



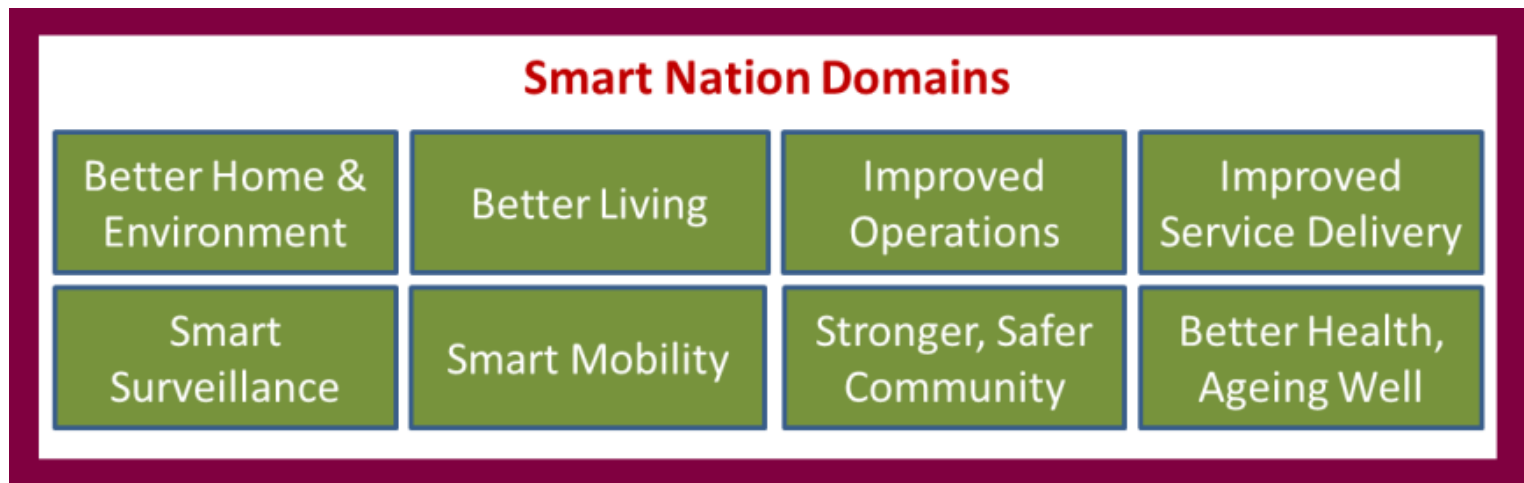
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Smart Platform Infrastructure Research on Integrative Technology (SPIRIT)

Nanyang Technological University (NTU)

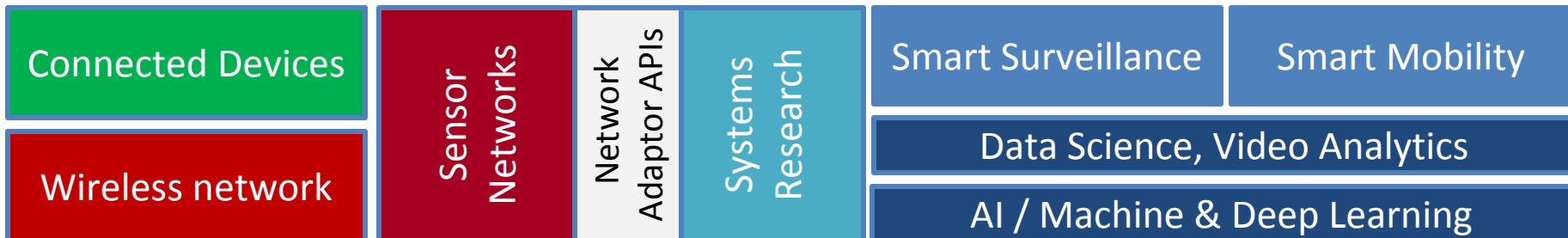
Programme Overview

- S\$11 millions funding awarded by NRF to establish a Translational R&D Centre for Smart Nation applications - the SPIRIT Centre
 - Perform Systems Research with the objective to design & develop a large-scale, complex **smart systems platform** for translational R&D of technologies relevant to smart nation applications
 - Platform will be a **testbed** for supporting rapid solutioning & fast prototyping of smart nation applications
 - To be a **one-stop shop** with broad capabilities

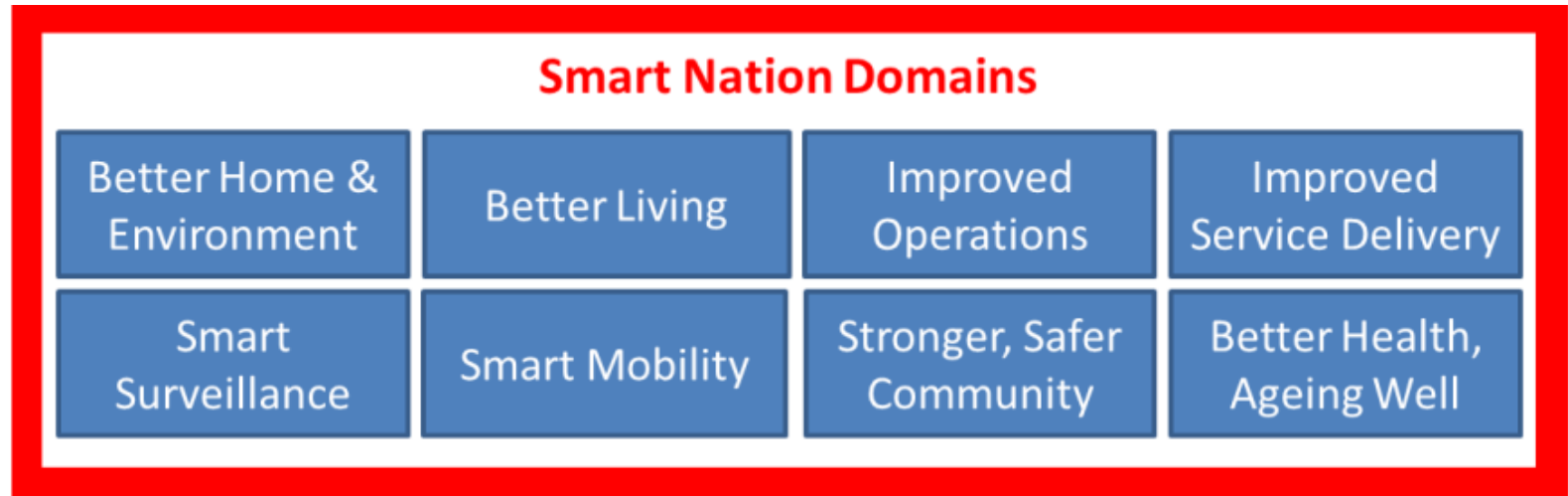


R&D Focus

- **Systems Research** on Platform Architecture
 - To support translational R&D on **data science & video analytics**
 - To handle **massive amount of data from diversified sensing sources** via heterogeneous network interfaces
 - To meet stringent demand in response time of smart nation applications
 - SDLC guided by **Enterprise Architecture** methodology
- **Wireless communication research** on IoT and sensor network
 - Existing expertise and proven track records in **wireless communication, sensor networks, acoustics, and AI**.
 - **Project-centric cooperation** between centre and the public and private sectors
 - Campus-Wide Test Bed: NTU's Yunnan Garden campus will be transformed into a **real-life test bed**.



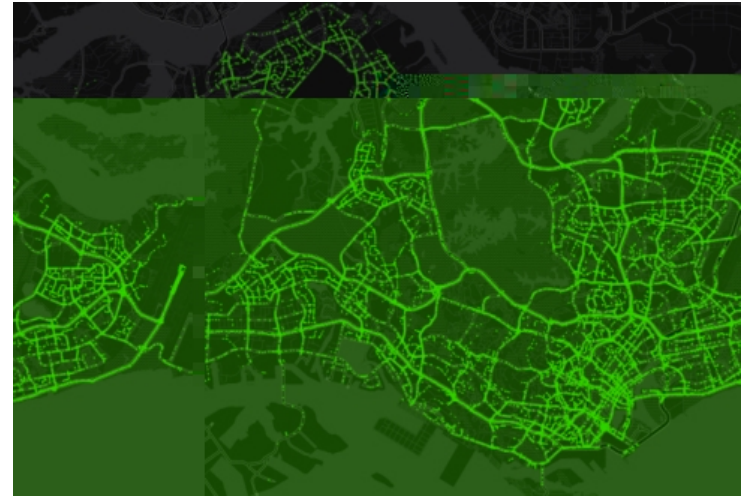
Critical Technologies & Drivers for Smart Nation



Smart Nation: Technology Perspective

Smart Nation/Cities is enabled by the widespread adoption of new technologies such as:

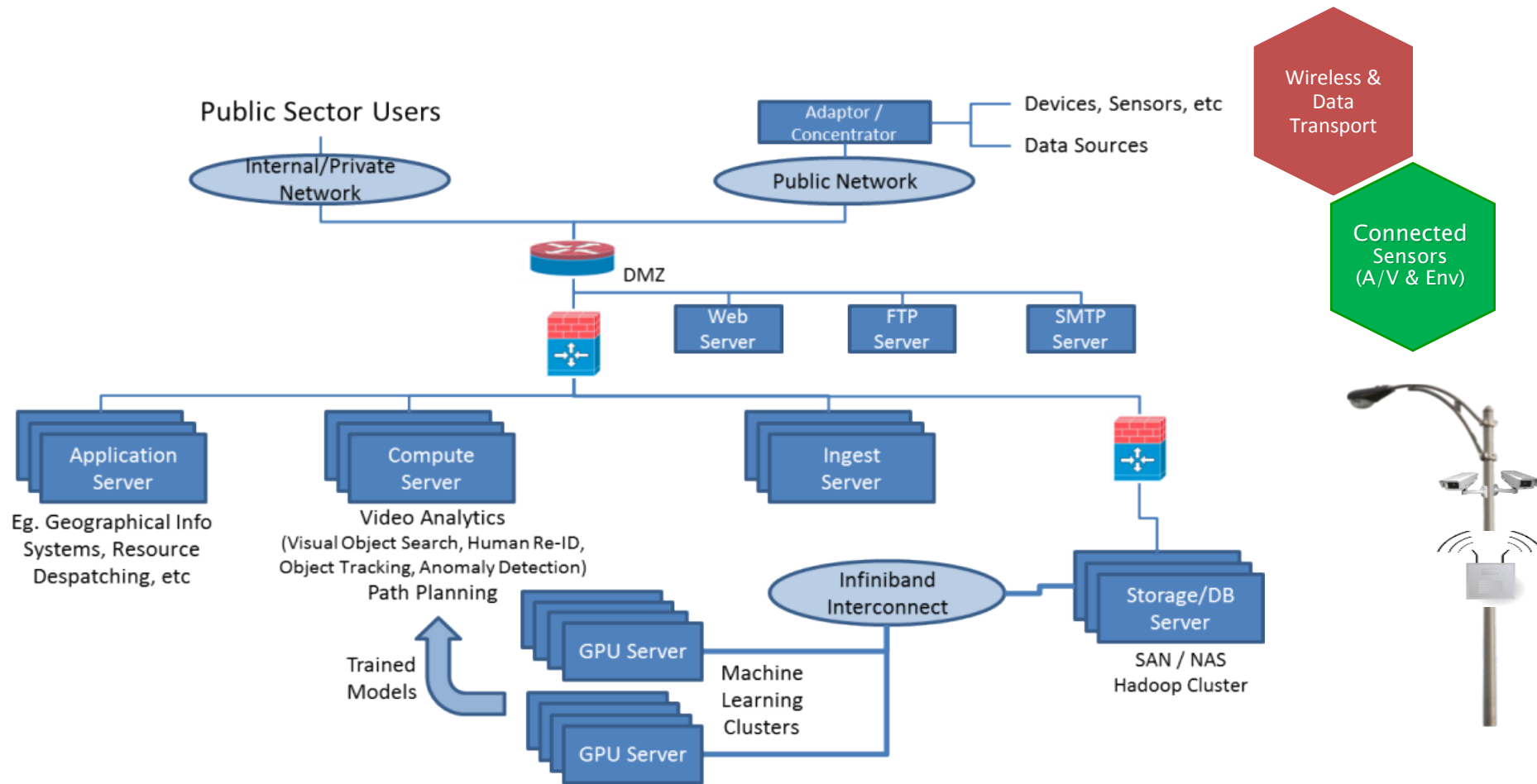
- Sensors
- Internet of Things (IoT)
- Cloud computing
- Mobile technology and
- Big data analytics
- Cybersecurity



to develop intelligent systems in order to improve government operations, support better living, create opportunities, and to support stronger and safer communities.

Smart Nation/Cities is a systems engineering technology that aims to disrupt and challenge traditional operations and decision-making processes

Systems Research for Platform Architecture



Platform needs to handle massive amount of data from diversified sensing sources via heterogeneous network interfaces

Connected
Sensors
(A/V & Env)

Total RSU Counts
40 ~ 50 units

Car Parks = 19
Major Junctions = 9
Bus Stops = 18
Traffic Lights = 2

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NTU-Singapore Judiciary Collaboration: A.I. to Aid Courtroom Procedures

- **Objective:** Improve judicial efficiency through A.I. techniques
- **Approach:** R&D for an Intelligent Case Retrieval System
 - Decision support tools for the judges and legal professionals
 - Develop advanced machine learning algorithms, intelligent information retrieval and natural language processing techniques
 - Support efficient retrieval of precedent cases, perform automatic summarization and legal reasoning



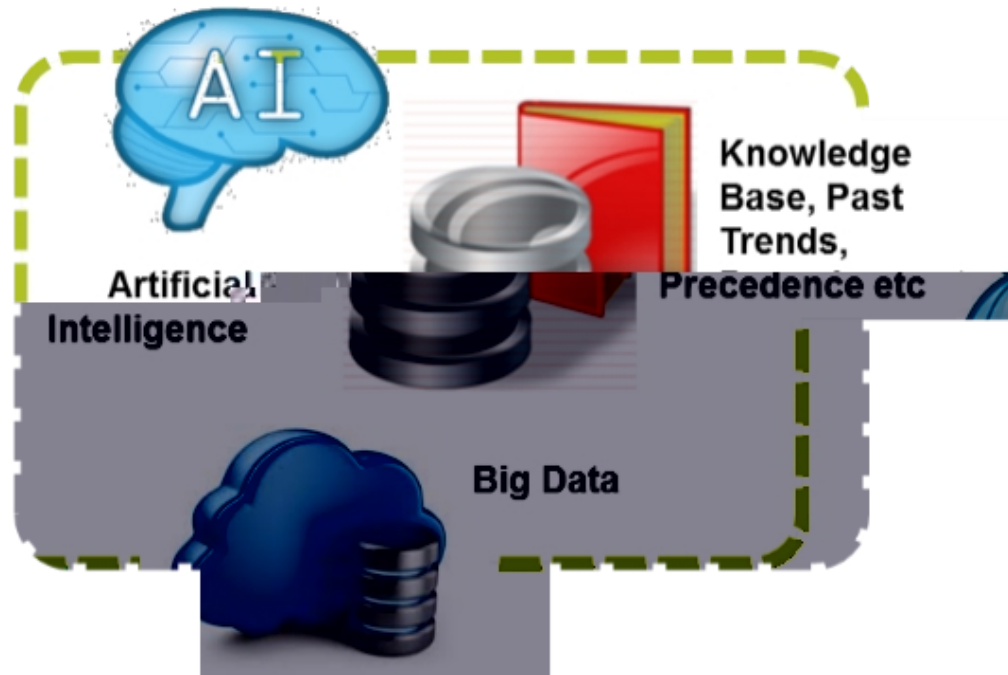
ICRS: Decision Support through AI



Users are guided to provide the scenarios and circumstance for the system to decrypt

Intelligence comes from:

- Natural language processing
- Topic Modelling
- Intelligent Search/Retrieval
- Automated Summarization



Wealth of knowledge created from knowledge bases, big data collections and fronted by an A.I. query and response engine

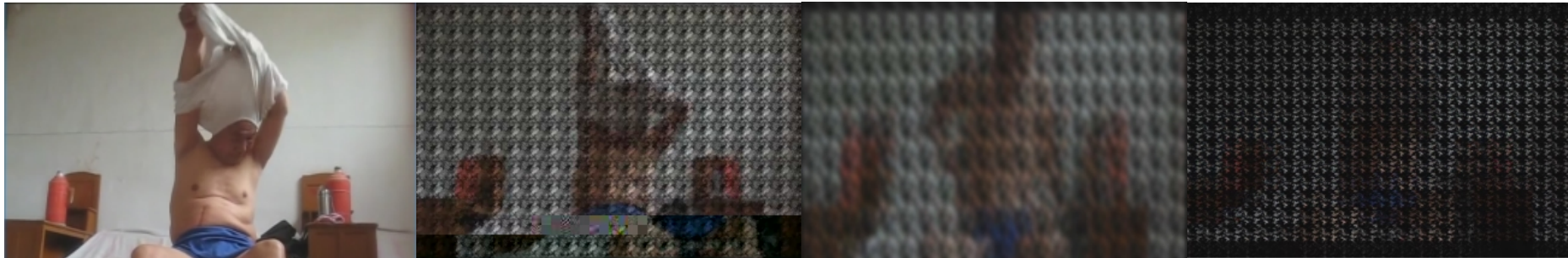
NTU-MITRE Smart Nation Collaboration Worker Health and Safety

- **Objective:** Improve construction site safety through predictive analytics
- **Approach:**
 - Fuse diverse data sources from low-cost smart sensors (e.g. visual, audio, environmental/health sensing) to detect “near-miss” events between human and machine or machine to machine on construction sites.
 - Develop advanced machine learning algorithms to identify patterns and generate predictive analytics.
 - Generate data visualization dashboards which allow decision makers to leverage these new data sources to improve safety planning and mitigate risks.



Compressive Sensing

- **Video Transmission for Elderly Care**
 - Achieves 2x – 40x compression with Tunable Quality.
 - Lightweight design, suitable for sensor nodes.
 - Software/Hardware Prototype available.
 - Smooth plugin to existing systems.



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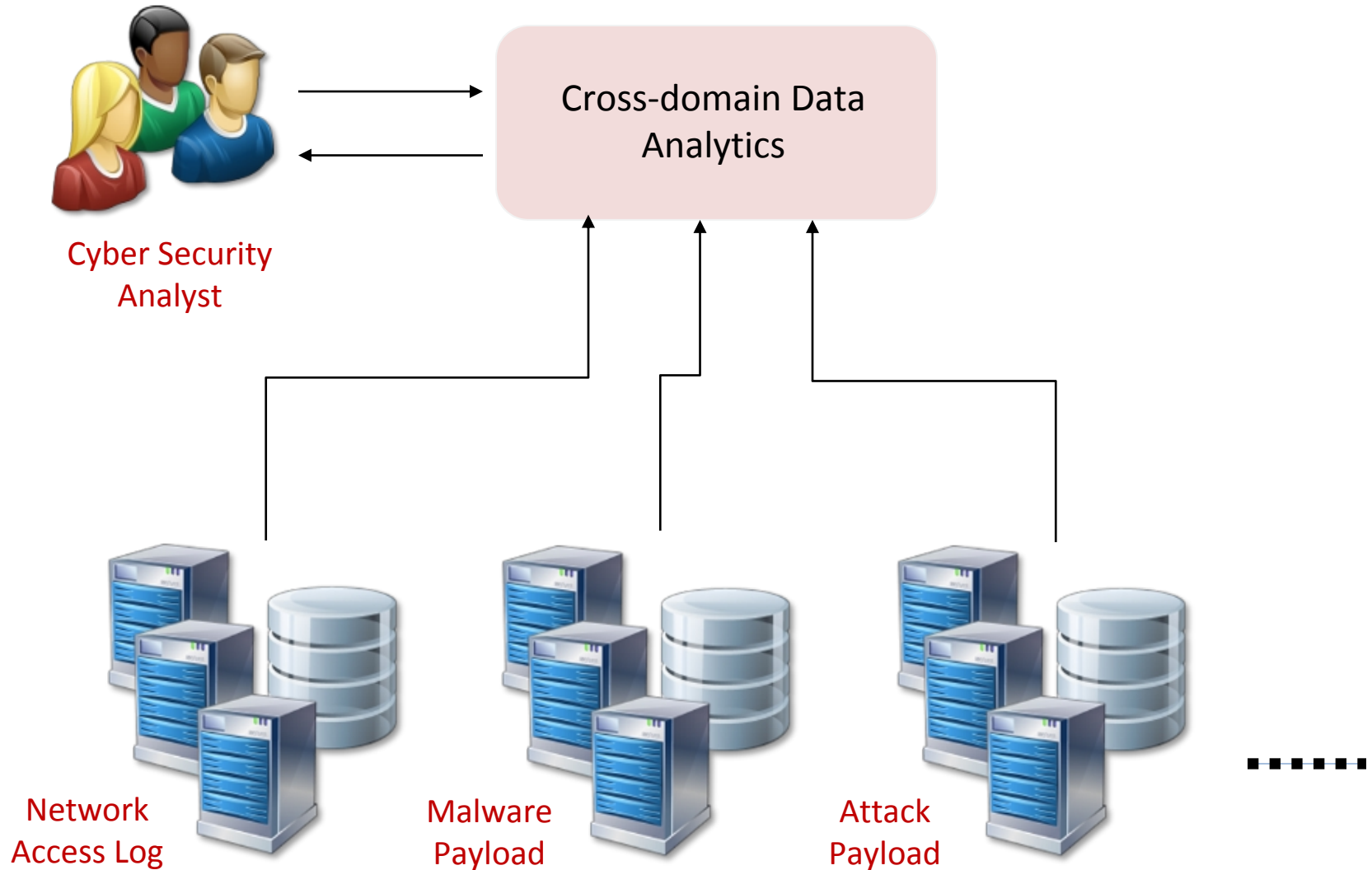
45%

70%

90%

Technology: “Secure and Lightweight Compressive Sensing using Stream Cipher”,
Accepted for publication in IEEE Transactions on Circuits and Systems II.

Cybersecurity Big Data Analytics

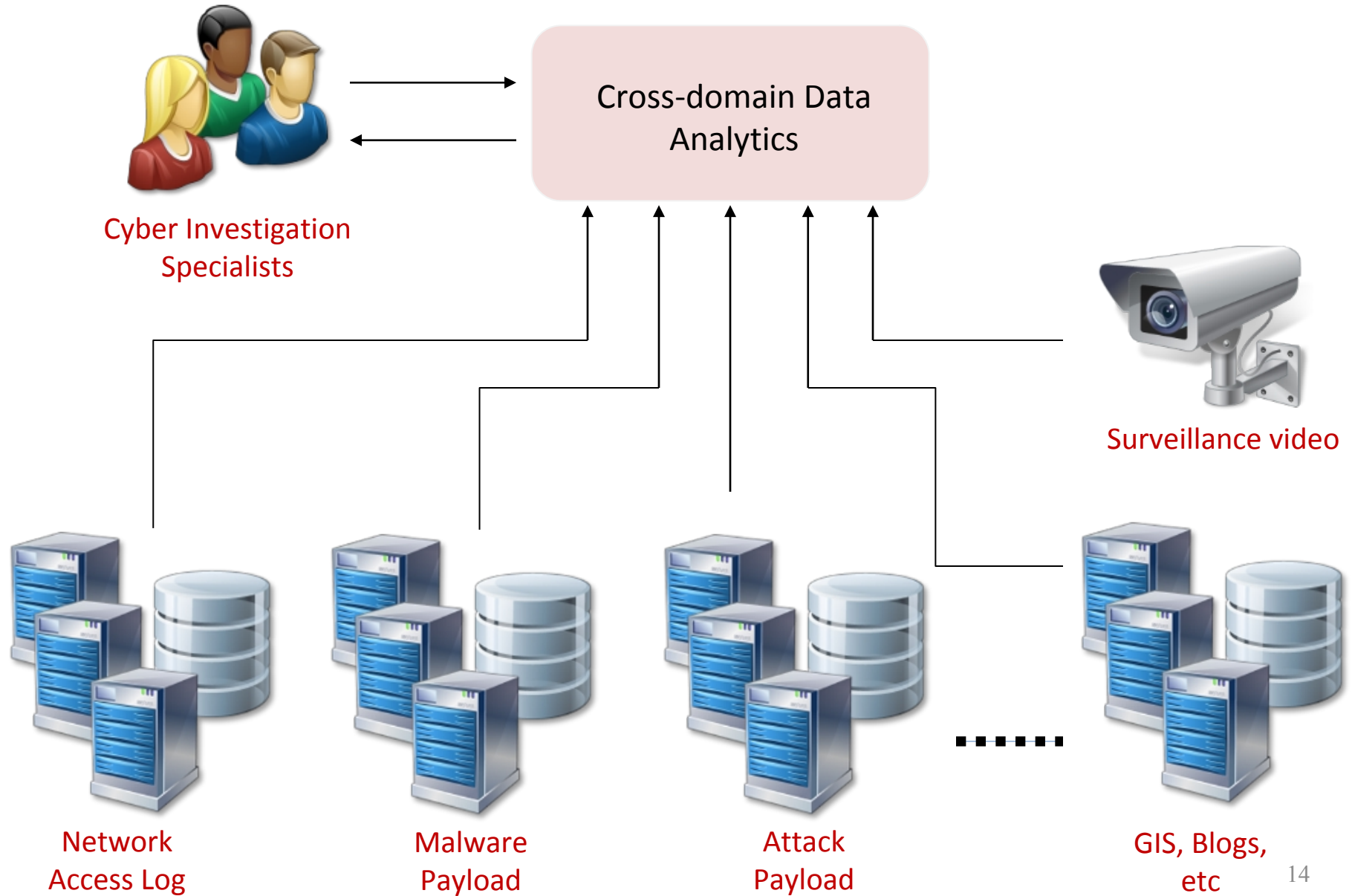


Cyber Fusion

- Cyber fusion: Linking cyber security & physical security systems
 - Leads gathered through Digital Forensics can be followed up by physical security systems E.g.
 - APT found to be originated from malware residing in a computer
 - Malware could have been introduced by contaminated thumb drive
 - Infected USB drive could have been placed by Attacker(s)
 - Physical security system could help identify the culprit
 - Video analytics
 - Image analytics
 - Biometric recognition

This project was conducted in collaboration with the Global Safety Division of NEC Corp.

Linking Cyber Security & Physical Security



Thank You!



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