



Home Assistant

Ali Sina (218318428)

Arash Saffari (218791632)

David Luu (216157463)

John Donato Prabahar (219087279)

Omer Omer (218636878)

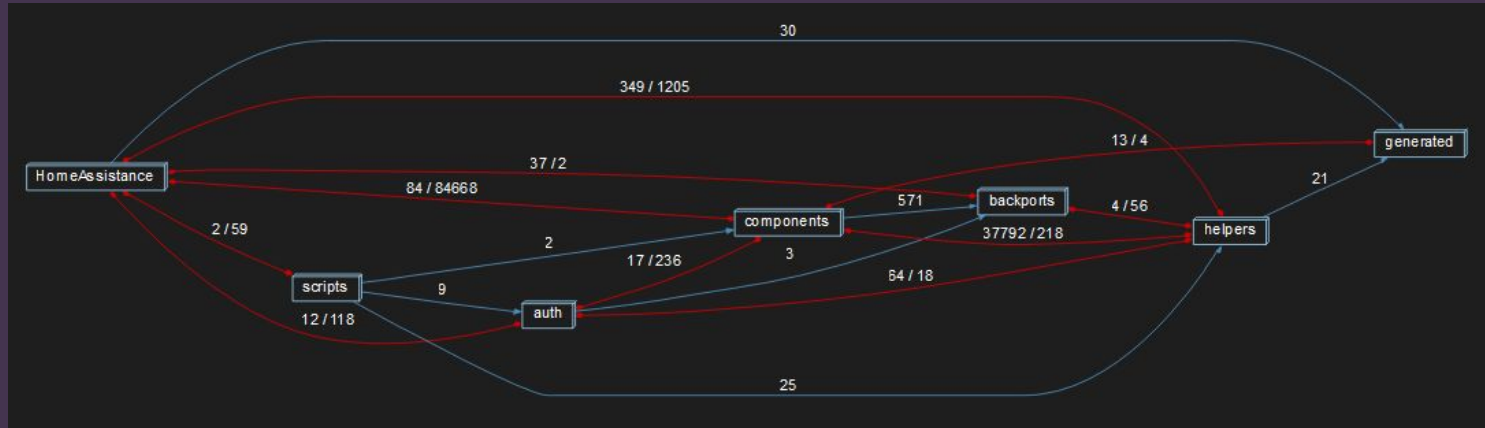
Siyan Sriganeshan (218707190)

01

Derivation Process

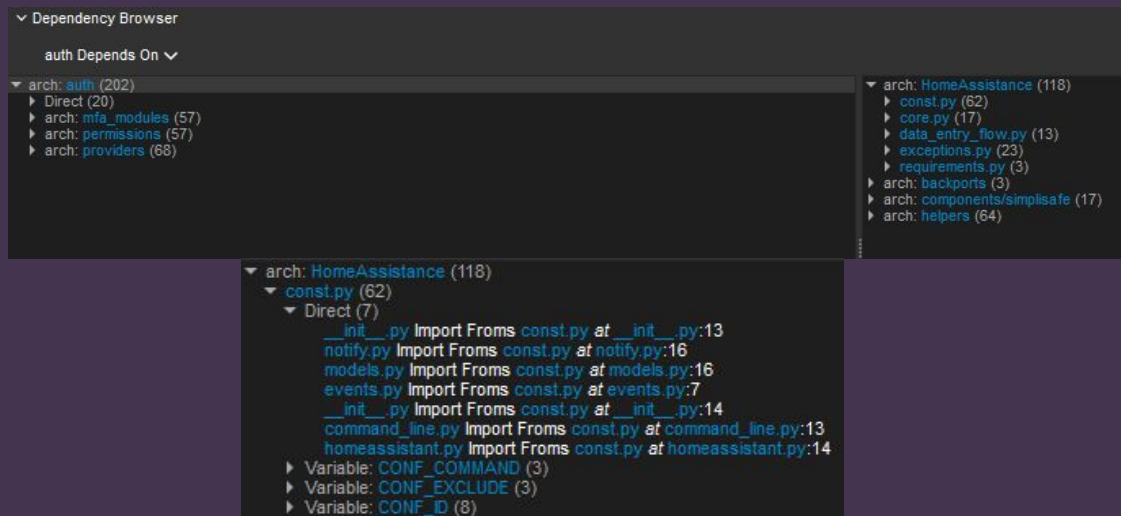
Derivation Process

- Event Bus, Service Registry, and State Machine were all found in core.py, so it was all placed in an entity called Home Assistant



Derivation Cont.

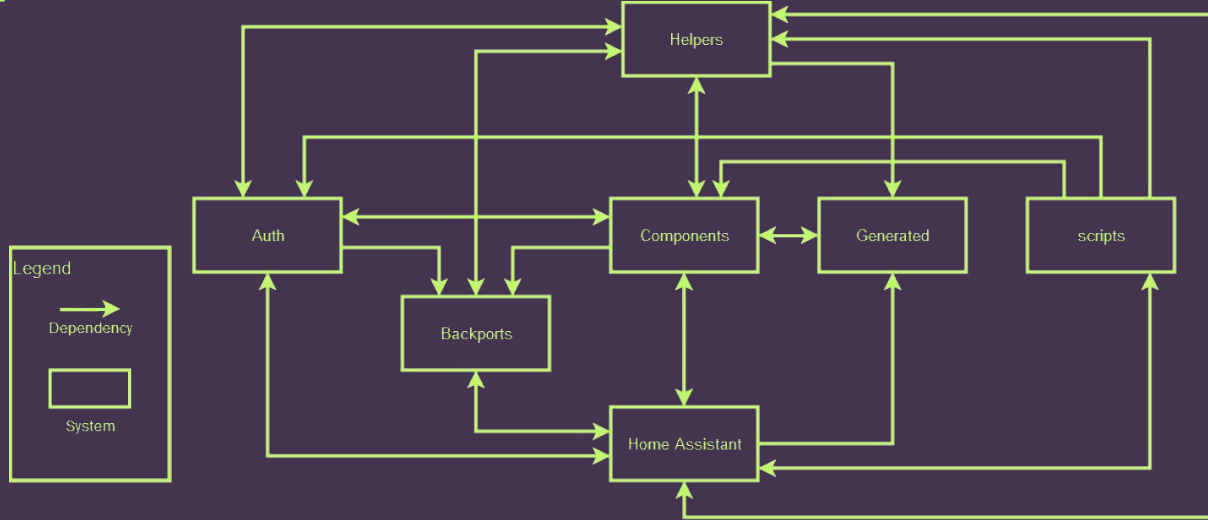
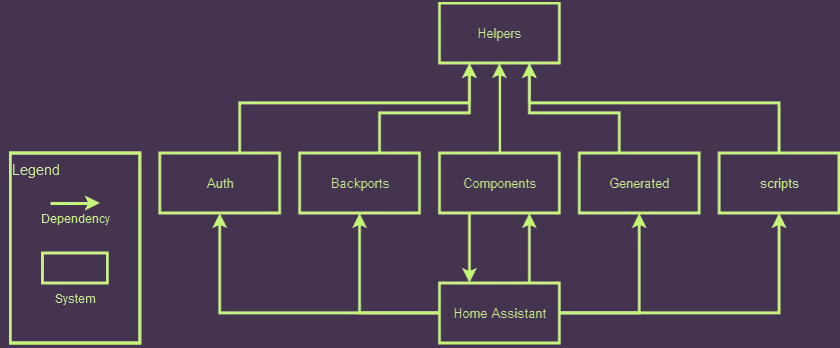
- The dependencies were then examined using the dependency browser
- Would could then examine the code and determine the four W's



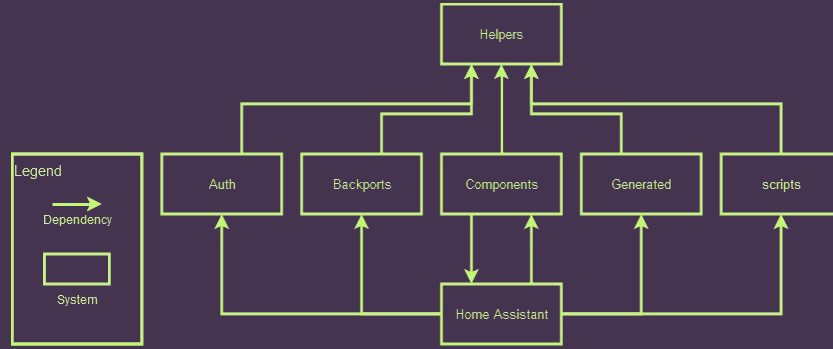
02

Revised Dependencies

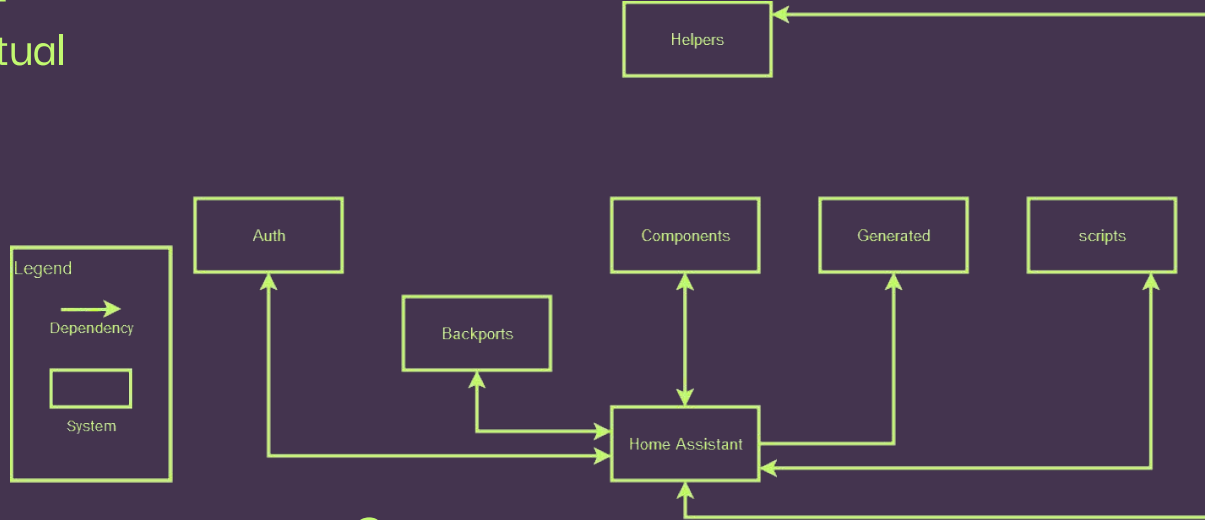
Conceptual To Concrete



Divergences Of Home Assistant



Conceptual



Concrete

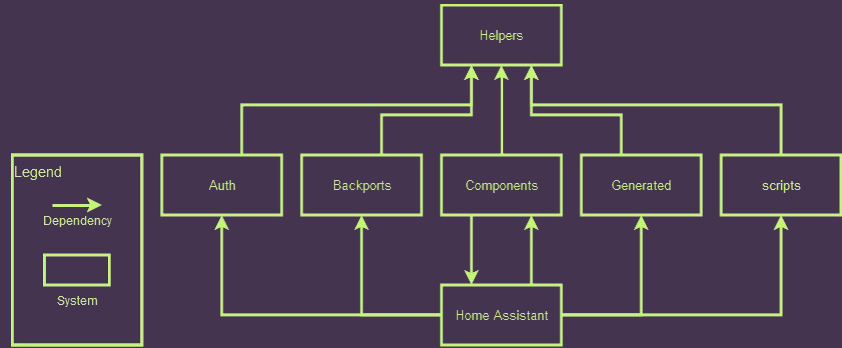
Home Assistant Cont.

- Callback Function
- Determines whether method is safe to call within event loop
- Has most dependencies in helper entity

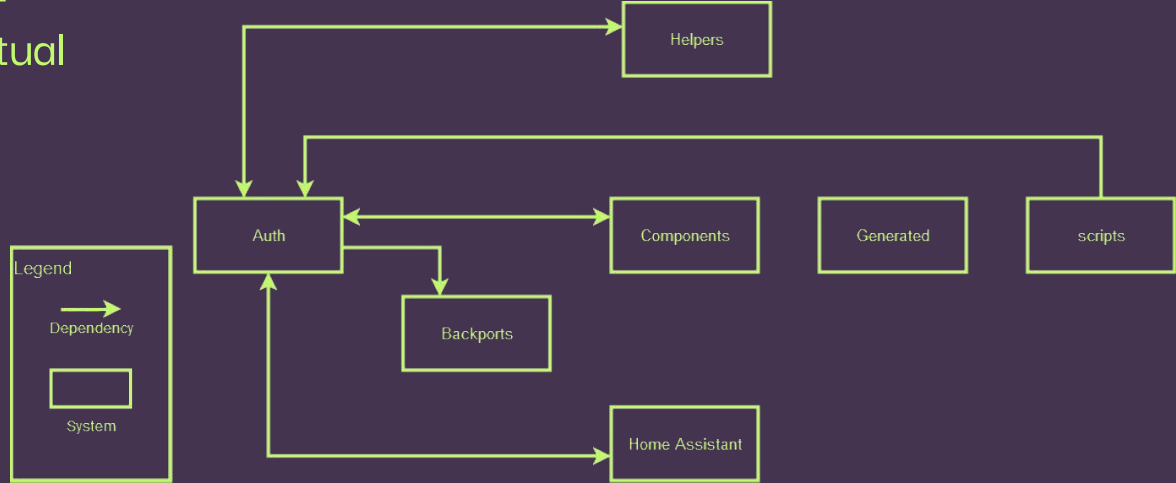
```
def callback[_CallableT: Callable[..., Any]](func: _CallableT) -> _CallableT:
    """Annotation to mark method as safe to call from within the event loop."""
    setattr(func, "_hass_callback", True)
    return func
```

```
▸ arch: auth (12)
▸ arch: backports (36)
▸ arch: components (84)
▸ arch: generated (30)
▸ arch: helpers (339)
▸ arch: scripts (2)
```


Divergences Of Auth



Conceptual



Concrete

Auth Cont.

- Mainly imports and uses from variables and classes, mainly from Home Assistant
- Most classes would need auth to make sure proper users access it

```
▶ arch: HomeAssistant (118)
▶ arch: backports (3)
▶ arch: components/simplisafe (17)
▶ arch: helpers (64)

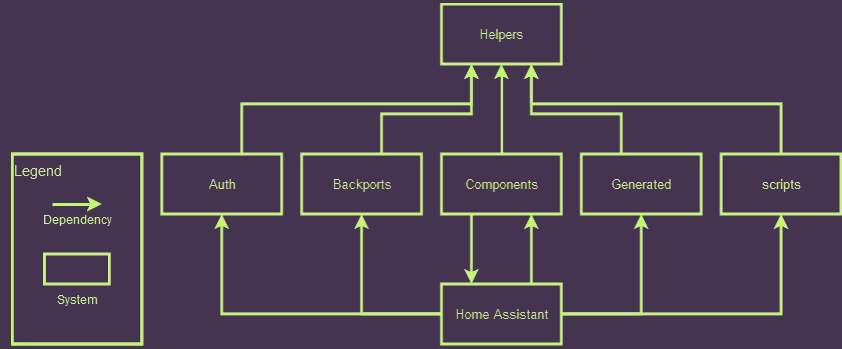
▼ arch: backports (3)
  __init__.py Import Froms functools.py at __init__.py:9
  jwt_wrapper.py Import Froms functools.py at jwt_wrapper.py:11
  util.py Import Froms functools.py at util.py:6
▼ arch: components/simplisafe (17)
  __init__.py Import Froms typing.py at __init__.py:11
  auth_store.py Import Froms typing.py at auth_store.py:9
  jwt_wrapper.py Import Froms typing.py at jwt_wrapper.py:12
  __init__.py Import Froms typing.py at __init__.py:7
  insecure_example.py Import Froms typing.py at insecure_example.py:5
  notify.py Import Froms typing.py at notify.py:11
  totp.py Import Froms typing.py at totp.py:7
  models.py Import Froms typing.py at models.py:8
  events.py Import Froms typing.py at events.py:5
  merge.py Import Froms typing.py at merge.py:5
  models.py Import Froms typing.py at models.py:5
  util.py Import Froms typing.py at util.py:7
  __init__.py Import Froms typing.py at __init__.py:8

▼ arch: helpers (64)
  __init__.py (20)
  area_registry.py (3)
    events.py Imports EVENT_AREA_REGISTRY_UPDATED at events.py:20
    events.py Uses EVENT_AREA_REGISTRY_UPDATED at events.py:32
  category_registry.py (3)
  config_validation.py (2)
  device_registry.py (3)
  entity_registry.py (5)
  event.py (1)
  floor_registry.py (3)
  importlib.py (6)
  issue_registry.py (8)
  label_registry.py (3)
  network.py (3)
  storage.py (4)

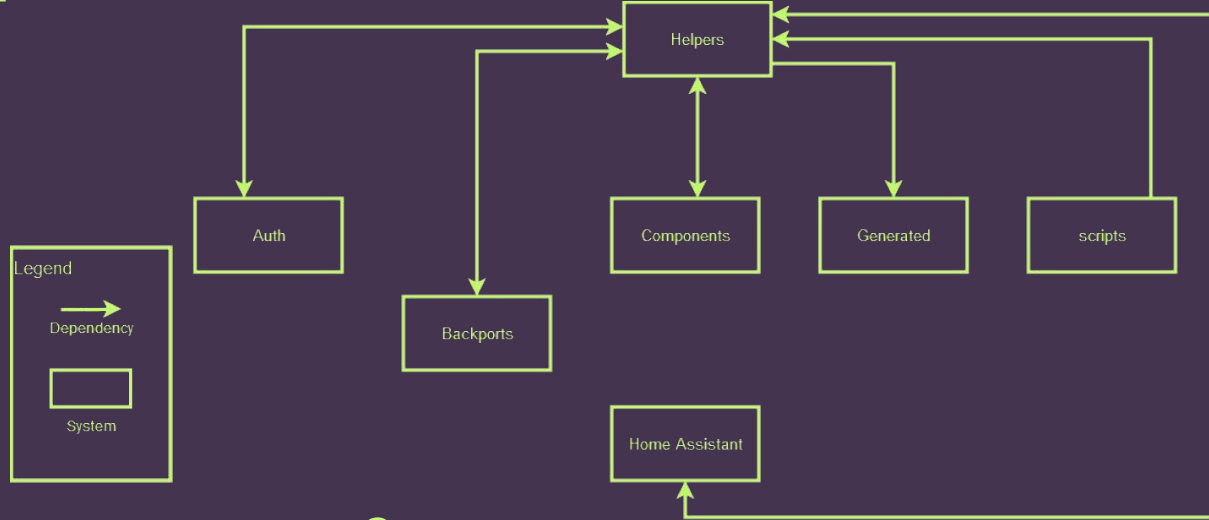
from homeassistant.helpers.area_registry import EVENT_AREA_REGISTRY_UPDATED
from homeassistant.helpers.category_registry import EVENT_CATEGORY_REGISTRY_UPDATED
from homeassistant.helpers.device_registry import EVENT_DEVICE_REGISTRY_UPDATED
from homeassistant.helpers.entity_registry import EVENT_ENTITY_REGISTRY_UPDATED
from homeassistant.helpers.floor_registry import EVENT_FLOOR_REGISTRY_UPDATED
from homeassistant.helpers.issue_registry import EVENT_REPAIRS_ISSUE_REGISTRY_UPDATED
from homeassistant.helpers.label_registry import EVENT_LABEL_REGISTRY_UPDATED
from homeassistant.util.event_type import EventType

# These are events that do not contain any sensitive data
# Except for state_changed, which is handled accordingly.
SUBSCRIBE_ALLOWLIST: Final[set[EventType[Any] | str]] = {
    EVENT_AREA_REGISTRY_UPDATED,
    EVENT_COMPONENT_LOADED,
    EVENT_CORE_CONFIG_UPDATE,
    EVENT_DEVICE_REGISTRY_UPDATED,
    EVENT_ENTITY_REGISTRY_UPDATED,
    EVENT_REPAIRS_ISSUE_REGISTRY_UPDATED,
    EVENT_LOVELACE_UPDATED,
    EVENT_PANELS_UPDATED,
    EVENT_RECORDER_5MIN_STATISTICS_GENERATED,
    EVENT_RECORDER_HOURLY_STATISTICS_GENERATED,
    EVENT_SERVICE_REGISTERED,
    EVENT_SERVICE_REMOVED,
    EVENT_SHOPPING_LIST_UPDATED,
    EVENT_STATE_CHANGED,
    EVENT_THEMES_UPDATED,
    EVENT_LABEL_REGISTRY_UPDATED,
    EVENT_CATEGORY_REGISTRY_UPDATED,
    EVENT_FLOOR_REGISTRY_UPDATED,
}
```

Divergences Of Helpers



Conceptual



Concrete

Helpers Cont.

- Helpers imports data like currencies, countries, and languages from generated files for error checking
- By importing helpers can quickly access that data whenever needed

```
▼ arch: HomeAssistant (1205)
  ▼ config.py (26)
    ▶ Direct (3)
    ▼ Variable: YAML_CONFIG_FILE (2)
      check_config.py Imports YAML_CONFIG_FILE at check_config.py:16
      async_check_ha_config_file Uses YAML_CONFIG_FILE at check_config.py:144
    ▼ Function: async_hass_config_yaml (3)
      async_prepare_reload Calls async_hass_config_yaml at entity_component.py:352
      async_reload_integration_platforms Calls async_hass_config_yaml at reload.py:41
      async_integration_yaml_config Calls async_hass_config_yaml at reload.py:168
    ▼ Function: async_process_component_and_handle_errors (3)
      async_prepare_reload Calls async_process_component_and_handle_errors at entity_component.py:359
      _resetup_platform Calls async_process_component_and_handle_errors at reload.py:63
      async_integration_yaml_config Calls async_process_component_and_handle_errors at reload.py:169
    ▼ Function: async_setup_platform (4)
```

```
▶ arch: HomeAssistant (1205)
▶ arch: auth (18)
▶ arch: backports (56)
▶ arch: components (218)
▶ arch: generated (21)
```

```
▼ arch: generated (21)
  ▶ int.py (5)
  ▼ countries.py (4)
    config_validation.py Imports COUNTRIES at config_validation.py:110
    config_validation.py Import Froms countries.py at config_validation.py:110
    selector.py Imports COUNTRIES at selector.py:16
    selector.py Import Froms countries.py at selector.py:16
  ▼ currencies.py (5)
    config_validation.py Imports currencies.py at config_validation.py:109
    key_dependency Uses ACTIVE_CURRENCIES at config_validation.py:2062
    key_dependency Uses HISTORIC_CURRENCIES at config_validation.py:2062
    key_dependency Uses currencies.py at config_validation.py:2066
    key_dependency Uses currencies.py at config_validation.py:2066
  ▼ languages.py (7)
    config_validation.py Import Froms languages.py at config_validation.py:111
    config_validation.py Imports LANGUAGES at config_validation.py:111
    entity_platform.py Imports languages.py at entity_platform.py:36
    async_load_translations Uses languages.py at entity_platform.py:463
    async_load_translations Uses NATIVE_ENTRY_IDS at entity_platform.py:463
    async_load_translations Uses languages.py at entity_platform.py:464
    async_load_translations Uses DEFAULT_LANGUAGE at entity_platform.py:464
```

```
from homeassistant.exceptions import HomeAssistantError, TemplateError
from homeassistant.generated import currencies
from homeassistant.generated.countries import COUNTRIES
from homeassistant.generated.languages import LANGUAGES
from homeassistant.util import raise_if_invalid_path, slugify as util_slugify
import homeassistant.util.dt as dt_util
from homeassistant.util.yaml.objects import NodeStrClass

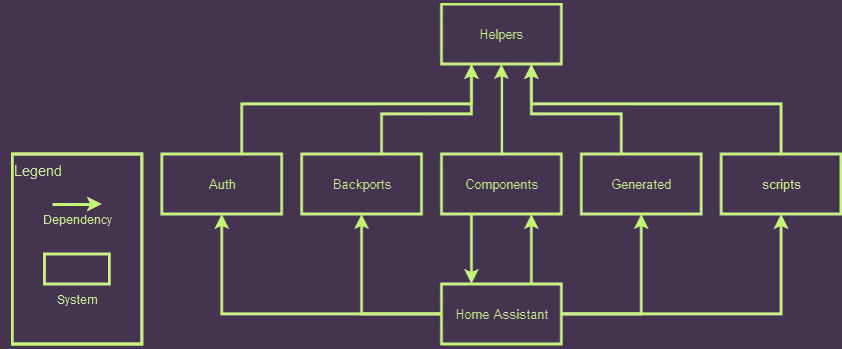
currency = vol.In(
    currencies.ACTIVE_CURRENCIES, msg="invalid ISO 4217 formatted currency"
)

historic_currency = vol.In(
    currencies.HISTORIC_CURRENCIES, msg="invalid ISO 4217 formatted historic currency"
)

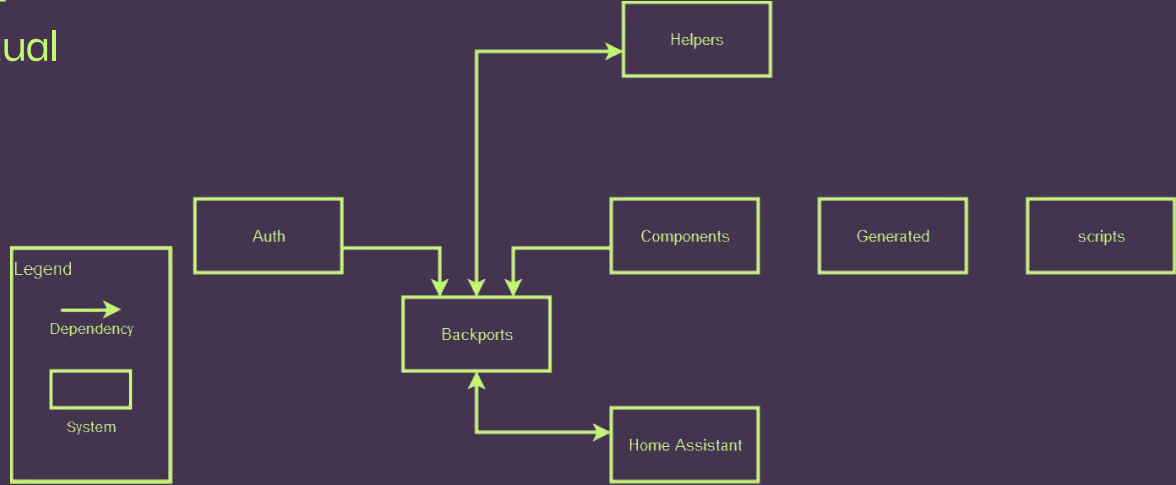
country = vol.In(COUNTRIES, msg="invalid ISO 3166 formatted country")

language = vol.In(LANGUAGES, msg="invalid RFC 5646 formatted language")
```

Divergences Of Backports



Conceptual



Concrete

Backports Cont.

DeprecatedAlias

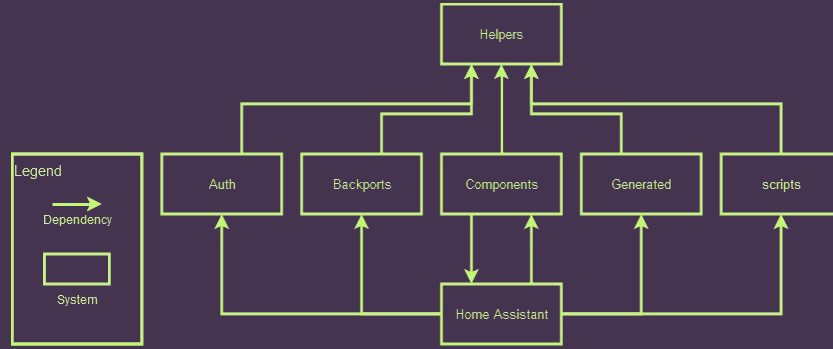
- Tracks Deprecation
- Replacement Suggestion
- Timeline for Depreciation
- Warns Users

```
▼ arch: homeassistant (2)
  enum.py Import Implicits __init__.py at enum.py:15
  funtools.py Import Implicits __init__.py at funtools.py:15
▼ arch: homeassistant/helpers (4)
  enum.py Import Froms deprecation.py at enum.py:15
  enum.py Import Implicits __init__.py at enum.py:15
  funtools.py Import Froms deprecation.py at funtools.py:15
  funtools.py Import Implicits __init__.py at funtools.py:15
```

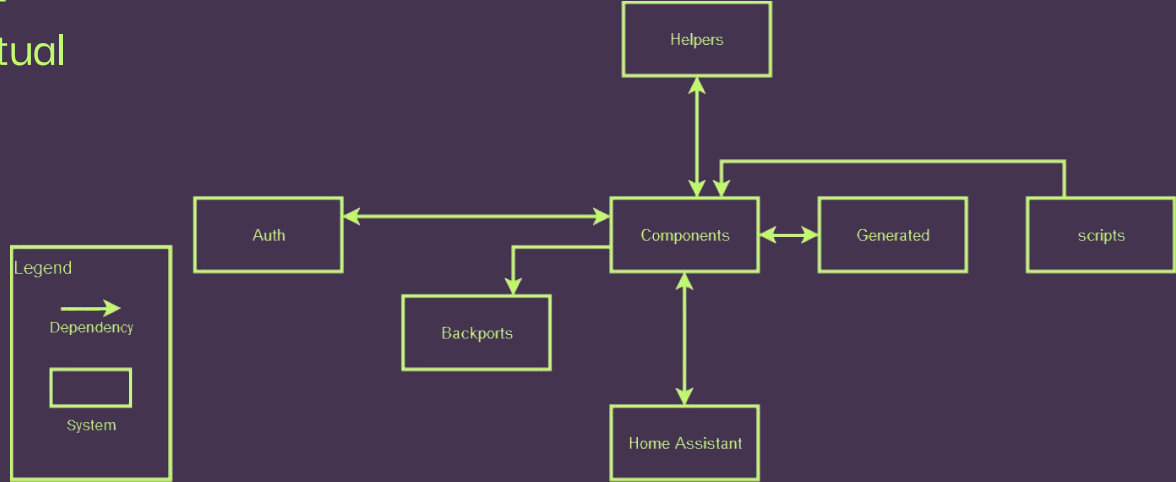
```
from homeassistant.helpers.deprecation import (
    DeprecatedAlias,
    all_with_deprecated_constants,
    check_if_deprecated_constant,
    dir_with_deprecated_constants,
)
```

```
# cached_property deprecated as of 2024.5 use funtools.cached_property instead.
_DEPRECATED_cached_property = DeprecatedAlias(
    _cached_property, "funtools.cached_property", "2025.5"
)
```

Divergences Of Components



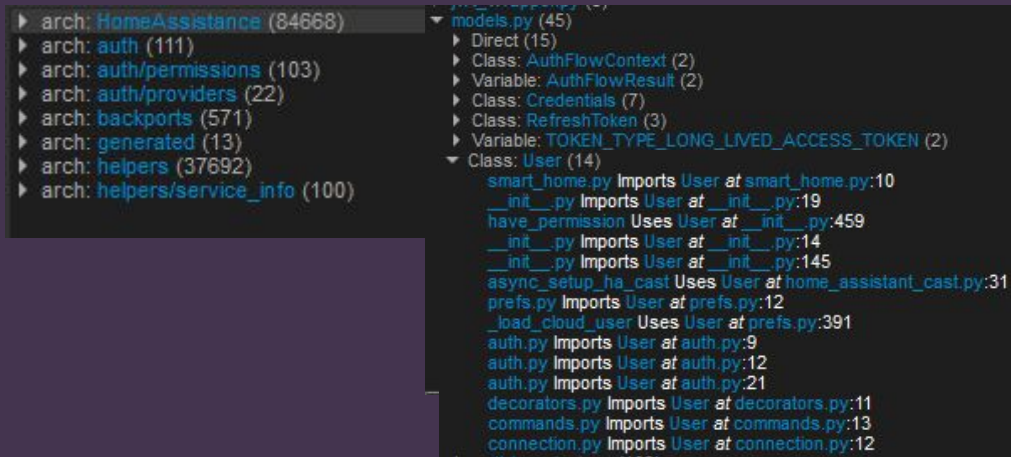
Conceptual



Concrete

Components Cont.

- User Imports
- User imports at auth module
- User decorators, commands, and connections imports



The screenshot shows an IDE with two panels. The left panel displays the 'arch' package structure, and the right panel shows the contents of 'models.py'.

Left Panel (Package Structure):

- arch: HomeAssistance (84668)
- arch: auth (111)
 - arch: auth/permissions (103)
 - arch: auth/providers (22)
- arch: backports (571)
- arch: generated (13)
- arch: helpers (37692)
- arch: helpers/service_info (100)

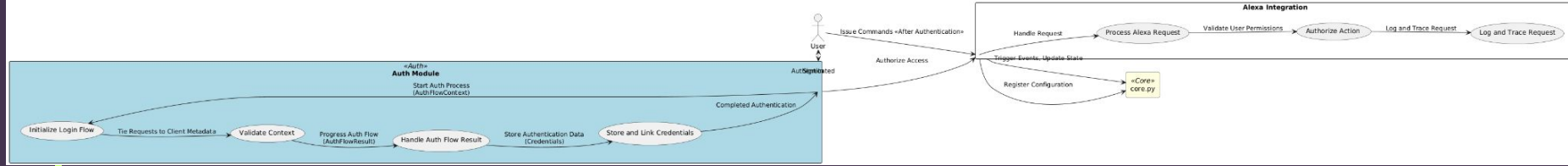
Right Panel (models.py):

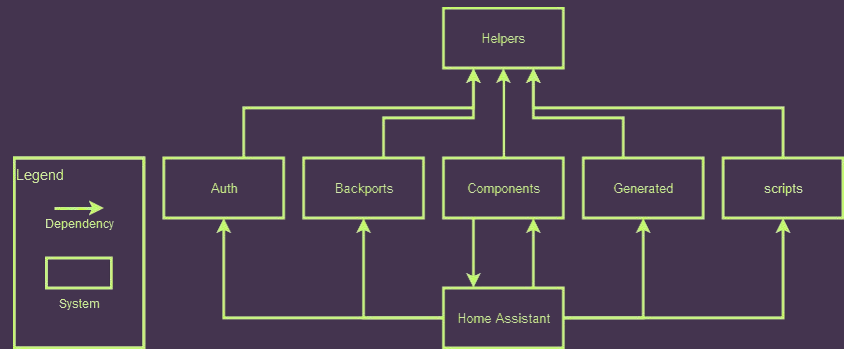
```
models.py (45)

- Direct (15)
- Class: AuthFlowContext (2)
- Variable: AuthFlowResult (2)
- Class: Credentials (7)
- Class: RefreshToken (3)
- Variable: TOKEN_TYPE_LONG_LIVED_ACCESS_TOKEN (2)
- Class: User (14)
  - smart_home.py Imports User at smart_home.py:10
  - __init__.py Imports User at __init__.py:19
  - have_permission Uses User at __init__.py:459
  - __init__.py Imports User at __init__.py:14
  - __init__.py Imports User at __init__.py:145
  - async_setup_ha_cast Uses User at home_assistant_cast.py:31
  - prefs.py Imports User at prefs.py:12
  - _load_cloud_user Uses User at prefs.py:391
  - auth.py Imports User at auth.py:9
  - auth.py Imports User at auth.py:12
  - auth.py Imports User at auth.py:21
  - decorators.py Imports User at decorators.py:11
  - commands.py Imports User at commands.py:13
  - connection.py Imports User at connection.py:12

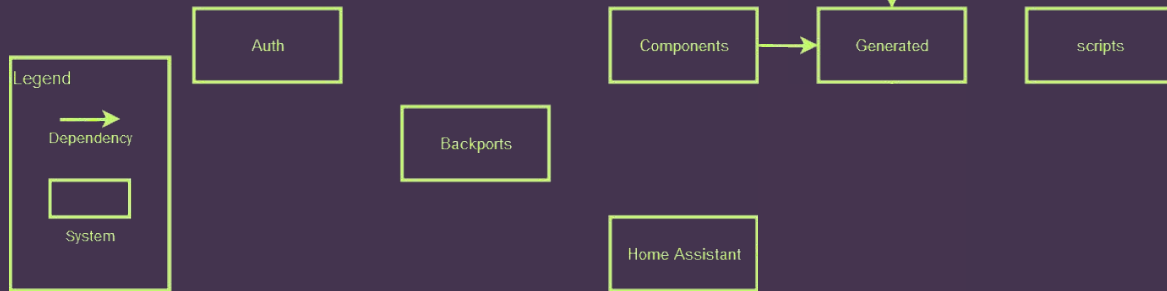
```


Use Case of Auth





Conceptual



Concrete

Divergences Of Generated

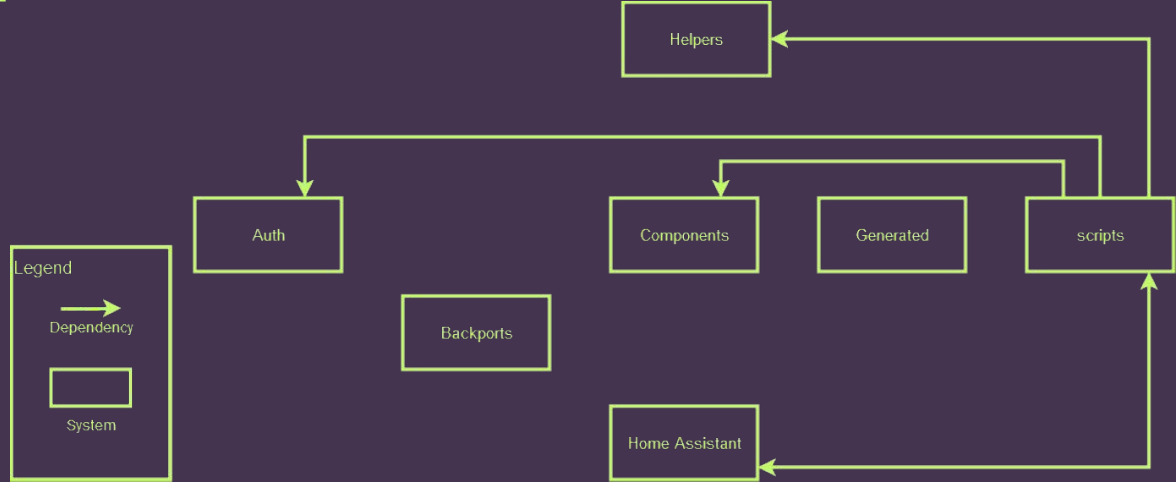
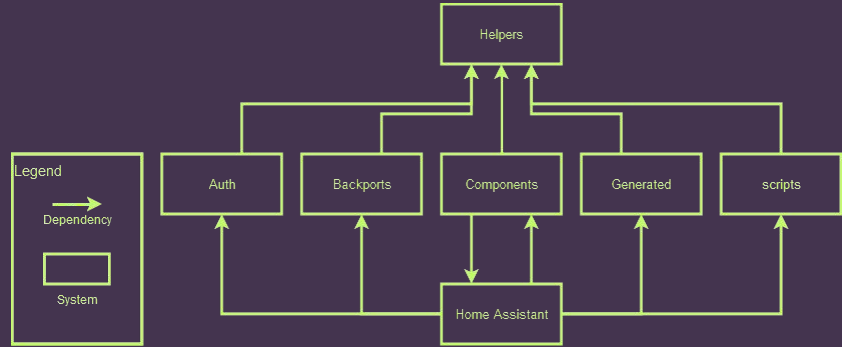
Generated Cont.

- Only four dependencies
- All important from typing.py from various sub components
- Final is defined more specifically in the code later

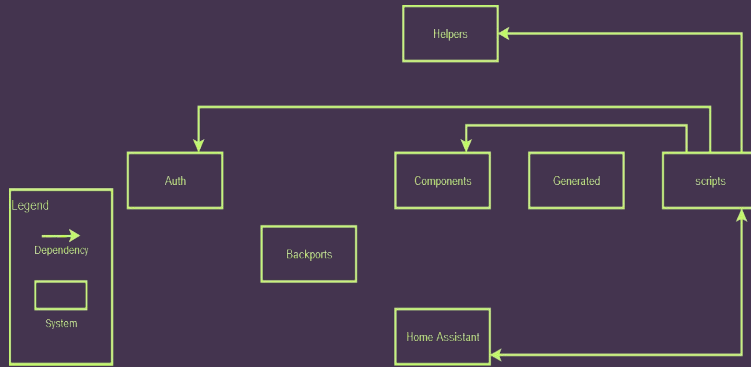
```
arch: components/simplisafe (4)  
amazon_polly.py Import Froms typing.py at amazon_polly.py:8  
bluetooth.py Import Froms typing.py at bluetooth.py:8  
countries.py Import Froms typing.py at countries.py:12  
dhcp.py Import Froms typing.py at dhcp.py:8
```

```
from __future__ import annotations  
  
from typing import Final  
  
SUPPORTED_ENGINES: Final[set[str]] = {  
    "generative",  
    "long-form",  
    "neural",  
    "standard",  
}
```

Divergences Of Scripts



Scripts Cont.



```
▶ from typing import TYPE_CHECKING

from homeassistant import runner
▶ from homeassistant.auth import auth_manager_from_config
from homeassistant.auth.providers import import homeassistant as hass_auth
from homeassistant.config import get_default_config_dir
from homeassistant.core import HomeAssistant
▶ from homeassistant.helpers import device_registry as dr, entity_registry as er
```

```
def main() -> int:
    """Start Home Assistant."""
    validate_python()

    args = get_arguments()

    if not args.ignore_os_check:
        validate_os()

    if args.script is not None:
        # pylint: disable-next=import-outside-toplevel
        from . import scripts

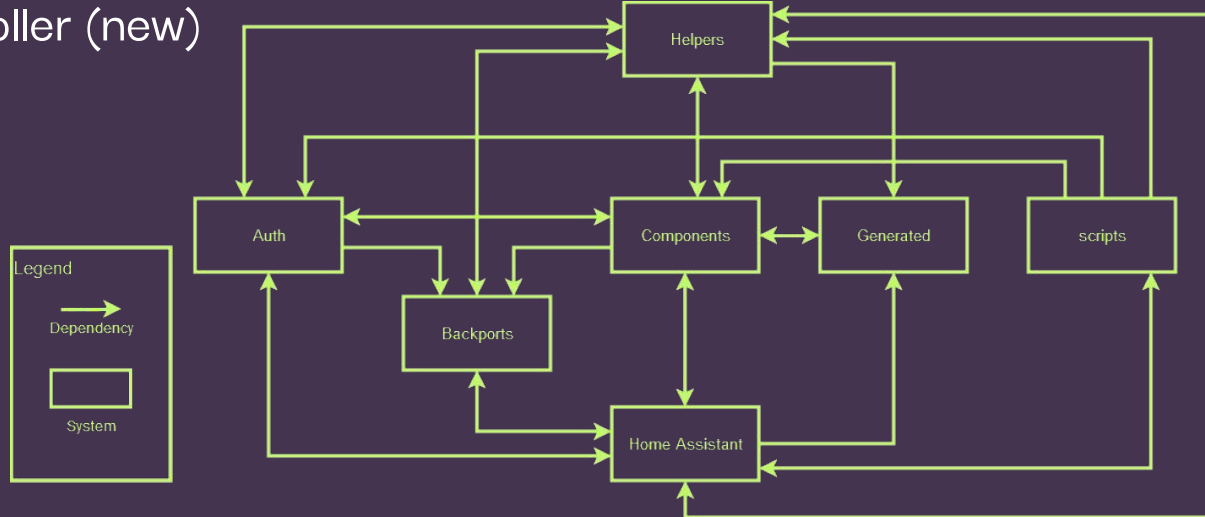
    return scripts.run(args.script)
```

03

Lessons Learnt

Overall Architecture

- Event-Bus
- Microservices
- Model - View - Controller (new)



Limitations of findings

- Open Source with almost 4000 contributors
 - Jason Hu committed in summer 2018 and winter 2019, not to be seen again
 - No real roles except for Paulus
- Architectures diagrams found online are based off the Concrete

Lessons Learned

- For some functions, proper comments are provided to explain the function but in most cases, the comments are reserved to giving a short explanation of the code's function and explain a line.
- This makes understanding the code very difficult as we would have to analyze the code and figure out or infer what a line/function does.
- This struggle showed us the importance of proper documentation and how it helps with understanding the architecture and it helps with future maintenance.

THANK YOU