WORKGROUP 5: FUTURE-READY TECHNOLOGIES

SERVICES AND DIGITAL ECONOMY
TECHNOLOGY
ROADMAP

22 NOVEMBER 2018

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OUTLINE

A	**MARKET STUDY**	1 Market Potential	2 Key Drivers	3 Others
B	**TECHNOLOGY STUDY**	1 Technology Readiness Map	2 Technology Capabilities	3 Application Use cases
C	**CONCLUSIONS**	1 SWOT Analysis	2 Recommendations	

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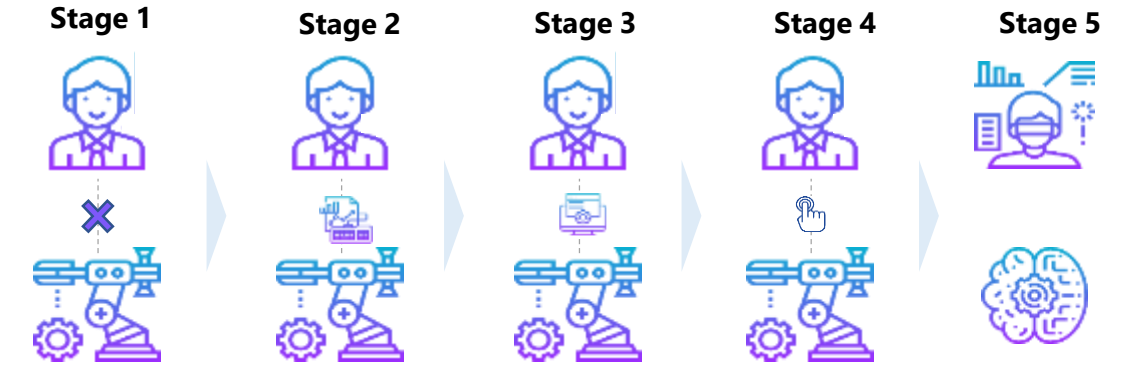
New Era of Human and Machines: Embracing Future-ready Technologies

- Evolution of Human-Machine interaction: 3 main systems
  - Digital Autonomous Systems (Intelligent Machine)
  - Intelligent Connected Systems (Machine-Machine)
  - Psychological Collaborative Systems (Human-Machine)

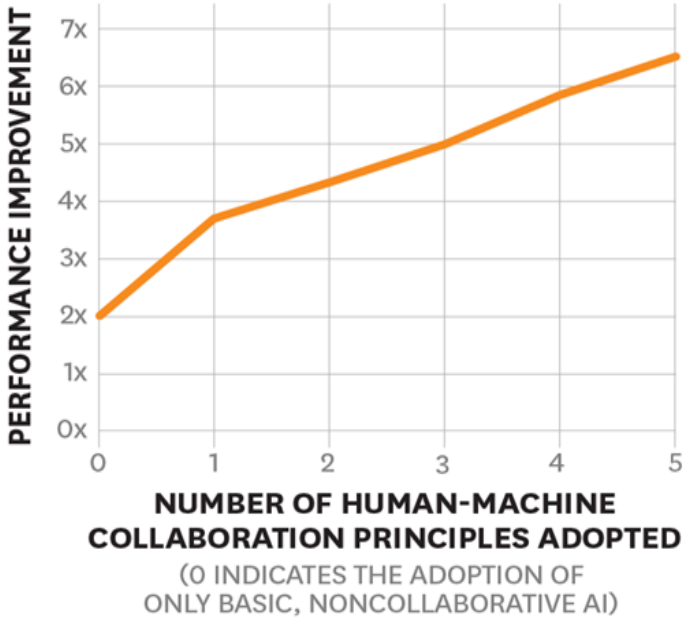
Market Study

The Trajectory of human-machines collaboration, powered by technology



Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
1960s to 1980s	1980s to 1990s	1990s to present	Emerging within the next 2-5 years	Emerging within the next 5-10 years
Interactions between machines and humans **not possible** due to limitations in hardware and interfaces	Minimal interactions between machines and humans possible by means of **intermediate hardware and interfaces** e.g. keyboards Multiple users interact with a single machine at this stage	Interactions between machines and humans are **facilitated by smart screens**; screens manipulated based on direct physical contact or spoken interaction A single user interacts with a single machine at this stage	Humans interact with machines through intuitive interactions as machines are equipped with devices to **respond to ambient cues and intentional movements** e.g. gesture, mood, gaze A single user interacts with multiple machines at this stage	**Humans and machines can be used interchangeably** as both have been equipped with capabilities to compensate shortcomings Machines can interact with each other as well as humans at this stage

Increase in the number of human-machine collaboration improves performance.



Technology will transform this relationship and is poised to generate value that do not exist today

Technology Drivers…

Rise of Deep Tech…

Rise of the Computing Power

By **2025**, computing power will rival the human brain[2]

Rise of Robots

The mobile robots marker will reach USD **$10.6 billion** between 2015 and 2020[3]

Rise of Artificial Intelligence

AI tools will create **USD$3 trillion** in business value by 2021[4]

The market value of cognitive computing will reach **USD$1.2 trillion** by 2020[5]

… will transform human-machine collaboration…

Collaborative Human Machine Systems Perform Better than Humans or Machines in Isolation

Up to **7x** performance improvement with human-machine collaboration[1]

… generating significant impacts.

Massive Productivity Improvement

Completely New Way Of Delivering Services

New Services Offered That Does Not Exist Today

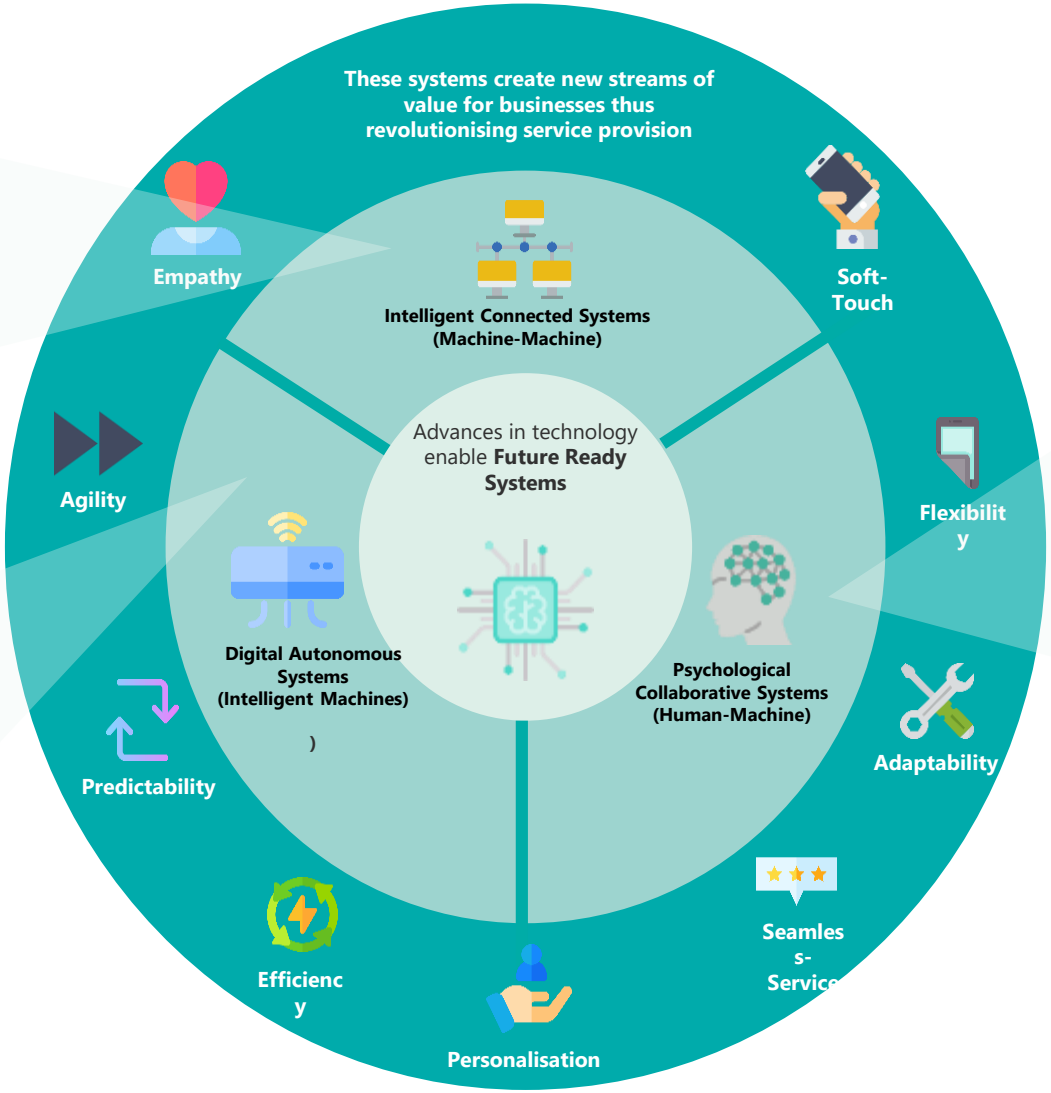
Human-machine systems can be categorized in three buckets to further Future Ready Systems

Intelligent Connected Systems (Machine-Machine)

1. Connected Vehicles
2. Swarm Bots

Digital Autonomous Systems (Intelligent Machines)

1. Digital Automation Platforms & Services
2. Autonomous Systems



Psychological Collaborative Systems (Human-Machine)

1. Intelligent Human Sensing Robots
2. Humanoid Robotics

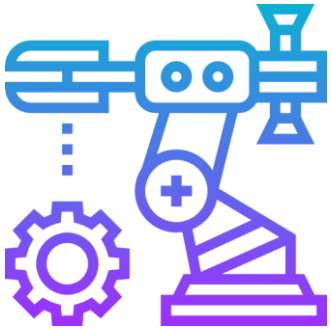
Preliminary and to be validated by WG group

SINGAPORE SHOULD PLAY A KEY ROLE IN BUILDING HUMAN-MACHINE SYSTEMS BASED ON FUTURE TECH

"As-A-Service" Platforms

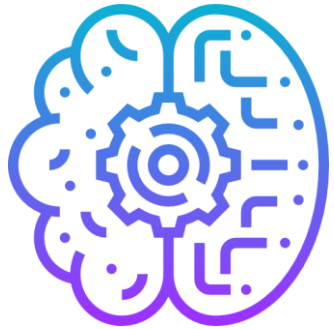
Providing "as-a-service" platforms for Future Ready tech applications which can be powered by HPC

Exporter of A. Bots



Become a key player in A.Bots that leverages psychological collaborative systems

Test-Bed for Future Tech



Allowing organizations to innovate and develop future tech solutions in Singapore

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WG5 FUTURE READY TECHNOLOGIES: TECHNICAL WRITE-UP

1. **Digital Autonomous Systems (Intelligent-Machine)**
   - Autonomous Systems
   - Digital Automation Platform
2. **Intelligent Connected Systems (Machine-Machine)**
   - Connected Vehicles
   - Swarm Bots
3. **Psychological Collaborative Systems (Human-Machine)**
   - Human Sensing Robots (Co-bots)
   - Perceptive Robotics (Humanoid)

Capabilities

(1-2 years, 3-5 years, >5years)

- Smart inspection
- Proactive maintenance
- Conditional /High/Full Automation
- Extension of human capabilities
- Human-like perception of emotional intelligence
- Collaborative systems for complex tasks

etc.

Key Enabling Technologies

(1-2 years, 3-5 years, >5years)

- Computing Technologies e.g., Exascale Computing, Cognitive Computing, Neuromorphic Computing, In-memory Computing, etc.
- Emotion AI
- Intentioneering
- Self-organised Collaboration
- Context Awareness

etc.

Challenges | Methodologies | Applications

Use Cases

Digital Identity for Personalisable Services

1~2 Year	3~5 year	>5 year
Proactive monitoring and analysis e.g., crowd monitoring & controls, transportation management, health and sentiment analysis	Virtual personal assistants, e.g., digital tutors, city planners, health advisor, legal and financial agents	Personalisable machines/robots with human in the feedback loop e.g., retail services agents, healthcare robots

Digital Service Engineers for Maintenance Repair and Operation (MRO)

1~2 Year	3~5 year	>5 year
Smart agents/tools sets will conduct real-time inspections, diagnose failures, and capture knowledge from disparate media and/or real-time data feeds	Human-centric intelligent auxiliary systems to facilitate human to work e.g., read instructions, capture data, locate precisely, etc.	Virtual personal assistance (VPS) to provide proactive recommendations with rationalisation and provenance for maintenance

Smart Build Environments

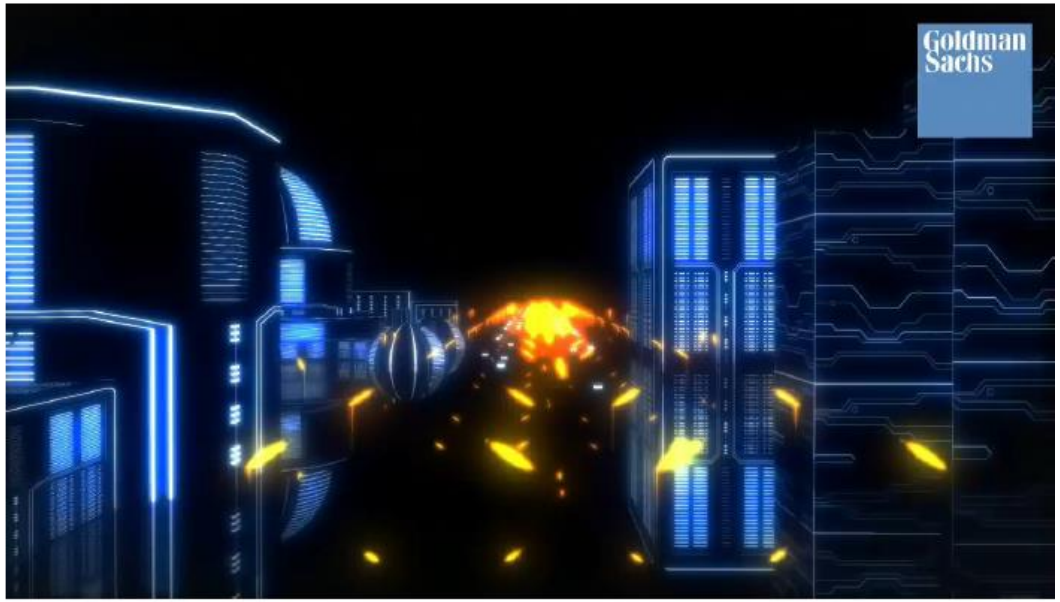
1~2 Year	3~5 year	>5 year
Smart building inspection to study the building performance and safety compliance.	Data-driven building optimisation via Building Management System (BMS), Automatic Meter Reading (AMR), etc.	Preventative maintenance to surface performance anomalies, give recommendation, and predict energy consumption.

TECHNOLOGY READINESS MAP ON DIGITAL AUTONOMOUS SYSTEMS

	Categories	Now~2 Years	3~5 years	>5 years
Digital Automation Platforms	Capabilities	**Smart Inspection:** - Observe, learn, and capture knowledge from disparate media and/or real-time data feeds; - High performance inspection for detection or quality control;	**Preventive maintenance:** - maintain self-sovereign identity; - interpret human intention for engineering design and analysis;	**Proactive enhancement:** - give recommendations with rationalisation and provenance for production improvement; - transfer knowledge between systems e.g., virtual personal assistance (VPS)
	Technologies	• GPU-accelerated Computing • Narrow AI/ML • Nature Language Processing (NLP) • IoT sensors and wearables • Edge computing • Chat bots • Computer vision	• Exascale Computing • General AI for decision making, reasoning, and planning • Cognitive computing • Assistive Technology • Augmented Reality • Semantic technology	• Neuromorphic Computing • Commensense AI for proactive improvement • Virtual Assistant • Deep Neural Network ASICs • High performance blockchain
	Application Scenarios/Use Cases	Smart Building Environment Automate analytics of building performance (e.g., to inspect building for safety and compliance), drive performance and cost optimization of their real estate portfolio by surfacing performance anomalies, recommend preventative maintenance, predict energy consumption, and etc.		
Automatous systems/robots	Capabilities	**Conditional Automation** - auto steering and monitoring - semi-auto for dynamic tasks - human take over when needed	**High Automation** - auto steering and monitoring - fully auto for dynamic tasks - more auto driving modes/conditions;	**Full Automation** - auto steering and monitoring - all driving modes/conditions that can be managed by a human driver
	Technologies	• Perception-detection • Route planning and learning for simple uncrowded environments • Augmented reality • Deep learning	• Perception-tracking • Route planning and learning for unstructured and Semi-crowded environments	• Perception-prediction • Route planning and learning for complex, unstructured and human environments
	Application Scenarios /Use Cases	Autonomous Bots/Vehicles – Land Autonomous systems including autonomous vehicles, mobile bots, machines or devices which can navigate, plan routes, and complete tasks indoor and/or outdoor autonomously with less human invention		

USE CASES ON INTELLIGENT-MACHINE

Construction --- Building inspection, maintenance
Financial Service --- virtual assistant as financial advisor
Professional Service --- virtual assistant
ICT and media --- videos or contents recommendation
Food manufacturing --- smart inspections
Retail --- Personalisable robots for recommendation
Manufacturing --- digital twins for MRO
Education --- virtual tutors



Digital Automation Platforms and Services

Now~2 Years	3~5 years	>5 years
Proactive health monitoring, Identification of manpower shortage, mass sentiment analysis, and crowd monitoring and controls	Virtual personal assistants such as digital tutors, health/legal/ financial advisors to help rapid digital workforce reconstruction	Personalisable machines/robots to help on personalized customizable retail services and have a feedback loop with human

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TECHNOLOGY READINESS MAP ON INTELLIGENT CONNECTED SYSTEMS

	Categories	Now~2 Years	3~5 years	>5 years
Connected vehicles	Capabilities	**Basic Connectivity and great analytics abilities:** Be capable of vehicles to vehicles communications, and vehicles to roadside infrastructure communication, and to share data, to use mobility data for traffic safety and efficiency.	**Strong connectivity and greater analytics abilities:** Be capable of communication between vehicles and a broad range of infrastructures, and advanced traffic management system using massive mobility data.	**Intelligent reasoning and decision making:** Be capable of collaboration between vehicles and vehicles, between vehicles and infrastructures in an intelligent and efficient manner.
	Technologies	• In-memory Computing • V2X communication • Narrow AI / Data analytics • Vehicles platooning • Intelligent traffic advisor • Driver assistance system	• Strong AI / Big data analytics • 5G • Context-aware system • Intelligent traffic management • Remote vehicles platooning	• Advanced context-aware system • Security • Advanced traffic management system
	Application Scenarios/Use Cases	Connected vehicles for safety: Vehicles can sense the movement of vehicles and pedestrians in its neighbourhood, and can predict their movement to avoid possible collisions.		
Swarm bots	Capabilities	**Collaborative systems with human intervention:** Be capable of collaborative tasks with central control or human intervention. Robots are able to communicate with neighbouring ones, collect data, and execute the activities assigned by the central controller.	**Collaborative systems with little human intervention:** Be capable of collaborative tasks with little human intervention, self-organised, and making decisions by individual bots. Robots are able to negotiate with neighbouring ones, generate and execute the activities towards a set of tasks.	**Collaborative systems for complex tasks:** Be capable of self-organized, making decisions by individual bots under complex environments, and adapting organisation structures to tasks.
	Technologies	• Machine to Machine communication • Planning and scheduling • Localization • Narrow AI • Cloud intelligence • Petascale computing	• Multimodal context awareness • Self-organized systems • Context-aware system • Strong AI • Edge computing • Exascale Computing	• Context-aware system for complex tasks • Self-organized cooperation • Low cost bots • Collaboration of robotics with different operating systems
	Application Scenarios /Use Casees	Micro swarm bots for maintenance and healthcare: Micro swarm robotics can be used to inspect the engine without removing it from the aircraft. On the other hand, tiny swarm robotics for healthcare can carry medicals to accurately travel to targeted tissues and destroy them.		

USE CASES ON MACHINE-MACHINE

Professional/Manufacturing service --- maintenance
Logistic --- container ship terminal
Sea transport --- search for missing marine
Security --- security monitoring system
Retail --- service robotics
Healthcare - Medicine

Swarm Bots for Engine Maintenance

Now~2 Years	3~5 years	>5 years
Micro robots are able to bring cameras to the inside of the engine so that human can do defects detection. They collaborate to cover the whole engine to save time.	Micro robots are able to communicate with neighboring ones, perform defects detection by themselves, and even collaborate to do repairs.	Miro robots can collaborate to complete the defects detection and repair task in an efficient and intelligent way.

TECHNOLOGY READINESS MAP ON PSYCHOLOGICAL COLLABORATIVE SYSTEMS

	Categories	Now~2 Years	3~5 years	>5 years
Human Sensing Robots (Co-bots)	Capabilities	**Advanced Sensing for Automated Planning Capabilities**: • Robust detection of humans for safety purposes. • Advanced force control of end-effectors. • Automated route planning and navigation.	**Advanced Sensing for Shared Human-Robot Workspaces**: • Increased implementation of shared workspaces. • Enhanced safety in terms of human-robot interaction. • Improved productivity.	**Advanced Sensing for Joint Workflow**: • Optimum productivity.
	Technologies	• 3D Sensing Cameras • Cognitive computing • Automated planning • Affective Computing	• Human behaviour prediction • Advanced Emotion Analytics • Physical Human Robot Interaction	• Neuromorphic Computing • Intention Influence • Robot knowledge sharing
	Application Scenarios/Use Cases	Future robotic systems shall be equipped with a variety of sensors and advanced algorithms that permit robust detection of human presence along with their behaviour. The development of these technologies progressively improves the collaboration quality between man and machine over the next 5 years.		
Perceptive Robots (Humanoid)	Capabilities	**Extension of Human Capabilities**	**Advanced Perception of Emotional Intelligence**	**Human-like Perception of Emotional Intelligence**
	Technologies	• 3D Sensing Cameras • Advances in SLAM • Personal recommendation systems (based on human preference) • Wearable sensors	• Emotion sensing • Soft robots	• Neuromorphic Computing • Deep learning accelerator)
	Application Scenarios /Use Casees	Robotic Caregiver/Companion type of systems that are able to converse and psychologically understand the needs of a human.	Robotic Mediator type of systems that are able to follow the basic constructions of human law and norms of society. This leads the robot to have the capacity to act as a mediator between humans though, it does not impose any regulation and merely acts as an aid to reach a conclusion.	Robotic Authority type of systems with their improved emotional, legal, and moral understanding, can act as a part of the social hierarchy. In several instances, they can act as an authority.

USE CASES ON HUMAN-MACHINE

Retail---customer service robots
Retail---entertainment robots
Hotel---service robots
Food service--- customer service robots
Security---surveillance robots
Financial service---payment services (e.g. Credit card)
Healthcare/Eldercare – personal robots

Perceptive Robots (Humanoid)

Now~2 Years	3~5 years	>5 years
Recommender algorithms utilized in services and retail to customers, companion bots, in restaurants for F&B industry, provide entertainment in malls, home security, home monitoring.	In hotels and travel agencies for tourism, connected home and housing, mobility assistance in eldercare, in hospitals as robotic caregiver systems to post-surgery patients, to provide assistance to customers in banks.	To assist in providing paediatric care and telemedicine, medical diagnosis, medical therapy, robotic authority (e.g., traffic enforcement, etc)

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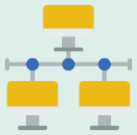
SWOT Analysis - System Specific Analysis

Legend: Positives / Negatives

Our analysis of Singapore and the global landscape reveals that there are *both system specific as well as system agnostic elements* to the SWOT analysis.

System	Indicators	Singapore's Standing	Rationale
 Digital Autonomous System (Intelligent Machine)	 Self Driving Vehicles	2nd Globally[1]	Singapore has **supportive policy and legislation, robust infrastructure and high customer acceptance**[2]
	 High Performance Computing	19th Globally[7]	Singapore **has 2 of the high performance computers** listed in the Top500 list[7]
 Intelligent Connected system (Machine-Machine)	 Advanced Cloud Technology	1st in APAC[6]	High ranking as a result of **high-quality broadband, governmental support, emphasis on cybersecurity and strong IP protection laws**[6]
	 Advanced Communication Technology	10th Globally[9]	Singapore is **still at a trial phase for advanced communications** behind the front runners China, South Korea, Japan and the US[3]
 Psychological collaborative system (Human-Machine	 Advanced Robotics	2nd / 3rd Globally[4 5]	**National Robotics Programme received SGD$450 million** over the last 3 years has greatly supported robotics development[4]
	 Advanced AI	Not listed in top 10 list for #AI professionals working in the country	Proactive government initiatives an funding; however, **lack of talent** will be a constraint to develop the technology[8]

Source: (1) eGov Innovation, https://www.enterpriseinnovation.net/article/us-singapore-lead-country-readiness-index-self-driving-vehicles-716424406, (2) KPMG https://assets.kpmg.com/content/dam/kpmg/nl/pdf/2018/sector/automotive/autonomous-vehicles-readiness-index.pdf, (3) Singtel https://www.singtel.com/about-Us/news-releases/journey-to-5g-singtel-and-ericson-to-launch-singapores-first-5g-pilot-network (4) The Robo Report https://www.therobotreport.com/10-automated-countries-in-the-world/ (5) Smart Cities World https://www.smartcitiesworld.net/data/data/index-ranks-global-robotics-and-ai-readiness (6) Asia Cloud Computing http://www.asiacloudcomputing.org/research/2018-research/cri2018 (7) Top500 https://www.top500.org/statistics/details/osfam/1 (8) Top 10 countries with most AI professionals, http://www.chinadaily.com.cn/bizchina/2017top10/2017-07/13/content_30093900_10.htm (9) CTIA https://api.ctia.org/wp-content/uploads/2018/04/Race-to-5G-Report.pdf

SWOT Analysis - System Agnostic Analysis

What is Working Well

- **Strong Presence of Technology Companies:** Singapore ranks second in top Asian locations for tech companies
- **Strong support by the government on Technology in R&D:** Smart Nation initiatives focussed on assistive technologies, analytics and robots for healthcare
- **High Quality Talent Pool:** Singapore ranks first in Asia Pacific in the Global Talent Competitiveness Index (GTCI) 2017
- **Investment in R&D:** The Government has committed SG$19 billion to R&D over the for the Research Innovation Enterprise 2020 Plan; a component of this is the development of the ASPIRE1 the first peta-scale supercomputer in Southeast Asia
- **Investment in Technology by Multiple Sectors:** The financial and technology industries are is investing heavily in new and emerging technologies in order to improve its service offerings
- **World Class Innovation:** The 2017 Global Innovation Index ranked Singapore as the most innovative country in Asia, while the 2017 Bloomberg Innovation Index ranked Singapore sixth globally
- **Geographic Location:** Singapore's unique geographic location within the ASEAN region and in the broader Asian continent, lends itself to become a hub to service intelligence driven technology. Singapore's size allows such technologies to be tested in this area

What is Not Working Well

- **Lack of Local Market:** Lack of successful start-ups in deep-tech areas, compared to dynamic innovation hubs like the Silicon Valley and Israel
- **Aggressive Overseas Markets:** China and the US alone account for 46% of global R&D spending, severely outpacing any other country in this area, competing with them on the same level is challenging due to the sheer size of both countries
- **Lack of Talent:** Demand far exceeds supply of local technology talent; the government estimates that there are 400 graduates a year with the right qualifications for the tech jobs; the shortage of tech talent forces Singapore firms to outsource abroad
- **Overdependence on Government Grants:** Many tech start-ups here are of "lower risk, lower growth" calibre leading to fewer deep-tech start-ups that, despite being riskier ventures, could reap greater rewards
- **Lack of Commercialisation of Future Tech:** It is challenging to bridge the value of death for Future Tech due to inability to commercialize, the market stagnating or betting on the wrong technology
- **Lack of Scale in Data:** Many emerging systems require data to train them, Singapore lacks the size compared to, for example, China and India, who have much larger populations and consequently larger data pools

Legend

Market | Policy & Regulation | Talent | Capital | Innovation Ecosystem

Three guiding principles to leverage Singapore's unique strengths and overcome its weaknesses to build its Future Ready Technology capabilities

A **Singapore should aim to become a hub where Future Ready Technologies is developed, piloted and scale up by concerted effort of local and global stakeholders**

Leverage Singapore's unique geographic location and highly innovative and 'trusted' environment to attract global investments and talent

B **Singapore develops a technology infrastructure that provides enabling ingredients to develop Future Ready Tech as well as access to the Future Ready tech to maximize adoption – ISaaS**

Adopt As-a-Service philosophy in developing and disseminating technology into the ecosystem

C **Singapore should continue building its capabilities for the Future Ready Tech – National Competency Program***

Singapore boasts a strong talent pool but is constrained in scale; focussing on Future Ready Tech early on will ensure long term sustainability and competitive advantage

* Junior STEM (Science, Technology, Engineering and Mathematics) is required to build a funnel of talent for national competency programme

Recommendations

1

- Firstly, Singapore should aim to develop **research and development (R&D) programme for Future-Ready Systems** - ***Intelligent-Systems-as-a-Service (ISaaS) platforms*** for **R&D** of Future-Ready Systems such as Intelligent-Machine, Machine-Machine and Human-Machine systems and its innovative services. These platforms should comprise of advanced computing architectures and provide democratised access to newly created APIs including "warm" and "perceptive" human-centric API system technologies. This includes the seeding of a next generation computing platform on a Public-Private-Partnership (PPP) basis. Furthermore, to support ISaaS and to accelerate R&D for emerging technologies and adoption, a roadmap for an advanced computational infrastructure and exascale performance capability (e.g., at least 1 exaFLOPS) should be put in place in Singapore by 2025.

2

- Secondly, Singapore should set up **the SDE Future-Ready Living Lab Framework** addressing the ***value chain of technology readiness levels*** and together with GLCs, MNCs, SMEs, IHLs, R&D organisations and start-ups to build a scalable and sustainable SDE in Singapore. Singapore's unique geographic location and highly innovative and 'trusted' environment will help attract global investments and talent. This framework should include series of tech innovative challenges focusing on building and incorporating the future-ready systems such as Intelligent-Machine, Machine-Machine, Human-Machine, etc.

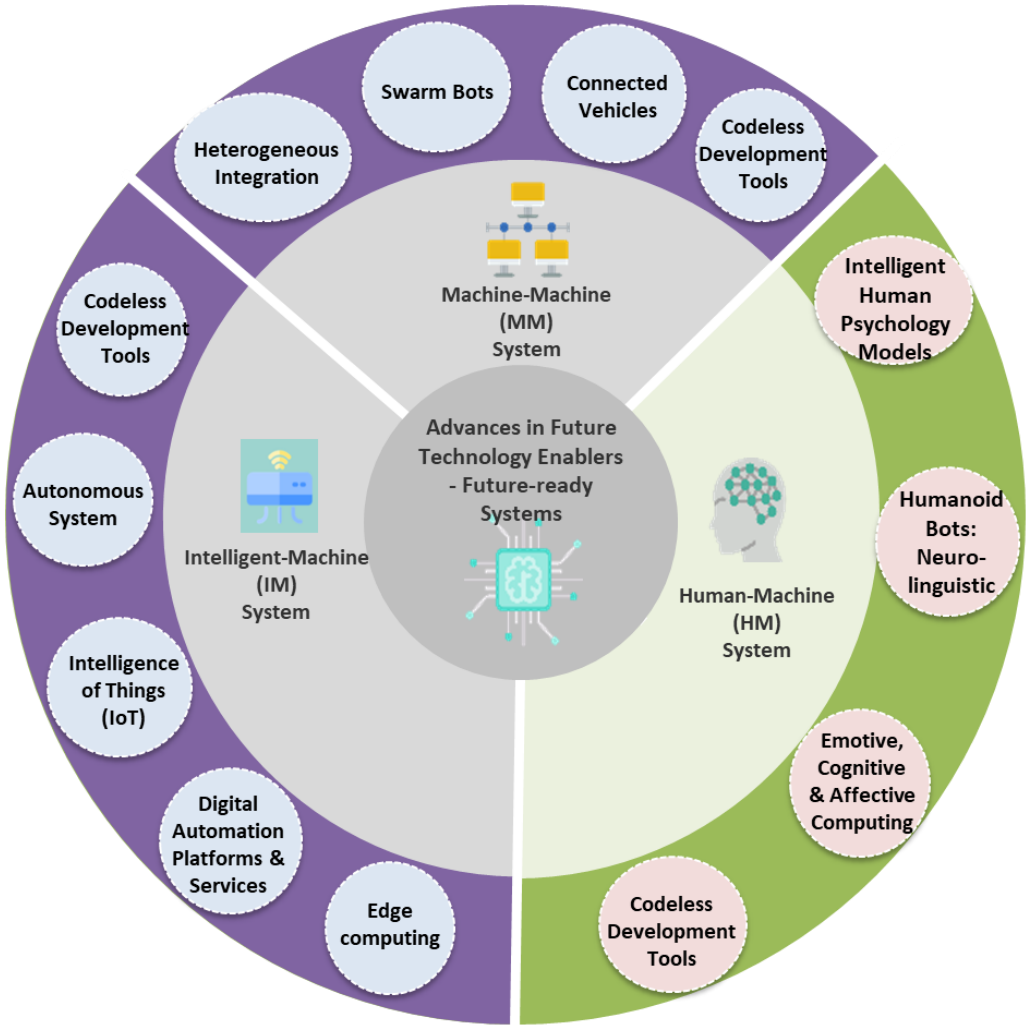
3

- To set up **National Competency Programme** to focus on Intelligent Systems ***capability building*** incorporating multi-disciplinary of intelligence of Things (IoT – not "Internet"), Autonomy and Social-Psychology combined. Singapore currently boasts a strong talent pool but is constrained in scale; focussing on training programmes and fostering growth of talent, will enable long-term sustainability and competitive advantage.

Example Outcome: Singapore to become a hub for A-bots

Singapore has a competitive advantage in the development of HM systems and could aim to become a hub where **Augmented Bots – 'A Bots'** R&D

- **Multiple countries around the world** have invested in developing IM and MM Systems
- Singapore should continue to conduct R&D in this area but not prioritise its resources in this area due **to the stiff competitive landscape**



Legend

Future-ready System Technology

- **HM Systems** are endowed with capabilities to recognise, interpret and express emotions in human psychological models
- Singapore has a significant competitive advantage in these systems as not many countries have invested in developing these solutions.
- By focussing R&D resources on developing HM systems, Singapore can build a strong foundation to anchor this R&D in this future-ready system technology and adoption in Singapore early.
- **Key differentiating factors of Singapore**:
  - pervasive high-bandwidth digital infrastructure,
  - multi-racial cultural behavioural understanding,
  - psychological personalization sensitivity,
  - high productivity/efficiency,
  - trusted entities, etc.

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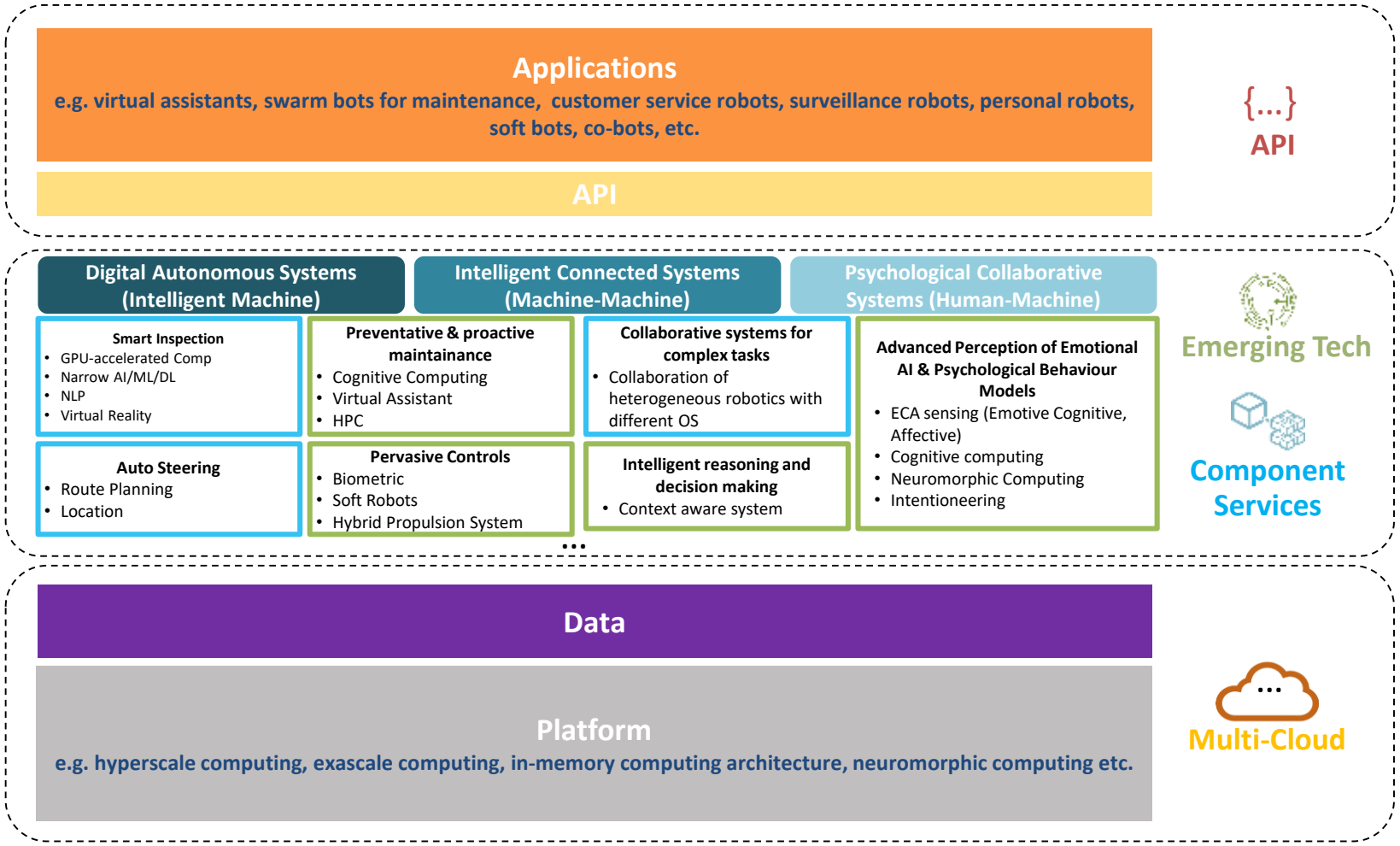
Alignment of Future Ready Technologies in Cloud Native Architecture



1 Digital Autonomous Systems (Intelligent Machine)

- 1.1 Exascale Computing
- 1.2 General AI for decision making and reasoning
- 1.3 Cognitive computing

Technologies will improve autonomous systems' abilities such as environment sensing, division making, and operation & control.

2 Intelligent Connected Systems (Machine-Machine)

- 2.1 Self-organised cooperation
- 2.2 Context-aware systems
- 2.3 In-memory computing

Multiple bots can communicate with neighbouring bots, sensors, infrastructure and interact with other bots in a distributed, intelligent and collaborative manner

3 Psychological Collaborative Systems (Human-Machine)

- 3.1 Human Behaviour prediction
- 3.2 Advanced Emotion Analytics
- 3.3 Physical Human Robot Interaction

Future robotic systems shall be equipped with a variety of sensors and advanced algorithms that permit robust detection of human presence along with their behavior.

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Alignment of Future Ready systems to the DE Framework

INTEGRATING ECOSYSTEMS

SDE Future Ready Living Lab Framework

Addresses the value chain of technology readiness levels and together with GLCs, MNCs, SMEs, IHLs, R&D organisations and start-ups to build a scalable and sustainable SDE in Singapore

DIGITALISING INDUSTRIES

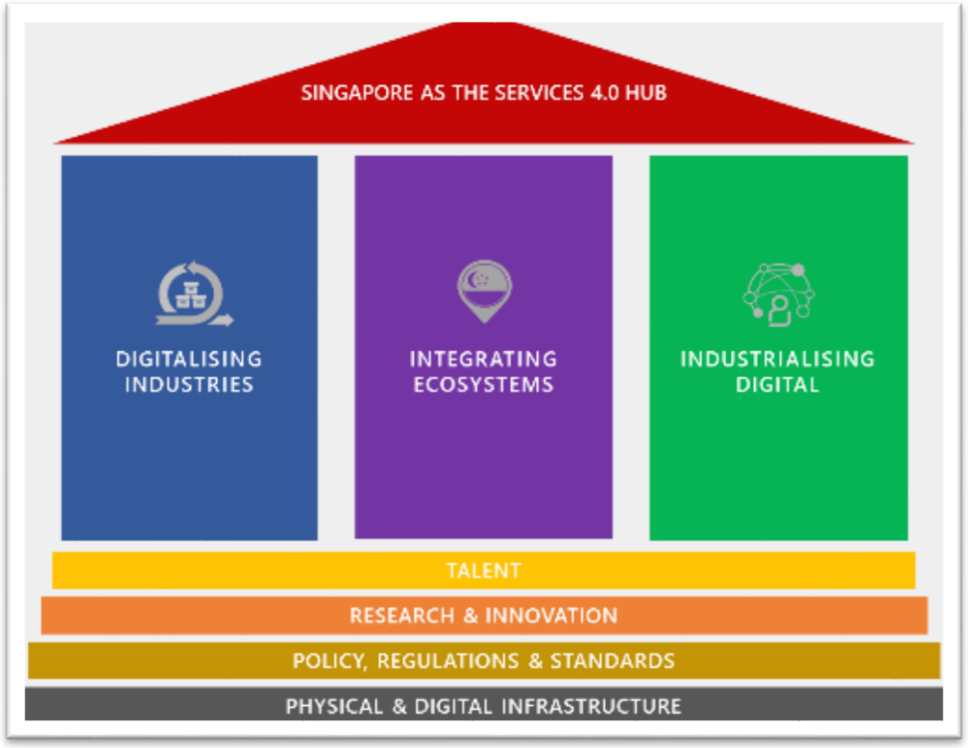
SDE Future Ready Living Lab Framework

To support technology innovation challenges focusing on building and incorporating the future ready technologies.

TALENT

National Competency Programme

Capability building incorporating multi-disciplinary of intelligence of Things (IoT – not "Internet"), Autonomy and Social-Psychology combined



INDUSTRIALISING DIGITAL

SDE Future Ready Living Lab Framework

This includes the seeding of a next generation computing platform on a Public-Private-Partnership (PPP) basis. To support ISaaS and for accelerating emerging technologies R&D and adoption,

RESEARCH & INNOVATION

R&D Programme for Future-Ready Systems

Develop research and development (R&D) programme for Future-Ready Systems - Intelligent-Systems-as-a-Service (ISaaS) platforms for R&D of Future-Ready Systems such as Intelligent-Machine, Machine-Machine and Human-Machine systems and its innovative services

PHYSICAL & DIGITAL INFRA

Intelligent Systems as A Service (ISaaS)

Uses advanced computing architectures e.g. exascale performance capability by 2025

THANK YOU

SG:D
EMPOWERING POSSIBILITIES

INFOCOMM MEDIA DEVELOPMENT AUTHORITY