

# High Availability Concepts

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# Introduction

- High Availability – the buzzword and the meaning
- Vladimir Bronstein – experience with high availability in telecom equipment

# Topics of Discussion

- High Availability – what is it and why we need it?
- High Availability – problems to solve
- High Availability – how to make it?

# What

- Five nines 99.999% - 5 minutes in a year downtime
- Service availability (always on, internet dial tone)
- Absolute reliability and survivability
- Data integrity and protection

# Why

- Internet centralized service model
- Many people rely on internet delivered service (service dependency)
- Around the clock operation – no “maintenance time”.
- “Carrier-grade” systems – a buzzword
- Business downtime costs a lot of money

# Problems

- Equipment and software not reliable enough
- MTBF and MTTR – availability =  $(MTBF + MTTR)/MTTR$
- Complex systems – combination of MTBF of components
- MTTR – for software – automatic recovery (reboot) – still bad

# How

- No single point of failure – hardware, software, network
- Redundancy for hardware
- Warm restarts for software (problematic) – so better rely on hardware redundancy as well

# Redundancy Types

- Load sharing, hot standby, cold standby
- 1:1, 1:N, M:N
- Chain redundancy versus block redundancy



# Software challenges

- Faults and Fault isolation
- Failures – result of faults
- Ways to recover – redundancy hot failover
- Hardware failover – switching HW resources (network, fans, CPUs)
- Software failover – applications, protocols, databases etc

# Design principles

- Hot swappability support – to replace faulty units (FRUs)
- Resource (equipment and software modules) model and management
- Logging, trace, reporting of failures/switchovers
- Checkpointing (data mirroring or synchronization) initially and continuously
- Provisioning – redundancy state, software upgrades, different versions.

# Solutions

- Proprietary (long known in telecom industry).
- Standard (SAFORUM middleware interface specification)
- Off the shelf software – Linux Carrier Grade Platform
- GoAhead software