DCX Manager Service

European streetlight systems typically control power to dedicated streetlight circuits based on a dusk to dawn schedule. This creates startup latencies for control commands when the streetlight segment powers ON because the DCI will have marked the entire population as confirmed down. Control commands are delayed until the DCI function that determines the devices are UP which can take several minutes or longer depending on the number of OLCs and the complexity of the repeating paths.

The DCX Manager service coordinates power control with the disabling of device connectivity monitoring by the DCI so the device state remains as it was just before power is switched OFF. The DCX Manager also coordinates internal group controllers at the dusk/dawn points of the day. The DCI manager application that does the following:

Power Down Sequence

1. Optionally sends either an OFF, or DefaultLevel before switching OFF power. This is to accommodate different OLC behavior. A configurable delay is applied after this operation is accomplished.
2. Set the `lon.sys/if/system/if/system/o/mode/value` to `'Maintenance'` to prevent monitoring failures that could mark the devices as down.
3. Execute a script to disable all DCI functions except for operations function.
4. Controls the datapoint that will switch the segment power off or directly controls an Adam-6266 Modbus TCP Digital I/O device.

Power Up Sequence

1. Update a datapoint to switch ON segment power. Direct control for and Adam-6266 is used when it is part of the system.
2. Execute a script to enable all the DCI functions that were disabled at power down.
3. Set `lon.sys/if/system/if/system/0/mode/value` to `'Onnet'`
4. Send an initial group level command to the internal group controllers.

The DCX manager service will preserve the power line repeating mode used by the system when nighttime operation is restored.

The DCX manager discovers and controls an Adam 6266 Modbus TCP device the is configured to be on the WAN/eth1 subnet with a 192.168.2.x address and is configured to access the SmartServer IoT MQTT broker at the address: 192.168.2.222. You must set up WAN/eth1 with this static configuration on the SmartServer, and confirm that this interface is enabled for MQTT communication on port 1883.

The DCI manager also provides a group control point that can propagate a group level SNVT_swich value a configured time after the Segment power is applied (60s default). This can feed the input to the other group controller function blocks. The value is sent and expected to be handled by lighting controllers only on the transition to ON. The transition to OFF is expected to not reach lighting controllers because the power is cut.

Integration

Your SmartServer IoT should be configured as follows:

1. The WAN/eth0 port should be configured with the static address of 192.168.2.222. Subnet 255.255.255.0 and no gateway.
2. The IAP/MQ server on port 1883 of the eth1 interface must be enabled in the `Configuration.Feature` page.
3. In the `Configuation.Lon` page, the PL repeating must be enabled, and the Single LonTalk interface should be selected.
4. The SmartServer should be powered by the U70 Power Line adapter.
5. This solution was tested using both 3.64 and 4.00 SmartServer IoT firmware versions.
6. Any IO device that is powered with external DC switching power supplies should include a filter to limit potential impact on power line communication.
7. If you use the Advantech Adam-6266 DIO module, configure it to have the address: 192.168.2.5, and configure it to connect to the SmartServer MQTT broker at address 192.168.2.222 using MQTT protocol on port 1883.
8. Only one LonTalk adapter is supported.
9. Power Line repeating must be enabled.

The DCX Manager supports external hardware to implement an optional cabinet override switch (optional), and a relay to drive the contactor controlling the circuit power. It is important to not use an external device that generates updates on a heartbeat if the system is to be managed without having physical access to the switch. This allows the user to set the `iLocalOvrd` datapoint to {value:100, state:1} to fully enable the DCI while device network configuration is done during provisioning and connection operations. If the external device does not allow you to disable heartbeats, you can delete the connection while management operations are being performed.

If you are using the Advantech Adam-6266 digital IO device, the DCX manager will detect its presence, and use native MQTT messaging. The DCX manager service uses DI.1 as the Cabinet override switch and use Relay 1 as the driver of the power contactor. In this case the IO-1 device in figure 1 is replaced with the Adam-6266, and the connections are automatic. Other IO devices will require connections to be

established using the connection widget in the CMS. Figure 1 shows how data flows:

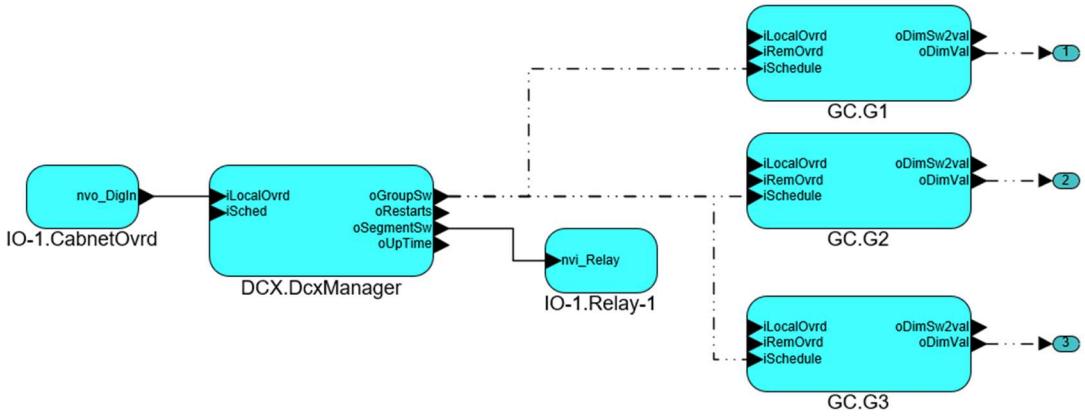


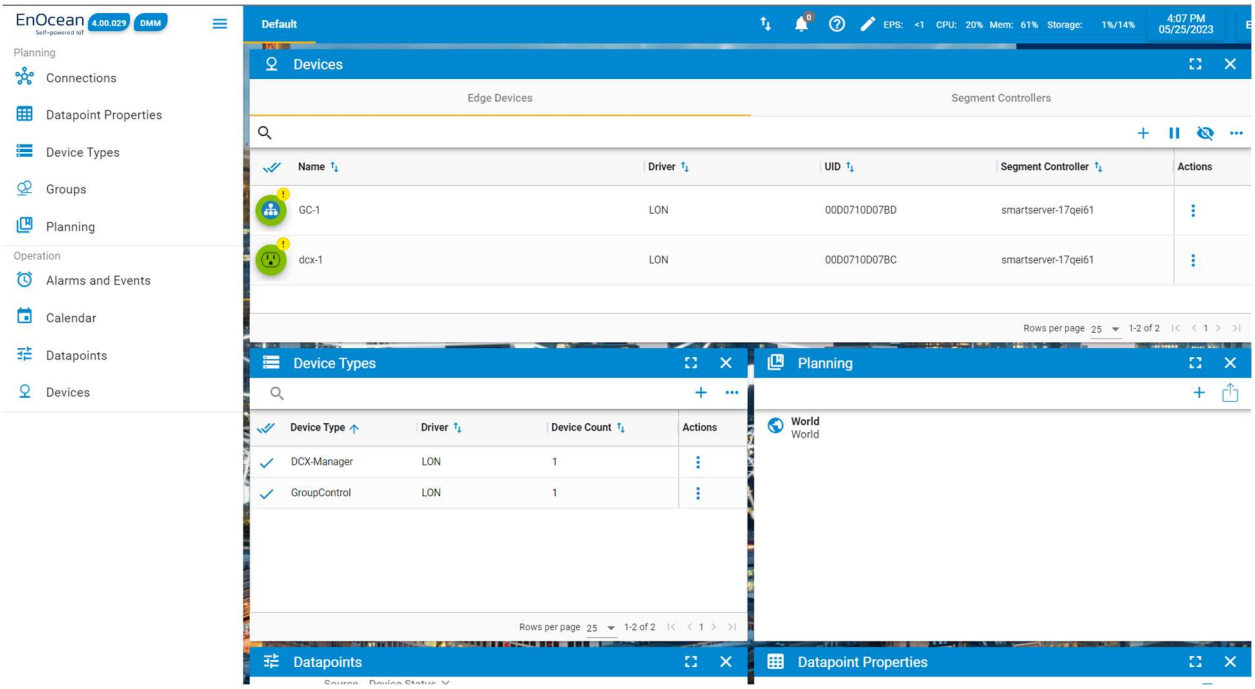
Figure 1 - DCX Manager Connections.

The input `iLocalOvrd` on the DCX Manager is a persistent value that is initially set to {value:100, state:1}. **Having an external device connected to `iLocalOvrd` is optional but managing the value correctly (set to {value:100, state:1} is essential while provisioning of devices on the power line channel.** More on this in a later section.

DCX Manager Installation

These instructions are executed on a SmartServer with the following starting conditions mentioned in the previous section:

1. Connect by SSH as user apollo to your SmartServer IoT version 3.64 or higher.
2. Type: `sudo mkdir -p /media/sdcard/apps/dcx`
3. Type: `sudo chown -R apollo:apollo /media/sdcard/apps`
4. As user apollo, use winscp or similar scp client to copy the file `DCX_deploy.zip` to the folder: `/media/sdcard/apps/dcx.`
5. In the SSH session, type: `cd /media/sdcard/apps/dcx`
6. In the SSH session, type: `unzip -o DCX_deploy.zip`
7. In the SSH session, type: `chmod +x setup.sh`
8. In the SSH session, type: `sudo ./setup.sh` and provide the apollo password when prompted.
9. When the setup script has completed, the DCX manager (dcx) and group controller (gc) services should be enabled and running. **It will take 2 minutes before these services determine they need to self-instantiate their internal devices.**
10. Here is the expected result:



Sequence of Operation

When the dcx-1 device self-instantiates, it initializes `iLocalOvrd` to {value:100, state:1} so normal power line operation is enabled. The output `oSegmentSw` will be driven at {value:100, state:1} to power streetlights connect to the segment contactor. In order the following occur when `iLocalOvrd` transitions from {value:0, state:0} to {value:100, state:1}

1. `oSegmentSw` is set to {value:100, state:1} if the Adam-6266 is present, R1 is close.
2. 5 seconds later the point `oGroupSw` is set to {value:`cpDefLevel`, state:1}. This is sent to the group controllers that then distribute the value to connected OLCs.
3. 10 + `cpGroupDelay` (default 30) seconds later lon.sys mode is set to '`Onnet`'. This enables driver to manage background polling defined using the Datapoint Properties Widget. Also at this point, the DCI functions needed for PL repeating operation are fully enabled.

In the ON to OFF transition, here is the sequence:

1. `Lon.sys` mode is set to '`Maintenance`'.
2. Disable DCI functions used to manage repeating and Up/Down state.
3. The `oGroupSw` is optionally switched OFF. When the `cpOffSequence` is set to OFF_BY_POWER, no message is sent. Some OLCs may store there last level before switching OFF, and in this case, a `cpOffSequence` `OFF_WITH_DEFAULT` will set the value to the `cpDefLevel` value before power is switched.
4. `cpGroupDelay` seconds later, disable DCI functions used to manager repeating and up/down state and se `oSegmentSw` to {value:0, state:0} and switch OFF the Adam-6266 R1 relay.

In this system, the segment power is scheduled at the dusk/dawn points. Diming operations are managed by scheduling the inputs to the group controllers. Best results are achieved by not scheduling dimming command less than 5 minutes from the dusk transition. There is likely a fair amount of traffic that will result when the DCI repeating functions are enabled.

Control Priority

There are two points that drive the operation of the DCX Manager. The point `iLocalOvrd` provides persistent control of the DCI functions as mentioned in the previous section. The user will set this point {value:100, state:1} performing device commissioning.

During operation, the point `iSched` is used to schedule the operation of the streetlight segment power. The sequencing is the same as described in the previous section. The value to `iSched` will play through to the `oGroupSw` point to provide a starting level for all the group controllers that are connected. Dimming of individual groups is done with individual schedules as needed. It is best practice to allow 5-15 minutes before scheduling group inputs to different levels. The same goes on the end of lighting period. Scheduling group updates inside of 5-15 minutes of the time `iSched` of the DCX manager is set to {value:0, state:1}

LTE Monitoring

LTE will sometimes encounter a problem that will cause unexpected restart of the LTE service. When this occurs, there is potential that requests will be lost. The DCX manager has two datapoints that help system management software monitor and recover from this infrequent occurrence. The datapoint `oUptime` reports the time lte had been running sense the start of the DCX manager service. It is updated every 60s and set to 0 when a restart is detect. The datapoint `oRestarts` is incremented with each restart.

Some LTE restarts are expected. This occurs when XIF files are added and if you switch OFF repeating which is never recommended in system that are installed and use repeating. Understand that when repeating is enabled, all LonTalk messages pass through the DCI which decides how to handle the message from a repeating perspective. When repeating is turned OFF, the LTE engine will restart and likely reprovision the population of managed PL devices.

Notes

1. The DCX Manager uses scripts to send commands through the DCI console. You must not have an active DCI console shell when this occurs. It is fine to use the DCI console after you have changed `iLocalOvrd` and have allowed the DCX manager to finish the sequence.
2. If you use PL devices that are always powered to perform IO operations for segment power, this device should be provisioned first.
3. If by mistake you have an active DCI console when the script to enable DCI functions is run, these script commands will fail.
4. I you find that commissioning functions are not working, you can run the scripts `/var/apollo/data/apps/dcxMngr/dcxOn.sh` or `/var/apollo/data/apps/dcxMngr/dcxOnStatic.sh`