

SECURE IoT HOME GATEWAY & HOME REGISTRY – IDEA & VISION

OPEN STANDARDS DEVELOPMENT



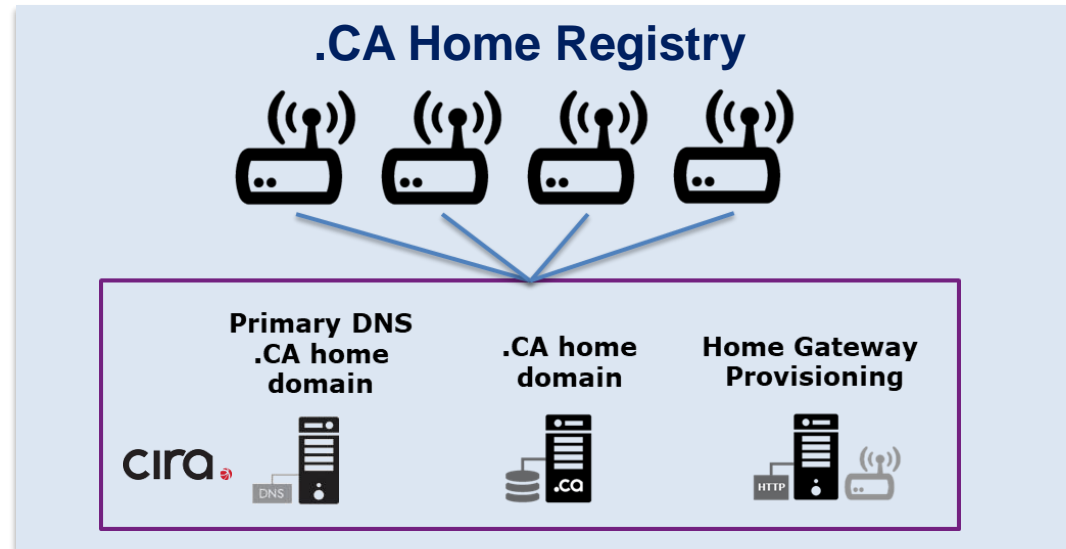
Jacques Latour, CTO
Canadian Internet Registration
Authority

January 24, 2018

2 DISTINCT IDEAS INTO ONE SOLUTION

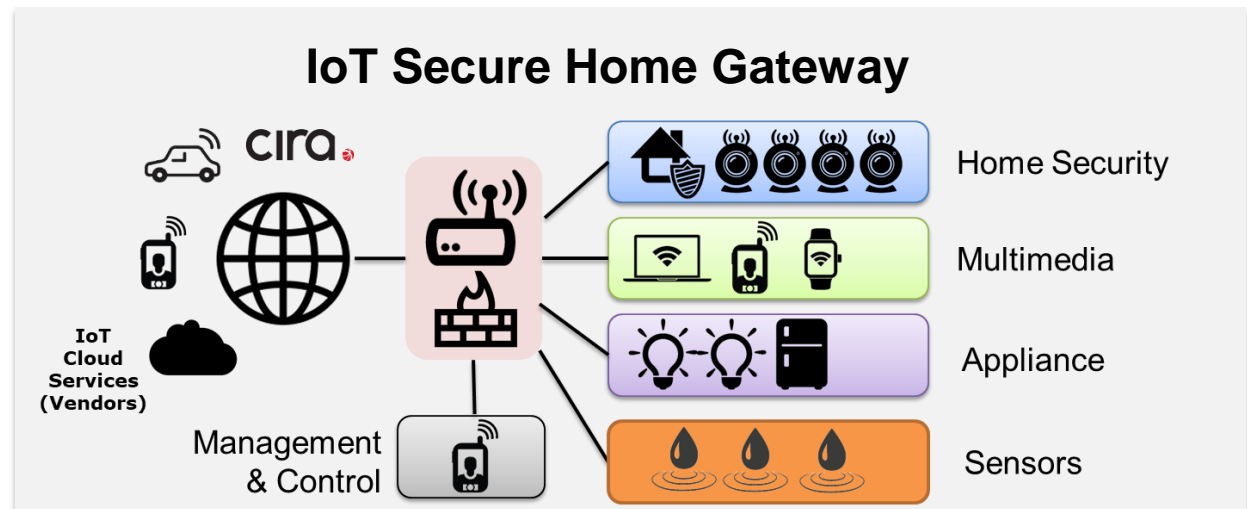
IDEA #1 – ccTLD Home Registry Value Proposition:

- For ccTLD, to have a domain per household
- Leverage the DNSSEC chain of trust by having a registered domain for home use



IDEA #2 – Secure Gateway Value Proposition:

- To create a security framework to protect the Internet from IoT device attacks
- To enhance the home network privacy & security with network access controls



SECURE HOME GATEWAY & REGISTRY IDEA

- For many internet organizations, the #1 risk on their risk register is a large scale (Dyn like) DDoS attack. One of the mitigation mechanisms for this risk is to prevent weaponization of IoT devices
- Protecting IoT devices at the edge is another layer of security that should be further developed
- The security controls would be aimed at protecting the IoT devices from the internet, and to protect the internet from IoT devices.

IoT THREAT LANDSCAPE SPECIFIC TO THE INTERNET - CURRENT

- IoT device compromises:
 - Used in internet attacks i.e. MIRAI/DYN Attack (DDoS) targeting DNS servers (1.2 Tbs)
- IoT traffic reflection and amplification
 - IoT device used to amplification traffic attack (DDoS) NTP, DNS, SNMP.
- DNS compromises
 - Can be used to spoof DNS name, redirecting users to compromised web sites or services.
- IoT devices must not have wide open internet access, inbound/outbound internet access must be controlled.

TODAY'S HOME NETWORK & IOT
IMPLEMENTATION ARE DISPARATE,
KIND OF SCARY & IN NEED OF STRUCTURE!



THE HOME NETWORK OF THE FUTURE MUST BE SAFE, SECURE AND SIMPLE TO USE!



THE HOME NETWORK MUST BE REACHABLE FROM THE INTERNET SEAMLESSLY AND SECURELY



EVEN YOUR CAR WILL BE CONNECTED TO YOUR HOME NETWORK



because your **home** is bigger than your **house**

THE HOME NETWORK GROWS TO INCLUDE PERSONAL AND WEARABLE IOT, INSIDE AND OUTSIDE THE HOME...

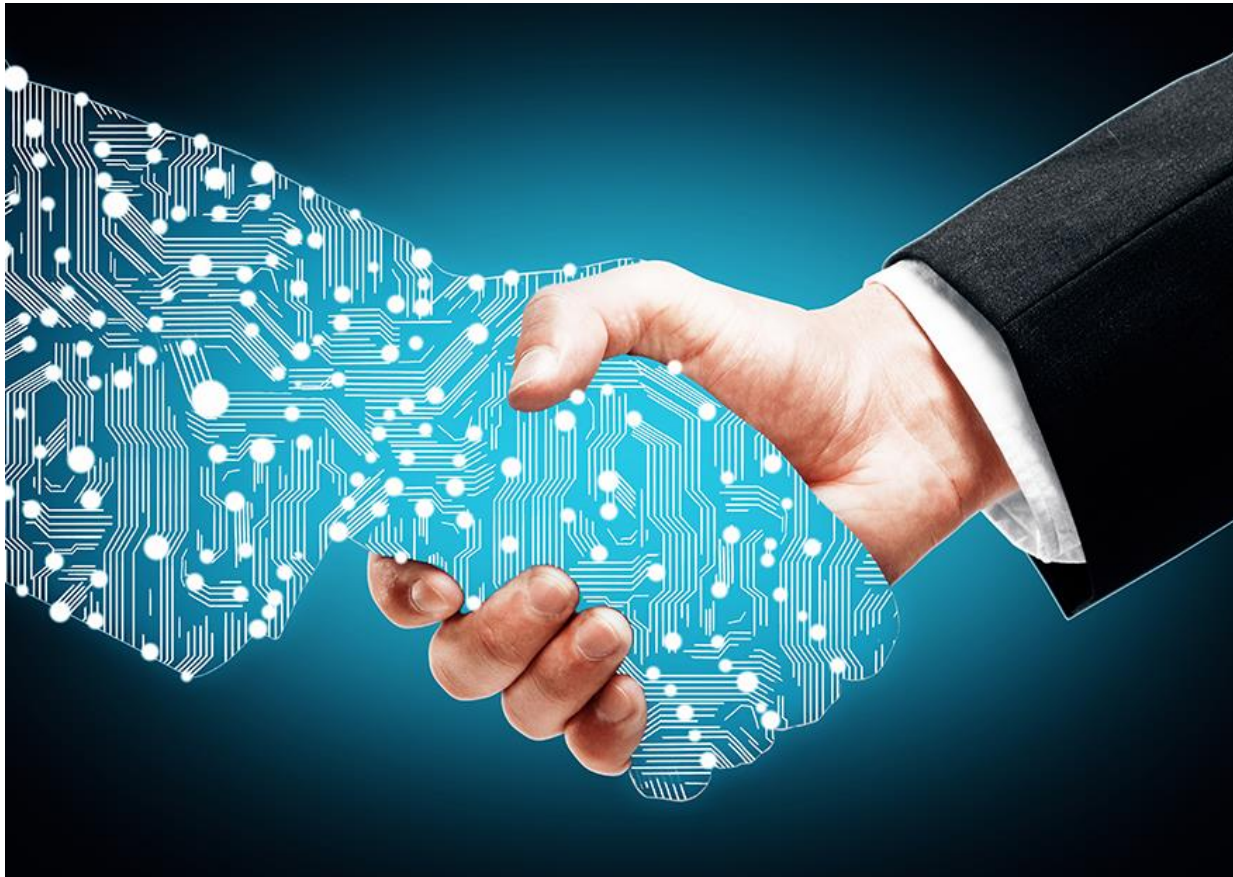


because eventually they will be IPv6 enabled

YOUR HOME NETWORK SECURITY BOTH
INTERNAL AND EXTERNAL MUST BE
PROTECTED USING A COMMON KEY



LEVERAGING THE CHAIN OF TRUST IN DNSSEC AND SOME INNOVATION TO CREATE A SECURE HOME NETWORK PLATFORM

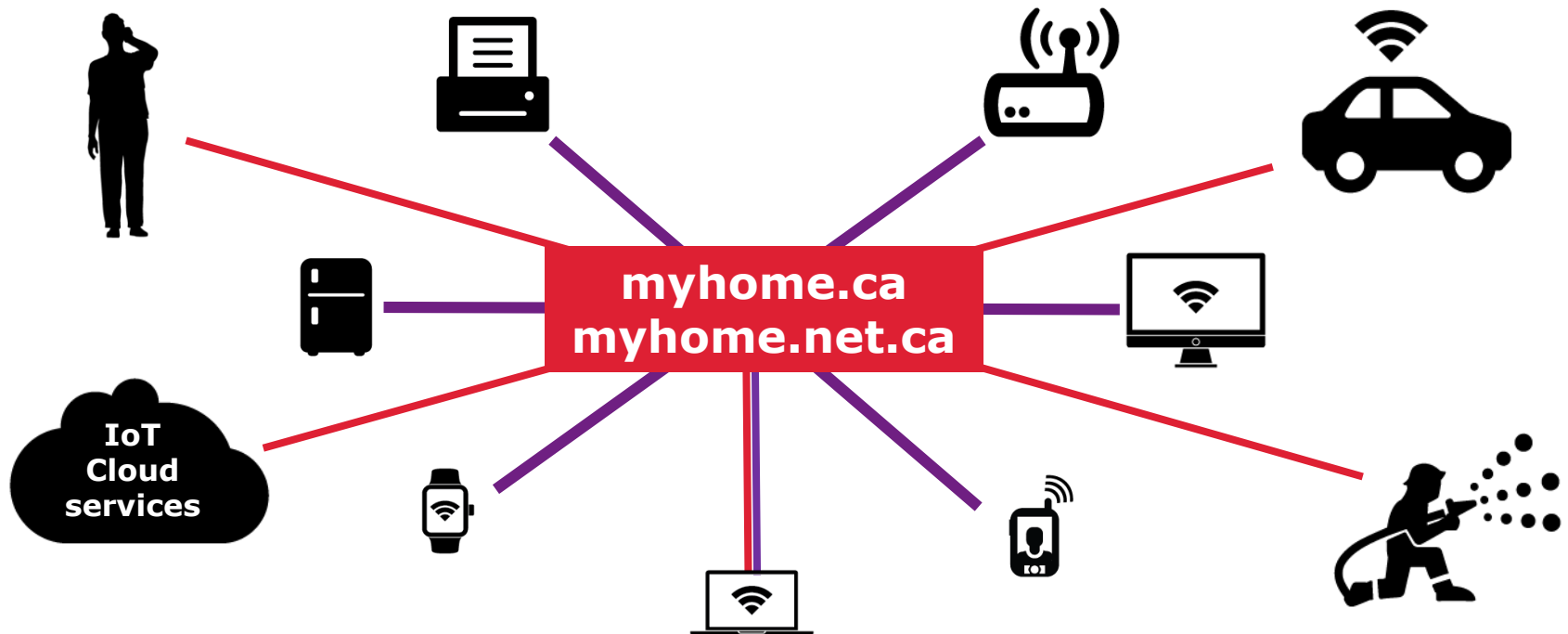


DO WE NEED TO SAY MORE?

Public service announcement: We're out of IPv4 addresses !!!



WHAT DOES THIS BRING TO THE ccTLD DOMAIN INDUSTRY?



A domain name per household!!!

HOME.ARPA. DRAFT-IETF-HOMENET-DOT-14

- IETF working on making the default home network address: [yourprinter.]home.arpa.

<<The naming mechanism needs to function without configuration from the user. While it may be possible for a name to be delegated by an ISP, homenets must also function in the absence of such a delegation.>>

- Let's make delegated "home" domains function without user configuration!

THE FOCUS IS ON AUTOMATION

Registry Automation



+

Home Network Automation

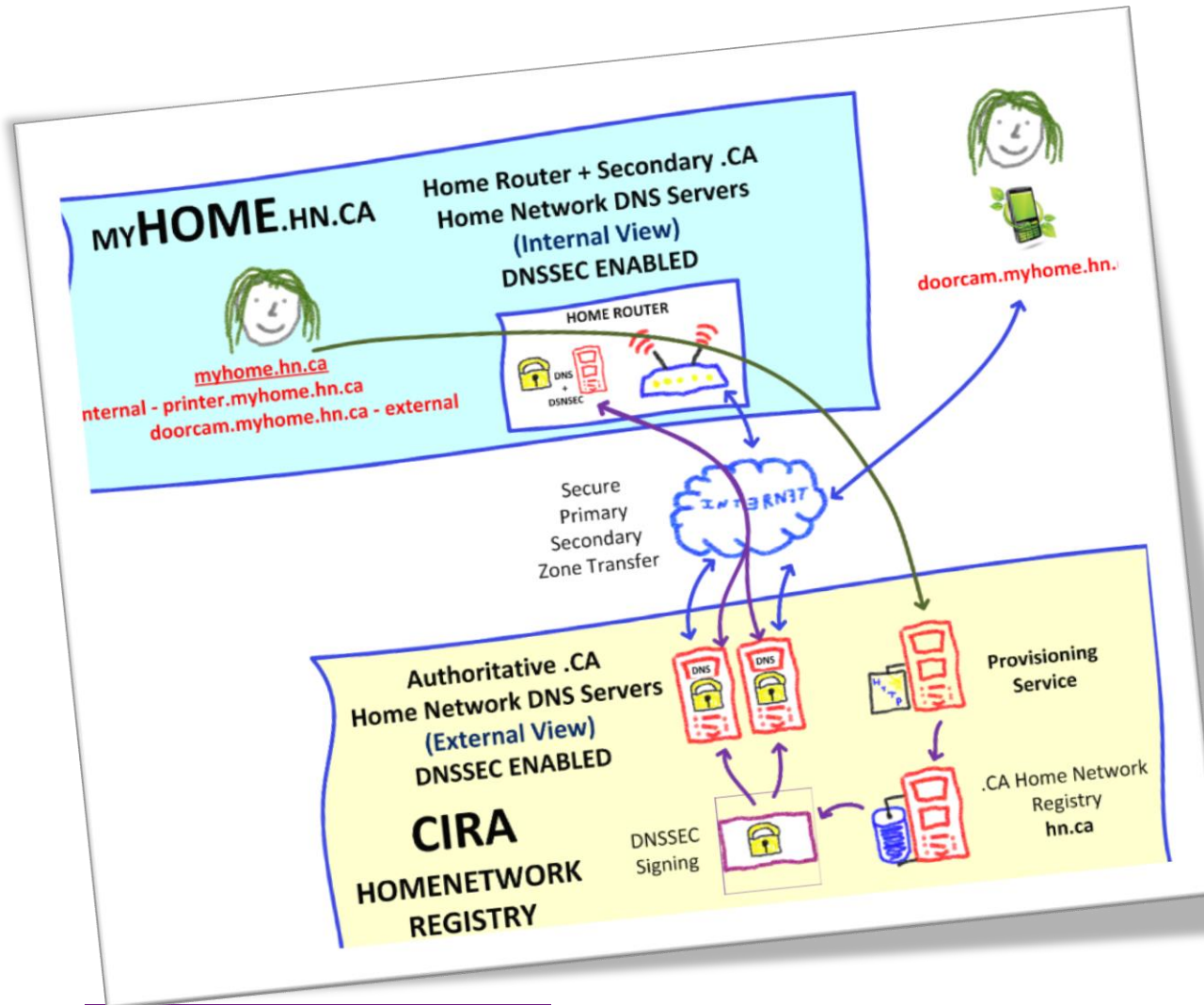


Innovation



Your local ccTLD will provision your DNSSEC signed domain internally on your gateway and externally as DNS primary, and establish a secure chain of trust to your home gateway, **magically** solving all your worries and keeping your online family safe 😊

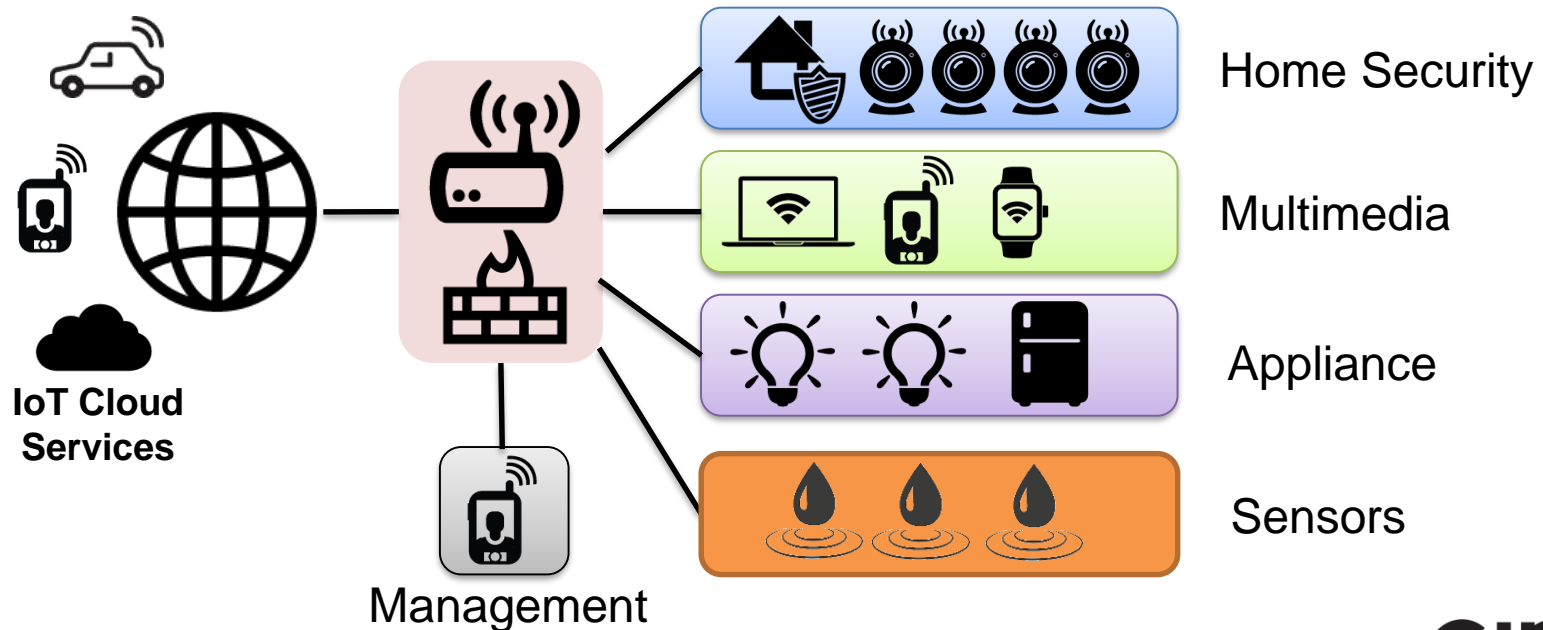
REMEMBER, IT'S AN IDEA.
SO FAR IT LOOKS LIKE THIS...



WHAT ABOUT IoT SECURITY?

WHAT ABOUT THE HOME NETWORK?

- Protect IoT device (inbound and outbound access)
- Rule 1: Place behind firewall
- Rule 2: Segment network by IoT type (NAC)
- Rule 3: Control access to and from the IoT device

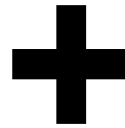


NETWORK ACCESS CONTROL (NAC) & DEFAULT SECURITY CONTROLS

- Something like ; packetfence on openwrt
- Example of default zone security controls / policies
 - Home Security -> may have access to cloud
 - Emergency services may have access
 - Sensors -> no access to internet
 - Appliances may have access this zone
 - Appliance -> no access to internet
 - VPN may have access this zone
 - Allow myhome.ca to access myparents.ca
 - Only for Home Security and sensors

STEP 1

- When you buy a home gateway, it comes bundled with a .CA home network domain




A 2nd or 3rd level domain
i.e. myhome.net.ca
i.e. myhome.ca

RFID card
(Code to activate
provisioning and
domain)

STEP 2

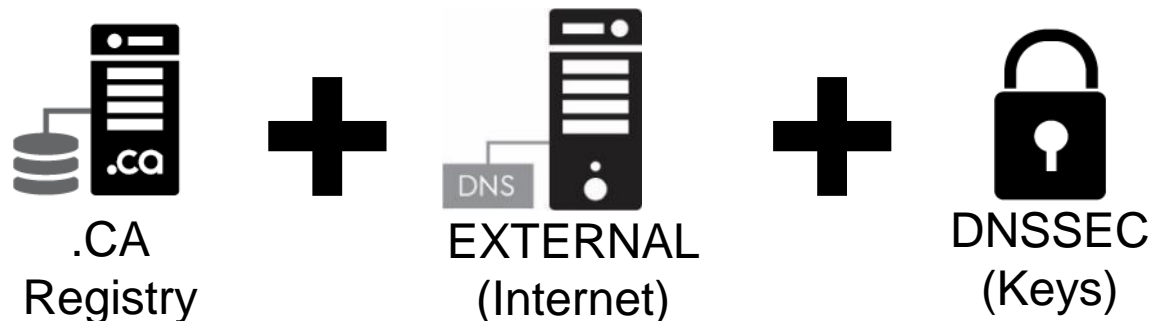
- Then you follow the provisioning instructions
 - Install & open the CIRA Home Gateway app
 - Turn on the Home Gateway
 - “TAP” your mobile to discover the home gateway
 - Pick a domain name, 2nd or 3rd level domain name
 - Enter the secret code (“TAP” RFID card)
 - Home Gateway ready for configuration



myhome.ca +  **code**

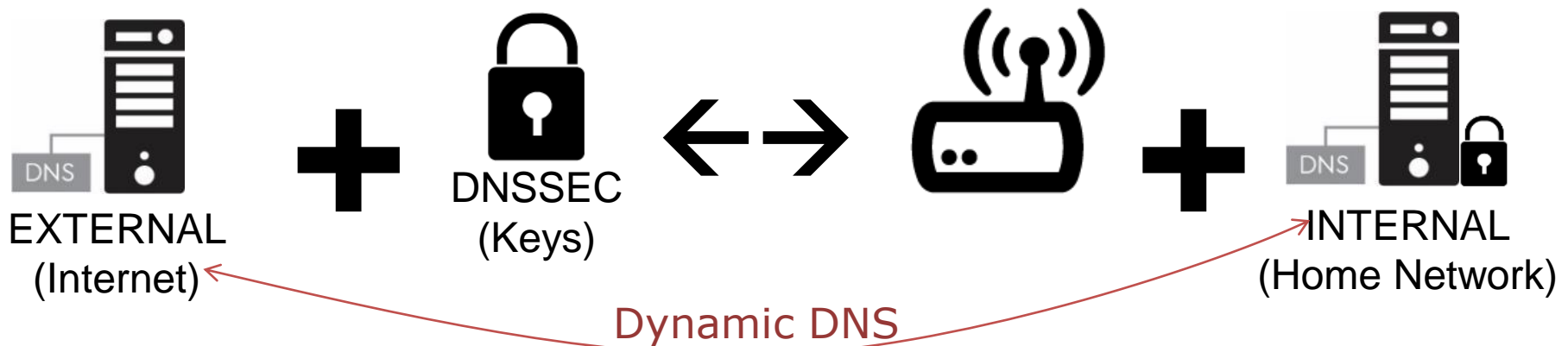
STEP 3

- Automated Backend Provisioning @ CIRA
 - CIRA creates the .CA domain name in the registry
 - CIRA signs the .CA domain with DNSSEC
 - CIRA is primary for the external DNS view of the .CA domain
 - CIRA provides secondary DNS to the .CA domain



STEP 4 (NEEDS WORK)

- Automated Home Gateway provisioning
 - Establish secure connection to Home Gateway
 - Securely send private DNSSEC key to Home Gateway, setup internal DNS and DNSSEC
 - Configure Home Gateway for DNS integration with registry (à la dynamic DNS) for external services



STEP 5

- Setup secure home network infrastructure
 - Using your trusted mobile & the app, “TAP” the Home Gateway to:
 - Learn the WIFI password
 - Get the IPSec password, SSO tokens and keys to VPN in your home network
 - Use your mobile and “TAP” all your IoT devices to add on your home WIFI network, easy peasy 😊

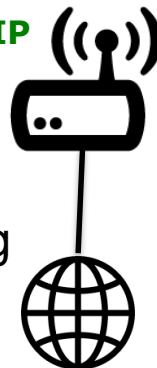


AT THIS POINT WE HAVE

- A home gateway fully provisioned with a .CA domain name, with both internal and external domain name resolution, signed with DNSSEC.
 - WIFI and other networks securely provisioned and setup
- Now we're ready to provision the IoT devices

fridge.la-house-a-latour.ca Internal IP
printer.la-house-a-latour.ca Internal IP

Internal domain fully operational
Secured internally by DNSSEC

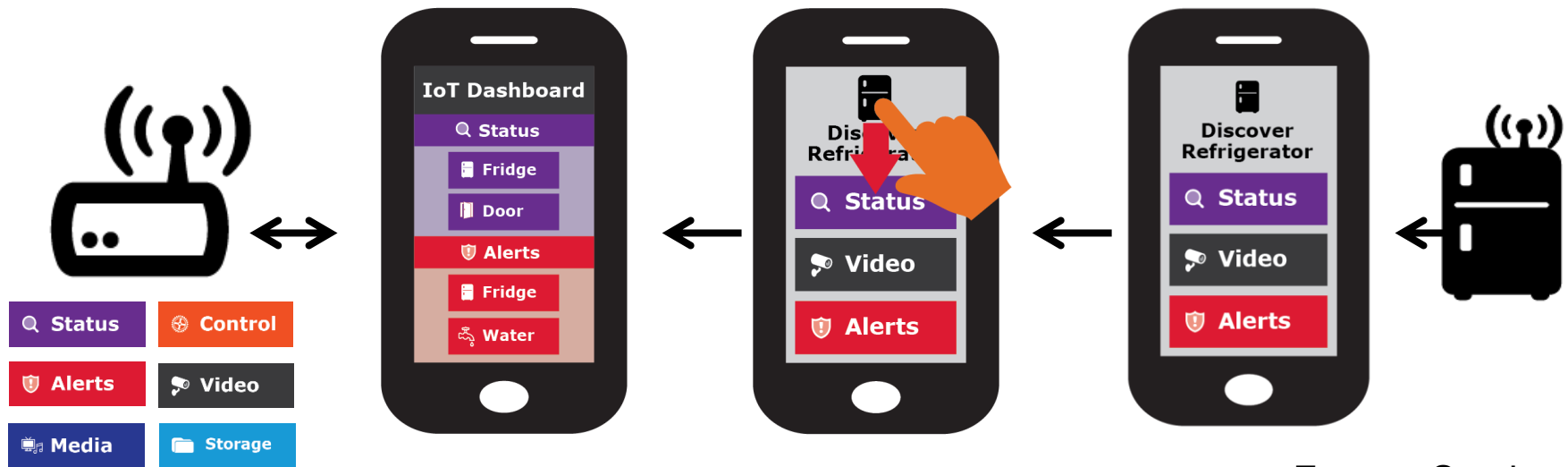


External domain to allow exposing
internal services and make them
available externally

vpn.la-house-a-latour.ca External IP

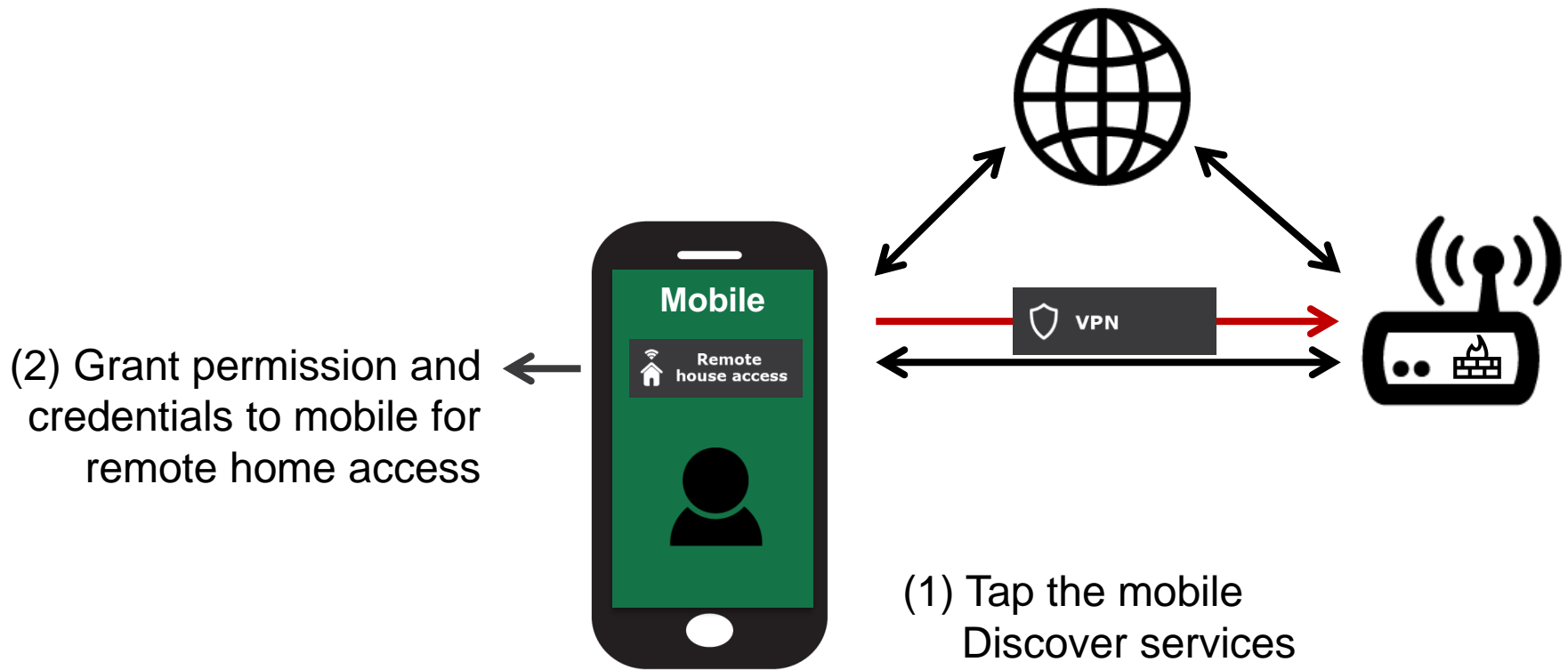
NOW, LET'S SEE HOW WE PROVISION IoT DEVICES IN HOME NETWORK

- Once the IoT device has network access TAP to discover
- IoT device exposes via RFID (or similar) the services available
- Pick relevant IoT services category fro provisioning

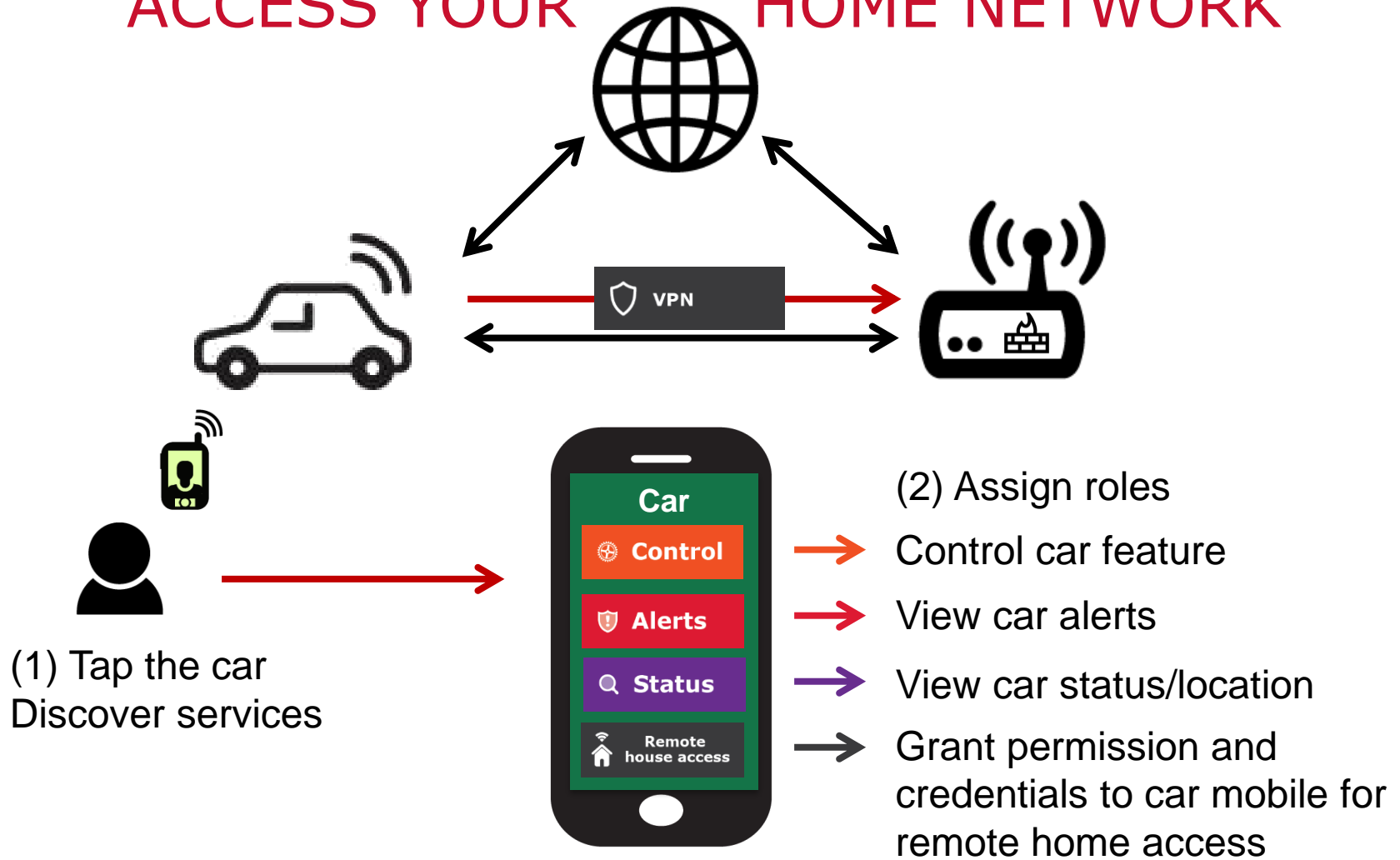


Expose Services
JSON blob / RFID

ADDING REMOTE VPN ACCESS TO TRUSTED MOBILE



ADDING YOUR CAR TO REMOTE ACCESS YOUR HOME NETWORK



IoT SERVICE / ACTION TYPE

 **Status**

- Status: Up/down, on/off, ok/bad, status variable

 **Video**

- Audio/Video: Camera, video feed

 **Media**

- Media: Audio/Video media feed, TV, music

 **Storage**

- Storage: Data storage, NAS (pictures, files, data)

 **Alerts**

- Alerts: Up/down, on/off, ok/bad, "Water detected"

 **Control**

- Control: Turn up/down, on/off, change device value

 **Cloud Service**

- Cloud Service: IoT vendor, Google, MS, DropBox

 **VPN**

- VPN (VPN inside myhouse.ca)

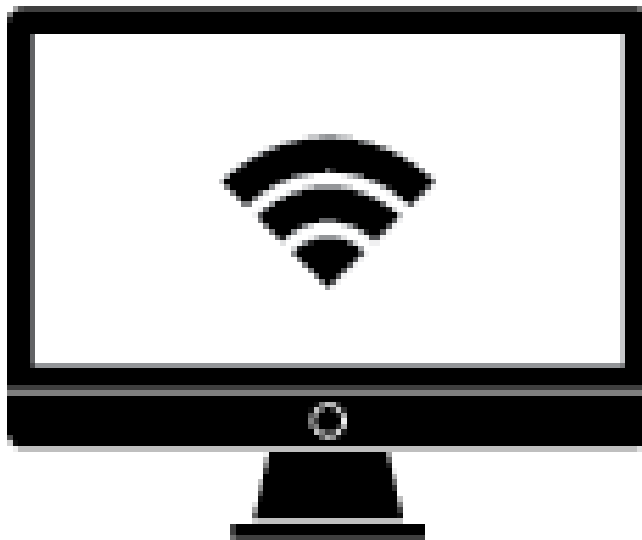
 **Remote house access**

- Remote house access
- Other Sensors/ Actuator functions?

TODO:

SCENARIO: ADDING A SMART TV

- WORK IN PROGRESS



TODO:**+ ADD SCENARIOS FOR EACH DEVICE TYPE**

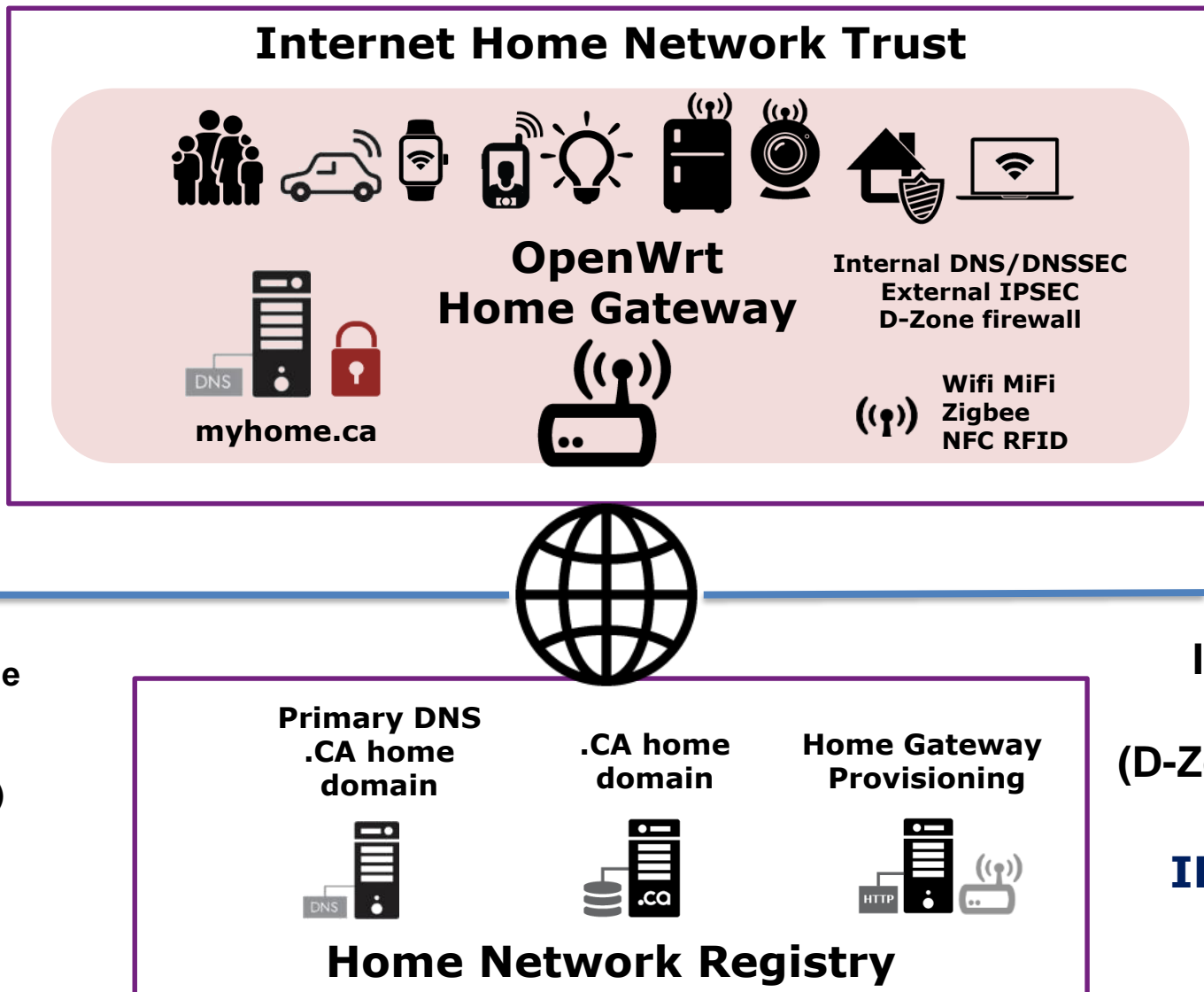
- TODO: as part of the functional specification documentation.
- Example of pushing WIFI to the device
- show that the fridge is exposing service
- And ready to receive services {WIFI}
- No web interface on IoT device
- Focus on cloud / vendor, show they integrate into this solution, can be multi vendor multi cloud provides



YOUR HOME NETWORK SECURITY IS COMPROMISED?

- Get the ccTLD to perform an emergency DNSSEC key roll over, externally and on the home gateway
- Will have new keys on home gateway
- This will make all VPN keys & certificate invalid
- A roll over will force the generation of new keys.
 - Trusted “management” home gateway mobile access must be re-established using an out of band token
 - Remote home access trust must be re-established
 - Local network access controls should remain the same

HIGH LEVEL SOLUTION ARCHITECTURE



WHAT DO YOU THINK?



Want to help?

GOING FORWARD, IT'S A JOURNEY!

ccTLD VALUE PROPOSITION

- Motivation
 - Ensure long term ccTLD relevance in the future of IoT
 - To create a secure **<internet home>** IoT environment
- Proposing ccTLD to develop a solution
 - To keep the home network safe and secure
 - To leverage DNSSEC as an innovation platform to create a hub for “home trust”
 - That leverages the ccTLD registry expertise
 - To enhance OpenWRT with this functionality

NEXT STEPS – BUILD A PROTOTYPE

- Develop a Proof of Concept and prototype
 - Using .CZ Omnia Home Gateway (openWRT)
 - Home Gateway App (Android/iPhone)
 - Develop some IoT discoverable devices (RFID)
- Use public GitHub to document the functional specification and repo for prototype software
 - Functional specification
 - Software repository

THIS SLIDE DECK IS A VISION IT'S WHAT WE'LL BE USING IN 5 YEARS

- Is work in progress, presented as a story
 - Story how a home gateway can be IoT friendly and how a ccTLD registry provision a secure domain per household
- Is meant to define a security framework and associated standards
 - IETF, ISO/IEC, others..
- Is tuned around implementation at .CA / CIRA, but not specific just for CIRA
- Is to solicit feedback
- Is another layer of defence in depth to protect the internet

The new <Internet Home>

<https://github.com/CIRALabs/Home-Network-Registry-Gateway>