

Next-Generation Network as Code

A versionable database with a SoT

Tim Sehn & Ken Celenza

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>>> network .toCode()

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Introductions

Tim Sehn

- Founder and CEO of the company that created Dolt
- Dolt is Git for data. Think MySQL + Git = Dolt.
- Previously SVP Eng at Snapchat
- Before that grew up at Amazon. Last job was running the border network in AWS.



Ken Celenza

- Managing Director at Network to Code
- Traditional network engineer by day, coder by night
- Converted full time ***network automator*** in 2016
- 20 years in the industry, primarily supporting enterprises



Agenda

- Current state of SoT
- Manage Data Like Code...
- Demonstration
- Wrap up

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Current State of SoT

Why is SoT (data) Important?

- Configurations do not provide **tracking**
 - Who created the configuration?
 - Why did they make the change?
 - When did they make the change?

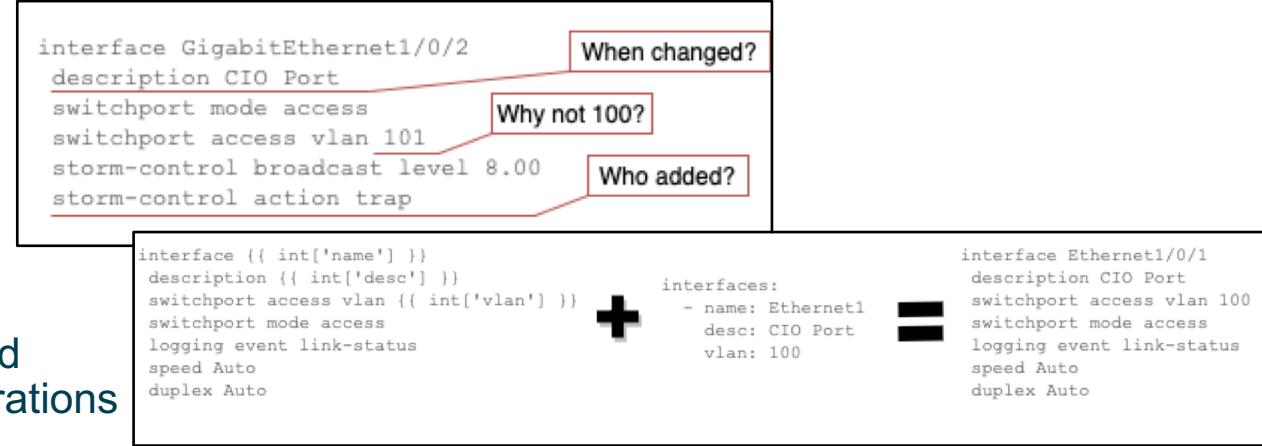
```
interface GigabitEthernet1/0/2
description CIO Port
switchport mode access
switchport access vlan 101
storm-control broadcast level 8.00
storm-control action trap
```

When changed?
Why not 100?
Who added?

Why is SoT (data) Important?

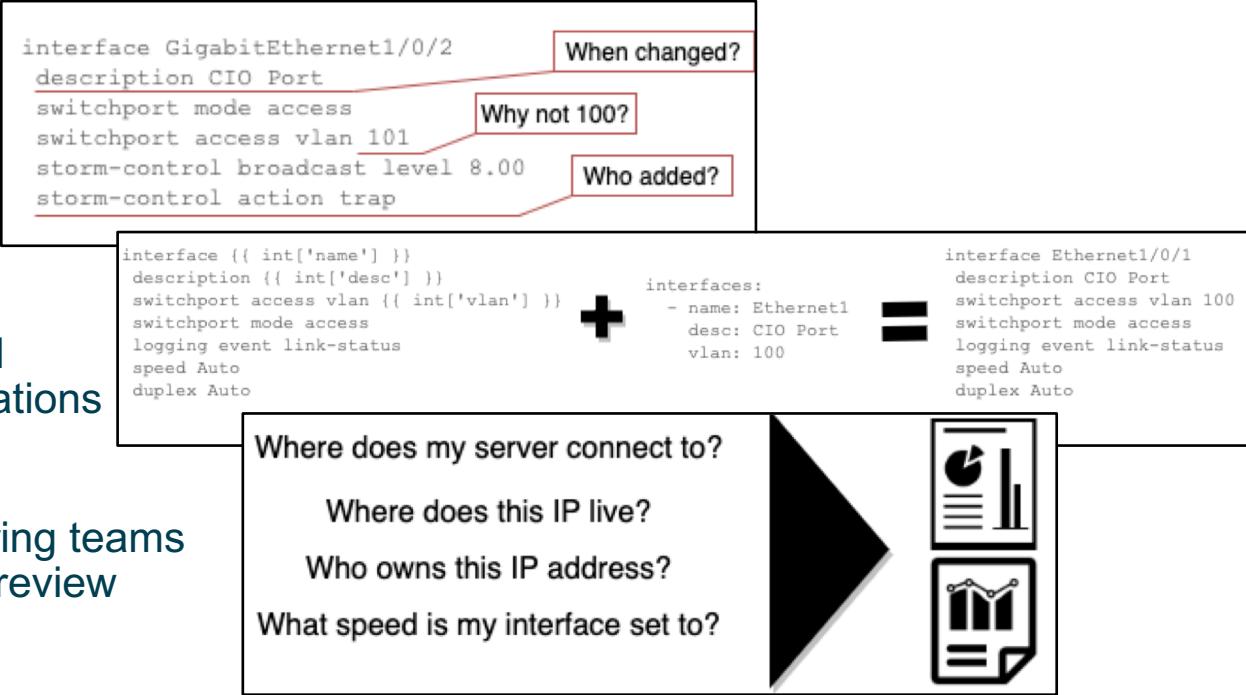
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- Ensures **consistency**, if data cannot fit in, can't be added
 - Allows ability to disaggregate data from the configurations



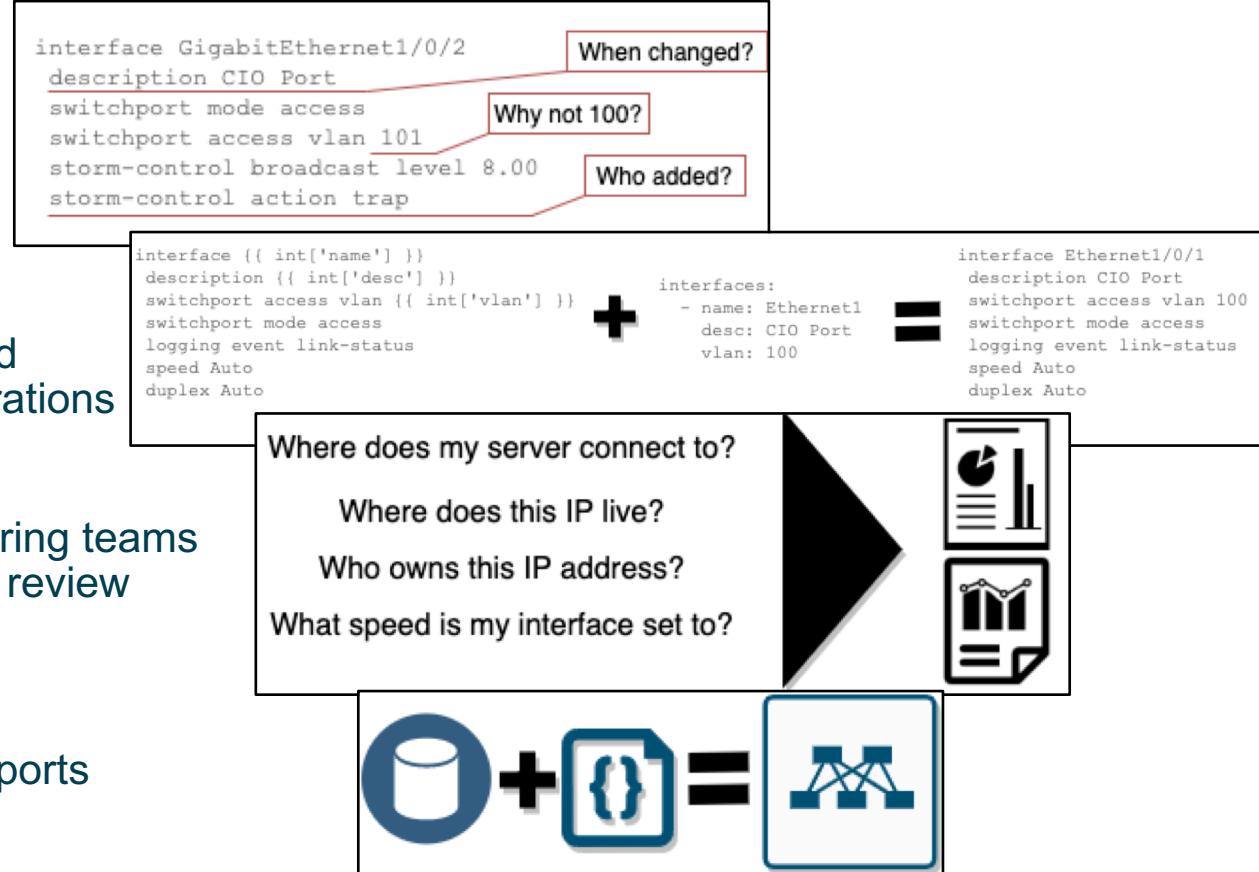
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 - The data is valuable outside of the network engineering teams
 - Only method is to take valuable engineering time to review
 - Data becomes auditable, rather than configuration



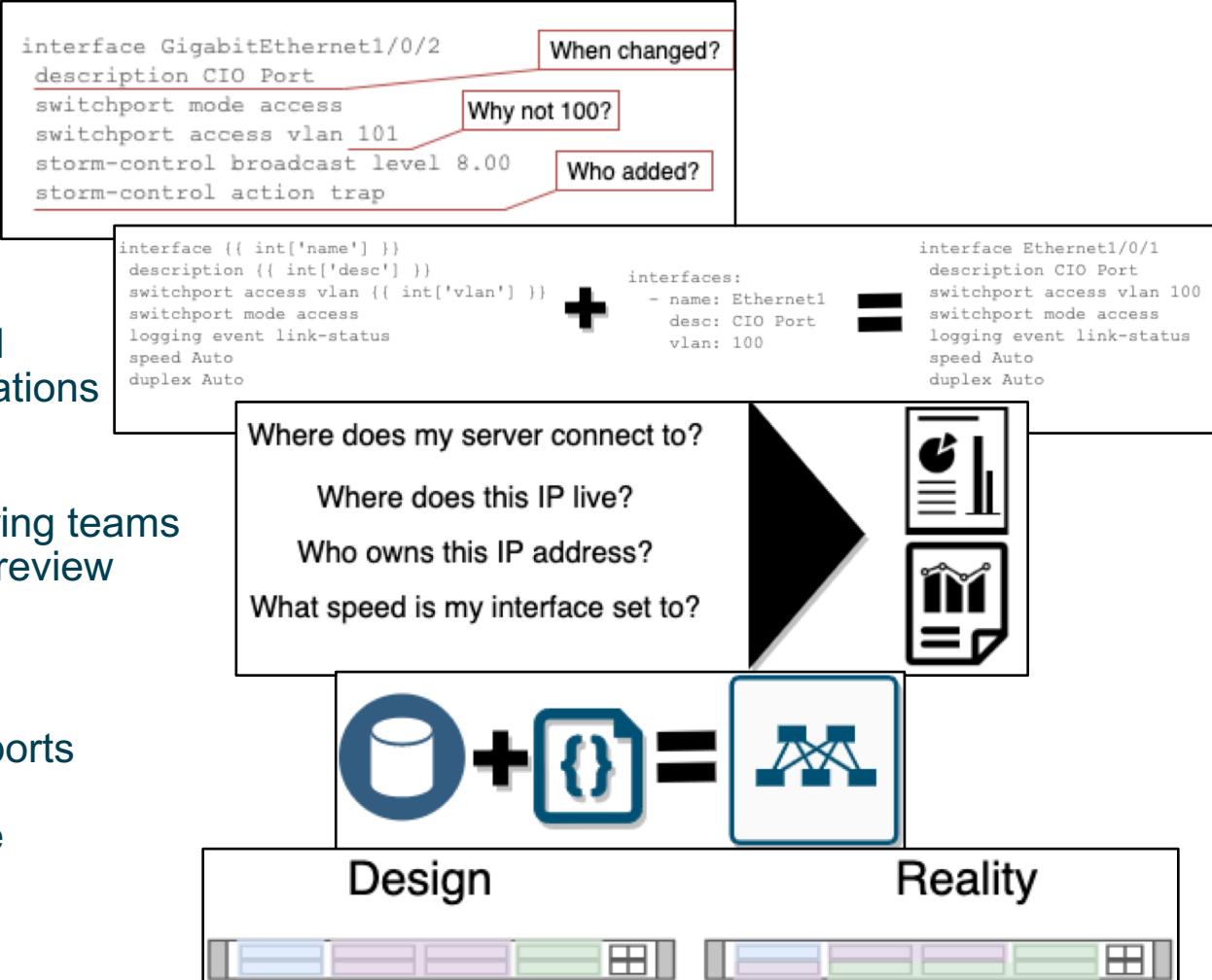
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 - Documentation can be auto-generated visuals or reports
- Designs are intended to be consistent, reality is otherwise
 - Data allows a design to be **flexible**



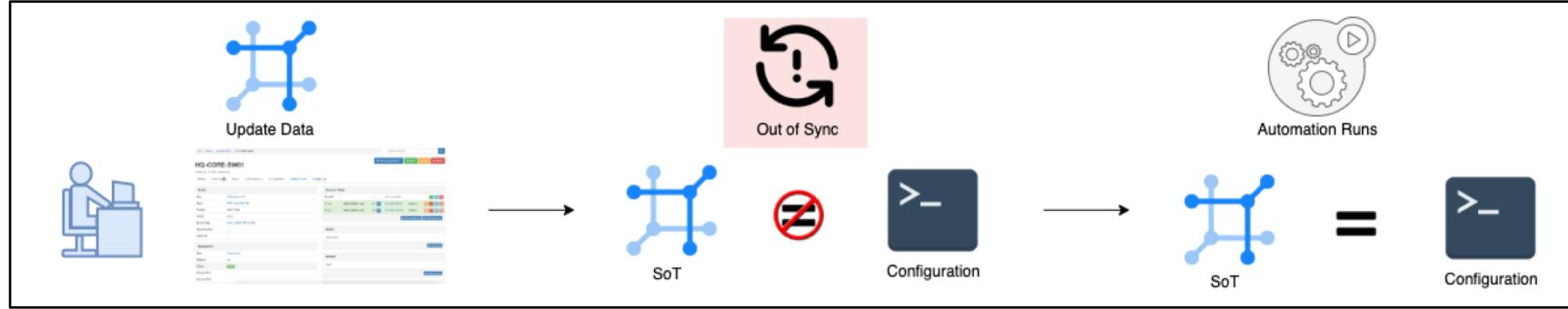
Managing SoT is Difficult

The **Source of Truth** with a **database** is an integral part of any automation strategy, but remains difficult to manage the data.

- Data volume is **massive** for network infrastructure for **human scale**
 - Potentially millions of data points, near impossible in YAML or equivalent
 - Human entry is both a necessity and error-prone
- **Standards** within the SoT are **impossible to enforce**
 - Once data is in, no easy way to roll back
 - Lack of ruthless standardization
- There is **no staging** of data, and thus **no ability to test**
 - There is no assurance of accuracy or standards
- Trust of the data is **hard to gain, easy to lose**
 - Most common response is, “I just look at the config”

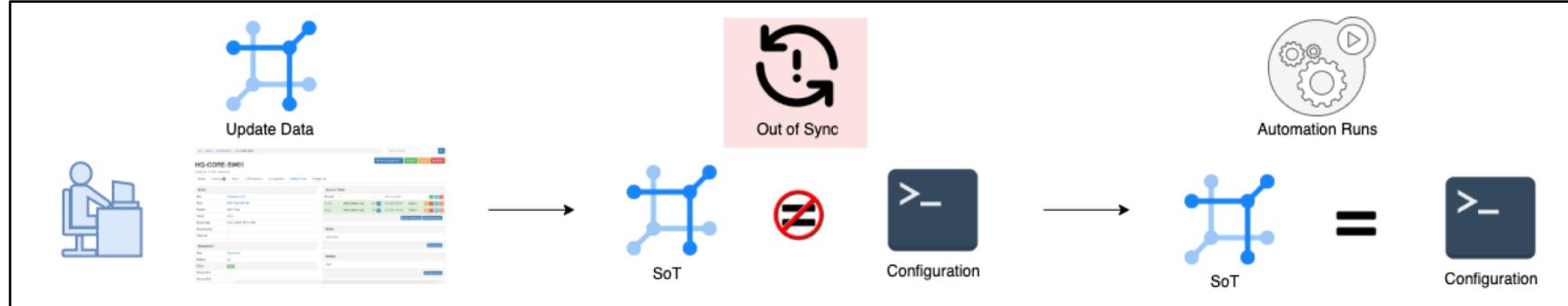
SoT Lifecycle

Before

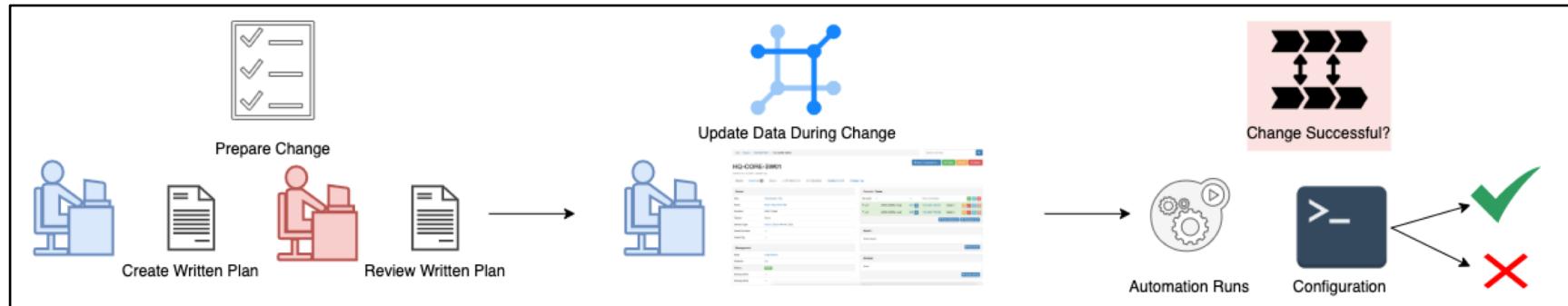


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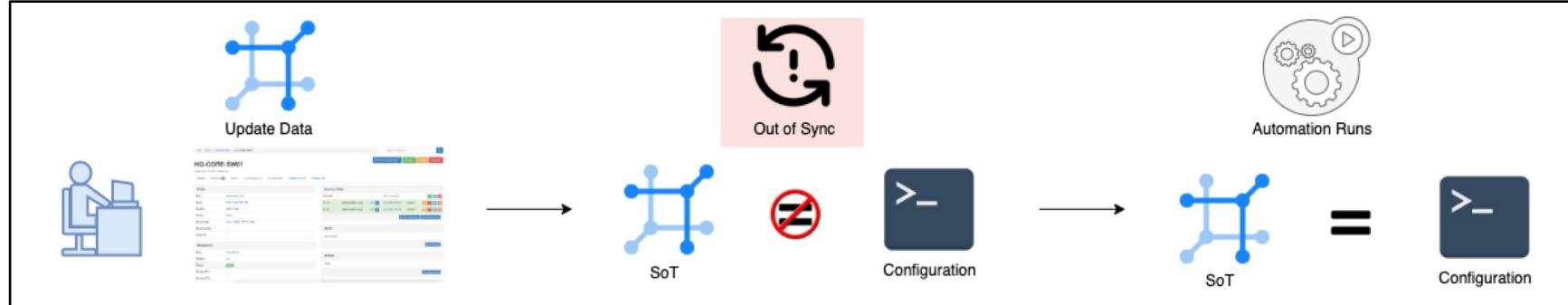


During

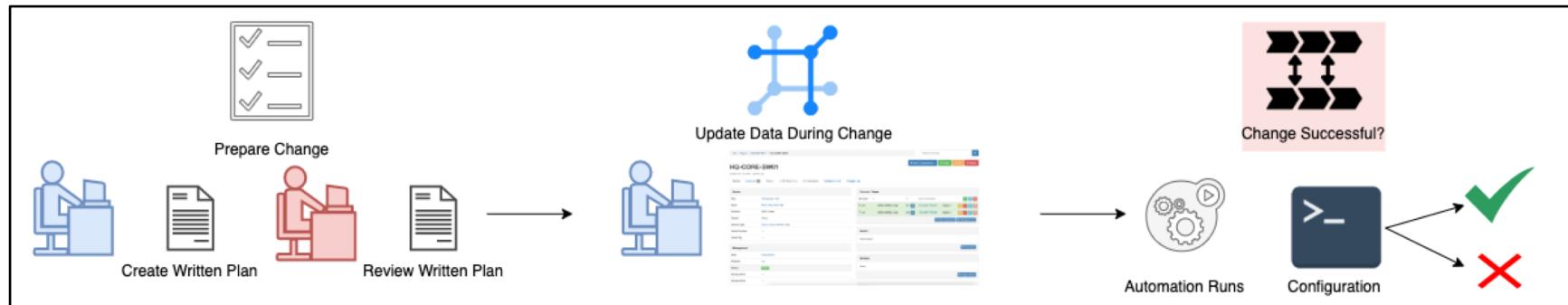


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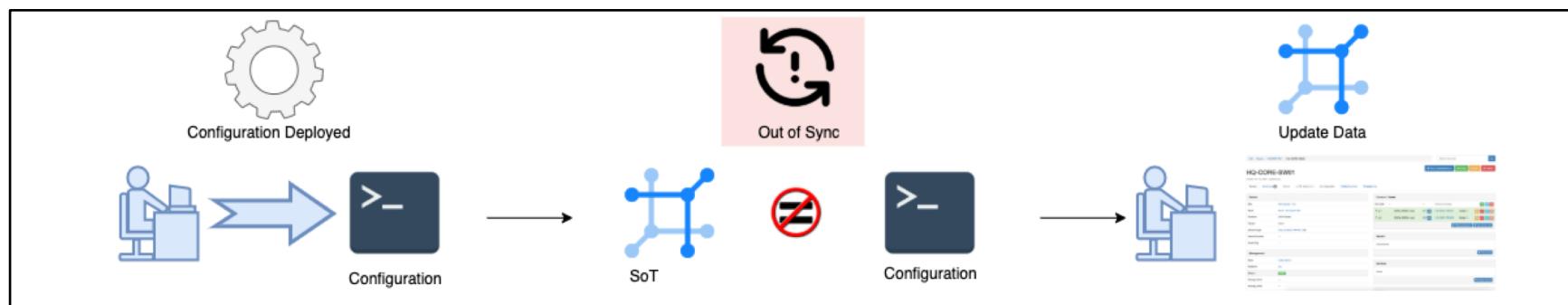
Before



During



After



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Manage Data Like Code (IaC)

How to Manage Data Like Code...

Git

- Provides the ability to version data in such a way the exact state of the data at any point in the past is known.
- Provides the ability to know who is the owner of the data.
- Provides the ability to populate data in a staging area, without modifying the production data.
- Tooling integration with things such as CI systems.
- Decentralized storage of the data.



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- Provides ACID-based transactions of the data.
- Has a native querying language to obtain, filter, and all around work with the data.
- Provides schema enforcement of the data.
- The ability to scale to large datasets.



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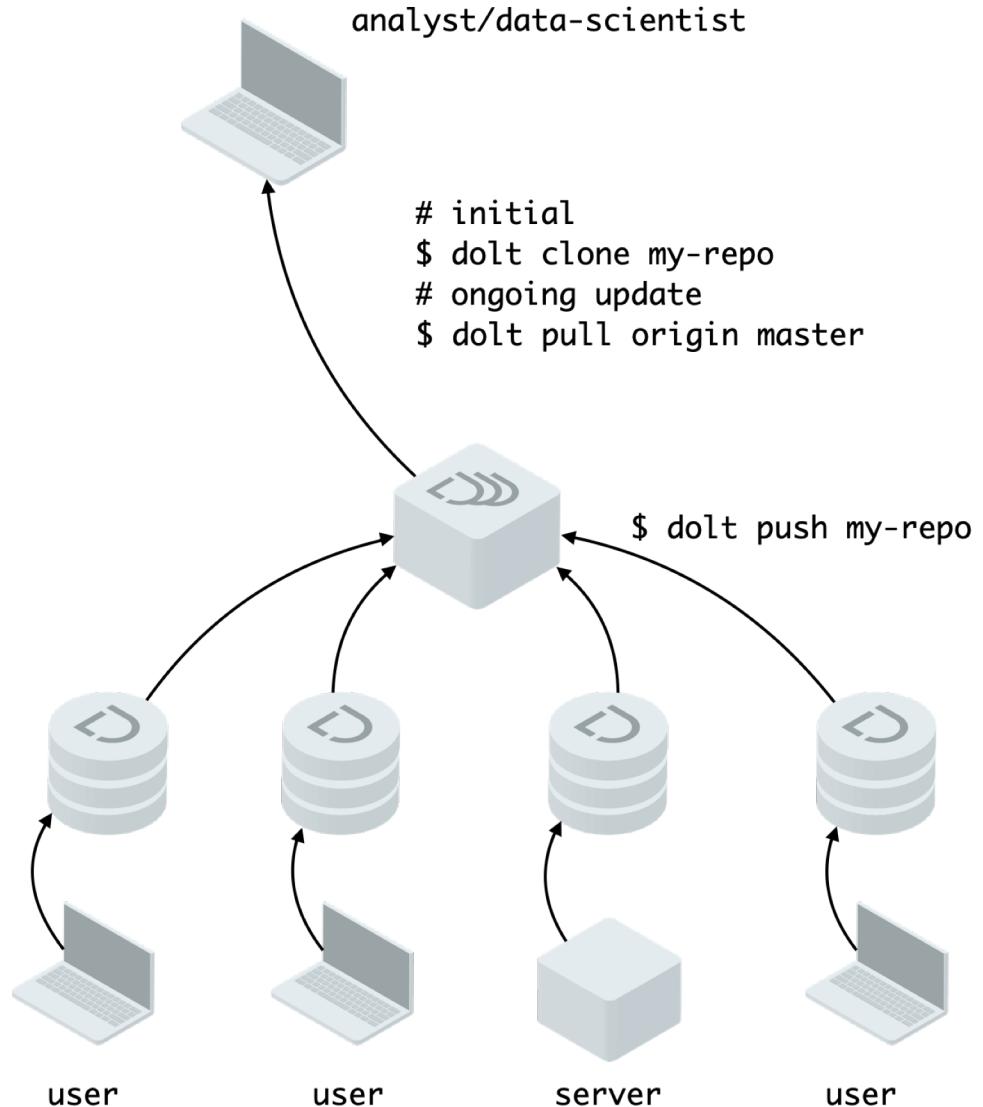


What if one tool combined both?

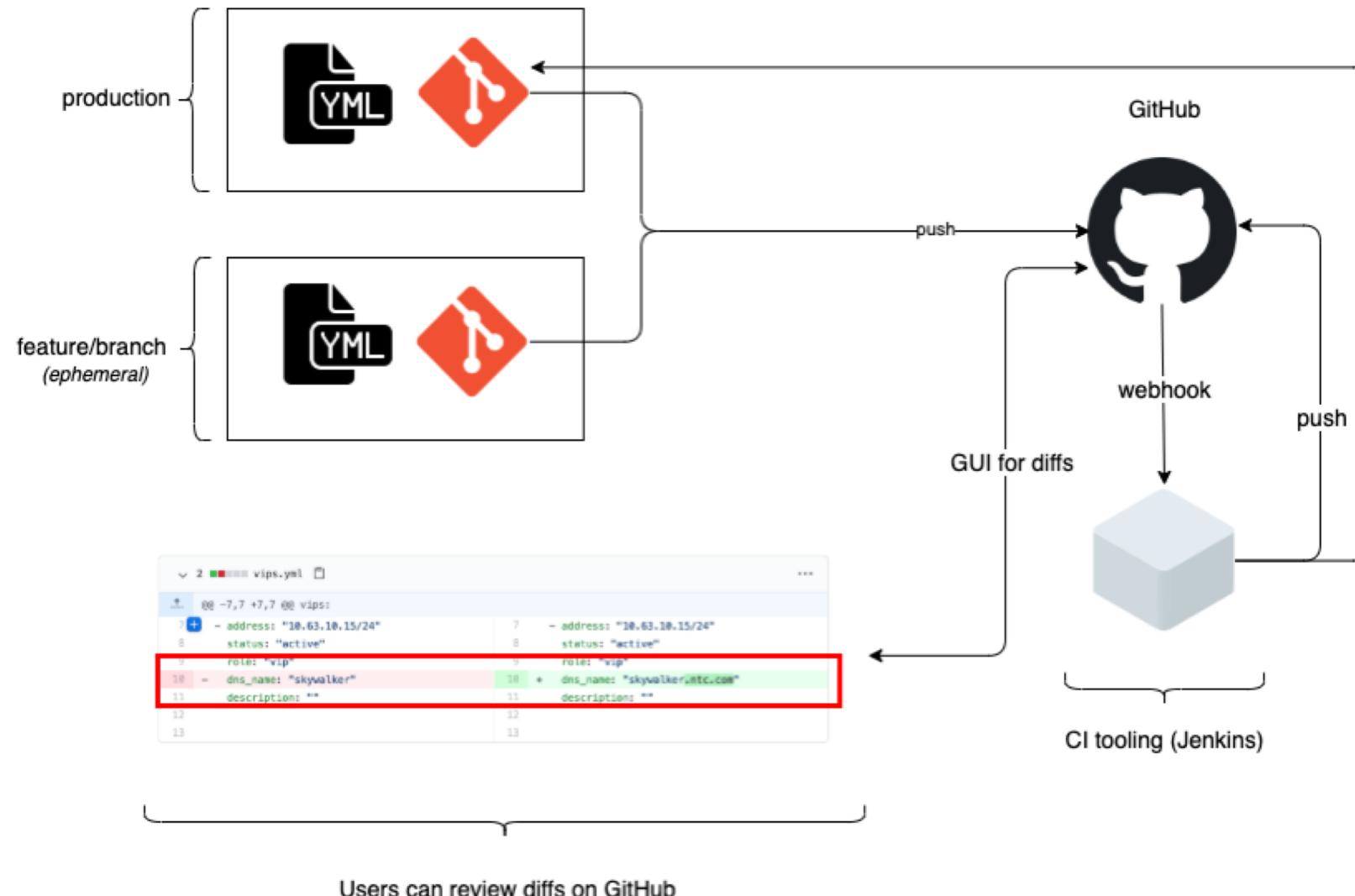


Dolt

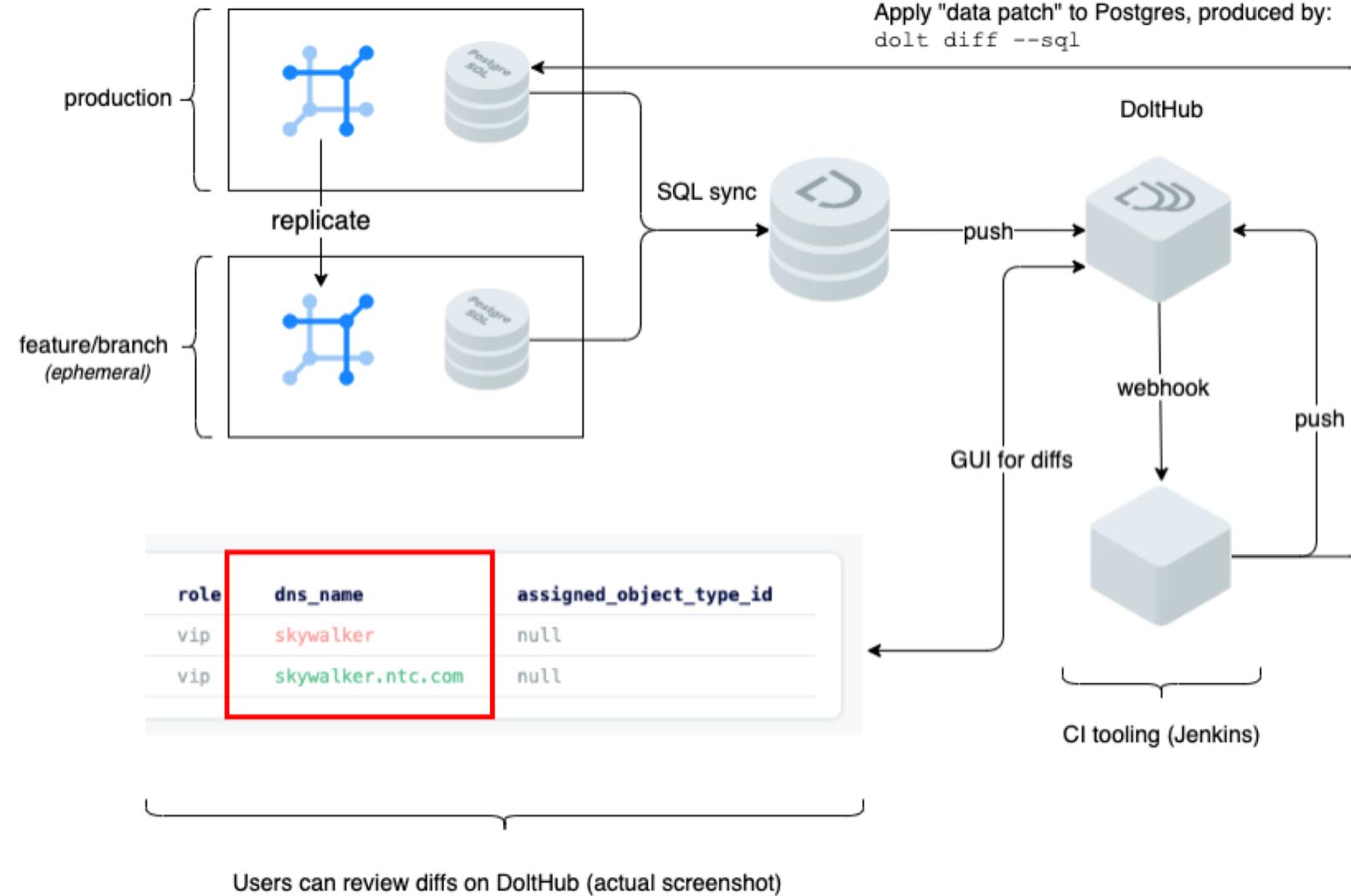
- Git + MySQL = Dolt
- Goal:
 - Support 100% of Git operations
 - Support 100% of MySQL SQL
 - Invent SQL to do Git operations
- Progress:
 - Supports 90% of Git operations
 - Supports 93% of MySQL SQL
 - System tables for Git read operations
 - Branching and committing via SQL functions
- We also built DoltHub
 - DoltHub is a place on the internet to share Dolt repositories
 - DoltHub supports Pull Requests, Webhooks, Forks, Permissions



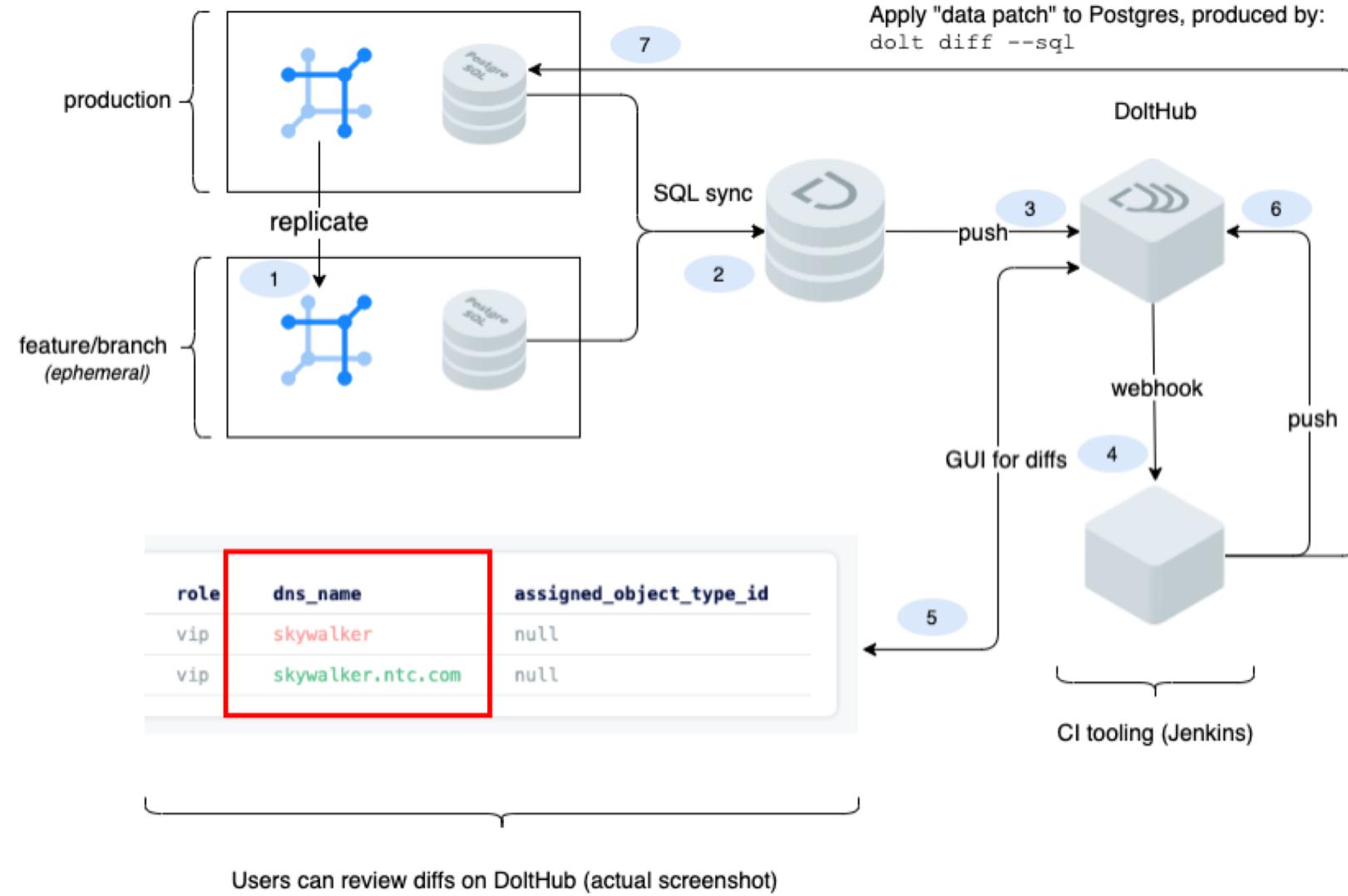
IaC Design with YAML



IaC Design with Dolt (Demo)



Demonstration Workflow



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Demonstration

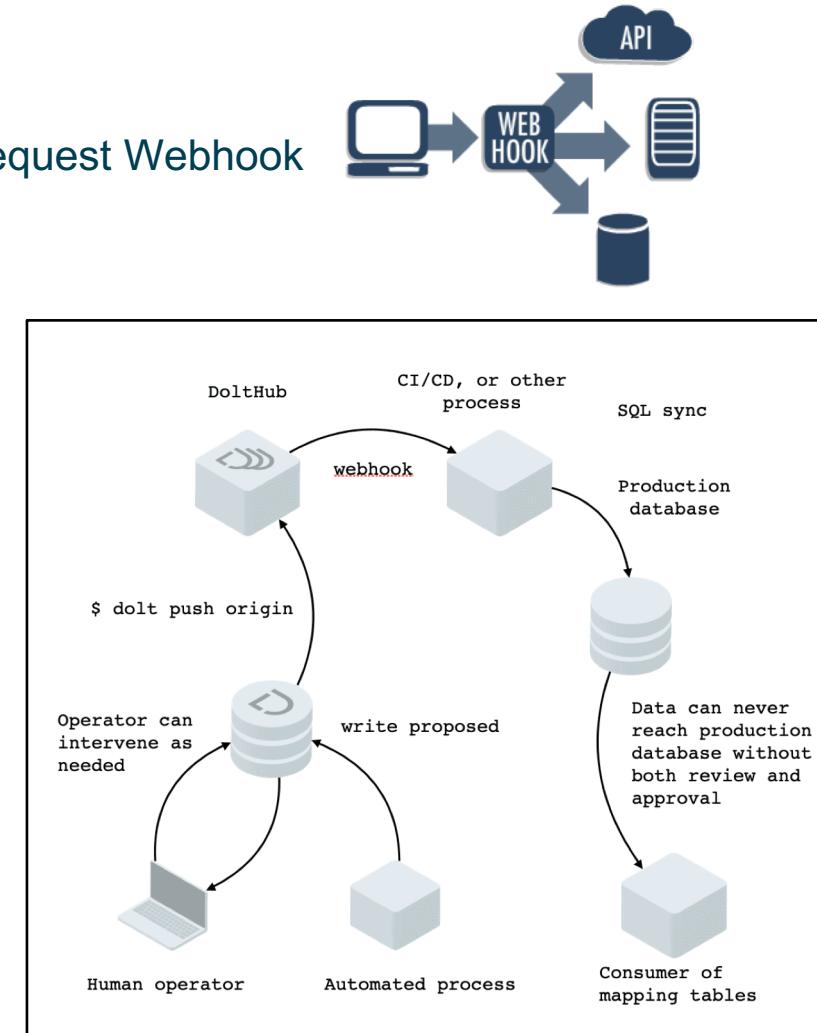
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Wrap Up

Features to Support Workflow

- DoltHub Webhooks
 - We wanted to show off integration testing on Pull Requests
 - The standard way to do this is attach a Jenkins build to the GitHub Pull Request Webhook
 - Implemented WebHooks on DoltHub for commits
- SQL Sync
 - NetBox uses PostgreSQL
 - Migrating NetBox to MySQL would be resource intensive
 - A utility to sync changes from PostgreSQL to Dolt and back to PostgreSQL supported all use cases
 - Implemented in Python via DoltPy, leveraging SQLAlchemy as underlying engine
 - Solution will work with many applications to use whatever database supported wants but use Dolt as the "Master" copy



Conclusion

Challenges / Lessons Learned

- Building a non-integrated solution took several iterations to work “naturally”
- Issues **converting Postgres** to MySQL dialect
- Introducing multiple new technologies
 - Amount of total technologies
- Having a **GraphQL API** is awesome!!

Call to Action

- Want to build similar workflow... reach out to us

Links

- <https://blog.networktocode.com/post/Versionable-Database/>
- <https://www.liquidata.co/>
- <https://media.ccc.de/v/denog11-26-automate-yourself-within-six-months>

Contact

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 - Chat: join us at: <https://slack.networktocode.com>

END