# Design Considerations for Applying ICN to IoT "draft-zhang-icnrg-icniot-00.txt"

Ravi Ravindran
(ravi.ravindran@huawei.com)
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# Authors


- Yanyong Zhang (Winlab, Rutgers)
- Dipankar Raychaudhuri  (Winlab, Rutgers)
- Alfredo Grieco (Politecnico di Bari (DEI))
- Emmanuel Baccelli (INRIA)
- Jeff Burke (UCLA)
- Ravi Ravindran (Huawei)[ED]
- G.Q. Wang (Huawei)
- Andres Lindgren(SICS)
- Bengt Ahlgren (SICS)
- Olav Shelen (Lulea University of Technology)

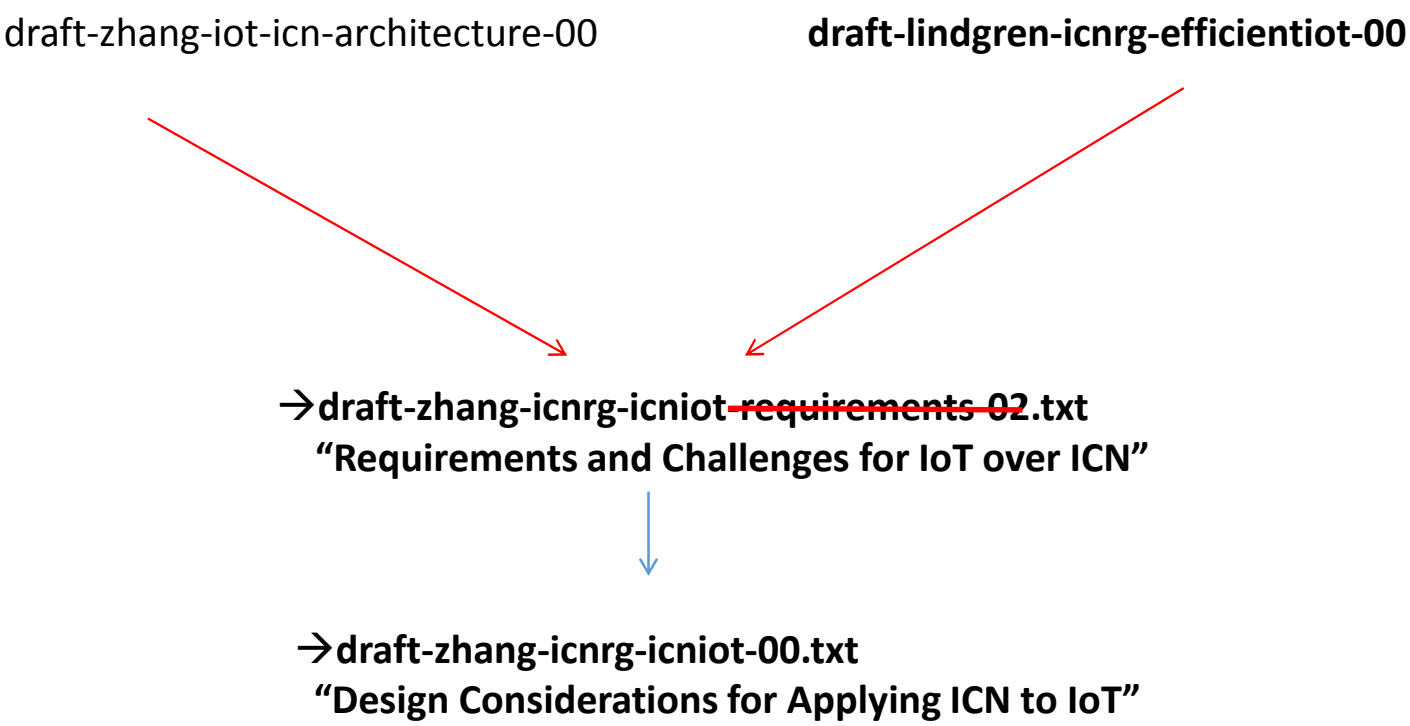
# Last Meeting

- Call for adoption
- Many comments from Dirk, Dave, Borje, Lixia, Marie-Jose, Hassana
- Many comments addressed from previous reviewers as well in the last revision
- Please check this presentation for the comments summarized in the last meeting

https://github.com/ravi3442/share/blob/master/Next-steps-draft-zhang-icnrg-icniot.pdf

# Draft History

- **These drafts have evolved since first presented at IETF-90**



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New Section on motivating why ICN could serve IoT applications better.

Section on suitability of DTN for ICN-IoT

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# Section 2 : Motivating ICN for IoT

**Addresses the comment to why ICN better suits IoT than current solutions**

Four use cases have been discussed:

- Smart Mobility
- Smart Building
- Smart Grid
- Smart Industry

- Each of the use cases points to challenges such as inter-operability, Energy efficiency, Naming, Security, Scalability, Reliability, Availability, Mobility, in-network computing, real-time control and data distribution.

- Which is easy to be engineered over features offered by ICN than over IP.

# Section 3: IoT Architectural Requirements

- 3.1 Naming
  - Clarification on what Names represent - they can be content, data, services or devices (or a group)
  - One of the requirements of the names is to have semantic meaning compared to the address based names that we have today.
- 3.2 Security and Privacy has been promoted after Naming
  - Added a subsection on trust – need for a name certification services, names can be self-certified or structured names.
- 3.4 Resource Constraints
  - Use of terminology Type 1/2/3 depending on the nature of the constrained device
- 3. 9 Communication Reliability
  - Comment whether we need to something more richer than ROLL routing model
  - We removed the reference to ROLL, but suggest the need for richer communication patterns, such as to support D2D communication.

# Section 3: IoT Architectural Requirements

- 3.11 : Adhoc and Infrastructure Modes
  - Comment if this distinction is required
  - Considering a unified IoT platform, the requirement is to support scalable and low latency communication in the infrastructure mode, while supporting efficient neighbor discovery and support ad hoc communication in ad hoc mode
  - Support also need for hybrid mode of communication.
- 3.12 : Unified Architecture
  - Comment on it being too generic
  - Previously called OpenAPI
  - Rewrote this to convey the need to have a unified architecture across heterogeneous IoT systems with standard API for naming, discovery, push/pull, pub/sub, encryption and signature mechanisms to allow interaction between heterogeneous consumer, producers, IoT services, compared to proprietary APIs today.

# Section 4: Application-Layer Unified IoT Solutions

- Previously called “Overlay Based Unified IoT Solution”
  - Addresses the comment on using the term “Overlay” improperly to mean what happens in IoT today.
- 4.2.2. New subsection on suitability of DTN to IoT
  - Previous work on using DTN for IoT
  - DTN Bundle protocol meets some of the IoT requirements like decoupling senders and receivers
  - But basically is a host centric protocol
  - While ICN deals with information naming, discovery, dissemination, mobility etc.

# Section 5: Advantages of ICN for IoT

- Comment on no mention about Security and Privacy aspects
- New subsection to address this
  - Object based Security and Location independence
  - Name-Data Integrity and Authenticity
  - Confidentiality
  - For constrained environments, offloading cryptographic operations to the closest gateway
  - Also usefulness if names are self-certified

# Section 6: ICN Design Considerations

## 6.2 : Security and Privacy

- Promoted this discussion on Security and Privacy after Naming
- More challenges on Security and Privacy in Challenged environments
  - Traditional mechanisms fail considering energy efficiently and long battery life
  - Using physical  wireless signals for security features
- In the infrastructure part, there are more vulnerabilities
  - Faking Sensor Data using malicious sensors
  - Name Spoofing leading to DoS attacks
  - Stale mapping attacks if a name resolution service is used
  - False announcement attack leading to inappropriate routing
  - Collusion attack between User, Network and the Mapping System
- Privacy of data considering it is collected, stored  upon which several learning algorithms are applied
  - Need a Privacy framework on how these functions are executed.

# Section 6: ICN Design Considerations

- 6.4 Caching and Storage
  - Removing explicit reference to capabilities of the constrained devices
  - Need for examples (missed this comment, will be addressed in the next version)
- 6.6 Mobility Management
  - Comment to separate this from the routing discussion
  - A new subsection
  - Challenges on Consumer and Producer mobility has been discussed
- 6.10 Communication Reliability
  - Need more IoT specific challenges here
  - Reliability here is based on what ICN provides in terms of Multi-Homing, Caching and Stateful forwarding
  - QoS considerations when mission ciritical IoT traffic in introduced
  - Reliability consideration during congestion or long/short-term disruptions and last mile wireless impairments
  - Also consider the use of opportunistic Store and Forward at critical points in the network.
  - Brings in Control and Forwarding plane overhead costs, which has to be considered.
  - This mostly focusses on the infrastructure side of things, we will try to extend it from the constrained perspective.

# Section 6: ICN Design Considerations

- 6.11 Resource Constraints and Heterogeneity
  - Renamed it from “Energy Efficiency”
  - Comment on extending this with more relevant discussion
  - Considering the cost of transmission in embedded system, we discuss the need for short local names versus global names
  - And how these can be mapped at the aggregator gateway points
  - Also points to the discussion on other network services and function such as naming, name resolution, routing/forwarding etc to optimize IoT device resource usage.

# Next Steps

- We can further improve on some of the comments that are still unaddressed
- Hope we can adopt this as a RG document to solicit more comments from the community for further improving this draft