**Candela**
**TECHNOLOGIES**
Network Testing and Emulation Solutions

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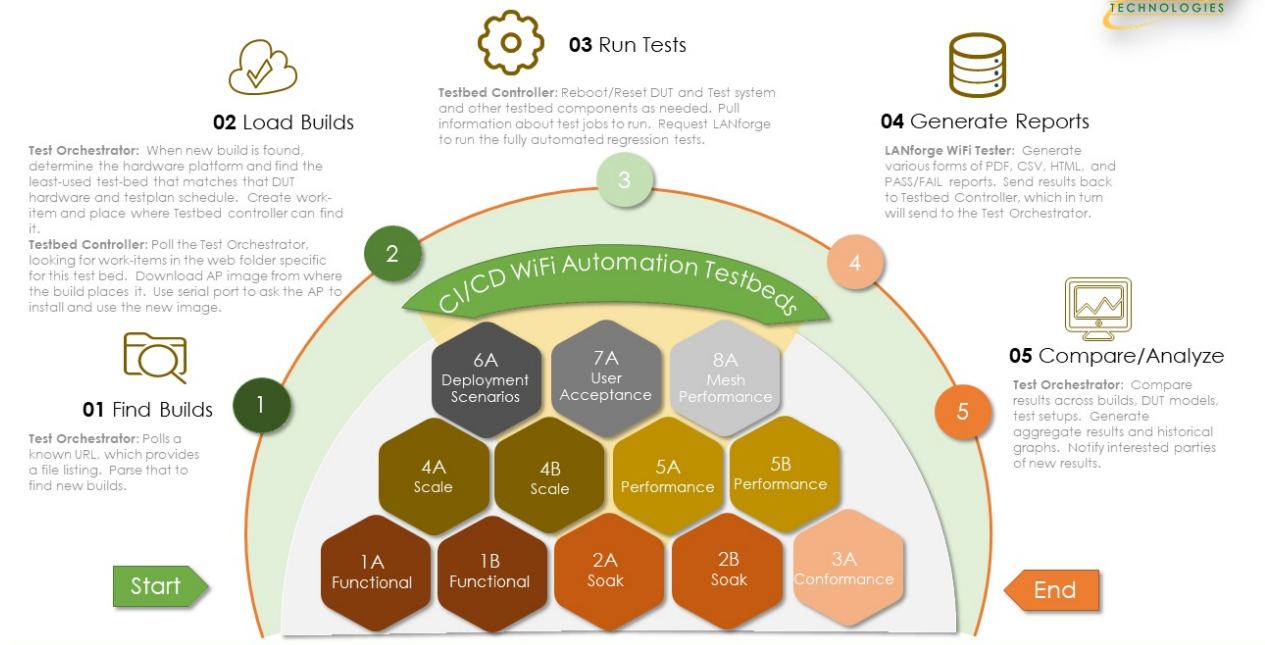+1 (360) 380-1618 [PST, GMT -8]

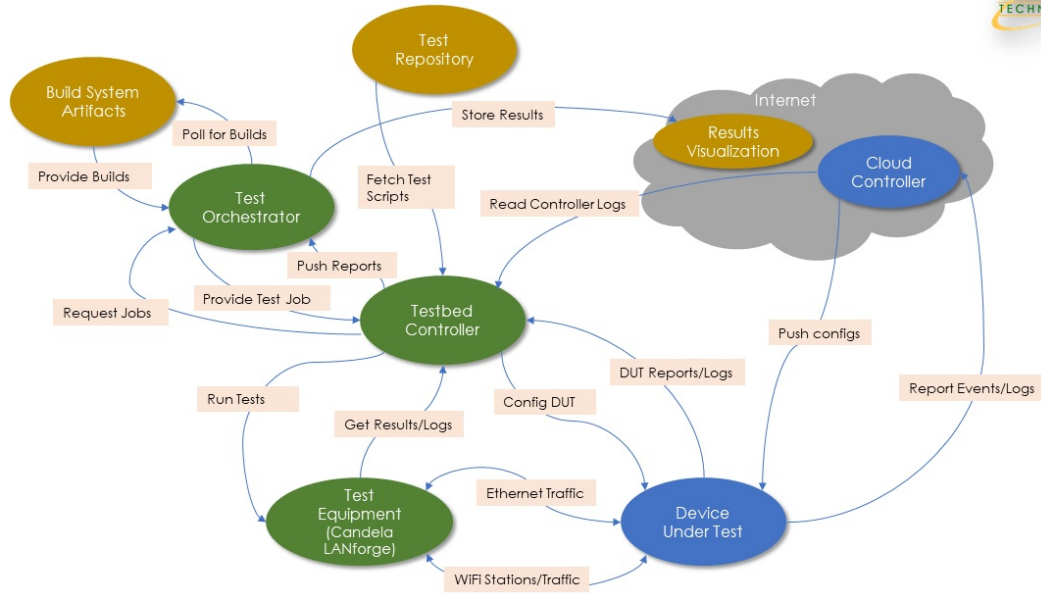# CI/CD Automated WiFi Testing with LANforge

This system is useful for CI/CD and other Automated testing, as well as personal test beds. It is designed to be fully functional as a remote access test system. This test bed includes an RF chamber, powerful 6-radio + 10G LANforge WiFi test system, remote power switch, usb camera, and optional external control system for orchestrating tests across multiple systems.

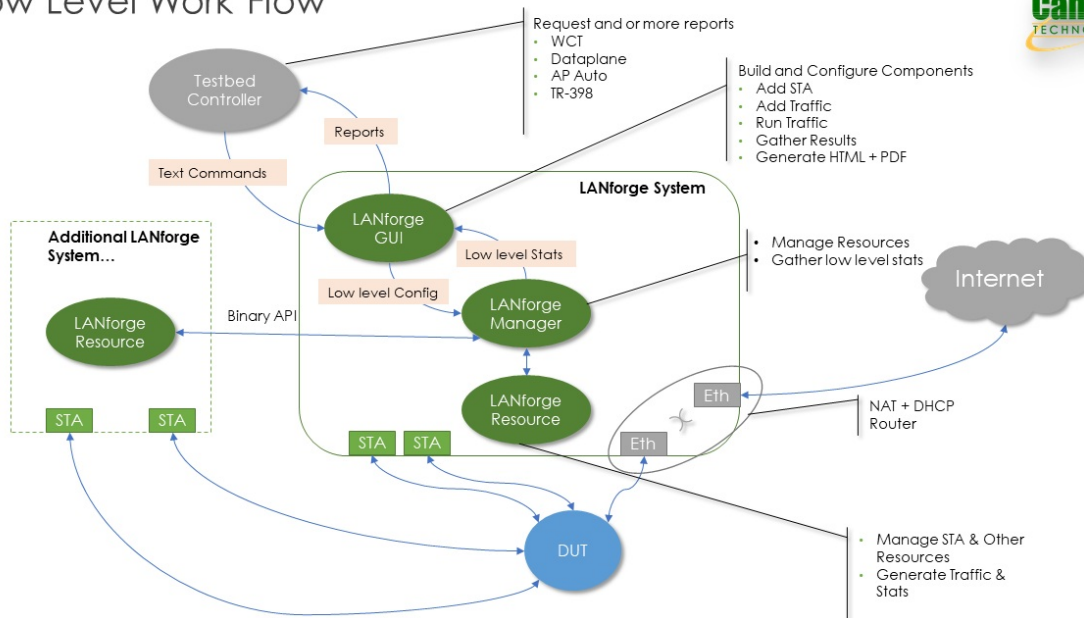## Continuous Integration(CI) / Continuous Delivery(CD) Automation



**03** Run Tests

**Testbed Controller:** Reboot/Reset DUT and Test system and other testbed components as needed. Pull information about test jobs to run. Request LANforge to run the fully automated regression tests.

**02** Load Builds

**Test Orchestrator:** When new build is found, determine the hardware platform and find the least-used test-bed that matches that DUT hardware and testplan schedule. Create work-item and place where Testbed controller can find it.
**Testbed Controller:** Poll the Test Orchestrator, looking for work-items in the web folder specific for this test bed. Download AP image from where the build places it. Use serial port to ask the AP to install and use the new image.

**04** Generate Reports

**LANforge WiFi Tester:** Generate various forms of PDF, CSV, HTML, and PASS/FAIL reports. Send results back to Testbed Controller, which in turn will send to the Test Orchestrator.

**01** Find Builds

**Test Orchestrator:** Polls a known URL, which provides a file listing. Parse that to find new builds.

**05** Compare/Analyze

**Test Orchestrator:** Compare results across builds, DUT models, test setups. Generate aggregate results and historical graphs. Notify interested parties of new results.

CI/CD WiFi Automation Testbeds

| 6A Deployment Scenarios | 7A User Acceptance | 8A Mesh Performance |
| 4A Scale | 4B Scale | 5A Performance | 5B Performance |
| 1A Functional | 1B Functional | 2A Soak | 2B Soak | 3A Conformance |

Start

End

See an **example historical report** auto-generated by Candela's LANforge CI/CD test suite.

# CI/CD Automation Work Flow



Build System Artifacts
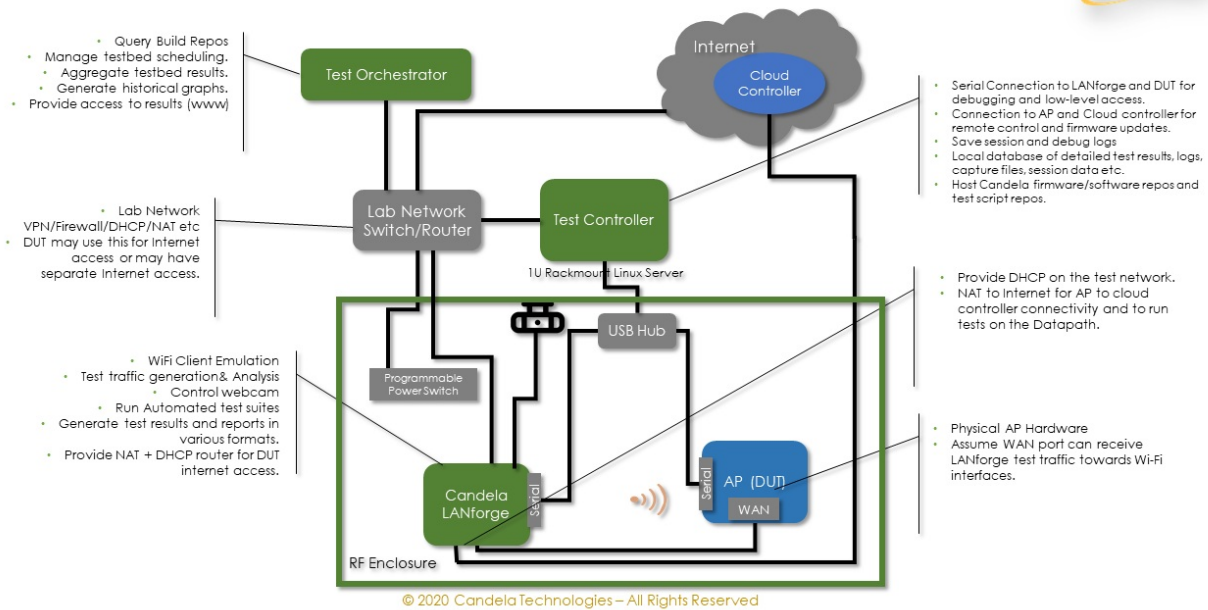
Test Repository

Internet

Results Visualization

Cloud Controller

Poll for Builds

Store Results

Provide Builds

Fetch Test Scripts

Read Controller Logs

Test Orchestrator

Push Reports

Request Jobs

Provide Test Job

Testbed Controller

Push configs

Report Events/Logs

DUT Reports/Logs

Run Tests

Get Results/Logs

Config DUT

Test Equipment (Candela LANforge)

Ethernet Traffic

Device Under Test

WiFi Stations/Traffic

# Low Level Work Flow



Testbed Controller

Request and or more reports
- WCT
- Dataplane
- AP Auto
- TR-398

Build and Configure Components
- Add STA
- Add Traffic
- Run Traffic
- Gather Results
- Generate HTML + PDF

Reports

Text Commands

LANforge System

Additional LANforge System…

LANforge GUI

Low level Stats

- Manage Resources
- Gather low level stats

Internet

LANforge Resource

Binary API

Low level Config

LANforge Manager

STA  STA

LANforge Resource

Eth

NAT + DHCP Router

STA  STA

Eth

DUT

- Manage STA & Other Resources
- Generate Traffic & Stats

# Testbed Diagram

**Test Orchestrator**
- Query Build Repos
- Manage testbed scheduling.
- Aggregate testbed results.
- Generate historical graphs.
- Provide access to results (www)

- Serial Connection to LANforge and DUT for debugging and low-level access.
- Connection to AP and Cloud controller for remote control and firmware updates.
- Save session and debug logs
- Local database of detailed test results, logs, capture files, session data etc.
- Host Candela firmware/software repos and test script repos.

**Lab Network**
- VPN/Firewall/DHCP/NAT etc
- DUT may use this for Internet access or may have separate Internet access.

**Lab Network Switch/Router**

**Test Controller**
1U Rackmount Linux Server

- Provide DHCP on the test network.
- NAT to Internet for AP to cloud controller connectivity and to run tests on the Datapath.

**Internet** — Cloud Controller

**USB Hub**

- WiFi Client Emulation
- Test traffic generation & Analysis
- Control webcam
- Run Automated test suites
- Generate test results and reports in various formats.
- Provide NAT + DHCP router for DUT internet access.

**Programmable Power Switch**

**Candela LANforge** — Serial

**AP (DUT)** — Serial — WAN

- Physical AP Hardware
- Assume WAN port can receive LANforge test traffic towards Wi-Fi interfaces.

RF Enclosure

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# Testbed Images



## Lights Out AP Testbed Setup

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Detailed picture of test bed with 4 /AC wave-2 radios and 4 AX radios.

**Notes on test bed.**

- LANforge test system acts as WiFi stations and upstream server for traffic generation.
- LANforge may act as NAT router for DUT: DUT connects to eth2 and gets DHCP, eth3 on LANforge performs NAT and connects to the upstream network (Internet).
- Serial console ports on DUT and LANforge are brought to outside control node. Or optionally, DUT serial console may connect to LANforge and then no external control node is needed.

**Suggested tests.**

- Dataplane: Throughput over different packet sizes, wifi modes, NSS and more.
- Capacity: Throughput over different numbers of WiFi stations.

- Stability: Throughput and stability over longer time, with UDP, TCP, HTTP, VOIP traffic mix and optional station reconnects while under load.

## Includes these Building Blocks

- **Hardware**
  - LANforge Multi station Emulation and Traffic Generation Hardware – Suggested 6 wave-2 radios (3x 2.4GHz, 3x 5GHz NICs), 2 10gE ports. More affordable options available.
  - CT820a-Medium RF Chamber.
  - Remote access power switch.
  - USB hub.
  - LED light.
  - USB camera.
  - 20db fixed attenuator for each LANforge SMA port.
  - Optional Controller system (1U rackmount server or similar).

- **Software**
  - Scripts to poll build tools to find new images (Test Orchestrator) and create historical reports from multiple test-bed runs.
  - Scripts to handle tests created by the Test Orchestrator (Test Bed Controller).
  - LANforge WiFi software for test creation and execution, traffic generation and more. Supports automated as well as manual testing.

## Key Measurements

- PASS/FAIL results table for many tests.
- Key Performance Indicator CSV data for many test cases. May be used to graph historical performance over different builds.
- Detailed per test measurements, pdf reports and graphs.

## Approxmiate System Pricing

- Mid-level system: $40k
- High-end system: $65k

**Lead Times:** Most LANforge systems can generally be shipped within a few weeks after receiving customer PO. RF chambers may need more lead time.

## Assembly Instructions

- Illustrated lights-out chamber setup guide

## Quick-Start guide

**Internal chamber setup.**

1. Configure remote power switch for DHCP and connect to inside power in the RF chamber. Use Ethernet cable to connect the power switch to the chamber wall connector 1. Record the IP address of the power switch.
2. Connect LANforge management Ethernet port to chamber wall connector 2.
3. Connect LANforge uplink Ethernet port (eth3 usually) to chamber wall connector 3.
4. Connect DUT serial port to USB hub.
5. Connect LANforge serial port to USB hub.
6. Connect USB hub cable to RF chamber wall connector.

7. Connect DUT WAN Ethernet port to LANforge port eth2. This specific configuration assumes that the DUT AP is NOT acting as a router or providing its own DHCP server.

8. Connect 20-db or similar fixed-attenuators to the SMA ports on the LANforge (or optionally, on DUT). This helps keep the RF signal from being too strong, considering the LANforge stations and DUT are just a few inches apart. Connect SMA antennas to the attenuators.

9. Plug in LED light, LANforge system, powered USB hub and DUT to the remote power switch.

**External chamber setup.**

1. Connect USB port to controller will connect to provide serial-console access to DUT and LANforge.

2. Connect RF Ethernet ports 1 and 2 to lab network.

3. Connect RF Ethernet ports 3 to Internet network (or lab network in simpler setups) DUT will use this to access the Internet and/or cloud-controllers.

4. Connect AC power cord from RF chamber to wall socket.

**Network configuration notes.**

1. LANforge management port should have a DHCP address reserved for it so that it always gets the same well-known IP address.

2. LANforge port eth3 must use a staticly configured IP address, configured from within the LANforge tool.

3. WiFi station IP addresses will be given out by LANforge port eth2, so lab network does not need to care about serving DHCP to the WiFi stations. NAT on LANforge port eth3 will make sure lab network does not conflict with WiFi station addressing.



For more information, please contact sales@candelatech.com or give us a call at: 1-360-380-1618