

ResiliNets: Motivation, Challenges, and Disciplines

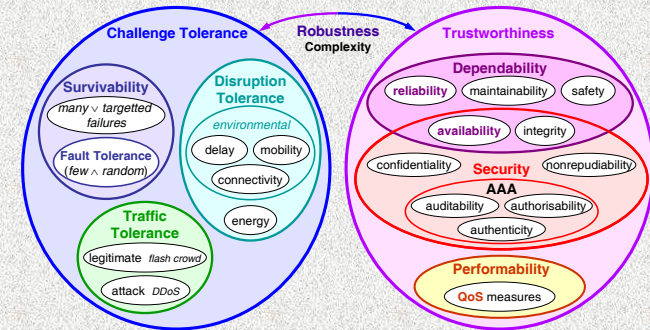
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Resilience Motivation

- Pervasive network infrastructure with increasing...
 - dependence by individuals, businesses, nations
 - consequences of disruption to lives, security, commerce
 - attractiveness as target from bad guys
- Networks are now part of **critical infrastructure**
 - on which other critical infrastructure depends
 - power grid, transportation, financial markets, ...
- **Resilience**
 - ability to provide & maintain acceptable level of service in the face of challenges to normal operation

Resilience Aspects and Disciplines



- Resilience subsumes disciplines relating to:
 - **challenge tolerance**: survivability, disruptions, traffic
 - **trustworthiness**: dependability, security, performability
 - **robustness**: **trustworthiness** in the face of **challenges**

Challenges to Resilience

- Challenges
 - unintentional misconfiguration and operational mistakes
 - large-scale natural disasters
 - malicious attacks including terrorists and DDoS crackers
 - comm. environment: wireless, mobile, delay
 - unusual but legitimate traffic (e.g. flash crowd)
 - lower level service failures including due to faults
- From faults to service failures
 - dormant faults triggered by challenges or operation
 - active faults manifest as errors
 - errors *may* degrade network operation (fault tolerance)
 - degraded network operation *may* lead to service failure

ResiliNets Approach

- **ResiliNets**: resilient and survivable networking
- Strategy for resilience: **D²R² + DR**
 - **D²R²**: real-time loop defend, detect, remediate, recover
 - **DR**: background actions of diagnose and refine
- Principles to guide design of resilient networks
 - prerequisites, tradeoffs, enablers, behaviour
- 2-dimensional system state space
 - operational space
 - normal, partially degraded, severely degraded
 - service space
 - acceptable, impaired, unacceptable