

# Spacelord: Private and Secure Smart Space Sharing

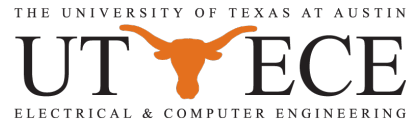
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<sup>2</sup>University of Texas at Austin

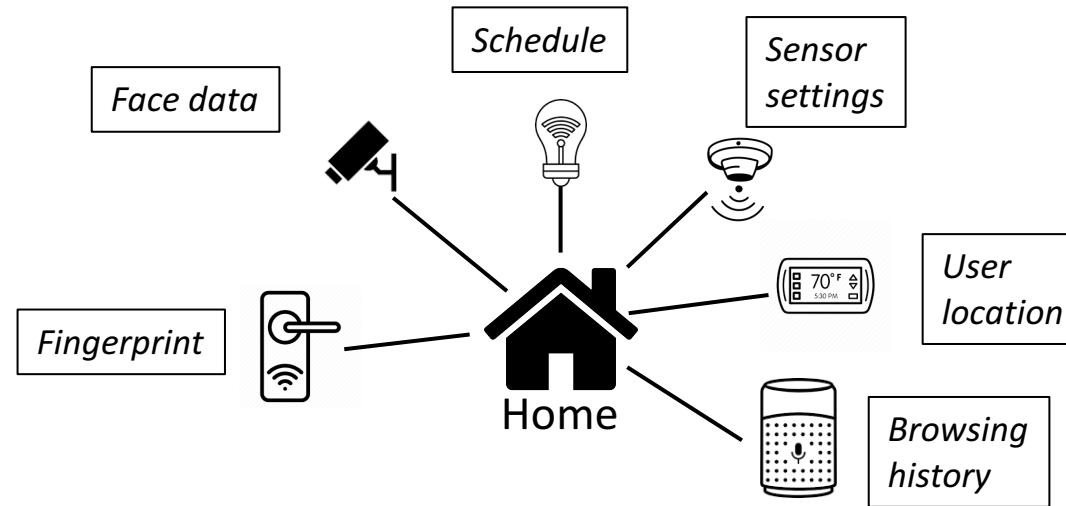
<sup>3</sup>Microsoft Research

December 8, 2022



# A traditional smart space

*Each smart device holds user personalized state*

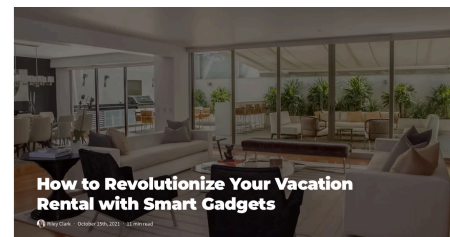
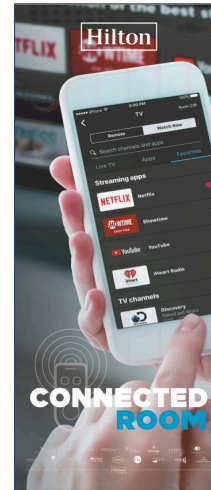
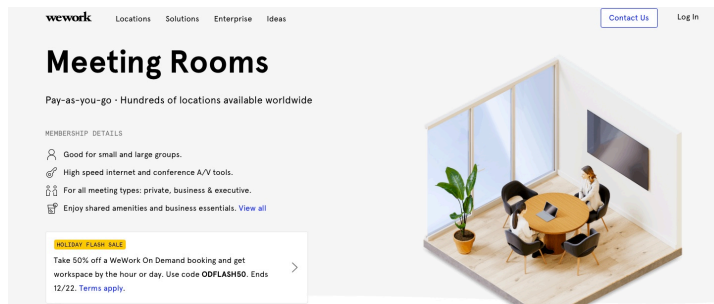


*A traditional smart space contains a range of smart devices*

- *The user has complete physical control over the devices*
- *Setting up the device is a one-time operation*

# Smart device in rental spaces

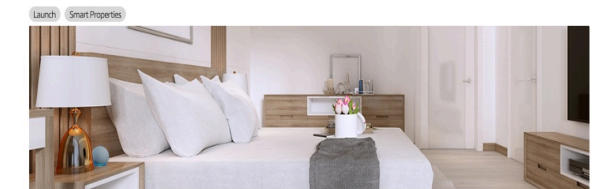
- Smart devices are increasingly being adopted in short-term rentals
  - Airbnb
  - Hotels
  - Hospitals
  - Shared meeting rooms



## Alexa Smart Properties for Hospitality Launches in the UK

Alvaro Sahun Pacheco Oct 13, 2021

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Today we are excited to announce the launch of Alexa Smart Properties for Hospitality in the UK. From today, solution providers and UK properties can start integrating Alexa's world-class AI into valuable end-to-end experiences at scale. Alexa Smart Properties simplifies tasks for guests like playing music, ordering room service, calling the front desk and even checking out.

*Mercurio Hotels, part of Accor, will introduce the new Alexa experience across select properties in collaboration with Hotel Cloud. You can check out the experience at Mercurio Hyde Park Hotel, a 72 room luxury hotel in central London, today!*

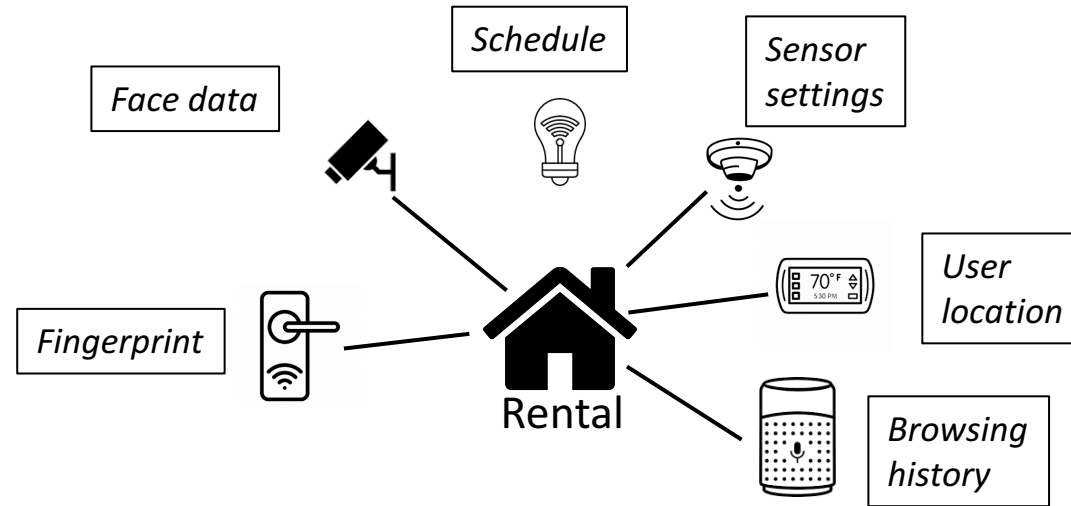
## How Guests Will Experience Alexa Smart Properties for Hospitality

Using Alexa in their room, guests can control and adjust compatible in-room devices such as lights, thermostats and blinds, or play music from popular services. Many exciting Alexa Smart Properties features — such as music and smart home controls — are available out-of-the-box, though hospitality providers may also choose to develop custom skills to further personalise their guests experience. For example, guests can ask Alexa for information like the Wi-Fi password or fitness centre location, request hotel services like housekeeping ("Alexa, I need towels"), call the concierge, and more.

Additionally, hoteliers and property managers have the option to enable skills from the Alexa Skills Store on the devices they manage so that their customers can check airport wait times, play games, get a quick guided workout, play sleep sounds to help them fall asleep, and more. Alexa's Skill selection includes popular skills like [Audible Stories](#), [BBC News](#), [BBC Sounds](#), [Sleep Sounds](#), and many more.

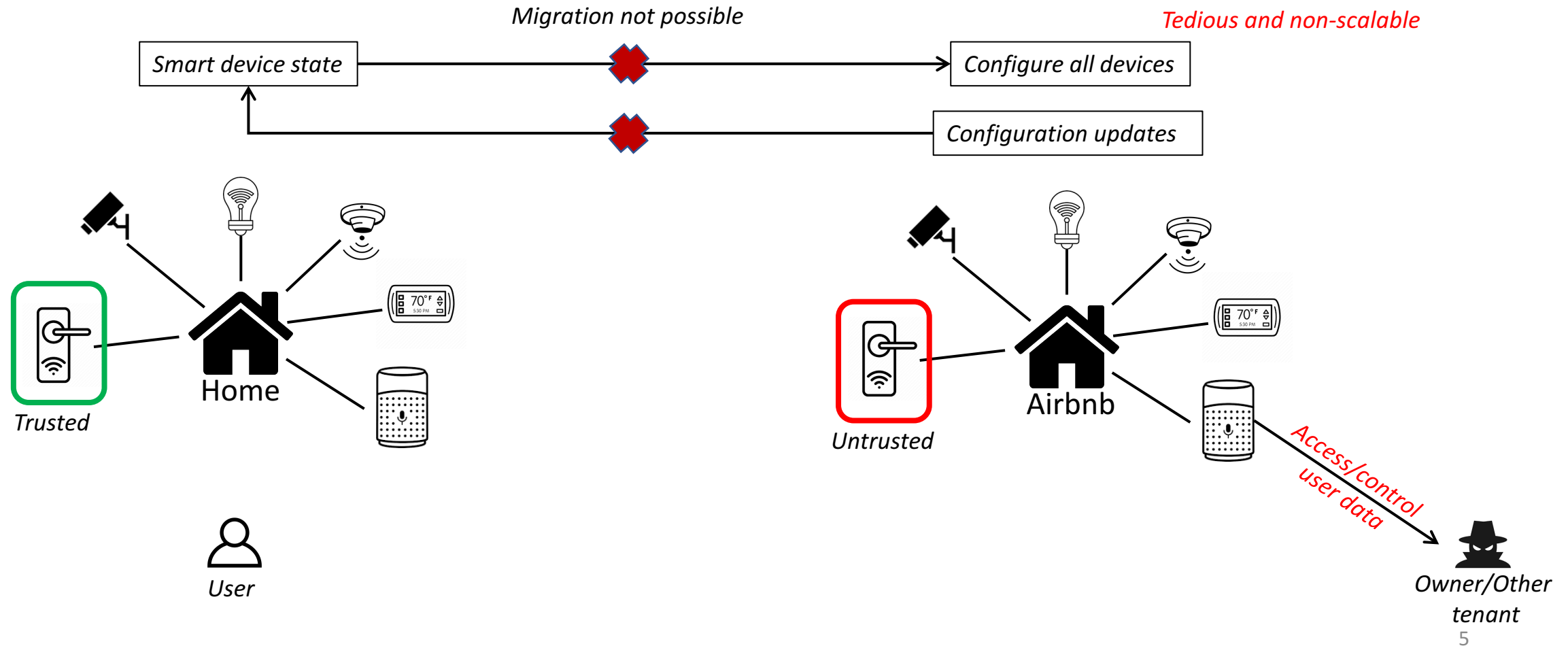
Guest's use of Alexa in their room is optional. Echo smart speakers have a Microphone Off button that electronically disconnects the microphone. With Alexa for Hospitality, guests use Alexa without connecting their Amazon account to the Alexa enabled device and voice recordings are not saved. For more information on privacy visit [www.amazon.co.uk/alexahospitality/guest](https://www.amazon.co.uk/alexahospitality/guest).

# New threats in rental smart devices



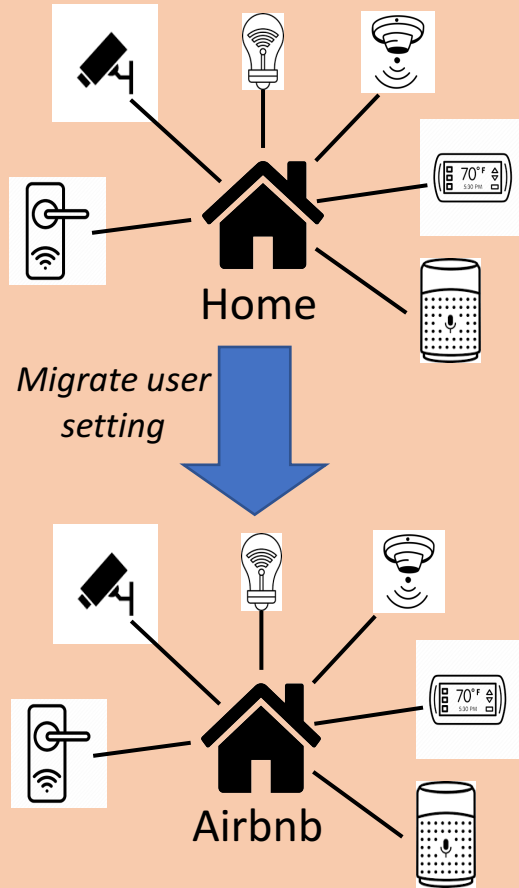
- *User unaware of device firmware authenticity*
- *User privacy can be monitored by rental owner*

# Bringing user configuration to rental space

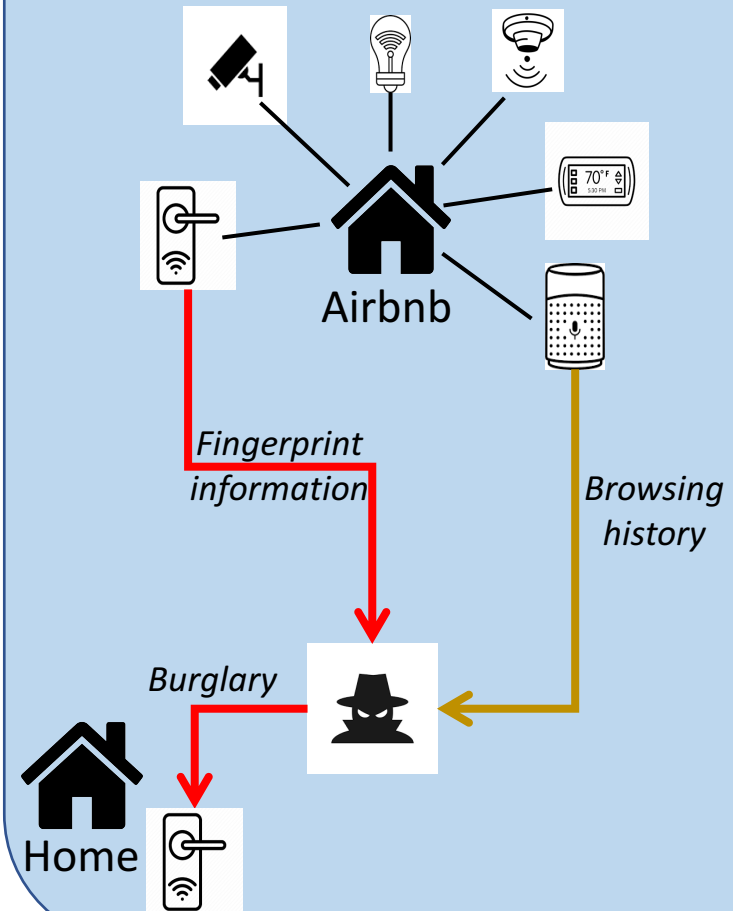


# Summarizing key challenges

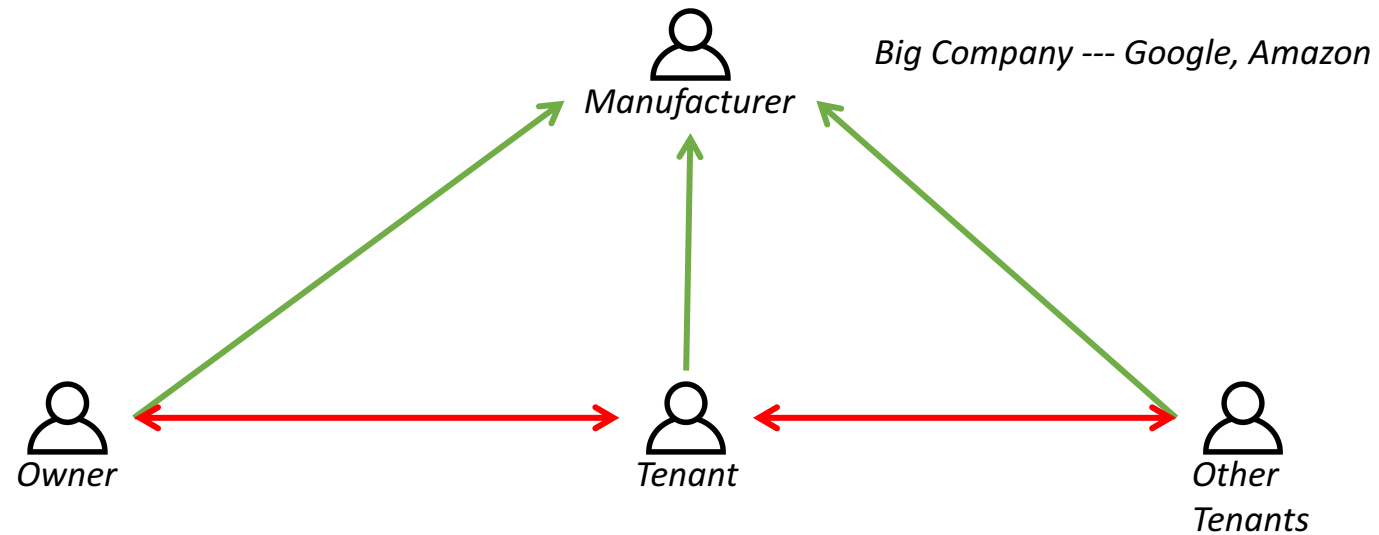
## *Device functionality*



## *User privacy/security concerns*



# Spacelord threat model

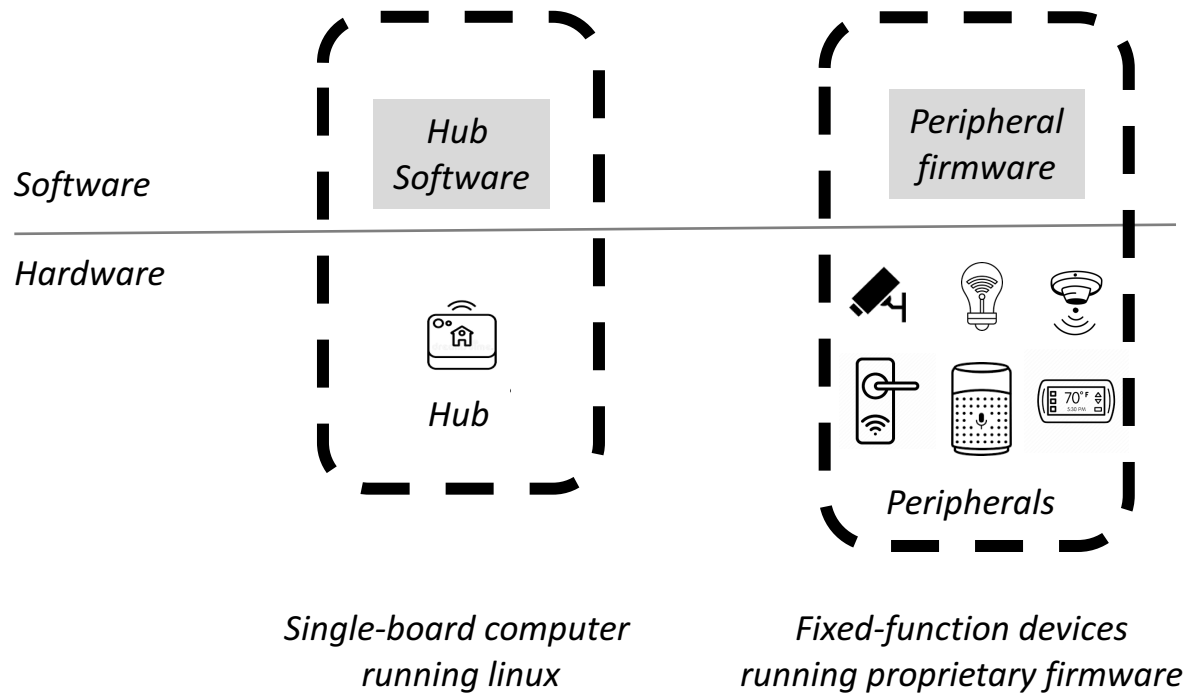


# Spacelord highlights

- [Device functionality] Enables seamless device state migration across spaces
- [Trust] Protect user privacy and security across shared spaces
- [Prototype] Evaluate secure device state migration across a range of smart devices

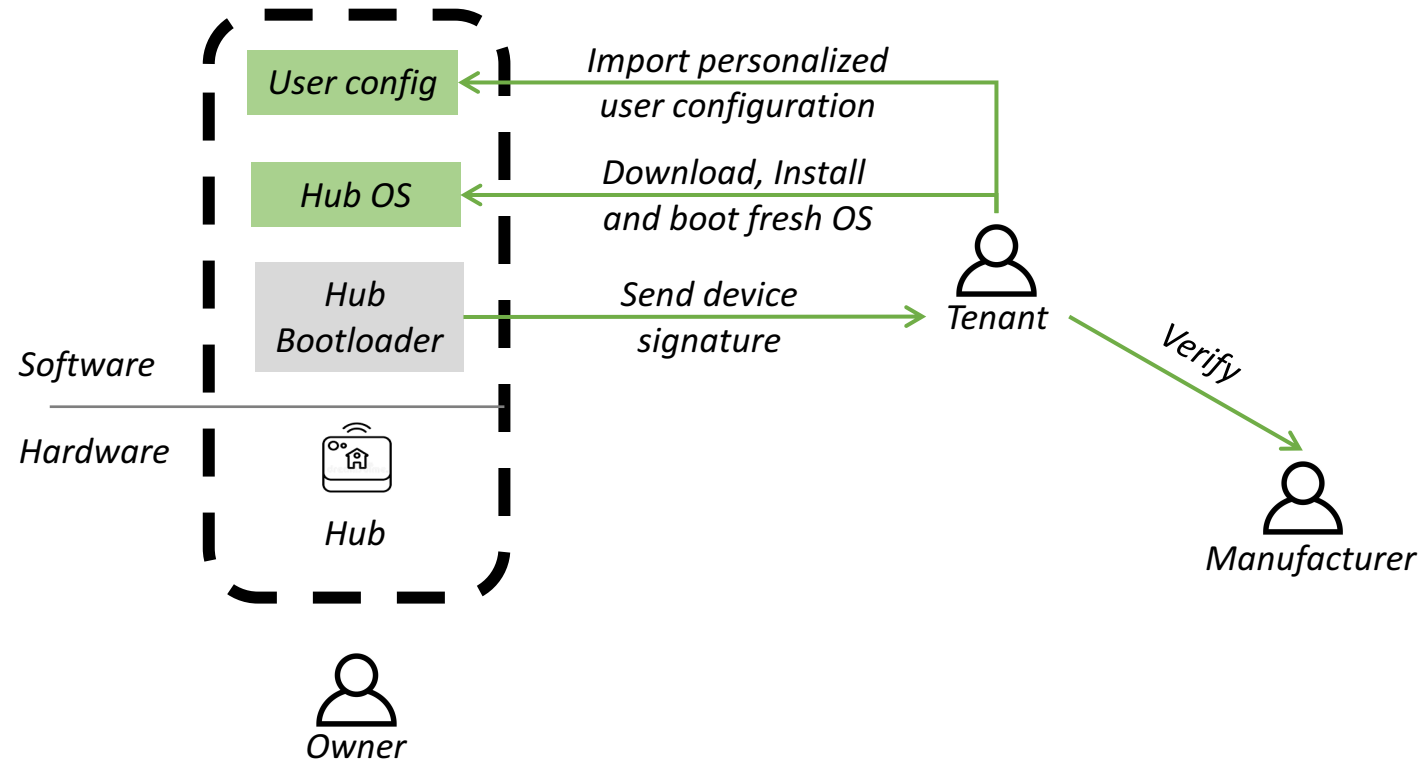


# Smart rental space components



- *Tenant needs to establish trust with the hub and all peripherals*
- *Seamlessly configure hub and peripherals to migrate configuration*

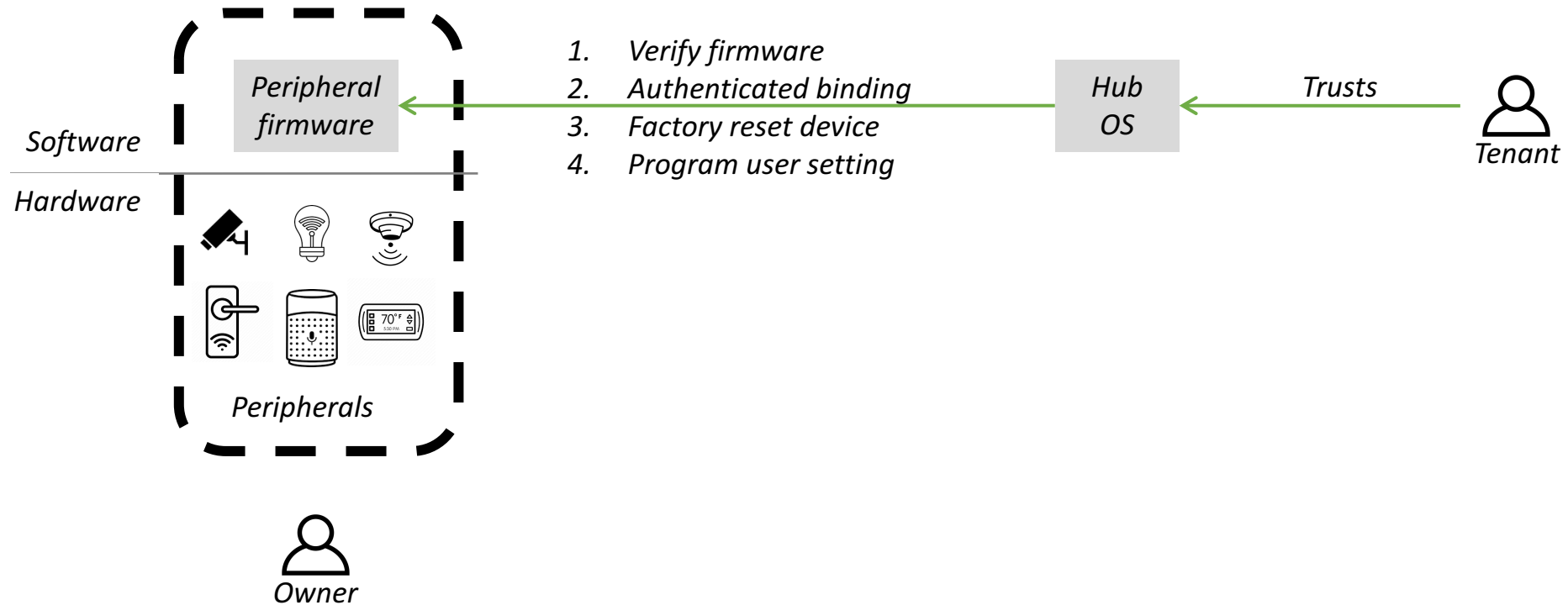
# Trusting the hub



*[Trust] The user can runs her entire software stack*

*[Func] Download an abstract specification of user configuration*

# Trusting the peripherals



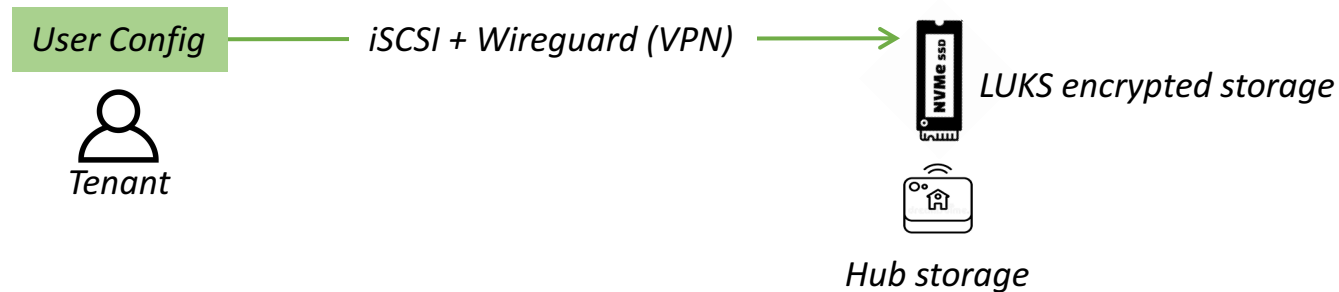
*[Trust] Hub OS resets and attests fixed-function peripherals*  
*[Func] Hub OS programs user configuration into peripherals*

# Trusting hub storage

*The tenant should ensure data in hub storage is not compromised during or after she leaves the space.*

*--- User configuration is transferred to hub over secure VPN (wireguard).*

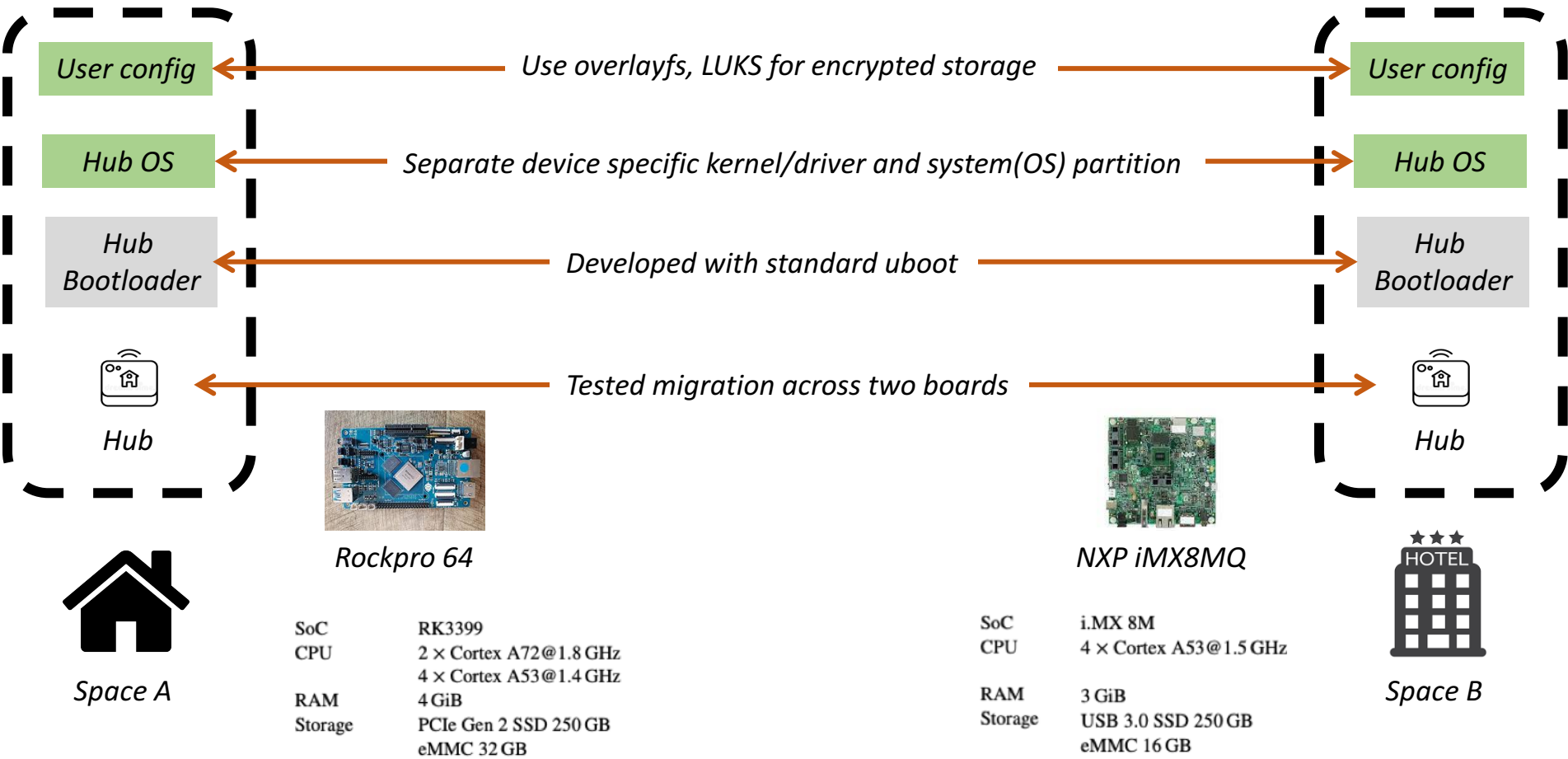
*--- Hub local storage is encrypted by Linux Unified Key Setup (LUKS).*



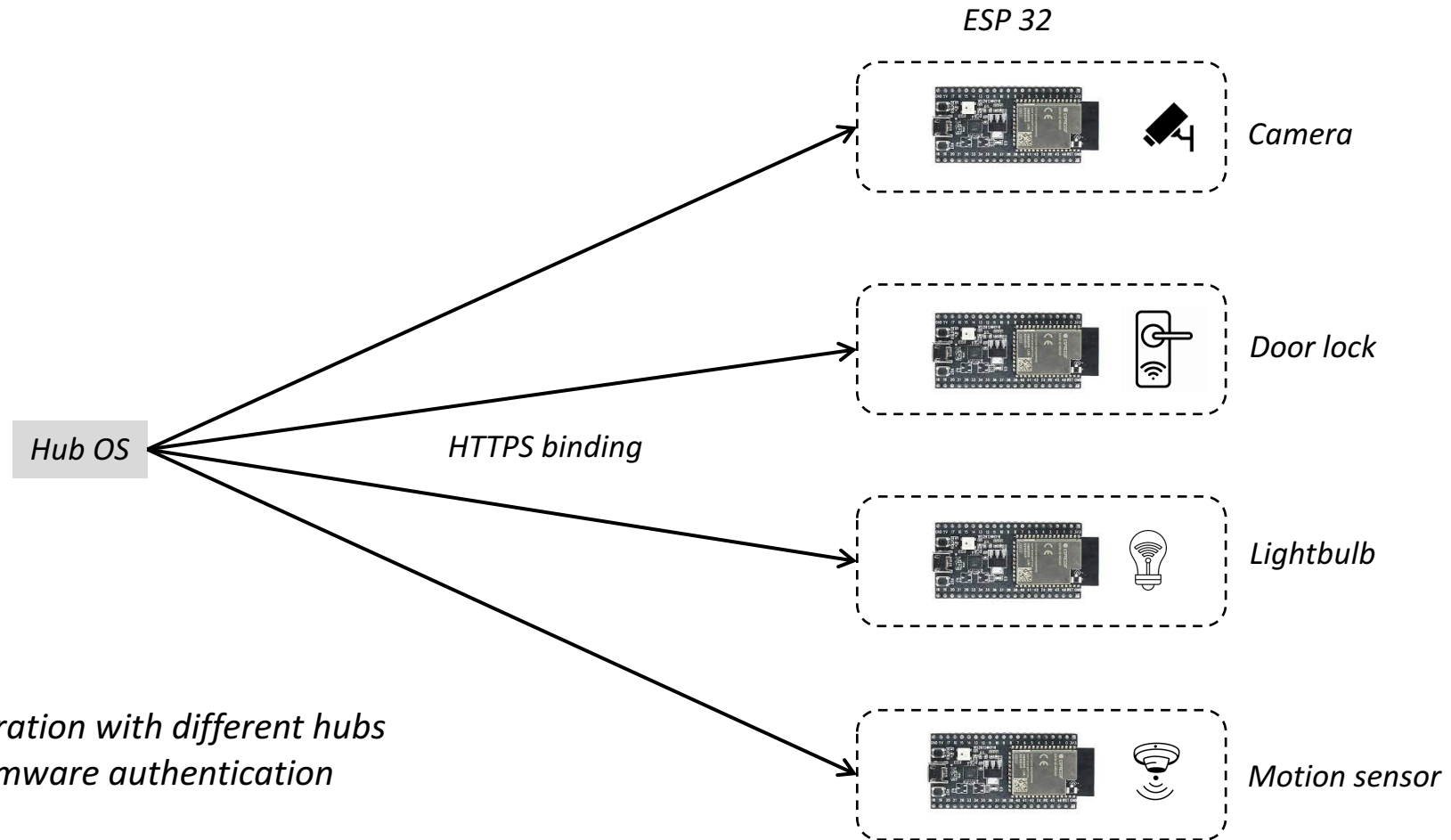
*[Trust] All user data in local storage is encrypted*

*[Func] User data is synchronized to network storage*

# Spacelord hub implementation

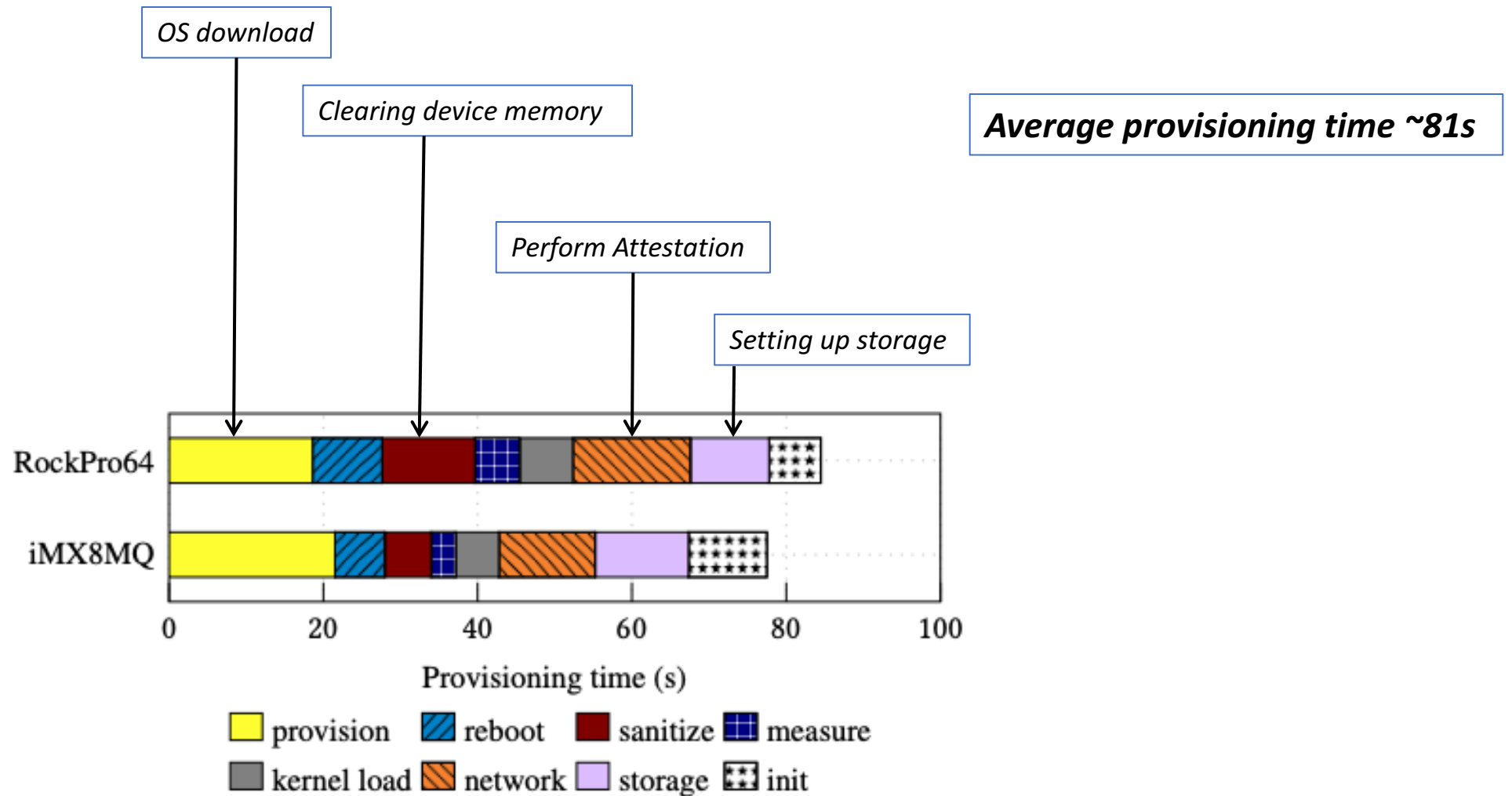


# Spacelord peripheral implementation



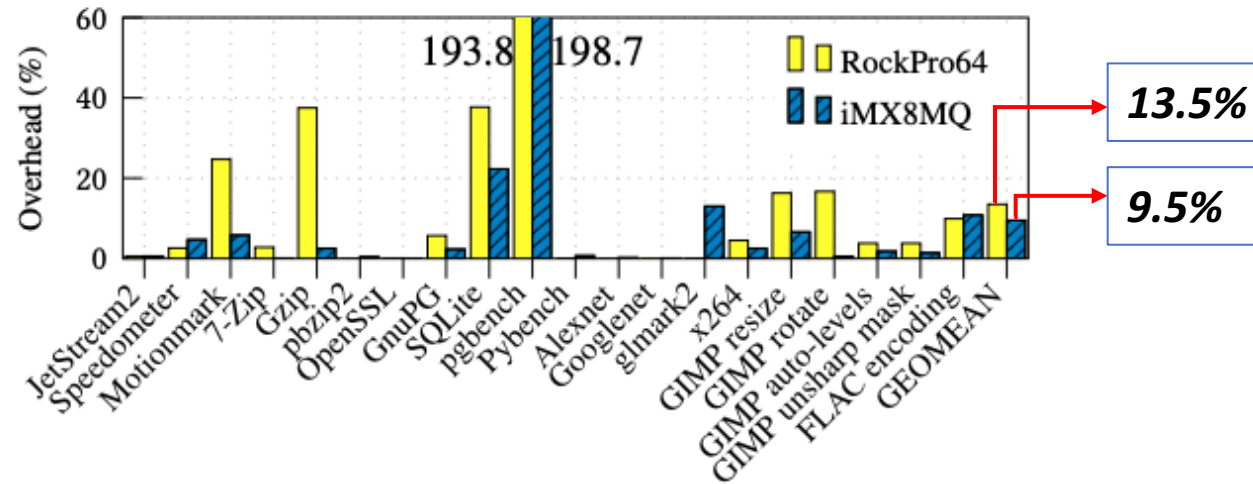
- *Tested Settings migration with different hubs*
- *Device reset and firmware authentication*

# Provisioning time



# Phoronix evaluation

- We run around 20 of phoronix benchmarks to measure the system performance
- Each test run 20 times or if the standard deviation <3.5%.



*[Key takeaway] The runtime overhead is not significant with our network based storage*



# Concluding thoughts

- Smart devices in rental spaces are a reality
- This completely changes the threat and use model
- Spacelord provides security and functionality for smart rental spaces
- Spacelord artifact is evaluated and available for download



*Paper*



*Code*