October 2021

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## ABSTRACT

In most video collaboration systems, only one user may share their screen at a time. If another user wishes to also share their screen, commonly the previous user's shared screen disappears. Techniques are presented herein that allow any meeting participant to control the distribution of video streams. In particular, aspects of the presented techniques enable multiple participants to share their screens, allow individual users to choose which shared screens they wish to view on their local "stage," and allow a user to synchronize their stage with other participants.

## DETAILED DESCRIPTION

In most video collaboration systems, only one user may share their screen at a time. If another user wishes to also share their screen, commonly the previous user's shared screen disappears. While there have been a few industry developments concerning the simultaneous sharing of multiple users' screens, significant challenges remain. For example, there is no method by which the distribution of streams may be controlled, thereby allowing the synchronization of multiple streams of content in a single video conference and further allowing participants to select which screens they wish to view and to be synchronized with other participants.

To address the types of challenges that were described above, techniques are presented herein that allow any meeting participant to control the distribution of video streams.

Figure 1, below, depicts elements of how aspects of the techniques presented herein may work within the context of a first illustrative example.
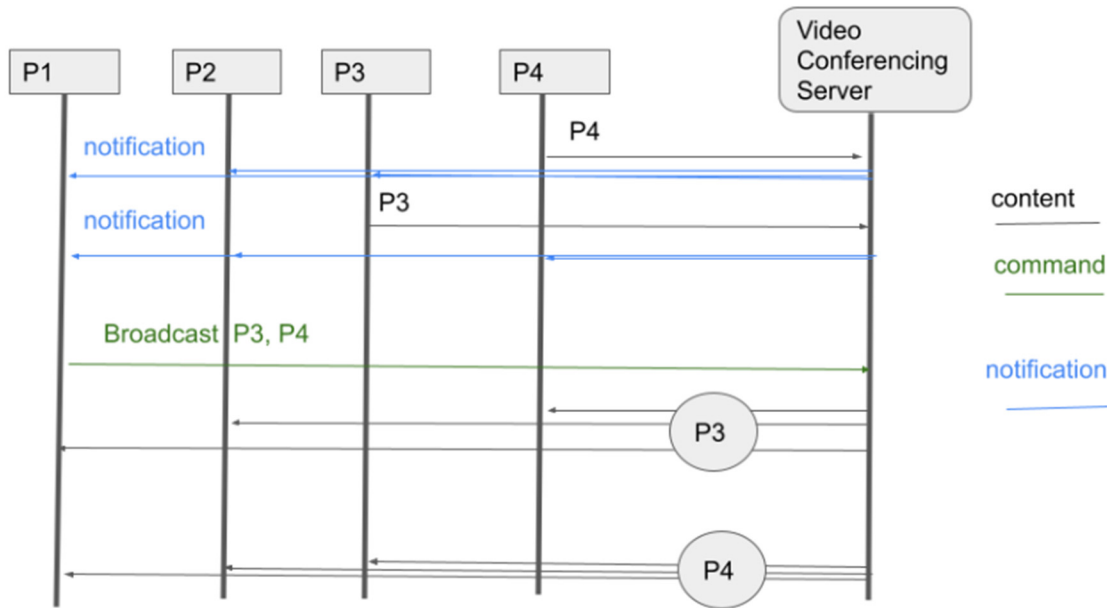
*Figure 1: Controlling Distribution of Multiple Video Collaboration Streams*

As shown in Figure 1, above, the first illustrative example encompasses four video collaboration participants – P1, P2, P3, and P4. At some point, consider that participants P3 and P4 begin to share content. The video streams from participants P3 and P4 proceed to the video collaboration server. When the video collaboration server receives those streams, it notifies the participants of the available content streams. Such a notification may include, for example, a snapshot of the content stream that the server has received. A notification may be repeated periodically, thereby allowing the snapshot to be updated.

A participant may choose, from the available content streams, the specific content they wish to place on their own local view (i.e., their "local stage").

Continuing with the first illustrative example, assume that participant P1 wishes to allow the content from participants P3 and P4 to be simultaneously viewed by all of the participants.

First, participant P1 may drag and drop the shared content from participant P3 and P4 into their own local view. Participant P1 can then send a command to the video collaboration server to broadcast their local view, which at this point contains the content from participant P3 and P4. After the video collaboration server receives the broadcast command, it may send the content on participant P1's local view to everyone, which means

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that participant P1's local view will overwrite the other participants' previous local views, and everyone will then see the same content on their local views.

In general, each participant may send such commands to the video collaboration server to share their local view and overwrite the other participants' previous local views. Additionally, each participant may send a command to the video collaboration server to stop broadcasting a specific content stream. There are two ways to stop broadcasting content. A participant who is sharing content (i.e., P3 or P4 in the previous example) can stop sharing the content, and that content would then cease being shared to all of the participants, or a participant can send a request to stop sharing content from another source (i.e., P1 to request stopping content from P3). This can be achieved by the participant who is sharing their local stage removing content from their local stage, and then the other participants will no longer see that content on the synchronized stage.

While setting up a video collaboration session, or from overall limits that may be set by an organization's administrator, it is possible under aspects of the techniques presented herein to limit the maximum number of allowed content streams that are to be broadcast simultaneously (e.g., how many participants may share at the same time). It is also possible to limit the ability to start or stop additional content streams to just a subset of the participants (e.g., who can broadcast their view with everyone).

Alternatively, under aspects of the techniques presented herein, employing the same method as described above, a participant may announce a Uniform Resource Locator (URL) of content to the video collaboration server instead of sharing a content stream. Such a URL may identify a web page. The video collaboration server will then, as above, notify all of the other participants about the available content and optionally add a preview of the rendered page. A participant may request to broadcast that content, upon which the server will send the request to every other participant in the collaboration session, allowing the participants to see the URL content. Additionally, under aspects of the techniques presented herein, a meeting host may have the ability to stop a share, if and as needed, at any time.

The narrative that is presented below will describe and illustrate elements of an end-user experience according to aspects of the techniques presented herein.

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Such an end-user experience employs a "stage" concept from the "move participants to the stage" feature that is currently available in different video collaboration systems. A stage refers to a meeting participant's local view, that is, the area where a user defines what they want to see as their main display. In the current meeting experience of different video collaboration systems, the active speaker or shared content would appear on the stage by default, and a user can customize their stage by adding more participants to the stage. But currently, a user would never be able to see multiple shared screens on the stage because there is no way for multiple meeting participants to simultaneously share their screens. By employing aspects of the techniques presented herein, a meeting participant is able to select from all of the shared screens to determine what to place on their local stage.

Elements of the user experience according to aspects of the techniques presented herein may be explicated with the aid of a second illustrative example, comprising 15 participants in a meeting with five of the participants (Kristin Stone, Clarissa Smith, Kevin Woo, David Wilcox, and Sonali Pritchard) sharing their screens.

As shown in Figure 2, below, the user is initially viewing Kristin's screen, which is the only screen on the user's stage. There is a blue banner message displayed above the stage informing the user of the existence of the other four shared screens. If the user wishes to add more shared screens to their stage, there are two approaches that they may pursue according to aspects of the techniques presented herein.
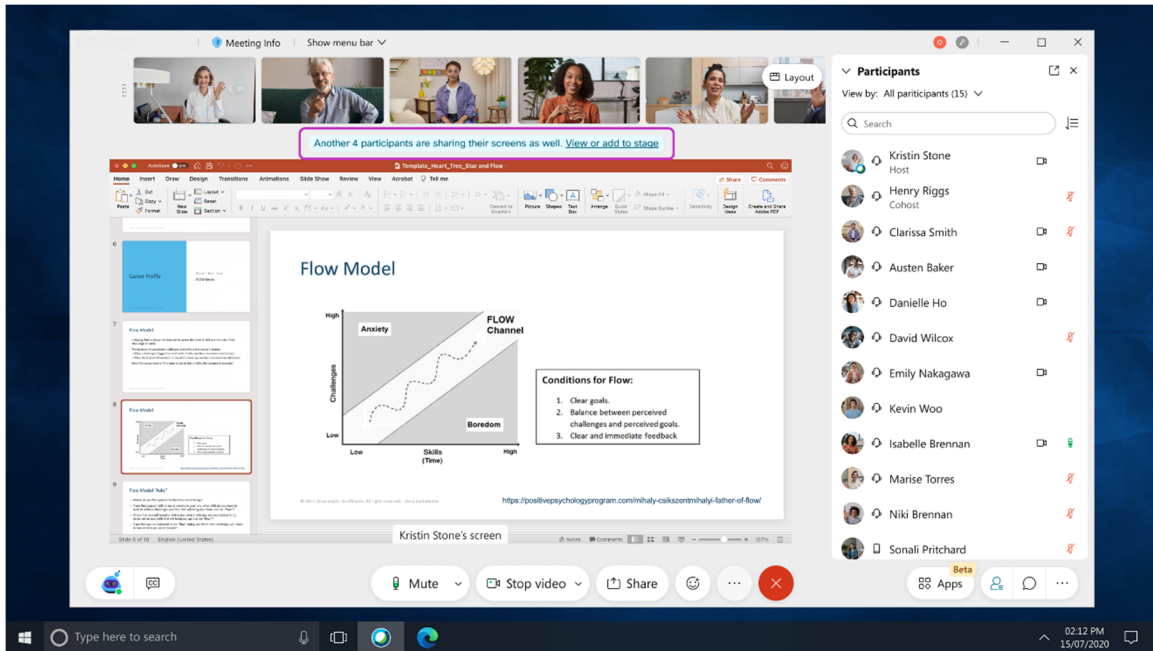
*Figure 2: Single Shared Screen Currently on Local Stage*

Under a first approach, a user can select the "View or add to stage" link that is presented at the end of the blue banner message above the stage and near the top of the screen, as shown in Figure 2, above. A modal window will then open, as shown in Figure 3, below, where the user can view all of the shared screens in a list.
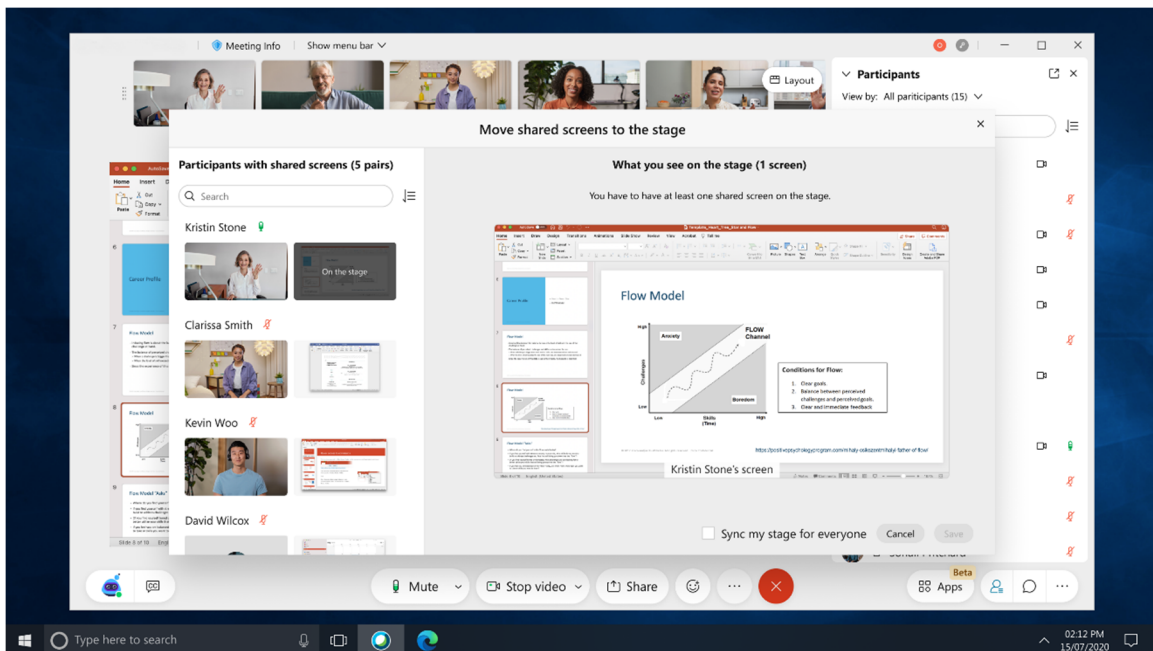


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*Figure 3: Illustrative List of Shared Screens That May be Selected*

As depicted in Figure 4, below, the user may then drag and drop certain shared screens to their local stage to make them visible.
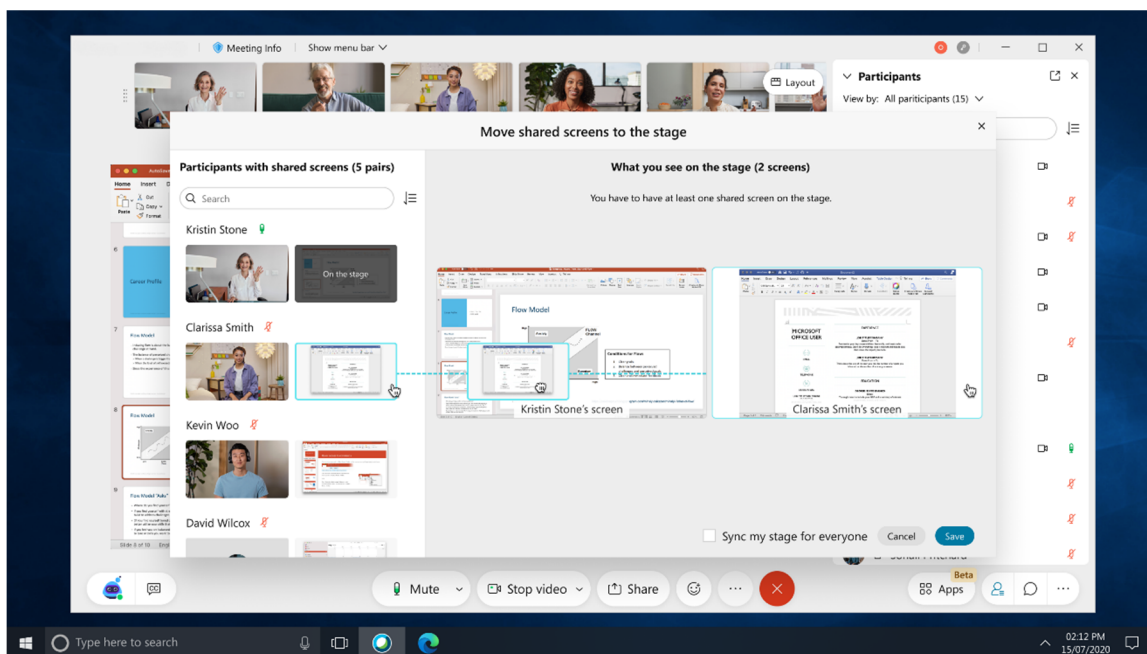


*Figure 4: Exemplary Drag-and-Drop of Shared Screens to Local Stage*

Additionally, through a checkbox that is included at the bottom right-hand corner of the modal window, a user has the option of synchronizing their stage view for everyone else so that all of the meeting participants will see the same content that is presented on their stage.

Under a second approach, a user may employ a "View by" control from the participant panel, as shown in Figures 5 and 6, below, to see all of the participants who are sharing screens.
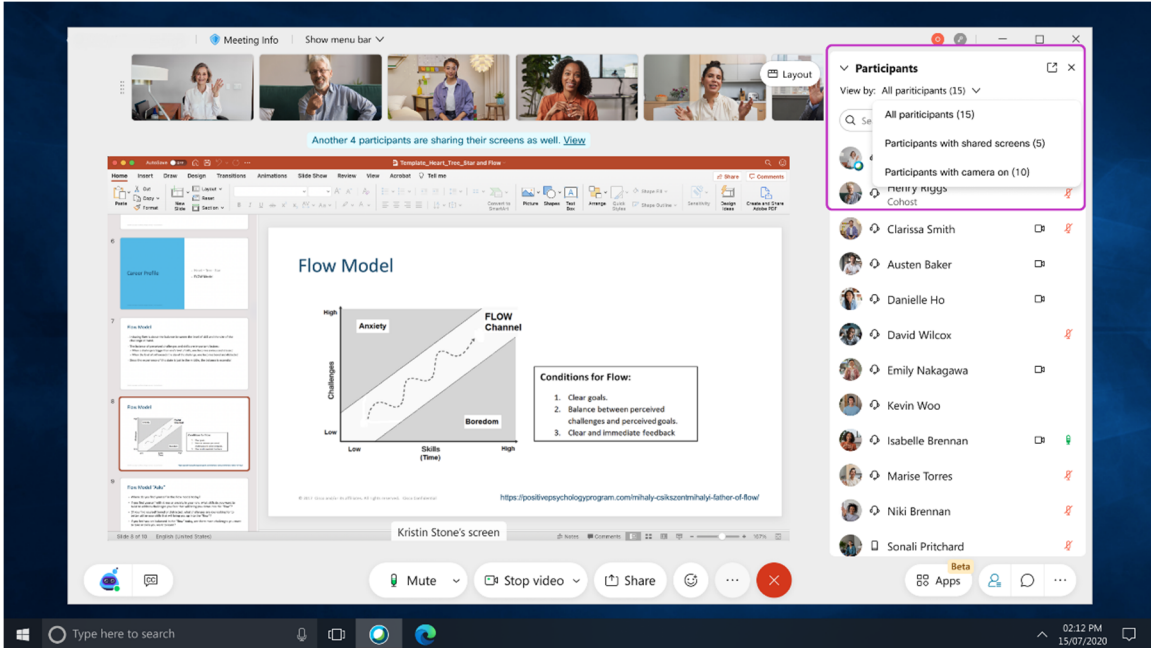
*Figure 5: Exemplary Option to View Participants with Shared Screens*
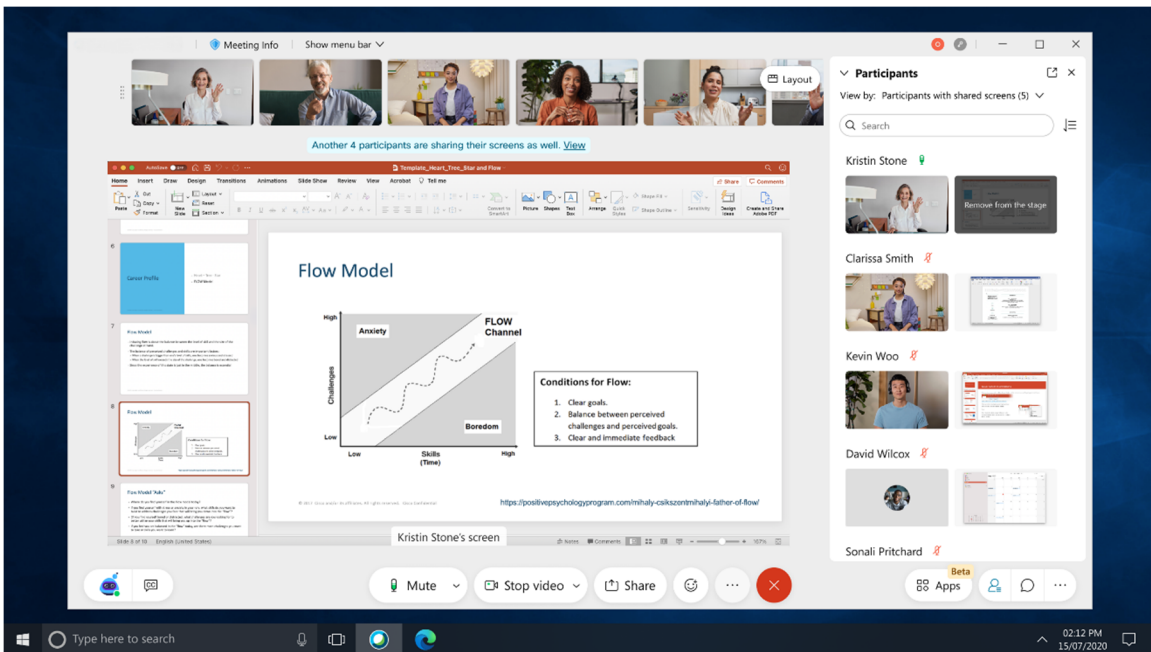


*Figure 6: Illustrative List of Participants with Shared Screens*

From there, the user may hover over any shared screen or a participant's camera view to add them to the user's stage, as shown in Figure 7, below.

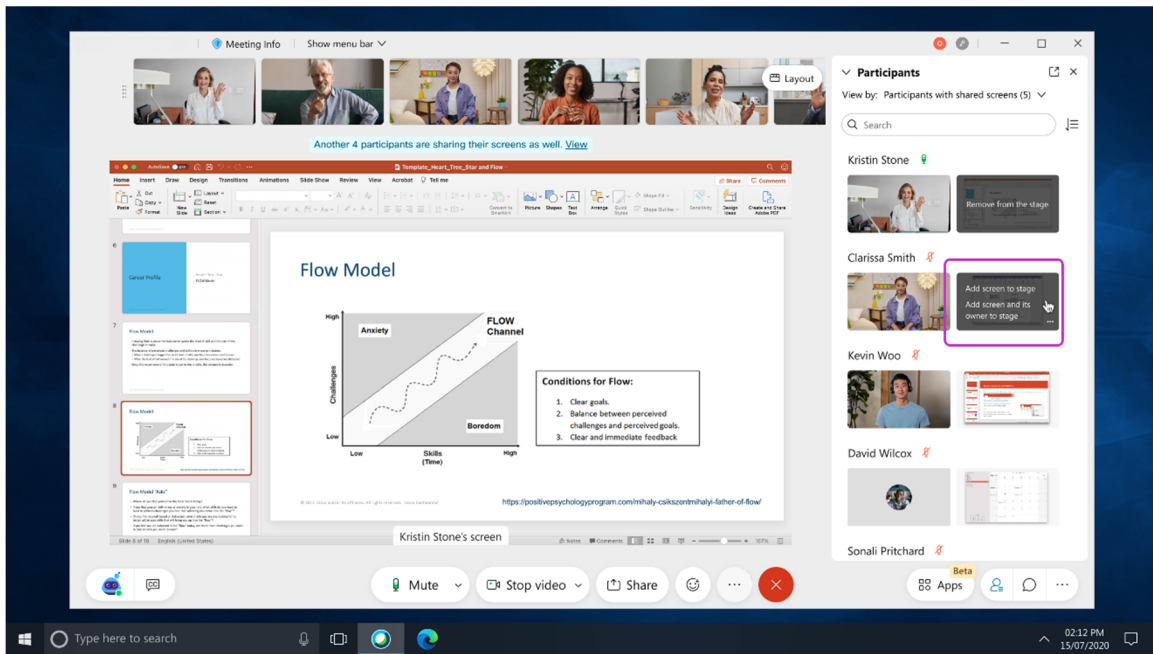7                                                                        6673

*Figure 7: Exemplary Hovering Over Shared Screen to Move to Local Stage*

As depicted in Figure 8, below, once the user adds a screen to their stage, that screen will appear on the user's local stage.
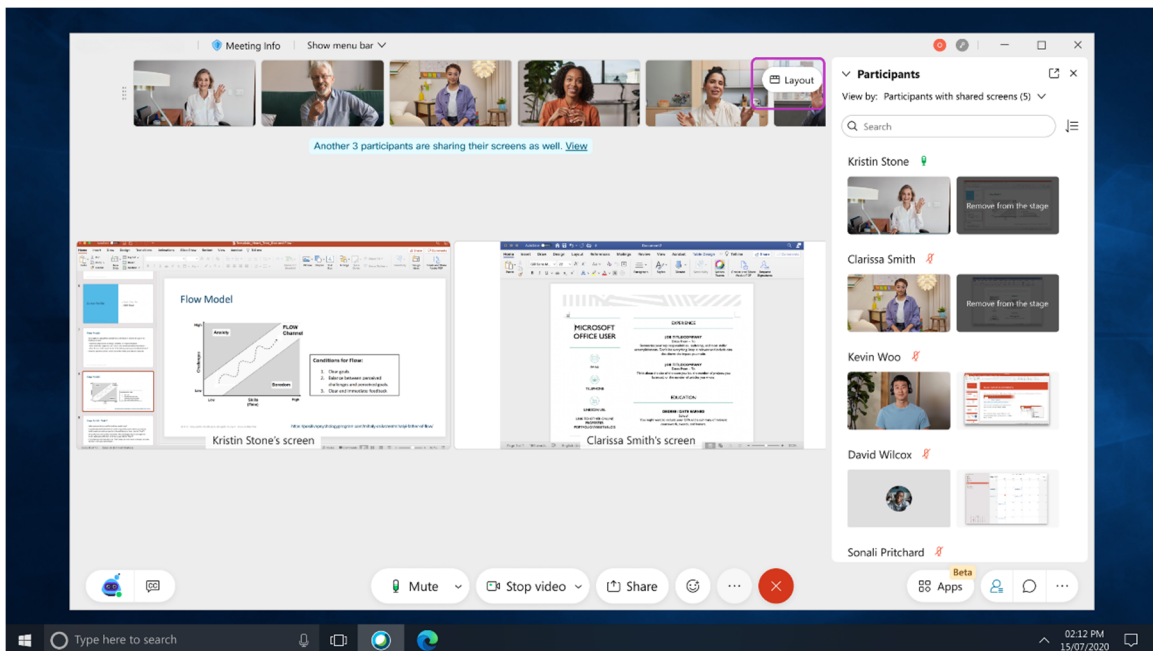


*Figure 8: Exemplary Screen Layout Options*

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The user has the option to synchronize their stage, for everyone to see, as demonstrated in Figure 9, below.
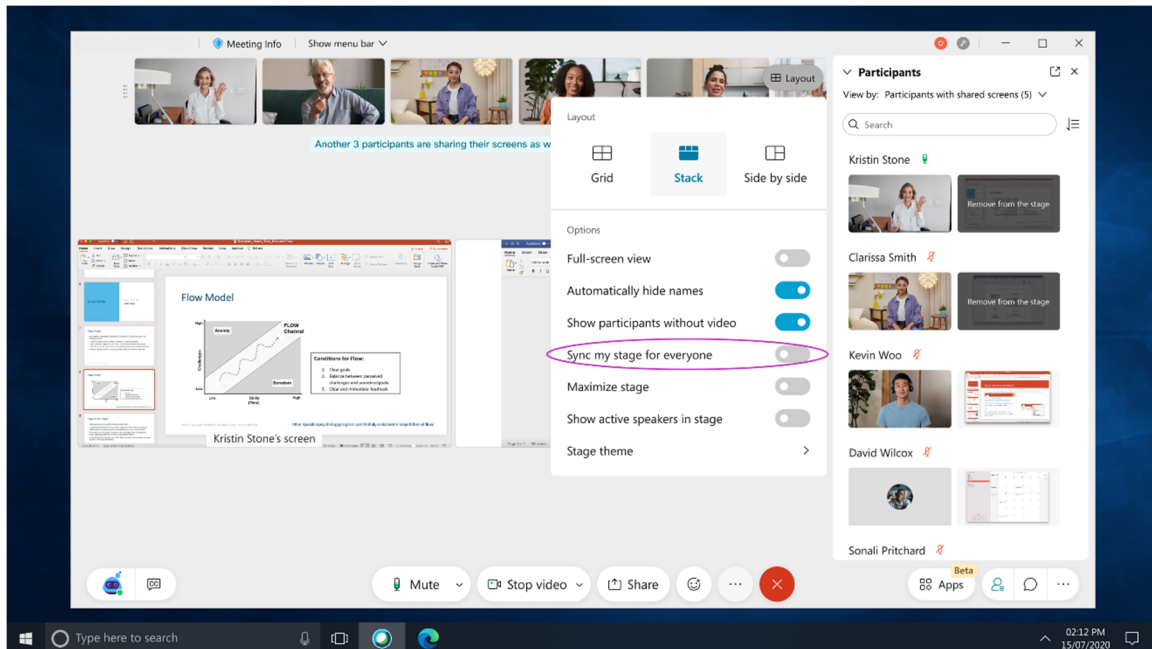


*Figure 9: Illustrative Synchronization of Local Stage with All Participants*

In summary, techniques have been presented that allow any meeting participant to control the distribution of video streams. In particular, aspects of the presented techniques enable multiple participants to share their screens, allow individual users to choose which shared screens they wish to view on their "stage," and allow a user to synchronize their stage with other participants.

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