



BOARD OF REGENTS

SUMMARY OF ITEM FOR ACTION **INFORMATION** OR DISCUSSION

TOPIC: Network Models of Regional Innovation Clusters and their Influence on Economic Growth (information item)

COMMITTEE: Economic Development and Technology Commercialization

DATE OF COMMITTEE MEETING: June 18, 2013

SUMMARY: Universities play a critical role in the innovation ecosystem and the topic examines models for stimulating innovation and regional economic development. Network models can identify clusters where innovation and entrepreneurial efforts may be targeted and will help focus resources on high-yield economic activities, and measure the results of these activities more effectively.

ALTERNATIVE(S): This item is for information purposes.

FISCAL IMPACT: This item is for information purposes.

CHANCELLOR'S RECOMMENDATION: This item is for information purposes.

COMMITTEE RECOMMENDATION:

DATE:

BOARD ACTION:

DATE:

SUBMITTED BY: Joseph F. Vivona (301) 445-2783



Network Models of Regional Innovation Clusters and their Influence on Economic Growth

Using Big Data and Social Network Analysis in Planning and Economic Development

Regents' Committee on Economic Development and Technology Commercialization
June 18, 2013

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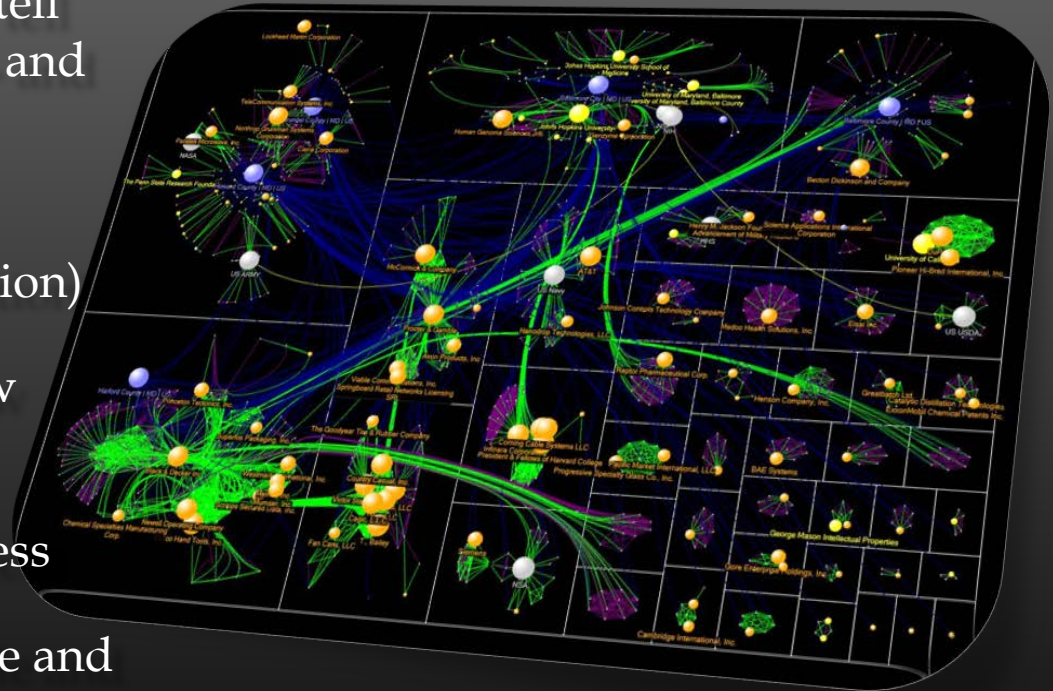
ARCHITECTURE
PLANNING &
PRESERVATION



UNIVERSITY OF
MARYLAND

Today's Talk

1. Regional Innovation Clusters: Why current metrics don't tell us what we need to know - and how to fix it
2. Innovation Networks & economic growth (dissertation)
3. Creating new tools and new metrics (current research)
4. Maryland - work in progress
5. Discussion: What's possible and how DBED can help

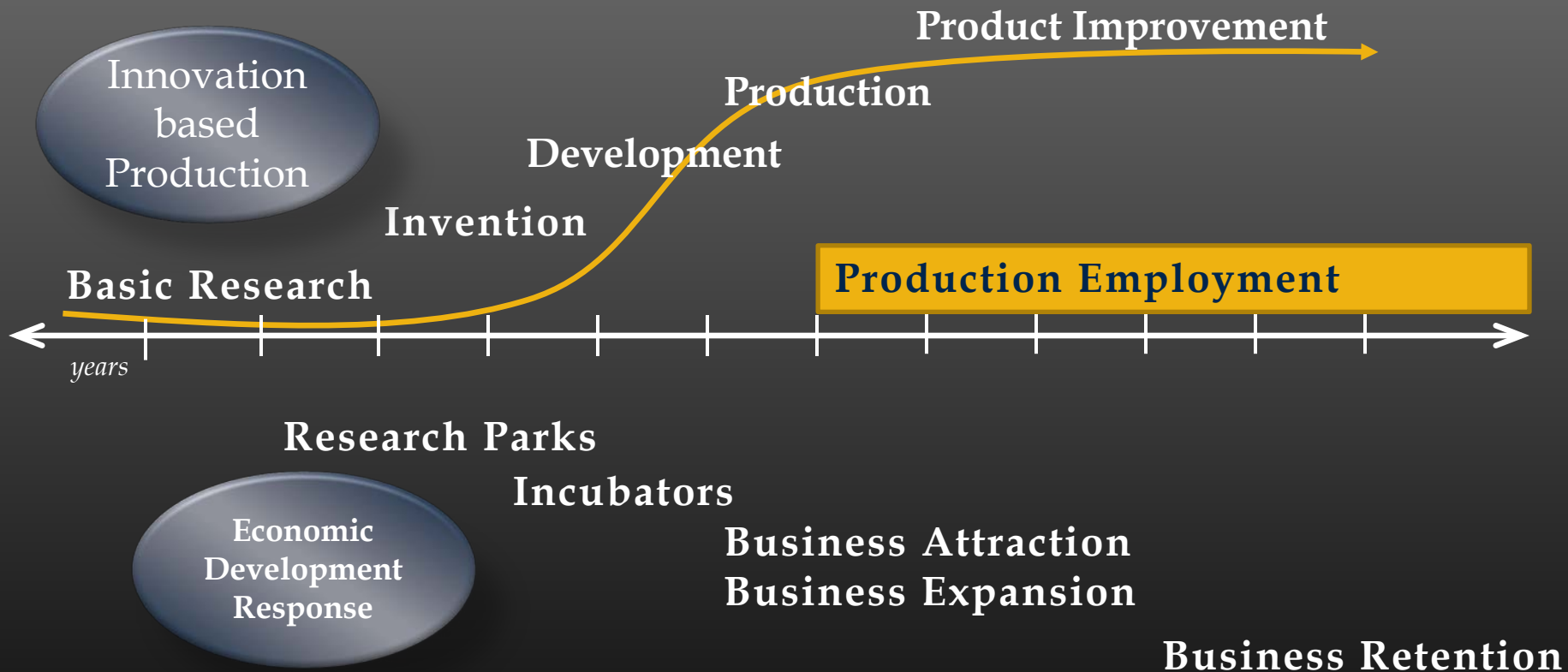


Baltimore Innovation Network 2008 - 2010
Created with NodeXL

<http://www.terpconnect.umd.edu/~dempy/docs/md05162013.pptx>

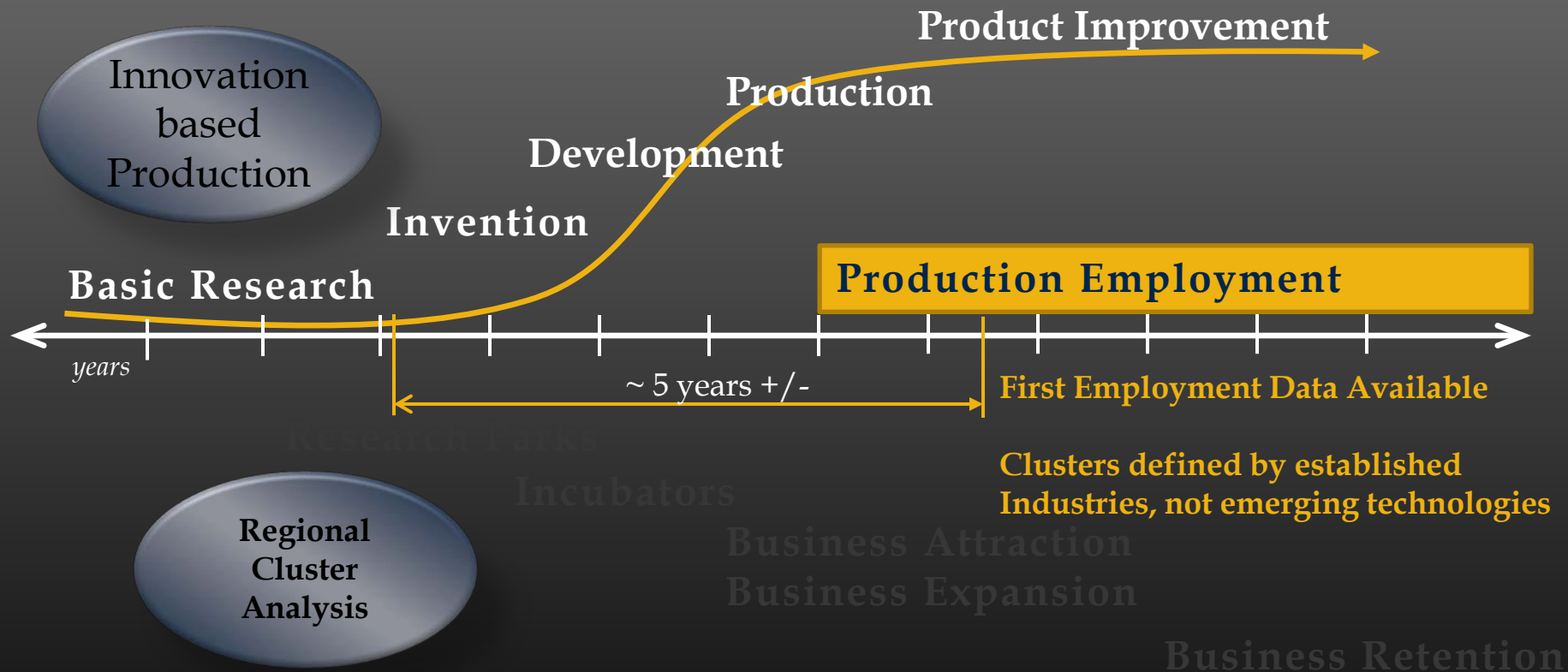
Innovation Driven Growth

a simple stylized model



Innovation Driven Growth

how do we measure it now?

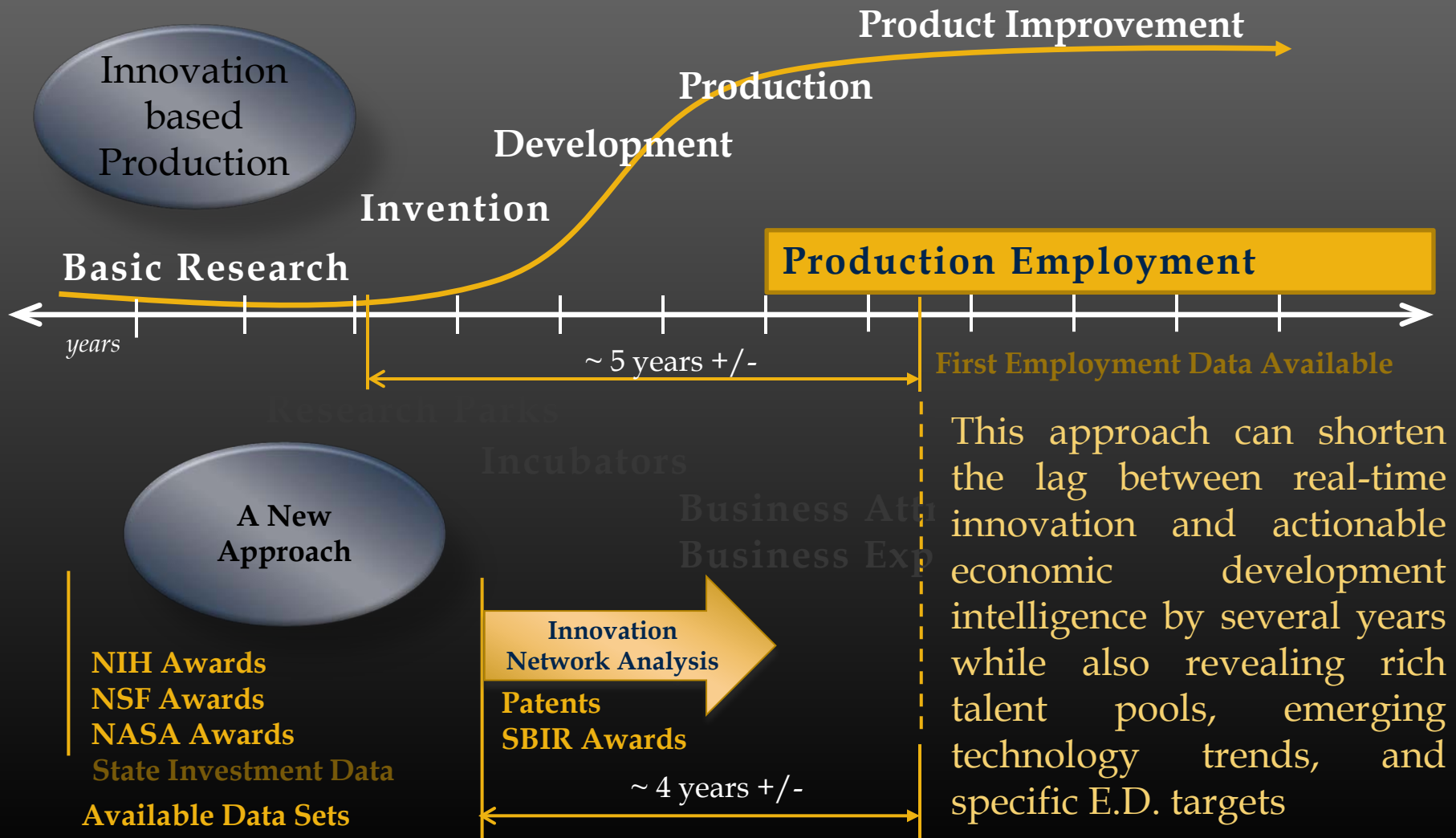


Bottom Line

Industry clusters -by whatever name- reflect the state of innovation about five years ago

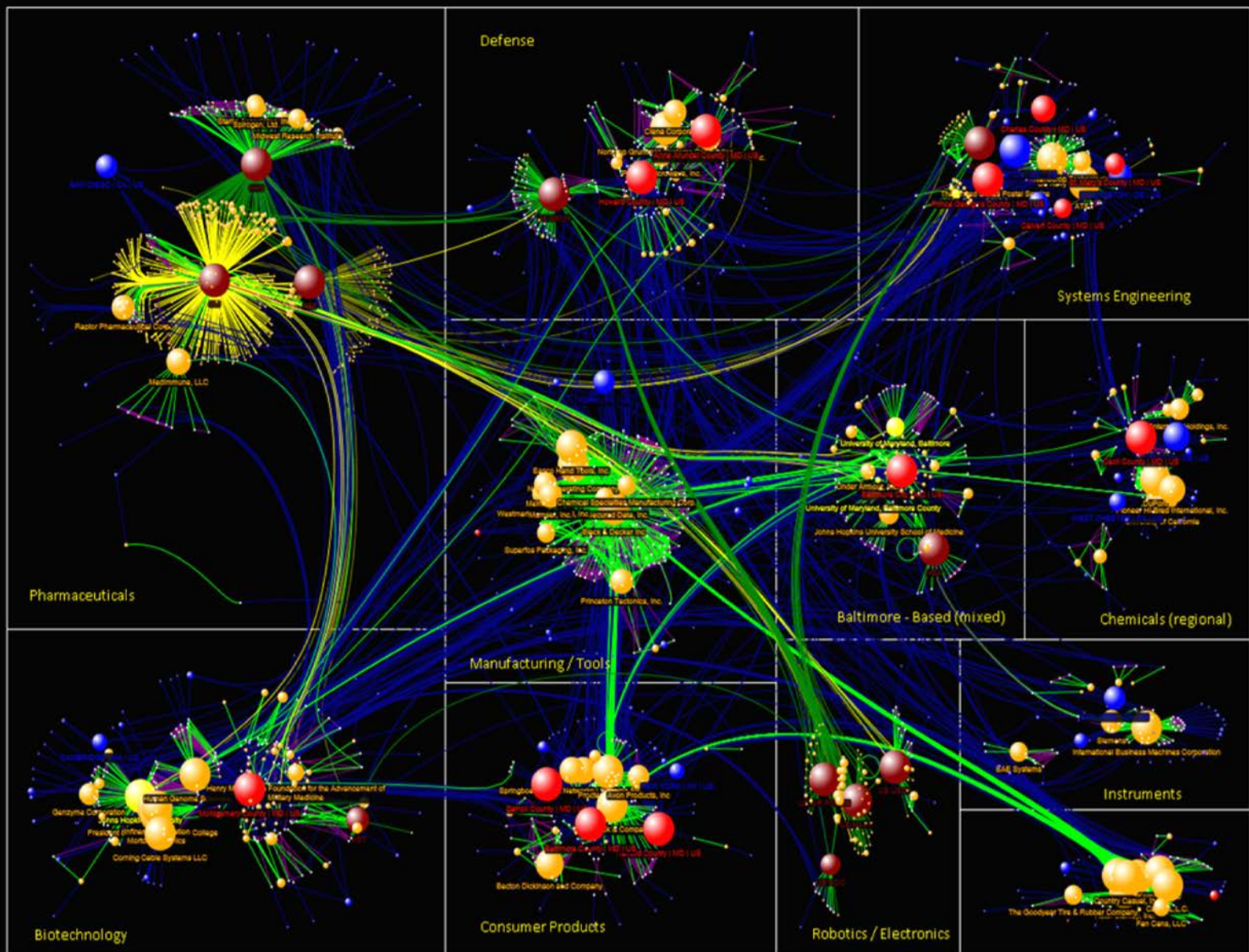
Innovation Driven Growth

gaining early actionable intelligence



Maryland - a Preview

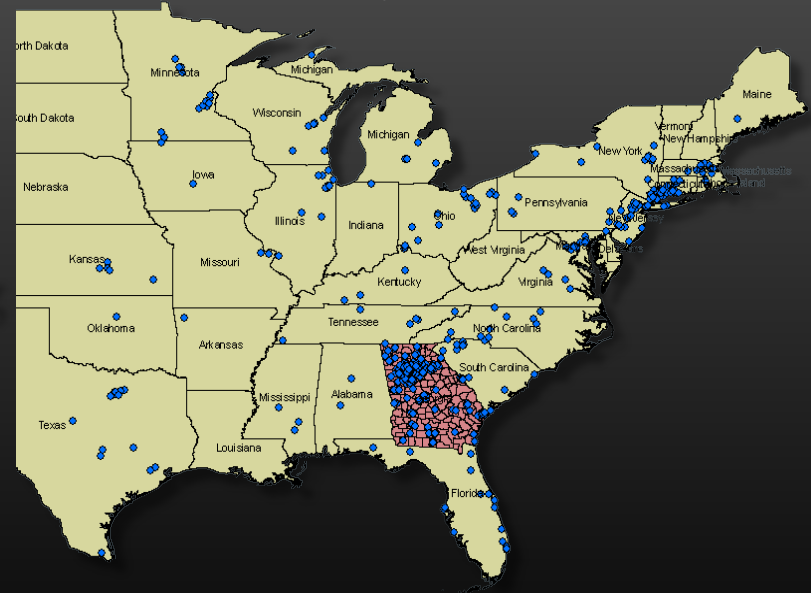
Core Innovation Network 2008 - 2010



Regional Innovation Clusters are Complex Systems

Complex Systems:

- involve many interconnected or interacting parts
- exhibit *emergence* - behaviors that cannot be understood or predicted by looking at the components of the system alone
- Emergence is based on a few simple rules of interaction
- Networks are ideal for modeling complex systems



Georgia Innovation Network 2008 – 2010
Locations of selected actors

Networks & Network Models

Networks made up of nodes and links (ties, edges)

Nodes are actors, agents or objects

People

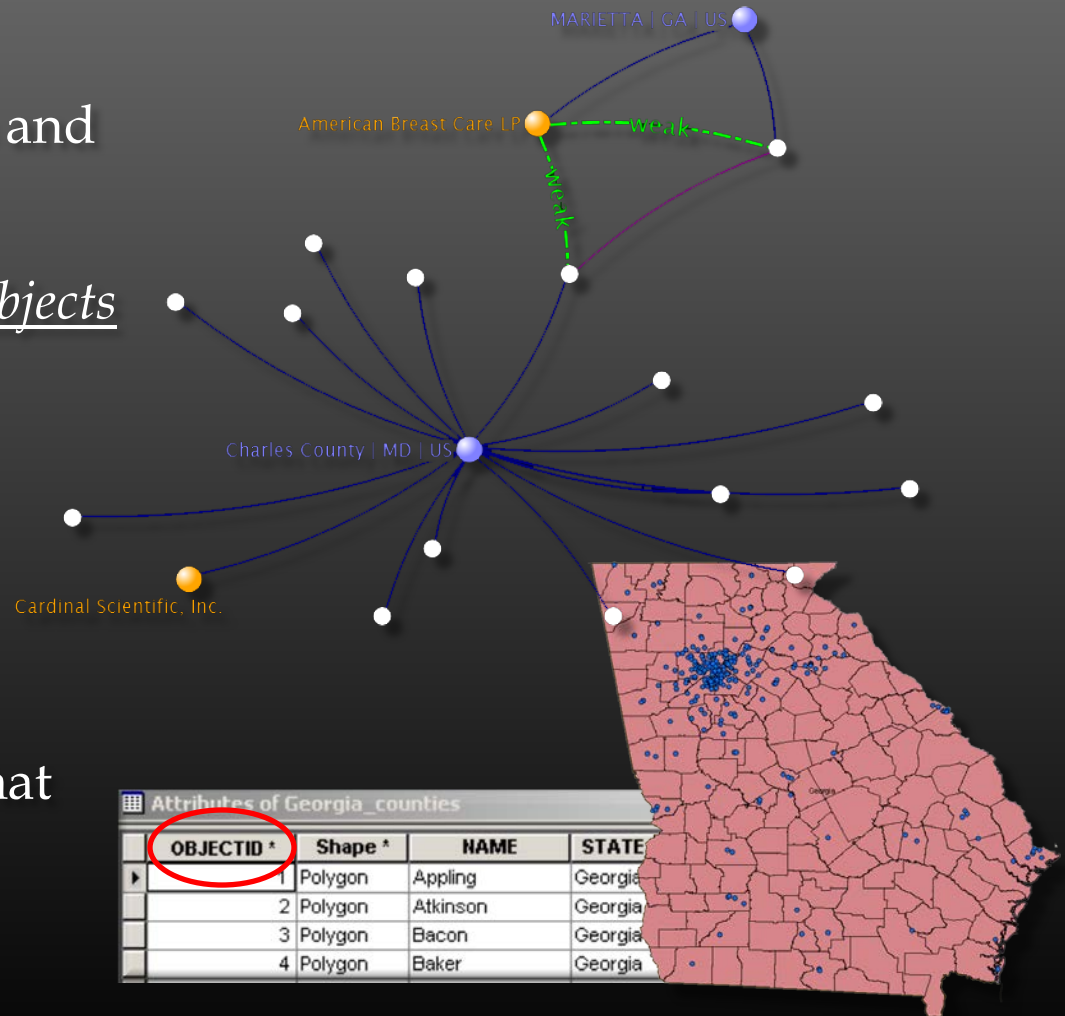
Organizations

Agencies

Places *

documents

Links are the relationships that connect the nodes



Analyzing Regional Innovation Clusters

Extract relationships from patent and research grant data - about 7M records

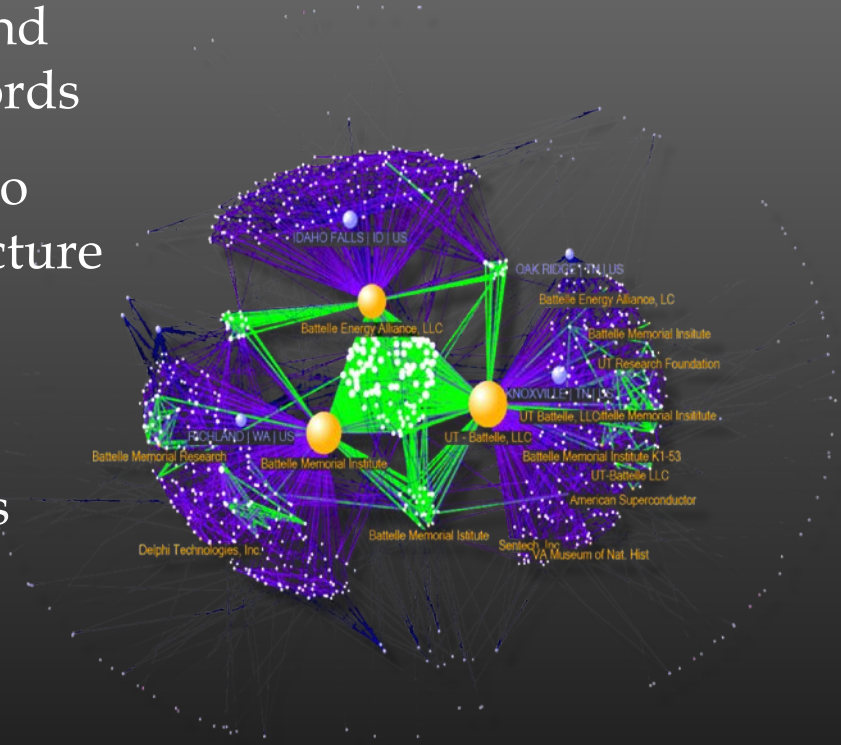
Use social network analysis (SNA) to analyze and visualize network structure

Theoretical grounding in sociology and science of complexity

Behavior of the core network guides behavior of whole network

Clustering based on intensity of relationships

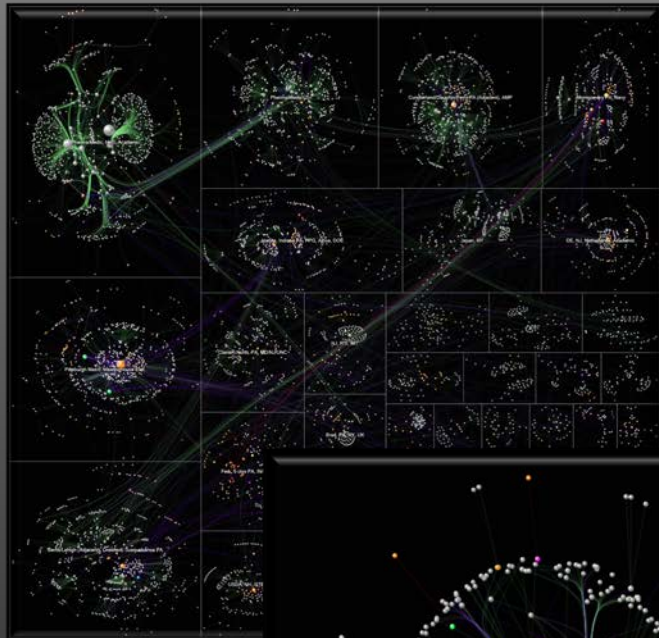
This reveals emerging technologies - what people and firms are working on - and specialized talent pools



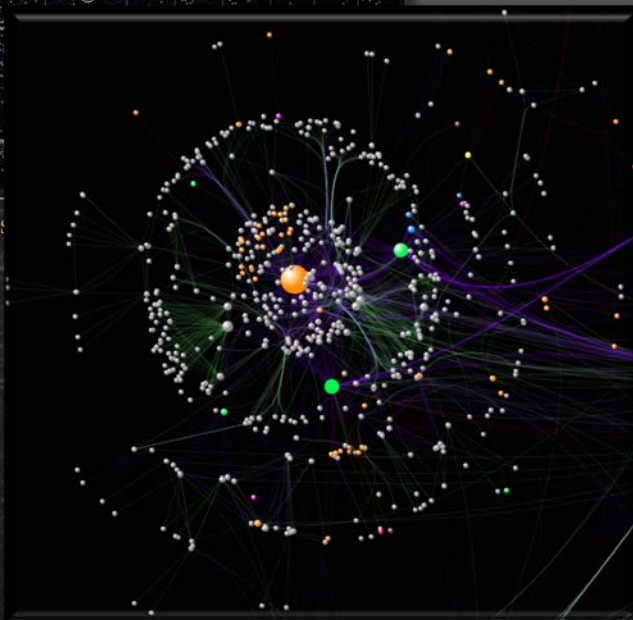
Battelle Innovation Network 2005 – 2010
Created with NodeXL

Created with NodeXL

Battelle Innovation Network 2005 – 2010



PA Innovation Clusters



Westinghouse cluster, Pittsburgh PA

Network graphics created with NodeXL

Network graphics created with NodeXL

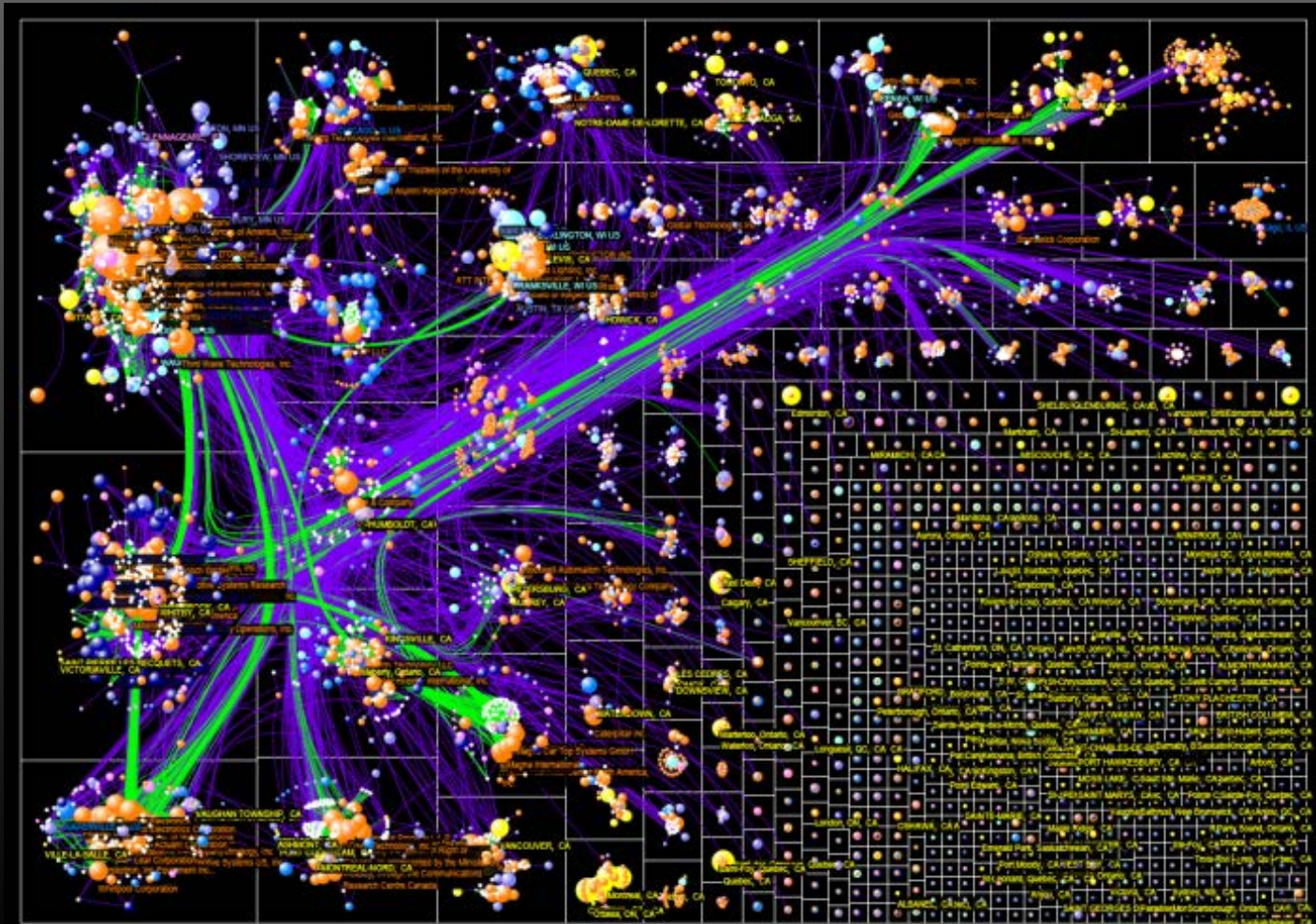
1. Innovation networks are (or could be) drivers of economic development in tier 2 manufacturing regions.
2. Innovation is more global and more interconnected than previously thought
3. **Network structure influences manufacturing employment growth within about 3 years of patent application (more for med & pharma)**
4. Economic development strategies that enhance innovation networks may be a cost-effective alternative to current capital intensive strategies.

Dissertation Conclusions

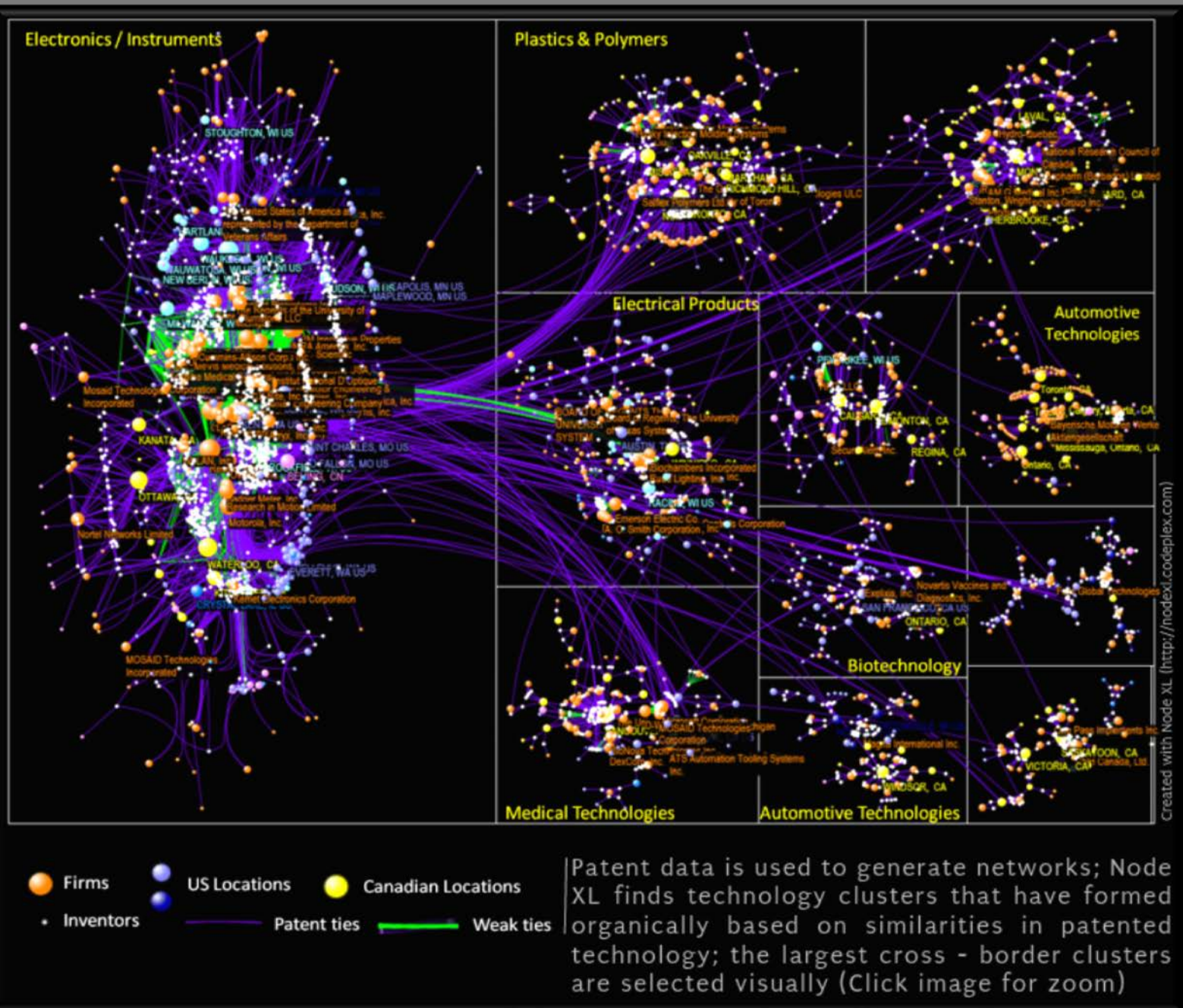
Dissertation Conclusions

Great Lakes Regional Innovation & Manufacturing Clusters (all clusters)

This example looks at US - Canada cross-border innovation around the great lakes. How do we quickly find, simplify and understand the driving innovation clusters in this region?



Great Lakes Regional Innovation & Manufacturing Clusters (core)



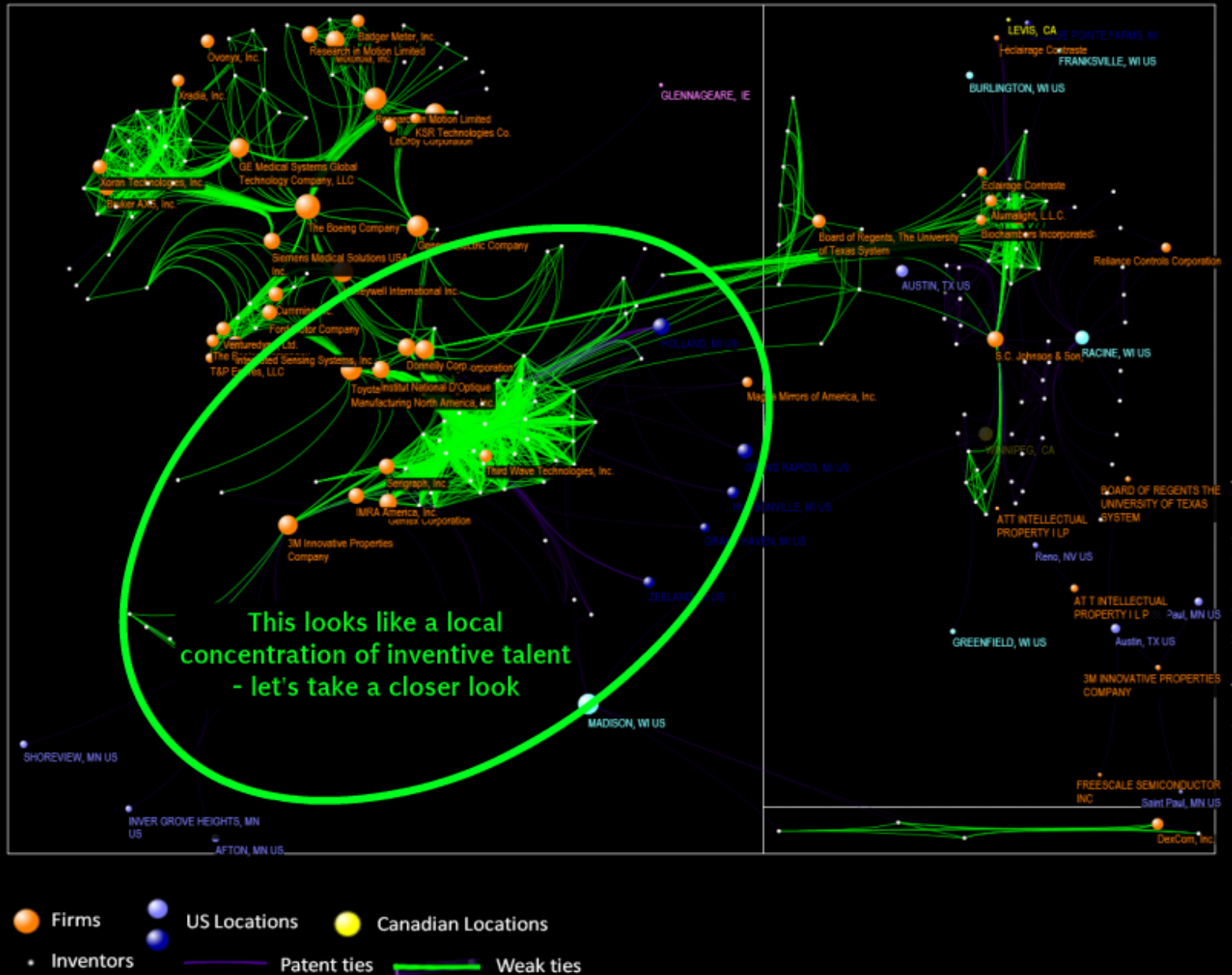
Weak tie Selection



- Firms
- US Locations
- Canadian Locations
- Inventors
- Patent ties
- Weak ties

Weak tie sub-networks are identified; weak ties represent similarities in patent technologies. May also represent the "commonalities and complementarities" that contribute to industry clusters. (click to zoom)

Quickly Identifying Key Innovators

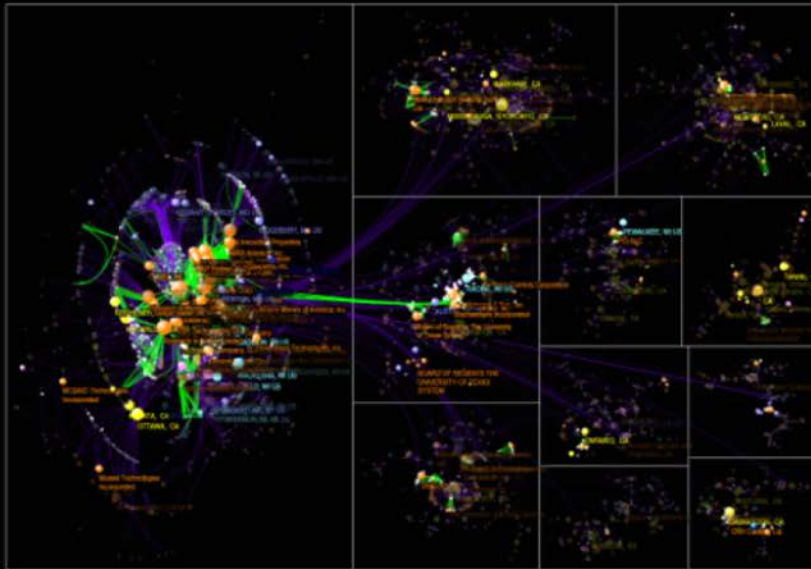


Identifying Local Talent Pools

The visualization displays a network graph with a central cluster of green nodes and edges, surrounded by peripheral nodes and edges in orange and blue. The nodes are labeled with company names, including QIAGEN, CA, ThermoFisher Scientific, and others. The edges represent relationships between these entities.



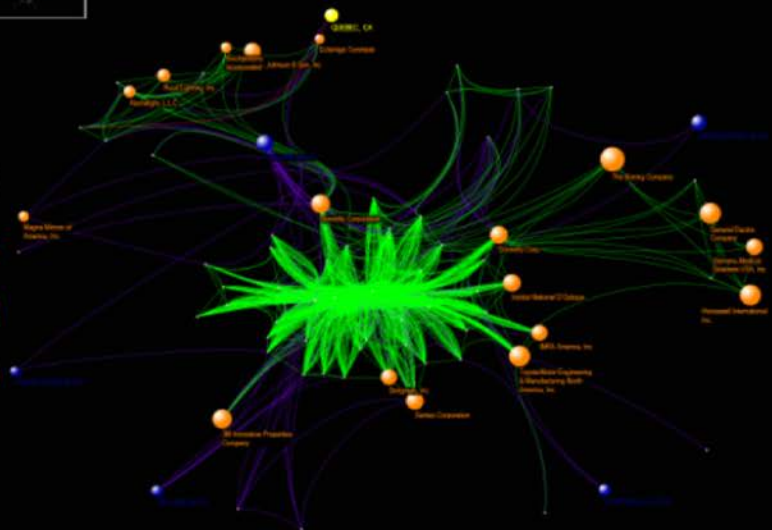
Impact on Planning Practice



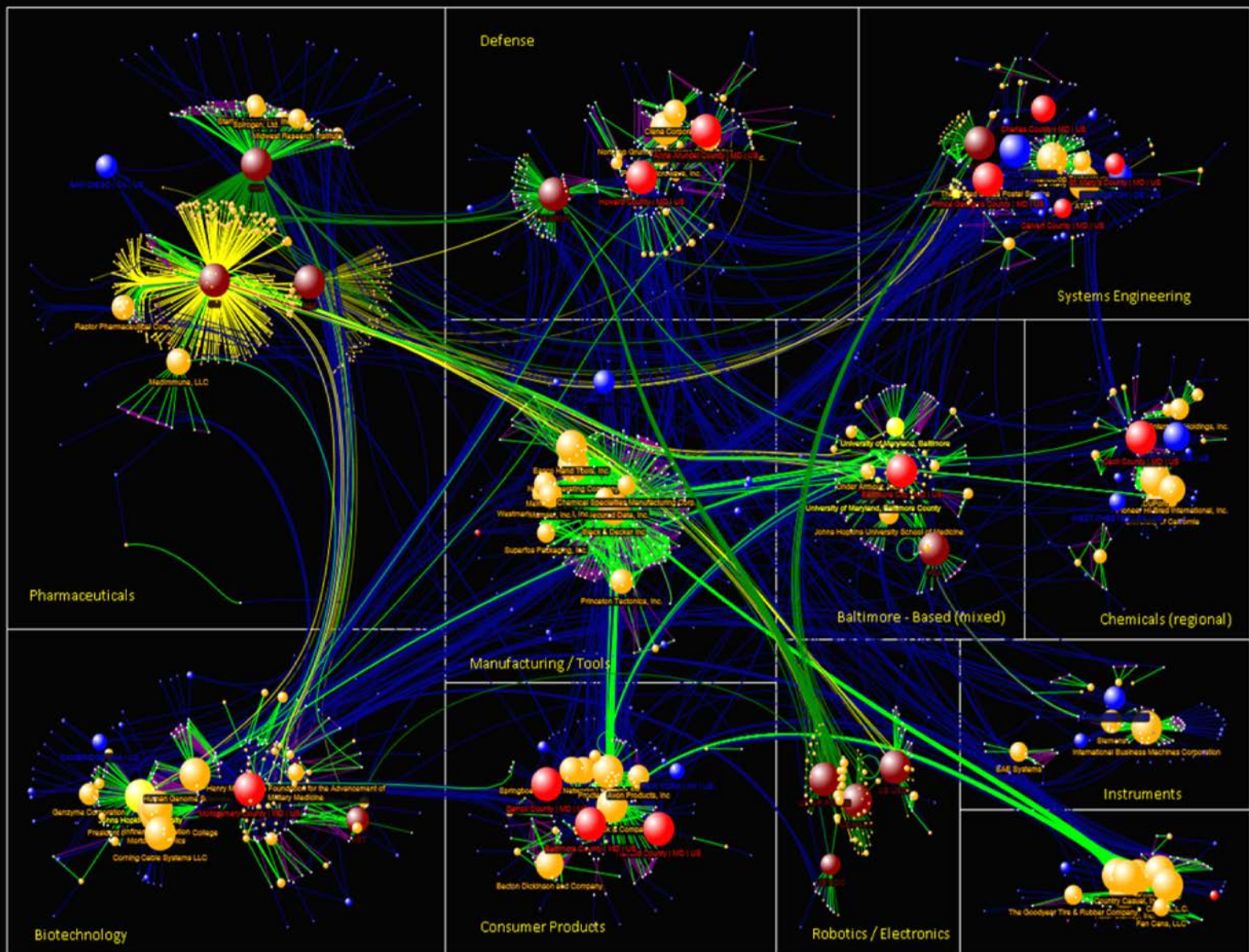
These represent immediate and specific economic development opportunities that can have a positive, measurable influence on manufacturing employment.

What this means for economic development

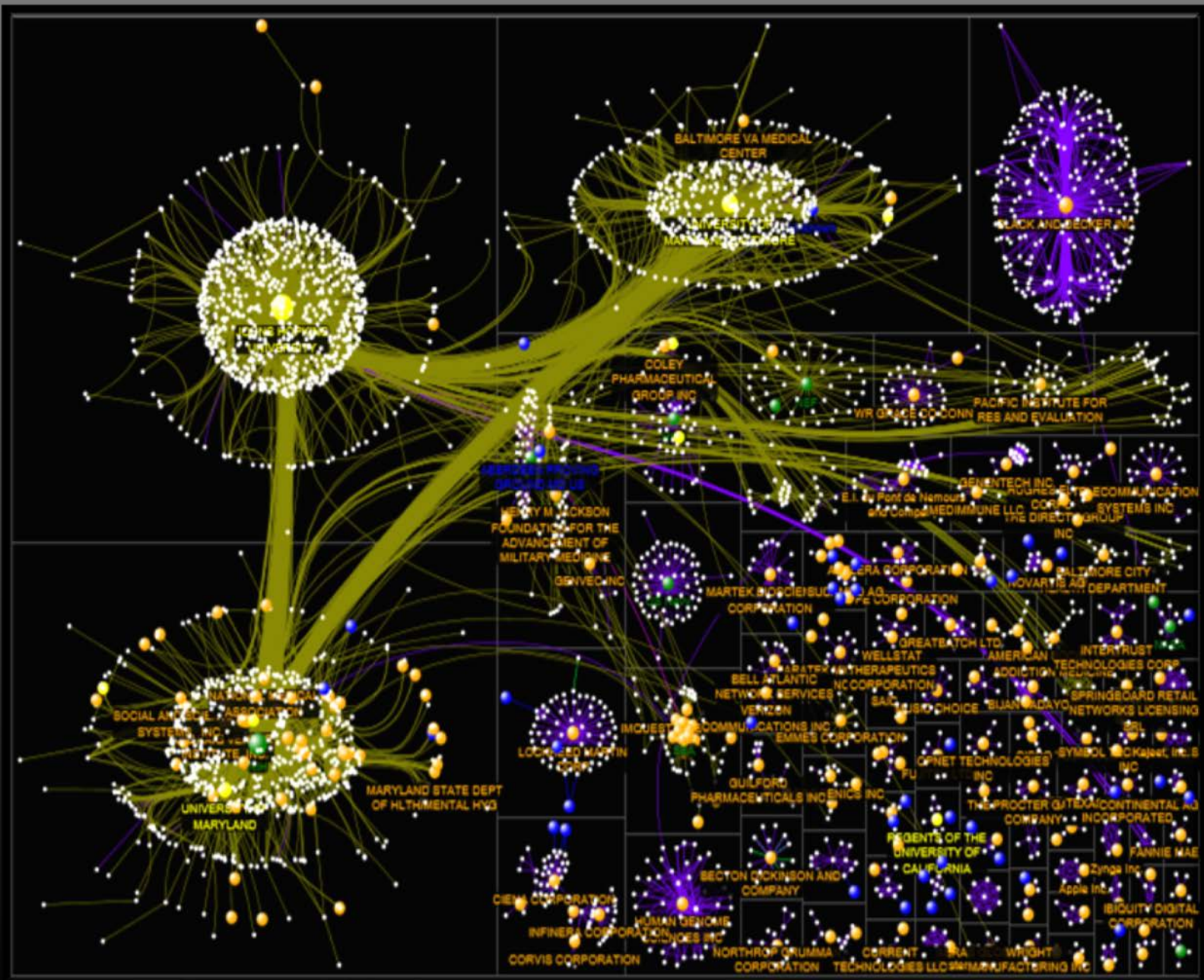
This approach gives you a list of firms to go talk to and specific things to talk with them about. It also identifies specific talent clusters. These are things that traditional cluster analysis has never done.



Maryland Core Innovation Network 2008 - 2010




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(preliminary)
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Changes in the Maryland Network

Why do we see changes?

- Still work in progress
 - Data issue?
 - Specific to type of research?
 - Lagged influence of recession?
 - Could be...???
- May represent structural changes

What does it mean?

- If data issue or anomaly
 - Nothing
- If type of research or recession influence – understanding of those dynamics
- If structural
 - Diminished benefits of agglomeration
 - Limited leverage of R&D
 - Economic Development more difficult

What's Next?

Current Research

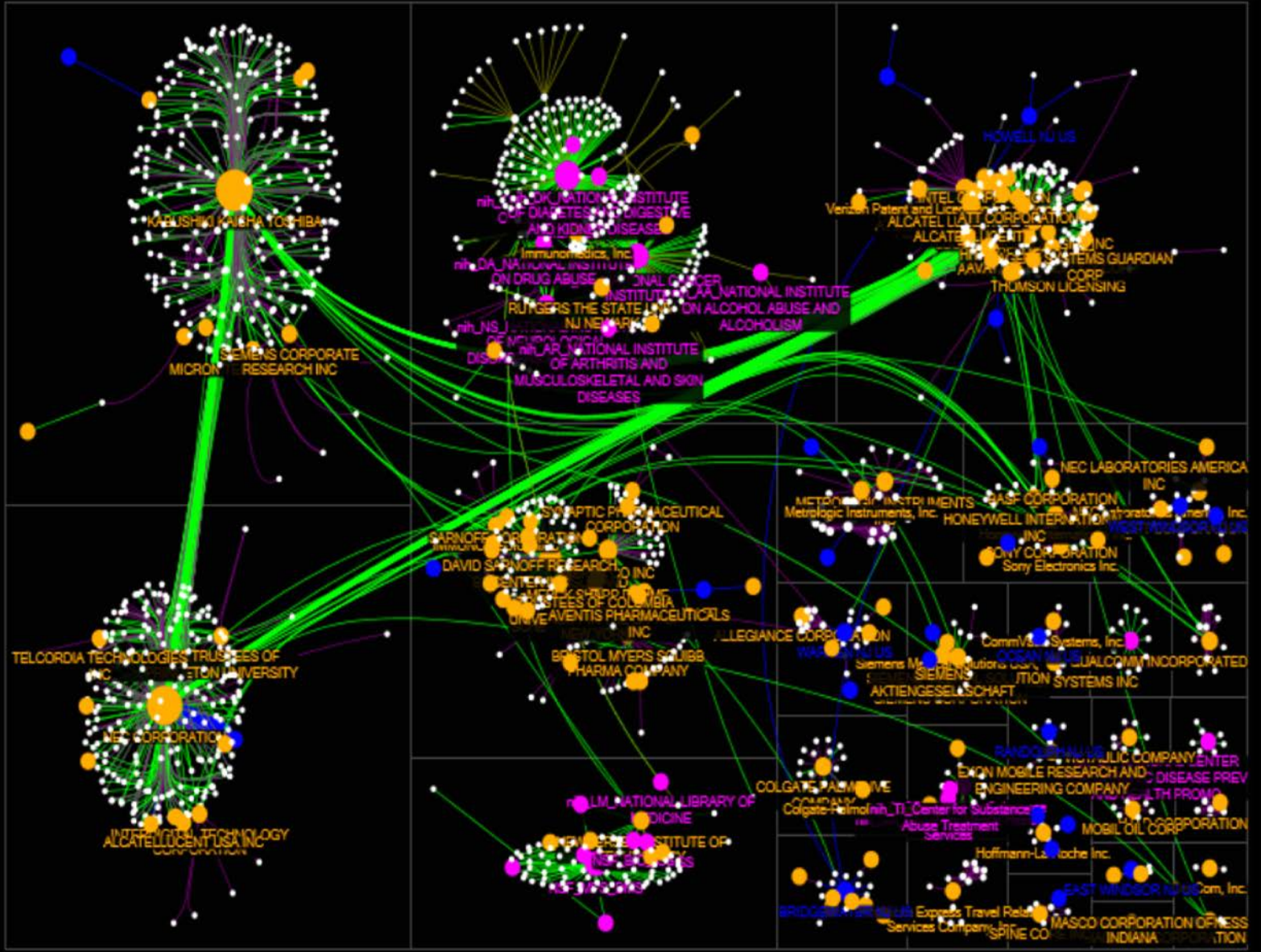
- Database and web interface development
- Field testing & research
- Urban planning and economic dev. Apps
- Document and teach methods
- Funded by EDA and UMD Office of Research

Future Possibilities

- Workforce Development applications
- Integration of additional data sources
- Sensitivity analysis and predictive models
- Other applications?
- Pending proposal with DLLR / DBED

More Examples

New Jersey Core Innovation Network 2011 - 2013



The graph visualization displays a complex network of connections between various entities, including companies, universities, and government agencies. The nodes are represented by colored circles, and the edges represent connections between them. The graph is divided into several clusters, with a central cluster of companies and a peripheral cluster of educational and research institutions.

Central Cluster (Companies):

- PEPCO MANUFACTURING CO.
- DINORATO SHEET METAL, INC.
- NORDT PRECISION METAL MANUFACTURING
- M C CUSTOM SHEET METAL FABRICATION
- LUTHE SHEET METAL INC.
- LINK-BURNS MFG. CO., INC.
- KEANE CIRCUITS, INC.
- INTEST CORPORATION
- HOPPECKE BATTERIES INC.
- H & H INDUSTRIAL CORPORATION
- ELMCO TWO, INC.

Peripheral Cluster (Educational and Research Institutions):

- Princeton University
- Rutgers, The State University
- Simon's Rock College
- University of Maryland
- University of Virginia
- University of Wisconsin
- University of Michigan
- University of California
- University of Texas
- University of Illinois
- University of Pennsylvania
- University of Washington
- University of Arizona
- University of Colorado
- University of Oregon
- University of Nevada
- University of New Mexico
- University of Idaho
- University of Montana
- University of Wyoming
- University of Utah
- University of Arizona
- University of Colorado
- University of Oregon
- University of Nevada
- University of New Mexico
- University of Idaho
- University of Montana
- University of Wyoming
- University of Utah

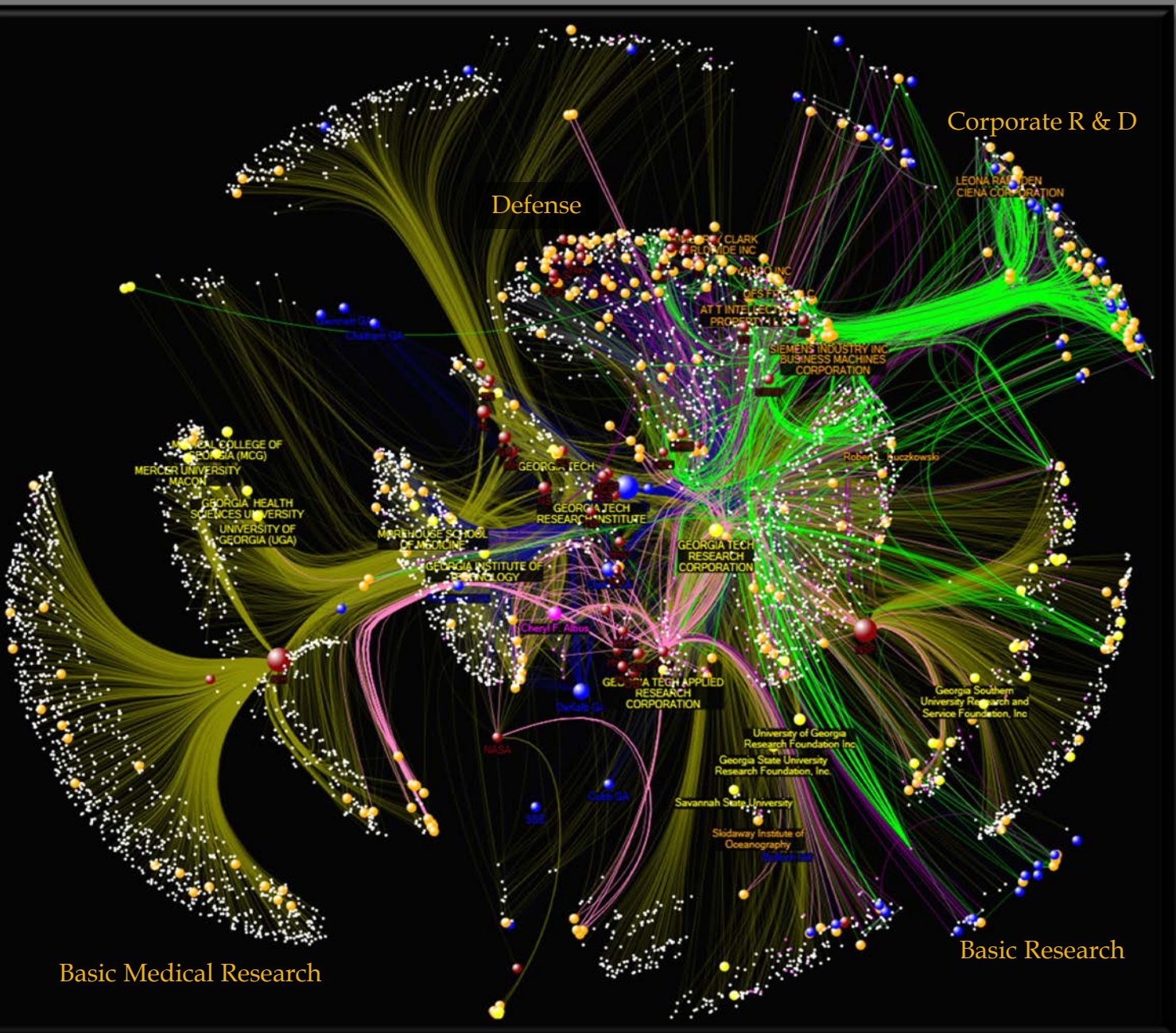
Other Entities:

- Authoritative Technologies International, Inc.
- New Jersey Institute of Technology
- Swedish Diagnostics, Inc.
- Exxon Company USA
- UNIDISTRIBUTED County, RI
- MONMOUTH County, RI
- Washburn County, WI
- MADISON County, RI
- BURTON County, RI
- WOMENET County, RI
- Mersey County, RI
- UNION County, RI
- GLoucester County, RI
- Tiger Optics, LLC
- CAMDEN County, NJ
- WARREN LIGHTNING ROD COMPANY
- VEE DENNIS MANUFACTURING CO.
- THOSANI, INC.
- TELECOM ASSISTANCE GROUP, INC.
- SEMIWOLE WIRE & CABLE CO. INC.
- SAVY SHEET METAL INC.
- PERCO MANUFACTURING CO.
- DINORATO SHEET METAL, INC.
- NORDT PRECISION METAL MANUFACTURING
- M C CUSTOM SHEET METAL FABRICATION
- LUTHE SHEET METAL INC.
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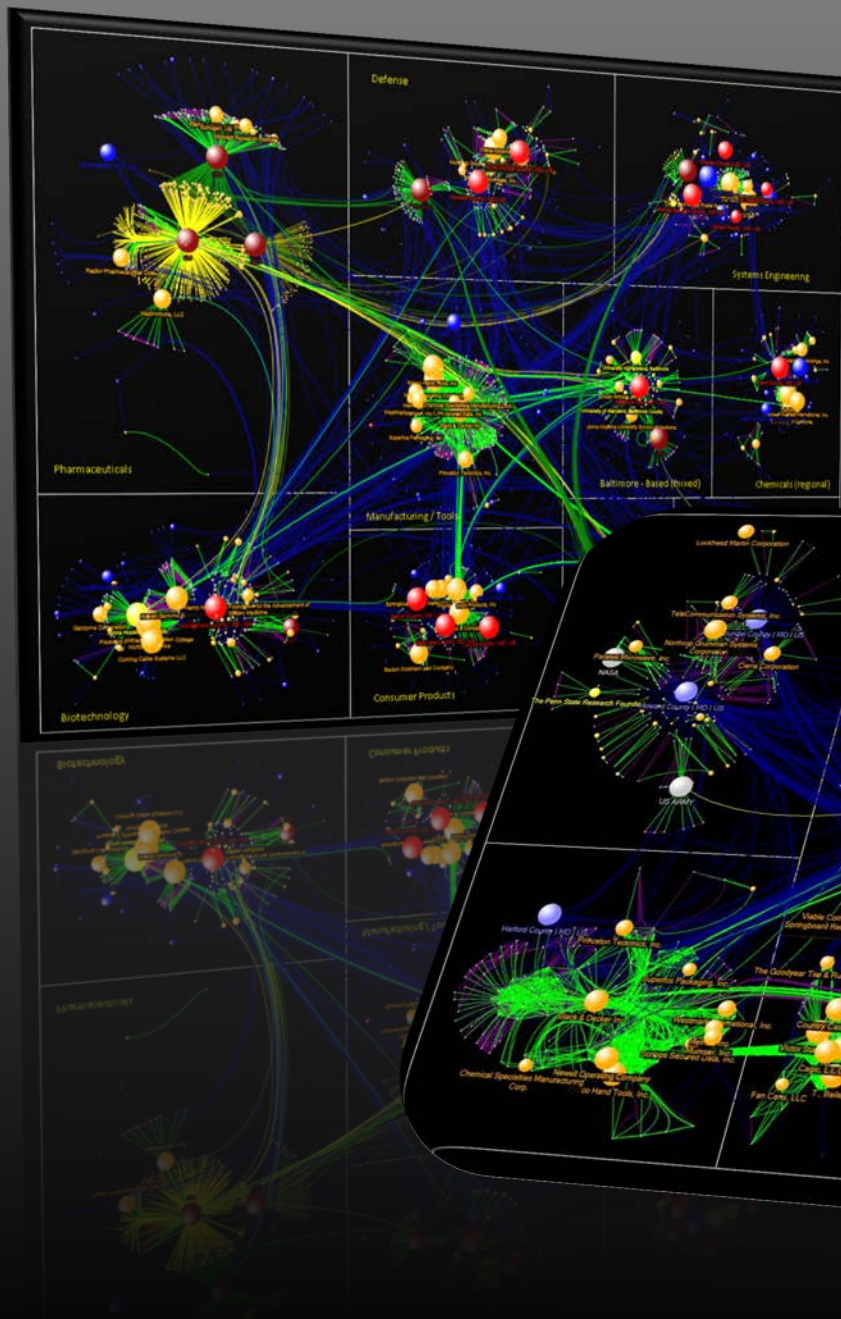
Fruchterman-Reingold layout

In NodeXL

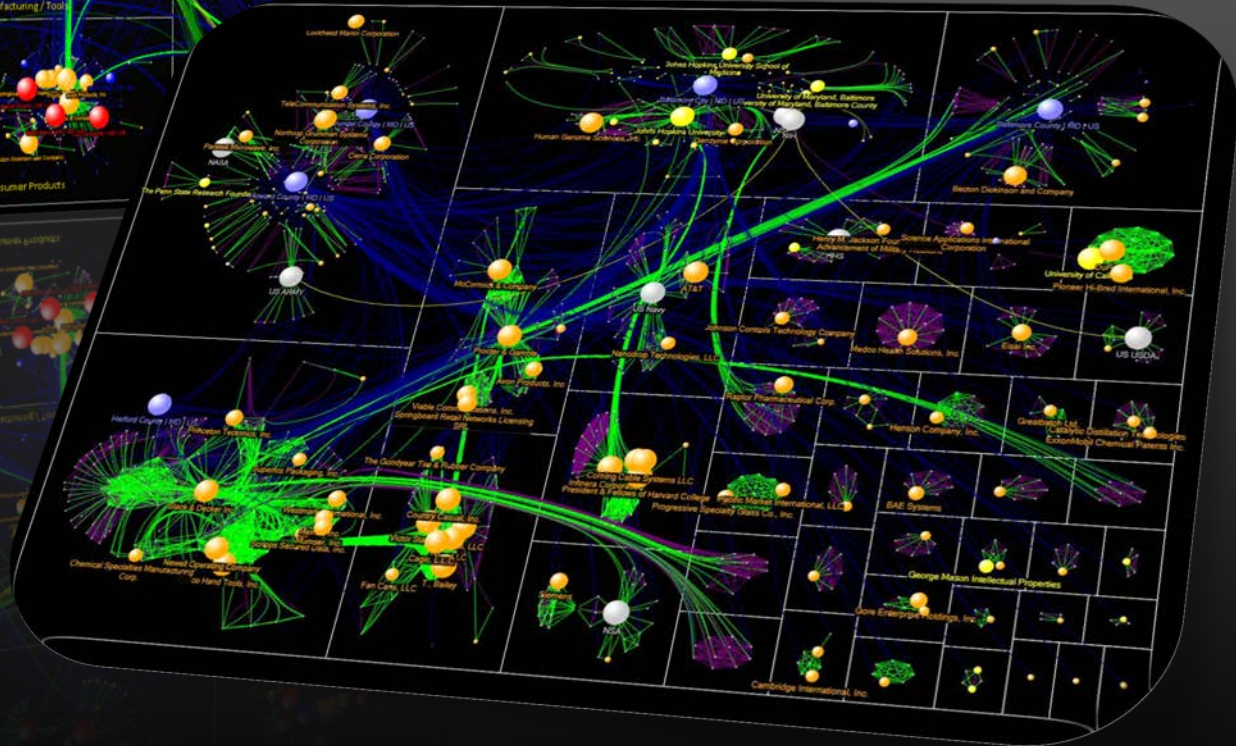
Georgia Tech Innovation Network 2008 - 2010 (2 steps)



Maryland Innovation Clusters 2008 - 2010



Maryland Innovation Network 2008 – 2010
Created with NodeXL



Baltimore Innovation Network 2008 – 2010
Created with NodeXL

University of Maryland Human Computer Interaction Lab Influence on NSF Network 2000 - 2011

