

NDN-FCH: The Big Rewrite TM

11th NDN hackathon, 2021-05-23

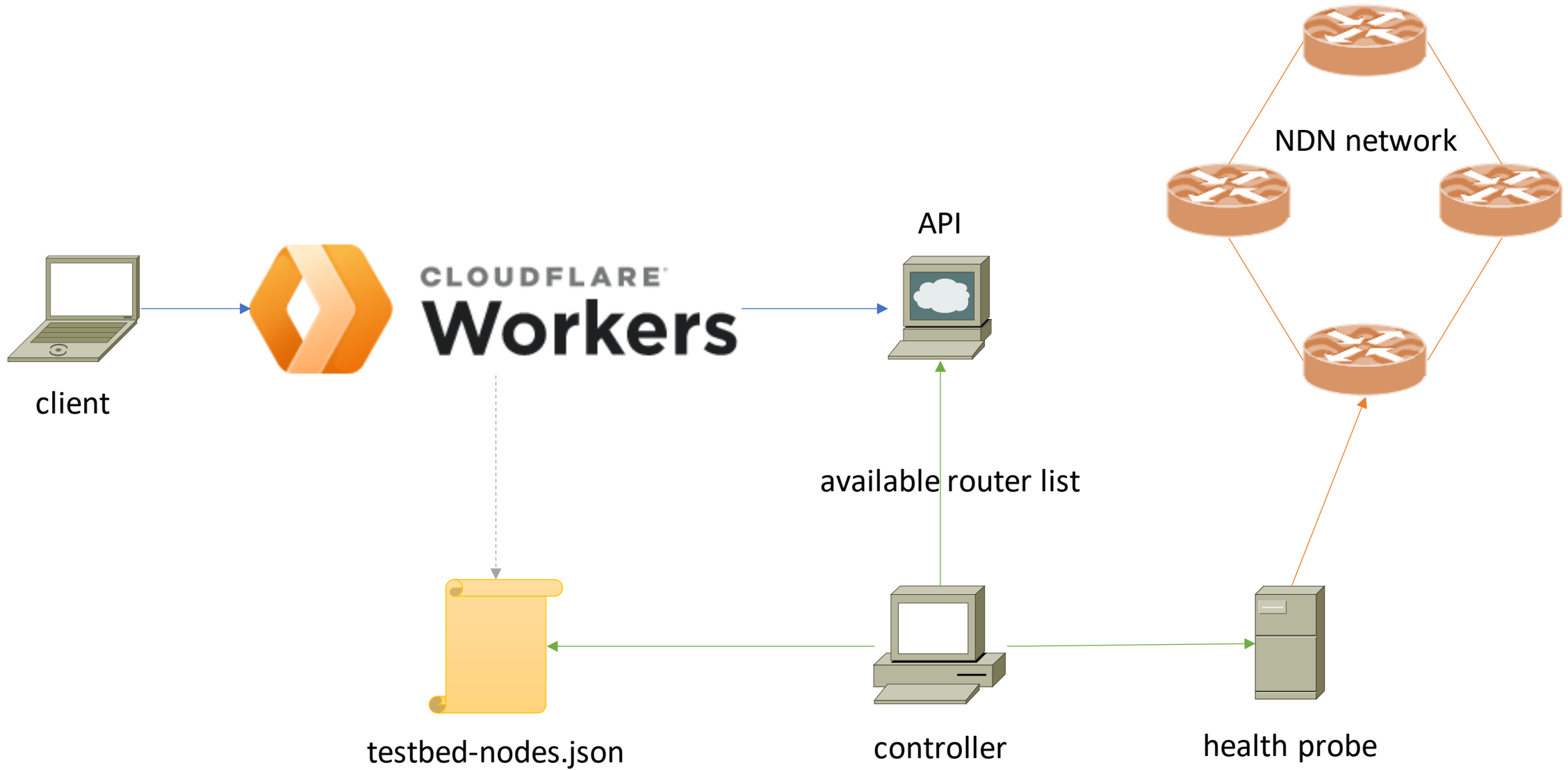
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NDN-FCH: The Big Rewrite TM

current NDN-FCH	The Big Rewrite TM
limited ability to choose transport protocols	JSON response contains available transport protocols
no router health monitoring	periodical reachability tests from around the world <ul style="list-style-type: none">• IPv4 & IPv6• UDP, WebSockets, HTTP/3 over QUIC
single point of failure (9hr downtime in 60 days)	frontend on Cloudflare Workers <ul style="list-style-type: none">• proxy to origin API servers• fallback algorithm with country-level accuracy
MaxMind database download broken since 2019	download GeoLite2 with MaxMind license key
geo closest != network closest	collect RTT feedback from clients, improve future recommendations to clients in the same AS number (partial completion during hackathon)



System Architecture



Coders



Junxiao Shi
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- controller (Go)
- HTTP/3 probe (Python)
- Cloudflare Workers



Zhiyi Zhang
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- API server (Python)



Eric Newberry
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- UDP probe (Go)
- WebSocket probe (Go)



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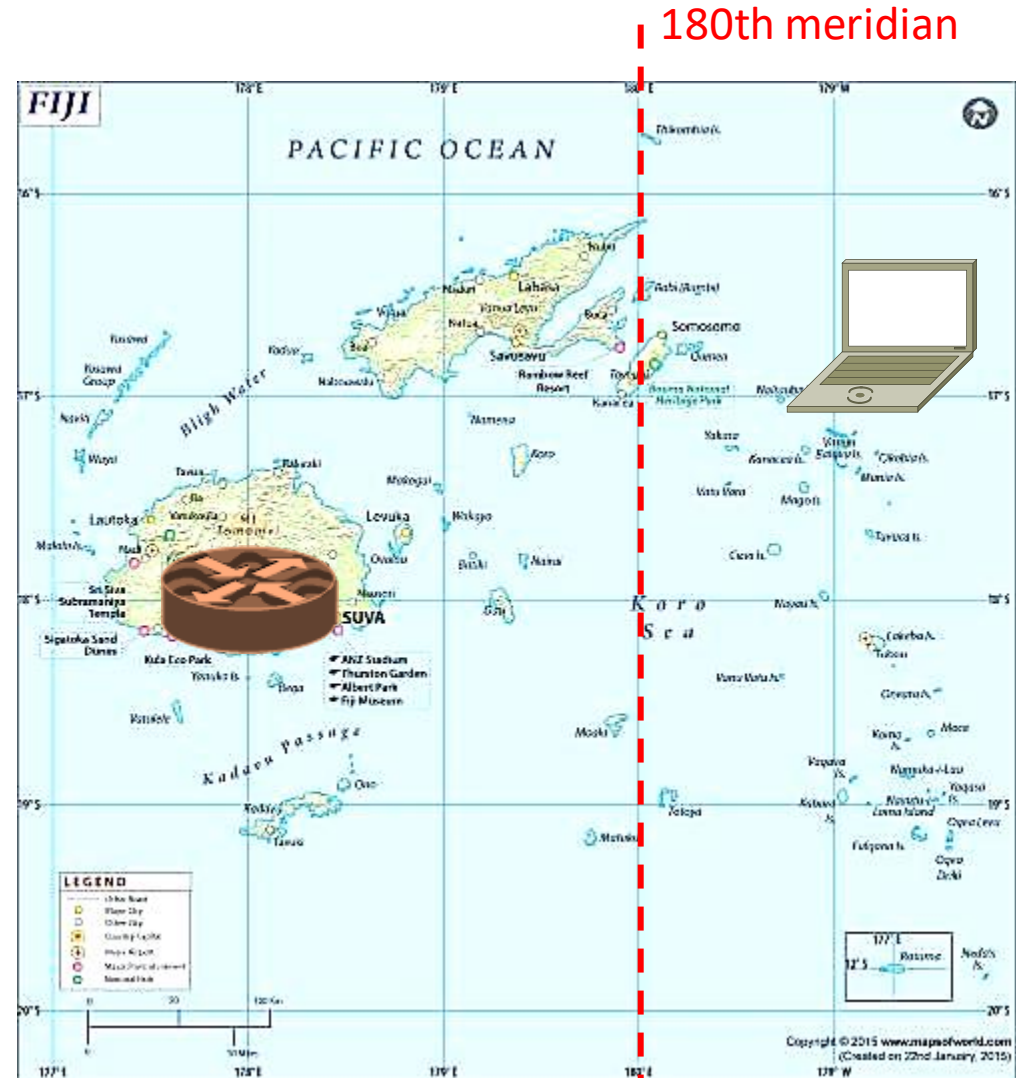
- Cloudflare Workers

Availability: Robustness at Every Level

- Frontend is on Cloudflare Workers.
 - Cloudflare outage is rare.
- API service has multiple replicas, operating independently.
 - If all replicas fail, the frontend has fallback logic using `testbed-nodes.json`.
- Controller and health probes are optional.
 - If they fail, API service keeps using the last known router list.

The Earth is Not Flat

- Previous NDN-FCH runs KNN algorithm with plane coordinates.
- In Fiji:
 - Naitauba Island: $W179^{\circ} S17^{\circ}$
 - Suva: $E178^{\circ} S18^{\circ}$
- Distance on earth: 153km
- Distance on flat plane: 39741km
- We fixed it: `geopy.distance`



map credit: holidaymapq.com

Health Monitoring

- In previous NDN-FCH system:
 1. testbed-nodes.json is updated every 10 minutes.
 - It reports known outages and ndnping results from WUSTL.
 2. API service retrieves testbed-nodes.json hourly.
 - If firewall blocks port, ndnping may succeed but client cannot access router.
- In our NDN-FCH system:
 1. Start with testbed-nodes.json + static list of @yoursunny's NDN network.
 2. Connect to every router and send Interests over every transport protocol.
 - UDP, WebSockets, HTTP/3 (@yoursunny network only).
 - IPv4 and IPv6 separately.
 3. If Data come back, router is up.
 4. API service returns available routers only.

IP Geolocation: no more MaxMind

- Previous NDN-FCH determines IP geolocation using MaxMind GeoLite2 database.
- Workers receive IP geolocation automatically.
 - Free plan used to get country-level accuracy only.
 - Cloudflare blog, [2021-04-13](#): "Geolocation data is now accessible and free for all developers on our Workers platform, including users on the free plan!"
- Frontend Workers script fills in Cloudflare-supplied IP geolocation before sending request to API service.
 - MaxMind no longer needed. Fewer moving parts.

Deployment

- Source code: <https://github.com/11th-ndn-hackathon/ndn-fch>
- API service, controller, health probes are Docker containers.
 - One replica deployed in Dallas. Another planned for Europe.
- Frontend Workers script is on Cloudflare Free plan.

```
$ curl -i 'https://fch.ndn.today/?k=2&cap=udp'
```

```
HTTP/2 200
```

```
x-fch-query: k=2&cap=udp&ipv4=1&ipv6=1&lon=9.49100&lat=51.29930
```

```
ndn-testbed.ewi.tudelft.nl,dmi-ndn-testbed1.dmi.unibas.ch
```

- NDNts @ndn/autoconfig can be configured to use this server.
 - <https://pushups.ndn.today> , see the request in F12 – Network tab

Future Work

- NDNLIPv2 fragmentation and reassembly in UDP probe.
 - Detect if firewall blocks IP fragments.
- Send more than one Interest from health probes.
 - Router wouldn't be marked as failed due to a single timeout.
- Remember recent history of router health in controller.
 - If a router is flapping, don't use it unless there's no other choice.
- Client app/library for NFD and microcontrollers.
 - `ndn-autoconfig` program and `esp8266ndn` library need to be updated to use HTTPS.