Hybrid Optoelectronic Router

Ryohei Urata,
Tatsushi Nakahara, Hirokazu Takenouchi, Toru Segawa, Ryo Takahashi

NTT Photonics Laboratories, NTT Corporation

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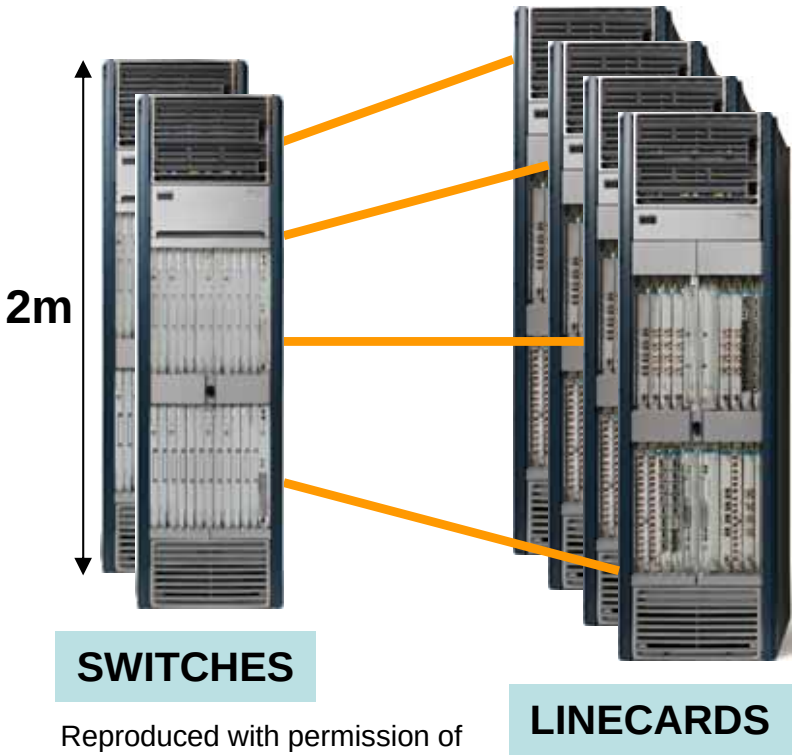
Electrical Routers

Multi-rack Router System



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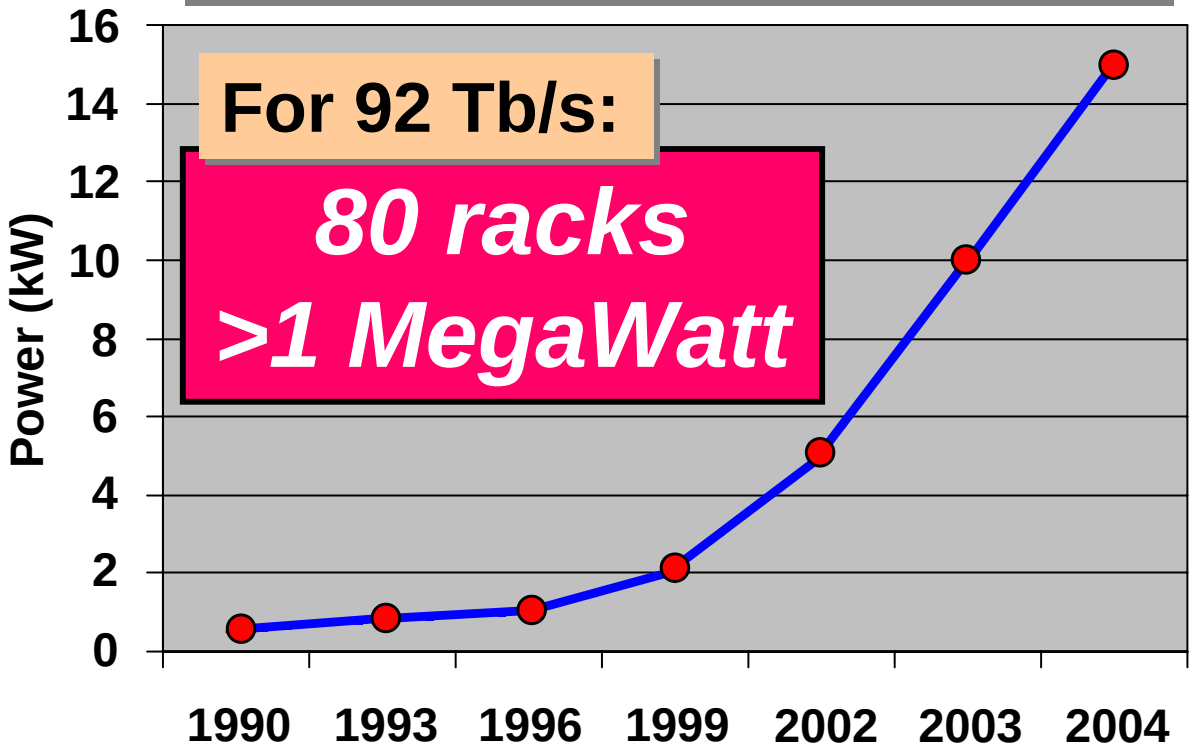
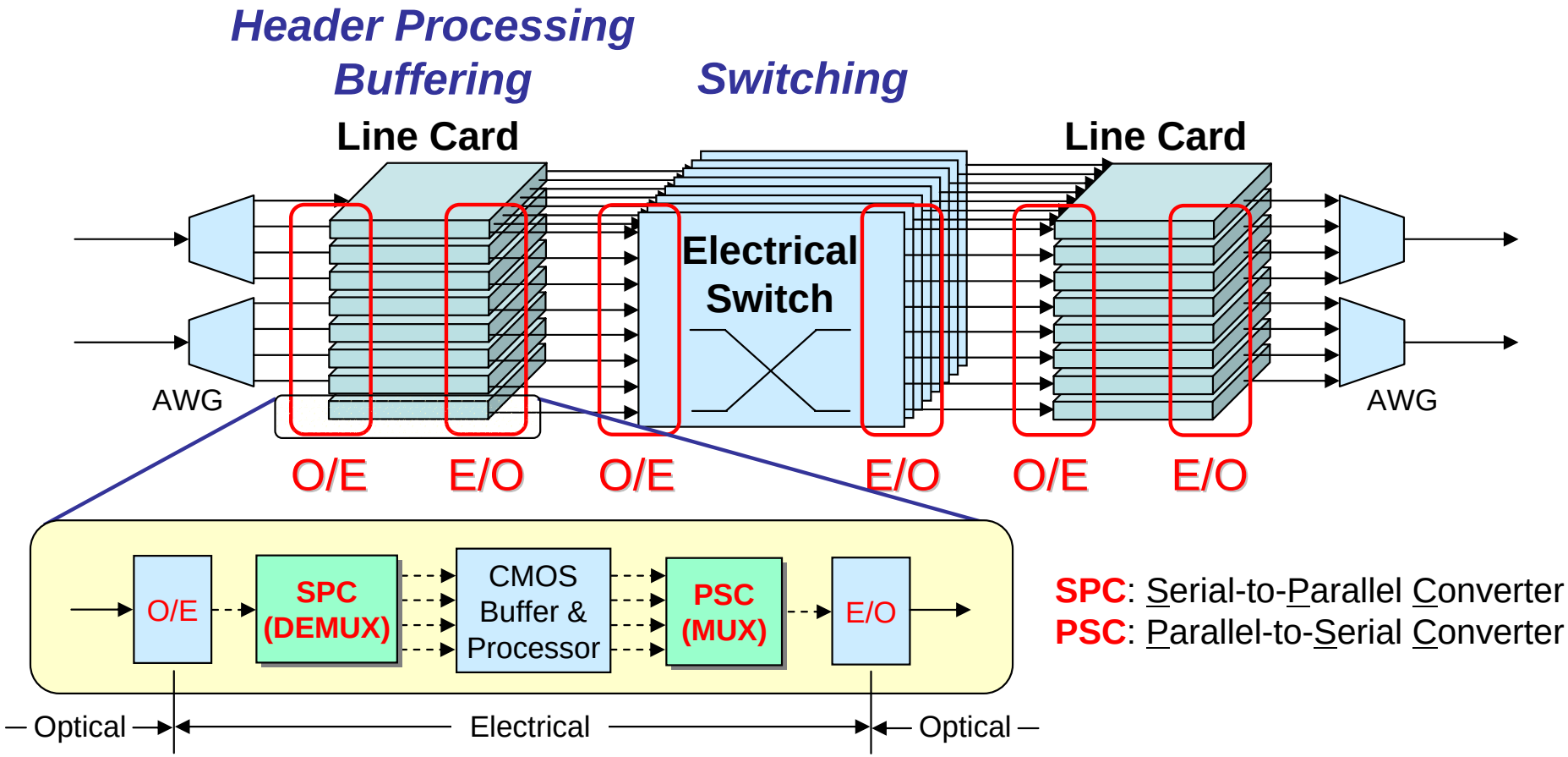
Power consumption per rack/chassis



Need to…

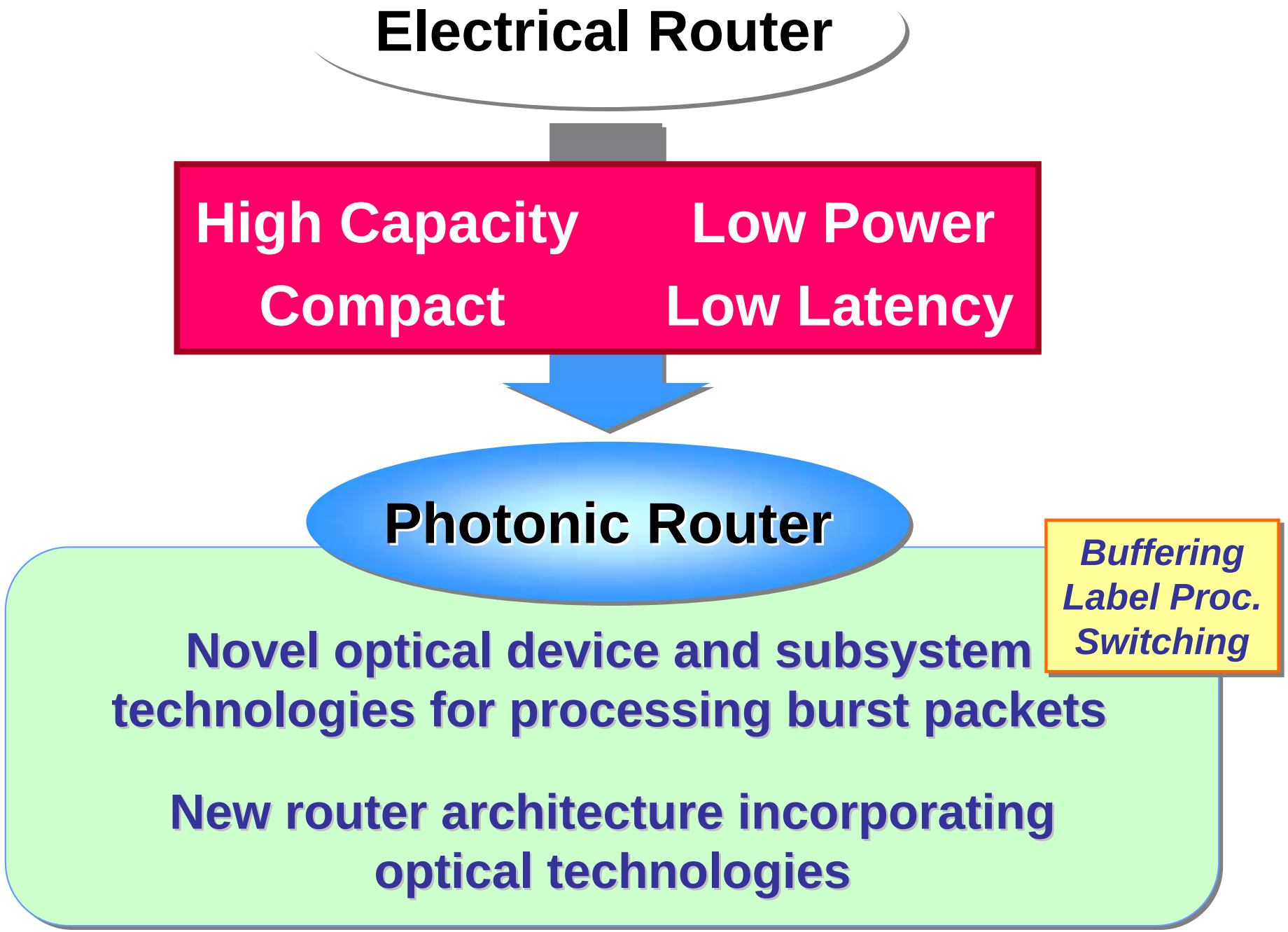
- **Reduce power consumption**
- **Reduce size**
- **Increase performance**
  - **Increase throughput**
  - **Increase traffic engineering capability**

Problem with Electrical Routers



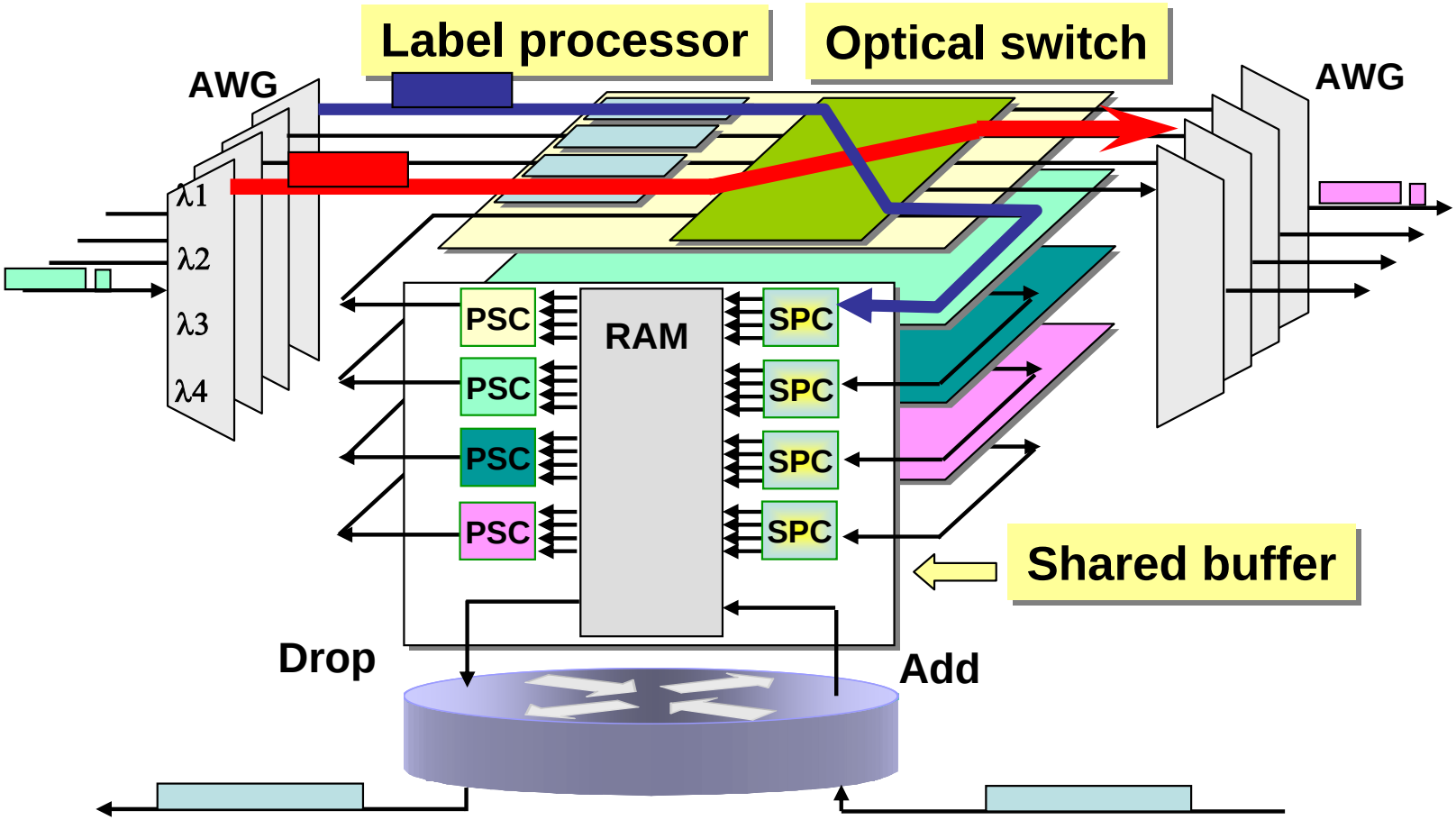
- **Excessive buffering and processing**
- **Problems at the interfaces (MUX/DEMUX)**
  - **High power consumption**
  - **Speed limited by electronic components**

Photonic Router



Hybrid Optoelectronic Router Node Architecture

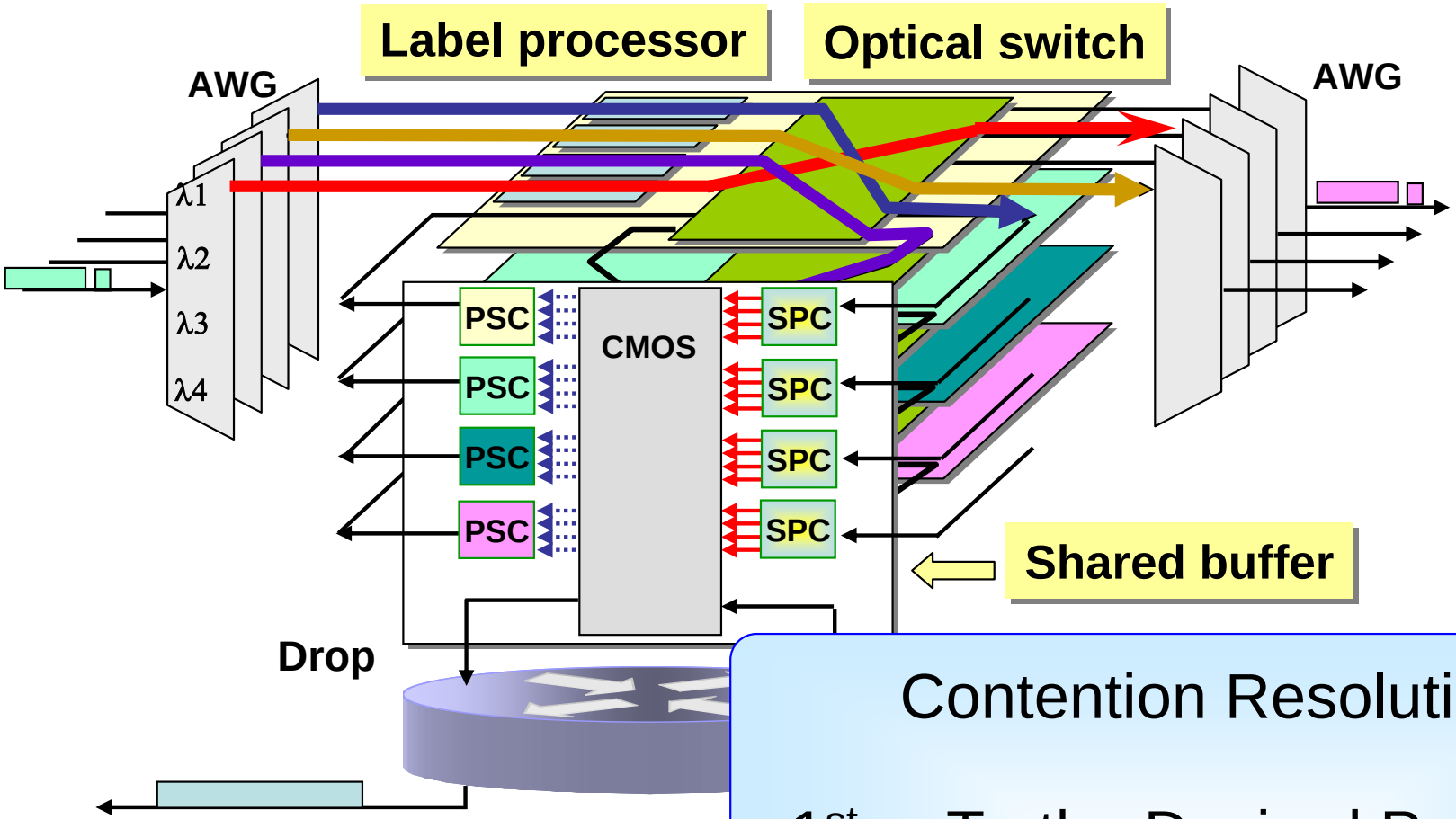
Node Architecture



No contention → **Passes through transparently**

Contention → **Forwarded to shared buffer**

Node Architecture



Contention Resolution

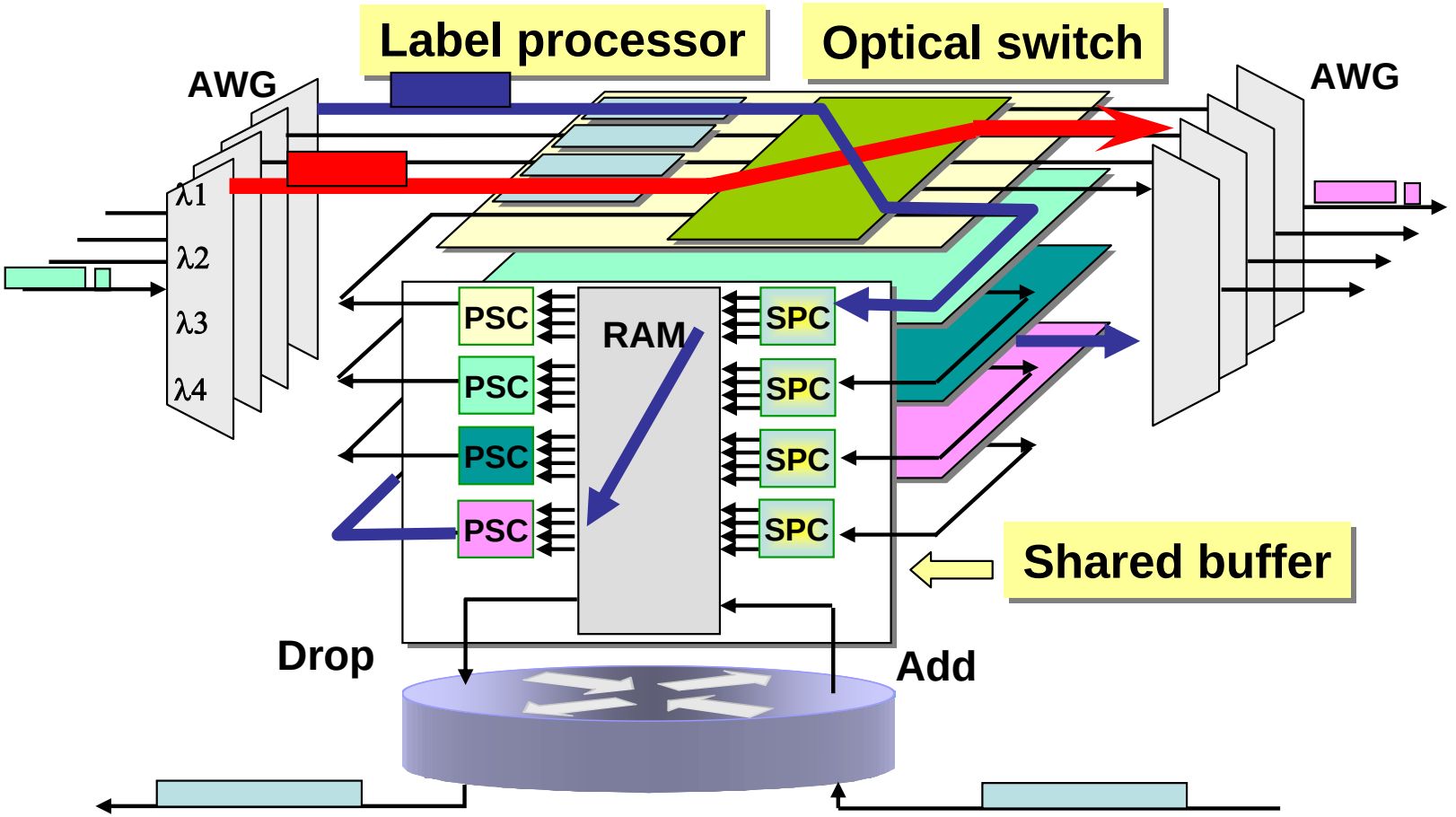
1st : To the Desired Port

2nd : Buffering in CMOS

3rd : Wavelength Conversion

4th : Deflection Routing

Node Architecture

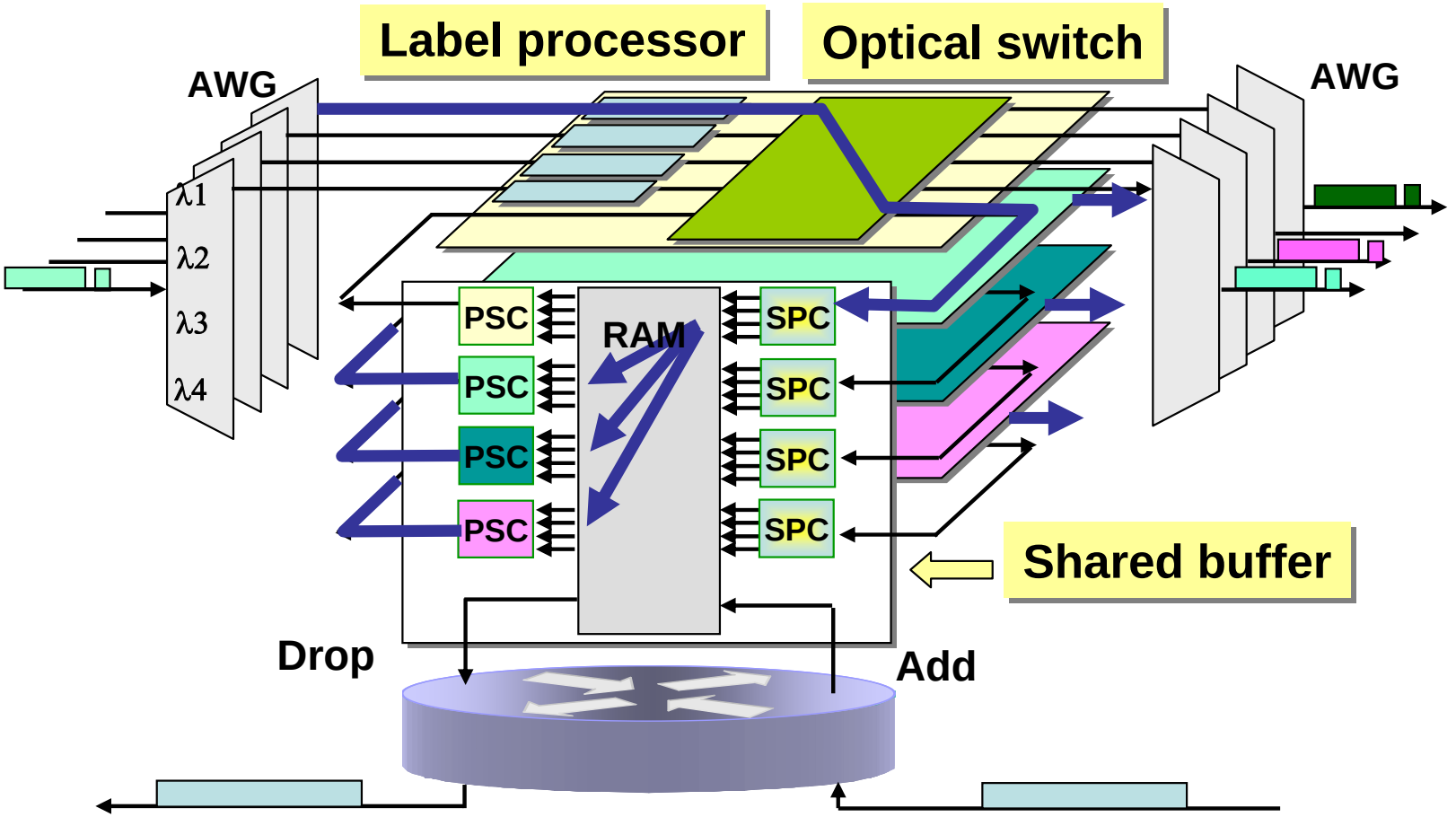


Buffering in CMOS RAM

Traffic engineering between wavelength layers

3R regeneration based on TTL

Node Architecture

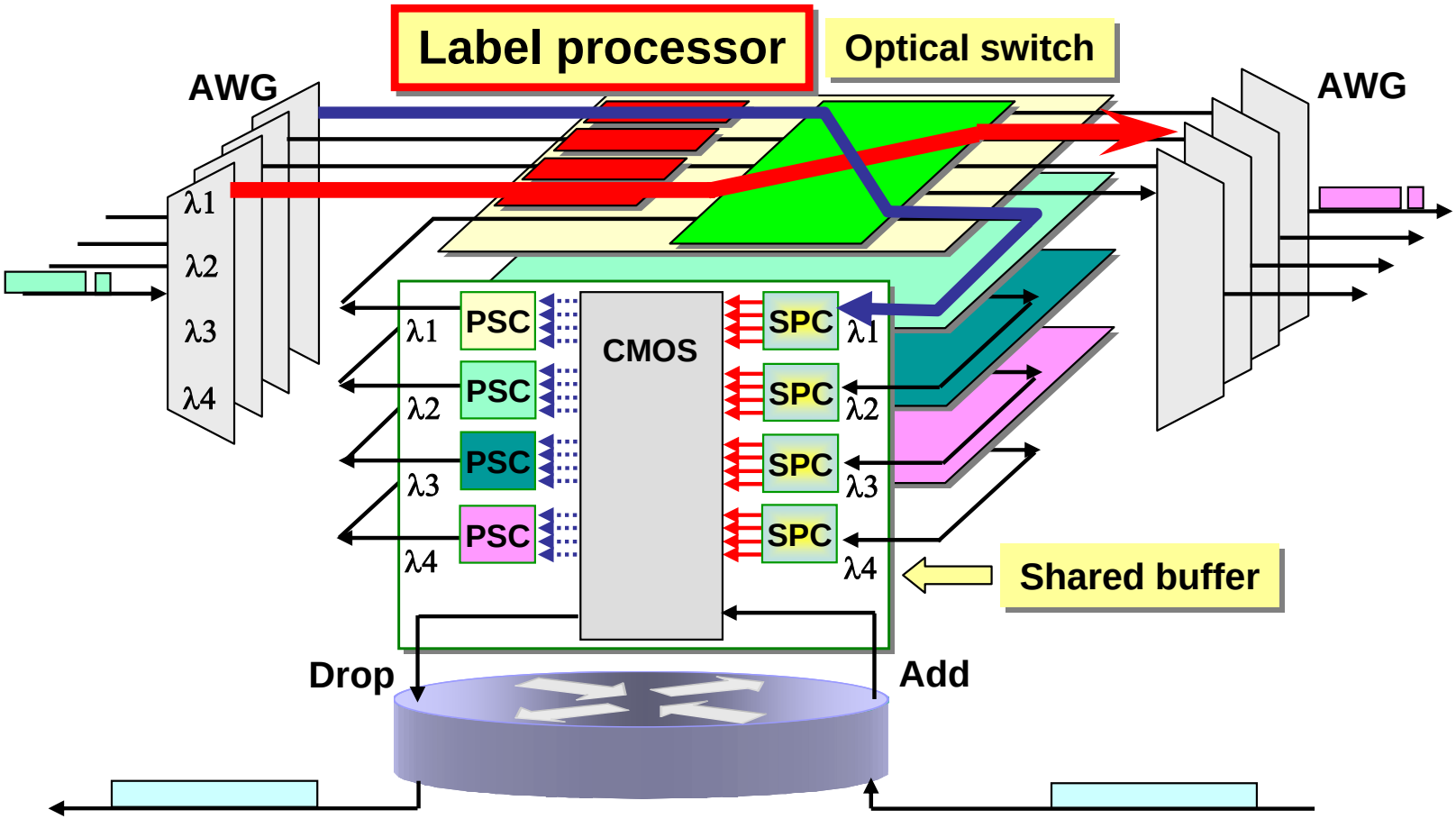


Buffer supports various services

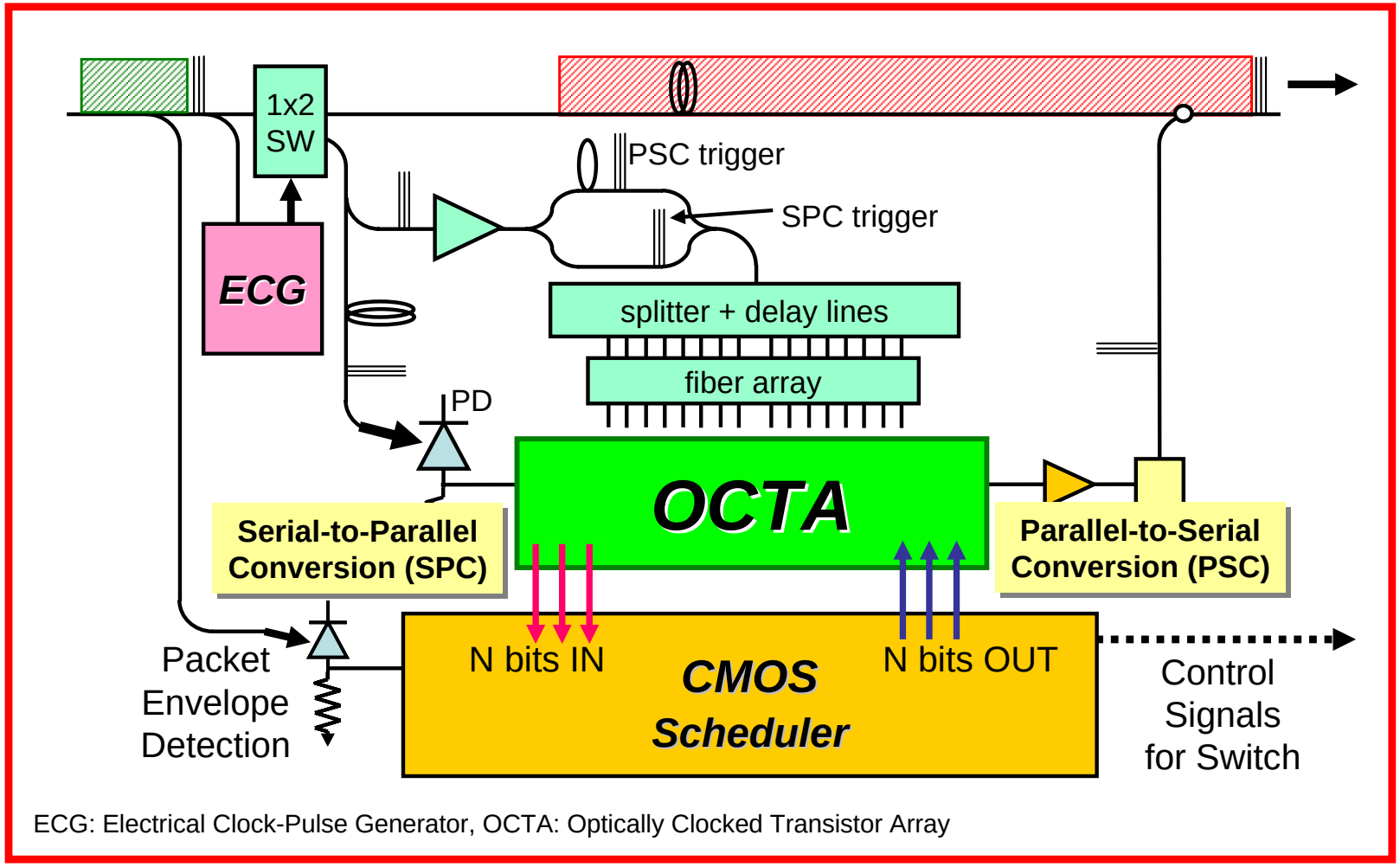
QoS, FEC, Multicast routing, Policy routing

Sub-Systems

Label Processor



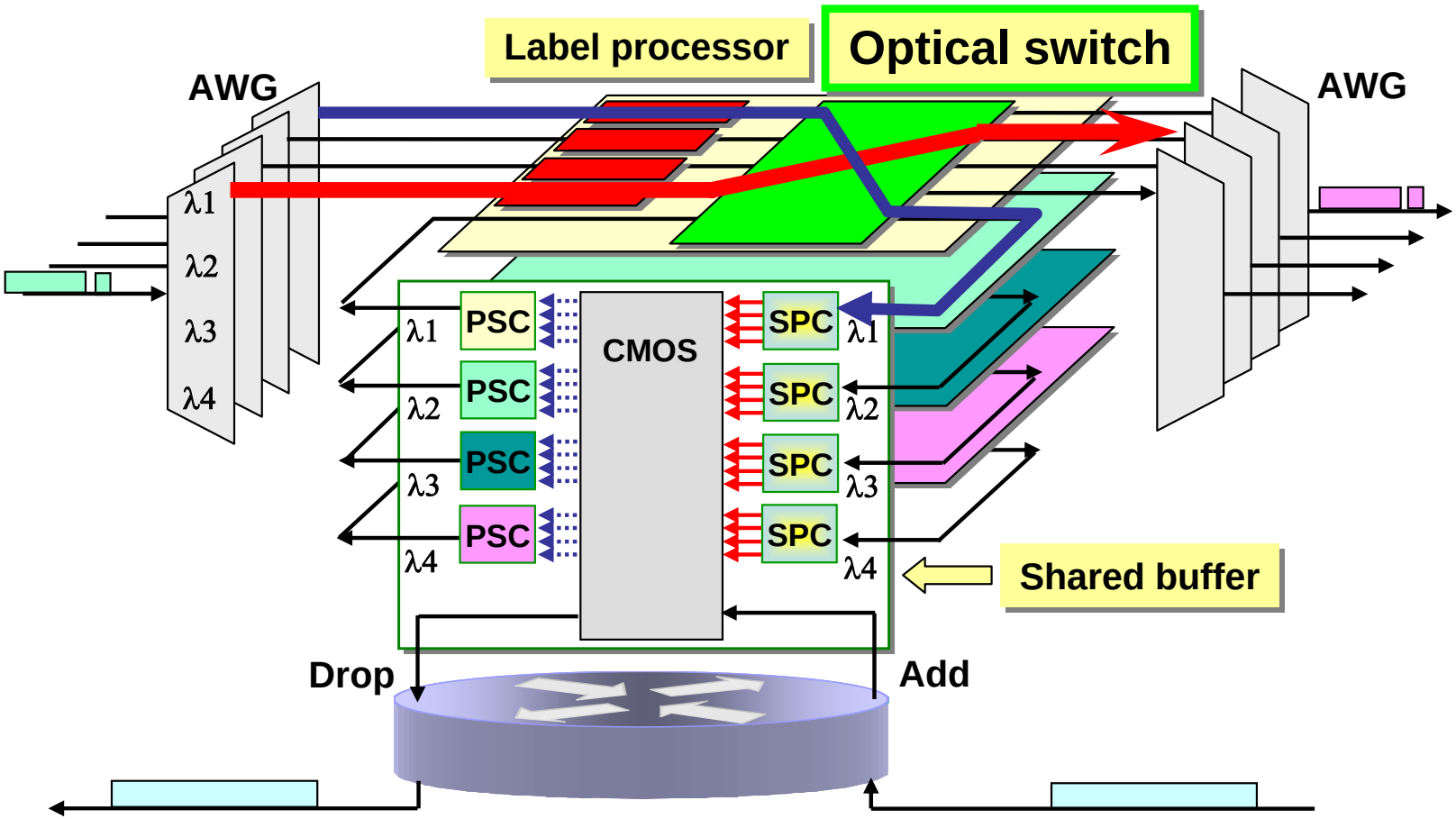
Label Processor Sub-System



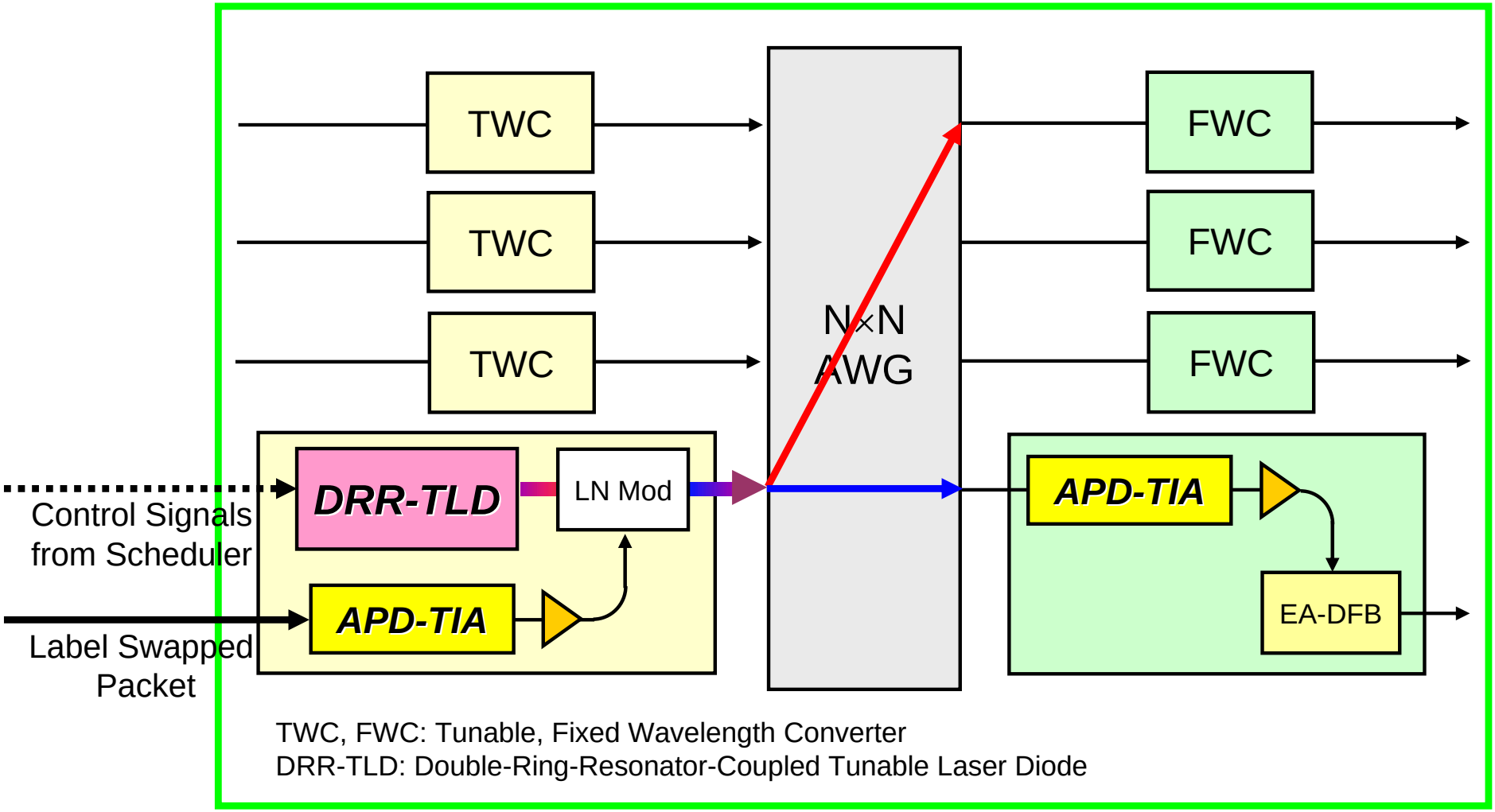
Detect input label, packet envelope ⇒ Process label, configure switch

Merges SPC, PSC, clock generation for compact, low-power system

Optical Switch



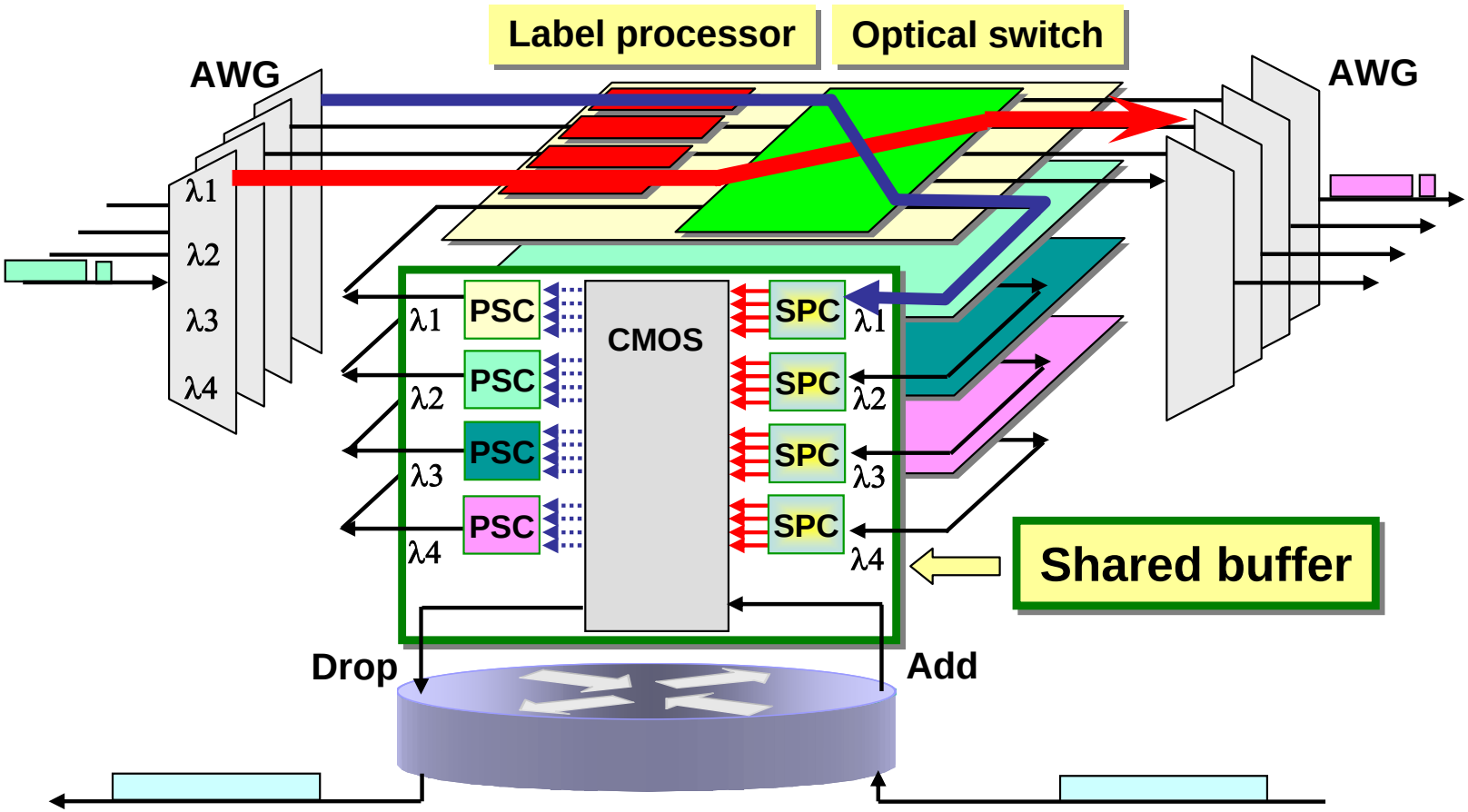
Optical Switch Sub-System



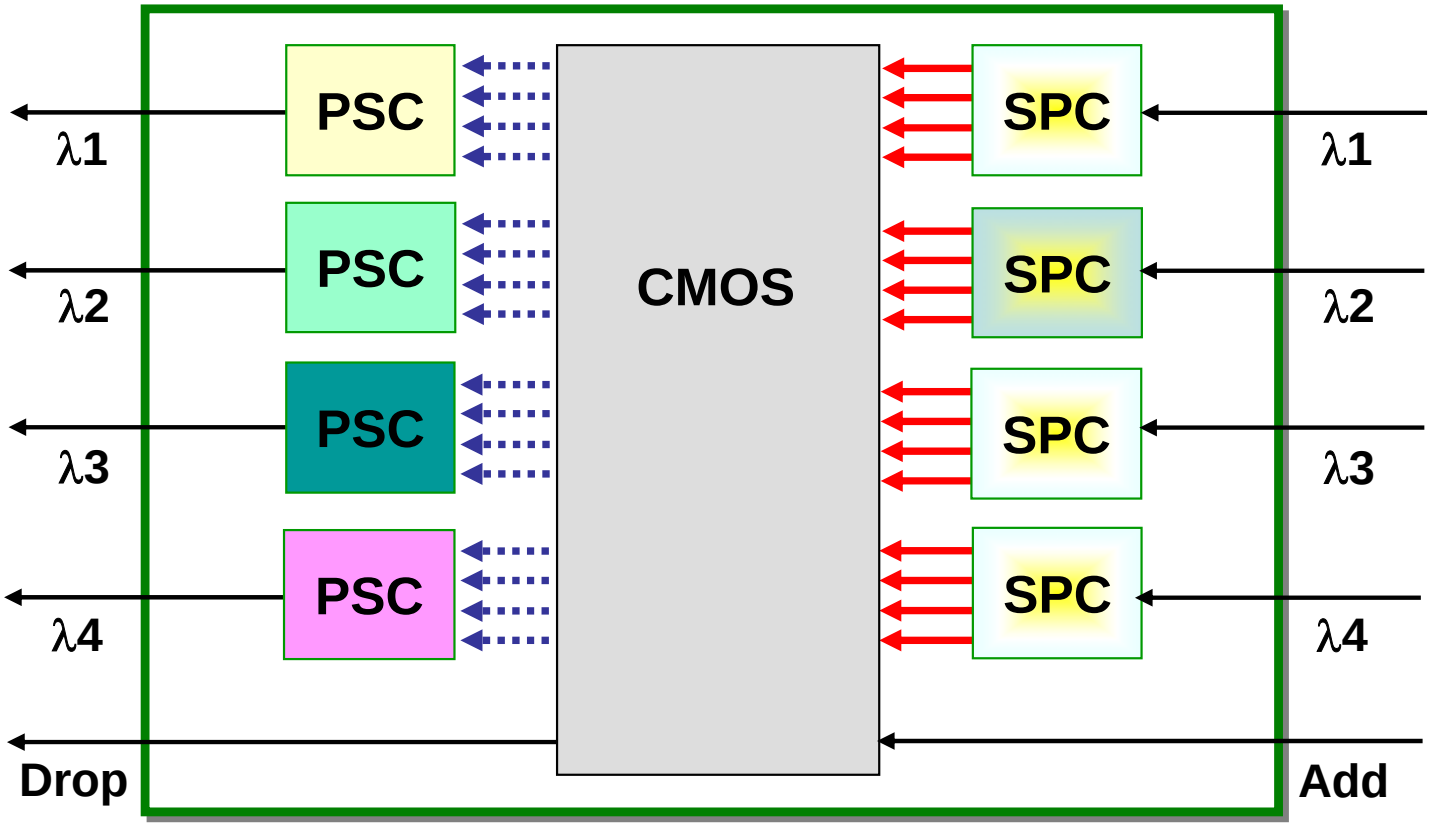
N×N non-blocking switch for packet-level switching

Low power, compact, fast switching, scalable

Shared Buffer



Shared Buffer

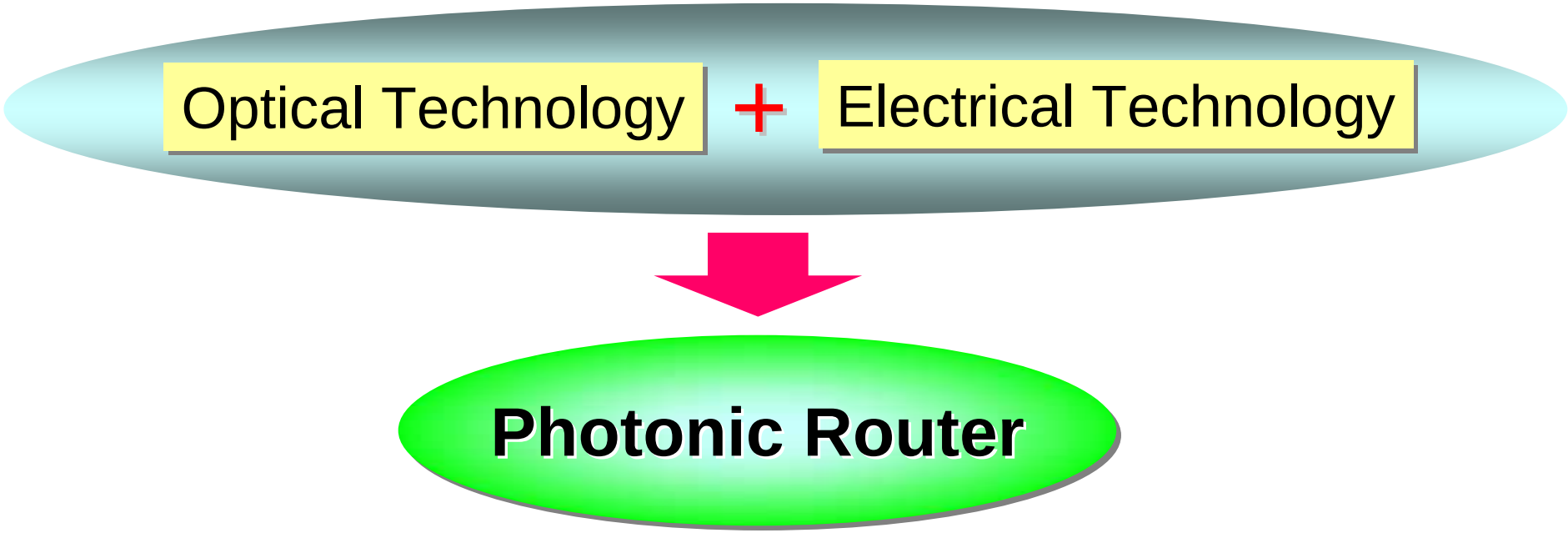


SPC: Serial-to-Parallel Conversion
PSC: Parallel-to-Serial Conversion

Selective buffering, high-level packet functions

Asynchronous burst mode compliant, low power, CMOS functionality

Conclusion



- **Optical technologies for high-speed burst packet processing**
- **Node architecture for transparency *and* high functionality**

- Optically Clocked Transistor Array (OCTA)
- Double-Ring Resonator Tunable Laser
- All-Optical Serial-to-Parallel Converter (SPC)
- Optical Clock-Pulse-Train Generator (OCPTG)

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