Load balancing Timing Analysis

PHASE_DURATION: 30000 ms
LOAD_TIMEOUT: 80 ms (Determined based on longest times ever observed)
STATE TIMEOUT: 170 ms (as recommended by lfqt5)

The worst case time observed so far for the load balancing module is ~80 ms. Each LB cycle consists of the execution of LoadManage, LoadTable (includes read from physical devices) and HandleRead functions along with power migration (includes write to physical devices via interface) steps, if any. Other significant events include:
i) Receiving global state, computation of Normal, sending Computed Normal if Leader
ii) Receiving computed Normal and revalidating local state

In the analysis below, two supply nodes and one demad node are considered, to start with. These experiments were done with the PSCAD simulation. Multiple times reported are for different instances of the test output. r-facts4 was the leader of the group. The times reported below are assuming that the group is already formed.

*Time taken by r-facts3 **without** a power migration step: <10 ms*
*Time taken by r-facts3 **with** a power migration step: 66.905 ms, 63.13 ms*

*Time taken by r-facts4 **without** a power migration step: <10 ms*
*Time taken by r-facts4 **with** a power migration step (including request to SC): 79.528 ms, 63.595 ms, 44.755 ms; 59.947 ms, 51.294 ms otherwise*

*Time taken by r-facts5 **without** a power migration step: <10 ms*
*Time taken by r-facts5 **with** a power migration step: 65.789 ms*

The following are the times, solely for power negotiation and migration:

r-facts3

2012-May-12 02:39:30.229526 : Notice(5): Demand message received from: fa0cf868-92c6-5b6d-a310-8fcb6f19da4e
2012-May-12 02:39:30.252172 : Debug(7): Message 'yes' received from fa0cf868-92c6-5b6d-a310-8fcb6f19da4e
2012-May-12 02:39:30.268658 : Debug(7): Message 'accept' received from fa0cf868-92c6-5b6d-a310-8fcb6f19da4e
2012-May-12 02:39:30.269887 : Warn(3): Migrating power on request from: fa0cf868-92c6-5b6d-a310-8fcb6f19da4e
2012-May-12 02:39:30.271415 : Notice(5): P* = -17.0318

At r-facts3, time from the instant demand message was received to the time power migration is initiated: 41.889 ms

r-facts5

2012-May-12 02:39:30.197469 : Notice(5): Sending 'demand' from: fa0cf868-92c6-5b6d-a310-8fcb6f19da4e
2012-May-12 02:39:30.206261 : Debug(7): Message 'request' received from 843fed0b-f195-5959-b0ec-a55bb5086850
2012-May-12 02:39:30.215332 : Debug(7): Message 'request' received from 7236df5f-e93e-5881-bcc8-e992d22eeb0f
2012-May-12 02:39:30.237247 : Debug(7): Message 'drafting' received from 843fed0b-f195-5959-b0ec-a55bb5086850
2012-May-12 02:39:30.242051 : Debug(7): void freedm::lbAgent::Step_PStar()
2012-May-12 02:39:30.242959 : Notice(5): P* = 18.6012

At r-facts5, time from the instant request message was received from r-facts3 to the instant power migration is initiated: 36.698 ms

2012-May-12 02:39:30.250044 : Debug(7): Message 'drafting' received from 7236df5f-e93e-5881-bcc8-e992d22eeb0f
2012-May-12 02:39:30.255920 : Debug(7): void freedm::lbAgent::Step_PStar()
2012-May-12 02:39:30.256779 : Notice(5): P* = 18.6012

At r-facts5, time from the instant request message was received from r-facts4 to the time power migration is initiated: 41.447 ms

r-facts4

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2012-May-12 02:39:30.195376 : Notice(5):    Sending 'request' from: 7236df5f-e93e-5881-bcc8-e992d22eeb0f
2012-May-12 02:39:30.205556 : Debug(7):     Message 'demand' received from fa0cf868-92c6-5b6d-a310-8fcb6f19da4e
2012-May-12 02:39:30.231687 : Debug(7):     Message 'yes' received from fa0cf868-92c6-5b6d-a310-8fcb6f19da4e
2012-May-12 02:39:30.259504 : Debug(7):     Message 'accept' received from fa0cf868-92c6-5b6d-a310-8fcb6f19da4e
2012-May-12 02:39:30.264170 : Warn(3):      Migrating power on request from: fa0cf868-92c6-5b6d-a310-8fcb6f19da4e
2012-May-12 02:39:30.265606 : Debug(7):     void freedm::lbAgent::Step_PStar()
2012-May-12 02:39:30.267062 : Notice(5):    P* = -3.83984
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At r-facts4, time from the instant demand message was received from r-facts5 to the instant power migration is initiated: 61.506 ms