Project 1

> **1. Propose a solution and an estimation on the timeline to implement this feature, given the limitations, to maximize productivity, scalability and maintainability.**

In ordre to build a new feature on top of a legency system, we should prevent to make lot of code changes on it. So my solution will minimilize the code change in both `comment` and `post` modules in **9gag** system.

The direction of this solution is to put a message queue behind `comment` microservice, detail step as following:

1. Update DB schema by adding `originalPostId` in `posts` table.
2. Update create post API for `POST 'https://9gag.com/submit'` , we need to add new params `originalPostId` , which indicate the post is a repost from other post, and store `originalPostId` value in `posts` tables, here is a example.

```
  curl 'https://9gag.com/submit' \
  -H 'authority: 9gag.com' \
  -H 'accept: */*' \
  -H 'accept-language: en-US,en;q=0.9' \
  -H 'content-type: application/json' \
  -H 'cookie: ${cookie with session info}' \
  ...
  --data-raw '{"title":"bearbrick","originalPostId":"a2KKZKE",
"tags":"BEARBRICK","nsfw":0,"isAnonymous":0,"uploadId":"10279791_167621571
3865_2193","type":"photo"}' \
  --compressed
```

3. Add message queue (SQS/Kafka) behind `comment` microservice

   Every time user post a comment to comment microservice, it will fire a event to the MQ we created in step 1. message body should include the cookie from the users. There are lot of MQ solution but i will suggest `SQS` or `Kafka`, because both of them is easy to setup and have a relatively high thoughput compare to `rabbitMQ` and `redisMQ`

4. Setup AWS lambda to trigger post API

   Once event fired to the MQ, the AWS lambda will read the event from the message queue, and then it trigger the create post API from the lambda. Please remember to add a new argument `originalPostId` and include the `session` info in cookies.

   Cause it is a async action for lambda to trigger create post, so we can control the outflow for MQ by create serveral number of lambda function.

   *Remark: of course AWS lambda is not a must, we can also deploy our own EKS service the handle this process and scale it with `helm` *

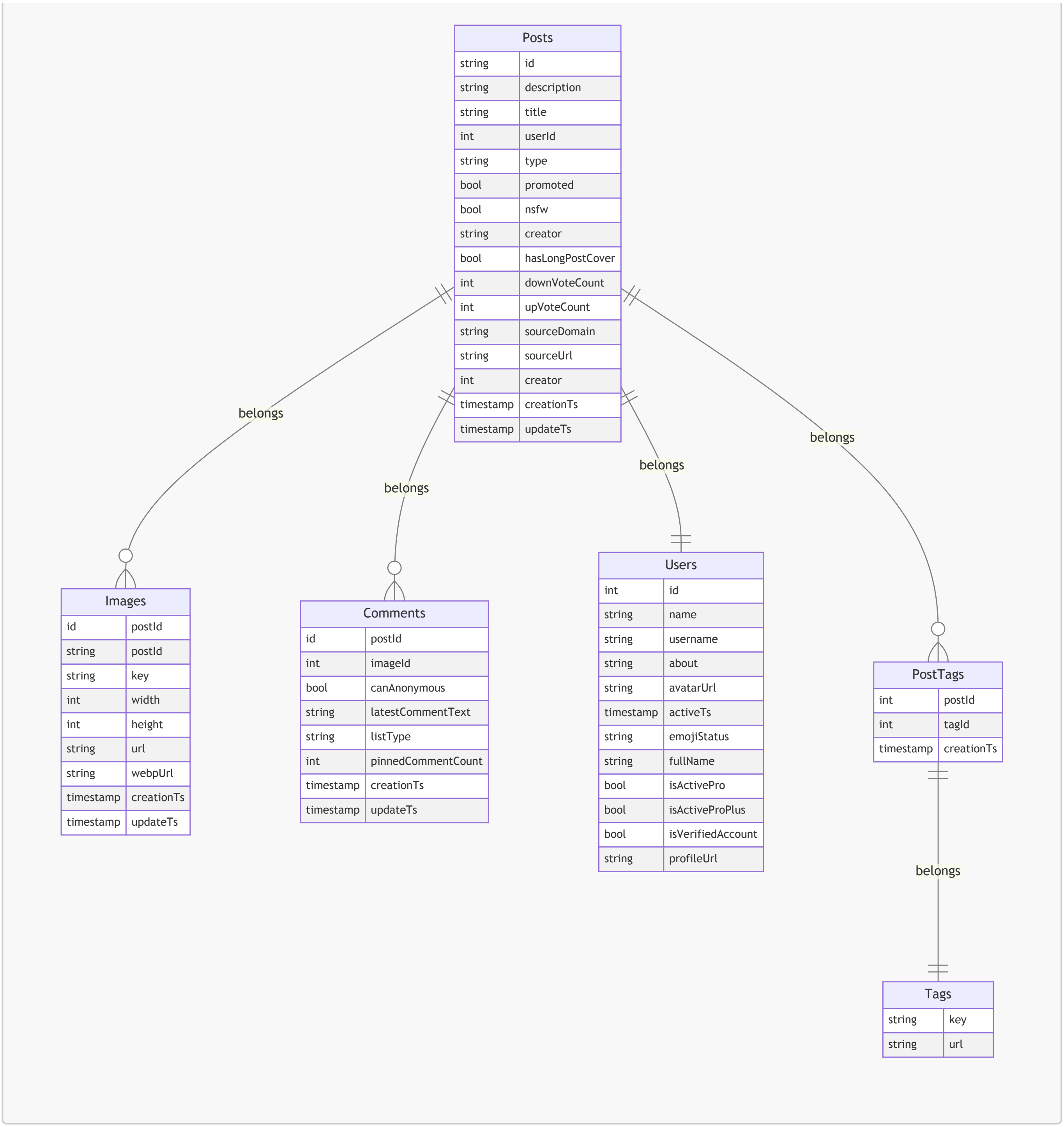
5. After we trigger the existing API for post, the legency logic should work properly including trigger notification and sync data to elastic search.

After studying the `post` data and `comment` API from **9gag**, my suggestion for the feature is to add a separate async message queue after comment module in 9gag backend to implement `repost` feature. The implementation step as following: 6. add a new `repost` when user call `POST /v2/add-comment.json`, default is `false`.

```
curl 'https://comment.9gag.com/v2/add-comment.json' \
  -H 'authority: comment.9gag.com' \
  -H 'accept: */*' \
  -H 'accept-language: en-US,en;q=0.9' \
  -H 'content-type: application/x-www-form-urlencoded' \
  -H 'origin: https://9gag.com' \
  -H 'referer: https://9gag.com/' \
  ...
  --data-raw
'appId=${appId}&url=${url}&auth=${auth}&repost=true&text=cool&opToken=${to
ken_here}' \
  --compressed
```

1. update DB schema

   After studying the API endpoint from **9gag**, i assume the mysql db schema should be as following



Posts

string	id
string	description
string	title
int	userId
string	type
bool	promoted
bool	nsfw
string	creator
bool	hasLongPostCover
int	downVoteCount
int	upVoteCount
string	sourceDomain
string	sourceUrl
int	creator
timestamp	creationTs
timestamp	updateTs

Images

id	postId
string	postId
string	key
int	width
int	height
string	url
string	webpUrl
timestamp	creationTs
timestamp	updateTs

Comments

id	postId
int	imageId
bool	canAnonymous
string	latestCommentText
string	listType
int	pinnedCommentCount
timestamp	creationTs
timestamp	updateTs

Users

int	id
string	name
string	username
string	about
string	avatarUrl
timestamp	activeTs
string	emojiStatus
string	fullName
bool	isActivePro
bool	isActiveProPlus
bool	isVerifiedAccount
string	profileUrl

PostTags

int	postId
int	tagId
timestamp	creationTs

Tags

string	key
string	url

And the only DB changes should be add a `originalPostId` in `posts` table

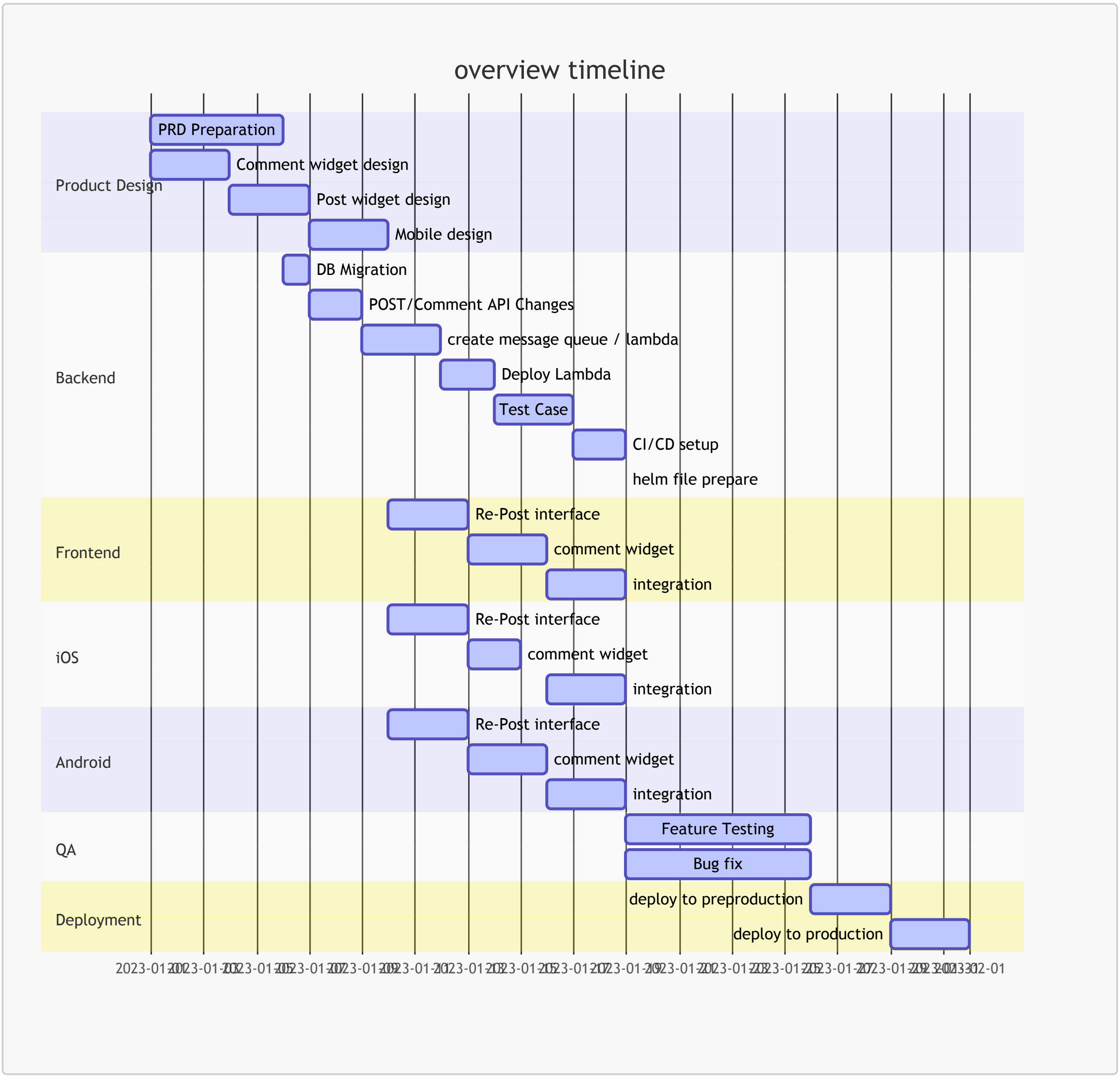
Posts	
string	id
string	originalPostId
string	description
string	title
int	userId
string	type
bool	promoted
bool	nsfw
string	creator
bool	hasLongPostCover
int	downVoteCount
int	upVoteCount
string	sourceDomain
string	sourceUrl
int	creator
timestamp	creationTs
timestamp	updateTs

Timeline

Here is my rough estimation for this feature

- UI/UX Design 1 weeks
- Backend Development 2-3 weeks
    - db migration file preparation.
    - API changes for new params.
    - create new message queue / lambda
    - CI/CD setup for new service including (SQS/Kafka) message queue and lamdba worker
    - helm file preparation for autation CD
- Frontend Development 2 weeks
    - new Post interface with `repost` feature
    - new comment widget with option for `repost`
- IOS Development 2 weeks
    - new Post interface with `repost` feature
    - new comment widget with option for `repost`
- Android Development 2 weeks
    - new Post interface with `repost` feature
    - new comment widget with option for `repost`

- Testing and Debugging 1 weeks
    - QA testing for feature
    - Debug both frontend and backend that raise during testing
    - Execute some load test in staging enviornment and compare the difference between old version and new version.
- UAT Testing 1 weeks
    - Let Product Owner have a final check
- Deployment 1 weeks
    - Deploy new feature to pre-production environment and see may missing for deployment step
    - Then deploy to production environment and monitor the feature to ensure it work as expected.
    - Also monitor the any performance issue for production DB and `memcache`.



> ## 2. What SDLC methodology do you prefer and fit our needs? What steps will you take to do better during the complete development cycle?

There are several SDLC methodology can ensure the project complete, but i think Agile methodology is well-suited for 9gag, cause Agile have the flexibiliity, quick adaptation to changes and also continuous improvement, which is very effective to a medium to small team to move fast and delivering high-quality feature in a timely manner.

To ensure a successful development cycle, the following steps can be taken:

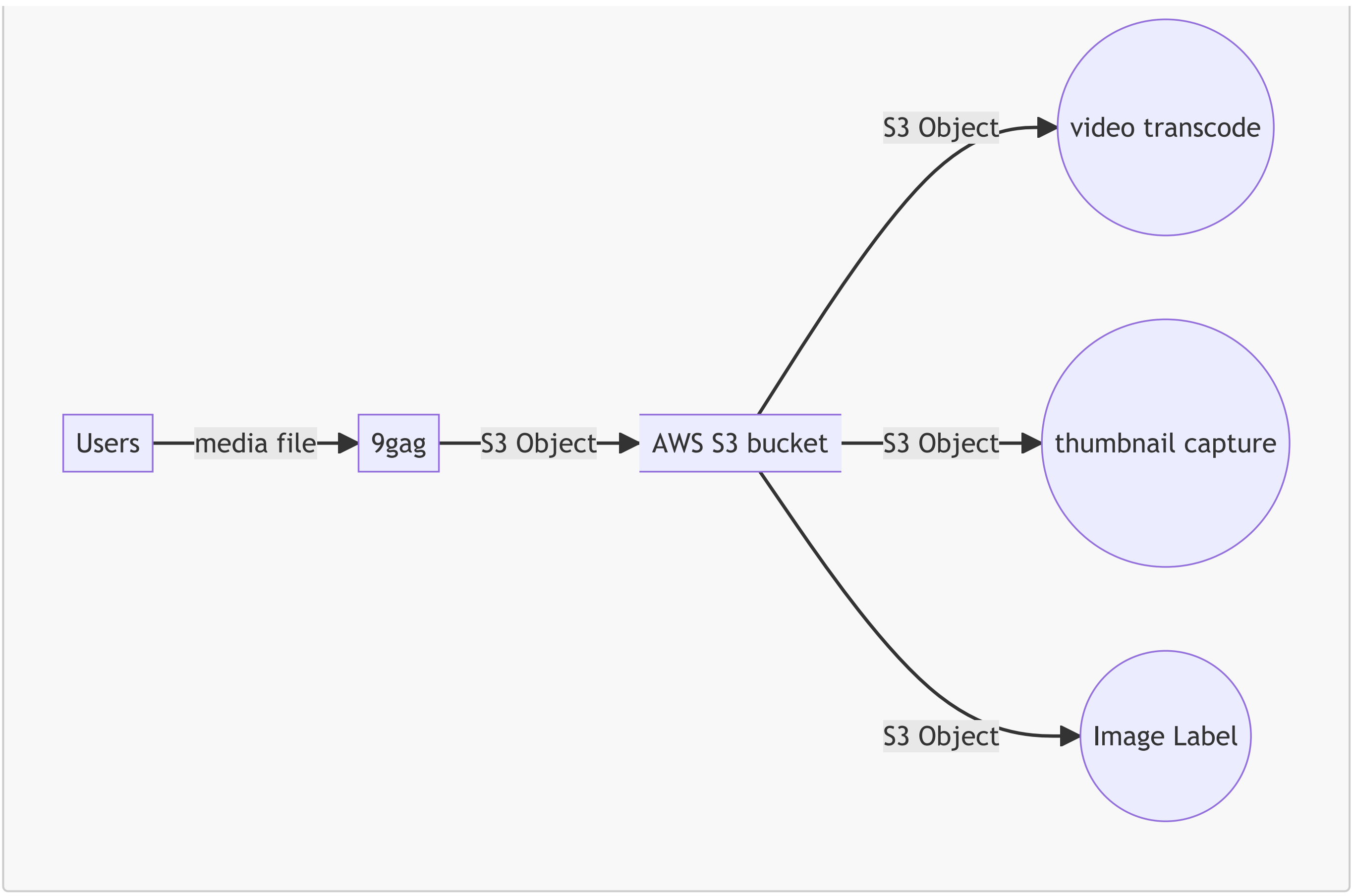
1. Define requirements in planning phase,
2. hold daily stand-up meetings to discuss progress and identify any blocker.
3. continously review the code to ensure the code is clean, man scalable.
4. Introduce unit test during development process, to ensure the code work as expect during CI/CD process.
5. hold retrospective after each sprint to improve the development process. It will help the dev team to working as efficiently as possible.

> ## 3. Should we or how could we rebuild/revitalize 9GAG's legacy system while developing new features across all platforms at the same time?

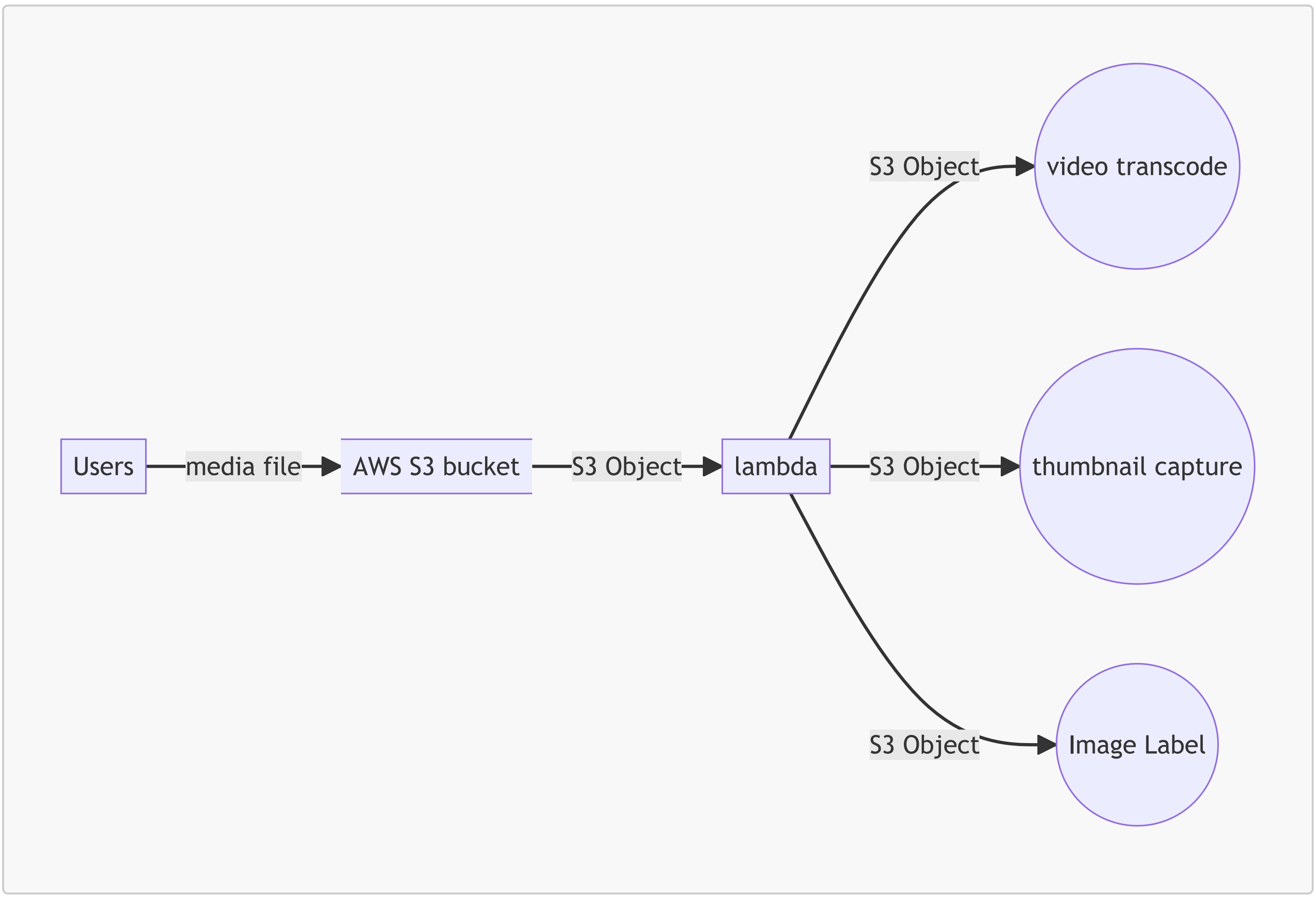
Before we decide wehter to rebuild or reviatlize legacy system, we should first assess the current system to determine what needs to be updated or rebuild and what benefit will bring to 9gag after rebuild. These benefits many be improving the performance, reducing the cost.

After assessing the system diagram and my experience when i using **9gag**, the first thing i would suggest to improve is the way user upload media(both images and videos) to 9gag. For current situation, the media file is upload to 9gag backend API, then **9gag** process the video transcode and capture video thumbnail tasks async. Cause the file is upload to **9gag** backend, so it will consume the network bandwidth of **9gag** cloud service and the user experience may affect during high traffic period.

Assuming the currect data flow as following,



New approcach will be as following, users will upload media file though `AWS S3 SDK` and the file will go to bucket directly, and you can setup the event source from S3 and trigger lambda to process video transcode and image label etc.:



Secondly, understand that most 9gag backend is build by PHP 8.0, which is a simple and easy to pick up language. Although PHP 8.0 is quite a new version and this should be good from security perspective, but unable to take advantage to `multithread` and `non-blocking` which may affect the system performance and cost. So would suggest to revamp `notification` or `vpvote`/`downvote` microservice, cause these 3 feature should be the most high traffic service in **9gag** backend. In order to provide better solution, I need to have a more detail context about the architecture design and the bottleneck on current arch, rather than just rewrite the microservice from **PHP** to other programming language.