Optical burst switching with burst access mode passive optical networks

C.Y. Li*, P.K.A. Wai*, and V.O.K. Li+

*Department of Electronic & Information Engineering,
The Hong Kong Polytechnic University

+Department of Electrical & Electronic Engineering,
The University of Hong Kong

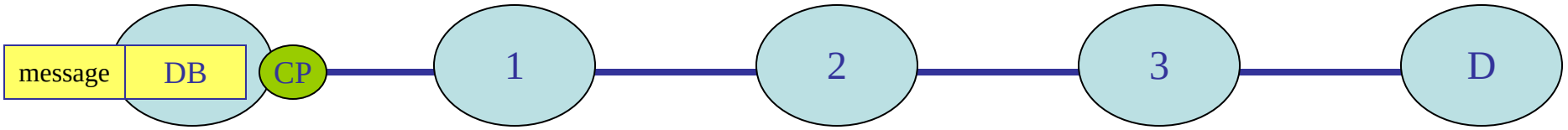
THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

Contents

- Review of optical burst switching (OBS) and passive optical network (PON)
- The problem of using PONs as the access networks of OBS networks
- The burst mode access PONs
- Performance evaluation
- Conclusion

Optical burst switching (OBS)

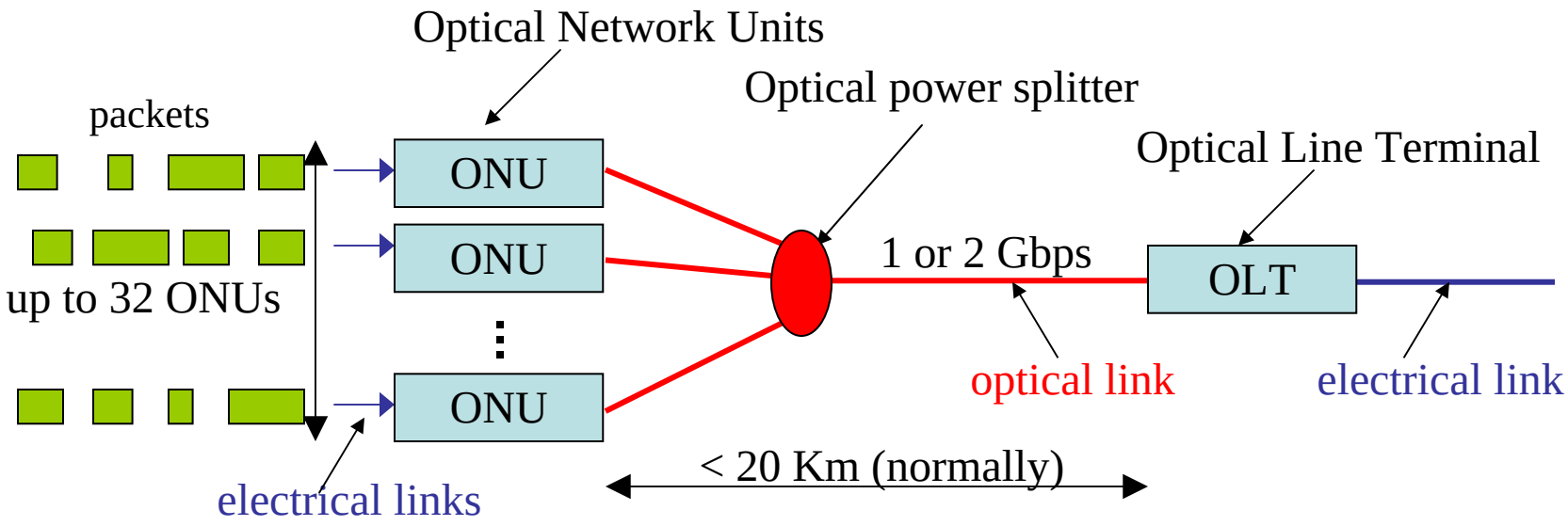
(a practical approach for optical packet switching)



- We do not need any fiber delay lines with OBS.
- The control packet (CP) contains the routing information and is first sent out to setup the routing path for the data burst (DB).
- The CP is processed electrically node by node from the source to destination to reserve the required resources.
- After an offset time, the source node sends out the DB regardless of the status of resource reservation.
- No processing and delay are required for the DB at the intermediate nodes.

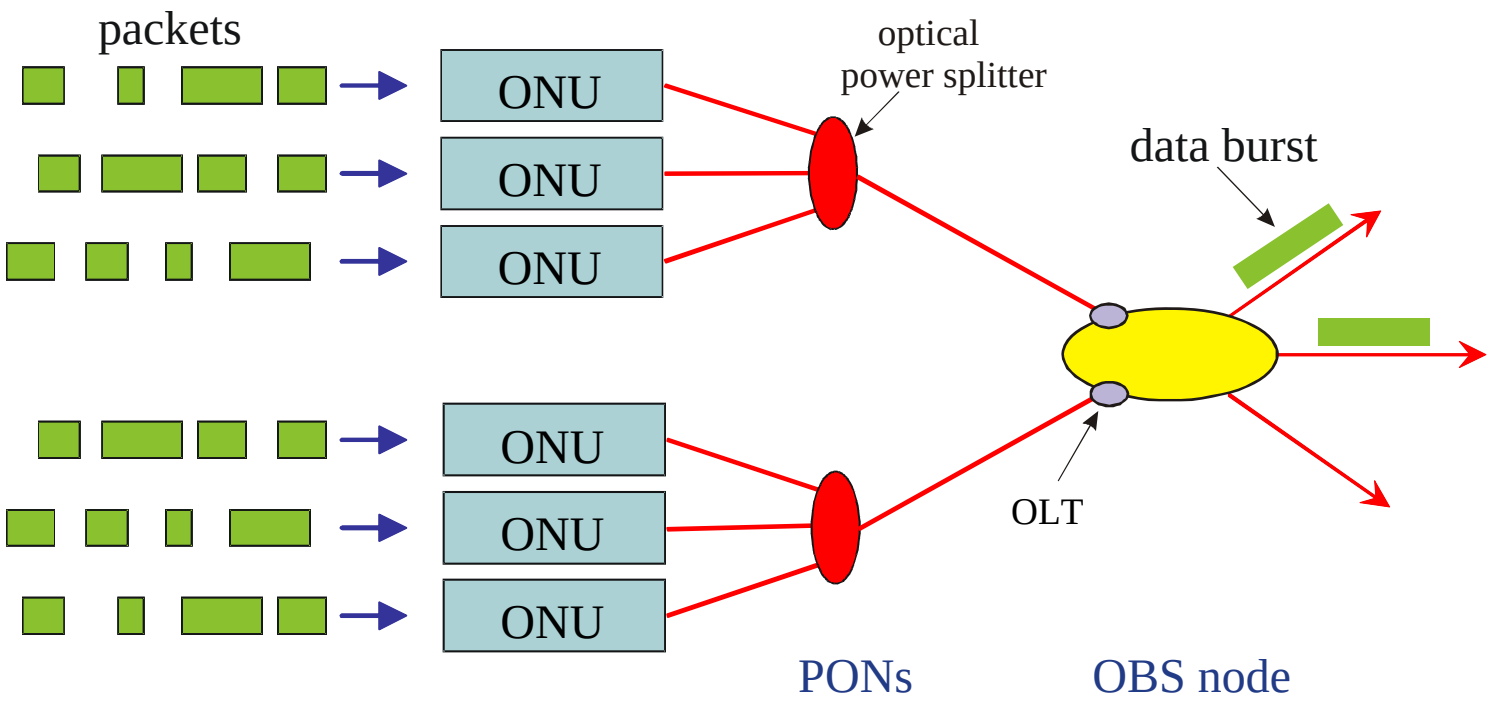
Passive optical network

(an important broadband access network)

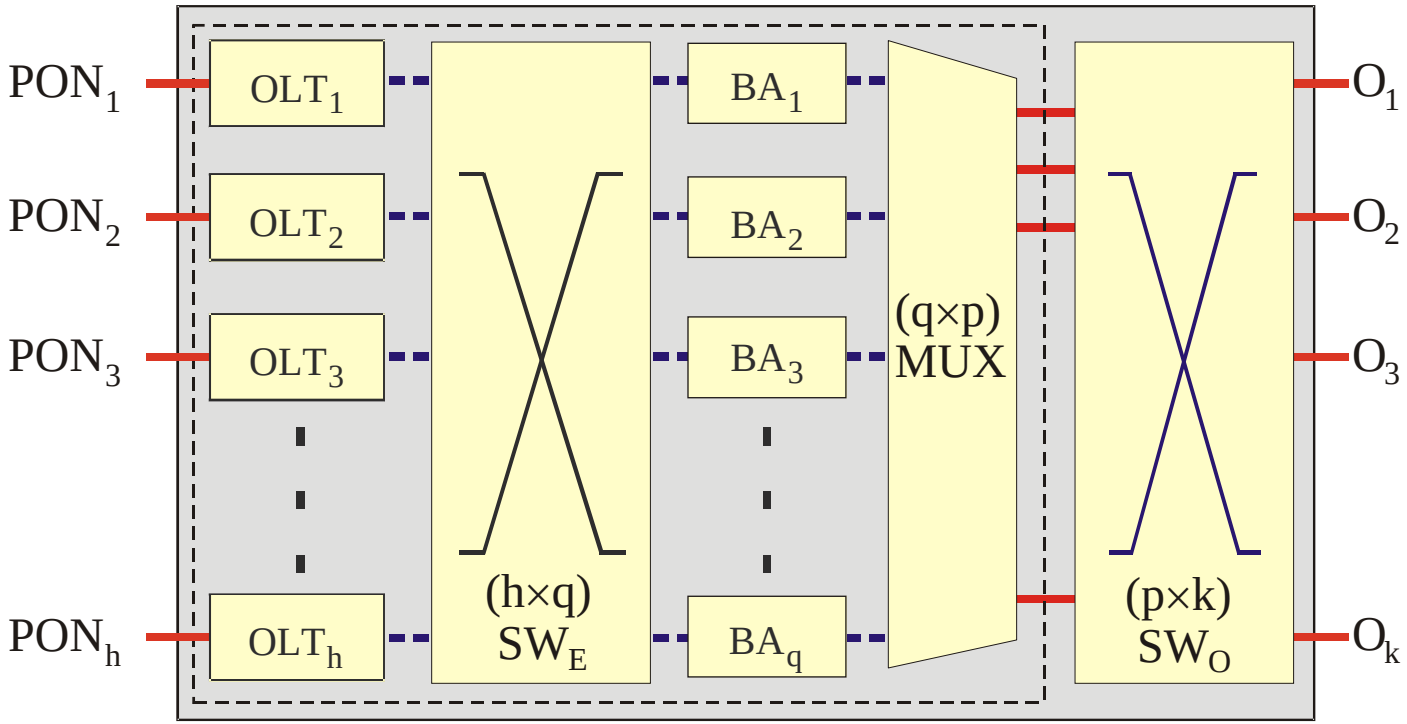


- **Data rates: 1 or 2 Gbps between OLT and ONUs**
- **Coverage: 32 ONUs and up to 20 Km**
- **Electrical links at the network side of OLT and the user side of ONUs**
- **Optical links between the OLT and ONUs**
- **Broadcast downstream transmission, point-to-point upstream transmission**

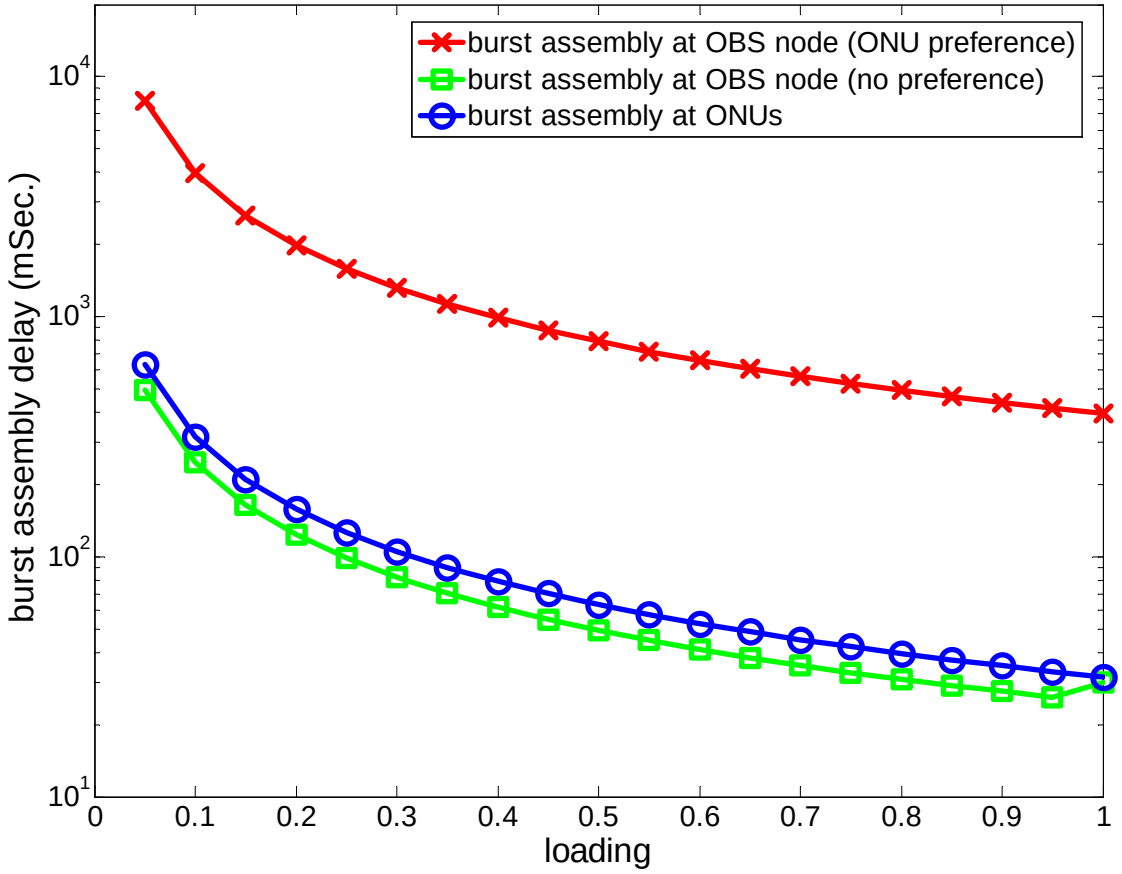
PONs as the access networks of OBS

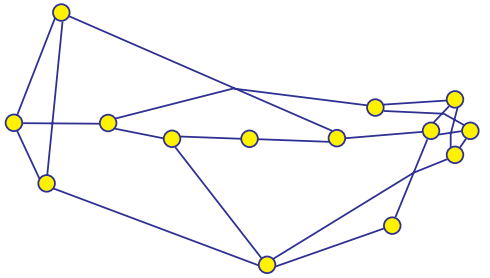


A possible OBS node architecture

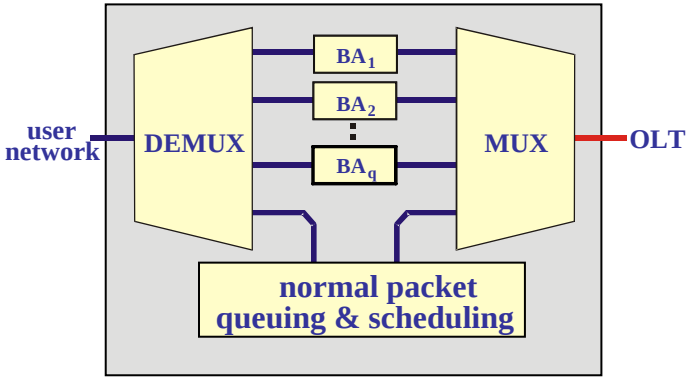


Burst assembly delay





NSFNet

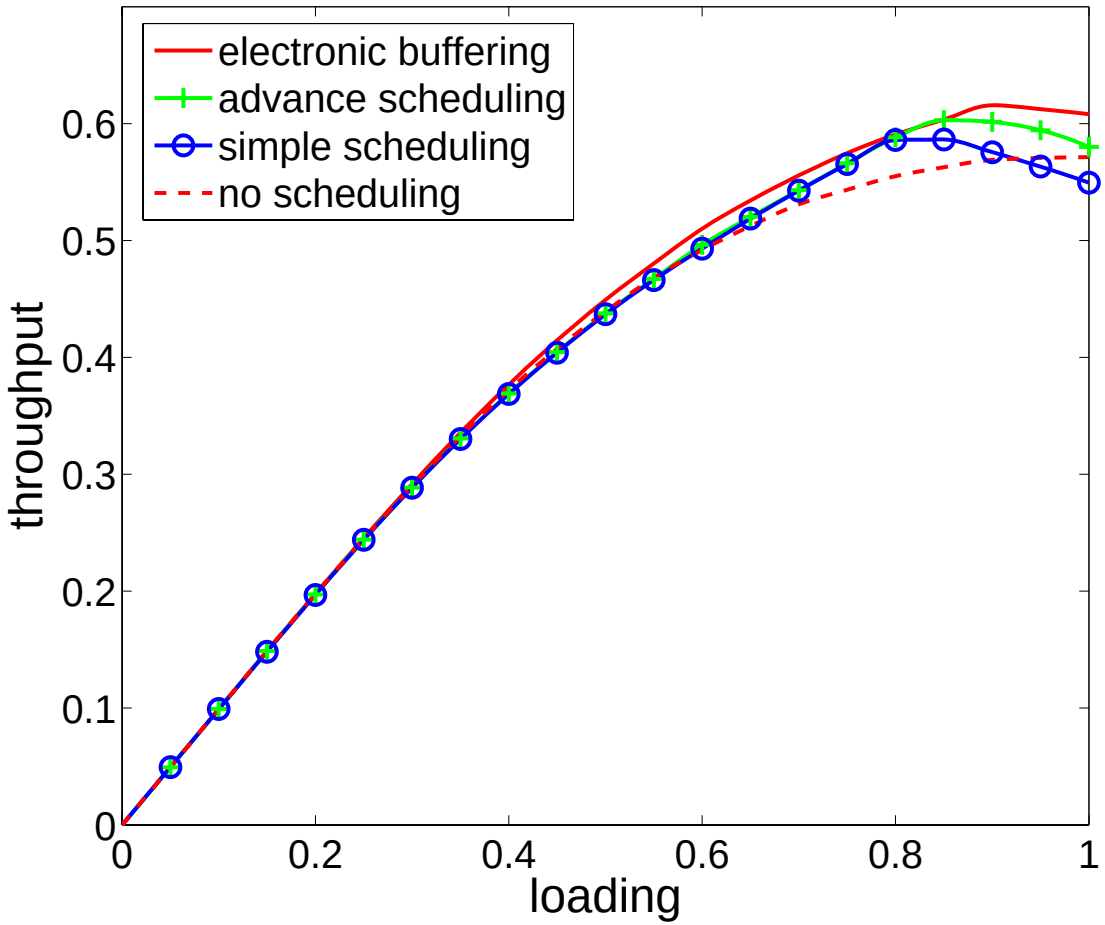


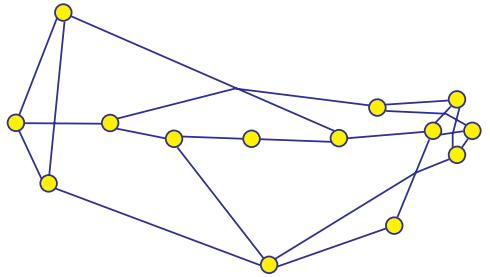
Proposed ONU

OBS node output contention resolutions

- Electronic buffering
  - Electronic buffer is used at the OBS node for output contention resolution.
- Advance scheduling
  - No buffer is assumed. OBS node searches a common time window in both PON upstream and node output channels for the ONU data burst transmission.
- Simple scheduling
  - OBS node uses only a *channel available* counter t_{ca} to record the time when a PON upstream channel has no scheduled transmission.
- No scheduling
  - OBS node consider only the PON upstream channel utilization when scheduling the ONU data burst transmission.

The throughput of OBS with different ONU data burst scheduling schemes

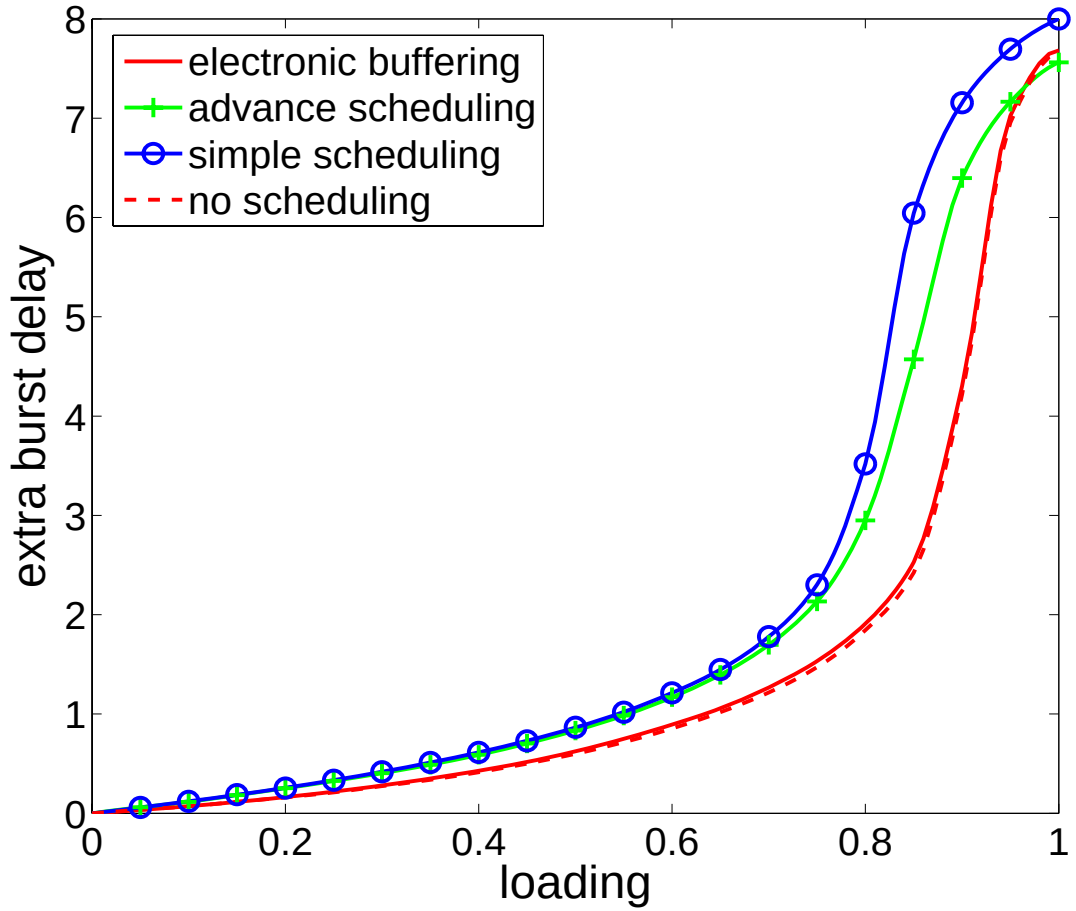


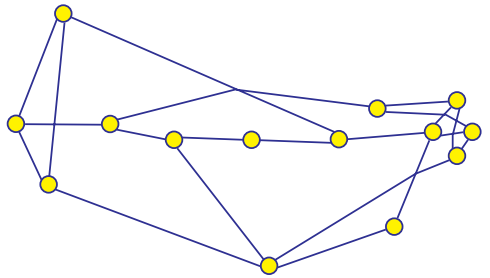


NSFNet

- Poisson burst generation at ONUs
- Uniform traffic distribution
- Latest Available Unused Channel with Void Filling (LAUC-VF) OBS channel reservation

The extra delay of OBS with different ONU data burst scheduling schemes





NSFNet

- Poisson burst generation at ONUs
- Uniform traffic distribution
- Latest Available Unused Channel with Void Filling (LAUC-VF) OBS channel reservation

Conclusion

- In this paper, we propose to use PONs as the access networks of OBS networks.
- We find that pushing the burst assembly process to the ONUs can significantly reduce the burst assembly time in some situations.
- To solve the OBS node output contention, four data burst scheduling schemes have been investigated.
- From simulation results, we observe that a simple scheduling scheme is itself adequate in most situations.