Cyber-Physical System in Manufacturing

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12/03/2018

King Mongkut's University of Technology Thonburi

AGENDA

01: Introduction

02: iStarch: industry 4.0 exercise for starch manufacturing

03: Future direction

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02: iStarch: industry 4.0 exercise for starch manufacturing

03: Future direction

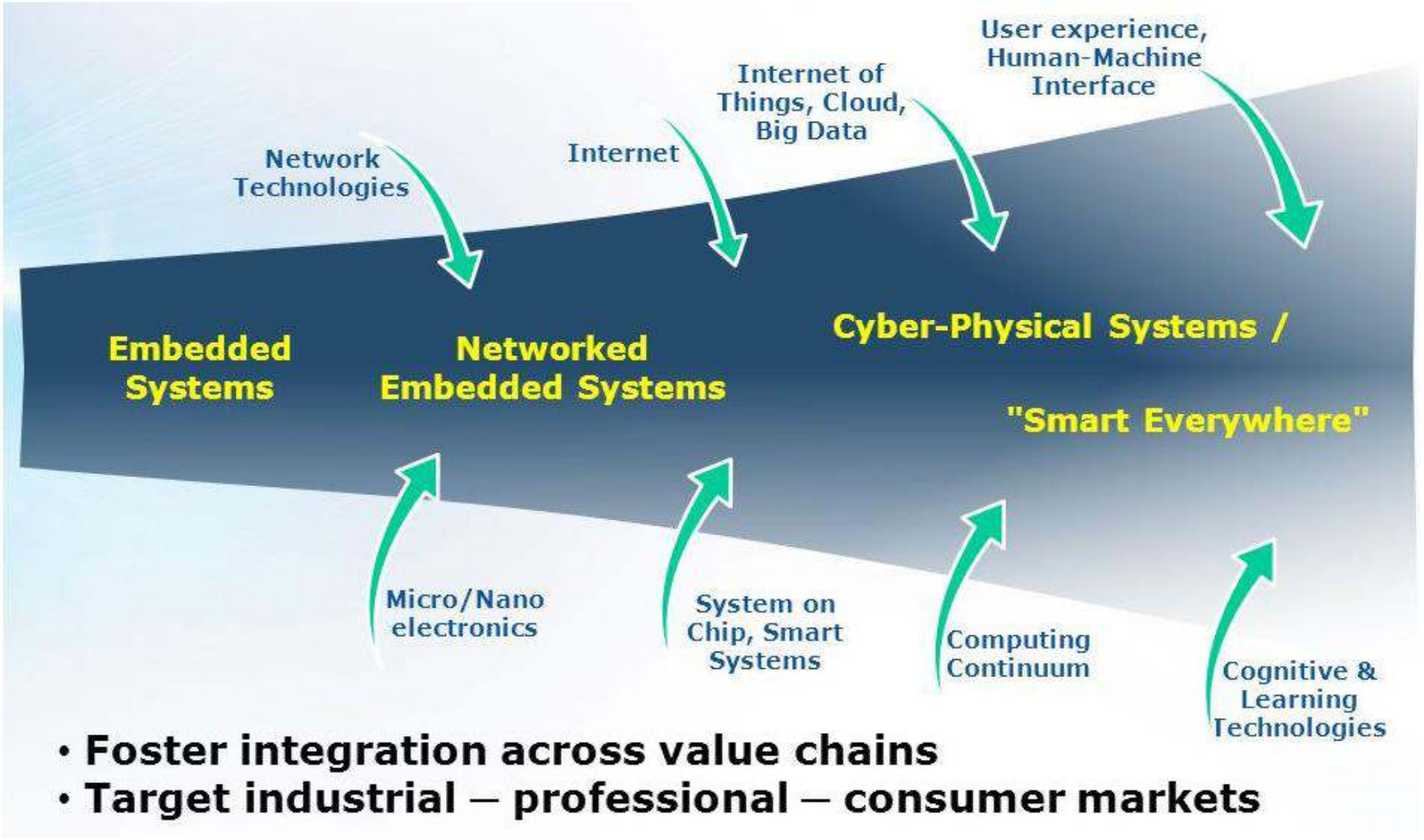
Cyber Space: Cyber physical + Digital human + …

http://www.moddb.com/mods/cyberpunk/images/cyberspace

Cyber physical via Cyber physical system

http://design-engine.com/thingworx-augmented-reality-and-iot-in-the-workplace/

Cyber physical system evolution



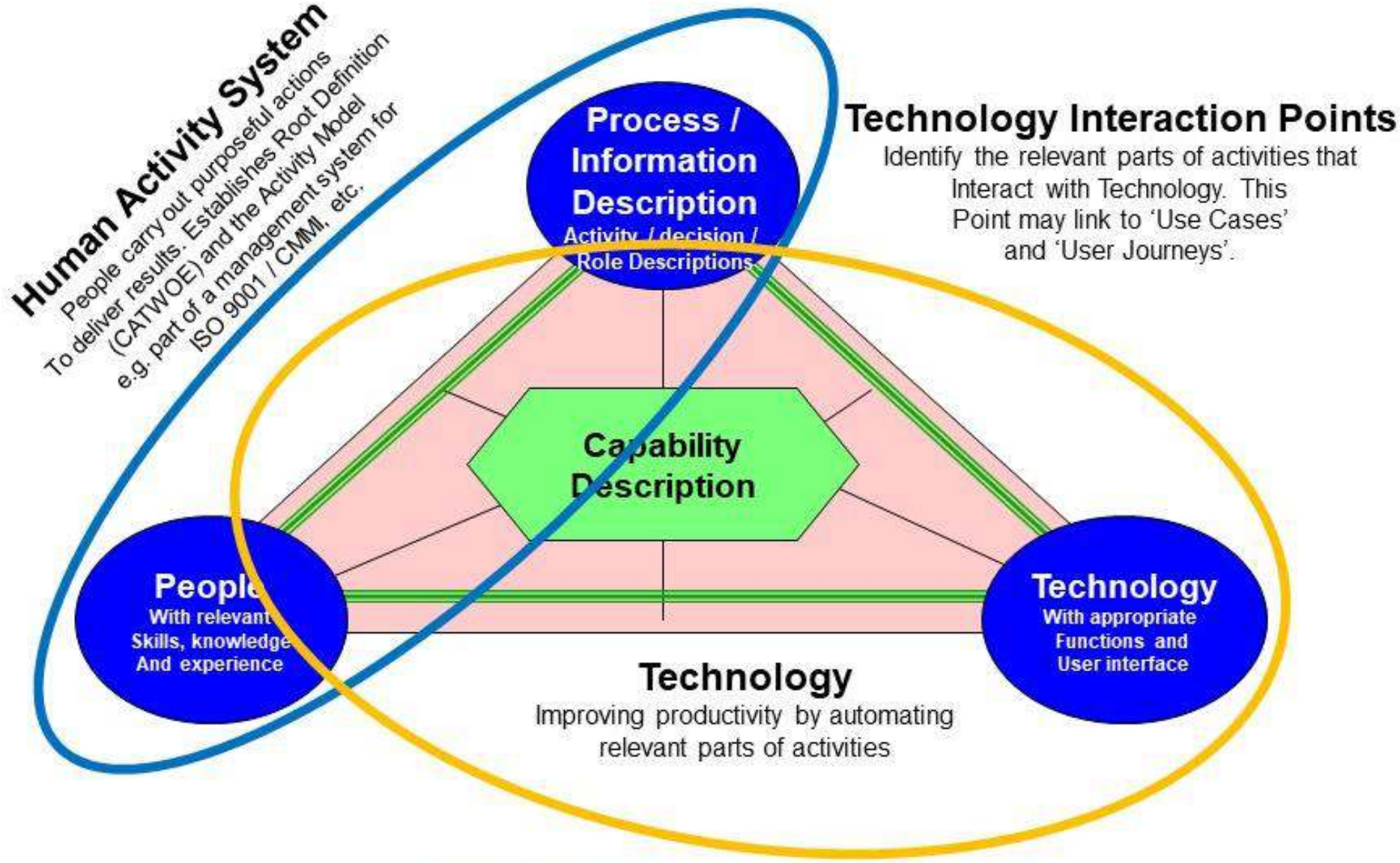
Source: Werner Steinhogl, European Commission

Digital human

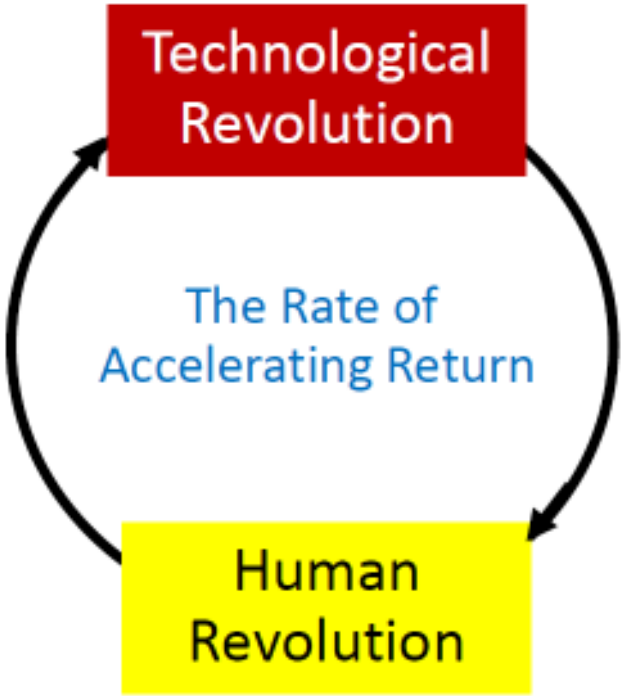
Digital humanity evolution

Gerd

Socio-Technological System



01: Introduction



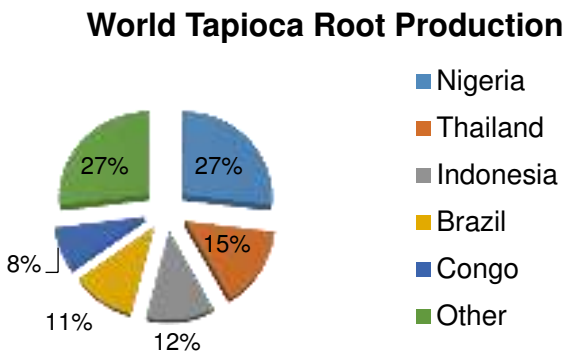
Physical Civilization		Dual Civilization
Social System	→	Socio-Technical System
Physical Humanity	→	Digital Humanity
Physical System	→	Cyber-Physical System

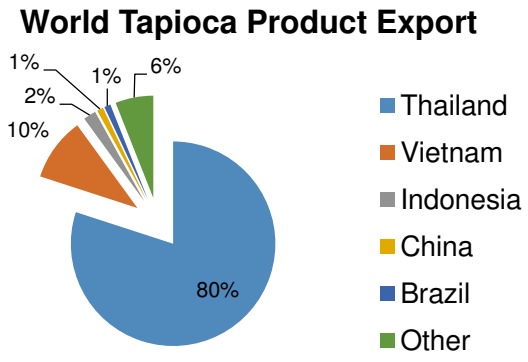
We are ending a 4 billion years-old hegemony of **"Darwinian Evolution"**

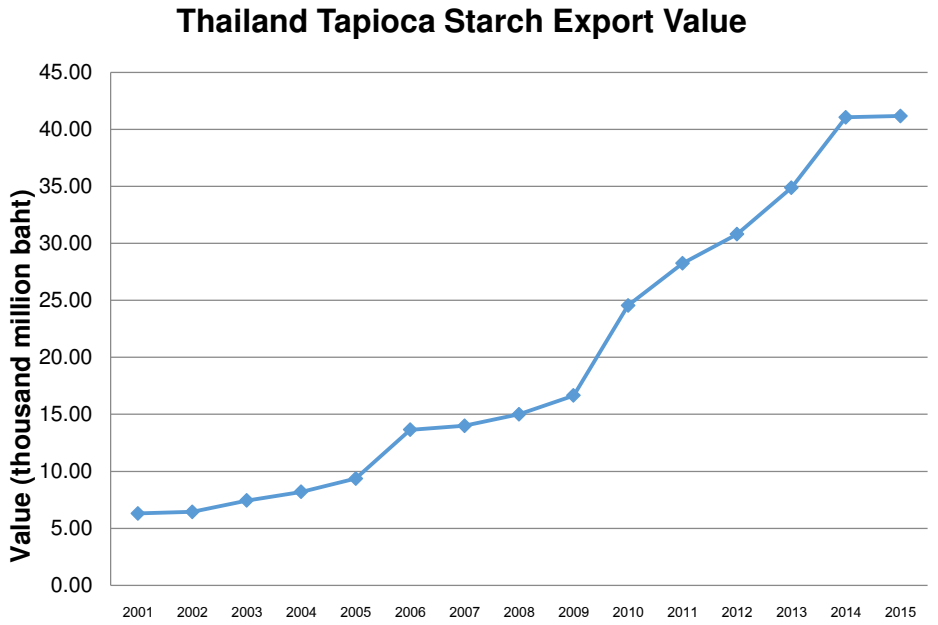
Source: Andrew MaAfee, Erick Bryjolfsson

02: iStarch project

02: iStarch project: Motivation

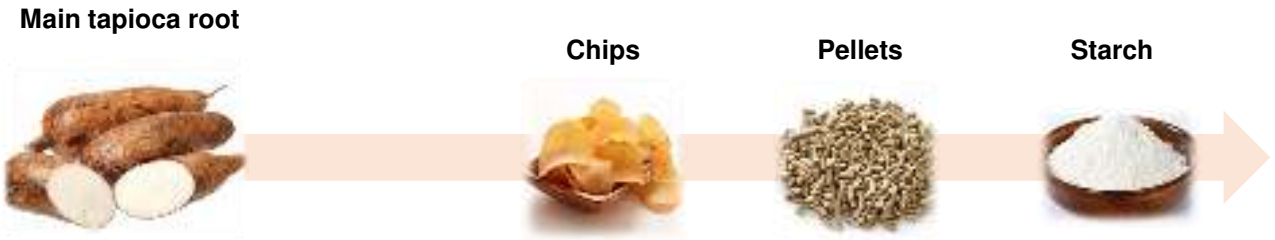






Harvested area:
1.4 Million hectare

Root productivity:
22.6 tons/hectare
(World average 12 tons/hectare)



02: iStarch project: Motivation

- Most Operated manually by workers
- Decision based on worker's experiences
- Product quality unstable
- Take a long time to diagnose abnormal operation

More than 50% of starch factories in Thailand are manually operate

02: iStarch project

Process engineer

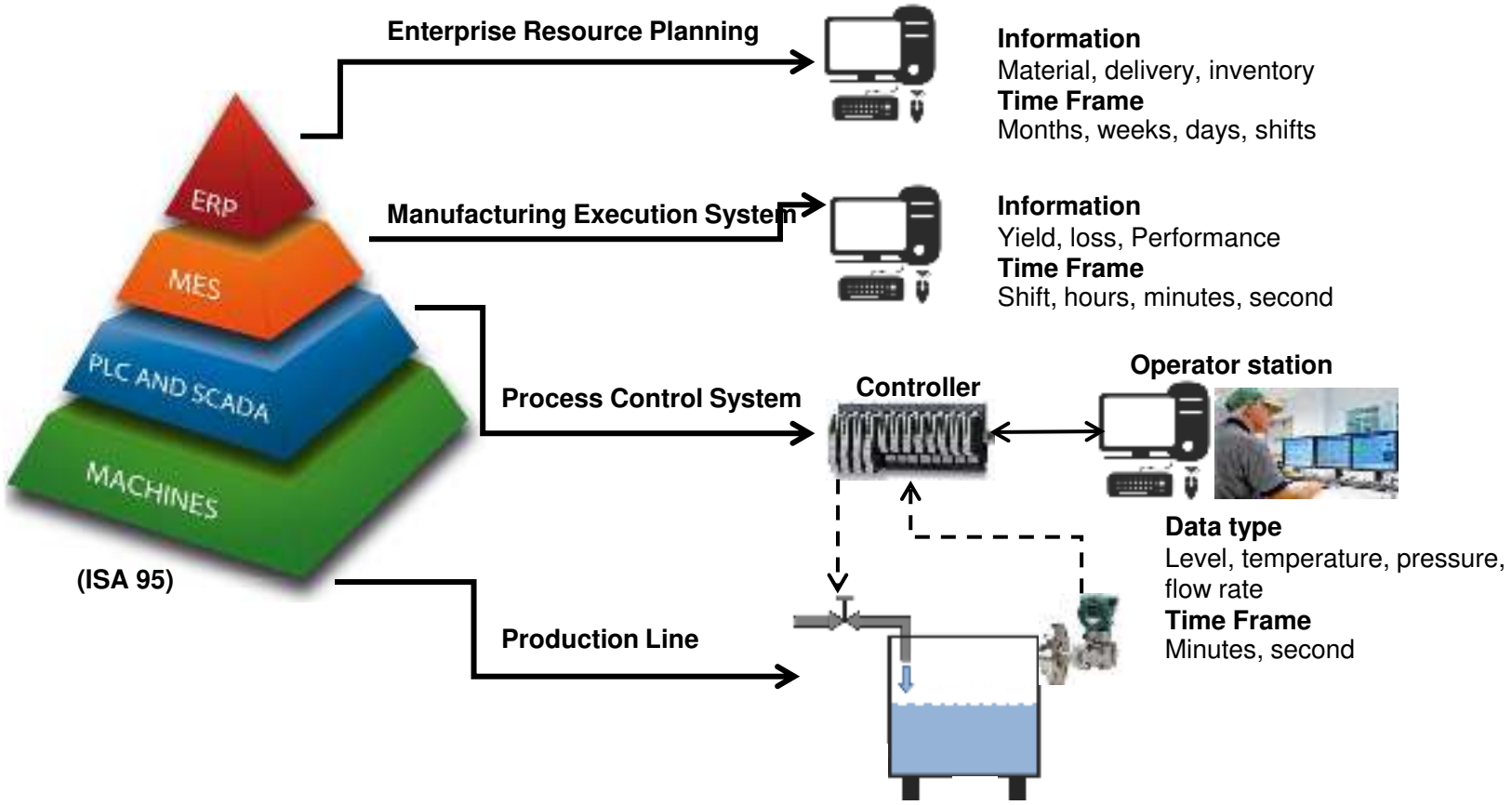
Systems engineer

Challenge: cost-effective automation with intelligent manufacturing.

Manual ----> Intelligent automation

Factory

02: iStarch project: industry 3.0 automation system



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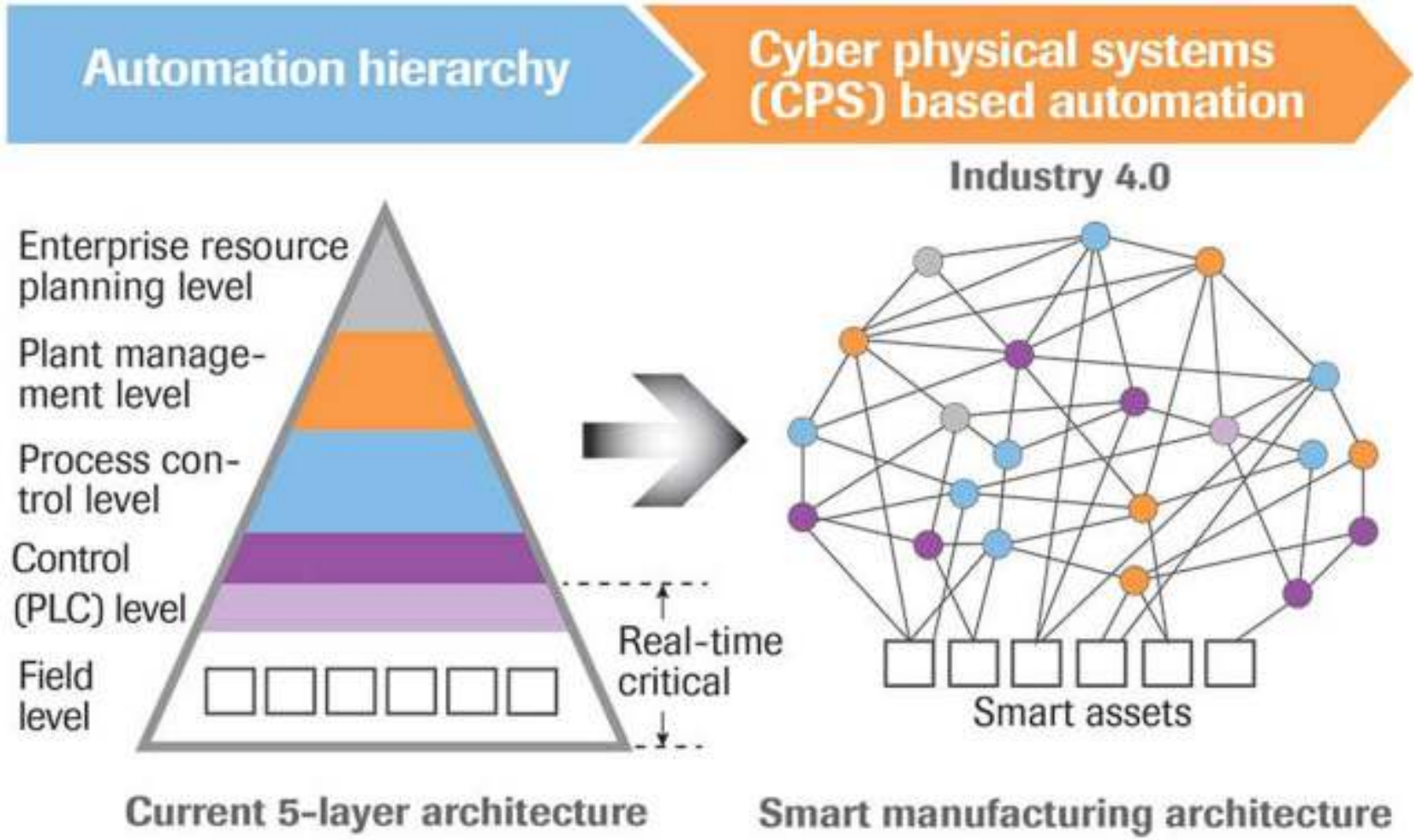

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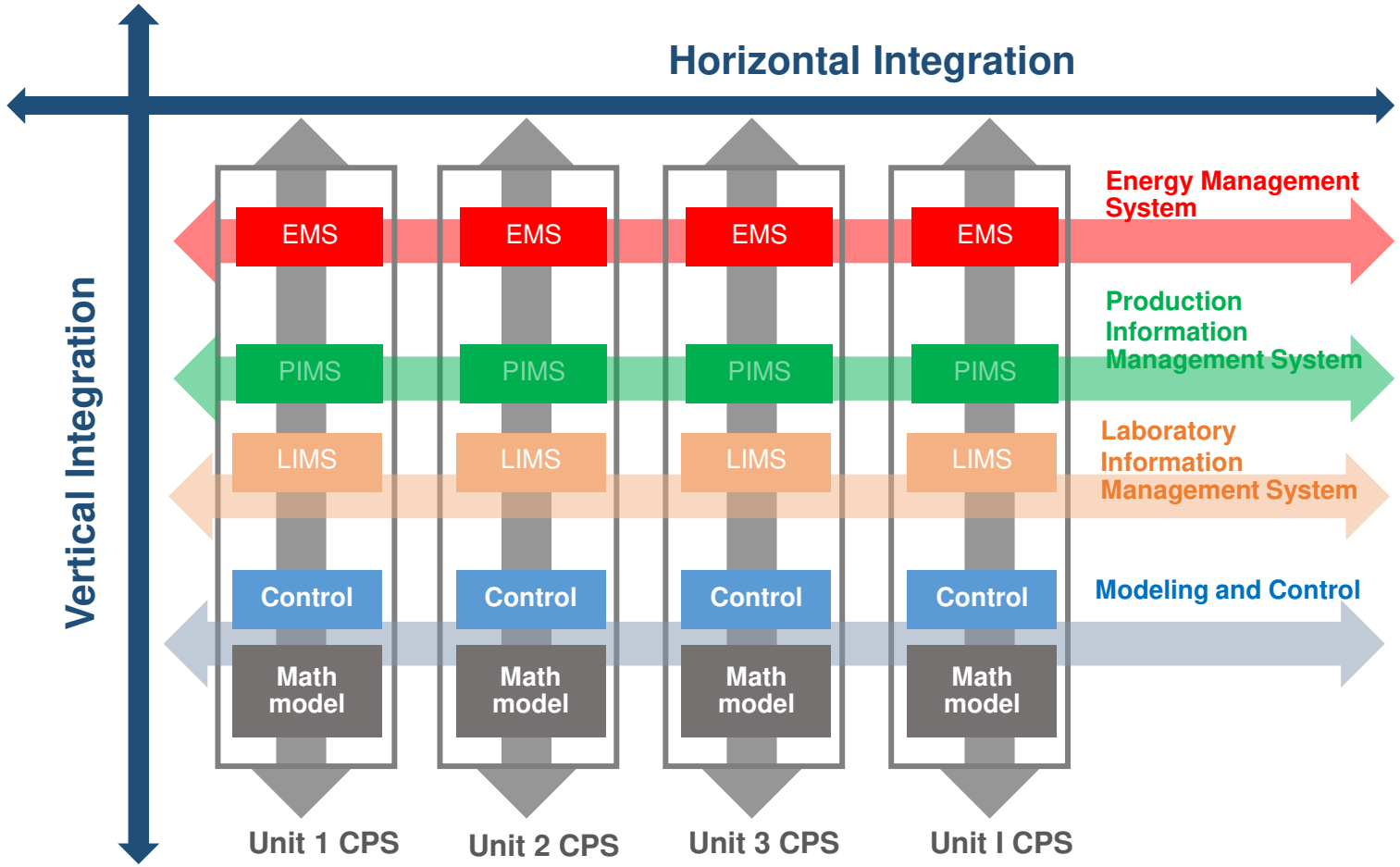
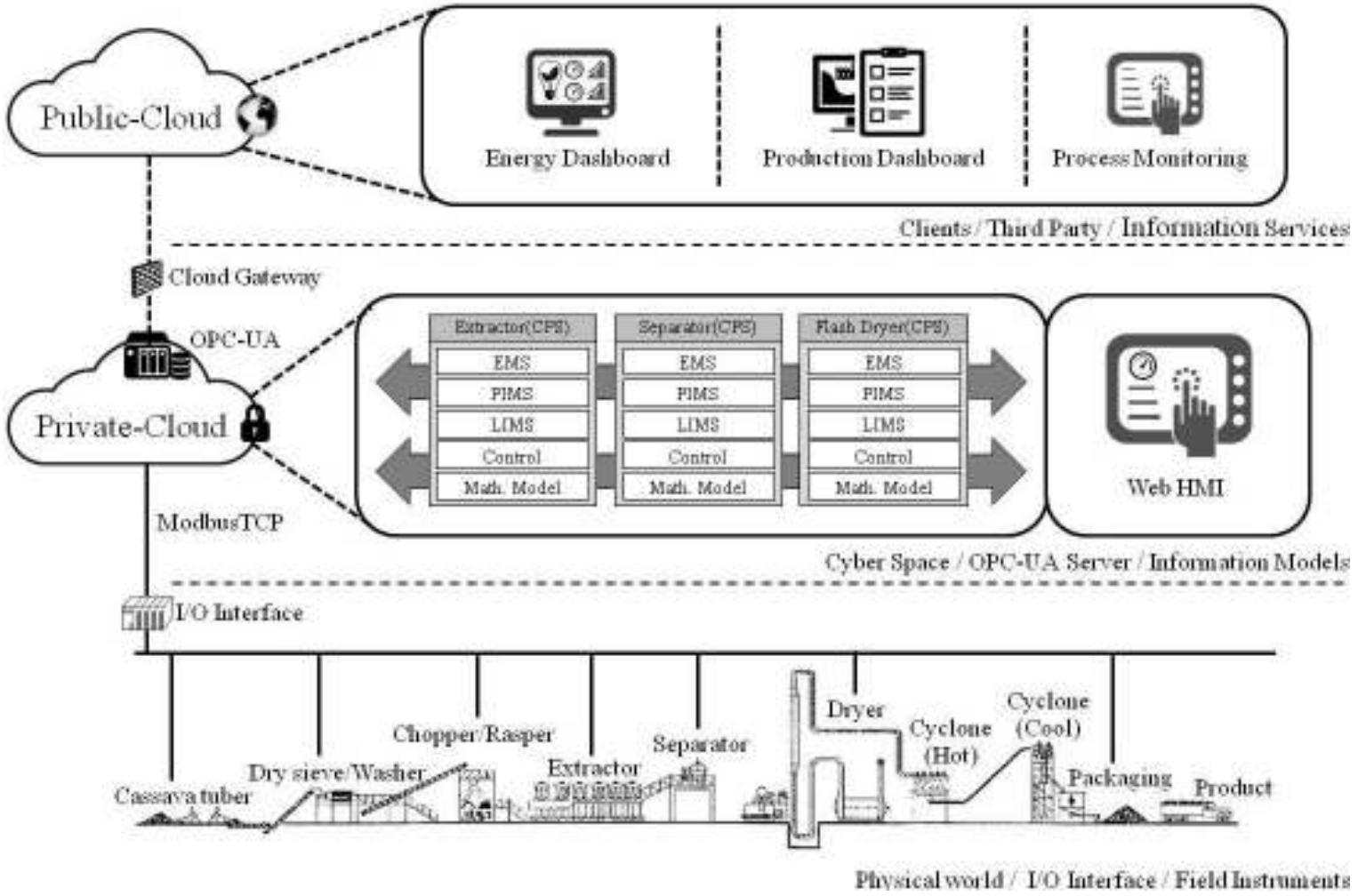


02: iStarch project: Our system architecture design



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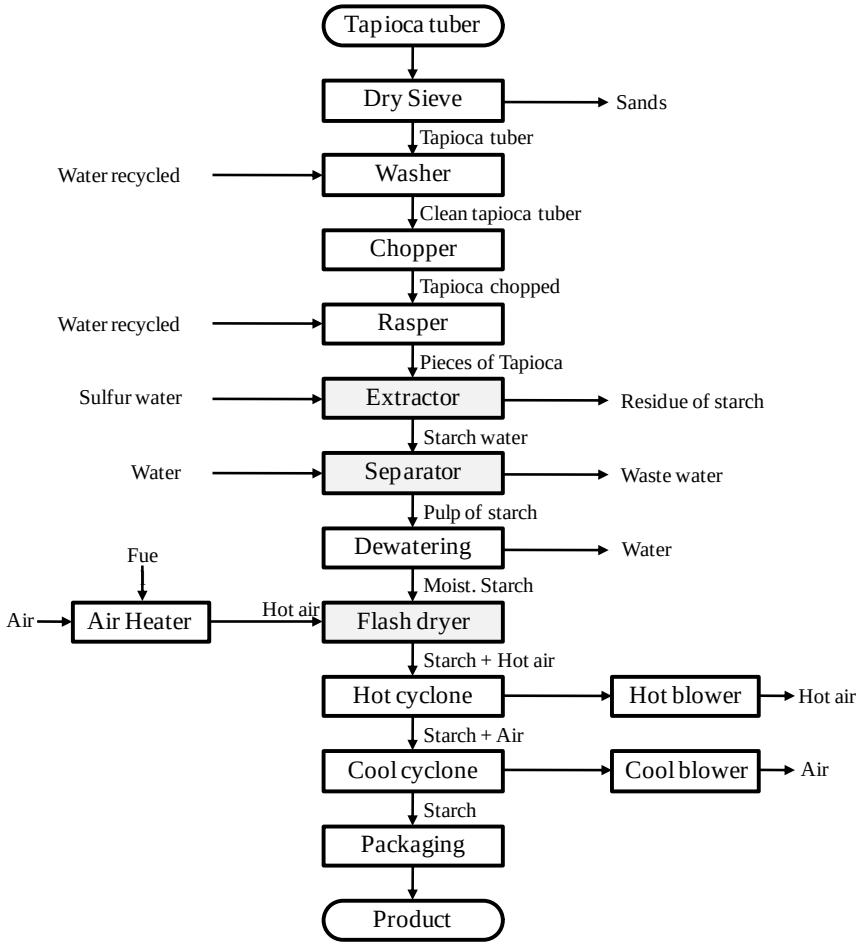
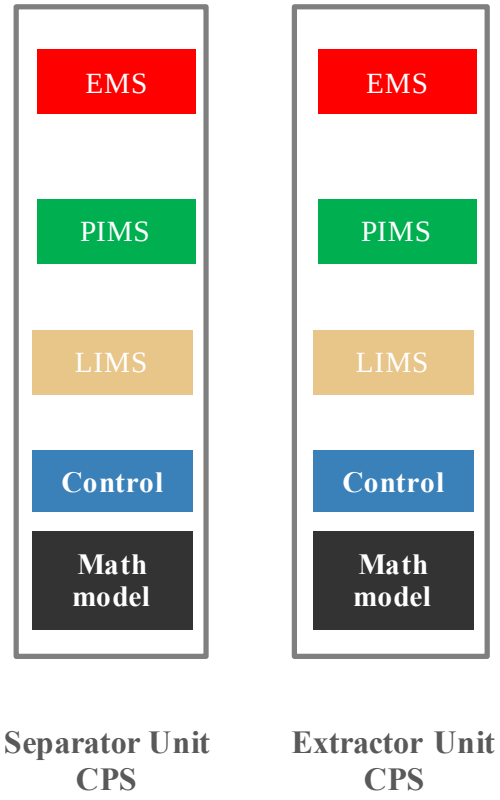
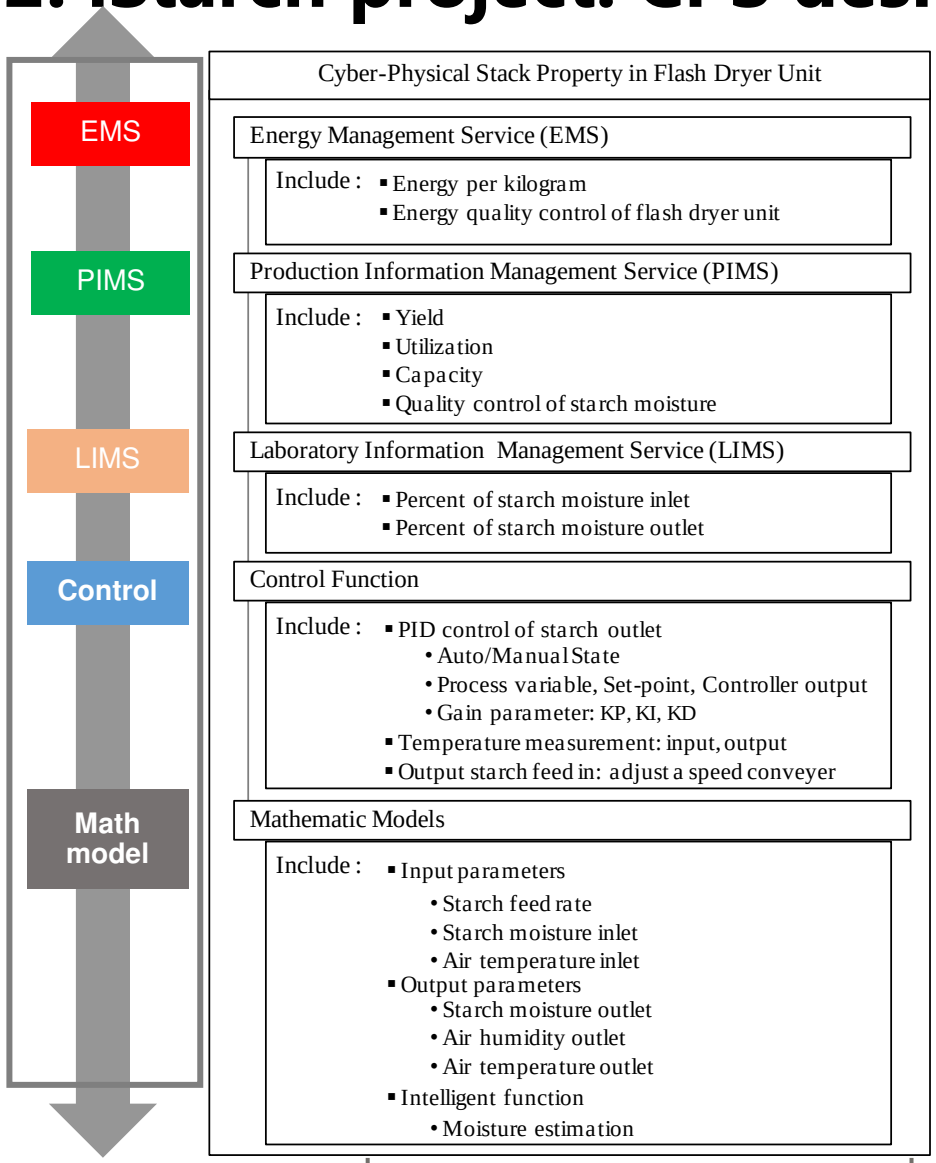


Machine cyber-physical system



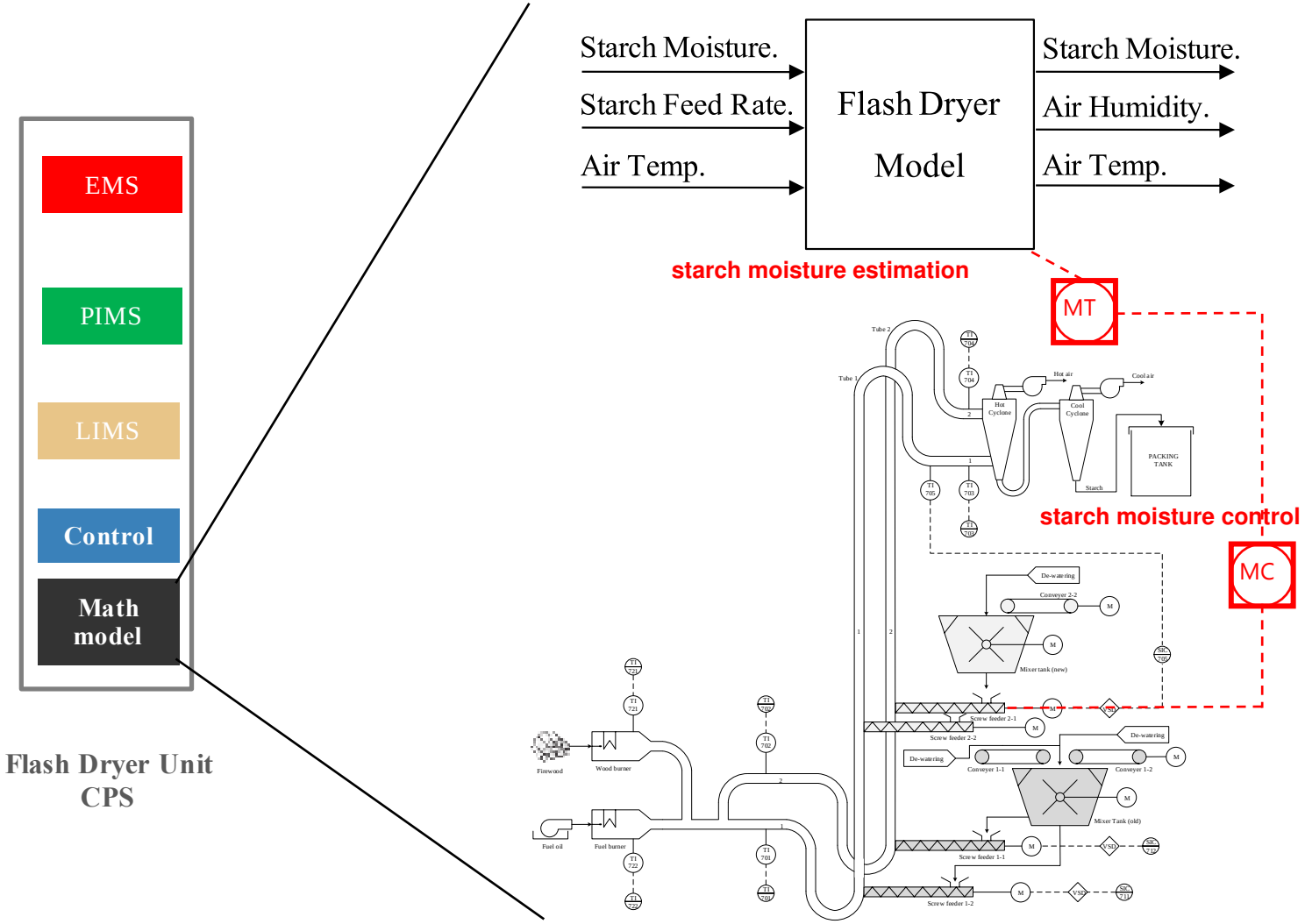
02: iStarch project: CPS design



- The structure of information model of flash dryer unit is shown in this picture.
- Flash dryer unit information model developed based on Microsoft .NET framework using OPC UA base object types, variable types and reference types.
- Services of machine CPS is consisting of EMS, PIMS, LIMS, Control function, Mathematical Model.

OPC® FOUNDATION

02: iStarch project: CPS design



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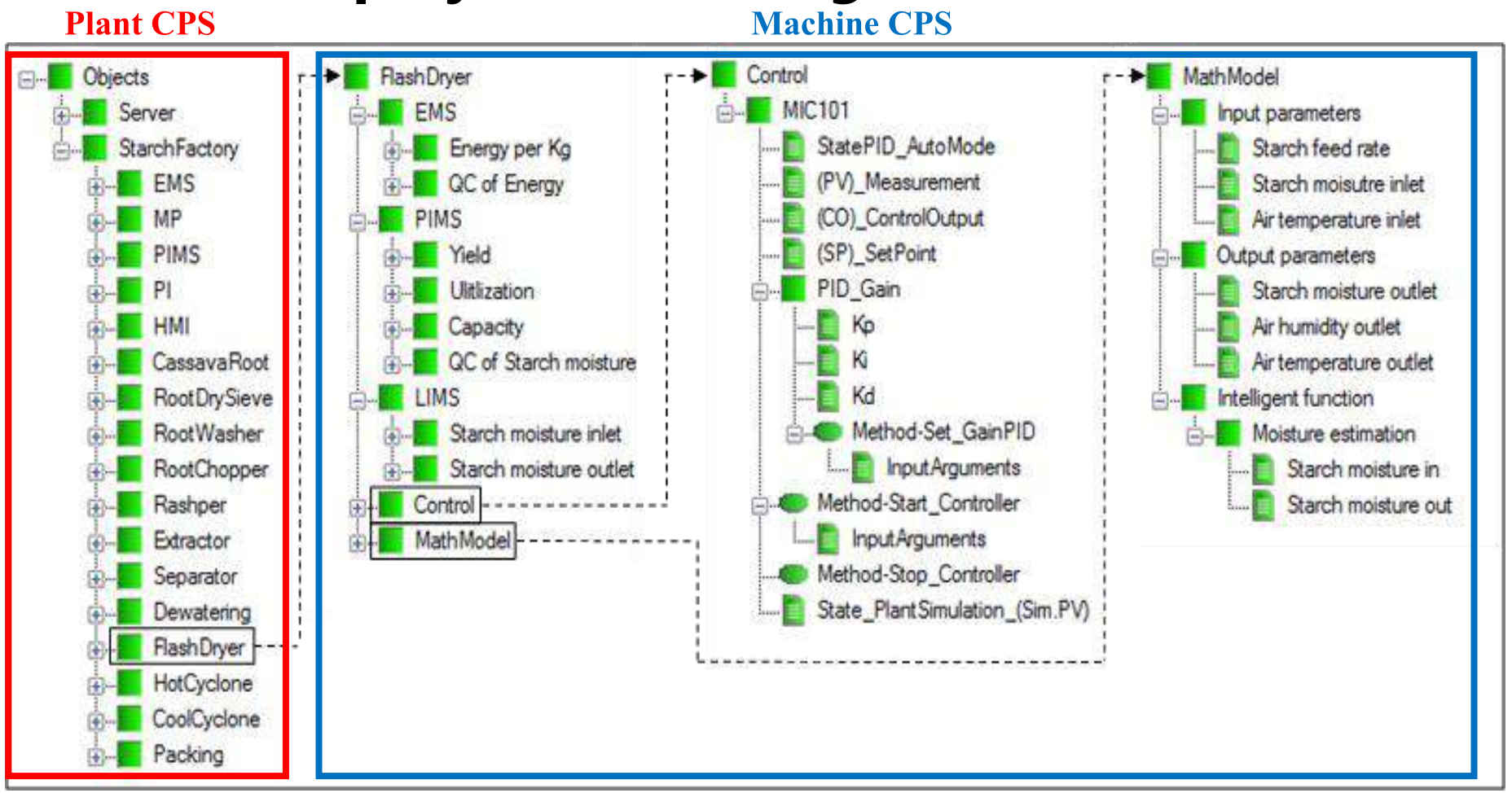

- Plant CPS and machine CPS were designed by OPC-UA and develop by .NET framework.

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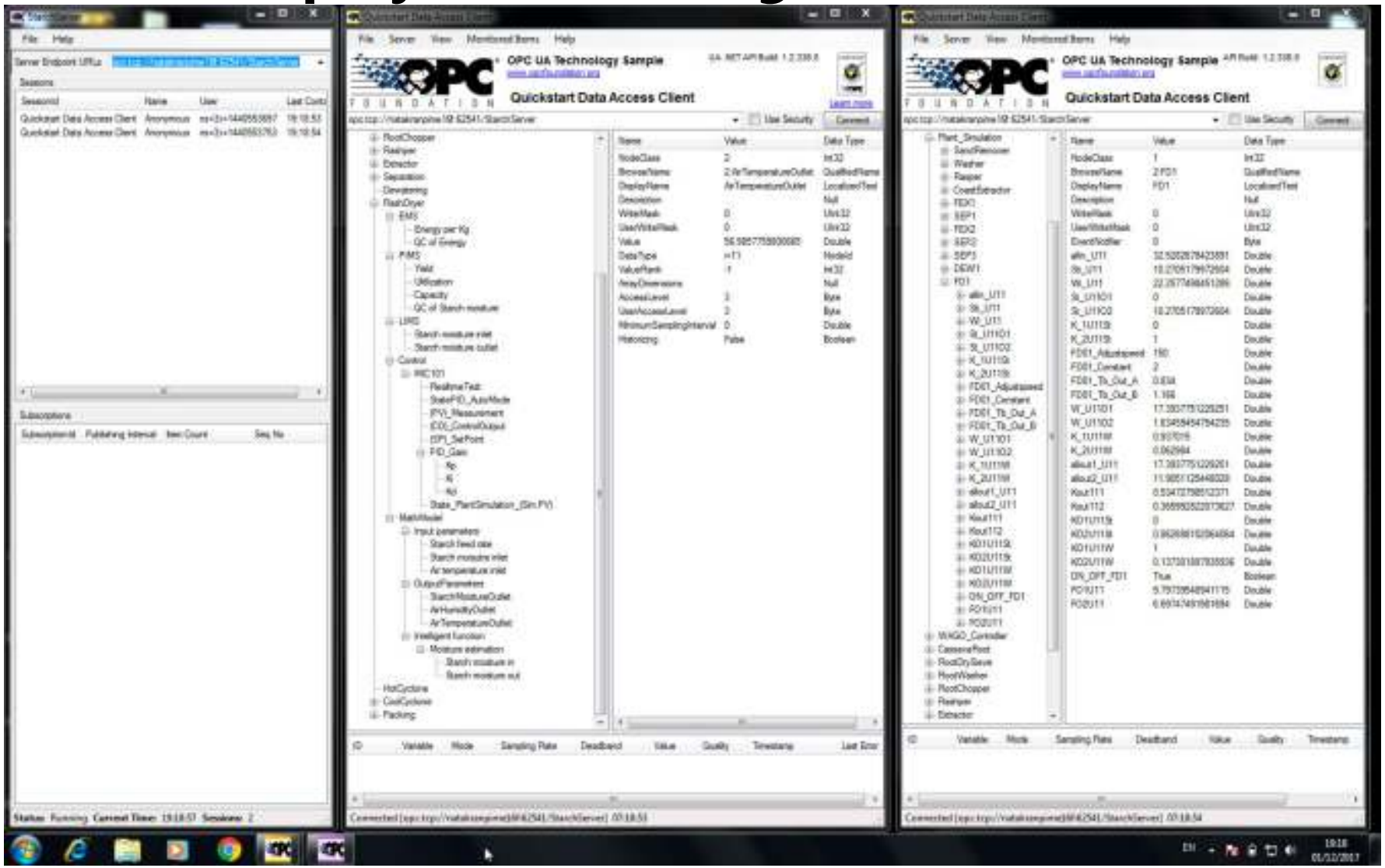
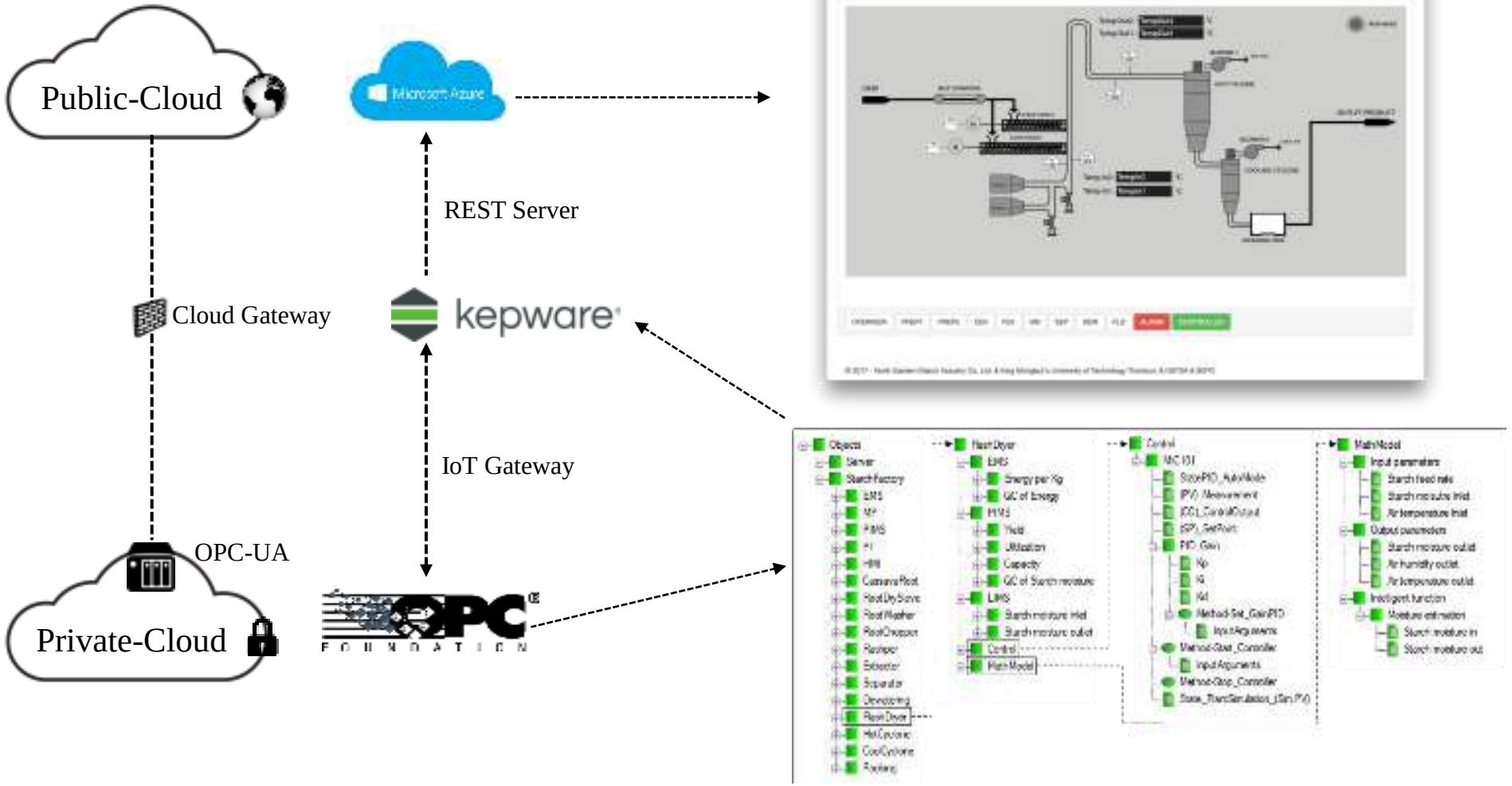


02: iStarch project: infomation services



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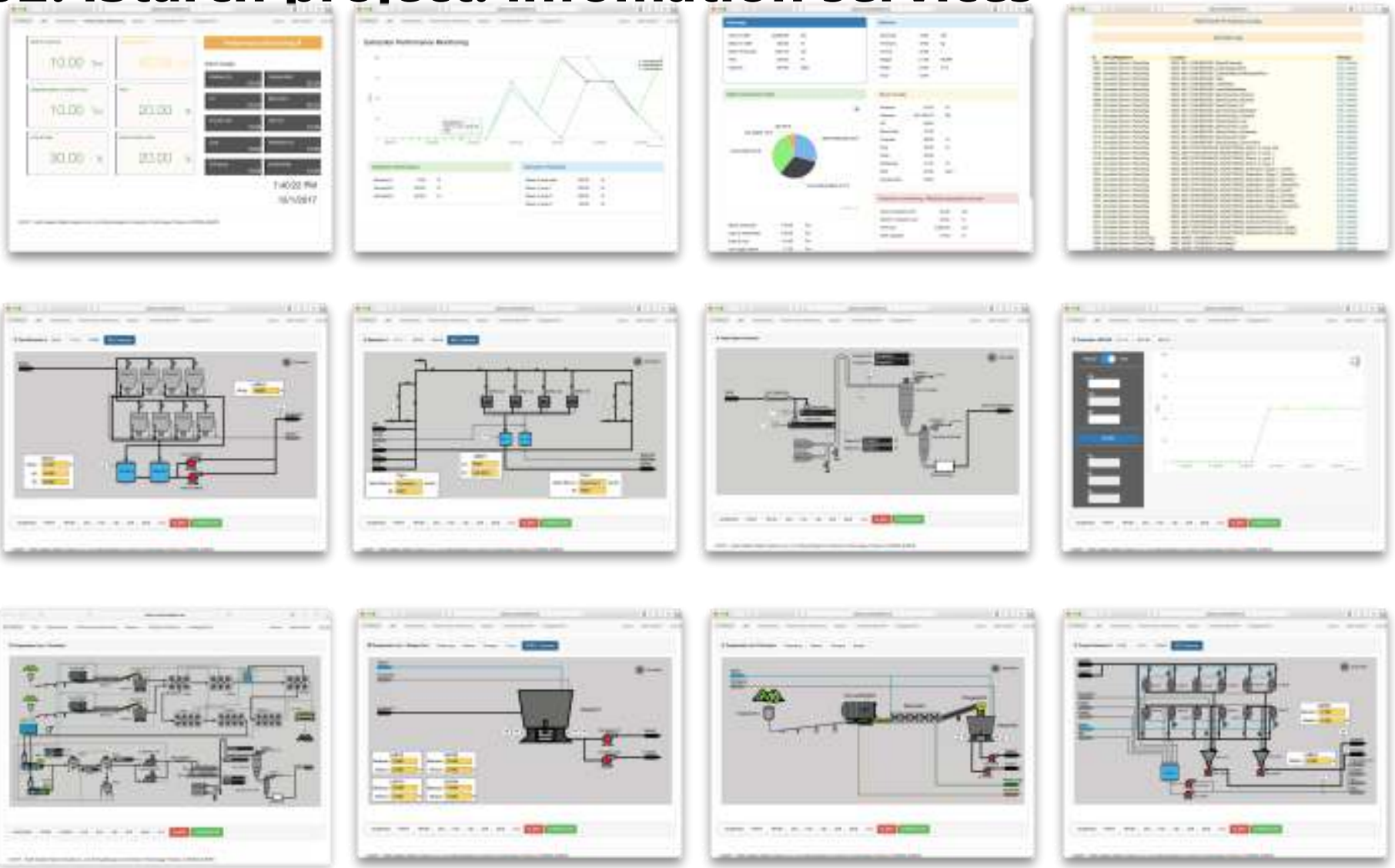
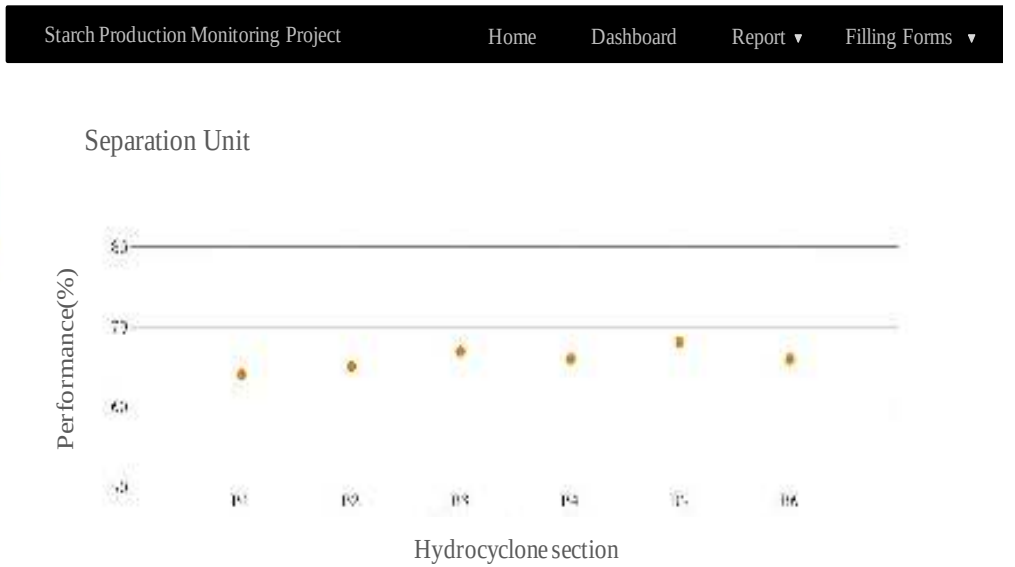
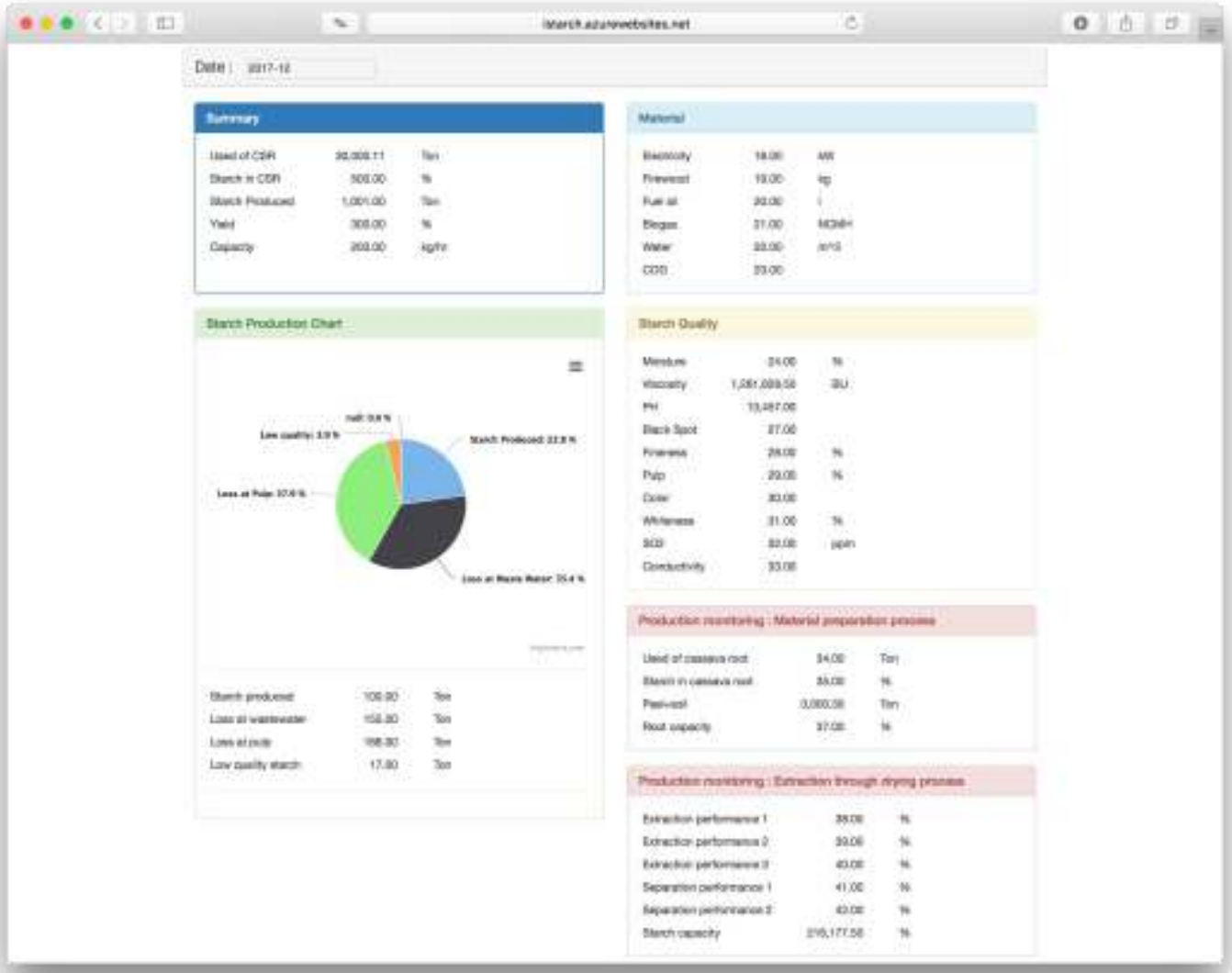


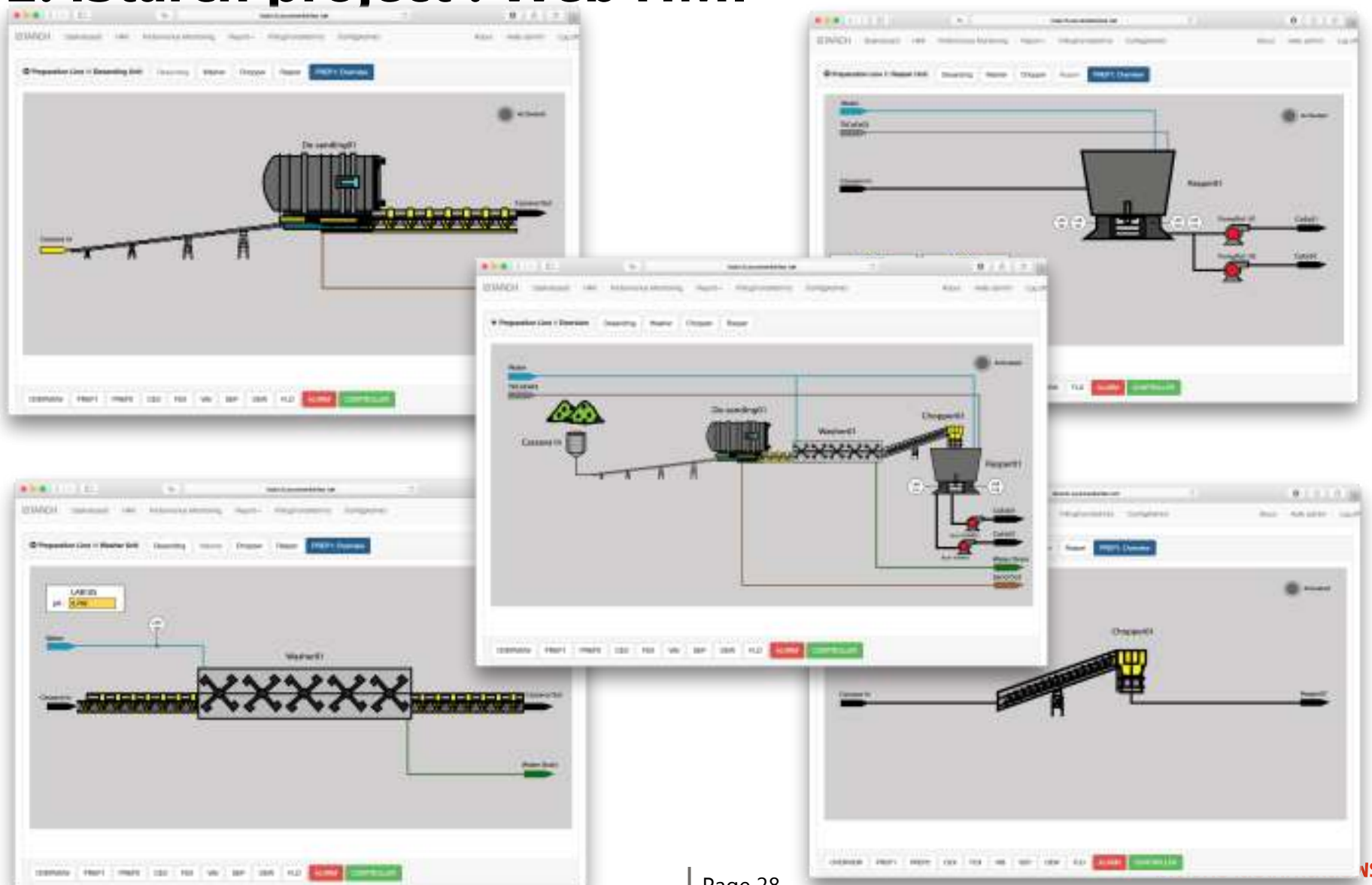
02: iStarch project: Production monitoring



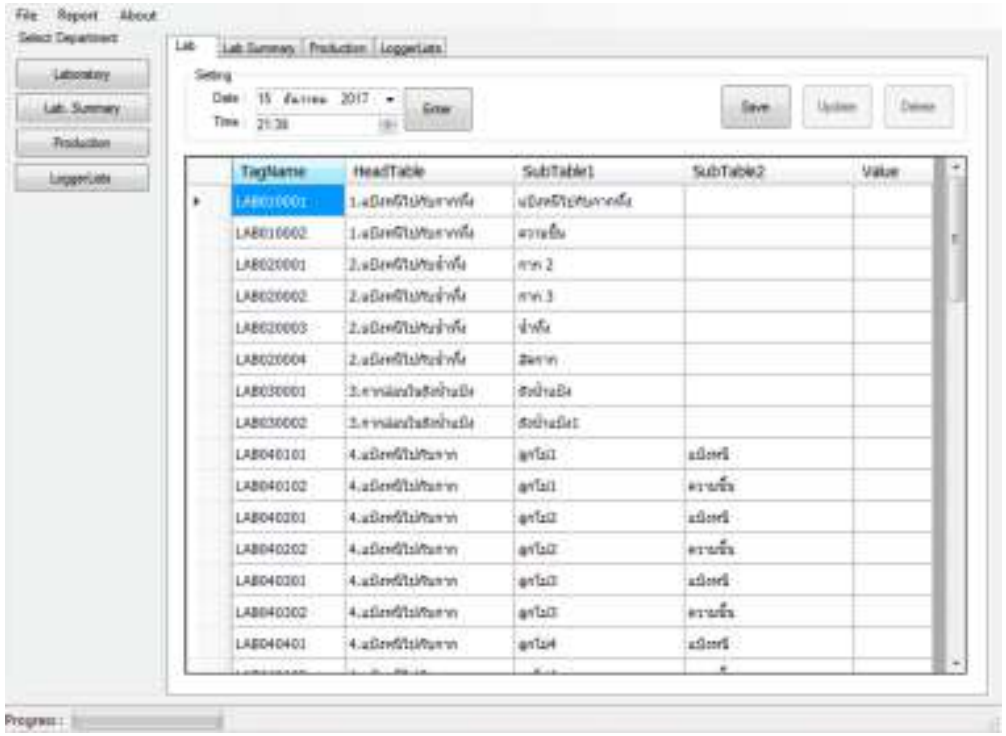
02: iStarch project: Production reports

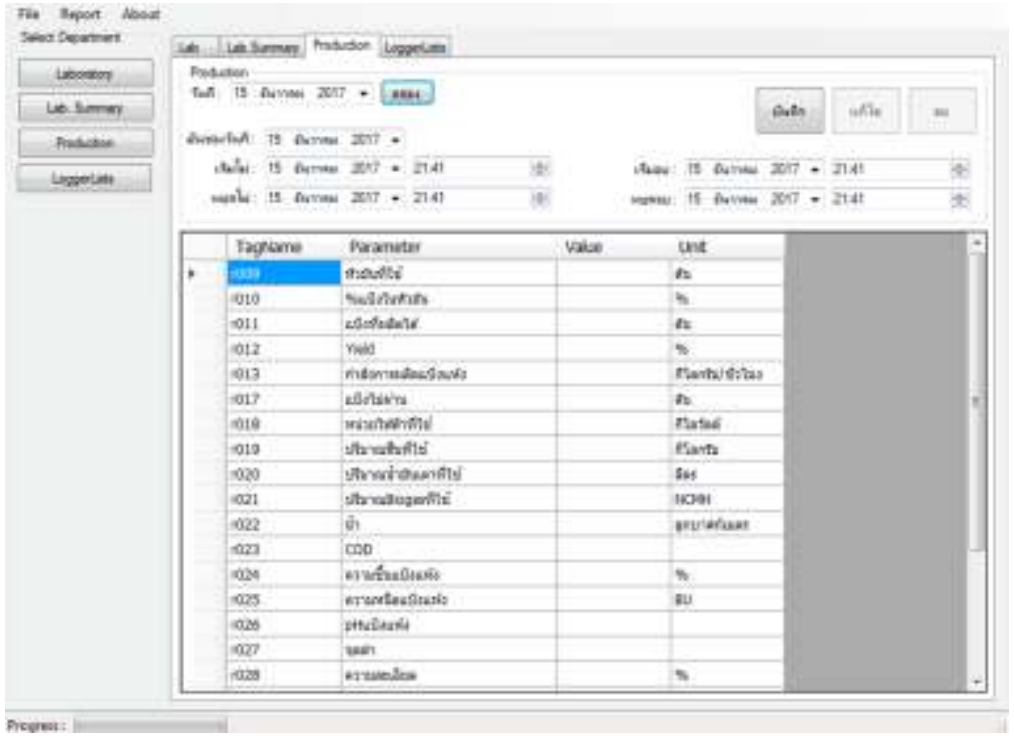


02: iStarch project : Web HMI



02: iStarch project: Laboratory information management





02: iStarch project: Hardware implementations






03: Future works

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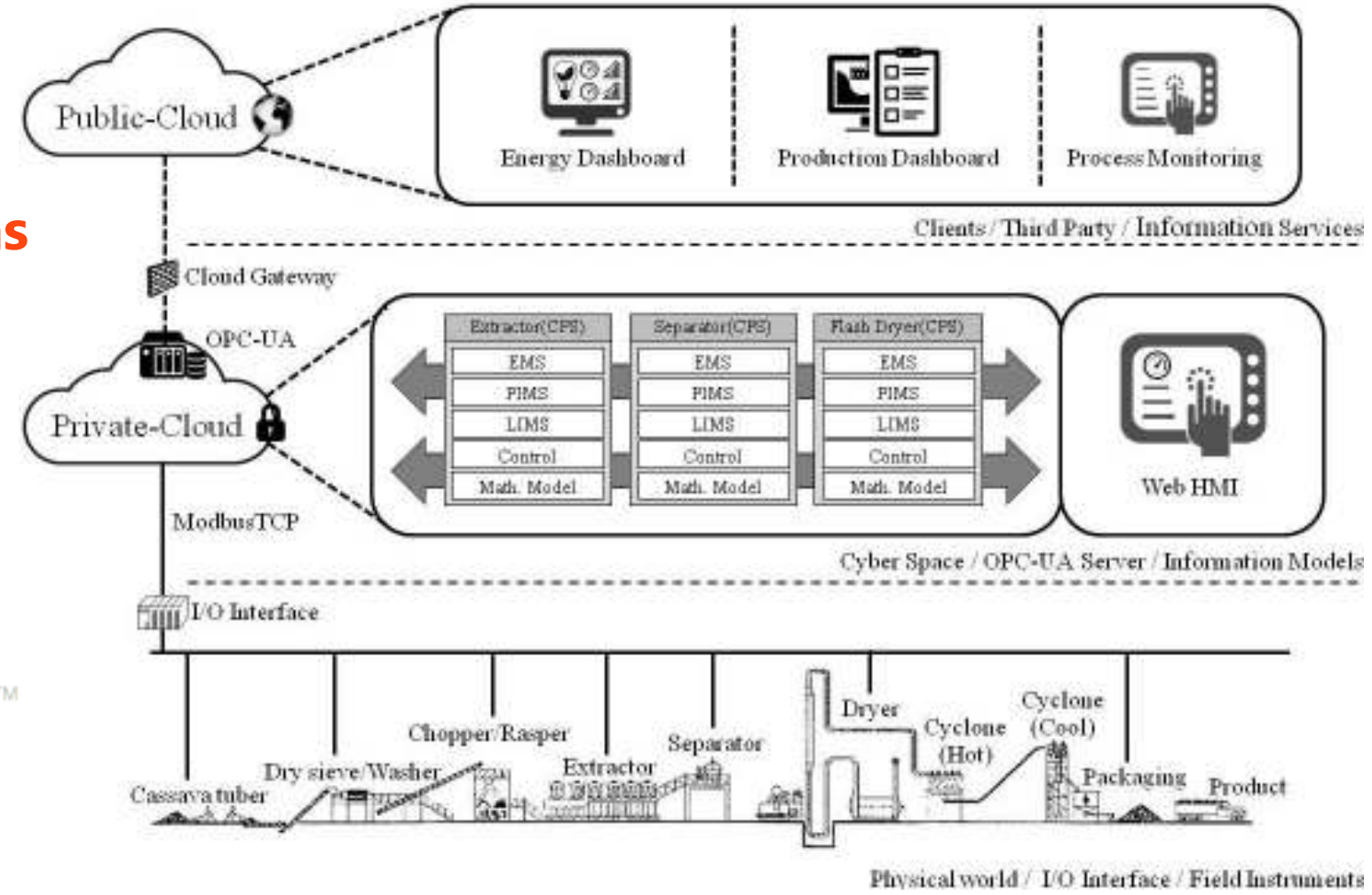
Intelligent functions

- Expert system
- Predicted alarm
- Optimization

TensorFlow™



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