

Web Application Design Homework

CS4262 Distributed Systems

Due – September 8 before 11:55 PM

Learning Outcomes

- To understand the scalability needs of growing online businesses
- To propose and justify a suitable technical solution to address different scalability requirements.

Case

Himal is a fresh graduate working at a reputed local software development firm. He used to conduct part-time classes for O/L, A/L, and IT exams during his undergraduate days. He loved the opportunity to help other people to learn, as well as the pocket money it brought in. Though he loves to teach, he is no longer able to conduct regular classes due to work commitments. As an alternative way of expressing his passion to teach, he decided to launch a self-phased learning website called LetsLearn.lk. He thought of transforming his experience in conducting classes for school kids to build a better learning platform that is targeted specifically to Sri Lankan school children. He also saw this as an opportunity to retain his web development skills (his current job does not involve web-development) and earn a little bit of extra cash through advertising on the learning platform. Suppose Himal's online learning platform evolved through the following phases.

Phase 1

Knowing that some content is already available through Dialog TV, PeoTV, Ethisalat Web Patashala, eschool.lk, Khan Academy, etc., Himal initially developed a website that only integrates existing resources and contents. In this phase, he primarily relied on other's contents and presented them to website visitors by grouping them under different subject areas in a connected way. He relied on integrating Google Ads and few banner ads on the website to get revenue.

Phase 2

After several weeks of operations, Himal realized through he gets about 200 users a day, they do not spend a lot of time on using resources and give up after following a couple of lessons. He realized that it is necessary to provide ways to engage users and give feedback on what they have learned. Himal decided to add online quizzes to each key lesson to give users feedback on what they have learned. Based on learner's response to quizzes, LetsLearn.lk suggests which lessons to look at next. It may even suggest the same lesson or same lesson in alternative forms, when it realized that the learner has not understood the subject matter. To increase further engagement with the website, and allow learners to track the lessons they have taken and their quiz marks, he allowed users to login to the system using third-party authentication solutions like Login with Facebook and Google. Through this Himal could track the users and maintain a session for each of them.

Phase 3

After several months of operation with the improvements implemented in Phase 2 and social media marketing, LetsLearn.lk attracted ~1,000 unique users per day. Most of these users came during late afternoons and evenings. Also, there were more visitors during weekends, holidays, and school vacation time. An average user session lasted for ~20 min and some sessions even lasted ~2 hours. As Himal was tracking users, he could further understand contents liked by each user, quiz performance, user's age range, etc. He realized that a much better and unique service could be provided by targeting the specific learning needs of each individual. To do this he and his team (a couple of friends that also joined LetsLearn.lk initiative) had to create and add new contents, as

publicly available content was insufficient to provide a unique and well-connected learning experience, especially in local languages. Quizzes were also introduced in the middle of a lesson (as in some of the Udacity classes) for better learning and testing experience. Different forms of quizzes were also introduced. As the newly added content was the intellectual property of LetsLearn.lk and gave its competitive advantage, Himal did not want to host the videos openly on public video sites. LetsLearn.lk also introduced a paid subscription service to access some of the new contents.

Phase 4

After many improvements in Phase 3 and 1.5 years of operation, LetsLearn.lk now attracts ~25,000 unique users on certain days, e.g., during time of the year where schools conduct term tests. On many occasions, the number of concurrent sessions exceeded 10,000 and average session time has increased to ~45 min. In addition to students, it was also realized that many school leavers and tuition masters also tend to visit the website to improve their Mathematics, English, and IT skills or use the material for their own classes. Himal saw this as an opportunity to expand the coverage of LetsLearn.lk beyond O/L and A/L content and expand it to any course his users may want to learn. LetsLearn.lk added a teacher's corner, for educators that want to use LetsLearn.lk's content in their teaching. It also now supports conducting online quizzes/exams ranging from minutes to hours. Himal also realized that the website can be opened to other regional countries which follow the British education system. These changes resulted in the creation of many new contents and integration of existing contents.

Task

For each of the 4 phases above, propose a suitable solution architecture (with justification) while considering the following (5 marks for each phase):

- Workload and its characteristics
- High-level architecture of the solution, e.g., client-server, 2-tire, 3-tire, cloud-based, etc.
- Hardware requirements, e.g., server, networking, load balancing, etc.
- Software and middleware requirements, e.g., web server, database, streaming, etc.

The proposed solution for each phase should contain design details, product names, capacities, pricing, etc. Students are encouraged to use the Class Discussion Forum on Yammer to discuss anything related to this task.

Resources

Some of the following resources may help you better design your solution at different stages:

- www.godaddy.com
- <http://azure.microsoft.com/en-us/>
- www.bluehost.com
- <http://slt.lk/business/enterprises>
- <http://www.dialog.lk/business/>
- www.mysql.com/why-mysql/cloud/
- www.akamai.com/html/solutions/index.html
- www.zdnet.com/article/rdbms-vs-nosql-how-do-you-pick/
- www.slideshare.net/quipo/nosql-databases-why-what-and-when?related=2

What to Submit

Two students per team. Submit a report containing solutions for each of the above 4 phases. Limit your report to 750 words (approximately 3 pages of single line spaced text). Diagrams and tables are highly encouraged and will not be counted within 3-page limit. Set the file name to HW_index_no1_index_no2.pdf.