TestNG Cross-Browser Parallel Execution Explanation

# Cross-Browser Parallel Execution in TestNG

Cross-browser testing is a process where the same set of tests is executed on multiple browsers   
 simultaneously to ensure that the application works consistently across different environments (like Chrome, Firefox, Safari, etc.).   
 Parallel execution refers to running tests concurrently on these browsers, speeding up the test execution process.  
   
 \*\*Configuration for Cross-Browser Parallel Execution in TestNG\*\*  
   
 To execute tests across different browsers in parallel, we need to:  
 1. Set up TestNG to run tests in parallel on multiple browsers (like Chrome, Firefox, Edge).  
 2. Use a combination of `@Parameters` and the `@Test` annotation to specify which browser to use for each test.  
   
 \*\*Example Configuration in TestNG XML:\*\*  
   
 <suite name="Cross-Browser Parallel Suite" parallel="tests" thread-count="3">  
 <test name="Chrome Tests">  
 <parameter name="browser" value="chrome"/>  
 <classes>  
 <class name="com.example.tests.BrowserTest"/>  
 </classes>  
 </test>  
   
 <test name="Firefox Tests">  
 <parameter name="browser" value="firefox"/>  
 <classes>  
 <class name="com.example.tests.BrowserTest"/>  
 </classes>  
 </test>  
   
 <test name="Edge Tests">  
 <parameter name="browser" value="edge"/>  
 <classes>  
 <class name="com.example.tests.BrowserTest"/>  
 </classes>  
 </test>  
 </suite>  
   
 \*\*Test Class to Handle Different Browsers:\*\*  
   
 public class BrowserTest {  
   
 WebDriver driver;  
   
 @BeforeClass  
 @Parameters("browser")  
 public void setUp(String browser) {  
 if (browser.equalsIgnoreCase("chrome")) {  
 System.setProperty("webdriver.chrome.driver", "path/to/chromedriver");  
 driver = new ChromeDriver();  
 } else if (browser.equalsIgnoreCase("firefox")) {  
 System.setProperty("webdriver.gecko.driver", "path/to/geckodriver");  
 driver = new FirefoxDriver();  
 } else if (browser.equalsIgnoreCase("edge")) {  
 System.setProperty("webdriver.edge.driver", "path/to/edgedriver");  
 driver = new EdgeDriver();  
 }  
 }  
   
 @Test  
 public void testTitle() {  
 driver.get("https://www.example.com");  
 String title = driver.getTitle();  
 Assert.assertEquals(title, "Example Domain");  
 }  
   
 @AfterClass  
 public void tearDown() {  
 driver.quit();  
 }  
 }  
   
 \*\*Explanation of Key Points:\*\*  
   
 1. \*\*parallel="tests"\*\*: This tells TestNG to run \*\*entire tests\*\* in parallel. Each `<test>` tag (e.g., Chrome Tests, Firefox Tests) will be executed in parallel.  
 2. \*\*thread-count="3"\*\*: This specifies that \*\*up to 3 tests\*\* can run concurrently (one for each browser).  
 3. \*\*@Parameters("browser")\*\*: This annotation allows you to pass the browser name from the TestNG XML to the test class.  
 4. \*\*setUp(String browser)\*\*: The `setUp` method uses the browser parameter to decide which WebDriver (Chrome, Firefox, or Edge) to initialize for the tests.  
 5. \*\*WebDriver initialization\*\*: The `driver` is initialized based on the browser specified in the `@Parameters` annotation. This way, TestNG will launch the tests on Chrome, Firefox, and Edge concurrently, each in its own thread.  
   
 \*\*Execution Flow:\*\*  
   
 - \*\*TestNG will run the tests on different browsers (Chrome, Firefox, and Edge)\*\* in parallel.  
 - For each browser, TestNG will:  
 - Start a separate \*\*WebDriver instance\*\* for that browser.  
 - Execute the same test (e.g., `testTitle()`) on the specified browser.  
 - After the test execution, the driver will quit, and the next browser will run in parallel.  
   
 \*\*Visual Flow:\*\*  
   
 - \*\*Thread 1\*\*: Runs tests on \*\*Chrome\*\* using the `ChromeDriver`.  
 - \*\*Thread 2\*\*: Runs tests on \*\*Firefox\*\* using the `FirefoxDriver`.  
 - \*\*Thread 3\*\*: Runs tests on \*\*Edge\*\* using the `EdgeDriver`.  
   
 Once all the tests finish, TestNG will conclude the parallel execution.  
   
 \*\*Summary:\*\*  
 - \*\*Cross-browser parallel execution\*\* allows running tests on multiple browsers at the same time, improving testing speed.  
 - \*\*TestNG XML configuration\*\* specifies which browsers to use and how many threads (browsers) to run simultaneously.  
 - By using the \*\*@Parameters annotation\*\* in TestNG, you can pass browser names and set up WebDriver accordingly for each browser.