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**1) Introduction:** The file AH\_dynamicRWA.opcfa is an optical network simulator developed in OPNET modeler 14.5 in order to simulate dynamic routing and wavelength assignment in WDM/DWDM optical networks like ASON. This read me file explains the steps and pre-requisites for using this simulator. At least basic knowledge of C++, OPNET modeler and its architecture is assumed here. The source code in AH\_dynamicRWA process model is commented to enable the user to change it appropriately.

### **2) Configurations required for using AH\_dynamicRWA simulator:**

To use this simulator, following needs to be installed and configured on the machine.

- a) Opnet 14.5 modeler or later.
- b) Visual C++ (For other compilers and their configurations, refer to FAQs section on [www.opnet.com/support](http://www.opnet.com/support)).
- c) Newran03 random number generator library (Provided). However, to generate a static library for use with AH\_dynamicRWA simulator, please refer to <http://www.robertnz.net/nr03doc.htm>

### **3) Extracting AH\_dynamicRWA.opcfa file:**

Start OPNET.

File->Manage Model Files -> Expand Project File Archive

This will extract the network simulator files, which includes:

- a) Project files

- b) AH\_dynamicRWA Node Model
- c) AH\_dynamicRWA Process Model
- d) AH\_mypm Link Model

Before running the simulator, open the process model.

Click on HB (Header block). Change the path to the 'path\_output' variable to the appropriate path of the output file.

Click on 'init1.enter' executive and set the director for the seed being used with newran random number generator.

```
if(current_node_id == 1)
{
    Random::SetDirectory("c:\\seed\\"); // set directory for seed control

    Random::Set(urng);           // set urng as generator to be used

    Random::CopySeedFromDisk(false); // get seed information from disk
}
```

To run the simulator, click Configure/Run Discrete Event Simulation (DES) button. There you can choose the simulation time. Also make sure, that on the left hand pane "Advanced->Linking->Common Linking Libraries" contain the path to the static library for random number generator. (By default it is C:\newran03\Rand\_Gen03.lib)

#### 4) Architecture of AH\_dynamicRWA and types of simulations that can be carried out

The network simulator is designed such a way that both centralized and distributed control planes can be analyzed. For routing, shortest path routing is used both in terms of hop length and number of free wavelengths available. First-Fit algorithm is being used as a wavelength assignment algorithm.

To use shortest path routing in terms of number of hops or in terms of number of free wavelengths available over the edges, along with first-fit algorithm, click on FB (Function Block) and please uncomment the appropriate (use only one of the two options at a time) in the function "*static void Create\_Send\_PATH (int src\_indx, int dest\_indx, double CT)*". By default, the shortest path routing in terms of number of hops is enabled.

To vary the number of wavelengths, click HB (Header Block) and change the value of the variable, defined as "*#define no\_of\_wavelengths 16*".

To vary the connection holding time (has exponential distribution), click HB (Header Block) and change the value of the variable, defined as "*double mean\_connection\_holding\_time = 50.0*".

To change the start time and stop time of the traffic source generator, open AH\_dynamicRWA node model, right click the "*traffic source*" processor, click edit attributes and there the start time and stop time for the traffic source generator can be updated.

To vary the inter-arrival times between the individual connection requests and the type of distribution being used, go to project space i.e. subnet top, right click the appropriate node whose traffic generation capability needs to be updated, click the “*Traffic Source . Packet Interarrival Time*” attributes, and change the interarrival time between individual lightpath request and the type of distribution being used with it.

This network simulator can be used to simulate two different kinds of architectures. Centralized network control plane and distributed plane.

In the distributed plane, each node in the network has a capability to generate lightpath traffic. Each node will do the routing and wavelength assignment computation locally/distributed. By default, distributed architecture is enable. To change it to centralized plane, please refer to the source code comments in idle.enter executive in AH\_dynamicRWA process model.

## **5) Contact**

In case of reporting any bugs, please contact the author [ali.hassan@elec.qmul.ac.uk](mailto:ali.hassan@elec.qmul.ac.uk)