
Risk Management Methods
Applied to Operators' Deployment of
Next-Generation Network Infrastructure

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- Migration plans for incumbent operators
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Ongoing Debate for Operators: Maintain PSTN or Replace with NGN?



Maintain PSTN:

- Cash-Cow using legacy infrastructure
- Avoid massive capital expenditures
- Reduce Technology Risk and Operational Risk

Ongoing Debate for Operators: Maintain PSTN or Replace with NGN?

Replace with NGN:

- Critical mass of VoIP
- Revenue from new services
- Reduced OPEX
- Defensive against MSOs and ILECs
- Reduce Technology Risk and Operational Risk

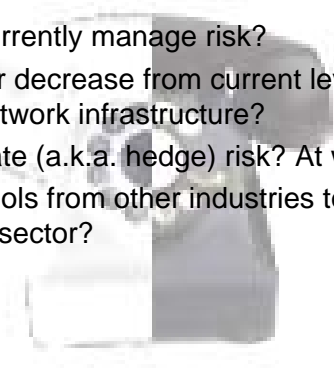


Maintain PSTN:

- Cash-Cow using legacy infrastructure
- Avoid massive capital expenditures
- Reduce Technology Risk and Operational Risk

Given the Scale and Scope...What About Risk Management?

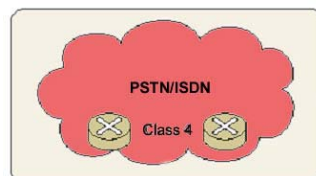
- How do operators currently manage risk?
- Does risk increase or decrease from current levels as operators replace network infrastructure?
- Can operators mitigate (a.k.a. hedge) risk? At what cost?
- How can we apply tools from other industries to telecommunications sector?



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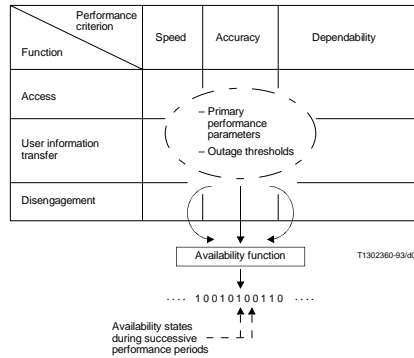
Conventional Framework for Risk Management

- Voice telephony
- ITU, FCC, ATIS, T1A1, NRSC, etc.
- Risk: Availability & Reliability of network \leftrightarrow Outage Frequency & Severity
- Statistical model



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ITU Recommendation I.350 (1993)



Source: International Telecommunications Union (ITU)

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FCC Ruling 47CFR63.100

“Any local exchange or inter-exchange common carrier or competitive access provider that operates transmission or switching facilities and provides access service or interstate or international telecommunications service, that experiences an outage which potentially affects at least 30,000 and less than 50,000 of its customers on any facility which it owns, operates or leases, must notify the Commission if such outage continues for 30 or more minutes. Satellite carriers and cellular carriers are exempt from this reporting requirement.”

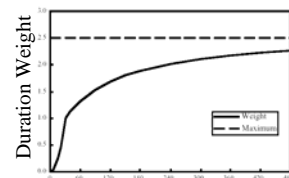
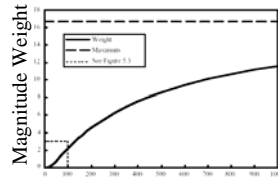
Source: Federal Communications Commission (FCC)

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ATIS: Combine FCC Data Into Single Index that Measures "Impact"

"Outage Index"

"Service Weight" x "Magnitude Weight" x "Duration Weight"

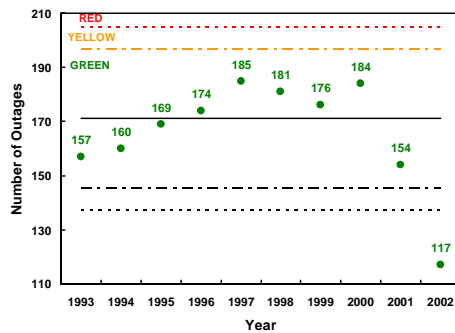


Source: Alliance for Telecommunications Industry Solutions (ATIS)

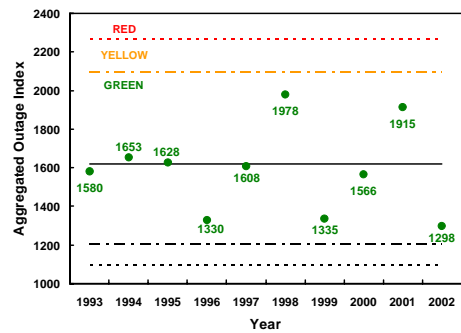
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Historical Control Charts for Outage Frequency and Severity

Annual PSTN Outage Frequency Control Chart



Annual Aggregated PSTN Outage Index Control Chart

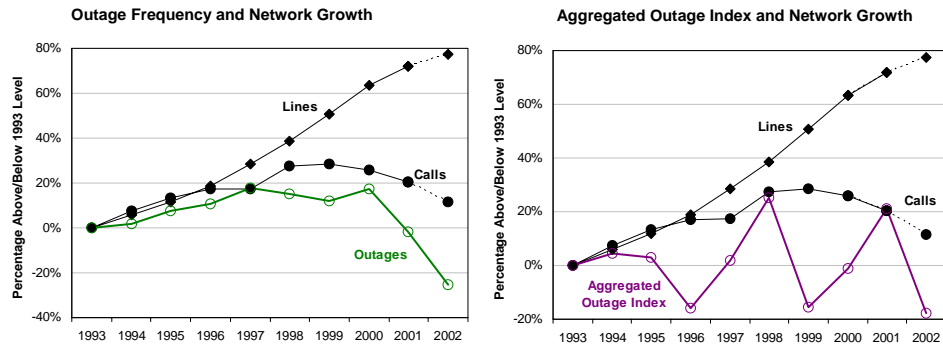


Conclusion: PSTN is "in control"!

Source: Network Reliability Steering Committee (NRSC) and Alliance for Telecommunications Industry Solutions (ATIS)

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Historical Outage Frequency and Severity vs. Network Growth



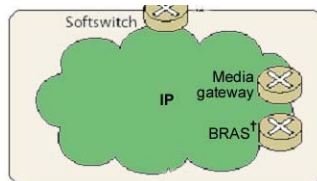
Conclusion: Stability in spite of growth!

Source: Network Reliability Steering Committee (NRSC) and Alliance for Telecommunications Industry Solutions (ATIS)

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Extension of Risk Management Framework to IP

- What is an outage?
- Whose network?
- Limited data?
- Statistical model?



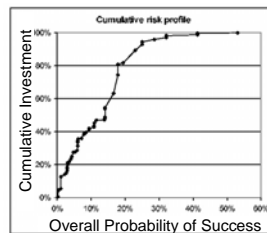
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Survey of Advanced Risk Management Methods (1 of 2)

Technology Risk Management

- Branscomb & Auerswald (2001): Technical Risk (product won't work) & Market Risk (product won't sell) are inseparable.

- Hartmann & Myers (2000):
Technology Risk = $1 - (P_1 * P_2 * P_3)$
Market Risk = $1 - (P_4 * P_5 * P_6)$
Overall Probability Success = $P_1 * P_2 * P_3 * P_4 * P_5 * P_6$



- Molnar & Sharda (1999): Outcome Systems Investment model for telecom
Analytical methods for each of seven layers
Will the technology have an effect on industry structure?

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Survey of Advanced Risk Management Methods (2 of 2)

Operations Risk Management

- Hoffman (2002):
Early identification and avoidance of business disruption.
Balance: maintain enough focus to control risk, without being obsessed and overbearing, which becomes an unreasonable drag on productivity.
- King (2001):
Operational risk is the adverse deviation of a firm's performance due to how the firm is operated.
"Delta-EVT" is a hybrid model that takes into account assignable and un-assignable risk.
Delta is an error-propagation model, where risk factors in value-adding processes cause losses in the business unit.
Extreme Value Theory (EVT) models substantial events that are external to the business unit.
For frequency of loss... Poisson distribution.
For severity of loss... Generalized Pareto distribution.

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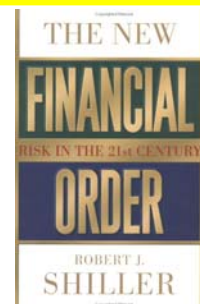
Lessons Learned

- Incumbent operators have embarked on a massive overhaul of the backbone network that supports voice telephony.
- Basic questions remain unanswered:
 - Is VoIP scalable?
 - Will Quality-of-Service (QOS) improve?
 - Will operational snags undermine rosy financial projections?
 - Do the rewards outweigh the risks for an investment that will cost \$billions?
- Conventional risk management is myopic.
- Should consider a more holistic approach to risk (e.g. technological, operational, regulatory and financial risk factors).
- Advanced quantitative methods from other industries may apply.
- Much more research needed!

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Thank You!

"To secure and advance our economic prospects, we must work to enhance the positive, productive power of technological advancements while at the same time reducing the downside "revenge effects" of new technology. What matters now is a greater understanding of how technology poses risks for us, of the economic implications of these risks, and hence of the ways financial innovations can mitigate or control these risks. It is popular to say that there are no economic risks to new technology. But the risks are real."



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