Design Considerations for Applying ICN to IoT "draft-zhang-icnrg-icniot-01.txt"

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https://tools.ietf.org/html/draft-zhang-icnrg-icniot-01

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Last Meeting (IETF 99)

- Call for adoption, still waiting for comments from the review volunteers
  - Spoke to the volunteers, said it is underway
- Received detailed review from Dave
  - Shared a supplementary document capturing the changes
- Still waiting for the comments from volunteers
- The revised draft addresses these comments

Draft History

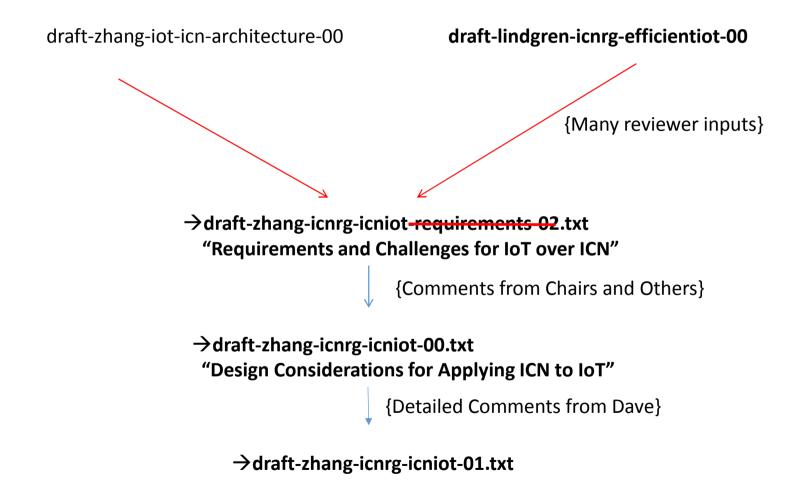- **These drafts have evolved since first presented at IETF-90**

draft-zhang-iot-icn-architecture-00   **draft-lindgren-icnrg-efficientiot-00**

{Many reviewer inputs}

→**draft-zhang-icnrg-icniot ~~requirements 02~~.txt**
"Requirements and Challenges for IoT over ICN"

{Comments from Chairs and Others}

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

{Detailed Comments from Dave}

→**draft-zhang-icnrg-icniot-01.txt**

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General Updates

- Reduced the use of term "requirements" throughout the draft, as the focus is on design considerations

- Replaced the term "Platform" with "Architecture"

- Avoid making sweeping generalization - we have taken care of that throughout the draft

- Authors list is still the same, we will update in the next round with only the active contributors

Abstract

- Replaced "propose to build ICN-IoT platform" with ".. Information Centric Network (ICN) architecture can provide a common set of protocols and services, called "ICN-IoT" which can be used to build IoT platforms."

- Removed the draft layout summary from the Abstract

Section 1: IoT Motivation

- Replaced the use of "unified platform" with "unified architecture"

- We removed the text under the requirement on OpenAPI to this section, emphasizing the current scenario dominated by heterogenous architectures and protocols

- Modified the statement on "all" to "most" of the IoT applications are information-centric

Draft Updates

- **Section 2: Motivating ICN for IoT**
  - "Contextual Networking" (forward reference to Section 3.6)
  - Significant updates to the use case scenarios
    - Generally these focusses on the specificities of the use case, why ICN architectures would be useful and challenges.
    - Smart Mobility
    - Smart Building
    - Smart Grid use case has been re-written with relevant recent ICN work
    - Smart Industrial Automation

Draft Updates

- **Section 3: IoT Architectural Requirements**
  - Naming:
    - Clarifying previous text on "names need to be secure"
      - replaced with new text around naming requirement to both device-centric and content-centric communications and secure binding between name of the device or the content and the key.
    - Semantic Meaning usefulness of names at odds with privacy
      - Replaced this a more general requirement of choice of names should be dependent on application and networking requirements such as privacy and scalability

  - Security
    - Clarified the scope privacy
      - Privacy includes several aspects: (1) privacy of data producer/consumer that is directly related to each individual vertical domain such as heath, electricity, etc., (2) privacy of data content, and (3) privacy of contextual information such as time and location of data transmission.
      - Discussion related to name certification service (NCS), required to bind keys and certificates to consumer/producer names, to generate self-certified IDs moved to the name requirement section.
  - Scalability
    - Taken comment on "scalability affected due to object count, state and rate of information updates generated by the sensing devices."
  - Contextual Communication
    - Defines now two types of contexts , long-term quasi static, and short term contexts which is more challenging to handle.

Draft Updates

- **Section 3 : IoT Architectural Requirements**
  - Storage and Caching
    - Suggestion to separate this, we have kept it together in the requirements but separated in the design consideration section
    - Clarification on applying policies on caching that is either application or network driven
    - Clarification on Name resolution to store copies rather than cached ones
  - Communication Reliability
    - Modified statement on requiring IoT systems requiring seamless mobility under normal operating conditions rather than during extreme disruption
    - Clarification on what we mean an IoT domain being a collection of IoT nodes with gateways connecting to the infrastructure
  - OpenAPI
    - Moved this to introduction

- **Section 4: State of Art**
  - Clarification on IP based IoT systems as being meaning service overlays
  - Section 4.1 : Silo IoT Architecture
    - Comment on current protocols like BACNET are device centric, leading to fragmented IoT space requiring service gateways/overlays for inter-operability
  - Section 4.2 : Application Layer Unified IoT solution
    - Addressed the comment on object based security model being no less complex than session based security model
    - Cost amplification in the session based security model for constrained devices, because of number of sessions and the session state it has to maintain every time data is requested.
    - On traffic characteristic of IoT requires multicast support, which has limited support in the Internet, hence have to reply on application layer multicast mechanism.
    - Addressed comment on need for self-organization at service, content and topology level , which IP doesn't support inherently.

Draft Updates

Section 4.2.2. : Suitability of DTN

- Addressed the earlier statement of DTN being end point centric
  - Clarified DTN names services or end hosts, could potentially name content too, but would require bundle protocol with more architectural/protocol component from ICN.

Section 5: Advantages of ICN for IoT

- Naming of Device/Data/Services : Clarified some points around naming in IP versus naming in ICN which can be generalized to all these three resources (content, services, hosts).

- Security : took the comment - Removed initial discussion of trust. Explain how the same security functionality secures objects both while being transmitted and when stored in caches.

Draft Updates

Section 6: Design Challenges and Considerations for IoT

6.1 Naming Devices Data and Services

- Naming of Devices: Clarified the need for carefully name devices in addition to content it generates, persistent identity to ensure mobility, names can be contextual , ensure the device is always reacheable inspite of request aggregation.
- Added a new challenge using hierarchical names, requires third party to validate name-key binding
- On trust : On Web-of-trust alternative comment has been taken
- Semantic based naming : Clarified the text on using key words to request content, challenges around more advanced functionality to match metadata in data objects with requested keyword metadata.
- Scoping has been re-written from application and network's point of view.
- Confidentiality of names: Most of this has been re-written, cites recent work on Attribute Based Encryption and Access Control Delegation scheme.

Draft Updates

- **Section 6.3**
  - Security and Privacy :
    - Clarified comment that this is contextual in the context of IoT, and added ICN feature to support session based security based on the draft to create and maintain session based trust association, in addition to data object security.
    - Modified discussion related to security implications for resource constrained devices
    - Some attacks related to ICN infrastructure with NRS has been elaborated on.
- **Section 6.4**
  - Caching and Storage
    - As suggested, we have split these two discussions
    - Storage has been discussed in the context of long term and short term storage. The latter being used to improve reliability over unreliable wireless links.
- **Section 6.5**
  - Routing and Forwarding
    - Challenges associated with routing in constrained domain has been added, in addition to routing directly on names versus using a name resolution service.

Draft Updates

- **Section 6.6**
  - Mobility Management
    - Added challenges around different types of mobility that needs to be handle considering the diversity and heterogeneity of access mechanism in addition to consumer/producer mobility challenges
- **Section 6.10**
  - Self Organization
    - Has been rewritten considering the need to scale IoT device provisioning – on boarding, device/service discovery, naming etc.
- **Section 6.12**
  - Edited this section to remove the initial general discussion to make it more focused on optimization challenges in constrained IoT segments.

- **New Section 7-10**
  - Differences from T2TRG
  - Security Considerations
  - Acknowledgements
  - Conclusions
- Also cited many recent works in the ICN-IoT space throught the draft.

Next Steps

- The draft has taken inputs from chairs and other reviewers over the last two iterations to change its focus from a requirements to a design considerations and challenges draft.

- Request the chairs to formally adopt it as a RG draft to improve it further.