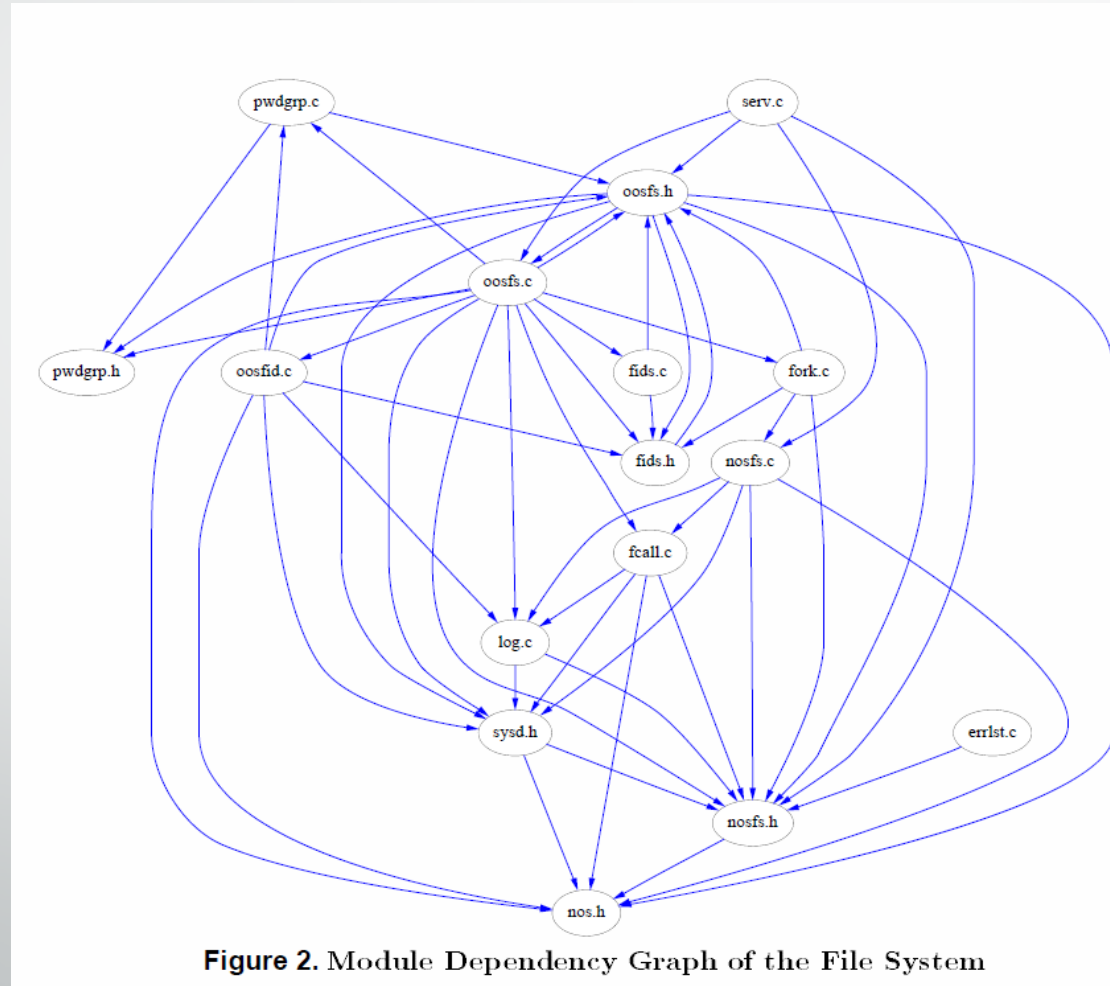




# Software Module Clustering

Exhauro Project

# Problem Definition



# Problem Definition

$$MF_k = \begin{cases} 0 & si \ i = 0 \\ \frac{i}{i + \frac{1}{2}j} & si \ i > 0 \end{cases}$$

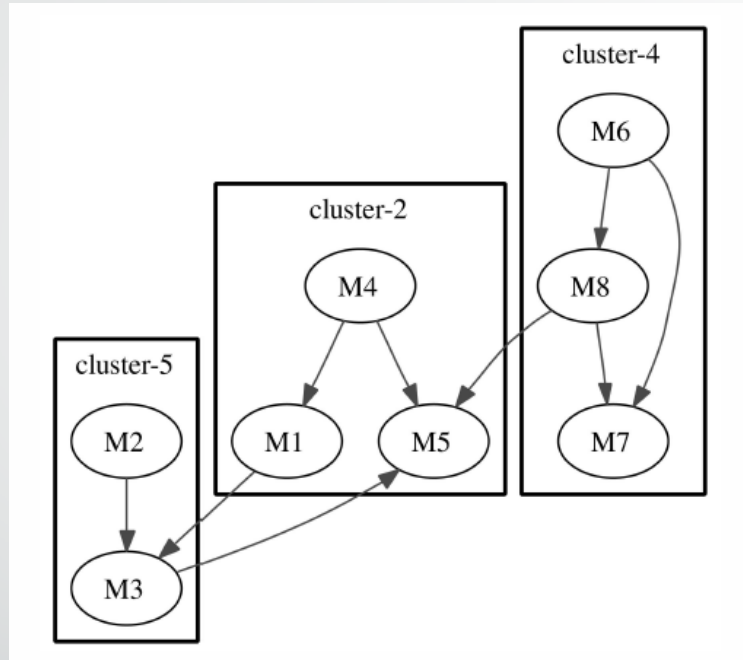
i: intra-connectivity  
j: inter-connectivity

Modularization factor

$$MQ = \sum_{k=1}^n MF_k$$

Modularization quality

# Example



$$MF_1 = MF_3 = MF_6 = MF_7 = MF_8 = 0$$

$$MF_5 = \frac{1}{1 + \frac{1}{2} \cdot 2} = \frac{1}{2}$$

$$MF_2 = \frac{2}{2 + \frac{1}{2} \cdot 3} = \frac{4}{7}$$

$$MF_4 = \frac{3}{3 + \frac{1}{2} \cdot 1} = \frac{6}{7}$$

$$MQ = \frac{1}{2} + \frac{4}{7} + \frac{6}{7} = \frac{27}{14} = 1.928571\dots$$



# Multi-objective Formulation

## Maximizing Cluster Approach

- the sum of intra-edges of all clusters (maximizing),
- the sum of inter-edges of all clusters (minimizing),
- the number of clusters (maximizing),
- MQ (maximizing),
- the number of isolated clusters (minimizing).

## Equal-size Cluster Approach

- the sum of intra-edges of all clusters (maximizing),
- the sum of inter-edges of all clusters (minimizing),
- the number of clusters (maximizing),
- MQ (maximizing),
- the difference between the maximum and minimum number of modules in a cluster (minimizing).

# State of The Art



Journal of Systems and Software

Volume 117, July 2016, Pages 384-401



## Hyper-heuristic approach for multi-objective software module clustering

A. Charan Kumari <sup>a</sup> , K. Srinivas <sup>b</sup>

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Author(s)

Roman Bazylevych ; Roman Burtnyk



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## A multi-agent evolutionary algorithm for software module clustering problems

Authors

[Authors and affiliations](#)

Jinhuang Huang, Jing Liu , Xin Yao