Partial Service/Application Migration and Device Adaptive User Interface across Multiple Screens

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Introduction

Multiple use cases have been developed and approved from the last two Web and TV workshop in Tokyo and Berlin. Especially, approved issues 4, 7, 8, 15, 25 directly deals with migrating service and applications from one screen (or device) to the other. As an extension of our previously proposed "second screen scenario", we have further developed both the indoor and outdoor usage of "multiple screen scenario" and tried to categorize, specify and fill in the missing spots in currently identified issues. They include **full vs partial migration**, **device I/O capability and screen real-estate problem**, along with **privacy/security** issues.

Full vs Partial Migration

Currently, issue-15 (Application Migration) only deals with full application migration. An application on the device_A migrates to device_B preserving the application state and functions. Then device_B takes over device_A's role and the connection between device_A and B is lost after the migration. However there exists another subcase where only a part of the application is to be migrated while maintaining the connection between device_A and B. This is when two devices are interacting to run a single application using two screens. One could either render a video, and the other may control.

Similar scenario is stated in issue-7 (Service Migration), however it is somewhat different. Issue-7 does not migrate the visual user interface rendered on the original device. The service user interface specially designed for migration discovers a second screen and migrates the state, but not exactly the same user interface. This results in requiring re-design, or extra design of the service user interface.

Usually a web content or service is provided to the end user with explicit control interface on

a single screen.to allow the user to execute a command by click, roll over, or drag and drop. If this very user interface could migrate over to the control device (e.g. smartphone) the re-design of the service user interface may not be needed.

Therefore in our opinion, the migration should not only support "full migration" or "predefined service user interface migration" but also "partial migration" which allows the user to manually select a portion of an application or service to be migrated to the control device. The portion could possibly be a section, frame or any part of the user interface explicitly shown on the original service/application device.

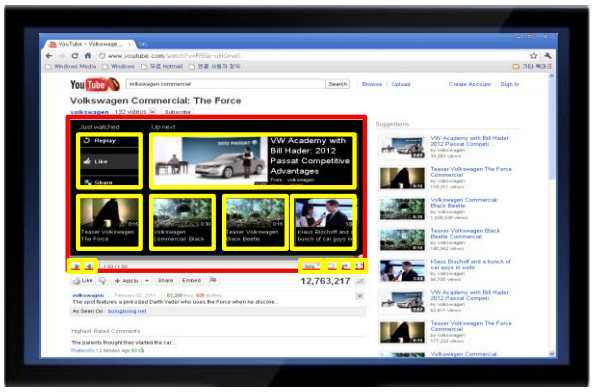


Figure 1. A web service/application is rendered on a web TV, controlled by a dedicated remote control or keyboard/ mouse.

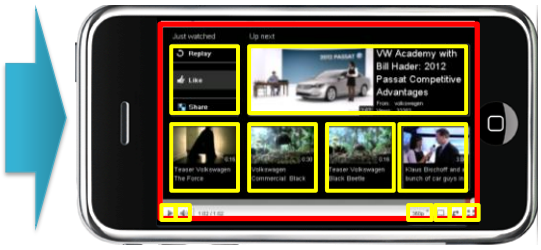


Figure 2. By selecting and migrating a specific region of interest, the frame is rendered onto the second screen. Clicking the play, rewind, volume up&down menu on the migrated interface reflects its value on the original screen.

The figure 1 and 2 above briefly introduces an example of partial migration. The additional requirements missing from the currently approved list is the standardized markup for separating "migratable section or frame". By inserting the migratable frame tag, the user agent may parse the region for either service/application push or pull.

Device I/O Capability and Screen Real-estate Problem

Since the I/O capability differs across the display devices, migrating a service or application is followed by UI adaptation problem. Currently, connecting to a web page by PC and mobile phone adaptively renders the optimized page by the web server detecting the target device's browser/OS. This is only possible when the mobile page is ready to service.

Migrating a service/application without considering the target device I/O capability (screen resolution, network, touchscreen, keyboard, mouse etc) could result in the service failure. If the service or application to be migrated requires a minimum resolution of 640x480 but available device can only render 320x280, it would not be able to provide a proper service. Moreover, if the service requires a mouse to control, the target device without a mouse should not accept the service migration.

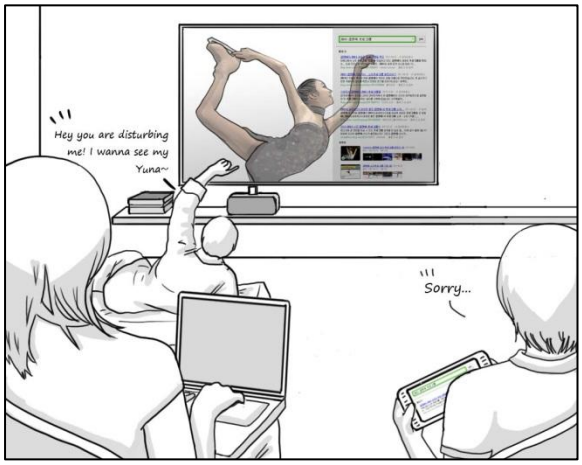


Figure 3. Two independent service/ application (video stream and search page) is running on a single screen while the family is watching the figure skating. The search page is controlled by a remote control device.

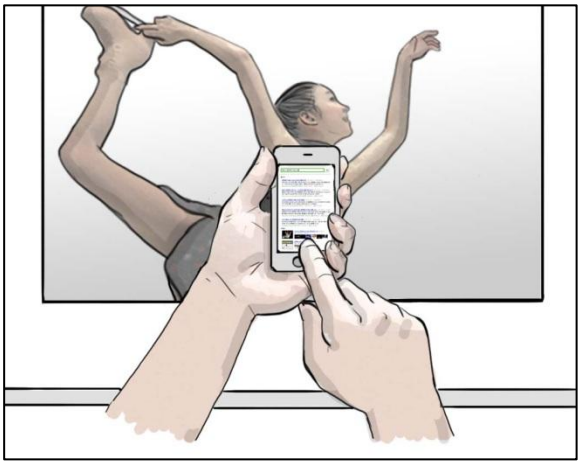
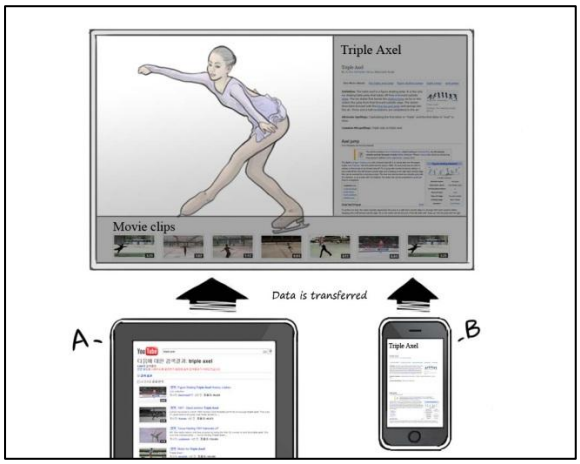


Figure 4. As one of the family members complains about the search page disturbing the video, the user retrieves the search page using his smartphone.



. Figure 5. Different service/applications are migrated onto the same screen. The service/application is adaptively rendered to the appropriate position and size accordingly

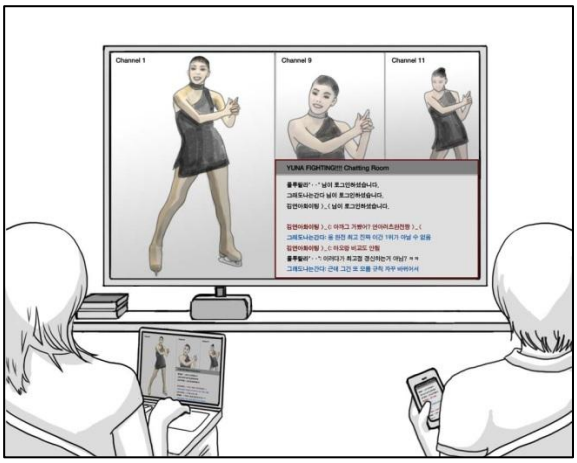


Figure 6. Multiple windows of service/ applications can be manually sized, placed by the user in control.

Figures above deal with the screen real-estate problem. Figure 3 and 4 shows a generic second screen scenario. In reverse, migrating multiple service/application onto a single screen arises the issue of application window sizing and allocation. It could be either predefined by the service provider. However, in order to provide a richer user experience, such migration should provide a higher degree of freedom. Manual sizing and allocation of migrated service/applications are needed.

Privacy/Security Issues upon Migration

Migrating a service/application from a personal device to a public screen might visually intrude one's privacy by exposing private information. This is especially important outdoors interacting with a public display. For example, personal ID, address, or even bank account may be shown in the public. Therefore a context-adaptive privacy policy is required on the web service/application. This may also be applied to the parental protection of hazardous contents, or the contents that may not be appropriate to be shown in the public setting to be stopped playing or directly hidden under a warning window etc.

This could be realized by similar approach with the partial migration. The section or a frame to be protected could be tagged with a certain markup. It can either separate contents into simply "private" and "public" or even more detailed level of protection.

Concluding Remark

This research is currently funded by the Korea Communications Commission under grant number 11912-03001 (Development of Inter-screen Collaboration Service using Dynamic Reconfiguration of Web Converged Contents). This lies directly on Web and TV, especially the service/application migration. We are currently identifying standardization needs on harnessing multiple screen collaborations and developing required technologies. We hope to provide insights along with our participation in the past Berlin Workshop and harness discussions relating the topics.