When building the user interface of a custom module, the portal engine development approach allows you to quickly create pages based on common patterns directly in your browser (see the example in Creating custom modules for more information). However, if you need custom functionality or content adjustments that you cannot configure through the properties of the available UI page templates, you need to develop an ***extender*** and assign it to the corresponding UI element.

Extenders allow you to prepare custom code that the system executes when initializing the controls used on a page or the page itself. For example, you can use extenders to dynamically modify control properties or assign handler methods to events that occur during the page or control life cycle.

Development approaches for custom user interface pages

Before you start developing a user interface page that requires customization, carefully consider which of the following approaches best fits your needs:

- **Pages with portal engine templates and extenders** - allows you to leverage the templates and automatic features of the portal engine and add custom code-behind logic using extenders. Suitable for pages that share a common pattern with other pages (for example object listing pages), but require one or more custom adjustments.
- **Manual user interface pages** - for pages that require heavy customization, it may be easier to implement the entire page as a separate web form. Gives you full control over the content and logic of the page, but you need to develop the whole page manually. See Manually creating the interface for custom modules for more information about this approach.

Implementing extenders

To develop a new extender, you need to create a class in the web project and write the required code:

1. Open your project in Visual Studio (using the **WebSite.sln** or **WebApp.sln** file).
2. Add a new class in your module's code folder:
   - If your module uses a separate assembly, add the extender class into the corresponding project.
   - For modules that do not have their own project, use the **CMSModules/<module code name>** folder in the **App_Code** directory (or *Old_App_Code* directory on web application installations).

   Extender naming convention: We recommend using the *Extender* suffix in the name of the class and the corresponding file.
3. Make the class inherit from an appropriate base class:
   - **ControlExtender<TControl>** - for extenders that target a control. Set the generic parameter to the type of the control that you are extending (see Extender types).
   - **PageExtender<CMSPage>** - for extenders that apply to pages. Use **CMSPage** as the type in the generic parameter.

     The extender base classes are located under the **CMS.Base.Web.UI** namespace.
4. Override the **OnInit()** method in the extender class.
   - You can add any custom initialization code for the page or control, for example assign handler methods to events.
   - When extending a control, you can access a strongly typed instance of the given control through the **Control** property of the extender class.
5. Add any other code required to implement your custom functionality (such as the handler methods assigned to events in the *OnInit* method).
6. If you created the extender in *App_Code*, you need to add the **RegisterCustomClass** assembly attribute above the class declaration (and any namespace declarations). The attribute registers the class under a specific name.
7. Save the file (build the solution if your project is a web application or if you use a separate project for the module code).

Basic example

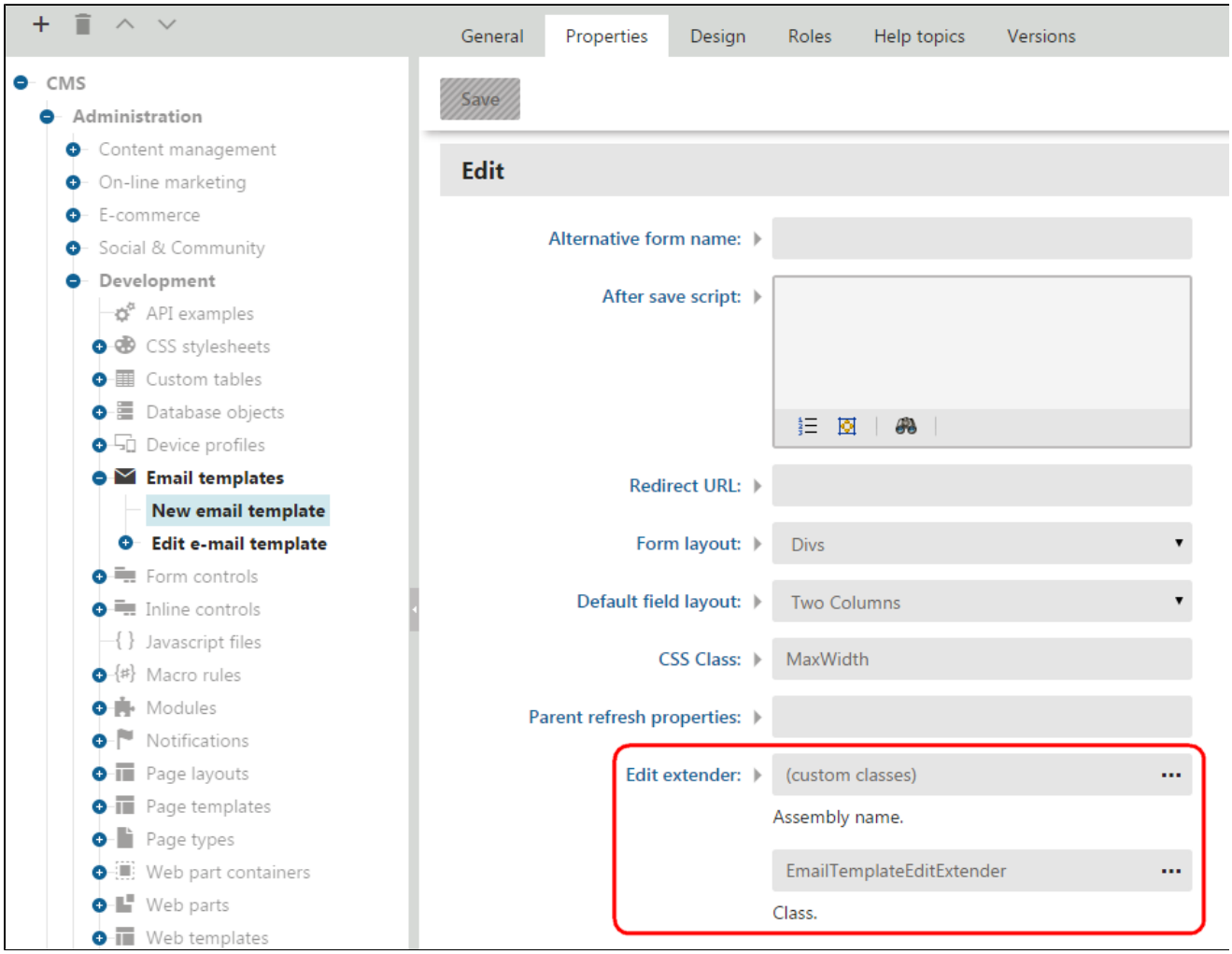
```
using CMS;
using CMS.Base.Web.UI;
using CMS.UIControls;

[assembly: RegisterCustomClass("CustomExtender", typeof(CustomExtender))]

public class CustomExtender : ControlExtender<UniGrid>
{
        public override void OnInit()
        {
                // Sets a property of the extended page's UniGrid control
                Control.ShowObjectMenu = false;
        }
}
```

Assigning extenders to module pages

After you implement the extender class, you need to assign it to the UI element representing the related page in the module's interface:

1. Open the **Modules** application and edit the related module.
2. Select the **User interface** tab.
3. Use the tree to select the UI element representing the page that you wish to extend:
4. Open the element's **Properties** tab:
5. Find the appropriate **Extender** property (see Extender types).
6. Select your extender class using the property:
    - **Assembly name**
        - Choose ***(custom classes)*** for extender classes created and registered in *App_Code*.
        - If you added the extender to a separate module project, choose the matching assembly.
    - **Class** - select the specific extender class (the value includes the class's namespace).
7. Click **Save**.

The extender is now applied to the given user interface page and the system runs the extender's initialization code when the page is loaded.



Extender types

The following table lists the default UI page templates that you can customize using extenders:

UI page template	Primary control	Extender property (Properties tab of UI elements)
Object listing Listing with site selector	UniGrid	Listing -> Grid extender
Listing with general selector	UniGrid UniSelector	Listing -> Grid extender Dialog settings -> Selector extender
New / Edit object	UIForm	Edit -> Edit extender
Edit bindings	UniSelector	Binding -> Edit extender
Vertical tabs (and other tab templates)	UITabs	Tabs -> Tab extender
Custom control	Any base class of the selected user control	Control settings -> Control extender

Control extenders must inherit from the **ControlExtender<TControl>** class, where *TControl* is a control used on the given UI template. To assign a control extender, edit the module on the **User interface** tab, select the given UI element and use the appropriate extender property on the **Properties** tab.

> **Note**: The extender control type does not necessarily need to match the primary control related to the property through which the extender is assigned. If the type does not match, the extender automatically searches the underlying control hierarchy for the first control of the matching type. For example, you can create a *UIForm* extender for a different type of control without knowing how deep in the control hierarchy the form is located.

If you are developing an extender for the page itself (not a specific control), the extender must inherit from **PageExtender<CMSPage>**. To assign a page extender, edit the module on the **User interface** tab, select a UI element and use the **Code behind -> Extender** property on the **Properties** tab. You can assign page extenders to UI elements with any type of page template.

Example - Extending a module's listing page

The following example demonstrates how to create an extender that adds the following features to the listing page of the sample *Company overview* module:

- A header action button that allows users to send email to all listed offices
- List actions for sending email to specific offices
- An indicator that shows which offices are currently open, based on the time zone of each office's location

> To follow the example, you first need to create the **Company overview** custom module according to the instructions in Creating custom modules.

Adding class fields

Before you can create the extender, you need to expand the *Office* class used within the *Company overview* module to include fields for storing an email address and a reference to a time zone.

1. Open the **Modules** application and edit the **Company overview** module.
2. Select the **Classes** tab and edit the **Office** class.
3. Open the **Fields** tab and create a **New field**:
    - **Field type**: Standard field
    - **Field name**: OfficeEmail
    - **Data type**: Text
    - **Field caption**: Office email address
    - **Form control**: Email
4. Click **Save**.
5. Create another **New field**:
    - **Field type**: Standard field
    - **Field name**: OfficeTimeZoneID
    - **Data type**: Integer number
    - **Reference to**: Time zone
    - **Reference type**: Not required
    - **Field caption**: Office time zone
    - **Form control**: Time zone selector (select via the *(more items...)* option)
6. Click **Save**.
7. Switch to the **Code** tab of the class editing interface.
8. Click **Save code**.

The *Office* class now contains the *OfficeEmail* and *OfficeTimeZoneID* fields, which allow users to set an email address and select a time zone when editing offices. By saving the new code of the class, you also updated the *OfficeInfo* API class in the web project (allows the system to handle the new fields).

Note: On web application installations, you need to manually build the solution in Visual Studio to process the changes in the code.

Updating the listing grid definition

Because the example extends the listing page of the *Company overview* module, you need to update the grid definition that specifies the page's content.

By default, the grid definition used by the listing page of the Company overview module is stored in the ***~/App_Data/CMSModules/CompanyOverview/UI/Grids/CompanyOverview_Office/default.xml*** file. Edit the grid definition and change it to the following XML code:

```
<?xml version="1.0" encoding="utf-8" ?>
<grid>
        <actions>
                <action name="edit" caption="$General.Edit$" fonticonclass="icon-edit"
fonticonstyle="allow" />
                <action name="#delete" caption="$General.Delete$" fonticonclass="icon-
bin" fonticonstyle="critical" confirmation="$General.ConfirmDelete$" />
                <action name="email" commandargument="OfficeEmail" caption="Send
email" fonticonclass="icon-message" />
        </actions>
        <columns>
                <column source="OfficeDisplayName" caption="Office name" wrap="false"
localize="true">
                        <filter type="text" size="200" />
                </column>
                <column source="OfficeAddress" caption="Address" width="35%" />
                <column source="OfficeTimeZoneID" caption="Is Open (Office hours 9 AM
- 5 PM)" externalsourcename="officehours" />
                <column source="OfficeEmail" caption="Email address" width="100%" />
        </columns>
        <options>
                <key name="DisplayFilter" value="true" />
        </options>
</grid>
```

The updated grid definition contains:

- A new ***email*** action, which will be handled by the extender.
- A column with the **OfficeTimeZoneID** field as its source. The extender will handle the ***officehours*** source name and provide the output of the column.
- A column displaying the **OfficeEmail** value.

See also: Reference - UniGrid definition

Creating the extender class

1. Open your project in Visual Studio.
2. Create a new class named ***OfficeListExtender.cs*** in the module's code folder (by default *~/App_Code/CMSModules/CompanyOverview*).
3. Add the following *using* statements to the start of the code:

```
using System;
using System.Linq;
using System.Web.UI.WebControls;

using CMS;
using CMS.Base;
using CMS.Base.Web.UI;
using CMS.Base.Web.UI.ActionsConfig;
using CMS.Globalization;
using CMS.Helpers;
using CMS.UIControls;
```

4. Use the following code for the class:

```
[assembly: RegisterCustomClass("OfficeListExtender", typeof(OfficeListExtender))]

public class OfficeListExtender : ControlExtender<UniGrid>
{
        /// <summary>
        /// Adds custom code that occurs during the initialization of the
extended control.
        /// </summary>
        public override void OnInit()
        {
                // Calls a method that adds a custom header action button
                InitHeaderActions();

                // Registers a method that handles the functionality of header
actions
                Control.HeaderActions.ActionPerformed +=
HeaderActions_ActionPerformed;

                // Assigns handlers to the UniGrid control's OnAction and
OnExternalDatabound events
                Control.OnAction += Control_OnAction;
                Control.OnExternalDataBound +=
Control_OnExternalDatabound;
        }


        /// <summary>
        /// Initializes header actions.
        /// </summary>
        private void InitHeaderActions()
        {
                // Prepares the "Email all" header action
        HeaderAction mailAllButton = new HeaderAction
                {
                        ButtonStyle = ButtonStyle.Default,
                        Text = ResHelper.GetString("Email all"),

                        // Sets a name that identifies the action when handling
the 'ActionPerformed' event
                        CommandName = "emailall",
                };
                Control.HeaderActions.AddAction(mailAllButton);
        }
```

```
        /// <summary>
        /// Performs header actions.
        /// </summary>
        private void HeaderActions_ActionPerformed(object sender,
CommandEventArgs args)
        {
                switch (args.CommandName.ToLowerCSafe())
                {
                        // Runs when a user clicks the "Email all" header action
button
                        case "emailall":
                                // Gets a string containing all office emails
separated by commas
                                string officeEmails = String.Join(",",
CompanyOverview.OfficeInfoProvider.GetOffices().Select(o => o.OfficeEmail));

                                // Prepares a mailto link for all office emails
                                string officesMailtoLink = HTMLHelper.HTMLEncode
(String.Format("mailto:" + officeEmails));

                                // Opens the mailto link when the header action
button is clicked
                                string scriptText = "win = window.open('" +
officesMailtoLink + "', 'emailWindow');" +
                                                                        "if (win
&& win.open && !win.closed) win.close();";
                                ScriptHelper.RegisterStartupScript(Control.Page,
typeof(string), "OpenAllMailToLink", ScriptHelper.GetScript(scriptText));
                                break;
                }
        }


        /// <summary>
        /// Handles the UniGrid control's OnAction event.
        /// </summary>
        /// <param name="actionName">The name of the UniGrid action that was used.
</param>
        /// <param name="actionArgument">The value of the data source column in
the UniGrid row for which the action was used.</param>
        private void Control_OnAction(string actionName, object actionArgument)
        {
                if (actionName == "email")
                {
                        // Gets the email of the office for which the "Send
email" action was used
                        string officeEmail = HTMLHelper.HTMLEncode
(ValidationHelper.GetString(actionArgument, ""));

                        // Opens a mailto link
                        string scriptText = "win = window.open('mailto:" +
officeEmail + "', 'emailWindow');" +
                                                                "if (win && win.
open && !win.closed) win.close();";
                        ScriptHelper.RegisterStartupScript(Control.Page, typeof
(string), "OpenMailToLink", ScriptHelper.GetScript(scriptText));
                }
        }
```

```
        /// <summary>
        /// Handles the Unigrid control's OnExternalDataBound event.
        /// </summary>
        private object Control_OnExternalDatabound(object sender, string
sourceName, object parameter)
        {
                if (sourceName == "officehours")
                {
                        // Gets the ID of the time zone assigned to the office
                        int timeZoneId = ValidationHelper.GetInteger(parameter,
0);

                        // Loads a TimeZoneInfo object representing the office's
time zone
                        CMS.Globalization.TimeZoneInfo timeZone =
TimeZoneInfoProvider.GetTimeZoneInfo(timeZoneId);

                        // Gets the current time, converted to the office's time
zone
                        DateTime currentDateTime =
                                TimeZoneHelper.ConvertTimeZoneDateTime(DateTime.
UtcNow, TimeZoneInfoProvider.GetTimeZoneInfo("GMT_UTC"), timeZone, false);

                        // Formats the office's local time into a string
                        string officeLocalTime = "(Local time: " +
currentDateTime.ToString("h:mm tt") + ")";

                        // Checks whether the office's local time is within
office hours and displays the result in the column
                        if (currentDateTime.TimeOfDay < new TimeSpan(9, 0, 0) ||
currentDateTime.TimeOfDay > new TimeSpan(17, 0, 0))
                        {
                                return "<span class=\"StatusDisabled\">" +
ResHelper.GetString("general.no") + "</span> " + officeLocalTime;
                        }
                        else
                        {
                                return "<span class=\"StatusEnabled\">" +
ResHelper.GetString("general.yes") + "</span> " + officeLocalTime;
                        }
                }

                return parameter;
    }
}
```

5. Save the class (build the solution on web application installations).

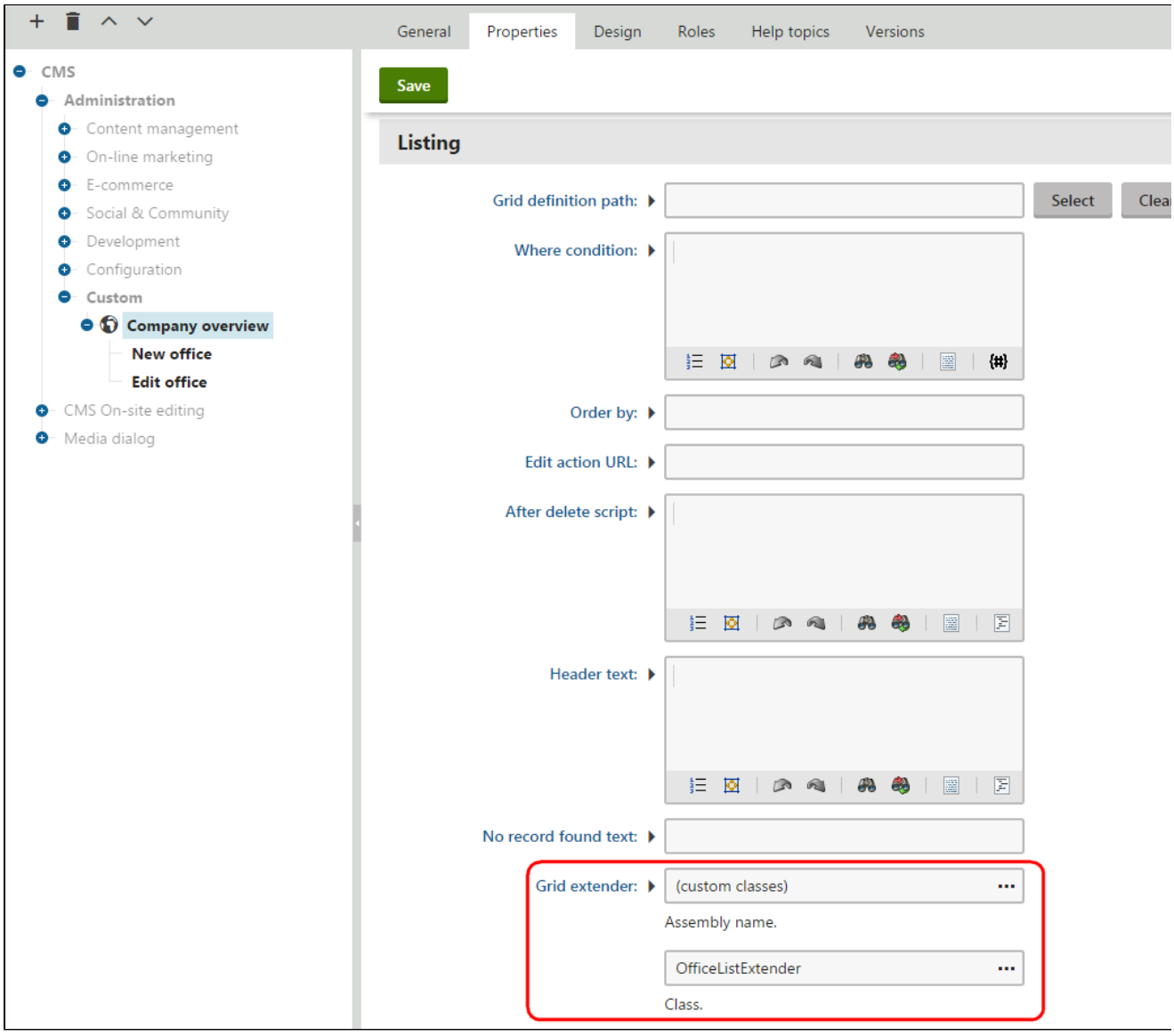
The code provides the functionality of the listing page customizations and registers the extender under the name ***OfficeListExtender***.

For more information about the UniGrid *OnAction* and *OnExternalDatabout* events, see: UniGrid

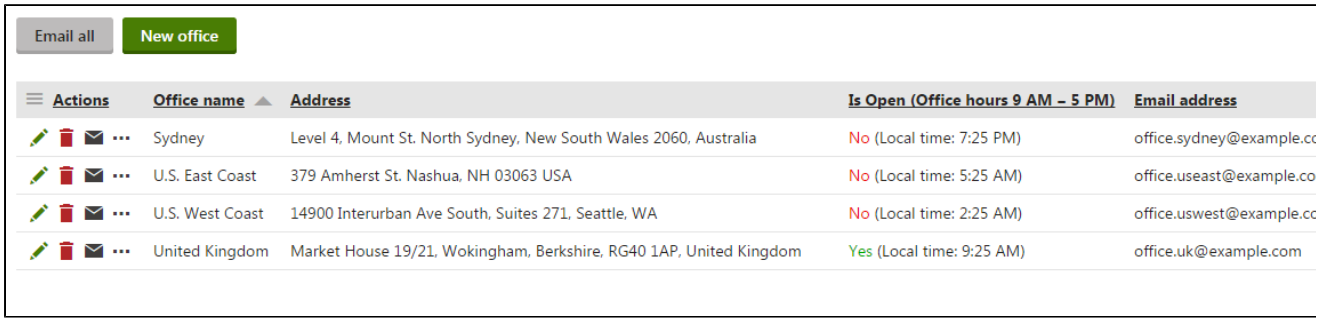
Assigning the extender to a UI element

To apply the extender to the listing page of the *Company overview* module:

1. In the **Modules** application, edit the **Company overview** module.
2. Select the **User interface** tab.
3. Select the **CMS -> Administration -> Custom -> Company overview** element in the UI element tree.
4. Open the **Properties** tab of the element.
5. Scroll down to the **Listing** category and set the **Grid extender** property:
   - **Assembly name**: (custom classes)
   - **Class**: OfficeListExtender
6. Click **Save**.



The extender is now applied to the listing page of the *Company overview* module. To view the results, open the **Company overview** application (under the **Custom** category). The **Email all** header action button and the **Send email** actions of individual offices open *mailto* links, and the **Is Open** column shows which offices currently have office hours. You need to create offices with email address values and an assigned time zone to fully try out the customizations.


Email all
New office
Actions
Office name
Address
Is Open (Office hours 9 AM – 5 PM)
Email address
Sydney
Level 4, Mount St. North Sydney, New South Wales 2060, Australia
No (Local time: 7:25 PM)
office.sydney@example.co
U.S. East Coast
379 Amherst St. Nashua, NH 03063 USA
No (Local time: 5:25 AM)
office.useast@example.co
U.S. West Coast
14900 Interurban Ave South, Suites 271, Seattle, WA
No (Local time: 2:25 AM)
office.uswest@example.co
United Kingdom
Market House 19/21, Wokingham, Berkshire, RG40 1AP, United Kingdom
Yes (Local time: 9:25 AM)
office.uk@example.com