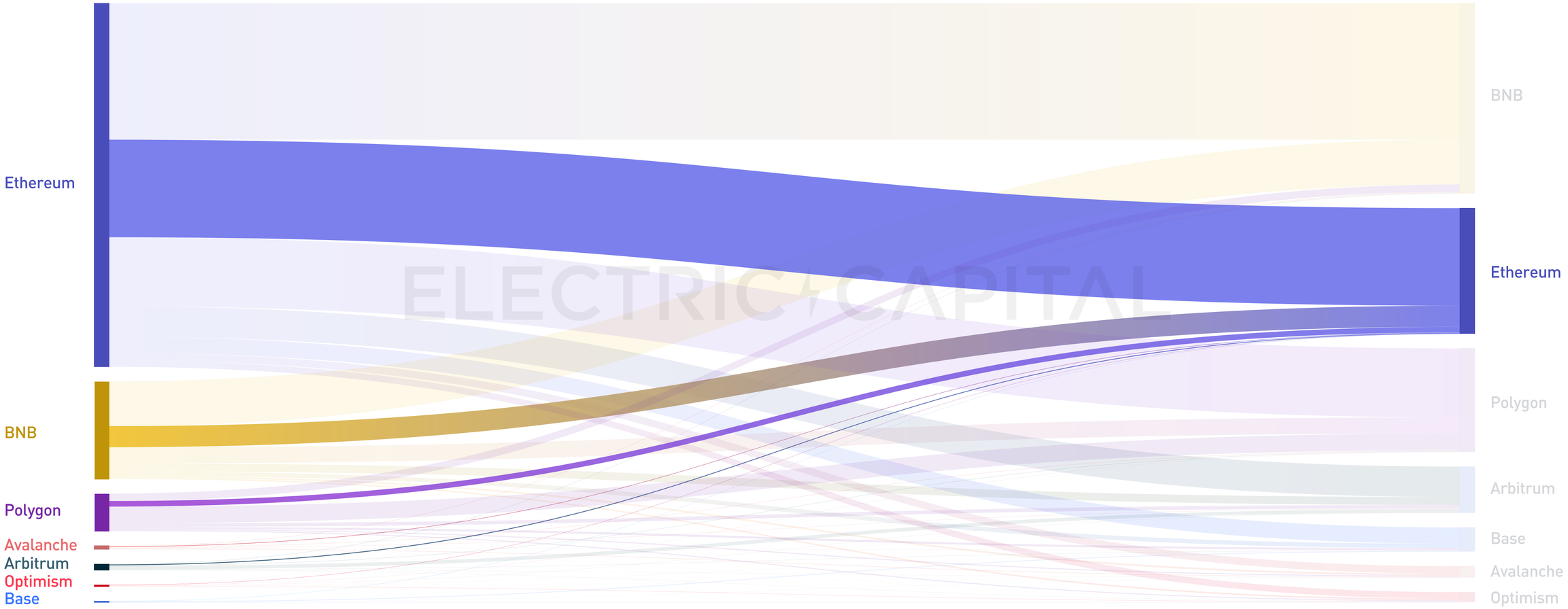
Bytecode CFG node source (2023)



Most of Ethereum's contract logic is only found on Ethereum

Approximately 20% of the logic that appears on Ethereum came from BNB and Polygon

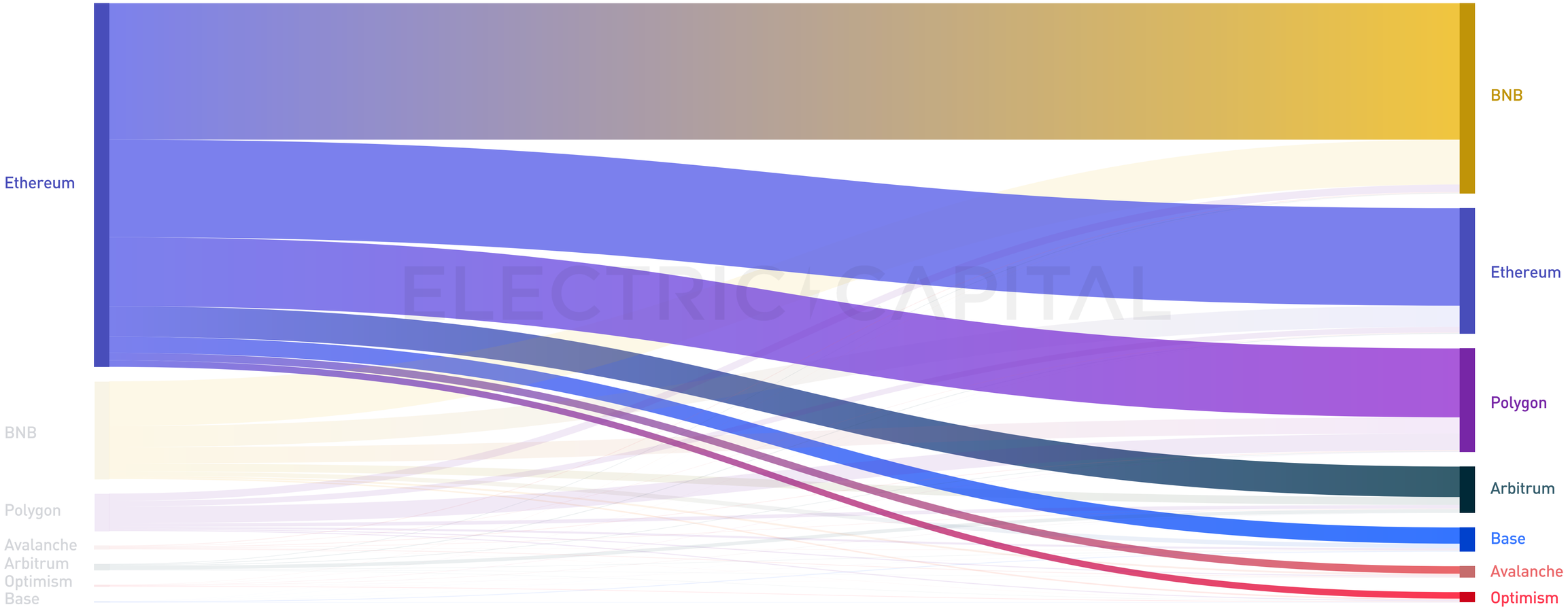
Bytecode CFG node source (2023)



Ethereum is the biggest exporter of new on-chain logic

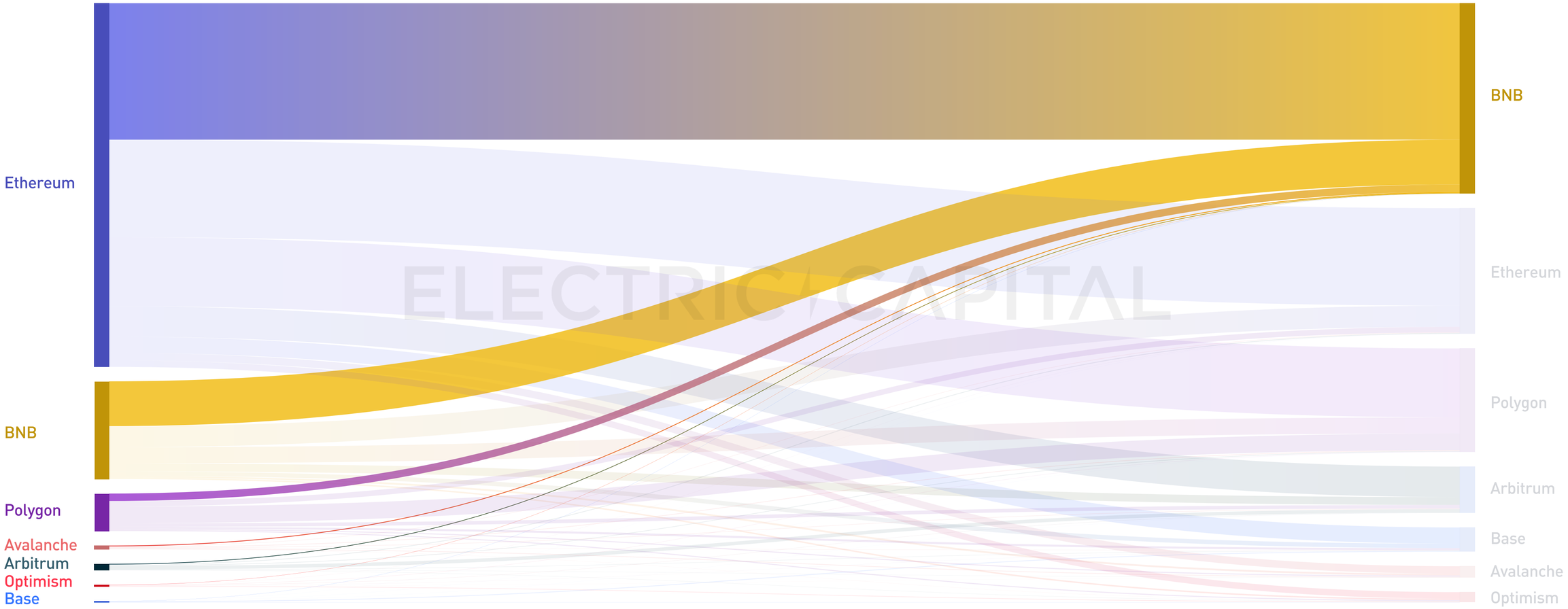
New contract logic is deployed on Ethereum and then on other chains like BNB, Polygon, and Arbitrum

Bytecode CFG node source (2023)



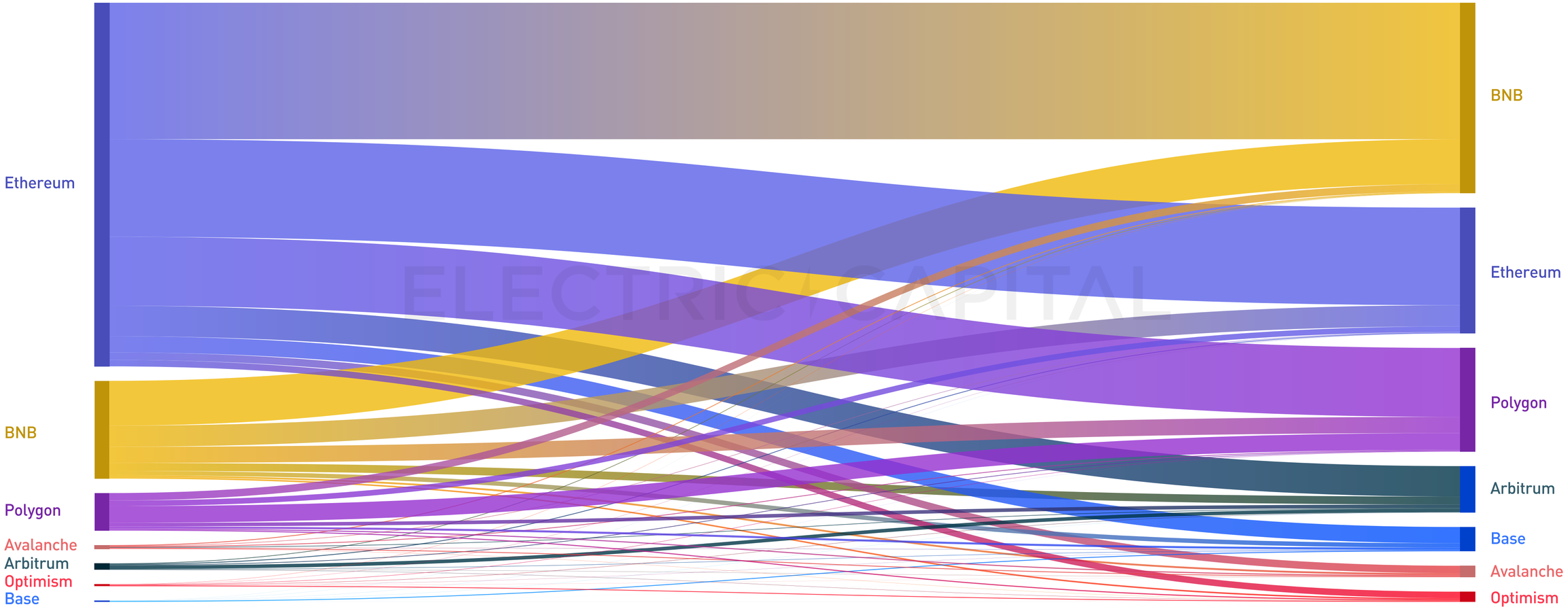
BNB has the most contract logic, but much of it comes from code first written on Ethereum

Bytecode CFG node source (2023)



Most contract logic in L2s originated from Ethereum

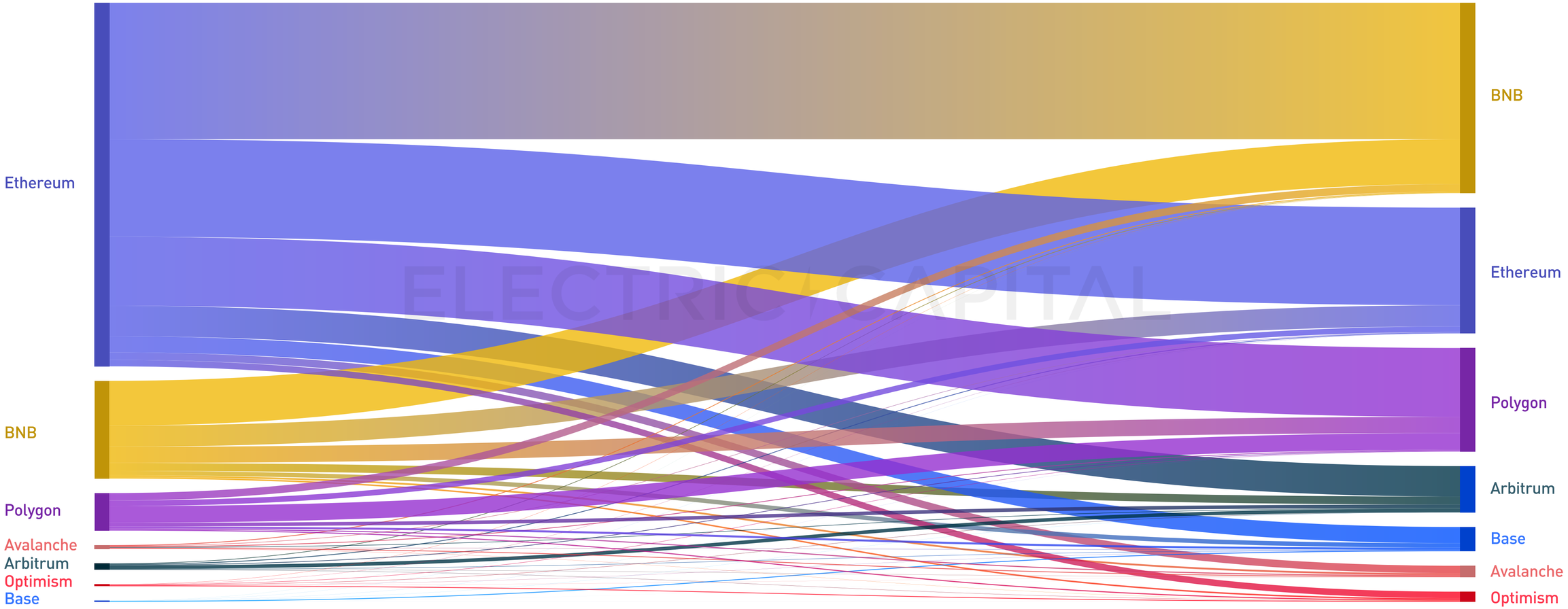
Bytecode CFG node source (2023)



BNB & Polygon are the next largest creators + exporters of logic

New logic that appears on BNB & Polygon can make its way onto Ethereum, BNB, Polygon, and Ethereum L2s

Bytecode CFG node source (2023)



Where else are developers working?

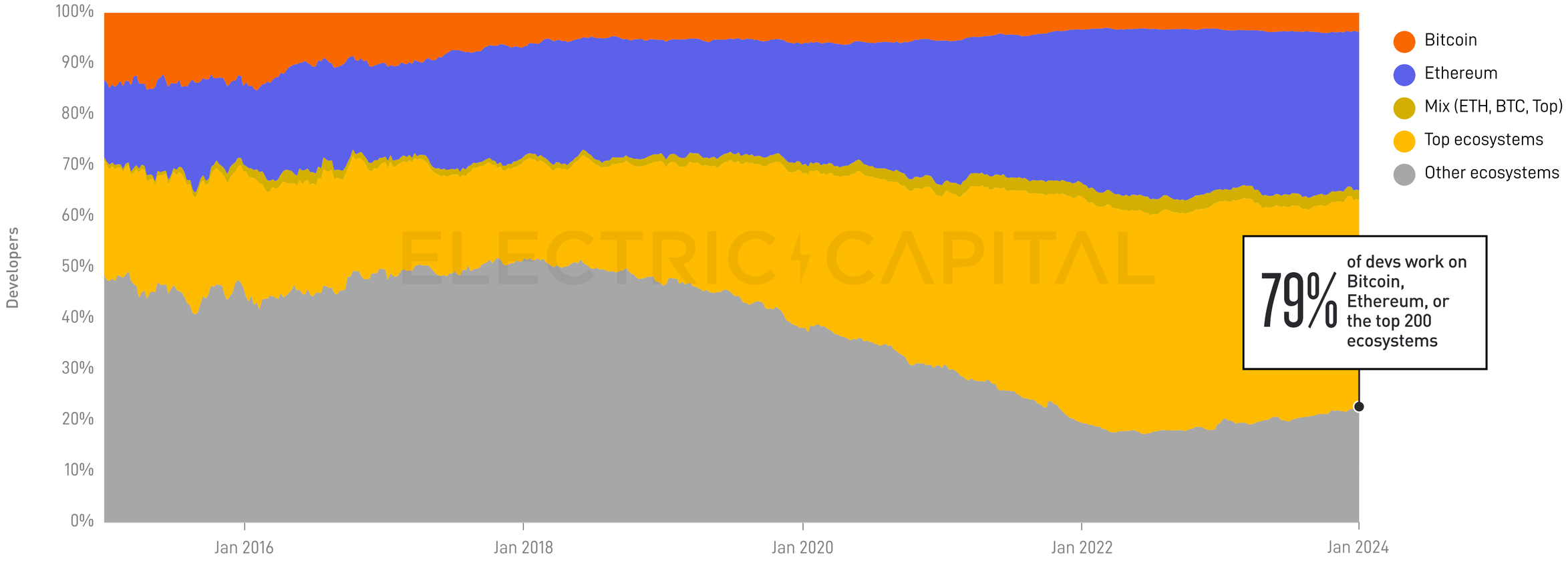
Let’s deep dive into individual crypto ecosystems...

02

Ecosystem Deepdive

Today, 79% of crypto developers work on Bitcoin, Ethereum, or the top 200 crypto ecosystems by network value[1]

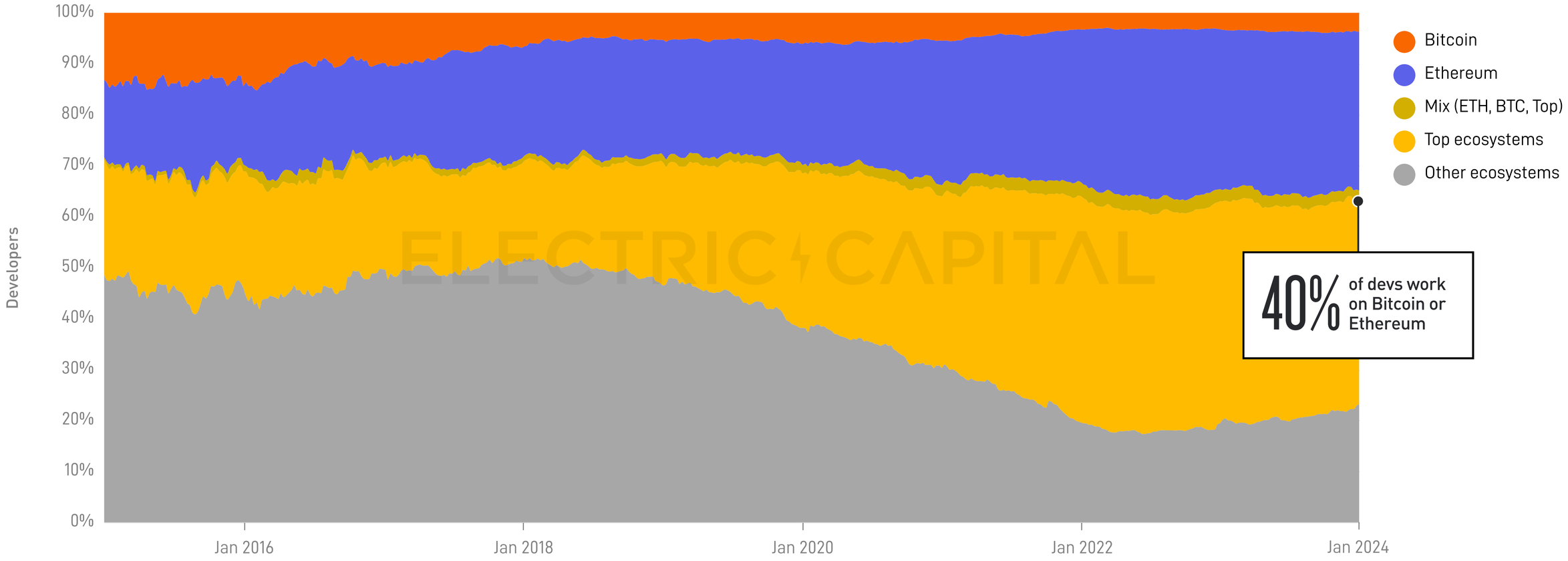
Monthly active developers in Bitcoin, Ethereum, top ecosystems (excl. Bitcoin and Ethereum)[1], and other ecosystems



1 - Top Ecosystems include the top 200 ecosystems by network value or private valuation and top decentralized projects with 50+ monthly active developers at the end of 2023, excluding Bitcoin and Ethereum.

Bitcoin and Ethereum account for 40% of all crypto developers; this number has remained consistent since 2015

Monthly active developers in Bitcoin, Ethereum, top ecosystems (excl. Bitcoin and Ethereum)[1], and other ecosystems



1 - Top Ecosystems include the top 200 ecosystems by network value or private valuation and top decentralized projects with 50+ monthly active developers at the end of 2023, excluding Bitcoin and Ethereum.

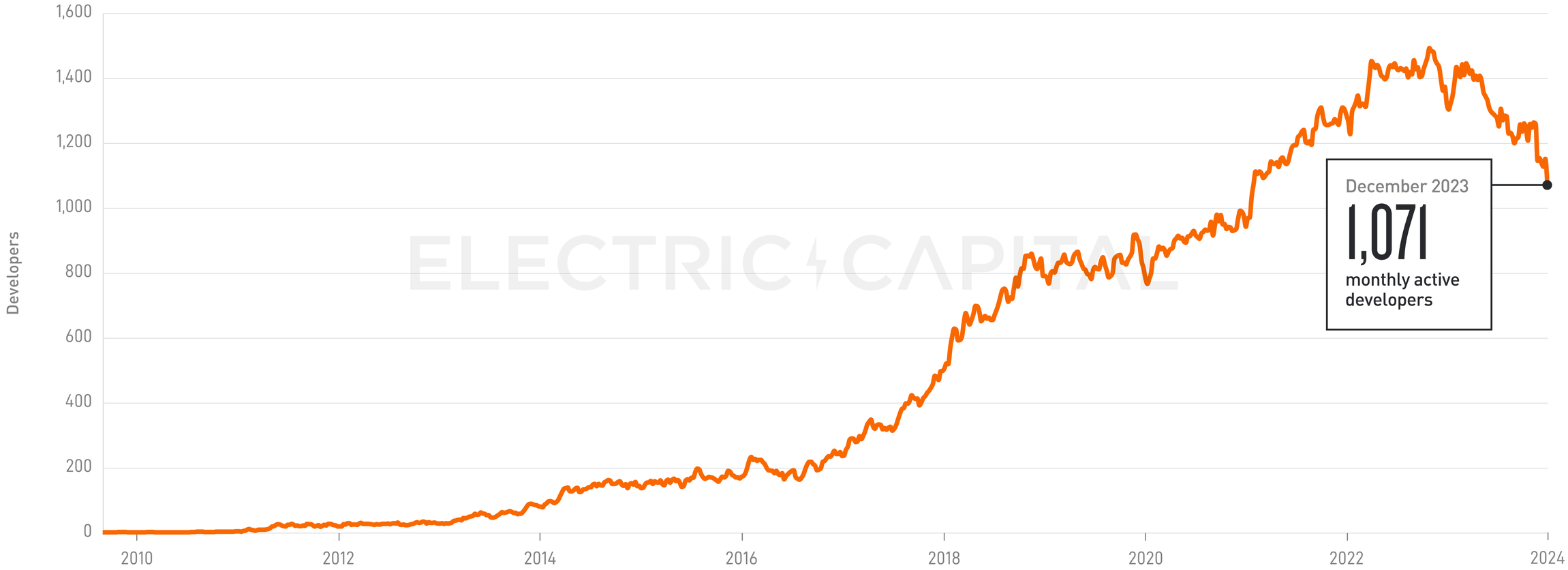
What are devs in Bitcoin and Ethereum doing?

02
Ecosystem Deepdive

Bitcoin

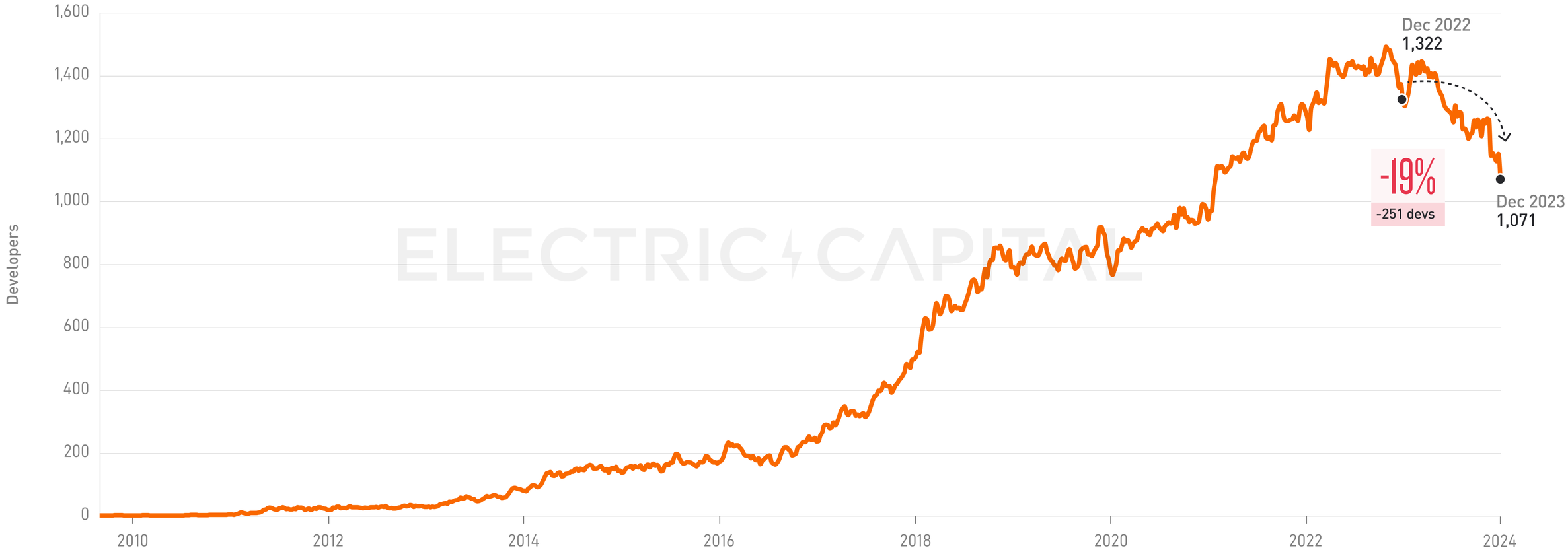
1,071 monthly active developers support Bitcoin

Bitcoin monthly active developers



In 2023, monthly active developers fell by -19%

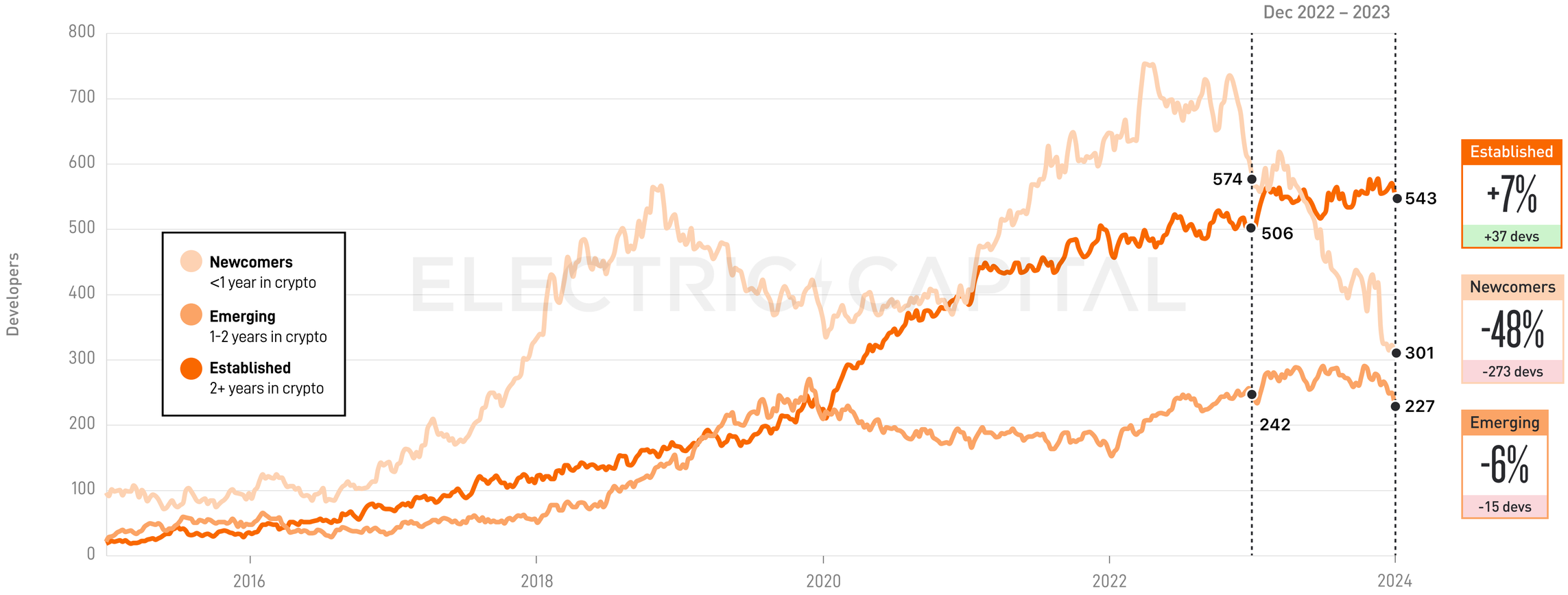
Bitcoin monthly active developers



Established devs grew steadily: 80% more Established than Newcomers

Established devs grew steadily +7%, Newcomers fell -48%, and Emerging devs fell -6%

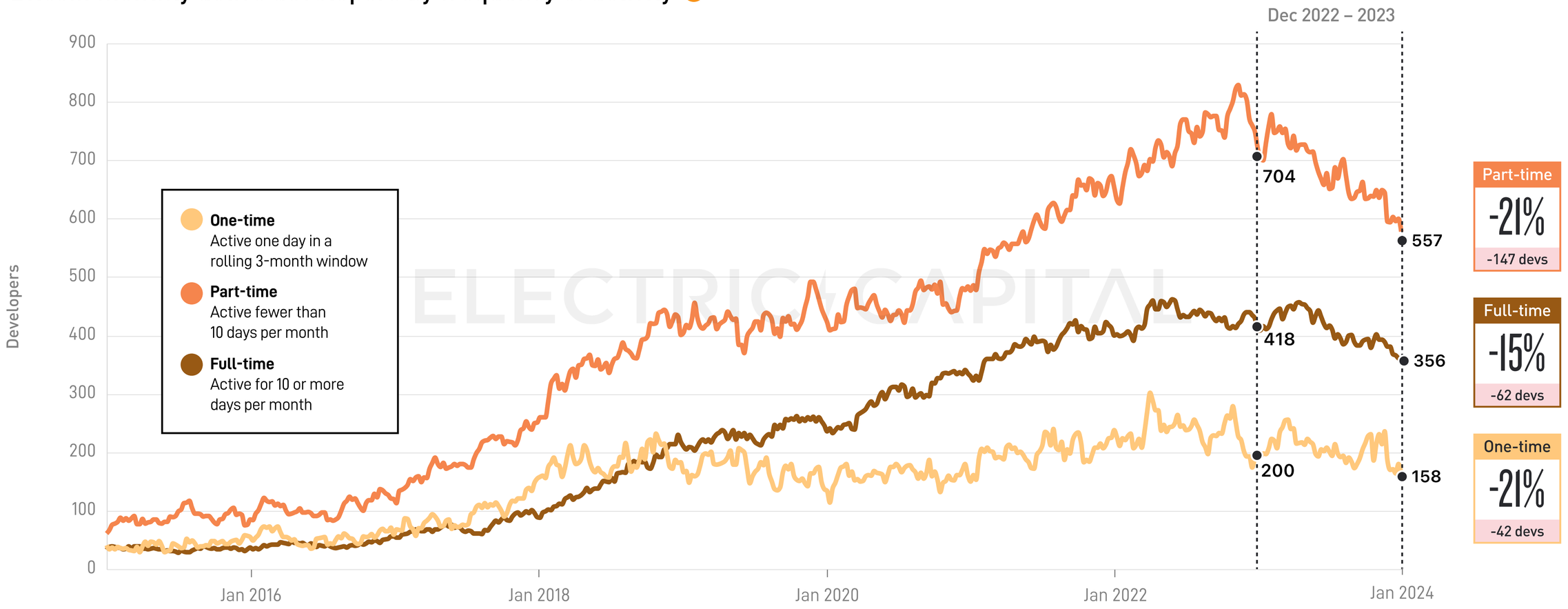
Bitcoin monthly active developers by tenure



59% of the developers who left were Part-time

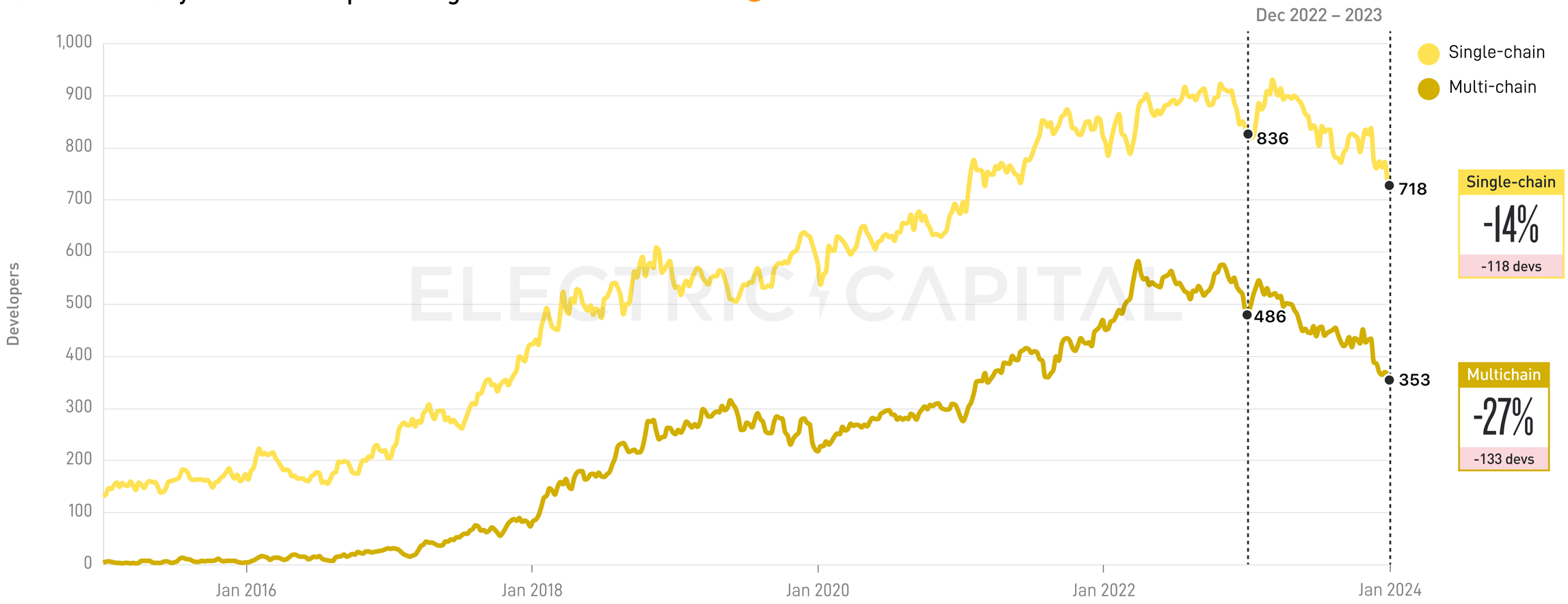
Part-time devs fell by -147 devs, Full-time devs fell by -62 devs, and One-time devs fell by -42 devs

Bitcoin monthly active developers by frequency of activity



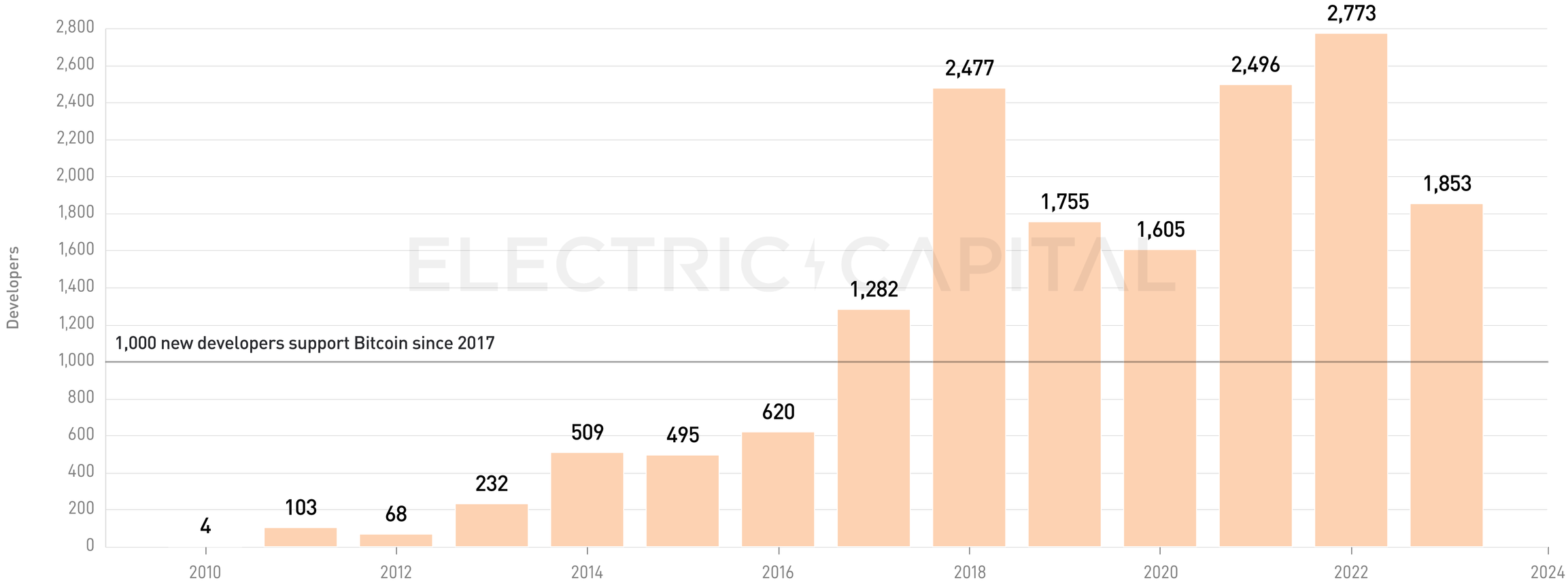
Devs who build only for Bitcoin are more likely to stick vs devs building for multiple chains (-14% vs. -27%)

Bitcoin monthly active developers: single-chain vs. multi-chain



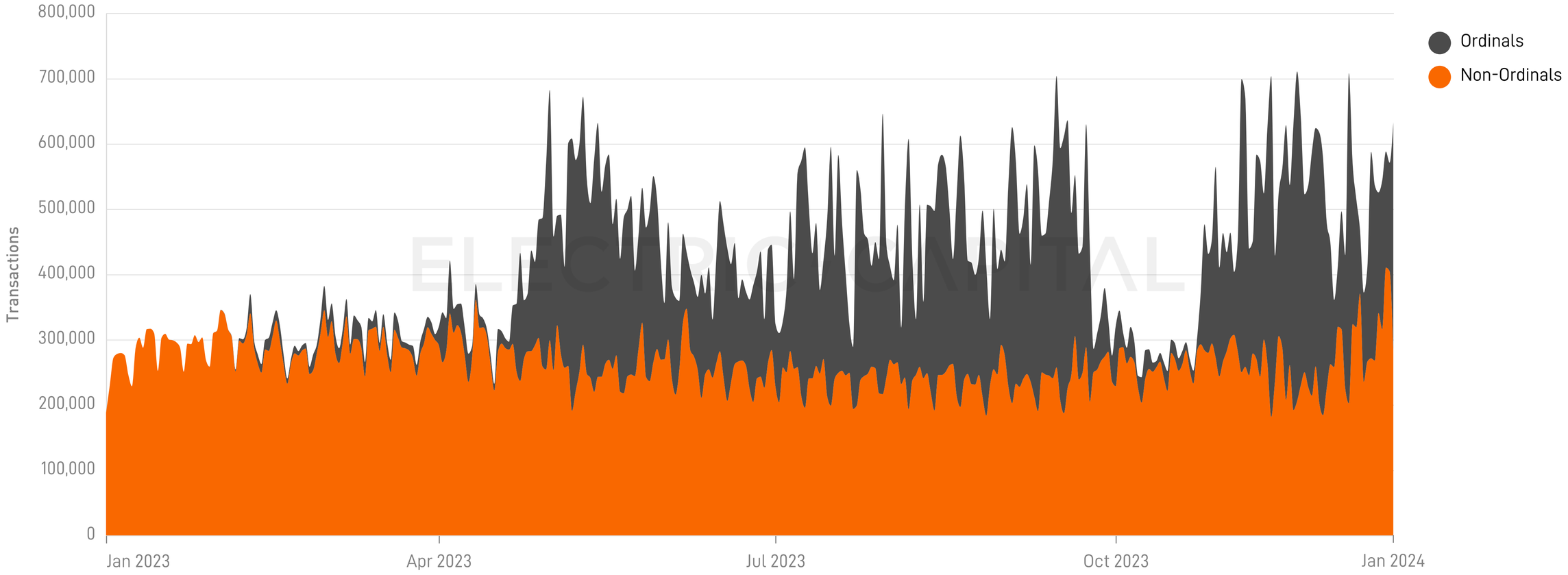
Developers join Bitcoin across market conditions: Over 1000 new developers have joined Bitcoin every year since 2017

Bitcoin new developers



Bitcoin transaction volumes spiked in 2023 because of Ordinals, prompting fresh conversations around scaling Bitcoin

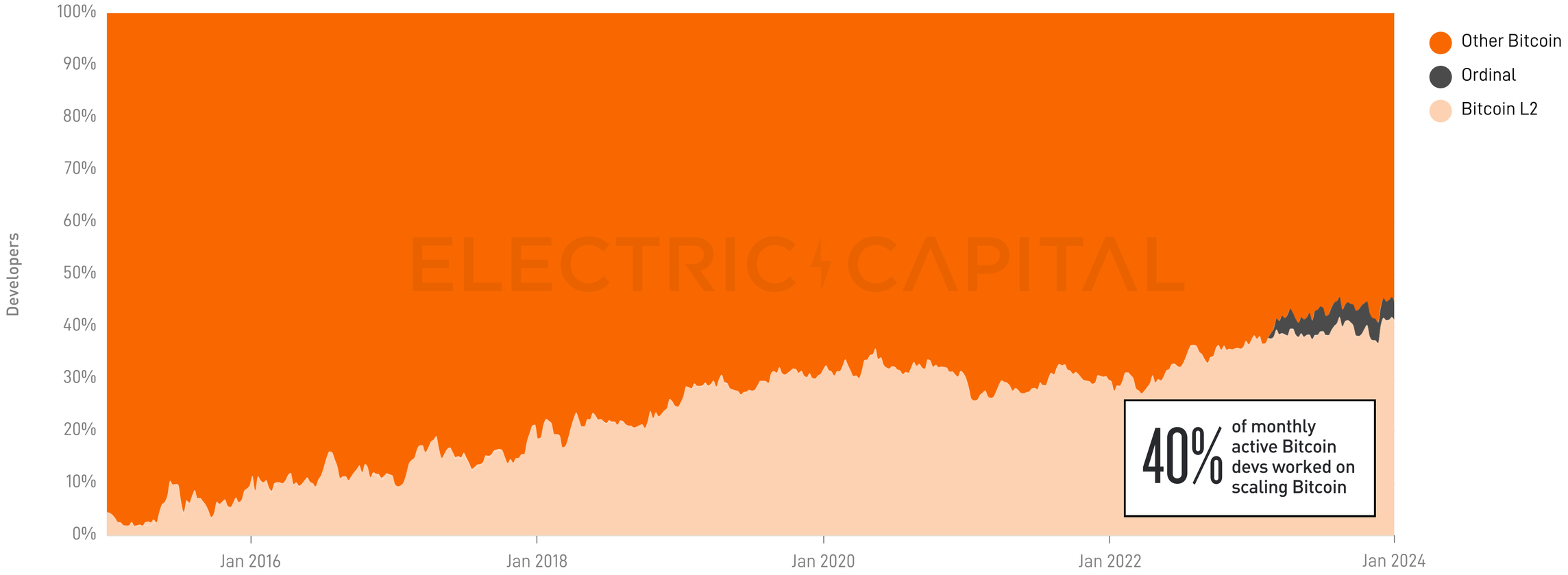
Bitcoin transaction volume: Ordinals vs. Non-Ordinals



Ordinal tx activity includes mints, transfers, and trades.

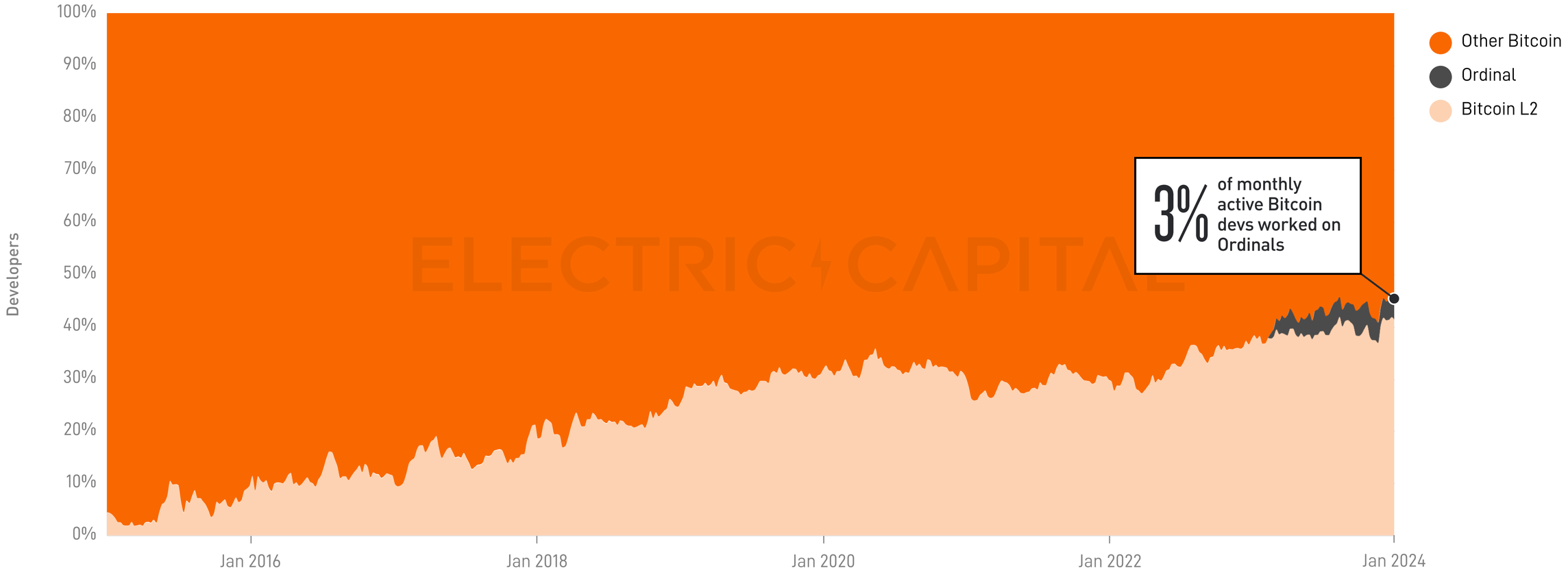
40% of all Bitcoin open-source developers were focused on Bitcoin L2s and scaling solutions in 2023

Distribution of Bitcoin developers working on different types of projects



While the share of open-source developers working on Ordinals is only 3%, the community was consistently active in 2023

Distribution of Bitcoin developers working on different types of projects



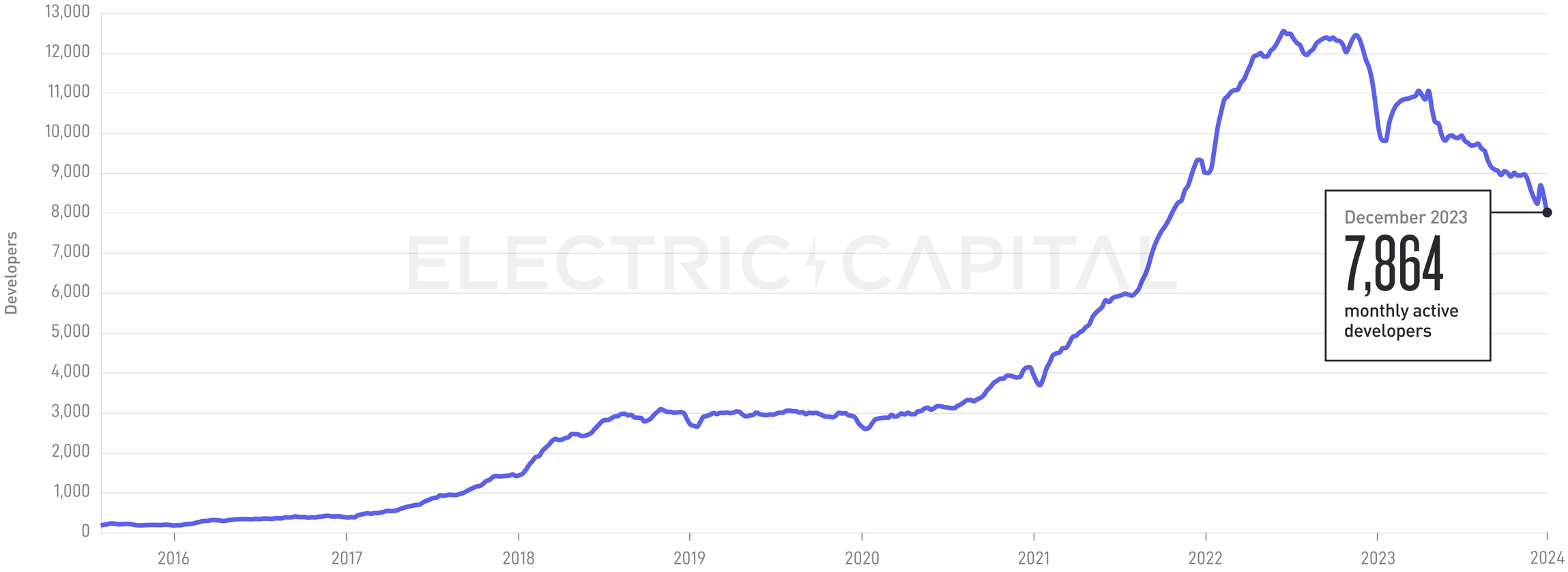
02

Ecosystem Deepdive

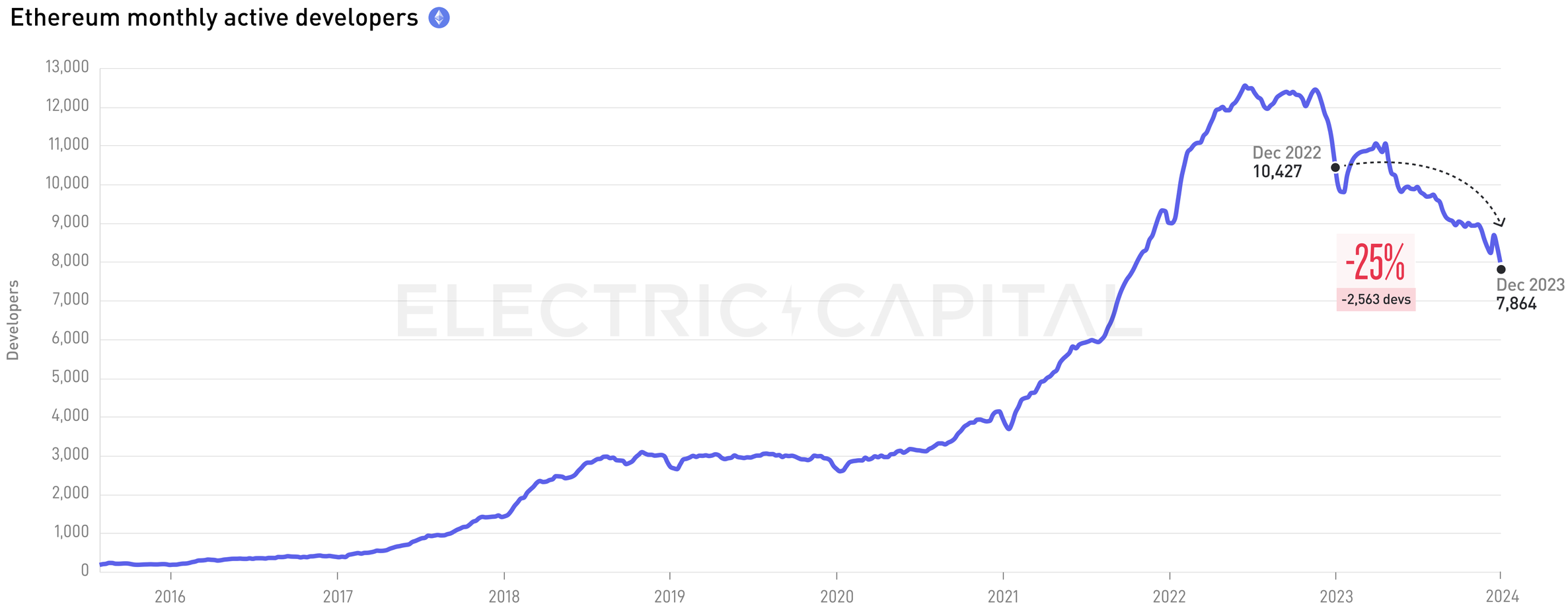
Ethereum

7,864 monthly active developers supported Ethereum

Ethereum monthly active developers

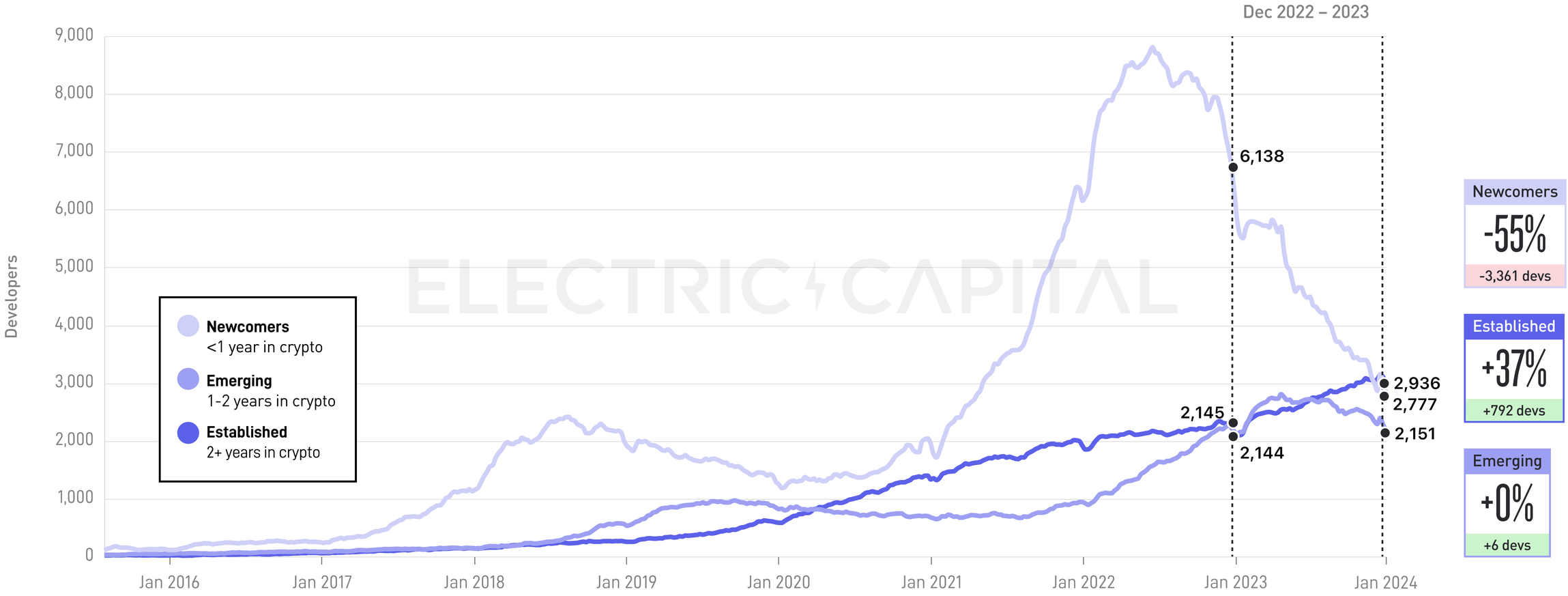


In 2023, monthly active developers fell by -25%



Most of the developers who left were Newcomers (-55%), while Established grew (+37%) and Emerging devs stayed flat

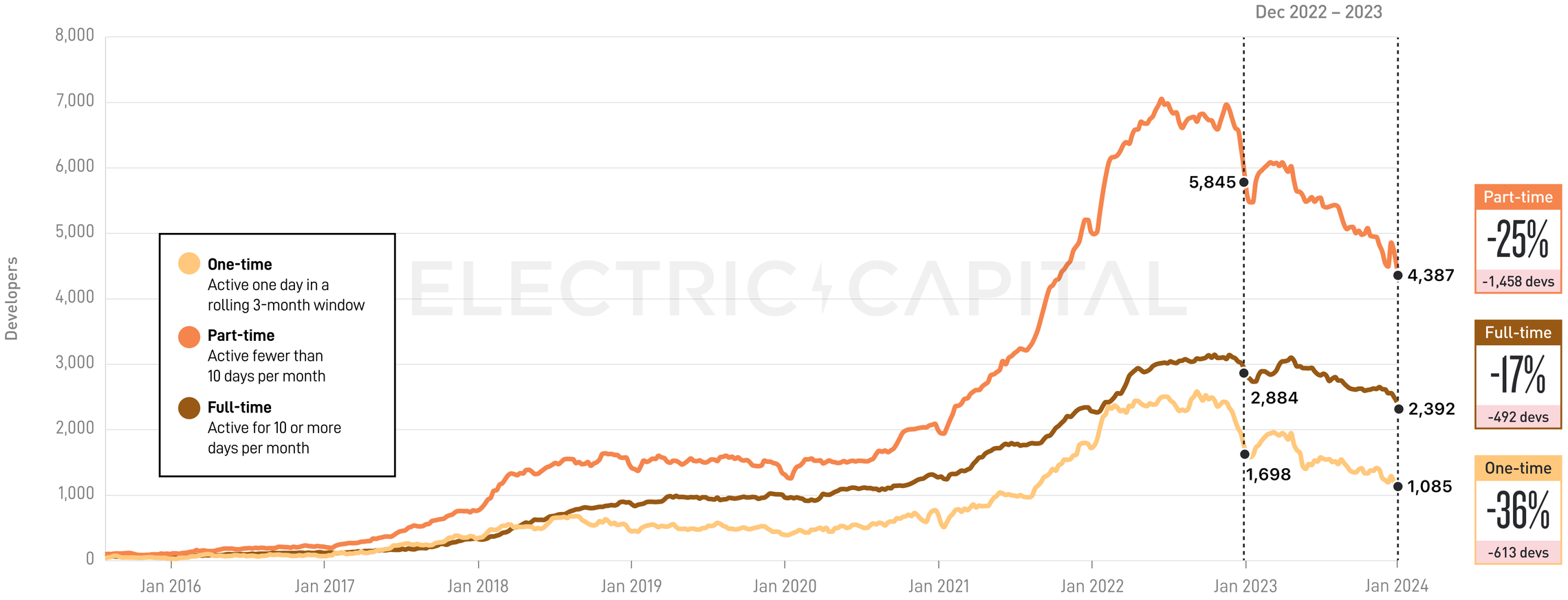
Ethereum monthly active developers by tenure



57% of the developers who left were Part-time

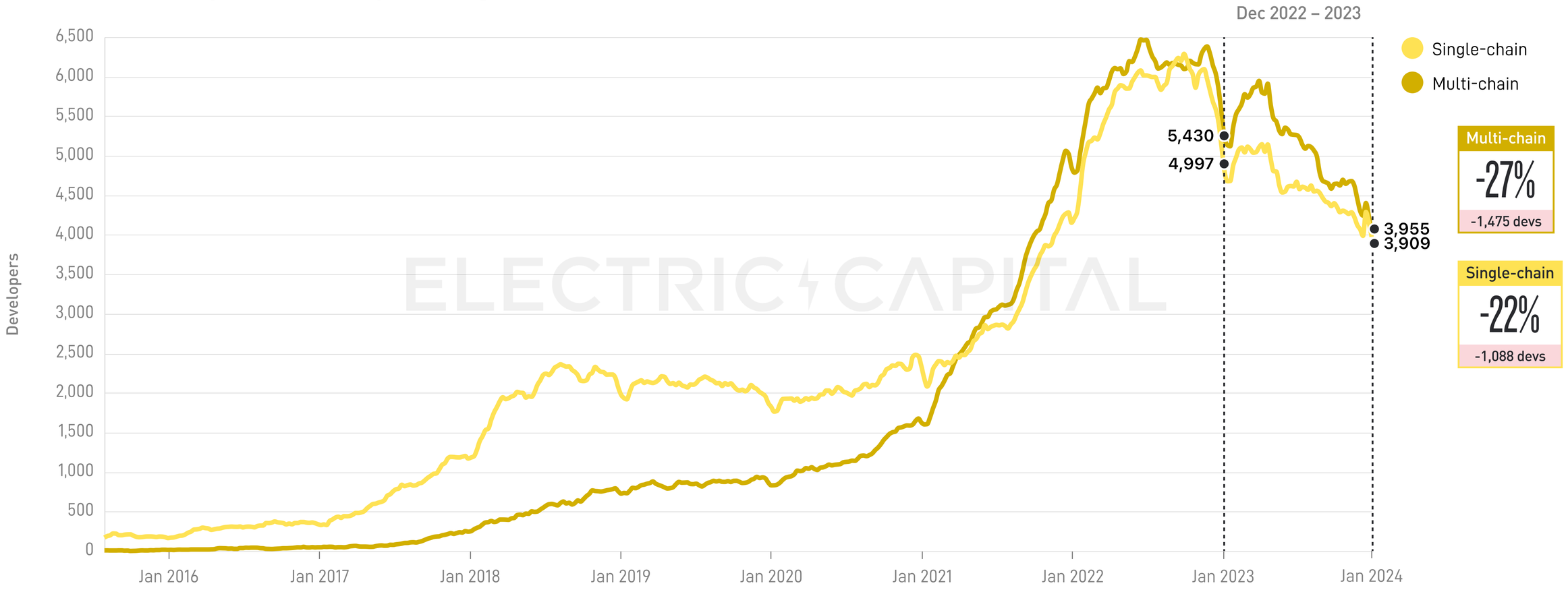
Part-time devs fell by -1,458 devs, Full-time devs fell by -492 devs, and One-time devs fell by -613 devs

Ethereum monthly active developers by frequency of activity



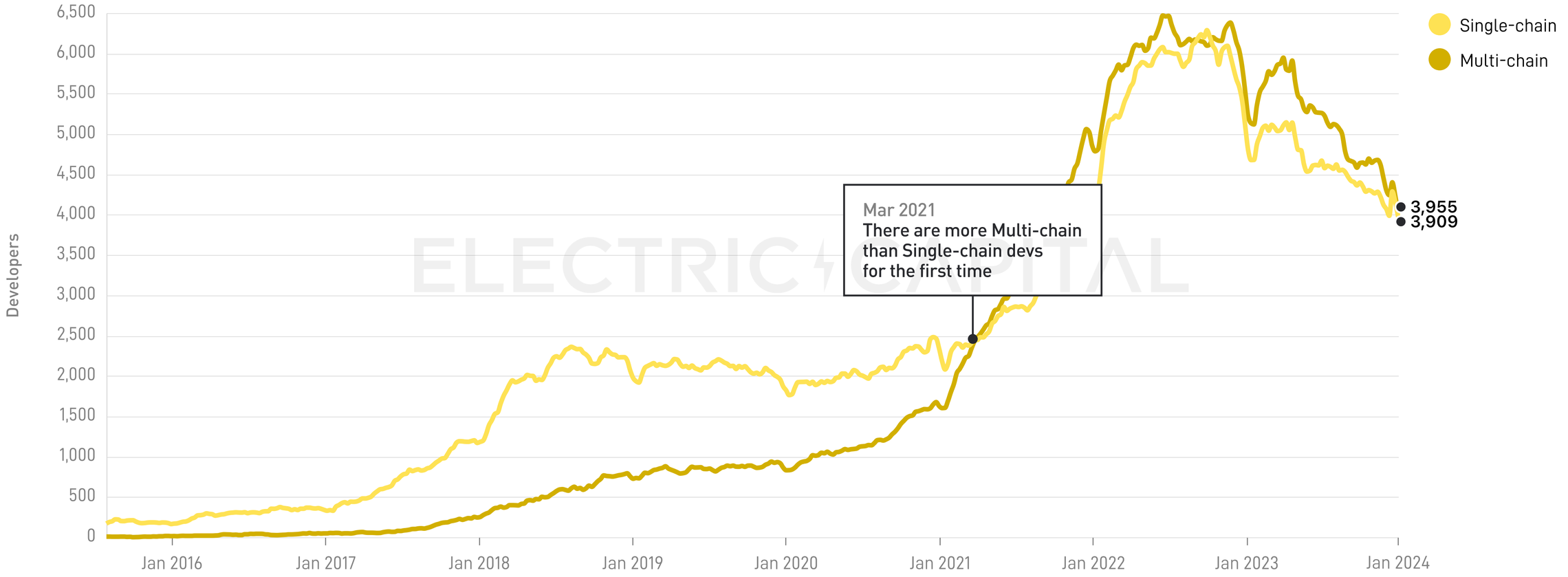
Losses were spread evenly across Multi-chain (-27%) and Single-chain (-22%) developers

Ethereum monthly active developers: Single-chain vs. Multi-chain

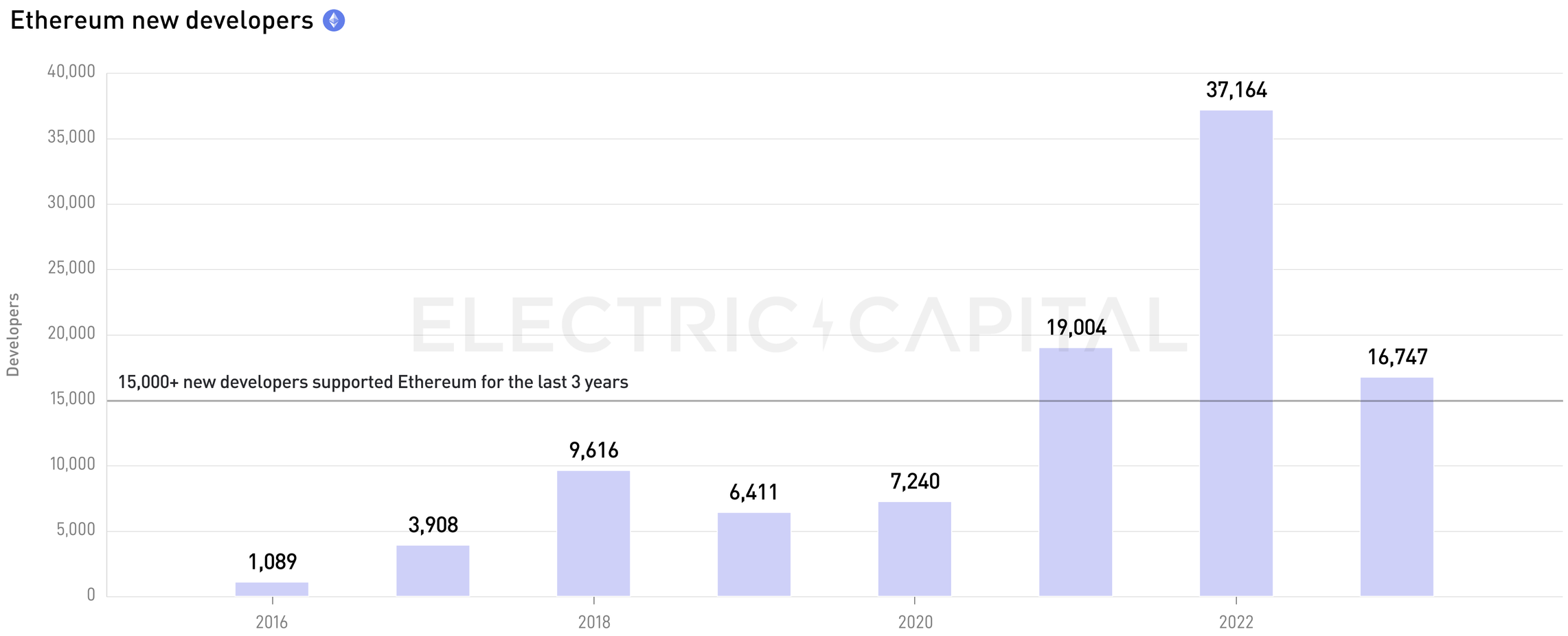


Ethereum became more Multi-chain for the first time in 2021

Ethereum monthly active developers: Single-chain vs. Multi-chain

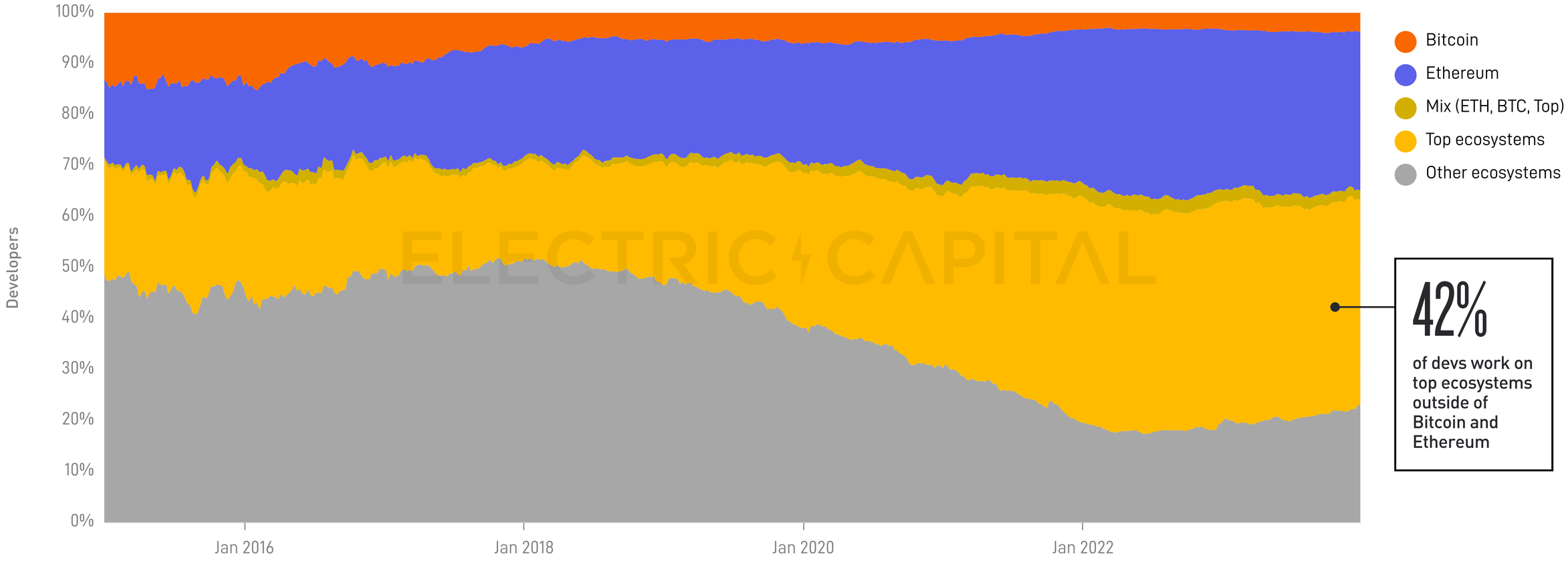


15,000+ new devs supported Ethereum in ‘21, ‘22, & ‘23



42% of crypto developers work on top ecosystems outside of Bitcoin and Ethereum

Monthly active developers in Bitcoin, Ethereum, top ecosystems (excl. Bitcoin and Ethereum)[1], and other ecosystems



1 - Top Ecosystems include the top 200 ecosystems by network value or private valuation and top decentralized projects with over 50+ monthly active developers at the end of 2023, excluding Bitcoin and Ethereum.

02

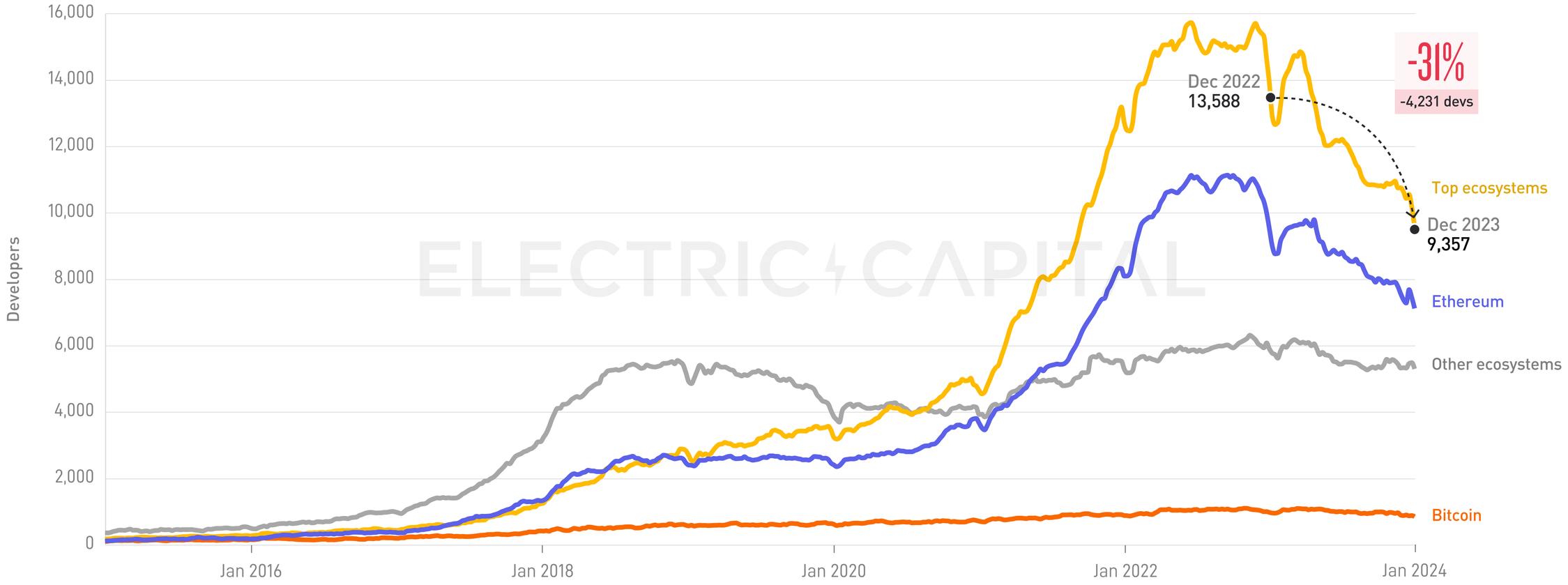
Ecosystem Deepdive

How are these top 200 ecosystems doing?

Top 200 crypto ecosystems

9,357 monthly active developers work on top 200 ecosystems outside of Bitcoin and Ethereum, down -31% year-over-year

Monthly active developers in top ecosystems (excluding Bitcoin & Ethereum)[1] vs. other ecosystems



1 - Top Ecosystems include the top 200 ecosystems by network value or private valuation and top decentralized projects with over 50+ monthly active developers at the end of 2023, excluding Bitcoin and Ethereum.

Which ecosystems grew despite the overall developer growth headwinds?

Q4 2023 vs. Q4 2022

Fastest growing ecosystems by overall developers

Q4 2023 vs. Q4 2022

By overall monthly developers (150+ devs)

	Ecosystem	Overall
1	Scroll	453%
2	Aztec Protocol	221%
3	Celestia	180%
4	Aleo	167%
5	TON	37%
6	Internet Computer	37%
7	Metis Token	33%
8	zkSync	32%
9	Status	31%
10	Starknet	30%

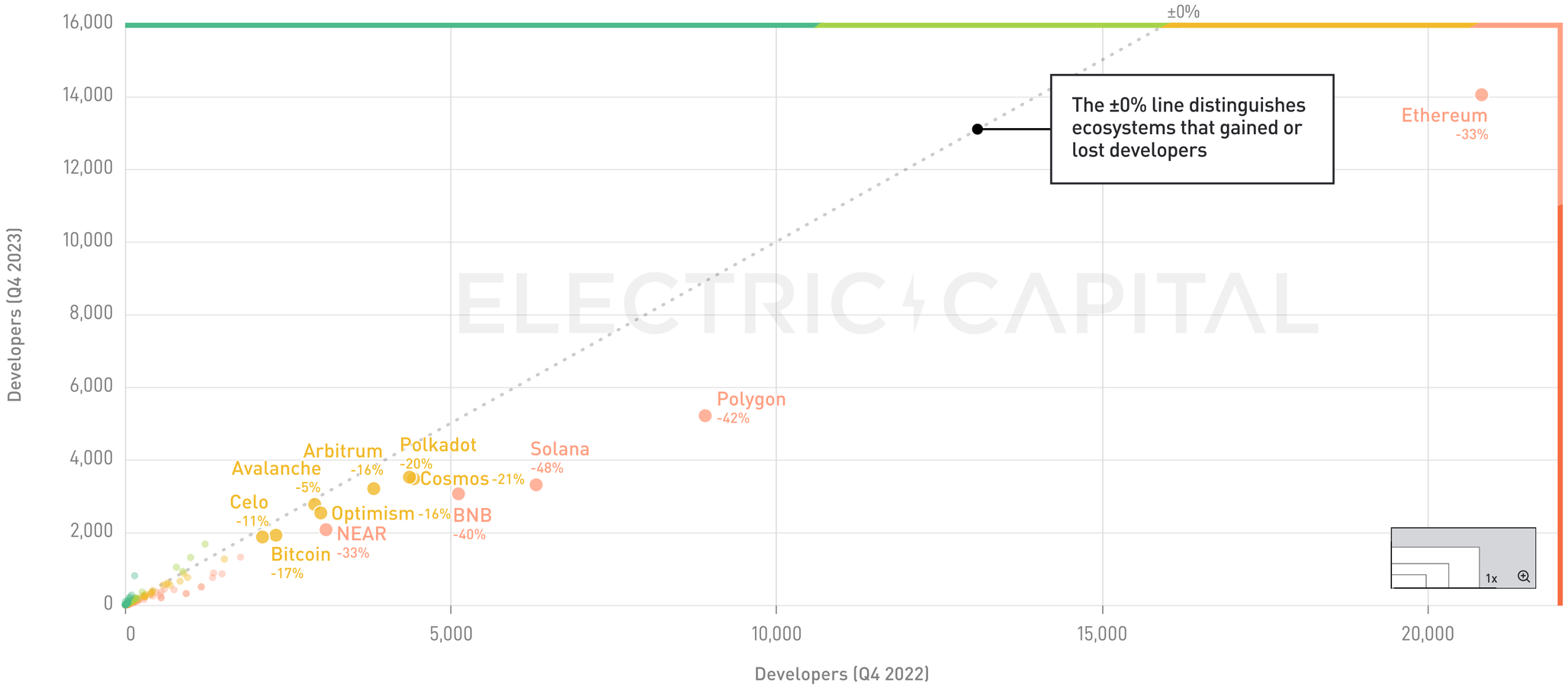
ELECTRIC CAPITAL

Let's start by looking at overall developers in each ecosystem.

Overall developers
Q4 2023 vs. Q4 2022

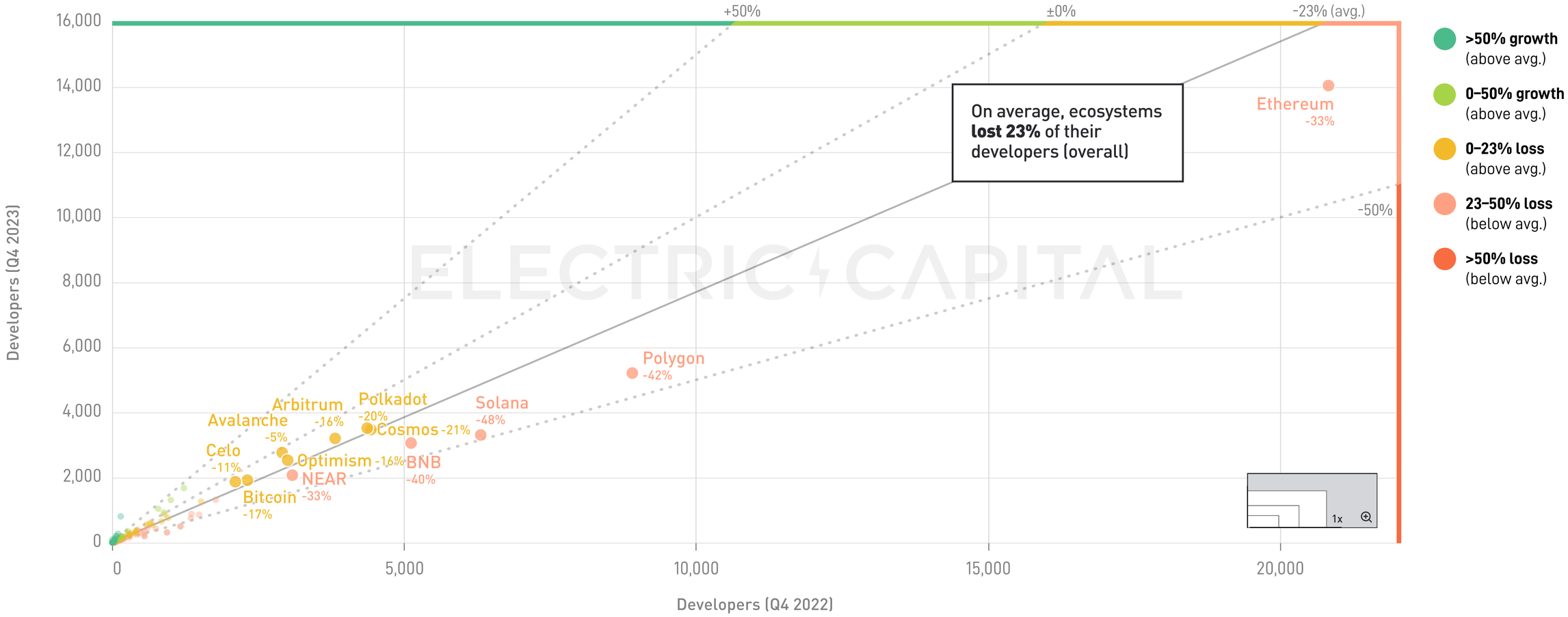
We can compare the numbers of developers in Q4 2022 and Q4 2023 to visualize the year-over-year growth for each ecosystem

Overall developer growth (~2000+ developers): Q4 2023 vs. Q4 2022



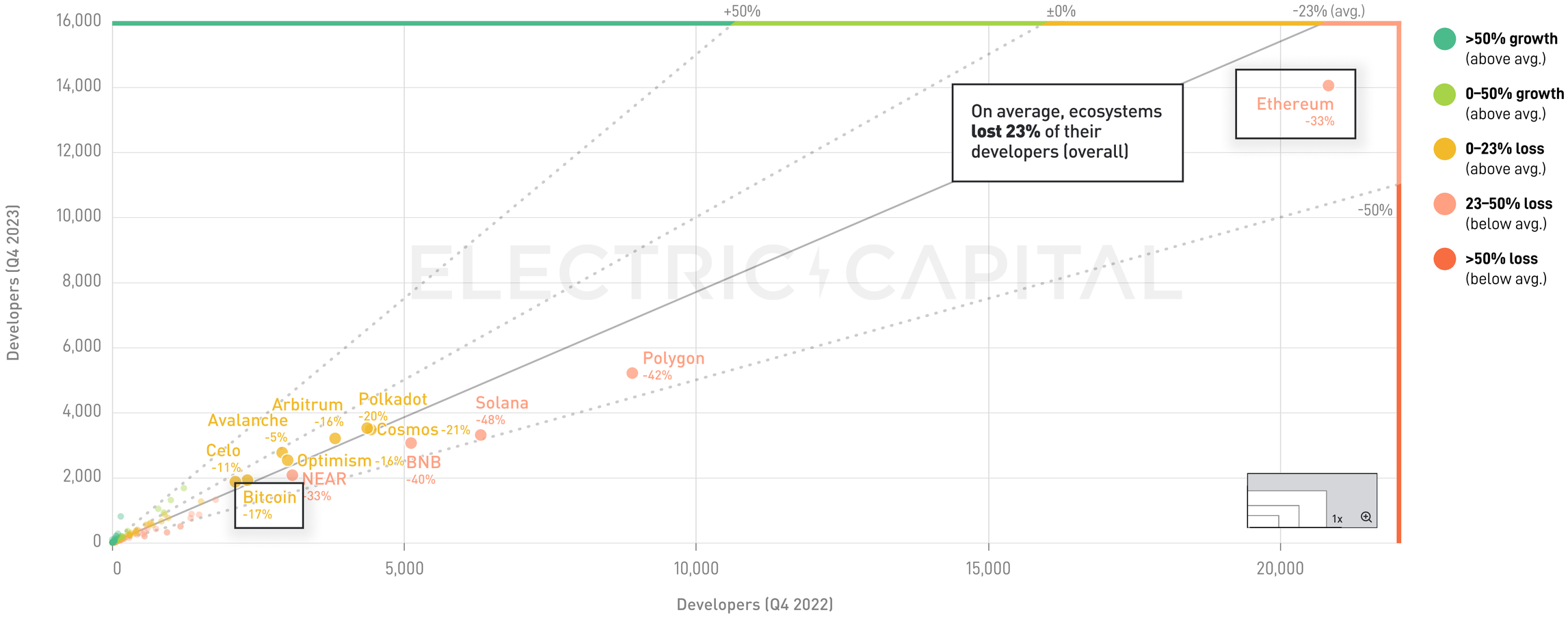
On average, top ecosystems lost 23% of their overall developers
We use this -23% as a benchmark to understand ecosystems

Overall developer growth (~2000+ developers): Q4 2023 vs. Q4 2022



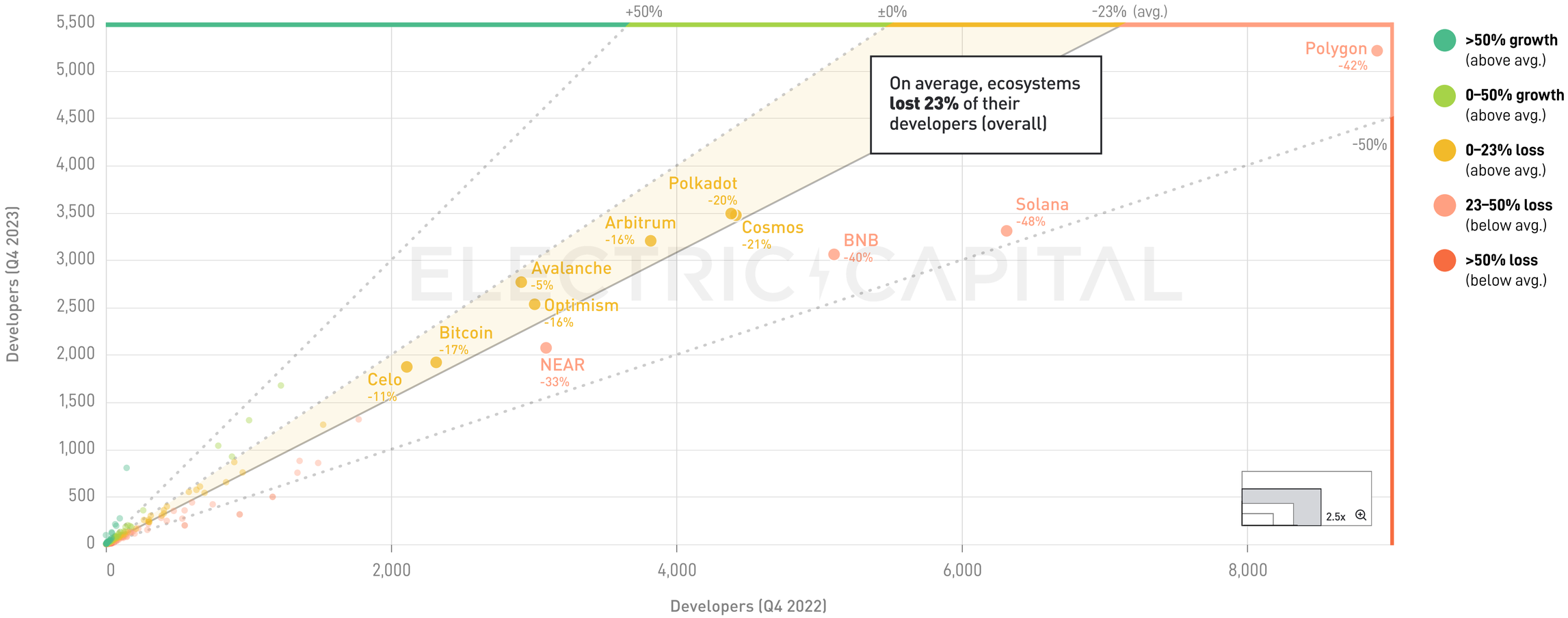
Bitcoin had -17% fewer overall developers in Q4 2023 (above the -23% benchmark); Ethereum had -33% fewer developers (below benchmark)

Overall developer growth (~2000+ developers): Q4 2023 vs. Q4 2022



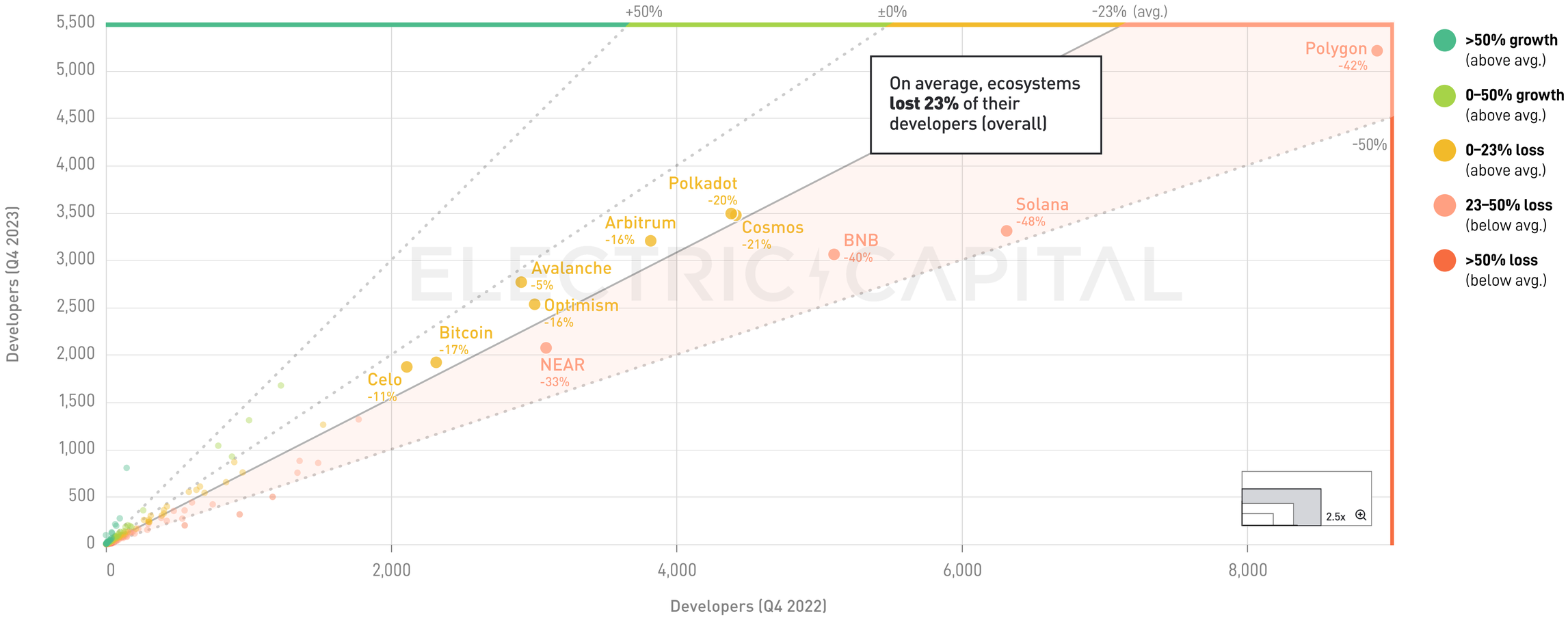
Ecosystems with up to 5.5k devs: Avalanche (-5%), Celo (-11%), Optimism (-16%), Arbitrum (-16%), Polkadot (-20%), & Cosmos (-21%) lost developers

Overall developer growth (~2000-5000 developers): Q4 2023 vs. Q4 2022



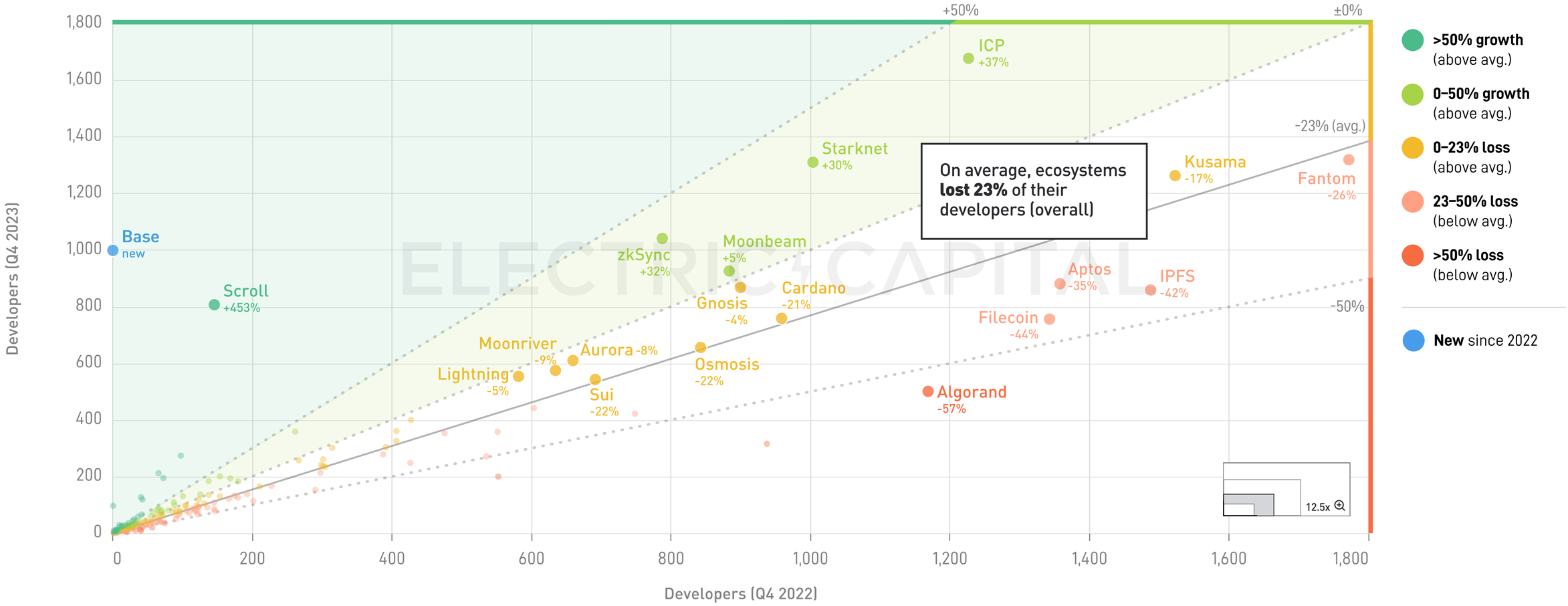
NEAR (-33%), BNB (-40%), Polygon (-42%), and Solana (-48%) performed below benchmark because of high growth in 2022

Overall developer growth (~2000-5000 developers): Q4 2023 vs. Q4 2022



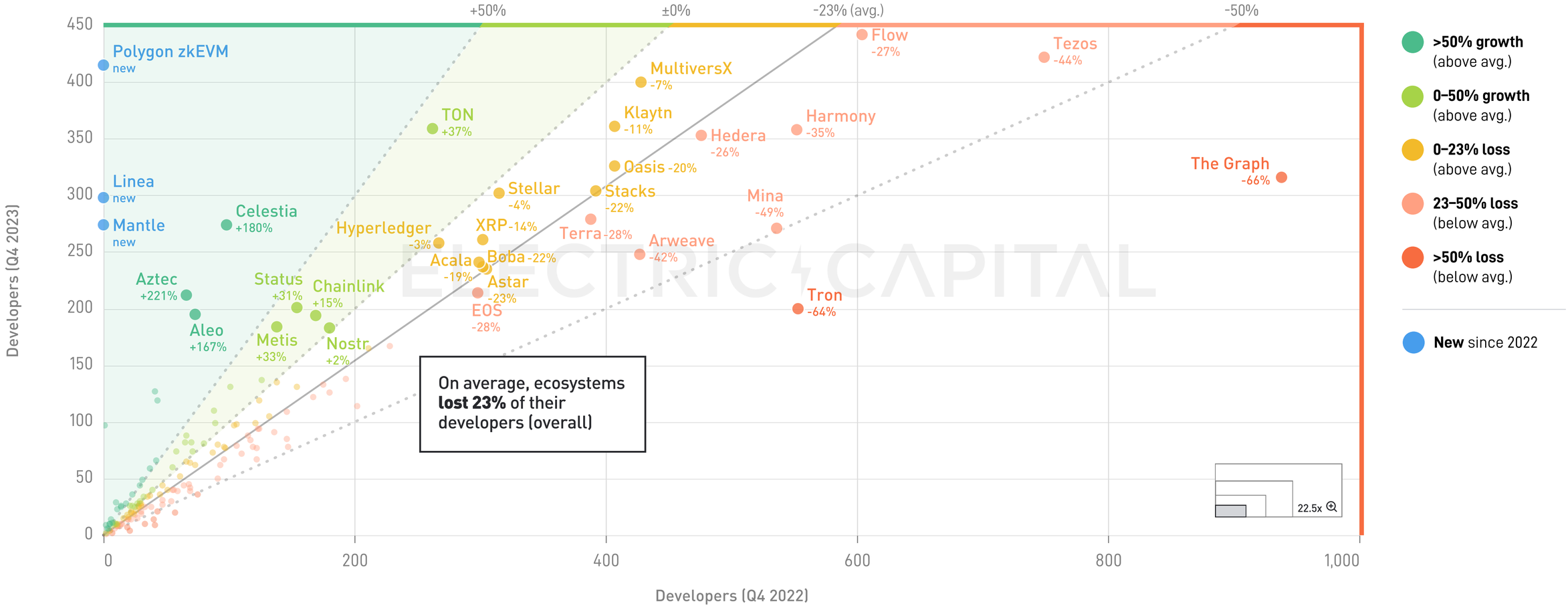
Zooming in, we see smaller ecosystems like Scroll (+453%), ICP (+37%), zkSync (+32%), Starknet (+30%), and Moonbeam (+5%) gained developers

Overall developer growth (~500-2000 developers): Q4 2023 vs. Q4 2022



Aztec (+221%), Celestia (+180%), Aleo (+167%), TON (+37%), Metis (+33%), Status (+31%), Chainlink (+15%), and NOSTR (+2%) also gained developers

Overall developer growth (~200-500 developers): Q4 2023 vs. Q4 2022



Overall Devs includes One-time and Multi-chain developers. Let's consider only Full-time and Single-chain developers, starting with Full-time developers.

Full-time developers
Q4 2023 vs. Q4 2022

Fastest growing ecosystems by Full-time developers

Q4 2023 vs. Q4 2022

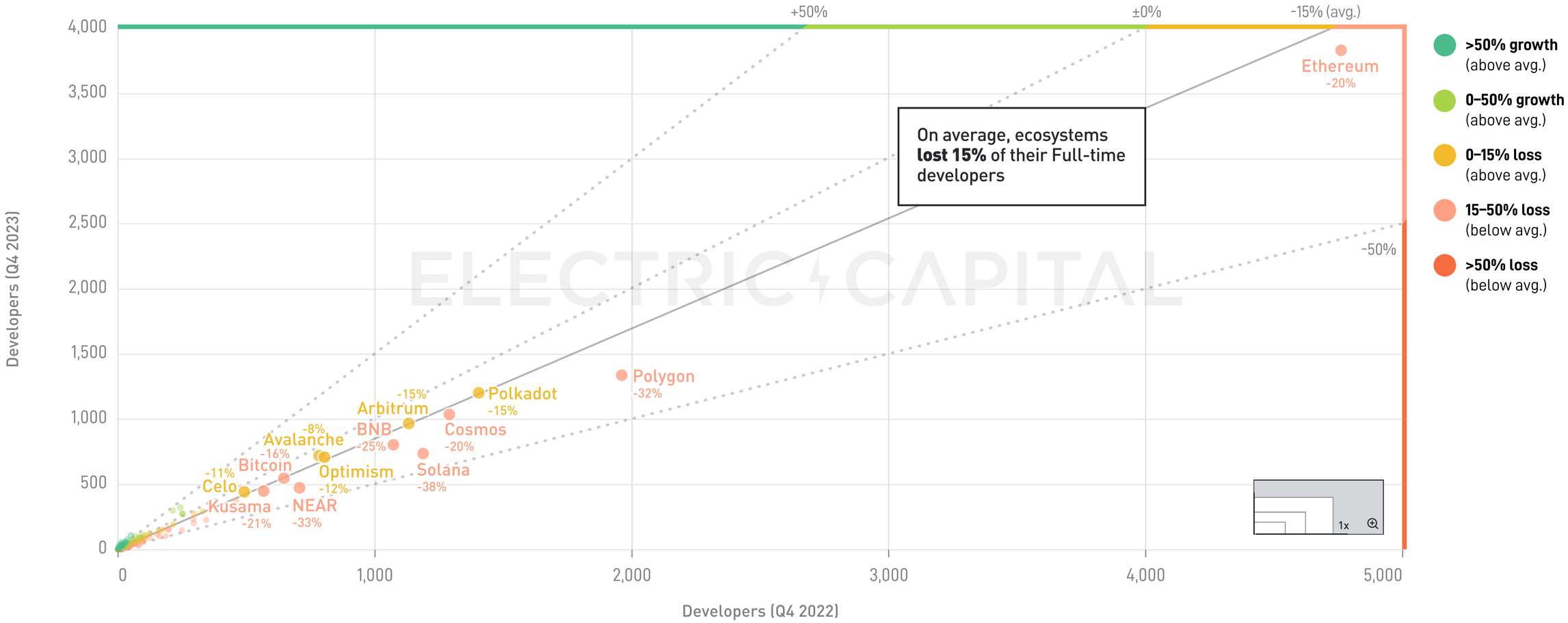
By Full-time developers (50+ devs)

	Ecosystem	Full-time
1	Aztec	279%
2	Mina	112%
3	Scroll	97%
4	Celestia	93%
5	Metis	78%
6	Status	47%
7	zkSync	39%
8	Starknet	32%
9	TON	26%
10	Chainlink	17%

ELECTRIC CAPITAL

On average, top ecosystems lost 15% of their Full-time devs
We can use this -15% as a benchmark to understand ecosystems

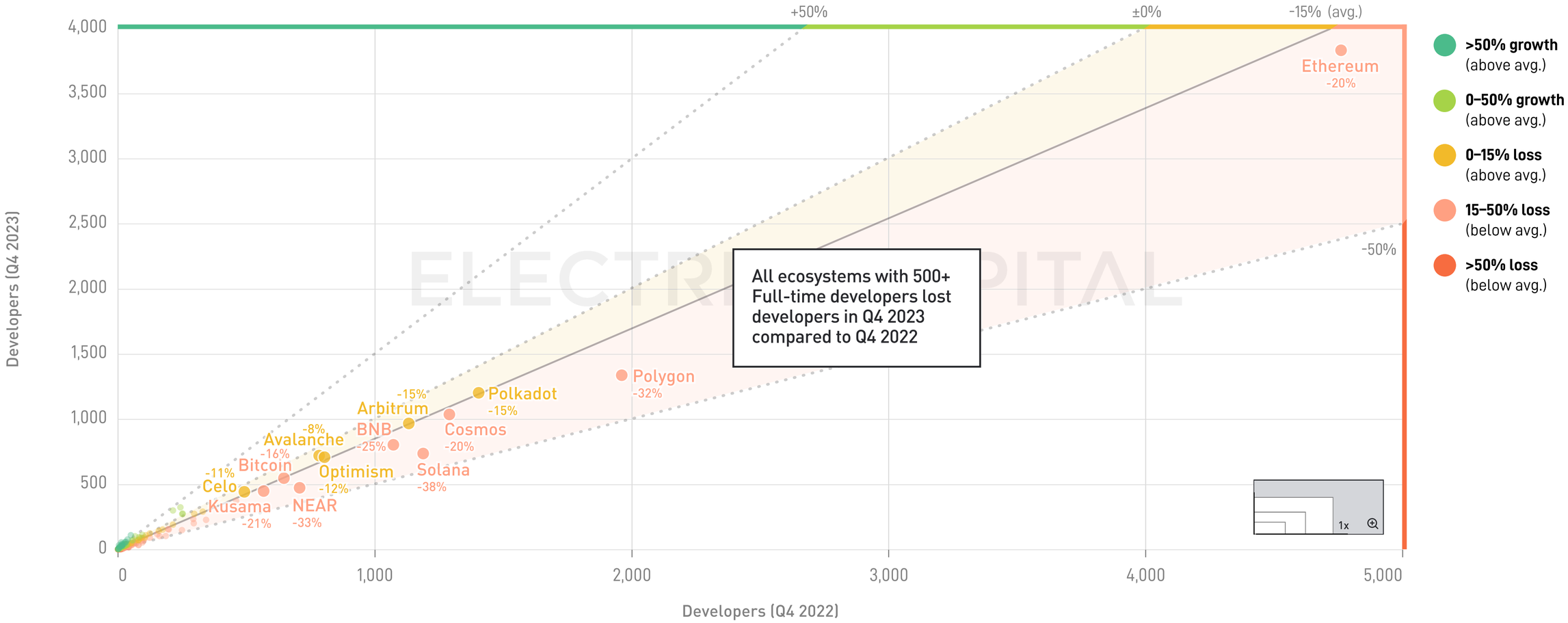
Full-time developer growth (~500+ developers): Q4 2023 vs. Q4 2022



ELECTRIC CAPITAL

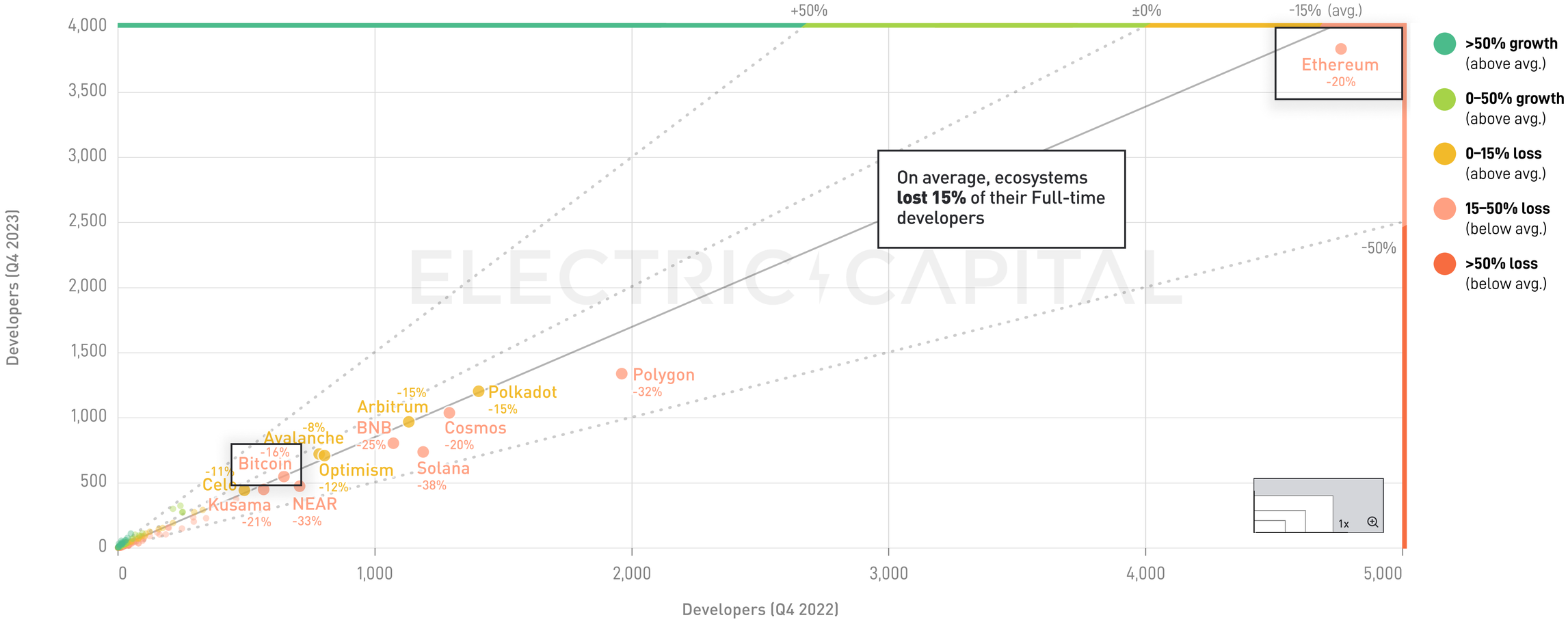
All top ecosystems with more than 500+ Full-time developers in Q4 2022 lost devs in Q4 2023

Full-time developer growth (~500+ developers): Q4 2023 vs. Q4 2022



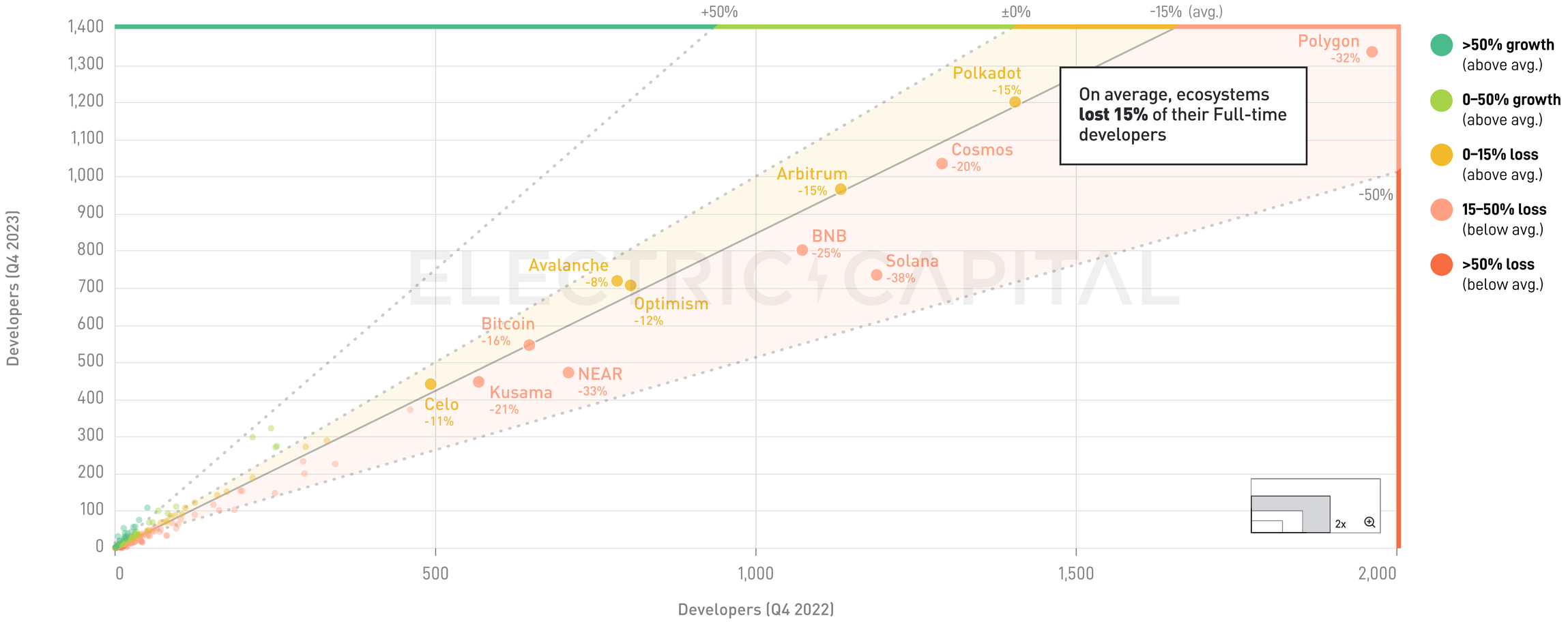
Bitcoin had -16% fewer Full-time developers and Ethereum had -20% fewer; both steeper losses than the -15% benchmark across top ecosystems

Full-time developer growth (~500+ developers): Q4 2023 vs. Q4 2022



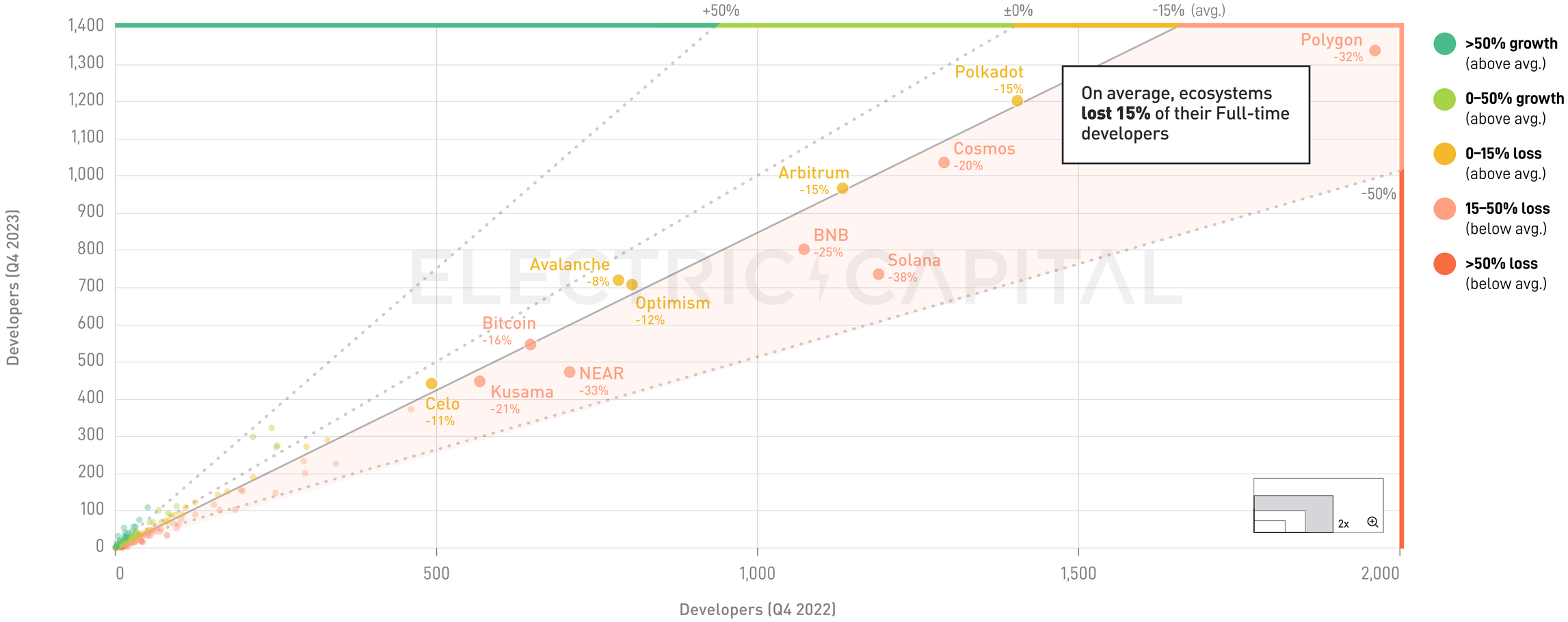
Avalanche (-8%), Celo (-11%), Optimism (-12%), Arbitrum (-15%) and Polkadot (-15%) growth was above benchmark; Cosmos (-20%), Kusama (-21%) & BNB (-25%) were below benchmark

Full-time developer growth (~500-1500 developers): Q4 2023 vs. Q4 2022



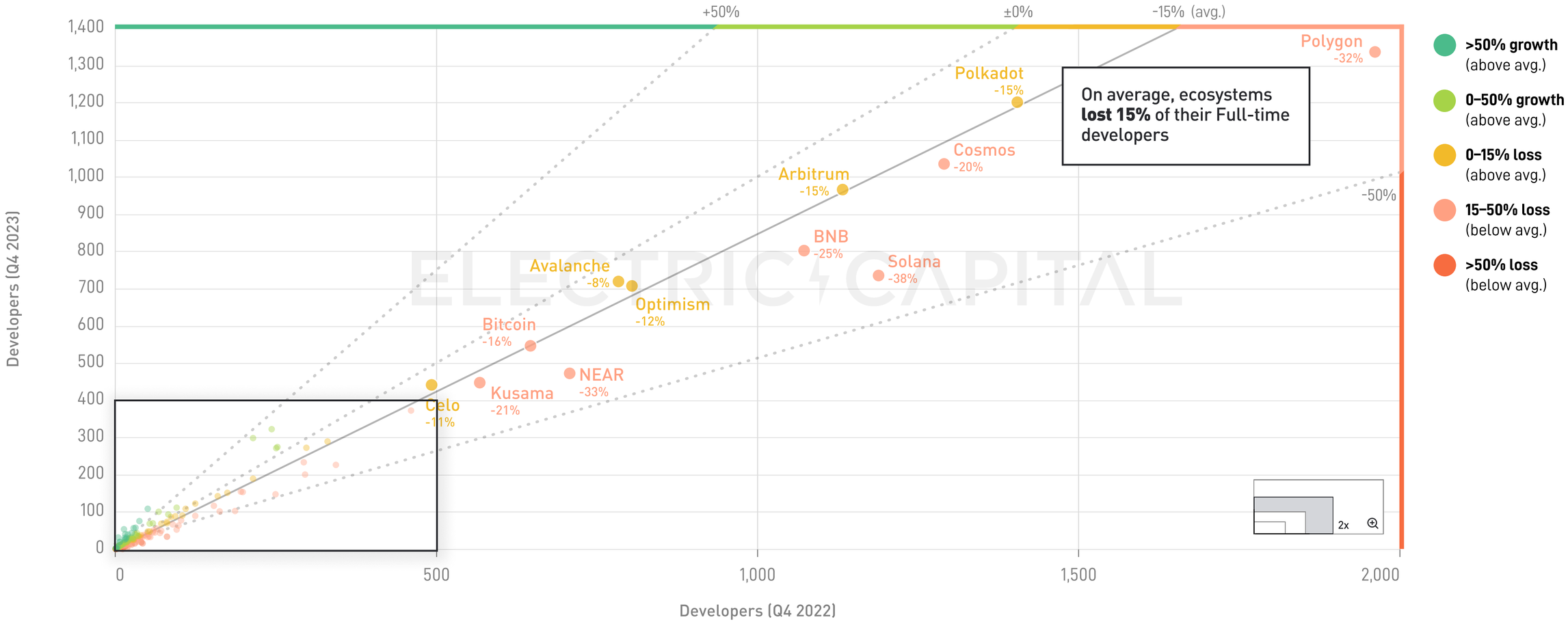
Ecosystems that gained the most devs in 2022 lost the most in 2023; Polygon (-32%), NEAR (-33%), & Solana (-38%) were below benchmark

Full-time developer growth (~500-1500 developers): Q4 2023 vs. Q4 2022



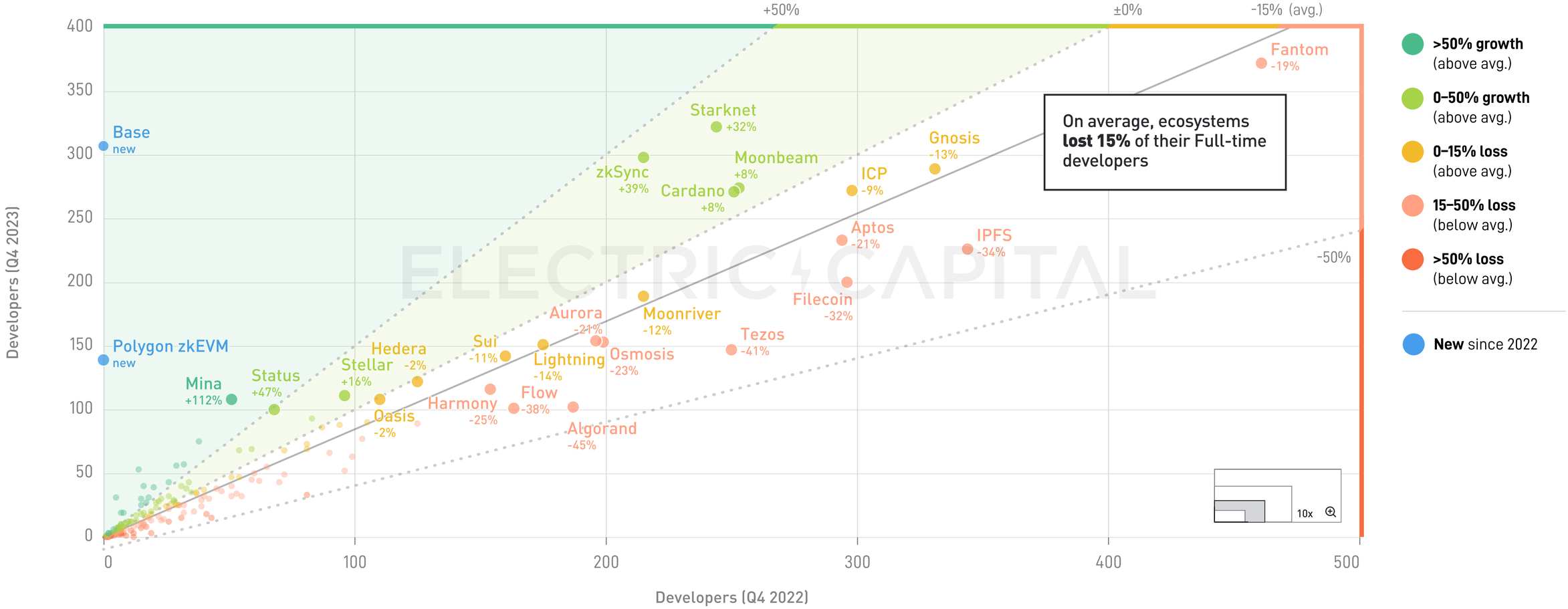
Let's zoom in to ecosystems with 100-500 devs

Full-time developer growth (~500-1500 developers): Q4 2023 vs. Q4 2022



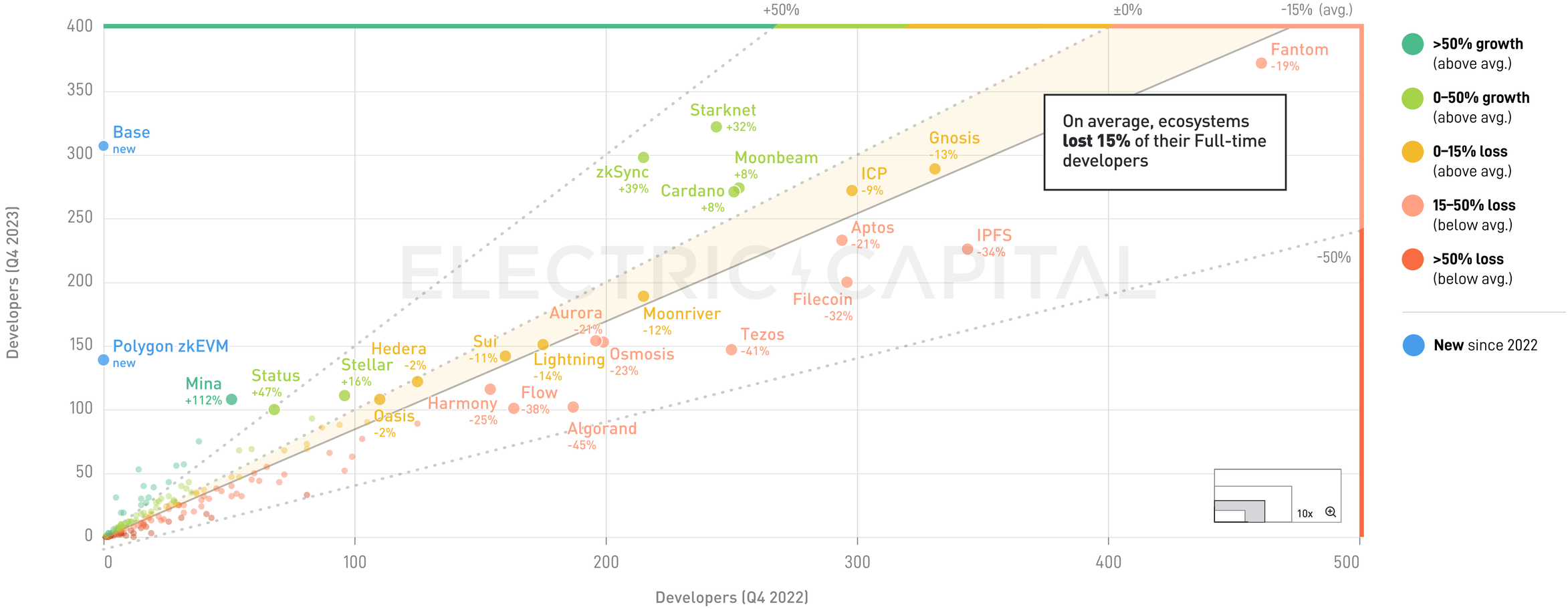
Mina Protocol (+112%), Status (+47%), zkSync (+39%), Starknet (+32%), Stellar (+16%), Moonbeam (+8%), and Cardano (+8%) gained Full-time developers in Q4 2023

Full-time developer growth (~100-500 developers): Q4 2023 vs. Q4 2022



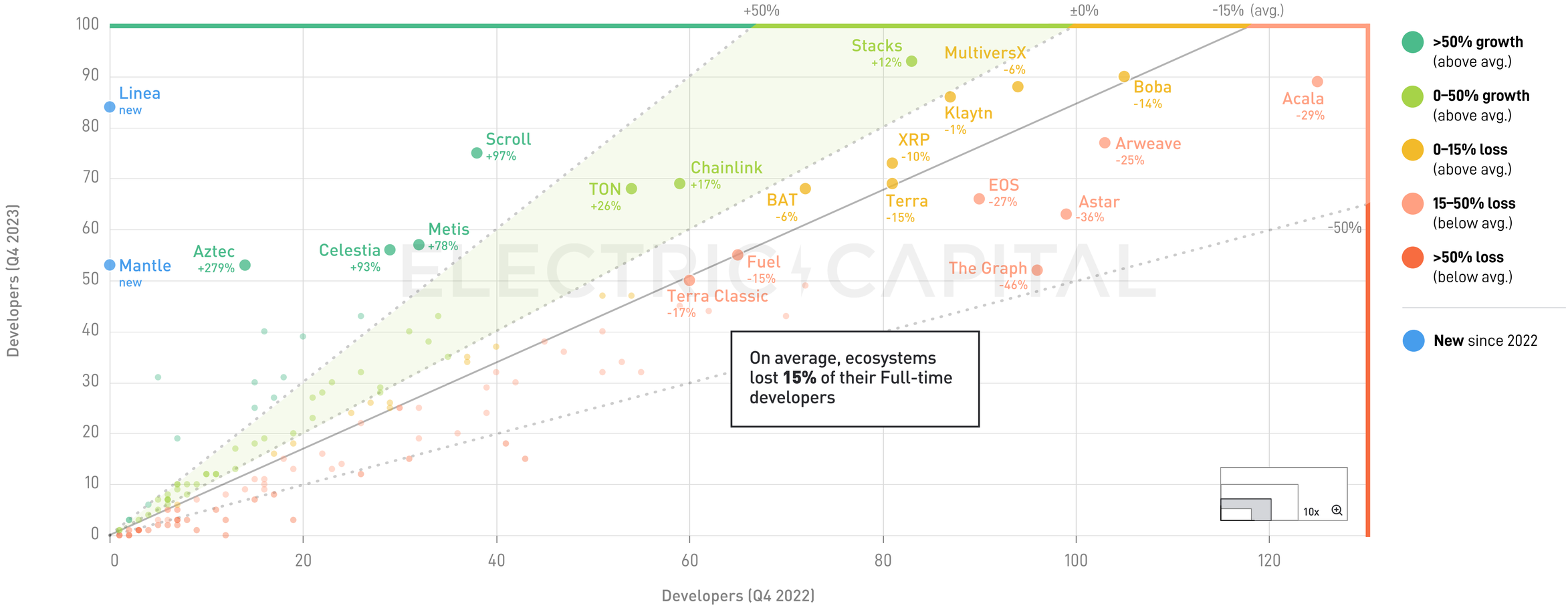
Oasis (-2%), Hedera (-2%), ICP (-9%), Sui (-11%), Moonriver (-12%), Gnosis (-13%), Lightning (-14%) lost Full-time developers in Q4 2023

Full-time developer growth (~100-500 developers): Q4 2023 vs. Q4 2022



Several ecosystems with 50+ Full-time devs gained devs including Aztec (+279%), Scroll (+97%), Celestia (+93%), Metis (+78%), TON (+26%), Chainlink (+17%), and Stacks (+12%)

Full-time developer growth (~50-100 developers): Q4 2023 vs. Q4 2022



Single-chain developers are uniquely committed to an ecosystem.

How are chains doing with Single-chain developers?

Single-chain developers
Q4 2023 vs. Q4 2022

Fastest growing ecosystems by Single-chain devs

Q4 2023 vs. Q4 2022

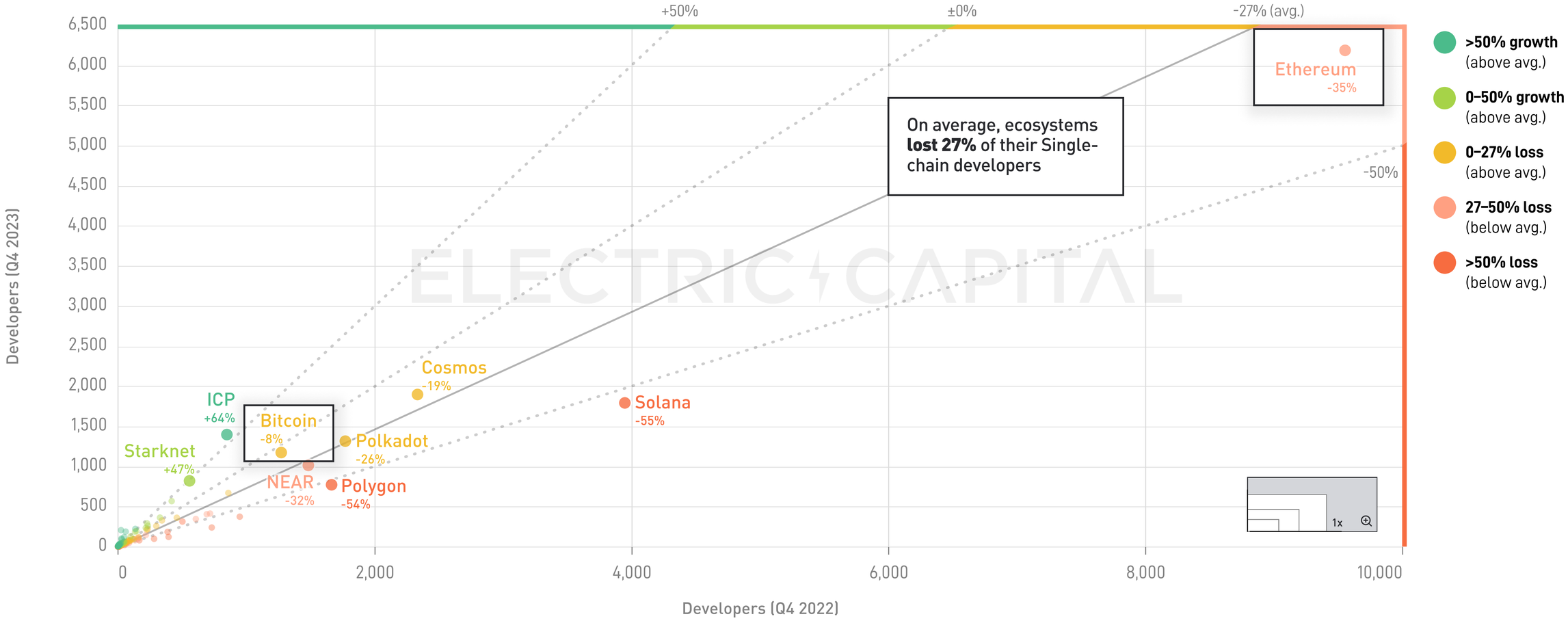
By Single-chain developers (100+ devs)

	Ecosystem	Single-chain
1	Scroll	688%
2	dYdX	248%
3	Celestia	202%
4	Aztec	136%
5	Internet Computer	64%
6	zkSync	61%
7	Starknet	47%
8	Optimism	38%
9	Avalanche	35%
10	Status	34%

ELECTRIC CAPITAL

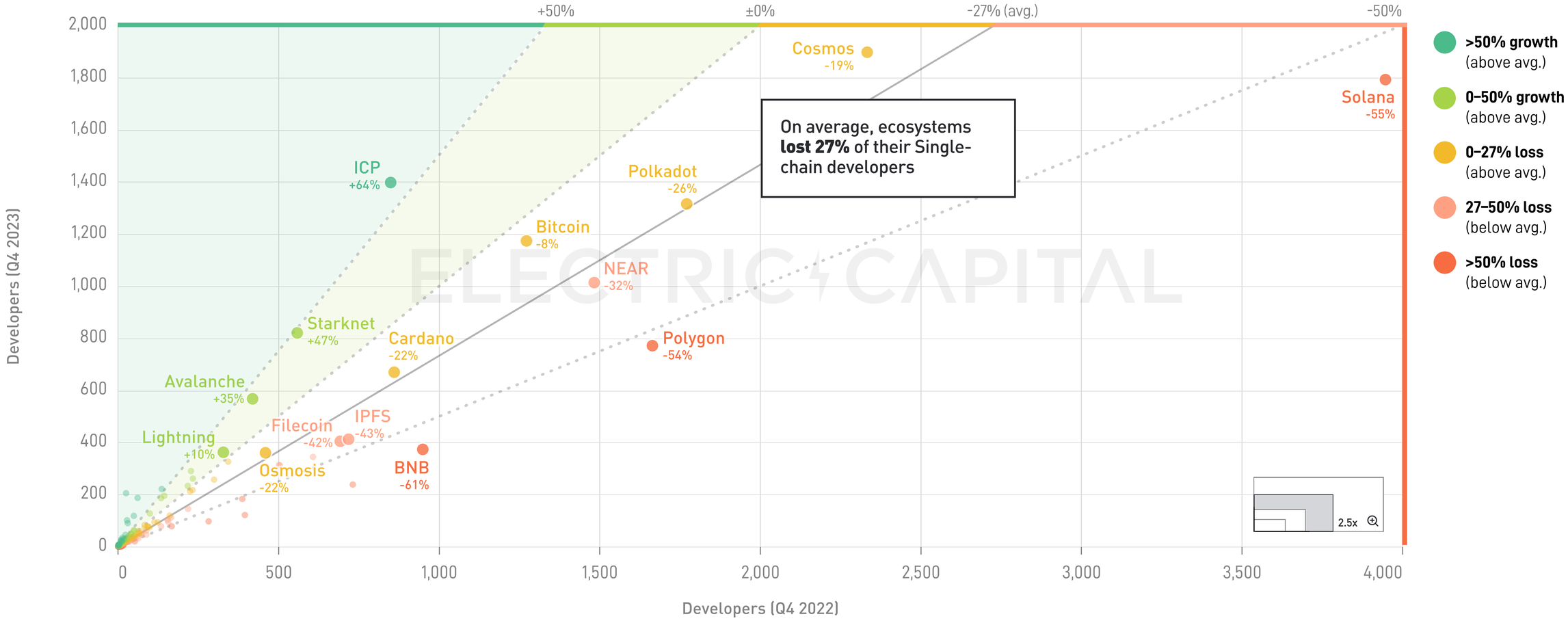
Bitcoin Single-chain developers fell -8% (above the -27% benchmark) while Ethereum Single-chain developers fell -35% (below benchmark)

Single-chain developer growth (~1000+ developers): Q4 2023 vs. Q4 2022



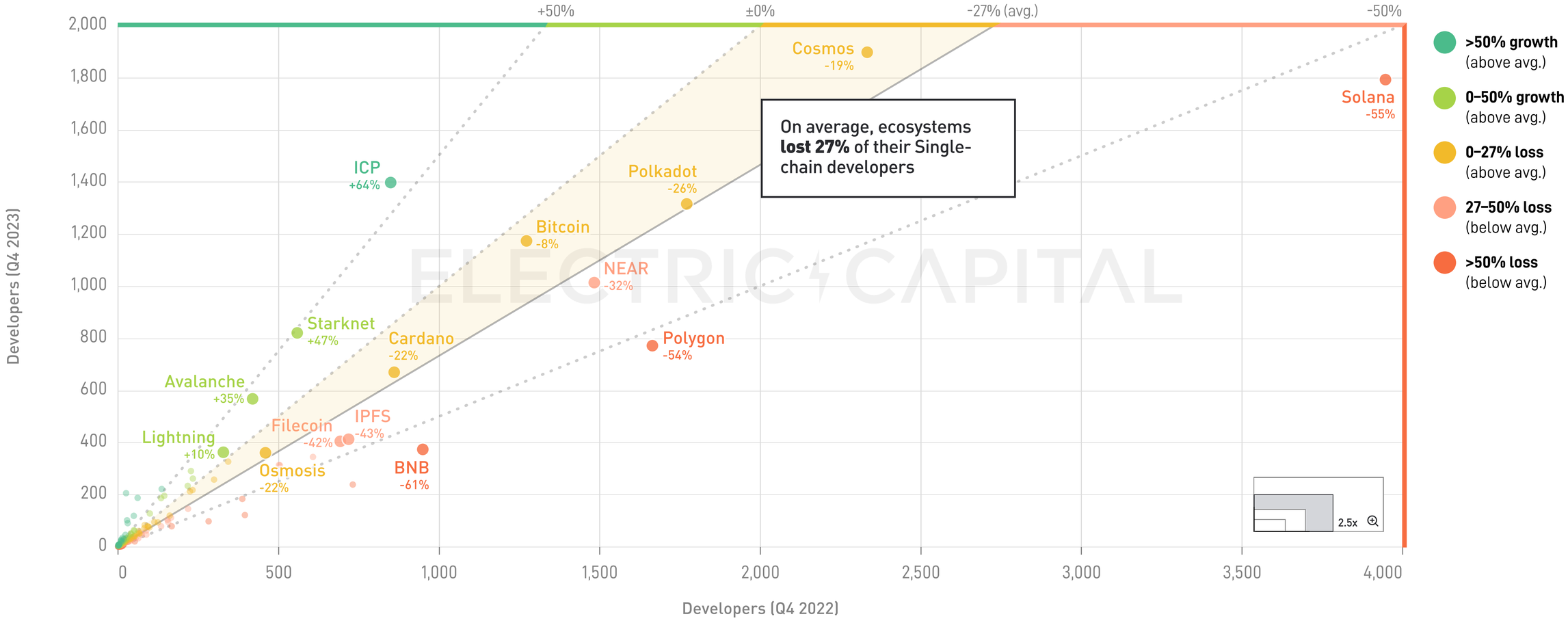
Several ecosystems gained Single-chain developers including ICP (+64%), Starknet (+47%), Avalanche (+35%), and Lightning (+10%)

Single-chain developer growth (~500-2500 developers): Q4 2023 vs. Q4 2022



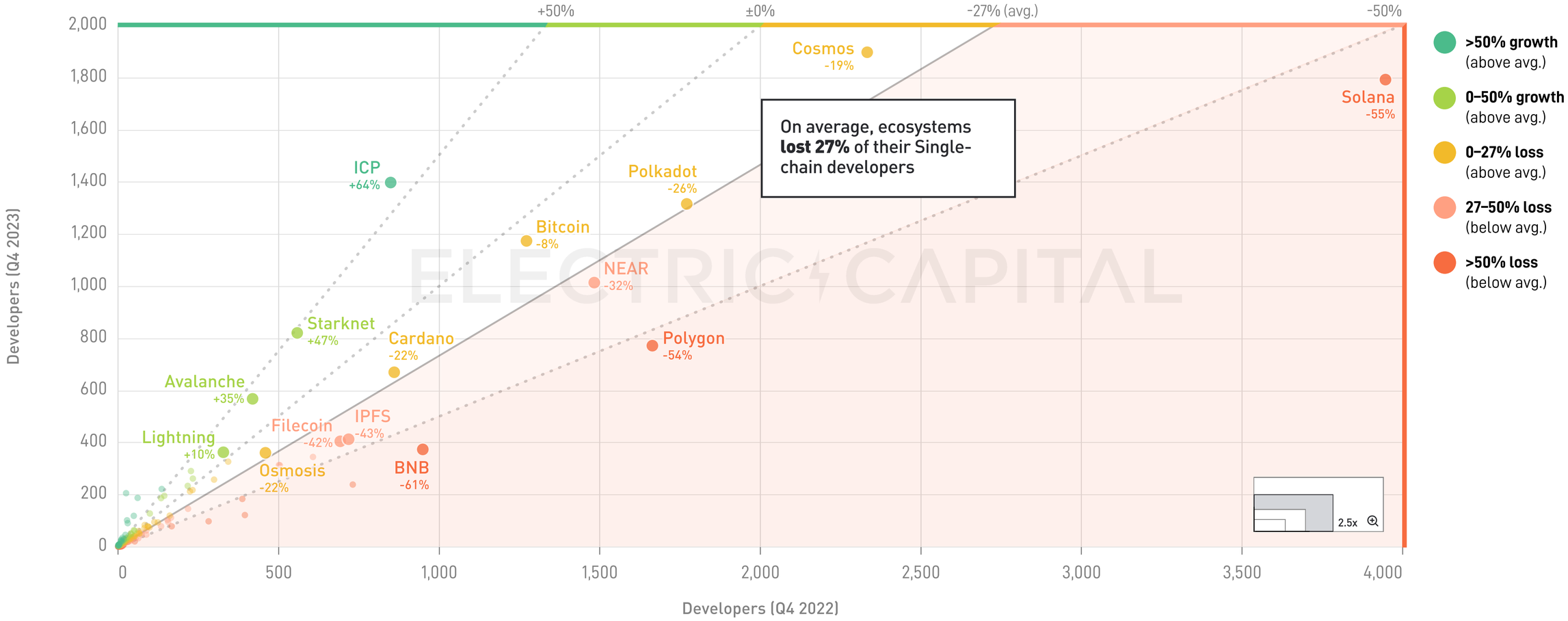
Other ecosystems lost Single-chain developers including Cosmos (-19%), Cardano (-22%), Osmosis (-22%), and Polkadot (-26%)

Single-chain developer growth (~500-2500 developers): Q4 2023 vs. Q4 2022



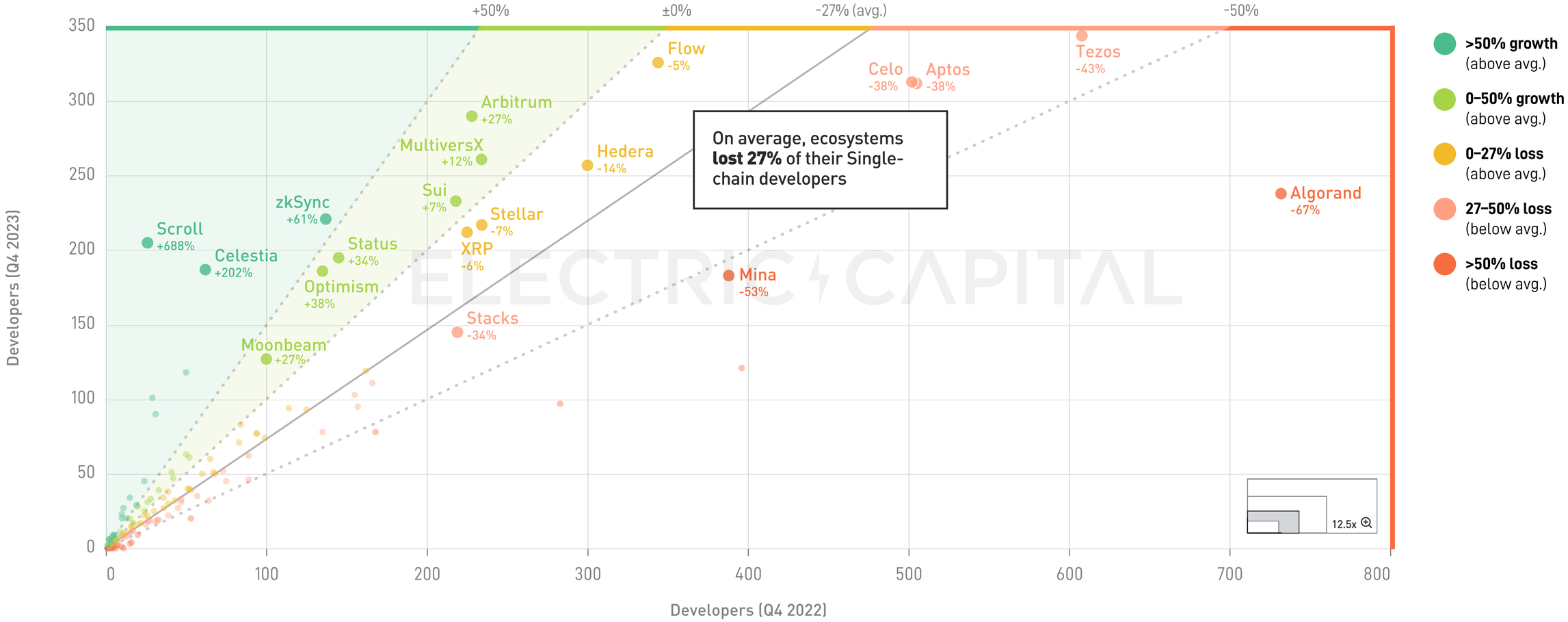
NEAR (-32%), Filecoin (-42%), IPFS (-43%), Polygon (-54%), Solana (-55%), and BNB (-61%) had substantially fewer Single-chain developers in Q4 2023

Single-chain developer growth (~500-2500 developers): Q4 2023 vs. Q4 2022



Zooming in, we see that Scroll (+688%), Celestia (+202%), zkSync (+61%), Optimism (+38%), Status (+34%), Moonbeam (+27%), Arbitrum (+27%), MultiversX (+12%), and Sui (+7%) all gained Single-chain developers

Single-chain developer growth (~150-500 developers): Q4 2023 vs. Q4 2022

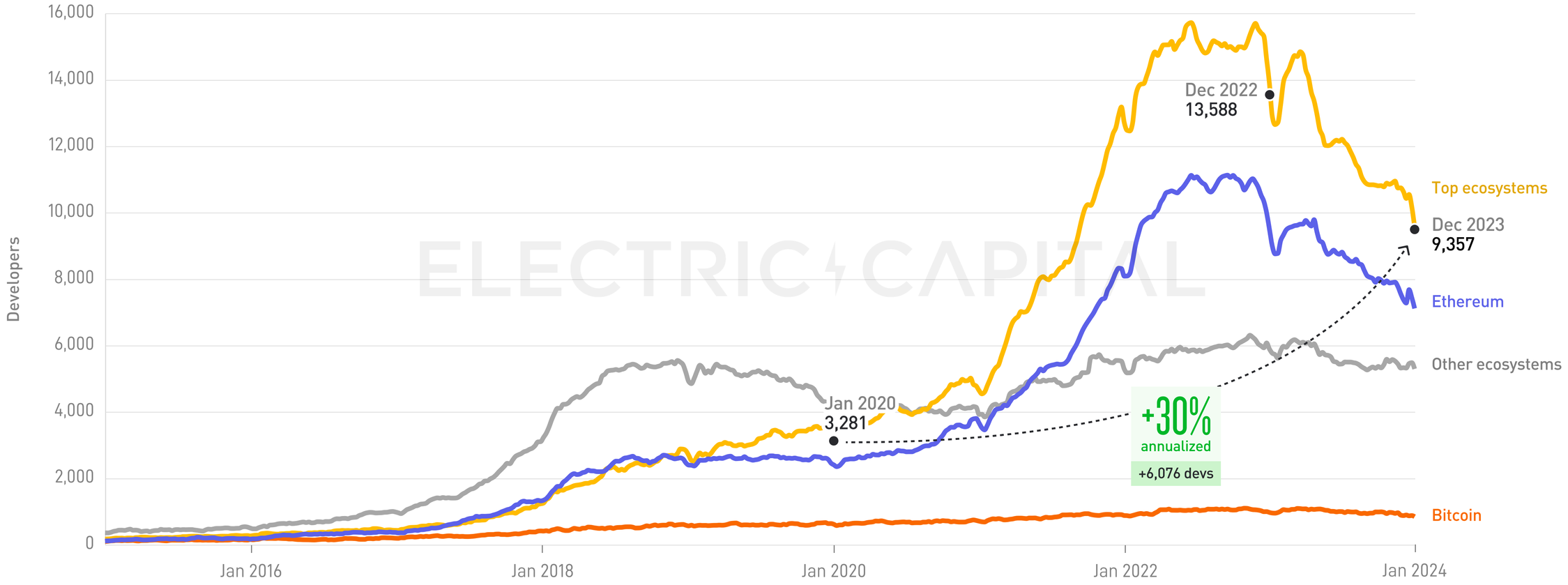


Unsurprisingly, comparing a deep bear market (2023) with the year after a big bull run (2022) shows attrition.

How doe the 2023 bear market compare to the 2020 bear market?

Developers grew significantly since the last bear market: there were +6,076 more monthly developers, reflecting +30% annualized growth since 2020

Monthly active developers in top ecosystems (excluding Bitcoin & Ethereum) vs. other ecosystems



Overall developers from the same point in each bear cycle.

Overall developers
Q4 2023 vs. Q4 2020

Fastest growing ecosystems by overall monthly devs

Q4 2023 vs. Q1 2020

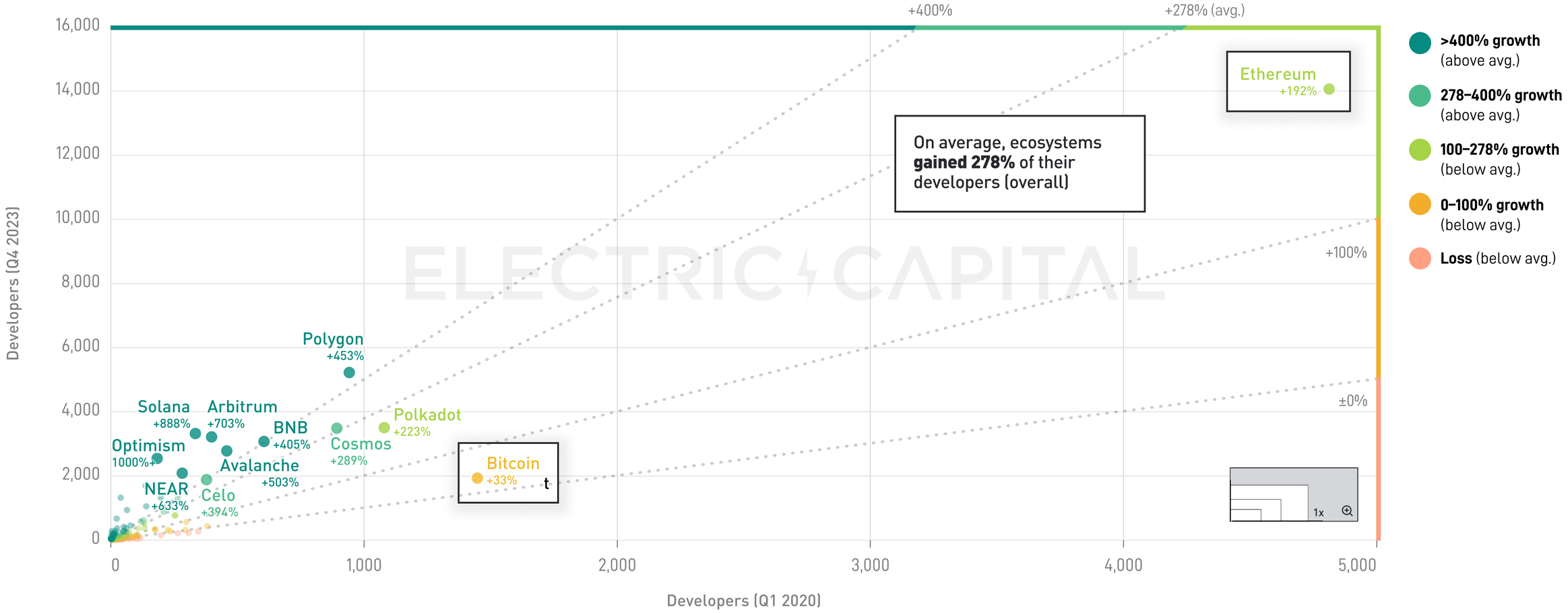
By overall monthly developers (150+ devs)

	Ecosystem	Overall
1	Starknet	33x
2	Osmosis	27x
3	Moonbeam	14x
4	Optimism	14x
5	Internet Computer	12x
6	Solana	10x
7	Arbitrum	8x
8	zkSync	7x
9	NEAR	7x
10	Fantom	7x

ELECTRIC CAPITAL

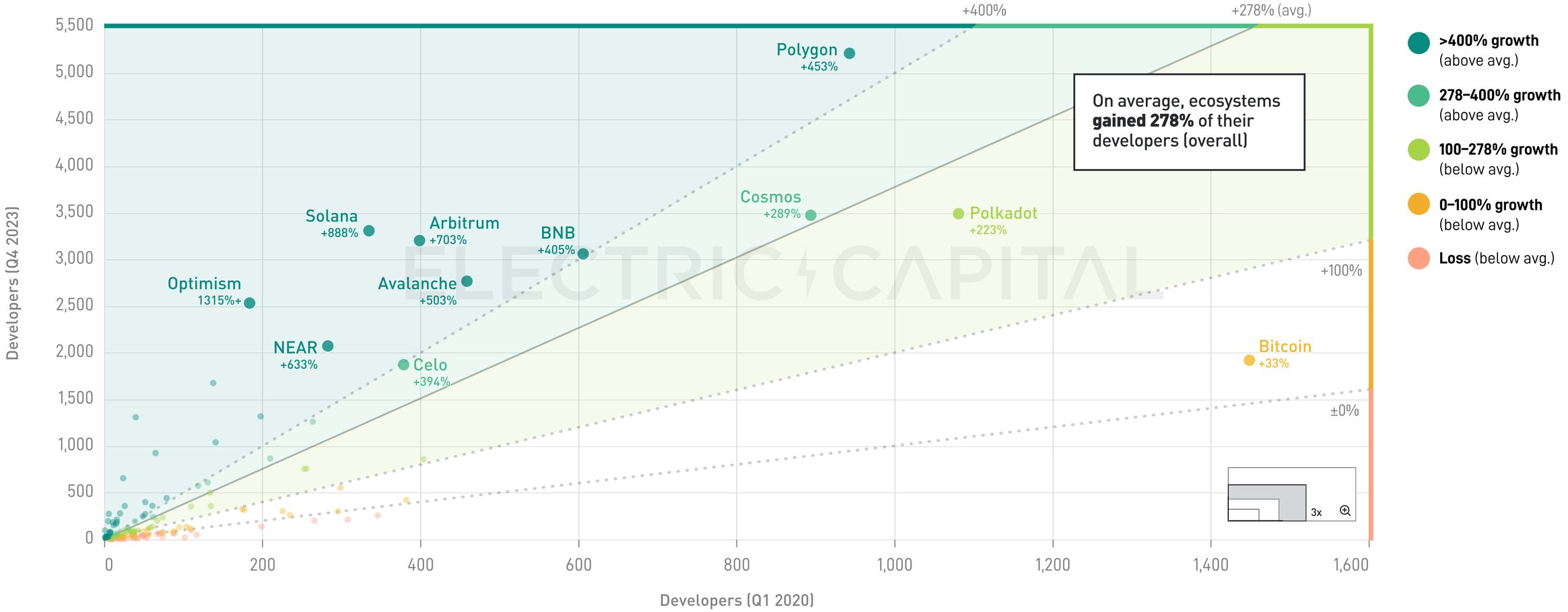
Since 2020, the number of overall Ethereum (+192%) and Bitcoin (+33%) devs grew substantially, as it did for most ecosystems (+278% benchmark)

Overall developer growth (~2000+ developers): Q4 2023 vs. Q1 2020



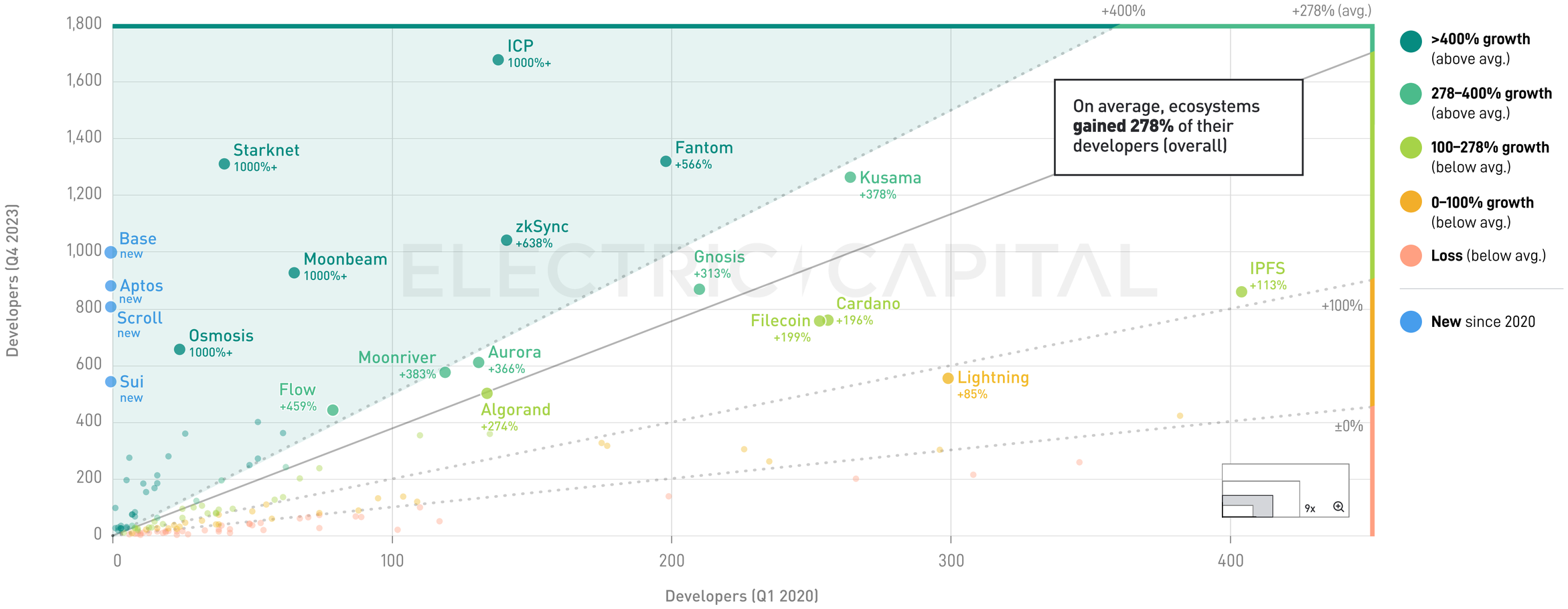
Optimism (+1315%), Solana (+888%), Arbitrum (+703%), NEAR (+633%), Avalanche (+503%), Polygon (+453%), BNB (+405%), Celo (+394%), and Cosmos (+289%) were all above benchmark, while Polkadot (+223%) tripled their Full-time developers

Overall developer growth (~2000-5000 developers): Q4 2023 vs. Q1 2020



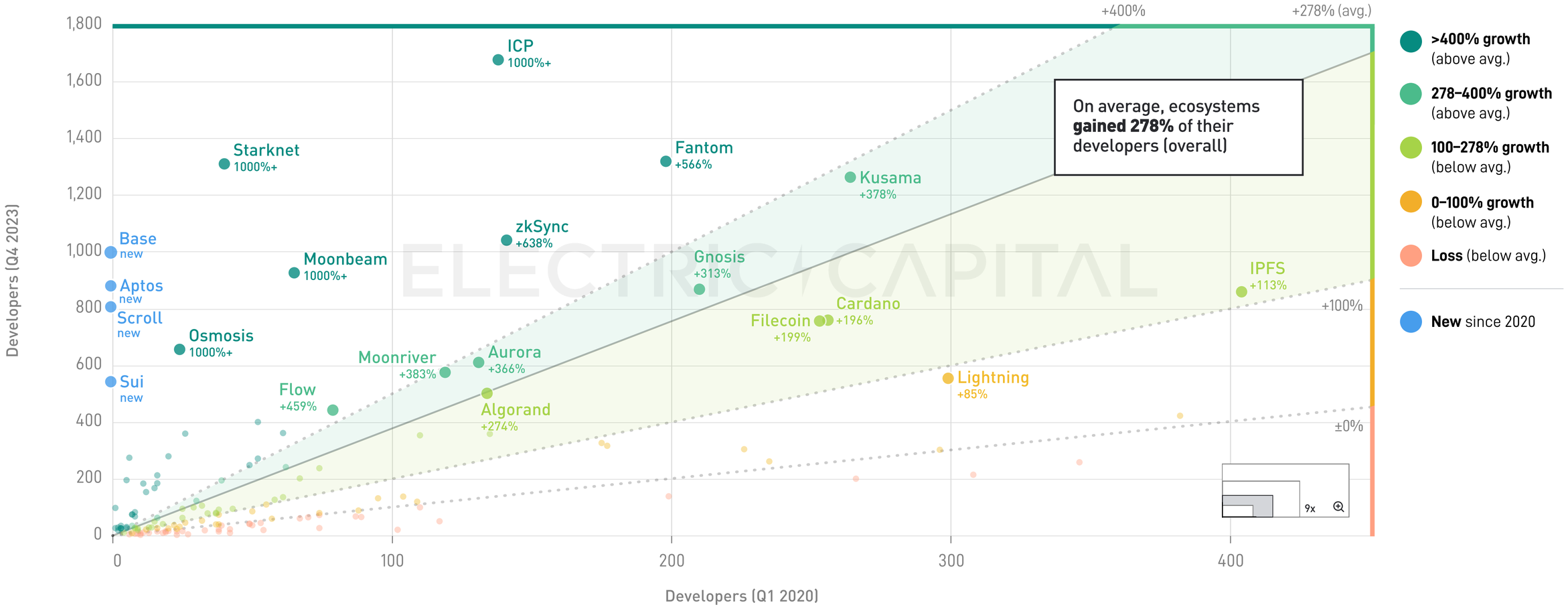
Zooming in, we see newer ecosystems like Osmosis and Moonbeam grew to have >600 developers, while Starknet and older ecosystems like ICP (1000%+), zkSync (+638%), and Fantom (+566%) grew to have >1000 developers

Overall developer growth (~500-2000 developers): Q4 2023 vs. Q1 2020



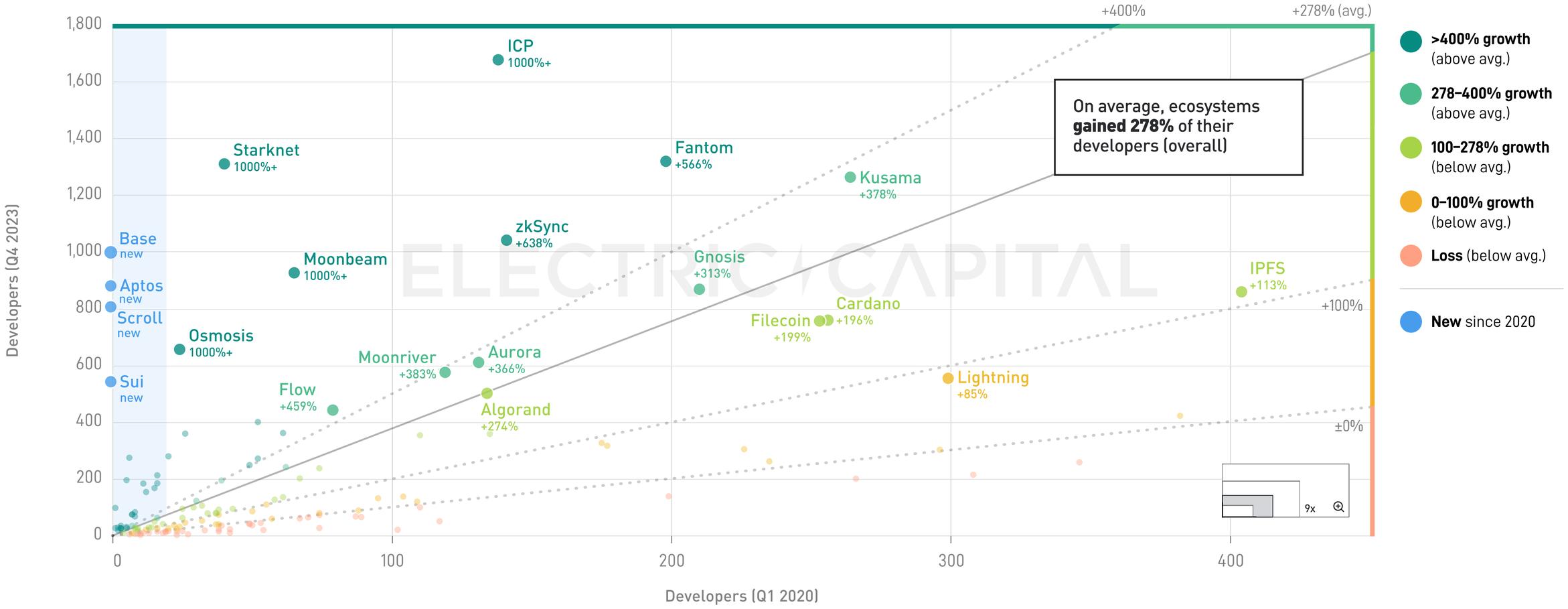
Flow (+459%), Moonriver (+383%), Kusama (+378%), Aurora (+366%), Gnosis (+313%) were above benchmark; Algorand (+274%), Filecoin (+199%), Cardano (+196%), IPFS (+113%) were below

Overall developer growth (~500-2000 developers): Q4 2023 vs. Q1 2020



Base, Aptos, Scroll, Sui did not exist in 2020 & have created communities with 500+ developers

Overall developer growth (~500-2000 developers): Q4 2023 vs. Q1 2020



Let's look at the most prolific group of developers at this point in the bear cycle: Full-time developers.

Full-time developers
Q4 2023 vs. Q4 2020

Fastest growing ecosystems by Full-time devs

Q4 2023 vs. Q1 2020

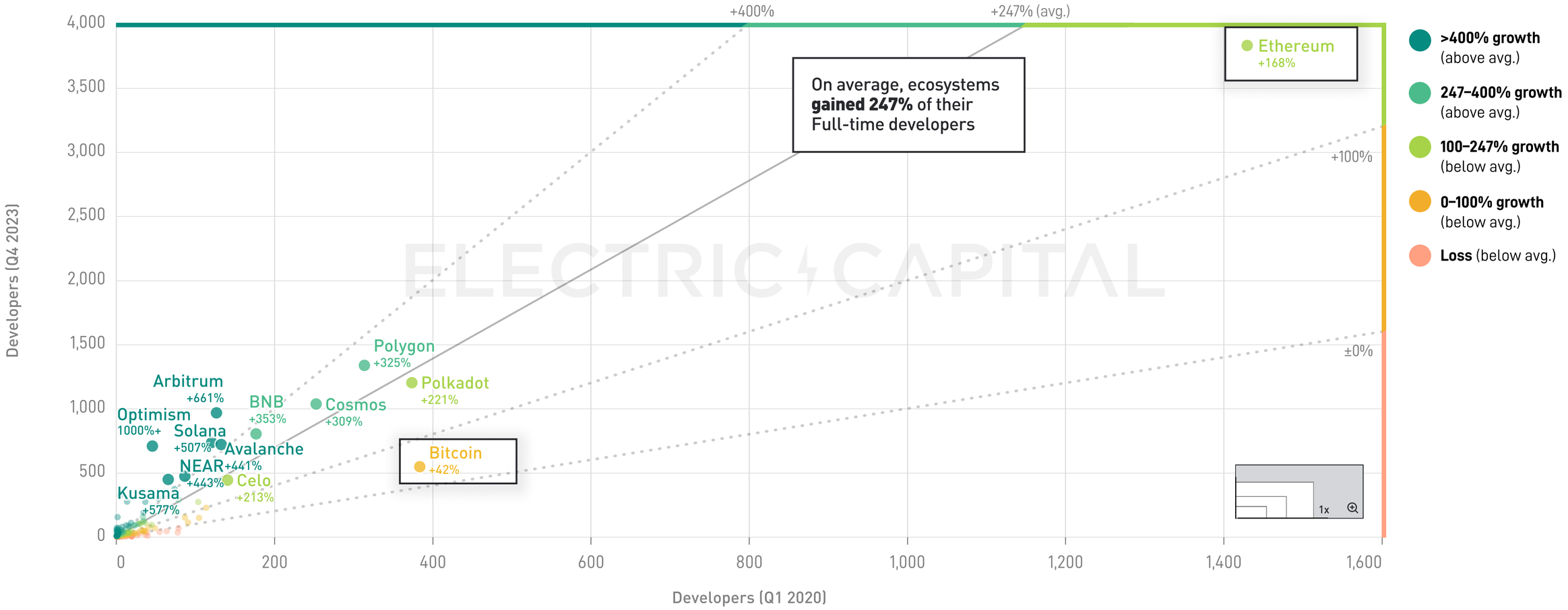
By Full-time developers (100+ devs)

	Ecosystem	Full-time
1	Osmosis	77x
2	Starknet	64x
3	Moonbeam	20x
4	Optimism	15x
5	Arbitrum	8x
6	Internet Computer	7x
7	Kusama	7x
8	Solana	6x
9	zkSync	6x
10	NEAR	5x

ELECTRIC CAPITAL

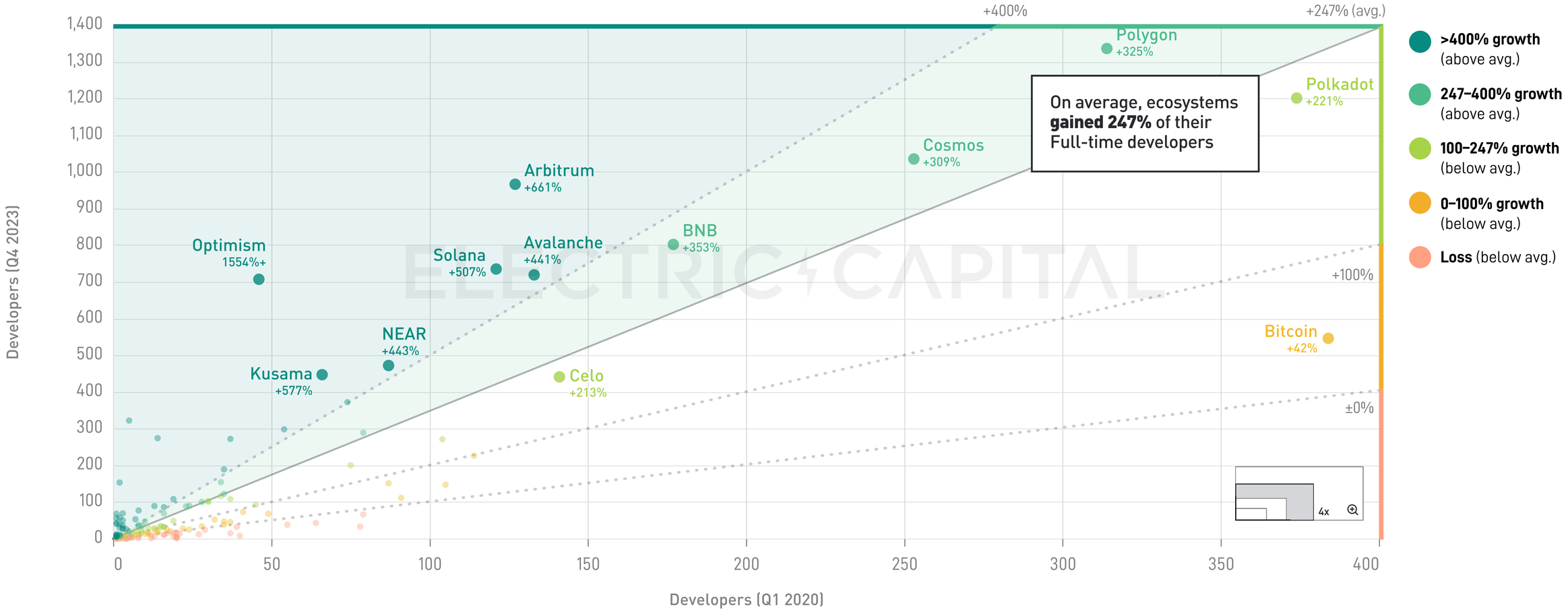
Since 2020, the number of Full-time Ethereum (+168%) and Bitcoin (+42%) devs grew substantially, as it did for most ecosystems (+247% benchmark)

Full-time developer growth (~500+ developers): Q4 2023 vs. Q1 2020



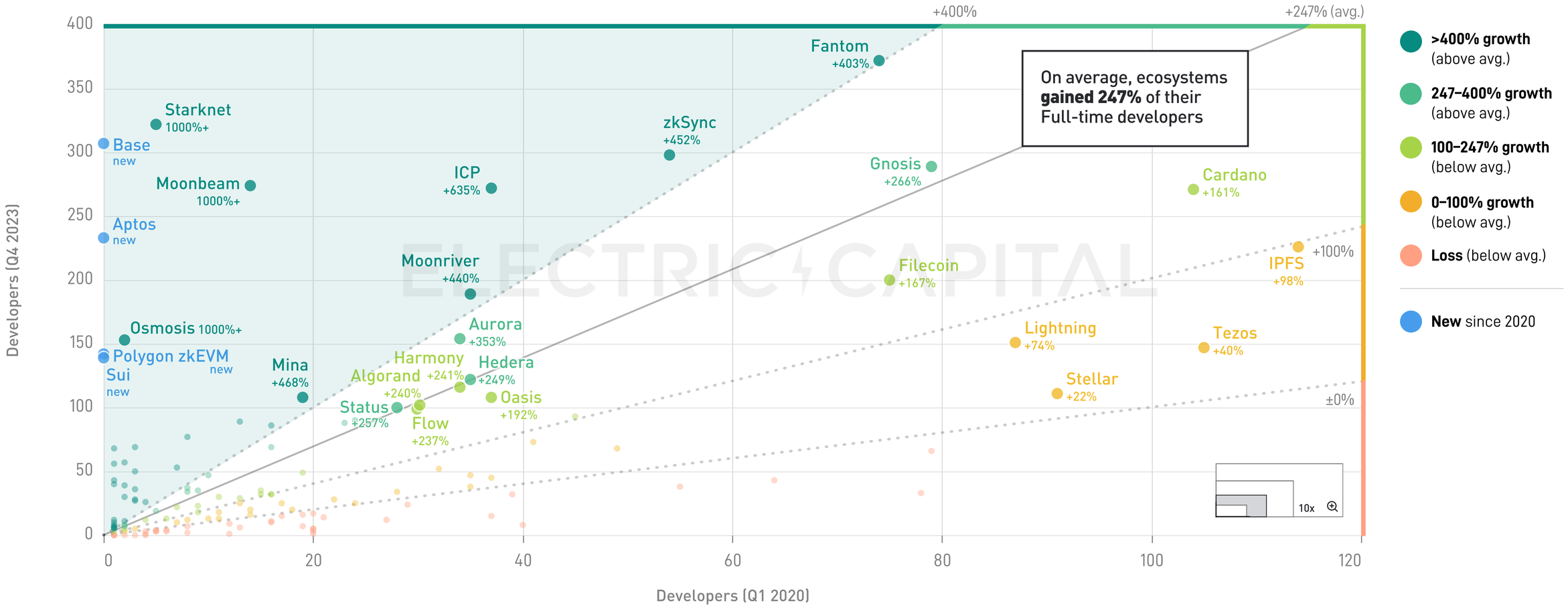
Optimism (1554%+), Arbitrum (+661%), Kusama (+577%), Solana (+507%), NEAR (+443%), Avalanche (+441%), BNB (+353%), Polygon (+325%), and Cosmos (+309%) were above benchmark, and Polkadot (+221%) and Celo (+213%) tripled their Full-time developers

Full-time developer growth (~500-1500 developers): Q4 2023 vs. Q1 2020



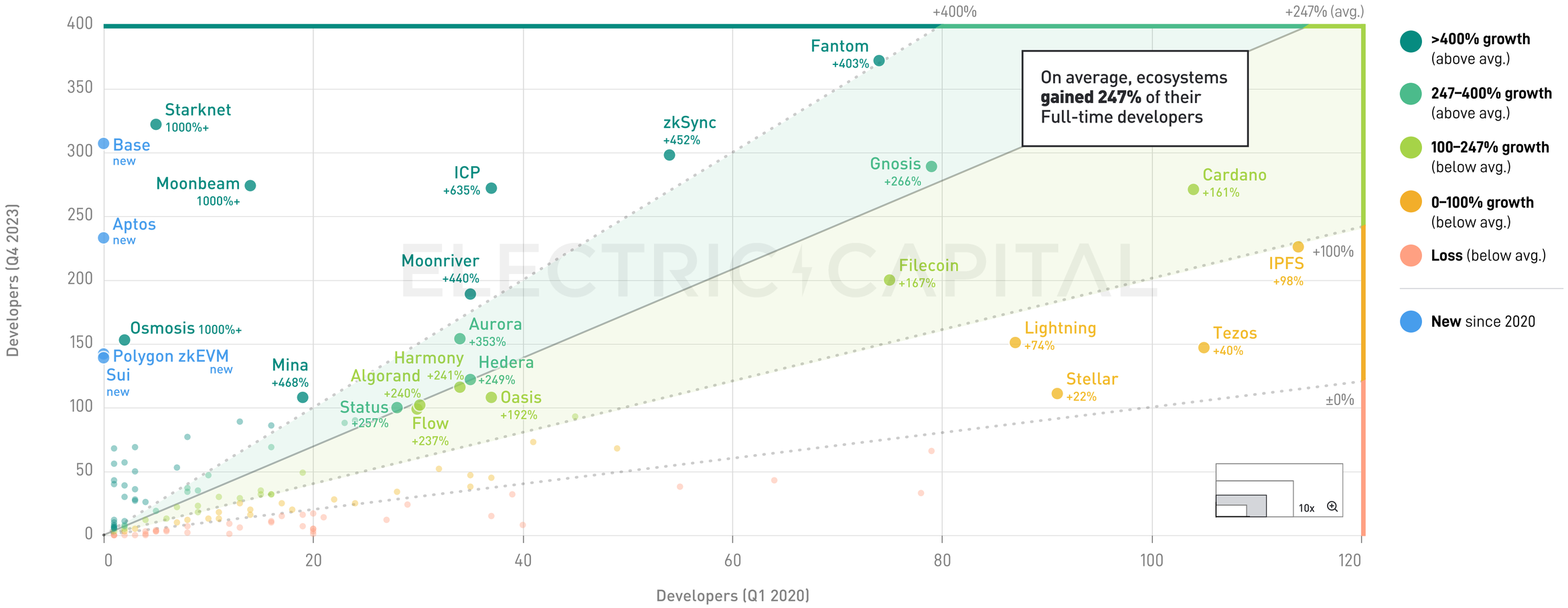
Zooming in, we see newer ecosystems like Starknet, Osmosis, and Moonbeam and older ecosystems like ICP (+635%), Mina Protocol (+468%), zkSync (+452%), Moonriver (+440%), and Fantom (+403%) grew to have >100 Full-time developers

Full-time developer growth (~100-500 developers): Q4 2023 vs. Q1 2020



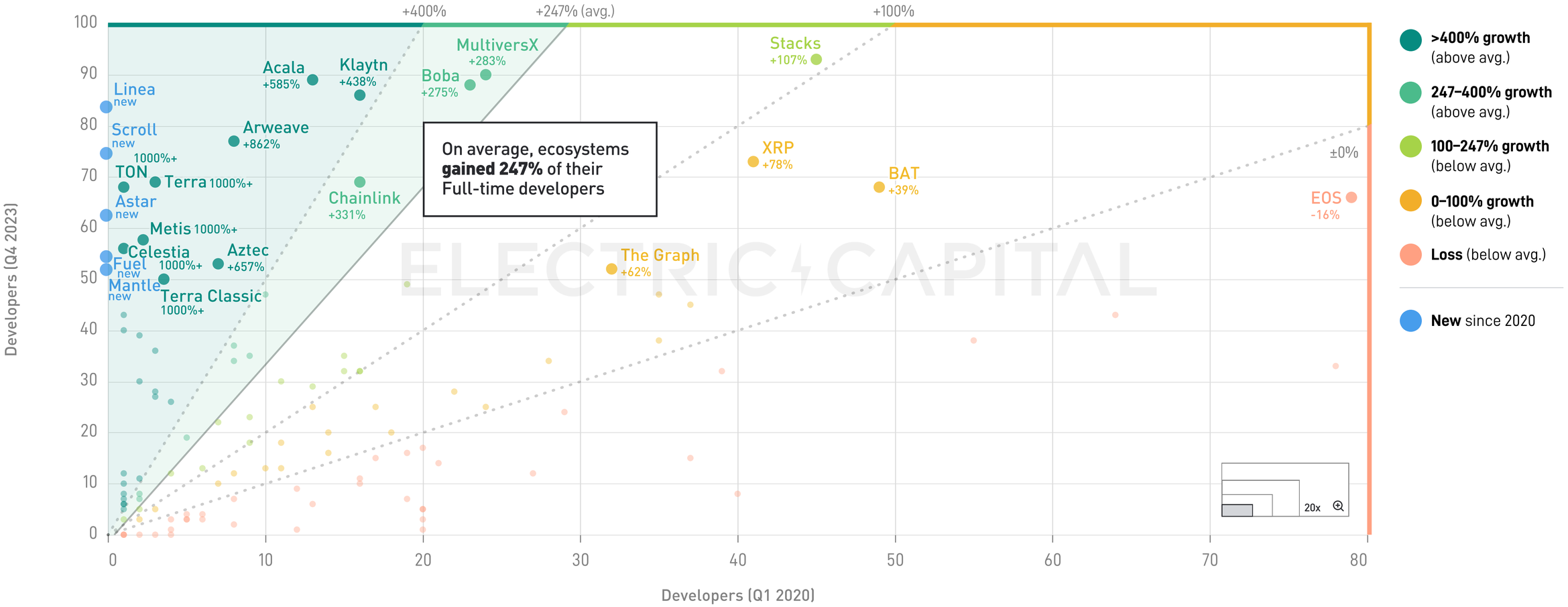
Aurora (+353%), Gnosis (+266%), Status (+257%), and Hedera (+249%) were above benchmark, while Harmony (+241%), Algorand (+240%), Flow (+237%), Oasis (+192%), Filecoin (+167%), and Cardano (+161) grew but were below benchmark

Full-time developer growth (~100-500 developers): Q4 2023 vs. Q1 2020



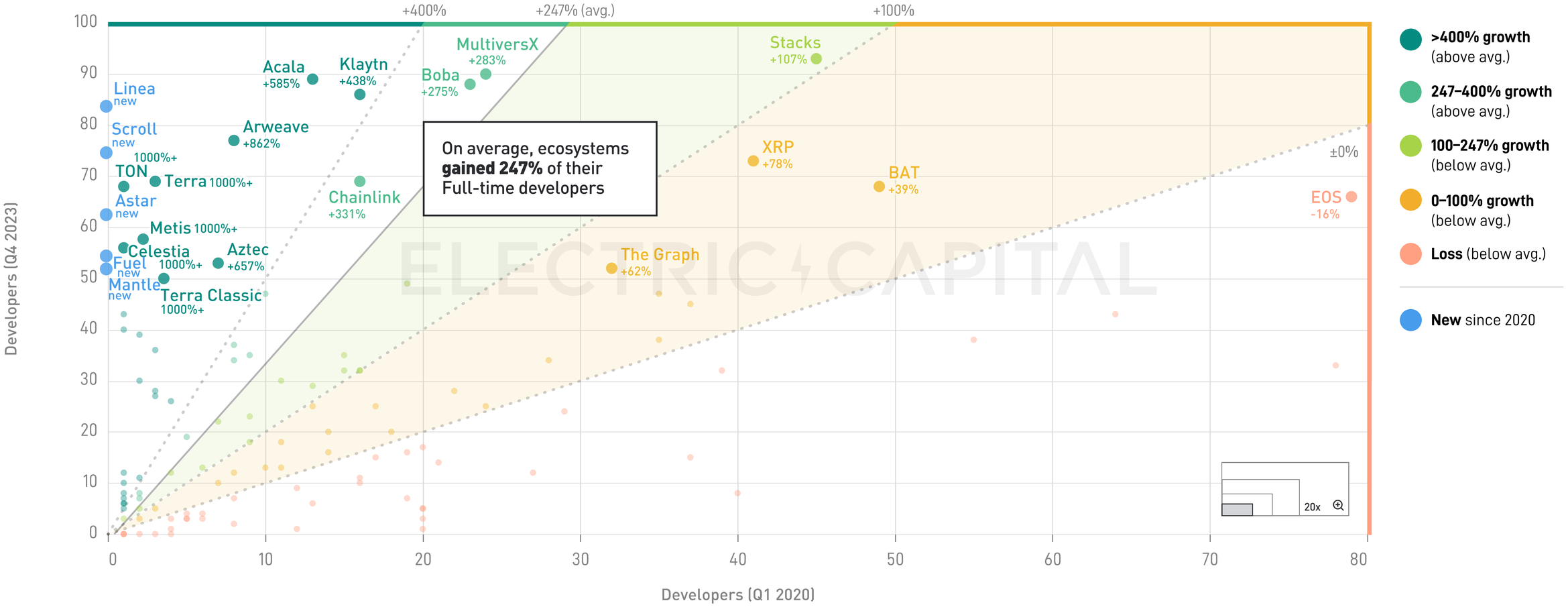
Newer ecosystems like TON, Celestia, Metis have >50 Full-time developers, and Arweave (+862%), Aztec (+657%), Acala (+585%), Klatyn (+438%), Chainlink (+331%), MultiversX (+283%), and Boba (+275%) were all above benchmark

Full-time developer growth (~50-100 developers): Q4 2023 vs. Q1 2020



Stacks (+107%), XRP (+78%), The Graph (+62%), and Basic Attention Token (+39%) grew, but below benchmark

Full-time developer growth (~50-100 developers): Q4 2023 vs. Q1 2020



Let's look at Single-chain developers at this point in the bear cycle.

Single-chain developers
Q4 2023 vs. Q4 2020

Fastest growing ecosystems by Single-chain devs

Q4 2023 vs. Q1 2020

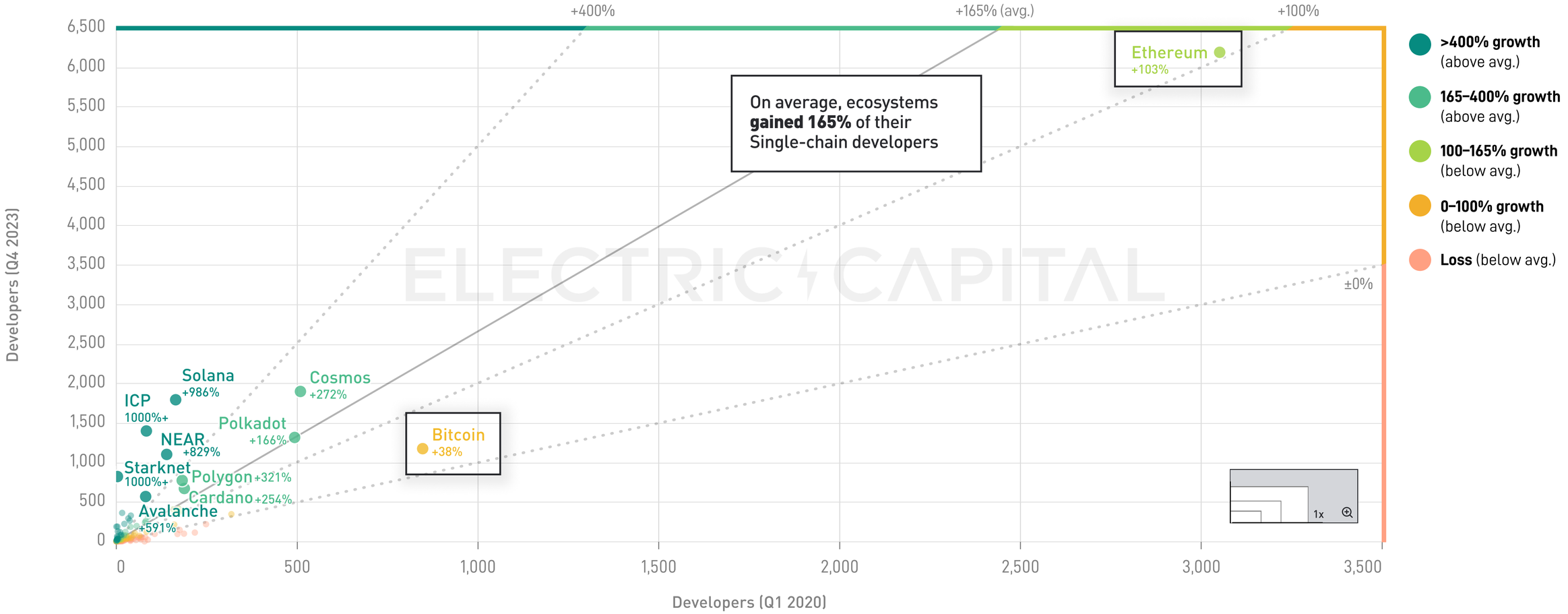
By Single-chain developers (150+ devs)

	Ecosystem	Single-chain
1	Starknet	205x
2	Celestia	47x
3	Optimism	31x
4	Osmosis	21x
5	Internet Computer	17x
6	Solana	11x
7	zkSync	10x
8	NEAR	9x
9	Arbitrum	9x
10	Flow	8x

ELECTRIC CAPITAL

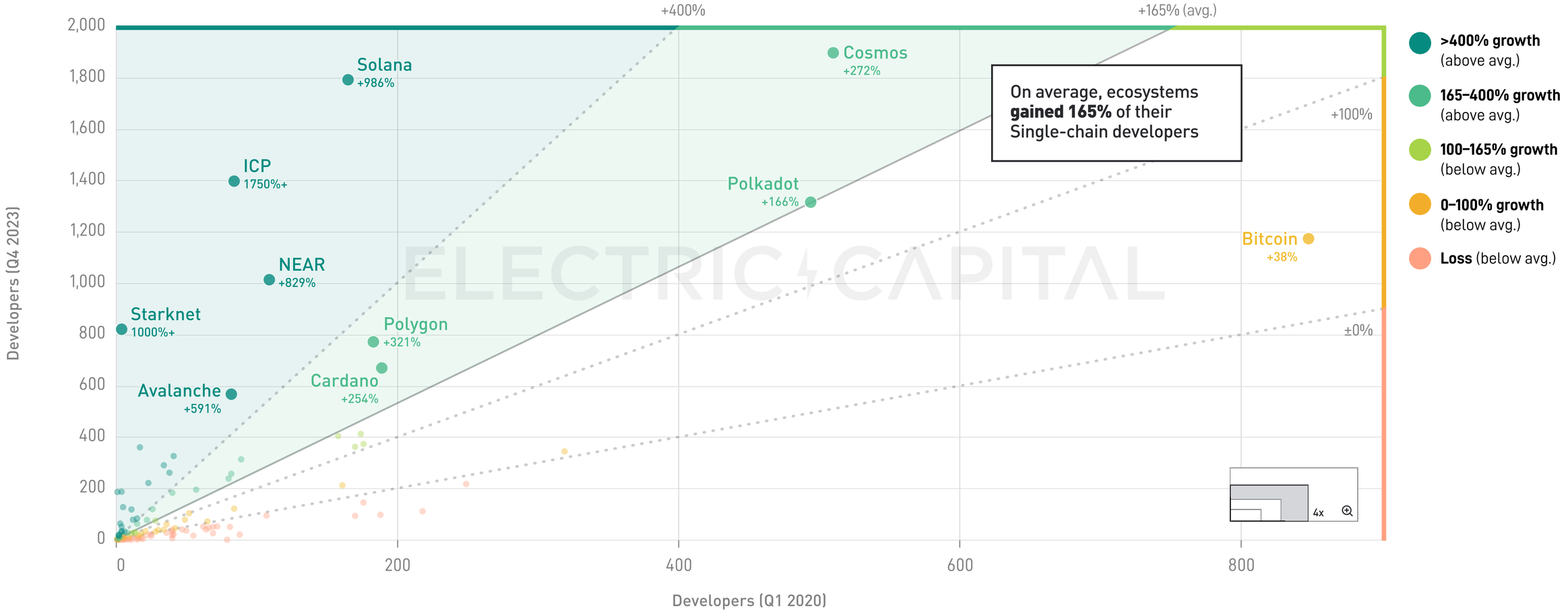
The number of Single-chain Ethereum (+103%) and Bitcoin (+38%) devs grew substantially, as it did for most ecosystems (+165% benchmark)

Single-chain developer growth (~500+ developers): Q4 2023 vs. Q1 2020



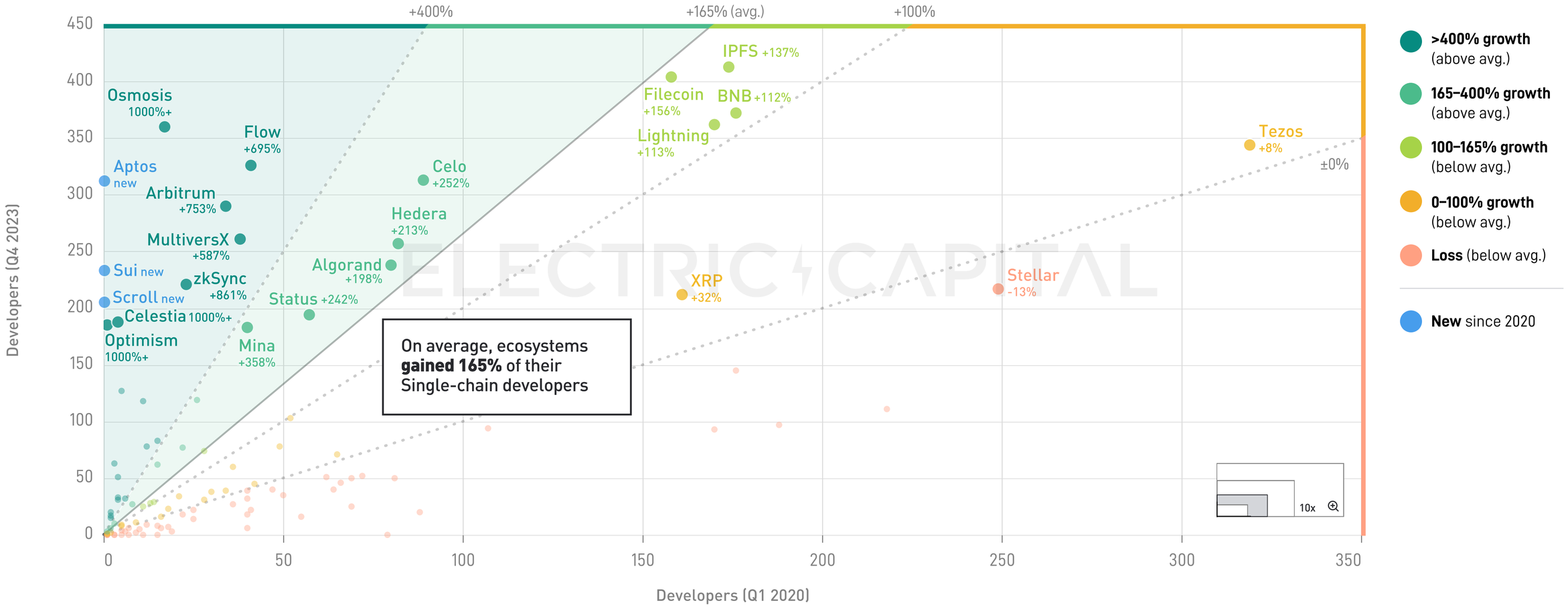
Zooming in, we see Starknet (1000%+), Avalanche (+591%), Polygon (+321%) and Cardano (+254%) now have >500 Single-chain developers, and ICP (+1750%), Solana (+986%), NEAR (+829%), Cosmos (+272%), and Polkadot (+166%) now have >1000 Single-chain developers

Single-chain developer growth (~500-2000 developers): Q4 2023 vs. Q1 2020



Zooming in, we see Optimism, Celestia, and Osmosis now have >100 Single-chain devs, and zkSync (+861%), Arbitrum (+753%), Flow (+695%), MultiversX (+587%), Mina (+358%), Celo (+252%), Status (+242%), Hedera (+213%), and Algorand (+198%) were above benchmark

Single-chain developer growth (~150-500 developers): Q4 2023 vs. Q1 2020



03
Use Cases

03

Use Cases

What are the most common use cases in crypto?

We can look at on-chain data to get a better understanding.

Which types of contracts are used the most?

We can estimate this by looking at the top 15 contracts on Ethereum by gas-usage as a proxy

Highest Traffic Ethereum Smart Contracts

	Contract	Type
1	Uniswap V2: Router 2	DeFi
2	Uniswap: Universal Router	DeFi
3	Uniswap: Universal Router 2	DeFi
4	Tether: USDT Token	DeFi
5	Jaredfromsubway.eth	MEV
6	Arbitrum: Sequencer Inbox	L2
7	MetaMask: Swap Router	DeFi
8	Blur.io: Marketplace 2	NFT
9	zkSync Era: Validator Timelock	L2
10	1Inch v5: Aggregation Router	DeFi
11	Center: USDC Token	DeFi
12	Seaport 1.1	NFT
13	Maestro: Router 2	DeFi
14	Uniswap V3: Router 2	DeFi
15	Banana Gun: Router	DeFi

ELECTRIC CAPITAL

12 of the top 15 contracts were for DeFi and NFT

Highest Traffic Ethereum Smart Contracts

	Contract	Type
1	Uniswap V2: Router 2	DeFi
2	Uniswap: Universal Router	DeFi
3	Uniswap: Universal Router 2	DeFi
4	Tether: USDT Token	DeFi
5	Jaredfromsubway.eth	MEV
6	Arbitrum: Sequencer Inbox	L2
7	MetaMask: Swap Router	DeFi
8	Blur.io: Marketplace 2	NFT
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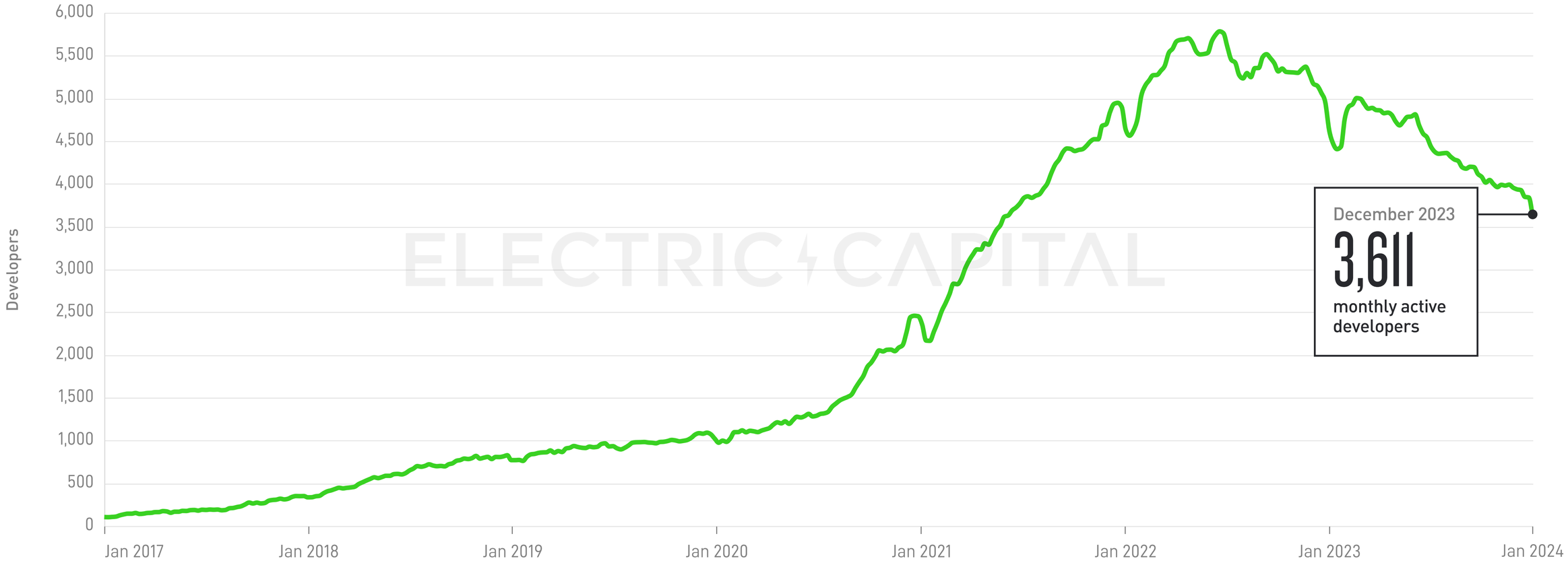
12	Seaport 1.1	NFT
13	Maestro: Router 2	DeFi
14	Uniswap V3: Router 2	DeFi
15	Banana Gun: Router	DeFi

DeFi

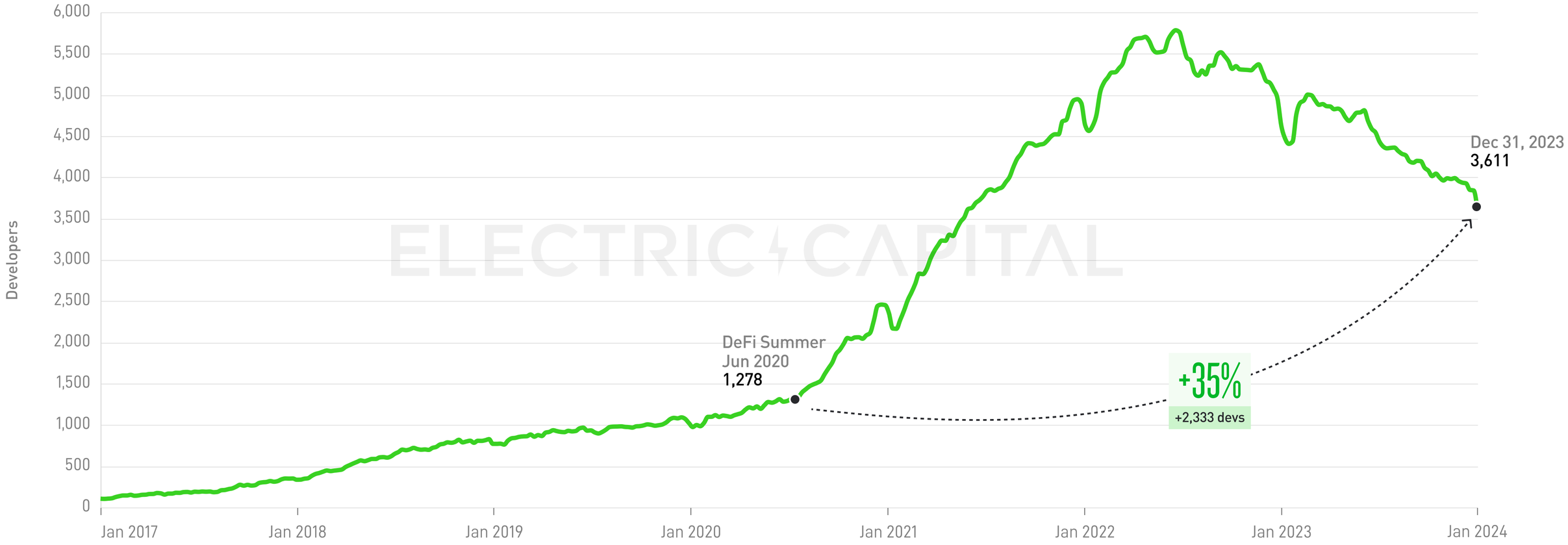
3,611 monthly active developers worked on DeFi

DeFi monthly active developers



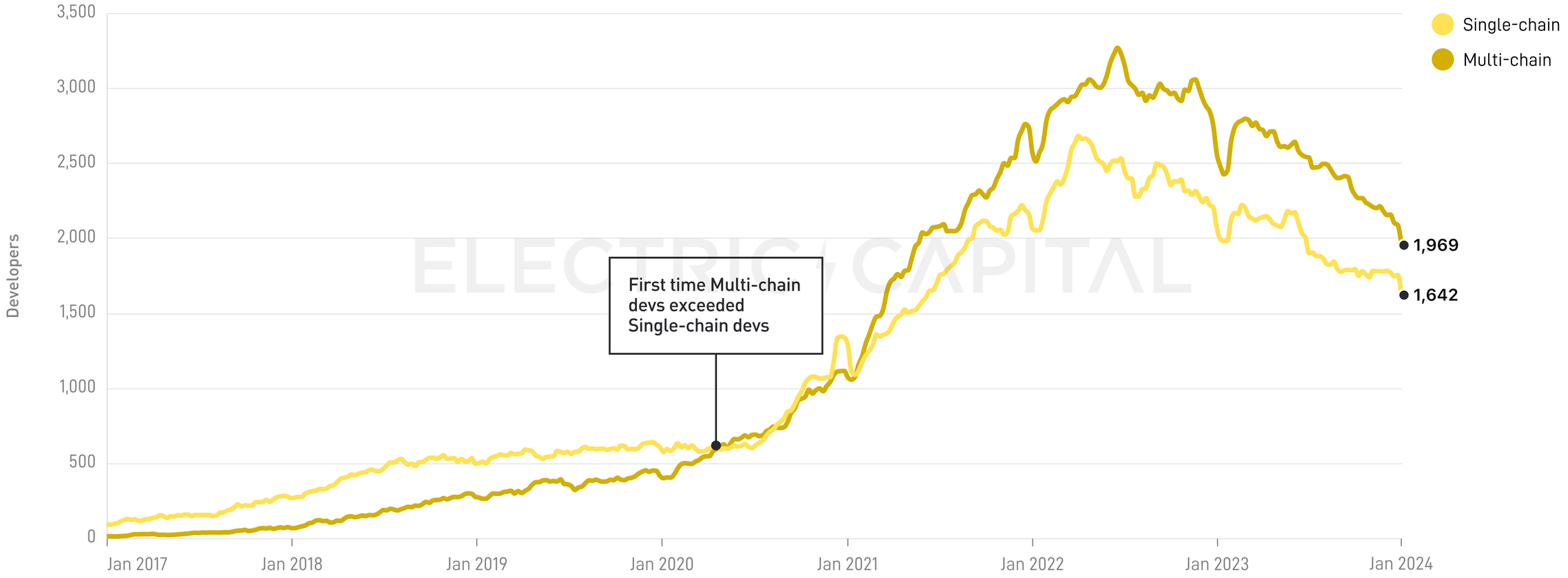
The number of DeFi developers has grown +35% annualized since DeFi Summer in 2020

DeFi monthly active developers



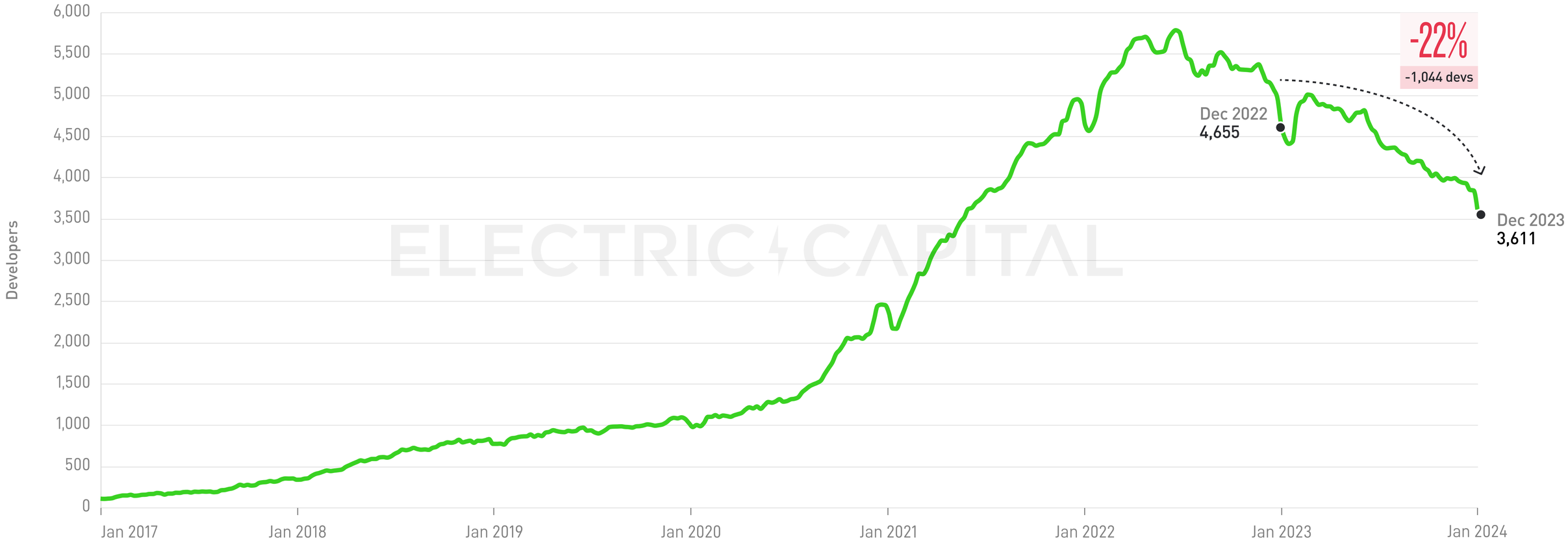
Unlike base chains, most DeFi devs are Multi-chain

DeFi monthly active developers: single-chain vs. multi-chain



The number of DeFi developers fell -22% in 2023

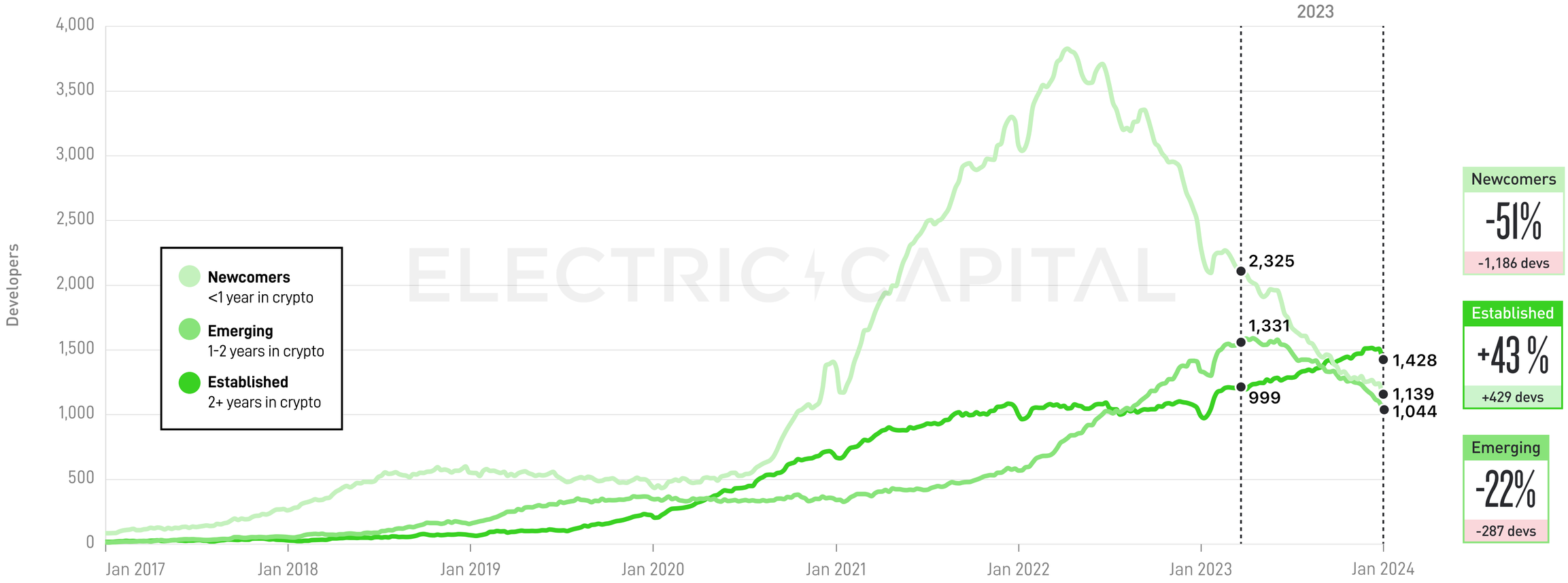
DeFi monthly active developers



Most of the decline came from Newcomers who left

Established devs grew +43%, Newcomers fell -51%, & Emerging devs fell -22%

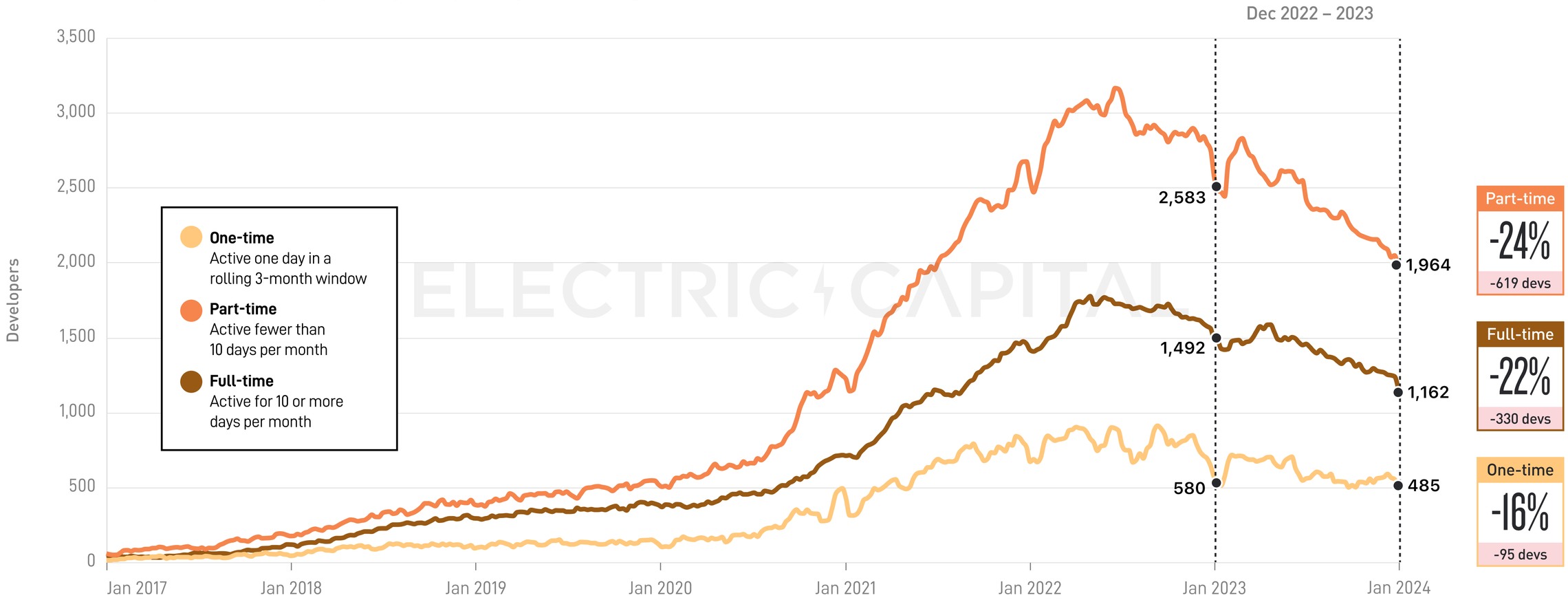
DeFi monthly active developers by tenure



57% of developers who left were Part-time

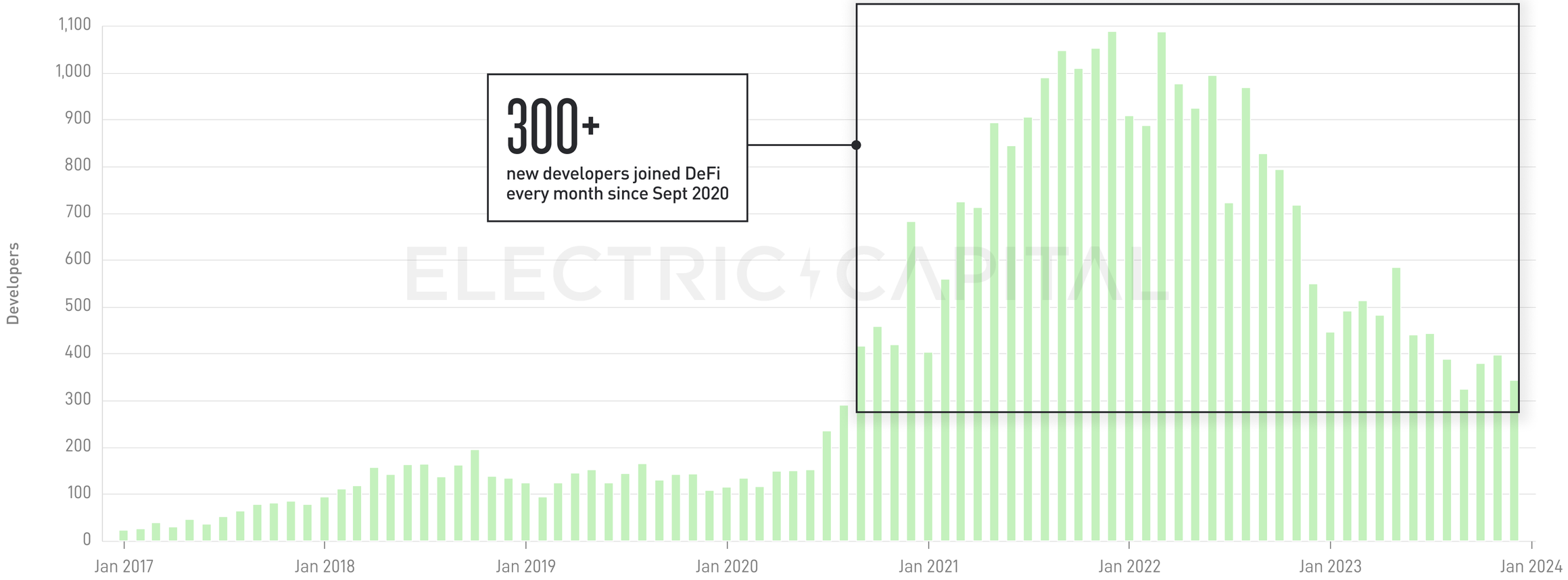
Part-time devs fell by -619 devs, Full-time devs fell by -330 devs, and One-time devs fell by -95 devs

DeFi monthly active developers by frequency of activity



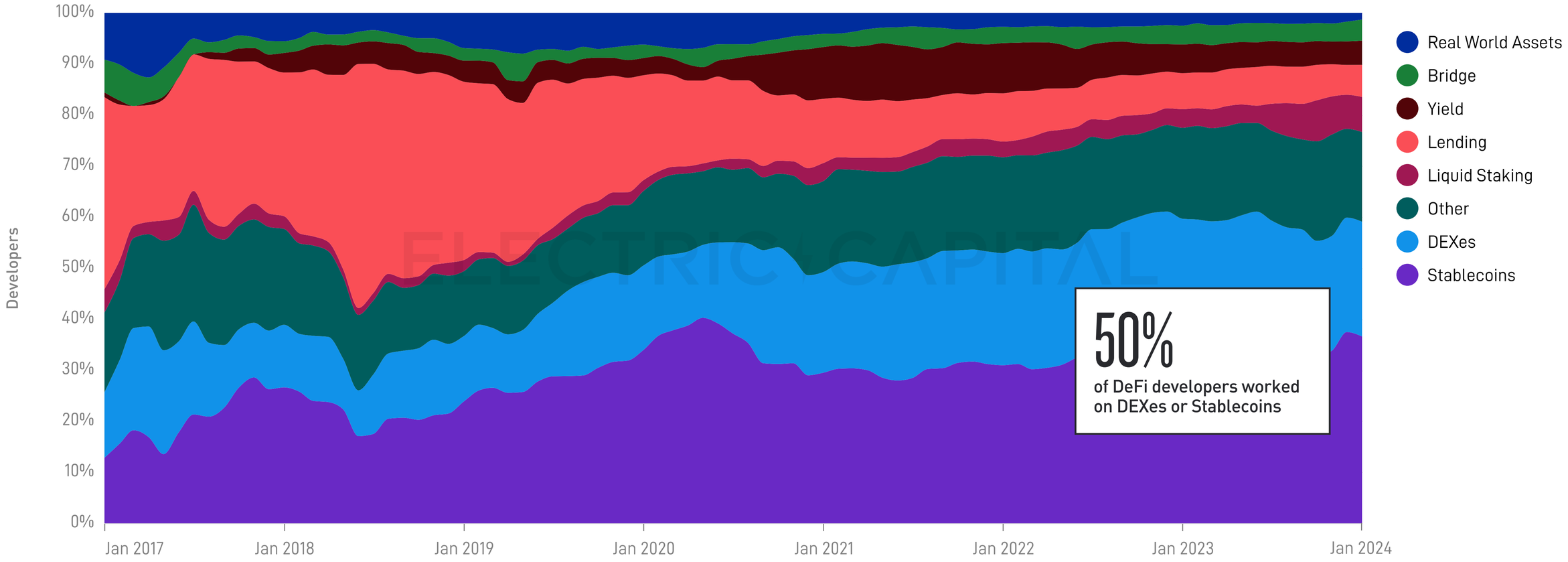
More than 300 new developers have joined DeFi every month since Sept 2020

DeFi new developers



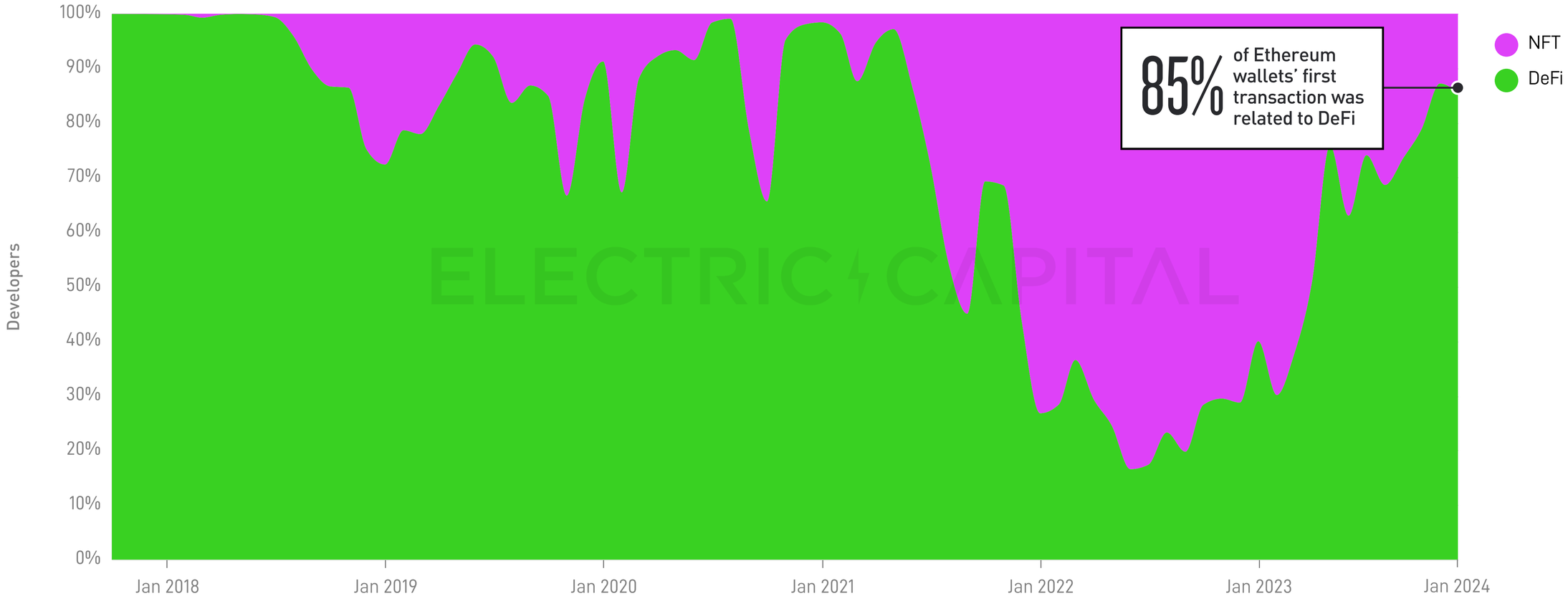
50% of DeFi devs worked on Stablecoins or DEXes

Distribution of DeFi developers working in different application areas over time



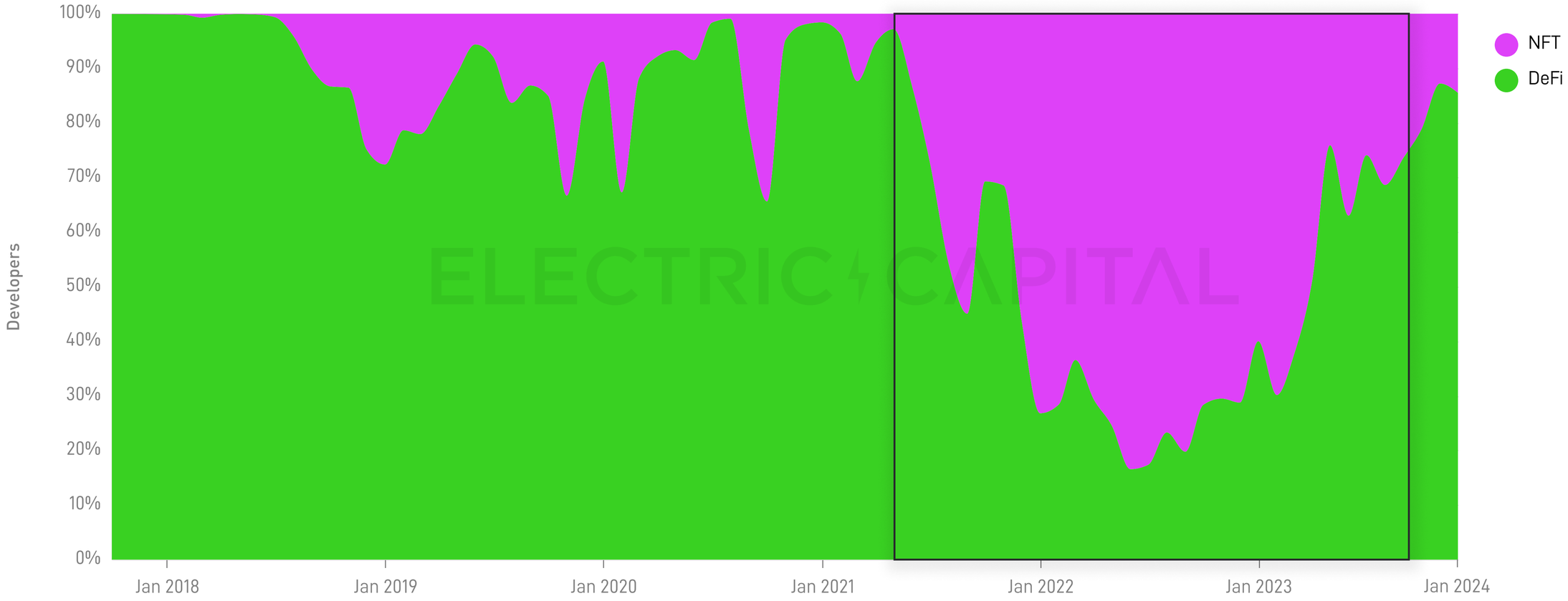
By the end of 2023, 85% of Ethereum wallets' first transactions were related to DeFi

Distribution of Ethereum developers working on NFT and DeFi projects



From 2021 to 2023, first transactions were more likely to be related to NFTs, but that is no longer the case

Distribution of Ethereum developers working on NFT and DeFi projects



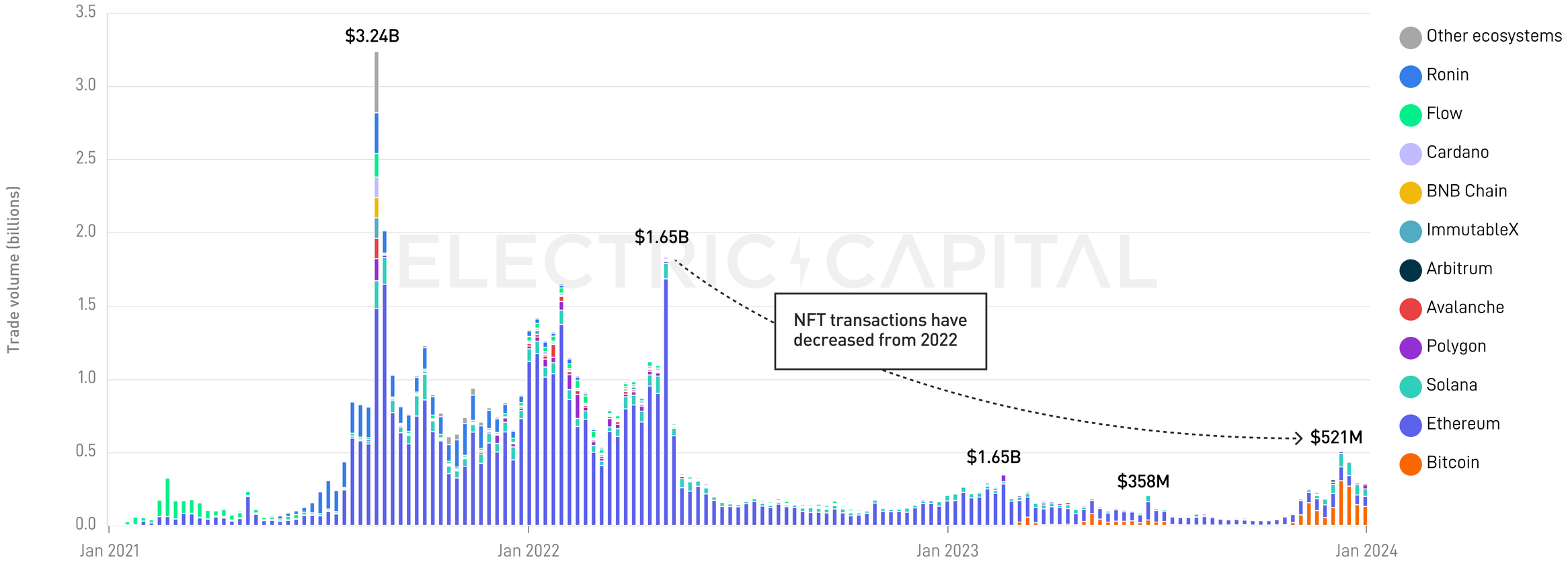
What happened to NFTs?

03
Use Cases

NFTs

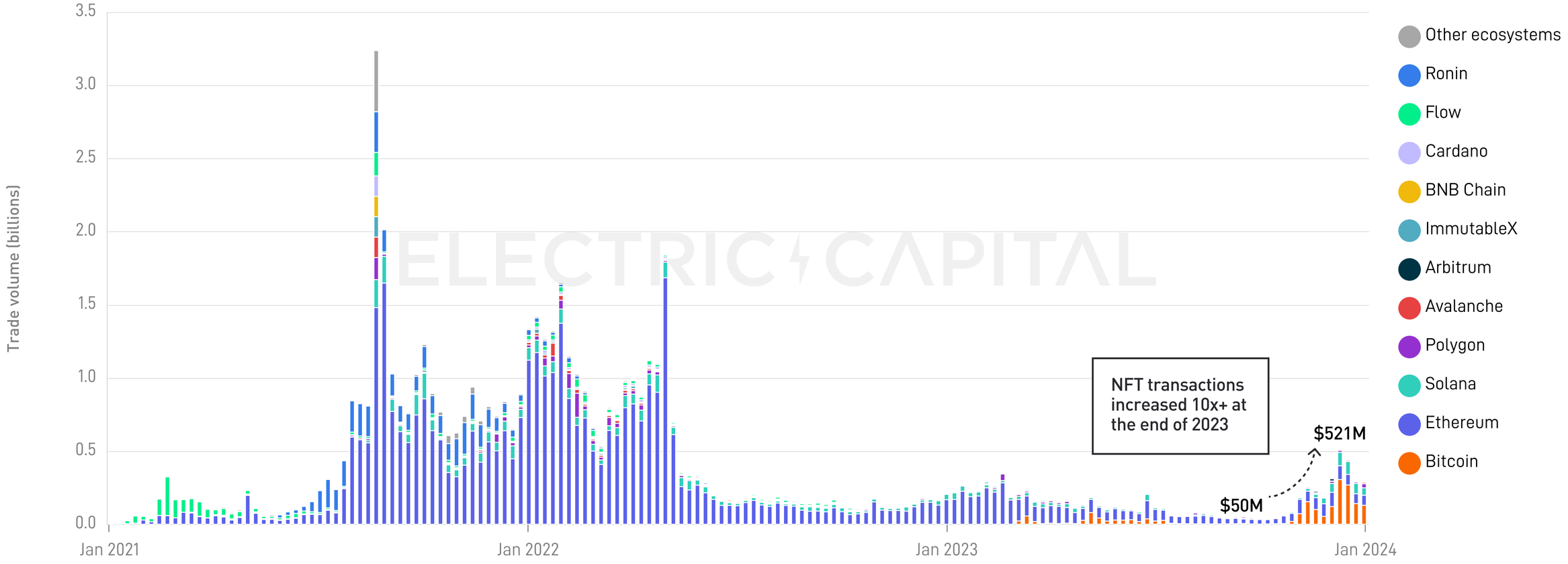
NFT transactions volume is down from 2022 highs

NFT trade volume on different chains



NFT transactions are starting to increase again

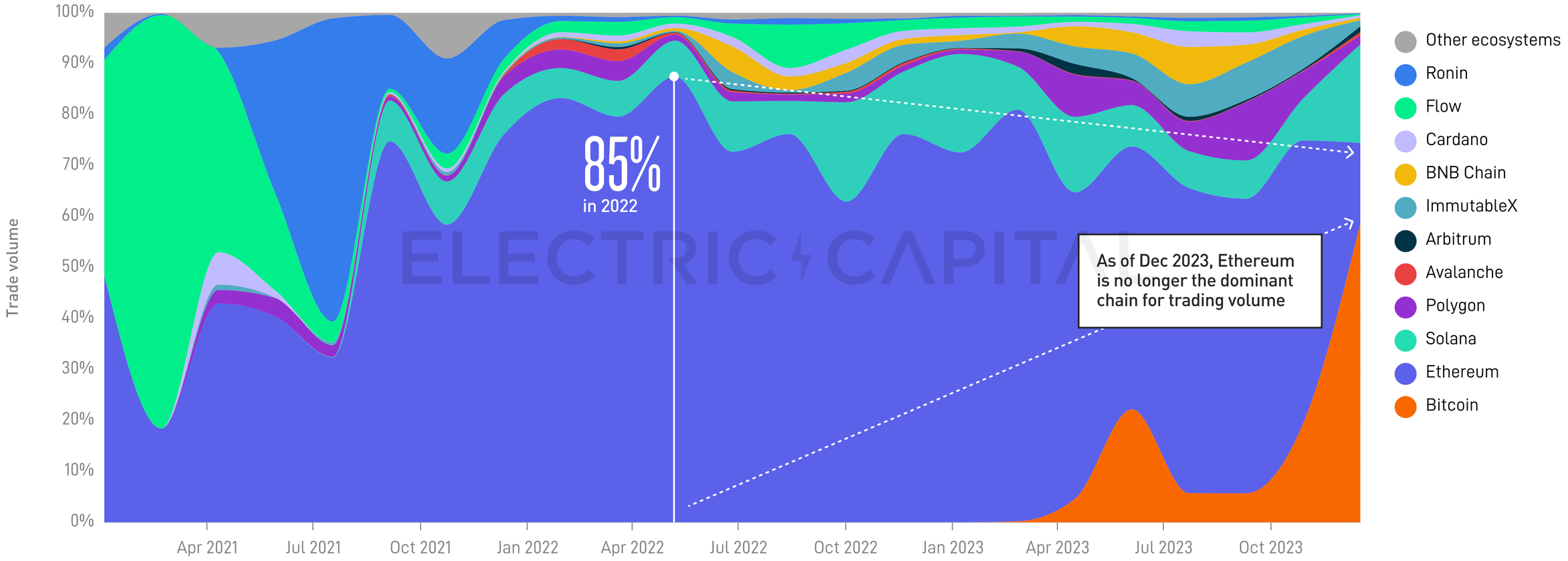
NFT trade volume on different chains



Though NFTs are resurging, Ethereum no longer dominates trading volume

Bitcoin and Solana have greater NFT trading volume than Ethereum

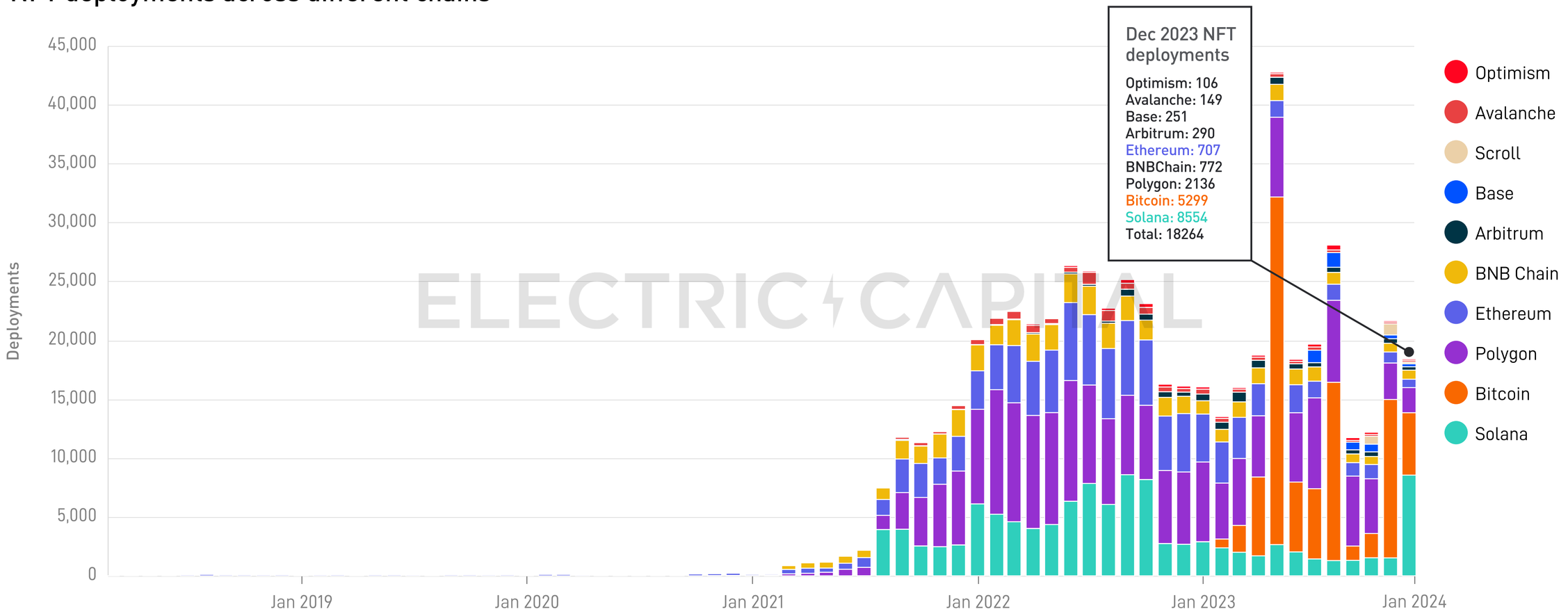
NFT trade volume on different chains



Like NFT transaction volume, are NFT developers shifting their activity (measured by deployments) from Ethereum to Bitcoin and Solana?

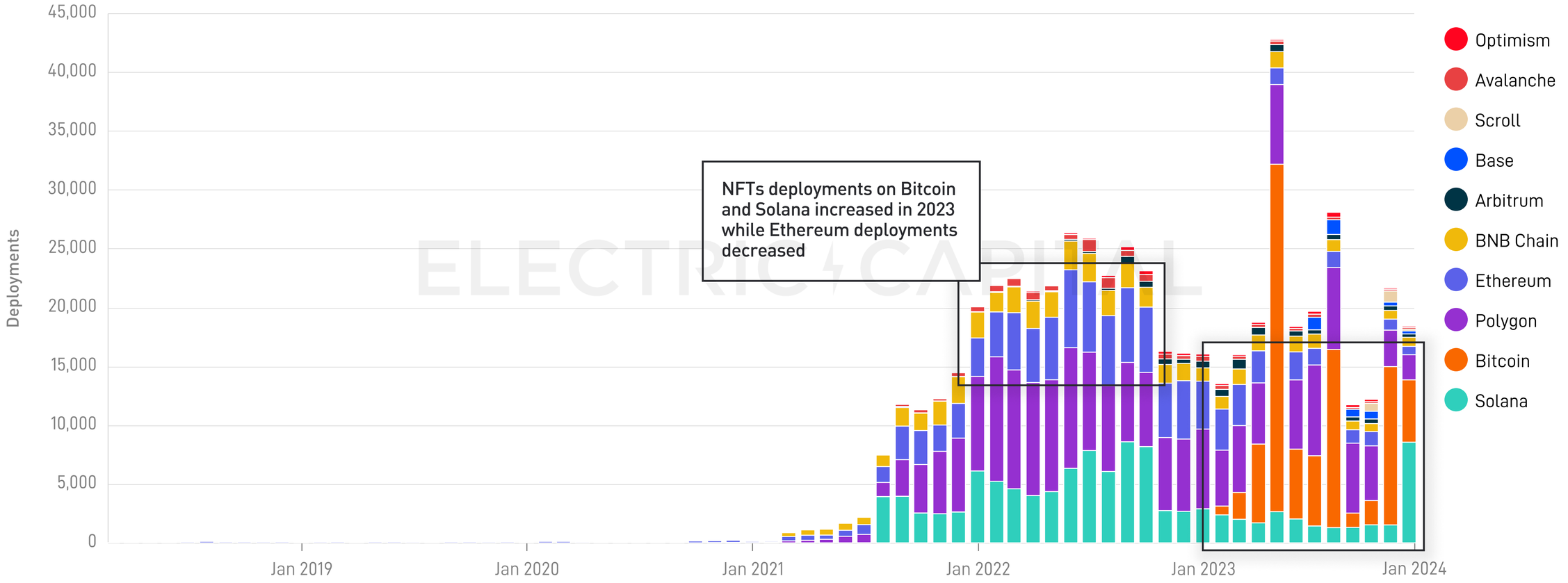
There were 14,560 NFT deployments across Bitcoin, Solana, and Ethereum at the end of 2023

NFT deployments across different chains



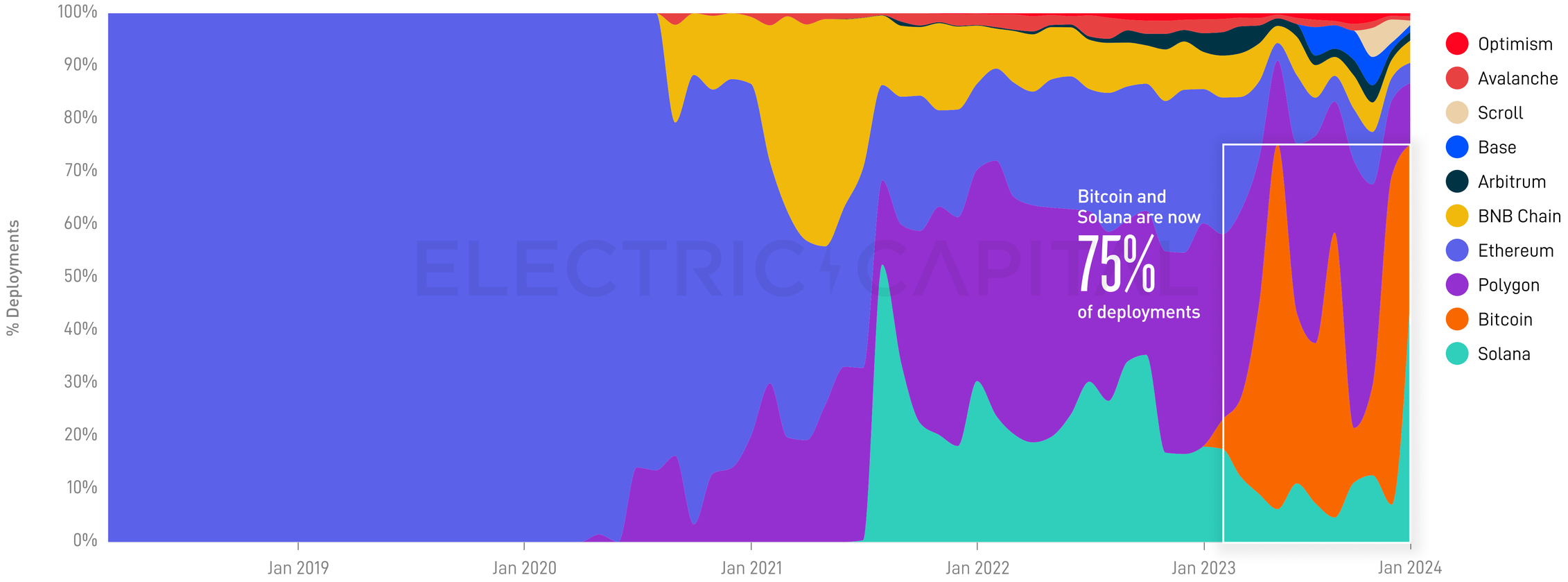
Ethereum NFT deployments are at lows while Bitcoin and Solana NFT deployments are at historical highs

NFT deployments across different chains



Bitcoin and Solana reached 75% of NFT deployments at the end of 2023

NFT deployments across different chains



04

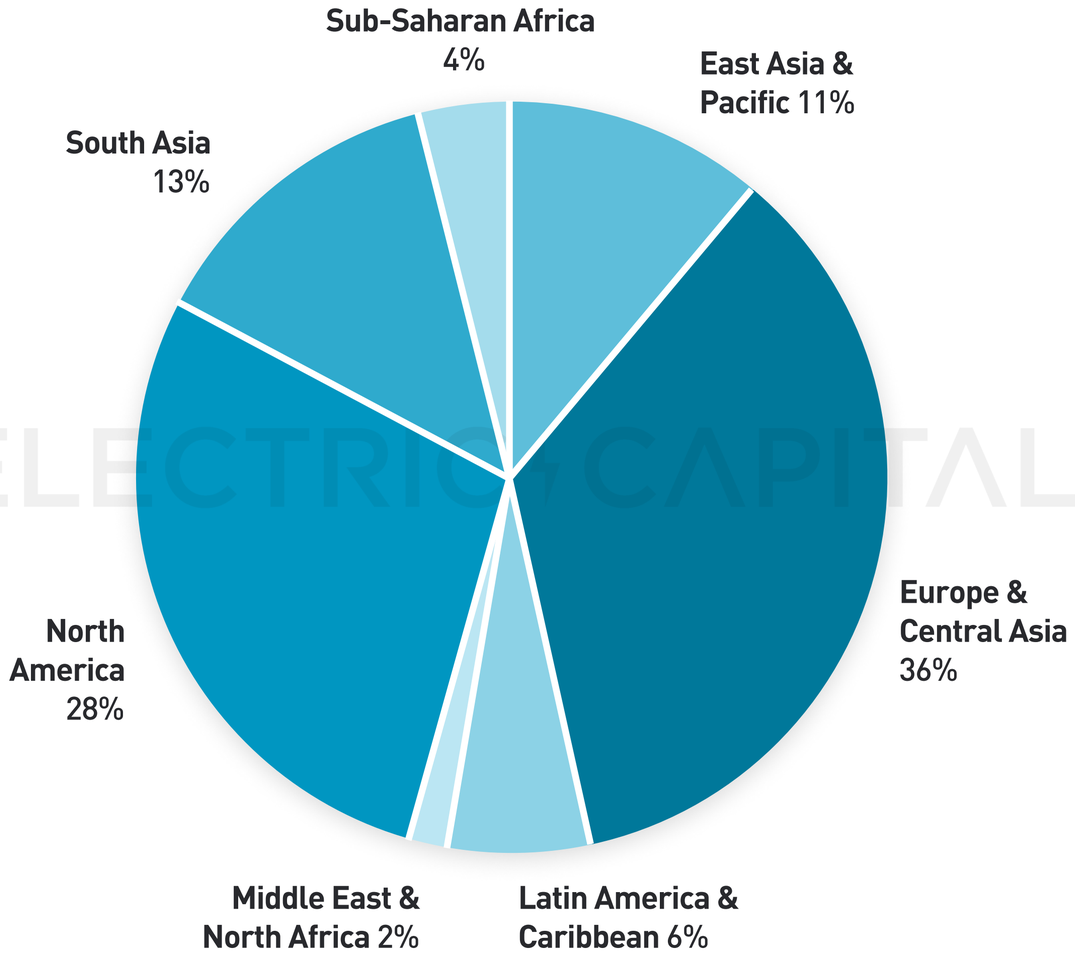
Developers in Context

Where are crypto developers located around the world?

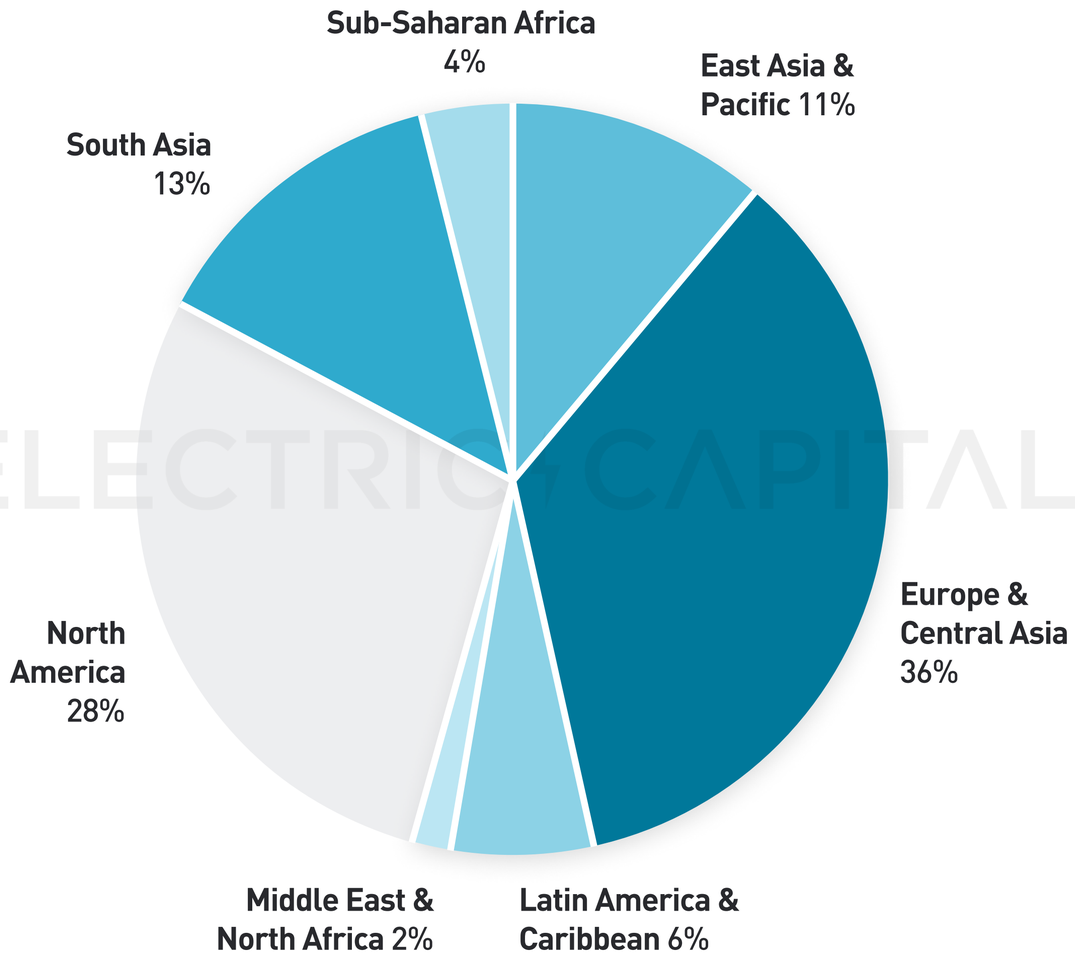
We looked at the self-reported location data for 25K developers...

There are several hubs of crypto developer activity worldwide

North America, Europe, and Asia have the largest share of developers, accounting for 88% of developers

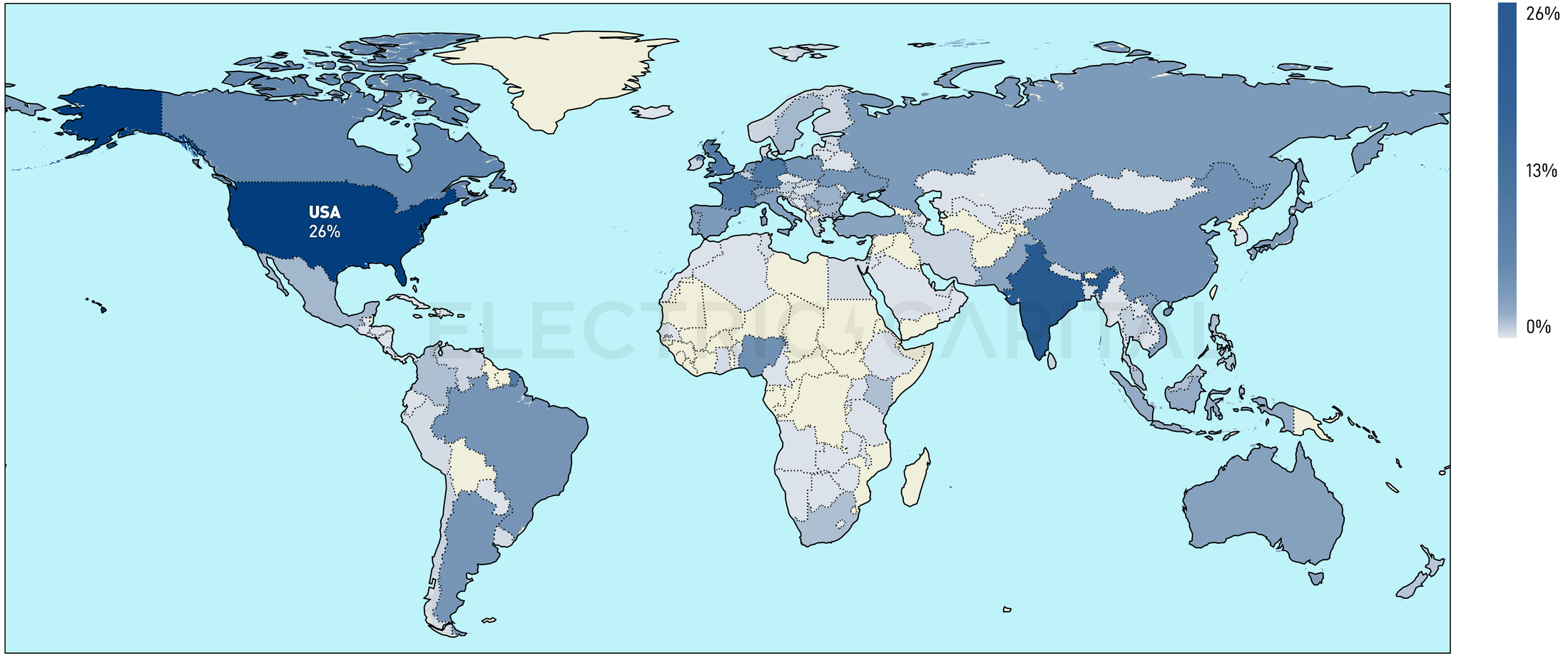


72% of crypto developers live outside of North America



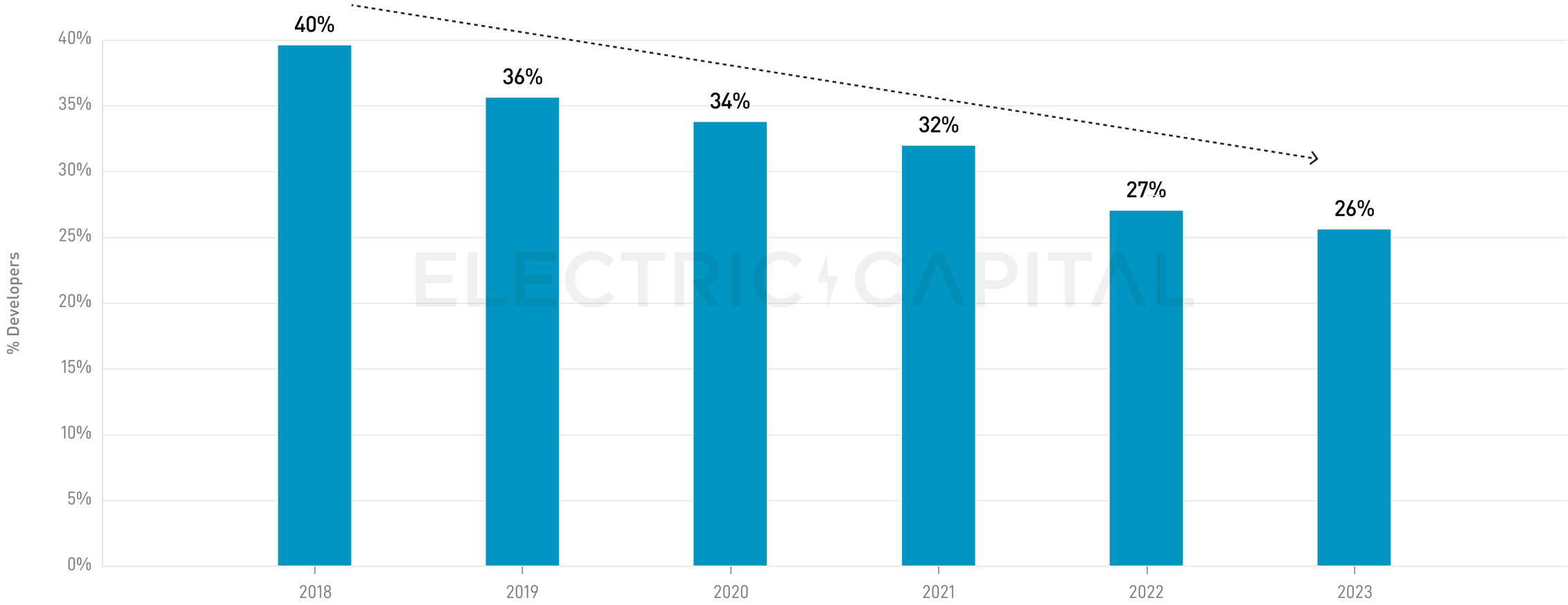
74% of crypto developers live outside of the US

India has a 12% share of crypto developers while the UK, Germany, and France each have >5%



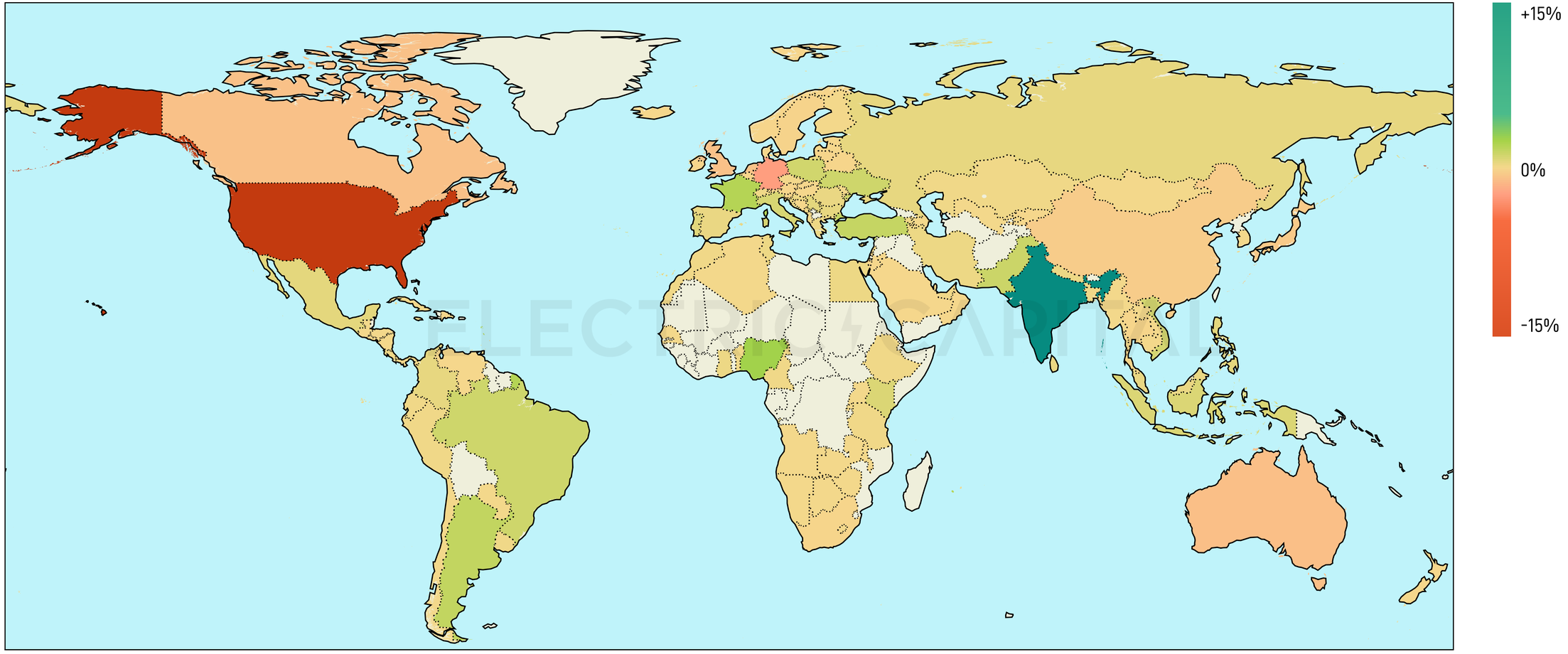
While the developer ecosystem is up 2x compared to 2018, the US lost 14% developer share (40% in 2018 to 26% in 2023)

Percent of crypto developers in the United States



The distribution of developers changed meaningfully since 2018

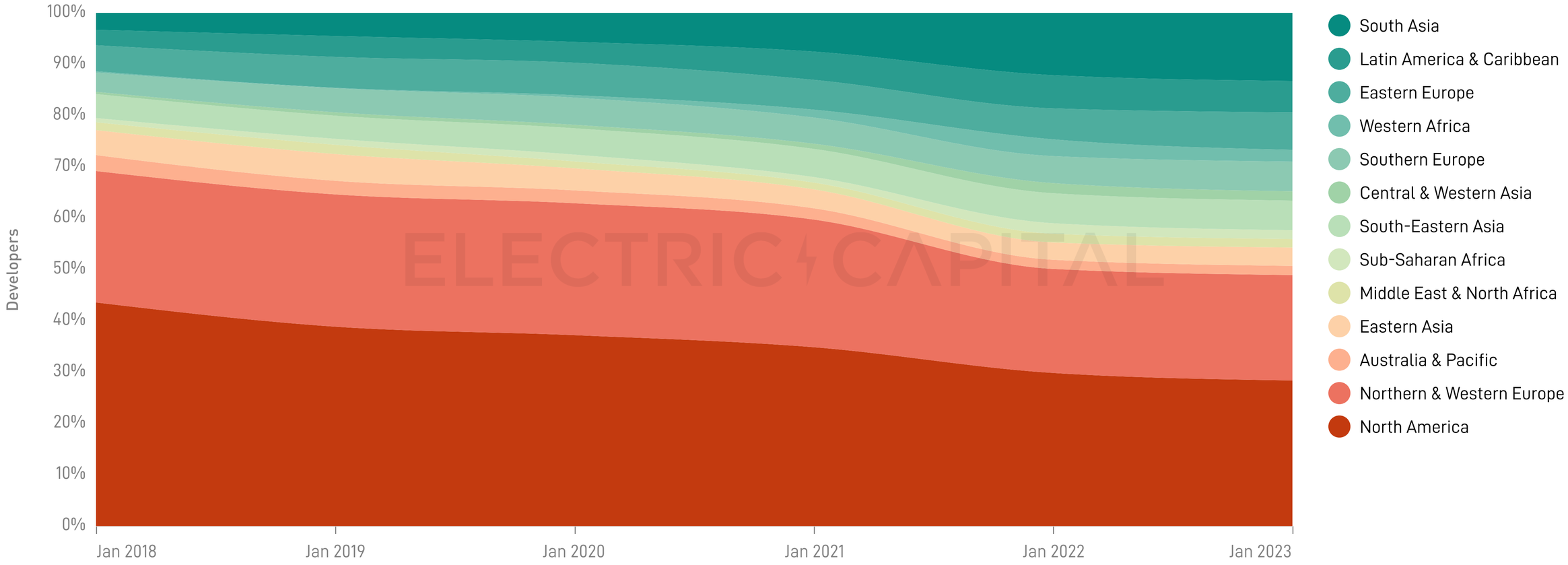
The US, Germany, Australia, UK, and Canada lost share while India, Nigeria, France, and Argentina gained



Developers shifted out of North America and Europe since 2018

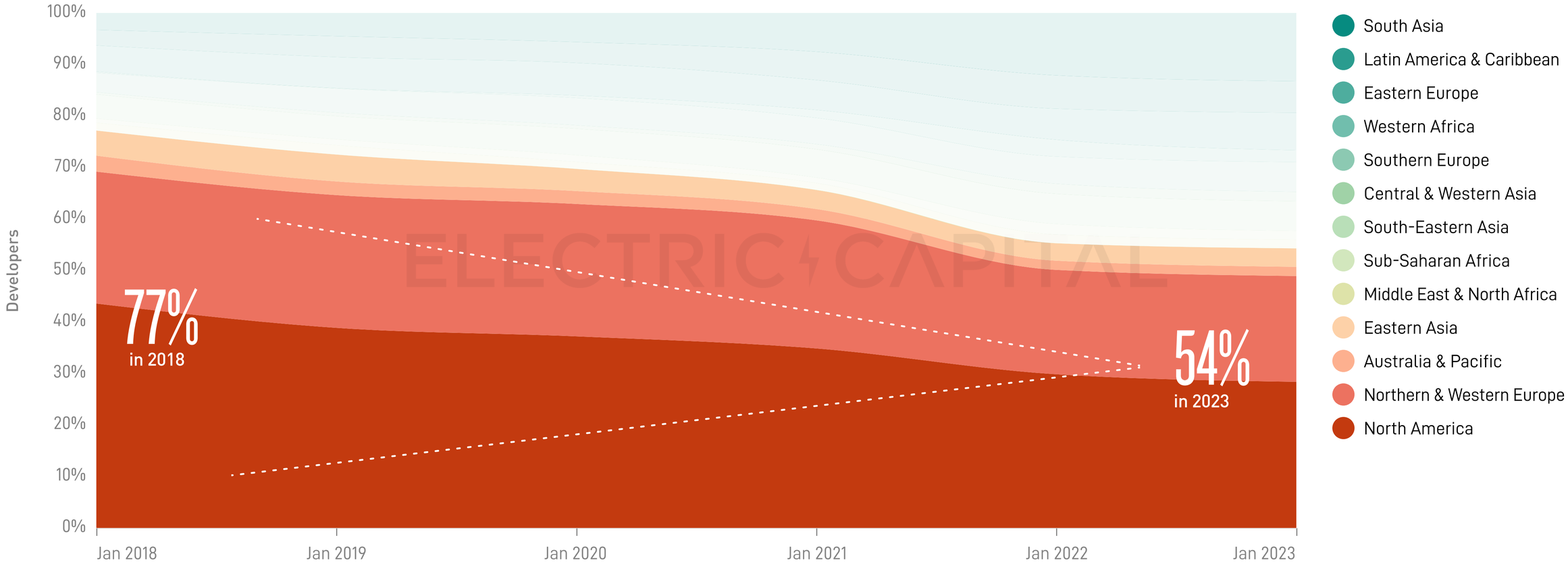
Many emerging markets have grown share while North America, Northern & Western Europe have lost share

Regional distribution of all crypto developers over time



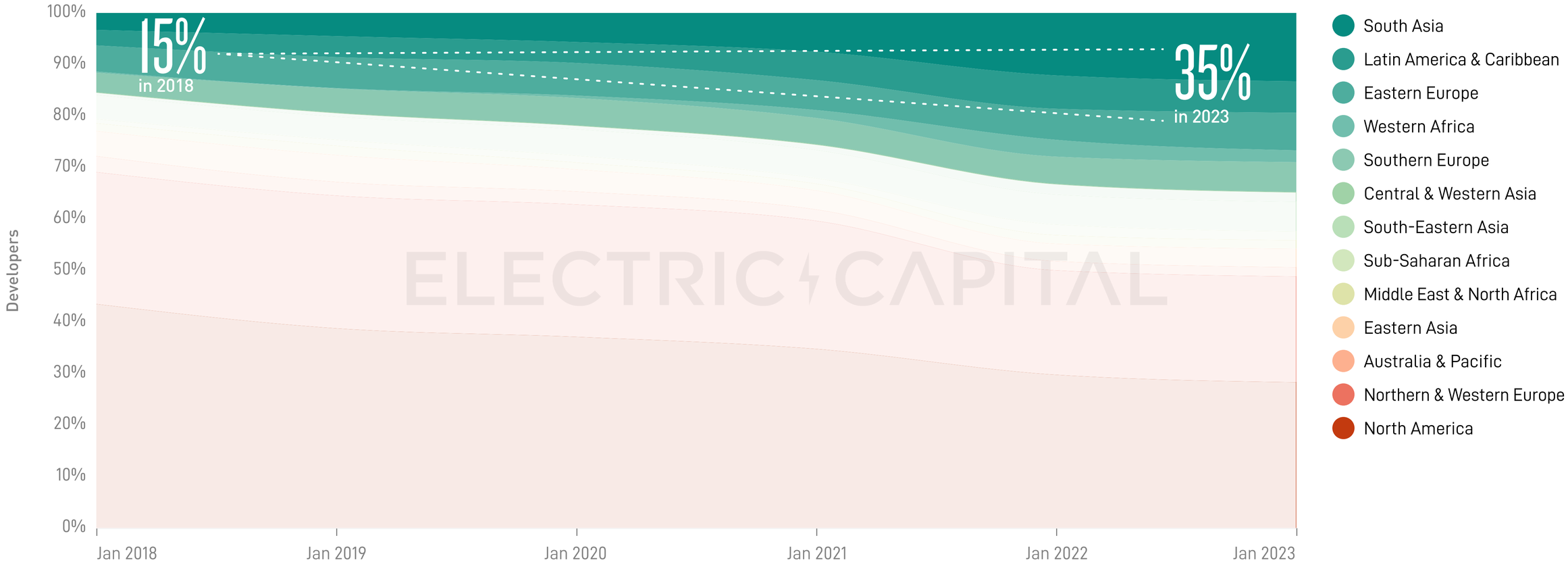
North America, Northern & Western Europe, Australia & Pacific, and Eastern Asia collectively lost -23% share since 2018

Regional distribution of all crypto developers over time



South Asia, Latin America, Eastern Europe, Western Africa, and Southern Europe collectively grew share by +20% since 2018

Regional distribution of all crypto developers over time



05
Appendix

Definitions

Developers: We count original code authors as developers. This means that a developer who merges a pull request is not an active developer on the project, but the original authors of the commits are.

Open-source Developers: Developers who contribute to publicly available source code

Monthly Active Developers: Unique developers who committed code at least once in the past 28 days

Newcomers: Developers whose first contribution was within 365 days of the specified date (less than or equal to 1 year)

Emerging Developers: Developers whose first contribution was 366 to 730 days prior to the specified date (1-2 years)

Established Developers: Developers whose first contribution is more than 730 days prior to the specified date (>2 years)

Single-chain Developers: Developers who work on a project(s) that supports only one chain

Multi-chain Developers: Developers who either a) work on a project(s) that supports multiple chains, or b) work on multiple projects, supporting more than one chain

Contract Deployer: Address from which a smart contract is deployed

Full-time Developers: Contributed code 10+ days out of a month

Part-time Developers: Contributed code fewer than 10 days out of a month

One-time Developers: Contributed code once in a rolling 3-month window

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Contributing to the Report

Finally, one last thank-you to all participants in the open-source community. To date, we've had over 500 contributors, with new participants contributing every year.

Submit a pull request in our GitHub:
github.com/electric-capital/crypto-ecosystems

This data continues to help fuel DeveloperReport.com every year.

See you all next year!