ArcGIS Runtime: Labeling patterns and best practices

Richard Shepherd, Christopher Light, Alexander Payne

Runtime Text development team

Samples by Peter Dimitrov

2021 ESRI DEVELOPER SUMMIT

What are Labels?

- Text created for each feature
- Uses the feature's attributes
- Preferred position
- Moves to avoid overlap

ObjectId	Shape	Passenger	Start
10	Line Geometry	Bob	1-Aug-2003
11	Line Geometry	Tina	2-Aug-2003

Line feature

Line label

"$feature.passenger + ' ' + $feature.start"

What are Label Definitions?

Rules are collected in a LabelDefinition

LabelDefinitions are attached to:

- FeatureLayer
- GraphicsOverlay
- ArcGISMapImageSublayer
- SubtypeSublayer

```
{
    "allowOverrun": true,
    "deconflictionStrategy":"dynamic",
    "labelExpressionInfo":
    {
      "expression":"$feature.passenger + ' ' + $feature.start"
    },
    "labelPlacement": "esriServerLineLabelPlacementAboveAlong",
    "lineConnection": "minimizeLabels",
    "priority": 5,
    "minScale": 3000,
    "maxScale": 100,
    "removeDuplicates": "none",
    "stackLabel": false,
    "symbol": {"type": "esriTS", "color": [0,78,78,255], "backgroundColor": null,
    "textLayout":"followFeature"
}
```

What do Labels do?

The labels are not stored

They are continually updated:

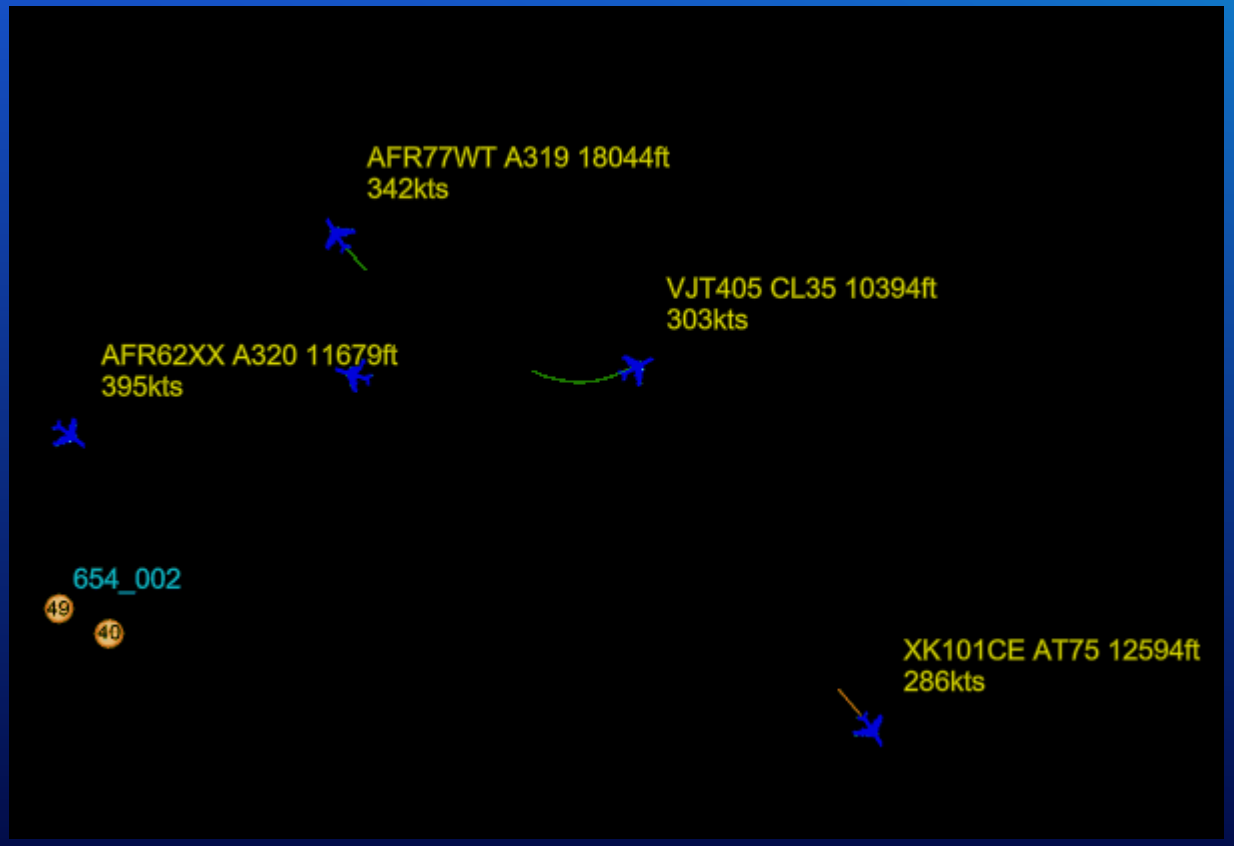
- as the application zooms, pans or rotates

What do Labels do?

The labels are not stored

They are continually updated:

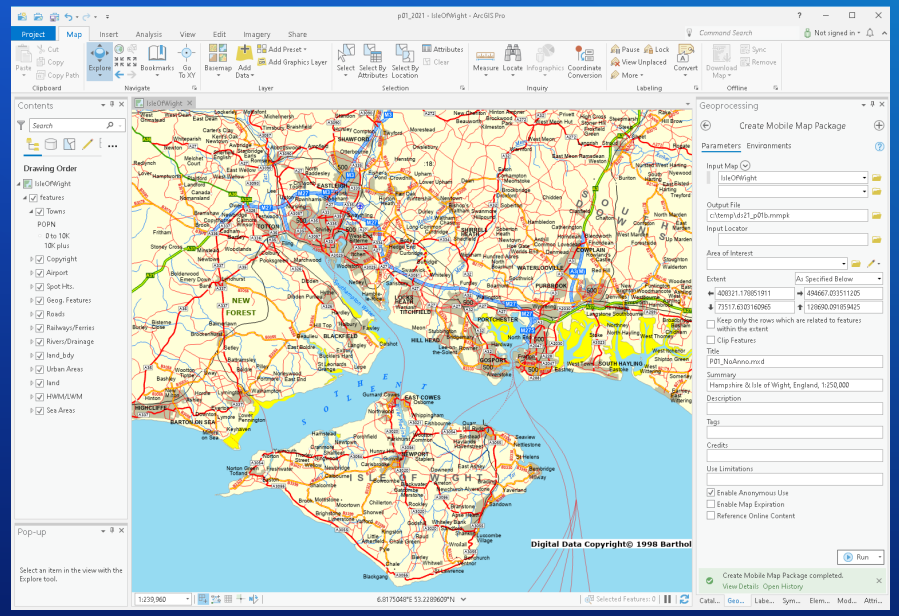
- as the application zooms, pans or rotates
- as the features move
- or the attributes change



Where do LabelDefinitions come from?

Authored in ArcGISPro or in ArcGIS Online

- Feature Classes have Label Classes
- Published to Mobile Map Packages or Online Services



Where do LabelDefinitions come from?

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- Feature Classes have Label Classes
- Published to Mobile Map Packages or Online Services
- Runtime reads and converts them to LabelDefinitions

LabelDefinitions contain the most used settings

- Optimizes the behavior for mobile devices
- Not identical to the original

Where do LabelDefinitions come from?

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- Feature Classes have Label Classes
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LabelDefinitions contain the most used settings

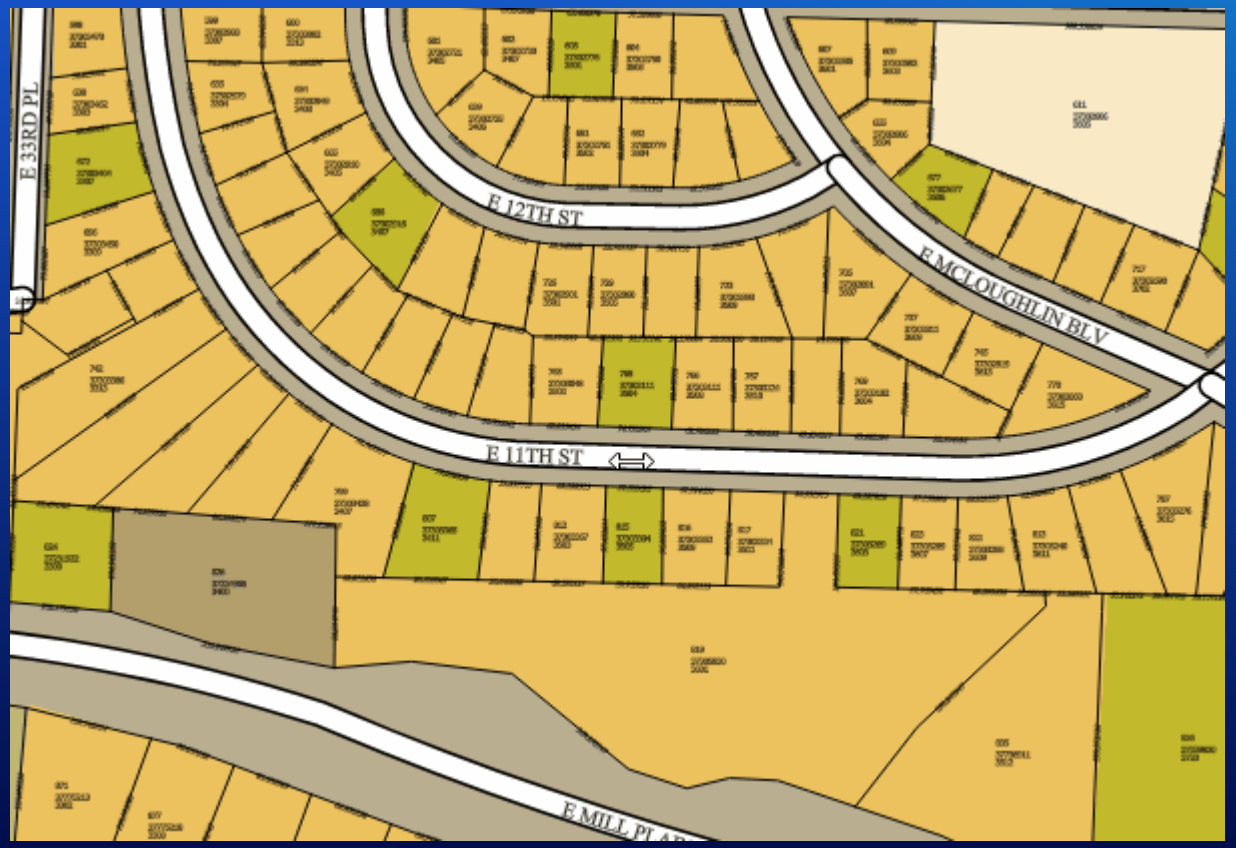
- Optimizes the behavior for mobile devices
- Not identical to the original

Runtime developers can Create, Edit or Remove LabelDefinitions

What is the Reference Scale?

Give the experience of a paper map

- Draw at design size when viewed at the Reference Scale
- Symbols and Text keep their size on the map



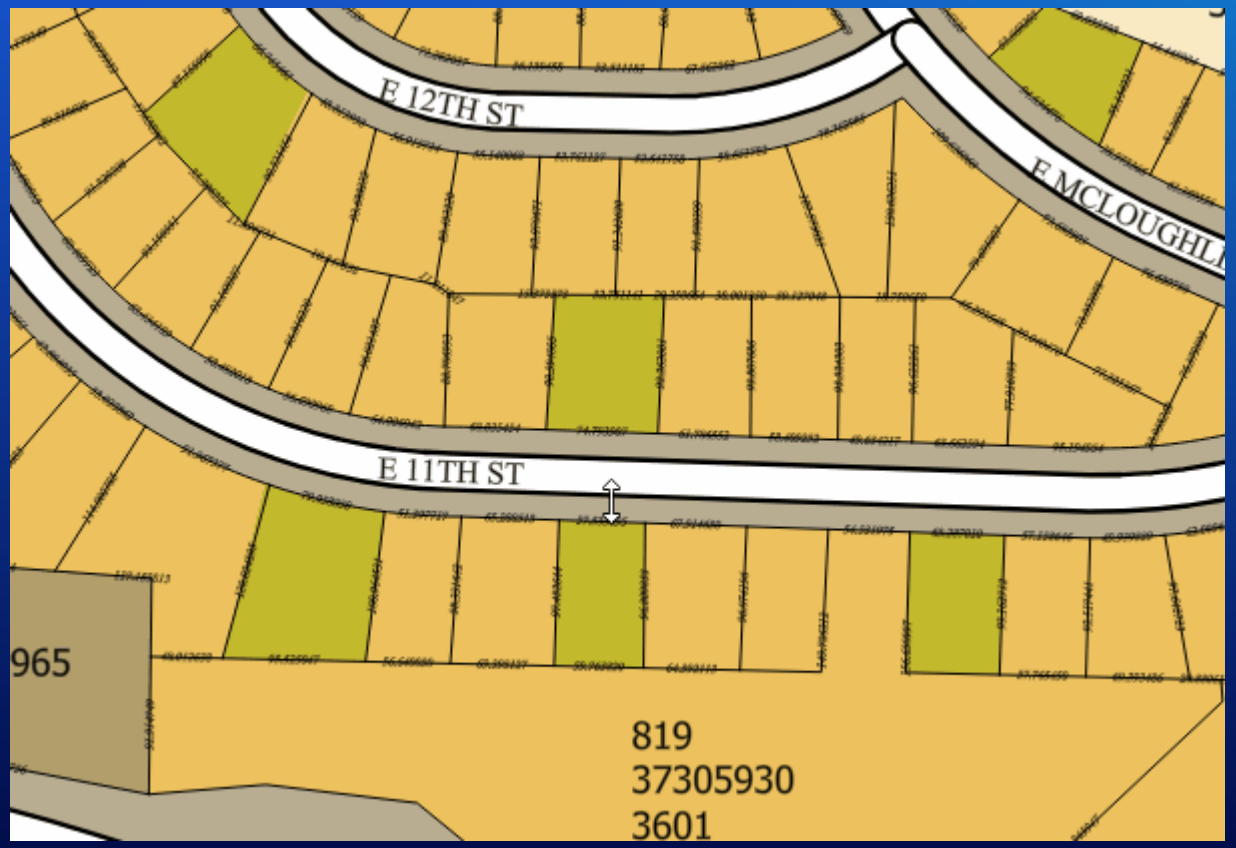
What is the Reference Scale?

If the Map as no Reference Scale

- Text remains the same size

If the Map has a Reference Scale

- Layers can opt out



Exploring in more detail

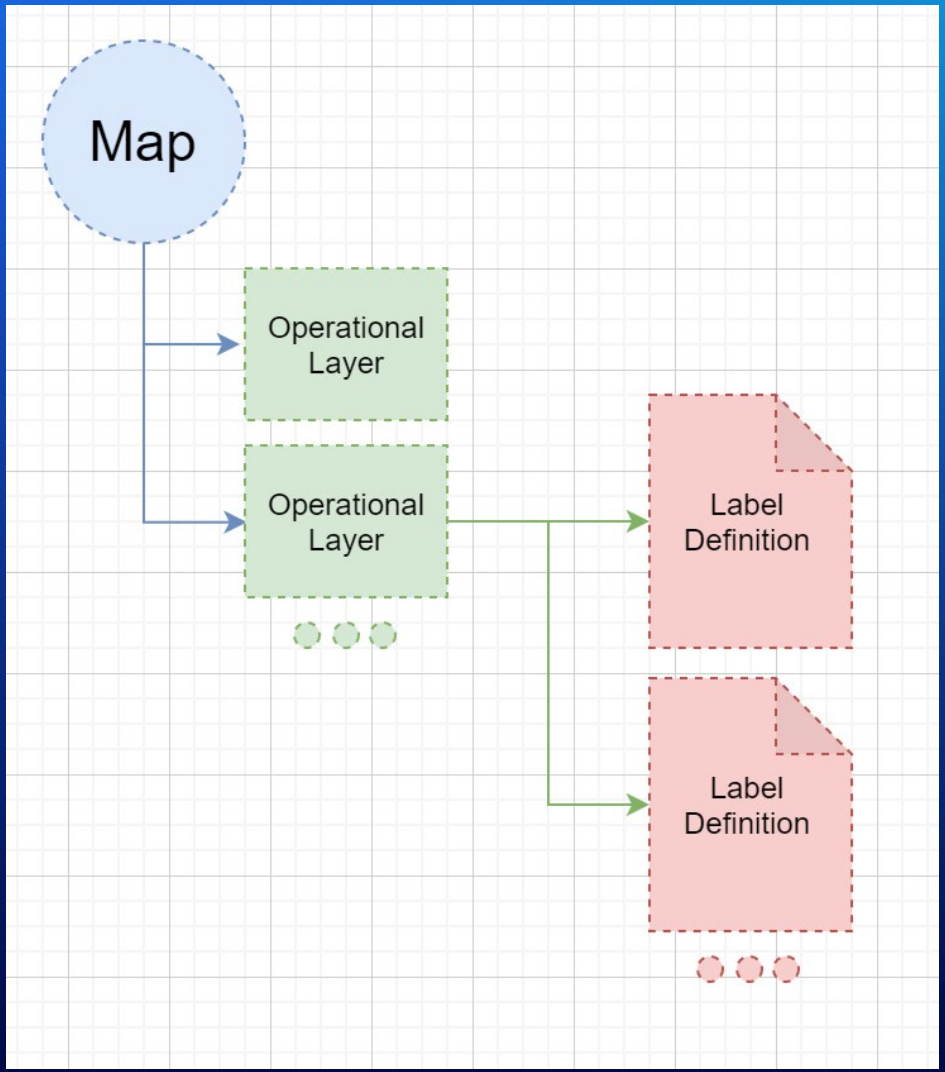
- LabelDefinition properties
- 3D Labeling
- Labeling Expressions

Introduction to 2D Labeling

Christopher – ArcGIS Runtime Labeling

What is a Label Definition

- Rules (properties) attached to…
  - FeatureLayer
  - GraphicOverlay
  - ArcGISMapImageSublayer
  - SubtypeSublayer



Interfacing with the Label Definition

- JSON description
- Labeling API
  - Scheduled for update 100.11

JSON Example

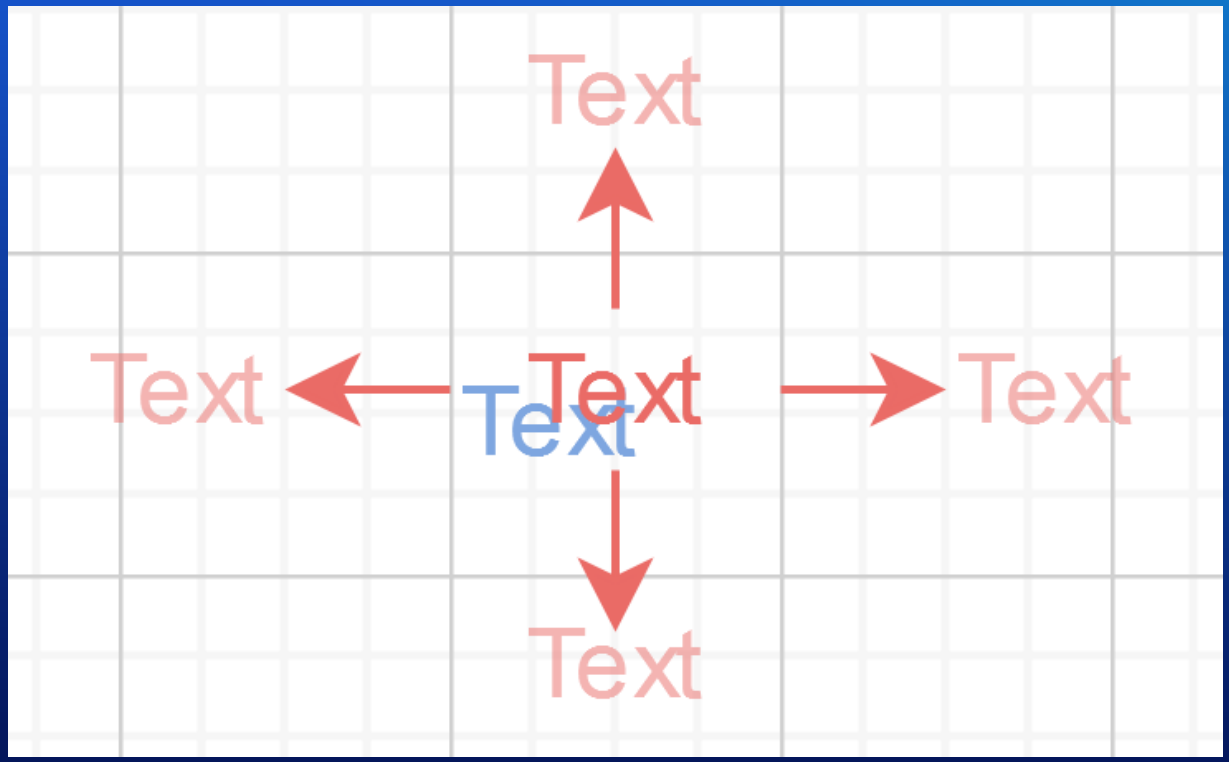
```
LabelDefinition labelDefinition = LabelDefinition.fromJson(json);
featureLayer.getLabelDefinitions().set(0, labelDefinition);
```

Supported Label properties

- Grouped by features…
  - All features
  - Point
  - Line
  - Polygon
  - Line and Polygon
  - Line and Point
- JSON Label Definition properties
  - developers.arcgis.com/web-map-specification/objects/labelingInfo/

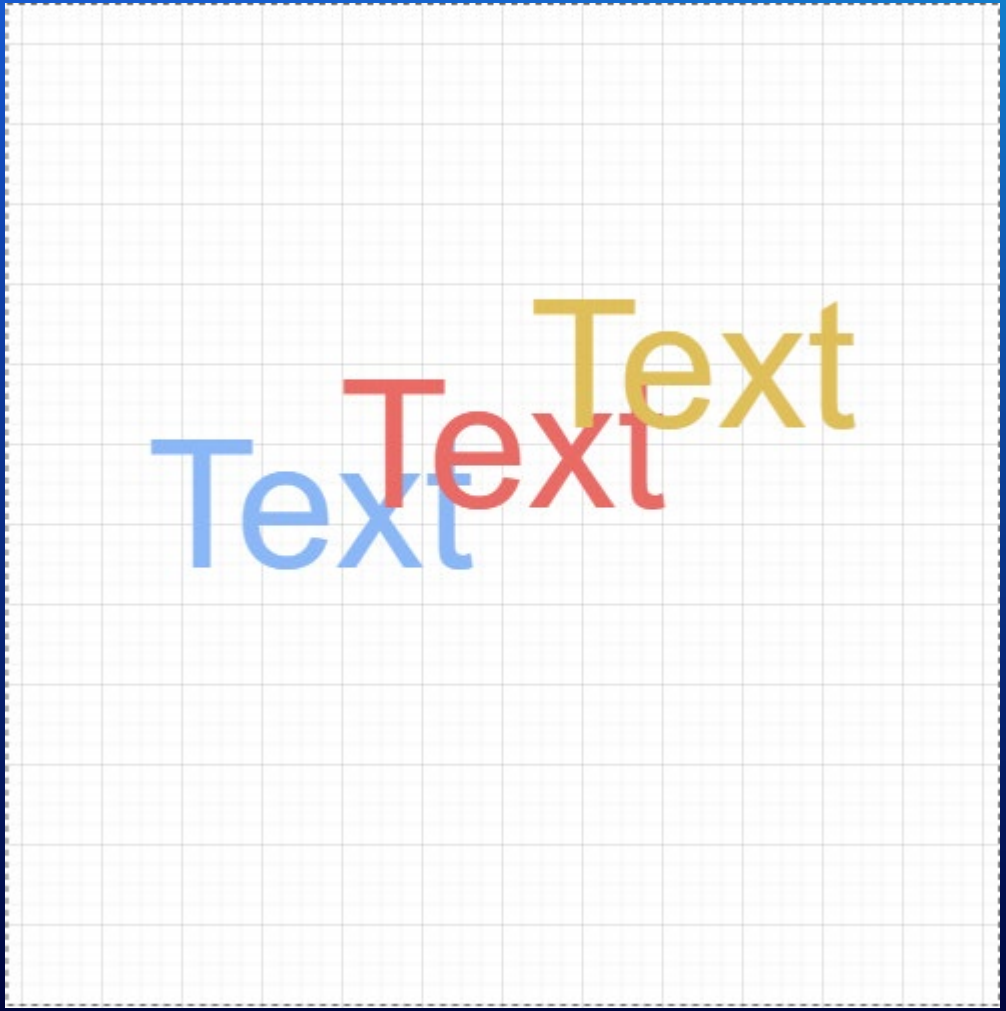
Label Definition Properties (All features): Deconfliction

- `deconflictionStrategy`
- **How to avoid higher priority labels.**



Label Definition Properties (All features): Deconfliction

- `allowOverlapOfLabel`
- **Are other labels allowed to overlap this label**

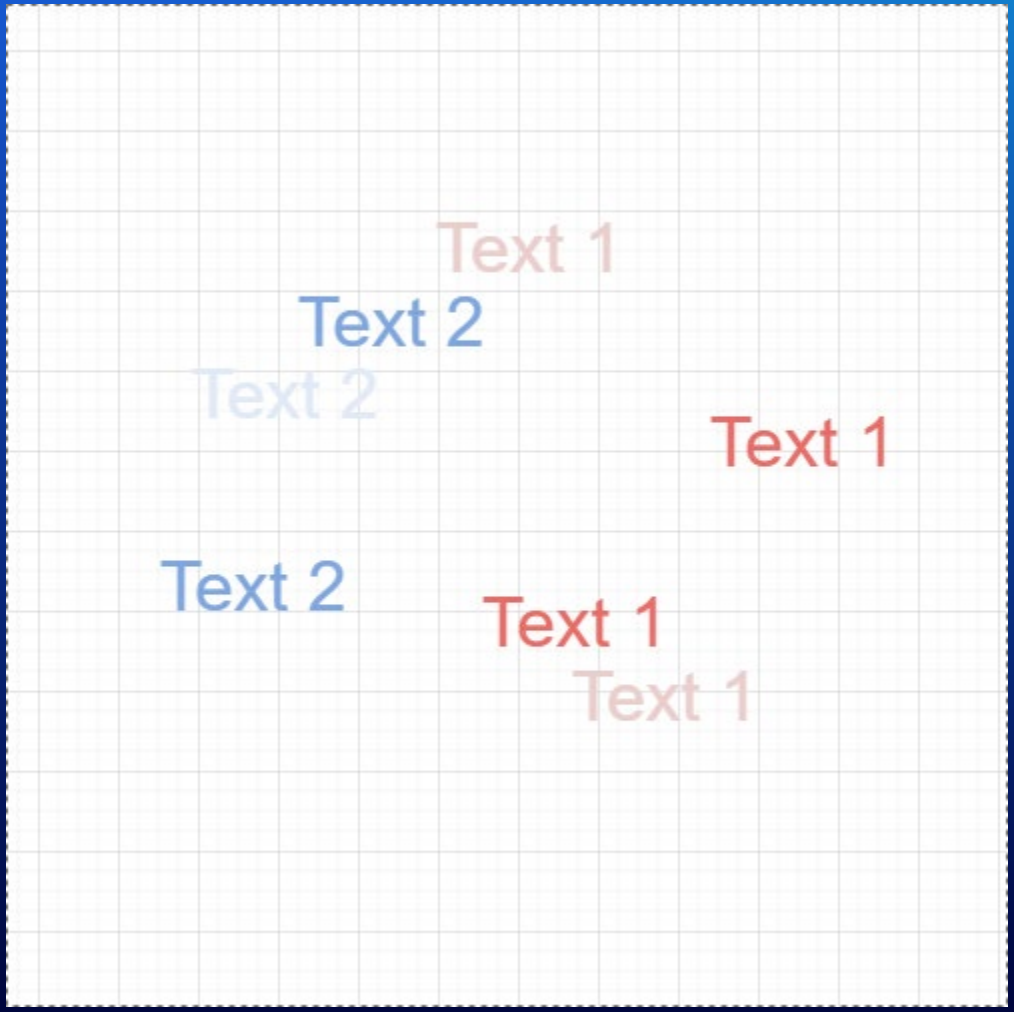


Label Definition Properties (All features): Deconfliction

- `priority`
- **Which labels are placed first and preferred when deconflicting**

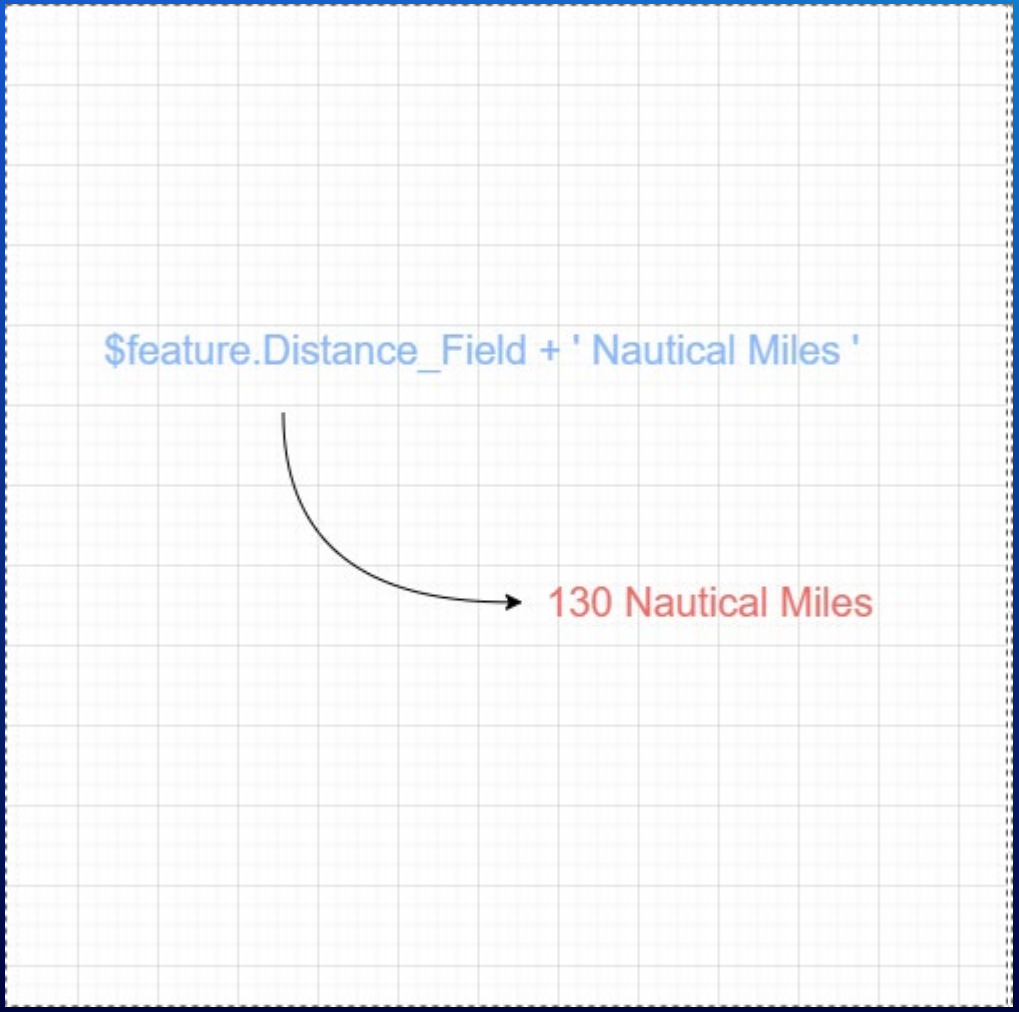
Label Definition Properties (All features): Deconfliction

- `removeDuplicates`
- **Remove features with the same text**



Label Definition Properties (All features): Expression

- `labelExpression`
- **Expression describing how to build the text label**



Label Definition Properties (All features): Expression

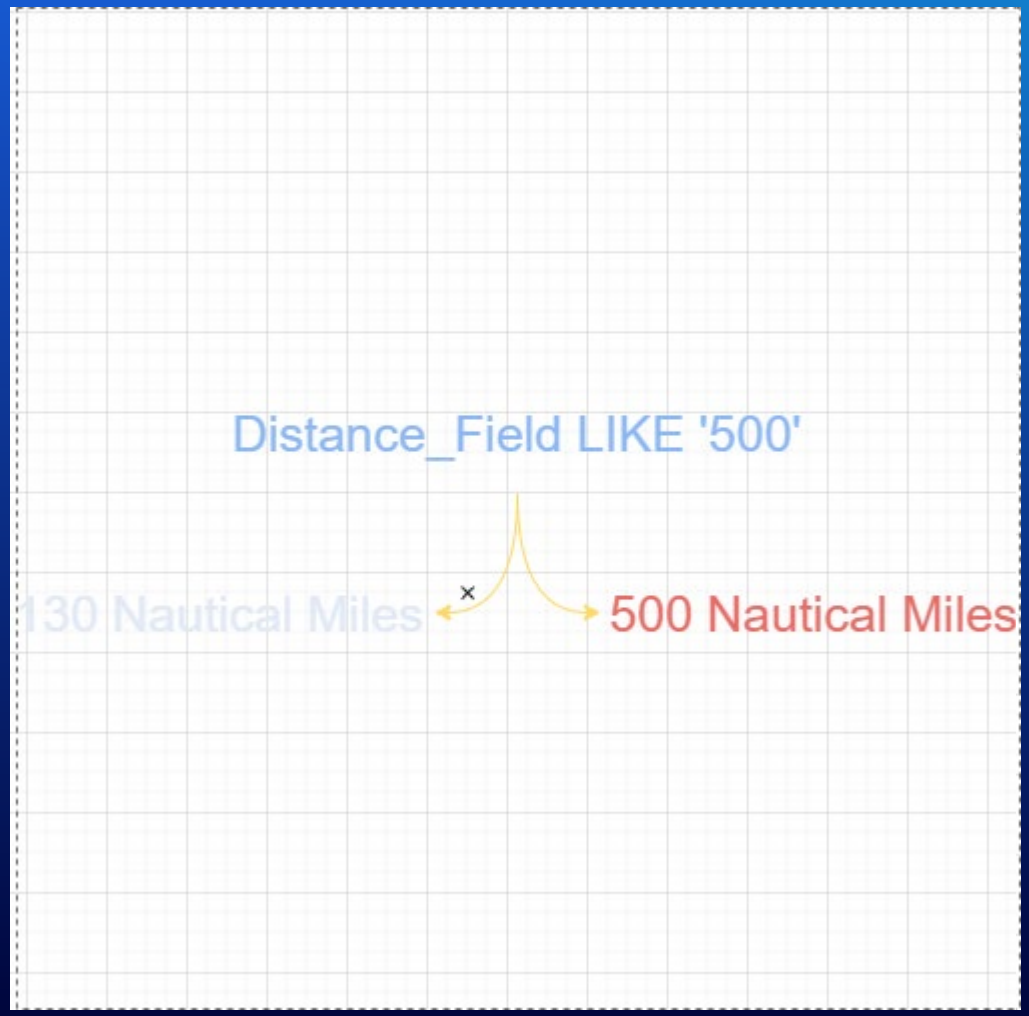
- `useCodedValues`
- **Should Simple Expressions translate domain identifiers into meanings**

Label Definition Properties (All features): Expression

- `name`
- **Used as an identifier only**

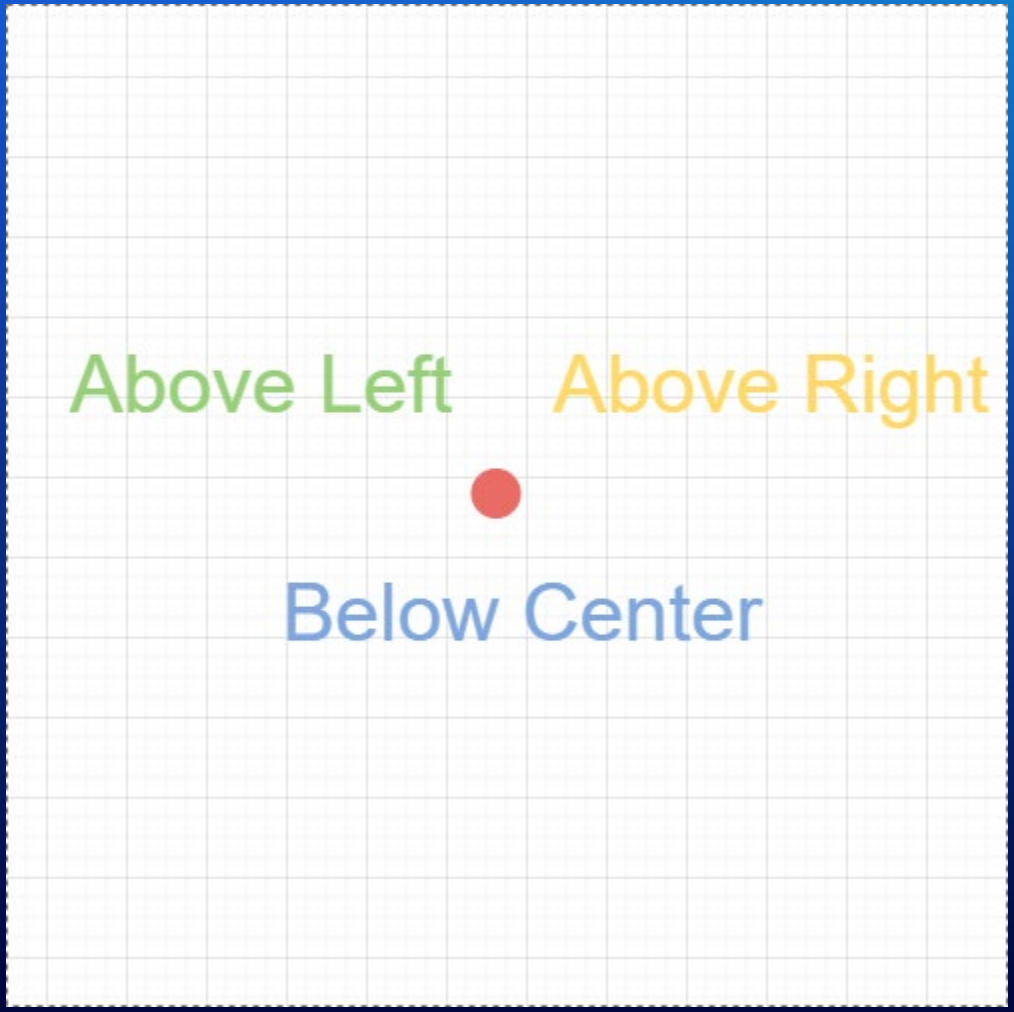
Label Definition Properties (All features): Expression

- `where`
- **Which features from the layer and extent should have labels calculated for them**



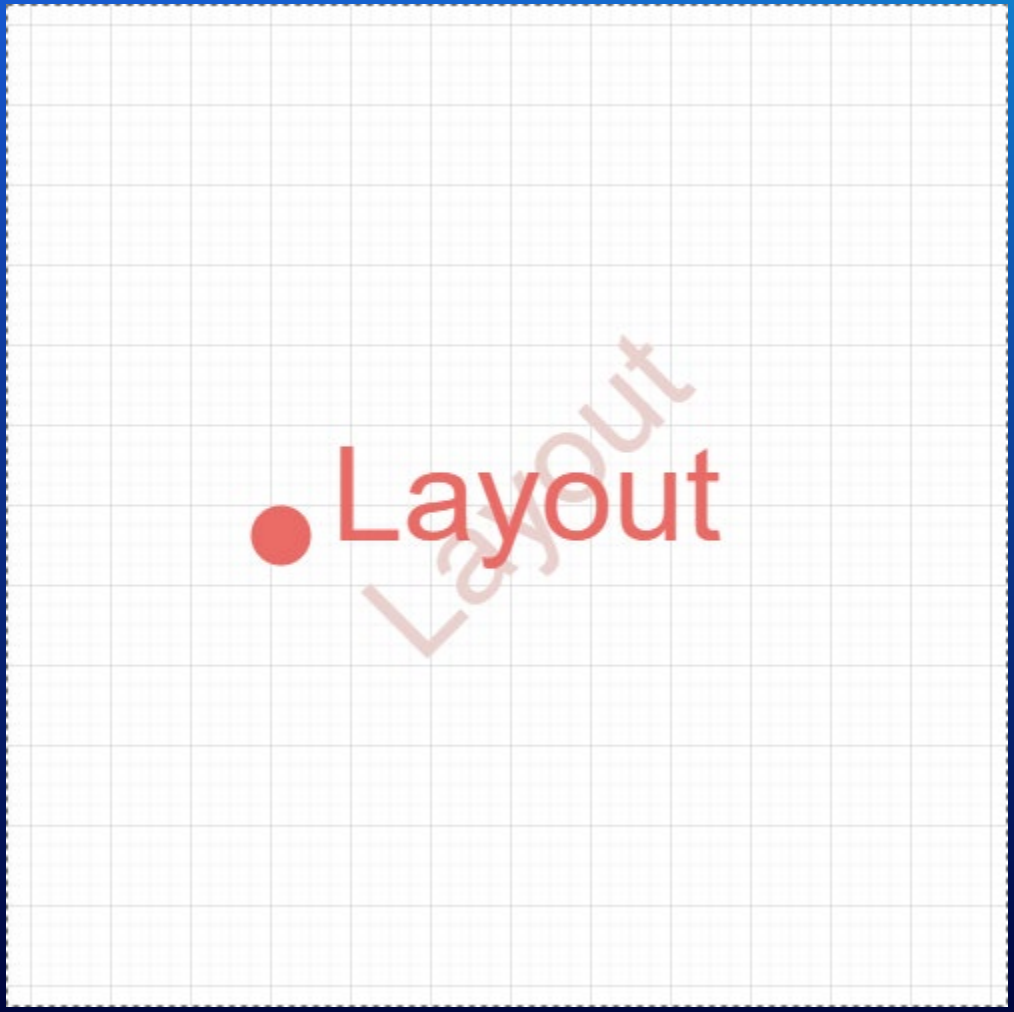
Label Definition Properties (All features): Placement

- `labelPlacement`
- **Preferred position of the label**



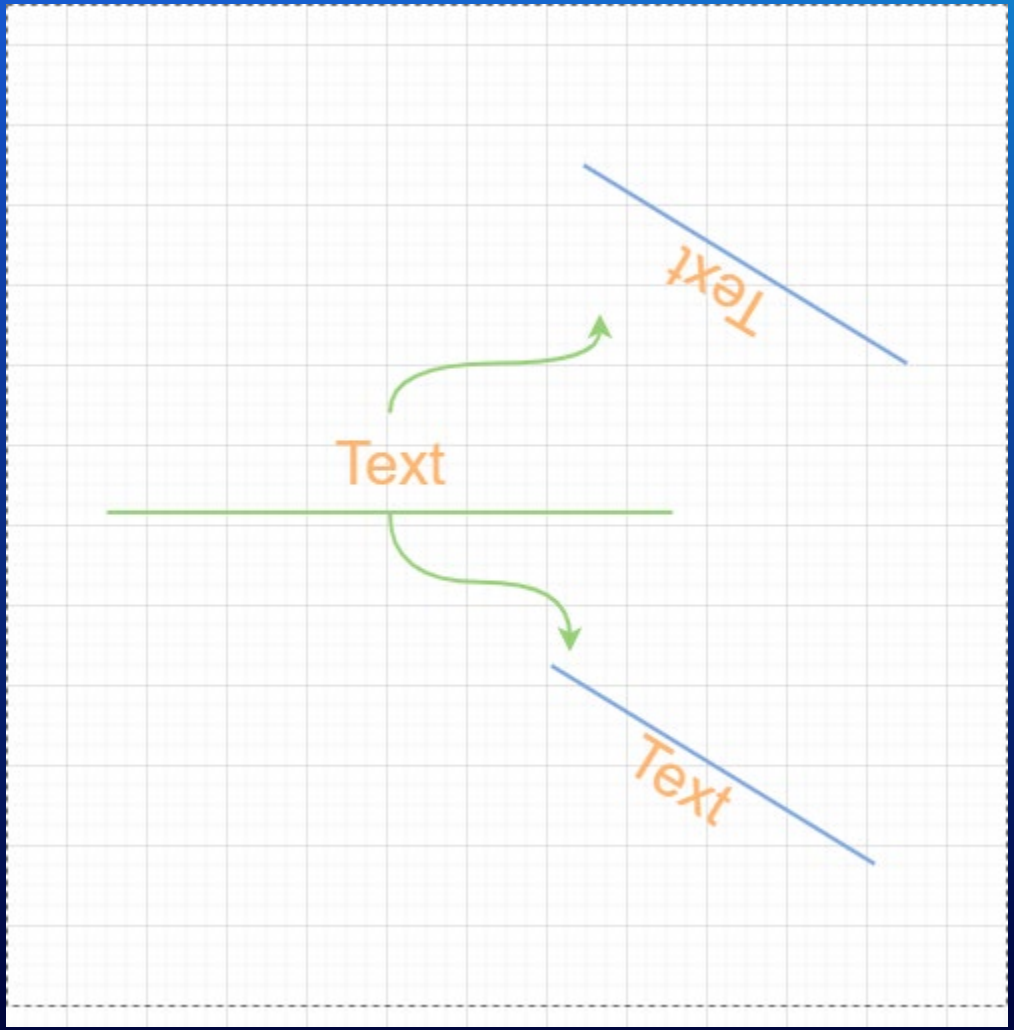
Label Definition Properties (All features): Placement

- `textLayout`
- **How the label text direction is aligned at its position**



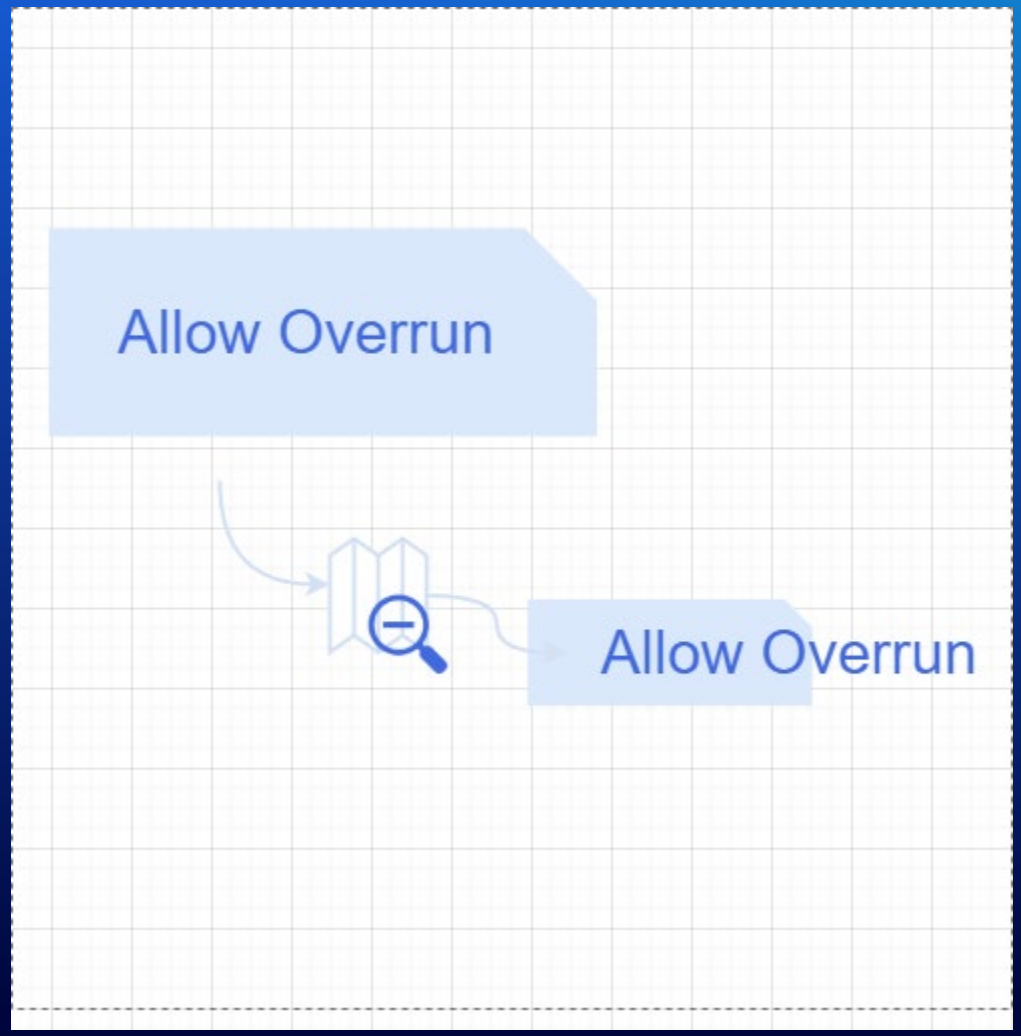
Label Definition Properties (All features): Placement

- `textOrientation`
- **Orient to screen or feature**



Label Definition Properties (All features): Scale

- `allowOverrun`
- **Visibility when the feature is smaller and label**



Label Definition Properties (All features): Scale

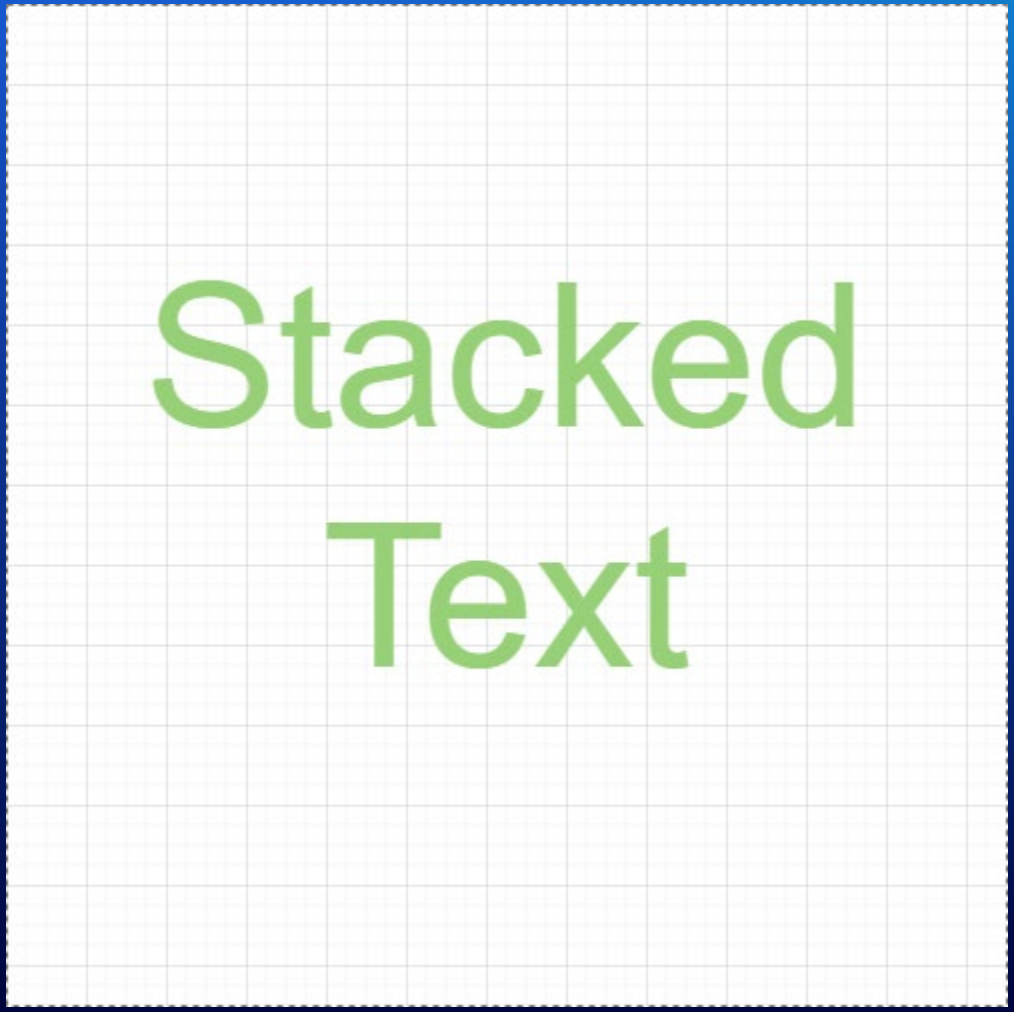
- `maxScale`
- **Visibility when scale is smaller than the maxscale**

Label Definition Properties (All features): Scale

- `minScale`
- **Visibility when scale is larger than the minScale**

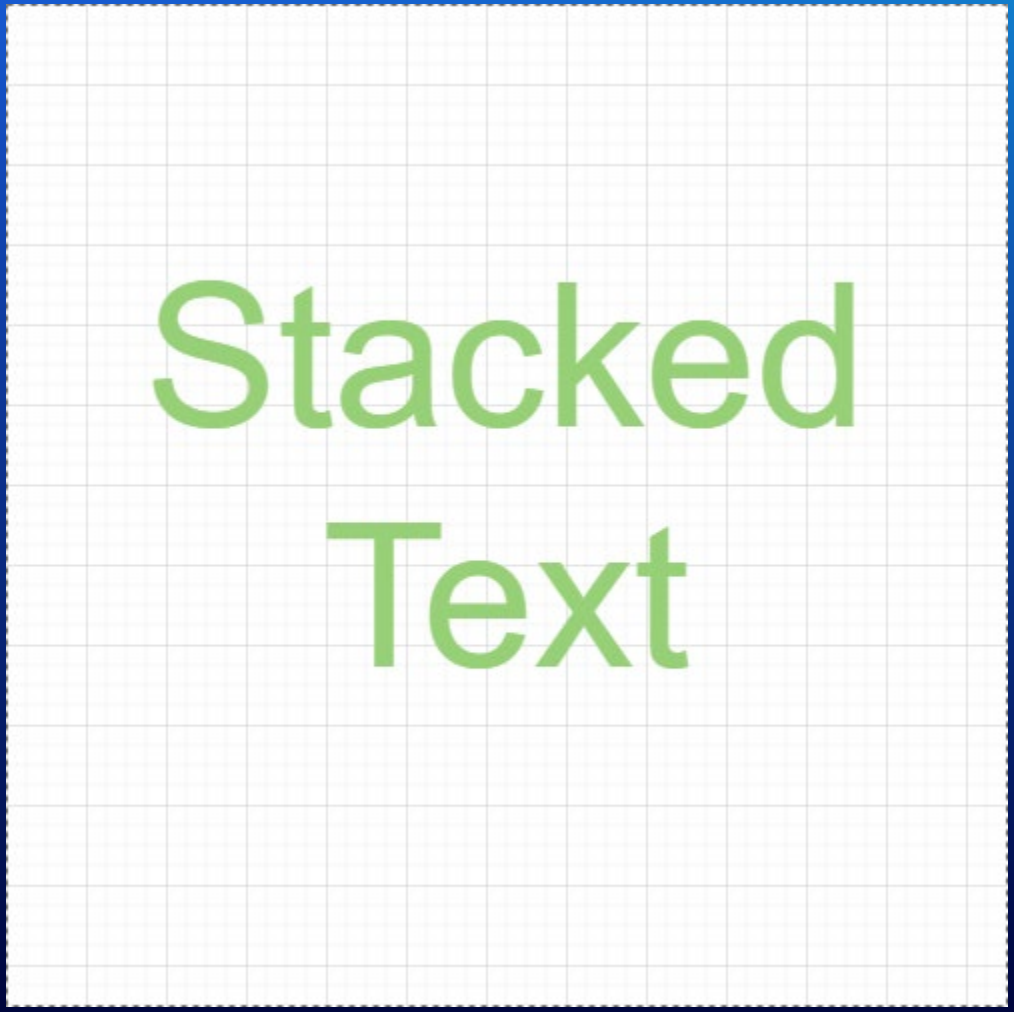
Label Definition Properties (All features): Stacking

- `stackLabel`
- **Apply wrapped or stacked text**



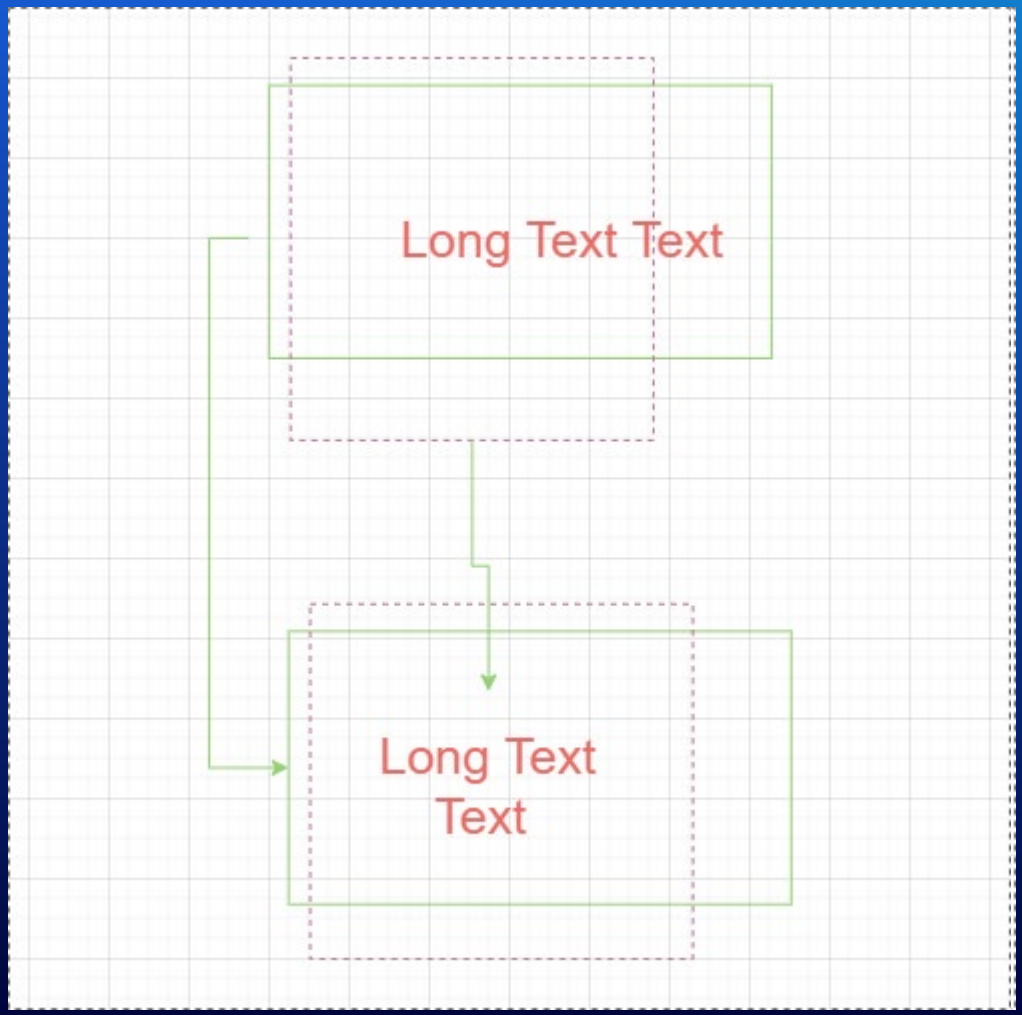
Label Definition Properties (All features): Stacking

- `stackAlignment`
- **Stacked text horizontal alignment according to TextSymbol**



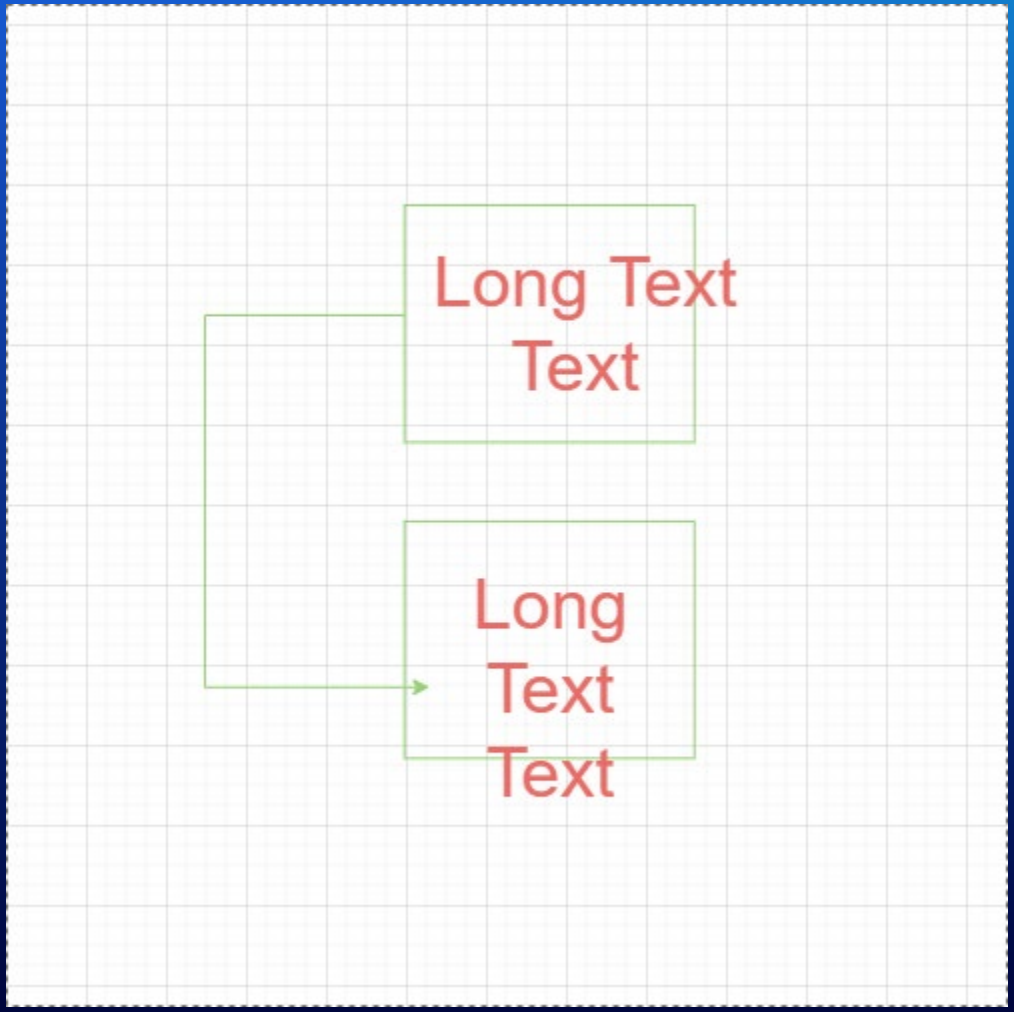
Label Definition Properties (All features): Stacking

- `stackBreakPosition`
- **Where a row of text should be broken**



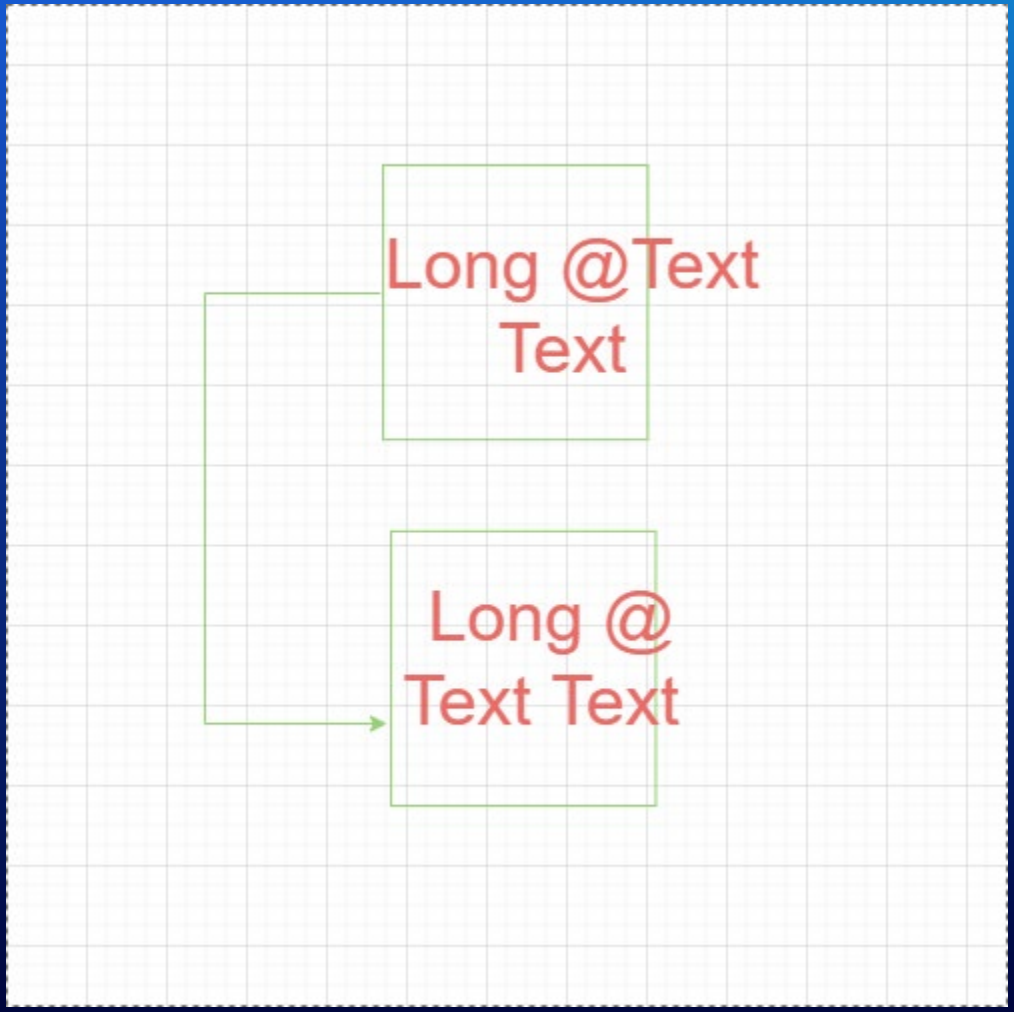
Label Definition Properties (All features): Stacking

- `stackRowLength`
- **Maximum length of a text row**



Label Definition Properties (All features): Stacking

- `stackSeparators`
- **What separator character to use when breaking**

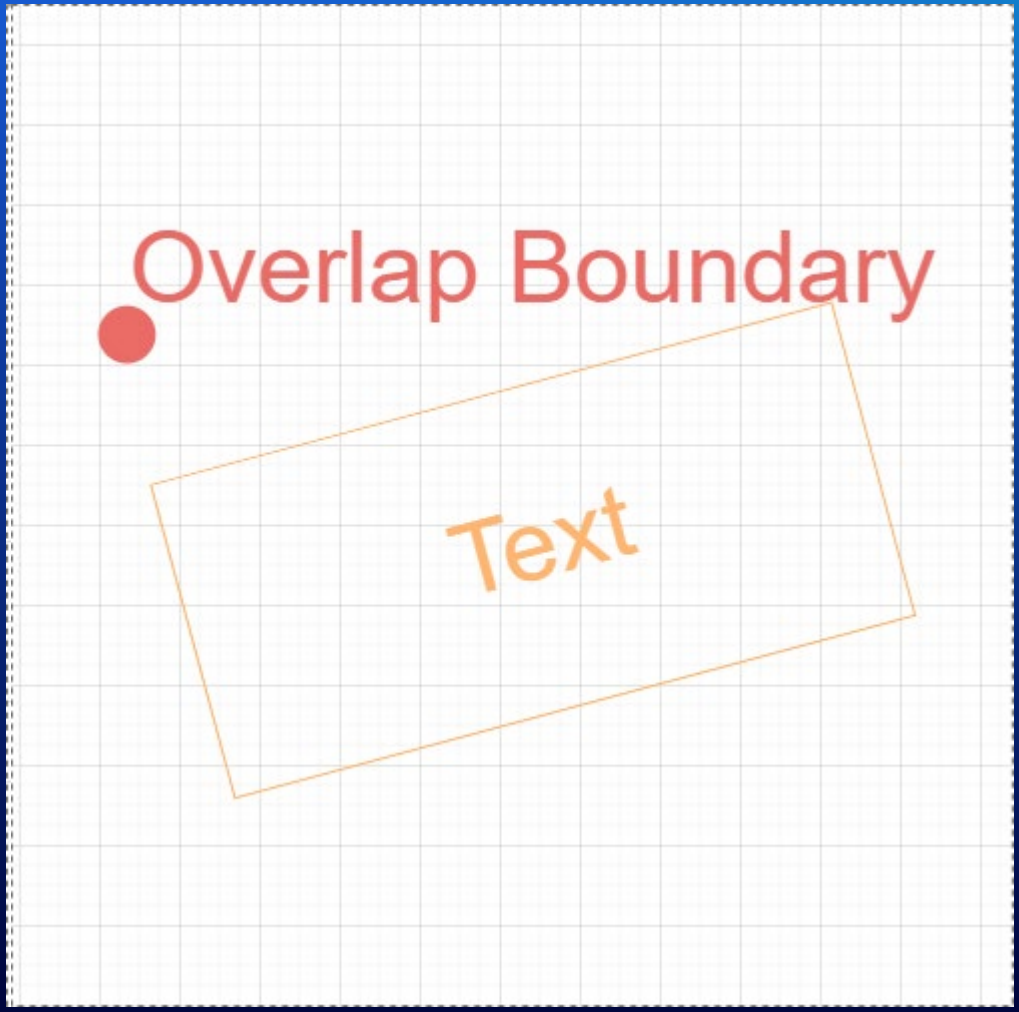


Label Definition Properties (All features): Symbol

- Angle *(depreciated)*
- backgroundColor
- borderLineColor
- borderLineSize
- color
- font
- haloColor
- haloSize
- horizontalAlignment
- kerning
- rightToLeft
- rotated
- text
- type
- verticalAlignment
- xoffset *(depreciated)*
- yoffset *(depreciated)*

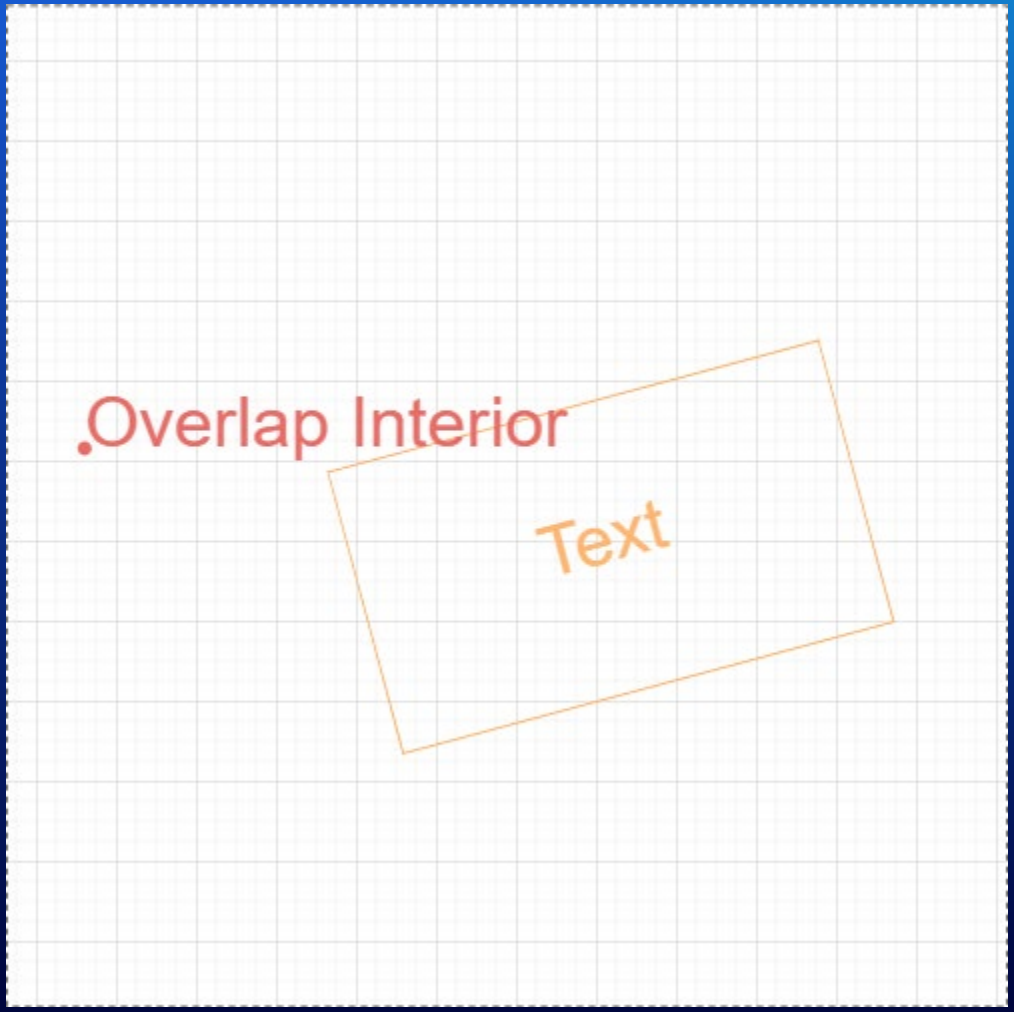
Label Definition Properties (Polygons)

- `allowOverlapOfFeatureBoundary`
- **Whether other labels are allowed to overlap this polygon feature's edge**



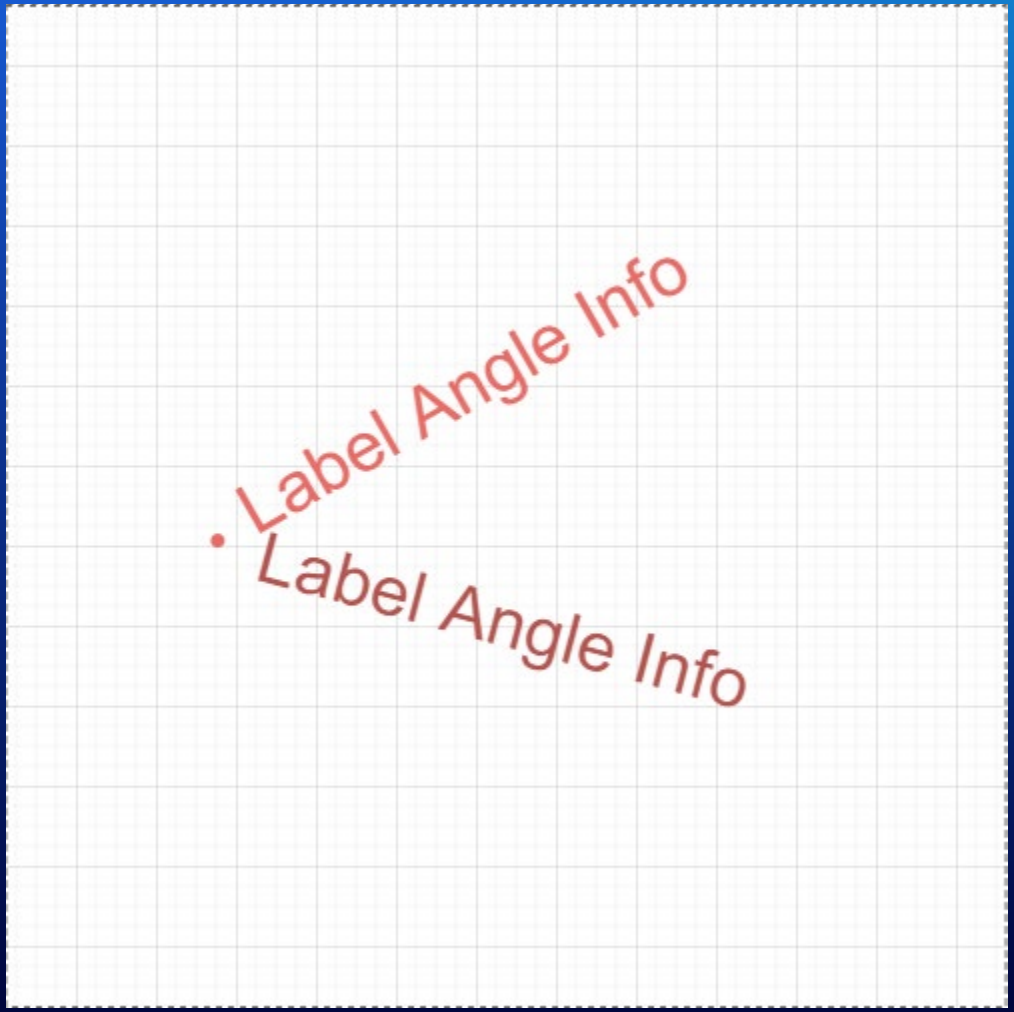
Label Definition Properties (Polygons)

- `allowOverlapOfFeatureInterior`
- **How much other labels are allowed to overlap this feature**



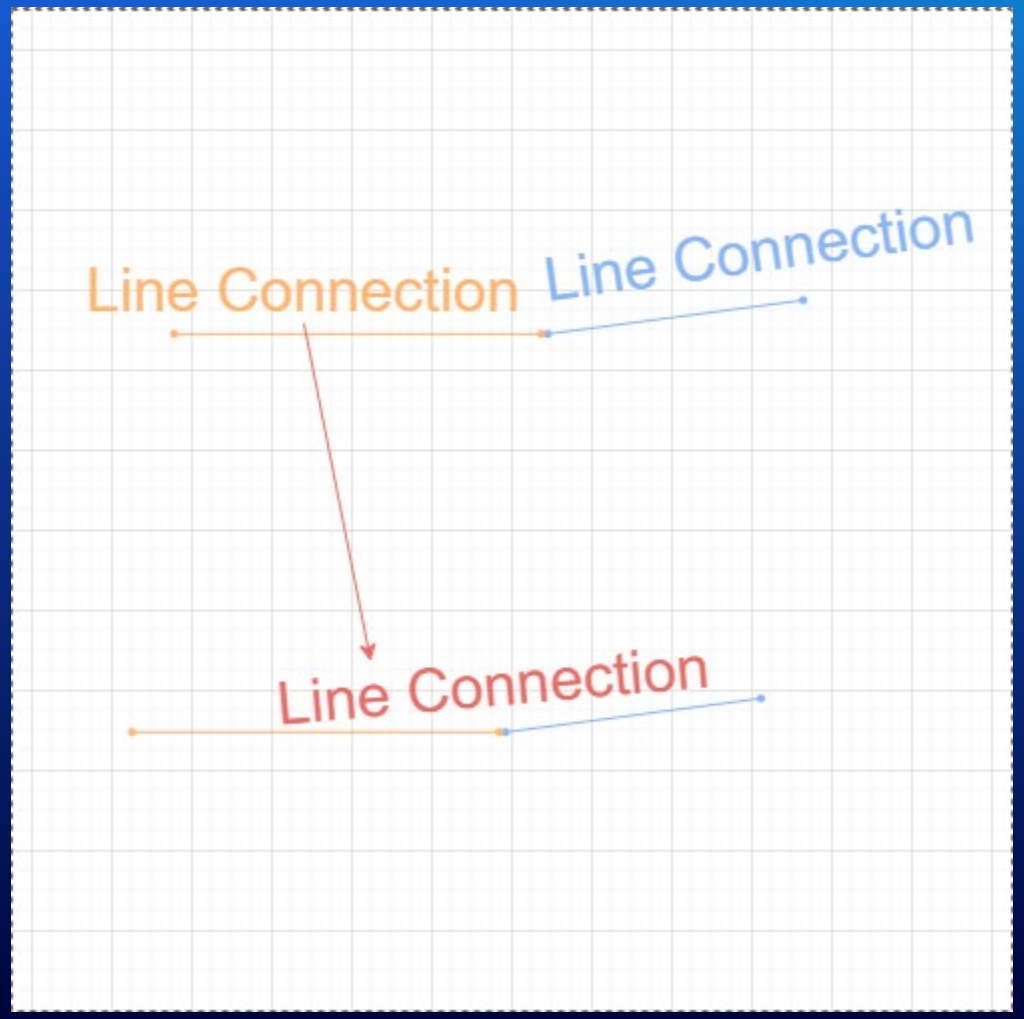
Label Definition Properties (Points)

- `labelAngleInfo`
- **How to position a label following the direction of an angle**



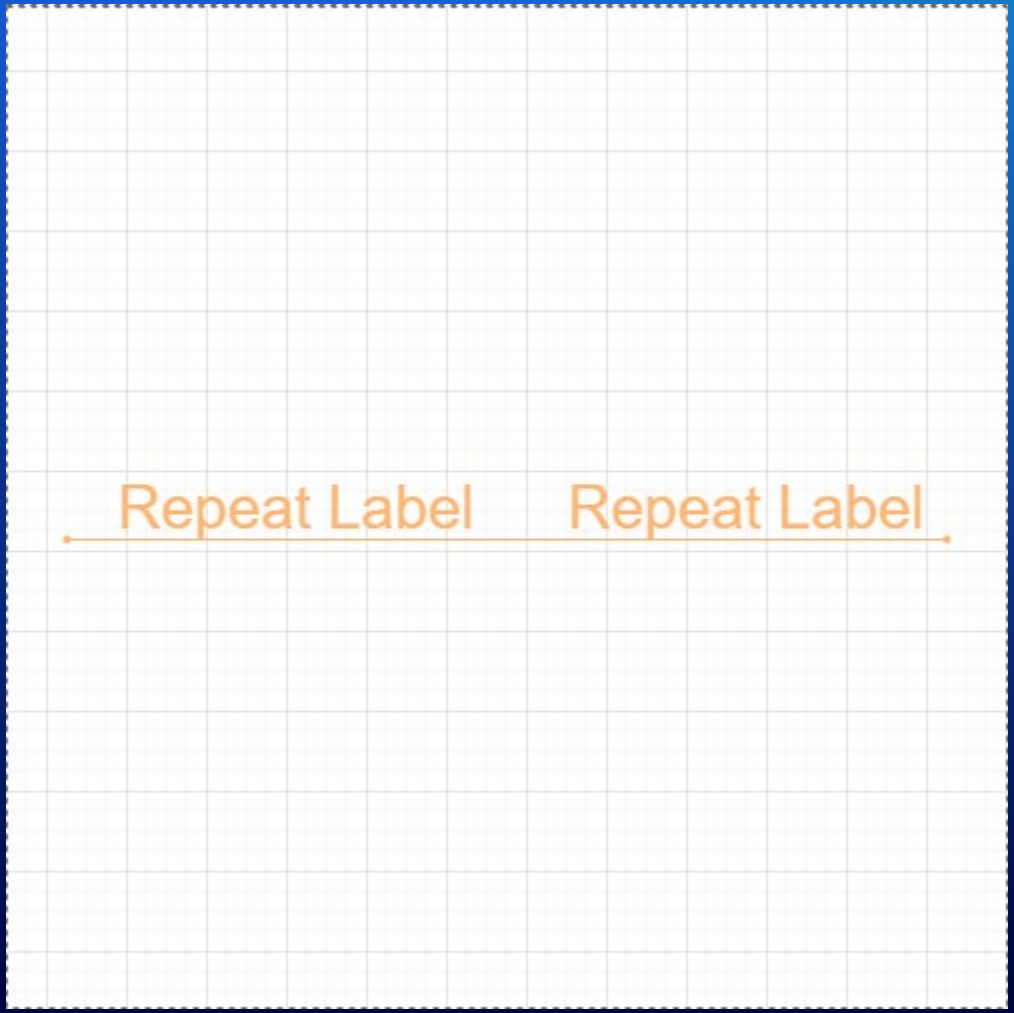
Label Definition Properties (Line)

- `lineConnection`
- **Whether line features with the same label, and matching end vertices, should be joined or shared**



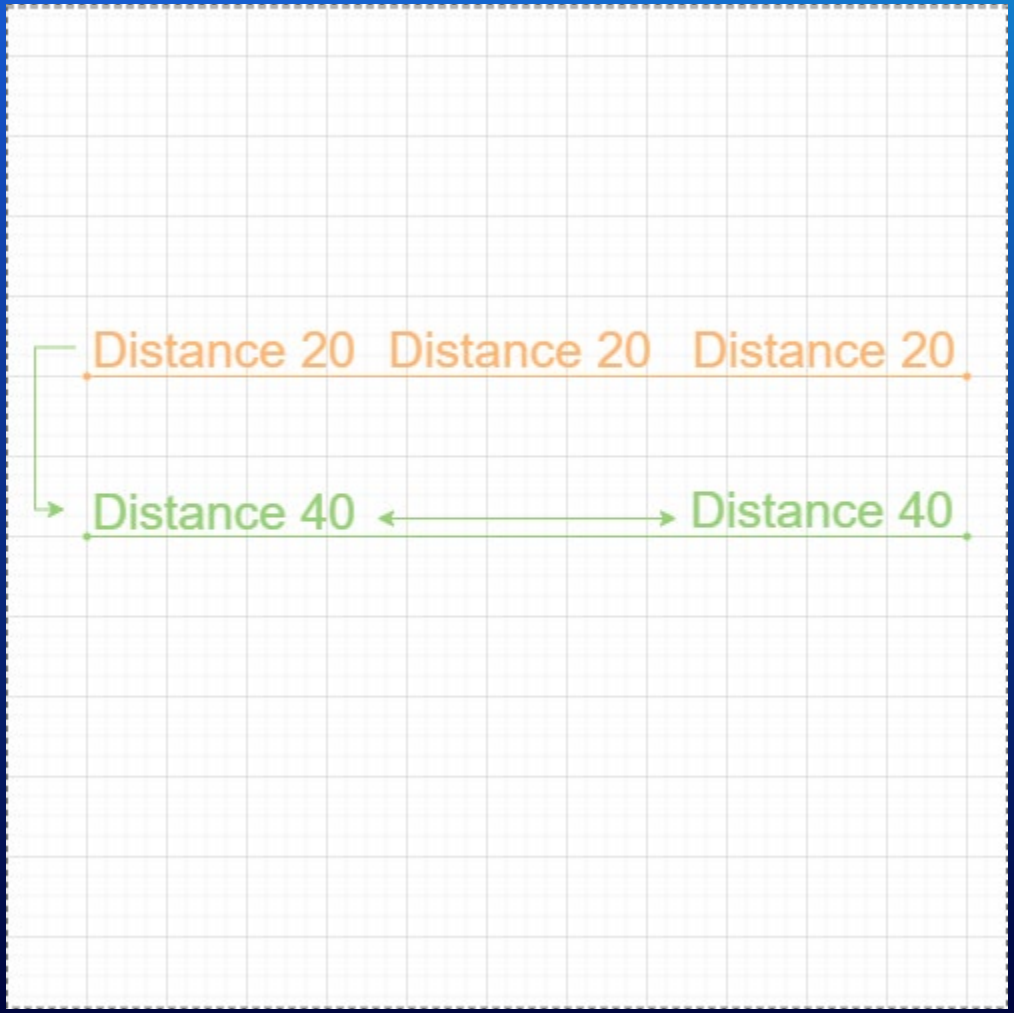
Label Definition Properties (Line)

- `repeatLabel`
- **Multiple label copies placed along or across the feature**



Label Definition Properties (Line)

- `repeatLabelDistance`
- **Repetition density**



Label Definition Properties (Lines and Polygons)

- `multiPart`
- **How many labels should be placed on multi-part features**

Label Definition Properties (Lines and Points)

- `offsetDistance`
- **Distance from point or line feature**

Labeling API (100.11)

- 1:1 functionality with JSON
- Labeling API + JSON

Labeling API Example

```
List<LabelDefinition> labelDefinitionCollection = featureLayer.getLabelDefinitions();
LabelDefinition labelDefinition = labelDefinitionCollection.get(0);
labelDefinition.setPlacement(LabelingPlacement.POINT_BELOW_CENTER);
```

Introduction to 2D Labeling

Christopher – ArcGIS Runtime Labeling

Introduction to 3D Labeling

Alexander – ArcGIS Runtime Labeling

3D Labeling

- Features from Webscenes
- Features from Mobile Scene Packages *(ex 3D Points)*
- Graphic Overlay Features

- Same Label properties as 2D Labeling
- Remember to enable Labeling for both the Feature Layer and the Scene

3D Labeling: Supported Label Properties

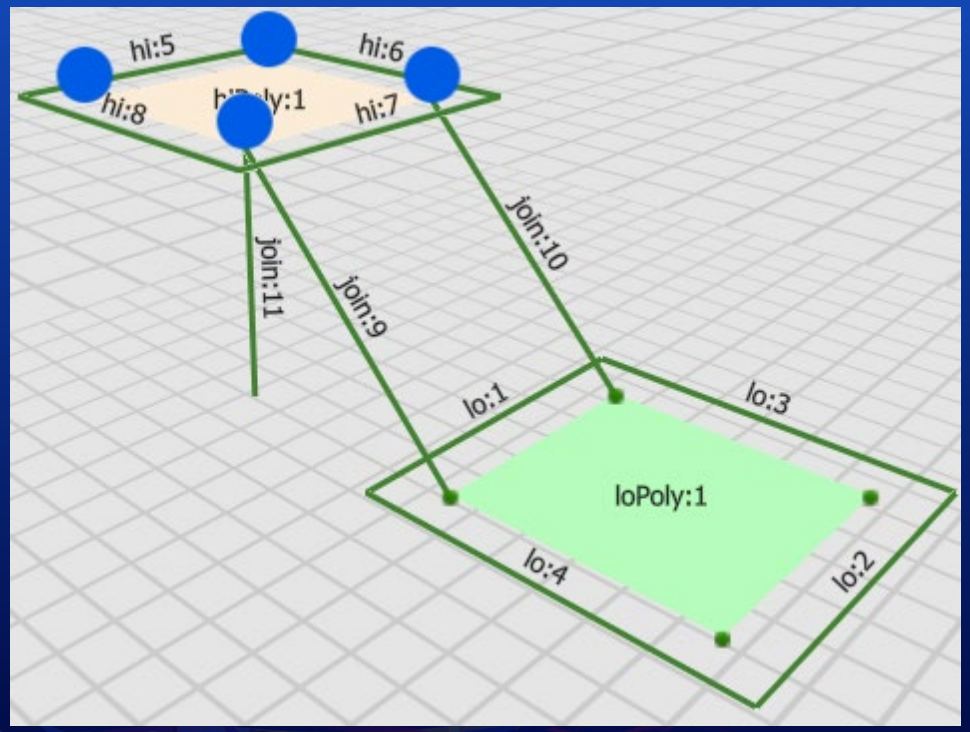
- Label Expression
- Label Placement
- Max Scale
- Min Scale
- Multi-Part Strategy
- Priority
- Remove Duplicates
- Remove Duplicates Distance
- Stack Alignment
- Stack Break position
- Stack Label
- Stack Row Length
- Stack Separators
- Symbol
- Use Coded Values
- Where

3D Labeling: Future Properties

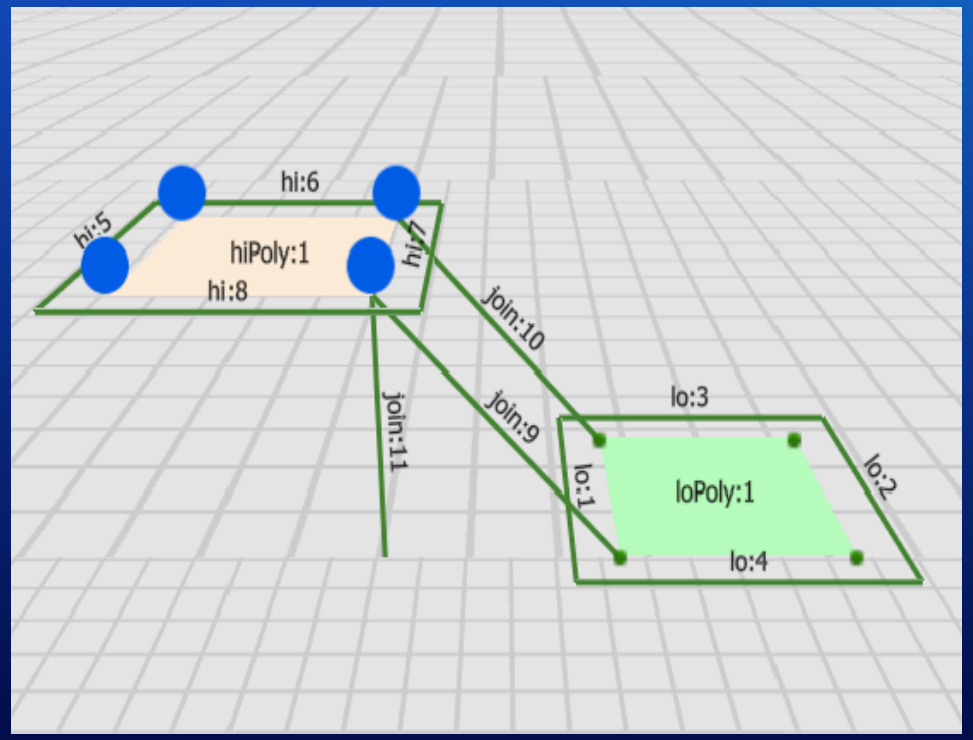
- Allow Overlap Of Feature Boundary
- Allow Overlap Of Feature Interior
- Allow Overlap Of Label
- Allow Overrun
- Deconfliction Strategy
- Line connection
- Repeat Label
- Repeat Label Distance
- Label Angle Info
- Text Layout
- Text Orientation
- Offset Distance

3D Labeling: Future Properties

- Text Layout



- Offset distance



3D Labeling: Future developments

- Support for more Labeling properties
- Underground Labeling visibility enhancements
- Labeling 3D points loaded from Mobile Scene Packages

Introduction to 3D Labeling

Alexander – ArcGIS Runtime Labeling

Expressions in Labeling

Where clauses, Label Expressions & Formatting Tags

SQL ‘Where’ Clauses

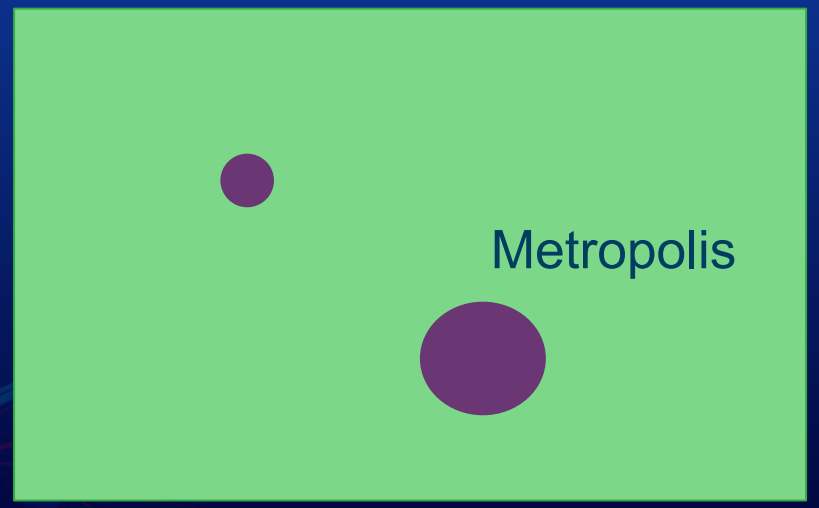
ObjectId	Name	Display	Size
21	Midtown	N	15
22	Smallville	Y	10
23	Metropolis	Y	20

FeatureLayer
DefinitionExpression

“Display = ‘Y’”

LabelDefinition
WhereClause

“Size > 12”



SQL ‘Where’ Clauses

- FeatureLayer
  - DefinitionExpression: “Type = ‘Urban’”
  - LabelDefinition[0]
    - WhereClause: “POPN < 10000”
    - ..
  - LabelDefinition[1]
    - WhereClause: “POPN >= 10000 and POPN < 50000”
    - ..
  - LabelDefinition[2]
    - WhereClause: “POPN >= 50000”
    - ..

SQL ‘Where’ Clauses

- FeatureLayer
  - DefinitionExpression: “Type = ‘Urban’”
  - LabelDefinition[0]
    - WhereClause: “POPN < 10000”
    - minScale: 20000
  - LabelDefinition[1]
    - WhereClause: “POPN >= 10000 and POPN < 50000”
    - minScale: 100000
  - LabelDefinition[2]
    - WhereClause: “POPN >= 50000”
    - minScale: 0

Label Expressions

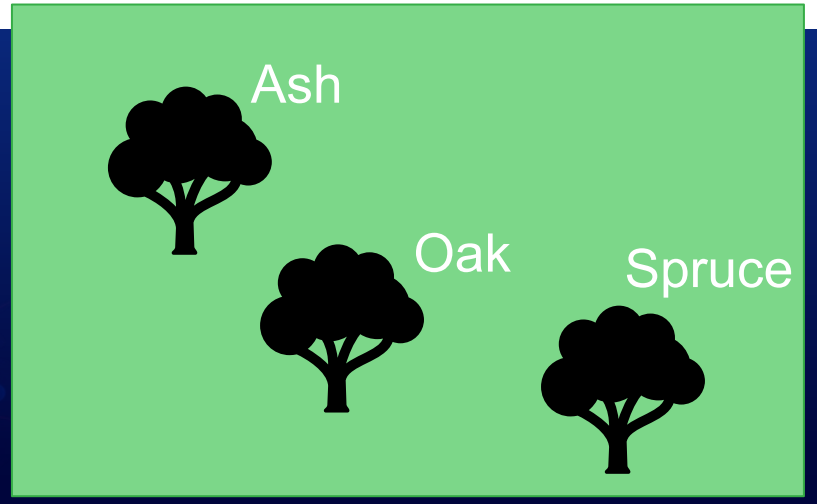
ObjectId	Tag
21	Ash
22	Spruce
23	Oak

```
{
    "labelExpressionInfo":
    {
        "expression":"$feature.tag",

        "value":"{tag}",
    },

    "labelExpression": "[TAG]",
}
```

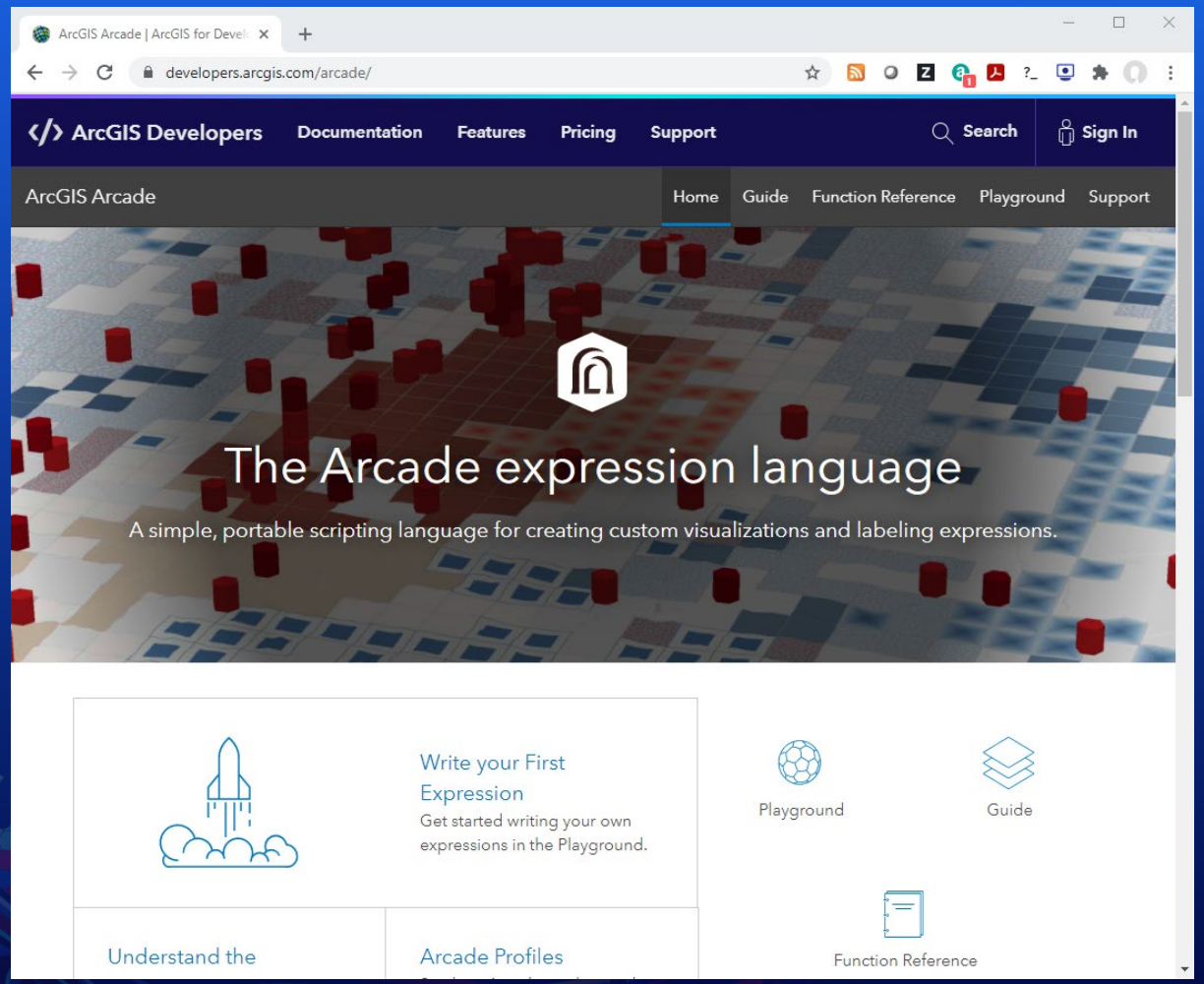
Arcade expression

Webmap expression

Simple/REST expression



https://developers.arcgis.com/arcade/



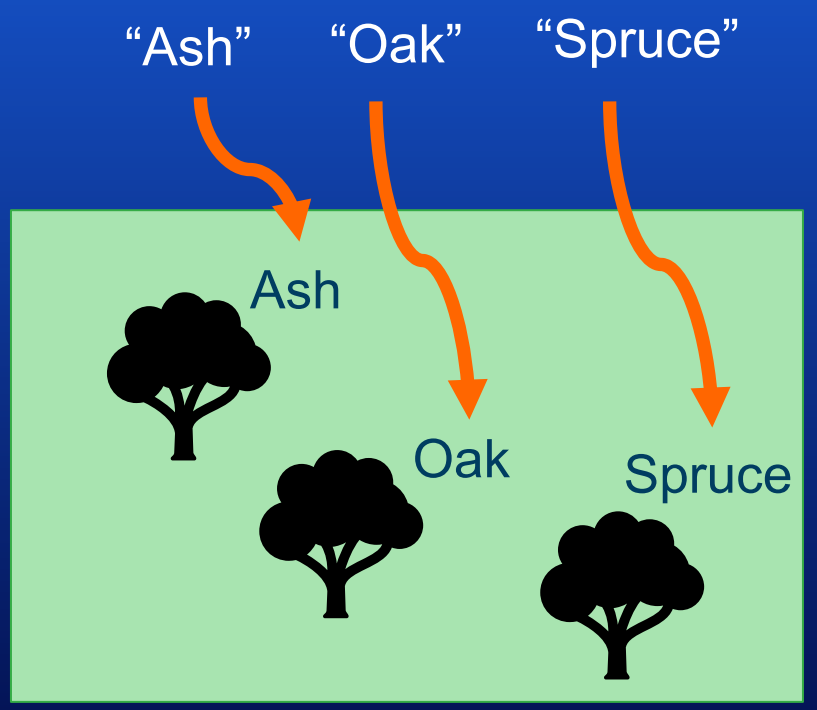
The website includes:

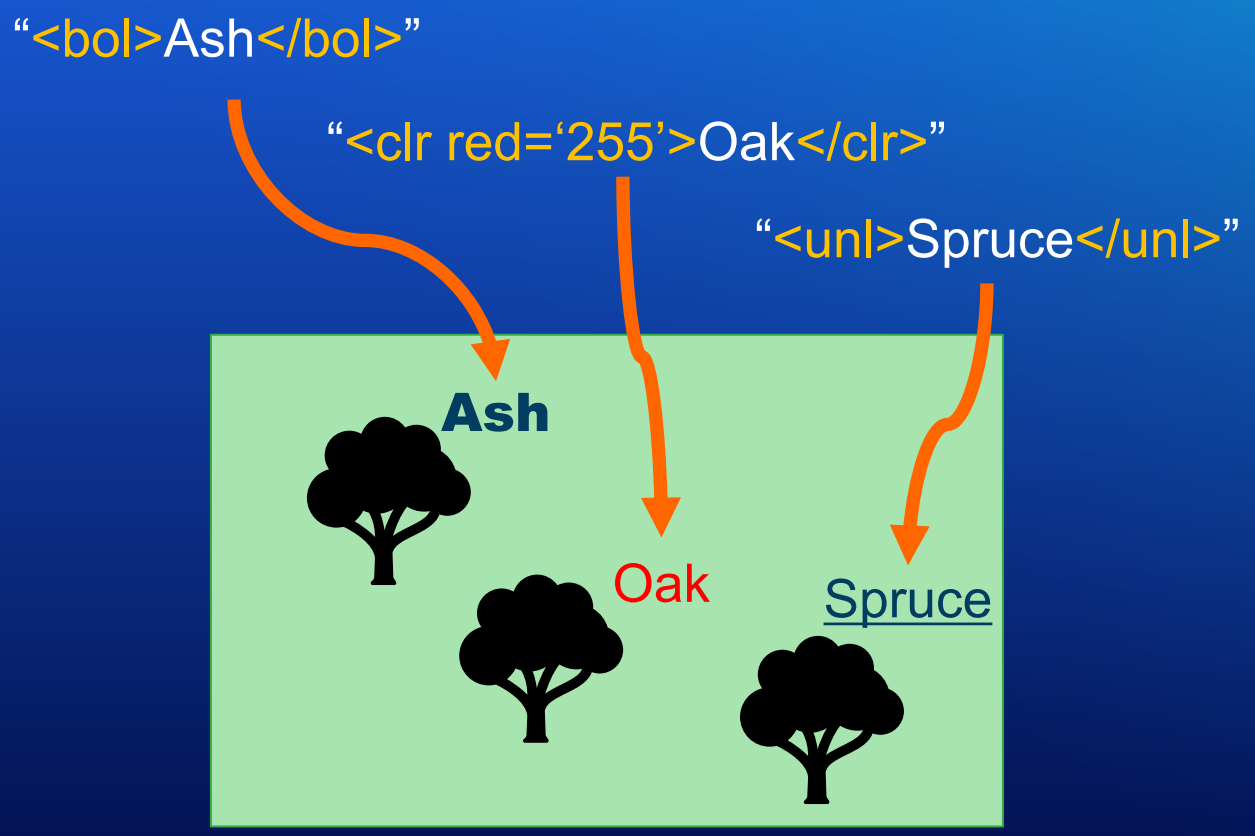
- **Documentation**
- **Playground**

Arcade Label Expression use:

- **Feature attributes & geometry**
- **Library of functions**
- **JavaScript-like syntax**

Formatting Tags





Formatting Tags

- Currently Supported
  - <BOL>
  - <CLR>
  - <FNT name size scale>
  - <ITA>
  - <UND>

- Planned for future support
  - <ACP>
  - <BGD>
  - <CHR>
  - <SCP>
  - <SUB>
  - <SUP>
  - <WRD>

Spruce

ArcGIS Runtime: Labeling patterns and best practices

Richard Shepherd, Christopher Light, Alexander Payne

Runtime Text development team

Samples by Peter Dimitrov

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