Continuity and Resilience (CORE)

ISO 22301 BCM Consulting Firm

Presentations by Speakers at 8th India Business & IT Resilience Summit

6th June 2019, Mumbai

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Resilience in Cyber Physical Systems

C Kajwadkar (C K)

6th June 2019

Heat Around Us

- Disruptive World of Business Transformations
- The Digital Era
- Scary Scale of Natural Disasters & Terrorism
- Technology Risks in Hyper Connected World
- Cyber Threats in Ubiquitous World of ICT
- 'Kill Chain' Management

The Crystal Ball ..Horizon 2020/21

- Perceptible Impact of Global warming
- Heightened Global Stress….. Territorial Control, Economical, Nuclear
- High Severity Threats : Natural Disasters, Physical & Cyber Terrorism
- No More New : IoT, Pattern Recognition, Machine Learning, AI, Robotics
- Predictive Analytics : Audio, Video, Social n/w, Structured, Unstructured
- Deeper Penetration of e-Governance …From Tax collection to Garbage collection
- …..
- …..

The Crystal Ball ..Horizon 2025

4th Industrial Revolution: Higher Momentum

- Matured Drivers : ML, AI ,IOT,
- Common Jargons : WNS,C2X, M2M
- Dominance of CPS and CPCS
- Every thing 'smart/intelligent'
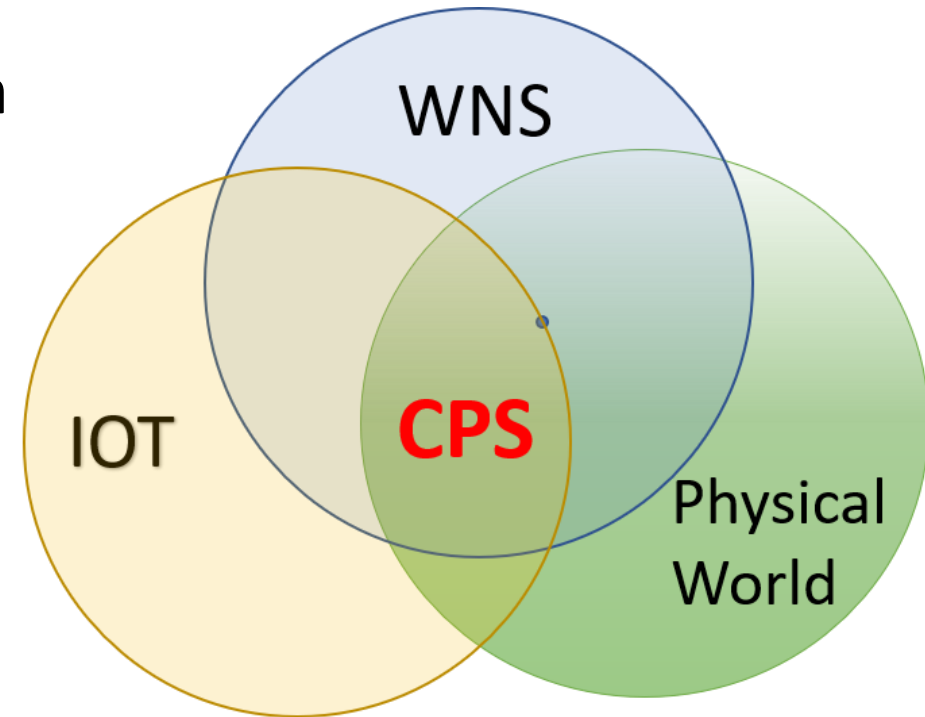
WNS: Wireless Sensor Networks , C2X : Car to Everything
M2M = Machine to Machine
CPS Cyber Physical Systems
CPCS: Cyber Physical Cloud Systems

The Crystal Ball ..Horizon 2025

- Increasing Dependence (or Helplessness?)
  - Smart Grids, Transportation , Cities
  - Agri , Green House Asset management
  - Health care system
  - Navigation & Rescue
  - Autonomous Vehicles, C2X
  - Machine Vision
  - Biological Network Analysis
  - Military Robotic Systems
  - …

Crown Jewels in Cyber Physical World

- Human Life...society at large
- Supplies/ Services : Food, Water, Electricity, Piped Natural Gas
- Control Systems : Air, Road , Sea traffic management systems
- ......
- .....

High Level Building Blocks of CPS

- Physical Electro Mechanical Systems
  - Some thing that is static or moving or both
    - Transformers, RTUs, Turbines, Oil rigs
    - Equipment/ gadgets/ devices in hospitals or mines, manufacturing units
    - Machines, Automotive devices / appliance
    - Rides in amusement parks
- Embedded systems
  - Systems that are 'part' of some thing or 'full' Systems themselves
- Sensors & Feedback systems
  - Mobile or non Mobile IoT , Industrial IoT
- Computational systems
  - Operating Systems, Inter-system Communication, Data store, Computational Algorithms etc

Resilience in CPS

- Requires Holistic System view
  - Support of heterogeneous physical environments
  - Large-scale systems integration with multiple monitoring and control Systems
- Convectional IT focuses on Security : Information / Cyber
- CPS need Safety as well as Security

Thrust on 'Resilience'…   Rather than Recovery

- Resilient by Design
- 'Built-in' Safety as well as Security
- Military grade testing
- Hack Proof and Fail Proof operations
- Auto healing systems rather than 'recoverable systems'

Challenges

- Vulnerable Components Like sensors, cameras
- Vulnerable firmware in embedded systems
- Risk of Hardware trojans... Time bombs
- Weak computational systems
- Engineering design that equally supports <u>Safety</u> & <u>Security</u>
- Comprehensive Test Methodology & tools
- Bleak opportunity for so called <u>'THOROUGH'</u> Integrated Testing
- System upgrade itself can be a risk ..(Roll Back ? Impossible!)
- Overflowing Logs

What Do We Do ?

Need for Track Change

- Resilience by design is the only way
- Lay emphasis on Safety as well as Security
- Develop Fail proof, Hack proof and <u>FOOL</u> proof systems
- Make 'Recovery Manager' a redundant role
- Set the stage of talent specialized in 'Resilient Design'

Wake Up Call

When Going Gets Tough, Tough Get Going...

Let Us Begin Our Journey Towards
Societal Resilience

Thank you