



IEEE 802.17

RPR Performance

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Motivation

- **Need to simulate worst case scenarios and ensure that the proposed standard works under these conditions**
- **Ensure that we find a solution that has no fundamental weaknesses**



Performance problems

- **Oscillations due to reactive flow control**
- **Low bandwidth utilization with bursty traffic**



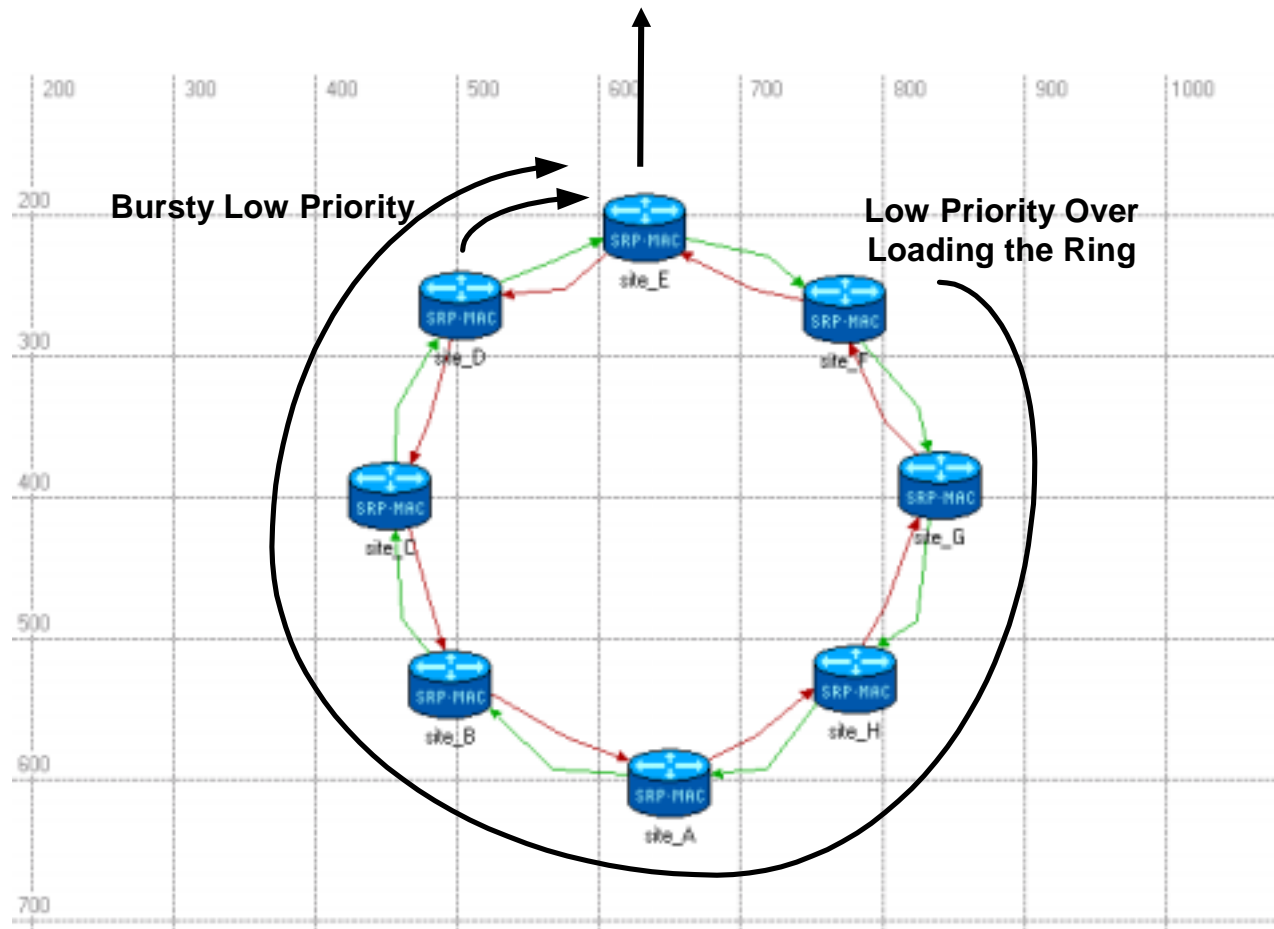
Scenario #1



Dealing with Low priority Bursty Traffic

- **Assume loaded ring**
- **Bursty traffic is being injected**
- **Bursty traffic will be modeled as periodic pulses**

Scenario #1 Simple Hubbing





Scenario #1 Parameters



Traffic Generation Parameters

| | <u>Site F (Heavy Loaded)</u> | <u>Site D (Bursty)</u> | |
|-------------------|------------------------------|------------------------|---------|
| Start Time | 0.1 | 0.1 | seconds |
| ON State Time | 10 | 0.001 | seconds |
| OFF State Time | 0 | 0.02 | seconds |
| Packet Size | 1500 | 1500 | bytes |
| Traffic generated | 800 Mbps | 600 Mbps | (OC12) |
| | 3 Gbps | 600 Mbps | (OC48) |

For Gandalf

Decay Interval 102.88 usec



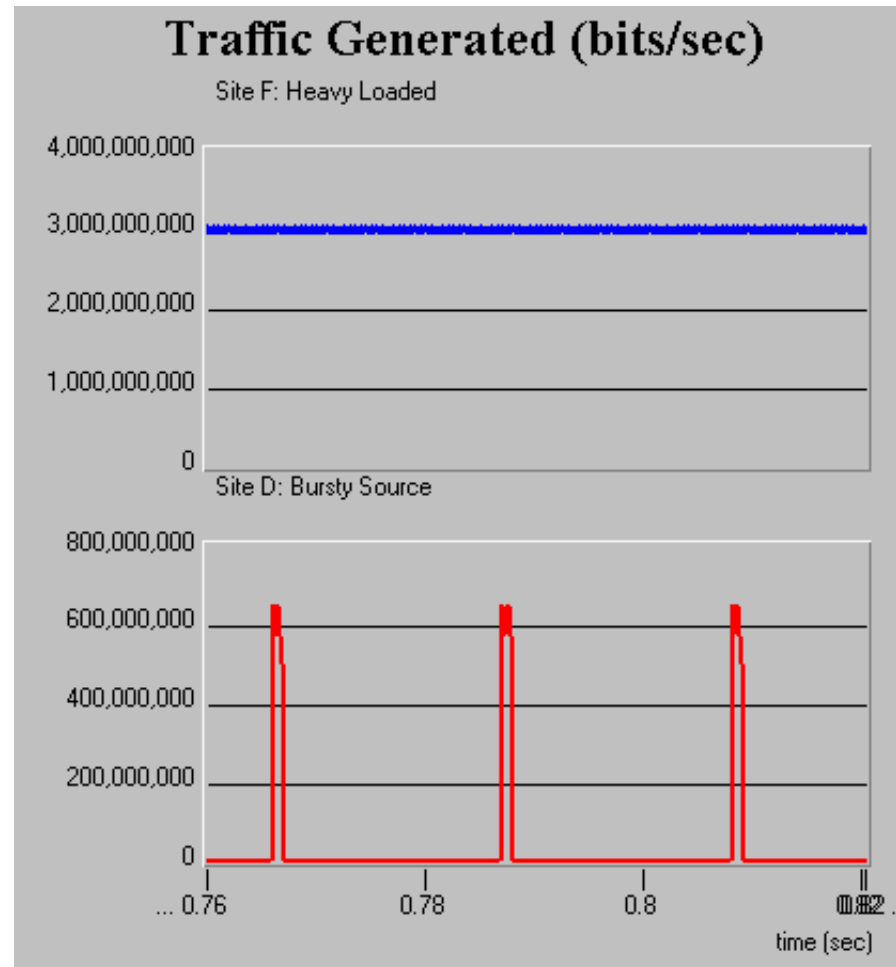
Scenario #1

Traffic Generated for OC-48



Low priority
traffic generated at
upstream node

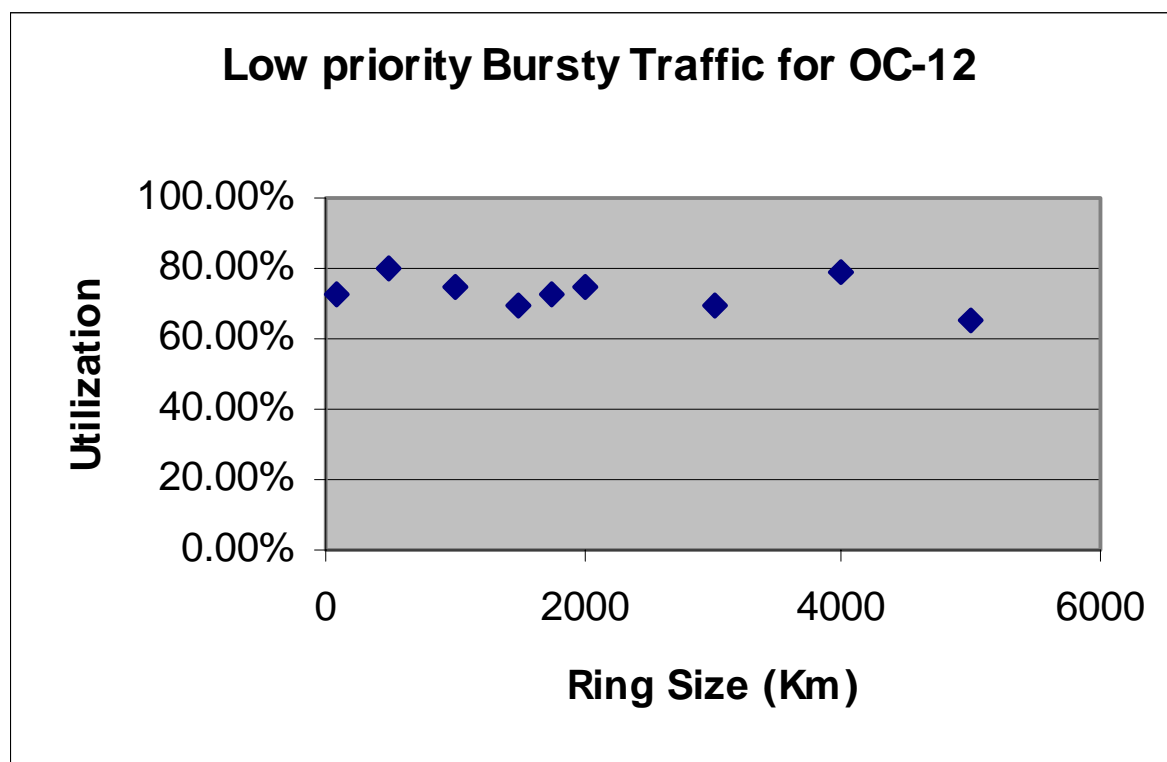
Low priority
traffic generated at
downstream node





Scenario #1

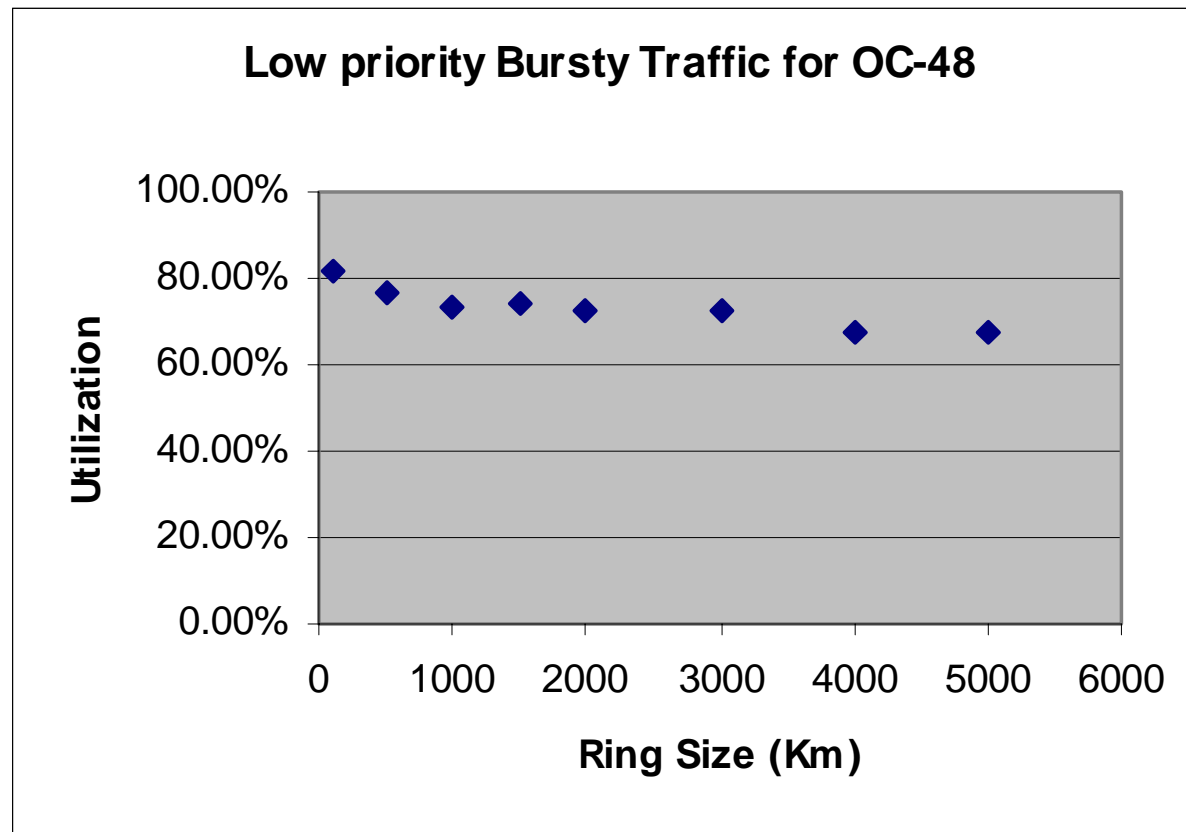
Gandalf Results





Scenario #1

Gandalf Results



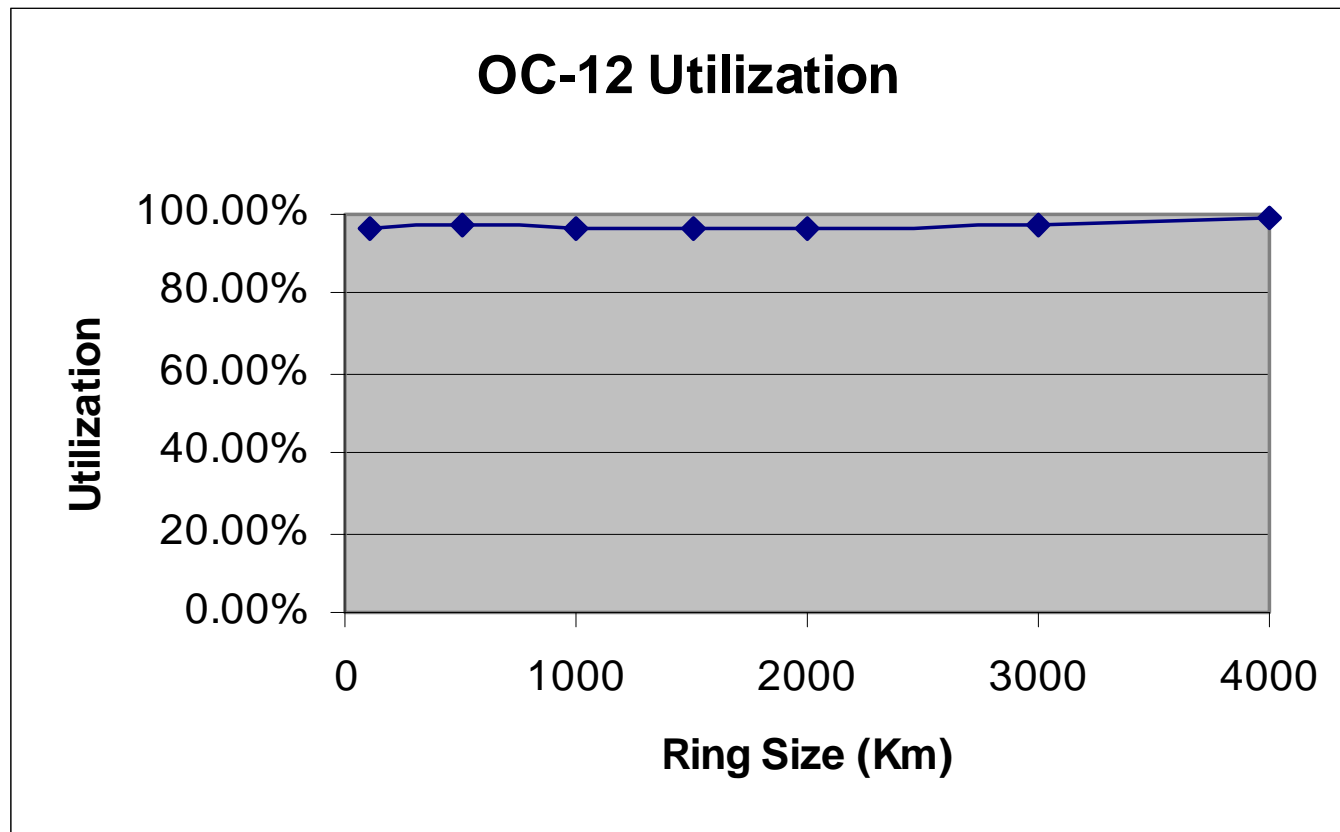


Explanation of Problem

- **Burst of inserted traffic causes congestion**
- **This triggers reactive flow control message (my-usage)**
- **Panic backoff throttles upstream source to low value even though burst is gone**
- **Slow ramp up mechanism independent of traffic conditions**
- **Result: Low BW efficiency**

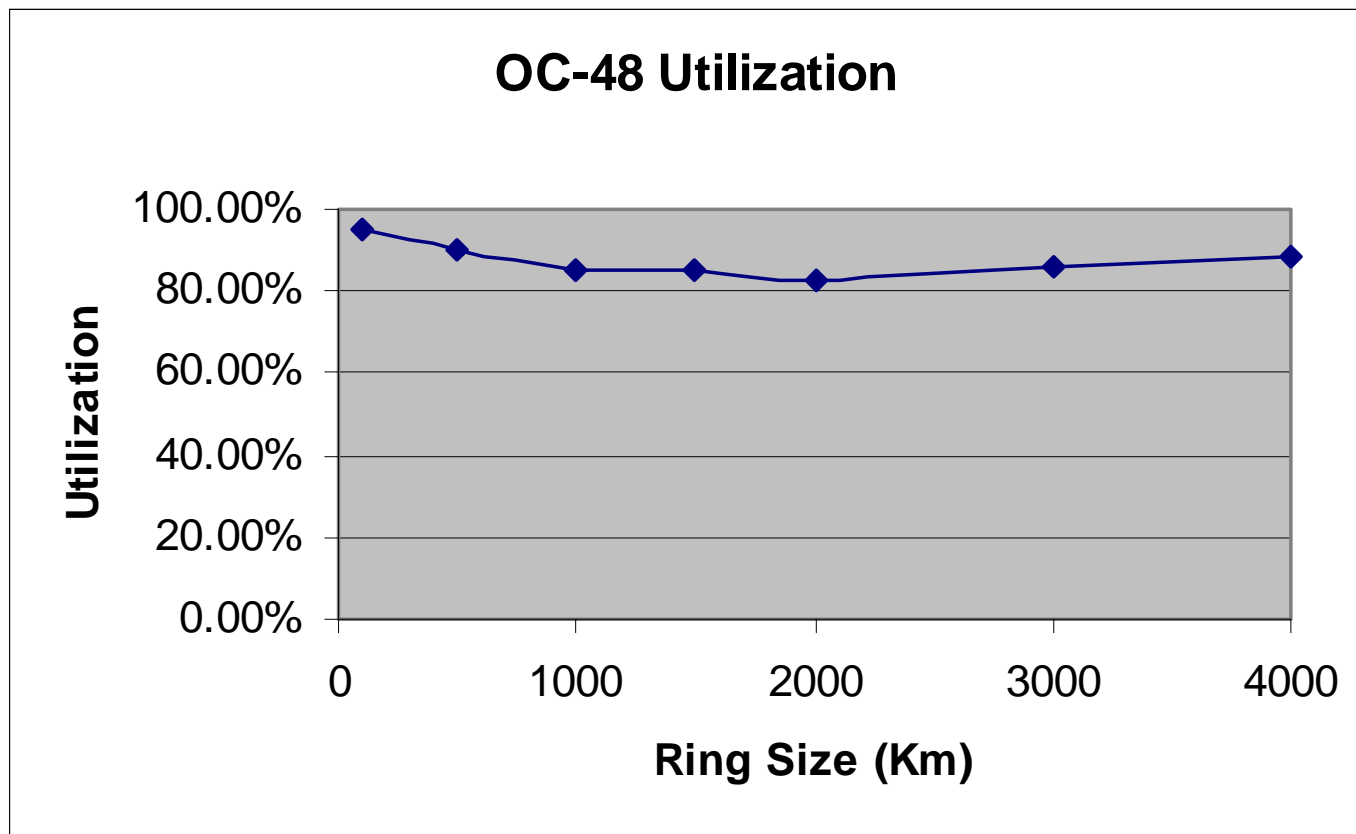


Scenario #1 VoQ Results





Scenario #1 VoQ Results





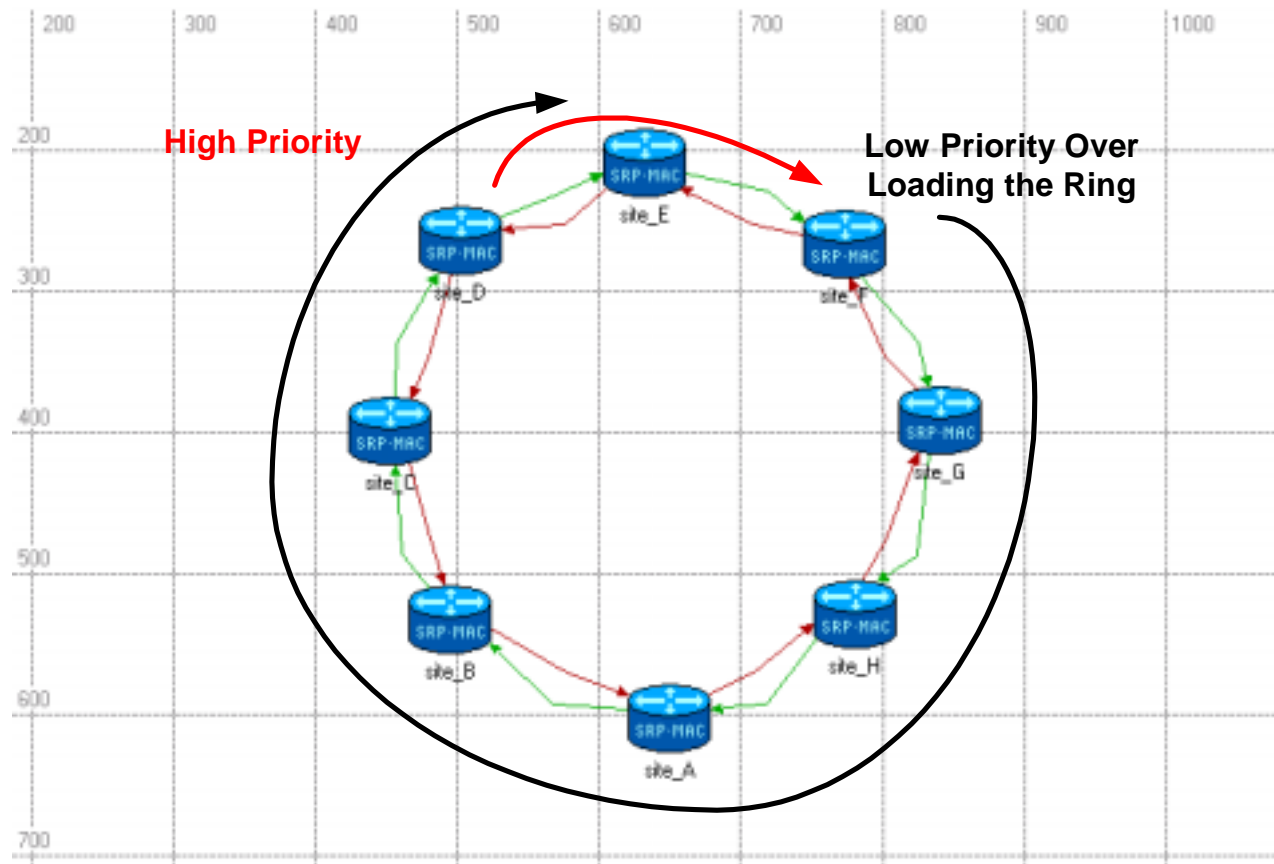
Scenario #3: High priority low intensity



- **Assume loaded ring**
- **Add high priority traffic**
 - **Low intensity**
 - **Constant dist**



Scenario #3 Setup





Scenario #3 Parameters



Traffic Generation Parameters

| | <u>Site F (Low priority)</u> | <u>Site D (High Priority)</u> |
|-------------------|------------------------------|----------------------------------|
| Start Time | 0.2 | 0.1 |
| ON State Time | 10 | 10 |
| OFF State Time | 0 | 0 |
| Packet Size | 1500 | 1500 |
| Traffic generated | 800 Mbps 3 Gbps | 50 Mbps (OC12) 50 Mbps (OC48) |

For Gandalf

Decay Interval 102.88 usec

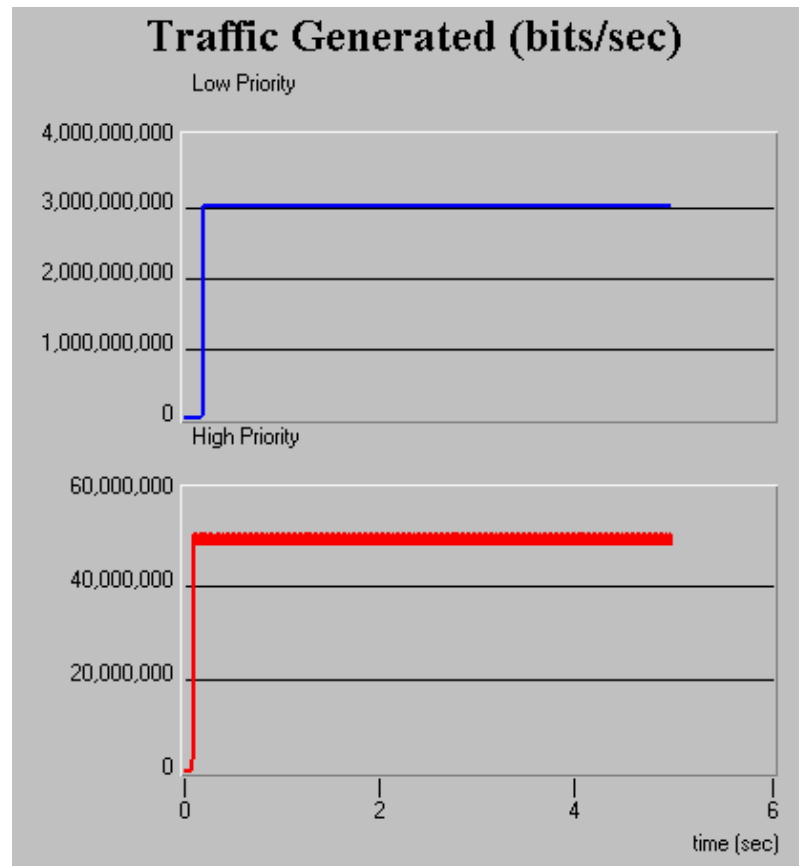


Scenario 3: Traffic Generated for OC48



Low priority
traffic generated at
upstream node

High priority
traffic generated at
downstream node



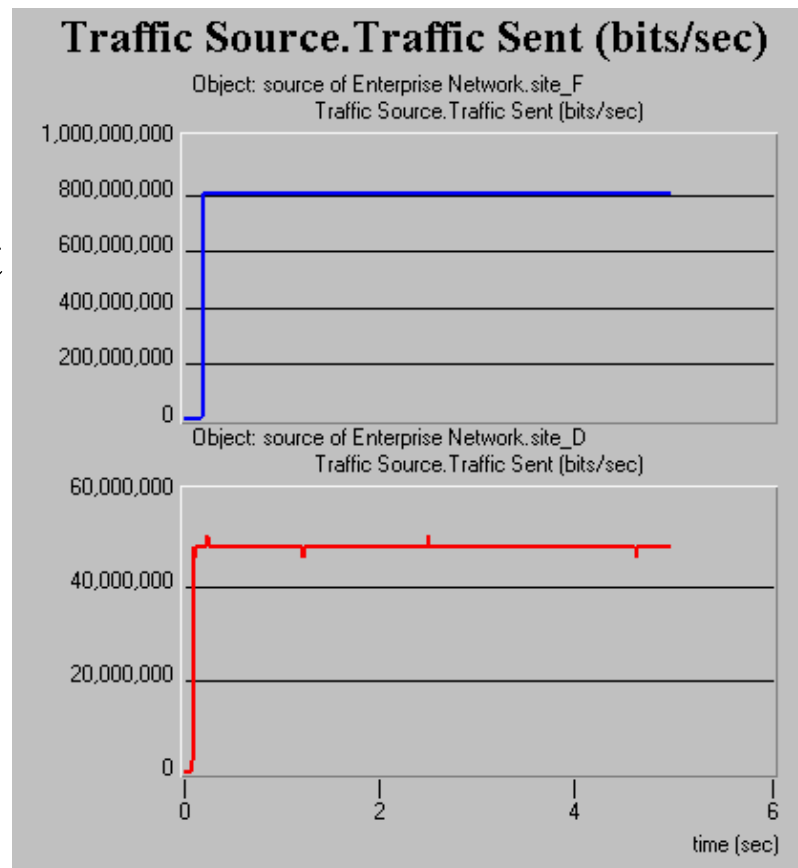


Scenario 3: Traffic Generated for OC12



Low priority
traffic generated at
upstream node

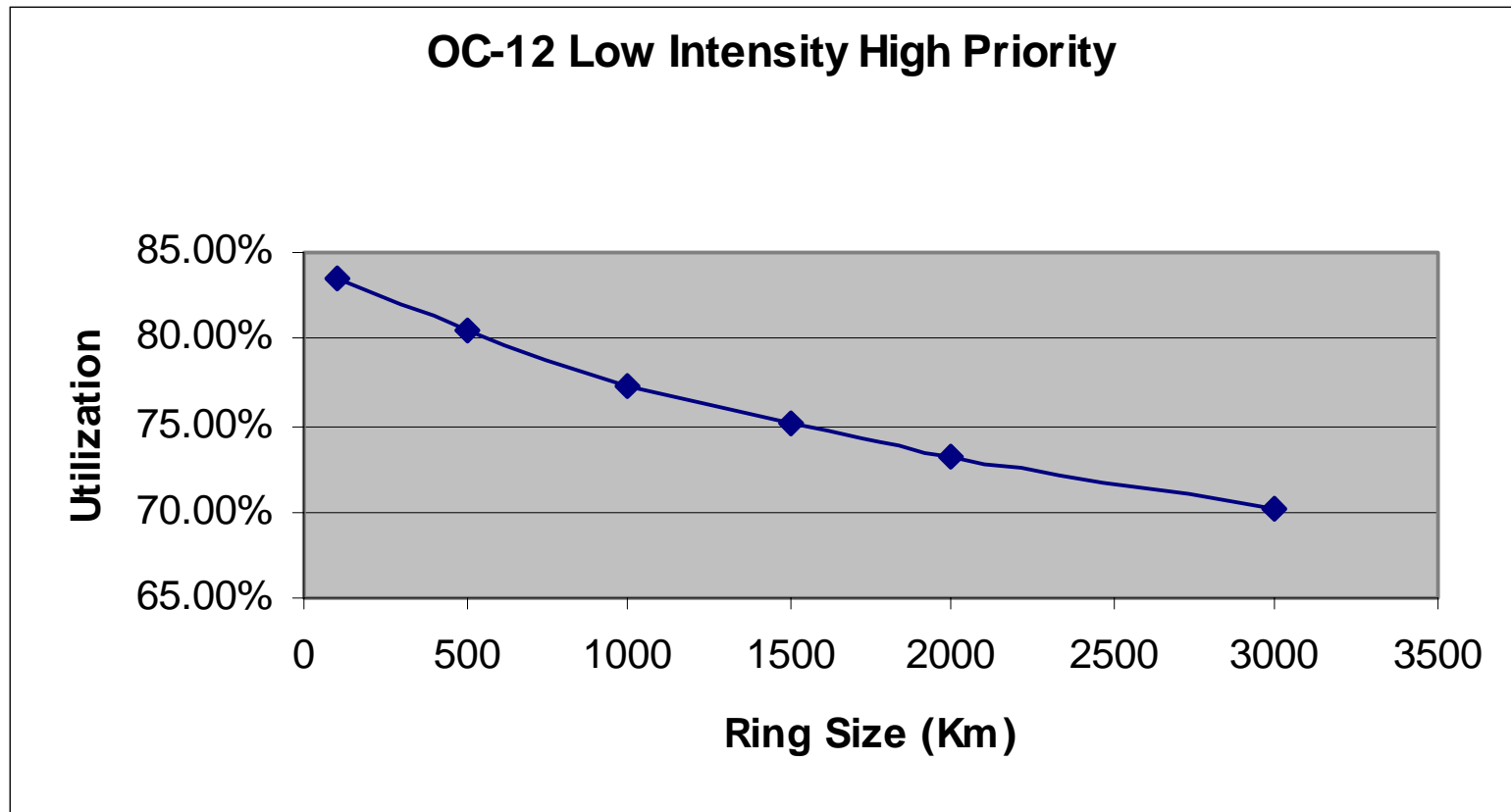
High priority
traffic generated at
downstream node





Scenario #3

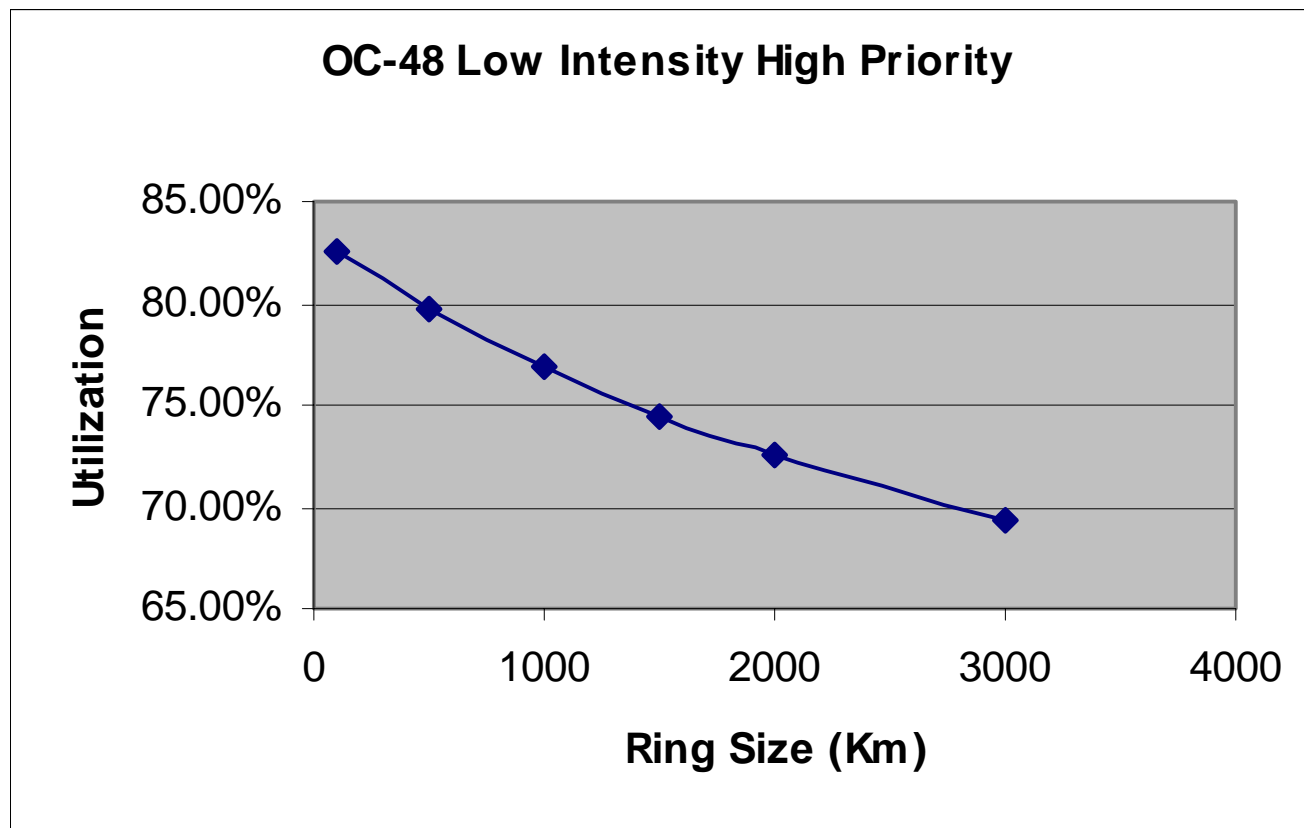
Gandalf Results





Scenario #3

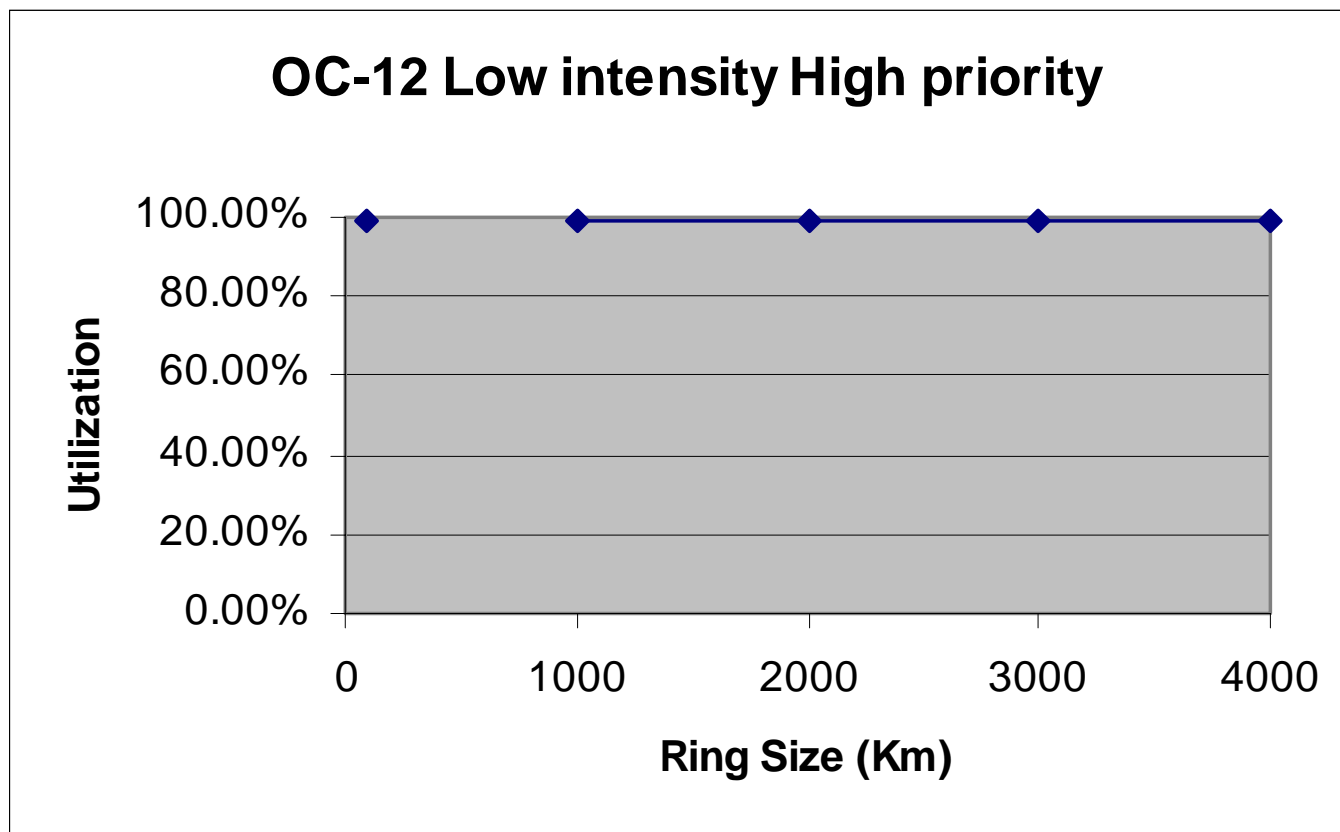
Gandalf Results





Scenario #3

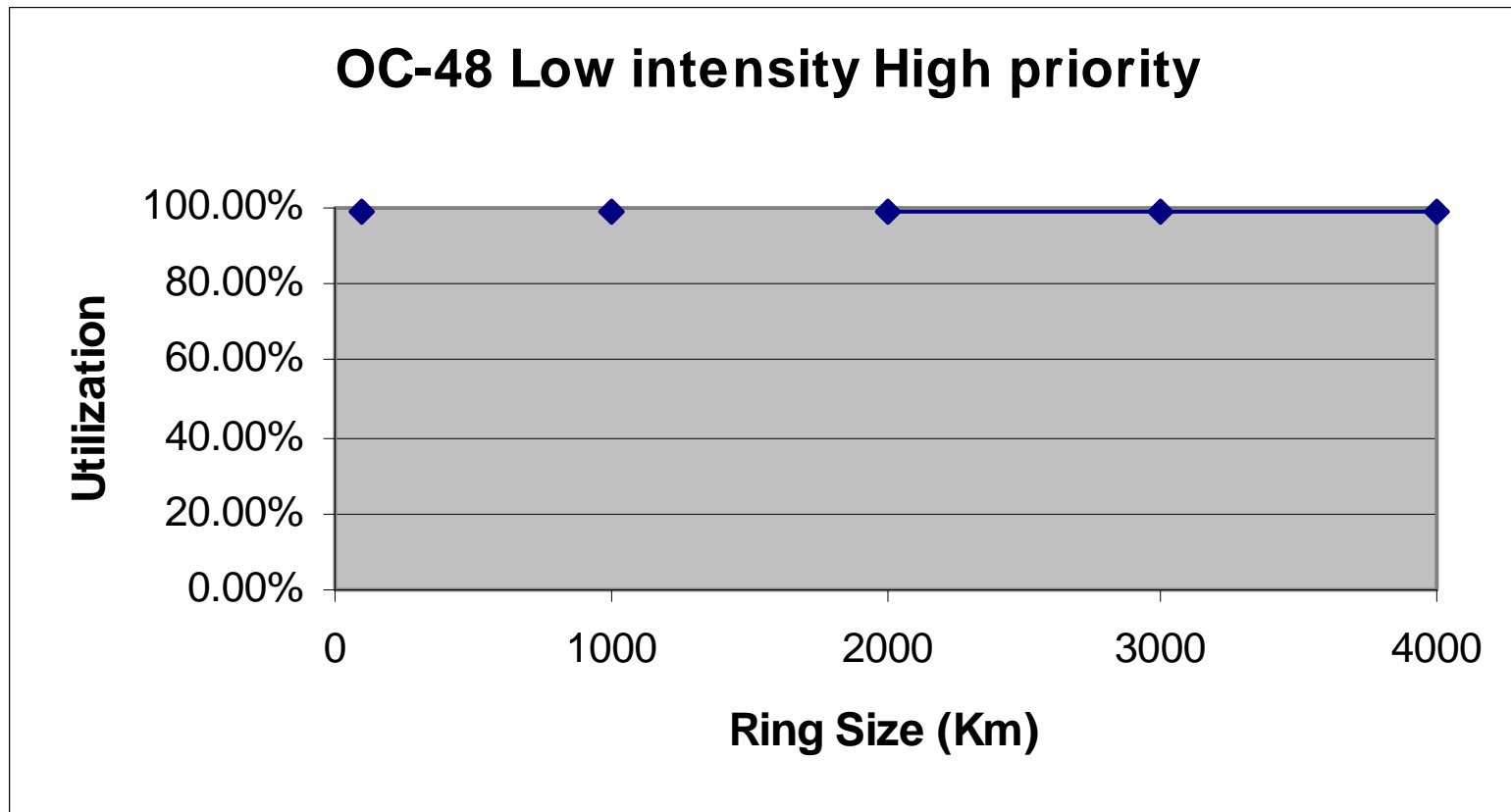
VoQ Results





Scenario #3

VoQ Results





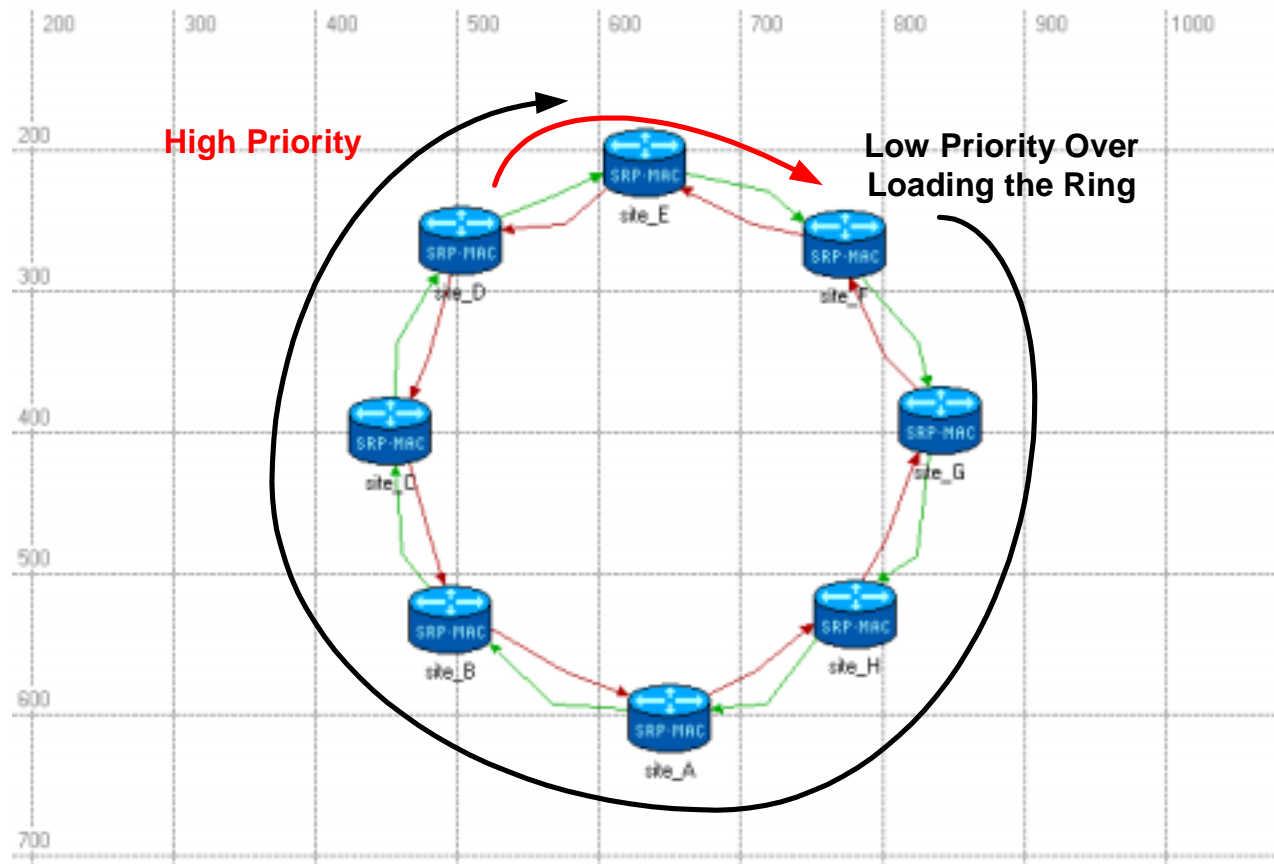
Scenario #4: Bursty High Priority



- **Assume loaded ring**
- **Add bursty high priority traffic**



Scenario #4 Setup





Scenario #4

Parameters



Traffic Generation Parameters

| | <u>Site F (Low priority)</u> | <u>Site D (High Priority)</u> |
|-------------------|------------------------------|------------------------------------|
| Start Time | 0.1 | 0.2 |
| ON State Time | 10 | 0.001 |
| OFF State Time | 0 | 0.02 |
| Packet Size | 1500 | 1500 |
| Traffic generated | 800 Mbps 3 Gbps | 600 Mbps (OC12) 2.4 Gbps (OC48) |

For Gandalf

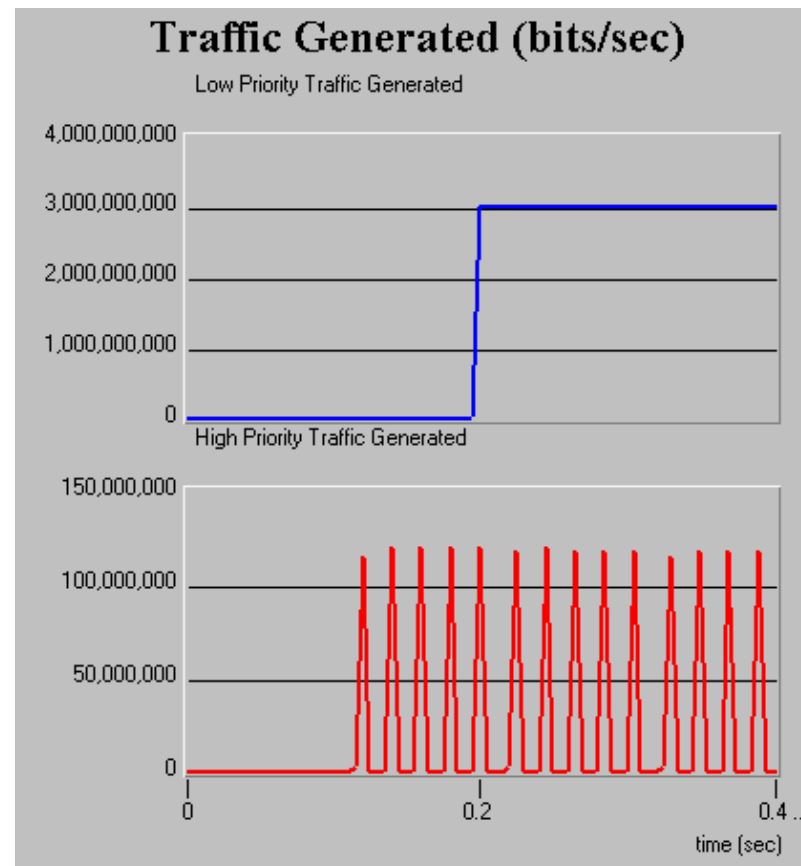
Decay Interval 102.88 usec



Scenario 4: Traffic Generated

Low priority traffic generated at upstream node

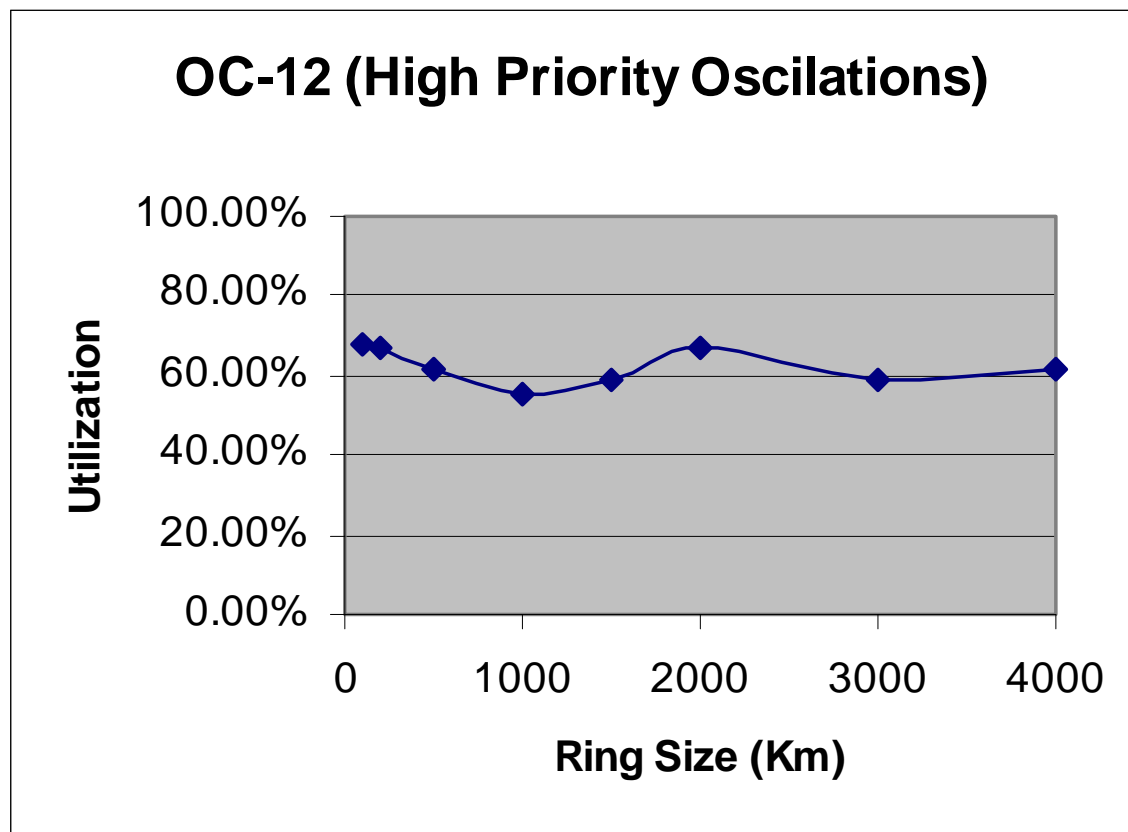
High priority traffic generated at downstream node





Scenario #4

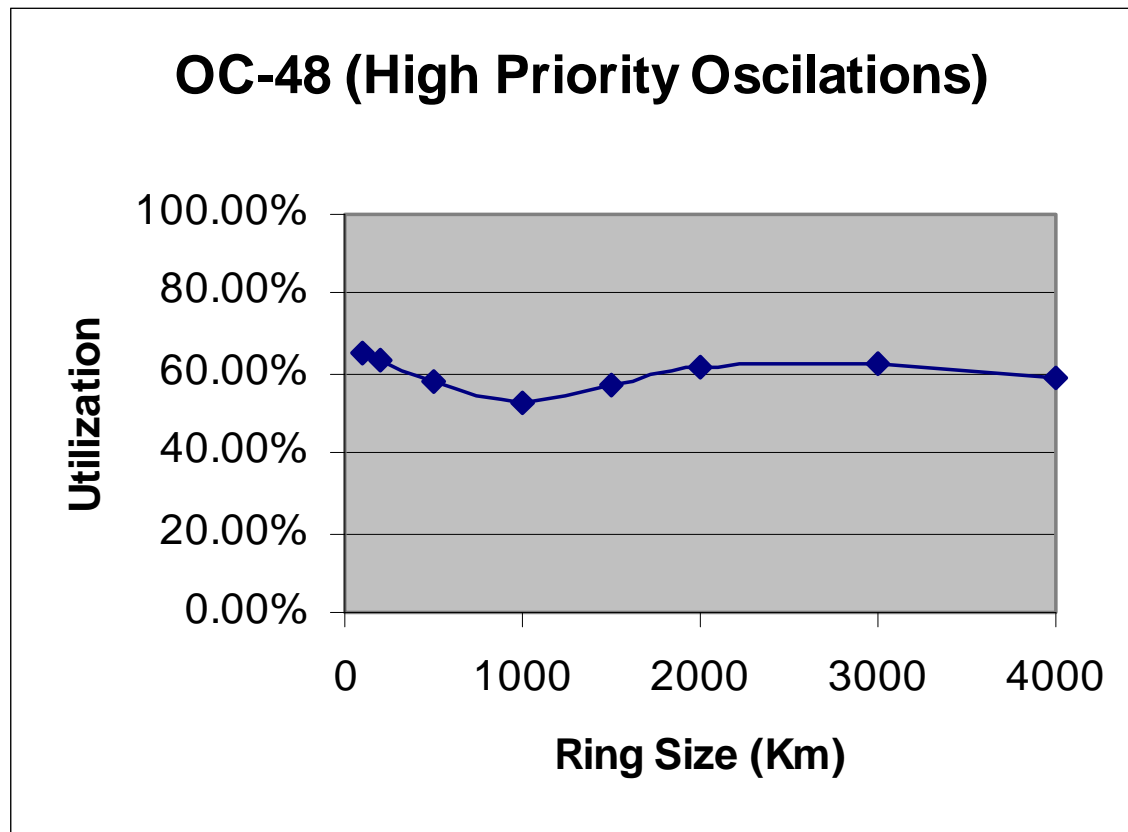
Gandalf Results





Scenario #4

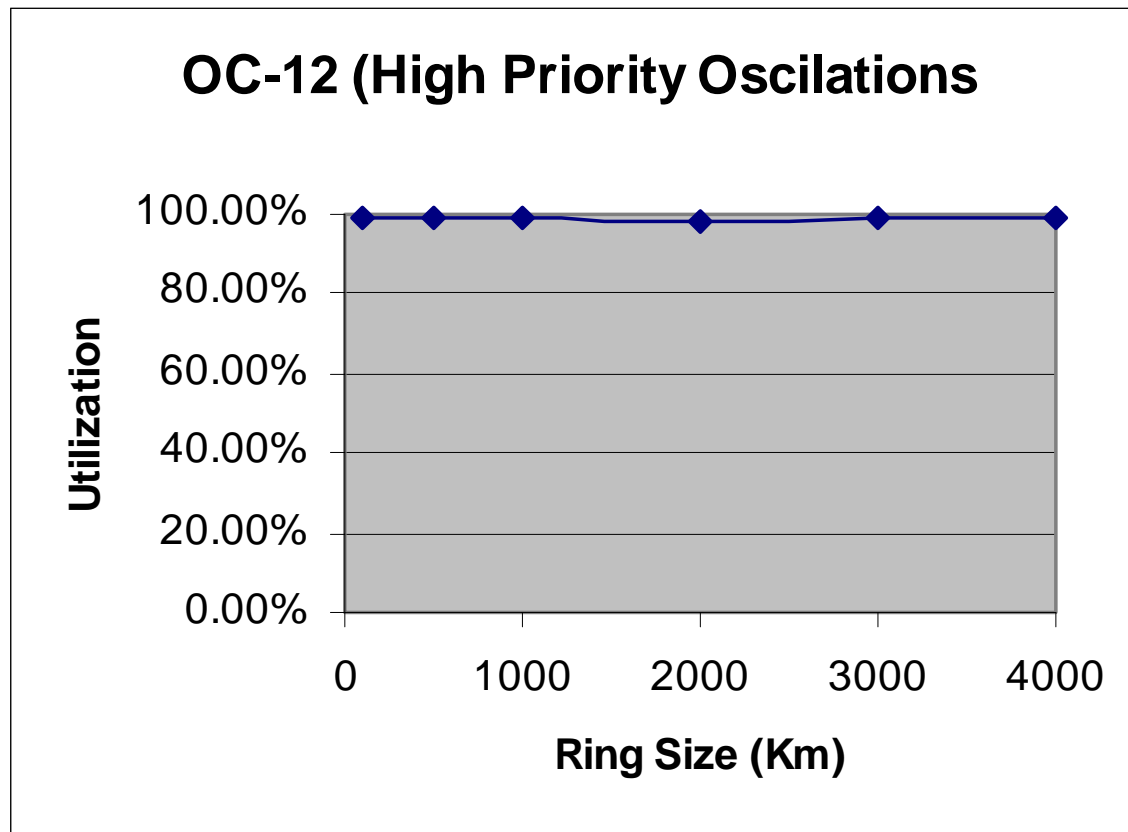
Gandalf Results





Scenario #4

VoQ Results





Scenario #4

VoQ Results



- **OC48 (Results not available yet)**



Conclusions

- **Special attention needs to be given to selection of the flow control mechanism because of:**
 - **Dramatic effect on bandwidth utilization (can be as low as 55%!)**
 - **Low priority traffic can affect high priority traffic**



Conclusions ...

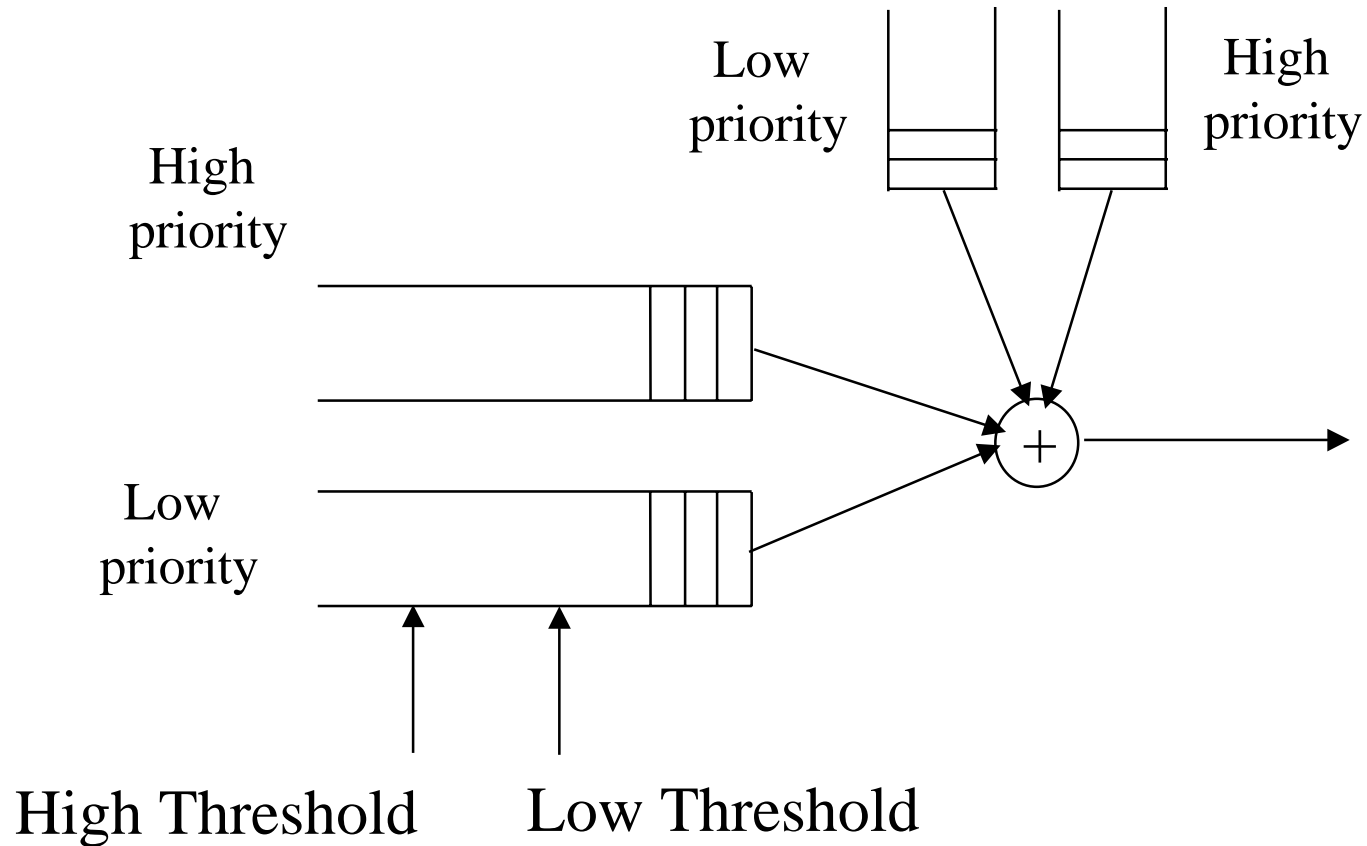
- **Found some simple traffic patterns that cause these problems**
 - **Are there others?**
- **Need further investigation by WG**
 - **Extent of the problems not clear**
 - **Need to look at other traffic patterns including TCP and multimedia traffic**



Backup Charts



Transit Buffer Analysis (SRP-fa)

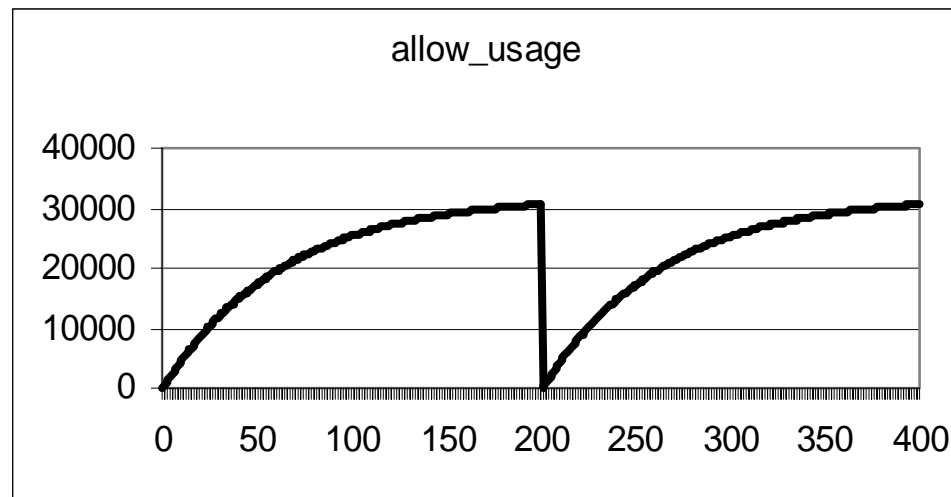




SRP-fa Ramp up Mechanism



- $\text{allow_usage} = \text{allow_usage} + \frac{\text{MAX_LINE_RATE} - \text{allow_usage}}{\text{LP_ALLOW}}$





VoQ Mechanism for throttling and ramping up



- **AvailableRingBW = link capacity – SUM ri**
- **RCF = AvailableRingBW / SUM wi**
- **Total allocated bandwidth =
committed bandwidth + station weight *RCF
(fi = ri + wi*RCF_min)**