Decentralized Internet Infrastructure (Proposed IRTF RG)

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Decentralized, Cloudless, Thing-to-Thing

- Have gotten used to centralized structures
  - Web apps, mobile apps, early IoT
- Strong incentives for going centralized
  - Easy to understand
  - Economic incentives: counting users, locking in users, receiving constant revenue…
  - Centralized has become the accepted mantra for developing services -- people are brought up to think that way
  - Mixing up communication services with choices for system design and implementation
- Centralized not *always* great
  - Constrained networks do not want to (cannot) be connected to the cloud all the time
  - People want to run their home IoT system even when equipment/cloud service provider goes bust
  - For managing local services, identities etc., privacy and independence concerns may overweigh convenience -- no trust in cloud...
  - The cloud is not always convenient...

“Distributed/Decentralized Internet Infrastructure”

- Exploring potential to **decentralize Internet Infrastructure with distributed ledger technology**

- Identifying use cases and their commonalities
- Understanding available/emerging technologies and their features and constraints
- Analyzing impact on Internet technologies and IETF work

Initial Thoughts

- Intuitively there is an interesting networking angle to ledger technologies
  - Redesigning previously centralized infrastructure systems
  - Solving problems that were hard to address in the past
  - Addressing new use cases
- IoT
  - Identity management
  - Distributed protocol registries
  - Data sharing -- finding data and paying for it
  - Also see Carsten’s presentation at previous DIN meeting
- Distributed Web
  - Thomas’s OAuth work
  - Data sharing
- ICN
  - Name, identity, PK resolution systems (just a thought…)

Scope of a Potential IRTF Activity

- Forum for researchers concerned with Decentralized Network Applications and Operations
- Framing document
- Investigating and documenting use cases
  - And their requirements regarding ledger infrastructure etc.
  - With a focus on Internet technologies (not necessarily global Internet)
  - Security/privacy (cryptography expertise)
- Creating frameworks for most important use cases
  - Selecting applicable ledger technologies
  - Specifying transaction models, smart contract, operational requirements
  - Opportunity to avoid silo approach (specific ledger systems for individual use cases)
- Creating and operating testbeds
  - Operational infrastructure that can be used by others

Topics

- Applicability of cryptographic data structures to internet infrastructure
  - Scalability
  - Security properties
- Economics, “fairness,” and property models
  - incentives
- Infrastructure elements
  - Naming
  - Identity
  - IoT
  - Routing (BGP)
- Data sharing
  - Authorization
  - Delegation

Relation to T2TRG

- **Resource directories** -- leveraging distributed ledger
- **Data and service sharing** -- finding resources and paying for usage
  - Local data centers
  - Edge computing resources
- **New authorization schemes** -- leveraging reputation stored in ledgers
- **Trust management** -- how can I trust users, mobile code etc. ?
  - Leveraging distributed consensus algorithms?

- **Interesting Questions**
  - Use case details and their requirements (e.g., consensus algorithms)
  - Applicable DLT, also considered constrained devices and communication resources

Proposed DINRG

- Melinda Shore and Dirk Kutscher
- Charter: https://trac.ietf.org/trac/irtf/wiki/blockchain-federation
- Mailing List: https://www.ietf.org/mailman/listinfo/din

Edge Computing

- Currently hot topic du jour in (Industrial) IoT and related areas
- Mainstream: Running VMs on gateways
  - Always connected to cloud backend
  - Apply NFV MANO
- **Research thesis: Can we do it less ossified?**
  - Enabling distributed computing in networks of Things
  - “Where is the edge and why should I care?”
  - Compute function location and corresponding data flows should be determined by capabilities of nodes, operational requirements and local optimization objectives
  - Functions can end up on a gateway -- or on any other supporting node
- **Research Questions**
  - What are the right compute abstractions?
  - Different options, e.g., ICN and Named Function Networking
  - How would this fit into T2TRG environments?