# Ontologies in R

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When dealing with hierarchical data, ontologies, dendrograms, and trees can be a good way of visualizing relationships between the so-called "parent" and "child" nodes of a dataset. This document provides a cursory overview of hierarchical data and some useful packages in R to deal with such data.

## Prep

Start by clearing your workspace and loading necessary packages (not included).

## Load and clean data

### Load

We start by loading the cleaned IISS data. This dataframe contains information about the count of military units at the country-year level. It is hierarchical in the sense that we break up military equipment into type and subtype (not included).

### Prep

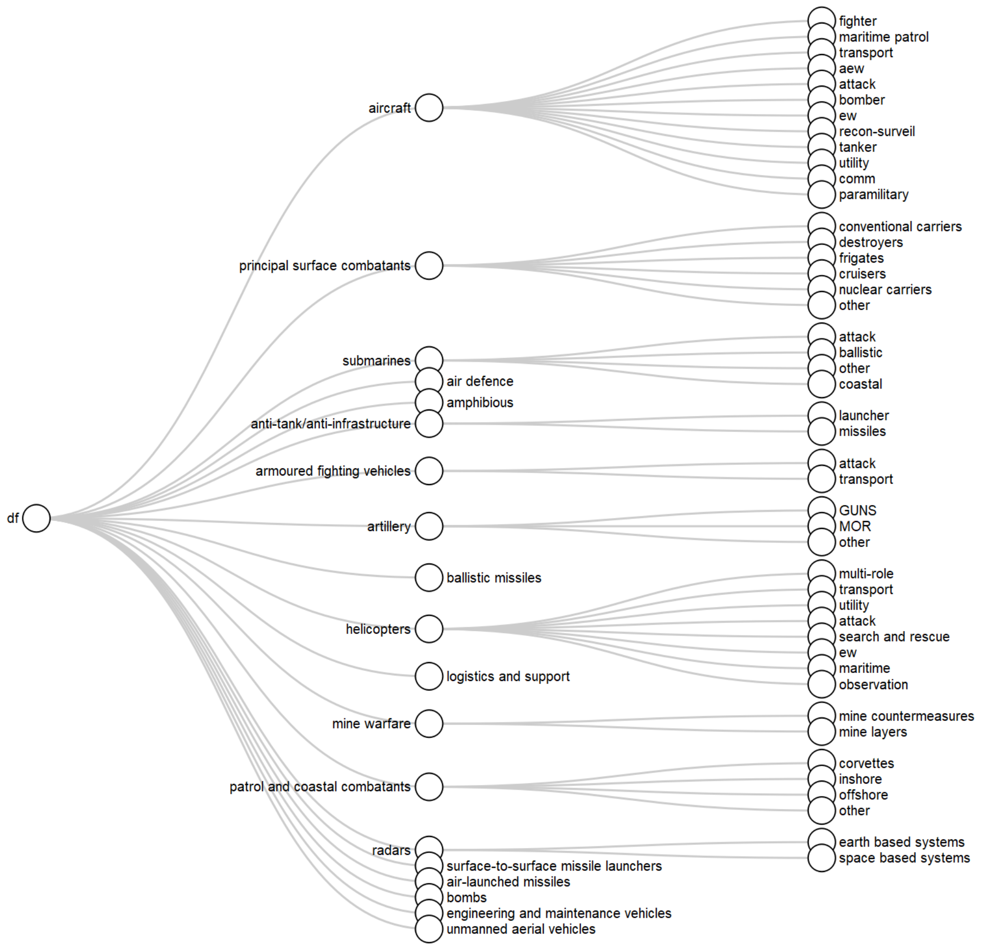
We need the data in tree format.

```r
# Temp recode carriers
df$tek[df$tek == "principal surface combatants_aircraft carriers_nuclear"] <-
  "principal surface combatants_nuclear carriers"
df$tek[df$tek == "principal surface combatants_aircraft carriers_non-nuclear"] <-
  "principal surface combatants_conventional carriers"

df <-
  df %>%
  dplyr::select(tek) %>%
  tidyr::separate(tek, c("parent", "child"), sep = "_", remove = TRUE) %>%
  dplyr::distinct() %>%
  dplyr::filter_all(dplyr::any_vars(!is.na(.)))

df$child[df$child == "all"] <- NA
```

## Create tree

Our first example uses the package *collapsibleTree*. Becuase this package (and other packages that we will look at) is designed to produce interactive plots for .html files and Shiny web apps, saving the images as static files can be a little tricky. The function widgetToPng() allows one to easily save .html visualizations as a static .png image.

```
# Define the plot-saving function
widgetToPng <- function(widget, file = "widget.png",  ...) {
  temp <- tempfile(fileext = ".html")
  file <- R.utils::getAbsolutePath(file)
  htmlwidgets::saveWidget(widget, temp)
  webshot(
    temp, file,
    selector = "#htmlwidget_container",
    zoom = 2,
    delay = 0.5,
    ...
  )
}

# Plot the collapsibleTree object inside the plot-saving function
widgetToPng(
collapsibleTree::collapsibleTree(df, hierarchy = c("parent", "child"),
                                 collapse = FALSE, width = 800, height = 800),
"collapsibleTree.png"
)
```



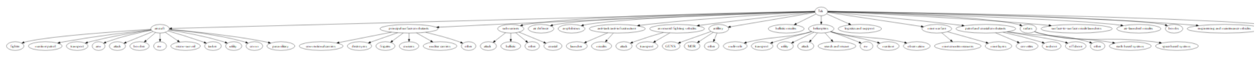
Our next example uses the package *data.tree*. Using *data.tree* requires a little bit of re-formatting, but nothing too complicated. Calling print() on the object df_tree shows us the new structure of the data frame. In order to plot the tree, simply call plot().

```
# Remove NAs
df$child[is.na(df$child)] <- ""

# Generate pathString as new column
df$pathString <-
  paste("Tek",
        df$parent,
        df$child,
        sep = "|")
```

```r
# Create list
df_tree <-
  data.tree::as.Node(df, pathDelimiter = "|")

print(df_tree, limit = 15)
```

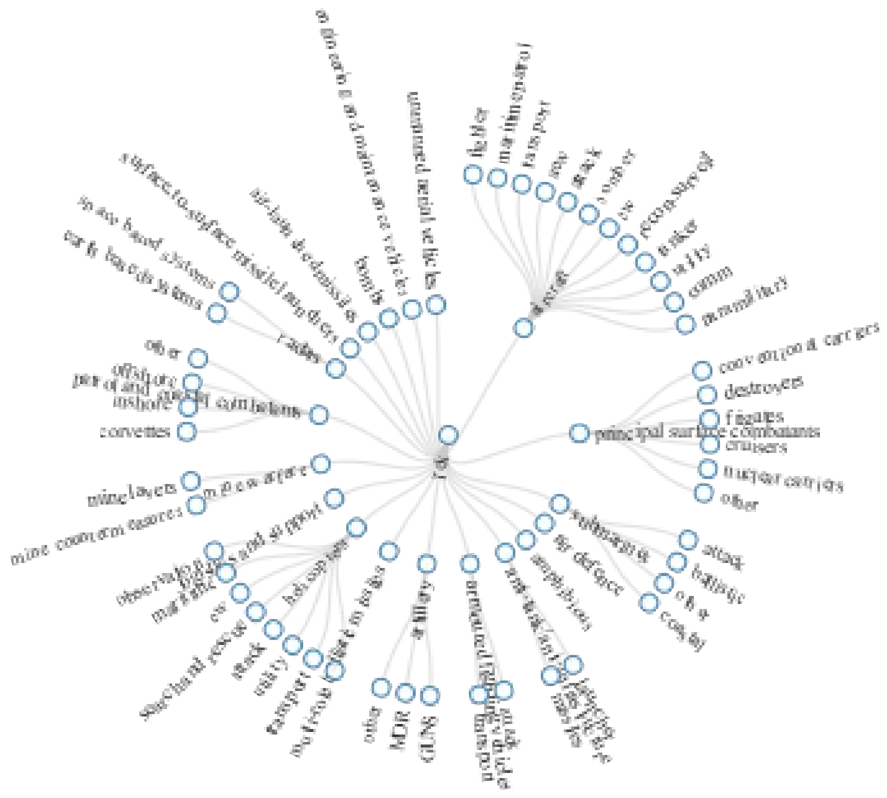
```
##                      levelName
## 1  Tek
## 2   ¦--aircraft
## 3   ¦   ¦--fighter
## 4   ¦   ¦--maritime patrol
## 5   ¦   ¦--transport
## 6   ¦   ¦--aew
## 7   ¦   ¦--attack
## 8   ¦   ¦--bomber
## 9   ¦   ¦--ew
## 10  ¦   ¦--recon-surveil
## 11  ¦   ¦--tanker
## 12  ¦   ¦--utility
## 13  ¦   ¦--comm
## 14  ¦   °--paramilitary
## 15  °--... 18 nodes w/ 33 sub
```

```r
widgetToPng(
plot(df_tree),
"collapsibleTree2.png"
)
```



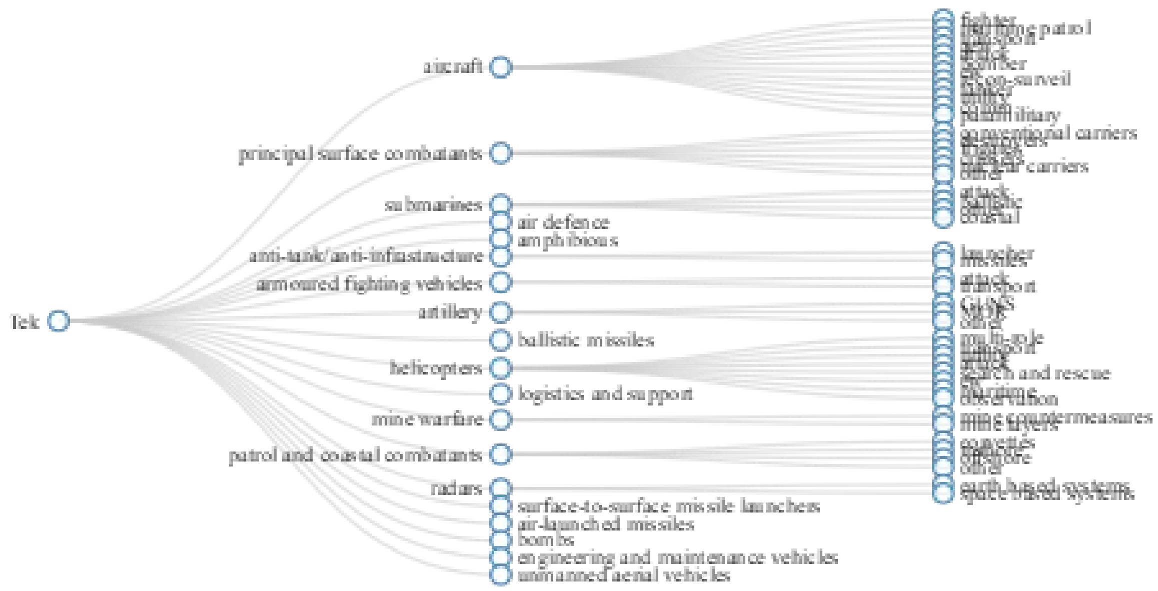
This isn't particularly helpful as a visualization, so we turn to the package *networkD3* to better visualize our data.tree object.

```r
df_list <-
  data.tree::ToListExplicit(df_tree, unname = TRUE)

df_vis <-
  networkD3::radialNetwork(df_list)

df_vis
```



networkD3 has plenty of tree and dendrogram templates to choose from.

```r
df_vis <-
  networkD3::diagonalNetwork(df_list)

df_vis
```



These packages allow one to easily manipulate a data.frame object to a hierarchical dataset with ease. There are more complex methods which involve edges and vertices. This information will be added to the document at a later date.

For further reading, see the vignettes for the packages discussed above:

- collapsibleTree
- data.tree
- networkD3

There are many other packages in R designed to visualize hierarchical data. They all essentially have the same capabilities as the packages we have looked at in this document. Here are a few of them:

- igraph
- ontologyX
- ggdendro