ENERGY STAR® Connected Thermostats

Certification Body Webinar
1/5/2017

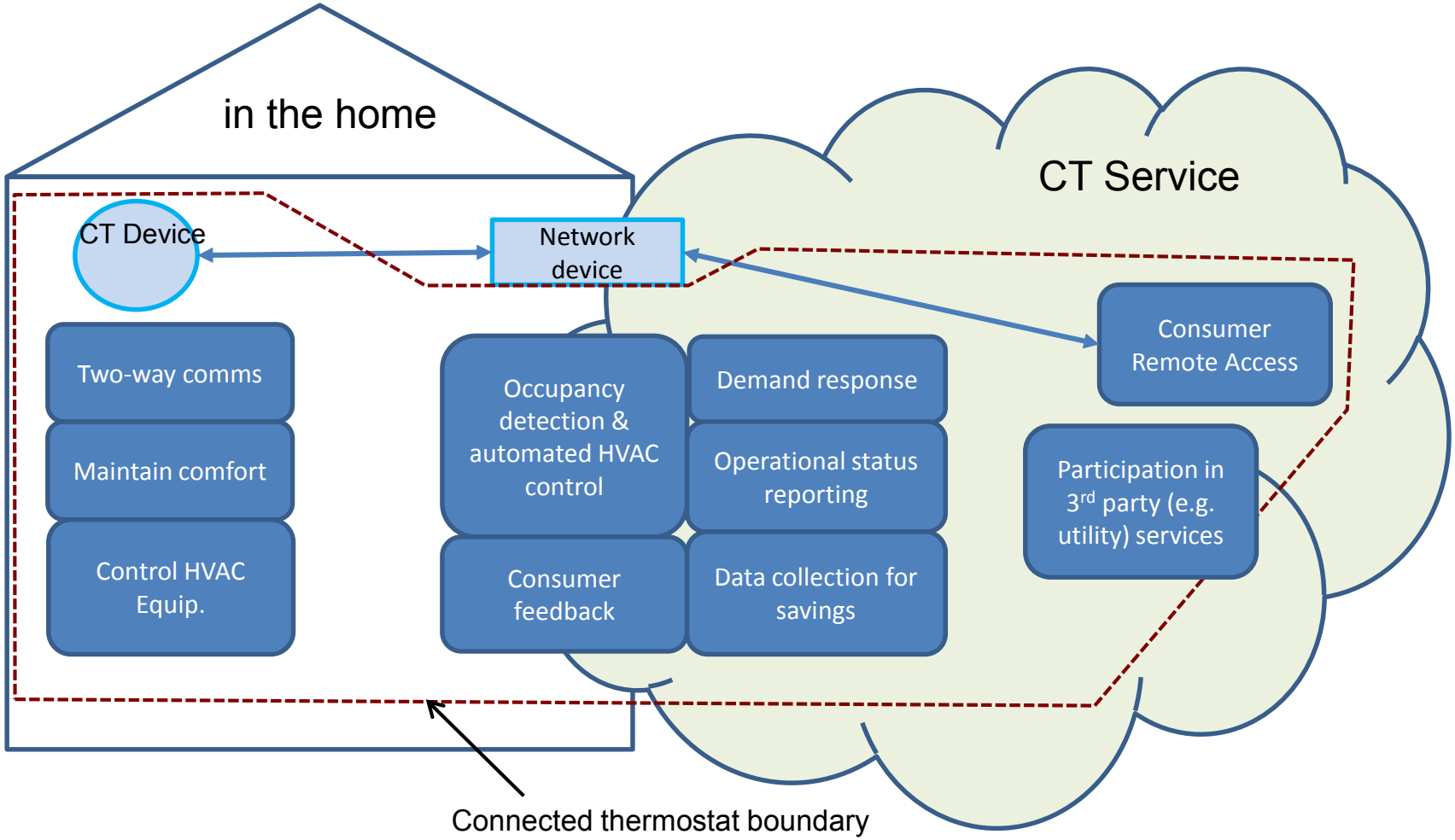
Agenda

- Version 1.0 Specification Overview
- CB Application and Next Steps
- Open Questions & Comments

Definitions

- Connected Thermostat (CT) Device: A device that controls heating, ventilation, and air-conditioning (HVAC) equipment to regulate the temperature of the room or space in which it is installed, and has the ability to communicate with sources external to the HVAC system.
- CT Product: the CT product includes the CT device in the home with associated firmware, as well as a CT service supported by hardware and software outside of the home.
- CT Service Provider: The organization that brands the CT service. CT services typically include smart phone and web control applications, messaging relevant to energy consumption, and application programming interfaces (API) that enable consumer-authorized interconnection with utilities and other 3rd parties.

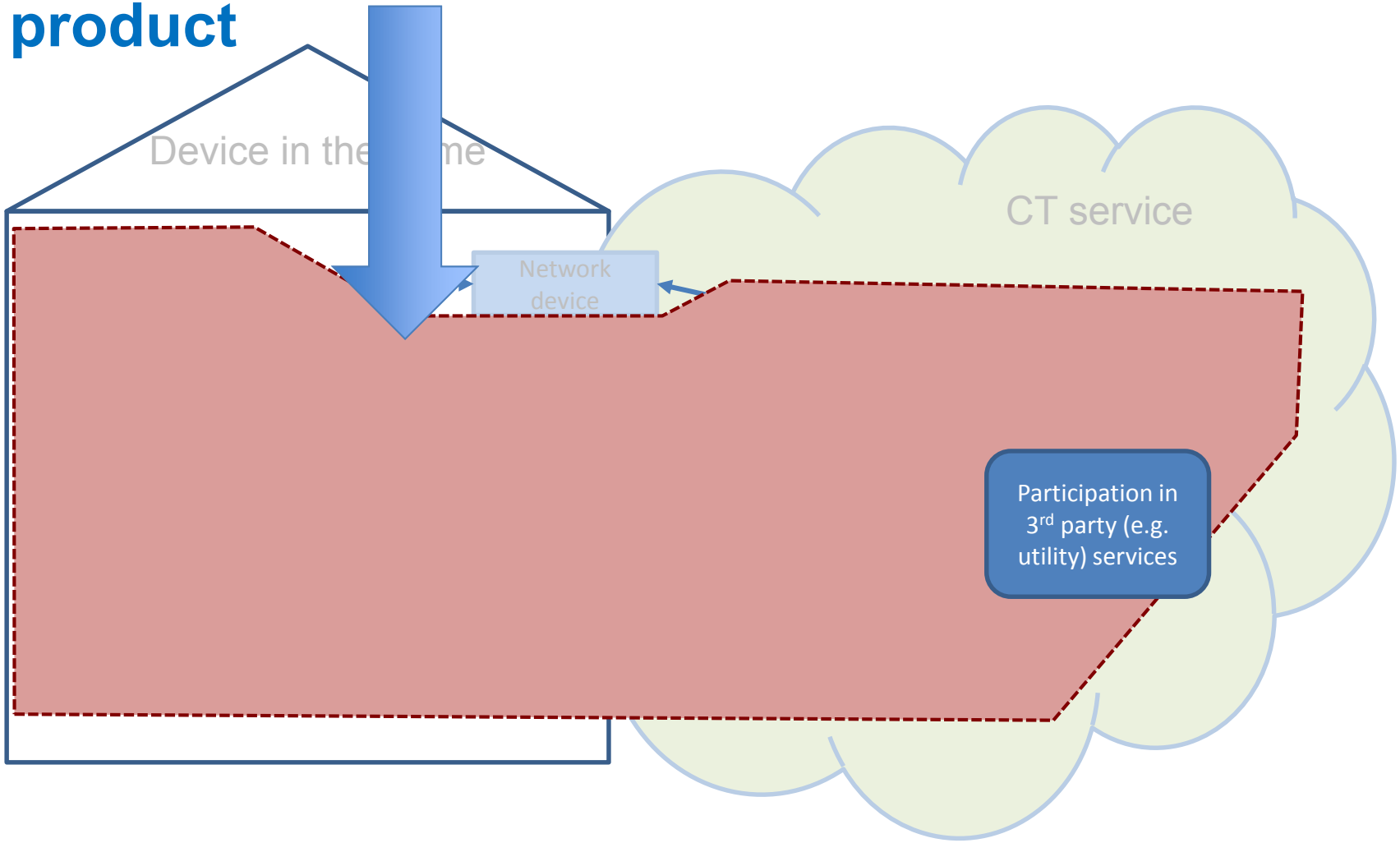
What do we mean by connected thermostat?



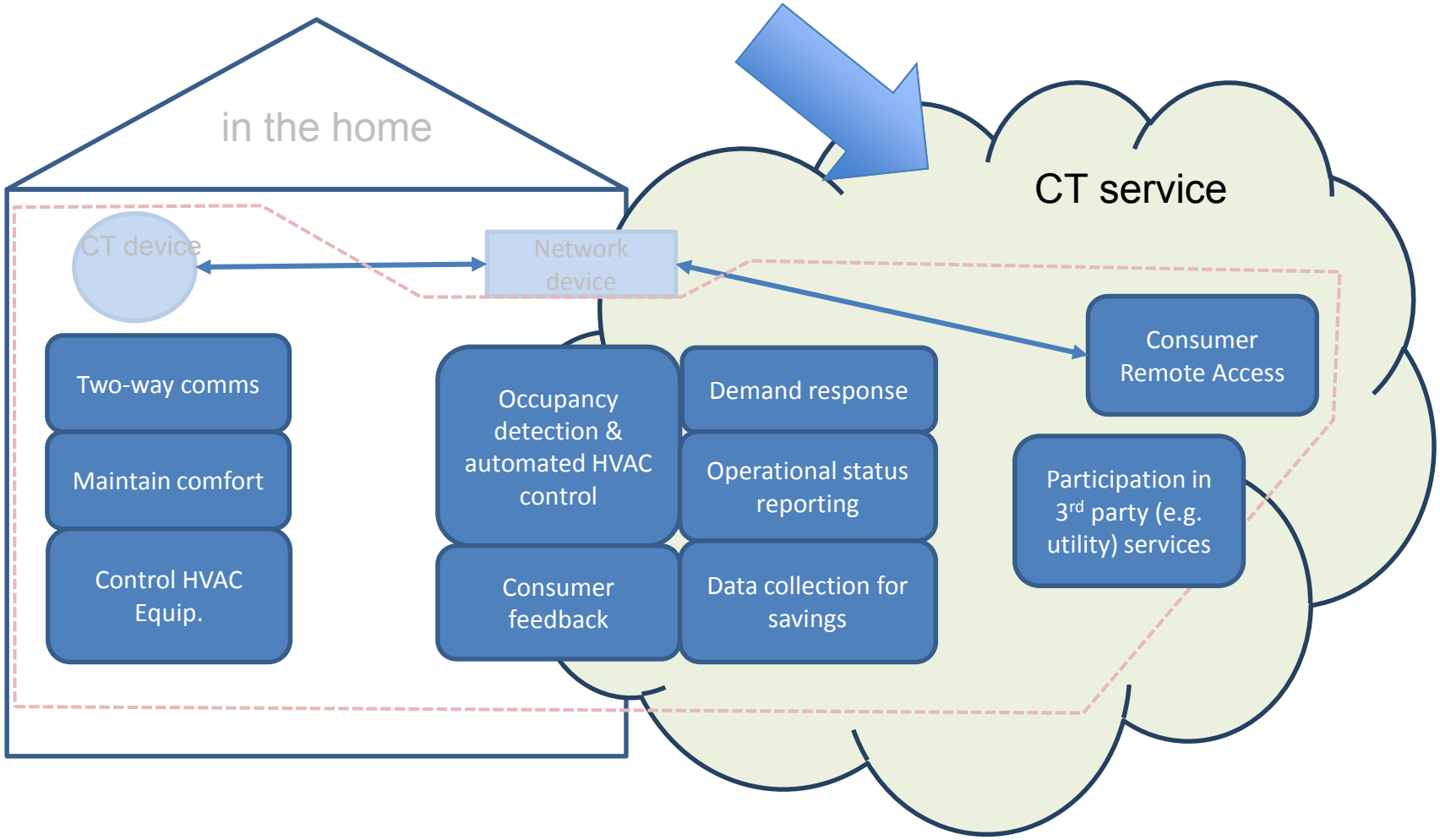
Introduction

- Connected Thermostats (CT) differ from typical ENERGY STAR® products:
  - CT Product consists of a CT device and a CT service
  - ENERGY STAR Partner is the CT service provider (who may or may not manufacture the CT device)
  - Qualification includes demonstration of energy savings in US homes that can be attributed to the CT product
- Overview of certification process:
  - CT device is tested in a lab
  - CT product meets basic criteria
  - CT service provider submits data output from the ENERGY STAR CT Field Savings software
  - Optional – CT service provider also submits an A/B study that assesses CT savings

Hardware + Service is the ENERGY STAR product



Service Provider is the ENERGY STAR Partner



Scope

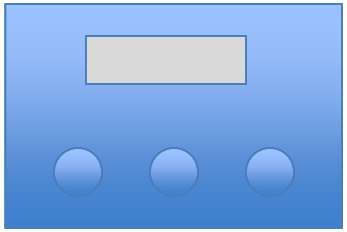
- In scope: CT products, whether part of a larger product or not. Examples of larger products:
  - Home security system
  - Home automation system (e.g. part of paid TV offering)
  - Home Energy Manager
- Out of scope
  - Line voltage CTs
  - CT products that are unable to collect requisite field data required by the ENERGY STAR CT Field Savings software

Line Voltage Thermostat: Thermostat that is powered by and/or switches >30Vac

Partners and OEMs

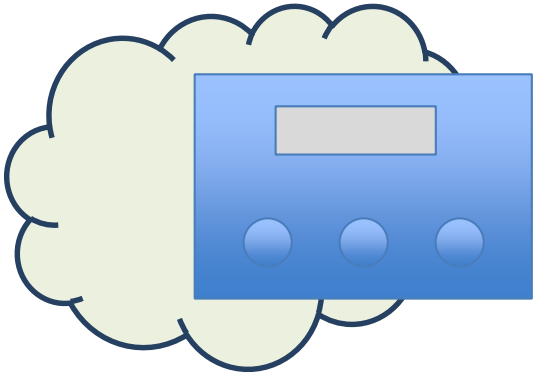
- ENERGY STAR Partner is the CT service provider
- CT service provider may or may not be the CT device manufacturer
- Both CT device and CT service could have an OEM that is different than the consumer facing brand owner

Earning the ENERGY STAR



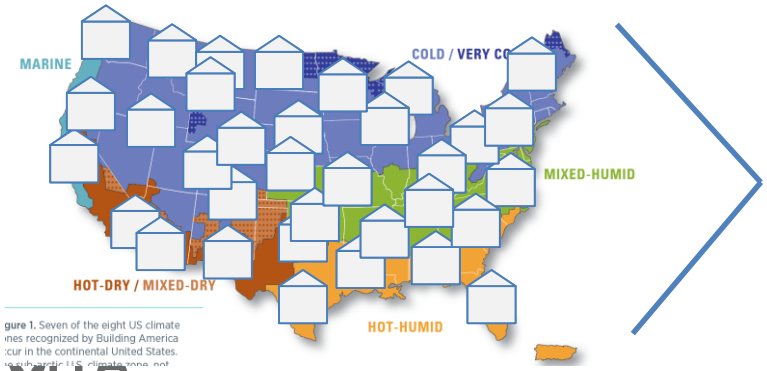
1. Thermostat device passes basic tests

Report from laboratory testing



2. Thermostat product demonstrates basic capability

Product examination



Heating savings

Cooling savings

3. Demonstrate field savings using EPA software tools to analyze and aggregate data from hundreds of US homes

Qualification Criteria – CT Device (section 3A)

- Mandatory functionality in the absence of connectivity
  - View room temp
  - Adjust set temperature
  - Switch between heating, cooling and off
- Static temperature accuracy of ± 2°F
- Network standby power ≤ 3 W
- Time to standby ≤ 5 min
- Notes on device criteria:
  - Test procedures are in the specification
  - CT device, and therefore standby power, includes all equipment needed to establish connectivity (e.g. hubs, power converters) unless they can reasonably be expected to be in a home anyway, such as a WiFi router.

Qualification Criteria – CT Product (section 3B)

- May be enabled through any combination of CT Device and CT service
- Must be maintained through subsequent software revisions
- Criteria
  - Users can set and maintain a schedule
  - Provision of feedback to occupants about the energy impacts of their choices
  - Provision for users to see info related to their HVAC energy consumption, e.g. HVAC run time
  - Can collect data needed for field savings metric calculation
  - Basic DR criteria
    - Grid DR comms using open standards for all layers
    - Open access: API or similar for DR at least
- Affirmed for certification and verification through product examination

Data from CT Product for field savings metric

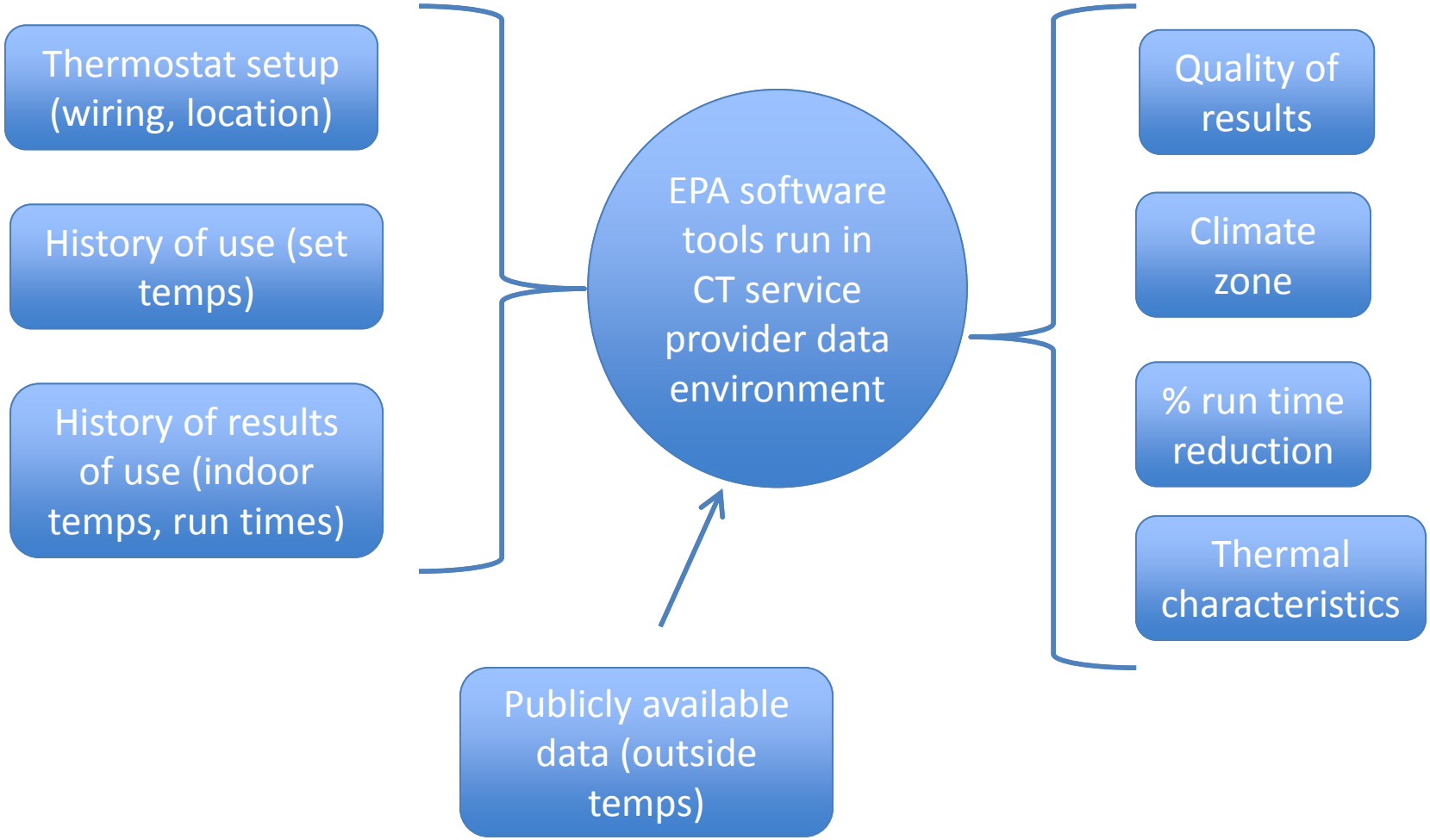
- Unique thermostat ID
- ZIP code (installed location)
- Controlled HVAC equipment type (as defined in the spec) to the extent it can be determined by the CT product
- Daily cooling equipment run time (minutes)
- Daily heating equipment run time (minutes)
- Hourly auxiliary heat run time (minutes)
- Hourly emergency heat run time (minutes)
- Hourly average conditioned space temperature (to 0.5°F)
- Hourly average heating setpoint temperature (to 1.0°F)
- Hourly average cooling setpoint temperature (to 1.0°F)

Qualification Criteria – Field Savings (section 3C)

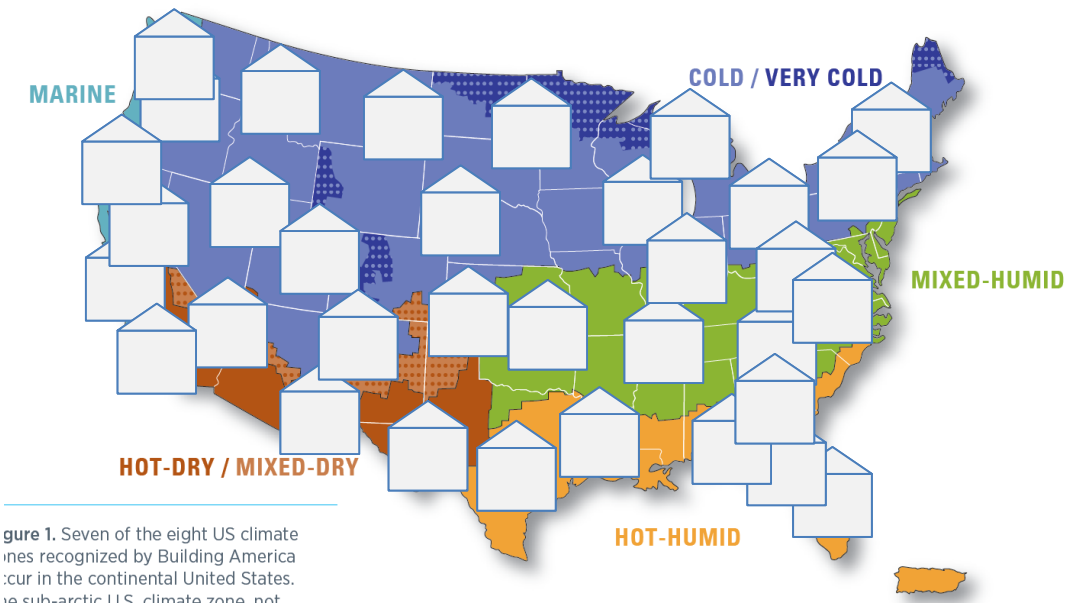
Metric	Statistical measure	Performance Requirement
Annual % run time reduction, heating (HS)	Lower 95% confidence limit of weighted national average	≥ 8%
	20th percentile of weighted national average	≥ 4%
Annual % run time reduction, cooling (CS)	Lower 95% confidence limit of weighted national average	≥ 10%
	20th percentile of weighted national average	≥ 5%
Average resistance heat utilization for heat pump installations (RU)	National mean in 5°F outdoor temperature bins from 0 to 60°F	Reporting requirement

- Demonstrated by software output (.csv file) from CT service provider
- Alternate path: metric results still required, but field savings demonstrated by A/B test (agreed to by EPA) instead

Savings Metric For Each Home



For Sample of Hundreds of Homes



gure 1. Seven of the eight US climate
ones recognized by Building America
:cur in the continental United States.
ne sub-arctic U.S. climate zone, not

- Cold/Very Cold
- Marine savings
- Mixed Humid
- Hot Dry/Mixed Dry
- Hot Humid savings

Weighted average National savings

Statistical information: deciles, standard error of the mean, etc.

Product Families

- A group of closely related CT products
  - share a primary strategy for delivering savings
  - use similar CT devices
- Each CT device that is part of a CT product within the product family is separately tested to ensure it meets the CT device requirements in section 3) A.
- Each CT service/CT device combination shall comply with CT product requirements in section 3) B.
- All installations within a product family shall be considered as a single population for determining field savings, and the metric performance scores shall apply to all members of the product family.

Product Families: Examples

- For CT products that derive savings from automatic temperature changes without prompting users, the user interface differences of CT devices would be irrelevant.
- For CT products that rely on occupancy detection to deliver savings, including motion sensing by the CT device and CT services that track occupants via mobile device location services:
  - CT products with similar occupancy detection can be in the same product family.
  - CT products with dissimilar occupancy detection would fall into different product families, unless the occupancy detection is not part of a primary savings strategy.
- For CT products that can provide different services in different utility service territories based on utility program offerings, (e.g. precooling is available in areas with time-of-use rates), these variations can be in a single product family, as long as they do not impact primary savings strategies.
- For CT products that include the capability to add services that may increase energy savings, all variations may be in the same product family.

Test Methods

ENERGY STAR Requirement	Test Method Reference
Functionality in the absence of connectivity	As per section 4) D. and 4) E.
Static temperature accuracy	As per section 4) D. and 4) F.
Network standby power consumption	IEC 62301, Ed. 2.0, 2011-01, Household electrical appliances – Measurement of standby power, subject to clarifications in section 4) D. and 4) G.
Time to standby	
Reduction in average annual % run time, heating (HS)	ENERGY STAR Method to Demonstrate Connected Thermostat Field Savings, V1.0
Reduction in average annual % run time cooling (CS)	
Reporting requirement: Average resistance heat utilization for heat pump installations (RU)	

Certification and Verification of CTs

ENERGY STAR Requirement Section	Data source	Verification testing
3) A: CT Device requirements	Laboratory Test Report	Per the ES requirement*
3) B: CT Product requirements	Product examination	As per usual
3) C: CT Field Savings	Software output file (.csv format) supplied by CT service provider	Partners submit information to EPA periodically

*EPA plans to issue more specific direction on verification testing that may limit testing and field savings review

Submitting Data on Certified CTs to EPA

- Information related to the Partner/CT Service Provider should be submitted as part of the “core” information.
  - The “manufacturer” fields (including OEM name) from the general fields refer to the CT service provider and CT service
- Information related to the CT Device in combination with the CT Service is included in the product details fields.
- CBs submit a unique product submission for each service and device model that have the same performance.
  - Additional versions of the service may be submitted in the additional models field assuming no change in performance for the combination.
  - Additional device model numbers may be submitted in the additional device models field if no change in performance for the combination (e.g., different finishes)
- Multiple CT Devices under a CT Service (Product families) with different performance are submitted as unique submissions and connected through the FamilyID field.

Timeline of specification development

- Jun 2014 EPA announces approach to CTs, using field data to demonstrate product savings
- Jan 2015 Framework for metric; data collection begins
- Jun 2015 Draft 1 Specification + software alpha release
- Jul 2015 Revised metric framework
- Nov 2015 Draft 2 Specification + Draft 1 Field Savings Method; data collection and metric development continues
- 2015 – Q3 2016 Intensive metric and software development
- Sep 2016 Draft 2 Field Savings Method + Beta software release
- Oct 2016 Draft 3 CT Specification
- Nov 2016 Draft Final CT Field Savings Method + V1.0 software release
- Dec 2016 Draft Final and Final Specification + Final Savings Method

Timeline to implement Version 1.0

- December 23: Deadline for comments on the QPX requirements.
- January 5: Connected Thermostat CB Training Webinar
- Week of January 9: Web services available for testing
- January 13: Deadline for first batch of CB applications
- January 17: EPA announces recognized CBs
- Late January: V1.1 ENERGY STAR CT Field Savings Software released for use; Web services will be live.
- First Connected Thermostat is Certified: EPA will post the certified product list.

Application Process

- If you have not already, please send a signed application and evidence that you have contacted your accreditation body requesting a scope expansion for the Connected Thermostat program to certification@energystar.gov
- EPA will recognize CBs for this new category pending a formal scope expansion from an accreditation body.
- Submission deadline for those CBs that want to be among the first batch recognized will be January 13.
- EPA will continue to accept applications at any time, but cannot guarantee prompt recognition for those that apply after January 13.

Submission Deadline
January 13

Thank You!

Abi Daken
EPA, ENERGY STAR
(202) 343-9375
Daken.Abigail@epa.gov

Eamon Monahan
EPA, ENERGY STAR
(202) 343-9589
Monahan.Eamon@epa.gov

ConnectedThermostats@energystar.gov

certification@energystar.gov