

# Mobile IPv6 Route Optimisation for Network Mobility (MIRON)

draft-bernardos-nemo-miron-01

## How this solution fits the Aeronautics requirements?

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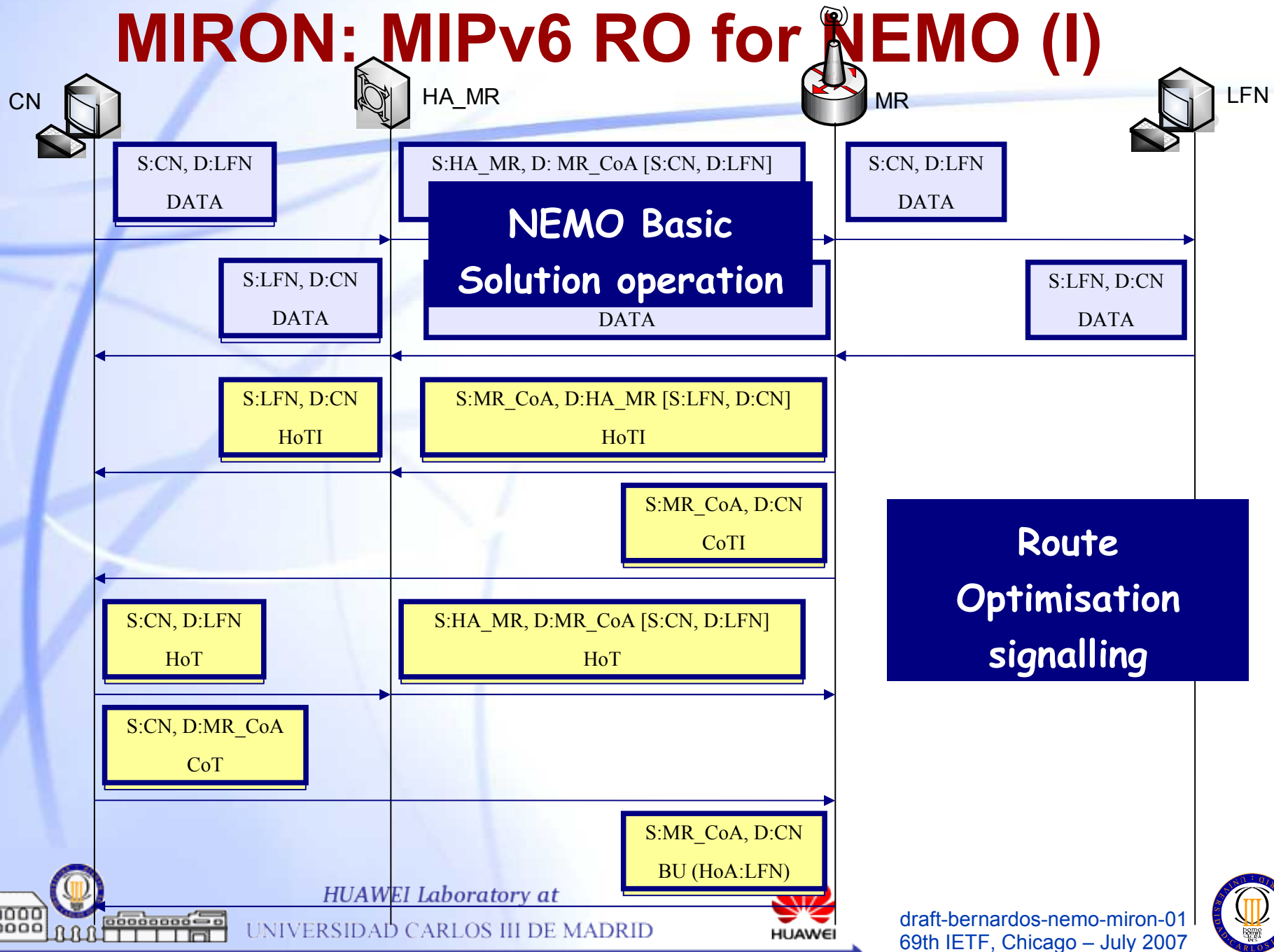


# Outline

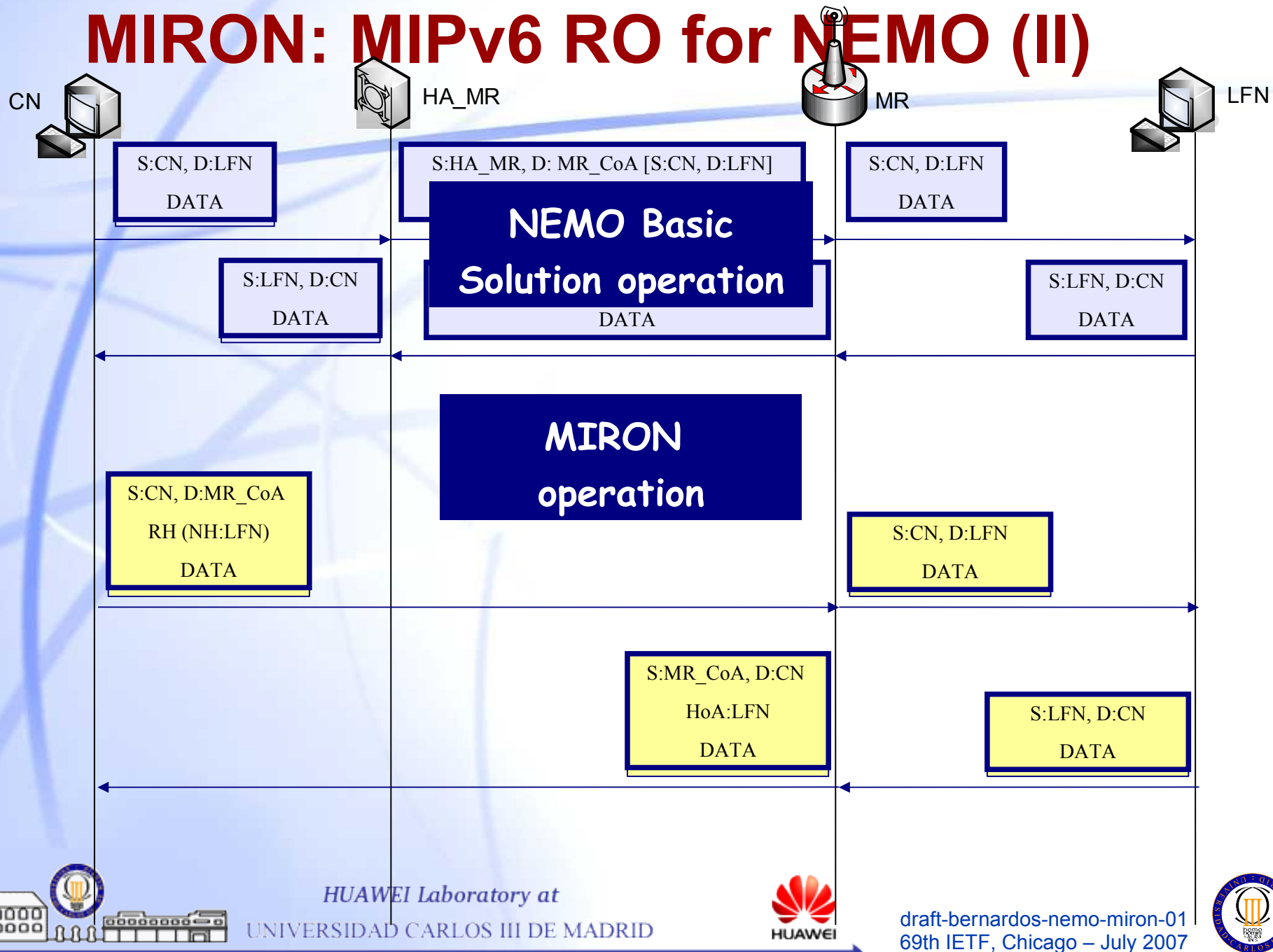
- **MIRON: Mobile IPv6 Route Optimisation for NEMO**
  - ◆ **Solution overview**
- **How MIRON fits the Aeronautics requirements?**
  - ◆ **Requirements' analysis**
    - draft-eddy-nemo-aero-reqs-01.txt
- **Conclusions and Next Steps**



# MIRON: MIPv6 RO for NEMO (I)



# MIRON: MIPv6 RO for NEMO (II)



# How MIRON fits the Aeronautics requirements?

## Req1 - Separability

- “a NEMO RO scheme **MUST** have the ability to be bypassed by applications that desire to use bi-directional tunnels through an HA”
  - ◆ **Fulfilled by MIRON**
    - The Route Optimisation is performed in a per-flow basis and the decision about which flows are optimised is taken by the MR
  - ◆ In general, this is easy to achieve if the NEMO RO is performed by the MR on a per-flow basis



# How MIRON fits the Aeronautics requirements?

## Req2 - Multihoming

- "RO schemes **MUST** permit an MR to be simultaneously connected to multiple access networks, having multiple prefixes and Care-Of Addresses in a MONAMI6 context"
  - ◆ **Fulfilled by MIRON**
    - Since the MR performs all the MIPv6-RO operations on behalf of connected LFNs, MIRON can benefit directly from any MONAMI6 mechanism
  - ◆ **We think that NEMO multihoming issues should be tackled specifically by a general NEMO multihoming framework**
    - The problem has to be addressed first in the NEMO Basic Support





# How MIRON fits the Aeronautics requirements?

## Req3 - Latency

- "an RO solution **MUST** be capable of configuring and reconfiguring itself (and reconfiguring after mobility events) without blocking unoptimized packet flow during its initiation and before or after transitions in the active access links"
  - ◆ **Fulfilled by MIRON**
    - While the MR performs all the MIPv6-RO operations on behalf of LFNs, their communications still use the MRHA tunnel



# How MIRON fits the Aeronautics requirements?

## Req4 - Availability

- "an RO solution **MUST NOT** imply a single point of failure, whether that be a single MR, a single HA, or other point within the ground network“
  - ◆ **Fulfilled by MIRON (if extended appropriately)**
    - HA failure: issue not introduced by MIRON
    - MR failure: some additional mechanisms required
    - Home Network reachability: issue not introduced by MIRON
  - ◆ **Current NEMO Basic Support protocol does not fulfil that today, and therefore needs additional work to be carried-out**
    - This should be done by a general NEMO framework





# How MIRON fits the Aeronautics requirements?

## Req5 - Integrity

- "an RO scheme **MUST NOT** cause packets to be dropped at any point in operation, when they would not normally have been dropped in a non-RO configuration"
- ◆ It takes longer to finish a handover of a route optimised flow using MIRON than a normal NEMO handover
  - MIRON can be extended to use micromobility solutions and/or bi-casting



# How MIRON fits the Aeronautics requirements?

## Req6 - Scalability

- "an RO scheme **MUST** be simultaneously usable by ten thousand nodes without overloading the ground network or routing system"
- ◆ **Fulfilled by MIRON**
  - Required resources grow linearly with the number of optimisations being performed, and these required resources do not impose any constraint for modern available routers
  - MIRON does not impact in any way the global routing system



# How MIRON fits the Aeronautics requirements?

## Req7 - Throughput

- "an RO scheme **MUST** be capable of operating on traffic streams with individual rates up to 5 Mbps, and aggregates of 50 Mbps, while accounting for less than 9.6 kbps of bandwidth for its own signaling overhead"
  - ◆ **Fulfilled by MIRON**
    - 1500 LFN-CN flows can be optimised with 9.6 kbps
    - MIRON reduces from 40 to 24 bytes the data packet overhead
  - ◆ **These numbers may be subject to revision**



# How MIRON fits the Aeronautics requirements?

## Req8 - Security

- **"IPsec MUST be usable over the RO scheme, and the data used to make RO decisions MUST be authenticable, perhaps using some form of IPsec"**
  - ◆ **Not completely fulfilled by MIRON**
    - MIRON supports to route optimise communications that use IPsec ESP data traffic
    - IPsec AH is not supported
    - If IPsec is preferred to secure RO signalling, MIRON could be extended to support it
  - ◆ **It is not clear what "the data used to make RO decisions MUST be authenticable, perhaps using some form of IPsec" actually means**



# How MIRON fits the Aeronautics requirements?

## Req9 - Adaptability

- **"New applications, potentially using new transport protocols or IP options **MUST** be possible within an RO scheme"**
  - ◆ **Fulfilled by MIRON**
    - **MIRON MAY make use of information about higher layer protocols to classify between flows that prefer the MRHA tunnel or a route optimised path**
    - **The use of unexpected/new higher layer protocols and/or applications would not make MIRON fail, but just revert on using the MRHA tunnel**



# How MIRON fits the Aeronautics requirements?

## Desirable requirements (I)

- **Des1 – Configuration**

- ◆ "it is desirable that a NEMO RO solution be as simple to configure as possible and also easy to automatically disable if an undesirable state is reached"
  - MIRON configuration would be as simple as configuring today's firewalls. A MIRON MR does not require more configuration than a MIPv6 MN

- **Des2 – Nesting, and Des4 - VMN Support**

- ◆ MIRON, as it is described in the draft, does not provide RO capabilities for nested MRs nor VMNs
  - However, MIRON has been extended to support these capabilities in a separated work





# How MIRON fits the Aeronautics requirements?

## Desirable requirements (II)

- **Des3 - System Impact**

- ◆ "low complexity in systems engineering and configuration management is desirable in building and maintaining systems using the RO mechanism"

- **Fulfilled by MIRON**

- ◆ Only the MR is required to be modified, configured, maintained and updated

- **Des5 – Generality**

- ◆ "an RO mechanism that is "general purpose", in that it is also readily usable in other contexts outside of aeronautics and space exploration, is desirable"

- **Fulfilled by MIRON**

- ◆ It has been designed as a general NEMO RO framework, not being focused to address any particular scenario



# Conclusions and Next Steps (I)

- **Aeronautics requirements**

- ◆ **Some of them are not RO specific and should be tackled by a general NEMO framework**
  - E.g., multihoming, availability
- ◆ **The three different Aeronautical Communications scenarios have very different requirements and constraints**
  - **ATS (Air Traffic Services)**
    - ◇ security is CRITICAL
    - ◇ CNs are known, so trust relationships are possible
    - ◇ IPsec-like RO possible
  - **AOS (Air Operational Services)**
    - ◇ CNs are known in advance (will probably belong to the same domain that the aircraft)
    - ◇ IPsec-like RO possible
  - **PIES (Passenger Information and Entertainment Services)**
    - ◇ CNs are unknown (potentially, any host in the Internet can be a CN)
    - ◇ Availability of pre-established trust relationships cannot be assumed
    - ◇ MIPv6-like RO more feasible



# Conclusions and Next Steps (II)

- **MIRON and the Aeronautics requirements**
  - ◆ MIRON meets almost all the described requirements without change
  - ◆ Some requirements should be addressed by a general NEMO solution
    - MIRON would be compatible with them
  - ◆ Some of them requires MIRON to be slightly adapted and/or extended
  - ◆ Some others requires more attention
    - IPsec AH support
- **Next Steps**
  - ◆ Provide input in the Requirement specification work
  - ◆ Work on MIRON solution to make it a candidate solution

