

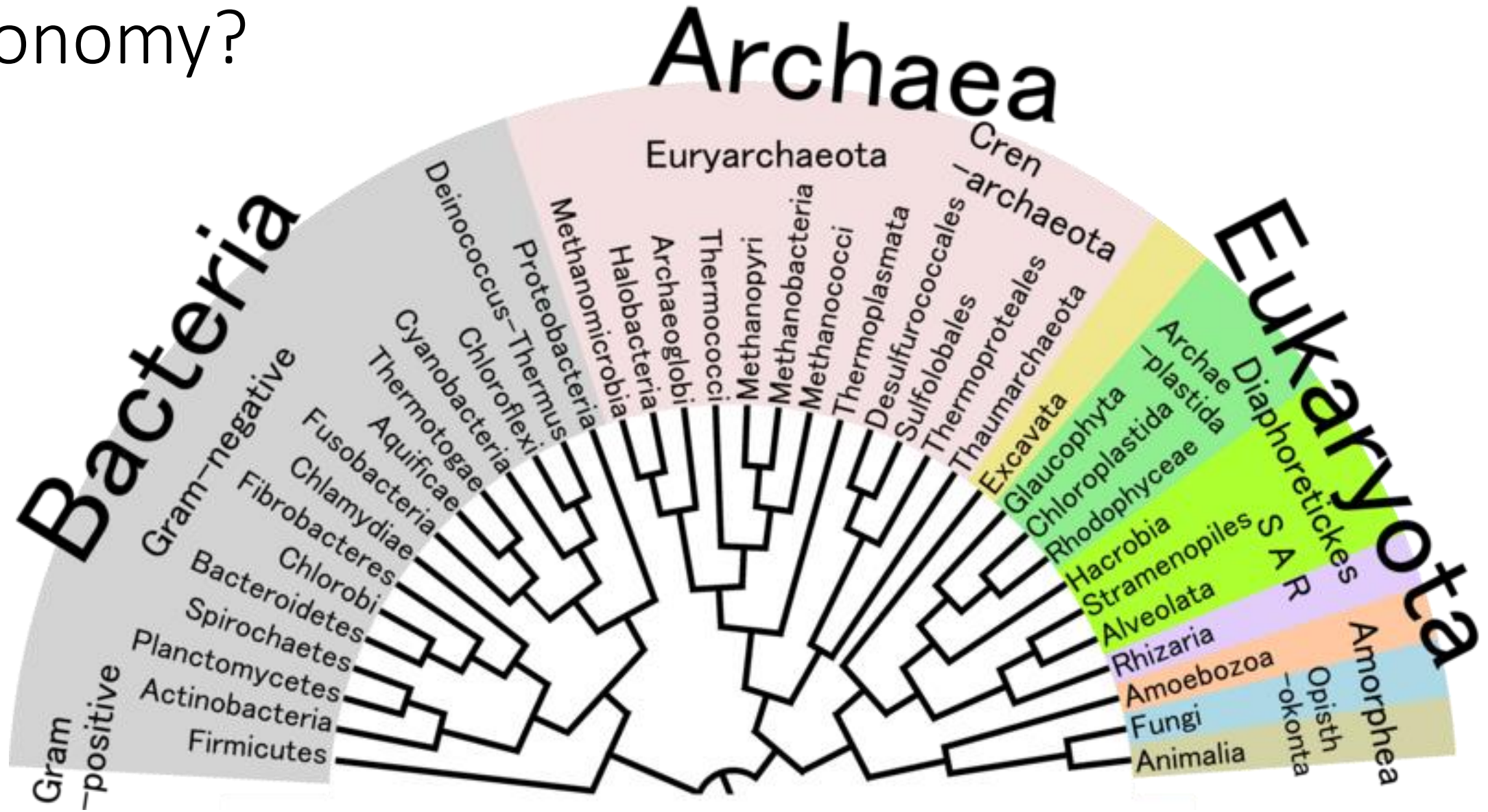
Centralization Taxonomy

draft-mcfadden-consolidation-taxonomy-00

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Taxonomy?



Why a Taxonomy?

- Report of the Centralization Workshop briefly suggests it
- Discussion at IETF 114 made clear that “centralization” meant different things to different people
 - No judgement on validity or applicability
- Further work on centralization in the IETF may benefit from a look at specific facets of the topic
- Goal: support future work in DINRG

Where Did the Taxonomy Come From

- Workshop report provides a short list without much discussion
- IETF 114 discussion was robust and engaging
 - . . . But all over the place!

Background From the Workshop Report

- “- the economy of scale enables one to generate the same service outcome with far lower production costs, and consume fewer resources for each instance of the service transaction.
- a large user pool produces big data which helps improve service customization for each user, letting bigger companies gain an edge over smaller competitors.
- centralized application developments reduce the number of platforms, hence substantially reduce the cost in development and maintenance, and circumvent interoperability issues. Consolidated development and operational efforts also help mitigate technical expertise shortages.
- most of all, monopoly players can dictate to the market the terms of the service and the service price bought to the market, which causes longer term stagnation of the market and increased inefficiency within the market, which acts as a drag on further innovation.”

What is in a -00 Version of the Taxonomy

- Divides the topic into four key areas
 - Economic consolidation
 - Traffic and Infrastructure consolidation
 - Architectural consolidation
 - Service and application consolidation

Economic consolidation

- Economic consolidation on the Internet refers to the effects of market consolidation on competition and the economic power of a small set of companies that dominate economic activity in the Internet
- There are two aspects to economic consolidation on the Internet:
 - Economic consolidation means that a small number of companies dominate the marketplace and hence, the revenues gathered from the use of the Internet
 - Economic consolidation also means that a small number of companies control the flow of capital among enterprises that provide services on the Internet

Traffic and Infrastructure Consolidation

- A significant majority of the Internet's traffic is delivered from very large content services
- These companies naturally attempt to provide the best possible service for their customers
- The result is a “flattening” of the Internet's traditional topology
 - In fact, a recent study shows that these large services can reach more than 76% of the Internet without having to traverse traditional Tier 1 and Tier 2 ISPs. over the elements of the infrastructure being used to deliver services.
 - An empirical view of this consolidation in February of 2022 [shows that the number of webpages that are hosted on these networks has increased from 2015 to 2020 at a rate exceeding 80%.

Architectural Consolidation

- Two developments have led to architectural consolidation:
 - The emergence of intermediary services
 - The movement of transport related code to the application layer

Architectural Consolidation: Intermediaries

- Technologies like CDNs are built into the network for the efficient delivery of content and services
- The end-user is largely unaware that the service or application is being hosted by an organization other than the one they think they contacted
- Content delivery is pushed as close to the consumer as possible to ensure that the end-user experience is as optimal as possible
- The result is a series of security, economic and policy concerns associated with the small number of very large providers of these intermediary services

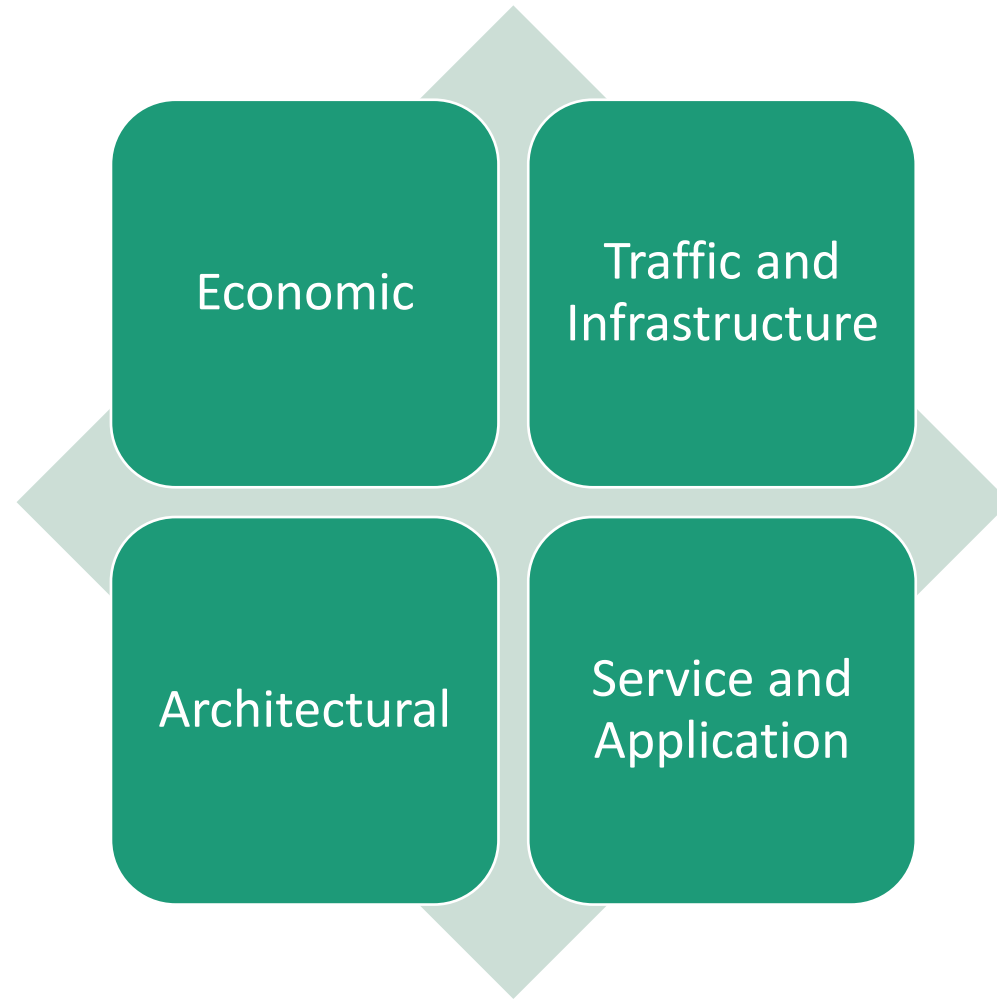
Architectural Consolidation: Application Layer

- Companies that control the applications attempt to control all aspects of the communication.
- The advantage of this kind of architectural consolidation is that it allows the largest players to introduce technological innovation more quickly than if multiple layers of the stack required innovation in parallel
- With tools like DNS over HTTPS, we see applications taking control of the infrastructure of transport
- Applications essentially provide their own ecosystem (from centralized control of DNS services all the way to the end-user experience)

Service and Application Consolidation

- Services and applications are those tools that users see when they interact with the Internet
- They take advantage of the infrastructure (and, access) parts of the Internet's ecosystem
- ISOC: “a small number of companies operating some of the Internet's most popular services dominate this market. Many of these companies act as multi-sided markets or platforms, meaning they offer a base upon which other applications, processes or technologies can be developed.”

Consolidation Taxonomy



Conclusion

- Taxonomy is intended to help guide further discussion of consolidation in DINRG (and elsewhere)
- Currently a -00 draft in search of comments
 - Useful?
 - Accurate?
 - Comments?
- Intent: -01 draft after IETF 115 based on feedback