

RESILIENT & INTELLIGENT NEXT-GENERATION NETWORKS & SYSTEMS

INFORMATION AND COMMUNICATION NETWORKS IN THE POST-NEW NORMAL ERA

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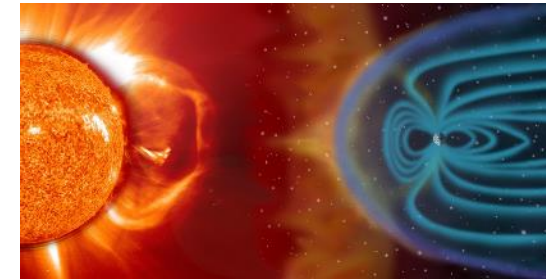
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A RESILIENT SOCIETY NEEDS RESILIENT NETWORKS

- CoVID-19 has been an eye-opener
- Networks are critical resources that cannot be taken for granted
- Digital services are going to be the norm in the future
- Continuous innovation in communication networks and services relying on such networks
 - Key to growth of society and economy
 - True in the analog era, and will remain true in the 21st century as well
- People expect networks to be omnipresent and 100% available
 - Like roads, water and electricity
- Yet ...



NEXT-GEN SYSTEMS ARE A GAME CHANGER

Applications that will emerge by the end of the 5G era

- AR/VR, Tactile Internet, Robo-taxis, Passenger Drones
- Direct Brain-to-Brain Communications and augmenting human-brain with storage implants
- Pervasive, continuous sensing driven by billions of IoT devices
 - Heterogeneous, low-cost, ultra low-power, software-driven device ecosystem
 - Extensive data generation, edge processing, data monitoring and alert systems
- Tight coupling between network, computer systems, data and humans
 - The cybernetic society will be upon us

Implicit is the assumption that these networks will be trustworthy, secure, reliable and safe

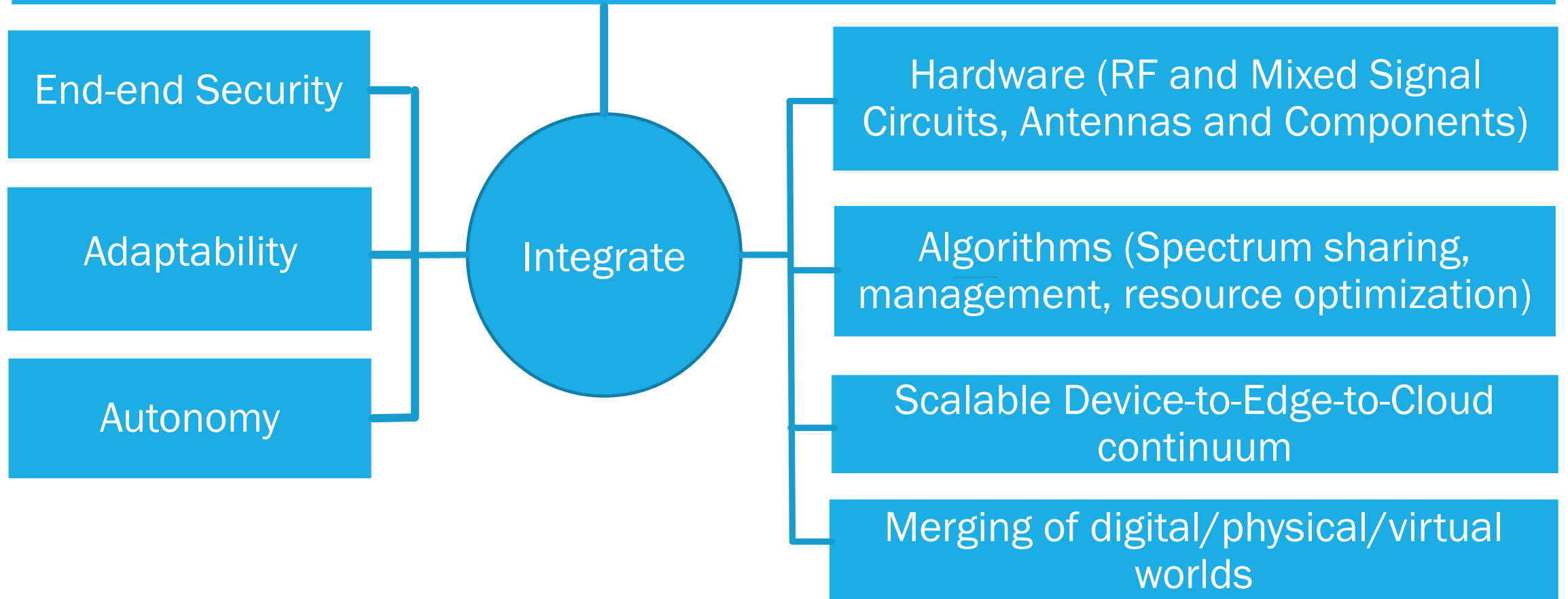
- Will we use any of the above applications even if they are 99.9% reliable?

2 minutes of failure a day is okay?



NEXTG RESEARCH FRAMEWORK @ NSF

Resilient Systems



RINGS PROGRAM

Resilient & Intelligent NextG Systems

- \$40M effort in Phase 1
- Augment current \$100M/year investments in networking and computing research
- Target advances in both resilience & communication networks/systems
- Resilience-motivated designs
- Diverse partnerships
- Ready-to-use city-scale testbeds
- Awards in early 2022



NEXTG RESEARCH BACKED BY TRANSLATION

Platforms for Advanced Wireless Research (PAWR)

- <https://advancedwireless.org>
- Robust support for various 5G models/stacks
 - OpenRAN, O-RAN, vRAN, xRAN, Open Air Interface (OAI), srs5G, free5GC
 - Home for multi-vendor testing efforts
- Designed for NextG/Beyond-5G
 - Fully virtualized
 - End-to-end programmable
 - Remote operations and use
 - BYOD testing
- NSF + 35-member industry consortium
 - \$100M program



POWDER

Salt Lake City, UT

Software defined networks and massive MIMO

<https://powderwireless.net>



COSMOS

West Harlem, NY

Millimeter wave and backhaul research

<http://cosmos-lab.org>



AERPAW

Raleigh, NC

Unmanned aerial vehicles and mobility

<https://aerpaw.org>

Colosseum – Boston, MA
World's largest RF emulator

Rural Broadband Platform
TBD
Coming June 2021

JUNO PROGRAM: JAPAN-US NETWORK OPPORTUNITY

- NSF-NICT collaboration was established in 2010
 - The two agencies jointly funded the first set of Japan-US proposals in the area of Future Internet Design
- The JUNO Program between NSF and NICT was formally established in 2013 with the signing of an MOU
- JUNO (2013): Japan-US Network Opportunity: R&D for "Beyond Trillions of Objects"
 - *Network Design and Modeling*
 - *Mobility*
 - *Optical Networking*
- JUNO2 (2017): Japan-US Network Opportunity: R&D for "Trustworthy Networking for Smart and Connected Communities"
 - *Trustworthy IoT/CPS Networking*
 - *Trustworthy Optical Communications and Networking*
- JUNO3 (2021): Workshop in Nov 2020.
- ... and beyond: opportunities for NextG collaboration
 - Resilient systems, open-source 5G/NextG, federated testbeds

SUMMARY

- The US is looking forward to NextG with resilience as its focus
- NSF has stood up an array of programs and testbeds to support NextG research and practice
 - With international, U.S. federal agencies and industry
- Healthy collaboration between NSF and NICT
- Openness and transparency will be NextG strengths
 - Networks, computer systems and data
- More opportunities to engage.

