



CAF Performance Testing

How does the recent vote affect you?

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CAF Performance Testing

How does the recent vote affect you?

- **The Vote and What Changed?**
- **Now What?**

Latest Understanding of The Vote.....

- **Delays Start Dates**
- **Introduces Mandatory Pre-test**
- **Enhances Subscriber Recruitment**
- **Redefines IXP Test Server Locations**
- **Addresses Test Congestion**
- **Clarifies Rules of Compliancy**

This is Calix's interpretation of the order and not a legal opinion. For more details, see: <https://www.fcc.gov/document/enforcing-rural-broadband-quality-standards>



When to Start Testing?



- **Start dates delayed as much as 2 years to align with deployment obligations**

Program	Pre-testing start date	Testing start date
CAF Phase II (Price-cap carrier funding)	January 1, 2020	July 1, 2020
Rural Broadband Experiments	January 1, 2021	January 1, 2022
Alaska Plan	January 1, 2021	January 1, 2022
A-CAM I	January 1, 2021	January 1, 2022
A-CAM I Revised	January 1, 2021	January 1, 2022
ACAM II	January 1, 2022	January 1, 2023
Legacy Rate of Return	January 1, 2022	January 1, 2023
CAF II Auction	January 1, 2022	January 1, 2023
New NY Broadband Program	January 1, 2022	January 1, 2023

Source: FCC DOC-36069A1, section 77 (page 29)

- **Pre-testing will be required**

- Executed in accordance with the mandated FCC test requirements
- USAC will provide a random sample of locations before testing begins
- No penalties unless the carrier completely fails to pre-test (5% fund withholding)
- Results must be submitted to USAC within one week of the end of each quarter

Source: FCC DOC-36069A1, section 74 (page 28)



Where to test from? Subscriber's home

- USAC will provide a set of random test locations from the HUBB at the beginning of the testing
- Additional locations will be shared to replace subscribers no longer active or if they opt-out
- Should it not be possible for a carrier to recruit at least 5 locations, non-CAF locations can be used with a waiver**
- Carriers may use the same locations for both latency and speed testing
- In some cases, carriers may add additional locations for statistical gain***

Total Subs*	Subs per test
50 or fewer	5**
51 – 500	10% of subs
Over 500	50***

* Number per state and per service tier combination

* Only active subscribers (not homes passed) currently in the HUBB

Source: FCC DOC-36069A1, sections 15, 29, 44, 45, 47, 71

How to minimize subscriber opt-out

NEW

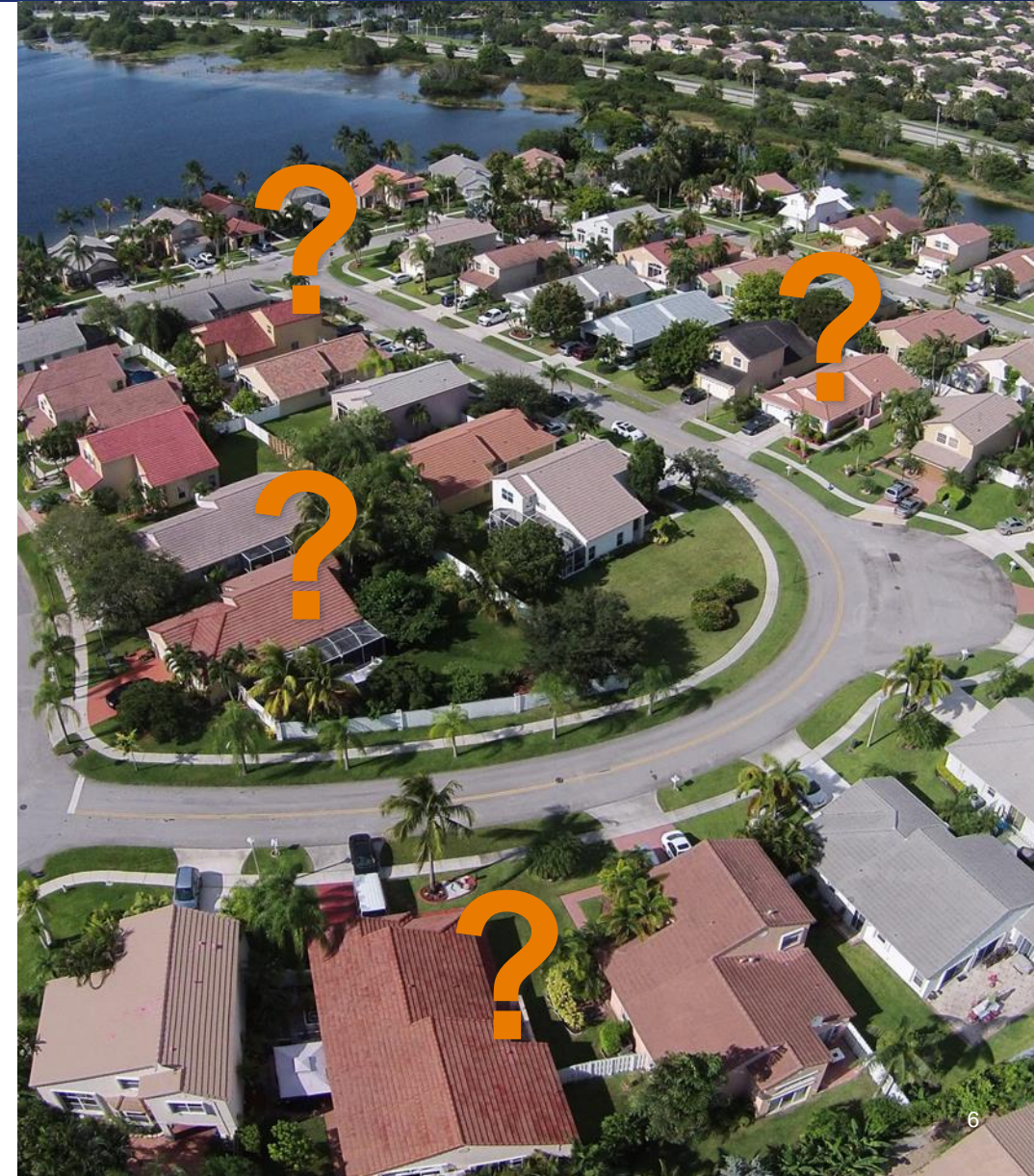
FCC will provide consumer facing website that

- Urges public's participation to ensure that carriers are living up to the obligations
- Assures that that no customer proprietary network information is involved
- Advises that this testing is no different than routine performance testing

Solutions that do not require additional hardware

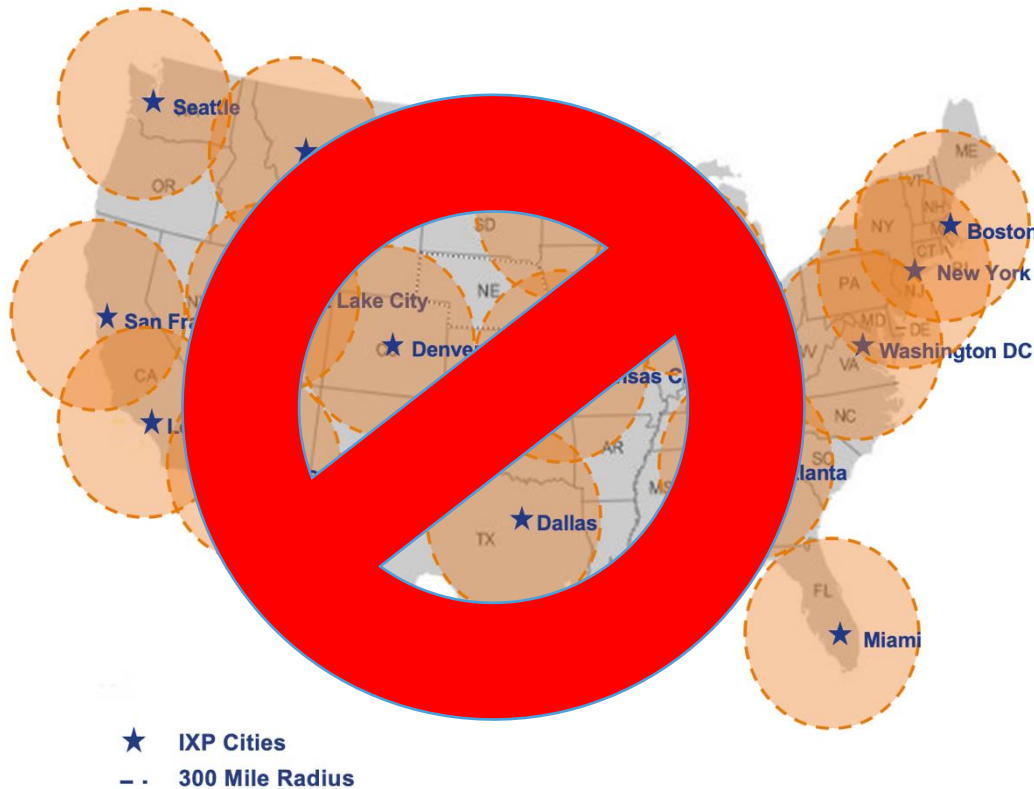
- The FCC recognizes that, "Numerous vendors are also developing software solutions that will allow providers to test the service at customer locations without requiring any additional hardware at the customer's premises. that many vendors provide software-based solution that do not require additional hardware"

Source: FCC DOC-36069A1, section 46 (page 18-19)



Where to test to?

- ~~All tests must terminate or pass through one of these 16 IXP cities~~



Proposed Order

- Rather than a specific city, an IXP is now defined as: “any building, facility, or location housing a public Internet gateway that has an active interface to a qualifying (Autonomous System Number) ASN”.
- The order proposes 44 “safe harbor” ASNs that represent unique connections to middle mile networks listed on the following slides.
- Carriers must test speed and latency from the customer premises of an active subscriber to a remote test server located at or reached by passing through any IXP housing a public Internet gateway that has an active interface to a qualifying ASN.

FCC Designated ASN's



ASN	Organization	ASN	Organization
3356	Level 3 Parent, LLC	174	Cogent Communications
2914	NTT America, Inc.	6939	Hurricane Electric, LLC
6453	TATA Communications Inc	3491	PCCW Global, Inc
6461	Zayo Bandwidth	3549	Level 3 Parent, LLC
209	CenturyLink Communications, LLC	701	MCI Communications Services d/b/a Verizon Business
7018	AT&T Services, Inc	7922	Comcast Cable Communications, LLC
2828	MCI Communications Services d/b/a Verizon Business	1239	Sprint
11164	Internet2	7029	Windstream Communications, LLC
22773	Cox Communications Inc.	577	Bell Canada
6128	Cablevision Systems Corp.	20115	Charter Communications
11404	Vanoppen.biz LLC	6327	Shaw Communications Inc.
702	MCI Communications Services d/b/a Verizon Business	7385	Integra Telecom, Inc.

Source: FCC DOC-36069A1, Appendix A (page 35-36)



FCC Designated ASN's cont.



ASN	Organization	ASN	Organization
852	TELUS Communications Inc.	5650	Frontier Communications of America, Inc.
812	Rogers Communications Canada Inc.	13768	Cogeco Peer 1
2381	WiscNet	29791	Internap Corporation
26554	US Signal Company, LLC	703	MCI Communications Services d/b/a Verizon Business
2686	AT&T Global Network Services, LLC	13760	Southern Light, LLC
6079	RCN	19151	WV FIBER
7342	VeriSign Infrastructure & Operations	4181	TDS TELECOM
29838	Atlantic Metro Communications, LLC	11096	FloridaNet
293	Esnet	14537	Continet 8 LLC
23473	PAVLOV MEDIA INC	40805	JMF Solutions, Inc

Source: FCC DOC-36069A1, Appendix A (page 35-36)



What to test? Network latency

How you test

- Single UDP packet or a group of 3 ICMP or UDP packets sent at essentially the same time. Similar to Ping Test

Test Frequency

- Full week per quarter, from 6:00 pm -12:00 am
- 1 test per minute (60 tests/hr * 6 hrs * 7 days = 2,520 tests per location)
- All test results (pass and fail) must be submitted

Test Exceptions

- If consumer load exceeds 64 Kbps downstream, retry in next minute. It is recommended that you save information on what the load was when this happens

Awaiting Clarification

- Format of the data will be provided by USAC



What to test? Network Speed

How you test

- Single measurement of download/upload speed of 10 - 15 seconds duration
- To avoid congestion, testing need not be started at the top of hour but recommended to start before 15 minutes for purposes of retries.

Test Frequency

- Full week / quarter from 6pm-12am
- One download and one upload test per hour (6 tests/day * 7 days = 42 tests per location)
- All test results (pass or fail) must be submitted

Test Exceptions

- If consumer load exceeds 64 Kbps downstream, or 32 Kbps upstream; record the load and retry
- The load check-and-retry must continue at one-minute intervals until the test can be run or the hourly test window ends
- Awaiting details from USAC which is working on a system to pull data from you

UPDATED



Network Speed test confusion

What speed to test?

- The **CAF-required** (or other program required) broadband speed
 - Example: If the carrier is required to provide 10/1 speed, then that is the criteria against which the speed test is judged, so 80% of results must be greater than 8 Mbps.
 - Important: This requirement has nothing to do with the subscriber's actual subscribed speed. Hint: if that subscriber above is subscribed to a 12/2 service, then 8 Mbps should be easily met.
- Note: if the subscriber has selected a lower speed than the **required** speed, then the carrier must temporarily increase the subscriber's speed for test purposes.

The "150%" exception <- Rule removed

- ~~Any test result that is over 150% of the subscriber's **advertised** speed is discarded.~~

UPDATED



How will the FCC interpret the results?



To reach 100% compliance

- Latency - 95% or more of all testing hours measurements of round-trip latency are at or below 100 ms
- Speed - 80% of download and upload measurements must be at or above 80 percent of the CAF-required speed tier.

Other Stipulations

- The speed for which the provider should be testing is the speed required by the relevant CAF rules, not the advertised speed. If a provider must deploy 10/1 but advertises and sells 12/2, the compliance will be calculated against 10/1 not 12/2
- Carrier may upgrade subscribers that have advertised rates lower than the funded rate

LATENCY TEST

ATR*	95%	Score
100	÷ 0.95	105.3
97.5	÷ 0.95	102.6
95	÷ 0.95	100.0
9.5	÷ 0.95	97.4
80.8	÷ 0.95	85.0

SPEED TEST

ATR*	80%	Score
100	÷ 0.80	125.0
95	÷ 0.80	188.8
90	÷ 0.80	112.5
85	÷ 0.80	106.3
80	÷ 0.80	100.0
75	÷ 0.80	93.8
68	÷ 0.80	85.0



How are penalties determined?

Using the compliance percentage from the previous slide

Compliance Levels and Support Reductions

	Qualifying Compliance %-X	Requiring Quarterly Reporting	Monthly Support Withheld
Full Compliance	$X \geq 100\%$	No	N/A
Level 1	$85\% \leq x < 100\%$	Yes	5%
Level 2	$70\% \leq x < 85\%$	Yes	10%
Level 3	$55\% \leq x < 70\%$	Yes	15%
Level 4	$X < 55\%$	Yes	25%

Source: FCC DA 18-710, section 64, page 25

Compliancy relief: “...When a non-compliant carrier comes into a higher level of compliance, USAC will now return the withheld support up to an amount reflecting the difference between the levels’ required withholding.”

Source: FCC DOC-36069A1, section 70 (page 28)

From the order:

“All carriers not fully compliant in a particular state must submit quarterly reports providing one week of testing hours test results, subject to the same requirements we establish in this Order, and describing steps taken to resolve the compliance gap, and USAC will withhold a percentage of a non-compliant carrier’s monthly support.”

Source: FCC DA 18-710, section 63 (page 24)



A New Twist to Calculating Penalties?



The new order combines both

- **CAF recovery penalties for noncompliance** test results from difficult-to-deploy testing architectures due to potential middle mile facilities over which they have limited control.
- **Final milestone deployment obligations** actual number of required physical locations to which service was not deployed



***Footnote 183 on page 27:** For instance, Carrier X was required to deploy to 100 locations, but only deployed to 90 total locations, a shortfall of 10 locations. Of those 90 locations, only 90% (81) met the requisite speed and latency requirements, a shortfall of 19 (from the 100 required). If the average support per line in the state was \$100, Carrier X would be required to refund \$32,886 ($\$100 \times (10 + 19) \text{ locations} \times 6 \text{ years} \times 1.89$) in support.*



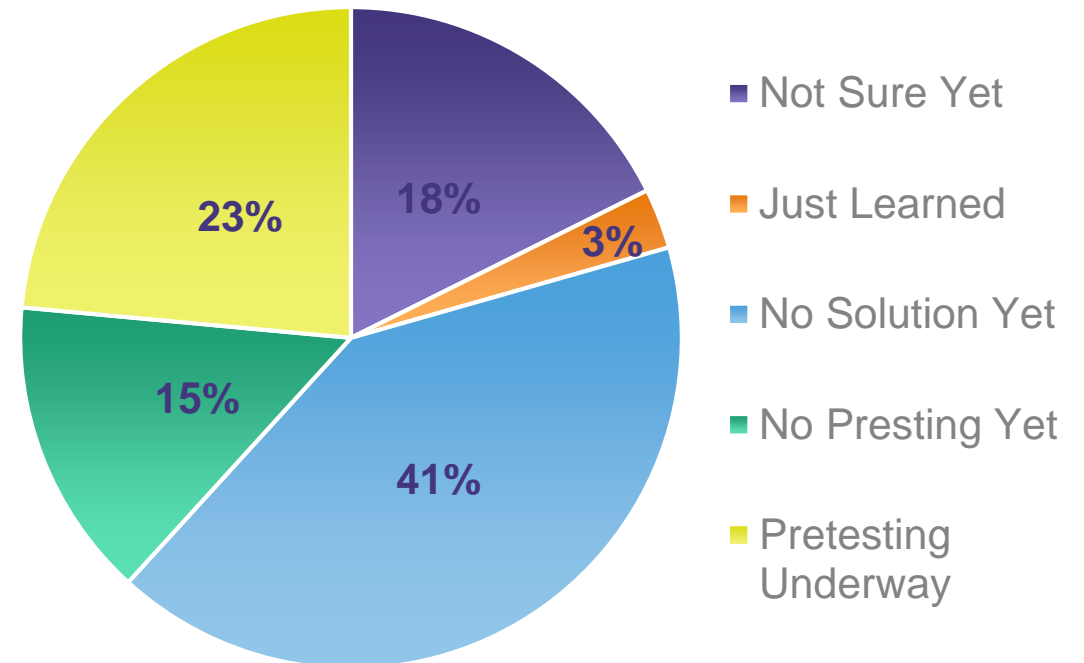
Now What?

Check point: Where are you today?

Where is your company at with the CAF Performance Testing requirement?

- We're not even sure we need to test yet
- Just found learned we need to test
- We know we need to test, but have no solution yet
- We've selected a solution but haven't started pre-testing yet
- Pre-testing underway

Testing Preparation Stage



Date: 8/25/19



You have been given a year; How do you use it?

“You must choose, But choose wisely”

1. Put everything ~~on~~-hold and wait?
2. Finish building out the test architecture for:
 - Troubleshooting for customer trouble calls
 - Monitoring network performance for monthly customer mailers
 - CAF testing and report



“You have been given a break, but you have not been given a reason to delay”



One Test Architecture → Multiple Test Use Cases



Test Controller

- Schedules and initiates test's start, end and frequency



Speed Test

- Checks network
- Initiate speed testing – file upload and download
- Notify test completion



Latency Test

- Checks network
- Initiate latency testing – UDP packets
- Notify test completion

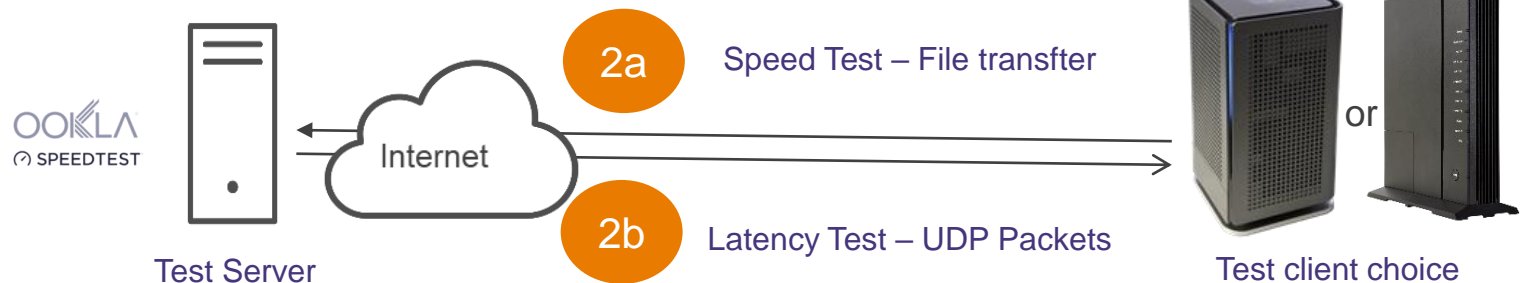
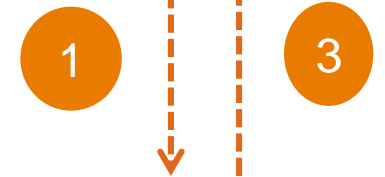


Test Report

- Collects and reports test data



Test controller



Calix Solution Overview – 4 Components

1. Test Controller

- Calix Support Cloud DME – add on
- Calix Support Cloud EME – included

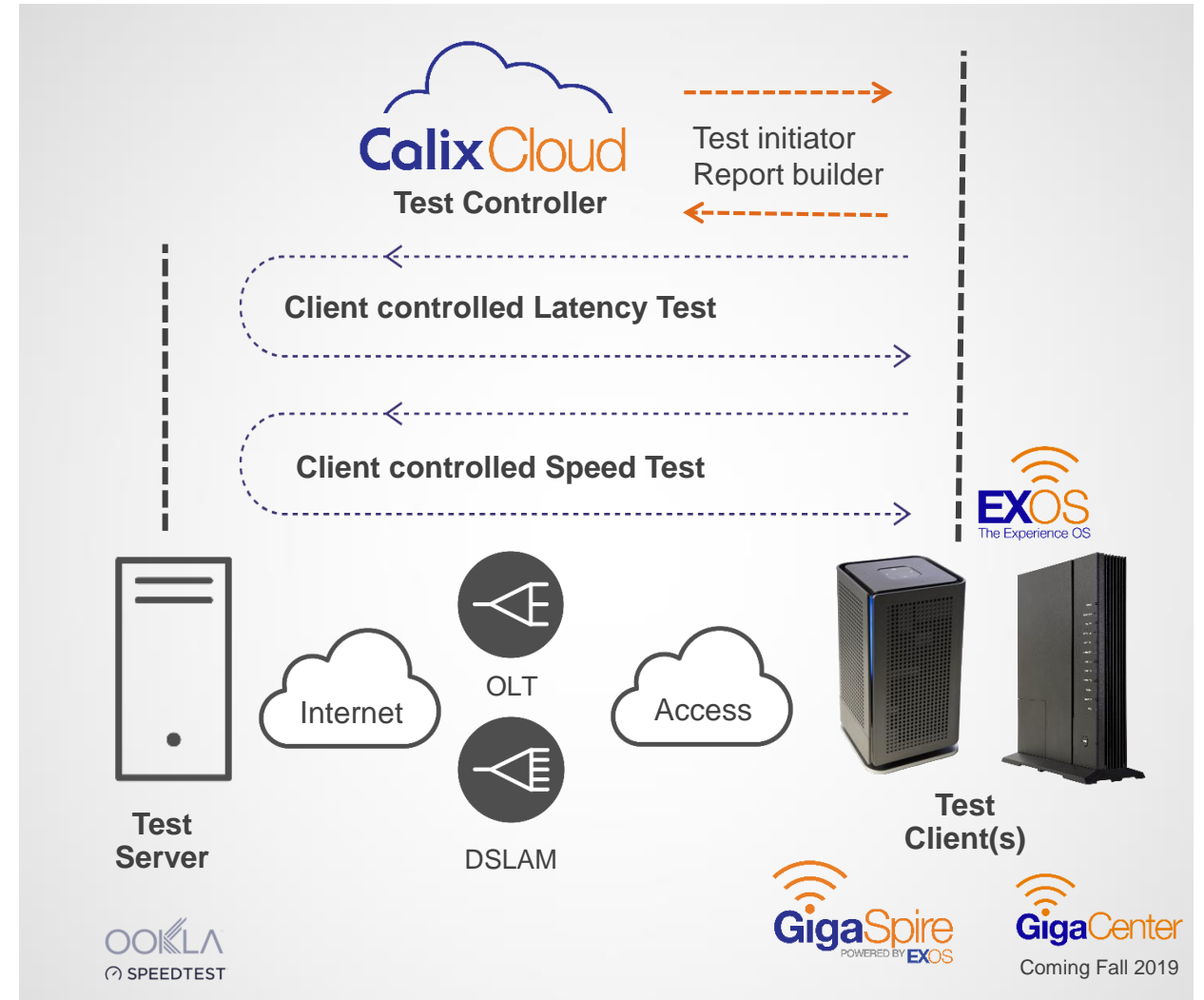
2. Test Client

- GigaSpire BLAST
- GigaSpire MAX
- GigaCenter

3. Test Server

- Industry known, widely available (Ookla)
 - Global leader in network testing, over 10 million tests every day

4. Access to Experts



Test Controller using CSC DME or EME

Automates test scheduling and initiation and builds FCC reports

- Integrated in your current Calix Control Cloud functionality
- Takes the hassle out of knowing the letter of FCC order
- Accurately builds the FCC report based on FCC USAC standards
- Can be used for non-CAF testing

TEST
SCHEDULING

TEST
INITIATION AND
CONTROL

REPORT
BUILDER



Calix Cloud



Two Test Client Options: Quick, Simple and No Extra Boxes

- Stands up quickly
 - Test controller is built into the CSC
 - Test client is built into GigaSpire
- Eliminates cost of additional test box
- Avoids testing across an unmanaged home
- Simple and turnkey: No extra HW to install and support
- Introduces latest smart home subscriber experience
- **Will continue to adapt to the FCC rules as they become available**




GigaSpire
POWERED BY EXOS




GigaCenter

Coming Fall 2019



Broadband Performance Testing Service



Implementation workshop



- Knowledge transfer on FCC CAF speed and latency test requirements
- Assistance setting up FCC testing framework and schedule
- Calix Support Cloud (CSC) review of network operations functions applicable to broadband testing

Ongoing testing assistance



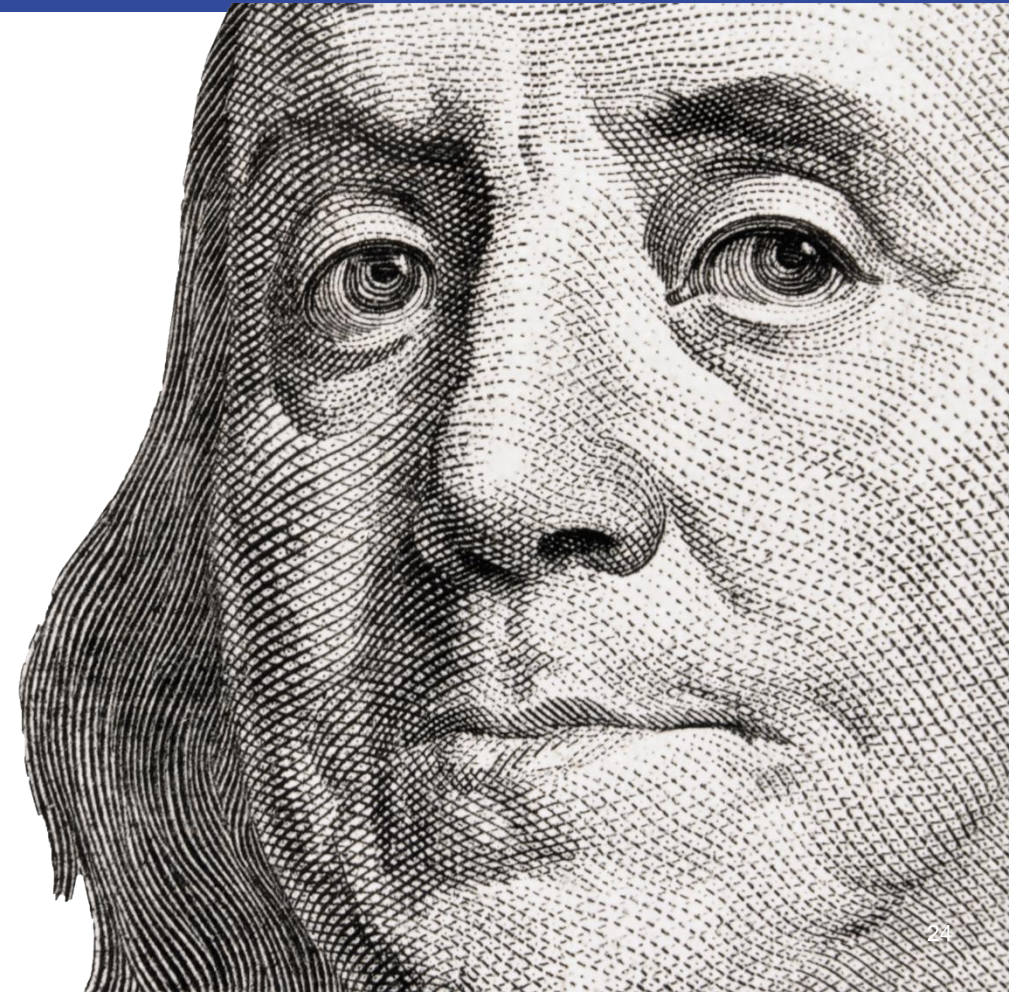
- Periodic FCC compliance updates
- Regular proactive monthly testing
- Reporting and analysis of performance results
- Report preparation assistance for regulatory compliance



Test Early and Often

**“By failing to prepare,
you are preparing to fail”**

Benjamin Franklin



STAY TUNED FOR MORE FCC UPDATES

- Look for the final published FCC order
- More details from USAC on how CAF test data will be formatted; and test locations will be shared
- Calix will adapt its software to meet the new rules
- Check www.calix.com/CAF on a regular basis
 - Future FCC updates
 - Past webinars
 - Solution updates





Questions?

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**THANK
YOU!**

