

# スケーラブルディスプレイシステムChOWDERと iTownsを用いた3D WebGISの超高解像度表示

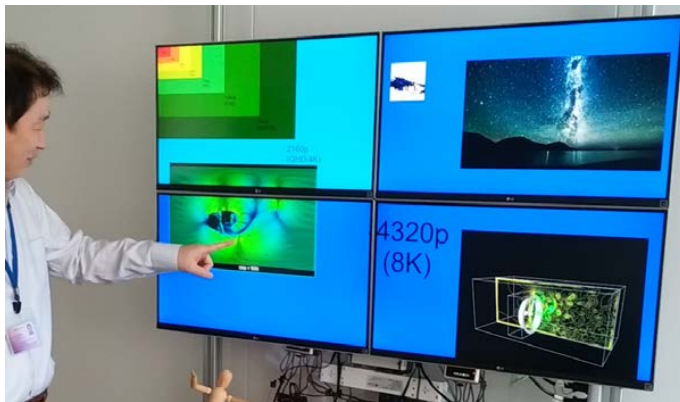


スマートIoT推進フォーラム 技術戦略検討部会 テストベッド分科会  
第3回データ分析・可視化タスクフォース

理化学研究所 計算科学研究センター  
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# ChOWDER (The Cooperative Workspace Driver)

- **A Web-based Scalable Display System for**
  - Team discussions
  - Remote collaboration among multiple sites
  - Large scale visualization
- Built on modern web technologies
  - HTML5, JavaScript, P2P-protocols, etc.





# Displayable Content Types

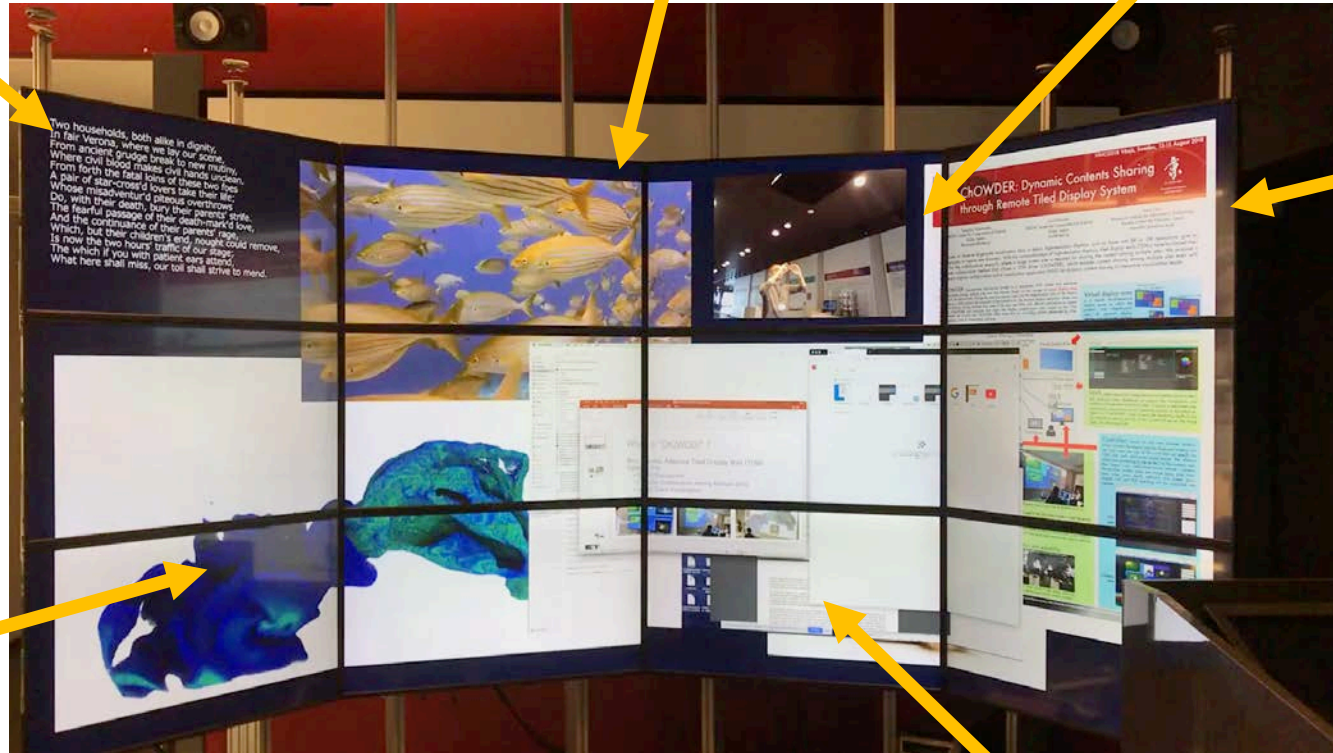
Interactive  
Text

Movie  
(mov, mp4)

Webcam

PDF

Image  
(jpg, png, bmp)



3D GIS  
(New!)

Desktop screen

# “VDA” Concept

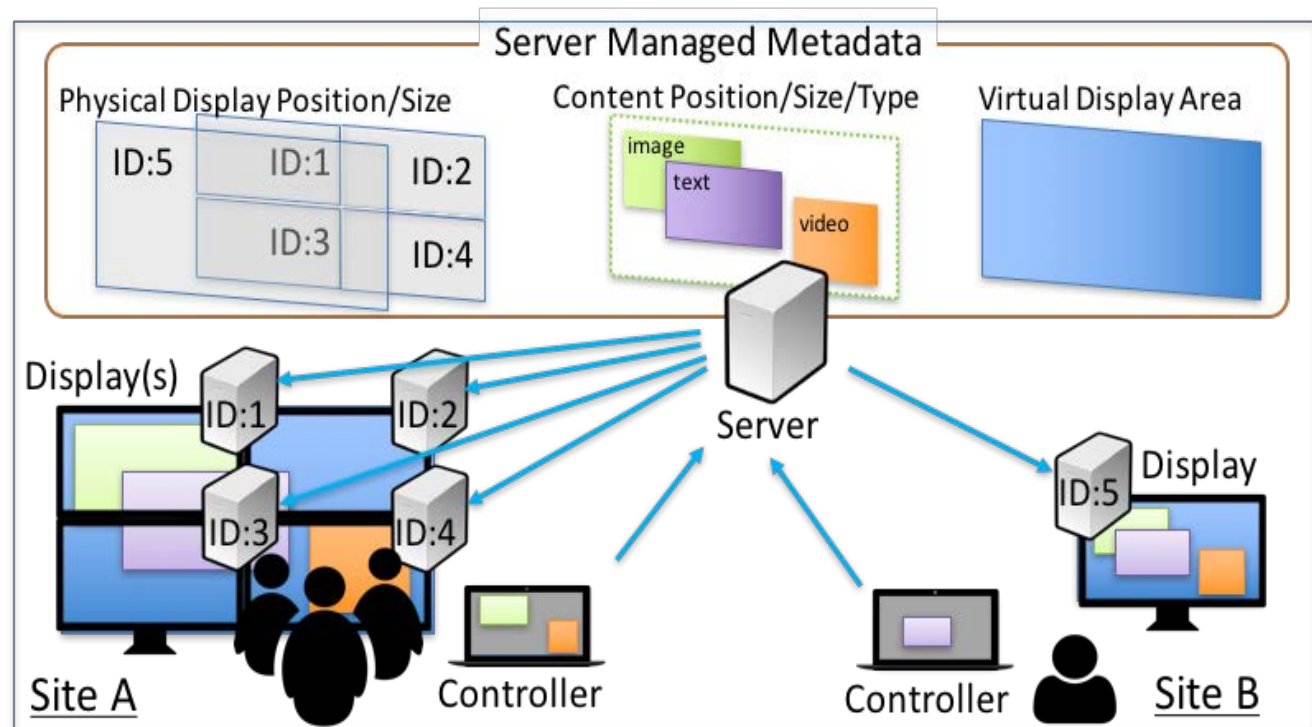
## VDA (Virtual Display Area)

- a server managed logical two dimensional display space.
- manages the metadata of physical display devices and displaying contents.

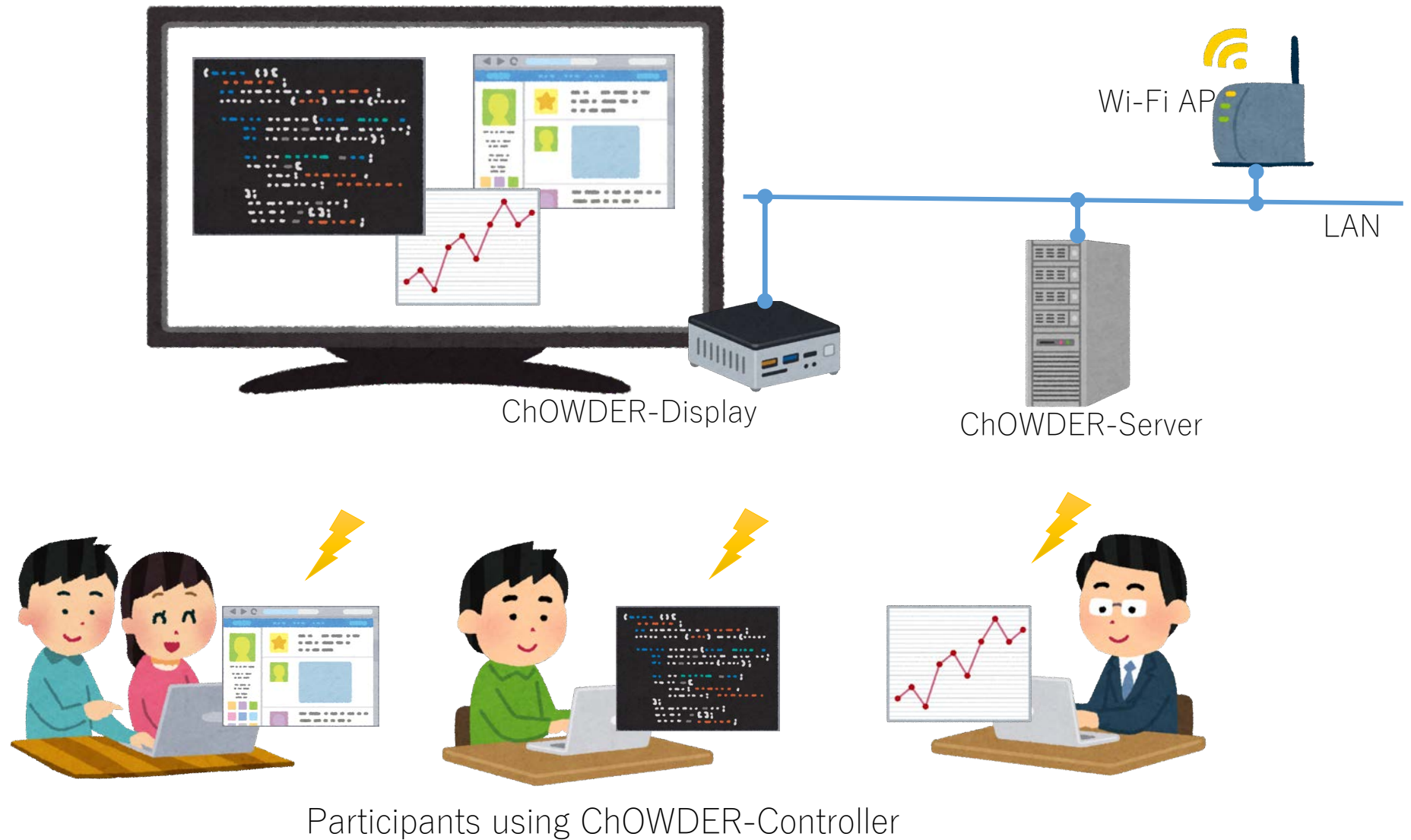
## Metadata:

- position on a VDA
- magnification ratio on a VDA
- etc.

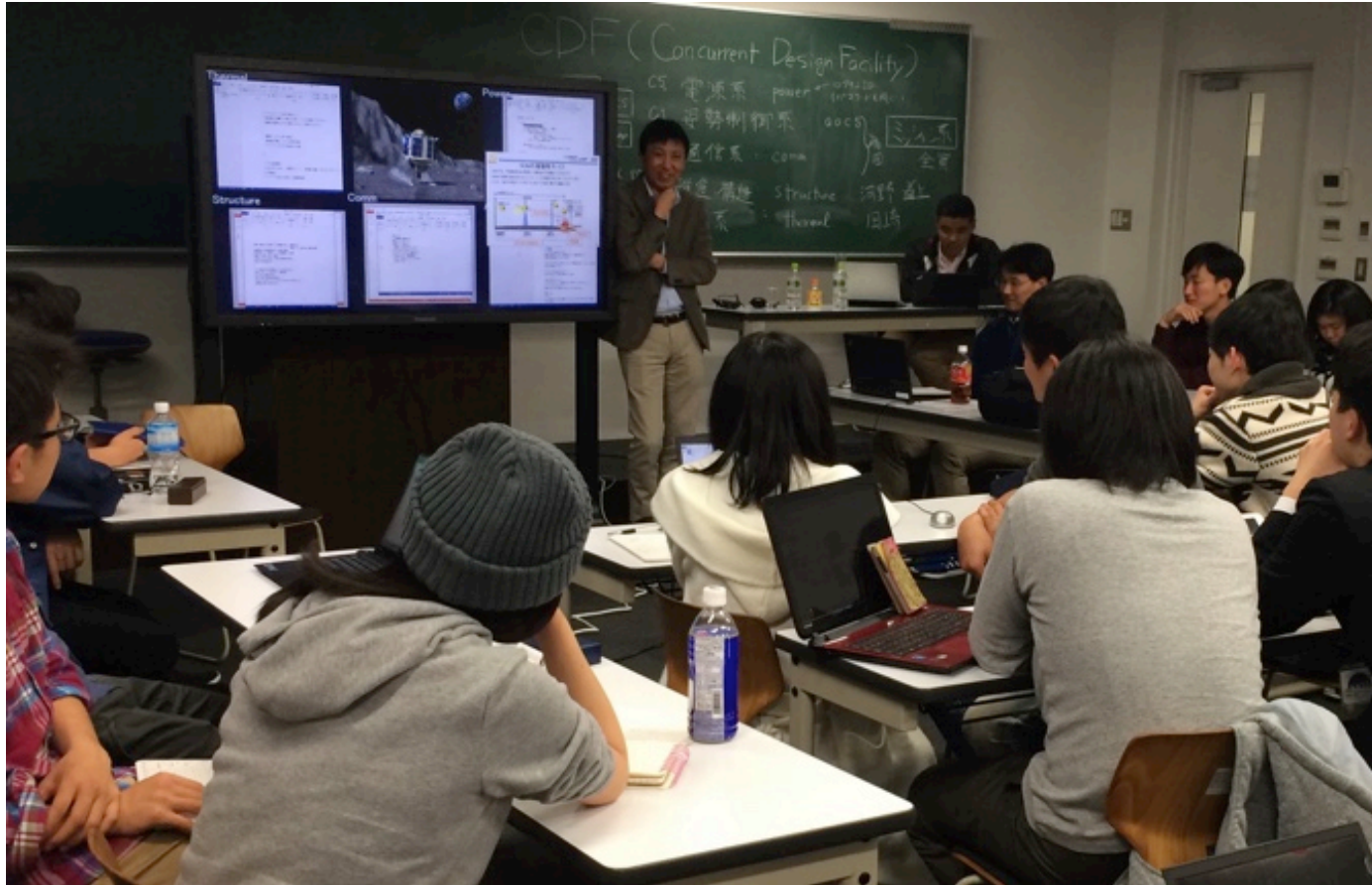
This ability to change the magnification of the physical display is a key feature of the VDA.



## Illustrated of Use Case 1: Co-located Collaboration



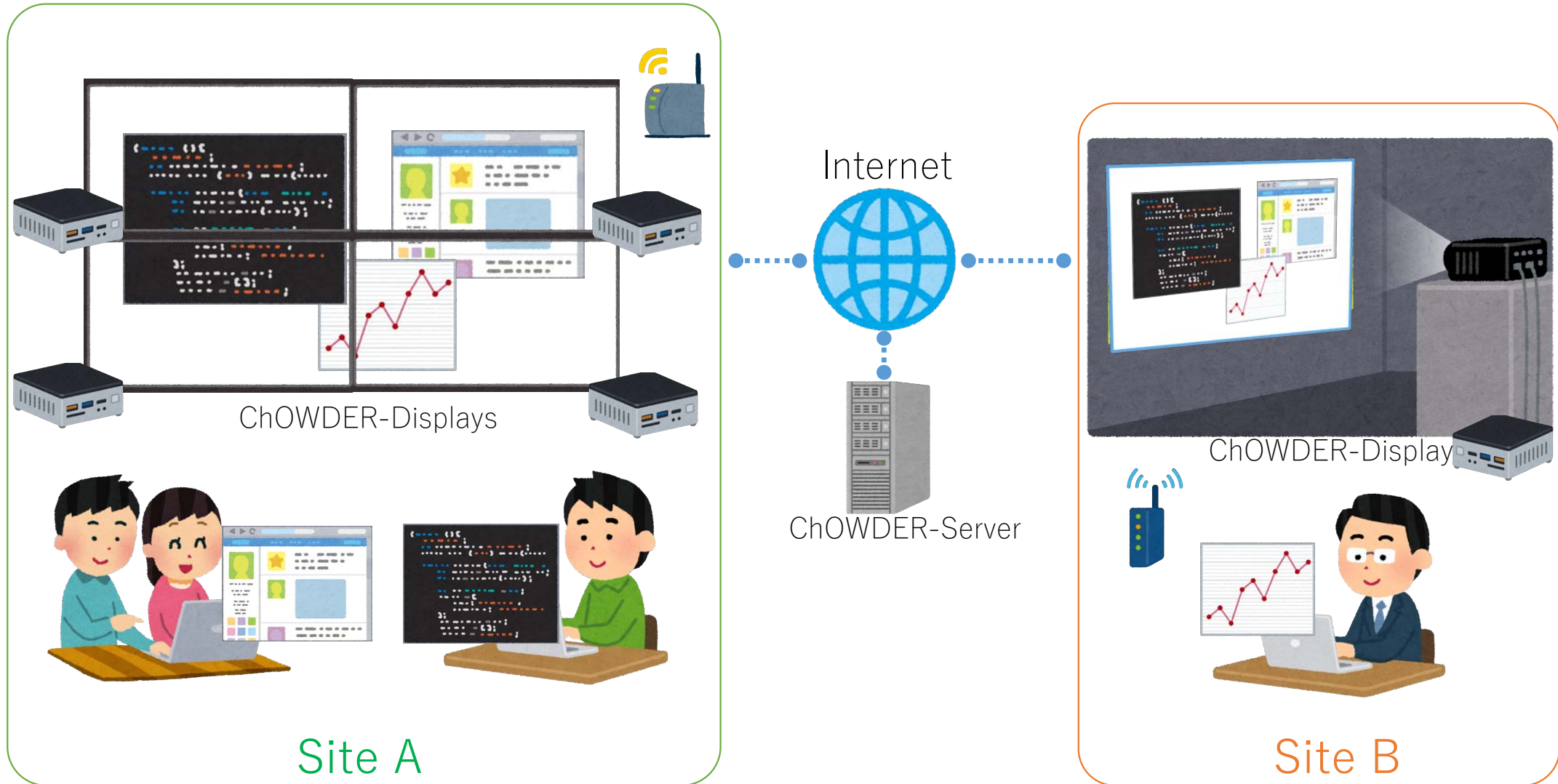
# Use Case 1: Co-located Collaboration



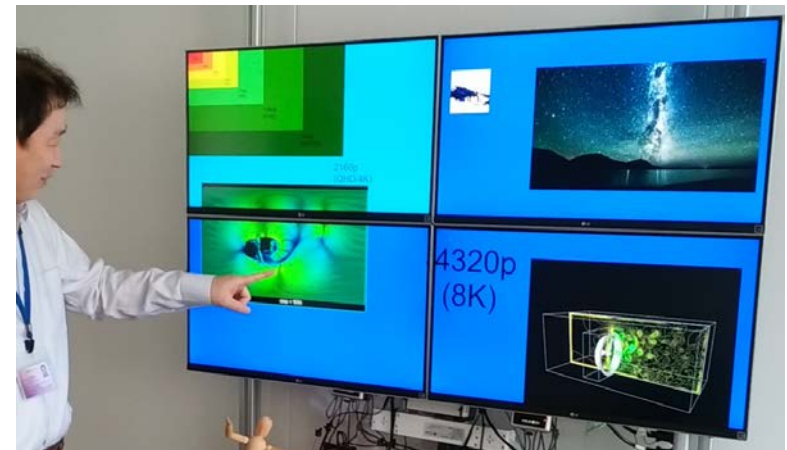
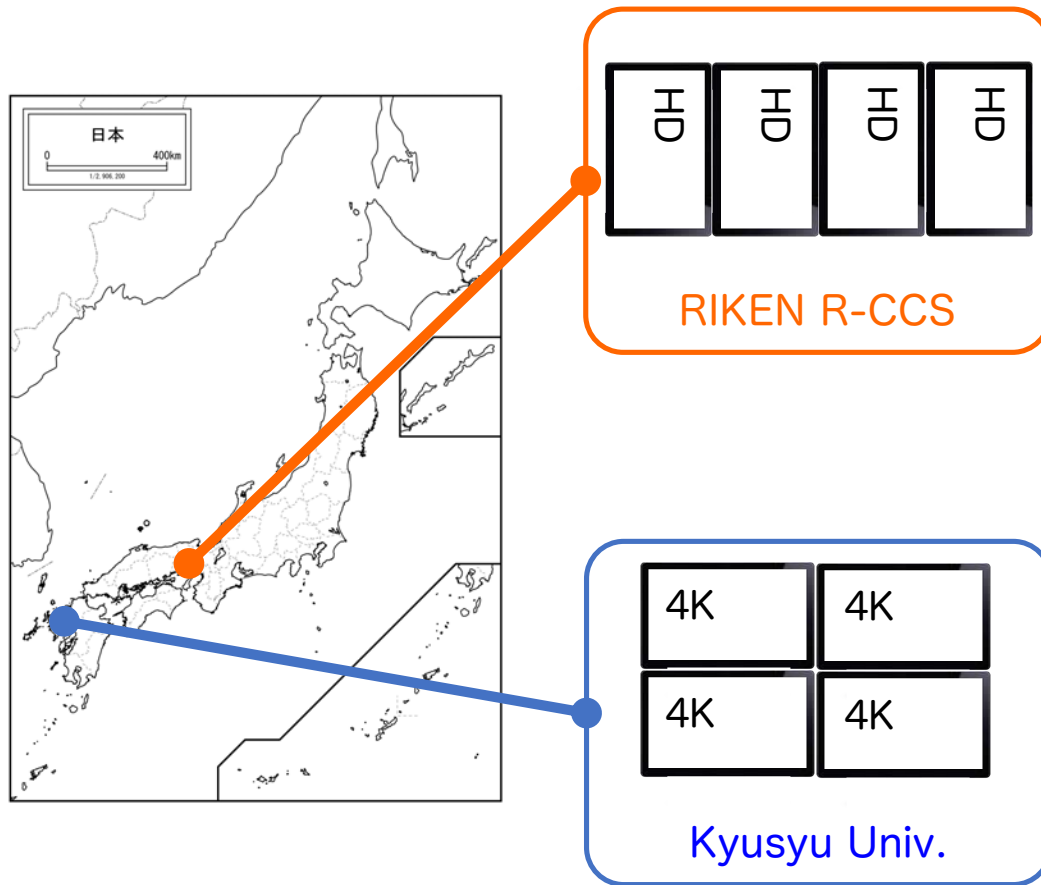
A small satellite (CubeSat) design exercise using concurrent design method.  
Image courtesy of Fujii-Tatsukawa Lab., Tokyo University of Science.



## Illustrated of Use Case 2: Remote Collaboration



## Use Case 2: Remote Collaboration

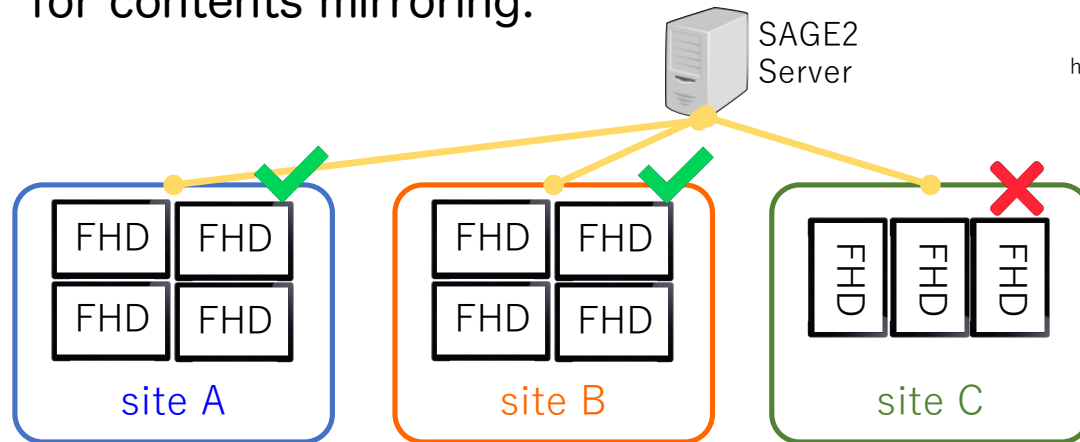


Contents can be mirrored between remote sites where have different display constitution.



# Related Work of Web-based Scalable Display System

- **SAGE2**
  - A de facto standard in HPC field
  - Web-based, JavaScript, Node.js
  - Utilizable for remote collaboration
- Limitation on remote collaboration
  - All sites need same display configuration for contents mirroring.

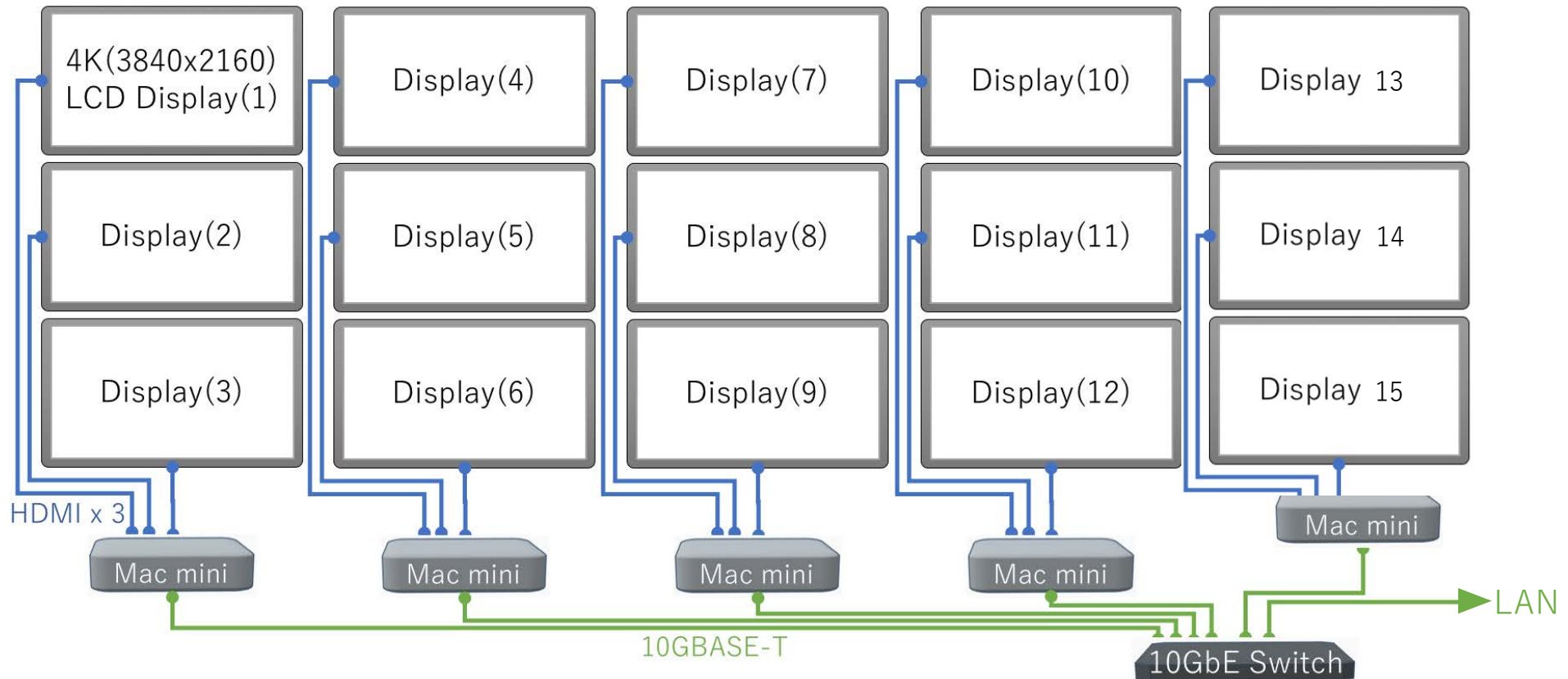


**SAGE2**<sup>TM</sup>

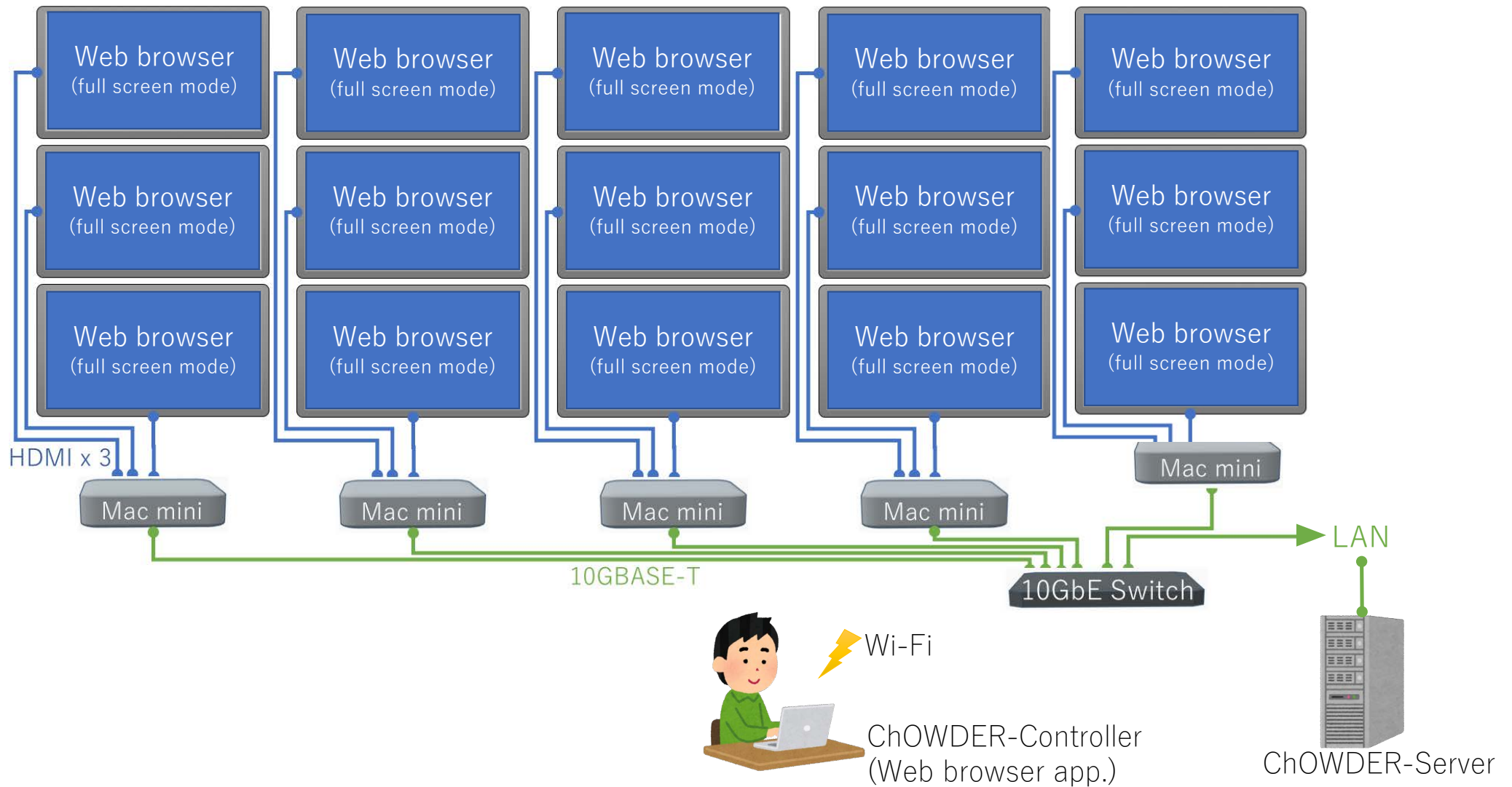


<http://sage2.sagecommons.org/wp-content/gallery/misc/sage2-displays-cybercommons-people.jpg>

# Tiled Display System @ R-CCS

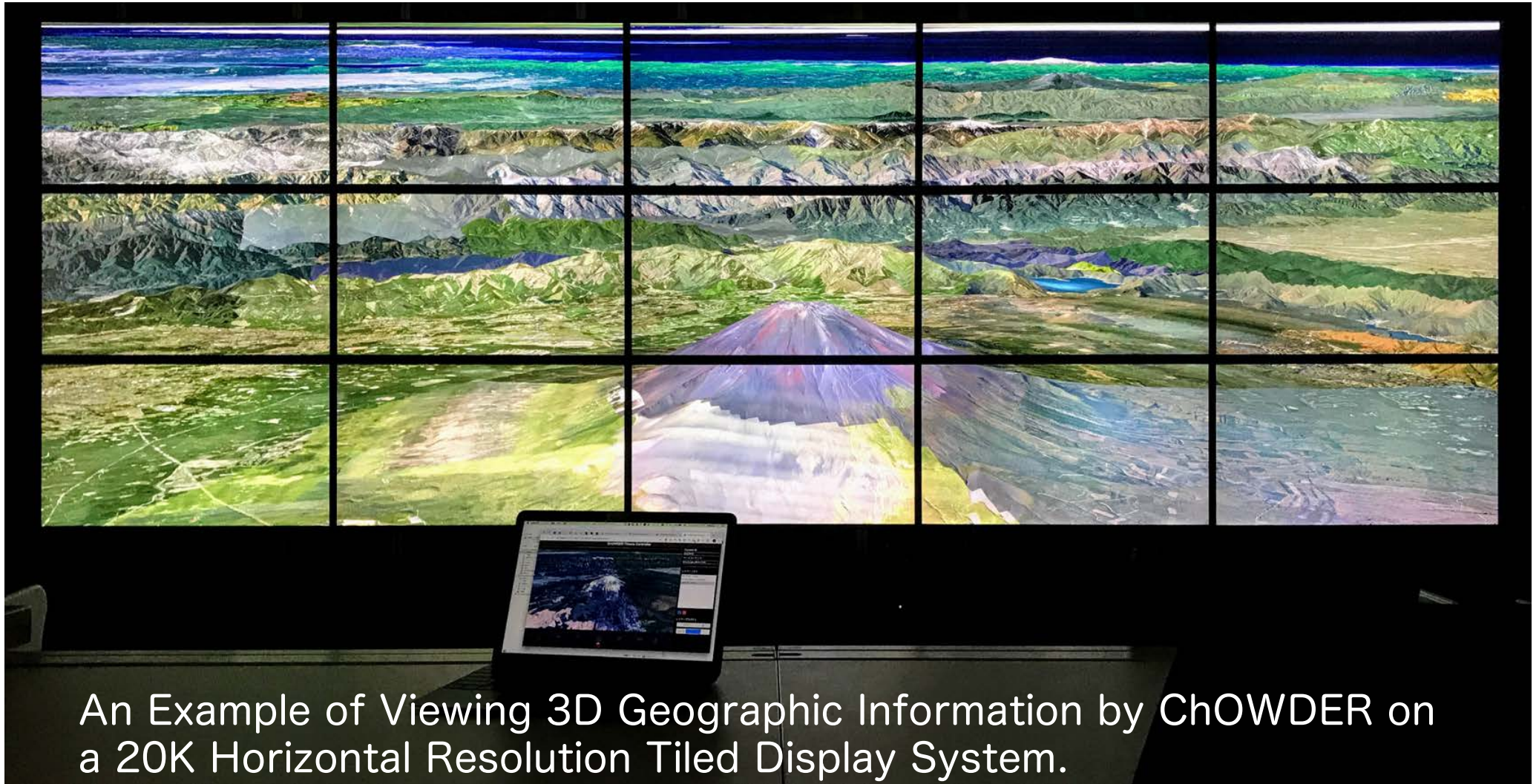


# ChOWDER System @ R-CCS





# A New Feature: 3D Web GIS Viewer

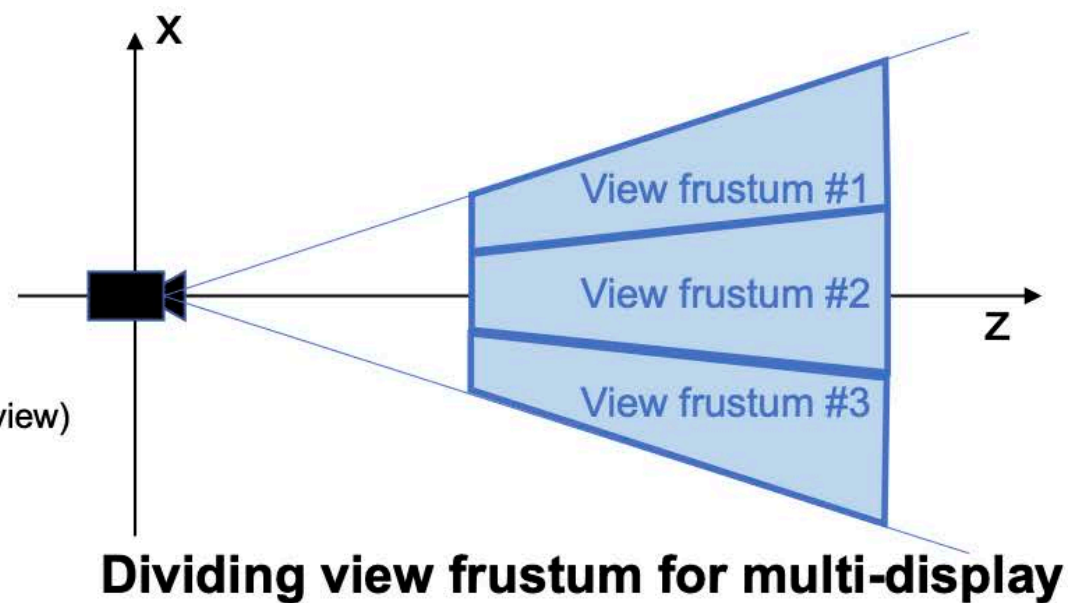
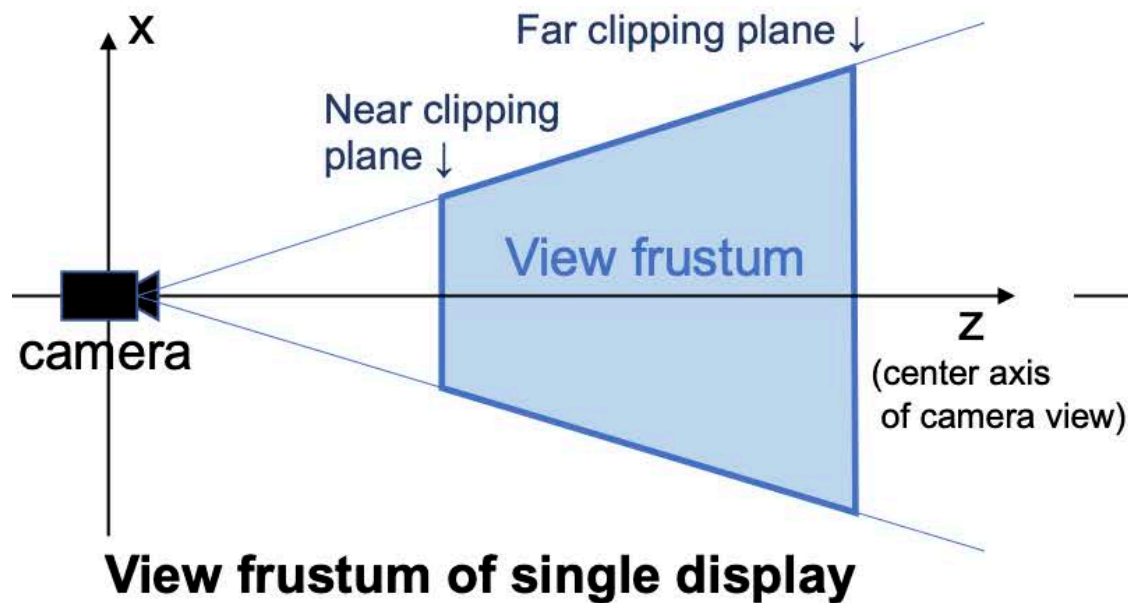


An Example of Viewing 3D Geographic Information by ChOWDER on a 20K Horizontal Resolution Tiled Display System.

Map data published by Geospatial Information Authority of Japan

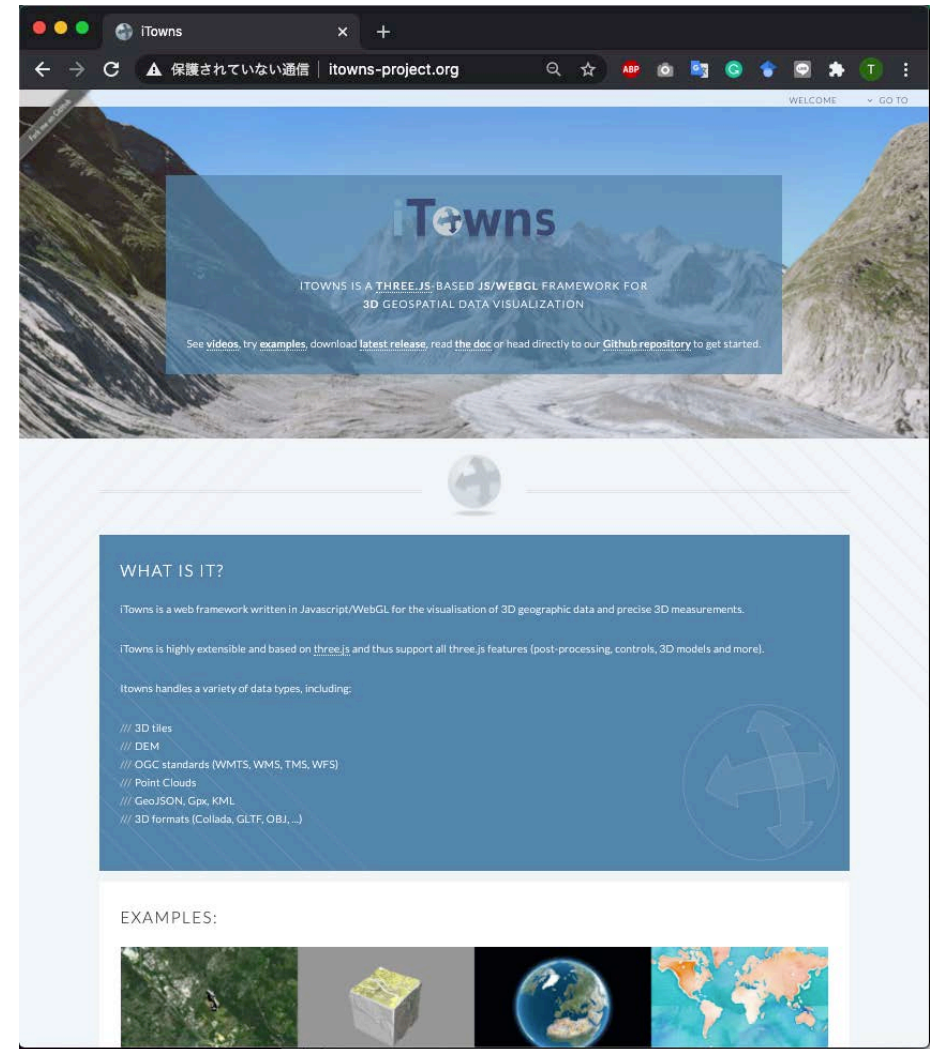
# View Frustum Dividing Using Three.js

- To display the 3D content on distributed display should be divided its view frustum.
- Three.js (a library of JavaScript) has API which enables to offset of the view frustum.



# iTowns

- Open source 3D Web GIS
- Built on Three.js
  - enabled camera-offset API.



<http://www.itowns-project.org/>



# Related Work(1)

- SAGE2
  - De fact standard Web-based scalable display system
  - Can render a Google maps content span the multiple displays
- Google maps is a 2D GIS



<http://sage2.sagecommons.org/wp-content/uploads/slideshow-gallery/brazil-rnp-riooffice2-painesage2rnprij.jpg>

# Related Work(2)

- Liquid Galaxy
  - Introduced as distributed rendering software for Google Earth
  - Needs cylindrical-shaped multi-display

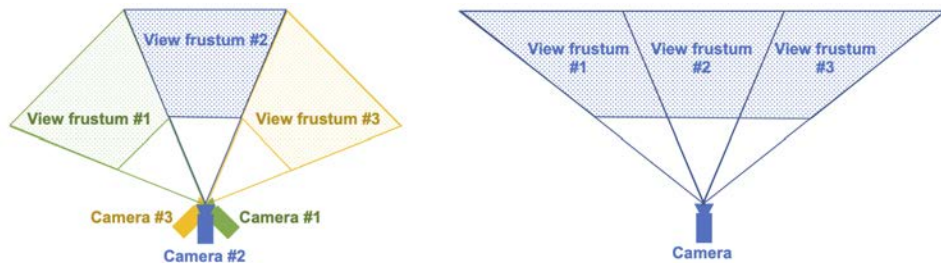


Fig. 4. Comparison of View Frustum Segmentation Methods. Liquid Galaxy (left) and ChOWDER (right).



<https://liquidgalaxy.org/img/carousel/0.jpg>



# Displaying User-Defined Data on GIS Viewer

- Users can overlay their own data on the map view as standard GIS tools can do.



Showing a typhoon cloud captured by the meteorological satellite converted into the point-cloud of about 500 million points.

The meteorological satellite data courtesy of The National Institute of Information and Communications Technology and CReS, Chiba University.  
Map data published by Geospatial Information Authority of Japan



# 補足資料

- GitHubにてソースコードとドキュメントを配布
  - <https://github.com/SIPupstreamDesign/ChOWDER>
  - BSD2 ライセンス
  - “202009”ブランチが最新（開発中）版
- 発表済論文
  - Kawanabe, T., Hatta, K., and Ono, K. (2020, September). ChOWDER: A New Approach for Viewing 3D Web GIS on Ultra-High-Resolution Scalable Display. In Proceedings of *The 2020 IEEE International Conference on Cluster Computing* (pp. 412-413).
  - KAWANABE, Tomohiro, et al. Showing Ultra-High-Resolution Images in VDA-Based Scalable Displays. In: *International Conference on Cooperative Design, Visualization and Engineering*. Springer, Cham, 2019. p. 116-122.
  - Kawanabe, T., Nonaka, J., & Ono, K. (2018, August). Chowder: Dynamic contents sharing through remote tiled display system. In *11th International Symposium on Visual Information Communication and Interaction, VINCI 2018* (pp. 108-109). Association for Computing Machinery.