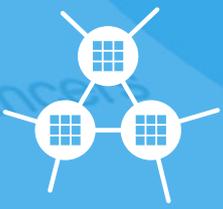


SpreadSheetSpace Link

WHITE PAPER - September 2016





SpreadSheetSpace Link

Summary

SpreadSheetSpace Link is the basic gateway to the SpreadSheetSpace, i.e., to a virtual space in which spreadsheets can establish links, exchange updates and maintain alignment.

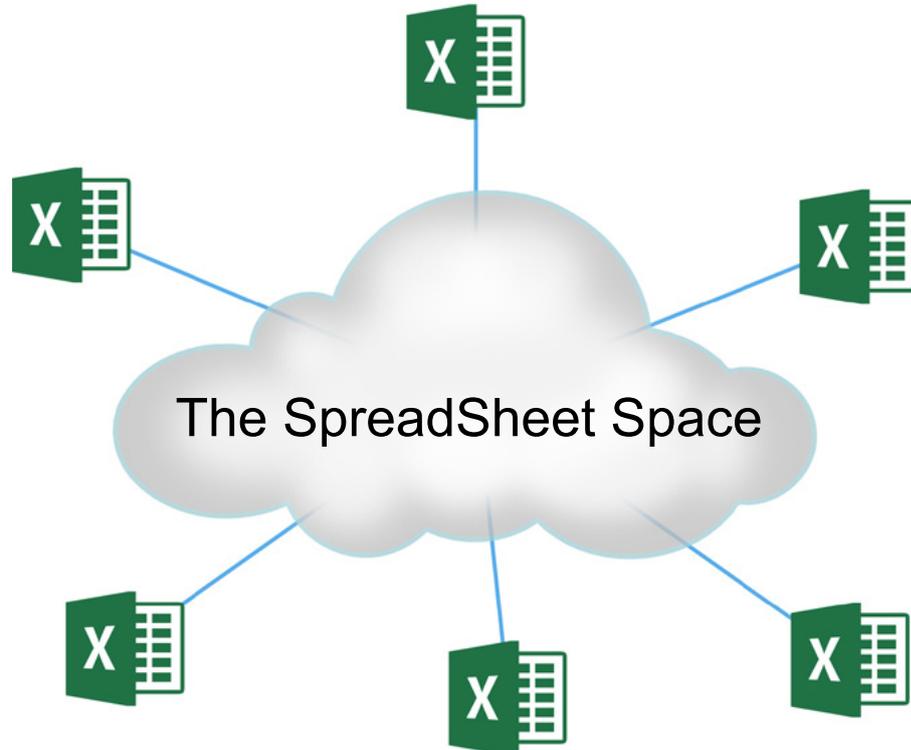
Link can be easily installed as an additional component (add-in) to any Microsoft Windows® version of Microsoft Excel® without administration privileges and immediately increases user productivity and collaborative work.

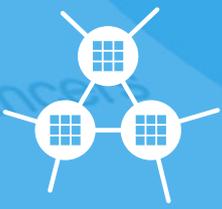
Link allows Excel users to expose Views of cells, ranges of cells, tables and whole sheets to other users and to link their spreadsheets to existing Views. The combined action of several expose-link connections gives birth to systems of connected spreadsheets through which Excel users maintain a unique version of a distributed information base.

No more exchange of Excel files in the form of email attachments, no more multiple versions of the same file, no more wrong decisions based on out-of-date data.

Link gives Excel users the possibility to develop personalized analyses and presentations based on data available in the Spreadsheet Space and to count on the fact that such analyses and presentations are constantly up-to-date.

This white paper introduces the Link concept, i.e., why Link was conceived, how it works, what new interaction patterns enables and how it compares against spreadsheet sharing. It then shortly describes the Link environment and how a user can download and use it.





SpreadSheetSpace Link

The Link concept

Link enables workgroup collaboration through tabular data exchange using Excel as an interface. The following use cases explain the typical scenarios that **Link** addresses.

The first use case is related to **information publication**. Information publication refers to the situation in which an Excel user publishes spreadsheet data that evolves over time, to be used by other Excel users to build dynamical analyses and presentations. The fact that the data provided evolves over time forces the publisher to send new data versions at any update and the receiver to check the incoming mail and get the new data at any new message through multiple copy/paste/attach/mail send/mail receive operations. **Link** allows Excel users to create Views of the spreadsheet data that they want to expose and to link to existing Views. The SpreadSheetSpace platform maintains the Views aligned. To create Views Excel users simply select the data view that they want to publish, enter the target Excel user list and issue a Create View command, under the Outbound button. The target users simply select the location at which they want to place the Views in their spreadsheets and issue a Join View command under the Inbound button. The create/join command pair creates permanent connections between the exposed Views in the source spreadsheets and the linked Views in the target spreadsheets, so as to guarantee alignment.

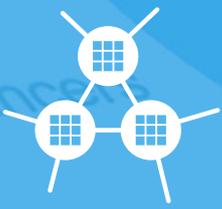
The second use case is related to **information collection**. Information collection refers to the situation in which an Excel user creates a Form to be filled out by another user and provides the Form to such a user to have him/her fill it out, update and finally submit. The possibility to update the Form over time requires the exchange of successive email messages through multiple copy/paste/attach/mail send/mail receive operations. **Link** allows Excel users to create forms and to have other Excel users fill them out. The Form creator simply creates and formats a cell range, enters the target Excel user requested to fill out the form, and issues a Create Form command under the Outbound button. The target Excel user simply selects the location at which the Form must be installed in his/her spreadsheet and issues a Install Form command under the Inbound button. The Create Form/Install Form command pair creates a permanent connection between the installed Form and the created Form, so that any update in the installed Form reflects on the created Form.

Product list management is a simple example of the first use case. A product list manager maintains the general product list in a central Excel spreadsheet and publishes the regional product lists, which are linked to the general product list, to the regional area managers. The regional managers link their spreadsheets to the central spreadsheet and create personal analyses and presentations. As the regional manager spreadsheets and the central spreadsheet constantly maintain alignment, the personal analyses and presentations automatically follow the evolution of the general product list (e.g., product price variation, stock availability, etc.).

Budgeting is a simple example of the second use case. A budget coordinator collects budget data from the contributing organizational structures (e.g., procurement, human resource, research, etc.), which in turn collect data from lower level organizational structures. The global budget can be seen as a live composition of data evolving over time, typically following top-down directives from the budget coordinator to the contributors and bottom-up data updates from the contributors to the budget coordinator.

How Link improves Excel

Link improves Excel by providing a powerful, secure, scalable and easy to use platform



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to allow Excel users to interconnect their spreadsheets, thus supporting a widespread diffusion of such a practice. More specifically **Link** allows Excel users to create Views of Excel data so as to allow other Excel users to maintain their workbooks synchronized with such Views in a secure and managed way from any location, thus enabling the creation of customized analyses and presentations automatically evolving with the source Excel data. **Link** supports the establishment of peer-to-peer relationships as well as the creation of systems of connected spreadsheets when many spreadsheets have mutual dependencies.

The distinctive characteristics that make Link unique and distinguish it from what Excel currently supports are listed below:

- Link gives Excel users the possibility to exchange cells, cell ranges, tables and whole sheets inside Excel without resorting to external mail tools.
- Link gives Excel users the possibility to maintain Excel spreadsheets permanently synchronized, thus transforming Excel into a live tool.
- Link gives Excel users the control over data access. Excel users expose Views of spreadsheet data to other Excel users, who simply link to such Views.
- Link gives Excel users the possibility to configure the synchronization policy that best suits their needs (i.e., in real time, or on explicit user 'refresh' command).
- Link ensures that all Excel users access the latest data versions and allows each user to manipulate them in identical or unrelated ways. Data Integrity is guaranteed.
- Link supports both raw data Views and data Views enriched with formats, styles and formulas, thus giving Excel users the possibility to prepare live presentations.
- Link overcomes any connection limitation due to its strong security enforcement. It works at the application layer and interoperates with enterprise-grade firewalls and proxies.
- Link turns out to be a powerful data mashup tool, in that it supports the integration of data exposed by multiple Excel spreadsheets.
- Link allows performing distributed data analysis in Excel, thanks to Excel large set of tools and features, such as Pivot tables, Pivot Charts and more.
- Link works with all Excel versions. It requires neither a special version of Excel (Enterprise, Office 365® Pro) nor a special environment (SharePoint Server®).

The Link Functionalities

Link enables two functionalities, namely Create/Join and Create/Install.

Create View/Join View

These two functionalities allow creating a permanent asymmetric connection from the spreadsheet of the Excel user who distributes information (i.e., the source) to the spreadsheets of the Excel users who receive information (i.e., the targets). The "permanent" adjective denotes the fact that the relationship remains until it is removed. The "asymmetric" adjective denotes the fact that the two Excel users play different roles. The source exposes a View of a cell range (of fixed size) or of a table (of variable size) while the targets creates local images of such a cell/range/table by linking to the exposed View. Being images of



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something else, linked Views are write protected. Any update in an exposed View appears in the linked Views.

Four aspects deserve to be described in more depth.

- **Formats and Styles:** The formats and the styles assigned to cell ranges and tables exposed as Views are preserved in the linked Views
- **Formulas vs Values:** Values and not formulas are reported in the linked Views. The information on the way the cell values are computed is lost in linked View to exposed View synchronization.
- **Cell ranges vs Table:** While cell ranges are rectangular areas of fixed size, tables, in the Excel sense, are rectangular areas of variable size, typically made up of records having the same structures in the rows. When an exposed View is related to a table the size changes are reported in the corresponding linked View.
- **Update policies:** When the value of a cell included in a cell range/table exposed as a View changes it is expected that the change appears in the linked View. This is actually what happens, but the time at which it happens depends on how the source and the target user have configured their operation. The Join View operation can be configured either real time or manual. Real time means that a change in a joined View immediately appears in the target spreadsheet, whereas manual means that any update of a joined View is reported on the target spreadsheet only when explicitly requested by the user.

Create Form/Install Form

These two functionalities allow creating a permanent asymmetric connection from a spreadsheet of an Excel user who is requested to fill out a Form to the spreadsheet of the Excel user who is supposed to collect the form. The Create Form/Install Form process is activated by this latter user, who prepares the form, i.e., formats a cell range, enters the id of the user to be requested to fill out the form, and issues the create command. The user requested to fill out the Form selects the location at which he/she wants to install the Form in a spreadsheet and issues the Install Form command. Once the command is executed a permanent asymmetric connection from the installed Form and the original Form is created.

The Link Environment

Link consists of two components, namely the Excel Add-In and the Management Console.

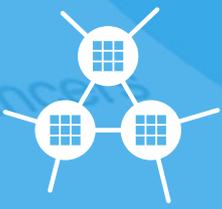
The Excel Add-in

The Excel Add-In allows the Excel users

- to send and receive cells, cell ranges, tables and sheets
- to expose cells, cell ranges, tables and whole sheets and to link to them
- to create and install forms.

The Excel Add-in is compatible with Excel 2003, 2007, 2010 and 2013.

The Add-In exhibits a user interface matching the Excel look and feel, adding the SpreadSheetSpace tab in the Excel ribbon. Through such an interface the users may configure sheet synchronization, display the update notifications and edit the update policies.



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The Web Console

The Web Console provides the functionalities to manage and control the Link service. In particular it supports the management of all the user's Views, Forms and Sharing. The Web Console also allows to manage user's profile data (e.g., name, password, etc.) as well as to set the user's preferences.

Link Provisioning

Link is provisioned in the form of a service. Any Excel user that wants to use it must simply access the SpreadSheetSpace web site (www.spreadsheetspace.net) and follow the instructions.

Two actions are required, namely registration in the SpreadSheetSpace platform and Excel configuration through add-in download. The add-in can be easily removed through the standard Windows procedure (Control Panel->Uninstall).

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