How companies find and evaluate graduate computer programmers

Kjetil Raaen and Per Lauvås jr
Westerdals – Oslo School of Art, Communication and Technology
Institute of Technology

Abstract

How do companies of today hire computer programmers? Within existing research we find that social media now plays an important part when companies are searching for and evaluating talent. We also find multiple studies who describe technical evaluation tools that may be necessary in a screening process when many candidates are fighting for the same position.

Through semi-structured interviews with 10 companies, we find that these companies use multiple channels when they search for candidates. We propose a model with four steps to explain the recruitment process: *Discovery, Contact, Screening* and *Selection*. Online and physical presence is important for our companies fighting for the attention of talented students. They arrange hackathons and competitions to get to observe candidates, and not just their programming skills. They will attend different student events within university campus, and they will give guest lectures.

The ideal situation for a company is when a talented student seeks out the company out of her own interest. The candidate is especially interesting if she may document her knowledge and skill-set through an online presence. If so, a candidate's code will be a natural topic within an interview. The interview is still an important part of the recruitment process. To place a job advertisement is still common, but it creates a lot of overhead. We find that the companies are reluctant to place themselves in a situation where screening tools become necessary.

1 Introduction

At Westerdals Oslo ACT we educate programmers. Thus, we are specifically interested in how *recently graduated* computer programmers are found and evaluated. The traditional hiring process may be perceived as quite rigid. It starts with a company placing a job advertisement in some media where they hope competent candidates might see it. In response people who want the job submit a resume and a cover letter, in addition to diplomas and transcripts. There is copious anecdotal evidence that this is no longer how it works, if it ever was. In this paper,

This paper was presented at the NIK-2018 conference; see http://www.nik.no/.

we work towards a more thorough understanding of the process where potential employees and employers come together. Our focus is on recently graduated computer programmers (hereafter, *programmers*), but we believe our results could be relevant within a wider scope.

This paper asks the two often overlapping questions: *How do companies search for and find recently graduated programmers?* And further, *how do they evaluate the candidates?*

Beyond the academic interest, we hope this work will help educators guide their students towards the fora and venues where they might find employers. Further, it should be possible to tweak educational programmes so that students naturally produce the material employers look for when selecting their employees. While education should be based on updated research, a clear understanding of how graduates succeed in their careers improves the relevance and quality of the studies.

2 Background

While hiring practices of graduates are not thoroughly studied in the context of the IT industry, the concept in general is well understood. A British study [12] is the most comprehensive we have found. Among its myriad findings some are very relevant in our context. For finding candidates among graduates, UK companies use specialist media, professional bodies as well as online job-boards. Most companies also work with universities, intending to meet potential future employees face-to-face. Further, the traditional method of recruiting through word of mouth and informal networks is still common. Some use recruitment agencies, though there is some scepticism around this approach.

The same report also writes about the selection process, splitting it in three main parts. First, applications are screened based on relatively simple criteria. This step is based on submitted written documentation, mainly CV and cover letter. Employers look for motivations for the job, and how candidates think they will fit in the role. Secondly, there is an intermediate selection stage, gathering more information from the candidates. This can take the form of a remote test, or a telephone interview. Thirdly, the final selection usually involve a face-to-face interview session.

For the IT industry specifically, studies focus on certain tools, mostly online. This reviewed literature can be split in two general categories: *Social media* and *Evaluation tools*.

Social media

A study from Sri Lanka [1] shows that online means of both finding and evaluating candidates are popular. Almost all the studied companies use job-listing websites, and most also use their own company website for attracting applicants. More than half also use various social networking sites. For more active search, *LinkedIn* is by far the most popular tool. An international study dives deeper into the details of the use of social media in hiring [3], which has become an important channel for both finding and evaluating candidates. Social media has crystallised into three major classes, all of them of some relevance to those recruiting.

First, we have informal platforms, sites such as *Facebook* and *Instagram*, where people share experiences from their lives. When hiring, these are used to investigate candidates' background and interests. However, there are some caveats to this.

Distracting though irrelevant information might influence employers by giving a biased impression of a candidate. Seeing a candidate in unprofessional settings could bias a recruiter.

Second, we have professional social networking sites such as *LinkedIn*. These sites are designed for facilitating meetings between employers and employees. In addition to providing the same data as a resume, they also provide information from an individual's network. Previous coworkers and managers, but also friends, can express their views on the skills and abilities of a candidate. This information is easily available, but often considered superficial. Participants can also remove anything they perceive as negative.

Third, some social platforms are specifically designed for programmers to cooperate and share. *GitHub* and *StackOverflow* are the two best known examples of this concept. On these sites, potential employers can potentially watch candidates' work on actual projects utilising the same abilities they need for a job. Marlow and Dabbish [10] interviewed both GitHub community members and employers to investigate how profiles on the site are maintained and assessed. Maintaining a presence on such sites requires significant effort. Thus, candidates who are active on these sites are very likely highly motivated. As Marlow and Dabbish describe it:

> GitHub signaled personal characteristics of the employee such as being a team player, showing commitment to their work, or demonstrating how he/she spent their free time.

Conversely, relatively few people are able to maintain such activity, thus this pool of candidates is narrow.

Recruitment tools

Recent advances in technology have made it possible to evaluate candidates easier than it was before. Some of these tools may be used in the screening process. With screening process, we mean an initial filtering of candidates when there are a lot of applicants for a position. The screening process reduces the number of candidates for the job at an early stage and thus reduces the total costs of finding the right person for the job.

Guillaume et al. [5] argue that finding the right candidate for the job may be a matter of calculation, considering the matching of candidate to position a computational optimisation problem. When we try to automate, or at least technically facilitate, the matching of a candidate with a job description, categorisations will play an important part. Malherbe et al. [9] describes this field as E-recruitement:

> E-recruitment can be defined as the process of matching people to appropriate jobs using different on- and off-line strategies and technologies.

They further emphasise the importance of job categorisation. They recommend using a dynamic bottom-up categorisation approach within a market that is changing rapidly. They argue that the use of a top-down static approach is still common, but will yield less desirable results.

We also find a company where the foundation is academic. Bergersen started Technebies as a continuation of his PhD. In his doctoral dissertation [2] he describes

Letter	Size	Business	Programmer ratio	Participants
A	Large	IT Consulting	High	1
B	Medium	Digital agency	Medium	2
C	Large	FinTech	Medium	1
D	Small	Software development	High	3
E	Small	Media agency	Low	1
F	Micro	Design software	High	2
G	Large	IT Consulting	High	5
I	Medium	User experience	High	1
J	Small	Digital agency	Medium	1

Table 1: Overview of the companies.

an instrument that measures programming skills. Given enough time (less than a day) the instrument can provide an evaluation of the programming skills of the candidate after a series of programming assignments.

Within the field of IT, certifications are quite common as a way of documenting competence in a specific field of interest. Certifications may be used as a screening tool both formally and informally [6]. When there is no formal requirement for a specific certification, a candidate may still be ranked higher in the initial screening if the certification is in place.

3 Method

Because our research question was fairly broad, and we did not expect clear-cut answers, we decided to follow a qualitative approach. We wanted first hand accounts from people in the industry and did not have a clear idea of what we would find, we chose to do a survey based on semi-structured interviews [11, Chapter 13]. This paper uses data from the same interviews used for our previous paper [8].

Recruiting participants

To find participants, we attended a career fair at *Westerdals — Oslo ACT* on the 17th of January 2017 and asked the participants if they were interested in hiring programmers and talk to us about it. Among those who were interested in this proposal, we scheduled interviews with 10 different companies during the rest of January and February 2017. Only one of these 10 companies did not attend the career fair. This specific company was recruited when they approached Westerdals regarding hiring of students a few days after the career fair.

The companies

To give an indication of size, we use the EU definition of *Micro, Small and Medium Sized Enterprises (SME)* [4, Article 2]. We use the staff head count only and do not include the *financial ceiling* part of their definition. The definition uses 3 categories: *Micro*, from 0 to 9 employees, *small* from 10 to 49, *medium* from 50 to 249. In our study, we label companies with more than 249 employees *large*. We also find it reasonable to say something about the current level of competency regarding computer programming. Some of the companies have a large proportion of programmers in their workforce. A few of the companies have recently started to

see the value of recruiting programmers. We call this category *Programmer ratio*, as in the ratio of programmers already in the company, and we label the levels *low*, *medium* and *high*. Note that this categorisation is somewhat subjective. The name of the business these companies belong to is based on their own description. *Participants* refer to the number of participants in the interview (in addition to the interviewers). The companies are summarised in table 1. We decided to exclude company H after the interview because they revealed that they themselves did not hire programmers. They did facilitate hiring candidates for multiple start-ups, but we considered this second-hand information and omitted the interview from the data material.

Conducting the interviews

When we arranged the interviews, we asked to talk to those who hired programmers. The companies interpreted this differently, and sent from one to five people to the interviews. After we arrived in a meeting room provided by the informants, we introduced the purpose of the interview and asked that one participant in each interview signed a consent form on behalf of the company. The form explained that we would keep companies and people involved anonymous. It further described the purpose of the research project and how data from the interview would be stored and later deleted. Then we started an audio recording of the interview. Because the interviews were semi-structured we had only planned a few questions in advance. All interviews started with the question

> When you are hiring, what do you look for in a recently graduated computer programmer?

After getting a satisfactory answer to the question, we experienced in our first couple of interviews that the talk naturally drifted towards the recruitment process.

> How are you searching for and evaluating potential employees?

We therefore decided to include the question as a follow-up question in subsequent interviews. The focus was the *recent graduates* in computer programming, as these are the people we as educators are releasing to the industry. The average length of an interview was 33 minutes, with a range from 24-52 minutes. After the interviews we transcribed the conversation and sent transcripts to the informants for verification and comments.

Analysing the data

When we analysed the data, we employed an inductive approach to identify themes in the data [11, Chapter 18]. When we were satisfied we had identified the most relevant themes, we sorted all text in segments according to each theme. This allowed us to see how prevalent each theme was, as well as getting a more clear idea about what the dataset as a whole implied about each theme. We discovered that the recruitment process could and should be separated from the initial research topic regarding what the companies were looking for in a candidate. Thus, we split the data in two, and this paper presents the results regarding the recruitment process.

Limitations

While this method allowed us to answer an open-ended question, it does have some limitations. First of all, the number of companies interviewed is limited. It allowed identifying major themes and important topics, but might not catch all details. Also, because we did not ask detailed questions, a topic not mentioned by the interviewee cannot be excluded as irrelevant, we can only conclude that it was not mentioned. Because we did not focus fully on the hiring process itself, we did not ask explicitly whether the companies are satisfied with their hiring process. Thus, it is possible that some of the tools are used more because of habit than because they work. Furthermore, all companies were selected from the same pool - companies attending a career fair at our own campus. They represent a good cross-section of those who hire from our institution, but we may have missed some potential types of employers by this approach. Lastly, the qualitative approach in general makes it hard to weigh the importance of each theme we identify.

4 Findings

Our method provided much and varied information. We found that there is a natural distinction between the search for a candidate and the later filtering and selection process.

Searching for candidates

We found that companies employ quite different strategies when searching for new employees. However, some strategies were prevalent. The most consistent was that all companies combined multiple channels for recruiting. It seems none want to risk relying on a single point of contact between the company and employees.

For some companies, the ideal situation is that future employees find them. These hope that their brand and presence in different media will entice people to actively contact the company asking if they can work there. One said simply:

> *Company B:* We want those who want to work here. We hold back and hope people get the point.

This implies that they would rather not actively look for candidates, and rely on their name to attract candidates.

Another popular approach is organising or participating in events targeted at enthusiastic programmers. *Hackathon* is an event where programmers meet up, usually for a weekend, and try to get as far as possible in the project within the allotted time. Usually there is also a competitive aspect, with winners declared at the end. Alternatively, employers might host less organised competitions, where a topic is posted at the start, prizes are offered. One company explicitly stated:

> *Company C:* In the future, we will organise more hackathons to identify the most promising candidates. Such competitive recruiting gives very interesting candidates.

During these events, our informants know that they will meet the most dedicated candidates, and they may at the same time get an understanding of a broad set of qualities, and not only the technical skills.

Some also mention that they look for recruits at industry conferences such as Web Rebels[1]. It is unclear to us how common it is for students to participate in such events, but those hiring assume candidates they find there will be passionate. And passion is something they are looking for specifically [8]. Similarly, our informants all participate in college job fairs. This finding is biased because almost all our informants were recruited to this study through just such an event. What we can say, however, is that most of them found this channel quite effective.

One company participating in this study actively looked through online programming cooperation networks such as GitHub and StackOverflow. While very few recently graduated programmers in a given town are prominent on such networks, those few would probably be very valuable to a company. Another targeted approach is going through networks, either maintained on a corporate level, or the private networks of existing employees. Some maintain contacts in academia which they ask to recommend students. One participant said.

> *Company A:* We have a good network at [two Norwegian universities] which we use to find out who we should contact. These tips usually work out very well.

This company did however not give a detailed explanation about how these tips work. Another way of working directly with academia involves holding guest lectures. Usually a welcome break from the regular lecturers for the students, such lectures give them a different perspective on a topic. The company giving the guest lecture usually does not get paid, but gets a unique opportunity to talk directly to students, and introduce the company. Many companies find it important to be visible to students as the students will head into the industry within a limited space of time.

Finally, we have traditional job ads, though presented online. Most of our informants use this approach to some degree. Of these, ads on their own company webpage seem to be preferred. If a candidate finds one of those ads, it is safe to assume that they are at least somewhat curious about the company in question. Our participants generally agree that ads in large public job databases such as finn.no generate too much noise.

> *Company I:* We have tried Finn.no, but we get too many applicants. We would rather have a more clear target.

That is, they get too many applications from people they have no interest in. Thus, these ads generate more work for a lower quality result. Some also use ads in social media, primarily Facebook. This gives somewhat better targeting, but still casts a wide net.

To find good candidates among inexperienced programmers, none of our participants mentioned using traditional ads in print media. Even more modern online ads are in general considered inefficient. Our participants prefer more focused approaches of being visible to and interesting for a narrow group of candidates

Evaluating candidates

When discussing with our participants how they evaluate their candidates, responses can roughly be grouped into traditional and more innovative approaches. While

[1] https://webrebels.org/

many respondents want to emphasise the more innovative aspects of their hiring process, it seems clear that all also use traditional techniques.

Most of the companies participating still expect a resume, cover letter as well as diplomas and transcripts from candidates before considering them. This holds true even if the candidate has been asked to apply, or the company has some prior knowledge of the candidate. Despite this requirement, it seems the companies generally look at these documents superficially. Of these, the cover letter is most important. One informant explains:

> *Company G:* Simply showing that you have taken the time to actually write a cover letter targeted at the company you are applying for (...) is something I think is a must for anyone who is looking for a job.

We also see participants using the cover letter to get a first impression of the personality of the candidate.

The other traditional tool used while recruiting is the job interview. While some participants are reluctant to use the word *interview*, and might want to call it a *meeting* or even *chat*, they all seem to do something very similar. They bring candidates to the workplace where they meet representatives of the employer. Larger companies have both technical and administrative, usually HR, personnel in these conversations. Smaller companies might let the same person fill both roles. We know that many personality traits are important when selecting an employee [8], and these meetings let employees get to know the candidate. Thus, none of our participants seem to have a formal protocol or instructions for conducting the interview. We also noticed a difference in how interviewers viewed their interviewees. HR representatives seem more likely to look at appearance, such as clothing and politeness, while the technical people looked for enthusiasm and curiosity. Some also split the interview in two parts, one where various people from the company meet the candidate, and one more in-depth technical interview. In addition to the somewhat formalised interviews, some employers also bring candidate to social settings. This allows them to evaluate how well the candidate fits into the culture and social community at the work place.

In addition to these traditional methods for evaluating candidates, online tools are also important. All our participants look for the online presence of a candidate. Looking at general social media profiles can give an impression of personality traits and interests. If an applicant has profiles at more specialised social media, such as GitHub and StackOverflow these can give an impression of technical skills as well as ability to cooperate within their field. Blogs may cover both these aspects. Further, some companies ask applicants to deliver portfolios of projects to show what they can do, as well as how they work.

One company use a home assignment in the evaluation process. The task is open ended so that the candidate can solve the assignments in multiple ways as they prefer. The main purpose of these tests is to be a conversation starter at the technical interview, and thus the quality of the work is not the most important criterion.

Some techniques double as both tools to find candidates and evaluating them. Hackathon and competitions, as mentioned in the previous section serve this double purpose. They attract relevant candidates, mostly students, while at the same time giving the companies a relatively long and intense period to evaluate the

candidates. Another such long-term technique is internship. Companies offer short-term positions to multiple inexperienced candidates, and pick the ones that work best in the position for long-term employment.

In general, the modern process of hiring programmers seems quite traditional, with applications followed by interviews and potential internships for inexperienced candidates. There is some innovation, but this is generally on top of traditional practice.

5 Discussion

In general, our findings match what previous work has found [1, 12]. It is clear that our participants from the IT industry in Norway recruit in much the same way as other industries in other countries. We find some idiosyncrasies though. Some are effects of the high demand and low supply in the market. Our participants in general did not have to deal with huge stacks of applications, and could thus mostly skip the early, crude steps of the screening process. Further, none of our participants used automated tools at any point in the process. In contrast to some previous findings [6], none of our informants said anything about certifications. In addition, while there is some doubt about our own finding that career fairs at educational institutions are a popular venue for recruiting because we recruited our participants at such an event, we find support for this in other work [12].

Social Media

Our findings generally support results of previous work described in section 2 [1, 3, 10], at least when it comes to social media. Social media is important both for finding and evaluating candidates. The most important type of social media is networks for professional cooperation, specifically GitHub and StackOverflow. Employers of programmers consider presence on these sites a sort of portfolio for the programmer. Thus, the focus on such sites might reflect a broader trend towards portfolios in hiring. However, none of the work we identified looked at how these social media tools fit in the context of the full hiring process. We found that rather than replacing any part of the process, online tools complement and extend the traditional approach. A recruiter might find candidates on LinkedIn, and then ask them to submit a resume. Later, interviewers might bring up a candidate's GitHub account and discuss their public projects. In general, the traditional concepts of personal acquaintances, cover letter, resume, and interview are still what give young programmers their first job.

Recruitment tools

Recruitment tools, such as tools to optimise the matching process [5] or to measure programming skills [2], were not described directly by our informants. This does not necessarily mean that they are not in use. We did not explicitly ask if the companies did use them, but they were completely absent in our interviews. We saw that home assignments could be relevant as a starting point for a conversation in an interview. However, we did not hear any descriptions of on-the-spot tests with or without a specific recruitment tool. One informant actually argued that it is quite easy to evaluate if a candidate can write good program code through a technical interview. Especially if the candidate has an online presence that includes code. If so, the

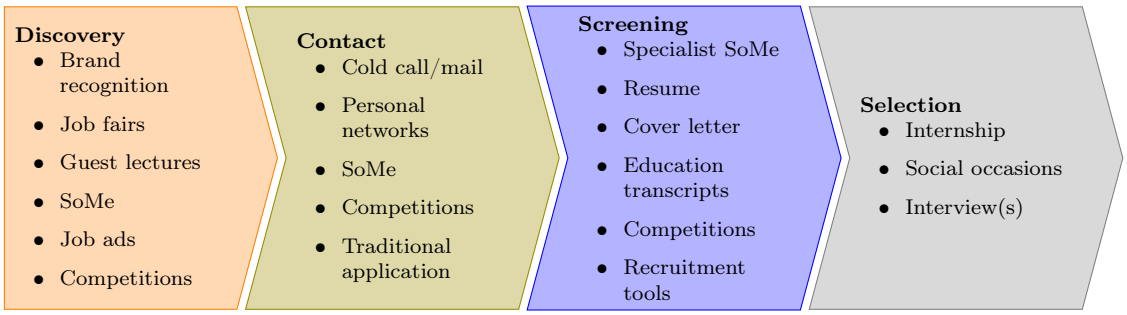

Figure 1: The process of hiring in four major steps.

candidate may explain the purpose of the written code and the thought processes behind it. That will provide a deeper understanding of the qualifications of the candidate than a stressful test.

The lack of stories of recruitment tools in our interview may partly be explained by the current state of the market for programming candidates. Especially when it comes to screening tools. It could be that companies do not have a large number of applicants for a position, so screening is less interesting. IKT-Norge (ICT Norway) reported [7] a critical lack of ICT competance within the Norwegian work force. The universities are not able to release enough candidates to the industry. Computer programmers and system developers were mentioned specifically in the report.

It is interesting to see how companies deliberately try to avoid to come in a situation where screening tools are necessary. To the best of our knowledge, this has not been described in relevant studies. Our companies are reluctant to post job advertisements where anyone may apply. That will create unwanted attention from candidates who are not interesting. The employers will rather try to create a good reputation by meeting future candidates through visits to campuses and by arranging hackathons and competitions. If they succeed, they will *attract* interesting candidates through other channels than open advertisements.

Model for hiring process

Figure 1 summarises the main findings of this work, as well some information from previous work. Splitting the process in four major steps, we see certain tools and strategies used in each of them. The steps we identified are first *discovery*, which describes how candidates discover the company. Further, *contact* denotes the initial communication between candidate and employer. *Screening* is the process of selecting a small number of candidates for further consideration, and *selection* is the final phase before hiring. This last step is frequently repeated until the needed number of candidates are left.

6 Conclusion

After interviewing ten different companies hiring recently graduated programmers, some things are clear. Our companies want enthusiastic and adaptable employees with great interpersonal skills, and recruiting practices are designed to identify such candidates. This overall goal is what makes company visibility both online and offline so important. It fuels the often optimistic idea that the ideal employees find the company without even seeing a job ad. Further, it pushes focus towards meeting

and talking to candidates, and relying on hunches and *personal chemistry*.

None of our participants have a formalised process for hiring, nor are the results in any way transparent. This is understandable, given the subjective qualities they are looking for, but it does increase the risk of bias. Further, with no transparency it is impossible for others to find out why a certain individual was hired.

One participant mentioned tips from educators as their main source of graduate candidates. It is not clear exactly how this process works. To the authors, it seems unclear how this process can be compatible with university employees' ethical standards.

Implications for graduates

Among the motivations for this work was finding out how best to prepare students for getting jobs as programmers. Based on our results, we can infer some good strategies for graduates who want to get an interesting job.

- Establish and maintain an online presence, preferably being active in open source development or blogs.
- Be proactive, research potential employers online and contact them directly.
- Participate in job fairs, competitions and hackathons. And remember: you will not only be evaluated on your technical skills.
- Use your network, ask friends and acquaintances if they can recommend you for a job.
- Follow more traditional tips such as writing a good resume and cover letter, and obtain good academic results.

It is important to note that many of these findings are somewhat hypothetical, and based on an ideal situation of having a wide variety of candidates to consider. In practice, it is currently often difficult to find even one qualified candidate for a programming job.

Future work

In the future, we would like to address some of the limitations of this work. The themes and categories identified in the interviews map well to a questionnaire rating these qualities in terms of importance. By inviting a larger number of companies to answer, we may generate quantitative data and identify which qualities are most important. This will also allow us to include a broader selection of companies. Another approach to similar questions is looking at what employers *say* they are looking for in job ads.

Furthermore, we would like to follow up with a similar approach targeted at a different pool of companies. We could for example ask the same questions of high tech manufacturing companies or public institutions, which were not included in this research. Inviting companies with a very different profile might generate new insights.

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