HPC Asia 2020. Jan. 15-17, 2020

ChOWDER: A VDA-Based Scalable Display System for Displaying High-Resolution Visualization Results

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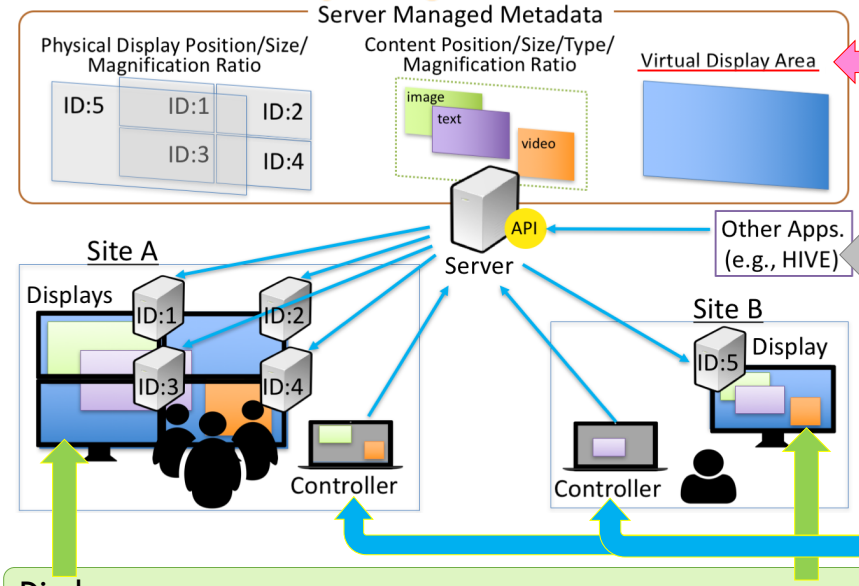
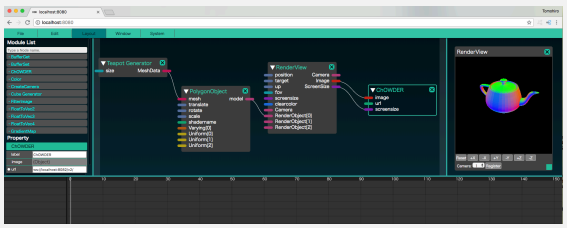
ChOWDER (COoperative Workspace DrivER) [1] is a simple web-based scalable display system that does not require any specialized hardware or software. The main characteristic is the virtual two-dimensional display space, called VDA (Virtual Display Area), which enables dynamic and flexible display system configuration. Herein, we present the use of ChOWDER for displaying high-resolution visualization results generated from large-scale simulations by taking advantage of the technical characteristics of the ChOWDER.

System diagram of ChOWDER

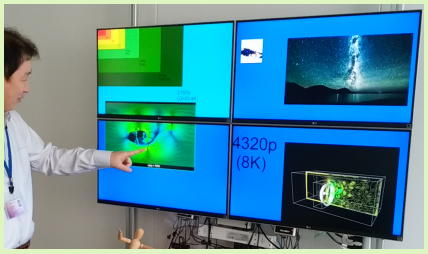


VDA (Virtual Display Area) is a virtual two-dimensional display space managed by the server, which allows dynamic physical display placement, and represents the main difference to other web-based tiled display systems such as the well-known SAGE2 [2]. This functionality increases the flexibility of the system, and enables the dynamic change of the display configuration.



HIVE[3] (Heterogeneously Integrated Visual-analytics Environment) has primarily been developed to support the visualization and analysis of large-scale simulation data. It adopts a web-based user interface for consistency across operating systems. In the interface, there is a "ChOWDER" node to send the rendering results to the ChOWDER by setting the URL of the ChOWDER server, the image itself, and the image size.

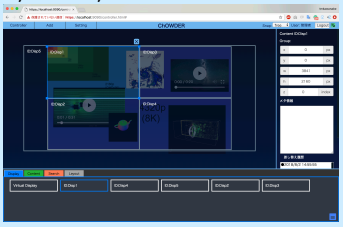
Displays have simply consisted of the web browser window, it is used in the full-screen mode so that the entire physical display can be used as the content display area. In this figure, Site A uses four displays and each display is connected to a different PC. By using ChOWDER, these displays perform as a single display area. Site B uses a single display, however, the VDA allows the same content to be shared between both sites even each site having display devices with different resolutions.



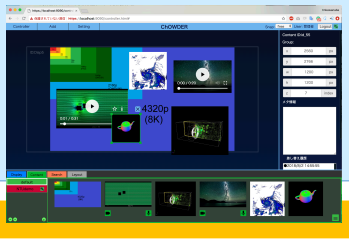
Remote collaboration use case between Kyushu Univ. (left) and RIKEN R-CCS (right).
This use case shows that the VDA allows the same content to be shared between both sites even each site has the display devices with different resolution and aspect ratio.

Controllers work on the web browser window as same as the displays. On the VDA view (figure below), the user can specify the VDA size and add/move/resize/remove the physical displays which are connecting to the server. On the contents view, the user can add/move/resize/remove contents. Acceptable content types are image, text, pdf, video, webcam, and screen share.

VDA view

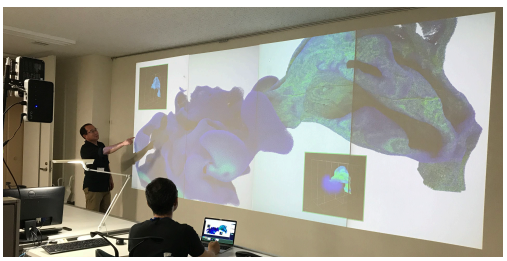


Contents view

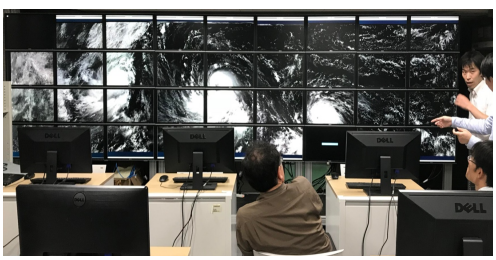


Study examples of showing high-res images

Displaying a pre-rendered ultra-hi-res visualization result of a whole earth climate simulation on 4x3 tiled displays (15360x5680 total pixels) which consisted of 12 4K displays and 4 Mac-minis. By using the newly implemented function that enables image subdivision transmission [4], we observed about 3x faster-displaying speed than SAGE2 [2].
(Data courtesy of JAMSTEC and AORI/The University of Tokyo (HPCI SPIRE3) collaboration with RIKEN AICS)



Displaying a visualization result of a CFD simulation on 4x1 tiled displays (3200x1280 total pixels) which consisted of four HD LCD projectors and four Raspberry-pi. The image was rendered on the HIVE [3] and sent directly to the ChOWDER server via ChOWDER 's WebAPI.



9x4 tiled displays (17280x4800 total pixels) driven by 9 Linux workstations, displaying a large-scale climate image from the weather satellite HIMAWARI-8.
(Photo courtesy of Center for Environmental Remote Sensing, Chiba University and National Institute of Information and Communications Technology.)

[1] T. Kawanabe, J. Nonaka, and K. Ono. 2018. ChOWDER: Dynamic Contents Sharing through Remote Tiled Display System. In VINCI 2018. 108–109.
[2] T. Marrinan, J. Aurisano, A. Nishimoto, et al. 2014. SAGE2: A new approach for data intensive collaboration using Scalable Resolution Shared Displays. In CollaborateCom 2014. 177–186.
[3] J. Nonaka, K. Ono, N. Sakamoto, et al. 2018. HIVE: A Cross-Platform, Modular Visualization Ecosystem for Heterogeneous Computational Environ- ments. In SC'18 Research Poster.
[4] T. Kawanabe, J. Nonaka, D. Sakurai, et al. 2019. Showing Ultra-High-Resolution Images in VDA-Based Scalable Displays. In CDVE2019. 116-122.

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ChOWDER is an open source software distributed via *https://github.com/SIPupstreamDesign/ChOWDER*