Digital Energy
MDS

APPLICATION BULLETIN

NUMBER:
August 2014

MDS Orbit MCR Series

GE MDS, LLC. 175 Science Parkway, Rochester, NY 14620 USA
Phone +1 (585) 242-9600, FAX +1 (585) 242-9620 Web: www.gemds.com

Orbit MCR IPSec VPN

Device to Device Tunnel Using Pre-Shared Key

Introduction

This document describes how to setup a device-to-device IPsec VPN using two Orbit MCR devices over the cellular network. This setup allows an end-device connected to the first Orbit (say via LAN) to securely talk to the end-device connected to the second Orbit.

The Orbit devices can be managed from the back-office using SSH, NETCONF via the static IP address assigned to their cellular interface. The end-devices can be accessed from back-office using port forwarding (destination NAT) configuration on each Orbit.

Scope

This bulletin is intended for system engineers and end users who are familiar with the Orbit command line interface (CLI) and interested setting up a device-to-device IPsec VPN tunnel using pre-shared key between two Orbits to enable secure communication between end-devices. Please refer to Orbit MCR technical manual for details on how to access Orbit CLI.

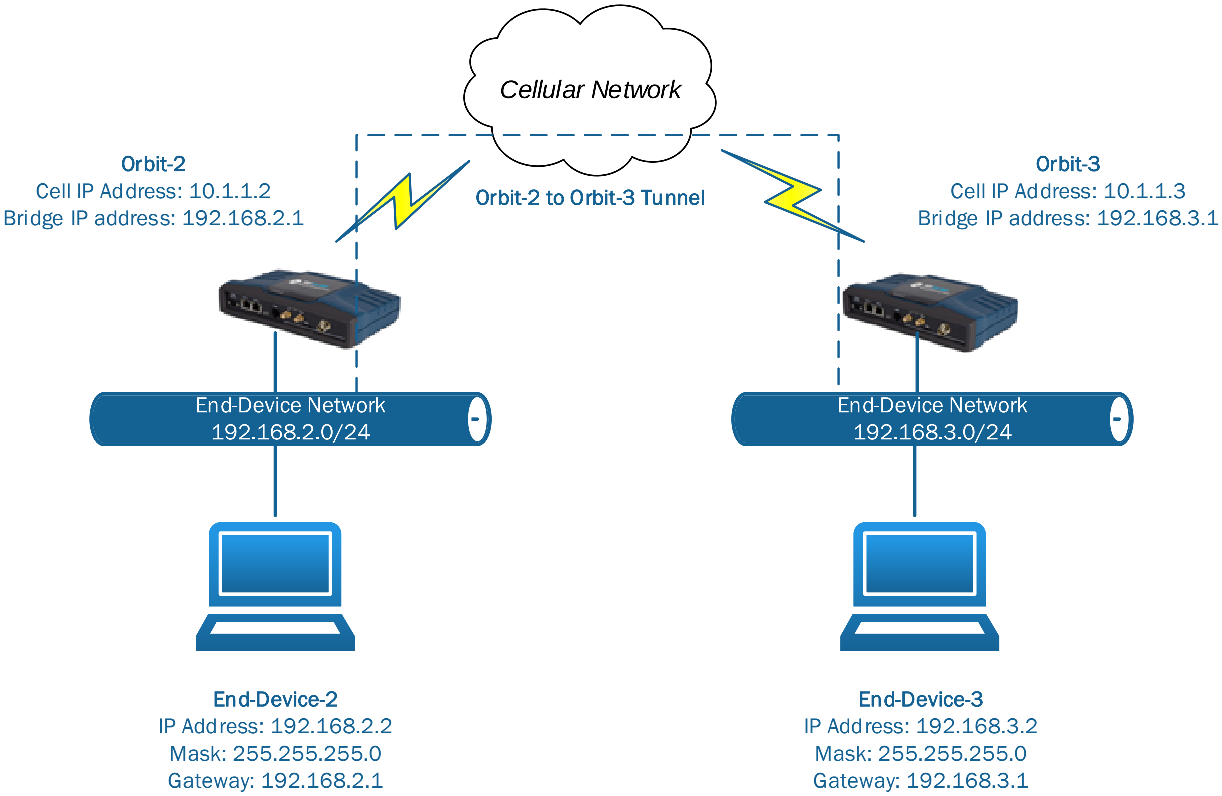
Firmware Compatibility

This is bulletin is applicable to Orbit MCR devices running firmware version 1.6.2 or greater.

Terms

CLI	Command Line Interface
VPN	Virtual private Network

Network Setup



For Orbit-2 to Orbit-3 tunnel, Orbit-2 is the “initiator” and Orbit-3 is the responder.

General Notes

We assume that we are starting with factory default configuration on each Orbit and that the Cell interface has already been configured (Please refer to Orbit technical manual on how to configure Cell interface).

You can copy the commands listed in this bulletin, paste them into a text file and change any details necessary to match the your network configuration (highlighted below), and then copy and paste the commands into the CLI (after you have entered “configuration” mode as shown below) for quick and convenient configuration.

NOTE: Do not forget to turn off CLI auto-wizard as shown below. Otherwise, copy-paste of commands might not work properly.

```
(none) login: admin
Password:

admin connected from 127.0.0.1 using console on (none)

admin@(none) 21:12:32> set autowizard false

admin@(none) 21:12:32> config
Entering configuration mode private
[ok][2014-05-06 21:12:33]

[edit]
admin@(none) 21:12:33%
```

Orbit-2 Configuration – Setting up NTP (optional)

Configure system to obtain time via NTP

NOTE: Although not required for pre-shared-key based IPsec VPN to work, it is recommended that NTP be configured on the unit.

1. Enable NTP to obtain system time from NTP server (10.1.1.10).

NOTE1: We assume that a NTP server with IP address 10.1.1.10 is available and accessible on the cellular network. The certificate based IPsec tunnel setup requires system time on Orbit to be synchronized with an NTP server, otherwise certificate validation and hence tunnel setup will fail.

```
set system ntp use-ntp true
set system ntp ntp-server 10.1.1.10
```

NOTE2: In case the cellular plan allows internet access, you can use following configuration:

```
set system ntp use-ntp true
set system ntp ntp-server 0.pool.ntp.org
set system ntp ntp-server 1.pool.ntp.org
set system ntp ntp-server 2.pool.ntp.org
set system ntp ntp-server 3.pool.ntp.org
```

2. Commit configuration

```
commit
```

Orbit-2 Configuration - IPsec tunnel to Orbit-3

Configure IPsec tunnel

1. Enable VPN service

```
set services vpn enabled true
```

2. Create IKE policy named "IKE-POLICY-PSK"

```
set services vpn ike policy IKE-POLICY-PSK-ORBIT3 auth-method pre-shared-key
set services vpn ike policy IKE-POLICY-PSK-ORBIT3 pre-shared-key mysecretkey
set services vpn ike policy IKE-POLICY-PSK-ORBIT3 ciphersuite CS1 encryption-algo aes128-cbc
set services vpn ike policy IKE-POLICY-PSK-ORBIT3 ciphersuite CS1 mac-algo sha256-hmac
set services vpn ike policy IKE-POLICY-PSK-ORBIT3 ciphersuite CS1 dh-group dh14
```

3. Create IKE peer named "ORBIT3".

```
set services vpn ike peer ORBIT3 ike-policy IKE-POLICY-PSK-ORBIT3
set services vpn ike peer ORBIT3 local-identity address 10.1.1.2
set services vpn ike peer ORBIT3 peer-endpoint address 10.1.1.3
set services vpn ike peer ORBIT3 peer-identity address 10.1.1.3
set services vpn ike peer ORBIT3 peer-identity-no-idr false
set services vpn ike peer ORBIT3 role initiator
```

4. Create IPsec policy named "IPSEC-POLICY". Configure dh-group if perfect forward secrecy (PFS) is required.

```
set services vpn ipsec policy IPSEC-POLICY ciphersuite CS1 encryption-algo aes128-cbc
set services vpn ipsec policy IPSEC-POLICY ciphersuite CS1 mac-algo sha256-hmac
set services vpn ipsec policy IPSEC-POLICY ciphersuite CS1 dh-group dh14
```

5. Create IPsec connection named "ORBIT3"

```
set services vpn ipsec connection ORBIT3 ike-peer ORBIT3
set services vpn ipsec connection ORBIT3 ipsec-policy IPSEC-POLICY
set services vpn ipsec connection ORBIT3 local-ip-subnet 192.168.2.0/24
set services vpn ipsec connection ORBIT3 remote-ip-subnets [ 192.168.3.0/24 ]
set services vpn ipsec connection ORBIT3 failure-retry-interval 1
```

Update firewall configuration from defaults

6. All traffic from local LAN network (192.168.2.0/24) to remote network (192.168.3.0/24) is sent over the IPsec tunnel. However, all other traffic originating from LAN network that is not going to remote network needs to be masqueraded.

```
set services firewall address-set CELL-IP
set services firewall address-set LOCAL-NETS addresses [192.168.2.0/24 ]
set services firewall address-set REMOTE-NETS addresses [192.168.3.0/24 ]

set services firewall nat source rule-set MASQ rule 1 match src-address address-set LOCAL-NETS
set services firewall nat source rule-set MASQ rule 1 match dst-address not
set services firewall nat source rule-set MASQ rule 1 match dst-address address-set REMOTE-NETS
set services firewall nat source rule-set MASQ rule 1 source-nat interface
```

Update firewall configuration to allow IKE/IPsec traffic

7. Add rules to allow IKE, DNS, NTP traffic and IPsec (ESP) traffic into the Cell interface.

NOTE: The IN_UNTRUSTED and OUT_UNTRUSTED filters have been applied on the Cell interface in incoming and outgoing direction (respectively) as part of factory default configuration.

```
set services firewall filter IN_UNTRUSTED rule 2 match protocol udp
set services firewall filter IN_UNTRUSTED rule 2 match src-port services [ dns ike ntp ]
set services firewall filter IN_UNTRUSTED rule 2 actions action accept
set services firewall filter IN_UNTRUSTED rule 3 match protocol esp
set services firewall filter IN_UNTRUSTED rule 3 actions action accept

set services firewall filter OUT_UNTRUSTED rule 1 match src-address address-set CELL-IP
set services firewall filter OUT_UNTRUSTED rule 1 match src-address add-interface-address true
set services firewall filter OUT_UNTRUSTED rule 1 actions action accept

set services firewall filter OUT_UNTRUSTED rule 2 match src-address address-set LOCAL-NETS
set services firewall filter OUT_UNTRUSTED rule 2 match dst-address not
set services firewall filter OUT_UNTRUSTED rule 2 match dst-address address-set REMOTE-NETS
set services firewall filter OUT_UNTRUSTED rule 2 actions action accept
```

8. Add rules to allow all traffic from end-device-3 subnet (192.168.3.0/24) to end-device-2 subnet (192.168.2.0/24) through the tunnel.

```
set services firewall filter IN_UNTRUSTED rule 4 match ipsec direction in
set services firewall filter IN_UNTRUSTED rule 4 match ipsec tunnel-src-address 10.1.1.3/32
set services firewall filter IN_UNTRUSTED rule 4 match ipsec tunnel-dst-address 10.1.1.2/32
set services firewall filter IN_UNTRUSTED rule 4 actions action accept
```

9. Add rules to allow all traffic from end-device-2 subnet (192.168.2.0/24) to end-device-3 subnet (192.168.3.0/24) through the tunnel.

```
set services firewall filter OUT_UNTRUSTED rule 2 match ipsec direction out
set services firewall filter OUT_UNTRUSTED rule 2 match ipsec tunnel-src-address 10.1.1.2/32
set services firewall filter OUT_UNTRUSTED rule 2 match ipsec tunnel-dst-address 10.1.1.3/32
set services firewall filter OUT_UNTRUSTED rule 2 actions action accept
```

Update network interface configuration from defaults

10. Disable DHCP server

```
set services dhcp enabled false
```

11. Update Bridge interface IP address to 192.168.2.1/24

```
delete interfaces interface Bridge ipv4
set interfaces interface Bridge ipv4 address 192.168.2.1 prefix-length 24
```

Commit Configuration

12. Commit configuration

```
commit
```

Orbit-3 Configuration - Loading certificates, setting up NTP

NOTE: From here on, we simply provide the configuration commands. Please refer to earlier sections in this bulletin to understand the intent of these commands.

Configure system to obtain time via NTP

NOTE1: We assume that a NTP server with IP address 10.1.1.10 is available and accessible on the cellular network. The certificate based IPsec tunnel setup requires system time on Orbit to be synchronized with an NTP server, otherwise certificate validation and hence tunnel setup will fail.

```
set system ntp use-ntp true
set system ntp ntp-server 10.1.1.10
```

NOTE2: In case the cellular plan allows internet access, you can use following configuration:

```
set system ntp use-ntp true
set system ntp ntp-server 0.pool.ntp.org
set system ntp ntp-server 1.pool.ntp.org
set system ntp ntp-server 2.pool.ntp.org
set system ntp ntp-server 3.pool.ntp.org

commit
```

Orbit-3 Configuration – IPsec tunnel from Orbit-2

Configure IPsec tunnel

```
set services vpn enabled true

set services vpn ike policy IKE-POLICY-PSK-ORBIT2 auth-method pre-shared-key
set services vpn ike policy IKE-POLICY-PSK-ORBIT2 pre-shared-key mysecretkey
set services vpn ike policy IKE-POLICY-PSK-ORBIT2 ciphersuite CS1 encryption-algo aes128-cbc
set services vpn ike policy IKE-POLICY-PSK-ORBIT2 ciphersuite CS1 mac-algo sha256-hmac
set services vpn ike policy IKE-POLICY-PSK-ORBIT2 ciphersuite CS1 dh-group dh14

set services vpn ike peer ORBIT2 ike-policy IKE-POLICY-PSK-ORBIT2
set services vpn ike peer ORBIT2 local-identity address 10.1.1.3
set services vpn ike peer ORBIT2 peer-endpoint address 10.1.1.2
set services vpn ike peer ORBIT2 peer-identity address 10.1.1.2
set services vpn ike peer ORBIT2 peer-identity-no-idr false
set services vpn ike peer ORBIT2 role responder

set services vpn ipsec policy IPSEC-POLICY ciphersuite CS1 encryption-algo aes128-cbc
set services vpn ipsec policy IPSEC-POLICY ciphersuite CS1 mac-algo sha256-hmac
set services vpn ipsec policy IPSEC-POLICY ciphersuite CS1 dh-group dh14

set services vpn ipsec connection ORBIT2 ike-peer ORBIT2
set services vpn ipsec connection ORBIT2 ipsec-policy IPSEC-POLICY
set services vpn ipsec connection ORBIT2 local-ip-subnet 192.168.3.0/24
set services vpn ipsec connection ORBIT2 remote-ip-subnets [ 192.168.2.0/24 ]
```

Update firewall configuration from defaults

```
set services firewall address-set CELL-IP
set services firewall address-set LOCAL-NETS addresses [192.168.3.0/24 ]
set services firewall address-set REMOTE-NETS addresses [192.168.2.0/24 ]

set services firewall nat source rule-set MASQ rule 1 match src-address address-set LOCAL-NETS
set services firewall nat source rule-set MASQ rule 1 match dst-address not
set services firewall nat source rule-set MASQ rule 1 match dst-address address-set REMOTE-NETS
set services firewall nat source rule-set MASQ rule 1 source-nat interface
```

Update firewall configuration to allow IKE/IPsec traffic

NOTE: The IN_UNTRUSTED and OUT_UNTRUSTED filters have been applied on the Cell interface in incoming and outgoing direction (respectively) as part of factory default configuration.

```
set services firewall filter IN_UNTRUSTED rule 2 match protocol udp
set services firewall filter IN_UNTRUSTED rule 2 match src-port services [ dns ike ntp ]
set services firewall filter IN_UNTRUSTED rule 2 actions action accept
set services firewall filter IN_UNTRUSTED rule 3 match protocol esp
set services firewall filter IN_UNTRUSTED rule 3 actions action accept

set services firewall filter OUT_UNTRUSTED rule 1 match src-address address-set CELL-IP
set services firewall filter OUT_UNTRUSTED rule 1 match src-address add-interface-address true
set services firewall filter OUT_UNTRUSTED rule 1 actions action accept
```

Update firewall configuration to allow end-device traffic through the tunnel

```
set services firewall filter IN_UNTRUSTED rule 4 match ipsec direction in
set services firewall filter IN_UNTRUSTED rule 4 match ipsec tunnel-src-address 10.1.1.2/32
set services firewall filter IN_UNTRUSTED rule 4 match ipsec tunnel-dst-address 10.1.1.3/32
set services firewall filter IN_UNTRUSTED rule 4 actions action accept

set services firewall filter OUT_UNTRUSTED rule 2 match ipsec direction out
set services firewall filter OUT_UNTRUSTED rule 2 match ipsec tunnel-src-address 10.1.1.3/32
set services firewall filter OUT_UNTRUSTED rule 2 match ipsec tunnel-dst-address 10.1.1.2/32
set services firewall filter OUT_UNTRUSTED rule 2 actions action accept
```

Update network interface configuration from defaults

```
set services dhcp enabled false
delete interfaces interface Bridge ipv4
set interfaces interface Bridge ipv4 address 192.168.3.1 prefix-length 24
```

Commit Configuration

```
commit
```

Testing tunnel (to Orbit-3) on Orbit2

1. Validate that tunnel is connected.

```
admin@(none) 13:53:48% run show services vpn
services vpn ipsec ipsec-status connection ORBIT3
state            connected
failure-reason     none
last-timestamp     2014-05-06T19:28:49+00:00
ima-evaluation     none
ima-recommendation none
```

2. Validate that you can pass traffic by pinging Orbit-3 bridge IP address (192.168.3.1) from Orbit-2 (using its Bridge IP address i.e. 192.168.2.1 as source address)

```
admin@(none) 13:47:58% run ping 192.168.3.1 src-address 192.168.2.1
PING 192.168.3.1 (192.168.3.1) from 192.168.2.1 : 56(84) bytes of data.
64 bytes from 192.168.3.1: icmp_req=1 ttl=64 time=5570 ms
64 bytes from 192.168.3.1: icmp_req=2 ttl=64 time=4573 ms
64 bytes from 192.168.3.1: icmp_req=3 ttl=64 time=3583 ms
```

Testing tunnel (from Orbit-2) on Orbit3

1. Validate that tunnel is connected.

```
admin@(none) 13:53:48% run show services vpn
services vpn ipsec ipsec-status connection ORBIT2
state            connected
failure-reason     none
last-timestamp     2014-05-06T19:28:49+00:00
ima-evaluation     none
ima-recommendation none
```

2. Validate that you can pass traffic by pinging Orbit-2 bridge IP address (192.168.2.1) from Orbit-3 (using its Bridge IP address i.e. 192.168.3.1 as source address)

```
admin@(none) 13:59:06% run ping 192.168.2.1 src-address 192.168.3.1
PING 192.168.2.1 (192.168.2.1) from 192.168.3.1 : 56(84) bytes of data.
64 bytes from 192.168.2.1: icmp_req=1 ttl=64 time=5048 ms
64 bytes from 192.168.2.1: icmp_req=2 ttl=64 time=4058 ms
64 bytes from 192.168.2.1: icmp_req=3 ttl=64 time=3058 ms
```

```
64 bytes from 192.168.2.1: icmp_req=4 ttl=64 time=2079 ms
64 bytes from 192.168.2.1: icmp_req=5 ttl=64 time=1079 ms
64 bytes from 192.168.2.1: icmp_req=6 ttl=64 time=250 ms
```

You should also be able to ping end-device-3 from end-device-2 and vice versa.

Troubleshooting

The following are common reasons for VPN connection failure:

1. Mismatch in pre shared key configured on the devices.
2. Mismatch in ciphersuites configured for IKE policy on device and the peer.
3. Mismatch in ciphersuites configured for IPsec policy on device and the peer.
4. Mismatch in remote and local IP subnets configured for IPsec connection on device and the peer.

You can monitor internal IPsec logs on orbit using following commands:

```
admin@(none) 17:13:26% run monitor start charon.log
[ok][2014-05-07 17:13:31]

….internal IPsec logs appear here…

admin@(none) 17:13:26% run monitor stop charon.log
[ok][2014-05-07 17:13:31]
```

End of application bulletin.