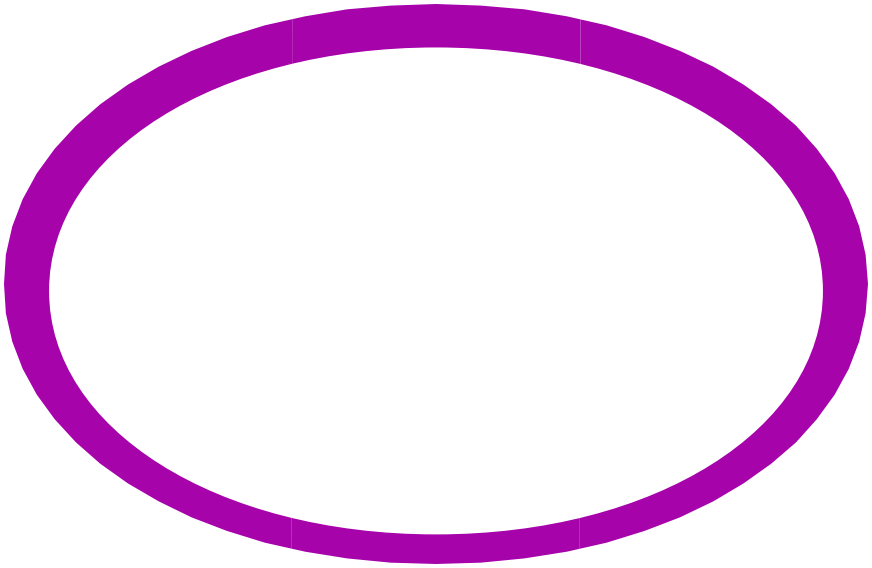

Research challenges - agile optical networks

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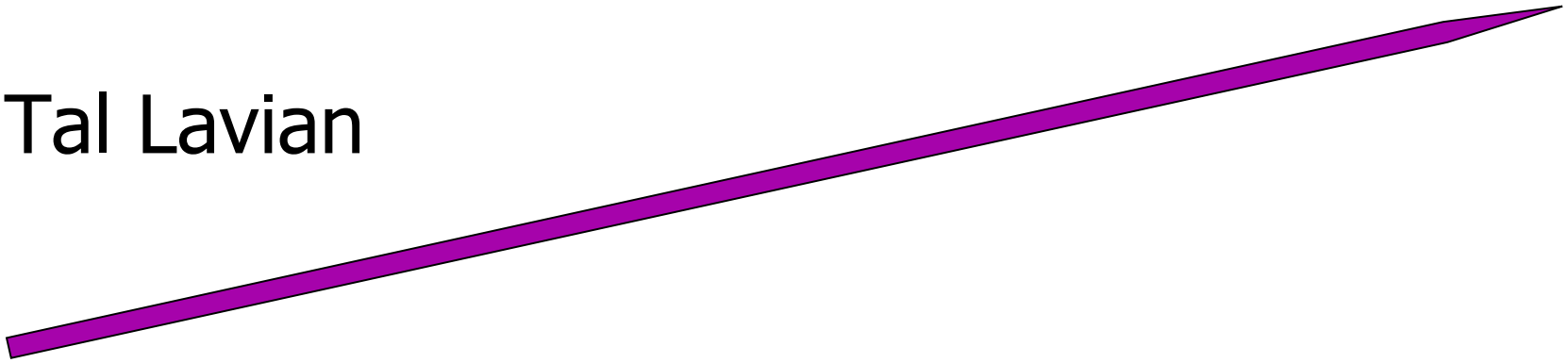

Need for new services

- Optical networking is evolving
  - Much more bandwidth
  - Agile reconfiguring of light path
- Need to take advantage of this and tie it to applications and services
  - Need to define the glue and the interface between the applications and lower levels.
- Can't do computation in the optical core
  - Need to move the intelligence from the core to the edge.
- I'd like to find what is the right research in this area and focus on this.

Streaming media as bandwidth driver_

- Streaming needs big pipes – 2-3 orders or magnitudes more than web surfing.
  - Speed of 3Mbs is about 1GB per hour
- Constant traffic (can be turn on for hours with no one watching)
- Web looks like a big traffic driver on the edge – but it is small traffic on the core.
  - One hour web, 10 second a page, 360 pages, 10KB page → 3.6MB

Optical Ethernet – RPR

- RPR – Resilient Packet Ring – IEEE 802.17
- Ethernet over MAN (Ethernet is winning all time)
- Distributed L2 switch over MAN
  - Can have one part of the same subnet at SF, another part in SJ and SC
  - Virtual organization over MAN with NO routing.
  - Started to be deployed in the field
- Cost – much cheaper than WAN

ASON – Automatically Switched Optical Networks

- Dynamically switch the light path
- Enabler for many applications
- Controlled by UNI and NNI – Allow applications to set the light path
- Allow to add the intelligence into the optical core

EFM –Ethernet First Mile

- Ethernet at the first mile start to be attractive.
- Drive more bandwidth to the end users
- Three proposals :
  - 22Mbs on the current phone line
  - PON –Passive Optical Network – split the optical link to 4 and additional 8 total 32 customers (60Mbs per residence)
  - Point-to-point optical – more expansive
- SBC and alike are interested.

- The tight of way is the main issue. Optical fibers work fine in harsh environment
  - Sewer net, Power line, Gas line, water line.

Where are the bottlenecks

- Optical networking is evolving
  - Much more bandwidth
  - Agile reconfiguring of light path
- As soon as one problem is solved, the bottleneck is moving to a new place
- Currently it looks like the bottleneck is at the first mile
- Streaming media - bottleneck push on routers
- Much more bandwidth in the MAN move the bottlenecks away from the access and the edge
- Peering points between service provides

OXC – Optical Cross Connect

- Optical cross connects – less need for core routing
  - Fat pipes replace core routers with NO delay
- It looks more like circuit switching instead of packet switching (ouhh)
- MPLS, MP! S, LDP – Label Distribution Protocol – room for binding it to services on the edge.

- UNI - User Network Interface , - allow the end machines and edge to send service request to the core
- NNI – Network Network Interface, - control of the core (if the core agree to provide the service, might say no)