Building Sustainable Communities through Network Building
by Valdis Krebs and June Holley

Communities are built on connections. Better connections usually provide better opportunities. But, what are *better* connections, and how do they lead to more effective and productive communities? How do we build connected communities that create, or take advantage of, opportunities in their region or marketplace? How does success emerge from the complex interactions within and between communities?

This paper investigates building sustainable communities through improving their interactions – internally and externally – *using network ties to create economic opportunities*. Improved connectivity is created through an iterative process of *knowing the network* and *knitting the network*. Improved connectivity starts with a map – knowing the complex human system you are embedded in.

Know the Net

The Appalachian Center for Economic Networks [ACEnet], a regional economic development organization in Athens, Ohio has long followed the connectivity mantra – create effective networks for individual, group and regional growth and vitality. Recently ACEnet has begun to map and measure the emergent social and economic connections in the grassroots food industry in this region of Appalachia.

Network maps provide a revealing snapshot of a business ecosystem at a particular point in time. These maps can help answer many key questions in the community building process.

- Who are playing leadership roles in the community? Who is not, but should be?

- Are communities of interest developing around key regional and economic issues?

- Who are the experts in the area?

- Who are the mentors that others seek out for advice?

- Who are the innovators? Are ideas shared and acted upon?

- Are collaborative projects forming between local businesses?

- Which businesses will provide a better return on investment – both for themselves and the community they are embedded in?

- Are the right connections in place? Are any key connections missing?

These are all important questions that ACEnet wants to answer so that they can help build a more vibrant economy in Appalachian Ohio.

Before you can improve your network you need to know where you are currently at – the 'as is' picture. A network map shows the nodes and links in the network. Nodes can be people, groups or organizations. Links can show relationships, flows, or transactions. A link can be directional [A provides expertise to B: A → B] or non-directional [A works with B, and vice versa: A – B]. A network map is an excellent tool for visually tracking your ties and designing strategies to create new connections. A network map is also an excellent 'talking document' – a visual representation that opens up many conversations about possibilities.

Transformation that leads to healthy communities is the result of many (often small) collaborations among network nodes. Complexity scientists describe this phenomenon—where local interactions lead to global patterns — as *emergence*. We can guide emergence by understanding, and catalyzing, connections. For example, knowing where the connections are, and are not, allows a community development organization to influence local interactions. This

is particularly important in policy networks where key nodes play an important role in what flows throughout the network. Influencing a small number of well-connected nodes often results in better outcomes than trying to access the top person or calling on random players in the policy network. If you know the network you can focus your influence.

What does a vibrant, effective community network look like? Since 1997, much research has been done to discover the qualities of vibrant networks. Research by large consulting firms, major universities, and research labs have all addressed the question. Sociologists, physicists, mathematicians, and management consultants have all discovered similar answers about effective networks. The amazing discovery is that people in organizations, routers on the internet, cells in a nervous system, molecules in protein interactions, and pages on the WWW are all organized in efficient network structures that have similar properties.

Five general patterns are observed in all effective networks:

1. Birds of a feather flock together: nodes link together because of *common attributes, goals or governance*.
2. At the same time *diversity* is important. Though clusters form around common attributes and goals, vibrant networks maintain connections to diverse nodes and clusters. A diversity of connections is required to maximize innovation in the network.
3. Robust networks have several paths between any two nodes. If several nodes or links are damaged or removed, other pathways exist for uninterrupted information flow between the remaining nodes.
4. The *average path length*[1] in the network tends to be short without forcing direct connections between every node. The power of the indirect[2] tie is used.

---

[1] The average path length in a network is a convenient measure of the network's global efficiency. The longer the average path length, the longer it takes for messages to travel between any two nodes, and the more distorted they are when they arrive.

[2] An indirect tie is a network path that connects two nodes through on or more intermediaries. Here A and B, and B and C have direct ties while A and C have an indirect tie through the intermediary B. **A–B–C**

5. Some nodes are more *prominent* than others – they are either hubs[3], brokers[4], or boundary spanners[5]. They are critical to network health and growth.

In 1997, IBM became interested in how organizations were, or were not, changing in the networked information economy. They asked 15 of their world-wide customers to participate in a study. Each participating organization had just gone through a major change. IBM management consultants evaluated each organization's 'mastery of change' – how well these organizations managed the change they experienced. The hypothesis of the study was that organizations with better human networks would adapt to and manage change better than those organizations with poor connections. After the IBM statistician crunched all of the research data, certain network patterns were highly correlated with mastery of change. The most obvious finding was that organizations with short network paths of information flow and knowledge exchange were able to adapt to change effectively. In these organizations it took only a few hops[6] for anyone to communicate to anyone else. In non-adaptive organizations, the paths were long, involving many hops between people[7]. Common wisdom about human networks – long communication paths lead to slow processing and distorted information. In addition to short path lengths, those organizations whose network measures revealed strong emergent leadership[8] had an even higher correlation with adaptability.

---

[3] Nodes with many direct connections that quickly disperse information.

[4] Nodes that connect otherwise disconnected parts of the network – they act as liaisons.

[5] Nodes that connect two or more clusters – they act as bridges between groups.

[6] One link = One hop… i.e. there are two hops from A to C: A–B–C… 1) A to B, 2) B to C.

[7] Usually a path that has more then 3 'hops' between two people is considered too long for effective communication.

[8] Emergent leaders are found in networks that receive a high network centralization metric. Network centralization is one of the many social network metrics available in *InFlow*, a network mapping and measuring software package.

In the late 1990s research within large organizations measured the benefit of networks.

- Teams with better access[9] to other teams inside and outside the organization finished their assignments faster.
- Teams with better connections discovered, and transferred, the knowledge they needed within the organization.
- Managers with 'better connections'[inside and outside the organization] spotted and developed more opportunities for their departments or organizations.
- Project managers with better network connections were more successful in reaching project goals within time and financial parameters.

Even though we know several keys to building effective networks, this knowledge is rarely put to use. Networks, whether social or business, are usually left to grow without a plan. When left unmanaged, networks follow two simple, yet powerful driving forces:

1. Birds of a feather flock together.
2. Those close by, form a tie.

This results in many small and dense clusters with little or no diversity. Everyone in the cluster knows what everyone else knows and no one knows what is going on in other clusters. The lack of outside information, and dense cohesion within the network, removes all possibility for new ideas and innovations. We see this in isolated rural communities that are resistant to change, or in a classic "old boy network". Yet, the dense connections, and high degree of commonality forms good work groups – clusters of people who can work together smoothly.

Instead of allowing networks to evolve without direction, successful individuals, groups and organizations have found that it pays to actively manage your network. Using the latest research we can now *knit* networks to create productive individuals and communities.

---

[9] Quick access to information and knowledge found elsewhere in the organization is dependent on short path lengths between the searching team and all other teams.

5

Knit the Net

A vibrant community network is generally built in 4 phases, each with it's own distinct topology.

Each phase builds a more adaptive and resilient network structure than the prior phase. Network

mapping can be used to track your progress through these four stages.

1) Scattered Clusters
2) Single Hub-and-Spoke
3) Multi-Hub Small-World Network
4) Core/Periphery

Experience shows that most communities start as small emergent clusters organized around

common interests or goals. Usually these clusters are isolated from each other. They are very

small groups of 1-5 people or organizations that have connected out of necessity. Many of these

small clusters are found in under-developed communities – see Figure 1. If these clusters do not

organize further, the community structure remains weak and under-producing.
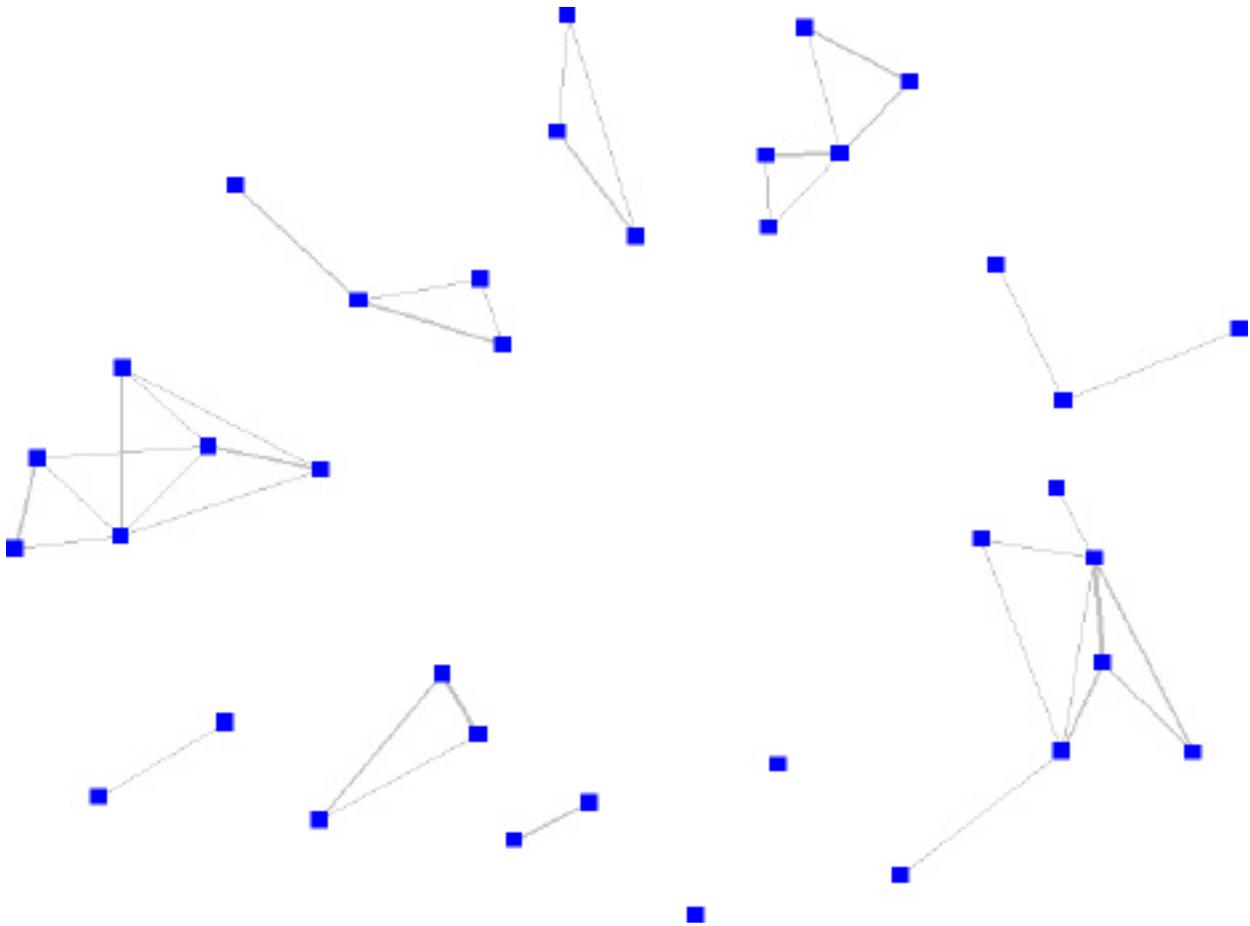
Figure 1 – Scattered Clusters

Without an active leader who takes responsibility for building a network, spontaneous

connections between groups emerge very slowly, or not all. We call this network leadership role

a *network weaver*. Instead of allowing these small clusters to drift in the hope of making a lucky

connection, the weaver actively creates new interactions between the clusters. Through this

activity useful community structures are emerge.

The first network type the weaver creates is the hub and spoke model, with the weaver as the

hub. The weaver has the vision, the energy, and the social skills to connect to diverse individuals

and groups and start information flowing to and from them. The weaver usually has external

links outside of the community to bring in resources and innovation. This is a critical phase for

community building because everything depends on the weaver who is the lone hub in the

network. Figure 2 shows the weaver connecting the previously scattered little clusters.
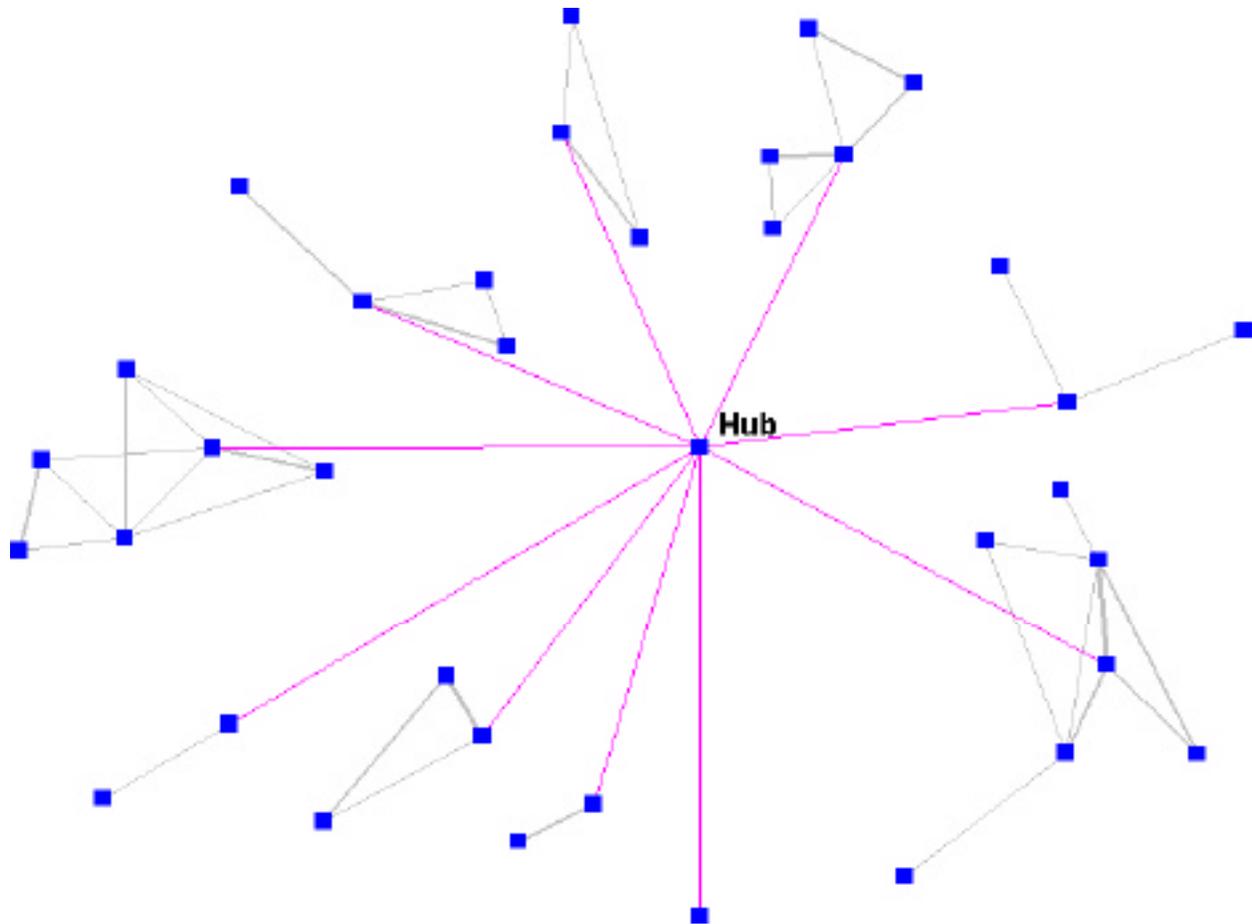
Figure 2 – Hub-and-Spoke Network

Initially the network weaver forms relationships with each of the small clusters. During this

phase the weaver is learning about each individual or small cluster – discovering what they know

and what they need. However, the spokes of the hub do not remain separated for long. The

weaver begins connecting those individuals and clusters who can collaborate or assist one

another in some way. Concurrently the weaver begins encouraging others to begin weaving the

network as well. The weaver is creating interactions within the nascent community. Not all

interactions will blossom into successful relationships or collaborations. But this is not a

problem. A 100% success rate is not necessary for effective network weaving. In networks, a

connection that does not work immediately often lies dormant and blossoms in the future when

conditions and needs may be different inside and outside the community.

Training in network building is important at this juncture. Network mapping reveals the

progress and identifies emerging network weavers. The hub-and-spoke model is only a

temporary step in community growth. It is utilized at a time when the community needs strong

leadership. It should not be utilized for long because it concentrates both power and

vulnerability in one node – the hub. If the leader/hub fails or leaves then we are back to the

disconnected community in Figure 1.

Even though it is a temporary structure, the hub-and-spoke model is usually the best topology to

bring together the scattered clusters seen in most immature communities. An organization with a

vision, and contacts to external ideas and resources, can play the role of the hub. This is the role

ACEnet assumed when it saw that SE Ohio was the home to many small, uncoordinated food

clusters. There was the Farmer's Market crowd, the natural bakery, and worker-owned Mexican

restaurant and a few other individuals creating unique food products or growing the produce to

make them. ACEnet brought all of these unconnected groups together around a kitchen

incubator – a state of the art facility for preparing and packaging a large variety of food items. A

9

hub-and-spoke model is the appropriate structure in the initial stages of community building, but it should be transitory – giving way to more robust and adaptive topologies. These topologies are also more democratic, supporting several leaders.

As the weaver connects to many groups, information is soon flowing into the weaver about each group's skills and goals. An astute weaver can now start to introduce clusters that have common goals/interests or complementary skills to each other. As clusters connect, their spokes to the hub can weaken, freeing up the weaver to attach to new groups. Although the spoke links weaken, they never disappear – they remain weaker, dormant ties, able to be re-activated whenever necessary. The weaver knows that a network dependent upon a lone hub will be fragile. The more connections that don't include the hub, the more resilient the community will be.

As the hub gains credibility in the community it will attract more individuals and groups that want to connect to the weaver, who now is developing a reputation as a 'connector'. In order to accommodate new connections, the weaver must teach its early connections how to weave their own network. This happened with ACEnet as several of the businesses and small non-profits began to build their own network neighborhood, bringing in new nodes and links into the early Athens community network. As the overall network grows, the role of the weaver changes from being the central weaver, to being a facilitator of network building throughout the community. There are two parts to network weaving. One is relationship building, particularly across traditional divides, so that people have access to innovation and important information. The second is learning how to facilitate collaborations for mutual benefit. Collaborations can vary

10

from simple and short term—entrepreneurs purchasing supplies together—to complex and long-term—such as a major policy initiative or creation of a venture fund. This culture of collaboration creates a state of emergence, where the outcome—a healthy community—is more than the sum of the many collaborations. The local interactions create a global outcome that no one could accomplish alone.

This transition from network weaver to network facilitator is critical. The network weaver now begins to facilitate the network weaving of other key individuals, groups or organizations in the network. The original weaver is creating new weavers who will eventually take over much of the network building and maintenance. If the change is not made then the community network remains dependent on the central weaver who is now probably overwhelmed with connections. At the transition point the weaver changes from being a direct leader to an indirect leader, influencing new emergent leaders appearing throughout the community. This transition is necessary for the network to increase its scale, impact and reach.

The change from weaver to facilitator is critical in moving from a fragile single-hub topology to a more robust multi-hub topology. The first advantage of a multi-hub topology is elimination of a single point of failure. ACEnet is still a dominant hub in SE Ohio, and its failure would affect the region greatly – but not as significantly as five years ago when the network was sparser and more dependent on ACEnet. Now ACEnet has the luxury of spending time in new pursuits such as expanding the network to other areas inside and outside of Appalachia.

As the weaver connects various individuals, organizations and clusters, these entities connect to each other loosely. A new dynamic is revealed here – the strength of 'weak ties'. Weak ties are connections that are not as frequent, intense, or resilient as strong network ties that form through extended successful collaboration. Strong ties are usually found within a network cluster, while weak ties are found between clusters. As clusters begin to connect, the first bridging links are usually weak ties. Over time weak ties may retain their structure by bridging separate clusters or they may grow in to become strong ties binding previously separate groups into a new larger cluster.

Weak ties are also important in innovation. New ideas are often discovered outside the local domain. To get transformative ideas you often have go outside of your group. Two very diverse groups that have threads in common can often help each other with these transformative ideas. A successful formula for creating ties for innovation is to find other groups that are both similar *and* different to your own. Similarity helps the communication and building of trust, while diversity presents new ideas and perspectives for possible combination into new products and services. *Connect through your similarity and innovate through your diversity!*

Now that other hubs are appearing in the network, the weaver may connect the hubs to each other, creating a multi-hub community. Not only is this topology less fragile, it is also the best design to minimize the average path length throughout the network – remember, the shorter the hops the better for work flow, information exchange and knowledge sharing! Information percolates most quickly through a network where the best connected nodes [hubs] are all

connected to each other. A network with many hubs is also very resilient and cannot be easily

dismantled.

Figure 3 shows a multi-hub small-world network. Here four clusters [designated by the thick red

links] have created many weak ties [gray links] to each other. The weak ties may, or may not,

strengthen to create one tightly coupled larger cluster.   The multiple hubs can be small

businesses or other community development firms.
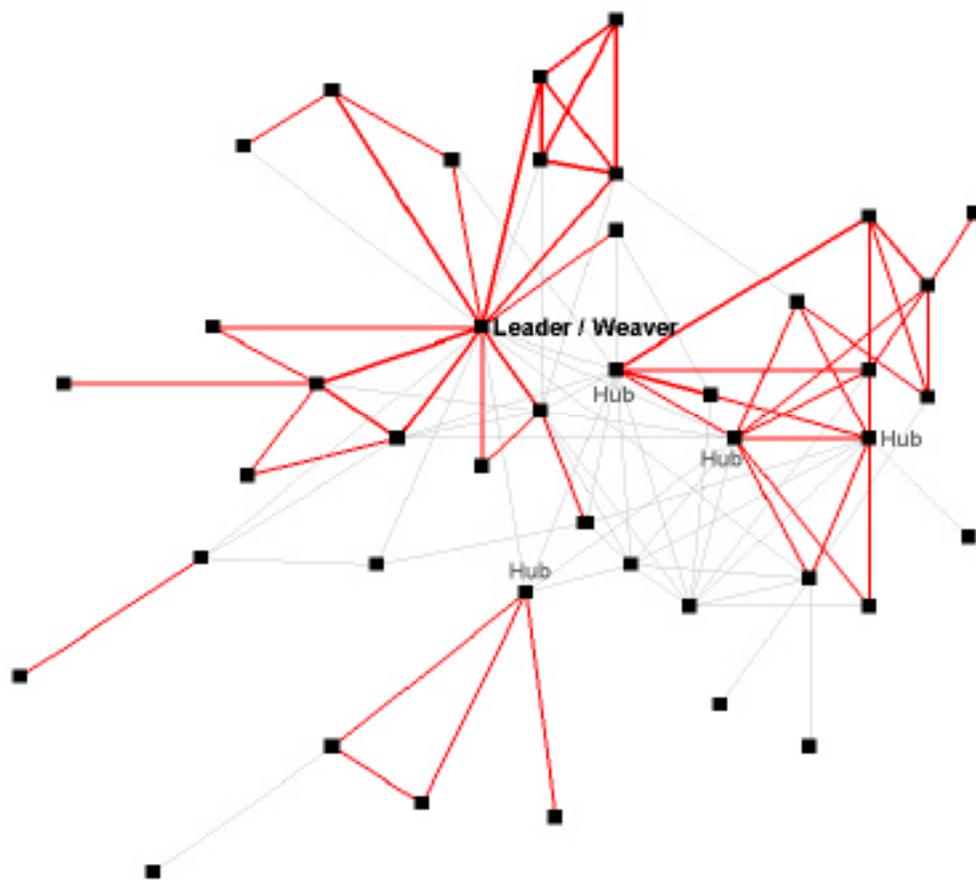

Figure 3 – Multi-Hub Small World Network

The important next step is to strengthen some of the weak ties in the network to become strong ties. This happens after turf issues have been handled. A multi-hub network may be difficult to achieve if political and 'turf' issues are raging through the network. If two or more community development organizations start battling over turf and control of the community then the result may be two or more competing, single hub networks that ignore the larger community needs and just focus on survival of their own network. With the known brittleness of single hub networks, this puts the community at risk as the networks fail to combine due to parochial competition.

The end-goal for vibrant, sustainable community networks is the *core/periphery* model. This topology emerges after many years of network weaving by multiple hubs. It is a stable structure that can link to other well-developed networks in other regions. The network core in this model contains the key community members who have developed strong ties between themselves. The periphery of this network contains three groups of nodes that are usually tied to the core through weak ties.

1) Those new to the community and working to get to the core
2) Bridges to diverse communities elsewhere
3) Unique resources that operate outside of the community, and may span several communities

The economic landscape is full of imperfectly shared ideas and information. The periphery allows us to *reach* ideas and information not currently prevalent in the network. The core allows us to *act* on those ideas and information.

14

The periphery is the open, porous boundary of the community network. It is where new

members/ideas come and go. It is where inflows and outflows of knowledge and innovations

occur. The periphery *monitors* the environment, while the core *implements* what is discovered

and deemed useful.
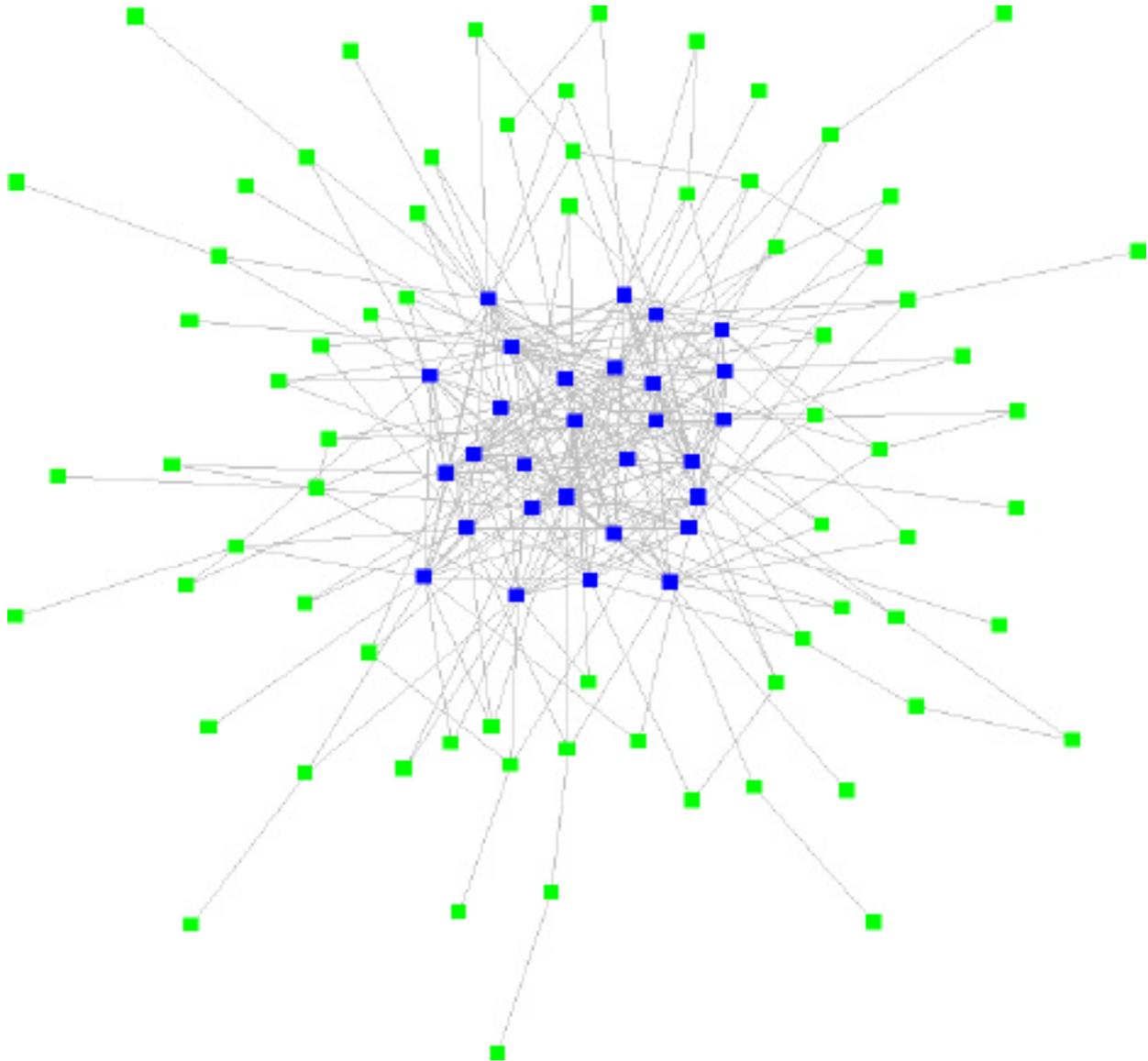
Figure 4 – Core/Periphery Network

Figure 4 shows a well developed core/periphery structure. The blue nodes are the core, while the green nodes reside in the periphery. This network core is very dense[10] -- not all cores will have as high a concentration of connections as this one. Too much density can lead to rigidity and an overload of activity. Monitoring your network using social network analysis can help you see where your network needs more/less weaving or re-weaving to match the current environment.

At this point the network weaver's initial task is mostly completed. Now, attention turns toward network maintenance and building bridges to other networks. The network weaver can begin to form inter-regional alliances to create new products, services and markets—or to shape and influence policy that will strengthen the community or region. This happens by connecting network cores to each other utilizing their peripheries. The network weaver maximizes the reach of the periphery into new areas, while keeping the core strong. What other opportunities and connections are possible? The weaver now focuses on projects of large substance that will have major impact on the community.

Conclusion

As we have seen weaving a network requires two iterative and continuous steps:

1. **Know the network** – take regular snapshots of your network and evaluate your progress.
2. **Knit the network** – follow the four (4) phase network knitting process.

All throughout this process network maps guide the way – they reveal what we know about the network and they uncover possible next steps for the weaver.

---

[10] Network density is calculated by the number of existing connections as a percentage of the total possible. Any density greater than 50% is very high and very rare in most human networks of normal size.

We have seen ACEnet perform a role in the network that is very similar to a catalyst in a chemical reaction. In the particle world, the catalyst helps form new molecules and substances by assisting interactions that would not have happened straightforwardly. In the social and economic world, the network weaver catalyzes interactions in complex human systems via introductions, collaborations, and mentoring creating new partnerships, clusters, innovations, and economic activity. Global benefits emerge from many local interactions.

Starting with a disconnected community, a network builder can start weaving together the necessary skills and resources to build first a simple single hub network. This will be followed by a more efficient and resilient multi-hub network, finishing with a sustainable core/periphery structure. Once the network is strong, it can connect to other distant community networks to create more opportunities.

Valdis Krebs is a management consultant and the developer of **_InFlow_** network software.
http://www.orgnet.com
valdis@orgnet.com

June Holley is the President of the Appalachian Center for Economic Networks [ACEnet]
http://www.acenetworks.org
juneh@acenetworks.org