System design

GeoNet consortium

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Outline

- Introduction
  - GeoNet design goals
  - An overview of the GeoNet system design

- GeoNet system design
  - Enabling IPv6
  - Geographic routing and addressing
  - Mobility
  - Multicast
  - Management layer
    - Security

- Conclusions and Future work

Introduction: design goals

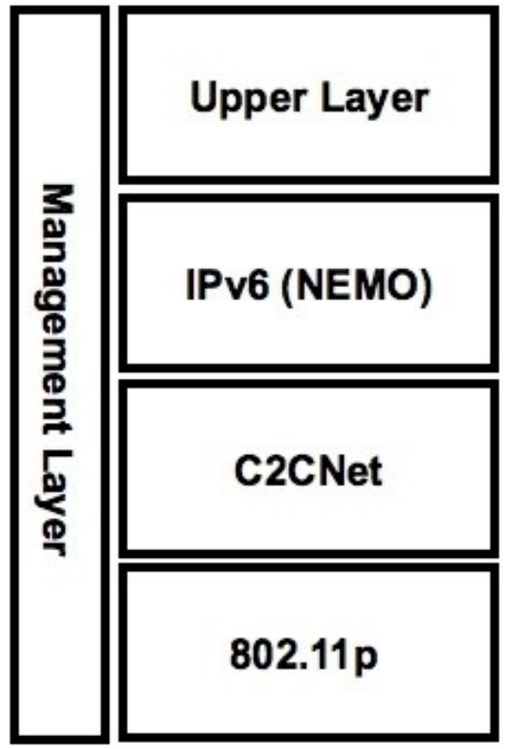
- IPv6 support
- Communication modes
  - Vehicle-based (V2V)
  - Roadside-based (V2I and I2V)
  - Internet-based
- Destination set
  - Point-to-point
  - Point-to-multipoint
- Compatibility and interoperability
- Security and Location Privacy
- …

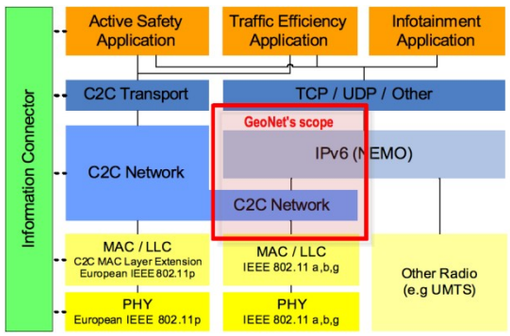
Introduction: design overview (I)

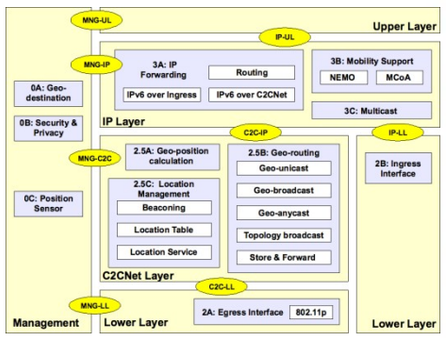
- GeoNet follows a classical protocol layered architecture

← well, not that one

but this one →

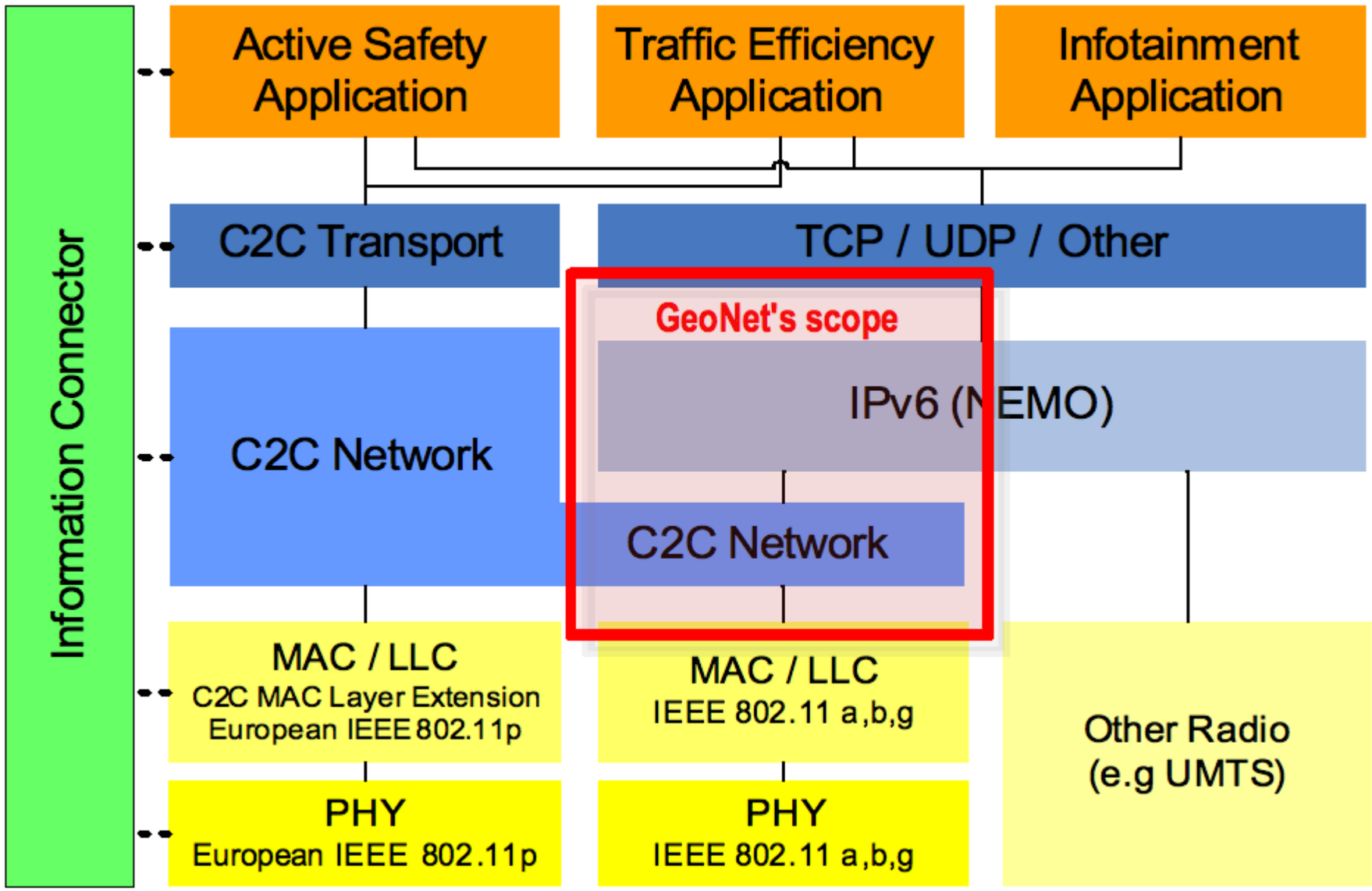




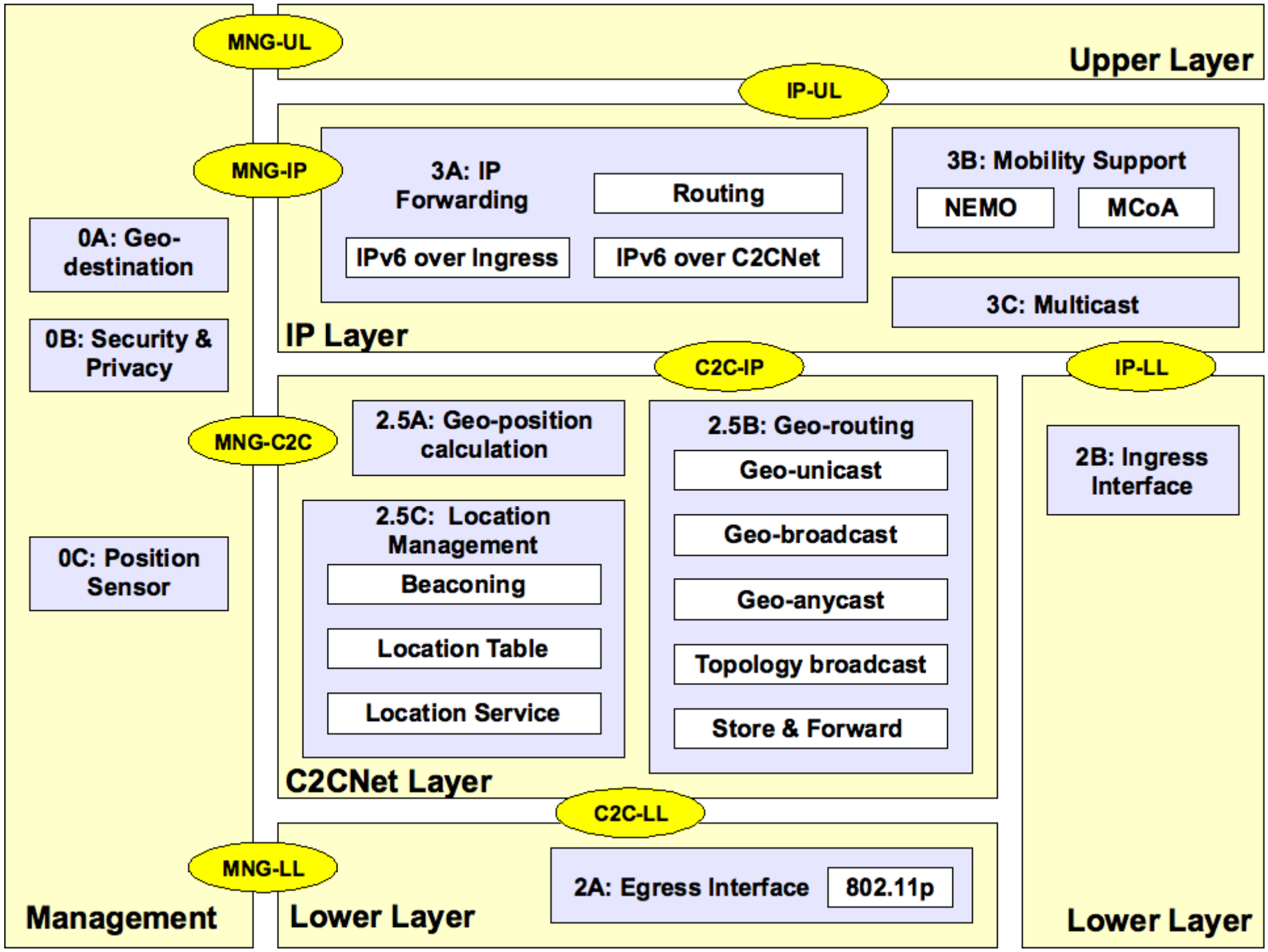


Introduction: design overview (II)

- Scope of GeoNet in C2C-CC Architecture



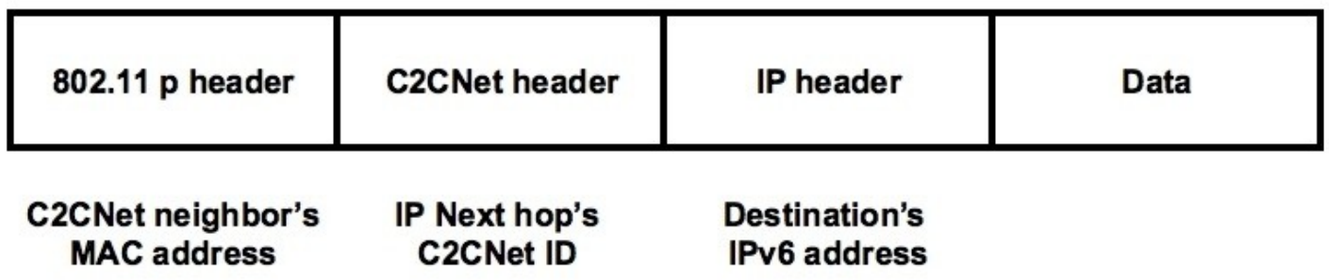
System Design: overview



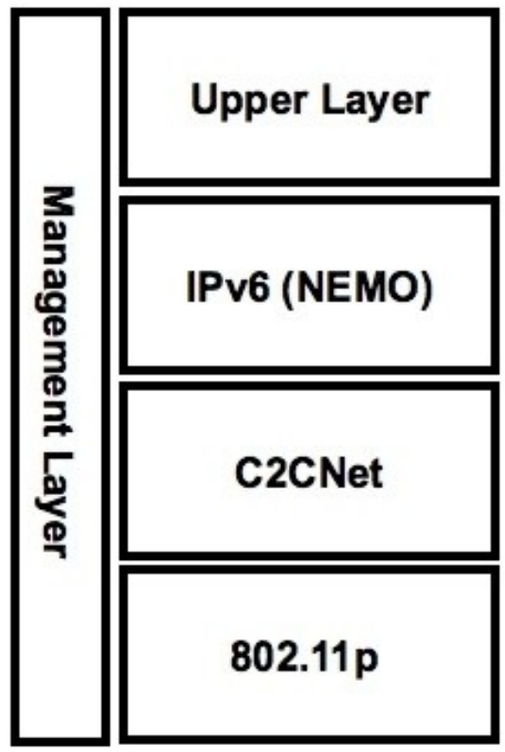
System Design: enabling IPv6 (I)

- IPv6 GeoNetworking
  - Combination of C2C-CC's GeoNetworking with IPv6
- Design goals: re-use existing standards, minimise impact on existing systems

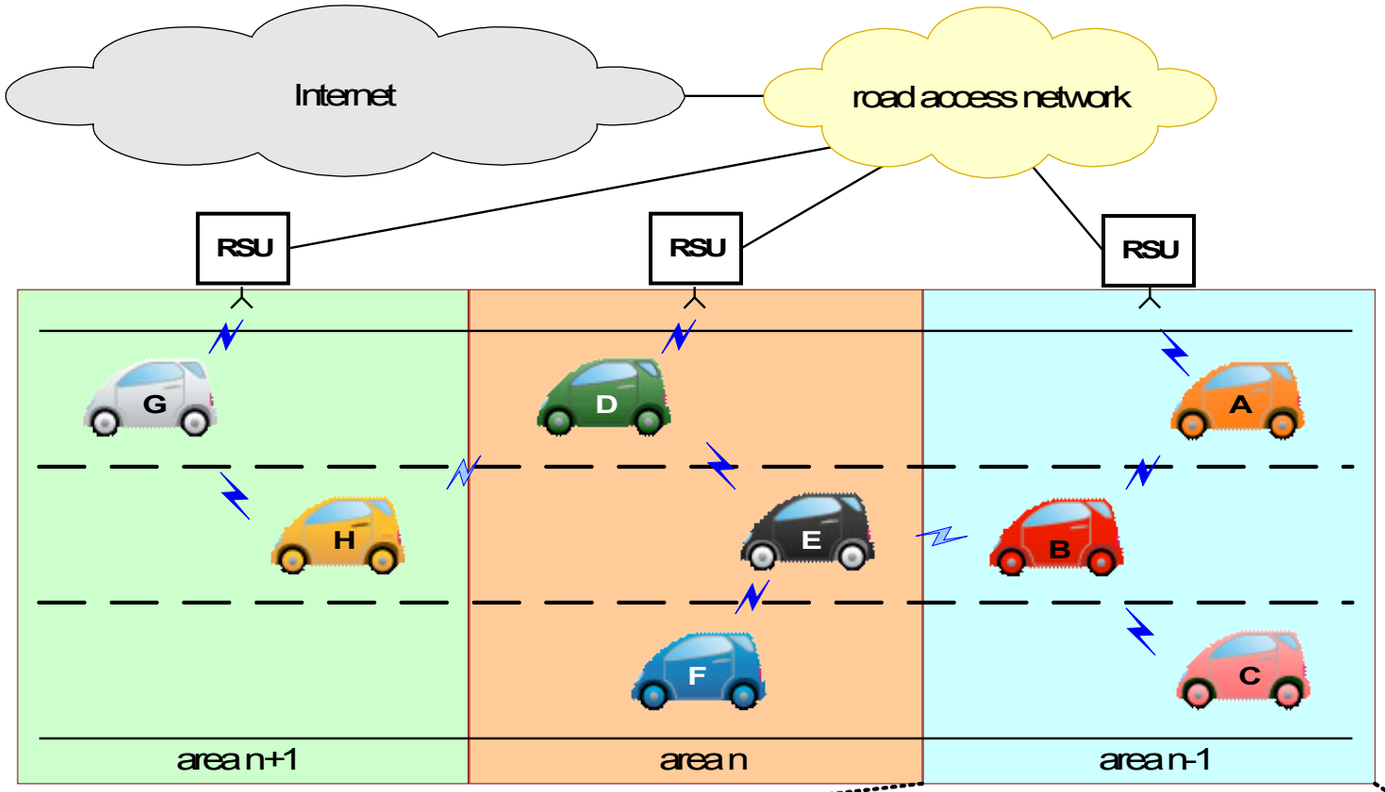
- GeoNet scope: IPv6 over C2CNet over lower layer
  - C2CNet: sub-IP layer for IPv6
- C2CNet identifier: sub-IP address
  - Identifier at sub-IP layer
  - Interface identifier for IPv6

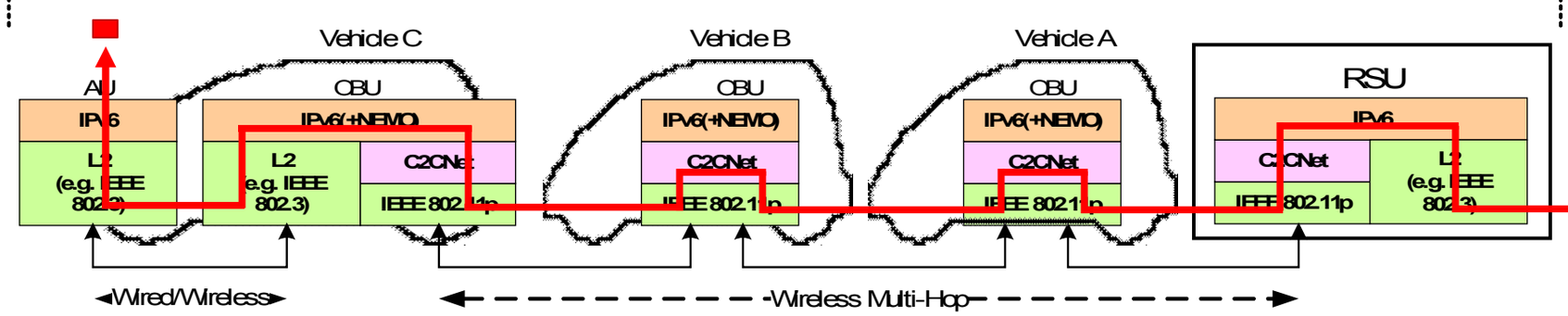


- IPv6 link
  - C2CNet provides IPv6 with a multicast link,
  - including nodes within a non-overlapping geographical area



System Design: enabling IPv6 (II)





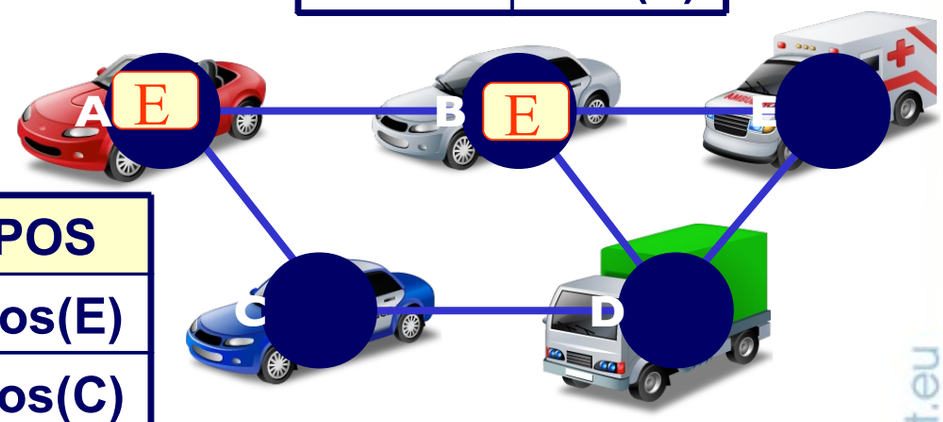
IPv6 viewpoint:

System Design: geographic routing

- C2CNet layer takes care of routing packets within the GeoNet domain
  - C2C-CC specification taken as ***starting*** point
  - It has been ***extended*** and improved
    - Not only single-hop broadcast,
    - GeoUnicast multi-hop,
    - GeoBroadcast multi-hop
- 3 main components
  - Geo-position calculation
  - Position based routing
  - Location management
    - Beaconing
    - Location service
    - Location table

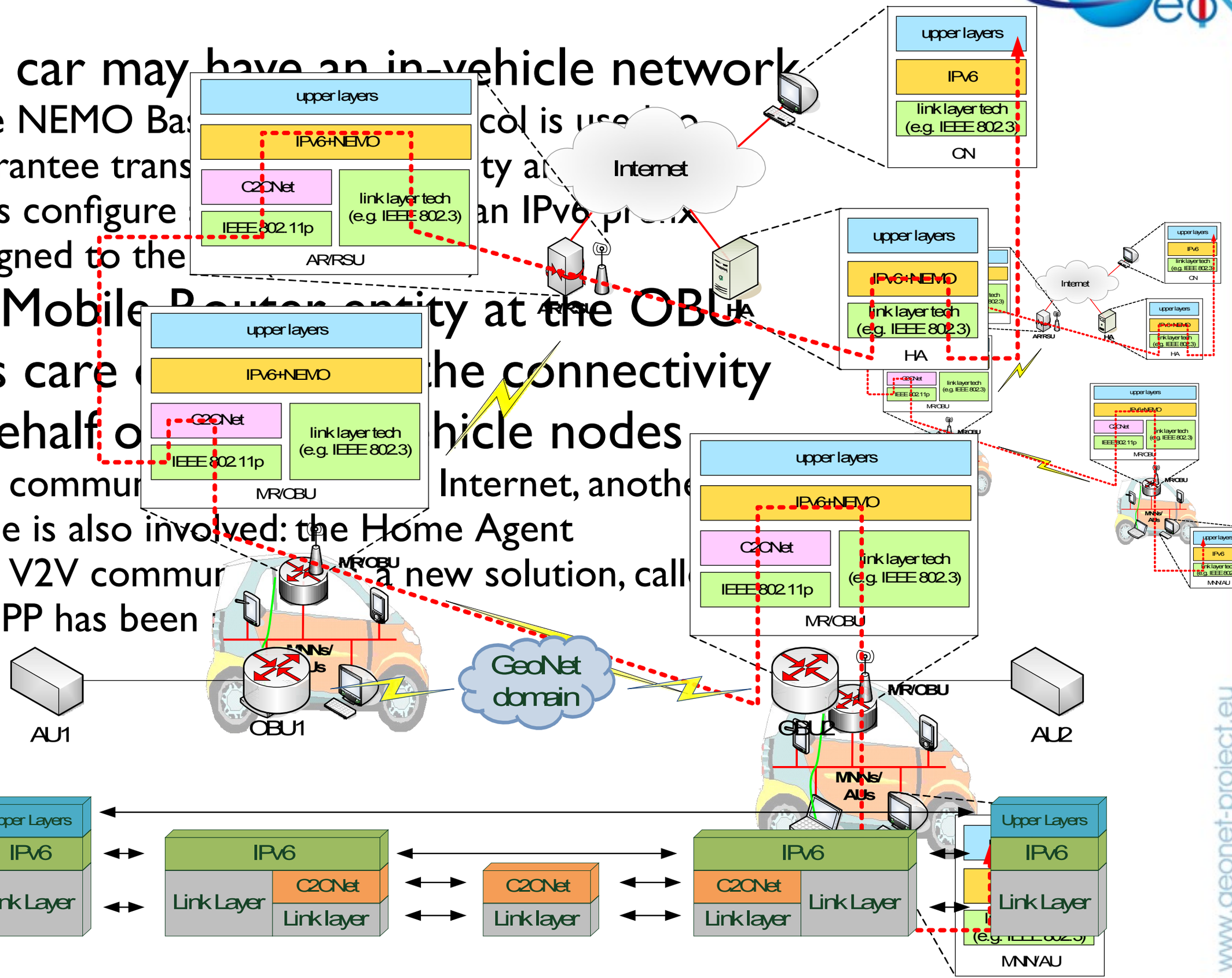
NEIGH	POS
A	Pos(A)
D	Pos(D)
E	Pos(E)

NEIGH	POS
B	Pos(E)
C	Pos(C)



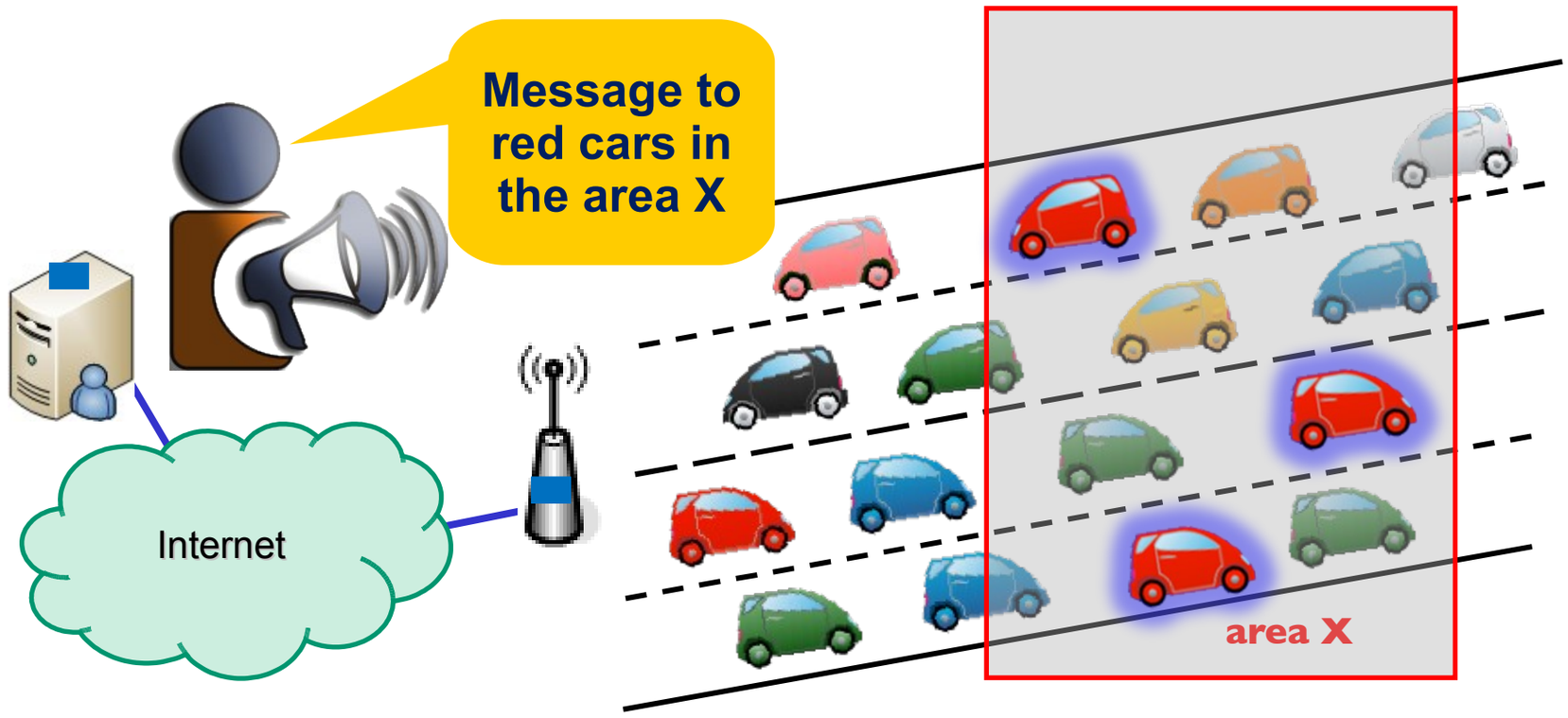
System Design: mobility

- Each car may have an in-vehicle network
  - The NEMO Bas… col is use…
    guarantee trans… ty a…
  - AUs configure … an IPv6 pr…
    assigned to the …
- The Mobile Router entity at the OBU… takes care … the connectivity on behalf o… hicle nodes
  - For commun… Internet, anothe… node is also involved: the Home Agent
  - For V2V commun… a new solution, call… MNPP has been …



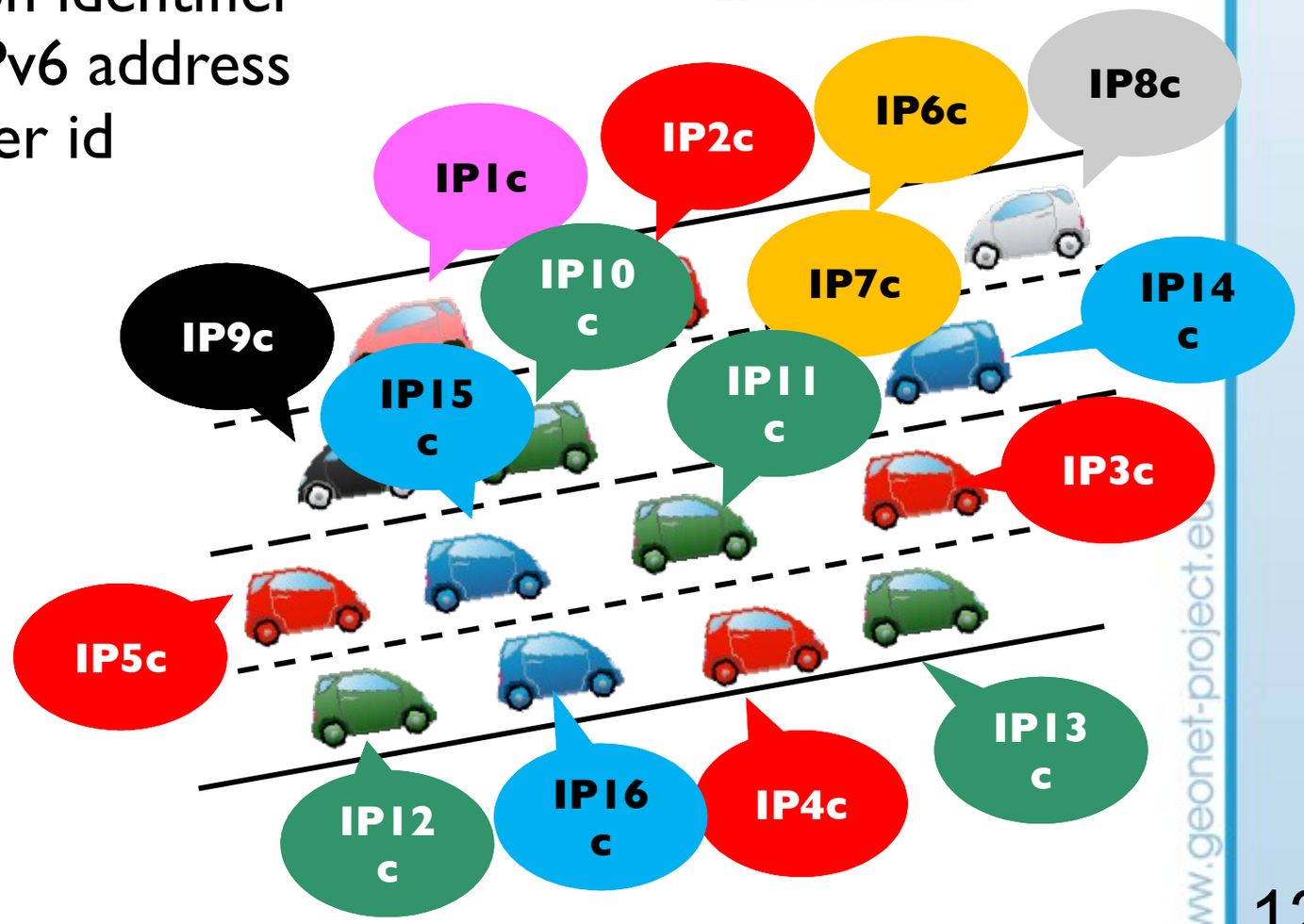
System Design: multicast

- Design goal: extend IPv6 multicast to also support a geographical scope
  - Multicast groups based on the geographical location of the receivers are possible
  - IP multicast: the sender may also be in the Internet
- 5 different approaches specified and analysed
  - Simplest one implemented for testing purposes



System Design: mngmt. layer

- Takes care of cross-layer issues
- A critical module is "Security and Privacy"
  - It deals with issues raised by the combination of IPv6 and GeoNetworking protocols:
    - Location Privacy (tracking)
    - Revealing geographic location from the IPv6 address used as communication identifier
    - Secure binding between the IPv6 address and the geocast (C2CNet) layer id
    - IPv6 address spoofing
- Example: Location privacy
  - Each vehicle has a number of different C2CNet IDs
  - Periodically, the used C2CNet IDs are changed
    - This implies a change of IP addresses



Conclusions & Future work

- The GeoNet architecture design
  - allows for an integration of IPv6 and GeoNetworking
  - meeting the goals and requirements specified at the beginning of the project
  - targeting as few changes at the IPv6 side as possible
  - extending C2CNet work when needed and providing feedback to C2C-CC and standardisation bodies
- Work ahead
  - More extensive experimentation in Field Operational Tests (FOTs)
  - Tighter integration of IPv6 and GeoNetworking: Position aware IP applications

Questions