

AMP Sprite Animations

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TODO:

1. Test canvas
2. WebGL optimization for GPU memory size

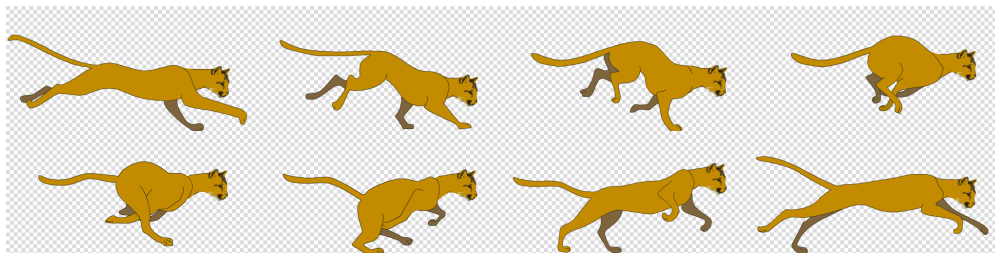
Overview

``amp-sprite-anim`` is an element that combines multiple frames in one image and animates them one-by-one in sequence. See [this example](#).

``amp-sprite-anim`` specifies two key configuration options:

1. The source of images.
2. The animation frame rate.

Classically, the sprite animations are specified using a single image, such as:



Each fragment in this sequence is a frame. The frame rate defines how long each frame in the sequence is displayed for before animation proceeds to the next frame.

Quick analysis

Sprite animations are good because:

1. They are dead-simple.
2. They allow some degree of responsiveness for quality/network/CPU tradeoff. Notice that animation cannot start until all images are downloaded.
3. Comparing to GIFs, they allow pause/resume.
4. Comparing to videos: each frame is directly addressable. It's easy to go to a particular frame.
5. It's straightforward to compose sprite animations into more advanced animations w/o sync problems.

They are bad because:

1. One image per frame is not optimizable in terms of delivery and memory usage. GIF and videos use information from many frames to achieve compression.
2. It's very hard to animate on GPU.

All-in-all, however, if number of frames is not too big, sprite animations are a reasonably-good instrument.

Why component

So, why not allow keyframe animations in CSS and forgo a separate component? There are few reasons:

1. We are currently working on AMP Animations where we are considering prohibiting some part of CSS animations. In particular background animation. Background animation is virtually unoptimizable in GPU, especially with anything more than 2-3 images.
2. However, knowing how many frames are involved, we can still apply some animations.
3. A component could easily allow a more flexible configuration of how images are discovered and loaded.
4. A component can allow composition with other animations.
5. Sprite animations are one of the most common cases for background animations. Having this component could allow us to disallow background animations for general animations since they are poorly optimized.

`amp-sprite-anim` component

An alternative name is "amp-sprite-anim" to avoid confusion with old-style sprite icons.

```
<amp-sprite-anim frame-rate="16">
  <source src(set)=" "
    offset-x=" "
    offset-y=" "
    frame-width="256"
    frame-height="150"
    frames="4">
  <source src(set)=" " ...>
</amp-sprite-anim>
```

This format is subject to experimentation, but initially, per this format:

- Multiple frames can be specified in one image in one row.

- If the file has multiple rows, they have to be specified in separate `source` tags. That's ok since we can ensure that the image is loaded only once. Likewise, the same image can be used for multiple amp-animation tags which we can also ensure across all `amp-sprite-anim` tags.
- Obviously, one frame per image is also possible.
- Srcset provides images for different resolutions based on the actual frame width.

Implementation

There are many ways of implementing sprite animations. Our requirement here is to only use tools available in Web Animations to ensure that main thread is not involved.

The most straightforward approach is to animation background and background-offset properties as shown in [this example](#).

When number of frames is small, an alternative approach could display images on separate divs on top of each other and animation can be done via opacity. This could potentially be done on GPU, but the cost will be additional GPU memory consumption.

Composing with `amp-sprite-anim`

AMP Animations spec [describes a way](#) to compose animations from individual elements. This is not yet implemented, but could work well enough for sprite animations.

```
<amp-sprite-anim id="spritel" frame-rate="16">
  <source>
</amp-sprite-anim>

<amp-animation id="anim1">
  {
    "target": "spritel",
    "animation": "animate",
    "duration": 1500,
  }
</amp-animation>
```

Since sprite animation element exports animation in a Web Animations format, this definition can be easily integrated as a subroutine into a large animation.