

DALI planet plugin

Document version 2, March 2015 for plugin code version 0.52. Document author: A-Lurker.

This plugin is based on the work initiated by zoot1612 with major changes and modifications by A-Lurker:

forum.micasaverde.com/index.php/topic,9677.msg201758.html#msg201758

Background

This plugin is designed to execute commands through DALI gateways. In particular these gateways are suitable:

Creative Lighting

DIDIO 8017

creativelighting.com.au/images/documents/DIDIO%208017%20User%20Manual.pdf

Tridonic

DALI Interface RS232 PS/S

tridonic.com/ae/products/dali-interface-rs232.asp

It is envisioned that other gateways could be utilised, with the appropriate code modifications. The following are possible candidates? Some are KNX to DALI gateways.

Lunatone DALI RS232 SCI - rebranded Tridonic - refer Lunatone Cockpit software
Wago 750-641, DALI/DSI Master Module
GE Lighting: DALI Type 2, SKU: 65324
Embedded Systems DALI RS485
Starfield RT03
DALCNET DGM01-1248
Helvar Digidim 503 AV RS232

License

This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License version 3 (GPLv3) as published by the Free Software Foundation;

In addition to the GPLv3 License, this software is only for private or home useage. Commercial utilisation is not authorized.

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

What the plugin does not do

The plugin is primarily for control and status. The plugin executes DALI communications as requested. It's up to the user to make use of it as needed.

Ideally the DALI system should be set up with the software normally associated with the gateway in use. However a DALI system can be set up using the plugin but you need to understand what you are doing, in order to sort out the finer points.

Groups can be operated and scenes executed by Lua software but the configuration of groups and scenes cannot be done programmatically. You have to configure them as described further below.

The plugin does no polling and it does not support DALI switches and sensors. All devices are assumed to be dimmable lights. Extended commands are not catered for. Type 8 colour devices are not catered for but with sufficient information, it should be possible to modify the software to control these devices, such as RGBW and tunable white LED strips.

Setup

Configuring the hardware and software can take some time due to the speed of the serial link. Consequently it's not practical to have the configuration of the software totally automated ie automatically configured every time the Vera Luup engine is restarted. As an indication, imagine having to update 16 scenes, in 64 devices, via the serial link every time the Vera Luup engine is restarted. Let alone the current light output levels, groupings, fade rates and fade times, etc. It's very helpful to watch the log file, which indicates when the longer processes have FINISHED.

So instead of automated boot up processes, four main manual processes are in place and require some initial supervision by the user.:

- 1) first and most importantly setting up the DALI addresses of all the devices.
- 2) getting the original configuration of the hardware. That is, from all the attached devices.
- 3) altering the original configuration to suit your needs
- 4) managing steps 1, 2 & 3 as devices are added or removed or their configuration needs to be altered

This is explained in more detail below and needs to be understood to achieve a useful outcome.

Installation

This plugin has been tested using Vera UI5 and Firefox 35.0.1 only. Operation under UI7 is any one's guess. The installation for UI5 is as follows and **MUST** be done in the correct order:

1) Upload files:

Go to UI5-->APPS-->Develop Apps-->Luup files and upload the five files.

Select the 'Create device' button on the same page. Enter 'D_DaliPlanet1.xml' into the 'Upnp Device Filename' entry box and select the "Create device" button immediately below. Do a luup engine reload using the 'Reload' button and a browser refresh (generally F5).

2) Enter key variables:

Once the device can be seen in the User Interface and after sufficient "Reloads" and browser refreshes, the 'Advanced' tab will have entry boxes for the following:

GatewayType:

Enter a single digit as follows:

- 1 for the Creative Lighting DIDIO gateway
- 2 for the Tridonics gateway in Mode 1.
- 3 for the Tridonics gateway in Mode 2 – default for the Tridonic gateway

ip:

If using an LAN connection, then enter the IP address for the DALI gateway. If you need to change the port address, you can add that on to the end of the IP address using the usual colon notation. The port address is not normally required, as it defaults to the port address of the selected gateway.

Do another luup engine reload using the 'Reload' / 'Save' button and a browser refresh for the entered values to be incorporated.

3) 'Set Addresses' button:

After the plugin is first installed, no child devices are created for any of the attached DALI devices. You have to make use of the 'Set Addresses' button on the 'Sync Hardware' Tab. This button invokes a routine that gives each device attached to the DALI bus a 'Short Address'.

The address numbering starts at address 63 and works downwards. This way, it's easier to renumber the addresses later on, to match a physical layout of your own choosing, rather than using the initial random layout produced initially – refer to section headed 'Short addresses':

Not that any devices that already have a Short Address, will retain that address. Push the 'Set Addresses' button – no obvious feedback occurs - come back in ten minutes:

Warning: 'Set Addresses' can take sometime to run, depending on the number of attached devices. It takes about ten minutes for 'Set Addresses' to process 64 devices and proportionally less for less devices. Watch the log for the 'Set Addresses' conclusion:

'luup_log:119: DaliPlanet debug: FINISHED the Set Up command: programmed xx devices'

You can add a new device(s) at any time by re: running Set Addresses. Existing short addresses will be retained. New addresses will be added and associated with the added hardware.

You can turn debugging on and off: refer to the 'Advanced' Tab variable 'DebugEnabled': On = 1 and Off = 0 (default). The short address search and assignment process can be viewed in the log file and does not require 'DebugEnabled' to be enabled.

DALI Planet

Test Devices Sync hardware Groups and Scenes Advanced

Room: no room

Assign short addresses --> Set Addresses

Enter old address -->

Enter new address -->

Change Short Address

Read fade values from hardware --> Get Fade Values

Write fade values from hardware --> Set Fade Values

Read power on levels from hardware --> Get Levels

Write power on levels from hardware --> Set Levels

4) Short addresses:

During the execution of 'Set Addresses', each device is randomly assigned its own short address (refer to a DALI glossary). After 'Set Addresses' has completed, it makes sense to renumber all the devices to suit the actual physical layout of the devices, depending on how they will be used and grouped in the future. Doing so at a later time will require extensive reworking of DALI groups and scenes and changes to any Vera scenes or Lua coding and is definitely not recommended, although possible.

Reassigning addresses: enter the old address and the new address and hit the 'Change DALI Address' button. The code protects against duplicates. If an address is already in use, you will have to change that device, to some other temporary address first. Eg: you have say addresses 1,2,3 and want to swap 1 and 3. Change 1 to say 63 and change 3 to 1 and then 63 to 3. Watch the log file for any messages. Eg 'FINISHED the Change DALI Address command – OK'. Keep repeating this step for all the addresses that need changing. Changing an address occurs straight away.

Check the addressing using the Fade/Up down button on the 'Test Devices' Tab. Make sure each light responds to the address you have assigned it.

Note than you can enter the 'MASK' value ie 255 as the new address and the short address of the device will be erased completely.

Once tested OK, do a Luup engine reload and a browser refresh. Only do this once the device addressing is correct. Otherwise you will end up with devices that contain the random physical layout assigned by the short addressing creation process.

5) Child devices:

A child device will appear for each device attached to the DALI bus after the Luup engine reload and a browser refresh. At this point you should be able to turn each light on/off and dim them using the child device.

6) Fade rates and times:

Your hardware already contains default fade rates and times for each device. Operate the 'Get Fade Values' button to sync the software with the hardware. This may take a few minutes, if there are a large amount of devices. Watch the log for completion.

7) Power on levels:

Your hardware already contains a default power on level for each device. Operate the 'Get Levels' button to sync the software with the hardware. This may take a few minutes, if there are a large amount of devices. Each child device will then have a PowerOnLevel variable – browser refresh required. Watch the log for completion.

8) Changing Fade values and power on levels.

Restart the Luup engine and the browser. Now under each child device in the 'Advanced' tab you will see these new variables:

FadeTime: 0 to 15

FadeRate: 1 to 15, 0 is not allowed

PowerOnLevel: 0 to 254

fadeTime is used by the commands: DirectArcCommand and DALI_GO_TO_SCENE

fadeRate is used by the commands: DALI_UP and DALI_DOWN

fadeTime is the time to dim up or down from level a to level b

fade time in seconds = $0.5 * (2^n)^{0.5}$ or $2^{(n/2)-1}$ where n = 0 to 15; (0.5 to 90.5 secs)

fade rate in steps per second = $506 / (2^n)^{0.5}$ where n = 1 to 254; (357.8 to 2.8 steps/secs)

fadeRate = 253/fadeTime

You can optionally change these values at any time in the future as follows:

Enter the new variable value(s) as required for each child device and then operate the 'Set Fade Values' button and/or the 'Set Levels' button to sync the hardware with the software. Restart the Luup engine and the browser again.

9) Syncing to any Groups and Scenes already contained in the attached hardware:

Your hardware may already contain groups and scenes set up by some other DALI program.

Regardless even if the hardware has no existing groups or scenes, Vera needs to know about any existing arrangements. Once again these commands can take significant time. This section of the install must be completed to ensure the plugin and the hardware are fully synchronised. If not done; all bets are off.

Go to the 'Groups and Scenes' tab. Operate the 'Get Groups' button – no obvious feedback occurs. Watch the log for: 'FINISHED the Get Groups command'. Next operate the 'Get Scenes' button – no obvious feedback occurs. Watch the log for: 'FINISHED the Get Scenes command'. The

'DebugEnable' flag does not need to be set in both cases.

After a Luup engine reload and a browser refresh, child devices will appear for any group already programmed into the hardware. The 'Advanced' tab should show new variables for groups and scenes respectively:

The screenshot shows the DALI Planet software interface. At the top, there is a blue header bar with the title "DALI Planet". On the left side of the header is a gear icon. To the right are several icons: a question mark, a gear, a trash can, and an 'X'. Below the header, the text "Room: no room" and a heart icon are visible. The main area contains a table with two columns. The first column lists group identifiers from "Group0" to "Group13". The second column contains either the word "Empty" or a numerical value like "0,1". A vertical scroll bar is located on the right side of the table.

Group0	Empty
Group1	Empty
Group2	Empty
Group3	0,1
Group4	Empty
Group5	Empty
Group6	Empty
Group7	Empty
Group8	Empty
Group9	Empty
Group10	Empty
Group11	Empty
Group12	Empty
Group13	Empty

Scene4	Empty
Scene5	Empty
Scene6	1.150,2.150
Scene7	Empty
Scene8	Empty
Scene9	Empty
Scene10	Empty
Scene11	Empty
Scene12	Empty
Scene13	Empty
Scene14	Empty
Scene15	Empty
AllGroups	g0:e g1:e g2:e g3:0,1 g4:e g5:e g6
AllScenes	s0:e s1:e s2:e s3:e s4:e s5:e s6:1

10) Make groups (optional):

At this point it is possible to optionally create groups as required. This can also be done at a later time as needed. Just enter the the short addresses of the devices, that are to be part of the group, in a comma separated list eg

Group 0 2,5,6
 Group 1 1,5,8,9,11
 Group 2 Empty
 ...
 Group 15 Empty

Operate the Save/Reload button and refresh the browser. This saves the variables.

Push the 'Set Groups' button. This pushes the new info to the hardware. This hardware update can take some time. However the software is designed to minimise the update time, so that it only updates changed groups. Watch the log for: 'FINISHED the Set Groups command'.

Operate the Save/Reload button and refresh the browser. New child devices will appear for each group created. Operating a group device will now affect the operation and status of the devices in the group.

Warning: every time you delete a group (by setting it to empty) and then creating a new group, the Vera device IDs increment. This will affect any Luup code that may have used these groups.

The screenshot shows the DALI Planet software interface. At the top, there's a blue header bar with the title 'DALI Planet' and icons for help, sync, and exit. Below the header, there are tabs: 'Test Devices', 'Sync hardware', 'Groups and Scenes' (which is highlighted in blue), and 'Advanced'. On the left, there are two sections: 'Read groups from hardware --->' and 'Write groups to hardware --->'. Each section has a blue button labeled 'Get Groups' and 'Set Groups' respectively. Below these, there are two more sections: 'Read scenes from hardware --->' and 'Write scenes to hardware --->'. Each section has a blue button labeled 'Get Scenes' and 'Set Scenes' respectively.

Lastly push the 'Get Groups' button again. This reads back the altered hardware settings into a variable called 'AllGroups' and is used by the program as a backup – don't change this variable. It is **important to complete this step**, otherwise future changes may not function correctly.

Operate the Save/Reload button and refresh the browser.

11) Make Scenes (optional):

It is now possible to optionally create scenes as required. This can also be done at a later time as needed. Just enter the device's short addresses and output level, as a full stop separated pair. Add in each device pair, to a comma separated list eg

Scenes 0 1.150

Scenes 1 1.0,2.110,5.120,8.150

Scenes 2 Empty

...

Scenes 15 Empty

Operate the Save/Reload button and refresh the browser. This saves the variables.

Push the 'Set Scenes' button again. This pushes the new info to the hardware. This hardware update can take some time. However the software is designed to minimise the update time, so that it only updates changed scenes. Watch the log for: 'FINISHED the Set Scenes command'.

Operate the Save/Reload button and refresh the browser.

Lastly push the 'Get Scenes' button. This reads back the altered hardware settings into a variable called 'AllScenes' and is used by the program as a backup – don't change this variable. It is **important to complete this step**, otherwise future changes may not function correctly.

Operate the Save/Reload button and refresh the browser.

Testing a scene:

In the 'Test Devices' tab you can enter an address and a scene number and then operate the 'Go To Scene' button. The scene will active the devices according to the scene and the address used:

DALI Planet

Room: no room

Test Devices Sync hardware Groups and Scenes Advanced

Enter DALI device address -->

[Dali Planet status page](#)

Fade Up Down Stop Fading
Step Down Off Step Up On
Recall Min Level Recall Max Level

Enter DALI scene number -->

Go To Scene Run Test

Value 1:
Value 2:
Value 3:

Address = 255 ie the broadcast address. If they are in the scene, all the devices will change to the scene settings.

Address = group number + 64. If the devices are in the addressed group, they will change to the scene settings. Note adding 64 signifies that the supplied address is a group address, as opposed to a single device address.

Address = a single device – 0 to 63. If the device is in the scene, it will change to the scene settings.

Note that when a scene is invoked, all the devices change their status in the UI to match.

Invoking a scene in Lua:

```
local DALI_PLANET_ID = dn -- where dn is the device number of the parent
local DALI_PLANET_SID = 'urn:dali-org:serviceId:Dalil'

-- sa is the scene address; add 64 for group addresses, use 255 for all
local sceneAddress = sa
local sceneNumber = sn -- where sn is the scene number in the range 0 to 15

luup.call_action(DALI_PLANET_SID, "RunScene", {sceneAddress, sceneNumber}, DALI_PLANET_ID)
```

'Test Devices' tab:

The 'Test Devices' Tab is primarily for testing during set up of devices. It doesn't have much of an on going role after set up. In most cases it directly commands the gateway and does not make use

of or necessarily affect the upnp variables.

There are effectively two stages to using the plugin:

- prior** to the 'Set Addresses' operation ie short address assignment
- after** the 'Set Addresses' operation ie short address assignment

With one only device connected to the DALI bus:

Prior to operating the 'Set Addresses' button, the plugin will not create any child devices for the plugin.

However, the plugin allows you to test, just **one only** device, connected to the DALI bus using the Broadcast address (255 dec). The device can be tested and its status viewed.

You can inspect and test different DALI devices by connecting each individual device in turn, on to the bus, **one at a time**.

However if all the devices already have a short address, then you can wire them all on to the bus and test them using their short addresses.

With multiple devices connected to the DALI bus:

After operating the 'Set Addresses' button, all the devices will have a short addresses. You can wire them all on to the bus and test them using short addressing.

Groups

To send commands to a group (rather than a single device), in the 'Test Devices' tab enter the group number + 64 as the address. Eg for group three enter 67. See image below.

Right hand side of the Setting Tab

There are three entry boxes:

Value1, Value2 and Value3 and the button 'Run Test'.

These variables are arbitrary values fed to the function runTest(). A function of your own making – refer to 'L_DaliPlanet1.lua'

These are purely for any one that wants to try out some code of their own. Refer to function runTest() in the Lua code. This may be removed in future releases.

Web page

You can see a status report for a device by looking at the web page: refer to the link on 'Test Devices' Tab. Enter a DALI short address and push the Submit button. As the gateway has to retrieve all the information first, there is about a three second delay before the result is displayed. Resubmitting the same address, updates the information, assuming its been altered elsewhere.

DALI Planet ver: 0.52

Enter DALI address -->

```
device at address:          3
group membership is        none

lamp power on?             true
maximum level               254
actual level                254
minimum level                1
min physical level           1
power on level               254
failure level                254

scene level 0                 255
scene level 1                 255
scene level 2                 255
scene level 3                 255
scene level 4                 255
scene level 5                 255
scene level 6                 255
scene level 7                 255
scene level 8                 255
scene level 9                 255
scene level 10                255
scene level 11                255
scene level 12                255
scene level 13                255
scene level 14                255
scene level 15                255

current fade time            6    fade time in seconds: 4.0
current fade rate             1    steps per second:     357.8

version?                      1
DTR contents                  0
missing short address?       false
random address is            12806746 = 0xC36A5A

device type is                LED lamp
ballastStatus                  false
powerFailure                   false
missingShortAddr                false
lampFailure                     false
resetState                      false
fadeReady                        false
lampArcPowerOn                  true
limitError                       false
```

Variables

The Parent device has the following variables & functions:	
Variables:	
GatewayType	0 = Creative lighting DIDIO, 1 = Tridionics mode 1
ip	set the ip address as needed or blank for serial. Ip port is not required.
Addresses	CSV style eg none or some: " or '1,2,42,61'
PluginVersion	x.xx
Group0 to Group15	'Empty' or address eg '3,4'
Scene0 to scene15	'Empty' or address/level pair eg '3.180,4.180'
Functions:	
SetupCommand	Scans the DALI systems and generates all the child devices
FadeUpDown	Fades a single light up or down – for demo only
DALIcommand	For running single DALI commands – test only
TransferViaDTR	Allows a value to be transferred to a DALI register – test only
GetGroups	Reads group settings from the hardware – records a back up
SetGroups	Writes group settings to the hardware
GetScenes	Reads scene settings from the hardware – records a back up
SetScenes	Writes scene settings to the hardware
RunScene	Executes a scene number for the supplied scene address(es)

Each Child device acts as a standard Vera Dimmer:	
Standard variables:	
LoadLevelStatus	0 to 100
is dimmed to this level	
Additional variables:	
PowerOnLevel	0 to 254
Fade time	0 to 15
Fade rate	1 to 15, 0 is not allowed
Functions:	
SetLoadLevelTarget	LoadLevelTarget
	0 to 100
	attempt to dim to this level

DALIcommand parameters – examples – for testing only:		
Var1	Var2	Var2
"Withdraw"	none	none
"StepDownOff"	DALI address	none
"StoreDTRAsScene"	DALI address	Scene number 0 to 15
"DirectArcCommand"	DALI address	0 to 254

Connection to Vera

The DALI gateway can be connected to Vera using a serial to LAN or serial to USB converter.

Creative Lighting DIDIO

Note that this gateway uses two stop bits in its RS232 protocol.

Tridonic

The following is an example set up; using the 'Tridonic DALI Interface RS232 PS/S' in 'Data transfer mode 2' and the 'ATC1000 TCP/IP Ethernet to Serial RS232 RS485 RS422' converter, manufactured by Shenzhen ATC Technology Co. Ltd – refer ebay:

<http://www.szatc.com/product/low-cost-tcpip-to-rs-232422485-converter>

When using this converter no software drivers, such as 'VCOM', are required. Use the converter's web page to set up a static ip address and to select the serial settings:

TCP mode:

Telnet Server/Client	Server
Port Number	50000
Remote Server IP Address	don't care
Client mode inactive timeout	0
Server mode protect timeout	0

UDP mode:

Select disabled

UART:

Mode	RS232
Baudrate	38400
Character Bits	8
Parity Type	None
Stop Bit	1
Hardware Flow Control	none
Delimiter	Non selected

The converter appears to use the Telnet protocol to pass the serial data around in 7 bit mode

rather than binary mode? However it doesn't appear to respond to Telnet commands.

Setting up the Tridonic gateway:

The Tridonic DALI Interface RS232 PS/S gateway has two modes:

- Data transfer mode 1
- Data transfer mode 2 (default)

When purchased, the gateway defaults to 'Data transfer mode 2'. This is the more recent protocol. Note however 'Data transfer mode 1' can also be used. Both modes have tested OK with the plugin. They run at different baud rates.

It also has the following special powering requirements, which is very inconvenient. Depending on the serial arrangements you choose to use, the use of RTS and DTR to drive these inputs may be a potential solution (good luck on that):

RJ45 pin 3	-6V to -12 V at say 5 mA (measured as: -2.3 mA at 10V)
RJ45 pin 8	+6V to +12 V at say 5 mA (measured as: +2.3 mA at 10V)

Other connectivity possibilities:

The WIZ125SR is also a good candidate for RS232 to LAN connectivity and has been successfully used:

http://www.mouser.com/ds/2/443/WIZ125SR_Datasheet_EN_V1.0-5569.pdf

Lighting hardware:

There are numerous DALI power supplies designed to drive LED lights using constant current outputs. So for example, many LED lights, use a constant current 350 mA power supply at about 32 Volts open circuit ie about 10 Watts. There are DALI PSU's specifically designed for these LED lights:

PSUs

At your own risk:

Tridonic Talexconverter LCAI: draws little power whilst the light is off. Does not get overly warm with light at maximum output. Dims to 85 out of 254, which is satisfactory.

Constant current Mean Well PSUs: draws little power whilst the light is off. Does not get overly warm with light at maximum output. Only dims to 149 out of 254 – that's not really dim enough.

<http://au.mouser.com/new/meanwell/meanwell-lcm40-60-powersupplies/>

Constant current and constant Voltage Hytronik PSU's ie does LED strips as well: is warm while the

light is off, as it draws considerable standby power. Gets quiet warm with light at maximum output. Dimms to 50 out of 254, which is pretty satisfactory. Slight flicker while fading at very low levels.

<http://www.hytronik.com/product/1-x-20w-dali-driver.html#.VN3bGy52ab8>

The Tridonic unit offers good performance and is preferred.

With Martec warm white Infinity 10 W LED light. Note: Watts reported in the table below will not be overly accurate.				
PSU at 245V	Standby	Min physical level		Max level
Tridonic Talexconverter LCA1 15 W 350 mA one4all	2.3W	2.2W	85	7.5W
Mean Well	3.4W	4.6W	149	13.3W
Hytronik	5.8W	5.9W	50	11.0W

Other examples:

LED RGBW strip:

This LED strip driver works OK. It's not a type 8 device ie true color RGB driver. It sets up as four short addresses Type 6 (LED light), so you end up with a child dimmer device for each of the four channels. However using groups and scenes, it should be possible to handle most simple requirements. These units should be coupled with an "Efficiency Level 4 or 5" AC adaptor to minimise standby power:

Constant Voltage 4CH DALI Dimming Driver RGB 3A/CH×3 W 9A/CH LED Dimmer DC12V-24
refer ebay: http://www.bincolor.com/En/Pro_BC-344.html

Other drivers:

<http://www.transformatorer.com/en/p/led-control-gears>

http://www.helvar.com/sites/default/files/product_datasheets/LL1x20-E-DA_datasheet_REF_T220241A_05052014_EN.pdf

http://www.helvar.com/sites/default/files/product_datasheets/LL60_2-E-DA-iC_datasheet_REF_T220431B_16102014_EN.pdf

Compatible LED lights:

At your own risk:

Just replace the supplied LED driver with the DALI driver set to 350 mA constant current.

http://www.electriciansupplies.com.au/shop/index.php?main_page=product_info&cPath=12_490_523_524&products_id=3086

<https://www.lightingillusions.com.au/shop/led-downlights/white-warm-white-infinity-10w-smd-led-dimmable-high-output-fixed-round-downlight-mlir3012wd-11864>

Background info:

<http://www.dte.us.es/docencia/etsii/itis/emc/Transparencias/domoinmo/dl>

http://openrb.com/wp-content/uploads/2013/11/DALI_RS485_datasheet.pdf

http://www.roallivingenergy.com/documents/AN4_Ozone_DALI_and_PWM_Dimming.pdf

<http://www.digikey.com/Web%20Export/techzone/microcontroller/nxp-an10960.pdf>

<http://documentation.renesas.com/doc/DocumentServer/U17333EE1V0AN00.pdf>

http://evolt-ektor.com/media/DALI_Scenes.pdf

http://evolt-ektor.com/media/DALI_Groups.pdf

<http://www.dte.us.es/docencia/etsii/itis/emc/Transparencias/domoinmo/dl>

