

24-Mar-2020

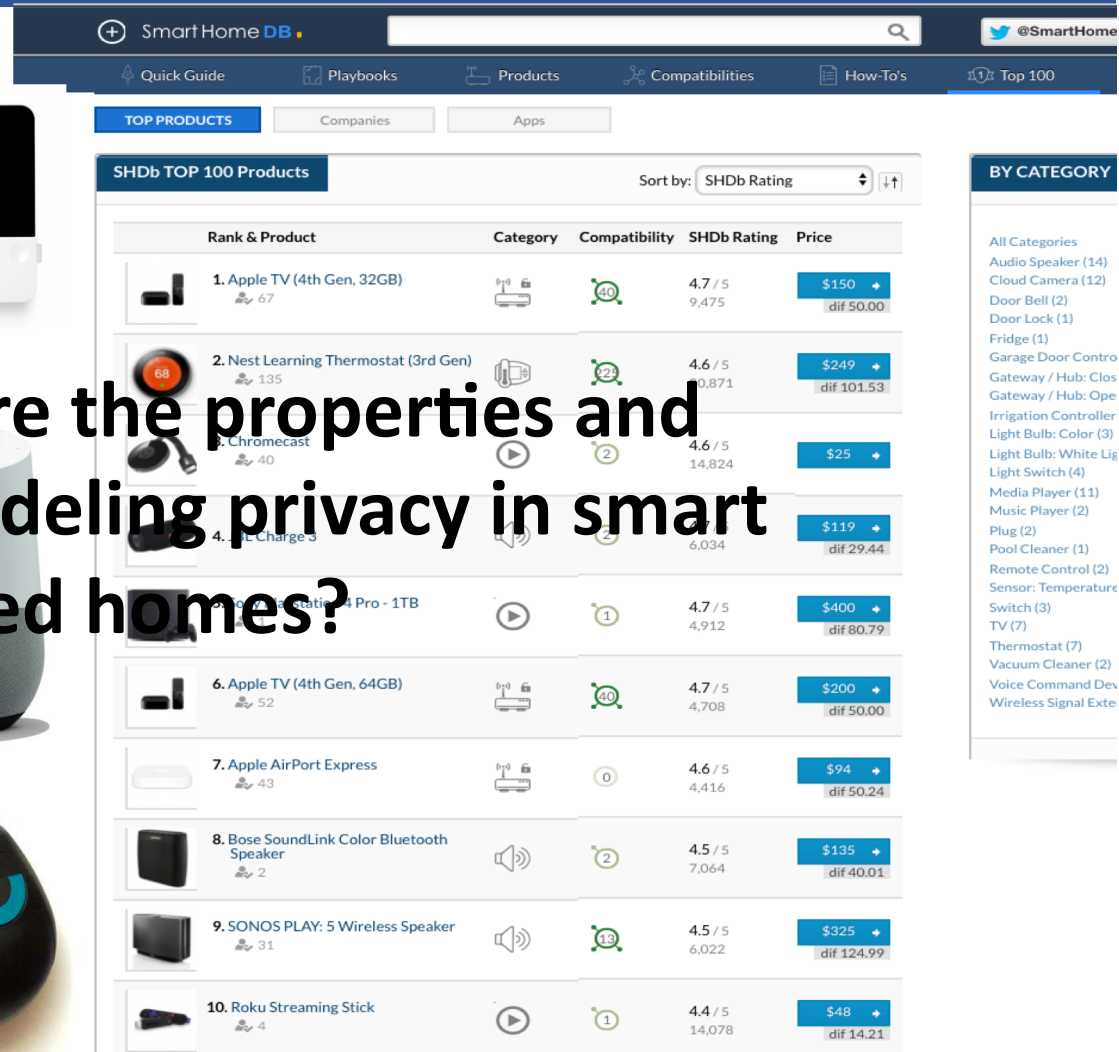
# A Privacy-Centered System Model for Smart Connected Homes

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# THE SMART CONNECTED HOME

How can we capture the properties and requirements for modeling privacy in smart connected homes?



Smart Home DB

Quick Guide Playbooks Products Compatibilities How-To's Top 100

TOP PRODUCTS Companies Apps

SHDb TOP 100 Products Sort by: SHDb Rating

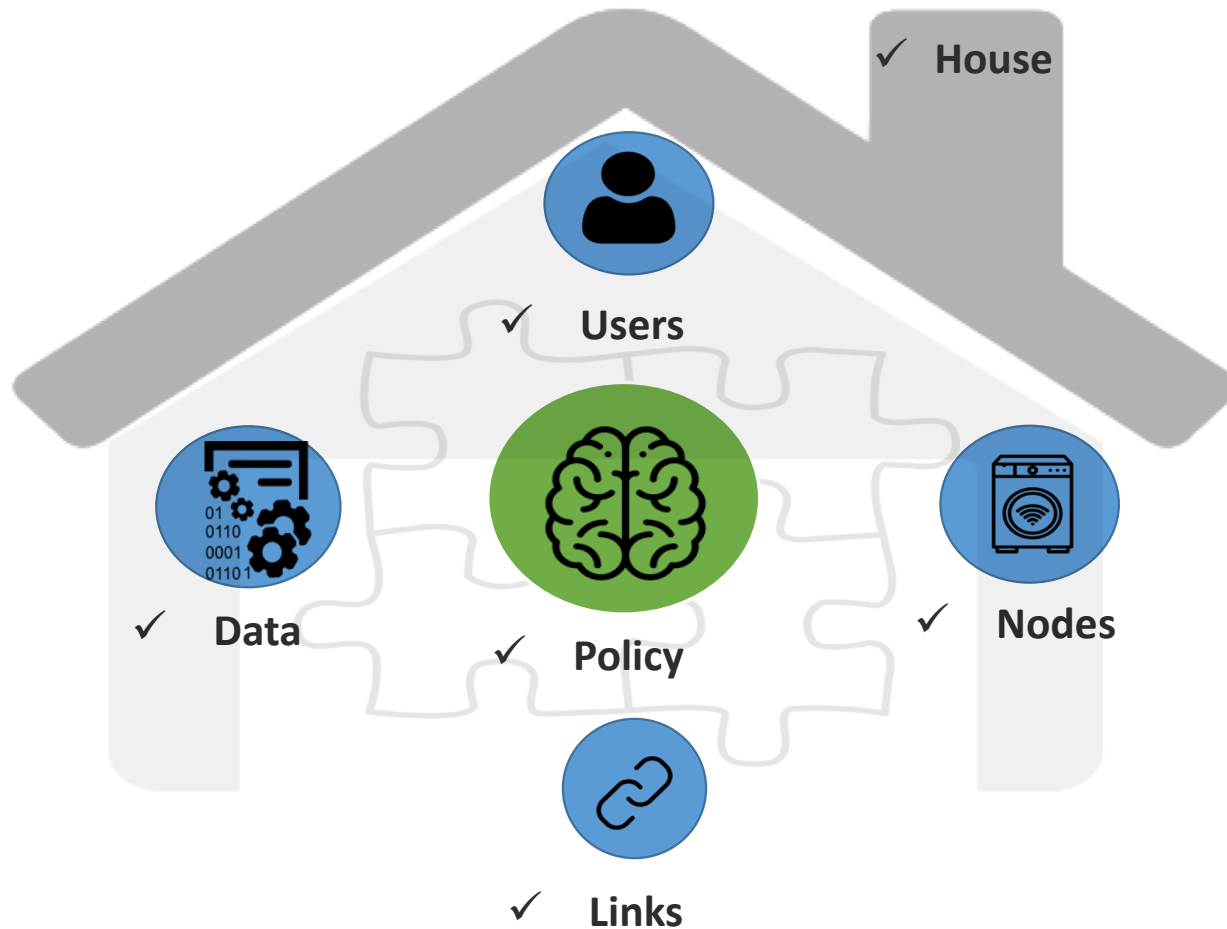
Rank & Product	Category	Compatibility	SHDb Rating	Price
1. Apple TV (4th Gen, 32GB) 67	TV	40	4.7 / 5 9,475	\$150 dif 50.00
2. Nest Learning Thermostat (3rd Gen) 135	Thermostat	23	4.6 / 5 10,871	\$249 dif 101.53
3. Chromecast 40	Streaming Stick	2	4.6 / 5 14,824	\$25 dif 29.44
4. Apple Watch Series 3 67	Wearable	2	4.6 / 5 14,824	\$119 dif 29.44
5. Apple TV (4th Gen, 64GB) 52	TV	1	4.7 / 5 4,912	\$400 dif 80.79
6. Apple TV (4th Gen, 64GB) 52	TV	40	4.7 / 5 4,708	\$200 dif 50.00
7. Apple AirPort Express 43	Router	0	4.6 / 5 4,416	\$94 dif 50.24
8. Bose SoundLink Color Bluetooth Speaker 2	Speaker	2	4.5 / 5 7,064	\$135 dif 40.01
9. SONOS PLAY: 5 Wireless Speaker 31	Speaker	13	4.5 / 5 6,022	\$325 dif 124.99
10. Roku Streaming Stick 4	Streaming Stick	1	4.4 / 5 14,078	\$48 dif 14.21

BY CATEGORY

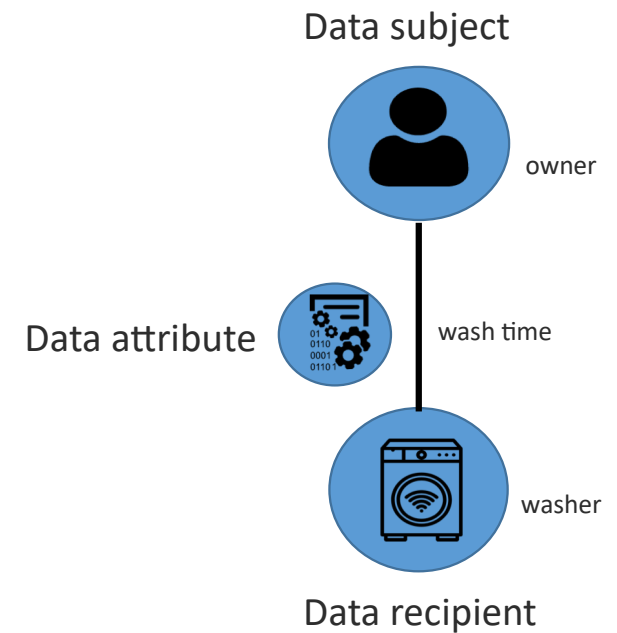
- All Categories
- Audio Speaker (14)
- Cloud Camera (12)
- Door Bell (2)
- Door Lock (1)
- Fridge (1)
- Garage Door Control
- Gateway / Hub: Clos
- Gateway / Hub: Ope
- Irrigation Controller
- Light Bulb: Color (3)
- Light Bulb: White Lig
- Light Switch (4)
- Media Player (11)
- Music Player (2)
- Plug (2)
- Pool Cleaner (1)
- Remote Control (2)
- Sensor: Temperature
- Switch (3)
- TV (7)
- Thermostat (7)
- Vacuum Cleaner (2)
- Voice Command Dev
- Wireless Signal Exte

# THE PRIVACY-CENTERED SYSTEM MODEL

- ✓ The smart connected home system model



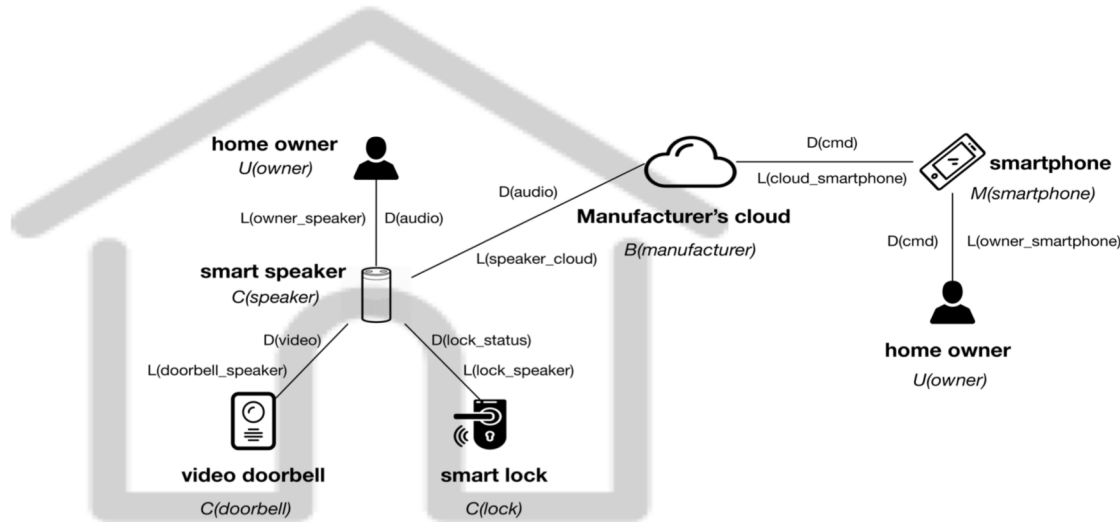
- ✓ Leveraging the theory of *Contextual Integrity*\* as a definition of privacy



\* Nissenbaum, Helen. "Privacy as contextual integrity." *Wash. L. Rev.* 79 (2004): 119.

# PRIVACY THREAT IDENTIFICATION IN ACTION

✓ Privacy-centered model of the smart connected home



Policy,  $P =$   
 $\{(doorbell\_speaker, \{(video, \{read\})\}, doorbell, speaker, \emptyset),$   
 $(lock\_speaker, \{(lock\_status, \{read\})\}, lock, speaker, \emptyset),$   
 $(speaker\_cloud, \{(audio, \{read\})\}, speaker, manufacturer,$   
 $Time = \{8 : 00 - 24 : 00\} \wedge Location = \{house\}),$   
 $(cloud\_smartphone, \{(cmd, \{read\})\}, smartphone,$   
 $manufacturer, \emptyset),$   
 $(owner\_smartphone, \{(cmd, \{read\})\}, owner, smartphone, \emptyset),$   
 $(owner\_speaker, \{(audio, \{read\})\}, owner, speaker, \emptyset)\}$

✓ Using high-order logic formulas to identify threats

Identification



Profiling



Localization and Tracking



Threat does not exist

Threat is a potential future threat

Threat is present

## NEXT STEPS

- ✓ Evaluate the **completeness** of the proposed model



- ✓ Express the system model using a **formal specification** language

- ✓ Leverage the model for performing **quantitative risk analysis**





**THANK YOU**  
**FOR *YOUR***  
**ATTENTION !**



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