Energy-efficiency aspects of Service Oriented Networking

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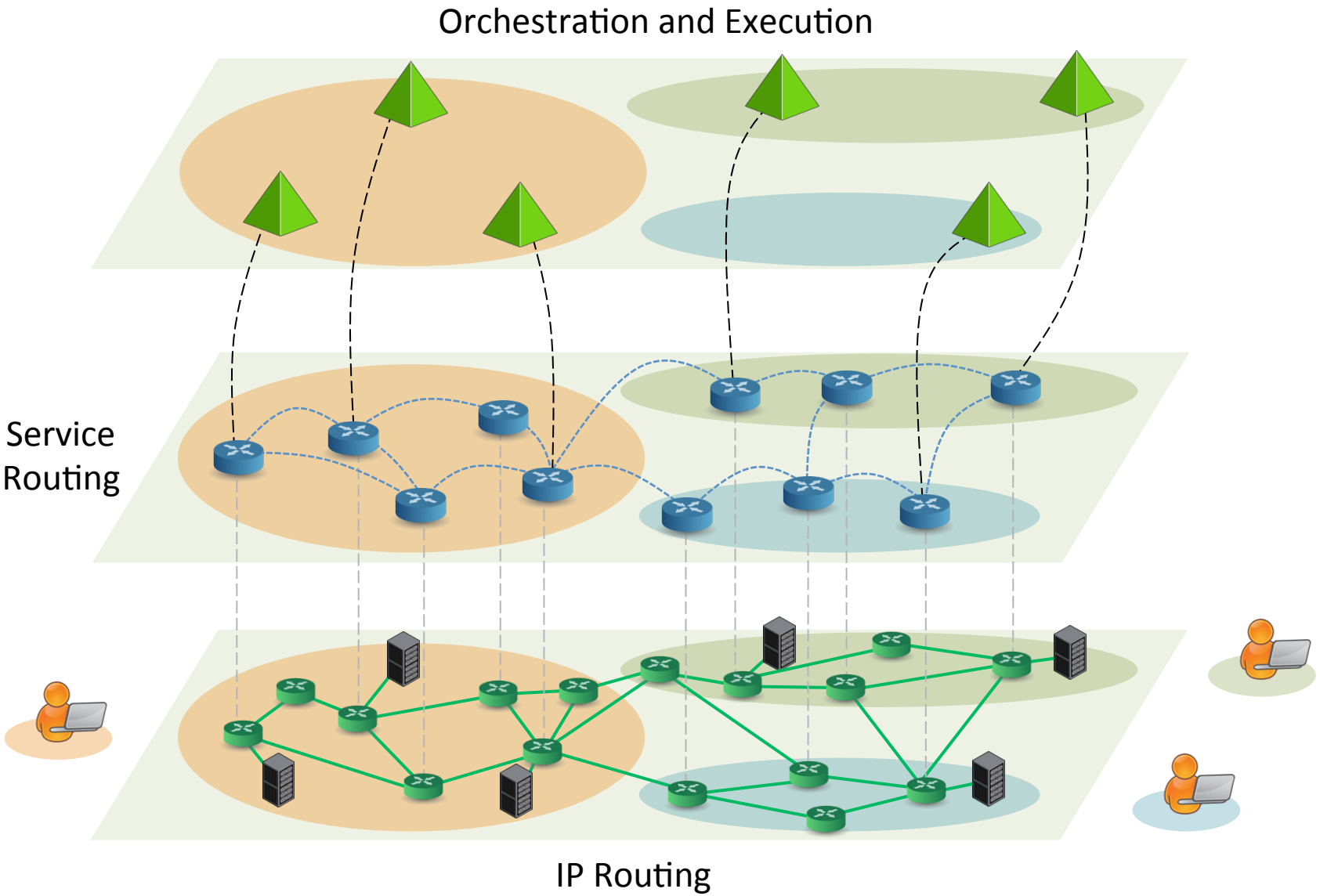
Service Oriented Networking – problem space

- Media applications are no longer stand-alone or just running in end terminals
- Cloud storage and applications are limited and unsuitable for dynamic, real-time, high-bandwidth applications
  - Granularity
  - Localisation
  - Configurability
- CDNs are fine for distributing static content efficiently
- ICN takes CDNs a stage further with fine grained caching
- Neither are suitable for deploying and accessing service processing capabilities

Service Oriented Networking - approach

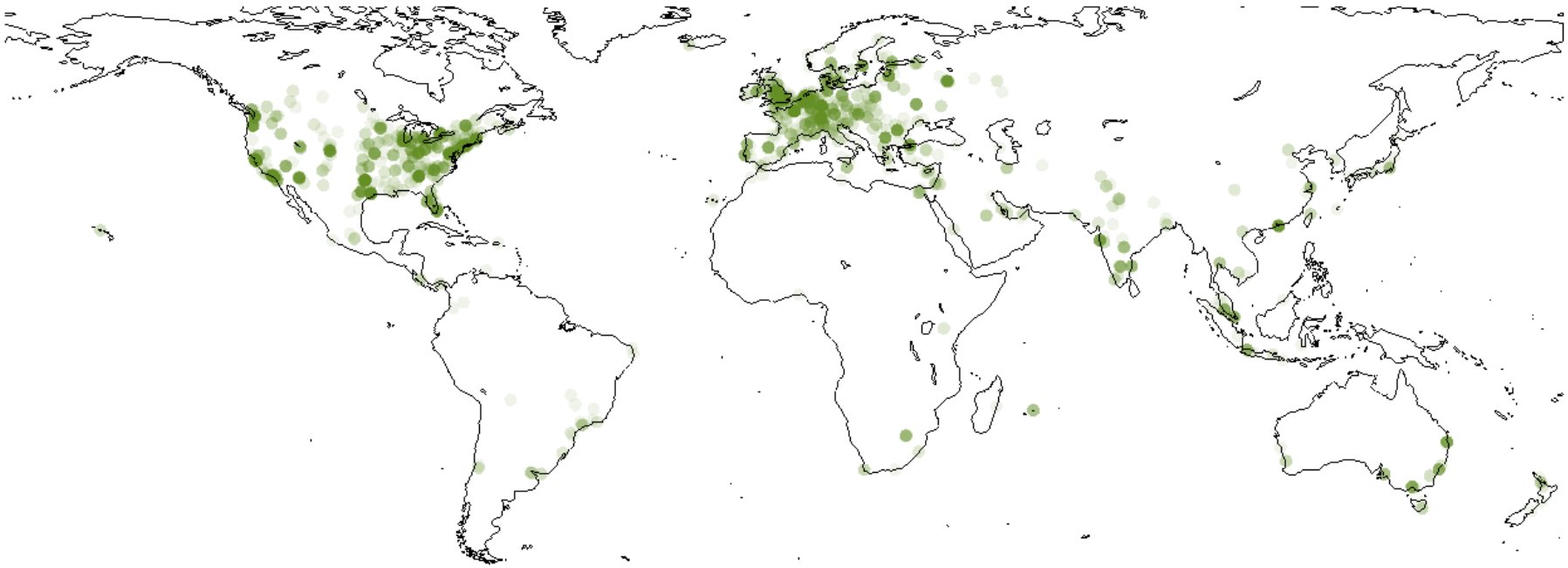
- Positioning of service processing nodes at a very fine granularity
  - in access points close to the users;
  - collocated with routers within an ISP's network;
  - in local data-centres owned and operated by ISPs;
  - in traditional data-centres and service farms operated by cloud and service providers.
- Infrastructure and tools for services to be flexibly deployed over this distributed service-execution platform to **optimise** the location of individual service component instances
- Native service-oriented routing based on anycast
  - Inherent support for load-balancing, resilience and elasticity
- A ***fusion*** of service deployment and execution technologies with native service-centric routing to provide a service-oriented network ecosystem

Service Oriented Networking Layers



Fine grained service placement

Fine grained service placement



Current DC locations - www.datacentermap.com

Fine grained service placement

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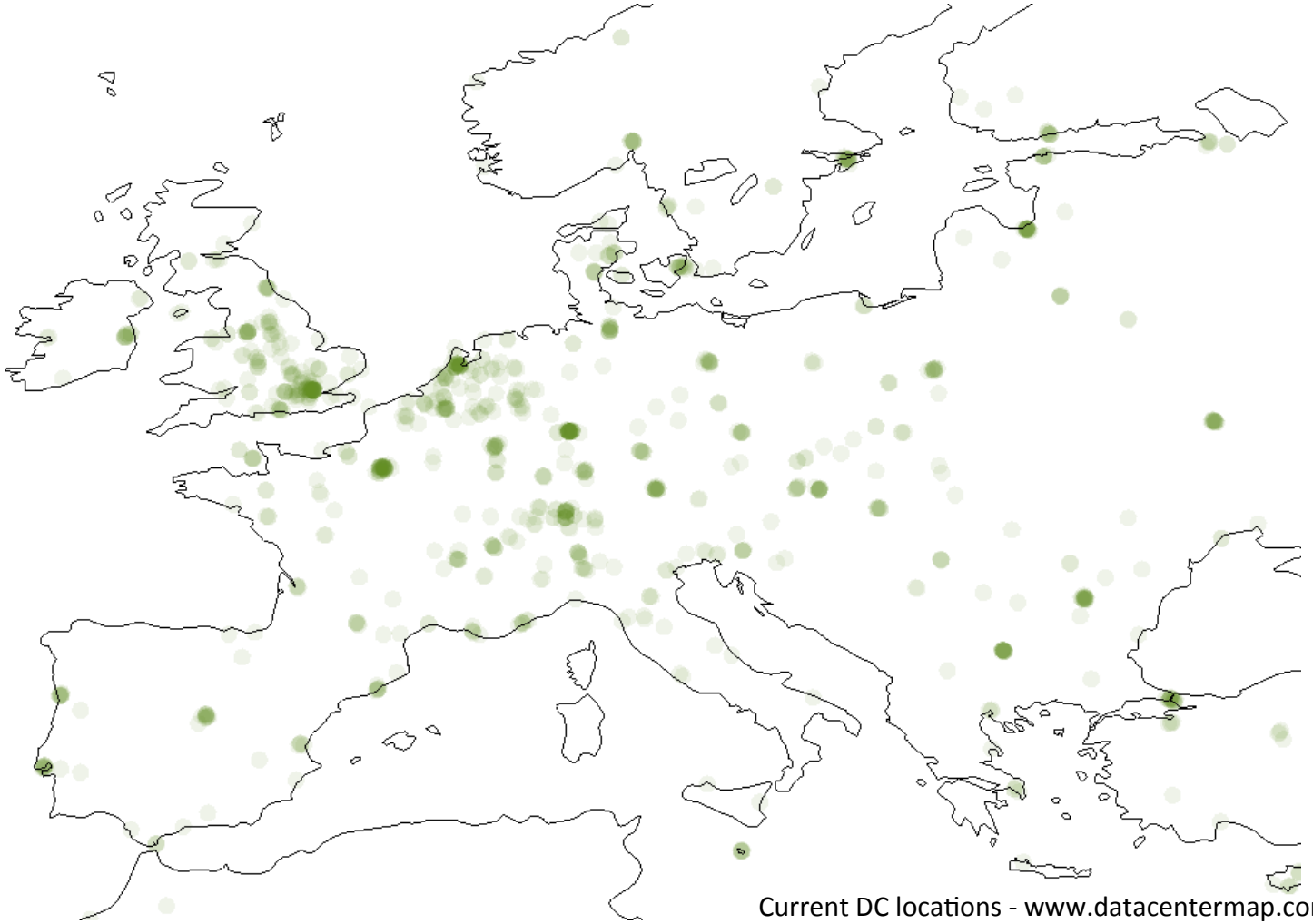
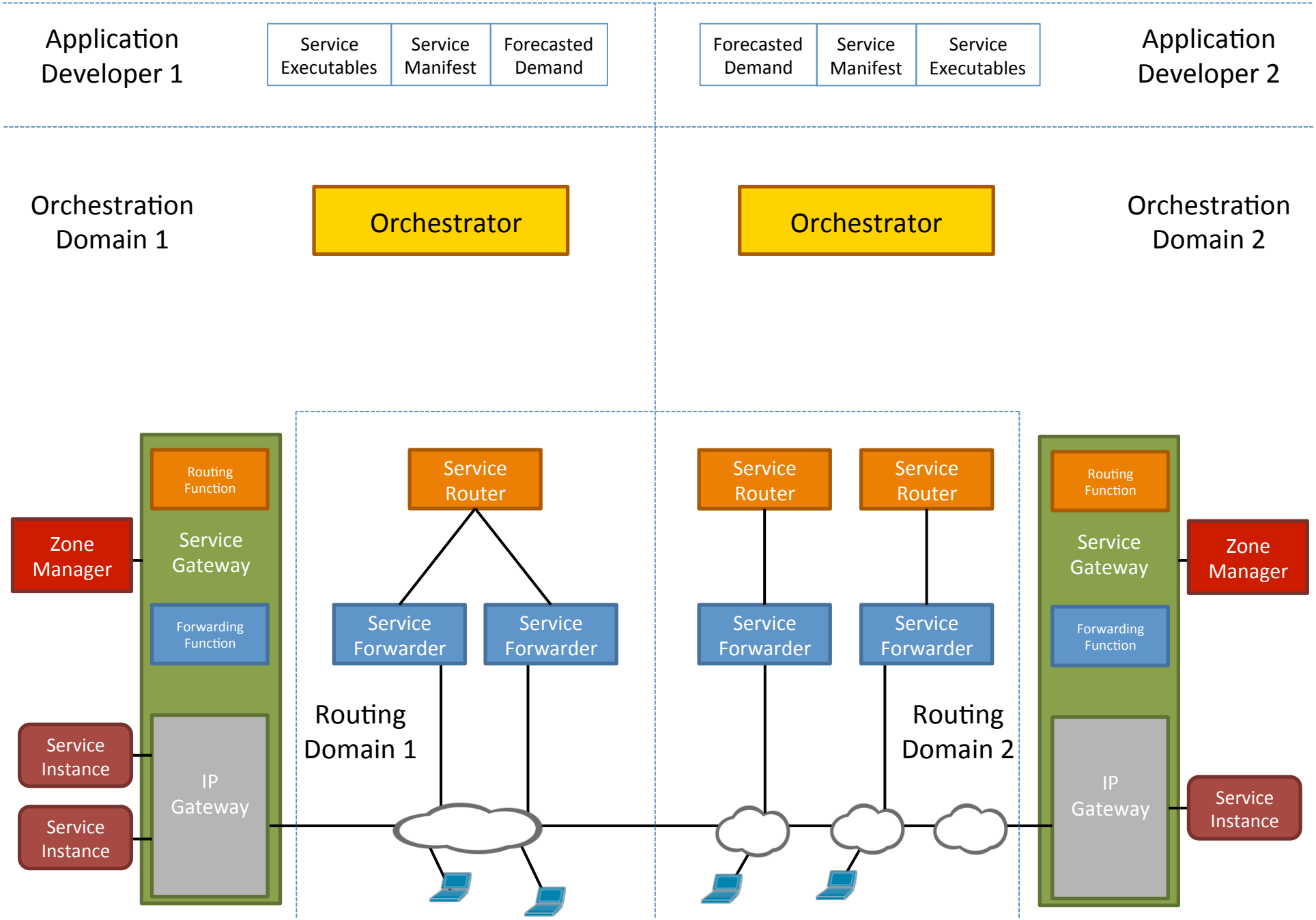


Current DC locations - www.datacentermap.com

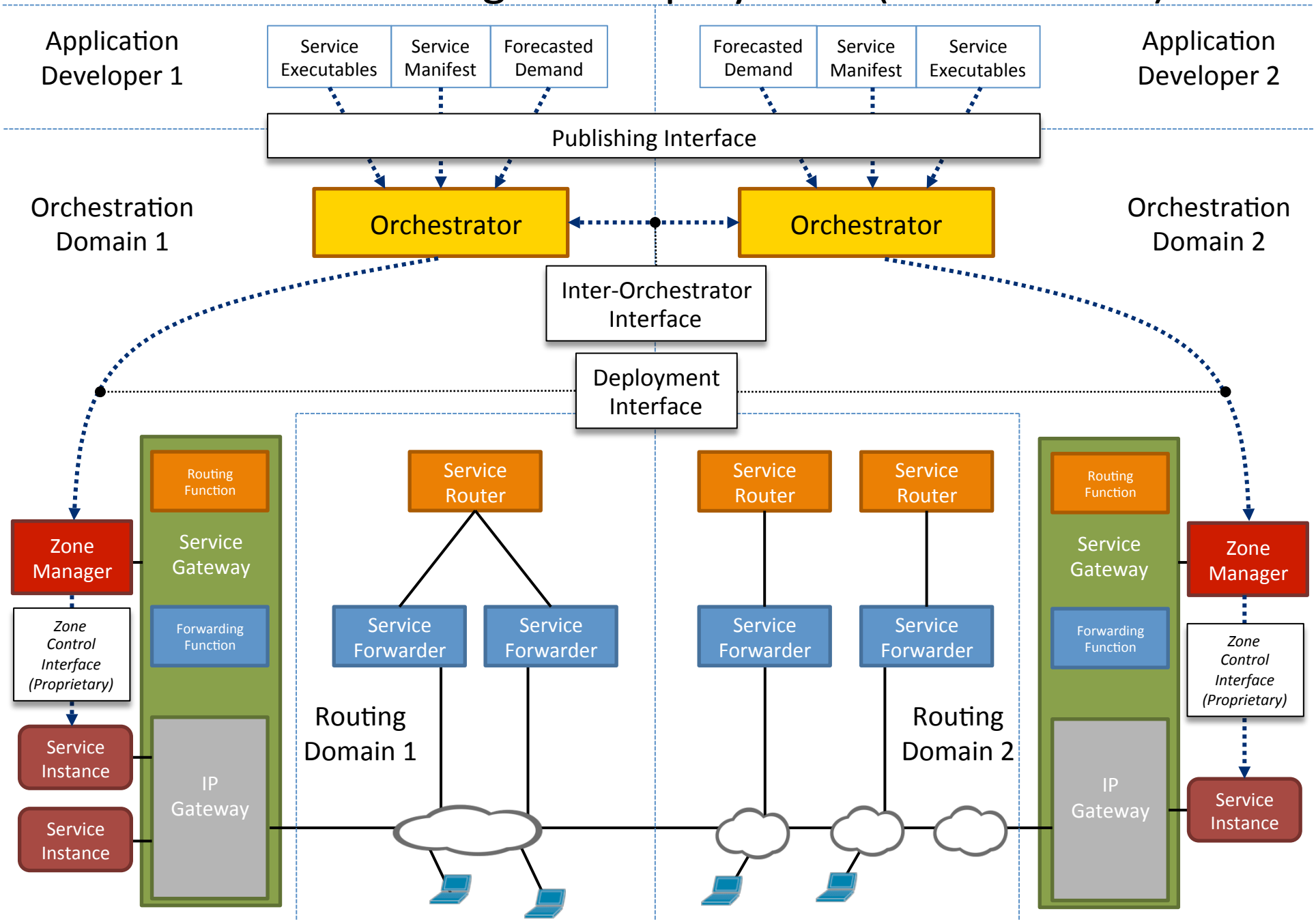
Green and energy-efficiency aspects

- Optimal service instance placement and selection
  - Fine-grained localisation, close to demand/usage
  - Primarily to meet performance targets
  - Reduces network impact of traffic
- FUSION does not have specific green/energy-efficient objectives, but:
- additional energy-efficiency considerations could include:
  - Service deployment/instantiation phase
    - Which Data Centre is greenest
      - trade-off between network load and DC energy-efficiency
    - Availability of specialised resources (e.g. GPUs) for some processes
    - Intra-DC aspects: locate high b/w components close to one another
  - Service invocation/query/routing phase
    - Multi-metric anycast routing, utilising network (e.g. latency) and service-layer metrics (e.g. server load)
    - Potential inclusion of green metrics (network and service level)

FUSION Architecture



Service Publishing and Deployment (Instantiation)



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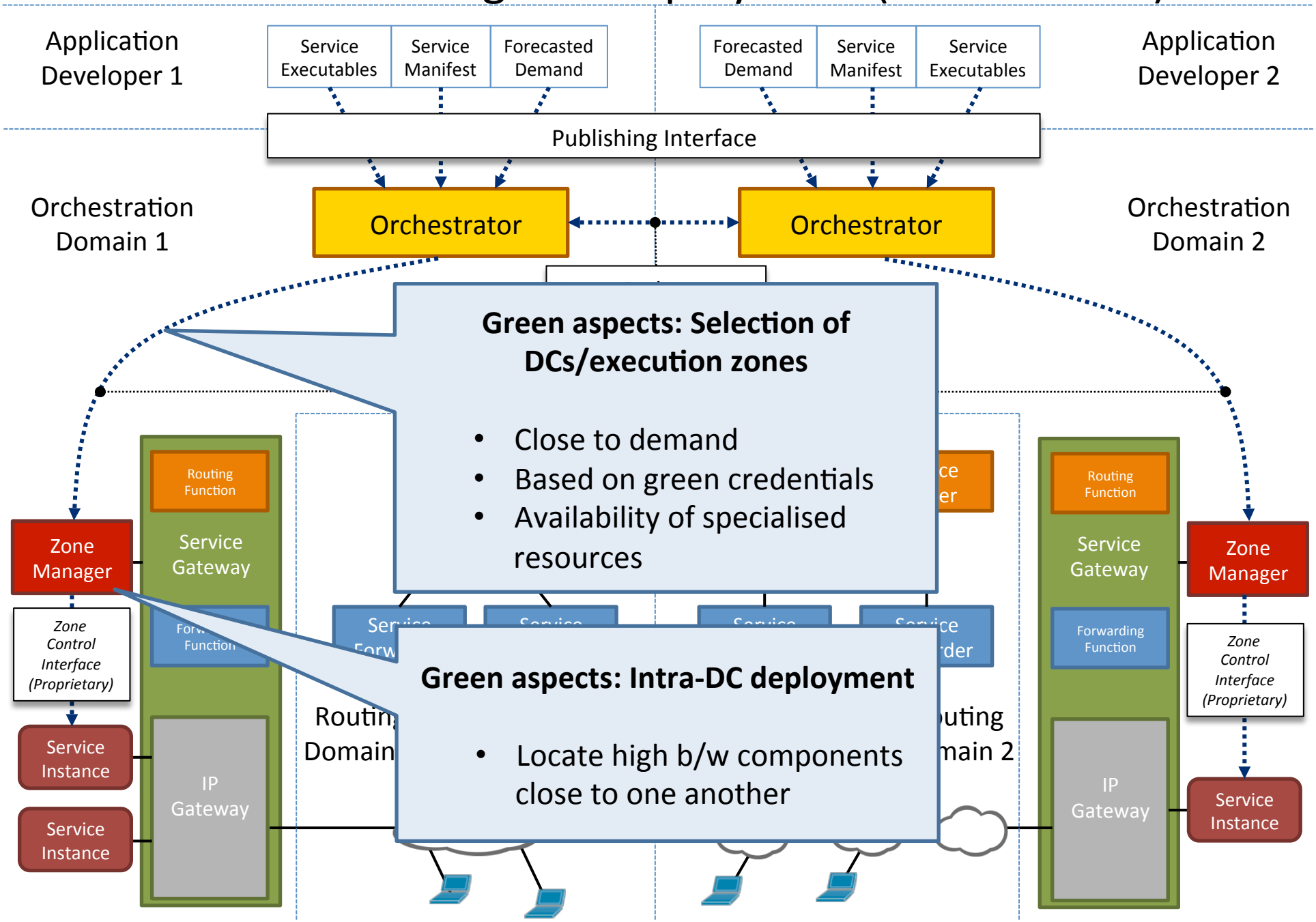
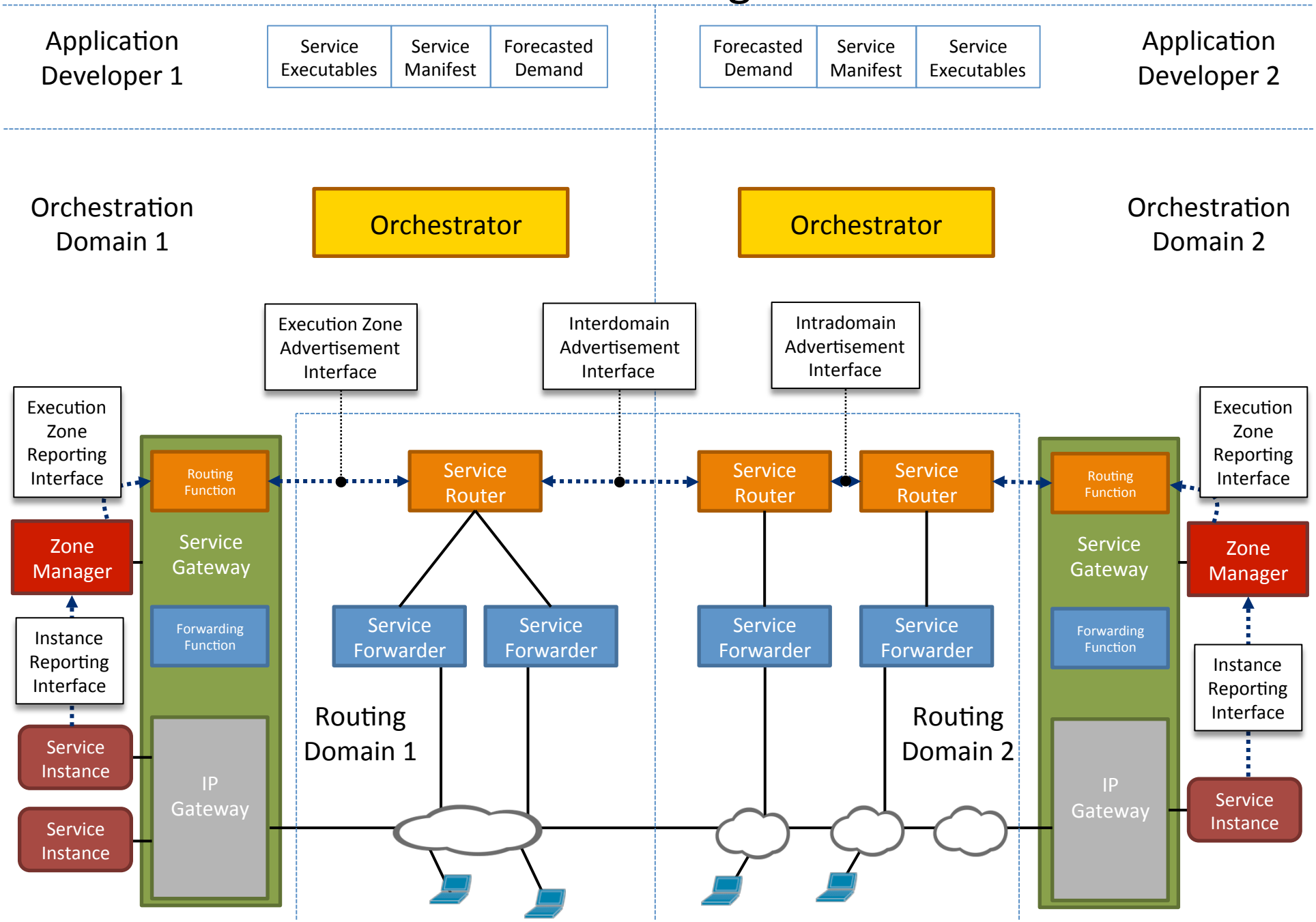


Service Routing Plane



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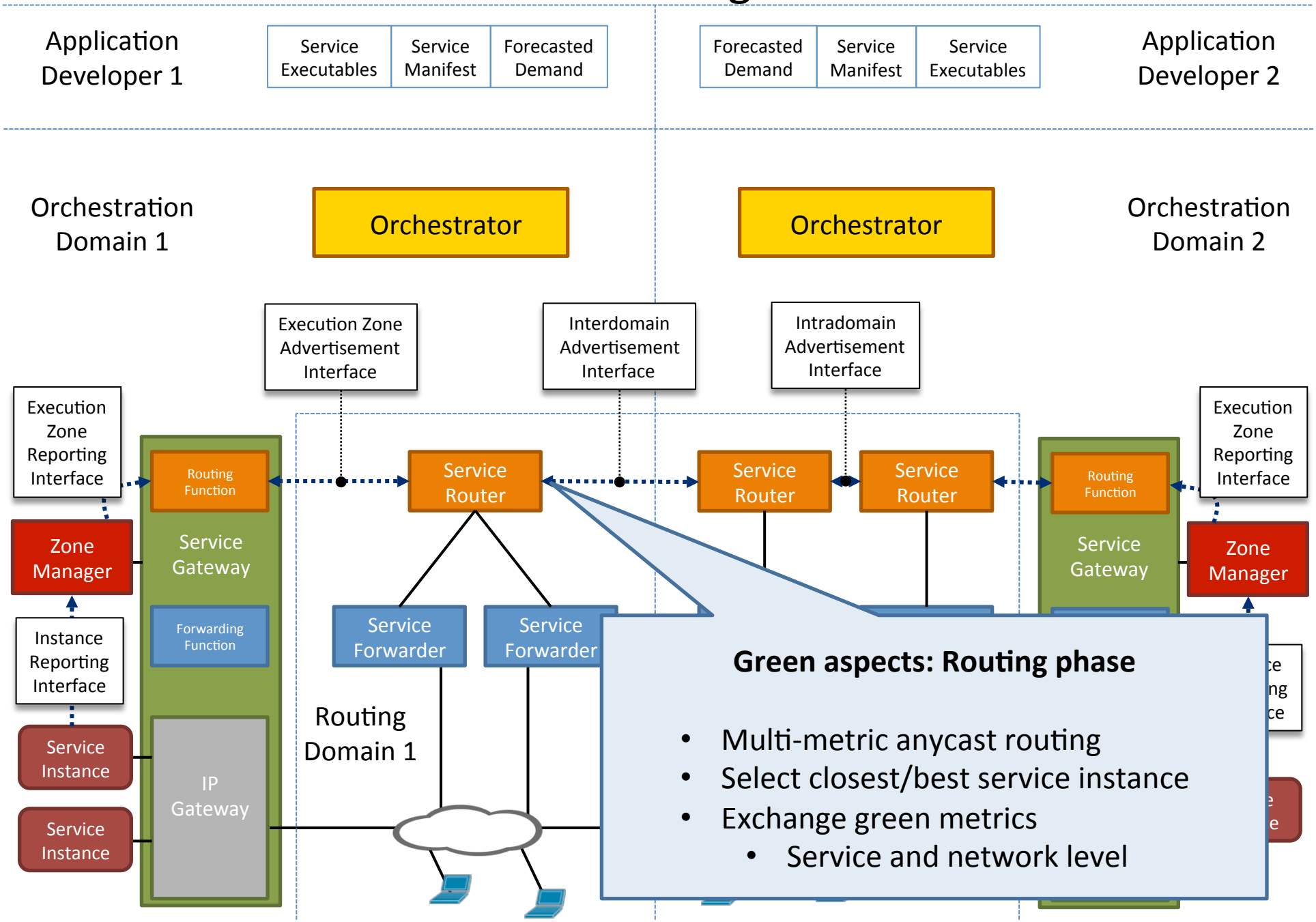
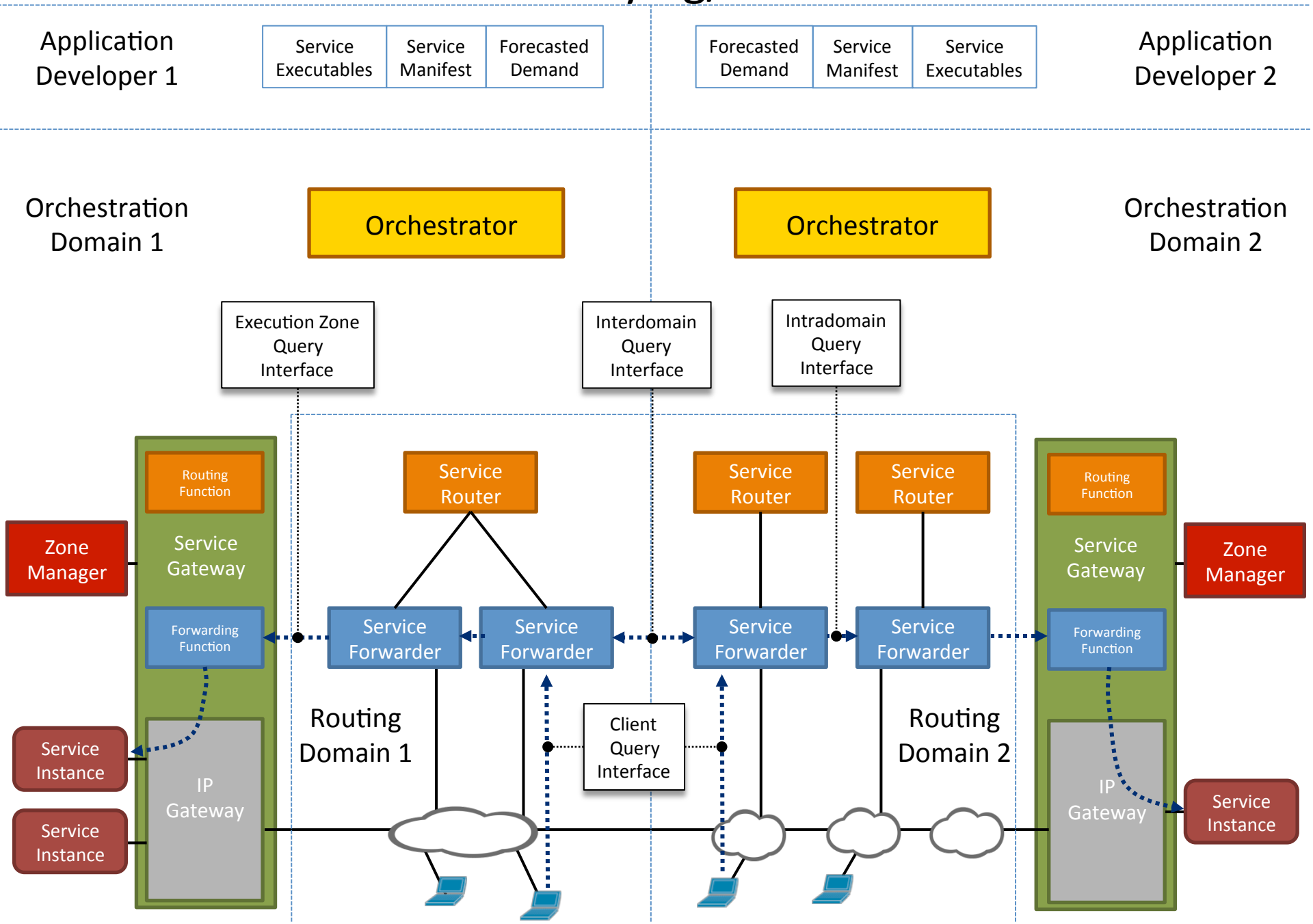


Service Querying/Invocation



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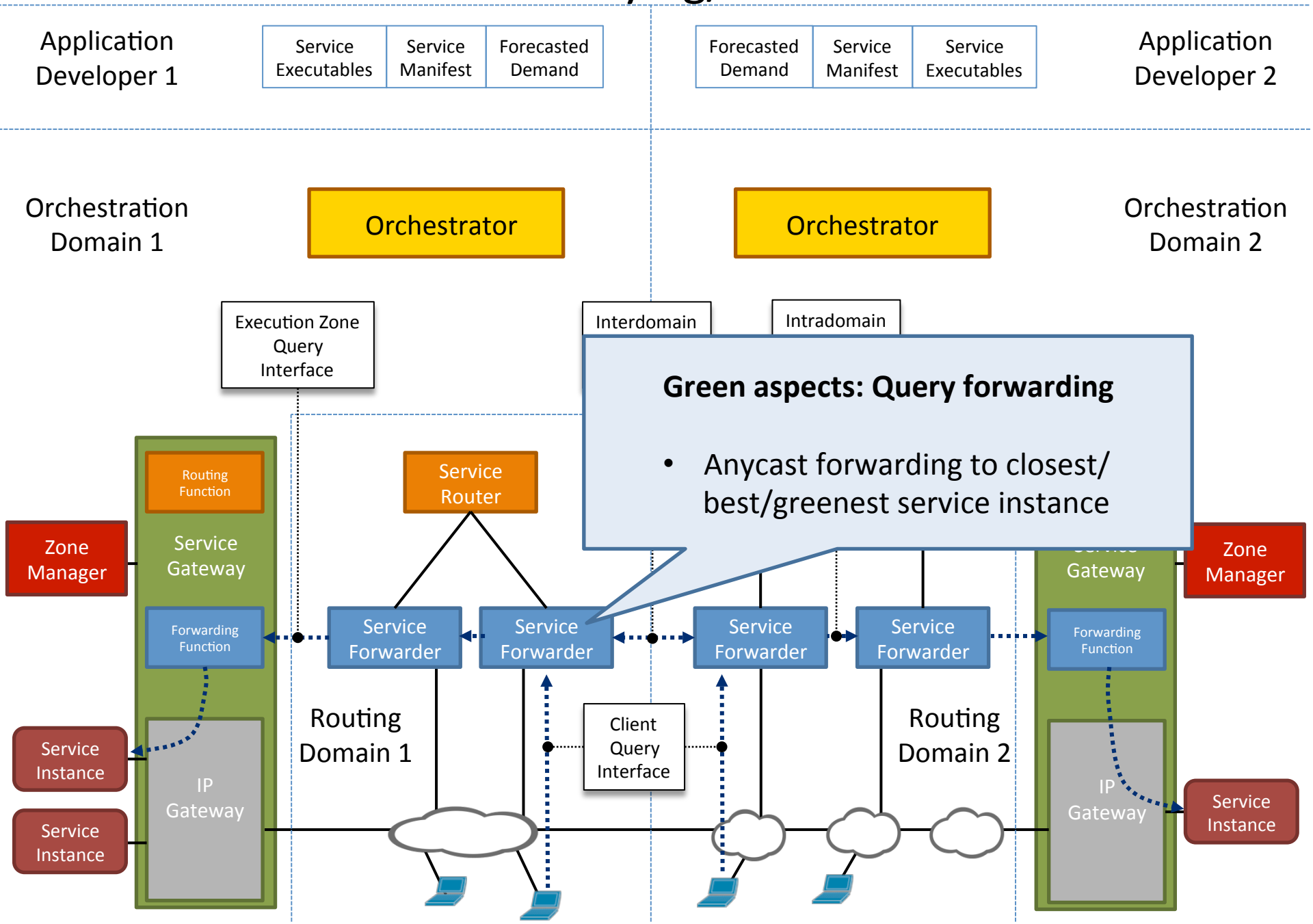
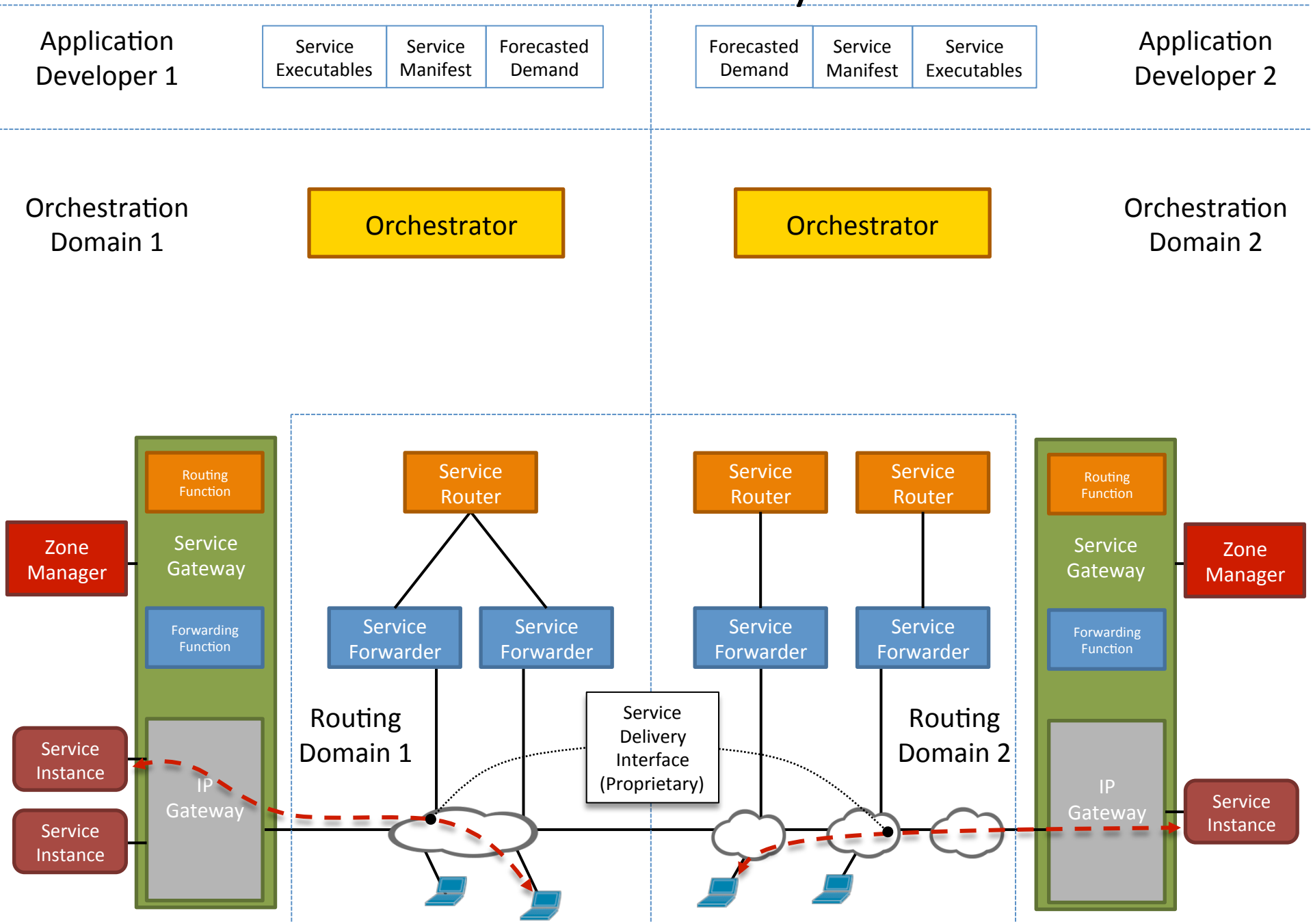


Service Delivery



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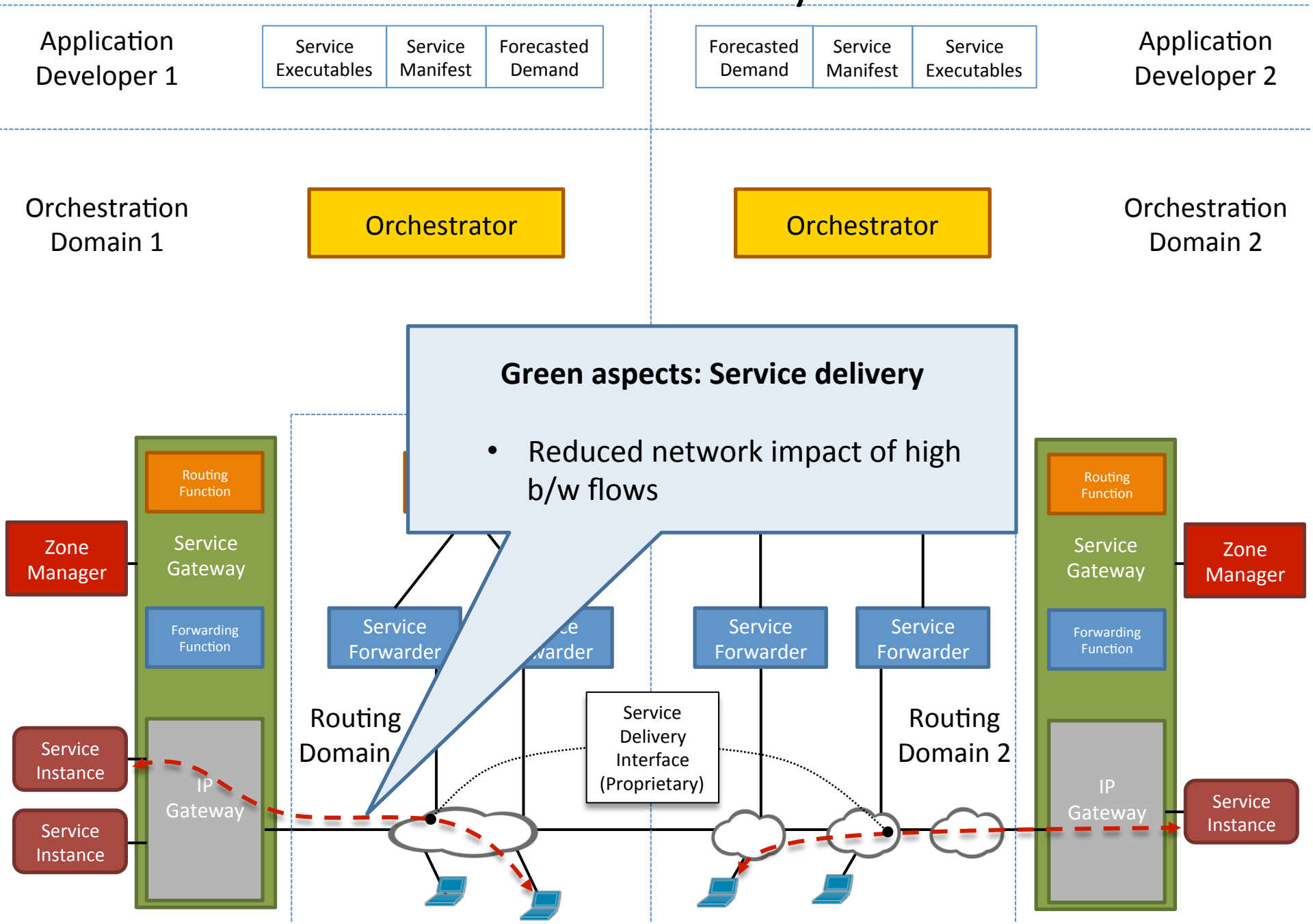

Summary

- FUSION is currently aiming at optimal service instance placement and selection
  - Fine-grained localisation, close to demand/usage
    - To increase performance (latency, b/w) and reduce network impact of traffic
- Additional energy-efficiency considerations could include:
  - Selection of DCs based on green credentials
  - Multi-metric anycast routing to include green metrics
- Research questions:
  - Metrics to describe energy efficiency
    - Aggregation issues and how to combine with network distance metrics
  - How to trade-off network and DC energy impact
    - Is a distant but more energy-efficient DC better?
    - When to sacrifice service performance for energy efficiency?

FUSION Partners

- University College London, UK
- Alcatel-Lucent Bell NV, Belgium
- Telekomunikacja Polska S.A., Poland
- Spinor GmbH, Germany
- iMinds, Belgium

www.fusion-project.eu