



Aalto University
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Interconnectivity Ecosystem in Finland

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Outline

- “Internet topology” research
- Our approach: “Interconnection Ecosystem”
- Some cool visuals and graphs
- Future studies

The past 10+ years of "Internet topology" research

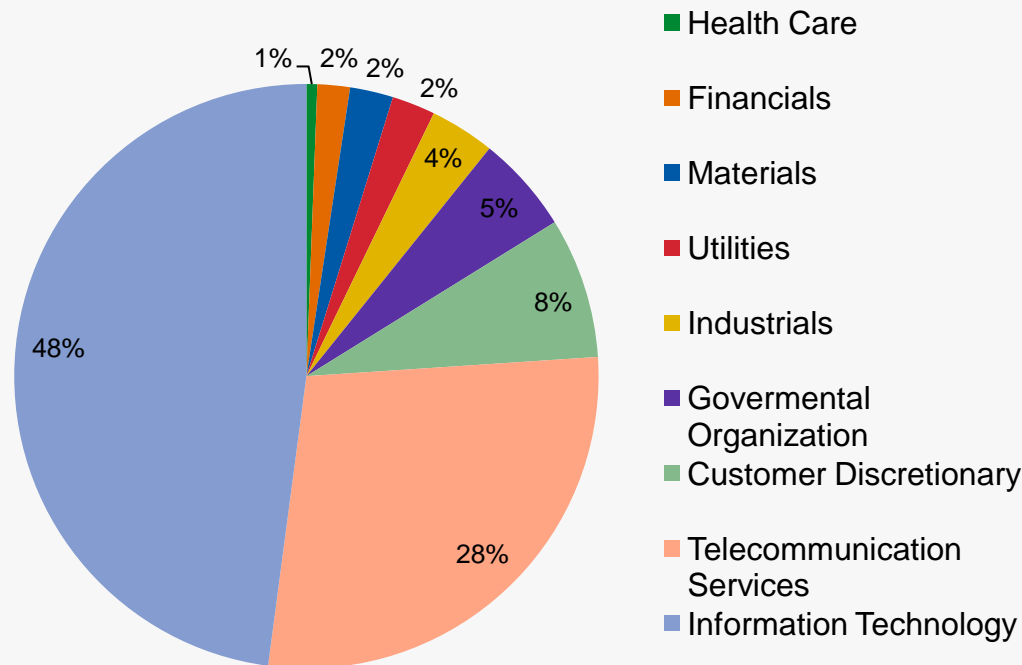
- Over the last decade there have been numerous studies starting with Govindan and Reddy (1997), Faloutsos et al. (1999)
- Fundamental problem: BGP was not designed with AS-level discovery in mind.
- Abstracting the Internet to a simple graph?
- Emerging approaches towards economically viable and realistic AS-Graphs

Our Approach: Interconnectivity Ecosystem

- Combining the most up-to-date publicly available BGP data
- Applying topology discovery methods tailor-made for Finland
- IP to ASN Mapping, AS to Organization Mapping, etc.
- Categorization of organizations and SBUs with GICS
- Interviews with the representatives from stakeholders
- Visualization of the dataset

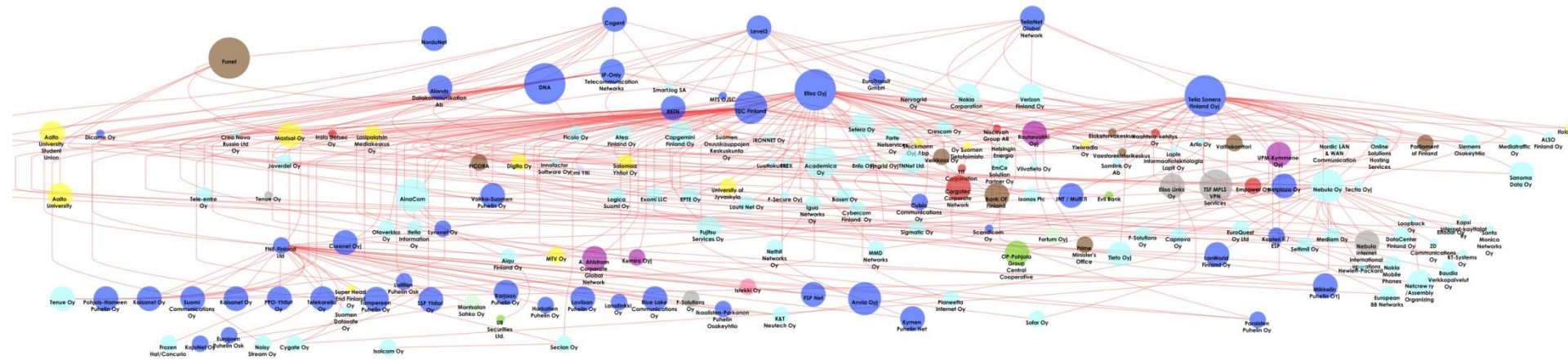
Sectorial Categorization

There are **177 ASes** which have a PoP (Point of Presence) in Finland engage in BGP Interconnectivity, and they are administered by **167 private and public entities**.



We can designate **166** of those ASes as **Finnish ASes** – i.e., the main line of business of the ASN-owning organizations take place in Finland.

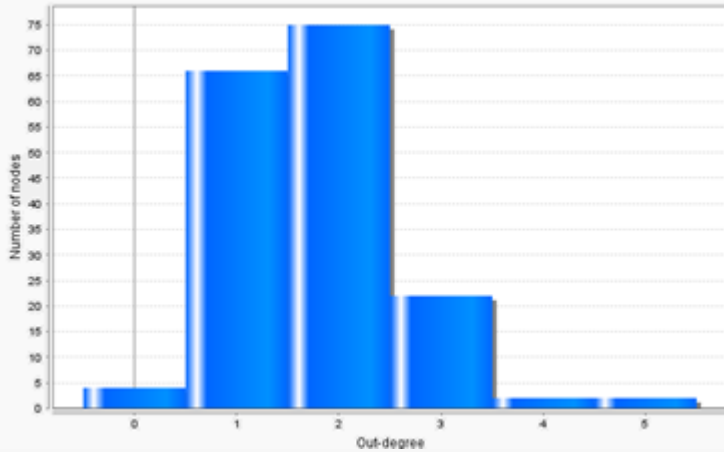
Measurements: more of a reflection of what we can measure than what we want to measure



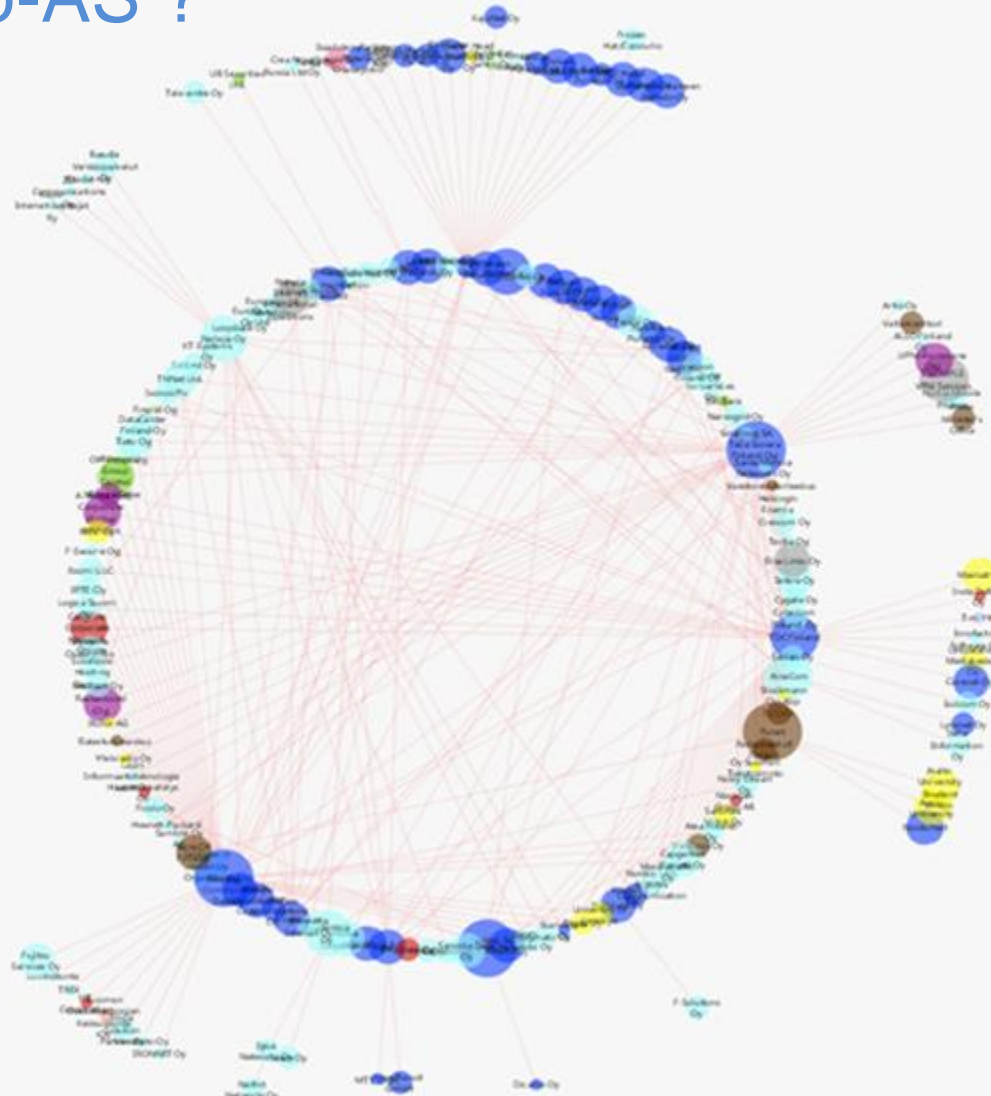
Hierarchical graph of the customer-provider relationships

Customer Discretionary	
Customers Staples	
Financials	
Governmental Organization	
Health Care	
Industrials	
Information Technology	
Materials	
Multiple ASN	
Telecommunication Services	
Utilities	

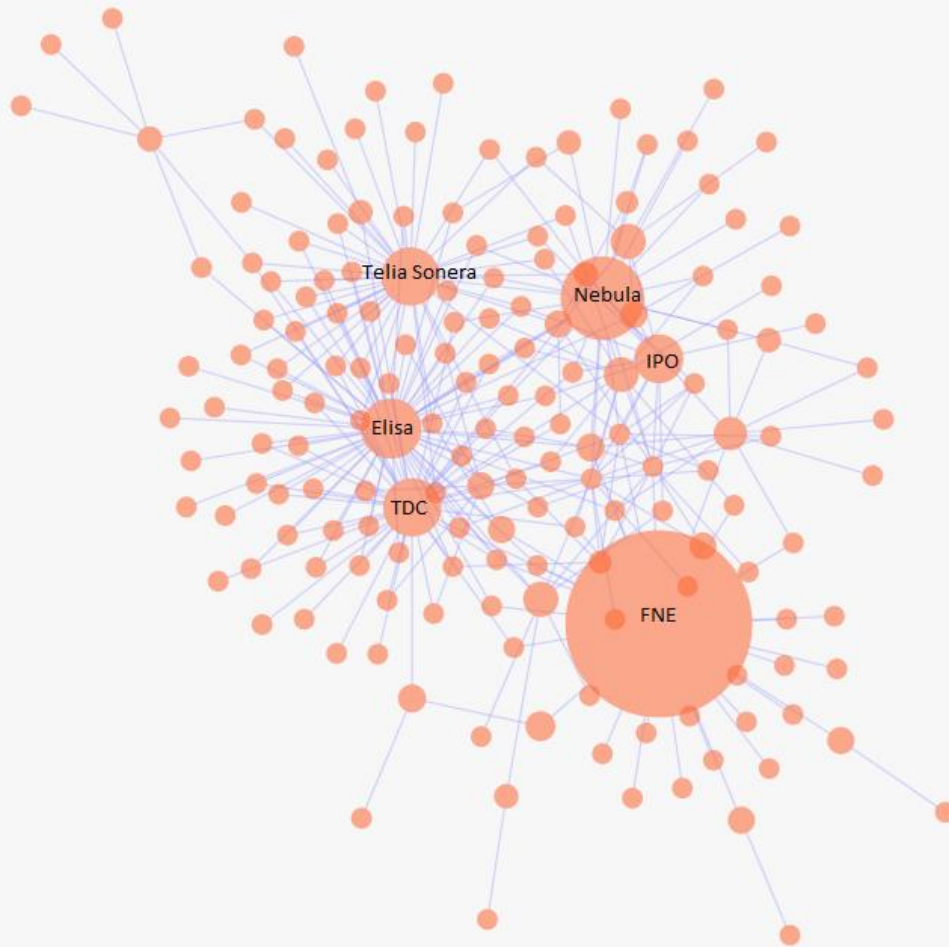
“Single-homed” Stub-AS ?



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Betweenness Centrality of the ASes



Betweenness is the weighted sum of the number of shortest paths passing through a given node or link.

Future Studies

- Public peering
- Mobile internet interconnections and roaming
- IPv6
- Longitudinal analysis based on BGP data
- Pricing and contractual schemes and cost allocation
- Small ISPs, last mile and open access networks

Thanks!
Suggestions,
Questions?