



Would You Like Fries with That?

AI for Developer Productivity

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Today's Menu

- Problem statement: why would we want this in the first place?
- Deepdive: getting interesting data out of backstage
- Deepdive: doing interesting things with this data
- Learnings & outlook
- Q&A time!

Developers are under pressure: And their productivity is slowing down.

Organizations are looking for a platform to reduce
toil and increase productivity.

39%

Increasing workload /
demand from other teams
lead to increased overhead.¹

76%

More than three-quarters
of organizations say the
cognitive load is so high
that it is a source of low
productivity.¹

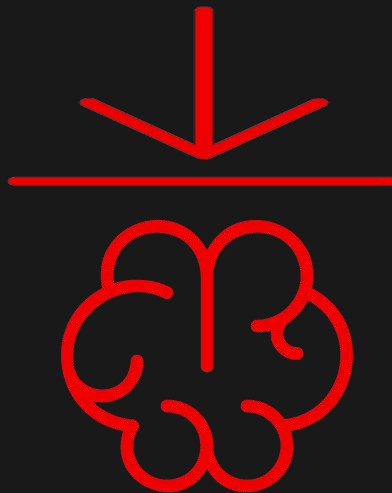
37%

Adapting to the
pressures of digital
transformation is third
biggest challenge.¹

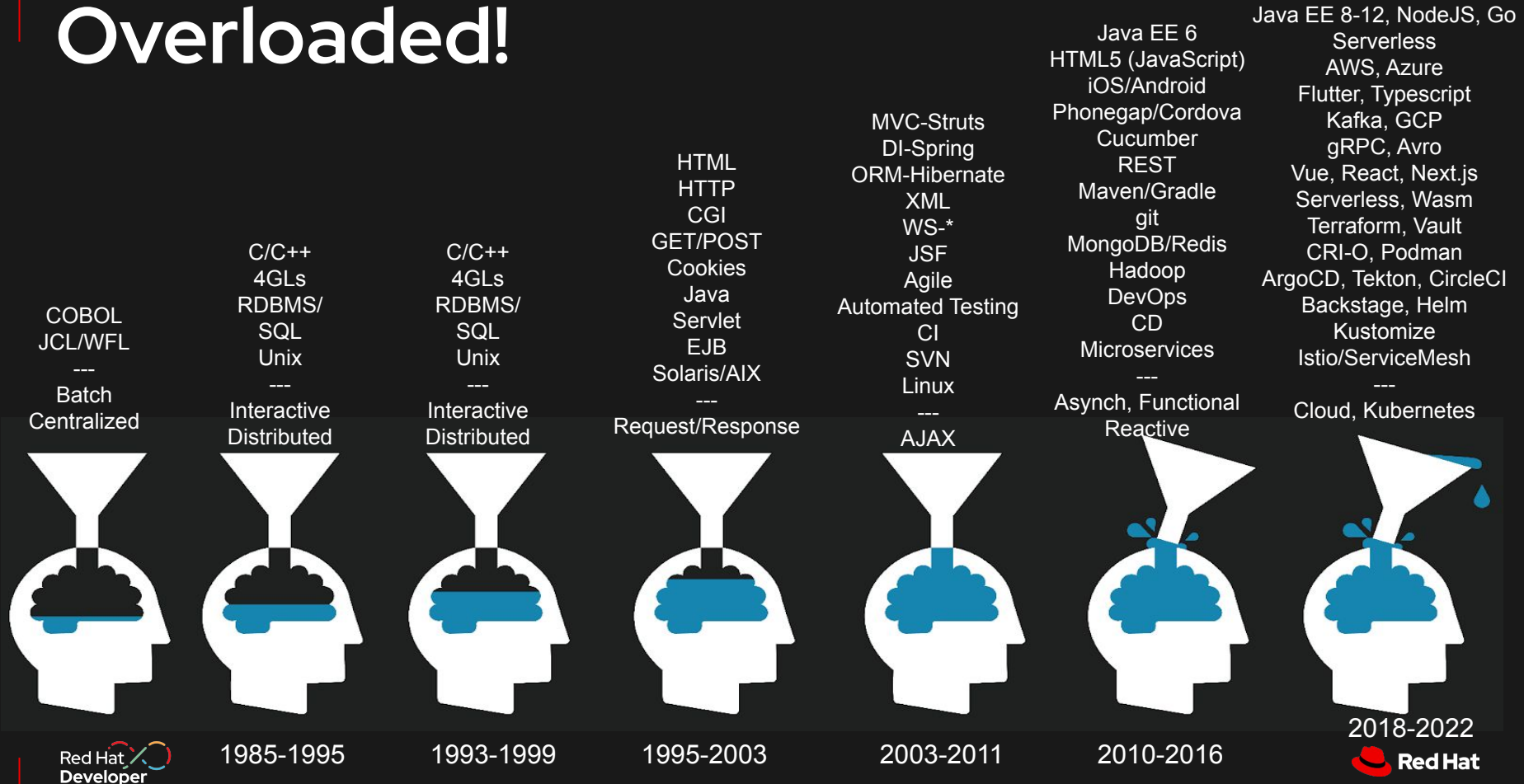
35%

Learning skills to
adapt to new
technologies and
approaches¹

Cognitive Load



Overloaded!



As the enterprise adopts an IDP and scales,
finding what is relevant to you becomes
harder to actually find



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MY ORG

All 15

CATEGORIES

main

Order Cheeseburger

Create an order for cheeseburger with customizable size, sauces, and toppings.

👤 kitchen-team

Choose

main

Order Chicken Burger

Create an order for a chicken burger with customizable size, sauces, and toppings.

👤 kitchen-team

Choose

side

Order Chicken Nuggets

Create an order for chicken nuggets with customizable quantity and sauces.

👤 kitchen-team

Choose

side

Order Chicken Tenders

Create an order for chicken tenders with customizable quantity and sauces.

👤 kitchen-team

Choose

side

Order Coleslaw

Create an order for coleslaw with customizable size and ingredients.

👤 kitchen-team

Choose

main

Order Double Cheeseburger

Create an order for double cheeseburger with customizable size, sauces, and toppings.

👤 kitchen-team

Choose

side

Order Fries

Create an order for fries with customizable size and sauces.

👤 kitchen-team

Choose

main

Order Hamburger

Create an order for a hamburger with customizable size, sauces, and toppings.

👤 kitchen-team

Choose

drink

Order Iced Tea

Create an order for iced tea with customizable flavor, size, and additional options.

👤 customer-service-team

Choose

drink

Order Milkshake

Create an order for milkshake with customizable flavors and size.

side

Order Mozzarella Sticks

Create an order for mozzarella sticks with customizable quantity and dipping sauces.

side

Order Onion Rings

Create an order for onion rings with customizable size and sauces.

“Would you like fries
with that?”



Amazon famously does this too

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Designing Distributed Systems: Patterns and Paradigms for Scalable, Reliable Services 1st Edition

by Brendan Burns (Author)

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Without established design patterns to guide them, developers have had to build distributed systems from scratch, and most of these systems are very unique indeed. Today, the increasing use of containers has paved the way for core distributed system patterns and reusable containerized components. This practical guide presents a collection of repeatable, generic patterns to help make the development of reliable distributed systems far more approachable and efficient.

Author Brendan Burns—Director of Engineering at Microsoft Azure—demonstrates how you can adapt existing software design patterns for designing and building reliable distributed applications. Systems engineers and application developers will learn how these long-established patterns provide a common language and framework for dramatically increasing the quality of your system.

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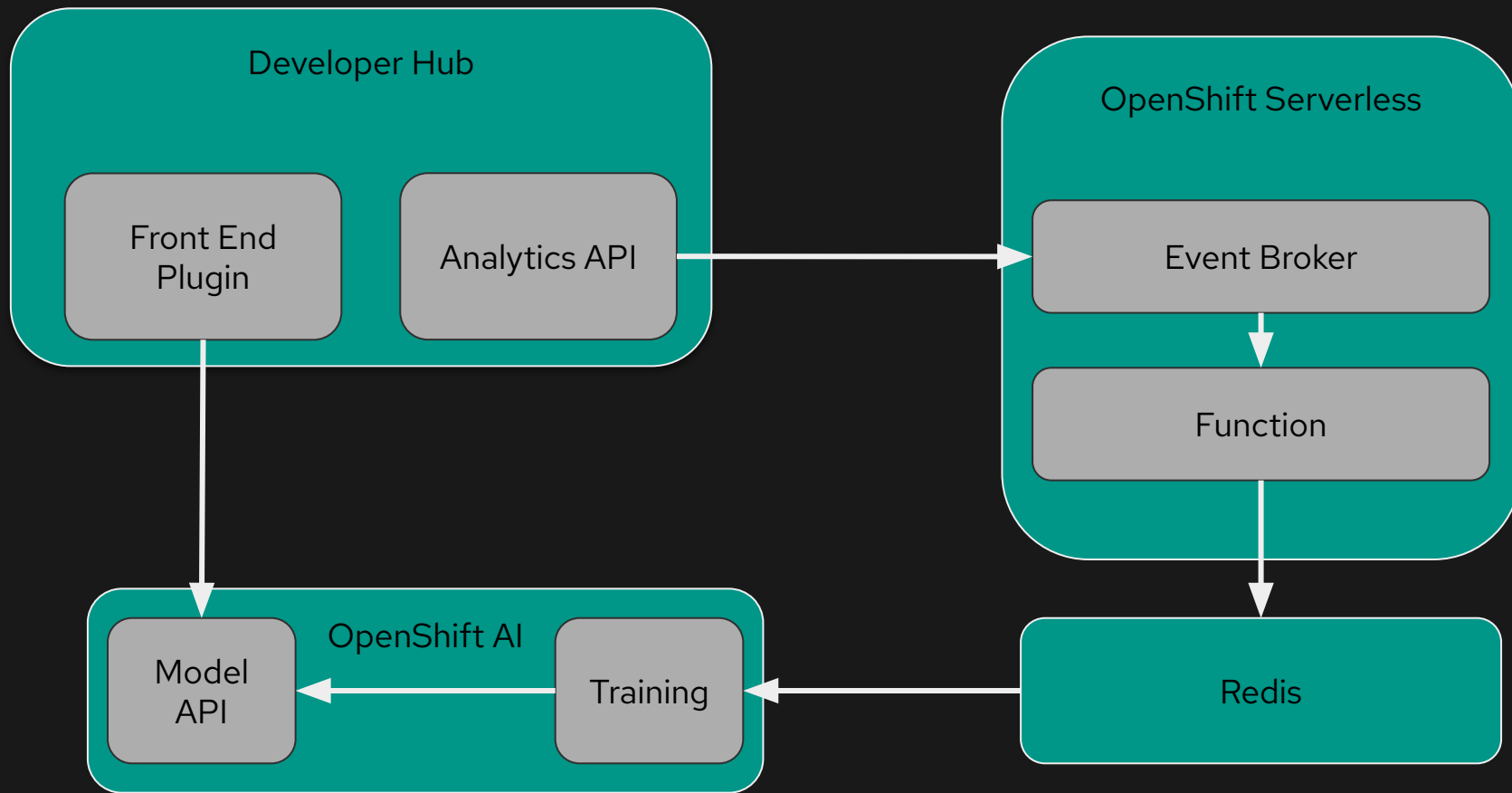
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Order Fries

Create an order for fries with customizable size and sauces.

side

kitchen-team



Order Milkshake

Create an order for milkshake with customizable flavors and si...

drink

customer-service-team



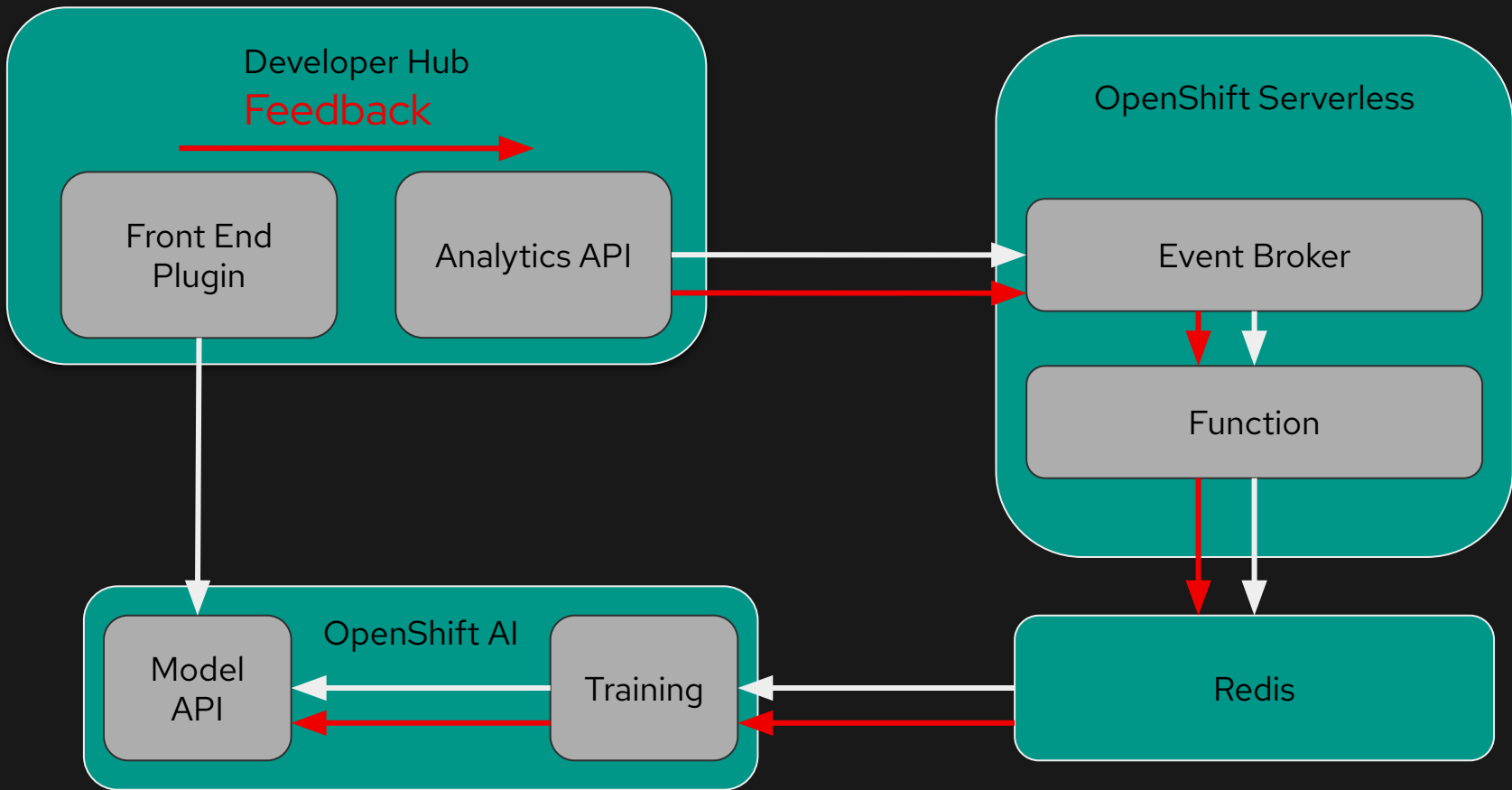
Order Cheeseburger

Create an order for cheeseburger with customizable size, sau...

main

kitchen-team





The infrastructure

Ingredients:

- Setup 100% self-contained in one cluster
- Helm charts & argo :)
- GitHub actions to build container images, npm packages and publish charts



Creating the generic analytics plugin

The recipe:

- Subscribe to session state
- Event logging API
- Metadata to enhance events
- Forward logs to endpoint



Session IDs



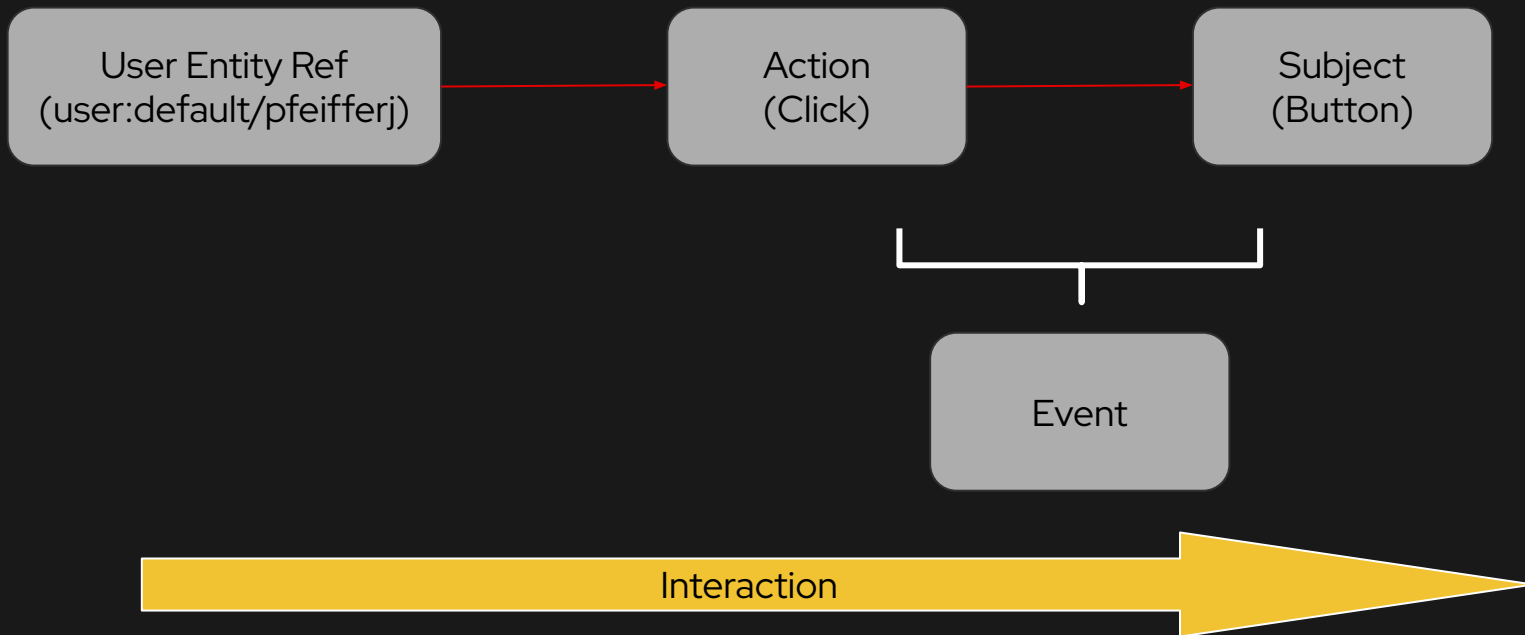
```
try {  
  this.sessionApi.sessionState$.subscribe(this.handleSessionStateChange);  
  ...  
}
```

Session IDs



```
private handleSessionStateChange = (sessionState: SessionState) => {  
  ...  
  if (sessionState === SessionState.SignedIn) {  
    ...  
    document.cookie = `sessionId=${this.sessionId}; path=/`;  
    ...  
  }  
}
```

Analytics Events



Example Event

```
[
  {
    "action": "navigate",
    "subject": "/playlist",
    "attributes": {},
    "context": {
      "routeRef": "playlist:index-page",
      "pluginId": "playlist",
      "extension": "App"
    }
  },
  {
    "User ID": "user:default/pfeifferj"
  },
  {
    "Team Metadata": {
      "metadata": {
        "namespace": "default",
        "annotations": {
          ...
        },
        "name": "pfeifferj",
        ...
      },
      "apiVersion": "backstage.io/v1alpha1",
      "kind": "User",
      "spec": {
        "profile": {
          "displayName": "Josephine Pfeiffer",
          "email": "josie@redhat.com",
          "picture": "https://avatars.githubusercontent.com/u/22047071?v=4"
        },
        "memberOf": ["management-team"]
      },
      "relations": [
        {
          "type": "memberOf",
          "targetRef": "group:default/management-team",
          "target": {
            "kind": "group",
            "namespace": "default",
            "name": "management-team"
          }
        }
      ]
    }
  },
  {
    "Session ID": "psq280qakwrlwxqhizu"
  }
]
```

```
[
  {
    "action": "navigate",
    "subject": "/playlist",
    "attributes": {},
    "context": {
      "routeRef": "playlist:index-page",
      "pluginId": "playlist",
      "extension": "App"
    }
  }
]
```

```
[
  {
    "action": "navigate",
    "subject": "/playlist",
    "attributes": {},
    "context": {
      "routeRef": "playlist:index-page",
      "pluginId": "playlist",
      "extension": "App"
    }
  },
  {

```

```
    }
  ],
},
{
  "Session ID": "psq280qakwrlwxqhizu"
}
```

```
},  
{  
  "User ID": "user:default/pfeifferj"  
},  
{
```

```
[  
  {  
    "action": "navigate",  
    "subject": "/playlist",  
    "attributes": {},  
    "context": {  
      "routeRef": "playlist:index-page",  
      "pluginId": "playlist",  
      "extension": "App"  
    }  
  },  
  {  
    "User ID": "user:default/pfeifferj"  
  }  
],  
{  
  "Team Metadata": {  
    "metadata": {  
      "namespace": "default",  
      "annotations": {
```

```
        "picture": "https://avatars.githubusercontent.com/u/220471?v=4"  
      },  
      "memberOf": ["management-team"]  
    },  
    "relations": [  
      {  
        "type": "memberOf",  
        "targetRef": "group:default/management-team",  
        "target": {  
          "kind": "group",  
          "namespace": "default",  
          "name": "management-team"  
        }  
      }  
    ]  
  }  
},  
{  
  "Session ID": "psq280qakwrlwxqhizu"  
}  
]
```



```
},  
{  
  "Session ID": "psq280qakwrlwxqhizu"  
}  
]
```

```
[  
  {  
    "action": "navigate",  
    "subject": "/playlist",  
    "attributes": {},  
    "context": {  
      "routeRef": "playlist:index-page",  
      "pluginId": "playlist",  
      "extension": "App"  
    }  
  },  
  {  
    "User ID": "user:default/pfeifferj"  
  }  
],  
{  
  "Team Metadata": {  
    "metadata": {  
      "namespace": "default",  
      "annotations": {
```

```
      "047071?v=4"  
    }  
  },  
  "memberOf": ["management-team"]  
},  
"relations": [  
  {  
    "type": "memberOf",  
    "targetRef": "group:default/management-team",  
    "target": {  
      "kind": "group",  
      "namespace": "default",  
      "name": "management-team"  
    }  
  }  
],  
},  
{  
  "Session ID": "psq280qakwrlwxqhizu"  
}  
]
```

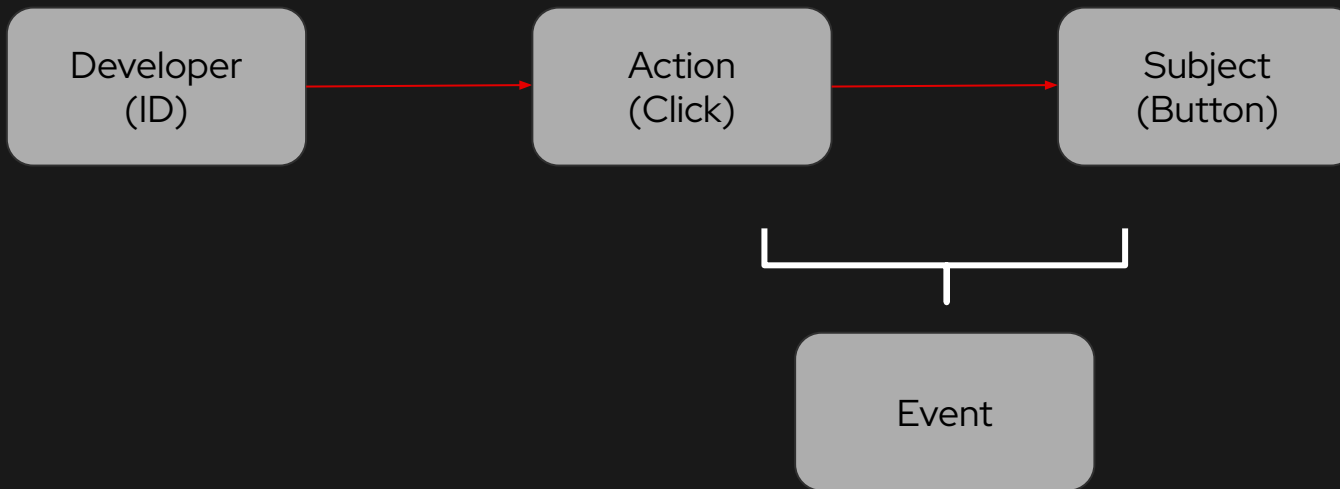
The Predictive Mechanism

What are we predicting?

If a customer orders fries, what is the most likely thing they will order next?

If a developer chooses this template, what is the most likely thing they will add? – How can we help?

Method

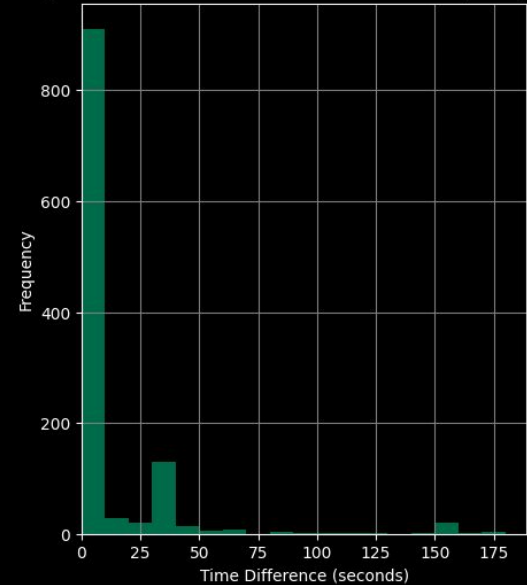


EDA

What numbers are we munching?

- 7 Users with different permissions
- 1250 logged Interactions
- 51 Chains of interactions
- 65 Event (action + subject) Combinations
- Modeled after 12 "Golden Paths"
- Training Data & Spontaneous user interactions

Histogram of Time Differences Between Actions (0-185) seconds



What's on the menu?

- LSTM
- Hidden Markov Models
- Large Language Models (Fries?)
- Findings and Future Outlook

LSTM

Long Term Short Term Memory

- Advantageous when using a sequential input
- Good at capturing patterns in user behaviour- on Wednesdays more people order takeaway

Food Inspection:

- **Good:** Capturing Long Range Dependencies and Patterns
- **Bad:** Hard to interpret - Hard to explain the outcomes of a black box

Hidden Markov Model

- **Known State:** Customer wants to order a Burger without Cheese
- **Unknown State:** Customer is Lactose intolerant
- **Known State:** User Creates a Database on a K8 Cluster
- **Unknown State:** User wants to make his own scalable Web App Backend

Food Inspection:

- **Good to use when** - Few Manageable States
- **Do not use when** - Understanding more complex behaviour

Conclusion

- **LSTM**: complex, data-rich environments where capturing long-term dependencies and learning directly from data is crucial. Best for scenarios where customer behavior is dynamic and less predictable.
- **HMM**: Simple, interpretable model with limited data and clearly defined states. Sequence modelling with a reasonable number of states and known dependencies.

LLM

Proposal: Prompt the LLM with the current State & Suggest Options

Based on the given sequence of actions, it appears the user is exploring creation options and navigating through different sections of the catalog and creation areas. The next likely action could be:

'**navigate_/create/templates/default/order-cheeseburger**' or any other specific order creation template, as they have already been in the creation area and might proceed to create a specific item.

'**click_explore**' or '**navigate_/explore**', if they continue to explore other available options.

Food Inspection:

Pros: Reasoning behind Options

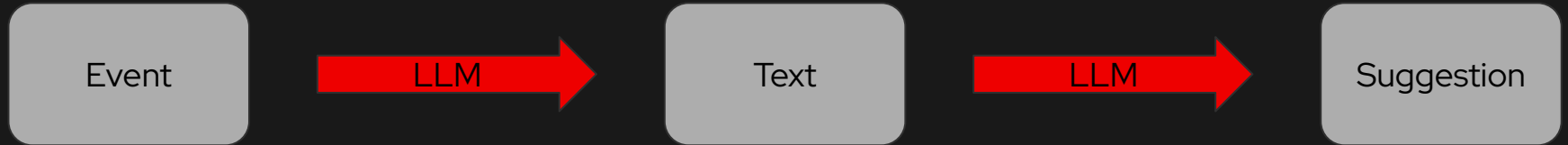
Cons: Expensive Transactions , Many Queries, Context Length

Reworked: LLM

New Proposal:

Taking inspiration from Bioinformatics

- Using an LLM to convert action to natural language
- Using LLM to predict next action based on a natural language prompt - Give the final options



LLM Burger Prediction

Given that the user has ordered a **chicken burger with mayonnaise and ketchup**, the next most likely selections would be:

Medium Size - Since the user has chosen a specific combination of condiments (mayonnaise and ketchup), they may want a balanced portion.

Additional Sauces - It is less likely they would add another sauce, but if they do, barbecue or honey mustard might be considered to complement the existing sauces.

Topping choices by likelihood

- **Lettuce** - This is a common topping that pairs well with chicken burgers.
- **Tomato** - Often chosen with lettuce to create a classic combination.
- **Cheese** - Another popular choice to enhance the flavor profile.

Findings: Data Science

HMM - Hard to measure as previously unseen sequences appear. - Good if there are only few golden paths.

LSTM - After a while of training, results are at 60% accuracy for the validation set.

LLM - Good idea to add context and explanation - Unforeseen Hallucinations might happen. Further pursuing the LLM in Bioinformatics Approach!

Outlook:

- Add context

- Add real user data

Findings: Backstage/Infrastructure

Backstage docs - Not that great yet

Backstage Community - The maintainers are very helpful

GitOpsing everything - Takes an initial time investment but pays off 100x

Outlook:

- Fine tune logging mechanisms
- Make options more configurable
- Add testing

GitHub - Stay tuned...

github.com/pfeifferj/backstage-ai-demo



Q & A Time!

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Backup Slides :)

<https://www.nytimes.com/2019/10/22/business/mcdonalds-tech-artificial-intelligence-machine-learning-fast-food.html>

The New York Times

Artificial Intelligence > | Harvesting Data for A.I. | A.I. Data Race, Explained | What Is 'Synthetic Data'? | Key Figures in the Field | A.I. Faces Quiz

Would You Like Fries With That? McDonald's Already Knows the Answer

The fast-food chain is turning to artificial intelligence and machine learning in the hopes of predicting what customers want before they decide.

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