# Conclusions

Articulation points removal is one of the known network decomposition methods described and studied in relation to traditional monoplex networks. However, attention to multiplex networks has recently been increasing in the network science community due to their ability to model and capture interdependencies in complex systems. In this work, we study AP removal procedure in multiplex networks for the first time. We observe one of the effects of multiplexity – catastrophic cascade of failures – and show its significant impact on AP related percolation processes.

We compare percolation in monoplex, and two- and three-layer ER networks. Our findings indicate that increasing the number of layers increases the number of interdependencies which amplify the cascade effect, which leads to a higher probability of network collapsing during AP removal. According to our results, only networks with mean degree $c > c^\*$ can have a nonzero residual connected component, a functional core of the network untouched, and we show that $c^\*$ tends to increase with the number of layers. These increased values of $c^\*$ that we found provide explanation to the fact that most real-world multiplex networks have almost zero sized residual GCC compared to monoplex networks.

We also analyze orders of percolation phase transition in these experiments. We find that emergence of residual GCC in multiplex ER networks is a discontinuous percolation transition due to existence of interdependencies in the networks. This differs from continuous percolation transition in monoplex networks and once more underlines the role interdependencies play in multiplex networks dynamics.

We also perform AP removal in scale-free multiplex networks with varying in-layer degree exponents $\lambda\_1, \lambda\_2$. We show that $c^\*$ in this case increases with any of $\lambda\_1, \lambda\_2$ decreasing. In scale-free networks, the degree exponent is responsible for the proportion of hub nodes. Thus, the negative correlation between the fraction of hubs and network resilience to the cascade of failures is revealed.

Finally, we discover a worrying fraction of real-world multiplex networks having zero residual GCC. Almost all real complex systems are shown to struggle to maintain their functional cores after AP removal decomposition. This means we do not engineer our systems to be resilient enough to withstand such AP nodes failures due to our yet little understanding of multiplex phenomena. This work highlights the importance of considering multiplexity in complex system engineering and emphasizes the need for further study and development of network decomposition techniques specific to multiplex networks.