Fairness Requirements

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Agenda

- **Summary of carrier requirements presented**

- **Design Implications**

  - **Interrelationship Digraph**

- **Conclusions**

Previous Presentation from Carriers and Providers

- **Sprint**
  - Size
    - Entire network size 500 nodes
    - Ring 30+ nodes on OC-12 Ring
  - Servies
    - 2 priorities
      - Low delay and jitter, guaranteed BW
      - Bounded delay
      - At present only one class of traffic: BE
    - Scalable to higher speed interfaces
  - OA&M
    - Operational: Facilitate upgrade to increase customer BW requests
    - Troubleshooting requirement: like SONET OA&M
    - Carrier grade
      - Protection required:
      - High availability

Carrier Requirements (Cont'd)

- **MCI**
  - Size
    - 2 stations on access rings
    - Potential to add more stations on the ring
  - Services
    - Virtual Private Network
    - Virtual lease line model
    - Security
    - Future services
  - OA&M
    - Resiliency
    - Scalable services without fork lifting
    - <1% preemptable traffic

Carrier Requirements (Cont'd)

- **BellSouth**

  - ## Ring Size
    - Metro Applications:
    - Access rings: OC-3-OC-48, IOF rings: OC-12-OC-192
    - <6 node   6-12 nodes, span 10-15km max
    - Ring size 50 km

  - ## Services
    - Multiple QoS support
    - Mixed with guaranteed BW&latency
    - Low priority burstable and weighted distributed
    - Best effort: Statistical multiplexing
    - Protection options

  - ## OA&M requirements
    - SONET like OA&M functions
    - Manual switch
    - Source routing

Carrier Requirements (Cont'd)

- **Global Crossing**
  - Size:
    - Metro ethernet services (ethernet distance extension to the WAN)
    - 150 km ring circumference, 40km span
  - Services
    - Ethernnet services: Transparent LAN. Virtual private line.
    - Customer separation AND maintaining customer VLAN:***Service label***
    - weighted fairness with BW allocation due different aggregation point on a ring for different burstable customers
    - Flexible architecture for new revenue generating: BW, delay
  - OA&M
    - Symetrical and asymetrical contracts
    - Operation monitoring to meet SLA:unicast-*Source and Destination*
    - Fairness needed to have no impact by network loading
    - 50 ms protection
    - Statistics
    - SONET like OA&M functions

Carrier Requirements (Cont'd)

SBC

- Size:
  - metro, access and inter-office (WAN)
  - Multi-node ring
    - Reduce equipment: port consolidation
    - Shared media: fairness scheme
  - Scalable WAN ports: SONET, DWDM, GbE
    - GFP
  - Reduce equipment cost

- Services
  - Service for variable BW
  - Service for circuit emulation

- OA&M
  - Carrier grade
    - Protection
    - 99.999 availability SONET, DWDM, GbE
  - Reduces circuit administration

- Interoperability
  - Functional supplier interchangeability
  - Not just element interchangeability
  - Not just inter-working
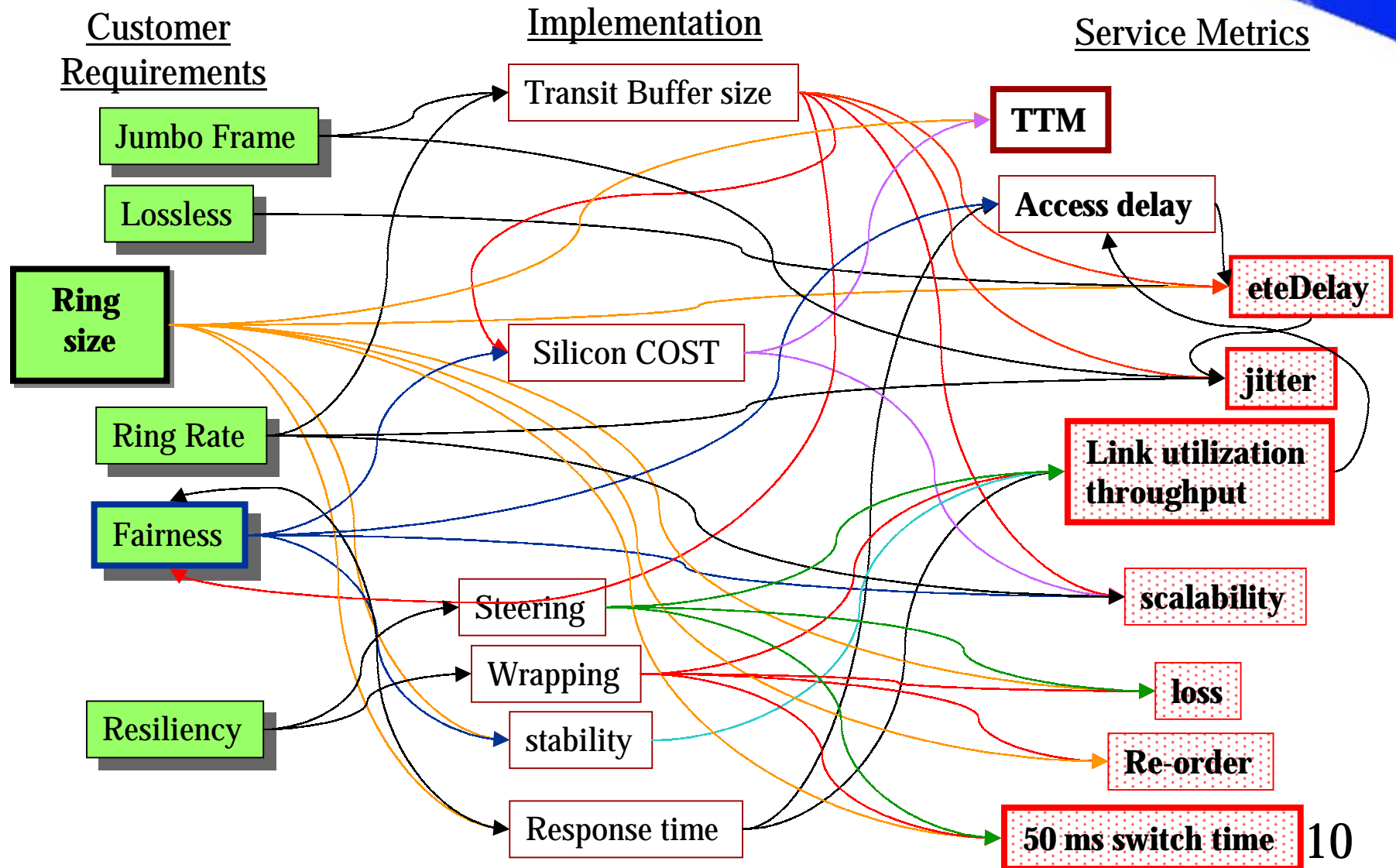
Bell Canada

- Size
  - MAN:
    - Metro Core ring: 8 nodes, 170 km, max span 15 km
    - Access ring: 2-6 nodes, 20-50 km

- Services
  - Carrier class transparent LAN service
  - Ethernet technology: reduce operation cost
  - VPN
    - Customer separation
  - Scalable to thousand to millions of <u>VPN</u>
  - Lower cost higher BW
    - Higher BW demand: GE to customer
  - Support for multicast
  - <u>Require Low latency transport</u>

- OA&M
  - Carrier Grade
    - Reliability
    - Resiliency
  - Scalable and flexible lowest cost per managed bit

Requirement Summary

- Size
  - Acess
  - Metro
  - WAN

- Services Metrics
  - BW, Delay, and Loss
    - Impact RPR:
      - Oversubscribe, Congestion management/avoidance,
      - Buffering: Ingress and egress buffers,Tandem buffers

- SLA
  - BW
    - CIR: need traffic engineering
  - Weighted fairness for class
    - Differentiated service/ priorities
    - delay and jitter bound
  - Five 9 availability
    - Protection
    - Non preemptable traffic
  - New Preemptable service: No protection on failure.

- Need tracability for all the services: simple OA&M framework

RPR Interrelationship Digraph

Customer Requirements

- Jumbo Frame
- Lossless
- **Ring size**
- Ring Rate
- **Fairness**
- Resiliency

Implementation

- Transit Buffer size
- Silicon COST
- Steering
- Wrapping
- stability
- Response time

Service Metrics

- **TTM**
- **Access delay**
- **eteDelay**
- **jitter**
- **Link utilization throughput**
- **scalability**
- **loss**
- **Re-order**
- **50 ms switch time**

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Implications

- Must limit the scope of application
  - Ring circumference
  - number of stations
    - Doe not limit to Metro Ring e.g.
      - NHL all star play off, Cybercast cross USA but limited to 4 nodes.
      - Ring size 6000miles/9700km
      - Metro Ring size of the future is 1000 km

- Have to ask "Does the implementation meet customer requirements?"
  - Link utilization
  - Low jitter
  - Bounded delay
  - Reduce complexity
  - scalability

- Reduce Operation Cost
  - Reduce operation complexity
  - Reduce equipment cost

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Conclusions: To get to the right Requirements

Use Carrier requirements to define a set metric for RPR specific Requirements (shall) and objective (should**)**

- **Define the reference network**
  - TTM is important, limit the scope: RING SIZE
  - Understand competing technologies

- **Motion: RPR standard to focus on realistic Ring size for TTM**
  - Max stations on a RING: 64 (max ~30)
  - Ring circumference: 2000 km (<200km Metro rings)
    - **Ring SPAN: PHY dependent optics cost e.g. LX**
  - Scalable Ring Speed with future PHY

- **Motion: Fairness scheme supports multiple Tos and BW guarantee**

Conclusions: To get to the right Requirements

- Metrics **(Customer Requirements)**

		Yes	No
– Fairness: must solve media contention			
• **Support BW guaranteed service**		-	-
• Support weighted fairness for different ingress demand		-	-
• Support multiple CoS based on parameters: BW, delay, jitter		-	-
– Protection			
• Support protected and un-protected services		-	-
• Protection switch time (50ms)		-	-
– Operation Simplicity			
• Minimize operation cost: training, debugging		-	-
• Facilitate network engineering		-	-
– Scalable			
• From 155M to 10G,		-	-
• 40G and beyond		-	-
- Feasibility, cost, complexity		-	-
– Support customer separation			

- **Use the Table to decide and ask "is the design adequate?"**

- **Understand the interrelationship to make good trade-off**

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Questions and Answers

References

- **Previous Carrier/Providers presentations**
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