

**IETF – INTAREA WG**

<https://datatracker.ietf.org/doc/draft-jia-intarea-scenarios-problems-addressing/>

<https://datatracker.ietf.org/doc/draft-jia-intarea-internet-addressing-gap-analysis/>

# **Internet Addressing - Problem Statement and Gap Analysis**

**IETF 111 – Online**

**2021.07.30**

# Background

- **Internet Addressing** is the core method to direct packets within the global Internet communication system
- However, large parts of the overall communication system occur in *limited domains* (RFC 8799)
- Within those limited domains, requirements, node behaviors, address semantics, and packet forwarding may be significantly different from the Internet addressing paradigm
- This often requires **additional adaptation technologies** to realize the distinguishing requirements of the specific scenarios

# Objective of Both Drafts

- Revolving around the following question:  
*Should limited **domains purely rely on IP addresses** and therefore deal with the complexity of translating any semantic mismatch themselves, **or should flexibility for supporting those limited domains be a key focus for an evolved Internet addressing?***
- Formulate **Problem Statement**
  - providing **examples** for communication scenarios in which existing Internet addressing structure is a potential hindrance
- Provide a first **Gap Analysis**
  - Providing an overview on many recognized extensions to core Internet addressing properties

## Generally:

- **Stimulate discussion** on the emerging needs for addressing with the possibility to fundamentally re-think the addressing in the Internet beyond the current objectives of IPv6
- While we recognize the existence of several proposals to fixing aspects we identified, our drafts are not about promoting one over the other but **recognizing the need for and working towards an architectural approach to an extensible and evolved Internet addressing**

# Updates on Problem Statement Draft

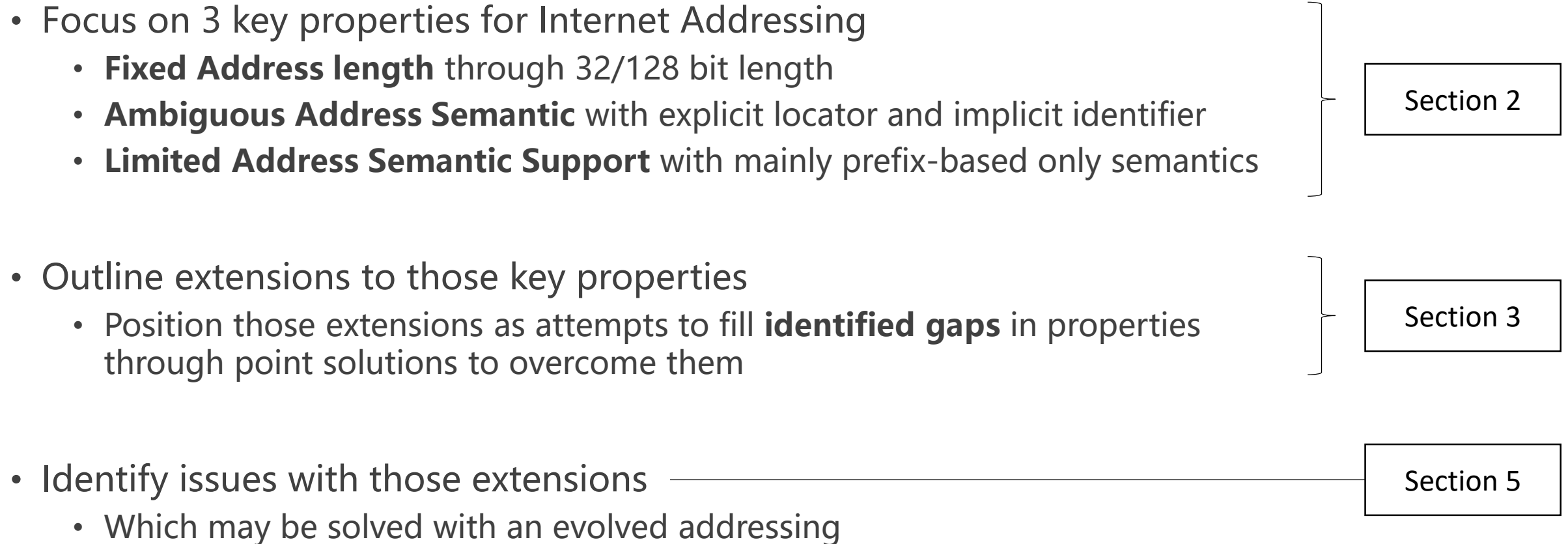
**Welcomed new co-authors:** Nirmala Shenoy (Rochester Institute) & Paulo Mendes (Airbus)

1. Introduction
2. Communication Scenarios in Limited Domains
  - 2.1. Communication in Constrained Environments
  - 2.2. Communication within Dynamically Changing Topologies
  - 2.3. Communication among Moving Endpoints
  - 2.4. Communication Across Services
  - 2.5. Steering Communication Traffic
  - 2.6. Communication with built-in security
  - 2.7. Communication in Alternative Forwarding Architectures
3. Issues in Addressing
4. Problem Statement

Updated scenarios with input from our new co-authors Nirmala & Paulo

Simplified Section 3 in the light of separate gap analysis draft, while adding **fragility** and **extensibility** as additional concerns

# Gap Analysis Draft: Main Flow of the Document

- Focus on 3 key properties for Internet Addressing
  - **Fixed Address length** through 32/128 bit length
  - **Ambiguous Address Semantic** with explicit locator and implicit identifier
  - **Limited Address Semantic Support** with mainly prefix-based only semantics

Section 2
- Outline extensions to those key properties
  - Position those extensions as attempts to fill **identified gaps** in properties through point solutions to overcome them

Section 3
- Identify issues with those extensions
  - Which may be solved with an evolved addressing

Section 5

# Gap Analysis Draft: Summary of Extensions Described

20+ extensions described and referenced – happy to receive pointers to more approaches

	Length Extension	Identity Extension	Semantic Extension
6LoWPAN	x		
ROHC	x		
TOR		x	
ODoH		x	
SLAAC		x	
CGA		x	x
NAT	x	x	
HICN		x	x
ICNIP	x	x	x
CCNx names	x	x	x
EIBP	x	x	x
GeoAddressing	x		x
REED	x (with P4)		x
DetNet		x	
Mobile IP			x
SHIM6			x
SRv6			x
HIP		x	x
VxLAN		x	x
LISP		x	x
SFC		x	x

The identified extensions provide evidence of **shortcomings** of Internet addressing prosperities.

# Gap Analysis Draft: Summary of Issues Identified per Extension

	Limiting Address Semantics	Complexity and Efficiency	Security	Fragility
6LoWPAN		x		x
ROHC		x		x
TOR		x		x
ODoH		x		
SLAAC		x		
CGA	x		x	
NAT		x		x
HICN	x			
ICNIP	x	x		
CCNx name	x			
EIBP	x	x		
Geo addr	x			x
REED	x			
DetNet		x		
Mobile IP		x		x
SHIM6				x
SRv6				x
HIP			x	x
VxLAN		x		
LISP	x	x		
SFC		x		x

Includes aspects like

- Repetitive encapsulation
- Compounding issues with header compression
- Introducing path stretch
- Complicating traffic engineering

The identified extensions provide evidence of **gaps remaining** around the Internet addressing.

# Insights: Problem Statement & Gap Analysis

- There are many scenarios in which existing Internet addressing shows **shortcomings** in realizing them
- Internet community has recognized those shortcomings to the original properties of Internet addressing, and thus developed **point extensions** to fix them.
- There are a number of **compounding issues** with those extensions, particularly **fragility** when considering point extensions in coexistence
- Doing point extensions to addressing, possibly over any existing or new header field imaginable, may be seen as a powerful tool for extending the Internet
  - But developing point solutions may lead to further issues being identified, most importantly it may increase the **complexity** as well as **fragility** of the overall system



# Our expectation for our Work

- Promote discussion to develop an architectural but more importantly a sustainable approach to make **Internet addressing extensible** in order to capture the many new use cases we will still identify for the Internet to come)
- **Any inaction** on our side will only **compound the issues** we identified, eventually hampering the future Internet's readiness for those new use cases.

# Next Steps

- Problem draft
  - Expand on possibly missing communication **scenarios**
- Gap analysis
  - Add missing **extensions** to Internet addressing
  - Elaborate on issues through more **evidence/references**
- Seek new **co-authors** and contributors
- Goal is **adoption** of the documents for future work in INT area

# Open Questions to Community

- Have the extensions shown that **gaps to addressing** have been identified by the Internet community?
- Are the identified issues worth thinking of **different approaches** to addressing the identified gaps?
  - Do we think we can avoid the issues or just uncover others?
- Do you agree that an architectural approach is required that makes **extensibility** of addressing a key principle to future Internet addressing?
  - Or can we afford to continue doing what we have done so far?
- Are there **contributors to this discussion** who would want to work with us to push the discussion and associated material further?

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# THANKS!

Questions / Comments?