

# Service-based Fog Computing

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# Nowadays

- ≈ 52% of Internet Traffic crossed CDNs in 2016, expected to grow to 70% by 2021
  - [Cisco Visual Networking Index, white paper, June 2017](#)
- ≈ 92% of data centre traffic will be handled in the cloud by 2020
  - [Cisco Global Cloud Index](#)
- 86% of mobile traffic handled by the cloud in 2017 ([Statista](#))
- 20.35 Billion IoT devices in 2017, expected growth to 50+ by 2023 ([Statista](#))
- What is the relationship between **CDN** and the **Cloud** and How it relates to the **Fog**?

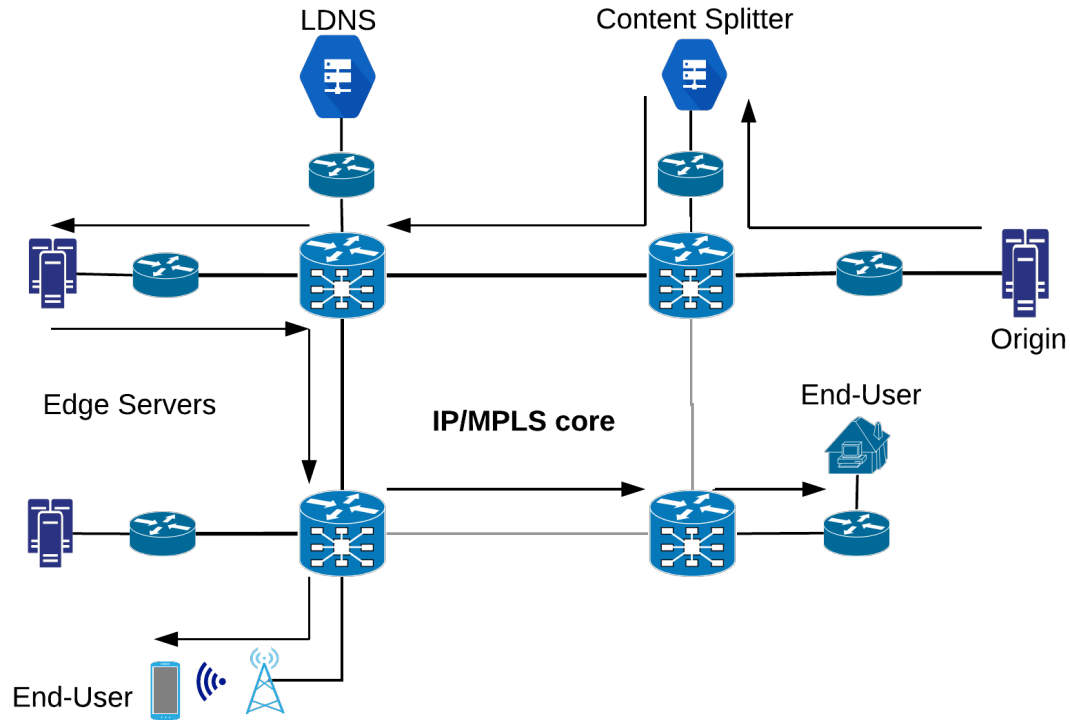
# The Fog: a CDN-Cloud Interplay

- The Fog is an architecture to deliver elastic resource at the **true edge** for IoT communications
- IoT comms are based on applications (**services**)
- The cloud by itself comes short in:
  - **Recognising** and **connecting** services
  - Managing **remotely** distributed resources
- Can CDN come into play here?
  - What if we can request resources based on services?
  - And can those resources be provisioned in **multiple** locations?
  - What are the **requirements** to be met?

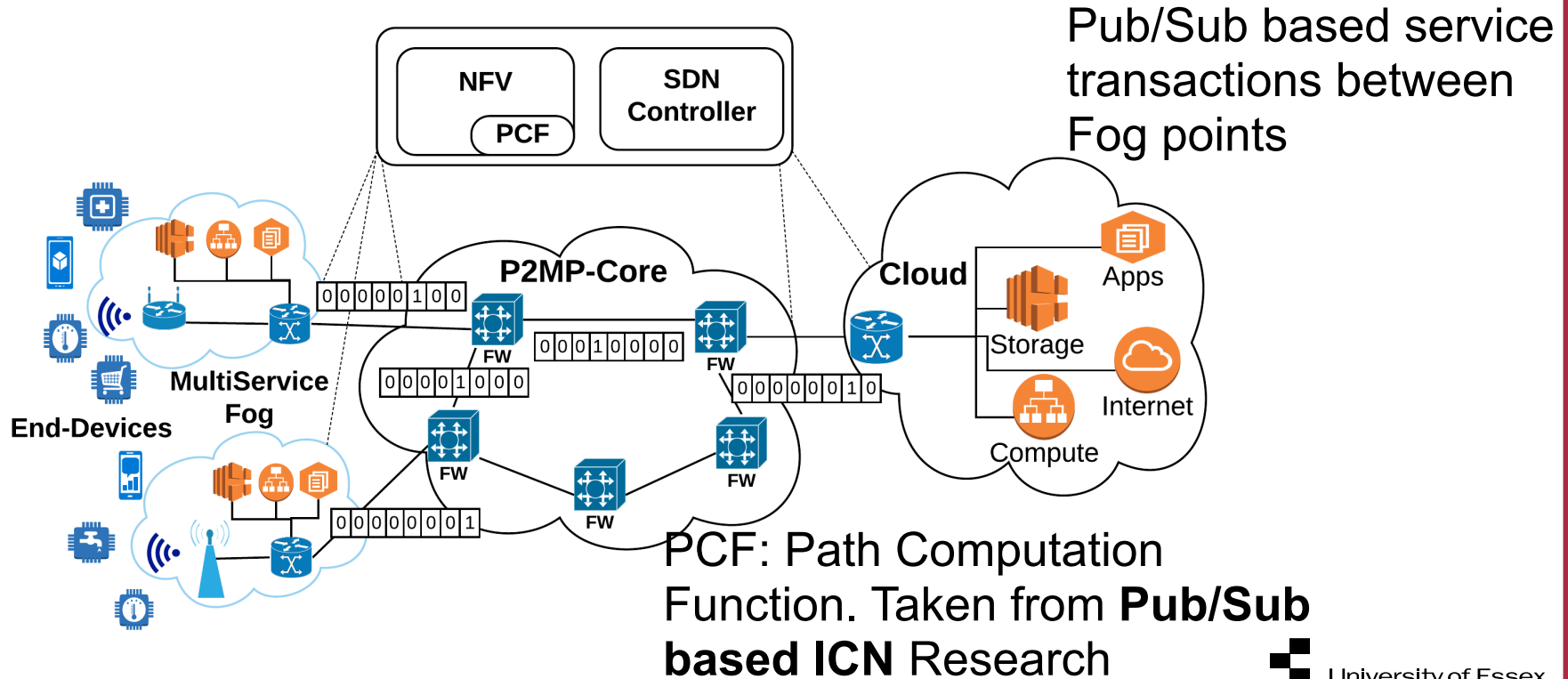
# Requirements for Fog

- To meet the load expectations, the Fog need to have:
  - High adaptability and service resiliency
  - Enable privacy-preserving communications
  - Accurate request mapping (**DNS** is troublesome)
  - Efficient resource management
    - resources should scale to dynamic workload
    - resources should move quickly to where needed
  - Efficient Networking
    - Flexible, dynamic and fast multicast where needed and to the true edge
- Can the CDN approach be used off-the-shelf?

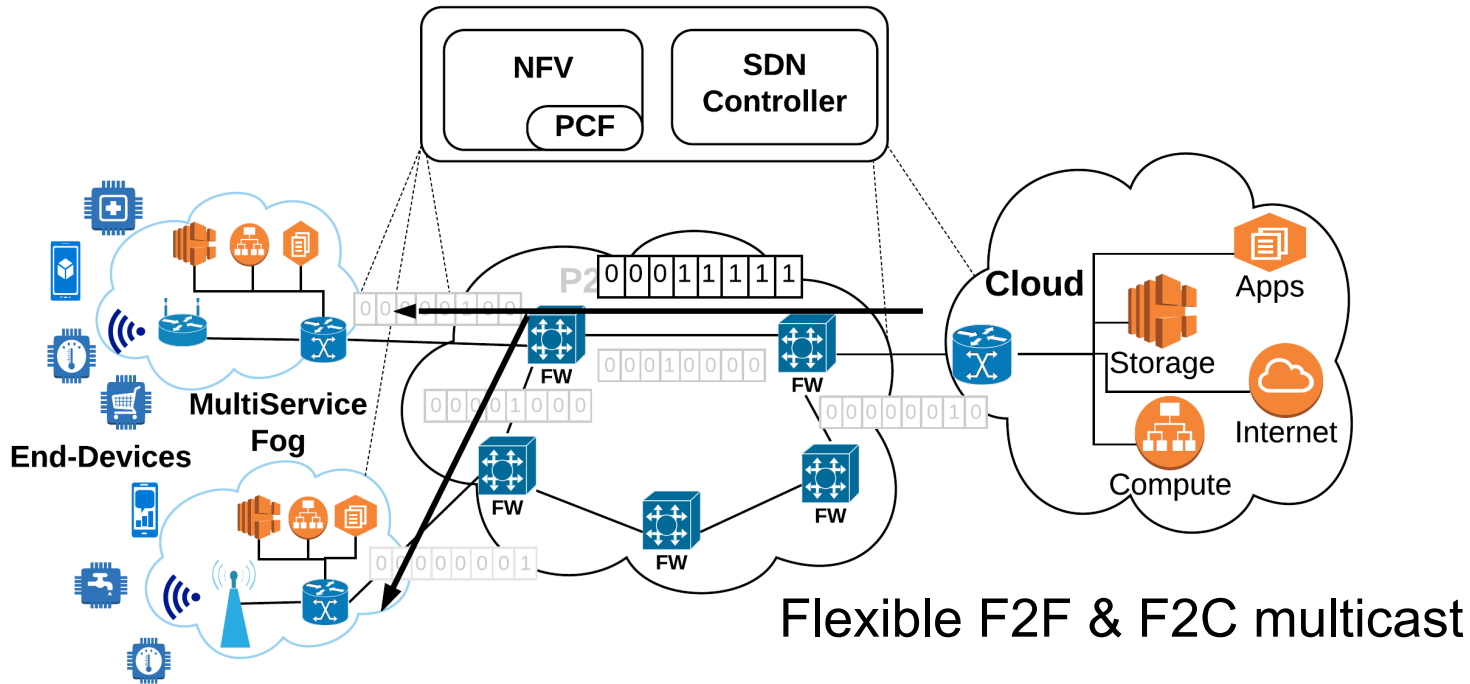
# How CDN works



# Service-based Fog



# Service-based Fog cont'd

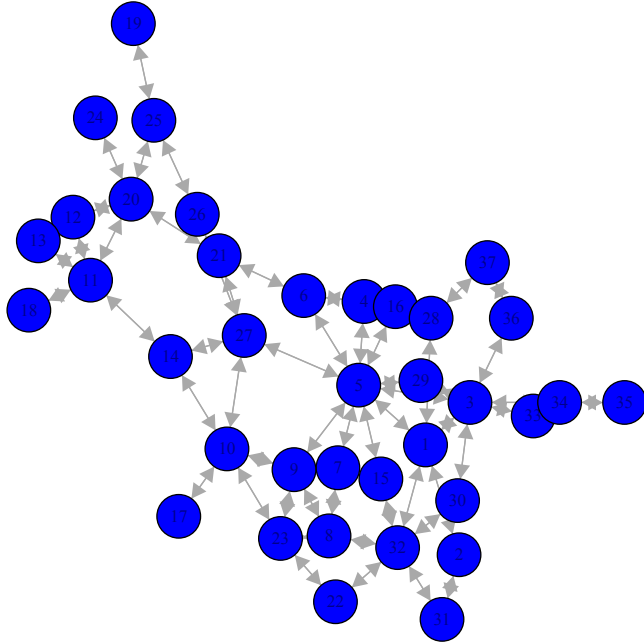


# Service-based Fog cont'd

- Flexible name registry
  - Unlike current DNS, the PCF decouples service names from location
    - Multiple locations (publishers) point to a single name
    - No DNS-redirection
    - request mapping to true nearest
- Flexible, source-routed, multicast trees
- Management through distributed instances of VNFs



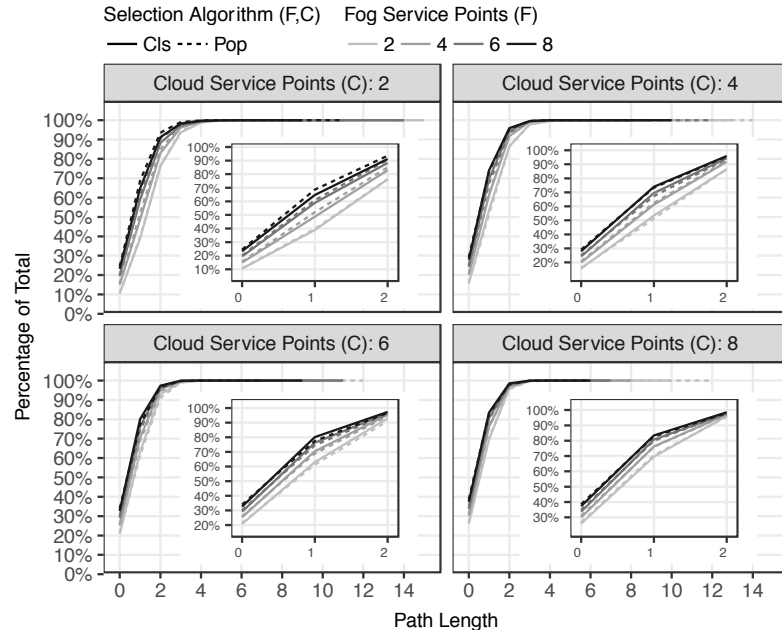
# Performance



- Modelled over Geant2012 graph
- Increasing #service points
- Performance indicators
  - Resources: bits in the network
  - Latency: path length (hop-count)
- Compare with a Fog architecture that applies traditional DNS redirection.

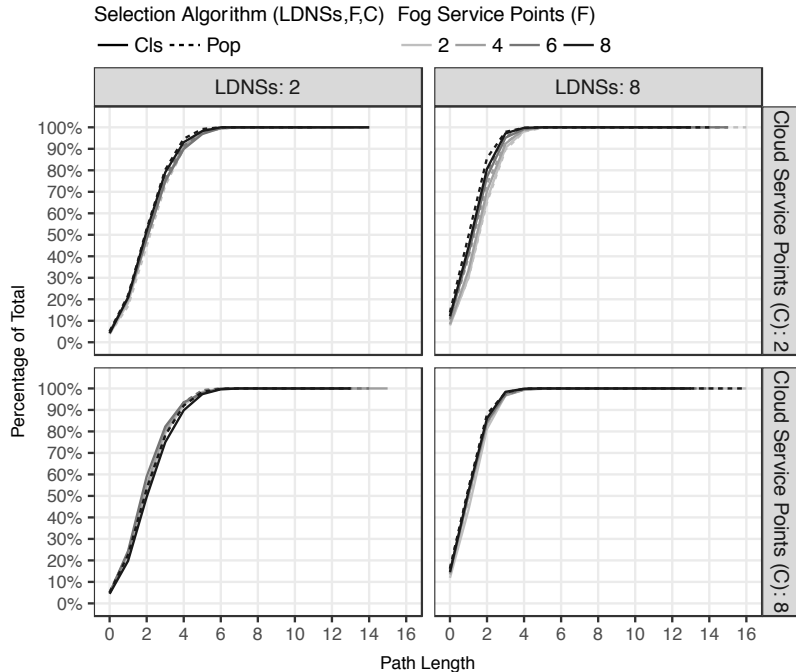


# Path Length: Service-based Fog



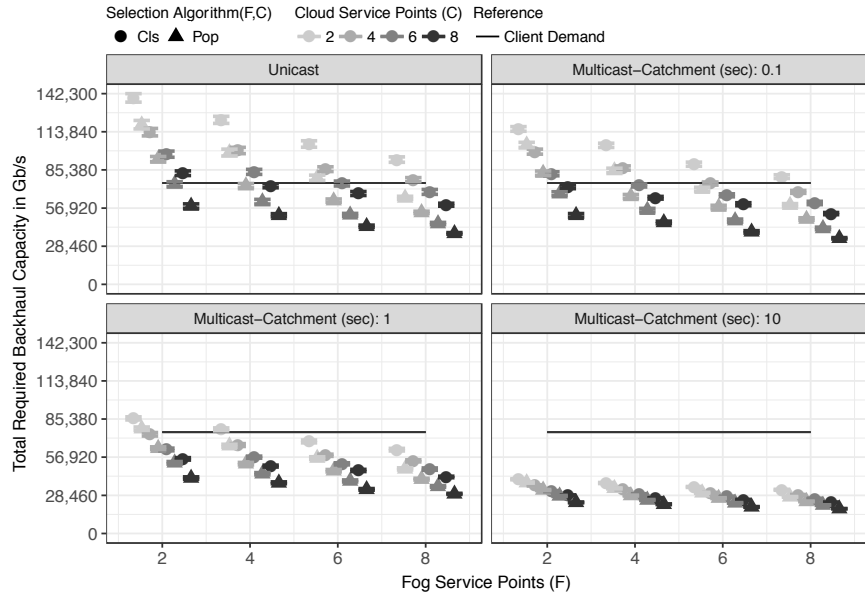
- ~20-40% of demands are localized
  - i.e. Path length == zero
- For small #service points (2,2):
  - ~75% of paths are 2 hops or less
- For larger #service points (8,8):
  - ~85% of paths are 1 hop or less
  - ~98% are of 2 hops or less

# Path Length: DNS-based Fog



- ~5-17% of demands are localized
  - i.e. Path length == zero
- For small #service points (2,2):
  - ~45% of paths are 2 hops or less
- For larger #service points (8,8):
  - ~55% of paths are 1 hop or less
  - ~90% are of 2 hops or less
- Dominate effect of #LDNSs

# Backhaul Capacity: S.B. Fog



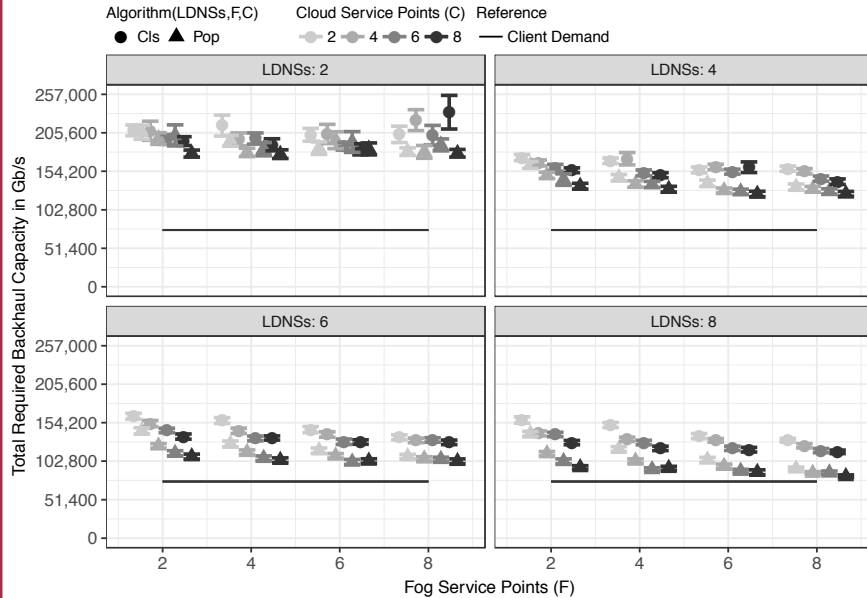
Backhaul reduction with #service points

- Higher demands Localization
- Both unicast and multicast
- Below egress demands

Further reduction with multicast

- Backhaul further reduction with larger catchment interval

# Backhaul Capacity: D.B. Fog



- Less Backhaul reduction
  - Dominated by #LDNSs
  - Increasing service points less effective
  - Less localization

# Conclusion

- A mix of CDN and ICN approaches is applied in delivering a Service-base Fog substrate
- Mapping handled in the PCF
  - No DNS suboptimal mapping
- Multicast in the network
- Reduced Network cost & end-to-end delay
  - Backhaul capacity
  - Shorter path lengths

# Thank you

Q & A...