

The value chain of software includes three types: **utilities** like calculator or map, **applications** like accounting or HR, and **networks** like address books or social networks. Utilities are the least valuable while networks are the most valuable to users, founders, and investors. This post focuses solely on networks.

There are several network topologies such as star/hub, bus, ring, mesh, tree, hybrid, daisy chain, and point-to-point. Each type of network has different properties such as order, size, density, defensibility, and directionality. Networks have characteristics such as scalability, security, vulnerability, fault tolerance, quality of service, congestion, and pollution. Networks could be personal or public, homogeneous or heterogeneous, single-tenant or multi-tenant with several effects such as asymptotic, same-side, cross-side, direct, indirect, negative, or virality. Networks have obstacles like chicken-or-egg and switching cost. Most importantly, networks have a **"Network Effect"**, which is often confused with virality, implies that every user (node) added to the network increases the value of the network to all other users in the network.

This Network Effect is what makes networks more scalable, defensible, and valuable than utilities or conventional applications. In fact, network effects have been responsible for 70% of all the value created in technology since the creation of the web in 1995. Founders and investors who deeply understand how networks work are better positioned to build category-defining companies, especially in Web3.

However, not all network effects are created equal. The value of a network is calculated based on different laws which are rather guidelines than laws because they all wrongly assume that all nodes and all edges (connections or links) in a network are equal. Indeed, some nodes are just users while others are influencers with different levels such as Nano, Micro, Macro, and Mega. Also, some connections are *"strong ties"* in terms of closeness, activity, or durability like family members, while others are *"weak ties"* like acquaintances. Connections can also be directed or undirected. Networks could be Personal Networks like Twitter or Personal Utility Networks like Facebook.

The Network Effect could be calculated based on 3 main laws:

- **Sarnoff's Law – Network Value is $V=n$**

A blog is a broadcasting or publishing network with a star topology consisting of one-to-many connections from the central hub (ex: YouTube). The connections are typically weak, the density of the network is low, and its value is equal to the number of subscribers or nodes.



- **Metcalf's Law – Network Value is $V=n^2$**

An email system or a personal social network is a network with a mesh topology consisting of one-to-one or many-to-many connections (ex: address book). The density is higher than a blog, and the network's value is equal to the square of the number of contacts or nodes.



- **Reed's Law – Network Value is $V=2^n$**

A public social network is a clustered network referred to as Group Forming Network (GFN) (ex: Facebook). A GFN network could be a mesh network where many people know many other people, or a fully mesh network where everybody knows everybody else in the network. GFNs are the strongest networks with the highest density, defensibility, utility, power, and value that grows exponentially equals to 2 to the power of number of users or nodes.



In conclusion, if you are an entrepreneur or an investor interested in Web3, understanding what type of network you wish to build matters – a lot!!!



Prophyles



Web3 and the Network Effect

Sliding up the value chain

Lowest Value -



+ Highest Value



Star

One-to-Many
 Low density
 Weak connections
 Least Valuable
 Broadcast & Publishing
 Blogs, websites, social media

Sarnoff's Law

Network Value: $V=n$



Mesh

One-to-One or Many-to-Many
 Variable Density
 Variety of connections
 Second Most Valuable
 Transactional
 Personal social networks, emails

Metcalf's Law

Network Value: $V=n^2$



Clustered

Group Forming Network (GFN)
 Many-to-Many or All-to-All
 High Density
 Variety of connections
 Most Valuable
 Relational
 Marketplaces, public social networks

Reed's Law

Network Value: $V=2^n$