

NUS Technology

Know How

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Document Control

Version	Change description	Changed by	Date
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Group	Slot	Level	Description	Explanation	How to pass?
	Technology	Level 1	Have a basic understanding and can discuss about concepts, terms or relevant things of one technology.	Demonstrated understanding on basic concepts: <i>(Web)</i> + IP, Javascript, HTML, CSS, front-end, back-end, responsive design, AJAX, CMS, DOM, ... + Ruby on Rails: Gemfile, Migrations, Rake, YAML, Scaffolding, CRUD... (http://guides.rubyonrails.org/getting_started.html) + PHP: basic concepts in working framework <i>(Mobile)</i> + Push notification, SDK, UDID, Accelerometer + Android: Action, Activity, Intent, Canvas, Drawable, Layout Resource, Manifest File, Surface, View, etc. (https://developer.android.com/guide/appendix/glossary.html) + iOS: activity viewer, app delegate, Auto Layout, etc. (https://developer.apple.com/library/content/referencelibrary/Getting)	+ Pass the training phase
		Level 2	Have good knowledge of one technology, can apply it to solve problems	Demonstrated ability to: + setup project from scratch, can develop a feature from front-end to back-end + integrate with third-party libraries, external APIs + use logger, debugger tool to debug and fix simple issues	+ Provide evidence OR + Pass an interview
		Level 3	Have deep knowledge of one technology and can use it to solve complex problems	Demonstrated ability to: + be recognized in a team as a main contact when having difficult issues in a technology + debug and fix difficult bugs by looking into the source code of framework/library or self-study relevant technologies. + understand low-level features of a language/framework (ex: metaprogramming, profiling, benchmarking)	+ Provide evidence For criteria about "low-level features of language/framework", if no evidences are available, developer can explicitly request an interview.
		Level 4	Be a "go-to" person of the company, be regularly asked by the company to give advice or solution for challenging and difficult technical problems		
	Work quality	Level 1	Understand and follow pre-defined coding convention with few mistakes	Demonstrated ability to understand and follow: + common coding convention in programming: naming convention (camelcase, snakecase, ...), indentation, file extension, folder structure. + convention of frameworks/languages being used at work: Rails, PHP, Android, iOS, ...	+ Provide evidence
		Level 2	Consistently follow best practices and GUI standards in development	Demonstrated ability to understand and consistently follow: + NUS Best Practices + NUS GUI Standard Specification	+ Provide evidence
		Level 3	Able to produce accurate and extensive code review for an existing app, or organize code review session for members in a project. Have knowledge of some common design patterns	Demonstrated ability to: + organize at least 2 code review sessions + have knowledge of common design patterns: Singleton, Decorator, Factory; understand when/how/why to use them? Show examples of using them before (evidence)	+ Provide evidence For criteria about Design patterns, if no evidences are available, developer can explicitly request an interview.
		Level 4	Quickly see the coding issues in a project and able to propose long-term ideas to improve or mitigate mistakes in other projects. Have a strong knowledge of design patterns.		

Technical skills	Architecture	Level 1	Understand and follow the basic architecture from one of the technologies being used at the company	Demonstrated understanding on how/why/when to use an architecture. + MVC	+ Pass the training phase
		Level 2	Have applied understanding of multiple common architectural patterns & styles	Demonstrated understanding and ability to use the following architectures: + MVC (Web + Mobile) + MVVM (Mobile) + Micro-services (Web) Demonstrated understanding on: SOA, MVP, Event-driven	+ Provide evidence For criteria about "Micro-services, SOA, MVP, Event-driving", if no evidences are available, developer can explicitly request an interview.
		Level 3	Able to propose architectural design for small to medium-sized projects which is solid, optimal and be stable in long-term	Demonstrated ability to: + propose and implement the initial architecture of an app which is running stably on production + suggest necessary changes to the design of an existing app to make it more stable or improve its performance significantly	+ Provide evidence
		Level 4	Have extensive knowledge of architectural design, able to propose solid & optimal designs for large scale projects		
	Adaption	Level 1	Able to work in a simple module of a project under supervision	Demonstrated ability to complete assigned tasks of simple module under supervision	+ Provide evidence
		Level 2	Able to work on related modules of a project without frequent support	Demonstrated ability to understand requirements, the relationship between several modules and complete assigned tasks without frequent support	+ Provide evidence
		Level 3	Can work comfortably on a fairly large codebase with multiple modules or complex interaction	Have worked efficiently for more than 3 months in a project which has codebase larger than 10K lines of code (for web app) or 2K lines of code (for mobile app) (excluding library).	+ Provide evidence
		Level 4	Able to handle all technical aspects in complex projects, can give suggestion to improve the application in terms of architecture and performance		
	Knowledge acquisition	Level 1	Able to read and understand a technical content based on given detailed information	Demonstrated ability to: + read an article containing the solution for a problem and can apply it without much support + receive knowledge transferred by others and apply it in a project (how to use a tool, a library, how to fix this issue, ...)	+ Provide evidence
		Level 2	Able to quickly self-learn technologies/methods being used in a project and use them at ease	Demonstrated ability to: + understand which libraries/frameworks are being used in a project, how to use them, where they are being used. + not always ask simple things. + understand the workflow of a feature, extend it and fix relevant issues. + actively share useful knowledge within a team (new methods for doing things, how a feature works, tools to improve team's productivity)	+ Provide evidence
		Level 3	Able to master a new technology quickly and distribute it to others via training, tech-talk, blog posts	Satisfy one of the following: + Have 1 training, 2 tech-talk and 2 blog posts (or tech notes). + Have been assigned as a leader in a team to study new technology and apply it in multiple projects + Demonstrated ability to study difficult problem/new technology in a project and then help the team to: (i) resolve the issues from technical viewpoint; (ii) answer/respond to clients with the root cause and the actions to take	+ Provide evidence

		Level 4	Able to lead and develop a new branch of technology for business focus		
	<i>Estimation</i>	Level 1	Able to provide estimate for a simple task with guidance	Demonstrated ability to: + frequently provide reasonable rough estimate for the implementation time of a feature	+ Provide evidence
		Level 2	Able to study and provide estimate for individual tasks based solely on requirements	Demonstrated ability to: + consistently provide reasonable estimate for a scope of work consisting of several related features (including design, implement, test, release) + investigate problems and figure out solutions before providing estimate	+ Provide evidence
		Level 3	Able to provide an appropriate estimate for a whole project based on pre-defined work breakdown structure	Demonstrated ability to: + break down a given scope of work into smaller pieces, estimate the time to get them done and how to get them done + provide an approved estimate for a project with efforts >= 400 hours, or several scopes of work with total efforts >= 400 hours	+ Provide evidence
		Level 4	Able to define and validate a project estimate of a complex project. Able to foresee potential issues or roadblocks, and negotiate the estimate with the clients effectively		
	<i>Deployment/Distribution</i>	Level 1	Able to deploy the app and run necessary tools for deployment under supervision	Demonstrated ability to: (Web) + run existing scripts/tools for deployment (capistrano, mina) + know necessary commands to deploy the app or debug simple deployment issues + configure basic settings in the app to make it ready for deployment (Mobile) + know how to run the app on emulator, how to build for devices + understand the process to submit the app to Google Play/App Store	+ Provide evidence OR + Pass an interview
		Level 2	Have good knowledge to config, deploy and monitor the app on different environments	Demonstrated ability to: (Web) + setup a server from the scratch (ex: setting up Apache, Nginx, Passenger, database) + setup deployment script in the source code (capistrano, mina, ...). + use relevant techniques like: SSH, SCP, cronjob,... + understand several services of AWS (EC2, ElasticBeanstalk, Elastic Balancer, Route53, RDS) (Mobile) + config and submit the app the Google Play/App Store. Know how to distribute the apps to different users (OTA) or devices	+ Provide evidence OR + Pass a hands-on test OR + Pass an interview
		Level 3	Have vast knowledge of tools and methodologies to suggest and implement deployment strategies for complex applications (continuous delivery)		
		Level 4	Act as primary contact for deployment/distribution related inquiries and issues. Able to develop deployment specifications and provide training for related parties		

	<i>Non-functional requirements</i>	Level 1	Have knowledge of the non-functional requirements of the current project and NUS best practices	Demonstrated ability to: + know non-functional requirements of his/her current project (ex: which browsers/devices are supported?) + know responsive design + know NUS best practices	+ Pass the training phase AND + Provide evidence
		Level 2	Understand the non-functional requirements of the current project and NUS best practices	Demonstrated ability to: + understand how to achieve responsive design (using @media query, adaptive layout, auto layout, constraints, etc.) + understand NUS best practices	+ Provide evidence
		Level 3	Have a good understanding on compatibility, performance, scalability, maintainability, testability of a project	Demonstrated ability to: + understand how to achieve compatibility (responsive design, cross browsers, cross devices, etc.) + understand caching at different levels (database, server, front-end), optimize SQL query + install tools for tracking bugs/monitoring performance (New Relic, Bugsnag, Airbrake, etc.) and analyze the reports to figure out issues + understand testing: unit testing, functional testing, TDD, BDD. + write unit testing + follow best practices in security (authorization, authentication), frequently give advice to improve project security	+ Provide evidence For criteria about "understanding testing: unit testing, functional testing, TDD, BDD, etc", if no evidences are available, developer can explicitly request an interview.
		Level 4	Have a deep understanding on the multiple aspects of non-functional requirements and know solutions for these requirements		
	<i>Decision Making</i>	Level 1	Make appropriate decision on simple problems under supervision when necessary information is available		+ Provide evidence
		Level 2	Make appropriate decision on simple problems in timely manner with limited support		+ Provide evidence
		Level 3	Make appropriate decisions on difficult problems in timely manner	Demonstrated ability to: + decide appropriate architectures, frameworks or tech stack for a project + decide appropriate strategies/methods to improve the app (caching strategy, security methods, deployment strategy, ...)	+ Provide evidence OR + Pass an interview
		Level 4	Make right decisions in complex situations at strategic-level, take charge of the group when necessary to make decisions		
		Level 1	Capable of internal interaction through all core communications (project team discussion).	Demonstrated ability to: + keep team updated on his task + understand requirements clearly given a detailed explanation + not repeatedly ask for simple clarification + not miss important information of the project/team + actively raise issues if any (ex: inform supervisor when investigating a simple issue after 30-45 mins but no solutions found)	+ Provide evidence
		Level 2	Exhibit good communication skills in working with team. Communicate potential issues as soon as known	Demonstrated ability to: + understand requirements with limited support + ask questions to clarify unclear problems + explain clearly simple technical points to others (BA/QC/Dev) + raise potential issues as soon as they are known	+ Provide evidence

Communication	<i>Insight</i>	Level 3	Exhibit good communication skills via accurate and timely status reports as well as direct communication. Can make difficult issues easy to understand by non-technical people	Demonstrated ability to: + send accurate and timely reports to manager in a project/team + analyze requirements from BA and provide clear feedback/explanation if necessary + receive an issue, analyze it to understand its root cause and explain in a way that the whole team can understand and know how to resolve	+ Provide evidence
		Level 4	Demonstrate strong written and verbal communication skills	Demonstrated ability to: + explain project goal, status clearly to all team members + keep all stakeholders updated on the project status + convey ideas/issues clearly and concisely + possess effective non-verbal communication (body language, eye contact, hand gesture, etc)	+ Provide evidence
		Level 5	Demonstrate excellent written and verbal communication skills in various contexts involving important members from many parties		
	<i>Documentation</i>	Level 1	Able to write simple document as requested under close supervision	Demonstrated ability to write simple internal documents (task log, note) under supervision	+ Provide evidence
		Level 2	Able to write documents with limited guidance	Demonstrated ability to write simple documents (short description for a function/class/file) with limited guidance	+ Provide evidence OR + Pass a hands-on test
		Level 3	Able to write simple to complex documents in a project such as Software Architecture Document, System Documentation		+ Provide evidence OR + Pass a hands-on test
		Level 4	Able to write complex reports, distribute them to the team and use them to discuss with clients		
	<i>Meeting</i>	Level 1	Effectively attend simple meetings	Demonstrated ability to: + join meeting on time + pay attention to the topic of the meeting + listen and speak up in discussions + not always sit passively on the sidelines	+ Provide evidence
		Level 2	Lead simple internal meetings	Demonstrated ability to lead the following meetings: code review, scrum meeting, issue discussion, brainstorming.	+ Provide evidence
		Level 3	Lead or facilitate fairly complex meetings with clients	Demonstrated ability to lead/facilitate the following meetings with clients: formal reviews, workshops, requirement discussion, issue discussion, etc	+ Provide evidence
		Level 4	Lead or facilitate complex meetings in which the most senior members from each party might join the meeting		
		Level 1	Able to provide needed information to the supporter as requested after receiving feedback or request from clients	Demonstrated ability to work with clients through a middle-man, this includes: + working after receiving clear and sufficient information from supervisor + providing needed information as requested	+ Provide evidence
		Level 2	Able to work directly with clients using written communication, support is still needed for discussing complex topics	Demonstrated ability to work directly with clients via tools such as: Trello, Skype, Slack... but support is still needed in some complex topics or difficult issues (scrum meeting, status reports, requirement clarification)	+ Provide evidence

	<i>Client interaction</i>	Level 3	Able to work directly with clients using written communication without support	Demonstrated ability to: + work directly with clients (daily) as a main developer via tools such as Trello, Asana, Skype, Slack. + discuss directly with clients on various things related to issues, requirements, project status	+ Provide evidence
		Level 4	Able to work directly with clients via written and verbal communication to solve different issues in a project		
		Level 5	Able to discuss with clients in a strategic level to build long-term relationship, plan the project or grow the company's business		
	<i>Technical Requirement</i>	Level 1	Receive and understand technical points of a project	Demonstrated ability to: + understand technical requirements used in a project after being distributed by others (technology stack, frameworks, libraries, tools, languages) + follow the designs done by others (database design, architectural design, system design) under supervision	+ Provide evidence
		Level 2	Gather and validate the feasibility of technical points in a project	Demonstrated ability to: + propose which technologies/frameworks/tools can be used in a project based on the requirements + raise issues if any technical point seems unfeasible (no available technologies, unsupported features, deprecated features, ...) + follow the designs done by others with limited support	+ Provide evidence
		Level 3	Authors, reviews and approves technical requirements and designs for a project	Demonstrated ability to: + make final decision on the technology stack, architecture, server, tools, frameworks, languages, libraries used in a project based on the requirements. + review/approve the designs (database design, architecture design, system design) done by others, give useful advice, warning, suggestion to improve the design before sending to clients	+ Provide evidence
		Level 4	Accountable for overall design for a project, contributes to architectural decisions		
	<i>Accountability</i>	Level 1	Be responsible for implementing part(s) of feature(s) or small module	Demonstrated ability to: + implement/maintain part(s) of feature(s) or small module + take responsibility when issues found on his work + to not hide issue on his tasks, actively raise them and get support to resolve	+ Provide evidence
		Level 2	Be responsible for several features or a small project	Demonstrated ability to: + implement/maintain several features or a small project + work or support new members to resolve the issues related to his/her work or adjacent work + provide information related to his/her work as requested	+ Provide evidence
		Level 3	Be responsible for core functionalities of one or several projects	Demonstrated ability to: + act as a core member of a team who can help new member to work on any part of an existing project. + help the team to answer questions from clients regarding certain features of the app	+ Provide evidence
		Level 4	Accountable for all technology on multiple projects		

Job knowledge	Processes	Level 1	Understand and follow the approach adopted in a project		+ Provide evidence
		Level 2	Have good knowledge of software development approaches. Able to discuss and suggest suitable approaches	Demonstrated ability to: + know terms/processes used in the following approaches: Agile, Scrum, Waterfall, Milestone-based; know their pros and cons. + suggest suitable approach to team, provide feedback if something does not work or is not suitable	+ Provide evidence OR + Pass an interview (must be explicitly requested by the developer)
		Level 3	Have strong knowledge of many development approaches, can comfortably discuss and successfully lead a project following a certain approach		
	Domain Knowledge	Level 1	Understand standard terms belonging to the domain of a project on which he/she have worked	Examples: + E-commerce: merchant, buyer, invoice, payment gateway, inventory, cart, etc. + Booking: listing, check-in, check-out, dispute, refund, etc.	+ Provide evidence
		Level 2	Understand terms, protocols, processes and applications in one domain on which he/she have worked		+ Provide evidence
		Level 3	Have good knowledge of multiple domains in several projects	Have worked on at least 3 projects from different domains. Some common domains: e-commerce, finance, education, booking, legal, hospital, sports	+ Provide evidence
		Level 4	Has designed and implemented several products/solutions in several domains.		
	Role	Level 1	Understand the goals of the team and each team member's role within it	Demonstrated ability to: + know the goal and deadline of the project/task he/she is working on + understand the role of each member + ask right question to right person + honestly report the work/status to the team	+ Provide evidence
		Level 2	Be an active team member in a project, work collaboratively with others to achieve project goals	Demonstrated ability to: + work on his task and voluntarily support his co-worker in the best of his knowledge + be a reliable team member, get work done as promised and share burden with other team members + keep team members informed on the status of his tasks	+ Provide evidence
		Level 3	Can discuss plans and ideas with others and coordinate the working between different roles in a project	Demonstrated ability to: + play an important role in a project in which BA or other roles can ask for advice, solution or answers + help the team to make a plan for the project (release schedule, scope of work) + discuss and lead the team to work on a problem	+ Provide evidence
		Level 4	Facilitate collaboration across the organization (with different departments) to achieve a common goal		
	Time management	Level 1	Track time for assigned tasks and deliver them on reasonable time	Demonstrated ability to: + write task log frequently and send it to manager/supervisor when requested + raise issue if there is a risk to miss deadline	+ Provide evidence
		Level 2	Can prioritize assigned tasks and avoid unimportant details to complete tasks on time		+ Provide evidence

Management		Level 3	Demonstrate good time-management skills in task management	Demonstrated ability to prioritize and complete assigned tasks across multiple projects	+ Provide evidence
		Level 4	Demonstrate excellent time-management skills in various contexts (planning, execution, reports, ...)		
	Direction	Level 1	Receive regular supervision on daily basis		+ Provide evidence
		Level 2	Self directed, able to support other engineers in his knowledge	Demonstrated ability to: + frequently support co-workers to get their tasks done + give them necessary advice, suggestion to improve their productivity (useful tools/libraries, best practices, ...)	+ Provide evidence
		Level 3	Provide guidance to a team	Demonstrated ability to: + provide guidance in term of technical support, requirement analysis, client interaction + act as a team lead	+ Provide evidence
		Level 4	Provide guidance and supervision to multiple teams		