

Enabling Data-Driven Broadband Policymaking using BQT+

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How do we Build Transparent Broadband Data Infrastructure?

Internet Service Providers

Policymakers



Unreliable & Noisy
Internet Availability, Quality, and Cost



How to reduce dependence on self-reported data from ISPs?

How Do We Build Transparent Broadband Data Infrastructure?



Service Availability,
Quality, and Cost



A screenshot of a broadband service website. At the top, the word "Availability" is in red, followed by a home icon and a redacted address. To the right is a link "Edit address". Below this is a green banner with a mobile phone icon and text: "Unlock extra savings on select Cox Internet plans and experience unbeatable 5G reliability on-the-go when you add Cox Mobile after purchase." with a "Find out how" link. The main heading is "GET HIGH-SPEED INTERNET AT AN AFFORDABLE PRICE FROM A LEADING INTERNET PROVIDER" followed by a paragraph: "Delve into a realm of fast and consistent connectivity without breaking the bank. Our competitive pricing coupled with unparalleled customer service makes Cox the go-to internet provider for budget-friendly high-speed internet solutions." Below this is a "Quality" section with a green dot and text "SAVE \$15.00/mo. with Cox Mobile" and a blue checkmark and text "INCLUDES Panoramic Wifi equipment". The "Quality" section contains three items: "100 Mbps" (circled in red) with "Max download speed" and "Quality" below it; "Go Fast" with a description "Great for browsing the web, social media, email, and more"; and two pricing options: "\$35.00/mo" (circled in red) with "with Cox Mobile, for 24 mos. No annual contract or cancellation fees." and "\$50/mo" with "without Cox Mobile, no annual contract or cancellation fees." To the right are buttons for "Order now", "Customize plan", and a link for "Plan details".

Independent querying enables verifiable, address-level broadband data

BQT Operationalizes Independent Querying at Scale

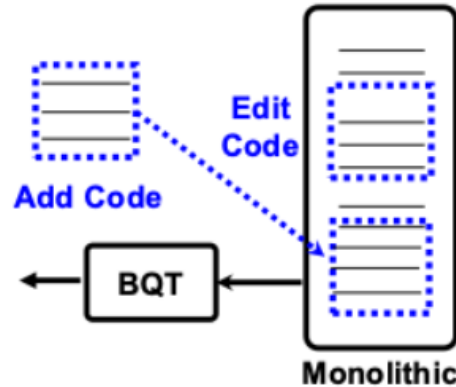
- Automates ISP interface querying
- Street-level granularity



Transparent broadband data infrastructure

Policy workloads demand Extensibility and Robustness

- **BEAD** → Must extend querying to many more ISPs (**extensibility**)
- **Affordability** → Longitudinal monitoring, non-experts running repeated queries (**robustness**)



BQT cannot keep up with evolving policy workloads

Problem Statement

How can a querying system enable **non-technical** users to sustain **longitudinal**, address-level data collection across **evolving ISP interfaces**?

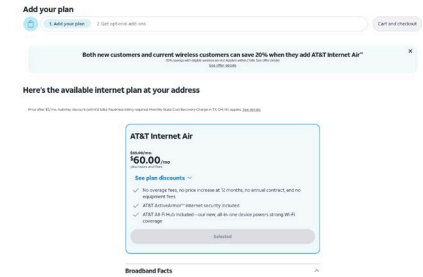
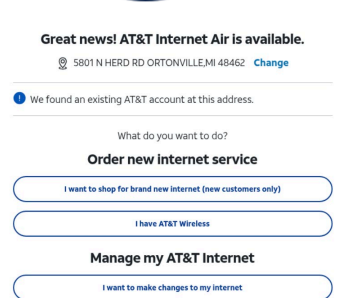
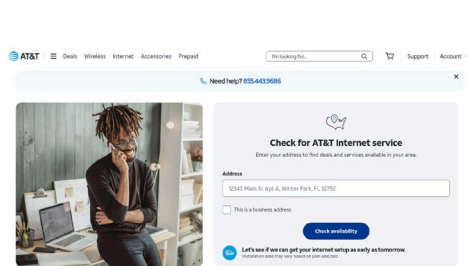
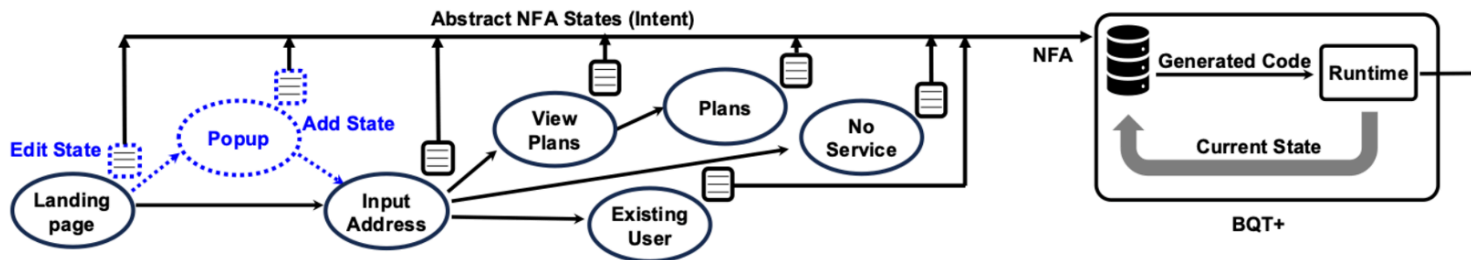
BQT+'s Key Design: Disaggregation

- **Intent:** What we want to measure
- **Execution:** how interface is traversed
- **NFA** enables dynamic branching

Natural Language Intent Authoring

```

1 prompt
2 ...
3 StatePrompt(
4   name="Handle Existing Customer Question",
5   description="Handle the question about existing AT&T customer",
6   triggers=["If asked 'Are you an existing AT&T customer?' or similar"],
7   actions=["Click 'No' or 'New Customer' button", "TERMINATE AT THIS POINT"],
8 ),
9 ...
10 ]
  
```



Extensibility and Robustness in Practice

- Adding ISPs require localized changes
- Interface churn does not trigger rewrites

Lines of Text to Generated Lines of Code Ratio

**Can sustain longitudinal, address-level data collection
across heterogeneous ISPs**

Policy Impact: Virginia Case Study

- 62k addresses analyzed
- Only **4.5% of CBGs** have affordable plans
- Findings directly informed legislative action

Sustained longitudinal data collection is essential for tracking affordability

Policy Impact: BEAD Monitoring

- 4 states, 64 ISPs, 62k addresses
- Identified **availability** and **affordability** gaps

**Sustained longitudinal data collection is essential for
BEAD oversight**

Summary

- BQT+ is **robust, extensible, lowers technical debt**, supports policy workloads
- BQT+ enables a **transparent broadband data infrastructure**
- **Next step:** Release BQT+ as a service, with easy-to-use interfaces for non-technical users

Independent broadband data is infrastructure