

PREDICTIVE

PREFETCHING

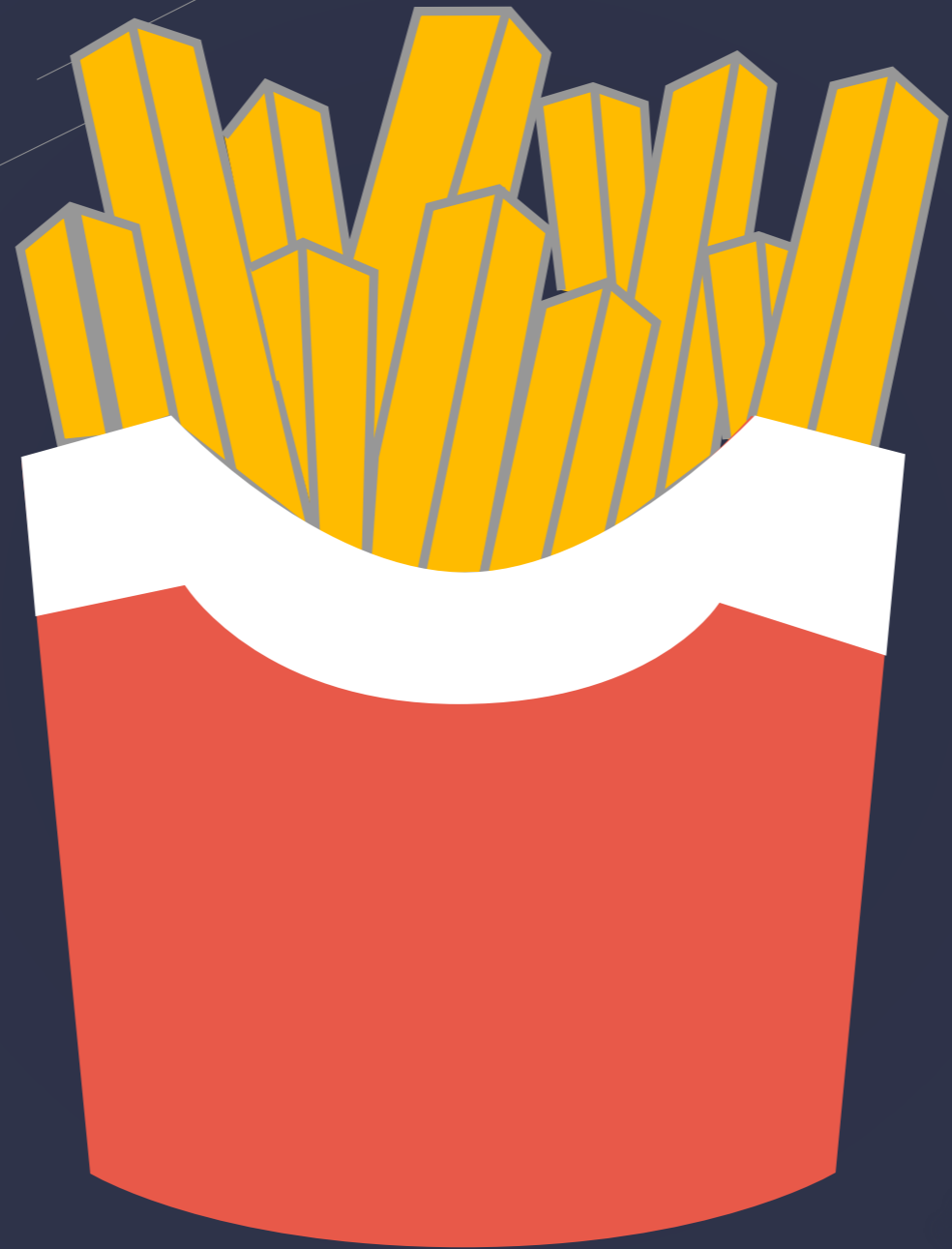




Divya Tagtachian

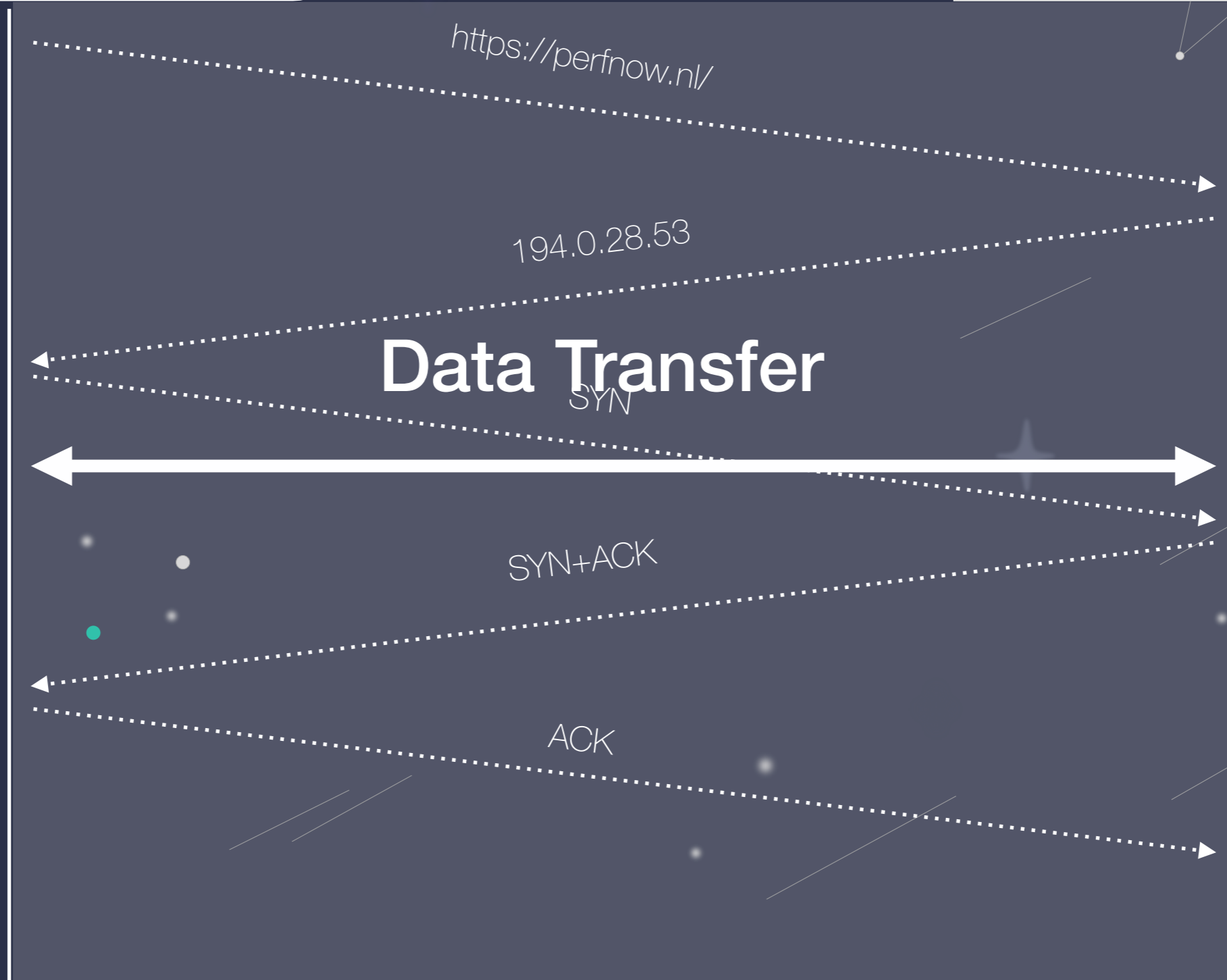
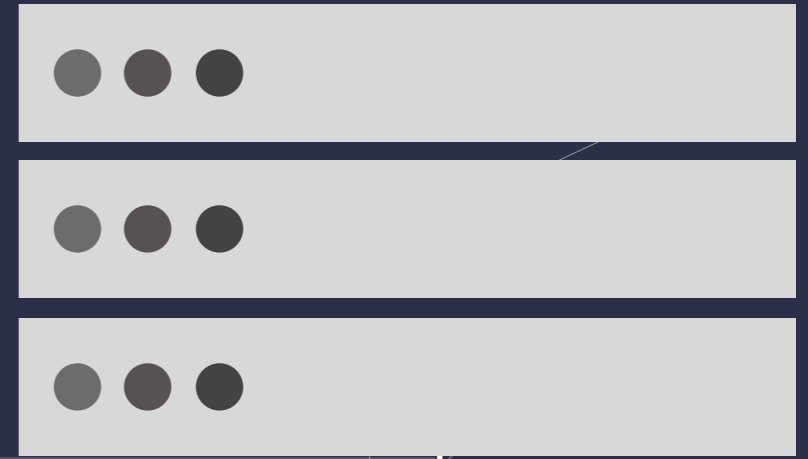
@shortdiv





PREFETCHING™

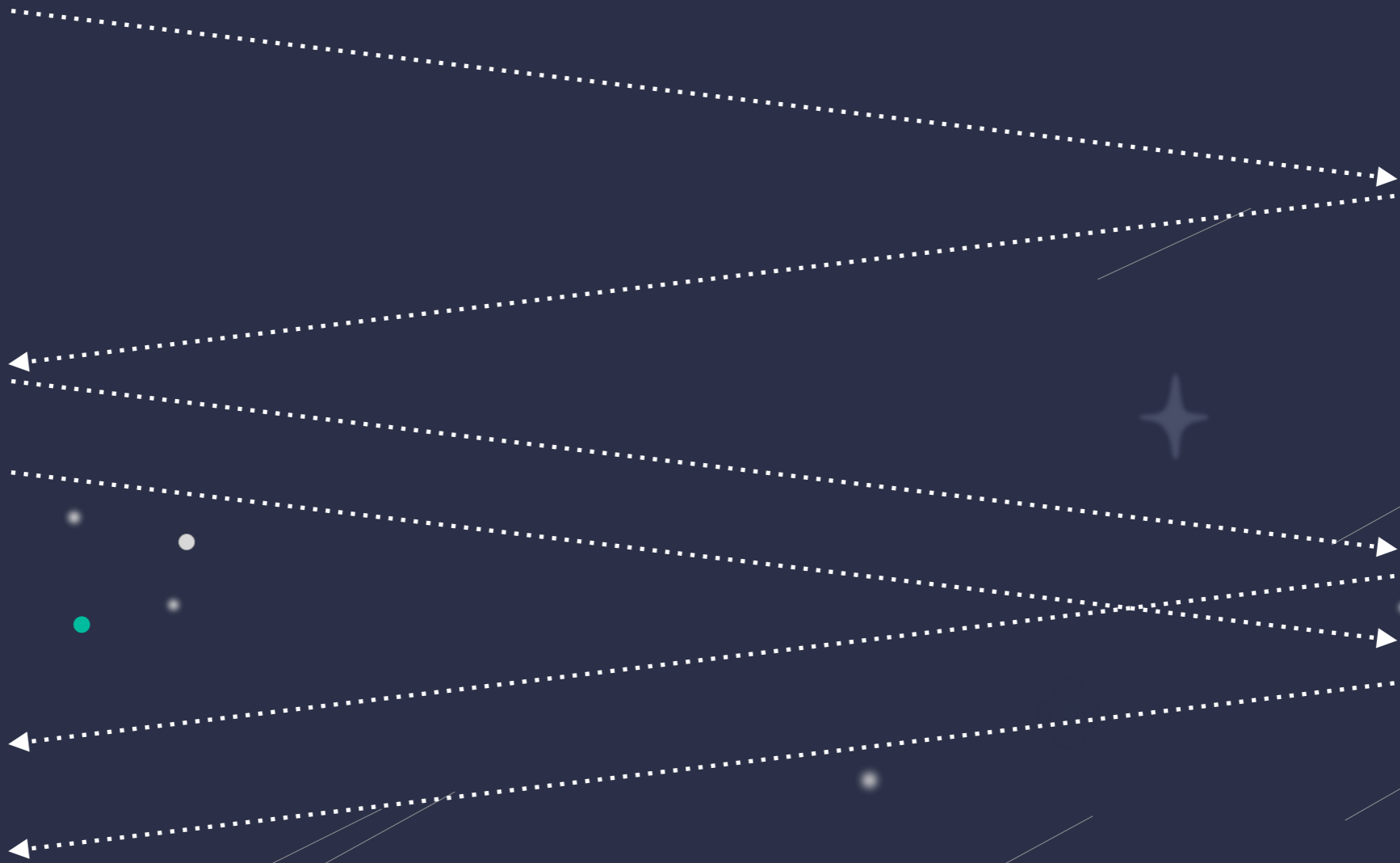






GET /index.html

GET /style.css
GET /script.js





www.perfnow.nl



DNS Prefetching

Link Prefetching

Prerendering

DNS Prefetching

```
<link rel="dns-prefetch"  
      href="http://cdn.example.com">
```

DNS Prefetching

Link Prefetching

Prerendering

Link Prefetching

```
<link rel="prefetch"  
  href="http://cdnz.com/library.js">
```

DNS Prefetching

Link Prefetching

Prerendering

Prerendering

```
<link rel="prerender"  
  href="http://cdnz.com/about.html">
```

DNS Prefetching

Link Prefetching

Prerendering

Hint	Cost (if wrong)	Benefit (if correct)
DNS Prefetch	Very low	Low
Link Prefetch	Mid high	High
Prerender	Very high	Very high



<https://duckduckgo.com/?q=wtf+are+war+fries&t=h &ia=web>



wtf are war fries



A crash course on The Netherlands' War Fries



Call 'em what you will - friet, friets, patat, Vlaamse Frieten - but one thing is sure, the Dutch can't seem to get enough of 'em! In fact, they love 'em so much they eat over 41 million kilos of these tasty guys per year! (But Dutch people don't just stop at fries. Every Dutchie

Recipe for War Fries



The perfect fries are the Belgium/Dutch (most of the credits to Belgium). They are big fries and if they are prepared good, the outside is a little crunchy, but the inside is soft. When you bite, you first go to a little crispy part and then the soft potato, what is the main part of the frie. Mc donalds fries, are french fries. Really thin.





https://cant-dutch-this.netlify.com



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[Go dutch, you won't regret it.](#) 30 Sept 2018



[WTF is war fries?](#) 24 Aug 2018





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Go dutch, you won't regret it. 30 Sept 2018

WTF is war fries? 24 Aug 2018

Fries, the dutch way. 4 June 2018



TGI Friet day 1 May 2018





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SPECULATIVE



PREDICTIVE











Tomorrow

Today

	Overcast	Rain
Overcast	0.75	0.25
Rain	1	0



/about → /menu

/about → /contact

/about → /contact

/about → /menu

/menu → /contact

/menu → /

/menu → /about

/menu → /

/about → /menu 50%

/about → /menu

/about → /contact 50%

/about → /contact

/menu → /contact 25%

/menu → /about 25%

/menu → / 50%

/menu → /



Google
Analytics

Pages

SAVE EXPORT SHARE INSIGHTS

All Users
100.00% Pageviews

+ Add Segment

Nov 13, 2019 - Nov 19, 2019

Explorer Navigation Summary

Pageviews vs. Select a metric

Day Week Month

Pageviews



Group pages by: Ungrouped Current Selection: / Show rows: 10

Entrances Nov 13, 2019 - Nov 19, 2019: 33.33%

Exits Nov 13, 2019 - Nov 19, 2019: 0.00%

Previous Pages Nov 13, 2019 - Nov 19, 2019: 55.67%

Next Pages Nov 13, 2019 - Nov 19, 2019: 100.00%

Previous Page Path	Pageviews	% Pageviews
/posts/	1	100.00%

Next Page Path	Pageviews	% Pageviews
/posts/	2	100.00%

Search:

Search:

This report was generated on 11/20/19 at 6:18:24 PM - Refresh Report

```
1 {
2   "columnHeader": {
3     "dimensions": [
4       "ga:previousPagePath",
5       "ga:pagePath"
6     ],
7     "metricHeader": {
8       "metricHeaderEntries": [
9         {
10          "name": "ga:pageviews",
11          "type": "INTEGER"
12        },
13        {
14          "name": "ga:exits",
15          "type": "INTEGER"
16        }
17      ]
18    }
19  },
20  "data": {
21    "rows": [
22      {
23        "dimensions": [
24          "(entrance)",
25          "/"
26        ],
27        "metrics": [
28          {
29            "values": [
```

```
36     {
37       "dimensions": [
38         "/",
39         "/"],
40     ],
41     "metrics": [
42       {
43         "values": [
44           "4",
45           "1"],
46     ]
47   }
48 ],
49 },
50 {
51   "dimensions": [
52     "/",
53     "/posts/"],
54 ],
55   "metrics": [
56     {
57       "values": [
58         "4",
59         "0"],
60     ]
61   }
62 ],
63 },
64 {
65   "dimensions": [
```

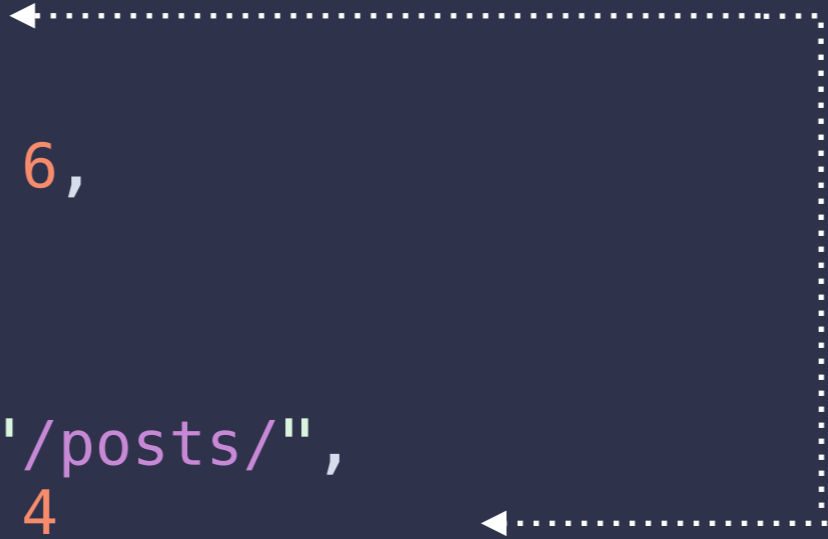
```
36     {
37       "dimensions": [
38         "/",
39         "/"],
40     ],
41     "metrics": [
42       {
43         "values": [
44           "4",
45           "1"]
46       }
47     ]
48   },
49   {
50     "dimensions": [
51       "/",
52       "/posts/"],
53     ],
54     "metrics": [
55       {
56         "values": [
57           "4",
58           "0"]
59       }
60     ]
61   },
62   {
63     "dimensions": [
64
65
```

```
1 {
2   "/": {
3     "pagePath": "/",
4     "pageviews": 6,
5     "exits": 0,
6     "nextPageviews": 6,
7     "nextExits": 0,
8     "nextPages": [
9       {
10        "pagePath": "/posts/",
11        "pageviews": 4
12      },
13      {
14        "pagePath": "/about/",
15        "pageviews": 1
16      },
17      {
18        "pagePath": "/contact/",
19        "pageviews": 1
20      }
21    ],
22    "percentExits": 0,
23    "topNextPageProbability": 0.6666666666666666
24  },
25  "/posts/": {
26    "pagePath": "/posts/",
27    "pageviews": 9,
28    "exits": 0,
29    "nextPageviews": 9
```

```
1 {
2   "/": {
3     "pagePath": "/",
4     "pageviews": 6,
5     "exits": 0,
6     "nextPageviews": 6,
7     "nextExits": 0,
8     "nextPages": [
9       {
10        "pagePath": "/posts/",
11        "pageviews": 4
12      },
13      {
14        "pagePath": "/about/",
15        "pageviews": 1
16      },
17      {
18        "pagePath": "/contact/",
19        "pageviews": 1
20      }
21    ],
22    "percentExits": 0,
23    "topNextPageProbability": 0.6666666666666666
24  },
25  "/posts/": {
26    "pagePath": "/posts/",
27    "pageviews": 9,
28    "exits": 0,
29    "nextPageviews": 9
```

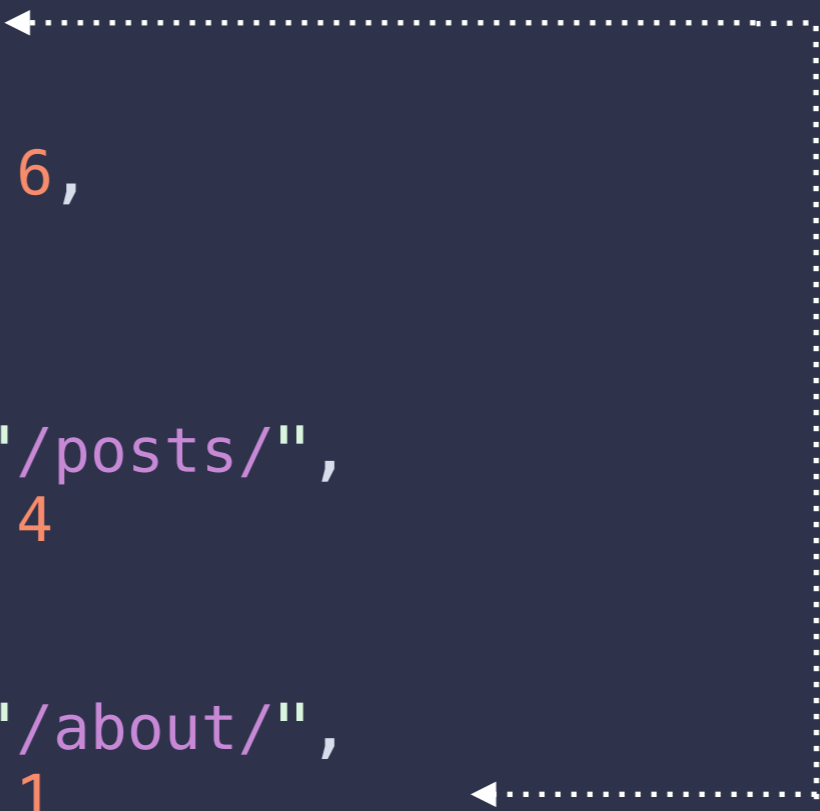
```
1 {
2   "/": {
3     "pagePath": "/",
4     "pageviews": 6,
5     "exits": 0,
6     "nextPageviews": 6,
7     "nextExits": 0,
8     "nextPages": [
9       {
10        "pagePath": "/posts/",
11        "pageviews": 4
12      },
13      {
14        "pagePath": "/about/",
15        "pageviews": 1
16      },
17      {
18        "pagePath": "/contact/",
19        "pageviews": 1
20      }
21    ],
22    "percentExits": 0,
23    "topNextPageProbability": 0.6666666666666666
24  },
25  "/posts/": {
26    "pagePath": "/posts/",
27    "pageviews": 9,
28    "exits": 0,
29    "nextPageviews": 9
```

$$\frac{4}{6}$$



```
1 {
2   "/": {
3     "pagePath": "/",
4     "pageviews": 6,
5     "exits": 0,
6     "nextPageviews": 6,
7     "nextExits": 0,
8     "nextPages": [
9       {
10        "pagePath": "/posts/",
11        "pageviews": 4
12      },
13      {
14        "pagePath": "/about/",
15        "pageviews": 1
16      },
17      {
18        "pagePath": "/contact/",
19        "pageviews": 1
20      }
21    ],
22    "percentExits": 0,
23    "topNextPageProbability": 0.6666666666666666
24  },
25  "/posts/": {
26    "pagePath": "/posts/",
27    "pageviews": 9,
28    "exits": 0,
29    "nextPageviews": 9
```

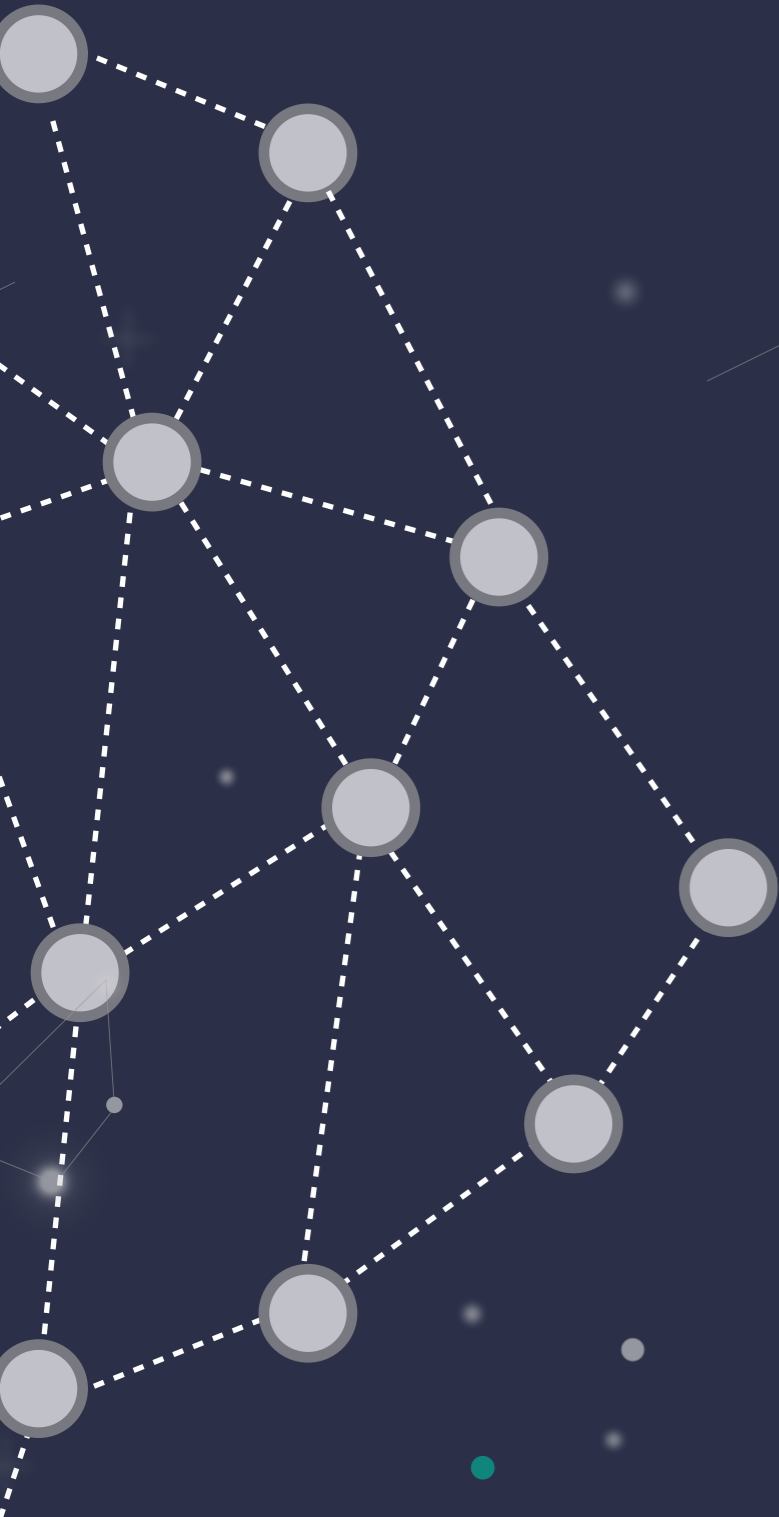
$$\frac{1}{6}$$



PREDICTIVE

Build

Automation





Google
Analytics



11ty



netlify

```
1 const axios = require('axios');
2 const {google} = require('googleapis')
3 const fs = require('fs')
4 const path = require('path')
5
6 const authClient = new google.auth.JWT({
7   email: process.env.SERVICE_ACCOUNT_EMAIL,
8   key: fs.readFileSync(path.join(__dirname, "../../key.pem"), 'utf8'),
9   scopes: ['https://www.googleapis.com/auth/analytics.readonly']
10 })
11
12 const queryParams = {
13   resource: {
14     reportRequests: [
15       {
16         viewId: process.env.VIEW_ID,
17         dateRanges: [{startDate: '30daysAgo', endDate: 'yesterday'}],
18         metrics: [
19           {expression: 'ga:pageviews'},
20           {expression: 'ga:exits'}
21         ],
22         dimensions: [
23           {name: 'ga:previousPagePath'},
24           {name: 'ga:pagePath'}
25         ],
26         orderBy: [
27           {fieldName: 'ga:previousPagePath', sortOrder: 'ASCENDING'},
28           {fieldName: 'ga:pageviews', sortOrder: 'DESCENDING'}
29         ],

```

```
11
12 const queryParams = {
13   resource: {
14     reportRequests: [
15       {
16         viewId: process.env.VIEW_ID,
17         dateRanges: [{startDate: '30daysAgo', endDate: 'yesterday'}],
18         metrics: [
19           {expression: 'ga:pageviews'},
20           {expression: 'ga:exits'}
21         ],
22         dimensions: [
23           {name: 'ga:previousPagePath'},
24           {name: 'ga:pagePath'}
25         ],
26         orderBys: [
27           {fieldName: 'ga:previousPagePath', sortOrder: 'ASCENDING'},
28           {fieldName: 'ga:pageviews', sortOrder: 'DESCENDING'}
29         ],
30         pageSize: 10000
31       }
32     ]
33   }
34 }
```

```
35
36 module.exports = async function() {
37   try {
38     await authClient.authorize()
39     const analytics = google.analyticsreporting({
40       version: 'v4'
```

```
33 }
34 }
35
36 module.exports = async function() {
37   try {
38     await authClient.authorize()
39     const analytics = google.analyticsreporting({
40       version: 'v4',
41       auth: authClient
42     })
43     const response = await analytics.reports.batchGet(queryParams)
44     let [report] = response.data.reports
45
46     const aggregatePages = async (pages) => {
47       ...
48       return predictions
49     }
50
51     const aggPages = await aggregatePages(report);
52
53     return aggPages
54   } catch (err) {
55     console.log("err")
56     return err
57   }
58 }
```

```
1 {
2   "pagePath": "/posts/",
3   "nextPagePath": "/posts/thirdpost/",
4   "nextPageCertainty": 0.3333333333333333
5 },
6 {
7   "pagePath": "/",
8   "nextPagePath": "/posts/",
9   "nextPageCertainty": 0.6666666666666666
10 },
11 {
12   "pagePath": "/posts/thirdpost/",
13   "nextPagePath": "/posts/",
14   "nextPageCertainty": 0.42857142857142855
15 },
16 {
17   "pagePath": "/posts/secondpost/",
18   "nextPagePath": "/posts/thirdpost/",
19   "nextPageCertainty": 0.5
20 },
21 {
22   "pagePath": "/about/",
23   "nextPagePath": "/contact/",
24   "nextPageCertainty": 0.5
25 },
26 {
27   "pagePath": "/contact/",
28   "nextPagePath": "/",
29   "nextPageCertainty": 0.6666666666666666
```

```
1 {
2   "pagePath": "/posts/",
3   "nextPagePath": "/posts/thirdpost/",
4   "nextPageCertainty": 0.3333333333333333
5 },
6 {
7   "pagePath": "/",
8   "nextPagePath": "/posts/",
9   "nextPageCertainty": 0.6666666666666666
10 },
11 {
12   "pagePath": "/posts/thirdpost/",
13   "nextPagePath": "/posts/",
14   "nextPageCertainty": 0.42857142857142855
15 },
16 {
17   "pagePath": "/posts/secondpost/",
18   "nextPagePath": "/posts/thirdpost/",
19   "nextPageCertainty": 0.5
20 },
21 {
22   "pagePath": "/about/",
23   "nextPagePath": "/contact/",
24   "nextPageCertainty": 0.5
25 },
26 {
27   "pagePath": "/contact/",
28   "nextPagePath": "/",
29   "nextPageCertainty": 0.6666666666666666
```

```
1 <!doctype html>
2 <html lang="en">
3   <head>
4     <meta charset="utf-8">
5     <meta name="viewport" content="width=device-width, initial-scale=1">
6     <title>{{ renderData.title or title or metadata.title }}</title>
7     <meta name="Description" content="{{ renderData.description }}">
8     <link rel="stylesheet" href="{{ '/css/index.css' | url }}">
9
10    {% for entry in prefetchLinks %}
11      {% if entry.pagePath == page.url %}
12        <link rel="prefetch" href="{{ entry | prefetchNextURL }}">
13      {% endif %}
14    {%- endfor -%}
15  </head>
16
17  <body>
18    {{ content | safe }}
19  </body>
20
21 </html>
```



```
1 module.exports = function(eleventyConfig) {
2   const THRESHOLD = 0.5
3
4
5   eleventyConfig.addFilter('prefetchNextURL', (entry, url) => {
6     // check threshold //
7     if (entry.nextPageCertainty > THRESHOLD) {
8       return entry.nextPagePath
9     }
10  })
11
12  ...
13 }
```

DEMO

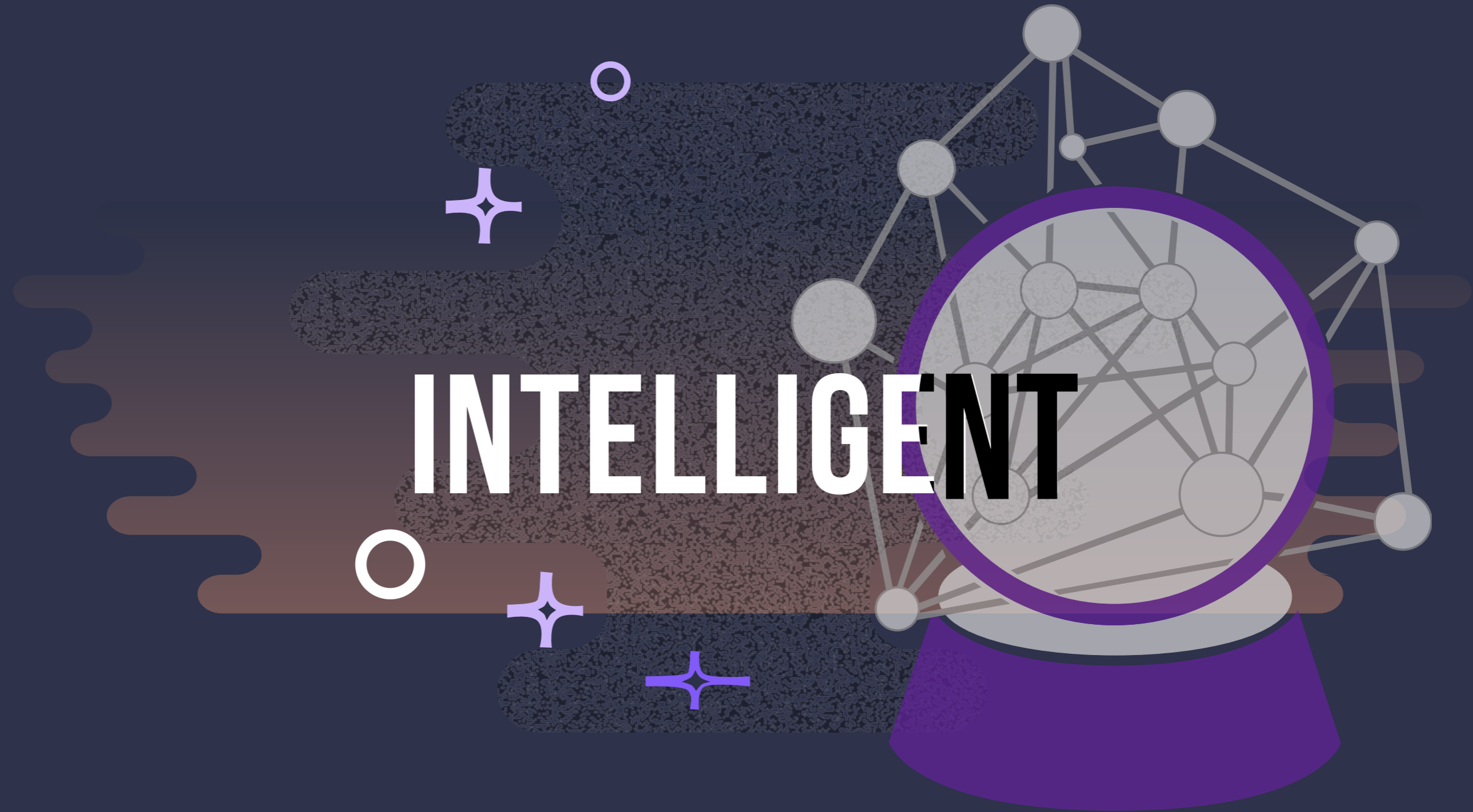


Guess.js

NAÏVE



INTELLIGENT











/about → /menu

/about → /menu

/about → /menu

/about → /contact

/menu → /contact

/menu → /

/menu → /

/menu → /about

/ → /about → /menu

/contact → /about → /menu

/ → /about → /menu

/ → /about → /contact

/contact → /menu → /contact

/ → /menu → /

/ → /menu → /

/about → /menu → /about



GDPR

BUILD TIME



REALTIME





PREDICTIVE

Serverless

.....

Functions

```
1 const axios = require('axios');
2 const {google} = require('googleapis')
3 const fs = require('fs')
4 const path = require('path')
5
6 const authClient = new google.auth.JWT({
7   email: process.env.SERVICE_ACCOUNT_EMAIL,
8   key: fs.readFileSync(path.join(__dirname, "../../key.pem"), 'utf8'),
9   scopes: ['https://www.googleapis.com/auth/analytics.readonly']
10 })
11
12 const queryParams = {
13   resource: {
14     reportRequests: [
15       {
16         viewId: process.env.VIEW_ID,
17         dateRanges: [{startDate: '30daysAgo', endDate: 'yesterday'}],
18         metrics: [
19           {expression: 'ga:pageviews'},
20           {expression: 'ga:exits'}
21         ],
22         dimensions: [
23           {name: 'ga:previousPagePath'},
24           {name: 'ga:pagePath'}
25         ],
26         orderBy: [
27           {fieldName: 'ga:previousPagePath', sortOrder: 'ASCENDING'},
28           {fieldName: 'ga:pageviews', sortOrder: 'DESCENDING'}
29         ],

```



```

35
36 export const reportServer = async function(event, context, callback) => {
37   try {
38     await authClient.authorize()
39     const analytics = google.analyticsreporting({
40       version: 'v4',
41       auth: authClient
42     })
43     const response = await analytics.reports.batchGet(queryParams)
44     let [report] = response.data.reports
45
46     const aggregatePages = async (pages) => {
47       ...
48       return predictions
49     }
50
51     const aggPages = await aggregatePages(report);
52     return {
53       status: 200,
54       headers: {
55         "Access-Control-Allow-Origin": "*",
56         "Access-Control-Allow-Headers": "Content-Type"
57       },
58       body: JSON.stringify({ "results": aggPages })
59     }
60
61
62
63
64

```

```
35
36 exports.handler = async (event, context, callback) => {
37   try {
38     await authClient.authorize()
39     const analytics = google.analyticsreporting({
40       version: 'v4',
41       auth: authClient
42     })
43     const response = await analytics.reports.batchGet(queryParams)
44     let [report] = response.data.reports
45
46     const aggregatePages = async (pages) => {
47       ...
48       return predictions
49     }
50
51     const aggPages = await aggregatePages(report);
52     return {
53       statusCode: 200,
54       headers: {
55         "Access-Control-Allow-Origin": "*",
56         "Access-Control-Allow-Headers": "Content-Type"
57       },
58       body: JSON.stringify({ "results": aggPages })
59     } catch (err) {
60       console.log("err")
61       return err
62     }
63   }
64 }
```

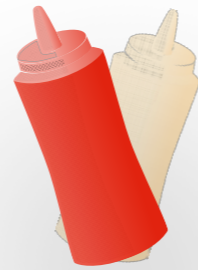
DEMO



THRESHOLD

Bandwidth	Threshold	Recommended
Slow 2G	0.9	DNS/Link Prefetch
2G	0.9	DNS/Link Prefetch
3G	0.5	DNS/Link Prefetch
4G	0.2	Link Prefetch
Data Saver	0	Null

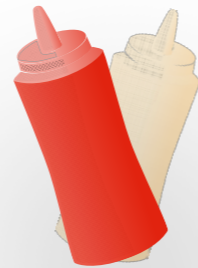
Hint	Cost (if wrong)	Benefit (if correct)
DNS Prefetch	Very low	Low
Link Prefetch	Mid high	High
Prerender	Very high	Very high



Open Sauce

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Sorry, Americans.



THANKS

@shortdiv

<https://noti.st/shortdiv/jsHO3Z/predictive-prefetching>

<https://github.com/shortdiv/cant-dutch-this/>