



Unlocking Sustainability at Scale

With Static Site Generation and Composable Architecture

7 March 2024

Novicell



Mikkel Keller
Chief Technology Officer
Novicell UK

\$WHOAMI

Seasoned software architect with a computer science background and deep roots in the Internet.

25 years of experience in the industry.

Comprehensive knowledge of Internet technologies, software principles, patterns and enterprise architecture.

A special love for all things digital



Topic of the day

A practical deep dive into the technical intricacies of unlocking sustainability at scale for a global website with thousands of composed pages.

Introducing the case

A real life-sized project – not a toy story

About AlixPartners

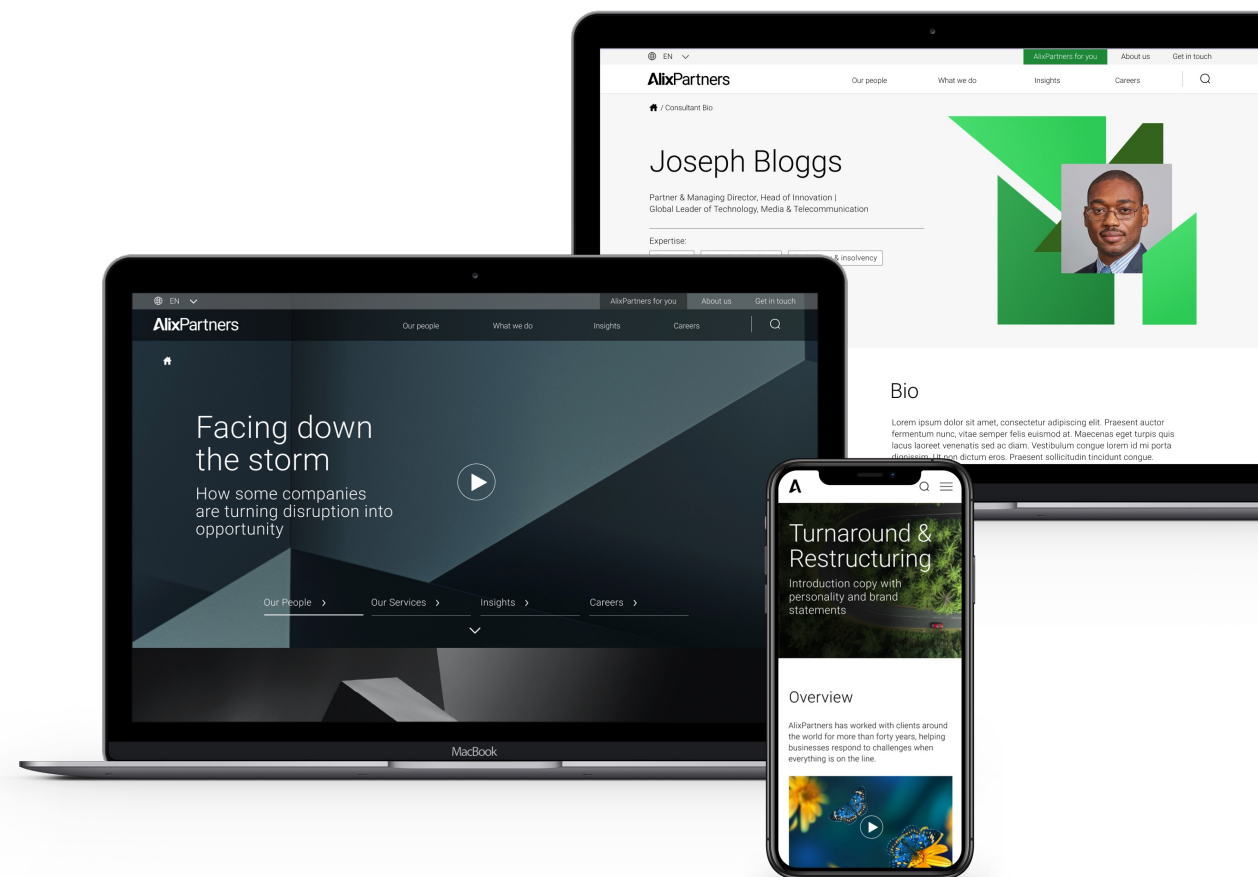
AlixPartners is a global consultancy firm headquartered in New York, working at the leading edge of corporate strategic thinking.

The high-level brief

The aim is to develop a sustainable, modern, elegant and seamlessly integrated brand experience that articulates and demonstrates our proposition to clients.

Our website needs to showcase our firm, our work, our people, and the opportunities we have for talent.

AlixPartners



Let's break that down

AlixPartners

High-level translation of the brief

A global consultancy

- Globally available, performant and secure corporate website.
- Multi-lingual with regional subsites.
- Distributed editorial team.

Showcase our firm, our work, our people, and the opportunities we have for talent

- Content and data from various systems and integrations.

- Corporate content (250+ pages)
- News and events (1400+ pages)
- Biographies (1000+ pages)
- Insights and articles (1400+ pages)
- Vacancies (100+ pages at any time)

A sustainable, modern, elegant, and seamlessly integrated brand

- Integrated on-site experience.
- Findability and relevance.
- Sustainable platform.

Sustainability by design

And how this maps to website platform architecture

Sustainable (product) design strategies

What can we learn?

Circular economy:

The impacts the product will have across its full life cycle.

Provisions should be made to ensure options for maximising the product's value across its full life cycle and keeping materiality in a value flow.

Patterns:

- Dematerialisation.
- Recyclability.
- Repairability.
- Reusability.
- Disassembly.
- Longevity.
- Efficiency.
- Modularity.

Anti-patterns:

- Design for obsolescence.
- Design for disposability.
- Dark Patterning:
Psychological nudging,
urgency, doom scrolling, etc.

How does this map to software design?

Dematerialisation

- Less content, fewer pages, fewer words, fewer digital assets, fewer and darker colours.
- Content and brand strategy.

Recyclability

- Software itself is not typically recyclable but can promote recyclability by using open-source code and reusable components.

Repairability

- Designing software with a modular architecture promotes easier "repair" of issues, upgrades and maintenance.
- Postponing a rebuild.

Reusability

- Emphasising the creation of modular, reusable components that can be leveraged across different applications

Disassembly.

- A well-targeted and well-scoped microservices can be reused in future projects.
- Moving from monolithic to microservice architecture

Longevity

- Backward compatibility, version support, and long-term maintenance.
- Composable architecture embraces change and thereby postpones the end of life.

Efficiency

- Optimising resource usage and performance to minimise environmental impact.
- Code optimisation, algorithmic efficiency, energy consumption, and resource utilisation.

Modularity

- Modular design supports sustainability by enabling software systems to adapt to changing requirements, technology trends, and environmental constraints over time.

The 3 classic sustainable software areas

- Hosting and storage = infrastructure.
- Processing and compute = Infrastructure + software architecture and system design.
- Transfer and size = software architecture and system design.

Disclaimer:

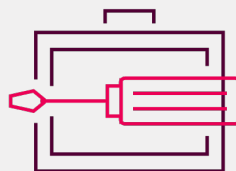
- Today will be a practical guide to sustainable software design rooted in a real-life example.
- Mostly about system and data architecture.
- Less about hosting and storage.
- Less about frontend frameworks.

Sustainable pre-requisites and tactics



01 – Compose content

- True headless and federated content layer.
- Aggregate and cross-pollinate content and data from multiple systems.
- Dedicated microservices for ingestion of content and data.
- Publish-time pre-processing over request-time processing and caching.



02 – Expose content

- Multiple source APIs reduced to a single content delivery API.
- Preparing a page for static site generation requires ALL content and global elements, contrary to a single-page application where content can be reused.
- Efficient delivery of page data in a single request.
- Efficient delivery of all routes.
- Efficient bulk API for delivering content for routes in a single API request.



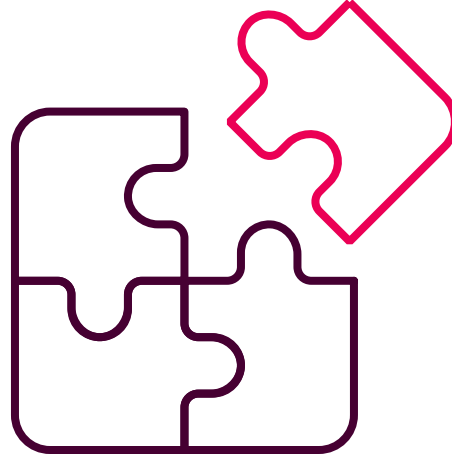
03 – Generate static site

- Effective frontend build and static site generation process.
- Ability to generate a full and partial static site and know when to apply which.
- Strategies to reduce the number of static site generation requests.
- Composable automation vs manual trigger by editors.
- Editor friendly.



1. Content composition

Sustainable data pre-processing



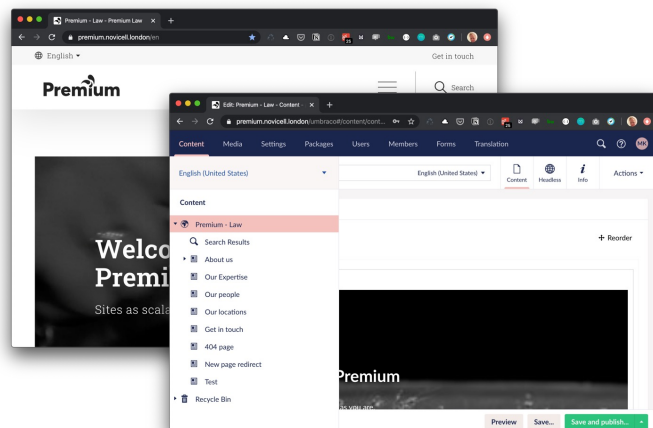
Enabler **True 'headless'**

How to achieve the composition of platforms and services to enable a seamless and fully integrated user experience

Nowhere near headless

CMS and website are together as one – together, they will live, and they will die.

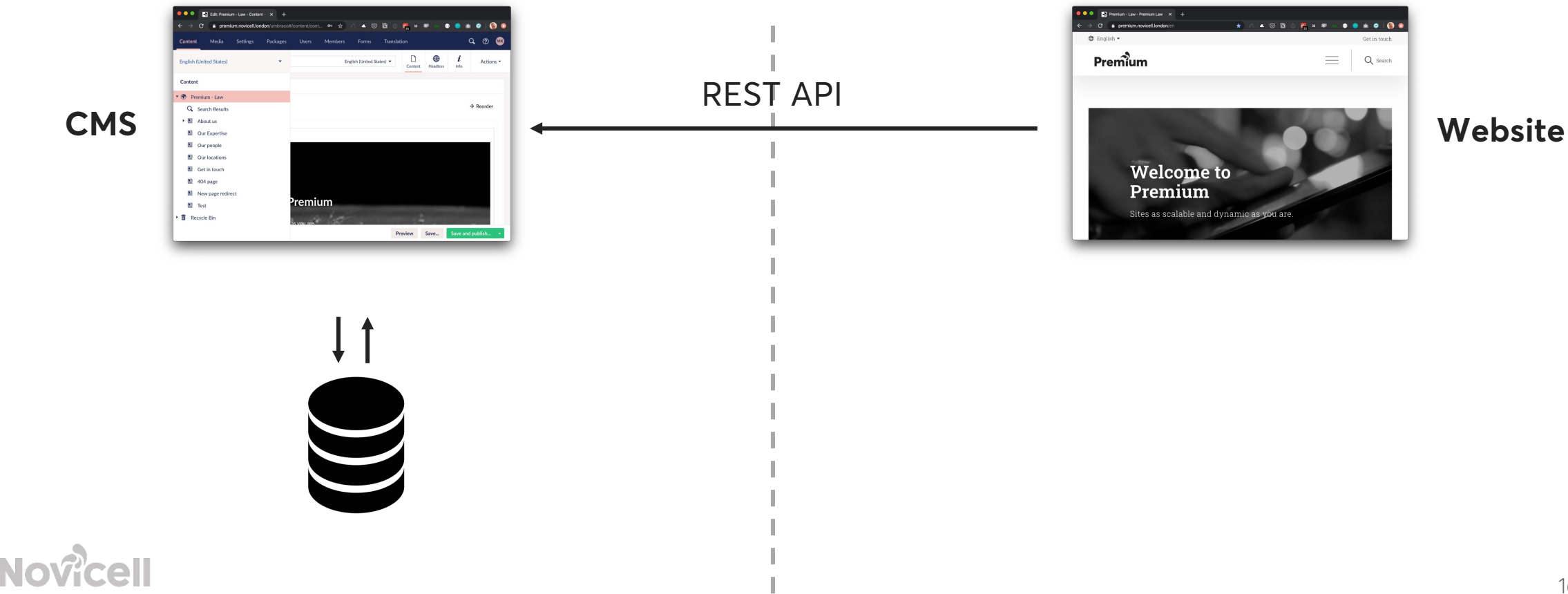
Website & CMS



Database

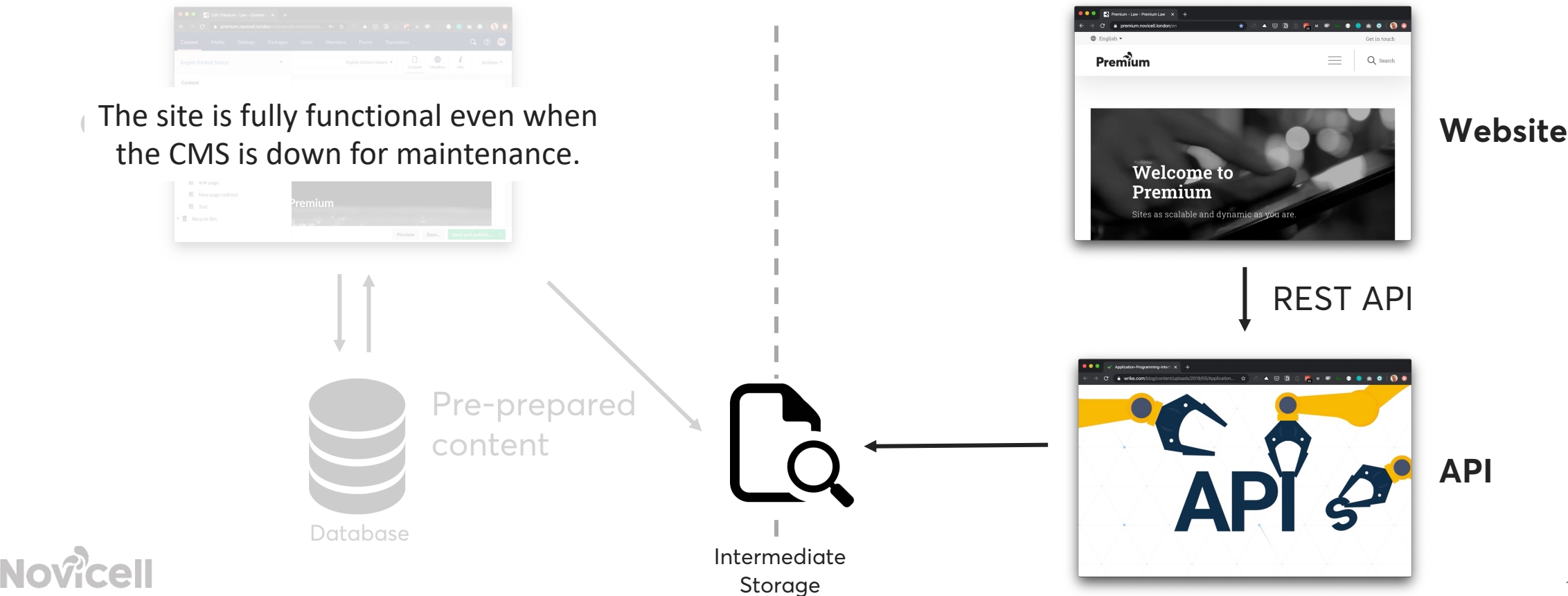
Headless

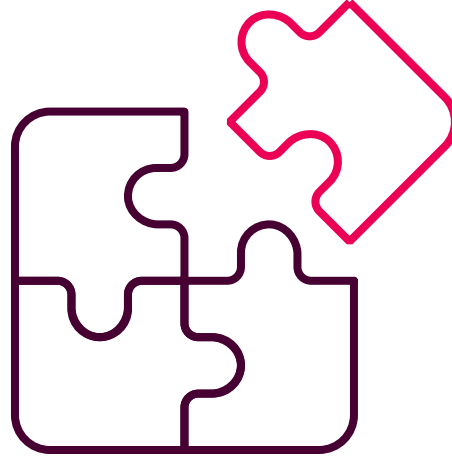
The CMS and website are two different systems.



True headless

Separation of the website and the CMS with indirection.





Enabler

Content federation layer

How to achieve the composition of platforms and services to enable a seamless and fully integrated user experience

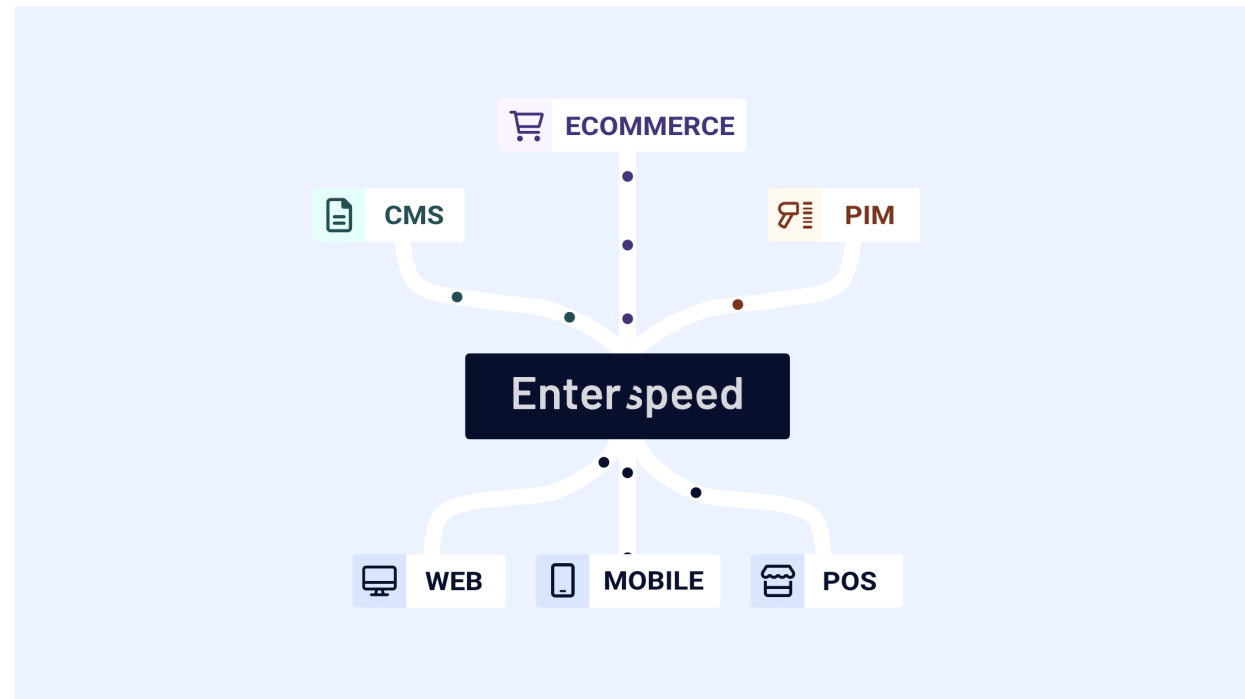
Content federation

Content federation as a service

- A headless, tech-agnostic infrastructure.
- Centrepiece in composable architecture.
- Blazingly fast.
- Sustainable.
- If microservices are Lego, Enterspeed is the building system.

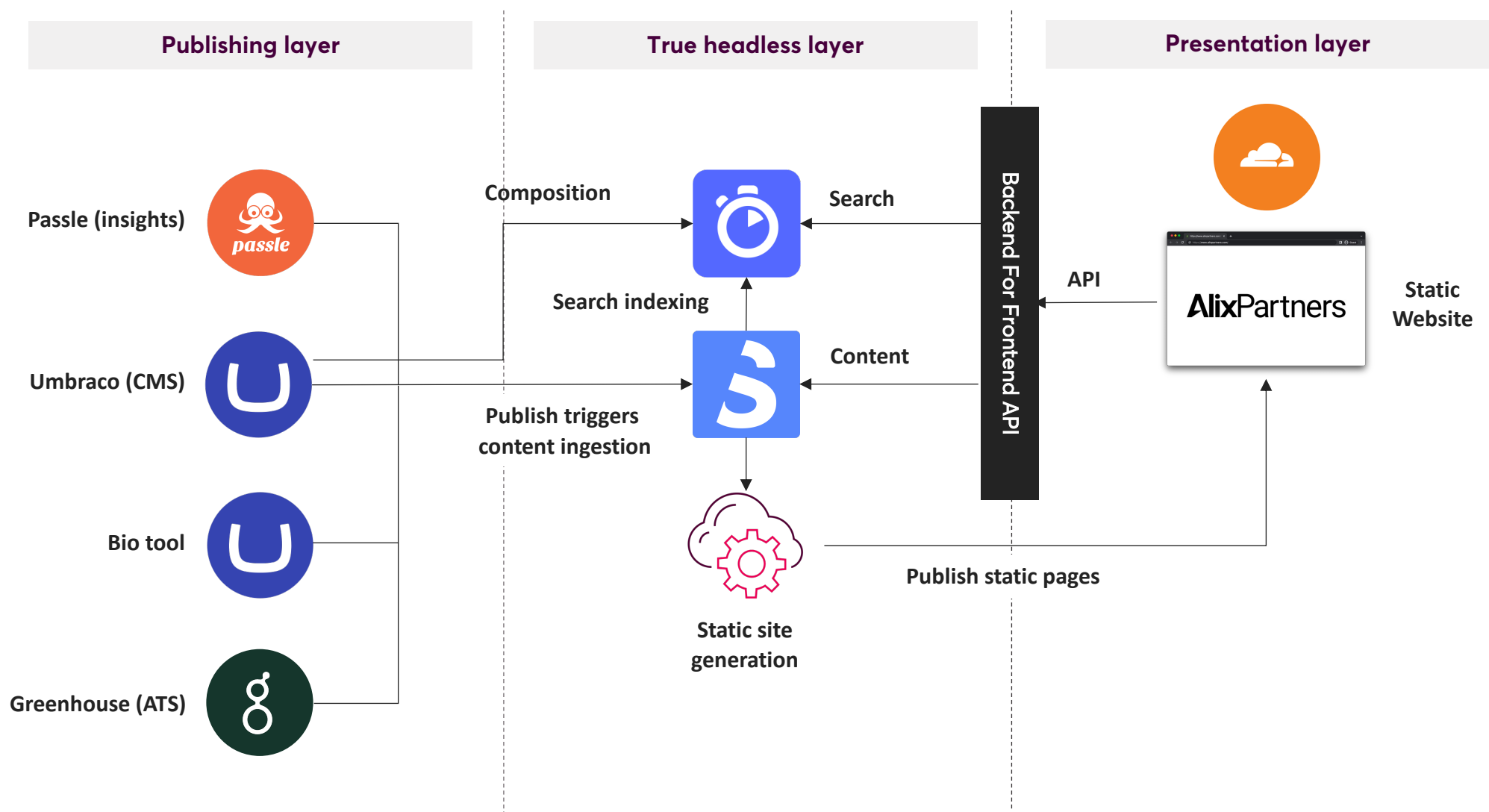


Enterspeed provides software as a service tool for implementing headless at scale with any system, any source, anywhere.



Composable architecture with static site

Composable architecture

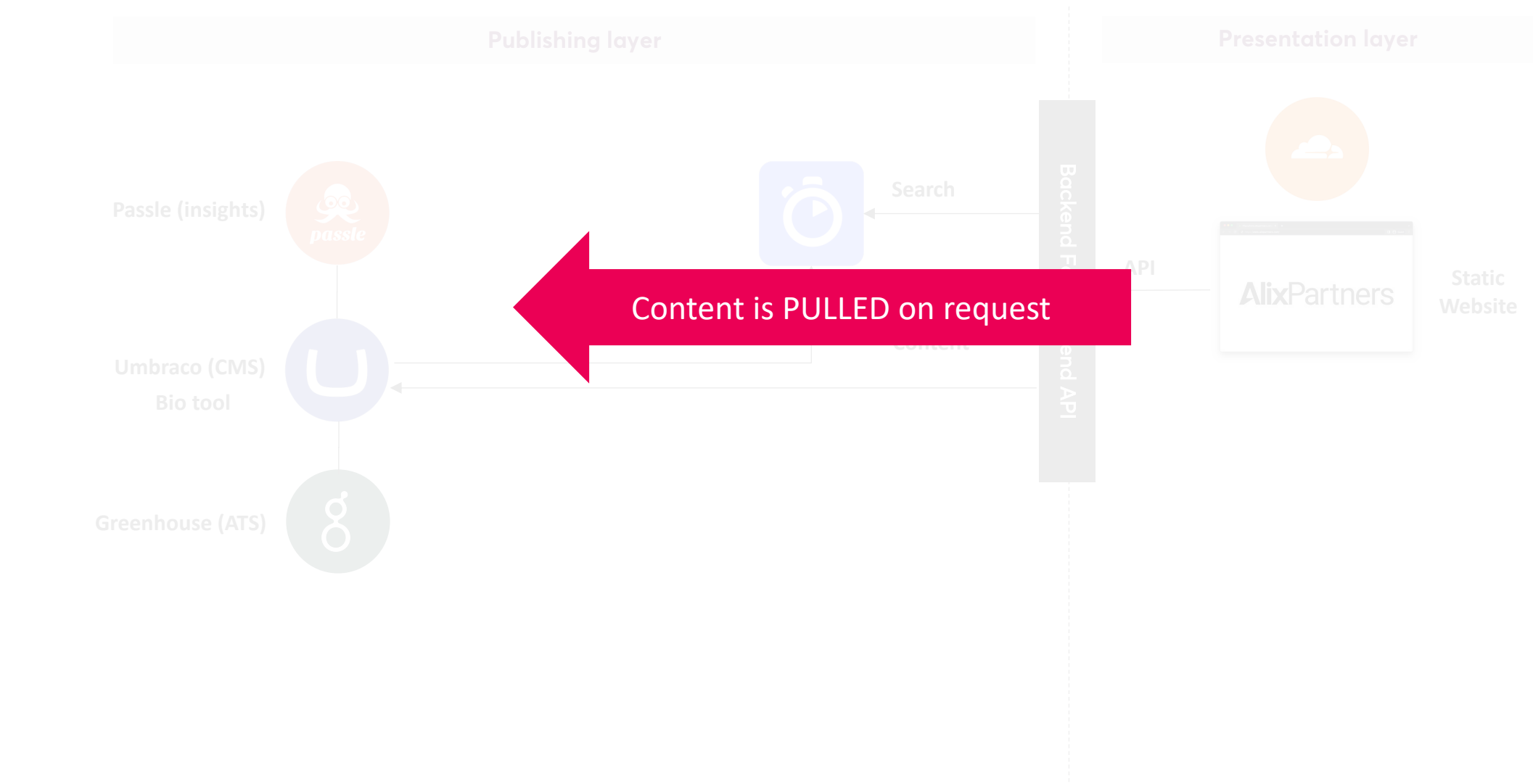


Publish time pre-processing

Intelligent pre-processing of page data at publish time - processing once, when content is created and updated, rather than processing on every request

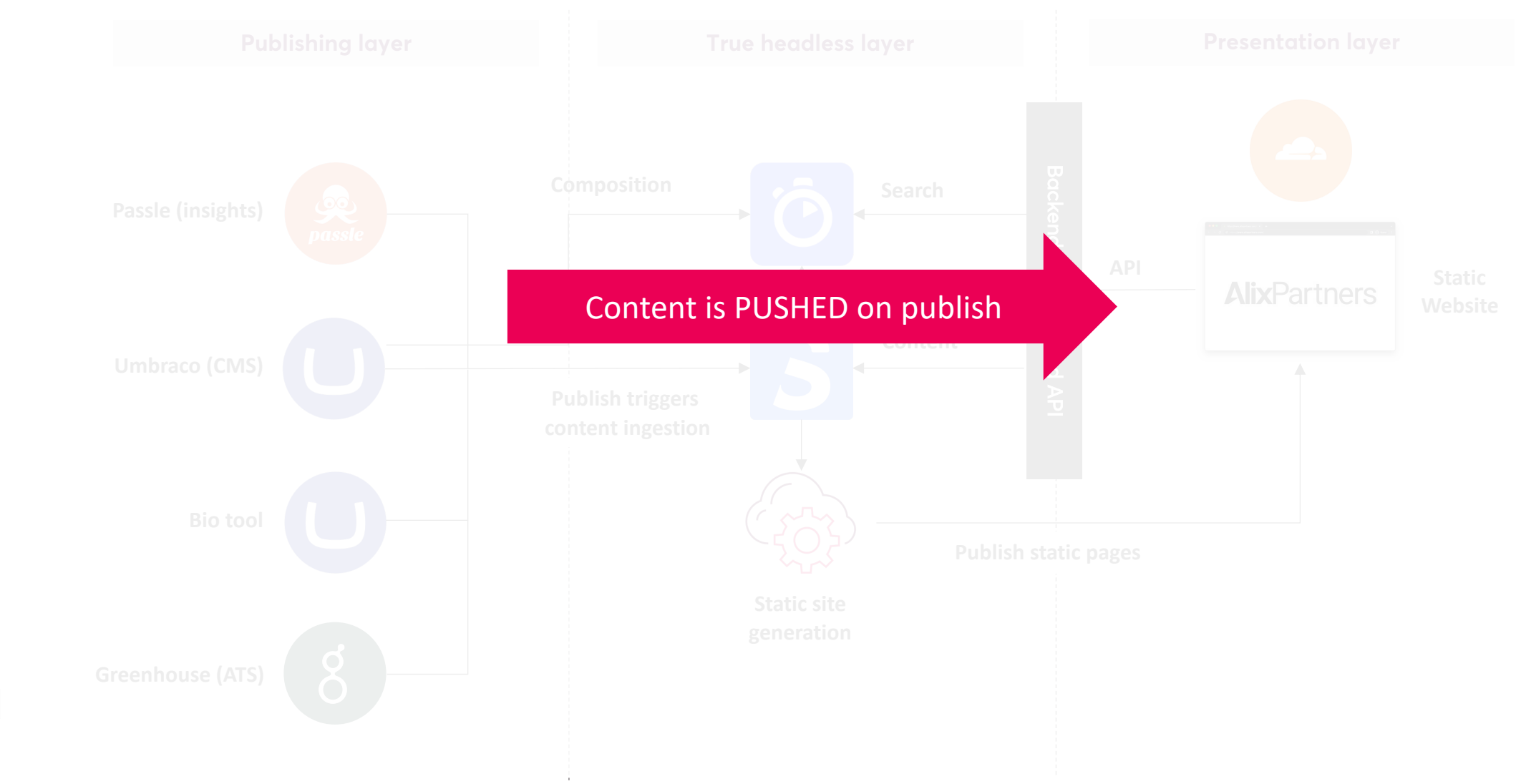
Let's compare with a single page application

Headless architecture



Composable architecture with static site

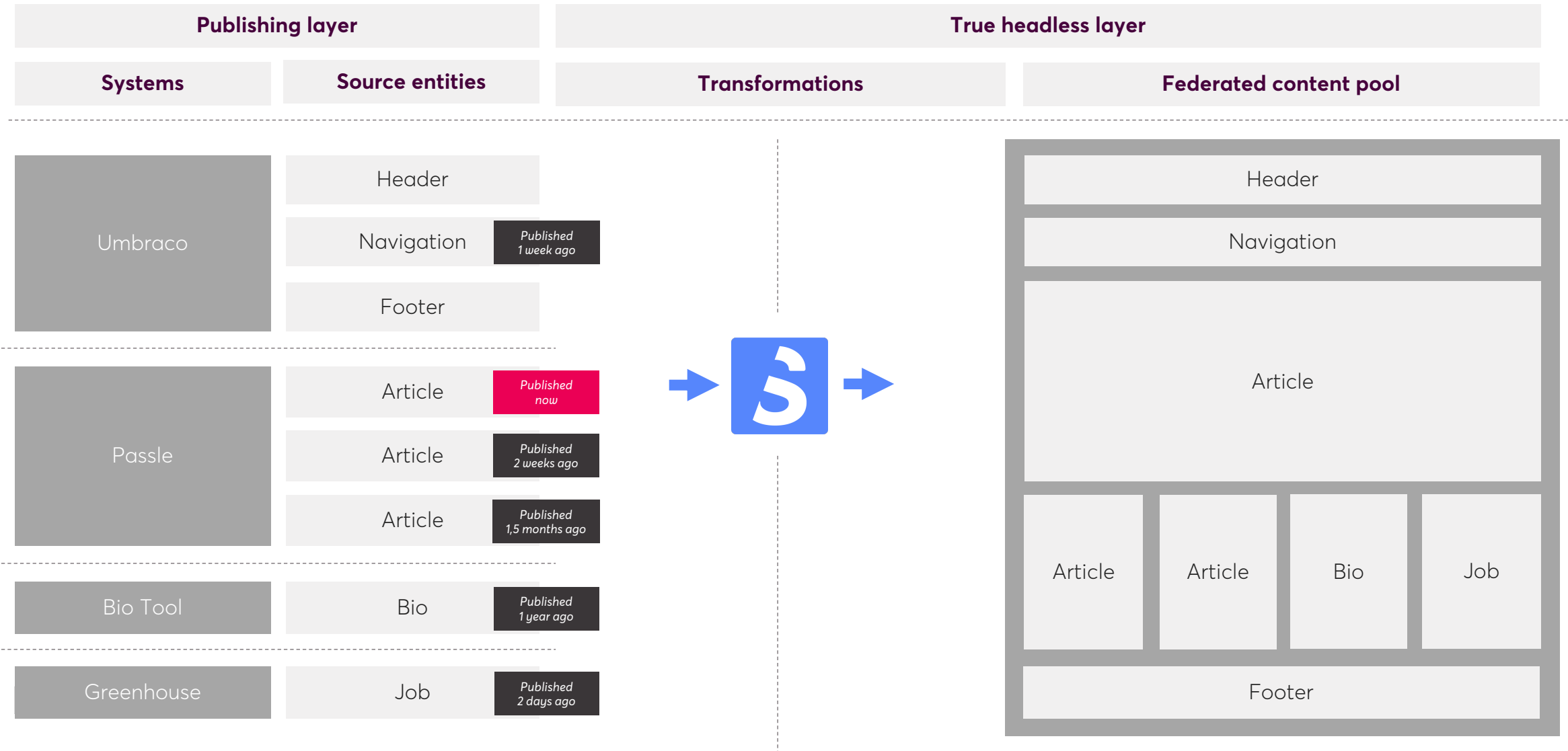
Composable architecture



Publish-time pre-processing

- Intelligent pre-processing of page data at publish time.
- Processing once, when content is created and updated, rather than processing on every request.
- Triggered by a publish action in Umbraco (or any other system).
- Generating one or more view models for specific use cases.
- Storing the generated view model in fast storage.
- Whenever content changes, a new publishing event triggers updating the existing model.
- Effectively minimising the workload at request time by displacing the workload from request time to publish time.

Page composition by example



Key differences in summary

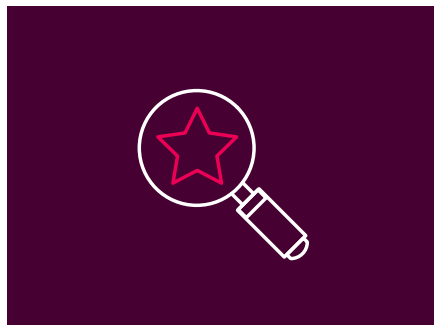
Key differences between headless and true headless



Role of the CMS

With traditional **headless**, the CMS is the key player. All other data sources need to be integrated into the CMS, which will make it monolithic.

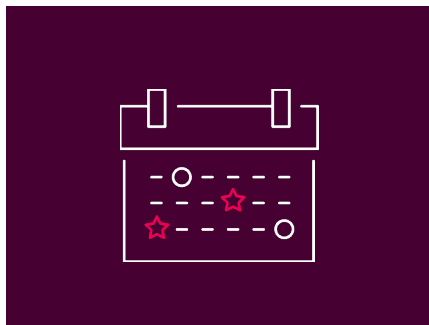
With **true headless**, the CMS is just another microservice delivering content to the federated content layer.



Flexibility

True headless builds on composable principles, greatly increasing flexibility.

Since each microservice has a single responsibility, it is easy to unplug and substitute.



Longevity

True headless builds on composable principles, greatly increasing life expectancy due to the flexibility and smaller cost of change.

A monolithic platform on the other hand is more likely to become increasingly difficult to maintain over time and will require a full rebuild.



Sustainability

True headless utilises re-processing of content and data at publish time and static site generation, significantly boosting sustainability over the traditional **headless** approach.

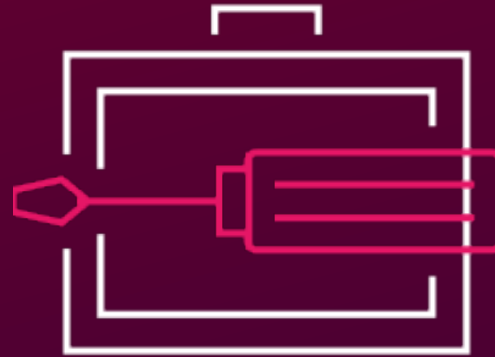
Dedicated microservices for ingestion of content and data, minimising reserved computation.



Cost

In the short term, **headless** is more cost-effective than **true headless** due to the reduced architectural complexity.

However, with **true headless**, the cost of change, e.g. changing early decisions later, is significantly less and will end up with a lower total cost of ownership.



2. Content delivery

Sustainable content delivery

Composition = multiple API

NOT TRUE

Composition = caching

NOT TRUE

Orchestrate or solo performance?

Does multiple source systems equal the need for API orchestration for content delivery?

Orchestrated

- Federated API management / API Gateway.
- GraphQL queries across multiple source APIs.
- Only as good as the weakest link.

Solo performance

- With a content federation layer, content delivery is reduced to a single content delivery API.
- Aggregated and cross-pollinated content is inherent.
- Full control over the API output.
- Blazingly fast.

Single API request per page

Preparing a page for static site generation requires **ALL** content and global elements, contrary to a single-page application where content can be reused.

With the composable layer, we achieved just that.



```
1 {
2   "modelAlias": "content",
3   "originId": "1112-en-us",
4   "meta": {
5     "statusCode": 200,
6     "path": "-1,1111,1112",
7     "template": "contentPage",
8     "type": "contentPage",
9     "culture": "en-us",
10    "url": "https://www.alixpartners.com/about-us/",
11    "createDate": "2023-07-20T09:42:29",
12    "updateDate": "2024-03-06T20:08:43",
13    "sortOrder": 4,
14    "includeInSearch": true
15  },
16  "page": {
17    "content": {
18      "header": { ← 1 → },
19      "blocks": {
20        "gridColumns": "12",
21        "items": [ ← 9 → ]
22      }
23    },
24    "models": {
25      "styles": "",
26      "enableContentScroll": false,
27      "seo": { ← 8 → },
28      "openGraph": { ← 6 → },
29      "navigation": {
30        "mainNavigation": {
31          "navigationItems": [
32            {
33              "name": "Our people",
34              "target": "",
35              "isInternal": true,
36              "relativeUrl": "/our-people/",
37              "url": "https://www.alixpartners.com/our-people/",
38              "culture": "en-us",
39              "originId": "1124-en-us"
40            },
41            { ← 7 → },
42            { ← 7 → },
43            { ← 7 → }
44          ]
45        },
46        "mainNavigationDisabled": false,
47        "serviceNavigation": { ← 2 → },
48        "serviceNavigationDisabled": false,
49        "languagePicker": { ← 1 → },
50        "languagePickerDisabled": false,
51        "breadcrumbsDisabled": false,
52        "searchDisabled": false,
53        "enableShareButton": true
54      },
55      "footer": { ← 1 → },
56      "logo": { ← 2 → },
57      "systemPages": { ← 5 → },
58      "siteSearchCultures": {
59        "siteSearchCultures": [
60          "en-us"
61        ]
62      }
63    },
64    "breadcrumbs": [
65      {
66        "link": {
67          "name": "Home",
68          "target": "",
69          "isInternal": true,
70          "relativeUrl": "/",
71          "url": "https://www.alixpartners.com/",
72          "culture": "en-us",
73          "originId": "1112-en-us"
74        }
75      }
76    ]
77  }
78 }
```

```

{"alias":{"content":"","originId":"1111-en-us","meta":{"statusCode":200,"path":"","_id":1111,"template":{"frontPage":{"type":"site","culture":"en-us","url":"https://www.alixpartners.com/","createDate":"2023-07-20T09:41:23","updateDate":"2024-03-06T21:38:23","sortOrder":0,"includeInSearch":true},"page":{"content":{"header":{"header":{"component":{"content":{"component":{"headline":"Finding a Profitable Path to Growth","text":"Insights from the 5th annual AlixPartners Disruption Index","callToAction":{"name":"Read our 2024 Disruption Index report","target":"_blank","isInternal":false,"relativeUrl":"","url":"https://disruption.alixpartners.com/e684e62d-f459-491d-97e4-ae6056686ba7/","culture":"","originId":""},"textAlignment":"Left","video":{"alt":"","previewUrl":"https://cdn.cloudinary.com/alixpartners/video/upload/c_limit,h_500,w_500/f_auto/v1698849765/Video/AP_Scene5_Motion_Dark_1_James_Ward_s_conflicted_copy_2022-01-06_i009na.jpg","secureUrl":"https://res.cloudinary.com/alixpartners/video/upload/v1698849765/Video/AP_Scene5_Motion_Dark_1_James_Ward_s_conflicted_copy_2022-01-06_i009na.mp4","publicId":"Video/AP_Scene5_Motion_Dark_1_James_Ward_s_conflicted_copy_2022-01-06_i009na","publicIdForTransformation":"Video:AP_Scene5_Motion_Dark_1_James_Ward_s_conflicted_copy_2022-01-06_i009na","version":"v1698849765","resourceType":"video","width":1920,"height":1080,"format":"mp4","userTransformation":"","hasUserTransformation":false,"cdnBaseUrl":"https://cdn.cloudinary.com/alixpartners/video/upload/","cdnDefaultUrl":"https://cdn.cloudinary.com/alixpartners/video/upload/t_default/q_auto/f_auto/v1698849765/Video/AP_Scene5_Motion_Dark_1_James_Ward_s_conflicted_copy_2022-01-06_i009na","cdnUrl":"https://cdn.cloudinary.com/alixpartners/video/upload/v1698849765/Video/AP_Scene5_Motion_Dark_1_James_Ward_s_conflicted_copy_2022-01-06_i009na"},"videoThumbnail":null,"toggleAutoplay":true,"togglePlayButton":false,"toggleVideoLoop":true,"navigationItems":[{"name":"AlixTalks","target":"_blank","isInternal":false,"relativeUrl":"","url":"https://features.alixpartners.com/alixtalks/index.html","culture":"","originId":""},{name":"A world disrupted","target":"","isInternal":true,"relativeUrl":"/disruption/","url":"https://www.alixpartners.com/disruption/","culture":"en-us","originId":"1756-en-us"},{"name":"Inflationary trends","target":"","isInternal":true,"relativeUrl":"/disruption/inflation/","url":"https://www.alixpartners.com/disruption/inflation/","culture":"en-us","originId":"1767-en-us"},{"name":"Artificial Intelligence","target":"","isInternal":true,"relativeUrl":"/what-we-do/artificial-intelligence/","url":"https://www.alixpartners.com/what-we-do/artificial-intelligence/","culture":"en-us","originId":"1583-en-us"}]},"invertColors":true,"toggleSearchBar":true,"preSelectedFacet":"","searchBarHintText":"Find anything..."},"settings":{"backgroundColor":"","topMargin":"Default","customTopMargin":0,"bottomMargin":"None","customBottomMargin":0,"cssClasses":"top-50","anchorName":"","backgroundImage":null},"alias":"fullWidthHeroWithVideoAndNavigationElement"}]},"blocks":{"gridColumns":12,"items":[{"component":{"content":{"component":{"headline":"When it really matters","text":"We're the people who global business leaders, their advisors, and stakeholders call for insight, action, and results. Find out more about the variety of work we do and our delivery of outsized outcomes.","callToAction":{"name":"Explore our role at pivotal moments","target":"","isInternal":true,"relativeUrl":"/what-we-do/when-it-really-matters/","url":"https://www.alixpartners.com/what-we-do/when-it-really-matters/","culture":"en-us","originId":"1813-en-us"},"image":{"alt":"","previewUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/c_limit,h_500,w_500/f_auto/v1704989451/Imagery/Homepage/_D814563-RET-edit_jqignq","secureUrl":"https://res.cloudinary.com/alixpartners/image/upload/v1704989451/Imagery/Homepage/_D814563-RET-edit_jqignq.jpg","publicId":"Imagery/Homepage/_D814563-RET-edit_jqignq","publicIdForTransformation":"Imagery:Homepage:_D814563-RET-edit_jqignq","version":"v1704989451","resourceType":"image","width":2000,"height":672,"format":"jpg","userTransformation":"","hasUserTransformation":false,"cdnBaseUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/","cdnDefaultUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/t_default/q_auto/f_auto/v1704989451/Imagery/Homepage/_D814563-RET-edit_jqignq","cdnUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/v1704989451/Imagery/Homepage/_D814563-RET-edit_jqignq"},"imageAlignment":"Background","invertColors":false,"isFloatingPanel":false},"settings":{"backgroundColor":"999999","topMargin":"Custom","customTopMargin":0,"bottomMargin":"None","customBottomMargin":0,"cssClasses":"cuw-banner","anchorName":"","backgroundImage":null},"alias":"fullWidthBannerElement","columns":12,"rows":1,"items":[]},"component":{"content":{"component":{"headline":"Careers","text":"We hire amazing people, and as a result, have built a business that makes a difference. We want our people to share our success and provide an environment that is stimulating, supportive and dynamic.  
That means working on high-impact, exciting projects, alongside colleagues that are equally at the top of their game. Colleagues who have your back, respect you, and value diverse perspectives."},"imageAlignment":"Left","callToAction":{"name":"Find a job","target":"","isInternal":true,"relativeUrl":"/careers/job-search/","url":"https://www.alixpartners.com/careers/job-search/","culture":"en-us","originId":"1128-en-us"},"link":{"name":"Careers at AlixPartners","target":"","isInternal":true,"relativeUrl":"/careers/job-search/","url":"https://www.alixpartners.com/careers/job-search/","culture":"en-us","originId":"1128-en-us"},"image":{"alt":"","previewUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/c_limit,h_500,w_500/f_auto/v1695989095/Imagery/jason_b9kvao.png","secureUrl":"https://res.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/jason_b9kvao.png","publicId":"Imagery/jason_b9kvao","publicIdForTransformation":"Imagery:jason_b9kvao","version":"v1695989095","resourceType":"image","width":711,"height":700,"format":"png","userTransformation":"","hasUserTransformation":false,"cdnBaseUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/","cdnDefaultUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/t_default/q_auto/f_auto/v1695989095/Imagery/jason_b9kvao.png","cdnUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/jason_b9kvao.png"},"invertColors":false,"isFloatingPanel":false},"settings":{"backgroundColor":"","topMargin":"Custom","customTopMargin":0,"bottomMargin":"None","customBottomMargin":0,"cssClasses":"","anchorName":"","backgroundImage":null},"alias":"fullWidthPromoPanelElement","columns":12,"rows":1,"items":[]},"component":{"content":{"component":{"headline":"Our people","text":"Our hand-picked, senior-led teams combine strategic vision and real-world experience with a unique propensity to action and an unstinting focus on results.  
Together, alongside our clients, we identify and implement practical and sustainable solutions at pace-when it really matters."},"callToAction":{"name":"Meet our experts","target":"","isInternal":true,"relativeUrl":"/our-people/","url":"https://www.alixpartners.com/our-people/","culture":"en-us","originId":"1124-en-us"},"image":{"alt":"","previewUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/c_limit,h_500,w_500/f_auto/v1695989095/Imagery/OurPeople_z1echw.png","secureUrl":"https://res.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/OurPeople_z1echw.png"},"imageAlignment":"Left","callToAction":{"name":"Find a job","target":"","isInternal":true,"relativeUrl":"/careers/job-search/","url":"https://www.alixpartners.com/careers/job-search/","culture":"en-us","originId":"1128-en-us"},"link":{"name":"Careers at AlixPartners","target":"","isInternal":true,"relativeUrl":"/careers/job-search/","url":"https://www.alixpartners.com/careers/job-search/","culture":"en-us","originId":"1128-en-us"},"image":{"alt":"","previewUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/c_limit,h_500,w_500/f_auto/v1695989095/Imagery/jason_b9kvao.png","secureUrl":"https://res.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/jason_b9kvao.png","publicId":"Imagery/jason_b9kvao","publicIdForTransformation":"Imagery:jason_b9kvao","version":"v1695989095","resourceType":"image","width":711,"height":700,"format":"png","userTransformation":"","hasUserTransformation":false,"cdnBaseUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/","cdnDefaultUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/t_default/q_auto/f_auto/v1695989095/Imagery/jason_b9kvao.png","cdnUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/jason_b9kvao.png"},"invertColors":false,"isFloatingPanel":false},"settings":{"backgroundColor":"","topMargin":"Custom","customTopMargin":0,"bottomMargin":"None","customBottomMargin":0,"cssClasses":"","anchorName":"","backgroundImage":null},"alias":"fullWidthPromoPanelElement","columns":12,"rows":1,"items":[]},"component":{"content":{"component":{"headline":"Our people","text":"Our hand-picked, senior-led teams combine strategic vision and real-world experience with a unique propensity to action and an unstinting focus on results.  
Together, alongside our clients, we identify and implement practical and sustainable solutions at pace-when it really matters."},"callToAction":{"name":"Meet our experts","target":"","isInternal":true,"relativeUrl":"/our-people/","url":"https://www.alixpartners.com/our-people/","culture":"en-us","originId":"1124-en-us"},"image":{"alt":"","previewUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/c_limit,h_500,w_500/f_auto/v1695989095/Imagery/OurPeople_z1echw.png","secureUrl":"https://res.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/OurPeople_z1echw.png"},"imageAlignment":"Left","callToAction":{"name":"Find a job","target":"","isInternal":true,"relativeUrl":"/careers/job-search/","url":"https://www.alixpartners.com/careers/job-search/","culture":"en-us","originId":"1128-en-us"},"link":{"name":"Careers at AlixPartners","target":"","isInternal":true,"relativeUrl":"/careers/job-search/","url":"https://www.alixpartners.com/careers/job-search/","culture":"en-us","originId":"1128-en-us"},"image":{"alt":"","previewUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/c_limit,h_500,w_500/f_auto/v1695989095/Imagery/jason_b9kvao.png","secureUrl":"https://res.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/jason_b9kvao.png","publicId":"Imagery/jason_b9kvao","publicIdForTransformation":"Imagery:jason_b9kvao","version":"v1695989095","resourceType":"image","width":711,"height":700,"format":"png","userTransformation":"","hasUserTransformation":false,"cdnBaseUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/","cdnDefaultUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/t_default/q_auto/f_auto/v1695989095/Imagery/jason_b9kvao.png","cdnUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/jason_b9kvao.png"},"invertColors":false,"isFloatingPanel":false},"settings":{"backgroundColor":"","topMargin":"Custom","customTopMargin":0,"bottomMargin":"None","customBottomMargin":0,"cssClasses":"","anchorName":"","backgroundImage":null},"alias":"fullWidthPromoPanelElement","columns":12,"rows":1,"items":[]},"component":{"content":{"component":{"headline":"Our people","text":"Our hand-picked, senior-led teams combine strategic vision and real-world experience with a unique propensity to action and an unstinting focus on results.  
Together, alongside our clients, we identify and implement practical and sustainable solutions at pace-when it really matters."},"callToAction":{"name":"Meet our experts","target":"","isInternal":true,"relativeUrl":"/our-people/","url":"https://www.alixpartners.com/our-people/","culture":"en-us","originId":"1124-en-us"},"image":{"alt":"","previewUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/c_limit,h_500,w_500/f_auto/v1695989095/Imagery/OurPeople_z1echw.png","secureUrl":"https://res.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/OurPeople_z1echw.png"},"imageAlignment":"Left","callToAction":{"name":"Find a job","target":"","isInternal":true,"relativeUrl":"/careers/job-search/","url":"https://www.alixpartners.com/careers/job-search/","culture":"en-us","originId":"1128-en-us"},"link":{"name":"Careers at AlixPartners","target":"","isInternal":true,"relativeUrl":"/careers/job-search/","url":"https://www.alixpartners.com/careers/job-search/","culture":"en-us","originId":"1128-en-us"},"image":{"alt":"","previewUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/c_limit,h_500,w_500/f_auto/v1695989095/Imagery/jason_b9kvao.png","secureUrl":"https://res.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/jason_b9kvao.png","publicId":"Imagery/jason_b9kvao","publicIdForTransformation":"Imagery:jason_b9kvao","version":"v1695989095","resourceType":"image","width":711,"height":700,"format":"png","userTransformation":"","hasUserTransformation":false,"cdnBaseUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/","cdnDefaultUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/t_default/q_auto/f_auto/v1695989095/Imagery/jason_b9kvao.png","cdnUrl":"https://cdn.cloudinary.com/alixpartners/image/upload/v1695989095/Imagery/jason_b9kvao.png"},"invertColors":false,"isFloatingPanel":false},"settings":{"backgroundColor":"","topMargin":"Custom","customTopMargin":0,"bottomMargin":"None","customBottomMargin":0,"cssClasses":"","anchorName":"","backgroundImage":null},"alias":"fullWidthPromoPanelElement","columns":12,"rows":1,"items":[]},"component":{"content":{"component":{"headline":"Our people","text":"Our hand-picked, senior-led teams
```

API requirements for efficient SSG

- ✓ Efficient delivery of page data in a single request.
- ✓ Efficient delivery of all published routes.
- ✓ Efficient API for delivering bulk content for multiple routes in a single API request.

Get content by IDs, or handles

The Post version of the Delivery API is used to fetch many view by IDs or handles.

Note: The maximum handles and ids combined in one request is limited to 1000

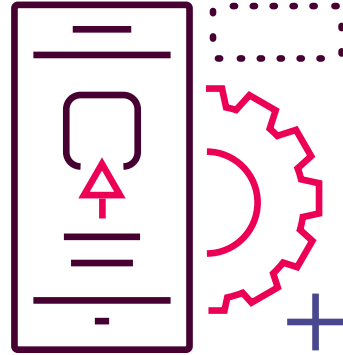
HEADER PARAMETERS

X-API-Key required	string Example: <code>environment-1637c4d0-e878-4738-b866-152106a4f88c</code> Api key to validate your environment.
Content-Length required	number The length of the message body, in bytes (this header is automatically added by most clients).



3. Static site generation

Sustainable static site generation



Technology stack

First things first

Tech stack



Astro

Multi-page application framework for content-driven websites.



Vue.js

Framework for building user interfaces.



Tailwind

Utility-first CSS framework.



Storybook

Playground for UI component development.



Umbraco

We all know and love.



Algolia

search as a service.



Cloudinary

Digital asset delivery.



Enterspeed

Content federation and composable building system.

Frontend stack

Platforms

Infrastructure



Docker

Containerisation of microservices.



Azure DevOps

CI/CD and SSG pipeline.



Azure

Hosting and infrastructure.



Cloudflare

Web application security and performance.

Tech stack



Astro

Multi-page application framework for content-driven websites.



Vue.js

Framework for building user interfaces.



Tailwind

Utility-first CSS framework.



Storybook

Playground for UI component development.



Umbraco

We all know and love.



Algolia

search as a service.



Clouinary

Digital asset delivery.



Enterspeed

Content federation and composable building system.



Docker

Containerisation of microservices.



Azure DevOps

CI/CD and SSG pipeline.



Azure

Hosting and infrastructure.



Cloudflare

Web application security and performance.

Static Site
Generation
superstars

Novicell

A story about sustainability and user (editor) experience

- A sustainable sink in the shower room of our office building.
- Fully automatic.
- But hypersensitive.
 - It will turn off while in use.
 - Built-in timeout to save water consumption.
 - Count to 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 before it will dispense water again.
 - If you are too eager, start from zero again.
- Sustainability is not just about being reusable if it's not usable in the first place.



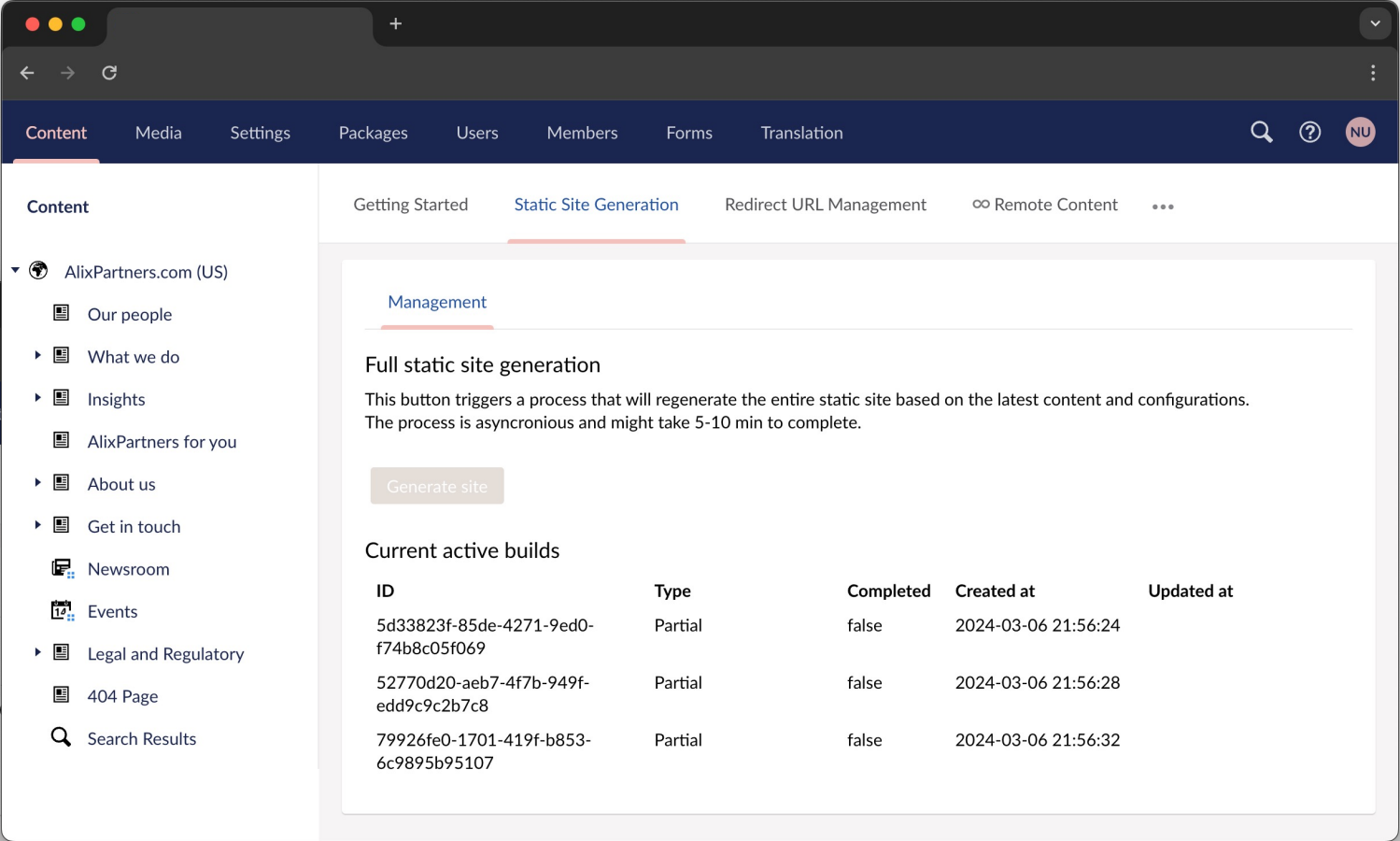
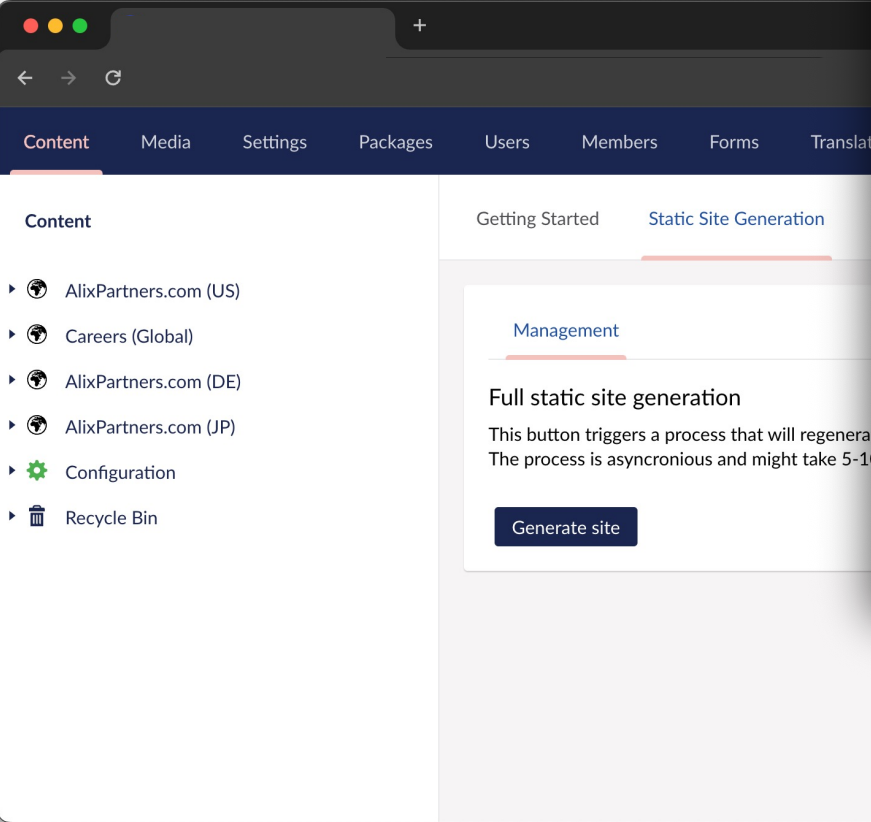
Everything everywhere all at once?

- Obviously, we need the ability to generate the full site.
 - but, to optimise, we need the ability to only generate a part of site.
 - Knowing when to apply which is crucial.
-
- What is the significance of a content change?
 - A single page.
 - A regional site.
 - Navigation, headers and footers.
 - Global elements.
 - Related content (hydrated in the browser).
 - Search (search as a service).
-
- The editor knows best – and then the automation won't fail.



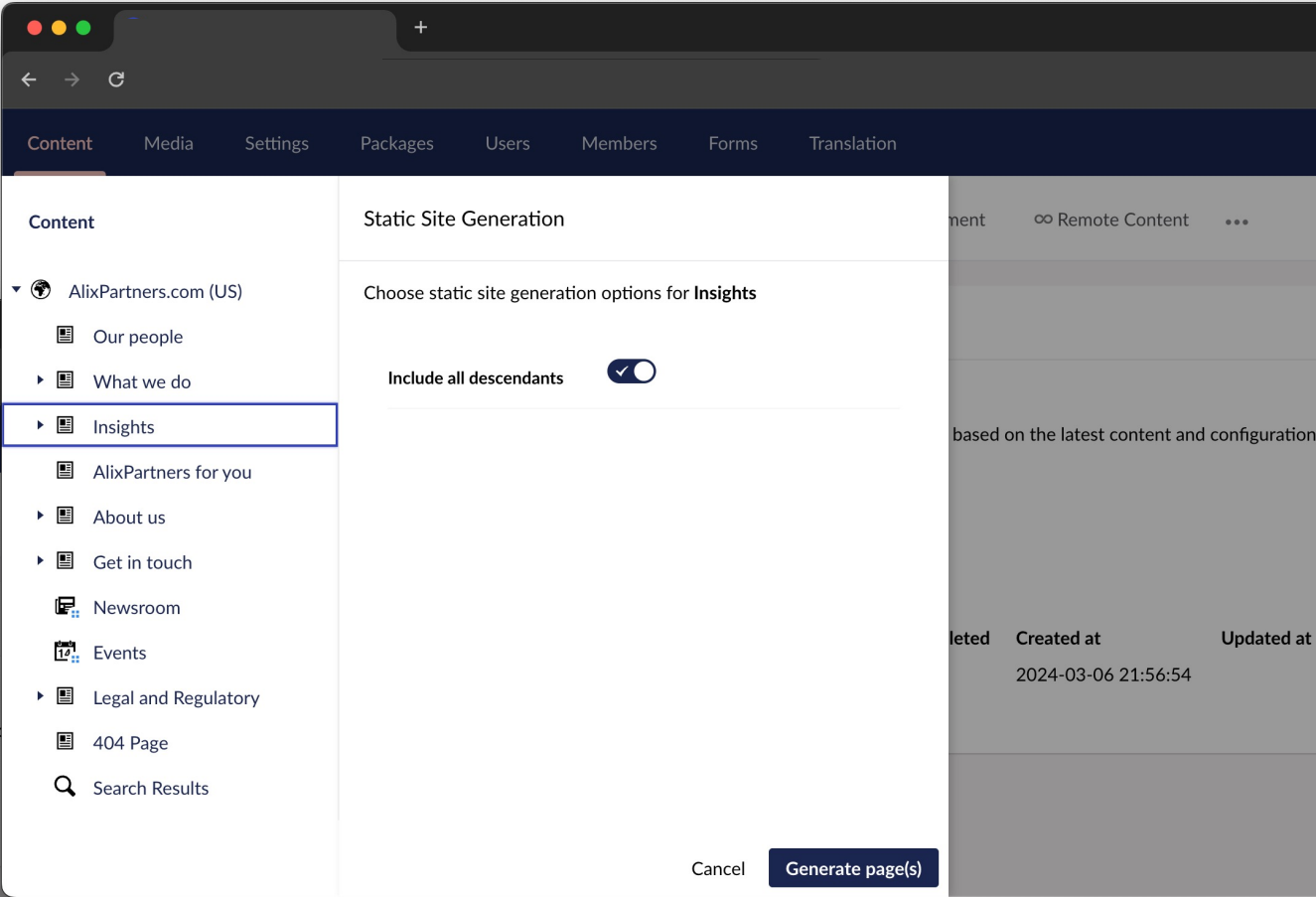
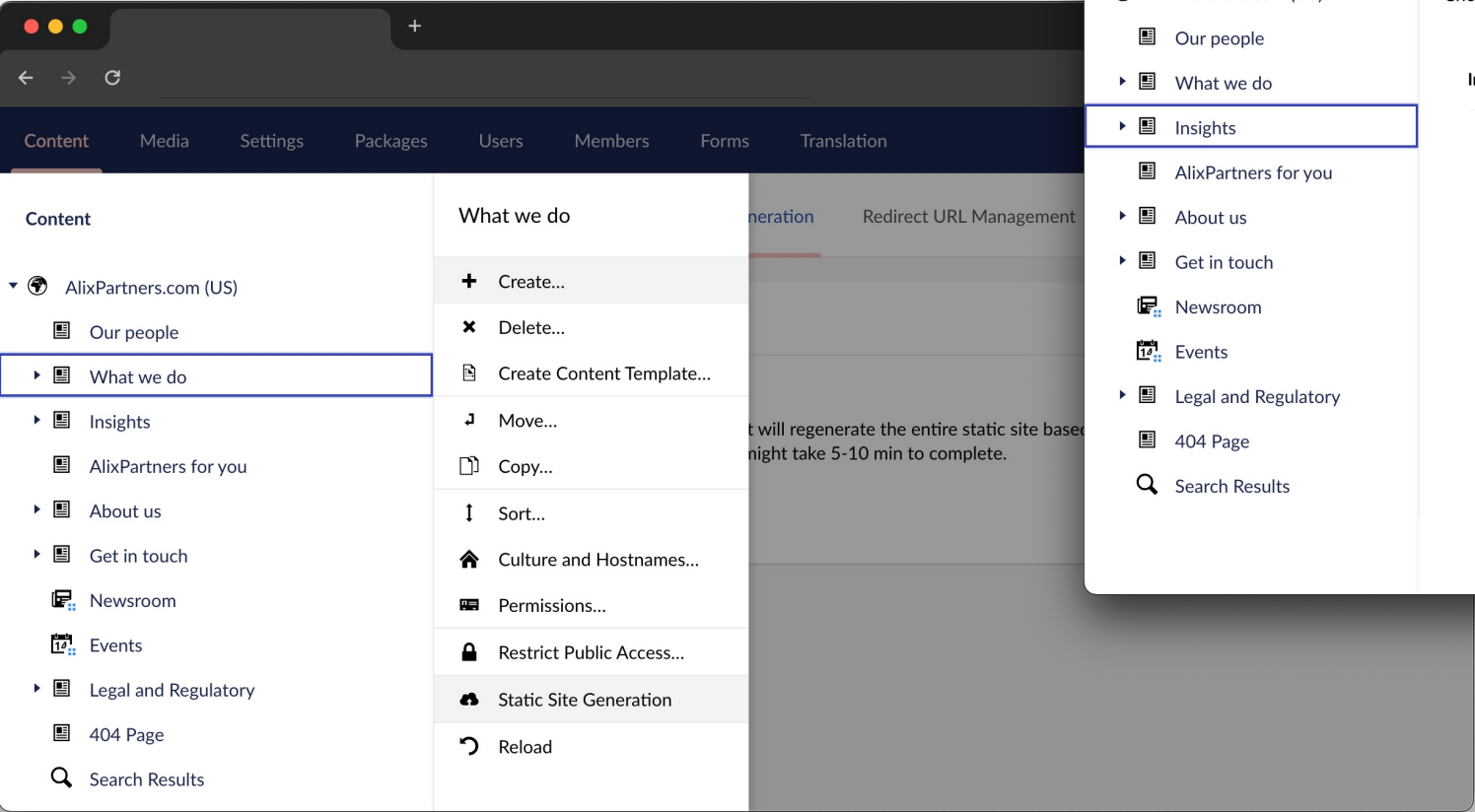
Umbraco integration

Full static site generation from dashboard



Umbraco integration

Partial static site generation from the content tree



Real-time preview

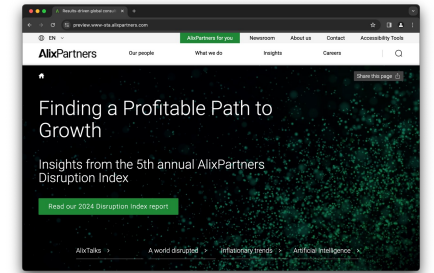
Remember the sink! We do NOT want to have to count to 10.

Let's save the editor from having to generate pages just for preview.

- The federated content layer contains and maintains two individual content pools:
 - Published content.
 - Preview content.
- Astro supports server-side rendering, static site generation and dynamic rendering.

We take advantage of these properties:

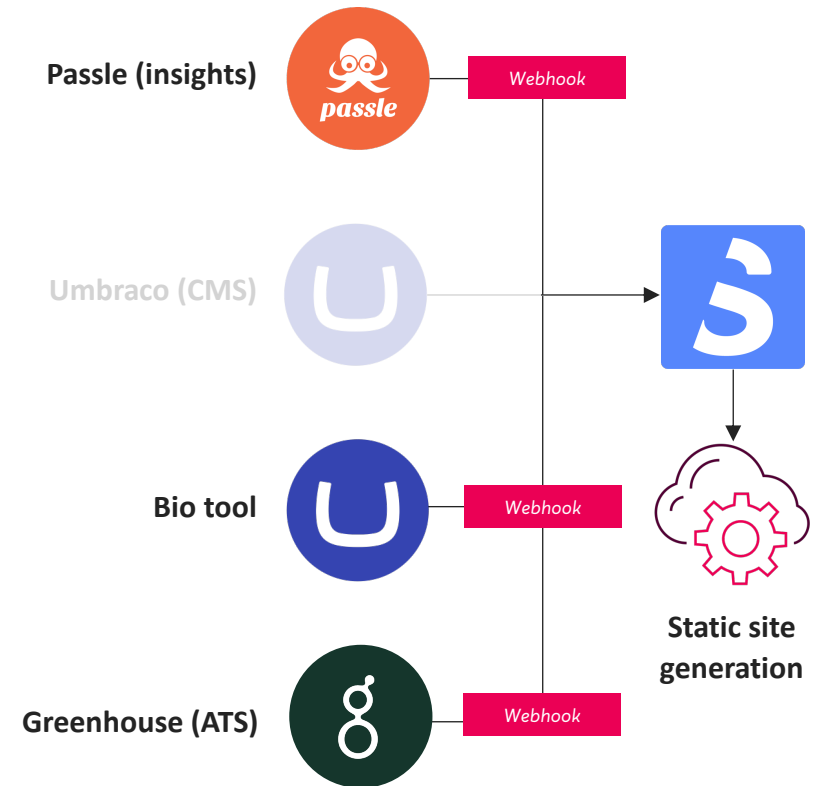
- Hosting a separate and restricted preview application with NGINX and Node.js in a docker container.
- Dynamically rendered in the browser using the content delivery API to fetch page content.
- Links to the preview application can be distributed and viewed internally, supporting stakeholder review and approval flows.



Editors control vs. composable automation

Biographies, insights and vacancies are automatically ingested into the federated content pool

- As we just saw, the editor can trigger static site generation from Umbraco.
- However, some content is automatically composed in the content federation layer.
- Enterspeed has webhooks that will send a ping when a page model has been generated.



Reduction strategy

How do we reduce the number of static site generation requests?

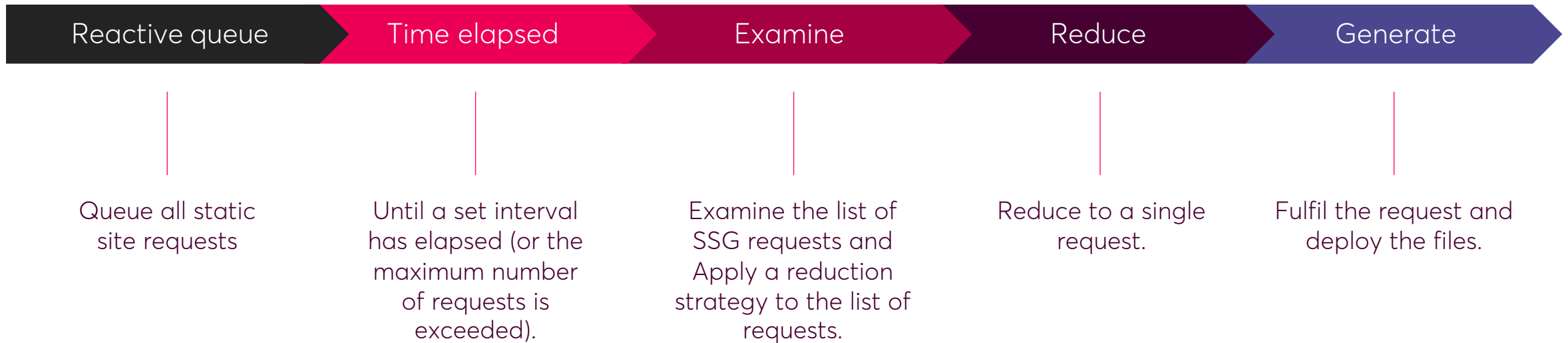
The challenge

Static site generation requests can come from many sources:

- Distributed editor.
- Automated webhooks.
- Potentially unnecessary concurrent requests from editors around the world.
- Scheduled publish.
- Potentially thousands of concurrent requests when re-synchronising data.

Reduction strategy

How do we reduce the number of static site generation requests?



```
// Look for full static site generation build session among all session in queue
var fullBuildSession = buildSessions
    .LastOrDefault(b:BuildSession => b.StaticSiteGenType.Equals(obj: StaticSiteGenType.Full));

// Reduce to a single session
var session = fullBuildSession is not null
    // If a full SSG build session is in the collection we reduce to a single full site build
    // and cancel all others sessions
    ? await _buildSessionFactory.NewBuildSessionAsync(new StaticSiteGenRequestModel
    {
        StaticSiteGenType = StaticSiteGenType.Full,
        Keys = new string[] { },
        SessionId = Guid.NewGuid().ToString()
    }) // Task<BuildSession>
    // If no full SSG build session is in the collection we create a combined partial build session
    // from all sessions and cancel all other sessions
    : await _buildSessionFactory.NewBuildSessionAsync(new StaticSiteGenRequestModel
    {
        StaticSiteGenType = StaticSiteGenType.Partial,
        Keys = buildSessions // IList<BuildSession>
            .SelectMany(b:BuildSession => b.Keys)
            .Distinct() // IEnumerable<string>
            .ToArray(),
        SessionId = Guid.NewGuid().ToString()
    }); // Task<BuildSession>
```


Static site hosting and deployment

All hosting is consolidated in Azure

We reviewed a few different approaches to static site hosting.

- Azure function with blob storage.
- Azure static web app (**favourite contender**).
- Minimal .NET host with blob storage.

Learnings

- Too little control over the deployment.
- No support for partial deploys.
- Timeout on deployment due to the number of folders and files.
- Got annoyed I took action.

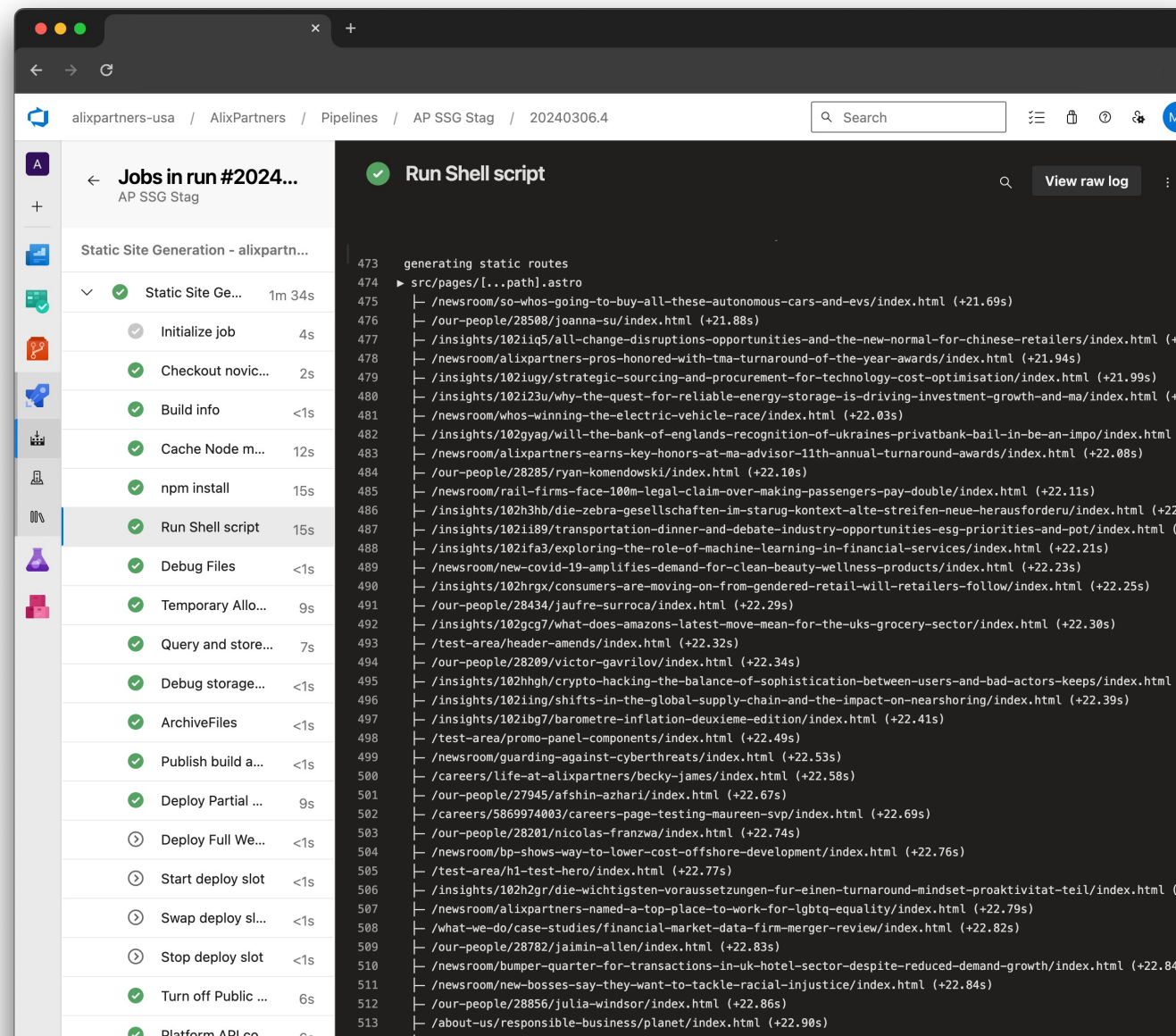


Static site hosting and deployment

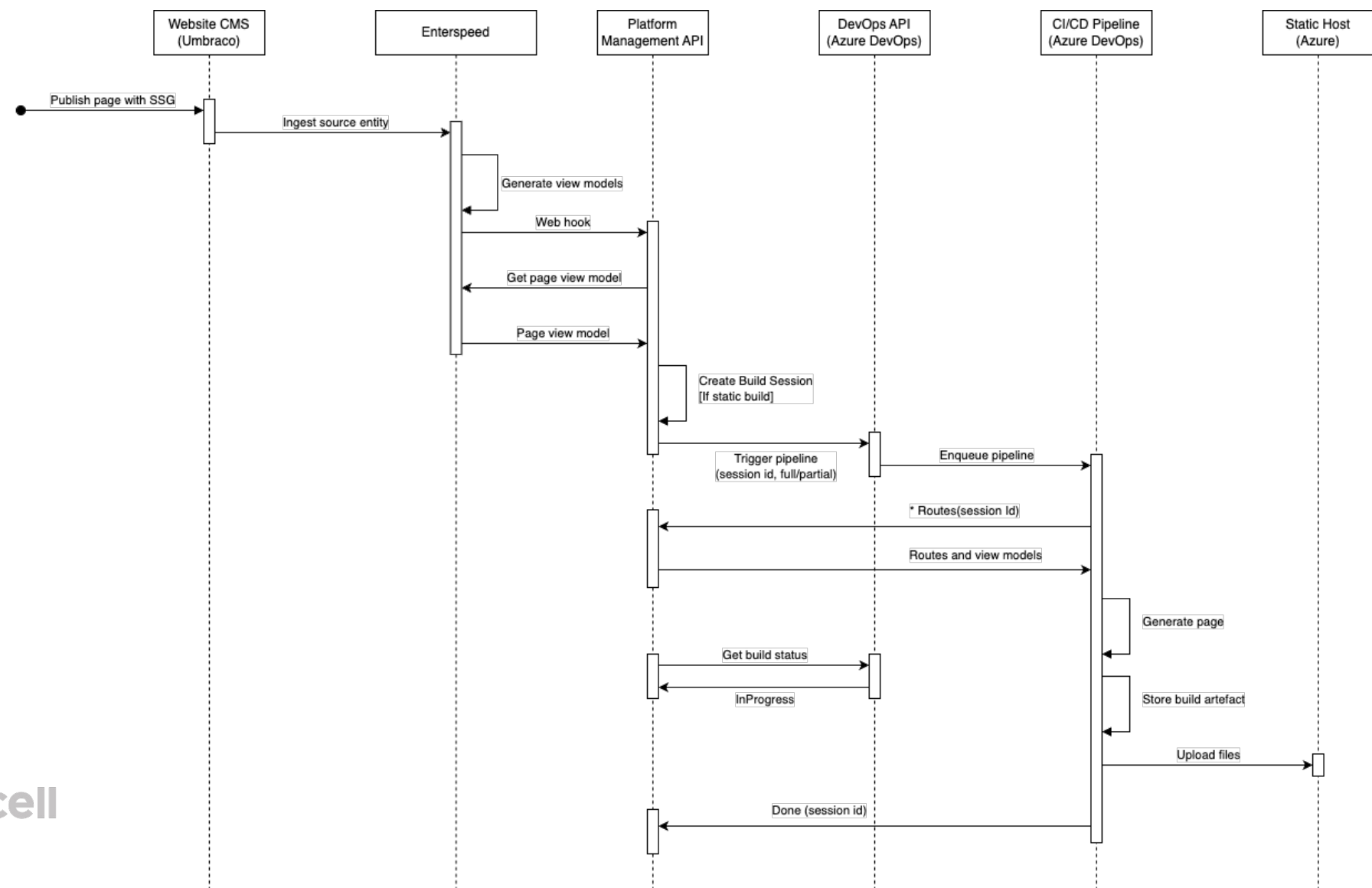
All hosting is consolidated in Azure

Result

- We ended up selecting an ultra-simple .NET host in a docker container backed by blob storage.
- Using Azure DevOps for static site generation and deployment.
- Managed by a dedicated Platform API microservice.



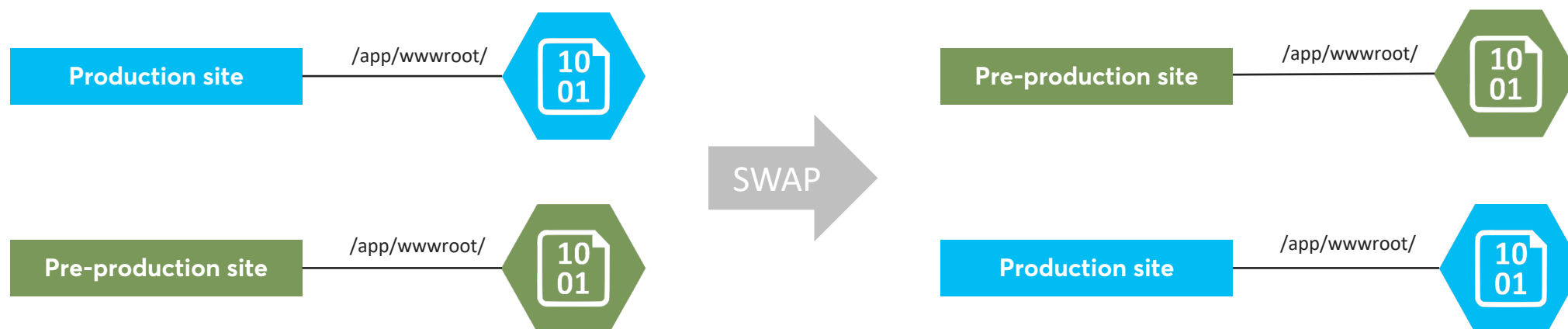
Static site generation flow



Zero downtime deploys

Blue/green deployments with Azure Container App Service and Blob Storage.

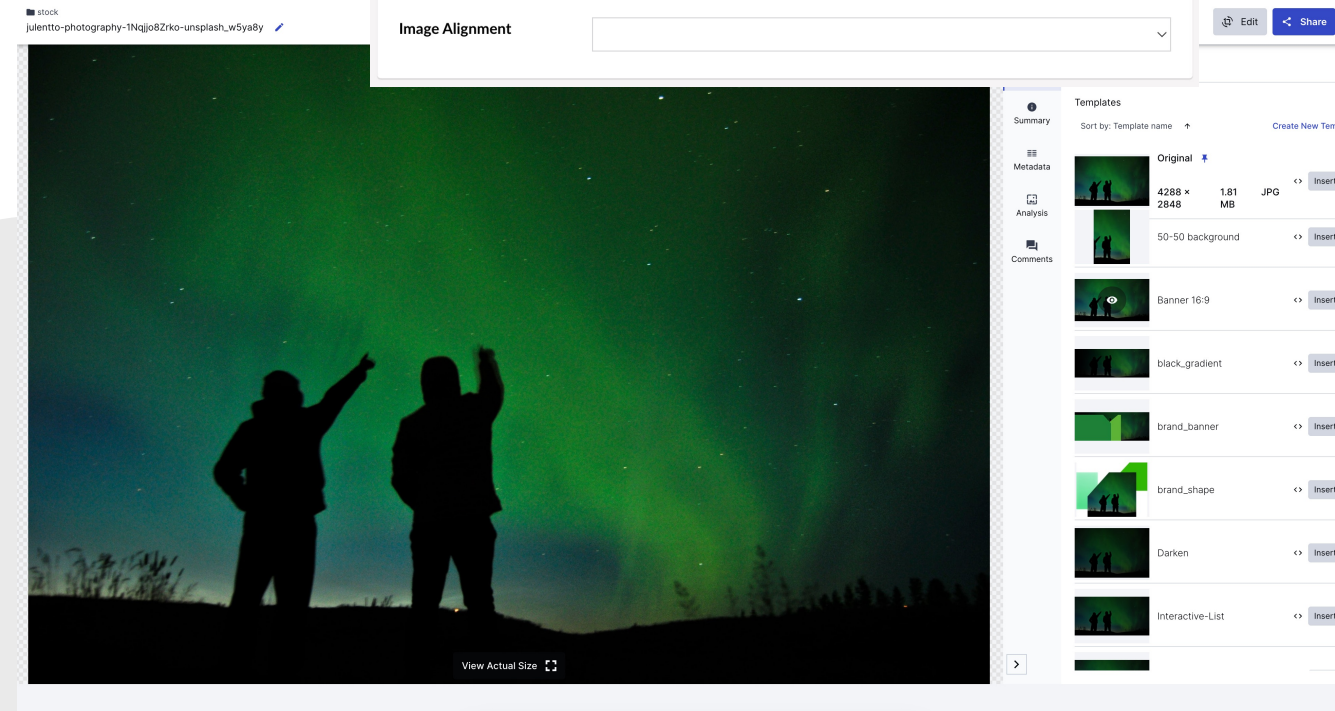
- Blue/green deployment is a deployment strategy with two separate but identical environments. One environment (blue) runs the production website, and the other environment (green) is ready and awaiting a new deployment.
- Once the pre-production deployment has been verified, the two environments are swapped.



Digital asset delivery

Outsourced to Cloudinary

- Digital Asset Management and Delivery.
- Global CDN delivery and intelligent and performant transformation API.
- Integrated into Umbraco.
- But best of all, image delivery is outsourced and we do not have to worry about uploading files when deploying a static site.



Dynamic in a static world

Not everything is static.

- 301 and 302 redirects from renames and the old site structures.
- Multilingual 404 pages.
- Generating vCards on the fly.
- Media files from the Umbraco media library.
 - Stored and served from Azure Blob Storage.
 - It saves us from uploading assets with each deploy.
- Spent a lot of energy on finding the solution. Turns out the best solution is dead simple.

Dynamic in a static world

```
[ApiController]  
[Route( template: "")]
```

👤 Keller

```
public class FallbackController : ControllerBase  
{
```

...

```
[Route( template: "{**requestedUrl}")]
```

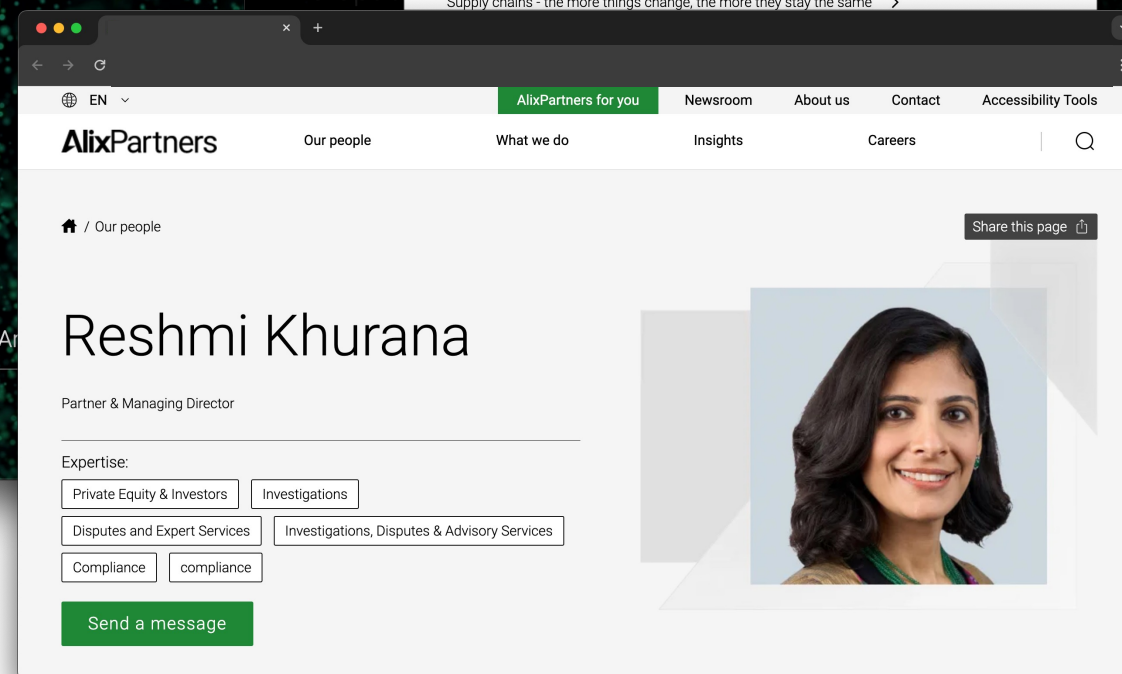
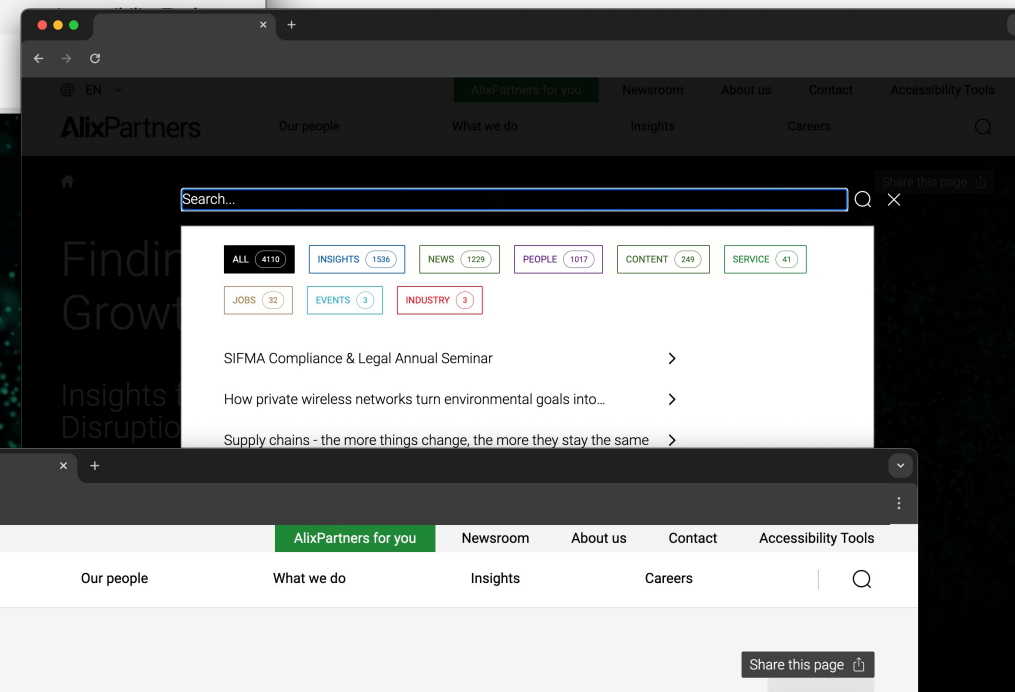
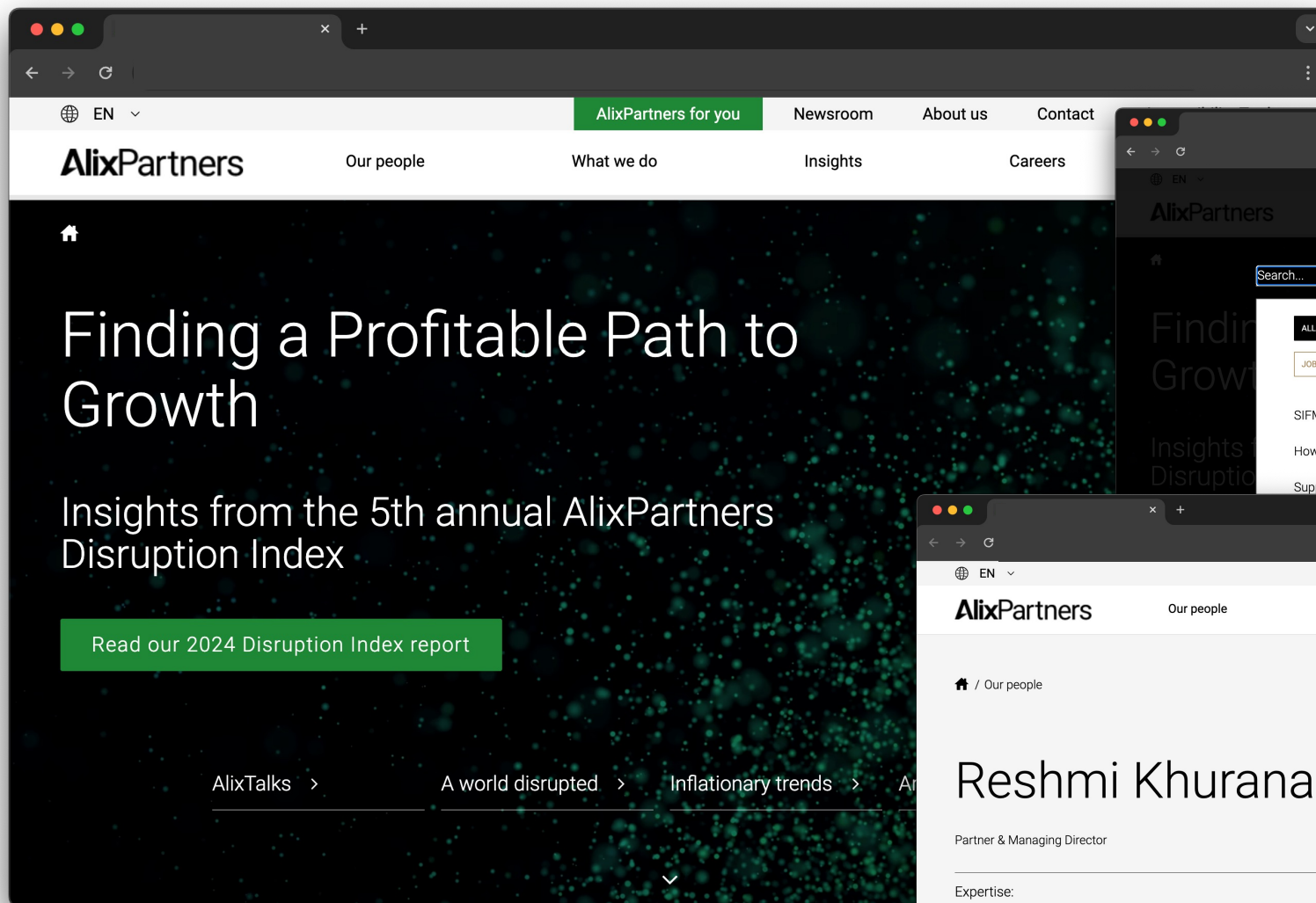
👤 Keller

```
public async Task<IActionResult> Fallback(string? requestedUrl)  
{  
    var location = new Uri($"https://{Request.Host}{Request.Path}{Request.QueryString}");  
    var originalUrl:string = location.AbsoluteUri;  
  
    return await _fallbackNavigationService.WhereTo(originalUrl);  
}
```



Wrapping up

Time for a status – did we make a difference?



Website carbon results for: [website.www-sta.alixpartners.com](https://www.sta.alixpartners.com)



Hurrah! This web page achieves a carbon rating of A

This is cleaner than **87%** of all web pages globally



Learn about our [rating system](#)

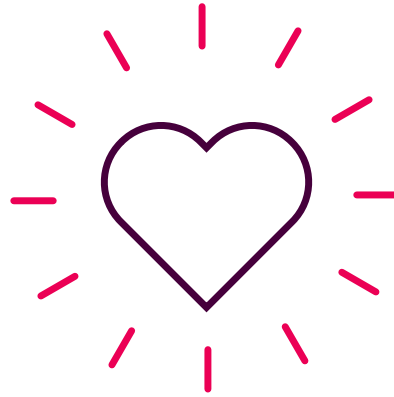
This page was last tested on 13 Feb, 2024. [Test again](#)

Copy URL 



Only **0.14g of CO2** is produced every time someone visits this web page.

[How do we calculate this?](#)



Thank you.