CONSTRAINT LAYOUT

ROMI FADILLAH RAHMAT

HOW CONSTRAINT LAYOUT WORKS

- In common with all other layouts, ConstraintLayout is responsible for managing the positioning and sizing behaviour of the visual components (also referred to as widgets) it contains. It does this based on the constraint connections that are set on each child widget.
- In order to fully understand and use ConstraintLayout, it is important to gain an appreciation of the following key concepts:
  - Constraints
  - Margins
  - Opposing Constraints
  - Constraint Bias
  - Chains
  - Chain Styles
  - Barriers

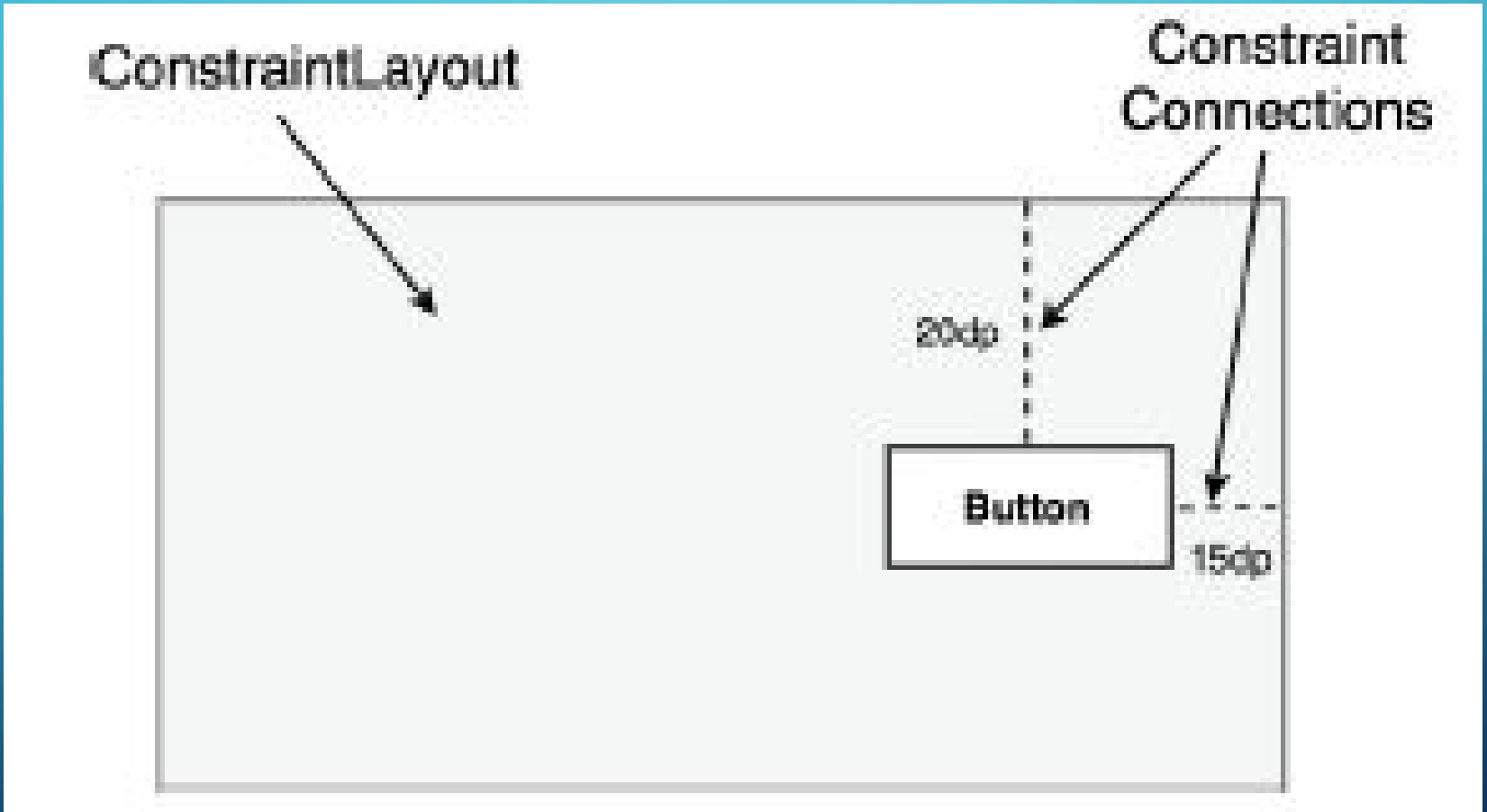
CONSTRAINTS

- Constraints are essentially sets of rules that dictate the way in which a widget is aligned and distanced in relation to other widgets, the sides of the containing ConstraintLayout and special elements called guidelines.
- Constraints also dictate how the user interface layout of an activity will respond to changes in device orientation, or when displayed on devices of differing screen sizes. In order to be adequately configured, a widget must have sufficient constraint connections such that it's position can be resolved by the ConstraintLayout layout engine in both the horizontal and vertical planes.

MARGINS

- A margin is a form of constraint that specifies a fixed distance. Consider a Button object that needs to be positioned near the top right-hand corner of the device screen. This might be achieved by implementing margin constraints from the top and right-hand edges of the Button connected to the corresponding sides of the parent ConstraintLayout as illustrated in the next figure.

CONSTRAINT CONNECTIONS

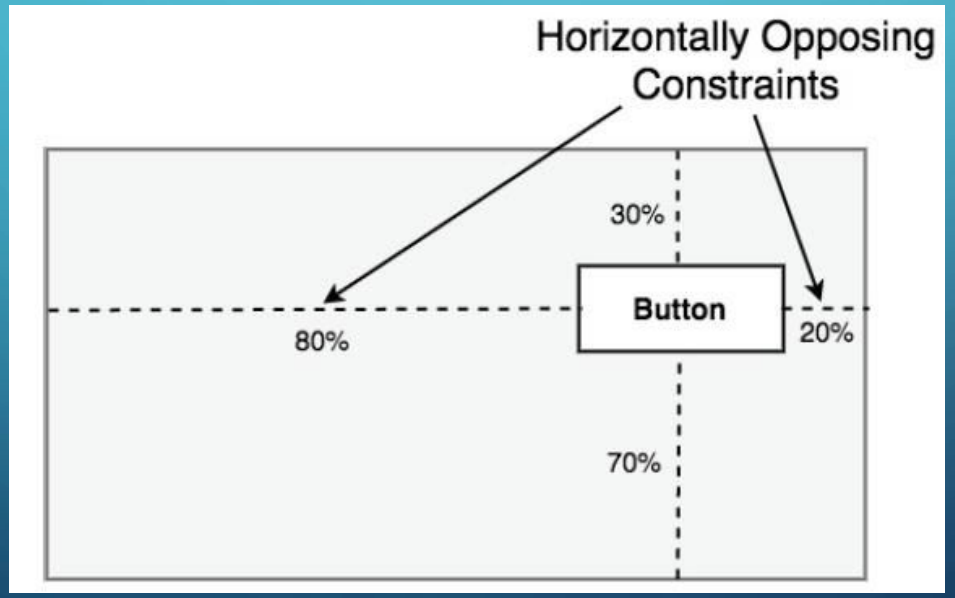


CONSTRAINT

- each of these constraint connections has associated with it a margin value dictating the fixed distances of the widget from two sides of the parent layout. Under this configuration, regardless of screen size or the device orientation, the Button object will always be positioned 20 and 15 device-independent pixels (dp) from the top and righthand edges of the parent ConstraintLayout respectively as specified by the two constraint connections.
- While the above configuration will be acceptable for some situations, it does not provide any flexibility in terms of allowing the ConstraintLayout layout engine to adapt the position of the widget in order to respond to device rotation and to support screens of different sizes. To add this responsiveness to the layout it is necessary to implement opposing constraints.

OPPOSSING CONSTRAINTS

- Two constraints operating along the same axis on a single widget are referred to as opposing constraints. In other words, a widget with constraints on both its left and right-hand sides is considered to have horizontally opposing constraints.

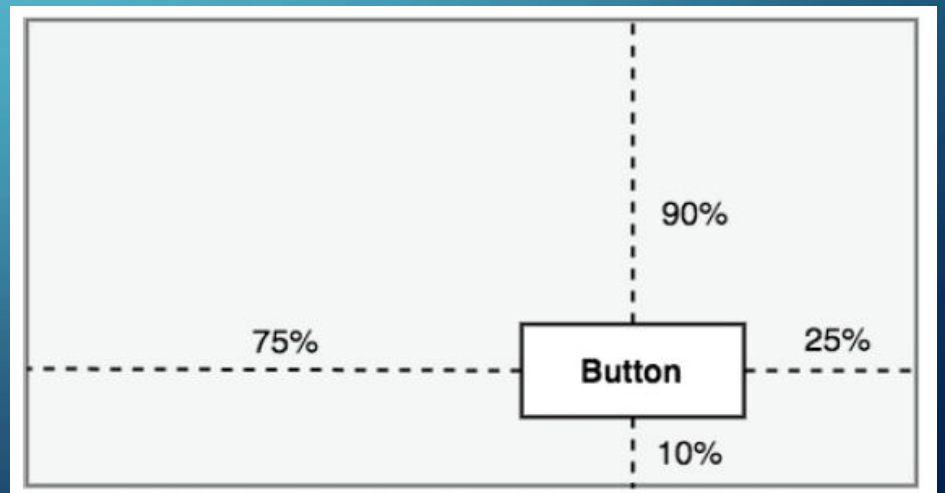


OPPOSSING CONSTRAINT

- The key point to understand here is that once opposing constraints are implemented on a particular axis, the positioning of the widget becomes percentage rather than coordinate based.
- Instead of being fixed at 20dp from the top of the layout, for example, the widget is now positioned at a point 30% from the top of the layout. In different orientations and when running on larger or smaller screens, the Button will always be in the same location relative to the dimensions of the parent layout.

CONSTRAINT BIAS

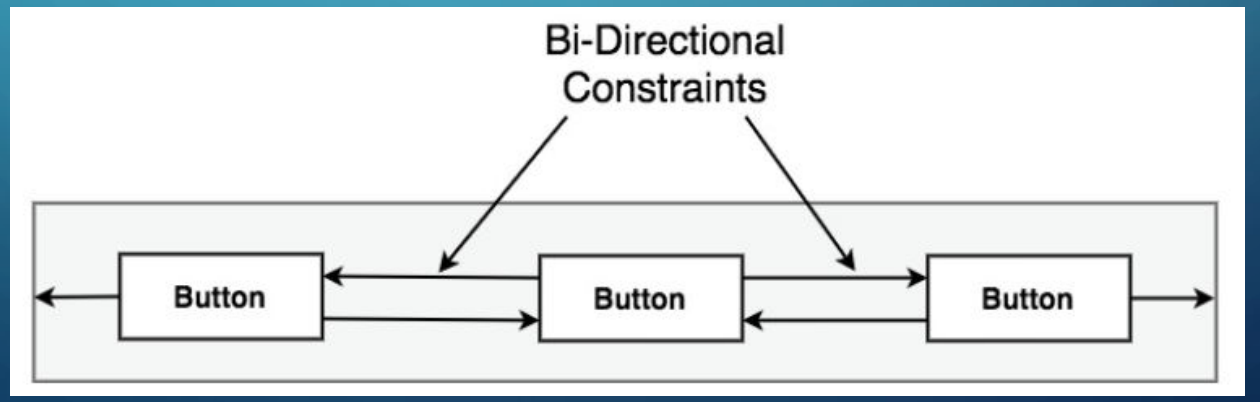
- It has now been established that a widget in a ConstraintLayout can potentially be subject to opposing constraint connections.
- To allow for the adjustment of widget position in the case of opposing constraints, the ConstraintLayout implements a feature known as constraint bias. Constraint bias allows the positioning of a widget along the axis of opposition to be biased by a specified percentage in favor of one constraint.
- shows the previous constraint layout with a
- 75% horizontal bias and 10% vertical bias



Widget Offset using Constraint Bias

CHAINS

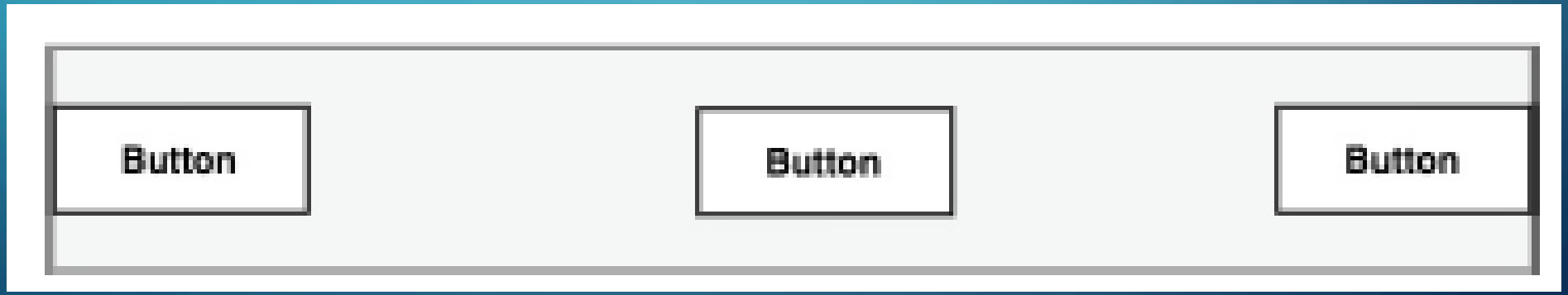
- ConstraintLayout chains provide a way for the layout behavior of two or more widgets to be defined as a group. Chains can be declared in either the vertical or horizontal axis and configured to define how the widgets in the chain are spaced and sized.
- Widgets are chained when connected together by bi-directional constraints.
- The first element in the chain is the chain head which translates to the top widget in a vertical chain or, in the case of a horizontal chain, the left-most widget. The layout behavior of the entire chain is primarily configured by setting attributes on the chain head widget.



CHAIN STYLES

- The layout behavior of a ConstraintLayout chain is dictated by the chain style setting applied to the chain head widget. The ConstraintLayout class currently supports the following chain layout styles:
  - **Spread Chain** – The widgets contained within the chain are distributed evenly across the available space. This is the default behavior for chains.

- **Spread Inside Chain** – The widgets contained within the chain are spread evenly between the chain head and the last widget in the chain. The head and last widgets are not included in the distribution ofspacing.



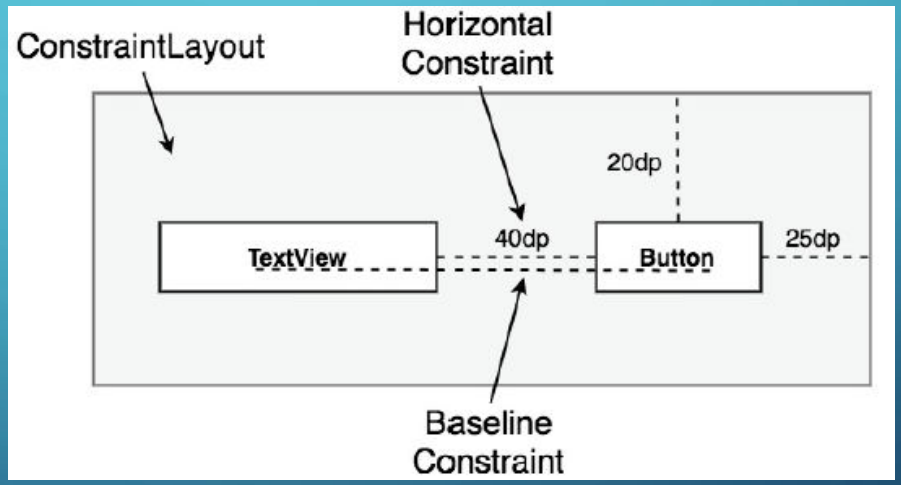
- **Weighted Chain** – Allows the space taken up by each widget in the chain to be defined via weighting properties.

- **Packed Chain** – The widgets that make up the chain are packed together without any spacing. A bias may be applied to control the horizontal or vertical positioning of the chain in relation to the parent container.

BASELINE ALIGNMENT

- A common requirement, however, is for a widget to be aligned relative to the content that it displays rather than the boundaries of the widget itself. To address this need, ConstraintLayout provides baseline alignment support.

- In this case, the TextView needs to be baseline aligned with the Button view. This means that the text within the Button needs to be vertically aligned with the text within the TextView. The additional constraints for this layout would need to be connected

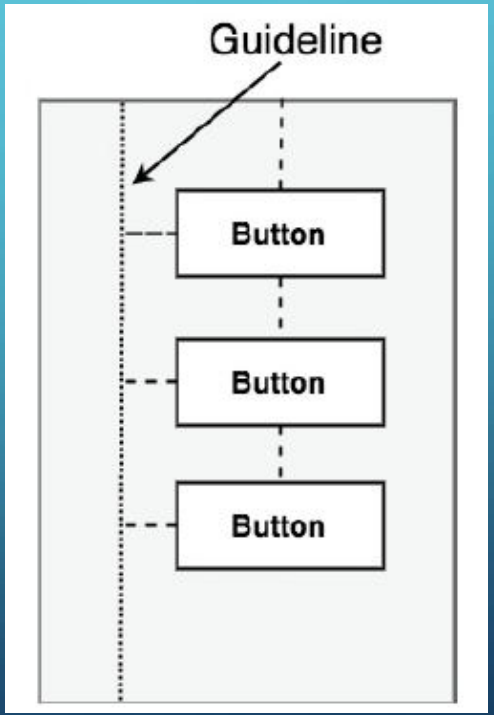


- The TextView is now aligned vertically along the baseline of the Button and positioned 40dp horizontally from the Button object's left-hand edge.

GUIDELINES

- Guidelines are special elements available within the ConstraintLayout that provide an additional target to which constraints may be connected. Multiple guidelines may be added to a ConstraintLayout instance which may, in turn, be configured in horizontal or vertical orientations. Once added, constraint connections may be established from widgets in the layout to the guidelines. This is particularly useful when multiple widgets need to be aligned along an axis.

- for example, three Button objects contained within a ConstraintLayout are constrained along a vertical guideline:



CONFIGURE WIDGET DIMENSIONS

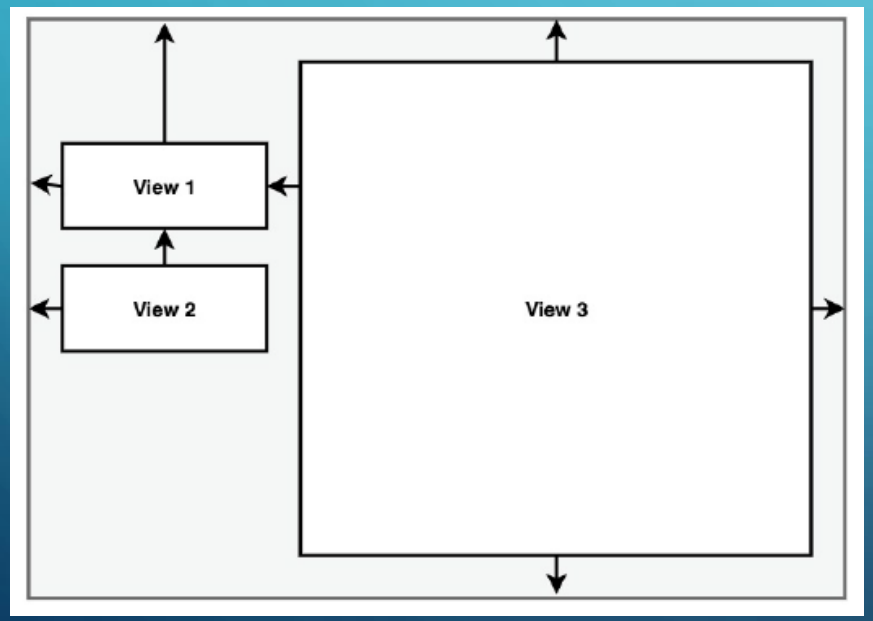
- Controlling the dimensions of a widget is a key element of the user interface design process. The ConstraintLayout provides three options which can be set on individual widgets to manage sizing behavior. These settings are configured individually for height and width dimensions:
- **Fixed** – The widget is fixed to specified dimensions.
- **Match Constraint** –Allows the widget to be resized by the layout engine to satisfy the prevailing constraints. Also referred to as the AnySize or MATCH_CONSTRAINT option.
- **Wrap Content** – The size of the widget is dictated by the content it contains (i.e. text or graphics).

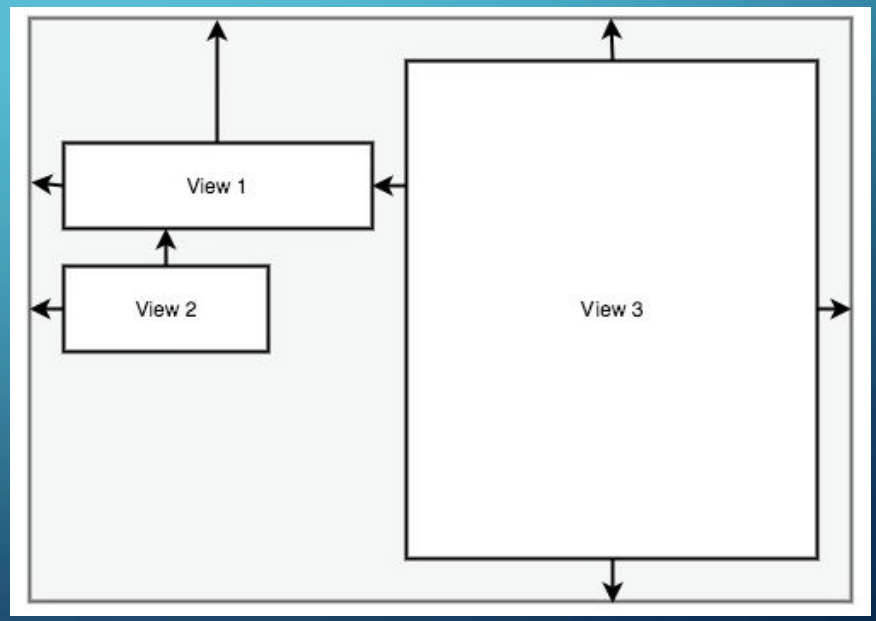
BARRIERS

- Rather like guidelines, barriers are virtual views that can be used to constrain views within a layout. As with guidelines, a barrier can be vertical or horizontal and one or more views may be constrained to it (to avoid confusion, these will be referred to as constrained views).
- Unlike guidelines where the guideline remains at a fixed position within the layout, however, the position of a barrier is defined by a set of so called reference views.
- Barriers were introduced to address an issue that occurs with some frequency involving overlapping views.

BARRIER EXAMPLE

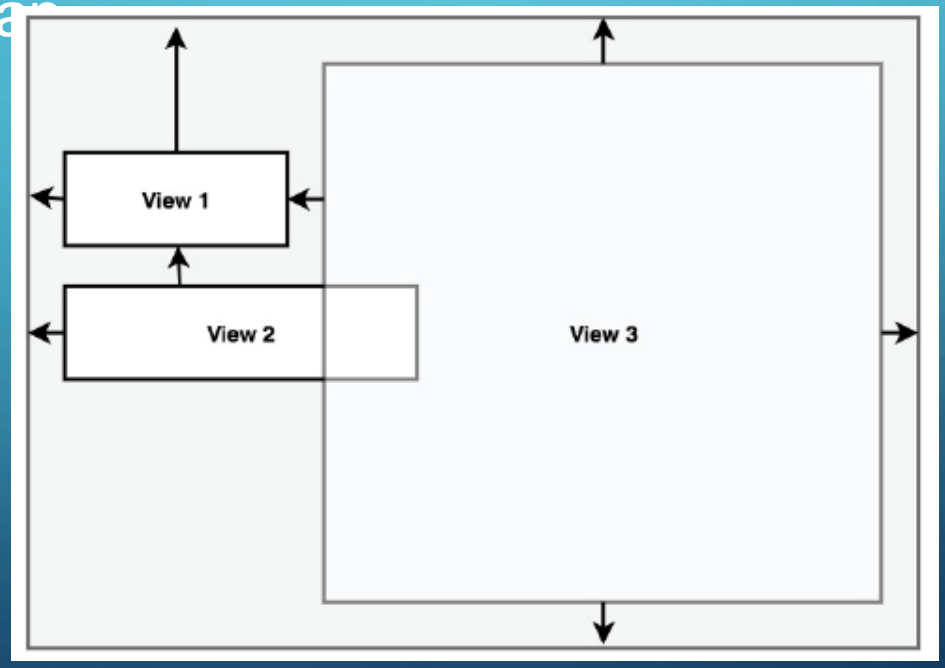
- The key points to note about the above layout is that the width of View 3 is set to match constraint mode, and the left-hand edge of the view is connected to the right hand edge of View 1. As currently implemented, an increase in width of View 1 will have the desired effect of reducing the width of View 3





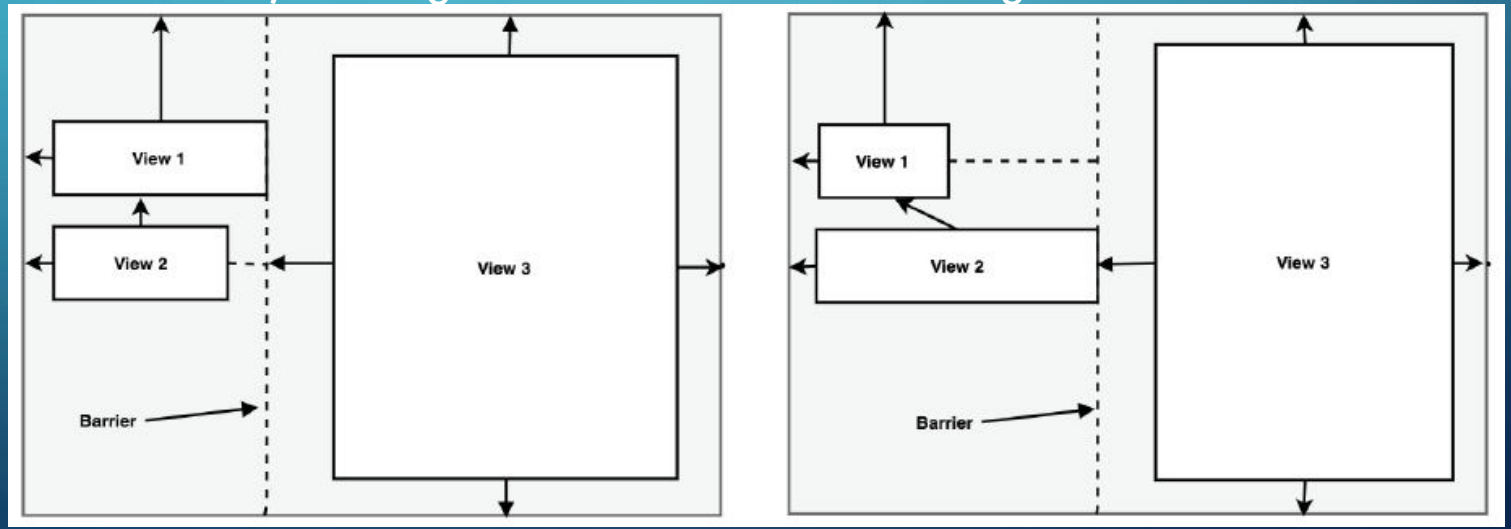
BARRIER EXAMPLE

- A problem arises, however, if View 2 increases in width instead of View 1. Clearly because View 3 is only constrained by View 1, it does not resize to accommodate the increase in width of View 2 causing the views to overla



BARRIER EXAMPLE

- A solution to this problem is to add a vertical barrier and assign Views 1 and 2 as the barrier's reference views so that they control the barrier position. The left-hand edge of View 3 will then be constrained in relation to the barrier, making it a constrained view.
- Now when either View 1 or View 2 increase in width, the barrier will move to accommodate the widest of the two views, causing the width of View 3 change in relation to the new barrier position



RATIOS

- The dimensions of a widget may be defined using ratio settings. A widget could, for example, be constrained using a ratio setting such that, regardless of any resizing behavior, the width is always twice the height dimension.

CONSTRAINT LAYOUT ADVANTAGES

- ConstraintLayout provides a level of flexibility that allows many of the features of older layouts to be achieved with a single layout instance where it would previously have been necessary to nest multiple layouts. This has the benefit of avoiding the problems inherent in layout nesting by allowing so called “flat” or “shallow” layout hierarchies to be designed leading both to less complex layouts and improved user interface rendering performance at runtime.

CONSTRAINT LAYOUT ADVANTAGES

- ConstraintLayout was also implemented with a view to addressing the wide range of Android device screen sizes available on the market today.
- The flexibility of ConstraintLayout makes it easier for user interfaces to be designed that respond and adapt to the device on which the app is running.

SUMMARY

- ConstraintLayout is a layout manager introduced with Android 7.
- It is designed to ease the creation of flexible layouts that adapt to the size and orientation of the many Android devices now on the market.
- ConstraintLayout uses constraints to control the alignment and positioning of widgets in relation to the parent ConstraintLayout instance, guidelines, barriers and the other widgets in the layout.
- ConstraintLayout is the default layout for newly created Android Studio projects and is the recommended choice when designing user interface layouts.
- With this simple yet flexible approach to layout management, complex and responsive user interfaces can be implemented with surprising ease.

- THANK U