CHAPTER 10
Getting Analytical: Metrics

The Internet has made it simple to conduct A/B tests. These tests allow us to evaluate a new feature's performance with a subset of users. From there, we can more easily infer how that same feature may perform with all users.

Most Agile development processes prefer A/B experimentation over human judgment. Agile development emphasizes iterative development rather than determining requirements upfront and then building the product in a single, final release.

PMs lead the charge with A/B testing, developing new features and hypotheses on what will improve product performance, evaluating test results, and making ship or no-ship decisions on new releases.

The metrics interview reflects this new reality. Interviewers routinely ask individuals which metrics they would evaluate to determine success, how they would interpret test results, and what actions they would take based on the data. With these questions, the interviewer is assessing whether the candidate understands metrics that relate to the overall business goal and whether they can drive the A/B testing process.

Many companies have incorporated metrics questions into the PM interview, with Facebook (FB) being the most infamous. FB calls the metrics interview the "execution" interview. I find it mislabeled. To me, "execution" refers to one's ability to get things done. However, FB uses "execution" to refer to one's "executive decision making" skills.

Examples of Metrics Questions

Typically, interviewers ask metrics questions as a set of four consecutive questions:

Metrics Question Type	Examples

Identifying	You're the PM for ___. Which metrics would you track?
Prioritizing	What's the most important metric?
Diagnosing	___ metric went down X% week-over-week. Why?
Recommending	How would you fix the problem?

The last category of metrics questions revolves around evaluating A/B test data. For instance, the interviewer might say, "LinkedIn is testing a new feature. Here are the A/B test results. Review the data and recommend whether LinkedIn should launch or not launch the feature."

How to Approach Metrics Questions

Question Type: Identifying Metrics
Example: You're the PM for ___. Which metrics would you track?

With this question, interviewers will have metrics in mind. Miss those metrics, and they will judge your answer unfavorably. It's regrettable, but it's human nature.

To protect yourself, brainstorm as many metrics as you can. Even if you miss a few, interviewers will be impressed with your effort and quantity. For instance, if you come up with 20 metrics, interviewers will be more likely to forgive you for missing one or two.

It's easier to brainstorm if you've researched and memorized metrics in advance. To get you started, I've listed some popular metrics for ecommerce, mobile, and enterprise software later in this section.

If you haven't had a chance to research and memorize metrics in advance, the AARM Metrics™ framework can help facilitate brainstorming.

What Is the AARM Metrics™ Framework?

A cquisition

A ctivation

R etention

M onetization

Acquisition is all about signing up customers for a service. The bar for signing up for a service has gotten lower and lower, thanks to the popularity of free signup and pay later "freemium" models. The typical metric to track here is lazy registrations.

Activation is getting users who have completed a lazy registration to fully register. For a networking site like LinkedIn, this may include a user uploading a photo or completing their profile page.

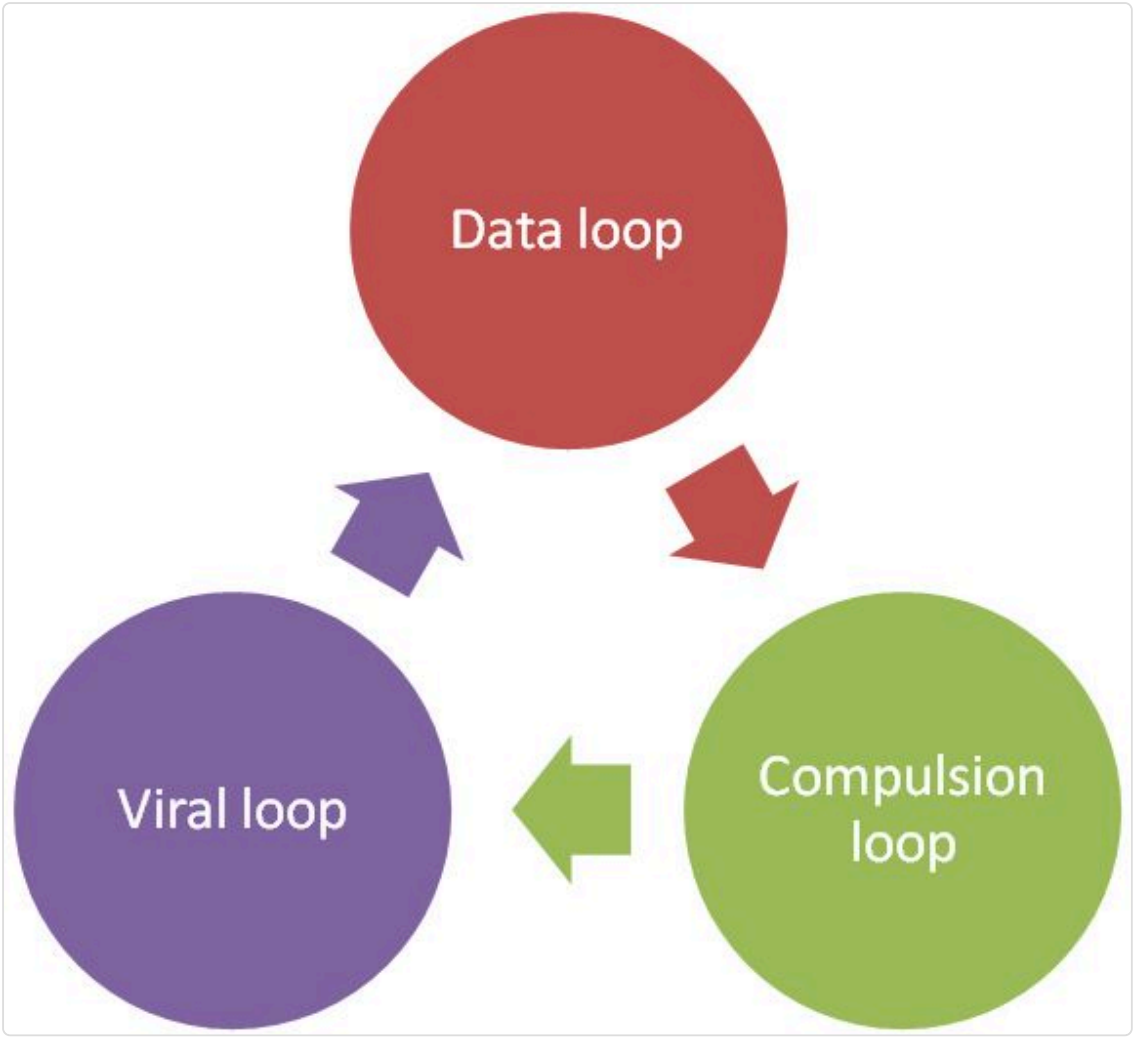
Retention is getting users to use the service often and behave in a way that helps the user or the business. Here, I use the term retention to include both user engagement and tactics to reduce customer churn. Examples include a user adding more information to their profile page, checking the newsfeed frequently, or inviting friends to try the service.

Monetization is collecting revenue from users. It could include the number of people who are paying for the service or the average revenue per user (ARPU).

Category	Incl. metrics related to…	Example
Acquisition	Signing up	# of app downloads
Activation	Completing the sign-up or onboarding process	# of people who complete the sign-up process

Retention	Engaging with the product and reducing churn	Daily active users, # of posts per user
Monetization	Generating revenue	Lifetime value (LTV), average revenue per user (ARPU)

What Is the Three Loops™ Framework?



The Three Loops™ framework is another tool I use to remind myself of key retention metrics:

1. The **data loop** is about adding more information. For instance, adding a photo or a list of favorite movies is contributing to a social network's data loop.

2. The **compulsion loop** is about checking an application frequently. For example, a video game might ask users to check in throughout the day to see how many new tokens they've earned.

3. The **viral loop** is about inviting friends to try the service. For example, LinkedIn encourages users to invite more connections. Adding connections makes LinkedIn more valuable to the users; it allows them to contact more people and see more profile information. And LinkedIn is thrilled that users serve as ambassadors for their service, reducing their customer acquisition costs.

The Three Loops™ framework also points out how each loop reinforces the others. As a single user adds more personal information to a service, it motivates their friends to check the service more often. When friends see new information, they find the service more valuable, which prompts them to invite more friends. And when those friends join the service, they add more data, beginning the cycle anew.

Common Metrics for Ecommerce Sites

Category	Example
Acquisition	Daily sessions
	Cost per acquisition (CPA)
	Cost per click (CPC)
	Cost per impression (CPM)
	Top search engine terms leading to the website
	Mailing list click-through rate
	Mailing list open rate
	Mailing list conversion rate
	Mobile app downloads

Activation	New registered users
	Mobile app opens
	Number of searches on website or app
	New cart started
	User information given (address, credit card, etc.)
	New customers with a successful purchase
Retention	Conversion rate
	Recommendation engine conversion rate
	Shopping cart abandonment
	Shopping cart size
	Visits from activated users per month
Monetization	Revenue per customer
	Lapsed customers
	Purchases per year
	Revenue per click
	Cost of sale (ad spend / revenue)
	Customer lifetime value (CLV)
	Cost of shipping
Other	Average listing position on the Google search results page for the most important keywords

	Cost of goods sold
	Shipping time
	Stockouts
	Returns
	Checkout errors
	Number of reviews left by customers
	Viral coefficient (number of users that each customer refers)
	Market share
	Customer engagement on social media
	Net or gross margin

Common Metrics for Mobile Applications

Category	**Example**
Acquisition	Number of mobile installs
	Cost per install
Activation	Number of accounts created, after mobile download

Retention	Daily and monthly active usage
	Time in-app
	Star rating
	Session length
	Percentage of users who rate the app
Monetization	Percentage who are paid users
	Lifetime value
	Average revenue per user
	Churn

Common Metrics for Enterprise Software

Category	**Example**
Acquisition	Leads
	Virality
Activation	New registered users
Retention	Daily active usage
	Time on-site
	Interval between logins
	Churn

Monetization	Conversions
	Deal size
	Renewal rate
	Monthly recurring revenue
	Revenue per user
	Revenue per lead
	LTV
Other	Uptime

Question Type: Prioritizing Metrics
Example: What's the most important metric?

With this question, interviewers are testing your judgment as you choose a single metric. It's easy to do the opposite: track dozens of metrics and lose focus. Interviewers also want to assess your ability to defend your opinion.

When approaching this question, identify a shortlist of two or three potential metrics you'd consider to be the "success" metric. Use a table to discuss the strengths and weaknesses of each and then make your final recommendation.

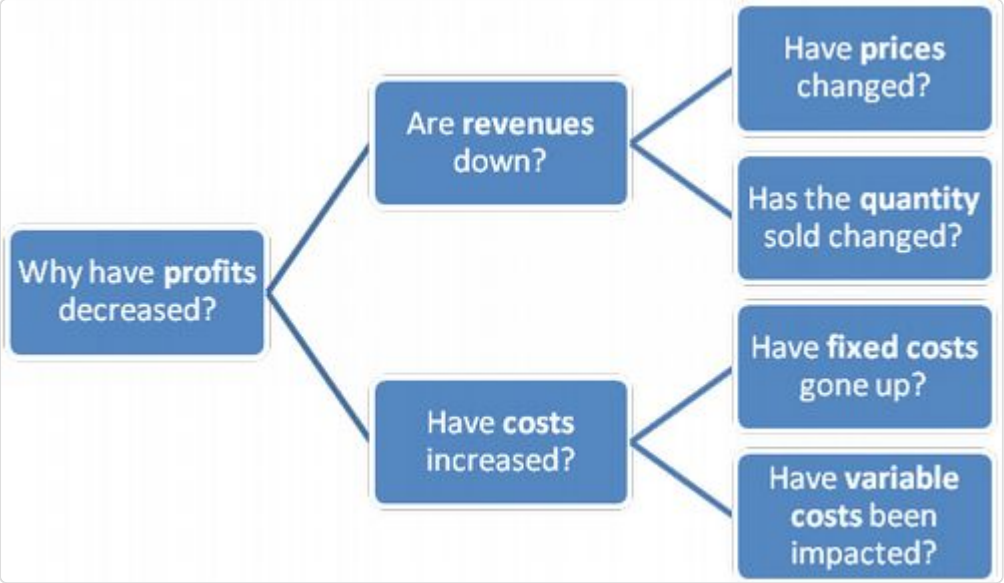
Question Type: Diagnosing a Metric
Example: ___ metric went down X% week-over-week. Why?

Interviewers are looking for proactive candidates who can tackle an ambiguous problem and determine the root cause by developing hypotheses.

Approach this question by drawing an issue tree first. Then systematically explore each issue. Finally, deduce the issue by the process of elimination.

Tip: Draw an issue tree

An issue tree is a graphical representation of issues that impact the main problem or question. The most recognizable issue tree is the profitability tree:



This issue tree answers the question: what issues affect a profit drop?

Using an issue tree makes one's answer more:

1. **Satisfying**. An issue tree, especially a detailed one, feels like a more complete and exhaustive diagnosis.
2. **Accurate**. An issue tree is a checklist. A checklist can save you from missing a critical issue.
3. **Logical**. The tree organizes sub-issues under a single branch, making your diagnosis logical and easy to follow.
4. **Archivable**. The interviewer can copy or photograph your issue tree diagram, which they can reference when writing interview notes.

Constructing a detailed, organized issue tree is not easy. Here are a few tips:

- **Don't agonize.** Organizing issues into a tree structure can be hard. If it helps, list issues into a bulleted list. Then organize those issues into a tree. If you're running out of time, skip the tree; a bulleted list is fine.

- **Reuse existing issue trees**. Save time by leveraging existing issue trees. You can find dozens of issue trees in *Interview Math* and *The Product Manager Interview*.

- **It's not a decision tree**. Your issue tree shouldn't have chance, decision, or end nodes; those belong on a decision tree. By getting issue and decision trees mixed up, you'll belie your experience.

Question Type: Recommending a Solution
Example: How would you fix the problem?

Once you've isolated the issue, most interviewers expect a solution. This is another opportunity for you to brainstorm.

Creativity and quality count. Propose three solutions, discuss the pros and cons of each, and then make a single recommendation without hedging.

Tip: Making Decisions Based on A/B Test Results

Ideally, we would run A/B test experiments for win-win situations. For example, it would be amazing if a new feature was found to increase revenue by five percent and seven-day logins by three percent. However, the real world often requires us to make win-lose trade-offs. For instance, a new feature increases revenue five percent, but 30-day logins decrease by three percent. What should a product manager do?

When faced with this dilemma, make the decision that's in line with the corporate strategic goal. Ask the interviewer, "What's the current objective?" For instance, if the boss is desperate to meet a quarterly profit goal, choose the feature that maximizes revenue at the expense of engagement.

Practice Questions

1. What metrics would you look at to evaluate LinkedIn's success?

2. What's the most important metric you'd track?

3. Let's say the metric you chose went down X% week-over-week. Diagnose what happened.

4. Now that you've diagnosed it, how would you fix the problem?

5. Review this A/B test result. What would you do?

6. Suggest a killer feature to improve LinkedIn. What metrics would you track to determine success?

Answers

What metrics would you look at to evaluate LinkedIn's success?

Activation

- New user registrations
- Mobile downloads

Retention and Engagement

- Users who complete signup
- Usage: 1-, 7-, and 30-day
- Time on-site
- Interval between logins
- Content posted (e.g., newsfeed updates and articles)
- Flagged content
- # of invites sent
- Private messages sent
- Average number of connections
- Lapsed users

Monetization

- Conversions from free to paid usage
- Average revenue per user
- Monthly recurring revenue
- Monthly subscription cancellations

- LTV
- CAC

Other

- Uptime
- Net promoter score

Key Takeaway

Use frameworks. Kickstart your brainstorming with AARM™ . It'll increase your chance of coming up with a complete and satisfying answer.

What's the most important metric you'd track?

INTERVIEWER: That's a long list of metrics. Of those metrics, which metric is the most important one to focus on?

CANDIDATE: Is the company focused on growth or revenue?

INTERVIEWER: What's your guess?

CANDIDATE: LinkedIn has been around for more than 10 years. I imagine the business goals and metrics have evolved over the years. In the early days, it made sense for the company to focus on user growth because of network effects. That is, LinkedIn is more useful when I have 200 contacts on the platform vs. two.

Later, LinkedIn needed to prove that it could monetize its sizable user base. Now, as part of Microsoft, revenue no longer appears to be the primary concern. Instead, Microsoft wants to make LinkedIn an indispensable part of your workday. It doesn't matter to Microsoft if you're accessing LinkedIn through the mobile app, Microsoft Office, or Microsoft's CRM suite. They want LinkedIn to be a central part of your office time.

INTERVIEWER: Your intuition is correct. Continue.

CANDIDATE: So, to recap, we're going to set aside user growth and revenue in favor of engagement. Three engagement metrics come to mind:

- Usage: 1-, 7-, and 30-day

- Time on-site
- Interval between logins

There are pros and cons to each, so let me run through them quickly.

The candidate writes the following on the whiteboard:

Metric	Pros	Cons
Usage: 1-, 7-, and 30-day	Would measure engagement frequency Would infer need (craving) for service	Wouldn't measure engagement quality
Time on-site	Would infer quality of engagement	Wouldn't measure engagement frequency Could be imperfect
Interval between logins	Would measure engagement frequency Would infer need for service	Wouldn't measure engagement quality

CANDIDATE: Of these options, I'd recommend time on-site. It speaks specifically to the quality of engagement whereas the other two do not.

INTERVIEWER: I agree that quality matters more than quantity. I noticed that you mentioned that time on-site could be an imperfect metric. Can you tell me more about that?

CANDIDATE: Time on-site is an approximation. Most analytics applications derive time on-site by taking the difference between the last and first pages visited during a

session. As you can imagine, there are many loopholes with this calculation. For example, what is the time spent for a user who visits one page and leaves?

Another imperfection is user behavior. Let's say a user opens the first page, leaves for the night, and triggers a page view the next day? Analytics software shouldn't include time away from the computer.

INTERVIEWER: How can we mitigate those flaws?

CANDIDATE: We could improve the metric's accuracy by having the application monitor events on a page. For example:

- Monitor whether a user scrolled or clicked a button.
- Show a popup that asks, "Are you still there?"

INTERVIEWER: That makes sense. Thank you.

Key Takeaway

Minimize your risk. While the interviewer specifically asked for one metric, you run the risk of choosing the one she wasn't looking for. Protect yourself by starting with a shortlist of three metrics and then narrowing it down to one.

Let's say the metric you chose went down X% week-over-week. Diagnose what happened.

INTERVIEWER: Let's say LinkedIn's time on-site decreased seven percent week-over-week. Diagnose what happened.

CANDIDATE: Is the decrease related to location, operating system, or browser?

INTERVIEWER: No.

CANDIDATE: Any differences from a demographic perspective?

INTERVIEWER: Location, demographics, and technology platform are good points, but let's set those aside. I'd like you to focus on user behaviors.

CANDIDATE: Got it. As a user, I imagine the three most popular LinkedIn behaviors are viewing profiles, reading the newsfeed, and searching for people.

INTERVIEWER: People searches do happen quite frequently for our recruiter persona. But for non-recruiters, people searches don't happen as often as everyone thinks. So, why don't we focus on viewing profiles and reading the newsfeed?

CANDIDATE: Okay, let me sketch out an issue tree. I'll use it to explain why profile and newsfeed viewing can affect our time spent on-site.

INTERVIEWER: Sounds good.

The candidate draws the following issue tree on the whiteboard:

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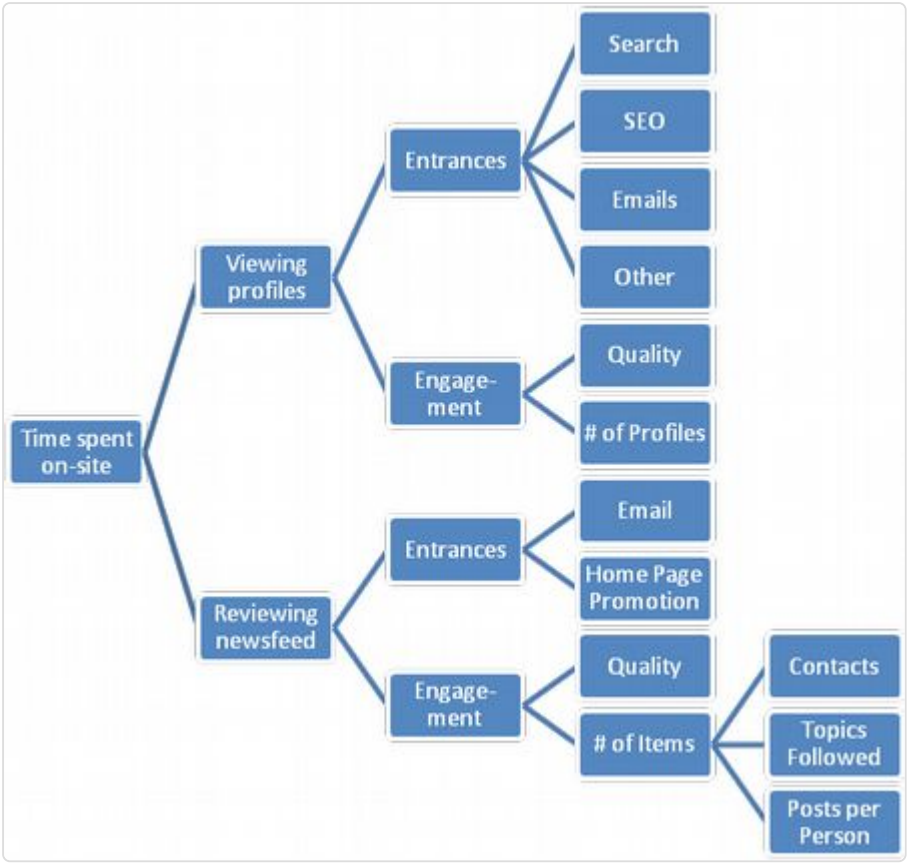


INTERVIEWER: Walk me through the "viewing profiles" branch.

CANDIDATE: Both entrances and engagement can affect time spent on-site. When it comes to entrances, people may arrive at a profile page through a search within the LinkedIn site or via Google, which we call SEO. Users may also view profiles by clicking on names listed in a newsfeed.

INTERVIEWER: How about the engagement branch?

CANDIDATE: Naturally, a user can't view a profile if it doesn't exist.

INTERVIEWER: So why would that decrease time on-site?

CANDIDATE: Let's say LinkedIn conducted a cleanup campaign to delete fake profiles. If millions of fake profiles suddenly disappeared from the site, users would naturally spend less time on-site.

INTERVIEWER: Got it. Let's say the internal analytics team has helped narrow down your hypotheses. They've determined that time spent on-site viewing profiles has decreased via the SEO channel. Why do you think this is?

CANDIDATE: Are we seeing any differences in in-bound SEO traffic? Volume differences? Mix shifts like differences in audience or referrer quality such as Google vs. Bing?

INTERVIEWER: Good hypotheses, but let's say there aren't any third-party changes.

CANDIDATE: Have we done something differently on our side? Perhaps changed the UX for visitors coming in through SEO channels?

INTERVIEWER: Yes.

CANDIDATE: Can you tell me more?

INTERVIEWER: We've instituted a tighter login wall. All users must log in to view any profile.

CANDIDATE: Ah, that must be the reason for the decrease in time on-site.

INTERVIEWER: You got it.

Key Takeaway

Draw an issue tree. Not only is it an attractive visual, but it also offers an organized checklist for you to pinpoint the problem.

Now that you've diagnosed it, how would you fix the problem?

INTERVIEWER: So how would you fix it?

CANDIDATE: I've got a couple of ideas in mind. Before I go through them, I want to ask a clarifying question: what was the reasoning behind the login wall in the first place?

INTERVIEWER: Originally, we implemented a login wall because we wanted to drive new user signups. However, user growth is not the primary focus these days. We're more concerned with third parties trying to scrape our content.

CANDIDATE: Got it. Give me a moment to brainstorm a couple of solutions.

The candidate writes the following on the whiteboard:

Solution	Pros	Cons
Remove login wall	Would increase time spent on-site	Would make site susceptible to scrapers
Implement a simpler login wall	Would decrease impact on time-spent metric	May not be enough to deter scrapers
Implement a CAPTCHA wall	Would decrease impact on time-spent metric Would be a more effective deterrent against scrapers	Could frustrate visitors
Implement an IP address-based login wall	Would increase time spent on-site Wouldn't frustrate users Would be a more effective deterrent against scrapers	Loopholes may occur

Utilize digital fingerprinting	Would increase time spent on-site Would be a more effective deterrent against scrapers Wouldn't frustrate users	Could increase error rate

INTERVIEWER: That's a good list. Can you tell me more about the last two?

CANDIDATE: Third-party scrapers use a finite set of servers to scrape sites. For example, they might spin up an AWS server to do the scraping. These servers rotate among a set of IP addresses. We could create a blacklist of IP addresses that have abnormal user activity. We could also whitelist IP addresses with normal activity.

INTERVIEWER: That makes sense. How about the last idea?

CANDIDATE: Digital fingerprinting is a way to uniquely identify web visitors. Any website can poll a user's system configuration including screen size and installed fonts. Based on that information, websites can uniquely identify a user with 95%+ accuracy.

INTERVIEWER: So which idea would you recommend?

CANDIDATE: Of these ideas, I like digital fingerprinting the most. It would revive our time on-site metric and work unobtrusively in the background. It would also ward off the web scrapers. The privacy implications would be a bit creepy; however, I wouldn't expect any PR issues because most online users understand that complete anonymity on the Internet is not 100% possible.

Key Takeaway

Clarify the goal. By understanding the intent of the login wall (driving signups vs. deterring web scrapers), the candidate could focus his brainstorming activity around solutions for the latter.

Review this A/B test result. What would you do?

INTERVIEWER: LinkedIn is testing a new feature: asking a new user to upload their profile photo during the sign-up phase. Currently, a new user is asked to upload a

profile photo after the sign-up process.

The experimentation team ran a two-week A/B test for the new feature. Review the data. Make a recommendation on whether we should launch the feature or not.

	Lift	P-Value
Number of users completing signup	-13.21 percent	0.02
Profile completeness	+1.65 percent	0.01
Number of users who posted	+2.11 percent	0.05
Number of posts	+4.85 percent	0.01
Number of invites sent	+2.36 percent	0.02
1-day retention	+2.12 percent	0.07
7-day retention	+1.08 percent	0.20
30-day retention	N/A	N/A

CANDIDATE: On one hand, engagement has gone up significantly. Increases in the following metrics are remarkable:

- Number of users who posted
- Number of posts
- Number of invites

The slight increase in profile completeness is a good sign too.

On the other hand, there's a double-digit drop in the number of users completing signup.

INTERVIEWER: Okay, so would you launch this feature or not?

CANDIDATE: It depends on the company's goal. Is it more important to get more users? Or is it more important to get engaged users?

At this stage, I feel it would be more important to get engaged users.

INTERVIEWER: So that's your final answer? Launch the feature?

CANDIDATE: Instead of launch vs. no-launch, I'd like to explore two additional options:

- **Run the test for a longer duration**. We might see more statistically significant data for 7- and 30-day retention.
- **Try a different design**. It could very well be that the strategy is correct, but the implementation could be improved.

INTERVIEWER: Sounds like a good plan. One last question: why did we show the p-value column?

CANDIDATE: P-value is a measure of whether the results are statistically valid. That is, with a sufficient p-value, we know that the results can't be explained by something other than the feature changed specified in the A/B test. Typically, I am comfortable accepting data with a p-value of less than .05.

Key Takeaways

Be comfortable with win-loss features. Not every feature is a win-win. Features often have trade-offs. Good PMs can rationalize the path forward even when it isn't clear to others.

Don't settle for the options presented. The interviewer presented only two options: launch or not. In this case, there are additional options including trying a different design or running the A/B test experiment for a longer period.

Decisions depend on the context. Once again, the goal matters. A decision that might make sense for one goal (e.g., user growth) might not make sense for another (e.g., engagement).

Suggest a killer feature to improve LinkedIn. What metrics would you track to determine success?

CANDIDATE: There are a lot of different reasons people use LinkedIn. Professionals look for jobs and career development opportunities. Recruiters look for new candidates. Salespeople look for new contacts.

For me, the persona that resonates most is the professional. I'm always searching for conferences and courses focused on professional development. That's the scenario I'd like to explore.

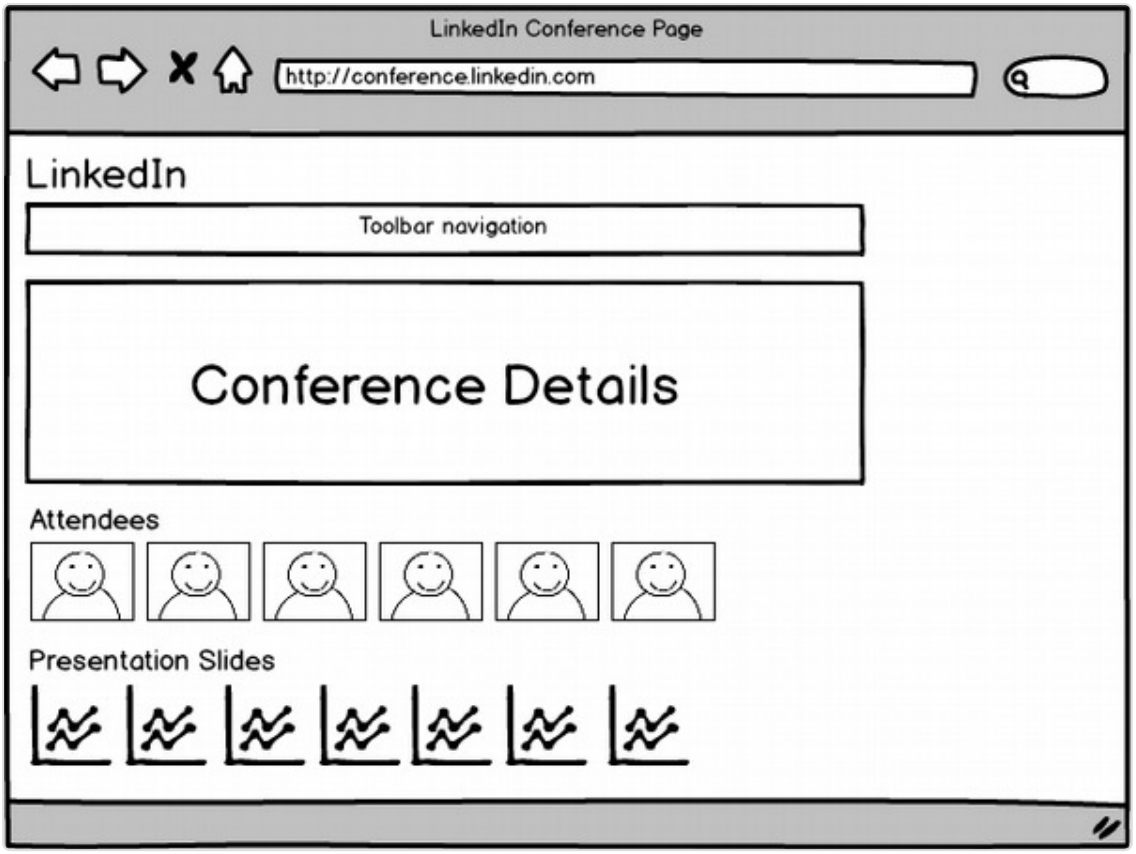
INTERVIEWER: Go ahead.

CANDIDATE: When I think about the conference scenario, I think of three use cases:

1. As a potential conference attendee, I want to find new conferences that I can attend.

2. As a conference attendee, I'd like to see who else is attending the conference so that I can keep a list of people to network before, during, and after.

3. As a conference attendee, I'd like to access conference materials easily.



So, here's my solution: a conference page hosted on LinkedIn. It would have conference details, such as event name, date, location, cost, and links to the conference agenda.

Right below it would be registered attendees. Users could click to contact them via LinkedIn's messaging system. And below that would be links to pre- and post-conference slide material.

LinkedIn's revenue opportunities with this new conference page could include:

- Conference organizers pay monthly subscription fees
- Get revenue share on all conference fees
- Collect a small transaction fee on all registrations

INTERVIEWER: Interesting. Let's talk about getting conference details data. How would you do it?

CANDIDATE: Three ideas come to mind:

1. Conference organizers could post details manually.
2. LinkedIn could build a crawler to index the web and parse conference data.
3. LinkedIn could define a conference data format and have conference organizers upload the data to LinkedIn, either in a text file or a server-to-server API call.

INTERVIEWER: How would you determine if this new feature was successful?

CANDIDATE: There are a couple of metrics I would consider:

- **Acquisition.** How many conference organizers signed up for the service? This measure would tell us whether the feature was compelling and worth spending time on.
- **Engagement.** Of the conference organizers who signed up, how many conference pages did they create? How often? And for the conference attendees, how often did they visit the site? What kind of positive behaviors did they undertake, whether it was contacting or connecting with other conference attendees or downloading presentation materials? We would want the feature to add value to both organizers and attendees.
- **Monetization.** Last, how much money was LinkedIn making? They wouldn't want to waste time working on something that was not contributing either short- or long-term revenue potential.

Key Takeaways

Mix and match frameworks. This question is a combination of product design and metrics. The sample answer combines the CIRCLES™ and AARM™ frameworks seamlessly.