# Fiedler Vector Experiment in Agatha subgraph Experiment

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**DataSet**: the specification of a smaller subset of Agatha for initial experts, aapp-aapp (10M nodes, 100M edges).

## 1.Experiment with Fiedler Vector Algorithm:
1- compute Laplacian => L = D-A
2- compute eigenvector, eigenvalue (select second smallest)
3- selects all rows of the **second** column of the eigenvectors matrix (Fiedler vector)
4- returns the indices that would sort an array(**small**)
5- reorder matrix based on permutation of the rows and columns (above node order)
6- Calculate Bits Per Link (BPL)

## 1.2 Scipy implementation:
Sadly, the Fiedler vector built-in function on Scipy does not implement the same functionality of the Fiedler vector algorithm.
## 1.3 Networkx implementation:
It does not work for sparse graphs. It just crashes as soon as we convert it to a dense matrix.

## 1.4 Parameterize via ARPACK:
We found out that in Here Try various parameters (tolerance, maxiter), we try to explore different parameters and observe anything in particular, but no chance.

| Eigenvalues, Eigenvectors | Tolerance | | | | MaxIter | | | |
|---|---|---|---|---|---|---|---|---|
| | 0.01 | 0.001 | 0.0001 | 0.00001 | 500 | 1000 | 2000 | 3000 |
| Matrix_1k | 8.82 ms | 14.5 ms | 13.5 ms | 9.78 ms | 12.1 ms | 7.73 ms | 11.7 ms | 12.2 ms |
| Matrix_2k | 13.6 ms | 18.1 ms | 10.4 ms | 13.8 ms | 11.8 ms | 12.8 ms | 12.8 ms | 4.43 ms |
| Matrix_3k | 19.4 ms | 24.2 ms | 21.1 ms | 16.8 ms | 5.47 ms | 14.4 ms | 11.9 ms | 13.1 ms |
| Matrix_5k | 16.5 ms | 19.4 ms | 25.4 ms | 28 ms | 26.3 ms | 31 ms | 30.6 ms | 12.6 ms |
| Matrix_10k | 39.7 ms | 52 ms | 27 ms | 38 ms | 31.1 ms | 60.6 ms | 44.6 ms | 25 ms |
| Matrix_100k | 43.2 s | 24 s | 1min 35s | 1min 59s | No convergence | No convergence | 37 s | 49.1 s |

ARPACK error -1: No convergence (501 iterations, 0/2 eigenvectors converged) [ARPACK error -14: DNAUPD did not find any eigenvalues to sufficient accuracy.]

## 1.6 Eliminate zero
How do you balance the 0's in the Fiedler vector?

## 1.7 Converting matrix into dense matrix:
It just ends up in a crash, out of memory, according to tracking memory in the cluster via htop.
## 1.8 Explore different hardware in Darwin:
We increase memory to 100Gb, even go up to 400Gb , sadly not that much of an impact, neither with increase 32 memory-per-socket, not really that much of an impact.