

FREEDM DGI: Power Management Test Plan

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Precondition:

- The Group Management module (GM) pushes the peer list when group reorganization takes place.
- State Collection module collects the power level at each node and computes the Normal (relative to group members).

| Case | Current State of the System | | | Action Performed by Power Management | Expected State of the System | | | As Expected? | Test Date |
|------|-----------------------------|--------|--------|--|------------------------------|------------------------|------------------------|--------------|-----------|
| | Node 1 | Node 2 | Node 3 | | Node 1 | Node 2 | Node 3 | | |
| 1 | Normal | Normal | Normal | Do Nothing | | | | Yes | 04/10/12 |
| 2 | Normal | Normal | Demand | Local load optimization at Node 3* | | | Σ | | |
| 3 | Normal | Normal | Supply | Node 3 could sell power to utility* | | | | | |
| 4 | Normal | Demand | Normal | Local load optimization at Node 2* | | Σ | | | |
| 5 | Normal | Demand | Demand | Local load optimization at Nodes 2&3* | | Σ | Σ | | |
| 6 | Normal | Demand | Supply | Migration from Node 3->2 as long as i) lease is not expired or ii) GM notifies that 2 has failed | | Δ | Δ /Reduce DESD* | Yes | 04/10/12 |
| 7 | Normal | Supply | Normal | Node 2 could sell power to utility* | | | | | |
| 8 | Normal | Supply | Demand | Migration from Node 2->3 as long as i) lease is not expired or ii) GM notifies that 3 has failed | | Δ /Reduce DESD* | Δ | Yes | 04/10/12 |
| 9 | Normal | Supply | Supply | Nodes 2&3 could sell power to utility* | | | | | |
| 10 | Demand | Normal | Normal | Local load optimization at Node 1* | Σ | | | | |
| 11 | Demand | Normal | Demand | Local load optimization at Nodes 1&3* | Σ | | Σ | | |
| 12 | Demand | Normal | Supply | Migration from Node 3->1 as long as i) lease is not expired or ii) GM notifies that 1 has failed | Δ | | Δ /Reduce DESD* | Yes | 04/10/12 |
| 13 | Demand | Demand | Normal | Local load optimization at Nodes 1&2* | Σ | Σ | | | |
| 14 | Demand | Demand | Demand | Local load optimization at Nodes 1,2&3* | Σ | Σ | Σ | | |
| 15 | Demand | Demand | Supply | Migration from Node 3->1/ 3->2 as long as i) lease is not expired or ii) GM notifies that 1/2 failed | Δ | Δ | Δ /Reduce DESD* | Yes | 04/10/12 |
| 16 | Demand | Supply | Normal | Migration from Node 1->2 as long as i) lease is not expired or ii) GM notifies that 2 has failed | Δ /Reduce DESD* | Δ | | Yes | 04/10/12 |
| 17 | Demand | Supply | Demand | Migration from Node 2->1/ 2->3 as long as i) lease is not expired or ii) GM notifies that 1/3 has failed | Δ | Δ /Reduce DESD* | Δ | Yes | 04/10/12 |
| 18 | Demand | Supply | Supply | Migration from Node 2->1/ 3->1 as long as i) lease is not expired or ii) GM notifies that 1 has failed | Δ | Δ /Reduce DESD* | Δ /Reduce DESD* | Yes | 04/10/12 |

* Not incorporated in the current version

Δ Make physical setting to accept incoming power over the shared power bus. Σ Rely on Utility

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| | | | | | | | | | |
|----|--------|--------|--------|--|------------------------|------------------------|------------------------|-----|----------|
| 19 | Supply | Normal | Normal | Node 1 could sell power to utility* | | | | | |
| 20 | Supply | Normal | Demand | Migration from Node 1->3 as long as i) lease is not expired or ii) GM notifies that 3 has failed | Δ /Reduce DESD* | | Δ | Yes | 04/24/12 |
| 21 | Supply | Normal | Supply | Nodes 1&3 could sell power to utility* | | | | | |
| 22 | Supply | Demand | Normal | Migration from Node 1->2 as long as i) lease is not expired or ii) GM notifies that 2 has failed | Δ /Reduce DESD* | Δ | | Yes | 04/10/12 |
| 23 | Supply | Demand | Demand | Migration from Node 1->2/ 1->3 as long as i) lease is not expired or ii) GM notifies that 2/3 failed | Δ /Reduce DESD* | Δ | Δ | Yes | 04/24/12 |
| 24 | Supply | Demand | Supply | Migration from Node 1->2/ 3->2 as long as i) lease is not expired or ii) GM notifies that 2 has failed | Δ /Reduce DESD* | Δ | Δ /Reduce DESD* | Yes | 04/10/12 |
| 25 | Supply | Supply | Normal | Nodes 1&2 could sell power to utility* | | | | | |
| 26 | Supply | Supply | Demand | Migration from Node 1->3/ 2->3 as long as i) lease is not expired or ii) GM notifies that 3 has failed | Δ /Reduce DESD* | Δ /Reduce DESD* | Δ | Yes | 04/10/12 |
| 27 | Supply | Supply | Supply | Nodes 1, 2 & 3 could sell power to utility* | | | | | |

Integrated Tests: A) Faults needed to be tested

| # | Current State of the System | Action Performed by DGI | Expected State of the System | Test Date |
|---|--|---|------------------------------|-----------|
| 1 | The supplying node's DGI fails during a migration. (Cases 6,8,12,15-18,20,22-24,26) | New normal is computed and power migration, if possible | | 04/24/12 |
| 2 | The receiving node's power electronics fail during a migration. (Cases 6,8,12,15-18,20,22-24,26) | New group formed & ongoing migrations are terminated | | |
| 3 | More supply nodes exist in comparison to demand nodes – potential congestion (Cases 18,24,26) | | | |

Integrated Tests: B) State change during a power migration-result of integrating with State Collection

| # | Current State of the System | Action Performed by DGI | Expected State of the System | Test Date |
|---|--|--------------------------------|---|-----------|
| 1 | The supplying node's load changes to Normal or Demand during a migration. (Cases 6,8,12,15-18,20,22-24,26) | Ongoing power migration ceases | | 04/24/12 |
| 2 | The receiving node's load changes to Normal or Supply during a migration. (Cases 6,8,12,15-18,20,22-24,26) | Ongoing power migration ceases | The demand node whose load is changed will stop 'accepting power' | 04/24/12 |

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Δ Make physical setting to accept incoming power over the shared power bus. Σ Rely on Utility