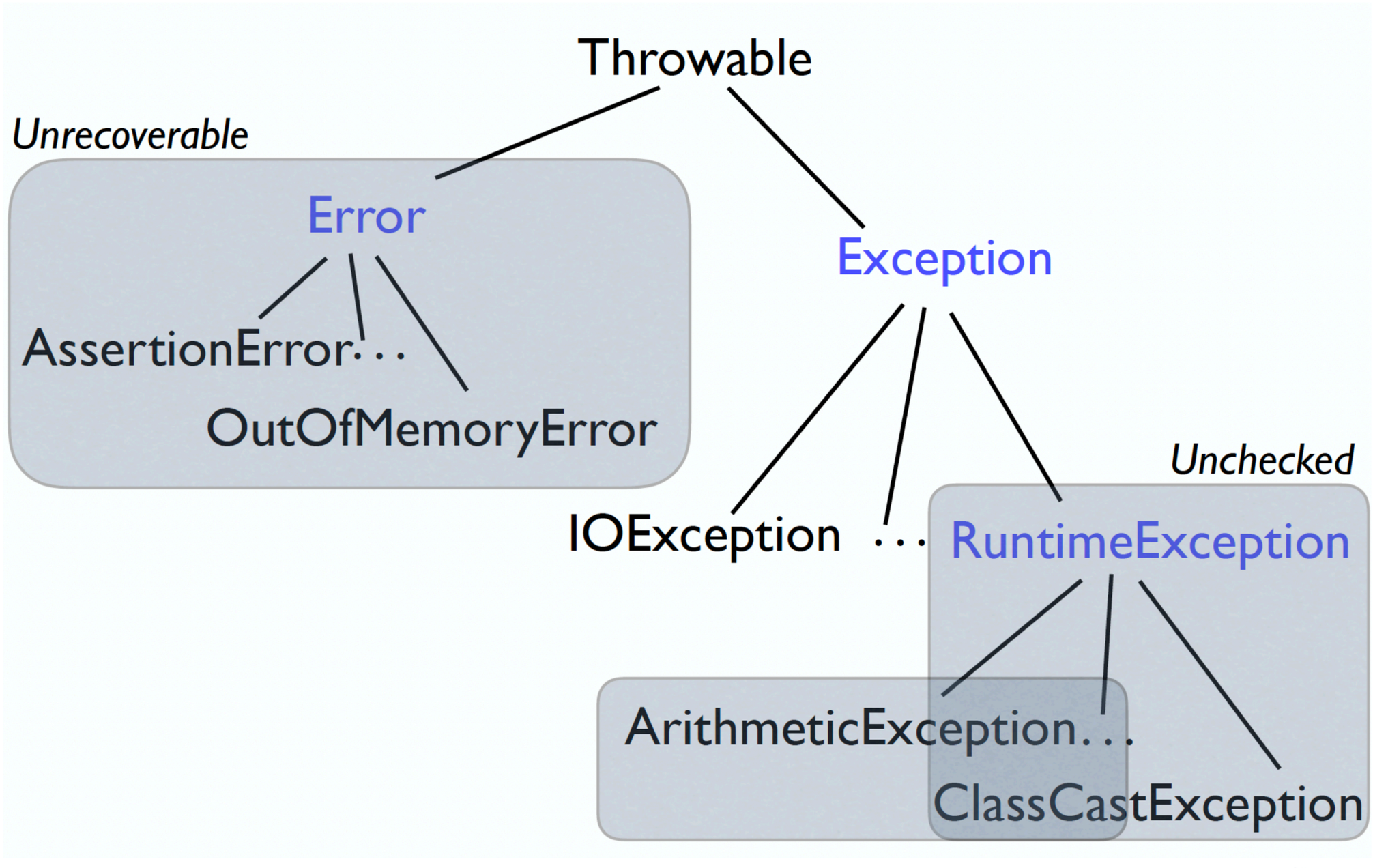
First, a Quick Review!

Short Summary of Exceptions



https://docs.oracle.com/en/java/javase/20/docs/api/java.base/java/lang/Throwable.html

Using Exceptions: Syntax

To **throw** an exception:

```
throw Throwable;
```

To **catch** an exception and deal with it:

```
try {
  statements
  // The catch belongs to the try.
} catch (Throwable parameter) {
  statements
}
```

Your methods may “throw” a Throwable up the call stack:

```
public void methodName (parameters) throws Throwable { .. }
```

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Short Summary of User Stories

User stories describe our requirements.

- Follow a syntax:

“As a [persona], I [want to], [so that].”

User Story:

As a bank customer, I want to Login to my account using a bank card and PIN code so that I can perform a transaction.

Acceptance Tests give us criteria for completion:

Correctly validate bank card and PIN code
Lock card if user enters incorrect PIN 3+ times

A good user story is ….

- **Independent, i.e.** they can be developed in any order and changes to one won’t affect others.
- **Negotiable, i.e.** they capture the essence of desired features but leave wiggle room for implementation details.
- **Valuable, i.e.** they add value to end users.
- **Estimable**, **i.e.** we can guess the time to develop the User Story.
- **Small, i.e.** we can develop it quickly.
- **Testable, i.e.** associated with clear acceptance criteria.

How to improve this user story?

As a user, I want the web page to load in a reasonable time duration so I am not wasting time.

Acceptance tests?

How to improve this user story?

As a passenger, I want several available drivers to be displayed so that I can choose the most suitable option for me.

Acceptance tests?

How to improve this user story?

As a user, I want to customize the system behaviour so that I have a good user experience.

Acceptance tests?

Back to the SOLID principles

```java
public class Invoice {
    5 usages
    private Book book;
    3 usages
    private int quantity;
    3 usages
    private double discountRate, taxRate, total;

    public Invoice(Book book, int quantity, double discountRate, double taxRate) {
        this.book = book;
        this.quantity = quantity;
        this.discountRate = discountRate;
        this.taxRate = taxRate;
        this.total = this.calculateTotal();
    }
    1 usage
    public double calculateTotal() {
        return ((book.price - book.price * discountRate) * this.quantity) * (1 + taxRate);
    }

    public void printInvoice() {
        System.out.println(quantity + "x " + book.name + " " + book.price + "$");
        System.out.println("Discount Rate: " + discountRate);
        System.out.println("Tax Rate: " + taxRate);
        System.out.println("Total: " + total);
    }

    public void saveToFile(String filename) {
        // Creates a file with given name and writes the invoice
    }
}
```

Does this code respect the SOLID principles?

Example from [Yiğit Kemal Erinç](), The SOLID Principles of Object-Oriented Programming Explained in Plain English

```java
public class Rectangle {
    2 usages
    public double width;
    2 usages
    public double height;

    no usages   new *
    public Rectangle(double width, double height) {
        this.width = width;
        this.height = height;
    }
}
```

```java
public class AreaCalculator {
    no usages   new *
    public double Area(Rectangle[] shapes) {
        double area = 0;
        for (var s : shapes) {
            area += s.width * s.height;
        }

        return area;
    }
}
```

Does this code respect the SOLID principles?
What if we want to calculate areas of Circles?

Example from Joel Abrahamsson http://joelabrahamsson.com

```java
class Rectangle {
    protected int width, height;

    public Rectangle() {
    }

    public Rectangle(int width, int height) {
        this.width = width;
        this.height = height;
    }

    public int getWidth() {
        return width;
    }

    public void setWidth(int width) {
        this.width = width;
    }

    public int getHeight() {
        return height;
    }

    public void setHeight(int height) {
        this.height = height;
    }

    public int getArea() {
        return width * height;
    }
}
```

```java
class Square extends Rectangle {
    public Square() {}

    public Square(int size) {
        width = height = size;
    }

    @Override
    public void setWidth(int width) {
        super.setWidth(width);
        super.setHeight(width);
    }

    @Override
    public void setHeight(int height) {
        super.setHeight(height);
        super.setWidth(height);
    }
}
```

Does this code respect the SOLID principles?

Example from [Yiğit Kemal Erinç, The SOLID Principles of Object-Oriented Programming Explained in Plain English]

```java
public class FreeParking implements ParkingLot {

    @Override
    public void parkCar() {

    }

    @Override
    public void unparkCar() {

    }

    @Override
    public void getCapacity() {

    }

    @Override
    public double calculateFee(Car car) {
        return 0;
    }

    @Override
    public void doPayment(Car car) {
        throw new Exception("Parking lot is free");
    }
}
```

```java
public interface ParkingLot {

    void parkCar(); // Decrease empty spot count by 1
    void unparkCar(); // Increase empty spots by 1
    void getCapacity(); // Returns car capacity
    double calculateFee(Car car); // Returns the price based on number of hours
    void doPayment(Car car);
}
```

Does this code respect the SOLID principles?

Example from [Yiğit Kemal Erinç, The SOLID Principles of Object-Oriented Programming Explained in Plain English]

Imagine you're writing software to keep track of cars. You've designed an interface called Car with the following two methods:

turnOnEngine();

accelerate();

Your employer asks you to modify your code to keep track of an electric car. But electric cars have no engine!

Does this code respect the SOLID principles?

Imagine you are refactoring software to keep track of computers. You come across a class called WindowsBox which looks like this:

```
public class WindowsBox {

    private final Keyboard keyboard;
    private final Monitor monitor;

    public WindowsBox() {
        monitor = new Monitor();
        keyboard = new StandardKeyboard();
    }
}
```

Does this code respect the SOLID principles?

Example from https://www.baeldung.com/solid-principles

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Imagine you are refactoring software to keep track of cat owners. You come across an interface called KeepCat which looks like this:

```
public interface KeepCat {
    void changeCatLitter();
    void feedCat();
    void petCat();
    void brushCat();
}
```

Some cat owners co-parent cats, however. They may only change the litter for their cat, while their partner handles the brushing!

Does this code respect the SOLID principles?

Example from https://www.baeldung.com/solid-principles

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Troubleshooting git

What do we mean by …

git clone? git pull? git push?

git status? git log? git commit?

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Git is your friend

We'll learn more about how to use git when you start working in teams.

But by now you likely know that:

- ***git*** is a distributed version control system that enables teams to collaboratively work on repositories of code
- modifications are represented as ***commit*** *objects*
- the git history is just an ***immutable, linked list of commits.***
- you also know some basic git commands.

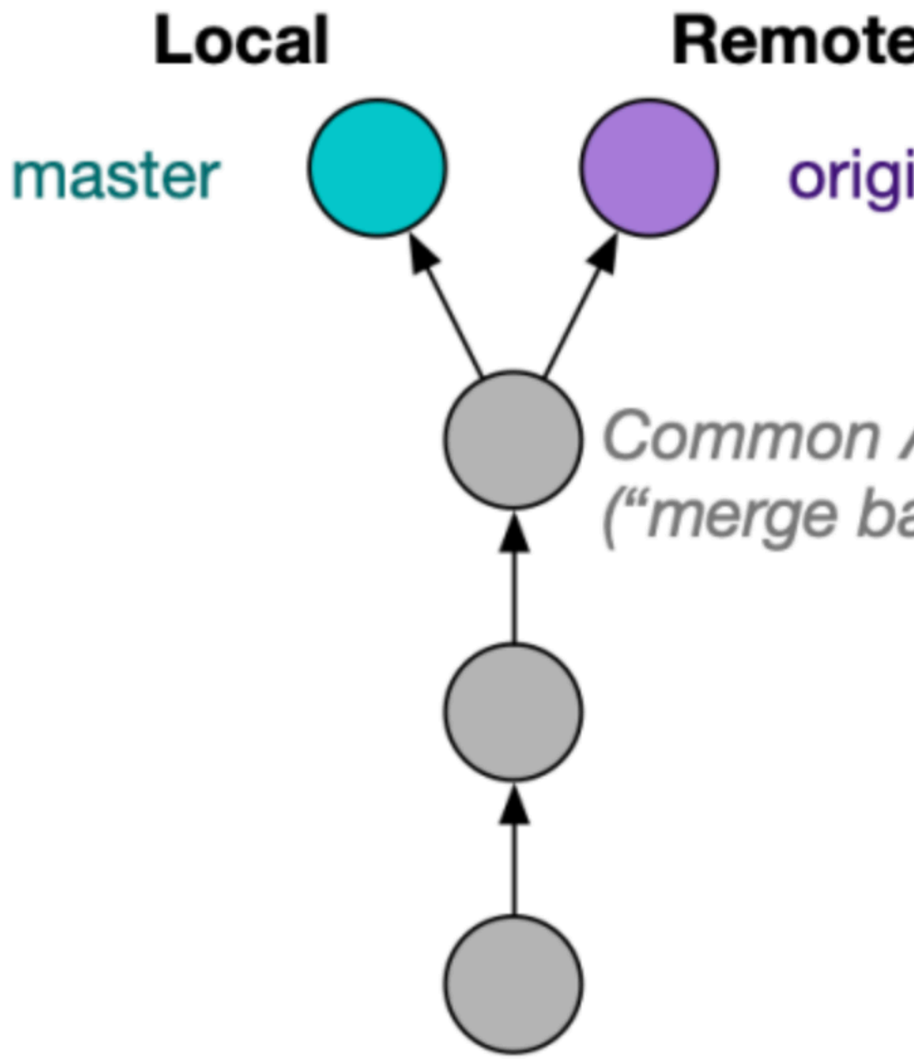
What if you encounter this?

```
[susanjaglal@Susans-iMac Lab06 % git add --all
[susanjaglal@Susans-iMac Lab06 % git commit -m "Made some changes to the lab"
[master aeb9e2c] Made some changes to the lab
 1 file changed, 1 insertion(+), 1 deletion(-)
[susanjaglal@Susans-iMac Lab06 % git status
On branch master
Your branch is ahead of 'origin/master' by 2 commits.
  (use "git push" to publish your local commits)

nothing to commit, working tree clean
[susanjaglal@Susans-iMac Lab06 % git push
To https://markus108.utm.utoronto.ca/git/markus22f/repo/CSC207H5/teststudent
 ! [rejected]        master -> master (fetch first)
error: failed to push some refs to 'https://markus108.utm.utoronto.ca/git/markus
22f/repo/CSC207H5/teststudent'
hint: Updates were rejected because the remote contains work that you do
hint: not have locally. This is usually caused by another repository pushing
hint: to the same ref. You may want to first integrate the remote changes
hint: (e.g., 'git pull ...') before pushing again.
hint: See the 'Note about fast-forwards' in 'git push --help' for details.
```

How or why might this have happened?

What's going on?

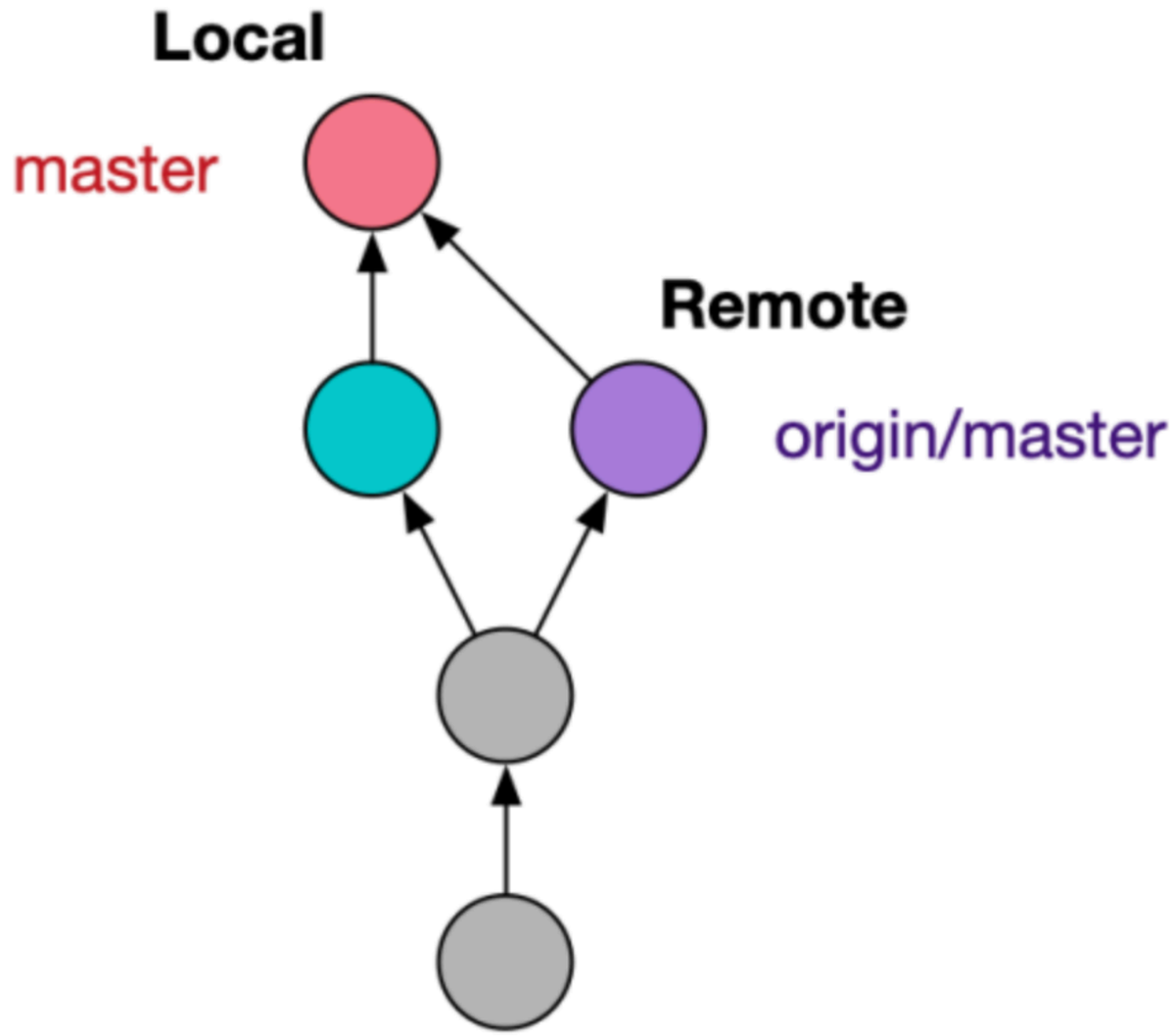


This history of the repository is stored as a lists of commits.

But now the local repository's commits are out of sync with the remote one!

Image from https://blog.sffc.xyz/post/185195398930/why-you-should-use-git-pull-ff-only

How can we cope?



If the altered files don’t conflict, you might be able to execute **git pull.**

This will fetch the remote files, and merge them with your local files. This creates a new “**merge commit**” in the process. You are effectively calling both “**git fetch**” AND “**git merge**”

You can also try git pull --ff-only

This will fetch the remote files and attempt to add the local changes, if the changes are not divergent.

It will not create “merge commit” in the process.

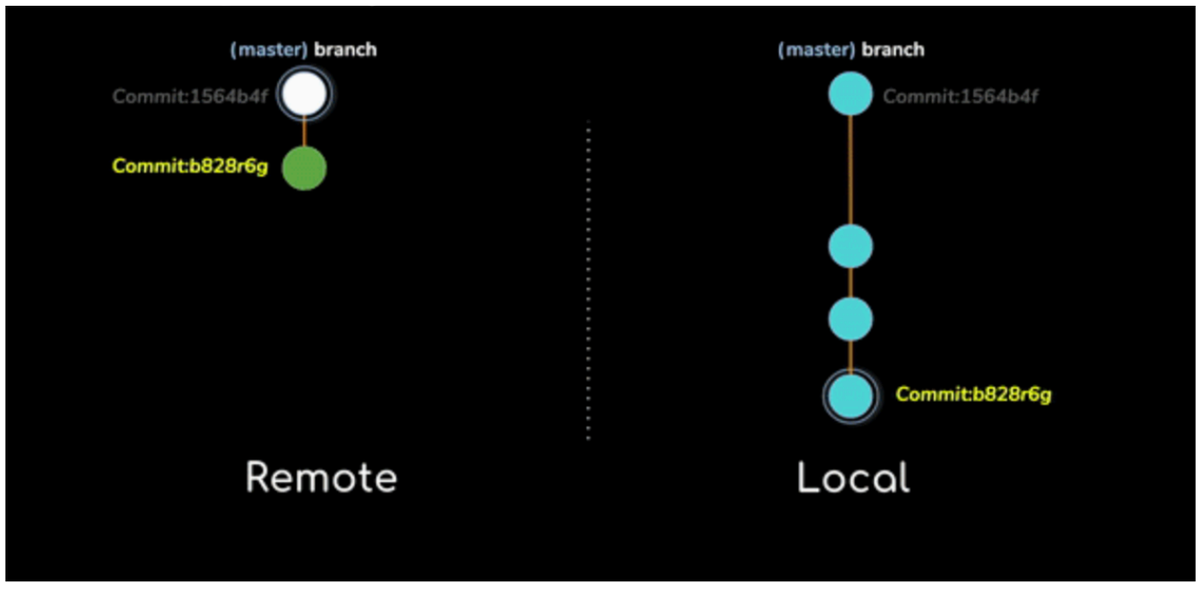
This might be convenient if you don’t want to add another commit to your history of commits. You can then keep writing locally and commit when you feel ready.

But you might be unlucky …

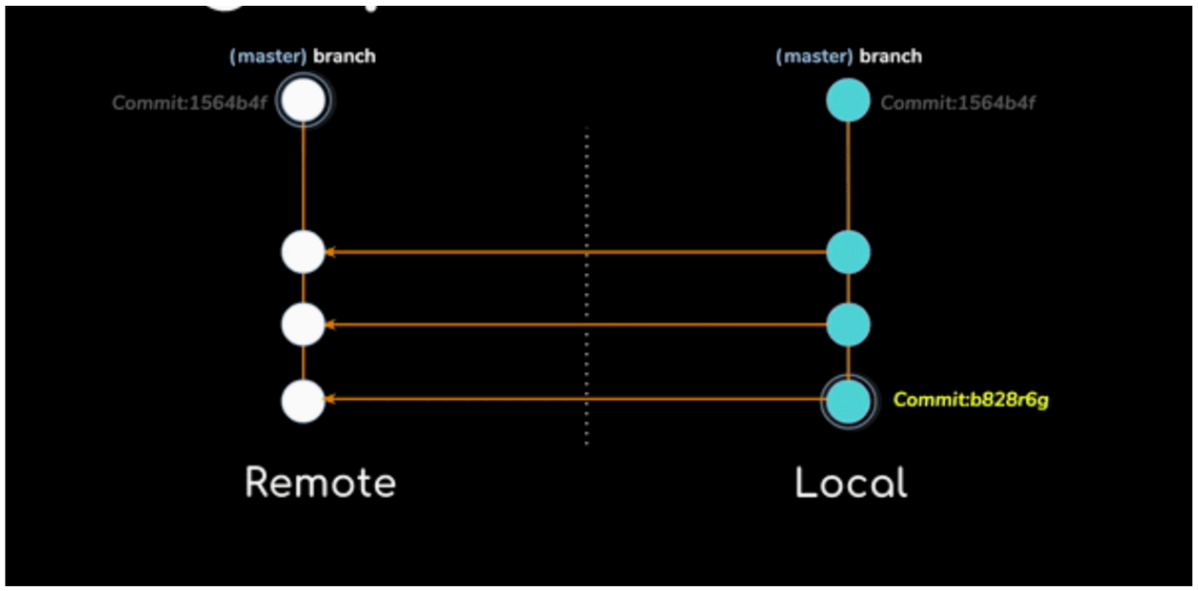
```
susanjaglal@Susans-iMac Lab06 % git pull
remote: Enumerating objects: 14, done.
remote: Counting objects: 100% (14/14), done.
remote: Compressing objects: 100% (8/8), done.
remote: Total 9 (delta 5), reused 5 (delta 1)
Unpacking objects: 100% (9/9), 1.19 KiB | 244.00 KiB/s, done.
From https://markus108.utm.utoronto.ca/git/markus22f/repo/CSC207H5/teststudent
   49fef55..891ec47  master     -> origin/master
hint: You have divergent branches and need to specify how to reconcile them.
hint: You can do so by running one of the following commands sometime before
hint: your next pull:
hint:
hint:   git config pull.rebase false  # merge
hint:   git config pull.rebase true   # rebase
hint:   git config pull.ff only       # fast-forward only
hint:
hint: You can replace "git config" with "git config --global" to set a default
hint: preference for all repositories. You can also pass --rebase, --no-rebase,
hint: or --ff-only on the command line to override the configured default per
hint: invocation.
fatal: Need to specify how to reconcile divergent branches.
```

What to do?

One option might be … ‘git push -f’



Before



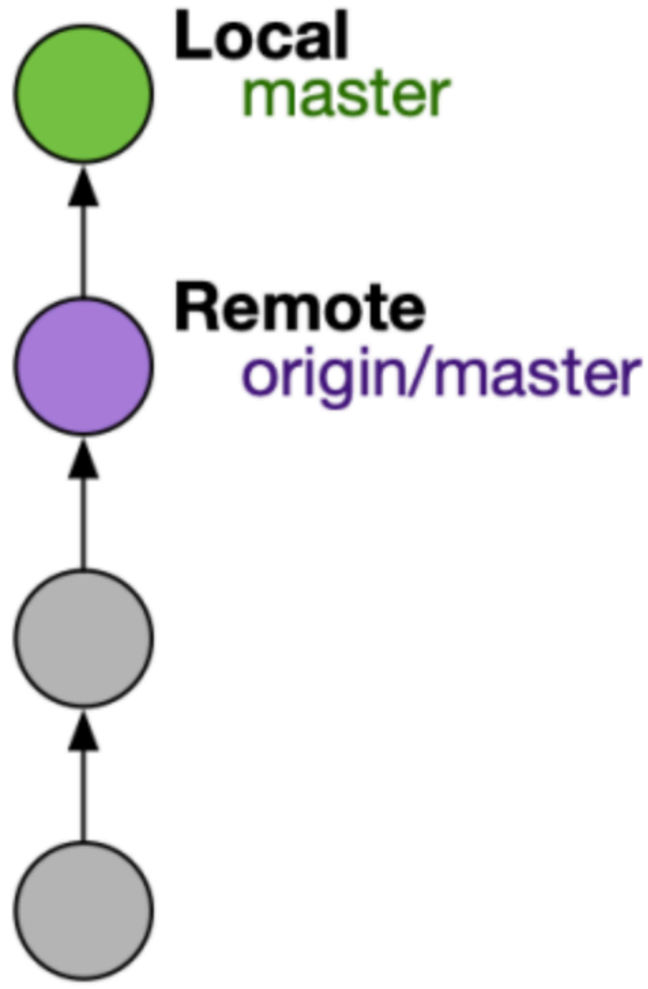
After

This is … a somewhat nuclear solution.
It will overwrite the remote history of commits.

Why is this dangerous?

Image from https://opensource.com/article/22/4/git-push

Another option … ‘git pull -rebase’



This pulls the remote history of commits, and adds your local history to the end of them.

You can some options as defaults, if you like

```
susanjaglal@Susans-iMac Lab06 % git pull
remote: Enumerating objects: 14, done.
remote: Counting objects: 100% (14/14), done.
remote: Compressing objects: 100% (8/8), done.
remote: Total 9 (delta 5), reused 5 (delta 1)
Unpacking objects: 100% (9/9), 1.19 KiB | 244.00 KiB/s, done.
From https://markus108.utm.utoronto.ca/git/markus22f/repo/CSC207H5/teststudent
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hint: preference for all repositories. You can also pass --rebase, --no-rebase,
hint: or --ff-only on the command line to override the configured default per
hint: invocation.
fatal: Need to specify how to reconcile divergent branches.
```

But sometimes you need more

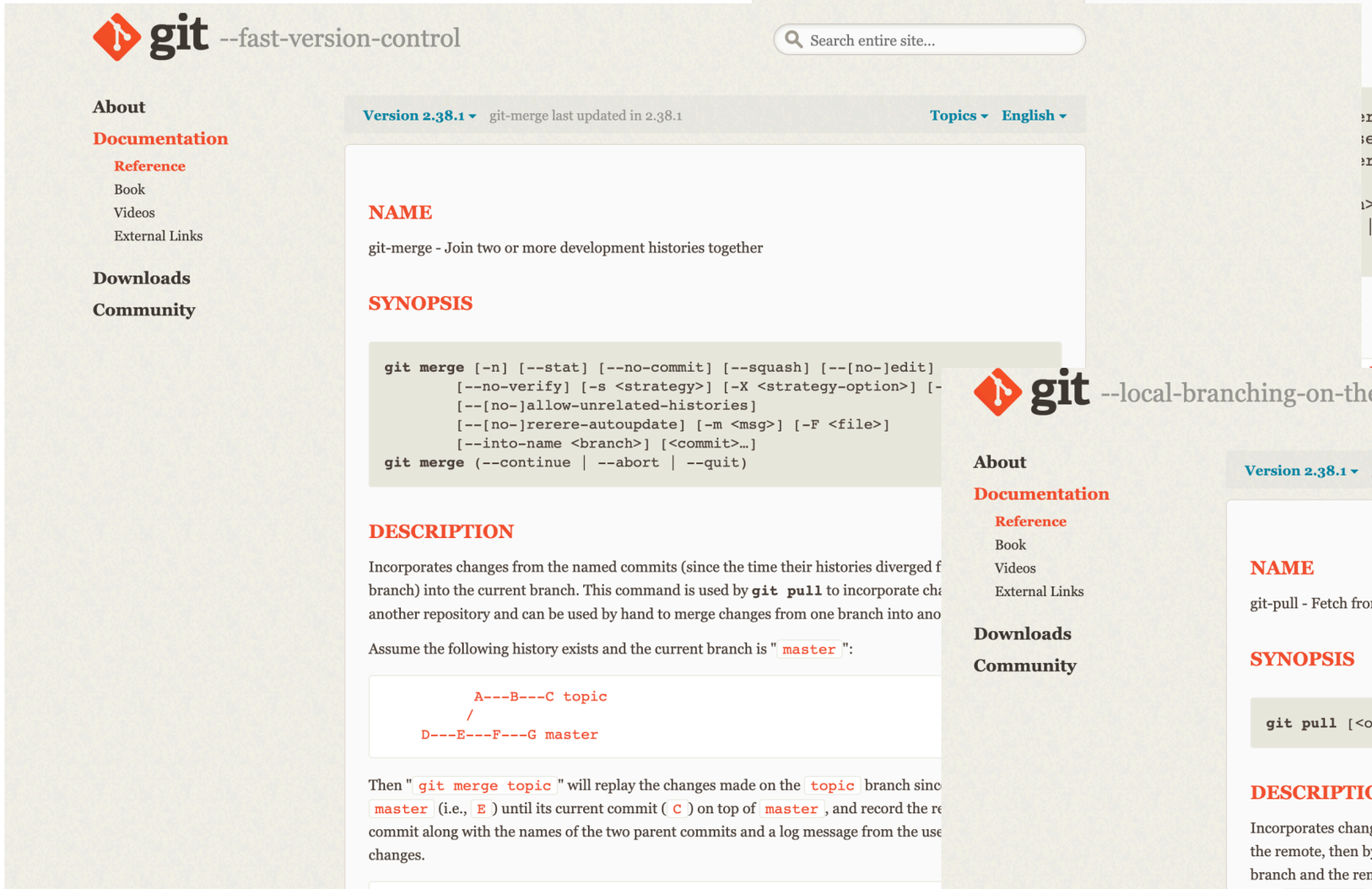
It may be that there are commits that cannot be so easily resolved and that stand in conflict.

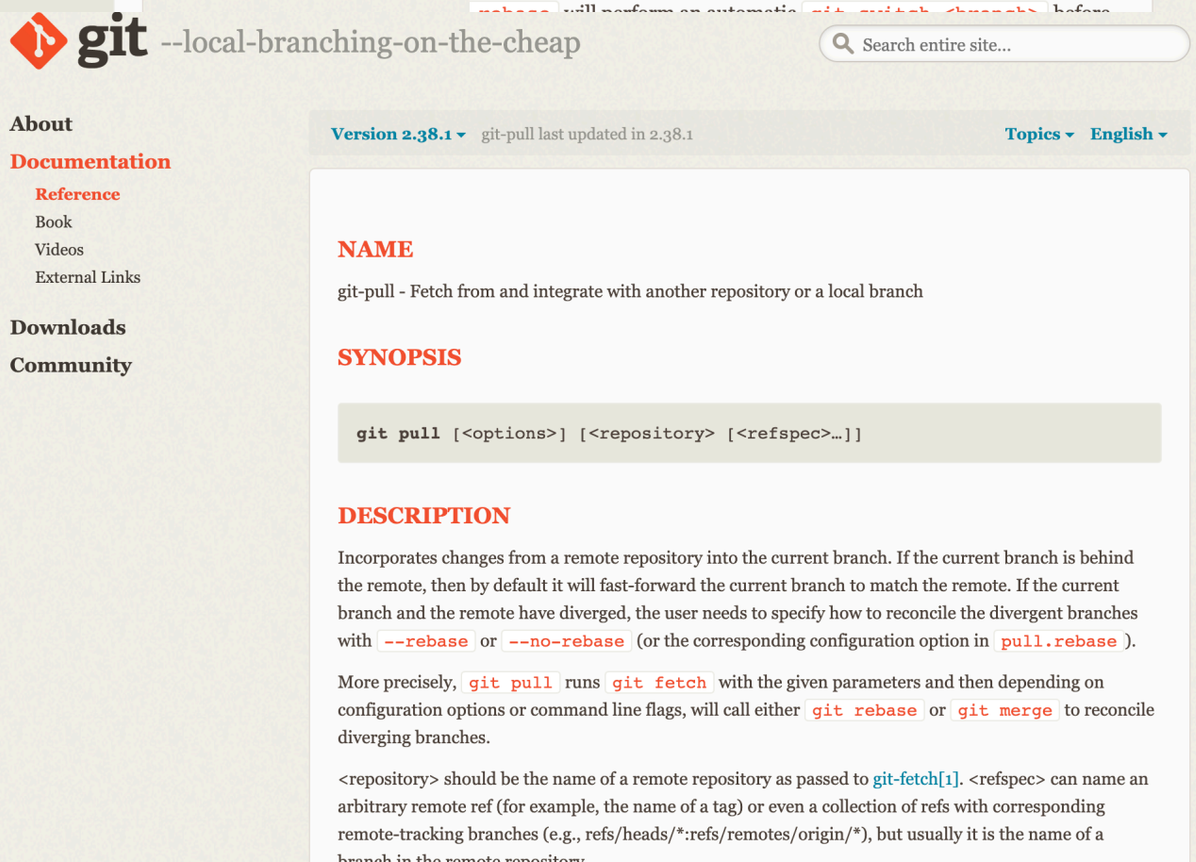
In this case you will have to do some work to resolve conflicts, and merge your local code with that which is remote.

We will talk more about this when we start working in groups.

More information

https://git-scm.com/

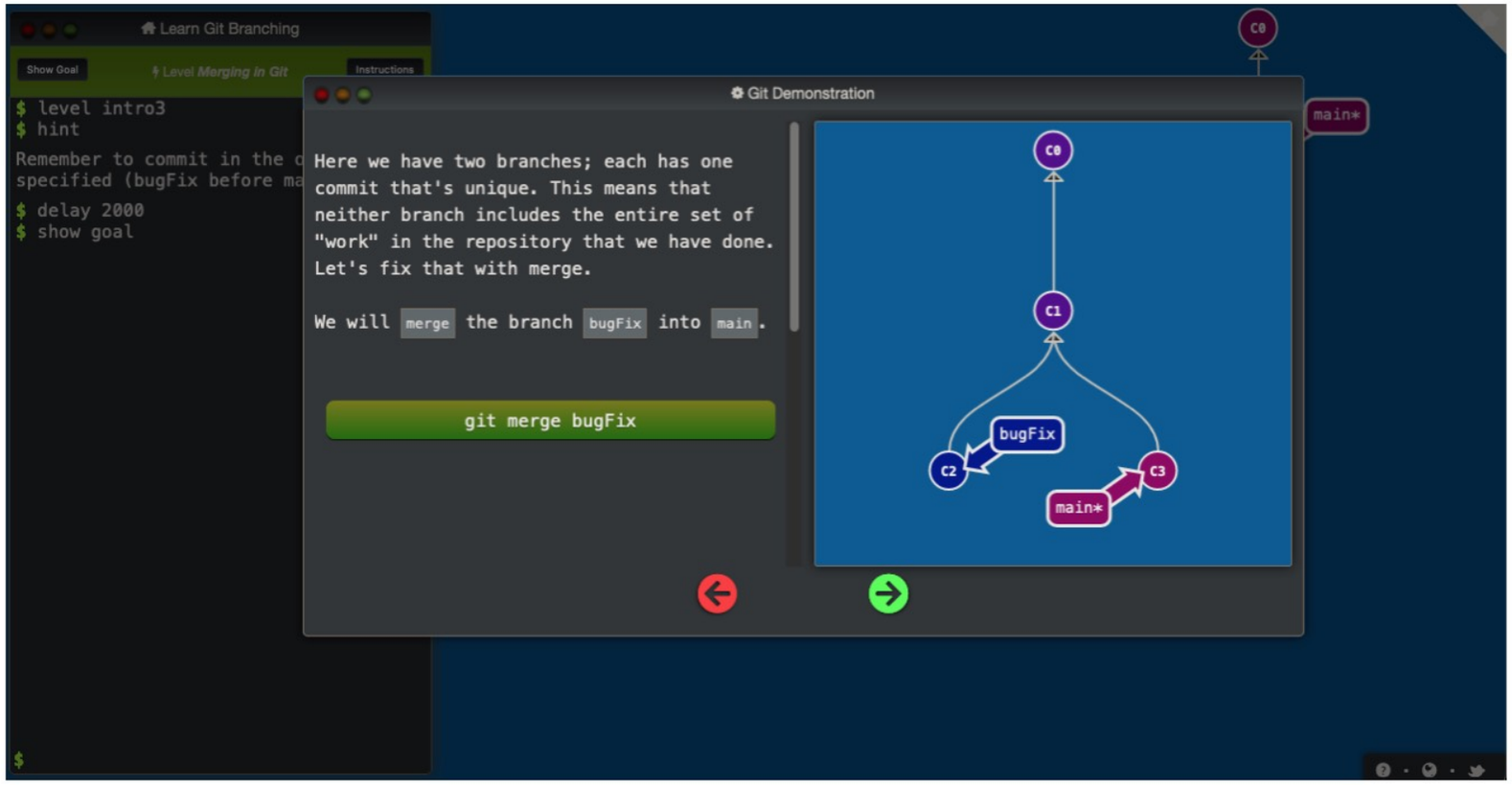




Extra Practice with Git

A great online tool where you can learn more about and/or practice using branches, merging, rebasing, etc!

https://learngitbranching.js.org/



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What methods to all Objects inherit?

What's an Iterator?

What's an Iterable?

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