CORD CUTTING CALCULATOR

DIRECTED STUDIES REPORT

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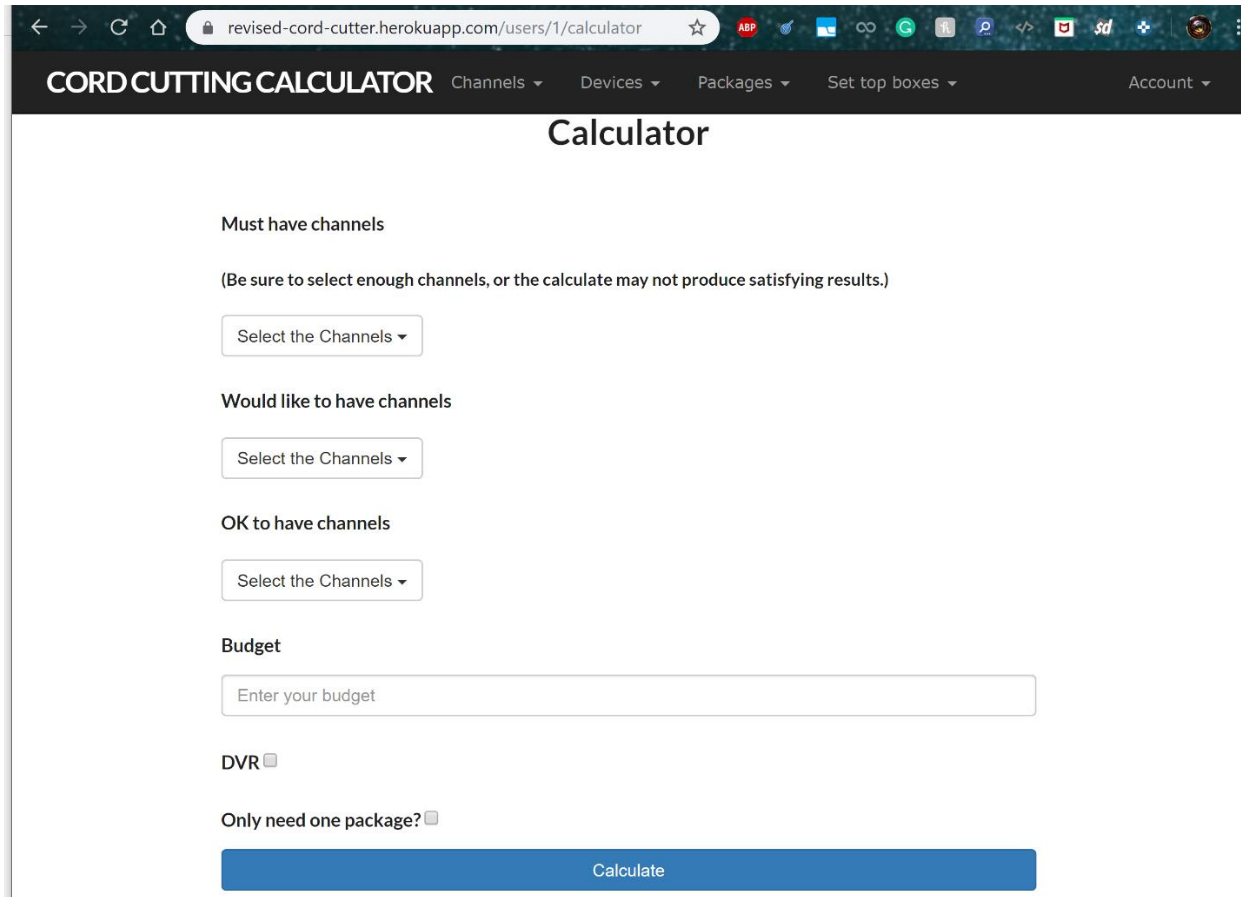
INTRODUCTION

Now-a-days there exists many streaming services which provide service to stream live tv channels. This has given rise to multiple options for a user to select to consume entertainment, namely FuboTV, Sling, YouTube TV, Hulu, Philo. Each service provider bundles channels differently from each other like YouTube Tv offers 70 channels to live stream for $49.99 a month whereas Philo offers 58 channels to live stream for $20 a month and the channels offered by one is not necessarily offered by others. So, there is not one best service provider for all. It differs for each individual user based on the content they want to consume and the budget and, moreover the individual preferences changes over time which might result in reconsidering the service provider.

This app, 'Cord-Cutting-Calculator' recommends users a right service provider based on their requirements. The app home page looks like below. It has options to enter channels a user needs and the budget in which they are looking for. Channels to input are categorized into three, namely,

- Must have
- Would like to have
- Ok to have



Calculator

Must have channels

(Be sure to select enough channels, or the calculate may not produce satisfying results.)

Select the Channels

Would like to have channels

Select the Channels

OK to have channels

Select the Channels

Budget

Enter your budget

DVR

Only need one package?

Calculate

Documentation

Previous version the documentation explains much more about the product design and its functionalities. It can be found here, https://github.com/Ziyi1215/Cord-Cutting-Calculator/tree/master/documentation/Spring2019. This documentation reports the work done in Fall 2019. The report focuses mainly on the design and implementation of Generic parser that extracts channels from service provider website.

User Stories

1. **CRAWL PROVIDER WEBSITE:**
   As an Admin User
   I want to fetch channels from streaming provider programmatically
   So that when I create a new Package, I don't have to manually enter channels by looking up on streaming provider website.

2. **REVIEW & APPROVE NEW SCRAPED CHANNELS:**
   As an Admin User
   I want to approve new channels the app picks up from the streaming provider
   So that I can update the system's global channels collection

3. **EDIT NEW SCRAPED CHANNELS:**
   As an Admin User
   I want to Edit the new channel's name that the app picked up from the streaming provider website
   So that I can register the channel name appropriately into the system

4. **CREATE PACKAGE FROM SCRAPED CHANNELS:**
   As an Admin User
   I want to create the Package with channels extracted from streaming provider website
   So that the app can save the Package and recommend it to users

5. **CRAWL PROVIDER WEBSITE IN EDIT PACKAGE:**
   As an Admin User
   I want to fetch channels from streaming provider in edit package page
   So that I can scrape the channels for existing package and update it

6. **SETUP HEROKU ENVIRONMENT FOR SCRAPPER LIBRARIES:**
   As an application owner
   I want to migrate to new Heroku

So that a new instance of the app can run using the new framework to extract channel from streaming provider websites

7. **DATA MIGRATION**
   As an application owner
   I want to migrate data to new instance of the app
   So that user can use the application existing data and admin can use new features to create packages with less hassle
8. **NEW STREAMING DEVICES:**
   As an Admin user
   I want to update streaming devices of the app
   So that they accurately represent real data and user can benefit more

Crawl Provider Website

The main idea of this task is to make the application read and extract the channels off the provider website like Hulu. This would bypass the Admin's task of manually reading the channels off the provider website and entering into the application, turning the task of creating new package very efficient and Admin friendly. There are couple of approaches to solve this and all of them involving parsing the webpage.

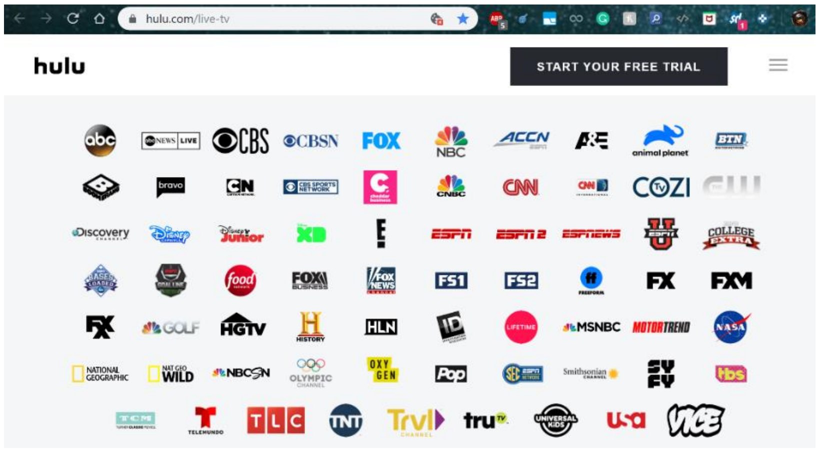
- First approach is to write specific parsers for each of the service provider like, one parser to extract channels from Hulu and another parser to extract channels from Sling. As webpage and their structure for each provider differ, different parsers might be needed to parse different providers.
- Second approach is to write a generic parser for all providers. This generic parser does only extract specific information from the page, only channels for now. This approach still faces the challenges that arise from variant websites that each provider has. Below discussed are the analysis and methods to solve these challenges.

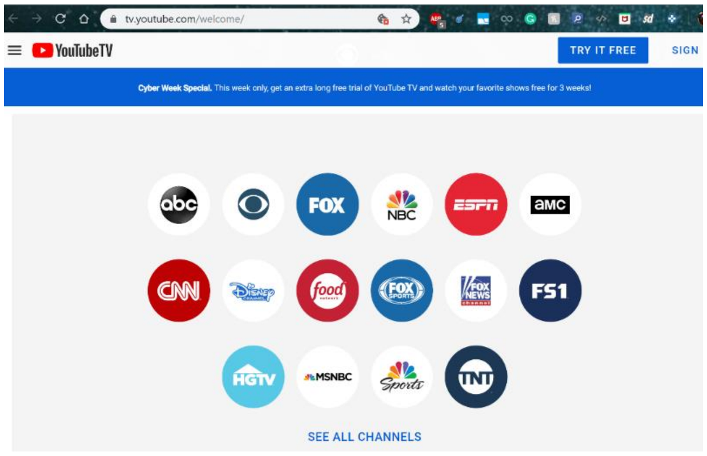
GENERIC PARSER:

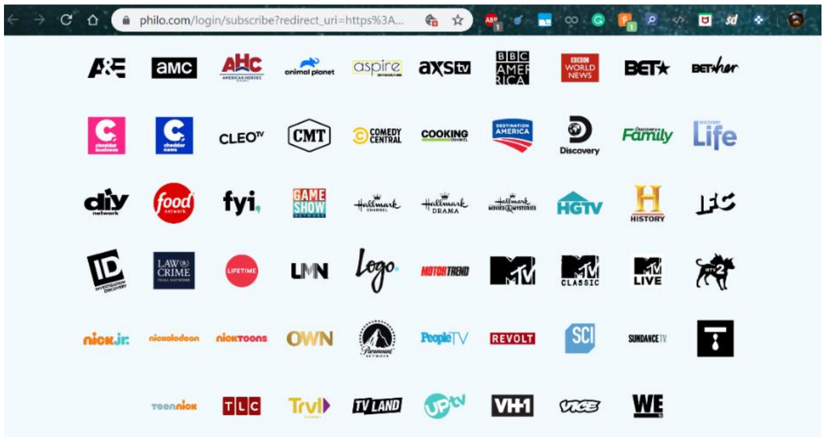
In addition to the above-mentioned challenges of different structured webpages for each provider, there is a challenge of parsing dynamic webpage. All the provider webpages are dynamic i.e. the html has only the skeleton of the webpage without of most of the content and the content itself is loaded during page load by JS scripts. This dynamic nature of the webpage makes the simple static parsers like famous Nokogiri obsolete without support of other library that can run JS code.

Watir is famous library that helps in crawling and parsing dynamic webpages. But Watir requires a browser to run in the background and the current setup, AWS Cloud9 environment doesn't support any heavy visually applications to run, even headless browsers. It is extremely restrictive in this aspect. To make Watir work, the whole application setup was migrated to Google Cloud.

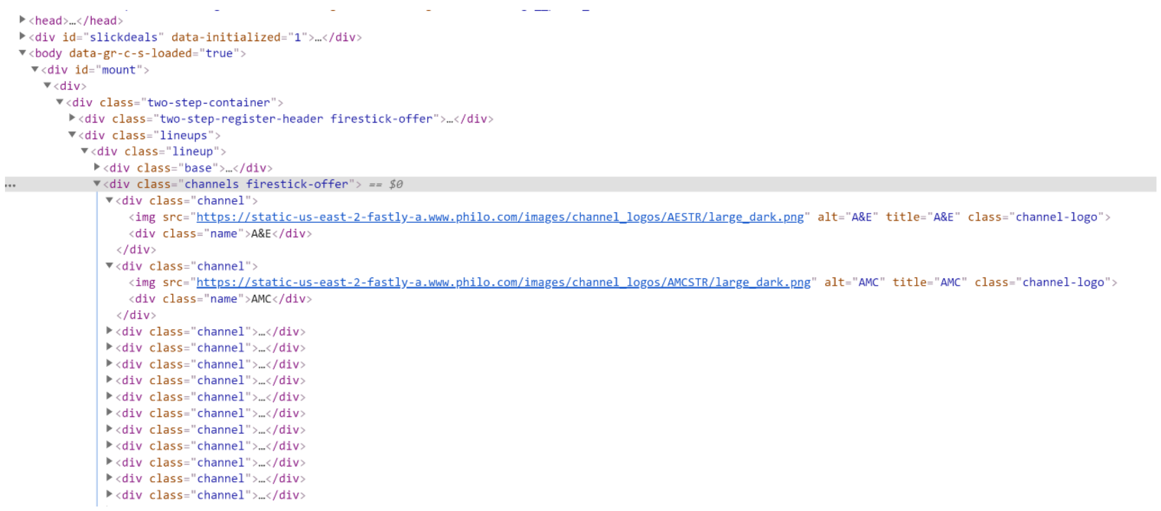
After analysis of html markup pages of Hulu, YouTube TV, Philo, Fubo TV, Sling a pattern is detected. Every provider displays all channels together as below.




tv.youtube.com/welcome/
YouTubeTV
TRY IT FREE
SIGN
Cyber Week Special. This week only, get an extra long free trial of YouTube TV and watch your favorite shows free for 3 weeks!
SEE ALL CHANNELS



All these channels are segregated into a single html element like div. A sample such div structure for Hulu is mentioned below. Div ‘channels firestick-offer’ is the main element which holds all the channels and each channel is wrapped in an additional div and holds few elements in it. The original element, responsible for the channel logo is img and it has attributes ‘alt’ and ‘title’ which holds the channel’s name. The most commonly observed pattern in multiple providers webpage is this behavior that all channels are wrapped together in the html element and it has an attribute namely ‘alt’ or ‘title that holds the channel’s name.



```
▶<head>…</head>
▶<div id="slickdeals" data-initialized="1">…</div>
▼<body data-gr-c-s-loaded="true">
  ▼<div id="mount">
    ▼<div>
      ▼<div class="two-step-container">
        ▶<div class="two-step-register-header firestick-offer">…</div>
        ▼<div class="lineups">
          ▼<div class="lineup">
            ▶<div class="base">…</div>
...         ▼<div class="channels firestick-offer"> == $0
              ▼<div class="channel">
                  <img src="https://static-us-east-2-fastly-a.www.philo.com/images/channel_logos/AESTR/large_dark.png" alt="A&E" title="A&E" class="channel-logo">
                  <div class="name">A&E</div>
                </div>
              ▼<div class="channel">
                  <img src="https://static-us-east-2-fastly-a.www.philo.com/images/channel_logos/AMCSTR/large_dark.png" alt="AMC" title="AMC" class="channel-logo">
                  <div class="name">AMC</div>
                </div>
              ▶<div class="channel">…</div>
              ▶<div class="channel">…</div>
              ▶<div class="channel">…</div>
              ▶<div class="channel">…</div>
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              ▶<div class="channel">…</div>
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              ▶<div class="channel">…</div>
              ▶<div class="channel">…</div>
              ▶<div class="channel">…</div>
              ▶<div class="channel">…</div>
```
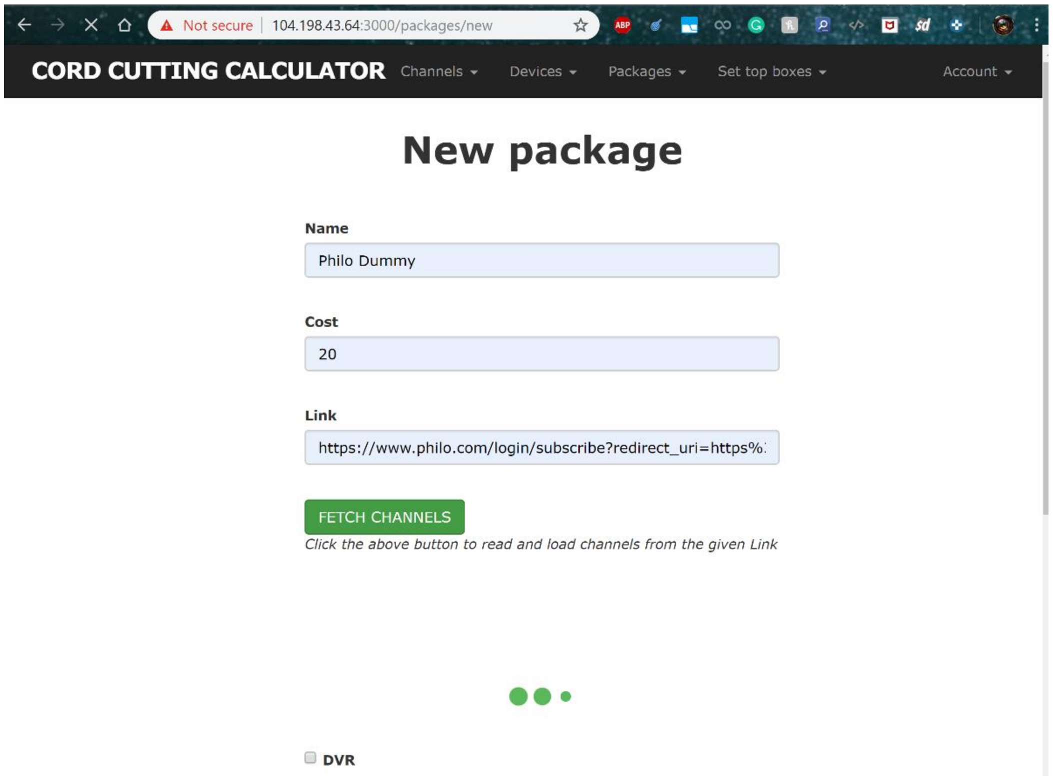

The generic parser is built based on this observed pattern to extract channels. It uses simple approach of iterating through entire DOM of page and identifies the class-name of the div that holds any channel-name, it is ‘channel’ from the example above. The generic parser leverages the channels already existing in the database to find this html element that encloses the given channel.

After discovering the class-name of this enclosing element, the algorithm looks for all html elements with the same class-name and extracts the channel present in attributes ‘alt’ and ‘title’ of each element. This might lead to duplicate channel-names and so are filtered later.

Next step after extracting the list of unique channel names found on the website is to segregate these channels into two sets. One set is channels that the system is already aware of, call it Known set. Cord-Cutter has a global list of channels in its database. Another set is the list of new channels that are now included into the global list, call it Unknown set.

The above algorithm concludes the generic parse which crawls the provider webpage and extracts all the channels into Known and Unknown Set, which are used in the later stages. Below is the app page that facilitates Admin to call this Generic parser from the frontend by clicking the button ‘Fetch Channels’.


Not secure | 104.198.43.64:3000/packages/new

CORD CUTTING CALCULATOR Channels ▾ Devices ▾ Packages ▾ Set top boxes ▾ Account ▾

New package

Name: Philo Dummy

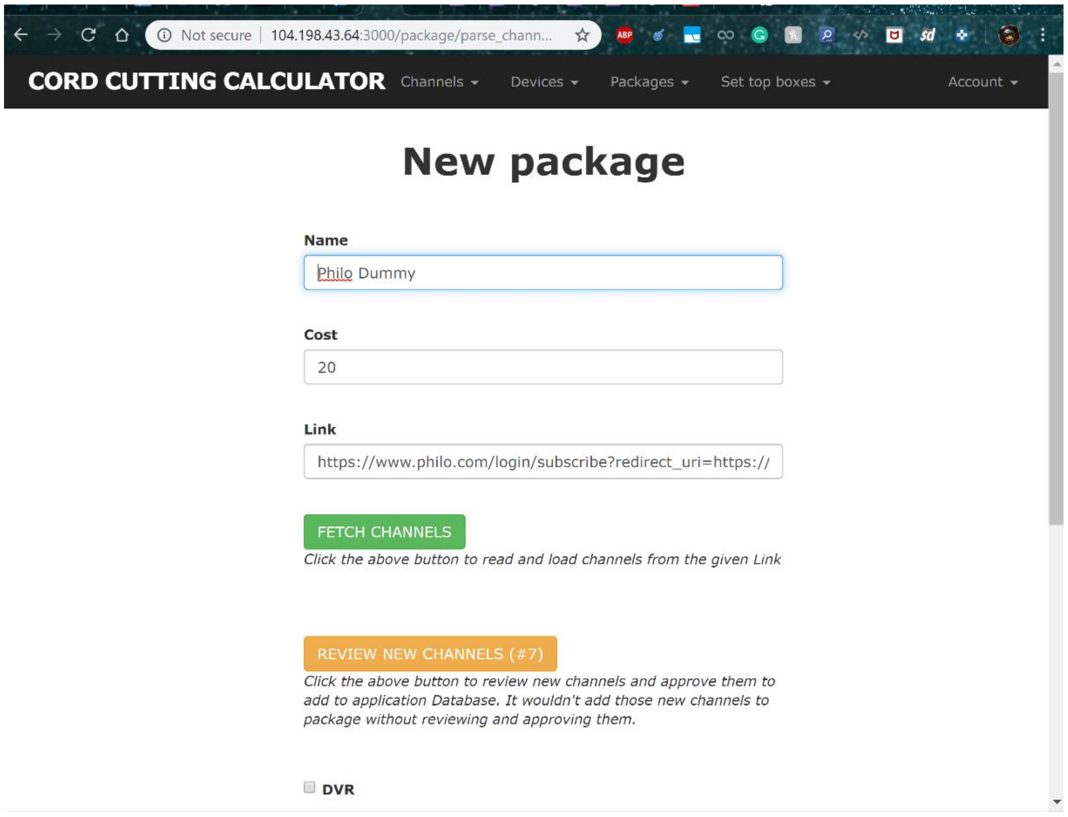
Cost: 20

Link: https://www.philo.com/login/subscribe?redirect_uri=https%

FETCH CHANNELS

Click the above button to read and load channels from the given Link

DVR


Not secure | 104.198.43.64:3000/package/parse_chann...

CORD CUTTING CALCULATOR Channels ▾ Devices ▾ Packages ▾ Set top boxes ▾ Account ▾

New package

Name: Philo Dummy

Cost: 20

Link: https://www.philo.com/login/subscribe?redirect_uri=https://

FETCH CHANNELS

Click the above button to read and load channels from the given Link

REVIEW NEW CHANNELS (#7)

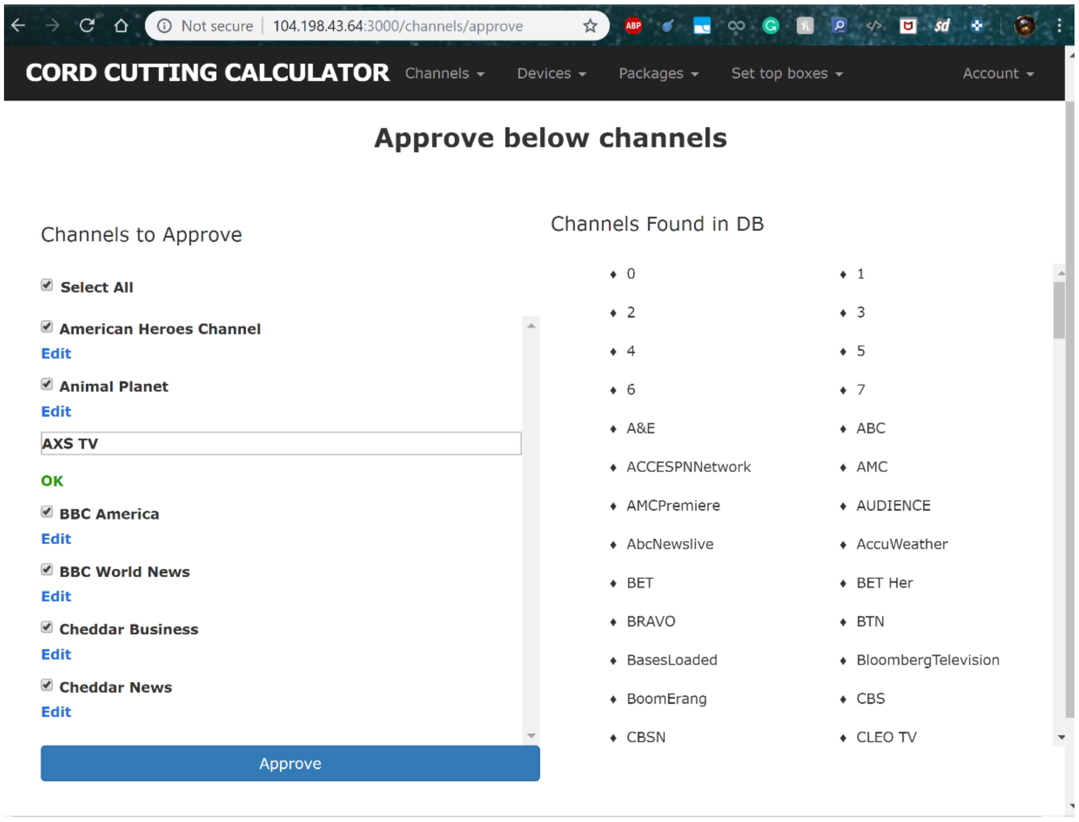
Click the above button to review new channels and approve them to add to application Database. It wouldn't add those new channels to package without reviewing and approving them.

DVR

Review & Approve New Channels

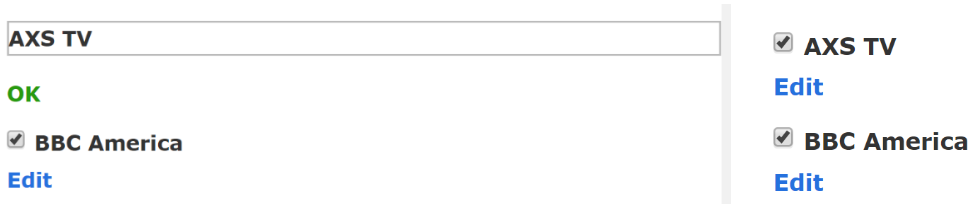
The Generic Parser extracts the channels from the service provider page and segregates them into two sets Known and Unknown set as explained in the previous sections. All the channels in the unknown set are not included in the package yet because they don't exist in the database. First these channels have to be added to database and then they can be attached to the package Admin wants to create. After the generic parse finishes scraping the provider webpage and segregating the channels, it provides with an option to review and approve the new channels. This option is shown in the previous pic, orangish button with name 'REVIEW NEW CHANNELS'. On the button it has list of new channels like #7 in the above example.

Clicking on the 'REVIEW NEW CHANNELS' would redirect the app to approve screen. It looks like as presented below. It displays two columns; left column is the scrollable list of new channels the parser scraped off from the provider webpage and it includes an 'Approve' button at the end of column. Upon clicking this, all these checked new channels are persisted into database. Right column is a scrollable list of existing channels in the database. This column is for the reference of existing channels in the database and Admin can refer to these when approving the new channels. Admin is provided with the flexibility to uncheck any of these new channels and they are not added to the database. It also has a feature to check all or uncheck all channels with 'Select All' option.



Edit New Channels

As presented in the above screenshot, approve page has Blue edit buttons below each channel which provides an option to edit any channel name Admin wishes to change. In the above example 'AXS TV' is in edit mode and displays Green 'OK' button below the channel. Clicking 'OK' would display the channel back in check box mode with modified channel name as present in the image below.


AXS TV

OK

☑ BBC America

Edit

☑ AXS TV

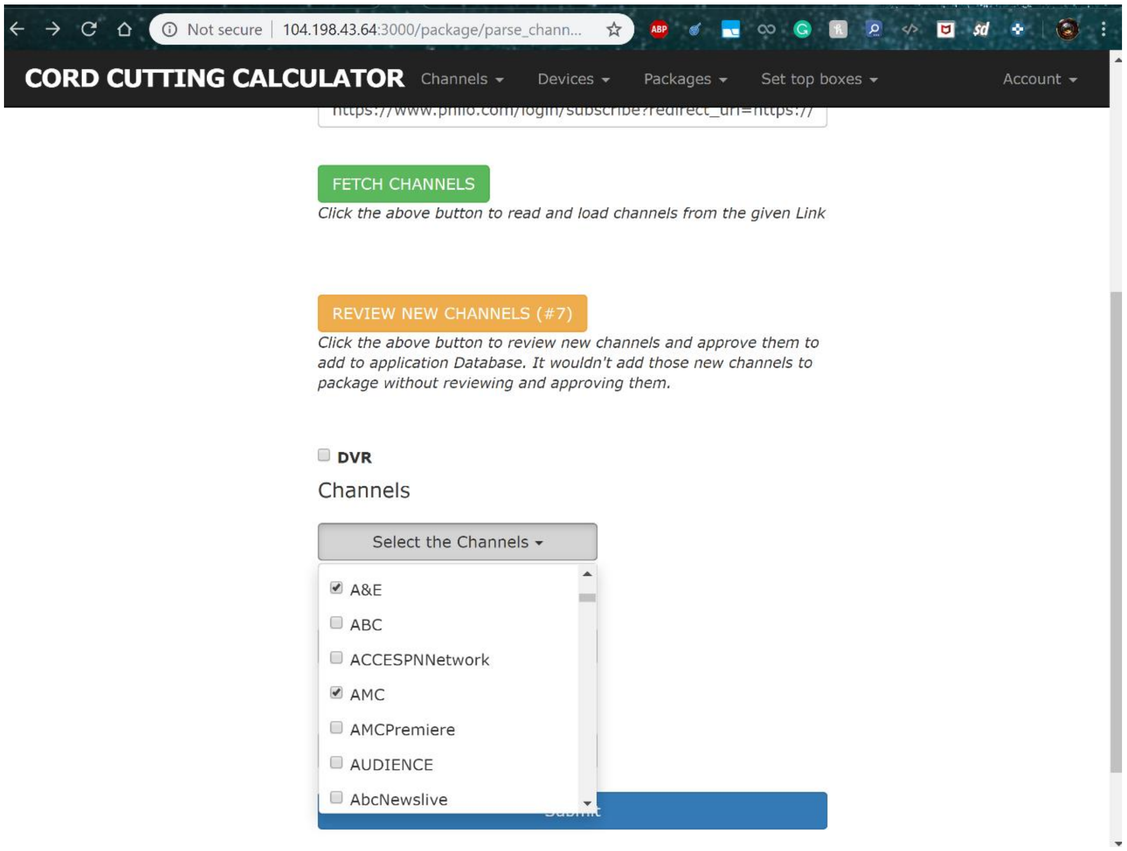
Edit

☑ BBC America

Edit

Create Package from scraped Channels

The task in this story is to create new package with all the channels scraped off the provider website including the new channels the Admin has approved in the previous step. All the scraped channels are pre-checked in the Channels listings. Admin has the flexibility to uncheck channels before submitting.


Not secure | 104.198.43.64:3000/package/parse_chann...
CORD CUTTING CALCULATOR
Channels
Devices
Packages
Set top boxes
Account
https://www.philo.com/login/subscribe?redirect_url=https://
FETCH CHANNELS
Click the above button to read and load channels from the given Link

Click the above button to review new channels and approve them to add to application Database. It wouldn't add those new channels to package without reviewing and approving them.

☐ DVR

Channels

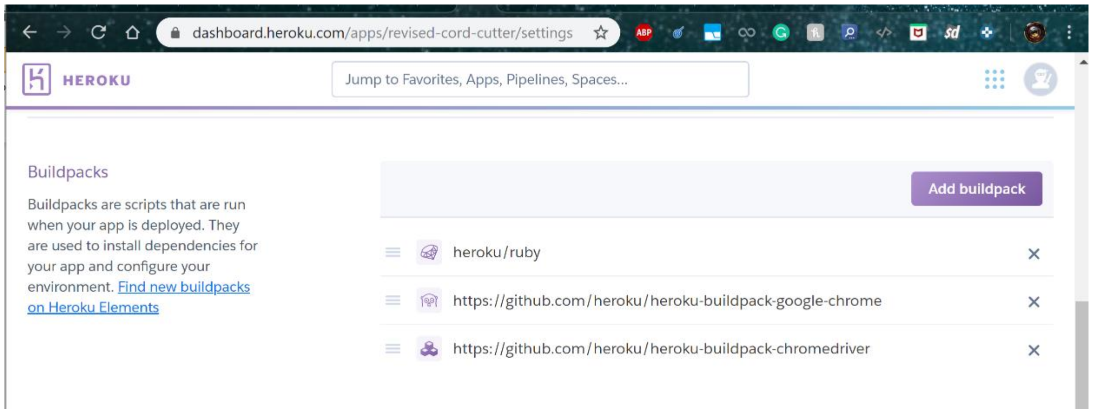
☑ A&E
☐ ABC
☐ ACCESPNNetwork
☑ AMC
☐ AMCPremiere
☐ AUDIENCE
☐ AbcNewslive

Crawl Provider Website from Edit Package

Edit package is very similar to new package page except that information about package is pre-filled including the channels. Edit package page has ‘Fetch Channels’ that would scrape the website and override the existing the checked list of channels with channels from provider website. If there are any new channels added to provider website and application isn’t aware of them, application would show up an option to review and approve the new channels. It is similar to as mentioned in the previous section.

Setup Heroku Environment

Revised Cord cutter uses Watir library which require Selenium drivers and chrome drivers. These libraries are provided in the buildpacks of the Heroku application as mentioned below. Buildpacks can be accessed from settings. More details about the steps are explain in this article, https://www.simon-neutert.de/2018/watir-chrome-heroku/.


dashboard.heroku.com/apps/revised-cord-cutter/settings
HEROKU
Jump to Favorites, Apps, Pipelines, Spaces...
Add buildpack

Buildpacks

Buildpacks are scripts that are run when your app is deployed. They are used to install dependencies for your app and configure your environment. Find new buildpacks on Heroku Elements

heroku/ruby
https://github.com/heroku/heroku-buildpack-google-chrome
https://github.com/heroku/heroku-buildpack-chromedriver

Data Migration

New application, ‘revised-cord-cutter’ is deployed at Heroku but its database is empty and for the application to be useful, the data existing in the current application has to be migrated to this new application. This data migration is necessary as the existing application has a huge data about streaming providers and the channels they support. This task is handled using Heroku Postgres tools.

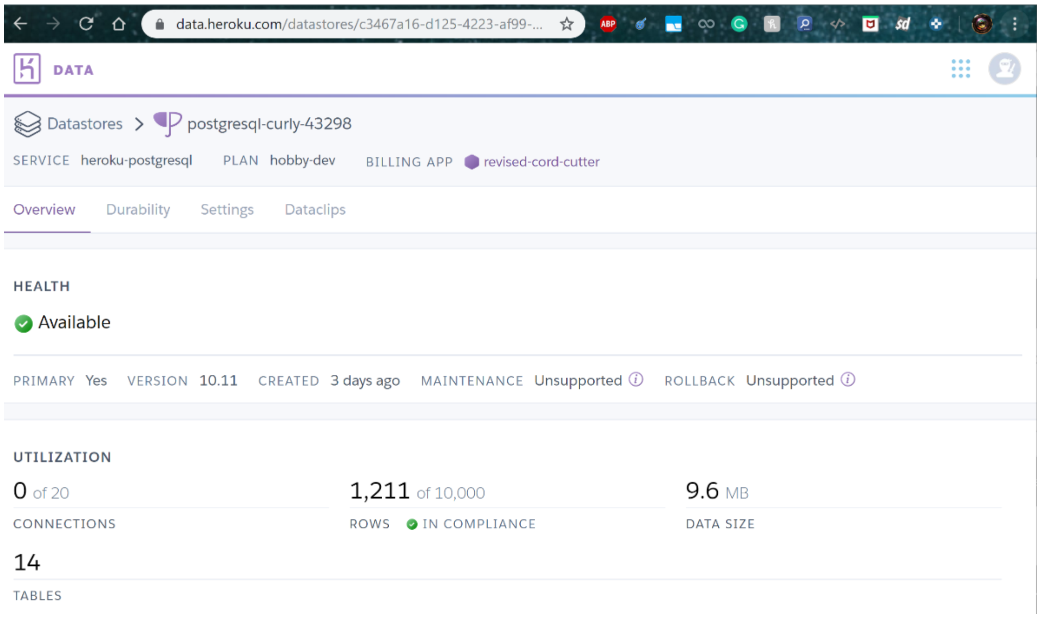
Heroku provides command line support for most of Postgres operations and one of them is for restores and backups. Heroku provides direct support for transferring data from another app to current app using below command.

```
$ heroku pg:copy 'ANOTHER-APP-DATABASE-URL' DB-NAME --app APP-NAME
```

Here DB-NAME and APP-NAME are Database name and App name as in Heroku console. After finding the database url for current app, data is transferred using following command,

```
$ heroku pg:copy
'postgres://ioksixzxtgclid:9f3c14b1179a97d14a18c6100c1bbed559a091e873c298bdd94e510ab6f73
c4e@ec2-54-221-236-144.compute-1.amazonaws.com:5432/d8cbp9vdkfclpc' postgresql-curly-
43298 --app revised-cord-cutter
```

This migrated all 14 Tables of data from current app to new revised app.


data.heroku.com/datastores/c3467a16-d125-4223-af99-...

DATA

Datastores > postgresql-curly-43298

SERVICE heroku-postgresql PLAN hobby-dev BILLING APP revised-cord-cutter

Overview Durability Settings Dataclips

HEALTH

Available

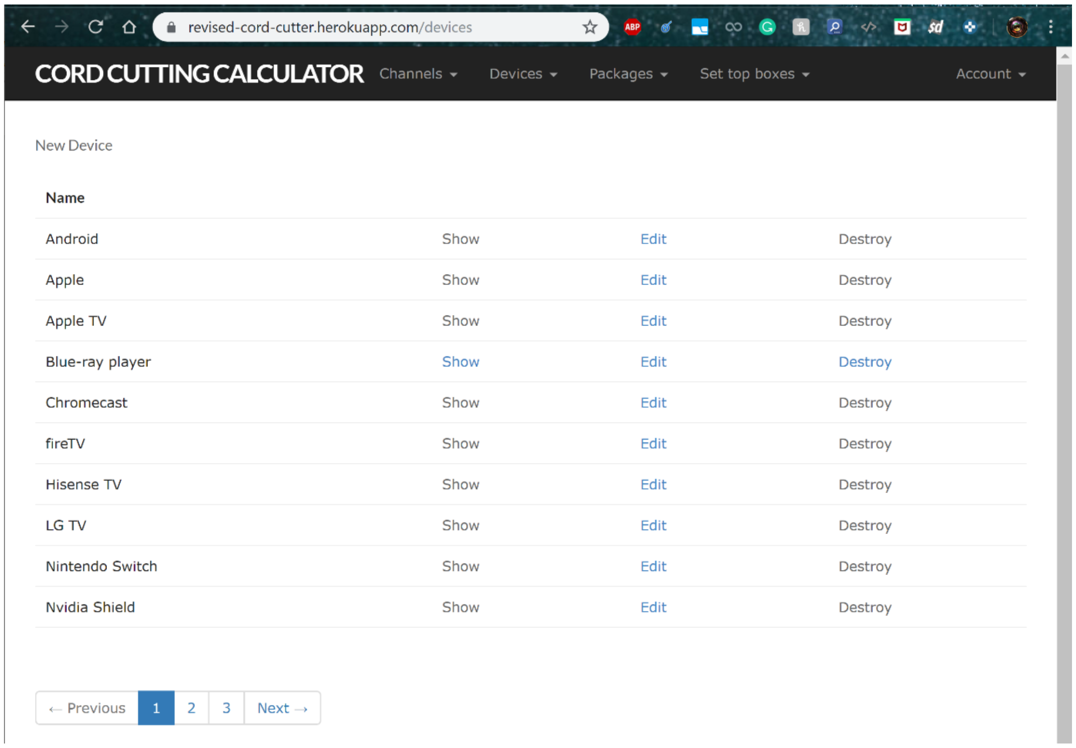
PRIMARY Yes VERSION 10.11 CREATED 3 days ago MAINTENANCE Unsupported ROLLBACK Unsupported

UTILIZATION

0 of 20	1,211 of 10,000	9.6 MB
CONNECTIONS	ROWS IN COMPLIANCE	DATA SIZE
14		
TABLES		

New Streaming Devices

Streaming devices in the existing application are too generic like ‘Streaming media players’ instead of Apple TV, Roku. Specific streaming devices will be more beneficial to user and this task is to create them. Created around 21 of them and below is the list them.


revised-cord-cutter.herokuapp.com/devices

New Device

Name			
Android	Show	Edit	Destroy
Apple	Show	Edit	Destroy
Apple TV	Show	Edit	Destroy
Blue-ray player	Show	Edit	Destroy
Chromecast	Show	Edit	Destroy
fireTV	Show	Edit	Destroy
Hisense TV	Show	Edit	Destroy
LG TV	Show	Edit	Destroy
Nintendo Switch	Show	Edit	Destroy
Nvidia Shield	Show	Edit	Destroy

Future Work

Parser

The simple and smart parser designed in this implementation works great, but it has its limitations.

- It wouldn’t capture channels mentioned under different class-named html element. This can be handled by finding class names of multiple channels instead of halting the algorithm after finding one channel in the page.
- On other side, there can be more than just channels with same class name, like in case of YouTube TV it extracts information like devices it supports too.
- The scope of the parser can be improved by including extracting price of the package, devices supported by provider and there are providers with multiple packages like Sling Blue, Orange. Complex parsers can be designed to help capture all these data.

Parsehub

Instead of building complex parsers, one can export the logic of parsing the provider webpage to third party applications like ParseHub. ParseHub is UI friendly, simple to use parsing tool. User can select the elements he wants to parse from a webpage and set conditions and rules on the elements to parse. Simple demo is presented here, https://www.parsehub.com/intro. Data extracted can be saved as JSON or CSV formats on AWS. This extracted data can be accessed programmatically through Parsehub APIs. ParseHub provides functionality of scheduled jobs too which will help in exporting the scraped data off these providers periodically by the application. It is worth trying to check its feasibility with respect to our use case. If Admin can create a job for every service provider on ParseHub, then the extracted data can be ingested into system through APIs. It is a worth trial and evaluate for our use cases.

Application Details

- Revised Cord Cutter:
  https://revised-cord-cutter.herokuapp.com/
- Github: Branch – **auto_load_channels**
  https://github.com/Ziyi1215/Cord-Cutting-Calculator/tree/auto_load_channels
  https://github.com/dileep-g/Cord-Cutter - forked standalone repo for this code
  Not merged with master, cause master has a different code.
- Revised Documentation:
  https://github.com/Ziyi1215/Cord-Cutting-Calculator/tree/master/documentation/Fall2019
- Previous Cord Cutter:
  https://cord-cutting-calculator.herokuapp.com/
- Previous Documentation:
  https://github.com/Ziyi1215/Cord-Cutting-Calculator/tree/master/documentation/Spring2019

References

- WATIR:
  http://watir.com/
  https://leanpub.com/watirways/read

- POSTGRES BACKUP & RESTORE:
  https://devcenter.heroku.com/articles/heroku-postgres-backups
- Heroku Environment setup:
  https://www.simon-neutert.de/2018/watir-chrome-heroku/
- ParseHub:
  https://www.parsehub.com/intro