



Fault Tolerant Networking 2002

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What is Fault Tolerant Networking:

- To the Customer
- To the Carrier
- To the Research Community

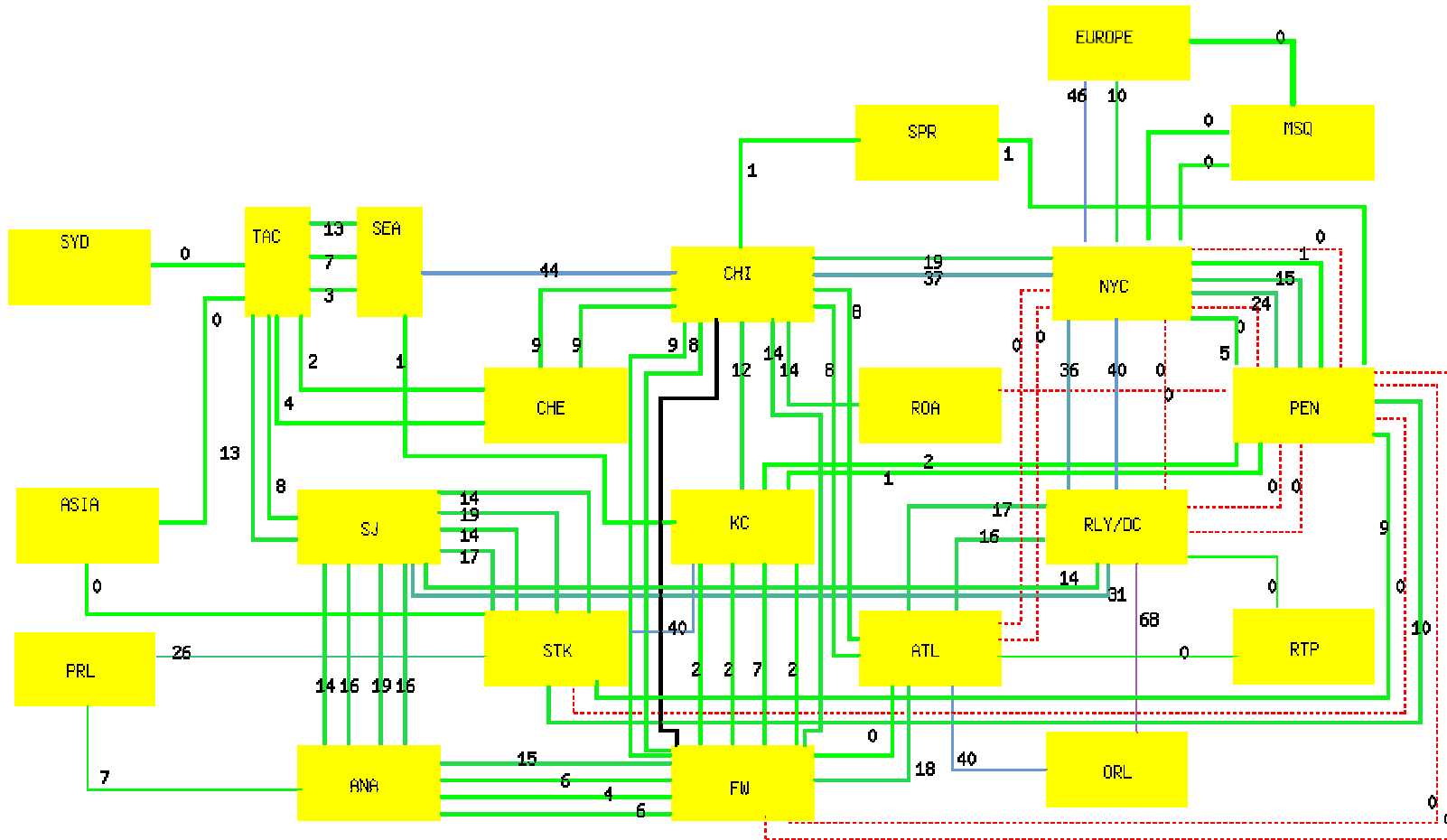
- To the Customer:
 - A byproduct of the service they purchase.
 - SLA's say 99% availability.
- To the Carrier:
 - Adds substantial cost to provide.
 - Which the customers above expect for free.
- To the Research Community
 - ?

- Today customer tail circuits ride SONET facilities end-to-end with the exception of the last mile of local loop. (This is true for Sprint at least.)
 - For some customers, even the last mile is on SONET facilities with ring or ADM shelf extension right to customer premises.
- The only things that are not SONET protected today on Sprint are:
 - the IP Core network
 - and there is no protect router port to switch to when the primary router fails.
 - This is too much capital to invest in and pass on to the customers.
 - (Customers want gold plated service, but are not willing to pay for it.)

- Software
 - Is responsible for an inordinate amount of customer outages, or perceived outages due to bugs.
 - This is the fault tolerant part of “fault tolerant” networking that is missing today.
 - Sadly, the things being added to the router SW code bases today on the pretext of adding survivability probably contribute more to exacerbate the problem by introducing instability into the code bases.
 - e.g. MPLS

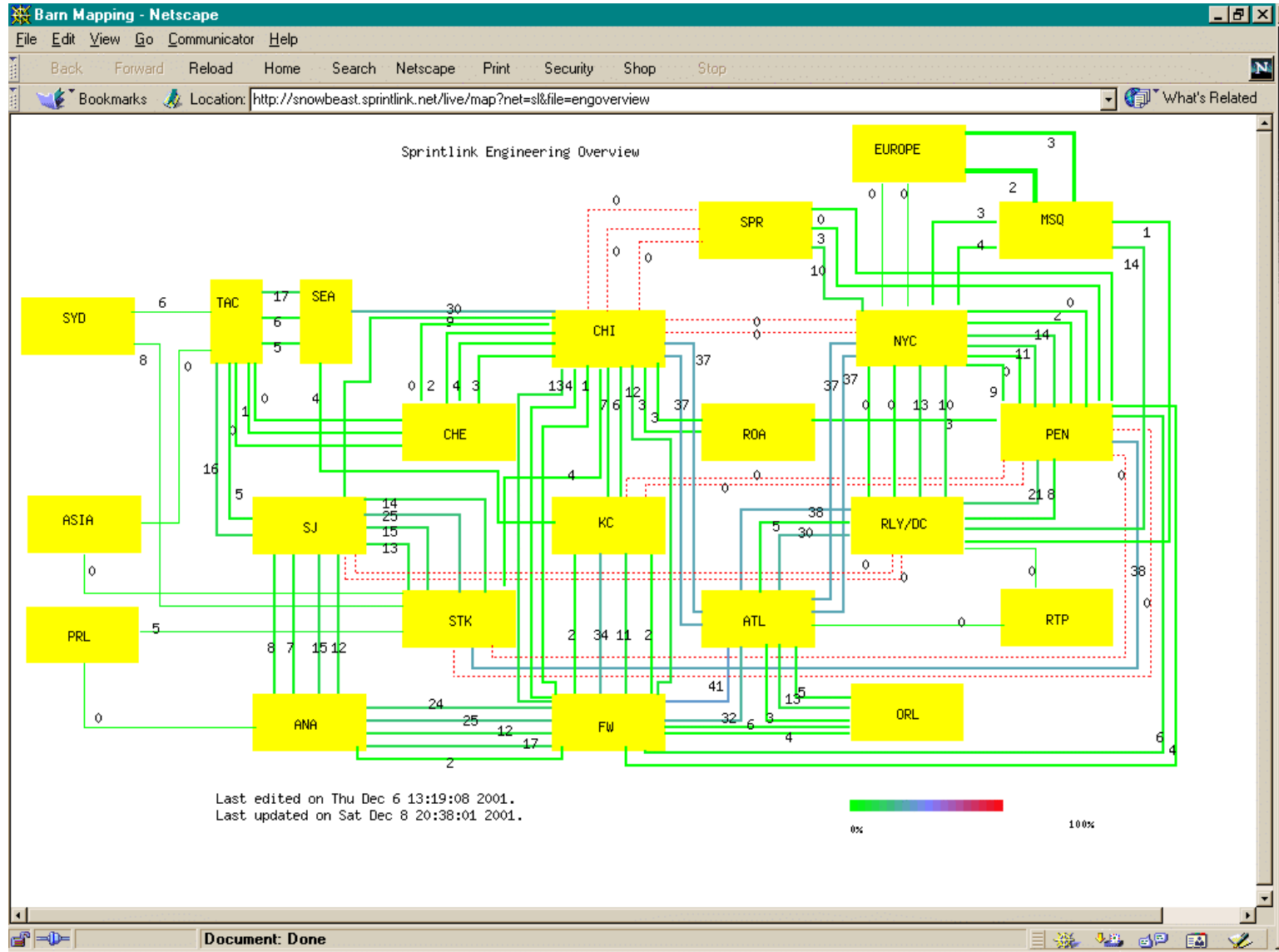
- Like Software
 - Induces problems
 - Usually through software...
 - Examples:
 - Provisioning un-maps customer circuit during maintenance.
 - We all affectionately know this as a groom. ☺
 - NOC personnel make mistakes with routing policy or assign wrong route-map to customers, etc....again these are perceived as outages.

- Perception
 - The vendors and the research community all seem to have an erroneously perceived perception that outages are singular in nature and in what they effect.
- Reality
 - Outages affect multiple elements and enormous amounts of aggregate bandwidth when they occur.
 - TE examples always seem to be in terms of 100's of Mbs, not the NxGb they are in reality.
- Reality (2)
 - These are operational networks and you've sold a service to a customer who you have an obligation to provide service to in the event of a failure in your network.



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- There seems to be an inordinate amount of work done on TE & MPLS.
 - We don't use this today.
 - You can't TE around 11 OC48s failing.
- Optical Cross Connect Technologies (OXC)s
 - We know how to use these to save some costs, and more effectively manage our fiber plant, but we lose router survivability – This is a problem we have to solve.
- Securing the Logical Infrastructure
 - How do we protect the control plane, and the elements themselves from the individuals who want to wreak havoc with it.

- SW Tools
 - One thing that is noticeably lacking today are traffic analysis tools on the router platforms themselves.
 - Its hard to tell what are transitive flows, and where they came from, what are U-Turns in the same PoP, etc...
 - This means you need hooks to the routing tables to know what is going on.
- We'd rather know what is going on with the traffic in the network, than what we could do with it if the network broke.
 - This truly helps us build more cost efficient networks.

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